Parameter manual

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be in motion be in motion

BAUMÜLLER

b maXX®

BM4400,

BM4600,

BM4700

Basic unit
Firmware version 03

E	5.03039.14

Read the Operating Manual before starting any work!

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General

1.1 Information about the Parameter Manual

In this manual information is to be found referring to the parameters for the devices bmaXX®BM4400, BM4600, BM4700 for

WinBASS II from version 1.07
ProDrive from version 1.00
Controller-firmware from version 03.00

The parameters will affect the behavior of the controller.

The controller affects the behavior of the power unit and of the motor which is connected to it.

A survey of the control structures is found in ▹Control structures◃ from page 13.

After an adaptation of the parameter values was made to their application, they must be saved. References to this are found in ▹Data Management◃ from page 43.

A procedure for the commissioning is found in ▹Commissioning◃ from page 57.

Operating principle of the single software modules and its parameters is described in chapters ▹Configuration◃ from page 83 to ▹Applications◃ from page 335.

A detailed description of the parameters sorted according to the parameter numbers is found in chapter ▹Parameters◃ from page 337.

A brief survey of all the parameters is shown in ▹Parameter list◃ from page 679.

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2

FUNDAMENTAL SAFETY INSTRUCTIONS

In this chapter we prescribe the warnings of dangers, which can arise during parameterization of the Baumüller b maXX® 4400 controller unit and we explain the meaning of the information sign. Attention is invited to the manufacturer's limitation of liability.

2.1 Warnings

Warnings

Warnings are identified by symbols in this Parameter Manual. The notices are introduced by signal words which express the magnitude of the danger.

Observe the notices without exception and exercise caution to prevent accidents, personal injury and damage to property.

⚠	**DANGER!** ....warns of an imminently dangerous situation which will result in death or serious injury if not avoided.

⚠	**WARNING!** ....warns of a potentially dangerous situation which may result in death or serious injury if not avoided.

CAUTION!

....warns of a potentially dangerous situation which may result in minor or slight injury if not avoided.

NOTICE!

....warns of a potentially dangerous situation which may result in material damage if not avoided.

2.2 Information sign

NOTE!

....highlights useful tips and recommendations, as well as information for efficient and problem-free use.

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- Non-compliance with the Operating Manual b maXX BM4000 (5.12008)
- Non-compliance with this Parameter Manual

3

CONTROL STRUCTURES

In this chapter the topology of the b maXX®-controller is described. The model of the control system is described by using graphics.

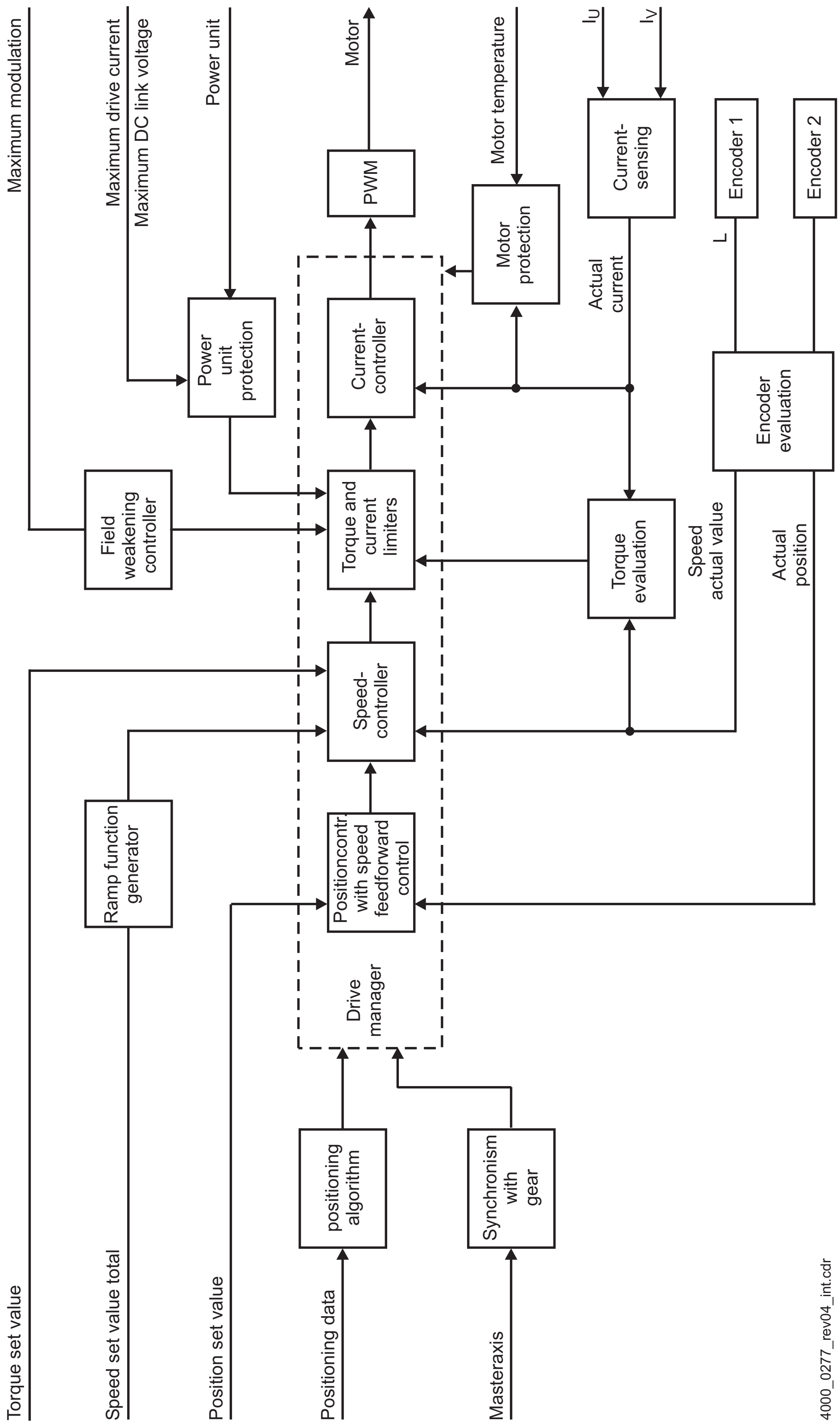


Figure 1: Overview

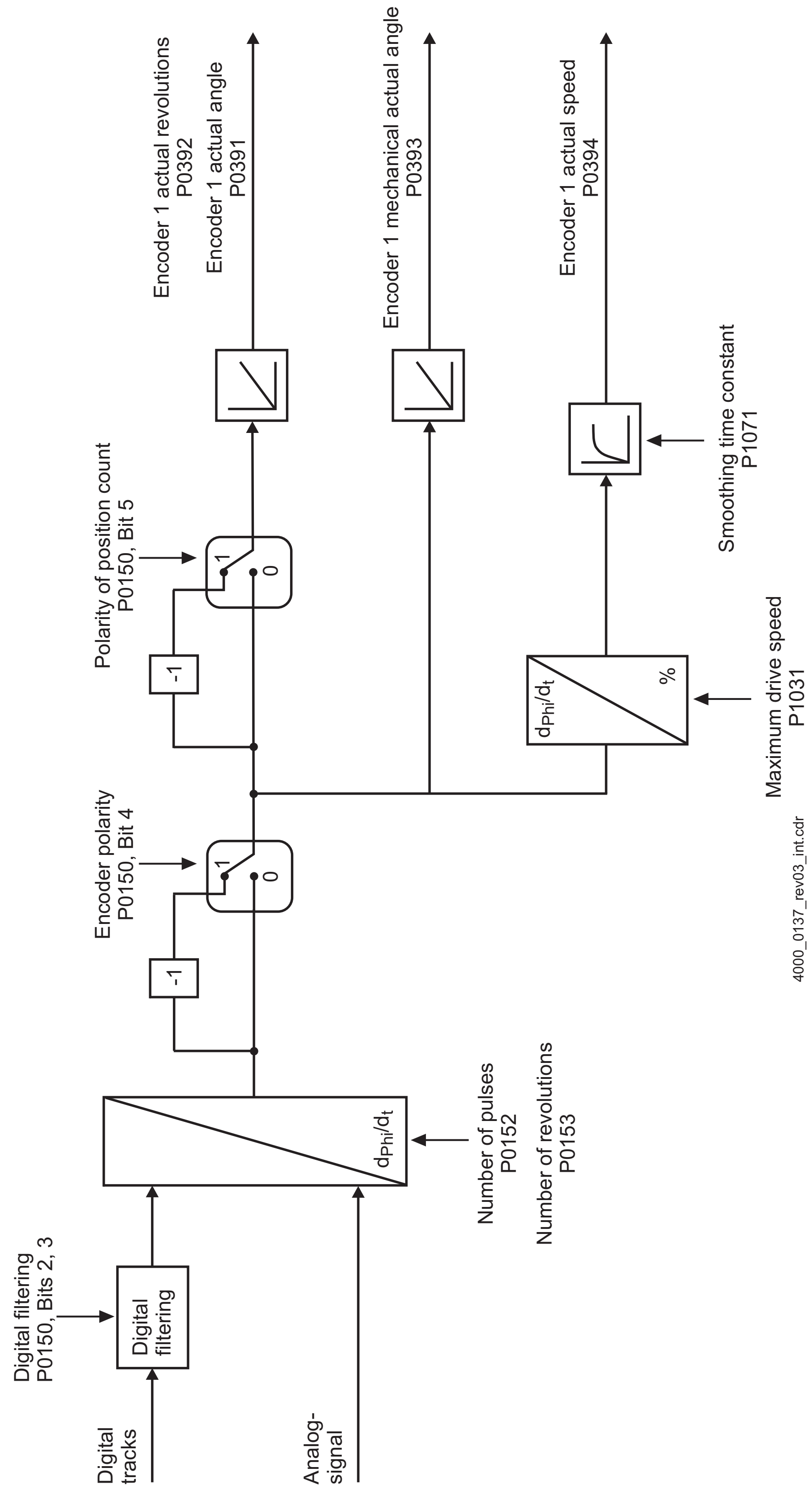


Figure 2: Encoder evaluation

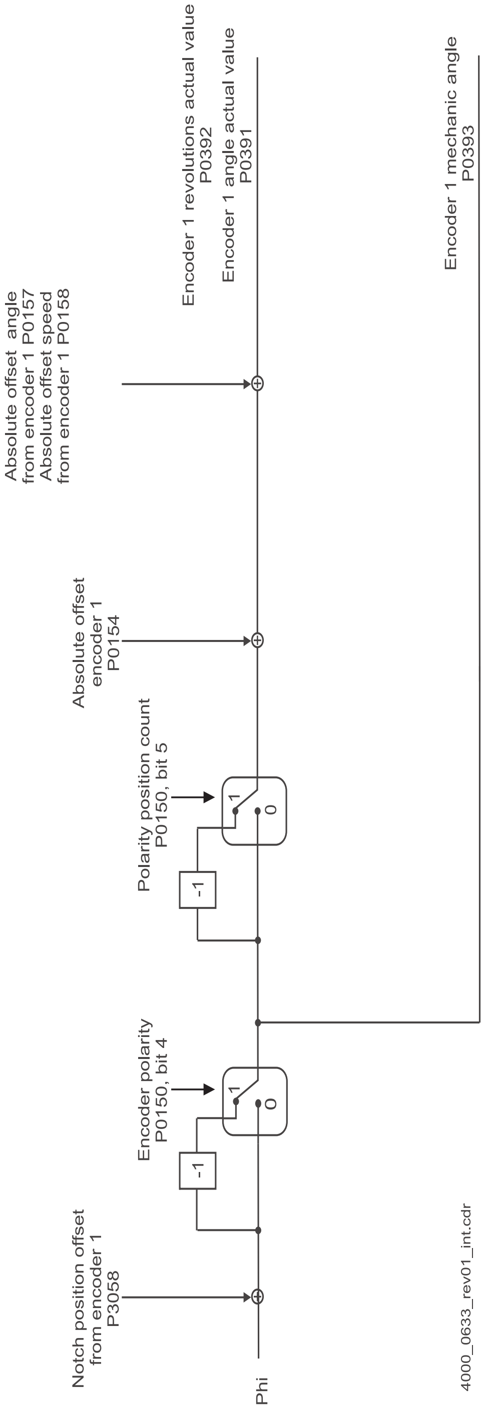


Figure 3: Encoder offset

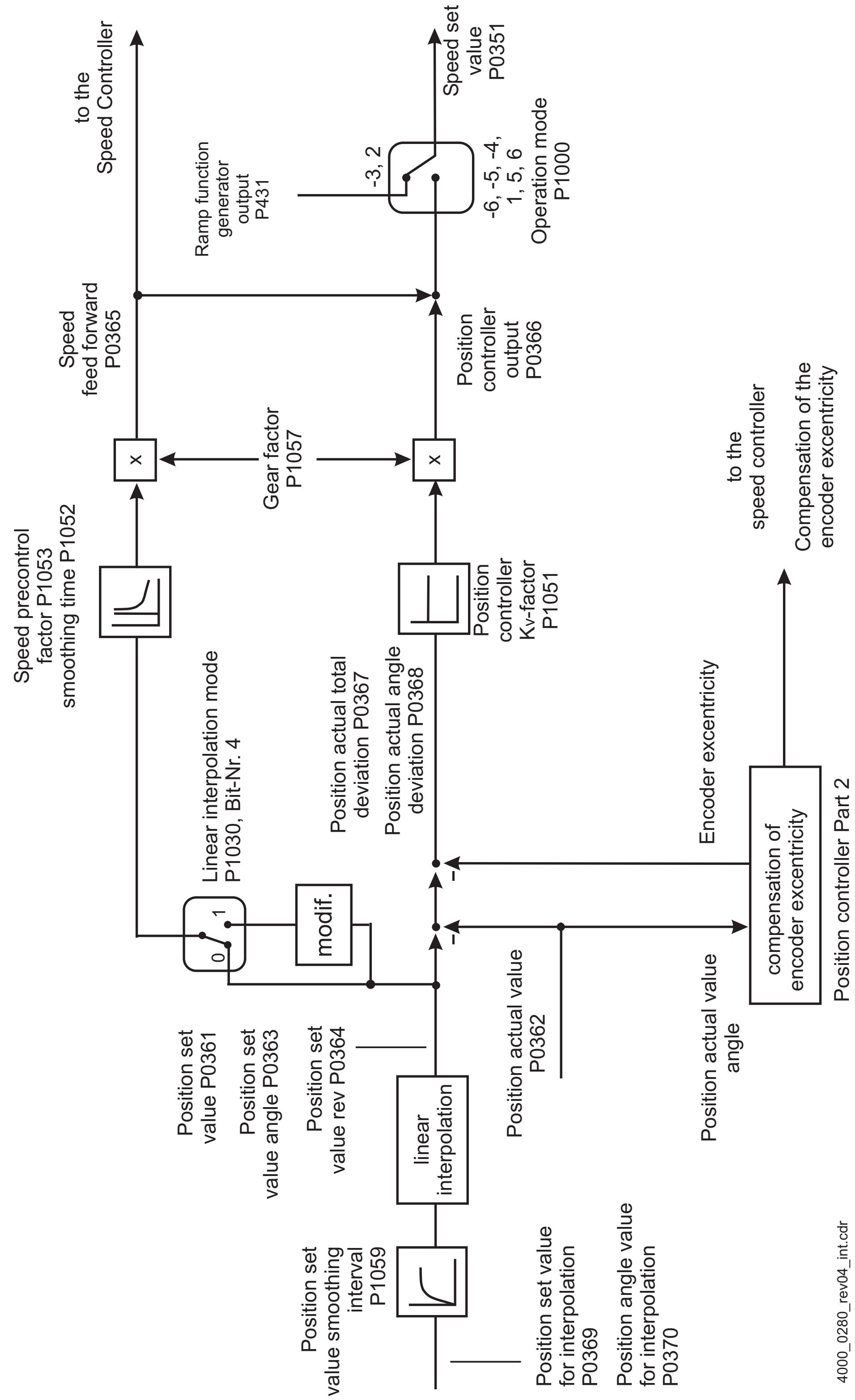


Figure 4: Position controller Part 1

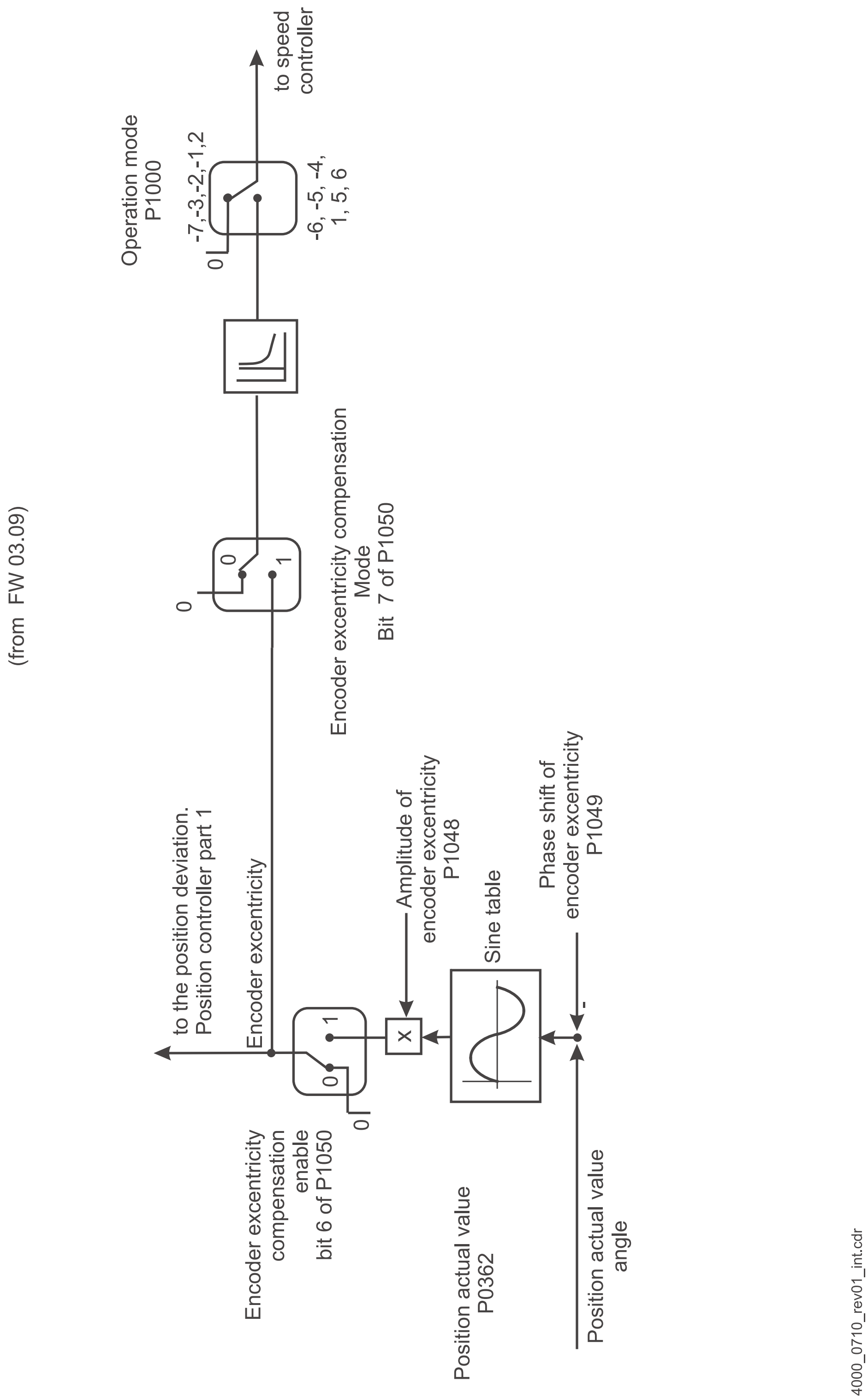


Figure 5: Position controller Part 2, Encoder excentricity compensation

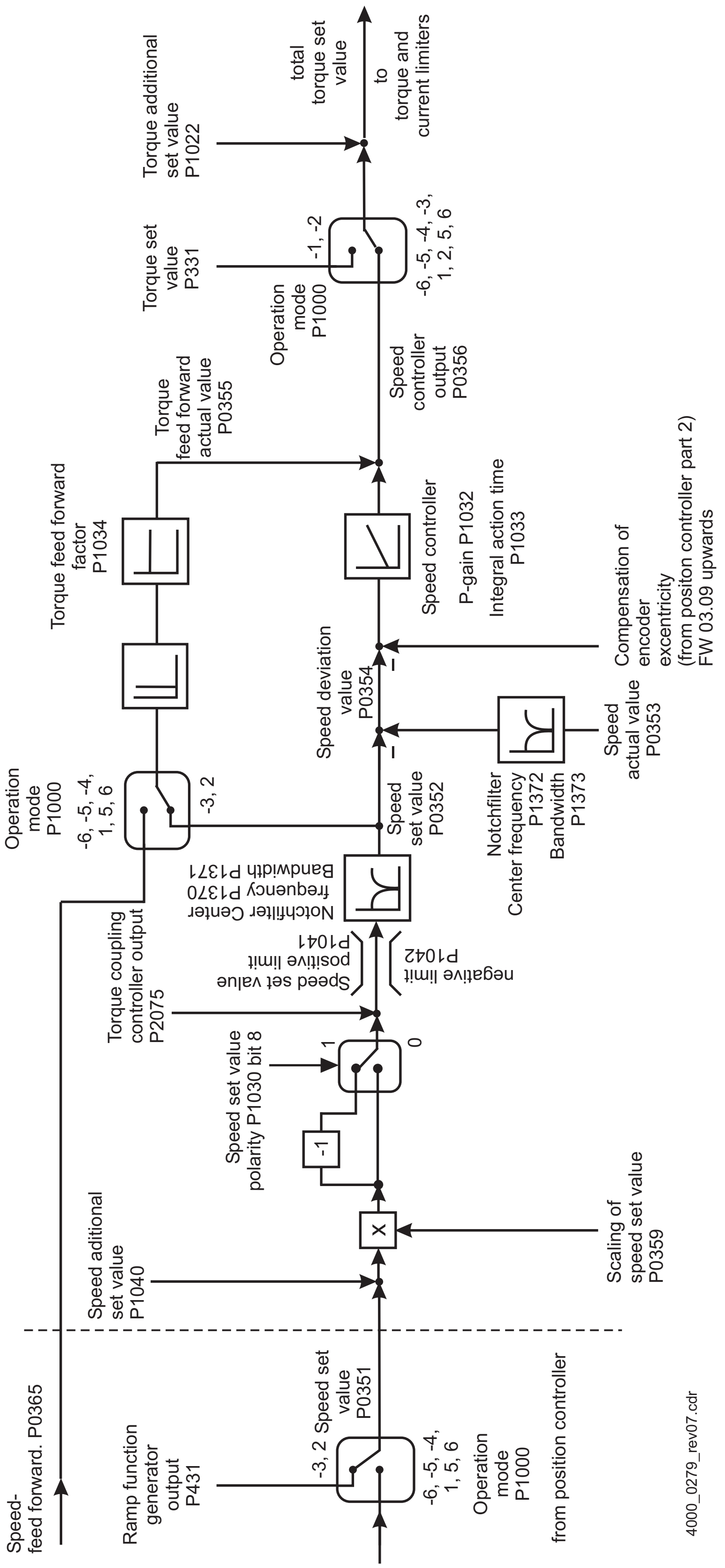


Figure 6: Speed controller

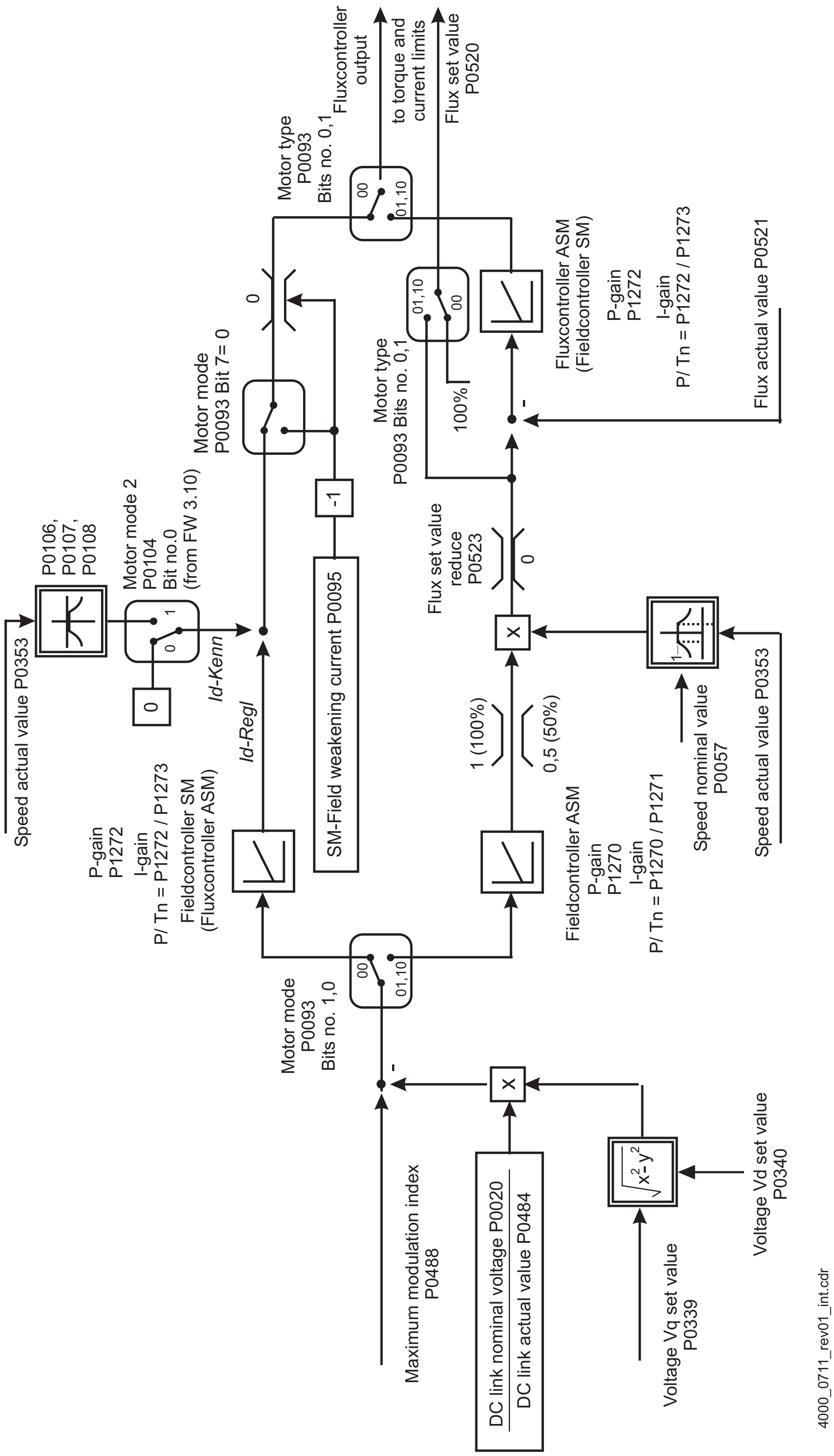


Figure 7: Fieldcontroller, Fluxcontroller

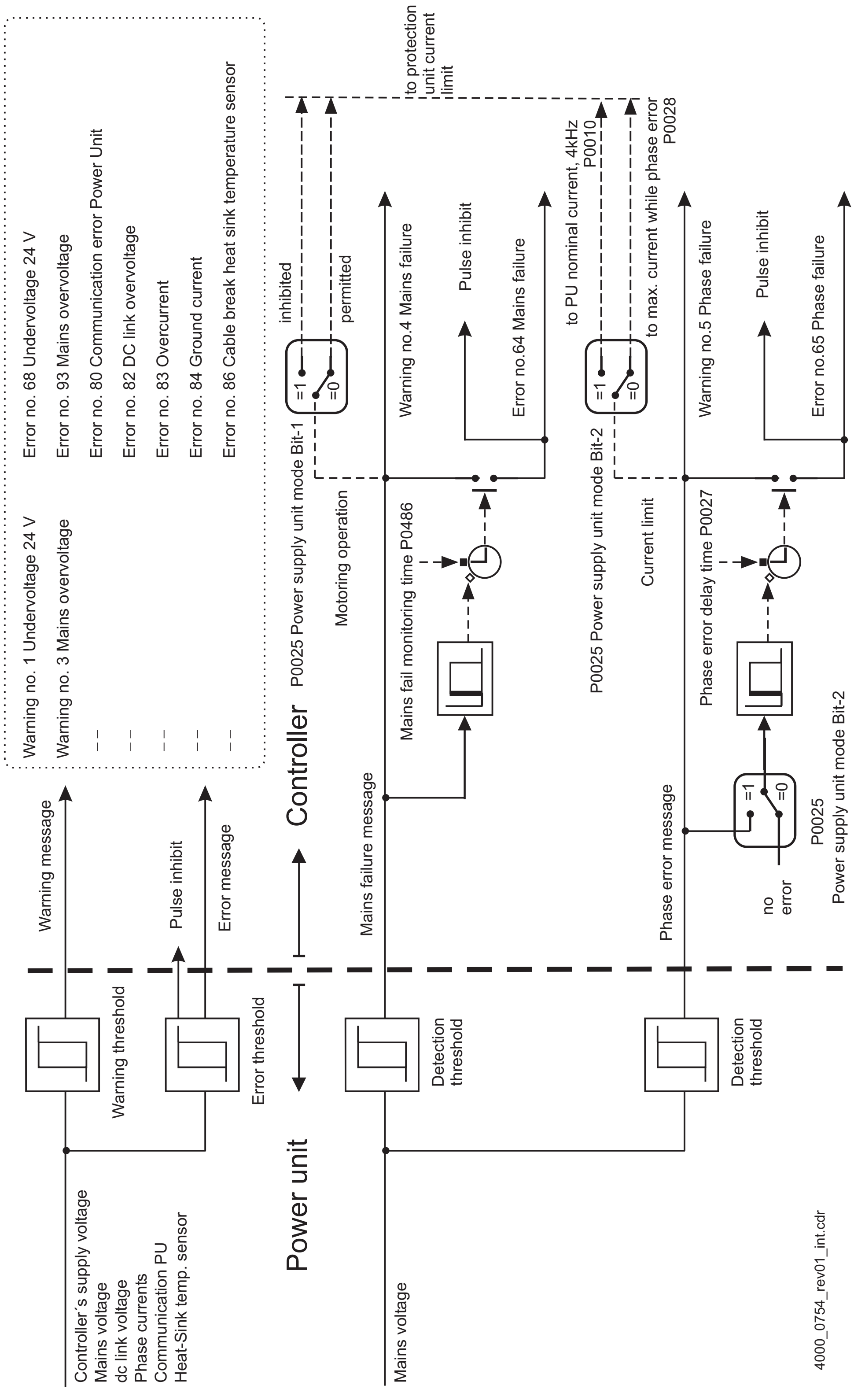


Figure 8: Device protection PU warnings and error messages

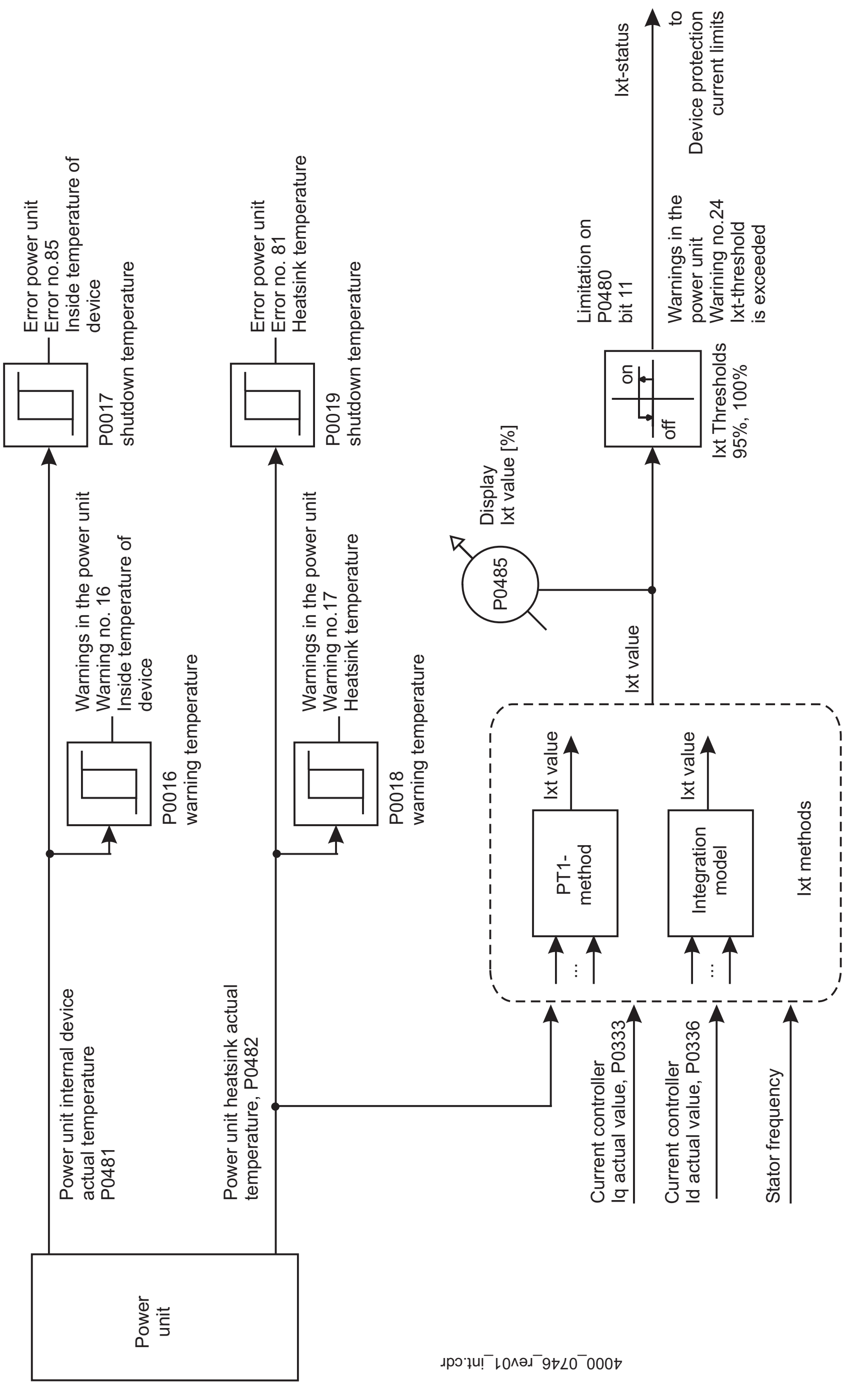


Figure 9: Device protection overload monitoring

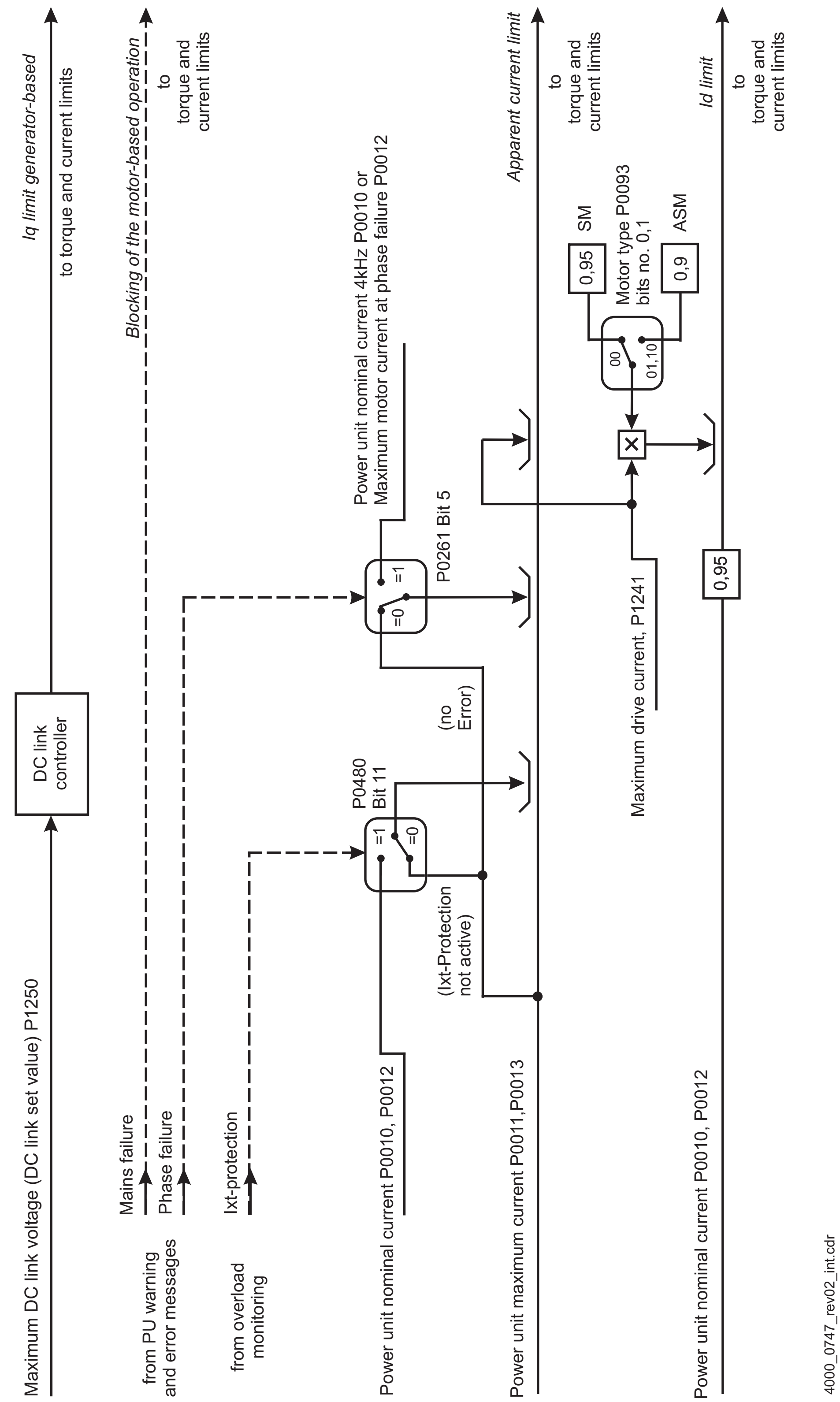


Figure 10: Device protection current limiting (standard devices)

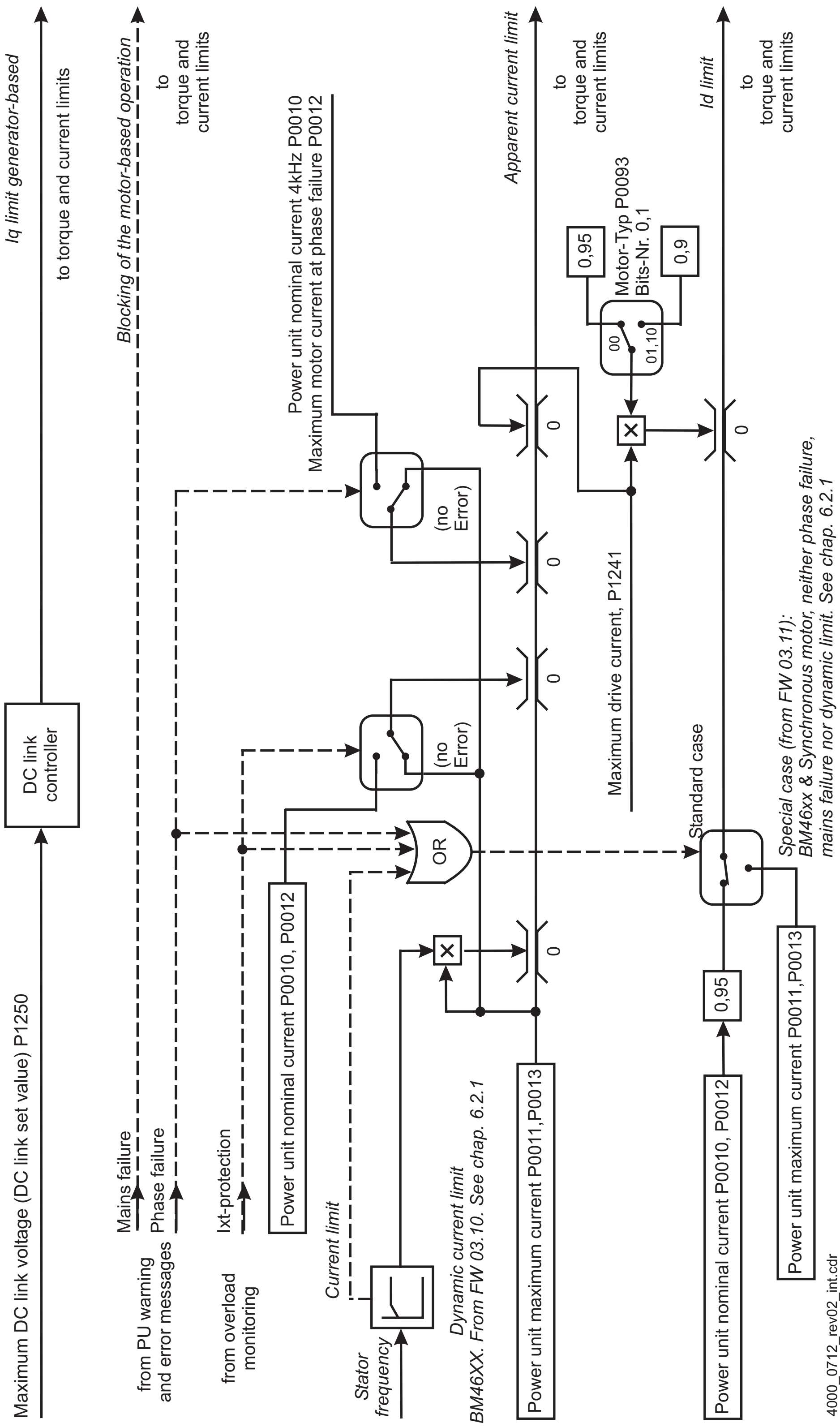


Figure 11: Device protection current limiting (BM46xx)

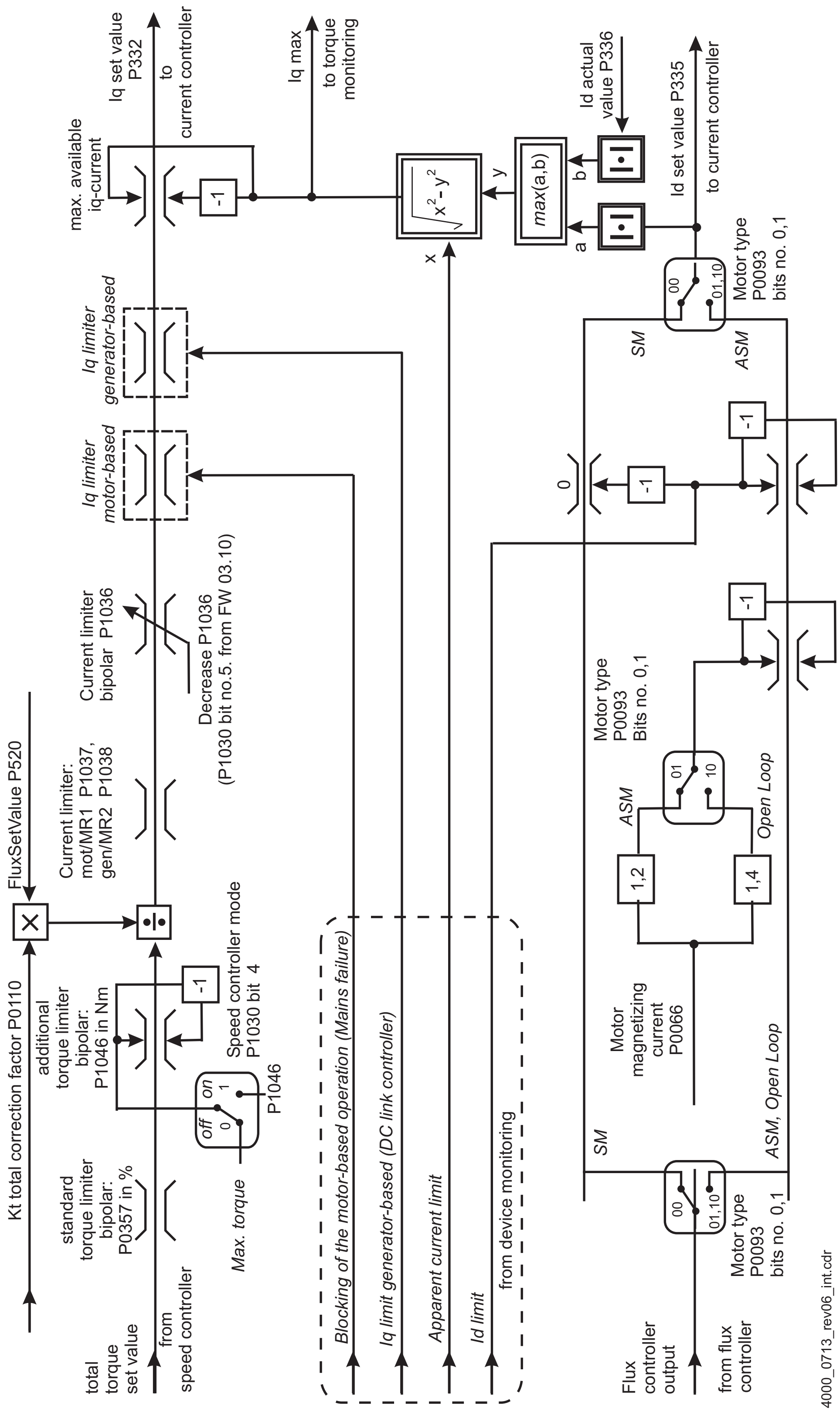


Figure 12: Torque limits and current limits

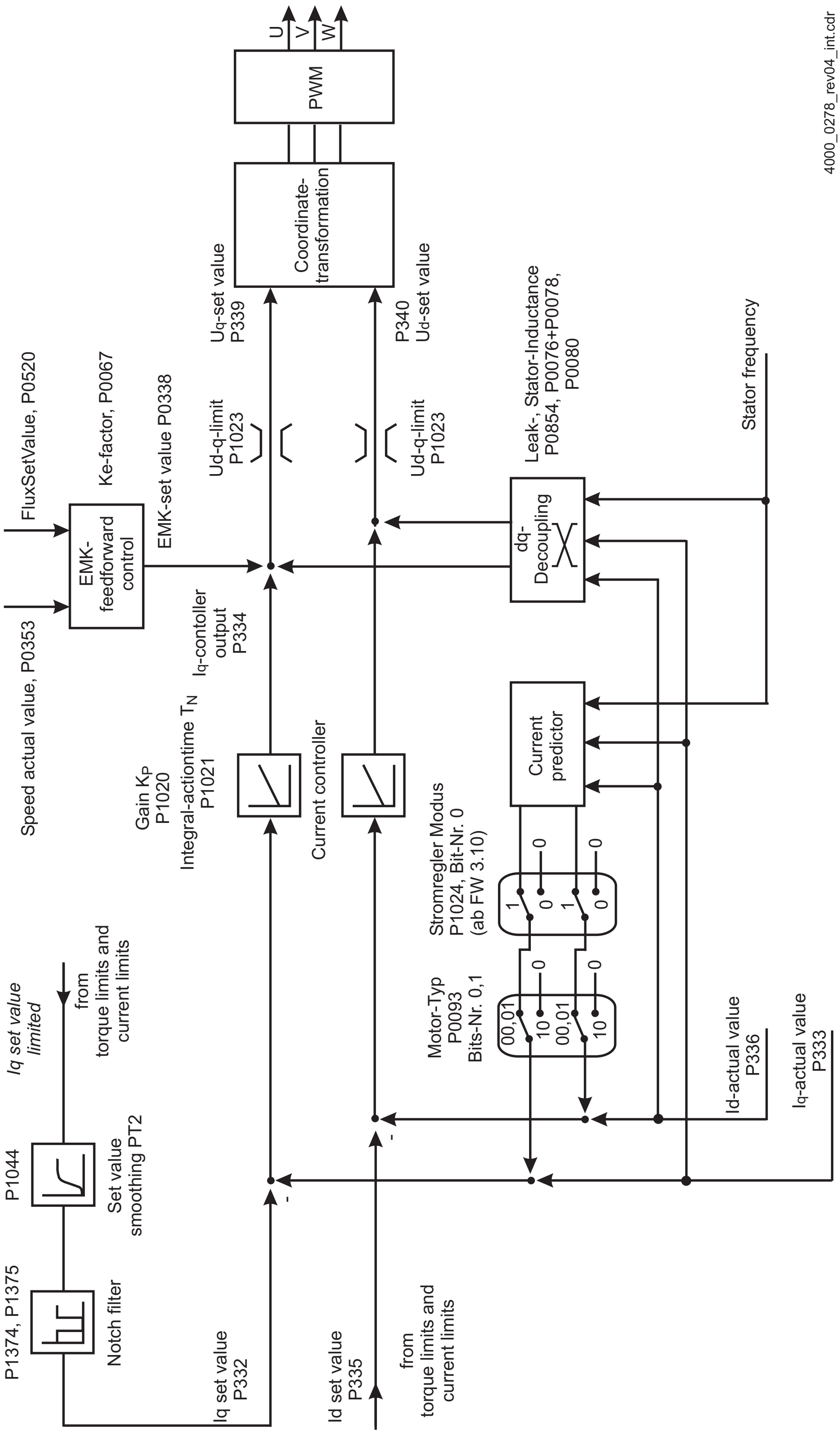


Figure 13: Current controller

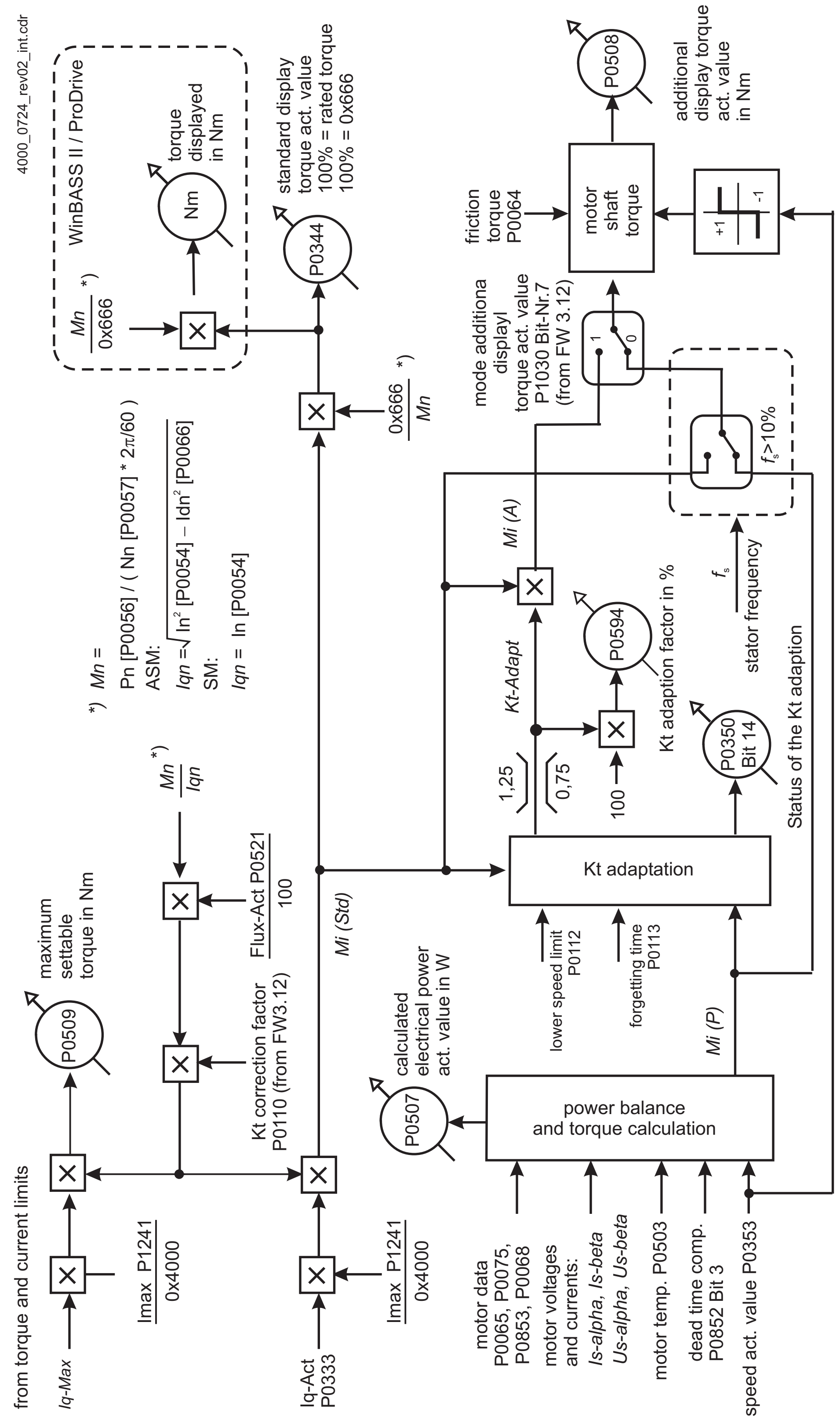


Figure 14: Torque monitoring

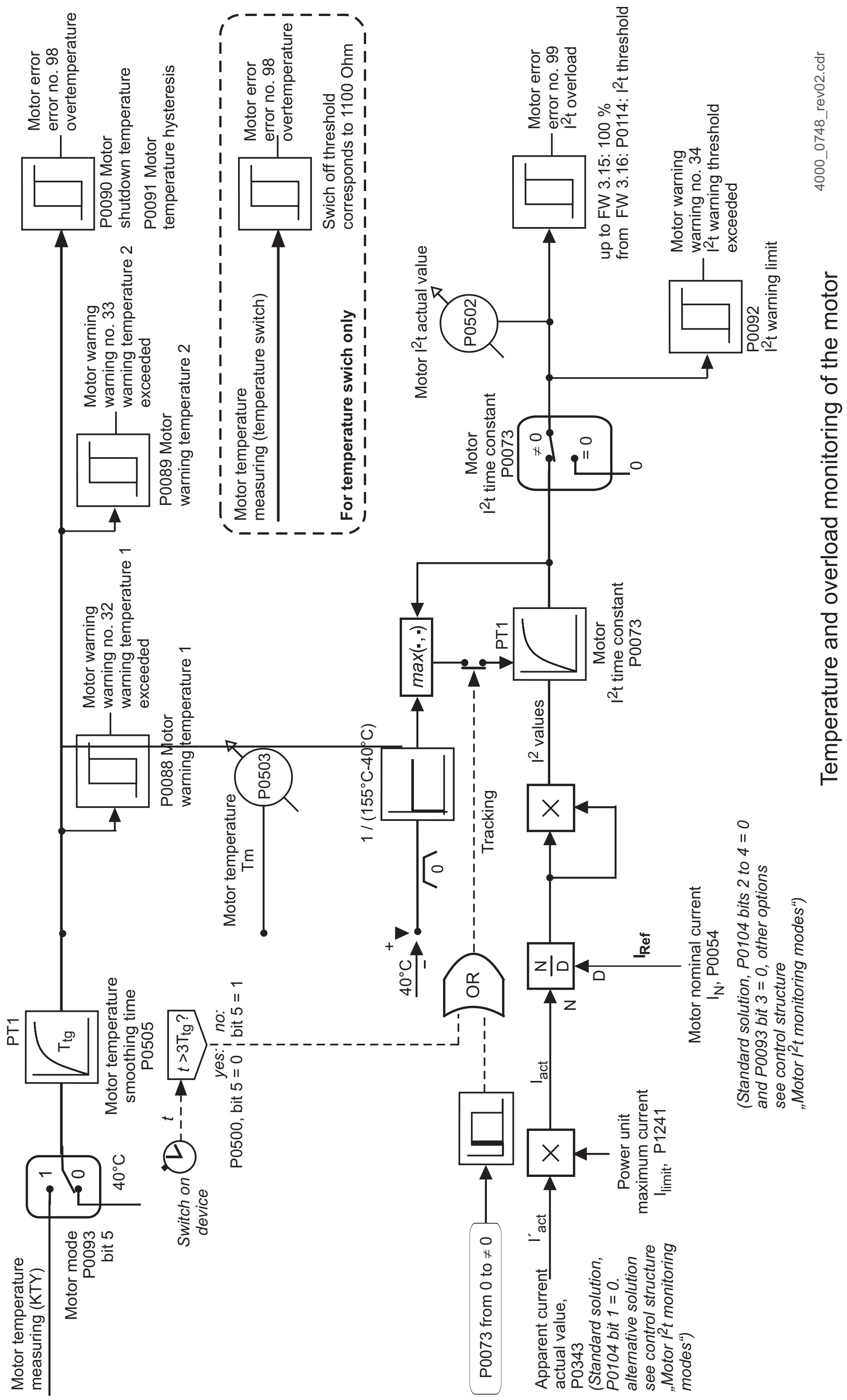


Figure 15: Motor protection

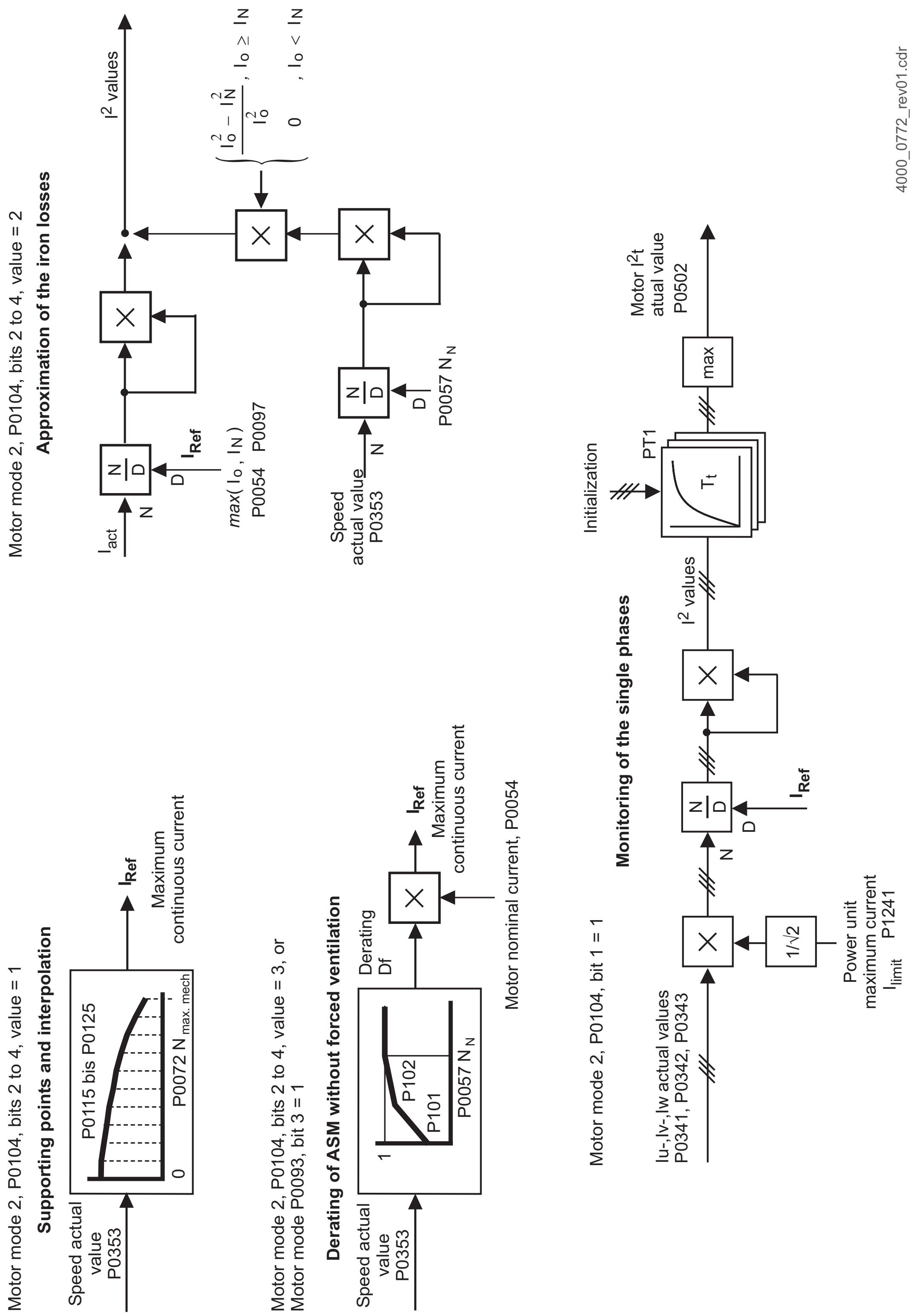


Figure 16: Motor I^2t monitoring modes

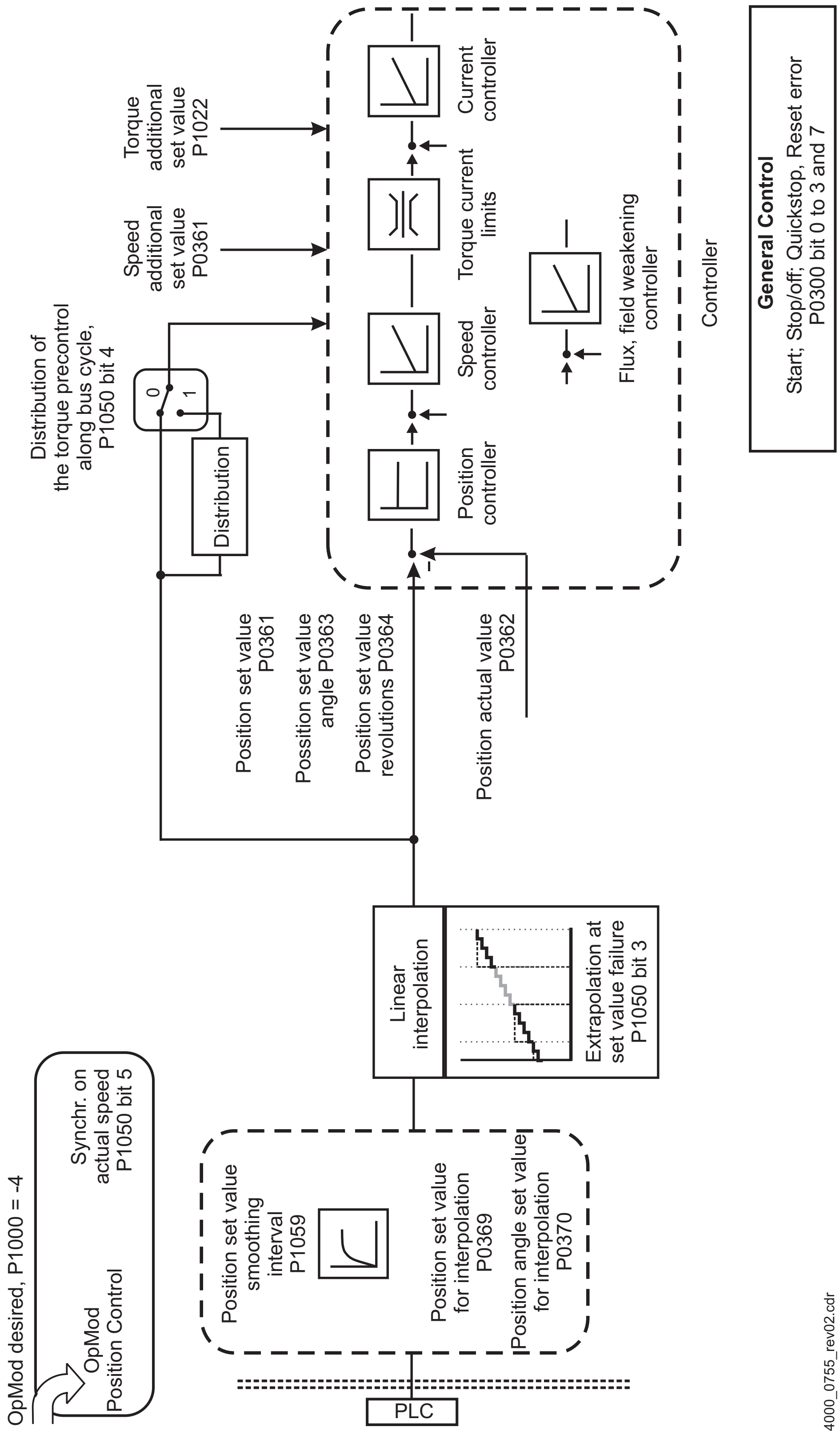


Figure 17: Operating mode position control (-4)

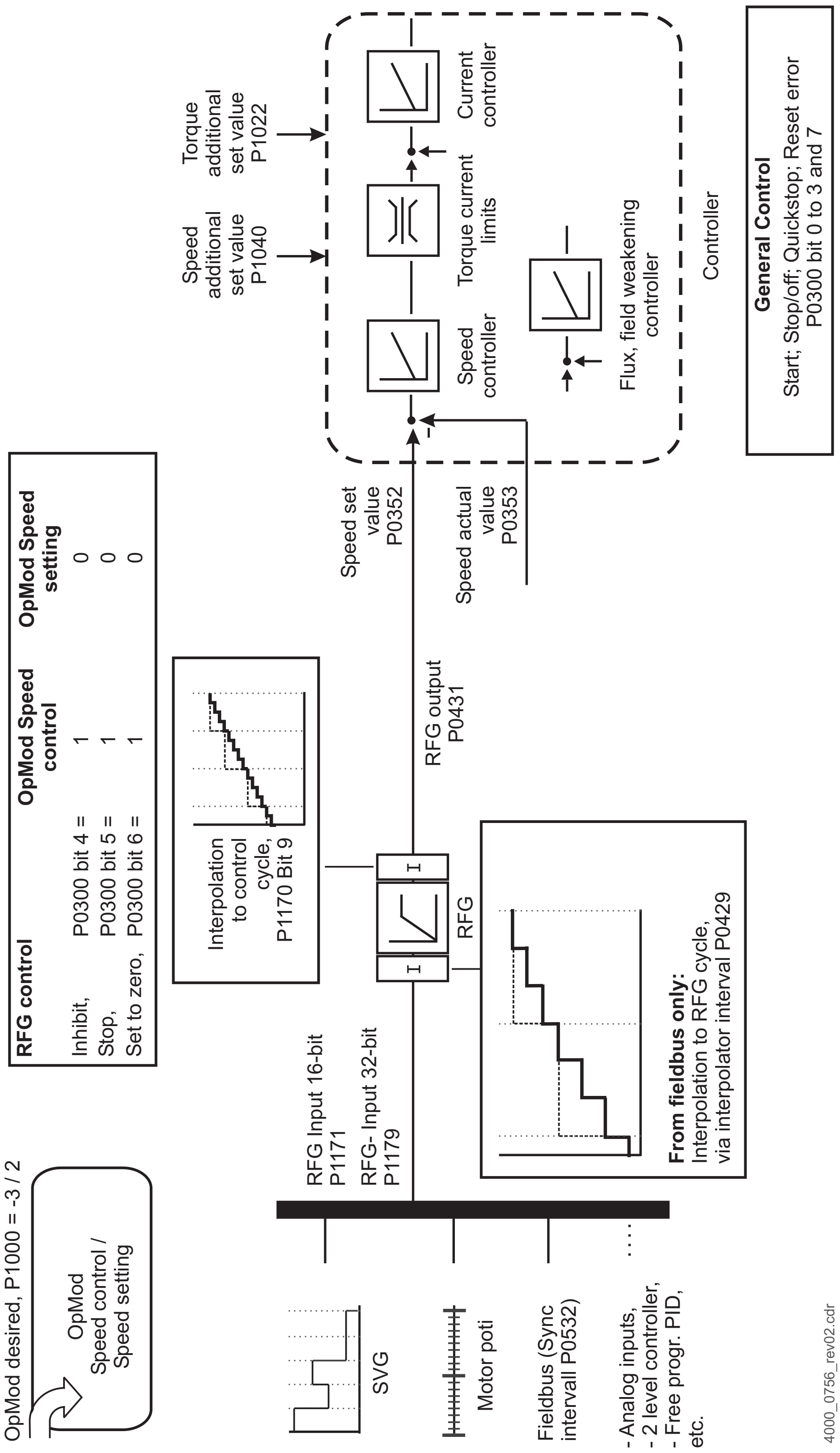


Figure 18: Operating mode speed control (-3) / speed setting (2)

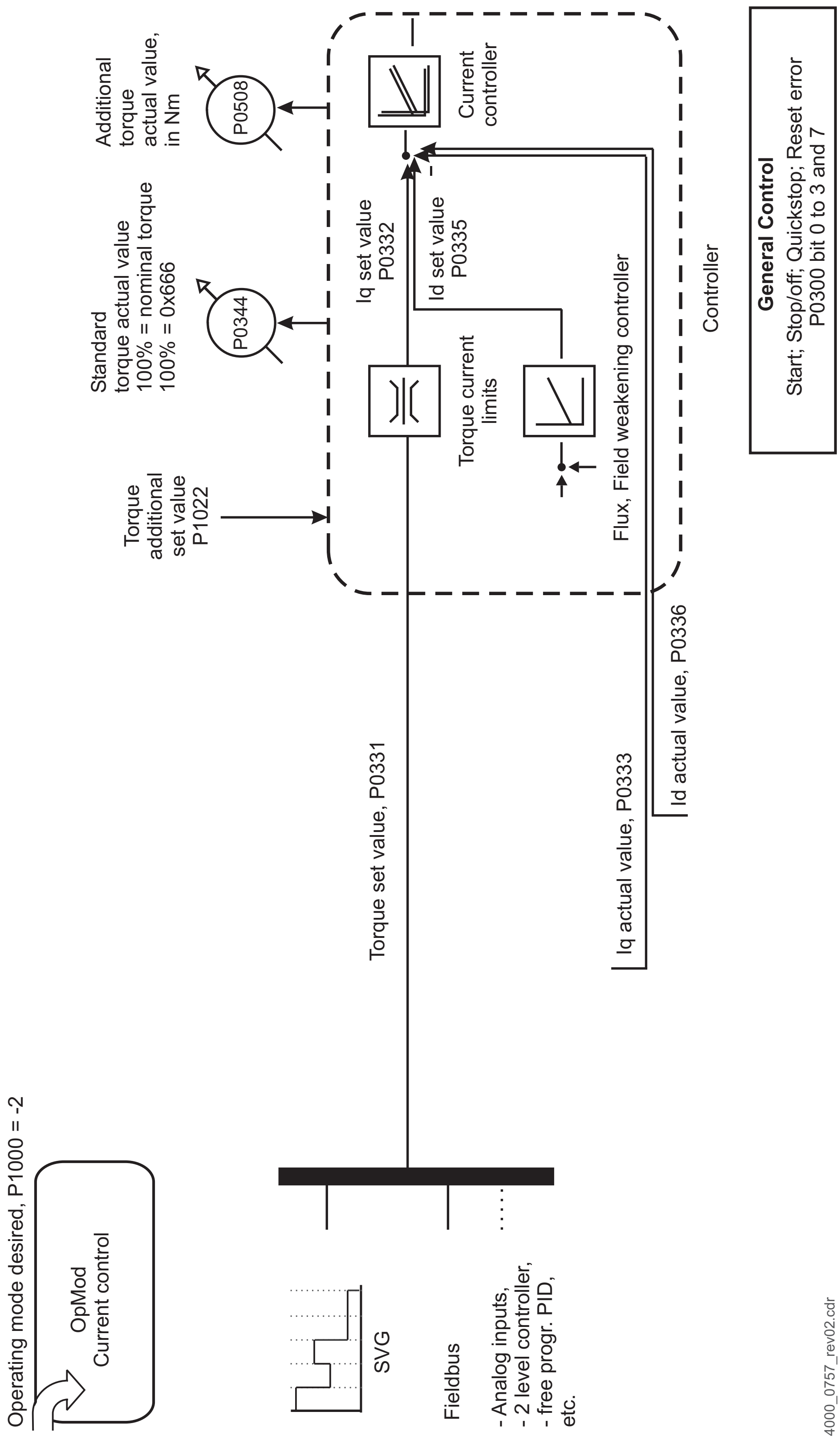


Figure 19: Operating mode current control (-2)

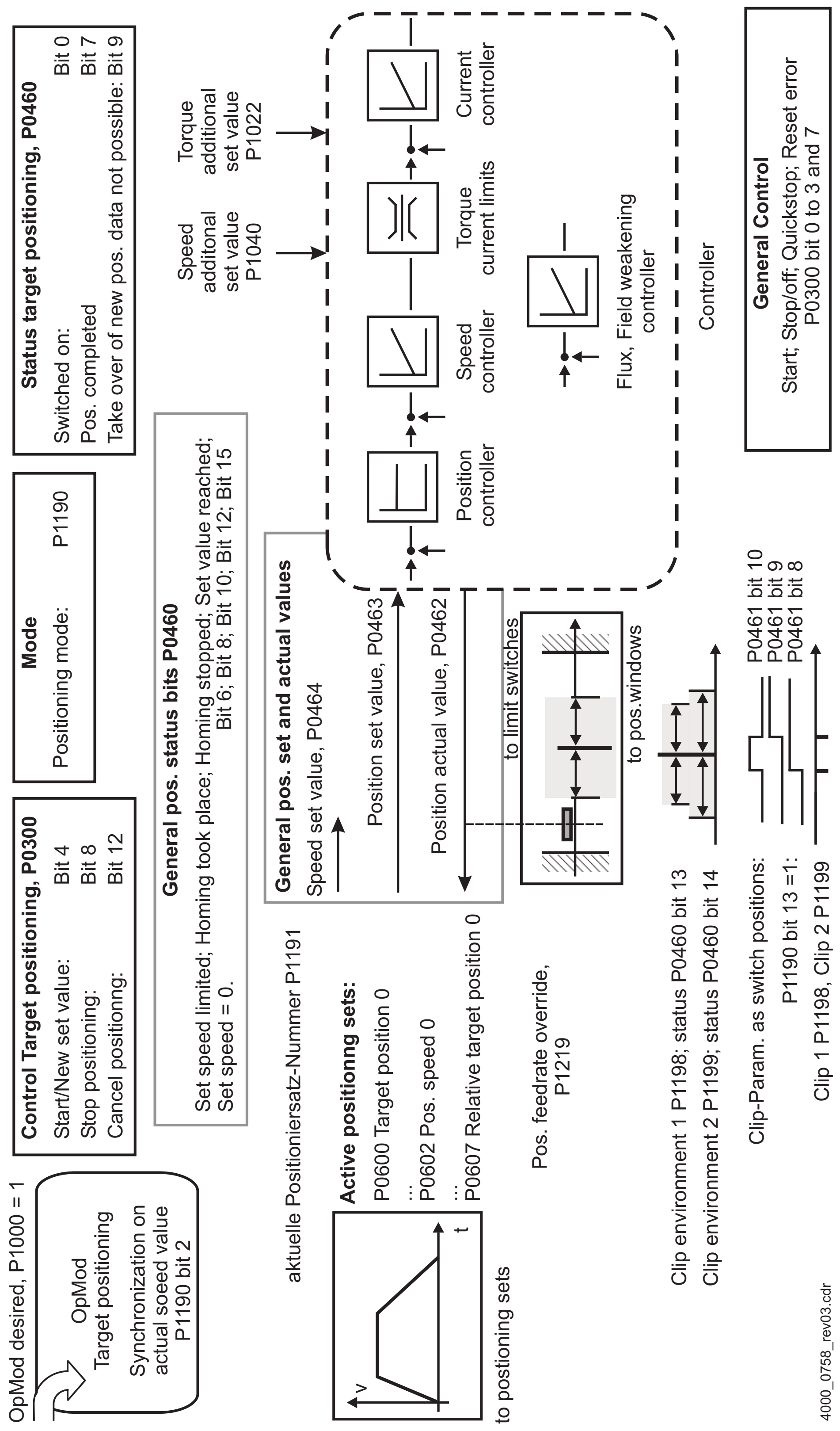


Figure 20: Operating mode target position set value (1)

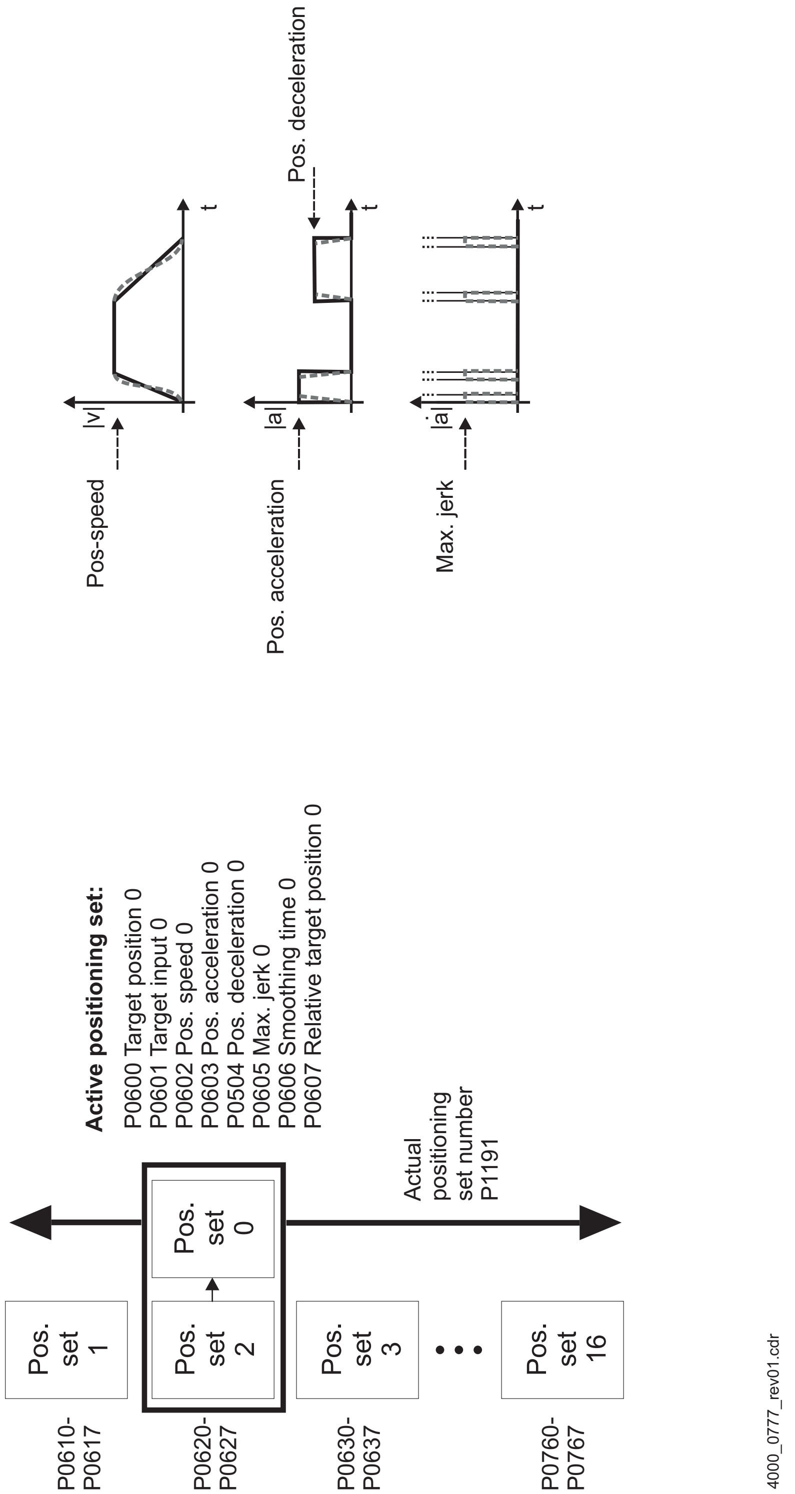


Figure 21: Operating mode target position set value, positioning sets

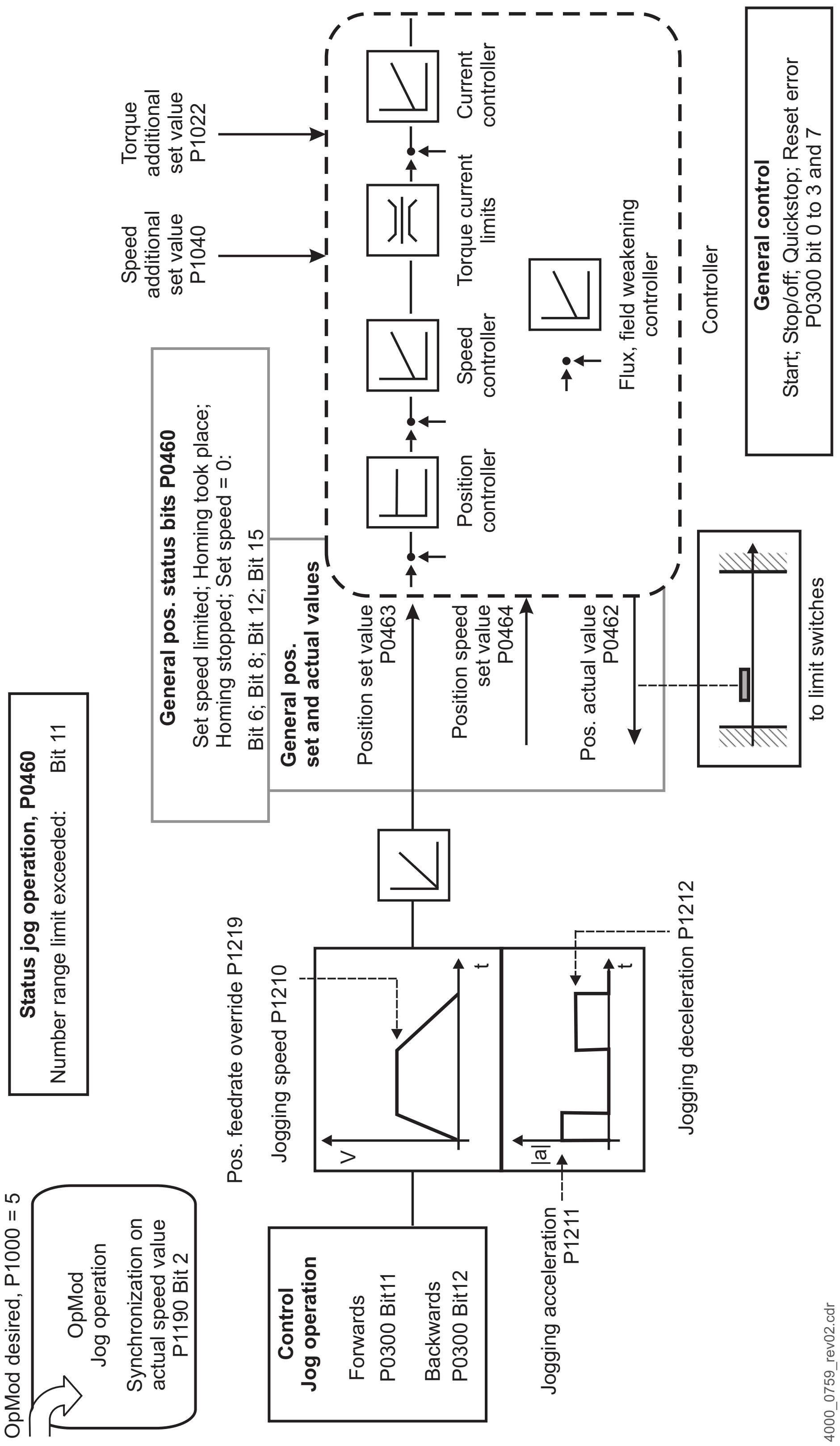


Figure 22: Operating mode jog operation (5)

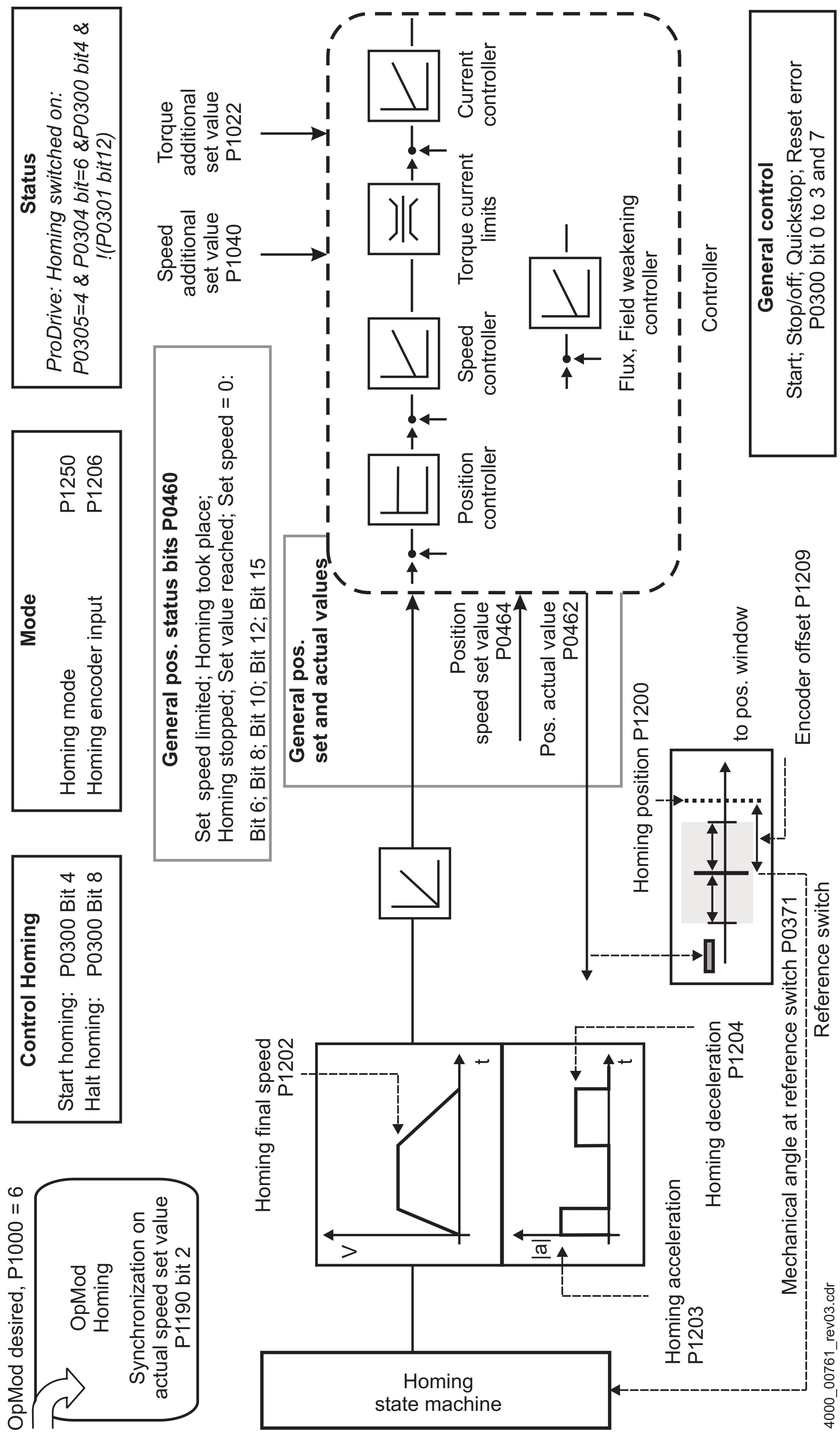


Figure 23: Operating mode homing (6)

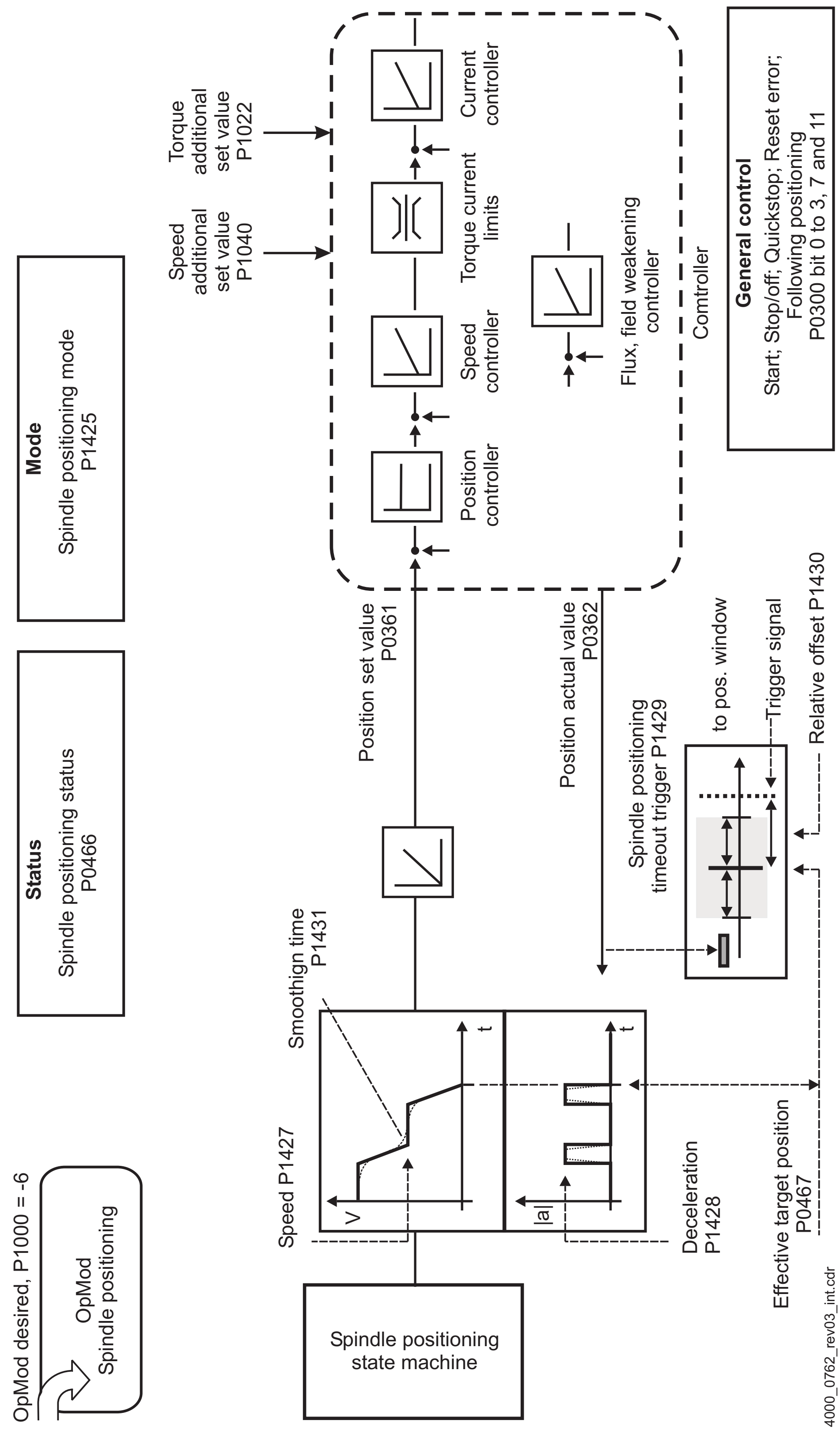


Figure 24: Operating mode spindle positioning (-6)

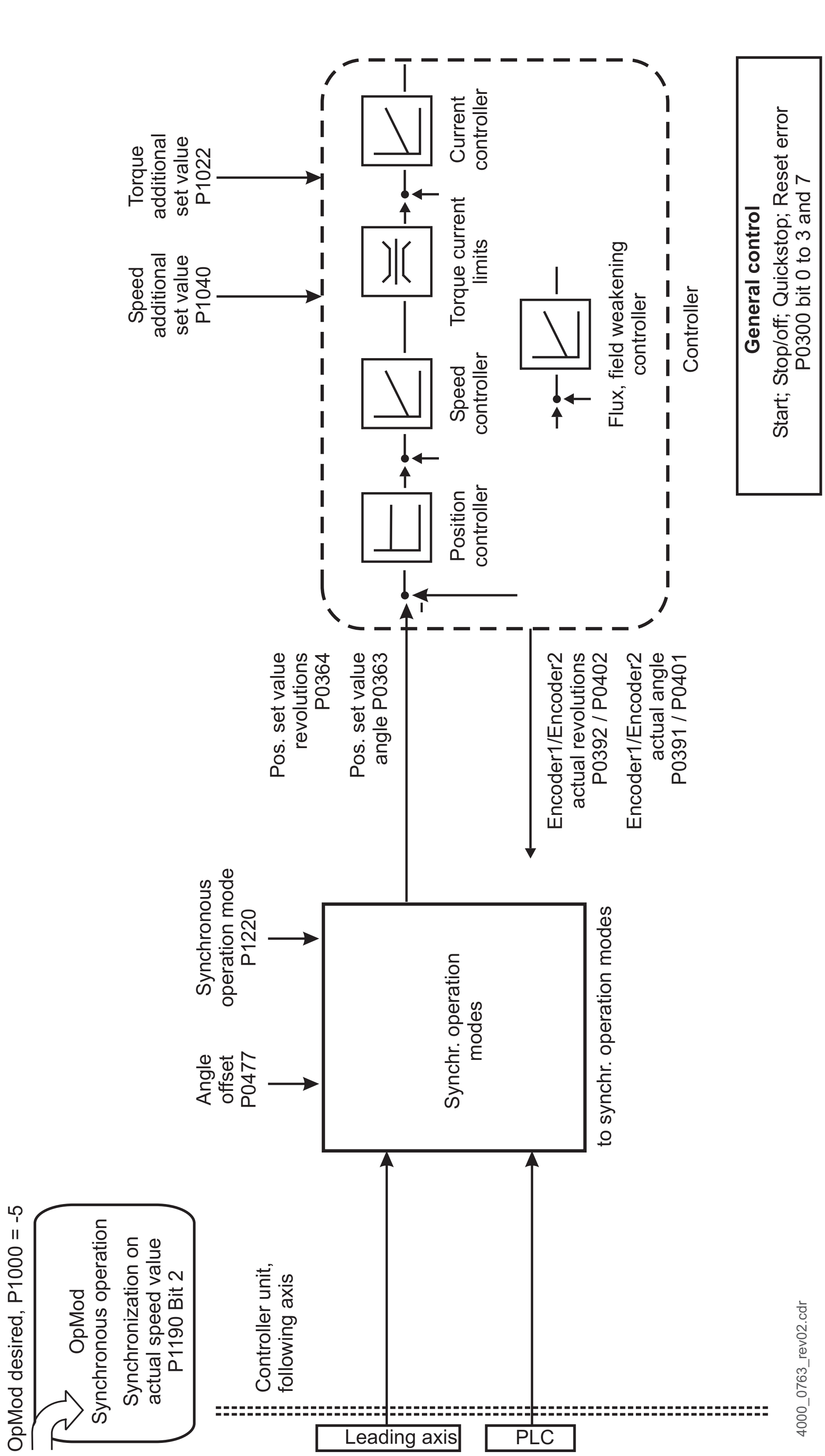


Figure 25: Operating mode synchronous operation (-5)

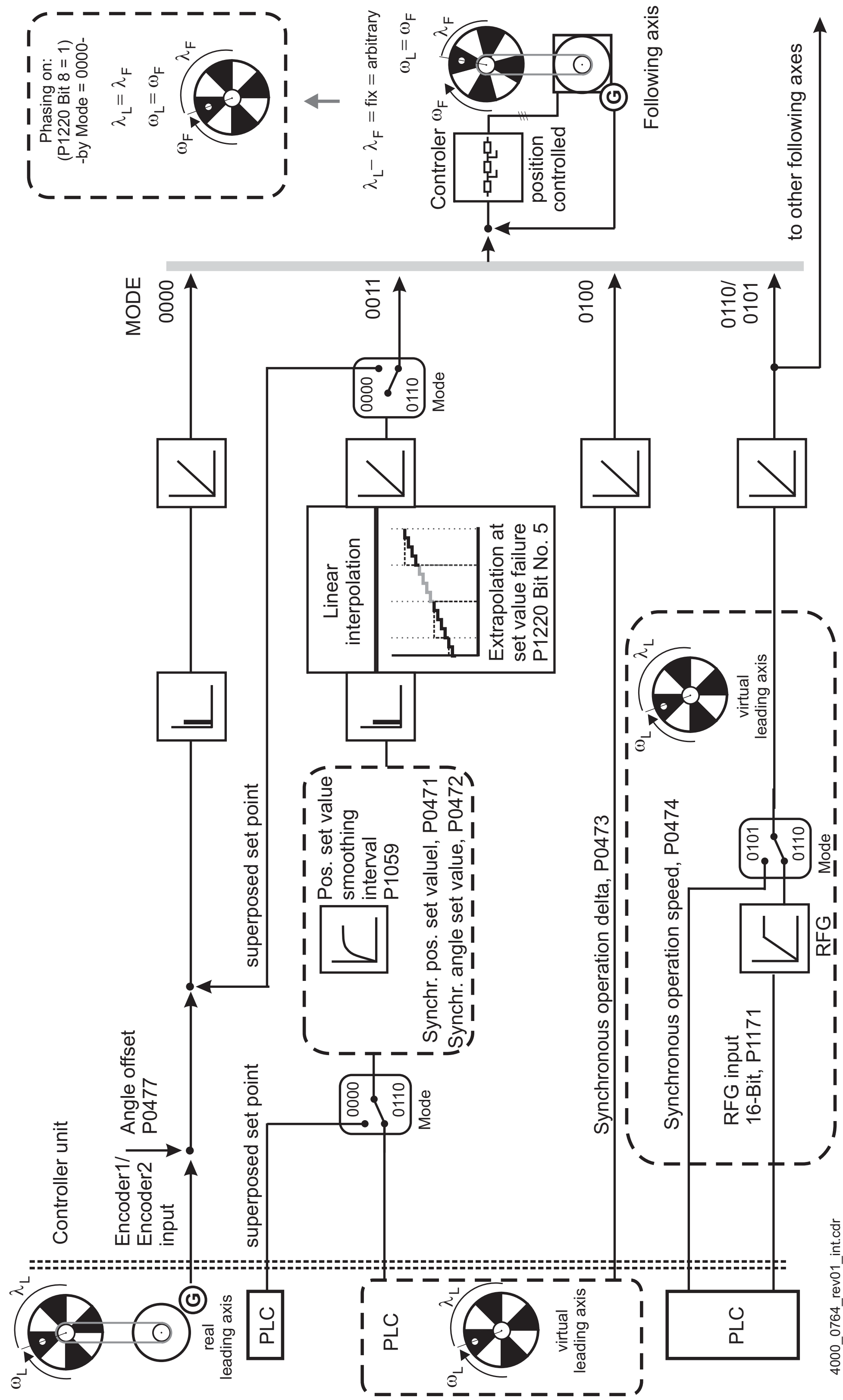


Figure 26: Operating mode synchronous operation - Modes of synchronous operation

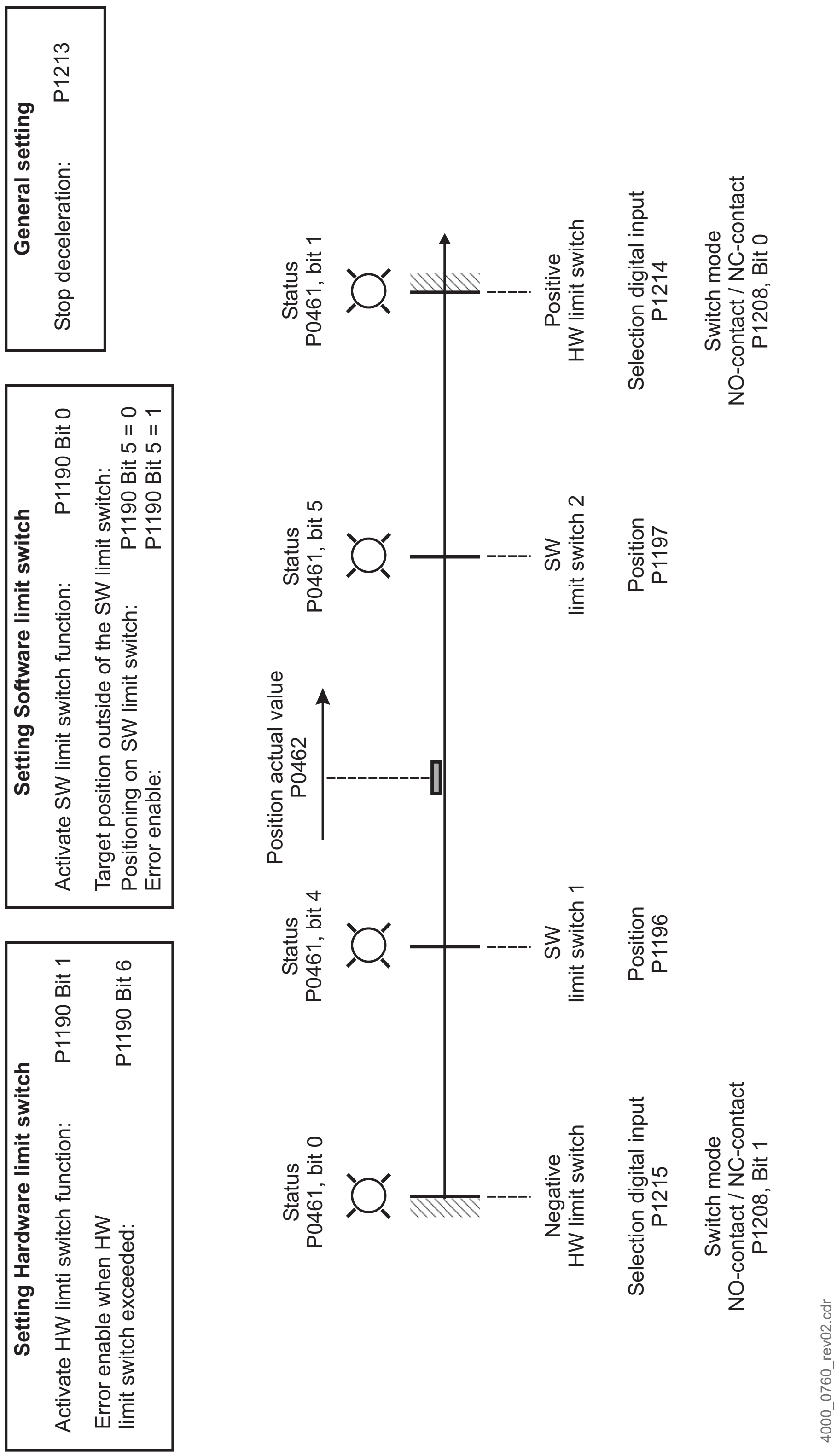


Figure 27: Limit switch

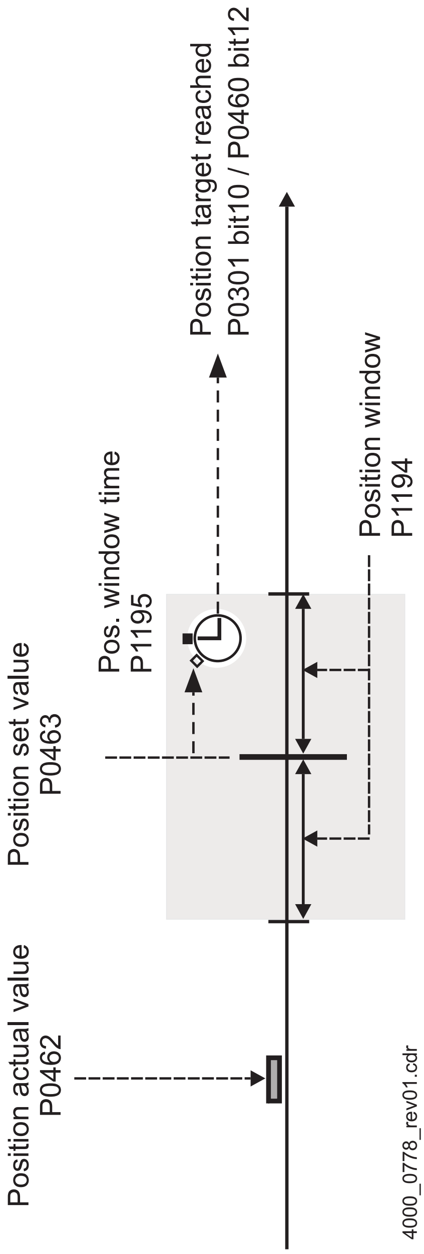


Figure 28: Positioning window

4

DATA MANAGEMENT

In this chapter we describe the functionality of the software module „Data Management“ and the data transfer via ProDrive.

It is described how to load and save parameters without connecting WinBASS / ProDrive and how to switch over. Besides that, also the operating principle of **PSI** (**P**arameter **S**torage **I**nterface) is explained.

All parameters, assigned to the ProDrive page „Data Management“ are described in chapter ▹Data management◃ from page 198.

4.1 General information

PSI

The PSI (Parameter Storage Interface) is an external data storage used to parameterize the device without WinBASS / ProDrive

Drive data

The complete configuration of the device is called drive data, i.e. all storable information in the EEPROM. The drive data include the complete controller parameters (parameter set) and information which is not assigned to the controller parameters e.g. measured dead time voltages.

Parameter set

The parameter set contains the complete controller parameters, which can be saved in the EEPROM of the controller or in the PSI. These parameters are saved either in '**central data**' or in the created, max. 8 switchable data sets.

Date sets

Data sets are 8 separated memory areas (DS1 - DS8) for special parameters (data set parameter). Data set parameters can be can be switched over in the online mode (operation enabled) (e.g. at change of recipe and so on).

Central data

Central data (ZD) are those parameters, which are valid for the total system and which must not be application-specifically switched over in the online mode (e.g. encoder-, motor-, system settings).

Data transfer / ProDrive

ProDrive enables the storage of the parameter set from the controller RAM in a PC data storage (Upload) or the download from the PC data storage into the controller RAM/ EEPROM or into the PSI.

Some parameters of the parameter set should not be downloadable into the controller RAM/EEPROM. These parameters (**not downloadable parameters**) are defined Baumueller internally.

From ProMaster/ProDrive-Version 1.14.01.10 it is possible to download the parameter set only into the controller RAM without writing into the EEPROM (parameterizations which require an EEPROM access, e.g. to create a data set, will be executed anyway and the EEPROM will be written).

NOTE!

During the download of the parameter set, the values resistance, inductance and/or dead time compensation data are transferred from the parameter set and activated for using. It must be proofed whether these data are correct for the connected motor. Otherwise the drive can start with uncontrollable movings. If you are not sure, whether the values are correct, start an auto-tuning of the drive.

Offline mode / ProDrive

With ProDrive it is possible to create a paramater set as a file in offline mode (ProDrive is not connected with the device), in order to download this file later into the devices.

Data set comparison / ProDrive

The comparison between data sets is possible in ProDrive.

4.2 PSI

On the front of the controller is a connector (X2) for an external data storage (external EEPROM), the **PSI** (**P**arameter **S**torage **I**nterface). Several machines can be parameterized by means of the PSI without WinBASS / ProDrive.

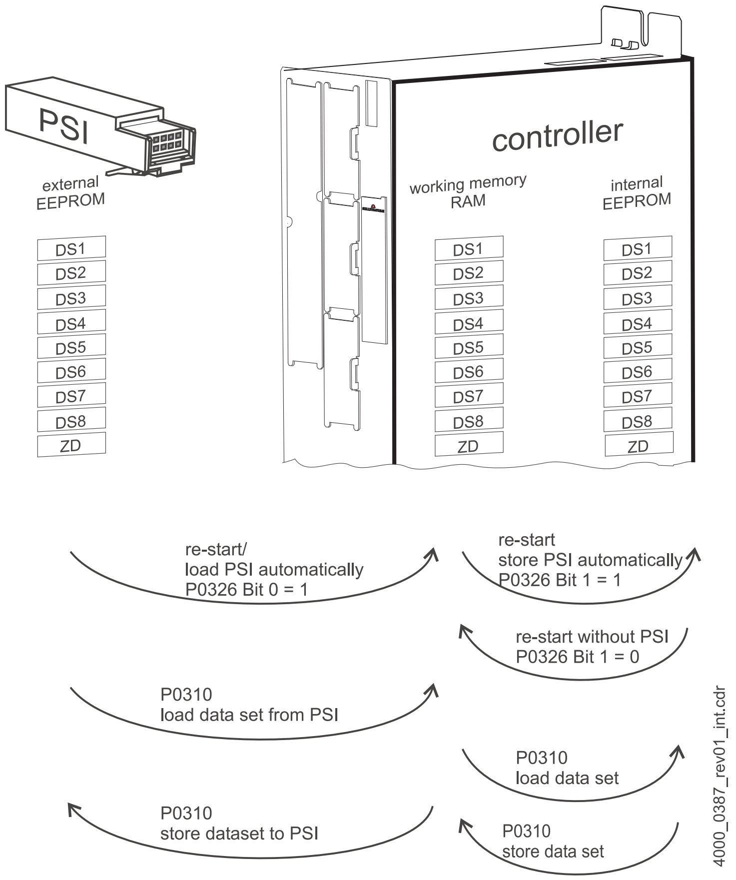


Figure 29: Data manager controller - PSI

	NOTE! The PSI must only be plugged or unplugged if the controller is without tension!

4.3 Data sets

4.3.1 Organization

Within the controller there are eight separate memory partitions for parameters marked by the ’data set’ attribute (DS1 to DS8).

The numbers of these parameters start from P1000. Parameter P1000 also exists in data set 1, in data set 2, in data set 3, ... and in data set 8.

Additionally there is a ’window’, which represents the actual active data set (DS 0). One of these eight data sets is always active. Data set 1,2,3,4,5,6,7 or 8 can be activated by writing to the parameter ▹P0312◃ Active data set number. Doing so, the window is shifted from DS 0 to the memory area of the activated data set.

Example:
Data set 3 is activated.
The ’window’ of the active data set addresses data set 3.

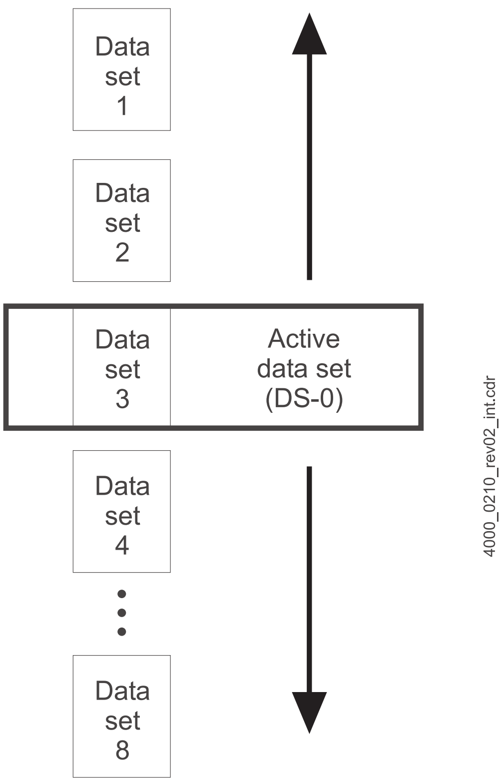


Figure 30: Active data set

Basically, by use of external option modules or field buses you can only access the data of the **active data set** (DS 0).

4.3.2 Marking

b maXX®® has two parameters for marking data sets:

Parameter	Data type	Meaning
▷P1010◁ Data set Identification number	UINT	Here you can mark each data set (DS1 to DS8) with an unique number from 0 to 65535
▷P1011◁ Data set name	STRING	Here you can assign each data set (DS1 to DS8) an arbitrary name

4.3.3 Data set switching

Data sets can be switched in online-mode (operation enabled), that means during active controlling.

Because of the mechanical inertia of the system to be controlled and the high controller sample rate you can assume a mechanical bumpless transfer.

NOTE!

When switching data sets you cannot regard inconsistent set values and monitoring values. During switch over it cannot be guaranteed, that e.g. a monitoring value of the new data set is less than the respective valid actual value of the data set, which was active before. In this case a monitoring function may be activated, which may e.g. cause pulse inhibit.

The activation doesn't take place via data management command ▷P0310◁ but only by writing of the according value in ▷P0312◁ Active data set number. In this parameter the user can read the number of the actual selected data set.

During input the following conditions are checked before data switching in online-mode (operation enabled):

1 Is the value ≤ 8 and ≥ 1?

2 Is the value valid, that means does the specified data set already exist?

3 Are the following parameter in the current data set and in the data set destination identical
a) PWM switching frequency (▷P1240◁)
b) Motor control encoder 1 or encoder 2 ▷P1030◁
c) Position control encoder 1 or encoder 2 ▷P1050◁

Only when above conditions are fulfilled, online-mode (operation enabled) data set switching can be performed.

Possible error messages:

- Data set not yet created
- Incorrect target data set number
- Currently a data transfer from EEPROM or PSI into the RAM or converse is active. Data set switching is not possible.
- Drive is not stopped (this error is only displayed in certain cases e. g. at encoder switching).

4.4 How to change, load, copy and save parameters

Changes of parameter values (e.g. by WinBASS II / ProDrive or via a field bus) only affect the user memory of the controller. The parameters must be explicitly saved in the EEPROM or the PSI if changes shall be kept at the next switch-on.

Central data and data sets

It is not possible to save a single parameter in the EEPROM/PSI, but only an entire data set. It is possible to save a single data set or all data sets. If a single data set or all data sets are saved, the central data is also saved automatically.

The data sets can be loaded separately or completely from the EEPROM or the PSI into the user memory with the data management command. An automatic data set switchover can occur with a complete loading, if the parameter value of ▹P0312◃ "Active data set number" in the EEPROM or the PSI does not differ from the actual value in the RAM.

The copy function of data sets allows to copy parameter values of a valid data set source into another data set target. If the data set target was not created yet, it is automatically created by the controller. If the data set target was created then the original parameter values are overwritten.

PC-data medium (up-/download)

The parameter set can be saved in a file (upload) with WinBASS II / ProDrive in a working directory or in the ProDrive project setting.

A parameter set can be loaded from a file in the working directory or in the ProDrive project setting into the controller RAM/EEPROM (download). The names of these files end with *.bpd.

4.5 Start-up behavior

- Without PSI
  After b maXX® was restarted the drive data, i.e. the parameter set (all parameters of the central data and all parameters of the created data sets) and the information which is unassigned to the controller parameters (e.g. the measured dead time voltages) are loaded from the controller-internal EEPROM into the user memory. The controller activates the data set, which is saved in parameter ▹P0327◃ Boot data set within the EEPROM. Invalid data sets are ignored.

- PSI are plugged and programmed
  If in the PSI the function 'load PSI automatically' ▹P0326◃ bit 0 = 1 is set, the parameter set is loaded from the PSI instead from the controller-internal EEPROM into the RAM after switching on.
  Due to further setting 'save PSI automatically' ▹P0326◃ bit 1 = 1, the data which was loaded from the PSI are automatically saved into the controller-internal EEPROM and the previous parameterization is reset.

  Several machines can be parameterized without WinBASS II / ProDrive by means of the PSI via this mechanism.

For the control of the switch-on behavior the mode bit of parameter ▹P0326◃ as they are saved in the PSI and not the bit of this parameter, which were set in the controller, because the parameter ▹P0326◃ is read out of the PSI immediately after switching on.

Subsequently the information which is unassigned to the controller parameters (e.g. the measured dead time voltages) is loaded from the controller-internal EEPROM into the RAM.

NOTE!

The settings for the loading behavior after switching on 'load PSI automatically' and 'save PSI automatically' (mode bits of parameter ▹P0326◃) are saved in the PSI module. If these settings are changed, the PSI always has to be programmed again, in order to save the settings in the PSI module.

4.6 State of delivery

In the delivery state only data set no. 1 is valid. The other data sets DS 2 to DS 8 are deleted. Boot data set and active data set (DS 0) are data set 1. All parameters have their default values. Switching to another data set is not possible.

After parameterization of the controller and homing or notch position search the parameters should be saved in the controller's internal EEPROM. In case an error occurs, when saving to the EEPROM (e. g. by switching off the controller during the programming procedure), the controller writes the default values in the parameter after switching on again (factory setting).

4.7 Software module data management

The software module data management includes the commands and the parameter with the help of which it is possible to load the values of parameters from the EEPROM/PSI into the RAM or to save the values of parameters from the RAM into the EEPROM/PSI. The switching on ratio can be parameterized with the data management. The data management enables the handling of data sets, e.g switching (or activation) of data sets, copying of parameter values between data sets, setting of the boot data set,...

4.7.1 Parameter overview

- ▹P0310◃ **Data management command**
  The values of the parameters can be loaded separately or completely in data sets from the EEPROM or the PSI into the user memory with the data management command. The parameter values of a created data set can be copied in another data set.

- ▹P0327◃ **Boot data set**
  The boot data set is defined over ▹P0327◃ and must be created yet.

- ▹P0311◃ **Data management status**
  In order to display the result, the status parameter ▹P0311◃ Data management status:
  - writing error (false value, parameter write-protected, invalid parameter number)
  - Error while reading
  - Command processing active
  - Error code

- ▹P0314◃ **Data set source**
  According to ▹P0310◃ data management command refers to data set source to the EEPROM or PSI (e.g. at loading of data set) or to the RAM (e.g. at data set save into EEPROM/PSI).

- ▹P0315◃ **Data set target**
  According to ▹P0310◃ the data management command the data set target refers to a data set in the EEPROM/PSI or in the RAM.

- ▹P0312◃ **Active data set number**
  The number of the active data set is displayed here. The setting of this parameter activates an immediate data set switchover in the online mode (operation enabled).

- ▹P0313◃ **Valid data sets**
  Bit mask in order to show which of the eight data sets are created in the controller.

- ▹P0316◃ **Error data set parameter**
  Shows the number of the parameter, where an error occurred at memory access (reading/writing). The transferring procedure is continued at the next parameter if an error occurs during command processing - it does not interrupt the transferring procedure. When multiple errors occur, only the last error will be displayed.

- ▹P0317◃ **EEPROM write count**
  Number of EEPROM write cycles. This counter is incremented at each command which activates a memory access to the EEPROM.

- ▹P0318◃ **PSI write count**
  Number of PSI write cycles to the PSI. This counter is incremented at each command which activates a memory access to the EEPROM.

- ▹P0325◃ **PSI valid data sets**
  Bit mask in order to show the created data sets in the PSI.

- ▹P0326◃ **PSI mode**
  Switching on ratio with connected PSI

- ▹P1010◃ **Data set ID**
  Relate a unique identification number (0 to 65535) to every data set (DS 1 to DS 8).

- ▹P1011◃ **Data set name**
  Assign a free selected name (max. 80 characters) to every data set (DS 1 to DS 8)

4.7.2 Control interfaces

The software module data set manger responds via WinBASS II / ProDrive or via the field bus.

A command is activated via fieldbus by writing a command code into parameter ▹P0310◃ data management command. Additional auxiliary parameters (as e.g. ▹P0314◃ Data set source) must be also entered.

When operating the system via WinBASS II / ProDrive, no data set command codes or auxiliary parameters must be observed; the user interface does this automatically.

4.7.3 Data management commands and possible error messages

The values of the parameters can be loaded separately or completely in data sets from the EEPROM or the PSI into the user memory with the data management commands in ▹P0310◃ and additional auxiliary parameters (as e.g. ▹P0314◃ Data set source). The copy function of data sets allows to copy parameter values of a valid data set source into another data set target.

- **Quit data management**

This command resets the internal state machine of the data management module and leads to a reset of all error bits or to the error status word of the data management status ▹P0311◃.

- Possible error messages:
  none

- **Save all parameters from the created data sets into EEPROM**

This command saves all parameters of the generated data sets from the RAM into the EEPROM. One of the data sets also can be the active data set in the online mode (operation enabled). During copying procedure into the EEPROM a data set switching is allowed.

This command causes incrementation of the write count ▹P0314◃ EEPROM write count.

Possible error messages:

- no or invalid EEPROM header
- Invalid section in EEPROM
- Invalid data in EEPROM
- EEPROM write error
- EEPROM too small
- unidentified error

- **Completely load EEPROM into RAM**

This command loads all drive data from EEPROM into the RAM of the controller. Only the data sets are read, which have been generated in the controller. The numerically assignment of the data sets in EEPROM and RAM is kept.

An automatic data set switchover can occur with a complete loading, if the parameter value of ▹P0312◃ "Active data set number" in the EEPROM or the PSI does not differ from the actual value in the RAM.

During copying procedures the switching of data sets is invalid.

Possible error messages:

- Drive not stopped
- Value less than the minimum value
- Value greater than the maximum value
- Read-only parameter
- Parameter cannot be changed because of operational status
- Invalid parameter value
- Checksum error during test

- **Completely delete EEPROM**

This command deletes the header entry in EEPROM only. Thus all data within EEPROM expire their validity.

This command causes incrementation of the write count ▹P0317◃ EEPROM write count.

Possible error messages:

- EEPROM write error
- unidentified error

- **Set default values for active data set**

This command writes the standard values from the ROM (factory set) into all parameters of the active data set. Only possible in the offline mode (at a stopped drive).

Possible error messages:

- Drive not stopped

- **Set default values for all generated data sets**

This command writes the standard values from the ROM (factory set) into all parameters of the generated data sets. Only possible in the offline mode (at a stopped drive).

Possible error messages:

- Drive not stopped

- **Create data set <n>**

A state of delivery controller has one data set (data set 1), which is created and activated. The user cannot switch over to other data sets. The controller allows to switch over in another data set, if the user generates a further data set (2 to 8) via this command . This action shall guarantee, that the user does not switch over to an unchanged data set. The user that way is forced to willingly enable a data set for switching.

This command creates a data set, which can be selected by ▹P0315◃ Data set target. The parameter values of this data set are set to default values and are saved in the EEPROM.

This command causes incrementation of the write count ▹P0317◃ EEPROM write count.

Possible error messages:

- data set already was created
- Wrong data set number (other than 1 to 8)

- **Delete data set <n>**

This command deletes the attribute „Created“ of a data set (see ▹P0313◃). When a data set becomes deleted, the controller can no longer switch to that data set. No values - neither in the EEPROM, nor in the RAM of the controller are changed. Only the flag is updated in the EEPROM, which shows what data sets were created. The data set stated in ▹P0315◃ Data set target must not be the data set, which is active at the moment.

This command causes incrementation of the write count ▹P0317◃ EEPROM write count.

Possible error messages:

- Data set not yet activated
- Wrong data set number (other than 1 to 8)

- **Copy data set <x> to data set <y> (from RAM into RAM, result into EEPROM)**

In the RAM this command copies parameters from data set x (▹P0314◃ data set source) to parameters of data set y (▹P0315◃ data set target). The copying procedure takes a few milliseconds - therefore this command is valid in offline-mode (drive stopped) only.

Only existing data set sources must be specified. If a data set target is specified, which is not existing, then it is automatically generated. If the data set target was created then the original parameter values are overwritten. Finally the copied data are saved into the EEPROM (=data set target).

Thereby the write count is incremented ▹P0317◃ EEPROM write count.

Central data is also saved to EEPROM.

Possible error messages:

- Data set not yet activated
- Wrong data set source number
- Wrong data set destination number
- Drive not stopped

- **Load data set <x> from EEPROM into RAM data set <x>**

This command loads all parameters of data set x (▹P0314◃ data set source) from the EEPROM into the controller's user memory. The data set target corresponds to the data set source. The data set must have been generated. The data set must not be the actual active data set in online-mode (operation enabled). During the copying procedure the switching of data sets is inhibited.

Possible error messages:

- Data set not yet activated
- Wrong data set source number
- Drive not stopped
- Value less than the minimum value
- Value greater than the maximum value
- Read-only parameter

- Parameter cannot be changed because of operational status
- Invalid parameter value
- Checksum error during test

- **Save data set <x> from RAM into EEPROM data set <x>**

This command saves all parameters of data set x (▷P0314◁ data set source) from RAM into EEPROM. The data set must have been generated. In online-mode (operation enabled) the data set can also be the actual active data set. During the copying procedure into the EEPROM the data set switching is allowed.

This command causes incrementation of the write count ▷P0317◁ EEPROM write count.

Central data is also saved to EEPROM.

If the EEPROM is reset, the controller saves the data sets, which were created into the EEPROM.

Possible error messages:

- Data set not yet activated
- Wrong data set source number
- no or invalid EEPROM header
- Invalid section in EEPROM
- Invalid data in EEPROM
- EEPROM write error
- EEPROM too small
- unidentified error

- **Save all parameters of the valid data sets into the PSI**

This command saves all parameters of the generated data sets from RAM into PSI. One of these data sets can also be the active data set in the online mode (operation enabled). During copying procedure into PSI a data set switching is inhibited.

This command causes incrementation of the write count ▷P0318◁ PSI write count .

Possible error messages:

- PSI not plugged
- Unidentified error

- **Load PSI completely into RAM**

This command loads the parameter set from PSI into the controller RAM. The numerically assignment of the data sets in PSI and RAM remain.

During copying procedures the switching of data sets is invalid.

After reading the PSI the controller takes over the data set configuring from the PSI into the user memory (RAM). Due to this, the controller resets the data sets, which were generated in the controller, but were not saved in the PSI. Accordingly the controller generates new data sets in the RAM, which were read from the PSI and which were not generated in the controller yet. In order to receive this new configuration after the next switch-off, the command „Write all parameters of the generated data sets into EEPROM“ must be executed.

Possible error messages:
- PSI not plugged
- PSI reset
- Drive not stopped
- Value less than the minimum value
- Value greater than the maximum value
- Read-only parameter
- Parameter cannot be changed because of operational status
- Invalid parameter value
- Checksum error during test

- **Reset PSI completely**

This command resets PSI. Thus all data within EEPROM expire their validity (the attribute „Created“ is lost).

This command causes incrementation of the write count ▹P0318◃ PSI write count .

Possible error messages:
- PSI not plugged
- Writing error on PSI

4.7.4 Survey of data management commands

▹P0310◃ Data set management Command	Value	▹P0314◃ Data set source	▹P0315◃ Data set desti-nation	▹P0317◃ EEPROM write count	▹P0318◃ PSI write counts	Central data
Quit data management	0					
Save all parameters of the valid data sets into EEPROM	1			Counter is incremented		yes
Completely load EEPROM into RAM	2					
completely delete EEPROM	3			Counter is incremented		yes
Set default values for active data set	4					
Set default values for all generated data sets	5					yes
Create data set <n>	6		Data set to be created	Counter is incremented		
Deleted data set <n>	7		Data set to be reset	Counter is incremented		
Copy data set <x> to data set <y>	8	Source data set	Data set desti-nation	Counter is incremented		yes
Load data set <x> from EEPROM	9	Data set in EEPROM				
Save data set <x> into EEPROM	10	Data set in RAM = EEPROM		Counter is incremented		yes
Write all parameters of the valid data sets into the PSI	12				Counter is incremented	yes
Load PSI completely into RAM	13					
Reset PSI completely	14				Counter is incremented	yes

5

COMMISSIONING

In this chapter we describe an exemplary commissioning of a b maXX® device with a Baumüller motor DS 56-M with resolver or sine-cosine encoder with HIPERFACE®. Execute the commissioning, to make sure that the delivered devices are in an accordant condition. This commissioning is **not** for the complete installation of the device for your application.

5.1 Safety instructions

Please refer to the relevant information in chapter ▷Fundamental safety instructions◁ from page 11.

DANGER!

Risk of fatal injury from electrical current!

The control cabinet is equipped with power cables which carry dangerous voltages.

Therefore:

- Disconnect all relevant cables from voltage (all cables in no-voltage condition) and protect them against accidental reactivation.
- Refer to the relevant safety rules when commissioning power electronics.

5.2 Requirements to the executing personnel

The personnel, who is assigned for commissioning, must have enough knowledge about:

- Safety technology
- PC-operation (windows),
  especially in the program WinBASS II (up to FW 03.09) or ProDrive (from FW 03.07)
- Connection and operating methods of the device b maXX® 4400.

5.3 Preconditions

The commissioning is an exemplary checking of the functionality of the device. When commissioning you assure yourself if the device is ready for operation.

Commissioning with Baumüller motors

The, described, exemplary commissioning is specified to Baumüller motors. In order to reduce the scope of work, a motor database is provided within the operating software WinBASS II / ProDrive, which provides the most values automatically (reads out), so that the checking of the values can be concentrated on.

If, however, another configuration (e. g. another encoder) is selected, more values must be entered, because the reading of the data isn't available completely anymore.

Commissioning of motors of other manufacturers

Motors of other manufacturers we have not included into the motor data base. In this case the values must be fed on one's own initiative. However, it is possible to include these motors into the motor database.

WARNING!

Risk of fatal injury from mechanic effects!

With a non-free-rotating motor the motor and parts, which are connected to the motor can be damaged/destroyed.

Therefore:

- Assure, that the motor can rotate freely during commissioning.

5.4 Preparations

Precondition for the commissioning is that mounting and installation are correctly executed.

1 Assure, that mounting is correctly executed and especially that all related safety instructions were referred to (see mounting in manual of b maXX® 4400).

NOTE!

Figures referring to the next working steps are found in the manual of the basic unit b maXX® 4400 .

2 Assure, that the installation is correctly executed, and that especially all related safety instructions were referred to.

3 WinBASS II / ProDrive must be installed onto the PC/laptop. The controller firmware versions, which are supported by WinBASS II / ProDrive are found in WinBASS II / ProDrive-Online-Help in the menu 'User indications/supported b maXX® devices'.

NOTE!

The controller firmware versions, which are supported by WinBASS II are found in the WinBASS II online help in the menu 'User indications/Supported b maXX® devices', or on the WinBASS II CD in the readme file under 'User indications/Supported b maXX® devices'.

At commissioning you can, among other things, enter motor and encoder data in the operating software or make corrections of wrong values. In order to efficiently execute the commissioning, it is advantageous to have all data when starting with commissioning. Data for Baumüller motors are within the operating software in the form of the 'motor database'.

4 Assure, that you have all the necessary data.

Motor data (type plate)

This data e. g. is found on the type plate of the motor, which is used at commissioning.

Name	Value, e. g.	is used to enter in parameter list/parameters
Motor type, -designation	DS 56-M	Parameter list/configuration motor ▷P0050◁ Motor type code
Rated voltage U_N	330 V	Parameter list/configuration motor ▷P0053◁ Motor nominal voltage
Rated current I_N	4.0 A	Parameter list/configuration motor ▷P0054◁ Motor nominal current
Rated speed n_N	3000 RPM	Parameter list/configuration motor ▷P0057◁ Motor nominal speed

In this example we are using the motor data base, the values from the chart then only serve as a purpose of control.

Motor data (data sheet)

This data is to be found on the data sheet of the motor, which you use when you are commissioning.

Name	Value, e. g.	is used to enter in parameter list/parameters
Limit current I_{peak}	14.3 A	Parameter list/configuration motor ▷P0069◁ Motor peak current
Number of pole pairs	3	Parameter list/configuration motor ▷P0065◁ Motor number of pole pairs
Max. speed $n_{max.}$	6000	Parameter list/configuration motor ▷P0072◁ Motor maximum speed mechanic
Notch position, if specified[1)]	240°	Parameter list/configuration motor ▷P0082◁ Motor notch position

[1)] You can also let the notch position be determined by WinBASS II / ProDrive (see ▷Find notch position◁ on page 77).

Encoder data (data sheet)

This data you will find on the data sheet of the encoder, which you use during commissioning.

Name	Value, e. g.	is used to enter in parameter list/parameters
Encoder type	Stegmann SinCos® SRS 50	at sine-cosine encoders with HIPERFACE®interface the encoder type is automatically entered via the HIPERFACE®interface
PPR count	1024	Parameter list/configuration encoder/BM_u_Enc1-PulsesPerRev
Encoder type	Resolver	-
PPR count	1	Parameter list/configuration encoder/BM_u_Enc1-PulsesPerRev

5 Assure, that the motor fulfills the following conditions:

- Equipped with a suitable encoder, in our example: Resolver or SinCos® SRS50
- Connected to b maXX® 4400
- Ready-to-operate

6 Make sure, that switching elements for pulse enable and quickstop disable are connected to b maXX® 4400 (e.g. in a switchboard) and are operating. Assure, that the switches are in off-position (inactive).

7 Assure, that all safety devices are connected line- and motor sided and are ready-to-operate.

8 Assure, that the encoder for the motor control (resolver or sine-cosine-encoder with HIPERFACE®) is connected with the encoder cable to the encoder module BM4-ENC-01 or BM4-ENC-02 in slot A.

9 If necessary, assure, that the safety relay is plugged in and is connected according to the instructions.

10 Assure that the PC/laptop is connected with a serial cable (RS232/9-pole sub-D connector) with the plug connection X1 of the controller.Start WinBASS II / ProDrive.

11 After starting the ProDrive main page appears. Usually you can proceed as follows.

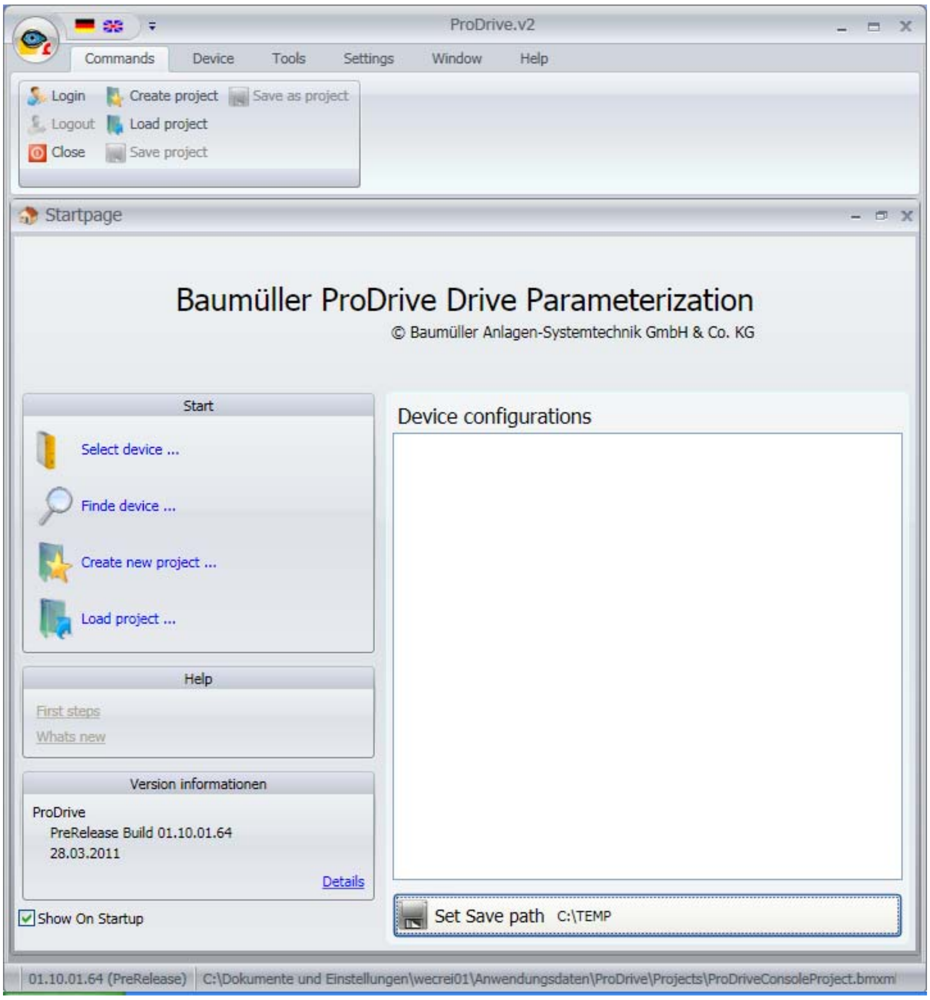


Figure 31: ProDrive: Start window

12 On the main page select ’Select device’. The window ’Select device’ appears (see ▹Figure 38◃ on page 68)

13 Select the serial interface under (1), where the PC is connected with the b maXX device.

14 Then select the type of device, b maXX4400 drive under (2) and the firmware status under version.

15 Then press ’Test’ (3). If an online connection with the b maXX device is established, then an according session (4) is shown. The shown version and the version of the device have to match. If you press ’Connect’ (see ▹Figure 34◃ on page 64) and the versions don’t match the error message ’Conflict version’ will appear. The XML data update, which is provided, can solve this conflict.

NOTE!

In case there is no session for the present controller firmware version you need an update for the WinBASS II / ProDrive program.

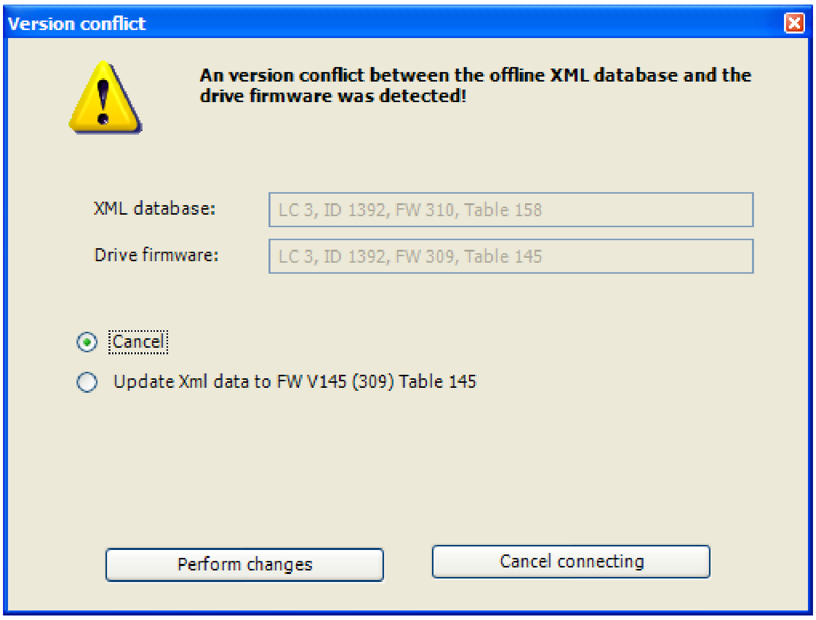


Figure 32: ProDrive: version conflict

NOTE!

In case there is a PLC in the b maXX® device a communication with WinBASS II / ProDrive to the controller only can be established, if a project is existing in the PLC!

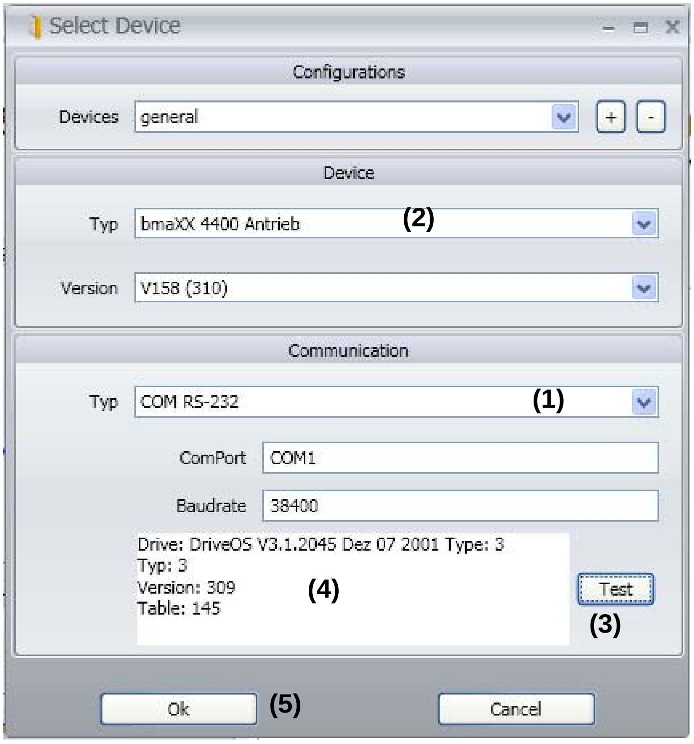


Figure 33: ProDrive: Select device

16 With a click on 'Ok' (5) the graphically user interface is started.

Further notes and explanations are found in the online help of the program. This online help is initiated with F1 or under ?/help subjects or on the following starting window with 'Help'.

17 Wait until the following display mask appears and there, click on the 'ProDrive Navigation' button.

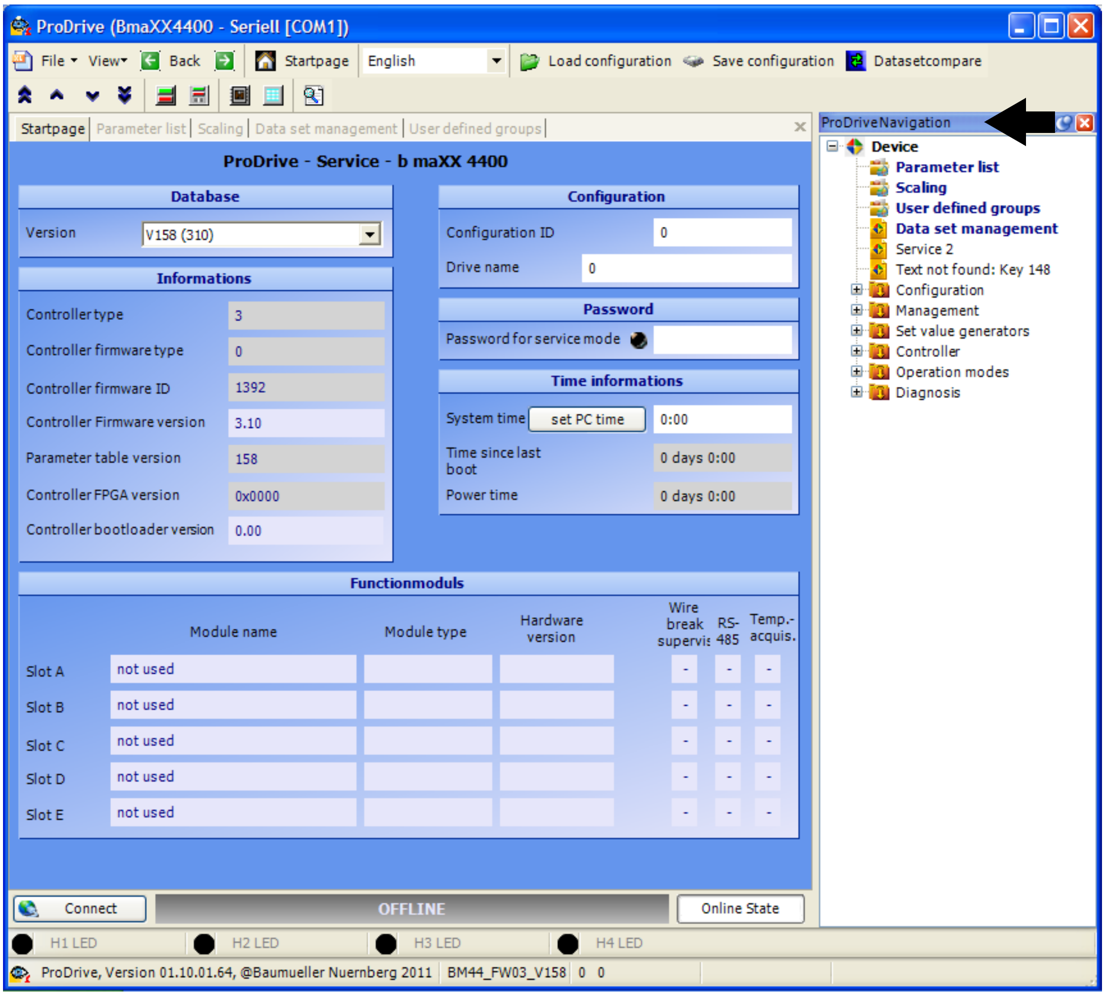


Figure 34: ProDrive: main page

18 Click in the ProDrive Navigation on 'Power unit'.

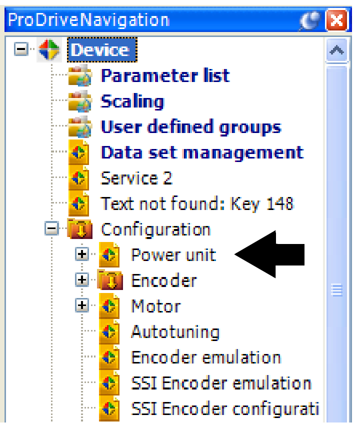


Figure 35: ProDrive: Navigation

5.5 Survey

The following survey shows commissioning schematically. The individual steps of the commissioning are found in detail in ▹Executing commissioning◃ from page 66.

NOTE!

If your device has not got a safety relay, pass over the steps 5, 6, 13 and 14 of the starting sequence (see ▹Figure 41◃).

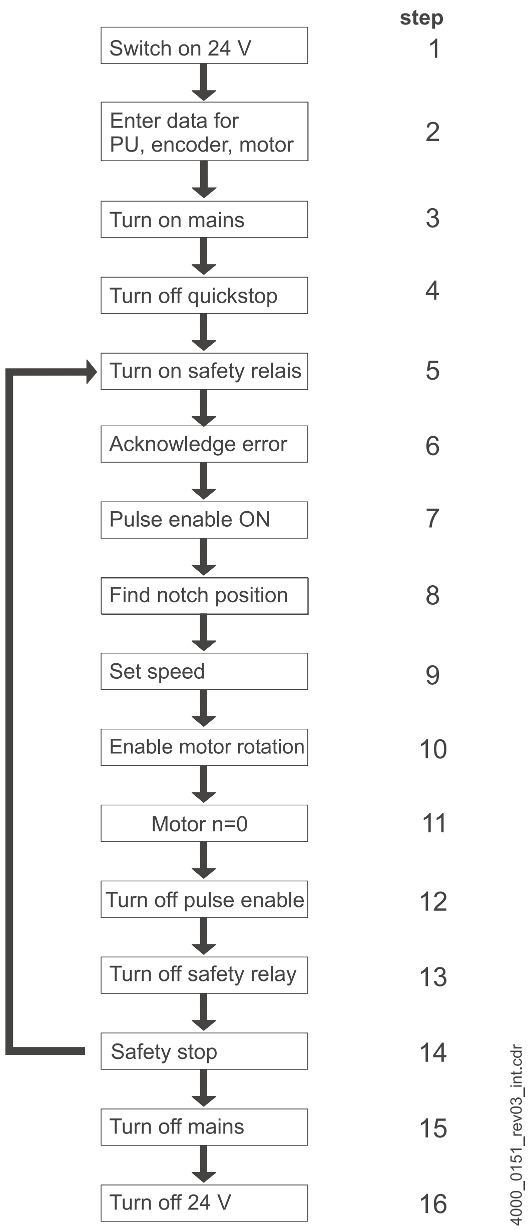


Figure 36: Starting sequence

5.6 Executing commissioning

Start with the commissioning, after you have completed the preparations.

1 Effectuate the power supply to the b maXX® (supply voltage + control voltage). Hereupon the device starts up and shows its operational readiness by flashing the orange-colored LED H-2 (Power ON).

- LED H-2 must light up orange, this means Power ON, the device is ready-to-operate.
- LED H-2 may **not** light up green: The green shining LED H-2 signifies ’operation enabled’! The motor is power supplied and may rotate! Immediately cancel this with the switch element pulse enable or quickstop!
- LED H-3: the red LED means current limit reached. Reduce the load of the motor. Continue the parameterization.
- LED H-4: a red flashing LED signifies a state of error. In step 6 it will be shown how to quit error messages with the help of the operating program WinBASS II / ProDrive. Continue the parameterization.

2 **Now** plug on the (RS232-)cable connector from the PC/laptop to the controller at the b maXX®.
This cable connector establishes the communication between the PC and the b maXX® .

3 Start WinBASS II (up to FW 3.09) or ProDrive (from FW 3.07), as far as it isn’t running yet.

NOTE!

In case you get an error message referring to a plug-in module, then please first check if the plug-in module is accurately cabled and if needed, is supplied with voltage.

NOTE!

The LED H4 „Error“ flashes in case of warnings and errors without error reaction. Only error messages with error reaction are signaled by constant lighting up of the LED.

Warnings/ reset errors

4 Then click on 'Drive management'

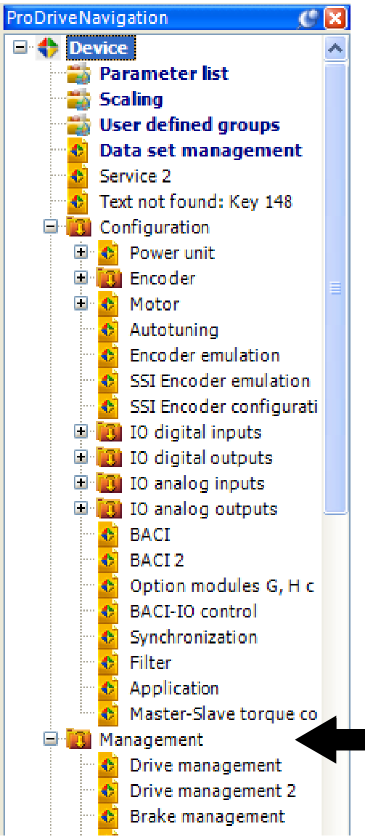


Figure 37: ProDrive: Navigation

5 Activate the voltage supply for the safety relay (in case a safety relay exists).

6 „Quit“ existing warnings/errors in the window „Drive Manager“ (if necessary press the button „Quit messages“ several times).

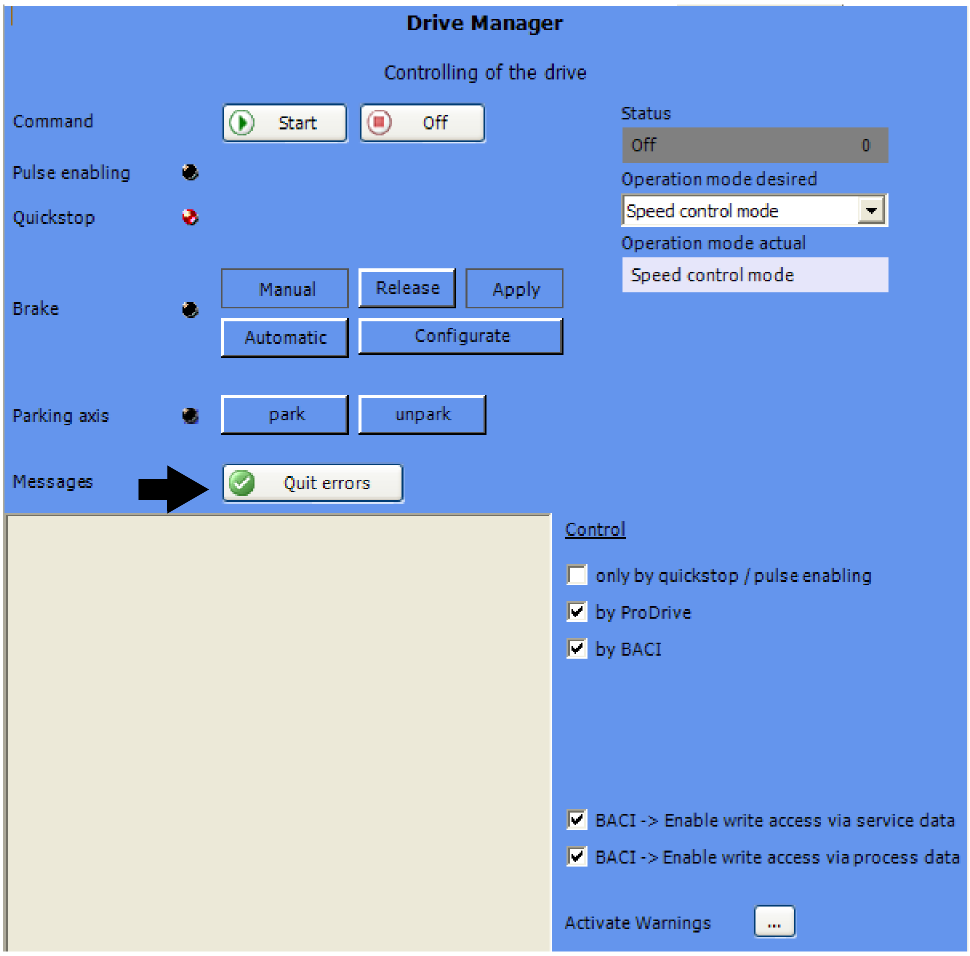


Figure 38: ProDrive: Drive Manager

NOTE!

Because of the manifold combination possibilities of motors and encoders we will only give one example. Enter the **given** data of motor and encoder!

7 Click on 'Power unit'.

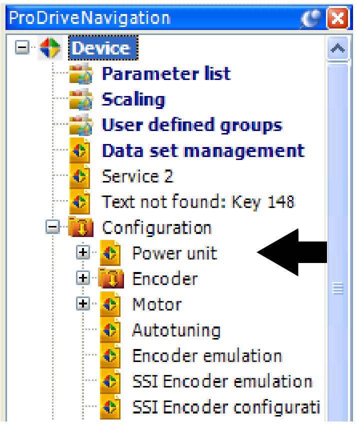


Figure 39: ProDrive: Navigation

8 The current, which is necessary for your application is entered in 'Maximum current of the drive', the maximum is the limit current of the motor (according to data sheet): 2.5 A in order to operate the motor and the power unit.

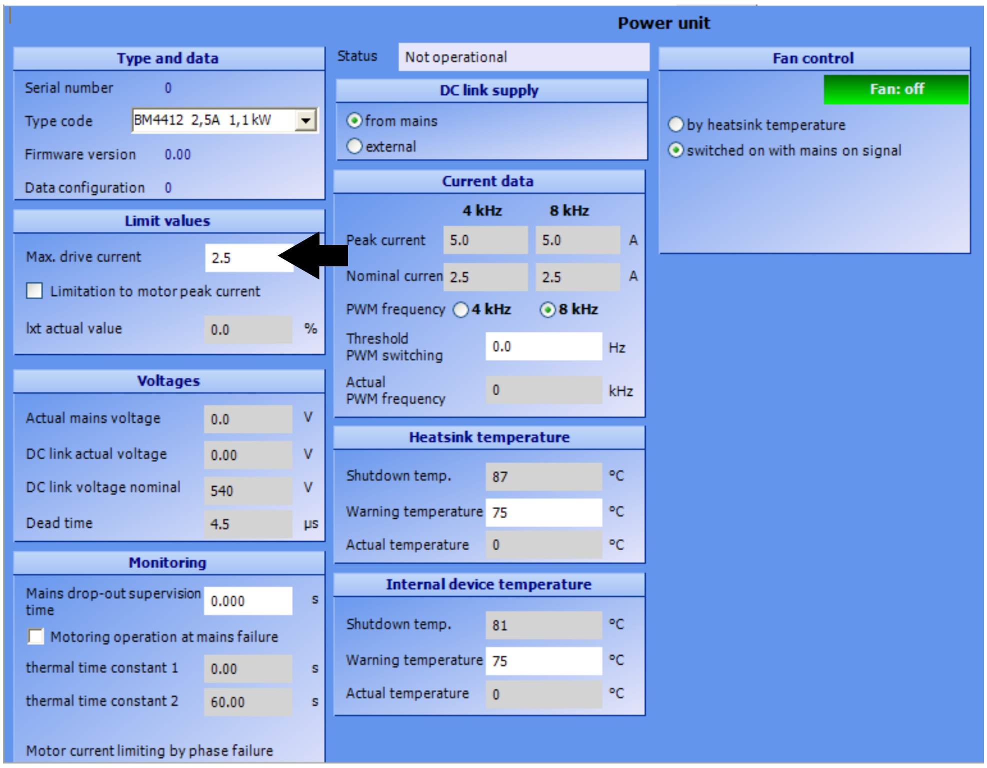


Figure 40: ProDrive: Power unit

Parameterize encoder

Now parameters still have to be entered for the encoder.

9 Go back to the ProDrive Navigation .

10 Click on the tab ’main page’

On the main page you can see, at which slot the encoder module is plugged in (resolver - BM4-ENC-01 or sine-cosine-encoder with HIPERFACE® - BM4-ENC-02).

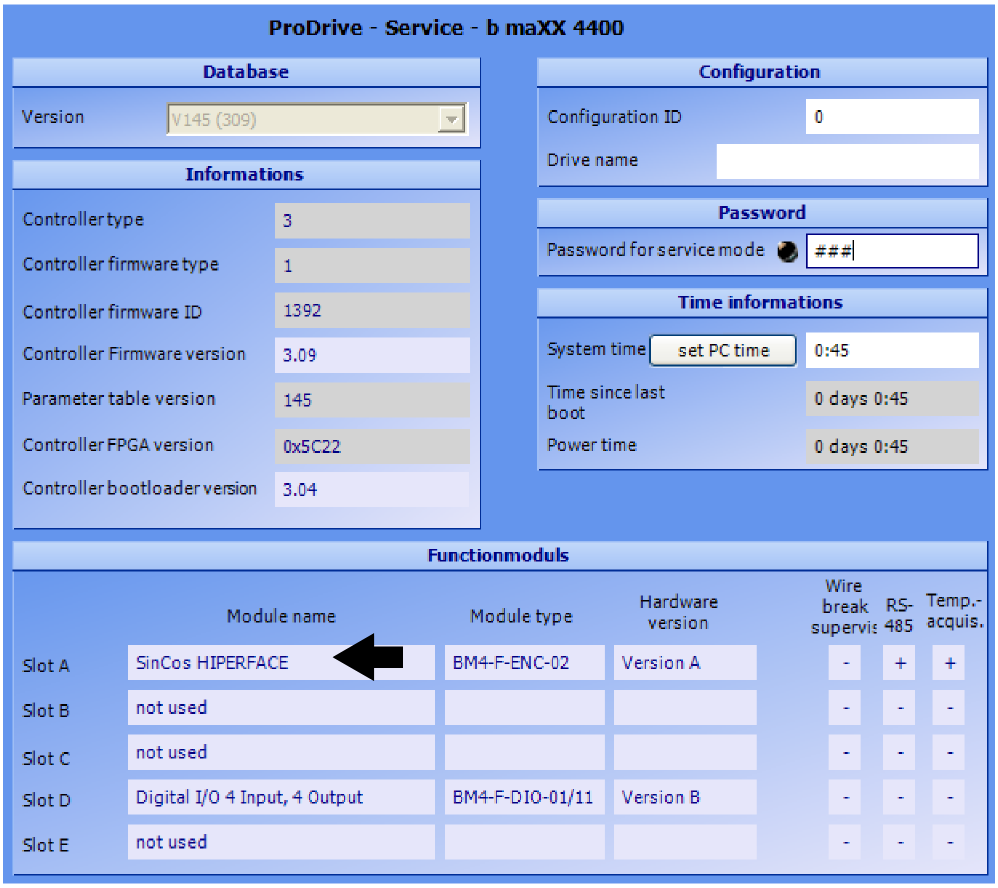


Figure 41: ProDrive: main page

11 Check, if the plug-in modules were detected correctly.

NOTICE!

Risk of material damage from errors in the hardware identification!

The device in which the b maXX®4400 is installed, can be damaged or can work defective, if a module or more modules were not recognized or were recognized wrong.

Therefore:

- Cancel commissioning, if at least one plug-in module was not or was recognized wrong. Contact Baumüller Nürnberg GmbH.

12 Go back to the ProDrive Navigation.

13 Double-click on ’Encoder’.

14 Click on ’Encoder1’ if your encoder module is in slot A.
Click on ’Encoder2’ if your encoder module is in slot B.

The window ’encoder1-configuration’ opens.

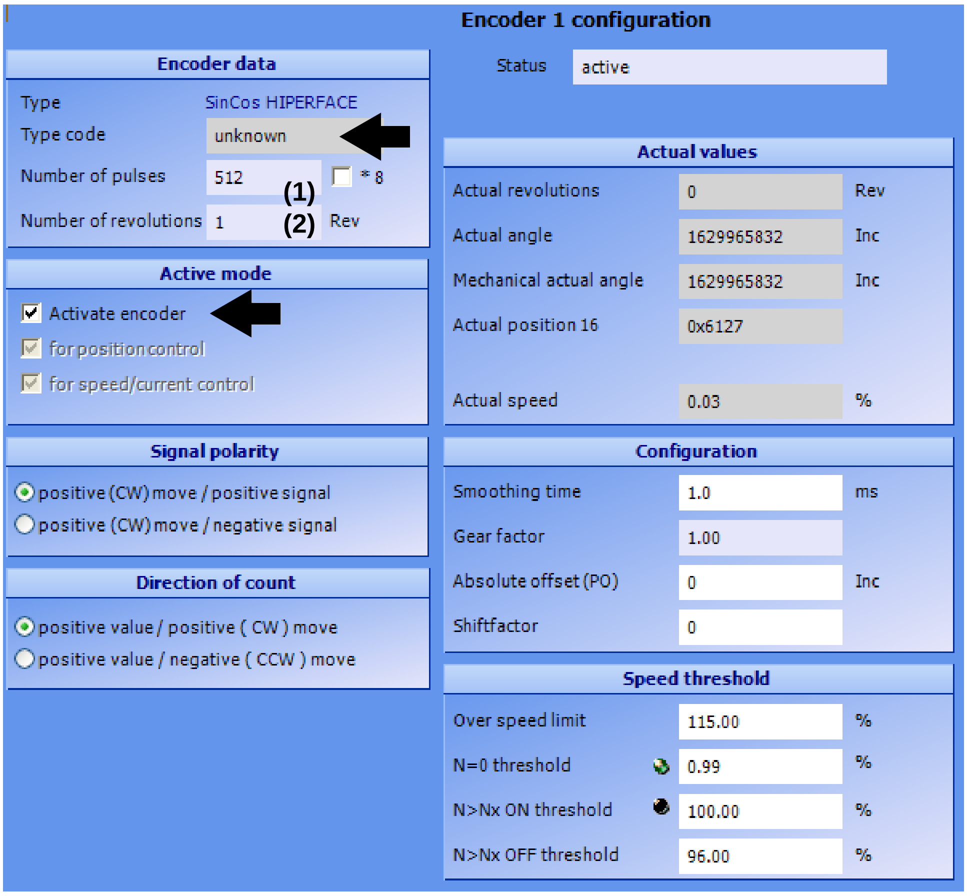


Figure 42: ProDrive: Encoder 1 configuration

15 When using a resolver or sine-cosine encoder without communication-interface. With a sine-cosine encoder with communication-interface the data is automatically transferred over the interface - do not change data.

- (1) Resolver: PPR count parameter = 1 (here „number of pole pairs“ is meant), sine-cosine without HIPERFACE®
  e.g. PPR count parameter = 1024 (here „sine periods per revolution“ is meant)
- (2) Resolver: rotations = 1, sine-cosine without HIPERFACE®
  e.g. rotations = 1
- Both encoders: activation (activate encoder)

Enter overspeed limit manually in block ’Speed threshold’.

16 Change to the ProDrive Navigation and there click on ’Motor’.

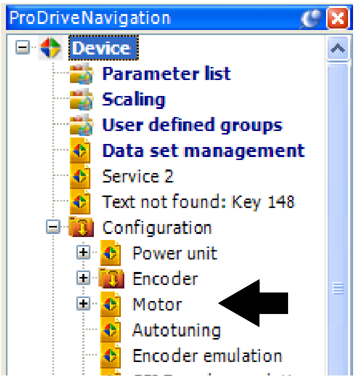


Figure 43: ProDrive: Navigation

Use motor database

17 Click in the motor window on the button ’Motor database’.

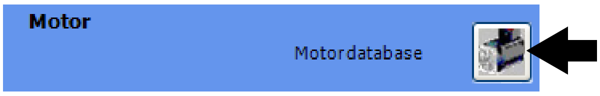


Figure 44: ProDrive: Motor database

18 The following window appears

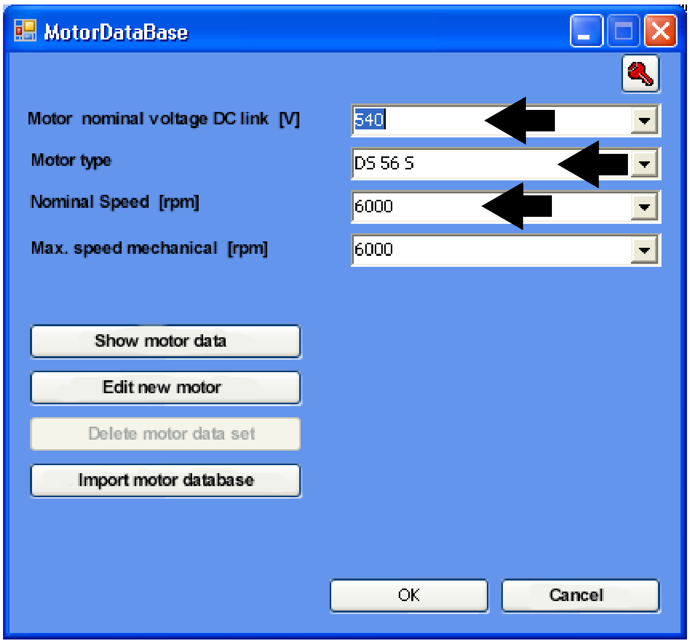


Figure 45: ProDrive: Selection of the motor

19 In this window you enter:

- the motor nominal voltage: „540 V“
- the motor type: ’DS 56-S’
- the nominal speed: ’6000 rev/min’

- the maximum speed is automatically taken over from the value for basic speed.

NOTE!

The values for the nominal speed and the maximum speed are the same at synchronous motors and therefore, at choice of nominal speed, are taken over into the maximum speed.

At asynchronous motors you must select both values separately. Software for asynchronous motors: in preparation.

20 Activate button Ok.
With this all data is taken from the motor database over in the accordant parameters and display fields of WinBASS II / ProDrive.

21 Check all values of the motor with the motor data sheets (this is only a purpose of control, if you use the motor database of Baumüller). When you are using a motor of an other manufacturer, you must do this anyway).

NOTE!

When you use a motor of an other manufacturer, you may also import the manufacturer's motor data to the motor database.

Motor data change

Normally, you will find no deviations between the motor data sheet and values from the motor database chosen automatically.

In case, you want to change values, you have got to do the following:

22 Click on the tab 'Main page'. On the main page you enter next to 'Enable service operation': 'service' and close this input with enter.
Now you are able to change the so-far write-protected data in the screen menu. If you would like to re-establish the write-protection, then enter with 'Off' instead of 'Service'.

23 Click in the ProDrive Navigation on 'Motor'.

Check motor data **24** In the motor window and in the sub-window synchronous motor or asynchronous motor all important motor data or motor parameters are displayed.

Check all data.

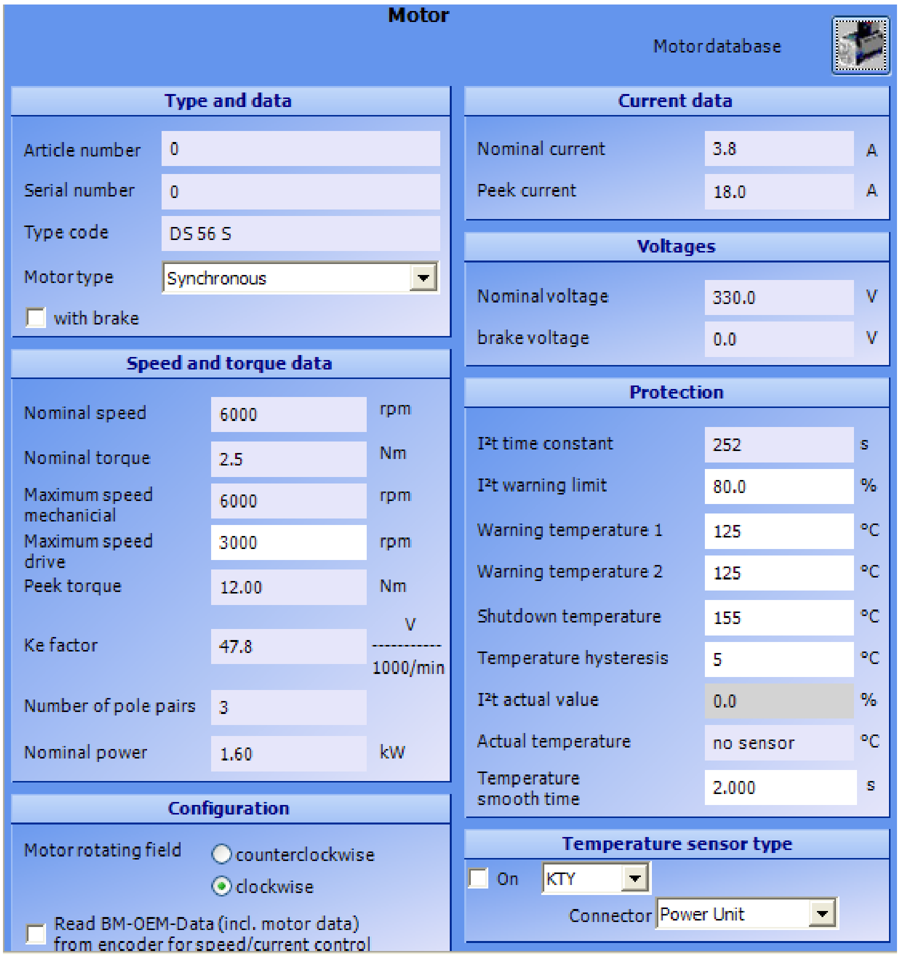


Figure 46: ProDrive: Motor

Use parameter list If you **are not** using the Baumüller motor database, you can enter all motor parameters also with help of the 'parameter list'.

25 Click on the tab parameter list.

26 In the parameter list click on ’configuration motor’.

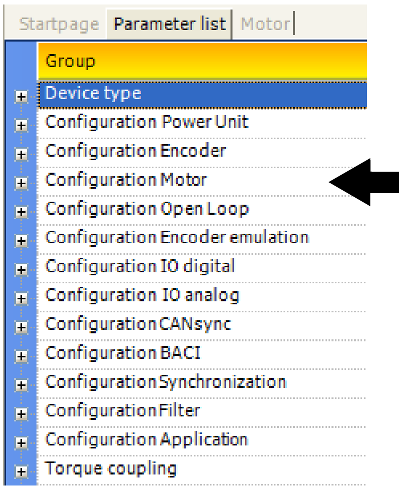


Figure 47: ProDrive: Parameter list

The following motor parameters must be defined:

- Maximum speed mech. (P0072 motor maximum speed mechanical)
- Number of pole pairs (P0065 Motor number of pole pairs)
- Rotating field (P0087 Motor rotating field)

Now save the entered data.

27 Click in the icon bar on the icon ’Data management’.

Figure 48: ProDrive: Data management

28 Click in the data management on the button ’Save all’.

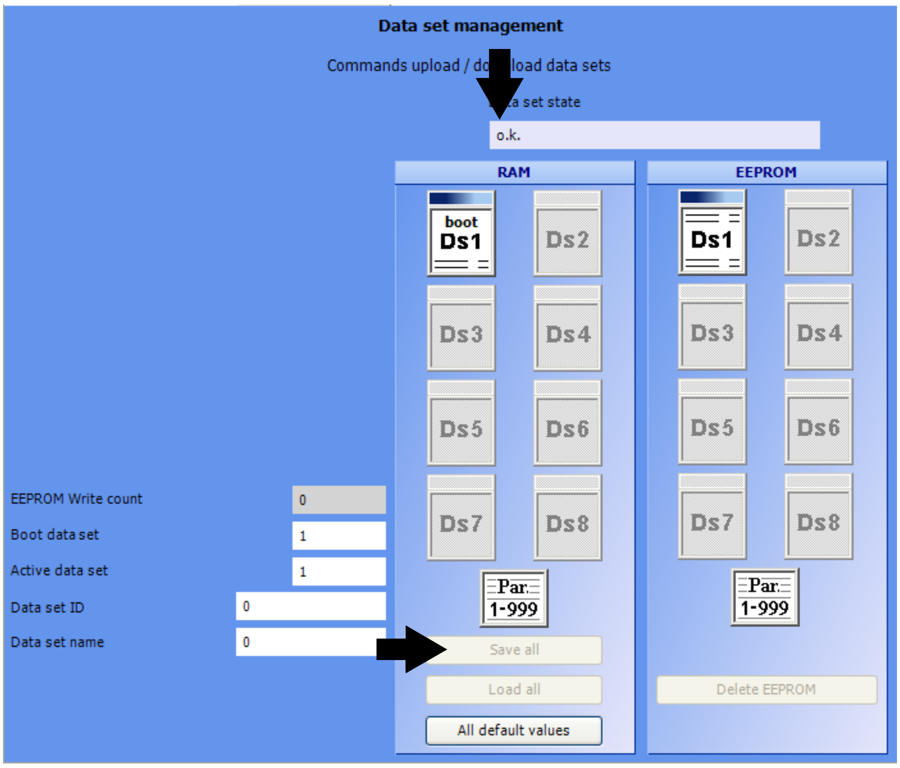


Figure 49: ProDrive: Data management

29 Wait until next to ’Data Management status’ is shown: ’o.k.’

Thus the parameter set is saved in the EEPROM.

30 Turn off the voltage supply for the safety relay (if existing).

31 Disconnect the device from the mains- and the control voltage.

32 Turn on the power supply for the safety relay (if a safety relay is existing)

33 Effectuate the power supply to the b maXX®
(supply voltage + control voltage).

By switching on and off you can check, if your settings lead to warnings or errors.

Find notch position

Now the notch position of the motor still must be found.

34 Go to the ProDrive Navigation and double-click on ’Operating mode’, then click on ’Find notch position’.

35 Click on the icon ’Drive manager dialogue’.

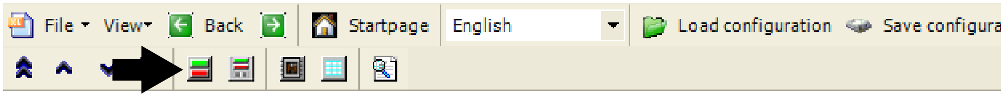


Figure 50: ProDrive: Drive manager dialogue

Additionally the window ’Drive manager dialogue’ appears.

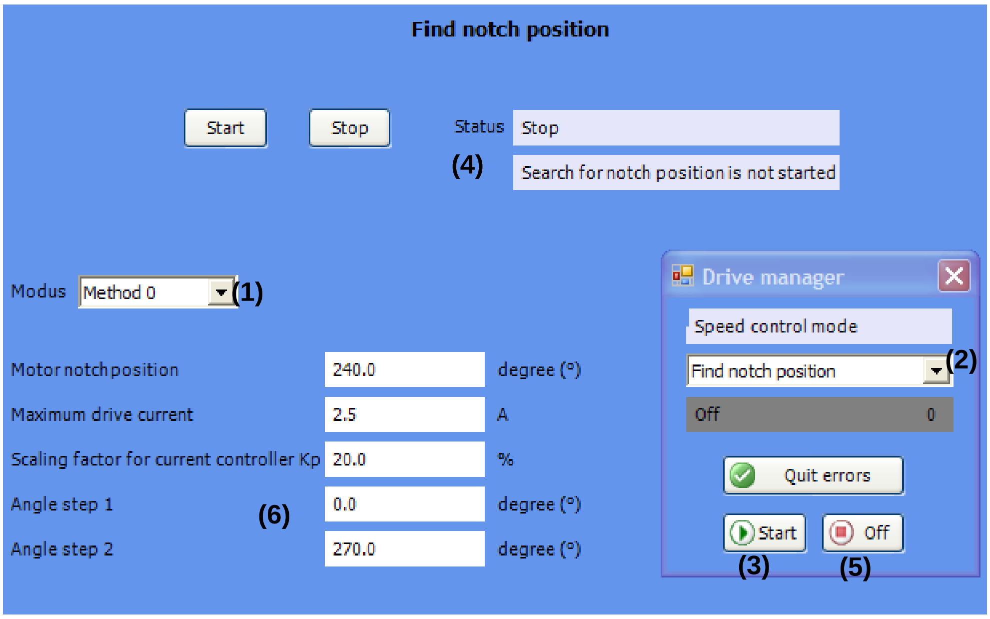


Figure 51: ProDrive: Find notch position: Drive manager

36 Select method 0 for ’mode’ (1).

37 Select ’find notch position’ in the scroll list (2).

WARNING!

Risk of fatal injury from mechanic effects!

With a non-free-rotating motor the motor and parts, which are connected to the motor can be damaged/destroyed.

Therefore:

- Assure, that the motor can rotate freely during commissioning.

38 Activate the inputs for pulse enable and the quickstop disable.

39 Click on ’Start’ (3).

40 Wait until the text appears in this field (4): ’Notch position was found’.

41 Then click on „Off“ (5).

42 Check if the measured value meets the expected value (6)
(at Baumüller motors: resolver: 330° ± 5°, sine-cosine absolute encoder 240° ± 5°).

43 Inactivate the pulse enable and quickstop disable.

With this activity all parameterization workings for an exemplary commissioning are completed. Now the proper functions can be checked, by rotating the motor for a short time.

First rotating of the motor.

44 Go back to the ProDrive Navigation.

45 Double-click on: 'Set value functions'.

46 Click on: 'Ramp function generator'.

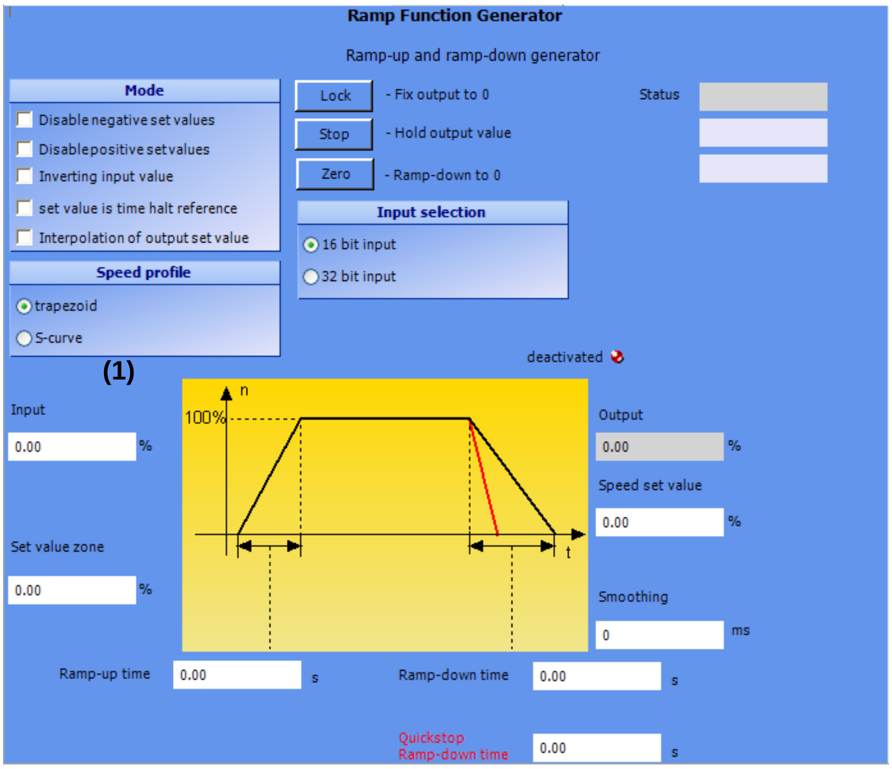


Figure 52: ProDrive: Ramp function generator

47 Enter the values into the following entry fields:
(Ramp function generator) input (1)
Enter with value ’10’.

48 In case you have shut the window ’drive manager dialogue’: click on the icon ’Drive management’.

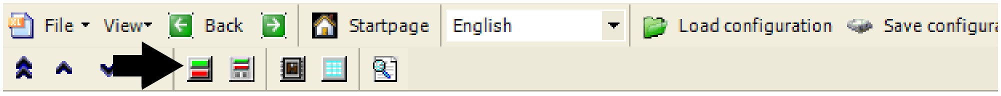


Figure 53: ProDrive: Drive manager dialogue

Additionally the window ’Drive manager dialogue’ appears.

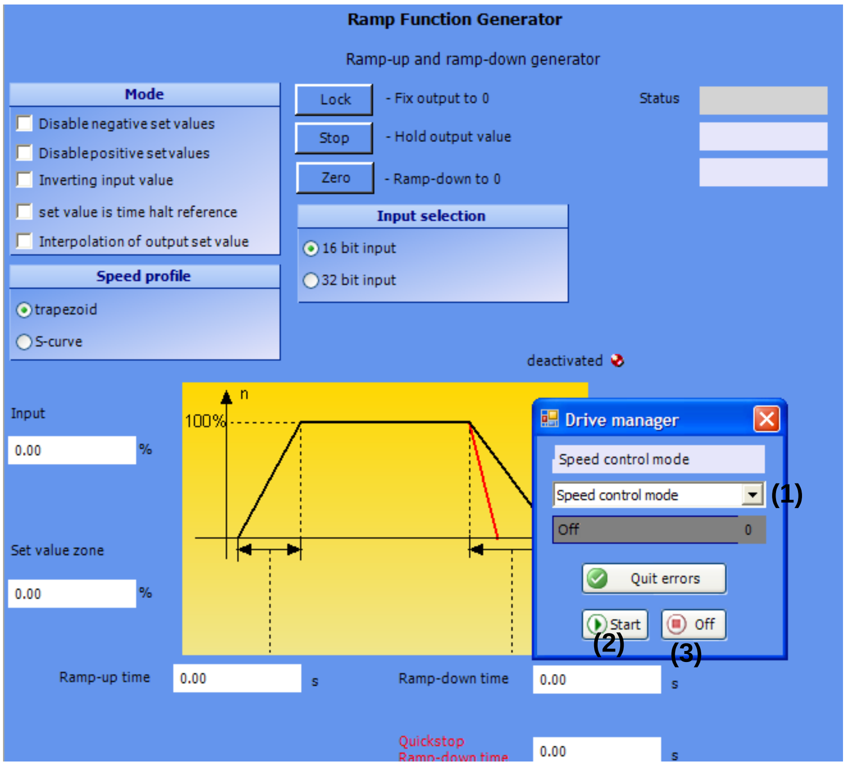


Figure 54: ProDrive: Ramp function generator - Drive manager

49 Select in the drive manager dialogue in the scroll list (1) the operating mode ’Speed control’.

50 Activate the pulse enable and the quickstop disable.

51 Click on the drive manager dialogue menu on the button ’Start’ (2)
Now the motor should rotate with 10% of the maximum speed.

52 Click in the drive manager menu on the button ’Off’ (3)
Now the motor will stop.

53 Inactivate the pulse enable and quickstop disable.

Parameter set save

This parameter set now should be saved.

54 Click in the icon bar on the icon ’Data set management’.

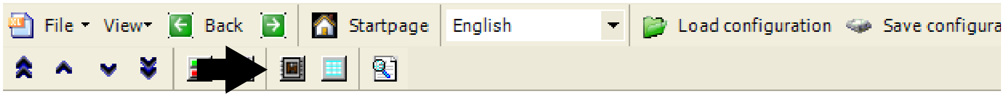


Figure 55: ProDrive: Data management - icon bar

55 Click in the data management on the button ’Save all’.

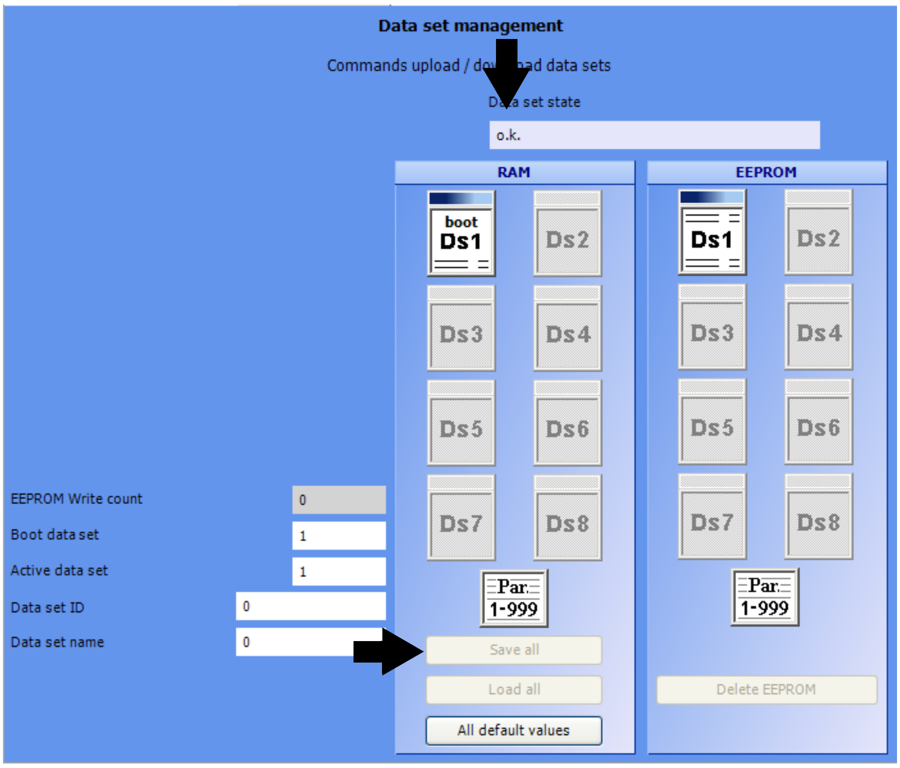


Figure 56: ProDrive: Data management

56 Wait until next to ’Data management status’ is shown: ’o.k.’
Thus the parameter set is saved in the EEPROM.

Drive switch off

To complete commissioning switch off the drive.

57 Turn off the voltage supply for the safety relay (if existing).

58 Separate the device from the mains- and control voltage over the accordant switching elements .

Thus the commissioning is successfully completed.

6

OVERVIEW OF THE SOFTWARE MODULES

In the following we describe the working principles of each software module and its parameters. A comprehensive description of the parameters sorted by parameter numbers are to be found in chapter ▷Parameters◁ from page 337.

6.1 Allocation of the software modules in time slots

Time slice allocation	Software modules
every 125 µs	Current controller, position controller, speed controller, Analog inputs, analog outputs, freely-programmable PID controller, oscilloscope function
every 250 µs	Synchronous operation-set value generator, probe control
every 500 µs	Ramp function generator, Current - speed controller - control Reading in digital inputs, NC-controlled homing
every 1 ms	Digital outputs, monitoring IEE, Encoder-manager, Open loop manager, Mains monitor, PT1-filter, Two-level-controller*, evaluation digital inputs*
every 2 ms	Search of notch position, positioning, spindle positioning, Error reaction return motion mode, Phasing
every 4 ms	Drive manager, status word2
every 8 ms	Overload management
every 16 ms	Operation mode switch-over for IEE Probe and SSI encoder simulation, set value generator, LED control Motor temperature sensing

*: dispatched, e. g. according to system working load possibly allocated to several time slots

6.2 Project tree

A structure was chosen similar to the WinBASS II project tree.

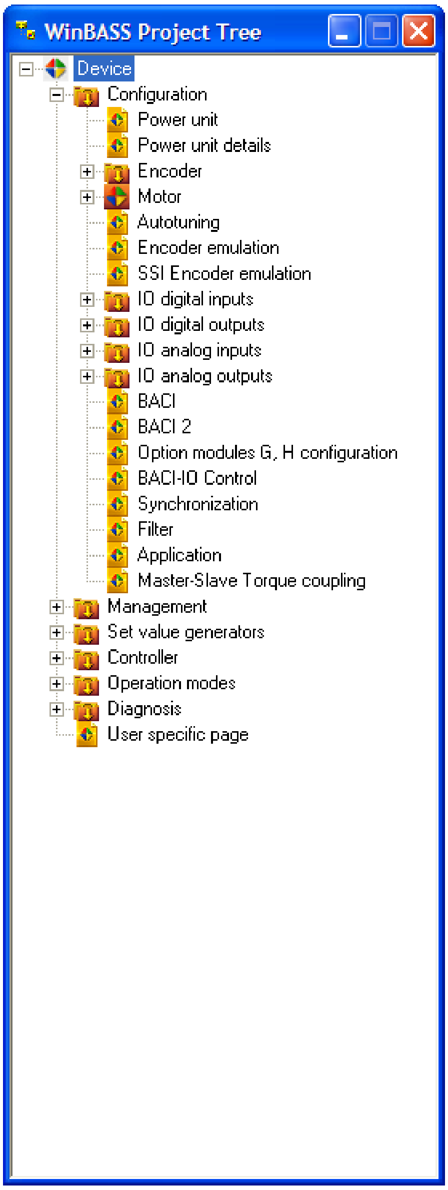


Figure 57: WinBASS II: Project tree

7 CONFIGURATION

7.1 Power unit power supply

The device can operate with the integrated power supply as well as in DC link network with an external power supply unit.

7.1.1 Monitoring overview

The device configuration was split functionally in two software modules: power unit and power supply.

The power supply module is configured in parameter ▷P0025◁. The status of the supply unit is shown in ▷P0490◁.

The power unit module is configured in parameter ▷P0024◁. The status of the power unit supply is shown in ▷P0480◁.

The following monitorings are implemented in the module power unit and in the module power supply.

Monitoring	Warning no.	Error no.	Reaction
Undervoltage 24V	1	68	IS
Mains undervoltage	2	--	--
Mains overvoltage	3	93	IS
Mains failure	4	from FW 03.09: 64 [3] up to FW 3.08: 91	adjustable
Phase failure	5	from FW 03.09: 65 [1] up to FW 3.08: 90	from FW 03.09: IS [2] up to FW 03.08: adjustable
Inside over temperature of device	16	85	IS
Heatsink over temperature	17	81	IS
Time-out at DC-link charging	18	--	--
Undervoltage U DC link	23	--	--
Ixt-threshold exceeded	24	--	--

Communication error power unit	--	80 (Details in ▹P0233◃)	--
U DC link overvoltage	--	82	IS
Overcurrent	--	83	IS
Ground current	--	84	IS
Cable break heatsink temperature sensor	--	86	IS
Safety relay off (or defect) 4)	20	87	IS
Bridge short-circuit	--	88	IS
Power unit not ready-to-operate	--	89	IS

1) The phase failure message can turn into an error if the mode "Limit of motor current to rated current with timeout phase failure-error delay time" in bit no. 2 of the parameter „Supply unit mode“ (▹P0025◃) was set.

2) From FW 03.09 the reaction is always the immediate pulse inhibit.
For update reasons concerning the previous FW versions to FW 03.09 or higher, all error reactions further on can be selected, but immediate pulse inhibit is always active!
The operating software ProDrive allows only the setting immediate pulse inhibit from FW 03.09.

3) The mains failure warning would at once turn into an error by default. The error message can be suppressed for a time, which is set in P0486. The suppressing time is set to 0 by default.

4) The controller signals the error "Error safety relay" (error no. 87), if pulse enable has been given and if either case occurs:
1: the safety relay is not controlled or
2: the safety relay is faulty

If there is no pulse enable and if the cases 1 or 2 arise, the controller signals only one warning (warning no. 20).

Overview of the messages in the hierarchic warning and error system

Monitoring in the module supply unit	P0260 Warnings System 1 Bit no. 0 =1		P0200 Error System 1 Bit no. 4 =1	
	P0261 Warnings Power supply		P0205 Error Power Supply	
	Bit no.	Warning no.	Bit no.	Error no.
Undervoltage 24V	1	1	4	68
Mains undervoltage	2	2	--	--
Mains overvoltage	3	3	-- 1)	-- 1)
From FW 03.09: Mains failure	4	4	0	64
From FW 03.09: Phase failure	5	5	1	65
Monitoring in the module power unit	P0260 Warnings System 1 Bit no. 1 = 1		P0200 Error system 1 Bit no. 5 = 1	
	P0262 Warnings in the power unit		P0206 Error Power Unit	
	Bit no.	Warning no.	Bit no.	Error no.
Inside over temperature of device	0	16	5	85
Heatsink over temperature	1	17	1	81
Time-out at DC-link charging	2	18	--	--
Undervoltage U DC link	7	23	--	--
Ixt-threshold exceeded	8	24	--	--

Communication error power unit	--	--	0	80 (subsequent parameter ▹P0233◃)
U DC link overvoltage	--	--	2	82
Overcurrent	--	--	3	83
Ground current	--	--	4	84
Cable break heatsink temperature sensor	--	--	6	86
Safety relay off (or defect)	4	20	7	87
Bridge short-circuit	--	--	8	88
Power unit not ready-to-operate	--	--	9	89
to FW 03.08 phase failure reserved from FW 03.09	--	--	10	90
to FW 03.08 mains input failure reserved from FW 03.09	--	--	11	91
Mains overvoltage	-- 1)	-- 1)	13	93

1) Warning and error message of the overvoltage on the mains occur in different SW modules: The warning in the **mains supply** warning ▹P0261◃ and the error in the error **power unit** ▹P0206◃

NOTE!

The monitoring of the mains undervoltage (24 V) is only available at specific hardware types of the controllers (see ▹P2037◃). Please, do not hesitate to contact us, if you have questions, referring to the controller hardware type.

NOTE!

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the instruction handbook b maXX® 4400 (ES), 4600 (ES), 4700(ES).

NOTE!

The warnings and error messages of the module power supply are not identical with the warnings and error messages of the mains monitor (▹P0260◃ bit no.4, ▹P0205◃ bit no. 15, ▹P0257◃). The monitoring limits of the module power supply are fixed in the device and can differ from the parameterized values in the mains monitor.

7.1.2 Monitoring including an immediate pulse inhibit are not settable

The following monitorings with immediate pulse inhibit take place in the power unit. The error thresholds of these monitorings are permanently fixed in the power unit.

- Undervoltage 24V
- Communication error power unit
- Overvoltage DC link

- Overcurrent
- Earth current
- Open circuit heatsink - temperature sensor
- Safety relay off (or defect)
- Bridge short-circuit
- Overvoltage mains

In case of an error the power unit generates a pulse inhibit, signals the error cause to the controller and then signals the not-ready to operate status (error no. 89). The errors are passed on by the controller.

These monitorings in the control structure are presented in ▹Figure 8◃ on page 22.

7.1.3 Mains failure monitoring

(from firmware version FW 03.01):

When operating with internal supply the mains status is monitored for mains failure. When operating with external supply the "Ready to operate" message of the supply unit (connected via hardware input X100.3) is monitored instead. If the "Ready to operate" message is missing, this results in the same reaction as at a mains failure with internal supply.

Warning no. 4 is set as soon as the drive detects "Mains failure". The reaction time to a mains failure (time between the start of the mains failure and the setting of the warning) is max. 50 ms (see ▹Figure 58◃). The warning is set independent of the drive state (pulse blocked or enabled).

The drive cannot be enabled, if the drive state is not enabled and the mains failure warning is set.

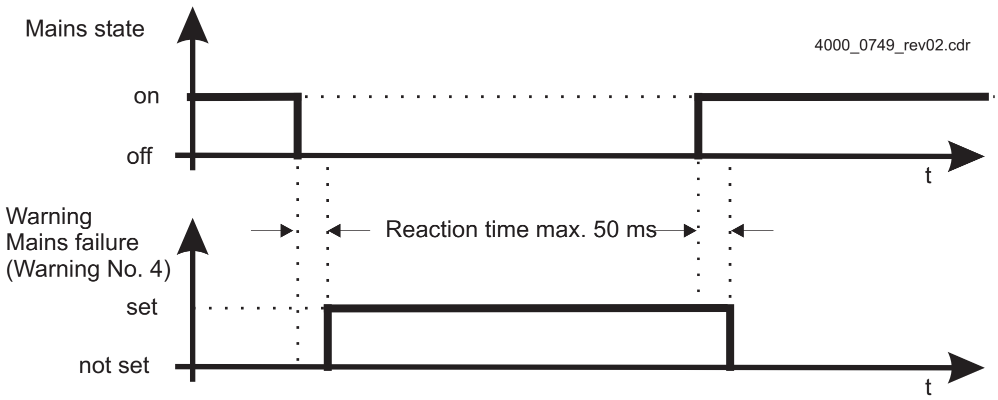


Figure 58: Reaction time of the mains failure recognition

The parameters ▹P0025◃ Power supply mode and ▹P0486◃ Mains failure monitoring time.set the behavior of the enabled drive state during a mains failure.

In general the error message 64 is set (Mains failure monitoring time ▹P0486◃ = 0) simultaneously with the mains failure warning and the pulses are blocked. A time period (▹P0486◃ > 0). in order to suppress the error message can be set. The drive remains in the enabled state during this time. After this time has elapsed the error is signaled and the error reaction is set. If the mains is available within this time and is recognized, no error message is set (see ▹Figure 59◃ and ▹Figure 60◃).

In parameter ▹P0025◃ Power supply mode is set whether motoring operation is inhibited (bit 1 = 0, default) or enabled during time.

At mains failure motoring operation only then is useful, if either there still is enough energy in the DC link or several axes via the DC link are coupled and another axis additionally supplies energy into the DC link.

If motoring operation is also activated at mains failure, it must be assured, that the mains does not recover during the motoring operation (e.g. by switching off the main contactor). Otherwise a destruction of the charge circuit can occur!

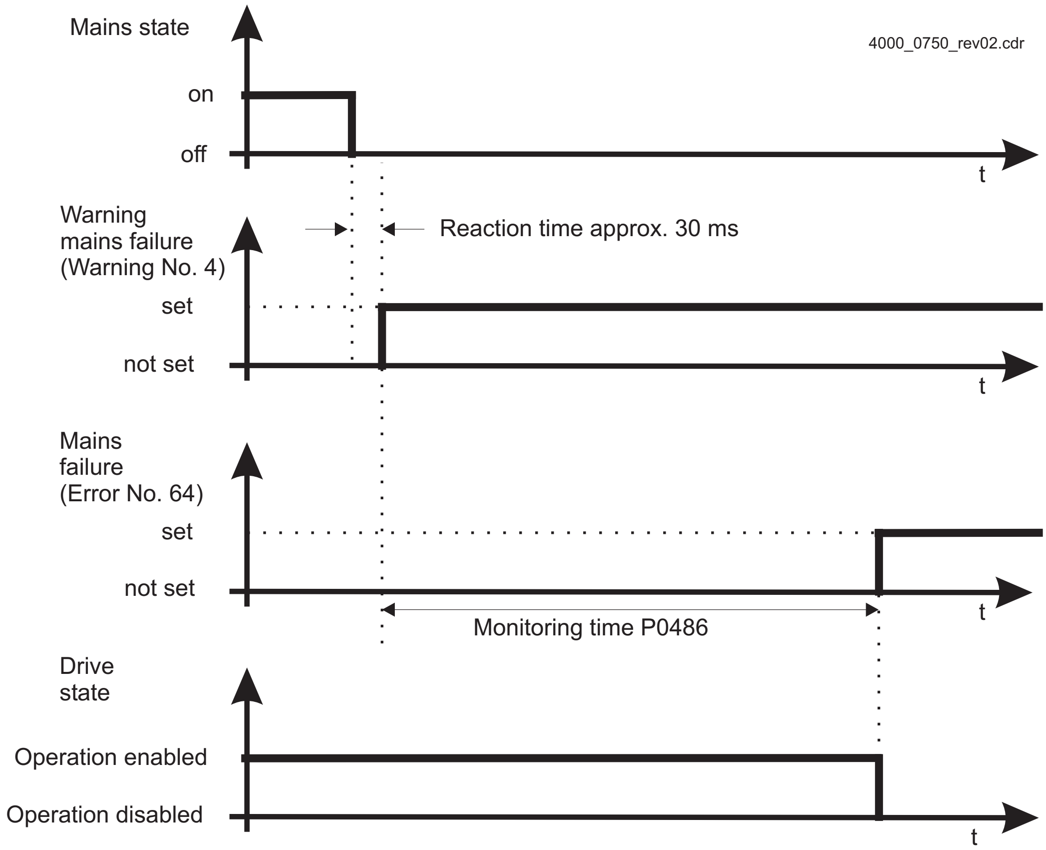


Figure 59: Mains failure takes longer than mains failure monitoring time

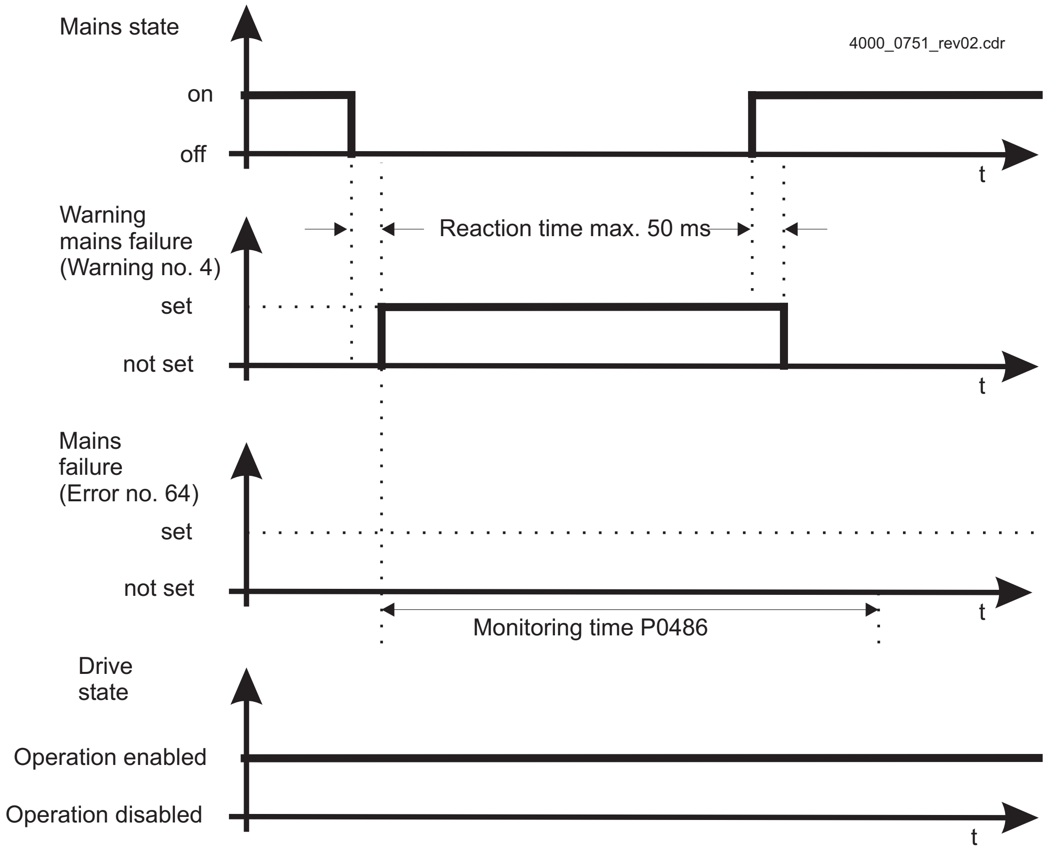


Figure 60: Mains failure takes shorter than mains failure monitoring time

If the mains is available within the mains failure monitoring time, but the DC link was discharged strongly and at the same time the field (ASM) or the field weakening current (SM) is impressed, the log-out of the mains failure can be delayed by the part of the power unit until the DC link has been sufficiently charged.

The mains failure time gap, which can be bridged, is subject to the operating point before the failure, the load, the operating mode and the motor type.

NOTE!

The parameter ▹P0486◃ Mains failure monitoring time is not to be understood as a bridging time, where a mains failure must be bridged without an error message. ▹P0486◃ is the suppressing time for the error message no. 64 Mains failure. It depends on many factors (e.g. the operating point before the failure, the load, the motor type) whether a mains failure can be bridged within a shorter time than the time, which was set in ▹P0486◃ without an error.

7.1.4 Phase failure monitoring

(from firmware version FW 03.06):

The phase failure monitoring is only possible at operation with an internal supply (Power supply unit mode ▹P0025◃ bit 1 = 0). A phase failure can not be recognized at external supply.

If the drive recognizes phase failure the warning no. 5 (phase failure) is set. The warning is set independent of the drive state (pulse enabled or inhibited.

A restricted operation of the drive is possible during phase failure.The options for operation at phase failure are set via the parameter Power supply unit mode ▹P0025◃.

Current limit to reduced current without time monitoring

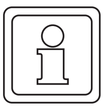
If bit 2 of parameter Power supply unit mode (▹P0025◃) is not set (default setting), the motor current is limited automatically to the maximum motor current (▹P0028◃) at phase failure. The drive can continue to be operated with this reduced current without an error message. There is no time limit for this operation.

As soon as phase failure is no longer present, it is automatically switched back to operation without current limit.

Current limit to nominal current with time monitoring

If bit 2 of parameter Power supply unit mode (▹P0025◃) is set, the motor current is automatically limited to the nominal current of the power unit to 4 kHz (▹P0010◃) at phase failure. Furthermore, time monitoring takes place. If phase failure takes longer than the Phase failure delay time ▹P0027◃, error no. 65 "Phase failure" is set and the pulses are inhibited.

If duration of phase failure is shorter than the Phase failure delay time, the system automatically switches back to operation without current without current limit and without an error message.



NOTE!

The warnings and error messages of the module power unit are not identical with the warnings and error messages of the mains monitor (▹P0260◃ bit no. 4, ▹P0205◃ bit no. 15, ▹P0257◃). The monitoring limits of the module mains supply are fixed in the device and can differ from the parameterized values in the mains monitor.

7.1.5 Thermal load

The thermal load, i.e. the power input capability of the device is limited - it therefore presents the thermal effective current of the device of which the rated current is the limit of the device. If the effective current of the device exceeds the rated current limit the device can be damaged or even destructed.

During the continuous current operation the current of the drive may not exceed the rated current of the device. In all other cases the device must be operated such a way that the effective current of the device doesn't exceed the rated current limit during an operating cycle. However, the actual current of the device may exceed the rated current during an operating cycle (overload). See chapter "The correlation between the nominal and the peak currents" of the operating instructions of the device.

In order to protect the device against unpermitted overload, the internal temperature, the heatsink temperature of the device as well as the estimated thermal overload is monitored.

7.1.6 Temperature monitoring of the power unit

The temperature monitoring protects the device against unpermissible thermal overload.

Monitoring:

- The actual value of the internal temperature of the device ▷P0481◁ is checked for the temperature warning threshold ▷P0016◁. The warning no. 16 "internal temperature of device" is generated if it is exceeded. If the switch off threshold ▷P0017◁ is exceeded the pulses are inhibited and the error number 85 "Internal overtemperature of the device" is generated.
- The actual value of the heatsink temperature ▷P0482◁ is checked for the temperature warning threshold ▷P0018◁. The warning no. 17 "heatsink temperature" is generated if it is exceeded. If the switch off threshold ▷P0019◁ is exceeded the pulses are inhibited and error number 81 "heatsink overtemperature" is generated.

The temperature monitoring takes place in the power unit. The controller informs the power unit about the temperature thresholds ▷P0016◁ to ▷P0019◁ meanwhile the power unit transmits the warning or the error message to the controller and executes an error reaction if required.

The temperature monitoring of the power unit in the control structure is presented in ▷Figure 8◁ on page 22.

The device can be protected in a limited manner against unpermitted thermal overload by the temperature monitoring. On the one hand hot spots occur at different locations of the device, which cannot all be covered by temperature sensors - on the other hand the dynamics of the temperature sensors are limited. Highly dynamic and thermal transients, as it is the case in the IGBT modules, cannot be detected. Due to these reasons a thermal model of the device must be added (overload-monitoring of the power unit).

7.1.7 Overload monitoring of the power unit (Ixt)

In the b maXX® 4400 different mechanisms avoid an overload of the power unit. The procedure, which is used is dependent of the size and of the current grading.

Generally the PT1 model is used for monitoring. Exceptions are valuated individually. For an overview of the devices and the corresponding monitoring procedures, see chapter 3.5 of the b maXX 4400 Instruction handbook.

NOTE!

The dependence of the output frequency of the continuous current of the power unit must be considered, because this isn't taken into account in the overload monitoring. See chapter "Technical data" in the operating instructions of the device.

All methods have in common:

- that the Ixt-warning at an Ixt-value ≥ 100 % is set and at a value ≤ 95 % is deleted and
- that while the Ixt-warning (warning no. 24) is present the output current I_{max} (▷P0011◁, ▷P0013◁) is limited to I_{nom} (▷P0010◁, ▷P0012◁).
- If the "Maximum current of the drive" ▷P1241◁ is lower than the nominal current of the power unit (▷P0010◁, ▷P0012◁), the current can never be reduced by the overload monitoring.
- By the very first acceleration (cold power unit) in the motor the maximum current of the power unit (▷P0011◁, ▷P0013◁) can flow during the overload period ▷P0015◁.
- If the "Maximum current of the drive" ▷P1241◁ is lower than the maximum current of the power unit (▷P0011◁, ▷P0013◁), accordant to the current time integral, the period at which can be driven at the "maximum current of the drive" increases (release time of the Ixt warning > overload time ▷P0015◁).
- The overload monitoring doesn't replace the PU temperature monitoring.

The function overload monitoring in the control structures is shown in ▷Figure 9◁ on page 23.

The different procedures are described below.

1 PT1-method

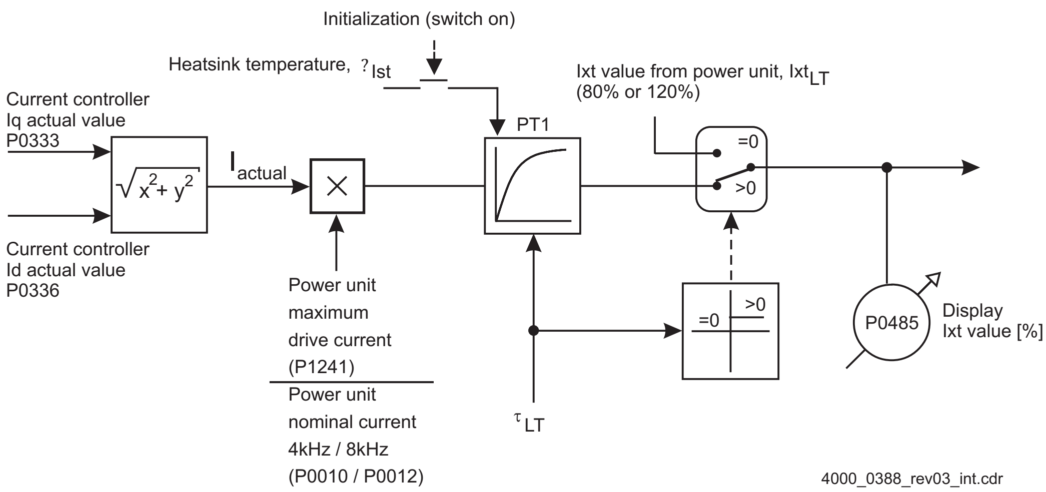


Figure 61: Overload monitoring of the power unit PT1 model

Current controller Iq actual value		P0333
Current controller Id actual value		P0336
Apparent current-actual value	(I_{actual}) [A_{eff}]	$\sqrt{P0333^2 + P0336^2}$
Power unit rated current 4 kHz/8 kHz	(I_{rated}) [A_{eff}]	P0010 / P0012
Power unit peak current 4 kHz/8 kHz	(I_{max}) [A_{eff}]	P0011 / P0013
Power unit peak current of drive	(I_{limit}) [A_{eff}]	P1241
Power unit overload time	(t_u)[s]	P0015
Power unit heat sink temperature actual value	(ϑ_{actual}) [°C]	P0482

Power unit Ixt value	(Ixt) [%]	P0485
Power unit Ixt value from power unit	(Ixt-power unit) [%]	
Power unit Ixt offset	(Ixt-offset) [%]	
Power unit overload factor max.	(u_{max}) [%]	
Power unit overload factor current	(u) [%]	
Power unit thermal time constant	(τ_{LT})[s]	
Power unit release time	(t_{off}) [s]	Time up to limit on I_{nom}

$$u_{max} = \frac{I_{max}}{I_{nom}} \cdot 100 \qquad [\%]$$

$$u = \frac{I_{act}}{I_{nom}} \cdot 100 \qquad [\%]$$

$$\tau_{LT} = -\frac{t_u}{\ln\left(\frac{u_{max} - 100}{u_{max}}\right)} \ [s]$$

– Release time

$$t_{off} = \tau_{LT} \cdot \ln\left(\frac{u}{u - 100}\right)$$

Example:

$I_{rated} = 10\ A_{eff}$

$I_{max} = 15\ A_{eff}$

$t_u = 1\ [s]$

$I_{limit} = 12\ A_{eff}$

$$u_{max} = \frac{15}{10} \cdot 100 = 150 \qquad [\%]$$

$$u = \frac{12}{10} \cdot 100 = 120 \qquad [\%]$$

$$\tau_{LT} = -\frac{1}{\ln\left(\frac{150 - 100}{150}\right)} = 0,91 \qquad [s]$$

$$t_{off} = 0,91 \cdot \ln\left(\frac{120}{120 - 100}\right) = 1,63 \qquad [s]$$

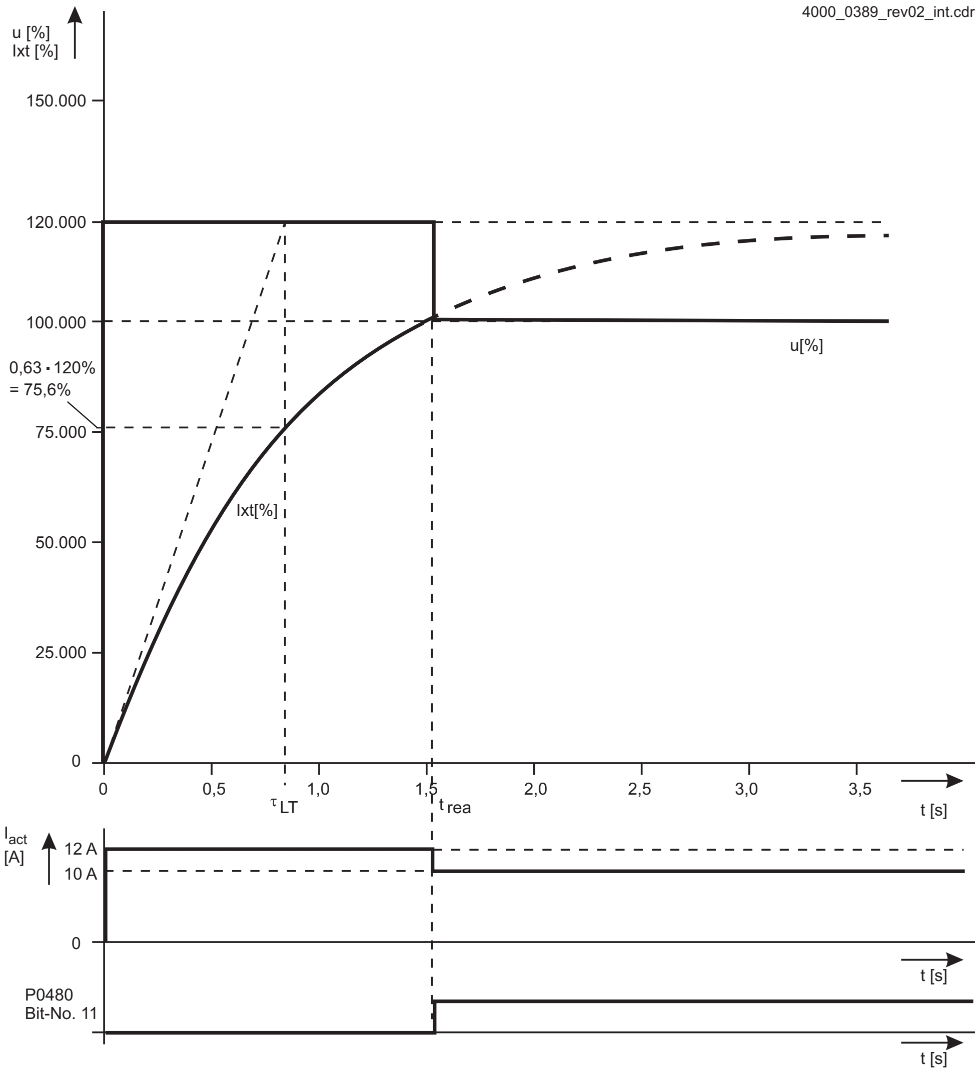


Figure 62: Curves overload monitoring PT1 model

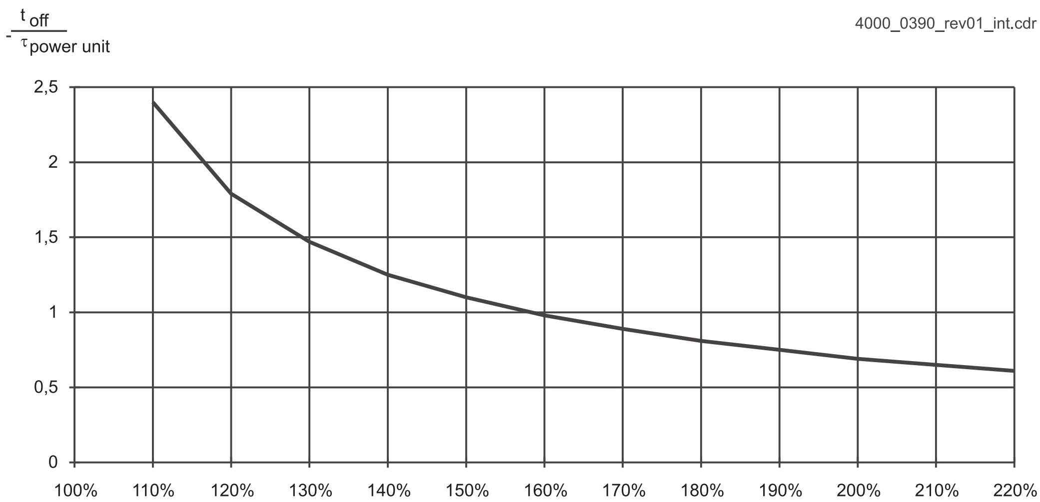


Figure 63: Release time as a function of the thermal time constant and overload, PT1 model

A "cold" power unit is assumed at the characteristic ▹Figure 63◃ on page 93.

If the "Power unit overload time" equals 0, the overload monitoring does not take place in the controller. Instead of that the Ixt value is determined in the power unit and is transmitted to the controller (Ixt power unit). For this purpose two Ixt values were defined: 80% (normal operation) and 120% (overload).

The PT1 model is initialized after the device has been switched on and after the heat sink temperature is greater than 45°C:

$$\text{Ixt offset} = \frac{\vartheta_{act} - 45°C}{85°C - 45°C} \cdot 100\ [\%]$$

2 Integration model

The model integrates the difference of the currents between 105% of the according power unit rated current and the actual current. A reduction occurs at an internal Ixt-value of ≥ 100% (overload time [tu] * maximum current of the drive [I_{max}]) or a heat sink temperature > 70 °C. At stator frequencies < 3 Hz is at an internal Ixt-value of 0.3 s * I_{max}.

The reduction of the apparent current reduction occurs if the Ixt-value decreased by 30 s * I_{max}. At stator frequencies smaller than 5 Hz the Ixt-value must completely decrease to 0.

▹P0485◃ is used to show the status between OK (P0485 = 95%; no reduction) and overload (P0485 = 100%; reduction active). A continual Ixt-value is not shown in P0485, because step changes in the value process of the Ixt-display in P0485 would not be able to avoid because of the further requirements for a current limit.

3 Temperature model + Integration model

In the temperature model additionally to the Ixt value of the integration model, especially for the specific power unit internal temperatures are calculated for the following:

- IGBT modules
- Supply (thyristor modules, at the basic units no power modules, only).

The Ixt actual value ▹P0485◃ is set to 95%, if the internal Ixt value is < 95% and all the calculated temperature values are within the permitted range.

If the Ixt value exceeds the 100% or one of the temperatures exceed the limit range then ▹P0485◃ is set to 100% and thus the reduction of the total current is activated.

7.1.8 Protection function automatical reducing of PWM switch frequency

Because of the Ixt model the IGBTs used in the power unit are adequately protected against overload for the operation with a stator frequency greater than 10 Hz. The thermal stress of the IGBTs however becomes greater with a decreasing stator frequency. For the case that the power unit must often have high current in the range of small stator frequency, the IGBTs could be damaged early because of thermal overload.

From firmware FW 03.09:

In order to avoid this early damage, the PWM switch frequency is reduced at small stator frequency. The threshold of frequency switching is settable with ▹P0489◃ threshold of PWM switching.

At ▷P0489◁ = 0 the function of the switching frequency reduction is deactivated. The actual PWM switching frequency is displayed in parameter ▷P0491◁ Momentary PWM switching frequency.

At a PWM frequency ▷P1240◁ = 8 kHz there is a reduction to 4 kHz and at ▷P1240◁ = 4 it is switched over to 2 kHz.

The automatic switchover of the PWM switching frequency does not change the value of the set PWM frequency ▷P1240◁.

Examples:

For PWM frequency (▷P1240◁) = 8 kHz:

Stator frequency < Threshold of PWM-switching (▷P0489◁),
Momentary PWM switching frequency ▷P0491◁ is 4 kHz

Stator frequency ≥ Threshold of PWM-switching (▷P0489◁),
Momentary PWM switching frequency ▷P0491◁ is 8 kHz

For PWM frequency (▷P1240◁) = 4 kHz:

Stator frequency < Threshold of PWM-switching (▷P0489◁),
Momentary PWM switching frequency ▷P0491◁ is 2 kHz

Stator frequency ≥ Threshold of PWM-switching (▷P0489◁),
Momentary PWM switching frequency ▷P0491◁ is 4 kHz

Special case BM46XX

At acceleration devices (b maXX® 46XX) the PWM switch frequency at stator frequencies below 10 Hz must be divided in half, therefore the minimum value of ▷P0489◁ for these devices is 10 Hz.

NOTE!

The automatic reducing of PWM switch frequency function is only available at controllers which are assembled for the "external PWM" (PWM is realized in the FPGA of the controller). See ▷P2037◁. Please, do not hesitate to contact us, if you have questions, referring to the controller hardware type.

NOTE!

The automatic reducing of PWM switch frequency function neither changes the nominal current (▷P0010◁, ▷P0012◁) nor the maximum current of the device (▷P0011◁, ▷P0013◁). These values are defined by the PWM switch frequency, which was set, exclusively.

NOTE!

At the implementation of the PWM switchover in the running operation the errors in the controller were minimized. However, errors cannot be excluded. Therefore, the option of reducing the PWM frequency automatically is suitable for simple (not critical) applications, only.

7.1.9 Pulse width modulation (PWM), motor-voltage

PWM frequency

Valid values: 2, 4, 8 kHz.

The power units are designed for the PWM frequencies 4 kHz and 8 kHz. Some of the power units are at 4 kHz suitable to higher currents.

In the ▹P1240◃ the PWM frequencies 4 kHz and 8 kHz can be set, only.

The PWM frequency of 2 kHz can be reached if the set PWM frequency ▹P1240◃ is 4 kHz and the function "Automatic switchover of the PWM switching frequency" is triggered (see ▹Protection function automatical reducing of PWM switch frequency◃ on page 94).

NOTE!

If it is intended to operate the device with a PWM frequency of 2 kHz, at first must be checked if operating this drive with this frequency is permitted (e.g. if the rating data of the motor or of the motor filter when using such a filter still are valid regarding this PWM frequency).

The currently acting PWM frequency is presented in the Parameter "Actual PWM switching frequency" (▹P0491◃).

Reducing the PWM frequency during operation (automatic reduction of the PWM frequency) doesn't change the value of the set PWM frequency ▹P1240◃ that means that in this case the present PWM frequency deviates from the set PWM frequency ▹P1240◃.

Generally the following applies:

- The noise emerging from the motor caused by pulse shaped voltage signals drops if the PWM frequency increases.
- The thermal load in the IGBT module decreases if the PWM frequency drops.
- The current controller cycle time can increase if the PWM frequency drops.
- The bandwidth of the current controller is inversely proportional to the current controller cycle time.
- The setting range of the output frequency is inversely proportional to the current controller cycle time.

The effective PWM frequency determines the current controller cycle time.

PWM frequency (P0491)	Current controller cycle time
2 kHz	250 µs
4 kHz / 8 kHz	125 µs

The current controller cycle time determines the setting range of the output frequency.

The setting range of the output frequency refers to the stationary operation and to the linear range of the PWM, i.e. without overmodulation.

The quality of the generated output voltages is determined by checking how close it is to the effects of perfect sine voltages and depends on the ratio-output frequency f_{I-R} (f_{I-R} = 1/current controller cycle time).

$$f_{max} = \frac{f_{I-R}}{K_{pf}} \qquad \text{; with } K_{pf} \text{ typically} \approx 18$$

In the following the output frequency setting range is determined accordant to the current controller cycle time (or accordant to the PWM frequency) - see chapter "Electrical data" in the operating manual of the device.

Current controller cycle time	Output frequency operating range 0 - f_{max}
250 µs	0 - 225 Hz
125 µs	0 - 450 Hz

Furthermore, the controller defines an upper limit regarding the output frequency of 599 Hz. The output frequency in the steady operation is monitored. If the limit value of 599 Hz is violated the controller reacts with a pulse disable and the error number 213 (▹P1240◃) is displayed (to obtain details please contact the responsible Baumüller sales department, keyword: export restrictions).

The controller allows the converter generating output voltages of frequencies between f_{max} and 599 Hz. However, the quality of these voltages cannot be guaranteed.

Modulation index

The modulation or the modulation level determines the motor voltage. A value of 0% modulation index corresponds to zero voltage of the active mains rectifier unit and 100% corresponds to the maximum linear range of PWM. The output voltage at 100% modulation index is: Power unit UDC actual value ▹P0484◃ / $\sqrt{2}$. Overmodulation starts from 100% on. With 110% the PWM is in block operation.

Modified space vector modulation (MSVM)

With MSVM it is possible to reduce the average switch frequency of the IGBTs by one third, so that the switch losses also reduce by one third. Particularly advantageous it is, to use the modified SVM-procedure if there is a high modulation. (MSVM).

At smaller modulation it is possible to reduce switch losses by a third, but the switching current ripples can be up to twice as great as at the standard SVM.
With a continuously decreasing stator frequency the current space vector rotates slower and slower and even comes to a standstill. The term of the average thermic load for the IGBTs of the three half bridges, used at greater stator frequency, cannot be used here anymore. For certain IGBTs it therefore is not possible anymore to reduce losses with this procedure.

Switching to MSVM

With ▷P0487◁ switching PWM mode or with MSVM threshold it is selected, from which modulation on the PWM the MSVM is activated.

This parameter is settable from 0 to 100%. From 80% modulation on the switching losses with MSVM are reduced by one third without increasing the switching current ripples compared with SVM.

Overmodulation

With the implemented modulation operation in the controller the transition from linear modulation range, overmodulation until to the block operation is continuously.

With block operation the output voltage is 10% greater than with SVM without overmodulation. The torque deviations are disadvantageous (5th, 7th, 11th, ...). Therefore an operation in the great overmodulation must be avoided.

Limitation of the modulation index with field weakening controller

In order to limit the modulation index in steady state operation ▷P0488◁ Maximum control setting of modulation is defined. This parameter can be set from 80% to 110%.

The dynamic output voltage in order to build-up the motor current reaches 110% of the control setting.

- With an asynchronous motor the steady-state output voltage of the inverter from field weakening is limited to the maximum modulation, which was set.
- With a synchronous motor the steady-state output voltage of the inverter is limited to the maximum modulation, which was set, if the field weakening is activated for the synchronous motor and ▷P0336◁ current controller Id actual value is smaller than the set field current ▷P0095◁ field weakening current for synchronous motor. If the necessary motor voltage increases with the speed, then the drive will function in block operation.

Automatic switching of the PWM switch frequency (from FW 03.09)

The PWM switch frequency can be reduced automatically. The reduction occurs below a stator frequency threshold. See ▷Protection function automatical reducing of PWM switch frequency◁ on page 94.

NOTE!

The support of modulation in block operation and the automatically switchover of the PWM switch frequency is only available at controllers which are assembled for the "external PWM" (PWM is realized in the FPGA of the controller). See ▷P2037◁. Please, do not hesitate to contact us, if you have questions, referring to the controller hardware type.

7.1.10 Device types

From FW 03.10 onwards besides the universal devices b maXX® 44XX also the acceleration devices b maXX® 46XX and the continuous current devices b maXX® 47XX are supported. (See chapter "Design and Operation" in the "Instruction Handbook b maXX BM4400, BM4600, BM4700").

The devices BM44XX, BM46XX, BM47XX consist of one mains rectifier unit for the input side, DC link capacitors and of an inverter unit for the output side. If the DC link voltage of the device is supplied from the mains voltage via the internal mains rectifier unit the BM4XXX is named Basic device. If the DC link voltage is supplied externally the BM4XXX device is named Power module (see instruction handbook b maXX 4400, 4600, 4700).

Universal device BM4400

An universal unit is a converter which can implement electric drives in industrial applications.

Acceleration devices BM46XX

These units were derived from the BM44XX. The characteristic for these devices is that the peak current is twice the nominal current, whereat the devices were developed for a specific motion cycle. The devices weren't developed to be operated with peak current during standstill or with output frequencies lower than 10Hz. These devices apply to the output-frequency-dependent maximum current derating BM46XX. See chapter "Electrical data" in the operating instruction of the unit.

In order to protect the b maXX® 46XX devices, below a stator frequency of 10 Hz (threshold over ▹P0489◃ parameterizable, but at least 10 Hz) the power unit peak current (▹P0011◃/▹P0013◃) is reduced internal linear from 75% (fs = 0 Hz) to 100% (fs = ▹P0489◃) and the PWM switch frequency is reduced to 4 kHz or 2 kHz.

With a PWM frequency ▹P1240◃ = 8 kHz a reduction to 4 kHz occurs, with ▹P1240◃ = 4 kHz a switchover to 2 kHz takes place.

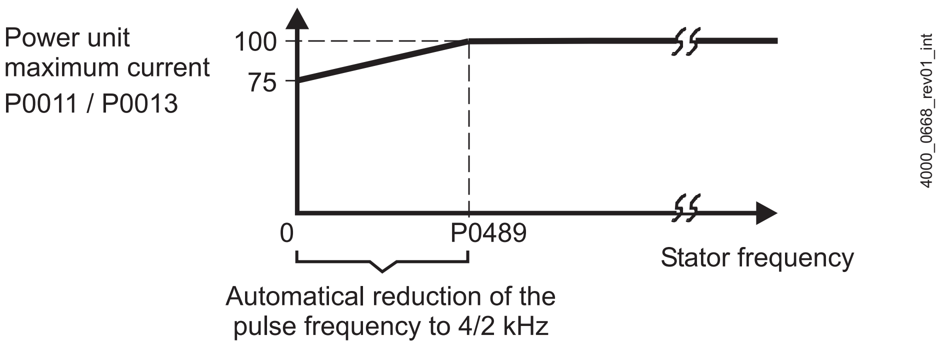


Figure 64: Stator frequency dependent decrease of the peak current and the pulse frequency.

NOTE!

Increased synchronous motor-field weakening current limit BM46xx

With BM46xx-devices in combination with a synchronous motor, exceptionally a higher magnetizing current is permitted. Contact the application department of Baumüller to obtain detailed information.

On the one hand the parameter Field weakening current for synchronous motor ▹P0095◃ is limited to 95% of the power unit peak current 4 Hz ▹P0011◃, instead of the default value 95% of the power unit rated current ▹P0010◃.

On the other hand internally the amplitude of the magnetizing current is limited to 95% of the power unit peak current (▹P0011◃ or ▹P0013◃), instead of the default value 95% of the power unit rated current (▹P0010◃ or ▹P0012◃).

The internal limit of the amplitude of the magnetizing current to 95% of the maximum current of the drive ▹P1241◃ remains unchanged.

Continuous current devices b maXX® 47XX

These devices were derived from the BM44XX to maximize the available nominal current. These devices are only available with none peak current or only with low peak current. For this reason overload monitoring (Ixt monitoring) is not executed at these devices.

7.2 Encoder

This software module operates the assignment of the encoders 1 and 2 for position control (actual position value), motor control (determination of field angle regarding the field orientation and of the actual speed value to control the speed) and the synchronous operation (set value of the following axis) as well as the configuration of the encoderless monitoring of the field angle (for motor control) and the speed (for speed control).

The following encoder types can be evaluated:

Encoder type	**Encoder module** See ▹P0550◃ / ▹P0551◃
Resolver	ENC-01 ENC-21 (replaced ENC-01) ENC-11 (with reduced level or transmission ratio)
Square wave incremental encoder	ENC-03
Sine incremental encoder[1)]	ENC-04 (with zero point detection) ENC-08 (with zero point detection and with commutation)
Sine-cosine encoder with SSI	ENC-07 (without encoder supply) ENC-17 (with 5 V-supply) ENC-27 (with 24 V-supply)
Sine-cosine encoder with EnDat®	ENC-05 (EnDat 2.1) ENC-06 (EnDat 2.2)
Sine-cosine encoder with HIPERFACE®	ENC-02 ENC-12 (without terminating resistor at RS-232)

1) also referred to as sine-cosine incremental encoder

Activate

The evaluation of the encoder signals is activated via bit 0 of the "Encoder mode" ▹P0150◃ and. ▹P0160◃ (bit 0 = 1).

The selection of encoder 1 or encoder 2 for the motor control is processed via the "Speed mode" " ▹P1030◃ bits 1...0 (bits 1...0 = 01: Encoder 1; bits 1...0 = 10: Encoder 2). At position-controlled operation modes the encoder for the position control is selected via "position controller mode" ▹P1050◃ bit 2 (bit 2 = 0: Encoder that was selected for motor control; bit 2 = 1: (second) encoder, which NOT was selected for the motor control).

During synchronous operation mode 0000 "Real master axis in the relative angular synchronism" two encoders are required. Via the encoder input (encoder 1 or encoder 2) the evaluation for the motor control and the position control of the following axis is activated; via the other encoder the position set value of the position set value of the following axis is set.

7.2.1 Encoder 1

For use one of the option modules of type ENC-xx must be existent. The function module in slot A responds to encoder 1. In addition, encoder 1 is the predefined slot for the motor control encoder.

Parameter overview ProDrive

Number	Name / meaning	Remark
	Encoder data	
--	Module type slot A	ProDrive-variable to set the available module types. It specifies the type key parameter P0151 for encoder without communication.
▹P0151◃	Encoder 1 type code	Display. Designation of encoder. The type key is evaluated automatically from the encoder at the communication encoder.
▹P0152◃	Encoder 1 number of pulses or pole pairs	Number of pulses, number of pole pairs, number of sine periods per revolution or position values per revolution.
▹P0150◃	Encoder 1 mode	Bit 1, multiplier for number of pulses: =0: 1 =1: 8
▹P0153◃	Encoder 1 revolutions	Number of complete revolutions, which the encoder can display
	Status	
▹P0390◃	Encoder 1 status	Bits 0, 1, 3 reserved for internal state machine Bit 8: Toggle bit for zero pulse
	Activate	
▹P0150◃	Encoder 1 mode	Bit 0, encoder evaluation: 1: active
▹P1050◃	Position controller mode	Bit 2: Selection for position control, synchronous operation (depends on P1030 bits 1, 0)
▹P1030◃	Speed controller mode	Bits 1, 0: Selection encoder for motor control
	Polarity	
▹P0150◃	Encoder 1 mode	Bit 4
	Direction of counting	
▹P0150◃	Encoder 1 mode	Bit 5

Number	Name / meaning	Remark
	Actual values	
▹P0392◃	Encoder 1 actual revolutions	Display
▹P0391◃	Encoder 1 actual angle	Display
▹P0393◃	Encoder 1 mechanical actual angle	Display
▹P0395◃	Encoder 1 actual position 16	Display
▹P0394◃	Encoder 1 actual speed	Display
	Configuration	
▹P1057◃	Gear factor	
▹P1071◃	Encoder 1 smoothing time constant	
▹P0154◃	Absolute offset encoder 1	
▹P0159◃	Encoder 1 shift factor	
	Speed thresholds	
▹P1072◃	Encoder 1 overspeed limit	
▹P1073◃	Encoder 1 N=0 threshold	
▹P1074◃	Encoder 1 N>Nx ON threshold	
▹P1075◃	Encoder 1 N>Nx OFF threshold	

7.2.2 Encoder 2

For use one of the option modules of type ENC-xx must be existent. The function module in slot B responds to encoder 2. In addition, encoder 2 is the predefined slot for the position control encoder (if a second encoder finds use for this).

Parameter overview ProDrive

Number	Name / meaning	Remark
	Encoder data	
--	Module type slot B	ProDrive-variable to set the available module types. It specifies the type key parameter P0161 for encoder without communication.
▹P0161◃	Encoder 2 type code	Display. Designation of encoder.
▹P0162◃	Encoder 2 number of pulses or pole pairs	Number of pulses, number of pole pairs, number of sine periods per revolution or position values per revolution.

Number	Name / meaning	Remark
▹P0160◃	Encoder 2 mode	Bit 1, multiplier for number of pulses: =0: 1 =1: 8
▹P0163◃	Encoder 2 revolutions	Number of complete revolutions, which the encoder can display
	Status	
▹P0400◃	Encoder 2 status	Bits 0, 1, 3 reserved for internal state machine Bit 8: Toggle bit for zero pulse
	Activate	
▹P0160◃	Encoder 2 mode	Bit 0, encoder evaluation: 1: active
▹P1050◃	Position controller mode	Bit 2: Selection for position control, synchronous operation (depends on P1030 bits 1, 0)
▹P1030◃	Speed controller mode	Bits 1, 0: Selection encoder for motor control
	Polarity	
▹P0160◃	Encoder 2 mode	Bit 4
	Direction of counting	
▹P0160◃	Encoder 2 mode	Bit 5
	Actual values	
▹P0402◃	Encoder 2 actual revolutions	Display
▹P0401◃	Encoder 2 actual angle	Display
▹P0403◃	Encoder 2 mechanical actual angle	Display
▹P0405◃	Encoder 2 actual position 16	Display
▹P0404◃	Encoder 2 actual speed	Display
	Configuration	
▹P1057◃	Gear factor	
▹P1081◃	Encoder 2 smoothing time constant	
▹P0164◃	Absolute offset encoder 2	
▹P0169◃	Encoder 2 shift factor	
	Speed thresholds	
▹P1082◃	Encoder 2 overspeed limit	
▹P1083◃	Encoder 2 N=0 threshold	
▹P1084◃	Encoder 2 N>Nx ON threshold	
▹P1085◃	Encoder 2 N>Nx OFF threshold	

7.2.3 Encoderless evaluation of the field angles and of the speed

The encoderless evaluation of the field angle (for the motor control and field orientation) and of the actual speed value (for speed control) from a motor model is active at an encoderless ASM, only.

In the channels A or B function modules of the type ENC-xx are not required at the encoderless operation. If available they can be activated for diagnostics purposes. However, these are evaluated but have no effect on the motor control.

Parameter overview

Number	Name / meaning	Remark
	Data	
	Encoderless evaluation of the field angle and the motor actual speed value via the motor currents and the voltages by a motor model.	
	Polarity	
	Typically a positive speed at motors having a clockwise rotating field and u,v,w-phase sequence.	
	Status	
▹P0093◃	Motor mode	active at encoderless motor type
	Actual values	
▹P0353◃	Speed actual value	Display
	Configuration	
▹P1061◃	Smoothing time for open loop speed actual value	
	Speed thresholds	
▹P1062◃	Open loop overspeed limit	
▹P1063◃	Open loop N=0 threshold	
▹P1064◃	Open loop N>Nx ON threshold	
▹P1065◃	Open loop N>Nx OFF threshold	

7.2.4 Encoder monitoring

Overview monitoring

The following relevant monitoring were implemented in the software modules encoder 1, encoder 2 and encoder manager (there were no system warning implemented for these modules).

Monitoring	Error no. encoder1/ encoder 2	Reaction
Communication error	112 / 128 (details in ▹P0234◃ / ▹P0235◃)	IS
Error at overwriting of encoder position information	114 / 130	IS
Cable break	115 / 131	IS
Overspeed	116 / 132	IS
Amplitude limit exceeded	117 / 133	IS
Encoder type unknown	118 / 134	IS
Invalid data field for motor data	119 / 135	IS
Incorrect motor data	120 / 136	IS
Saving error of motor data	121 / 137	IS
Motor data write-protected. (is not valid for BM motors)	122 / 138	IS
Field angle error	123 / 139	IS
Encoder without temperature measuring	124 / 140	adjustable
Memory capacity in the encoder for electronic type plate too small	125 / 141	adjustable
	Error no.	
Absolute position encoder 1 unknown	144	IS
Absolute position encoder 2 unknown	145	IS
Encoder module 1 is missing	146	IS
Encoder module 2 is missing	147	IS
Encoder module for measured value storage is missing	148	IS
At resolver no measured value storage possible	149	IS
Triggering not possible, because no incremental encoder	150	IS

Overview of the messages in the hierarchic warning and error system.

Monitoring in encoder 1 / encoder 2 module	P0200 Error system 1 bit no. 7 = 1 / bit no. 8 = 1 P0208 / P209 error encoder 1 / encoder 2	
	Bit no.	Error no.
Communication error	0	112 / 128 (following parameter ▹P0234◃/▹P0235◃)
Error at overwriting of encoder position information	2	114 / 130
Cable break	3	115 / 131
Overspeed	4	116 / 132
Amplitude limit exceeded	5	117 / 133
Encoder type unknown	6	118 / 134
Invalid data field for motor data	7	119 / 135
Incorrect motor data	8	120 / 136
Saving error of motor data	9	121 / 137
Motor data write-protected. (is not valid for BM motors)	10	122 / 138
Field angle error	11	123 / 139
Encoder without temperature measuring	12	124 / 140
Memory capacity in the encoder for electronic type plate too small	13	125 / 141
Monitoring in encoder manager module	P0200 Error system 1 bit no. 9 = 1 P0210 Error encoder manager	
	Bit no.	Error no.
Absolute position encoder 1 unknown	0	144
Absolute position encoder 2 unknown	1	145
Encoder module 1 is missing	2	146
Encoder module 2 is missing	3	147
Encoder module for measured value storage is missing	4	148
At resolver no measured value storage possible	5	149
Triggering not possible, because no incremental encoder	6	150

Encoder cable break monitoring

In order to monitor cable break the signal level of the encoder channels are evaluated. At encoders with sine and cosine channels at least one of the channels must have a level which is above the settable minimum threshold (about 20% of the nominal operation voltage). At rectangular incremental encoders the A-channel must comply with the minimum level at the minimum (50% of the nominal operating voltage). At all the other cases the cable break error is activated (no. 115 or no. 131).

Sine-square monitoring of the encoder voltages

Der Controller evaluates the actual amplitude of the encoder signal (Am in ▹Figure 65◃) from the sine- and cosine track of the encoder. The signals of the sine- and cosine track are scanned with a frequency of 8 kHz. The calculation of the sum from the quadrant of the sine- and cosine tracks also is made with 8 kHz. The signal amplitude is scaled in the controller (80% approximately correspond to 80% of the typical value 0.5 V and to 96% to the maximum value 0.6 V of the encoder signal). At an error-free operation the sum from the quadrant of the sine- and cosine tracks nearly are constant. However the signal level, which is produced by the encoders, is not always constant, especially there is a dependence of the angular frequency and therewith of the speed.

The controller recognizes the limit exceeded of the amplitude monitoring if the amplitude falls below the fixed low threshold by 30% (0.187 V) or exceeds the adjustable upper threshold, encoder 1 (2) Sin^2x upper limit ▹P1076◃ (▹P1086◃) (settable range 85% to 110%, i.e. 0.53 - 0.69 V).

Violation of the amplitude limits are indicated in the accordant status bit 14 of the "Encoder 1(2) Status" ▹P0390◃ (▹P0400◃).

The sine-squared monitoring can be activated in the "Encoder 1 (2) mode "▹P0150◃ (▹P0160◃) (bit 7 = 1).

If monitoring is activated, in general single violation of the amplitude limit of the encoder 1(2) error no. 117 (133) "Amplitude limit exceeded with the pulse enable being inhibited.

Monitoring time window

To avoid that single (not critical) violations of the amplitude limits lead to a pulse inhibit, the monitoring of the amplitude limits can be processed within a time window.

Within a settable time window the exceeding of the amplitude limits are counted, ▹P1077◃ (▹P1078◃) for each encoder separately. As soon as there are two exceedances of the amplitude limit within the time window, they are set in the according status bit 14 encoder 1 (2), ▹P0390◃ (▹P0400◃) for about 200 ms. In addition, the accordant error no. 117 (133) is enabled and the pulse enable is inhibited.

If the window time of the encoder monitoring has expired the counter for the exceedances of the amplitude limits is reset and the time window is started again.

If the value of the time window ▹P1077◃ (▹P1078◃) is set to 0 the time window function is switched off (standard conditions).

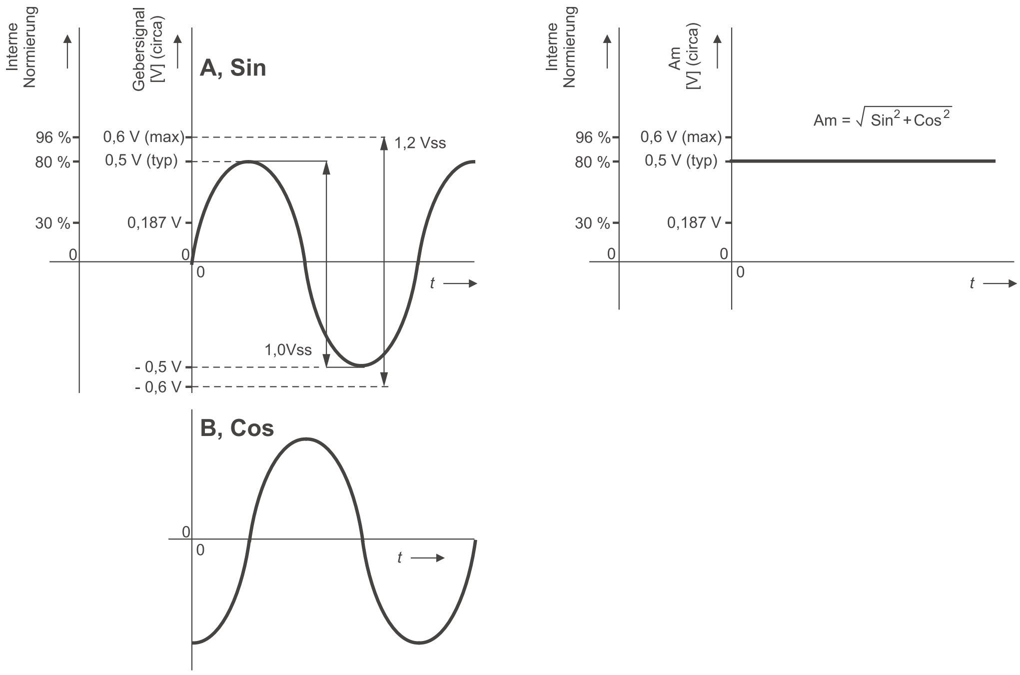


Figure 65: Sine-/cosine-tracks and the actual amplitude of the encoder signal

NOTE!

- The amplitude monitoring is not a cable break monitoring and only to a limited extent is in the position to sense existing cable breaks.
  It cannot be guaranteed that the single break of one of the cable sin+/sin- or cos+/cos- will be sensed with the implemented amplitude monitoring.
- It is not possible to detect a cable break with the indirect method of the amplitude monitoring if the machine is at a standstill. Therefore a cable break perhaps can be sensed with the amplitude monitoring not before the machine was started.
- A recognition is only possible with very low output frequencies (< 200 Hz) of the sine- and cosine signals and additionally with very little change of frequency, i.e. speed change at the curve, because of the underscanning of the sine-/cosine signals with incremental encoders, with absolute value encoders with hiperface or with encoders with EnDat 2.1 interface.
- It is assumed that a cable break cannot be scanned indirectly with the amplitude monitoring at drive systems with a powerful acceleration.
- There is no amplitude monitoring at EnDat 2.2 encoders, because these Baumüller encoders are operated with all-digital interface exclusively.
- The amplitude monitoring of the encoder voltage does not operate with a square wave incremental encoder with the module ENC-03. This type possesses an own cable break monitoring (ENC-03: Mounting version with and without cable break monitoring), which cannot be switched off.
- The amplitude monitoring of the encoder voltage does not operate with a pure digital encoder with SSI protocol (ENC-27). This type possesses an own cable break monitoring, which can be switched off.

Field angle monitoring at synchronous motors

With the help of the motor model the controller determines the revolving field direction of the rotor. This is then compared with the revolving field direction, which is calculated from the encoder whcih is used for the motor control. If there are angle errors greater than 45°electric, the according status bit encoder 1(2) status, ▹P0390◃ (▹P0400◃), bit 15 is set. If the monitoring is activated, which which is set with the bit 6 in motor mode, ▹P0093◃, the according error encoder 1 (2) bit 5, ▹P0208◃ (▹P0209◃) is released and pulse enable is inhibited.

By setting of field angle monitoring threshold (▹P1087◃) in dependence of speed actual value ▹P0353◃, additionally the field angle monitoring can be switched on and off. If the speed is smaller than the field angle monitoring threshold (▹P1087◃) this monitoring remains deactivated.

The field angle monitoring only works for the encoder, which has been adjusted for the motor control.

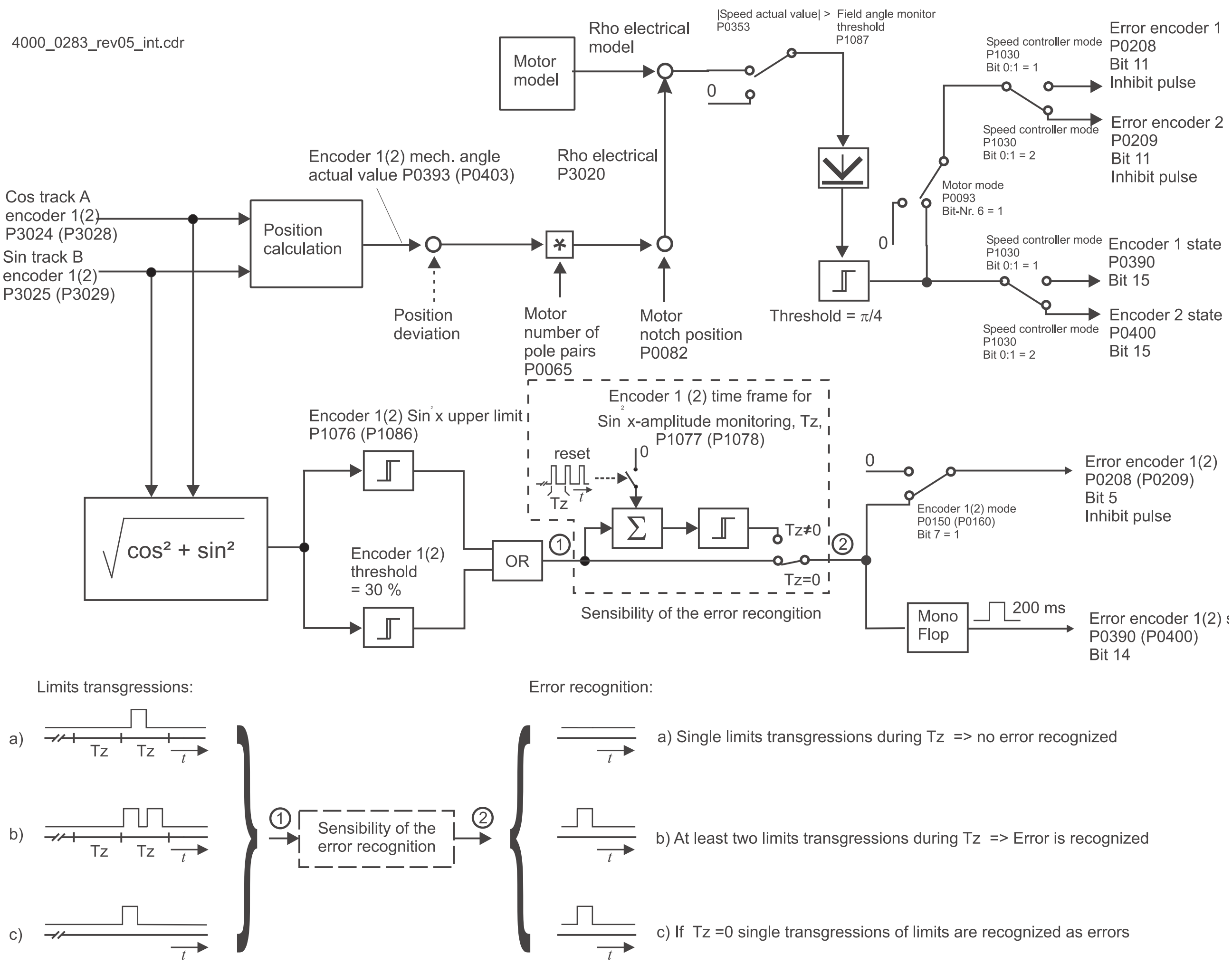


Figure 66: Sin^{2}cos^2-monitoring and field angle monitoring of a synchronous motor

7.2.5 Offset- and amplitude error correction of a resolver

The mechanical angle of a motor with resolver is generated from the SINE and COSINE track of the resolver. As both of these signals are analog, it can occur that the signals are distorted due to offset, phase and amplitude errors. In order to diminish the distortion to the angle evaluation a correction procedure of the offset and the amplitude error is implemented. The correction can be activated or deactivated by setting of the bit 10 in the parameter encoder 1 mode ▹P0150◃ for encoder 1 (encoder 2 mode ▹P0160◃ for encoder 2).

7.3 Motor

The motor requirements are described in chapter "Technical data" of the operating instruction of the devices BM4400, BM4600, BM4700. The motors are to be operated in star connection. The motor control and the motor parameters were applied for this circuit, only.

7.3.1 Electronic motor type plate

Stegmann and Heidenhain encoders provide the option to save OEM (OEM = Original Equipment Manufacturer) data in the EEPROM. This memory is used to save Baumüller specific information in the following sections of the encoder (BM-OEM-data):

- Motor data
- Notch position, offset
- Absolute offset

BM-OEM section motor data			
Name	**Param.-no.**	**Name**	**Param.-no.**
Data configuration	P0052	Ke factor	P0067
Type code	P0050	Attenuation factor	P0068
Article number	P0096	Peak current	P0069
Serial number	P0051	Peak torque	P0070
Flags	P0074	Field weakening speed	P0071
Nominal voltage	P0053	Maximum speed mechanical	P0072
Nominal current	P0054	I^2t time constant	P0073
Nominal operation mode	P0055	Stator resistance	P0075
Nominal power	P0056	Stator leakage inductance	P0076
Nominal speed	P0057	Rotor resistance	P0077
Power factor	P0058	Rotor leakage inductance	P0078
Nominal frequency	P0061	Magnetizing inductance	P0079
Slip frequency 1	P0059	Lq inductance	P0080
Slip frequency 2	P0060	Ld inductance	P0081
Temperature 1	P0062	Inertia	P0083
Temperature 2	P0063	Temperature sensor type	P0084
Friction moment	P0064	Shutdown temperature	P0090
Number of pole pairs	P0065	Standstill current	P0097
Magnetizing current	P0066	Standstill torque	P0098

BM-OEM section notch position, offset	
Name	**Parameter no.**
Notch position offset	P3058/P3059
Notch position	P0082

BM-OEM section absolute offset	
Name	**Parameter no.**
Absolute offset angle	P0157/P0167
Absolute offset revolution	P0158/P0168

Parameter overview data management

Number	Name / Meaning	Remark
▹P2031◃	System command	Write BM-OEM data (different modes)
▹P2030◃	Password	Level for writing the BM-OEM-data (depending on the writing mode)
▹P0150◃ ▹P0160◃	Encoder 1/2 mode	Bit 0 activate encoder
▹P0093◃	Motor mode	Bit 4: Read BM-OEM data From FW 03.09: can be operated alternatively with ▹P2099◃
▹P2099◃	OEM data selection from encoder memory	From FW 03.09: Read BM-OEM data (different modes)

7.3.2 Motor database

The motor database of the operating software ProDrive contains the following parameter (SM valid for synchronous machines only; ASM valid for asynchronous machines, only; ASM-with-encoder for asynchronous machines with encoder feedback, ASM-encoderless for encoderless, only; INFO includes information, i.e. it is not used in the motor control).

Parameter	Unit	Parameter	Remarks
Manufacturer	--	--	INFO
Motor type (*Motor type code)*	--	P0050	INFO

Parameter	Unit	Parameter	Remarks
Nominal voltage DC link	V	P0020	relevant only for ▷P2122◁ and ▷P2123◁ at "Find notch position" with method 2
Nominal speed	U/min	P0057	--
Nominal power	kW	P0056	--
Maximum speed mechanical	U/min	P0072	up to FW 3.16: INFO from FW 3.16: see 7)
Nominal operation mode	--	P0055	INFO
Nominal voltage	V	P0053	--
Number of pole pairs	--	P0065	--
Ke Factor	V/1000U/min	P0067	-- 1)
Kt Factor	Nm/A	-- 2)	INFO 2)
Peak current	A	P0069	up to FW 3.08 INFO from FW 3.09: Limitation of the "Maximum drive current" ▷P1241◁
Peak torque	Nm	P0070	INFO
Nominal current	A	P0054	--
Nominal torque	A	-- 3)	INFO 3)
Friction moment	Nm	P0064	up to FW 3.07 only INFO. from FW 3.08 4)
Attenuation factor	Nm/1000U/min	P0068	up to FW 3.07 only INFO. from FW 3.08 4)
Motor shutdown temperature	°C	P0090	--
I^2t time constant	s	P0073	--
Inertia	$kg*cm^2$	P0083	use only for parameterization of the speed controller at auto-tuning
Temperature sensor type	--	P0084	--
Stator resistance	Ohm	P0075	--
Rotating field	--	P0087	--
Standstill current	A	P0097	SM 2), up to FW 3.16: INFO from FW 3.16: see 8)
Standstill torque	Nm	P0098	SM, INFO 3)
Lq inductance	mH	P0080	SM
Ld inductance	mH	P0081	SM, INFO

Parameter	Unit	Parameter	Remarks
Notch position (depending on the selected encoder	Grad	P0082	SM [6] NOTE!
Slip frequency cold	Hz	P0059	ASM-with-encoder
Slip frequency warm	Hz	P0060	ASM-with-encoder
Slip temperature cold	°C	P0062	ASM-with-encoder
Slip temperature warm	°C	P0063	ASM-with-encoder
Nominal frequency	Hz	P0061	ASM
Power factor	--	P0058	ASM-with-encoder
Stator leakage inductance	mH	P0076	ASM
Rotor resistance	Ohm	P0077	ASM
Rotor leakage inductance	mH	P0078	ASM
Magnetizing inductance	mH	P0079	ASM, INFO
Magnetizing current	A	P0066	ASM-with-encoder (SM [5])

[1] At a "cold" motor in case of a synchronous motor and at a "warm" motor when having an asynchronous motor.

[2] The Kt factor in the motor database isn't used in the motor control. Just as there is no controller parameter defined for the Kt factor. A Kt factor is determined for the motor control from the internal nominal torque and the nominal current torque internally in the controller (see ▷Torque monitoring◁ on page 228). ProDrive calculates a Kt factor from the stall torque P0098 and stall current P0097 and provides it and makes it as information available on the synchronous motor page.

[3] The nominal torque in the motor database is not used in the motor control. Furthermore, no controller parameter was defined for the nominal torque. A nominal torque from the nominal power P0056, the nominal current P0056 and the nominal speed P0054 is determined in the controller for the motor control (see ▷Torque monitoring◁ on page 228). ProDrive calculates the nominal torque the same way and provides the information on the general motor page.

[4] These parameters are used for the calculation of the additional torque display ▷P0508◁ only and this display effects the motor control only if the additional torque limit ▷P1046◁ is activated (speed controller mode ▷P1030◁ Bit 4 = 1).

[5] In case the accordant SM requires field weakening current at the rated point, half the motor nominal current is entered here; otherwise zero is set. Half of the motor nominal current is recommended for the field weakening current limit ▷P0095◁ at the field weakening method "field weakening at the voltage limit" (▷P0093◁ Bit 7 = 0). If the SM requires field weakening current neither the value ▷P0066◁ is copied in ▷P0095◁ nor is the value ▷P0066◁ considered. If the method "field weakening at the voltage limit is used together with the recommended value P0066 the value P0066 must manually be entered in P0095. The FW 3.09 takes a special position. AT the FW 03.09 the effective limit of the field weakening current at "Field weakening at the voltage limit" is the greater value of the parameters ▷P0066◁ and ▷P0095◁-.

[6] Notch position - note:

NOTE!

If the wiring was made incorrectly the real notch position can differ from the notch position in the database. A motor which is operated with an incorrect notch position can move unintentional with a maximum power!

[7)] Parameter is used to define the continuous current limit curve and at the motor mode 2 ▹P0104◃ bit 4...2 = 001: Is used for motor-I2t S1-characteristic used by means of supporting points

[8)] At motor mode 2 ▹P0104◃ bit 4...2 = 010: Is used for motor I2t S1 characteristic by means of iron losses

7.3.3 Motor general

Parameter overview, ProDrive page

Parameters with informative character only (Info) have no influence on the control.

Number	Name / meaning	Remark
	Data	
▹P0096◃	Motor article number	Info
▹P0051◃	Motor serial number	Info
▹P0050◃	Motor type code	Info
▹P0093◃	Motor mode	Bit 0 to 1, motor type
	Speed and Torque	
▹P0057◃	Motor nominal speed	
--	Motor nominal torque	Info. ProDrive display *)
▹P0072◃	Motor max. speed mechanical	Info
▹P1031◃	Motor maximum drive speed	Speed scaling factor
▹P0070◃	Motor peak torque	Info
▹P0067◃	Motor Ke factor	
▹P0065◃	Motor number of pole pairs	
▹P0056◃	Motor nominal power	
	Configuration	
▹P0087◃	Motor rotating field	
▹P0093◃	Motor mode	Bit 4: mode bit for motor data from encoder
	Currents	
▹P0054◃	Motor nominal current	Only used in case ASM encoder-less
▹P0069◃	Motor peak current	up to FW 03.08: Info from FW 03.09: Limitation of the maximum current of the drive. See ▹P0069◃, ▹P1041◃, ▹P0093◃ bit 15.
	Voltages	

Number	Name / meaning	Remark
▹P0053◃	Motor nominal voltage	Only used in case ASM encoder-less and for calculation of the additional torque actual value ▹P0508◃
▹P0085◃	Motor brake voltage	Info
	Overload monitoring	
▹P0073◃	Motor I^2t time constant	Value = 0: monitoring off
▹P0092◃	Motor I^2t warning limit	
▹P0502◃	Motor I^2t actual value	Display
	Temperature monitoring	
▹P0088◃	Motor warning temperature 1	
▹P0089◃	Motor warning temperature 2	
▹P0090◃	Motor shutdown temperature	
▹P0091◃	Motor temperature hysteresis	
▹P0505◃	Motor temperature smooth time	
▹P0503◃	Motor actual temperature	Display
	Temperature sensor type	
▹P0093◃	Motor mode	Bit 5: evaluate temperature Bit 10 to 11: connection of sensor
▹P0084◃	Motor temperature sensor type	

*) ProDrive calculates and displays this value:

Mn-ProDrive = (1000 * Pn [P0056]) / (2*pi* Nn [P0057] / 60)

7.3.4 Synchronous motor

Parameter overview, ProDrive page

Parameters with informative character only (Info) have no influence on the control.

Number	Name / meaning	Remark
	Notch position	
▹P0082◃	Motor notch position	
	Field weakening	
▹P0095◃	Field weakening current for SM	Only in case FW 3.09: Parameter ▹P0066◃ acts additionally to P0095 in the field weakening for SM
▹P0093◃	Motor mode	Bit 7: Field weakening mode

Number	Name / meaning	Remark
Temperature adaption		
▹P0093◃	Motor mode	Bit 8: Temperature tracing
Torque/current factor		
--	Kt factor	Info. ProDrive display *)
Resistance and inductance, data sheet		
▹P0075◃	Motor stator resistance	
▹P0080◃	Motor Lq inductance	
▹P0081◃	Motor Ld inductance	Info
Resistance and inductance, measured values		
▹P0853◃	Measured motor stator resistance	Display
▹P0854◃	Measured motor leakage inductance	Display

*) ProDrive calculates and displays this value:

Kt factor ProDrive = Mo [P0098] / Io [P0097]

The Kt factor which is calculated internally in the controller is not displayed (i.e. a display parameter is not available). This factor is described in chapter ▹Torque monitoring◃ from page 228.

7.3.4.1 Maximum permitted speed of the synchronous motor (electrical conditioned)

The overcurrent limit at the converter ($U_{dc\ link\ max.}$) sets the following limit to the maximum permitted speed of the synchronous motor.

$$n_{emax} = \frac{1000}{K_{ecold}} \cdot \frac{U_{zkmax}}{\sqrt{2}}$$

with

$U_{dc\ link\ max.}$ = 780 V for BM4400, BM4600 and BM4700

$U_{dc\ link\ max.}$ = 400 V for BM4426 single phase

$K_{E\ (cold)}$: Ke-factor for the cold machine in no-load operation in V / 1000 min^{-1} (independent of the value set in the parameter ▹P0067◃)

Without additional protective measures the operation of the synchronous motor is not permitted via n_{emax}.

DANGER!

Risk of injury from electricity!

The overcurrent limit at the converter is exceeded.

Therefore:

- Never operate the motor without additional protective measures over the electrical conditioned admitted maximum speed.

7.3.5 Asynchronous motor

Parameter overview, ProDrive page

Parameters with informative character only (Info) have no influence on the control.

Number	Name / meaning	Remark
	Exciting field	
▹P0066◃	Motor magnetizing current	Only relevant for the operation of the ASM with encoder. For the encoderless operation only information.
▹P0058◃	Motor power factor	For the operation of the ASM with encoder only information.
	Temperature adaption	
▹P0093◃	Motor mode	Bit 8: Temperature tracing
	Motor nominal frequency	
▹P0061◃	Motor nominal frequency	For the operation of the ASM with encoder only information.
	Slip frequency (for temperature tracing active)	
▹P0060◃	Motor slip frequency 2	
▹P0059◃	Motor slip frequency 1	
▹P0504◃	Motor actual slip frequency	Display
▹P0503◃	Motor actual temperature	Display
▹P0062◃	Motor temperature 1	
▹P0063◃	Motor temperature 2	
	Slip frequency (for temperature tracing not active)	
▹P0060◃	Motor slip frequency 2	Nominal slip frequency
	Resistance and inductance, data sheet	
▹P0075◃	Motor stator resistance	
▹P0076◃	Motor stator leakage inductance	

Number	Name / meaning	Remark
▷P0077◁	Motor rotor resistance	
▷P0078◁	Motor rotor leakage inductance	
▷P0079◁	Motor magnetizing inductance	Info
Resistance and inductance, measured values		
▷P0853◁	Measured motor stator resistance	
▷P0854◁	Measured motor leakage inductance	
▷P0854◁	Measured stator- and rotor resistance	
Torque generation		
▷P0093◁	Motor mode	Bit 9: Waiting time mode bit

7.3.6 Asynchronous motor encoderless (open loop)

Parameter overview, ProDrive page

Parameters with informative character only (Info) have no influence on the control.

The actual speed value setting for the encoderless operation (smoothening time and monitoring) are listed in ▷Encoderless evaluation of the field angles and of the speed◁ on page 105.

Number	Name / meaning	Remark
Exciting field		
▷P0506◁	Computed motor magnetizing current	
▷P0058◁	Motor power factor	
Motor nominal frequency		
▷P0061◁	Motor nominal frequency	
Speed synchronization by switch on		
▷P0093◁	Motor mode	Bit 13 to 14: Speed search options
▷P0381◁	Startup time open loop	
Torque generation		
▷P0093◁	Motor mode	Bit 9: Waiting time mode bit. From FW 3.11 for open loop no longer available
Temperature adaption		
▷P0093◁	Motor mode	Bit 8: Tracing switch
Resistance and inductance, data sheet		
▷P0075◁	Motor stator resistance	

Number	Name / meaning	Remark
▹P0076◃	Motor stator leakage inductance	
▹P0077◃	Motor rotor resistance	
▹P0078◃	Motor rotor leakage inductance	
▹P0079◃	Motor magnetizing inductance	Info
Resistance and inductance, measured values		
▹P0853◃	Measured motor stator resistance	
▹P0854◃	Measured motor leakage inductance	
▹P0855◃	Measured stator- and rotor resistance	
Torque boost		
▹P0382◃	Starting torque boost for Open Loop	
▹P0383◃	Speed range for torque boost	

The drive controller b maXX® 4400 makes an operation of an asynchronous motor in speed control without a rotary encoder possible (also known as "open loop"). However, a position-controlled operation (operating modes position control, synchronous operation, positioning, etc.) is not possible, because the speed of an asynchronous motor in the encoderless operation on principle cannot be evaluated exactly.

The encoderless control operation is based upon calculating the speed of an asynchronous motor from its voltage model. The motor voltages are not measured, but the voltage set values, which where calculated from the motor control are used instead. For this purpose the motor data (as e. g. inductance and resistance) must be exactly known or must be determined with the help of auto-tuning. Delay compensation also must be activated, so that the non-linearity of the power unit can be compensated (see ▹Auto-tuning◃ from page 134).

On the controller default values for the delay compensation voltages are specified from FW 3.10 and later. In this way it is possible to activate the delay compensation, even if delay measuring was not made. These default values must be seen as typical values only and perhaps should be adjusted with the standardization factor ▹P1321◃.

Mainly at low frequencies (below about 5 Hz), the reliability of the encoderless operation is dependent on the accuracy of the motor parameters and on the compensation of the dead time voltages. Basically the reliability and performance (dynamics, accuracy, etc.) of the operation with an encoder cannot be reached by the encoderless operation.

The amplitudes of the dead time voltages are proportional to the PWM-frequency. It is recommended to use a PWM-frequency of 4 kHz for encoderless operation instead of 8 kHz. Furthermore, an online shift (available from FW 3.09 and later) to a lower PWM-frequency (from 4 to 2 kHz, or from 8 to 4 kHz) with low stator frequencies can improve the encoderless operation (see ▹P0489◃).

It may occur that the following requirements must be met, so that a reliable operation is assured: PWM-frequency = 4 kHz; temperature adjustment of the stator resistor and of the slip rate is activated; identification and activation in the motor commutation of the stator resistor, inductance as well as dead time voltage.

Limitations of the encoderless control at very low speeds

The motoring operation is also possible at very low speeds and also until standstill. Generating operation in order to brake until standstill is also possible.

For the encoderless operation of the asynchronous motors, the controller continually will be calculating the orientation of the electrical variables at the magnetic rotor flux. At a continuous operation at zero frequency, interferences and/or discrepancies in the motor model (inaccuracy of parameter values, temperature-, saturation-influences, etc.), can affect the orientation. The controller cannot detect the orientation loss. If the orientation is lost, the motor cannot be controlled anymore. In this case other monitorings are activated, e. g. speed controller-block time monitoring.

A longer lasting generator-based operation at very low speeds is not possible. A continuous operation (from about 1-2 seconds onward) cannot be guaranteed at no load (or very low motor load) or at standstill (or very low speeds).

It is advised not to use this motor type, if a continuous operation is critical.

Switch on / enable at rotating machine

On principle at release of the drive in the encoderless operation there at first is no speed information existent. Therefore a release of the drive at rotating motor is problematic. In the basic setting it can happen that the motor does not correctly start.

In order to be able to enable the drive also at rotating motor, a special procedure ('flying restart') can be implemented, to try to calculate the speed of the motor. This behavior can be activated in the parameter motor mode (▹P0093◃). Thereby also the speed direction, where the speed shall be evaluated can be specified. For a drive, which e. g. may mechanically only rotate in one direction, the speed search should also only be activated in this direction. Therewith it is avoided, that the motor rotates in the other direction during speed evaluation.

The maximum time for the calculation of the speed can be set via parameter search time of the speed for open loop (▹P0381◃). For the search time the following points must be considered:

- The time, which is necessary for the calculation of the speed conforms to the rotor time constant. The default setting for the search time is 2 seconds, eventually at motors with great rotor time constant a longer search time is necessary. As a guide value the decouple of the rotor time constant (▹P0522◃) can be taken.
- The search time, which was set is the maximum search time in each speed direction. If the evaluation of speed is activated in both speed directions and was not successful in the first speed direction, it is tried to calculate the speed in the other speed direction. Therefore the total search time at the maximum can be the double of the time, which was set in the parameter.

Increasing of the starting torque in the encoderless operation

With encoderless operation the starting torque is at zero speed, depending on the accuracy of the stator resistance used in the model by 10 to 20% less than the torque at higher speed, although the current torque stays constant. Therefore the maximum starting torque can be too small.

In order to improve the starting behavior, the increase of starting torque function is implemented. Thereby the maximum torque limit with the speed actual value zero is increased by the value, which was set in the parameter Increase of starting torque for open loop

(▹P0382◃). If the speed actual value is higher than in the parameter Speed range of starting torque increase (▹P0383◃), the increase is canceled again. Between zero speed and ▹P0383◃ the increase is linearly interpolated.

Commissioning asynchronous motor encoderless (open loop):

1 Selection of the motor from motor database of WinBASS II / ProDrive or setting of the data on the basis of motor type plate. The following values are necessary:
- Rated voltage U_N ▹P0053◃
- Rated current I_N ▹P0054◃
- Rated power (▹P0056◃)
- Rated speed (▹P0057◃)
- Power factor (▹P0058◃)
- Rated frequency (▹P0061◃)
- Number of pole pairs (▹P0065◃)

2 Star connection:
Assure that the motor is operated in a star connection (if the motor can be operated in the delta connection only, contact the responsible support services of Baumüller).

3 Set PWM-frequency ▹P1240◃ to 4 kHz (recommended). From FW 3.09 and later, it is also possible to shift the PWM-frequency automatically to a lower PWM-frequency at a lower stator frequency. See ▹P0489◃.

4 Execute calculations of stator resistance and total leakage inductance of the motor as well as the dead time of the power unit with the help of auto-tuning.

5 Initiate to calculate the current controller parameters with the help of the calculated stator resistance and total leakage inductance.

6 Accepting of the calculated motor parameters for the motor control and activating of delay compensation (it is possible to use default values instead of the measured values from FW 3.10 and later).

7 Setting of smoothing time for the open loop speed actual value (▹P1061◃), proposed value range between 5 and 20 ms. The greater the torque of inertia of the drive, the greater the smoothing time can be selected.

8 It is recommended not to activate the option Build-up torque without waiting time for the field build-up (bit 9 of the motor mode ▹P0093◃). From FW 3.11 and later, the option "Without waiting time" is inhibited for asynchronous motor encoderless (open loop) operation.

9 Set ramp function generator: Recommended are low ramp-up- and ramp-down times (< 1 s), especially in the lower speed range (< 10% rated speed)

10 Set speed controller (see ▹Auto-tuning◃ on page 134).

11 Save data set

NOTE!

Torque build-up without waiting time for the field build-up, asynchronous motor encoderless (open loop) operation

If the option of the torque build-up without waiting time for the field build-up is activated (bit 9 of ▷P0093◁ Motor mode is set to 1) at the asynchronous machines, it must be considered that the motor cannot generate its torque immediately, because the field was not build-up yet. If the option "Torque build-up without waiting time" is activated, the user must provide the required time, which the field needs to build up, before a torque may be build up.

A simultaneous torque- and field build-up at the motor type asynchronous motor encoderless (open loop) can cause, that the field orientation gets lost and that the motor blocks and stops. Do not activate this option for the encoderless operation. From FW 3.11 and later, the option "Without waiting time" is inhibited for the asynchronous motor encoderless.

7.3.7 Overview Monitoring

The following monitorings are realized:

Monitoring	Warning no.	Error no.	Reaction
Temperature sensor - motor short-circuited ($T_{M\text{-}Sensor} \leq -30°C$)	--	96	adjustable
Temperature sensor - motor not connected ($T_{M\text{-}Sensor} > 300°C$)	--	97	adjustable
Temperature threshold 1 exceeded	32	--	--
Temperature threshold 2 exceeded	33	--	--
Motor overtemperature	--	98	IS
I^2t warning threshold exceeded	34	--	--
I^2t overload	--	99	IS
▷P1214◁ Maximum current of the drive > ▷P0069◁ Motor peak current (from FW 03.09)	--	100	adjustable

Overview of the messages in the hierarchic warning and error system

Monitoring in motor module	P0260 Warnings System 1 Bit no. 2 = 1		P0200 Errors System 1 Bit no. 6 = 1	
	P0263 Warnings Motor		P0207 Errors Motor	
	Bit no.	Warning no.	Bit no.	Error no.
Temperature sensor - motor short-circuited	--	--	0	96
Temperature sensor - motor not connected	--	--	1	97
Temperature threshold 1 exceeded	0	32	--	--
Temperature threshold 2 exceeded	1	33	--	--
Motor overtemperature	--	--	2	98
I^2t warning threshold exceeded	2	34	--	--
I^2t overload	--	--	3	99

7.3.8 Motor temperature monitoring

The temperature monitoring protects the motor coils against thermal overload.

The motor temperature monitoring within the control structures of chapter 3 is shown in ▹Figure 15◃ on page 29: Motor protection.

The temperature monitoring of the motor is operated in the 16-ms time slice (see ▹Allocation of the software modules in time slots◃).

Two different encoder types can be utilized:

- KTY84/130 (PTC with an almost linear characteristic for precise evaluation of the temperature).
- Temperature switch (motor protection thermistor (PTC) conforming to DIN 44080-082)

The selection is made using Parameter ▹P0084◃ Motor temperature sensor type.

Monitoring:

- With the KTY84/130 temperature encoder, the current motor temperature in °C is obtained smoothed (▹P0505◃ Motor temperature smooth time), in Motor temperature actual value ▹P0503◃ displayed and then checked against the two temperature warning thresholds ▹P0088◃ and ▹P0089◃ and if they are exceeded, Warning no. 32 or 33 are generated. If the Motor shutdown temperature ▹P0090◃ is exceeded the motor is shut down and the error no. 98 Motor overtemperature is generated.
- With the temperature switch, the temperature value determined is compared to an internal permanently set switch-off threshold. This switch-off threshold corresponds to a resistance value of 1100 ohms. If it is exceeded, error no. 98 Motor overtemperature is generated. When using the temperature switch the Motor temperature actual value ▹P0503◃ displays permanently the value 40°C.

The activation of the motor temperature monitoring is carried out using the Bit 5 from the motor mode ▹P0093◃. When the temperature monitoring is deactivated, the Motor temperature actual value ▹P0503◃ displays permanently a value of 40°C.

The temperature monitoring can protect the motor against an incorrect thermal overload to a certain extent, only. On the one hand hot spots are generated in different parts of the motor which cannot all be covered with temperature sensors - on the other hand the dynamic of the temperature sensors is limited. Very dynamic thermal transients cannot be detected. Besides the winding temperature other factors can limit the thermal load of the motor as well. For this reason the temperature monitoring must be added by the monitoring of a thermal model of the motor (overload-monitoring of the motor).

7.3.9 Motor overload monitoring (I^2t)

The overload monitoring protects the motor against thermal overload. By use of an I^2t-model the thermal load of the motor is simulated and monitored.

The I^2t monitoring is not a replacement for the motor temperature monitoring.

The I^2t monitoring is operated in the 8 ms time slice (see ▹Allocation of the software modules in time slots◃).

I^2t model:

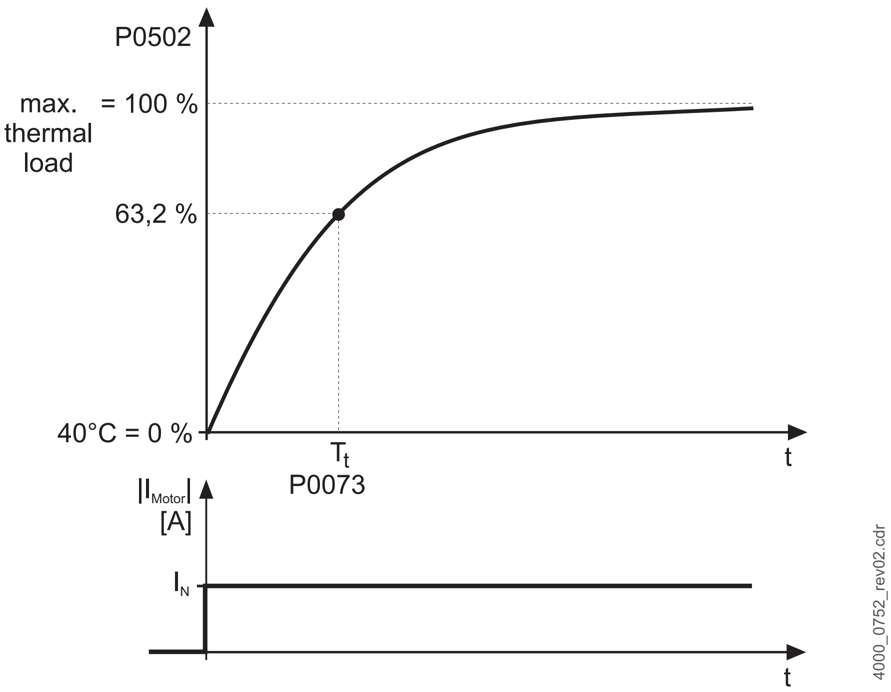


Figure 67: Time curve of the motor I^2t actual value in the nominal operating point

The time curve of the I^2t model during nominal current is presented in ▹Figure 67◃. The standardization of the I^2t model corresponds to 40°C ↔ 0% (maximum value of the environmental temperature) and the maximum thermal load of the motor ↔ 100%. The maximum thermal load of the motor corresponds to the maximum continuous load of the motor (e.g. motor nominal current at motor nominal speed).

NOTE!

The overload monitoring of the motor applies to motors, which are specified for continuous operation (S1) at an ambient air temperature of not more than 40°C. Installation altitude of machine must be below 1000 m above sea level. If these motors shall be applied at an ambient air temperature greater than 40°C or at an installation altitude above 1000 m above sea level, the Motor nominal power ▹P0056◃ and the Motor nominal current ▹P0054◃ must be reduced. For this purpose, the motor manufacturers provide corresponding derating factors.

The maximum thermal load of the motor and motor operating temperature

In general the maximum thermal load corresponds to the maximum permissible continuous temperature of the winding. The maximum load however can be limited by other factors.

The maximum permissible continuous temperature of the winding depends on the insulation class of the motor. It results from the permissible temperature increase plus a hotspot safety margin and refers to a specified maximum environmental temperature of 40°C. The maximum continuous temperature NEMA motor insulation class F is specified with 155°C, for example.

The steady-state temperature of the motor at a maximum admitted continuous current load (such as the acquired motor temperature) cannot be predetermined. The continuous current load of the motor can determine the environmental temperature, insulation class, production tolerances and the cooling type etc. Therefore, the error 205 "Motor I2t-overload" can occur even though a motor temperature actual value is lower than the permitted continuous temperature of the winding. Refer to the motor manufacturer for details (such as the temperature measurement).

I^2t Monitoring

The overload monitoring of the motor in the control structures is shown in ▹Figure 15◃ on page 29 (chapter 3 control structures).

If the **motor I2t-time constant** ▹P0073◃ unequal zero then the motor overload monitoring is active.

If the motor overload monitoring is active and the motor I^2t-actual value ▹P0502◃ reaches the I^2t-warning limit ▹P0092◃, the motor warning no. 34 "I^2t-warning threshold exceeded" is set. The warning is withdrawn without a hysteresis under the warning threshold. As soon as the I^2t-actual value reaches the 100%-value the pulse inhibit is released and the motor error no. 99 "Motor I^2t overload" is set.

The I^2t threshold can be parameterized by "Motor I^2t threshold" ▹P0114◃ as of FW 3.16. The parameter is 100% by default. The I^2t threshold can be set in order to adjust tolerances after manufacturing or to generate an additional overload reserve. In any case take advice from the motor manufacturer.

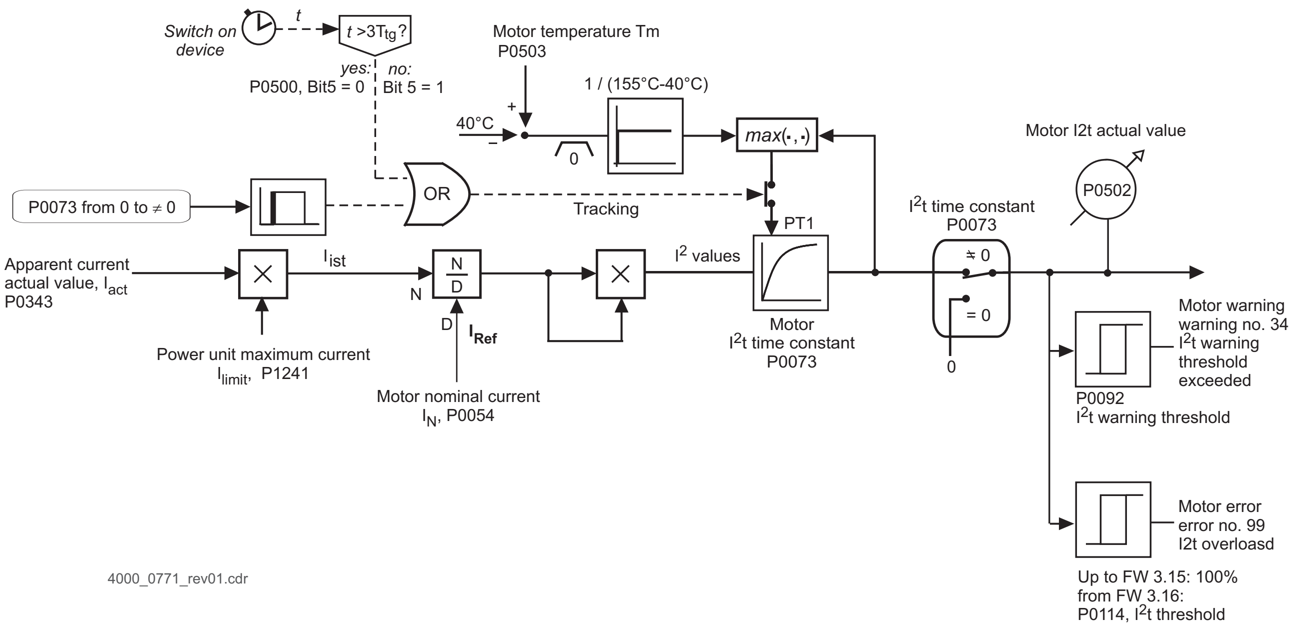


Figure 68: Motor I^2t overload monitoring

Initialization of the PT1 element

If the motor temperature sensing is not available or can not be activated the PT1 element is initialized to 0%.

If a temperature sensor is available the sensing of the motor temperature in the motor mode ▷P0093◁ bit 5 can be activated. The motor temperature actual value ▷P0503◁ is smoothed with the smoothing time constant ▷P0505◁.

Provided that the sensing of the motor temperature is activated the motor I^2t time constant ▷P0073◁ = 0 or the "NOT READY TO STRT" of the PT1 element on the motor temperature actual value is followed up or initialized. Thereby, 40°C ↔ 0% and approximately (simplified) 155°C ↔ 100%. Therefore, the error number 99 "Motor I2t overload" can occur in spite of low current or when it is switched on.

NOTE!

If there is no motor temperature sensor available or activated the I^2t model is not able to detect a warm motor after an interruption and restart. Without a temperature sensor the I^2t model assumes a cold motor when it is started.

Example for a motor overload monitoring (standard solution)

Power unit: b maXX® BM 44xx	I_{limit} = 8 A_{eff}
Motor: DS 56 L - 3000;	I_{motor} = 5.1 A_{eff};
Motor I^2t-time constant	T_t = 10 min = 600 s

		Value
Power unit peak current I_{limit}	▹P1241◃	8 A
Motor rated current I_N	▹P0054◃	5.1 A
Motor I^2t-warning limit	▹P0092◃	80 % (warning limit)
Motor mode bit no. 3	▹P0093◃	Bit no. 3 = 0 (forced-air cooling)
Motor I^2t time constant, T_t	▹P0073◃	600 s
Apparent current actual value I'_{act}	▹P0343◃	rise from 0 to 100 % I_{limit} of power unit

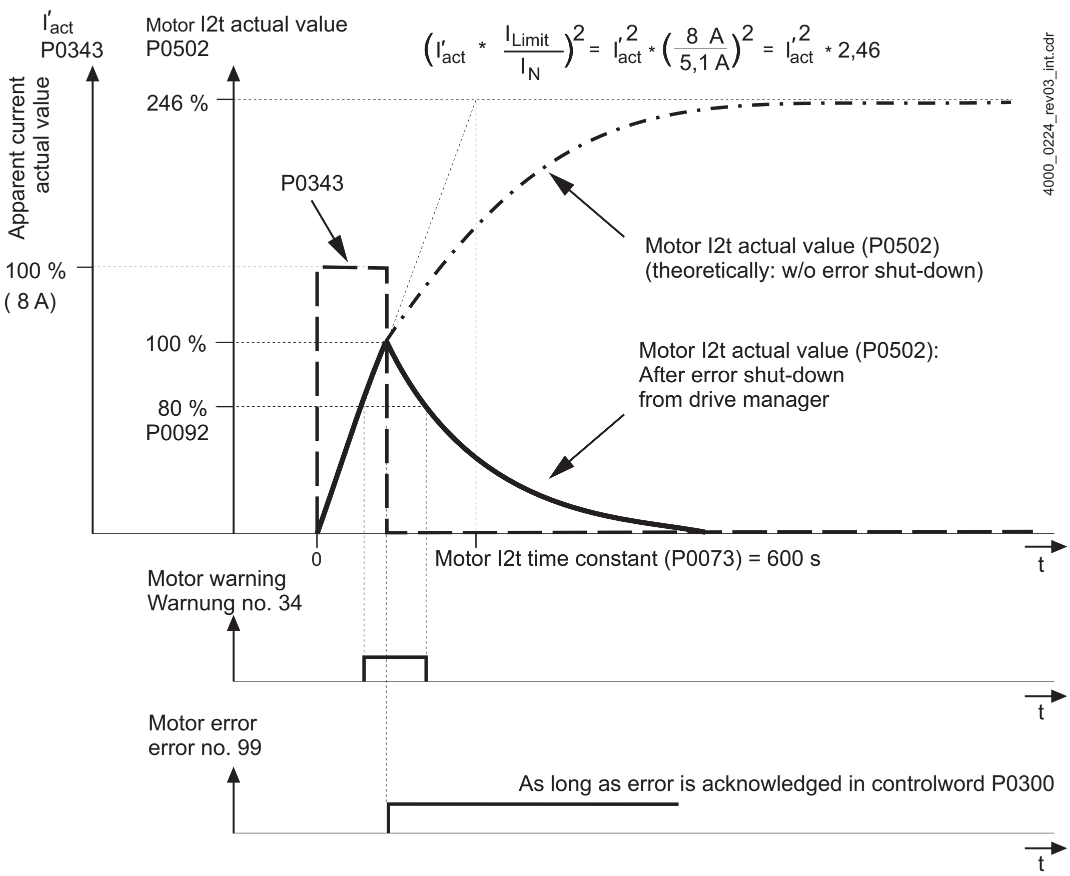


Figure 69: Example motor overload monitoring (standard solution)

Standard solution and extended options

Within the total motor speed range the nominal current value is used as reference to calculate the I^2t actual value. Refer to chapter ▹Speed variable monitoring◃ on page 130 for implementations of a speed-dependent I^2t monitoring.

By default, the apparent current of the motor is monitored. However, at low speeds the 3 phases are unequally loaded. Refer to chapter ▹Monitoring of the single phases◃ on page 133 for information about monitoring each phase separately.

NOTE!

In case you consider UL 508 C:
If the motor is not protected by a motor temperature sensor against overheating, the motor overload monitoring must be activated. Among other things the rated power of the motor must be entered correctly.

NOTE!

The I^2t-threshold can be set by the application parameter ▷P3336◁ at FW versions greater than 3.13-3 and smaller than 3.14 (i.e. for FW 3.13-4 only, at the moment), assumed that bit 15 is set in mode 2 ▷P0104◁. If this is not the case the I^2t threshold remains at 100%. The threshold is standardized just the same by the application parameter, i.e. 100% ↔ 100, whereby the threshold is limited to 400% at the maximum.

Caution: By default the application parameter 23 ▷P3336◁ is zero.

For detailed information about this case please refer to the central application department of the company Baumüller.

7.3.9.1 Speed variable monitoring

The standard solution referring to the constant maximum continuous current throughout the total speed range is inadequate to many applications with synchronous and asynchronous machines. Therefore, in the following implementation solutions are introduced considering the speed-dependence of the maximum continuous current of the I^2t motor model.

Speed variable I^2t overload monitoring of synchronous machines

In general higher current (as rated current) can be applied at synchronous machines in the speed range lower than the rated speed due to the reduced iron losses. In contrast, in general the maximum continuous current sinks if the speed is greater than the rated speed due to increased iron losses.

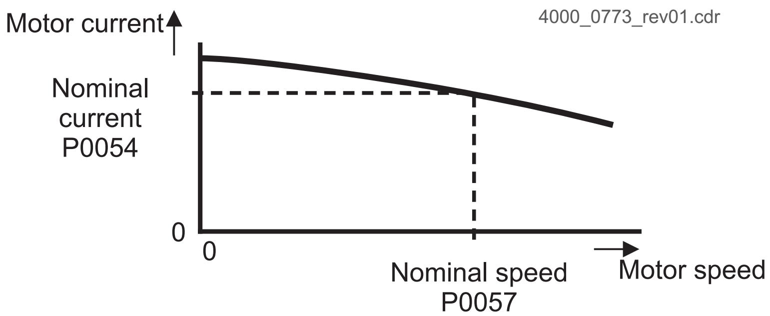


Figure 70: Typical continuous current limit identification of synchronous motors

The I^2t model speed dependence is provided by two solutions selectable via the parameter ▷P0104◁.

<u>Continuous current limit curve by means of lookup table and interpolation</u>

This option (activatable by speed-dependent modes ▷P0104◁ bits 2 to 4, value = 1) requires that support points are provided for the continuous current limit characteristic (S1 characteristic or S1 current limit curve) over the speed curve so that the calculation of an interpolated current limit curve can be made. By means of the interpolated current limit curve and the effective speed the maximum permissible continuous current can be calculated. The number of current supporting points includes 11 points whereat the first point should be equal to the standstill current (▷P0097◁). The 10 current values remaining are entered by a fixed delta of the maximum mechanical speed (▷P0072◁) divided by 10. The values of the current support points can be entered by the parameters ▷P0115◁ to ▷P0125◁ manually or can be called up and loaded in case of Baumüller machines as a pre-manufactured set via the motor data base in ProDrive. In case there is no complete set available or at least one supporting point is zero, this option cannot be activated.

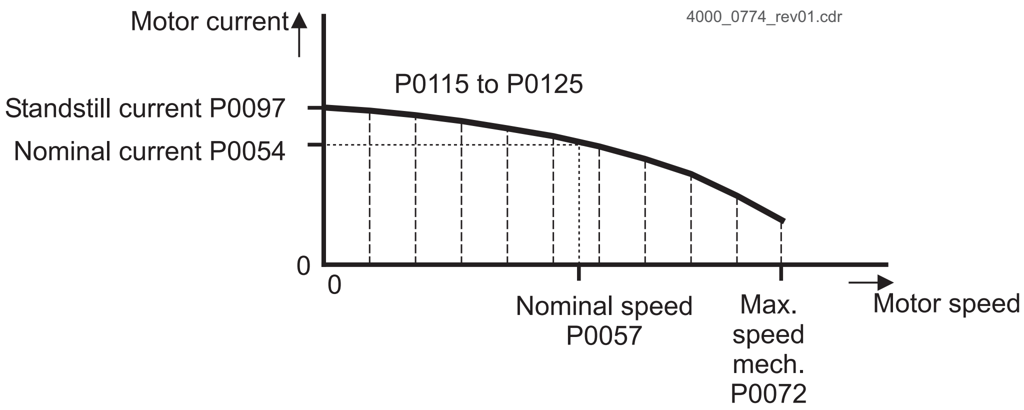


Figure 71: Continuous current limit curve by means of lookup table and interpolation (see ▷Figure 68◁ on page 128)

<u>Continuous current limit characteristic by approximation of the iron losses</u>

This option serves as an alternative by the current supporting points and interpolation method if the information of the maximum continuous current as function of the speed is not available. It can be activated by speed-dependent modes ▷P0104◁ bits 2 to 4, value = 2 and contains the approximation of the iron losses in dependence of the speed to calculate the I^2 value. Thereby the iron losses are calculated using the standstill current (▷P0097◁), the nominal current (▷P0054◁), the nominal speed (▷P0057◁) and the speed actual value (▷P0353◁) and are added to the effective I^2 value. The standstill current is used as a reference for the continuous current, as well (the iron losses are assumed zero at standstill). This option is specific to the motor standstill current > motor rated current only. Between standstill and nominal speed this method applies to the continuous current curve quite accurate (within motor manufacturing tolerances). From speeds greater than the nominal speed the accuracy decreases steadily with increasing speed but in a conservative manner (a rather small continuous current is permitted than permitted depending on the motor data).

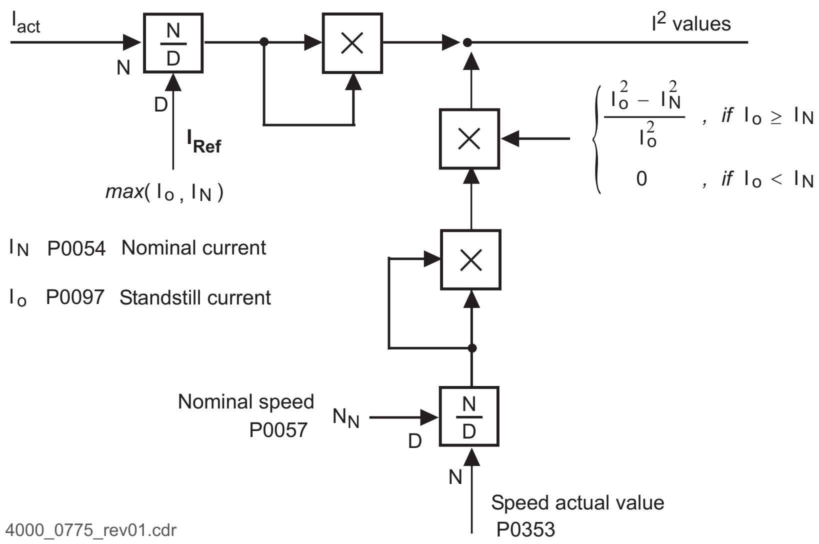


Figure 72: Continuous current limit curve by approximation of the iron losses (see ▷Figure 68◁ on page 128)

Speed variable I^2t overload monitoring of asynchronous machines

<u>Overload monitoring for motors without forced-air cooling</u>

There is the possibility to set the overload monitoring for asynchronous motor standard motors without forced-air cooling from FW 03.10. In this case the maximum continuous current as the function of the speed is decreased (see ▷Figure 73◁ on page 132). This decrease is standardly not active, it is activated by the setting of bit no. 13 in ▷P0093◁ to 1. Two settable decrease factors, motor I^2t-decrease factor 1 (▷P0101◁) and motor I^2t-decrease factor 2 (▷P0102◁), define the decrease characteristic curve (see ▷Figure 67◁ on page 126).

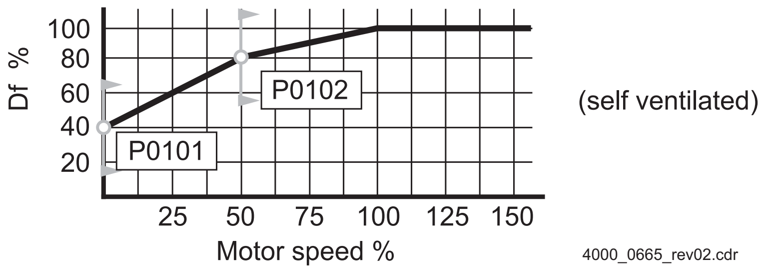


Figure 73: Decrease factor of the maximum constant current of the asynchronous motor without forced-air cooling

7.3.9.2 Monitoring of the single phases

The standard solution referring to the monitoring of the complete current is insufficient for many applications at low speeds and in standstill.

During slow motion the 3 phases are unequally loaded. By I^2t monitoring mode ▹P0104◃ bit 1 (current monitoring mode) to 1 instead of the I^2 values of the apparent current the I^2 values can be evaluated separately for every phase. The "Motor I^2t actual value" ▹P0502◃ includes the value of the most strongly loaded phase. By default this option is not activated.

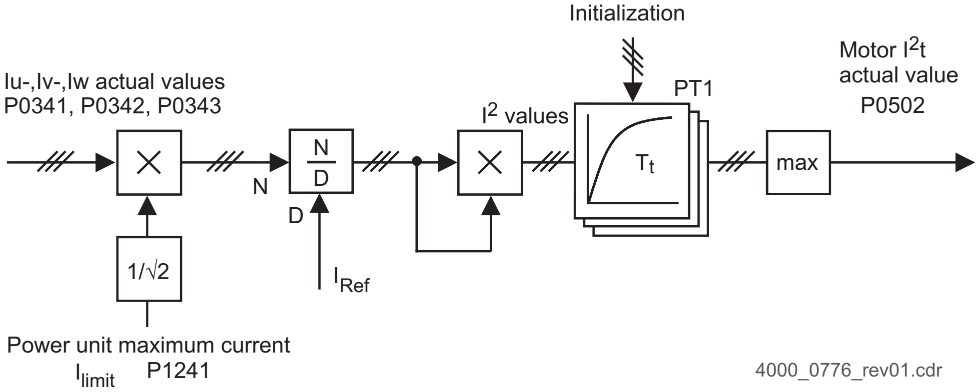


Figure 74: Motor-I^2t, monitoring of the single phases (see ▹Figure 68◃ on page 128)

7.4 Auto-tuning

7.4.1 Automatic parameterizations

NOTE!

The evaluated values from the automatic parameterizations are to be understood as approximate values. The controller parameters must be set manually if required.

Current controller

For the parameters of the current controller P-gain (▷P1020◁) and the reset time ▷P1021◁) a self-optimization can be processed. By a WinBASS II / ProDrive command can be decided if these parameters shall be set by the measured resistance and inductance or by values from the motor data sheet. The parameterization is processed accordant to the absolute value optimum (see ▷General overview current controller◁ on page 235).

Usually, the values of resistance and inductance from the motor data sheet, also by taking into consideration the production tolerances, are sufficient for the parameterization. Only, if the data sheet values are not known (motors of an external supplier) or the values of resistance and inductance for the motor control differ widely from the motor data, then it is recommended to measure inductance and resistance and to use the measured values for the parameterization

Speed controller

For the parameter of the speed controller P-gain (▷P1032◁), integral action time (▷P1033◁) and torque feed forward factor (▷P1034◁) auto-tuning can be executed. If the parameters are set with the measured inertia of the drive ▷P0858◁ or with the overall inertia from the drive data (motor torque inertia ▷P0083◁ + load inertia ▷P0109◁) is decided with a WinBASS / ProDrive-command.

The parameterization is made accordant to the symmetrical optimum. It is assumed that the load is mainly determined by the load inertia and that the closed current control loop is characterized by an equivalent time constant of 1.5 tab (sampling time, tab = 125 µs). The current control loop is assumed to be parameterized using the absolute value optimum.

The optimization of the speed controller parameters considers the smoothing time of the actual speed value as well (▷P1071◁, ▷P1081◁ or ▷P1061◁). At the same time the so-called speed ripple of the encoder type is considered as well (alternatively, if there is no encoder the speed ripple of the actual speed estimation). Via the P-gain of the speed controller this ripple generates a ripple in the torque current set value. In order to limit this ripple the Kp factor is limited if this is required. A potential limitation of the Kp factor is signaled in "Auto-tuning status" ▷P0851◁ Bit 20.

See ▷General overview speed controller◁ on page 213.

In the case of optimizing an asynchronous encoderless motor the torque feed forward factor ▷P1034◁ is switched off or is set to zero.

7.4.2 Automatic measurements

At the moment there are four measurements implemented at the function auto-tuning:

- Stator resistance measurement,
- Leakage inductance measurement (stator inductance measurement in case of a synchronous motor)
- Dead time voltages measurement of the inverter unit
- Measurement of the drive inertia

NOTE!

- The function "Auto-tuning" cannot calculate equivalent parameters for the motor model of the connected electric machine! BM4400 is not an intelligent measuring device for the electric machines! Only the control-relevant parameters are determined with the function auto-tuning, which besides the electrical machine also include the cable as well as perhaps additional filters between the converter output of the motor and the connecting terminals of the motor.
- If a motor filter (or sine filter) between the device and motor is available there is no automatic measurement possible (R, L, dead time voltage). The capacitance of the filter would invalidate the measurement.
- If there is a non-negligible elasticity between the motor and the load (two-mass vibrational system) the automatic measuring of the inertia isn't possible. The available resilience would invalidate the measurement.

For operating mode with encoder feedback the dead time compensation is not essential. For ASM encoderless (open loop) only a delay time measurement must be executed and then the delay compensation must be activated.

After the inertia was measured ProDrive also displays the evaluated mechanic time constant besides the value of the measured inertia as well (see ▷Details speed controller◁ on page 213).

Current amplitude at the automatic measuring

The current (auto-tuning current), which is used with the resistor-, inductance- and dead time voltages measurement accords to the maximum current of the drive ▷P1241◁. However the auto-tuning current is limited in the controller in order to protect the power unit to the half of the power unit rated current ▷P0010◁, ▷P0012◁ and to protect the motor to the rated current of the motor ▷P0054◁.

The amplitude of the current reaches 80% of the auto-tuning current for the resistor- and inductance measuring.

A current amplitude of about 50% of the auto-tuning current is used for the dead time voltages measurement. The minimum value between the calculated magnetizing current and 50% of the auto-tuning current is used in the case of encoderless induction motor.

In general the greater current provides the better measuring results.

The torque producing current, which is used at the inertia measurement is directly specified by ▷P0857◁ (maximum current for measurement of the inertia). The magnetizing current for the synchronous motor is set to zero and for the asynchronous motor is set to ▷P0066◁ or ▷P0506◁.

7.4.3 The starting and the procedure of the measurements

Measuring procedure

- The resistance- and inductance measurement can only be started commonly.
- The delay measurement can only be started if simultaneously also the resistance- and inductance measurement is activated or if the resistance- and inductance measurement has already been successfully carried out once.
- If you start inertia measuring it should be checked, if the parameters of the current controller have been correctly set. The drive is accelerated with a torque-producing current of maximum current for the measurement of inertia (▹P0857◃) until to the maximum speed, which was set in parameter (▹P0856◃) and then braked to zero again. The inertia is calculated from this acceleration- and deceleration time.

The status flashes if the measurement is being carried out, and it shines green if a measurement has been successfully completed.

7.4.4 Optimization procedure

Once determined the values of resistance and inductance for the optimization (from measurement or from data sheet) the calculating of the current controller parameters can be activated. If the result turns out to be non-satisfactorily the parameters can be measured again or the values corresponding to the motor date sheet can be directly set with other values. The optimization can be carried out again. The controller parameters must be set manually if required.

After measurement of inertia the calculation of the speed controller parameters can be activated. If the measuring result isn't satisfying these parameters can be recalculated from the motor data sheet or can be directly set with the other values. If the P-gain ▹P1032◃ would be limited when optimizing, the actual speed value-smoothing time (▹P1071◃, ▹P1081◃ or ▹P1061◃) can be increased and the optimization is executed once more. Due to this the P-gain ▹P1032◃ is to be less limited or even not at all limited.

7.4.5 Apply to the motor control

The acceptance of the measured resistance and of the measured inductance in the motor control is permitted only if the accordant measuring was successfully processed. Otherwise the motor control uses the values from the motor data sheet. The value of the inductance is used in the d-q-decoupling network and in the current prediction of the current controller as well as in the motor model of the encoderless motor operation. The value of the resistor is used in the motor model of the encoderless motor operation and in the evaluation of the additional actual torque value from a power balance.

If the dead time compensation is active the acceptance of the dead time voltages in the dead time compensation is permitted only if the accordant measurement is successfully performed. Otherwise the dead time compensation uses the default values.

ℹ	**NOTE!** Auto-tuning effects the actual data set only.

Voltage values of the delay compensation

The values for the delay compensation are not only dependent on the according power unit, but also on the switch frequency of the power transistors, on the mains voltage or the DC-link rated value, as well as on the power unit Udc link rated value ▹P0020◃. With the help of auto-tuning the required values are determined.

The determined values operate only in the memory of the controller. If the values should remain alter a reset of the controller, the parameter set or a data set must be saved in the EEPROM. The values of the delay compensation will be saved together with the central data.

- It is recommended to adapt the power unit Udc link rated value ▹P0020◃ to the existent DC link voltage, before measuring and the subsequent activation of the delay compensation.
- If the power unit is connected to another mains voltage, a new delay measuring must be executed. Perhaps the adaption of the power unit Udc link rated value ▹P0020◃ to the new Udc link voltage is adequately. For example, the encoderless asynchronous motor (open loop) is able to be operate with this method.
  However, better results are attained by making a new measurement.
- After changing the switching frequency (4 kHz to 8 kHz or vice versa ▹P1240◃) the measurement of the delay compensation must be executed again.
  The values of the delay compensation for the automatic switchover from 8 to 4 kHz or from 4 to 2 kHz (▹P0489◃) are automatically adapted in the controller internally.
- Also at exchange of controller cartridge or of the power unit a new calculation must be made.
- The voltage values of the delay compensation will not be transmitted at a parameter set upload to the PC, because they are only valid for a certain power unit. Therefore it is not possible to transmit these values per download from one controller to another.
- After a parameter set download or a controller firmware update the saved measured values for the delay compensation remain.
- Up to Firmware 3.09: If the voltage values of the delay compensation are not measured in the device, the controller resets automatically bit 2 in parameter ▹P1320◃ to activate the delay compensation.
- Up to Firmware 3.09: If a delay measurement is not executed in the controller, the delay compensation will not be activated after a download of a parameter set, even if the activation of delay compensation is set.

From firmware-version FW 03.10

From firmware version FW 03.10:

The controller defines the default values (see as typical values) for the delay compensation. This makes it possible to activate delay compensation, even if there was no delay measurement executed before.

- Bit 2 in parameter ▹P1320◃ to activate the delay compensation will not be reset automatically and default values will be used for the delay compensation if compensation is activated.
- If delay compensation is not executed in the controller, the delay compensation will be activated with default values after a download of the parameter set, even if delay compensation with **measured** values is set in the parameter set.
- In exceptional cases, a compensation with default values is inadequately (undercompensation or too high), then, with help of the scaling factor ▹P1321◃ an adaption can be made. With an encoderless asynchronous motor (open loop) an overcompensation

causes an unstable operation. An overcompensation reduces the maximum reachable torque.

- The default values for the delay compensation for the DC-link voltage are defined at 540 V. Thereby is presumed that the power unit Udc-link rated value ▹P0020◃ is equal with the DC-link voltage Udc-link actual value ▹P0484◃.
  If the default values shall be used and the power unit is connected to another mains voltage, then either

  a. the power unit Udc-link rated value ▹P0020◃ must be adapted to the existent DC-link voltage ▹P0484◃ or
  b. the scaling factor ▹P1321◃ must be set after ▹P1321◃ [%] = 100 * ▹P0484◃ / ▹P0020◃.

  Under certain conditions for (a) and (b) a fine tuning ▹P1321◃ must take place.
- The default values for the delay compensation are automatically adapted to the selected switch frequency (4 kHz / 8 kHz). In spite of this, in exceptional cases, an adaption to the scaling factor ▹P1321◃ is required after a switchover.

From firmware-version FW 03.11

From firmware-version FW 03.11:

From firmware FW 03.11 the delay compensation is nearly independent of the DC-link voltage and of the switching frequency. However, best results are reached if the rated- and the actual value of the DC-link voltage are equal. If the measured values are used, it is advantageous to set equal switching frequencies for the measurement and for the operation.

Precondition for the independence of voltage and frequency of the measured values is a measurement with a firmware from FW 03.11. Otherwise the delay compensation is the same as to FW 03.10.

Incompatibility items

The measured values for the delay compensation from FW 03.11 are not downward compatible. That means, that in principle the delay time must be executed again, if, for example the firmware was downgraded from FW 03.11 to FW 03.10.

The default values of the delay compensation and of the according scaling factor is not forward compatible, the adjusted scaling factor at the FW 03.10 must be adjusted again at the FW 03.11.

7.5 Encoder emulation

7.5.1 Incremental encoder emulation

NOTE!

For the use of incremental encoder emulation there must be one of the function modules incremental encoder emulation IEE-01 or IEE-02 in the slot C.

The incremental encoder emulation generates and provides signals which are typical for a 5 V rectangular incremental encoder.

The generated signal can either be used by the incremental encoder emulation to synchronize a following axis (operation mode synchronism) or to detect the position of the axis by a primary control.

Set values for the incremental encoder emulation are provided from the following sources:

- Actual position values encoder 1 or encoder 2
- Set position value (e.g. externally specified by the fieldbus).

Position actual values of one of the encoders or external set values are processed in the controller and the pulse sequences A and B are generated and then the zero pulse is derived.

As output signals two signals, which are phase quadrature TTL-rectangular-pulse sequences A and B, are provided. Also the inverted pulse sequences $\overline{A}$ and $\overline{B}$, the zero pulse 0 together with its inverted signal $\overline{0}$ is provided.

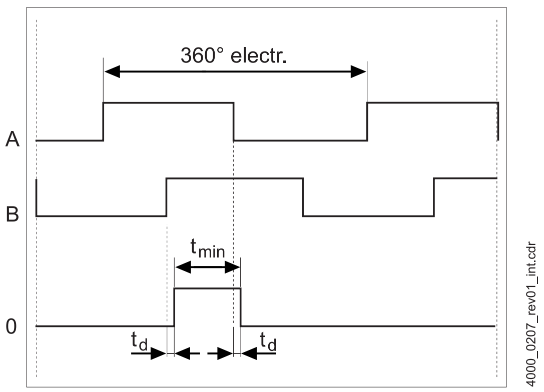


Figure 75: Pulse sequence of incremental encoder emulation

NOTE!

In order to minimize disturbances the cables from the controller to the superimposed PLC must be twisted pair cables.

Technical specifications of incremental encoder emulation

Input voltage	5V ±5 % (max. 100 mA) without load
Signal level: Output High Voltage at I_{OH} = -20 mA	2.5 V_{min}
Signal level: Output Low Voltage at I_{OL} = 20 mA	0.5 V_{max}
Output frequency for incremental encoder emulation = Input frequency control	IEE-01: max. 1.5625 MHz IEE-02: max 500 kHz
Switching time: rise time	< 50 ns
Switching time: fall time	< 50 ns
Delay time	$\|t_d\| \leq$ 50ns
Power consumption	0.525 W

Maximum speed

Calculation of maximum possible speed n_{max} dependent on the set PPR count N and of the maximum output frequency f_{max} incremental encoder emulation:

$$n_{max} = \frac{f_{max}}{N}$$

Example: N = 10 000 PPR counts

$\Rightarrow$ n_{max} (IEE-01) ≈ 156 U/s = 9360 RPM

$\Rightarrow$ n_{max} (IEE-02) ≈ 50 U/s = 3000 RPM

Delay time

Due to the different operating principles of both emulations there are also different delays:

IEE-01: The delay between the position value of the source signal and of the position, which is determined with the evaluation of pulse sequences A and B, is about 310 µs, at source position set value by adding the cycle time, by which the position set point is specified.

for your information:

Delay, if set value source = Encoder:

Delay = 310 µs (sensing + output)

Delay, if set value source = Position set value:

Delay = Cycle time setting position set value + 310 µs (sensing + output)

IEE-02: Delay, if set value source = Encoder:

Delay < 1.5 µs

Delay, if set value source = Position set value:

Delay < Cycle time setting position set value + 1.5 µs

The setting „zero pulse of emulation immediate“ is only supported from module IEE-01.

The zero pulse generation can only be switched off at the IEE-02 module.

Parameter overview

Number	Name
▹P0560◃	(Incremental) encoder emulation module version
▹P0561◃	(Incremental) encoder emulation status
▹P0562◃	(Incremental) encoder emulation mode
▹P0563◃	(Incremental) encoder emulation pulses per revolution
▹P0564◃	(Incremental) encoder emulation offset index signal

NOTE!

The IEE-02 modules are supported only by the following controllers:

- b maXX 4000 ES: always
- b maXX 4000:
  only by controllers which are **not** assembled for the "external PWM" (PWM is realized in the FPGA of the controller). See ▹P2037◃.

Please, do not hesitate to contact us, if you have questions, referring to the controller hardware type.

7.5.2 SSI encoder emulation

NOTE!

For the use of SSI encoder emulation there must be implemented the function module SSI encoder emulation SIE-01 in the slot A or B.

The SSI encoder emulation generates and provides a serial position data transmission which is typical for a SSI interface.

Set values for the SSI encoder emulation are provided from the following sources:

- Actual position values encoder 1 or encoder 2
- Set position value (e.g. externally specified by the fieldbus).

Position actual values of one of the encoders or external set values are sent as telegrams with configurable length (number of bits for multiturn (revolutions) and singleturn (angle)), adjustable format (binary code / Gray code) and switchable parity (even/odd) via the data line.

The transmission of the data is made synchronous to a maximum data rate of 1.5 MBaud; the minimum data rate is 200 kBaud.

The cycle must be generated by an external control or a SSI encoder input according to the SSI standard (200 kHz … 1,5 MHz). The SSI encoder emulation generates the cycle itself with a frequency of approx. 50 kHz in the test mode.

Parameter overview

Number	Name
▷P0565◁	SSI encoder emulation status
▷P0566◁	SSI encoder emulation mode

7.6 Digital inputs

If you intend to use the digital inputs you must have one of the DIO-01 or DIO-02 function modules.

Digital inputs can be used for external control of single or even of several bits in parameters. The single bits in the parameter „Control word of the drive manager“ for example can be checked and therewith the drive manager can be controlled.

Four parameter blocks are provided for the digital inputs. That way a maximum of four inputs can be evaluated simultaneously. These enable to write to all writable 16-bit-parameters.

Each parameter block consists of five parameters:

- Select digital input x:
  Channel selection
- Target number digital input x:
  Input of target parameter number
- bit-select digital input x:
  Selection of the bits of the target parameter, which must be changed.
- Bit pattern at LOW digital input x:
  Bit pattern, written to target parameter when digital input LOW.
- Bit-pattern at HIGH digital input x:
  Bit pattern, written to target parameter when digital input HIGH.

At the inputs only edges are evaluated.

Thus it is possible to influence a single parameter by use of several inputs .

Example: Two inputs influence the same parameter bit:

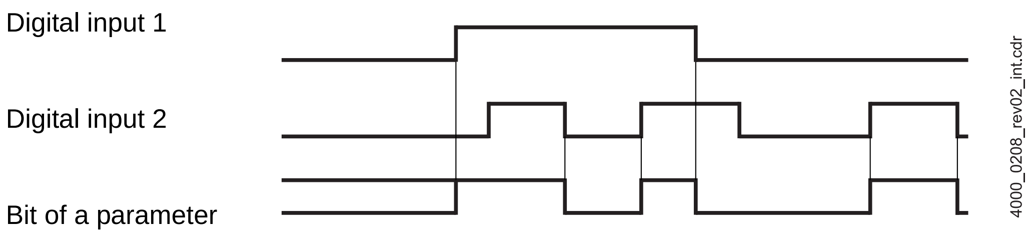


Figure 76: Edge evaluation of digital inputs

Any of the four inputs are scanned every millisecond at intervals of approx. 20 µs.

If two signals change their condition simultaneously, the signal with higher significance is accepted (digital input 1 has the lowest significance, digital input 4 has the highest one). Furthermore there is one parameter for each of the 5 module slots, which shows the status of the module slot inputs from (▷P0410◁ to ▷P0414◁).
Thereby channel 1 corresponds to bit 0, channel 2 to bit 1 and so on. These 5 parameters are read-only.

NOTE! A digital input is activated by writing to all parameters, which are associated to this input. The following sequence must be observed: **1** Select digital input x **2** Target number digital input x **3** Bit selection digital input x **4** Bit pattern at LOW digital input x **5** Bit pattern at HIGH digital input x Deactivation of a digital input is done by writing the value ’0’ to parameter Target number digital input x.

Procedure when programming:

1 Select module slot with the digital input and the according **input**.

2 **Fill** in target number of requested input.
⇒ still there is no effect on target parameter.

3 Enter bit selection of requested output
Only the bits, which have been set in the parameter **bit selection**, also can be modified in the target parameter according to pattern in the parameters **bit pattern at High** or **bit pattern at Low**. Accordingly such bits are kept the same in the target parameter, which equal 0 in **bit selection**.

4 **Bit pattern at Low** and **bit pattern at High** is determined
At a pos. edge of the digital input the target parameter is changed as follows:
Target parameter = (target parameter *and not* (**bit_selection**))
or (**bit pattern at High** *and* **bit_selection**)

At a neg. edge of the digital input the target parameter is changed as follows:
Target parameter = (target parameter *and not* (**Bit_selection**))
or(**Bit-pattern at Low** *and* **Bit_selection**)

- Example 1:

In slot D (module slot 4) there is a module for digital inputs.

By operating module input 3, the parameter ▷P0440◁ Set value generator mode shall be set to 0 (when switch is LOW) and set to 1 (when switch is HIGH).
i. e. according to signal status bit 0 to 15 are ’ANDed’ bitwise with the LOW or HIGH pattern.

Parameter block 1 shall be used.

The following parameters then must be written:

Selection digital input 1	▷P1090◁	P0403$_{hex}$
Target number digital input 1	▷P1091◁	440
Bit selection digital input 1	▷P1092◁	FFFF$_{hex}$
Bit pattern at LOW digital input 1	▷P1093◁	0000$_{hex}$
Bit pattern at HIGH digital input 1	▷P1094◁	0001$_{hex}$

- Example 2

In slot D (module slot 4) there is a module for digital inputs.

By programming an additional input (module slot 4) now value 2 and 3 in parameter ▹P0440◃ Set value generator mode should be able to be be adjusted.

Parameter block 1 and 2 shall be used.

So the following programming is necessary:

Selection digital input 1	▹P1090◃	P0403$_{hex}$
Target number digital input 1	▹P1091◃	440
Bit selection digital input 1	▹P1092◃	FFFD$_{hex}$
Bit pattern at LOW digital input 1	▹P1093◃	0000$_{hex}$
Bit pattern at HIGH digital input 1	▹P1094◃	0001$_{hex}$
Selection digital input 2	▹P1095◃	P0404$_{hex}$
Target number digital input 2	▹P1096◃	440
Bit selection digital input 2	▹P1097◃	FFFE$_{hex}$
Bit pattern at LOW digital input 2	▹P1098◃	0000$_{hex}$
Bit pattern at HIGH digital input 2	▹P1099◃	0002$_{hex}$

→ The digital input 1 now operates on bits 0 or 2 to 15;
the digital input 2 on the bits 1 to 15.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Example for initial value ▹P0440◃	1	1	1	1	0	0	0	0	1	1	1	1	0	1	0	1
Input 1 → HIGH	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0	**1**
Input 2 → HIGH	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	1
Input 1 → LOW	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1	**0**
Input 2 → LOW	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0

- Example 3

In slot D (module slot 4) there is a module for digital inputs.

One input (module input 5) shall influence bit 4 and bit 11 of the parameter ▷P0300◁ control word.

Parameter block 3 shall be used.

So the following programming is necessary:

Selection digital input 3	▷P1100◁	$P0405_{hex}$
Target number digital input 3	▷P1101◁	300
Bit selection digital input 3	▷P1102◁	0810_{hex}
Bit pattern at LOW digital input 3	▷P1103◁	0800_{hex}
Bit pattern at HIGH digital input 3	▷P1104◁	0010_{hex}

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value ▷P0300◁	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Input 2 → HIGH	0	0	0	0	**0**	0	0	0	0	0	0	**1**	1	1	1	1
Input 2 → LOW	0	0	0	0	**1**	0	0	0	0	0	0	**0**	1	1	1	1

7.7 Digital outputs

If you intend to use digital outputs, you must have at least one of the DIO-01 or DIO-02 function modules.

Digital outputs can be used to forward certain states to the higher-level control or for display purposes. That way, e. g. certain bits or bit combinations of the parameter ’Status word of the drive manager’ can be signaled externally.

For the digital outputs 4 parameter blocks are provided.
That way a maximum of four outputs can be emitted simultaneously. Outputs, which are not set, are set to ’LOW’.

Each parameter block consists of four parameters:

- Select digital output x:
  Channel selection
- Source number digital output x:
  Number of parameter, which is to be displayed (only 2-byte-Parameter permitted).
- Bit selection digital output x:
  Selection of the bits of the source parameters, which have to be identical.
- Bit pattern digital output x:
  If this pattern and the selected bit pattern of the source parameter are identical, the selected output will be switched to HIGH.

The four inputs are scanned every millisecond.

Furthermore, for every of the 5 module slots there is a parameter, which reflects the status of the inputs of the module slots ▷P0415◁ to ▷P0419◁). Thereby channel 1 accords to bit 0, channel 2 to bit 1 and so on. The 5 parameters are read-only.

NOTE!

You can activate a digital output by writing to all parameters, which are associated with this output. The following sequence must be observed:

1 Select digital output x

2 Source number digital output x

3 Bit selection digital output x

4 Bit pattern digital output x

Deactivation of a digital output is done by writing the value ’0’ to parameter source number digital output x or by writing the value ’0’ to parameter bit selection digital output x.

Procedure when programming:

1 Select module slot with the digital outputs and select respective **output**.
2 Fill in **source number** of required output.
⇒ still no effect on output.source parameter.
3 **Set bit selection** of the requested output:
⇒ the selected bits of the source parameter are set to 1.
4 **Enter bit-pattern** of the same output.
The selected bits of the source parameter are compared with the **bit pattern**. If these correspond, the output is set to high
⇒ effects on the target parameter.

- Example:

In slot D (module slot 4) you have plugged in a module for digital outputs.

The digital output 2 of the module shall go to HIGH, if in parameter ▷P0200◁ Error system 1 is bit 0 = 0 and bit 2 = 1.

In order to do so, parameter block 3 shall be used:

The following parameters then must be written:

Selection digital output 3	▷P1118◁	$P0402_{hex}$
Source number digital output 3	▷P1119◁	200
Bit selection digital output 3 bit 0, bit 2	▷P1120◁	0005_{hex}
Bit pattern digital output 3 bit 0 = 0 and bit 2 = 1	▷P1121◁	0004_{hex}

7.8 Analog inputs

7.8.1 Overview analog inputs

If you intend to use analog inputs, you must have at least one of the AIO-01, AIO-02, AIO-03 or AIO-04 function modules.

Analog inputs can be used to read-in external voltages (external currents at AIO-04). That way, e.g. via the parameter ’Ramp function generator input value’, the set speed can be specified with the help of an analog input voltage.

For the analog inputs 2 parameter blocks are provided.

That way a maximum of 2 inputs can be evaluated simultaneously.

They enable to write to all 16-bit- and 32-bit-parameters that are not read-only. However, with 32-bit parameters only the high-word of the parameter can be written to, the low-word remains unchanged. The high-word of the maximum value is valid for the 32-bit parameter.

Each parameter block consists of 7 parameters:

- Select analog input x:
  Channel selection
- Smoothing time analog input X:
  Input of time constants of smoothing capacitor in ms.
- Scaling factor analog input x:
  Input of the scaling factor.
- Target number analog input x:
  Number of the parameter which has got to be changed.
- Offset analog input x:
  Offset input.
- Threshold value analog input x:
  Sensitivity of the input.
- Value analog input x:
  Current input value

The sampling of the specified analog input operates every 125 µs.

The input value is selected via Select analog input. This value is rounded-off by use of Rounding-off time and is converted with the Scaling factor. Then the offset is added. If this result is smaller than the threshold value, it is set to 0.

The result is multiplied with the maximum value of the target parameter and written to the target parameter.

NOTE!

A connection occurs, as soon as the **target number** has been set.

In order to deactivate an input the **target number** must be set to 0. The latest output value is kept within the target parameter.

Procedure when programming:

1 Select module slot with the analog input s and select the according **input.**
2 Set the required smoothing time.
3 Select **scaling factor**.
4 Set **offset** according to existing offset.
5 Eventually set **threshold** according to existing threshold.
6 Set **target number**.

With reprogramming to another target number the target number first must be set to zero and then has to be programmed as recommended above in order to avoid unwanted effects.

7.8.2 Calculation basis for AIO-01, AIO-02 and AIO-03

Greater absolute value of range limits of target parameter:	Maximum value
Analog input voltage:	U_{in} { -10 ... +10 V }; U_{inmax} = +10 V;

Calculation formula:

- for unipolar parameter:

$$\text{VALUE ANALOG INPUT }[\%] = \frac{U_{in}[V] + 10\ V}{2 \cdot U_{inmax}[V]} * \text{Scaling} * 100\ \% + \text{Offset}$$

If VALUE ANALOG INPUT is > 100 %,
then VALUE ANALOG INPUT = 100 % is set.

Is |VALUE ANALOG INPUT [%]| < threshold value [%],
then VALUE ANALOG INPUT = 0 % is set.

- for bipolar parameter:

$$\text{VALUE ANALOG INPUT}[\%] = \frac{U_{in}[V]}{U_{inmax}[V]} * \text{Scaling} * 100\ \% + \text{Offset}$$

If VALUE ANALOG INPUT is > 100 %,
then VALUE ANALOG INPUT = 100 % is set.

If VALUE ANALOG INPUT is < -100 %,
then VALUE ANALOG INPUT = -100 % is set.

Is |VALUE ANALOG INPUT [%]| < threshold value [%],
then the value analog input = 0 % will be set.

To the target parameter the following value is written:

$$\text{Target parameter value} = \frac{\text{VALUE ANALOG INPUT [\%]}}{100\ \%} \cdot \text{Maximum value}$$

When using 32-bit-parameters, the maximum value equals the high-word of the parameter's maximum value. Only the high-word is written to the target parameter. The low-word remains unchanged.

7.8.3 Examples for AIO-01, AIO-02 and AIO-03

Input voltage ↔
VALUE ANALOG INPUT [%] * Maximum value of target parameter

→ target parameter value

Scaling = 1; Offset = 0%; Threshold value = 0%;

Unipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	75 %	* maximum value	
0 V	↔	50 %	* maximum value	
-5 V	↔	25 %	* maximum value	
- 10 V	↔	0 %	* maximum value	

Bipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	50 %	* maximum value	
0 V	↔	0 %	* maximum value	
- 5 V	↔	-50 %	* maximum value	
- 10 V	↔	-100 %	* maximum value	

Scaling = 1; Offset = 0 %; Threshold value = 10.1%;

Unipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	75 %	* maximum value	
0 V	↔	50 %	* maximum value	
- 5	↔	0 %	* maximum value	
- 9 V	↔	0 %	* maximum value	(threshold!)
- 10 V	↔	0 %	* maximum value	

Bipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	50 %	* maximum value	
1 V	↔	0 %	* maximum value	(threshold!)
- 1 V	↔	0 %	* maximum value	(threshold!)
- 5 V	↔	-50 %	* maximum value	
- 10 V	↔	-100 %	* maximum value	

Scaling = 2; Offset = -100%; Threshold value = 0%

Unipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	50 %	* maximum value	
0 V	↔	%	* maximum value	
5 V	↔	0 %	* maximum value	(limit!)
- 10 V	↔	0 %	* maximum value	(limit!)

Bipolar target parameter:

10 V	↔	100 %	* maximum value	
5 V	↔	0 %	* maximum value	
0 V	↔	-100 %	* maximum value	
- 5 V	↔	-100 %	* maximum value	(limit!)
- 10 V	↔	-100 %	* maximum value	(limit!)

Example characteristic curves:

Unipolar target parameter
Offset = 0 %; Scaling = 1

Bipolar target parameter
Offset = 0 %; Scaling = 1

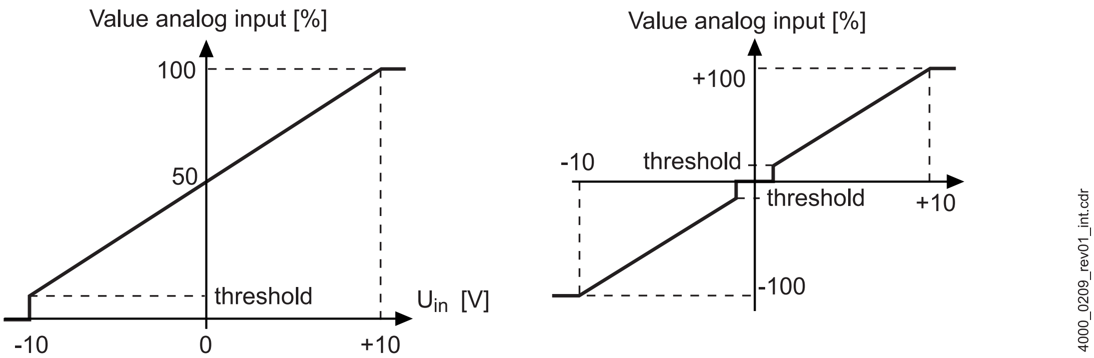


Figure 77: Analog input: characteristic curve examples

7.8.4 Calculation basis for AIO-04

Greater absolute value of range limits of target parameter:	Maximum value
Analog input current:	I_{in} {0 ... +20 mA}; I_{inmax} = 20 mA;
adjustable measuring range	{0 ... +20 mA} {4 ... +20 mA}

Calculation formula for unipolar parameter:

- Measuring range 0 ... +20 mA

$$\text{VALUE ANALOG INPUT }[\%] = \frac{I_{in}[mA]}{I_{inmax}[mA]} * 100\,\% * \text{scaling} + \text{Offset }[\%]$$

$$\text{TARGET PARAMETER VALUE} = \text{VALUE ANALOG INPUT }[\%] \cdot \text{Maximum Value of the target parameter}$$

- Measuring range 4 ... +20 mA

$$\text{VALUE ANALOG INPUT }[\%] = \frac{I_{in}[mA]}{I_{inmax}[mA]} \cdot 100\% * \text{scaling} + \left(\text{Offset }[\%] \cdot \frac{16\text{ [mA]}}{20\text{ [mA]}}\right)$$

$$\text{TARGET PARAMETER VALUE} = \left(\frac{I_{in}[mA] - 4\text{ [mA]}}{16\text{ [mA]}} \cdot 100\% + \text{Offset }[\%]\right) \cdot \text{Max. value of the target parameter}$$

- For both measuring ranges is applicable:

If VALUE ANALOG INPUT is > 100 %,
then VALUE ANALOG INPUT = 100 % is set.

Calculation formula for bipolar parameters:

- Measuring range 0 ... +20 mA

$$\text{VALUE ANALOG INPUT }[\%] = \left(\frac{I_{in}[mA]}{I_{inmax}[mA]} \cdot 100\% \cdot 2\text{ scaling}\right) - (100\% + \text{Offset }[\%])$$

$$\text{TARGET PARAMETER VALUE} = \text{VALUE ANALOG INPUT }[\%] \cdot \text{Maximum value of the target parameter}$$

- Measuring range 4 ... +20 mA

$$\text{VALUE ANALOG INPUT}[\%] = \left(\frac{I_{in}[mA]}{I_{inmax}[mA]} \cdot 100\% \cdot 2 \cdot \text{scaling}\right) - \left(100\% + \left(\text{Offset }[\%] \cdot \frac{16\text{ [mA]}}{20\text{ [mA]}}\right)\right)$$

Target parameter value [%] =

$$= \left(\frac{I_{in}[mA] - 4\text{ [mA]}}{16\text{ [mA]}} \cdot 100\% \cdot 2 - 100\ \% + \text{Offset }[\%]\right) \cdot \text{Max. value of the target parameter}$$

- For both measuring ranges is valid:

  If VALUE ANALOG INPUT is > 100 %,
  then VALUE ANALOG INPUT = 100 % is set.

  If VALUE ANALOG INPUT is < -100 %,
  then VALUE ANALOG INPUT = -100 % is set.

7.8.5 Examples for AIO-04

- Examples for determination unipolar target parameters

Scaling = 1; Offset = 0%; Threshold value = 0%;

Unipolar target parameter:
measuring range: 0 ... +20 mA

20 mA	↔	100 %	* maximum value
15 mA	↔	75 %	* maximum value
10 mA	↔	50 %	* maximum value
5 mA	↔	25 %	* maximum value
0 mA	↔	0 %	* maximum value

Unipolar target parameter:
measuring range: 4 ... +20 mA

20 mA	↔	100 %	* maximum value
15 mA	↔	68,75 %	* maximum value
10 mA	↔	37,5 %	* maximum value
5 mA	↔	6,25 %	* maximum value
4 mA	↔	0 %	* maximum value

Scaling = 1; Offset = 20%; Threshold value = 0%;

Unipolar target parameter:
measuring range: 0 ... +20 mA

20 mA	↔	100 %	* maximum value
15 mA	↔	95 %	* maximum value
10 mA	↔	70 %	* maximum value
5 mA	↔	45 %	* maximum value
0 mA	↔	20 %	* maximum value

Unipolar target parameter:
measuring range: 4 ... +20 mA

20 mA	↔	100 %	* maximum value
15 mA	↔	88,75 %	* maximum value
10 mA	↔	57,5 %	* maximum value
5 mA	↔	26,25 %	* maximum value
4 mA	↔	20 %	* maximum value

- Examples for determination bipolar target parameters

Scaling = 1; Offset = 0%; Threshold value = 0%;

Bipolar target parameter: measuring range: 0 ... +20 mA				Bipolar target parameter: measuring range: 4 ... +20 mA			
20 mA	↔	100 %	* maximum value	20 mA	↔	100 %	* maximum value
15 mA	↔	50 %	* maximum value	15 mA	↔	37,5 %	* maximum value
10 mA	↔	0 %	* maximum value	10 mA	↔	-25 %	* maximum value
5 mA	↔	-50 %	* maximum value	5 mA	↔	-87,5 %	* maximum value
0 mA	↔	-100 %	* maximum value	4 mA	↔	-100 %	* maximum value

Scaling = 1; Offset = 20%; Threshold value = 0%;

Bipolar target parameter: measuring range: 0 ... +20 mA				Bipolar target parameter: measuring range: 4 ... +20 mA			
20 mA	↔	100 %	* maximum value	20 mA	↔	100 %	* maximum value
15 mA	↔	70 %	* maximum value	15 mA	↔	57,5 %	* maximum value
10 mA	↔	20 %	* maximum value	10 mA	↔	-5 %	* maximum value
5 mA	↔	-30 %	* maximum value	5 mA	↔	-67,5 %	* maximum value
0 mA	↔	-80 %	* maximum value	4 mA	↔	-80 %	* maximum value

Scaling = 0,5; Offset = 50%; Threshold value = 0%;

Bipolar target parameter: measuring range: 0 ... +20 mA				Bipolar target parameter: measuring range: 4 ... +20 mA			
20 mA	↔	100 %	* maximum value	20 mA	↔	100 %	* maximum value
15 mA	↔	75 %	* maximum value	15 mA	↔	68,75 %	* maximum value
10 mA	↔	50 %	* maximum value	10 mA	↔	37,5 %	* maximum value
5 mA	↔	25 %	* maximum value	5 mA	↔	6,25 %	* maximum value
0 mA	↔	0 %	* maximum value	4 mA	↔	0 %	* maximum value

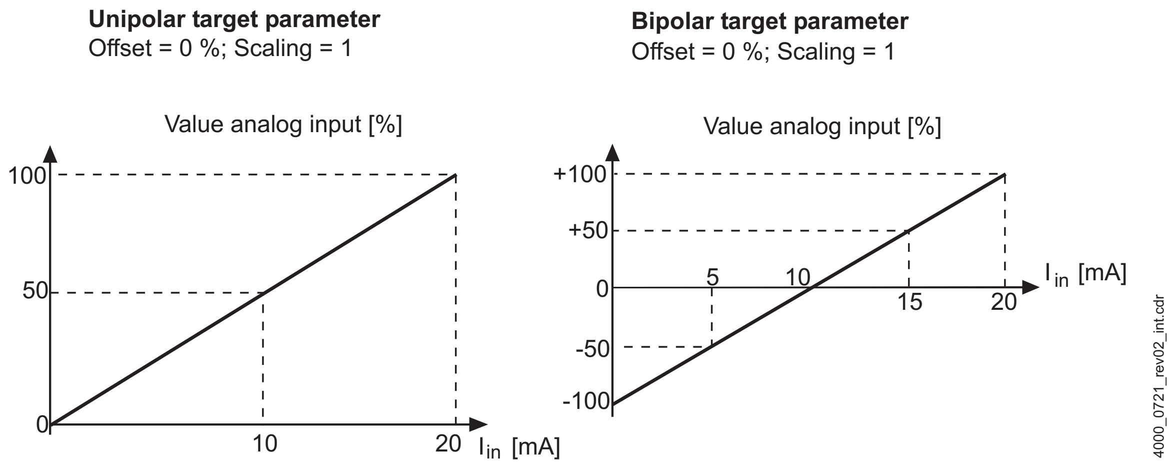


Figure 78: Analog input: characteristic curve examples for AIO-04

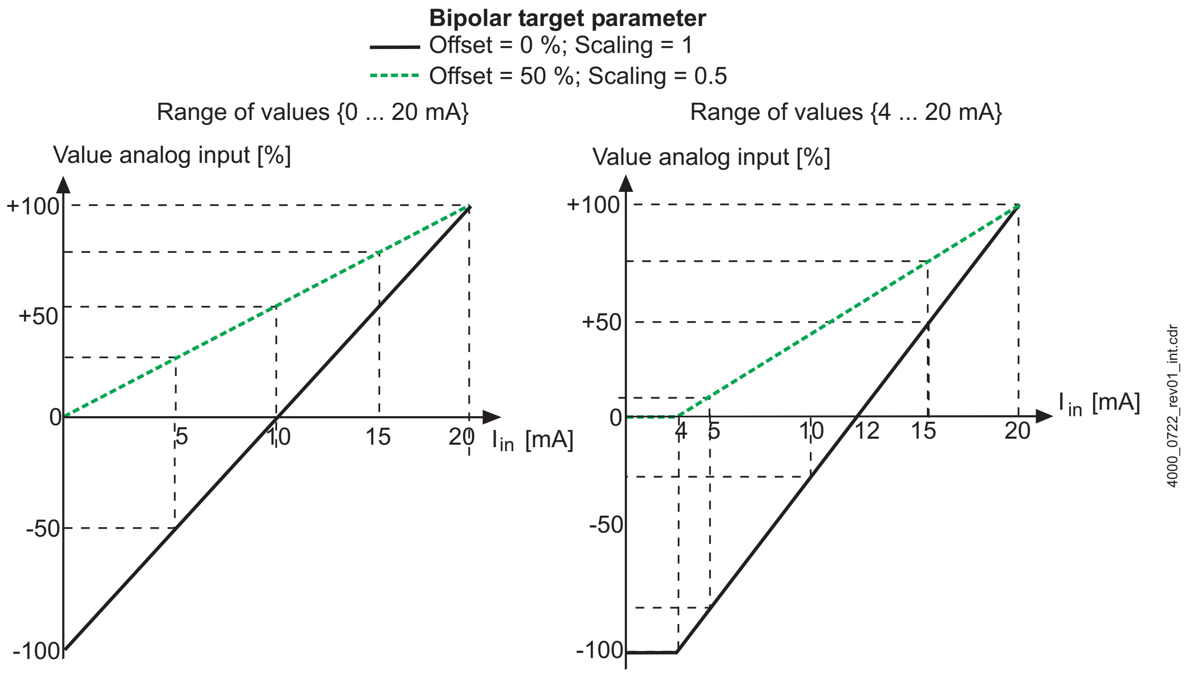


Figure 79: Analog input: characteristic curve examples for AIO-04

7.9 Analog outputs

If you intend to use analog inputs, you must have one of the AIO-01, AIO-02, AIO-03 or AIO-04 function modules.

With the analog outputs any drive parameter, as e. g. current actual value, speed actual value or position deviation error, but also status parameters can be displayed. 16 bit as well as 32 bit parameters can be displayed.

For the analog outputs two parameter blocks are provided. That way a maximum of 2 outputs can be evaluated simultaneously. The outputs are updated every 125 µs.

Four parameters belong to every parameter block:

- Select fast analog output ▷P1150◁ and ▷P1154◁
  Select of the output channel and of the function module slots.
- Source parameter number analog output ▷P1151◁ and ▷P1155◁
  Parameter number for the source parameter, which shall be generated at the output. The calculation of the output value acts automatically in accordance with the type of the parameter: 16 oder 32 Bit, signed oder unsigned.
- Scaling factor analog output ▷P1153◁ and ▷P1157◁
  Scaling factor for the calculation of the output value.
- Offset analog output ▷P1152◁ and ▷P1156◁
  With the offset the output value is able to be shifted by a possible offset error of the analog output.

NOTE!

Only two analog outputs can be parameterized or connected, even if there are two or three AIO modules plugged.

7.9.1 Calculation basis

For the calculation of the analog outputs it is assumed that there is a standard scaling in the drive. The most actual value parameters as for example speed, torque and current are internally scaled to the value 4000_{hex} (with 16 bit parameters) or 40000000_{hex} (with 32 bit parameters). That means that a parameter value of 4000_{hex} (or 40000000_{hex}) accords to 100 %.

If the parameter, which is to be output, is shown in the scaling, the simplified conversion formulae can be used.

Signed parameters:

U_{off} = parameter value [%] * scaling [WinBASS II / ProDrive] * 10 V + offset [V]

Unsigned parameters:

U_{off} = parameter value [%] * scaling [WinBASS II / ProDrive] * 20 V - 10 V + offset [V]

For the scaling of parameters, which do not accord to the standard scaling, the general calculation formulae are valid. Thereby the internal representation must be used in order to calculate the parameter value. The internal representation can be taken from the according parameter description.

16 bit Signed Parameters

$$U_{off} = \frac{\text{Parameter value [internal]}}{4000_{hex}} \cdot \text{Scaling [WinBASS]} \cdot 10\ V + \text{Offset [V]}$$

32 bit Signed Parameters

$$U_{off} = \frac{\text{Parameter value [internal]}}{40000000_{hex}} \cdot \text{Scaling [WinBASS]} \cdot 10\ V + \text{Offset [V]}$$

16 bit Unsigned Parameters

$$U_{off} = \frac{\text{Parameter value [internal]}}{4000_{hex}} \cdot \text{Scaling [WinBASS]} \cdot 20\ V - 10\ V + \text{Offset [V]}$$

32 bit Unsigned Parameters

$$U_{off} = \frac{\text{Parameter value [internal]}}{40000000_{hex}} \cdot \text{Scaling [WinBASS]} \cdot 20\ V - 10\ V + \text{Offset [V]}$$

7.9.2 Sample 1 - Parameters with scaling

In slot E (module slot 5) you have plugged in a module for analog outputs.

The value of the parameter P1 ▹P0394◃ Encoder 1 actual speed value shall be displayed on output 1. The parameter block 1 must be used for this.

Following settings are necessary:

Select fast analog output 1	▹P1150◃	0501_{hex}
Source number fast analog output 1	▹P1151◃	394
Offset fast analog output 1	▹P1152◃	0 (no offset)
Scaling factor fast analog output 1	▹P1153◃	1

(100 % speed results in 10 V at the output)

7.9.3 Sample 2 - Parameters without scaling

In slot E (module slot 5) you have plugged in a module for analog outputs.

The value of the parameter ▹P0367◃ position controller position deviation error shall be displayed in total on the output 2. Therefore parameter block 2 must be used. The range of ±2 revolutions shall be displayed as ±10 V (the parameter is a 32 bit parameter with a preceding sign and is represented with a 16 bit revolution, 16 bit angle).

The required scaling factor is calculated as follows:

$$\text{Scaling [WinBASS]} = \frac{U_{off} - \text{Offset [\%]}}{10\ \text{V}} \cdot \frac{40000000_{hex}}{\text{Parameter value [intern]}}$$

Thereby U_{off} = 10V (value at the output) shall accord to a parameter value of 00020000_{hex} (2 revolutions). 0 is set as offset. The outcome is:

$$\text{Scaling [WinBASS]} = \frac{10\ \text{V}}{10\ \text{V}} \cdot \frac{40000000_{hex}}{00020000_{hex}} = 2000_{hex} = 8192_{dez}$$

Following settings are necessary:

Select fast analog output 2	▷P1154◁	0502_{hex}
Source number fast analog output 2	▷P1155◁	367
Offset fast analog output 2	▷P1156◁	0 (no offset)
Scaling factor fast analog output 2	▷P1157◁	8192

7.9.4 Sample 3 - unsigned parameter without scaling

The value of the parameter ▷P0484◁U $_{DC\ link}$ actual value shall be displayed as analog output 1.

Scaling of the parameter is 4000_{hex}: 540 V, it is a 16 bit unsigned parameter. At 0 V U DC link voltage 0 V shall be displayed, at 600 V U DC link voltage 10 V.

Calculation.
From the formula for 16 bit parameter it can be seen that for the value range 0 to 4000_{hex} a voltage of -10V to +10V is output.

In the example however there only should be a positive voltage, that is why an offset of 10 V must be added. This is to be reached by using the value 10 V for the offset ▷P1152◁ (▷P1156◁).

Now the scaling factor ▷P1153◁ (▷P1157◁) can be calculated:

$$\text{Scaling [WinBASS]} = \frac{U_{off} + 10\ \text{V} - \text{Offset [\%]}}{20\ \text{V}} \cdot \frac{4000_{hex}}{\text{Parameter value [intern]}}$$

U_{off} = 10 V; Offset = 10V;

$$\text{Parameter [internal]} = \frac{600\ \text{V} \cdot 4000_{hex}}{540\ \text{V}}$$

$$\text{Scaling [WinBASS]} = \frac{10\ \text{V} + 10\ \text{V} - 10\ \text{V}}{20\ \text{V}} \cdot \frac{540\ \text{V} \cdot 4000_{hex}}{600\ \text{V} \cdot 4000_{hex}} = 0,45$$

Following settings are necessary:

Select fast analog output 2	▹P1150◃	0501_{hex}
Source number fast analog output 2	▹P1151◃	484
Offset fast analog output 2	▹P1156◃	10V
Scaling factor fast analog output 2	▹P1153◃	0.45

7.10 Direct access to digital in-/outputs via the PLC

7.10.1 Overview

The b maXX® controller from firmware version FW 03.01 onwards offers in connection with an existent drive PLC the option to read out or to control the digital in-/outputs of one or several function modules of the type DIO-01 and FIO-01 on the slots A to E.

The controller provides the PLC with special addresses for I/O mappings on which the user program of the PLC can read or write. The contents of the mappings are exchanged in every control cycle that means **every 125 µs** between PLC and function module.

The bit assignment in the I/O mapping is defined by the hardware version status of a function module.

The hardware version status is coded in the bits 8 ... 10 of the module identification (parameter module type slot A ... module type slot E. ▹P0550◃ ... ▹P0554◃):

Hardware identification					HW version status										
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

```
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |            reserved
|  |  |  |  |  |  |  |
|  |  |  |  |  0  0  0  reserved
|  |  |  |  |  0  0  1  Version status a
|  |  |  |  |  0  1  0  Version status b
|  |  |  |  |  0  1  1  Version status c
|  |  |  |  |  1  0  0  Version status d
|  |  |  |  |  1  0  1  Version status e
|  |  |  |  |  1  1  0  Version status f
|  |  |  |  |  1  1  1  Version status g
|  |  |  |  |
x  x  x  x  x  Module function identification (0 0 1 0 1binary for DIO-01 and FIO-01)
```

Example:

At a DIO-01 with hardware version status c the ID = $2B00_{hex}$.

At usage of different version statuses a decoding of the hardware version status which is dependent on the function module type is necessary in the PLC user program in order to guarantee a correct bit assignment.

NOTE!

The hardware version status is not identical to the layout status.

7.10.2 Configuration

An I/O mapping address of the data type WORD (16 bit) individually is assigned to a function module. Each module possesses an own address in order to read the digital inputs from the function module and another address to write on these digital outputs.

A sharing of inputs of a function module is possible by the PLC and controller, during the usage of outputs which are configured bitwise as either only the controller or only the PLC uses the outputs of a module.

The configuration of the assignment of the outputs at the controller or at the PLC operates with the controller parameter ▹P0579◃ function module selection for PLC I/O accesses. Each of the five lower bits is assigned to a function module slot A...E. If the particular bit is not set, only the controller may access to the outputs. Output information from the PLC mapping does not reach the module then. Conversely, if the according bit is set, the PLC can write to the outputs of the assigned module. In this case output links of the controller do not effectuate the module but only the controller output mapping (status of the digital outputs in module slot A... status of the digital outputs in module slot E - ▹P0415◃... ▹P0419◃). Further on the controller output mapping is displayed in WinBASS II / ProDrive.

A reconfiguring of the output assignment controller or PLC also is possible in the operating status. It must be considered that after reconfiguring the according activated output mapping is set immediately.

7.10.3 Addresses of I/O mapping

w_InputSlotA	AT %MW3,1262082	:.1262082	:	WORD; (* input mapping slot A *)
w_InputSlotB	AT %MW3,1262086	:.1262086	:	WORD; (* input mapping slot B *)
w_InputSlotC	AT %MW3,1262090	:.1262090	:	WORD; (* input mapping slot C *)
w_InputSlotD	AT %MW3,1262094	:.1262094	:	WORD; (* input mapping slot D *)
w_InputSlotE	AT %MW3,1262098	:.1262098	:	WORD; (* input mapping slot E *)

w_OutputSlotA	AT %MW3,1262080	:.1262080	:	WORD; (* output mapping slot A *)
w_OutputSlotB	AT %MW3,1262084	:.1262084	:	WORD; (* output mapping slot B *)
w_OutputSlotC	AT %MW3,1262088	:.1262088	:	WORD; (* output mapping slot C *)
w_OutputSlotD	AT %MW3,1262092	:.1262092	:	WORD; (* output mapping slot D *)
w_OutputSlotE	AT %MW3,1262096	:.1262096	:	WORD; (* output mapping slot E *)

7.10.4 Usable I/O modules

The following b maXX® function modules are provided for the PLC direct accesses:

- BM-F-DIO-01
- BM-F-FIO-01

7.10.5 Structure of I/O mappings for DIO-01 and FIO-01 (4-bit digital in, 4-bit digital out)

The function modules DIO-01/FIO-01 are provided with:

4 x inputs I1...I

4 x outputs Q1...Q

The assignment of the bits in the I/O mapping is dependent on HW version status (bits 8 ... 10 in the module ID).

- **Hardware version status a (module identification: 29xx$_{hex}$)**

I/O input mapping

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

```
|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|    |    |    |    |    |    |    |    0    0    0    0    0    0    0    0    No short-circuit and 24 V supply of
|    |    |    |    |    |    |    |                                            the E/As is existent
|    |    |    |    |    |    |    |    1    1    1    1    1    1    1    1    Short-circuit or 24 V supply of E/As
|    |    |    |    |    |    |    |                                            is missing
|    |    |    |    |    |    |    |
|    |    |    |    x    x    x    x    reserved
|    |    |    |
-I4  -I3  -I2  -I1            -I4... -I1: Inputs are read inverted
```

I/O output mapping

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

```
|    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |
|    |    |    |    |    |    |    |    |    |    |    |    -Q1  -Q2  -Q3  -Q4
|    |    |    |    |    |    |    |    |    |    |    |
x    x    x    x    x    x    x    x    x    x    x    x    reserved
```

- **Hardware version status b (module identification: 2Axx$_{hex}$)**

I/O input mapping

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

```
|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|    |    |    |    |    |    |    |    0    0    0    0    0    0    0    0    No short-circuit and 24 V supply of
|    |    |    |    |    |    |    |                                            the E/As is existent
|    |    |    |    |    |    |    |    1    1    1    1    1    1    1    1    Short-circuit or 24 V supply of E/As
|    |    |    |    |    |    |    |                                            is missing
|    |    |    |    |    |    |    |
|    |    |    |    |    x    x    x    reserved
|    |    |    |    |
|    -I4  -I3  -I2  -I1            -I4... -I1: Inputs are read inverted
|
x    reserved
```

I/O output mapping

```
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 |  4  |  3  |  2  |  1  | 0 |
  |    |    |    |    |    |    |   |   |   |   |    |     |     |     |    |
  |    |    |    |    |    |    |   |   |   |   |    |     |     |     |    x    reserved
  |    |    |    |    |    |    |   |   |   |   |    |     |     |     |
  |    |    |    |    |    |    |   |   |   |   |   -Q4   -Q3   -Q2   -Q1       Outputs inverted
  |    |    |    |    |    |    |   |   |   |   |
  x    x    x    x    x    x    x   x   x   x   x   reserved
```

Values in order to control the inverted outputs Q1 ... Q4:

Q1: $1D_{hex}$ → Output 1 is set
Q2: $1B_{hex}$ → Output 2 is set
Q3: 17_{hex} → Output 3 is set
Q4: $0F_{hex}$ → Output 4 is set

- **Hardware version status c and d (module identification: $2Bxx_{hex}$ and Cxx_{hex}**

I/O input mapping

```
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
  |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |
  |    |    |    |    |    |    |   |   0   0   0   0   0   0   0   0    No short-circuit and 24 V supply of
  |    |    |    |    |    |    |   |                                    the E/As is existent
  |    |    |    |    |    |    |   |   1   1   1   1   1   1   1   1    Short-circuit or 24 V supply of E/As
  |    |    |    |    |    |    |   |                                    is missing
  |    |    |    |    |    |    |   |
  |    |    |    |    x    x    x   x   reserved
  |    |    |    |
 -I4  -I3  -I2  -I1
```

I/O output mapping

```
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 |  3  |  2  |  1  |  0  |
  |    |    |    |    |    |    |   |   |   |   |   |    |     |     |     |
  |    |    |    |    |    |    |   |   |   |   |   |   -Q4   -Q3   -Q2   -Q1   Outputs inverted
  |    |    |    |    |    |    |   |   |   |   |   |
  x    x    x    x    x    x    x   x   x   x   x   x   reserved
```

Values in order to control the inverted outputs Q1 ... Q4:

Q1: $0E_{hex}$ → Output 1 is set
Q2: $0D_{hex}$ → Output 2 is set
Q3: $0B_{hex}$ → Output 3 is set
Q4: 07_{hex} → Output 4 is set

7.11 BACI

7.11.1 Introduction

BACI(**BA**umüller-**C**omponent-**I**nterface) define the hardware- and the software interface of Baumüller between controller and option cards in the b maXX® system.

Both the controller and the control system is able to communicate with other option cards, like field bus slave, field bus master cards, IEI option module and so on via this interface. Among each other controller and PLC can also exchange data.

7.11.2 System overview

There is always a BACI communication connection between a BACI master and up to five option cards as BACI slaves. The controller module always takes in the role of the master. The PLC takes in the role of a slave towards the controller, towards all the other option modules it takes in the role of the BACI master.The control of the communication connection is automatically executed by the b maXX® system. A data access over BACI is always actively executed by a BACI master. A data transfer from slave to slave is not possible.

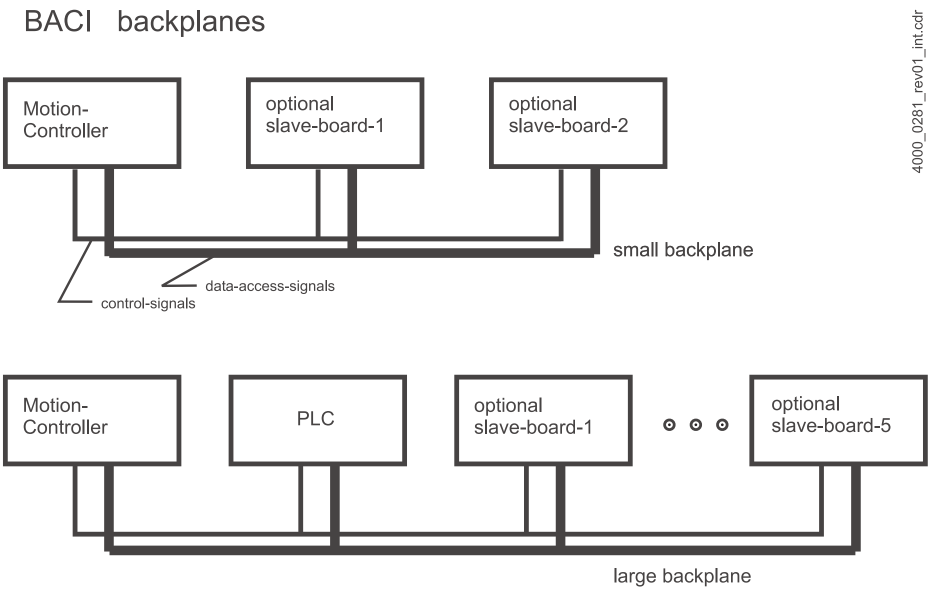


Figure 80: b maXX® option card bus

7.11.3 BACI services

The BACI differs between the following communication services:

1 **System configuration** (after power on) and reconfiguration (during the running operation)

2 **Cyclic data** - quick synchronous exchange of (e. g. set- and actual values) - no sign sequences

3 **Service data** for the time-uncritical data transfer of adjusted- or configured parameters.

4 **Command interface** - b maXX®internal to automatic configuration, diagnostics.

5 **Synchronization, interrupt.** The controller working cycle can be synchronized via the control lines with a synchronous signal that e.g. is generated by a field bus option module.

Furthermore, you can generate cyclic interrupts on field bus modules with the controller. For further information please refer to the description of the according field bus module.

NOTE!

The controller only operates option modules on the slots G and H.

The controller can exchange cyclical data at the time with max. two option modules (a control module belongs to this, too). Service data and commands can be operated simultaneously with two option modules at maximum.

The PLC can communicate cyclical on all slots with several option modules.

The controller provides parameters for the BACI system configuration and for the adjusting of cyclic communication between controller and the option module, where cyclic data shall be exchanged.

7.11.4 Configuration of the BACI via controller parameter

Slot selection
▹P0827◃

After switching on the controller it checks the assignment of both slots G and H in the sequence, which has been stated. It automatically configures the first option module, which it finds for the cyclic communication and herewith uses the parameters ▹P0800◃ to ▹P0819◃. If the controller recognizes a second option module it configures the second module with the parameters ▹P0860◃ to ▹P0879◃)

The assignment between the modules and the BACI configuration parameter can be exchanged with the setting in the parameter option module selection (▹P0827◃). For details see description of this parameter.

The controller only evaluates this parameter after switching off/switching on the system.

Hardware-/ Software-configuration of the optional modules

The parameters option module G configuration 1 ▷P0830◁ ... option module G configuration 8 ▷P0837◁ as well as option module H configuration 1 ▷P0840◁ ... option module H configuration 8 ▷P0847◁ provide specific configuration parameters for the option modules on slot G and H module. The option modules can read out these parameter during the initialization and accordingly make initializations or settings. The meaning of the inputs in these parameters is module specific and can be found in the particular manual of the option modules.

Configuration of the set value and actual value parameters

Parameters are designated as set values, which are cyclically written from the option card to the controller; the parameters, which are read cyclically from the controller are designated as actual values. If there is a cyclic communication, a specified scope of set values and actual values is exchanged one to another in a defined period at a determined point of time. After switching on this configuration is read from the particular controller parameters and is notified to the option card. The option card on its part can assign a deviant configuration to the controller. This happens automatically on system initialization. After completion of this initialization the configuration parameters in the controller show the configuration which is currently valid.

Moreover, after running up the system, that means in the running operation, an option card with the controller can declare and effectuate a change of configuration. In this case the controller configuration parameters reflect the changed configuration.

For the cyclic set value and actual value transmissions the kind and scope of the parameters are limited:

- The number of the possible set value and actual value transmissions between controller and option card are, at the moment, limited by the b maXX® controller of controller type 2 to eight set values and 8 actual values.
- Only those parameters may be written to cyclical, which possess the attribute 'cyclic writable' (in this manual marked with CW).
- Only those parameters may be cyclically read, which have a 16- or 32-bit data type. So for example character strings are excluded from the cyclic transfer. But these can be read or be written as service data.

Set values:

The parameters option module 1 master para-number set value ▷P0801◁ to ▷P0808◁ determine the parameter numbers of the max. 8 theoretically possible cyclic actual values.

Actual values:

The parameter option modules 1 master para-number actual value ▷P0809◁ to ▷P0816◁ determine the parameter numbers of the max. 8 theoretically possible cyclic actual values.

Cyclic transfer rate:

Parameter option module 1 master cycle time ▷P0800◁ and option module 2 master cycle time ▷P0860◁ specify at which intervals the controller (per 125 µs) places the cyclic transfer for the assigned slave (see parameter option module select ▷P0827◁:

The value refers to a multiple of 125 µs.

Value	Meaning
0	no cyclic data exchange
1	not permissible
2	250 µs
3	375 µs
and so on	

7.11.5 Definition of time of cyclic transfer:

Option module 1 master cycle offset set values ▷P0818◁ or.
Option module 2 master 1 cycle offset set values▷P0878◁
as well as
Option module 1 master cycle offset actual values ▷P0819◁ or.
Option module 2 master 1 cycle offset actual values▷P0879◁
specify the cyclic offset for the data exchange of the set values or actual values for the accordant slaves. This offset defines in which controller cycle of a transfer period the data exchange for the set values or actual values should take place.

When using two BACI slaves it is to be considered at cycle time parameterization, cycle offset set values and cycle offset actual values, that not both slaves exchange data in a controller cycle, because otherwise a time-slice time-error could occur during the running operation (error no. 19).

Example:

At the same cycle time (▷P0800◁) and (▷P0860◁) the offset values however should be

Option module 1 master cycle offset set value ▷P0818◁ and
option module 1 master cycle offset actual values ▷P0819◁ are not identical.

The accordant is valid for
Option module 2 master 1 cycle offset set value ▷P0878◁ and
Option module 2 master 1 cycle offset actual values ▷P0879◁.

NOTE!

At an unfavorable choice of the cycle offsets, during the cyclic communication access conflicts between controller and option card can arise.

Hence these offsets shouldn't be changed from the recommendations given in the option module manuals without having exact knowledge of the temporal connections!

7.11.6 Definition of time cyclic trigger signal generation:

The controller can read out a cyclic trigger signal to the option module in the selected data exchange interval. The offset (unit µs) option module 1 master 1 trigger offset ▷P0817◁ determines the temporal reference between the beginning of the communication interval and the reading out of the trigger signal.

7.11.7 Sequence cyclic communication:

The following diagram outlines the temporal process of a cyclic BACI communication between controller and ***an*** option card.. The parameters ▷P0800◁ to ▷P0819◁ are used in order to configure the option card (option module selection ▷P0827◁ is 0).

The following settings are effective:

The value refers to a multiple of 125 µs.

Parameter	Value	Description
Option module 1 master cycle time ▷P0800◁	4	Data exchange every 500 µs. This accords to the sync-interval, on which the controller synchronizes.
Option module 1 master cycle offset set values ▷P0818◁	0	Set values are transmissioned in the controller cycle, which follows the sync pulse, that means, in the interval zero.
Option module 1 master 1 cycle offset actual values ▷P0819◁	3	Actual values are transferred in the third controller interval, that means in the last interval before the next sync pulse.

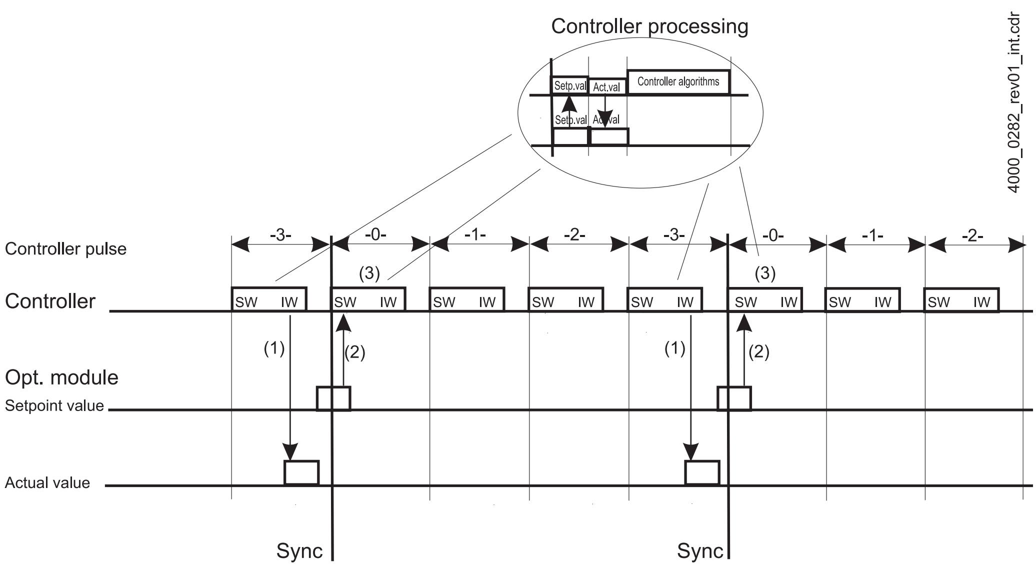


Figure 81: BACI timing cyclic communication

The individual processes during the communication are characterized in the diagram by parenthesized numerals, e.g. (3).

(1) Transmission of the actual values from the controller to the option card in the third controller interval. The actual values are, if necessary, rescaled within the option card and e. g. are made available to the field bus.

(2) Preparation of the set values by the option card and transmission of the set values to the controller

(3) Within controller processing the set values are written in the target parameters and then the control algorithm is calculated. At the end of the controller task new actual values are available.

The detail drawing of the controller processing shows, how the controller first reads in the set values over the BACI interface of the option card, then writes the actual values to the option card and then calculates the control algorithms.

7.11.8 Error monitoring

By the usage of BACI different error sources are possible.

- Configuration errors
- Delay errors

All errors are detected by the system and are signaled via the error mechanisms of the controller and are, for example, shown in WinBASS II / ProDrive.

Parameter error in function- or option modules ▷P0204◁ show, that an error in connection with an option module has occurred. The error code in the parameters error option module G ... error option module M (▷P0245◁ ... ▷P0250◁ shows the exact cause of error. In case there are two errors at one module simultaneously, the controller shows the error code, which it has recognized last of all.

Configuration errors

The most configuration errors are:

Error	Meaning
Invalid parameter number for set value 1..8	The parameter number doesn't exist or isn't cyclic writable
Invalid parameter number for actual value 1..8	The parameter number doesn't exist or isn't cyclic readable (false data type)
False value for cycle time	The data of the communication interval is 0 or 1
False value for cycle offset	The value for cycle offset, that means the information, in which the controller interval set values or actual values are exchanged is invalid. Cycle offset never may never be greater than or equal to the value of the cycle time, because the counting method of cycle offset begins at 0.
PCI-error or general reading error/writing error	Reading error/writing error on the configuration register of the option module - cause: module faulty.
Timeout within the configuration phase after system start	The option module doesn't initialize its BACI driver or it initializes it too late. Error reaction is adjustable. Possible causes: · At the PLC: program is not started. · At field bus cards: system initialization is not completed.

Delay errors cyclic communication:

Delay errors of the BACI can appear at all communication services during the cyclic communication and at the service data communication.

Error	Meaning
Invalid value at set value parameter 1 ... 8	The cyclic to be written value violates the min-/max limit of the named parameter
BACI-timeout with cyclic data	The controller monitors the cyclic communication over a timeout mechanism. A timeout-counter starts at the first successful cyclic set value transmission. Every further successful cyclic set value transmission retriggers this time counter.
Access conflicts with slave at cyclic communication	At an unfavorable choice of the cycle offsets, during the cyclic communication access conflicts between controller and option card can arise. Hence these offsets shouldn't be changed from the recommendations given in the option module manuals without having exact knowledge of the temporal connections! Measures when having access conflicts: Modification of the offset points.
Error cycl. communication: alive-counter conflict	The so-called alive-counter-mechanism of BACI cyclically monitors the reciprocative existence and correct operating of the communication partner. The controller signals an alive-counter conflict, if the option card doesn't react to the cyclic communication demands anymore. Measures: Restarting of the system, checking of the user program in the PLC, if the associated option module is a control.

Delay errors service data

The BACI service data communication occurs between b maXX®controller and the b maXX® option modules like field bus slaves modules or Omega-drive PLC. At field bus slave option modules the service data communication is initialized via the field bus master, at the Omega drive PLC via a communication module BACI_PAR_WRITE.

If there is an error during delay time at service data communication, the b maXX® controller signals an error code at the accordant option module. Field bus slave modules code these error messages into the according field-bus-specific error messages and forward them to the master.

At service data communication with an Omega-drive-PLC at error there is a b maXX® error code at the error output I_ERR of the service data communication module BACI_PAR_WRITE.

In the following list are the possible error codes:

Error code hex.	Error code dec.	Meaning
0100_{hex}	256	The parameter with this number does not exist in the controller.
0101_{hex}	257	Invalid data type
0102_{hex}	258	Value less than the minimum value
0103_{hex}	259	Value greater than the maximum value
0104_{hex}	260	Parameter is write protected, it is read-only.
0105_{hex}	261	reserved
0106_{hex}	262	Parameter cannot be changed because of the actual operation status (e. g. the changing of certain parameters in the drive status 4 is not permitted for all parameters)
0107_{hex}	263	Invalid parameter value (e. g. parameter BM_i_Ds0_OperationMode (▹P0304◃) may not be written to with the value).
...	...	reserved
$011B_{hex}$	283	With parameter BM_w_Ds0_CommSource (▹P1001◃) the access to the parameter via the service data interface is inhibited. The checkbox on the on the WinBASS- or ProDrive-page „Drive manager“, checkbox: „BACI, enable write accesses to service data" must be activated.

Diagnostic message

For a diagnosis of the BACI-communication services the controller offers the following development parameters:

Parameter	Meaning
▹P3344◃	Internal BM_u_BaciStatus.
▹P3345◃ ▹P3385◃	Counter for access conflicts with option module.
▹P3346◃ ▹P3386◃	Counter for Alive-Counter-Errors (see above)
▹P3347◃ ▹P3387◃	Counter for reconfiguration operations during the current operation
▹P3348◃ ▹P3388◃	Counter for the cyclic data exchange of set values.
▹P3349◃ ▹P3389◃	Counter for den cyclic data exchange of actual values.
▹P3350◃ ▹P3390◃	Counter for BACI commands
▹P3351◃ ▹P3391◃	Counter for service data communication

7.12 Synchronization

The control cycle can be synchronized to an external signal via a fieldbus, as for example by an option module. The source of the external signal is determined in the "Source for Sync signal" ▹P0531◃.

The signal cycle (fieldbus cycle) on which the control is synchronized is set in the "Sync interval" ▹P0532◃. In general the synchronization is switched off (▹P0532◃ to 0 µs).

Requirements to the synchronization signal

The external signal must meet the accuracy requirements.

- The cycle time of the synchronization signal must have one of the following values.
  - 250 µs
  - 500 µs
  - 1 ms
  - 2 ms
  - 4 ms
  - 8 ms
- The synchronization is triggered to the falling edge of the signal. The low status must be present with at least 200 ns, to recognize the edge. The permissible deviation of the synchronization interval from the specified rated value is 800 ppm (accords to 800/1000000). This means, that the permissible deviant at a 2 ms cycle is 1.6 µs. A greater tolerance can not be corrected by the drive anymore.
- In order to reach a greater permission of deviation of the signal, the tolerance can be set via the parameter Sync. Tolerance ▹P0533◃. This tolerance at the same time is the range within the drive is accepted as synchronous to the external signal.

Synchronization procedure

The beginning of the cycle time is synchronized to the falling edge of the synchronization signal. This is possible only with an accuracy of 1600 ppm (accords to 1600/1000000).

The control keeps on running with a cycle of 125 µs if there is a failure of the synchronization signal or if the signal is out of the tolerance range. As soon as valid synchronization signals are recognized it automatically is synchronized to the signal.

The state of the synchronization is displayed in ▹P0530◃ "Synchronization status".

Shift of the control beginning

Furthermore it is possible to shift the control beginning with respect to the synchronous signal. This is set via the parameter Sync. Offset ▹P0534◃.

A positive value of sync. offset shifts the beginning of the controller cycle of sync pulse to the right, a negative value accordingly to the left.

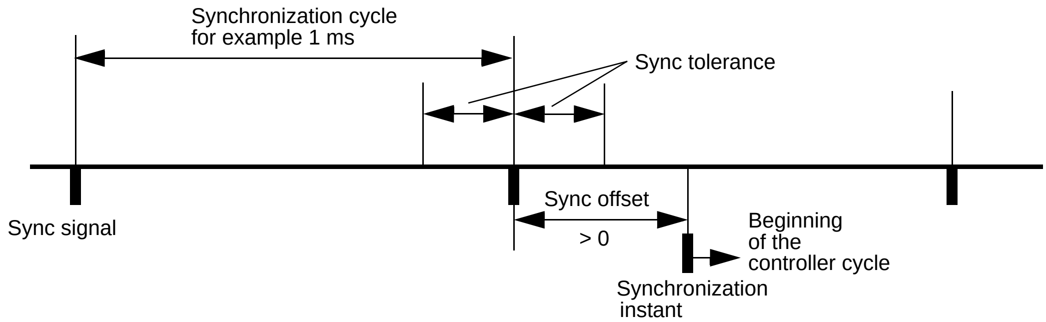


Figure 82: Synchronization timing, sync offset < 0

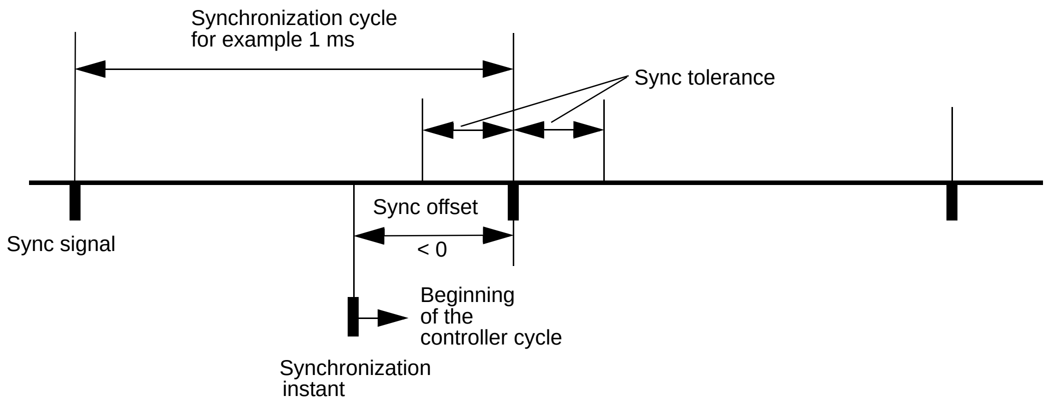


Figure 83: Synchronization timing, sync offset < 0.

7.13 Display filter

Starting from firmware version FW 03.06, the b maXX® controller provides two PT 1 filters for smoothing of display values, which freely can be parameterized. The filter time constants can be set via ▹P2045◃ and ▹P2046◃ in the range from 0 ms to 32.767 s.

One filter is calculated in each 1 ms controller time slot interval.
The controller alternately calculates filter 1 and filter 2 if both filters are active. This means that each filter is calculated every 2 ms.

Smoothing operates on:

- WinBASS / ProDrive
- Analog outputs
- BACI cyclic data (process data)
- BACI service data

The values, which were smoothed by the PT1 element are shown, internal the controller calculates with unsmoothed values.

In the oscilloscope function the controller always uses unsmoothed parameter values for the recording as well as for the trigger compare values.

7.14 Application parameters

Application parameters (Application parameter 1 ▹P3314◃ to Application parameter 25 ▹P3338◃) are at your disposal, e. g.:

- Linking of in- and outputs
- Access via field busses or PLC

All application parameters are saved at the storage of data sets.

7.15 Master-Slave torque coupling

With help of the function "Master-Slave torque coupling" the load of two drives, which move a load jointly, is divided up into a defined relation.

As direct data transmission between the drives is required for this function, a control as EtherCAT master and accordingly an EtherCAT slave card is required for the drives, which are used.

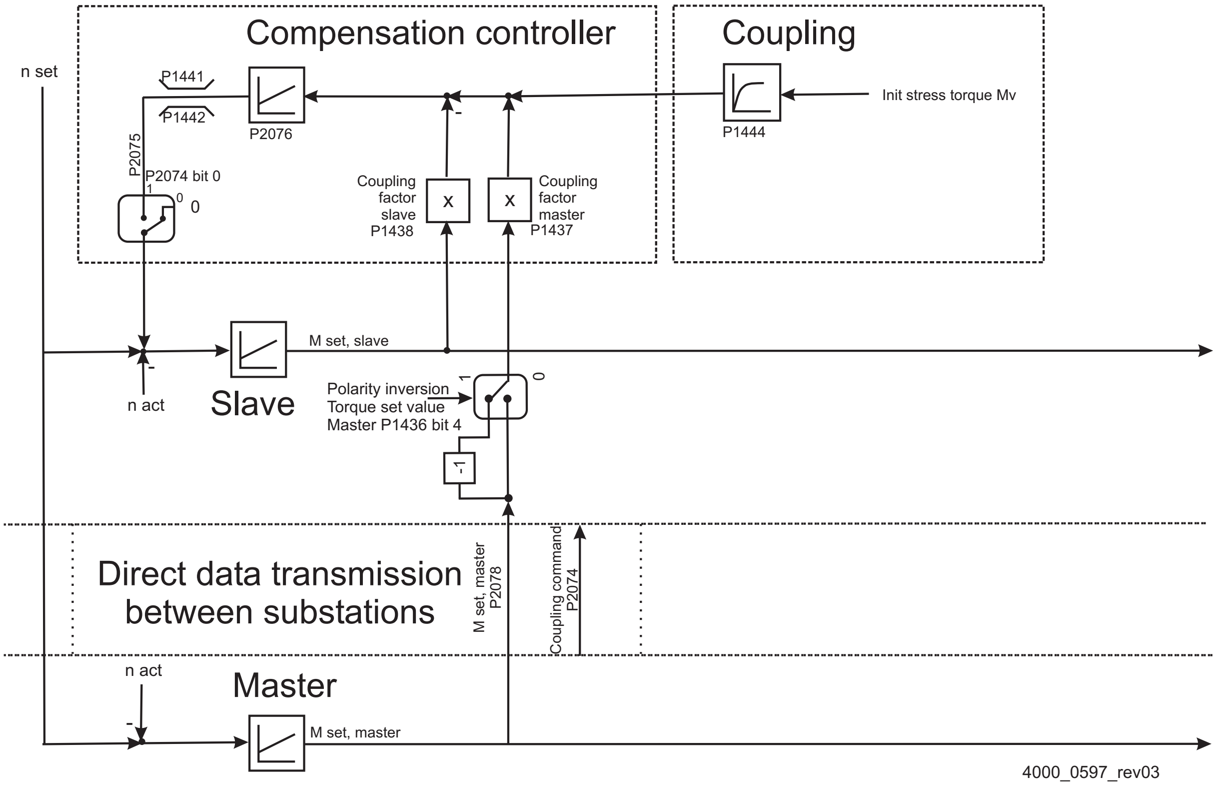


Figure 84: Torque coupling:

Preconditions:

Torque coupling must comply with the following preconditions:

- Drives are rigidly coupled
- Slave operates in operating mode speed control or speed setting 1
- Master and slave have the same speed value, e. g. via EtherCAT
- Via EtherCAT the direct data transmission between master and slave is possible

A compensating controller on the slave drive calculates an additional speed set value from its set torque of the master (receipt via data transmission) and set torque of the slave according to the torque scaling for the slave. Via the rigid coupling, the torques then are set accordant to the torque scaling (see ▷Figure 84◁ on page 175).

In order to bias the drives in standstill and if necessary also during movement an initial stress can additionally be applied, which can also be specified speed-dependent. (see ▹Figure 85◃ on page 176)

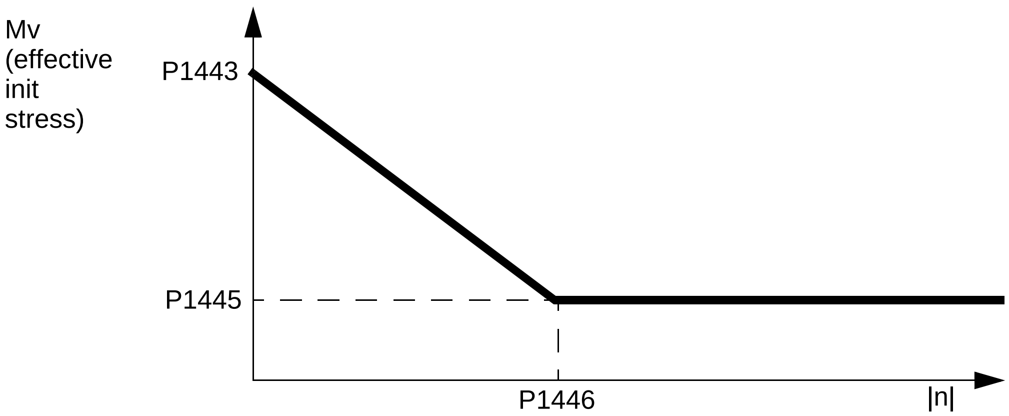


Figure 85: Speed-dependent reducing of initial stress

|n| < ▹P1446◃: $M_V = \frac{P1445 \cdot n}{P1446} + P1443 \cdot \left(1 - \frac{n}{P1446}\right)$

|n| > ▹P1446◃: $M_V = P1445$

The coupling is activated on the master (▹P1436◃ bit 3), this setting from the slave then becomes effective (▹P2074◃ bit 0), if master and slave are enabled, because only then the control loop is closed.

Direct data transmission between substations

The following parameter must be cyclical transferred and therefore must be accordingly mapped from the controller and the EtherCAT.

- ▹P2074◃ Coupling command master to slave
- ▹P2078◃ Torque set value master
- ▹P2079◃ Status word master

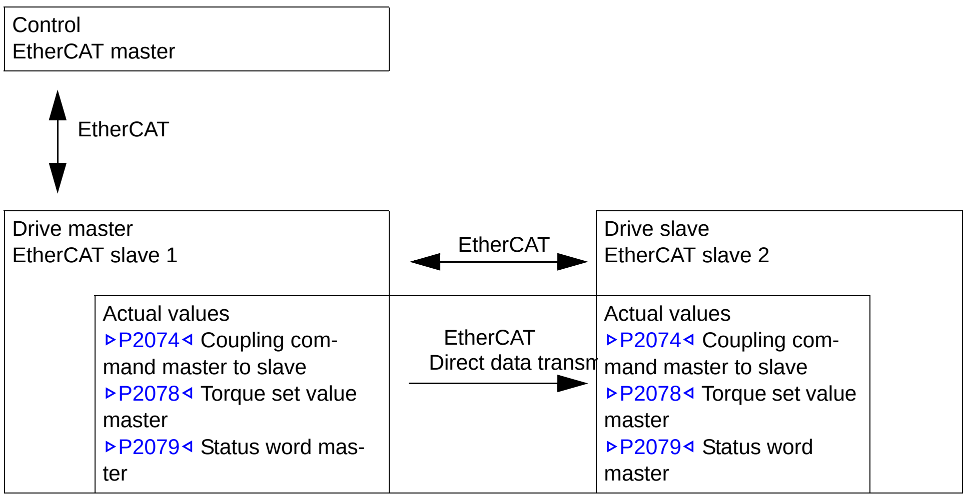


Figure 86: Direct data transmission between substations

Also see ▹Configuration of the BACI via controller parameter◃ from page 165.

The controller master writes its actual values (▷P2074◁ ... ▷P2079◁) in the telegram, which was received from the control and transfers it to the controller slave. In the same bus cycle the controller slave reads these values as its set values. Therefore

- the controller master in the Ethercat ring must physically lay in front of the controller slave, so that this receives the actual values,
- must ▷P2074◁ ... ▷P2079◁ be mapped in the controller master and controller slave in the same address range.

An exemplary configuration file for the set-up of direct data transmission between substations under TwinCAT is to be found under "http://www.baumueller.de/downloads_software.htm subsection Files/Programme b maXX® Ethercat Querverkehr"

Error behavior: The slave error behavior to the master can, accordant to the available error reactions, be parameterized, see ▷P0215◁ error 235.

NOTE!

If mechanical coupling is canceled, while the torque coupling is active (▷P2074◁ bit 0 = 1), the slave can possibly accelerate up to the overspeed limit (▷P1072◁ or ▷P1082◁).

7.16 Option module G, H-configuration

Survey of which parameter numbers are used for which slot:

	Slot G	Slot H
Option module configuration 1	▷P0830◁	▷P0840◁
Option module configuration 2	▷P0831◁	▷P0841◁
Option module configuration 3	▷P0832◁	▷P0842◁
Option module configuration 4	▷P0833◁	▷P0843◁
Option module configuration 5	▷P0834◁	▷P0844◁
Option module configuration 6	▷P0835◁	▷P0845◁
Option module configuration 7	▷P0836◁	▷P0846◁
Option module configuration 8	▷P0837◁	▷P0847◁

The exact use of the parameter is described in the technical manual according to the option module.

- ☐ CANopen ⇒ 5,02065
- ☐ Profibus DB ⇒ 5.03045
- ☐ SERCOS ⇒ 5.04013
- ☐ EtherCAT (SoE) ⇒ 5.04013
- ☐ EtherCAT (CoE) ⇒ 5.07017

7.17 DS402 Factor Group

In order to adapt to user-specific units the DS402 Factor Group (CiA CANopen device profile for drives and motion control part 2: Operation modes and application data) is supported.

Position- and speed weighting provides calculation or recalculation to the most important drive parameters.

The conversion and write access to the accordant drive parameters take place by each write access to the writable parameters. Read only parameters are updated cyclically.

$$\text{Position weighting DS402} = \frac{\text{Position resolution encoder increments P2172}}{\text{Position resolution motor revolutions P2173}}$$

$$\text{Speed weighting DS402} = \frac{\text{Speed resolution encoder increments DS402 P2176}}{\text{Speed resolution motor revolutions DS402 P2177}}$$

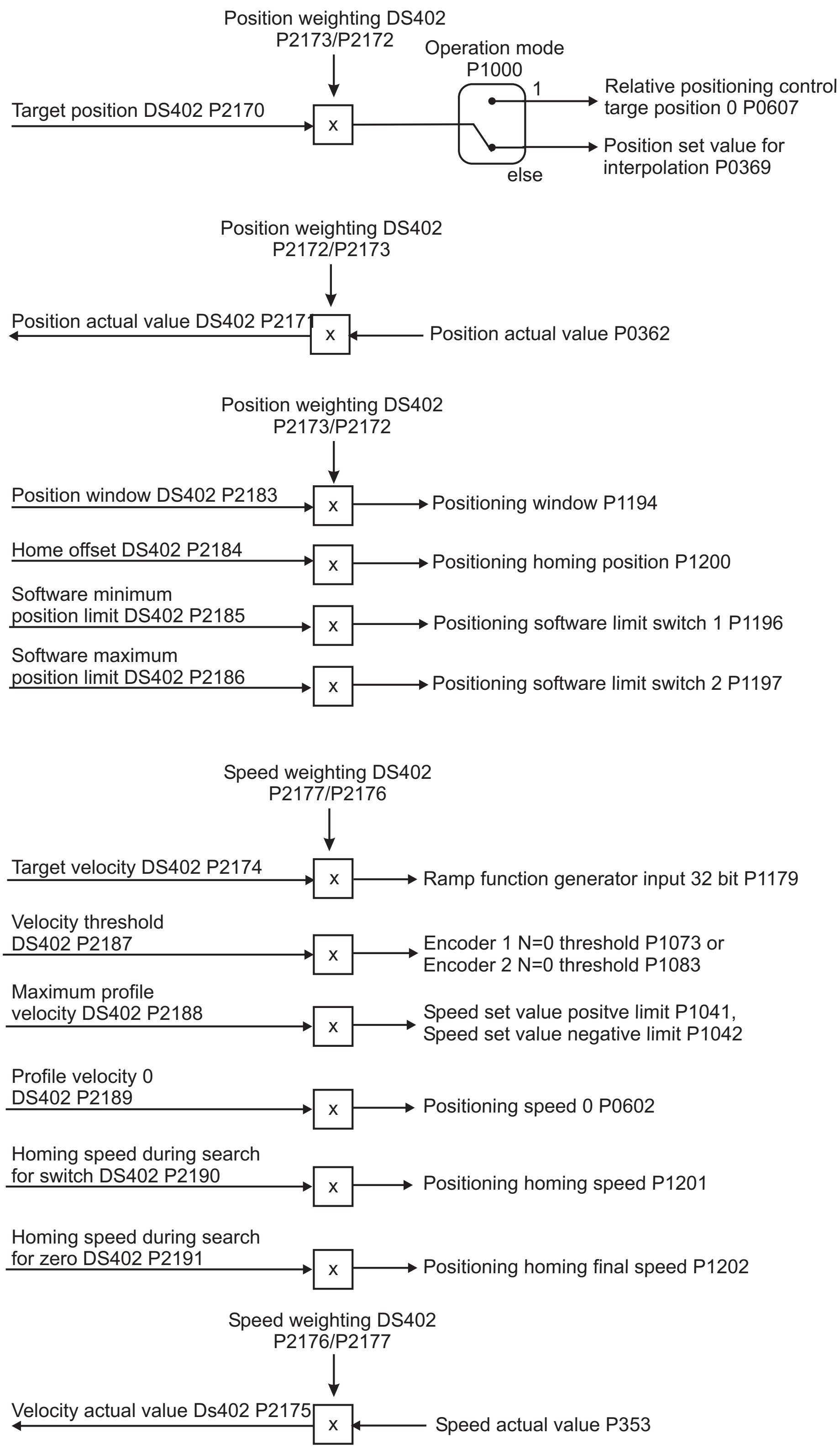


Figure 87: Position weighting and speed weighting

8

MANAGEMENT

8.1 Drive management

The drive manager controls the essential system resources of the device using a state machine. These are for example the complete device control in the different operation modes, the change-over of operation mode, troubleshooting, the managing of all communication interfaces and so on.

The state machine for the device control (see ▹Figure 89◃ on page 186) and the commands in the control word thereby accord to the Drivecom/CANopen standard.

- **Control**

The drive control takes place via the control word ▹P0300◃ and via hardware control inputs. Thereby a control is possible via the hardware inputs only, without operating the control word. Herewith in the parameter communication source ▹P1001◃ the bits for the motor control accordingly must be reset.

The control word ▹P0300◃ and the accordant commands are described in the parameter description in detail.

The following control inputs are existent:

- Quickstop-input (SH):
  - Terminal: FX 3-4
    Input in order to enable a quickstop. A zero level at this input effects the enable of a quickstop reaction. For the normal operation high level is necessary.
- Pulse enable (IF):
  - Terminal: FX 3-5
    Enables the pulses of the PWM. This input directly effectuates the power unit driver. No pulses can be generated from the power unit, if there is zero level.
- Controller enable (RF):
  - Via parameter ▹P0576◃ any kind of digital input of a function module as input for the controller enable can be selected. The signal is internally always considered as set (high), if an input was not selected. The controller enable then operates together with the pulse enable or via the control word command.
- Input reset errors:
  - In order to reset errors, any kind of digital input of a function module can be selected via parameter ▹P0575◃. A rising edge at this input enables an error resetting.

- **Device control statuses**

  (Number / 7-segment-display)

  - (0/0) NOT READY TO START

- the electronics are voltage-supplied
- Initialization is running
- Drive operation is inhibited
- ’Ready to operate’ relay is OFF (drive is not ready to run)

- (1/1) INHIBIT START
  - Software/hardware initialization is completed
  - Application can be reparameterized
  - Drive function is inhibited
  - Switch-on is inhibited
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (2/2) READY-TO-START
  - Application can be reparameterized
  - Drive function is inhibited
  - Operation is enabled
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (3/3) SWITCHED ON
  - Application can be reparameterized
  - Drive function is inhibited
  - At automatic operation holding brake the drive is carrying current before transition in OPERATION ENABLED.
  - Power unit is ready for use, there is supply voltage
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (4/4) OPERATION ENABLED
  - Application can be reparameterized
  - Drive operation is enabled
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (5/5) INHIBIT OPERATION ACTIVE
  - Application can be reparameterized
  - Drive operation is enabled
  - Command ’shut down’ is active
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (6/6) ’SHUT DOWN DRIVE’ ACTIVE
  - Application can be reparameterized
  - Drive operation is enabled
  - Command ’shut down’ is active
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (7/7) QUICKSTOP ACTIVE
  - Application can be reparameterized
  - Quickstop function is active
  - Drive operation is enabled
  - ’Ready to operate’ relay is ON (drive is ready to operate)

- (14/E) ERROR REACTION ACTIVE
  - Application can be reparameterized
  - An error-dependent action is carried out
  - Drive operation can be enabled

- (15/F) ERROR
  - Application can be reparameterized
  - Drive function is inhibited
  - ’Ready to operate’ relay is OFF (drive is not ready to run)

- **Introduction of the device control display**

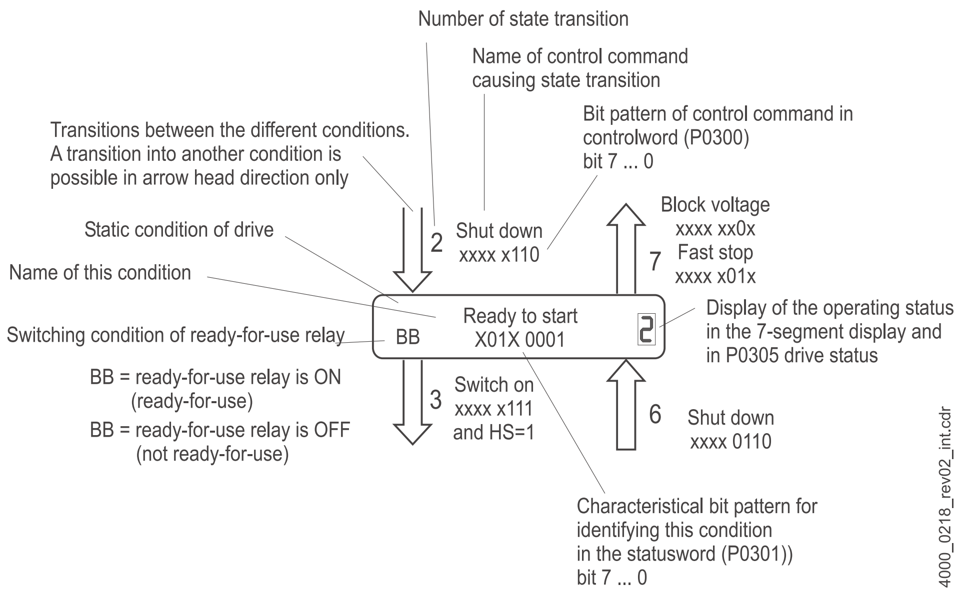


Figure 88: Introduction of the device control

Within the status (see ▹Figure 88◃ the bits 7 ... 0 of the status word ▹P0301◃ in binary form are shown as XXXX XXXX.

At the transition states (arrows, see ▹Figure 88◃ above) the bits 7 .... 0 of the control word ▹P0300◃ are shown in binary form as xxxx xxxx.

All digits, which are marked with X (that means the bits of the status word) or x (that means the bits of the control word) are without a meaning for the control of the state machine and the representation of the current status.

- **Device control state machine**

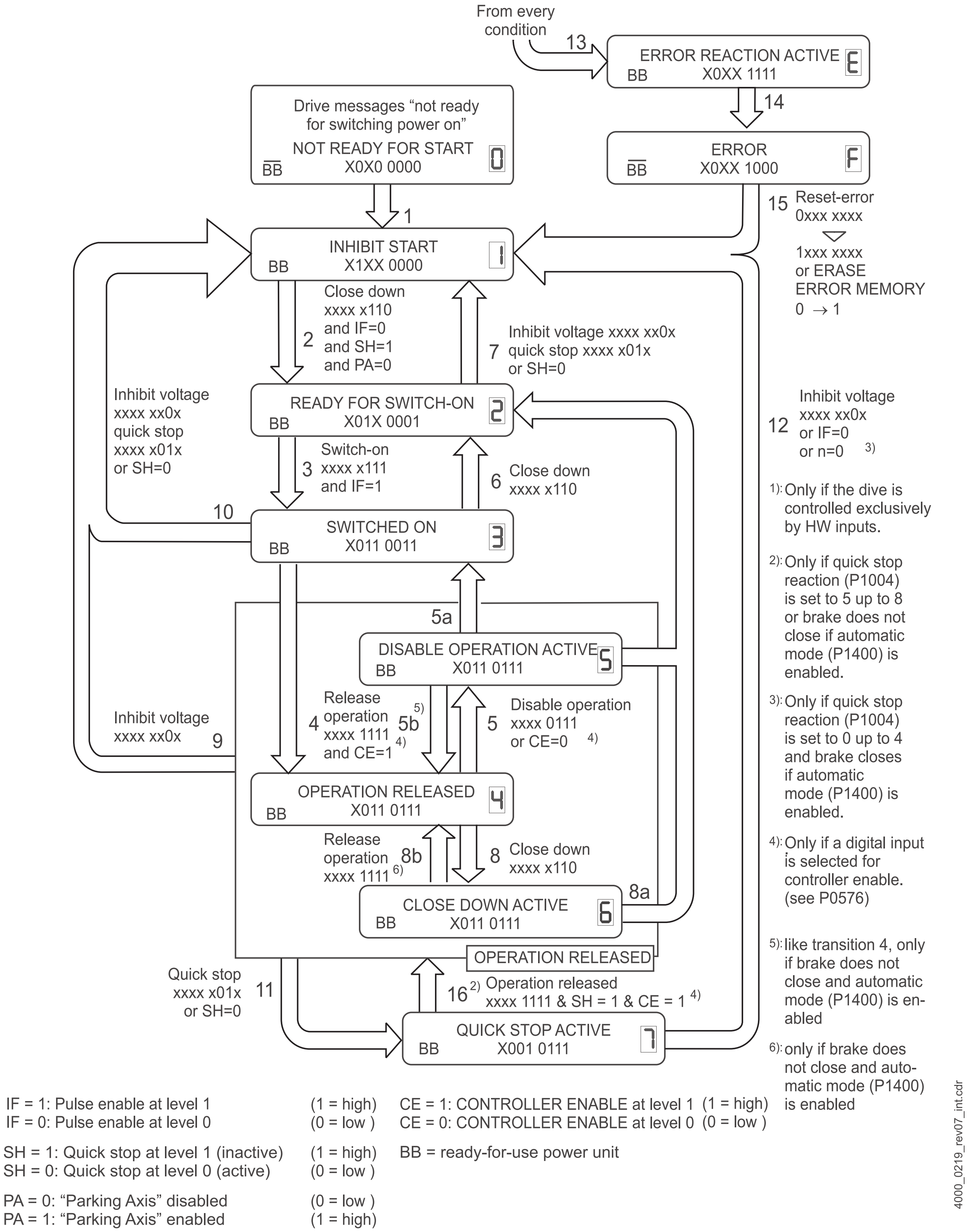


Figure 89: Device control state machine

- **State transitions of device control**

0 Input of the state machine ➔ NOT READY-TO-START
- Event:
  - Switch on electronic voltage
  - Hardware reset or
  - Software reset
- Action:
  - ’Ready to operate’ relay is switched off
  - Initialization and self-test are started

1 NOT READY-TO-START ➔ SWITCH-ON INHIBIT
- Event:
  - Initialization and self-test are completed error-free
- Action:
  - Ready-to-operate relay is switched on

2 INHIBIT START ➔ READY-TO-START
- Event:
  - Command ’shut down’
- Condition:
  - Axis not parked
  - Quickstop-input FX 3-4 = high and
  - With enable control only via the hardware switch: pulse release FX3-5=Low
- Action:
  - none

3 READY-TO-START ➔ SWITCHED ON
- Event:
  - Command ’switch on“
- Condition:
  - Pulse enable FX 3-5 = high
  - Feed unit reports ’ready for use’, supply voltage is present
- Action:
  - Feed unit ’ready for use’-signal monitoring will be activated

4 SWITCHED ON ➔ OPERATION ENABLED
- Event:
  - Command ’operation enabled“
- Condition:
  - CONTROLLER ENABLE input = high (only, if an additional hardware signal is used for the controller enable)
  - Pulse enable FX 3-5 = High
- Action:
  - Drive operation is enabled and
  - Holding brake is open
    Only if brake is in automatic mode (▷P1400◁) and brake status monitoring is on (▷P1400◁) and
  - brake lining monitoring (▷P1400◁) does not signal an error

5 OPERATION ENABLED ➔ INHIBIT OPERATION ACTIVE

- Event:
  - Command 'inhibit operation' or
  - CONTROLLER ENABLE input = low (only, if an additional hardware signal is used for the controller enable)
  - Pulse enable input FX 3-5 = Low
- Action:
  - Drive inhibit is commenced (according to settings: braking or coasting to a standstill)

5a DISABLE OPERATION ACTIVE ➔ SWITCHED ON

- Event:
  - Pulse enable input FX 3-5 = Low
- Condition:
  - Zero speed is reached or
  - for 'inhibit operation' an immediate pulse inhibit has been adjusted
- Action:
  - Drive operation is inhibited, pulses are inhibited

5b INHIBIT DRIVE ACTIVE ➔ OPERATION ENABLED

- Event:
  - Command 'operation enabled"
- Condition:
  - CONTROLLER ENABLE input = high (only, if an additional hardware signal is used for the controller enable)
  - Pulse enable FX 3-5 = High
  - INHIBIT reaction (▹P1006◃) is not set to 'Inhibit drive function' (pulse inhibit, value 0).
  - Holding brake could not be applied and the brake is switched on in the automatic mode (▹P1400◃) and in the brake status monitoring (▹P1400◃)
- Action:
  - Drive operation is enabled

6 SWITCHED ON ➔ READY-TO-START

- Event:
  - Command 'shut down' or
  - Pulse enable input FX 3-5 = Low
- Action:
  - Feed unit 'ready for use'-signal monitoring will be deactivated

7 READY-TO-START ➔ INHIBIT READY TO START

- Event:
  - Command 'quickstop' or
  - Command 'inhibit voltage' or
  - Quickstop input FX3-4 = Low
- Action:
  - none

8 ENABLE OPERATION ➔ SHUT DOWN DRIVE ACTIVE

- Event:
  - Command ’shut down’
- Action:
  - Shut down of drive is commenced (according to settings: braking or coasting to a standstill)

8a SHUT DOWN DRIVE ACTIVE ➔ READY-TO-START

- Condition:
  - Zero speed is reached or
  - For drive shut down the immediate pulse inhibit is set
- Action:
  - Drive operation is inhibited
  - Feed unit ’ready for use’-signal monitoring will be deactivated

8b SHUT DOWN DRIVE ACTIVE ➔ OPERATION ENABLED

- Event:
  - Command ’operation enabled“
- Condition:
  - Pulse enable FX 3-5 = High
  - SHUT DOWN reaction (P1005) is not set to ’Inhibit drive function’ (pulse inhibit, value 0)
  - Holding brake could not be applied and brake is switched on in the automatic mode (P1400) and brake status monitoring (P1400).
- Action:
  - Drive operation is enabled

9 OPERATION ENABLED ➔ SWITCH-ON INHIBIT

- Event:
  - Command ’inhibit voltage’
- Action:
  - Drive operation is inhibited
  - Feed unit ’ready for use’-signal monitoring will be deactivated

10 SWITCHED ON ➔ INHIBIT READY TO START

- Event:
  - Command ’inhibit voltage’ or
  - Command ’quickstop’ or
  - Quickstop input FX3-4 = Low
- Action:
  - none

11 OPERATION ENABLED ➔ QUICKSTOP ACTIVE

- Event:
  - Command ’quickstop’ or
  - Quickstop input FX3-4 = Low
- Action:
  - Quickstop function is activated

12 QUICKSTOP ACTIVE ➔ INHIBIT START

- Event:
  - Command 'inhibit voltage' or
  - Quickstop is stopped (speed 0 has been reached) and holding brake is applied (holding brake only relevant, if brake automatic mode (▹P1400◃) and status monitoring (▹P1400◃) have been switched on) or
  - Pulse enable input FX 3-5 = Low
- Action:
  - Drive operation is inhibited
  - Feed unit 'ready for use'-signal monitoring will be deactivated

13 All conditions ➔ ERROR REACTION ACTIVE

- Event:
  - Drive error is recognized
- Action:
  - 'Ready to operate' relay is switched off
  - Error-dependable error reactions are activated

14 ERROR REACTION ACTIVE ➔ ERROR

- Event:
  - Error reaction is completed
- Action:
  - Drive operation is inhibited
  - Feed unit 'ready for use'-signal monitoring will be deactivated

15 ERROR ➔ INHIBIT READY TO START

- Event:
  - Command 'reset error' or
  - RESET ERROR MEMORY input = Low $\rightarrow$ High
- Condition:
  - Error doesn't exist anymore
- Action:
  - Reset error is carried out
  - Ready-to-operate relay is switched on

16 QUICKSTOP ACTIVE ➔ OPERATION ENABLED

- Event:
  - Command ’operation enabled’
- Condition:
  - Quickstop reaction (▹P1004◃ or ▹P1009◃ is set to ’Remain in quickstop” (values 5 to 8) or
  - Quickstop reaction (▹P1004◃ or ▹P1009◃) is *not* set to "Remain in quick-stop" (value smaller than 5) and
    Holding brake cannot be closed and
    brake in automatic mode (▹P1400◃) and
    status brake monitoring (▹P1400◃) is switched on
  - Quickstop-input FX 3-4 = High
  - Pulse enable input FX 3-5 = high
  - Controller enable input = high (provided that an additional hardware signal for controller enable is used)
- Action:
  - Drive function is enabled again

Change of state occurs only if the actions were completely executed. The sequence of the actions is the same as their execution during status change. After complete controller processing of the actions the next status is reached and new commands are accepted.

- **Activation of the ready-to-start relay**

The switching condition of the ready-to-operate relay is only changed at the following transition conditions.

Transition	Switching action at Ready-to-operate relay	Comment
0	Switch off	beginning of drive initialization
1	Switch on	drive initialization completed
13	Switch off	errors appeared in drive
15	Switch on	all errors are accepted and the drive is error-free

An exact operating status for the ready to start relay results from every status of the drive manager..

Status	Operating status of the ready-to-operate relay
NOT READY TO START	OFF
INHIBIT START	ON
READY-TO-START	ON
SWITCHED ON	ON
OPERATION ENABLED	ON
QUICKSTOP ACTIVE	ON
ERROR REACTION ACTIVE	ON
ERROR	OFF

- **Monitoring of the ready to start signal of the feed unit**

The status of the monitoring is only changed by the following conditions:

Transition	Switching action	Comment
3	Switch on	The length of time for the charging of the DC link is internally considered
6 8 9 10 12, 13	Switch off	

The outcome of this is that for every condition of the drive manager an exact switching status for the DC link monitoring is achieved.

Status	Switching status for monitoring
NOT READY TO START	OFF
INHIBIT START	OFF
READY-TO-START	OFF
SWITCHED ON	ON
OPERATION ENABLED	ON
QUICKSTOP ACTIVE	ON
ERROR REACTION ACTIVE	OFF
ERROR	OFF

- **Parking axis (from FW 03.08)**

If a controller is operated in a field bus interconnection without motor and encoder, then the output of errors (display, error-LED) can be suppressed, by activating the display status "Parking axis".

In the display status "Parking axis" in the display a "P" is shown and the error LED fails. This is also valid if the errors occur. But errors and operating status are, as usual signaled via the status word and the error parameters. The transition in another drive status than status 1 (inhibit start) or status F (error) is not possible.

After exiting the display status "Parking axis" in the display the actual drive status (1 or F) is displayed. There are error and warning messages as usual and these are displayed (display, error LED). A change into other states is possible again.

The requirements "Activate parking axis" and "Cancel parking axis" are set via the parameter ▹P2070◃ Parking axis control word. Status and errors of requirements are signaled via the parameter ▹P2071◃ Parking axis status word.

The controller accepts the command "Activate parking axis" only then, if the following preconditions are complied with:

- Controller is in operation status 1 (inhibit start) or operation status F (error)
- Drive is in standstill (N=0 threshold fallen below)
- Controller is not in display status "Parking axis"

The command "Cancel parking axis" is accepted, if the controller is in display status "Parking axis".

8.2 Brake management

The brake can, dependent of the drive status at drives with motor holding brake, be switched manually or automatically.

The control can be executed via the power unit or via a digital output. For the sensing of the brake status the power unit checkback signals and the digital input are available. Brake status and brake lining can be monitored. At activated monitoring an error message is generated if an error occurs (brake could not be opened/applied or brake lining insufficient).

An adaption to the different reaction times of holding brakes is possible via parameterizable checkback- and delay times.

Manual brake control (▹P1400◃ bit 0 = 0)

Independently of the status of the drive the brake can be opened and applied (▹P0302◃ bit 0, accords to the function range up to firmware FW 03.05).

Automatic brake control (▹P1400◃ bit 0 = 1)

Dependent of the status in the device control (see ▹Drive management◃ from page 181), in the mode 'Automatic' the brake is controlled, in the statuses 0 ('Not ready-to- start') to 3 ('Switched on') the brake is applied. At transition in status 4 ('Operation enabled') the brake is opened.

For purposes of commissioning (▹P0880◃ bit 1 = 1) the brake can also manually be opened and applied in the mode 'Automatic'. This option is not available on the WinBASS II/ProDrive interface, the parameter must be directly written via the parameter list.

Opening of Brake

In the state transition 3 → 4 („Switched on“ → „Operation enabled“) the motor is current carrying when the drive is started, before the brake is opened. This avoids the sinking of a suspended axis. Precondition for this is an operation mode, which, at the least is speed-controlled.

NOTE!

The sinking of a suspended axis in the following cases is **not** avoided:

- The drive operates in one of the operation modes", "Auto-tuning" or "current control".
- An asynchronous motor is operated without encoder ("open loop").
- A torque-additional-set value (▹P1022◃) is switched-in.

For the opening of the brake 3 different modes can be selected, also see torque characteristics ▹Figure 90◃ on page 195.

- Suspended axes without holding torque input

The torque to hold the load is generated after the brake was opened. Due to the necessary control deviation there is a slightly sinking of the load.
If the external load torque at a sinking axis is known, a compensating holding torque can be impressed before opening the brake:

- Sinking axis with holding torque input

The torque for the load holding is generated before the brake is opened. If the torque is reached the command "open brake" is send. If the holding torque is exactly accordant to the torque load, the drive does not sink. If there is any torque difference between torque load and parameterized holding torque leads to a slight movement and is adjusted. The brake is not opened if the parameterized holding torque is not reached; the drive passes over into status "error".

- Sinking axis with holding torque input and delay brake command

The torque for the load holding is generated before the brake is opened. The command "Open brake" takes place after a parameterizable time ▹P1407◃, independent of the torque being reached. If the holding torque exactly corresponds to the torque load, the drive does not sink. If there is any torque difference between torque load and parameterized holding torque, this leads to a slight movement and is adjusted.

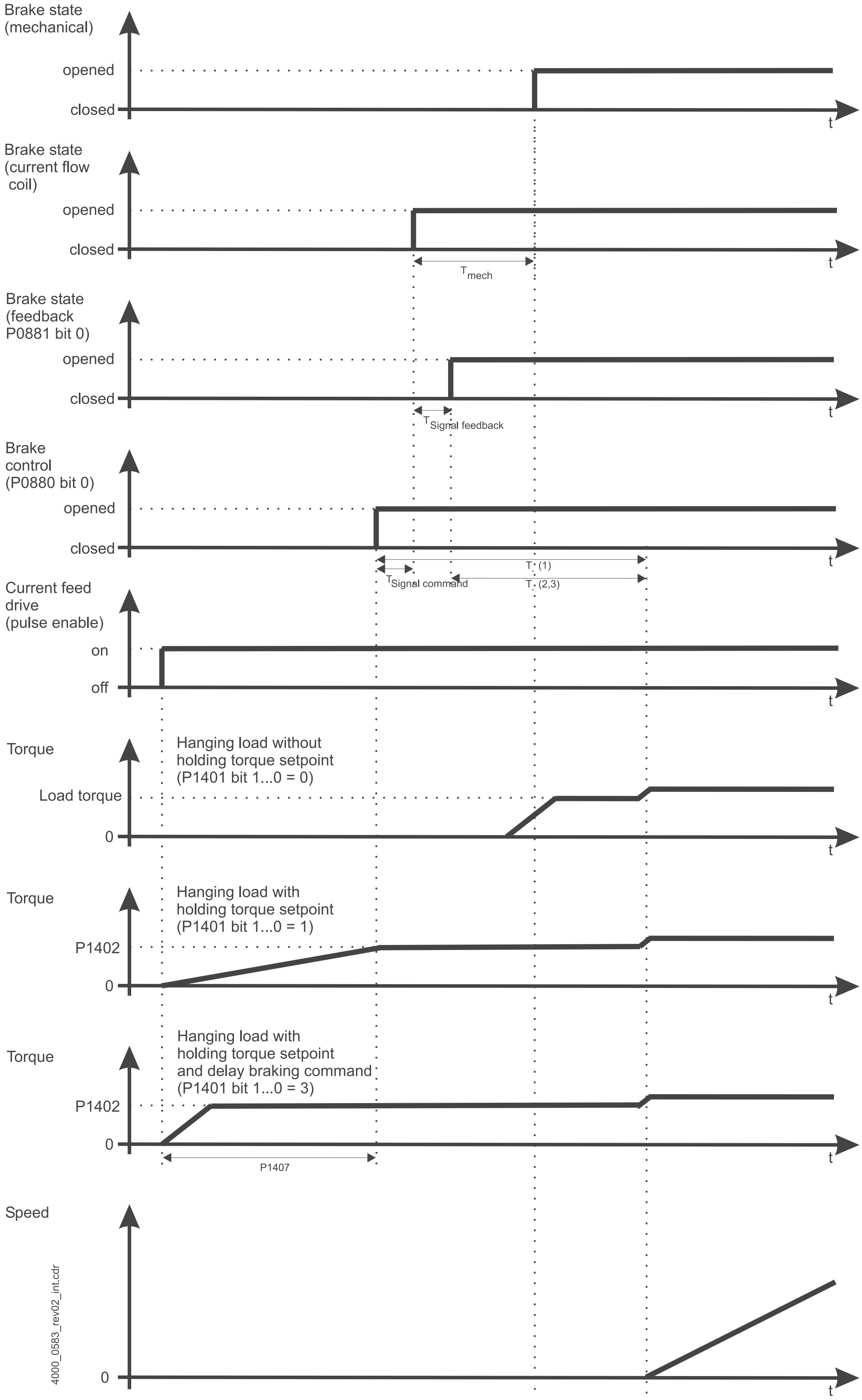


Figure 90: Drive activation in brake control mode 'Automatic'

In order to set the delay of motion beginning T_B (▹P1406◃) the following is recommended:

1 In case the status monitoring is switched off (▹P1400◃ bit 1 = 0):

$$T_B > T^{1)}_{SignalCom} + T^{2)}_{mech}$$

2 if status monitoring is switched on (▹P1400◃ bit 1 = 1) and the checkback signal signalizes the current status by the brake:

$$T_B > T_{mech} - T^{3)}_{SignalCheckback}$$

3 if status monitoring is switched on (▹P1400◃ bit 1 = 1), checkback via digital input (▹P0883◃ bit 0 = 1) and the checkback signal signalizes the mechanic status of the brake:

$$T_B = 0$$

1) Processing time of command in the controller:
At brake control via power unit (▹P0882◃ bit 0 =) max. 70 ms
At control via digital output (▹P0882◃ bit 0 = 1) max. 2 ms

2) Operate time of holding brake dependent to type, approx. 75-350 ms

3) Current build-up time brake coil (dependent of type, about 30ms) + processing time checkback in the controller: at status checkback via power unit (▹P0883◃ bit 0 = 0) max. 100 ms.
With checkback via digital input (▹P0883◃ bit 0 = 1) max. 40 ms.
The following must be valid for a correct error reaction: ▹P1404◃ Timeout checkback signal: > $T_{SignalCom}$ + $T_{SignalCheckback}$

Applying the brake

When applying the brake it is regarded, if the drive still is on torque or if the pulses are inhibited.

Pulse is enabled (drive is on torque)

If the drive is decelerated active (reaction to quickstop/shut down/inhibit/drive error) and if, against the end of braking operation, the torque shall be reduced (pulse inhibit), the brake closes when reaching a parameterizable speed threshold. The subsequent pulse inhibit additionally can be decelerated in case this is necessary for the compensation of a mechanic delay. However, the pulses are inhibited, in either case, at the soonest until such time as the deceleration ramp would have been finished without intervention of the brake. After applying the brake and after timeout, the deceleration ramp is interrupted, see ▹Figure 91◃ on page 197 speed-controlled deceleration ramp, chain dotted line.

If the activated status monitoring recognizes, that the brake cannot be closed, the drive remains under torque in status „quickstop active/shut down drive active/inhibit operation active“, in order to avoid the sinking of a suspended axis. An accordant error message is signaled in this status. The user still can set the drive into a torque-free position and then switch off the drive torque (pulse inhibit or inhibit voltage). The conditions and events, which are necessary for the state transition ’Enabled’ are found in the description of state transitions of device control (▹page 187◃ et seqq).

In status ’Error reaction active’ this checking does not occur, i. e. also at activated status monitoring and brake, which does not apply, the transition in state ’Error’. The drive therewith becomes torque-free.

Pulses are inhibited (drive is torque-free)

If the drive suddenly becomes torque-free due to a pulse inhibit (hardware input or reaction to quickstop/shut down/inhibit/drive error), the brake can immediately or with the reaching of speed threshold (see above) be applied. It is recommended to initiate the brake being shut down (▹P1401◃ bit 2 = 0) at suspended load, as the drive can be accelerated by the extrinsic torque, so that the speed threshold is not reached and the brake is not applied.

ATTENTION:

If the pulses are immediately inhibited (HW-input or reaction to quickstop/shut down/inhibit/drive error is pulse inhibit), P1405 "Delay pulse inhibit" is not effective, because the pulses are already inhibited at the point of the interfering of the brake manager!

NOTE!

At an immediate pulse inhibit the sinking of a suspended axis cannot be completely avoided.

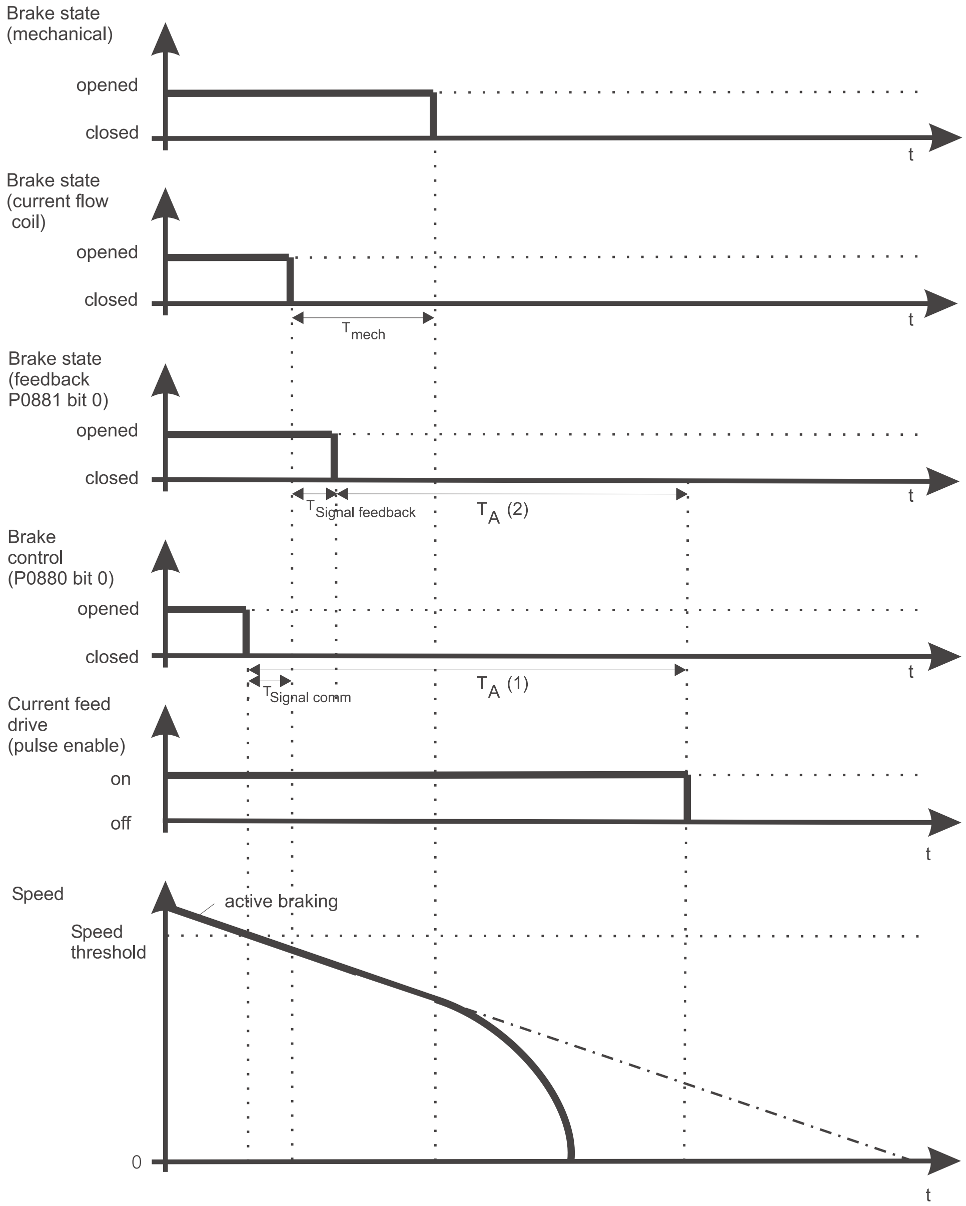


Figure 91: Braking operation in brake control mode „Automatic'

For the setting of deceleration of pulse inhibit T_A (▷P1405◁) the following recommendation is valid:

1 In case the status monitoring is switched off (▷P1400◁ bit 1 = 0):

$$T_A > T^{1)}_{SignalCom} + T^{2)}_{mech}$$

2 if status monitoring is switched on (▷P1400◁ bit 1 = 1) and the checkback signal signalizes the current status by the brake:

$$T_A > T_{mech} - T^{3)}_{SignalCheckback}$$

3 if status monitoring is switched on (▷P1400◁ bit 1 = 1), checkback via digital input (▷P0883◁ bit 0 = 1) and the checkback signal signalizes the mechanic status of the brake:

$$T_A = 0$$

1) Time see opening of brake

2) Release time of holding brakes are type-dependent, approx. 125-400 ms

3) Duration current suppression brake coil (type-dependent, approx. 30 ms) + processing checkback time in the controller: at checkback status via power unit (▷P0883◁ bit 0 = 0) max. 100 ms
At checkback via digital input (▷P0883◁ bit 0 = 1) max. 10 ms.

For a correct error reaction the following must be valid: ▷P1404◁ Timeout checkback signal: > $T_{SignalCom}$ + $T_{SignalCheckback}$

8.3 Data management

A description of the data management function principle you will find in chapter ▷Data Management◁ from page 43.

The following parameters belong to the ProDrive pages:

Number	Name / Meaning	Remark
▷P0310◁	Data management command	
▷P0311◁	Data management status	
▷P0317◁	EEPROM write count	
▷P0318◁	PSI write count	
▷P0326◁	PSI mode	
	Data sets	
▷P0312◁	Active data set number	
▷P0313◁	Valid data sets	
▷P0327◁	Boot data set	
▷P1010◁	Data set ID	
▷P1011◁	Data set name	

9

SET VALUE FUNCTIONS

9.1 Ramp function generator

9.1.1 General overview ramp function generator

The ramp function generator is for the generating of acceleration- or deceleration ramps in speed-controlled operating modes speed specification (▹P1000◃ = 2) and speed control ▹P1000◃ = -3). Furthermore it is used for the control of braking processes (quickstop, shut down drive, inhibit drive).

Furthermore in the synchronism mode "Virtual master axis with ramp function generator" (▹P1220◃ bits 0 to 3) of the synchronism operation mode (▹P1000◃ = -5) is used for the calculation of the set position value of the following controller.

The ramp function generator cycle is 500 µs.

Characteristics

The ramp function generator has an input with a separately adjustable ramp-up- and ramp-down time. Furthermore, the ramp-down-time for the quickstop function is separately adjustable.

The input value and the output value of the ramp function generator are relative variables (±100%) and are standardized to the motor's maximum speed of the drive ▹P1031◃.

Due to the ramp-up- or the ramp-down time the ramp slope for the acceleration- and braking process is determined. The times thereby refer to 100% set value change.

For the further acceleration- or deceleration a smoothing element (smoothening) with an adjustable time constant is connected to the ramp function generator.

Control possibilities

The ramp function generator offers the following control possibilities directly via the control word also see ▹P0300◃ on page 414:

- Inhibit ramp function generator (set output permanently to 0, i.e. ramp-down at the current limit)
- Stop ramp function generator (freeze output value)

- Inhibit ramp function generator set value (set input internal to 0, that means ramp-down at the deceleration ramp)

Furthermore with the ramp function generator mode ▹P1170◃ the following options are able to be selected:

- Inhibition of the positive or the negative set values
- Sign inversion of set values
  The internal operating sequence is an inhibit prior to sign inversion.
- Setting of the ramp type:
  - Trapezoidal speed profile; square-wave acceleration:
    You have got the possibility to smooth the speed via a filter element.
  - S-curve with square speed profile; trapezoidal acceleration:
    The resulting acceleration- or deceleration time at a 100% set value change results from

    $$T_{\text{Total acceleration time}} = T_{\text{Acceleration time}} + T_{\text{SC Acceleration time}}$$

    or

    $$T_{\text{Deceleration total time}} = T_{\text{Deceleration time}} + T_{\text{SC Deceleration time}}$$

  - Interpolation of the ramp function generator output set value: interpolation of the ramp function generator cycle on the control cycle (from FW 03.09)
  - Selection between a 16-bit-parameter (▹P1171◃) or a 32-bit-parameter (▹P1179◃) as input value for the ramp function generator (from FW 03.09 onwards)
- Reference value for ramp function generator stop time ▹P1174◃
  Set value change of 100% $\Rightarrow$ 0%
  Set value change of actual set value $\Rightarrow$ 0%

In addition the following function can be activated via "Factor interpolator interval" ▹P0429◃:

- Interpolation of the ramp function generator input set value: Interpolation of the set value cycle to the ramp function generator cycle.

NOTE!

For a correct functioning of the braking operations at the quickstop- or deceleration ramp, the speed controller must sufficiently be parameterized.

9.1.2 Interpolation of the ramp function generator input set value

A cyclic and synchronous transferred speed set value, which is (▹P1171◃ or ▹P1179◃) mapped to the ramp function generator-input set value, can be interpolated optional to the ramp function generator cycle (= 0.5 ms).

The speed profile thereby is read by the control and is transferred to the set value cycle, which was set.

The controller can interpolate from the set value cycle to the ramp function generator cycle.

For this the controller requires the information about the ratio between the set value cycle (=interpolation interval) and the "Sync interval" which is to be set in the factor interpolator interval ▹P0429◃.

Factor Interpolator-Interval ▹P0429◃ = Interpolation interval / Sync interval ▹P0532◃

The number of the interpolated set values in the ramp function generator is the same:

(Interpolation interval / ramp function generator cycle) -1

Using the factor interpolator interval ▹P0429◃ = 0 the interpolation of the ramp function generator remains switched off (standard setting).

Please observe the following:

- In general this function is not active (factor interpolator-interval ▹P0429◃ = 0).
- Due to the interpolation there is a delay of the input set value by one set value cycle.
- This interpolator may not be confused with the interpolator of the ramp function generator cycle (500 µs) on the control cycle (125 µs). In this connection its activation is recommended (▹P1170◃ bit 9 = 1).
- If the control transmits a speed profile, it is recommended to switch off the ramp generator if interpolation is active.
- The interpolator is built in front of the ramp function generator control and the ramp generator. If the interpolator is active the existing functions of the ramp function generator, as for example polarity reversal of the input value, direction inhibit, quickstop function and ramp generator and so on, are kept up.

NOTE!

It must be interpolated at the ramp function generator from 1 ms set value cycle.

Example 1: Field bus cycle (= Sync interval ▹P0532◃) = 1 ms,
set value cycle (= interpolation interval) = 6 ms,
ramp function generator cycle = 0.5 ms

→ only in every sixth field bus cycle a set value, which was recalculated is transferred.

→ Factor Interpolator Interval ▹P0429◃ = 6

→ Interpolator generates 11 interpolated set values in the ramp function generator (6/0.5 - 1).

Example 2: Field bus cycle (= Sync interval ▹P0532◃) = 1 ms,
set value cycle (= interpolation interval) = 1 ms,
ramp function generator cycle = 0.5 ms

→ in every field bus cycle a new set value is transferred.

→ Factor Interpolator Interval ▹P0429◃ = 1

→ Interpolator generates an interpolated set value in the ramp function generator.

Interpolator active and ramp generator switched off:

The acceleration- and deceleration times must be set to 0 in order to switch off the ramp function. The ramp function generator then operates in the transparent mode (output = input), that means that the cyclic input set values are active immediately . As the deceleration time is also used for the quickstop- or error reaction (stop at the deceleration ramp"), there is a stop at the current limit. If this is not requested the stop reaction must be set at the quickstop ramp and the stop time in ▹P1174◃.

If the ramp function generator rounding-off time (▹P1175◃), which was added, shall be inactive it must be set to 0.

Interpolator and ramp generator active:

The transparent mode is deactivated if ramp time greater than 0 s are parameterized. The times, which were set limit the max. acceleration or deceleration of the cyclic input set values. If the S-curve profile is active additionally the acceleration change (jerk) is limited via the S-curve times.

Accordingly the speed profile of the cyclic speed set values changes, if there is a operating limitation.

9.1.3 Interpolation of the ramp function generator output value

Interpolation of the ramp function generator cycle (500 µs) to the control cycle (125 µs). In general this function is not active, it can be activated by setting the ramp function generator mode ▹P1170◃ bit 9 = 1.

NOTE!

The activation of the interpolation of the ramp function generator's output value is recommended if torque feed forward is used in the speed controller (torque feed forward factor ▹P1034◃ unequal to zero).

9.2 Set value generator

Function

The set value generator creates for each of the four time zones a constant set value. Thereby the set value and the time is settable for every zone.

The set value generator is able to effectuate the following target parameters (settable via ▹P0440◃ set value generator mode):

- Ramp function generator input ▹P1171◃
- Additional speed set value (▹P1040◃)
- Torque set value ▹P0331◃
- Current positioning set (▹P1191◃)

In the first three modes the time is set together with the output time for the according set value. In the mode 'switchover current positioning data set' the time determines the dwell time in the target position.

Furthermore it can be set, if after expiration of the last time zone the set value generator starts with the first time zone again (endless operation), or if only a cycle is passed through and the last set value remains.

Thus, e.g. the following speed set value process can be generated:

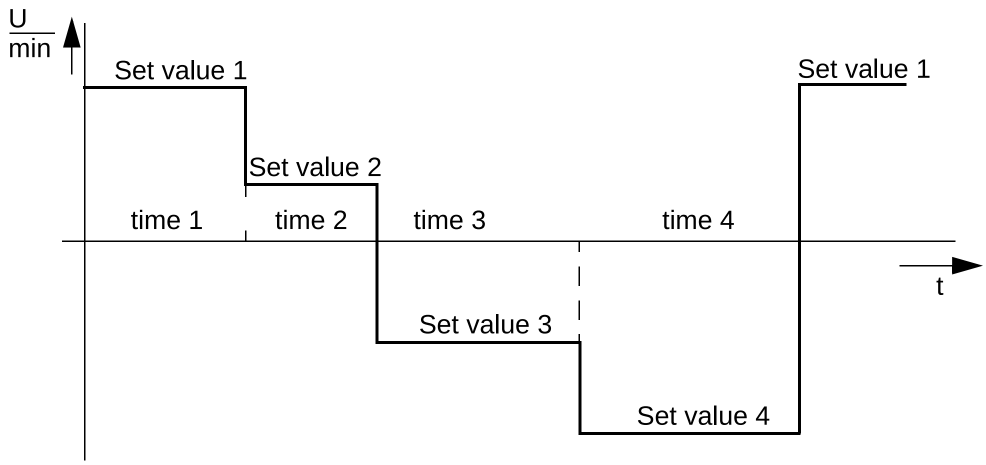


Figure 92: Set value generator; speed set value characteristic

The set value generator has a cycle time of 16 ms and is only active if the device is enabled. After enable of the device it is always started with the first set value from the profile, which was set.

9.3 Motor potentiometer

With the help of the integrated motor potentiometer in the b maXX® controller, speed set value changes can be specified, which are dependent of two control bits (motorpot+ (▹P1410◃ bit 1) and motorpot- (▹P1410◃ bit 2)), which e. g. can be manipulated via digital inputs in operating mode speed control (-3) and speed setting (2). The motor potentiometer immediately writes to the ramp function generator input (▹P1171◃).

The activation of the motor potentiometer occurs via the control parameter Motor potentiometer mode (▹P1410◃).

The parameter Motor potentiometer increments (▹P1413◃) specifies, by which amount the output of the motor potentiometer is increased or decreased.

Via ▹P1410◃ motor potentiometer mode bit 4 is set, if the function motor potentiometer is working edge- or level-sensitive.

- Edge sensitive:
  At rising edge of Motorpot+ or Motorpot- ▹P1413◃ Motor potentiometer Increment is once added or subtracted.
- Level sensitive:
  At high level of Motorpot+ or Motorpot- every 32 ms ▹P1413◃ Motor potentiometer is added or subtracted.

An upper and lower limit limits the output of the motor potentiometer.

The features of the motor potentiometer are data-set related.

At activation of the motor potentiometer (also at data set switching, if the motor potentiometer in the new data set is activated and in the original data set is deactivated) is set according to parameterization of the output of the motor potentiometer to 0 or is synchronized with the HLG input.

The output of the motor potentiometer is then checked for limits and if necessary is adjusted, if motorpoti +/- is activated. If, for example the upper limit is changed in such away, that the output of the motor potentiometer is beyond this limit, the output is corrected not until then to the limit value as soon as the motor poti+ function has been activated. Then immediately the change occurs without transient reaction.

9.4 Error reaction return motion mode

The error reaction "Return motion" can be set besides the standard error reactions as "Pulse inhibit" and "Stop" for a few errors, like for example error - no. 64 "Mains failure".

If an error with the reaction "Return motion" is enabled the drive moves to a target position, which was parameterized for this. The speed profile during the positioning to the return motion target is specified by a parameterizable trapezoid (maximum speed, maximum acceleration). The maximum speed may not be greater than the maximum speed of the drive ▹P1031◃. The return motion target can be specified absolutely or relatively referring to the actual value position ▹P0363◃.

If the return motion target is not reached, an accordant error message is settled (▹P0215◃).

The position deviation of return motion is monitored, the return motion target is not reached, if

1. at a profile generation, which is not completed yet, a dynamic position deviation accordant to the limits from ▹P1054◃ (position deviation limit dynamic) and ▹P1056◃ (position deviation time)
2. at a profile generation, which is completed, a static position deviation according to the limits from ▹P1055◃ (position deviation static) and ▹P1056◃ (position deviation time)

For this, position deviation monitoring in ▹P1050◃ (position controller mode) does not need to be activated, the status is not displayed in contrast to the general position deviation monitoring ▹P0360◃ (position controller status).

Return motion positioning is not a own operation mode. During positioning to the return motion target the drive remains in the status „Error reaction active" (see „Device control state machine" in ▹Drive management◃ from page 181).

10

CONTROLLER

Field-oriented control

The advantage of a field-oriented current controller compared with the current control in the stationary coordinate system (sinusoidal phase currents) is than the set and actual values almost act like direct current.

Furthermore the motor current can be divided in torque current isq or q-current as well as in field current isd or d-current. In this way, the controlled variables functionally can be allocated to q or d coordinates. q-coordinate: Position, speed, torque current; d-coordinate: Field weakening, magnetic flux, field current.

The division of the motor current due to coordinate transformation in d and q components is not perfect. A cross coupling between d and q coordinates, directly proportional to the motor inductance and the output frequency is existing. However, it largely can be compensated by a decoupling network. The integral parts of the d and the q current controller complete the decoupling.

Cascade control

A cascade control are nested control loops. The output variable of a controller serves as reference variable for the other controller.

The cascade control requires that the time constant of the internal control loop is much smaller than the external one (time separation principle).

Benefits of the cascade control:

- Due to the time separation principle the entire control can be beneficially divided into small and simple control loops, whereat one control loop can be set without significant influence from the external loops. The immediate next nested loop can be replaced by an equivalent PT1 element which is characterized by a simple equivalent time constant. The commissioning now can be processed stepwise from the innermost to the outermost control loop.
- In opposite to a directly operating controller or a single-loop feedback control the control accuracy increases.
- The acquired controlled variables can be limited by the set values.
- The effects of non-linear drive elements are limited. Disturbances in the system are compensated more quickly.

Disadvantages of the cascade control:

- Due to the time separation principle the equivalent time constants of the control loops increase from the inside to the outside. Eventually, the control behavior of a cascade control can be slower than the single-loop feedback control.

Functions

In the position controller the set-position and the actual position measured by the encoder system is compared. The difference is evaluated in the P controller (Kv) and a demand is transmitted to the speed controller.

In the speed controller the set speed (from the position controller or directly from the set value generator via ramp function generator) and the actual speed measured by the encoder are compared. The difference is evaluated in a PI controller (Kp, Tn). A torque set value request is calculated. The torque set value is transmitted with the available information of the evaluated magnetic flux and of the motor Kt factor and a request in form of a set torque current at the torque current controller.

In the field weakening controller the required motor voltage and the available voltage are compared. By insufficient available voltage the magnetic ASM flux will be diminished or in case of the SM a negative set field current is sent to the field current controller. In the case of ASM in the flux controller the flux set value (from the field weakening controller) and the flux actual value (from the motor model) are compared. The difference is evaluated in a PI controller (Kp, Tn) and a set field current is sent to the field current controller.

On the one hand in the current controller the set torque current (from the speed controller or directly from the torque set value ▹P0331◃) and the torque current measured by the current sensing are compared; on the other hand the set field current (from the SM field weakening controller or the ASM flux controller) and the actual field current measured by the current sensing are compared. The differences are evaluated in the accordant PI controller (with identical Kp and Tn). A request in the form of voltage set values in the stationary coordinate system is transmitted to the PWM modulator.

Flexible precontrols (speed- and acceleration precontrol), additional set value (speed, torque) as well as flexible source and target parameter (set values, actual values) are available.

10.1 Position controller

10.1.1 Parameter overview, ProDrive

Number	Name / meaning	Remark
	Set values	
▹P0361◃	Position set value	
▹P0364◃	Position set value revolutions	
▹P0363◃	Position set value angle	
	P controller	
▹P1051◃	Position controller Kv factor	
▹P0366◃	Position controller output	Display

Number	Name / meaning	Remark
Speed feed forward		
▹P1053◃	Speed precontrol factor	
▹P1052◃	Speed precontrol smoothing time	
Actual values		
▹P0362◃	Position actual value	Display [1)]
▹P0392◃ / ▹P0402◃	Encoder 1 / encoder 2 actual revolutions	Display
▹P0391◃ / ▹P0401◃	Encoder 1 / Encoder 2 actual angle	Display
Deviation value		
▹P0367◃	Position actual total deviation	Display
▹P0368◃	Position actual angle deviation	Display
Gear factor		
▹P1057◃	Gear factor	
Outputs		
▹P0365◃	Speed feed forward	Display
▹P0351◃	Speed set value	

1) The parameter is initialized at operation enable to encoder angle and can be updated during operations.

10.1.2 General overview position controller

The position controller is implemented as P controller with adjustable speed precontrol.

The position controller's gain factor Kv in s^{-1} can be set in ▹P1051◃. The speed precontrol is adjustable with parameter ▹P1053◃ (Speed precontrol factor) and ▹P1052◃ (Speed precontrol smoothing time).

The speed precontrol is implemented as a DT1-element. All changing in the position set value are differentiated according to time, multiplied with the parameter speed precontrol factor(▹P1053◃) and then smoothed with the time constant in ▹P1052◃.

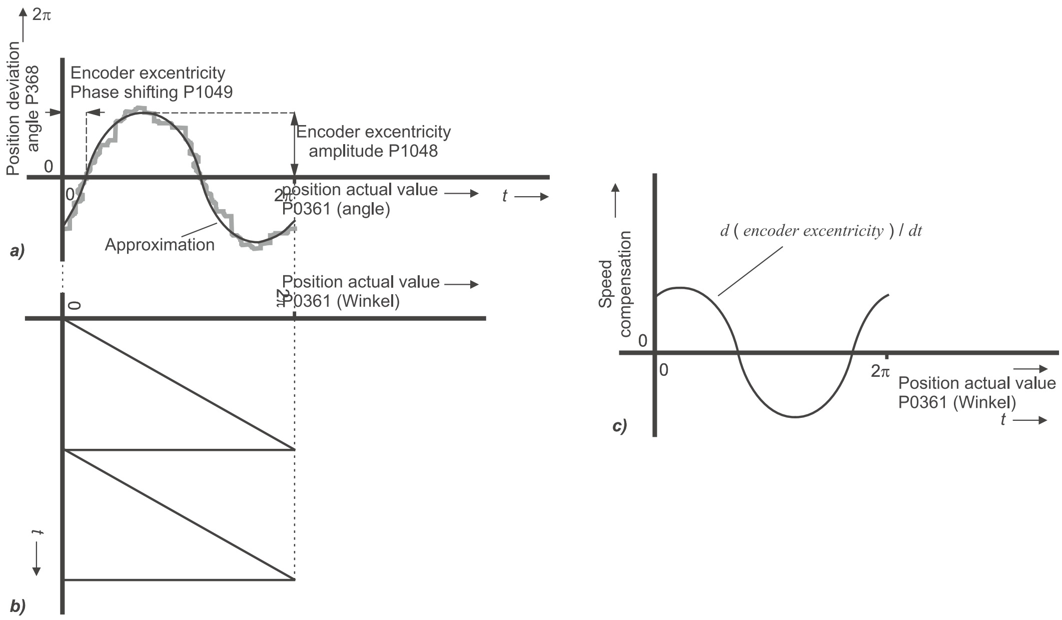
With speed precontrol = 100% and constant position set value change rate per time unit, the speed precontrol executes exactly the required speed set value. The position controller in this case contributes only the correction set value required for follow-up correction of angle.

10.1.3 Software compensation of encoder eccentricity (from FW 03.09 onwards)

The position deviation, which is caused by an encoder eccentricity is marked in such a way, that it cannot be compensated by the position- and speed controller (higher gain of the controller parameters lead to a stronger strain of the motor). The position deviation, can be approached by a sine position signal as a function of the position value angle.

Exze = $Exze_{Ampl}$ ▹P1048◃ * sin (actual value position-angle - $Exze_{Phase}$ ▹P1049◃)

The parameter ▹P1048◃ thereby determines amplitude and the parameter ▹P1049◃ the phase shifting of the encoder eccentricity.



a) Error of encoder eccentricity and its approach
b) Variation of the position value angle

c) Derivation of encoder eccentricity error

Figure 93: Error eccentricity

The controller parameters cannot be correctly parameterized due to the encoder eccentricity error.

From FW 03.09 onwards there is the possibility to compensate the error of the encoder eccentricity per software. The error of the encoder eccentricity must be determined, i. e. the amplitude and the phase of the upon mentioned sine signal by the analysis of the position deviation (see ▹Figure 93◃ a) and must be written to the parameters ▹P1048◃ and ▹P1049◃. The compensation only can be enabled by the setting of bit 6 = 1 of the position controller mode ▹P1050◃. Thereby the measured error of the encoder eccentricity is deviated from the position error. The influence of the encoder eccentricity on the speed controller can be compensated optional and by the setting of bit 7 = 1 of the position controller mode. In order to achieve this, the encoder eccentricity is deviated (see ▹Figure 93◃ c) and the derivation is subtracted from the speed error (see ▹Figure 115◃ on page 264 and ▹Figure 116◃ on page 265).

The software compensation of the encoder eccentricity is switched off in general and is only existent for the operating modes at which the position controller is active. In order to use the option of the compensation in the speed controller, the position- and actual speed values must come from the same encoder.

10.2 Speed controller

10.2.1 Parameter overview, ProDrive

Number	Name / meaning	Remark
Set values		
▷P0351◁	Speed set value	
▷P1040◁	Speed additional set value	
▷P0359◁	Scaling of speed set value	
▷P0352◁	Speed set value total	Display
Set value notch filter		
▷P1370◁	Center frequency speed set value notch filter	Value=0: Notch filter switched off
▷P1371◁	Bandwidth speed set value notch filter	
Set value limit		
▷P1041◁	Speed set value positive limit	
▷P1042◁	Speed set value negative limit	
Actual values		
▷P0353◁	Speed actual value	Display
Actual value notch filter		
▷P1372◁	Center frequency speed actual value notch filter	
▷P1373◁	Bandwidth speed actual value notch filter	
▷P0358◁	Speed actual value after notch filter	Display
Deviation value		
▷P0354◁	Speed deviation value	Display
PI controller		
▷P1032◁	Speed controller P-gain	
▷P1033◁	Speed controller integral-action time	
Feed forward		
▷P1034◁	Torque feed forward factor	
Outputs		
▷P0355◁	Torque feed forward	Display
▷P0356◁	Speed controller output	Display
Torque reduction (brake operation)		
▷P1045◁	Time for reducing torque (=0:off)	

Number	Name / meaning	Remark
Maximum set torque		
▹P0509◃	Maximum set torque	Display
Standard torque monitoring [4)]		
▹P0357◃	Standard torque limiter bipolar	[1)]
▹P0344◃	Standard torque actual value	Display [2)]
▹P0110◃	Kt adjustable correction factor	[3)]
Additional torque monitoring [4)]		
▹P1030◃	Speed controller mode	Bit 4: Activation of the additional torque limiter bipolar
▹P1046◃	Additional torque limiter bipolar	take effect only if ▹P1030◃ bit 4 = 1
▹P0508◃	Additional torque actual value	Display (take effect in the controller only if the additional torque limiter bipolar ▹P1046◃ is active and this limit is reached)
▹P0064◃	Motor friction moment	
▹P0068◃	Motor attenuation factor	
▹P1030◃	Speed controller mode	Bit 7 Mode of the additional speed monitoring (directly from power balance or from Kt adaption) [5)]
▹P0350◃	Speed controller status	Bit 6 Status of the Kt adaption [5)]
▹P0594◃	Motor Kt adaptation factor actual value	Display [5)]
▹P0112◃	Kt adaptation lower speed limit	[5)]
▹P0113◃	Motor Kt adaptation suppression time	[5)]

1) The torque limit is standardized according to the maximum current of the drive ▹P1241◃. ProDrive enters the value directly in Nm and calculates the correspondent standardized value, which is also displayed. **Please note: If the maximum current of the drive ▹P1241◃ is changed, the standardized value of the torque limit ▹P0357◃ remains unchanged, but the displayed value in Nm is changed.**

2) The parameter is standardized according to the motor nominal torque. ProDrive displays the standardized value and the converted value in Nm.

3) The default setting of the parameter (100%) must normally not be changed.

4) The standard operation for the torque monitoring is normally sufficient.

5) The parameters are displayed only if the mode of the additional torque monitoring is set to Kt adaption (▹P1030◃ bit 7 = 1).

10.2.2 General overview speed controller

The speed controller is implemented as PI controller with torque precontrol.

The P gain and the integral time of the speed controller can be entered in ▹P1032◃ and ▹P1033◃. The torque precontrol can be set in ▹P1034◃.

The Kp factor of the "Speed controller P-gain" ▹P1032◃ which can be set with ProDrive has no unit.

The controller internally operates with standardized values. They are standardized with "Maximum current of the drive" Imax (▹P1241◃) and with "Maximum speed of the drive" Nmax (▹P1031◃). These standardized values are settable. In order to be able to enter the P-gain of the speed controller having a permanent standardization the P-gain (▹P1032◃) instead is permanently standardized by Ib = 10 A and Nb = 50 Hz * 60 s·min^{-1} = 3000 min^{-1} (or ω_b = 314,16 rad/s); internally the gain is re-standardized to P1241 and P1031.

In order to reach the physical unit in A*s/rad (speed in rad/s), Kp (▹P1032◃) has to be converted:

$$\mathrm{Kp\ n}\left[\mathrm{A} \cdot \frac{\mathrm{s}}{\mathrm{rad}}\right] = \mathrm{Kp}[\mathrm{P1032}] \cdot \frac{10\mathrm{A}}{2\pi \cdot 50\mathrm{Hz}}$$

By auto-tuning an automatical parameterization of the speed controller can be processed after the symmetric optimum, whereat additionally the torque precontrol factor is calculated, see ▹Automatic parameterizations◃ on page 134.

10.2.3 Details speed controller

Traditionally the physical unit of the P gain is specified in [A·s/rad] (Speed controller output = Torque current set value) instead of [Nm] (Speed controller output = Torque set value). On the contrary in the control structures the output of the speed controller is considered as the torque set value, in order to present the field weakening of the ASM and the torque monitoring better. Due to this in the accordant parameter description for the following set values and controlled variables besides the denormalization in [A] an alternative denormalization in [Nm] is additionally displayed: Torque set value ▹P0331◃, torque precontrol ▹P0355◃, speed controller output ▹P0356◃ and torque additional set value ▹P1022◃.

In the following the optimization of the speed controller is processed the traditional way (P gain in A s/rad).

Speed control loop with physical units

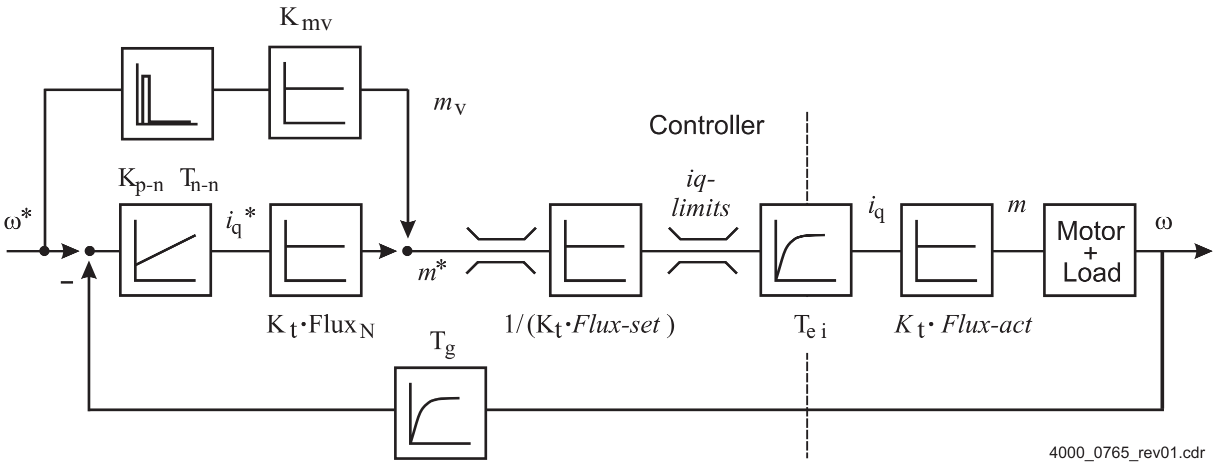


Figure 94: Block diagram speed controller output = torque current set value

ω	Angular speed of the drive, rad/s
$T_{e\,i}$	Equivalent time constant of the closed current loop, s.
K_t	Torque motor constant, Nm/A.
T_g	Smoothing time, s
$K_{p\text{-}n}$	P-gain of the speed controller, in A·s / rad
$T_{n\text{-}n}$	integral-action time of the speed controller in s
Flux	Normalized magnetic Flux; Flux nominal value: $Flux_N$ = 1 (bzw. 100%)
m_v	Torque feed forward, in Nm
$K_{m\,v}$	Torque feed forward factor, in Nm/(rad/s)

The block diagram of the speed controller ▷Figure 94◁ is converted as follows. The speed controller is represented with the standardized Kp [P1032]. The torque and current limits are ignored (it is assumed that the controller doesn't reach its limit). The torque pre-control is ignored (the torque precontrol is handled separately). The smoothing of the speed actual value is shifted to the direct trajectory of the loop (thereby a DT1 element in the reference variable appears). Because the optimization is made at rated values the following simplified block diagram with normalized P gain results if *Flux-set* = *Flux-actual* = $Flux_N$ = 1:

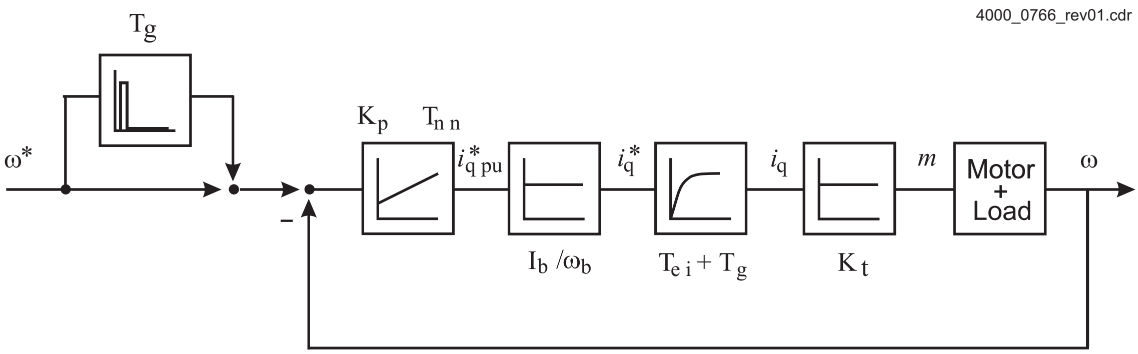


Figure 95: Block diagram speed controller with normalized P gain

with

$i^*_{q\ pu}$ Normalized Iq set value (standardized with 10 A).

Usually the speed control distance is mainly determined by the inertia of the drive (or motor + load, rigidly coupled). In this case an advantageous mechanical time constant can be defined.

Mechanical time constant of the drive

The mechanical time constant of the drive T_{mech} is a good measure of the acceleration ability per ampere of the drive. It is defined by using the normalizing factors Nb = 3000 min^{-1} (or ω_b = 314,16 rad/s) and I_b = 10 A as follows:

$$T_{mech} = \frac{J}{K_t} \cdot \frac{3000\text{rpm} \cdot \frac{2\pi}{60\text{s}}}{10\text{A}} \cdot \frac{1}{\text{Flux}}$$

with

Flux magnetic flux (flux = 100%, according to the definition of the mechanical time constant)

J Inertia in [kg m^2]; J =1x10^{-4} $\cdot J_a$

J_a Drive inertia in [kg cm^2] ($J_{a\text{-}m}$ ▹P0858◃ or J_M ▹P0083◃ + J_L ▹P0109◃)

K_t Motor-Kt factor [Nm/A] (see chapter ▹Torque monitoring◃ on page 228)

The mechanical time constant shows how long it takes at a drive to accelerate from 0 to 3000 min^{-1} at a constant torque current of 10 A.

EXAMPLE: Motor type = SM;
Pn [P0056] = 13,7 kW;
Nn [P0057] = 2500 U/min;
I_n [P0054] = 26 A ;
J_a = J_M [P0083] + J_L [P0109] = 100 kg·cm^2 + 300 kg·cm^2 = 400 kg·cm^2:

Nominal torque = Pn / (Nn · 2π /60) = 13,7 kW / (2500 U min^{-1}· 2π /60) = 52,3 Nm

K_t = Nominal torque / I_n = 52,3 Nm / 26 A = 2,01 Nm/A

T_{mech} = 3,14x10^{-3} · J_a / K_t = 3,14x10^{-3} · 400 kg·cm^2 / 2,01 Nm/A = 0,62 s

Parameterization of the speed controller with symmetrical optimum

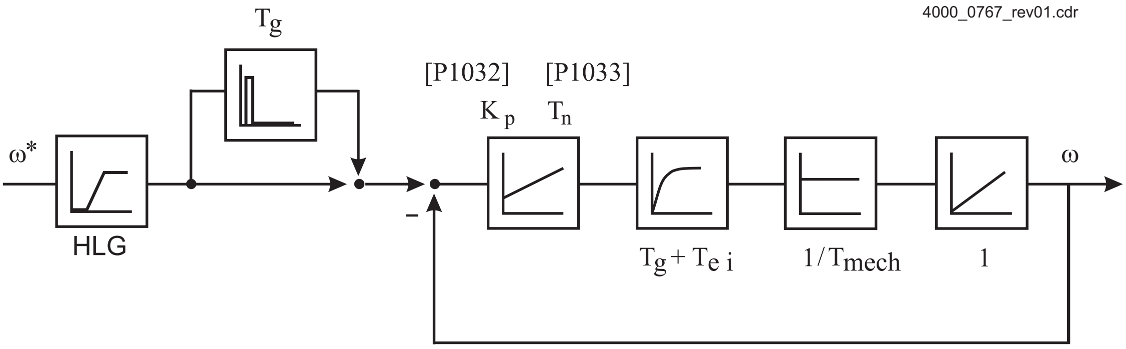


Figure 96: Block diagram speed controller with mechanical time constant and ramp function generator

By means of the mechanical time constant the speed controller can be represented as in ▹Figure 96◃ and is parameterized with the symmetrical optimum (good disturbance rejection).

$$Kp\ [P1032] = \frac{T_{mech}}{a_{so} \cdot (T_g + T_{e\,i})}$$

$$Tn\ [P1033] = a_{so}^{\ 2} \cdot (T_g + T_{e\,i})$$

with:

T_{mech}	Mechanical time constant of the drive
T_g	Smoothing time (encoder1 ▹P1074◃, encoder2 ▹P1081◃ or encoderless ▹P1061◃)
$T_{e\,i}$	Equivalent time constant of the closed current loop
a_{so}	Draft factor of the symmetrical optimum (with a_{so} < 1 unstable, typically a_{so} = 2 or 2,6).

If it is assumed that the current controller is parameterized with the absolute value optimum then $T_{e\,i} = 3 \cdot T_{ab}$. Whereat T_{ab} current controller cycle = 0.125 ms, i.e. $T_{e\,i}$ = 0.375 ms. Finally by a_{so} = 2,6:

$$Kp\ [P1032] = \frac{T_{mech}}{2{,}6 \cdot (T_g + 0.375\text{ms})} = \frac{0{,}38 \cdot T_{mech}}{(T_g + 0.375\text{ms})}$$

$$Tn\ [P1033] = 2{,}6^2 \cdot (T_g + 0.375\text{ms}) = 6{,}76 \cdot T_g + 2.535\text{ms}$$

A controller which was parameterized with a symmetrical optimum has a considerable overshoot at the step response (approx. 43% with a_{so} = 2 and 30% at a_{so} = 2,6). Additionally a D element is added to the set value due to the smoothing of the speed actual value. Therefore, it is necessary that at a direct speed set value input (operating modes speed control (-3) and speed default (2)) to smooth the reference variable at rapid speed set value changes (in an external control unit) or limit its increase by a ramp function generator in the controller as shown in ▹Figure 96◃ on page 216.

EXAMPLE: T_{mech} = 0.62 s;
$T_{e\,i}$ = 0.375 ms (current controller parameterized with absolute value optimum);
T_g [P1071] = 2 ms;
Encoder type = Sine-cosine number of pulses 1024;
a_{so} = 2.6:

$$Kp[1032] \approx 0.4 * T_{mech} / (T_g + 0.3\text{ ms}) = 0.4 * 0.62\text{ s} / (2\text{ ms} + 0.3\text{ ms}) = 107.8.$$

$$Tn[1033] \approx 7 * T_g + 2.1\text{ ms} = 7 * 2\text{ ms} + 2.1\text{ ms} = 16.1\text{ ms}.$$

Kp limit due to torque current ripple

The speed ripple of the encoder type (or in case of encoderless operation that of the speed estimation) causes a ripple in the torque current set value via the P gain of the speed controller. The smoothing of the speed actual value reduces the speed ripple. The Kp factor shall be limited or the actual value smoothing shall be set so that the ripple in the Isq set value 10% of the motor nominal current is not exceeded. If the Kp factor is limited the integral time should be increased to comply with the symmetrical optimum whereat the parameterization is made with a greater a_{so} factor (see ▹Automatic parameterizations◃ from page 134).

Torque feed forward

The torque feed forward is implemented as a D element. All changes in the speed set value ▹P0352◃ (in the operating modes speed control (-3) and speed setting (2)) or in the speed feed forward ▹P0365◃ (in the position-controlled operating modes), Δn_{Set} are differentiated and are multiplied with the torque feed forward factor ▹P1034◃.

The relation between speed feed forward ▹P0355◃ and a change Δn_{Set} in a control interval (T_{ab} = 0.125 ms), is as follows:

$$\text{Torque feed forward [P0355]} = \text{Torque feed forward factor [P1034]} \cdot \Delta n_{Set}$$

The parameter "Torque feed forward factor" ▹P1034◃ is used directly, without denormalization in the controller.

Δn_{Set} (from ▹P0352◃ or ▹P0365◃) is standardized to "Maximum speed of the drive" N_{max} ▹P1031◃ whereby the torque feed forward ▹P0355◃ is standardized to the maximum torque of the drive (or "Maximum current of the drive" I_{max} ▹P1241◃ · Kt-factor · FluxN, whereat FluxN = 1 or 100%).

The simplified mechanical equation of the torque feed forward is:

$$m_v = J \cdot \frac{\Delta\omega}{T_{ab}} = J \cdot \frac{\Delta n_{Set} \cdot N_{max} \cdot \frac{2\pi}{60s}}{T_{ab}}$$

with

m_v = Torque feed forward in Nm
= Torque feed forward [P0355] · I_{max} · Kt,

hence:

$$\text{Torque feed forward [P0355]} = \frac{J}{Kt} \cdot \frac{N_{max} \cdot \frac{2\pi}{60s}}{I_{max}} \cdot \frac{\Delta n_{Set}}{T_{ab}}$$

The definition of the mechanical time constant and of the T_{ab} = 0.125 result in the following:

Torque feed forward [P0355] =

$$\left(T_{mech} \cdot \frac{10A}{3000\ U\ min^{-1} \cdot \frac{2\pi}{60s}}\right) \cdot \frac{N_{max} \cdot \frac{2\pi}{60s}}{I_{max}} \cdot \frac{1}{125 \cdot 10^{-3}} \cdot \Delta n_{Set} =$$

$$T_{mech} \cdot \frac{N_{max}}{I_{max}} \cdot 26{,}67 \cdot \Delta n_{Set}$$

For this reason the Torque feed forward factor [P1034] equals:

$$\text{Torque feed forward factor [P1034]} = T_{mech} \cdot \frac{N_{max}}{I_{max}} \cdot 26{,}67$$

EXAMPLE: T_{mech} = 0,62 s;
T_{ab} = 0,125 ms;
N_{max} [P1031] = 3000 RPM;
I_{max} [1241] = 75 A:

Torque feed forward factor [P1034] =

T_{mech} * (N_{max}/I_{max}) / 37,5 =

0,62 s * (3000 RPM / 75 A) * 26,67 = 661.

The torque feed forward considers the field weakening as well - this results in the following:

$$\text{Torque current feed forward} = \frac{\text{Torque feed forward [P0355]}}{\text{Flux set value [P0520]}}$$

NOTE!

- If the "Maximum current of the drive" ▹P1241◃ or the "Maximum speed of the drive" ▹P1031◃ was changed the torque feed forward factor ▹P1034◃ must be calculated again (e.g. via the auto-tuning).
- Because the torque feed forward was implemented as a D element (without smoothing in the controller cycle) the entire torque feed forward which is required in a set value cycle is applied in the first controller cycle. The torque feed forward becomes spicular and may not be achievable due to the current limit. Therefore, the following is recommended:
  - At the position control mode (-4) activate "Allocation of the torque feed forward to bus cycle" ("Position controller mode" ▹P1050◃ bit 4 to 1).
  - Activate the interpolation from the ramp-up generator cycle to the control cycle at the operation modes speed control (-3) and speed setting (2) ("Ramp-up generator mode" ▹P1170◃ bit 9 to 1) and if required also activate the interpolation from set value cycle to the ramp-up generator cycle (via factor interpolator interval ▹P0429◃, in general not activated or = 0).

General note regarding optimization

The parameterization results presented here as well as the auto-tuning are to be regarded as benchmarks. The controller parameter must be set manually, if required.

Relationship between T_{mech} and BM5000-Ks factor

In the controller of the BM5000 series another measure than the mechanic time constant T_{mech} is used to characterize the accelerating ability per ampere of the device. The Ks factor is defined at the measuring point as follows:

$$Ks = \frac{Kt}{J} \cdot \frac{180^{o}}{\pi \text{ rad}} \cdot Fluss_N$$

$Flux_N$	Nominal magnetic flux (= 100%)
Ks	Ks factor in [(degree / s^2) / A]
J	Torque of inertia in [kg m^2]
Kt	Kt factor in [Nm / A]

The relationship between T_{mech} and Ks factor is:

$$Ks = \frac{1}{T_{mech}} \cdot \frac{3000 \text{ U min}^{-1} \cdot \frac{2\pi}{60s}}{10A} \cdot \frac{180^{o}}{\pi \text{ rad}} = \frac{1800}{T_{mech}}$$

EXAMPLE: T_{mech} = 0,62 s:

Ks factor = 1800 / T_{mech} = 1800 / 0,62 = 2903,22 (degree/s^2) / A

Relationship between the speed controller parameters of the BM4400 and the BM5000 series

The P gain of the BM5000 speed controller was standardized by the Ks factor (its unit is s^{-1}). Therefore, on the one hand it's independent of the specific features of the motor and of the load or of the Kt factor and the inertia. On the other hand in the BM5000 the speed controller cycle (RT0 cycle) is settable, whereat RT0 cycle $\geq$ Ictrl-cycle (controller cycle). If RT0 cycle > Ictrl cycle there is an additional delay ($T_{d\,n}$) of the average value:

$$T_{d\,n} \approx 0.5 \cdot (\text{RT0 cycle} - \text{Ictrl cycle}).$$

P-gain Kp and integral-action time Tn parameterized with absolute value optimum:

$$\text{Kp [BM5000]} = \frac{1}{a_{so} \cdot (T_g + T_{e\ i\text{-}BM5000} + T_{d\ n\text{-}BM5000})}$$

$$\text{Tn [BM5000]} = a_{so}^2 \cdot (T_g + T_{e\ i\text{-}BM5000} + T_{d\ n\text{-}BM5000})$$

$$T_{e\ i\text{-}BM5000} = 3 \cdot \text{Ictrl}_{cycle}$$ (Current controller with absolute value optimum paramterized)

$$T_{d\ n\text{-}BM5000} \approx 0.5 \cdot (\text{RT0}_{cycle} - \text{Ictrl}_{cycle})$$

A design factor a_{so} = 2.6 roughly accords to the "rigid" speed controller setting in the ProDrive for BM5000.

At the same inertia of the drive, speed actual value smoothing and symmetric optimum dimensional factor the following ratios apply:

$$\text{Kp [BM5000]} = \text{Kp [P1032]} \cdot \frac{1}{T_{mech}} \cdot \frac{T_g + 0.375\ \text{ms}}{T_g + T_{e\ i\text{-}BM5000} + T_{d\ n\text{-}BM5000}}$$

$$\text{Tn [BM5000]} = \text{Tn [P1033]} \cdot \frac{T_g + T_{e\ i\text{-}BM5000} + T_{d\ n\text{-}BM5000}}{T_g + 0.375\ \text{ms}}$$

EXAMPLE: Motor type = SM;
J_a = 600 kg·cm²;
T_g = 2 ms;
BM4400: T_{mech} = 0.62 s,
Kp [1032] = 107.8,
Tn [1033] = 16.1 ms;
BM5000: RT0 cycle = 0.250 ms,
Icontr cycle =0.125 ms:

$T_{d\,n}$ = 0.5·(0.250 ms - 0.125 ms) = 0.0625 ms

$$Kp\ [BM5000] = 107.8 \cdot \frac{1}{0.62\ s} \cdot \frac{2\ ms + 0.375\ ms}{2\ ms + 0.375\ ms + 0.0625\ ms} = 169.42\ s^{-1}$$

$$Tn\ [BM5000] = 16.1\ ms \cdot \frac{2\ ms + 0.375\ ms + 0.0625\ ms}{2\ ms + 0.375\ ms} = 16.52\ ms$$

10.2.4 Notch filter

In order to suppress unwanted resonant frequencies three notch filters are implemented for speed set value (▹P1370◃, ▹P1371◃), speed actual value (▹P1372◃, ▹P1373◃) and torque set value or Iq set value (▹P1374◃, ▹P1375◃).

The notch filters for speed set value and speed actual value are to be found in ProDrive under Speed controller details. The notch filter for torque set value or Iq set value is to be found in ProDrive under Current controller details.

▹Figure 97◃ Shows the amplitude response of the notch filter at a center frequency of 1000 Hz and a bandwidth of 500 Hz. The gain of the notch filter at the center frequency equals to zero.

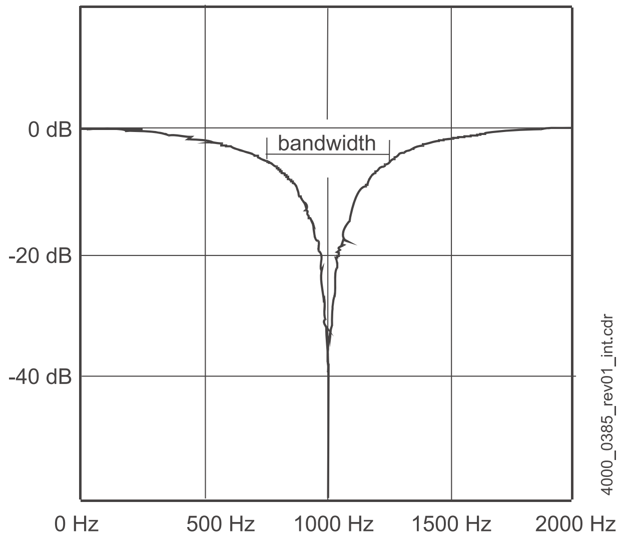


Figure 97: Amplitude response notch filter

Notes:

- It always must

$$\text{Bandwith} < 2 \cdot \text{center frequency}$$

- A notch filter is switched off, if the according center frequency = 0 Hz (default value).

10.2.5 Cross current- and torque limits

The maximum available torque

The maximum torque of the machine is proportional to the available torque-generating current I_{qmax}. This current is calculated from the available current of the drive $I_{max.}$, with the subtraction of the magnetizing current I_d ▹P0336◃.

$$I_{qmax} = \sqrt{I_{max}^2 - I_d^2}$$

The available current of the drive is normally equal to the maximum current of the drive ▹P1241◃. This current can be reduced because of the Ixt monitoring or phase failure monitoring. This current can also be reduced because of the stator frequency dependent reduction of the peak current for the acceleration device BM46XX.

In the field weakening range the torque is additionally limited by the maximum power. Therefore the maximum settable torque (as parameter ▹P0509◃ available from FW 03.08) in the basic speed range constantly and sinks in the field weakening range inversely proportional to the speed (see ▹Figure 98◃).

Cross current limits

Furthermore the torque can be limited by a limit of the set value of the torque-generating current component Iq, from one of the torque limits ▹P1036◃, ▹P1037◃ or ▹P1038◃ (effective is always the smallest one of all limits). In the basic speed range the resulting torque limits are proportional to the cross current limits.

In case of the asynchronous motor, the torque limits of the mentioned current limits drop inversely proportional to the motor speed (see ▹Figure 98◃), as in the field weakening range more torque-generating current is necessary for the same torque (compared to the situation in the base speed range).

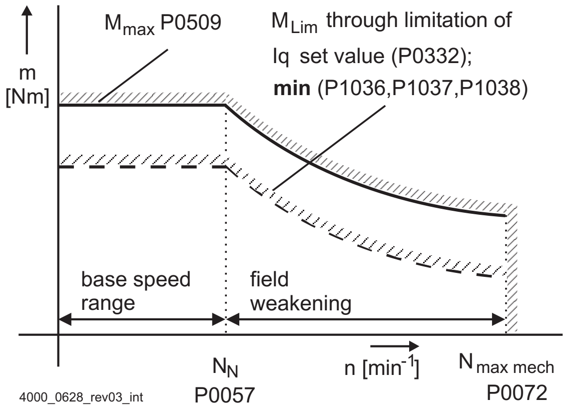


Figure 98: Torque limits asynchronous motor

In the case of a surface permanent magnet synchronous motor, where the reluctance torque is negligible, the resulting torque limits are also proportional to the cross current limits.

Torque limits

The torque limit ▹P0357◃ is the standard torque limit. From FW 3.08 on an additional torque limit in Nm ▹P1046◃ is available.

The torque limits, torque limit bipolar ▹P0357◃ and torque limit bipolar in Nm ▹P1046◃ (from FW 03.08), effect the torque set value (output of the speed controller) and therefore remain constant in field weakening (see ▹Figure 99◃ (a) for an example with the asynchronous motor).

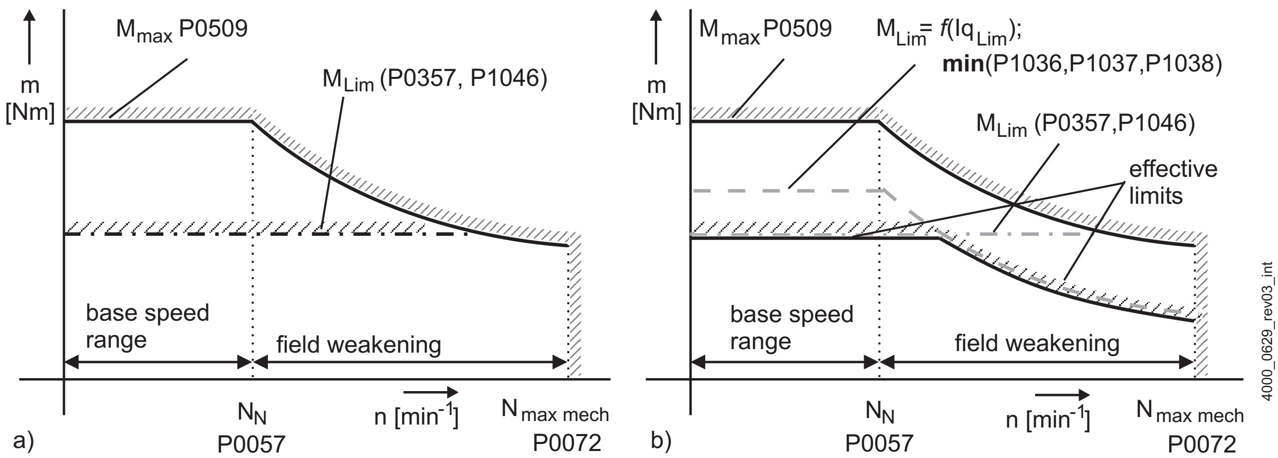


Figure 99: a) Asynchronous motor: torque limit via ▹P0357◃ and ▹P1046◃
b) Asynchronous motor: several torque limits enabled

If several limits (▹P0357◃, ▹P1036◃, ▹P1037◃, ▹P1038◃ or ▹P1046◃) simultaneously are active, the smallest of all torque limits is effective, as shown in ▹Figure 99◃ (b).

Additional display of the actual torque limit [▹P1046◃]

The torque limit bipolar in Nm ▹P1046◃ is based on the calculated motor torque actual value in Nm ▹P0508◃ (see ▹Torque monitoring◃ from page 228) and will be implemented using an additional controller (see ▹Figure 100◃ (a)).

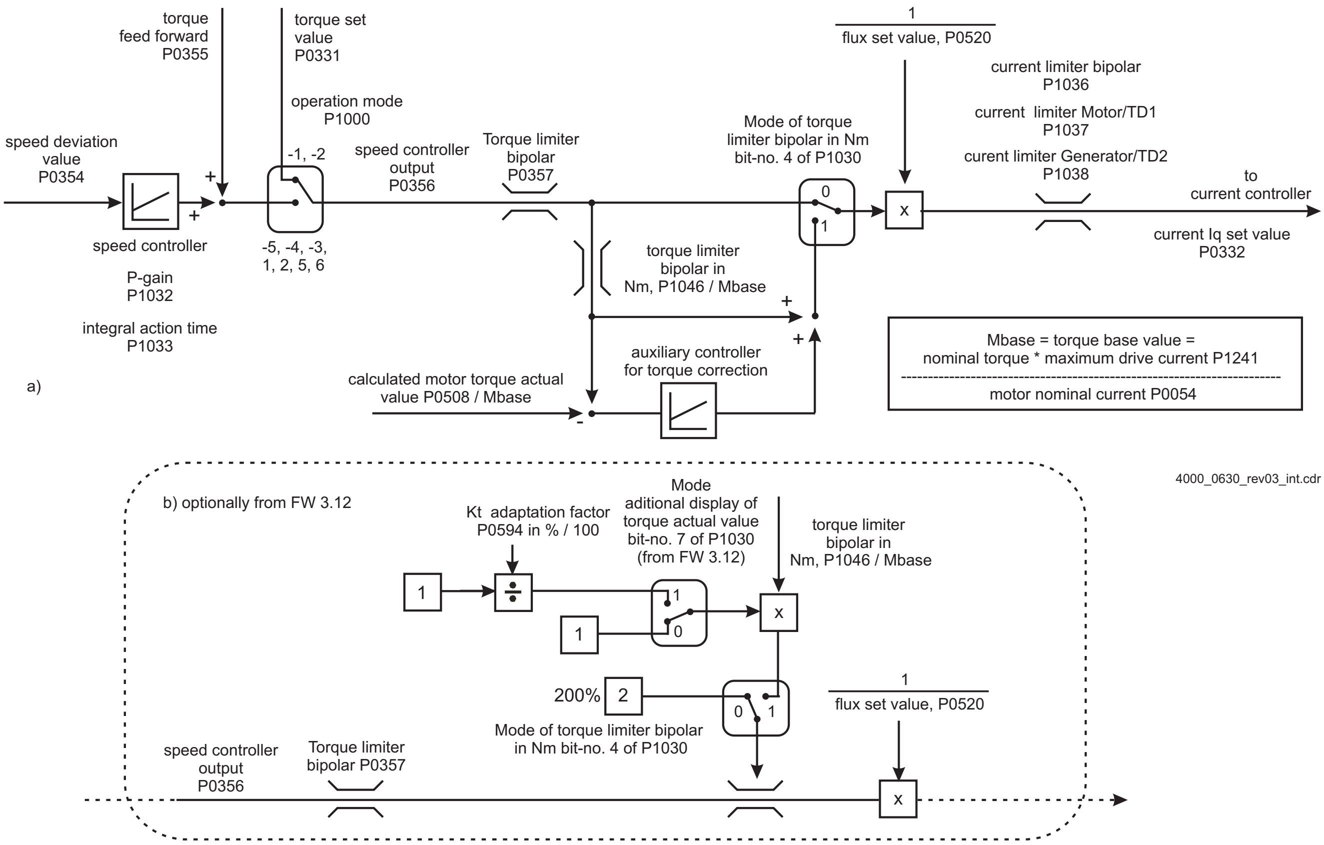


Figure 100: Torque limits ▹P1046◃ in the closed-loop structure.

From FW 3.12 the option is available to calculate the motor torque actual value ▹P0508◃ indirectly from the power balance using a Kt adaption (mode of the speed controller ▹P1030◃ Bit 7 = 1). If this mode is set, the torque limiter bipolar in Nm ▹P1046◃ will be implemented from the Kt adaption as shown in ▹Figure 100◃ (b).

The torque limit bipolar in Nm ▹P1046◃ is not active in general. The limit can be activated, if bit 4 of the speed controller mode (▹P1030◃) is set to 1 (see ▹Figure 100◃).

Speed dependent current limit

Speed dependent current limit (from FW 03.10)

From the starting speed ▹P0105◃ the limit bipolar of the torque-forming current ▹P1036◃ can be reduced inversely proportional to the motor speed. The reduction is not active in general. It can be activated by the setting of bit no. 5 in the speed controller mode ▹P1030◃ to 1.

At the synchronous motor this reduction sets a limit for the U_d-voltage, which is requested by the current component Iq. At the asynchronous motor the field weakening range of the machine is divided into two ranges. One with consistent and one with reduced power, whereat the peak torque limit decreases inversely proportional to the square of the speed.

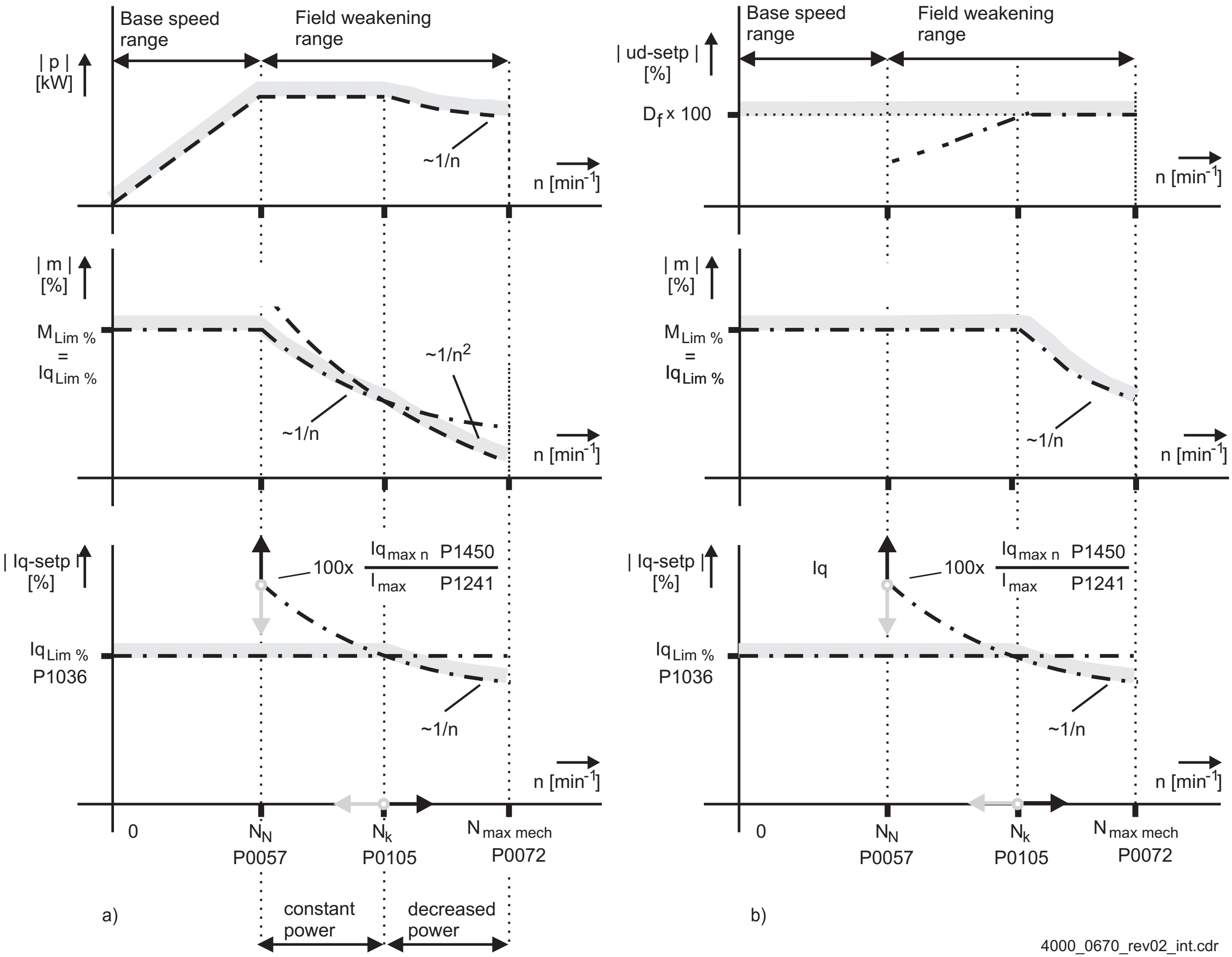


Figure 101: Reduction of current limit bipolar
a): asynchronous motor field weakening ranges
b): synchronous motor limit U_d-voltage

The starting speed ▹P0105◃ is internally calculated in the controller in dependence of the maximum cross current at rated speed ▹P1450◃ and from the value of the current limit bipolar ▹P1036◃.

Calculation. of the maximum cross current at rated speed, ▹P1450◃

- **Asynchronous motor**

For the following calculations, the value of the leakage impedance at rated speed is used

$X_{sigma\ n}$ = L_{sigma} · F_n [▹P0061◃] · 2 ·π,

with
L_{sigma} (total leakage inductance of the motor) from motor data =
$L_{sigma\ s}$ [▹P0075◃] + $L_{sigma\ r}$ [▹P0078◃],

or

L_{sigma} from auto-tuning (measured) = $L_{sigma\ meas}$ [▷P0854◁].

It is recommended to use the measured value from L_{sigma}.

In case it is not measured and the value of the additional inductance L_f (filter-choke, cables etc.) between converter and motor is known, it is recommended to use the total inductance instead of the inductance, which was set in the motor data base.

$$L_{sigma} = L_{sigma} \text{ (from motor database)} + L_f.$$

At the asynchronous motor the maximum cross current at rated speed can be calculated according to the breakdown torque or according to the highest possible torque per ampere. The smallest of these calculated values should be set in ▷P1450◁. Usually the value according to the breakdown torque is smaller than of the highest possible torque per ampere.

- **According to the breakdown torque**

  Approximately,

$$I_{q\ max\ \ n} \text{ [▷P1450◁]} = D_f \cdot M_{kn} / K_t$$

  whereat,

$K_t = M_n / I_{qn}$

$M_n = P_n$ [▷P0056◁] / (N_n [▷P0057◁] $\cdot 2 \cdot \pi / 60$)

$$I_{qn} = \sqrt{(I_n \cdot [>P0054<])^2 - (I_{dn} \cdot [>P0066<])^2}$$

$M_{kn} = (1/2) \cdot (Z_p$ [▷P0065◁] $/ (2\pi \cdot F_n$ [▷P0061◁]$)) \cdot (U_n$ [▷P0053◁]$)^2 / X_{sigma\ n}$

D_f: safety factor draft, $0 < D_f < 1$

The maximum permitted torque must be selected considerably smaller than the breakdown torque: $D_f \leq 1 / \sqrt{2}$, recommendation: approx. 70%.

Example: $Zp = 2$
$F_n = 400$ Hz
$U_n = 324$ V
$L_{sigma} = 1.76$ mH
$P_n = 4.5$ kW
$N_n = 11700$ min^{-1}
$I_n = 12.5$ A
$I_{dn} = 5.4$ A
$D_f = 1 / \sqrt{2}$

Intermediate result $M_n = 3.67$ Nm
$I_{qn} = 11.27$A
$K_t = 0.326$ Nm/A
$X_{sigma\ n} = 4.42$ Ohm
$M_{kn} = 9.44$ Nm

Result: $I_{q\ max\ \ n}$ [▷P1450◁] = 20.5 A.

- **According to the highest possible torque per ampere**

In the field weakening range the maximum amplitude of voltage u_d is limited to $(1 / \sqrt{2})\ U_{phase\text{-}max}$. With $U_{phase\text{-}max} = U_{zk\ n} / \sqrt{6}$

$I_{q\ max\ n}$ [▹P1450◃] $= D_f \cdot (1/\sqrt{2}) \cdot (U_{zk\ n} / \sqrt{6}) / X_{sigma\ n}$,

whereat

$U_{dc\ link\ n}$: the actual DC link power according the the existent supply voltage independent of parameter ▹P0020◃.

D_f: Safety factor draft, $0 < D_f < 1$

Example: $F_n = 400$ Hz
$L_{sigma} = 1.76$ mH
$U_{dc\ link\ n} = 540$ V
$D_f = 1/\sqrt{2}$

Intermediate result $X_{sigma\ n} = 4.42$ Ohm

Result: $I_{q\ max\ n}$ [▹P1450◃] = 24.9 A.

- **Synchronous motor**
  - According to the breakdown torque

Approximately

$I_{q\ max\ n}$ [▹P1450◃] $= D_f \cdot (U_{dc\ link\ n} / \sqrt{6}) / X_{Ln}$

whereat

$X_{Ln} = L_q \cdot Z_P$ [▹P0065◃] $\cdot N_n$ [▹P0057◃] $\cdot 2 \cdot \pi / 60$

with

L_q = L_q measured ▹P0854◃ or L_q from the motor data ▹P0080◃

D_f Safety factor draft, $0 < D_f < 1$

It is recommended to use the measured value from L_q-inductance.

In case it is not measured and the value of the additional inductance L_f (filter-choke, cables etc.) between converter and motor is known, it is recommended to use the total inductance instead of the inductance, which was set in the motor data base.

$L_q = L_q$ (from motor database) $+ L_f$

The maximum permitted torque must be selected considerably smaller than the breakdown torque: $D_f \leq 1 / \sqrt{2}$. In order to keep the field weakening in the linear range, $D_f = 1/2$ is recommended. But if the controller tolerates disproportionately high field weakening changes compared to the Iq changes, then $D_f = 1 / \sqrt{2}$ can be used.

Example: $U_{dc\ link\ n} = 540$ V
$L_{q\ measured} = 8.11$ mH
$N_n = 3800\ min^{-1}$
$Z_p = 5$
$D_f = 1 / \sqrt{2}$

Intermediate result $X_{Ln} = 16.13$ Ohm

Result: $I_{q\ max\ n}$ [▹P1450◃] = 9.67 A.

- **Deviations of the mains voltage**

  Deviations of the mains voltage of ±10% usually are admitted. At the non regulated DC-link the DC link voltage can decrease if the motor is operated motoric at the current limit. If necessary the calculated maximum cross current at rated speed ▹P1450◃ must accordingly be reduced. In any case it is useful to check the U_d-voltage amplitude referring to this.

10.2.6 Torque monitoring

Standard display of the actual torque value ▹P0344◃

The parameter ▹P0344◃ shows the internal torque of the motor and is the standard torque display.

In the controller the torque actual value ▹P0344◃ is calculated from the actual value of the cross current as follows:

$$M_{i(Std)} = \frac{Iq_{act} \cdot I_{max} \cdot Flux_{act} \cdot Kt_{Nom}}{M_{Nom}} \qquad \text{in \%}$$

with:

$M_{i/Std)}$:	Standard torque display in % ▹P0344◃
Iq_{act}:	Cross current actual value ▹P0333◃
I_{max}	Maximum current of the drive in A ▹P1241◃
$Flux_{act}$:	Flux actual value in % ▹P0521◃
M_{Nom}	Motor nominal torque in Nm
Kt_{Nom}	Nominal value of the kt factor (torque constant)

whereat:

$$M_{Nom} = \frac{1000 \cdot \text{Motor nominal power [P0056]}}{\left(\frac{2\pi \cdot \text{Motor nominal speed [P0057]}}{60}\right)}$$

and

$$Kt_{Nom} = \frac{\text{M-Nom}}{\text{Iq-Nom}}$$

Also at synchronous motors (cylindrical rotor synchronous motor):

- $Flux_{act}$ = 100% in the whole speed range (also in the field weakening range)
- Kt is assumed as a constant, i.e. the equitation for the actual value of the cross current is valid for the linear range of the torque-current characteristic of the motor.

$I_{q\text{-}nom}$ (nominal value of the cross current) is calculated as follows:

- **Asynchronous motor**

$$I_{q\text{-}nom} = \sqrt{(I_{nom}{}^2 - I_{d\text{-}nom}{}^2)}$$

with

I_{nom}	Rated current motor ▹P0054◃.
$I_{d\text{-}nom}$	Rated magnetizing current ▹P0066◃.

- **Synchronous motor**

$$I_{q\text{-}nom} = I_{nom}.$$

Magnetizing current

In the most cases the rated magnetizing current is negligible, e.g. the effect to the torque actual value ▹P0344◃ is about 0.5% if the $I_{d\text{-}nom}$ is smaller than 10% of the rated current of motor (i.e. the deviation compared to the case where $I_{q\text{-}nom}$, as with the asynchronous motor, is calculated with regard to the $I_{d\text{-}nom}$, accords to 0.5%).

The effects are significant from values greater than 20% (deviation about 2%).

If the requested precision of the actual value of the torque is critical due to this influence, it is recommended to determine the rated data of the synchronous motor at the starting speed of the field weakening ($I_{d\text{-}nom}$= 0) for unchanged rated motor current and to set in Pn ▹P0056◃ and Nn ▹P0057◃.

Display of the standard torque display P0344 in WinBASS / ProDrive

In WinBASS / ProDrive the torque actual value is shown in 0.1 Nm:

$$\text{Display} = \left(\frac{\text{Torque} - \text{Actual}}{100} \cdot \text{NomTorqueMotor}\right)$$

with

Torque-act: ▹P0344◃

whereat

Nominal torque motor = Pn[▹P0056◃] / (Nn[▹P0057◃]) · 2 · π / 60)

The torque actual value in parameter ▹P0344◃ is smoothed by a time constant of 2 ms.

The torque display ▹P0508◃ is smoothed by a time constant of 4 ms if directly calculated from a power balance (▹P1030◃ bit 7 to 0) and by a time constant of 2 ms, if calculated from a Kt adaption (▹P1030◃ bit 7 to 1).

Additional display of the actual torque value, power balance based torque calculation at asynchronous motors ▹P0508◃

See structure of the torque monitoring ▹Figure 14◃ on page 28.

The torque actual value in Nm ▹P0508◃ is available from FW 3.08 as additional display of the actual torque value. The parameter shows the torque at the motor shaft and is calculated from a power balance.

- **Additional display of the torque value calculated directly from the power balance**

  (From FW 3.08)

  (From FW 3.12 as default setting ▹P1030◃ bit 7 = 0)

The internal torque of the asynchronous motor, is determined from the air-gap power P_i, the stator frequency f_s and the pole pair number Z_p ▹P0065◃:

$$M_{i(P)} = \frac{P_i \cdot Z_p}{2 \cdot \pi \cdot f_s}$$

Finally after deduction of friction torque ▹P0064◃ (in consideration of speed direction), there is the torque at the principal mode of motor ▹P0508◃.

Torque in Nm ▹P0508◃ = $M_{i(P)}$ – Friction torque ▹P0064◃.

In this case the torque actual value shown in parameter ▹P0508◃ is smoothed by a time constant of 4 ms.

- **Additional display of the torque value calculated optionally from a Kt adaption**

(From FW 3.12 as optional setting ▹P1030◃ bit 7 = 1)

From FW 3.12 the additional display of the actual torque value can be generated optionally from a Kt adaption and the standard torque actual value $M_{i(std)}$. With the Kt adaption factor ▹P0594◃ the internal torque $M_{i(A)}$ is calculated as follows:

$M_{i(A)}$ = Kt adaption factor [P0594] * $M_{i(std)}$

After subtraction of the friction torque ▹P0064◃ (in consideration of the speed direction) the torque at the motor shaft ▹P0508◃ finally results in:

Torque in Nm [P0508] = $M_{i(A)}$ – Friction torque [P0064]

The Kt adaption factor describes the ratio between the internal torque from the cross current $M_{i(std)}$ and the torque from the power balance $M_{i(P)}$ and is won as adaption of the Kt factor.

Kt adaption factor [P0508] $\rightarrow$ $M_{i(P)} / M_{i(std)}$

The time constant (integral action time) of the Kt adaption is 16 ms.

The torque display P0508 is less sensitive to distortions in the signal after the Kt adaption of the monitored actual speed value than the direct calculation from the power balance.

The torque actual value shown in parameter ▹P0508◃ in this case is smoothed by a time constant of 2 ms.

Speed threshold and suppression time

The uncertainties of the torque calculated from the power balance – relative to the actual torque value – geometrically increase more and more at contracted speed. For very small stator frequencies the accuracy of the calculation cannot be ensured. Therefore the adaption of the internal Kt factor is suppressed for speed values, which are lower than the lower speed limit ▹P0112◃. The suppression time of the Kt adaption factor can be set in ▹P0113◃. The status of the adaption is shown in ▹P0350◃ bit 6.

- **Power balance**

The internal power is won from a simplified power balance (see ▹Figure 102◃).

$P_i = P_e$ (▷P0507◁) - P_{cu1} - P_{fe}

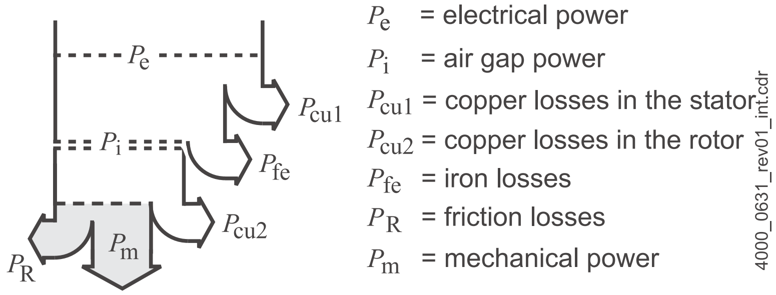


Figure 102: Calculation of internal power from the power balance of an asynchronous motor

Whereat P_E (▷P0507◁) is the assumed electrical power in W of the motor. The delays of the power unit affect the accuracy of this parameter and must be compensated (see ▷Auto-tuning◁ from page 134). The copper losses in the stator P_{cu1} and the iron losses P_{fe} can be calculated according to the simplified additional diagram of an asynchronous motor (▷Figure 103◁) as follows.

$$P_{cu1} = 3 \cdot I_S^2 \cdot R_S \quad \text{and} \quad P_{fe} \cong 3 \cdot U^2 \cdot I \cdot R_{fe} \quad .$$

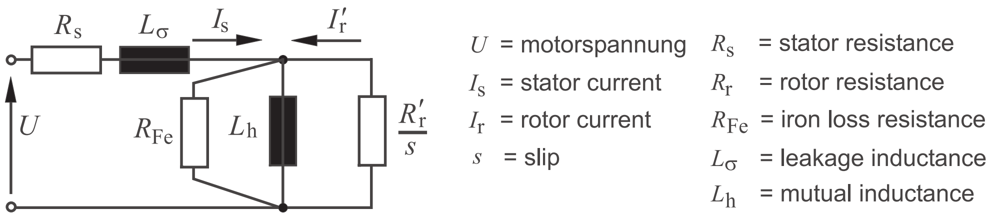


Figure 103: Single phase circuit diagram of an asynchronous motor

The accuracy of a calculated torque ▷P0508◁ strongly depends on the correct calculated copper losses in the stator, i.e. from the stator resistor value R_S ▷P0075◁ (rated value at about 25° C). If you handle motors not equipped with an electronic type plate, the stator resistor must be filled in. Alternatively this value can be measured by autotuning with a cold motor ▷P0853◁.

For motors with temperature sensor the stator resistor value is adapted dependent on the motor temperature T_M ▷P0503◁ (temperature adaption with bit 5 in ▷P0093◁ set to 1 is active). For motors without temperature sensor the stator resistor should be adjusted or entered $T_{m\ warm}$ according to the motor temperature:

$$R_{S\ warm} \cong R_{S\ cold} \cdot \left(1 + K_{adapt} \cdot \frac{T_{m\ warm} - T_{m\ cold}}{100\,°C}\right)$$

whereby K_{adapt} = 0.3 - 0.4 and $t_{m\ cold}$ = 25 °C.

The iron loss resistor R_{fe} is converted in the controller from the motor attenuation constant ▷P0068◁. For this conversion the following parameters are necessary:

- Motor rated power ▹P0056◃
- –▹P0057◃ Motor rated speed
- –▹P0053◃ Motor rated voltage

For the calculation of the torque ▹P0508◃ the values of friction torque ▹P0064◃ and motor attenuation constant ▹P0068◃ are necessary. At motors without electronic type plate the values for ▹P0064◃ and ▹P0068◃ must be inserted.

If these values are not known, the controller can calculate rough estimates for the specified parameter from the rated data of the motor. Therefore first of all the motor attenuation constant ▹P0068◃ and/or ▹P0064◃ the friction torque must be set to zero. Then the maximum current of the drive ▹P1241◃ is set again (please note: the controller calculates internal variables for iron resistance and friction torque, the parameters ▹P0068◃ and/or ▹P0064◃ remain unchanged, i.e. with value zero).

Besides the selected necessary motor data for operation mode, the following parameters are necessary for the calculation of the torque ▹P0508◃ and for the use of the torque limits ▹P1046◃:

- Number of pole pairs ▹P0065◃
- Motor attenuation constant Kd ▹P0068◃
- Friction torque ▹P0064◃
- Stator resistor value (▹P0075◃ or ▹P0853◃)

If the motor data for the calculation of the torque ▹P0508◃ are used for the first time or were changed, once more the maximum current of the drive ▹P1241◃ should be set, in order to assure, that the iron resistance was calculated from the correct (actual) value of the attenuation constant. Only then the parameter set can be saved.

The uncertainties of the calculated torque from the power balance increase geometrical - relatively to the actual torque value - at continuously diminishing speed. For very small stator frequencies the calculation accuracy cannot be guaranteed anymore. That is why the parameter ▹P0508◃ shows for stator frequencies less than 10 Hz (for speed smaller than 10% of the motor rated speed from FW 3.09) the actual torque value ▹P0344◃ in Nm, which is calculated from the torque-generating component of the current I_q .

Furthermore, for the additional security ▹P0508◃ at speed with less than half the rated speed it is limited to the following values:

|▹P0508◃| $\geq$ (|▹P0344◃| - 0.1 · Motor rated torque)

At evaluation of torque actual value ▹P0508◃ at zero speed or close to it and at very small load it must be considered, that the static friction in the friction model is not taken into consideration (the static friction is greater than the running friction of ▹P0064◃).

Power balance based torque calculation at synchronous motors

The torque, which was calculated according to the power balance ▷P0508◁ and the accordant torque limits ▷P1046◁ can in principle also be used for the synchronous motors.

Synchronous motor ▷P0344◁ provides torque actual values with a great accuracy. Especially at motors with less power and according to the operating conditions ▷P0344◁ can definitely provide more exact values than ▷P0508◁.

On the other hand ▷P0508◁ compared to ▷P0344◁ is less sensitive against change of rotor temperature (provided that there is a temperature sensor and that the temperature adaption is activated) and saturation appearances.

Correction value of the motor torque constant (from FW 03.12)

Herewith the correction of the standard torque actual value ▷P0344◁ is done, e.g. for applications at which the torque actual value is a process control variable and needs a higher accuracy.

Correction formula:		M-act-corr = (Kt-corr/100) * M-act
	M-act-corr	corrected display value ▷P0344◁
	M-act	original torque actual value ▷P0344◁
	Kt-corr	correction value in % ▷P0110◁

The correction factor ▷P0110◁ acts directly in the motor commutation and indeed in the calculation of the cross current set value from the torque set value.

The correction factor ▷P0110◁ acts also in the additional motor torque actual value ▷P0508◁ in the speed area where the display ▷P0508◁ takes over the value of ▷P0344◁ (i.e. in the lower speed area).

NOTE!

If the correction factor ▷P0110◁ is on its default value, the torque actual value ▷P0344◁ will act as in the previous software version (before FW 3.12).

If the correction factor ▷P0110◁ will be changed during the enabled operation of the drive, this change causes a momentarily torque fault in the speed control cycle. Therefore the value should be changed as possible in the disabled operation.

10.2.7 Torque reduction after controlled brake operations

From firmware version FW 03.01.

With the parameter ▷P1045◁ a smooth torque reduction can be set after controlled brake operations. After braking the drive to zero speed the torque limiter is reduced linear via the set time to 0 and then the drive is inhibited. This smooth torque reduction operates at all controlled braking operations with the drive manager, thus at the commands "Inhibit operation", "Drive shut down", "Quickstop" (▷P0301◁), provided that a braking procedure with transition into an inhibited status was set as a reaction to the command. Furthermore the smooth torque reduction operates at error reactions, on which a braking operation is released. Furthermore the smooth torque reduction takes effects on error reactions, through which a braking operation is released.

10.3 Current controller

10.3.1 Parameter overview, ProDrive

Number	Name / meaning	Remark
Torque set values (Sources for the Iq set value)		
▷P0356◁	Speed controller output	Display [1)]
▷P0331◁	Torque set value	[2)]
▷P1022◁	Torque additional set value	
Current set values		
▷P0335◁	Current Id set value	Display
▷P0332◁	Current Iq set value	Display
Set value notch filter and PT2 smoothing		
▷P1374◁	Center frequency Iq set value notch filter	Value = 0: Notch filter switched off
▷P1371◁	Bandwidth speed set value notch filter	
▷P1044◁	Cut off frequency 2 order delay	Value = 0: PT2 switched off
Iq set value limit		
▷P1030◁	Speed controller mode	Bit 2, type of torque limit
▷P1039◁	Current limiter hysteresis	
▷P1037◁	Current limiter Motor/TD1	
▷P1038◁	Current limiter Generator/TD2	
▷P1036◁	Current limiter bipolar	
▷P1030◁	Speed controller mode	Bit 5, mode of the speed dependent current limit
▷P1450◁	Maximum q-current at nominal speed	
▷P0105◁	Application speed of speed dependent current limit	Display
Actual values		
▷P0336◁	Current Id actual value	Display
▷P0333◁	Current Iq actual value	Display
▷P0341◁	Phase U current actual value	Display
▷P0342◁	Phase V current actual value	Display
Id, Iq, PI controller		
▷P1020◁	Current controller P-gain	
▷P1021◁	Current controller integral-action time	
Feed forward		
▷P0067◁	Motor Ke factor	

Number	Name / meaning	Remark
	Output limit	
▹P1023◃	Current controller output limiter	
	Outputs	
▹P0334◃	Current Iq controller output	Display
▹P0340◃	Voltage Vd set value	Display
▹P0339◃	Voltage Vq set value	Display
▹P0338◃	Voltage EMF set value	Display

1) Not effective at operating mode current control (current control ▹P1000◃ = -2)

2) Effective only at operating mode current control

10.3.2 General overview current controller

The current controllers for direct-axis current and quadrature current are implemented as PI controller with a dq decoupling feed forward for both controllers and an EMF feed forward for the q-current controller. Additionally the controllers are supported by a current prediction procedure (according to the principle of a Smith predictor).

The P gain and the integral time of the current controller are to be entered in ▹P1020◃ and ▹P1021◃. The P gain and the integral time are always the same at the Iq and the Id controllers. The EMF pre-control are set by the Ke factor ▹P0067◃.

The Kp factor of the current controller ▹P1020◃, which is adjustable via ProDrive does not have an unit. It is permanently standardized by 1000 V / $\sqrt{6}$ and 100 A.

By means of auto-tuning an automatic parameterization of the current controller can be carried out after the symmetric optimum, see ▹Automatic parameterizations◃ on page 134.

10.3.3 Details current controller

Parameterization of the current controller with absolute value optimum

According to the absolute value optimum (good command response) and considering the internal standardizations the gain ▹P1020◃ and the integral-action time ▹P1021◃ can be adjusted as follows:

Tn [▹P1021◃] = Le / Re, in ms

Kp [▹P1020◃] = (Le / (2·Td)) / Kpb $\approx$ 0,65 · Le

Whereas Le in mH

Re in Ω

Standardization quantity Kpb = (1000V / $\sqrt{6}$) / 100 A

Alternative time constant of the controller unit Td = 1,5·Tab, in ms

Sampling time Tab = 0,125 ms

- SM

  Re = Rs [▹P0075◃] or Rs measured [▹P0853◃], in Ω

  Le = Lq [▹P0080◃] or Lq measured [▹P0854◃], in mH

  Assuming that Lq = Ld.

- ASM

  Re = Rs [▹P0075◃] + Rr [▹P0077◃] or ≈ 1,5·Rs measured [▹P0853◃], in Ω

  Le = Lσ (total leakage inductance);

  Lσ = Lσs [▹P0076◃] + Lσr [▹P0078◃] or = Lq measured [▹P0854◃], in mH

Example: SM: Lq [P0080] = 27 mH;
Rs [P0075] = 6,53 Ω:

Tn [P1021] = Lq [P0080] / Rs [P0075] = 27 / 6,53 = 4,1 ms;

Kp [P1020] ≈ 0,65 Lq [P0080] = 17,55;

Motor inductance saturation at SM

It is assumed that the motor inductance is constant in the total current range. However, it must be considered whether the motor inductance runs into saturation, e.g if the maximum value of the current set value is much greater than the motor nominal current ▹P0054◃. In this case the inductance value corresponding to the maximum current value should be used to calculate the current controller.

dq decoupling

The following value of the inductance is necessary for the dq decoupling:

SM: Lq [P0080] or Lq measured [P0854]

ASM: Lσ = Lσs [P0076] + Lσr [P0078], or Lq measured [P0854]

The controller can work without this value (P0080, P0076 + P0078 or P0854 = 0). However, the achievable dynamic could be reduced thereby.

EMF feed forward

The EMF feed forward ▹P0338◃ is adjustable with the Ke factor ▹P0067◃. The controller can also work without Ke factor (P0067 = 0). The achievable dynamic can be reduced thereby.

The difference of current set value and current actual value at activated current prediction can be very great at transients, if the Ke factor was set inaccurately and is adjusted accordant to the integral time of the current controller.

If there is no value available for the Ke factor the following procedure is possible:

- Enable drive and run at no load,
- Specify speed set value (if possible) accordant to the nominal speed of the motor,
- By changing Ke ▹P0067◃ bring the Iq controller output ▹P0334◃ to approximately 0%.

NOTE!

If the entered value of the motor Ke factor ▹P0067◃ is too great the motor cannot be controlled anymore due to the excessive voltage feed forward.

Current prediction

The current prediction works accordant to the principle of the Smith predictor in which the stator current is emulated by a stator winding model.

- Not sensitive to discrepancy in the model stator resistance
- Model inductance must be > Motor-inductance/2
- 0.7 * Motor-Ke < Model-Ke < 1.3 * Motor-Ke
  The difference between current set value and the actual value with the activated current prediction can be very great at transients, if the Ke factor was set inaccurately. The difference is set accordant to the integral time of the current controller.

The absolute value optimum of the current controller dynamic can be increased (the Kp factor can be increased) due to the current prediction procedure without causing an excessive overshoot in the step response. In the best of cases (the model parameters correspond to the motor parameters) it is possible to double the Kp factor.

The current prediction is not available for the operation of the encoderless ASM (open loop).

The current prediction is switched off if

- Rs [P0075] (or Rs measured [P0853]) or
- SM: Lq [P0080],
- ASM: Lσ = Lσs [P0076] + Lσr [P0078], (or Lq measured [P0854])

is set to 0.

The current prediction can be switched off by setting bit 0 of parameter ▹P1024◃ (Current controller mode) without setting the values for resistance and inductance to zero as of FW 03.10.

10.4 Udc link controller

10.4.1 Parameter overview, ProDrive

Number	Name / meaning	Remark
	Set value	
▹P1250◃	DC link controller set value	
	PI controller	
▹P1251◃	DC link controller P-gain	
▹P1252◃	DC link controller integral-action time	
	Actual value	
▹P0484◃	Power Unit DC link actual value	Display

10.4.2 General overview Udc link controller

The controller for the DC link voltage, Udc controller in brief, is a controller which is effective to the limit of the torque current.

Thereby the controller limits the generator Iq current, because in the generator operation (braking of the drive) increases the DC link voltage Udc as a consequence of the regenerated current.

Depending on the speed direction and the sign of the torque current either the upper or the lower limit of the current Iq is changed so that the Udc actual value does not exceed the Udc controller set value limit P1250.

The Udc link controller is implemented as PI controller.

The P gain and the integral time of the Udc controller can be entered in ▹P1251◃ and ▹P1252◃.

10.5 Flux controller, field weakening controller

10.5.1 Field weakening controller - SM

10.5.1.1 Parameter overview, Field weakening controller - SM, ProDrive

Number	Name / meaning	Remark
Field weakening mode		
▹P0093◃	Motor mode	Bit 7, mode of field weakening
▹P0095◃	Field weakening current for SM	
Set value		
▹P0488◃	Maximum modulation index	
PI controller		
▹P1272◃	Flux controller P-gain	
▹P1273◃	Flux controller integral-action time	
Field weakening current characteristic (feed forward)		
▹P0104◃	Motor mode 2	Bit 0, characteristic mode bit
▹P0106◃	Application speed of the id-curve for synchronous motor	
▹P0107◃	Speed base coordinate of the id-curve for synchronous motor	
▹P0108◃	Current base coordinate of the id-curve for synchronous motor	
▹P0353◃	Speed actual value	
Set values		
▹P0335◃	Current Id set value	Display

10.5.1.2 General overview field weakening controller - SM

The field weakening controller is implemented as PI controller.

The Kp factor of the field weakening controller - SM ▹P1272◃, which can be set via ProDrive has no unit. The field weakening controller - SM integral time can be entered in ▹P1273◃.

Normally it isn't necessary to change the standard setting of Kp ▹P1272◃ and Tn ▹P1273◃.

10.5.1.3 Details field weakening controller - SM

Typical values (empirical values):

Kp field weakening controller SM ▹P1272◃	2.0 to 3.0
Integral-action time field weakening controller SM ▹P1273◃	Tn = 2 / (6*f_1).

f_1: Fundamental frequency at the beginning of the field weakening

10.5.1.4 Field weakening synchronous motors

At some synchronous motors a field weakening current is necessary in order to reach the type of operation mode. It is possible to achieve a speed increase of about 10 % to 20 % with field weakening against the rated speed at about the same torque for normal synchronous motors.

There are two types of field weakening, field weakening with constant field current and field weakening at the voltage limit (see ▹Figure 7◃ on page 21).

- Field weakening with permanent field weakening current:
  If bit 7 of the parameter Motor mode (▹P0093◃) is set,
  a constant field weakening current independent of the speed is impressed in the motor. The designated constant magnetizing current must be set in the parameter field weakening current for synchronous motor (▹P0095◃).
- Field weakening at the voltage limit:
  If the bit 7 of the parameter Motor mode (▹P0093◃) is not set,
  the set value voltage is compared with the set maximum modulation index (▹P0488◃). If the set value voltage reached the value of the maximum modulation (▹P0488◃), the flux controller starts, as necessary, to adjust a field weakening in the motor. The maximum field weakening current, which can be reached is determined in parameter ▹P0095◃ and must be set individually (e.g. equal to the rated value (▹P0066◃).

Field weakening current limit

The parameter Field weakening current for synchronous motor ▹P0095◃ describes the maximum amplitude of the field weakening current.

The parameter P0095 is limited to 95% of the power unit rated current 4 kHz ▹P0010◃ (absolute limit of the parameter) and usually may not be set greater than the rated current of the motor (▹P0054◃). The exception is the acceleration device BM46XX (see chapter ▹Device types◃ on page 99).

The amplitude of the magnetizing current is, excluding the parameter P0095, internally is limited to 95% of the power unit rated current (▹P0010◃ or ▹P0012◃) and additionally to 95% of the maximum current of the drive ▹P1241◃. An exception is made by the acceleration device BM46XX (see chapter ▹Device types◃ on page 99).

SM Field weakening controller

In the SM field weakening controller the set value voltage is compared with the maximum voltage, i.e. the voltage according to the maximum set modulation (▹P0488◃). If the set value voltage reaches maximum voltage then, according to the requirement, the flux controller starts to process a negative field current in the motor. The amplitude of the reachable field weakening current is limited by the parameter ▹P0095◃ and must be entered separately (if unknown and the motor requires field current, half of the nominal motor current can be entered here).

Field weakening current characteristic curve:

From FW 03.10 the field weakening controller of the synchronous motor can be supported by a precontrolled field weakening characteristic curve (not enabled by default, it can be activated via ▹P0104◃ bit 0).

Definition of the field weakening current characteristic curve for synchronous motor (also see ▹Figure 7◃ on page 21):

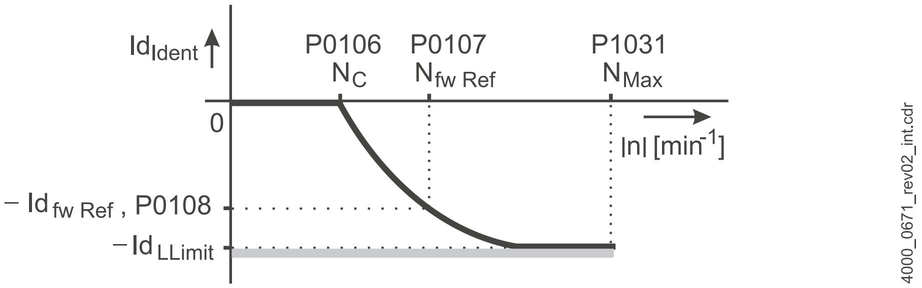


Figure 104: Field weakening current for characteristic curve for synchronous motor

If $n < N_C$, $id_{Ident} = 0$,

else $$id_{Ident} = -id_{fwRef} \cdot \frac{N_{fwRef}}{N_{fwRef} - N_C} \cdot (1 - N_C / n)$$

Whereat:

id_{Ident}:	Field weakening current characteristic curve
n:	Speed actual value, ▹P0335◃
N_C:	Starting of speed of the field weakening, ▹P0106◃ ($N_C \leq N_{Max}$)
$Idfw_{Ref.}$:	Current support coordinate of the field weakening current characteristic curve, ▹P0108◃
$Nfw_{Ref.}$:	Speed support coordinate of the field weakening current characteristic curve, ▹P0107◃ ($Nfw_{Ref.} > N_C$)

If the field weakening current characteristic curve is not activated, then $id_{Ident} = 0$.

The current controller ID-set value is generated by the addition of the field weakening current characteristic curve to the field weakening controller output (see ▹Figure 7◃ on page 21).

$$id_{Set} = id_{Ident} + id_{Contr}$$

Limitation of the current controller Id-set value:

if $id_{Set} < -Id_{fwMax}$, *then* $id_{Set} = -Id_{fwMax}$, *else if* id_{Set} < - Id_{LLimit}, *then* id_{Set} = - Id_{LLimit}.

Whereat:

id_{Set}:	Current controller Id set value ▷P0335◁.
Id_{fwMax}:	Maximum field weakening current ▷P0095◁.
Id_{LLimit}:	Id_{LLimit} = 0,95 * min (I_{Max}, $I_{LT\text{-}Nom}$)
I_{Max}:	Peak current of drive ▷P1241◁
$I_{LT\text{-}Nom}$:	Power unit rated current ▷P0010◁, ▷P0012◁

Magnetizing current P0066 for synchronous motor

The rated magnetizing current (▷P0066◁) is loaded from the electronic type plate (motor data base), ▷P0066◁ but is not automatically used for the field weakening operation (except with FW 03.09, see note below). According to the kind of field weakening the requested magnetizing current (permanent or maximum field weakening current) must separately be set in the parameter Field weakening current for synchronous motor (▷P0095◁).

Up to firmware version FW 03.08 and from FW 03.10:

The magnetizing current is loaded from the electronic type plate (motor data base) in the parameter Motor magnetizing current (▷P0066◁), but is not used for the field weakening operation at synchronous motors. The requested magnetizing current must be separately set in the parameter Field weakening current for synchronous motor (▷P0095◁).

Only with firmware version FW 03.09:

As a maximum field weakening current for the operation of synchronous motors the higher value of ▷P0066◁ and ▷P0095◁ is used.

10.5.2 Flux controller, field weakening controller - ASM

10.5.2.1 Parameter overview, Flux controller, field weakening controller - ASM, ProDrive

Number	Name / meaning	Remark
	Set value, field weakening controller	
▷P0488◁	Maximum modulation index	
	PI controller, field weakening controller	
▷P1270◁	Field weakening controller P-gain	
▷P1271◁	Field weakening controller integral-action time	

Field weakening characteristic (feed forward)		
▹P0057◃	Motor nominal speed	
▹P0353◃	Speed actual value	
Set value limitation, field weakening controller		
▹P0523◃	Flux set value reduce	
Set values, field weakening controller		
▹P0520◃	Flux set value	Display
PI controller, flux controller		
▹P1272◃	Flux controller P-gain	
▹P1273◃	Flux controller integral-action time	
▹P0522◃	Calculated rotor time constant	Display, info [1)]
Actual values, flux controller		
▹P0521◃	Flux actual value	Display
Set values, flux controller		
▹P0335◃	Current Id set value	Display

[1)] The flux controller doesn't use this value internally.

10.5.2.2 General overview field weakening controller - ASM

The field weakening controller - ASM is implemented as PI controller.

The Kp factor of the field weakening controller - ASM ▹P1270◃, which can be set via the ProDrive has no unit. The field weakening controller ASM reset time can be entered in ▹P1271◃.

Normally it is not necessary to change the standard setting of Kp ▹P1270◃ and Tn ▹P1271◃.

10.5.2.3 Details field weakening controller - ASM

Typical values (empirical values):

Kp field weakening controller ASM ▹P1270◃	1.0 to 5.0
Integral-action time field weakening controller ASM ▹P1271◃	5.0 ms

The parameters of the field weakening controller - ASM depend on the mechanical time constant T_{mech}. If, e.g. T_{mech} is less, the Kp field weakening controller must be set greater.

10.5.2.4 General overview flux controller

The output of the field weakening controller is connected to the set value of the flux controller at synchronous motors. The output of the flux controller supplies the Isd set value. The flux actual value is calculated from a model of the asynchronous motor.

The flux controller is implemented as PI controller.

The Kp factor of the flux controller ▷P1272◁ which can be set via ProDrive has no unit. The flux controller reset time can be entered in ▷P1273◁.

Normally it is not required to change the standard setting of Kp ▷P1272◁ and Tn ▷P1273◁.

Background referring to the flux controller

By using a flux controller the field build-up process can be accelerated by applying a high field current in the motor for a short time.

10.5.2.5 Details flux controller

Typical values (empirical values):

Kp flux controller ASM ▷P1272◁	3.0 to 6.0
Integral-action time controller ASM ▷P1273◁	Tn = Tr / 2
Tr: Rotor time constant ▷P0522◁	

10.5.2.6 Field weakening asynchronous motors

At the operating range of an asynchronous motor it is always differed between the base speed range (below the rated speed of the motor), whereat the flow remains constant, and the field weakening range (over the rated speed), whereat, in order to achieve greater speed than the rated speed, the flow decays inversely proportional to the speed (see ▷Figure 105◁). The typical characteristic curves of the motor torque and of the motor power in the base speed - and in the field weakening range are displayed in ▷Figure 106◁ .

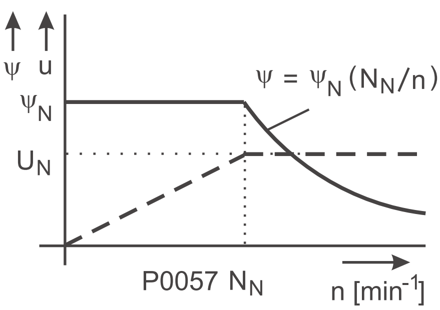


Figure 105: Flow and voltage

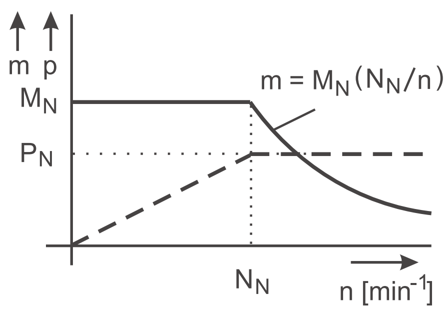
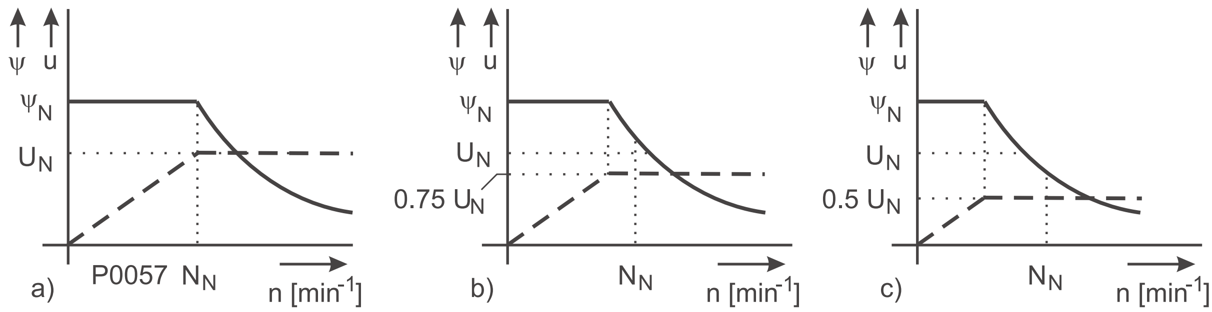


Figure 106: Torque and power

If the DC-link voltage is high enough, normally an automatic field weakening starts, as soon as the motor has reached the rated speed, see ▹Figure 107◃ (a).

If the motor has not reached its rated speed yet and the output voltage of the drive cannot be increased anymore (inadequately DC link voltage), the field weakening is supported by an additional controller (see ▹Figure 7◃ on page 21), which evaluates the difference between the maximum value and the actual value of the modulation index, in order to start an earlier field weakening (see ▹Figure 107◃ (b) and (c)).



a) Sufficient DC-link voltage
b) DC-link voltage = 75 % from the rated value
c) DC-link voltage = 50 % from the rated value

Figure 107: Field weakening at asynchronous motors

10.6 Free programmable PID controller

In order to solve customer-specific control tasks this freely programmable PID controller can be used.

The cycle time of the PID controller is 12530 µs.

Control structure of the PID controller:

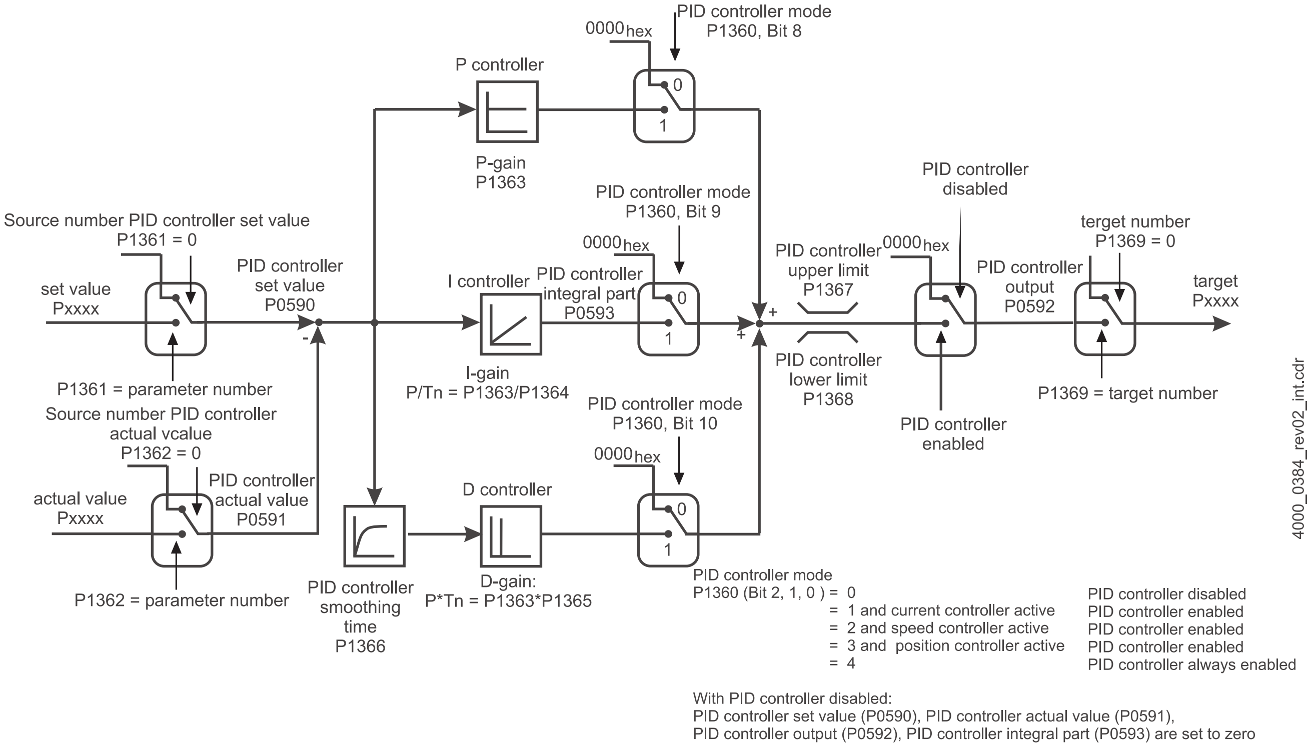


Figure 108: Freely programmable PID controller

The set values and actual values can:

- be connected by the specification of parameter number with sources.
- be written by analog inputs or the PLC

They remain unchanged in case they are not connected with sources or are not written.

The target of the output can be selected via target number PID controller ▹P1369◃.

set value, actual value and output are scaled values.

P-gain is a scaled value,
e.g. PID controller as a speed controller:

Output = (set value - actual value) * P-gain

Torque [%] = (speed set value [%] - speed actual value [%]) *P-gain

If P-gain = 1, then the torque = 100% at a speed control deviation of 100%.

By means of selection of the accordant bits (8 to 10) in PID-controller mode ▹P1360◃ the programmable controller is able to be configured as P-, PI-, PD-, PID- I-, ID-, and D-controller.

The activation of the PID controller can be synchronized by selection of the bits 0 to 2 in the PID controller mode ▹P1360◃ with current-, speed- or position controller.

For the PID controller the following transmission function is valid:

$$Y(s) = K_p + \frac{K_p}{T_n} \cdot s + K_p \cdot T_{vor} \cdot s$$

That means, that K_P for the D- and I-controller component also then is effective, if the P-controller is deactivated.

Therewith the following becomes valid:

$$K_I = \frac{K_p}{T_n}$$

$$K_D = K_p \cdot T_{vor}$$

10.7 Two-level-controller

The b maXX® controller has 2 two-level controllers, which independently are operating and which are freely configurable.

With the two-level controller 1 fixed and variable switching thresholds can be monitored. At the two-level controller 2 there are no relative switching thresholds.

The operating mode of the according two-level controller is configurable.

The two-level controller works according to the data type of the actual value within a value range

- from -32768 to +32767 with signed variables (INT, DINT) and
- from 0...65535 with unsigned data types (UINT, UDINT, WORD, DWORD).

Accordant the parameters are interpreted for the switching thresholds with or unsigned.

At specification of 32 bit parameters the two-level controller only evaluates the high word (bit 31 ... 16) for the actual value.

Structure diagram of two-level-controller 1:

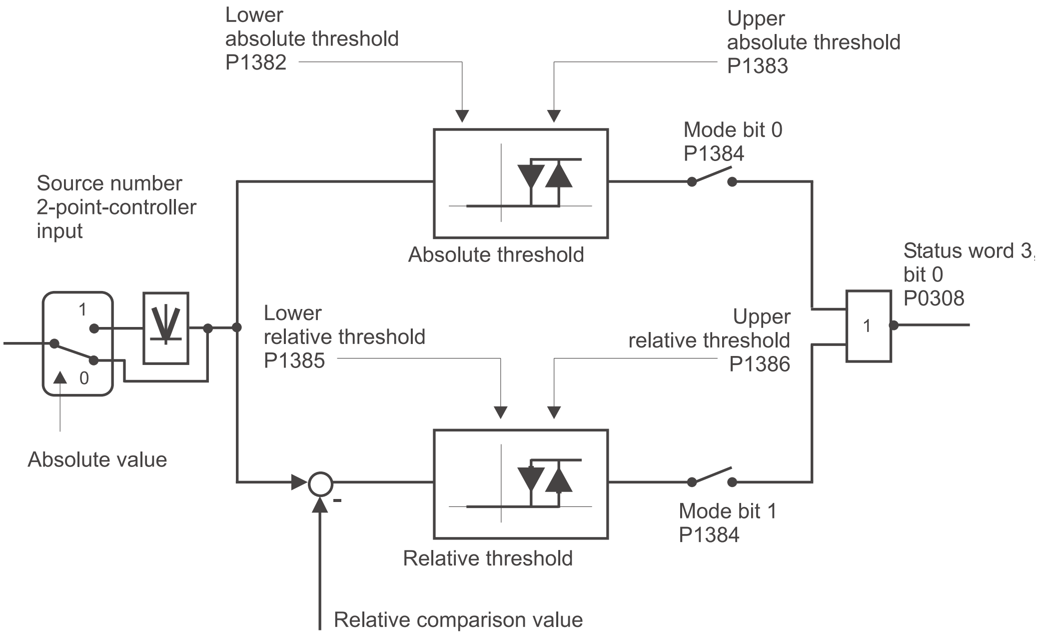


Figure 109: Structure diagram of two-level-controller 1

Controller structure diagram two-level-controller 2:

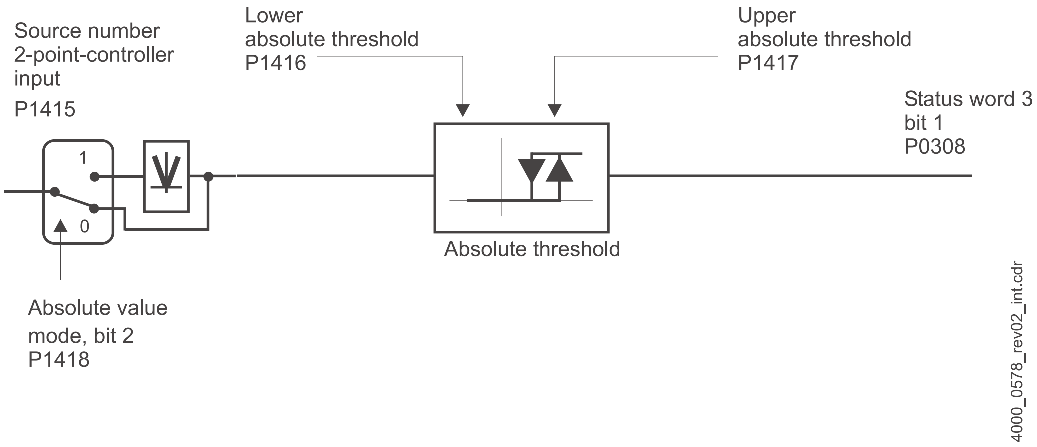


Figure 110: Controller structure diagram of two-level-controller 2

10.7.1 Two-level-controller with absolute thresholds

This operation mode is the classical application of two-level controllers.

The following is valid for two-level controllers 1:

Both parameters, TLC_AbsLowerThreshold, (▹P1382◃) and TLC_AbsUpperThreshold, (▹P1383◃) determine the hysteresis. The lower switching threshold always must be smaller than the upper switching threshold - the controller internally does not check the ratio of these values.

The two-level-controller with absolute thresholds is activated by bit 0 = 1 in parameter Two-level-controller 1 (▹P1384◃) mode:

The two-level-controller switches off, if the following is valid:
Two-level-controller input $\geq$ Two-level-controller upper switching threshold

The two-level-controller switches on, if the following is valid:
Two-level-controller input $<$ Two-level-controller lower switching threshold

Usage e. g. for temperature monitoring, speed monitoring a. s. o.

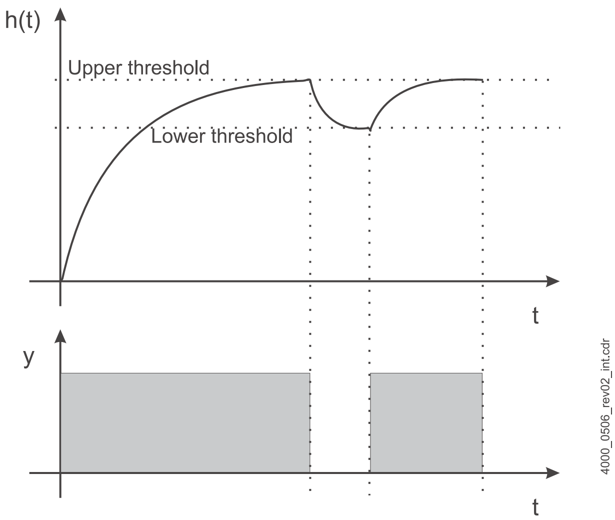


Figure 111: Two-level-controller with absolute thresholds

Accordingly the following is valid for the two-level controller 2:

Activation with bit 0 = 1 in parameter Operation mode Two-level-controller 2 (▹P1418◃). Threshold values are the upper threshold (▹P1417◃) and the lower threshold (▹P1416◃).

10.7.2 Two-level-controller with relative thresholds

Only valid for two-level controller 1.

In this operating mode the actual value 2-level-controller (▹P1380◃) is compared with an upper and lower switching threshold, which is calculated from the momentary value of the parameter number relative compare value (▹P1381◃). Therefore the switching point is not a definite value, but follows the momentary value, which is specified in parameter ▹P1381◃.

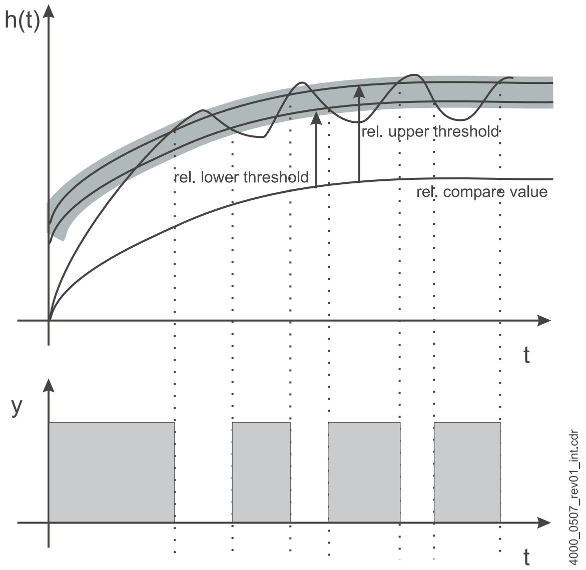


Figure 112: two-level-controller with relative thresholds

The switching hysteresis arises from the difference between the lower and upper switching threshold.

The two-level-controller with relative thresholds is activated by bit 1 = 1 in parameter operating mode Two-level-controller ▹P1384◃:

The two-level-controller switches off, if the following is valid:
Two-level-controller input $\geq$ Two-level-controller relative upper switching threshold

The two-level-controller switches on, if the following is valid:
Two-level-controller input $<$ Two-level-controller lower switching threshold

Example for use: Heatsink control of the power unit

The output of the two-level-controller switches a solenoid valve for the cooling water supply of the power unit cooling.

In order to avoid dew, the heatsink temperature of the power unit never may be less than the environmental temperature.

Control size is the heatsink temperature (parameter Power Unit heatsink actual temperature, ▹P0482◃). This actual value is compared with the relative compare value of the environmental temperature at the heatsink. This can e.g. be determined via an external temperature sensor which is connected at the analog input.

The relative offset must be 5 °C. Hysteresis also 5 °C, e.g. that the 2-level-controller relative lower threshold = 5 and the 2-level-controller relative upper threshold = 10.

10.7.3 Combination of the operating modes absolute and relative thresholds.

Both threshold types can be activated commonly, in order to limit and monitor the behavior of the relative threshold by a constant, absolute threshold controller. The output of the 2-level-controller 1 is activated if the actual value remains under the relative ***and*** absolute lower threshold and is deactivated, if the actual value exceeds the relative ***or*** absolute upper threshold (NOR logic).

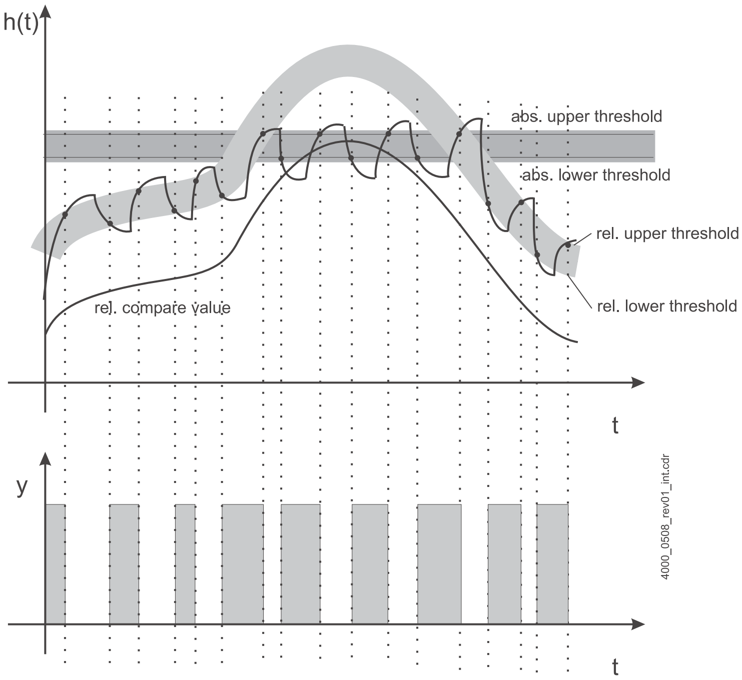


Figure 113: Combination absolute and relative thresholds

10.7.4 Sign-independent monitoring

By setting mode bit 2 ▹P1384◃ or ▹P1418◃ the controller generates the absolute value of the actual value and compares this with the thresholds which accordingly must be positive. Application for this purpose e. g. speed monitoring (independent of pos. and neg. rotational direction).

10.7.5 Linking of the controller output with the target parameter

The output of the 2-level-controller can directly be used to change a writable b maXX® parameter. This method is related to that of the digital inputs. All 16 bit parameters can be used as a target parameter. With 32-bit parameter the high-word only (bits 16...31) is writable.

When switching off a two-level controller the bit pattern at LOW (in consideration of bit selection) is automatically written to the target parameter.

Meaning of the linking parameters:

Parameters for two-level controller 1:

Parameter name	Number	Meaning
Target parameter number 1 output	▹P1387◃	Target parameter number
Bit selection 1	▹P1388◃	Selection of the bits in the target parameter, which have to be changed
Bit pattern at LOW 1 output	▹P1389◃	Bit pattern, which is written in the target parameter at controller output LOW.
Bit pattern at HIGH 1 output	▹P1390◃	Bit pattern, which is written to target parameter at controller output HIGH.

Parameters for two-level controller 2

Parameter name	Number	Meaning
Target parameter number 2 output	▹P1419◃	Target parameter number
Bit selection 2	▹P1420◃	Selection of the bits in the target parameter, which have to be changed
Bit pattern at LOW 21 output	▹P1421◃	Bit pattern, which is written in the target parameter at controller output LOW.
Bit pattern at HIGH 2 output	▹P1422◃	Bit pattern, which is written to target parameter at controller output HIGH.

At a pos. edge of the two-level controller output the target parameter is changed as follows:

Target parameter =		(target parameter *and not* (**bit_selection**))
	OR	(**Bit pattern at high** *AND* **bit_selection**)

At a neg. edge of the two-level controller output the target parameter is changed as follows:

Target parameter =		(target parameter *and not* (**bit_selection**))
	OR	(**bit pattern at low** *AND***bit_selection**)

If an error occurs at writing to the target parameter (e. g. value greater than the maximum value or smaller than the minimum value), by the controller (error code 24) an according error message occurs.

11 OPERATING MODES

The drive operating modes which are implemented in the controller firmware are meant here. The following operating modes were implemented.

Operating mode	Identifier
Auto-tuning	-7
Spindle positioning	-6
Synchronous operation	-5
Position control	-4
Speed control	-3
Current control	-2
Find notch position	-1
Target position set value	1
Speed setting	2
Jog operation	5
Homing operation	6

The operating modes are set in the parameter "Set operating mode" ▷P1000◁. The current operating mode is shown in the "Operation mode actual" ▷P0304◁.

11.1 Operating modes general

In this chapter the functions and parameters are described which are valid for several operating modes.

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Set value generator according to the operating mode

- Synchronization of the control cycle to an external set value
- Moving mean value generation of position set values
- General positioning set values and actual values
- General positioning state
- General positioning feed forward override
- Position switch monitoring
  - HW limit switch
  - SW limit switch

11.1.1 Operating mode switch-over

The switching between the operating modes is possible at inhibited drive (off-line switch-over) as well as at the enabled drive (online switchover).

The operating mode notch position search (-1) is a special case. A switchover into this operating mode can only be taken over at inhibited drives.

The switchover can be inhibited to avoid temporary inconsistencies between the operating mode and dependent-on-mode bits in the control word (control word ▷P0300◁ bit 13). If the bit is set the set operating mode remains. A change of the set operating is accepted only if the bit 3 in the ▷P0300◁ is deleted. A new operating mode can therefore be activated with the control word. The switchover inhibit applies to all operating modes.

The present state of the operating switchover is shown in the "Status word 3" ▷P0308◁ bit 2.

11.1.2 Smooth switch-over in operating mode position control (-4)

The function "Synchronization to actual speed value" makes a smooth switch-over into the operating mode position control (-4) at constant speed possible. The function can be activated via the "position controller mode" ▷P1050◁ bit 5 = 1.

This function can be used e.g. at the cyclical set value specification by a PLC via ▷P0369◁ "position set value for interpolation" or ▷P0370◁ "position set value angle for interpolation". At the same time it makes sense to activate the extrapolation at set value fail (▷P1050◁ bit 3 = 1), in case the operating mode switchover and the set value specification don't take place at the same time.

Additionally, the function "set value inhibit" in the parameter "control word" ▷P0300◁ bit 11 inhibits the position set values. As long as it is set the controller doesn't accept the position set values in ▷P0369◁ and ▷P0370◁ continues to extrapolate. If the bit "set value inhibit" is reset the set values are accepted by the controller.

The speed synchronization in the position control (-4) is possible in the following operating modes:

- Spindle positioning (-6)
- Synchronous operation (-5)
- Speed control (-3)
- Target position set value (1)
- Speed setting (2)
- Jog operation (5)
- Homing operation (6)

11.1.3 Smooth switch-over in positioning operating modes

If the function "Synchronize to actual speed value" (▹P1190◃ "positioning mode" bit 2 = 1) it is possible to switch over smoothly from one arbitrary operating mode (except of notch position search (-1)) in one of the following positioning operating modes:

- Synchronous operation (-5)
- Target position set value (1)
- Jog operation (5)
- Homing operation (6)

The speed set value of the new operation mode is synchronized to the current speed actual value and then is accelerated or is braked to the defined set speed.

Thereby, the drive keeps the last speed for 16 ms (based on the switch-over operation mode). Within this time a new positioning job can be initiated which is taken over directly. After the 16 ms expired the ramp which was set in parameter ▹P1213◃ "positioning stop delay" is accelerated or braked to the set speed.

Exception: The synchronization in the required target position operates only if the trapezoidal profile or the s-curve profile (▹P1190◃ bit 3 = 0 and bit 4 = 0) was set.

11.1.4 Set value generator in dependence with the operating mode

Dependent of the operating mode the set value generator can act on the following target parameters (settable by "set value generator mode" ▹P0440◃ bits 0 to 2):

Target parameter	Parameter no.	Operating modes
Ramp function generator input	▹P1171◃	Speed control (-3) / Speed setting (2)
Speed additional set value	▹P1040◃	Target position set value (1), Speed control (-3) / Speed setting (2)
Torque set value	▹P0331◃	Current control (-2)
Positioning actual record number	▹P1191◃	Target position set value (1)

The set value generator is described in the chapter ▹Set value generator◃ on page 203.

11.1.5 Synchronization of the control cycle on an external set value

At control-operated modes the controller cycle can be synchronized on an external signal (set value via a fieldbus). The configuration of the drive is described in the chapter ▹Synchronization◃ on page 172.

11.1.6 Sliding average of position set values

At unsmoothed position set values or to reduce possible acceleration peaks of a specified curve it is possible to smooth cyclic and synchronized position set values using the sliding average method.

By parameterization of "position set value - smoothing interval" (▹P1059◃) the number of interpolation points to generate the sliding average (number of the averaged values). 0 means that no smoothing takes place.

Accordant to operating mode the following position set values can be smoothed:

Position set value	Parameter no.	Operating mode
Position set value for interpolation	▹P0369◃	Position control (-4)
Position angle value for interpolation	▹P0370◃	Position control (-4)
Synchronous operation position set value	▹P0471◃	Synchronous operation (-5)
Synchronous operation angle set value	▹P0472◃	Synchronous operation (-5)

11.1.7 Positioning set values and actual values

Set values and actual values	Parameter no.	Operating modes		
		Target position set value (1)	Jog operation (5)	Homing operation (6)
Positioning control position actual value	▹P0462◃	X	X	X
Positioning control position set value	▹P0463◃	X	X	
Positioning control speed set value	▹P0464◃	X	X	X

11.1.8 General positioning state

Positioning Status P0460				
Bit	**Meaning**	**Operating modes**		
		Target position set value (1)	Jog operation (5)	Homing operation (6)
6	1: Set speed > Maximum speed; limited to maximum speed	X	X	X
8	1: Homing took place	X	X	X
10	1: Running positioning or homing stopped	X		X
12	1: Set value reached	X	X	X
15	1: Set speed = 0	X	X	X

11.1.9 Positioning feed forward override

The feed forward override is valid for the following operating modes:

- Target position set value (1)
- Jog operation (5)

Using the factor "Positioning feed forward override" ▹P1219◃ the jogging speed ▹P1210◃ (jog operation) or the maximum traverse speed of the positioning set ▹P0602◃ (positioning target) "online" (during the movement) can be adapted.

Jog operation: operating jogging speed = ▹P1210◃ * (▹P1219◃ in %) / 100

Target position set value
operating traversing speed = ▹P0602◃ (▹P1219◃ in %) / 100

The limit to the maximum speed of the drive is made after multiplying by the feed forward override.

11.1.10 Positioning switch monitoring

The following positioning switches are supported: Limit switch (hardware or software limit switch) and reference switch.

Limit switch

The limit switch limits the traversing range.

HW limit switches differ in positive or negative limit switches whereas SW switches are marked by "1" or "2". The following should apply to the limit switches:

negative HW limit switch < SW limit switch 1 < SW limit switch 2 < positive HW limit switch

In addition:

negative switch ← negative direction   positive direction → positive switch

The limit switch monitoring applies to the following operation modes:

- Target position set value (1)
- Jog operation (5)

The limit switches are shown in Figure 27 on page 41.

Reference switch

In the Homing (6) operating mode the HW positioning switches serve as homing mark or reference switches. Either one of the HW positioning switches which were defined at the positioning target (1) or the jogging mode (5) operating type as the limit switch or a separate HW positioning switch (zero switch) are used. Reference switches (or zero switches) are described in detail in the Operating mode Homing (6) on page 288.

Reference switch monitoring applies to the homing (6) mode.

Wiring the switches

The HW end and the HW origin switch can be wired as a NO contact or as a NC contact. The wiring type can be set in the drive via the parameter P1208. Due to safety reasons (detection of an open circuit) a NC contact is recommended.

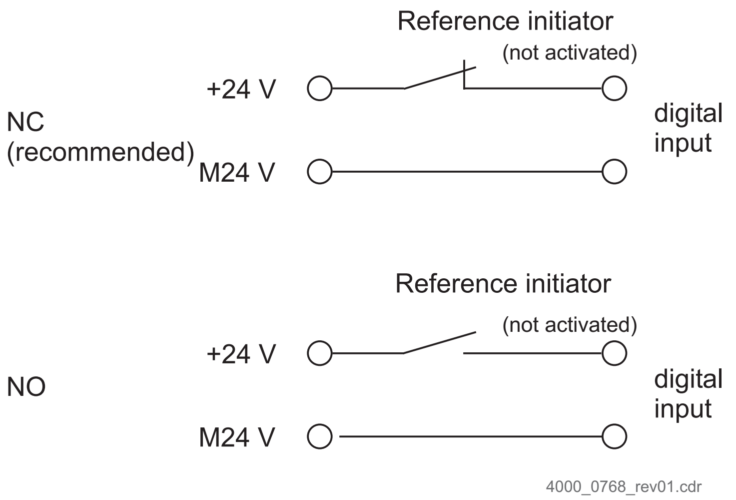


Figure 114: Wiring of the digital inputs

11.1.10.1 Hardware limit switch

The hardware limit switch monitoring is controlled via the parameter Positioning mode (P1190), bit 1. Bit 1 activates or deactivates monitoring. An error message can be set with bit 6, which additionally to the braking procedure is then shown.

The status of the limit switch is displayed independently of the operating mode and of the further settings always in parameter P0461 Positioning switch status.

Selection of the digital inputs for hardware limit switch.

For the hardware limit switches any inputs of a digital IO module may be used. The selection of the input for the limit switch operates with the help of parameter ▹P1214◃ (positive hardware limit switch) or ▹P1215◃ (negative hardware limit switch).

Hardware limit switch monitoring

If the operating mode position target position setting is active and the drive is enabled and one of the hardware limit switches is activated, the following reaction operates:

- In the parameter ▹P0461◃ Positioning switch status the accordant bit for the HW-limit switch is set.
- With the ramp, which was set, it is immediately decelerated to speed = 0 in the parameter Positioning stop deceleration ▹P1213◃.
- The travel direction further into the switch is inhibited.
- If the behavior 'Error message" has been selected (Positioning mode ▹P1190◃ bit 6 = 1), an error is initiated.
  Error 198: Negative hardware limit switch active
  Error 199: Positive hardware limit switch active
  The generated error does not result in a pulse inhibit. The drive remains position-controlled. This error must be accepted and then a new traveling request can be executed.

Exceed the limit switch

If now a new positioning request is started a checking of the traveling direction operates:

New positioning data leads in inhibited speed direction:

- The positioning data is not executed.
- Inhibited speed direction remains inhibited.
- In the error generation behavior the error message anew is generated.

New positioning data leads in open speed direction:

- The positioning data is executed.
- The inhibited speed direction remains inhibited further on, as long as accordant HW-limit switches are set.
- In the error generation behavior the error message is generated again, if at the end of the positioning data (new target position) the accordant HW-limit switch is still set.

The HW-limit switch can not be used to stop (interrupt) a running positioning, because, in any case, the new target positioning must lead in the open speed direction.

Special case both limit switches active

If both hardware limit switch are active then both travel directions are inhibited. Before a travel request can be executed, a limit switch must be vacant.

11.1.10.2Hardware zero switch

The HW-zero point monitoring is controlled via the parameter positioning mode (▹P1190◃), bit 1. The monitoring is activated or deactivated by bit 1.

Independent of the operation mode and the further settings, the status of the zero point switch is always displayed in the parameter ▹P0461◃ Positioning switch state.

11.1.10.3Software limit switch

The SW limit switch monitoring is activated or deactivated via Positioning mode (▹P1190◃), bit 0.

Software limit switch parameter

The position of the SW limit switch is set in the parameter ▹P1196◃ (SW limit switch 1) and ▹P1197◃ (SW limit switch 2).

Software limit switch monitoring

The behavior of the software limit switch monitoring can be set. There are two different modes:

- **Behavior of automatic limitation**

  If the behavior automatic limitation is set for the software limit switches (Positioning mode ▹P1190◃ bit 5 = 0), target positions, which are outside the limit switch are limited to the accordant limit switch. The software limit switch is approached. Furthermore the status flag for the accordant software limit switch is set and the message setpoint reached is not displayed.

- **Behavior of error message**

  If error message has been selected for the software limit switch (Positioning mode ▹P1190◃ bit 5 = 1), the drive generates the error message 196 or 197 ’Software limit switch 1 or 2 active’, if the positioning target is outside the limit switch.

  The drive thereby remains position-controlled (braked with ▹P1213◃ Positioning stop deceleration) and doesn’t execute the incorrect request. The affected limit switch is shown in the parameter Positioning switch status (▹P0461◃).

  As long as the error message is present, no new positioning requests are executed. At first the error message must be accepted. Also the status message target position is not displayed.

  If a positioning request with invalid target position is activated, while the drive still is in motion, the running positioning still procedure is completed.

11.2 Operating mode position control (-4)

The operating mode position control is a control-operated positioning.

This operating mode is set with parameter ▹P1000◃ = -4.

The operating mode position control is shown in ▹Figure 17◃ on page 31.

The following general parameter and functions are available to the position control operation mode (see ▹Operating modes general◃ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Synchronization of the control cycle to an external set value
- Moving mean value generation of position set values

11.2.1 Parameter overview position control

Number	Name / meaning	Remark
	Set values for interpolation	
▹P0369◃	Position set value for interpolation	
▹P0370◃	Position angle set value for interpolation	
	Smoothing average	
▹P1059◃	Position set value smoothing interval	
	Interpolation	
▹P1050◃	Position controller mode	Bit 3: Extrapolation at set value failure Bit 4: Distribution of the torque control along the bus cycle
	Interpolated set values (input position controller)	
▹P0361◃	Position set value	
▹P0363◃	Position set value angle	
▹P0364◃	Position set value revolutions	
	Overall operating mode settings	
▹P1050◃	Position controller mode	Bit 5: Synchronization on actual speed
	Actual values	
▹P0362◃	Position actual value	Display [1)]
▹P0392◃ / ▹P0402◃	Encoder 1 / encoder 2 actual revolutions	Display
▹P0391◃ / ▹P0401◃	Encoder 1 / encoder 2 actual angle	Display

[1)] The parameter is initialized to the encoder angle and can be updated during operation.

11.2.2 Linear interpolation of the position set value

At the operating mode Position control the position set value (▹P0369◃, ▹P0370◃), which is transmitted in each bus cycle, is linearly interpolated in the control cycle.

The ▹Figure 115◃ demonstrates the ideal example with a position set value transfer rate (▹P0800◃, ▹P0860◃) of 4 control cycles (each 125 µs).

Linear position interpolation
(no pre-control smoothing, pre-control factors = 100%)

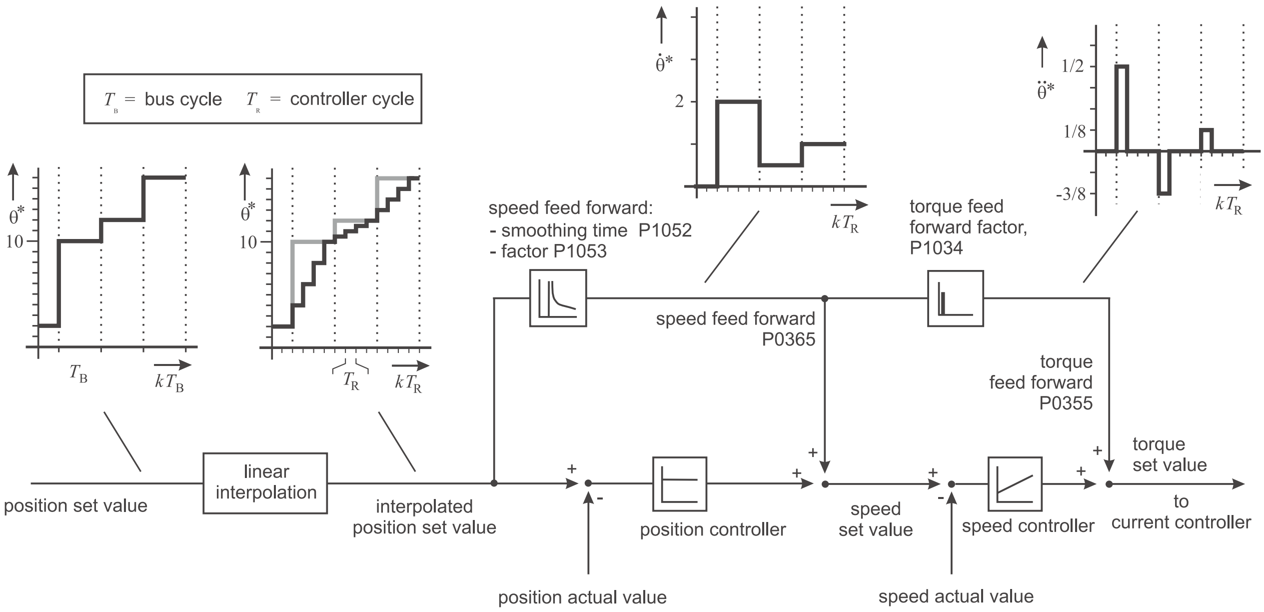


Figure 115: Example linear position interpolation

Due to the interpolation the speed control is stair-step-shaped and the torque control (or the acceleration control) becomes spicular.The torque control, which is necessary in a bus cycle occurs in the controller cycle of the bus cycle. The spikes of the torque control can cause noise in the drive and due to its current limit they practically cannot be implemented from the power unit. This can result in the speed control having to be rounded-off and/or sub-scaled (see ▹P1052◃ and ▹P1053◃). Another possibility is to sub-scale the torque control ▹P1034◃. But this can result in an increase of the position deviation.

From FW 03.08 onwards, a modification of the control at the linear interpolation position can be made, so that the torque control is distributed equally on the bus cycle. This means that the torque control in the bus cycle becomes content, whereat its average value remains unchanged. In this case the speed precontrol is not constant within a bus cycle anymore, but linearly changes with a rising, which corresponds to the distributed torque precontrol value. ▹Figure 116◃ shows the modified linear interpolation accordant to the example of ▹Figure 115◃ (no precontrol rounding-off, precontrol factor = 100%). As the precontrols do not accord to the interpolated position anymore (e. g. the integral of the speed precontrol is halved), the position deviation theoretically will be increased. Practically the position deviation can be reduced, because the control parameters can be increased and the precontrol can be used better.

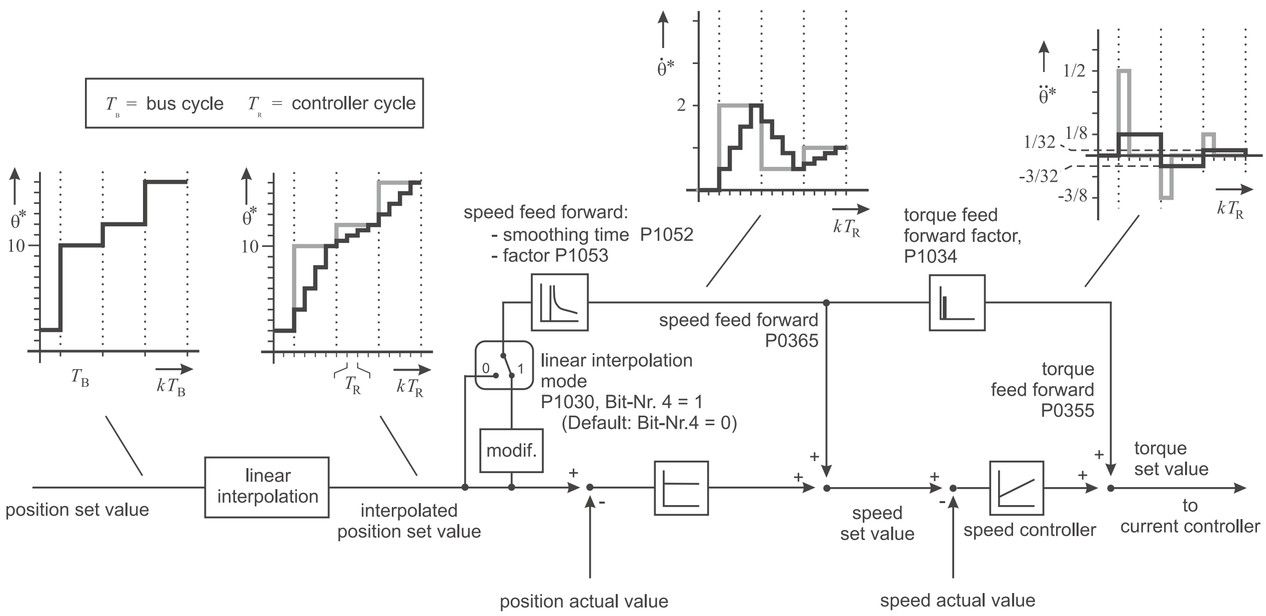


Figure 116: Modified linear position interpolation

The modification of the linear position interpolation is only available for the operating mode position control and in general is not active, but it can be activated, if the bit 4 (linear interpolation mode) of the position controller mode ▷P1050◁ is set to 1 (also see ▷Notch filter◁ from page 221).

11.3 Operating mode speed control (-3) / speed setting (2)

The operation modes speed control and the speed setting are the same speed-controlled operation modes. However, the handling of the ramp function generator control bits differ (or if positive or negative logic is used).

In order to differentiate between these operating modes in the control they are set via different commands. The operation mode speed control is set via the ▹P1000◃ = -3, the operation mode speed setting via ▹P1000◃ = 2.

Speed control and speed setting modes are shown in ▹Figure 18◃ on page 32.

The following general parameters and functions are provided to the speed control or the speed specification (see ▹Operating modes general◃ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Set value generator according to the operating mode
- Synchronization of the control cycle to an external set value

Ramp function generator for the external speed set values

In the operation mode speed control/speed setting the speed set value is specified by a ramp-function generator. The ramp-function generator reduces an overshoot of the actual speed value if abrupt speed set value changes occur. For this, an abrupt speed set value change is converted into a ramp function. At a ramp function "trapezoid" the acceleration is limited whereas at a ramp function "S-curve" a jerk limitation can occur. If the set value changes are not abrupt, whereat the acceleration does not exceed the limits of the ramp function, the ramp function generator does not cause a limit to the set value.

The set value generator and the motor potentiometer can directly write on the 16-bit ramp function generator input ▹P1171◃. It can be written from the fieldbus or via analog inputs directly into the input of the ramp function generator (16 bit) ▹P1171◃ or (32 bit) ▹P1179◃. Furthermore, the two-state controller or the freely programmable PID controllers can write on the ramp function generator input.

The ramp function generator and its parameters are described in the chapter ▹Ramp function generator◃ from page 199.

11.3.1 Parameter overview speed control / speed setting

Number	Name / meaning	Remark
	Set values (input ramp function generator)	
▹P1171◃ / ▹P1179◃	Ramp function generator input 16 bit / Ramp function generator input 32 bit	Depending on ▹P1170◃ bit 8: 0: P1171 enabled 1: P1179 enabled
	Set values (output ramp function generator)	
▹P0431◃	Ramp function generator output	
	Speed controller set values	
▹P0351◃	Speed set value	
▹P1040◃	Speed additional set value	
▹P0352◃	Speed set value total	
	Speed controller actual value	
▹P0353◃	Speed actual value	Display

11.4 Operating mode current control (-2)

The current control operating mode is a torque setting mode. Indirectly dependent of the Kt factor and the magnetic flux set value a set torque current is commanded (see ▹Torque monitoring◃ on page 228). The set field current is determined by the SM field weakening controller or by the ASM flux controller. The torque current is controlled in the d-q current controller.

The operation mode current control is set via the ▹P1000◃ = -2.

The operation mode current control is shown in ▹Figure 19◃ on page 33.

At the operation mode current control the controller receives the torque set value from the writable torque set value ▹P0331◃ (it is possible to add an additional torque set value ▹P1022◃). The torque set parameter value can be predefined by analog inputs, by a fieldbus, by a set value generator, by a two-state controller or by a freely programmable PID controller.

The following general parameter and functions operating mode is available to the current control operating mode (see ▹Operating modes general◃ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Set value generator according to the operating mode
- Synchronization of the control cycle to an external set value

11.4.1 Parameter overview current control

Number	Name / meaning	Remark
	Torque set values	
▹P0331◃	Torque set value	
▹P1022◃	Torque additional set value	
	Magnetic flux	
▹P0520◃	Flux set value	Display
▹P0521◃	Flux actual value	Display
	Torque current	
▹P0332◃	Current Iq set value	Display
▹P0333◃	Current Iq actual value	Display
	Torque actual value	
▹P0344◃	Standard torque actual value	Display
▹P0508◃	Additional torque actual value	Display
	Field current	
▹P0335◃	Current Id set value	Display
▹P0336◃	Current Id actual value	Display

11.5 Operating mode target position set value (1)

The operation mode Target position set value is a drive-controlled positioning. Because of the setting of the target position in the drive the traveling profile is calculated in the drive and the target position is approached. The profile for the own axis can be calculated only.

This operating mode is set with parameter ▹P1000◃ = 1.

The target position mode is shown in▹Figure 20◃ on page 34.

With the positioning a

- linear positioning or a
- rotary table positioning

can be achieved.

The target position mode is provided by general parameters and functions (see ▹Operating modes general◃ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Set value generator according to the operating mode
- Synchronization of the control cycle to an external set value
- General positioning of set values and actual values
- General positioning state
- General positioning feed rate override
- Hardware limit switch monitoring
- Software limit switch monitoring

For the speed profile a trapezoidal profile (time optimum), a S-curve (jerk smoothed) or a $\sin^2$ profile (jerk smoothed) can be selected ▹P1190◃ bits 3, 4.

The drive has 16 positioning data sets (1 ... 16) and an active positioning data set (0), in which the positioning data (e.g. positioning set value (target position), positioning speed, positioning acceleration, a. s. o.) is saved.

The positioning data can

- static (that means before the positioning) or
- dynamic (during an active traveling process)

be changed. At dynamic changes the traveling profile automatically is adjusted to the new positioning data.

The target position can

- absolute
- relative to the target position or
- relative to the instantaneous actual position (’on the fly positioning’)

be specified.

11.5 Operating mode target position set value (1)

For the sensing of the positioning actual value one of the supported encoder systems can be used. In order to establish an absolute reference from the drive position to the travel distance at the encoder systems, which do not supply absolute positioning information (e. g. incremental encoder and singleturn encoder), there are different possibilities of homing. These are achieved as an own operating mode and are prescribed in a separate section.

11.5.1 Notes to the original and new control of positioning

The starting behavior and the handshake procedure of the position target position setting was changed with software version 3.0.

As far as version 3.0 the behavior was as with the V-controller. The position starting was made with bit 11 (start positioning) of the control word ▹P0300◃, bit 4 was used for the handshake procedure (new set value).

The new behavior (from version 3.0) uses bit 4 only. With every rising edge in this bit the positioning data settings are copied (set X in set 0), internally taken over and the positioning procedure is started.

The original behavior still is possible. Herewith bit 9 must be set in parameter ▹P1190◃ Positioning mode. A description of the original starting behavior is found in ▹Appendix positioning ('original behavior')◃ from page 281.

In the following only the new behavior is prescribed.

11.5.2 Positioning settings

The controller has 16 positioning settings (1..16) and one active positioning data set (0).

Positioning setting no.	Positioning data
0	▹P0600◃ to ▹P0607◃
1	▹P0610◃ to ▹P0617◃
2	▹P0620◃ to ▹P0627◃
...	
16	▹P0760◃ to ▹P0767◃

Each set consists of eight positioning data. Based on the positioning set 0 (active positioning set) the positioning data are as listed in the following:

Positioning setting 0	
Positioning data	**Description**
▹P0600◃	Target position
▹P0601◃	Target input
▹P0602◃	Positioning speed
▹P0603◃	Positioning acceleration

Positioning setting 0	
Positioning data	**Description**
▹P0604◃	Positioning deceleration
▹P0605◃	Maximum jerk
▹P0606◃	Smoothing time
▹P0607◃	Relative target position

Via parameter Positioning current data record ▹P1191◃ it is set, from which positioning data set the data is accepted at the next starting command (rising edge in the control bit ’New setpoint’, control word ▹P0300◃ bit 4). Thereby the data is copied from the specified positioning data set into the positioning data set 0.

P1191 Value	Positioning setting no.
0	0 [1)]
1	1
2	2
...	...
16	16

1) ▹P1191◃ = 0 means that the data is not copied from other positioning sets into positioning set 0

Additionally a mode (also see ▹P1190◃, bit 11) can be set, where the positioning data can be taken over, if there is a change of the actual positioning set ▹P1191◃ and the positioning can be started. In this case there is no edge in the control bit "New setpoint" required, but the bit must be set.

11.5.3 Positioning procedures

There are two different positioning procedures:

- Procedure of single positioning settings (’single set point”):
  With this procedure a positioning data set is started and the drive is positioned on the target and stops there. It is possible to activate a new task, even during positioning (edge of new setpoint). This is immediately accepted, the drive changes directly to the new positioning data.
  This procedure is selected, if the bit ’change setting immediately” (bit 5 im control word ▹P0300◃) is not set.
- Setpoint setting (“Set of setpoints”): Procedure of a speed profile.
  With this procedure several positioning data are, one after another, activated. The drive shall not come to a standstill at the first target, but should activate the next data from the first target position.
  This procedure is selected, if the bit ’Immediately change set” (bit 5 in control word ▹P0300◃) is set.

The status of the bit ’Immediately change set” in the control word is evaluated together with the activation of a travel request, that means always at the rising edge of ’New set point”.

11.5.4 Control of target position set value

In order to control the target position set value the following bits are used in the control word ▹P0300◃:

Control word P0300		
Bit	Name	Meaning
4	Start: New set value	Signal for the acceptance of the data and for the starting of the positioning procedure. Used for the handshake procedure. Rising edge activates a positioning procedure
8	Stop	Stop running positioning. The function is specified in ▹Stop running positioning◃ on page 277.
12	Reset	Cancel running positioning. The function is specified in ▹Cancel positioning◃ on page 277.
5	Immediately change set	Mode of the positioning procedure: 0: Do not change set immediately, procedure of single positioning settings. 1: Change set immediately, procedure of set value setting. See ▹Positioning procedures◃ on page 271.
6	absolute/relative	Mode of target input via control word: 0: absolute 1: relative See ▹Target inputs◃ on page 276.

The status of the position target setting is shown in the status word ▹P0301◃ as well as in the "Positioning status" ▹P0460◃.

Status word P0301		
Bit	Name	Meaning
10	1: Target position reached	Message that the positioning target has been reached.
12	1: Set value acknowledge	Handshake signal, resetting of the drive over the acceptance of the positioning data:
Positioning control status P0460		
0	1: Target position set value switched on	
7	1: Target position set value completed	
12	1: Set value reached	
10	1: Running positioning stopped	
6	1: Set speed > Maximum speed; limited to maximum speed	
15	1: Set speed = 0	

Notes:

- Target position reached
  The message Target positioning reached specifies that the target positioning was reached. It is then displayed if the control word bit "New set value" is deleted. Because of the handshake procedure this message is not displayed, if the bit "New setpoint" is set.
  The option "automatic start after positioning set change" (bit 11 in ▹P1190◃ Positioning mode) is an exception. In this case the message ’set value reached’ is not suppressed, even if the control bit ’new set value’ was set.
- Set value acknowledge:
  The set value acknowledge is the controller’s answer to a new starting command. The drive sets this bit, if the positioning data was accepted and the positioning was started. The drive deletes the bit as soon as it is prepared to accept new set values. As long as this bit is set, the control may not initiate a new positioning request. However the data in the positioning sets may be changed.

Initial homing requirement referring to target position mode

The "Positioning mode" ▹P1190◃- bit 8 determines if the drive allows a position target setting if homing did not take place yet. "Positioning status" ▹P0460◃ bit 8 shows whether homing was successfully made or not.

Bit	Meaning	Remark
	Positioning mode P1190	
8	Homing for positioning 0: is not necessary 1: is necessary	
	Positioning control status P0460	
8	Homing for positioning 0: not executed or not successfully executed 1: successfully executed	Bit 8 is set as soon as homing was made after switching on. At first the bit is deleted after switching on. After a successful homing the bit remains set until the controller is switched off.

11.5.5 Actions with rising edge in New set value

- The selected positioning set (▹P1191◃) is copied to the active positioning set 0. If the positioning set is on 0, there is no data copied. In this case the data are directly used from the positioning set 0.
- With a relative positioning the target position is calculated.
- If the software limit switches are active the target position on the permissible traveling range is checked and according to the setting (▹P1190◃, bit 5) an error is generated or the target position is limited.
- The status flag ’target position reached” in the status word (bit 10) is reset.
- The status flag ’Set value acknowledge” in the status word (bit 12) is set in order to display that the positioning data have been accepted.
- In the mode "Single set value” the positioning data is immediately accepted (also if the drive still is positioning) and the positioning is made with the new data.

- In the mode ’Set of set values” the data become effective not until the previous target has been reached.

11.5.6 Operating sequence handshake at single positioning sets (single set value)

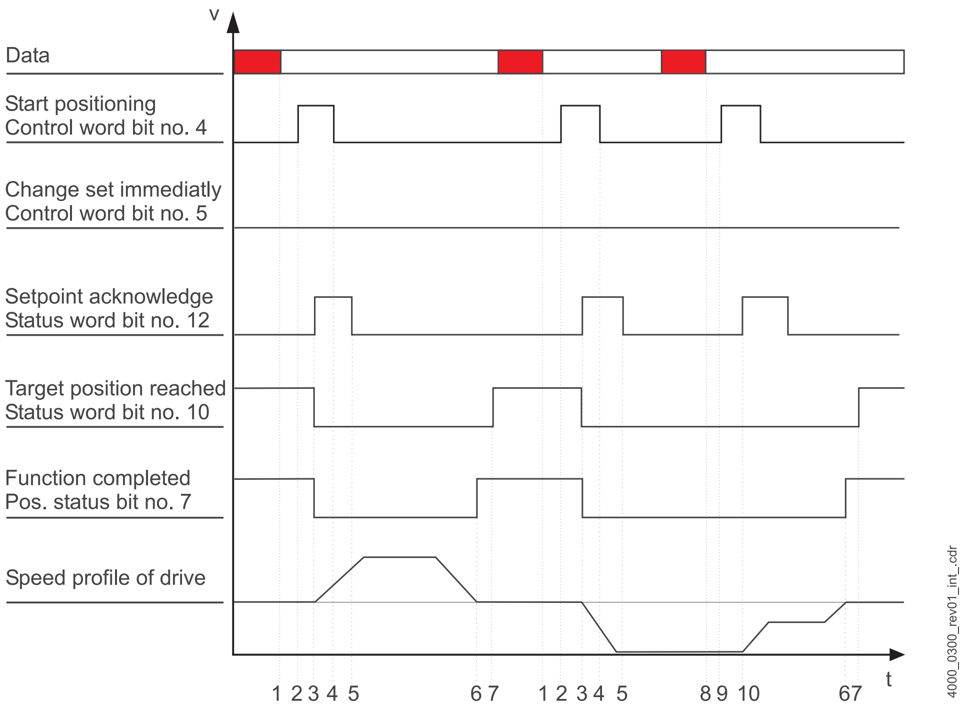


Figure 117: Positioning handshake (single set value)

1 The control has transmitted the positioning data to the drive. The data are effective, not before an edge in the bit ’New set value.

2 The control sets the bit ’New set value” in the control word. The rising edge is the starting request for the positioning. As the mode "single positioning sets" shall be used, the bit "Immediately change set" (bit 5 in the control word) must be deleted at the edge.

3 The drive signals by the setting of the set value acknowledge, that the starting request was recognized. The set values were accepted and the positioning procedure was started. The message “Target position reached” is canceled and in the parameter Positioning Status ▹P0460◃ by deleting of the bit "Function completed" is shown, so that the ramp generator generates new values.

4 The control resets ’New set value’.

5 As a reaction on the deleted bit ’New set value’ the drive also resets the bit ’Set value acknowledge’ in the status. From now on the message ’Set value reached” is displayed again. It is suppressed as long as “New set value” is set.

6 The drive reaches the target position. The ramp generator signals ’Function completed”, but from the smoothing generator values can still be specified.

7 The drive signals target position reached. This happens in dependence on the positioning window (▹P1194◃), which was set and on the positioning window time (▹P1195◃).

8 New Positioning data are send when a positioning is active at the same time. These data are not taken into account until a new edge was recognized in "New setpoint".

9 The control sets "New set value", although the last positioning was not terminated. The data are accepted and are immediately valid.

10 By the setting of the set value acknowledge, the drive signals that it has recognized the starting request. The new set values were accepted and are immediately valid, even if the previous positioning has not been terminated yet.

11.5.7 Operating sequence handshake with set value specification ('set of set values")

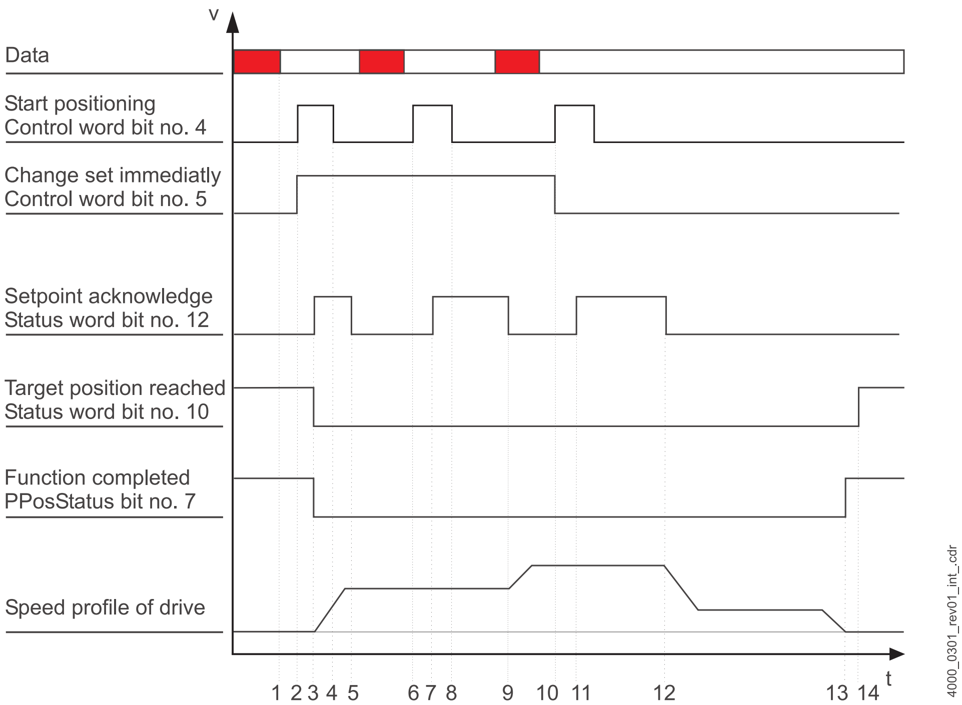


Figure 118: Handshake with set value setting ('Set of set values")

1 The control has transmitted the positioning data to the drive. The data are valid if there is an edge in the bit "New setpoint".

2 The control sets the bit "New set value" in the control word. The rising edge is the starting request for the positioning. As the mode set value setting shall be used, the bit "Immediately change set" (bit 5 in the control word) must be set at the edge.

3 The drive signals by the setting of the set value acknowledge, that the starting request was recognized. The set values were accepted and the positioning procedure was started. The message "Target position reached" is canceled and in the parameter Positioning Status ▹P0460◃ by deleting of the bit "Function completed" is shown, so that the ramp generator generates new values.

4 The control resets 'New set value'.

5 As a reaction on the reset bit 'New set value' the drive also resets the bit 'Set value acknowledge' in the status.

6 The control has send new data and again sets the bit New set value, so that the data are accepted. At this point of time the drive has not yet reached the first target position.

7 The drive signals by the setting of the set value acknowledge, that the starting request was accepted. As the previous target was not reached yet, they are not valid yet. The new positioning data become valid, if the first target position is reached.

8 The control cancels bit no. 5 ’Set homing position’ again.

9 The drive has reached the first target position and now activates the new positioning data. Hence the drive is ready to receive new set values. The drive signals this by deleting the set value acknowledge.

10 The control has set new data and again sets the bit New set value, so that all data can be accepted. The positioning data must be the last data in this setting sequence. The drive must stop in the target. This is why the bit ’Immediately change set” must be deleted.

11 The drive signals by the setting of the set value acknowledge, that the starting request was accepted. As the previous target was not reached yet, they are not valid yet. The new positioning data become valid, if the first target position is reached.

12 The drive has reached the second target position and now activates the new positioning data. Hence, the drive is ready to receive new set values. The drive signals this by deleting the set value acknowledge.

13 The ramp generator signals ’Function completed”, however, values can still be specified from the smoothing generator.

14 The drive signals target position reached. This happens in dependence on the set positioning window and the positioning time window.

11.5.8 Target inputs

The number range for the positioning consists of 16 bit revolutions and 16 bit angles, whereat the position as well as also the actual position value basically is to be referred to as unsigned. There is one exception - the CANopen mode. In this case a calculated range displacement between the target position and the actual position target is to be made. Hereby the target is to be seen as a signed value, the range of values therefore extends from -2^{15} revolutions to $+2^{15}$ revolutions.

There are different possibilities to specify the target position:

- Absolute target input:
- Relative target input in positive or negative direction, referring to the last target position
- Relative target input in positive or negative direction, referring to the actual position value at the point of time of the activation of the request.
- Relative target signed, referring to the last target input.
- Absolute/relative target input via control word:
  The setting, whether the target is absolute or relative (referring to the last target) is made via the bit 6 in the control word ▹P0300◃. This is a relative target, if at the rising edge of ’New setpoint” the bit 6 is set. If the bit is deleted, this is an absolute target input. If there is a relative target input the target input is signed, but is made via the same parameter ▹P0600◃.
- Absolute/relative target input via control word: CANopen mode:
  In this special mode the differentiation of the absolute or relative target input is made via bit 6 in the control word ▹P0300◃, but for the absolute target input a range displacement in the target position is calculated. In this mode the number range for the positioning is to be seen as signed. The target input is made via the parameter ▹P0607◃.

- Absolute positioning to angle in positive or negative direction or shortest distance
  In this case only the angle of target input is used, hence the angle is moved to the next position, which is possible.
- Positioning to absolute angle with selectable number of revolutions
  In this case it is positioned to the specified angle. The number of the revolutions is thereby calculated relatively.
- Modulo positioning in direction of the shortest distance (distance optimized)
  This positioning can be used at axes, where an endless positioning (rotary axis operations) is wanted and the target positioning shall be specified in the modulo format. The ratio of an intermediary transmission element (e. g. gear) is considered via the definition of the modulo value range (▷P1239◁ Modulo position). Therefrom the controller calculates the shortest distance to the target position.

11.5.9 Stop running positioning

By the setting of the stop bits (control word ▷P0300◁, bit 8) a running positioning can be stopped. For the deceleration ramp the data of the current positioning data set is used. The execution of the stop command is immediately displayed in positioning status ▷P0460◁, bit 10. If the set speed = 0 (positioning status ▷P0460◁, bit 15) and simultaneously the zero speed message (encoder 1 status ▷P0390◁ or encoder 2 status ▷P0400◁, bit 10) is existing, the axis is considered as stopped and set value reached (status word ▷P0301◁, bit 10) is set.

With the reset of the stop bits automatically the remaining distance is moved and the status bit set value is reached (status word ▷P0301◁, bit 10) as well as positioning status ▷P0460◁, bit 10 is deleted.

If set speed = 0 is set the interrupted positioning at the earliest can be continued again.

If there already is a stop bit when a starting command is set, positioning is not started. The stop-bit must be canceled so that it can start.

In the stop status the profile data and the target position can be changed also. Therefore a rising edge in the start-bit (control word ▷P0300◁, bit 4 „New set value“ or bit 11 „Start positioning“) is necessary. However, the positioning profile cannot be changed.

At a Sin²-positioning the new profile data only is accepted, if set speed = 0 (positioning status ▷P0460◁, bit 15) and the stop bit (control word ▷P0300◁, bit 8) has been set!

11.5.10 Cancel positioning

By the setting of the interrupt bit (control word ▷P0300◁, bit 12) a running positioning can be interrupted. For the deceleration ramp the data of the current positioning data set are used. The execution of the interrupt command is immediately displayed in positioning status ▷P0460◁, bit 10. With the bit 'Set value reached' (status word ▷P0301◁, bit 10) the end of the interrupt procedure is displayed.

Not before set speed = 0 (positioning status ▷P0460◁, bit 15) is set the interrupted positioning can be continued again. For this purpose the interrupt bit must not be set.

Contrary to the stopping of a running positioning via the stop bit (control word ▷P0300◁, bit 8) positioning is not continued at the resetting of the interruption bit!

11.5.11 Set value profiles

There are two different acceleration profiles implemented for the positioning.: Trapezium-profile, s-curve profile and sin²-profile.

- It is calculated with a constant acceleration with the trapezium profile (time optimal), the modification of the acceleration therefore operates with a step function. In order to absorb the conditionally jerk it is possible to round-off the generated profile by a rounding-off (PT-1 element). A change of rounding-off - for example by activation of another positioning set - should only be executed after completion of a positioning operation. If another rounding-off time is activated during a running positioning, this can lead to the drive moving to the positioning target with underdrive at the end of positioning.
- With the S-curve profile (jerk limited) the acceleration is not changed with a step function but trapezoidal. The maximum jerk (change of the acceleration) can be set.
- At Sin²-profile (jerk free) the acceleration is changed sinusoidal. The profile accords to the inclined sine wave according to VDI 2143.

The positioning time at otherwise same boundary conditions (same distance, same maximum speed and acceleration) is at the S-curve profile always longer than at the trapezium profile.

11.5.12 Comparison of the travel profiles of the positioning

	Trapezium profile	S-curve profile	Sin² profile
Speed profile	Trapezoidal	S-shaped (square)	Sin²-shaped
acceleration profile	Block-shaped	Trapezoidal	Sine-shaped
Bump [1)]	Bumpless	Bumpless	Bumpless
Jerk [2)]	3 or 4 jerks	Jerk-free	Jerk-free
Online changes of pos. data possible	Yes	Yes	No
Mode Single Setpoint possible	Yes	Yes	Yes
Mode Set of setpoints possible	Yes	Yes	No

1) Bump = jump in speed = a $\rightarrow \infty$

2) Jerk = jump in acceleration = da/dt $\rightarrow \infty$

In the following both profiles as well as the effects of the smoothening generator with trapezium profile are shown as example.

Position key data for example:

- Travel distance = 5 motor revolutions = 50000_{hex}
- Positioning speed = 1000 Inc/ms²
- Positioning acceleration = 20 I/ms²
- Positioning delay = 20 I/ms²

Time optimal positioning (trapezoid profile of speed)

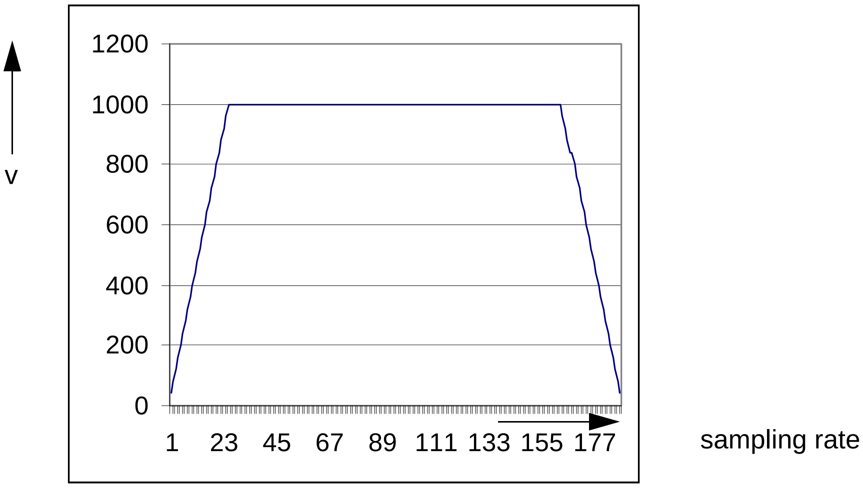


Figure 119: Time optimal positioning

Time optimal positioning with smoothing = 10 ms (smoothing element)

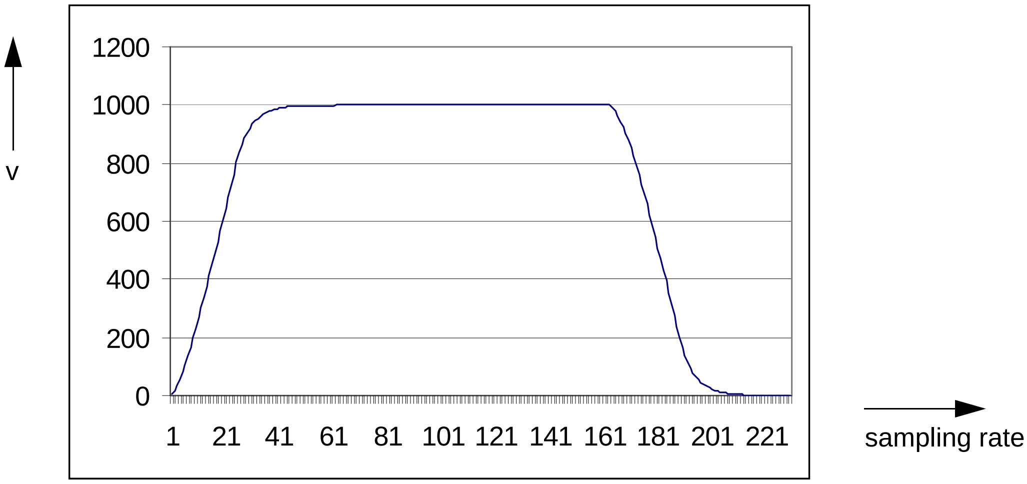


Figure 120: Time optimal positioning with smoothing

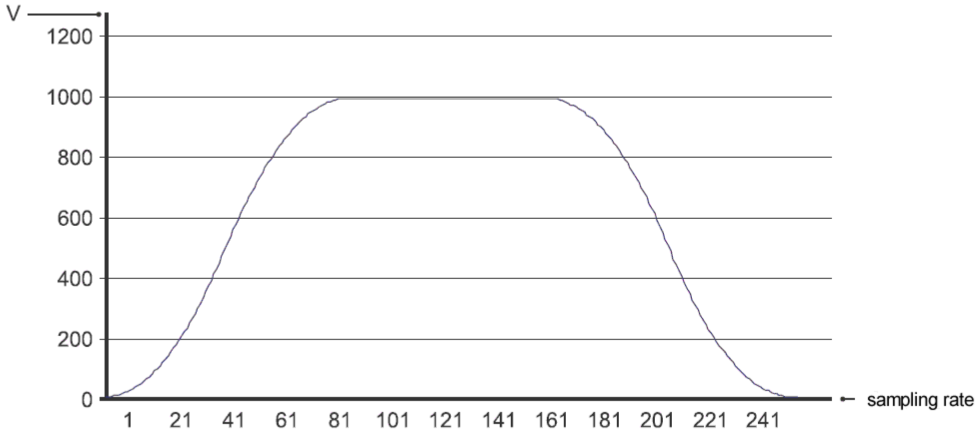


Figure 121: Jerk-limited positioning (S-curve profile of speed) with curve = 2

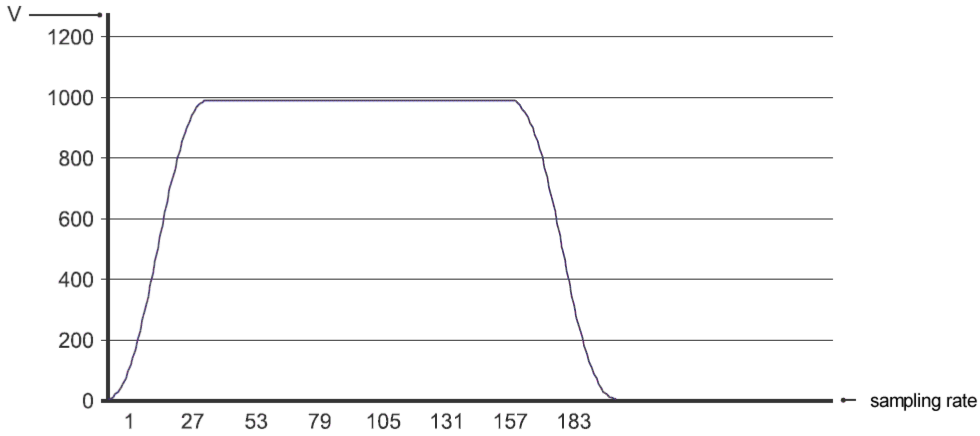


Figure 122: Jerk-limited positioning (S-curve profile of speed) with curve = 10

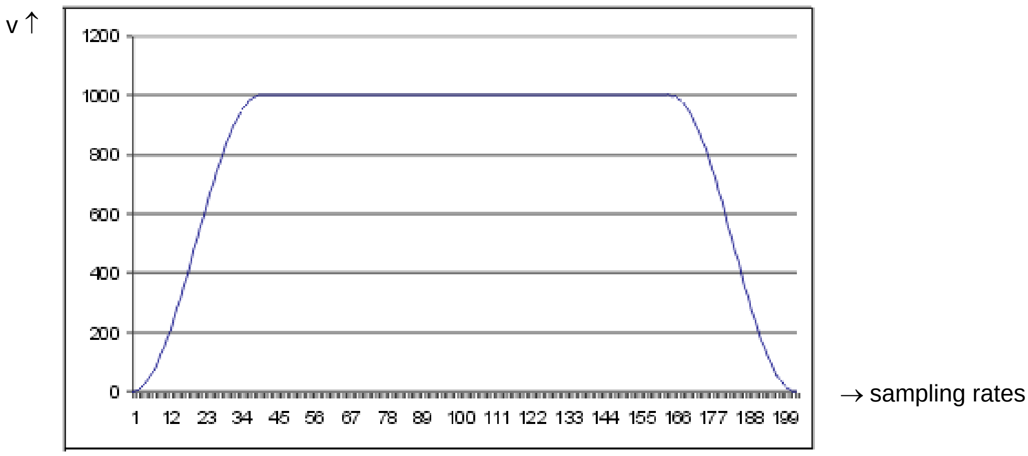


Figure 123: jerk-free positioning with Sin² profile

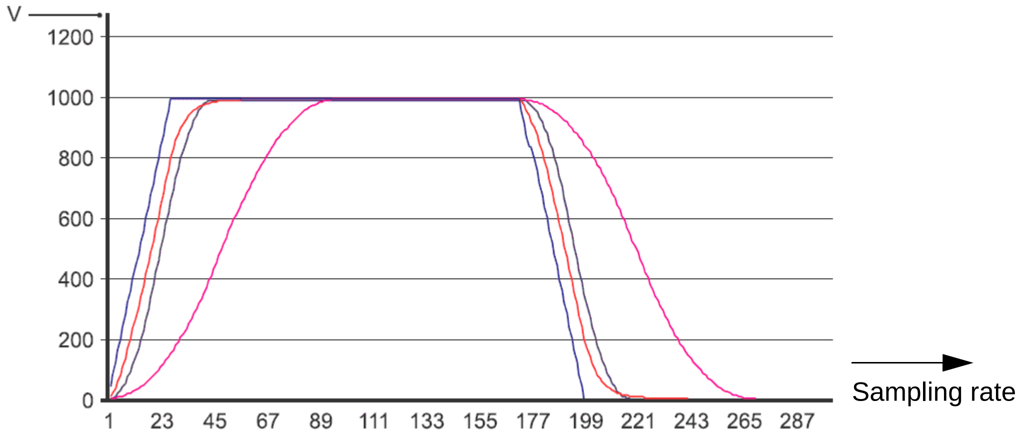


Figure 124: Comparison of the curves (trapezium profile and S-curve profile)

	Trapezium profile time optimal	Trapezium profile with smoothing	S-curve profile (jerk-free)	Sin² profile (jerk-free)
Time [samples]	188	230	207 or 257	203
Starting behavior	-	o	+	+
Reaching target	-	+	+	+
acceleration profile	rectangular form	Smoothing element behavior	trapezoidal	sine-shaped
Wave inclination	-	o	+	++

11.5.13 Appendix positioning ('original behavior')

In the following the original starting- and handshake behavior of positioning is prescribed.. This behavior can be set with parameter ▹P1190◃ positioning mode.

Sequence

The controller has 16 positioning data sets (1...16) and an positioning data set (no. 0).

At the beginning of positioning one of the sixteen positioning sets is selected (1 ... 16) with ▹P1191◃ positioning actual sequence number or a positioning data set e.g. is transferred via a field bus. Positioning is started with the command Start positioning (bit 11 in the control word).

The start bit always must be set when starting a positioning. The positioning then is completed independent on the start bit.

Dependent upon the positioning target input (parameter ▹P0601◃ target input 0, ▹P0611◃ target input 1, and so on) the following differences result for this start bit:

- When having an absolute limited target setting (target input = 0, limited to maximum traveling distance) the start bit can remain being set. It always is positioned to the actual absolute target position. That means, that only a new (absolute) target position must be written at the start bit, which was set.

- It depends on the positive edge of the start bit, if the relative target settings (target input = 1, -1) are as usual . A new target position is generated relatively to the original target position, if there is a positive edge of the start bit.
- It also depends on the positive edge of the start bit at the flying relative target settings (target in put = 2, -2, 7). A new target position is generated which is relative to the actual position, if the positive edge of the start bit occurs.
- When having an absolute unlimited target setting (target input = 3, not limited to maximum traveling distance) the drive will be positioned to the shorter distance to the target. The maximum traveling distance can be exceeded if the software limit switch function is off.

Target positions may be changed at any time.

With the trapezium profile the changes immediately become effective, also if the drive is in motion at the moment. It immediately begins positioning to the new target position, if the condition, which is depending on the target input is fulfilled for the start bit. Changes due to the switchover of the positioning data set are immediately effective. The change of positioning speed, positioning acceleration and positioning delay is only effective if simultaneously the start bit is set. The parameter ▷P0601◁ target input 0 or ▷P0611◁ target input 1, and so on has no influence on this.
If the starting command has been accepted by the drive controller the drive begins with the positioning function and target position reached (bit 10 in status word) changes to 0.
If the positioning function recognizes a quickstop requirement, this has the consequence, that, according to the QUICKSTOP-code the drive decelerates to standstill and the positioning is switched off.
If the operation is enabled again and a new start is requested, the drive positions in **absolute** positioning mode to the original target position again.

NOTE!

The selected position data set was only then copied into position data set 0 (until prototype version 1003), if the value of the parameter with ▷P1191◁ positioning actual set number has changed considering the last position cycle and the bit Start positioning was set. In order to change (online changes) the positioning parameters during the running positioning (bit 11 in the control word remains) the parameters from position data set 0 must be described. The permissible range of values of parameter with ▷P1191◁ Positioning actual set number was determined from 1...16. The value 0 was not permissible.

From prototype version 1004 onwards also the value 0 for parameters with ▷P1191◁ Positioning current set number is permitted.

If the value is zero, then no copying of the positioning sets from the positioning sets 1 to 16 follows. The controller always works with positioning set 0. Online changes must occur in positioning set 0.

If value of ▷P1191◁ positioning actual set number is unequal zero, i. e. 1 ... 16, then the controller copies parameter values from the selected positioning set into positioning set 0 **at the rising edge** of bit 11 in the control word. In order to change positioning parameters during the running positioning (bit 11 in the control word remains), the parameters from positioning set must be described. The output values of the selected positioning set parameters therewith remain when there are online changes.

The parameter values of position data set 0 only then changes its values to the values of the selected position set, if the according firmware version fulfills relevant copying conditions in the controller.

- Operating sequence of an absolute positioning (target input = 0, 'original behavior')

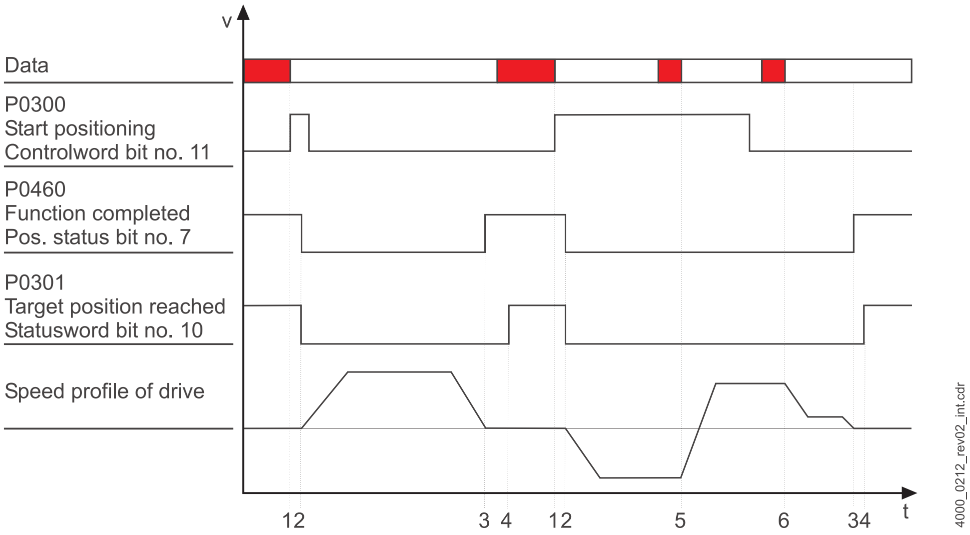


Figure 125: Sequence absolute positioning

Description of transitions:

Transition	Meaning	Explanation
1	Start positioning L ⇒ H	Positioning data valid; Transmit starting request to control word.
2	function completed H ⇒ L and target pos. reached H ⇒ L	Positioning is started.. Start position can be reset. Between (1) and (2) a delay of 3 to 5 ms arises!
3	function completed L ⇒ H	Set value is completed by ramp function generator. Attention: Via the smoothing generator still more position set values can be displayed; see positioning status bit 15
4	Target position reached L ⇒ H	Accordingly later 'Function completed' is set which is dependent upon the pos. window and the pos. window time.
5	new target position valid	Start bit is set; transmit new target position or the pos.-set was changed (therefore in the example a rotating direction inversion takes place).
6	New pos.-speed valid	A new positioning speed was transmitted or the positioning set was changed.

NOTE!

In order to change the current positioning speed or the current acceleration values during the process, bit 11 in the control word has got to be set.

- Operating sequence of a normal relative positioning (target input = 1 or -1, 'original behavior')

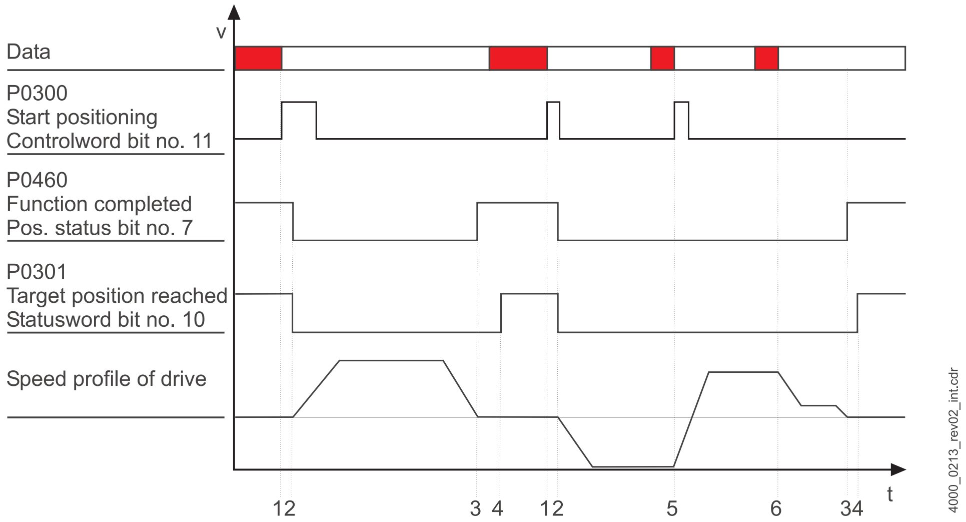


Figure 126: Sequence of a normal relative positioning

Description of transitions:

Transition	Meaning	Explanation
1	Start positioning L ⇒ H	Positioning data valid; Transmit starting request to control word.
2	function completed H ⇒ L and target pos. reached H ⇒ L	Starting edge in bit 11 of the control word recognized. Positioning is started. Start position can be reset. Between (1) and (2) a delay of 3 to 5 ms arises!
3	function completed L ⇒ H	Setpoint is completed by ramp function generator. Attention: Furthermore position setpoints can be displayed by the smoothing generator; see positioning status bit 15
4	Target position reached L ⇒ H	Accordingly later 'Function completed' is set which is dependent upon the pos. window and the pos. window time.
5	new target position valid	Transmit new target position, target input changed or the pos. set was changed. Start bit is set again.. New travel distance is added to the one before (in the example there is a rotating direction inversion is made, because for example target input has changed from +1 to -1).
6	New pos.-speed valid	A new positioning speed was transmitted or the positioning set was changed.

- Handshake procedure at positioning (original behavior)

In order to guarantee a reliable, time-independent mechanism for positioning control, we have implemented a handshake procedure.

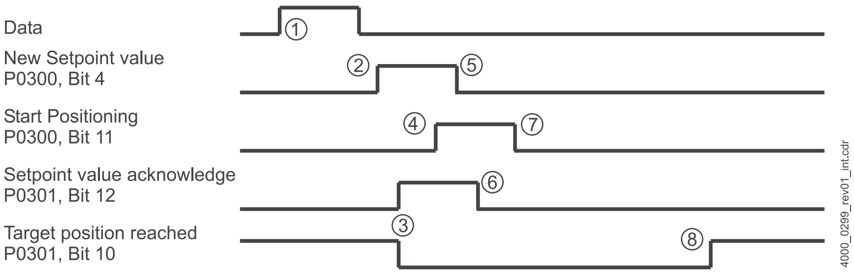


Figure 127: Handshake procedure at positioning

Description of the instants ① to ⑧:

① The control writes new position data.

② The control sets ’new set value’ in the control word in order to mark the data as valid.

③ The controller resets the new set values by setting of ’Accept set value’ in the status word. Simultaneously, the message ’target position reached’ is deleted in the status word. That way, for the consecutively procedure it is made sure, that the target reached message of the previous positioning is no longer present. The message will only be set again, when the newly transmitted positioning request has been accomplished.

④ The control starts the positioning task by setting of the bit ’start positioning’ in the control word. Only after receipt of this command, the positioning will be started.

⑤ The control resets the bit for ’new set value’. This may be made even before the positioning starts.

⑥ The controller resets the falling edge in the control bit ’new set value’ by resetting the set value acknowledge.

⑦ The control resets the bit for ’Start positioning’. This may take place during the running positioning or also after this has been completed.

⑧ As soon as the controller has ended the positioning and the target was reached, he creates the message "Target position reached“..

With the help of the handshake procedure a time-independent controlling of the positioning is possible. However it is not imperative to use the handshake procedure. It is possible to transmit positioning data to the controller without the ’New set value’ command. These will be valid as soon as the ’Start positioning’ command is given. The handshake-operation assures by the message ’Target position reached“ that ’Start positioning’ is reset.

11.6 Operating mode Jog operation (5)

The jog mode is a position-controlled operation mode. The jog mode operation is the manual procedure of the drive e.g. to set up a machine or to evaluate position set values which are required later.

This jog operation mode is set with parameter ▹P1000◃ = 5.

The jog operation mode is shown in ▹Figure 22◃ on page 36.

By pressing the buttons "Forward" or "Backward" (▹P0300◃ control word bit 11 or 12) the drive can be moved even without specifying position set value. The motions result in acceleration/braking ramps which are marked by jogging speed ▹P1210◃, jogging acceleration ▹P1211◃ and jogging deceleration ▹P1212◃.

The following general parameters and functions are available to the operation mode position target setting (see ▹Operating modes general◃ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- General positioning of set values and actual values
- General positioning state
- General positioning feed rate override
- Hardware limit switch monitoring
- Software limit switch monitoring

11.6.1 Control of jog operation

For the control of jog operation the following bits in control word ▹P0300◃ are used:

Control word P0300	
Bit	Meaning
11	1: Jogging forwards
12	1: Jogging backwards
8	1: Stop homing with ▹P2123◃

The jog operation status is displayed in the status word ▹P0301◃ as well as in the "Positioning status" ▹P0460◃.

Status word P0301	
Bit	Meaning
10	1: Jogging speed reached

Positioning Status P0460	
Bit	Meaning
6	1: Set speed > Maximum speed; limited to maximum speed
8	1: Homing took place successfully
12	1: Jogging speed reached
15	1: Set speed = 0

Bit 8 is set as soon as homing was successfully made. At first the bit is deleted after it was switched on or after starting homing new. After successful homing the bit remains until the controller is switched off.

11.7 Operating mode Homing (6)

Homing mode (drive-controlled homing) is the initialization run of an axis at which the exact position actual value is to be evaluated by means of a homing signal (e.g. from a switch).

This homing mode is set with parameter ▷P1000◁ = 6.

The jogging mode is shown in ▷Figure 23◁ on page 37.

Normally an exact knowledge of the absolute position of the drive is necessary to operate positioning drives. If an incremental encoder is used for the position actual value sensing or if for the actual value sensing with resolver more than one motor revolution is necessary within the entire travel range, thus a homing is necessary.When having absolute value encoders, here also, with the help of homing the position actual value sensing can be initialized.

The following operation mode - general parameters and function are available to the operation mode homing (see ▷Operating modes general◁ from page 255):

- Operating mode switch-over
- Smooth switch-over in operating mode position control (-4)
- Smooth switch-over in positioning operating modes
- Set value generator according to the operating mode
- Synchronization of the control cycle to an external set value
- Moving mean value generation of position set values
- General positioning of set values and actual values
- General positioning state
- General positioning feed rate override
- Hardware limit switch monitoring
- Software limit switch monitoring

Control-operated homing

At homing there is a basic difference between drive-controlled homings and control-operated homing. At a drive-controlled homing the sequence control system and the movement of the motor is self-controlled by the drive and therewith the reference switch is started.

However, at control-operated homing, the drive is operated by the control via the position setpoints and evaluates the reference switch. The control-operated homing is not implemented as an own operation mode, but as an additional function in the operation modes position control and synchronous operation This procedure is described in ▷Function control-operated homing◁ from page 325.

In the following we furthermore describe the drive-operated homing. This is implemented in b maXX® as an own operation mode.

Encoder input of homing

The parameter "Positioning encoder input homing" ▷P1206◁ selects the encoder input.

Use of the zero mark of the encoder

Generally homing uses a switch as reference mark. The zero reference mark of the encoder mostly is used for a greater accuracy. However homing without consideration of the zero reference mark are possible.

The zero pulse is used as zero reference mark for incremental encoders. Resolvers and sine-cosine encoder use the mechanic zero angle. Mechanic zero angle thereby means 0° in the parameter mechanic actual angle value, ▹P0393◃ (encoder 1) or ▹P0403◃ (encoder 2).

In consideration of the zero marking in general the zero pulse or zero angle of the position encoder is used, but it also explicitly can be selected an encoder for the zero marking.

Hardware reference switch

As a reference switch either one of the limit switches (negative or positive hardware limit switch, see ▹Hardware limit switch◃ on page 260) or a separate zero point switch can be used. The input of the zero point switch is selected by the parameter ▹P1216◃.

The status of the reference switch is displayed in the "Positioning switch status" ▹P0461◃ bit 2 and in the "Status word 2" ▹P0303◃ bit 2.

Homing methods

The type of homing (switch, starting direction etc.) is set with parameter ▹P1205◃. The different homing methods thereby accord to the drive profile of CANopen.

Reference point

If the drive reached the reference point after homing the parameter Reference point ▹P1200◃ and the current position set value and the position actual value to the reference point value except for the reference method ▹Homing without setting of homing position◃ on page 292.

11.7.1 Control of homing

For the control of homing the following bits are used in the control word ▹P0300◃:

Control word P0300	
Bit	Meaning
4	1: Start homing
8	1: Stop homing with ▹P2123◃

The status of homing is displayed in the status word ▹P0301◃ and in the "Positioning status" ▹P0460◃.

Positioning status P0460	Status word P0301	Meaning
Bit	Bit	
6	--	1: Set speed > Maximum speed; limited to maximum speed
8	12	1: Homing took place successfully
10	--	1: Running positioning stopped
12	--	1: Set value reached
15	--	1: Set speed = 0
--	13	1: Error homing

▹P0460◃ bit 8 and ▹P0301◃ bit 12 are set as soon as homing was made successfully. At first the bit is deleted after it was switched on or after starting homing new. After successful homing the bit remains until the controller is switched off.

11.7.2 Operating sequence of homing with consideration to zero pulse or zero angle

Exemplary in the following the sequence of homing to the negative limit switch with consideration to the zero pulse/zero angle is described. The sequence of other homings mainly accords to this sequence, differences especially appear in the traveling direction but also in the switching edge.

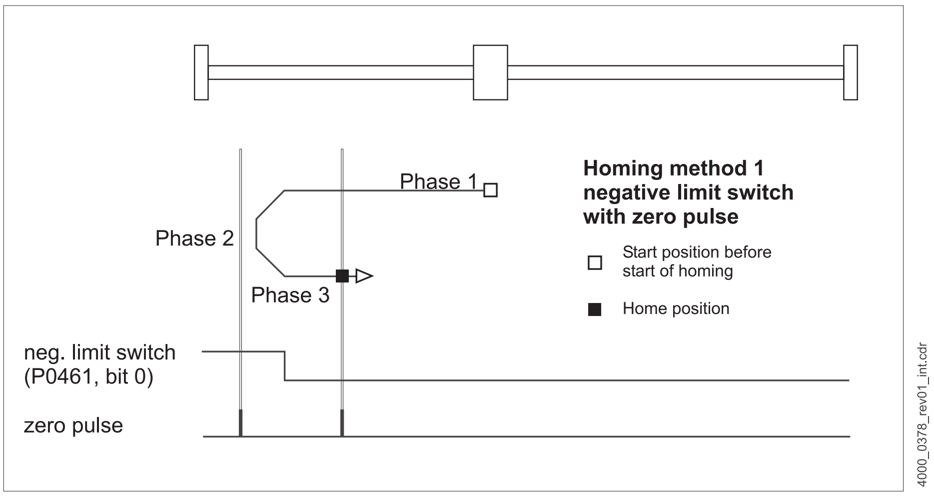


Figure 128: Operating sequence homing on negative limit switch with zero pulse.

- Phase 1
  In phase 1 it is driven with homing speed (▹P1201◃), until homing switch has been reached. The acceleration, which is required, in order to reach the homing speed is set with ▹P1203◃ Positioning homing acceleration.
  In case the switch already has been set before it is started, is directly started with phase 2.

- Phase 2
  After reaching the homing switch the drive is braked with ▹P1204◃ reference delay and is accelerated to one eighth of homing speed (but at least to final speed of homing) with reverse traveling direction. Now the switch is exited again.
- Phase 3
  The next switching edge triggers braking according to ▹P1202◃ final speed of homing. As soon as this speed has been reached the zero marking is evaluated. The drive continues with final homing speed till the zero pulse or the zero angle of the encoder has been recognized. At recognition of the zero pulse or zero angle the drive is stopped and the homing position is set.
  Maximum travel distance can be preset at encoders with zero pulse in this phase. If the zero pulse is not detected within this distance, "Homing" error no. 205 is reported and homing is interrupted

11.7.3 Displacement of zero angle

Under consideration of the zero angle or zero pulse, at homing it can happen that this is near switching tolerances of the homing switch. That is why it can happen that at several homings two different homing positions are found one revolution away from each other. The zero angle or the zero pulse is then not always recognized in the same encoder revolution because of the switching tolerances.

At sine incremental encoders with zero pulse in this case the encoder or the switch must be mounted in a way so that the zero pulse isn’t near the switching tolerances anymore.

At absolute value encoders the encoder zero angle with the parameter ▹P1209◃ Encoder offset for die internal calculation must be displaced in such a way that it is outside the tolerances of the switch. The measured angle at the homing switch is displayed in the parameter ▹P0371◃ mechanic angle at homing switch.

11.7.4 Maximum distance for zero pulse detection

A maximum distance can be preset at encoders with zero pulse, which may be moved after the switching edge until the zero pulse is detected.

If the zero pulse is not detected within this distance, "Homing" error no. 205 homing is reported and homing is interrupted.

11.7.5 Homing sequence only on switch

At homing only on switches no evaluation of the zero pulse or zero angle takes place. The exactness therewith is dependent of the switching tolerances of the switch.

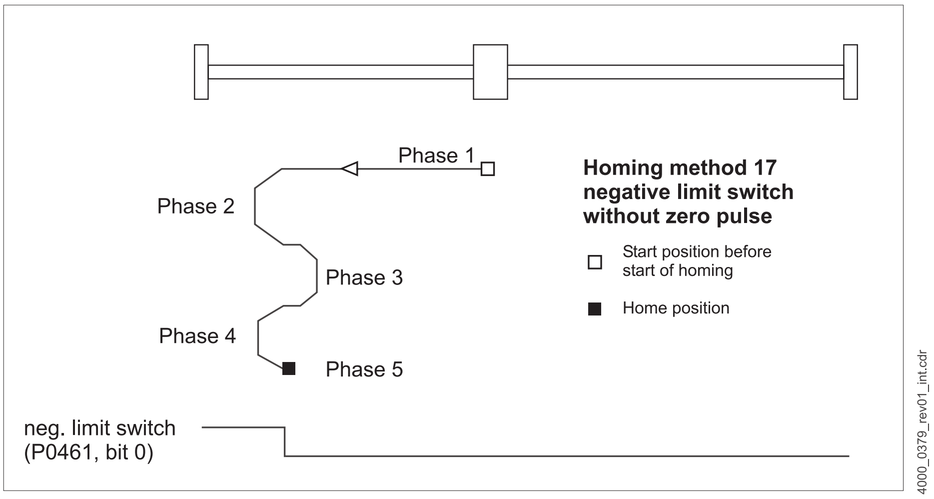


Figure 129: Homing sequence on neg. limit switch without zero pulse

- Phase 1
  In phase 1 is driven with homing speed (▷P1201◁), until homing switch has been reached. The acceleration, which is required, in order to reach the homing speed is set with ▷P1203◁ Positioning homing acceleration.
- Phase 2
  After reaching the homing switch the drive is braked with ▷P1204◁ reference delay and is accelerated to one eighth of homing speed (but at least to final speed of homing) with reverse traveling direction. Now the switch is exited again.
- Phase 3
  The falling switching edge of the switch causes an a new reversal of the travel direction. Again the drive approaches the switch, once again with an eighth of the homing speed.
- Phase 4
  After reaching the homing switch the drive is braked and is accelerated in reversed travel direction on homing speed, the drive therewith is slowly driven out of the switch.
- Phase 5
  At the falling switching edge of the switch the drive is immediately braked to 0 and homing position is set.

11.7.6 Homing without setting of homing position

For specific applications the setting of the homing position also can be deactivated (▷P1190◁, bit 12). The set values and actual values of positioning are not changed, the drive instead remains at the homing position and the position values, for example, are able to be read from a control.

11.7.7 Note

Limit switch

The traveling distance is not limited by the hardware- or software limit switch at homing!

The limit switches must be constructed in such a way that they cannot be passed over. The output condition ’active” therefore must be able to be left at the negative limit switch only in positive direction.

Stopping of Homing

By the setting of control word bit 8 ("Stop") homing is interrupted.

Homing is continued at the point where it was interrupted, by deleting the stop-bit.

The stop-procedure is displayed via P0460 Positioning status bit 10 = 1.

Interruption of homing by the user

In order to interrupt an operating homing, the bit "Start homing" (▹P0300◃ control word bit 4) must be deleted. By setting of "Start homing", homing is started again.

Interruption with error message 205

The error 205 during homing causes an interruption of homing from the controller. Possible causes:

- There is no encoder module at the selected encoder slot ⇒ Selection of the encoder input with ▹P1206◃ correction or with setting an automatic selection.
- Switch error, for example homing switch and hardware limit switch are set at the same time ⇒ check switch.
- The homing method, which was selected requires encoders with zero pulse or a distance code ⇒ of the according encoder type.
- A fail (reserved) homing method is set ⇒ select supported method (see ▹P1205◃).
- A maximum distance was set for the zero pulse search and the zero pulse was not detected within the specified distance.

Other possible problems at homing

If homing is not completed after reaching the reference switch (feedback via bit 10 of ▹P0301◃ status word fails), the settings of the positioning window ▹P1194◃ could be the reason. The drive must be in the positioning window after reaching the homing position for the positioning window time which was set. The setting of the positioning window perhaps is too small, so that these conditions cannot be fulfilled.

Reproducible

In order to reach homing positions the following conditions must be complied with:

- The homing speeds, - acceleration, -deceleration as well as the encoder offset may not be changed after it once has been set.
- In phase 1 the homing speed must be reached.

11.7.8 Homing method 1 (neg. limit switch)

Homing is executed on the negative limit switch. If the limit switch is not used when starting, it is traveled in direction of the switch. The homing position is the first zero pulse or zero angle to the right of the switch (also after the switch is inactive again).

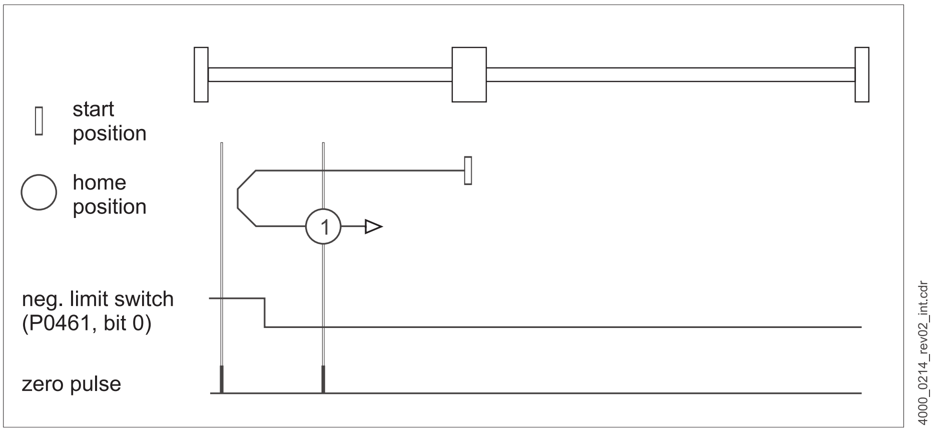


Figure 130: Homing method 1

11.7.9 Homing method 2 (pos. limit switch)

Homing is executed on the negative limit switch. If the limit switch is not used when starting, it is traveled in direction of the switch. The homing position is the first zero pulse or zero angle to the right of the switch (also after the switch is inactive again).

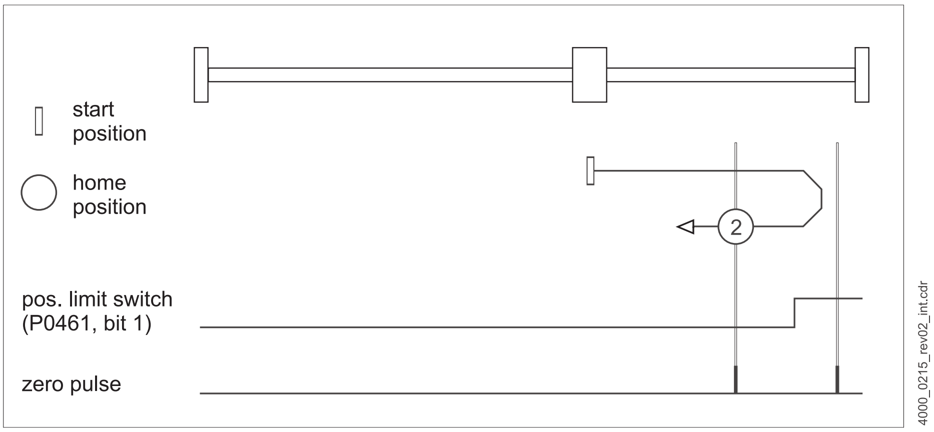


Figure 131: Homing method 2

11.7.10 Homing methods 3 and 4 (pos. zero point switchover)

Homing is executed to the positive zero point change-over switch, that means, the switch can be somewhere in the traveling range and is continuously active from the switching point onwards in positive direction. The starting direction of travel is dependent on the switching status and the methods which are used.

Homing position is the first zero pulse on the left or on the right of the switch.

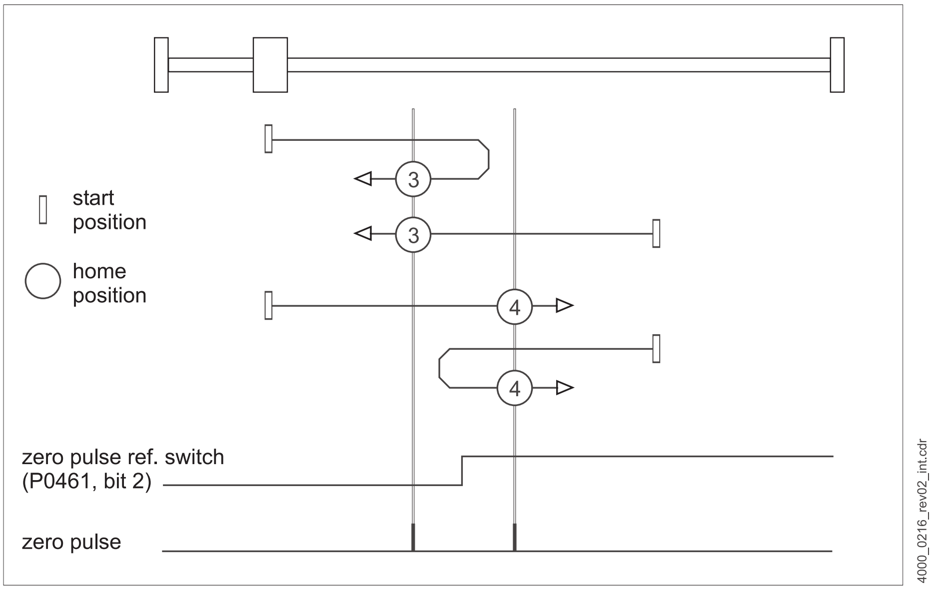


Figure 132: Homing method 3 and 4

11.7.11 Homing methods 5 and 6 (neg. zero point change-over switch)

Homing is executed on the negative zero point switch, this means the switch can be anywhere in the traveling range and is active from the switching point in negative direction. The starting direction of traveling is dependent on the switching status and the methods which is used.

The homing position is the first zero pulse or zero angle on the left or right from the switch.

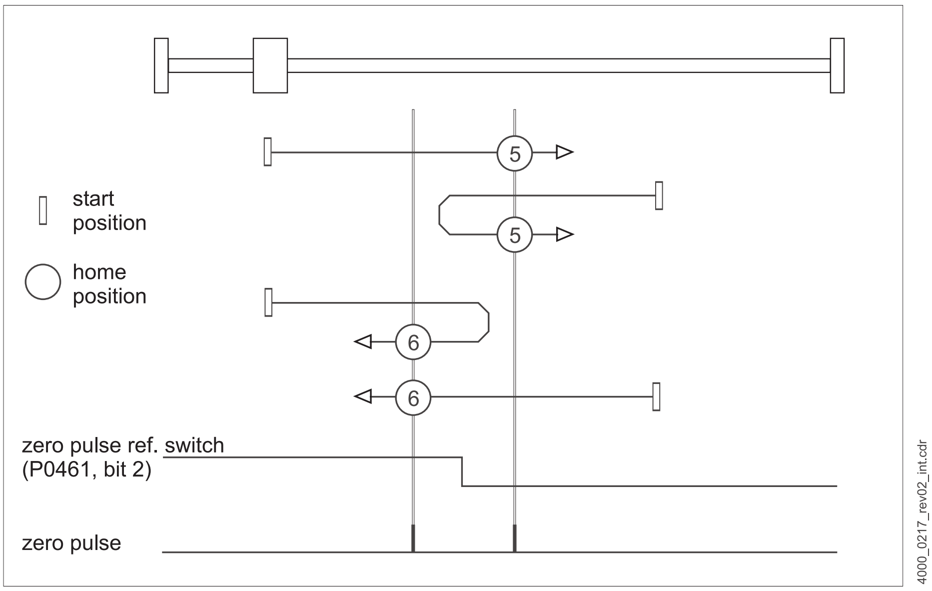


Figure 133: Homing method 5 and 6

11.7.12 Homing methods 7 to 14 (homing switch)

These homing methods are intended for cases in which the homing switch only is active via a part of the traveling range.

Homing methods 7 to 10

At homing methods 7 to 10 the travel starting direction is positive except the homing switch is active when starting homing. In this case the travel direction is dependent on the switching edge which is searched for. If the travel starting direction leads away from the switch, the travel direction is changed at the positive limit switch.

Homing position is one of the zero pulses or the zero angles at the rising or the falling edge of the switch.

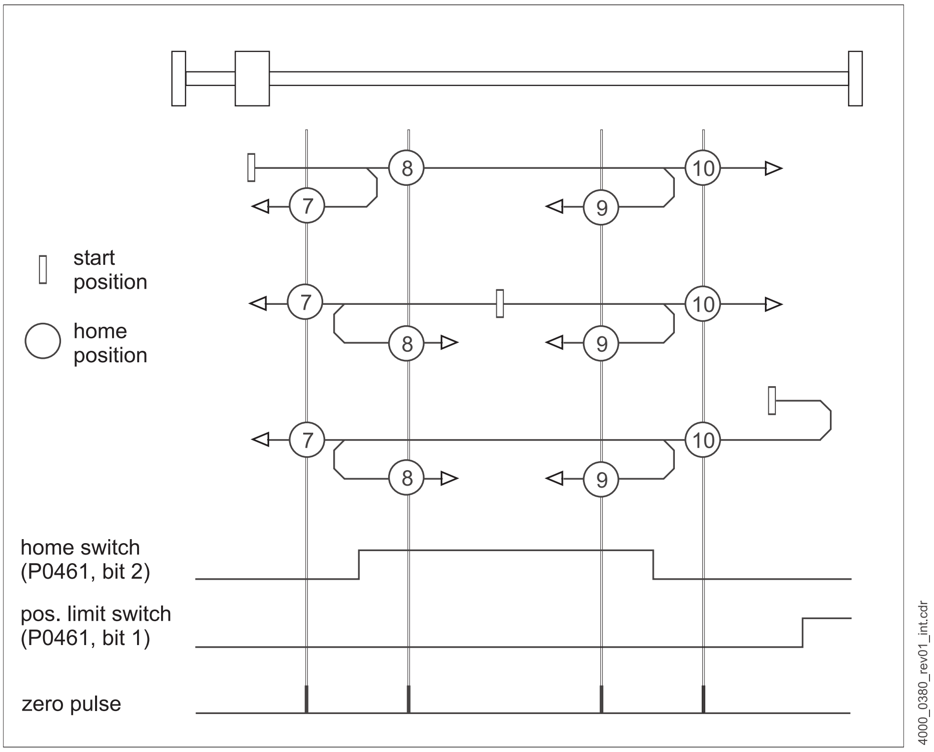


Figure 134: Homing methods 7 to 10

Homing methods 11 to 14

The travel starting direction is positive at the homing methods 11 to 14, except the homing switch was activated at starting the homing. In this case the travel direction is dependent on the switch edge, which is searched for. If the travel starting direction leads away from the switch the travel direction is changed at the negative limit switch.

Homing position is one of the zero pulses or the zero angles at the rising or the falling edge of the switch.

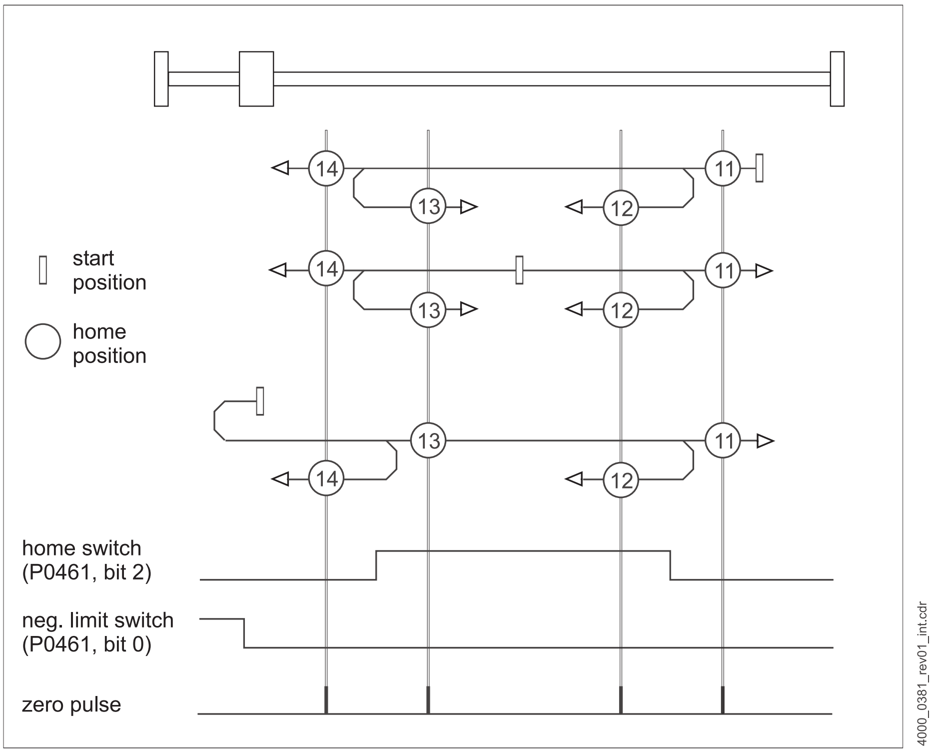


Figure 135: Homing methods 11 to 14

11.7.13 Homing methods 15 and 16 (reserved)

These methods are, accordant to the drive profile of CANopen, reserved for future options.

11.7.14 Homing methods 17 to 30 (without zero pulse or zero angle)

Homing methods 17 to 30 do not use a zero pulse or a zero angle as an additional reference mark. It is only referenced on the switch. Otherwise these methods accord to homing 1 to 14.

Exemplary only homing from 19 to 20 is shown.

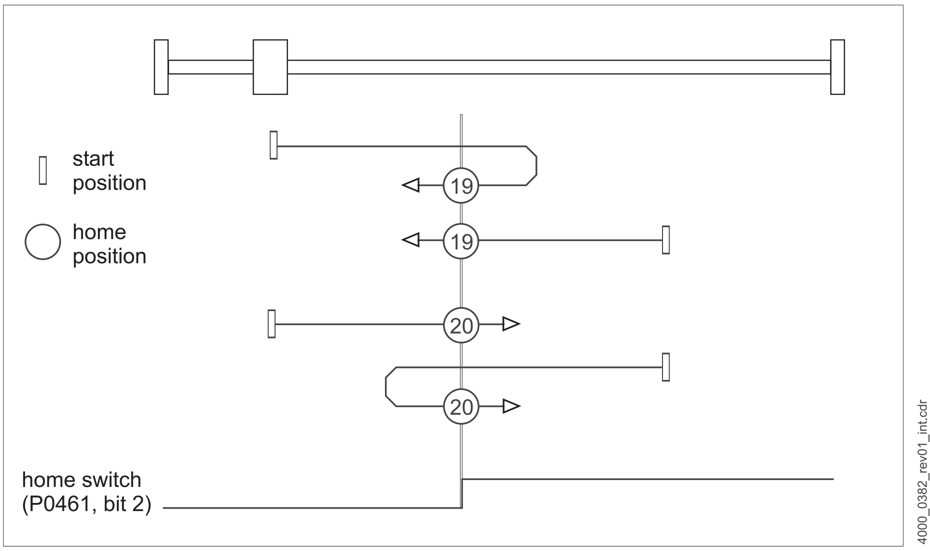


Figure 136: Homing methods 19 and 20

11.7.15 Homing methods 31 and 32 (reserved)

These methods are, accordant to the drive profile of CANopen, reserved for future options.

11.7.16 Homing methods 33 and 34 (only zero pulse)

These homing methods do not use switches but only the zero pulse or zero angle as reference mark.

The homing position is the next zero pulse or zero angle in negative or positive direction.

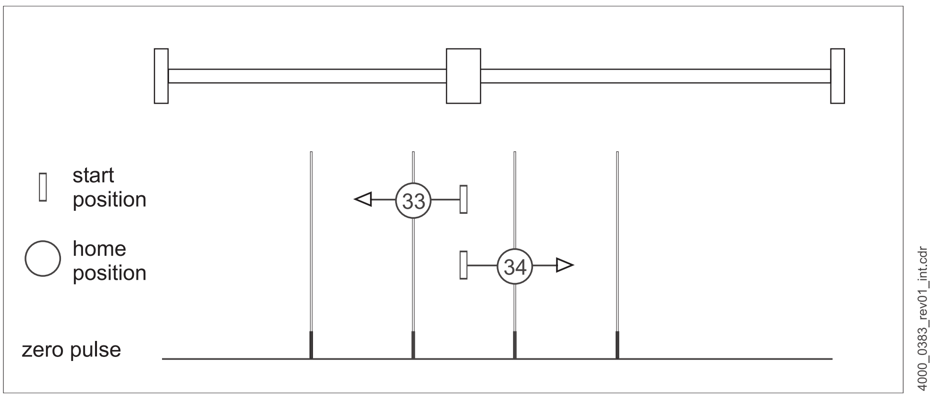


Figure 137: Homing method 33 and 34

11.7.17 Homing method 35 (only setting of homing position)

At this homing method the homing position is set at the actual position. The drive thereby remains at the actual position.

11.7.18 Manufacturer-specific homing methods

There still are more manufacturer-specific homing methods. The methods –1 to –5 are identical with some of the profile-compliant homing methods. They are only existent due to compatibility reasons. The assignment is shown in the following table:

Manufacturer-specific method	corresponds to method	Description
-1	34	next zero pulse or zero angle, clockwise rotation
-2	33	Next zero pulse or zero angle, counter-clockwise
-3	35	Setting of homing position
-4	17	negative limit switch without zero pulse
-5	18	positive limit switch without zero pulse

Homing method –6:

This method is not contained in the profile-compliant homings. The next zero angle (shortest direction) is approached and there the homing position is set.

The homing methods -7 and -8:

With these methods it is referenced to a mechanic endstop.

At -7 the drive moves with clockwise rotation and at -8 with counter-clockwise rotation to the mechanic endstop.

- Phase 1
  Approaching of the mechanic limit stop with the **homing speed.** The torque is limited to ▹P1218◃ **Positioning of homing torque limit** when starting homing.
  In order to recognize the mechanic limit stop, it is checked if the drive is at the current limit (speed controller status ▹P0350◃ bit 13 = 1) and if, at the same time, there is a zero-speed message (encoder 1 status ▹P0390◃ or encoder 2 status ▹P0400◃, bit 10). If both conditions via the ▹P1217◃ **Positioning homing block time** are present, then the mechanic limit stop is considered as recognized.
- Phase 2
  If the mechanic endstop has been identified, at this position the homing position is set and consequentially the torque limit ▹P1218◃ **Positioning homing torque limit** is canceled again.

The homing methods -9 and -10:

With these methods a mechanical endstop is reached and consequentially it is referenced to an encoder zero angle or accordingly zero pulse.

At -9 the drive moves with clockwise rotation and at -10 with counter-clockwise rotation to the mechanic limit stop.

- Phase 1
  Identical with homings –7 and –8
- Phase 2
  If the mechanic endstop has been identified, the torque limit ▹P1218◃ **Positioning homing torque limit** is canceled again and is referenced in reversal direction with **▹P1202◃ Homing end speed** to the encoder zero angle or zero pulse.

	NOTE! The controller cannot differ between the homing methods –7, -8, -9 and –10. It cannot differentiate if the blocking was caused by a mechanic endstop or because of other reasons! In the second case the drive is referenced wrong!

11.8 Operating mode Spindle positioning (-6)

The spindle is aligned at the spindle positioning mode (corresponds to the M19 command of the CNC machines).

Spindle positioning mode is set with parameter ▹P1000◃ = -6.

Spindle positioning mode is displayed in ▹Figure 24◃ on page 38.

Modes of spindle positioning are set in the "Spindle positioning mode" ▹P1425◃.

The status of the spindle positioning is shown in the "Spindle positioning status" ▹P0466◃

The target positioning type can be defined in "Spindle positioning mode" ▹P1425◃ bits 3 and 2:

- Direct position specification: Target angle ▹P1426◃
- By a trigger signal: Zero pulse of the positioning encoder, digital input 1 or zero pulse of the positioning encoder by using a digital input 1. In addition "Spindle positioning relative offset" ▹P1430◃ can be set.

The operating target position is displayed in ▹P0467◃.

At spindle positioning the drive is positioned within a positioning window around the target positioning ▹P0467◃. The window width is set in ▹P1194◃.

With the activation of ▹P1000◃ set mode = -6 (spindle positioning) the drive switches to position control (if not active so far), thereby synchronizes to the actual speed set value and begins to brake to the spindle positioning speed ▹P1427◃. If this is reached, the drive positions in the target position ▹P0467◃.

If the positioning set value reaches the window around the target positioning (target positioning ▹P0467◃, positioning window ▹P1194◃) and if the positioning actual value is within this window for a minimum time "Positioning window time" ▹P1195◃ the drive sets in the ▹P0466◃ Spindle positioning status the message "In position" (the message "In position" is available in bit 10 of the ▹P0301◃ Status word).

The following operating mode - general parameters and functions are available in the spindle positioning mode (see ▹Operating modes general◃ from page 255):

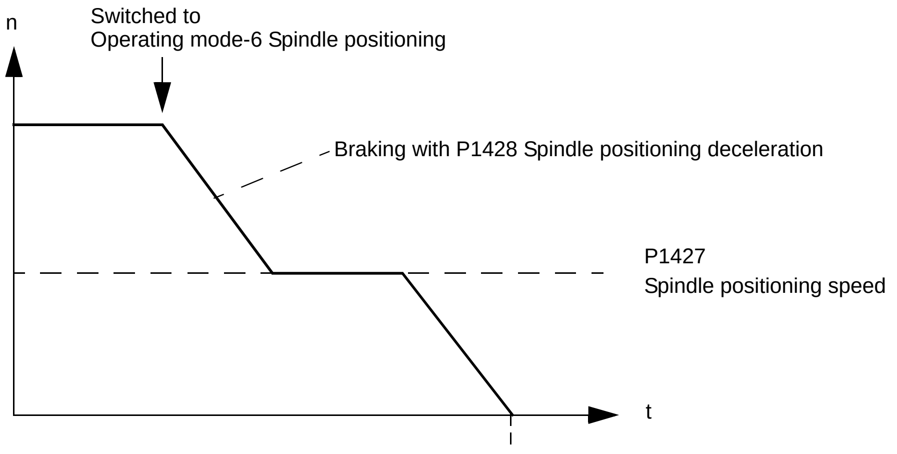
- Operating mode switch-over [1)]
- Smooth switch-over in operating mode position control (-4)

[1)]) From operating mode current control (-2) you, however, may switch to spindle positioning online, but the speed must be zero!

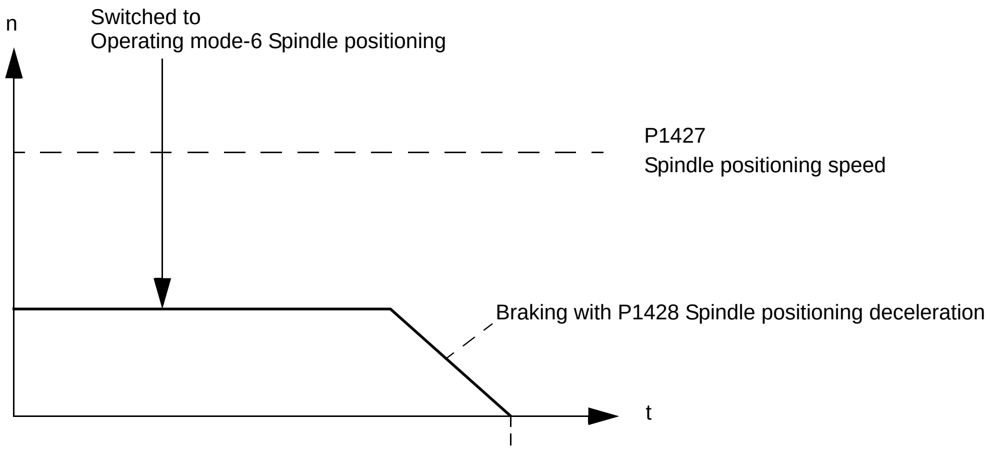
11.8 Operating mode Spindle positioning (-6)

11.8.1 Speed profile after switch-over to the operating mode spindle positioning

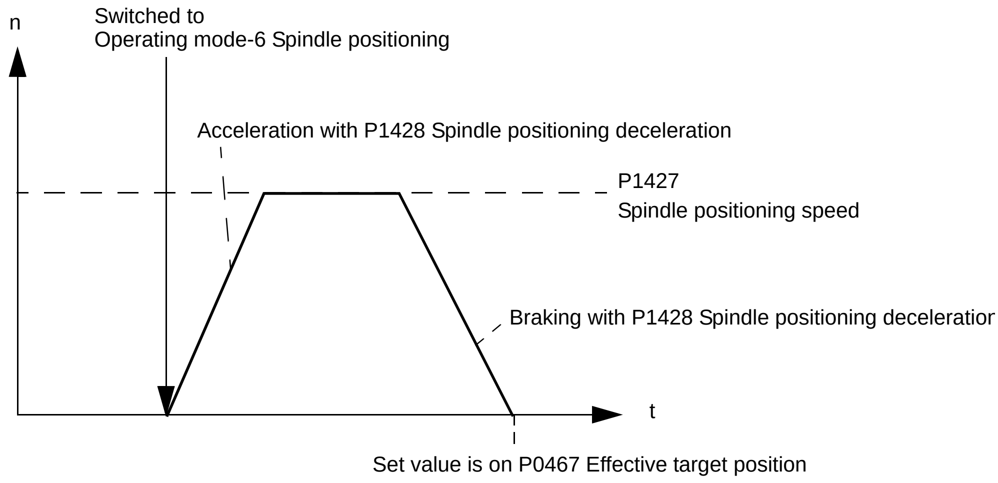
Speed set value > Spindle positioning speed



Speed set value < Spindle positioning speed



Speed set value = 0 (N=0-message of motor-leading encoder is set)



In order to achieve a smoothing of the ramp edges a PT1-element is implemented. By use of parameter ▹P1431◃, you can set the time constant of the PT1-element.

11.8.2 Mode „Spindle positioning to target angle“

In this mode after switching in mode spindle positioning and reaching spindle positioning speed to the set ▹P1425◃ spindle positioning target angle positioning.

For this purpose bit 2 and 3 in the ▹P1425◃ Spindle positioning mode must be parameterized to 0.

Exception is speed actual value = 0:

Additionally the rotational direction can be defined via the bits 0 and 1 in the ▹P1425◃ Spindle positioning mode. For this the actual speed value must be 0, that means the N=0-message of the encoder from the motor must be set.

Bit 1-0: 00: Towards greater position set values

01: Towards smaller position set values

10: Shortest distance

11: reserved

11.8.3 Mode „Spindle positioning to trigger signal“

After switching into the operating mode spindle positioning and the reaching of the spindle positioning speed, in this mode it is positioned to the next zero pulse or to a switch signal. Therefore the touch probe function is used. By means of this, the position of the trigger signal can be determined. It may not be used from any other function during this time.

The value of bit 2 and 3 in the ▹P1425◃ Spindle positioning mode specifies, if the spindle positioning is on:

00: the angle of ▹P1426◃ Spindle positioning target angle or

01: the zero pulse of the position encoder or

10: the rising edge of the digital input 1
of the DIG-IO module operates on the module slot D or

11: on the zero pulse of the position encoder with the additional use of the digital input 1 of the DIO module on module slot D as qualification signal (high level).

Error messages

The error no. 203 „Spindle positioning: Error at initialization“:

This error is set, if at accordant selection via ▹P1425◃ Spindle positioning mode

- there is no option module with zero pulse evaluation at the encoder input for the position control or
- there is no DIO module on the module slot D or
- the setting of the ▹P1425◃ Spindle positioning mode has an invalid value or
- the touch probe function is used by another function.

The error is recognized with the activation of the operating mode Spindle positioning at the earliest. In the case of an error it is braked to speed = 0. The drive remains enabled. Before an error reset the setting of ▹P1425◃ Spindle positioning mode must be corrected. Due to safety reasons additionally the control bit 11 in the ▹P0300◃ control word must be set to continue positioning, because some field busses accept error messages automatically.

The error no. 204 „Spindle positioning: Timeout at trigger signal“:

This error is set, if monitoring time is completed (▹P1429◃ Spindle positioning timeout trigger signal trigger signal) and no trigger signal is recognized from the controller. It is braked to speed = 0 and the error no. 204 "Spindle positioning: timeout at trigger signal" is set. The drive remains enabled. Before making an error reset the setting of ▹P1425◃ Spindle positioning mode must be checked and the function of the selected trigger signal (▹P1413◃ Status of digital inputs in module slot D ⇒ bit 0 or ▹P0390◃ Encoder 1 status ⇒ bit 8 or ▹P0400◃ Encoder 2 status ⇒ bit 8) must be ensured. Because some field busses accept error messages automatically, due to safety reasons the control bit 11 in the ▹P0300◃ control word must be set additionally in order to continue the positioning procedure.

With the setting of 0 ms monitoring is switched off.

Possible sequence of a spindle positioning to a trigger signal

1 Possibility: Position of the trigger signal is unknown

This status is to be recognized at ▹P0466◃ Spindle positioning status bit 8 = 0.

Here, at first the trigger signal must be exceeded, to determine the trigger position. Thereby the actual speed is maintained. If the actual speed is smaller than the spindle positioning speed, it is accelerated to this speed at the most.

If the trigger signal was recognized, the bit 8 is set in ▹P0466◃ Spindle positioning status, it is braked to spindle positioning speed and then moved to the next possible trigger position.

2 Possibility: Position of the trigger signal is known

This status is recognizable due to ▹P0466◃ Spindle positioning status bit 8 = 1.

If, due to a spindle positioning, which was previously performed, the position of the trigger signal was determined, then the spindle positioning speed is braked immediately and the next possible trigger position is approached.

The touch probe function is not used in this status.

„Offline“-measuring of trigger position

With the setting of the bit 9 in the ▹P1425◃ Spindle positioning mode, the determination of trigger position can be made although spindle positioning is off. The trigger position can be determined in another operation mode, as e.g. in speed control. The trigger position is immediately approached, if spindle positioning is activated (process see second possibility)

This offline measuring is only then completed, if the trigger position still is unknown (▹P0466◃ Spindle positioning status bit 8 = 0).

Forcing of trigger position measuring

By setting of the bit 8 in the ▹P1425◃ Spindle positioning mode the determination of trigger positioning can be forced. Independent on ▹P0466◃ Spindle positioning status bit 8, the position of the trigger signals is again determined with each switchover into the spindle positioning (process see first possibility).

This function is only intended for commissioning purposes.

Displacement of the calculated target position by offset parameter:

With ▹P1430◃ spindle positioning relative offset ▹P0467◃ the spindle positioning effective target position, which results from the trigger position, can be displaced.

It only operates on the spindle positioning to the trigger signal and it allows a displacement of limit position without changing the mechanical position of the switch or of the encoder. The relative offset is always added independent on the direction of rotation to the position of zero pulse or switch signal.

Only the low-word of the parameter is used. The high-word of the parameter is not used at the moment and must be set to zero.

11.8.4 Spindle positioning with automatic referencing

Here the actual position value and the set position value is set to the reference point value (▹P1200◃ Positioning reference point) after spindle positioning. As a reference signal the zero pulse of the positioning encoder or of the rising edge of the digital input 1 on module slot D. The selection is made via bit 2 and 3 of the ▹P1425◃ Spindle positioning mode.

By setting of bit 10 in the ▹P1425◃ Spindle positioning mode the automatic referencing of the position values is activated. The positioning value at homing position is set via ▹P1200◃ Homing position.

Sequence:

Spindle positioning is executed as usual. As soon as the conditions for „In position“ (▹P0466◃ Spindle positioning status, bit 12*)* are fulfilled, it is checked, if the position encoder, which was set, is not yet referenced (▹P0360◃ Position controller status bit 10 = 0). If this is the case, now the homing position is set. The the bit 10 "Encoder for position sensing is referenced" is set in the ▹P0360◃ Position controller status and the bit 13 „Homing position set“ in the ▹P0301◃ status word.

Via the bit 11 of the ▹P1425◃ Spindle positioning mode the position of homing position can be defined.

Bit 11 = 0:

Homing position is at position after completion of spindle positioning

⇒ ▹P0467◃ Spindle positioning effective target position.

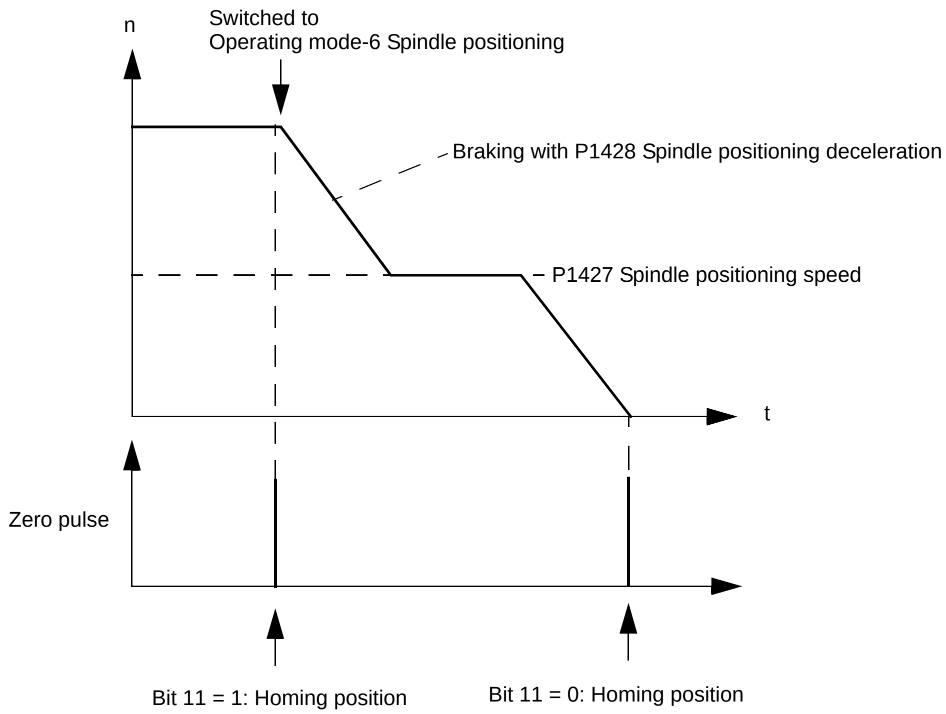
Position set- and position actual values are set at the target position to the value of ▹P1200◃ Homing position.

Bit 11 = 1:

Homing position is at the position of the trigger signal at the moment of saving.

Position set- and position actual value are set at the target position to the value of ▹P1200◃ Homing position, corrected by the moved distance since the moment of saving.

Position set- and position actual value at target position = homing position value +ΔS



11.8.5 Following positionings via command bit 11 of the control word

A following positioning is a positioning after the first spindle positioning. The controller also is in operating mode spindle positioning.

In order to start a following positioning, the control bit 11 in the ▹P0300◃ control word must be set. That means, that a positive edge is required in this control bit. A running positioning must first be completed, before a new positioning can be started (no "online"-positioning possible).

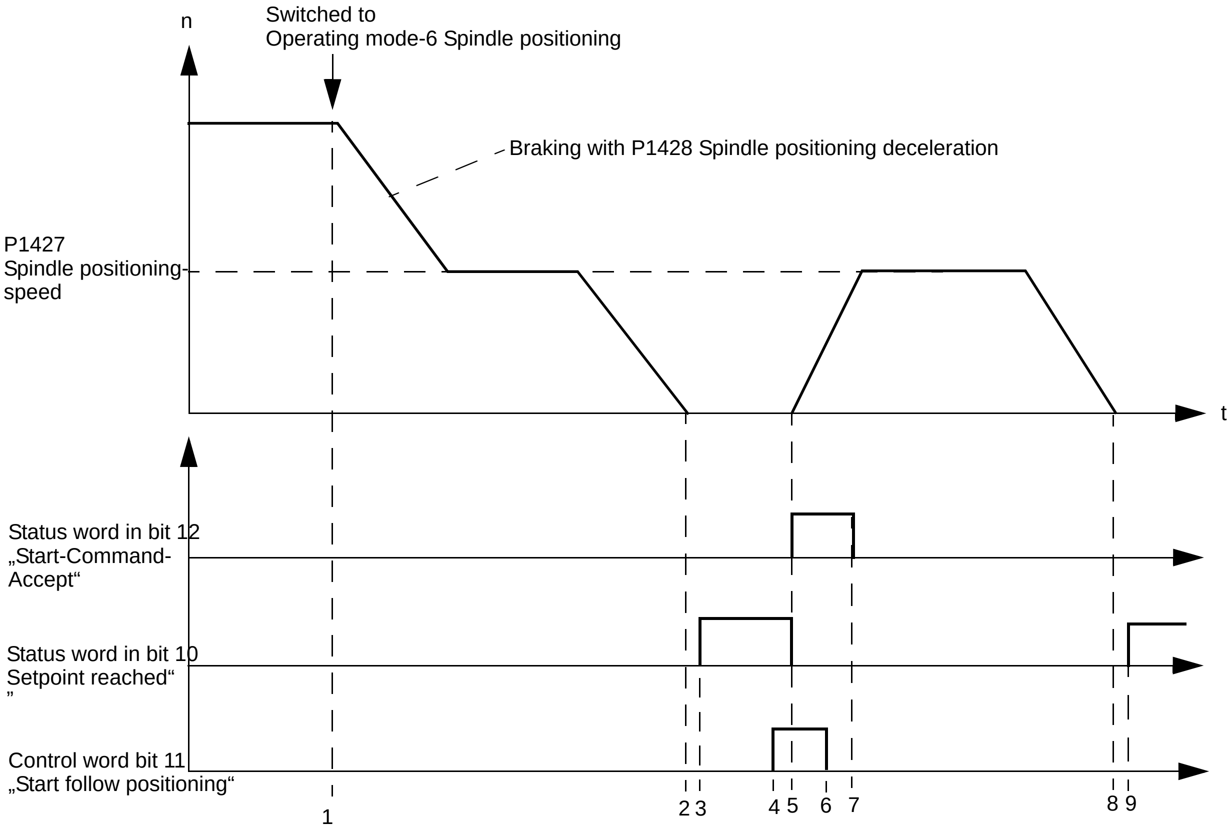
The controller accepts a recognized and accepted start command by the setting of bit 12 „Start-Command-Acknowledge“ in the ▹P0301◃ status word. With the starting the bit 10 „Set value reached“ in the ▹P0301◃ status word is deleted. The bit 12 „In position“ in the ▹P0466◃ Spindle positioning status is a copy of bit 10 „Set value reached“ in the ▹P0301◃ status word.

NOTE!

The bit 11 of the control word is only used for the following positioning. The first positioning is always executed immediately after switching to operating mode spindle positioning independent of the status of bit!

For a handshake at following positioning the „Start-command-acknowledge“ is used. After a spindle positioning error (no. 203 or 204) the bit "set value reached" is not set and therewith no falling edge.

Operating sequence of a spindle positioning with a subsequent following positioning



Time instant 1:	Switching to operating mode Spindle positioning; Braking to $n_{spindle}$ ▷P1427◁
Time instant 2:	Position set value has ▷P0467◁ reached effective target position.
Time instant 3:	Position actual value is in the positioning window and pos. window time has run out → Controller sets „Set value reached“
Time instant 4:	„Start following positioning“ is set.
Time instant 5:	Controller has recognized a start command, resets „Set value reached“, sets the „Start-Command-Acknowledge“ and begins with following positioning.
Time instant 6:	„Start following positioning“ is deleted.
Time instant 7:	Controller deletes „Start-Command-Acknowledge“.
Time instant 8:	Position set value has ▷P0467◁ reached effective target position.
Time instant 9:	The position actual value is in the positioning window and pos. window time has run out⇒ Controller sets „Set value reached“ = 1

Types of following positioning

In ▹P1425◃ Spindle positioning mode bit 4 is set if there should be a following positioning „absolute/relative".

Bit 4 = 0: absolute following positioning

Bit 4 = 1: relative subsequent positioning

Absolute positioning using ▹P1426◃ Spindle positioning target angle

Only the low-word of the ▹P1426◃ is copied to the low-word of the valid target position. The high-word of the ▹P1426◃ is not used at the moment and must be set to zero.

In order to start an absolute following positioning the control bit 11 must be set (positive edge).

The direction of positioning is determined via the bit 0 and 1 of the ▹P1425◃ Spindle positioning mode.

00: Towards greater position set values

01: Towards smaller position set values

10: Shortest distance

11: reserved (value not permissible ⇒
error no. 203 „Spindle positioning: error at initialization“)

Relative positioning using ▹P1430◃ Spindle positioning relative offset

Independent of the direction, which was set, the new target position calculates from the last valid target position plus or minus ▹P1430◃ Spindle positioning relative offset. Only the low-word is used of parameter▹P1430◃. A positive edge in the control bit 11 is necessary in order to start.

The direction of positioning is determined via the bit 0 of the ▹P1425◃ Spindle positioning mode.

0: Towards greater position set values

1: Towards smaller position set values

NOTE!

The value of the bit 4 (following positioning absolute / relative) in the ▹P1425◃ Spindle positioning mode makes no difference at switchover into the operating mode spindle positioning. At the first spindle positioning it is always positioned **absolutely** to ▹P1426◃ Spindle positioning target angle or the trigger signal! The actual rotational direction thereby remains. A change is not possible.

If, at switching, the motor is in standstill (N=0-message), bit 0 and 1 of the ▹P1425◃ Spindle positioning mode decide on the positioning direction.

11.9 Operating mode Synchronous operation (-5)

At synchronous operation a following axis (also referred to as slave axis) is moved synchronous to a master axis.

Synchronous operation mode is set via the ▹P1000◃ = 5

The synchronism mode is displayed in ▹Figure 25◃ on page 39 and in ▹Figure 26◃ on page 40.

In principle the synchronism mode is a position controlled operating mode. The following axis is moved angle-synchronous to the master axis (**angular synchronism**).

In case there is a defined reference between the master axis and the following axis it is referred to as **absolute** angular synchronism. If there is not a defined reference it is referred to as **relative** angular synchronism.

In principle the synchronous operation mode (-5) is a relative angular synchronism. The angle is fixed between the master and the following axis when enabling the drive in the operating mode synchronous operation or when switching over into this operating mode during the running operation. That means that between the master axis and the following axis there exists a fixed but not defined angular relation to one another. At controller inhibit or change into another operating mode the angular relation between master axis and following axis is lost. However, with a phasing module an absolute angular synchronism mode 0000 can be reached.

The set value for the following axis can result from a **real** master axis via one of the encoder inputs or it can be specified directly from a **virtual** master axis directly via a parameter, e.g. via a fieldbus. In this case the positioning set values or positioning delta set values can be predefined. Furthermore a virtual master axis can be calculated in the following axis drive. In this case the speed set values are specified at the following axis.

Furthermore, it is possible to overlay the set value of a real master axis (synchronous operation mode 0000) by an additional set value, e.g. from a fieldbus or to add a register offset angle.

Speed synchronous operation

At speed synchronous operation the speed of the master axis and of the following axis are proportional to one another. The following axis works speed-controlled only, there is no position control. At the angular synchronism the speeds of the master axis and of the following axis are proportional to one another as well. The difference between both synchronism types is that at the speed synchronous operation the angular deviations between master axis and following axis are not compensated due to errors (such as load changes).

An operation in speed synchronous operation is reached at the operating mode synchronous operation (-5), if the position controller is switched off (P-gain of the position controller = Kv factor = 0). In this case the speed feed forward exclusively must generate the required speed set value.

Synchronous operation modes

It is differed between the following synchronous operation modes (▹P1220◃ Synchronous operation mode; bit 0 to 3):

- Mode 0000: "Real master axis in relative angular synchronous operation"
  The set value for the following axis is specified in this mode directly via an encoder in-

put; for that two encoder inputs are required. Via an encoder input (encoder 1 or encoder 2) the evaluation for the motor (controller orientation) and for the position control is activated - with the other encoder input the position set value of the following axis is read.

Additional functions:

- With the help of the phasing module (see ▷Phasing module◁ from page 314) an absolute angle synchronous operation (defined angle between master- and slave axis) can be reached.
- Additionally to the set value over the encoder input it is possible to superimpose a movement via a synchronized set value, a master can be implemented over a synchronous set value input. The set value specified over the parameters ▷P0471◁ or ▷P0472◁, is interpolated from the specified interval (sync interval, ▷P0532◁) to the control cycle and takes effect additively to the set value over the encoder input.
- Furthermore, an offset angle can be set which can be used as a register function. This register offset angle (register angle set value absolute ▷P0477◁) can be written to as well as moved on. The offset angle is added to the position set value of the master axis.

- Mode 0011: Synchronous set value assignment via position parameter:
  Virtual master axis, relative angular synchronous operation, synchronous set value assignment via position parameter
  In this synchronous operation mode the position set values are directly determined, e. g. via a field bus. The set value input operates via the parameters ▷P0471◁ or ▷P0472◁ and thereby must take place in a fixed interval. The set value is interpolated via the interpolator from the interval input (sync interval, ▷P0532◁) on the control cycle (125 µs).
  After each controller enable or online switchover into this operating mode the synchronous set value must be initialized. This is made by writing the parameter ▷P0471◁ or ▷P0472◁. The first writing of one of the two parameters therefore is an initialization but not yet a set value setting. Bit 8 is set in ▷P0470◁ Synchronous operation status, after the synchronous set value was initialized.
  In ▷P0470◁ Synchronous status the bit no. 9 "actual synchronous set value active" is set, if a new set value is written after that. As soon as the synchronous operation module recognized this new set value, the bits 9 and 10 "synchronous extrapolation is active" are deleted in the synchronous status and the set value interpolation starts. If the new set values are written slower than the specified interval, then the behavior depends on the value of bit 5 in the ▷P1220◁ Synchronous operation mode.
  Bit 5 = 0: no extrapolation at set value fail
  Bit 5 = 1: extrapolation at set value fail.

- Mode 0100: "Synchronous set value input via position delta input"
  Virtual master axis, relative angular synchronous operation, synchronous set value assignment via position delta parameter
  The set value input is made over the parameter ▷P0473◁. A position delta (change of set value) is specified. The specified position delta is not interpolated, referring to the control cycle (125 µs) it must be predetermined.

- Mode 0110: Virtual master axis with ramp function generator
  Virtual master axis is calculated in slave axis drive with ramp function generator, relative angular synchronous operation

A speed set value via the ramp function generator input 16 bit ▹P1171◃ is predetermined. In the slave axis drive a virtual axis then is calculated (that means a position set value). The drive then follows this virtual master axis via a synchronous operation. This mechanism makes sense, if there still are further axes e. g. via an encoder emulation connected as slave axes. Then these axes receive the set value of the virtual master axis as an input. Therewith all axes follow the same position set value – also the axis which calculates the virtual master axis at its own.

- Mode 0101: Virtual master axis without ramp function generator
  Virtual master axis is calculated in slave axis drive without ramp function generator, relative angular synchronous operation
  Operating principle is the same as with the virtual master axis with ramp generator, only that in this case the ramp generator is by-passed. The set value input operates over the parameter ▹P0474◃ Synchronous operation speed set value.

Electronic gear

The electronic gearing extends the functionality of the operating mode synchronous operation by a ratio between slave axis and master axis.

The transmission ratio "i" of the electronic gear function is calculated with the following equation:

$$i = \frac{\text{Revolutions slave axis}}{\text{Revolutions master axis}} = \frac{\text{P1221}}{\text{P1222}}$$

Denominator and numerator of the gear ratio consist of integers without decimal places. The nominator may also be negative. This way the function of a reverse gear can be realized.

In the following table we have stated some gear ratios and the corresponding parameter values.

i	Rev. master axis ▹P1222◃	Rev. slave axis ▹P1221◃
0.2	10	2
- 0.78	100	- 78
1.15	100	115
9,452	1000	9452
0,3333	10	3

Edit modes of the electronic gear

The parameters ▹P1221◃ and ▹P1222◃ can be edited during operation (switching over the conversion ratio). At "Transparent mode active" (▹P1220◃ bit 4 = 0) the changes are immediately effective. At "Transparent mode deactivated (▹P1220◃ bit 4 = 1) the ratio remains at first; if the editing mode changes from 1 to 0 the changed parameters then are taken over at the same time.

NOTE!
- With edit mode = 0 (transparent mode) unwanted gear ratios may occur!
- With edit mode = 1 there will be no unwanted transmission ratios.

Example: Reversal of gear ratio from 0.8 to 1.15

with edit mode = 0 (transparent mode)

Rev. master axis	Rev. slave axis	Edit mode	Gear ratio i
10	8	0	0.8
10 → 100	8	0	0.8 → **0.08**
100	8 → 115	0	0.08 → 1.15

or

Rev. master axis	Rev. slave axis	Edit mode	Gear ratio i
10	8	0	0.8
10	8 → 115	0	0.8 → **11.5**
10 → 100	115	0	11.5 → 1.15

with edit mode = 1

Rev. master axis	Rev. slave axis	Edit mode	Gear ratio i
10	8	0	0.8
10	8	0 → 1	0.8
10 → 100	8	1	0.8
100	8 → 115	1	0.8
100	115	1 → 0	1.15

Extrapolation at a set value failure

Only relevant at the set value assignment in the mode 0011. "Synchronous set value assignment via position parameter" and with the specification of the overlaid motion in the mode 0000. "Real master axis in the relative angular synchronism" which occurs due to writing to the parameters ▹P0471◃ or ▹P0472◃.

If bit 5 of the parameter "Synchronism mode" ▹P1220◃ is set the last set value change is calculated (extrapolated) if there is a failure of the set value selection (or overlaid motion). Thereby, the most recent speed remains.

NOTE!

- The extrapolation (▹P1220◃ bit 5) is temporally unlimited, if the set value fails completely the last speed value is kept.
- If the extrapolation is not set (▹P1220◃ bit 5) extrapolation is not made at a set value fail. The last position set value remains. Therewith, the drive sudden stops during the time of the fail.

11.9.1 Phasing module

By means of the phasing module an absolute angular synchronism can be reached in the synchronism mode 0000 "Real master axis in the relative angular synchronism" (defined angle between the master axis and the following axis. The module allows an automatic compensation of the angular offset between

Master axis + offset angle ▹P0477◃ + overlaid motion (sum of position set values)

and the following axis. Precondition for this is a ratio of the master axis to the following axis of 1:1 and a defined reference of the encoder actual values to the mechanics.

The phasing module can be activated via ▹P1220◃ bit 8.

The angular set values which where calculated by the phasing module are incorporated before the consideration of the gearing factor i. e. directly into the set value of the master axis. The travel distance is calculated modulo 360 degrees.

The displacement angle between the master and the slave axis is always evaluated once at the switching over into the synchronous operation mode 0000 "Real master axis in relative angular synchronous operation", independent on the switch status of the phasing module. Thus the displacement angle is able to be processed, even if the phasing module is activated later.

The angular offset is processed in trapezoidal-shaped speed. The maximum acceleration is settable on ▹P1224◃.

The following modes are available via the synchronous operation mode ▹P1220◃:

Traversing procedure Start (bit 13):

- 0: Start traversing procedure individually via the command. (▹P0476◃ = 1)
- 1: Traversing procedure is always active (as soon as a compensating angular offset occurs)

Maximum traveling speed (bit 12):

- 0: Static: Constant maximum traveling speed from the time of activation of the traveling procedure onwards. The maximum traveling speed is adjustable ▹P1223◃.
- 1: Maximum traversing speed which is dynamic and can be changed in dependence on the speed set value. The speed factor is adjustable ▹P1226◃.

Minimum traversing speed at overlaid traversing procedure (bit 11, bit 12):

- Bit 11 = 1, bit 12 = 0: Ensuring a minimum resulting axis speed (▹P1225◃).

Traveling direction (bit 10, bit 9)

- 01: Traveling is always done relative in positive direction.
- 10: Traveling is always done relative in negative direction.
- 00: Traveling is always done the shortest route.

The status of the phasing module is displayed in the bits 12 to 15 of the parameter ▷P0470◁.

11.10 Operating mode Find notch position (-1)

The operating mode Find notch position is set with parameter ▹P1000◃ = -1.

The operating mode Find notch position (Find pole position) is used to detect the mounting position (notch position, pole position) of the encoder at synchronous motors.

When having Baumüller motors with absolute encoders and electronic type plate the notch position is saved in the electronic type plate and therefore does not have to be determined.

At motors with absolute value encoder without electronic type plate the notch position is determined once and is saved in the EEPROM of the controller.

The following values for notch position are typically at Baumüller motors according to encoder type: resolver: 330° ± 5°, sine-cosine encoder 240° ± 5°.

NOTE!

At motors with relative encoder system the notch position search must be made after each switch-on and each activation of the motor-connected encoder!

If parameter ▹P0087◃ Motor rotating field of a synchronous motor with encoder is changed by the user, the notch position is invalid. The controller does not realize automatically, that the notch position is invalid. The user must execute notch position search again to commission the motor hazard-free.

CAUTION!

A motor that is operated with an incorrect notch position can move unintentional with maximum power!

Dangerous movings can be caused from faulty triggering of connected motors. Causes could be:

- Incorrect or faulty wiring or cabling
- Error at the operation of the components
- Incorrect input of parameters before commissioning
- Error at the sensor or signal encoder
- Defective components
- Error in the software

This error can appear immediately after switch on or after an undefined time period during operation.

Therefore:

- Activate position deviation speed monitoring. This monitoring reliably avoids an uncontrolled running of the motor.

11.10.1 Parameter overview find notch position

Number	Name / meaning	Remark
	Settings	
▷P0094◁	Motor mode notch position	Methods 0 to 3
	Status	
▷P0501◁	Motor status notch position	Bit 4
	Data	
▷P0082◁	Motor notch position	
▷P1241◁	Power unit maximum drive current	
	HF injection step 1 (method 2 only)	
▷P2120◁	Frequency of current - find notch position M2 S1	
▷P2122◁	Amplitude of voltage - find notch position M2 S1	
▷P2148◁	Injection amplitude 1 in Volt	
	HF injection step 2 (method 2 only)	
▷P2121◁	Frequency of current - find notch position M2 S2	
▷P2123◁	Amplitude of voltage - find notch position M2 S2	
▷P2149◁	Injection amplitude 2 in Volt	

11.10.2 Methods to find notch position

There are four methods to determine the notch position (see ▷P0094◁ Motor mode notch position).

Method	Meaning
0	Continuous current feed angle and rotating motor shaft
1	Nearly continuous position of the motor shaft and variable current feed angle
2	Injection method (from FW 03.09)
3	Advanced method 1 (from FW 03.10).

At the methods 0, 1 and 3 the controller itself specifies a current setpoint, whose maximum value I_{notch} is limited to the nominal current of the motor ▷P0054◁ and to 70 % of the power unit nominal current (▷P0010◁ or ▷P0012◁).

Because it is supplied in field direction during notch position search, saturation effects can appear. The proportional gain is reduced at the methods 0, 1 and 3 to the value of parameter ▷P2126◁, to avoid an instable current controller.

If the notch position is determined successfully, bit 4 "Notch position was found" is set in ▹P0501◃ "Motor status notch position" at the end of notch position search.

If the notch position is determined not successfully, motor error no. 102 "Group error at notch position search" in parameter "Error motor" (▹P0207◃) is displayed. The error messages are detailed in the following parameter "Error finding notch position" (▹P0237◃).

- Referring to method 0:
  In order to use this method the motor must be easily movable by one pole pair in both directions.

  For "Find notch position" the current setpoint increases linear from 0% to 100% of I_{notch}. The current increase is adjustable with parameter ▹P3021◃ "Delta I" (default value = 15% I_{notch}/s)

  Up to FW 03.08 the current decreases abruptly to zero at the end of the current increase (the procedure can be heard as a clunk). From FW 03.09 (and for method 0 only) the current will be controlled linearly with negative Delta I ▹P3021◃ to 0% (procedure can not be heard).

  Up to FW 03.08 the find notch position is done only once. From FW 03.09 the find notch position is done in two steps with different current feed angles (current feed angle 1 = 0° and current feed angle 2 = 270°) in order to do a plausibility test. From FW 03.10 the current feed angles are settable: Current feed angle1 = ▹P2140◃ with default value = 0° and current feed angle 2 = ▹P2141◃ with default value = 270°, where current feed angle 1 greater than current feed angle 2 is allowed.

  The supply of the single phases at an amplitude *i* and some angles can be seen in the following table.

Rotating field	Supply angle	i_u	i_v	i_w
right	0°	0	√3 * *i* / 2	- √3 * *i* / 2
left	0°	0	- √3 * *i* / 2	√3 * *i* / 2
right	90°	-*i*	*i* / 2	*i* / 2
left	90°	-*i*	*i* / 2	*i* / 2
right	270°	0	- √3 * *i* / 2	√3 * *i* / 2
left	270°	0	√3 * *i* / 2	- √3 * *i* / 2

  - The motor finds its notch position in the correspondent positions.
  - The notch position is detected from the related encoder angles respectively (partial results). The partial results are compared and if the difference is not greater than 22,5° the notch position is deemed to be found. The notch position (▹P0082◃) is the arithmetic average of the partial results.
  - At results, which are not feasible (difference between the partial results is greater than 22.5°) the notch position search is repeated once. If the error repeatedly occurs the notch position search is aborted with an error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 4 "Plausibility step 1"). A wrong setting of the rotating field ▹P0087◃ can also yield this error message.

If the angle ▹P2140◃ and ▹P2141◃ have the same values, the procedure "find notch position" is done once only or the current setpoint increases once only, then the plausibility test fails. A wrong rotating field can not be recognized.

The distance between Current feed angle 1 ▹P2140◃ and Current feed angle 2 ▹P2141◃ is ideally 90°. If the distance is less than 45° or greater than 135° a wrong rotating field can not be recognized certainly. If the distance is about 0° or 180° the notch position search can result in a shifted angle (by 180°) with frictional drives. **Danger: In this case the drive moves in the wrong direction with maximum power if the speed controller is active.**

- Referring to method 1:
  The motor **does not need to** be demounted for this optimization in any case.

  The motor slot must be able to turn easily one or two degrees to each side.

  At this method the current set value is also increased linearly to the maximum current I_{notch}. The current increase can be set in parameter ▹P3021◃ (Default value = 15% I_{notch} / s).

  With the follow-up correction of the electrical angle during the procedure the movement of the motor is minimized. The angle follow-up is done with the speed Delta Rho ▹P3022◃ (Default value = 13.730°/s).

  The drive stay possibly in state 4 if the notch position cannot be found. From FW 03.13 the notch position search is aborted with error message at the end of the internal 60 s time limit. Motor error no. 102 "Group error at notch position search", find notch position sub-error no. 32 "Timeout".

- Referring to method 2 (from firmware version FW 03.09):

  For use of this method the motor must have a recognizable anisotropy (i.e. series inductance (Ld) < cross inductance (Lq)). The motor shaft may be locked during notch position search.

  The motor does not move or only a little at a very well mounted drive.

  The motor is applied with high-frequency voltage. This causes clearly audible noise.

  The notch position search is made in two steps. In step 1 an angle directed to the rotor is detected by means of a following controller (notch position candidate), the field direction is still unknown. In step 2 the field direction is detected and the notch position determined (notch position candidate is possibly shifted by 180°), therefore saturation effects are used.

  With the parameters Frequency of the current (▹P2120◃) and Amplitude of voltage (▹P2122◃ or ▹P2148◃) voltage and frequencies can be specified in step 1. The parameters must be adjusted that the current is approx. 30% of the machine nominal current. If the current is too less, the founded notch position can be wrong.

  With the parameters Frequency of the current (▹P2121◃) and Amplitude of voltage (▹P2123◃ or ▹P2149◃) voltage and frequencies can be specified in step 2. The parameters must be adjusted that the current is in the range of the machine nominal current.

Standard values for the frequency of the current ▹P2120◃ and ▹P2121◃ are 1000 Hz and 250 Hz respectively.

ProDrive provides the possibility to calculate the amplitudes of voltage from the selected current amplitude, the selected frequency and the series inductance (Ld) automatically.

The gain of the following controller is set with ▹P2124◃, default value = 0.15. This setting should not be changed normally. The following controller is used only in step 1.

▹P2125◃ determines the minimum value of the 2nd harmonic part, which is necessary for a valid detection of the field direction in step 2. ▹P2147◃ shows the measured 2nd harmonic part (from FW 03.10).

- In step 1 an angle directed to the rotor is detected twice from different start angle values (angle difference = 45°). Both resulting values (partial results) are compared. If the difference is not greater than 22.5° the notch position candidate is calculated as the arithmetic average of the partial results and step 1 is finished.
- At results, which are not feasible (difference between the partial results is greater than 22.5°) step 1 is repeated. If the difference remains after the third repetition the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 4 "Plausibility step 1").
- In step 2 the field direction is detected. The notch position is calculated (the notch position candidate is possibly shifted by 180°) and entered in ▹P0082◃.
- At results in step 2, which are not feasible (2nd harmonic part ▹P2124◃ less than the minimum value ▹P2125◃) the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 8 "Plausibility step 2").
- If the amplitude of current is too low to detect the 2nd harmonic part ▹P2124◃ the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 512 "Plausibility step 2 invalid" (from FW 03.10)).

The delay compensation must be switched off in method 2 (▹P1320◃ bit 2 = 0).

- Referring to method 3 (from firmware version FW 03.10):

This method corresponds to method 1, however equipped with additional setup possibilities and plausibility tests.

At this method the current set value is increased linearly to the maximum current I_{notch} as in method 1. The current increase can be set in parameter ▹P3021◃ (Default value = 15% I_{notch} / s). The follow-up correction of angle occurs with speed ▹P3022◃ (default value = 13.730°/s).

In opposite to method 1, the maximum traverse angle (▹P2128◃) and the waiting time from current stop to read-out the notch position (▹P2127◃) are adjustable additionally. Default values ▹P2128◃ = 0.5° and ▹P2127◃ = 100 ms.

The motor must be able to turn easily twice the value of the maximum traverse angle (▹P2128◃) to either side (overall the permitted motion is 4*traverse angle).

- In opposite to method 0, the notch position is determined twice (partial results) and the partial results are compared with each other. At results, which are not feasible (difference between the partial results is greater than 22.5°) the notch position search is once repeated. If the error repeatedly occurs the notch position search is aborted with an error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 4 "Plausibility step 1").

- If the rotor turns more than 180° during notch position search, the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 8 "Plausibility step 2").
- If the rotor turns more than 4*traverse angle during notch position search ▹P2128◃, the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 64 "Drive has moved more than 4*traverse angle").
- If the notch position search exceeds the internal 60 s time limit, the notch position search is aborted with error message (motor error no. 102 "Group error at notch position search", find notch position sub-error no. 32 "Timeout".

A reduction of the traverse angle ▹P2128◃ to values less than 0.5° does not lead to a quasi-motionless notch position search. This can be reached only with method 2.

Use method 3 only when method 1 leads to no satisfactory results.

Overview

Monitoring	P0260 Warning system 1		P0200 Error system 1 bit no. 6 = 1	
	P0263 Warning Motor		P0207 Error Motor	
	Bit no.	Warning no.	Bit no.	Error no.
Group error at notch position search (from FW 03.09)	--	--	6	102 (following parameter P0237)
Monitoring	--		P0237 Error at notch position search	
	--	--	Bit no.	Sub-error no.
Overcurrent step 1	--	--	0	1
Overcurrent step 2	--	--	1	2
Plausibility step 1	--	--	2	4
Plausibility step 2	--	--	3	8
Time out	--	--	5	32
Drive has moved more than 4*traverse angle	--	--	6	64
Plausibility step 2 invalid (from FW 03.10)	--	--	9	512

Errors at notch position search

In case of error the drive components inclusive wiring, in particular the motor encoder and its parametrization and the setting of the motor parameter (rotation field, pole pair number, etc.) must be checked at first. Furthermore the current controller should be optimized (using methods 0, 1 and 3) before the notch position search is started.

Measures for troubleshooting and for additional information to the message in the error following parameter ▹P0237◃ "Error finding notch position" see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX 4400, 4600, 4700".

The default values of the parameters Delta I ▹P3021◃ (methods 0,1,3), Delta Rho ▹P3022◃ (methods 1,3), Traverse angle ▹P2128◃ (method 3), Waiting time ▹P2127◃, Scaling factor current controller Kp ▹P2126◃ (methods 0,1,3), Gain of following controller ▹P2124◃ and Minimum saturation level ▹P2125◃ (method 2) are preset robust enough for most cases. Normally they must not be changed. In case of error the support of Fa. Baumüller is preferred due to the complexness of the procedures.

If the troubleshooting can not help at methods 1, 2 and 3 then the motor (or encoder) is not qualified for these methods. Possible causes are:

- Methods 1 and 3:
  - Drives with too great friction, ratchet, break loose torque
  - Drives with minimum torque and friction
  - Too small resolution and quality of the encoder signal, etc.
- Method 2:
  - A not enough impressed magnetic anisotropy of the motor
  - Magnetic unbalance of the three phases
  - Value of the Ld inductance too high, etc.

NOTE!

At methods 1, 2 and 3 an incorrect rotating field ▹P0087◃ is not detected.

11.11 Operating mode Auto-tuning (-7)

The operating mode auto-tuning is set with parameter ▷P1000◁ = -7.

The operation mode auto-tuning is described in the chapter ▷Auto-tuning◁ from page 134.

12

TECHNOLOGY FUNCTIONS

A technology function is a completed software unit that carries out a concretized industrial task in the production technology. It can combine software modules or drive operation modes of the controller firmware.

12.1 Function control-operated homing

Control-operated homing is implemented in b maXX® as an additional function in the operation modes 'position control' and 'synchronous operation' with synchronous set value setting.

At control-operated homing the control must furthermore control the drive via the position set values, which means, that it must execute the moving control. Thereby the control must assure, that the drive is processed accordingly slow, in order to recognize the homing position with the required accuracy.

Similar to the drive-operated homing the selection of the encoder input for homing is made by the parameter "Positioning encoder input homing" ▹P1206◃.

The process of control-operated homing is selected via ▹P0300◃ Control word, the feedbacks of the drive accordingly take place in ▹P0301◃ Status word.

Process of control-operated homing

The controller is in 'position control' (operation mode -4) or in 'synchronous operation' (operation mode -5).

- Phase 1 - start of homing
  By setting of bit no. 4 (homing start) in ▹P0300◃ control word, the control signalizes the beginning of homing.
- Phase 2 - find homing switch
  The drive from now on evaluates the homing switch and signals the status of the homing switch via parameter ▹P0461◃ Positioning switch status. As soon as the switch is activated (the NO or NC must accordingly be parameterized), the actual position is saved.

  Hereby it has to be differed if homing should be executed with zero pulse or with encoder zero angle:

  - Homing with zero pulse means, that the actual position will be not saved until to the next zero pulse.
  - Homing to the encoder zero angle means, that the homing position of the positioning value is used, which corresponds to the positioning value at the encoder zero angle. Encoder zero angle thereby means 0° in the parameter Mechanic actual angle value, ▹P0393◃ (encoder 1) or ▹P0403◃ (encoder 2).
    As soon as homing position has been found, this is signaled by the setting of bit 12 in ▹P0301◃ status word. However the position set values and actual values are not set again internally, because the drive is furthermore receiving position set values from the controller.
- Phase 3 - set homing position (drive)
  The control must now brake the drive to zero speed. Thereupon bit 5 'Set homing position' is set in ▹P0300◃ Control word. As long as this bit is set, there are no new position set values accepted in the drive, the original position set value remains active. The drive stands position controlled on this position.
  Furthermore, the homing position is set after recognition of the flag in the drive, this means that the set values and the actual values are adjusted. Herewith the difference between the actual value position and the saved actual value position at the homing position is considered. That means, that it does not matter which distance the drive has processed since the recognition of the homing position, the difference is considered.
  As soon as the drive has set its homing position, it signals this by bit 13 in ▹P0301◃ status word.
- Phase 4 - control adjusts its position values
  As soon as the drive has set its homing position and has signaled this by bit 13 in ▹P0301◃ status word, the control can read out the new actual value and can correct its own set values and actual values accordingly.
- Phase 5 - controller again activates the position values
  The controller takes back the bit 5 'set homing position' again. From this point of time on, the set values in the drive are evaluated again.
- Phase 6 - ending of homing, changeover into normal operation
  The controller completes homing by deleting bit 4 in ▹P0300◃ control word. As a reaction on this, the drive in turn, resets bit 12 'homing position found' and bit 13 'homing completed' in ▹P0301◃ status word.

12.2 Function Touch probe

With the touch probe function the positioning actual values of encoder 1 or encoder 2 can be saved on an external signal.

There are two touch probes, which are independent from one another. Thereby touch probe 1 is assigned to encoder 1 and touch probe 2 to the encoder 2.

As a trigger signal for the touch probe different settings can be selected. At occurrence of the trigger signal the current actual value position of the accordant encoder is saved and is displayed in the assigned touch probe display parameters.

The accuracy of touch probe is guaranteed by the accuracy of the encoder system which is used:

- With rectangular incremental encoders the resolution per revolution accords to the quadruple of PPR count.
- With Sine-cosine absolute encoders as well as with sine incremental encoders additionally the analog information is evaluated from the sine and cosine tracks.
- Only the information from the analog evaluation exists at resolvers.

The delay error (time from appearance of trigger event to the internal storage of actual value position) is when using the function module FIO-01 about 4 µs, when using function module DIO-01 approx. 10 ms.

The following events can trigger the storage:

- rising and/or falling edge at digital input 1. A digital IO module is attached to slot D.
- rising and/or falling edge at digital input 2. A digital IO module is attached to slot D.
- Zero pulse of the current encoder.
- Zero pulse of the according encoder in connection with an additional qualifying signal (high- or low level) at the digital input 1 or 2. A digital IO module must be attached to slot D.

Each trigger event can be saved single or continuous (e.g. rising edge at the digital input 1). If a rising and a falling edge of a digital input is triggered, there must be an edge clearance of at least 20 µs (module FIO-01) or 10 ms (module DIO-01), due to the limits of the digital IO module.

12.3 Function Master-Slave torque coupling

By means of the function "Master-slave torque coupling " the load of two drives which commonly are moving a load can be divided into a defined ratio. As a part of the drive's configuration this function is described in the chapter ▹Master-Slave torque coupling◃ from page 175 in detail.

13

DIAGNOSTIC TOOLS

13.1 Oscilloscope function

For the quick and user-friendly commissioning the b maXX® controller offers an integrated oscilloscope function.

Function range of oscilloscope function:

Number of channels:	8
Sampling time:	2^n * 125 µs (n = 0....65535)
Recording:	triggered or not triggered
triggering:	• by internal status change, • change of value or • external digital or analog inputs
Number of triggers	2
Trigger linking:	Logic operation of both trigger events: AND, OR, XOR
Trigger time referring to Memory depth:	parameterizable 0 ... 100% (i. e. recording with or without history referring to the trigger event)

Trigger sources:	• Digital signals (selection of relevant bits via bit masks possible) e.g.:
	  ○ Status change
	  ○ Error- or warning events
	  ○ external digital inputs
	• analog signals
	  ○ Set- or actual values
	  ○ analog inputs

1 Command, in order to initiate recording in bmaXX® controller immediately.

2 Command, in order to interrupt a running recording. No values are shown.

3 Command to start a recording with the trigger condition (trigger settings (see ▹Oscilloscope configuration◃ from page 330)).

4 Export recorded measuring data to an external CSV file (table).

5 Invoking dialog ’oscilloscope configuration’
(also see ▹Oscilloscope configuration◃ from page 330).

6 Buttons to position the scales.

7 Buttons to switch on or switch off the measuring curves.

8 Invoking dialog ’oscilloscope limits’
(also see ▹Oscilloscope scaling◃ from page 330).

9 The greater the storage of oscilloscope is set, the longer the measuring values are recorded, but also the longer the transmission of data will take.

Oscilloscope configuration

In this window trigger conditions can be configured and the source parameters for the maximum of eight channels can be selected. The deactivating of channels automatically enlarges the available storage for the remaining channels.

Oscilloscope scaling

It is possible to set limits for each scale of the measuring curves. The limits , which were set in the mode "User limits" are immediately accepted. At ’autom. limits’ the limits are automatically calculated from the minimum- and maximum values, which are available.

13.2 Mains monitor

The mains monitor permits a 3-phase mains monitoring and consists of the following components:

- Display of actual mains frequency and of the actual RMS of the supply voltage.
- Sensing of extreme values of mains frequency and of supply voltage RMS.
- Monitoring of warning limits and issuing of warning messages
- Monitoring of error limits and issuing of error messages

It is imperative, that a supply voltage measurement module BM4-UME-01 is attached on the module slot B!

The mains monitor is activated by the setting of the bit 0 in the ▹P2057◃ mains monitor mode. Its cycle time is 1 ms.

The following mains ratios can be monitored:

- Mains input failure and Phase failure
- Overvoltage and Undervoltage
- Exceeding and falling below the frequency

Display of actual supply voltage and mains frequency:

Supply voltage Actual value (RMS value)

The actual supply voltage is sensed in the control cycle every 125 µs and is rounded-off via a PT1-element with a time constant of 1 ms. This value, which was rounded-off, is in the parameter ▹P2064◃ mains monitor supply voltage-actual value and is updated every 125 µs.

NOTE!

The parameter ▹P2064◃ mains monitor supply voltage-actual value is not to be mixed up with the ▹P0483◃ Power unit supply voltage-actual value. The value of the ▹P0483◃ is sensed by the bmaXX®-basic unit, whereas ▹P2064◃ is measured via the mains input terminals of the BM4-UME-01. The pick off points for both supply voltages can differ, e. g. in front of or behind the mains choke or the line filter (⇒ voltage drops and rounds-off). Furthermore the ▹P0483◃ power unit supply voltage-actual value in the controller is updated about every 50 ms.

Mains frequency-Actual value

For the actual mains frequency every 40 ms via two measured values there is a averaged value in ▹P2065◃ mains monitor-actual value.

The displays of ▹P2064◃ and ▹P2065◃ additionally can be rounded-off via the freely-programmable PT1-filters of the controller. Only the unrounded-off values effectuate the monitoring and the extremum sensing of the mains monitors!

Sensing of extremums of supply voltage and mains frequency:

The maximum- and minimum values are displayed in the following parameters:

- ▹P2066◃ Maximum mains voltage-actual value (RMS value); Reset-value = 0 V
- ▹P2067◃ Minimum mains voltage-actual value (RMS value); Reset-value = 736.6 V
- ▹P2068◃ Maximum mains frequency actual value; Reset-value = 0.1 Hz
- ▹P2069◃ Minimum mains frequency-actual value; Reset-value = 312.5 Hz

A one-time reset of this parameter can be made by the setting of bit 1 in ▹P2057◃ mains monitor mode. A completed reset is acknowledged in ▹P2057◃ mains monitor status bit 16 = 1. After the reset of the bit 1 in ▹P2057◃ mains monitor mode also the status bit 16 is reset.

The values of the extremum parameters remain after deactivating the mains monitor. However, they can not be stored and are lost after the 24 V-controller supply is switched off.

Warnings of the module mains monitor:

When falling below- or exceeding a warning limit the according bit is set in ▹P2057◃ mains monitor status immediately and a warning message is issued. If the value is in the permissible range, then the warning message and the mains monitor status bit immediately is withdrawn.

A warning in the module mains monitor is signaled via the bit 4 of ▹P2062◃ warning system 1. Via the bit bar of ▹P0265◃ warning mains monitor the kind of mains monitor warning, which is existent, can be found out. There can be several mains monitor warnings simultaneously.

▹P0265◃ Bit	Meaning	Warning no.
0	Mains monitor has determined warning Mains failure	64
1	Mains monitor has determined warning Phase failure	65
2	Mains monitor has determined that warning limit is below ▹P2058◃ Mains undervoltage.	66
3	Mains monitor has determined that the warning limit has been exceeded ▹P2059◃ for Mains overvoltage	67
4	Mains monitor has determined that the lower warning limit of frequency ▹P2060◃ is below.	68
5	Mains monitor has determined an exceeding of the upper warning limit of frequency ▹P2061◃.	69

The separate warnings can be activated or deactivated via ▹P2062◃ Mains monitor warning mask.

The warning limits for overvoltage, undervoltage, exceeding and the falling below the frequency are parameterizable. The setting is made via the parameters ▹P2058◃ to ▹P2061◃.

Special cases Mains failure and Phase failure:

Here the error limits or error conditions accord to the warning. However there is an immediate warning message, whilst the set time in ▹P2063◃ mains monitor-mains error reaction delay for the error message must run out.

NOTE!

The mains monitor warnings are not identical with the warnings of the module power supply (▹P0261◃ Warnings power supply). The valid warning limits are stored in the device and can differ from the parameterizable values in the mains monitor.

Error messages of the module Mains monitor:

When falling below or exceeding an error limit the accordant error bit is immediately set in the ▹P2057◃ mains monitor status. However, error 79 „Mains monitor group error" (▹P0205◃ error power supply bit 15 = 1) is generated, if the error has been there at least the time, which was set in ▹P2063◃ mains monitor-mains error reaction delay. If the value is in the permissible range, then the warning message and the mains monitor status bit immediately is withdrawn. An enabled error message is kept.

The kind of mains monitor error, which is existent, can be determined, via the sub-error bit bar of the ▹P0236◃ error mains monitor. Multiple bits can be set.

▹P0236◃ Bit	Meaning
0	Mains monitor has detected error Mains failure.
1	Mains monitor has detected error Phase failure
2	Mains monitor has detected error Undervoltage mains
3	Mains monitor has detected error Overvoltage mains.
4	Mains monitor has detected error Mains frequency at the lower frequency limit
5	Mains monitor has detected error Mains frequency at the upper frequency limit.

The separate error messages can be activated or deactivated via the ▹P2056◃ mains monitor mode.

The Error limits for overvoltage, undervoltage, frequency exceed and falling below the frequency are parameterizable. The setting is made via the parameters ▹P2080◃ to ▹P2083◃.

The error reaction of the mains monitor error 79 is settable. „No reaction“ was preset as default value.

Compensation for short-term interferences:
They should be filtered by the internal rounding-off or by mean value generation or by ▹P2063◃ mains monitor-mains error delay reaction. If there are errors, which repeatedly are occurring, the internal error counter is counted down when returning into the "green range" and is not immediately deleted, in order to keep the previous settings.

Special cases mains failure and phase failure:
Here the error limits or error conditions accord to the warning. The accordant error bit in the ▹P2057◃ mains monitor status is immediately set and a warning message is generated. The according error message is generated, if the failure was for at least ▹P2063◃ the mains error-delay reaction. If an error bit was set in ▹P2057◃ mains monitor status and if the error cause disappears before the mains error-delay reaction, the error bit is deleted again.

NOTE!

The mains monitor-error messages are not identical to the error messages of the module mains supply (▹P0205◃ error mains supply) and of the module Power unit (▹P0206◃ error power unit). The valid error limits are permanently set in the device and can differ from the parameterizable values in the mains monitor. The parameterizable error enable times can be a further difference.

Programming notes:

- Setting of rated mains frequency:
  For the correct monitoring of mains frequency the setting of rated frequency in bit 9 of ▹P2057◃ mains monitor mode is necessary:
  Bit 9 = 0: f_{mains} = 50 Hz (presetting)
  Bit 9 = 1: f_{mains} = 60 Hz
- Activation of the mains monitor
  There is no information about the mains status, e. g. via checkback main contactor. This information can be put on a link to the bit 0 of the ▹P2057◃ mains monitor mode via a digital input.
  Alternative the described working mode under options can be selected.
- It is not checked, if the set warning limit is „more determinate“ than the error limit. Both limits are monitored independent, so that it can happen that at unfavorable programming the error message can occur before the warning!
- Mains voltage measurement module BM4-UME-01
  The mains monitor can only be activated, if there is a BM4-UME-01 module in slot B. Otherwise the error no. 49 "Error in function module B“ is generated.

Further options of the module mains monitor:

- Setting of the operating mode of the mains monitor
  Operating mode means in which drive status the mains monitor shall operate. It includes the total functionality (warnings, errors, extremum acquisition) of the mains monitor.
  The operating mode is set via the bit 8 of the ▹P2057◃ mains monitor mode.
  Bit 8 = 0: Active only in statuses 3 (SWITCHED ON), 4 (OPERATION RELEASED), 5 (INHIBIT OPERATION ACTIVE), 6 (DRIVE SHUT DOWN), 7 (QUICK STOP ACTIVE) and E (ERROR REACTION ACTIVE) of unit control.
  Bit 8 = 1: Active in each unit control state
- Offset measuring for the mains voltage measurement
  In order to reach a higher accuracy of the measured supply voltage, via the bit 10 in ▹P2057◃ mains monitor mode an offset measurement can be activated. The completion of measurement is displayed via ▹P2057◃ mains monitor status bit 15 = 1.
  Up to the time of offset measurement the mains must be switched off.
  The offset points are not saved and must be measured again after each switch-off of the 24 V-controller supply.

14 APPLICATIONS

From the controller FW 3.10 onward there is a limited PLC functionality SoftDrivePLC where programming procedures and links to controller parameters can be executed.

The SoftDrivePLC is available to the application department of Baumüller. So it can offer complete drive solutions without a PCL option module. Up to now two solutions or applications can be operated with ProDrive: Servo pump and CLDP.

For more information please contact the responsible support of Baumüller

NOTE!

Controllers including the SoftDrivePLC functionality must be ordered separately. The Baumüller type key shows if this functionality is integrated or not.

14.1 Servo pump

Highly efficient and dynamically operated hydraulic pump by an electrical servo motor and by a converter.

14.2 CLDP

The CLDP (Closed Loop Differential Pump) is a hydraulic linear axis. It consists of a hydraulic cylinder with a directly coupled internal gear pump, an electrical servo motor and a converter. Similar to the servo pump there is a highly-efficient and dynamically operating of the internal gear pump and finally of the CLDP.

15

PARAMETERS

For the controller b maXX® 4400 there are more than 500 parameters, which are described in this chapter.

15.1 Structure of controller parameter range

Every parameter has

- a name,
- an association to a function group,
- an unique number,
- a data type,
- and fixed attributes or characteristics.

15.1.1 Range of numbers

Not all parameter numbers have been assigned yet - according to function association and meaning. The following table shows the parameter range of numbers:

Range	Parameter numbers from	up to
Reserved for invalid number	0	0
Controller identification	1	5
Power unit identification	6	49
Motor data for 1st Motor	50	149
Encoder data for 1st Encoder	150	159
Encoder data for 2nd Encoder	160	169
Actual values and operational data	170	599
Positioning data sets	600	799
BACI configuration	800	849
Autotuning	850	859

Range	Parameter numbers from up to	
BACI configuration	860	879
Brake control	880	884
Reserved	885	899
Array parameters	900	999
Active data set	1000	1999
Oscilloscope function	2000	2029
System	2030	2199
Reserved	2200	2999
Development parameters	3000	3499
Reserved	3500	65535

15.1.2 Field bus addressability

Access on parameters by use of field busses is done using the parameter numbers only. Some field busses do not support 16-bit-numbers or limit the valid range of numbers. Thereby the arrangement of the parameters in number ranges for b maXX® was selected in such a way, that all parameters relevant for the operation of the controller are addressable by standardized field busses.

NOTE!

When handling data set parameters, you can access by use of the parameter number only the parameters of the active data set.

Overview of field busses and accessibility of device parameters.

Field bus	Directly accessible parameter range in LC/MC appliance	Manufacturer parameter number in protocol	Expansion by two-step access possible
OPC	All	Parameter name	Not necessary
USS	0 - 2047	Para-no.	yes
PROFIBUS	0 - 1999 (without 900 - 999)	Para-no.	yes
CANopen	0 - 16384	Para-no. + 4000_{hex}	yes
SERCOS	0 - 4095	Para-no. + 8000_{hex}	yes

15.1.3 Data type

Every parameter has a data type. The data type reflects the number of bytes occupied by the parameter and the interpretation of each single bit. The b maXX® recognizes the following data types:

Data type	Bit number	Value range
INT	16	-32768 to 32767
UINT	16	0 to 65,535
DINT	32	-2,147,483,648 to 2,147,483,647
UDINT	32	0 to 4,294,967,295
WORD	16	0 to $FFFF_{hex}$
DWORD	32	0 to $FFFFFFFF_{hex}$
STRING	80 * 8	80 ASCII characters

Some parameters become standardized from the ranges of integer values stated in the table above into smaller or greater ranges of values. WinBASS II / ProDrive carries out this scaling automatically, which must eventually be taken into account when accessing by use of external field busses.

Example:

Parameters **P0053 MotorNomVolt**

Data type = UINT (normal range of values, 0 to 65535)

Scaled range of values: 0 to 6553.0 V.

One increment equals 0.1 Volts

15.1.4 Attributes

Every parameter can have one or more attributes - see detailed parameter description

Attribute	Meaning
A	Parameter only serves as display (identification, operational status, actual value, etc.)
EE	The parameter is part of the ’central data’ and can be saved in EEPROM. This parameter will be automatically loaded from the controller’s internal EEPROM when the controller is started.
DS	Data set parameter. This parameter can be saved to one of the eight existing data sets and automatically is load from the controller-internal EEPROM, when the controller is switched on.
-	The parameter will not be saved (effective for e.g. actual values) B. for actual values)
CW	The parameter may be written cyclic (e.g. via the field bus). Normally this affects the synchronous to be written setpoints or the control word of the controller. Parameters, who don’t have this attribute, can be written to only by using the service data communication (or WinBASS II / ProDrive) - thereby consider parameter ’Communication source’ ▷P1001◁).

15.1.5 Reserved bits

In the description of the parameters, especially of the mode parameters and status parameters several bits are marked as reserved. The bits can obtain an importance with future extensions. For these bits the following is valid:

- In setting parameters the bits are to be set to 0.
- In status parameters these bits are not to be evaluated.

15.2 Structure of the parameter description

All parameter descriptions are based on the following scheme:

P1172	Hochlaufgeber Hochlaufzeit	0.00 to 650.00 s	
DS	**Ramp function generator ramp-up time**	0.00 s	
IF	BM_u_Ds0_RFG1RampUpTime	100:1	CW

The different branches of the scheme are described below:

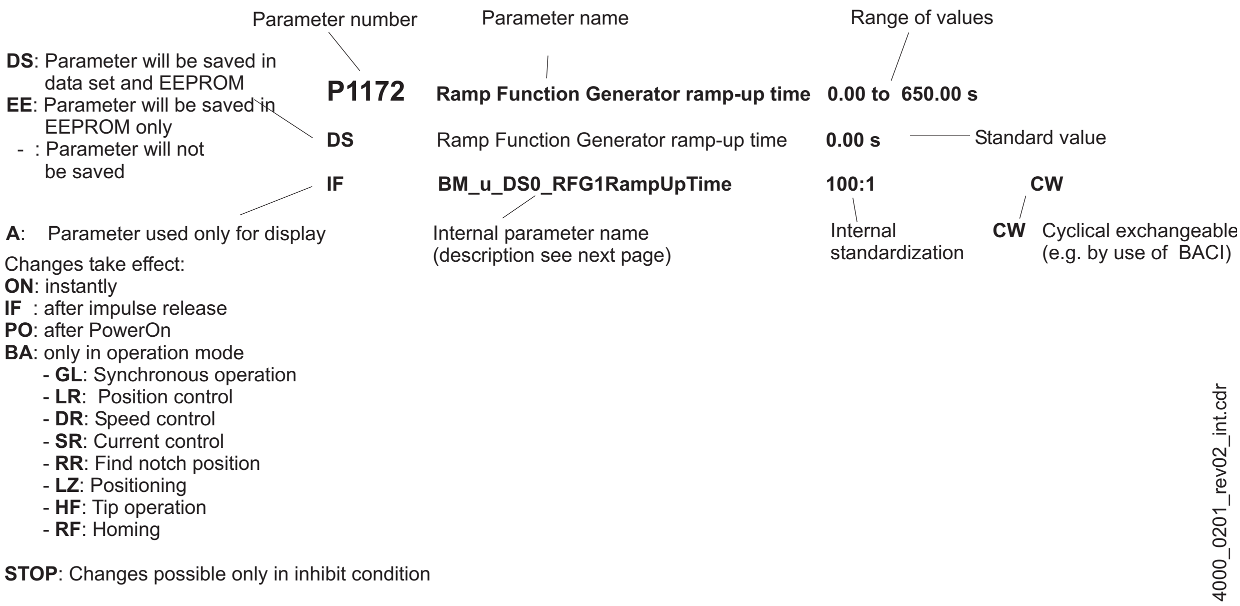


Figure 138: Parameter description scheme

The construction of the internal parameter name is shown below:

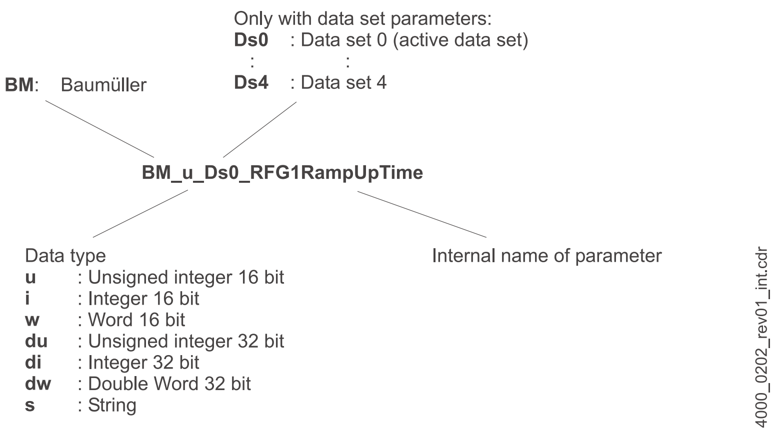


Figure 139: Construction of internal parameter name

In the tables in which we have listed the meaning of the single error bits, you will also find - by certain parameters - the column ’Reaction’ and ’Following parameter’. Thereby was meant:

Reaction

IS = Pulse inhibit, the drive reacts to this error with pulse inhibit. This reaction can, on behalf of the security, not be changed.

Adjustable = You can adjust the reaction of the drive to this error. Use for the selection of the code the following table:

Selection code	Function	Name
0	Pulse inhibit	DRIVE_REACTION_PULSEINHIBIT
1	Ramp down at the ramp function generator	DRIVE_REACTION_RFG_STOP
2	Ramp down at the quickstop ramp	DRIVE_REACTION_QUICK_STOP
3	Ramp down at the current limit	DRIVE_REACTION_CURRENT_LIM_STOP
-1	No reaction	DRIVE_REACTION_NONE
-3	Return motion (from FW 03.08)	DRIVE_ERR_REACTION_RET_MOTION

Following parameter

With following parameters we denote the parameter(s), in which further details according an error event are shown.

Example:
In the parameter ▹P0206◃ by the bit 0 an error is displayed (error no. 80) in the power unit. In the „Following parameter“ ▹P0233◃ then the exact error cause of the communication error with help of the displayed error number can be read.

15.3 Parameter description

P0001	Regler Typ	1 to 3	
-	**Controller type**	1	
A	BM_u_ControllerType	1:1	-

Identification of controller type.

Value	Meaning
1	LC controller (LC1)
2	LC controller with 28xx-processor (LC2)
3	LC controller with 28xx-processor (LC3)

P0002	Regler Firmware-Typ	0 to 65535	
-	**Controller firmware type**	0	
A	BM_u_SoftwareType	1:1	-

Differentiation between standard firmware and customized firmware.

Value	Meaning
0	Standard software
1 to 65535	Customized software

P0003	Regler Firmware-Nummer	0 to 65535	
-	**Controller firmware ID**	0	
A	BM_u_SoftwareID	1:1	-

Baumüller internal software number.

P0004	Regler Firmware-Version	0.00 to 655.35	
-	**Controller firmware version**	0.00	
A	BM_u_SoftwareVersion	100:1	-

Software version, which is used.

XX.xx

incompatible version

compatible version

Figure 140: Controller software version

P0005	Parametertabellen-Version	0 to 65535	
-	**Parameter table version**	0	
A	BM_u_ParamTableVersion	1:1	-

Version of parameter table used.

P0006	Leistungsteil Typenschlüssel	20 ASCII characters	
-	**Power unit type code**	““	
A	BM_s_AmpType	1:1	-

Display of power unit type code. 0 means unknown power unit.

P0007	Leistungsteil Seriennummer	0 to 65535	
-	**Power unit serial number**	0	
A	BM_ud_AmpSerialNr	1:1	-

Display of power unit serial number. 0 means unknown serial number.

P0008	Leistungsteil Datenkonfiguration	0 to 65535	
-	**Power unit data configuration**	0	
A	BM_u_AmpDataConfig	1:1	-

Baumüller internal power unit data code.

P0009	Leistungsteil Firmware-Version	0 to $FFFF_{hex}$	
-	**Power unit firmware version**	0_{hex}	
A	BM_u_AmpSW_Version	1:1	-

Version of power unit software, which is used.

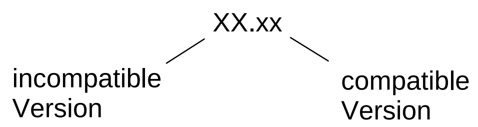


Figure 141: Software version of power unit

Example: 0201_{hex} is according to software version 2.01.

P0010	Leistungsteil Nennstrom 4 kHz	0.0 to 6553.5 A	
EE	**Power unit nominal current 4kHz**	2.5 A	
A	BM_u_AmpNomCurrent4kHz	10:1 A	-

Display of power unit nominal current at 4 kHz switching frequency.

P0011	Leistungsteil Maximalstrom 4 kHz	0.0 to 6553.5 A	
EE	**Power unit peak current 4kHz**	2.5 A	
A	BM_u_AmpPeakCurrent4kHz	10:1 A	-

Display of power unit peak current at 4 kHz switching frequency. The peak current is greater or equal to the power unit nominal current at 4 kHz.

P0012	Leistungsteil Nennstrom 8 kHz	0.0 to 6553.5 A	
EE	**Power unit nominal current 8kHz**	2.5 A	
A	BM_u_AmpNomCurrent8kHz	10:1 A	-

Display of power unit nominal current at 8 kHz switching frequency.

P0013	Leistungsteil Maximalstrom 8 kHz	0.0 to 6553.5 A	
EE	**Power unit peak current 8kHz**	2.5 A	
A	BM_u_AmpPeakCurrent8kHz	10:1 A	-

Display of power unit peak current at 8 kHz switching frequency. The peak current is greater or equal to the power unit nominal current at 8 kHz.

P0014	Leistungsteil therm. Zeitkonstante 1	0.00 to 655.35 s	
EE	**Power Unit thermal time constant 1**	1.00 s	
A	BM_u_AmpTimeConst1kHz	100:1 s	-

Display of the defined time constant ’Power unit therm. 1”. During „Power unit therm1 time. the power unit can be operated with peak current. After that, the current will be limited to the nominal current.

P0015	Leistungsteil Überlastzeit	0.00 to 655.35 s	
EE	**Power Unit overload time**	1.00 s	
A	BM_u_AmpTimeConst2	100:1 s	-

Display of the "Power unit overload time" defined in the power unit. During "power unit overload time" the power unit can be operated with peak current. After that, the current will be limited to the nominal current. On the basis of this value the thermal PT1 time constant is calculated used for the overload monitoring of the power unit.

If "Power unit overload time" = 0, the overload monitoring of the power unit does not take place in the controller. Instead the Ixt value is determined in the power unit and transferred to the controller. Therefor two Ixt values are defined: 80% (normal operation) and 120% (overload).

P0016	Leistungsteil Innenraum-Warntemperatur	0 to 125 °C	
EE	**Power unit internal device warning temperature**	75 °C	
ON	BM_u_AmpAmbientWarnTemp	1:1	-

Warning threshold for interior air temperature within power unit. If the inside air temperature exceeds this threshold, warning 16 is generated. The warning threshold of every power unit has a predefined individual value. Warning threshold can be changed.

P0017	Leistungsteil Innenraum-Abschalttemperatur	0 to 125 °C	
EE	**Power unit internal device shutdown temperature**	0 °C	
A	BM_u_AmpAmbientMaxTemp	1:1 °C	-

Display of shutdown threshold for ambient temperature. If the interior air temperature exceeds this threshold, the power unit will be shut down and error 85 will be generated.

P0018	Leistungsteil Kühlkörper-Warntemperatur	0 to 125 °C	
EE	**Power unit heatsink warning temperature**	75 °C	
ON	BM_u_AmpHeatsinkWarnTemp	1:1 °C	-

Warning threshold for heatsink temperature within power unit. If the heatsink temperature exceeds this threshold, warning 17 is generated. The warning threshold of every power unit has a predefined individual value. Warning threshold can be changed.

P0019	Leistungsteil Kühlkörper-Abschalttemperatur	0 to 125 °C	
EE	**Power unit heatsink shutdown temperature**	0 °C	
A	BM_u_AmpHeatsinkMaxTemp	1:1 °C	-

Display of shutdown threshold for heatsink temperature. If the heatsink temperature exceeds this threshold, the power unit is shut down and error 81 is generated.

P0020	Leistungsteil Uzk-Nennwert	280 to 1000 V	
EE	**Power unit DC link nominal voltage**	540 V	
	BM_u_AmpNomDcLinkVolt	1:1 V	-

Nominal value of DC link voltage for internal scaling of voltage in the control. This value is not to be changed.

From FW 03.10 on: If notch position with method 2 (see ▹P0094◃) will be used, the parameter must correspond to the actually available DC link voltage in the supply voltage (see ▹P2122◃ and ▹P2123◃).

P0021	Leistungsteil Totzeit	0.0 to 6553.5 µs	
EE	**Power unit dead time**	0.0 µs	
A	BM_u_AmpDeadTime	10:1 µs	-

Dead time required for power transistors. Internal value, not relevant for user.

P0022	Leistungsteil Bürdenfaktor Iac	-1.65 to 1.65 V	
EE	**Power unit burden factor Iac**	0 V	
A	BM_i_AmpBurdenFactor_Iac	100:1 V	-

Conversion factor for current measuring. Internal value, not relevant for user.

Displayed value is $\sqrt{2}$ x power unit maximum current 4 kHz (P0011)

P0023	Leistungsteil Bürdenfaktor Vdc	0.00 to 10.00 V	
EE	**Power unit burden factor Vdc**	0 V	
A	BM_u_AmpBurdenFactor_Vdc	100:1 V	-

Conversion factor for DC link voltage measurement. Internal value, not relevant for user.

Displayed value accords to 1000 V U_{ZK}.

P0024

P0024	Leistungsteil Modus	0 to $FFFF_{hex}$	
EE	**Power unit mode**	1_{hex}	
	BM_w_AmpMode	1:1	-

Adjustment for behavior of power unit.

Bit	Meaning	
2 ... 0	Value bits 2 ... 0	Fan control
	0	One or more fans are switched on if the threshold of either the indoor temperature **or** the heatsink temperature was exceeded. One or more fans are switched off if the indoor temperature **and** the heatsink temperature were fallen below the thresholds.
	1	One or more fans are switched on with mains-on signal
	2	BG 1-3: The heatsink fan is controlled via the heatsink temperature only. BG 4-7: The indoor fan is controlled via the indoor temperature only. The heatsink fan is supplied externally with 230 V and is not controlled by the power unit.
	3	Fan always on
	4	Fan always off
15 ... 3	Reserved	

P0025

P0025	Einspeiseeinheit Modus	0 to $FFFF_{hex}$	
EE	**Power supply unit mode**	0_{hex}	
	BM_w_PSU_Mode	1:1	-

Adjustments for power supply unit.

Bit	Meaning
0	0: DC link voltage is generated by the device from the mains. 1: DC link voltage is supplied externally
1	0: at mains failure the motoring operation is inhibited 1: Motoring operation is also possible at mains failure
2	Current limit mode 0: Limitation of motor current to phase error current peak motor current at phase error (▹P0028◃) 1: Limitation of motor current to power unit nominal current at 4 kHz with timeout phase error delay time (▹P0027◃)
15 ... 3	Reserved

- Bit 1 (from firmware version FW 03.01):
  At mains failure motoring operation only then is useful, if either there still is enough energy in the DC link or several axes via the DC link are coupled and another axis additionally supplies energy into the DC link.
  If motoring operation is also activated at mains failure, it must be assured, that the mains does not recover during the motoring operation (e.g. by switching off the main contactor). Otherwise a destruction of the charge circuit can occur!

- Bit 2 (from firmware version FW 03.06):
  If bit 2 of parameter supply unit mode (▷P0025◁) is set, the controller activates a time monitoring at identification of phase failure. The drive signals the warning „Phase error“. The motor current is limited on the nominal current of the power unit to 4 kHz. After expiration of error delay time and if the phase error condition furthermore exists, the drive generates error no. 65 „Phase error“ and inhibits the pulses to the power unit. In case the phase error is corrected during the phase error delay time, the controller switches back into a non-reduced current operation without signaling an error.
  If bit 2 of the parameters supply unit mode (▷P0025◁) is not set, the controller limits the motor current to the defined current in parameter „maximum motor current while phase error“ (▷P0028◁). There is no time monitoring. The controller generates the warning: Phase error.

P0026	Max. Phasenausfall-Fehlerverzögerungszeit	0 to 65535 ms	
A	**Max. phase error delay time**	0	
	BM_u_AmpPhaseErrMaxDelayTime	1:1 ms	-

Maximum time, at which the drive is operated at nominal current at phase error. This parameter shows the upper limit for parameter Phase error delay time (▷P0027◁). This limit is a constant of the connected power unit.

P0027	Phasenausfall-Fehlerverzögerungszeit	0 to 65535 ms	
EE	**Phase error delay time**	0	
	BM_u_AmpPhaseErrDelayTime	1:1 ms	-

Timeout parameterization for phase error. The maximum possible value is specified by the parameter Max. phase error delay time (▷P0026◁).

If bit 2 of parameter supply unit mode (▷P0025◁) is set, the controller activates a time monitoring at identification of phase failure. The drive signals the warning 'Phase failure'. The motor current is limited to nominal current of the power unit at 4 kHz. If phase failure condition remains furthermore, although sequence of error delay time was done, the drive generates error no. 65 'Phase failure error' and inhibits the pulses towards the power unit. In case the phase error is corrected during the phase error delay time, the controller switches back into a non-reduced current operation without signaling an error.

P0028	Maximal-Motorstrom bei Phasenausfall	0.0 to 6553.5 A	
A	**Max. motor current while phase error**	0	
	BM_u_AmpPhaseErrMaxCurrent	10:1 A	-

If bit 2 of parameter Supply unit mode (▷P0025◁) has not been set, this parameter determines the maximum current, at which the drive can be operated at phase error. This limit is a constant of the connected power unit.

P0030	Leistungsteil Bürdenfaktor Netzspannung	0 to 65535	
A	**Power unit burden factor Vmain**	0	
	BM_u_AmpBurdenFactor_Main	1:1	-

Power unit-specific burden factor for the measurement of the mains voltage.

P0031	Leistungsteil Bürdenfaktor Motor Temperatur	0 to 65535	
A	**Power unit burden factor motor temperature**	0	
	BM_u_AmpBurdenFactor_MotTemp	1:1	-

Power unit-specific burden factor for the measurement of motor temperature.

P0050	Motor Typenschlüssel	20 ASCII characters	
EE	**Motor type code**	""	
	BM_s_MotorType	1:1	-

Type code of motor. The displayed value is read from motors equipped with electronic type plate and is for your information only. A blank character string marks an unknown motor.

P0051	Motor Seriennummer	0 to 65535	
EE	**Motor serial number**	0	
	BM_ud_MotorSerialNr	1:1	-

Serial number of motor at motors with electronic type plate. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0052	Motor Datenkonfiguration	0 to 65535	
EE	**Motor data configuration**	0	
	BM_u_MotorDataConfig	1:1	-

Internal marking of version of motor data configuration.

P0053 | Motor Nennspannung | 0.0 to 6553.5 V

EE | **Motor nominal voltage** | 0.0 V

BM_u_MotorNomVolt | 10:1 V | -

Nominal voltage of motor, necessary from firmware version FW 03.08 for the control. If you handle motors not equipped with an electronic type plate, you must set the nominal voltage.

P0054 | Motor Nennstrom | 0.1 to 6553.5 A

EE | **Motor nominal current** | 0.1 A

BM_u_MotorNomCurrent | 10:1 A | -

Nominal current of motor, required for I^2t monitoring and for the controlling of asynchronous motors.

If you handle motors not equipped with an electronic type plate, you must set the nominal current.

NOTE!

For the current scaling (that means, as a reference value for current values stated in percent) not the motor nominal current is used. Instead, the adjusted maximum output current of the controller (▹P1241◃, power unit maximum drive current) is used!

P0055 | Motor Nennbetriebsart | 0 to $FFFF_{hex}$

- | **Motor nominal operation mode** | 0_{hex}

A | BM_u_MotorNomOpMode | 1:1 Nm | -

This parameter shows the nominal operating mode of the motor in coded form, just as they are printed on the motor type plate (in accordance with DIN 57 530).

The high byte designates the number of the operation mode 1 to 9 according to operation mode
S1 to S9.

The low byte specifies the relative switching time in % applying to ten minutes.

Example: Imprint in accordance with type plate: S3-40%

High byte = 3,
Low byte = 40_{dec}

P0056	Motor Nennleistung	0.00 to 655.35 kW	
EE	**Motor nominal power**	0.00 kW	
	BM_u_MotorNomPower	100: 1 kW	-

Nominal power of motor, is needed from firmware version FW 03.08 for the control. If you handle motors not equipped with an electronic type plate, the nominal power must be set.

P0057	Motor Nenndrehzahl	1 to 24000 RPM	
EE	**Motor nominal speed**	1 RPM	
	BM_u_MotorNomSpeed	1:1 RPM	-

Nominal speed of motor, is needed for firmware version FW 03.08 for the control. If you handle motors not equipped with an electronic type plate, you must set the nominal speed.

NOTE!

For speed scaling (this means as a reference value for percental speed sizes) not the motor nominal speed is used, but the set maximum speed (parameter ▹P1031◃ on page 559, motor maximum speed of the drive)!

P0058	Motor Leistungsfaktor	0.00 to 1.00	
EE	**Motor power factor**	0.00	
	BM_u_MotorPowerFactor	100:1	-

Power factor (cos φ) of the motor is needed for the control from firmware version FW 03.08. If you handle motors without electronic type plate the power factor must be set.

P0059	Motor Schlupffrequenz 1	0.00 to 655.35 Hz	
EE	**Motor slip frequency 1**	0.00 Hz	
	BM_u_MotorSlipFrequency1	100:1 Hz	-

The parameters ▹P0058◃ to ▹P0063◃ are relevant for asynchronous motors only.
The slip frequency of asynchronous motors depends on temperature. This parameter is only one coordinate of the characteristic curve. Within the controller this characteristic curve is simulated. To do so, only the first 2 coordinates are used (slip frequency 1 at temperature 1 and slip frequency 2 at temperature 2).
This parameter specifies the slip frequency at nominal torque and temperature 1 (e.g. cold motor). Slip frequency 1 must be less than slip frequency 2.
If you handle asynchronous motors not equipped with an electronic type plate, you must set slip frequency 1.

For the operating mode Open loop this parameter only serves as information.

P0060	Motor Schlupffrequenz 2	0.00 to 655.35 Hz	
EE	**Motor slip frequency 2**	0.00 Hz	
	BM_u_MotorSlipFrequency2	100:1 Hz	-

Description also see ▷P0059◁ on page 352.

This parameter defines the slip frequency of the motor at nominal torque and nominal temperature 2. Slip frequency 2 must be greater than slip frequency 1.
If you handle asynchronous motors not equipped with an electronic type plate, you must set slip frequency 2.

For the operating mode Open loop this parameter only serves as information.

P0061	Motor Nennfrequenz	0.0 to 6553.5 Hz	
EE	**Motor nominal frequency**	0.0 Hz	
A	BM_u_MotorNomFrequency	10:1 Hz	-

Display of motor nominal frequency in Hz, is necessary from firmware version FW 03.08 for the control.

If you handle motors not equipped with an electronic type plate, you must set the nominal frequency.

P0062	Motor Temperatur 1	0 to 65535 °C	
EE	**Motor temperature 1**	0 °C	
	BM_u_MotorTemp1	1:1 °C	-

Temperature value display, for which the motor slip frequency 1 is valid. Description also see ▷P0059◁ on page 352.

If you handle asynchronous motors not equipped with an electronic type plate, you must set temperature 1.

For the operating mode Open loop this parameter only serves as information.

P0063	Motor Temperatur 2	0 to 65535 °C	
EE	**Motor temperature 2**	0 °C	
	BM_u_MotorTemp2	1:1 °C	-

Temperature specification, for which the motor nominal slip frequency (slip frequency 2) is valid. Description also see ▷P0059◁ on page 352.

If you handle asynchronous motors not equipped with an electronic type plate, you must set temperature 2.

For the operating mode Open loop this parameter only serves as information.

P0064	Motor Reibmoment	0.00 to 655.35 Nm	
-	**Motor friction moment**	0.00 - 35 Nm	
A	BM_u_MotorFrictionMoment	100:1	-

Display of motor friction torques. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0065	Motor Polpaarzahl	1 to 120	
EE	**Motor number of pole pairs**	3	
	BM_u_MotorPolePairs	1:1	-

Number of motor pole pairs. If you handle motors not equipped with an electronic type plate, you must set the number of pole pairs.

P0066	Motor Magnetisierungsstrom	0.0 to 6553.5 A	
EE	**Motor magnetizing current**	0.0 A	
	BM_u_MotorMagnetCurrent	10:1 A	-

Nominal magnetizing current for asynchronous motors and synchronous motors (a field weakening current is necessary to reach the nominal operation point at some asynchronous motors).

NOTE!

The value of parameter P0066 Motor magnetizing current for synchronous motor is possibly not correct registered in motor database provided with WinBASS or ProDrive. If a motor needs a field weakening current to approach the nominal point, it must be checked whether the value of the motor data sheet and of the motor database are equal. If there is a discrepancy, the value of the motor data sheet must be used.

At motors **with electronic type plate** the magnetizing current $I_{d\text{-nom}}$ is automatically set.

- For synchronous motors

  The nominal magnetizing current ▷P0066◁ is not used automatically for the field weakening operation at synchronous motors. The requested magnetizing current or the maximum field weakening current respectively must be separately entered in the parameter field weakening current for synchronous motor (▷P0095◁).

NOTE!

Only at firmware version FW 03.09:

The parameter for the field weakening operation is used automatically at synchronous motors. For the case that a higher field weakening current is necessary than defined in the parameter, the parameter field weakening current for synchronous motor (▹P0095◃) can be set with the requested peak field weakening current or the maximum field weakening current respectively. For the operation of synchronous motors the permanent field weakening current or the maximum field weakening current is the greater one.

- For asynchronous motors

  At an unknown motor type **without electronic type plate** $I_{d\text{-}nom}$ can be taken from the type plate/motor data sheet.

  If $I_{d\text{-}nom}$ is unknown it can be approximately calculated:

  - by approximate calculation

    $$I_{d-nom} = |I| \cdot \sqrt{1-(k \cdot \cos\varphi_n)^2}$$

    Here is:
    $|I|$ = motor nominal current (▹P0054◃)
    $\cos \varphi_n$ = ▹P0058◃
    k = 1.0 to 1.3

  - The data from the motor type plate are input and there is a measuring of the stator resistance as well as of the total leakage inductance of the motor with the help of the function auto-tuning. The determined magnetizing current is displayed in the parameter Calculated magnetizing current (▹P0506◃) on the WinBASS II / ProDrive page „Open loop“. Magnetizing current for asynchronous motors.

NOTE!

For the operation with the encoder the above mentioned magnetizing current **must** be entered in parameter ▹P0066◃.

- The magnetizing current is calculated from the motor type plate for operating mode **Open loop** and the stator resistance as well as of the total leakage inductance. It is displayed in the parameter calculated magnetizing current (▹P0506◃). The parameter motor magnetizing current ▹P0066◃ is not used. The stator resistance as well as the total leakage inductance can be measured with auto-tuning, if they are unknown.

P0067	Motor Ke-Faktor	0.0 to 6553.5 V/1000/min	
EE	**Motor Ke factor**	0.0 V/1000/min	
	BM_u_MotorKeFactor	10:1 V/1000/min	-

Motor-EMF, referring to 1000 RPM (back-EMF constant) of the synchronous-/or the asynchronous motor.

In the case of the ASM, the Ke-factor refers to a "hot" (operating temperature) motor, whereat the difference between "cold" and "hot" motor is generally negligible. In case of SM the Ke-factor refers to a "cold" motor, whereat the difference between "cold" and "hot" motor, as a rule of thumb, amount to 5%.

If you handle motors not equipped with an electronic type plate, you must enter manually the Ke-factor.

See ▷General overview current controller◁ on page 235.

NOTE!

If the entered K_e factor of the motor is too great, an uncontrolled running of the motor can happen due to an excessive voltage feed forward

P0068	Motor Dämpfungskonstante Kd	0.00 to 655.35 $\frac{\mathrm{Nm}}{1000\mathrm{U/min}}$	
-	**Motor attenuation factor**		
A	BM_u_MotorAttenuationFact	100:1	-

Display of motor attenuation factor Kd. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0069	Motor Spitzenstrom	0.0 to 6553.5 A	
EE	**Motor peak current**	0.0 A	
	BM_u_MotorPeakCurrent	10:1 A	-

Peak current of motor (corresponds to the maximum standstill current $I_{0,max}$ at SM). The displayed value is read from motors equipped with electronic type plate and is for your information only.

From firmware version FW 03.09, onwards:
At a change of this parameter value the value is compared with the value in the according data set of the parameter Peak current of the drive (▷P1241◁). If ▷P0069◁ is smaller than ▷P1241◁, the parameter Peak current of the drive (▷P1241◁) for each data set is limited automatically to the motor peak current (▷P0069◁) and the error message 100 is generated. The response to this error can be set, by default this is „no reaction“.
This limiting function only operates if the bit 15 in the parameter Motor mode (▷P0093◁) was set. By default bit 15 = 0 and therewith this function is not active.

P0070	Motor Spitzenmoment	0.00 to 42949672.95 Nm	
EE	**Motor peak torque**	0.00 Nm	
	BM_u_MotorPeakTrq	100:1 Nm	-

Peak torque of motor (corresponds to the maximum standstill torque $M_{0,max}$ at SM). The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0071	Motor Feldschwächdrehzahl	1 to 65535 RPM	
EE	**Motor field weakening speed**	1 RPM	
	(BM_u_MotorMaxSpeedElectr)	1:1 RPM	-

Maximum speed of motor, independent of mechanical construction. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0072	Motor Maximaldrehzahl mechanisch	1 to 65535 RPM	
EE	**Motor max. speed mechanical**	1 RPM	
	(BM_u_MotorMaxSpeedMech)	1:1 RPM	-

Maximum speed of motor, permissible with the mechanical construction used. At operation of the motor via this speed the motor can incur mechanical damage. The parameter has an informative character prior to FW 3.16, only.

From FW 3.16 the parameter at the motor mode 2 ▷P0104◁ bits 2 to 4, value = 1 (motor I^2t S1 characteristic by means of supporting points) is used to define the motor continuous current limit curve ▷P0115◁ to ▷P0125◁. The parameter can be changed in the inhibited status, only.

P0073	Motor I2t-Zeitkonstante (=0:aus)	0 to 3600 s	
EE	**Motor I2t time constant (=0:off)**	0 s	
	BM_u_MotorTimeConstant_I2t	1:1 s	-

Also see ▷Motor overload monitoring (I^2t)◁ from page 126.

Thermal time constant of the motor T_t [s]. T_t can be taken from the data sheet of the motor and is to be calculated into seconds.

With ▷P0073◁ = 0 or in the state "NOT READY TO START" the PT1 element of the motor overload monitoring is set or initialized to the motor temperature (if the motor temperature is registered with a sensor, otherwise the PT1 element is zero). Thereby, 40°C ↔ 0% and approximately (simplified) 155°C ↔ 100% of the motor I^2t actual value ▷P0502◁. Therefore, the error number 99 "Motor I2t overload" can occur although the current is low or when it is switched on.

If you handle motors not equipped with an electronic type plate, you must set the I^2t time constant.

If time constant = 0 is selected, the overload monitoring is switched off.

P0074

EE

Motor Flags	0 to $FFFF_{hex}$	
Motor flags	0_{hex}	
BM_w_MotorFlags	1:1	-

Characteristics of the motor, see table below.

Bit	Meaning
0	0: Motor-rotating field counter-clockwise 1: Motor-rotating field clockwise rotation (typical for Baumüller motors)
1	0: Synchronous motor 1: Asynchronous motor
15 ... 2	Reserved

These flags are read at the initialization of the controller or at the re-initialization of the encoder from the electronic type plate of the encoder and control according operation mode parameters of the controller.

- Bit 0 controls the status of bit 0 in the parameter motor rotating field - see parameter ▹P0087◃ on page 361
- Bit 1 controls the statuses of the bits 0 and 1 in parameter motor mode - see parameter ▹P0093◃ on page 362

P0075

EE

Motor Ständerwiderstand	0.000 to 500.000 Ω	
Motor stator resistance	0.000 Ω	
BM_u_MotorStatorResist	1000:1 Ω	-

The stator resistance is needed for the control.

The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by autotuning (also see ▹Auto-tuning◃ from page 134).

P0076

EE

Motor Ständerstreuinduktivität	0.00 to 655.35 mH	
Motor stator leakage inductance	0.00 mH	
BM_u_MotorStatorLeakInduct	100: 1 mH	-

Leakage inductance of single-phase equivalent circuit diagram of the asynchronous motor is needed for the control. The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by auto-tuning (also see ▹Auto-tuning◃ from page 134).

P0077	Motor Rotorwiderstand	0.000 to 500.000 Ω	
EE	**Motor rotor resistance**	0.000 Ω	
	BM_u_MotorRotorResist	1000:1 Ω	-

Rotor resistance of single-phase equivalent circuit diagram of the asynchronous motor, is needed for the control. The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by autotuning (also see ▷Auto-tuning◁ from page 134).

P0078	Motor Rotorstreuinduktivität	0.00 to 655.35 mH	
EE	**Motor rotor leakage inductance**	0.00 mH	
	BM_u_MotorRotorLeakInduct	100: 1 mH	-

Rotor leakage inductance of single-phase equivalent circuit diagram of the asynchronous motor, is needed for the control. The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by autotuning (also see ▷Auto-tuning◁ from page 134).

P0079	Motor Hauptinduktivität	0.00 to 655.35 mH	
EE	**Motor magnetizing inductance**	0.00 mH	
	BM_u_MotorMagnetInduct	100: 1 mH	-

Magnetizing inductance of single-phase equivalent circuit diagram of the asynchronous motor. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0080	Motor Lq-Induktivität	0.00 to 655.35 mH	
EE	**Motor Lq inductance**	0.00 mH	
	BM_u_MotorLqInduct	100: 1 mH	-

Lq inductance of synchronous motor. This parameter is needed for the control. The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by auto-tuning (also see ▷Auto-tuning◁ from page 134).

P0081	Motor Ld-Induktivität	0.00 to 655.35 mH	
EE	**Motor Ld inductance**	0.00 mH	
	BM_u_MotorLdInduct	100: 1 mH	-

Ld inductance of synchronous motor. This parameter is needed for the control. The parameter has an informative character only.

P0082	Motor Rastwinkel	0.0 to 360.0 °	
EE	**Motor notch position**	240.0 °	
	BM_u_MotorNotchPos	65535:360°	-

Notch position (mounting angle of encoder <-> electrical angle 0°) of synchronous motor. If you handle motors not equipped with an electronic type plate, you must find out the notch position by using the operational status ’Find notch position’.

P0083	Motor Trägheitsmoment	0.00 to 42949672.95 kg*cm²	
EE	**Motor torque inertia**	0.00 kg*cm²	
	BM_ud_MotorTrqInertia	100:1 kg*cm²	-

Inertia of motor, is necessary for the calculation of parameter of speed controller. The displayed value is read at motors with electronic type plate, at motors without electronic type plate the value must be set, or must be determined by auto-tuning (also see ▷Auto-tuning◁ from page 134).

P0084	Motor Temperatursensor-Typ	0 to 255	
EE	**Motor temperature sensor type**	0	
	BM_u_MotorTempSensorType	1:1	-

Two different types of temperature sensors used are available.

Value	Meaning
0	KTY 84
1	Temperature switch or motor protection PTC thermistor (MSKL)

If you handle motors not equipped with an electronic type plate, you must set the temperature sensor type.

P0085	Motor Bremsen-Spannung	0.0 to 6553.5 V	
EE	**Motor brake voltage**	24.0 V	
	BM_u_MotorBrakeVolt	10:1 V	-

Voltage of motor brake. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0086

EE

Motor Bremsen-Trägheitsmoment	0.00 to 42949672.95 kg*cm²		
Motor brake torque inertia	0.00 kg*cm²		
BM_ud_MotorBrakeTrqInertia	100:1 kg*cm²	-	

Torque inertia of motor brake. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0087

EE

Motor Drehfeld	0 to 1	
Motor rotating field	1	
BM_u_MotorRotatingField	1:1	-

Adjustment of the control to the rotating field of the motor.

Value	Meaning
0	Counter-clockwise rotating field
1	Clockwise rotating field

The setting of the rotating field is automatically read with motors with electronic type plates (as long as the read-out is activated - see motor mode ▷P0093◁ on page 362). A permanent change of the rotating field by this parameter is not possible, because the changing will be automatically replaced by the values read from the type plate at the next controller start-up.

If the value of this parameter is changed in case of a synchronous motor with encoder by the user, the notch position is no longer valid. The does not realize automatically, that the notch position is no longer valid. The user must execute notch position search again to commission the motor hazard-free.

P0088

EE

Motor Warntemperatur 1	-80 to 250 °C	
Motor warning temperature 1	125 °C	
BM_i_MotorWarnTemp1	1:1 °C	-

Warning threshold 1 of motor temperature monitoring.

P0089

EE

Motor Warntemperatur 2	-80 to 250 °C	
Motor warning temperature 2	125 °C	
BM_i_MotorWarnTemp2	1:1 °C	-

Warning threshold 2 of motor temperature monitoring.

P0090	Motor Abschalttemperatur	-80 to 250 °C	
EE	**Motor shutdown temperature**	150 °C	
	BM_i_MotorMaxTemp	1:1 °C	-

Shutdown threshold of motor temperature monitoring.

P0091	Motor Temperaturhysterese	0 to 5 °C	
EE	**Motor temperature hysteresis**	5 °C	
	BM_i_MotorMonHysteresis	1:1 °C	-

Hysteresis for motor temperature monitoring thresholds.

P0092	Motor I2t-Warngrenze	0.0 to 100.0 %	
EE	**Motor I2t warning limit**	0.0 %	
	BM_u_MotorI2t_ULim	4000_{hex}:100 %	-

Also see ▹Motor overload monitoring (I^2t)◃ from page 126.

I^2t warning limit at motor overload.

Scaling: 100% ↔ Maximum thermal load of the motor

P0093	Motor mode	0 to $FFFF_{hex}$	
EE	**Motor mode**	0_{hex}	
	BM_w_MotorMode	1:1	-

With this parameter the motor is controlled.

Bit	Meaning
1 ... 0	**Motor type:** 00: Synchronous 01: Asynchronous 10: Asynchronous encoderless (open loop) (from FW 03.06) 11: Reserved
2	Reserved
3	**Motor cooling type** (used in overload monitoring) (from FW 03.10) 0: air forced ventilation 1: self ventilation (derating curve standard induction motors), see below bit 3 note
4	**Motor data:** 0: Motor data and absolute data offset (▹P0157◃/▹P0158◃ or ▹P0167◃/▹P0168◃ are not read from the encoder, but from the controller EEPROM 1: Motor data, absolute data offset (▹P0157◃/▹P0158◃ or ▹P0167◃/▹P0168◃) and notch position offset (▹P3058◃ or ▹P3059◃) are taken over from the encoder for the motor control From FW 03.09 on data can alternatively be read from the encoder with ▹P2099◃.

Bit	Meaning
5	**Motor temperature:** 0: The motor temperature is not evaluated 1: The motor temperature is evaluated
6	**Field angle monitoring:** 0: Off 1: On
7	**Mode of field weakening for synchronous motor** (also see ▹Field weakening synchronous motors◃ on page 240): 0: At the voltage limit (this mode can be supported by a field weakening current characteristic. See "Motor mode 2" ▹P0104◃ bit 0. 1: Permanent with consistent field current
8	**Temperature tracing control:** 0: Switched off 1: Active **Motor type asynchronous motor:** Temperature tracing of slip frequency **Motor type asynchronous encoderless (open loop):** Temperature adaption of slip frequency and stator resistance **All motor types:** Temperature adaption of stator resistance for the calculated motor torque ▹P0508◃.
9	**For asynchronous motor only:** Observe waiting time for field setup: 0: At a simultaneously pulse- and controller enable the torque set value only then becomes effective after procedure of 3 x T_R. 1: At simultaneously pulse- and controller enable, immediate torque build-up in the base speed range (to nominal speed). Above nominal speed the torque set value will take effect only after 3 x T_R.
11 ... 10	**Selection connection motor temperature sensor** 00: Connection at the power unit 01: Connection at the encoder input slot A 10: Connection at the encoder input slot B 11: Reserved
12	**To FW 03.05** Monitoring motor control 0: No monitoring 1: Monitoring active **From FW 03.06** if motor brake is in control mode „Manual“ (▹P1400◃, bit 0 = 0) 0: No monitoring 1: Monitoring active
14 ... 13	**From FW 03.06** Speed search for open loop control at release at rotating machine 00: Speed search deactivated 01: Speed search for clockwise rotation activated 10: Speed search for counter-clockwise activated 11: Speed search in both speed directions
15	**From FW 03.09** Automatic limiting of the parameter Peak current of the drive (▹P1241◃) to the motor peak current (▹P0069◃) 0: Limiting deactivated, default setting 1: Limiting activated

- Bit 3:
  - 0: Forced cooling: There is no derating characteristic of the maximum continuous current regarding the overload monitoring of the motor
  - 1: Self cooling: Derating characteristic of the maximum continuous current in

dependence of the speed. For standard induction motors without forced cooling. characteristic settable via ▹P0101◃ and ▹P0102◃.

From firmware 03.16 identical with the speed-dependent monitoring mode value 3 in ▹P0104◃ bits 2 to 4.
See ▹Motor overload monitoring (I^2t)◃ from page 126

- Bit 4:
  If you have motors equipped with electronic type plate the motor data can be read from the type plate.
  With this bit you can set, if the motor data shall be read from the electronic type plate, or if they are adjusted manually by use of parameters. When the type plate is read out, the same encoder is used as for motor control.
  From firmware version FW 03.09 motor data, absolute data offset and notch position offset also can be read via ▹P2099◃.

- Bit 5:
  Motor temperature evaluation can be switched on or off. When motor temperature evaluation is switched on, the motor temperature will be monitored also with respect to preadjusted temperature limits.
  If motor temperature evaluation is switched off in ▹P0503◃ (motor temperature actual value) always value 40°C is displayed.

- Bit 7:
  For operation of synchronous motors, a field weakening function is implemented. Therewith an increased RMM of about 10% to 20% can be achieved opposite to the nominal speed. The required field weakening current is adjusted in parameter ▹P0095◃.
  From firmware version **FW 03.10** on:
  If field weakening is set at the voltage limit (bit 7 = 0), the field weakening controller can be supported with a pilot-controlled field weakening current characteristic. This characteristic is not active by default. The characteristic can be activated with bit 0 = 1 in ▹P0104◃ Motor mode 2.

- Bit 8:
  Control bit of the temperature tracing control. The bit is effective only if the motor temperature evaluation is activated (see bit 5).
  The slip frequency of asynchronous motors depends on temperature. In order to optimize controlling, with this bit you can activate the temperature follow-up correction.
  - Motor type asynchronous motor (operation with encoder):
    Temperature tracing will be defined by the characteristic from the slip frequencies ▹P0059◃ and ▹P0060◃ and the temperature values ▹P0062◃ and ▹P0063◃.
  - Motor type asynchronous encoderless (open loop):
    The calculated actual slip frequency and the value of the stator resistance for the magnetic flux calculation are adapted internally via the temperature.

  At all motor types the stator resistance is used after the temperature adaption for motor torque calculation from a power balance (▹P0508◃).

- Bit 9:
  With asynchronous motors the behavior at drive enable can be adjusted:

Value	Meaning
0	Before the enabling of torque set value, a waiting time of three times the rotor time constant required, in order to set up the field, must be regarded. During the time of field setup the drive remains in status ’ready-to-operate’. After expiration of this term the drive changes into status ’operation enabled’ (see description of drive management).
1	When the drive is enabled, the torque set value is enabled immediately. The drive immediately changes into status ’operation enabled’. Anyway, it is to be considered, that the motor cannot build up the torque immediately, because the field is not yet set up.

  At the motor type asynchronous encoderless (open loop), the simultaneous torque- and field-build-up causes the loss of the field-orientation and the motor blocks and stops. Do not activate this option for the asynchronous encoderless (open loop). From FW 3.11 and later, the option "Without waiting time" is inhibited for the asynchronous encoderless (open loop).

- Bit 12:
  - Up to firmware version FW 03.05:
    Via control word 2 (bit 0) the motor brake can be controlled. The controller can recognize via an internal checkback input, if current is flowing through the motor brake or not. If the monitoring of the motor brake control is activated, the controller generates an error message (no. 166), in case the brake is to be controlled via the control word 2 but no current flow is sensed by the brake (or an interposed relay). The error delay time is approx. 220 ms.
  - From firmware version FW 03.06:
    The motor brake can be controlled via control word 2 (bit 0) at manual brake control (▷P1400◁ holding brake control mode 0 = 0). The controller can recognize via an internal checkback input, if current is flowing through the motor brake or not. If the monitoring of the motor brake control is activated, the controller generates an error message (no. 166), in case the brake is to be controlled over the control word 2 but no current flow is sensed by the brake (or an interposed relay). The error delay time can be parameterized between 100 ms and 1000 ms (▷P1404◁ Holding brake time-out checkback signal).

During the writing of parameter motor mode, if bit 4 is set and the drive is not enabled, the encoder is new initialized and the electronic type plate is completely read out of the encoder.

NOTE!

When changing over the controlling of asynchronous and synchronous motor the notching angle must be checked on correct setting.

P0094	Motor Rastwinkel-Modus	0 to FFFF$_{hex}$	
EE	**Motor mode notch position**	0$_{hex}$	
	BM_w_MotorNotchPosMode	1:1	-

There are four methods to find out the notch position (see ▹Operating mode Find notch position (-1)◃ on page 316):

Value / Method	Meaning
0	Continuous current feed angle and rotating motor shaft
1	Nearly continuous position of the motor shaft and variable current feed angle
2	Injection method (from FW 03.09)
3	Advanced method 1 (from FW 03.10).

P0095	Feldschwächstrom für Synchronmotor	0.0 to 6553.5 A	
EE	**Field weakening current for synchronous motor**	0.0 A	
	BM_u_SmFieldWeakeningCurrent	10:1 A	-

A field weakening current is required to reach the nominal operating point at some synchronous motors. Otherwise for normal synchronous motors there is the possibility to increase the speed of about 10 % to 20 % with the field weakening function at about the same torque.

The parameter P0095 Field weakening current for synchronous motor is limited to 95% of the nominal current of the power unit at 4 kHz (▹P0010◃/▹P0012◃) and may generally not be set greater than the motor nominal current (▹P0054◃). Additionally the amplitude of the magnetizing current is internally limited to 95 % of the nominal current of the power unit (▹P0010◃ or ▹P0012◃) - except of parameter P0095 - and to 95 % of the maximum current of the drive (P1241). The exception is the acceleration device (see chapter ▹Device types◃ on page 99).

If the method **Field weakening at the voltage limit** is selected (bit 7 of parameter Motor mode (▹P0093◃), parameter P0095 fixes the maximum field weakening current.

If the method **Field weakening with consistent field weakening current** is selected (bit 7 of parameter Motor mode (▹P0093◃), parameter P0095 fixes the value of the constant field weakening current.

The nominal magnetizing current (▹P0066◃), which is loaded from the electronic type plate (motor data base), is **not** used automatically for the field weakening operation at synchronous motors. If this field weakening current or a greater field weakening current is necessary, this value must be set with parameter (▹P0095◃) to the requested value.

NOTE!

Only for firmware version FW 03.09:

The nominal magnetizing current (▹P0066◃), which is loaded from the electronic type plate (motor data base) and is used automatically for the field weakening operation at synchronous motors. For the case that a higher field weakening current than in the parameter (▹P0066◃) is necessary, this value can be set with parameter (▹P0095◃) to the requested value. The permanent field weakening current or the maximum field weakening current respectively for the operation of synchronous motors is the greater one of ▹P0066◃ and ▹P0095◃.

P0096	Motor Artikelnummer	0 to 4294967295	
EE	**Motor article number**	0	
	BM_ud_MotorArticleNumber	1:1	-

Serial number of motor at motors with electronic type plate. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0097	Motor Stillstandsstrom	0.0 to 6553.5 A	
-	**Motor Standstill current**	0.0 A	
A	BM_u_MotorStandstillCurr	10:1	-

Display of the motor standstill current (I_0). The displayed value is read from motors equipped with electronic type plate.

Prior to FW 3.16 the parameter has an informative character, only

From FW 3.16 the parameter is used at the "Motor I2t characteristic by means of iron losses" (motor mode 2 ▹P0104◃ bits 4 to 2, value = 2). The parameter can be changed as of FW 3.16 in the inhibited status, only.

At motors without an electronic type plate the parameter must be set.

P0098	Motor Stillstandsmoment	0.00 to 42949672.95 Nm	
-	**Motor standstill torque**	0.00 A	
A	BM_ud_MotorStandstillTrq	100:1	-

Display of motor standstill torque (M_0). The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0099	Motor Bremsen-Haltemoment	0.0 to 6553.5 Nm	
-	**Motor brake torque**	0.0 Nm	
A	BM_u_MotorBrakeTrq	10:1	-

Display of motor brake torque. The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0100	Motor Getriebefaktor	0 to $FFFF_{hex}$	
-	**Motor gear factor**	257	
A	BM_u_MotorGearFactor	1:1	-

Display of the motor gear factor.

Between motor slot and encoder, at slow-running motors it is useful, to use a gear ratio in order to increase the resolution of the encoder.

Coding of gear ratio:

High-byte: Counter of gear (1...255)
Low byte Denominator of gear (1...255)
The displayed value is read from motors equipped with electronic type plate and is for your information only.

P0101	Motor I2t-Herabsetzungsfaktor 1	10.0 to 100.0 %	
EE	**Motor I2t derating factor 1**	40.0 %	
	BM_u_MotorI2tDeratFact1	4000_{hex}:100.0 %	-

From firmware version 03.10.

Adjustable derating factor of the maximal continuous current at zero speed. This factor is applied in the motor overload monitoring of self ventilated standard induction motors (bit 3 in ▹P0093◃, motor mode, set to 1).

P0102	Motor I2t-Herabsetzungsfaktor 2	10.0 to 100.0 %	
EE	**Motor I2t derating factor 2**	70.0 %	
	BM_u_MotorI2tDeratFact2	4000_{hex}:100.0 %	-

From firmware version FW 03.10.

Adjustable derating factor of the maximal continuous current at half nominal speed. This factor is applied in the motor overload monitoring of self ventilated standard induction motors (bit 3 in ▹P0093◃, motor mode, set to 1).

This parameter cannot be set smaller than parameter ▹P0101◃.

P0104	Motor Modus 2	0 to $FFFF_{hex}$	
EE	**Motor mode 2**	0_{hex}	
	BM_w_MotorMode2	1:1	-

From firmware-version FW 03.10.

Second motor mode word. The motor will be controlled with this parameter.

<table>
<tr><th>Bit</th><th colspan="2">Meaning</th></tr>
<tr><td>0</td><td colspan="2">Mode of the field weakening current characteristic for a synchronous motor (relevant only if field weakening at the voltage limit is selected ▹P0093◃ bit 7 = 0). Also see ▹Field weakening synchronous motors◃ on page 240.
0: not enabled
1: enabled</td></tr>
<tr><td>1</td><td colspan="2">Current monitoring mode (current mode):
(from FW 03.16)
0: Apparent current
1: Single Phases</td></tr>
<tr><td rowspan="6">4 ... 2</td><td>Value</td><td>Speed dependent modes</td></tr>
<tr><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Continuous current limit curve by means of lookup table and interpolation</td></tr>
<tr><td>2</td><td>Continuous current limit characteristic by approximation of the iron losses</td></tr>
<tr><td>3</td><td>Derating curve for motors without forced-air cooling</td></tr>
<tr><td>4 to 7</td><td>Reserved</td></tr>
<tr><td>14 ... 1</td><td colspan="2">Reserved</td></tr>
<tr><td>15</td><td colspan="2">See below notice bit 15</td></tr>
</table>

- Bit 0:
  Mode of the feedforwarded field weakening current characteristic for a synchronous motor.
  - Bit 0 = 0: not enabled
    Bit 0 = 1: enabled

  If the characteristic is activated, it will be added to the d-current set value, i.e. to the output of the field weakening controller. The characteristic operates only if field weakening at the voltage limit (bit 7 = 0 motor mode ▹P0093◃) is selected. The characteristic is set via the parameters ▹P0106◃, ▹P0107◃ and ▹P0108◃.

- Bit 1:
  Combinable with all speed-dependent motor-I^2t modes: P0104 bits 2 to 4.

- Bits 2 to 4:
  Speed dependent modes

  Value 1: Can be activated if the motor continuous current limit curve is applicable, only (synchronous motor). This means that all elements of the characteristic or of the parameters ▹P0115◃ to ▹P0125◃ are non-zero.

  Value 2: Requires the correct motor data Motor rated current ▹P0054◃-, Motor standstill current ▹P0097◃ and Motor rated speed ▹P0057◃

  Value 3: Identical with bit mode 3 "Motor cooling type" in ▹P0093◃.

- Bit 15:

NOTICE!

Activation of the settable motor I^2t threshold via the application parameter ▹P3336◃:

0: not enabled
1: enabled

See ▹Motor overload monitoring (I^2t)◃ from page 126.

P0105	Einsatzdrehzahl drehzahlabh. Stromgrenze	0 to 65535 U/min	
	Application speed of speed dependent current limits	65535 U/min	
A	BM_u_NkIqLimSym	1:1 U/min	-

From firmware version FW 03.10.

The parameter shows the application speed of the speed dependent current limits.

The maximum torque-producing current component Iq will be decreased inversely proportional to the motor speed from the application speed P0105. This reduction is not active by default. It can be activated with setting bit 5 = 1 in the speed controller mode (▹P1030◃).

The application speed P0105 is calculated internally in the controller depending on the maximum quadrature current at nominal speed ▹P1450◃ and the value of the current limit bipolar ▹P1036◃.

P0106	Einsatzdrehzahl der Id-Kennlinie für Synchronmotor	0 to 65535 U/min	
EE	**Application speed of the id-curve for synchronous motor**	65535 U/min	
	BM_u_AdjFwSpeed	1:1 U/min	-

From firmware version FW 03.10.

Application speed of a field weakening current characteristic for a synchronous motor.

The application speed P0106 defines together with the speed base coordinate ▹P0107◃ and the current base coordinate ▹P0108◃ the field weakening current characteristic for a synchronous motor.

The parameter P0106 is not part of the motor data base and is entered manually.

See ▹Parameter overview, Field weakening controller - SM, ProDrive◃ from page 239.

P0107	Drehzahl-Stützkoordinate der Id-Kennlinie für Synchronmotor	0 to 65535 U/min	
EE	**Speed base coordinate of the id-curve for synchronous motor**	65535 U/min	
	BM_u_RefFwSpeed	1:1 U/min	-

From firmware version FW 03.10.

The speed base coordinate defines together with the current base coordinate ▹P0108◃ and the application speed ▹P0107◃ the field weakening current characteristic for a synchronous motor.

The parameter P0107 is not part of the motor data base and is entered manually.

See ▹Parameter overview, Field weakening controller - SM, ProDrive◃ from page 239.

P0108	Strom-Stützkoordinate der Id-Kennlinie für Synchronmotor	0 to 6553.5 A	
EE	**Current base coordinate of the id-curve for synchronous motor**	0.0 A	
	BM_u_RefFwCurrent	10:1 A	-

From firmware version FW 03.10.

The current base coordinate P0108 defines together with the speed base coordinate ▹P0107◃ and the application speed ▹P0106◃ the field weakening current characteristic for a synchronous motor.

The parameter P0108 is not part of the motor data base and is entered manually.

See ▹Parameter overview, Field weakening controller - SM, ProDrive◃ from page 239.

P0109	Last Trägheitsmoment	0.0 to 500000.0 kg*cm^2	
EE	**Load inertia**	0.0 kg*cm^2	
	BM_ud_LoadInertia	10:1 kg*cm^2	-

From firmware version FW 03.10

The value of the load inertia is used to calculate the parameters of the speed controller from the data sheet. The parameter P0109 is not part of the motor data base and is entered manually or is determined by auto-tuning (also see ▹Auto-tuning◃ from page 134).

P0110	Kt einstellbarer Korrekturfaktor	75.0 to 125.0 %	
EE	**Kt adjustable correction factor**	100.0 %	
	BM_u_MotorKtAdjFact	4000_{hex}:100.0 %	-

From firmware version FW 03.12

Adjustable correction value for the motor torque constant Kt used in controller internally. The factor serves the correction of the torque actual value ▹P0344◃.

If the correction factor is on its default value, the torque actual value ▷P0344◁ will act as in the previous software version (before FW 3.12).

The parameter P0110 is not a part of the motor database and must be set manually.

The default setting of 100% of this parameter must normally not be changed.

Also see ▷Torque monitoring◁ from page 228.

P0112	Kt untere Drehzahlgrenze der Adaption	10.0 to 100.0 %	
EE	**Kt adaptation lower speed limit**	25.0 %	
	BM_u_MotorKtAdaptSpeedLim	10:1 %	-

(from FW 3.12 and later)

Lower speed limit of the Kt-adaption.

If the amplitude of the motor speed is above this limit, the Kt adaption is active (▷P0350◁ bit 14 = 1) and the Kt-adaption factor ▷P0594◁ will be determined.

If the motor is lower than this limit, the adaption is deactivated (▷P0350◁ bit 14 = 0) and the Kt adaption factor ▷P0594◁ returns to its default value (100%) with the time constant ▷P0112◁.

Standardization: 100.0 % ↔ motor rated speed (▷P0057◁).

P0113	Motor Kt Unterdrückungszeit der Kt-Adaption	0.016 to 60.000 s	
EE	**Motor Kt adaptation forgetting time**	0.100 s	
	BM_u_MotorKtAdaptForgTime	1000:1 s	-

(from FW 3.12 and later)

If the Kt adaption is deactivated (▷P0350◁ bit 14 = 0, or speed amplitude lower than the speed limit ▷P0112◁), the Kt adaption factor ▷P0594◁ returns to its default value (100%) with the rate of change of 25%/P0113.

P0114	Motor I^2t Schwelle	0.0 to 400.0%	
EE	**Motor I^2t threshold**	100%	
	BM_u_MotorI2tThreshold	4000_{hex}:100%	-

(from FW 3.16)

If the I^2t actual value (▷P0502◁) exceeds this threshold the error number 99 "Motor I2t-overload" is generated. A value of 100% by default just barely allows a continuous operation with continuous current limit characteristic of the motor. Also see ▷Motor overload monitoring (I^2t)◁ from page 126.

Scaling: 100% ↔ Maximum thermal load of the motor

The parameter can be changed at an inhibited controller, only.

P0115	Motor Dauerstrom-Grenzkennlinie 0	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 0**	0.0 A	
	BM_u_MotorS1MaxCurrent_0	10:1	-

See parameter ▹P0125◃

P0116	Motor Dauerstrom-Grenzkennlinie 1	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 1**	0.0 A	
	BM_u_MotorS1MaxCurrent_1	10:1	-

See parameter ▹P0125◃

P0117	Motor Dauerstrom-Grenzkennlinie 2	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 2**	0.0 A	
	BM_u_MotorS1MaxCurrent_2	10:1	-

See parameter ▹P0125◃

P0118	Motor Dauerstrom-Grenzkennlinie 3	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 3**	0.0 A	
	BM_u_MotorS1MaxCurrent_3	10:1	-

See parameter ▹P0125◃

P0119	Motor Dauerstrom-Grenzkennlinie 4	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 4**	0.0 A	
	BM_u_MotorS1MaxCurrent_4	10:1	-

See parameter ▹P0125◃

P0120	Motor Dauerstrom-Grenzkennlinie 5	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 5**	0.0 A	
	BM_u_MotorS1MaxCurrent_5	10:1	-

See parameter ▹P0125◃

P0121	Motor Dauerstrom-Grenzkennlinie 6	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 6**	0.0 A	
	BM_u_MotorS1MaxCurrent_6	10:1	-

See parameter ▹P0125◃

P0122	Motor Dauerstrom-Grenzkennlinie 7	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 7**	0.0 A	
	BM_u_MotorS1MaxCurrent_7	10:1	-

See parameter ▹P0125◃

P0123	Motor Dauerstrom-Grenzkennlinie 8	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 8**	0.0 A	
	BM_u_MotorS1MaxCurrent_8	10:1	-

See parameter ▹P0125◃

P0124	Motor Dauerstrom-Grenzkennlinie 9	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 9**	0.0 A	
	BM_u_MotorS1MaxCurrent_9	10:1	-

See parameter ▹P0125◃

P0125	Motor Dauerstrom-Grenzkennlinie 10	0.0 to 6553.5 A	
EE	**Motor Continuous current limit curve 10**	0.0 A	
	BM_u_MotorS1MaxCurrent_10	10:1	-

From firmware version FW 03.16.

The elements 0 to 10 or ▹P0115◃ to ▹P0125◃ are the supporting points for the continuous current limit characteristic of the motor in dependence of the speed (motor operation type: S1). The element 0 (▹P0115◃) shall thereby contain the value of the standstill current ▹P0097◃ while in the other elements the current values shall be entered in fixed time intervals of the maximum speed mechanical ▹P0072◃ divided by 10.

The selection as well as entering the values can be entered manually or can be loaded via an available supporting point record in the Baumüller motor database.

If the option motor I^2t-monitoring continuous current limit curve is supported by supporting points (motor mode 2 ▹P0104◃ bits 2 to 4, value = 1) the value zero cannot be entered.

The parameters can be changed in the inhibited status, only.

P0150

EE

	Geber 1 Modus	0 to FFFF$_{hex}$	
	Encoder 1 mode	1$_{hex}$	
	BM_w_Enc1Mode	1:1	-

Mode parameter for encoder 1

Bit	Meaning
0	0: deactivate encoder evaluation 1: activate encoder evaluation
1	0: multiplier for PPR count is 1 1: multiplier for PPR count is 8
3 ... 2	Digital filtering encoder evaluation: 00: 125 ns 01: 250 ns 10: 500 ns 11: 1.0 µs
4	Encoder polarity: 0: no sign inversion, clockwise rotating encoder generates positive speed actual value 1: sign inversion, clockwise rotating encoder generates negative speed actual value.
5	Polarity of position count: 0: positive speed actual value effectuates positive change of target position 1: positive speed actual value effectuates negative change of target position
6	Initialization of position value for incremental encoders (from FW 03.10): 0: initialization of the target position value without reference to zero pulse of encoder 1: initialization of the target position value with reference to zero pulse of encoder
7	Sine-squared monitoring of the encoder voltages 0: not active 1: active
8	Resetting of encoder errors: 0: Encoder errors can be acknowledged, the encoder then is initialized anew. 1: Encoder error cannot be acknowledged. With encoder errors the drive has to be switched off and on again.
9	Suppress error message ’absolute position unknown”: 0: No suppression of error message ’absolute position unknown”. 1: The error message ’Absolute position unknown” is suppressed.
10	Activate offset- and amplitude error correction of the resolver 1: Offset- and amplitude error correction is activated 0: Offset- and amplitude error correction is deactivated
11	Reserved
12	1: Absolute angle transfer of encoder 2 (from FW 03.09)
13	Incremental encoders: selection of the initialization procedure for position value of encoder with reference to zero pulse (bit 6 = 1) 0: relationship to zero pulse is established as quickly as possible 1: incremental assembly of the relationship
14	Absolute position of the encoder is read out 0: unsigned 1: with sign (details see description of bit 14)
15	Shutdown of communication protocol 0: at encoders with communication interface (HIPERFACE® or EnDat interface) encoder type, absolute position and if necessary electronic motor type plates from the encoder are read out. 1: No communication to the encoder, also the absolute position is not read out.

NOTE!

The bits 1, 2, 3, 6, 7, 10, 13 and 15 have no function at EnDat 2.2-encoders.

Description

- Bit 4 and bit 5, encoder polarity and polarity of position count:
  With these settings the evaluation of the encoder can be inverted. Thereby it is differed between the entire inversion (bit 4, encoder polarity), this means encoder evaluation for the motor control (parameter ▹P0393◃ mechanical angle) as well as for the actual value position (parameter ▹P0391◃ and ▹P0392◃) is inverted and of the inversion only for the actual value position (bit 5, polarity position count). The following options are obtained:

Bit 5	Bit 4	Description
0	0	No inversion: clockwise rotating encoder effectuates positive actual speed and enlargement of the actual position Example: Encoder is attached to the motor side and a positive motor speed direction results in an enlargement of the actual position.
0	1	Inversion of the entire encoder evaluation: clockwise rotating encoder effectuates a negative actual speed and a reduction of the actual position value Example: Encoder is attached to the load side and a positive motor speed direction (that means a negative speed direction of the load!) results in an enlargement of the actual position value.
1	0	Inversion only for position count, no inversion for motor control: clockwise rotating encoder effectuates positive speed actual value but a reduction of the actual position Example: Encoder is attached to the motor side and a positive motor speed direction results in a reduction of the actual position.
1	1	Inversion only for motor control, no inversion for position count: clockwise rotating encoder effectuates negative actual speed value and an enlargement of the actual position value Example: Encoder is attached to the load side and a positive motor speed direction (that means a negative speed direction of the load!) results in a reduction of the actual position value.

- Bit 6, Initialization of ▹P0391◃ Encoder 1 position value for incremental encoders
  The encoder actual value is set to zero at initialization. If bit 6 is set, a re-initialization of the encoder actual value occurs as soon as the controller recognizes the zero pulse. The angle is corrected so that the value is zero at zero pulse.
- Bit 8, Resetting of encoder errors:
  With this bit you can set, if an encoder error (cable break, communication error a.s.o.) is acknowledged per control word command or if the controller must be switched off and then on again.
- Bit 9, Suppress error message ’absolute position unknown”:
  The error message ’absolute position unknown’ can occur under the following three terms:

1. Error at the encoder communication (HIPERFACE® or EnDat-interface)

2. The drive control is on the synchronous motor (bit 0..1, parameter ▹P0093◃), the motor control is adjusted to this encoder (bit 0..1, parameter ▹P1030◃) and the encoder type are with communication but its communication-protocol (bit 15, parameter ▹P0150◃ or ▹P0160◃) is switched off.

3. Drive control is on synchronous motor (bit 0..1, parameters ▹P0093◃), the motor control is set acc. to this encoder (bit 0..1, parameters ▹P1030◃) and at encoder type it is a square-wave- or sine-incremental encoder.

NOTE!

The error message can be suppressed by the setting of the bit 9 only for the cases 2 and 3. In this case the user must assure, that after each encoder initialization a notch position search must be executed.

- Bit 12: Absolute angle transfer of encoder 2 (from firmware version FW 03.09):
  If this bit is activated at each initialization of encoder 1 the angle of encoder 2 is copied to the angle of the encoder 1. The value of revolutions is set to zero. The function only operates at incremental encoders. Therewith the angle position of the incremental encoder can be initialized without prior homing and the encoder, therewith is made quasi absolute.
  Preconditions:
  - at encoder input 2 (module slot B) an absolute value encoder is connected, which was initialized error-free.
  - at encoder input 1 (module slot A) an square-wave- or sine-incremental encoder is connected.
  - the position count of both encoders is 1:1.

  Application example:
  Motor control of a synchronous motor by an incremental encoder. The second absolute encoder serves as pole position sensor. If bit 12 is active, the operating mode „Find notch position“ is only once necessary, as long as the above mentioned preconditions are complied with.

- Bit 13 Incremental encoder: Select the initialization procedure for the ▹P0391◃ Encoder 1 position value with relationship to zero pulse.
  If encoder 1 mode bit 6 is set, the procedure for re-initialization of the encoder actual value can be selected via bit 13.
  - Bit 13 = 0: After the controller has recognized the zero pulse, the relationship to the zero pulse is established as quickly as possible (within a sampling of the controller).
  - Bit 13 = 1: If the abrupt correction (within a sampling of the controller) is not desired, an incremental assembly of the relationship between encoder actual value and zero pulse can be established. Then the regulation of the actual value occurs softly. This will take up to 4 s depending on the value of the angle to be changed.

  The relationship is established when bit 7 (absolute position not known) in ▹P0390◃ Encoder 1 state is deleted.

- Bit 14:
  The evaluation of the absolute position with sign can be activated with bit 14. If this bit is set, the controller treats the read out value as negative number in 2-complement when the most significant bit (MSB) is set.

The sign handling is supported only at length measurement systems with SSI protocol. For other encoders bit 14 has no action and is set to zero.

- Bit 15: Communication protocol
  With this bit it can be set, if at encoders with communication interface (HIPERFACE®interface at absolute encoder of company Stegmann or EnDat interface at absolute value encoders) the encoder type, the absolute position and if necessary the electronic type plate of the motor are read out of the encoder.
  If this bit is set, there is no communication executed to the encoder. In this case the values for number of pulses and revolution of the encoder are entered manually. Furthermore the encoder then cannot be used as an encoder for the motor control of synchronous motors, because the absolute position is necessary for this.

NOTE!

After changing of the mode parameter for encoder 1 a new starting of the controller is necessary.

From controller firmware version FW 03.05 the encoder is automatically initialized new with the new settings after changes at the settings for the encoder 1 have been made.

P0151	Geber 1 Typenschlüssel	20 ASCII characters	
-	**Encoder 1 type code**	""	
A	BM_s_Enc1Type	1:1	-

From firmware version FW 03.09.

Type code or type identification of encoder 1 or encoder 2.

- For encoder without communication (serial data interface) the following sign sequences are stored:
  - Resolver: „Resolver“
  - Square wave incremental encoder (5V; TTL): „Incremental encoder“
  - Sine incremental encoder (1 Vss): „Sine incr. encoder“
  - Sine incremental encoder (1 Vss) with commutation: „Sine incr. commutat.“
- Encoder with communication:
  - Sine-cosine encoder with Hiperface®
    Here the identification is displayed dependent of the read type-ID.

  Examples:
    - SRM 60 with ID 27_{hex}: „SRM 50/60 / SCM-Kit 101"
    - SKS 36 with ID 32_{hex}: „SKS 36"
    - At unknown ID „unknown“ is displayed.
  - Sine-cosine encoder with EnDat:
    Here the specified type code is composed of the following:

  Encoder type + Order designation + EnDat-version + EnDat-instruction set

Examples:

- Multiturn-rotary encoder EQN1325
  Order designation 01; EnDat-version 2; Instruction set 2.2:
  „MultiRotaryED01-2.2“
- Singleturn-rotary encoder ECN1313
  Order designation is not stored in the electronic type plate;
  EnDat-version 2; Instruction set 2.1:
  „SingleRotaryEDxx-2.1“
- Code-length measuring system LC483
  Order designation 02, EnDat-version 2; Instruction set 2.2:
  „CodeLinearED02-2.2“

- Sine-cosine encoder with SSI data interface:
  Here the display is dependent of the parameterization of the ▷P0570◁ SSI-encoder mode and of the ▷P0572◁ SSI-encoder length sine / measuring step.

Examples:

- Multiturn-rotary encoder: „MultiRotaryEnc SSI“
- Length measuring system: „CodeLinearEnc SSI“

If the communication is switched off at encoders with serial data interface, „unknown“ is displayed.

If the controller firmware version does not recognize the ID of the encoder module, the type code is set to „none“ .

At a deactivated encoder „disabled“ is displayed.

P0152	Geber 1 Strichzahl bzw. Polpaarzahl	1 to 32767
EE	**Encoder 1 number of pulses or pole pairs**	1
	BM_u_Enc'X'PulsesPerRev	1:1

Pulse number per revolution or number of pole pairs of encoder 1.

With incremental encoder: Pulse number per revolutions of the incremental encoder

At sine-cosine encoder (Stegmann or Heidenhain): Number of sine periods per revolution. Is automatically read out the encoder.

At resolver: Number of pole pairs of the resolver

At EnDat2.2-encoders (module type ENC-06) instead of the PPR count the resolution of the positioning value per revolution is shown in bit.

P0153	Geber 1 Umdrehungen	1 to 65535
EE	**Encoder 1 number of revolutions**	1
	BM_u_Enc1NomRev	1:1

Number of complete revolutions, which encoder 1 can display, i. e. in which the encoder can dissolve a definite absolute position.

P0154	Absolutmaßoffset Geber 1	-2147483648 to 2147483647	
EE	**Absolute offset encoder 1**	0	
PO	BM_di_Enc1Offset	1:1	-

The controller adds the value of this offset to the absolute value of encoder 1.

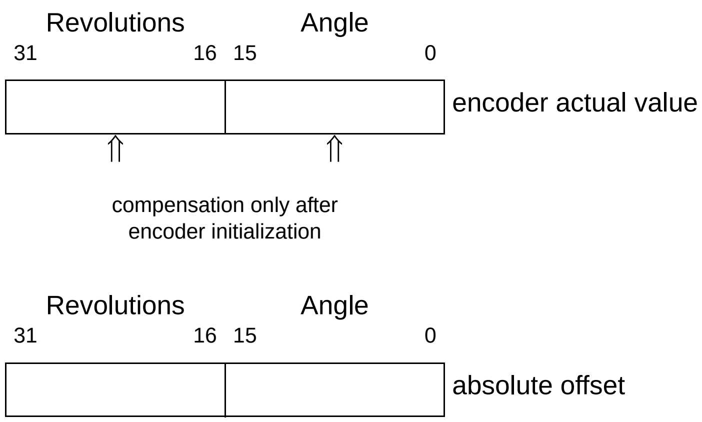
Thereby only the actual encoder values are influenced, which are used for the position control ▹P0391◃ and ▹P0392◃, the mechanical angle ▹P0393◃ encoder 1 mechanical actual angle value) is not influenced by the absolute offset.

Behavior is independent of a possible inversion of the encoder evaluation ▹P0150◃ encoder 1 mode, bit 4 and 5) always the same, the offset is added after inversion.

That actual value compensation takes effect even after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.

The encoder actual values can be adjusted with the absolute data offset by a maximum of ± 32767 revolutions whereat the resolution of angles is 16 bit (0 to 65535 represents 0 to 360º). The most significant bit within the absolute data offset represents the sign.

The effects of the read-out offset also see ▹Figure 3◃ on page 17.



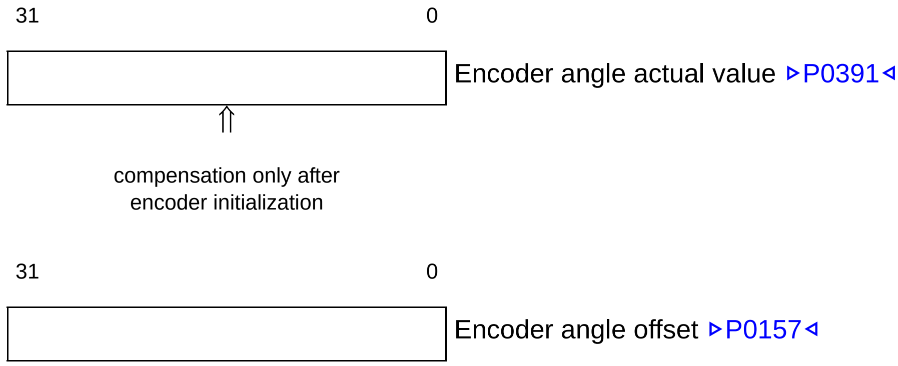
P0157	Absolutmaßoffset Winkel aus Typenschild Geber 1	0 to $FFFFFFFF_{hex}$	
EE	**Absolute offset angle encoder 1 from type plate**	0_{hex}	
PO	BM_ud_Enc1MtOffsetAngle	1:1	-

From firmware version FW 03.09.

The controller adds the value of this angle offset to the absolute value angle of encoder 1.

Thereby only the encoder-angle actual value is influenced, which is used for position control (▹P0391◃), the mechanical angle (▹P0393◃ encoder 1 mechanical angle actual value) is not influenced by the absolute offset. Behavior is independent of a possible inversion of the encoder evaluation ▹P0150◃ encoder 1 mode, bit 4 and 5) always the same, the offset is added after inversion, also see ▹Figure 3◃ on page 17.

That actual value compensation takes effect only after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.



▹P0157◃ can contrary to ▹P0154◃ absolute offset encoder 1 be stored in the encoder memory. If the readout of ▹P0157◃ is active (▹P2099◃ bit 2 = 1 or ▹P0093◃ bit 4 = 1 and ▹P1030◃ bit 1 = 0 and bit 0 = 1), then the value, stored in the encoder is used. If the readout of ▹P0157◃ is not active, then the stored value in the controller-EEPROM operates.

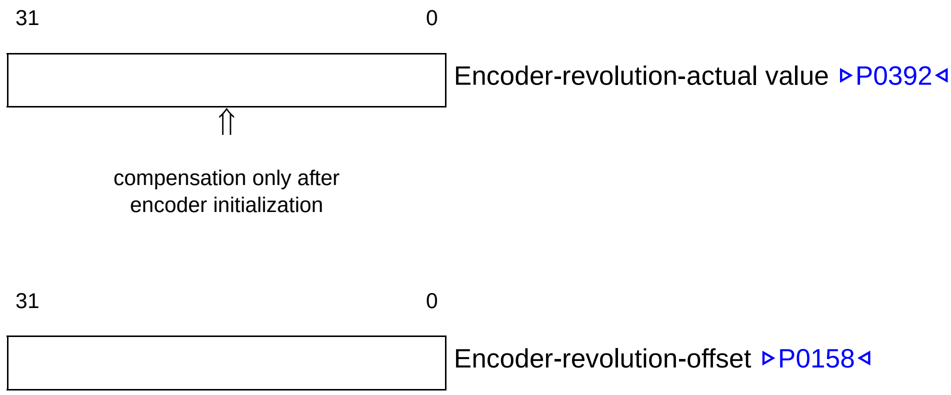
P0158	Absolutmaßoffset Umdrehungen aus Typenschild Geber 1	0 to FFFFFFFF$_{hex}$	
EE	**Absolute offset revolution encoder 1 from type plate**	0$_{hex}$	
PO	BM_ud_Enc1MtOffsetRev	1:1	-

(from firmware version FW 03.09)

The controller adds the value of this revolution-offset to the number of revolutions of encoder 1.

Behavior is independent of a possible inversion of the encoder evaluation ▹P0150◃ encoder 1 mode, bit 4 and 5) always the same, the offset is added after inversion, also see ▹Figure 3◃ on page 17.

That actual value compensation takes effect only after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.



▹P0158◃ can contrary to ▹P0154◃ absolute offset encoder 1 be stored in the encoder memory, in case it is existent. If the readout of ▹P0158◃ is active (▹P2099◃ bit 2 = 1 or

▹P0093◃ bit 4 = 1 and ▹P1030◃ bit 1 = 0 and bit 0 = 1), the value is used, which was stored in the encoder. If the readout of ▹P0158◃ is not active, then the stored value in the controller-EEPROM operates.

P0159	Encoder 1 Shiftfactor	0 to 16	
EE	**Encoder 1 shiftfactor**	0	
-	BM_u_Enc1ShiftFactor	1:1	-

With the shift factor the range of the ▹P0395◃ encoder 1 actual position value 16 can be selected.

P0160	Geber 2 Modus	0 to $FFFF_{hex}$	
EE	**Encoder 2 mode**	0_{hex}	
	BM_w_Enc2Mode	1:1	-

Mode parameter for encoder 2.

Bit	Meaning
0	0: deactivate encoder evaluation 1: activate encoder evaluation
1	0: multiplier for PPR count is 1 1: multiplier for PPR count is 8
3 ... 2	Digital filtering encoder evaluation: 00: 125 ns 01: 250 ns 10: 500 ns 11: 1.0 µs
4	Encoder polarity: 0: no sign inversion, clockwise rotating encoder generates positive speed actual value 1: sign inversion, clockwise rotating encoder generates negative speed actual value.
5	Polarity of position count: 0: positive speed actual value effectuates positive change of target position 1: positive speed actual value effectuates negative change of target position
6	Initialization of position value for incremental encoders (from FW 03.10): 0: initialization of the target position value without reference to zero pulse of encoder 1: initialization of the target position value with reference to zero pulse of encoder
7	Sine-squared monitoring of the encoder voltages 0: not active 1: active
8	Resetting of encoder errors: 0: Encoder errors can be acknowledged, the encoder then is initialized anew. 1: Encoder error cannot be acknowledged. With encoder errors the drive must be switched off and then on again.
9	Suppress error message ’absolute position unknown”: 0: No suppression of error message ’absolute position unknown”. 1: The error message ’Absolute position unknown” is suppressed.
10	Activate offset- and amplitude error correction of the resolver 1: Offset- and amplitude error correction is activated 0: Offset- and amplitude error correction is deactivated

Bit	Meaning
11	Reserved
12	1: Absolute angle transfer of encoder 1 (from FW 03.09)
13	Incremental encoders: selection of the initialization procedure for position value of encoder with reference to zero pulse (bit 6 = 1) 0: relationship to zero pulse is established as quickly as possible 1: incremental assembly of the relationship
14	Absolute position of the encoder is read out 0: unsigned 1: with sign (details see description of bit 14)
15	Switch-off of communication protocol: 0: at encoders with communication interface (HIPERFACE® or EnDat interface) encoder type, absolute position and if necessary electronic motor type plates from the encoder are read out. 1: No communication to the encoder, also the absolute position is not read out.

NOTE!

The bits 1, 2, 3, 6, 7, 10, 13 and 15 do not have a function at EnDat 2.2-encoders.

Description

- Bit 4 and bit 5, encoder polarity and polarity of position count:
  With these settings the evaluation of the encoder can be inverted. Thereby it is differed between the entire inversion (bit 4, encoder polarity), this means encoder evaluation for the motor control (parameter ▹P0403◃ mechanical angle) as well as for the actual value position (parameter ▹P0401◃ and ▹P0402◃) is inverted and of the inversion only for the actual value position (bit 5, polarity position count). The following options are obtained:

Bit 5	Bit 4	Description
0	0	No inversion: clockwise rotating encoder effectuates positive actual speed and enlargement of the actual position Example: Encoder is attached to the motor side and a positive motor speed direction results in an enlargement of the actual position.
0	1	Inversion of the entire encoder evaluation: clockwise rotating encoder effectuates a negative actual speed and a reduction of the actual position value Example: Encoder is attached to the load side and a positive motor speed direction (that means a negative speed direction of the load!) results in an enlargement of the actual position value.

Bit 5	Bit 4	Description
1	0	Inversion only for position count, no inversion for motor control: clockwise rotating encoder effectuates positive speed actual value but a reduction of the actual position Example: Encoder is attached to the motor side and a positive motor speed direction results in a reduction of the actual position.
1	1	Inversion only for motor control, no inversion for position count: clockwise rotating encoder effectuates negative actual speed value and an enlargement of the actual position value Example: encoder is attached to the load side and a positive motor speed direction (that means a negative speed direction of the load!) results in a reduction of the actual position value.

- Bit 6, Initialization of ▹P0401◃ Encoder 2 position value for incremental encoders
The encoder actual value is set to zero at initialization. If bit 6 is set, a re-initialization of the encoder actual value occurs as soon as the controller recognizes the zero pulse. The angle is corrected so that the value is zero at zero pulse.
- Bit 8, resetting of encoder errors:
With this bit you can set, if an encoder error (cable break, communication error a.s.o.) can be acknowledged per control word command or if the controller must be switched off and then on again.
- Bit 9, suppress error message 'absolute position unknown":
The error message 'absolute position unknown' can occur under the following three terms:

1. Error at the encoder communication (HIPERFACE® or EnDat-interface)

2. The drive control is on synchronous motor (bit 0-1, parameters ▹P0093◃), the motor control is set acc. to this encoder (bit 0-1, parameters ▹P1030◃) and the encoder type is with communication but its communication protocol (bit 15, parameters ▹P0150◃ or ▹P0160◃) is switched off.

3. Drive control is on synchronous motor (bit 0-1, parameters ▹P0093◃), the motor control is set acc. to this encoder (bit 0-1, parameters ▹P1030◃) and at encoder type it is a square-wave- or sine-incremental encoder.

NOTE!

The error message can be suppressed by the setting of the bit 9 only for the cases 2 and 3.
In this case the user must assure, that after each encoder initialization a notch position search must be executed.

- Bit 12: Absolute angle transfer of encoder 1 (from FW 03.09):
If this bit is activated at each initialization of encoder 2 the angle of encoder 1 is copied to the angle of the encoder 2. The value of revolutions is set to zero. The function only operates at incremental encoders. Therewith the angle position of the incremental encoder can be initialized without prior homing and the encoder therewith is made absolute.
Preconditions:

- at encoder input 1 (module slot A) an absolute encoder is connected, which was initialized error-free.
- at encoder input 2 (module slot B) a square-wave- or sine-incremental encoder is connected.
- the position count of both encoders is 1:1.

Application example:
Motor control of a synchronous motor by an incremental encoder. The second absolute encoder serves as pole position sensor. If bit 12 is active, the operating mode „Find notch position“ is only once necessary, as long as the above mentioned preconditions are complied with.

- Bit 13 Incremental encoder: Select the initialization procedure for the ▹P0401◃ Encoder 2 position value with relationship to zero pulse.
  If encoder 2 mode bit 6 is set, the procedure for re-initialization of the encoder actual value can be selected via bit 13.
  - Bit 13 = 0: After the controller has recognized the zero pulse, the relationship to the zero pulse is established as quickly as possible (within a sampling of the controller).
  - Bit 13 = 1: If the abrupt correction (within a sampling of the controller) is not desired, an incremental assembly of the relationship between encoder actual value and zero pulse can be established. Then the regulation of the actual value occurs softly. This will take up to 4 s depending on the value of the angle to be changed.

  The relationship is established when bit 7 (absolute position not known) in ▹P0400◃ Encoder 2 state is deleted.
- Bit 14:
  The evaluation of the absolute position with sign can be activated with bit 14. If this bit is set, the controller treats the read out value as negative number in 2-complement when the most significant bit (MSB) is set.
  The sign handling is supported only at length measurement systems with SSI protocol. For other encoders bit 14 has no action and is set to zero.
- Bit 15: Communication protocol
  With this bit it can be set, if at encoders with communication interface (HIPERFACE®interface at absolute encoder of company Stegmann or EnDat interface at absolute value encoders) the encoder type, the absolute position and if necessary the electronic type plate of the motor is read out the encoder.
  If this bit is set, there is no communication executed to the encoder. In this case the values for number of pulses and revolution of the encoder are entered manually. Furthermore the encoder then cannot be used as an encoder for the motor control of synchronous motors, because the absolute position is necessary for this.

NOTE!

After changing of the mode parameter for encoder 2 a new starting of the controller is necessary.

From controller firmware version FW 03.05 the encoder is automatically initialized with the new settings after changes at the settings for the encoder 2 have been made.

P0161	Geber 2 Typenschlüssel	20 ASCII characters	
-	**Encoder 2 type code**	""	
A	BM_s_Enc2Type	1:1	-

Type code or type identification of encoder 2, for further information see ▹P0151◃.

P0162	Geber 2 Strichzahl bzw. Polpaarzahl	1 to 32767	
EE	**Encoder 2 number of pulses or pole pairs**	1	
	BM_u_Enc2PulsesPerRev	1:1	

Pulse number per revolution or number of pole pairs of encoder 2:

With incremental encoder: Pulse number per revolutions of the incremental encoder

At sine-cosine encoder (Stegmann or Heidenhain): Number of sine periods per revolution. Is automatically read out the encoder.

At resolver: Number of pole pairs of the resolver

At EnDat2.2-encoders (module type ENC-06) instead of the PPR count the resolution of the positioning value per revolution is shown in bit.

P0163	Geber 2 Umdrehungen	1 to 65535	
EE	**Encoder 2 number of revolutions**	1	
	BM_u_Enc2NomRev	1:1	

Number of complete revolutions, which encoder 2 can display, i.e. in which the encoder can dissolve a definite absolute position.

P0164	Absolutmaßoffset Geber 2	-2147483648 to 2147483647	
EE	**Absolute offset encoder 2**	1	
PO	BM_di_Enc2Offset	1:1	-

The controller adds the value of this offset to the absolute value of encoder 2.

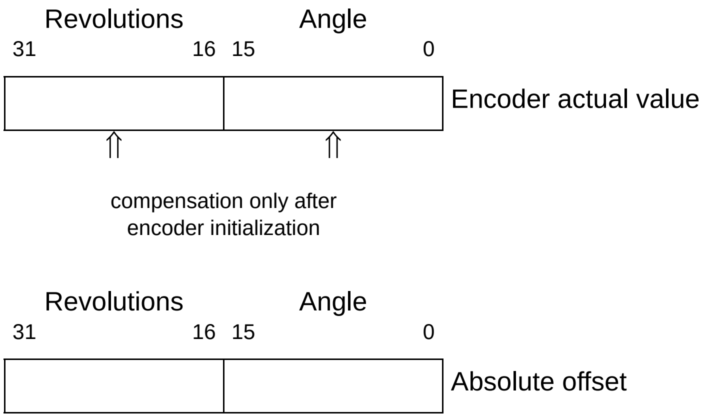
Thereby only the actual encoder values are influenced, which are used for the position control ▹P0401◃ and ▹P0403◃, the mechanical angle ▹P0403◃ encoder 2 mechanical actual angle value) is not influenced by the absolute offset.

Behavior is independent of a possible inversion of the encoder evaluation ▹P0160◃ encoder 2 mode, bit 4 and 5) always the same, the offset is added after inversion.

That actual value compensation takes effect even after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.

The encoder actual values can be adjusted with the absolute data offset by a maximum of ± 32767 revolutions whereat the resolution of angles is 16 bit (0 to 65535 represents 0 to 360º). The most significant bit within the absolute data offset represents the sign.

The effects of the read-out offset also see ▹Figure 3◃ on page 17.



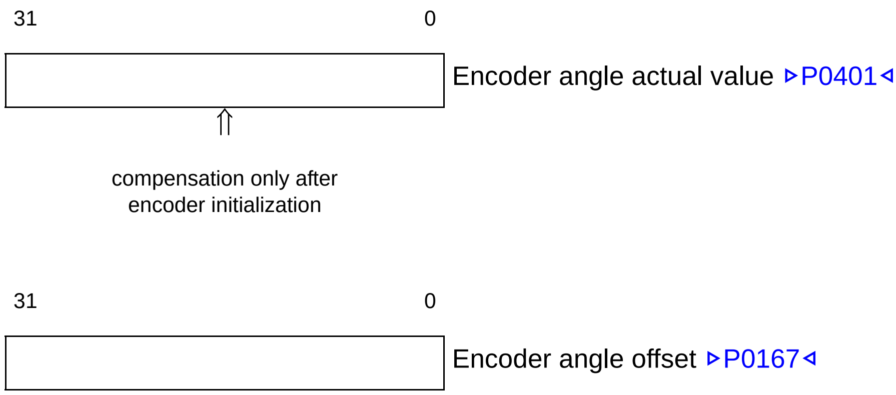
P0167	Absolutmaßoffset Winkel aus Typenschild Geber 2	0 to $FFFFFFFF_{hex}$	
EE	**Absolute offset angle encoder 2 from type plate**	0_{hex}	
PO	BM_ud_Enc2MtOffsetAngle	1:1	-

From firmware version FW 03.09.

The controller adds the value of this angle offset to the absolute angle value of encoder 2.

Thereby only the encoder-angle actual value is influenced, which is used for position control (▹P0401◃), the mechanical angle (▹P0403◃ encoder 2 mechanical actual angle value) is not influenced by the absolute offset. Behavior is independent of a possible inversion of the encoder evaluation▹P0160◃ encoder 2 mode, bit 4 and 5) always the same, the offset is added after inversion, also see ▹Figure 3◃ on page 17.

That actual value compensation takes effect only after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.



▹P0167◃ can contrary to ▹P0164◃ absolute offset encoder 2 be stored in the encoder memory, in case it is existent. If the readout of ▹P0167◃ is active (▹P2099◃ bit 17 = 1 or ▹P0093◃ bit 4 = 1 and ▹P1030◃ bit 1 = 1 and bit 0 = 0), then the value, stored in the encoder is used. If the readout of ▹P0167◃ is not active, then the stored value in the controller-EEPROM operates.

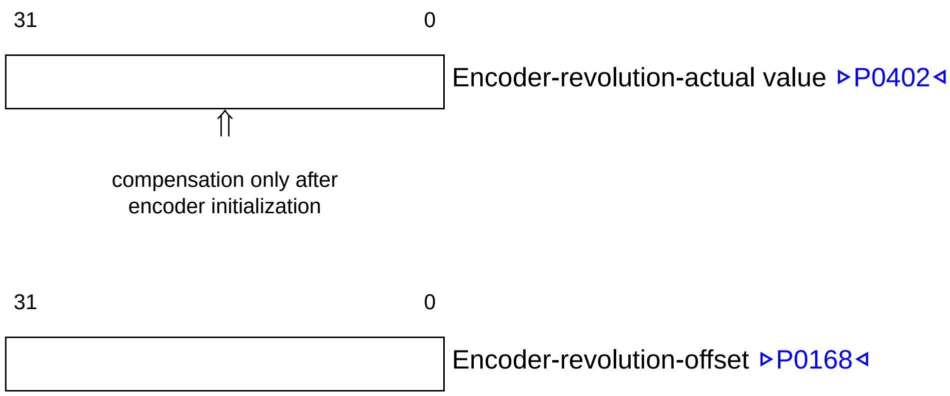
P0168	Absolutmaßoffset Umdrehungen aus Typenschild Geber 2	0 to FFFFFFFF$_{hex}$	
EE	**Absolute offset revolution encoder 2 from type plate**	0$_{hex}$	
PO	BM_ud_Enc2MtOffsetRev	1:1	-

From firmware version FW 03.09.

The controller adds the value of this revolution-offset to the number of revolutions of encoder 2.

Behavior is independent of a possible inversion of the encoder evaluation ▹P0160◃ encoder 2 mode, bit 4 and 5) always the same, the offset is added after inversion, also see ▹Figure 3◃ on page 17.

That actual value compensation takes effect only after start-up or after an encoder initialization; writing and saving to the parameter is not sufficient for that.



▹P0168◃ can contrary to ▹P0164◃ absolute offset encoder 2 be stored in the encoder memory, in case it is existent. If the readout of ▹P0168◃ is active (▹P2099◃ bit 17 = 1 or ▹P0093◃ bit 4 = 1 and ▹P1030◃ bit 1 = 1 and bit 0 = 0), then the value, stored in the encoder is used. If the readout of ▹P0168◃ is not active, then the stored value in the controller-EEPROM operates.

P0169	Encoder 2 Shiftfactor	0 to 16	
EE	**Encoder 2 shiftfactor**	0	
-	BM_u_Enc2ShiftFactor	1:1	-

With the shift factor the range of the ▹P0405◃ encoder 2 actual position value 16 can be selected.

P0200

P0200	Fehler System 1	0 to FFFFFFFF$_{hex}$	
-	**Error system 1**	0$_{hex}$	
A	BM_d_SysError1	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Reaction	Following parameter
0	Error in module µ-processor	Pulse inhibit	▹P0201◃
1	Error in module operating system	Pulse inhibit	▹P0202◃
2	Error in module Proprog communication	Adjustable	▹P0203◃
3	Error in functional or optional modules	Adjustable	▹P0204◃
4	Error in module feed unit	Adjustable	▹P0205◃
5	Error in module power unit	Adjustable	▹P0206◃
6	Error in module motor	Adjustable	▹P0207◃
7	Error in module encoder 1	Adjustable	▹P0208◃
8	Error in module encoder 2	Adjustable	▹P0209◃
9	Error in module encoder manager	Adjustable	▹P0210◃
10	Error in module drive manager	Adjustable	▹P0211◃
11	Error in module data set manager	Adjustable	▹P0212◃
12	Error in module position controller	Adjustable	▹P0213◃
13	Error in module speed controller	Adjustable	▹P0214◃
14	Error in module free programmability	Adjustable	▹P0215◃
15	Reserved	Adjustable	▹P0216◃
32 ... 16	Reserved		

P0201

P0201	Fehler Prozessor	0 to FFFF$_{hex}$	
-	**Error processor**	0$_{hex}$	
A	BM_w_ProcessorSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Errors in module processor.

Bit	Meaning	Error no.	Reaction
0	Reserved	0	
1	Watchdog-error	1	Pulse inhibit
2	False or unexpected interrupt has occurred	2	Pulse inhibit
3	NMI-Interrupt has occurred /bus error	3	Pulse inhibit
15 ... 4	Not assigned = 0	4 to 15	

P0202	Fehler Betriebssystem	0 to $FFFF_{hex}$	
-	**Error operating system**	0_{hex}	
A	BM_w_OperatingSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module operating system.

Bit	Meaning	Error no.	Reaction
0	Errors while booting	16	Pulse inhibit
1	Software error:	17	Pulse inhibit
2	Time slot configuration	18	Pulse inhibit
3	time slot - time error	19	Pulse inhibit
4	1= Not assigned memory	20	Pulse inhibit
5	Invalid error code	21	Pulse inhibit
6	Invalid warning code	22	Pulse inhibit
7	False FPGA version	23	Pulse inhibit
8	Two-state controller: Error at writing to target parameter	24	Pulse inhibit
9	Checksum error flash system data	25	Pulse inhibit
10	Type of power unit is not supported by firmware	26	Pulse inhibit
15 ... 11	Not assigned = 0	27 to 31	

P0203	Fehler PROPROG Kommunikation	0 to $FFFF_{hex}$	
-	**Error PROPROG communication**	0_{hex}	
A	BM_w_ProprogSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module Proprog communication driver.

Bit	Meaning	Error no.	Reaction
0	Timeout protocol	32	Adjustable
1	Protocol structure	33	Adjustable
2	Wrong module type	34	Adjustable
3	Too much data in the telegram	35	Adjustable
4	Not enough data in telegram	36	Adjustable
5	Invalid operand	37	Adjustable
6	Invalid memory type	38	Adjustable
7	Invalid operand address	39	Adjustable
8	Value less than the minimum value	40	Adjustable
9	Value greater than the maximum value	41	Adjustable
10	Parameter is write-protected	42	Adjustable
11	Parameters in this operation status not writable	43	Adjustable

Bit	Meaning	Error no.	Reaction
12	Invalid parameter value	44	Adjustable
13	Communication error WinBASS II / ProDrive ↔ controller	45	Adjustable
15 ... 14	Not assigned = 0	46 to 47	

P0204

Fehler in Funktions- oder Optionsmodulen — 0 to FFFF$_{hex}$

- **Error in function- or option modules** — 0$_{hex}$

A — BM_w_ExtendedModuleError — 1:1 — -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module expansion.

Bit	Meaning	Error no.	Reaction	Sequence parameter
0	Error in function module A	48	Level 3 error	▹P0240◃
1	Error in function module B	49	Level 3 error	▹P0241◃
2	Error in function module C	50	Level 3 error	▹P0242◃
3	Error in function module D	51	Level 3 error	▹P0243◃
4	Error in function module E	52	Level 3 error	▹P0244◃
5	Error in option module G	53	Level 3 error	▹P0245◃
6	Error in option module H	54	Level 3 error	▹P0246◃
7	Error in option module J	55	Level 3 error	▹P0247◃
8	Error in option module K	56	Level 3 error	▹P0248◃
9	Error in option module L	57	Level 3 error	▹P0249◃
10	Error in option module M	58	Level 3 error	▹P0250◃
11	Timeout when waiting for the RST signal (of the slaves)	59	Pulse inhibit	
12	CRC error in SPI transmission module ▸ controller	60	Adjustable	
13	CRC error in SPI transmission controller ▸ module	61	Adjustable	
15 ... 14	Not assigned = 0	62 to 63		

P0205

Fehler Netzeinspeisung — 0 to FFFF$_{hex}$

- **Error Power Supply Unit** — 0$_{hex}$

A — BM_w_PSU_SysError — 1:1 — -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module feed unit.

Bit	Meaning	Error no.	Reaction	Sequence parameter
0	Mains failure	64	Adjustable	
1	Phase error	65	Up to FW 03.08: adjustable from FW 03.09: Pulse inhibit[2)]	
3 ... 2	Not assigned = 0	66, 67		
4 [3)]	Undervoltage 24V	68	Pulse inhibit	
5 ... 14	Not assigned = 0	69 to 78		
15	Mains monitor group errors	79	Adjustable	▹P0236◃

1) default: no reaction

2) From FW 03.09 the reaction is always the immediate pulse inhibit.
Because of update reasons from previous FW versions to FW 03.09 and higher, all error reactions can be selected furthermore, but immediate pulse inhibit is always active!
The operating software ProDrive allows only the setting immediate pulse inhibit from FW 03.09.

3) only for BUC (b maXX 4100)

P0206	Fehler Leistungsteil	0 to $FFFF_{hex}$	
-	**Error Power Unit**	0_{hex}	
A	BM_w_AmpSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module power unit.

Bit	Meaning	Error no.	Reaction	Following parameter
0	Communication error Power unit	80	Pulse inhibit	▹P0233◃
1	Heat sink overtemperature	81	Pulse inhibit	
2	U DC link overvoltage	82	Pulse inhibit	
3	Overcurrent	83	Pulse inhibit	
4	Ground current	84	Pulse inhibit	
5	Device internal overtemperature	85	Pulse inhibit	
6	Cable break heat sink temperature sensor	86	Pulse inhibit	
7	Safety relay off (or defect) [1)]	87	Pulse inhibit	
8	Bridge short-circuit	88	Pulse inhibit	
9	Power unit not ready-to-operate	89	Pulse inhibit	
10	to FW 03.08 phase failure Not assigned = 0 from FW 03.09	90	Pulse inhibit	
11	to FW 03.08 mains input failure Not assigned = 0 from FW 03.09	91	Pulse inhibit	
12	Not assigned = 0	92	Pulse inhibit	
13	Mains overvoltage	93	Pulse inhibit	

Bit	Meaning	Error no.	Reaction	Following parameter
14	Not assigned = 0	94	Pulse inhibit	
15	Not assigned = 0	95		

[1)] The controller signals an error „Safety relay off (or faulty)“ (error no. 87), if pulse enable was given and if there is one of these cases:
1 The safety relay is not controlled or
2 the safety relay is faulty
If there is no pulse enable and if the cases **1** or **2** arise, the controller signals only one warning (warning no. 20).

P0207

-	Fehler Motor	0 to $FFFF_{hex}$	
	Error motor	0_{hex}	
A	BM_w_MotorSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module motor.

Bit	Meaning	Error no.	Reaction	Following parameter
0	Temperature sensor - motor short-circuited ($T_{M\text{-sensor}} \leq$ -30 °C)	96	Adjustable	
1	Temperature sensor - motor not connected ($T_{M\text{-semsor}}$ > +300 °C)	97	Adjustable	
2	Motor overtemperature	98	Pulse inhibit	
3	Error I^2t > 100 %	99	Pulse inhibit	
4	Error ▹P1241◃ Maximum current of the drive > ▹P0069◃ Motor peak current (from FW 03.09)	100	Adjustable	
5	Not assigned = 0	101		
6	Group error at notch position search (from FW 03.09)	102	Pulse inhibit	▹P0237◃
15 ... 7	Not assigned = 0	103 to 111		

P0208

-	Fehler Geber 1	0 to $FFFF_{hex}$	
	Error encoder 1	0_{hex}	
A	BM_w_Enc1SysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module encoder 1.

Bit	Meaning	Error no.	Reaction	Following parameter
0	Communication error encoder 1	112	Pulse inhibit	▹P0234◃
1	Reserved	113		
2	Error at overwriting of encoder position information	114	Pulse inhibit	

Bit	Meaning	Error no.	Reaction	Following parameter
3	Cable break encoder 1	115	Pulse inhibit	
4	Overspeed encoder 1	116	Pulse inhibit	
5	Amplitude limit exceeded	117	Pulse inhibit	
6	Encoder type unknown	118	Pulse inhibit	
7	Invalid data field for motor data	119	Pulse inhibit	
8	Incorrect motor data	120	Pulse inhibit	
9	Saving error of motor data	121	Pulse inhibit	
10	Motor data write-protected. (is not valid for BM motors)	122	Pulse inhibit	
11	Field angle error	123	Pulse inhibit	
12	Encoder without temperature measuring	124	Adjustable	
13	Memory capacity in the encoder for electronic type plate too small	125	Adjustable	
15 ... 14	Not assigned = 0	125 to 127		

P0209	Fehler Geber 2	0 to FFFF$_{hex}$	
-	**Error Encoder 2**	0$_{hex}$	
A	BM_w_Enc2SysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module encoder 2.

Bit	Meaning	Error no.	Reaction	Following parameters
0	Communication error encoder 2	128	Pulse inhibit	▹P0235◃
1	Reserved	129		
2	Error at overwriting of encoder position information	130	Pulse inhibit	
3	Cable break encoder 2	131	Pulse inhibit	
4	Overspeed encoder 2	132	Pulse inhibit	
5	Amplitude limit exceeded	133	Pulse inhibit	
6	Encoder type unknown	134	Pulse inhibit	
7	Invalid data field for motor data	135	Pulse inhibit	
8	Incorrect motor data	136	Pulse inhibit	
9	Saving error of motor data	137	Pulse inhibit	
10	Motor data write-protected. (is not valid for BM motors)	138	Pulse inhibit	
11	Field angle error	139	Pulse inhibit	
12	Encoder without temperature measuring	140	Adjustable	
13	Memory capacity in the encoder for electronic type plate too small	141	Adjustable	
15 ... 14	Not assigned = 0	141 to 143		

P0210 Error Encoder Manager 0 to FFFF$_{hex}$

- **Error encoder manager** 0$_{hex}$

A BM_w_EncManagSysError 1:1 -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module encoder manager.

Bit	Meaning	Error no.	Reaction
0	Absolute position encoder 1 unknown	144	Pulse inhibit
1	Absolute position encoder 2 unknown	145	Pulse inhibit
2	Encoder module 1 is missing	146	Pulse inhibit
3	Encoder module 2 is missing	147	Pulse inhibit
4	Encoder module for measured value storage is missing	148	Pulse inhibit
5	At resolver no measured value storage possible	149	Pulse inhibit
6	Triggering not possible, because no incremental encoder	150	Pulse inhibit
7	Digital I/O-module is missing	151	Pulse inhibit
8	Function module incremental encoder emulation is necessary and is missing	152	Pulse inhibit
9	Encoder module 1 required for incremental encoder emulation and missing	153	Pulse inhibit
10	Encoder module 2 required for incremental encoder emulation and missing	154	Pulse inhibit
11	Error during initialization of the incremental encoder emulation module	155	Pulse inhibit
12	Overfrequency function module incremental encoder emulation	156	Adjustable
13	Configuration error function module incremental encoder emulation	157	Pulse inhibit
14	SSI encoder emulation module is missing	158	Pulse inhibit
15	Not assigned = 0	159	

P0211 Fehler Antriebs-Manager 0 to FFFF$_{hex}$

- **Error drive manager** 0$_{hex}$

A BM_w_DriveManagSysError 1:1 -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module drive management.

Bit	Meaning	Error no.	Reaction
0	Timeout communication	160	Adjustable
1	Timeout BACI	161	Adjustable
2	Timeout cyclic communication	162	Adjustable
3	Timeout required data	163	Adjustable
4	Field bus error	164	Adjustable
5	Controller not synchronous to external signal	165	Adjustable

Bit	Meaning	Error no.	Reaction
6	**To FW 03.05:** Error at brake control **From firmware version FW 03.06:** Error at brake control in the manual control mode (▹P1400◃ bit 0 = 0)	166	Pulse inhibit
7	Error at brake control in the automatic control mode (▹P1400◃ bit 0 = 1): No release of holding brake when starting the drive	167	Pulse inhibit
8	Error at brake control in the automatic control mode (▹P1400◃ bit 0 = 1): No closing of holding brake at stopping of drive	168	Adjustable
9	Error at brake control in the automatic control mode (▹P1400◃ bit 0 = 1): Error holding brake status (cyclic monitoring)	169	Adjustable
10	Error holding brake lining	170	Adjustable
11	Initialize holding brake error	171	Pulse inhibit
12	Error holding brake: Holding torque not reached (from FW 03.09)	172	Pulse inhibit
15 ... 13	Not assigned = 0	172 to 175	

P0212	Fehler Datenmanagement	0 to FFFF$_{hex}$	
-	**Error data management**	0$_{hex}$	
A	BM_w_DataRecSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module data management.

Bit	Meaning	Error no.	Reaction
0	EEPROM copy error From FW 03.08: Reserved	176	Adjustable pulse inhibit
1	Write timeout EEPROM From FW 03.08: Reserved	177	Adjustable pulse inhibit
2	Checksum error EEPROM	178	Pulse inhibit
3	No boot data set	179	Pulse inhibit
4	Incompatible software	180	Pulse inhibit
5	There is no data set	181	Adjustable
6	Checksum error im PSI module	182	Adjustable
7	PSI is reset	183	Adjustable
8	PSI data invalid	184	Adjustable
9	Auto-tuning tables invalid. (execute auto-tuning again)	185	Adjustable
10	A/D correction table invalid (exchange controller cartridge)	186	Adjustable
11	EEPROM is deleted (from FW 03.08)	187	Pulse inhibit
15 ... 12	Not assigned = 0	188 to 191	

P0213	Error Position Controller	0 to $FFFF_{hex}$	
-	**Error Position controller**	0_{hex}	
A	BM_w_PosCtrlSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module position controller.

Bit	Meaning	Error no.	Reaction
0	Position deviation dynamic	192	Adjustable
1	Position deviation static	193	Adjustable
2	Encoder 1 is used for position control, but is inactive. This error is also shown, if the faulty positioning is in one of the inactive data records.	194	Pulse inhibit
3	Encoder 2 is used for position control, but is inactive. This error is also shown, if the faulty positioning is in one of the inactive data records.	195	Pulse inhibit
4	Software limit switch 1 exceeded	196	Adjustable
5	Software limit switch 2 exceeded	197	Adjustable
6	Hardware limit switch 1 exceeded	198	Adjustable
7	Hardware limit switch 2 exceeded	199	Adjustable
8	Homing necessary and not yet executed	200	Adjustable
9	Setpoint in mode Set-of-setpoints didn't arrive in time	201	Adjustable
10	Target position ≥ Modulo position	202	Adjustable
11	Spindle positioning: Error at initialization of the trigger	203	Adjustable
12	Spindle positioning: Timeout at trigger signal	204	Adjustable
13	Error at homing	205	
15 ... 14	Not assigned = 0	206 to 207	

P0214	Fehler Drehzahlregler	0 to $FFFF_{hex}$	
-	**Error Speed controller**	0_{hex}	
A	BM_w_SpeedCtrlSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module speed controller.

Bit	Meaning	Error no.	Reaction
0	Drive blocked Blocking time adjustable	208	Pulse inhibit
1	Encoder 1 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records.	209	Pulse inhibit
2	Encoder 2 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records.	210	Pulse inhibit

Bit	Meaning	Error no.	Reaction
3	Overspeed Open Loop	211	Pulse inhibit
4	Limit for the speed deviation is exceeded	212	Adjustable
5	Export restriction: Maximum electric frequency exceeded	213	Pulse inhibit
15 ... 6	Not assigned = 0	214 to 223	

P0215

P0215	Fehler Freie Programmierbarkeit	0 to $FFFF_{hex}$	
-	**Error in module free control section.**	0_{hex}	
A	BM_w_FreeCtrlSecSysError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module free control section.

Bit	Meaning	Error no.	Reaction
10 ... 0	Not assigned = 0	224 to 234	Adjustable
11	Torque coupling: General error in the master	235	Adjustable
12	Torque coupling: Operating mode in the slave is not speed control	236	Pulse inhibit
13	Configuration error reaction return motion is invalid	237	Pulse inhibit
14	Return motion destination was not reached	238	Adjustable
15	Application error (enabled by ▹P0302◃ bit 1)	239	Adjustable

P0216

P0216	Fehler CANsync	0 to $FFFF_{hex}$	
-	**Error CANsync**	0_{hex}	
A	BM_w_CANSyncError	1:1	-

Reserved

P0233

P0233	Fehler Leistungsteil Serielle Schnittstelle	0 to $FFFF_{hex}$	
-	**Error Power Unit serial interface**	0_{hex}	
A	BM_w_AmpHIPERFACEError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in module power unit serial interface.

Number	Meaning
6	Data overflow
7	Bit frame error
8	Invalid command state
9	Parity error
10	Checksum error

Number	Meaning
11	Unknown error code
12	Data number error
13	Invalid argument
14	Data field is write protected
15	Invalid access code
16	Data field is not changeable in its size
17	Word address outside of data field
18	Data field is nonexistent
36	Wrong data checksum
37	No response
38 to 65	Reserved
66	Invalid response

P0234	Fehler Geber 1-Serielle Schnittstelle	0 to FFFF$_{hex}$	
-	**Error Encoder 1 serial interface**	0$_{hex}$	
A	BM_w_Enc1SerComError	1:1	-

Meaning of error numbers see ▹P0235◃.

P0235	Fehler Geber 2-Serielle Schnittstelle	0 to FFFF$_{hex}$	
-	**Error Encoder 2 serial interface**	0$_{hex}$	
A	BM_w_Enc2SerComError	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in the module encoder 1 - serial interface

Error in the module encoder 2 - serial interface.

Number	Meaning
1	Analog signals outside specification
2	Error in internal angle offset
3	Data field partitioning table destroyed
4	Analog limit values not available
5	Internal I^2C-bus not operative
6	Internal checksum error
7	Internal watchdog error - encoder reset
8	Overflow of the counter
9	Parity error
10	Checksum error
11	Unknown error code
12	Data number error
13	Invalid argument

Number	Meaning
14	Data field is write protected
15	Invalid access code
16	Data field is not changeable in its size
17	Word address outside of data field
18	Data field is nonexistent
19 - 27	Reserved
28	Absolute monitoring of the analog signals
29	Transmission current critical
30	Encoder temperature critical
31	Speed too high - no position generation possible
32	Position singleturn unreliable
33	Multiturn position error
34	Multiturn position error
35	Multiturn position error
36	Invalid power unit data checksum
37	No response from encoder
38	Encoder address unknown
39	Error reading the absolute angle position
40	Invalid checksum of received data
41	Unknown encoder type
42 - 63	Reserved
64	No response from HIPERFACE®-encoder
65	No response from EnDat- or SSI-encoder
66	Useless response to encoder command
67	Encoder type not usable (from FW 03.09)
68 - 79	Reserved
80	CRC has determined an error
81	Invalid command
82	Error in response telegram
83	Alarm bit is set
84	Memory is occupied
85	Wrong data checksum
86	Motor data length and/or data version of encoder and controller firmware are not identical identical
87	No EnDat interface
88	Exceeding of transmission format which is able to be evaluated
89	Exceeding of the measuring step length which is to be evaluated
90	Signal period length < measuring step length
91	EnDat2.2: Error at initialization of the master module
92	EnDat2.2: Timeout at measuring the signal propagation time
93	EnDat2.2: Error - run-time compensation is switched off
94	EnDat2.2: Encoder type does not support EnDat2.2 (instruction set, power supply, clock frequency)
95	EnDat2.2: RM-bit 24 is not set ⇒ The absolute encoder position has not been found yet
96	Error lighting
97	Error signal amplitude

Number	Meaning
98	Error position value
99	Error overvoltage
100	Error undervoltage
101	Error overcurrent
102	Error battery
103 - 111	Reserved
112	Position error determined at multiple request (from FW 03.09)
113	Error activated by additional info 1 (from FW 03.09)
114	Error activated by additional info 2 (from FW 03.09)
115	Error activated by additional info 3 (from FW 03.09)
116	Error activated by additional info 4 (from FW 03.09)
117	Error activated by additional info 5 (from FW 03.09)
118	Error activated by additional info 6 (from FW 03.09)
119	Error activated by additional info 7 (from FW 03.09)

P0236

P0236	Fehler Netzmonitor	0 to FFFF$_{hex}$	
-	**Error mains monitor**	0$_{hex}$	
A	BM_w_MainsMonitorError	1:1	-

The mains monitor has determined a mains error. Therefore, at least one error requirement for the mains voltage or mains frequency must meet the requirements of the set time in ▹P2063◃ mains error reaction delay time.
Sub-error bit bar of the error 79 „Mains monitor group error (▹P0205◃ error supply unit bit 15 = 1):

Bit	Meaning
0	Mains monitor has detected error Mains failure
1	Mains monitor has detected error Phase failure
2	Mains monitor has detected error Undervoltage mains
3	Mains monitor has detected error Overvoltage mains
4	Mains monitor has detected error Mains frequency at the lower frequency limit
5	Mains monitor has detected error Mains frequency at the upper frequency limit
15 ... 6	Reserved

Multiple bits can be set.

The single error can be activated or be deactivated via ▹P2056◃ mains monitor mode.

P0237

P0237	Fehler bei Rastlagensuche	0 to FFFF$_{hex}$	
-	**Error finding notch position**	0$_{hex}$	
A	BM_w_RastRefError	1:1	-

From firmware version FW 03.09.

Following parameter (Sub error bit bar) of error motor ▷P0207◁ error no. 102. The parameter P0237 displays the error at finding notch position, see ▷P0094◁.

Bit no.	Sub error no.	Meaning
0	1	Overcurrent step 1
1	2	Overcurrent step 2
2	4	Plausibility step 1
3	8	Plausibility step 2
5	32	Time out
6	64	Drive has moved more than 4*traverse angle
9	512	Plausibility step 2 invalid (from FW 03.10)

Only one bit can be set.

Measures for troubleshooting and for additional informations see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

P0240	Fehler Funktionsmodul A	0 to FFFF$_{hex}$	
-	**Error function module A**	0$_{hex}$	
A	BM_w_SmallModuleErrorA	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in function module A.

Sub-error no.	Meaning	Reaction
0	Reserved	
1	Module not recognized	Adjustable
2	Module not permitted at this position	Pulse inhibit
3	24 V missing or output short-circuited	Adjustable
4	Invalid target parameter value by digital input	Adjustable
5	Direct PLC-I/O access for this module not permitted.	Adjustable
6	Another required module is missing, for BM 4100 NWR only	Pulse inhibit
7	Module may not be used in the active NWR mode or controller mode	Pulse inhibit
8	Reserved	
9	More than 2 Analog Modules are not allowed	Pulse inhibit
10	If input range is parameterized to 4 ... 20 mA (see ▷P0428◁) and current source is not connected, wire breakage or short-circuit (input current < 3,6 mA)	Adjustable
11	Current source impresses too much current (input current > 22 mA)	Adjustable
12	SSI configuration error (too many modules or illegal combination)	Adjustable
65535 ... 13	Not assigned = 0	

P0241	Fehler Funktionsmodul B	0 to $FFFF_{hex}$	
-	**Error function module B**	0_{hex}	
A	BM_w_SmallModuleErrorB	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in function module B.

Sub-error description see ▹P0240◃ on page 403.

P0242	Fehler Funktionsmodul C	0 to $FFFF_{hex}$	
-	**Error function module C**	0_{hex}	
A	BM_w_SmallModuleErrorC	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in function module C.

Sub-error description see ▹P0240◃ on page 403.

P0243	Fehler Funktionsmodul D	0 to $FFFF_{hex}$	
-	**Error function module D**	0_{hex}	
A	BM_w_SmallModuleErrorD	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in function module D.

Sub-error description see ▹P0240◃ on page 403.

P0244	Fehler Funktionsmodul E	0 to $FFFF_{hex}$	
-	**Error function module E**	0_{hex}	
A	BM_w_SmallModuleErrorE	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in function module E.

Sub-error description see ▹P0240◃ on page 403.

P0245	Fehler Optionsmodul G	0 to $FFFF_{hex}$	
-	**Error option module G**	0_{hex}	
A	BM_w_BigModuleErrorG	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module G.

Sub-Error no.	Meaning	Reaction
4096	Wrong parameter no. at setpoint parameter 1	Adjustable
4097	Wrong parameter no. at setpoint parameter 2	Adjustable
4098	Wrong parameter no. at setpoint parameter 3	Adjustable
4099	Wrong parameter no. at setpoint parameter 4	Adjustable
4100	Wrong parameter no. at setpoint parameter 5	Adjustable
4101	Wrong parameter no. at setpoint parameter 6	Adjustable
4102	Wrong parameter no. at setpoint parameter 7	Adjustable
4103	Wrong parameter no. at setpoint parameter 8	Adjustable
4104	Wrong parameter no. at setpoint parameter 9	Adjustable
4105	Wrong parameter no. at setpoint parameter 10	Adjustable
4106	Wrong parameter no. at setpoint parameter 11	Adjustable
4107	Wrong parameter no. at setpoint parameter 12	Adjustable
4108	Wrong parameter no. at setpoint parameter 13	Adjustable
4109	Wrong parameter no. at setpoint parameter 14	Adjustable
4110	Wrong parameter no. at setpoint parameter 15	Adjustable
4111	Wrong parameter no. at setpoint parameter 16	Adjustable
4112	Wrong parameter no. at actual value parameter 1	Adjustable
4113	Wrong parameter no. at actual value parameter 2	Adjustable
4114	Wrong parameter no. at actual value parameter 3	Adjustable
4115	Wrong parameter no. at actual value parameter 4	Adjustable
4116	Wrong parameter no. at actual value parameter 5	Adjustable
4117	Wrong parameter no. at actual value parameter 6	Adjustable
4118	Wrong parameter no. at actual value parameter 7	Adjustable
4119	Wrong parameter no. at actual value parameter 8	Adjustable
4120	Wrong parameter no. at actual value parameter 9	Adjustable
4121	Wrong parameter no. at actual value parameter 10	Adjustable
4122	Wrong parameter no. at actual value parameter 11	Adjustable
4123	Wrong parameter no. at actual value parameter 12	Adjustable
4124	Wrong parameter no. at actual value parameter 13	Adjustable
4125	Wrong parameter no. at actual value parameter 14	Adjustable
4126	Wrong parameter no. at actual value parameter 15	Adjustable
4127	Wrong parameter no. at actual value parameter 16	Adjustable
4128	Invalid value at setpoint parameter no. 1	Adjustable
4129	Invalid value at setpoint parameter no. 2	Adjustable
4130	Invalid value at setpoint parameter no. 3	Adjustable
4131	Invalid value at setpoint parameter no. 4	Adjustable

Sub-Error no.	Meaning	Reaction
4132	Invalid value at setpoint parameter no. 5	Adjustable
4133	Invalid value at setpoint parameter no. 6	Adjustable
4134	Invalid value at setpoint parameter no. 7	Adjustable
4135	Invalid value at setpoint parameter no. 8	Adjustable
4136	Invalid value at setpoint parameter no. 9	Adjustable
4137	Invalid value at setpoint parameter no. 10	Adjustable
4138	Invalid value at setpoint parameter no. 11	Adjustable
4139	Invalid value at setpoint parameter no. 12	Adjustable
4140	Invalid value at setpoint parameter no. 13	Adjustable
4141	Invalid value at setpoint parameter no. 14	Adjustable
4142	Invalid value at setpoint parameter no. 15	Adjustable
4143	Invalid value at setpoint parameter no. 16	Adjustable
4144	Invalid value for setpoint period	Adjustable
4145	Invalid value for actual value period	Adjustable
4146	Wrong value for cycle offset setpoints	Adjustable
4147	Wrong value for cycle offset actual values	Adjustable
4148	BACI timeout at cyclic data	Adjustable
4149	BACI timeout at service data	Adjustable
4150	Checksum error during test	Pulse inhibit
4151	Ramp-up Timeout when waiting for the slave type or when waiting for the resetting of config-pending-flag	Adjustable
4152	Invalid data transfer structure type	Adjustable
4153	Internal error: Wrong BACI status	Adjustable
4154	Access conflicts with slave by cyclic communication	Adjustable
4155	Error cyclic communication: Parameter value wrong	Adjustable
4156	Error cyclic communication: Alive-counter conflict	Adjustable
4157	Cmd interface: Channel number wrong (0 or > 6)	Adjustable
4158	Cmd interface: The channel which was indicated does not exist	Adjustable
4159	Cmd interface: Internal error - wrong pointer	Adjustable
4160	Cmd interface: Internal error - wrong status	Adjustable
4161	Cmd interface: Wrong package number	Adjustable
4162	Cmd interface: Wrong command number	Adjustable
4163	Cmd interface: Wrong status when handling the package	Adjustable
4164	Cmd interface: Timeout at command processing	Adjustable
4165	Cmd interface: Wrong package length	Adjustable
4166	Cmd interface: Descriptor not available	Adjustable
4167	Cmd interface: Wrong package type	Adjustable
4168	Cmd interface: Checksum error	Adjustable
4169	Module identification: PCI-error when reading	Adjustable
4170	Module identification: PCI-error when writing	Adjustable
4171	Module identification: General error at reading	Adjustable
4172	Module identification: General error at writing	Adjustable
4173	Internal error	Adjustable
4174	Configuration cyclic services: Parameters are cyclic not writable	Adjustable
4175	Configuration cyclic services: Invalid parameter number	Adjustable

Sub-Error no.	Meaning	Reaction
4176	Wrong option module error code	Adjustable
4177 to 8191	Reserved	
8192	Error CANopen timeout on CAN bus	Adjustable
8193	Error CANopen: Telegram failure	Adjustable

P0246

Fehler Optionsmodul H — 0 to $FFFF_{hex}$

- **Error option module H** — 0_{hex}

A — BM_w_BigModuleErrorH — 1:1 — -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module H.

Sub-error description see ▹P0245◃ on page 405.

P0247

Fehler Optionsmodul J — 0 to $FFFF_{hex}$

- **Error option module J** — 0_{hex}

A — BM_w_BigModuleErrorJ — 1:1 — -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module J.

Sub-error description see ▹P0245◃ on page 405.

P0248

Fehler Optionsmodul K — 0 to $FFFF_{hex}$

- **Error option module K** — 0_{hex}

A — BM_w_BigModuleErrorK — 1:1 — -

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module K.

Sub-error description see ▹P0245◃ on page 405.

P0249	Fehler Optionsmodul L	0 to $FFFF_{hex}$	
-	**Error option module L**	0_{hex}	
A	BM_w_BigModuleErrorL	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module L.

Sub-error description see ▷P0245◁ on page 405.

P0250	Fehler Optionsmodul M	0 to $FFFF_{hex}$	
-	**Error option module M**	0_{hex}	
A	BM_w_BigModuleErrorM	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Error in option module M.

Sub-error description see ▷P0245◁ on page 405.

P0251	Fehler-Parameter ID Proprog-Zugriff	0 to 65535	
-	**Error communication parameter no.**	0	
A	BM_u_ProprogCmdErrId	1:1	-

Number of parameter, where an error occurred during the access via the protocol (WinBASS II / ProDrive).

P0257	Fehlerspeicher Anzahl1	0 to 20	
-	**Error Buffer Count**	0	
A	BM_u_ErrBufCn	1:1	CW

In order to read out errors by a superior control there is an internal error memory from firmware version 03.11. In this error buffer, all occurring errors, which result in an error reaction of the drive are saved chronologically. A reading access on the error buffer is made by elements via an index parameter (▷P0258◁) and a value parameter (▷P0259◁). In order to read all errors of the error buffer e.g. via a control, the number of errors in the error buffer must firstly read out and must be used as the upper limit of the loop. From reading-index 0 onwards, then the accordantly addressed element of the error buffer (▷P0257◁) can be read out via the parameter „error buffer value“ (▷P0259◁). When quitting errors (bit 7 in the control word to 1) the error buffer is completely cleared, the parameter Error buffer count (▷P0257◁) is deleted and the index parameter (▷P0258◁) is set to 0. If the read pointer is set to a value $\geq$ the error buffer count, then the parameter „Error buffer value“ ignores the value.

P0258	Fehlerspeicher Index	0 to 19	
-	**Error Buffer Index**	0	
ON	BM_u_ErrBufIdx	1:1	CW

Index for the reading access on the error buffer.

Detailed description see parameter (▹P0257◃).

P0259	Fehlerspeicher Wert1	0 to 0xFFFF	
-	**Error Buffer Value**	0_{hex}	
A	BM_u_ErrBufValue	1:1	-

This parameter provides the addressed value from the error buffer via the index parameter (P0258).

Detailed description see parameter (▹P0257◃).

P0260	Warnungen System 1	0 to $FFFF_{hex}$	
-	**Warning System 1**	0_{hex}	
A	BM_w_SysWarning1	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Following parameter
0	Warning in module feed unit	▹P0261◃
1	Warning in module power unit	▹P0262◃
2	Warning in module motor	▹P0263◃
3	System warnings	▹P0264◃
4	Warning in module mains monitor	▹P0265◃
15 ... 5	Not assigned = 0	

P0261	Warnungen Netzeinspeisung	0 to $FFFF_{hex}$	
-	**Warning Power Supply Unit**	0_{hex}	
A	BM_w_PSU_Warning	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Warning no.
0	Reserved warning	0
1	Undervoltage 24V	1
2	Undervoltage mains	2

Bit	Meaning	Warning no.
3	Overvoltage mains	3
4	Mains failure	4
5	Phase error	5
15 ... 6	Not assigned = 0	6 to 15

P0262

	Warnungen Leistungsteil	0 to FFFF$_{hex}$	
-	**Warning Power Unit**	0$_{hex}$	
A	BM_w_AmpWarning	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Warning no.
0	Inside temperature of device	16
1	Heat sink temperature	17
2	Timeout at DC-link charging	18
3	Not assigned = 0	19
4	Safety relay off (or faulty)	20
6 ... 5	Not assigned = 0	21 to 22
7	Undervoltage U_{DC}	23
8	Ixt-threshold is exceeded	24
15 ... 9	Not assigned = 0	25 to 31

P0263

	Warnungen Motor	0 to FFFF$_{hex}$	
-	**Warning Motor**	0$_{hex}$	
A	BM_w_MotorWarning	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Warning no.
0	Temperature threshold 1 exceeded	32
1	Temperature threshold 2 exceeded	33
2	I^2t-threshold exceeded	34
15 ... 3	Not assigned = 0	35 to 47

P0264	Allgemeine Antriebswarnungen	0 to $FFFF_{hex}$	
-	**Global Drive Warnings**	0_{hex}	
A	BM_w_DriveWarning	1:1	-

Procedures for troubleshooting and for additional information see chapter "Troubleshooting and fault correction" in the "Instruction handbook b maXX® 4400, 4600, 4700".

Bit	Meaning	Warning no.
0	Drive not synchronous	48
3 ... 1	Reserved	49 to 51
4	Warning encoder 1	52
5	Warning encoder 2	53
15 ... 6	Not assigned = 0	54 to 63

P0265	Warnungen Netzmonitor	0 to $FFFF_{hex}$	
-	**Warning Mains monitor**	0_{hex}	
A	BM_w_MainsMonitorWarning	1:1	-

The mains monitor has determined a mains warning.

Bit	Meaning	Warning no.
0	Mains monitor has determined warning Mains failure	64
1	Mains monitor has determined warning Phase failure	65
2	Mains monitor has determined that warning limit is below ▹P2058◃ Mains undervoltage	66
3	Mains monitor has determined that the warning limit has been exceeded ▹P2059◃ Mains overvoltage	67
4	Mains monitor has determined that the warning limit Frequency ▹P2060◃ is below	68
5	Mains monitor has determined an exceeding of the upper warning limit Frequency ▹P2061◃	69
15 ... 6	Reserved	

Multiple bits can be set.

The separate warnings can be activated or deactivated via ▹P2062◃ Mains monitor warning mask.

The mains monitor warnings are not identical with the warnings of the module Mains supply. The valid warning limits are stored in the device and can differ from the programmable values in the mains monitor. In the mains monitor the warning limits are set via the parameters ▹P2058◃ to ▹P2061◃!

P0290	Client-Überwachungs-Timeout	0 to 65535 ms	
EE	**Client alive timeout**	2000 ms	
ON	BM_u_ClientAliveTimeout	1:1 ms	-

This parameter is for the setting of the connection monitoring between WinBASS II / ProDrive and the controller. This allows the controller to guide the drive at interrupted communication into a safe status.

If the value is zero no connection monitoring operates.

The controller checks the maximum time between two telegrams. If there is a telegram failure the controller signals an error. Error reaction is adjustable.

This mechanism is implemented from controller firmware version FW 03.01 and WinBASS version 1.08.

P0291	Empfangstimeout Proprog Protokoll	300 to 65535 ms	
EE	**Receive timeout proprog protocol**	500 ms	
ON	BM_u_ProprogCharTimeout	1:1 ms	-

This parameter determines the maximum value of the time which may elapse between two sequently signs of a telegram before the controller signals a communication error and synchronizes anew.

Deviations from the standard value are only then technically efficient, if the according settings of the value timeout have been made in the connection settings of WinBASS II / ProDrive or PROPROG wt, in order to, for example, allow protocol processing for modem operation.

P0297	Fehlerreaktion für Netzausfall	-3 to 3	
EE	**Error Reaction Mains Failure**	-1	
ON	BM_i_ErrReactionMainsFailure	1:1	-

Reaction of the controller by recognition of mains failure.

Up to and including b maXX® controller version FW 03.07.

Reaction-code	Meaning
-3	Return motion positioning ▹P2052◃ In ▹P0025◃ in this case motoring operation at mains failure must be permitted, the return of mains must be prevented, because it otherwise can lead to a destruction of the charge circuit.
-2	Reserved
-1	No reaction
0	Pulse inhibit
1	Stop. Ramp down at the ramp function generator (ramp down time ramp function generator ▹P1173◃)
2	Quickstop Ramp down at the quickstop ramp (stop time ramp function generator ▹P1174◃)
3	Stop. Ramp down at the current limit

From b maXX® controller version FW 03.08:

Do not use this parameter anymore. Adjusting of error reaction at a central position on WinBASS page „Drive manager/error Reaction“. For compatibility reasons the parameter remains and is effective further on. At WinBASS II / ProDrive uploads this parameter is not considered anymore, instead of that the fields of all error reaction parameters (▹P0902◃ ... ▹P0905◃).

P0298	Fehlerreaktion für BACI-Kommunikation	-3 to 3	
EE	**Error Reaction BACI communication**	-1	
ON	BM_i_ErrReactionBaci	1:1	-

Up to and including b maXX® controller version FW 03.07

Reaction of the controller at aborting of the cyclic set value transmission via the BACI. Reaction code see ▹P0297◃ on page 412.

The monitoring of the cyclic BACI-set value transmission starts after the first error-free transmission. If, due to the parameter timeout for cyclic BACI communication ▹P0839◃ determined monitoring time the controller does not receive any new set values, from this starting point on, then the controller signals the error ’BACI timeout at cycl. data’ - error code 4148 in parameter ▹P0245◃ on page 405.

From b maXX® firmware version FW 03.08:
Do not use this parameter anymore. See accordant notes ▹P0297◃.

P0299	Fehlerreaktion bei Sync-Fehlern	-3 to 3	
EE	**Error Reaction Sync Errors**	0	
ON	BM_i_ErrReactionSync	1:1	-

Up to and including b maXX® controller version FW 03.07

Reaction of the controller by synchronous loss to an external synchronous signal.

Reaction code see ▹P0297◃ on page 412.

From b maXX® firmware version FW 03.08:
Do not use this parameter anymore. See accordant notes ▹P0297◃.

P0300	Steuerwort	0 to FFFF$_{hex}$	
-	**Controlword**	0$_{hex}$	
ON	BM_w_Control word	1:1	CW

Also see ▷Drive management◁ from page 181.

This parameter is the input word used in the state machine of the device control.

Bit	Meaning
0	1: Command 'switch on' 0: Command 'shut down
1 1)	1: Command 'no voltage inhibit' (operating condition) 0: Command 'inhibit voltage'
2 1)	1: Command '**no** quickstop' (operating status) 0: Command 'quickstop'
3	1: Command 'operation enabled' 0: Command 'inhibit operation'
4	Depending on operation mode: Ramp function generator inhibit, start homing, new set value (start positioning)
5	Depending on operation mode: RFG-stop, set homing position, immediately change set
6	Depending on operation mode: RFG zero, absolute/relative target input
7	0 -> 1 reset error
8	Depending on operation mode: Stop
10 ... 9	Reserved
11	Depending on operation mode: Jogging forwards, start positioning, from FW 03.09 Inhibit set value; Start Following positioning
12	Depending on operation mode: Jogging backwards, reset positioning
13	0: Release operation mode switching 1: Inhibit operation mode switching
15 ... 14	Reserved

1) These bits are low active.

Description of bits (Control of drive state machine)

- Bit 0 to 3 and 7
  The device control commands are defined with the following bit combinations:

Command	Bit 7 Reset error	Bit 3 Operation enabled	Bit 2 Quickstop 1)	Bit 1 = 1: Inhibit voltage 1)	Bit 0 Switch on	Transitions
Shut down	X	X	1	1	0	2,6,8
Switch on	X	X	1	1	1	3
Inhibit voltage	X	X	X	0	X	7,9,10,12
Quickstop	X	X	0	1	X	7,10,11
Inhibit operation	X	0	1	1	1	X

Command	Bit 7 Reset error	Bit 3 Operation enabled	Bit 2 Quickstop[1]	Bit 1 = 1: Inhibit voltage [1]	Bit 0 Switch on	Transitions
Operation enabled	X	1	1	1	1	4
Reset error	0 → 1	X	X	X	X	15

The bits which are marked with X are of no significance for the accordant command.

[1] These bits are low active.

Description of the operating mode-dependent bits

- Bit 4 - Inhibit ramp function generator/new set value (start positioning)/start homing
  - Speed setting (operation mode 2)
    1: Enable ramp function generator
    0: Inhibit ramp function generator (output on 0)
  - Speed control (operation mode -3)
    Inverted meaning of bits compared with operation mode Speed specification 1 (operation mode 2)
    1: Inhibit ramp function generator (output on 0)
    0: Enable ramp function generator (enable output)
  - Position set mode (operation mode 1)
    1: Start positioning, new set value
  - Homing operation (operation mode 6)
    1: Starting of homing
  - Position control (operation mode -4) and synchronous operation (operation mode -5); Technology function "control-operated homing:
    1: Starting of the control-operated homing

- Bit 5 - RFG-stop/setting of home position/immediately change set
  - Position set mode (operation mode 1)
    Immediately change set
    0: Positioning of single positioning sets ('single set point"): Do not change data set immediately
    1: Positioning set value setting (set of setpoints): Change data set immediately.
  - Speed setting (operation mode 2)
    1: Ramp function generator ramp enabling
    0: Ramp function generator stop ramp-up (freeze output)
  - Speed control (operation mode -3)
    Inverted meaning of bits compared with operation mode Speed specification 1 (operation mode 2)
    1: Stop ramp function generator (freeze output)
    0: Enable ramp function generator
  - Position control (operation mode -4) and synchronous operation (operation mode -5):
    1: Setting of homing position (controlled homing)

- Bit 6 - RFG zero, absolute/relative target input
  - Position set mode (operation mode 1)
    0: absolute target input
    1: Relative target

  - Speed setting (operation mode 2)
    1: Ramp function generator enable input
    0: Set ramp function generator input on zero (braking with ramp)
  - Speed control (operation mode -3)
    Inverted meaning of bits compared with operation mode
    Speed setting (operation mode 2)
    1: Set ramp function generator input to zero (braking with ramp)
    0: Ramp function generator enable input
  - Position control (operation mode -4) and synchronous operation (operation mode -5); Technology function "control-operated homing:
    1: Set reference point

- Bit 7: Device control command ’Reset errors’.
  For the command is a change from 0 to 1 in this bit necessary.

- Bit 8: Stop
  - Position set mode (operation mode 1)
    0: Continue positioning
    1: Stop axis with profile delay
  - Homing operation (operation mode 6)
    0: Continue homing
    1: Stop homing with ▹P1213◃ Positioning stop deceleration

- Bit 11:
  - Operating mode jog:
    Jog forwards
  - Operating mode position set mode:
    Start positioning (only if old starting performance has been selected)
  - Operating mode Spindle positioning
    Start Following positioning
  - Operating mode Position control (from firmware version FW 03.09)
    Inhibit setpoints (position setpoints, which are written on ▹P0369◃ and ▹P0370◃, are not accepted, if this bit was set)

- Bit 12:
  - Operating mode jog:
    Jog backward
  - Operating mode position set mode:
    Reset positioning with profile delay

- Bit 13: For all operating modes: Inhibit operating mode switching
  In order to avoid inconsistencies between the set operating mode and the operating mode-dependent bits the operating mode switching can be inhibited precisely placed. If the bit is set, the operating mode, which was set remains active. The change of the set mode is taken over, if the bit was deleted. A new operating mode can therewith be activated synchronous with the control word.
  The momentary status for the operating mode switch is displayed in ▹P0308◃.

  0 - release operating mode switch

  1 - inhibit operating mode switch

Control word Total overview of all operating modes

Bit	Notch position -1	Current control -2	Speed control $-3^{2)}$	Speed setting 1 $2^{2)}$	Position control -4	Jog operation 5	Synchronous operation -5	Homing operation 6	Target position set value 1	Spindle positioning -6	Autotuning -7
0	Switch on (state machine device control)										
1	Inhibit voltage (state machine unit control) 1)										
2	Quickstop (state machine unit control) 1)										
3	Operation enabled (state machine device control)										
4	X	X	RFG inhibit	RFG inhibit1)	Start homing	X	Start homing	Start homing	New setpoint	X	X
5	X	X	RFG stop	RFG stop 1)	Setting of home position	X	Setting of home position	X	Immediately change set	X	X
6	X	X	RFG zero	RFG zero 1)	X	X	X	X	Absolute/ relative target input	X	X
7	Reset error (state machine unit control)										
8	X	X	X	X	X	X	X	Stop	Stop	X	X
9	X	X	X	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X	X	X	X
11	X	X	X	X	Inhibit setpoint values	Jog forwards	X	X	Start positioning3)	Start Following positioning	X
12	X	X	X	X	X	Jog backwards	X	X	Stop the running positioning	X	X
13	Inhibit operating mode										
14	X	X	X	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X	X	X	X

The bits which are marked with X are reserved and are to be set from the control to 0.

1) These bits are low active.

2) In den operating modes -3 and 2 the bits 4, 5 and 6 are prioritized as follows:
Bit 4 before bit 5 before bit 6

3) Only if original behavior is activated

P0301	Statuswort	0 to $FFFF_{hex}$	
-	**Status word**	0_{hex}	
A	BM_w_Status word	1:1	-

Also see ▹Drive management◃ from page 181.

This parameter is the output word used in the state machine of the device control. Every 4 ms it is updated.

Bit	Meaning
0 [1)]	1: Ready-to-start 0: NOT READY TO START
1 [1)]	1: Switched on 0: Not ready-to-operate
2 [1)]	1: Operation enabled 0: Operation inhibited
3 [2)]	1: Error 0: No error
4 [1)]	1: Mains voltage/DC link voltage is present 0: Mains voltage/DC link voltage is not present
5 [1)]	1: No requirements quickstop 0: Quickstop (or quickstop requirements are available)
6 [1)]	1: Inhibit start 0: No inhibit start
7	1: Warning 0: No warning
8	Depending on operation mode
9	Remote
10 [2)]	1: Setpoint reached 0: Setpoint not reached
11	1: Internal limit active 0: No internal limit active
12	Depending on operation mode
13	Depending on operation mode
15 ... 14	Real time bits, which can be parameterized - see parameters ▹P1290◃ to ▹P1293◃

1) Display operational status of drive manager

2) Meaning dependent on control word bit 8:

If stop = 0:	1: Setpoint reached 0: Setpoint not reached
If stop = 1:	1: Axis stopped 0: Axis brakes

The operation mode dependent bits (bits 8, 10, 12, 13) are set only in the enabled status except for a few. The exceptions are marked in the table "Total overview of all operating modes".

Description of bits

- Bit 0 to bit 6
  These bits show the status of the drive state machine.

Status of the unit control									
Drive state			Bit in status word P0301						
			6	5	4	3	2	1	0
No.	7-segment display	Name	Inhibit start	Quickstop	Mains voltage / DC link voltage is energized	Error	Operation enabled	Switched on	Ready-to-start
0	0	NOT READY-TO-START	0	X	X	0	0	0	0
1	1	INHIBIT START	1	X	X	0	0	0	0
2	2	READY-TO-START	0	1	X	0	0	0	1
3	3	SWITCHED ON	0	1	X	0	0	1	1
4	4	OPERATION ENABLED	0	1	X	0	1	1	1
7	7	QUICKSTOP ACTIVE	0	0	X	0	1	1	1
14	E	ERROR REACTION ACTIVE	0	X	X	1	1	1	1
15	F	ERROR	0	X	X	1	0	0	0

The bits which are marked with X are not determined.

- Bit 3: Error
  The controller will set this bit, as soon as an error (▷P0200◁ Error System 1) is present, which will cause an error reaction of the drive. The bit remains set during the error reaction and under the status error. The bit is deleted only after the error has been successfully reset.
  As soon as this bit is set, the error LED lights up.

- Bit 4: Mains voltage/DC link voltage is present
  The bit is set, if the mains voltage at the power unit is present and the DC link is loaded. It is deleted, if the mains fails.
  This bit is updated, independent of the device status.

- Bit 5: Quickstop or quickstop requirement active
  The bit is low active and is reset, as soon as a quickstop reaction has been enabled via the control word command 'quickstop' or via the hardware input 'quickstop' (FX 3-4).
  With reaching of status 'ready-to-start' this bit will be set.
  If as a quickstop reaction 'remain in quickstop" has been selected (▷P1004◁ values 5 to 8), this bit remains deleted as long as the drive is in quickstop position. The bit is set again as soon as the drive is enabled anew or status 'ready-to-start' is reached due to a command.

- Bit 7: Warning
  The bit displays, if there is a warning or an error in the controller, which causes that there is no error reaction. This status is external recognizable due to the flashing of the error LED.

- Bit 8: Status ramp function generator stop
  Speed control (operating mode -3) and speed setting (operating mode 2):
  The bit displays that the high ramp generator has been stopped, that means that the output was frozen.

- Bit 9: Remote
  The bit is set, if at the communication source ▹P1001◃ the motor control e.g. the access on the control word is controlled via BACI.

- Bit 10: Setpoint reached
  The meaning of this bit is dependent on the status of the control word bit no. Stop.
  - Position control (operating mode -4) and
    synchronous operation (operating mode -5):
    The bit is set, if the position deviation for the set position deviation time (P1056) is less than the set limits (static or dynamic position deviation).

  - Speed control (operating mode -3) and speed setting (operating mode 2):
    The bit is set, if at the ramp function generator of the output value the input value is the same as the input value and the speed controller deviation is less than the limit, which was set and the ramp function generator signals 'setpoint reached'. At active braking procedures (quickstop, inhibit operation) the bit is set, as soon as the drive stops. At active braking procedures (quickstop, inhibit operation) the bit is set as soon as the drive stops.

  - Target position setting (operating mode 1):
    - If stop = 0:
      The bit is set as soon as the actual position value for the set positioning window time is in the set positioning window. The bit is deleted if the drive is not in the positioning window anymore. In the operating mode target position setting the bit is, also at inhibited drive, updated - therewith the last target position is taken as set position. Consequently it can be recognized if the drive is moved manually from the last position.

    - If stop = 1:
      The bit is set, as soon as the axis has stopped. For this purpose the setpoint specification and the zero speed message (encoder 1 status ▹P0390◃ or encoder 2 status ▹P0400◃, bit 10) must be existent.
      The stop function is implemented only in target position set (operation mode 1).
      With inhibited drive the bit is deleted in all operating modes except the target position setting - in the target position setting it is updated due to the last target position.

  - Spindle positioning (operating mode -6)
    The bit is set as soon as the actual position value for the positioning window time, which was set, is in the positioning window, which was set. The bit is deleted if the drive is not in the positioning window anymore.

- Bit 11: Internal limit active
  The bit is set if an internal limit is active as for example current limit, speed limit, hardware- and software limit switch. This bit is updated, independent of the device status. Via parameter ▹P1008◃ mask for internal limits it is able to be determined which internal limits shall be displayed.

- Bit 12
  - Control-operated homing at Position control (operating mode -4) and synchronous operation (operating mode -5):
    1: Homing position detected:
    The homing position was found and the actual position value at the homing position has been saved. The home position now can be set.
  - Spindle positioning (operating mode -6):
    1: Start command acknowledge:
    The start of following positioning is acknowledged, if the spindle positioning module executes and positions the command. For this purpose the previous spindle positioning must be completed and then a rising edge must be recognized in the start-bit. This handshake only occurs at following positioning and at a start after a spindle positioning error (no 203 or 204).
  - Homing operation (operating mode 6)
    1: Homing completed
    Homing was successfully completed successfully by setting the homing position.
  - Target position setting (operating mode 1)
    Handshake signal, drive response referring to the acceptance of the positioning data:
    1: Confirmation of the drive to take over the set values
    0: Drive is ready to receive new set values.

- Bit 13
  - Position control (operating mode -4) and synchronous operation (operating mode -5):
    Homing completed: Homing (controller-led homing) was successfully completed by setting the homing position.
  - Spindle positioning (operating mode -6)
    1: Homing position is set:
    The spindle positioning with automatic referencing was completed successfully by the setting of the homing position.
  - Homing operation (operating mode 6)
    1: Error homing
    Homing was aborted without setting a homing position with error message.

Status word: Total overview of all operating modes

Bit	**Notch position** -1	**Current control** -2	**Speed control** -3	**Speed setting 1** 2	**Position control** -4	**Jog operation** 5	**Synchronous operation** -5	**Homing operation** 6	**Target position set value** 1	**Spindle positioning** -6	**Auto-tuning** -7
0	Ready-to-start (state machine unit control)										
1	Switched on (state machine unit control)										
2	Operation enabled (state machine device control)										
3	Error (state machine unit control)										
4	Mains voltage / DC link voltage is energized										
5	Quickstop (state machine unit control) [1]										
6	Inhibit start (state machine unit control)										
7	Warning										
8	X	X	RFG stop	RFG stop	X	X	X	X	X	X	X
9	Remote										
10	Setpoint reached										
	Notch position detected	X	Speed = 0 setpoint	Speed = setpoint	Position setpoint	Jog speed reached	Position setpoint	Homing completed	Target position reached [2]	In Position	Auto-tuning completed
11	Internal limit active										
12	X	X	Speed = 0 [2]	Speed = 0 [2]	Home position found	X	Home position found	Homing completed	Reset setpoint	Start command-acknowledge	X
13	X	X	X	X	Homing completed	X	Homing completed	Error homing	X	Homing position is set	X
14	adjustable over ▹P1290◃, ▹P1291◃										
15	adjustable over ▹P1292◃, ▹P1293◃										

The bits which are marked with X are reserved

The operation mode dependent bits (bits 8, 10, 12, 13) are set only in the enabled status except for the marked.

[1] These bits are low active.

[2] These bits are updated also in the disabled state.

P0302	Steuerwort 2	0 to $FFFF_{hex}$	
-	**Control word**	0_{hex}	
ON	BM_w_Controlword2	1:1	CW

Also see ▹Drive management◃ from page 181.

Second control word of drive manager.

Bit	Meaning
0	**To firmware version FW 03.05:** 0: Close motor brake 1: Open motor brake **From firmware version FW 03.06:** If there is a brake control in the manual control mode (▹P1400◃ bit 0 = 0): Edge-controlled command for opening/closing motor brake: 0 ⇒ 1: **Open motor brake** 1 ⇒ 0: **Close motor brake**
1	Edge-controlled command in order to generate the application error (error no. 239, also see ▹P0215◃.
15 ... 2	Reserved

P0303	Statuswort 2	0 to FFFF$_{hex}$	
-	**Status word**	0$_{hex}$	
A	BM_w_Status word	1:1	-

Also see ▹Drive management◃ from page 181.

The status word 2 of the drive manager is assigned as follows.

Bit	Meaning	Corresponds to bit in parameter
0	Synchronization 0: Drive not synchronous 1: Drive synchronous	▹P0530◃ Synchronization status Bit 0
1	Encoder error 0: No error 1: Error	▹P0200◃ Error System 1 Bit 7
2	Status of reference switch 0: Switch inactive 1: Switch is active	▹P0461◃ Positioning switch status Bit 2
3	Warning safety relay 0: Safety relay OK 1: Safety relay off or defect	▹P0262◃ Warnings power unit Bit 4
4	Encoder 1 initialized successfully 0: Initialization successful 1: Encoder error (communication with encoder)	▹P0208◃ error encoder 1 Bit 0
5	DC link voltage 0: Charging procedure completed 1: Undervoltage	▹P0262◃ Warnings power unit Bit 7
6	Zero speed 0: Speed greater n=0 threshold 1: n=0 threshold is below	▹P0390◃ Encoder 1 Status Bit 10
7	Notch position, field angle search 0: Find notch position inactive 1: Find notch position active	▹P0501◃ Motor notch position status Bit 1
8	Status of free digital input 1 in slot D 0: Input is set 1: Input is not set	▹P0413◃ Status of digital inputs in module slot D Bit 0
15 ... 9	Reserved	-

Note:

- Bit 2 (status of reference switch)
  The status of the zero switch is displayed.
- Bit 3
  The controller signals the error 'Safety relay off (or faulty)' (Error no. 87), if pulse enable has been given and if either case occurs:
  1. The safety relay is not controlled or
  2. The safety relay is defect
  If there is no pulse enable and if the cases a) or b) occur, the controller signals only one warning (no. 20).

P0304	Ist-Betriebsart	-7 to 6	
-	**Operation mode actual**	-3	
A	BM_i_OperationModeAct	1:1	-

This parameter displays the currently active drive operation mode. The operation mode of the drive is configured in parameter ▹P1000◃.

Value	Meaning
-7	Auto-tuning
-6	Spindle positioning
-5	Synchronous operation
-4	Position control
-3	Speed control
-2	Current control
-1	Find notch position
1	Target position set value
2	Speed setting
5	Jog operation
6	Homing operation

P0305	Antriebs-Status	0 to $FFFF_{hex}$	
-	**Drive status**	0_{hex}	
A	BM_w_DriveStatus	1:1	-

This parameter shows the current status of the drive.

Also see ▹Drive management◃ from page 181.

Value	Meaning	7 segment display
0	Not ready to start	0
1	Inhibit start	1
2	Ready-to-start	2
3	Switched on	3
4	Operation enabled	4

Value	Meaning	7 segment display
5	Inhibit operation active	5
6	Shutdown active	6
7	Quickstop active	7
14	Error reaction active	E
15	Error	F

P0306	Zustand dig. Eingänge Antriebsmanager	0 to $FFFF_{hex}$	
-	**Status digital inputs drive manager**	0_{hex}	
A	BM_w_DI_StatusDrvControl	1:1	-

Display of the status of the digital inputs for drive control (quickstop FX 3-4 and pulse enable FX 3-5).

Also see ▷Drive management◁ from page 181.

Bit	Meaning
0	1: Pulse enable input is closed 0: Pulse enable is open
1	1: Quickstop input is closed 0: Quickstop input is open
4 ... 2	Reserved
5	Drop-out delayed quickstop signal (also see ▷P0307◁) 1: Quickstop input is closed or delay time still is running 0: Quickstop input is open and delay time has expired
6 ... 15	Reserved

P0307	Verzögerung für Schnellhalt-Eingang	0 to 65535 ms	
EE	**Delay for quickstop input**	0 ms	
ON	BM_u_DI_QuickstopDelay	1:1 ms	CW

Adjustable delay time for the reaction on the quickstop input (FX3-4).

The initiating of the quickstop reaction is delayed be the time, which was set - the drive remains enabled during this time.

P0308	Statuswort 3	0 to $FFFF_{hex}$	
EE	**Status word**	0_{hex}	
ON	BM_w_Statusword 3	1:1	-

The status word 3 of the drive manager is assigned as follows:

Bit	Meaning
0	Two-level-controller 1 output 0: Output inactive 1: Output active
1	Two-level-controller 2 output 0: Output inactive 1: Output active
2	0: Operation mode switch released 1: Operation mode switch inhibited
3 ... 15	Reserved

P0310	Datenmanagement-Kommando	0 to 32	
EE	**Data management command**	0	
ON	BM_i_RecordCommand	1:1	-

See ▹Data Management◃ from page 43.

By use of this parameter the commands for the data management are defined.

Value	Meaning	▹P0314◃ Source data set	▹P0315◃ Target data set
0	Reset data management		
1	Save all parameters of the valid data sets into EEPROM		
2	Completely load EEPROM into RAM		
3	Reset EEPROM completely		
4	Set standard values for active data set		
5	Set standard values for all generated data sets		
6	Create data set <n>		Data set, which is to be created
7	Deleted data set <n>		DS to be deleted
8	Copy data set <x> to data set <y>	Source data set	Destination data set
9	Load data set <x> from EEPROM	DS in EEPROM	
10	Save data set <x> into EEPROM	DS in RAM = EEPROM	
11	Reserved		
12	Write all parameters of the valid data sets into the PSI		
13	Load PSI completely into RAM		
14	Reset PSI completely		
15 ... 32	Reserved		

P0311	Datenmanagement-Status	0 to FFFF$_{hex}$	
EE	**Data management status**	0	
A	BM_w_RecordStatus	1:1	-

See ▷Data Management◁ from page 43.

This parameter displays the status of the last data management command.

Return code	Meaning
00$_{hex}$	No error
01$_{hex}$	Write/read cycle in process
02$_{hex}$	Invalid parameter number
03$_{hex}$	Invalid data type
04$_{hex}$	Value less than the minimum value
05$_{hex}$	Value greater than the maximum value
06$_{hex}$	Read-only parameter
07$_{hex}$	Parameter cannot be changed because of operational status
08$_{hex}$	Invalid parameter value
09$_{hex}$	EEPROM header not existent or invalid
1A$_{hex}$	Invalid data in EEPROM
0B$_{hex}$	Invalid data in EEPROM
43C$_{hex}$	Checksum error during test
0D$_{hex}$	EEPROM write error
0E$_{hex}$	EEPROM too small
F0$_{hex}$	Unidentified error
10$_{hex}$	Incompatible parameter (-numbers)
11$_{hex}$	Data set operation in the active operation status not permissible (RUN)
12$_{hex}$	Selected data set has not been created yet
13$_{hex}$	Selected data set already exists - cannot be created anymore
14$_{hex}$	Wrong data set number (not equal 1 to 8)
15$_{hex}$	Wrong source data set number
16$_{hex}$	Wrong target data set number
17$_{hex}$	No enable possible during data set switch-over
18$_{hex}$	EEPROM is reset
19$_{hex}$	Auto-tuning parameters invalid $\rightarrow$ copying not permitted
1A$_{hex}$	PSI not plugged
1B$_{hex}$	PSI reset
1C$_{hex}$	PSI-data is not compatible (e.g. PSI-data generated by BM3xxx)

Value	Meaning
0000$_{hex}$	Command 'delete data management' successfully completed
1001$_{hex}$	'Write all parameters of valid data sets into EEPROM' successfully completed
1002$_{hex}$	'Completely read EEPROM' successfully completed
1003$_{hex}$	'Reset EEPROM completely' successfully completed
1004$_{hex}$	'Set standard values for active data set' successfully completed
1005$_{hex}$	'Make settings of standard values for entire data sets' successfully completed

Value	Meaning
1006_{hex}	'Create data set <n>' successfully completed
1007_{hex}	'delete data set <n>' successfully completed
1008_{hex}	'Copy data set <x> to data set <y>' successfully completed
1009_{hex}	'Load data set <x> from EEPROM' successfully completed
$100A_{hex}$	'Save data set <x> into EEPROM' successfully completed
$100B_{hex}$	Reserved
$100C_{hex}$	'Write all parameters of the valid data sets into the PSI' successfully completed
$100D_{hex}$	'Read PSI completely' successfully completed
$100E_{hex}$	'Reset PSI completely' successfully completed
$100F_{hex}$ to $10FF_{hex}$	Reserved
1100_{hex}	Data set switch-over was successfully

P0312

	Aktive Datensatznummer	1 to 8	
-	**Active data set number**	1	
ON	BM_u_ActiveDataSet	1:1	-

See ▹Data Management◃ from page 43.

Here, the number of the active data set is displayed. Writing to this parameter, in online mode causes an instant data set switch-over (certain status must be met anyway, see also ▹Data set switching◃ from page 47).

P0313

	Angelegte Datensätze	00_{hex} to FF_{hex}	
-	**Valid data sets**	01_{hex}	
A	BM_w_ValidDataSets	1:1	-

See ▹Data Management◃ from page 43.

Bit mask in order to show which of the eight data sets are created in the controller, e.g. which data sets can be saved or read. A set bit signals a created data set.

Bit	Meaning
0	0: Data set 1 is deleted 1: Data set 1 created
1	0: Data set 2 is deleted 1: Data set 2 created
2	0: Data set 3 is deleted 1: Data set 3 created
3	0: Data set 4 is deleted 1: Data set 4 created
4	0: Data set 5 is deleted 1: Data set 5 created
5	0: Data set 6 is deleted 1: Data set 6 created
6	0: Data set 7 is deleted 1: Data set 7 created

Bit	Meaning
7	0: Data set 8 is deleted 1: Data set 8 created
15 ... 8	Reserved

P0314

P0314	Quell-Datensatz	0 to 8	
-	**Data set source**	0	
ON	BM_u_RecCmdSource	1:1	-

See ▹Data Management◃ from page 43.

Source data set number for data set operations. According to ▹P0310◃ data set command the data set source refers to the EEPROM (e. g. at read data set) or to the RAM (e. g. at write data set in EEPROM).

P0315

P0315	Ziel-Datensatz	0 to 8	
-	**Data set destination**	1	
ON	BM_u_RecCmdTarget	1:1	-

See ▹Data Management◃ from page 43.

Target data set number for data set operations. The target data set refers, according to the ▹P0310◃ data set command either to a data set in the EEPROM or in the RAM.

P0316

P0316	Fehlerhafter Parameter	1 to max. Para-no.	
-	**Error data set parameter no.**	-	
A	BM_u_RecCmdError	1:1	-

See ▹Data Management◃ from page 43.

Here, the number of the parameter is displayed, which has caused an error during memory access (read/write). If an error occurs during command processing, the command does not interrupt the transfer process, but continues the transfer process with the next parameter.
When multiple errors occur, only the last error will be displayed.

P0317

P0317	Anzahl Schreibvorgänge EEPROM	1 to 65535	
-	**EEPROM write count**		
A	BM_u_EepromWriteCount	1:1	-

See ▹Data Management◃ from page 43.

Number of write counts in EEPROM. This counter will be incremented at each write access.

P0318	Anzahl Schreibvorgänge auf das PSI	1 to 65535	
-	**PSI write count**		
A	BM_u_PsiWriteCount	1:1	-

Number of write counts to the PSI data memory. This counter is incremented each time a command that initiates memory access on the PSI is processed.

P0319	Parameternummer für PSI-Zugriff	1 to 65535	
-	**PSI Parameter number**	1	
A	BM_u_PsiParameterId	1:1	-

Auxiliary parameter for direct read-out of PSI parameters. The PSI parameter number indicates, which parameter (addressed via the number) is to be read-out directly from PSI.

P0320	PSI Array index	0 to 65535	
-	**PSI Array index**	0	
A	BM_u_PsiArrayIdx	1:1	-

Auxiliary parameter for direct read-out of PSI parameters. Array index for addressing arrays directly from the PSI.

Arrays can be read only element by element. On index-0 the array size can be read out.

P0321	Datenbreite PSI Parameter	0 to 65535	
-	**PSI parameter data width**		
A	BM_u_PsiDataSize	1:1	-

Feed back value for direct read-out of PSI parameters. Holds, in coded form, the data size of the read-back data from PSI.

Value	Meaning
0	16 Bit
1	32 Bit
2	STRING

P0322	PSI Parameterwert bis zu 32 Bit	0 to $FFFFFFFF_{hex}$	
-	**PSI parameter value (32 bit)**		
A	BM_ud_PsiData32	1:1	-

Union for feed back values from data type: SINT, USINT, INT, UINT, DINT, UDINT, BYTE, WORD, DWORD. Leading bits are set to zero (cast).

P0323	PSI string parameter	40 ASCII characters	
-	**PSI string parameters**	""	
A	BM_s_PsiDataString	1:1	-

Feed back parameters for strings under direct read access to PSI.

P0324	PSI Datensatz-Auswahl	1 to 4	
-	**PSI Data set selection**	1	
A	BM_u_PsiDatasetSelect	1:1	-

Data set selector for direct access on parameters in PSI.

P0325	Angelegte Datensätze im PSI	0 to 65535	
-	**PSI valid data sets**		
A	BM_w_ValidDataSets	1:1	-

Bit mask used to display the data held within the PSI

P0326	PSI Betriebsart	0 to 65535	
-	**PSI mode**		
A	BM_w_DataSetMode	1:1	-

See ▹Data Management◃ from page 43.

This parameter is only relevant if a PSI is plugged at the controller.

With these parameters you can select the operation mode for the PSI.

The settings in this parameter must be saved on the PSI, as they are read out from the PSI after switch-on.

Bit	Meaning
0	0: Automatic loading from EEPROM The parameter set is automatically load from the EEPROM after powering up the controller. 1: Automatic loading from PSI The parameter set is automatically load from the PSI into the RAM after powering up the controller.
1	Only relevant if automatic loading from PSI is activated 0: The parameter set is automatically load only into the RAM after powering up the controller. 1: Automatic saving of the parameter set into the EEPROM The parameter set is automatically load into the RAM after powering up the controller and at last saved in the EEPROM of the controller.
15 ... 2	Reserved

P0327	Boot Datensatz	1 to 8	
EE	**Boot data set**	1	
PO	BM_u_BootDataset	1:1	-

See ▹Data Management◃ from page 43.

Data set, which is activated after switching on of the device as start data set. The data set must be already created.

P0330	Stromregler Status	0 to $FFFF_{hex}$	
-	**Current controller status**	0_{hex}	
A	BM_w_CurrentCtrlStatus	1:1	-

Status of current controller (no functions implemented yet).

P0331	Drehmoment Sollwert	-100.00 to +100.00 %	
EE	**Torque set value**	0.00 %	
ON	BM_i_TrqSetValue	4000_{hex}:100 %	CW

Torque set value at torque setting (operating mode current control).

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

Alternative scaling: 100% ↔ Maximum torque

with: Maximum torque = Maximum current (▹P1241◃) * Kt factor

Kt factor = Nominal torque / Nominal cross current

Nominal torque = Motor nominal power ▹P0056◃ / Nominal speed ▹P0057◃ * 2π / 60)

for SM: Nominal cross current = Motor nominal current ▹P0054◃

for ASM:

$$\text{Nominal cross current} = \sqrt{[\text{Motor nominal current P0054}]^2 - [\text{Nominal magnetizing current P0066}]^2}$$

Asynchronous motors in general as well as synchronous motors in the field weakening cannot reach the complete torque due to the field current. The actually available torque current consists of the maximum total current minus the field current.

P0332	Stromregler Iq-Sollwert	-200.00 to +200.00 %	
-	**Current Iq set value**	0.00 %	
A	BM_i_IqSetLimited	4000_{hex}:100 %	-

Limited quadrature current set value.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

P0333	Stromregler Iq-Istwert	-200.00 to +200.00 %	
-	**Current Iq actual value**	0.00 %	
A	BM_i_IqAct	4000_{hex}:100 %	-

Display of quadrature current actual value.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

P0334	Stromregler Iq-Regler Ausgang	-200.00 to +200.00 %	
-	**Current Iq controller output**	0.00 %	
A	BM_i_CtrlOut_Uq	4000_{hex}:100 %	-

Display of quadrature voltage setpoint from quadrature current controller.

Scaling: 100% ↔ Power unit U DC link nominal value (▹P0020◃)/$\sqrt{2}$

P0335	Stromregler Id-Sollwert	-100.00 to +100.00 %	
-	**Current Id set value**	0.00 %	
A	BM_i_IdSetLimited	4000_{hex}:100 %	-

Limited direct-axis current set value.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

P0336	Stromregler Id-Istwert	-200.00 to +200.00 %	
-	**Current Id Actual value**	0.00 %	
A	BM_i_IdAct	4000_{hex}:100 %	-

Display of actual value of the magnetizing direct-axis current.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

P0337	Stromregler Id-Regler Ausgang	-200.00 to +200.00 %	
-	**Current Id controller output**	0.00 %	
A	BM_u_IdOut	4000_{hex}:100 %	-

Display of direct-axis voltage set value from direct-axis current controller.
Function is not yet implemented.

Scaling: 100% ↔ Power unit U DC link nominal value (▹P0020◃)/$\sqrt{2}$

P0338	Spannung EMK-Sollwert	-200.00 to +200.00 %	
-	**Voltage EMF set value**	0.00 %	
A	BM_i_VemfSet	4000_{hex}:100 %	-

Display of torque generating voltage set value from EMF feed forward.

Scaling: 100% ↔ Power unit U DC link nominal value (▷P0020◁)/√2

P0339	Spannung Uq-Sollwert	-200.00 to +200.00 %	
-	**Voltage Vq set value**	0.00 %	
A	BM_i_VqSet	4000_{hex}:100 %	-

Effective quadrature voltage set value.

Scaling: 100% ↔ Power unit U DC link nominal value (▷P0020◁)/√2

P0340	Spannung U_d-Sollwert	-200.00 to +200.00 %	
-	**Voltage Vd set value**	0.00 %	
A	BM_i_VdSet	4000_{hex}:100 %	-

Effective direct-axis voltage set value.

Scaling: 100% ↔ Power unit U DC link nominal value (▷P0020◁)/√2

P0341	Strom Phase U-Istwert	-200.00 to +200.00 %	
-	**Current phase U actual value**	0.00 %	
A	BM_i_IphaseU	4000_{hex}:100 %	-

Display of the current actual value of ‚Phase U‘.

Scaling: 100% ↔ √2 ∗ Power unit maximum current (▷P1241◁)

P0342	Strom Phase V-Istwert	-200.00 to +200.00 %	
-	**Current phase V actual value**	0.00 %	
A	BM_i_IphaseV	4000_{hex}:100 %	-

Display of ‘phase V‘ current actual value.

Scaling: 100% ↔ √2 ∗ Power unit maximum current (▷P1241◁)

P0343	Scheinstrom-Istwert	0 to +200.00 %
-	**Apparent current actual value**	0.00 %
A	BM_u_Iamplitude	4000_{hex}:100 % -

Display of apparent current in %.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

P0344	Standard-Momenten-Istwert	-2000.00 to 2000.00%
-	**Standard torque actual value**	
A	BM_u_TorqueAct	0666_{hex}:100 % -

Display of the referred torque. This is the standard torque display. The torque is firstly computed in Nm and then scaled to the nominal torque of motor (see ▹Torque monitoring◃ from page 228). With a torque of motor nominal torque, the referring torque is 100%, accordant to 0666_{hex} in internal display.

As a parameter value of 4000_{hex} with output via the analog outputs with scaling factor = 1 results in a voltage of 10 V, with this scaling 1 V at the output 0666_{hex} (corresponds to motor nominal torque) with scaling factor = 1 is accomplished.

$$\text{Motor nominal torque} = \frac{1000 \cdot \text{motor nominal power (P0056)}}{2\pi \cdot (\text{ motor nominal speed(P0057)})/60}$$

In WinBASS II / ProDrive the actual torque value is shown in 0.1 Nm:

$$\text{Display} = \frac{\text{Torque actual value (P0344)}}{100\ \%} \cdot \text{motor nominal torque}$$

Parameter P0344 is smoothed with a 2 ms time constant

P0345	Scheinstrom-Istwert mit Iq-Vorzeichen	-200.00 to +200.00 %
-	**Apparent current actual value with Iq sign**	0.00 %
A	BM_i_IamplitudeIqSign	4000_{hex}:100 % -

The amount of this parameter accords to parameter apparent current actual value (▹P0343◃), the sign accords to the sign of parameter current controller Iq actual value (▹P0333◃).

P0350

P0350	Drehzahlregler-Status	0 to $FFFF_{hex}$	
-	**Speed controller status**	0_{hex}	
A	BM_w_SpeedCtrlStatus	1:1	-

This parameter reflects the status of the speed controller.

<table>
<tr><th>Bit</th><th colspan="3">Meaning</th></tr>
<tr><td>2 ... 0</td><td colspan="3">Reserved</td></tr>
<tr><td>3</td><td colspan="3">1: Error in module, error bit see error messages</td></tr>
<tr><td rowspan="4">4</td><td colspan="3">Drive blocked
The storage requirements for a blocking are „Torque limit or current limit reached)“ (speed controller status P0350 bit 13 = 1) and simultaneously an existing zero speed message.
According to setting in bit 3 of speed controller mode the following is valid (▹P1030◃):</td></tr>
<tr><td>Bit 3 of speed controller mode ▹P1030◃</td><td>Status zero speed message</td><td>Speed threshold</td></tr>
<tr><td>0</td><td>Bit 10 in encoder 1 status ▹P0390◃ or
Bit 10 in encoder 2 status ▹P0400◃</td><td>Encoder 1 N=0 threshold ▹P1073◃ or
Encoder 2 N=0 threshold ▹P1083◃</td></tr>
<tr><td>1</td><td>Bit 9 in encoder 1 status ▹P0390◃ or
Bit 9 in encoder 2 status ▹P0400◃</td><td>N=0 threshold blocking monitoring
▹P1261◃</td></tr>
<tr><td>5</td><td colspan="3">Speed set value is limited</td></tr>
<tr><td>6</td><td colspan="3">Status of the Kt adaption (see ▹P0594◃, ▹P0112◃ and ▹P0113◃):
0: not active
1: active</td></tr>
<tr><td>9 ... 7</td><td colspan="3">Reserved</td></tr>
<tr><td>10</td><td colspan="3">0: Motoring operation
1: Generating operation</td></tr>
<tr><td>11</td><td colspan="3">0: Torque direction 1 is active
1: Torque direction 2 is active</td></tr>
<tr><td>12</td><td colspan="3">1: Actual speed value equal to speed set
(control deviation ▹P0354◃ < limit control deviation ▹P1043◃)</td></tr>
<tr><td>13</td><td colspan="3">1: Torque limit or current limit reached</td></tr>
<tr><td>15 ... 14</td><td colspan="3">reserved</td></tr>
</table>

P0351

P0351	Drehzahl-Stellgröße	-200.00 to +200.00 %	
-	**Speed set value**	0.00 %	
-	BM_di_SpeedSetValue	40000000_{hex}:100 %	CW

Not limited set value input for speed controller. This parameter is also used for set value setting via the ramp function generator or from the position controller output.

In position controlled operating modes this parameter acts only as a display parameter, it is internally overwritten in every controller cycle by the position controller. In speed-controlled operating modes it may only be written to (e.g. via analogous input), if the ramp function generator is deactivated. At active ramp function generator the ramp function generator input must be used.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0352	Drehzahl-Sollwert	-100.00 to +100.00 %
-	**Speed set value total**	0.00 %
A	BM_di_SpeedSetValueTotal	40000000_{hex}:100 % -

Display of total effective speed set value, limited to 100 %.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0353	Drehzahl-Istwert	-200.00 to +200.00 %
-	**Speed actual value**	0.00 %
A	BM_di_SpeedActValue	40000000_{hex}:100 % -

Display of speed actual value.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0354	Drehzahl-Regelabweichung	-200.00 to +200.00 %
-	**Speed deviation value**	0.00 %
A	BM_i_SpeedCtrlDev	4000_{hex}:100 % -

Display of speed controller deviation value.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0355	Drehmoment-Vorsteuerung	-200.00 to +200.00%
-	**Torque feed forward**	0.00 %
A	BM_i_TrqFeedFor	4000_{hex}:100 % -

Display of torque set value from torque feed forward.

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

Alternative scaling: 100% ↔ Maximum torque

with: Maximum torque = Maximum current (▹P1241◃) * Kt factor

Kt factor = Nominal torque / Nominal cross current

Nominal torque = Motor nominal power ▹P0056◃ / Nominal speed ▹P0057◃ * 2π / 60)

for SM: Nominal cross current = Motor nominal current ▹P0054◃

for ASM:

$$\text{Nominal cross current} = \sqrt{[\text{Motor nominal current P0054}]^2 - [\text{Nominal magnetizing current P0066}]^2}$$

P0356	Drehzahlregler-Ausgang	-100.00 to +100.00 %	
-	**Speed controller output**	0.00 %	
A	BM_i_SpeedCtrlOut	4000_{hex}:100 %	-

Display of speed controller output (torque setpoint).

Scaling: 100% ↔ Power unit maximum current (▹P1241◃)

Alternative scaling: 100% ↔ Maximum torque

with: Maximum torque = Maximum current (▹P1241◃) * Kt factor

Kt factor = Nominal torque / Nominal cross current

Nominal torque = Motor nominal power ▹P0056◃ / Nominal speed ▹P0057◃ * 2π / 60)

for SM: Nominal cross current = Motor nominal current ▹P0054◃

for ASM:

$$\text{Nominal cross current} = \sqrt{[\text{Motor nominal current P0054}]^2 - [\text{Nominal magnetizing current P0066}]^2}$$

P0357	Standard-Momentengrenze bipolar	0.00 to 100.00 %	
-	**Standard torque limiter bipolar**	100.00 %	
ON	BM_u_TrqSymDirect	4000_{hex}:100 %	CW

Standard symmetrical torque limit for fast cyclic access (for example over analog input or over option card).

The operating torque set value from the sum "speed controller output" ▹P0356◃ (or set value of the Current control (-2) mode: "Torque set value ▹P0331◃) and "Torque additional set value" ▹P1022◃ is limited symmetrical by P0357.

The torque limit P0357 additionally has effects towards the "Addition torque limit bipolar" ▹P1046◃ if the latter was activated (see ▹P1030◃ bit 4) and toward the torque limits which is determined by the torque current limit (▹P1036◃, ▹P1037◃ and ▹P1038◃, dependent on the type of torque limit ▹P1030◃). The smallest value of all set limits is the operating one.

Scaling: 100% ↔ Power unit maximum current of the drive (▹P1241◃)

The displayed setting in WinBASS / ProDrive is in 0.1 Nm. All parameters in the following equation are in GUI format.

The motor nominal torque used in scaling is calculated from:

$$\text{Motor nominal torque} = \frac{1000 \cdot \text{motor nominal power (P0056)}}{2\pi \cdot (\text{motor nominal speed (P0057)})/60}$$

Change scaling by WinBASS / ProDrive:

For synchronous motor scaling of display is in % for display in Nm:

$$\text{Display} = \frac{\text{P0357}}{100\ \%} \cdot \frac{\text{power unit maximum current (P1241)} \cdot \text{motor nominal torque}}{\text{motor nominal current P0054)}}$$

and scaling of setting in Nm for display in %:

$$\text{P0357} = \frac{\text{display} \cdot \text{motor nominal current (P0054)} * 100\ \%}{\text{power unit maximum current (P1241)} \cdot \text{Motor nominal torque}}$$

For asynchronous motors the scaling of display in % for display in:

$$\text{Display} = \frac{\text{P0357}}{100\ \%} \cdot \frac{\text{power unit maximum current (P1241)} \cdot \text{motor nominal torque}}{\sqrt{\text{motor nominal current (P0054)}^2 - \text{motor magnetizing current (P0066)}^2}}$$

and scaling of setting in Nm for display in %:

$$\text{P0357} = \frac{\text{display} \cdot \sqrt{\text{motor nominal current (P0054)}^2 - \text{motor magnetizing current (P0066)}^2} * 100\ \%}{\text{power unit maximum current (P1241)} \cdot \text{motor nominal torque}}$$

Rescaling by field bus:

If the torque limit is served by field bus, this is as above described at first to be scaled into % and then with the internal format

100% $\leftrightarrow$ 4000_{hex} $\leftrightarrow$ Power unit maximum current of the drive (▹P1241◃)

is to be written into the parameter ▹P0357◃.

Described by analog inputs:

With a voltage variation of –10 V to +10 V at the analog input the value of the parameter torque limit changes cyclical ▹P0357◃ from 0 to 4000_{hex}, accords to 0 to 100% of the current limit, if the scaling factor is 1.

As the current is scaled to power unit maximum current of the drive ▹P1241◃, a dependence of the torque limit results from the analog voltage

for **synchronous motor**:

$$\frac{\text{Torque limit}}{\text{Analog input} + 10\ \text{V}} = \frac{\text{Power unit maximum current drive (P1241)} \cdot \text{motor nominal torque}}{20 \cdot \text{motor nominal current (P0054)}}\ \text{Nm/V}$$

and for **asynchronous motor:**

$$\frac{\text{Torque limit}}{\text{Analog input} + 10\ \text{V}} = \frac{\text{Power unit maximum current drive (P1241)} \cdot \text{motor nominal torque}}{\sqrt{\text{motor nominal current (P0054)}^2 - \text{motor magnetizing current (P0066)}^2}}\ \text{Nm/V}$$

Examples for the specification of torque limit by analog inputs for synchronous motor:

▹P1241◃ = 10 A; Motor nominal current (▹P0054◃) = 10 A;
Motor nominal torque = 20 Nm

Analog input	Torque limit cyclic (▹P0357◃)	Torque limit
-10 V	0%	0 Nm
-5 V	25%	5 Nm
0 V	50%	10 Nm
5 V	75%	15 Nm
10 V	100%	20 Nm

▹P1241◃ = 20 A; Motor nominal current (▹P0054◃) = 10 A;
Motor nominal torque = 20 Nm

Analog input	Torque limit cyclic (▹P0357◃)	Torque limit
-10 V	0%	0 Nm
-5 V	25%	10 Nm
0 V	50%	20 Nm
5 V	75%	30 Nm
10 V	100%	40 Nm

P0358

P0358	Drehzahl-Istwert nach Notchfilter	-200.00 to 200.00%
-	**Speed actual value after notchfilter**	0.00 %
A	BM_di_SpeedActNotchOut	40000000_{hex}:100.00 %

Display of the smoothed speed actual value limited to $\pm$ 200 %.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0359

P0359	Skalierung des Drehzahlsollwertes	0.00 to 100.00 %	
-	**Scaling of speed set value**	100.00 %	
ON	BM_i_ScalingSpeedSetValue	4000_{hex}:100.00 %	CW

Parameters for the scaling of speed set value with SERCOS S108 for commissioning purposes:

Speed set value total (▹P0352◃) =
(Speed set value (▹P0351◃) + Speed additional set value (▹P1040◃)) * ▹P0359◃

This parameter is not saved in the controller. After booting the controller P0359 = 4000_{hex} (accordant 100%).

P0360	Lageregler Status	0 to $FFFF_{hex}$	
-	**Position controller status**	0_{hex}	
A	BM_w_PosCtrlStatus	1:1	-

Display of position controller status.

Bit	Meaning
3 ... 0	Reserved
4	1: Dynamic position deviation limit exceeded
5	1: Static position deviation limit exceeded
6	1: Timeout dynamic position deviation
7	1: Timeout static position deviation
8	1: Position set values are extrapolated (extrapolation is activated).
9	1: Position deviation limit 2 exceeded
10	1: Encoder for position sensing is referenced [1)]
11	Reserved
12	1: Set value reached
15 ... 13	Reserved

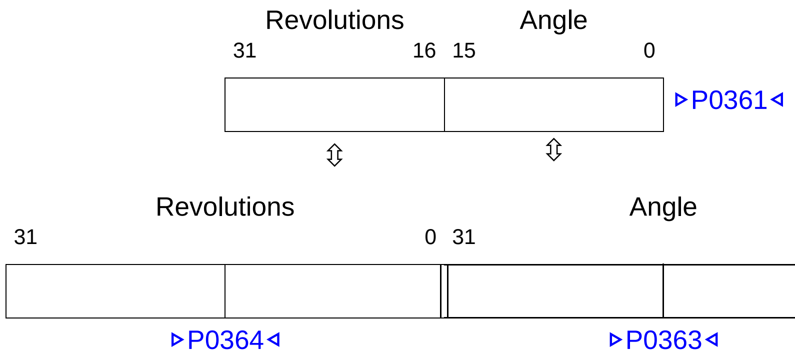
1)

- The status bit 10 is set,
  - if homing has been properly completed
  - or a spindle positioning with automatic referencing has been executed.
- The status bit 10 is deleted again,
  - if the encoder for position sensing is switched over via ▹P1050◃ position controller mode bit 2,
  - or an encoder error has occurred and is acknowledged,
  - or if homing is started.

P0361	Lage-Sollwert	0 to $FFFFFFFF_{hex}$	
-	**Position set value**	0_{hex}	
	BM_ud_PosSetValue	1:1	CW

Set value input of position controller. When the controller is enabled, the position set value is initialized on the actual position value.

Scaling:
One turn of the motor accords to internally **65536** increments. Within a position set value and a position value in the low-word is the motor angle and in the high-word is the number of the whole revolutions.



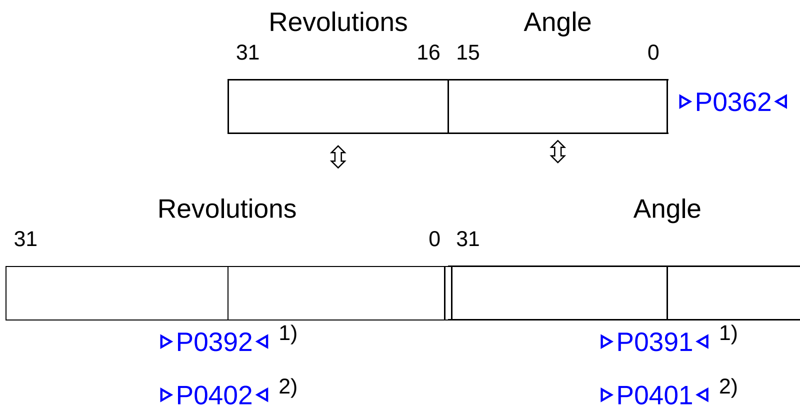
P0362	Lage-Istwert	0 to FFFFFFFF$_{hex}$	
-	**Position actual value**	0$_{hex}$	
	BM_ud_PosActValue	1:1	CW

This parameter displays the actual position value.

During initialization, the position value is initialized on the angle of the encoder system selected for position control (not motor control). From this point of time, independent of the actual operation mode and independent of the state of unit control it is actualized continuously.

In order to enable external homing, the position actual value can be written to in any state of operation.

Scaling:
One turn of the motor accords to internally **65536** increments. Within a position set value and a position value in the low-word is the motor angle and in the high-word is the number of the whole revolutions.



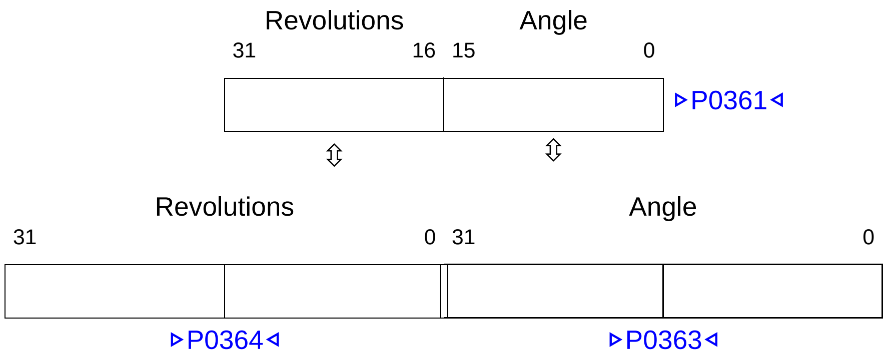
1) Encoder 1 for position control selected

2) Encoder 2 for position control selected

P0363

P0363	Lage-Sollwert Winkel	0 to $FFFFFFFF_{hex}$	
-	**Position set value angle**	0_{hex}	
	BM_ud_PosSetAngle	1:1	CW

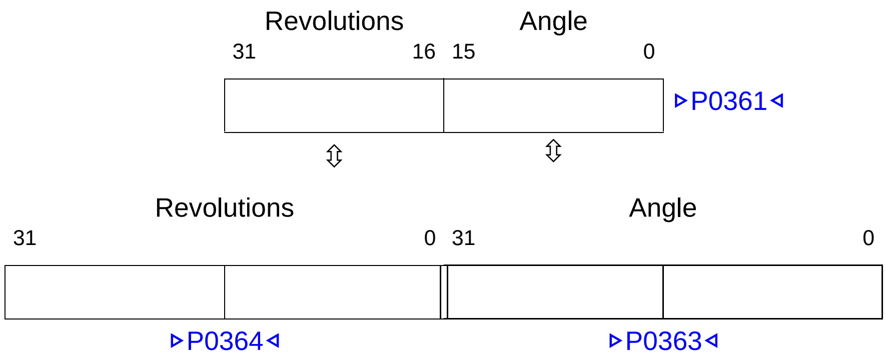
Angle of position setpoint in 32 bit resolution.



P0364

P0364	Lage-Sollwert Umdrehungen	0 to $FFFFFFFF_{hex}$	
-	**Position set value rev**	0_{hex}	
	BM_ud_PosSetRev	1:1	CW

Number of revolutions in position set value in 32 bit-resolution.



P0365

P0365	Drehzahl-Vorsteuerung	-200.00 to +200.00 %	
-	**Speed feed forward**	0.00 %	
A	BM_di_SpeedFeedFor	40000000_{hex}:100 %	-

Basic value of speed feed forward (only available at operating mode position control).

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0366

P0366	Lageregler-Ausgang	-200.00 to +200.00 %
-	**Position controller output**	0.00 %
A	BM_di_PosCtrlOut	40000000_{hex}:100 % -

Speed set value from the position controller without the partition of the speed feed forward control.

P0367

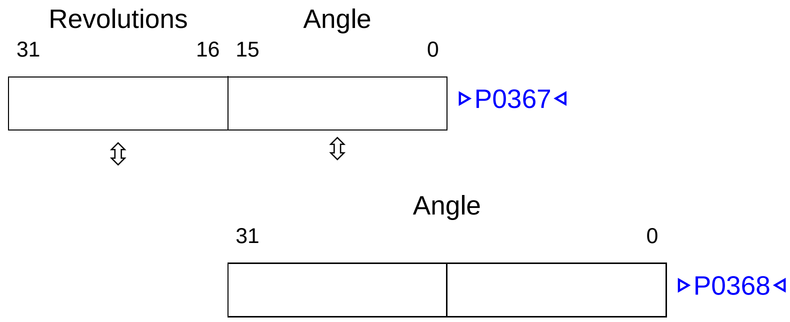
P0367	Lageregler-Schleppfehler gesamt	80000000_{hex} to $7FFFFFFF_{hex}$
-	**Position actual total deviation**	0_{hex}
A	BM_di_PosCtrlDev	1:1 -

Position deviation with 16-bit revolution and 16-bit angle.

Deviation is the difference between position set value and position value.

If very great position deviation occurs, the cause can be, amongst other things, a blocked motor, a set speed, which is not achievable or incorrectly adjusted controller coefficients, for example at the speed controller.

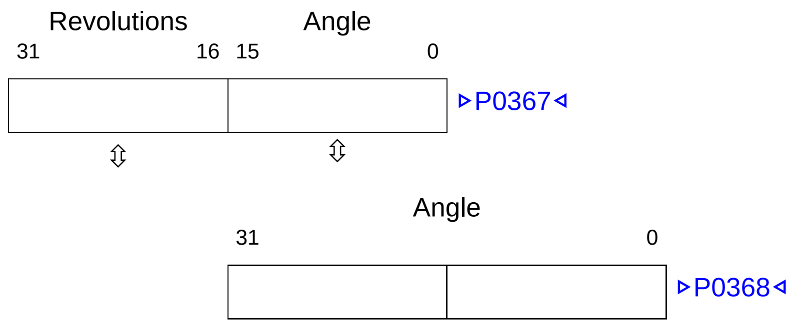
The scaling corresponds to the position set value and position value scaling.



P0368

P0368	Lageregler-Schleppfehler Winkel	80000000_{hex} to $7FFFFFFF_{hex}$
-	**Position actual angle deviation**	0_{hex}
A	BM_di_PosCtrlDevAngle	1:1 -

Position deviation with 32 bit angle.



P0369	Lagesollwert für Interpolation	0 to FFFFFFFF$_{hex}$	
-	**Position set value for interpolation**	0$_{hex}$	
ON	BM_ud_PosIpSetValue	1:1	CW

Interpolating position set value input (16 bit revolution, 16 bit angle).
Position set value input for cyclic, synchronous position set value setting.
The cyclic time is to be adjusted in the parameter Sync interval (▷P0532◁). The predetermined position set value is then interpolated from the cyclic time to the internal control interval.

From firmware version FW 03.08 onwards the following is valid:
By parameterizing parameter position set value-smoothing interval (▷P1059◁) you can set, if the controller shall execute a smoothing of the set values according to the method of the sliding-type mean value generation. Thereby the value of ▷P1059◁ specifies the number interpolation points for the mean value generation.
Value 0 means: There is no smoothing.

NOTE!

Dependent of the set value cycle (= ▷P0532◁ Sync interval), which was set, the change in the ▷P0369◁ between two set values (= position delta) may not exceed the accordant table value! Additionally, it is recommended to activate the position deviation error monitoring over the ▷P1050◁ position controller mode.

▷P0532◁ Sync interval	Permitted max. position delta
250 µs	± FFFF$_{hex}$
500 µs	± 1 FFFF$_{hex}$
1 ms	± 3 FFFF$_{hex}$
2 ms	± 7 FFFF$_{hex}$
4 ms	± F FFFF$_{hex}$
8 ms	± 1F FFFF$_{hex}$

P0370	Lagesollwert-Winkel für Interpolation	0 to FFFFFFFF$_{hex}$	
-	**Position angle value for interpolation**	0$_{hex}$	
ON	BM_ud_PosIpSetAngle	1:1	CW

Interpolating position set value angle input (32 bit angle).

Position set value input for cyclic synchronous position set value angle setting.

The cyclic time is to be adjusted in the parameter Sync interval (▷P0532◁). The predetermined position set value angle is then interpolated from the cyclic time to the internal control interval.

From firmware version FW 03.08 onwards the following is valid:
By parameterizing parameter position set value-smoothing interval (▷P1059◁) you can set, if the controller shall execute a smoothing of the set values according to the method of the sliding-type mean value generation. Thereby the value of ▷P1059◁ specifies the number interpolation points for the mean value generation.
Value 0 means: There is no smoothing.

P0371

P0371	Mechanischer Winkel am Referenzschalter	0 to FFFF$_{hex}$
A	**Mechanical angle at reference switch**	0$_{hex}$
	BM_u_MechAngleRefSwitch	1:1

Measured value of the mechanical angle ▹P0393◃ or ▹P0403◃ at the reference switch shifted by ▹P1201◃positioning encoder offset.

This value is measured only at homing, if homing occurs on encoder zero angle. By means of the value it can be specified if the reference switch is near the mechanical zero angle and therefore the reference point not always is able to be recognized in the same motor revolution because of switching tolerances of the reference switch.

In this case the value for the zero angle shifting (▹P1209◃ positioning encoder offset) should be set differently, so that encoder zero angle is outside the switching tolerances of the reference switch.

From firmware version FW 03.01.

P0380

P0380	Drehzahl-Status Open Loop	0 to FFFF$_{hex}$	
-	**Open loop speed status**	0$_{hex}$	
A	BM_w_OL_SpeedStatus	1:1	-

Only relevant if encoderless operation is set.

Bit	Meaning
5 ... 0	Reserved
6	Overspeed monitoring 0: N actual value ≤ overspeed threshold 1: N actual value > overspeed threshold
9 ... 7	Reserved
10	1: |N actual value|= 0 (actual value is below the zero-speed threshold) ▹P1063◃)
11	1: Speed actual value has exceeded the free speed threshold ▹P1064◃ 0: Speed actual value is below the free speed threshold ▹P1065◃
15 ... 12	Reserved

P0381

P0381	Suchzeit der Drehzahl für Open Loop	500 to 30000 ms	
EE	**Startup time open loop**	2000 ms	
ON	BM_w_OL_StartUpTime	1:1 ms	-

From firmware version FW 03.06.

Maximum search time for the determination of the motor speed at release of the drive with rotating motor. The determination of speed is executed only, if it is activated via parameter motor mode (▹P0093◃).

The required time, which is necessary for the evaluation of the speed depends on rotor time constant. The default setting for the search time is 2 seconds, for motors with great rotor time constant perhaps a longer search time is necessary. The recommended value is ten times the rotor time constant (▹P0522◃).

The search time, which was set, is the maximum search time in each speed direction. If the determination of speed in one rotating direction was not successful, attempt to determine the speed in the converse rotating direction. Therefore the total search time can be the double of the maximum time, which was set in the parameter. In the parameter Motor mode (▹P0093◃) furthermore the rotational direction can be specified, for which the speed is to be determined. For a drive, which e. g. may rotate only in one direction, the speed search shall only be activated in this direction.

P0382	Erhöhung des Anlaufmomentes für Open Loop	0.00 to 40.00 %	
EE	**Starting torque boost for Open Loop**	0.00 %	
ON	BM_w_OL_TorqueBoost	4000_{hex}:100 %	-

From firmware version FW 03.08.

At speed actual value zero the maximum torque limit is increased by the set value of this parameter. If the actual speed value is higher than the set time in the speed range of the increase of the torque boost (▹P0383◃), then the increase is set to zero again. Between zero speed and ▹P0383◃ the increase is linear interpolated.

P0383	Drehzahlbereich der Erhöhung des Antriebsmomentes	0.00 to 20.00 %	
EE	**Speed range for torque boost**	0.00 %	
ON	BM_u_OL_TrqBoostEndSpeed	4000_{hex}:100 %	-

From firmware version FW 03.08.

In order to set the speed range, at which the increase of the maximum torque limit shall be active.

P0390	Geber 1 Status	0 to $FFFF_{hex}$	
-	**Encoder 1 status**	0_{hex}	
A	BM_w_Enc1Status	1:1	-

In this parameter the status of the encoder evaluation for encoder 1 is displayed.

Bit	Meaning
3 ... 0	Reserved
4	1: Error at initialization
5	1: Error encoder-cable break
6	Overspeed monitoring 0: N actual value ≤ overspeed threshold 1: N actual value > overspeed threshold
7	1: Absolute position not known
8	Toggle bit for zero pulse, changes at each zero pulse

Bit	Meaning
9	N actual value < speed-zero-threshold for speed controller-block monitoring adjustable with parameter N=0 threshold block monitoring (from FW 03.08)
10	1: |N actual value|= 0 (actual value is below the zero-speed threshold)▹P1073◃)
11	1: Speed actual value has ▹P1074◃ exceeded the free speed threshold 0: Speed actual value is below the free speed threshold ▹P1075◃
13 ... 12	Reserved
14	1: Error encoder track monitoring (sine-square monitoring)
15	1: Error field angle monitoring

P0391

	Geber 1 Winkel-Istwert	0 to $FFFFFFFF_{hex}$	
-	**Encoder 1 actual angle**	0_{hex}	
A	BM_ud_Enc1ActAngle	1:1	-

Display of position value angle component of encoder 1 within one revolution, left-justified with encoder-dependent resolution.

The total position value is 64 bit long. For its construction see below:

63		32	31		0
31	Encoder 1 revolutions actual value ▹P0392◃	0	31	Encoder 1 angle actual value ▹P0391◃	0

The total position actual value is set to zero after switching on the electronics supply. If you have an absolute value encoder connected, it will be read out and the information will be transferred in the above stated form.

P0392

	Geber 1 Umdrehungen-Istwert	0 to $FFFFFFFF_{hex}$	
-	**Encoder 1 actual revolutions**	0_{hex}	
A	BM_ud_Enc1ActRev	1:1	-

Display of position actual value revolution component from encoder 1.

P0393

	Geber 1 mechanischer Winkel-Istwert	0 to $FFFFFFFF_{hex}$	
-	**Encoder 1 mechanical actual angle**	0_{hex}	
A	BM_ud_Enc1MechAngle	1:1	-

Actual value of mechanical angle within one revolution from encoder 1.

The mechanical angle actual value is used for motor control, not for position control. It is neither influenced by homing nor by ▹P0154◃ absolute offset encoder 1.

P0394	Geber 1 Drehzahl-Istwert	-200.00 to +200.00 %	
-	**Encoder 1 actual speed**	0.00 %	
A	BM_di_Enc1ActSpeed	40000000_{hex}:100 %	-

Speed actual value at encoder 1, referenced to maximum speed of system.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0395	Geber 1 Lage-Istwert 16	0 to $FFFF_{hex}$	
-	**Encoder 1 actual position 16**	0_{hex}	
A	BM_u_Enc1ActPos16	1:1	-

The parameter is a 16-bit-actual position value of the encoder 1 with a freely-adjustable range for whole rotations and angles. The range is selected via ▹P0159◃ Encoder 1 shift factor.

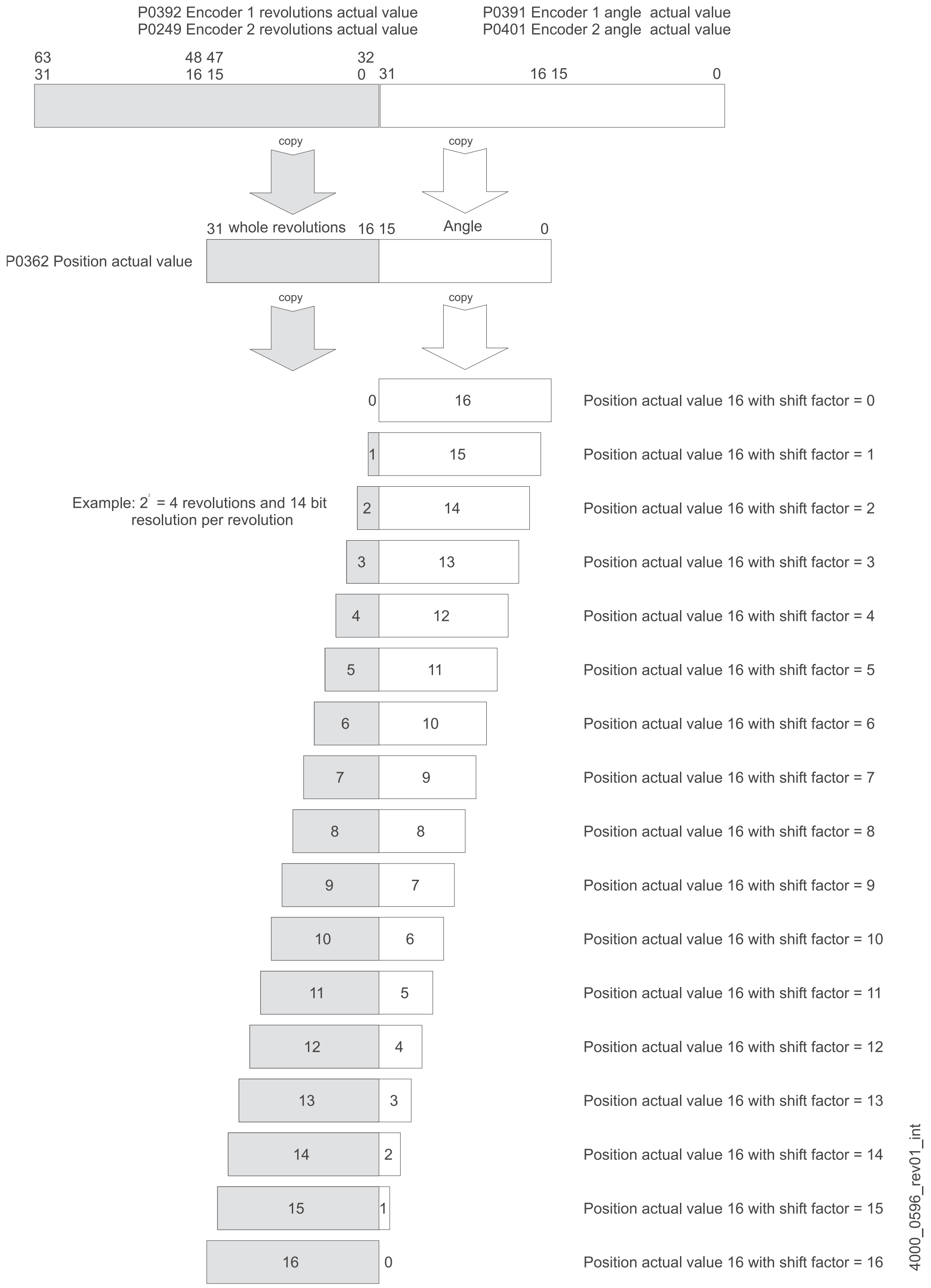


Figure 142: Encoder position actual value shift factor

P0400	Geber 2 Status	0 to FFFF$_{hex}$	
-	**Encoder 2 status**	0$_{hex}$	
A	BM_w_Enc2Status	1:1	-

In this parameter the status of the encoder evaluation for encoder 2 is displayed.

Bit	Meaning
3 ... 0	Reserved
4	1: Error at initialization
5	1: Error encoder power break
6	Overspeed monitoring 0: N actual value ≤ overspeed threshold 1: N actual value > overspeed threshold
7	1: Absolute position not known
8	Toggle bit for zero pulse, changes at each zero pulse
9	N actual value < speed-zero-threshold for speed controller-block monitoring adjustable with parameter N=0 threshold block monitoring (from FW 03.08)
10	1: |N actual value|= 0 (actual value is below the zero-speed threshold) ▹P1083◃)
11	1: Speed actual value has ▹P1084◃ exceeded the free speed threshold 0: Speed actual value is below the free speed threshold ▹P1085◃
13 ... 12	Reserved
14	1: Error encoder track monitoring (sine-square monitoring)
15	1: Error field angle monitoring

P0401	Geber 2 Winkel-Istwert	0 to FFFFFFFF$_{hex}$	
-	**Encoder 2 actual angle**	0$_{hex}$	
A	BM_ud_Enc2ActAngle	1:1	-

Display of the angle-term of encoder 2: angle within one rotation, left-justified with encoder-dependent resolution.

The total position value is 64 bit long. For its construction see below:

63 ... 32	31 ... 0
31 Encoder 2 revolutions actual value 0 ▹P0402◃	31 Encoder 2 angle actual value 0 ▹P0401◃

The total position actual value is set to zero after switching on the electronics supply. If you have an absolute value encoder connected, it will be read out and the information will be transferred in the above stated form.

P0402	Geber 2 Umdrehungen-Istwert	0 to FFFFFFFF$_{hex}$	
-	**Encoder 2 actual revolutions**	0$_{hex}$	
A	BM_ud_Enc2ActRev	1:1	-

Display of position actual value revolution component from encoder 2.

P0403

P0403	Geber 2 mechanischer Winkel-Istwert	0 to $FFFFFFFF_{hex}$	
-	**Encoder 2 mechanical actual angle**	0_{hex}	
A	BM_ud_Enc2MechAngle	1:1	-

Actual value of mechanical angle within one revolution from encoder 2.

The mechanical angle actual value is used for motor control, not for position control. It is neither influenced by homing nor by ▹P0164◃ absolute offset encoder 2.

P0404

P0404	Geber 2 Drehzahl-Istwert	-200.00 to +200.00 %	
-	**Encoder 2 actual speed**	0.00 %	
A	BM_di_Enc2ActSpeed	40000000_{hex}:100 %	-

Speed actual value at encoder 2, referenced to maximum speed of system.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0405

P0405	Geber 2 Lage-Istwert 16	0 to $FFFF_{hex}$	
-	**Encoder 2 actual position 16**	0_{hex}	
A	BM_u_Enc2ActPos16	1:1	-

The parameter is a 16-bit actual position value of the encoder 2 with freely-adjustable range for whole rotations and angles. The range is selected via ▹P0169◃ Encoder 2 shift factor (additional data see ▹P0395◃).

P0410

P0410	Status der digitalen Eingänge in Modulschacht A	0 to $FFFF_{hex}$	
-	**Function module A: status digital input**	0_{hex}	
A	BM_w_DI_Status_SlotA	1:1	-

Display of channel conditions in module slot A.

Display is only valid, if a digital input/output module is plugged into the related slot. In case no module is plugged, $FFFF_{hex}$ is displayed.

Bit	Meaning
0	Status digital input 1 0: Low 1: High
1	Status digital input 2 0: Low 1: High
2	Status digital input 3 0: Low 1: High

Bit	Meaning
3	Status digital input 4 0: Low 1: High
4	Status digital input 5 0: Low 1: High
5	Status digital input 6 0: Low 1: High
6	Status digital input 7 0: Low 1: High
7	Status digital input 8 0: Low 1: High
15 ... 8	Reserved

P0411

P0411	Status der digitalen Eingänge in Modulschacht B	0 to $FFFF_{hex}$	
-	**Function module B: status digital input**	0_{hex}	
A	BM_w_DI_Status_SlotB	1:1	-

Display of the status of the channels in module slot B.

Display is only valid, if a digital input/output module is plugged into the related slot. In case no module is plugged, $FFFF_{hex}$ is displayed.

Bit description see ▹P0410◃ on page 452.

P0412

P0412	Status der digitalen Eingänge in Modulschacht C	0 to $FFFF_{hex}$	
-	**Function module C: status digital input**	0_{hex}	
A	BM_w_DI_Status_SlotC	1:1	-

Display of the status of the channels in module slot C.

Display is only valid, if a digital input/output module is plugged into the related slot. In case no module is plugged, $FFFF_{hex}$ is displayed.

Bit description see ▹P0410◃ on page 452.

P0413

P0413	Status der digitalen Eingänge in Modulschacht D	0 to $FFFF_{hex}$	
-	**Function module D: status digital input**	0_{hex}	
A	BM_w_DI_Status_SlotD	1:1	-

Display of the status of the channels in module slot D.

Display is only valid, if a digital input/output module is plugged into the related slot. In case no module is plugged, $FFFF_{hex}$ is displayed.

Bit description see ▹P0410◃ on page 452.

P0414	Status der digitalen Eingänge in Modulschacht E	0 to FFFF$_{hex}$	
-	**Function module E: status digital input**	0$_{hex}$	
A	BM_w_DI_Status_SlotE	1:1	-

Display of the status of the channels in module slot E.

Display is only valid, if a digital input/output module is plugged into the related slot. In case no module is plugged, FFFF$_{hex}$ is displayed.

Bit description see ▹P0410◃ on page 452.

P0415	Status der digitalen Ausgänge in Modulschacht A	0 to FFFF$_{hex}$	
-	**Function module A: Status digital output**	0$_{hex}$	
A	BM_w_DO_Status_SlotA	1:1	-

Display of channel conditions in module slot A.

The displayed information depends upon if a module with digital outputs is plugged in or not.

Bit	Meaning
0	Status digital output 1 0: Low 1: High
1	Status digital output 2 0: Low 1: High
2	Status digital output 3 0: Low 1: High
3	Status digital output 4 0: Low 1: High
4	Status digital output 5 0: Low 1: High
5	Status digital output 6 0: Low 1: High
6	Status digital output 7 0: Low 1: High
7	Status digital output 8 0: Low 1: High
15 ... 8	Reserved

P0416	Status der digitalen Ausgänge in Modulschacht B	0 to $FFFF_{hex}$	
-	**Function module B: Status digital output**	0_{hex}	
A	BM_w_DO_Status_SlotB	1:1	-

Display of the status of the channels in module slot B.

The displayed information depends upon if a module with digital outputs is plugged in or not.

Bit description see ▹P0415◃ on page 454.

P0417	Status der digitalen Ausgänge in Modulschacht C	0 to $FFFF_{hex}$	
-	**Function module C: Status digital output**	0_{hex}	
A	BM_w_DO_Status_SlotC	1:1	-

Display of the status of the channels in module slot C.

The displayed information depends upon if a module with digital outputs is plugged in or not.

Bit description see ▹P0415◃ on page 454.

P0418	Status der digitalen Ausgänge in Modulschacht D	0 to $FFFF_{hex}$	
-	**Function module D: Status digital output**	0_{hex}	
A	BM_w_DO_Status_SlotD	1:1	-

Display of the status of the channels in module slot D.

The displayed information depends upon if a module with digital outputs is plugged in or not.

Bit description see ▹P0415◃ on page 454.

P0419	Status der digitalen Ausgänge in Modulschacht E	0 to $FFFF_{hex}$	
-	**Function module E: Status digital output**	0_{hex}	
A	BM_w_DO_Status_SlotE	1:1	-

Display of the status of the channels in module slot E.

The displayed information depends upon if a module with digital outputs is plugged in or not.

Bit description see ▹P0415◃ on page 454.

P0420 | Wert analoger Eingang 1 | -100.00 to +100.00 %

- | **Analog input 1 actual value** | 0.00 %

A | BM_i_AI1_Value | $7FFF_{hex}$:100% | -

This parameter displays the respective actual input value considering the scaling.

P0421 | Wert analoger Eingang 2 | -100.00 to +100.00 %

- | **Analog input 2 actual value** | 0.00 %

A | BM_i_AI2_Value | $7FFF_{hex}$:100% | -

This parameter displays the respective actual input value considering the scaling.

P0428 | Funktionsmodul Konfiguration | 0 to $FFFF_{hex}$

EE | **Function Module Configuration** | 0_{hex}

BM_w_FuncModConfig | 1:1 | -

From firmware version FW 03.12.

This parameter is used to determine the properties for the operation of a function module. The meaning of the bits depends on the module type. The mapping between the bits of the parameter and the slots for function modules is determined as follows:

Bit	Mapping
0, 1, 2	Slot A
3, 4, 5	Slot B
6, 7, 8	Slot C
9, 10, 11	Slot D
12, 13, 14	Slot E
15	reserved

The following is valid for the function module AIO-04 (current input 0 ... 20 mA):

Bit-no	Meaning
0	For a AIO-04 module at slot A 0: Input measuring range 0 ... 20 mA 1: Input measuring range 4 ... 20 mA
1	0: No direct A/D conversion; behavior as FW 03.11 1: Direct A/D conversion (see text)
3	For a AIO-04 module at slot B 0: Input measuring range 0 ... 20 mA 1: Input measuring range 4 ... 20 mA
4	0: No direct A/D conversion; behavior as FW 03.11 1: Direct A/D conversion (see text)

Bit-no	Meaning
6	For a AIO-04 module at slot C 0: Input measuring range 0 ... 20 mA 1: Input measuring range 4 ... 20 mA
7	0: No direct A/D conversion; behavior as FW 03.11 1: Direct A/D conversion (see text)
9	For a AIO-04 module at slot D 0: Input measuring range 0 ... 20 mA 1: Input measuring range 4 ... 20 mA
10	0: No direct A/D conversion; behavior as FW 03.11 1: Direct A/D conversion (see text)
12	For a AIO-04 module at slot E 0: Input measuring range 0 ... 20 mA 1: Input measuring range 4 ... 20 mA
13	0: No direct A/D conversion; behavior as FW 03.11 1: Direct A/D conversion (see text)
remaining bits	Reserved

In the measuring range 4 ... 20 mA the controller signals an error 48 ... 52 with the sub-error code 10, if the input current is less than 3,6 mA. At currents less than 4 mA the value 4 mA is specified as a measured value.

For both measuring ranges 0 ... 20 mA and 4 ... 20 mA the controller signals an error 48 ... 52 with the sub-error code 11, if the input current is greater than 22 mA.

The adjustable offset AI1_Offset ... AI4_Offset is considered at the end of the standardization and not at the data acquisition. Thus, the offset cannot be used to adjust a sensor with a current input to the measuring range, which is too less or too high.

The following is valid for all AIO modules:

With bit 1 of a triple-bit group it is possible that the A/D values for one or more selected modules can be written directly in the corresponding status parameter (P0420 to P0423). Thereby a smoothing occurs corresponding to the smoothing parameter, but there is **no**

- scaling,
- offset calculation,
- consideration of the threshold value,
- link to the stated target parameter.

A target parameter (e.g. ▹P1133◃) must be parameterized so that the channel is activated.

Meaning of bit 1 of a triple-bit group:

Bit = 0: Direct analog conversion is deactivated – compatible properties as FW 03.11

Bit =1: Direct analog conversion is activated

Standardization:

Module	Voltage range / current range	Value range
AIO-01 … AIO-03	-10 V … +10 V	0 … 32767
AIO-04	0 … +25 mA	0 … 32767

However, a standardization at AIO-04 takes place and it does not matter if the measuring range is set to 0 ... 20 mA or 4 ... 20 mA (determination with bit 0 of a group in P0428).

P0429

	Faktor Interpolator-Intervall (=0:aus)	0 to 64	
EE	**Factor Interpolator Interval (=0:off)**	0	
	BM_u_FactorinterpolInterval	1:1	-

In this parameter the interpolation of the ramp function generator input set value and the interpolation interval can be set. The resulting interpolation interval is calculated as follows:

Interpolation interval = Factor Interpolator-Interval ▹P0429◃ * Sync Interval ▹P0532◃

Details and examples for interpolation at the ramp function generator input see ▹Interpolation of the ramp function generator input set value◃ on page 200.

If Factor Interpolator Interval =0, the set value interpolation is switched off.

P0430

	Hochlaufgeber-Status	0 to $FFFF_{hex}$	
-	**Ramp Function Generator status**	0_{hex}	
A	BM_w_RFGStatus	1:1	-

Status of ramp function generator (RFG).

Bit	Meaning
3 ... 0	Reserved
4	1: RFG output is internally set to O (RFG_INHIBIT)
5	1: RFG is stopped on the ramp (HLG_STOP)
6	1: RFG input is internally set to set 0 (RFG_ZERO)
7	1: Quickstop ramp is active (RFG_SHALT)
8	1: Ramp-up is active
9	1: Ramp down is active
11 ... 10	Reserved
12	1: RFG output = RFG input (set value reached)
13	Status input set value 0: Input set value is constant 1: Input set value is interpolated
15 ... 14	Reserved

- Bit 12: Set value reached
The status bit 'Set value reached' is set, according to the meaning of the bits in the control word (▹P0300◃) as follows:

Control word bits			Operation	Bit 12 RFG output = RFG input (set value reached)
6	5	4		
0	0	0	Normal	Ramp function generator is active, bit 12 is set, if the following is valid: Ramp function generator output - ramp function generator input <= Ramp function generator set value-reached-bandwidth
0	0	1	RFG inhibit	Ramp function generator is active, bit 12 is set immediately. RFG output is set to 0-value.
0	1	0	RFG stop	Ramp function generator is deactivated. RFG output is frozen. Bit 12 is always FALSE.
1	0	0	RFG zero	Ramp function generator is active, bit 12 is set, if RFG output has reached value 0, i.e. the drive stands still.

- Bit 13: „Interpolation active"
If the interpolator set value cycle ↔ Ramp function generator cycle is active, this bit is operated. The activation of this interpolator is made via (▹P0429◃) Factor interpolator interval greater 0.

  At constant input set value or set value fail the bit is deleted.

  The ramp function generator input set value is interpolated from the set value cycle to the ramp function generator cycle (500 µs). The set value cycle (= interpolation interval) is specified via the factor interpolator interval (▹P0429◃) * Sync interval ▹P0532◃.

  This interpolator must not be mixed up with the internal interpolator of the ramp function generator cycle (500 µs) to control cycle (125 µs), which is activated via the bit 9 of Ramp function generator ▹P1170◃.

P0431	Hochlaufgeber Ausgang	-100.00 to +100.00 %
-	**Ramp Function Generator output**	0.00 %
A	BM_di_RFGOutput	40000000_{hex}:100 % -

Start value of ramp function generator.

Scaling: 100% ↔ 40000000_{hex}

P0440	Sollwertgenerator Modus	0 to $FFFF_{hex}$
EE	**Set value Generator mode**	0_{hex}
	BM_w_SvgMode	1:1 -

Also see ▹Set value generator◃ from page 203.

Operation mode of set value generator.

Bit	Meaning
2... 0	000: Switched off 001: Ramp function generator input 1 010: Additional speed set value 011: Torque set value 100: Switchover actual positioning set ▹P1191◃
3	Reserved
4	0: Endless operation of set value generator begins after sequence of the last phase with the first set value again. 1: Single cycle, only one cycle of the set value profile, which was set is passed through. At the end the last set value is kept.
15 ... 5	Reserved

Notes:

Operating mode 'Switchover actual' positioning set":
In this mode the set value generator switches between the specified positioning sets (1 to 16). If a change of positioning set also directly shall lead to an execution of positioning task, this must be set in positioning (also see parameter ▹P1190◃ Positioning mode).

The times, which were set are the dwell times in the target position. Time is measured from message. Target position reached. (Parameter ▹P0301◃ status word, bit 10).

P0441

	SWG Zeit 1	0.001 to 65.535 s	
EE	**SVG time 1**	1.000	
	BM_u_SvgTime1	1000:1 s	-

Also see ▹Set value generator◃ from page 203.

These parameters can be parameterized with values from 1 ms to 65 s. The set value generator has a cycle time of 16 ms. Therefore, only settings with a multiple of 16 ms are reasonable.
For these time values, the respective set values are switched onto the output of the set value generator.

P0442

	SWG Sollwert 1	-100.00 to +100.00 %	
EE	**SVG set value 1**	+100.00 %	
	BM_i_SvgSetValue1	4000_{hex}:100 %	CW

Also see ▹Set value generator◃ from page 203.

This parameter can be used with values from -100% to +100%. The set values are switched onto the set value generator output depending on the assigned time.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

For the mode 'switchover actual positioning set' the specified scaling of the parameter is not valid. In this case the range stretches from 0 to 16, at a scaling of 1:1.

P0443	SWG Zeit 2	0.001 to 65.535 s	
EE	**SVG time 2**	1.000	
	BM_u_SvgTime2	1000:1 s	-

Also see ▷Set value generator◁ from page 203.

These parameters can be parameterized with values from 1 ms to 65 s. The set value generator has a cycle time of 16 ms. Therefore, only settings with a multiple of 16 ms are reasonable. For these time values, the respective set values are switched onto the output of the set value generator.

P0444	SWG Sollwert 2	-100.00 to +100.00%	
EE	**SVG set value 2**	0.00%	
	BM_i_SvgSetValue2	4000_{hex}:100%	CW

Also see ▷Set value generator◁ from page 203.

This parameter can be used with values from -100% to +100%. The set values are switched onto the set value generator output depending on the assigned time.

Scaling: 100% ↔ Motor maximum speed (▷P1031◁)

For the mode ’switchover actual positioning set’ the specified scaling of the parameter is not valid. In this case the range from 0 to 16 is enough, at a scaling of 1:1.

P0445	SWG Zeit 3	0.001 to 65.535 s	
EE	**SVG time 3**	1.000	
	BM_u_SvgTime3	1000:1 s	-

Also see ▷Set value generator◁ from page 203.

These parameters can be parameterized with values from 1 ms to 65 s. The set value generator has a cycle time of 16 ms. Therefore, only settings with a multiple of 16 ms are reasonable. For these time values, the respective set values are switched onto the output of the set value generator.

P0446	SWG Sollwert 3	-100.00 to +100.00%	
EE	**SVG set value 3**	-100.00%	
	BM_i_SvgSetValue3	4000_{hex}:100%	CW

Also see ▷Set value generator◁ from page 203.

This parameter ▷P0446◁ can be used with values from -100% to +100%. The set values are switched onto the set value generator output depending on the assigned time.

Scaling: 100% ↔ Motor maximum speed (▷P1031◁)

For the mode 'switchover actual positioning set' the specified scaling of the parameter is not valid. In this case the range stretches from 0 to 16, at a scaling of 1:1.

P0447	SWG Zeit 4	0.001 to 65.535 s	
EE	**SVG time 4**	1.000	
	BM_u_SvgTime4	1000:1 s	-

Also see ▹Set value generator◃ from page 203.
These parameters can be parameterized with values from 1 ms to 65 s. The set value generator has a cycle time of 16 ms. Therefore, only settings with a multiple of 16 ms are reasonable. For these time values, the respective set values are switched onto the output of the set value generator.

P0448	SWG Sollwert 4	-100.00 to +100.00%	
EE	**SVG set value 4**	0.00%	
	BM_i_SvgSetValue4	4000_{hex}:100%	CW

Also see ▹Set value generator◃ from page 203.

This parameter can be used with values from -100% to +100%. The set values are switched onto the set value generator output depending on the assigned time.

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

For the mode 'switchover actual positioning set' the specified scaling of the parameter is not valid. In this case the range stretches from 0 to 16, at a scaling of 1:1.

P0449	Sollwertgenerator Ausgang	-100.00 to +100.00 %	
-	**Set Value Generator output**	+100.00 %	
A	BM_i_SvgOutput	4000_{hex}:100 %	-

Also see ▹Set value generator◃ from page 203.

Output of set value generator.

Scaling dependent of ▹P0440◃:

▹P0440◃ Bit 2..0 = 001, 010 100% ↔ Motor maximum speed (▹P1031◃)

▹P0440◃ Bit 2..0 = 011, 100 100% ↔ Maximum current of the drive (▹P1241◃)

P0460

P0460	Positionierung Status	0 to $FFFF_{hex}$	
-	**Positioning control status**	0_{hex}	
A	BM_w_PPosStatus	1:1	-

Also see ▹General positioning state◃ from page 259.

This parameter displays the status of the positioning. Here, the individual bits are not supported by all operation modes.

Bit	Meaning	Target position set value	Jog operation	Homing
0	1: Target position set value switched on	X		
5 ... 1	Reserved			
6	1: Set speed > Maximum speed; limited to maximum speed	X	X	X
7	1: Target position set value completed	X		
8	1: Homing took place	X	X	X
9	1: Takeover of new po. data not possible	X		
10	1: Running positioning or homing stopped	X		X
11	1: Number range limit exceeded		X	
12	1: Set value reached	X	X	X
13	1: Clip-environment 1 or switch position reached	X		
14	1: Clip-environment 2 or switch position reached	X		
15	1: Set speed = 0	X	X	X

P0461

P0461	Zustand der Positionsschalter	0 to $FFFF_{hex}$	
-	**Positioning switch status**	0_{hex}	
A	BM_w_PPosSwitchStatus	1:1	-

This parameter shows the status of the hardware- and software limit switches as well as of the reference switches.

Bit	Meaning	Target position set value	Jog operation	Homing
0	1: Negative HW limit switch active	X	X	
	1: Negative HW reference switch active			X
1	1: Positive HW limit switch active	X	X	
	1: Positive HW reference switch active			X
2	1: Reference switch (zero switch) active	X	X	X
3	1: Reserved			
4	1: SW-limit switch 1 active	X	X	X
5	1: SW-limit switch 2 active	X	X	X
7 ... 6	Reserved			
8	1: ▹P0362◃ Position actual value ≥ ▹P1198◃ clip environment 1	X		

Bit	Meaning	Target position set value	Jog operation	Homing
9	1: ▹P0362◃ Position actual value ≥ ▹P1199◃ clip environment 2	X		
10	1: Clip environment 1 ≤ Position actual value ≤ clip environment 2	X		
15 ... 11	Reserved			

Notes:

- The HW-switches (bit 0 to bit 2) are, independent of the operation mode and the drive status (inhibited/enabled), activated, that means for example also in the speed control.
- The SW limit switches are only in the operating modes 'Target position set " and 'Jogging" and only with enabled controller updated and displayed.

- Bits 8 to 10
  If bit 13 = 1 is adjusted in ▹P1190◃ Positioning mode, both clip environments are used for switch position and bits 8 to 10 are set correspondingly from the controller

Example: Clip environment 1 < clip environment 2

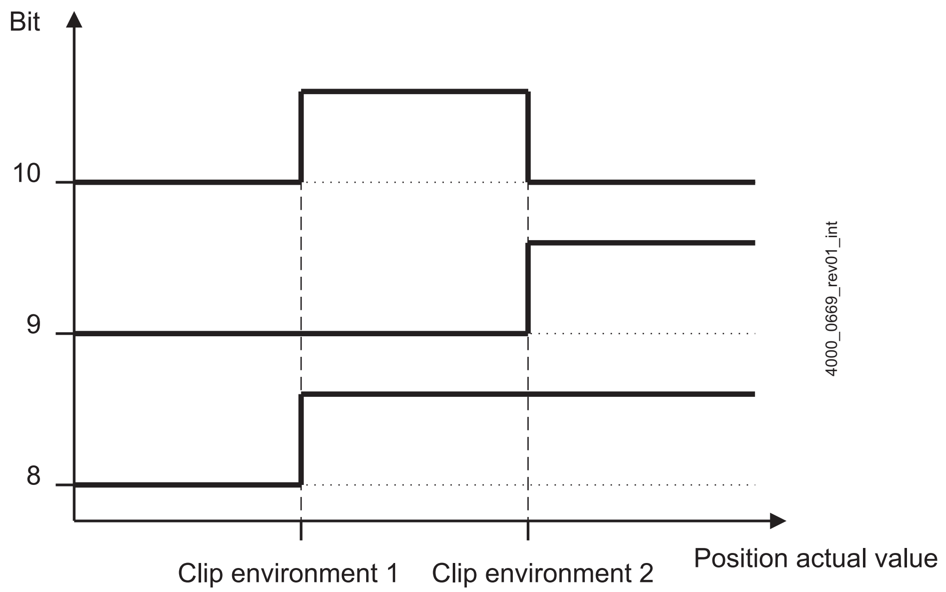


Figure 143: Clip environment 1 and 2

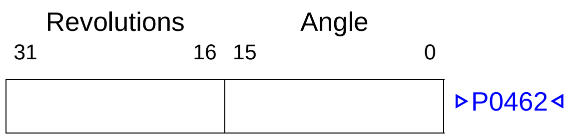
Bit 10 simulates a simple path-cam with 2 ms sampling interval. At high speed and short cam at the same time, undersampling can occur, i.e. bit 10 is not set in spite of crossing the cam.

The three bits are only evaluated in the operating mode „position set mode“ at enabled drive.

P0462	Positionierung Positions-Istwert	0 to FFFFFFFF$_{hex}$	
-	**Positioning control position actual value**	0$_{hex}$	
A	BM_ud_PPosActValue	1:1	-

Also see ▹Positioning set values and actual values◃ from page 258.

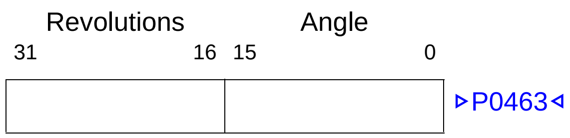
Scaling:
One turn of the motor accords to internally **65536** increments. Within a position set value and a position actual value is in the low-word the motor angle and in the high-word the number of whole revolutions.



P0463	Positionierung Positions-Sollwert	0 to FFFFFFFF$_{hex}$	
-	**Positioning control position set value**	0$_{hex}$	
A	BM_ud_PPosSetValue	1:1	-

Also see ▹Positioning set values and actual values◃ from page 258.

Scaling:
One turn of the motor accords to internally **65536** increments. Within a position set value and a position actual value is in the low-word the motor angle and in the high-word the number of whole revolutions.



P0464	Positionierung Geschwindigkeit-Sollwert	-13200 to +13200 Inc/ms	
-	**Positioning control speed set value**	0 Inc/ms	
A	BM_i_PPosSpeedSetValue	1:1 Inc/ms	-

Also see ▹Positioning set values and actual values◃ from page 258.

In this parameter, the actual set speed specified by the positioning is displayed in Inc/ms.

P0465	Endschalter Status	0 to FFFF$_{hex}$	
-	**Position switch status**	0$_{hex}$	
A	BM_w_PosSwitchStatus	1:1	-

Status of the position switches.

P0466 | Spindelpositionierung Status | 0 to FFFF$_{hex}$

- | **Spindle positioning status** | 0$_{hex}$

A | BM_w_SPosStatus | 1:1 | -

From firmware version FW 03.08.

Specifies the internal status of the function module.

Bit	Meaning
0	0: Spindle positioning switched off 1: Spindle positioning switched on
3 ... 1	Reserved
7 ... 4	Status of the actual position operation: 0000: Switched off 0001: Initialization 0010: Acceleration of spindle positioning speed 0011: Braking to spindle positioning speed 0100: Spindle positioning speed reached 0101: Positioning to angle target 0110: Set value specification completed 0111: Waiting for the trigger pulse 1000: Error status
8	Position of the trigger pulse is known
11 ... 9	Reserved
12	In position
15 ... 13	Reserved

P0467 | Spindelpositionierung wirksame Zielposition | 0 to FFFFFFFF$_{hex}$ Inc

- | **Spindle positioning effective target position** | 0$_{hex}$ Inc

A | BM_ud_SPosEffectiveTarget | 1:1 | -

This is the calculated target position in the format 16-bit rotation and 16-bit angle.

P0470 | Gleichlauf Status | 0 to FFFF$_{hex}$

- | **Synchronous operation status** | 0$_{hex}$

A | BM_u_SynCtrlStatus | 1:1 | -

Bit	Meaning
4 ... 0	Reserved
5	1: Homing on zero pulse of master axis has reached the predetermined tolerance threshold. (in homing on zero pulse of the leading axis mode only)
6	1: Homing on zero pulse of the master axis is completed (only in the mode homing on zero pulse of the master axis)
7	Reserved
8	1: Synchronous set value is initialized (only in the mode synchronous set value assignments)
9	1: An actual synchronous set value is present

Bit	Meaning	
10	1: Synchronous extrapolation is active	
11	Reserved	
12	1: Phasing module:	Module is switched on
13	1: Phasing module:	A new positioning request has been calculated and is waiting for processing
14	1: Phasing module:	A positioning request is processed active.
15	1: Phasing module:	The last positioning request has been completed. There is no new positioning request present.

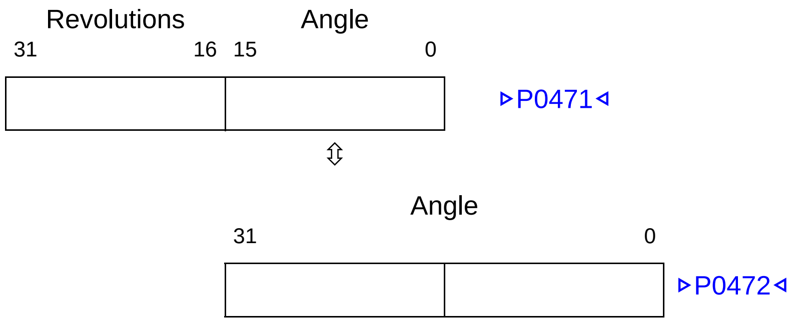
P0471 | Gleichlauf Lage-Sollwert | 0 to FFFFFFFF$_{hex}$

- | **Synchronous operation position set value** | 0$_{hex}$

BM_ud_SynCtrlPosSetValue | 1:1 | CW

This parameter serves in the mode "Synchronous set value assignment via position parameter" as set input. In the synchronous operation mode "Real master axis in relative angular synchronous operation" an overlaid movement can be implemented over this parameter. See ▹Operating mode Synchronous operation (-5)◃ on page 310.

Scaling:



From firmware version FW 03.08 onwards the following is valid:
By parameterizing parameter position set value-smoothing interval (▹P1059◃) you can set, if the controller shall execute a smoothing of the set values according to the method of the sliding-type mean value generation. Thereby the value of ▹P1059◃ specifies the number interpolation points for the mean value generation.
Value 0 means: There is no smoothing.

NOTE!

Independent of the set value cycle (= ▹P0532◃ Sync interval), the change in the ▹P0471◃ between two set values (= position delta) may not be more than ±32767! Additionally, it is recommended to activate the position deviation monitoring over the ▹P1050◃ position controller mode.

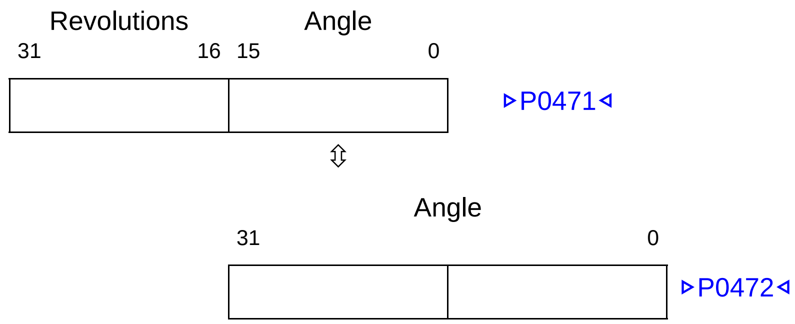
P0472

-

Gleichlauf Winkel-Sollwert	0 to $FFFFFFFF_{hex}$	
Synchronous operation angle set value	0_{hex}	
BM_ud_SynCtrlSetAngle	1:1	CW

This parameter serves in the synchronous operation mode "Synchronous set value assignment via position parameter" as set input. In the synchronous operation mode "Real master axis in relative angular synchronous operation" an overlaid movement can be implemented over this parameter. See ▹Operating mode Synchronous operation (-5)◃ on page 310.

Scaling



From firmware version FW 03.08 onwards the following is valid:
By parameterizing parameter position set value-smoothing interval (▹P1059◃) you can set, if the controller shall execute a smoothing of the set values according to the method of the moving mean value generation. Thereby the value of ▹P1059◃ specifies the number of interpolation points for the mean value generation.
Value 0 means: There is no smoothing.

P0473

-

Gleichlauf Sync.-Delta	80000000_{hex} to $7FFFFFFF_{hex}$	
Synchronous operation delta	0_{hex}	
BM_di_SynCtrlSetDeltaAngle	1:1	CW

These parameters act in the synchronous operation mode "Synchronous set value input via position delta input" as set input. The position-delta refers to the control cycle (125 µs). See ▹Operating mode Synchronous operation (-5)◃ on page 310.

In the synchronous operation modes "Synchronous set value assignment via position parameter" and "Real master axis in relative angular synchronous operation" it only acts as an indication for the angle difference calculated by the interpolator. The value displays the interpolated set value change (angle delta/$T_{control}$) on the control interval.

$$\text{Sync delta} = \frac{(\text{Phi set value}_{new} - \text{Phi set value}_{old}) \cdot T_{controlling}}{T_{sync}}$$

P0474

	Gleichlauf Drehzahl-Sollwert	-100.00 to +100.00 %	
-	**Synchronous operation speed set value**	0.00 %	
	BM_di_SynCtrlSpeedSetValue	40000000_{hex}:100 %	CW

Set value input for 'virtual master axis' function (Sync. operation mode 5 and 6).

Scaling: 100% ↔ Motor maximum speed (▹P1031◃)

P0476

	Start aktiver Verfahrvorgang	0 to 0001_{hex}	
-	**Start active movement**	0_{hex}	
ON	BM_u_PhaseControl	1:1	CW

By the writing of the parameter value with 1 or at parameter value equal 1, the starting of a positioning operates, if an offset angle is present which has not yet been positioned.

A positioning which has once been started cannot be interrupted. In a running positioning only changes of the maximum positioning speed as well as changes of the positioning speed modes are considered.

The changing of the other parameters of the phasing module become effective in the next positioning. The change of the register offset angle during a positioning results in a generation of a new positioning request immediately after completion of a procedure. If necessary, this is immediately started, if the above mentioned conditions are complied with.

P0477

	Register-Winkel Sollwert Absolut	0 to $FFFFFFFF_{hex}$	
-	**Register angle set value absolute**	0_{hex}	
ON	BM_ud_PhaseRegisterSetAngle	1:1	CW

The parameter is scaled to 32 bit angle, the value range accords to 0 to 360 degrees and is an absolute angle.

In this parameter an angle value can be entered, which after positioning remains as a constant offset angle between the master axis position set value and the position set value of the axis.

P0480

	Leistungsteil Status	0 to $FFFF_{hex}$	
-	**Power unit status**	0_{hex}	
A	BM_w_AmpStatus	1:1	-

Status messages from power unit.

Bit	Meaning
0	0: Fan is controlled via the heatsink temperature of the power unit 1: Fan is switched on with mains-on signal
4 ... 1	Reserved

Bit	Meaning
7 ... 5	PU overload monitoring model used from FW 03.10: 000: No overload monitoring 001: Ixt model (PT1) 010: Integration model 100: Temperature model + integration model
8	1: There is no error message from the power unit.
9	0: Power unit switching frequency: 4 kHz 1: Power unit switch frequency: 8 kHz (checkback from the power unit)
10	1: Pulses are enabled, power unit is operating in the switching mode (checkback from the power unit)
11	0: Normal operation, no current reduction of Ixt-monitoring 1: Ixt via the limit value, current reduction in intervention, current reduction to 100 % $I_{nominal}$
12	0: Fan is switched off 1: Fan is switched on
13	0: 24 V is switched off 1: 24 V is o.k.
15 ... 14	Reserved

P0481	Leistungsteil Geräte-Innentemperatur-Istwert	0 to 125 °C	
-	**Power unit internal device actual temperature**	0 °C	
A	BM_u_AmpActAmbientTemp	1:1 °C	-

Display of the power unit inside temperature of the device.

P0482	Leistungsteil Kühlkörpertemperatur-Istwert	0 to 125 °C	
-	**Power unit heatsink actual temperature**	0 °C	
A	BM_u_AmpActHeatsinkTemp	1:1 °C	-

Display of power unit heatsink temperature.

P0483	Leistungsteil Netzspannung-Istwert	0 to 800.0 V	
-	**Power unit actual mains voltage**	0.0 V	
A	BM_u_AmpActMainVolt	4000_{hex}:400 V	-

Display of power unit - mains voltage.

P0484	Leistungsteil Uzk-Istwert	0 to 200.00 %	
-	**Power Unit DC-link actual value**	0.00 %	
A	BM_u_AmpActDCLinkVolt	4000_{hex}:100.00 %	-

Measured actual value of DC link voltage.

Scaling: 100 % ↔ U_{DC} nominal value (▹P0020◃)

P0485	Leistungsteil Ixt-Wert	0 to 400.0 %	
-	**Power unit Ixt actual value**	0.0 %	
A	BM_u_AmpAct_Ixt	2000_{hex}:100 %	-

This parameter displays the actual Ixt value (computation result of an internal temperature model consisting of heatsink and IGBT) of the overload monitoring. If a value of 100% is reached, the current is limited to the nominal current value of the power unit (▹P0010◃ or▹P0012◃). If the Ixt value sinks below 95%, the current limit is again set to power unit maximum current of the drive▹P1241◃.

P0486	Netzausfall-Überwachungszeit	0.000 to 6.000 s	
-	**Mains fail monitoring time**	0.000 s	
	BM_u_AmpNetFailReactDelay	1000:1 s	CW

The drive reacts to a mains fail with mains fail monitoring time (▹P0486◃). During the set time the drive remains in the released status. The error reaction, which was set is released after this time. If the mains is available within this time there is no error message released. When detecting a mains fail a warning mains fail is always made, independent on the time, which was set here.

NOTE!

The parameter ▹P0486◃ Mains failure monitoring time is not to understand as bypass time in which a mains failure must bypassed without any error message. ▹P0486◃ is in fact the suppressing time for the error message no. 64 Mains failure. It depend on many factors whether a mains failure with shorter time than the time set in ▹P0486◃ can be bypassed without any error. Among other things on the operating point before the failure, the load and the motor type.

P0487	PWM Modus Umschaltung	0.00 to 100.00 %	
EE	**Switching PWM mode**	100.00 %	
ON	BM_u_PWM_Mode	4000_{hex}:100 %	CW

From firmware version FW 03.08.

With this parameter you select, from which modulation of the PWM the MRZM (modified space vector modulation) is activated. This parameter is settable from 0 to 100%. A value of 0.00% accords to zero voltage of the converter output (0.00% modulation) and 100% accord to modulation of PWM. From 80% modulation on the switching losses with MRZM are reduced by on third, without increasing the switching current ripples compared with RZM (space vector modulation).

P0488	Maximale Aussteuerung der Modulation	80.00 to 110.00 %	
EE	**Maximum modulation index**	100.00 %	
ON	BM_u_PWM_IndexMax	4000_{hex}:100 %	CW

From firmware version FW 03.08.

Parameter P0488 is specified in order to limit the modulation index. This parameter can be used with values of -80 V to +110 V. From 100% on over-modulation accordant to maximum linear range of PWM begins. At 110% the PWM is in block operation.

P0489	Schwelle der PWM-Umschaltung	0.0 to 1000.0 Hz
EE	**Threshold for PWM-frequency switching**	0.0 Hz
ON	BM_u_PWMFreq2kHzThreshold	10:1 Hz

From firmware version FW 03.09.

Threshold of frequency switching

▹P0489◃ = 0, frequency switching not active.

For PWM frequency (▹P1240◃) = 8 kHz:

Stator frequency < Threshold of PWM-switching (▹P0489◃),
Momentary PWM switching frequency ▹P0491◃ is 4 kHz

Stator frequency ≥ Threshold of PWM-switching (▹P0489◃),
Momentary PWM switching frequency ▹P0491◃ is 8 kHz

For PWM_Frequency (▹P1240◃) = 4 kHz:

Stator frequency < Threshold of PWM-switching (▹P0489◃),
Momentary PWM switching frequency ▹P0491◃ is 2 kHz

Stator frequency ≥ Threshold of PWM-switching (▹P0489◃),
Momentary PWM switching frequency ▹P0491◃ is 4 kHz

NOTE!

At acceleration devices (b maXX 46xx) the PWM-frequency **must always** be reduced below a stator frequency of 10 Hz. Therefore the minimum threshold for acceleration devices is 10 Hz.

P0490	Einspeiseeinheit Status	0 to FFFF$_{hex}$	
-	**Power Supply Unit status**	0$_{hex}$	
A	BM_w_PSU_Status	1:1	-

Status messages from power supply unit.

Bit	Meaning
0	0: DC link voltage is generated by the device from the mains. 1: DC link voltage is supplied by external supply.
7 ... 1	Reserved
8	Mains failure 1: no mains failure 2: mains failure
15 ... 9	Reserved

P0491	Momentane PWM Schaltfrequenz	0 to 8 kHz	
-	**Actual PWM switching frequency**	8 kHz	
A	BM_u_ActPWMFrequency	1:1 kHz	

From firmware version FW 03.09.

The actual PWM switch frequency is displayed. Valid values: 2, 4 and 8 kHz, see ▹Pulse width modulation (PWM), motor-voltage◃ on page 96.

P0500	Motor Status	0 to FFFF$_{hex}$	
-	**Motor status**	0$_{hex}$	
A	BM_w_MotorStatus	1:1	-

Status parameter for motor and motor temperature monitoring.

Bit	Meaning
0	Motor temperature: 0: Motor temperature evaluation switched off 1: Motor temperature evaluation switched on
1	0: Motor temperature measuring with KTY84 1: Motor temperature measuring with temperature switch
3 ... 2	Reserved
4	Motor brake: 0: Motor brake is applied 1: Motor brake is opened
5	Initial condition of the motor temperature actual value ▹P0503◃ 0: Not ready (Since the device was switched on 3 * smoothing time ▹P0505◃ has not expired yet) 1: Ready (Since the device was switched on 3 * smoothing time ▹P0505◃ has expired)
15 ... 6	Reserved

P0501 | Motor Rastwinkel-Status | 0 to FFFF$_{hex}$
- | **Motor status notch position** | 0$_{hex}$
A | BM_w_MotorNotchPosStatus | 1:1 | -

Status word for notch position search, also see ▹P0094◃.

Bit	Meaning
3 ... 0	Reserved
4	1: Notch position was found (method 0, 1, 2) 0: Notch position still is unknown
15 ... 5	Reserved

P0502 | Motor I2t-Istwert | 0.0 to 40000.0 %
- | **Motor I2t actual value** | 0.0 %
A | BM_ud_MotorAct_I2t | 4000$_{hex}$:100 % | -

Also see ▹Motor overload monitoring (I^2t)◃ from page 126.

Output of PT1 element for overload monitoring.

Scaling: 100% ↔ Maximum thermal load of the motor

P0503 | Motor Temperatur-Istwert | -30 to 251 °C
- | **Motor actual temperature** | 0 °C
A | BM_i_MotorActTemp | 1:1 °C | -

In this parameter, the motor temperature measured by using a temperature sensor is displayed. The display is smoothed with the smoothing time ▹P0505◃ using a PT1 element

P0504 | Motor aktuelle Schlupffrequenz | 0.00 to 655.35 Hz
- | **Motor actual slip frequency** | 0.00 Hz
A | BM_u_MotorActSlipFreq | 100:1 Hz | -

This parameter display the actually calculated slip frequency (temperature tracing).

P0505 | Motor-Temperatur Glättungszeitkonstante | 1.000 to 60.000 s
EE | **Motor temperature smooth time** | 2.000 s
A | BM_u_MotorTempSmoothTime | 1000:1 s | -

Smooth time of motor temperature actual value ▹P0503◃.

This parameter acts as the digital filter (PT1 element) of interferences on the motor temperature measuring lead. The smoothing operates regardless of a temperature sensor connected at the power unit or at an encoder module.

P0506	Berechneter Motor Magnetisierungsstrom	0.0 to 6553.5 A	
-	**Computed motor magnetizing current**	0.0	
A	BM_u_CalcMagnetCurrent	10:1 A	-

From firmware version FW 03.06.

Computed magnetizing current for the asynchronous motor

As the magnetizing current for a standard motor normally is not known, it is calculated from the other motor data and displayed in this parameter. The following data is necessary for this:

1 Nominal voltage (▹P0053◃), nominal current (▹P0054◃), nominal power (▹P0056◃), nominal speed (▹P0057◃), power factor (▹P0058◃), nominal frequency (▹P0061◃) and number of pole pairs (▹P0065◃). This data is shown on the motor type plate.

2 Stator resistance (▹P0075◃) and total leakage inductance ▹P0076◃ and ▹P0078◃. For an optimum operation it is recommended to determine both of these values with the help of auto-tuning.

P0507	Berechneter elektrischer Leistungs-Istwert	2000000.0 to 2000000.0 W	
-	**Calculated electrical power actual value**	0.0 W	
A	BM_di_ElectPowerAct	10:1 W	-

From firmware version FW 03.08.

Power p_e in W calculated from motor voltages and -currents:

$$p_e = \frac{3}{2} \cdot (u_{s\alpha} \cdot i_{s\alpha} + u_{s\beta} \cdot i_{s\beta})$$

Whereat the following internally evaluated variables are used:

$i_{s\alpha}$, $i_{s\beta}$ Motor current in steady-state ($\alpha\beta$) coordinates (in A, instantaneous values)

$u_{s\alpha}$, $u_{s\beta}$ Motor-voltages in steady-state ($\alpha\beta$) coordinates (in V, instantaneous values)

The parameter P0507 was smoothed with a time constant of 4 ms.

P0508	Zusatz-Momenten-Istwert	-20000.000 to 20000.000 Nm	
-	**Additional torque actual value**	0.000 Nm	
A	BM_di_TrqActValueNm	1000:1 Nm	-

From firmware version FW 03.08.

Additional actual torque value in Nm at the motor shaft. This parameter is calculated from a power balance, see ▹Torque monitoring◃ from page 228.

The parameter P0508 is smoothed by a time constant of 4 ms, if the torque display is evaluated directly from the power balance (▹P1030◃ bit 7 on 0) and with a time constant of 2 ms if the torque display was calculated from a Kt adaption (▹P1030◃ bit 7 on 1).

P0509	Maximal einstellbares Moment	0 to 20000.000 Nm	
-	**Maximum set torque**	0.000 Nm	
A	BM_di_TrqSetMaxNm	1000:1 Nm	-

From firmware version FW 03.08.

The parameter shows the maximum set torque. This parameter is calculated from the maximum current of the drive ▹P1241◃ with the removal of the magnetization current component ▹P0066◃. In the field weakening operation the maximum torque is additionally limited from the maximum motor power, e. g. the maximum torque decreases inversely proportional to speed. The displayed value is only for your information.

P0520	Fluss-Sollwert	0.00 to 125.00 %	
-	**Flux set value**	100.00 %	
A	BM_u_FluxSetValue	4000_{hex}:100 %	-

Flux set value.

P0521	Fluss-Istwert	0.00 to 150.00 %	
-	**Flux actual value**	0.00 %	
A	BM_u_FluxActValue	4000_{hex}:100 %	-

Flux actual value

P0522	Berechnete Rotorzeitkonstante	0.00 to 4000 ms	
-	**Calculated rotor time constant**	0 ms	
A	BM_u_TimeRotorActValue	1:1 ms	-

Actual value of rotor time constant (Tr).

P0523	Fluss-Sollwert Reduktion	20.00 to 100.00 %	
-	**Flux set value reduce**	100.00 %	
ON	BM_u_FluxSetReduce	4000_{hex}:100 %	CW

From firmware version FW 03.06.

Reduction of flux set value at asynchronous motors.

With the help of this parameter the flux set value can be limited, in order to reduce the loss at no-load or at light load. Therefore is to be considered, that the motor at reduced flow, can generate only a low torque. Flow-reducing therefore must be completed on time (at least 3 x rotor time constant), before a greater torque is necessary.

P0530

P0530	Synchronisierungs-Status	0 to $FFFF_{hex}$	
-	**Synchronization status**	0_{hex}	
A	BM_w_SyncStatus	1:1	-

Also see ▹Synchronization◃ from page 172.

Display of synchronization status.

Bit	Meaning
0	0: Drive not synchronous 1: Drive is synchronous
1	1: Drive is synchronized with a longer control cycle
2	1: Drive is synchronized with shorter control cycle
3	0: No synchronization signal was received 1: Synchronization signal was recognized

- regarding bit 0
  The bit is set, as soon as the drive runs synchronous to the external signal. That means, that the last two edges of the synchronization signal are within the valid range and the point of time of the falling edge is within the range, which was set via the parameter Sync. tolerance ▹P0533◃ (offset to control cycle).
- regarding bit 1
  The bit is set, if the synchronization signal was valid (distance between the edges within the tolerance), but the synchronization edge has appeared only after the adjusted instant. The drive will be synchronized by extending the control cycle. This bit can simultaneously be set with bit 0, then the drive is synchronous, but must re-synchronize.
- regarding bit 2
  The bit is set, if the synchronization signal was valid (distance between the edges within the tolerance), but the synchronization edge has appeared before the adjusted instant. The drive will be synchronized by reducing the control cycle. This bit can simultaneously be set with bit 0, then the drive is synchronous, but must re-synchronize.
- regarding bit 3
  The bit is set, if a synchronization edge was recognized, not depending of the signals being within the tolerances or not.

P0531

P0531	Quelle für Sync-Signal	0 to 6	
EE	**Source for sync signal**	0	
	BM_u_SyncSource	1:1	-

Also see ▹Synchronization◃ from page 172.

With the sync. signal you determine, which signal is valid for the synchronization via a field bus.

Value	Meaning
0	Synchronization switched off
1	Reserved
2	BACI signal SYNC_1
3	BACI signal SYNC_2
4	BACI signal TRIGGER_1
5	BACI signal TRIGGER_2
6	Start bit SSI encoder emulation

P0532

	Sync Intervall	0 to 8000 µs	
EE	**Sync interval**	0 µs	
	BM_u_SyncInterval	1:1 µs	-

Also see ▷Synchronization◁ from page 172.

Duration of sync interval.

Value	Meaning
0	Synchronization switched off
250	250 µs
500	500 µs
1000	1 ms
2000	2 ms
4000	4 ms
8000	8 ms

P0533

	Sync Toleranz	0.0 to 40.0 µs	
EE	**Sync tolerance**	12.8 µs	
	BM_u_SyncTolerance	5:1 µs	-

Also see ▷Synchronization◁ from page 172.

Adjustment of interval, in which the drive will be synchronous to the external signal.

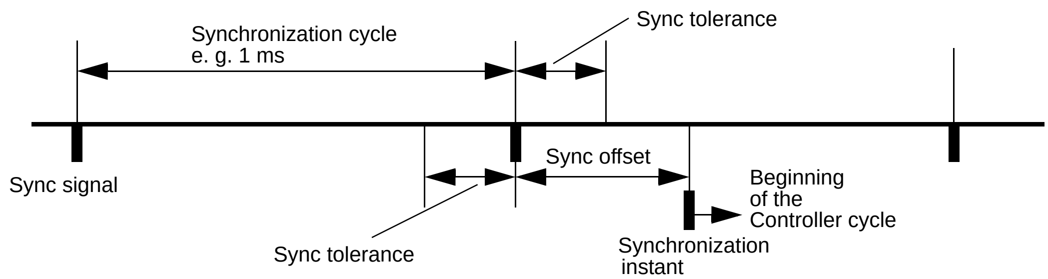


Figure 144: Synchronization time

P0534	Sync Offset	-4000.0 to +4000.0 µs	
EE	**Sync Offset**	0.0 µs	
	BM_i_SyncOffset	5:1 µs	-

Also see ▷Synchronization◁ from page 172.

Offset for the synchronization operation, that means offset between control cycle and synchronization signal. Positive values mean shifting the controller cycle backwards.

P0540	CAN Modus	0 to 1	
EE	**CAN mode**	0	
	BM_w_CAN_Mode	1:1	-

Reserved

P0541	CAN Status	0 to $FFFF_{hex}$	
-	**CAN status**	0_{hex}	
A	BM_w_CAN_Status	1:1	-

Reserved

P0542	CAN Baudrate (Konfig)	125 to 1000 kBit/s	
EE	**CAN baud rate (config)**	125 kBit/s	
	BM_u_CAN_BaudrateSet	1:1 kBit/s	-

Reserved

P0543	CAN Baudrate (DIP-Schalter)	125 to 1000 kBit/s	
EE	**CAN Baudrate (DIP-Switch)**	125 kBit/s	
A	BM_u_CAN_BaudrateDIP	1:1 kBit/s	-

Reserved

P0544	CAN Baudrate (aktiv)	125 to 1000 kBit/s	
-	**CAN baud rate (active)**	125 kBit/s	
A	BM_u_CAN_BaudrateAct	1:1 kBit/s	-

Reserved

P0545 | CAN Slave Nummer (Konfig) | 0 to 128

EE | **CAN slave number (config)** | 0

BM_u_CAN_SlaveNrSet | 1:1 | -

Reserved

P0546 | CAN Slave Nummer (DIP-Schalter) | 0 to 128

EE | **CAN slave number (DIP-switch)** | 0

A | BM_u_CAN_SlaveNrDIP | 1:1 | -

Reserved

P0547 | CAN Slave Nummer (aktiv) | 0 to 128

- | **CAN slave number (active)** | 0

A | BM_u_CAN_SlaveNrAct | 1:1 | -

Reserved

P0550 | Modultyp Steckplatz A | 0 to $FFFF_{hex}$

- | **Module type slot A** | 0_{hex}

A | BM_w_ModSlotAIdent | 1:1 | -

Code of module in slot A.

Bit	Meaning
4 ... 0	Reserved
7 ... 5	Module execution (see table ▹page 481◃)
10 ... 8	**Hardware version** of modules 000: Development 001: Hardware-version A 002: Hardware-version B 003: Hardware-version C 004: Hardware-version D 005: Hardware-version E 006: Hardware-version F 007: Hardware-version G
15 ... 11	**Module function** (see bit bar ▹page 481◃)

- Module functions versions ▹P0550◃

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Module					Hardware status			Module-specific			Reserved				

15	14	13	12	11		
0	0	0	0	0	no module	
0	0	0	0	1	Reserved	
0	0	0	1	0	ENC 07, ENC	Sine-cosine encoder SSI (from FW 03.09)
0	0	0	1	1	AIO-03	Analog I/O, 12 bit D/A - 12 bit A/D
0	0	1	0	0	ENC-02, ENC-12 *	Sine-cosine encoder HIPERFACE®
0	0	1	0	1	DIO-01	Digital I/O, 4 inputs, 4 outputs
0	0	1	1	0	Reserved	
0	0	1	1	1	ENC-06	EnDat2.2 - Encoder
0	1	0	0	0	ENC-01, ENC-11 *	Resolver
0	1	0	0	1	Reserved	
0	1	0	1	0	Reserved	
0	1	0	1	1	Reserved	
0	1	1	0	0	ENC-03	Square wave incremental encoder
0	1	1	0	1	Reserved	
0	1	1	1	0	IEE-02	Incremental encoder emulation
0	1	1	1	1	Reserved	
1	0	0	0	0	ENC-05	Sine-cosine encoder EnDat 2.1
1	0	0	0	1	AIO-01	Analog I/O, 8 bit D/A - 10 bit A/D
1	0	0	1	0	Reserved	
1	0	0	1	1	Reserved	
1	0	1	0	0	ENC-04	Sine incremental encoder
1	0	1	0	1	FIO-01	Digital I/O, 4 fast inputs 4 outputs
1	0	1	1	0	UME-01	Mains voltage sensing (standard slot B)
1	0	1	1	1	ENC-27	SSI encoder with 24 V supply
1	1	0	0	0	ENC-08	Sine incremental encoder with commutation
1	1	0	0	1	AIO-02	Analog I/O, 16 bit D/A - 16 bit A/D
1	1	0	1	0	SIE-01	SSI encoder emulation
1	1	0	1	1	AIO-04	Analog IN: 0 mA ... 20 mA; OUT: 16 bit D/A (±10 V)
1	1	1	0	0	ENC 21	Resolver
1	1	1	0	1	Reserved	
1	1	1	1	0	IEE-01	Incremental encoder emulation
1	1	1	1	1	Reserved	

*) differentiation see table ▹Module-specific meaning of bit 7 ... 5◃ on page 482

- Module-specific meaning of bit 7 ... 5

Module		Bit 7	Bit 6	Bit 5
ENC-01	Resolver	0: without 1: with temp. sensing	0: without RS485 1: with RS485	0: level standard
ENC-11	Resolver Level analog tracks with low gear ratio (Schneider/ NUM)	1: with temp. sensing	0: without RS485 1: with RS485	1: level Schneider/NUM
ENC-02	Sine-cosine HIPER-FACE®	0: without 1: with temp. sensing	1: with RS485	0: with terminating resistor
ENC-12	Sine-cosine HIPER-FACE® without terminating resistor at RS-232	1: with temp. sensing	1: with RS485	1: without terminating resistor
ENC-03	Square wave incremental encoder	1: with temp. sensing	0: without RS485	0: without track monitoring 1: with track monitoring
ENC-04	Sine incremental encoder	1: with temp. sensing	0: without RS485	Reserved
ENC-05	Sine-cosine EnDat 2.1	0: without temp. sensing 1: with temp. sensing	Reserved	Reserved
ENC-06	EnDat2.2-Encoder	Reserved	1: with RS485	Reserved
ENC-07 (from FW 03.09)	Sine-cosine SSI	0: without temp. sensing 1: with temp. sensing	0: Reserved	Encoder voltage supply 0: external 1: 5 V from module
ENC 21	Resolver with changed signal assignment	1: with temp. sensing	0: without RS485	0: level standard
ENC-08	Sine incremental encoder with commutation	Reserved	Reserved	Reserved

Examples

Module		Value P0550
ENC-01	Resolver (with temperature sensing), with RS 485	$43C0_{hex}$
	Resolver (without temperature sensing), without RS 485	4300_{hex}
ENC-02	Sine-cosine HIPERFACE® (with temperature sensing)	$43C0_{hex}$
	Sine-cosine HIPERFACE® (without temperature assignment)	2100_{hex}
ENC-03	Square wave incremental encoder (with temperature sensing)	$60A0_{hex}$
ENC-04	Sine incremental encoder	$300A_{hex}$
ENC-05	Sine-cosine EnDat (without temperature sensing)	8300_{hex}
ENC-06	EnDat2.2-Encoder	$3AC0_{hex}$
ENC-07	Sine-cosine SSI (from FW 03.09)	1300_{hex}
ENC-08	Sine incremental encoder with commutation	$C1E0_{hex}$
ENC-27	SSI encoder with 24 V supply	$BA00_{hex}$
AIO-01	Analog I/O, 8 bit D/A - 10 bit A/D	8800_{hex}
AIO-02	Analog I/O, 16 bit D/A - 16 bit A/D	$CBF0_{hex}$
AIO-03	Analog I/O, 12 bit D/A - 12 bit A/D	$1A00_{hex}$
AIO-04	Analog IN: 0 mA ... 20 mA; OUT: 16 bit D/A (±10 V)	$DBF0_{hex}$
DIO-01	Digital I/O, 4 inputs, 4 outputs	2800_{hex}
FIO-01	Digital I/O, 4 fast inputs 4 outputs	5800_{hex}

Module		Value P0550
IEE-01	Incremental encoder emulation	$F300_{hex}$
SIE-01	SSI-encoder emulation	$D100_{hex}$
UME-01	Mains voltage sensing (from FW 03.09)	$B100_{hex}$

P0551

P0551	Modultyp Steckplatz B	0 to $FFFF_{hex}$	
-	**Module type slot B**	0_{hex}	
A	BM_w_ModSlotBIdent	1:1	-

Code of module in slot B.

Description see ▷P0550◁ on page 480.

P0552

P0552	Modultyp Steckplatz C	0 to $FFFF_{hex}$	
-	**Module type slot C**	0_{hex}	
A	BM_w_ModSlotCIdent	1:1	-

Code of module in slot C.

Description see ▷P0550◁ on page 480.

P0553

P0553	Modultyp Steckplatz D	0 to $FFFF_{hex}$	
-	**Module type slot D**	0_{hex}	
A	BM_w_ModSlotDIdent	1:1	-

Code of module in slot D.

Description see ▷P0550◁ on page 480.

P0554

P0554	Modultyp Steckplatz E	0 to $FFFF_{hex}$	
-	**Module type slot E**	0_{hex}	
A	BM_w_ModSlotEIdent	1:1	-

Code of module in slot E.

Description see ▷P0550◁ on page 480.

P0555	FPGA-Version	0 to $FFFF_{hex}$	
-	**FPGA version**	0	
A	BM_w_FpgaVersion	1:1	-

Firmware version of programmable logic module situated in the controller.

P0556	Bootloader Firmware-Version	0 to 65535	
-	**Bootloader firmware version**	0	
A	BM_u_BootloaderVersion	1:1	-

Firmware version of bootstrap loader.

P0557	Programmier-Anforderung	0 to 1	
-	**Programming request**	0	
ON	BM_w_ProgRequest	1:1	-

Special parameter to start a firmware update over WinBASS II / ProDrive.

P0558	Konfigurations-Identifikationsnummer	0 to 4294967295	
EE	**Configuration ID**	0	
ON	BM_ud_ConfigId	1:1	-

This parameter acts as a storage of an item number or similar in the controller. The value is not processed by the controller , but is saved in the central data during storage of data sets.

P0559	Gerätename	80 ASCII characters	
EE	**Drive name**	„“	
ON	BM_s_DriveName	1:1	-

This parameter serves for the storage of a device name for example for the system configuration. The string is not evaluated by the controller, but saved during storage of data sets.

P0560	Geber-Nachbildung Modul-Version	0 to FFFF$_{hex}$	
-	**Encoder emulation module version**	0	
A	BM_w_EncEmuModVersion	1:1	-

Unit- and hardware version of function module incremental encoder emulation IEE-01. There is no version shown at module IEE-02.

Bit	Meaning
7 ... 0	Software version
15 ... 8	Hardware-ID of module

P0561	Geber-Nachbildung Status	0 to FFFF$_{hex}$	
-	**Encoder emulation status**	0$_{hex}$	
A	BM_w_EncEmuStatus	1:1	-

Status of incremental encoder emulation.

Bit	Meaning
2 ... 0	Reserved
3	1: Error in function module, error bit see error messages (only IEE-01)
4	Status of function module (HW) (only IEE-01) 0: STOP 1: RUN
7 ... 5	Reserved
8	IEE-02 only: 1: Zero pulse generation is switched on 0: Zero pulse generation is switched off
15 ... 9	Reserved

P0562	Geber-Nachbildung Modus	0 to FFFF$_{hex}$	
EE	**Encoder emulation mode**	0020$_{hex}$	
ON	BM_w_EncEmuMode	1:1	-

Mode of incremental encoder emulation.

Bit	Meaning
0	0: Incremental encoder emulation is coupled with position actual value G1/G2 1: Incremental encoder emulation is coupled with position set value
1	0: Incremental encoder emulation is switched off 1: Incremental encoder emulation is active
2	0: Incremental encoder emulation is coupled with encoder 1 1: Incremental encoder emulation is coupled with encoder 2
3	Polarity inversion for incremental encoder emulation: 0: at clockwise rotating encoder a clockwise rotating signal pattern is signaled 1: at clockwise rotating encoder a counterclockwise signal pattern is signaled

Bit	Meaning
4	from FW 03.09 0: Internal set value source (selection with bit 0 and bit 2) 1: Set value source is parameter „Encoder emulation application set value“ (▹P0569◃)
5	Evaluation only, if bit 0 **and** bit 4 are 0. 0: Activation of incremental encoder emulation after initialization and first zero pulse of the encoder (evaluation only, if an incremental encoder is coupled) 1: Activation of the incremental encoder emulation immediately after initialization of the encoder
6	Only IEE-01 module: 0: Zero pulse synchronous to track A, B (A=1 and B=1, length 90°, 16 bit resolution) 1: Zero pulse asynchronous to track A, B, but as exact as possible (independently of A and B, 90° < length < 180°, 24 bit resolution)
7	Reserved
8	IEE-02 only: 1: Switch off zero pulse generation 0: Switch on zero pulse generation
15 ... 9	Reserved

P0563	Geber-Nachbildung Strichzahl	1 to 32767 pulses/rev.	
EE	**Encoder emulation pulses per revolution**	1024 pulses/rev.	
ON	BM_ud_EncEmuPulsesPerRev	1:1 pulses/rev.	-

Number of pulses per revolution of incremental encoder emulation.

P0564	Geber-Nachbildung Offset Nullimpuls	0 to $FFFFFFFF_{hex}$	
EE	**Encoder emulation offset index signal**	0_{hex}	
ON	BM_ud_EncEmuOffsetIdxSig	1:1	-

Angle offset between zero angle of the over ▹P0562◃ selected encoder and the zero pulse of the incremental encoder emulation.

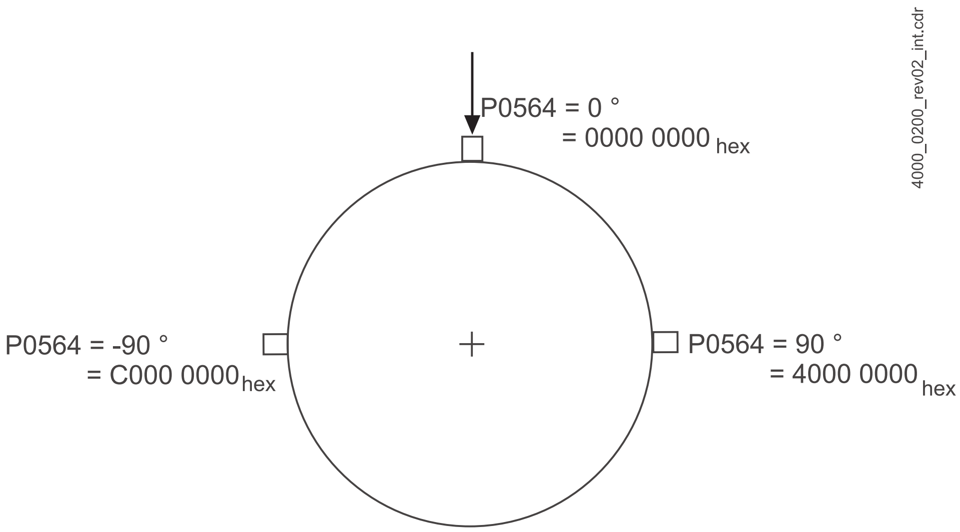


Figure 145: Incremental encoder emulation zero pulse

P0565	SSI-Geber-Nachbildung Status	0 to FFFF$_{hex}$	
-	**SSI-encoder emulation status**	0$_{hex}$	
A	BM_w_SsiEncEmuStatus	1:1	-

Status of the SSI encoder emulation.

Bit	Meaning
13 ... 0	Reserved
14	0: No timeout: 1: Timeout has appeared - clock signals are missing or clock frequency too low
15	0: Transfer inactive 1: Transfer active

P0566	SSI-Geber-Nachbildung Modus	0 to FFFF$_{hex}$	
EE	**SSI-encoder emulation mode**	0$_{hex}$	
ON	BM_w_SsiEncEmuMode	1:1	CW

Mode for the SSI encoder emulation Precondition for the SSI encoder emulation is a SSI encoder emulation module which was plugged to slot A or slot B.

Bit	Meaning
0	0: Deactivate SSI encoder emulation 1: SSI encoder emulation activated
1	Coding of transmission: 0: Binary transmission 1: Gray code
2	Activate parity: 0: Transmission with parity bit 1: Transmission without parity bit
3	Parity: 0: Parity even 1: Parity odd
5 ... 4	Coding of revolution and angle: 00: 16 bit multiturn (revolutions) + 16 bit singleturn (angle) 01: 12 bit multiturn (revolutions) + 20 bit singleturn (angle) 10: 20 bit multiturn (revolutions) + 12 bit singleturn (angle) 11: 12 bit multiturn (revolutions) + 12 bit singleturn (angle)
7 ... 6	Data source: 00: Actual value encoder 1 01: Actual value encoder 2 10: Position setpoint 11: Reserved

Bit	Meaning
8	Test mode: 0: Test mode switched off 1: Test mode activated. A cycle is output on the clock cables, which accords to the external signal source (e.g. control). On the data cables the related serial data is displayed together with the clock signal.
11 ... 9	Only for test mode: Sending interval cycle- and output data (from FW 03.09) 000: 125 µs 001: 250 µs 010: 500 µs 011: 1 ms 100 : 2 ms 101: 4 ms 110: 8 ms 111: 16 ms

NOTE!

A changing of the SSI data source or of the transmission parameter operates not until activation of the SSI encoder emulation, this means at a rising edge of bit 0.

P0567

P0567	Motorpotentiometer Ausgabewert	-100 % to +100 %	
-	**MP_Output**	0	
A	BM_i_MP_Output	4000_{hex}:100 %	-

Output of motor potentiometer At activation of motor potentiometer this output is written directly to the ramp function generator input(▷P1171◁).

P0568

P0568	Motorpotentiometer Status	0 to $FFFF_{hex}$	
-	**Motor potentiometer status**	0_{hex}	
A	BM_w_MP_Status	1:1	-

Status of the motor potentiometer:

Bit	Meaning
0	1: Motor potentiometer active
3 ... 1	Reserved
4	1: Ramp up end value at motor potentiometer+ reached
5	1: Ramp down end value at motor potentiometer- reached
6	1: Key motor potentiometer+ is pressed
7	1: Key motor potentiometer- is pressed
8	1: Motor potentiometer+ active
9	1: Motor potentiometer- active
10	1: Error at writing to target parameter (e.g. value greater max-value)
15 ... 11	Reserved

P0569	Geber-Nachbildung Applikations-Sollwert	0 to $FFFFFFFF_{hex}$	
-	**Encoder emulation application set value**	0_{hex}	
ON	BM_ud_EncEmuApplSetValue	1:1	CW

From firmware version FW 03.09.

This parameter is interpreted as 32-bit angle (360° accordant $FFFFFFFF_{hex}$).

If bit 4 in encoder emulation mode (▹P0562◃) is set, the top 24 bit are issued in each control cycle with linear fine interpolation at the incremental encoder-emulation module (IEE-01 or IEE-02).

The cyclic time must be adjusted in the parameter Sync interval (▹P0532◃). The predetermined position set value is then interpolated from the cyclic time to the internal control interval.

NOTE!

If the value of parameter Sync interval is (▹P0532◃) equal 0, there is no output to the incremental encoder-emulation module.

P0570	SSI-Geber Modus	0 to $FFFFFFFF_{hex}$	
EE	**SSI-Encoder mode**	0_{hex}	
ON	BM_ud_SsiEncoderMode	1:1	CW

From firmware version FW 03.09.
Mode for the evaluation of encoders with SSI protocol. Precondition for this is an available SSI encoder module on slot A or slot B. The parameter effects both slots.

Changes of this parameter are effective not until the related encoder is newly initialized (switch off encoder and switch on again or delete and set bit 0 in parameter ▹P0150◃/ ▹P0160◃ Encoder 1/2 Mode).

Bit	Meaning
3 ... 0	Length of multiturn data [Bit] 0000 = 0 Bit, 0001 = 1 Bit, ... , 1111 = 15 Bit
7 ... 4	Length of singleturn data [Bit] 0000 = 16 Bit, 0001 = 1 Bit, ... , 1111 = 15 Bit
8	1: Deactivation of data transfer monitoring [2)]
11 ... 9	Length of additional info [Bit]
13 ... 12	Use of additional info 1: 00: only as message; Display in SSI-encoder status 01: as error; Error release by controller 1x: Reserved
15 ... 14	Use of additional info 2 (settings see additional info 1)
17 ... 16	Use of additional info 3 (settings see additional info 1)
19 ... 18	Use of additional info 4 (settings see additional info 1)
21 ... 20	Use of additional info 5 (settings see additional info 1)
23 ... 22	Use of additional info 6 (settings see additional info 1)

Bit	Meaning
25 ... 24	Use of additional info 7 (settings see additional info 1)
28 ... 26	Transmission frequency [3)] 000: 100 kHz 001: 200 kHz 010: 400 kHz 011: 1 MHz 1xx: 2 MHz
29	Coding: 0: Binary transmission 1: Gray-Code [1)]
30	Parity Mode: 0: Odd Parity 1: Even Parity
31	1: Paritycheck on

1) The decoding from the gray code occurs separately between single- and multiturn data at the ENC-07/17 modules. Any additional information is not decoded.
At the ENC-27 module the decoding from the Graycode is made over the total range (single- and multiturn data (+ additional information)). If the additional information is transmitted binary on the encoder side, then after (incorrect) decoding only the first (=highest) additional information, which was transmitted is definitely unbiased. Therefore, it is essential that the additional information is transmitted before the position data (see ▹P0573◃).

2) Here the monitoring to the errors „Encoder does not response“ and „Error at data transmission“ are switched off for the ENC-07/17 modules. The errors, which were caused by additional information remain.

3) The maximum transmission frequency is dependent of the cable length and of the encoder, which are used. The permissible values can be looked up in the specification of the encoder manufacturer. The error-free function must be verified by the user!
For pure digital SSI encoder (module ENC-27) please note:
- only the transmission frequencies 200 kHz and 1 MHz are available!
- no parity check

Example on parameterization of additional info:

4 Bit additional info;
Additional info 1 and 4 must release an error;
Additional info 2 and 3 is for display of status only

Length of additional info = 4 ⇒ Bit 9 …11 = 100

Use of additional info 1 ⇒ Bit 12 …13 = 01
⇒ Sub-error 113 of error encoder X Serial interface

Use of additional info 2 ⇒ Bit 14 …15 = 00

Use of additional info 3 ⇒ Bit 16 …17 = 00

Use of additional info 4 ⇒ Bit 18 …19 = 01
⇒ Sub-error 116 of error encoder X Serial interface

Bit 20 … 25 must be set to zero.

P0571	SSI-Geber Status	0 to $FFFF_{hex}$
-	**SSI-Encoder status**	0_{hex}
A	BM_w_SsiEncoderStatus	1:1

From firmware version FW 03.09.

Status of the SSI encoder evaluation.

Bit	Meaning
0	Additional info 1
1	Additional info 2
2	Additional info 3
4	Additional info 4
5	Additional info 5
6	Additional info 6
11 ... 7	Reserved
12	1: Encoder error was released due to additional info [1)]
13	1: Error „Encoder does not respond“ [2)]
14	1: Error at data transmission [3)]
15	0: Data transmission inactive 1: Data transmission active

[1)] **Encoder error by additional info**
This bit is set, if at least one additional info is parameterized to the reaction „Error“ and if the according additional info is set.
In case of an error
- at encoder 1 the error encoder communication 112 is activated ⇒ ▹P0208◃ Error Encoder 1
- at encoder 2 the error encoder communication 128 is activated ⇒ ▹P0209◃ Error Encoder 2
The accordant sub-error number (113 to 119) in order to identify the activating additional info can be determined via ▹P0234◃ Error Encoder 1 Serial Interface ▹P0235◃ Error Encoder 2 Serial Interface.

[2)] **Error „Encoder does not response“**
The reasons for this error may be the following:
- The power supply of the encoder is switched off (external 24V-supply)
- Encoder is defective
- Cable break of SSI cables
- Encoder position is $FFFFFFFF_{hex}$
In case of an error
- at encoder 1 the error encoder communication 112 is activated ⇒ ▹P0208◃ Error Encoder 1
- at encoder 2 the error encoder communication 128 is activated ⇒ ▹P0209◃ Error Encoder 2
The sub-error number 65 is displayed via ▹P0234◃ Error Encoder 1 Serial Interface or ▹P0235◃ Error Encoder 2 Serial Interface.

[3)] **Error at data transfer**
The multi-scan position check determined an extension of the upper deviation.
The reasons for this error may be the following:
- The encoder is not resting
- Interferences on the SSI-connection
In case of an error
- At encoder 1 the error encoder communication 112 is activated ⇒ ▹P0208◃ Error Encoder 1
- At encoder 2 the error encoder communication 128 is activated ⇒ ▹P0209◃ Error Encoder 2
The sub-error number 112 is displayed via ▹P0234◃ Error Encoder 1 Serial Interface or ▹P0235◃Error Encoder 2 Serial Interface.

P0572	SSI-Geber Länge Sinus/Messschritt	0 to 65535	
EE	**SSI-Encoder length sinus / dig. step**	0	
ON	BM_u_SsiAnaDigRatio	1:1	CW

From firmware version FW 03.09.

At this parameter the ratio of length of period of signal and the length of digital step (digital resolution) is specified. It is for the setting of the length measuring system with SSI-protocol. Additionally the internal evaluation procedure is selected:

= 0: Evaluation as a rotary encoder / angular measuring system
= 1: Evaluation as pure digital length measuring system (only possible with ENC-27 module)
> 1: Evaluation as length measuring system

Changes of this parameter are effective not until the related encoder is newly initialized (switch off encoder and switch on again or delete and set bit 0 in parameter ▹P0150◃/ ▹P0160◃ Encoder 1/2 Mode).

NOTE!

The pure digital SSI length measuring encoders are only enabled for position control, not for motor commutation / speed control!

Example rotary encoder/Angular measuring system:

Rotary encoder with 12-bit multiturn and 13-bit singleturn resolution. An additional info as alarm bit, which shall activate an error. The data transmission in gray code is run with 400 kHz.

▹P0572◃ SSI-Encoder length sinus / dig. step = 0

▹P0570◃ SSI-Encoder 2 Mode = 2800 12DC$_{hex}$

- 13 bit singleturn-data: Bit 4 - 7 = 1101
- 12 bit multiturn-data: Bit 0 - 3 = 1100
- Length of additional info: Bit 9 - 11 = 001
- Use of additional info 1 as error: Bit 13 ... 12 = 01
- f = 400 kHz : Bit 28 ... 26 = 010
- Gray-coding: Bit 29 = 1

Example pure digital length measuring system:

Length measuring system with 24-bit position value, 50 µm resolution, no parity. The data transmission must be made binary serial right-justified with 200 kHz. The measuring range of 600 mm should correspond to 1 revolution.

▹P0570◃ SSI-encoder mode = 0400 00FA$_{hex}$

- 15 bit singleturn-data: Bit 4 - 7 = 1111
- 10 bit multiturn-data: Bit 0 - 3 = 1010
- f = 200 kHz: Bit 26 - 28 = 001
- Binary transmission: Bit 29 = 0

▹P0572◃ SSI-Encoder length sinus / dig. step = 1

- Evaluation as pure digital length measuring encoder

▹P0573◃ SSI-Encoder mode 2 = 1

- Transmission pure right-justified

▹P0574◃ SSI-Encoder resolution = 50

▹P0578◃ SSI-Encoder distance per revolution = 600.000

At the length measuring systems the division of the single- and multiturn data is not important. The sum of both data lengths must add up to the total data width.

Example length measuring system:

Length measuring system with 24-bit position value, 1 µm dig. resolution, 1 mm length of period and without additional info and parity. The data transmission must be made binary with 200 kHz.

▹P0572◃ SSI-Encoder length sinus / Dig. step = 1 mm / 1 µm = 1000

▹P0570◃ SSI-encoder mode = 0400 0008_{hex}

- 16 bit singleturn-data: Bit 4 - 7 = 0000
- 8 bit multiturn-data: Bit 0 - 3 = 1000
- f = 200 kHz: Bit 26 - 28 = 001
- Binary transmission: Bit 29 = 0

At the length measuring systems the division of the single- and multiturn data is not important. The sum of both data lengths must add up to the total data width.

P0573	SSI-Geber Modus 2	0 to $FFFF_{hex}$	
-	**SSI-Encoder mode 2**	0	
A	BM_u_SSIEncoderMode2	1:1	-

Changes of this parameter are effective not until the related encoder is newly initialized (switch off encoder and switch on again or delete and set bit 0 in parameter ▹P0150◃/ ▹P0160◃ Encoder 1/2 Mode).

Bit	Meaning
0	Transmission format (ENC-27 only): 0: Pine-tree profile 1: Serial right-justified
3 ... 1	Reserved
4	Position of the bits for additional information 1 (ENC-27 only, remaining bits follow in ascending order) 0: after LSB of the position data 1: before MSB of the position data
7 ... 5	Reserved
8	Cable break monitoring (ENC-27 only): 0: switch off 1: switch on
13... 9	Reserved
15 ... 14	Select analog correction table (ENC-07/17 only): 00: Heidenhain 01: Stegmann 10: No analog correction 11: Reserved

For pure digital SSI encoder (module ENC-27) please note:

- only transmission format "serial right-justified" available

Example:

1 0x0: Serial right-justified, binary, 1 bit additional information after LSB, 24 bits position data

Position			Additional information
			ZI 1
Bit 24	...	Bit 1	Bit 0

2 0x1: Serial right-justified, binary, 2 bits additional information before MSB, 24 bits position data

Additional information		Position		
add. info 2	add. info 1			
Bit 25	Bit 24	Bit 23	...	Bit 0

P0574

EE	**SSI-Encoder resolution**	0.00	
ON	BM_u_SSIEncResolution	100:1 µm/bit	-

SSI-Geber Auflösung — 0.00 to 655.35

Only for length measuring systems.

Resolution of the encoder in µm/bit (manufacturer information)

The parameter is effective to both encoder inputs. The parameter effects only when the encoder is a length measuring encoder.

Changes of this parameter are effective not until the related encoder is newly initialized (switch off encoder and switch on again or delete and set bit 0 in parameter ▹P0150◃/ ▹P0160◃ Encoder 1/2 Mode).

P0575

Digitaler Input-Kanal für Fehlerquittierung — 0 to $FFFF_{hex}$

EE	**Digital input channel for error acknowledge**	0_{hex}	
	BM_w_DI_AckErrInpChannel	1:1	-

Slot and channel select of digital inputs, which will be used to reset drive error messages.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Selection of input module slot (possible values 1 to 5, corresponding to slot A to E)

Value 0 means that no input channel has been selected. Resetting of errors by use of a digital input is deactivated then.

Example:
▹P0575◃ = 0**5**0**2**$_{hex}$; That means digital input for error reset is connected with pin **2** in the slot **E (= 5)** of the input module.

P0576 | Digitaler Input-Kanal für Reglerfreigabe | 0 to FFFF$_{hex}$
EE | **Digital input channel for enable operation** | 0$_{hex}$
BM_w_DI_EnOpInpChannel | 1:1 | -

Selection of slot and channel of digital input, which is used for the control signal ’controller enable’ (corresponds to command ’operation enabled’ in the drive manager state machine).

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Selection of input module slot (possible values 1 to 5, corresponding to slot A to E)

Value 0 means that no input channel has been selected. In this case no separate signal for controller enable exists; only the signal for pulse enable.

Example:
▹P0576◃ = 0**4**0**3**$_{hex}$; that means digital controller enable is connected with pin **3** in the slot **D** (= **4**) of the input module.

P0578 | SSI-Geber Weg pro Umdrehung | 0 to 429496729.5
EE | **SSI-Encoder distance per revolution** | 0.0
ON | BM_u_SSIEncDistPerRev | 10:1 µm/revolution | -

Only for length measuring systems.

Distance per revolution in µm/revolution.

The parameter is effective to both encoder inputs. The parameter effects only when the encoder is a length measuring encoder.

Changes of this parameter are effective not until the related encoder is newly initialized (switch off encoder and switch on again or delete and set bit 0 in parameter ▹P0150◃/ ▹P0160◃ Encoder 1/2 Mode).

This parameter defines which distance corresponds to a revolution of the motor. The parameter is the basis for all conversions between the length measuring system of the encoder and the (internal) rotatory position and the speed.

The number of pulses (▹P0152◃ or ▹P0162◃) is calculated together with ▹P0574◃:

Number of pulses = (encoder distance per revolution) / encoder resolution

NOTE!

The displayed value of the number of pulses is limited to 32767. But the exact value is considered internally.

Examples:

1 Encoder resolution = 50 µm/bit, encoder distance per revolution = 3276750 µm ≈ 3,28 m
→
Number of pulses = 65535,
Speed 100 rpm = 328 m/min = 5,46125 m/s = 5,46125 mm/ms

2 Encoder resolution = 0,5 µm/bit, encoder distance per revolution = 32767,5 µm ≈ 3,28 cm
→
Number of pulses = 65535,
Speed 100 rpm = 3,28 m/min = 0,0546125 m/s = 0,0546125 mm/ms

3 Encoder resolution = 50 µm/bit, encoder distance per revolution = 600 000 µm = 60 cm
→
Number of pulses = 12000,
Speed 100 rpm = 60 m/min = 1 m/s = 1 mm/ms

P0579	Funktionsmodul-Auswahl für PLC-I/O-Zugriffe	0 to $1F_{hex}$	
EE	**Function module selection for PLC I/O-access**	0_{hex}	
PO	BM_w_PlcModSelect	1:1	-

Selection of, which digital- or analog-I/O function module can activate the PLC direct-reading/or writing. In principle an access of the PLC on other function module types (for example touch probe, encoder, ...) is not possible.

Bit	Meaning
0	Function module slot A 0: Access by PLC not permitted 1: Access by PLC permitted
1	Function module slot B 0: Access by PLC not permitted 1: Access by PLC permitted
2	Function module slot C 0: Access by PLC not permitted 1: Access by PLC permitted
3	Function module slot D 0: Access by PLC not permitted 1: Access by PLC permitted
4	Function module slot E 0: Access by PLC not permitted 1: Access by PLC permitted
15 ... 5	Reserved

The directly access on I/Os of the controller are only possible by controllers with special FPGA version.

P0580	Messtaster Status	0 to $FFFF_{hex}$	
EE	**Touch probe status**	0_{hex}	
	BM_w_TouchPrStatus	1:1	-

Status of touch probe 1, 2.

Bit	Meaning
3...0	Reserved
4	Status of the functionality touch probe 1 0: Measured value storage touch probe 1 is switched off 1: Measured value storage touch probe 1 is enabled
5	Status of the functionality touch probe 2 0: Measured value storage touch probe 2 is switched off 1: Measured value storage touch probe 2 is enabled
7...6	Status of the measured value storage touch probe 1 00: No measured value saved yet 01: Measured value positive edge saved 10: Measured value negative edge saved 11: Measured values positive & negative edge saved (at continuous storage the bits remain after first storage by positive or/and negative edge)
9...8	Status of the measured value storage touch probe 2 00: No measured value saved yet 01: Measured value positive edge saved 10: Measured value negative edge saved 11: Measured values positive & negative edge saved (at continuous storage the bits remain after first storage by positive or/and negative edge)
10	Status touch probe 1: 0: inactive 1: active • The ’or-operation’ of the bits 7...6, can be used for faster access on the part of the control
11	Status touch probe 2: 0: inactive 1: active • The ’or-operation’ of the bits 9...8, can be used for faster access on the part of the control
12	Signalization toggle bit „New measured value probe 1 positive edge“
13	Signalization toggle bit „New measured value probe 1 negative edge“
14	Signalization toggle bit „New measured value probe 2 positive edge“
15	Signalization toggle bit „New measured value probe 2 negative edge“

P0581	Messtaster 1 Winkel positive Flanke	0 to $FFFFFFFF_{hex}$	
-	**Touch probe 1 angle positive edge**	0_{hex}	
A	BM_ud_TouchPr1ValPhiPos	1:1	-

Touch probe 1 (encoder 1) measured value edge positive (rising) edge. In case of triggering by zero pulse, the value is filed here.

P0582	Messtaster 1 Umdrehungen pos. Flanke	0 to FFFFFFFF$_{hex}$	
-	**Touch probe 1 revolutions pos. edge**	0$_{hex}$	
A	BM_ud_TouchPr1ValRevPos	1:1	-

Touch probe 1 (encoder 1) measured value edge positive (rising) edge. In case of triggering by zero pulse, the value is filed here.

P0583	Messtaster 1 Winkel neg. Flanke	0 to FFFFFFFF$_{hex}$	
-	**Touch probe 1 angle neg. edge**	0$_{hex}$	
A	BM_ud_TouchPr1ValPhiNeg	1:1	-

Touch probe 1 (encoder 1) measured edge negative (falling) edge. In case of triggering by zero pulse, nothing is filed here.

P0584	Messtaster 1 Umdrehungen neg. Flanke	0 to FFFFFFFF$_{hex}$	
-	**Touch probe 1 revolutions neg. edge**	0$_{hex}$	
A	BM_ud_TouchPr1ValRevNeg	1:1	-

Touch probe 1 (encoder 1) measured value revolutions negative (falling) edge. In case of triggering by zero pulse, nothing is filed here.

P0585	Messtaster 2 Winkel pos. Flanke	0 to FFFFFFFF$_{hex}$	
-	**Touch probe 2 angle pos. edge**	0$_{hex}$	
A	BM_ud_TouchPr2ValPhiPos	1:1	-

Touch probe 2 (encoder 2) measured value angle positive (rising) edge. In case of triggering by zero pulse, the value is filed here.

P0586	Messtaster 2 Umdrehungen pos. Flanke	0 to FFFFFFFF$_{hex}$	
-	**Touch probe 2 measured value revolutions pos. edge**	0$_{hex}$	
A	BM_ud_TouchPr2ValRevPos	1:1	-

Touch probe 2 (encoder 2) measured value revolutions positive (rising) edge. In case of triggering by zero pulse, the value is filed here.

P0587	Messtaster 2 Winkel neg. Flanke	0 to $FFFFFFFF_{hex}$	
-	**Touch probe 2 measured value angle neg. edge**	0_{hex}	
A	BM_ud_TouchPr2ValPhiNeg	1:1	-

Touch probe 2 (encoder 2) measured edge negative (falling) edge. In case of triggering by zero pulse, nothing is filed here.

P0588	Messtaster 2 Umdrehungen neg. Flanke	0 to $FFFFFFFF_{hex}$	
-	**Touch probe 2 measured value revolutions neg. edge**	0_{hex}	
A	BM_ud_TouchPr2ValRevNeg	1:1	-

Touch probe 2 (encoder 2) measured value revolutions negative (falling) edge. In case of triggering by zero pulse, nothing is filed here.

P0590	PID-Regler Sollwert	-100.00 to 100.00%	
-	**PID controller set value**	0.00 %	
A	BM_di_PrPIDSetValue	40000000_{hex}:100 %	CW

The source of this set value can be selected via source number PID controller set value ▷P1361◁. The PID controller reads the content of the via ▷P1361◁ specified parameter as set value.

If the source has not been selected (▷P1361◁ = 0), the PID controller set value of PLC or analog inputs can be written to.

If the set value is not connected by source number PID controller set value (▷P1361◁ = 0) or is not written to by PLC or analog inputs, remains unchanged.

At the deactivated status of the PID controller the set value of PID controller itself is set with zero.

P0591	PID-Regler Istwert	-100.00 to 100.00%	
-	**PID controller actual value**	0.00 %	
A	BM_di_PrPIDActValue	40000000_{hex}:100 %	CW

The source of this actual value can be selected via source number PID controller actual value ▷P1362◁. The PID controller reads the content of the specified parameter as actual value via ▷P1362◁.

If the source is not selected (▷P1362◁ = 0), the PID controller actual value of PLC or analog inputs can be written to.

If the actual value is not connected by source number PID controller set value (▷P1362◁ = 0) or not is written to by PLC or analog inputs, remains unchanged.
At the deactivated status of the PID controller the actual value of PID controller itself is set with zero.

P0592	PID-Regler Ausgang	-100.00 to 100.00%
-	**PID controller output**	0.00 %
A	BM_di_PrPIDOutput	40000000_{hex}:100 %

The target of the output can be selected via target number PID controller output ▹P1369◃.

At deactivated status of the PID controller the output of PID controller itself is set with zero.

P0593	PID-Regler I-Anteil	-100.00 to 100.00%	
-	**PID controller integral part**	0.00 %	
A	BM_di_PrPIDIntH32	40000000_{hex}:100 %	CW

At deactivated status of PID controller or at the configuration without I controller (▹P1360◃ bit 9 = 0) the integral part of PID controller is reset to zero.

P0594	Motor Kt Adaptionsfaktor-Istwert	75.0 to 125.0%
-	**Motor Kt adaptation factor actual value**	100.0 %
A	BM_u_MotorKtAdaptFactAct	4000_{hex}:100.0 %

(from FW 3.12 and later)

Ratio between the actual torque value of the power balance and of the cross current. The parameter is generated by the adaption of the internal motor torque constant.

If the motor speed is above the speed limit ▹P0112◃, the Kt adaption is active (▹P0350◃ bit 14 = 1) and the Kt adaption factor is determined.

If the motor is below this speed, the adaption is deactivated (▹P0350◃ bit 14 = 0) and the Kt-adaption factor returns to its default value (100%) with the suppression time ▹P0113◃.

The time constant (integral action time) of the Kt adaption is 16 ms.

P0600	Positionierung Zielposition 0	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 0**	0_{hex}	
	BM_ud_PPosTarget0	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

Scaling:
One turn of the motor accords to internally **65536** increments. Within a position set value and a position actual value in the low-word is the motor angle and in the high-word is the number of the whole revolutions.

Revolutions	Angle	
31 … 16	15 … 0	
		Positioning target position X

P0601	Positionierung Zielangabe 0	-2 to 13	
EE	**Positioning target input 0**	0	
	BM_i_PPosTargetInput0	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

The target input determines, how the specified position target is interpreted.

Value	Meaning
-2	Relative to actual position in direction of smaller position set values (flying)
-1	Relative to target position in direction of smaller position set values (normal)
0	Absolute - limited to maximum positioning range
1	Relative to target position in direction of greater position set values (normal)
2	Relative to actual position in direction of greater position set values (flying)
3	Absolute in direction of shorter distance to target. That means, the maximum travel distance can be exceeded (precondition: SW limit switch off!)
4	Relative to the target position (normal) in direction of greater or smaller position set values according to sign of the value of the parameter Relative positioning target position.
5	Absolute - to the next defined angle in direction of greater position set values; from the parameters positioning target position only the angle for the next target position is used.
6	Absolute - to the next defined angle in direction of greater position set values; from the parameters positioning target position only the angle for the next target position is used.
7	Relative to target position (flying) on defined angle in direction of greater or smaller position set values according to the signs of the parameter Relative positioning target position.
8	Absolute positioning, with the shortest possible manner, to the defined angle (only the angle is used for the net target position).
9	CANopen mode: Target input via parameter ▹P0607◃, differentiation absolute/relative target input via control word ▹P0300◃. Shifting range by 2^{31} increments.
10	Differentiation absolute/relative target input via control word ▹P0300◃, target input via parameter ▹P0600◃
11	Modulo positioning in direction of the shorter distance (distance optimized)
12	CANopen mode with the shortest distance at absolute target: Target input via parameter ▹P0607◃, difference absolute/relative target input via the control word (▹P0300◃), range displacement by 2^{31} increments, at absolute target the positioning is made towards the shortest distance to the target (e.g. maximum travel distance can be exceeded; Precondition: SW limit switch off!).
13	Absolute/relative positioning with shortest distance at absolute target: Target input via parameter ▹P0600◃, difference absolute/relative target input via control word (▹P0300◃), at absolute target positioning is made towards the shortest distance to the target (e.g. maximum travel distance can be exceeded; precondition: SW limit switch off!).

Note:

Target input = 7:

In order to calculate the new target position the parameters ’Relative positioning target position’ are used. The bit on the top is the sign. The maximum positioning range per positioning here is ±7FFFFFFF$_{hex}$.

In order to calculate the new target position the actual position value is used (flying).

The new target position calculates itself as follows:

- The angle to be reached is in the low-word of ’Relative positioning target position’ (absolute).

- The revolutions, which still must be reached are in the high-word of 'Relative positioning target position' (relative).
- The direction of positioning is defined via signs of 'Relative positioning target position'.

Target input = 8

Actual target position = 1000 5555_{hex}

Target positioning X = 5000 AAAA $_{hex}$ ▸ High word is not relevant

$AAAA_{hex}$ - 5555_{hex} = 5555_{hex}
▸ less than 8000_{hex}
▸ shorter distance at clockwise rotation
▸ new target position = 1000 AAAA $_{hex}$

Actual target position = 1000 5555_{hex}

Target positioning X = 5000 $FFFF_{hex}$▸ High word is not relevant

$FFFF_{hex}$ - 5555_{hex} = AAAA $_{hex}$
▸ greater than 8000_{hex}
▸ shorter distance at counter-clockwise rot.
▸ new target position = 0FFF $FFFF_{hex}$

Target input = 9:
CANopen mode:
The target input operates in parameter ▹P0607◃ and the differentiation absolute/relative target input operates via bit 6 in the control word (▹P0300◃). At absolute target input a range shift of 2^{31} increments is computed and the number range is interpreted as signed.

Target input = 10:
absolute/relative target input.
The specification if the target is absolute or relative (referring to the last target, is determined over the bit 6 in the control word. If at the rising edge of 'New set value" the bit 6 is set, this is a relative target. If the bit is deleted, this is an absolute target. The target is always specified via ▹P0600◃, at relative target the value then is interpreted signed.

Target input = 11:
This positioning can be used at axes, where an endless positioning (rotary axis operations) is wanted and the target positioning shall be specified in the modulo format. The ratio of an intermediary transmission element (e.g. gear) is considered via the definition of the modulo value range (▹P1239◃ Positioning modulo position). Therefrom the controller calculates the shortest distance to the target position.

If a value is written greater or the same as modulo position into the target position, then at the starting of positioning the error 202 is displayed and it is not started.

The counting of position set values (▹P0463◃) and of position actual values (▹P0462◃) further on occurs in the „normal“ absolute format. The conversion of actual position into the modulo format must occur controller-external.

In order to generate the reference between the normal absolute position format and the modulo format, after switch-on of controller.

- either homing is necessary
- or an absolute value encoder is to be used, whose absolute information is greater than the modulo position.

Target input = 12:
CANopen mode with the shortest distance at absolute target:

The target input operates in parameter ▹P0607◃ and control word (▹P0300◃) bit 6 differs between absolute/relative target input. At absolute target input a range shift of 2^{31} increments is computed and the number range is interpreted as signed. Furthermore the positioning is made at absolute target towards the shortest distance to the target, e.g. the maximum travel range can be exceeded.

Target input = 13:
Absolute / relative positioning with the shortest distance at absolute target:

The specification if the target is absolute or relative (referring to the last target), is determined via the bit 6 in the control word (▹P0300◃). If at the rising edge of 'New set value" the bit 6 was set, this is a relative target. If the bit is deleted, this is an absolute target. At absolute targets the positioning is made towards the shortest distance to the target, e.g. the maximum travel range can be exceeded. The target is always specified via ▹P0600◃, at relative target the value is interpreted signed.

Examples:

- Target input = 5
  - Actual target position = 1000 AAAA$_{hex}$
  - Positioning target position = 1234 5555$_{hex}$ --> high word not relevant
  - → New target position = 1001 5555$_{hex}$
- Target input = 6
  - Actual target position = 3333 2222$_{hex}$
  - Positioning target position = 1234 5555$_{hex}$ --> high word not relevant
  - → New target position = 3332 5555$_{hex}$
- Target input = 7
  - Actual act. position = 1200 8888$_{hex}$
  - Relative positioning target position = 0034 5555$_{hex}$
  - → New target position 1234 5555$_{hex}$
- Example for target input 11:
  - P1239 Positioning Modulo-Position = 00140000$_{hex}$ = 20 revolutions at positioning encoder
  - P0463 Actual set position = 00221111$_{hex}$ in normal absolute format
  - → Conversion of actual set position into the modulo format:
    SetpositionModulo = SetpositionAbsolute mod Modulo-Position
    = 00221111$_{hex}$ mod 00140000$_{hex}$
    = 000E1111$_{hex}$

  First positioning:

  Positioning target position = 00063333$_{hex}$ in the modulo format

  → New target position is calculated via the shortest distance

  distance to the „right“ (greater position set values)

  Distance$_{right}$ = Modulo-position - NewTargetPosition + TargetPositionModulo
  = 00140000$_{hex}$ - 000E1111$_{hex}$ + 00063333$_{hex}$ = 000C2222$_{hex}$

  Distance to „left“ (smaller position set values)

$Distance_{Left}$ = TargetPositionModulo - NewTargetPosition
= $000E1111_{hex}$ - 00063333_{hex} = $0007DDDE_{hex}$

→ $Distance_{Left}$ < $Distance_{Right}$

→ Positioning to the left

→ New target position in the normal absolute format:

TargetPositionAbsolute = SetpositionAbsolute - DistanceLeft
= 00221111_{hex} - $0007DDDE_{hex}$
= $001A3333_{hex}$

Second positioning:

Next target position = 00084444_{hex} in the modulo-format

$Distance_{Right}$ = 00084444_{hex} - 00063333_{hex} = 00021111_{hex}

$Distance_{Left}$ = 00140000_{hex} - 00084444_{hex} + 00063333_{hex} = $0011EEEF_{hex}$

→ $Distance_{Left}$ > $Distance_{Right}$

→ Positioning to the right

→ New target position in the normal absolute format:

TargetPositionAbsolute = SetpositionAbsolute + $Distance_{Right}$
= $001A3333_{hex}$ + 00021111_{hex}
= $001C4444_{hex}$

P0602

	Positionierung Positioniergeschwindigkeit 0	1 to 13200 Inc/ms	
EE	**Positioning speed 0**	100 Inc/ms	
	BM_u_PPosSetSpeed0	1:1 Inc/ms	CW

Also see ▷Operating mode target position set value (1)◁ from page 269.

The positioning speed is the term for the maximum positioning speed of the drive in operation mode 'positioning'.

P0603

	Positionierung Positionierbeschleunigung 0	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 0**	2.00 Inc/ms²	
	BM_u_PPosAcceleration0	100:1 Inc/ms²	CW

Also see ▷Operating mode target position set value (1)◁ from page 269.

Maximum acceleration of drive in operation mode 'positioning'. This parameter can only be changed in steps of 0,25.

P0604	Positionierung Positionierverzögerung 0	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 0**	2.00 Inc/ms²	
	BM_u_PPosDeceleration0	100:1 Inc/ms²	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

Analog to the maximum acceleration, the positioning deceleration describes the maximum deceleration of the drive in the operation mode positioning.

P0605	Positionierung maximaler Ruck 0	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 0**	1.25 Inc/ms^3	
	BM_u_PPosBend0	100:1 Inc/ms³	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

With this parameter the maximum jerk (change of acceleration) for the S-curve profile (jerk-limited positioning) is set. At usage of time-optimum positioning (trapezoidal profile) this parameter has no effects.

Example:

▹P0605◃ = 0,25 Inc/ms^3 (maximum jerk)

▹P0603◃ = 10.00 Inc/ms^2 (permissible acceleration)

Duration after which acceleration is reached:

$$t = \frac{10,00\frac{Inc}{ms^2}}{0,25\frac{Inc}{ms^3}} = 40\ ms$$

P0606	Positionierung Verschliffzeit 0	0 to 8191 ms	
EE	**Positioning smoothing time 0**	0 ms	
	BM_u_PPosSmooth0	1:1 ms	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

In order to achieve a smoothing of the travel ramp edges, a PT_1-element has been implemented. With this parameter the time constant of the PT_1-element can be set, if time optimal positioning (▹P1190◃ positioning mode bit 2 = 0) is activated.

If the setting reads 0 ms, smoothing is switched off.

P0607	Relative Positionierung Zielposition 0	-2147483648 to 2147483647	
EE	**Relative positioning control target position 0**	0	
	BM_di_PPosRelTarget0	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

Relative signed target position for positioning data set 0. This parameter is only valid for target “4: relative with signs”, “7: relative with absolute angle” and “9: CANopen-Mode”. The value sign of the of this parameter determines the direction of the positioning.

In the CANopen mode the parameter is also used for absolute target inputs. In this case a range shift is calculated.

P0610	Positionierung Zielposition 1	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 1**	0_{hex}	
	BM_ud_PPosTarget1	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0611	Positionierung Zielangabe 1	-2 to 13	
EE	**Positioning target input 1**	0	
	BM_i_PPosTargetInput1	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0612	Positionierung Positioniergeschwindigkeit 1	1 to 13200 Inc/ms	
EE	**Positioning speed 1**	100 Inc/ms	
	BM_u_PPosSetSpeed1	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0613	Positionierung Positionierbeschleunigung 1	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 1**	2.00 Inc/ms²	
	BM_u_PPosAcceleration1	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0614	Positionierung Positionierverzögerung 1	0.25 to 450.00 Inc/ms^2	
EE	**Positioning deceleration 1**	2.00 Inc/ms^2	
	BM_u_PPosDeceleration1	100:1 Inc/ms^2	CW

Description of the parameters see ▷P0604◁ on page 505.

P0615	Positionierung maximaler Ruck 1	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 1**	1.25 Inc/ms^3	
	BM_u_PPosBend1	100:1 Inc/ms^3	CW

Description of the parameters see ▷P0605◁ on page 505.

P0616	Positionierung-Verschliffzeit 1	0 to 8191 ms	
EE	**Positioning smoothing time 1**	0 ms	
	BM_u_PPosSmooth1	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0617	Relative Positionierung Zielposition 1	-2147483648 to 2147483647	
EE	**Relative positioning control target position 1**	0	
	BM_di_PPosRelTarget1	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0620	Positionierung Zielposition 2	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 2**	0$_{hex}$	
	BM_ud_PPosTarget2	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0621	Positionierung Zielangabe 2	-2 to 13	
EE	**Positioning target input 2**	0	
	BM_i_PPosTargetInput2	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0622	Positionierung Positioniergeschwindigkeit 2	1 to 13200 Inc/ms	
EE	**Positioning speed 2**	100 Inc/ms	
	BM_u_PPosSetSpeed2	1:1 Inc/ms	CW

Description of the parameters see ▷P0602◁ on page 504.

P0623	Positionierung Positionierbeschleunigung 2	0.25 to 450.00 Inc/ms^2	
EE	**Positioning acceleration 2**	2.00 Inc/ms^2	
	BM_u_PPosAcceleration2	100:1 Inc/ms^2	CW

Description of the parameters see ▷P0603◁ on page 504.

P0624	Positionierung Positionierverzögerung 2	0.25 to 450.00 Inc/ms^2	
EE	**Positioning deceleration 2**	2.00 Inc/ms^2	
	BM_u_PPosDeceleration2	100:1 Inc/ms^2	CW

Description of the parameters see ▷P0604◁ on page 505.

P0625	Positionierung maximaler Ruck 2	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 2**	1.25 Inc/ms^3	
	BM_u_PPosBend2	100:1 Inc/ms^3	CW

Description of the parameters see ▷P0605◁ on page 505.

P0626	Positionierung-Verschliffzeit 2	0 to 8191 ms	
EE	**Positioning smoothing time 2**	0 ms	
	BM_u_PPosSmooth2	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0627	Relative Positionierung Zielposition 2	-2147483648 to 2147483647	
EE	**Relative positioning control target position 2**	0	
	BM_di_PPosRelTarget2	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0630	Positionierung Zielposition 3	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 3**	0$_{hex}$	
	BM_ud_PPosTarget3	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0631	Positionierung Zielangabe 3	-2 to 13	
EE	**Positioning target input 3**	0	
	BM_i_PPosTargetInput3	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0632	Positionierung Positioniergeschwindigkeit 3	1 to 13200 Inc/ms	
EE	**Positioning speed 3**	100 Inc/ms	
	BM_u_PPosSetSpeed3	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0633	Positionierung Positionierbeschleunigung 3	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 3**	2.00 Inc/ms²	
	BM_u_PPosAcceleration3	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0634	Positionierung Positionierverzögerung 3	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 3**	2.00 Inc/ms²	
	BM_u_PPosDeceleration3	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0635	Positionierung maximaler Ruck 3	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 3**	1.25 Inc/ms³	
	BM_u_PPosBend3	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0636	Positionierung-Verschliffzeit 3	0 to 8191 ms	
EE	**Positioning smoothing time 3**	0 ms	
	BM_u_PPosSmooth3	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0637	Relative Positionierung Zielposition 3	-2147483648 to 2147483647	
EE	**Relative positioning control target position 3**	0	
	BM_di_PPosRelTarget3	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0640	Positionierung Zielposition 4	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 4**	0_{hex}	
	BM_ud_PPosTarget4	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0641	Positionierung Zielangabe 4	-2 to 13	
EE	**Positioning target input 4**	0	
	BM_i_PPosTargetInput4	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0642	Positionierung Positioniergeschwindigkeit 4	1 to 13200 Inc/ms	
EE	**Positioning speed 4**	100 Inc/ms	
	BM_u_PPosSetSpeed4	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0643	Positionierung Positionierbeschleunigung 4	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 4**	2.00 Inc/ms²	
	BM_u_PPosAcceleration4	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0644	Positionierung Positionierverzögerung 4	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 4**	2.00 Inc/ms²	
	BM_u_PPosDeceleration4	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0645	Positionierung maximaler Ruck 4	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 4**	1.25 Inc/ms³	
	BM_u_PPosBend4	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0646	Positionierung-Verschliffzeit 4	0 to 8191 ms	
EE	**Positioning smoothing time 4**	0 ms	
	BM_u_PPosSmooth4	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0647	Relative Positionierung Zielposition 4	-2147483648 to 2147483647	
EE	**Relative positioning control target position 4**	0	
	BM_di_PPosRelTarget4	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0650	Positionierung Zielposition 5	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 5**	0_{hex}	
	BM_ud_PPosTarget5	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0651	Positionierung Zielangabe 5	-2 to 13	
EE	**Positioning target input 5**	0	
	BM_i_PPosTargetInput5	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0652	Positionierung Positioniergeschwindigkeit 5	1 to 13200 Inc/ms	
EE	**Positioning speed 5**	100 Inc/ms	
	BM_u_PPosSetSpeed5	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0653	Positionierung Positionierbeschleunigung 5	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 5**	2.00 Inc/ms²	
	BM_u_PPosAcceleration5	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0654	Positionierung Positionierverzögerung 5	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 5**	2.00 Inc/ms²	
	BM_u_PPosDeceleration5	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0655	Positionierung maximaler Ruck 5	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 5**	1.25 Inc/ms³	
	BM_u_PPosBend5	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0656	Positionierung-Verschliffzeit 5	0 to 8191 ms	
EE	**Positioning smoothing time 5**	0 ms	
	BM_u_PPosSmooth5	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0657	Relative Positionierung Zielposition 5	-2147483648 to 2147483647	
EE	**Relative positioning control target position 5**	0	
	BM_di_PPosRelTarget5	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0660	Positionierung Zielposition 6	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 6**	0$_{hex}$	
	BM_ud_PPosTarget6	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0661	Positionierung Zielangabe 6	-2 to 13	
EE	**Positioning target input 6**	0	
	BM_i_PPosTargetInput6	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0662	Positionierung Positioniergeschwindigkeit 6	1 to 13200 Inc/ms	
EE	**Positioning speed 6**	100 Inc/ms	
	BM_u_PPosSetSpeed6	1:1 Inc/ms	CW

Description of the parameters see ▷P0602◁ on page 504.

P0663	Positionierung Positionierbeschleunigung 6	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 6**	2.00 Inc/ms²	
	BM_u_PPosAcceleration6	100:1 Inc/ms²	CW

Description of the parameters see ▷P0603◁ on page 504.

P0664	Positionierung Positionierverzögerung 6	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 6**	2.00 Inc/ms²	
	BM_u_PPosDeceleration6	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0665	Positionierung maximaler Ruck 6	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 6**	1.25 Inc/ms³	
	BM_u_PPosBend6	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0666	Positionierung-Verschliffzeit 6	0 to 8191 ms	
EE	**Positioning smoothing time 6**	0 ms	
	BM_u_PPosSmooth6	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0667	Relative Positionierung Zielposition 6	-2147483648 to 2147483647	
EE	**Relative positioning control target position 6**	0	
	BM_di_PPosRelTarget6	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0670	Positionierung Zielposition 7	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 7**	0_{hex}	
	BM_ud_PPosTarget7	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0671	Positionierung Zielangabe 7	-2 to 13	
EE	**Positioning target input 7**	0	
	BM_i_PPosTargetInput7	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0672	Positionierung Positioniergeschwindigkeit 7	1 to 13200 Inc/ms	
EE	**Positioning speed 7**	100 Inc/ms	
	BM_u_PPosSetSpeed7	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0673	Positionierung Positionierbeschleunigung 7	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 7**	2.00 Inc/ms²	
	BM_u_PPosAcceleration7	100:1 Inc/ms	CW

Description of the parameters see ▹P0603◃ on page 504.

P0674	Positionierung Positionierverzögerung 7	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 7**	2.00 Inc/ms²	
	BM_u_PPosDeceleration7	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0675	Positionierung maximaler Ruck 7	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 7**	1.25 Inc/ms³	
	BM_u_PPosBend7	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0676	Positionierung-Verschliffzeit 7	0 to 8191 ms	
EE	**Positioning smoothing time 7**	0 ms	
	BM_u_PPosSmooth7	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0677	Relative Positionierung Zielposition 7	-2147483648 to 2147483647	
EE	**Relative positioning control target position 7**	0	
	BM_di_PPosRelTarget7	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0680	Positionierung Zielposition 8	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 8**	0_{hex}	
	BM_ud_PPosTarget8	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0681	Positionierung Zielangabe 8	-2 to 13	
EE	**Positioning target input 8**	0	
	BM_i_PPosTargetInput8	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0682	Positionierung Positioniergeschwindigkeit 8	1 to 13200 Inc/ms	
EE	**Positioning speed 8**	100 Inc/ms	
	BM_u_PPosSetSpeed8	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0683	Positionierung Positionierbeschleunigung 8	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 8**	2.00 Inc/ms²	
	BM_u_PPosAcceleration8	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0684	Positionierung Positionierverzögerung 8	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 8**	2.00 Inc/ms²	
	BM_u_PPosDeceleration8	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0685	Positionierung maximaler Ruck 8	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 8**	1.25 Inc/ms³	
	BM_u_PPosBend8	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0686	Positionierung-Verschliffzeit 8	0 to 8191 ms	
EE	**Positioning smoothing time 8**	0 ms	
	BM_u_PPosSmooth8	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0687	Relative Positionierung Zielposition 8	-2147483648 to 2147483647	
EE	**Relative positioning control target position 8**	0	
	BM_di_PPosRelTarget8	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0690	Positionierung Zielposition 9	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 9**	0$_{hex}$	
	BM_ud_PPosTarget9	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0691	Positionierung Zielangabe 9	-2 to 13	
EE	**Positioning target input 9**	0	
	BM_i_PPosTargetInput9	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0692	Positionierung Positioniergeschwindigkeit 9	1 to 13200 Inc/ms	
EE	**Positioning speed 9**	100 Inc/ms	
	BM_u_PPosSetSpeed9	1:1 Inc/ms	CW

Description of the parameters see ▷P0602◁ on page 504.

P0693	Positionierung Positionierbeschleunigung 9	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 9**	2.00 Inc/ms²	
	BM_u_PPosAcceleration9	100:1 Inc/ms²	CW

Description of the parameters see ▷P0603◁ on page 504.

P0694	Positionierung Positionierverzögerung 9	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 9**	2.00 Inc/ms²	
	BM_u_PPosDeceleration9	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0695	Positionierung maximaler Ruck 9	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 9**	1.25 Inc/ms^3	
	BM_u_PPosBend9	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0696	Positionierung-Verschliffzeit 9	0 to 8191 ms	
EE	**Positioning smoothing time 9**	0 ms	
	BM_u_PPosSmooth9	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0697	Relative Positionierung Zielposition 9	-2147483648 to 2147483647	
EE	**Relative positioning control target position 9**	0	
	BM_di_PPosRelTarget9	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0700	Positionierung Zielposition 10	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 10**	0_{hex}	
	BM_ud_PPosTarget10	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0701	Positionierung Zielangabe 10	-2 to 13	
EE	**Positioning target input 10**	0	
	BM_i_PPosTargetInput10	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0702	Positionierung Positioniergeschwindigkeit 10	1 to 13200 Inc/ms	
EE	**Positioning speed 10**	100 Inc/ms	
	BM_u_PPosSetSpeed10	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0703	Positionierung Positionierbeschleunigung 10	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 10**	2.00 Inc/ms²	
	BM_u_PPosAcceleration10	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0704	Positionierung Positionierverzögerung 10	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 10**	2.00 Inc/ms²	
	BM_u_PPosDeceleration10	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0705	Positionierung maximaler Ruck 10	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 10**	1.25 Inc/ms^3	
	BM_u_PPosBend10	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0706	Positionierung-Verschliffzeit 10	0 to 8191 ms	
EE	**Positioning smoothing time 10**	0 ms	
	BM_u_PPosSmooth10	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0707	Relative Positionierung Zielposition 10	-2147483648 to 2147483647	
EE	**Relative positioning control target position 10**	0	
	BM_di_PPosRelTarget10	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0710	Positionierung Zielposition 11	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 11**	0$_{hex}$	
	BM_ud_PPosTarget11	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0711	Positionierung Zielangabe 11	-2 to 13	
EE	**Positioning target input 11**	0	
	BM_i_PPosTargetInput11	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0712	Positionierung Positioniergeschwindigkeit 11	1 to 13200 Inc/ms	
EE	**Positioning speed 11**	100 Inc/ms	
	BM_u_PPosSetSpeed11	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0713	Positionierung Positionierbeschleunigung 11	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 11**	2.00 Inc/ms²	
	BM_u_PPosAcceleration11	100:1 Inc/ms	CW

Description of the parameters see ▹P0603◃ on page 504.

P0714	Positionierung Positionierverzögerung 11	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 11**	2.00 Inc/ms²	
	BM_u_PPosDeceleration11	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0715	Positionierung maximaler Ruck 11	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 11**	1.25 Inc/ms³	
	BM_u_PPosBend11	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0716	Positionierung-Verschliffzeit 11	0 to 8191 ms	
EE	**Positioning smoothing time 11**	0 ms	
	BM_u_PPosSmooth11	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0717	Relative Positionierung Zielposition 11	-2147483648 to 2147483647	
EE	**Relative positioning control target position 11**	0	
	BM_di_PPosRelTarget11	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0720	Positionierung Zielposition 12	0 to FFFFFFFF$_{hex}$	
EE	**Positioning target position 12**	0$_{hex}$	
	BM_ud_PPosTarget12	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0721	Positionierung Zielangabe 12	-2 to 13	
EE	**Positioning target input 12**	0	
	BM_i_PPosTargetInput12	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0722	Positionierung Positioniergeschwindigkeit 12	1 to 13200 Inc/ms	
EE	**Positioning speed 12**	100 Inc/ms	
	BM_u_PPosSetSpeed12	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0723	Positionierung Positionierbeschleunigung 12	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 12**	2.00 Inc/ms²	
	BM_u_PPosAcceleration12	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0724	Positionierung Positionierverzögerung 12	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 12**	2.00 Inc/ms²	
	BM_u_PPosDeceleration12	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0725	Positionierung maximaler Ruck 12	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 12**	1.25 Inc/ms^3	
	BM_u_PPosBend12	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0726 Positionierung-Verschliffzeit 12 0 to 8191 ms

EE **Positioning smoothing time 12** 0 ms

BM_u_PPosSmooth12 1:1 ms CW

Description of the parameters see ▹P0606◃ on page 505.

P0727 Relative Positionierung Zielposition 12 -2147483648 to 2147483647

EE **Relative positioning control target position 12** 0

BM_di_PPosRelTarget12 1:1 CW

Description of the parameters see ▹P0607◃ on page 506.

P0730 Positionierung Zielposition 13 0 to FFFFFFFF_{hex}

EE **Positioning target position 13** 0_{hex}

BM_ud_PPosTarget13 1:1 CW

Description of the parameters see ▹P0600◃ on page 500.

P0731 Positionierung Zielangabe 13 -2 to 13

EE **Positioning target input 13** 0

BM_i_PPosTargetInput13 1:1 CW

Description of the parameters see ▹P0601◃ on page 501.

P0732 Positionierung Positioniergeschwindigkeit 13 1 to 13200 Inc/ms

EE **Positioning speed 13** 100 Inc/ms

BM_u_PPosSetSpeed13 1:1 Inc/ms CW

Description of the parameters see ▹P0602◃ on page 504.

P0733 Positionierung Positionierbeschleunigung 13 0.25 to 450.00 Inc/ms²

EE **Positioning acceleration 13** 2.00 Inc/ms²

BM_u_PPosAcceleration13 100:1 Inc/ms² CW

Description of the parameters see ▹P0603◃ on page 504.

P0734	Positionierung Positionierverzögerung 13	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 13**	2.00 Inc/ms²	
	BM_u_PPosDeceleration13	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0735	Positionierung maximaler Ruck 13	0.07 to 14.00 Inc/ms^3	
EE	**Positioning maximum jerk 13**	1.25 Inc/ms^3	
	BM_u_PPosBend13	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0736	Positionierung-Verschliffzeit 13	0 to 8191 ms	
EE	**Positioning smoothing time 13**	0 ms	
	BM_u_PPosSmooth13	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0737	Relative Positionierung Zielposition 13	-2147483648 to 2147483647	
EE	**Relative positioning control target position 13**	0	
	BM_di_PPosRelTarget13	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0740	Positionierung Zielposition 14	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 14**	0_{hex}	
	BM_ud_PPosTarget14	1:1	CW

Description of the parameters see ▷P0600◁ on page 500.

P0741	Positionierung Zielangabe 14	-2 to 13	
EE	**Positioning target input 14**	0	
	BM_i_PPosTargetInput14	1:1	CW

Description of the parameters see ▷P0601◁ on page 501.

P0742	Positionierung Positioniergeschwindigkeit 14	1 to 13200 Inc/ms	
EE	**Positioning speed 14**	100 Inc/ms	
	BM_u_PPosSetSpeed14	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0743	Positionierung Positionierbeschleunigung 14	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 14**	2.00 Inc/ms²	
	BM_u_PPosAcceleration14	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0744	Positionierung Positionierverzögerung 14	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 14**	2.00 Inc/ms²	
	BM_u_PPosDeceleration14	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0745	Positionierung maximaler Ruck 14	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 14**	1.25 Inc/ms³	
	BM_u_PPosBend14	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0746	Positionierung-Verschliffzeit 14	0 to 8191 ms	
EE	**Positioning smoothing time 14**	0 ms	
	BM_u_PPosSmooth14	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0747	Relative Positionierung Zielposition 14	-2147483648 to 2147483647	
EE	**Relative positioning control target position 14**	0	
	BM_di_PPosRelTarget14	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0750

EE

Positionierung Zielposition 15	0 to FFFFFFFF$_{hex}$	
Positioning target position 15	0$_{hex}$	
BM_ud_PPosTarget15	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0751

EE

Positionierung Zielangabe 15	-2 to 13	
Positioning target input 15	0	
BM_i_PPosTargetInput15	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0752

EE

Positionierung Positioniergeschwindigkeit 15	1 to 13200 Inc/ms	
Positioning speed 15	100 Inc/ms	
BM_u_PPosSetSpeed15	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0753

EE

Positionierung Positionierbeschleunigung 15	0.25 to 450.00 Inc/ms²	
Positioning acceleration 15	2.00 Inc/ms²	
BM_u_PPosAcceleration15	100: 1Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0754

EE

Positionierung Positionierverzögerung 15	0.25 to 450.00 Inc/ms²	
Positioning deceleration 15	2.00 Inc/ms²	
BM_u_PPosDeceleration15	100:1 Inc/ms²	CW

Description of the parameters see ▹P0604◃ on page 505.

P0755

EE

Positionierung maximaler Ruck 15	0.07 to 14.00 Inc/ms^3	
Positioning maximum jerk 15	1.25 Inc/ms^3	
BM_u_PPosBend15	100:1 Inc/ms³	CW

Description of the parameters see ▹P0605◃ on page 505.

P0756	Positionierung-Verschliffzeit 15	0 to 8191 ms	
EE	**Positioning smoothing time 15**	0 ms	
	BM_u_PPosSmooth15	1:1 ms	CW

Description of the parameters see ▹P0606◃ on page 505.

P0757	Relative Positionierung Zielposition 15	-2147483648 to 2147483647	
EE	**Relative positioning control target position 15**	0	
	BM_di_PPosRelTarget15	1:1	CW

Description of the parameters see ▹P0607◃ on page 506.

P0760	Positionierung Zielposition 16	0 to $FFFFFFFF_{hex}$	
EE	**Positioning target position 16**	0_{hex}	
	BM_ud_PPosTarget16	1:1	CW

Description of the parameters see ▹P0600◃ on page 500.

P0761	Positionierung Zielangabe 16	-2 to 13	
EE	**Positioning target input 16**	0	
	BM_i_PPosTargetInput16	1:1	CW

Description of the parameters see ▹P0601◃ on page 501.

P0762	Positionierung Positioniergeschwindigkeit 16	1 to 13200 Inc/ms	
EE	**Positioning speed 16**	100 Inc/ms	
	BM_u_PPosSetSpeed16	1:1 Inc/ms	CW

Description of the parameters see ▹P0602◃ on page 504.

P0763	Positionierung Positionierbeschleunigung 16	0.25 to 450.00 Inc/ms²	
EE	**Positioning acceleration 16**	2.00 Inc/ms²	
	BM_u_PPosAcceleration16	100:1 Inc/ms²	CW

Description of the parameters see ▹P0603◃ on page 504.

P0764	Positionierung Positionierverzögerung 16	0.25 to 450.00 Inc/ms²	
EE	**Positioning deceleration 16**	2.00 Inc/ms²	
	BM_u_PPosDeceleration16	100:1 Inc/ms²	CW

Description of the parameters see ▷P0604◁ on page 505.

P0765	Positionierung maximaler Ruck 16	0.07 to 14.00 Inc/ms³	
EE	**Positioning maximum jerk 16**	1.25 Inc/ms³	
	BM_u_PPosBend16	100:1 Inc/ms³	CW

Description of the parameters see ▷P0605◁ on page 505.

P0766	Positionierung-Verschliffzeit 16	0 to 8191 ms	
EE	**Positioning smoothing time 16**	0 ms	
	BM_u_PPosSmooth16	1:1 ms	CW

Description of the parameters see ▷P0606◁ on page 505.

P0767	Relative Positionierung Zielposition 16	-2147483648 to 2147483647	
EE	**Relative positioning control target position 16**	0	
	BM_di_PPosRelTarget16	1:1	CW

Description of the parameters see ▷P0607◁ on page 506.

P0800

	Optionsmodul 1 Master 1 Zykluszeit	0 to 32000 µs	
EE	**Option module 1 master 1 cycle time**	4000 µs	
PO	BM_u_Baci1M1Period	1:125 µs	-

This parameter is accepted after switching on, it also can be changed by the option module, but then it only acts as display.

This parameter specifies with which cycle time the new set values/actual values are transmitted. The value refers to a multiple of 125 µs.

Value	Meaning
0	no cyclic data exchange
1	not permissible
2	250 µs
3	375 µs
and so on	

P0801

	Optionsmodul 1 Master 1 Para-Nummer Sollwert 1	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 1**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal1	1:1	-

Configuration for the selected option module by parameter option module selection (▷P0827◁).

Parameter of the 1st set value (1 ... 8) for the cyclic communication. Only the numbers of the parameters may be specified, which are cyclic writable (attribute CW).

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0802

	Optionsmodul 1 Master 1 Para-Nummer Sollwert 2	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 2**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal2	1:1	-

2nd set value. Description of the parameters see ▷P0801◁ on page 528.

P0803

	Optionsmodul 1 Master 1 Para-Nummer Sollwert 3	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 3**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal3	1:1	-

3rd set value. Description of the parameters see ▷P0801◁ on page 528.

P0804	Optionsmodul 1 Master 1 Para-Nummer Sollwert 4	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 4**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal4	1:1	-

4th set value. Description of the parameters see ▷P0801◁ on page 528.

P0805	Optionsmodul 1 Master 1 Para-Nummer Sollwert 5	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 5**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal5	1:1	-

5th set value. Description of the parameters see ▷P0801◁ on page 528.

P0806	Optionsmodul 1 Master 1 Para-Nummer Sollwert 6	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 6**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal6	1:1	-

6th set value. Description of the parameters see ▷P0801◁ on page 528.

P0807	Optionsmodul 1 Master 1 Para-Nummer Sollwert 7	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 7**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal7	1:1	-

7th set value. Description of the parameters see ▷P0801◁ on page 528.

P0808	Optionsmodul 1 Master 1 Para-Nummer Sollwert 8	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. set value 8**	0$_{hex}$	
PO	BM_u_Baci1M1SetVal8	1:1	-

8th set value. Description of the parameters see ▷P0801◁ on page 528.

P0809	Optionsmodul 1 Master 1 Para-Nummer Istwert 1	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 1**	0$_{hex}$	
PO	BM_u_Baci1M1ActVal1	1:1	-

Configuration for the selected option module by parameter option module selection (▷P0827◁).

Parameter of the actual value (1 ... 8) for the cyclic communication. The parameter specified by the number must be data type INT, UINT, DINT, UDINT, WORD or DWORD.

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0810	Optionsmodul 1 Master 1 Para-Nummer Istwert 2	0 to $FFFF_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 2**	0_{hex}	
PO	BM_u_Baci1M1ActVal2	1:1	-

2nd actual value. Description of the parameters see ▹P0809◃ on page 529.

P0811	Optionsmodul 1 Master 1 Para-Nummer Istwert 3	0 to $FFFF_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 3**	0_{hex}	
PO	BM_u_Baci1M1ActVal3	1:1	-

3rd actual value. Description of the parameters see ▹P0809◃ on page 529.

P0812	Optionsmodul 1 Master 1 Para-Nummer Istwert 4	0 to $FFFF_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 4**	0_{hex}	
PO	BM_u_Baci1M1ActVal4	1:1	-

4th actual value. Description of the parameters see ▹P0809◃ on page 529.

P0813	Optionsmodul 1 Master 1 Para-Nummer Istwert 5	0 to $FFFF_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 5**	0_{hex}	
PO	BM_u_Baci1M1ActVal5	1:1	-

5th actual value. Description of the parameters see ▹P0809◃ on page 529.

P0814	Optionsmodul 1 Master 1 Para-Nummer Istwert 6	0 to $FFFF_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 6**	0_{hex}	
PO	BM_u_Baci1M1ActVal6	1:1	-

6th actual value. Description of the parameters see ▹P0809◃ on page 529.

P0815	Optionsmodul 1 Master 1 Para-Nummer Istwert 7	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 7**	0$_{hex}$	
PO	BM_u_Baci1M1ActVal7	1:1	-

7th actual value. Description of the parameters see ▹P0809◃ on page 529.

P0816	Optionsmodul 1 Master 1 Para-Nummer Istwert 8	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 parameter no. act value 8**	0$_{hex}$	
PO	BM_u_Baci1M1ActVal8	1:1	-

8th actual value. Description of the parameters see ▹P0809◃ on page 529.

P0817	Optionsmodul 1 Master 1 Trigger-Offset	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 trigger offset**	0$_{hex}$	
PO	BM_u_Baci1M1TriggOffset	1:1	-

Not yet implemented.

P0818	Optionsmodul 1 Master 1 Zyklus-Offset Sollwerte	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 cycle offset set values**	2	
PO	BM_u_Baci1M1CycleSetOffset	1:1	-

Configuration for the selected option module by parameter option module selection (▹P0827◃).

Cycle offset for set value transmission. Exact description see software module BACI.

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0819	Optionsmodul 1 Master 1 Zyklus-Offset Istwerte	0 to FFFF$_{hex}$	
EE	**Option module 1 master 1 cycle offset act. values**	0$_{hex}$	
PO	BM_u_Baci1M1CycleActOffset	1:1	-

Configuration for the selected option module by parameter option module selection (▹P0827◃).

Cycle offset for actual value transmission. Exact description see software module BACI

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0821

P0821	Hardware Konfiguration Modul G	0 to FFFFFFFF$_{hex}$	
EE	**Hardware configuration module G**	0	
PO	BM_d_HwConfigModuleG	1:1	-

This parameter is used for configuration of option modules.

P0822

P0822	Hardware Konfiguration Modul H	0 to FFFFFFFF$_{hex}$	
EE	**Hardware configuration module H**	0	
PO	BM_d_HwConfigModuleH	1:1	-

This parameter is used for configuration of option modules.

P0827

P0827	Optionsmodul Auswahl	0 to 6	
EE	**Option module selection**	0	
PO	BM_u_BaciModuleSelect	1:1	-

The controller only evaluates this parameter after the switching off/switching on of the system.

The controller has two separate configuration parameter blocks:
- BACI1-master1-parameters (▹P0800◃ to ▹P0819◃) and
- BACI2-master1-parameters (▹P0860◃ to ▹P0879◃)

This parameter acts as an allocation between option module slot and one or both BACI configuration parameter blocks according to the following table:

Value	Slave G	Slave H	Allocation of the BACI configuration parameters
0	X	-	▹P0800◃ to ▹P0819◃ are valid for the slave on slot G
	-	X	▹P0800◃ to ▹P0819◃ are valid for the slave on slot H
	X	X	▹P0800◃ to ▹P0819◃ are valid for the slave on slot G ▹P0860◃ to ▹P0879◃ are valid for the slave on slot H
1	X	-	▹P0800◃ to ▹P0819◃ are valid for the slave on slot G
	-	X	▹P0860◃ to ▹P0879◃ are valid for the slave on slot H
	X	X	▹P0800◃ to ▹P0819◃ are valid for the slave on slot G ▹P0860◃ to ▹P0879◃ are valid for the slave on slot H
2	X	-	▹P0860◃ to ▹P0879◃ are valid for the slave on slot G
	-	X	▹P0800◃ to ▹P0819◃ are valid for the slave on slot H
	X	X	▹P0860◃ to ▹P0879◃ are valid for the slave on slot G ▹P0800◃ to ▹P0819◃ are valid for the slave on slot H
3 to 65535			Reserved

P0830	Optionsmodul G Konfiguration 1	0 to $FFFF_{hex}$	
EE	**Option module G configuration 1**	0_{hex}	
PO	BM_w_BaciSlaveGConfig1	1:1	-

First word for the software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0831	Optionsmodul G Konfiguration 2	0 to $FFFF_{hex}$	
EE	**Option module G configuration 2**	0_{hex}	
PO	BM_w_BaciSlaveGConfig2	1:1	-

Second word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0832	Optionsmodul G Konfiguration 3	0 to $FFFF_{hex}$	
EE	**Option module G configuration 3**	0_{hex}	
PO	BM_w_BaciSlaveGConfig3	1:1	-

Third word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0833	Optionsmodul G Konfiguration 4	0 to FFFF$_{hex}$	
EE	**Option module G configuration 4**	0$_{hex}$	
PO	BM_w_BaciSlaveGConfig4	1:1	-

Fourth word acts as software module configuration of the optional module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0834	Optionsmodul G Konfiguration 5	0 to FFFF$_{hex}$	
EE	**Option module G configuration 5**	0$_{hex}$	
PO	BM_w_BaciSlaveGConfig5	1:1	-

Fifth word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0835	Optionsmodul G Konfiguration 6	0 to FFFF$_{hex}$	
EE	**Option module G configuration 6**	0$_{hex}$	
PO	BM_w_BaciSlaveGConfig6	1:1	-

Sixth word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0836	Optionsmodul G Konfiguration 7	0 to $FFFF_{hex}$	
EE	**Option module G configuration 7**	0_{hex}	
PO	BM_w_BaciSlaveGConfig7	1:1	-

Seventh word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0837	Optionsmodul G Konfiguration 8	0 to $FFFF_{hex}$	
EE	**Option module G configuration 8**	0_{hex}	
PO	BM_w_BaciSlaveGConfig8	1:1	-

Eighth word acts as software module configuration of the option module on slot G. The meaning of the parameter is module-dependent.

NOTE!

The exact use of the parameter is described in the technical manual according to the option module.

P0838	Timeout Hochlaufphase der BACI-Initialisierung	0 to 65535 s	
EE	**BACI Setup Timeout**	60 s	
PO	BM_u_BaciSetupTimeout	1:1 s	-

Timeout value for the time-monitoring of the configuration phase after a system-starting. If the value = 0, there is no time monitoring.

P0839	Timeout für zyklische BACI-Kommunikation	0 to 65535 ms	
EE	**BACI Cyclic Communication Timeout**	50 ms	
PO	BM_u_BaciCyclicTimeout	1:1 ms	-

Timeout value for the time monitoring of the cyclic communication in the running operation.
The controller monitors the cyclic communication over a timeout mechanism. A timeout-counter starts at the first successful cyclic set value transmission. Every further successful cyclic set value transmission retriggers this time counter.

The setting of the according error reaction is made with parameter Error reaction for BACI communication ▹P0298◃ on page 413.

If the value = 0 there is no time monitoring.

P0840	Optionsmodul H Konfiguration 1	0 to $FFFF_{hex}$	
EE	**Option module H configuration 1**	0_{hex}	
PO	BM_w_BaciSlaveHConfig1	1:1	-

First word acts as software module configuration of the optional module on slot H. The meaning of the parameter is module-dependent see parameter ▹P0830◃ on page 533.

P0841	Optionsmodul H Konfiguration 2	0 to $FFFF_{hex}$	
EE	**Option module H configuration 2**	0_{hex}	
PO	BM_w_BaciSlaveHConfig2	1:1	-

Second word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▹P0831◃ on page 533.

P0842	Optionsmodul H Konfiguration 3	0 to $FFFF_{hex}$	
EE	**Option module H configuration 3**	0_{hex}	
PO	BM_w_BaciSlaveHConfig3	1:1	-

Third word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▹P0832◃ on page 533.

P0843	Optionsmodul H Konfiguration 4	0 to $FFFF_{hex}$	
EE	**Option module H configuration 4**	0_{hex}	
PO	BM_w_BaciSlaveHConfig4	1:1	-

Fourth word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▹P0833◃ on page 534.

P0844	Optionsmodul H Konfiguration 5	0 to $FFFF_{hex}$	
EE	**Option module H configuration 5**	0_{hex}	
PO	BM_w_BaciSlaveHConfig5	1:1	-

Fifth word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▹P0834◃ on page 534.

P0845	Optionsmodul H Konfiguration 6	0 to FFFF$_{hex}$	
EE	**Option module H configuration 6**	0$_{hex}$	
PO	BM_w_BaciSlaveHConfig6	1:1	-

Sixth word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▷P0835◁ on page 534.

P0846	Optionsmodul H Konfiguration 7	0 to FFFF$_{hex}$	
EE	**Option module H configuration 7**	0$_{hex}$	
PO	BM_w_BaciSlaveHConfig7	1:1	-

Seventh word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter ▷P0836◁ on page 535.

P0847	Optionsmodul H Konfiguration 8	0 to FFFF$_{hex}$	
EE	**Option module H configuration 8**	0$_{hex}$	
PO	BM_w_BaciSlaveHConfig8	1:1	-

Eighth word acts as software module configuration of the option module on slot H. The meaning of the parameter is module-dependent see parameter▷P0837◁ on page 535.

P0848	Baci Fehlermeldungsverzögerung	0 to 65535 s	
EE	**Baci error detection delay**	30 s	
PO	BM_u_BaciErrDelay	1:1 s	-

The setup of a coupled system over the BACI extends up to an application-dependent duration. During this setup, especially as long as the total system is not yet working synchronous, error messages, which come from BACI, can be unwanted. This parameter determines the time in seconds, how long the controller suppresses error messages after initialization of BACI.

P0850 Selbstoptimierung Modus 0 to FFFF$_{hex}$

EE **Autotuning mode** 0$_{hex}$

ON BM_w_AutotuningMode 1:1 -

Description:

Bit	Meaning
0	**Stator resistance measurement:** 0: Stator resistance is not measured 1: Stator resistance is measured (see bit 4 also)
1	**Leakage inductance for asynchronous motor (inductance for synchronous motor):** 0: Inductance is not measured 1: Inductance is measured (see bit 4 also)
2	**Dead time measurement of the inverter:** 0: Dead time of the inverter is not determined 1: Dead time of the inverter is determined
3	**Inertia measurement of the drive:** 0: Inertia of drive is not determined 1: Inertia of drive is determined
4	**Mode bit for ProDrive.** **If resistance measuring and inductance measuring were successful:** 0: Do not activate R/L values automatically for motor control 1: Activate R/L values automatically for motor control
15 ... 5	Reserved

At auto-tuning the measurements, which where set with one are executed in this parameter. The bit 0 and the bit 1 is set by **WinBASS II / ProDrive** always simultaneously, e.g. via **WinBASS II / ProDrive** can only be set, if the resistor and the inductance can or cannot be measured. The dead time measuring can only be activated, if simultaneously also the resistor- and inductance measuring is activated or the bit 0 and bit 1 is set in ▷P0852◁ auto-tuning executed (resistor- and inductance was already executed successfully).

The inertia measurement may only be activated, if the parameter of the current controller has already been set correctly.

- Bit 4:
  ProDrive activates the R/L values for the motor control ▷P1320◁ bit 0 = 1 automatically, after resistance measuring and inductance measuring were successfully executed (▷P0852◁ bit 0 = 1 and bit 1 = 1). This functionality is only effective on the auto-tuning page of ProDrive (this page must remain open during the procedure).

P0851 Selbstoptimierung Status 0 to FFFFFFFF$_{hex}$

A **Auto-tuning status** 0$_{hex}$

BM_d_AutotuningStatus 1:1 -

This parameter shows the status of auto-tuning.

Description of the separate bits

Bit	Meaning
0	**Stator resistance measurement:** 1: Stator resistance measurement is successfully completed
1	**Leakage inductance for asynchronous motor (inductance for synchronous motor):** 1: Inductance measurement is successfully completed
2	**Dead time measurement of the inverter:** 1: Dead time measurement is successfully completed
3	**Torque of inertia measurement of the drive (from FW 03.08):** 1: Torque of inertia measurement is successfully completed
15 ... 4	Reserved
16	**Stator resistance measurement:** 1: Stator resistance measurement has just been executed
17	**Leakage inductance for asynchronous motor (inductance for synchronous motor):** 1: Inductance measurement has just been completed
18	**Dead time measurement of the inverter:** 1: Dead time measurement has just been executed
19	**Torque of inertia measurement of the drive (from FW 03.08):** 1: Torque of inertia measurement is just being executed
20	**Status of the optimization of the speed controller P-gain:** 0: Maximum value of Kp was not reached 1: Maximum value of Kp was reached
31 ... 21	Reserved

P0852	Selbstoptimierung durchgeführt	0 to $FFFF_{hex}$	
EE	**Auto-tuning done**	0_{hex}	
ON	BM_w_AutotuningDone	1:1	-

Description of the separate bits

Bit	Meaning
0	**Stator resistance measurement:** 0: Stator resistance measurement has never yet been executed 1: Stator resistance has already been successfully determined
1	**Leakage inductance for asynchronous motor (inductance for synchronous motor):** 0: Inductance measurement has never yet been executed 1: Inductance has already been successfully determined
2	**Dead time measurement of the inverter:** 0: Dead time measurement of the inverter was never yet executed 1: Dead time of the inverter already was successfully determined
3	**Torque of inertia measurement of the drive (from FW 03.08):** 0: Torque of inertia measurement of the drive has never been executed 1: Torque of inertia of the drive already was successfully determined
15 ... 4	Reserved

P0853	Gemessener Motorstatorwiderstand	0.000 to 500.000 Ω	
EE	**Measured motor stator resistance**	0.000 Ω	
ON	BM_u_MeasuredStatorResist	1000:1 Ω	-

The stator resistance of the single-phase equivalent circuit of the motor with autotuning.

P0854	Gemessene ASM-Lsigma, bzw. SM-Lq, Induktivität	0.00 to 655.35 mH	
EE	**Measured ASM-Lsigma, or SM-Lq, inductance**	0.00 mH	
ON	BM_u_MeasuredLeakInduct	100: 1 mH	-

This is the parasitic inductance of the drive measured with auto-tuning. This means the total leakage inductance of the one-phase circuit diagram of an asynchronous motor or the stator inductance of a synchronous motor. In addition to the accordant inductance also the cable and additional filters between the converter output of the motor and the connecting terminals of the motor.

P0855	Gemessener Motorstator- und Rotorwiderstand	0.000 to 500.000 Ω	
EE	**Measured stator- and rotor resistance**	0.000 Ω	
ON	BM_u_MeasuredRsRr	1000:1 Ω	-

The stator- and rotor resistance of the one-phase circuit diagram of an asynchronous motor determined with auto-tuning. The stator resistance if for a synchronous motor.

P0856	Maximaldrehzahl für Messung des Trägheitsmomentes	0 to 1500 RPM	
-	**Maximum speed for inertia measurement**	100 RPM	
ON	BM_u_AutotuningSpeedMax	1:1	-

From firmware version FW 03.08.

The drive is accelerated with a speed current of Maximum current for inertia measurement (▹P0857◃) to the maximum speed, which was set here and then is braked to a standstill again. From the determined ramp-up- and ramp-down time the torque of inertia is calculated.

P0857	Maximalstrom für Messung des Trägheitsmoments	0.00 to 90.00 %	
-	**Maximum current for inertia measurement**	10.00 %	
ON	BM_u_AutotuningCurrentMax	$100:4000_{hex}$	-

From firmware version FW 03.08.

The drive is accelerated with this maximum current to maximum speed for the measurement of the torque of inertia ▹P0856◃ and then is brought to a standstill again. From the determined ramp-up- and ramp-down time the torque of inertia is calculated.

Scaling: 100 % ↔ Power unit maximum current (▹P1241◃)

P0858	Gemessenes Trägheitsmoment	0.0 to 500000.0 kg*cm*cm
EE	**Measured inertia**	0.0 kg*cm*cm
ON	BM_ud_MeasuredInertia	10:1 kg*cm*cm -

From firmware version FW 03.08.

The torque of inertia of the drive, which was determined at autotuning is displayed here.

P0860	Optionsmodul 2 Master 1 Zykluszeit	0 to 32000 µs
EE	**Option module 2 master 1 cycle time**	4000 µs
PO	BM_u_Baci2M1Period	1:125 µs -

This parameter is accepted after switching on, it also can be changed by the option module, but then it only acts as display.

This parameter specifies after which number of control cycles the new setpoints/actual values are transmitted. The value refers to a multiple of 125 µs.

Value	Meaning
0	no cyclic data exchange
1	not permissible
2	250 µs
3	375 µs
and so on	

P0861	Optionsmodul 2 Master 1 Para-Nummer Sollwert 1	0 to $\mathrm{FFFF_{hex}}$
EE	**Option module 2 master 1 parameter no. set value 1**	0_{hex}
PO	BM_u_Baci2M1SetVal1	1:1 -

Configuration for the selected option module by parameter option module selection (▹P0827◃).

Parameter of the 1st set value (1 ... 8) for the cyclic communication. Only the numbers of the parameters may be specified, which are cyclic writable (attribute CW).

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0862	Optionsmodul 2 Master 1 Para-Nummer Sollwert 2	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 2**	0_{hex}	
PO	BM_u_Baci2M1SetVal2	1:1	-

2nd set value. Description of the parameters see ▹P0861◃ on page 541.

P0863	Optionsmodul 2 Master 1 Para-Nummer Sollwert 3	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 3**	0_{hex}	
PO	BM_u_Baci2M1SetVal3	1:1	-

3rd set value. Description of the parameters see ▹P0861◃ on page 541.

P0864	Optionsmodul 2 Master 1 Para-Nummer Sollwert 4	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 4**	0_{hex}	
PO	BM_u_Baci2M1SetVal4	1:1	-

4th set value. Description of the parameters see ▹P0861◃ on page 541.

P0865	Optionsmodul 2 Master 1 Para-Nummer Sollwert 5	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 5**	0_{hex}	
PO	BM_u_Baci2M1SetVal5	1:1	-

5th set value. Description of the parameters see ▹P0861◃ on page 541.

P0866	Optionsmodul 2 Master 1 Para-Nummer Sollwert 6	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 6**	0_{hex}	
PO	BM_u_Baci2M1SetVal6	1:1	-

6th set value. Description of the parameters see ▹P0861◃ on page 541.

P0867	Optionsmodul 2 Master 1 Para-Nummer Sollwert 7	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 7**	0_{hex}	
PO	BM_u_Baci2M1SetVal7	1:1	-

7th set value. Description of the parameters see ▹P0861◃ on page 541.

P0868	Optionsmodul 2 Master 1 Para-Nummer Sollwert 8	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. set value 8**	0$_{hex}$	
PO	BM_u_Baci2M1SetVal8	1:1	-

8th set value. Description of the parameters see ▷P0861◁ on page 541.

P0869	Optionsmodul 2 Master 1 Para-Nummer Istwert 1	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 1**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal1	1:1	-

Configuration for the selected option module by parameter option module selection (▷P0827◁).

Parameter of the 1st actual value (1 ... 8) for the cyclic communication. The parameter specified by the number must be data type INT, UINT, DINT, UDINT, WORD or DWORD.

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0870	Optionsmodul 2 Master 1 Para-Nummer Istwert 2	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 2**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal2	1:1	-

2nd actual value. Description of the parameters see ▷P0869◁ on page 543.

P0871	Optionsmodul 2 Master 1 Para-Nummer Istwert 3	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 3**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal3	1:1	-

3rd actual value. Description of the parameters see ▷P0869◁ on page 543.

P0872	Optionsmodul 2 Master 1 Para-Nummer Istwert 4	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 4**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal4	1:1	-

4th actual value. Description of the parameters see ▷P0869◁ on page 543.

P0873	Optionsmodul 2 Master 1 Para-Nummer Istwert 5	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 5**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal5	1:1	-

5th actual value. Description of the parameters see ▷P0869◁ on page 543.

P0874	Optionsmodul 2 Master 1 Para-Nummer Istwert 6	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 6**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal6	1:1	-

6th actual value. Description of the parameters see ▷P0869◁ on page 543.

P0875	Optionsmodul 2 Master 1 Para-Nummer Istwert 7	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 7**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal7	1:1	-

7th actual value. Description of the parameters see ▷P0869◁ on page 543.

P0876	Optionsmodul 2 Master 1 Para-Nummer Istwert 8	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 parameter no. act value 8**	0$_{hex}$	
PO	BM_u_Baci2M1ActVal8	1:1	-

8th actual value. Description of the parameters see ▷P0869◁ on page 543.

P0877	Optionsmodul 2 Master 1 Trigger-Offset	0 to FFFF$_{hex}$	
EE	**Option module 2 master 1 trigger offset**	0$_{hex}$	
PO	BM_u_Baci2M1TriggOffset	1:1	-

Configuration for the selected option module by parameter option module selection (▷P0827◁).

In the chosen data exchange interval the controller can read out a cyclic trigger signal to the option module. The offset (unit µs) determines the temporal reference between the beginning of the communication interval and the reading out of the trigger signal output.

Parameter is accepted when switching on, it can also be changed by the option module, but then it only acts as display.

P0878	Optionsmodul 2 Master 1 Zyklus-Offset Sollwerte	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 cycle offset set values**	2	
PO	BM_u_Baci2M1CycleSetOffset	1:1	-

Configuration for the selected option module by parameter option module selection (▹P0827◃). Cycle offset for setpoint transmission. Exact description see ▹BACI◃ from page 164.

This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0879	Optionsmodul 2 Master 1 Zyklus-Offset Istwerte	0 to $FFFF_{hex}$	
EE	**Option module 2 master 1 cycle offset act. values**	0_{hex}	
PO	BM_u_Baci2M1CycleActOffset	1:1	-

Configuration for the selected option module by parameter option module selection (▹P0827◃). Cycle offset for actual value transmission. Exact description see ▹BACI◃ from page 164. This parameter is accepted after switching on, it also can be changed by the option module, but then it only serves as display.

P0880	Haltebremse Kommando	0 to $FFFF_{hex}$	
-	**Holding brake command**	0_{hex}	
ON	BM_w_MotBrakeManCmd	1:1	CW

Command at the motor holding brake in the control mode (▹P1400◃ „Automatic“).
Bit 0 is operated from the of device control state machine. If the brake in the control mode ’Automatic’, however is to be controlled by direct writing of P0880 bit 0 for purposes of service, P0880 bit 1 is to be set. After the switching off of the service mode the brake remains in the actual status, i.e. the original status before the activation of the service mode is not restored.

If the motor holding brake on principle shall be manually controlled (▹P1400◃), then the command must be made via the control word 2 (▹P0302◃).

Bit	Meaning
0	Brake control in the automatic control mode (▹P1400◃ bit 0 = 1): 0: Apply the brake 1: Release the brake
1	Brake control in the automatic control mode (▹P1400◃ bit 0 = 1): 0: Switch off service mode 1: Switch on service mode
15 ... 2	Reserved

P0881 Haltebremse Zustand 0 to $FFFF_{hex}$

\- **Holding brake status** 0_{hex}

A BM_w_MotBrakeStatus 1:1 -

Status of motor holding brake.

Bit	Meaning
0	Brake status: 0: Brake is applied 1: Brake is released
1	Adjusted brake mode: 0: Manual 1: Automatic
2	0: Service mode is switched off 1: Service mode is switched on
3	Reserved
4	Brake error status: 0: No error 1: Error
7 ... 5	Reserved
8	Error status brake lining: 0: No error 1: Error
15 ... 9	Reserved

P0882 Haltebremse Stellsignal 0 to $FFFFFFFF_{hex}$

EE **Holding brake actuating signal** 2_{hex}

ON BM_d_MotBrakeOut 1:1 -

Actuating signal for the motor holding brake.

Bit	Meaning
0	Actuating signal: 0: Output power unit 1: Digital output
1	Polarity: 0: Opening the brake with actuating signal = low 1: Opening the brake actuating signal = high
15 ... 2	Reserved
23 ... 16	In case bit 0 = 1: Channel selection of the digital output (possible values 1 to 8, dependent of the used function module)
31 ... 24	In case bit 0 = 1: Slot selection of output module (possible values 1 to 5, correspond to slot A to E)

P0883	Haltebremse Bremszustandsrückmeldung	0 to FFFFFFFF$_{hex}$	
EE	**Holding brake state monitoring**	2$_{hex}$	
ON	BM_d_MotBrakeIn	1:1	-

Signal for checkback of the brake status (opened/closed).

Bit	Meaning
0	Checkback signal: 0: Output power unit 1: Digital input
1	Polarity: 0: Brake is open, if checkback signal = low 1: Brake is open, if checkback signal = high
15 ... 2	Reserved
23 ... 16	In case bit 0 = 1: Channel selection of the digital input (possible values 1 to 8, dependent of the used function module)
31 ... 24	In case bit 0 = 1: Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

P0884	Haltebremse Bremsbelagüberwachung	0 to FFFFFFFF$_{hex}$	
EE	**Holding brake liner monitoring**	1$_{hex}$	
ON	BM_d_MotBrakeLineMon	1:1	-

Digital input for checkback of the brake liner status (correct/incorrect)

Bit	Meaning
0	Polarity: 0: Brake liner is error-free, if checkback signal = low 1: Brake liner is error-free, if checkback = high
15 ... 1	Reserved
23 ... 16	Channel selection of the digital input (possible values 1 to 8, dependent of the used function module)
31 ... 24	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

P0902	Array für Fehler-Reaktionen	-32768, -3 to 3	
EE	**Error reaction table**	0	
ON	BM_a_ErrReaction	1:1	-

This array parameter has dimension 256. The data type of the array elements is INT (16 bit integer).

Each array element is the error reaction of an error of error numbers 1 ... 255 is assigned accordingly to the error parameters ▹P0201◃ to ▹P0216◃.

Examples:

- Array for error reaction [1] accords to error reaction of error code 1 processor error (see ▹P0201◃), bit 1 „Watchdog error.
- Array for error reaction [192] accords to error reaction of error code 192 error position controller (see ▹P0213◃), position deviation dynamic.

NOTE!

An array element is written only then, if the assigned error reaction is adjustable (see ▹P0200◃ to ▹P0251◃, reaction adjustable).

Reaction code	Meaning
-32768	Error reaction defined by parameter ▹P1007◃
-3	Return motion
-2	Reserved
-1	No reaction
0	Pulse inhibit
1	Stop, Ramp down at the ramp function generator
2	Quickstop, ramp down at the quickstop ramp
3	Stop, ramp down at the current limit

P0903	Fehlerreaktionstabelle Funktionsmodule	-32768, -3 to 3	
EE	**Error reaction table function modules**	0	
ON	BM_a_ErrReactionFunctionMod	1:1	-

This array parameter has dimension 32. The data type of the array elements is INT (16 bit integer). Value table see parameters ▹P0902◃.

The error numbers 48 to 52 signaled error in connection with functional modules (see error parameter ▹P0204◃ Error in function- and option modules. The sub error numbers 1 ... 15 in order to describe these errors more exactly (see parameters error function module A ▹P0240◃ to error function module E ▹P0244◃).

Each array field element of the parameter Error reaction table function modules is assigned to the error reaction of an error of the sub-error numbers 1 ... 15.

Example:

Error reaction code for error 49.2 on slot B:

Error reaction table function modules [2] accords to error reaction of error code 49:2 (see parameter ▹P0204◃ Error in function- or option modules, bit 1 and ▹P0241◃ Error function module B, sub-error number 2: Module not permitted at this position.)

NOTE!

An array element can only be written to, if the assigned error reaction is adjustable.

P0904	Fehlerreaktionstabelle Optionsmodule	-32768, -3 to 3	
EE	**Error reaction table option modules**	0	
ON	BM_a_ErrReactionOptionMod	1:1	-

This array parameter has dimension 128. The data type of the array elements is INT (16 bit integer). Value table see parameters ▹P0902◃.

The error numbers 53 to 58 signal error in connection with option modules (see error parameter ▹P0204◃ Error in function- or option modules. For a more exact description of these errors there are the sub-error numbers 4096...4176 (see parameters Error option module G ▹P0245◃ to Error option module M ▹P0250◃).

Each array element of the parameter Error reaction modules is assigned to the error reaction of an error of the sub-error numbers 4096...4176. Sub-error code 4096 corresponds to array index 0.

General the following is valid: Array index corresponds to sub-error code - 4096.

Example:

Error reaction code for error 53. 4097 on slot G:

Error reaction table option modules [1] corresponds to error reaction of error code 53:4097 (see parameter ▹P0204◃ Error in the function- or option modules, bit 5 and ▹P0245◃ Error option module G, sub-error number 4097: Wrong parameter no. at set value parameter 2)

NOTE!

An array element can only be written to, if the assigned error reaction is adjustable.

P0905	Fehlerreaktionstabelle Optionsmodule Applikation	-32768, -3 to 3	
EE	**Error reaction table option modules application**	0	
ON	BM_a_ErrReactionOptionModAppl	1:1	-

This array parameter has dimension 32. The data type of the array elements is INT (16 bit integer). Value table see parameters ▹P0902◃

The error numbers 53 to 58 signal error in connection with option modules (see error parameter ▷P0204◁ Error in function- or option modules. For application-specific errors there are the sub-error numbers 8192...8223 (see parameters Error option module G ▷P0245◁ to Error option module M ▷P0250◁).

Each array element of the parameter Error reaction modules is assigned to the error reaction of an error of the sub-error numbers 8192...8223. Sub-error code 8192 corresponds to array index 0.

General the following is valid: Array index corresponds to sub-error code - 8192.

Example:

Error reaction code for error 53. 4097 on slot G:

Error reaction table option modules [0] corresponds to error reaction of error code 53:8192 (see parameter ▷P0204◁ Error in the function- or option modules, bit 5 and ▷P0245◁ Error option module G, sub-error number 8192: .Error CANopen timeout on CAN bus.)

NOTE!

An array element can only be written to, if the assigned error reaction is adjustable.

P1000 Soll-Betriebsart -7 to 6

DS **Operation mode desired** -3

BM_i_Ds0_OperationMode 1:1 CW

With this parameter you determine the operation mode of the drive. The current active operating mode is displayed in parameter ▹P0304◃.

Value	Meaning
-7	Autotuning
-6	Spindle positioning
-5	Synchronous operation with electronic gearing
-4	Position control
-3	Speed control
-2	Current control
-1	Find notch position
1	Target position set value
2	Speed setting
5	Jog operation
6	Homing operation

Switching between operation modes is possible with drive inhibited (offline mode) and also drive enabled (online mode).

An exception is the operation mode 'Find notch position' (-1).
Switching to this operation mode (even from another operation mode) is accepted with drive inhibited only.

The changeover can be inhibited in order to avoid temporary inconsistencies between the operation mode and the operation-dependent bits in the control word ▹P0300◃. The current status is displayed in ▹P0308◃.

P1001 Kommunikationsquelle 0 to 000F$_{hex}$

DS **Communication source** 0001$_{hex}$

BM_w_DS0_CommSource 1:1 CW

This parameter controls the access rights of the different communication sources to parameters. Communication sources we call modules, which exchange data with a superimposed control by use of a communication interface.

We distinguish between the following communication sources:

- WinBASS II / ProDrive
- Option modules connected by BACI-interface

Basically, read access on parameters is always possible. The read access has different access modes. Here, we have determined the following:

- Write access using request data
- Write access using cyclic data
- Write access for motor control (which means on the control word)

With respect to access rights, WinBASS II / ProDrive is an exception; it has full access (write and read) on all parameters at any time.

Write access should always be granted to only one communication source, because other way write conflicts may occur. Then the source succeeds, which was the last one to write within the cycle, before the drive manager evaluates the control word.

Bit	Meaning
0	1: WinBASS II / ProDrive, motor control enabled [1)]
3 ... 1	Reserved
4	1: BACI, motor control enabled [1)]
5	1: BACI, write access using service data enabled
6	1: BACI, write access using cyclic communication (set values)
15 ... 7	Reserved

[1)] Note:
Only then, if in the parameter communication source the total bits for motor control (bit 0, 1 and 4) are reset, a controller enable is possible using only the hardware inputs pulse enable and quickstop.

NOTE!

In parameter P1001 communication source the BACI command interface must always be enabled, in order that service data can be parameterized via the option modules (e. g. CANopen, Sercos, ...).

P1002

DS	Antriebsmanager-Optionen	0 to FFFF$_{hex}$	
	Drive manager options	0$_{hex}$	
	BM_w_Ds0_DrvManagerOptions	1:1	CW

Also see ▷Drive management◁ from page 181.

Settings for the drive manager

Bit	Meaning
0	Reserved
1	1: Errors are able to be accepted via hardware input ’pulse enable’ (FX3-5).
15 ... 2	Reserved

P1003

DS	HALT-Reaktion	0 to 3	
	STOP reaction code	0	
	BM_i_Ds0_StopOptionCode	1:1	-

Not yet implemented.

P1004	SCHNELLHALT-Reaktion	0 to 8	
DS	**QUICKSTOP reaction code**	0	
ON	BM_i_Ds0_QuickstopCode	1:1	-

Also see ▹Drive management◃ from page 181.

This parameter determines the drive reaction in status quickstop. The reaction which was set is always valid for the digital input 'Quickstop' (FX3-4) and according to setting also for the command quickstop.

For the command 'Quickstop'" a separate reaction can be set from firmware version FW 03.03 via parameter ▹P1009◃ or the setting „Same reaction for command and digital input" can be selected. If another reaction as that for the digital input is selected for the command Quickstop, then the digital input has higher priority.

For a correct function of brake procedures at quickstop- or deceleration ramp the speed controller must be sufficiently parameterized.

Value	Meaning
0	Inhibit pulse
1	Braking operation at the deceleration ramp
2	Braking operation at the quickstop ramp (adjustable with P1174)
3	Braking operation at the current limit
4	Braking operation at the voltage limit
5	Braking operation at the deceleration ramp and remaining in status QUICKSTOP ACTIVE
6	Braking operation at the current limit and remaining in status QUICKSTOP ACTIVE
7	Braking operation at the current limit and remaining in status QUICKSTOP ACTIVE
8	Braking operation at the voltage limit and remaining in the status QUICKSTOP ACTIVE

At the settings 5 to 8 after the braking operation the drive remains in the status QUICKSTOP ACTIVE and again can be enabled.

P1005	STILLSETZEN-Reaktion	0 to 3	
DS	**SHUTDOWN reaction code**	0	
ON	BM_i_Ds0_ShutdownCode	1:1	-

Also see ▹Drive management◃ from page 181.

This parameter determines the drive reaction at transition of status OPERATION ENABLED towards READY FOR SWITCH ON (in the state machine of unit control).

For the correct functioning of brake procedures at quickstop- or deceleration ramp the speed controller must be sufficiently parameterized.

Value	Meaning
0	Inhibit drive function
1	Deceleration at the deceleration ramp of the RFG, which was selected.
2	Ramp down at the quickstop ramp (adjustable with ▹P1174◃)
3	Ramp down at current limit

P1006	SPERREN-Reaktion	0 to 3	
DS	**DISABLE OPERATION reaction code**	0	
ON	BM_i_Ds0_DisableOpCode	1:1	CW

Also see ▹Drive management◃ from page 181.

This parameter determines the drive reaction at transition of status OPERATION ENABLED towards SWITCHED ON (in the state machine of unit control).

For correct functioning of the brake procedures at the quickstop-or deceleration ramp the speed controller must be sufficiently parameterized.

Value	Meaning
0	Inhibit drive function
1	Deceleration at the deceleration ramp of the RFG, which was selected.
2	Ramp down at the quickstop ramp (adjustable with ▹P1174◃)
3	Ramp down at current limit

P1007	Fehler-Reaktion	0 to 3	
DS	**Error reaction code**	0	
ON	BM_i_Ds0_ErrorReactionCode	1:1	-

Up to and from b maXX® controller version FW 03.07

With this parameter the general error reaction is set. This applies to errors, which do not have pulse inhibit (e.g. Position deviation) and which also is not set to “No reaction”. At errors with separately settable error reaction the reaction, which was set there is valid.

Reaction-code	Meaning
-3	Return motion positioning (▹P2052◃)
-2	Reserved
-1	Reserved
0	Pulse inhibit
1	Stop. Ramp down at the ramp function generator (▹P1173◃)
2	Quickstop Ramp down at the quickstop ramp (▹P1174◃)
3	Stop. Ramp down at the current limit

From b maXX® controller version FW 03.08

With this parameter the general error reaction is set.

The following is valid for errors, whose error reaction is settable: Either you permanently define the error reaction or you reference it indirectly to this parameter.

The parameter value and therewith the error reaction of the errors, which were referenced hereunto, is changeable to the running time (via data set switch-over or writing to the parameter).

P1008	Maske für interne Begrenzungen	0 to FFFF$_{hex}$	
DS	**Mask for internal limits**	FFFF$_{hex}$	
ON	BM_w_Ds0_InternalLimitMask	1:1	CW

With this parameter it can be selected, which internal limits via bit 11 are signalized in parameter status word ▹P0301◃. Normally all limits are signalized.

Meaning of the individual bits:

Bit	Meaning
0	Current limit
1	Speed set value limit
2	Limit of positioning speed of positioning and jogging
3	Reserved
4	negative HW-limit switch is active
5	positive HW-limit switch is active
6	negative SW-limit switch is active
7	positive SW-limit switch is active

If a bit is set to 0, the according limit is not shown in the status word anymore.

P1009	Schnellhalt-Kommando Reaktion	-1 to 8	
DS	**Reaction quickstop command**	-1	
ON	BM_i_Ds0_QuickstopCmdCode	1:1	-

Available from firmware version FW 03.03.

Also see ▹Drive management◃ from page 181.

This parameter determines the drive reaction in status 'quickstop'. At setting 'Same reaction as hardware input' the setting according to parameter '▹P1004◃ Quickstop reaction' takes effect.

If here a separated reaction is set than for the digital input, then the digital input is of higher priority. That means, if during the reaction to the quickstop command the hardware quickstop is enabled, that the drive changes to the reaction, which was set in „▹P1004◃ Quickstop reaction".

For a correct function of brake procedures at quickstop- or deceleration ramp the speed controller must be sufficiently parameterized.

Value	Meaning
-1	same reaction as at hardware quickstop, setting operates via ▹P1004◃
0	Pulse inhibit
1	Braking operation at the deceleration ramp
2	Braking operation at the quickstop ramp (adjustable via ▹P1174◃)
3	Braking operation at the current limit
4	Braking operation at the voltage limit
5	Braking operation at the deceleration ramp and remaining in status quickstop active
6	Braking operation at the current limit and remaining in status quickstop active

Value	Meaning
7	Braking operation at the current limit and remaining in status quickstop active
8	Braking operation at the voltage limit and remaining in the status quickstop active

P1010

	Datensatz Identifikations-Nummer	0 to 65535	
DS	**Data set ID**	0	
ON	BM_u_Ds0_RecordId	1:1	CW

Also see ▹Data Management◃ from page 43.

Free selectable identification number of the data set.

P1011

	Datensatz Name	80 ASCII characters	
DS	**Data set name**	""	
ON	BM_s_Ds0_RecordName	1:1	-

Also see ▹Data Management◃ from page 43.

Free selectable name of data set with max. 80 characters.

P1020

	Stromregler P-Verstärkung	0.01 to 655.35	
DS	**Current controller P-gain**	1.00	
	BM_u_Ds0_CurrentCtrl_PGain	100:1	-

Proportional gain (Kp) of the current controller.

P1021

	Stromregler Nachstellzeit	0.0 to 1000.0 ms	
DS	**Current controller integral-action time**	2.5 ms	
	BM_u_Ds0_CurrentCtrl_ITime	10:1 ms	-

Integral-action time (Ti) of current controller.

If the Current controller integral-action time is zero, the integral component is set to 0 and the current controller operates without integral component.

P1022

	Momenten-Zusatz-Sollwert	-100.00 to +100.00 %	
DS	**Torque additional set value**	0.00 %	
	BM_i_Ds0_TrqAddValue	4000_{hex}:100 %	CW

Additional set value input for all operation modes.

The effective torque set value is the sum out of torque set value (torque set value ▹P0331◃ and speed controller output ▹P0356◃) and torque additional set value.

Scaling: 100 % ↔ power unit maximum current (▹P1241◃)

Alternative scaling: 100% ↔ Maximum torque

with: Maximum torque = Maximum current (▹P1241◃) * Kt factor

Kt factor = Nominal torque / Nominal cross current

Nominal torque = Motor nominal power ▹P0056◃ / Nominal speed ▹P0057◃ * 2π / 60)

for SM: Nominal cross current = Motor nominal current ▹P0054◃

for ASM:

$$\text{Nominal cross current} = \sqrt{[\text{Motor nominal current P0054}]^2 - [\text{Nominal magnetizing current P0066}]^2}$$

P1023

	Ausgangsbegrenzung der Stromregler	0 to 199.99 %	
DS	**Current controller output limiter**	199.99 %	
ON	BM_u_Ds0_VdqLimit	4000_{hex}:100 %	-

Limit of output voltage of the d- and q-current controller

Scaling: 100 % ↔ Power unit $U_{DC\ link}$ nominal value (▹P0020◃)/√2

P1024

	Stromregler Modus	0 to $FFFF_{hex}$	
DS	**Current controller mode**	1_{hex}	
ON	BM_w_Ds0_CurrentCtrlMode	1:1	-

From firmware version FW 03.10)

Setting of current controller

Bit	Meaning
0	Current prediction mode 0: not activated 1: activated (basic setting)
15 ... 1	reserved

P1029

	Fehlergrenze N-Regelabweichung	0 to 100%	
DS	**Error limit speed deviation**	100%	
ON	BM_u_ ErrorLimSpeedDev	4000_{hex}:100 %	CW

If the absolute value of the speed deviation is greater than the set value of this parameter, the error message 212 is set.

The cycle time of the monitoring is 500 µs.

In order to activate the monitoring bit 6 of ▹P1030◃ Speed controller mode must be set.

It is recommended to use this monitoring for applications with speed ramps below the current limit, i.e.

$|\text{Set value acceleration}| \leq |\text{Maximum acceleration of the drive}|$

The ▹P1029◃ may not be mistaken with the reporting limit for status bit "Setpoint reached in ▹P1043◃.

P1030

P1030	Drehzahlregler Modus	0 to $FFFF_{hex}$	
DS	**Speed controller mode**	1_{hex}	
	BM_w_Ds0_SpeedCtrlMode	1:1	-

Speed controller mode

Bit	Meaning
1 ... 0	Encoder for motor control: / speed controller, rotor angle and actual speed 00: are not obtained by an encoder (encoderless operation) 01: taken from encoder 1 10: taken from encoder 2
2	0: Torque limit Mot/Gen 1: Torque limit MR1/MR2
3	0: For the speed controller-block monitoring the speed threshold is valid, which is set in the parameters Open loop N=0 threshold (▹P1063◃), Encoder 1 N=0 threshold (▹P1073◃) or Encoder 2 N=0 threshold (▹P1083◃). 1: For the speed controller-block monitoring the speed threshold is valid, which is set in parameter N=0 threshold block monitoring (▹P1261◃).
4	Mode of additional torque limit bipolar (▹P1046◃) 0: Not active 1: active
5	Reduction of current limiter bipolar (▹P1036◃, ▹P0105◃, ▹P3426◃) 0: disabled 1: enabled
6	1: Activation of the monitoring of ▹P0354◃ speed deviation value
7	Mode of the ▹P0508◃ Additional torque actual value and ▹P1046◃ Torque limit 0: directly from power balance 1: from Kt adaption
8	Polarity inversion of the speed set value
15 ... 9	Reserved

regarding bit 2

Adjusting torque limit:

The torque limiter can either be set separately for each torque direction or can be set separately for the motoring or generating operation. With this bit, the type of limit is adjusted, which means by use of torque direction or by motoring/generating operation:

- Bit 2 = 0, motoring/generating torque limit:
  Parameter ▹P1037◃ operates as torque limit for motoring operation,
  Parameter ▹P1038◃ as torque limit for generating operation.
- Bit 2 = 1, dependent on torque limit:
  Parameter ▹P1037◃ operates as torque limit for torque direction 1,
  Parameter ▹P1038◃ as torque limit for torque direction 2.

Torque limit Mot/Gen
Bit 2 = 0:

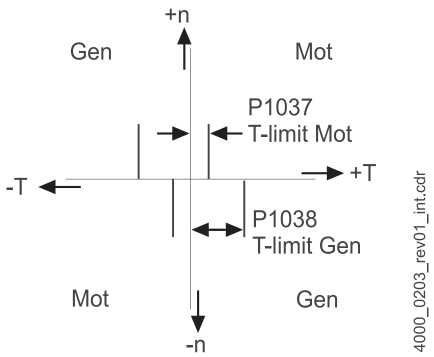


Figure 146: Torque limit Mot/Gen

Torque limit MR1/MR2
Bit 2 = 1:

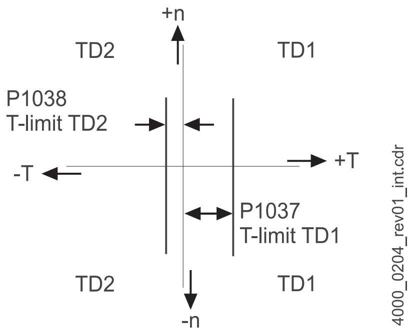


Figure 147: Torque limit MR1/MR2

regarding bit 6

The monitoring of the speed deviation takes place by comparing with the set limit in ▹P1029◃. The error 212 "Limit for the speed deviation is exceeded" is reported at exceeding.

P1031	Motor Maximaldrehzahl des Antriebs	20 to 24000 RPM	
DS	**Motor maximum drive speed**	3000 RPM	
	BM_u_Ds0_SpeedMax	1:1 RPM	-

Displays the maximum speed of motor. This parameter defines the speed scaling of speed actual values and speed set values.

NOTE!

The value of P1031 must not be less than the value of ▹P2053◃ "Error reaction return motion absolute max. speed"

P1032	Drehzahlregler P-Verstärkung	0.0 to 209715.1	
DS	**Speed controller P-gain**	10.0	
	BM_ud_Ds0_SpeedCtrl_PGain	10:1	-

Proportional gain of the speed controller, without unit. See ▹General overview speed controller◃ on page 213.

P1033	Drehzahlregler Nachstellzeit	0.0 to 2000.0 ms	
DS	**Speed controller integral-action time**	25.0 ms	
	BM_u_Ds0_SpeedCtrl_ITime	10:1 ms	-

Integral-action time of the speed controller. See ▹General overview speed controller◃ on page 213.

If the Speed controller integral-action time is zero, the integral part is set to 0 and the speed controller operates without integral part.

P1034	Momenten-Vorsteuerungs-Faktor	0 to 32767	
DS	**Torque feed forward factor**	0	
	BM_u_Ds0_TrqInertiaCompens	1:1	-

Factor for torque inertia compensation of the drive line (scaling factor for the speed control), without unit. See ▹General overview speed controller◃ on page 213.

P1036	Stromgrenze bipolar (symmetrisch)	0.00 to 100.00 %	
DS	**Current limiter bipolar**	100.00 %	
ON	BM_ud_Ds0_TrqLimSymmetrical	4000_{hex}:100 %	CW

Also see ▹P1030◃ on page 558.

With the bipolar limit, the quadrature current is limited symmetrically.

In addition, a current limit for the torque direction or for the motoring or generating operation is provided. Effective is always the smaller one of the adjusted limits (symmetrical or motor/generator or MR1/MR2).

Scaling: 100 % ↔ Power unit maximum current (▹P1241◃)

P1037	Stromgrenze motorisch/MR1	0.00 to 100.00 %	
DS	**Current limiter Motor/TD1**	100.00 %	
ON	BM_u_Ds0_TrqLimMot_TD1	4000_{hex}:100 %	CW

Also see ▹P1030◃ on page 558.

This current limit limits the quadrature current set value at motoring operation or in torque direction 1 (according to setting in ▹P1030◃, bit 2).

The current limiter can either be set separately for each torque direction or can be set separately for the motoring or generating operation. The type of limit is set via parameter ▹P1030◃ bit 2 - that means if torque direction is operated with torque direction or with motoring/generating operation.

Furthermore the current limit ▹P1036◃ is present, which symmetrical takes effect. Effective is always the smaller one of the adjusted limits (symmetrical or motor/generator or

MR1/MR2).

Scaling: 100 % ↔ Power unit maximum current (▷P1241◁)

P1038

P1038	Stromgrenze generatorisch/MR2	0.00 to 100.00 %	
DS	**Current limiter Generator/TD2**	100.00 %	
ON	BM_u_Ds0_TrqLimGen_TD2	4000_{hex}:100 %	CW

Also see ▷P1030◁ on page 558.

This current limiter limits the quadrature current set value at generating operation or in torque direction 2 (according to settings in ▷P1030◁, bit 2).

The current limiter can either be set separately for each torque direction or can be set separately for the motoring or generating operation. The type of limit is set via parameter ▷P1030◁ bit 2 - that means if torque direction is operated with torque direction or with motoring/generating operation.

Furthermore the current limit ▷P1036◁ is present, which symmetrical takes effect. Effective is always the smaller one of the adjusted limits (symmetrical or motor/generator or MR1/MR2).

Scaling: 100 % ↔ Power unit maximum current(▷P1241◁)

P1039

P1039	Stromgrenze Hysterese	0.00 to 100.00 %	
DS	**Current limiter hysteresis**	0.25 %	
ON	BM_u_Ds0_TrqLimHysteresis	4000_{hex}:100 %	CW

Also see ▷P1030◁ on page 558.

Hysteresis for quadrant switch-over at torque limit.

Scaling: 100 % ↔ Motor maximum speed of drive (▷P1031◁)

P1040

P1040	Drehzahl-Zusatz-Sollwert	-100.00 to +100.00 %	
DS	**Speed additional set value**	0.00 %	
ON	BM_di_Ds0_SpeedSetValueAdd	40000000_{hex}:100 %	CW

Additional speed set value input. The total speed set value here is limited to +/-100 % limited.

Scaling: 100 % ↔ Motor maximum speed of drive (▷P1031◁)

P1041	Drehzahlsollwert positive Grenze	0.00 to +100.00 %	
DS	**Speed set value positive limit**	+100.00 %	
ON	BM_di_Ds0_SpeedSet_ULim	40000000_{hex}:100 %	CW

Positive limit of speed set value. The speed set value in the positive area is limited to that value.

P1042	Drehzahlsollwert negative Grenze	-100.00 to -0.00 %	
DS	**Speed set value negative limit**	-100.00 %	
ON	BM_di_Ds0_SpeedSet_LLim	40000000_{hex}:100 %	CW

Negative limit of speed set value. The speed set value in the negative area is limited to that value.

P1043	Drehzahl-Regelabweichungs-Grenze	0.00 to 199.99 %	
DS	**Speed deviation limiter**	1.25 %	
ON	BM_u_Ds0_SpeedDevMax	4000_{hex}:100 %	CW

Alarm limit for speed regulation deviation. If the threshold, which was set with this parameter falls under the speed control deviation, the message 'Set value reached' in the speed controller status (▹P0350◃, bit no. 12) and at speed-controlled operation modes also ia displayed in the drive status word (▹P0301◃, bit no. 10).

P1044	Grenzfrequenz PT2 (=0:aus)	0 to 1260 Hz	
DS	**Cut off frequency 2 order delay (=0:off)**	0 Hz	
	BM_u_Ds0_CutOffFrequencyOrder2	1:1 Hz	CW

This parameter determines the base frequency of the filter of 2nd order (PT2) for the current set value of the speed controller.

This PT2-element is between the speed controller output and the q-current- controller input.

If the value is 0, the effect of the PT2-element isn't required.

P1045	Zeit für Momenten-Abbau (=0:aus)	0 to 8000 ms	
DS	**Time for reducing torque (=0:off)**	0 ms	
ON	BM_u_Ds0_TorqueReducingTime	1:1 ms	

From firmware version FW 03.01.

With this parameter a smooth torque reduction can be set according to controlled brake operations. After the braking of drive to zero speed the torque limiter is reduced linear via the set time to 0 and then the drive is inhibited (see ▹Torque reduction after controlled brake operations◃ from page 233).

The smooth torque reduction is switched off if time for reducing torque = 0.

P1046	Zusatz-Momentengrenze bipolar	0 to 20000.000 Nm	
DS	**Additional torque limiter bipolar**	20000.000 Nm	
ON	BM_Ds0_TrqSymLimitNm	1000:1 Nm	CW

From firmware version FW 03.08.

Symmetrical torque limitation for a quick cyclical access (e.g. .... option card). It acts additionally to the "Standard torque limit bipolar" ▹P0357◃.

The operating torque set value from the sum "speed controller output" ▹P0356◃ (or set value of OM current control (-2): " Torque set value ▹P0331◃ and "Torque additional set value" ▹P1022◃ is limited by P1046 symmetrically.

This parameter, e.g. the additional torque limit bipolar, normally is not active and can be activated, if the bit 4 of the speed controller mode is set to 1 (see ▹P1030◃).

The torque limit P1046 additionally acts to the "Standard torque limit bipolar" ▹P0357◃ and to the torque limits which are determined by the torque current limit (▹P1036◃, ▹P1037◃ and ▹P1038◃, dependent on the type of torque limit ▹P1030◃). The smallest value of all set limits is the effective one.

In opposition to the torque limits ▹P0357◃, the parameter P1046 is input directly in Nm.

The torque limit in P1046 is based on the calculated torque of ▹P0508◃.

P1048	Amplitude der Geberexzentrizität	0 to 2000000_{hex}	
DS	**Amplitude of encoder eccentricity**	0_{hex}	
ON	BM_ud_Ds0_EncEcceAmpl	1:1	CW

From firmware version FW 03.09.

The position deviation, which was caused by an encoder eccentricity, can be approached by a position sine signal as a function of the position value angle.

Exze = $Exze_{Ampl}$ ▹P1048◃ * sin (Position value angle - $Exze_{Phase}$ ▹P1049◃)

The parameter ▹P1048◃ thereby determines amplitude and the parameter ▹P1049◃ the phase shifting of the encoder eccentricity. The amplitude is limited to a few degrees (approx. 5.6°).

The scaling accords to 360° ⇔ 80000000_{hex}.

The phase shifting to the angle of the position value possesses the scaling 360° ⇔ $FFFF0000_{hex}$.

From FW 3.09 the information from parameter ▹P1048◃ and ▹P1049◃ can be used, in order to compensate the deviation of the encoder eccentricity (see ▹Software compensation of encoder eccentricity (from FW 03.09 onwards)◃ on page 209). Normally, this compensation is switched off and is only provided for the operating modes, where the position controller is active. For this purpose the parameters ▹P1048◃ and ▹P1049◃ must be set.

P1049	Phase der Geberexzentrizität	0 to FFFF$_{hex}$	
DS	**Phase of encoder eccentricity**	0$_{hex}$	
ON	BM_u_Ds0_EncEccePhase	1:1	CW

From firmware version FW 03.09.

The position deviation, which was caused by an encoder eccentricity, can be approached by a position sine signal as a function of the position value angle, see ▹P1048◃.

P1050	Lageregler Modus	0 to FFFF$_{hex}$	
DS	**Position controller mode**	0$_{hex}$	
ON	BM_w_Ds0_PosCtrlMode	1:1	-

Operation mode of position controller.

Bit	Meaning
0	1: Activation of dynamic position deviation monitoring
1	1: Activation of the static deviation monitoring
2	0: Position sensing operates with the encoder, which was selected for the motor control (see parameters ▹P1030◃) 1: Position sensing operates with the (second) encoder, which was NOT selected for the motor control (see parameter ▹P1030◃) Bit can only be changed, if the position control is in STOP status.
3	Extrapolation at set values failure by using the interpolating position set value: 0: No extrapolation, after sequence of the interpolator the delta is deleted. 1: Extrapolation, after sequence of the interpolator the delta remains valid.
4	Distribution of torque precontrol along the bus cycle utilizing the interpolative position set value (from FW 03.08 onwards): 0: Not active 1: Active
5	Synchronization on actual speed value when switching to operation mode position control (-4) (from FW 03.09 onwards) 0: Not active 1: Active
6	From FW 03.09 onwards Enable of software compensation of encoder eccentricity 0: No compensation 1: Compensation active
7	From FW 03.09 onwards Mode of software compensation of encoder eccentricity 0: only in position control 1: in position- and speed control
15 ... 8	Reserved

Also see position deviation limiter dynamic (▹P1054◃) and limiter static (▹P1055◃).

The selection of position value sensing via bit 2 can and of the linear interpolation mode via bit 4 can only be executed at inhibited controller.

- Bit 4, linear interpolation mode:
  With this bit you can set if, at linear interpolation, the torque precontrol value, which normally only is existent in the first controller cycle of a bus cycle, is to be distributed along the bus cycle and this in such a way, that the mean value of the torque precontrol is equal in each bus cycle. In this case the speed precontrol is not constant within a bus cycle, but linearly changes with a rising, which corresponds to the distributed torque precontrol value. This linear interpolation modification is only existent for the operating mode position control.
- Bit 5, synchronization on actual speed value
  This function allows a smooth switch-over at stable speed into the operating mode position control (-4). See ▹Smooth switch-over in operating mode position control (-4)◃ on page 256. It can, e.g. be used at the cyclic set value setting by a PLC via ▹P0369◃ position set value for interpolation or ▹P0370◃ position set value angle for interpolation. It makes sense to activate extrapolation (bit 3 = 1) simultaneously, if the operating mode switch-over and the set value setting is not simultaneously.
  Additionally the bit 11 in ▹P0300◃ control word to inhibit the position set values. As long as this is set, the controller does not accept the set values in ▹P0369◃ and ▹P0370◃ and continues to extrapolate. The set values will not be accepted by the controller until the bit „Set value inhibit“ is reset.
- Bit 6, enable of software compensation of encoder eccentricity
  The software compensation of the encoder eccentricity, which normally is switched off, is activated by the setting of bit 6 = 1. This compensation uses the information of the amplitude ▹P1048◃ and phase shifting ▹P1049◃ of the encoder eccentricity error. This compensation exists from FW 3.09 and only for the operating modes, at which the position controller is active (see ▹Software compensation of encoder eccentricity (from FW 03.09 onwards)◃ on page 209).
- Bit 7, compensation of encoder eccentricity mode
  If the compensation of the encoder eccentricity is enabled (position controller mode (position controller mode ▹P1050◃ bit 6 = 1), by the setting of bit 7 = 1 the influence of the encoder eccentricity can be compensated to the speed controller. Normally this option is not active (see ▹Software compensation of encoder eccentricity (from FW 03.09 onwards)◃ on page 209).

P1051	Lageregler Kv-Faktor	0.0 to 3276.7 1/s	
DS	**Position controller Kv factor**	10.0 1/s	
ON	BM_u_Ds0_PosCtrl_KVFactor	10:1 1/s	-

Proportional gain of position controller, in s^{-1}. See ▹General overview position controller◃ on page 209.

The position controller is implemented as P-controller. The K_V- factor is the gain factor of the position controller. At the synchronous operation mode (-5) with a switched off positioning controller (K_V=0) the following axis is set in the speed synchronous operation. In this case the speed feed forward generates the required speed set value.

P1052	Drehzahl-Vorsteuerung-Glättung	0.0 to 50.0 ms	
DS	**Speed precontrol smoothing time**	1.0 ms	
ON	BM_u_Ds0_SpeedFeedForSmooth	10:1 ms	-

Smoothing time constant of speed precontrol. See ▹General overview position controller◃ on page 209.

P1053	Drehzahl-Vorsteuerung-Faktor	0.00 to 125.00 %	
DS	**Speed precontrol factor**	100.00 %	
	BM_u_Ds0_SpeedFeedForFactor	4000_{hex}:100 %	-

Scaling factor of speed precontrol in %. See ▹General overview position controller◃ on page 209.

P1054	Schleppfehler-Grenze dynamisch	0 to $7FFFFFFF_{hex}$	
DS	**Position deviation limit dynamic**	00000800_{hex}	
	BM_di_Ds0_PosDevLimDyn	1:1	CW

The dynamic deviation limit becomes effective as soon as there is a new position set value at every moment of sampling of the position controller. The limit is symmetric to the actual assigned position set value.
If the actual deviation (control deviation) is greater than the adjusted deviation limit, this is displayed in the position controller status ▹P0360◃ by bit 4.
After monitoring time (deviation time,▹P1056◃) additionally bit 6 is set and the drive is inhibited, if in the parameter position controller mode the error enable for the dynamic deviation is set (bit 0 = 1).

Scaling: 16 bit revolutions, 16 bit angle. A motor revolution therefore accords to 65536 increments.

Switch-over between dynamic and static deviation monitoring explained by an example of a typical positioning set value input:

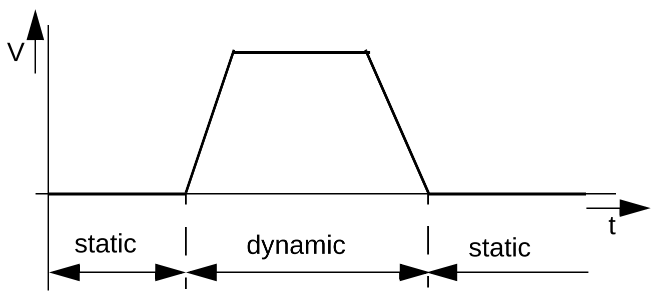


Figure 148: Position deviation limit static/dynamic

P1055	Schleppfehler-Grenze statisch	0 to 7FFFFFFF$_{hex}$	
DS	**Position deviation limit static**	00000100$_{hex}$	
	BM_di_Ds0_PosDevLimStatic	1:1	CW

The static deviation limiter then is effective, if the position controller either has no position set value or consistently receives the same position set value (also see diagram under ▹P1054◃). It is symmetrical around the actual assigned position set value.

If the actual deviation (control deviation) is greater than the adjusted deviation limit, this is displayed in the position controller status▹P0360◃ by bit 5.
After monitoring time (deviation time, ▹P1056◃) additionally bit 7 is set and the drive is inhibited, if in parameter position controller mode the error enable for the dynamic deviation is set (bit 1 = 1).

Scaling: 16 bit revolutions, 16 bit angle. A motor revolution therefore accords to 65536 increments.

P1056	Schleppfehler-Zeit	0.000 to 65.000 s	
DS	**Position deviation time**	1.000 s	
	BM_u_Ds0_PosDevTime	1:1000 s	-

Time window for the position deviation monitoring. This time window is effective only for the message in the position controller status bits 6 and 7, and for the error message. The status bits 4 and 5 always report the position deviation immediately.

Furthermore this time is important for the status message ’set value reached’ (bit 12) in the position controller status and in the drive status (status word, ▹P0301◃, only in the operating modes position control (operating mode -4) and synchronous operation (operating mode -5)). For this time the position deviation must be within the respective position deviation limit. Then the message ’set value reached’ will be displayed.

P1057	Getriebefaktor	0.02 to 327.67	
DS	**Gear factor**	1.00	
	BM_u_Ds0_GearFactor	100:1	-

Setting of gear ratio between motor and load.

Only necessary if two encoders are used one for motor control and one for load-sided position sensing. If there is a gear between motor and load, in this parameter the gear ratio motor: Load must be set.

P1058	Zweite Schleppfehlergrenze	0 to $7FFFFFFF_{hex}$	
DS	**Position deviation limit 2**	00000100_{hex}	
ON	BM_di_Ds0_PosDevLim2	1:1	CW

Second position deviation limit. It is valid both in the static and in the dynamic operation case. It lays symmetric around the actual predetermined position set value. If the actual position deviation (system deviation) is greater than the adjusted position deviation limit, this is displayed in the position controller status word (▹P0360◃). For the position deviation limit 2 bit 9 is set. A programmable error triggering in the controller, as by the parameters position deviation limit dynamic (▹P1054◃) and position deviation limit static (▹P1055◃) is not possible.

Scaling: 16 bit revolutions, 16 bit angle. A motor revolution therefore accords to 65536 increments.

P1059	Lagesollwert-Glättungsintervall	0 to 16	
DS	**Position set value smoothing interval**	0	
ON	BM_u_Ds0_PosSetSmoothInterval	1:1	CW

From firmware version FW 3.08.

This parameter determines the number of the averaged values to smooth cyclically and synchronously specified position set values.

The parameter is available for the operating modes position control and synchronous operation. See ▹Sliding average of position set values◃ on page 258.

Value 0 means: There is no smoothing.

The smoothing interval refers to the time cycle, writing new set values into the controller - depending on application BACI cycle time (▹P0800◃) or Sync interval (▹P0532◃).

NOTE!

- If set values are not written cyclical, e.g. separately for testing via WinBASS and the smoothing interval is unequal 0, then the active set value in the controller does not reach the specified set value until several writing operations have been executed (due to PT1-smoothening).
- Changing of the value at released drive can lead to momentary set value step-changes.
- The entered value in ▹P0369◃, ▹P0370◃, ▹P0471◃ or ▹P0472◃ is smoothed and the result is displayed in the same parameter. There are no additional parameters for the smoothening values.

P1061	Glättungszeit Open Loop Drehzahlistwert	0.0 to 50.0 ms	
DS	**Smoothing time for open loop speed actual value**	1.0 ms	
ON	BM_u_Ds0_OL_SpeedSmoothTime	10:1 ms	

Smoothing of the open loop actual speed value. In order to reject highly-frequent failures on the actual speed value the smoothing time constant for a digital PT1 element can be specified.

The minimum value of the time constant is limited internally in the controller to the sampling time (0.125 ms); in this case the smoothing is switched off.

Only relevant if encoderless operation is set.

P1062	Open Loop Überdrehzahl-Grenze	0.00 to 200.00 %	
DS	**Open loop overspeed limit**	115.00 %	
ON	BM_u_Ds0_Enc'X'Speed_ULim	4000_{hex}:100 %	CW

Limit value for overspeed monitoring in encoderless operation. If overspeed threshold is exceeded the status bit for overspeed in ▹P0380◃ speed status open loop (bit 6) is set and an error is enabled. If the speed is below the overspeed threshold, the status bit is reset directly (without hysteresis).

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

Only relevant if encoderless operation is set.

P1063	Open Loop N=0-Schwelle	0.00 to 25.00 %	
DS	**Open Loop N=0 threshold**	1.00 %	
ON	BM_u_Ds0_OL_Mon_LLim	4000_{hex}:100 %	CW

Speed threshold for the message 'Zero speed'. The message in ▹P0380◃ speed status open loop is set, if the amount of the actual speed value falls under the threshold, which was set. The message will be reset, if the absolute value of the speed actual value exceeds the threshold plus a 0.5%-hysteresis.

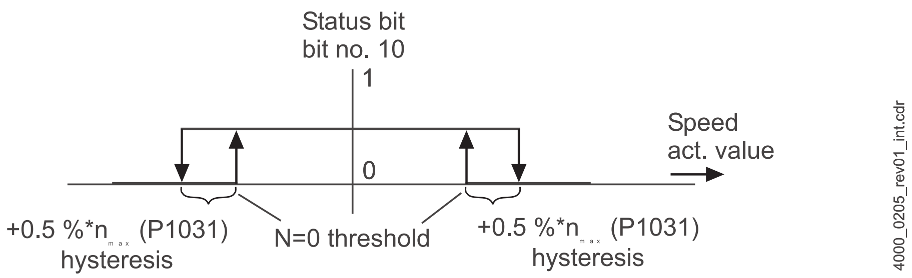


Figure 149: Speed threshold for zero-speed message

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

Only relevant if encoderless operation is set.

P1064	Open Loop N>Nx EIN-Schwelle	0.00 to 150.00 %	
DS	**Open loop N>Nx ON-threshold**	100.00 %	
ON	BM_u_Ds0_OL_Mon_ULimOn	4000_{hex}:100 %	CW

Freely usable speed threshold. If this speed threshold is exceeded (amount speed actual value > adjusted threshold) bit 11 in ▹P0380◃ speed status open loop is set. The bit is reset not until the threshold N>Nx OFF ▹P1065◃ is below.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

Only relevant if encoderless operation is set.

P1065	Open Loop N>Nx AUS-Schwelle	0.00 to 150.00 %	
DS	**Open loop N>Nx Off-threshold**	96.00 %	
ON	BM_u_Ds0_OL_Mon_ULimOff	4000_{hex}:100 %	CW

Freely usable speed threshold. If the speed threshold is below (amount speed actual value < adjusted threshold), bit no. 11 in ▹P0380◃ speed status open loop is reset. The bit will be set, if the threshold N>Nx ON (▹P1064◃) is exceeded.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

Only relevant if encoderless operation is set.

P1071	Geber 1 Glättungszeit	0 to 50.0 ms	
DS	**Encoder 1 smoothing time constant**	1.0 ms	
ON	BM_u_Ds0_Enc1SmoothTime	10:1 ms	-

Time constant of low-pass filter for encoder actual value smoothing. To suppress high frequency disturbance of the speed actual value, here you can assign a smoothing time constant for a digital PT1-element.

The minimum value of the time constant is limited internally in the controller to the sampling time (0.125 ms); in this case the smoothing is switched off.

P1072	Geber 1 Überdrehzahl-Grenze	0.00 to 200.00 %	
DS	**Encoder 1 overspeed limit**	115.00 %	
ON	BM_u_Ds0_Enc1Speed_ULim	4000_{hex}:100 %	CW

Limit value for the overspeed monitoring of encoder 1. If the overspeed threshold is exceeded the status bit for overspeed in ▹P0390◃encoder 1 status (bit 6) is set and an error is enabled. If the speed is below the overspeed threshold, the status bit is reset directly (without hysteresis).

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1073	Geber 1 N=0-Schwelle	0.00 to 25.00 %	
DS	**Encoder 1 N=0 threshold**	1.00 %	
ON	BM_u_Ds0_Enc1Mon_LLim	4000_{hex}:100 %	CW

Speed threshold for the message 'Zero speed'. The message in ▷P0390◁ Encoder 1 status will be set, if the absolute value of the speed actual value is less than the adjusted threshold. The message will be reset, if the amount of the speed actual value exceeds the threshold plus a 0.5%-hysteresis.

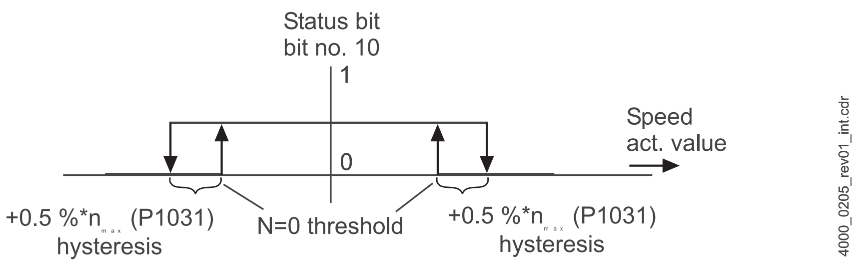


Figure 150: Speed threshold for zero-speed message

Scaling: 100 % ↔ Motor maximum speed of drive (▷P1031◁)

P1074	Geber 1 N>Nx EIN-Schwelle	0.00 to 150.00 %	
DS	**Encoder 1 N>Nx ON threshold**	100.00 %	
ON	BM_u_Ds0_Enc1Mon_ULimOn	4000_{hex}:100 %	CW

Freely usable speed threshold. If this speed threshold is exceeded (amount speed actual value > set threshold) bit 11 is set in ▷P0390◁ encoder 1 status. The bit is reset not until the threshold N>Nx OFF (▷P1075◁) is below.

Scaling: 100 % ↔ Motor maximum speed of drive (▷P1031◁)

P1075	Geber 1 N>Nx AUS-Schwelle	0.00 to 150.00 %	
DS	**Encoder 1 N>Nx OFF threshold**	96.00 %	
ON	BM_u_Ds0_Enc1Mon_ULimOff	4000_{hex}:100 %	CW

Freely usable speed threshold. If the speed threshold is below (amount speed actual value < set threshold) bit 11 in ▷P0390◁ encoder 1 status is reset. The bit will be set, if the threshold N>Nx ON (▷P1074◁) is exceeded.

Scaling: 100 % ↔ Motor maximum speed of drive (▷P1031◁)

P1076	Geber 1 Sin²x Obergrenze	85.00 to 110.00 %
DS	**Encoder 1 sin²x upper limit**	100.00 %
ON	BM_u_Ds0_Enc1SIN2xUpperLimit	see equation ▹P1076◃

Upper limit of the sin²x monitoring of the encoder 1.

$$\text{internal value} = \frac{(\text{P1076[GUI]})^2 \cdot 2048}{10000}$$

P1077	Geber 1 Sin²x-Grenzen Überwachungszeitfenster	0 to 4000 ms
DS	**Encoder 1 time frame for sin²x amplitude supervision**	0 ms
ON	BM_u_Ds0_Enc1AmpErrTimeLIM	8:1 ms

From firmware version FW 03.09.

The parameter determines the time window width for the supervision of the sin²x-limits of the encoder 1, and therewith displays the sensitivity of error detection. This sensitivity is proportional to the width of the time window. Within this time window the exceedances of the amplitude limits are counted. An error is generated as soon as two of these exceedances are counted. If the window time of the encoder supervision is expired the counter for the exceedances of the amplitude limits is reset and the time window is started again.

The following special case must be pointed out. If the time window width is set to zero, an error is also generated, if there is a single occurrence of an amplitude deviation.

P1078	Geber 2 Sin²x-Grenzen Überwachungszeitfenster	0 to 4000 ms
DS	**Encoder 2 time frame for sin²x amplitude supervision**	0 ms
ON	BM_u_Ds0_Enc2AmpErrTimeLIM	8:1 ms

From firmware version FW 03.09.

The parameter determines the time window width for the supervision of the sin²x-limits of the encoder 2, and therewith displays the sensitivity of error detection. This sensitivity is proportional to the width of the time window. Within this time window the exceedances of the amplitude limits are counted. An error is generated as soon as two of these exceedances are counted. If the window time of the encoder supervision is expired the counter for the exceedances of the amplitude limits is reset and the time window is started again.

The following special case must be pointed out. If the time window width is set to zero, an error is also generated, if there is a single occurrence of an amplitude deviation.

P1081	Geber 2 Glättungszeit	0.0 to 50.0 ms	
DS	**Encoder 2 smoothing time constant**	1.0 ms	
ON	BM_u_Ds0_Enc2SmoothTime	10:1 ms	-

Time constant of low-pass filter for encoder actual value smoothing. To suppress high frequency disturbance of the speed actual value, here you can assign a smoothing time constant for a digital PT1-element.

The minimum value of the time constant is limited internally in the controller to the sampling time (0.125 ms); in this case the smoothing is switched off.

P1082	Geber 2 Überdrehzahl-Grenze	0.00 to 200.00 %	
DS	**Encoder 2 over speed limit**	115.00 %	
ON	BM_u_Ds0_Enc2Speed_ULim	4000_{hex}:100 %	CW

Limit value for the overspeed monitoring of encoder 2. If overspeed threshold is exceeded the status bit for overspeed in ▹P0400◃ encoder 2 status (bit 6) is set and an error is enabled. If the speed is below the overspeed threshold, the status bit is reset directly (without hysteresis).

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1083	Geber 2 N=0-Schwelle	0.00 to 25.00 %	
DS	**Encoder 2 N=0 threshold**	1.00 %	
ON	BM_u_Ds0_Enc2Mon_LLim	4000_{hex}:100 %	CW

Speed threshold for the message 'Zero speed'. The message in ▹P0400◃ encoder 2 status will be set, if the absolute value of the speed actual value is less than the threshold, which was set. The message will be reset, if the absolute value of the speed actual value exceeds the threshold plus a 0.5%-hysteresis.

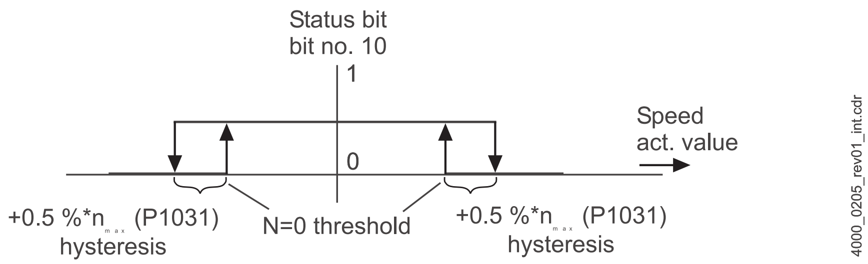


Figure 151: Encoder 2 zero-speed threshold

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1084	Geber 2 N>Nx EIN-Schwelle	0,00 bis 150.00 %	
DS	**Encoder 2 N>Nx ON threshold**	100.00 %	
ON	BM_u_Ds0_Enc2Mon_ULimOn	4000_{hex}:100 %	CW

Freely usable speed threshold. If this speed threshold is exceeded (amount speed actual value > set threshold) bit 11 is set in ▹P0400◃ encoder 2 status. The bit is reset not until the threshold N>Nx OFF (▹P1085◃) is below.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1085	Geber 2 N>Nx AUS-Schwelle	0.00 to 150.00 %	
DS	**Encoder 2 N>Nx OFF threshold**	96.00 %	
ON	BM_u_Ds0_Enc2Mon_ULimOff	4000_{hex}:100 %	CW

Freely usable speed threshold. If the speed threshold is below (amount speed actual value < set threshold) bit 11 in ▹P0400◃ encoder 2 status is reset. The bit will be set, if the threshold N>Nx ON (▹P1084◃) is exceeded.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1086	Geber 2 Sin²x Obergrenze	85.00 to 110.00 %
DS	**Encoder 2 sin²x upper limit**	100.00 %
ON	BM_u_Ds0_Enc2SIN2xUpperLimit	see equation ▹P1086◃

Upper limit of the sin²x monitoring of the encoder 2.

$$\text{internal value} = \frac{(P1086[GUI])^2 \cdot 2048}{10000}$$

P1087	Feldwinkel Überwachung Schwelle	0.00 to 50.00 %	
DS	**Field angle monitor threshold**	10.00 %	
ON	BM_u_Ds0_FieldAngMonitorThresh	4000_{hex}:100 %	CW

Speed threshold from which on field angle monitoring is active. Below the threshold no field angle monitoring is executed. Also see ▹Encoder monitoring◃ from page 106.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1090	Auswahl digitaler Eingang 1	0 to 0508$_{hex}$	
DS	**Selection digital input 1**	0$_{hex}$	
ON	BM_w_Ds0_DI1_InputChannel	1:1	-

Selection of slot and channel for digital input 1.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, corresponds to slot A to E)

Value 0 means that no input channel has been selected.

P1091	Zielnummer digitaler Eingang 1	0 to max. Para-no.	
DS	**Target number: digital input 1**	0	
ON	BM_u_Ds0_DI1_TargetPxxx	1:1	-

Number of parameter to be changed by digital input 1.

P1092	Bit-Auswahl digitaler Eingang 1	0 to FFFF$_{hex}$	
DS	**Bit selection digital input 1**	0$_{hex}$	
ON	BM_w_Ds0_DI1_BitSelection	1:1	CW

Selection of target parameter bits to be changed by digital input 1.

P1093	Bit-Muster bei LOW des digitalen Eingang 1	0 to FFFF$_{hex}$	
DS	**Set bit pattern for LOW state digital input 1**	0$_{hex}$	
ON	BM_w_Ds0_DI1_LowPattern	1:1	CW

Bit pattern, written to target parameter if digital input 1 is LOW.

P1094	Bit-Muster bei HIGH des digitalen Eingang 1	0 to FFFF$_{hex}$	
DS	**Set bit pattern for HIGH state digital input 1**	0$_{hex}$	
ON	BM_w_Ds0_DI1_HighPattern	1:1	CW

Bit pattern, written to target parameter if digital input 1 is HIGH.

P1095	Auswahl digitaler Eingang 2	0 to 0508_{hex}	
DS	**Selection digital input 2**	0_{hex}	
ON	BM_w_Ds0_DI2_InputChannel	1:1	-

Selection of slot and channel digital input 2.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1096	Zielnummer digitaler Eingang 2	0 to max. Para-no.	
DS	**Target number: digital input 2**	0	
ON	BM_u_Ds0_DI2_TargetPxxx	1:1	-

Number of parameter to be changed by digital input 2.

P1097	Bit-Auswahl digitaler Eingang 2	0 to $FFFF_{hex}$	
DS	**Bit selection digital input 2**	0_{hex}	
ON	BM_w_Ds0_DI2_BitSelection	1:1	CW

Selection of target parameter bits to be changed by digital input 2.

P1098	Bit-Muster bei LOW des digitalen Eingang 2	0 to $FFFF_{hex}$	
DS	**Set bit pattern LOW state digital input 2**	0_{hex}	
ON	BM_w_Ds0_DI2_LowPattern	1:1	CW

Bit pattern, written to target parameter if digital input 2 is LOW.

P1099	Bit-Muster bei HIGH des digitalen Eingang 2	0 to $FFFF_{hex}$	
DS	**Set bit pattern HIGH state digital input 2**	0_{hex}	
ON	BM_w_Ds0_DI2_HighPattern	1:1	CW

Bit pattern, written to target parameter if digital input 2 is HIGH.

P1100	Auswahl digitaler Eingang 3	0 to 0508$_{hex}$	
DS	**Selection digital input 3**	0$_{hex}$	
ON	BM_w_Ds0_DI3_InputChannel	1:1	-

Selection of slot and channel digital input 3.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1101	Zielnummer digitaler Eingang 3	0 to max. Para-no.	
DS	**Target number: digital input 3**	0	
ON	BM_u_Ds0_DI3_TargetPxxx	1:1	-

Number of parameter to be changed by digital input 3.

P1102	Bit-Auswahl digitaler Eingang 3	0 to FFFF$_{hex}$	
DS	**Bit selection digital input 3**	0$_{hex}$	
ON	BM_w_Ds0_DI3_BitSelection	1:1	CW

Selection of target parameter bits to be changed by digital input 3.

P1103	Bit-Muster bei LOW des digitalen Eingang 3	0 to FFFF$_{hex}$	
DS	**Set bit pattern for LOW state digital input 3**	0$_{hex}$	
ON	BM_w_Ds0_DI3_LowPattern	1:1	CW

Bit pattern, written to target parameter if digital input 3 is LOW.

P1104	Bit-Muster bei HIGH des digitalen Eingang 3	0 to FFFF$_{hex}$	
DS	**Set bit pattern for HIGH state digital input 3**	0$_{hex}$	
ON	BM_w_Ds0_DI3_HighPattern	1:1	CW

Bit pattern, written to target parameter if digital input 3 is HIGH.

P1105 | Auswahl digitaler Eingang 4 | 0 to 0508_{hex}

DS | **Selection digital input 4** | 0_{hex}

ON | BM_w_Ds0_DI4_InputChannel | 1:1 | -

Selection of slot and channel digital input 4.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1106 | Zielnummer digitaler Eingang 4 | 0 to max. Para-no.

DS | **Target number: digital input 4** | 0

ON | BM_u_Ds0_DI4_TargetPxxx | 1:1 | -

Number of parameter to be changed by digital input 4.

P1107 | Bit-Auswahl digitaler Eingang 4 | 0 to $FFFF_{hex}$

DS | **Bit selection digital input 4** | 0_{hex}

ON | BM_w_Ds0_DI4_BitSelection | 1:1 | CW

Selection of target parameter bits to be changed by digital input 4.

P1108 | Bit-Muster bei LOW des digitalen Eingang 4 | 0 to $FFFF_{hex}$

DS | **Set bit pattern for LOW state digital input 4** | 0_{hex}

ON | BM_w_Ds0_DI4_LowPattern | 1:1 | CW

Bit pattern, written to target parameter if digital input 4 is LOW.

P1109 | Bit-Muster bei HIGH des digitalen Eingang 4 | 0 to $FFFF_{hex}$

DS | **Set bit pattern for HIGH state digital input 4** | 0_{hex}

ON | BM_w_Ds0_DI4_HighPattern | 1:1 | CW

Bit pattern, written to target parameter if digital input 4 is HIGH.

P1110	Auswahl digitaler Ausgang 1	0 to 0508_{hex}	
DS	**Selection digital output 1**	0_{hex}	
ON	BM_w_Ds0_DO1_OutputChannel	1:1	-

Selection of slot and channel for digital output 1.

Bit	Meaning
7 ... 0	Channel selection of output module (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of output module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1111	Quellnummer digitaler Ausgang 1	0 to max.	Para-no.
DS	**Source number digital output 1**	0	
ON	BM_u_Ds0_DO1_SourcePxxx	1:1	-

Number of parameter for output by digital output 1.

P1112	Bit-Auswahl digitaler Ausgang 1	0 to $FFFF_{hex}$	
DS	**Bit selection digital output 1**	0_{hex}	
ON	BM_w_Ds0_DO1_BitSelection	1:1	CW

Selection of bits in source parameter to be compared for digital output 1.

P1113	Bit-Muster digitaler Ausgang 1	0 to $FFFF_{hex}$	
DS	**Bit pattern digital output 1**	0_{hex}	
ON	BM_w_Ds0_DO1_BitPattern	1:1	CW

Bit pattern to be compared with the bit pattern of source parameter for digital output 1.

P1114	Auswahl digitaler Ausgang 2	0 to 0508_{hex}	
DS	**Selection digital output 2**	0_{hex}	
ON	BM_w_Ds0_DO2_OutputChannel	1:1	-

Selection of slot and channel for digital output 2.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

The value 0 means no output channel selected.

P1115 Quellnummer digitaler Ausgang 2 0 to $FFFF_{hex}$

DS **Source number digital output 2** 0_{hex}

ON BM_u_Ds0_DO2_SourcePxxx 1:1 -

Number of parameter for output by digital output 2.

P1116 Bit-Auswahl digitaler Ausgang 2 0 to 0508_{hex}

DS **Bit selection digital output 2** 0_{hex}

ON BM_w_Ds0_DO2_BitSelection 1:1 CW

Selection of bits in source parameter to be compared for digital output 2.

P1117 Bit-Muster digitaler Ausgang 2 0 to $FFFF_{hex}$

DS **Bit pattern digital output 2** 0_{hex}

ON BM_w_Ds0_DO2_BitPattern 1:1 CW

Bit pattern to be compared with the bit pattern of source parameter for digital output 2.

P1118 Auswahl digitaler Ausgang 3 0 to 0508_{hex}

DS **Selection digital output 3** 0_{hex}

ON BM_w_Ds0_DO3_OutputChannel 1:1 -

Selection of slot and channel for digital output 3.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

The value 0 means, that an output channel has not been selected.

P1119 Quellnummer digitaler Ausgang 3 0 to max. Para-no.

DS **Source number digital output 3** 0

ON BM_u_Ds0_DO3_SourcePxxx 1:1 -

Number of parameter for output by digital output 3.

P1120	Bit-Auswahl digitaler Ausgang 3	0 to $FFFF_{hex}$	
DS	**Bit selection digital output 3**	0_{hex}	
ON	BM_w_Ds0_DO3_BitSelection	1:1	CW

Selection of bits in source parameter to be compared for digital output 3.

P1121	Bit-Muster digitaler Ausgang 3	0 to $FFFF_{hex}$	
DS	**Bit pattern digital output 3**	0_{hex}	
ON	BM_w_Ds0_DO3_BitPattern	1:1	CW

Bit pattern to be compared with the bit pattern of source parameter for digital output 3.

P1122	Auswahl digitaler Ausgang 4	0 to 0508_{hex}	
DS	**Selection digital output 4**	0_{hex}	
	BM_w_Ds0_DO4_OutputChannel	1:1	-

Selection of slot and channel for digital output 4.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

The value 0 means, that an output channel has not been selected.

P1123	Quellnummer digitaler Ausgang 4	0 to max.	Para-no.
DS	**Source number digital output 4**	0	
ON	BM_u_Ds0_DO4_SourcePxxx	1:1	-

Number of parameter for output by digital output 4.

P1124	Bit-Auswahl digitaler Ausgang 4	0 to $FFFF_{hex}$	
DS	**Bit selection digital output 4**	0_{hex}	
ON	BM_w_Ds0_DO4_BitSelection	1:1	CW

Selection of bits in source parameter to be compared for digital output 4.

P1125 | Bit-Muster digitaler Ausgang 4 | 0 to FFFF$_{hex}$
DS | **Bit pattern digital output 4** | 0$_{hex}$
ON | BM_w_Ds0_DO4_BitPattern | 1:1 | CW

Bit pattern to be compared with the bit pattern of source parameter for digital output 4.

P1130 | Auswahl analoger Eingang 1 | 0 to 0508$_{hex}$
DS | **Selection analog input 1** | 0$_{hex}$
ON | BM_w_Ds0_AI1_InputChannel | 1:1 | -

Selection of slot and channel for analog input 1.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1131 | Glättungszeit analoger Eingang 1 | 0.000 to 60.000 ms
DS | **Smoothing time analog input 1** | 1.000 ms
ON | BM_u_Ds0_AI1_Smoothing | 1000:1 ms | -

Smoothing time analog input 1.
In order to smooth interferences on the analog input signal a smoothing time constant in ms can be entered.

Smoothing is off, if the particular parameter value = 0 ms is set.

P1132 | Skalierungsfaktor analoger Eingang 1 | -2.0 to 2.0
DS | **Scaling factor analog input 1** | 1.0
ON | BM_i_Ds0_AI1_Scaling | 3FFF$_{hex}$:1 | -

Scaling factor analog input 1. These parameters enable a scaling of the analog input value.

The output values (see parameters ▹P0420◃ and ▹P0421◃) are with unipolar target parameters from 0 to +100% and with bipolar target parameters from -100% to +100%. Which analog input voltage is used to reach these maximum values, is dependent on the scaling factor.

P1133	Zielnummer analoger Eingang 1	0 to max.	Para-no.
DS	**Target number: analog input 1**	0	
ON	BM_u_Ds0_AI1_TargetPxxx	1:1	-

Number of parameter to be controlled by ’analog input 1’.

P1134	Offset analoger Eingang 1	-100.00 % to +100.00 %	
DS	**Offset analog input 1**	0.00 %	
ON	BM_i_Ds0_AI1_Offset	$7FFF_{hex}$:100 %	CW

Offset correction of analog input 1.

P1135	Schwellenwert analoger Eingang 1	0.00 % to +100.00 %	
DS	**Threshold value analog input 1**	0.00 %	
ON	BM_u_Ds0_AI1_Threshold	$7FFF_{hex}$:100 %	CW

Threshold value of analog input 1. By using the threshold value, you can control the input threshold of sensitivity.

P1136	Auswahl analoger Eingang 2	0 to 0508_{hex}	
DS	**Selection analog input 2**	0_{hex}	
ON	BM_w_Ds0_AI2_InputChannel	1:1	-

Selection of slot and channel for analog input 1.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1137	Glättungszeit analoger Eingang 2	0.000 to 60.000 ms	
DS	**Smoothing time analog input 2**	1.000 ms	
ON	BM_u_Ds0_AI2_Smoothing	1000:1 ms	-

Smoothing time analog input 2. In order to smooth interferences on the analog input signal a smoothing time constant in ms can be entered. Smoothing is off, if the particular parameter value = 1 ms has been set.

P1138	Skalierungsfaktor analoger Eingang 2	-2.0 to 2.0	
DS	**Scaling factor analog input 2**	1.0	
ON	BM_i_Ds0_AI2_Scaling	$3FFF_{hex}$:1	-

Scaling factor analog input 2.
These parameters enable a scaling of the analog input value. The output values (see parameters ▹P0420◃ and ▹P0421◃) are with unipolar target parameters from 0 to +100 % and with bipolar target parameters from -100 % to +100 %. Which analog input voltage is used to reach these maximum values, is dependent on the scaling factor.

P1139	Zielnummer analoger Eingang 2	0 to max. Para-no.	
DS	**Target number analog input 2**	0	
ON	BM_u_Ds0_AI2_TargetPxxx	1:1	-

Number of parameter to be controlled by ’analog input 2’.

P1140	Offset analoger Eingang 2	-100.00 % to +100.00 %	
DS	**Offset analog input 2**	0.00 %	
ON	BM_i_Ds0_AI2_Offset	$7FFF_{hex}$:100 %	CW

Offset correction of analog input 2.

P1141	Schwellenwert analoger Eingang 2	0.00 % to +100.00 %	
DS	**Threshold value analog input 2**	0.00 %	
ON	BM_u_Ds0_AI2_Threshold	$7FFF_{hex}$:100 %	CW

Threshold value of analog input 2. Responsiveness of input.

P1150	Auswahl schneller analoger Ausgang 1	0 to 0508_{hex}	
DS	**Selection fast analog output 1**	0_{hex}	
ON	BM_w_Ds0_AOF1_OutputChannel	1:1	-

Selection of slot and channel for fast analog output 1.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1151	Quellnummer schneller analoger Ausgang 1	0 to max. Para-no.	
DS	**Source number fast analog output 1**	0	
ON	BM_u_Ds0_AOF1_SourcePxxx	1:1	-

You can select a parameter for output by filling in its parameter number.
If this parameter is set to 0, the regarded channel is switched off.

P1152	Offset schneller analoger Ausgang 1	-10.00 to +10.00V	
DS	**Offset fast analog output 1**	V	
ON	BM_i_Ds0_AOF1_Offset	$7FFF_{hex}$:10 V	CW

Offset correction of fast analog output 1.

P1153	Skalierungsfaktor schneller analoger Ausgang 1	67108863.00 to 67108863.00	
DS	**Scaling fast analog output 1**	1.00	
ON	BM_di_Ds0_AOF1_Scaling	32:1	CW

Scaling factor fast analog output 1.

P1154	Auswahl schneller analoger Ausgang 2	0 to 0508_{hex}	
DS	**Selection fast analog output 2**	0_{hex}	
ON	BM_w_Ds0_AOF2_OutputChannel	1:1	-

Selection of slot and channel for fast analog output 2.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

The value 0 means, that an output channel has not been selected.

P1155	Quellnummer schneller analoger Ausgang 2	0 to max. Para-no.	
DS	**Source number fast analog output 2**	0	
ON	BM_u_Ds0_AOF2_SourcePxxx	1:1	-

You can select a parameter for output by filling in its parameter number.
If this parameter is set to 0, the regarded channel is switched off.

P1156	Offset schneller analoger Ausgang 2	-10.00 to +10.00V	
DS	**Offset fast analog output 2**	0.0 V	
ON	BM_i_Ds0_AOF2_Offset	$7FFF_{hex}$:10 V	CW

Offset correction of fast analog output 2.

P1157	Skalierungsfaktor schneller analoger Ausgang 2	67108863.00 to 67108863.00	
DS	**Scaling fast analog output 2**	1.00	
ON	BM_i_Ds0_AOF2_Scaling	32:1	CW

Scaling factor fast analog output 2.

P1170	Hochlaufgeber Modus	0 to $FFFF_{hex}$	
DS	**Ramp function generator mode**	0_{hex}	
	BM_w_Ds0_RFGMode	4000_{hex}:100 %	CW

Settings for ramp function generator.

Bit	Meaning
0 to 2	Reserved
3	1: Negative set values inhibited
4	1: Positive set values are inhibited
5	1: Polarity reversal of the actual set value
6	0: Trapezoidal speed profile with ramp function generator smoothing (PT_1-element) 1: S-curve with square speed profile
7	▹P1174◃ Ramp function generator stop time refers to: 0: Set value change of 100 % ⇒ 0 % 1: Set value change of actual set value ⇒ 0 %
8	Selection of the input parameter (from FW 03.09) 0: ▹P1171◃ Ramp function generator input (16-bit resolution;100 % ⇔ 4000_{hex}) 1: ▹P1179◃ Ramp function generator input (32-bit resolution; 100 % ⇔ 40000000_{hex})
9	Interpolation of the output set value on the control cycle (from FW 03.09) 0: No interpolation 1: Interpolation active
10	1: Synchronization to speed actual value is switched off
15 ... 11	Reserved

Explanatory notes:

- Bit 3 to 5
  The internal bit processing sequence is as follows:
  1. Inhibit of positive or negative set values (bit 3 or 4)
  2. Polarity inversion of the current set value (bit 5)
- Bit 7 = 1:
  After the value, which was set in the ▹P1174◃ ramp function generator stop time, the 0% set value is reached independent of the actual set value.

If the trapezoidal speed profile (▹P1170◃ ramp function generator mode bit 6 = 0) is set, then the stop time is only valid for the unsmoothed curve. With smoothing (▹P1175◃ ramp function generator smoothening > 0) the stop time prolongs dependent on the smoothing factor, which was set.
If the S-curve profile (▹P1170◃ ramp function generator mode bit 6 = 1) is set, at the stop it is braked with trapezoidal speed profile. A set smoothing takes no effect.

- Bit 8 = 1:
  The input set value ▹P1179◃ with high resolution is active, if bit 8 is set. In this case it must be considered, that the functions „Set value generator with target ramp function generator “ and „Motor potentiometer“ does not operate. Both functions always write on the 16 bit standard input of the ramp function generator ▹P1171◃.
- Bit 9 = 1:
  Each speed change at the ramp function generator output is interpolated linearly to the control cycle time (125 µs). In case of acceleration the speed controller then has a new set value in each cycle and the noise of the current set value is significantly reduced. Due to interpolation the active set value reaches the speed controller delayed by a ramp function generator cycle (500 µs).
- Bit 10
  At switch on of the ramp function generator (operation enabled), the ramp function generator is synchronized to the speed actual parameter by default. If Bit 10 is set, the synchronization is switched off and the ramp function generator input and output are initialized with 0.

P1171

DS	Hochlaufgeber Eingang 16-Bit	-100.00 to +100.00 %	
	Ramp function generator input 16 bit	0.00 %	
	BM_i_Ds0_RFG1Input	4000_{hex}:100 %	CW

Ramp function generator input value (100.00 % ↔ 4000_{hex}, -100.00 % ↔ $C000_{hex}$).

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1172

DS	Hochlaufgeber Hochlaufzeit	0.00 to 650.00 s	
	Ramp function generator ramp-up time	0.00 s	
	BM_u_Ds0_RFG1RampUpTime	100:1 s	CW

Acceleration ramp for speed-controlled operation modes.

The time selected here corresponds to 100 % set value change.

P1173

DS	Hochlaufgeber Rücklaufzeit	0.00 to 650.00 s	
	Ramp function generator ramp-down time	0.00 s	
	BM_u_Ds0_RFG1RampDownTime	100:1 s	CW

Deceleration ramp for speed-controlled operation modes.

The time selected here corresponds to 100 % set value change.

P1174	Hochlaufgeber Schnellhaltzeit	0.00 to 650.00 s	
DS	**Ramp function generator quickstop time**	0.00 s	
	BM_u_Ds0_RFG1StopTime	100:1 s	CW

The quickstop ramp is effective in all quickstop procedures, not only in the speed-controlled operation modes.

The time selected here corresponds to 100 % set value change.

The speed controller must be sufficiently parameterized for a correct functioning of the braking operations at the quickstop- or ramp-down generator.

P1175	Hochlaufgeber Verschliff	0 to 32 000 ms	
DS	**Ramp function generator smoothing time**	0 ms	
	BM_u_Ds0_RFG1Smoothing	1:1 ms	

In order to achieve a smoothing of the ramp edges a PT_1-element is implemented. By use of this parameter, you can set the time constant of the PT_1-element.
Smoothing is effective only if a trapezoidal profile is set as ramp form.

P1176	Hochlaufgeber S-Kurvenhochlaufzeit	0.00 to 650.00 s	
DS	**DS Ramp Function Generator S-curve ramp-up time**	0.00 s	
	BM_u_Ds0_RFG1SCurveUpTime	100:1 s	CW

Smoothing of the ramp edges in the ramp-up for the speed controlled operation modes. The time selected here corresponds to 100 % set value change.

The S-curve ramp-up time which has been set should be less than the set ramp-up time so that the defined ramp times can be adhered to:

$T_{\text{Total acceleration time}} = T_{\text{Acceleration time}} + T_{\text{SC Acceleration time}}$

P1177	Hochlaufgeber S-Kurvenrücklaufzeit	0.00 to 650.00 s	
DS	**DS Ramp Function Generator S-curve ramp-down time**	0.00 s	
	BM_u_Ds0_RFG1SCurveDownTime	100:1 s	CW

Smoothing of the ramp edges in the ramp-down for the speed controlled operation modes. The time selected here corresponds to 100 % set value change.

The S-curve ramp-down time which was set should be less than the ramp-down time, which was set so that the defined ramp times can be adhered to:

$T_{\text{Deceleration total time}} = T_{\text{Deceleration time}} + T_{\text{SC Deceleration time}}$

P1178	Hochlaufgeber Sollwert-Erreicht-Band	0.00 % to +200.00 %	
-	**Ramp Function Generator Set Value Zone**	0.00 %	
A	BM_u_Ds0_RFG1SetValZone	4000_{hex}:1 %	-

From b maXX® FW 03.06 this parameter defines the message threshold of the ramp function generator status 'Set value reached' (see ramp function generator status word ▹P0430◃, bit 12).

The status bit 'Set value reached' is set, if the following is valid:

Ramp function generator output - Ramp function generator input <= Ramp function generator set value-reached-bandwidth

P1179	Hochlaufgeber Eingang 32-Bit	-100.00 % to +100.00 %	
DS	**Ramp Function Generator input 32 bit**	0.00 %	
	BM_di_Ds0_RFG1Input32	40000000_{hex}:100.00 %	CW

From firmware version FW 03.09.

Ramp function generator input value with 32-bit resolution (+100,00 % ⇔ 4000 0000_{hex}, -100,00 % ⇔ C000 0000_{hex}). The input activation occurs via ▹P1170◃ ramp function generator mode bit 8 = 1.

Scaling: 100 % ↔ Motor maximum speed of drive (▹P1031◃)

P1190	Positionierung Modus	0 to $FFFF_{hex}$	
DS	**Positioning mode**	0001_{hex}	
	BM_w_Ds0_PPosMode	1:1	-

Also see ▹Control of target position set value◃ from page 272.

Mode of positioning. With this parameter with the functions, which are mentioned below can be switched on- or off.

Bit	Meaning	Target position set value	Jog operation	Homing
0	1: Function of software limit switch active	X	X	
1	1: Function of hardware limit switch active	X	X	
2	1: Synchronization on actual speed value	X	X	X
4 ... 3	Speed profile: 00: Trapezium 01: S-curve 10: Sin^2 11: Reserved	X		

Bit	Meaning	Target position set value	Jog operation	Homing
5	Adjustable performance, if a new target is outside the software limit switch: 0: Automatic limitation: Traveling on software limit switch, Positioning status bit 5 = 1 1: Error message; Drive stops (brakes with ▹P1213◃) Positioning status bit 5 = 1	X	X	
6	Settable behavior at traveling in HW limit switch 0: No error is enabled 1: Error is enabled	X	X	
7	Starting performance at controller enable 0: After enable a positive edge in the start bit is necessary 1: After enable it is immediately started if a start bit was set	X		
8	0: No homing for positioning is necessary 1: Homing for positioning is necessary	X		
9	0: Starting of a travel request via bit 4 (new set value) in the control word. 1: Starting of a travel request via bit 11 (start positioning) in the control word. Original starting performance, description see ▹Appendix positioning ('original behavior')◃ from page 281	X		
10	Speed profile at stop, only at sin² curve	X		
11	Automatic start of positioning after changing of the positioning set: 0: After switch-over of the actual positioning set (▹P1191◃) an edge in the bit 4 (or bit 11 at mode original behavior) is necessary, in order to accept the new positioning set and to start positioning. 1: If the bit 4 „New set value“ (or bit 11 „Start positioning“ at original performance) is set at switchover of the actual positioning set, the new positioning set is automatically taken over and the positioning is started.	X		
12	Homing with or without the setting of homing position 0: At the end of homing the homing position is set, i.e. the position actual values and set values with homing position are overwritten. 1: Homing position is not set, the prior position value remains after reaching the homing position.	X		
13	Using of ▹P1198◃ clip environment 1 and ▹P1199◃ clip environment 2 0: as clip environments round the target position 1: as switch and cam positions			
15 ... 14	Reserved			

Explanatory notes:

- Bit 0:
  With bit 0 the monitoring of the software limit switch for the operation modes target position set and jogging is switched on.
  - Bit 0 = 0:
    The monitoring of the software limit switch is deactivated.
  - Bit 0 = 1:
    The monitoring of the software limit switch is activated. The exact performance in the operation mode target position set depends on the setting of bit 5 and also is explained there.

In the operation mode jogging the drive is braked to 0 if it has reached a limit switch.

- Bit 1:
  With bit 1 the monitoring of the HW limit switch for the operating modes target position set and jogging is switched on.
  - Bit 1 = 0:
    HW limit switch monitoring inactive.
  - Bit 1 = 1:
    HW limit switch monitoring active. With the reaching of a limit switch the drive is braked to 0. Over bit 6 furthermore can be set if in this case an error shall be activated or not.
- Bit 2:
  If the function 'Synchronization on speed actual value' is activated, it is possible to switch over jerk-free from any operation mode (except 'find notch position') into one of the position-controlled operation modes (position set mode, synchronous operation, jog operation and homing).
  See ▹Smooth switch-over in positioning operating modes◃ on page 257.
- Bit 3 and bit 4:
  Via these bits the speed profile for positioning is set.

Bit 4	Bit 3	Description
0	0	Trapezoidal profile
0	1	S-curve profile
1	0	Sine^2 profile
1	1	Reserved

- Bit 5:
  With bit 5 the performance at starting of a positioning can be set, if a new target position is outside the software limit switch range and this also is switched active.
  - Bit 5 = 0:
    - If new target position outside:
      Travel to next software limit switch; Positioning switch status
      Bit 4 or 5 = 1
    - If current position already outside and the new target position inside:
      Travel to target position; Positioning status bit 4 or 5 = 0
    - If current position already outside and new target outside:
      Travel to next software limit switch; Positioning switch status
      Bit 4 or 5 = 1
  - Bit 5 = 1:
    - If new target position outside:
      no movement; Positioning switch status bit 4 or 5 = 1;
      Error 196 or 197
    - If current position already outside and new target position inside
      Travel to target position; Positioning status bit 4 or 5 = 0
    - If current position already outside and new target position outside
      no movement; Positioning switch status bit 4 or 5 = 1;
      Error 196 or 197

  The generated error does not result in a pulse inhibit. It must be accepted, before a new travel starting request is accepted. With each start there is a new software limit switch check.

Error 196: Software limit switch 1 active
Error 197: Software limit switch 2 active

- Bit 6:
  With bit 6 it is set if the drive with reaching of a HW limit switch shall enable an error or not. The setting of bit 6 is only effective, if the HW limit switch monitoring is activated (see description according bit 1).
  - Bit 6 = 0:
    HW-limit switch monitoring does not enable an error, the drive is only braked to zero speed. New positioning requests are only executed, if the starting direction leads away from the limit switch.
  - Bit 6 = 1:
    If a HW limit switch is exceeded, the drive is decelerated to zero speed and an error is enabled (error 198 or 199). This error does not result in a pulse inhibit, but it first must be accepted, before a new travel request is accepted. New positioning requests are only executed, if the starting direction leads away from the limit switch.
- Bit 7:
  With bit 7 starting performance at controller enable can be set.
  - Bit 7 = 0:
    After controller enable a positive edge in the start bit is required, so that the values from the positioning data set X can be overtaken into the positioning data set 0 and so that a relative positioning can be started.
  - Bit 7 = 1:
    It the start bit is set at controller release, the data is immediately accepted at controller release. Also a relative positioning is immediately started.
- Bit 8:
  With bit 8 it is determined if the drive accepts positioning, if no homing has taken place yet.
  - Bit 8 = 0:
    In order to operate in the operation mode positioning no homing is necessary
  - Bit 8 = 1:
    If the drive is enabled in operation mode positioning, without taking place of homing, an error message (error 200) is generated and the drive remains position-controlled in the current position. Positioning requests are not executed. Not until homing has been executed (once after switching on), positioning requests are executed.
- Bit 9: Starting behavior of positioning
  The starting behavior of positioning is influenced with bit 9. The choice between the behavior of V-controller or b maXX® version 1 and the new starting- and handshake-mechanism, which complies with the procedure at CANopen or Drivecom.
  - Bit 9 = 0:
    New starting- and handshake operation: Start of positioning and handshake in order to accept the data occurs with bit 4 in the control word. The bit 11 in the control word has no meaning.
  - Bit 9 = 1:
    Starting- and handshake-operation is like at V-controller or b maXX® version 1: Start of positioning is made via bit 11 in the control word 2. The bit 4 in the control word (new set value) is only for a handshake operation and has no direct influence on the positioning. In this case the mode “Immediately change set” (set of setpoints) cannot be used.

- Bit 10
  - Here the behavior at a stop can be set during the running $\sin^2$-positioning.
    Bit 10 = 0: Braking with $\sin^2$ profile; Deceleration value of the current positioning is valid.
  - Bit 10 = 1: Braking with S-curve; Deceleration value of ▹P1213◃ Positioning stop deceleration is valid.
    With this profile a stop can only be executed with an hardware limit switch. This stop is not to be mixed up with quickstop! Positioning and position control is switched off at quickstop, speed controlled via ramp function generator or is directly braked at the current limit and conclusively the drive is inhibited (zero-torque).
- Bit 12: Homing with or without the setting of homing position
  In standard, after reaching homing position, the actual values and set values are set to homing position. For a few operations, especially with multiturn absolute encoders it makes sense, to only determine the actual position value of the encoder, in order to consider it automatically in a control.
  For this purpose the setting of home position can be deactivated. The drive executes homing completely, the position values however, are not set to the adjusted home position, but remains unchanged. The control can now read out the actual position value at the home position.

The parameter Positioning mode can also be written at enabled drive, in order to change the positioning profile online. The changes are only then modified after a complete ending of an active positioning operation - that means with the starting of the next positioning operation. Changes at the settings for the monitoring of the hard- and software limit switches should, however, not be executed at released drive, due to safety reasons.

P1191	Positionierung aktuelle Satznummer	0 to 16	
DS	**Positioning record number actual**	1	
	BM_u_Ds0_PPosActRecordNumber	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

With this parameter the actual positioning set is selected. If at change of the active positioning set this automatically is started or if a starting edge in the control word is necessary, can be set via ▹P1190◃ positioning mode, bit 11.

Value	Meaning
0	Positioning data set 0 active, no data is copied into positioning set 0 from other positioning sets.
1	Positioning data set 1 active
2	Positioning data set 2 active
3	Positioning data set 3 active
4	Positioning data set 4 active
5	Positioning data set 5 active
6	Positioning data set 6 active
7	Positioning data set 7 active
8	Positioning data set 8 active
9	Positioning data set 9 active
10	Positioning data set 10 active

Value	Meaning
11	Positioning data set 11 active
12	Positioning data set 12 active
13	Positioning data set 13 active
14	Positioning data set 14 active
15	Positioning data set 15 active
16	Positioning data set 16 active

P1194

DS

Positionierung Positionier-Fenster — 0 to $FFFFFFFF_{hex}$

Positioning window — 00001000_{hex}

BM_ud_Ds0_PPosWindow — 1:1 — CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

If the drive reaches a window around the new target position, the bit ’target position reached’ in the status word is set. The positioning window lies symmetrical around the target position. Its size is determined by parameter ’positioning window’.

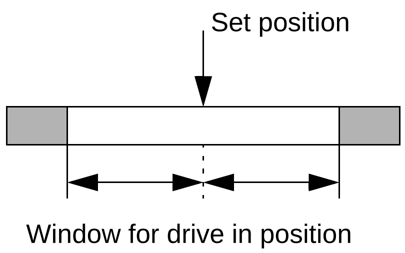


Figure 152: Positioning window

P1195

DS

Positionierung Positionier-Fensterzeit — 1 to 65535 ms

Positioning window time — 10 ms

BM_u_Ds0_PPosWindowTime — 1:1 ms — -

Also see ▹Operating mode target position set value (1)◃ from page 269.

In order to avoid the bit ’target position reached’ to be set during short-time overshooting of the positioning window, you can use this parameter to set a period, within which the drive must be inside the positioning window. Only after this time is up, the correct positioning will be then displayed.

P1196

DS

Positionierung Software-Endschalter 1 — 0 to $FFFFFFFF_{hex}$

Positioning software limit switch 1 — 00010000_{hex}

BM_ud_Ds0_PPosSWLimitSwitch1 — 1:1 — -

Also see ▹Operating mode target position set value (1)◃ from page 269.

Both of these parameters limit the permissible travel distance in the operation modes ’position set mode’ and ’jog operation’.

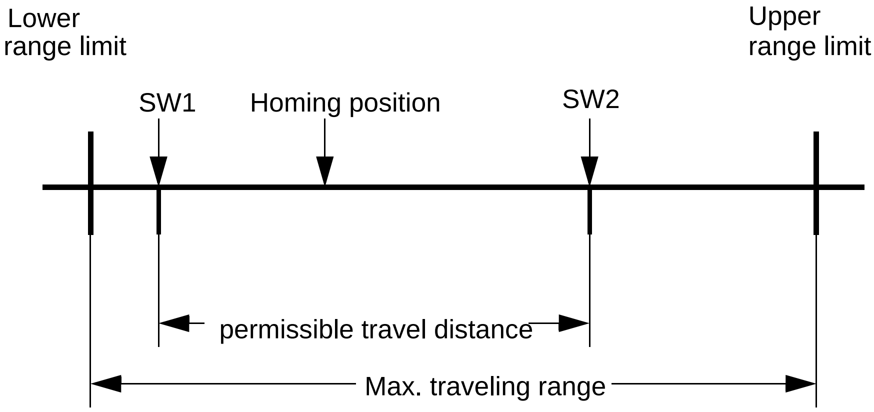


Figure 153: Positioning travel distance

Lower range limit = 00000000_{hex}

Upper range limit = $FFFFFFFF_{hex}$

The SW limit switch 1 holds the value for the permissible travel distance origin, the SW limit switch 2 holds the value for the permissible travel distance end.

For correct functioning of the software limit switches the following preconditions are required:

- In the parameter ▷P1190◁ Positioning mode bit 0 must be set.
- At use of incremental encoders or singleturn encoders homing is necessary, in order to establish a reference between the position actual value and of the actual position. In the homing operation, the SW limit switches are inactive!
- 0 < SW end switch 1 < reference point < SW end switch 2 < upper range mark.
- The maximum travel distance must not be exceeded in any operation mode (except homing).

Function of software limit switch:

- in the operation mode Target position specification (▷P1000◁ = 1
)In position set mode it will be checked, if the new target position is outside the permissible travel distance. If this is the case, it will be positioned to the SW limit switch, which value had been intended to cross. Additionally in the positioning switch status (▷P0461◁) either bit 4 for the software limit switch 1 or bit 5 for the software limit switch 2 is set.
  If the value of a SW limit switch is changed after homing, the drive may stand outside the new permissible travel distance. The actualization of the display in 'Positioning status' as well as the validity of the new value is executed at the next data acceptance. Independently of the target input, it will be positioned to the accordant SW limit switch, if the assigned target position also is laying outside.
- in the operating mode jog operation (▷P1000◁ = 5):
  As soon as a software limit switch has been reached the drive brakes with the positioning Stop deceleration (▷P1213◁), which was set and the accordant bit in positioning switch status is set. A traveling now is only possible in the opposite direction.
  If the value of a SW limit switch is changed after homing, the drive may stand outside

the new permissible travel distance. The actualization of the display in ’Positioning status’ is executed as soon as ’jog operation’ is used.

Only after completion of parameterization and commissioning of the positioning the drive possesses two software limit switches in the operation modes ’position set mode’ and ’jog operation’. If this has been carried out successfully, no more mechanical limit switches are required for these operation modes. However, as an additional protection we recommend hardware limit switches.

P1197	Positionierung Software-Endschalter 2	0 to FFFFFFFF$_{hex}$	
DS	**Positioning software limit switch 2**	FFFF$_{hex}$	
	BM_ud_Ds0_PPosSWLimitSwitch2	1:1	-

Also see ▹Operating mode target position set value (1)◃ from page 269.

Description see ▹P1196◃ on page 594.

P1198	Positionierung Clip-Umgebung 1	00000001$_{hex}$ to FFFFFFFF$_{hex}$	
DS	**Positioning clip environment 1**	00010000$_{hex}$	
	BM_ud_Ds0_PPosClipEnvironment1	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

If the actual value of position reaches a window around the target position, the bit ’Clip environment 1 reached’ (bit 13 in the parameter positioning status ▹P0460◃) is set. This window lays symmetrically around the target position, its size is defined by parameter ’Clip environment 1’.

With ▹P1190◃ Positioning mode bit 13 = 1 the clip environment parameter can be used as switch and cam position too. The result of this evaluation is shown in ▹P0461◃ Positioning switch status in bits 8 to 10.

P1199	Positionierung Clip-Umgebung 2	00000001$_{hex}$ to FFFFFFFF$_{hex}$	
DS	**Positioning clip environment 2**	00010000$_{hex}$	
	BM_ud_Ds0_PPosClipEnvironment2	1:1	CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

If the actual value of position reaches a window around the target position, the bit ’Clip environment 2 reached’ (bit 14 in the parameter positioning status▹P0460◃) is set. This window lays symmetrically around the target position, its size is defined by parameter ’Clip environment 2’.

With ▹P1190◃ Positioning mode bit 13 = 1 the clip environment parameter can be used as switch and cam position too. The result of this evaluation is shown in ▹P0461◃ Positioning switch status in bits 8 to 10.

P1200	Positionierung Referenzpunkt	0 to $FFFFFFFF_{hex}$	
DS	**Positioning homing position**	00020000_{hex}	
	BM_ud_Ds0_PPosHomePosition	1:1	CW

Also see ▹Operating mode Homing (6)◃ from page 288 and ▹Operating mode target position set value (1)◃ from page 269.

The homing position is the position value reflecting the absolute position of the drive at the homing position. This value must be set before homing.

If the drive has reached the home position after homing, the actual position set value and the actual position value are set to the homing position value.

The value of homing position must be within the permissible travel range, i.e. between the software limit switches (▹P1196◃ and ▹P1197◃).

P1201	Positionierung Referenzgeschwindigkeit	1 to 13200 Inc/ms	
DS	**Positioning homing speed**	500 Inc/ms	
	BM_u_Ds0_PPosHomingSpeed	1:1 Inc/ms	CW

Also see ▹Operating mode Homing (6)◃ from page 288.

The homing speed reflects the absolute value of the drive’s maximum positioning speed in operation mode ’homing’. With this speed, the reference switch will be reached.

P1202	Positionierung Referenz-Endgeschwindigkeit	1 to 50 Inc/ms	
DS	**Positioning homing final speed**	10 Inc/ms	
	BM_u_Ds0_PPosHomingFinalSpeed	1:1 Inc/ms	CW

Also see ▹Operating mode Homing (6)◃ from page 288.

The homing final speed determines the absolute positioning speed value, which the drive shall take to reach the encoder zero angle or zero pulse. This parameter is effective in operation mode ’homing’ only.

P1203	Positionierung Referenzbeschleunigung	0.25 to 450.00 Inc/ms²	
DS	**Positioning homing acceleration**	5.00 Inc/ms²	
	BM_u_Ds0_PPosHomingAcceler	100:1 Inc/ms²	CW

Also see ▹Operating mode Homing (6)◃ from page 288.

The homing acceleration reflects the maximum acceleration of the drive in operation mode ’homing’. For the braking of the drive in the operation mode homing the homing deceleration value is valid (▹P1204◃).

P1204	Positionierung Referenzverzögerung	0.25 to 450.00 Inc/ms²	
DS	**Positioning homing deceleration**	5.00 Inc/ms²	
	BM_u_Ds0_PPosHomingDeceler	100:1 Inc/ms²	CW

Also see ▷Operating mode Homing (6)◁ from page 288.

The homing deceleration reflects the maximum deceleration of the drive in operation mode 'homing'.

P1205	Positionierung Referenzfahrmodus	-6 to 35	
DS	**Positioning homing mode**	1	
	BM_i_Ds0_PPosHomingMode	1:1	-

Also see ▷Operating mode target position set value (1)◁ from page 269.

By this parameter it is determined how the homing is carried out. This covers the reaching direction of homing position and the homing initiator evaluation.

Value	Meaning
-12	Reserved
-11	Reserved
-10	Reaching of mechanical limit stop, with zero pulse or encoder zero angle, counter-clockwise
-9	Reaching of mechanical limit stop, with zero pulse or encoder zero pulse, clockwise rotation
-8	Reaching of the mechanical limit stop, counter-clockwise
-7	Reaching of the mechanical limit stop, clockwise rotation
-6	Reaching of the next encoder zero angle
-5	Reaching of positive limit switch (≙ 18)
-4	Reaching of negative limit switch (≙ 17)
-3	Setting of homing position (≙ 35)
-2	Reaching the encoder zero angle or zero pulse with counter-clockwise rotation (≙33)
-1	Reaching the encoder zero angle or zero pulse with clockwise rotation(≙34)
0	Reserved
1	Negative limit switch with zero pulse or encoder zero angle
2	Positive limit switch with zero pulse or encoder zero angle
3	Positive zero point switch with zero pulse or encoder zero angle, counter-clockwise
4	Positive zero point switch with zero pulse or encoder zero angle, clockwise rotation.
5	Negative zero point switch with zero pulse or encoder zero angle, clockwise rotation
6	Negative zero point switch with zero pulse or encoder zero angle, counter-clockwise
7	Zero point switch, counter-clockwise of edge A, with zero pulse or encoder zero angle, clockwise rotation
8	Zero point switch, on the right of edge A, with zero pulse or encoder zero angle, clockwise rotation
9	Zero point switch, on the left of edge B, with zero pulse or encoder zero angle, clockwise rotation
10	Zero point switch, on the right of edge B, with zero pulse or encoder zero angle, clockwise rotation
11	Zero point switch, on the right of edge B, with zero pulse or encoder zero angle, counter-clock-wise
12	Zero point switch, on the left of edge B with zero pulse or encoder zero angle, counter-clockwise

Value	Meaning
13	Zero point switch, on the right of edge A, with zero pulse or encoder zero angle, counter-clockwise
14	Zero point switch, on the left of edge A with zero pulse or encoder zero angle, counter-clockwise
15 to 16	Reserved
17	Negative limit switch
18	Positive limit switch
19	Positive zero point switch, counter-clockwise rotation
20	Positive zero point switch, clockwise rotation
21	Negative zero point switch, clockwise rotation
22	Negative zero point switch, counter-clockwise
23	Zero point switch, on the left of edge A, clockwise rotation
24	Zero point switch, on the right of edge A, clockwise rotation
25	Zero point switch, on the left of edge B, clockwise rotation
26	Zero point switch, on the right of edge B, clockwise rotation
27	Zero point switch, on the right of edge B, counter-clockwise
28	Zero point switch, on the left of edge B, counter-clockwise
29	Zero point switch, on the right of edge A, counter-clockwise
30	Zero point switch, on the left of edge A, counter-clockwise
31 to 32	Reserved
33	Next zero pulse or encoder zero angle, counter-clockwise
34	Next zero pulse or encoder zero angle, clockwise rotation
35	Setting of home position

At homing modes with reference on zero pulse or zero angle it is always referenced to the zero pulse on an incremental encoder and with an absolute encoder always to the zero angle. Exception is the homing mode -6, by which also with an incremental encoder is referenced to the zero angle.

Notes:

- The homing modes –5 to –1 are still existent due to compatibility reasons. They accord to the specified modes.
- The modes 1 to 14 use the zero pulse or zero angle as additional signal. With zero angle the mechanical zero angle is meant, that means 0° in mechanical angle (▹P0393◃ or ▹P0403◃).
- The modes 17 to 30 in principle accord to the modes 1 to 14, except that a zero angle or zero pulse is not used. In these modes referencing refers exclusively to the switch.
- The modes 33 to 35 do not use any switch.

P1206

P1206	Positionierung Gebereingang Referenzfahrt	0 to 2	
DS	**Positioning homing encoder input**	1	
	BM_u_Ds0_PPosHomingEncInp	1:1	CW

Also see ▹Operating mode Homing (6)◃ from page 288 and ▹Function control-operated homing◃ from page 325.

Selection of encoder input for homing (drive-operated or control-operated homing).

Value	Meaning
0	Automatic selection of the encoder input. It always is taken the encoder, which is set as encoder for the position control.
1	Encoder input 1
2	Encoder input 2

P1207

P1207	Referenzfahrt max.Strecke bis Nullimpuls	0 to $7FFFFFFF_{hex}$	
DS	**Homing max. position delta to zero pulse**	0_{hex}	
	BM_di_Ds0_HomMaxPosToZeropulse	1:1	CW

This parameter determines the maximum distance, which is moved from the last switching edge until zero pulse is detected. If the zero pulse is not detected within this distance, "Homing" error no. 205 is reported and homing is interrupted.

This function is deactivated, if the value is 0. There is no distance monitoring until to the zero pulse.

Scaling: 1 revolution corresponds to 65536 increments.

P1208

P1208	Positionierung Schalter-Modus	0 to $FFFF_{hex}$	
DS	**Positioning switch mode**	00_{hex}	
	BM_w_Ds0_PPosSwitchMode	1:1	-

Also see ▹Positioning switch monitoring◃ from page 259.

With this parameter, you can set for each reference initiator separately, if it is a normally open or normally closed contact.

Bit	Meaning
0	Mode positive limit switch 0: Switch is NO-contact 1: Switch is NC-contact
1	Mode negative limit switch 0: Switch is NO-contact 1: Switch is NC-contact
2	Mode zero switch 0: Switch is NO-contact 1: Switch is NC-contact
15 ... 3	Reserved

P1209	Positionierung Geberoffset	0 to $FFFF_{hex}$ Inc	
DS	**Positioning encoder offset**	0_{hex} Inc	
	BM_u_Ds0_PPosEncoderOffset	1:1 Inc	CW

Also see ▹Operating mode Homing (6)◃ from page 288.

During homing, the encoder offset is added to the actual encoder angle, thus enabling zero angle signal shifting. Thus the zero angle signal can be positioned outside the switching tolerances of the reference initiator.

P1210	Positionierung Tippgeschwindigkeit	1 to 13200 Inc/ms	
DS	**Positioning jogging speed**	500 Inc/ms	
	BM_u_Ds0_PPosJoggingSpeed	1:1 Inc/ms	CW

Also see ▹Operating mode Jog operation (5)◃ from page 286.

The jogging speed reflects the positioning speed of the drive in jog operation mode.

P1211	Positionierung Tippbeschleunigung	0.25 to 450.00 Inc/ms²	
DS	**Positioning jogging acceleration**	2.00 Inc/ms²	
	BM_u_Ds0_PPosJoggingAcceler	100:1 Inc/ms²	-

Also see ▹Operating mode Jog operation (5)◃ from page 286.

The jogging acceleration describes the max. acceleration of the drive in jog operation.

P1212	Positionierung Tippverzögerung	0.25 to 450.00 Inc/ms²	
DS	**Positioning jogging deceleration**	2.00 Inc/ms²	
	BM_u_Ds0_PPosJoggingDeceler	100:1 Inc/ms²	-

Also see ▹Operating mode Jog operation (5)◃ from page 286.

The jogging deceleration reflects the maximum deceleration of the drive in jog operation mode.

P1213	Positionierung Halt-Verzögerung	0.25 to 450.00 Inc/ms²	
DS	**Positioning stop deceleration**	5.00 Inc/ms²	
	BM_u_Ds0_PPosStopDeceleration	100:1 Inc/ms²	-

Acceleration or braking ramp by a limit switch or by a command via the control word.

- By a limit switch: The parameter is effective as soon as the drive passes a software or hardware limit switch. The drive brakes down to zero using the set stop-delay. However, it remains in the enabled status. See ▹Hardware limit switch◃ on page 260 and ▹Software limit switch◃ on page 262.

- Via the control word: Speed-synchronization ramp when changing into a positioning mode if the synchronization function has been activated ("positioning mode" ▹P1190◃ bit 2 = 1). See the chapter ▹Smooth switch-over in positioning operating modes◃ on page 257.

P1214

DS

Auswahl digitaler Eingang für positiven HW-Positionsschalter — 0 to $FFFF_{hex}$

Digital input channel for positive HW position switch — 0_{hex}

BM_w_Ds1_DI_PosLimitSwitch — 1:1 — -

Selection of slot and channel of the digital input, which is used for the positive hardware position switch (operating modes target position set value and jog operation) or for the positive hardware reference switch (operating mode homing).

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1215

DS

Auswahl digitaler Eingang für negativen HW Positionsschalter — 0 to $FFFF_{hex}$

Digital input channel for negative HW position switch — 0_{hex}

BM_w_Ds1_DI_NegLimitSwitch — 1:1 — -

Selection of slot and channel of the digital input, which is used for the negative hardware position switch (operating modes target position set value and jog operation) or for the negative hardware reference switch (operating mode homing).

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1216 | Auswahl digitaler Eingang für Nullpunktschalter | 0 to $FFFF_{hex}$

DS | **Digital input channel for zero point switch** | 0_{hex}

BM_w_Ds1_DI_OriginSwitch | 1:1 | -

Selection of slot and channel of the digital input, which is used for the zero point switch.

Bit	Meaning
7 ... 0	Channel selection (possible value 1 to 8, depending on function module)
15 ... 8	Slot selection of input module (possible values 1 to 5, correspond to slot A to E)

Value 0 means that no input channel has been selected.

P1217 | Positionierung Referenzfahrt Blockierzeit | 0.01 to 655.35 s

DS | **Positioning homing block time** | 1.00 s

RF | BM_u_Ds0_PposHomingBlockTime | 100:1 | CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

Adjustable block time only at homing modes to the mechanical limit stop.

The parameter specifies, after which time the mechanical limit stop is recognized, at blocking of the drive. The requirements for a blocking are “Drive at the current limit” (speed controller status ▹P0350◃ bit 13 = 1) and simultaneously existing zero speed message (encoder 1 status ▹P0390◃ or encoder 2 status ▹P0400◃, bit 10).

The homing block time must be less than ▹P1260◃ blocking time, as it otherwise causes an error reaction ’Drive blocked” (▹P0214◃ error speed controller).

P1218 | Positionierung Referenzfahrt Momentengrenze | 0.00 to 100.00 %

DS | **Positioning homing torque limit** | 25.00 %

RF | BM_u_Ds0_PposHomingTrqLim | $100:4000_{hex}$ | CW

Also see ▹Operating mode target position set value (1)◃ from page 269.

Limitation of torque only for homing modes to the mechanical limit stop.

Limitation begins with the starting of homing and is canceled with recognition of the mechanic limit stop.

P1219 | Positionierung Vorschub-Override | 0.00 to 655.35 %

DS | **Positioning feedrate override** | 100.00 %

BA | BM_u_Ds0_PSU_MainVoltSmoothTime0_ | 100:1 | CW

A set speed, which was set beforehand can be adjusted with this parameter „online“ (during movement). The factor operates on the following speeds:

- Maximum positioning speed of the active positioning set in the operation Position set mode

$$v_{max} = \frac{v_{max\ pos\ set} \cdot \text{homing torque limit [\%]}}{100\%} = \frac{v_{max\ pos\ set} \cdot P1219}{100\%}$$

- Jogging speed ▹P1210◃ in the operation mode jog operation

$$v_{max} = \frac{v_{max\ pos\ jog} \cdot \text{homing torque limit [\%]}}{100\%} = \frac{P1210 \cdot P1219}{100\%}$$

The limit to the maximum speed of the drive ▹P1031◃ occurs after the multiplication with the homing torque limit.

Special cases in the position set mode:

- The parameter does not operate „online“, if the Sin² profile is set.
- If multiplying with the ▹P1219◃ results in a maximum speed of 0 Inc/ms, then it is moved with a speed of 1 Inc/ms. That means, that it is not stopped!

P1220	Gleichlauf Modus	0 to FFFF$_{hex}$	
DS	**Synchronous operation mode**	0$_{hex}$	
	BM_w_Ds0_SynCtrlMode	1:1	-

See ▹Operating mode Synchronous operation (-5)◃ from page 310.

Mode of synchronous control

Bit	Meaning
3 ... 0	Synchronous operating modes (see ▹Operating mode Synchronous operation (-5)◃ from page 310): 0000: Real master axis in relative angular synchronous operation 0011: Synchronous set value assignment via position parameter 0100: Synchronous set value input via position delta input 0101: Virtual leading axis without ramp generator 0110: Virtual leading axis with ramp generator
4	Edit modes of the electronic gear: 0: Transparent mode: All changes are executed immediately 1: The parameters rev. slave axis and rev. master axis can be edited. The gear ratio still remains unchanged 1→0: The changed parameters rev. slave axis and rev. master axis are accepted simultaneously.
5	0: No extrapolation at set value failure 1: Extrapolation at set value failure
7 ... 6	Reserved
8	1: Phasing module: Module is switched on
10 ... 9	Phasing module: Modes of traveling direction: 00: Relative traveling direction shortest distance 01: Relative traveling direction always positive 10: Relative traveling direction always negative 11: Reserved

Bit	Meaning
11	1: Phasing module: At active movement a minimum resulting speed axis, due to the movement, is not under-run. Valid only if bit 12 = 0.
12	Phasing module: Maximum positioning speed mode: 0: Static via ▹P1223◃ 1: Dynamic via the factor ▹P1226◃ to the set speed. The bit 11 is thereby not considered.
13	Phasing-Module: Positioning is always activated, if a not yet positioned offset angle is existent - also without explicit command in order to start the phasing module (setting of bit 0 in parameter ▹P0476◃.
15 ... 14	Reserved

P1221

DS

Gleichlauf Umdrehung der Folgeachse -32767 to 32767

Synchronous operation revolution of slave 3000

BM_i_Ds0_SynCtrlRevSlave 1:1 CW

Also see ▹Operating mode Synchronous operation (-5)◃ from page 310.

Numerator in gear ratio of electronic gearing. The nominator may also be negative. This way the function of a reverse gear can be realized. We recommend to select the smallest possible values for ▹P1221◃ or ▹P1222◃ for the necessary gear ratio. Also see ▹P1222◃.

P1222

DS

Gleichlauf Umdrehung der Leitachse 1 to 32767

Synchronous operation revolution of master 3000

BM_i_Ds0_SynCtrlRevMaster 1:1 CW

Also see ▹Operating mode Synchronous operation (-5)◃ from page 310.

Denominator in gear ratio of electronic gearing. We recommend to select the smallest possible values for ▹P1221◃ or ▹P1222◃ for the necessary gear ratio. Also see ▹P1221◃.

The transmission ratio of the electronic gear is calculated with the following equation:

$$i = \frac{\text{rev slave axis}}{\text{rev master axis}} = \frac{P1221}{P1222}$$

The nominator may also be negative. This way the function of a reverse gear can be realized.

P1223	Maximale Verfahrgeschwindigkeit	1 to 1193048 Inc_{32bit}/ms	
DS	**Maximum driving speed**	298256 Inc_{32bit}/ms	
ON	BM_ud_PhaseSpeed	1:1 Inc_{32bit}/ms	CW

The range of values of the parameter is 1 to 1193048 INC/ms², whereat the increments refer to 32 bit angles (360° = 2^{32} Inc). This accords to about 8.4 * 10^{-5} degrees/s to about 100 degrees/s. The standard value accords to 25 degrees/s.

With this parameter the maximum positioning speed is adjustable at the trapezoidal procedure of the angular sum.

The parameter is not effective at a bit 12, which was set in parameter ▹P1220◃ (dynamic maximum positioning speed).

P1224	Beschleunigung	12.50 to 11930.50 Inc_{32bit}/ms²	
DS	**Acceleration**	716.00 Inc_{32bit}/ms²	
ON	BM_ud_PhaseAccel	100:1 Inc_{32bit}/ms²	CW

The range of values of the parameter is 12.50 to 1193.50 Inc/ms², whereat the increments refer to a 32 bit angle (360° = 2^{32}Inc). This accords to 1.05 degrees/s^2 to about 1000.00 degrees/s^2. The standard value accords to 60.01 degrees/s^2.

With the parameter the acceleration on the ramps is adjustable with the trapezoidal procedure of the angular sum.

Negative accelerations, which result from the changing of positioning speed due to the change of the maximum positioning speed (bit 11 or bit 12 in parameter ▹P1220◃ is set), are not limited by this parameter.

P1225	Minimal resultierende Geschwindigkeit	0 to 4294968 Inc_{32bit}/ms	
DS	**Minimal total speed**	0 Inc_{32bit}/ms	
ON	BM_ud_PhaseMinResSpeed	1:1 Inc_{32bit}/ms	CW

The range of values of the parameter is 0 to 4294968 Inc/ms, whereat the increments refer to 32 bit angles (360° = 2^{32} Inc). This accords to 0 degrees/s to about 360 degrees/s. The standard value corresponds to 0 degrees/s. The value, which was set, operates as absolute value with independent signs.

With this parameter a minimum total axis speed is adjustable, which may not be underrun by an additive overlaid movement.

This parameter is only effective if bit 11 is set and bit 12 in parameter ▹P1220◃ is not set.

P1226	Phasing Geschwindigkeitsfaktor	0.00 to 100.00 %	
DS	**Speed factor**	0,00 %	
ON	BM_ud_PhaseSpeedFactor	4000_{hex}:100 %	CW

If bit 12 is set in parameter ▹P1220◃ the maximum positioning speed of the phasing module is adjusted dynamic to the speed setpoint of the axis. The maximum positioning speed then is computed as follows:

$$\text{Maximum positioning speed} = \frac{\text{speed set value} \cdot \text{parameter 1226}[\%]}{100}$$

All values are calculated as absolute values and therewith are independent of the direction of rotation.

P1239	Positionierung Modulo Position	00010000_{hex} to $FFFFFFFF_{hex}$	
DS	**Positioning modulo position**	$FFFFFFFF_{hex}$	
STOP	BM_u_Ds0_PPOSModuloLimPos	1:1	-

With this parameter the modulo value range for the modulo positioning method is determined. A change of the parameter is only effective after a pre-established controller inhibit.

Details on modulo positioning are to be found under ▹P0601◃ Positioning target input.

P1240	Leistungsteil PWM Frequenz	4 to 8kHz	
DS	**Power Unit PWM frequency**	8 kHz	
STOP	BM_u_Ds0_PWM_frequency	1:1kHz	-

In this parameter the PWM frequency of the drive controller is set. Applicable values: 4 and 8 kHz. See ▹Pulse width modulation (PWM), motor-voltage◃ on page 96.

The switching frequency can only be changed in drive inhibited status. Also the switching between data sets, which have different switching frequency settings, is possible in inhibited status only.

If there is a risk of the IGBTs being overloaded, the switching frequency perhaps can automatically be reduced (also see ▹Protection function automatical reducing of PWM switch frequency◃ on page 94); thereby the entered value in P1240 is not changed. The instantaneous operating PWM frequency is displayed in ▹P0491◃.

P1241	Leistungsteil Maximalstrom des Antriebs	0.1 to 6553.5 A	
DS	**Power unit maximum drive current**	2.5 A	
	BM_u_Ds0_CurrentDriveMax	10:1 A	-

Maximum current output of power unit (effective value).

This parameter defines the current scaling, i.e. it is the reference value for all percental current parameters, which therewith also are effective values. The accordant amplitude is greater by the factor $\sqrt{2}$.

The value of the parameters must not be greater than the parameter power unit maximum current 4 kHz (▹P0011◃) or power unit maximum current 8 kHz (▹P0013◃). A greater value is not accepted.

From firmware FW 03.09:
In order to protect the motor, the parameter is limited at setting to motor peak current (▹P0069◃) and the error message 100 is generated, if the value of this parameter is greater than the motor peak current. The response to this error can be set, by default „no reaction“ occurs.
However this limiting function only operates and the error message is active, if the bit 15 in the parameter Motor mode (▹P0093◃) was set. By default this function is not active (bit 15 = 0).

P1250	Uzk-Regler Sollwert	700 to 900 V	
DS	**DC link controller set value**	850 V	
	BM_u_Ds0_DCLinkCtrlVoltSet	1:1 V	-

Maximum value of DC link voltage.

When the drive is braking, energy from the motor is fed back into DC link, which is loaded further by this. Not back supply devices can dissipate that energy only by use of a braking resistor.

In order to keep the DC link voltage rising too high, a regulation is applied which limits it to a preadjusted maximum value. This is achieved, if required, by reducing the deceleration torque of the drive, so the DC link voltage will not rise further.

P1251	Uzk-Regler P-Verstärkung	1.0 to 255.9	
DS	**DC link controller P-gain**	50.0	
	BM_u_Ds0_DCLinkCtrl_PGain	10:1	-

P-gain of the DC link controller without unit. See ▹General overview Udc link controller◃ on page 238.

P1252	Uzk-Regler Nachstellzeit	0.2 to 1000.0 ms	
DS	**DC link controller integral-action time**	20.0 ms	
	BM_u_Ds0_DCLinkCtr_ITime	10:1 ms	-

Integral action time of DC link controller. See ▹General overview Udc link controller◃ on page 238.

P1260	Blockierzeit (=0:aus)	0.0 to 6500.0 s	
DS	**Blocking time (=0:off)**	10.0 s	
	BM_u_Ds0_BlockingTime	10:1 s	-

Tripping time of blocking monitor.

Block monitoring becomes active, if the drive controller is at the current limit (speed controller status, ▹P0350◃ bit 13 = 1), and if at the same time there is a zero speed message (encoder 1 status ▹P0390◃ or encoder 2 status ▹P0400◃, bit 10 or bit 9, accordant to status of bit 3 in parameter Speed controller mode ▹P1030◃).

A blocked drive is displayed via bit 4 in the speed controller status.

When the tripping time of the blocking monitoring is up, the drive will be switched off and an error message is generated.

If blocking time = 0.0 s, the block monitoring is switched off.

P1261	N=0 Schwelle Blockierüberwachung	0.00 to 100.00 %	
DS	**N=0 threshold blocking control**	1.00 %	
ON	BM_u_Ds0_Mon_LLimBlocking	4000_{hex}:100 %	CW

From firmware version FW 03.08.

Speed-zero-threshold only for speed controller block monitoring in % of the maximum speed.

Via this parameter for speed controller-block monitoring an own zero speed threshold can be set, independent of the parameters Open loop N=0 threshold (▹P1063◃), Encoder 1 N=0 threshold (▹P1073◃) and Encoder 2 N=0 threshold (▹P1083◃). The activation of this threshold occurs with the setting of bit 3 in parameter Speed controller mode (▹P1030◃).

This parameter is not active in operation modes:

- homing to mechanic limit stop,
- positioning,
- controlled braking procedures.

P1270	Feldschwächregler P-Verstärkung	0.0 to 127.9	
DS	**Field weakening controller P-gain**	2.0	
	BM_u_Ds0_FieldWeakCtrl_PGain	10:1	-

P-gain of the ASM field weakening controller.

P1271	Feldschwächregler Nachstellzeit	0.0 to 1000.0 ms	
DS	**Field weakening controller integral-action time**	20.0 ms	
	BM_u_Ds0_FieldWeakCtrl_ITime	10: 1ms	-

Integral-action time of the ASM field weakening controller.

If the Field weakening controller integral-action time is zero, the integral part is set to 0 and the field weakening controller operates without integral part.

P1272	Flussregler P-Verstärkung	0.0 to 127.9	
DS	**Flux controller P-gain**	3.0	
	BM_u_Ds0_FluxCtrl_PGain	10:1	-

P-gain of ASM flux controller or of SM field weakening controller.

P1273	Flussregler Nachstellzeit	0.2 to 1000.0 ms	
DS	**Flux controller integral-action time**	20.0 ms	
	BM_u_Ds0_FluxCtrl_ITime	10:1 ms	-

Integral-action time of ASM flux controller or of SM field weakening controller.

P1290	Parameterauswahl Statusbit 14	0 to max. Para-no.	
DS	**Parameter selection statusbit 14**	0	
	BM_u_Ds0_StatusB14_IdSelect	1:1	-

Selection of the parameter for the freely defined status bit 14 in the drive manager status word (▷P0301◁).

If in the selected parameter (▷P1291◁) a bit from the mask is set, the bit 14 in the status word is set.

P1291	Bitmaske für Statusbit 14	0 to FFFF_{hex}	
DS	**Bit pattern Statusbit 14**	0_{hex}	
	BM_w_Ds0_StatusB14_Mask	1:1	-

Mask for the freely defined status bit 14 in the drive manager status word(▷P0301◁).

If in the selected parameter (▷P1290◁) a bit from the mask is set, the bit 14 in the status word is set.

P1292	Parameterauswahl Statusbit 15	0 to max. Para-no.	
DS	**Parameter selection statusbit 15**	0	
	BM_u_Ds0_StatusB15_IdSelect	1:1	-

Selection of the parameter for the freely defined status bit 14 in the drive manager status word (▷P0301◁).

If in the selected parameter (▷P1293◁) a bit from the mask is set, the bit 15 in the status word is set.

P1293	Bitmaske für Statusbit 15	0 to FFFF$_{hex}$	
DS	**Bit mask for status bit 15**	0$_{hex}$	
	BM_w_Ds0_StatusB15_Mask	1:1	-

Mask for the freely defined status bit 15 in the drive manager status word(▷P0301◁).

If in the selected parameter (▷P1292◁) a bit from the mask is set, the bit 15 in the status word is set.

P1310	Messtaster Modus	0 to FFFF$_{hex}$	
DS	**Touch probe mode**	0$_{hex}$	
	BM_w_Ds1_TouchPrMode	1:1	-

Mode for probe function
(also see ▷Function Touch probe◁ on page 327).

Bit	Meaning
0	0: Measured value storage switch off touch probe 1 1: Measured value storage enable touch probe 1
1	Rate of occurrence of triggering 0: Each trigger event once 1: continuous
2	Triggering touch probe 1 storage 0: By touch probe input 1: By zero pulse signal measured value 1 (encoder 1) Measured values at triggering due to zero pulse are filed like measured values at positive edges: TouchPr1ValPhi/RevPos
3	(only for bit 2 = 0 or bit 2 = 1 & bit 6 = 1) Touch probe 1 linking digital input 0: Touch probe 1 <- digital input 0 slot D 1: Touch probe 1 <- digital input 1 slot D
4	(only for bit 2 = 0) Triggering touch probe storage by positive edges at the touch probe input 0: switched off 1: enabled
5	(only for bit 2 = 0) Triggering touch probe 1 storage with negative edges at the touch probe input 0: switched off 1: enabled

Bit	Meaning
6	(only for bit 2 = 1) 0: Qualification touch probe 1 storage off 1: Qualification touch probe 1 storage on (only, if bit 2 = 1)
7	(only for bit 2 = 1 & bit 6 = 1) Signal level touch probe input 1 for qualification Touch probe 1 storage: 0: Low 1: High
8	0: Measured value storage switch off touch probe 2 1: Measured value storage enable touch probe 2
9	Rate of occurrence of triggering 0: Each trigger event once 1: continuous
10	Triggering touch probe 2 storage 0: By touch probe input 1: By zero pulse signal measured value 2 (encoder 2) Measured values at triggering due to zero pulse are filed like measured values at positive edges: Touch probe angle 2 pos. edge
11	(only for bit 10 = 0 or bit 10 = 1 & bit 14 = 1) Touch probe 2 linking digital input 0: Touch probe 2 <- digital input 0 slot D 1: Touch probe 2 <- digital input 1 slot D
12	(only for bit 10 = 0) Triggering touch probe 2 storage by positive edges at the touch probe input 0: switched off 1: enabled
13	(only for bit 10 = 0) Triggering touch probe 2 storage with negative edges at the touch probe input 0: switched off 1: enabled
14	(only for bit 10 = 1) 0: Qualification touch probe 2 storage off 1: Qualification touch probe 2 storage on (only, if bit 10 = 1)
15	(only for bit 10 = 1 & bit 14 = 1) Signal level touch probe input 2 for qualification Touch probe 2 storage: 0: Low 1: High

P1320	Selbstoptimierung verwenden	0 to $FFFF_{hex}$	
DS	**Auto-tuning application**	0_{hex}	
	BM_w_AutotuningApplication	1:1	-

Meaning of the single bits.

Bit	Meaning
0	**Stator resistance:** 0: Measured stator resistance is not used 1: Measured stator resistance is used in motor control
1	**Leakage inductance for asynchronous motor (inductance for synchronous motor):** 0: Measured inductance is not used 1: Measured inductance is used in motor control

Bit	Meaning
2	**Dead time measurement of the inverter:** 0: Measured dead time of the inverter is not compensated 1: Measured dead time of the inverter is compensated
3 - 15	Reserved

The measured motor parameters are used in motor control, if the according bit in P1320 is set. The setting of the bit is only then permitted, if the according bit in ▹P0852◃ has already been set. If the bits are not set in P1320, the motor control uses resistance / inductance from the motor data sheet.

If the bit is set in P1320 the dead time compensation is activated too. It depends on ▹P0852◃ which values are used:

▹P0852◃ bit 2 = 0: A dead time measuring was not carried out. Therefore default values are used for the compensation.

▹P0852◃ bit 2 = 1: The values measured within the auto-tuning are used.

P1321

	Normierungsfaktor Defaultwerte Totzeitkompensation	0 to 200.00 %	
DS	**Scaling factor default values dead time compensation**	100.00 %	
	BM_u_ScalDeadTimeCompDef	8000_{hex} :100 %	-

Scaling factor for the default values of the voltage dead time compensation.

If the dead time compensation is activated (▹P1320◃ bit 2 = 1) and if measured dead time values are not available from the auto-tuning, default values are used for the compensation.

If a compensation with default values is not enough in exceptional cases, an adaption can be done with P1321.

<effective dead time comp. value> = <default dead time comp. value> * P1321

The dead time voltage correction is only reasonable in the open loop operating mode.

P1360

	PID-Regler Modus	0 to $FFFF_{hex}$	
DS	**PID controller mode**	0300_{hex}	
ON	BM_w_Ds0_PrPIDCtrlMode	1:1	-

Mode parameter for the freely programmable PID controller.

Bit	Meaning
2 ... 0	Activation of PID controller: 000: deactivate PID controller 001: PID controller active only if current controller is active 010: PID controller is active only if speed controller is active 011: PID controller is active only if position controller is active 100: PID controller always active
7 ... 3	**Reserved**

Bit	Meaning
8	0: PID controller without P-controller 1: PID controller with P-controller
9	0: PID controller without I-controller 1: PID controller with I-controller
10	0: PID controller without D-controller 1: PID controller with D-controller
15 ... 11	Reserved

P1361

	Quellnummer PID-Regler Sollwert	0 to max. Para-no.	
DS	**Source number PID controller set value**	0	
ON	BM_u_Ds0_PrPID_SetValuePxxx	1:1	-

Selection of source of the PID controller set value by input of parameter number of source. Only INT16- or INT32-parameters can be selected.

At selection of an INT16 parameter: Set value = source parameter*2^{16}.

P1362

	Quellnummer PID-Regler Istwert	0 to max. Para-no.	
DS	**Source Number PID controller actual value**	0	
ON	BM_u_Ds0_PrPID_ActValuePxxx	1:1	-

Selection of source of the PID controller actual value by input of parameter number of source. Only INT16- and INT32-parameters can be selected.

At selection of an INT16 parameter: Actual value = source parameter*2^{16}.

P1363

	PID-Regler P-Verstärkung	0.00 to 327.67	
DS	**PID controller P-gain**	0.00	
ON	BM_u_Ds0_PrPIDCtrl_PGain	100:1	-

Proportional gain (Kp) of PID controller.

P1364

	PID-Regler Nachstellzeit	0 to 7200000 ms	
DS	**PID controller integral action time**	0 ms	
ON	BM_ud_Ds0_PrPIDCtrl_ITime	1:1 ms	-

Integral-action time (T_N) of the PID controller.

If the PID controller integral-action time is zero, the integral part is set to 0 and the PID controller operates without integral part.

P1365	PID-Regler Vorhaltzeit	0.000 to 60000.000 ms	
DS	**PID controller integral derivative time**	0.000 ms	
ON	BM_ud_Ds0_PrPIDCtrl_DTime	1000:1 ms	-

Integral derivative time (T_N) of PID controller.

P1366	PID-Regler Glättungszeit	0.0 to 2000.0 ms	
DS	**PID controller smoothing time**	0.0 ms	
ON	BM_ud_Ds0_PrPID_SmoothTime	10:1 ms	-

Smoothing time for D-controller of PID controller.

P1367	PID-Regler Obergrenze	-100.00 to 100.00%	
DS	**PID controller upper limit**	-100.00 %	
ON	BM_i_Ds0_PrPID_OutULimit	4000_{hex}:100 %	CW

It always must

PID controller upper limit ▹P1367◃ ≥ PID controller lower limit ▹P1368◃.

At a cyclic access to these parameter it must be provided, that these conditions are always adhered to.

P1368	PID-Regler Untergrenze	-100.00 to 100.00%	
DS	**PID controller lower limit**	-100.00 %	
ON	BM_i_Ds0_PrPID_OutLLimit	4000_{hex}:100 %	CW

It always must

PID controller lower limit ▹P1368◃ ≤ PID controller upper limit ▹P1367◃.

At a cyclic access to these parameter it must be provided, that these conditions are always adhered to.

P1369	Zielnummer PID-Regler Ausgang	0 to max. Para-no.	
DS	**Target number PID controller output**	0	
STOP	BM_u_Ds0_PrPID_TargetPxxx	1:1	-

Number of parameters, which must be changed by ’PID controller output’. Only INT16- and INT32-parameters can be selected.

At selection of a INT16-parameter is $\text{Target parameter} = \frac{\text{output}}{2^{16}}$.

P1370	Sperrfrequenz Drehzahlsollwert Notchfilter (=0:aus)	0 to 4000 Hz	
DS	**Center frequency speed set value notchfilter (=0:off)**	0 Hz	
ON	BM_u_Ds0_SpeedSetFcenter	1:1 Hz	-

With center frequency = 0 Hz the speed set value notch filter is switched off.

P1371	Bandbreite Drehzahlsollwert Notchfilter	10 to 2000 Hz	
DS	**Bandwidth speed set value notch filter**	100 Hz	
ON	BM_u_Ds0_SpeedSetBandwidth	1:1 Hz	-

Bandwidth of speed set value notch filter.

P1372	Sperrfrequenz Drehzahlistwert Notchfilter	0 to 4000 Hz	
DS	**Center frequency speed actual value notch filter**	0 Hz	
ON	BM_u_Ds0_SpeedActFcenter	1:1 Hz	-

At center frequency = 0 Hz the speed actual value notch filter is switched off.

P1373	Bandbreite Drehzahlistwert Notchfilter	10 to 2000 Hz	
DS	**Bandwidth speed actual value notch filter**	100 Hz	
ON	BM_u_Ds0_SpeedActBandwidth	1:1 Hz	-

Bandwidth of speed actual value notch filter.

P1374	Sperrfrequenz Iq-Sollwert Notchfilter (=0:aus)	0 to 4000 Hz	
DS	**Center frequency Iq set value notch filter (=0:off)**	0 Hz	
ON	BM_u_Ds0_IqSetFcenter	1:1 Hz	-

At center frequency = 0 Hz the Iq set value notch filter is switched off.

P1375	Bandbreite Iq-Sollwert Notchfilter	10 to 2000 Hz	
DS	**Bandwidth Iq set value notchfilter**	100 Hz	
ON	BM_u_Ds0_IqSetBandwidth	1:1 Hz	-

Bandwidth of Iq set value notch filter.

P1380	Parameternummer Istwert 2-Punkt-Regler 1	0 to $FFFFFFFF_{hex}$	
EE	**Parameter number input value two-level-controller 1**	0_{hex}	
ON	BM_ud_Ds0_TLC_In	1:1	-

Parameter number of the two-level-controller 1-input.

With value 0 no comparison to absolute thresholds operates.

If the selected parameter is a signed factor (data type INT, DINT), also the comparison with the absolute switching thresholds operates signed. In the other case if the selected parameter is unsigned (data type UINT, UDINT, WORD, DWORD), the comparison with the absolute switching thresholds also operates unsigned.

P1381	Parameternummer relativer Vergleichswert 2-Punkt-Regler 1	0 to $FFFFFFFF_{hex}$	
DS	**Parameter number relative compare value two-level-controller 1**	0_{hex}	
ON	BM_ud_Ds0_TLC_InRel	1:1	-

Parameter number of the relative comparison value of the two-level-controller 1.

With value 0 no comparison to relative thresholds operates.

P1382	Untere absolute Schaltschwelle 2-Punkt-Regler 1	-32768 to 32767	
DS	**Lower threshold absolute two-level-controller 1**	0	
ON	BM_i_Ds0_TLC_AbsLowerThreshold	1:1	-

Lower absolute switching threshold of the two-level-controller 1 corresponding to parameter 'parameter number two-level-controller" (▹P1380◃). In order that the two-level-controller 1 works with absolute comparison thresholds, bit 0 of parameter operation mode two-level-controller (▹P1384◃) must be set.

The two-level-controller 1 switches on, if the following is valid:
Parameter Actual value 1 $\leq$Two-level-controller lower absolute switch threshold

P1383	Obere absolute Schaltschwelle 2-Punkt-Regler 1	-32768 to 32767	
DS	**Upper absolute threshold two-level-controller 1**	0	
ON	BM_i_Ds0_TLC_AbsUpperThreshold	1:1	-

Higher absolute switching threshold of two-level-controller 1 corresponding to parameter 'parameter number two-level-controller 1" (▹P1380◃). In order that the two-level-controller 1 works with absolute comparison thresholds, bit 0 of parameter operation mode two-level-controller (▹P1384◃) must be set.

The two-level-controller 1 switches off, if the following is valid:
Parameter Actual value 1 $\geq$ two-level-controller upper absolute threshold

P1384	Betriebsart 2-Punkt-Regler 1	0 to $FFFF_{hex}$	
DS	**Mode two-level-controller 1**	0_{hex}	
ON	BM_w_Ds0_TLC_Mode	1:1	-

Operating mode two-level-controller 1 in accordance with the following table:

Bit	Meaning
0	0: Comparison actual value to absolute thresholds inactive (see ▹P1382◃ and ▹P1383◃) 1: Comparison actual value to absolute thresholds active
1	0: Comparison actual value to relative thresholds inactive (see ▹P1385◃ and ▹P1386◃) 1: Comparison actual value to relative thresholds active
2	0: No absolute-value generation at actual value (comparison signed) 1: No absolute-value generation at actual value (symmetrical monitoring)
15 ... 3	Reserved

If bit 0 and bit 1 are set, the switching thresholds of the relative and absolute comparisons are considered so that the process of the relative threshold can be limited and monitored by a firm absolute threshold controller. The output of the two-level controller 1 thus switches on, if the actual value is below the relative ***and*** absolute lower threshold and switches off, if the actual value exceeds the relative ***or*** absolute upper threshold (NOR logic).

If bit 2 is set the two-level-controller 1 generates the amount of the actual value and compares this with the thresholds, which also must be positive. Applications for this e.g. speed monitoring (independent of pos. and neg. rotational direction).

P1385	Untere relative Schaltschwelle 2-Punkt-Regler 1	-32768 to 32767	
DS	**Lower level relative two-level-controller 1**	0	
ON	BM_i_Ds0_TLC_RelLowerThreshold	1:1	-

Lower relative switching threshold of the two-level-controller 1 corresponding to parameter 'parameter number relative comparison value two-level-controller 1" (▹P1381◃). So that the two-level-controller 1 works with relative comparison thresholds, bit 1 of parameter TLC_mode (▹P1384◃) must be set.

The two-level-controller 1 switches on, if the following is valid:

Parameter Actual value 1 ≤ Parameter number relative comparison value + lower relative switch threshold

P1386	Obere relative Schaltschwelle 2-Punkt-Regler 1	-32768 to 32767	
DS	**Upper level relative two-level-controller 1**	0	
ON	BM_i_Ds0_TLC_RelUpperThreshold	1:1	-

Upper relative switching threshold of two-level-controller 1 referring to parameter 'parameter number relative comparison value two-level-controller 1" (▹P1381◃). So that the two-level-controller 1 works with relative comparison thresholds, bit 1 of parameter TLC_-mode (▹P1384◃) must be set.

The two-level-controller 1 switches off, if the following is valid:

Parameter Actual value 1 parameter number relative comparison value + upper relative switch threshold

P1387	Ziel-Parameternummer 2-Punkt-Regler 1 Ausgang	0 to 65535	
DS	**Target number two-level-controller 1 output**	0	
ON	BM_u_Ds0_TLC_TargetPxxx	1:1	-

Number of the parameter to be changed for the two-level-controller 1 output.

P1388	Bit-Auswahl 2-Punkt-Regler 1 Ausgang	0 to $FFFF_{hex}$	
DS	**Bit selection two-level-controller 1 output**	0_{hex}	
ON	BM_w_Ds0_TLC_BitSelection	1:1	-

Selection of the bits to be changed of the target parameter for the two-level controller 1 output.

P1389	Bitmuster bei LOW 2-Punkt-Regler 1 Ausgang	0 to $FFFF_{hex}$	
DS	**Set bit pattern for LOW state two-level-controller 1 output**	0_{hex}	
ON	BM_w_Ds0_TLC_LowPattern	1:1	-

Bit pattern which is written in the target parameter at two-level-controller 1 output LOW (negative edge).

P1390	Bitmuster bei HIGH 2-Punkt-Regler 1 Ausgang	0 to $FFFF_{hex}$	
DS	**Set bit pattern for HIGH state two-level-controller 1 output**	0_{hex}	
ON	BM_w_Ds0_TLC_HighPattern	1:1	-

Bit pattern, which is written to target parameter at two-level-controller 1 output HIGH (positive edge).

P1400

P1400	Haltebremse Ansteuerungsart	0 to $FFFF_{hex}$	
DS	**Holding brake control mode**	0_{hex}	
ON	BM_w_MotBrakeMode	1:1	-

Control of motor holding brake.

Bit	Meaning
0	Control mode: 0: Manual 1: Automatic
1	Brake control in the automatic control mode (▹P1400◃ bit 0 = 1) Brake monitoring status: 0: Brake status is not monitored, status of brake is not evaluated in the control mode ’Automatic’. 1: Brake status is monitored, status of brake in the control mode ’Automatic’ is evaluated. [1)] If set values and actual status do not correspond, after lapse of timeout (▹P1404◃) an error message (▹P0211◃) is generated.
2	Brake lining monitoring: 0: brake lining checkback signal is not read, brake lining is not monitored. Brake lining checkback signal is read out, brake lining is monitored. If the signal 1: signalizes an error, an error message is (▹P0211◃) generated.
15 ... 3	Reserved

[1)] e.g. start drive only, if the brake is really released.

P1401

P1401	Haltebremse Ansteuerungsart Automatik	0 to $FFFF_{hex}$	
DS	**Holding brake control automatic**	0_{hex}	
ON	BM_w_MotBrakeAutoMode	1:1	-

Control of motor holding brake in the automatic mode(▹P1400◃ bit 0 = 1).

Bit	Meaning
0	Brake release mode (from FW 03.09) 0: Without holding torque setting 1: With holding torque off ▹P1402◃
1	Evaluation only, if bit 0 = 1 (from FW 03.09) Release the brake if 0: Driving torque = Holding torque ▹P1402◃ 1: Time off ▹P1407◃ has expired after starting of the holding torque setup
2	Applying the brake at pulse inhibit: 0: Brake applies at pulse inhibit immediately. 1: Brake applies at pulse inhibit, as soon as the actual speed (amount) is below the speed threshold (▹P1403◃).
15 ... 3	Reserved

P1402	Haltebremse Drehmomentschwelle	-100.00 % bis 100.00 %
DS	**Holding brake torque threshold**	0.00 %
ON	BM_i_MotBrakeTorque	4000_{hex}:100.00 % -

From firmware version FW 03.09.

Torque threshold for torque-controlled releasing of the holding brake in the automatic operation (▹P1400◃ Bit 0 = 1).

This torque is set up before the brake is released and if the according mode was selected (▹P1401◃ bit 0 = 1).

Also see ▹Opening of Brake◃ from page 193.

P1403	Haltebremse Drehzahlschwelle	0.50 % to 100.00 %
DS	**Holding brake speed threshold**	1.00 %
ON	BM_u_MotBrakeSpeedLim	4000_{hex}:100.00 % -

Threshold value for speed-dependent intervention of motor holding brake in the automatic mode (▹P1400◃ bit 0 = 1).

The brake is applied in the following cases, as soon as the amount of the actual speed is below the threshold value:

- Drive brakes active (stop at the ramp)
- Drive is zero-torque (pulses are inhibited, ▹P1401◃ bit 2 must be 1)

P1404	Haltebremse Timeout Rückmeldesignal	100 to 1000 ms
DS	**Holding brake timeout checkback signal**	1000 ms
ON	BM_u_MotBrakeInTimout	1:1 ms -

Timeout for the evaluation of the checkback signal.

If, within the timeout period the expected brake status (released/applied) is not recognized, an error reaction occurs.

P1405	Verzögerung Impulssperre	0 to 1000 ms
DS	**Pulse inhibit delay**	500 ms
ON	BM_u_MotBrakeCloseDelay	1:1 ms -

Delay time in consideration of brake applying time and if necessary of the dead time by a relay in the automatic mode (▹P1400◃ bit 0=1).

After applying the brake during an active brake operation (e.g. quickstop at ramp) the pulses are inhibited at the earliest after sequence of time, which were set in ▹P1405◃ time. Therewith, it can be assured, that the drive only then becomes zero-torque, if the holding brake has generated its complete mechanical brake power.

- The evaluation of the brake status is switched off (▹P1400◃ bit 1 = 0):
  The pulse inhibit occurs not until expiry of the time, which was set in ▹P1405◃ after closing *command* has been placed.
- The evaluation of the braking status is activated (▹P1400◃ bit 1 = 1):
  The drive becomes torque-free not until procedure of the *set time* ▹P1405◃ after receiving checkback 'Brake is applied'.

The delay of the pulse inhibit does not function if the pulses are blocked already at engagement of the brake manager.

See ▹Applying the brake◃ on page 196.

P1406	Verzögerung des Starts der Bewegung	0 to 1000 ms	
DS	**Start of motion delay**	500 ms	
ON	BM_u_MotBrakeOpenDelay	1:1 ms	-

Delay time in consideration of brake releasing time and if necessary of the dead time by a relay in the automatic mode (▹P1400◃ bit 0=1).

After releasing the brake an acceleration occurs not until the time, which has been set in ▹P1406◃ 'Delay of the start of movement'. Therewith it can be ensured, that the drive does not work against the holding brake, which possibly has not been completely released.

- The evaluation of the brake status is switched off (▹P1400◃ bit 1 = 0):
  The acceleration occurs not until expiry of the time, which was set in ▹P1406◃ after opening *command* has been placed.
- The evaluation of the braking status is activated (▹P1400◃ bit 1 = 1):
  The drive becomes torque-free not until sequence▹P1406◃ of the set time in after receiving of *checkback 'Brake is released'.*

Also see 'Releasing of brake' ▹page 193◃.

P1407	Haltebremse Verzögerung Bremse öffnen	0 to 1000 ms	
DS	**Holding brake opening delay**	10 ms	
ON	BM_u_MotBrakeOpenCmdDelay	1:1 ms	-

From firmware version FW 03.09.

Delay between setup holding torque and command „Release the brake " in the automatic operation of holding brake (▹P1400◃ bit 0 = 1).

Is only evaluated, if, before releasing the brake, a holding torque must be set up and the brake must release after a parameterized time (▹P1401◃ Bit 1...0 = 3).

▹P1407◃ after beginning of the holding torque setup the command „Release the brake" is given.

See ▹Opening of Brake◃ from page 193.

P1410 Motorpotentiometer Betriebsart 0 to $FFFF_{hex}$

DS **Motor potentiometer mode** 0_{hex}

ON BM_w_Ds0_MP_Mode 1:1 -

This parameter determines the operation mode of motor potentiometer.

Bit	Meaning
0	0: Disable 1: Enable motor potentiometer
1	0: Motorpot+ off 1: Motorpot+ on
2	0: Motorpot- off 1: Motorpot- on
3	Synchronization of the motor potentiometer output at activation: 0: Output is synchronized to ramp function generator input (▹P1171◃) 1: Output is set to 0
4	Evaluation motorpot+/- 0: Edge-sensitive 1: Level sensitive:
15 ... 5	Reserved

P1411 Motorpotentiometer Hochlauf-Endwert -100 % to +100 %

DS **Motor potentiometer upper limit** 100 %

ON BM_i_Ds0_MP_UpperLimit 4000_{hex}:100 % -

Maximum value, which the motor potentiometer does not exceed though the 'Motorpot+' key is stroked.

This value must be greater than the lower limit value, which was set in parameter Motor potentiometer lower limit ▹P1412◃. If the condition is not complied with, the input value is declined.

NOTE!

If this limit value is changed and the actual output value (▹P0567◃) therewith is outside the range of the limit value, is moved at the first stroking of the 'Motorpot-' key (bit 1 of parameter Motor potentiometer mode) in the 'limited' direction and the output value is set to the new limit value.

P1412 Motorpotentiometer Rücklauf-Endwert -100 % to +100 %

DS **Motor potentiometer lower limit** -100 %

ON BM_i_Ds0_MP_LowerLimit 4000_{hex}:100 % -

Maximum value, which the motor potentiometer does not fall below though stroking the 'Motorpot-' key.

This value must be smaller than the upper limit value, which was set in parameter Motor potentiometer lower limit ▷P1411◁. If the condition is not complied with, the input value is declined.

NOTE!

If this limit value is changed and the actual output value (▷P0567◁) therewith is outside the range of the limit value, is moved at the first stroking of the 'Motorpot-' key (bit 2 of parameter Motor potentiometer mode) in the 'limited' direction and the output value is set to the new limit value.

P1413	Motorpotentiometer Zuwachs	0.00 % to 20.00 %	
DS	**Motor potentiometer increment**	1.00 %	
ON	BM_i_Ds0_MP_LowerLimit	100:1 %	-

The amount of change of the output value at keystroke is to be predetermined with this parameter.

If, e.g. the value 1 % is set, the ramp function generator input increases at each stroking of the 'Motorpot+' key to 1 % to a maximum of the ramp-up limit value.

The motor potentiometer increment is internally scaled as follows:

Increment $_{INT}$ = Increment (▷P1413◁) [%] /100% * Max (▷P1171◁)

whereas Max (▷P1171◁) = 16384 = internal scaling of 100 % of the RFG input

Increment $_{INT}$ = Increment (▷P1413◁) [%] /100% x 16384

P1415	Parameternummer Istwert 2-Punkt-Regler 2	0 to $FFFFFFFF_{hex}$	
EE	**Parameter number input value two-level-controller 2**	0_{hex}	
ON	BM_ud_Ds0_TLC2_In	1:1	-

Parameter number of the two-level-controller 2 input.

With value 0 no comparison to absolute thresholds operates.

If the selected parameter is a signed factor (data type INT, DINT), also the comparison with the absolute switching thresholds operates signed. In the other case if the selected parameter is unsigned (data type UINT, UDINT, WORD, DWORD), the comparison with the absolute switching thresholds also operates unsigned.

P1416	Untere absolute Schaltschwelle 2-Punkt-Regler 2	-32768 bis 32767	
DS	**Lower absolute threshold two-level-controller 2**	0	
ON	BM_i_Ds0_TLC2_AbsLowerThreshold	1:1	-

Lower absolute switching threshold of the two-level-controller 2 corresponding to parameter 'parameter number two-level-controller 2" (▷P1415◁). In order that the two-level-controller 2 works with absolute comparison thresholds, bit 0 of parameter TLC2_mode (▷P1418◁) must be set.

The two-level-controller 1 switches on, if the following is valid:

Parameter number actual value 2 ≤ lower absolute switch threshold.

P1417	Obere absolute Schaltschwelle 2-Punkt-Regler 2	-32768 bis 32767	
DS	**Upper absolute threshold two-level-controller 2**	0	
ON	BM_i_Ds0_TLC2_AbsUpperThreshold	1:1	-

Higher absolute switching threshold of two-level-controller 1 corresponding to parameter 'parameter number two-level-controller 1" (▷P1415◁). In order that the two-level-controller 1 works with absolute comparison thresholds, bit 0 of parameter two-level-controller 2 (▷P1418◁) must be set.

The two-level-controller 1 switches off, if the following is valid:

Parameter number actual value 2 .upper absolute switch threshold.

P1418	Betriebsart 2-Punkt-Regler 2	0 to $FFFF_{hex}$	
DS	**Mode two-level-controller 2**	0_{hex}	
ON	BM_w_Ds0_TLC_Mode	1:1	-

Operating mode two-level-controller 1 in accordance with the following table:

Bit	Meaning
0	0: inactive 1: active
1	Reserved
2	0: No absolute-value generation at actual value (comparison signed) 1: No absolute-value generation at actual value (symmetrical monitoring)
4 ... 3	Performance two-level-controller 2 output 00: Standard performance (switch on accordant hysteresis) 01: Set two-level-controller 2 output only once 10: reset two-level-controller 2 output only once 11: Reserved
5	0: no automatic reset by status word bit 15 1: automatic reset by status word bit 15
6 ... 15	Reserved

If bit 2 is set the controller generates then the actual value amount and compares it with the thresholds, which also must be positive. Application for this are e.g. speed monitoring (independent of pos. and neg. speed direction).

If bit 3 is set and bit 4 is not set, then the two-level-controller 2 output is set once, if the actual value falls below the value of the lower threshold for the first time . The output value remains, also if the actual value exceeds the upper threshold. This status can be canceled by resetting bit 3 or by resetting bit 0.

If bit 4 is set and bit 3 is not set, then the two-level-controller 2 output is reset once, if the actual value **exceeds** the upper threshold the first time. The output value remains 0, also if the actual value is below the lower threshold. This status can be canceled by resetting bit 4 or by resetting bit 0.

Via bit 5 you control, if the latch performance of the two-level-controller 2 (see mode bits 3 and 4) is reset, if the freely parameterizable bit 15 of the status word (▷P0301◁) is set. The evaluation of bit 15 of the status word occurs level-sensitive, not edge-sensitive. This means, that at the set bit 15 of the status word of the two-level-controller 2 always works as standard-two-level-controller, also if bit 3 or bit 4 is set in the mode.

P1419	Ziel-Parameternummer 2-Punkt-Regler 2 Ausgang	0 to 65535	
DS	**Target number two-level-controller 2 output**	0	
ON	BM_u_Ds0_TLC2_TargetPxxx	1:1	-

Number of the parameter to be changed for the two-level-controller 1 output.

P1420	Bit-Auswahl 2-Punkt-Regler 2 Ausgang	0 to $FFFF_{hex}$	
DS	**Bit selection two-level-controller 2 output**	0_{hex}	
ON	BM_w_Ds0_TLC2_BitSelection	1:1	-

Selection of the bits to be changed of the target parameter for the two-level controller 1 output.

P1421	Bitmuster bei LOW 2-Punkt-Regler 2 Ausgang	0 to $FFFF_{hex}$	
DS	**Set bit pattern for LOW state two-level-controller 2 output**	0_{hex}	
ON	BM_w_Ds0_TLC2_LowPattern	1:1	-

Bit pattern which is written in the target parameter at two-level-controller 1 output LOW (negative edge).

P1422	Bitmuster bei HIGH 2-Punkt-Regler 2 Ausgang	0 to $FFFF_{hex}$	
DS	**Set bit pattern for HIGH state two-level-controller 2 output**	0_{hex}	
ON	BM_w_Ds0_TLC2_HighPattern	1:1	-

Bit pattern, which is written to target parameter at two-level-controller 1 output HIGH (positive edge).

P1425	Spindelpositionierung Modus	0 to FFFF$_{hex}$	
DS	**Spindle positioning mode**	0$_{hex}$	
	BM_w_Ds0_SPosMode	1:1	CW

From firmware version FW 03.08.

Mode of spindle positioning (also see ▹Operating mode Spindle positioning (-6)◃ from page 301).

Bit	Meaning
1 ... 0	Definition of direction, if speed actual value = 0: If bit 4 = 0 ' absolute positioning 00: Towards greater position set values 01: Towards smaller position set Values 10: Shortest distance [2)] 11: Reserved If bit 4 = 1 ' relative subsequent positioning; Relevant is only bit 0 0: Towards greater position set values 1: Towards smaller position set values
3 ... 2	Settings of angle target or trigger source: 00: Positioning to P1426 Spindle positioning angle target 01: Positioning to zero pulse of the positioning encoder [1)] 10: Positioning of rising edge of the digital input 1 (DIO-module in module slot D) 11: Positioning of the zero pulse of the positioning encoder using the digital input 1 (-module in module slot D) as qualification signal (high level)
4	Positioning for subsequent positioning 0: Absolute positioning 1: Relative positioning
7 ... 5	Reserved
8	1: Always force the determination of trigger position; only at spindle positioning to zero pulse or switch signal relevant; see bit 2 and 3
9	1: Offline-measuring of trigger position; only at spindle positioning to zero pulse or switch signal relevant; see bit 2 and 3
10	1: Activation of referencing
11	0: Setting of homing position at the calculated ▹P0467◃ effective target position 1: Setting of homing position at the position of the trigger signal to the moment of saving
15 ... 12	Reserved

[1)] At using the zero pulse as a trigger source always the zero pulse of the encoder for the position sensing (▹P1050◃ position mode bit 2) is used.

[2)] Definition of direction, if speed actual value = 0:
At spindle positioning the setting „shortest path“ is only possible in mode „Angle target“ immediately after switchover. If it is positioned to the zero pulse or to the switch signal, only bit 0 is relevant for the setting of the direction.
N=0 at switchover and positioning to zero pulse/switch
⇒ Only bit 0 relevant for direction
N=0 at switchover and positioning to zero pulse to angle target
⇒ bit 0-1 relevant for direction
Subsequent positioning absolute ⇒ bit 0-1 relevant for direction
Subsequent positioning relative ⇒ Only bit 0 relevant for direction

P1426	Spindelpositionierung Zielwinkel	0 to 0000FFFF$_{hex}$ Inc	
DS	**Spindle positioning target angle**	0$_{hex}$ Inc	
	BM_ud_Ds0_SPosTargetAngle	1:1	CW

This is the absolute angle position to be moved to, referring to the homing position ▹P1200◃, that means to the position of the encoder for position sensing (▹P1050◃ position controller mode bit 2).

The Low-Word of the parameter is entered in the lower 16-bit (angle) of the effective target position ▹P0467◃. The High-Word of the parameter is not used at the moment and is to be set to zero.

P1427	Spindelpositioniergeschwindigkeit	0.01 to 100.00 %	
DS	**Spindle positioning speed**	1.00 %	
	BM_u_Ds0_SPosSpeed	100 %:4000$_{hex}$	-

If the operating mode Spindle positioning is activated, the drive brakes to the spindle positioning speed or it keeps up its specified speed.

If you switch from standstill to the operating mode Spindle positioning, the drive accelerates to a maximum of the spindle positioning speed.

100% spindle positioning speed accord to the maximum speed, which was set in the drive ▹P1031◃.

It must be considered that there is an internal limit of speed synchronization to 14999 RPM. If the spindle positioning speed, which was set has a speed greater than 14999 RPM, then at switchover to spindle positioning it is synchronized to a maximum of 14999 RPM.

P1428	Spindelpositionierverzögerung	0.25 to 450.00 Inc/ms²	
DS	**Spindle positioning deceleration**	2.00 Inc/ms²	
	BM_u_Ds0_SPosDeceleration	100:1	-

Here the maximum drive delay in the operating mode spindle positioning can be set. Simultaneously the value is valid for the acceleration of N=0 to the spindle positioning speed ▹P1427◃.

P1429	Spindelpositionierung Timeout Triggersignal	0 to 65535 ms	
DS	**Spindle positioning timeout trigger**	0 ms	
	BM_u_Ds0_SPosTimeoutTrigger	1:1	-

This time operates at the modes, which use the zero pulse or the digital input 1. If, after operating sequence of time there was no switch signal or zero pulse recognized by the controller, the speed is decelerated to 0 and the error no. 204 „Spindle positioning: Timeout at trigger signal“ is set. The drive remains enabled. Before making an error reset the setting of ▹P1425◃ Spindle positioning mode is to be checked and the function of the selected trigger signal (▹P0413◃ Status of digital inputs in module slot D or ▹P0390◃ Encoder 1 status ⇒ bit 8 or ▹P0400◃ Encoder 2 status ⇒ bit 8) must be ensured. Due to safety reasons additionally the control bit 11 in the ▹P0300◃ control word must be set (status = 1; no edge“!) in order to continue positioning, because some field busses reset error messages automatically.

With the setting of 0 ms monitoring is switched off.

P1430

DS	Spindelpositionierung relativer Offset	0 to 0000FFFF$_{hex}$ Inc	
	Spindle positioning relative offset	0$_{hex}$ Inc	
	BM_ud_Ds0_SPosRelativOffset	1:1	CW

At spindle positioning the relative offset operates on the zero pulse or on the digital input 1. It allows a displacement of limit position without changing the mechanical position of the switch or of the encoder. The relative offset is always added independent of the direction of rotation to the position of zero pulse or switch signal.

Furthermore, the parameter is used at relative subsequent positioning as travel distance from the standstill (▹P1425◃ Spindle positioning mode bit 4 = 1).

Only the Low-Word of the parameter is used. The High-Word of the parameter is not used at the moment and is to be set to zero.

Format: High-Word: Revolutions Low-Word: Angle

P1431

DS	Spindelpositionierung Verschliffzeit	0 to 8191 ms	
	Spindle positioning smoothing time	0 ms	
	BM_u_Ds0_SPosSmooth	1:1	-

In order to achieve a smoothing of the ramp edges a PT1-element is implemented. By use of this parameter, you can set the time constant of the PT1-element.

If the setting reads 0 ms, smoothing is switched off.

P1436

DS	Momentkopplung Modus	0 to FFFF$_{hex}$	
ON	**Torque coupling mode**	0$_{hex}$	
	BM_w_Ds0_TCMode	1:1	-

From firmware version FW 03.08.

Setting of torque coupling

Bit	Meaning
1 ... 0	Fixing of configuration: 00: No torque coupling 01: Drive takes over master functionality 10: Drive takes over slave functionality 11: Reserved

Bit	Meaning
2	Activate/deactivate coupling (only possible at master functionality, i.e. Bit 1...0 = 01) Slave-sided this setting will operate only then, if master and slave are released: 0: Switch off coupling 1: Switch on coupling
3	Activate/deactivate speed-dependent initial stress (only at slave, i.e. Bit 1...0 = 10) 0: Initial stress is independent of the speed (only ▹P1443◃ slave init slave is operating). 1: Switching-in of initial stress is speed-dependent (ramp operates accordant to ▹Figure 85◃ on page 176)
4	Polarity inversion of the torque set value master (at slave only bit 1...0 = 10
15 ... 5	Reserved

P1437

	Drehmoment Koppelfaktor Master	0.00 to 100.00 %	
DS	**Torque coupling factor master**	0.00 %	
ON	BM_w_Ds0_TCCoupFacM	4000_{hex}:100 %	-

From firmware version FW 03.08.

Scaling of torque coupling factor master (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

P1438

	Drehmoment Koppelfaktor Slave	0.00 to 100.00 %	
DS	**Torque coupling factor slave**	0.00 %	
ON	BM_w_Ds0_TCCoupFacS	4000_{hex}:100 %	-

From firmware version FW 03.08.

Scaling of slave torque at torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

P1439

	Ausgleichsregler P-Verstärkung	0.000 to 31.000	
DS	**Torque coupling P-gain Slave**	0.000	
ON	BM_u_Ds0_TCPid_Pgain	7918_{hex}:31000	-

From firmware version FW 03.08.

Proportional gain (k_P) of PI-compensating controller at torque coupling (only at slave, i.e. ▹P1436◃ bit 1...0 = 10).

P1440

	Ausgleichsregler Nachstellzeit	0 to 8000	
DS	**Torque coupling integral action time**	0	
ON	BM_u_Ds0_TCPid_Itime	1:1	-

From firmware version FW 03.08.

Integral action time (T_N) of PI-compensating controller at torque coupling (only at slave, i.e. ▹P1436◃ bit 1...0 = 10).

P1441	Ausgleichsregler Obergrenze	0.00 to 100.00 %	
DS	**Upper limiter compensating controller**	100.00	
ON	BM_i_Ds0_TCPid_OutULimit	4000_{hex}:100.00 %	CW

From firmware version FW 03.08.

Upper limiter of the compensating controller output at torque coupling (only at slave, i.e. ▹P1436◃ bit 1...0 = 10).

P1442	Ausgleichsregler Untergrenze	0.00 to 100.00 %	
DS	**Lower limiter compensating controller**	100.00	
ON	BM_i_Ds0_TCPid_OutLLimit	4000_{hex}:100.00 %	CW

From firmware version FW 03.08.

Lower limiter of the compensating controller output at torque coupling (only at slave, i.e. ▹P1436◃ bit 1...0 = 10).

P1443	Vorspannmoment Slave	-100.00 to 100.00%	
DS	**Slave initial stress**	0.00 %	
ON	BM_i_Ds0_TCTrqInitStress	4000_{hex}:100.00 %	-

From firmware version FW 03.08.

Initial stress of slave drive at torque coupling (only at slave i.e. ▹P1436◃ Bit 1...0 = 10). If bit 3 is not set in parameter ▹P1436◃, this additional torque operates independent of the speed (also see ▹Figure 85◃ on page 176).

P1444	Zeitkonstante Vorspannmoment Slave	0.010 to 32.767	
DS	**Slave initial stress filter time**	0.010	
ON	BM_i_Ds0_TCTrqInitStrFiltTime	$7FFF_{hex}$:32,767	-

From firmware version FW 03.08.

Time constant of PT-1 element, in order to switch-in the initial stress to the slave at torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

P1445	Reduziertes Vorspannmoment Slave	-100.00 to 100.00%	
DS	**Slave reduced initial stress**	0.00	
ON	BM_i_Ds0_TCTrqInitStrRed	4000_{hex}:100.00 %	-

From firmware version FW 03.08.

Reduced initial stress of slave drive at torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).
If ▹P1436◃ bit 3 is set, this additional torque operates from speed limit ▹P1446◃ (also see ▹Figure 85◃ on page 176).

P1446	Drehzahlgrenze reduziertes Vorspannmoment	0 to 100.00 %	
DS	**Speed limit reduced initial stress**	100.00	
ON	BM_u_Ds0_TCTrqInitStrRedSpLim	4000_{hex}:100.00 %	-

From firmware version FW 03.08.

Speed limit for reduced initial stress.
If ▹P1436◃ bit 3 is set, the reduced initial stress ▹P1445◃ operates from this speed limit onwards (also see ▹Figure 85◃ on page 176).

P1450	Maximaler q-Strom bei Nenndrehzahl	0 to 6553.5 A	
DS	**Maximum q-current at nominal speed**	6553.5 A	
	BM_u_ Ds0_NomIqMax	10:1 A	-

From firmware version FW 03.10.

Value of the maximum torque forming current at nominal speed. The value serves as calculation of the Application speed ▹P0105◃ for the reduction of the Current limiter bipolar ▹P1036◃.

From the Application speed ▹P0105◃ the current limits bipolar are reduced inversely proportional to the motor speed. This reduction is not active by default. It can be activated with setting bit 5 in Speed controller mode ▹P1130◃.

The parameter P1450 is not part of the motor data base and is entered manually.

See ▹Torque monitoring◃ from page 228 for the calculation of this value.

P2000	Quellnummer Oszilloskop, Kanal 1	0 to FFFFFFFF$_{hex}$	
EE	**Oscilloscope source channel 1**	0$_{hex}$	
	BM_ud_Transient_Source1Pxxx	1:1	-

Parameter numbers of the recorded parameters (1 ... 8) for the oscilloscope function. For the recording all 16- and 32-bit parameters can be used. String- and array parameters cannot be used for oscilloscope recording.

At 0 the channel is switched off.

P2001	Quellnummer Oszilloskop, Kanal 2	0 to FFFFFFFF$_{hex}$	
EE	**Oscilloscope source channel 2**	0$_{hex}$	
	BM_ud_Transient_Source2Pxxx	1:1	-

2nd recording parameter for the oscilloscope function.
Description see parameters ▷P2000◁.

P2002	Quellnummer Oszilloskop, Kanal 3	0 to FFFFFFFF$_{hex}$	
EE	**Oscilloscope source channel 3**	0$_{hex}$	
	BM_ud_Transient_Source3Pxxx	1:1	-

3rd recording parameter for the oscilloscope function.
Description see parameters ▷P2000◁.

P2003	Quellnummer Oszilloskop, Kanal 4	0 to FFFFFFFF$_{hex}$	
EE	**Oscilloscope source channel 4**	0$_{hex}$	
	BM_ud_Transient_Source4Pxxx	1:1	-

4th recording parameter for the oscilloscope function.
Description see parameters ▷P2000◁.

P2004	Quellnummer Oszilloskop, Kanal 5	0 to FFFFFFFF$_{hex}$	
EE	**Oscilloscope source channel 5**	0$_{hex}$	
	BM_ud_Transient_Source5Pxxx	1:1	-

5th recording parameter for the oscilloscope function.
Description see parameters ▷P2000◁.

P2005	Quellnummer Oszilloskop, Kanal 6	0 to $FFFFFFFF_{hex}$	
EE	**Oscilloscope source channel 6**	0_{hex}	
	BM_ud_Transient_Source6Pxxx	1:1	-

6th recording parameter for the oscilloscope function.
Description see parameters ▹P2000◃.

P2006	Quellnummer Oszilloskop, Kanal 7	0 to $FFFFFFFF_{hex}$	
EE	**Oscilloscope source channel 7**	0_{hex}	
	BM_ud_Transient_Source7Pxxx	1:1	-

7th recording parameter for the oscilloscope function.
Description see parameters ▹P2000◃.

P2007	Quellnummer Oszilloskop, Kanal 8	0 to $FFFFFFFF_{hex}$	
EE	**Oscilloscope source channel 8**	0_{hex}	
	BM_ud_Transient_Source8Pxxx	1:1	-

8th recording parameter for the oscilloscope function.
Description see parameters ▹P2000◃.

P2008	Quellnummer Triggerquelle 1	0 to $FFFFFFFF_{hex}$	
EE	**Oscilloscope trigger source 1**	0_{hex}	
	BM_ud_Transient_TriggSrc1Pxxx	1:1	-

Number of the parameters of the first trigger source for the oscilloscope function.

All 16- and 32-bit parameters can be used as a trigger source parameter. String- and array parameters cannot be used as trigger.

If the value is 0, it can not be triggered.

P2009	Quellnummer Triggerquelle 2	0 to $FFFFFFFF_{hex}$	
EE	**Oscilloscope trigger source 2**	0_{hex}	
	BM_ud_Transient_TriggSrc2Pxxx	1:1	-

Number of the parameters of the first trigger source for the oscilloscope function.

All 16- and 32-bit parameters can be used as a trigger source parameter. String- and array parameters cannot be used as trigger.

If the value is 0, it can not be triggered.

P2010	Maske Triggerquelle 1	0 to $FFFFFFFF_{hex}$	
EE	**Mask trigger source 1**	$FFFFFFFF_{hex}$	
	BM_d_Transient_TriggerMask1	1:1	-

Mask for trigger source 1.

At evaluation of trigger condition the controller ANDs the value of the first trigger source parameter with this bit mask and compare the value which was masked out with the trigger comparison value 1.

P2011	Maske Triggerquelle 2	0 to $FFFFFFFF_{hex}$	
EE	**Mask trigger source 2**	$FFFFFFFF_{hex}$	
	BM_d_Transient_TriggerMask2	1:1	-

Mask for trigger source 2.

At evaluation of trigger condition the controller ANDs the value of the second trigger source parameter with this bit mask and compares the value, which was masked out with the trigger comparison value 2.

P2012	Trigger-Vergleichsoperator 1	0 to 3	
EE	**Trigger compare operator 1**	0	
	BM_u_Transient_TriggerOp1	1:1	-

The transient operator compares the trigger source with the trigger comparison value according to the following formula:

Trigger result 1 =

(content of source number trigger source 1 ▹P2008◃
AND
Mask trigger source 1▹P2010◃) OPERATOR 1 → Trigger compare value 1 ▹P2014◃.

Value	Operation
0	greater than
1	less than
2	equal
3	not equal

According to data type of the trigger source parameter the comparison operation is signed or unsigned 16- bitwise or 32-bitwise.

P2013 | Trigger-Vergleichsoperator 2 | 0 to 3

EE | **Trigger compare operator 2** | 0

BM_u_Transient_TriggerOp2 | 1:1 | -

The transient operator compares the trigger source with the trigger comparison value according to the following formula:

Trigger result 2 =

(content of source number trigger source 2 ▹P2009◃
AND
Mask trigger source 2▹P2011◃) OPERATOR 2 → Trigger compare value 2 ▹P2015◃.

Value	Operation
0	greater than
1	less than
2	equal
3	not equal

According to data type of the trigger source parameter the comparison operation is signed or unsigned 16- bitwise or 32-bitwise.

P2014 | Trigger-Vergleichswert 1 | 0 to $FFFFFFFF_{hex}$

EE | **Trigger compare value 1** | $FFFFFFFF_{hex}$

BM_ud_Transient_TriggerCmpVal1 | 1:1 | -

Comparison value for trigger condition 1.

P2015 | Trigger-Vergleichswert 2 | 0 to $FFFFFFFF_{hex}$

EE | **Trigger compare value 2** | $FFFFFFFF_{hex}$

BM_ud_Transient_TriggerCmpVal2 | 1:1 | -

Comparison value for trigger condition 2.

P2016 | Triggerquellen-Verknüpfungs-Operator | 1 to 3

EE | **Trigger source combination operator** | 1

BM_u_Transient_TriggerCompi | 1:1 | -

The operator compares the results of two trigger conditions and sets the trigger, if the linking is logically combined.

Trigger = trigger result 1 OPERATOR trigger result 2

Trigger operators:

Value	Operation
1	AND
2	OR
3	Exclusively-OR

P2017	Triggerzeitpunkt in % der Speichertiefe	0 to 100 %	
EE	**Trigger delay in %**	0 %	
	BM_u_Transient_TriggerDelay	1:1 %	-

This parameter specifies, how many data is to be recorded before the trigger event. The percent specification refers to the entire recording memory.

Examples:

At 0 % the controller saves all values starting from the trigger event.

At 33 % the trigger time instant (identified by a vertical dashed line) lies at the end of the first third of the recording window.

P2018	Status der Triggerung	0 to $FFFF_{hex}$	
A	**Trigger status**	0_{hex}	
-	BM_u_Transient_TriggerStatus	1:1	-

This parameter shows the current status of the oscilloscope function.

Value	Status
1	Non-operated
2	Trigger monitoring ready, but no recording
3	Recording is running
4	Recording completed
5	Preparations in order to save are completed
6	Recording interrupted - drop memory contents
7	Waiting for the trigger event, but recording is already running, in order to record the history

P2019	Trigger-Kommando	1 to 6	
-	**Trigger command**	1	
ON	BM_u_Transient_TriggerComand	1:1	-

This parameter controls the oscilloscope function.

Value	Status
1	IDLE command
2	Stop recording
3	Start trigger monitoring

Value	Status
4	Start recording independent of trigger event
5	Recording data assured, transition to IDLE
6	Resetting of state machine. Standard value for source- and trigger parameter

P2020

A

Speichertiefe pro Kanal		0 to $FFFFFFFF_{hex}$	
Transient samples		0_{hex}	
BM_ud_Transient_Samples		1:1	-

After a recording this parameter provides the number of the executed measuring points.

The possible number of the measured values is dependent on:

- the measuring memory which is available
  (see parameters size oscilloscope memory ▷P2023◁),
- the number and
- the word length of each parameter, which is to be recorded.

P2021

EE

Abtastrate		0.125 ms to 8191 ms	
Sample rate		0.125 ms	
BM_u_Transient_SampleTime		1:0.125 ms	-

Sampling rate in multiples of 125 µs.

P2022

A

Aufzeichnungsdauer		0 to 8191 ms	
Measurement time		0 ms	
BM_ud_Transient_Duration		1:1 ms	-

After a recording this parameter shows the recording duration of the prior measurement.

This value is calculated from:
(memory depth per channel ▷P2020◁) * (sampling rate ▷P2021◁)

P2023

EE

Größe Oszilloskopspeicher		1024 to 16384	
Oscilloscope memory length		1024	
BM_ud_Transient_Memory		1:1	-

This parameter defines the usable memory depth for the oscilloscope function in words.

The greater the memory depth, the longer data transmission of controller to WinBASS lasts.

For testing purposes (e.g. optimization of trigger parameters) it is recommendable, to set memory depth low and to maximize not before in fact a lot of data shall be recorded.

P2024 | Startadresse Oszilloskopspeicher | 0 to FFFFFFFF$_{hex}$

A | **Oscilloscope memory start address** | 0_{hex}

BM_ud_Transient_MemoryStartAdr | 1:1 | -

Constant, which specifies the starting address of measured data memory.

P2025 | Oszilloskop Fehlercode | 0 to 65535

A | **Oscilloscope error code** | 0_{hex}

BM_u_Transient_ErrorCode | 1:1 | -

Error code of oscilloscope function:

Value	Status
0	No error
1	Parameter number for data source 1 is faulty
2	Parameter number for data source 2 is faulty
3	Parameter number for data source 3 is faulty
4	Parameter number for data source 4 is faulty
5	Parameter number for data source 5 is faulty
6	Parameter number for data source 6 is faulty
7	Parameter number for data source 7 is faulty
8	Parameter number for data source 8 is faulty
9	Parameter number for data source 8 or trigger source is incorrect
10	Parameter number for trigger source 1 is faulty
11	Parameter number for trigger source 2 is faulty
12	Wrong trigger operator
13	No source parameter specified
14...65535	Reserved

P2030 | Passwort | 0 to 65535

Password | 0

ON | BM_u_Password | 1:1 | -

Parameter used for the input of a system password and for the display of the current password level.

Special functions only can be changed or activated after input of a password (also see ▹P2031◃ system command). Thereby there are different password levels with different passwords.

After input of a valid password in this parameter the password level is shown. After switching-on and after input of an incorrect password the password level is set to 0.

The password for password level 1 is: 1234.

P2031 System Kommando — 0 to $FFFF_{hex}$

System command — 0_{hex}

STOP — BM_w_SystemCommand — 1:1 — -

Via this parameter certain special functions can be executed. The functions are partly protected via a password level, that means that it at first has to be entered with the valid password (also see ▹P2030◃ password).

If the command has been transmitted successfully , the command value is shown in the parameter. If the command, for example, was not accepted, because of the missing password, the parameter is reset to 0.

Table of commands and associated password level:

Value	Meaning	Password level
0000_{hex}	No command	0
0001_{hex}	Overwriting of position information (only revolutions) of encoder 1	1
0002_{hex}	Overwriting of position information (only revolutions) of encoder 2	1
0003_{hex}	Overwriting of position information (revolutions and angle) of encoder 1	2
0004_{hex}	Overwriting of position information (revolutions and angle) of encoder 2	2
0005_{hex}	Write all BM-OEM-sections (motor data, absolute data offset, notch position, offset) in encoder 1	3
0006_{hex}	Write all BM-OEM-sections (motor data, absolute data offset, notch position, offset) in encoder 2	3
0007_{hex}	Write BM-OEM-section absolute data offset (angle and revolutions for position controller) in encoder 1	1
0008_{hex}	Write BM-OEM-section absolute data offset (angle and revolutions for position controller) in encoder 2	1
0009_{hex}	Reserved	
$000A_{hex}$	Reserved	
$000B_{hex}$	Reserved	
$000C_{hex}$	Reserved	
$000D_{hex}$	Write BM-OEM-section notch position offset from ▹P3058◃ in encoder 1	3
$000E_{hex}$	Write BM-OEM-section notch position offset from ▹P3059◃ in encoder 2	3
$000F_{hex}$	Reserved	
0010_{hex}	Reserved	
0011_{hex}	Reserved	
0012_{hex}	Write BM-OEM-section motor data in encoder 1	3
0013_{hex}	Write BM-OEM-section motor data in encoder 2	3
0014_{hex}	Reserved	
0015_{hex}	Reserved	
$01XX_{hex}$	HIPERFACE®address of encoder 1 change to XX_{hex}	3
$02XX_{hex}$	HIPERFACE®address of encoder 2 change to XX_{hex}	3
1234_{hex}	Reserved	

Notes:

- Commands 0001_{hex} and 0002_{hex}
  Overwriting of position (only revolutions) in the encoder:

With this command the absolute position information for the revolutions can be overwritten at multiturn encoders (up to now only Stegmann encoders). The value for the angle is not changed. In the encoder the value is set, which is in the actual value position parameter of the according encoder (consideration to the value range of the encoder, e.g. 4096 revolutions).

- Commands 0003_{hex} and 0004_{hex}
  Overwriting of the position information (revolutions and angle) in the encoder:
  With this command the absolute position information can be set new at Absolute value encoders (up to now only Stegmann encoders). Thereby the revolutions as well as the angle in the encoder are overwritten. The values are set, which are in the actual position parameters of the according encoder (consideration to the value range of the encoder).
  Attention: After this command the controller must be booted again and then the notch position must be determined and saved, because the notch position, which was set is not correct anymore.

- Commands 0005_{hex} and 0006_{hex}
  Save all Baumüller-OEM data in the encoder:
  With this command the electronic type plate (▹P0157◃/▹P0158◃ or ▹P0167◃/▹P0168◃) and notch position offset (▹P3058◃ or ▹P3059◃) is saved in the encoder. For the electronic type plate the values are saved, which are set in the motor parameters.
  This function is only intended for development purposes.
  To read the data from the encoder see ▹P2099◃).
  Attention: In order to save in an EnDat 2.2-encoder the encoder must first be deactivated!

- Commands 0007_{hex} and 0008_{hex}
  Write absolute data offset (angle and revolutions for position controller) into encoder:
  With this command the absolute data offset is (▹P0157◃/▹P0158◃ or ▹P0167◃/▹P0168◃) saved in the encoder.
  To read the data from the encoder see ▹P2099◃).
  Attention: In order to save in an EnDat 2.2-encoder the encoder must first be deactivated!

- Commands $000D_{hex}$ and $000E_{hex}$
  Write notch position offset into the encoder:
  With this command the notch position offset (▹P3058◃ or ▹P3059◃) is saved in the encoder.
  This function is only intended for development purposes.
  To read the data from the encoder see ▹P2099◃.
  Attention:
  In order to save in an EnDat 2.2-encoder the encoder must first be deactivated.

- Commands 0012_{hex} and 0013_{hex}
  With this command the electronic type plate is saved in the encoder. For the electronic type plate the values are saved, which are set in the motor parameters.
  This function is only intended for development purposes.
  To read the data from the encoder see ▹P2099◃.
  Attention:
  In order to save in an EnDat 2.2-encoder the encoder first must be deactivated.

Example for the saving of a value encoder-memory:

1. in case ENDAT 2.2:
   Deactivate encoder (▹P0150◃ or ▹P0160◃ Bit 0 = 0)

2. activate password
   ▹P2030◃ = 1234 (level 1)
3. Specify value in the parameter
   Example: Absolute data offset ▹P0157◃/▹P0158◃ from encoder 1
   ▹P0157◃ = xxx
   ▹P0158◃ = yyy
4. Save parameter value in encoder
   Example: Absolute data offset ▹P0157◃/▹P0158◃ from encoder 1
   ▹P2031◃7_{hex}

Now the values xxx and yyy are saved in the encoder 1.

- Change commands $01XX_{hex}$ and $02XX_{hex}$
  HIPERFACE®-address of the encoder:

  With this command the HIPERFACE®-address of the encoder can be changed. This function is only intended for development purposes.

P2032	Systemzeit	0 to 4294967295 s	
	System time	0 s	
ON	BM_u_SystemTime	1:1 s	-

This parameter contains the system time in seconds. Time starts at each boot procedure with 0 and is incremented every second.

The system time can be set to any time by writing of the parameter. As time format the format „Seconds since 01.01.1970 0:00:00 o'clock“ must be used, which also is common in the PC sector.

P2034	Zeit seit letzten Boot-Vorgang	0 to 4294967295 s	
	Time since last boot	0 s	
ON	BM_ud_UpTime	1:1 s	-

The operating time since the last switch-on in seconds is showed by this parameter. With each boot procedure time starts with 0 again.

P2035	Betriebs-Sekundenzähler	0 to 4294967295 s	
	Power on seconds	0 s	
A	BM_ud_UpTimeSum	1:1 s	-

Not yet implemented.

P2037	Regler Hardware-Kennung	0 to 0xFFFF	
	Controller hardware type	0	
A	BM_u_HardwareVersion	1:1	-

Display of the hardware controller type

Bit	Meaning
0	Controller supports monitoring of mains undervoltage 24 V (24 V failure interrupt), e.g. for saving the system files at system switch off.
1	Controller interface 0: RS232 1: Ethernet interface
2	0: Controller with "internal" PWM (block operation is not supported); 1: Controller with "external" PWM (block operational)
3	Reserved
4	Hardware type: 0: b maXX BM4000 1: b maXX BM4000 ES
15 ... 5	Reserved

P2038	Regler FPGA Firmware-Nummer	0 to 0xFFFF	
	FPGA firmware ID	0	
A	BM_u_FPGASoftwareID	1:1	-

Internal software number of Baumüller:

Value	Meaning
1388	FPGA b maXX BM4000
1613	FPGA b maXX BM4000 ES for EtherCAT slave
1615	Reserved
1617	FPGA b maXX BM4000 ES for POWERLINK slave
1745	FPGA b maXX BM4000 ES for CANopen slave

P2039	Regler FPGA Firmware-Version	0,00 to 655,35	
	FPGA firmware version	0,00	
A	BM_u_FPGASoftwareVersion	100:1	-

Version of the FPGA software

XX.xx (XX: incompatible, xx: compatible)

P2040	Quellnummer für Anzeigefilter 1	0 to 3392	
EE	**Source number display filter 1**	0	
ON	BM_u_ParaFilter1SourcePxxx	1:1	-

This parameter determines at which source parameter is displayed filtered.

P2041	Quellnummer für Anzeigefilter 2	0 to 3392	
EE	**Source number display filter 2**	0	
ON	BM_u_ParaFilter2SourcePxxx	1:1	-

This parameter determines at which source parameter is displayed filtered.

P2045	Glättungszeitkonstante Parameterfilter 1	0.000 to 32.767 s	
EE	**Time constant parameter filter 1**	2.000 s	
ON	BM_u_ParaFilterTime1	1000:1	-

This parameter determines the smoothing time constant for the display filter 1.

P2046	Glättungszeitkonstante Parameterfilter 2	0.000 to 32.767 s	
EE	**Time constant parameter filter 2**	2.000 s	
ON	BM_u_ParaFilterTime2	1000:1	-

This parameter determines the smoothing time constant for the display filter 2.

P2050	Fehlerreaktion Rückzug Modus	0 to $FFFF_{hex}$	
EE	**Error reaction return motion mode**	0_{hex}	
ON	BM_w_RetMotionMode	1:1	-

Mode of error reaction Return motion (from firmware version FW 03.08)

A change of mode during a running return motion positioning (▹P2051◃ bit 3 = 1) has no effects on the actual return motion positioning.

Bit	Meaning
0	Interpretation Return motion target (referring to position actual value ▹P0362◃) 0: Absolute (short distance) 1: Relative to the actual position
15 ... 1	Reserved

P2051	Fehlerreaktion Rückzug Status	0 to $FFFF_{hex}$	
-	**Error reaction return motion status**	0	
A	BM_w_RetMotionStatus	1:1	-

From firmware version FW 03.08.

Status of error reaction return motion.

Bit	Meaning
0...2	Reserved
3	0: Return motion is not active 1: Return motion is active
4	0: Return motion target is not reached yet 1: Return motion target is reached Return motion positioning was correctly completed.
5	1: Configuration errors The configuration is unsuitable for Return motion (e.g. at mains failure a return motion should be made, but motoring operation is not permitted at mains failure)
6	1: Return motion destination was not reached At mains failure, it may be that the residual energy from the DC link is insufficient, to position the drive to the Return motion.
7	1: Return motion was interrupted The return motion positioning was interrupted, e.g. by a pulse inhibit (pulse enable FX 3-5 = Low).
8	Return motion positioning was interrupted at running set value generation because of a dynamic position deviation.
9	Return motion positioning was interrupted after completion of a set value generation because of a static position deviation.

P2052	Fehlerreaktion Rückzug Zielposition	0 to $FFFFFFFF_{hex}$	
EE	**Error reaction return motion destination**	0	
ON	BM_w_RetMotionDest	1:1	-

From firmware version FW 03.08.

Target position of error reaction Return motion.

A changing of target position during a running return motion positioning (▷P2051◁ bit 3 = 1) has no effects on the actual return motion positioning.

Scaling:

One turn of the motor accords to internally 65536 increments. The Low-word represents the motor angle, the High-word represents the number of whole revolutions.

Revolutions (31 … 16)	Angle (15 … 0)

P2053	Fehlerreaktion Rückzug Betrag max. Drehzahl	1 to 13200 Inc/ms	
EE	**Error reaction return motion absolute max. speed**	1000 Inc/ms	
	BM_w_RetMotionSpeed	1:1 Inc/ms	-

From firmware version FW 03.08.
Amount of maximum speed during the error reaction Return motion (see ▹9.4 Error reaction return motion mode◃ from page 205.

A changing of the maximum speed during the running Return motion positioning (▹P2051◃ bit 3 = 1) has no effects on the actual Return motion positioning.

NOTE!

The maximum speed must not be greater than the maximum speed of the drive ▹P1031◃.

P2054	Fehlerreaktion Rückzug Betrag max. Beschleunigung	0.25 to 450.00 Inc/ms²	
EE	**Error reaction return motion absolute max. acceleration**	2 Inc/ms²	
	BM_w_RetMotionAcc	100:1 Inc/ms²	-

From firmware version FW 03.08.
Amount of maximum acceleration and deceleration during error reaction return motion (see ▹9.4 Error reaction return motion mode◃ from page 205).

The actual acceleration also can be higher, because at starting of the return motion there is no synchronization on the speed actual value, if beforehand the actual speed of the drive was unequal 0.

A change of the max. acceleration during a running return motion positioning (▹P2051◃ bit 3 = 1) has no effects on the actual return motion positioning.

P2056	Netzmonitor Modus	0 to $FFFF_{hex}$	
EE	**Mains monitor mode**	0_{hex}	
	BM_w_MainsMonitorMode	1:1	CW

From firmware version FW 03.08.

Bit	Meaning
0	0: Mains monitor off 1: Mains monitor on
1	1: Reset of extremums of mains voltage and mains frequency
2	1: Activate error for mains failure
3	1: activate error for phase failure

Bit	Meaning
4	1: Activate error for undervoltage
5	1: Activate error for overvoltage
6	1: Activate error for frequency undershooting
7	1: Activate error for frequency exceeding
8	Mains monitor is operating: 0: Only in the states 3 (SWITCHED ON), 4 (OPERATION RELEASED), 5 (INHIBIT OPERATION ACTIVE), 6 (SHUTDOWN DRIVE), 7 (QUICKSTOP ACTIVE) and E (ERROR REACTION ACTIVE) of unit control. 1: In each unit control state
9	Setting of nominal mains frequency: 0: f_{mains} = 50 Hz 1: f_{mains} = 60 Hz
10	1: Activate offset measurement for mains voltage
15 ... 11	Reserved

Explanatory notes:

- Bit 0:
  Via the bit 0 = 1 the mains monitor is activated. The mains monitor can only be activated, if there is a BM4-UME-01 module in slot B. Otherwise the error no. 49 .Error in function module B. is generated.
  If the bit 0 = 0, mains monitoring is switched off via the mains monitor. The measured extremums for the mains voltage and the mains frequency remain, but can be reset via the bit 1 = 1.
- Bit 4 to 7:
  Here the selection of the errors takes place, at which the mains monitor generates the group error 79 (▷P0205◁ Error mains supply bit 15 = 1) inclusively the sub-error message ▷P0236◁.
- Bit 8:
  Here it can be set, in which drive states the mains monitor shall operate. The total functionality (warnings, errors, extremum acquisition) of the mains monitor is meant with „operate“.
- Bit 9:
  This setting must be made, before activating the mains monitor.
- Bit 10:
  In order to reach a higher accuracy of the measured mains voltage, via this bit a offset measurement can be activated. The completion of measurement is displayed via ▷P2057◁ mains monitor status bit 15 = 1.
  Up to the time of offset measurement the mains must be switched off.

P2057

P2057	Netzmonitor Status	0 to FFFFFFFF$_{hex}$	
-	**Mains monitor Status**	0$_{hex}$	
A	BM_d_MainsMonitorStatus	1:1	-

From firmware version FW 03.08.
Status of mains monitor.

Bit	Meaning
2 ... 0	Status of the mains monitor 000: Off - mains monitor switched off 001: RUN - mains monitor is switched on and is operating 010: Not assigned 011: Stand-By - mains monitor is switched on, but is not operating because of its operation mode 100 ... 111: Not assigned
3	1: No module BM4-UME-01 is on slot B
4	1: Mains monitor group error 79 was released
5	1: Error limit for mains failure reached
6	1: Error limit for phase failure reached
7	1: Warning limit ▹P2058◃ for mains undervoltage is below
8	1: Error limit ▹P2080◃ for mains input undervoltage is below
9	1: Warning limit ▹P2059◃ for mains overvoltage exceeded
10	1: Error limit ▹P2081◃ for mains overvoltage exceeded
11	1: Lower warning limit for mains frequency ▹P2060◃ is below
12	1: Lower error limit for the mains frequency ▹P2082◃ is below
13	1: Upper warning limit for the mains frequency ▹P2061◃ exceeded
14	1: Upper error limit for the mains frequency ▹P2083◃ exceeded
15	1: Offset determination for mains voltage measurement completed
16	1: Reset of saved extremums completed
31 ... 17	Not assigned

P2058

P2058	Warngrenze Unterspannung	250.0 to 400.0 V	
EE	**Warning limit undervoltage**	370.0 V	
	BM_u_MaMoVoltageWarnLLim	4000$_{hex}$:381.8 V	CW

From firmware version FW 03.08.

Settable warning limit for undervoltage of the monitoring module mains monitor. The voltage RMS must be set.

P2059 | Warngrenze Überspannung | 400.0 to 550.0 V
EE | **Warning limit overvoltage** | 40.0 V
BM_u_MaMoVoltageWarnULim | 4000_{hex}:381.8 V | CW

From firmware version FW 03.08.
Settable warning limit for overvoltage of the monitoring module mains monitor. The voltage RMS must be set.

P2060 | Untere Warngrenze Frequenz | 40.0 to 60.0 Hz
EE | **Warning lower limit frequency** | 47.0 Hz
BM_u_MaMoFreqWarnLLim | 10:1 Hz | CW

From firmware version FW 03.08.
Settable lower warning limit for the mains frequency of monitoring module mains monitor.

P2061 | Obere Warngrenze Frequenz | 45.0 to 70.0 Hz
EE | **Warning upper limit frequency** | 52.0 Hz
BM_u_MaMoFreqWarnULim | 10:1 Hz | CW

From firmware version FW 03.08.
Settable upper warning limit for the mains frequency of the monitoring module mains monitor.

P2062 | Netzmonitor Warnungsmaske | 0 to $FFFF_{hex}$
EE | **Mains monitor warnings mask** | $FFFF_{hex}$
BM_w_MaMoWarningMask | 1:1 | -

From firmware version FW 03.08.
Mask, in order to activate or deactivate several mains monitor warnings.

Bit	Meaning
0	1: Activate „Warning mains failure“
1	1: Activate „Warning phase failure“
2	1: Activate „Warning mains undervoltage“ ▹P2058◃
3	1: Activate „Warning mains overvoltage“ ▹P2059◃
4	1: Activate „Lower warning limit for the frequency ▹P2060◃ is below
5	1: Activate „Upper warning limit for the frequency ▹P2061◃ exceeded
15...6	Reserved

P2063	Netzmonitor Netzfehler-Reaktionsverzögerung	0.000 to 6.000 s	
EE	**Mains monitor mains failure reaction delay**	0.000 s	
	BM_u_MaMoNetFailReactDelay	1000:1 s	-

From firmware version FW 03.08.
Delay time for mains failure reaction monitoring module mains monitor.

P2064	Netzmonitor Netzspannungs-Istwert	0.0 to 763.6 V	
-	**Mains monitor mains voltage actual value**	0.0 V	
A	BM_u_MaMoActMainsVoltage	4000_{hex}:381.8 V	-

From firmware version FW 03.08.
Actual RMS of mains voltage, determined by the monitoring module mains monitor. A display of 0.0 V means, that there hasn't yet been a voltage measurement.

P2065	Netzmonitor Netzfrequenz-Istwert	0.0 to 312.5 Hz	
-	**Mains monitor mains frequency actual value**	0.0 Hz	
A	BM_u_MaMoActMainFreq	10:1 Hz	-

From firmware version FW 03.08.
From the monitoring module mains monitor determined current actual value of the mains frequency. A display of 0.0 Hz means, that there wasn't a frequency measurement implemented.

P2066	Maximaler Netzspannung-Istwert	0.0 to 763.6 V	
-	**Maximum mains voltage actual value**	0.0 V	
A	BM_u_MaMoActMaxActMainsVoltage	4000_{hex}:381.8 V	-

From firmware version FW 03.08.
From the monitoring module mains monitor maximum measured mains voltage actual value (RMS) since the last reset. A reset via ▷P2056◁ Mains monitor mode bit 1 = 1 sets the parameter to 0.0 V.

P2067	Minimaler Netzspannung-Istwert	0.0 to 763.6 V	
-	**Minimum mains voltage actual value**	763.6 V	
A	BM_u_MaMoActMinActMainsVoltage	4000_{hex}:381.8 V	-

From firmware version FW 03.08.
From the monitoring module Mains monitor measured minimum mains voltage actual value (RMS) since the last reset. A reset via ▷P2056◁ Mains monitor mode bit 1 = 1 sets the parameter to 763.6 V.

P2068	Maximaler Netzfrequenz-Istwert	0.0 to 312.5 Hz	
-	**Maximum mains frequency actual value**	0.1 Hz	
A	BM_u_MaMoActMaxActMainFreq	10:1 Hz	-

From firmware version FW 03.08.
From the monitoring module mains monitor measured maximum mains frequency actual value since the last reset. A reset via ▹P2056◃ mains monitor mode bit 1 = 1 sets the parameters to 0.1 Hz.

P2069	Maximaler Netzfrequenz-Istwert	0.0 to 312.5 Hz	
-	**Minimum mains frequency actual value**	312.5 Hz	
A	BM_u_MaMoActMinActMainFreq	10:1 Hz	-

From firmware version FW 03.08.

The minimum measured mains frequency actual value from the monitoring module mains monitor since the last reset. A reset via ▹P2056◃ mains monitor mode bit 1 = 1 sets the parameters to 312.5 Hz.

P2070	Parkende Achse Steuerwort	1 to 2	
-	**Parking axis control word**	0	
ON	BM_w_ParkingAxisControl	1:1	-

From firmware version FW 03.08.
The commands for the display status „Parking axis“ are specified via this parameter.

Value	Meaning
1	Activate „Parking axis“
2	Deactivate „Parking axis“

P2071	Parkende Achse Statuswort	0 to $FFFF_{hex}$	
-	**Parking axis status word**	0_{hex}	
A	BM_w_ParkingAxisStatus	1:1	-

From firmware version FW 03.08.
This parameter shows the status of „Parking axis“. Only the bit 0 to 2 are used.

Bit	Meaning
0	0: „Parking axis“ not active 1: „Parking axis“ active
1	1: Activate „Parking axis“ not possible
2	1: Deactivate „Parking axis“ not possible
15 ... 3	Reserved

P2073 | Momentkopplung Status Slave | 0 to $FFFF_{hex}$

- | **Torque coupling status slave** | 0_{hex}

A | BM_w_TCSlaveStatus | 1:1 | -

From firmware version FW 03.08.
Slave status of torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

Bit	Meaning
0	0: Slave functionality is switched off 1: Slave functionality is switched on
1	Reserved
2	Reserved
3	Torque coupling between master and slave 0: Coupling is switched off 1: Coupling is switched on
15...4	Reserved

P2074 | Momentkopplung Kommando Master | 0 to $FFFF_{hex}$

- | **Torque coupling command master** | 0_{hex}

ON | BM_w_TCMasterCmd | 1:1 | CW

From firmware version FW 03.08.
Coupling command of the master to the slave at torque coupling. This parameter is independently written by the master and must be send cyclical via direct data transmission between substations to the slave. Also see ▹Master-Slave torque coupling◃ from page 175.

Bit	Meaning
0	0: Switch off torque coupling 1: Switch on torque coupling
15...1	Reserved

P2075 | Momentkopplung Ausgleichsregler Ausgang | -100.00 to 100.00%

- | **Torque coupling controller output** | 0.00 %

A | BM_di_TCPidOutput | 40000000_{hex}:100.00 %

From firmware version FW 03.08.
Display of the limited controller output at torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

P2076	Momentkopplung Ausgleichsregler I-Anteil	-100.00 to 100.00%
-	**Torque coupling integral part**	0.00 %
A	BM_di_TCPidIntH32	40000000_{hex}:100.00 %

From firmware version FW 03.08.
Display of the unlimited, integral part of the controller output at torque coupling (only at slave, i.e. ▹P1436◃ Bit 1...0 = 10).

P2077	Momentkopplung Master Solldrehzahl	-100.00 to 100.00%	
-	**Torque coupling master torque set value**	0.00 %	
ON	BM_di_TCMSpeedSetVal	40000000_{hex}:100.00 %	CW

Master torque set value at torque coupling (not implemented yet).

P2078	Momentkopplung Master Momentsollwert	-100.00 to 100.00%	
-	**Torque coupling master torque set value**	0.00 %	
ON	BM_di_TCMTorqueSetValue	40000000_{hex}:100.00 %	CW

From firmware version FW 03.08.
Torque set value of the master at torque coupling. This parameter is independently written by the master and must be send cyclical via direct data transmission between substations to the slave. Also see ▹Master-Slave torque coupling◃ from page 175.

P2079	Momentkopplung Master Status	0 to $FFFF_{hex}$	
-	**Torque coupling master status**	0_{hex}	
ON	BM_w_TCMasterStatus	1:1	CW

From firmware version FW 03.08.
Master status of torque coupling. This parameter is independently written by the master and must be send cyclical via the direct data transmission between substations to the slave. Also see ▹Master-Slave torque coupling◃ from page 175.

Bit	Meaning
0	0: Master functionality is disabled 1: Master functionality is enabled
1	0: Master does not follow the speed set value 1: Master follows the speed set value
2	Error status master 0: No error 1: Error
15...3	Reserved

P2080	Fehlergrenze Unterspannung	250.0 to 400.0 V	
EE	**Error limit undervoltage**	360.0 V	
-	BM_u_MaMoVoltageErrLLim	4000_{hex}:381.8 V	CW

From firmware version FW 03.08.
Settable error limit for undervoltage of monitoring module mains monitor. The voltage RMS must be set.

P2081	Fehlergrenze Überspannung	400.0 to 550.0 V	
EE	**Error limit overvoltage**	530.0 V	
-	BM_u_MaMoVoltageErrULim	4000_{hex}:381.8 V	CW

From firmware version FW 03.08.
Settable error limit for overvoltage of the monitoring module mains monitor. The voltage RMS must be set.

P2082	Untere Fehlergrenze Frequenz	40.0 to 60.0 Hz	
EE	**Error lower limit frequency**	45.0 Hz	
-	BM_u_MaMoFreqErrLLim	10:1 Hz	CW

From firmware version FW 03.08.
Settable lower error limit for mains frequency of monitoring module mains monitor.

P2083	Obere Fehlergrenze Frequenz	45.0 to 70.0 Hz	
EE	**Error upper limit frequency**	55.0 Hz	
-	BM_u_MaMoFreqErrULim	10:1 Hz	CW

From firmware version FW 03.08.
Settable upper error limit for mains frequency of monitoring module mains monitor.

P2099	Auswahl OEM Daten aus Geberspeicher	0 to $FFFFFFFF_{hex}$	
EE	**OEM data selection from encoder memory**	0_{hex}	
ON (PO)	BM_d_EncSelReadData	1:1	-

From firmware version FW 03.09.

Selection of the Baumüller-OEM-data, which is read from the encoder-memory.

By writing of the parameter a re-initialization of the according encoder is enabled. For this the accordant encoder must be activated (▹P0150◃ or ▹P0160◃ Bit 0 = 1).

Bit	Meaning
0	1: Read BM-OEM motor data from the encoder 1 0: Read BM-OEM motor data from the controller-EEPROM or from encoder 2
1	1: Read absolute data offset (▹P0157◃ angle and ▹P0158◃ revolutions for position controller encoder 1) from encoder 1 0: Read absolute data offset from the controller-EEPROM
2	1: Read notch position offset (▹P3058◃) from encoder 1 0: Do not evaluate the notch position offset from encoder 1
9 ... 3	Reserved
10	0: Delete notch position ▹P0082◃ after reading out a notch position offset ▹P3058◃ ≠ 0 from encoder 1. Recalculate notch position offset ▹P3058◃ after find notch position. 1: DO NOT delete notch position ▹P0082◃ after reading out a notch position offset ▹P3058◃ ≠ 0 from encoder 1. DO NOT recalculate notch position offset ▹P3058◃ after find notch position.
11	0: Add notch position offset (▹P3058◃) to position actual value encoder 1. 1: Do not add notch position offset (▹P3058◃) to position actual value encoder 1.
15 ... 12	Reserved
16	1: Read BM-OEM motor data from the encoder 2 0: Read BM-OEM motor data from the controller-EEPROM or from encoder 1
17	1: Read absolute data offset (▹P0167◃ angle and ▹P0168◃ revolutions for position controller encoder 2) from encoder 2 0: Read absolute data offset from the controller-EEPROM
18	1: Read notch position offset (▹P3059◃) from encoder 2 0: Do not consider the notch position offset from encoder 2
25 ... 19	Reserved
26	0: Delete notch position ▹P0082◃ after reading out a notch position offset ▹P3059◃ ≠ 0 from encoder 2. Recalculate notch position offset ▹P3058◃ after find notch position. 1: DO NOT delete notch position ▹P0082◃ after reading out a notch position offset ▹P3059◃ ≠ 0 from the encoder 2. DO NOT recalculate notch position offset ▹P3058◃ after find notch position.
27	0: Add notch position offset (▹P3059◃) to position actiual value encoder 2. 1: Do not add notch position offset (▹P3059◃) to position actiual value encoder 2.
31 ... 28	Reserved

If bit 0 = 0 and bit 16 = 0, the motor data is read from the controller EEPROM.

Compatibility with firmware versions before FW 03.09:

Up to firmware version FW 03.08 the data only could be read from the encoder which controlled the motor (▹P0093◃ Bit 4 = 1), a selection and reading of the other encoder was not possible. A **set** ▹P0093◃ bit 4 therefore operates in such a way, as if ▹P2099◃ = 7_{hex} (motor control with encoder 1) or 70000_{hex} (motor control with encoder 2) was selected.

▹P0093◃ Bit 4 and ▹P2099◃ must not be used together in order to read out the data.

NOTE!

If data are to be read from BOTH encoders,

this must be done CONSECUTIVELY, otherwise this can cause access conflicts.

- This is guaranteed at directly reading out after Power-On.
- When reading out after completing initialization the condition must definitely be adhered to, because otherwise after the setting of ▷P2099◁the accordant data is read out not till then the saving of ▷P2099◁ into the controller EEPROM and a new start (Power-On) of the drive.

The following combinations are not clear and therefore are refused:

- Type plate (motor data) shall be read from both encoders
- Notch position offset shall be read from both encoders and DO NOT delete the notch position for any encoders is not activated (▷P2099◁ bit 10 = bit 26 = 0)

Examples for the reading of parameters from the encoder:

1 Read absolute data offset ▷P0157◁/▷P0158◁ from encoder 1

☐Activate encoder: ▷P0150◁ Bit 0 = 1:

☐▷P2099◁ set accordant bit: Set ▷P2099◁ = 2_{hex}

▷P0157◁ and ▷P0158◁ are now written to with the values from the encoder 1,

▷P0391◁ = ▷P0391◁ + ▷P0157◁
▷P0392◁ = ▷P0391◁ + ▷P0158◁

2 Read notch position offset from encoder 2, Accept encoder 2 = Encoder for Motor control, Do not delete notch position ▷P0082◁ (▷P2099◁ Bit 26 = 1)

☐Activate encoder: ▷P0160◁Bit 0 = 1,

☐▷P2099◁ set accordant bit: Set▷P2099◁= 4040000_{hex}

▷P3059◁ is now written to with the value from encoder 2:

▷P0401◁ = ▷P0401◁ + ▷P3059◁
▷P0403◁ = ▷P0403◁ + ▷P3059◁

Notch position = Function of ▷P0403◁, ▷P0065◁, ▷P0082◁

3 Read notch position offset from encoder 1, Acceptance encoder 1 = Encoder for Motor control, delete notch position ▷P0082◁ (▷P2099◁ Bit 10 = 0)

☐Activate encoder: ▷P0150◁ Bit 0 = 1:

☐▹P2099◃Set accordant bit: Se t▹P2099◃ = 4_{hex}

▹P3058◃ is now written to with the value from encoder 1,

▹P0391◃ = ▹P0391◃ + ▹P3058◃
▹P0393◃ = ▹P0393◃ + ▹P3058◃

Notch position = Function of ▹P0393◃, ▹P0065◃, if ▹P3058◃ ≠ 0
Notch position = Function of ▹P0393◃, ▹P0065◃, ▹P0082◃, if ▹P3058◃ = 0

In order to save the data in the encoder see ▹P2031◃.

For the effects of read-out offset also see ▹Figure 3◃ on page 17.

P2120	Frequenz des Stromes - Rastlagensuche M2 S1	125.000 to 1562.500 Hz	
EE	**Frequency of current - find notch position M2 S1**	906.250 Hz	
	BM_u_NotchFreqModulation1	15.625 Hz : 1	-

From firmware version FW 03.09.

Frequency of current in step 1 of the find notch position with method 2 (▹P0094◃).

Normally this parameter should not be changed. If necessary the parameter can be reduced, if the attainable current is too low (amplitude of voltage - find notch position M2 S1 ▹P2122◃ at maximum, but even though error at find notch position bit 2 = 1 ▹P0237◃).

The parameter can only be changed when the controller is disabled.

P2121	Frequenz des Stromes - Rastlagensuche M2 S2	31.250 to 1000.00 Hz	
EE	**Frequency of current - find notch position M2 S2**	250.00 Hz	
	BM_u_NotchFreqModulation2	15.625 Hz : 1	-

From firmware version FW 03.09.

Frequency of current in step 2 of find notch position with method 2 (▹P0094◃).

Normally this parameter should not be changed. If necessary the parameter can be reduced, if the attainable current is too low (amplitude of voltage - find notch position M2 S2▹P2123◃at maximum, but even though error at find notch position bit 3 = 1 ▹P0237◃).

Only values= 15,625 Hz * 2^n, with n = 1, 2, 3, 4, 5, 6 are permitted.

The parameter can only be changed when the controller is disabled.

P2122	Amplitude der Spannung - Rastlagensuche M2 S1	0 to 100 %	
EE	**Amplitude of voltage - find notch position M2 S1**	0 %	
	BM_u_NotchVoltModulation1	$FFFF_{hex}$:100 %	-

From firmware version FW 03.09.

Amplitude of injected voltage in step1 of find notch position with method 2 (see ▹P0094◃).

The parameter is normalized to the peak value of the maximum phase voltage: U_{DClink} ▹P0020◃/ $\sqrt{3}$.

The scaling accords to $FFFF_{hex}$ = 100%.

If the amplitude of the voltage is entered in P2122 in %, the accordant value is displayed in the parameter ▹P2148◃.

The parameter can only be changed when the controller is disabled.

P2123	Amplitude der Spannung - Rastlagensuche M2 S2	0 to 100 %	
EE	**Amplitude of voltage - find notch position M2 S2**	0 %	
	BM_u_NotchVoltModulation2	$FFFF_{hex}$:100 %	-

From firmware version FW 03.09.

Amplitude of injected voltage in step 2 of find notch position with method 2 (see ▹P0094◃).

The parameter is normalized to the peak value of the maximum phase voltage: U_{DClink} ▹P0020◃/ $\sqrt{3}$.

The scaling accords to $FFFF_{hex}$ = 100%.

If the amplitude of the voltage is entered in P2123 in %, the accordant value is displayed in the parameter ▹P2149◃.

The parameter can only be changed when the controller is disabled.

P2124	Verstärkung des Folgereglers - Rastlagensuche M2	0 to 4.00	
EE	**Gain of tracking controller - find notch position M2**	0.15	
	BM_ud_NotchVp	$FFFF_{hex}$:1.00	-

From firmware version FW 03.09.

Gain of tracking controller at find notch position with method 2 (▹P0094◃).

The setting normally should not be changed.

P2125	Mindestpegel der 2. Oberschwingung	0 to 800 %	
EE	**Minimum level of 2nd harmonic**	4.4 %	
	BM_u_NotchMinOS2	see equitation P2125	-

From firmware version FW 03.09.

Minimum value of the ratio of the 2nd harmonic and the fundamental frequency of the injected current ▹P2023◃ (or ▹P2149◃), which is necessary for a valid result of the field direction recognition (Plausibility step 2) at find notch position with method 2.

The parameter represents the minimum saturation effect for a valid result of the plausibility step 2.

The setting normally should not be changed.

$$\text{internal value} = 0x8000000_{hex} * (GUI / 100)^2$$

P2126	Skalierungsfaktor Stromregler kp - Rastlagensuche M0	0.0 to 100.0 %	
EE	**Scaling factor current controller kp - find notch position M0**	19.9 %	
	BM_u_PGainNotchPosM0	$FFFF_{hex}$:100 %	-

From firmware version FW 03.09.

Reducing of current controller gain at find notch position with method 0 (▹P0094◃).

P2127	Wartezeit nach Stromabschaltung bis N=0	0 to 2000 ms	
EE	**Waiting time after current stop until N=0**	100 ms	
ON	BM_u_NotchSlowDownTime	1:1 ms	CW

From firmware version FW 03.10.

Waiting time for notch position finding procedure using method 3 (▹P0094◃ = 3).

The setting normally should not be changed.

P2128	Verfahrwinkel bei Rastlagensuche mit Methode 3	0.0° to 15.0°	
EE	**Traverse angle for notch method 3**	0.5	
ON	BM_u_ NotchDeltaPhiMechM3	0x10000:360°	CW

From firmware version FW 03.10.

Maximum traverse angle for notch position finding procedure using method 3 (▹P0094◃ = 3).

The setting normally should not be changed.

P2140	Bestromungswinkel 1	0.0 to 360.0	
EE	**Current feed angle 1**	0.0°	
ON	BM_u_ NotchPhiEL1M0	0x10000:360°	CW

From firmware version FW 03.10.

Current feed angle 1 for notch position finding procedure using method 0 (see ▹Operating mode Find notch position (-1)◃ on page 316).

P2141	Bestromungswinkel 2	0.0 to 360.0	
EE	**Current feed angle 2**	270.0°	
ON	BM_u_ NotchPhiEL2M0	0x10000:360°	CW

From firmware version FW 03.10.

Current feed angle 2 for notch position finding procedure using method 0 (see ▹Operating mode Find notch position (-1)◃ on page 316).

P2147	Gemessene 2. Oberschwingung	0 to 800 %	
EE	**Measured 2nd harmonic**	0.0 %	
	BM_ud_NotchOS2	see equitation P2147	-

From firmware version FW 03.10.

At the injected current from ▹P2023◃ (or ▹P2149◃): Proportion of 2nd harmonic to the fundamental frequency.

The parameter represents the saturation effects in the Ld inductance of the motor.

This parameter is used for the plausibility step 2 at find notch position with method 2.

$$\boxed{\text{internal value} = 0x8000000_{hex} * (GUI / 100)^2}$$

P2148	Injektionsamplitude 1 in Volt	0 to 65535 V	
EE	**Injection amplitude 1 in Volt**	0 V	
	BM_u_NotchVoltModulation1V	1:1 V	-

From firmware version FW 03.10.

Amplitude of the injected voltage in volt (peak value of the phase voltage), step 1 for notch position finding procedure using method 2 (see ▹P0094◃).

If the amplitude of the voltage is entered in P2148 in V the accordant the standardized value (standardized to DC link voltage nominal / $\sqrt{3}$) is displayed in the parameter ▹P2122◃ in %.

The parameter can only be changed when the controller is disabled.

P2149	Injektionsamplitude 2 in Volt	0 to 65535 V	
EE	**Injection amplitude 2 in Volt**	0 V	
	BM_u_NotchVoltModulation2V	1:1 V	-

From firmware version FW 03.10.

Amplitude of the injected voltage in volt (peak value of the phase voltage), step 2 for notch position finding procedure using method 2 (see ▹P0094◃).

If the amplitude of the voltage is entered in P2149 in V the accordant the standardized value (standardized to DC link voltage nominal / $\sqrt{3}$) is displayed in the parameter ▹P2123◃ in %.

The parameter can only be changed when the controller is disabled.

P2170	Zielposition DS402	-2147483648 bis 2147483647	
-	**Target position DS402**	0	
ON	BM_di_TargetPositionDS402	1:1	CW

(from firmware version FW 03.14).

Target position with position weighting according to DS402 Factor Group.

This value will be standardized with the parameters of the position weighting (P2172, P2173) and will be written to the parameter ▹P0369◃ "Position set value for interpolation" (Operating mode cyclical position set value setting) or ▹P0607◃ "Relative positioning control target position 0" (Operating mode Target position set value modes 4,7,9,12) according to the operating mode (see ▹DS402 Factor Group◃ from page 178).

P2171	Lageistwert DS402	-2147483648 bis 2147483647	
-	**Position actual value DS402**	0	
A	BM_di_PosActValueDS402	1:1	-

(from firmware version FW 03.14).

Position actual value with position weighting according to DS402 Factor Group.

This value is calculated cyclically by standardization of ▹P0362◃ "Position actual value" with the parameters of the position weighting (P2172, P2173) (see ▹DS402 Factor Group◃ from page 178).

NOTE!

The calculation is only done, if at least one of the position weighting parameters (P2172, P2173) is set different to the default value.

P2172	Lageauflösung Geber Inkremente DS402	1 bis 0xFFFFFFFF	
EE	**Position resolution encoder increments DS402**	1	
ON	BM_ud_PosResEncIncDS402	1:1	-

(from firmware version FW 03.14).

Numerator of the position weighting (see ▹DS402 Factor Group◃ from page 178).

P2173	Lageauflösung Motor Umdrehungen DS402	1 bis 0xFFFFFFFF	
EE	**Position resolution motor revolutions DS402**	1	
ON	BM_ud_PosResMotRevDS402	1:1	CW

(from firmware version FW 03.14).

Denominator of the position weighting (see ▹DS402 Factor Group◃ from page 178).

P2174	Zielgeschwindigkeit DS402	-2147483648 bis 2147483647	
-	**Target velocity DS402**	0	
ON	BM_di_TargetVelocityDS402	1:1	CW

(from firmware version FW 03.14).

Target velocity with speed weighting according to DS402 Factor Group.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to the parameter ▹P1179◃ "Ramp Function Generator input 32 bit" (see ▹DS402 Factor Group◃ from page 178).

P2175	Geschwindigkeitsistwert DS402	-2147483648 bis 2147483647	
-	**Velocity actual value DS402**	0	
A	BM_di_VelActValueDS402	1:1	-

(from firmware version FW 03.14).

Velocity actual value with speed weighting according to DS402 Factor Group.

This value is calculated by standardization of ▹P0353◃ "Speed actual value" with the parameters of the speed weighting (P2176, P2177) (see ▹DS402 Factor Group◃ from page 178).

NOTE!

The calculation is only done, if at least one of the speed weighting parameters (P2176, P2177) is set different to the default value.

P2176	Geschwindigkeitsauflösung Geber Inkremente DS402	1 bis 0xFFFFFFFF	
EE	**Velocity resolution encoder increments/s DS402**	1	
ON	BM_ud_VelResEncIncDS402	1:1	-

(from firmware version FW 03.14).

Numerator of the speed weighting (see ▷DS402 Factor Group◁ from page 178).

P2177	Geschwindigkeitsauflösung Motor Umdrehungen/s DS402	1 bis 0xFFFFFFFF	
EE	**Velocity resolution motor revolutions/s DS402**	1	
ON	BM_ud_VelResMotRevDS402	1:1	-

(from firmware version FW 03.14).

Denominator of the speed weighting (see ▷DS402 Factor Group◁ from page 178).

P2183	Positionier-Fenster DS402	0 bis 0xFFFFFFFF	
-	**Position window DS402**	0	
ON	BM_ud_ PositionWindowDS402	1:1	CW

(from firmware version FW 03.14).

Positioning window with position weighting according to DS402 Factor Group object 6067h.

This value will be standardized with the parameters of the position weighting (P2172, P2173) and will be written to the parameter ▷P1194◁ "Positioning window" (see ▷DS402 Factor Group◁ from page 178).

P2184	Referenzpunkt DS402	-2147483648 bis 2147483647	
-	**Home offset DS402**	0	
ON	BM_ud_HomeOffsetDS402	1:1	-

(from firmware version FW 03.14).

Home offset with position weighting according to DS402 Factor Group object 607Ch.

This value will be standardized with the parameters of the position weighting (P2172, P2173) and will be written to the parameter ▷P1200◁ "Positioning homing position" (see ▷DS402 Factor Group◁ from page 178).

P2185	Software-Endschalter minimale Position DS402	-2147483648 bis 2147483647	
-	**Software minimum position limit DS402**	0	
ON	BM_di_SwPosLimMinDS402	1:1	-

(from firmware version FW 03.14).

Lower software limit switch with position weighting according to DS402 Factor Group object 607D subindex 01h.

This value will be standardized with the parameters of the position weighting (P2172, P2173) and will be written to the parameter ▹P1196◃ "Positioning software limit switch 1" (see ▹DS402 Factor Group◃ from page 178).

P2186	Software-Endschalter maximale Position DS402	-2147483648 bis 2147483647	
-	**Software maximum position limit DS402**	0	
ON	BM_di_SwPosLimMaxDS402	1:1	-

(from firmware version FW 03.14).

Upper software limit switch with position weighting according to DS402 Factor Group object 607D subindex 02h.

This value will be standardized with the parameters of the position weighting (P2172, P2173) and will be written to the parameter ▹P1197◃ "Positioning software limit switch 2" (see ▹DS402 Factor Group◃ from page 178).

P2187	Geschwindigkeit=0 Schwelle DS402	0 bis 65535	
-	**Velocity threshold DS402**	0	
ON	BM_u_VelocityThresholdDS402	1:1	-

(from firmware version FW 03.14).

Velocity threshold for the "Speed=0" message with speed weighting according to DS402 Factor Group object 606Fh.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to N=0 threshold of the encoder (Encoder 1: ▹P1073◃ "Encoder 1 N=0 threshold", encoder 2: ▹P1083◃ "Encoder 2 N=0 threshold", see ▹DS402 Factor Group◃ from page 178).

P2188	Maximale Positioniergeschwindigkeit DS402	0 bis 4294967295	
-	**Max profile velocity DS402**	0	
ON	BM_ud_MaxProfileVelocityDS402	1:1	-

(from firmware version FW 03.14).

Limitation of the profile velocity with speed weighting according to DS402 Factor Group object 607Fh.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to the thresholds for the limitation of the speed set value (▷P1041◁ "Speed set value positive limit", ▷P1042◁ "Speed set value negative limit", (see ▷DS402 Factor Group◁ from page 178).

P2189	Positioniergeschwindigkeit 0 DS402	0 bis 4294967295	
-	**Profile velocity 0 DS402**	0	
ON	BM_ud_ProfileVelocityDS402	1:1	-

(from firmware version FW 03.14).

Maximum profile velocity with speed weighting according to DS402 Factor Group object 6081h.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to parameter ▷P0602◁ "Positioning speed 0" (see ▷DS402 Factor Group◁ from page 178).

P2190	Referenzgeschwindigkeit DS402	0 bis 4294967295	
-	**Homing speed during search for switch DS402**	0	
ON	BM_ud_HomeSpeedSwitchDS402	1:1	-

(from firmware version FW 03.14).

Maximum speed for drive to the homing switch with speed weighting according to DS402 Factor Group object 6081h.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to parameter ▷P1201◁ "Positioning homing speed" (see ▷DS402 Factor Group◁ from page 178).

P2191	Referenz-Endgeschwindigkeit DS402	0 bis 4294967295	
-	**Homing speed during search for zero DS402**	0	
ON	BM_ud_HomeSpeedZeroDS402	1:1	-

(from firmware version FW 03.14).

The homing final speed determines the speed value, which the drive shall take to reach the encoder zero angle or zero pulse according to DS402 Factor Group object 6099 sub-index 02h. This parameter is effective in operation mode 'homing' only.

This value will be standardized with the parameters of the speed weighting (P2176, P2177) and will be written to parameter ▷P1202◁ "Positioning homing final speed" (see ▷DS402 Factor Group◁ from page 178).

P3021	Delta I	3 to 150%/s	
EE	**Delta I**	15%/s	
	BM_u_CurrentDiffPST	1:3%s	-

From firmware version FW 03.13.

Current increase in % per time unit at notch position search method 3.

Standardization: 100% = maximum current at notch position search I_{notch} (see ▹Operating mode Find notch position (-1)◃ on page 316).

P3022	Delta Rho	2.746 to 137.30°/s	
EE	**Delta Rho**	13.730 °/s	
	BM_u_ RhoDiffPST	1:2.746 °/s	-

From firmware version FW 03.13.

Angle speed of the electrical angle at notch position search method 3 (see ▹Operating mode Find notch position (-1)◃ on page 316).

P3058	Rastwinkel-Offset aus Geber 1	0 to $FFFF_{hex}$	
	MotorNotchPosOffsEnc1	0_{hex}	
PO	BM_u_MotorNotchPosOffsEnc1	360°:$FFFF_{hex}$	-

From firmware version FW 03.09.

Notch position offset from encoder 1. Also see ▹P2099◃.
In order to save the data in the encoder see ▹P2031◃.
For the effects of read-out offset also see ▹Figure 3◃ on page 17.

This function is only intended for development purposes.

P3059	Rastwinkel-Offset aus Geber 2	0 to $FFFF_{hex}$	
	MotorNotchPosOffsEnc2	0_{hex}	
PO	BM_u_MotorNotchPosOffsEnc2	360°:$FFFF_{hex}$	-

From firmware version FW 03.09.

Notch position offset from encoder 2. Also see ▹P2099◃.
In order to save the data in the encoder see ▹P2031◃.
For the effects of read-out offset also see ▹Figure 3◃ on page 17.

This function is only intended for development purposes.

P3252	Firmware-Nummer Feldbus G	0 to 65535	
-	**Firmware number fieldbus G**	0	
ON	BM_u_FwNumberFieldbusG	1:1	CW

Internal Baumueller firmware number

P3253	Firmware-Version Feldbus G	0 to 65535	
-	**Firmware version fieldbus G**	0	
ON	BM_u_FwVersionFieldbusG	1:1	CW

Display of the firmware version in the format: Major[2].Minor[2] which is uploaded to the option module in slot G.

P3254	Build-Nummer Feldbus G	0 to 65535	
-	**Build number fieldbus G**	0	
ON	BM_u_BuildNumberFieldbusG	1:1	CW

Number for counting beta versions, prototypes or release versions of the firmware which was loaded on the option module in slot G.

P3255	Parameter Tabellen-Version Feldbus G	0 to 65535	
-	**Parameter table version fieldbus G**	0	
ON	BM_u_ParaTbleVersionFieldbusG	1:1	CW

Parameter table version for slot G, which the fieldbus firmware supports and expects.

P3256	FPGA-ID Feldbus G	0 to 65535	
-	**FPGA-ID fieldbus G**	0	
ON	BM_u_FPGA_Id_FieldbusG	1:1	CW

Identifier of the FPGA firmware which is uploaded to the fieldbus option module in slot G. Internal Baumueller number.

P3257	FPGA-Version Feldbus G	0 to 65535	
-	**FPGA version fieldbus G**	0	
ON	BM_u_FPGA_VersionFieldbusG	1:1	CW

FPGA version of the firmware which is uploaded to the fieldbus option module in slot G.

P3258	Feldbus-Diagnose1 G	0 to $FFFFFFFF_{hex}$	
-	**Fieldbus Diagnostic 1 G**	0	
ON	BM_ud_FieldbusDiag1G	1:1	CW

Reserved

P3259	Feldbus-Diagnose2 G	0 to $FFFFFFFF_{hex}$	
-	**Fieldbus Diagnostic 2 G**	0	
ON	BM_ud_FieldbusDiag2G	1:1	CW

Reserved

P3260	Knotennummer G	0 to 65535	
-	**Node number G**	0	
ON	BM_u_NodeNumberG	1:1	CW

Bus node number of the fieldbus slave in slot G.

P3261	Slave Status G	0 to $FFFFFFFF_{hex}$	
-	**Slave status G**	0	
ON	BM_ud_SlaveStatusG	1:1	CW

Reserved

P3262	Aktuelle IP-Adresse G	0 to $FFFFFFFF_{hex}$	
-	**Actual IP-Address G**	0	
ON	BM_ud_Actual_IP_AddressG	1:1	CW

Effective IP address of the fieldbus slave in slot G.

P3263	Baudrate für CANopen G	0 to 4294967295	
-	**CANopen Baudrate G**	0	
ON	M_ud_CANopenBaudrateG	1:1	CW

For CANopen fieldbus option module only:
Effective adjusted baud rate of the CANopen slave in slot G.

P3272	Firmware-Nummer Feldbus H	0 to 65535	
-	**Firmware number fieldbus H**	0	
ON	BM_u_FwNumberFieldbusH	1:1	CW

Internal baumueller firmware number

P3273	Firmware-Version Feldbus H	0 to 65535	
-	**Firmware version fieldbus H**	0	
ON	BM_u_FwVersionFieldbusH	1:1	CW

Display of the firmware version in the format: Major[2].Minor[2] which is loaded to the option module in slot H.

P3274	Build-Nummer Feldbus H	0 to 65535	
-	**Build number fieldbus H**	0	
ON	BM_u_BuildNumberFieldbusH	1:1	CW

Number for counting beta versions, prototypes or also release version of the firmware which is loaded to the option module in slot H.

P3275	Parameter Tabellen-Version Feldbus H	0 to 65535	
-	**Parameter table version fieldbus H**	0	
ON	BM_u_ParaTbleVersionFieldbusH	1:1	CW

Parameter table version for slot H, which the fieldbus firmware supports and expects.

P3276	FPGA-ID Feldbus H	0 to 65535	
-	**FPGA-ID fieldbus H**	0	
ON	BM_u_FPGA_Id_FieldbusH	1:1	CW

Identifier of the FPGA firmware which is uploaded to the fieldbus option module in slot H. Internal Baumueller number.

P3277	FPGA-Version Feldbus H	0 to 65535	
-	**FPGA version fieldbus H**	0	
ON	BM_u_FPGA_VersionFieldbusH	1:1	CW

FPGA version of the firmware which is uploaded to the fieldbus option module in slot H.

P3278	Feldbus-Diagnose1 H	0 to $FFFFFFFF_{hex}$	
-	**Fieldbus Diagnostic 1 H**	0	
ON	BM_ud_FieldbusDiag1H	1:1	CW

Reserved

P3279	Feldbus-Diagnose2 H	0 to $FFFFFFFF_{hex}$	
-	**Fieldbus Diagnostic 2 H**	0	
ON	BM_ud_FieldbusDiag2H	1:1	CW

Reserved

P3280	Knotennummer H	0 to 65535	
-	**Node number H**	0	
ON	BM_u_NodeNumberH	1:1	CW

Bus node number of the fieldbus slave in slot H.

P3281	Slave Status H	0 to $FFFFFFFF_{hex}$	
-	**Slave status H**	0	
ON	BM_ud_SlaveStatusH	1:1	CW

Reserved

P3282	Aktuelle IP-Adresse H	0 to $FFFFFFFF_{hex}$	
-	**Actual IP-Address H**	0	
ON	BM_ud_Actual_IP_AddressH	1:1	CW

Effective IP address of the fieldbus slave in slot H.

P3283	Baudrate für CANopen H	0 to 4294967295	
-	**CANopen Baudrate H**	0	
ON	M_ud_CANopenBaudrateH	1:1	CW

For CANopen fieldbus option module only:
Effective adjusted baud rate of the CANopen slave in slot H.

P3314	Applikationsparameter 1	-2147483648 to 2147483647	
EE	**Application parameter 1**	0	
ON	BM_di_ApplicationParam1	1:1 s	CW

Application parameters are at your disposal, e.g.:

- Linking of in- and outputs
- Access via field busses or PLC

All application parameters are saved at the storage of data sets (retained).

P3315	Applikationsparameter 2	-2147483648 to 2147483647	
EE	**Application parameter 2**	0	
ON	BM_di_ApplicationParam2	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3316	Applikationsparameter 3	-2147483648 to 2147483647	
EE	**Application parameter 3**	0	
ON	BM_di_ApplicationParam3	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3317	Applikationsparameter 4	-2147483648 to 2147483647	
EE	**Application parameter 4**	0	
ON	BM_di_ApplicationParam4	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3318	Applikationsparameter 5	-2147483648 to 2147483647	
EE	**Application parameter 5**	0	
ON	BM_di_ApplicationParam5	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3319	Applikationsparameter 6	-2147483648 to 2147483647	
EE	**Application parameter 6**	0	
ON	BM_di_ApplicationParam6	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3320	Applikationsparameter 7	-2147483648 to 2147483647	
EE	**Application parameter 7**	0	
ON	BM_di_ApplicationParam7	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3321	Applikationsparameter 8	-2147483648 to 2147483647	
EE	**Application parameter 8**	0	
ON	BM_di_ApplicationParam8	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3322	Applikationsparameter 9	-2147483648 to 2147483647	
EE	**Application parameter 9**	0	
ON	BM_di_ApplicationParam9	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3323	Applikationsparameter 10	-2147483648 to 2147483647	
EE	**Application parameter 10**	0	
ON	BM_di_ApplicationParam10	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3324	Applikationsparameter 11	-2147483648 to 2147483647	
EE	**Application parameter 11**	0	
ON	BM_di_ApplicationParam11	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3325	Applikationsparameter 12	-2147483648 to 2147483647	
EE	**Application parameter 12**	0	
ON	BM_di_ApplicationParam12	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3326	Applikationsparameter13	-2147483648 to 2147483647	
EE	**Application parameter 13**	0	
ON	BM_di_ApplicationParam13	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3327	Applikationsparameter 14	-2147483648 to 2147483647	
EE	**Application parameter 14**	0	
ON	BM_di_ApplicationParam14	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3328	Applikationsparameter 15	-2147483648 to 2147483647	
EE	**Application parameter 15**	0	
ON	BM_di_ApplicationParam15	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3329	Applikationsparameter 16	0 to 4294967295	
EE	**Application parameter 16**	0	
ON	BM_ud_ApplicationParam16	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3330	Applikationsparameter 17	0 to 4294967295	
EE	**Application parameter 17**	0	
ON	BM_ud_ApplicationParam17	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3331	Applikationsparameter 18	0 to $FFFFFFFF_{hex}$	
EE	**Application parameter 18**	0	
ON	BM_d_ApplicationParam18	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3332	Applikationsparameter 19	0 to $FFFFFFFF_{hex}$	
EE	**Application parameter 19**	0	
ON	BM_d_ApplicationParam19	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3333	Applikationsparameter 20	-32768 to 32767	
EE	**Application parameter 20**	0	
ON	BM_i_ApplicationParam20	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3334	Applikationsparameter 21	-32768 to 32767	
EE	**Application parameter 21**	0	
ON	BM_i_ApplicationParam21	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3335	Applikationsparameter 22	-32768 to 32767	
EE	**Application parameter 22**	0	
ON	BM_i_ApplicationParam22	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3336	Applikationsparameter 23	0 to 65535	
EE	**Application parameter 23**	0	
ON	BM_u_ApplicationParam23	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

NOTICE!

FW versions that are greater than 3.13-3 and lower than 3.14 (i.e. FW 3.13-4 only, at the moment), the motor I^2t threshold can be parameterized by the application parameter P3336.
See ▹Motor overload monitoring (I^2t)◃ from page 126.

P3337	Applikationsparameter 24	0 to 65535	
EE	**Application parameter 24**	0	
ON	BM_u_ApplicationParam24	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3338	Applikationsparameter 25	0 to 65535	
EE	**Application parameter 25**	0	
ON	BM_u_ApplicationParam25	1:1 s	CW

Description of the parameter see parameter ▹P3314◃.

P3344	BACI Status	0 to $FFFF_{hex}$	
	BACI Status	0_{hex}	
A	BM_u_BaciStatus	1:1	-

Internal BACI status.

Value.	Meaning
0	Initialization phase
1	Waiting for the hardware enable signal RST of the BACI slaves
2	Ramp-up-/configuration phase
3	Ramp up completed
4	Normal operating conditions

P3345	BACI Zugriffsfehler Steckplatz G	0 to $FFFF_{hex}$	
	BACI Access Error Slot G	0_{hex}	
A	BM_w_BaciCntrAccessErr	1:1	-

Counter for access conflicts with option module.

High-Byte: Number of access errors at the transmission of actual values

Low-Byte: Number of access error at the transmission of set values.

P3346	BACI Zugriffsfehler AliveCounter Steckplatz G	0 to $FFFF_{hex}$	
	BACI Alive Counter Error Slot G	0_{hex}	
A	BM_w_BaciCntrAliveG	1:1	-

Counter for alive counter errors (also see ▷Delay errors cyclic communication:◁ on page 170).

High-Byte: Number of alive counter errors at transmission of actual values

Low-Byte: Number of alive counter errors at the transmission of set values

P3347	Zähler für BACI-Rekonfigurierungsvorgänge Steckplatz G	0 to $FFFF_{hex}$	
	BACI Reconfiguration Counter Slot G	0_{hex}	
A	BM_w_BaciCntrReconfigG	1:1	-

Counter for reconfiguration operations during the current operation

High-Byte: Number of initiation of reconfiguration operations during transmission of actual values

Low-Byte: Number of initiations of reconfiguration operations during set value transmissions

The characteristic, if a reconfiguration operation was started via actual values or via set values, is specified by the firmware of the particular option modules.

P3348	Zähler zyklischer Austausch von BACI-Sollwerten Steckplatz G	0 to $FFFF_{hex}$	
	BACI Set data Exchange Counter Slot G	0_{hex}	
A	BM_w_BaciCntrCyclSetValG	1:1	-

Counter for the cyclic data exchange of set values. If, e.g. the cycle time is set to 4 (1 ms), then, after one second of error-free cyclical transfer, this counter should have continued to count to 1000.

P3349	Zähler zyklischer Austausch von BACI-Istwerten Steckplatz G	0 to $FFFF_{hex}$	
	BACI Actual data Exchange Counter Slot G	0_{hex}	
A	BM_w_BaciCntrCyclActValG	1:1	-

Counter for the cyclic data exchange of actual values.

P3350	BACI Kommandozähler Steckplatz G	0 to $FFFF_{hex}$	
	BACI-Command Counter Slot G	0_{hex}	
A	BM_w_BaciCntrCmdG	1:1	-

Counter for BACI commands

High-Byte: Number of errors, which have occurred at command processing

Low-Byte: Number of commands

P3351	Zähler Bedarfsdatenzugriffe Steckplatz G	0 to $FFFF_{hex}$	
	Counter Service Data Access Slot G	0_{hex}	
A	BM_w_BaciCntrSrvDataG	1:1	-

Counter for service data communication.

High-Byte: Number of the reading service data transfer

Low-Byte: Number of the writing service data transfer

P3385	BACI Zugriffsfehler Steckplatz H	0 to $FFFF_{hex}$	
	BACI Access Error Slot H	0_{hex}	
A	BM_w_BaciCntrAccessErrH	1:1	-

See parameter description ▹P3345◃ on page 675.

P3386	BACI Zugriffsfehler AliveCounter Steckplatz H	0 to $FFFF_{hex}$	
	BACI Alive Counter Error Slot H	0_{hex}	
A	BM_w_BaciCntrAliveH	1:1	-

See parameter description ▹P3346◃ on page 676.

P3387	Zähler für BACI-Rekonfigurierungsvorgänge Steckplatz H	0 to $FFFF_{hex}$	
	BACI Reconfiguration Counter Slot H	0_{hex}	
A	BM_w_BaciCntrReconfigH	1:1	-

See parameter description ▹P3347◃ on page 676.

P3388	Zähler zyklischer Austausch von BACI-Sollwerten Steckplatz H	0 to $FFFF_{hex}$	
	BACI Set data Exchange Counter Slot H	0_{hex}	
A	BM_w_BaciCntrCyclSetValH	1:1	-

See parameter description ▹P3348◃ on page 676.

P3389	Zähler zyklischer Austausch von BACI-Istwerten Steckplatz H	0 to $FFFF_{hex}$	
	BACI Actual data Exchange Counter Slot H	0_{hex}	
A	BM_w_BaciCntrCyclActValH	1:1	-

See parameter description ▹P3349◃ on page 676.

P3390	BACI Kommandozähler Steckplatz H	0 to $FFFF_{hex}$	
	BACI-Command Counter Slot H	0_{hex}	
A	BM_w_BaciCntrCmdH	1:1	-

See parameter description ▹P3350◃ on page 677.

P3391	Zähler Bedarfsdatenzugriffe Steckplatz H	0 to $FFFF_{hex}$	
	Counter Service Data Access Slot H	0_{hex}	
A	BM_w_BaciCntrSrvDataH	1:1	-

See parameter description ▹P3351◃ on page 677.

P3426	Momentanwert drehzahlabh. Stromgrenze	-200,00 to +200,00%	
	Present value of the speed dependent current limiter	0,00%	
A	BM_i_CurrentLimSymAct	4000_{hex}:100%	-

This parameter displays the present value of the speed dependent current limit, if this limit is enabled (see ▹P1030◃ bit 5).

Standardization: 100.0% ↔ Power unit maximum current (▹P1241◃).

Appendix A - Parameter List

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0001	Controller type	1 to 2	1	1:1	343
P0002	Controller firmware type	0 to 65535	0	1:1	343
P0003	Controller firmware ID	0 to 65535	0	1:1	343
P0004	Controller firmware version	0.00 to 655.35	0.00	100:1	343
P0005	Parameter table version	0 to 65535	0	1:1	344
P0006	Power unit type code	20 ASCII characters	""	1:1	344
P0007	Power unit serial number	0 to 65535	0	1:1	344
P0008	Power unit data configuration	0 to 65535	0	1:1	344
P0009	Power unit firmware version	0 to $FFFF_{hex}$	0_{hex}	1:1	344
P0010	Power unit nominal current 4kHz	0.0 to 6553.5 A	2.5 A	10:1 A	345
P0011	Power unit peak current 4kHz	0.0 to 6553.5 A	2.5 A	10:1 A	345
P0012	Power unit nominal current 8kHz	0.0 to 6553.5 A	2.5 A	10:1 A	345
P0013	Power unit peak current 8kHz	0.0 to 6553.5 A	2.5 A	10:1 A	345
P0014	Power Unit thermal time constant 1	0.00 to 655.35 s	1.00 s	100:1 s	345
P0015	Power Unit thermal time constant 2	0.00 to 655.35 s	1.00 s	100:1 s	346
P0016	Power unit internal device warning temperature	0 to 125 °C	75 °C	1:1	346
P0017	Power unit internal device shutdown temperature	0 to 125 °C	0 °C	1:1 °C	346
P0018	Power unit heatsink warning temperature	0 to 125 °C	75 °C	1:1 °C	346
P0019	Power unit heatsink shutdown temperature	0 to 125 °C	0 °C	1:1 °C	347
P0020	Power unit DC link nominal voltage	280 to 1000 V	540 V	1:1 V	347
P0021	Power unit dead time	0.0 to 6553.5 µs	0.0 µs	10:1 µs	347
P0022	Power unit burden factor Iac	-1.65 to 1.65 V	0 V	100:1 V	347
P0023	Power unit burden factor Vdc	0.00 to 10.00 V	0 V	100:1 V	347
P0024	Power unit mode	0 to $FFFF_{hex}$	0_{hex}	1:1	348
P0025	Power supply unit mode	0 to $FFFF_{hex}$	0_{hex}	1:1	348
P0026	Max. phase error delay time	0 to 65535 ms	0	1:1 ms	349
P0027	Phase error delay time	0 to 65535 ms	0	1:1 ms	349
P0028	Max. motor current while phase error	0.0 to 6553.5 A	0	10:1 A	349
P0030	Power unit burden factor Vmain	0 to 65535	0	1:1	350

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0031	Power unit burden factor motor temperature	0 to 65535	0	1:1	350
P0050	Motor type code	20 ASCII characters	""	1:1	350
P0051	Motor serial number	0 to 65535	0	1:1	350
P0052	Motor data configuration	0 to 65535	0	1:1	350
P0053	Motor nominal voltage	0.0 to 6553.5 V	0.0 V	10:1 V	351
P0054	Motor nominal current	0.1 to 6553.5 A	0.1 A	10:1 A	351
P0055	Motor nominal operation mode	0 to $FFFF_{hex}$	0_{hex}	1:1 Nm	351
P0056	Motor nominal power	0.00 to 655.35 kW	0.00 kW	100: 1 kW	352
P0057	Motor nominal speed	1 to 24000 RPM	1 RPM	1:1 RPM	352
P0058	Motor power factor	0.00 to 1.00	0.00	100:1	352
P0059	Motor slip frequency 1	0.00 to 655.35 Hz	0.00 Hz	100:1 Hz	352
P0060	Motor slip frequency 2	0.00 to 655.35 Hz	0.00 Hz	100:1 Hz	353
P0061	Motor nominal frequency	0.0 to 6553.5 Hz	0.0 Hz	10:1 Hz	353
P0062	Motor temperature 1	0 to 65535 °C	0 °C	1:1 °C	353
P0063	Motor temperature 2	0 to 65535 °C	0 °C	1:1 °C	353
P0064	Motor friction moment	0.00 to 655.35 Nm	0.00 - 35 Nm	100:1	354
P0065	Motor number of pole pairs	1 to 120	3	1:1	354
P0066	Motor magnetizing current	0.0 to 6553.5 A	0.0 A	10:1 A	354
P0067	Motor Ke factor	0.0 to 500.0 V/1000/ min	0.0 V/1000/min	10:1 V/1000/min	356
P0068	Motor attenuation factor	0.00 to 655.35		100:1	356
P0069	Motor peak current	0.0 to 6553.5 A	0.0 A	10:1 A	356
P0070	Motor peak torque	0.0 to 6553.5 Nm	0.0 Nm	10:1 Nm	357
P0071	Motor field weakening speed	1 to 65535 RPM	1 RPM	1:1 RPM	357
P0072	Motor max. speed mechanical	1 to 65535 RPM	1 RPM	1:1 RPM	357
P0073	Motor I^2t time constant (=0:off)	0 to 3600 s	0 s	1:1 s	357
P0074	Motor flags	0 to $FFFF_{hex}$	0_{hex}	1:1	358
P0075	Motor stator resistance	0.000 to 500.000 Ω	0.000 Ω	1000:1 Ω	358
P0076	Motor stator leakage inductance	0.00 to 655.35 mH	0.00 mH	100: 1 mH	358
P0077	Motor rotor resistance	0.000 to 500.000 Ω	0.000 Ω	1000:1 Ω	359
P0078	Motor rotor leakage inductance	0.00 to 655.35 mH	0.00 mH	100: 1 mH	359
P0079	Motor magnetizing inductance	0.00 to 655.35 mH	0.00 mH	100: 1 mH	359
P0080	Motor Lq inductance	0.00 to 655.35 mH	0.00 mH	100: 1 mH	359
P0081	Motor Ld inductance	0.00 to 655.35 mH	0.00 mH	100: 1 m	359
P0082	Motor notch position	0.0 to 360.0 °	240.0 °	65535:360°	360
P0083	Motor torque inertia	0.00 to 42949672.95 kg*cm²	0.00 kg*cm²	100:1 kg*cm²	360
P0084	Motor temperature sensor type	0 to 255	0	1:1	360
P0085	Motor brake voltage	0.0 to 6553.5 V	24.0 V	10:1 V	360
P0086	Motor brake torque inertia	0.00 to 42949672.95 kg*cm²	0.00 kg*cm²	100:1 kg*cm²	361
P0087	Motor rotating field	0 to 1	1	1:1	361
P0088	Motor warning temperature 1	-80 to 250 °C	125 °C	1:1 °C	361
P0089	Motor warning temperature 2	-80 to 250 °C	125 °C	1:1 °C	361
P0090	Motor shutdown temperature	-80 to 250 °C	150 °C	1:1 °C	362

Parameter		Range	Standard value	Internal standardization	Page
P0091	Motor temperature hysteresis	0 to 5 °C	5 °C	1:1 °C	362
P0092	Motor I^2t warning limit	0.0 to 100.0 %	0.0 %	4000_{hex}:100 %	362
P0093	Motor mode	0 to $FFFF_{hex}$	0_{hex}	1:1	362
P0094	Motor mode notch position	0 to $FFFF_{hex}$	0_{hex}	1:1	366
P0095	Field weakening current for synchronous motor	0.0 to 6553.5 A	0.0 A	10:1 A	366
P0096	Motor article number	0 to 4294967295	0	1:1	367
P0097	Motor Standstill current	0.0 to 6553.5 A	0.0 A	10:1	367
P0098	Motor standstill torque	0.00 to 42949672.95 Nm	0.00 A	100:1	367
P0099	Motor brake torque	0.0 to 6553.5 Nm	0.0 Nm	10:1	368
P0100	Motor gear factor	0 to $FFFF_{hex}$	257	1:1	368
P0101	Motor I2t derating factor 1	10.0 to 100.0 %	40.0 %	4000_{hex}:100.0 %	368
P0102	Motor I2t derating factor 2	10.0 to 100.0 %	70.0 %	4000_{hex}:100.0 %	368
P0104	Motor mode 2	0 to $FFFF_{hex}$	0_{hex}	1:1	369
P0105	Application speed of speed dependent current limits	0 to 65535 U/min	65535 U/min	1:1 U/min	370
P0106	Application speed of the id-curve for synchronous motor	0 to 65535 U/min	65535 U/min	1:1 U/min	370
P0107	Speed base coordinate of the id-curve for synchronous motor	0 to 65535 U/min	65535 U/min	1:1 U/min	371
P0108	Current base coordinate of the id-curve for synchronous motor	0 to 6553.5 A	0.0 A	10:1 A	371
P0109	Load inertia	0.0 to 500000.0 $kg*cm^2$	0.0 $kg*cm^2$	10:1 $kg*cm^2$	371
P0110	Kt adjustable correction factor	75.0 to 125.0%	100.0%	4000_{hex}:100.0 %	371
P0112	Kt adaptation lower speed limit	10.0 to 100.0%	25.0%	10:1 %	372
P0113	Motor Kt adaptation suppression time	0.016 to 60.000 s	0.100 s	1000:1 s	372
P0114	Motor I^2t threshold	0.0 to 400.0%	100.0%	4000_{hex}:100.0 %	372
P0115	Motor Continuous current limit curve 0	0.0 to 6553.5 A	0.0 A	10:1	373
P0116	Motor Continuous current limit curve 1	0.0 to 6553.5 A	0.0 A	10:1	373
P0117	Motor Continuous current limit curve 2	0.0 to 6553.5 A	0.0 A	10:1	373
P0118	Motor Continuous current limit curve 3	0.0 to 6553.5 A	0.0 A	10:1	373
P0119	Motor Continuous current limit curve 4	0.0 to 6553.5 A	0.0 A	10:1	373
P0120	Motor Continuous current limit curve 5	0.0 to 6553.5 A	0.0 A	10:1	373
P0121	Motor Continuous current limit curve 6	0.0 to 6553.5 A	0.0 A	10:1	374
P0122	Motor Continuous current limit curve 7	0.0 to 6553.5 A	0.0 A	10:1	374
P0123	Motor Continuous current limit curve 8	0.0 to 6553.5 A	0.0 A	10:1	374
P0124	Motor Continuous current limit curve 9	0.0 to 6553.5 A	0.0 A	10:1	374
P0125	Motor Continuous current limit curve 10	0.0 to 6553.5 A	0.0 A	10:1	374
P0150	Encoder 1 mode	0 to $FFFF_{hex}$	1_{hex}	1:1	375
P0151	Encoder 1 type code	20 ASCII characters	""	1:1	378
P0152	Encoder 1 number of pulses or pole pairs	1 to 32767	1	1:1	379
P0153	Encoder 1 number of revolutions	1 to 65535	1	1:1	379
P0154	Absolute offset encoder 1	-2147483648 to 2147483647	0	1:1	380
P0157	Absolute offset angle encoder 1 from type plate	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	380
P0158	Absolute offset revolution encoder 1 from type plate	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	381

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0159	Encoder 1 shiftfactor	0 to 16	0	1:1	382
P0160	Encoder 2 mode	0 to $FFFF_{hex}$	0_{hex}	1:1	382
P0161	Encoder 2 type code	20 ASCII characters	""	1:1	386
P0162	Encoder 2 number of pulses or pole pairs	1 to 32767	1	1:1	386
P0163	Encoder 2 number of revolutions	1 to 65535	1	1:1	386
P0164	Absolute offset encoder 2	-2147483648 to 2147483647	1	1:1	386
P0167	Absolute offset angle encoder 2 from type plate	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	387
P0168	Absolute offset revolution encoder 2 from type plate	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	388
P0169	Encoder 2 shiftfactor	0 to 16	0	1:1	388
P0200	Error system 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	389
P0201	Error processor	0 to $FFFF_{hex}$	0_{hex}	1:1	389
P0202	Error operating system	0 to $FFFF_{hex}$	0_{hex}	1:1	390
P0203	Error PROPROG communication	0 to $FFFF_{hex}$	0_{hex}	1:1	390
P0204	Error in function- or option modules	0 to $FFFF_{hex}$	0_{hex}	1:1	391
P0205	Error Power Supply Unit	0 to $FFFF_{hex}$	0_{hex}	1:1	391
P0206	Error Power Unit	0 to $FFFF_{hex}$	0_{hex}	1:1	392
P0207	Error motor	0 to $FFFF_{hex}$	0_{hex}	1:1	393
P0208	Error encoder 1	0 to $FFFF_{hex}$	0_{hex}	1:1	393
P0209	Error Encoder 2	0 to $FFFF_{hex}$	0_{hex}	1:1	394
P0210	Error encoder manager	0 to $FFFF_{hex}$	0_{hex}	1:1	395
P0211	Error drive manager	0 to $FFFF_{hex}$	0_{hex}	1:1	395
P0212	Error data management	0 to $FFFF_{hex}$	0_{hex}	1:1	396
P0213	Error Position controller	0 to $FFFF_{hex}$	0_{hex}	1:1	397
P0214	Error Speed controller	0 to $FFFF_{hex}$	0_{hex}	1:1	397
P0215	Error in module free control section.	0 to $FFFF_{hex}$	0_{hex}	1:1	398
P0216	Error CANsync	0 to $FFFF_{hex}$	0_{hex}	1:1	398
P0233	Error Power Unit serial interface	0 to $FFFF_{hex}$	0_{hex}	1:1	398
P0234	Error Encoder 1 serial interface	0 to $FFFF_{hex}$	0_{hex}	1:1	399
P0235	Error Encoder 2 serial interface	0 to $FFFF_{hex}$	0_{he}	1:1	399
P0236	Error mains monitor	0 to $FFFF_{hex}$	0_{hex}	1:1	402
P0237	Error finding notch position	0 to $FFFF_{hex}$	0_{hex}	1:1	402
P0240	Error function module A	0 to $FFFF_{hex}$	0_{hex}	1:1	403
P0241	Error function module B	0 to $FFFF_{hex}$	0_{hex}	1:1	404
P0242	Error function module C	0 to $FFFF_{hex}$	0_{hex}	1:1	404
P0243	Error function module D	0 to $FFFF_{hex}$	0_{hex}	1:1	404
P0244	Error function module E	0 to $FFFF_{hex}$	0_{hex}	1:1	404
P0245	Error option module G	0 to $FFFF_{hex}$	0_{hex}	1:1	405
P0246	Error option module H	0 to $FFFF_{hex}$	0_{hex}	1:1	407
P0247	Error option module J	0 to $FFFF_{hex}$	0_{hex}	1:1	407
P0248	Error option module K	0 to $FFFF_{hex}$	0_{hex}	1:1	407
P0249	Error option module L	0 to $FFFF_{hex}$	0_{hex}	1:1	408
P0250	Error option module M	0 to $FFFF_{hex}$	0_{hex}	1:1	408
P0251	Error communication parameter no.	0 to 65535	0	1:1	408
P0257	Error Buffer Count	0 to 20	0	1:1	408

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0258	Error Buffer Index	0 to 19	0	1:1	409
P0259	Error Buffer Value	0 to FFFF$_{hex}$	0$_{hex}$	1:1	409
P0260	Warning System 1	0 to FFFF$_{hex}$	0$_{hex}$	1:1	409
P0261	Warning Power Supply Unit	0 to FFFF$_{hex}$	0$_{hex}$	1:1	409
P0262	Warning Power Unit	0 to FFFF$_{hex}$	0$_{hex}$	1:1	410
P0263	Warning Motor	0 to FFFF$_{hex}$	0$_{hex}$	1:1	410
P0264	Global Drive Warnings	0 to FFFF$_{hex}$	0$_{hex}$	1:1	411
P0265	Warning Mains monitor	0 to FFFF$_{hex}$	0$_{hex}$	1:1	411
P0290	Client alive timeout	0 to 65535 ms	2000 ms	1:1 ms	412
P0291	Receive timeout proprog protocol	300 to 65535 ms	500 ms	1:1 ms	412
P0297	Error Reaction Mains Failure	-3 to 3	-1	1:1	412
P0298	Error Reaction BACI communication	-3 to 3	-1	1:1	413
P0299	Error Reaction Sync Errors	-3 to 3	0	1:1	413
P0300	Controlword	0 to FFFF$_{hex}$	0$_{hex}$	1:1	414
P0301	Status word	0 to FFFF$_{hex}$	0$_{hex}$	1:1	418
P0302	Control word	0 to FFFF$_{hex}$	0$_{hex}$	1:1	422
P0303	Status word	0 to FFFF$_{hex}$	0$_{hex}$	1:1	423
P0304	Operation mode actual	-7 to 6	-3	1:1	424
P0305	Drive status	0 to FFFF$_{hex}$	0$_{hex}$	1:1	424
P0306	Status digital inputs drive manager	0 to FFFF$_{hex}$	0$_{hex}$	1:1	425
P0307	Delay for quickstop input	0 to 65535 ms	0 ms	1:1 ms	425
P0308	Status word	0 to FFFF$_{hex}$	0$_{hex}$	1:1	425
P0310	Data management command	0 to 32	0	1:1	426
P0311	Data management status	0 to FFFF$_{hex}$	0	1:1	427
P0312	Active data set number	1 to 8	1	1:1	428
P0313	Valid data sets	00$_{hex}$ to FF$_{hex}$	01$_{hex}$	1:1	428
P0314	Data set source	0 to 8	0	1:1	429
P0315	Data set destination	0 to 8	1	1:1	429
P0316	Error data set parameter no.	1 to max. Para-no.	-	1:1	429
P0317	EEPROM write count	1 to 65535		1:1	429
P0318	PSI write count	1 to 65535		1:1	430
P0319	PSI Parameter number	1 to 65535	1	1:1	430
P0320	PSI Array index	0 to 65535	0	1:1	430
P0321	PSI parameter data width	0 to 65535		1:1	430
P0322	PSI parameter value (32 bit)	0 to FFFFFFFF$_{hex}$		1:1	430
P0323	PSI string parameters	40 ASCII characters	""	1:1	431
P0324	PSI Data set selection	1 to 4	1	1:1	431
P0325	PSI valid data sets	0 to 65535		1:1	431
P0326	PSI mode	0 to 65535		1:1	431
P0327	Boot data set	1 to 8	1	1:1	432
P0330	Current controller status	0 to FFFF$_{hex}$	0$_{hex}$	1:1	432
P0331	Torque set value	-100.00 to +100.00 %	0.00 %	4000$_{hex}$:100 %	432
P0332	Current Iq set value	-200.00 to +200.00 %	0.00 %	4000$_{hex}$:100 %	432
P0333	Current Iq actual value	-200.00 to +200.00 %	0.00 %	4000$_{hex}$:100 %	433
P0334	Current Iq controller output	-200.00 to +200.00 %	0.00 %	4000$_{hex}$:100 %	433

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0335	Current Id set value	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	433
P0336	Current Id Actual value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	433
P0337	Current Id controller output	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	433
P0338	Voltage EMF set value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	434
P0339	Voltage Vq set value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	434
P0340	Voltage Vd set value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	434
P0341	Current phase U actual value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	434
P0342	Current phase V actual value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	434
P0343	Apparent current actual value	0 to +200.00 %	0.00 %	4000_{hex}:100 %	435
P0344	Standard torque actual value	-2000.00 to 2000.00%		0666_{hex}:100 %	435
P0345	Apparent current actual value with Iq sign	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	435
P0350	Speed controller status	0 to $FFFF_{hex}$	0_{hex}	1:1	436
P0351	Speed set value	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	436
P0352	Speed set value total	-100.00 to +100.00 %	0.00 %	40000000_{hex}:100 %	437
P0353	Speed actual value	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	437
P0354	Speed deviation value	-200.00 to +200.00 %	0.00 %	4000_{hex}:100 %	437
P0355	Torque feed forward	-200.00 to +200.00%	0.00 %	4000_{hex}:100 %	437
P0356	Speed controller output	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	438
P0357	Standard torque limiter bipolar	0.00 to 100.00 %	100.00 %	4000_{hex}:100 %	438
P0358	Speed actual value after notchfilter	-100.00 to 100.00%	0.00 %	40000000_{hex}:100.00 %	440
P0359	Scaling of speed set value	0.00 to 100.00 %	100.00 %	4000_{hex}:100.00 %	440
P0360	Position controller status	0 to $FFFF_{hex}$	0_{hex}	1:1	441
P0361	Position set value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	441
P0362	Position actual value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	442
P0363	Position set value angle	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	443
P0364	Position set value rev	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	443
P0365	Speed feed forward	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	443
P0366	Position controller output	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	444
P0367	Position actual total deviation	80000000_{hex} to $7FFFFFFF_{hex}$	0_{hex}	1:1	444
P0368	Position actual angle deviation	80000000_{hex} to $7FFFFFFF_{hex}$	0_{hex}	1:1	444
P0369	Position set value for interpolation	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	445
P0370	Position angle value for interpolation	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	445
P0371	Mechanical angle at reference switch	0 to $FFFF_{hex}$	0_{hex}	1:1	446
P0380	Open loop speed status	0 to $FFFF_{hex}$	0_{hex}	1:1	446
P0381	Startup time open loop	500 to 30000 ms	2000 ms	1:1 ms	446
P0382	Starting torque boost for Open Loop	0.00 to 40.00 %	0.00 %	4000_{hex}:100 %	447
P0383	Speed range for torque boost	0.00 to 20.00 %	0.00 %	4000_{hex}:100 %	447
P0390	Encoder 1 status	0 to $FFFF_{hex}$	0_{hex}	1:1	447
P0391	Encoder 1 actual angle	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	448
P0392	Encoder 1 actual revolutions	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	448
P0393	Encoder 1 mechanical actual angle	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	448
P0394	Encoder 1 actual speed	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	449
P0395	Encoder 1 actual position 16	0 to $FFFF_{hex}$	0_{hex}	1:1	449

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0400	Encoder 2 status	0 to $FFFF_{hex}$	0_{hex}	1:1	451
P0401	Encoder 2 actual angle	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	451
P0402	Encoder 2 actual revolutions	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	451
P0403	Encoder 2 mechanical actual angle	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	452
P0404	Encoder 2 actual speed	-200.00 to +200.00 %	0.00 %	40000000_{hex}:100 %	452
P0405	Encoder 2 actual position 16	0 to $FFFF_{hex}$	0_{hex}	1:1	452
P0410	Function module A: status digital input	0 to $FFFF_{hex}$	0_{hex}	1:1	452
P0411	Function module B: status digital input	0 to $FFFF_{hex}$	0_{hex}	1:1	453
P0412	Function module C: status digital input	0 to $FFFF_{hex}$	0_{hex}	1:1	453
P0413	Function module D: status digital input	0 to $FFFF_{hex}$	0_{hex}	1:1	453
P0414	Function module E: status digital input	0 to $FFFF_{hex}$	0_{hex}	1:1	454
P0415	Function module A: Status digital output	0 to $FFFF_{hex}$	0_{hex}	1:1	454
P0416	Function module B: Status digital output	0 to $FFFF_{hex}$	0_{hex}	1:1	455
P0417	Function module C: Status digital output	0 to $FFFF_{hex}$	0_{hex}	1:1	455
P0418	Function module D: Status digital output	0 to $FFFF_{hex}$	0_{hex}	1:1	455
P0419	Function module E: Status digital output	0 to $FFFF_{hex}$	0_{hex}	1:1	455
P0420	Analog input 1 actual value	-100.00 to +100.00 %	0.00 %	$7FFF_{hex}$:100%	456
P0421	Analog input 2 actual value	-100.00 to +100.00 %	0.00 %	$7FFF_{hex}$:100%	456
P0428	Function Module Configuration	0 to $FFFF_{hex}$	0_{hex}	1:1	456
P0429	Factor Interpolator Interval (=0:off)	0 to 64	0	1:1	458
P0430	Ramp Function Generator status	0 to $FFFF_{hex}$	0_{hex}	1:1	458
P0431	Ramp Function Generator output	-100.00 to +100.00 %	0.00 %	40000000_{hex}:100 %	459
P0440	Set value Generator mode	0 to $FFFF_{hex}$	0_{hex}	1:1	459
P0441	SVG time 1	0.001 to 65.535 s	1.000	1000:1 s	460
P0442	SVG set value 1	-100.00 to +100.00 %	+100.00 %	4000_{hex}:100 %	460
P0443	SVG time 2	0.001 to 65.535 s	1.000	1000:1 s	461
P0444	SVG set value 2	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	461
P0445	SVG time 3	0.001 to 65.535 s	1.000	1000:1 s	461
P0446	SVG set value 3	-100.00 to +100.00 %	-100.00 %	4000_{hex}:100 %	461
P0447	SVG time 4	0.001 to 65.535 s	1.000	1000:1 s	462
P0448	SVG set value 4	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	462
P0449	Set Value Generator output	-100.00 to +100.00 %	+100.00 %	4000_{hex}:100 %	462
P0460	Positioning control status	0 to $FFFF_{hex}$	0_{hex}	1:1	463
P0461	Positioning switch status	0 to $FFFF_{hex}$	0_{hex}	1:1	463
P0462	Positioning control position actual value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	465
P0463	Positioning control position set value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	465
P0464	Positioning control speed set value	-13200 to +13200 Inc/ ms	0 Inc/ms	1:1 Inc/ms	465
P0465	Position switch status	0 to $FFFF_{hex}$	0_{hex}	1:1	465
P0466	Spindle positioning status	0 to $FFFF_{hex}$	0_{hex}	1:1	466
P0467	Spindle positioning effective targe position	0 to $FFFFFFFF_{hex}$ Inc	0_{hex} Inc	1:1	466
P0470	Synchronous operation status	0 to $FFFF_{hex}$	0_{hex}	1:1	466
P0471	Synchronous operation position set value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	467
P0472	Synchronous operation angle set value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	468

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0473	Synchronous operation delta	80000000_{hex} to $7FFFFFFF_{hex}$	0_{hex}	1:1	468
P0474	Synchronous operation speed set value	-100.00 to +100.00 %	0.00 %	40000000_{hex}:100 %	469
P0476	Start active movement	0 to 0001_{hex}	0_{hex}	1:1	469
P0477	Register angle set value absolute	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	469
P0480	Power unit status	0 to $FFFF_{hex}$	0_{hex}	1:1	469
P0481	Power unit internal device actual temperature	0 to 125 °C	0 °C	1:1 °C	470
P0482	Power unit heatsink actual temperature	0 to 125 °C	0 °C	1:1 °C	470
P0483	Power unit actual mains voltage	0 to 800.0 V	0.0 V	4000_{hex}:400 V	470
P0484	Power Unit DC-link actual value	0 to 200.00 %	0.00 %	4000_{hex}:100.00 %	471
P0485	Power unit Ixt actual value	0 to 400.0 %	0.0 %	2000_{hex}:100 %	471
P0486	Mains drop-out supervision time	0.000 to 6.000 s	0.000 s	1000:1 s	471
P0487	Switching PWM mode	0.00 to 100.00 %	100.00 %	4000_{hex}:100 %	471
P0488	Maximum modulation index	80.00 to 110.00 %	100.00 %	4000_{hex}:100 %	472
P0489	Threshold for PWM-frequency switching	0.0 to 1000.0 Hz	0.0 Hz	10:1 Hz	472
P0490	Power Supply Unit status	0 to $FFFF_{hex}$	0_{hex}	1:1	473
P0491	Actual PWM switching frequency	0 to 8 kHz	8 kHz	1:1 kHz	473
P0500	Motor status	0 to $FFFF_{hex}$	0_{hex}	1:1	473
P0501	Motor status notch position	0 to $FFFF_{hex}$	0_{hex}	1:1	474
P0502	Motor I^2t actual value	0.0 to 40000.0 %	0.0 %	4000_{hex}:100 %	474
P0503	Motor actual temperature	-30 to 251 °C	0 °C	1:1 °C	474
P0504	Motor actual slip frequency	0.00 to 655.35 Hz	0.00 Hz	100:1 Hz	474
P0505	Motor temperature smooth time	1.000 to 60.000 s	2.000 s	1000:1 s	474
P0506	Computed motor magnetizing current	0.0 to 6553.5 A	0.0	10:1 A	475
P0507	Calculated electrical power actual value	2000000.0 to 2000000.0 W	0.0 W	10:1 W	475
P0508	Additional torque actual value	-20000.000 to 20000.000 Nm	0.000 Nm	1000:1 Nm	475
P0509	Maximum set torque	0 to 20000.000 Nm	0.000 Nm	1000:1 Nm	476
P0520	Flux set value	0.00 to 125.00 %	100.00 %	4000_{hex}:100 %	476
P0521	Flux actual value	0.00 to 150.00 %	0.00 %	4000_{hex}:100 %	476
P0522	Calculated rotor time constant	0.00 to 4000 ms	0 ms	1:1 ms	476
P0523	Flux set value reduce	20.00 to 100.00 %	100.00 %	4000_{hex}:100 %	476
P0530	Synchronization status	0 to $FFFF_{hex}$	0_{hex}	1:1	477
P0531	Source for sync signal	0 to 6	0	1:1	477
P0532	Sync interval	0 to 8000 µs	0 µs	1:1 µs	478
P0533	Sync tolerance	0.0 to 40.0 µs	12.8 µs	5:1 µs	478
P0534	Sync Offset	-4000.0 to +4000.0 µs	0.0 µs	5:1 µs	479
P0540	CAN mode	0 to 1	0	1:1	479
P0541	CAN status	0 to $FFFF_{hex}$	0_{hex}	1:1	479
P0542	CAN baud rate (config)	125 to 1000 kBit/s	125 kBit/s	1:1 kBit/s	479
P0543	CAN Baudrate (DIP-Switch)	125 to 1000 kBit/s	125 kBit/s	1:1 kBit/s	479
P0544	CAN baud rate (active)	125 to 1000 kBit/s	125 kBit/s	1:1 kBit/s	479
P0545	CAN slave number (config)	0 to 128	0	1:1	480
P0546	CAN slave number (DIP-switch)	0 to 128	0	1:1	480

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0547	CAN slave number (active)	0 to 128	0	1:1	480
P0550	Module type slot A	0 to $FFFF_{hex}$	0_{hex}	1:1	480
P0551	Module type slot B	0 to $FFFF_{hex}$	0_{hex}	1:1	483
P0552	Module type slot C	0 to $FFFF_{hex}$	0_{hex}	1:1	483
P0553	Module type slot D	0 to $FFFF_{hex}$	0_{hex}	1:1	483
P0554	Module type slot E	0 to $FFFF_{hex}$	0_{hex}	1:1	483
P0555	FPGA version	0 to $FFFF_{hex}$	0	1:1	484
P0556	Bootloader firmware version	0 to 65535	0	1:1	484
P0557	Programming request	0 to 1	0	1:1	484
P0558	Configuration ID	0 to 4294967295	0	1:1	484
P0559	Drive name	80 ASCII characters	""	1:1	484
P0560	Encoder emulation module version	0 to $FFFF_{hex}$	0	1:1	485
P0561	Encoder emulation status	0 to $FFFF_{hex}$	0_{hex}	1:1	485
P0562	Encoder emulation mode	0 to $FFFF_{hex}$	0020_{hex}	1:1	485
P0563	Encoder emulation pulses per revolution	1 to 32767 pulses/rev.	1024 pulses/ rev.	1:1 pulses/rev.	486
P0564	Encoder emulation offset index signal	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	486
P0565	SSI-encoder emulation status	0 to $FFFF_{hex}$	0_{hex}	1:1	487
P0566	SSI-encoder emulation mode	0 to $FFFF_{hex}$	0_{hex}	1:1	487
P0567	MP_Output	-100 % to +100 %	0	4000_{hex}:100 %	488
P0568	Motor potentiometer status	0 to $FFFF_{hex}$	0_{hex}	1:1	488
P0569	Encoder emulation application set value	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	489
P0570	SSI-Encoder mode	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	489
P0571	SSI-Encoder status	0 to $FFFF_{hex}$	0_{hex}	1:1	491
P0572	SSI-Encoder length sinus / dig. step	0 to 65535	0	1:1	492
P0573	SSI-Encoder mode 2	0 to $FFFF_{hex}$	0	1:1	493
P0574	SSI-Encoder resolution	0.00 bis 655.35	0.00	100:1 µm/bit	494
P0575	Digital input channel for error acknowledge	0 to $FFFF_{hex}$	0_{hex}	1:1	494
P0576	Digital input channel for enable operation	0 to $FFFF_{hex}$	0_{hex}	1:1	495
P0578	SSI-Encoder distance per revolution	0 bis 429496729.5	0.0	10:1 µm/rev	495
P0579	Function module selection for PLC I/O-access	0 to $1F_{hex}$	0_{hex}	1:1	496
P0580	Touch probe status	0 to $FFFF_{hex}$	0_{hex}	1:1	497
P0581	Touch probe 1 angle positive edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	497
P0582	Touch probe 1 revolutions pos. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	498
P0583	Touch probe 1 angle neg. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	498
P0584	Touch probe 1 revolutions neg. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	498
P0585	Touch probe 2 angle pos. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	498
P0586	Touch probe 2 measured value revolutions pos. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	498
P0587	Touch probe 2 measured value angle neg. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	499
P0588	Touch probe 2 measured value revolutions neg. edge	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	499
P0590	PID controller set value	-100.00 to 100.00%	0.00 %	40000000_{hex}:100 %	499
P0591	PID controller actual value	-100.00 to 100.00%	0.00 %	40000000_{hex}:100 %	499
P0592	PID controller output	-100.00 to 100.00%	0.00 %	40000000_{hex}:100 %	500
P0593	PID controller integral part	-100.00 to 100.00%	0.00 %	40000000_{hex}:100 %	500
P0594	Motor Kt adaptation factor actual value	75.0 to 125.0 %	100.0 %	4000_{hex}:100.0 %	500

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0600	Positioning target position 0	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	500
P0601	Positioning target input 0	-2 to 13	0	1:1	501
P0602	Positioning speed 0	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	504
P0603	Positioning acceleration 0	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	504
P0604	Positioning deceleration 0	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	505
P0605	Positioning maximum jerk 0	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	505
P0606	Positioning smoothing time 0	0 to 8191 ms	0 ms	1:1 ms	505
P0607	Relative positioning control target position 0	-2147483648 to 2147483647	0	1:1	506
P0610	Positioning target position 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	506
P0611	Positioning target input 1	-2 to 13	0	1:1	506
P0612	Positioning speed 1	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	506
P0613	Positioning acceleration 1	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	506
P0614	Positioning deceleration 1	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	507
P0615	Positioning maximum jerk 1	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	507
P0616	Positioning smoothing time 1	0 to 8191 ms	0 ms	1:1 ms	507
P0617	Relative positioning control target position 1	-2147483648 to 2147483647	0	1:1	507
P0620	Positioning target position 2	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	507
P0621	Positioning target input 2	-2 to 13	0	1:1	507
P0622	Positioning speed 2	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	508
P0623	Positioning acceleration 2	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	508
P0624	Positioning deceleration 2	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	508
P0625	Positioning maximum jerk 2	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	508
P0626	Positioning smoothing time 2	0 to 8191 ms	0 ms	1:1 ms	508
P0627	Relative positioning control target position 2	-2147483648 to 2147483647	0	1:1	508
P0630	Positioning target position 3	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	509
P0631	Positioning target input 3	-2 to 13	0	1:1	509
P0632	Positioning speed 3	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	509
P0633	Positioning acceleration 3	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	509
P0634	Positioning deceleration 3	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	509
P0635	Positioning maximum jerk 3	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	509
P0636	Positioning smoothing time 3	0 to 8191 ms	0 ms	1:1 ms	510
P0637	Relative positioning control target position 3	-2147483648 to 2147483647	0	1:1	510
P0640	Positioning target position 4	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	510
P0641	Positioning target input 4	-2 to 13	0	1:1	510
P0642	Positioning speed 4	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	510
P0643	Positioning acceleration 4	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	510
P0644	Positioning deceleration 4	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	511
P0645	Positioning maximum jerk 4	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	511
P0646	Positioning smoothing time 4	0 to 8191 ms	0 ms	1:1 ms	511
P0647	Relative positioning control target position 4	-2147483648 to 2147483647	0	1:1	511
P0650	Positioning target position 5	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	511

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0651	Positioning target input 5	-2 to 13	0	1:1	511
P0652	Positioning speed 5	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	512
P0653	Positioning acceleration 5	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	512
P0654	Positioning deceleration 5	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	512
P0655	Positioning maximum jerk 5	0.07 to 14.00 Inc/ms³	1.25 Inc/ms³	100:1 Inc/ms³	512
P0656	Positioning smoothing time 5	0 to 8191 ms	0 ms	1:1 ms	512
P0657	Relative positioning control target position 5	-2147483648 to 2147483647	0	1:1	512
P0660	Positioning target position 6	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	513
P0661	Positioning target input 6	-2 to 13	0	1:1	513
P0662	Positioning speed 6	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	513
P0663	Positioning acceleration 6	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	513
P0664	Positioning deceleration 6	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	513
P0665	Positioning maximum jerk 6	0.07 to 14.00 Inc/ms³	1.25 Inc/ms³	100:1 Inc/ms³	513
P0666	Positioning smoothing time 6	0 to 8191 ms	0 ms	1:1 ms	514
P0667	Relative positioning control target position 6	-2147483648 to 2147483647	0	1:1	514
P0670	Positioning target position 7	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	514
P0671	Positioning target input 7	-2 to 13	0	1:1	514
P0672	Positioning speed 7	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	514
P0673	Positioning acceleration 7	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms	514
P0674	Positioning deceleration 7	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	515
P0675	Positioning maximum jerk 7	0.07 to 14.00 Inc/ms³	1.25 Inc/ms³	100:1 Inc/ms³	515
P0676	Positioning smoothing time 7	0 to 8191 ms	0 ms	1:1 ms	515
P0677	Relative positioning control target position 7	-2147483648 to 2147483647	0	1:1	515
P0680	Positioning target position 8	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	515
P0681	Positioning target input 8	-2 to 13	0	1:1	515
P0682	Positioning speed 8	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	516
P0683	Positioning acceleration 8	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	516
P0684	Positioning deceleration 8	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	516
P0685	Positioning maximum jerk 8	0.07 to 14.00 Inc/ms³	1.25 Inc/ms³	100:1 Inc/ms³	516
P0686	Positioning smoothing time 8	0 to 8191 ms	0 ms	1:1 ms	516
P0687	Relative positioning control target position 8	-2147483648 to 2147483647	0	1:1	516
P0690	Positioning target position 9	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	517
P0691	Positioning target input 9	-2 to 13	0	1:1	517
P0692	Positioning speed 9	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	517
P0693	Positioning acceleration 9	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	517
P0694	Positioning deceleration 9	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	517
P0695	Positioning maximum jerk 9	0.07 to 14.00 Inc/ms³	1.25 Inc/ms³	100:1 Inc/ms³	517
P0696	Positioning smoothing time 9	0 to 8191 ms	0 ms	1:1 ms	518
P0697	Relative positioning control target position 9	-2147483648 to 2147483647	0	1:1	518
P0700	Positioning target position 10	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	518
P0701	Positioning target input 10	-2 to 13	0	1:1	518

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0702	Positioning speed 10	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	518
P0703	Positioning acceleration 10	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	518
P0704	Positioning deceleration 10	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	519
P0705	Positioning maximum jerk 10	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	519
P0706	Positioning smoothing time 10	0 to 8191 ms	0 ms	1:1 ms	519
P0707	Relative positioning control target position 10	-2147483648 to 2147483647	0	1:1	519
P0710	Positioning target position 11	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	519
P0711	Positioning target input 11	-2 to 13	0	1:1	519
P0712	Positioning speed 11	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	520
P0713	Positioning acceleration 11	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms	520
P0714	Positioning deceleration 11	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	520
P0715	Positioning maximum jerk 11	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	520
P0716	Positioning smoothing time 11	0 to 8191 ms	0 ms	1:1 ms	520
P0717	Relative positioning control target position 11	-2147483648 to 2147483647	0	1:1	520
P0720	Positioning target position 12	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	521
P0721	Positioning target input 12	-2 to 13	0	1:1	521
P0722	Positioning speed 12	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	521
P0723	Positioning acceleration 12	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	521
P0724	Positioning deceleration 12	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	521
P0725	Positioning maximum jerk 12	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	521
P0726	Positioning smoothing time 12	0 to 8191 ms	0 ms	1:1 ms	522
P0727	Relative positioning control target position 12	-2147483648 to 2147483647	0	1:1	522
P0730	Positioning target position 13	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	522
P0731	Positioning target input 13	-2 to 13	0	1:1	522
P0732	Positioning speed 13	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	522
P0733	Positioning acceleration 13	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	522
P0734	Positioning deceleration 13	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	523
P0735	Positioning maximum jerk 13	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	523
P0736	Positioning smoothing time 13	0 to 8191 ms	0 ms	1:1 ms	523
P0737	Relative positioning control target position 13	-2147483648 to 2147483647	0	1:1	523
P0740	Positioning target position 14	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	523
P0741	Positioning target input 14	-2 to 13	0	1:1	523
P0742	Positioning speed 14	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	524
P0743	Positioning acceleration 14	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	524
P0744	Positioning deceleration 14	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	524
P0745	Positioning maximum jerk 14	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	524
P0746	Positioning smoothing time 14	0 to 8191 ms	0 ms	1:1 ms	524
P0747	Relative positioning control target position 14	-2147483648 to 2147483647	0	1:1	524
P0750	Positioning target position 15	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	525
P0751	Positioning target input 15	-2 to 13	0	1:1	525
P0752	Positioning speed 15	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	525

Parameter		Range	Standard value	Internal standardization	Page
P0753	Positioning acceleration 15	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100: 1Inc/ms²	525
P0754	Positioning deceleration 15	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	525
P0755	Positioning maximum jerk 15	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	525
P0756	Positioning smoothing time 15	0 to 8191 ms	0 ms	1:1 ms	526
P0757	Relative positioning control target position 15	-2147483648 to 2147483647	0	1:1	526
P0760	Positioning target position 16	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	526
P0761	Positioning target input 16	-2 to 13	0	1:1	526
P0762	Positioning speed 16	1 to 13200 Inc/ms	100 Inc/ms	1:1 Inc/ms	526
P0763	Positioning acceleration 16	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	526
P0764	Positioning deceleration 16	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	527
P0765	Positioning maximum jerk 16	0.07 to 14.00 Inc/ms^3	1.25 Inc/ms^3	100:1 Inc/ms³	527
P0766	Positioning smoothing time 16	0 to 8191 ms	0 ms	1:1 ms	527
P0767	Relative positioning control target position 16	-2147483648 to 2147483647	0	1:1	527
P0800	Option module 1 master 1 cycle time	0 to 32000 µs	4000 µs	1:125 µs	528
P0801	Option module 1 master 1 parameter no. set value 1	0 to FFFF$_{hex}$	0$_{hex}$	1:1	528
P0802	Option module 1 master 1 parameter no. set value 2	0 to FFFF$_{hex}$	0$_{hex}$	1:1	528
P0803	Option module 1 master 1 parameter no. set value 3	0 to FFFF$_{hex}$	0$_{hex}$	1:1	528
P0804	Option module 1 master 1 parameter no. set value 4	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0805	Option module 1 master 1 parameter no. set value 5	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0806	Option module 1 master 1 parameter no. set value 6	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0807	Option module 1 master 1 parameter no. set value 7	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0808	Option module 1 master 1 parameter no. set value 8	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0809	Option module 1 master 1 parameter no. act value 1	0 to FFFF$_{hex}$	0$_{hex}$	1:1	529
P0810	Option module 1 master 1 parameter no. act value 2	0 to FFFF$_{hex}$	0$_{hex}$	1:1	530
P0811	Option module 1 master 1 parameter no. act value 3	0 to FFFF$_{hex}$	0$_{hex}$	1:1	530
P0812	Option module 1 master 1 parameter no. act value 4	0 to FFFF$_{hex}$	0$_{hex}$	1:1	530
P0813	Option module 1 master 1 parameter no. act value 5	0 to FFFF$_{hex}$	0$_{hex}$	1:1	530
P0814	Option module 1 master 1 parameter no. act value 6	0 to FFFF$_{hex}$	0$_{hex}$	1:1	530
P0815	Option module 1 master 1 parameter no. act value 7	0 to FFFF$_{hex}$	0$_{hex}$	1:1	531
P0816	Option module 1 master 1 parameter no. act value 8	0 to FFFF$_{hex}$	0$_{hex}$	1:1	531
P0817	Option module 1 master 1 trigger offset	0 to FFFF$_{hex}$	0$_{hex}$	1:1	531
P0818	Option module 1 master 1 cycle offset set values	0 to FFFF$_{hex}$	2	1:1	531
P0819	Option module 1 master 1 cycle offset act. values	0 to FFFF$_{hex}$	0$_{hex}$	1:1	531
P0821	Hardware configuration module G	0 to FFFFFFFF$_{hex}$	0	1:1	532
P0822	Hardware configuration module H	0 to FFFFFFFF$_{hex}$	0	1:1	532
P0827	Option module selection	0 to 6	0	1:1	532
P0830	Option module G configuration 1	0 to FFFF$_{hex}$	0$_{hex}$	1:1	533
P0831	Option module G configuration 2	0 to FFFF$_{hex}$	0$_{hex}$	1:1	533
P0832	Option module G configuration 3	0 to FFFF$_{hex}$	0$_{hex}$	1:1	533
P0833	Option module G configuration 4	0 to FFFF$_{hex}$	0$_{hex}$	1:1	534
P0834	Option module G configuration 5	0 to FFFF$_{hex}$	0$_{hex}$	1:1	534
P0835	Option module G configuration 6	0 to FFFF$_{hex}$	0$_{hex}$	1:1	534
P0836	Option module G configuration 7	0 to FFFF$_{hex}$	0$_{hex}$	1:1	535

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0837	Option module G configuration 8	0 to $FFFF_{hex}$	0_{hex}	1:1	535
P0838	BACI Setup Timeout	0 to 65535 s	60 s	1:1 s	535
P0839	BACI Cyclic Communication Timeout	0 to 65535 ms	50 ms	1:1 ms	535
P0840	Option module H configuration 1	0 to $FFFF_{hex}$	0_{hex}	1:1	536
P0841	Option module H configuration 2	0 to $FFFF_{hex}$	0_{hex}	1:1	536
P0842	Option module H configuration 3	0 to $FFFF_{hex}$	0_{hex}	1:1	536
P0843	Option module H configuration 4	0 to $FFFF_{hex}$	0_{hex}	1:1	536
P0844	Option module H configuration 5	0 to $FFFF_{hex}$	0_{hex}	1:1	536
P0845	Option module H configuration 6	0 to $FFFF_{hex}$	0_{hex}	1:1	537
P0846	Option module H configuration 7	0 to $FFFF_{hex}$	0_{hex}	1:1	537
P0847	Option module H configuration 8	0 to $FFFF_{hex}$	0_{hex}	1:1	537
P0848	Baci error detection delay	0 to 65535 s	30 s	1:1 s	537
P0850	Autotuning mode	0 to $FFFF_{hex}$	0_{hex}	1:1	538
P0851	Autotuning status	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	538
P0852	Autotuning done	0 to $FFFF_{hex}$	0_{hex}	1:1	539
P0853	Measured motor stator resistance	0.000 to 500.000 Ω	0.000 Ω	1000:1 Ω	540
P0854	Measured ASM-Lsigma or SM-Lq inductance	0.00 to 655.35 mH	0.00 mH	100: 1 mH	540
P0855	Measured stator- and rotor resistance	0.000 to 500.000 Ω	0.000 Ω	1000:1 Ω	540
P0856	Maximum speed for inertia measurement	0 to 1500 RPM	100 RPM	1:1	540
P0857	Maximum current for inertia measurement	0.00 to 90.00 %	10.00 %	100:4000_{hex}	540
P0858	Measured inertia	0.0 to 500000.0 kg*cm*cm	0.0 kg*cm*cm	10:1 kg*cm*cm	541
P0860	Option module 2 master 1 cycle time	0 to 32000 µs	4000 µs	1:125 µs	541
P0861	Option module 2 master 1 parameter no. set value 1	0 to $FFFF_{hex}$	0_{hex}	1:1	541
P0862	Option module 2 master 1 parameter no. set value 2	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0863	Option module 2 master 1 parameter no. set value 3	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0864	Option module 2 master 1 parameter no. set value 4	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0865	Option module 2 master 1 parameter no. set value 5	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0866	Option module 2 master 1 parameter no. set value 6	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0867	Option module 2 master 1 parameter no. set value 7	0 to $FFFF_{hex}$	0_{hex}	1:1	542
P0868	Option module 2 master 1 parameter no. set value 8	0 to $FFFF_{hex}$	0_{hex}	1:1	543
P0869	Option module 2 master 1 parameter no. act value 1	0 to $FFFF_{hex}$	0_{hex}	1:1	543
P0870	Option module 2 master 1 parameter no. act value 2	0 to $FFFF_{hex}$	0_{hex}	1:1	543
P0871	Option module 2 master 1 parameter no. act value 3	0 to $FFFF_{hex}$	0_{hex}	1:1	543
P0872	Option module 2 master 1 parameter no. act value 4	0 to $FFFF_{hex}$	0_{hex}	1:1	543
P0873	Option module 2 master 1 parameter no. act value 5	0 to $FFFF_{hex}$	0_{hex}	1:1	544
P0874	Option module 2 master 1 parameter no. act value 6	0 to $FFFF_{hex}$	0_{hex}	1:1	544
P0875	Option module 2 master 1 parameter no. act value 7	0 to $FFFF_{hex}$	0_{hex}	1:1	544
P0876	Option module 2 master 1 parameter no. act value 8	0 to $FFFF_{hex}$	0_{hex}	1:1	544
P0877	Option module 2 master 1 trigger offset	0 to $FFFF_{hex}$	0_{hex}	1:1	544
P0878	Option module 2 master 1 cycle offset set values	0 to $FFFF_{hex}$	2	1:1	545
P0879	Option module 2 master 1 cycle offset act. values	0 to $FFFF_{hex}$	0_{hex}	1:1	545
P0880	Holding brake command	0 to $FFFF_{hex}$	0_{hex}	1:1	545
P0881	Holding brake status	0 to $FFFF_{hex}$	0_{hex}	1:1	546
P0882	Holding brake actuating signal	0 to $FFFFFFFF_{hex}$	2_{hex}	1:1	546

Parameter		Range	Standard value	Internal standardiza-tion	Page
P0883	Holding brake state monitoring	0 to $FFFFFFFF_{hex}$	2_{hex}	1:1	547
P0884	Holding brake liner monitoring	0 to $FFFFFFFF_{hex}$	1_{hex}	1:1	547
P0902	Error reaction table	-32768, -3 to 3	0	1:1	548
P0903	Error reaction table function modules	-32768, -3 to 3	0	1:1	548
P0904	Error reaction table option modules	-32768, -3 to 3	0	1:1	549
P0905	Error reaction table option modules application	-32768, -3 to 3	0	1:1	549
P1000	Operation mode desired	-7 to 6	-3	1:1	551
P1001	Communication source	0 to $000F_{hex}$	0001_{hex}	1:1	551
P1002	Drive manager options	0 to $FFFF_{hex}$	0_{hex}	1:1	552
P1003	STOP reaction code	0 to 3	0	1:1	552
P1004	QUICKSTOP reaction code	0 to 8	0	1:1	553
P1005	SHUTDOWN reaction code	0 to 3	0	1:1	553
P1006	DISABLE OPERATION reaction code	0 to 3	0	1:1	554
P1007	Error reaction code	0 to 3	0	1:1	554
P1008	Mask for internal limits	0 to $FFFF_{hex}$	$FFFF_{hex}$	1:1	555
P1009	Reaction quickstop command	-1 to 8	-1	1:1	555
P1010	Data set ID	0 to 65535	0	1:1	556
P1011	Data set name	80 ASCII characters	„“	1:1	556
P1020	Current controller P-gain	0.01 to 655.35	1.00	100:1	556
P1021	Current controller integral-action time	0.0 to 1000.0 ms	2.5 ms	10:1 ms	556
P1022	Torque additional set value	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	556
P1023	Current controller output limiter	0 to 199.99 %	199.99 %	4000_{hex}:100 %	557
P1024	Current controller mode	0 to $FFFF_{hex}$	1_{hex}	1:1	557
P1029	Error limit speed deviation	0 to 100%	100%	4000_{hex}:100 %	557
P1030	Speed controller mode	0 to $FFFF_{hex}$	1_{hex}	1:1	558
P1031	Motor maximum drive speed	20 to 24000 RPM	3000 RPM	1:1 RPM	559
P1032	Speed controller P-gain	0.0 to 209715.1	10.0	10:1	559
P1033	Speed controller integral-action time	0.0 to 2000.0 ms	25.0 ms	10:1 ms	560
P1034	Torque feed forward factor	0 to 32767	0	1:1	560
P1036	Current limiter bipolar	0.00 to 100.00 %	100.00 %	4000_{hex}:100 %	560
P1037	Current limiter Motor/TD1	0.00 to 100.00 %	100.00 %	4000_{hex}:100 %	560
P1038	Current limiter Generator/TD2	0.00 to 100.00 %	100.00 %	4000_{hex}:100 %	561
P1039	Current limiter hysteresis	0.00 to 100.00 %	0.25 %	4000_{hex}:100 %	561
P1040	Speed additional set value	-100.00 to +100.00 %	0.00 %	40000000_{hex}:100 %	561
P1041	Speed set value positive limit	0.00 to +100.00 %	+100.00 %	40000000_{hex}:100 %	562
P1042	Speed set value negative limit	-100.00 to -0.00 %	-100.00 %	40000000_{hex}:100 %	562
P1043	Speed deviation limiter	0.00 to 199.99 %	1.25 %	4000_{hex}:100 %	562
P1044	Cut off frequency 2 order delay (=0:off)	0 to 1260 Hz	0 Hz	1:1 Hz	562
P1045	Time for reducing torque (=0:off)	0 to 8000 ms	0 ms	1:1 ms	562
P1046	Additional torque limiter bipolar	0 to 20000.000 Nm	20000.000 Nm	1000:1 Nm	563
P1048	Amplitude of encoder eccentricity	0 to 2000000_{hex}	0_{hex}	1:1	563
P1049	Phase of encoder eccentricity	0 to $FFFF_{hex}$	0_{hex}	1:1	564
P1050	Position controller mode	0 to $FFFF_{hex}$	0_{hex}	1:1	564
P1051	Position controller Kv factor	0.0 to 3276.7 1/s	10.0 1/s	10:1 1/s	565
P1052	Speed precontrol smoothing time	0.0 to 50.0 ms	1.0 ms	10:1 ms	566

Parameter		Range	Standard value	Internal standardization	Page
P1053	Speed precontrol factor	0.00 to 125.00 %	100.00 %	4000_{hex}:100 %	566
P1054	Position deviation limit dynamic	0 to $7FFFFFFF_{hex}$	00000800_{hex}	1:1	566
P1055	Position deviation limit static	0 to $7FFFFFFF_{hex}$	00000100_{hex}	1:1	567
P1056	Position deviation time	0.000 to 65.000 s	1.000 s	1:1000 s	567
P1057	Gear factor	0.02 to 327.67	1.00	100:1	567
P1058	Position deviation limit 2	0 to $7FFFFFFF_{hex}$	00000100_{hex}	1:1	568
P1059	Position set value smoothing interval	0 to 16	0	1:1	568
P1061	Smoothing time for open loop speed actual value	0.0 to 50.0 ms	1.0 ms	10:1 ms	569
P1062	Open loop overspeed limit	0.00 to 200.00 %	115.00 %	4000_{hex}:100 %	569
P1063	Open Loop N=0 threshold	0.00 to 25.00 %	1.00 %	4000_{hex}:100 %	569
P1064	Open loop N>Nx ON-threshold	0.00 to 150.00 %	100.00 %	4000_{hex}:100 %	570
P1065	Open loop N>Nx Off-threshold	0.00 to 150.00 %	96.00 %	4000_{hex}:100 %	570
P1071	Encoder 1 smoothing time constant	0 to 50.0 ms	1.0 ms	10:1 ms	570
P1072	Encoder 1 overspeed limit	0.00 to 200.00 %	115.00 %	4000_{hex}:100 %	570
P1073	Encoder 1 N=0 threshold	0.00 to 25.00 %	1.00 %	4000_{hex}:100 %	571
P1074	Encoder 1 N>Nx ON threshold	0.00 to 150.00 %	100.00 %	4000_{hex}:100 %	571
P1075	Encoder 1 N>Nx OFF threshold	0.00 to 150.00 %	96.00 %	4000_{hex}:100 %	571
P1076	Encoder 1 sin²x upper limit	85.00 to 110.00 %	100.00 %	see equation ▷P1076◁	572
P1077	Encoder 1 time frame for sin²x amplitude supervision	0 to 4000 ms	0 ms	8:1 ms	572
P1078	Encoder 2 time frame for sin²x amplitude supervision	0 to 4000 ms	0 ms	8:1 ms	572
P1081	Encoder 2 smoothing time constant	0.0 to 50.0 ms	1.0 ms	10:1 ms	573
P1082	Encoder 2 over speed limit	0.00 to 200.00 %	115.00 %	4000_{hex}:100 %	573
P1083	Encoder 2 N=0 threshold	0.00 to 25.00 %	1.00 %	4000_{hex}:100 %	573
P1084	Encoder 2 N>Nx ON threshold	0,00 bis 150.00 %	100.00 %	4000_{hex}:100 %	574
P1085	Encoder 2 N>Nx OFF threshold	0.00 to 150.00 %	96.00 %	4000_{hex}:100 %	574
P1086	Encoder 2 sin²x upper limit	85.00 to 110.00 %	100.00 %	see equation ▷P1086◁	574
P1087	Field angle monitor threshold	0.00 to 50.00 %	10.00 %	4000_{hex}:100 %	574
P1090	Selection digital input 1	0 to 0508_{hex}	0_{hex}	1:1	575
P1091	Target number: digital input 1	0 to max. Para-no.	0	1:1	575
P1092	Bit selection digital input 1	0 to $FFFF_{hex}$	0_{hex}	1:1	575
P1093	Set bit pattern for LOW state digital input 1	0 to $FFFF_{hex}$	0_{hex}	1:1	575
P1094	Set bit pattern for HIGH state digital input 1	0 to $FFFF_{hex}$	0_{hex}	1:1	575
P1095	Selection digital input 2	0 to 0508_{hex}	0_{hex}	1:1	576
P1096	Target number: digital input 2	0 to max. Para-no.	0	1:1	576
P1097	Bit selection digital input 2	0 to $FFFF_{hex}$	0_{hex}	1:1	576
P1098	Set bit pattern LOW state digital input 2	0 to $FFFF_{hex}$	0_{hex}	1:1	576
P1099	Set bit pattern HIGH state digital input 2	0 to $FFFF_{hex}$	0_{hex}	1:1	576
P1100	Selection digital input 3	0 to 0508_{hex}	0_{hex}	1:1	577
P1101	Target number: digital input 3	0 to max. Para-no.	0	1:1	577
P1102	Bit selection digital input 3	0 to $FFFF_{hex}$	0_{hex}	1:1	577
P1103	Set bit pattern for LOW state digital input 3	0 to $FFFF_{hex}$	0_{hex}	1:1	577
P1104	Set bit pattern for HIGH state digital input 3	0 to $FFFF_{hex}$	0_{hex}	1:1	577
P1105	Selection digital input 4	0 to 0508_{hex}	0_{hex}	1:1	578

Parameter		Range	Standard value	Internal standardiza-tion	Page
P1106	Target number: digital input 4	0 to max. Para-no.	0	1:1	578
P1107	Bit selection digital input 4	0 to $FFFF_{hex}$	0_{hex}	1:1	578
P1108	Set bit pattern for LOW state digital input 4	0 to $FFFF_{hex}$	0_{hex}	1:1	578
P1109	Set bit pattern for HIGH state digital input 4	0 to $FFFF_{hex}$	0_{hex}	1:1	578
P1110	Selection digital output 1	0 to 0508_{hex}	0_{hex}	1:1	579
P1111	Source number digital output 1	0 to max. Para-no.	0	1:1	579
P1112	Bit selection digital output 1	0 to $FFFF_{hex}$	0_{hex}	1:1	579
P1113	Bit pattern digital output 1	0 to $FFFF_{hex}$	0_{hex}	1:1	579
P1114	Selection digital output 2	0 to 0508_{hex}	0_{hex}	1:1	579
P1115	Source number digital output 2	0 to $FFFF_{hex}$	0_{hex}	1:1	580
P1116	Bit selection digital output 2	0 to 0508_{hex}	0_{hex}	1:1	580
P1117	Bit pattern digital output 2	0 to $FFFF_{hex}$	0_{hex}	1:1	580
P1118	Selection digital output 3	0 to 0508_{hex}	0_{hex}	1:1	580
P1119	Source number digital output 3	0 to max. Para-no.	0	1:1	580
P1120	Bit selection digital output 3	0 to $FFFF_{hex}$	0_{hex}	1:1	581
P1121	Bit pattern digital output 3	0 to $FFFF_{hex}$	0_{hex}	1:1	581
P1122	Selection digital output 4	0 to 0508_{hex}	0_{hex}	1:1	581
P1123	Source number digital output 4	0 to max. Para-no.	0	1:1	581
P1124	Bit selection digital output 4	0 to $FFFF_{hex}$	0_{hex}	1:1	581
P1125	Bit pattern digital output 4	0 to $FFFF_{hex}$	0_{hex}	1:1	582
P1130	Selection analog input 1	0 to 0508_{hex}	0_{hex}	1:1	582
P1131	Smoothing time analog input 1	0.000 to 60.000 ms	1.000 ms	1000:1 ms	582
P1132	Scaling factor analog input 1	-2.0 to 2.0	1.0	$3FFF_{hex}$:1	582
P1133	Target number: analog input 1	0 to max. Para-no.	0	1:1	583
P1134	Offset analog input 1	-100.00 % to +100.00 %	0.00 %	$7FFF_{hex}$:100 %	583
P1135	Threshold value analog input 1	0.00 % to +100.00 %	0.00 %	$7FFF_{hex}$:100 %	583
P1136	Selection analog input 2	0 to 0508_{hex}	0_{hex}	1:1	583
P1137	Smoothing time analog input 2	0.000 to 60.000 ms	1.000 ms	1000:1 ms	583
P1138	Scaling factor analog input 2	-2.0 to 2.0	1.0	$3FFF_{hex}$:1	584
P1139	Target number analog input 2	0 to max. Para-no.	0	1:1	584
P1140	Offset analog input 2	-100.00 % to +100.00 %	0.00 %	$7FFF_{hex}$:100 %	584
P1141	Threshold value analog input 2	0.00 % to +100.00 %	0.00 %	$7FFF_{hex}$:100 %	584
P1150	Selection fast analog output 1	0 to 0508_{hex}	0_{hex}	1:1	584
P1151	Source number fast analog output 1	0 to max. Para-no.	0	1:1	585
P1152	Offset fast analog output 1	-10.00 to +10.00V	V	$7FFF_{hex}$:10 V	585
P1153	Scaling fast analog output 1	67108863.00 to 67108863.00	1.00	32:1	585
P1154	Selection fast analog output 2	0 to 0508_{hex}	0_{hex}	1:1	585
P1155	Source number fast analog output 2	0 to max. Para-no.	0	1:1	585
P1156	Offset fast analog output 2	-10.00 to +10.00V	0.0 V	$7FFF_{hex}$:10 V	586
P1157	Scaling fast analog output 2	67108863.00 to 67108863.00	1.00	32:1	586
P1170	Ramp function generator mode	0 to $FFFF_{hex}$	0_{hex}	4000_{hex}:100 %	586
P1171	Ramp function generator input	-100.00 to +100.00 %	0.00 %	4000_{hex}:100 %	587

Parameter		Range	Standard value	Internal standardiza-tion	Page
P1172	Ramp function generator ramp-up time	0.00 to 650.00 s	0.00 s	100:1 s	587
P1173	Ramp function generator ramp-down time	0.00 to 650.00 s	0.00 s	100:1 s	587
P1174	Ramp function generator quickstop time	0.00 to 650.00 s	0.00 s	100:1 s	588
P1175	Ramp function generator smoothing time	0 to 32 000 ms	0 ms	1:1 ms	588
P1176	DS Ramp Function Generator S-curve ramp-up time	0.00 to 650.00 s	0.00 s	100:1 s	588
P1177	DS Ramp Function Generator S-curve ramp-down time	0.00 to 650.00 s	0.00 s	100:1 s	588
P1178	Ramp Function Generator Set Value Zone	0.00 % to +200.00 %	0.00 %	4000_{hex}:1 %	589
P1179	Ramp Function Generator input 32 bit	-100.00 % to +100.00 %	0.00 %	40000000_{hex}:100.00 %	589
P1190	Positioning mode	0 to $FFFF_{hex}$	0001_{hex}	1:1	589
P1191	Positioning record number actual	0 to 16	1	1:1	593
P1194	Positioning window	0 to $FFFFFFFF_{hex}$	00001000_{hex}	1:1	594
P1195	Positioning window time	1 to 65535 ms	10 ms	1:1 ms	594
P1196	Positioning software limit switch 1	0 to $FFFFFFFF_{hex}$	00010000_{hex}	1:1	594
P1197	Positioning software limit switch 2	0 to $FFFFFFFF_{hex}$	$FFFF_{hex}$	1:1	596
P1198	Positioning clip environment 1	00000001_{hex} to $FFFFFFFF_{hex}$	00010000_{hex}	1:1	596
P1199	Positioning clip environment 2	00000001_{hex} to $FFFFFFFF_{hex}$	00010000_{hex}	1:1	596
P1200	Positioning homing position	0 to $FFFFFFFF_{hex}$	00020000_{hex}	1:1	597
P1201	Positioning homing speed	1 to 13200 Inc/ms	500 Inc/ms	1:1 Inc/ms	597
P1202	Positioning homing final speed	1 to 50 Inc/ms	10 Inc/ms	1:1 Inc/ms	597
P1203	Positioning homing acceleration	0.25 to 450.00 Inc/ms²	5.00 Inc/ms²	100:1 Inc/ms²	597
P1204	Positioning homing deceleration	0.25 to 450.00 Inc/ms²	5.00 Inc/ms²	100:1 Inc/ms²	598
P1205	Positioning homing mode	-6 to 35	1	1:1	598
P1206	Positioning homing encoder input	0 to 2	1	1:1	600
P1207	Homing max. position delta to zero pulse	0 to $7FFFFFFF_{hex}$	0_{hex}	1:1	600
P1208	Positioning switch mode	0 to $FFFF_{hex}$	00_{hex}	1:1	600
P1209	Positioning encoder offset	0 to $FFFF_{hex}$ Inc	0_{hex} Inc	1:1 Inc	601
P1210	Positioning jogging speed	1 to 13200 Inc/ms	500 Inc/ms	1:1 Inc/ms	601
P1211	Positioning jogging acceleration	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	601
P1212	Positioning jogging deceleration	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1 Inc/ms²	601
P1213	Positioning stop deceleration	0.25 to 450.00 Inc/ms²	5.00 Inc/ms²	100:1 Inc/ms²	601
P1214	Digital input channel for positive limit switch	0 to $FFFF_{hex}$	0_{hex}	1:1	602
P1215	Digital input channel for negative limit switch	0 to $FFFF_{hex}$	0_{hex}	1:1	602
P1216	Digital input channel for zero point switch	0 to $FFFF_{hex}$	0_{hex}	1:1	603
P1217	Positioning homing block time	0.01 to 655.35 s	1.00 s	100:1	603
P1218	Positioning homing torque limit	0.00 to 100.00 %	25.00 %	100:4000_{hex}	603
P1219	Positioning homing torque limit	0.00 to 655.35 %	100.00 %	100:1	603
P1220	Synchronous operation mode	0 to $FFFF_{hex}$	0_{hex}	1:1	604
P1221	Synchronous operation revolution of slave	-32767 to 32767	3000	1:1	605
P1222	Synchronous operation revolution of master	1 to 32767	3000	1:1	605
P1223	Maximum driving speed	1 to 1193048 Inc_{32bit}/ ms	298256 Inc_{32bit}/ms	1:1 Inc_{32bit}/ms	606

Parameter		Range	Standard value	Internal standardiza-tion	Page
P1224	Acceleration	12.50 to 11930.50 Inc_{32bit}/ms^2	716.00 Inc_{32bit}/ms^2	100:1 Inc_{32bit}/ms^2	606
P1225	Minimal total speed	0 to 4294968 Inc_{32bit}/ms	0 Inc_{32bit}/ms	1:1 Inc_{32bit}/ms	606
P1226	Speed factor	0.00 to 100.00 %	0,00 %	4000_{hex}:100 %	607
P1239	Positioning modulo position	00010000_{hex} to $FFFFFFFF_{hex}$	$FFFFFFFF_{hex}$	1:1	607
P1240	Power Unit PWM frequency	4 to 8kHz	8 kHz	1:1kHz	607
P1241	Power unit maximum drive current	0.1 to 6553.5 A	2.5 A	10:1 A	607
P1250	DC link controller set value	700 to 900 V	850 V	1:1 V	608
P1251	DC link controller P-gain	1.0 to 255.9	50.0	10:1	608
P1252	DC link controller integral-action time	0.2 to 1000.0 ms	20.0 ms	10:1 ms	608
P1260	Blocking time (=0:off)	0.0 to 6500.0 s	10.0 s	10:1 s	609
P1261	N=0 threshold blocking control	0.00 to 100.00 %	1.00 %	4000_{hex}:100 %	609
P1270	Field weakening controller P-gain	0.0 to 127.9	2.0	10:1	609
P1271	Field weakening controller integral-action time	0.0 to 1000.0 ms	20.0 ms	10: 1ms	610
P1272	Flux controller P-gain	0.0 to 127.9	3.0	10:1	610
P1273	Flux controller integral-action time	0.2 to 1000.0 ms	20.0 ms	10:1 ms	610
P1290	Parameter selection statusbit 14	0 to max. Para-no.	0	1:1	610
P1291	Bit pattern Statusbit 14	0 to $FFFF_{hex}$	0_{hex}	1:1	610
P1292	Parameter selection statusbit 15	0 to max. Para-no.	0	1:1	611
P1293	Bit mask for status bit 15	0 to $FFFF_{hex}$	0_{hex}	1:1	611
P1310	Touch probe mode	0 to $FFFF_{hex}$	0_{hex}	1:1	611
P1320	Autotuning application	0 to $FFFF_{hex}$	0_{hex}	1:1	612
P1321	Scaling factor default values dead time compensa-tion	0 to 200.00 %	100.00 %	8000_{hex} :100 %	613
P1360	PID controller mode	0 to $FFFF_{hex}$	0300_{hex}	1:1	613
P1361	Source number PID controller set value	0 to max. Para-no.	0	1:1	614
P1362	Source Number PID controller actual value	0 to max. Para-no.	0	1:1	614
P1363	PID controller P-gain	0.00 to 327.67	0.00	100:1	614
P1364	PID controller integral action time	0 to 7200000 ms	0 ms	1:1 ms	614
P1365	PID controller integral derivative time	0.000 to 60000.000 ms	0.000 ms	1000:1 ms	615
P1366	PID controller smoothing time	0.0 to 2000.0 ms	0.0 ms	10:1 ms	615
P1367	PID controller upper limit	-100.00 to 100.00%	-100.00 %	4000_{hex}:100 %	615
P1368	PID controller lower limit	-100.00 to 100.00%	-100.00 %	4000_{hex}:100 %	615
P1369	Target number PID controller output	0 to max. Para-no.	0	1:1	615
P1370	Center frequency speed set value notchfilter (=0:off)	0 to 4000 Hz	0 Hz	1:1 Hz	616
P1371	Bandwidth speed set value notchfilter	10 to 2000 Hz	100 Hz	1:1 Hz	616
P1372	Center frequency speed actual value notchfilter	0 to 4000 Hz	0 Hz	1:1 Hz	616
P1373	Bandwidth speed actual value notchfilter	10 to 2000 Hz	100 Hz	1:1 Hz	616
P1374	Center frequency Iq set value notchfilter (=0:off)	0 to 4000 Hz	0 Hz	1:1 Hz	616
P1375	Bandwidth Iq set value notchfilter	10 to 2000 Hz	100 Hz	1:1 Hz	616
P1380	Parameter number input value two-level-controller 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	617
P1381	Parameter number relative compare value two-level-controller 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	617
P1382	Lower threshold absolute two-level-controller 1	-32768 to 32767	0	1:1	617

Parameter		Range	Standard value	Internal standardiza-tion	Page
P1383	Upper absolute threshold two-level-controller 1	-32768 to 32767	0	1:1	617
P1384	Mode two-level-controller 1	0 to FFFF$_{hex}$	0$_{hex}$	1:1	618
P1385	Lower level relative two-level-controller 1	-32768 to 32767	0	1:1	618
P1386	Upper level relative two-level-controller 1	-32768 to 32767	0	1:1	619
P1387	Target number two-level-controller 1 output	0 to 65535	0	1:1	619
P1388	Bit selection two-level-controller 1 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	619
P1389	Set bit pattern for LOW state two-level-controller 1 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	619
P1390	Set bit pattern for HIGH state two-level-controller 1 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	619
P1400	Holding brake control mode	0 to FFFF$_{hex}$	0$_{hex}$	1:1	620
P1401	Holding brake control automatic	0 to FFFF$_{hex}$	0$_{hex}$	1:1	620
P1402	Holding brake torque threshold	-100.00 % bis 100.00 %	0.00 %	4000$_{hex}$:100.00 %	621
P1403	Holding brake speed threshold	0.50 % to 100.00 %	1.00 %	4000$_{hex}$:100.00 %	621
P1404	Holding brake timeout checkback signal	100 to 1000 ms	1000 ms	1:1 ms	621
P1405	Pulse inhibit delay	0 to 1000 ms	500 ms	1:1 ms	621
P1406	Start of motion delay	0 to 1000 ms	500 ms	1:1 ms	622
P1407	Holding brake opening delay	0 to 1000 ms	10 ms	1:1 ms	622
P1410	Motor potentiometer mode	0 to FFFF$_{hex}$	0$_{hex}$	1:1	623
P1411	Motor potentiometer upper limit	-100 % to +100 %	100 %	4000$_{hex}$:100 %	623
P1412	Motor potentiometer lower limit	-100 % to +100 %	-100 %	4000$_{hex}$:100 %	623
P1413	Motor potentiometer increment	0.00 % to 20.00 %	1.00 %	100:1 %	624
P1415	Parameter number input value two-level-controller 2	0 to FFFFFFFF$_{hex}$	0$_{hex}$	1:1	624
P1416	Lower absolute threshold two-level-controller 2	-32768 bis 32767	0	1:1	624
P1417	Upper absolute threshold two-level-controller 2	-32768 bis 32767	0	1:1	625
P1418	Mode two-level-controller 2	0 to FFFF$_{hex}$	0$_{hex}$	1:1	625
P1419	Target number two-level-controller 2 output	0 to 65535	0	1:1	626
P1420	Bit selection two-level-controller 2 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	626
P1421	Set bit pattern for LOW state two-level-controller 2 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	626
P1422	Set bit pattern for HIGH state two-level-controller 2 output	0 to FFFF$_{hex}$	0$_{hex}$	1:1	626
P1425	Spindle positioning mode	0 to FFFF$_{hex}$	0$_{hex}$	1:1	627
P1426	Spindle positioning target angle	0 to 0000FFFF$_{hex}$ Inc	0$_{hex}$ Inc	1:1	628
P1427	Spindle positioning speed	0.01 to 100.00 %	1.00 %	100 %:4000$_{hex}$	628
P1428	Spindle positioning deceleration	0.25 to 450.00 Inc/ms²	2.00 Inc/ms²	100:1	628
P1429	Spindle positioning timeout trigger	0 to 65535 ms	0 ms	1:1	628
P1430	Spindle positioning relative offset	0 to 0000FFFF$_{hex}$ Inc	0$_{hex}$ Inc	1:1	629
P1431	Spindle positioning smoothing time	0 to 8191 ms	0 ms	1:1	629
P1436	Torque coupling mode	0 to FFFF$_{hex}$	0$_{hex}$	1:1	629
P1437	Torque coupling factor master	0.00 to 100.00 %	0.00 %	4000$_{hex}$:100 %	630
P1438	Torque coupling factor slave	0.00 to 100.00 %	0.00 %	4000$_{hex}$:100 %	630
P1439	Torque coupling P-gain Slave	0.000 to 31.000	0.000	7918$_{hex}$:31000	630
P1440	Torque coupling integral action time	0 to 8000	0	1:1	630
P1441	Upper limiter compensating controller	0.00 to 100.00 %	100.00	4000$_{hex}$:100.00 %	631

Parameter		Range	Standard value	Internal standardiza-tion	Page
P1442	Lower limiter compensating controller	0.00 to 100.00 %	100.00	4000_{hex}:100.00 %	631
P1443	Slave initial stress	-100.00 to 100.00%	0.00 %	4000_{hex}:100.00 %	631
P1444	Slave initial stress filter time	0.010 to 32.767	0.010	$7FFF_{hex}$:32,767	631
P1445	Slave reduced initial stress	-100.00 to 100.00%	0.00	4000_{hex}:100.00 %	631
P1446	Speed limit reduced initial stress	0 to 100.00 %	100.00	4000_{hex}:100.00 %	632
P1450	q-current maximal value at rated speed	0 to 6553.5 A	6553.5 A	10:1 A	632
P2000	Oscilloscope source channel 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	633
P2001	Oscilloscope source channel 2	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	633
P2002	Oscilloscope source channel 3	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	633
P2003	Oscilloscope source channel 4	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	633
P2004	Oscilloscope source channel 5	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	633
P2005	Oscilloscope source channel 6	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	634
P2006	Oscilloscope source channel 7	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	634
P2007	Oscilloscope source channel 8	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	634
P2008	Oscilloscope trigger source 1	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	634
P2009	Oscilloscope trigger source 2	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	634
P2010	Mask trigger source 1	0 to $FFFFFFFF_{hex}$	$FFFFFFFF_{hex}$	1:1	635
P2011	Mask trigger source 2	0 to $FFFFFFFF_{hex}$	$FFFFFFFF_{hex}$	1:1	635
P2012	Trigger compare operator 1	0 to 3	0	1:1	635
P2013	Trigger compare operator 2	0 to 3	0	1:1	636
P2014	Trigger compare value 1	0 to $FFFFFFFF_{hex}$	$FFFFFFFF_{hex}$	1:1	636
P2015	Trigger compare value 2	0 to $FFFFFFFF_{hex}$	$FFFFFFFF_{hex}$	1:1	636
P2016	Trigger source combination operator	1 to 3	1	1:1	636
P2017	Trigger delay in %	0 to 100 %	0 %	1:1 %	637
P2018	Trigger status	0 to $FFFF_{hex}$	0_{hex}	1:1	637
P2019	Trigger command	1 to 6	1	1:1	637
P2020	Transient samples	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	638
P2021	Sample rate	0.125 ms to 8191 ms	0.125 ms	1:0.125 ms	638
P2022	Measurement time	0 to 8191 ms	0 ms	1:1 ms	638
P2023	Oscilloscope memory length	1024 to 16384	1024	1:1	638
P2024	Oscilloscope memory start address	0 to $FFFFFFFF_{hex}$	0_{hex}	1:1	639
P2025	Oscilloscope error code	0 to 65535	0_{hex}	1:1	639
P2030	Password	0 to 65535	0	1:1	639
P2031	System command	0 to $FFFF_{hex}$	0_{hex}	1:1	640
P2032	System time	0 to 4294967295 s	0 s	1:1 s	642
P2034	Time since last boot	0 to 4294967295 s	0 s	1:1 s	642
P2035	Power on seconds	0 to 4294967295 s	0 s	1:1 s	642
P2037	Controller hardware type	0 to $FFFF_{hex}$	0	1:1	643
P2038	FPGA firmware ID	0 to $FFFF_{hex}$	0	1:1	643
P2039	FPGA firmware version	0.00 bis 655.35	0.00	100:1	643
P2040	Source number display filter 1	0 to 3392	0	1:1	644
P2041	Source number display filter 2	0 to 3392	0	1:1	644
P2045	Time constant parameter filter 1	0.000 to 32.767 s	2.000 s	1000:1	644
P2046	Time constant parameter filter 2	0.000 to 32.767 s	2.000 s	1000:1	644
P2050	Error reaction return motion mode	0 to $FFFF_{hex}$	0_{hex}	1:1	644

Parameter		Range	Standard value	Internal standardiza-tion	Page
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Revision survey

Version	Date of issue	Changing
5.03039.03	18.05.2005	- Insert chapter revision survey, time-slice, motor potentiometer, filter brake management. - Chapter two-level controller changed (second two-level controller) - Parameters 0531, 0025, 0026, 0027, 0028, 0208, 0209, 0390, 0400, 0550, 0150, 0160, 1170, 0301, 0430, 1251, 0093, 0211, 0302, 0500, 0562, 0563, 0564, 0581, 0460 changed - Parameters 0567, 0568, 1410, 1411, 1412, 1413, 0359, 0345, 1178, 0880, 0881, 0882, 0883, 0884, 1400, 1401, 1403, 1404, 1405, 1406, 2040, 2041, 2045, 2046 inserted - Parameter 0029 deleted
5.03039.04	01.08.2005	- Insert chapter open loop control for asynchronous machine - Insert parameters 0381, 0506, 0523 - Changing in chapter brake management and brake control parameters 0093, 0211, 0302, 0500, 0880, 1400 changed
5.03039.05	30.06.2006	- Chapter block monitoring - Position setpoint smoothing - Positioning „shortest distance“, rounding, operation mode spindle positioning - Error reaction return motion - Parking axis - Torque display - New BACI error codes, settable error reaction - Mains monitoring - Disable operation mode change via control word - Parameters 0382, 0383, 0466, 0487, 0488, 0507, 0508, 0509, 0856, 0857, 0858, 1046, 1059, 1261, 1425, 1436 - 1446, 2050 - 2082 inserted - Parameters 0020, 0025, 0027, 0053, 0056, 0057, 0059, 0060, 0061, 0062, 0063, 0066, 0072, 0073, 0075, 0076, 0076, 0077, 0080, 0081, 0083, 0093, 0094, 0095, 0200, 0203, 0204, 0207, 0211, 0216, 0236, 0240, 0265, 0297, 0298, 0299, 0300, 0301, 0304, 0334, 0337, 0339, 0340, 0355, 0356, 0357, 0360, 0369, 0370, 0390, 0395, 0405, 0471, 0472, 0530, 0601, 0850, 0851, 0852, 1000, 1007, 1023, 1050, 1053, 1076, 1086, 1087, 1138 changed

5.03039.06	05.11.2007	○ Linear interpolation ○ Sin²x monitoring with smoothing ○ external source for encoder emulation ○ speed synchronization ○ time slices ○ interpolation ramp-up generator ○ drive maximum current limitation ○ magnetizing current synchronous motor from motor data base ○ positioning CANopen short distance ○ SSI encoder evaluation ○ notch position from pole position sensor ○ encoder emulation correction of reaction time ○ enable holding torque before open the brake ○ field weakening with asynchronous motor ○ electronic type plate ○ search notch position with injection method ○ software compensation encoder eccentricity ○ error reaction phase loss ○ EnDat 2.2 encoder ○ standardization of encoder signal amplitude ○ reducing PWM switch frequency ○ torque calculation and torque limits ○ option module G/H configuration ○ new parameters: P0151, P0157, P0158, P0167, P0168, P0237, P0569, P0570, P0571, P0572, P1048, P1049, P1077, P1078, P1179, P1402, P1407, P2099, P2120, P2121, P2122, P2123, P2124, P2125, P2126, P3058, P3059 ○ changed parameters: P0066, P0069, P0093, P0094, P0095, P0150, P0160, P0206, P0207, P0211, P0300, P0550, P0562, P0566, P1050, P1170, P1241, P1401
5.03039.07	25.08.2010	Upgrading firmware version 03.10
5.03039.08	07.06.2011	○ Upgrading firmware version 03.11 ○ Commissioning adapted to ProDrive ○ Added parameters: P0257, P0258, P0259, P0429 ○ Changed parameters: P0020, P0025, P0073, P0081, P0092, P0095, P0326, P0344, P0430, P0502, P0852
5.03039.09	28.08.2012	○ AIO-04 inserted ○ Upgrading firmware version 03.12
5.03039.10	01.10.2013	○ Upgrading firmware version 03.12.2
5.03039.11	27.07.2015	○ Upgrading firmware version 03.13 and 03.14
5.03039.12	29.09.2015	○ Upgrading firmware version 03.15
5.03039.13	28.03.2017	General revision
5.03039.14	28.02.2018	Upgrading firmware version 03.16

Notes:

be in motion

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