DAC/DSC SYSTEM

Programming Manual

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Rev. 01

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IMPORTANT USER INFORMATION

This document has been prepared in order to be used by OSAI. It describes the latest release of the product.
OSAI reserves the right to modify and improve the product described by this document at any time and without prior notice.
Actual application of this product is up to the user. In no event will OSAI be responsible or liable for indirect or consequential damages that may result from installation or use of the equipment described in this text.

SUMMARY OF CHANGES

General

The following table lists the main changes and additions.

Changes to the chapter COMMISSIONING

- added paragraph WinBASS INTERFACE
- added paragraph PCBASS INTERFACE
- added paragraph DRIVES WITH SERCOS INTERFACE

Changes to the chapter PARAMETERS

- added paragraph POSITIONING at the end of the chapter
- added parameters P400 to P444 in the paragraph PARAMETER LIST

Changes to the chapter MAINTENANCE

- added new error codes in various positions in the paragraph ERROR MESSAGES

PREFACE

This manual contains the necessary information for normal operation of the products described therein. The drives may only be used, maintained and repaired by personnel familiar with the operation manual and the applicable regulations on working safety and accident prevention. The devices are manufactured to a high technical specification and are operationally safe. Provided that all safety instructions have been adhered to, there will be no personal danger during the installation and commissioning stages.
The commissioning is prohibited until it has been positively determined that the machine, into which these components are to be incorporated, complies with EC machine regulations.

This technical description replaces and nullifies all previous description. In order to provide the best possible service, we reserve the right to alter information without notice.

ABBREVIATIONS

AC	Alternating current
ADR	Address byte
AI	Function module analog inputs
AM	Asynchronous motor
AO	Function module analog outputs
BAPS	BUS6-VC-XX DSV-6 Parallel interface
BASS	BUS62X-XX DSM-62X Serial interface
BCC	Block check character
BOF	Begin of file
BSA	Reference potential analog
BSD	Reference potential digital
CE	Controller enabling
CPU	Central Processing Unit
CT	Function module coordinate transformation
DA	Digital analog
DC	Direct current
DI	Function module digital inputs
DSM	Function module data set management
EOF	End of file

EM	Encoder Manager

Ext	Function module current monitoring
MC	Main conductor
MCO	Main conductor on
MOE	Enable main conductor
I	Function module current control
I2t	Function module overload monitoring
Inc	Unit of position counter
IND	Index
Ink	No. of graduation marks
J/RI	Job/reply identification
LGE	Telegram length
LT	Function module power unit
M	Function module drive manager
MM	Function module motor model
Mot	Function module field angle calculation
MT	Function module motor temperature
N	Function module speed controller
OS	Function module operation system
P	Parameter number
P	Function module position controller
Para.	Paragraph
PD	Process data
PD	Parameter description
PI	Parameter identification
PIV	Parameter identification value
PN	Parameter no.
PS	Function module power supply
PV	Parameter value
PWM	Function module pulse width modulation
RFG	Function module ramp function generator
SM	Synchronous motor
STX	Start of text
SV	Function module service interface
SVG	Function module set value generator
TM	Temperature motor
USS ®	Function module interface to USS ® protocol
ZK	Intermediate circuit
BUS6-VC-XX	DSV-6
BUS62X-XX	DSM62X

END OF PREFACE

INDEX

SAFETY INFORMATION

COMMISSIONING

PARAMETER

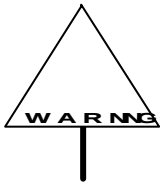
MAINTENANCE

END OF INDEX

SAFETY INFORMATION

GENERAL INFORMATION

These operating instructions contain all the information necessary for correct operation of the products described. The document is intended for specially trained, technically qualified personnel who are well-versed in all warnings and commissioning activities. The equipment is manufactured using state-of-the-art technology and is safe in operation. It can safely be installed and commissioned and functions with-out problems if the safety information in these operating instructions is followed.



When operating electrical equipment, some parts of the equipment always carry dangerous voltages.

Ignoring these safety instructions and warnings may result in serious personal injury and/or damage to property.

Only qualified personnel who are familiar with the safety information, assembly, operation and maintenance instructions may carry out work on this equipment.

Qualified Personnel

In the context of the safety-specific information in this document or on the products themselves, qualified personnel are considered to be persons who are familiar with setting up, assembling, commission-ing and operating the product and who have qualifications appropriate to their activities:

Trained or instructed or authorized to commission, ground and mark circuits and equipment in accordance with recognized safety standards.

Trained or instructed in accordance with recognized safety standards in the care and use of appropriate safety equipment.

Appropriate Use

You may only use the equipment/system for the purposes specified in the operating instructions and in conjunction with the equipment and components recommended or authorized by OSAI s.r.l.

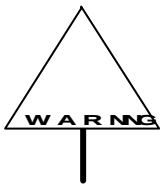
For safety reasons, you must not change or add components on/to the equipment/system.

The machine minder must report immediately any changes that occur which adversely affect the safety of the equipment/system.

END OF CHAPTER

COMMISSIONING

DANGER INFORMATION



This equipment carries a dangerously high voltage and have dangerous rotating parts (fans). Ignoring the safety and warning information may result in death, severe personal injury or damage to property.

You are responsible for mounting the power converter, the motor, the commutating reactor and any other equipment in accordance with appropriate safety regulations (e.g. DIN, VDE); equally, you must ensure that all other relevant national and local regulations are met with regard to cable ratings and protection, grounding, disconnecters, overcurrent protection, etc.

The most important factors for protecting people are the DIN/VDE protective measures and safety regulations. If there are no protective earth connections on the equipment, commutating reactor or the motor, personal injuries are inevitable, since the surfaces may carry dangerously high voltages.

The power converter's power cables are energized!

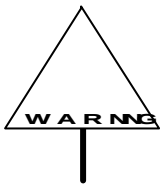
The mains unit and the field connector of the power converter carry a dangerous voltage even when the main contactor has dropped.

During operation, the principles on which the power converter and the motor work lead to leakage currents to earth that are dissipated via the specified protective earths and may result in a current-operated e.l.c.b on the input side blowing prematurely.

In the case of a short-circuit to frame or to ground, a direct proportion may arise in the leakage current that makes triggering a higher level current-operated e.l.c.b either more difficult or totally impossible.

Make the PE connection in accordance with DIN EN 60204/VDE 0113 Part 1/06.93; Section 8.2.2 taking into account provisional standard EN 50178/ VDE 0160/11.94, Sections 5.3.2.1 and 8.3.4.4.

Before carrying out commissioning, check whether the plastic covers over the power stage connections are in place.



You must only reset the converter when the controller is inhibited and the motor is at a standstill.

If an error occurs, the drive is deenergized and then coasts unbraked to a standstill. You should consider this situation particularly with motion and lifting drives.

Faulty drive response

During initial commissioning, faulty or uncontrolled motion of the driven machine elements is always possible. At this stage, you should therefore proceed with particular care.

Before switching on the drive, you must carefully check the functions of all the higher level safety equipment to prevent injury to people.

Take particular care when directly or indirectly touching the drive shaft with your hand. This is only allowed when the shaft is stationary and the power converter is deenergized. Any exposed parts of the machine, such as the shafts, fans, etc., must be covered during operation.

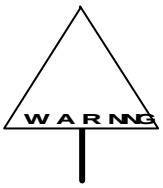
Contact protection in accordance with paragraph 4 Section 4 VBG 4

Protection against direct contact comprises all the measures against danger that can result from touching the active parts of electrical equipment.

You must therefore protect the active parts from being touched by means of insulation, the construction and arrangement of the equipment or permanently mounted guards. The guards in question are standard covers, barriers and procedures that guarantee that people cannot touch active parts that are carrying power.

Switching cabinets must have an emergency off facility to switch off any voltages that could be dangerous. This does not include equipment which, if switched off, would cause an even more dangerous situation. The emergency off releasing element must be arranged in such a way that it can be reached quickly in case of danger. In the case of work that is considerably more dangerous than usual, another person must be present.

The machine minder must ensure that unauthorized people do not work at the machine.

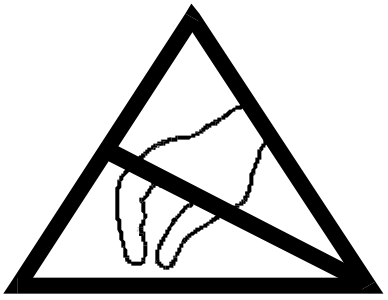


The machine minder must report immediately any changes that occur at the machine which adversely affect safety.

When dismounting safety equipment during commissioning, repair and maintenance work, you must ensure that the machine is taken out of commission in accordance with applicable regulations. You must remount and check safety equipment immediately after completing commissioning, repair and maintenance work.

NOTE

Observe electrostatic discharge protection: Before touching the plug, discharge electrostatic energy from your body by touching a grounded conductive object, for example.



WINBASS INTERFACE

OSAI DAC / DSC can be configured and calibrated online with a specific software package (WinBASS) run on a PC which is connected via serial line to connector X23 of the DSV-6 controller. This requires the following tools:

- PC
- RS232 serial cable (connects as described in the Installation Manual)
- WinBASS communication software

NOTE:
the names of the various power units sold by OSAI do not match to the names used in WinBASS. For the correct names to be used see the following cross-reference table:

If you use a **drive** with this name	…. select this corresponding name in the WinBASS **power unit** field:
DAM60-03/06 …	BUM60-3/6
DAM60-06/12 …	BUM60-6/12
DAM60-12/24 …	BUM60-12/24
DSM621 …	BUS621-10/15
DSM622 …	BUS622-15/22
DSM 623 …	BUS623-20/30
DSM 624-38/55	BUS624-38/55
DSM 624-45/65	BUS624-45/65
DAM61-30/45 …	BUM61_BUS61-30/45
DAM61-40/60 …	BUM61_BUS61-40/60
DSK62 …	BKH62-75/75
DSK63 …	BKH63-150/150

If you use a **power supply** module with this name ….	…. select this corresponding name in the WinBASS "**power supply**" field:
PSU 624 …	BUC 640V
PSU 625 …	BUC 640V

Installing the WinBASS software on the PC

The information below refers to the WinBASS release 5.06.

WinBASS requires a PC with the following minimum configuration:

- Windows 3.1 or more recent
- 4 MB memory (recommended 8 MB)
- 10 MB free disk space

For installing WinBASS you have only to:

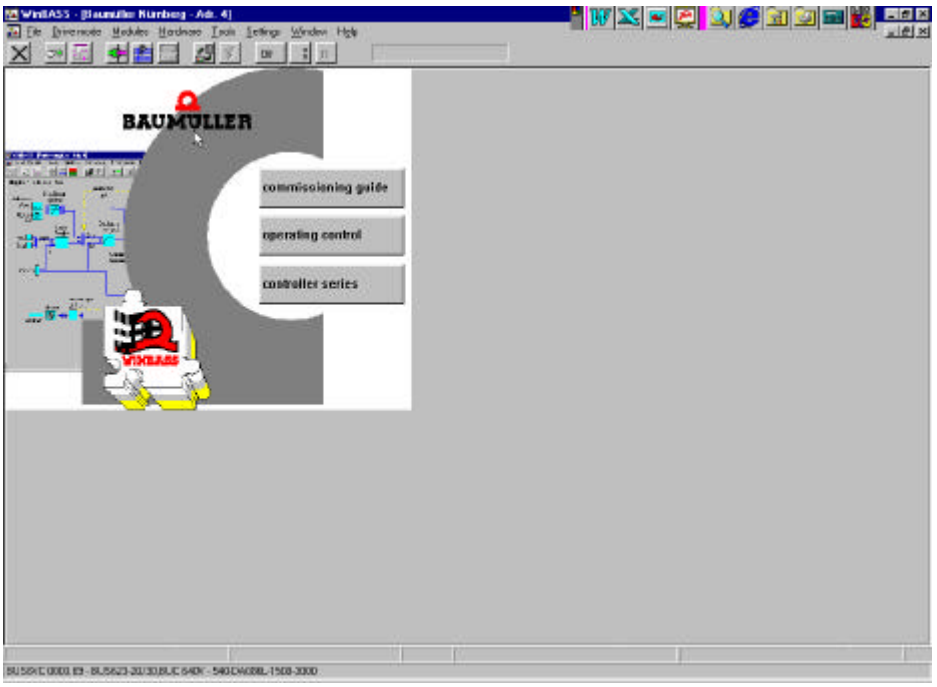
- insert the WinBASS CD-ROM into the PC's CD drive and wait for the automatic launch of the WinBASS package
- select the desired language
- the WinBASS version which will be installed in the directory C:\WINBASS is shown. Confirm with the SETUP button or cancel the installation with CANCEL
- after the welcome message confirm with the NEXT button.
- the “License Conditions” window opens. Confirm with the YES button.
- in the next window - “User” - you have to enter the user name and the serial number which is supplied with the CD. The input of the serial number is case sensitive, if you get it wrong, the password is not recognised.
- in the next window - “Target directory”- insert the directory (“Source”) from which the files are loaded (default is D:\) and the target directory (“Target”) on the PC into which they are to be copied (default is C:\WINBASS). Confirm these settings with the NEXT button.
- then the “Program folder” window opens, here you have to select the icon file name (default is Baumuller).). Confirm with the NEXT button.
- the next window - “Starting installation” - summarises the selections. By clicking on the “Install” button you start the WinBASS installation. The files copied are progressively listed in the “SETUP WinBASS” window.
- at the end the “End of installation” window opens where you can access the README file or immediately start WinBASS execution. Select the desired options and confirm with the CLOSE button.

The README files report modifications from one WinBASS release to the next.

The software is started by launching the file REGLER.EXE. This can be achieved by placing a link via a specific icon on the desktop. The appearing main menu allows selection of the controller used. Always select (V)ector (C)ontrol.

After closing this icon the main menu appears which contains the following commands:

- commissioning guide
- operating control
- controller series



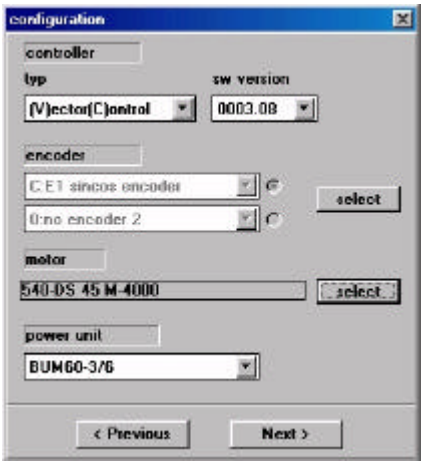
Commissioning Guide 

The Commissioning Guide is a guided procedure for the first installation and the configuration for combining a drive and a motor. For the following we assume that the drive and the motor have been correctly connected (see the Installation Manual).

The procedure can be started from the *Drive Mode / Commissioning Guide* menu or directly with the specific button in the tool bar or the central text button 

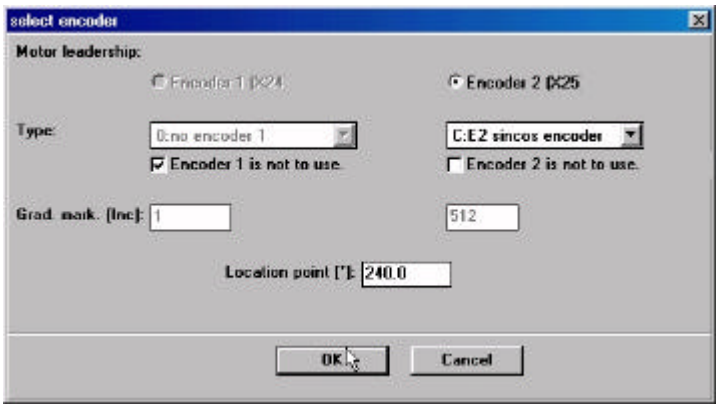
in the main menu. This procedure asks step by step to enter all the essential information for initialising the drive.

The procedure can be started on-line or off-line. After selecting the serial port used for communication with the drive (choose a serial port from COM1 to COM4), the Configuration window opens, where you have to enter the Controller data (type and software version), number and type of the transducers (encoder) and motor and drive model by selecting them among those proposed. The software version can be found on the drive's plate on its right side and then verified by reading the values of the parameters P174 and P163.



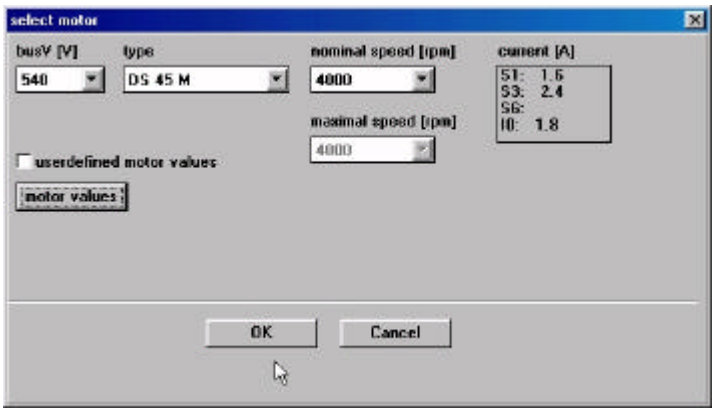
Configuring drive / motor

For selecting the transducers you press the corresponding text button *Select* which opens the Select Encoder window. You have to enable or disable the use of the two available transducers and specify the transducer type by selecting it among those proposed. If you use the SINCOS interface with cable link to connector X25, you must select only encoder 2 and choose *E2 sincos encoder* (see the next figure). Confirm with *OK*.



Select Encoder

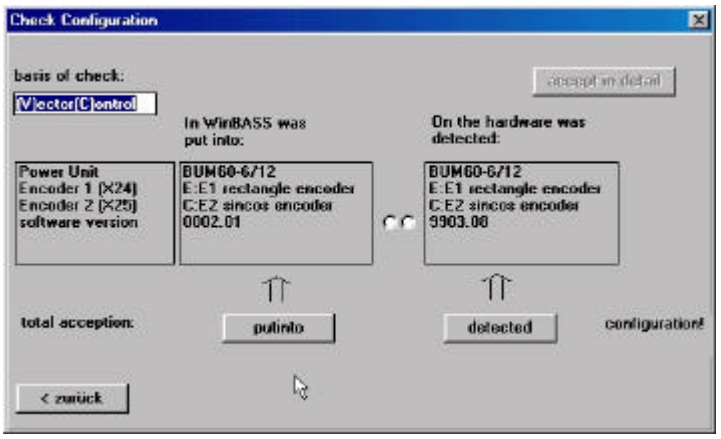
For selecting the motor type click on the corresponding text button *Select* and open the Select Motor window. Firstly you have to select the bus voltage (*busV*), then the motor type (*type*) and then the *nominal speed* based on the data you find on its rating plate. Now the nominal data for speed and current are automatically displayed. Confirm with *OK*.



Select Motor

Return to the Configuration window and click on *Next* in order to go to the next window. You can always go back for corrections by clicking on the *Previous* button.

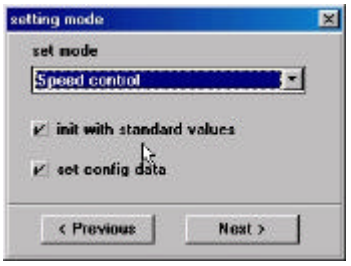
If you work on-line, the actual configuration found attached to the serial line is automatically compared to the one defined in WinBASS (power supply model, encoder, software version). Differences are shown in the Check Configuration window.



Check Configuration

Now you can choose using the putinto text button, whether you wish to accept the WinBASS configuration defined on the PC to be enabled on the drive or by clicking on the detected text button that the one found on the drive becomes that for WinBASS.

If the *"Init with standard values*" option in the next window - Setting Mode - is activated all parameters are initialised with the default values based on the selections made so far. Then after activating the "*Set config data*" option they are transferred in the drive's RAM memory.



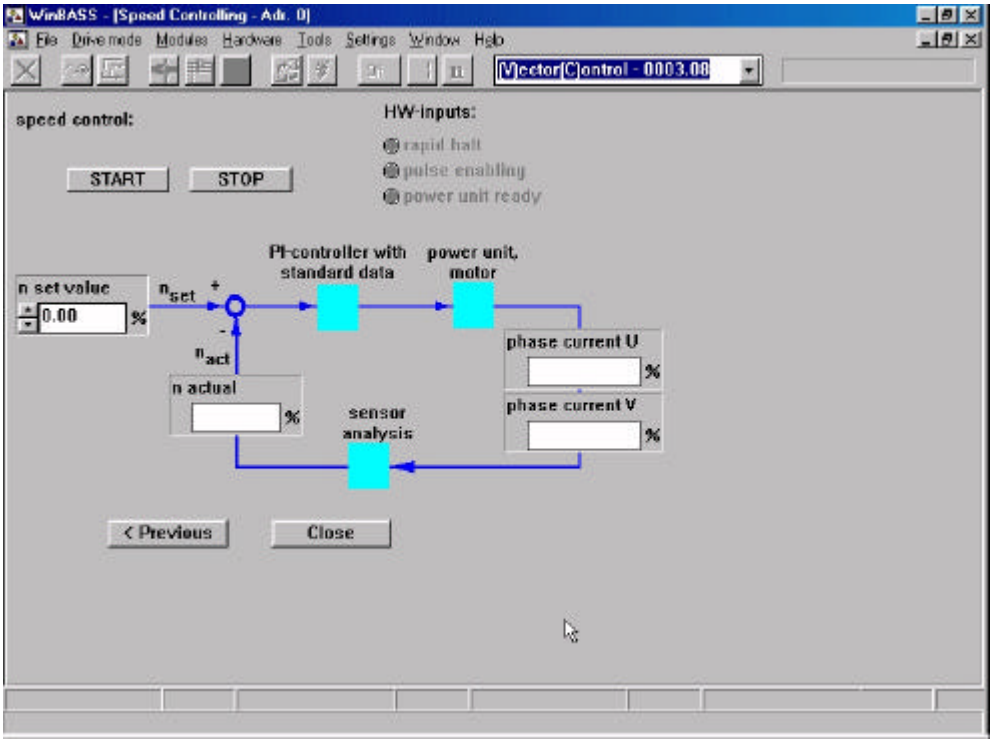
Setting Mode

If in on-line, at the end of the transfer you will be asked whether the data copied into the drive's RAM should also be saved in the non-volatile EEPROM memory. If you confirm, you are requested to switch the drive off and on again before proceeding further.

The next window is the Locating Angle window. Per default the displayed value for this angle is fixed and depends on the motor type. This value is set in the factory with a tolerance of a few degrees and should normally not be altered. Therefore, you should simply click on *Next*. For a description of the procedures for checking the Locating Angle see the relative section in this manual.

After clicking on *Next* the Speed Controlling window opens. Here you can control the speed with a standard configuration of the controller's PI values.

The drive has to be in state 1. Set a speed override (*n set value %*) which should not be greater than 10% and press the *Start* button. A this point a series of commands is transferred to the drive, which put it into state 4 and the motor starts to rotate at the requested speed. By means of a feedback signal you can check if the effective override speed of the motor (*n actual %*) is the same as the one programmed.



Speed Control

After interrupting the speed control by clicking on the *Stop* button and clicking on *Close* you finish the Commissioning Guide procedure and enter into Operating Control described below.

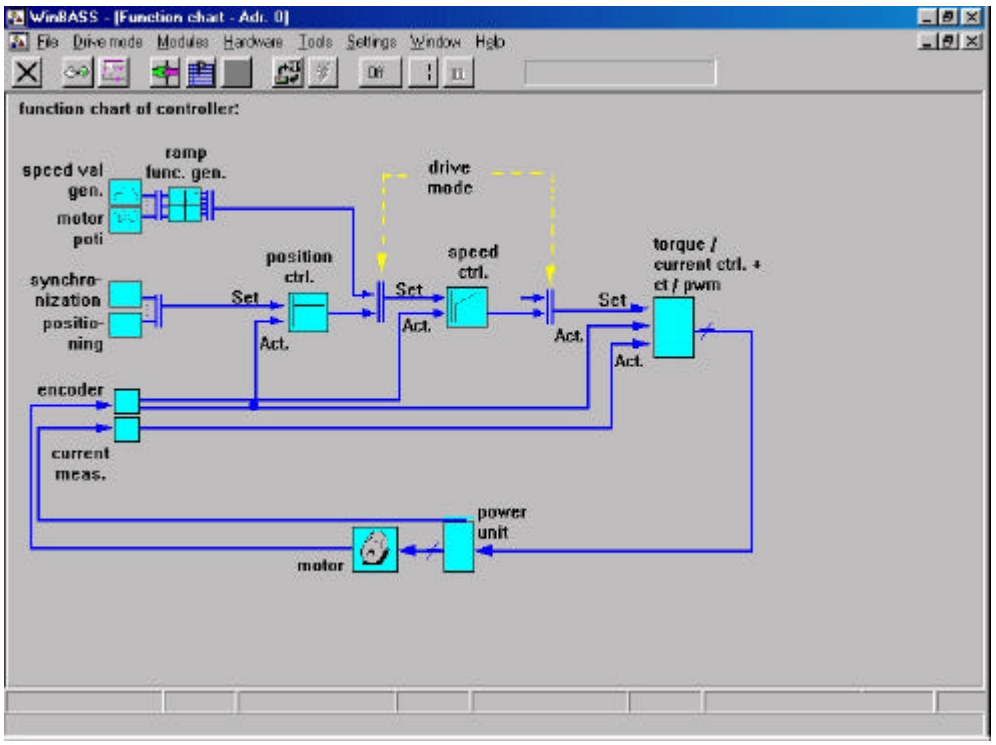
Operating Control 

In this environment you can completely check the adjustment and monitor the drive and motor parameters.

Operating Control can be enabled via a specific button in the tool bar or the 

central text button in the main menu.

When enabled the Function Chart window opens which at the top has a title bar, a menu bar and tool bar, in the centre an area containing all the logic macro blocks of the drive controller structure and at the bottom a status bar.



Function Chart

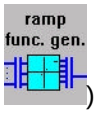
In the title bar, next to the name of the currently selected window you see the ID of the connected drive (example: *Adr.0*)

The menu bar lists all available commands which are described below.

The tool bar allows fast access to some of the main commands of the previous menu bar which are used most frequently.

	Close	closes the current window. You can open up to 4 windows at the same time which are shown as a cascade or next to each other. (also see the Windows menu in the menu bar). If all are closed, the main menu appears automatically.
	Commissioning guide	starts the guided configuration procedure for the drive (see the previous paragraph)
	Function charts	enables the Operating Plane status by opening the Function Chart window
	Connections	opens the Connections window displaying the state of the digital and analog inputs and outputs available on the drive
	Parameter list	opens the Parameter List window with the list of all the drive's parameters
	Start / stop	opens the Action window where you can enable (status 4) or disable (status 1) the drive from the PC. It has the same function as available in the Drive Manager (see)
	Data set manager (DSM)	opens the Data Set Manager window for saving the drive parameters
	Messages	opens the Messages window
	Online / Offline	selects the operating mode between on-line (serial communication active) and off-line (serial communication disabled)
	Drive manager	enables/disables the drive. This icon changes according to the drive status (similar to the H20 display on the drive). For example when the drive is enabled the symbol on this button changes to “4”
	Drive mode	selects the drive's operating mode. The icon on the button changes according the selecting mode: GI: synchronous L: position control n: speed control m: current control RI: Locating Position setting LP: Target Position definition V: speed definition LT: manual mode LR: automatic mode
	*nomefile*.UDL	The name of *nomefile*.UDL currently selected

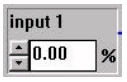
In the central part of the Function Chart window, there is a graphic representation of the main logic blocks into which the drive controller can be subdivided. It allows you to have an immediate overview of all the data flows managed by the controller.

When clicking on blocks shown by a blue box surrounded by a black line (example: ramp func. gen. 

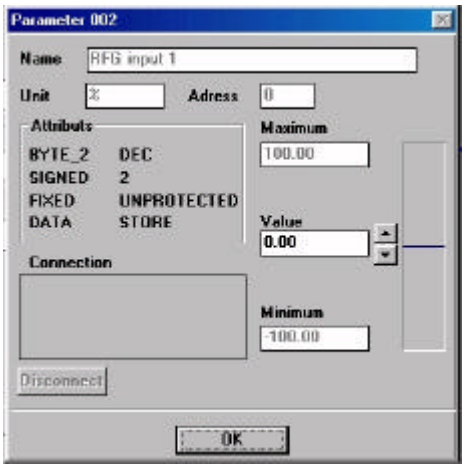
), you open further windows showing the components of that block in more detail. The blue boxes without the black line around them cannot be further expanded.

The 

text buttons in the various pages allow you to go quickly from one block to the previous or next one as far as data flow is concerned. By clicking on them you automatically open the corresponding window.

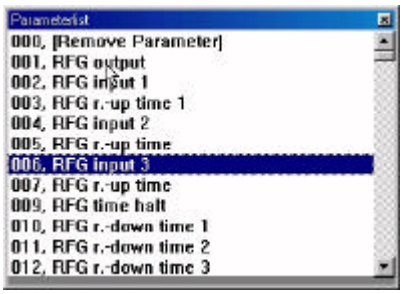
You can change the value of the variables 

displayed in the windows by simply scrolling with the arrows left of the variable field (if you use the right mouse button the value is multiplied/divided by a factor of ten) or by typing a new value into the field. If you click on the grey area with the name of the variable, you open the Parameter xxx window which lists all the attributes and possible connections for this variable (you can also open this window from the tool bar - *Parameter details*)



Parameter 002 window (example)

The status bar at the bottom of the Function Chart window can show the name and the value updated in real-time of up to four parameters which you can choose as you wish. You do this by clicking on the  Parameter List button (or in the tool menu - *Parameter list*) and then selecting one of the listed parameters by clicking with the left mouse button and then clicking on the left box of one of the four field copies in the status bar.



Parameter list: selecting a parameter

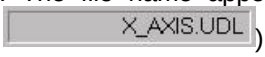
The name of the selected parameter is entered into that box and the right hand box shows its value.

Status bar: displaying the parameter RFG input 3

In order to cancel a displayed parameter you select *000 [Remove Parameter]* and then click on the field you want to clear.

File Management

The menu bar contains the commands for configuration file management (*File / Open*, *File / Save* e *File / Save as*). The drive configurations can be saved on the PC in files called *nomefile*.UDL (see *Data Set Management* described below).

If you open one of these files (*File / Open*), the WinBASS fields will be updated with the values stored in the file. The file name appears (after some seconds) in the pertinent button in the tool bar (example: 

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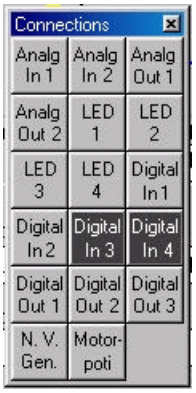
Print Management

The menu bar contains the commands for printing configuration files (*File / Print …*).

Print Preview List	shows the print preview of the variables list
Print Preview Module	shows the print preview of the variables module
Print List	prints the variables list (number, name, min. and max. value current value and measurement unit)
Print Module	prints the variables module
Printer Setup	sets the print parameters

Connections 

You can access this environment with the specific button or via the tool bar - *Connections*. It opens the Connections window listing all the analog and digital inputs and outputs available on the drive.



Connections window

The signals shown in light grey are not used. The dark grey ones are mapped to a variable. By placing the cursor on a dark grey signal you declare the variable to which the signal is linked (an example in the Application Notes of this manual shows how to create a link).

Data Set Management 

You can access this environment with the specific button or via the menu bar *Drive mode* / *Data set management*. Here you can manage the saving of drive parameters. The drive controller has several memory areas:

EEPROM	the non volatile memory areas where all the configuration data have to be saved. There are 4 areas identified by the numbers 0 to 3. When starting up the drive the data stored in EEPROM (0) are copied into the RAM work area.
RAM	the drive's work area

There are the following commands between the PC and the controller:

UPLOAD	copies the parameters from the drive controller memory (RAM or EEPROM) into a *nomefile*.UDL which is saved on the PC. If the drive is in status 4 (drive enabled), only RAM contents can be uploaded.
DOWNLOAD	loads the contents of a *nomefile*.UDL on the PC into the drive controller memory (RAM or EEPROM). If the drive is id status 4 (drive enabled), downloading into its EEPROM is not possible.
COMPARISON	compares two *nomefile*.UDL or a *nomefile*.UDL with the contents of the drive controller memory (RAM or EEPROM) and signals differences.

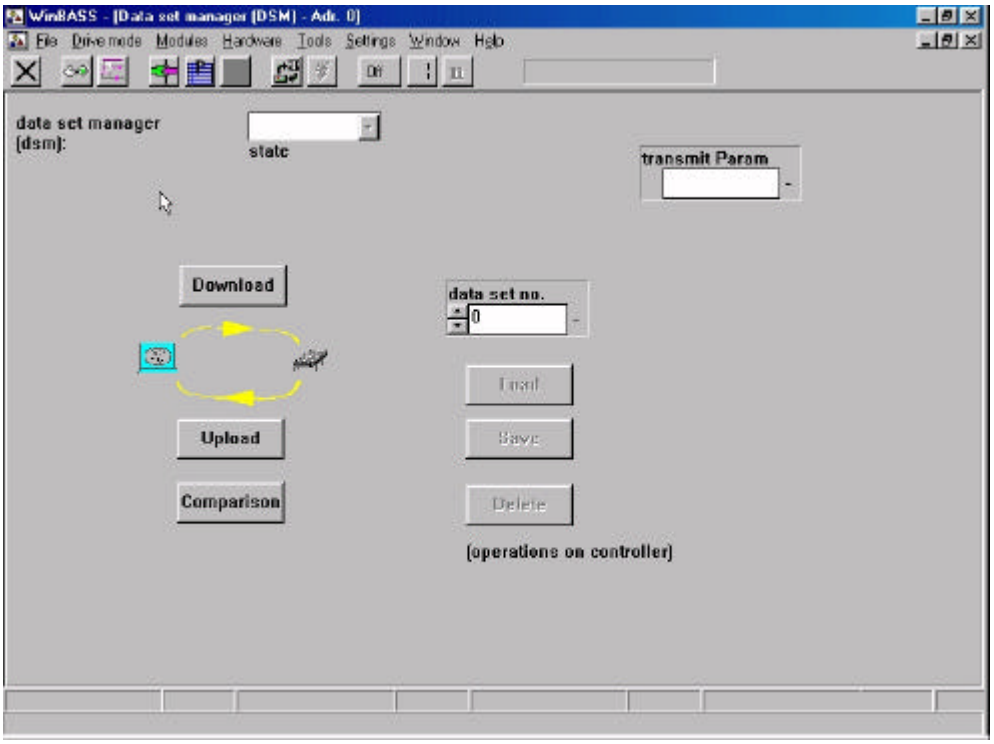
If an Upload / Download is activated in off-line, WinBASS automatically switches to on-line and returns to off-line once the transfer is finished. Parameters currently present on the PC are not changed by an Upload / Download which concerns only the *nomefile*.UDL. In case of error during the transfer an error message is issued.

Only in on-line there are also the following commands on the controller:

LOAD	copies the parameters from EEPROM (0 ..3) into RAM
SAVE	copies the parameters from RAM into EEPROM (0 .. 3)
DELETE	resets the controller's EEPROM (0 .. 3)

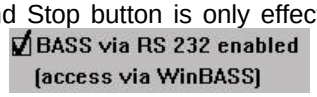
During the various phases of parameter transfer the *Transmit Param* field shows the progressive index of the parameter which is being transferred.

Any change of the drive parameters done by WinBASS acts on the working parameters in the RAM area. In order to make these changes effective also after the drive has been switched off, they obviously have to be saved (SAVE) into the EEPROM 0 before switching the drive off.



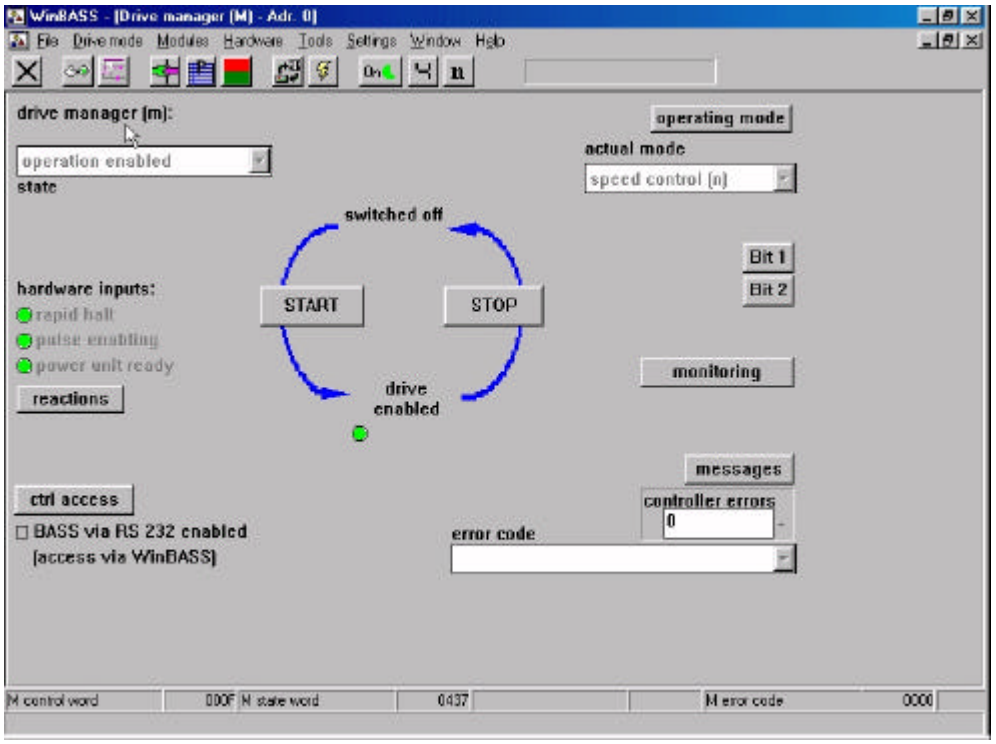
Data Set Manager

Drive Manager 

You can access this environment with the specific button or via the menu bar *Drive mode / Drive manager*.
With the Drive Manager you *Start* (the controller switches from state 1 to state 4) and *Stop* (the controller switches from state 4 to state 1) the drives, even if the inputs for starting the drive have not yet been configured (see Application Notes in this manual). This allows a first check of the motor functioning also outside the system.
However, if the inputs are already configured, they overrule the Drive Manager in such way that it will be, for example, impossible to switch to state 4 using the Start button, if the corresponding physical input is not yet enabled. Clicking on the Start and Stop button is only effective if the controller has previously been enabled via the corresponding flag 

over the serial line.
The Drive Manager window mainly contains the following information:

- internal signal for drive ready (Phase 1, *power unit ready)*
- status of the hardware inputs (*rapid halt*, *pulse enabling*)
- internal signal for *drive enabled*
- controller status (*state*)
- operating mode (*actual mode*), which can be changed to another one available using the *operating mode* text button
- possibly error messages (number and meaning)



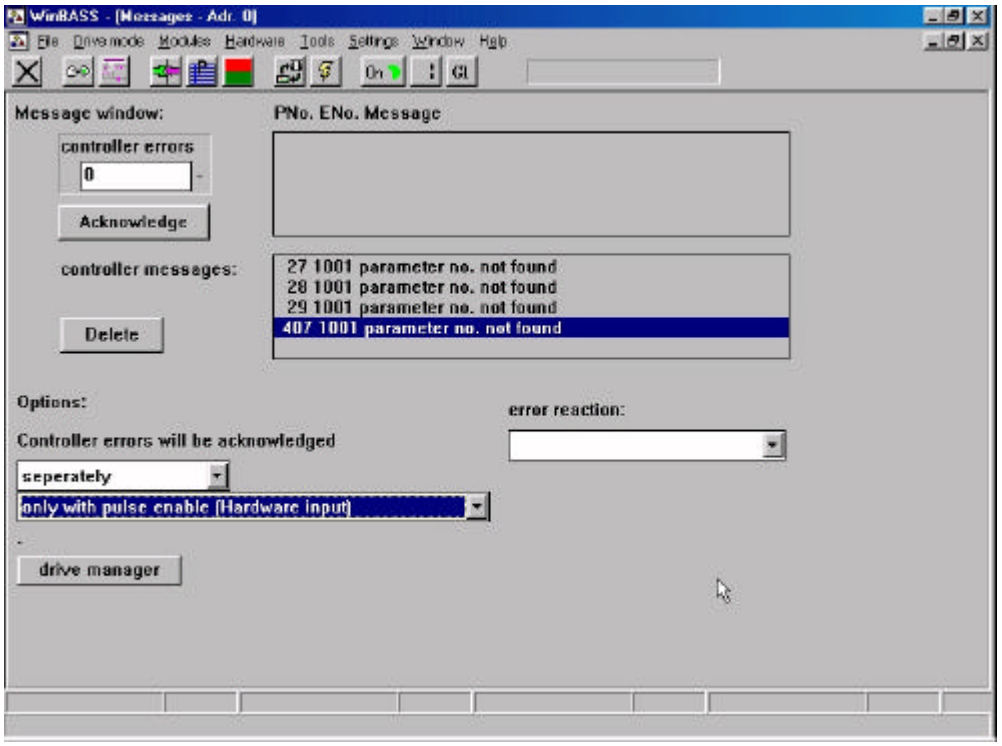
Drive Manager

Messages 

During drive configuration or functioning there may be errors which are immediately shown on the H20 display on the drive's front panel. If a PC is connected via serial line, one or more messages will be generated at the same time and then saved in a list in the Message Window, which can be accessed anytime from the menu bar *Drive mode* / *Messages* or with a specific button in the tool bar.

The same messages are also shown in the Drive Manager window in the two fields *P125 Controller Errors* (number of active messages) and *Error Code* (text of the first active message).

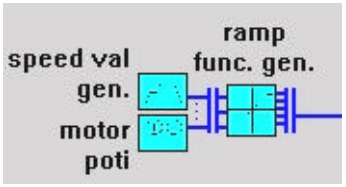
In order to leave the error condition (Fxx.xx), after a new message is displayed, you have to read the message (on the H20 or in WinBASS) and then reset the error with a dedicated input (see Application Notes in this manual) or by clicking on the *Acknowledge* button in the Message window.



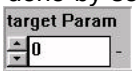
Messages

Set Value Generators

In this environment you can move the motor by a set value generated inside the drive (e.g. during commissioning also without an external axes controller) or coming from an external analog input (NC)).

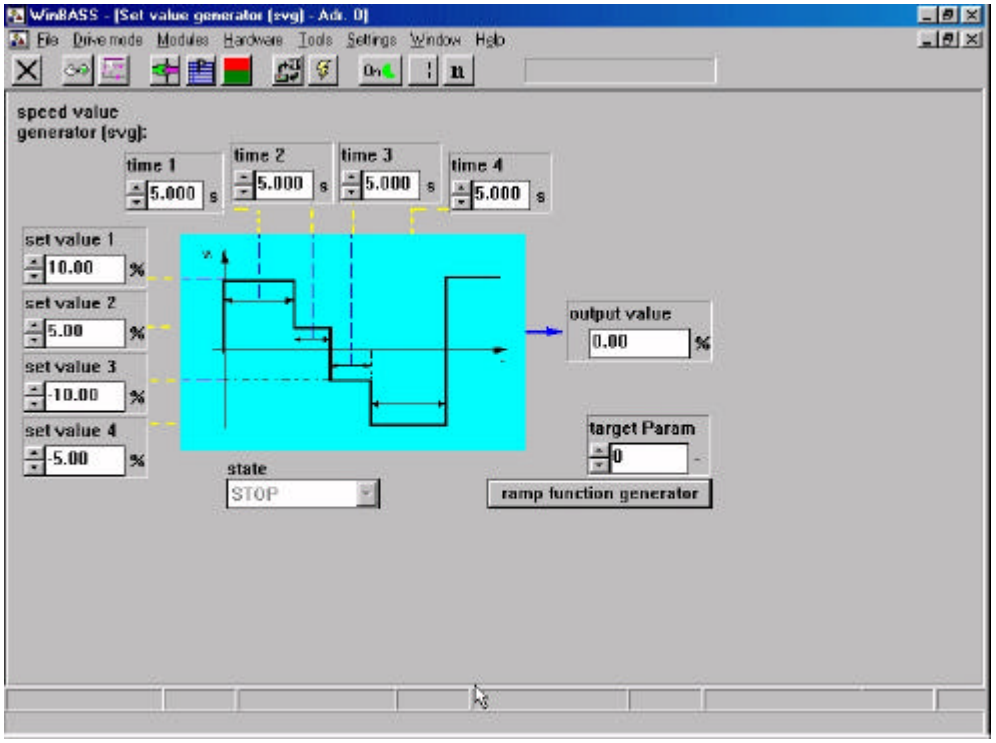


You can access this environment with *Drive Mode / Set Value Generators* or by clicking on one of the three available blocks in the Function Chart window.

With **Speed Value Generator (svg)** you can generate a sequence of maximum four moves which are executed in a cycle. Each of them is defined by an amplitude (*set value*), expressed as a percentage of the maximum speed configured for this motor and a duration (*time*) in seconds. The output parameter *Output Value* indicates the actual value. This value influences the motor only, if *Output Value* is linked to an input of the Ramp Function Generator. This is simply done by selecting the value **2** (*P002 RFG input1*), **4** (*P004 RFG input2*) or **6** (*P006 RFG input 3*) as 

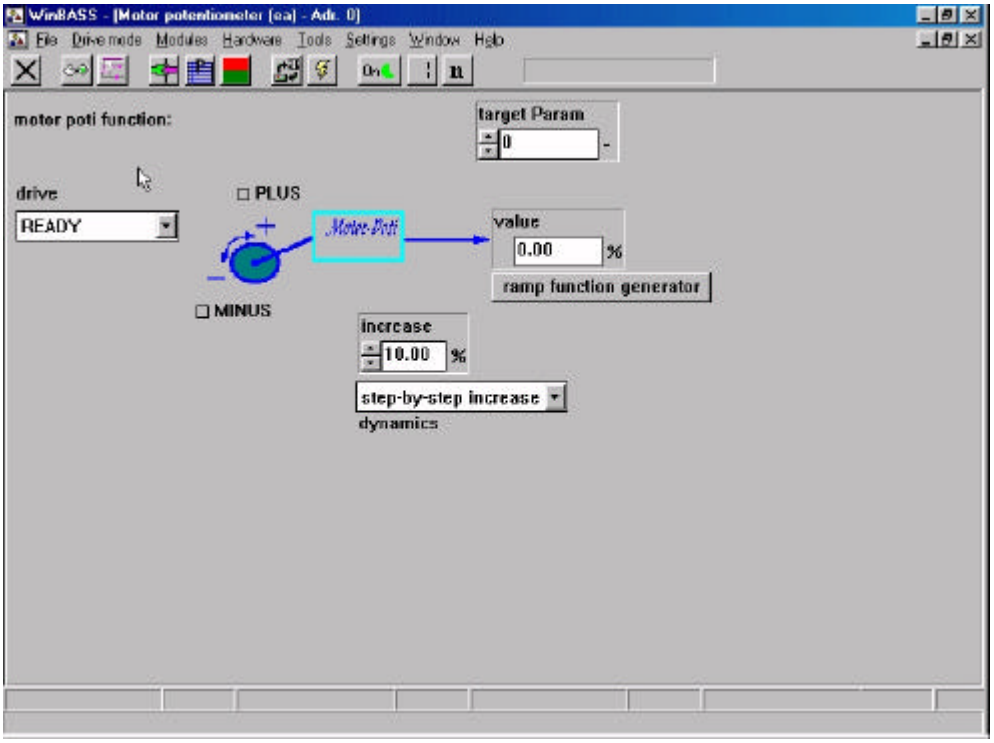
Target Parameter. If you now select Ramp Function Generator window, you will see that the input so connected cannot be changed manually and the measurement unit is shown in the purple field 

in order to show that the link has taken effect.



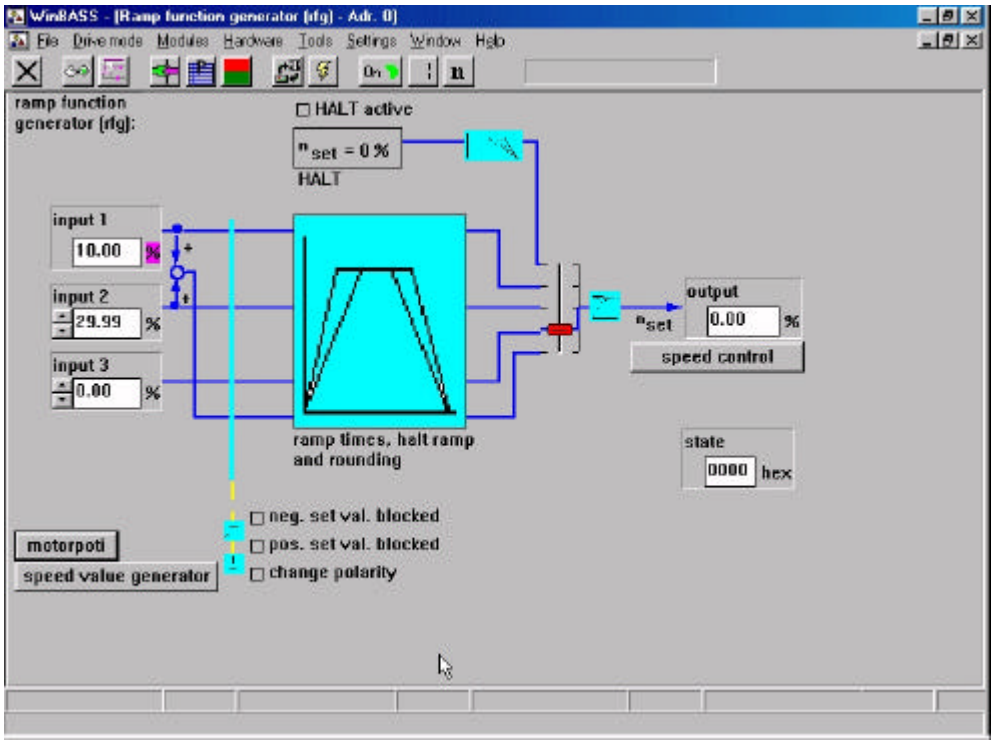
Speed Value Generator (svg)

Similarly to the above you can use the **Motor Potentiometer Function (ea)** to generate a drive-internal set value expressed as a percentage value of the maximum speed allowed for the specific motor. This is achieved by defining the variation rule (*dynamics*) of the set value as well as the percentage increment (*increase*) and then clicking on the boxes *PLUS* and *MINUS* in order to enable the variation. Also here the variation influences the motor only if *Value* is linked to an input of the Ramp Function Generator using the *Target Param* field (see above).



Motor Potentiometer Function

In the **Ramp Function Generator (rfg)** you can choose (with the red multiplex switch) and enable various combinations of the three input values (made evident by the data flow shown in blue lines) in order to obtain a set value for controlling the motor. Ten input values for the ramp generator can be changed by a percentage at any time just by using the scroll arrows. Also these parameters can be linked to any internal parameter such as for example, the motor potentiometer output or the speed generator (see above) or external parameter such as the analog input coming from an NC (for this last connection see the Application Notes in this manual).



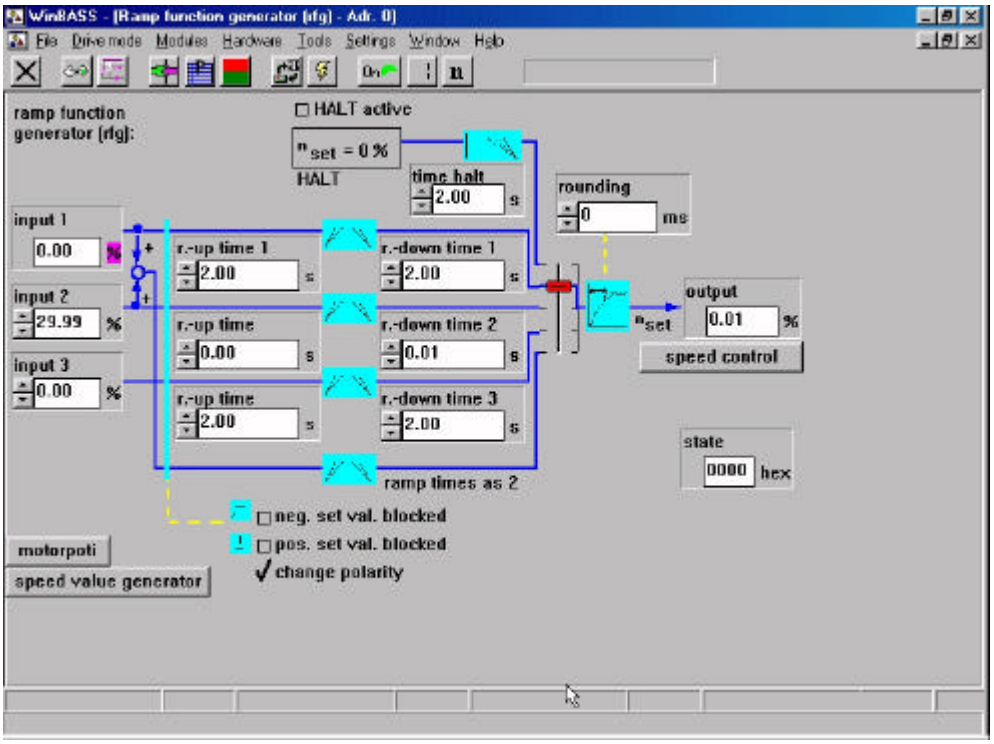
Ramp Function Generator (1)

You see that, by means of suitable switches, you may filter the passage of positive or negative set values or invert the motor rotation with the box *change polarity*.

P001 RFG output parameter is linked to the *P050 N n set val* parameter (calculated override speed) of the Speed Controller. The effective motor movement will happen, when the drive is enabled.

By clicking on the blue window in the middle you can expand the section, where you can define the acceleration and deceleration ramp with durations expressed in seconds.

When enabling the HALT signal (*HALT active*) the drive is stopped according to the times defined with the *time halt* parameter.



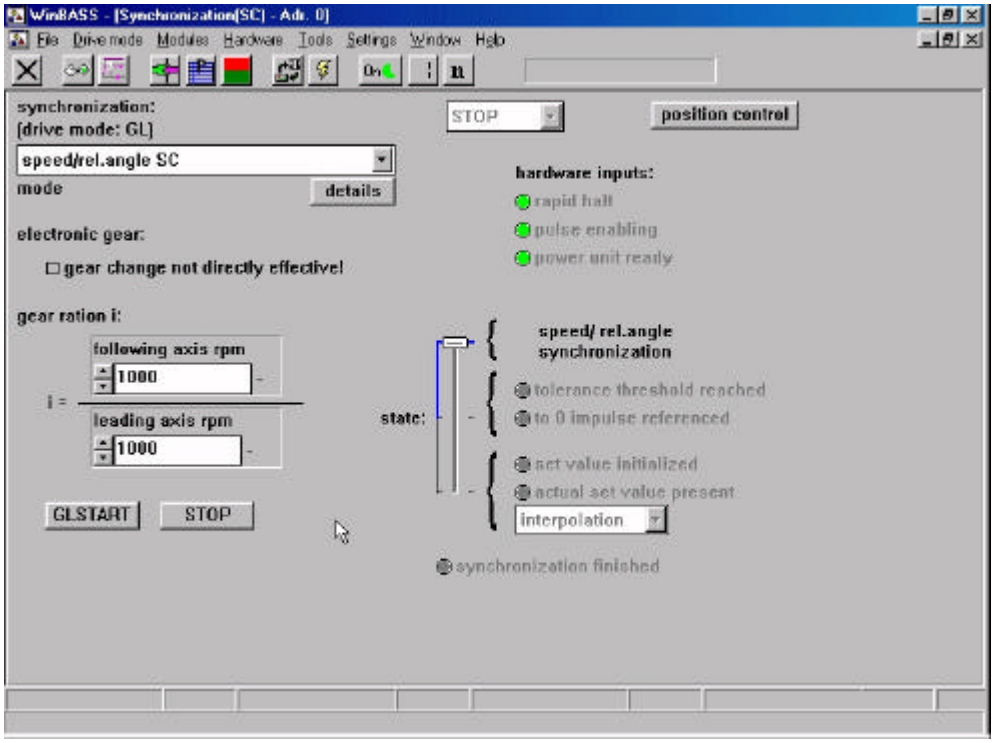
Ramp Function Generator (2)

Synchronization

You can access this environment with *Drive mode / Synchronization (SC)* in the menu bar or by clicking on the corresponding block in the Function Chart window.
This mode is used for defining and enabling a master/slave feature between the two drives. On the slave drive (which receives the encoder position of the master as input on the X24 connector) you have to define the type of synchronisation and the following ratio.

The Synchronization window contains the following information:

Synchronization mode	**current mode of synchronisation**
Hardware input	the state of the three signals: rapid halt, pulse enable and power unit ready
Electronic gear	enables the electronic gear change. In order to avoid undesired behaviour, you have to select **electronic gear:** ☑ **gear change not directly effective!** before you define the gear ratio. Then for enabling this ratio you have to deselect **electronic gear:** ☐ **gear change not directly effective!**
Gear ratio	You can enter integer values also negative ones for the numerator but not for the denominator.
Start / Stop	enables / disables drive sychronization



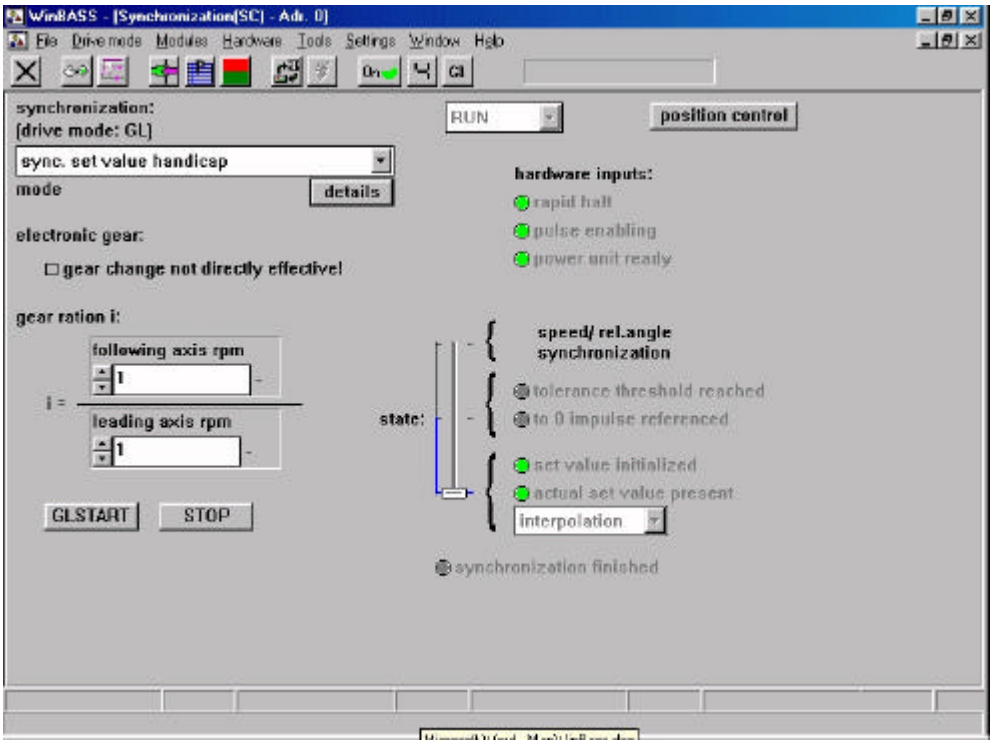
Synchronization

Clicking on the **details** button brings you to next window - Synchronization Details

Sercos drives: OSAI DAC Sercos drives use the (GL) synchronization mode. The position command coming from the CNC via fibre optic cable is converted inside the drive and used as if it were the position of a master to be followed (which normally is read as an encoder input on the X24 connector instead). For a correct functioning of the Sercos interface the parameters have to be set as follows:

- P122 Mode: sync set value
- P255 Following axis rpm: 1
- P256 Leading axis rpm: 1

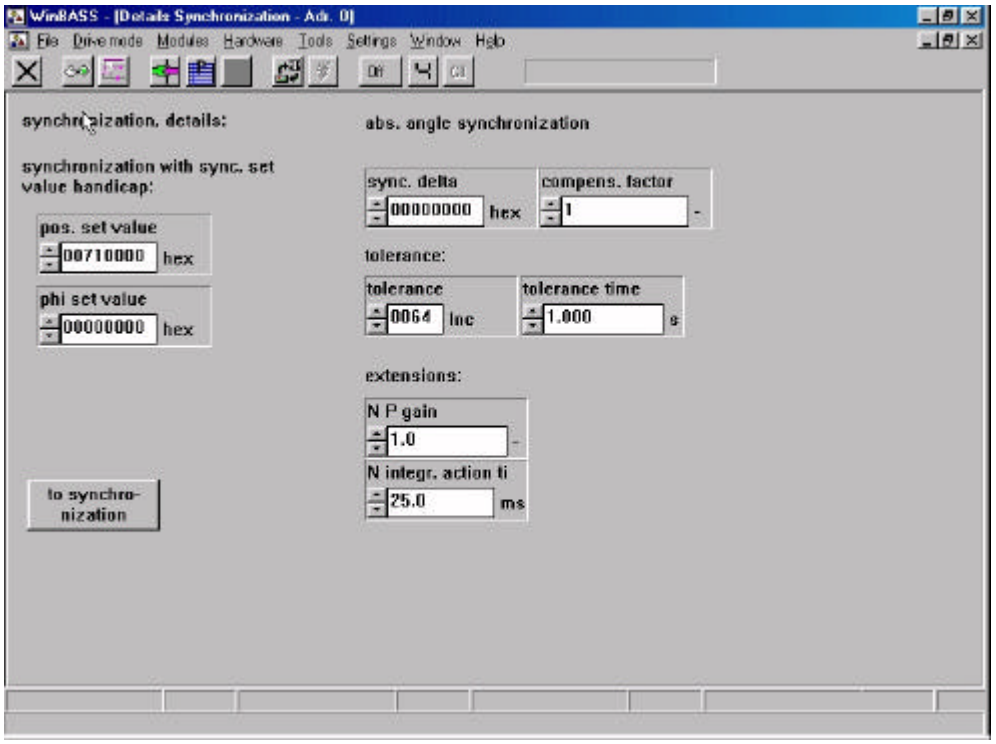
NOTE:
varying the parameters P255/P256 means obtaining physical moves which differ from those requested (programmed) by the NC. Obviously this can lead to servo errors from the CNC.



Synchronization: configuration of an OSAI DAC Sercos drive

Clicking on the details button brings you to next window - Synchronization Details - where you have to set the parameters as follows:

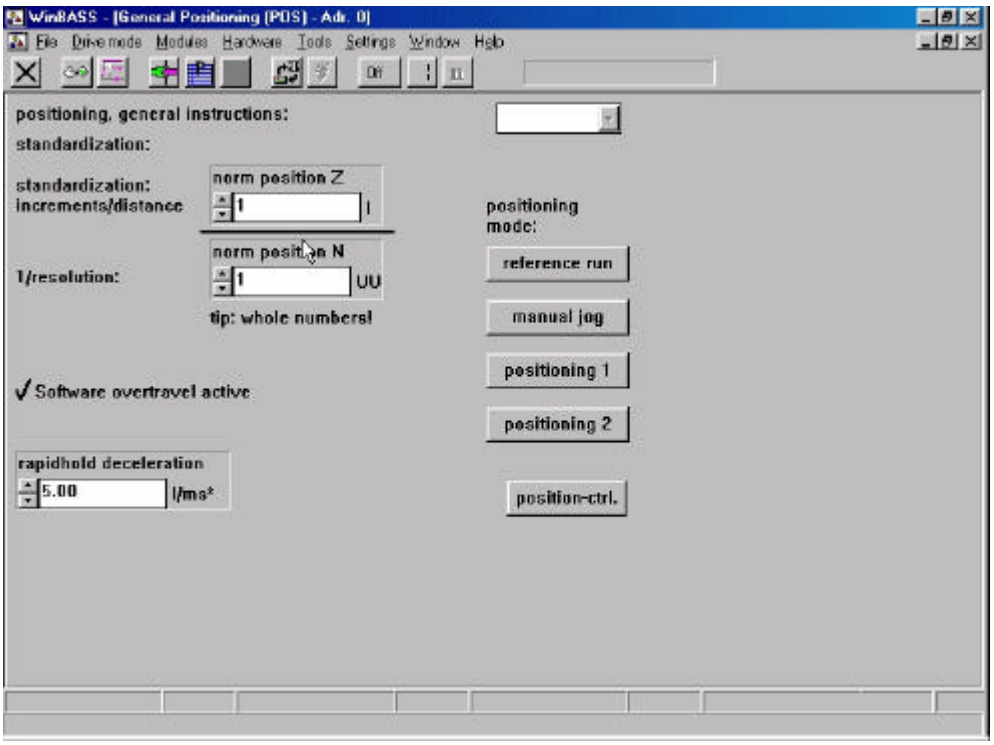
- P254 Sync delta: 0
- P252 Compens factor 1
- P253 Tolerance: 64
- P259 Tolerance time: 1
- P324 N P Gain: 1
- P325 N integr action ti: 25



Synchronization, details: configuration of an OSAI DAC Sercos drive

Positioning

You can access this environment with *Drive Mode / Positioning* in the menu bar or by clicking on the corresponding block in the Function Chart window.



General Positioning

Firstly you have to set the value of the two following parameters remembering that one turn of the motor corresponds to 65535 pulses:

- norm position Z = [65535 / mechanical step] = [pulses / mm]
- norm position N = [1 / required resolution] = [1 / mm]

both values must be positive integers.

Therefore the conversion factor will be equal to:

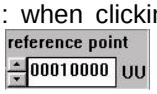
input parameter [I] = input parameter [BE] * norm position Z [I] / norm position N [BE]

Example:

if one rotation of the motor corresponds to an effective axis move of 16 mm and the required resolution is 0.01 mm, you get:

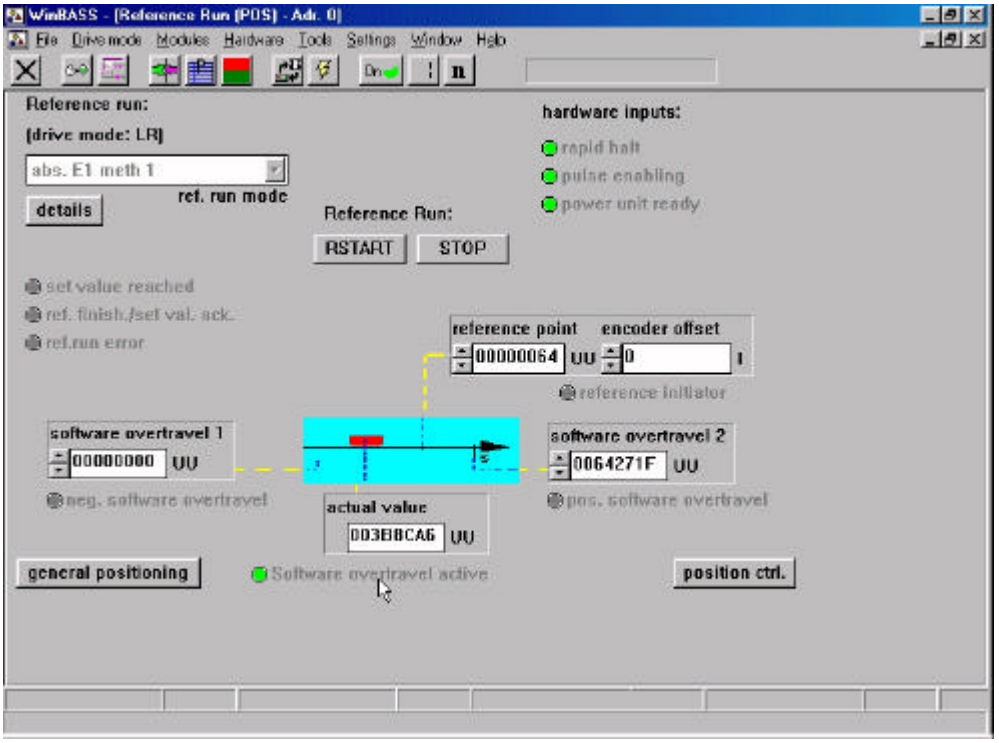
- norm position Z = 65535 / 16 = 4095
- norm position N = 1 / 0.01 = 100

Reference Run (cycle for homing the axes): when clicking on the 

button the Reference Run window opens, where in the field 

Reference Point you can input a value which the motor will reach, when you click on the 

Rstart button. The move can be interrupted using the Stop button. The window shows the current motor position and the overtravel values which may be changed at any time.



Reference Run

Manual Jog DA VERIFICARE !: When you click on the 

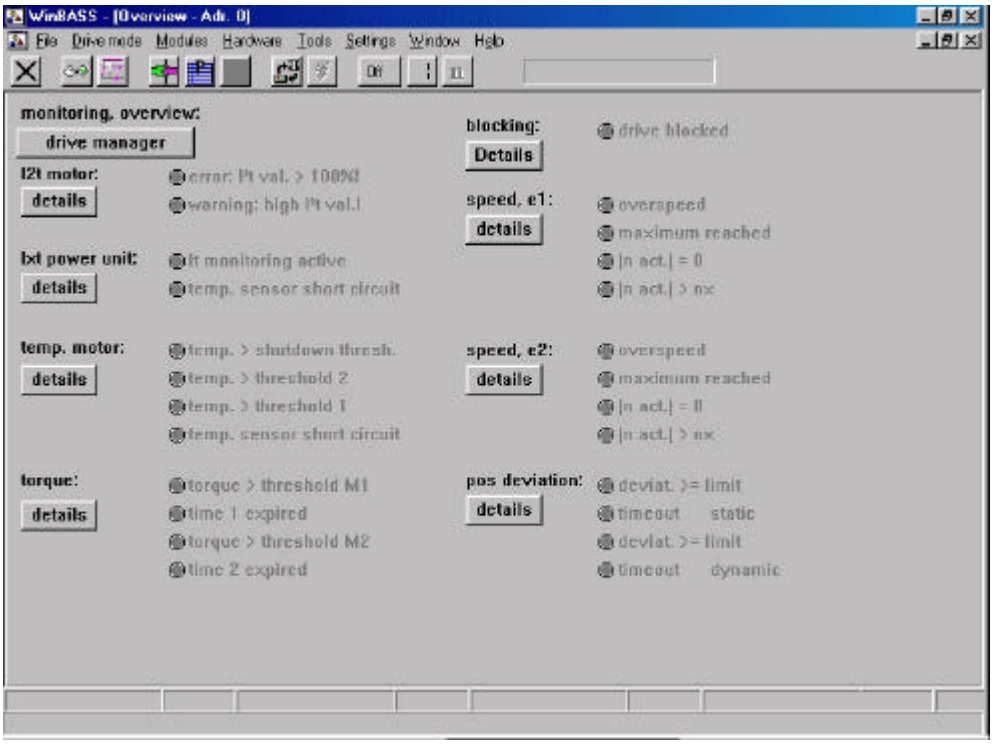
button you enter the Manual Jog window, where you can manually move the motor with the 

Touch+ and Touch- buttons.

Monitoring

You can access this environment with *Modules / Monitoring* in the menu bar. From the Monitoring Overview window you can enter the specific window for each function:

- overview
- motor overload
- power unit overload
- torque monitoring
- motor temperature
- position deviation
- speed encoder 1
- speed encoder 2
- blocking



Monitoring Overview

Compacts

You can access this environment with *Modules* / *Compacts* in the menu bar.

It gives a short and concise summary of some drive parameters for:

- status parameters
- mode parameters
- controller state parameters
- synchronisation state parameters
- positioning state parameters

Additional Parameters

The currently not used parameters (from no. P468 to no. P499) are addressed by generic names (from ZK0 to ZK31) and displayed on two dedicated pages.

Input

By selecting *Hardware* / *Inputs* you can call up the configuration windows for the two analog inputs (AI1 and AI2) and the four digital inputs (DI1, DI2, DI3 and DI4) of the drive. In these windows you can define the parameter as required in each case (see the Application Notes in this manual).

Ext. Inputs

There are none on OSAI drives.

Outputs

By selecting *Hardware* / *Outputs* you can call up the configuration windows for the two analog outputs (AO1 and AO2) and the three digital outputs (DO1, DO2 and DI3) of the drive. In these windows you can define the parameter as required in each case.

Ext. Outputs

There are none on OSAI drives.

LEDs

By selecting *Hardware* / *LEDs* you can call up the configuration windows for the four H22 LEDs on the front of the drive.

I/O State

By selecting *Hardware* / *I/O State* you can call up several windows which group the various digital and analog input and output signals in real-time. This makes it easy for you to monitor these signals.

Encoder

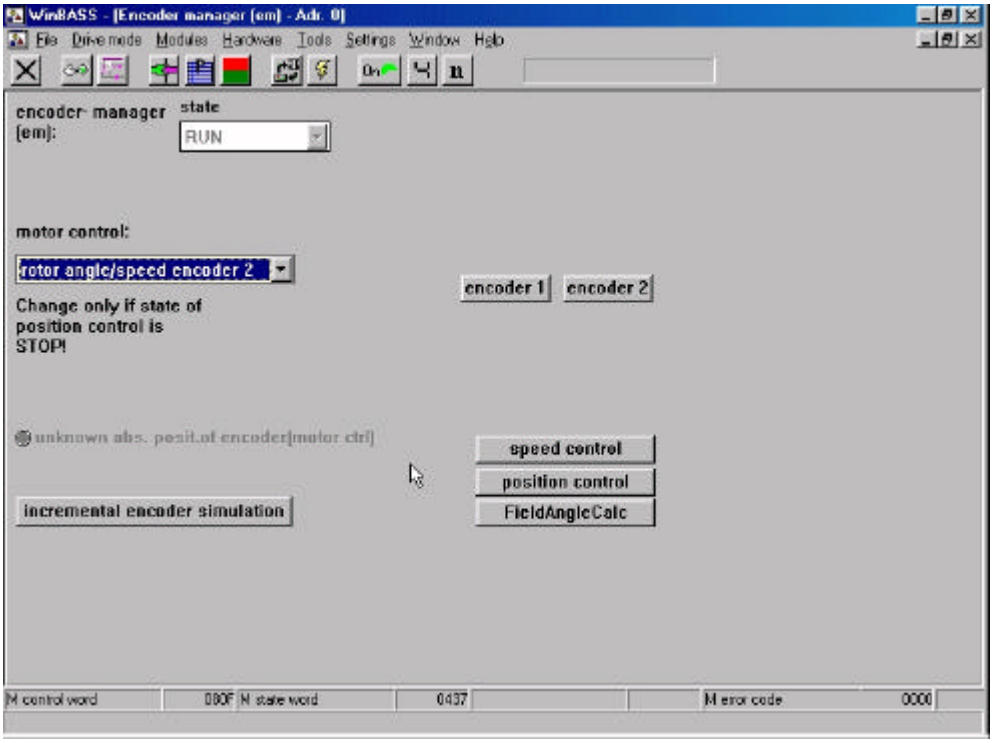
You can access this environment with *Hardware* / *Encoder* in the menu bar, where you can select one of the following commands:

- Encoder 1 (e1)
- Encoder 2 (e2)
- Encoder manager (em)
- Incremental encoder sim.
- Touch Probe Cycle (MZ)

You can also call up the Encoder Manager by clicking on the corresponding block 

in Function Chart window.

The Encoder Manager opens, where text buttons make it easy to go to the next windows for encoder 1(connector X24) and 2 (connector X25), the encoder simulation (connector X23) and probe management.



Encoder Manager

Encoder 1: you access this window with *Hardware* / *Encoder* / *Encoder 1* in the menu bar. The encoder 1 (connector X24) is used as input for an incremental master encoder in case of a slave drive or as input for an incremental external encoder for a SERCOS drive.

Encoder 2: you access this window with *Hardware* / *Encoder* / *Encoder 2* in the menu bar. The encoder 2 (connector X25) is used for connecting to the SINCOS interface of the DAC motors.

Incremental encoder simulation: you access this window with *Hardware* / *Encoder* / *Incremental encoder sim* in the menu bar. The encoder simulation (connector X23) transforms the encoder type signals for the NC into SINCOS type signals from the DAC motors.

Touch Probe Cycle (MZ): in this window you can configure the parameters for the probe cycle with a SERCOS drive.

Motor Data

You enter this environment with *Hardware* / *Motor data* in the menu bar.

The relative window displays all characteristic parameters of the configured motor. These have to match those on the motor's rating plate and normally must not be changed.

Power Unit

You enter this environment with *Hardware* / *Power unit (pu)* in the menu bar.

The relative window displays all characteristic parameters of the configured drive. These have to match those on the motor's rating plate and normally must not be changed.

User Modules

You enter this environment with *Tools* / *User Modules* in the menu bar.

In off-line you can create customised modules (pages) to display parameter groups for your special requirements. If you access this window for the first time, you will find 21 empty boxes. At the same time the Parameter List window opens with all available parameters. Firstly you have to enter the name with which this module will be saved and called into the relative field in the right corner at the top. Then you create the desired page: you click with the left mouse button first on the parameter to be selected from the Parameter List and than on one of the boxes. The parameter will automatically be entered with name, number and measurement unit. Later entries into a box cancel the previous ones. If you want to cancel a box, select the parameter *000 Remove Parameter*. You do not need to compile all boxes. You may position the parameter as you like, they are saved as created.

When you close the module it will be saved under the selected name. If no name has been entered, the module will not be saved. If you call up an existing module and cancel all boxes, the whole module will be cancelled.

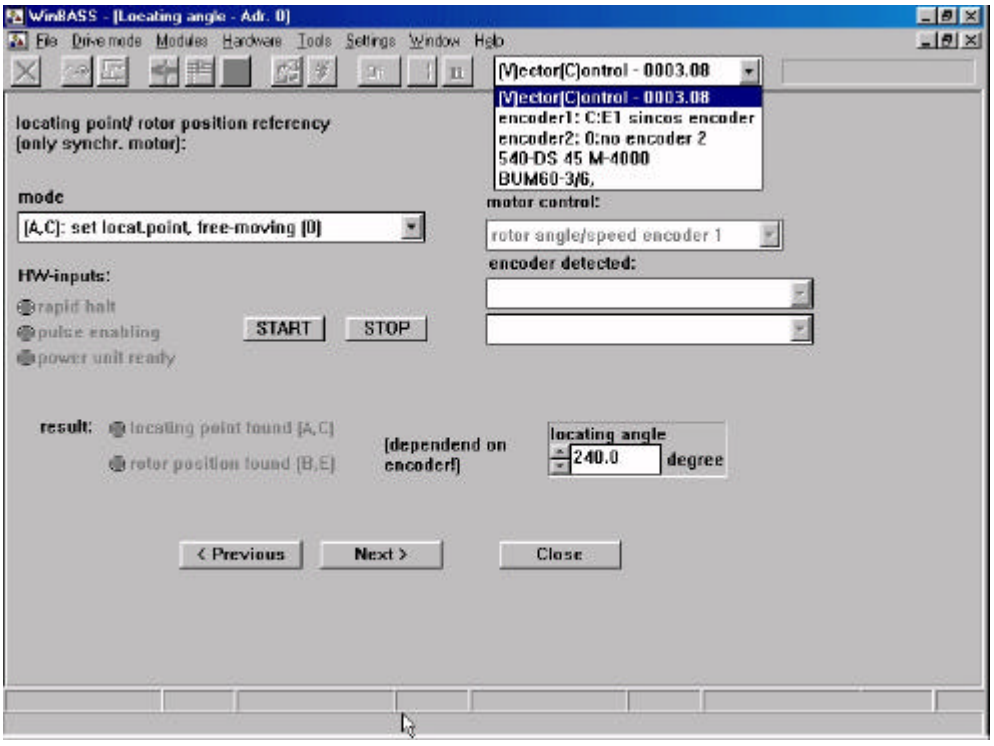
In order to display the created module, select *Drive mode* / *User modules* in the menu bar.

Locating Angle

This window is automatically opened in the first installation phase when issuing the “commissioning guide” command.

The Locating Angle is the phase angle between the encoder and the motor. An adjustment of this parameter is only meaningful for synchronous motors. It has a fixed value depending on the motor type which is determined in the factory with a tolerance of some degrees and must normally not be changed. The value in the locating angle field for DS series motors (axes applications) has to be 240. Check the value and, if necessary, correct it manually. For DA series motors (spindle applications) it does not have any significance.

The Locating Angle window allows to check and, if necessary, to change this value. There are three automatic procedures which are started with the *Start* button. These procedures assume a controlled motor movement. Therefore, it is necessary to check that the motor can rotate freely. When clicking on *Start*, the motor makes small movements at the end of which in case of a successful result the value found (approx. 240° for SINCOS motors) is displayed in the *locating angle* field and the relative green LED (*result*) comes on. If you find a value much different from the expected one, please contact Support Services.



Locating Angle

PCBASS INTERFACE

As an alternative to WinBASS you can configure and set up an OSAI DAC / DSC drive on-line by using a specific software (PCBASS) on a PC linked to the X23 connector of the DSV-6 controller via a standard serial line. Therefore you need the following tools:

- PC
- RS232 serial cable (see Installation Manual)
- PCBASS communication software

Installing the PCBASS package on the PC

The PCBASS package requires the following minimum PC configuration:

- MS-DOS 3.3 or later versions
- 500 KB of memory
- 1 MB free space on the hard disk

In order to install the PCBASS you have to create a directory (e.g. C:\PCBASS) and to copy the contents of the floppy disk into it.

You run the software by launching the UDL.BAT program.

PCBASS Interface - Main menu

Essentially PCBASS provides two main functions:

- UP / DOWNLOAD: transfer of the drive parameters between the PC and the drive
- PCBASS: real-time set-up of the drive parameters

After launching the software (UDL.BAT) the following screen with the main menu is displayed:

Main menu

The first line at the top contains the following information:

- controller type of the selected drive (always has to be **BUS6V**)
- UP/DOWNLOAD version

The last line at the bottom lists the commands available in this environment:

Command	**Description**
Alt X – Exit	for leaving PCBASS
F4 – Show	for displaying the list of configuration files (*filename*.DAT and *filename*.CFG) for reading the drive parameters. *filename* indicates the drive's firmware release which can be read in P174 and P163 parameters.
Alt F3 – Close	for leaving some PCBASS environments
F5 – ChDir	for changing the PCBASS work directory
Alt O –Opt	for opening the Options window containing the serial communication configuration
Alt A – Act	for enabling the reading of the error generated by the drive controller. The screen then shows the Drive Error button which you can enable via the key [**v**].
Alt D – Deact	for disabling communication error control previously enabled via [**Alt**]-[**A**] Act.

When selecting the [**F4**] **– Show** command the “Show file” window opens which displays all files and sub-directories in the PCBASS work directory.

The [**ALT**]**-[O**] command opens the following “Options” window where you can configure the following parameters:

Parameter	**Range**	**Recommended**	**Description**
COM	1 – 4	1	number of the PC's serial port
Drive Address	0 – 255	0	address of the connected drive (see the DAC installation manual)
ID Start	1- 65535	1	Number of the first parameter to be read
ID End	1 - 65535	700	number of the last parameter to be read. Currently about 700 parameters are used, therefore you should enter this number if you want to read them all.
Comm Tries	1 – 20	5	number of tries during communication
Language	1 = German 2 = English	2	selecting the language
Colour Table	1 = Colour 2 = Monochrome	1	enabling a colour monitor

Timeout (msec)		1000	communication time-out

The listed values are the recommended values, but you can change them by browsing with the [**TAB**] key. Changes are confirmed with the [**OK**] key or ignored with the [**CANCEL**] key.

Finally the main menu contains the following commands (which you can launch by pressing the key for the underlined character):

Controller	selecting the controller type
File Compare	comparing the .UDL files saved with the UPLOAD command
Read Com**p**are	displaying the file generated with the File Compare command
Upload -> PC	saving the drive parameters in a .CFG file on the PC
Download -> Drive	loading the configuration parameters from the PC into the drive's memory
Up / Download **E**rror	displaying the errors occurred during parameter transfer
PC**B**ass	enabling real-time parameter monitoring and modification

In the following these commands are described in detail.

PCBASS Interface – Controller

With this command you open the “Select Controller” window listing the available controllers. You must always and only select the **BUS6V** type and then press **OK** to confirm.

PCBASS Interface – File Compare

With this feature you can compare the contents of two *filename*.UDL. The command opens the “Compare mode” window. If you confirm with **OK**, the Source File appears with a list of the available .UDL files. Select the one you want and press **OK**. Then the Compare File window is displayed, where you have to select the second file with which to compare. Again confirm with **OK** to open the Read Compare window which shows a list of parameters which are different in the two files. The Data Source column contains the values in the Source file and the Data Compare those found in the Compare file. You can print this file ([**F1**] **Print**) and then exit [**Alt**]-[**F3**] **Close**.

PCBASS Interface – Read Compare

With this function you can display the contents of a file previously created with the File Compare command.

PCBASS Interface – Upload -> PC

With this command you can read the parameter configuration on the drive and save it on the PC. This is very useful for backing it up or archiving it for the installation of a new drive.

Pressing the [**U**] key opens the “Upload mode” window offering the following choice:

Range (-> Options)	indicates the range for the variables to be read. Selecting this item you read the range previously selected OPTION (from ID Start to ID End) – **recommended mode**
Mask	when selecting this item and confirming with **OK**, you display the list of the *filename*.CFG files with the masks of available parameters according to the drive release (indicated by *filename*). In this mode only the parameters relevant for this release are read.

After confirming with **OK**, the following “Memory module - Upload from” window opens offering the following choice:

RAM Memory	to be selected if you want to read and save the drive's current RAM working area – **recommended mode**
EEPROM Data Set	to be selected if you want to read and save a configuration previously saved in the drive's non-volatile memory. There are four memory banks identified by the numbers 0 to 3. At drive start-up the contents of the bank EEPROM 0 is copied into the RAM.

After confirming with **OK**, the “Upload file” window appears showing the list of *filename*.UDL files on the PC. Here you have to enter the name of the file in which you want to save the information read from the drive. Therefore select the destination directory and file using the [**TAB**] and arrow keys and confirm with **OK**.

Now the “Info” is displayed, where you can enter a comment string, which will be saved in the file. After writing the string, confirm again by pressing **OK**.

Then the “Upload” screen appears and parameter reading starts. The parameter numbers are progressively displayed on the screen. Obviously, the duration of this process depends on the number of parameters to be read.

In the selected directory the Upload procedure creates 3 files with the specified name and the following extensions:

*filename***.**UDL data file in an internal format

*nomefile***.**LST data file in printable ASCII format

*nomefile***.**ERR error log file

At the end of the Upload, the system automatically returns to the main menu. If an error occurred, you can check its code from the main menu using the Up / Down Error command (see below).

PCBASS Interface – Download -> Drive

With this command you can download into the drive memory a parameter configuration previously saved on the PC.

Pressing the [**D**] key opens the “Memory module - Download to ” window offering the following choice:

RAM Memory	The data are loaded into the drive's working area – **recommended mode**
EEPROM Data Set	The data are loaded into the drive's non-volatile memory

After confirming with **OK**, the “Download file” window appears showing the list of *filename*.UDL files on the PC. Select the directory and the file containing the data you want to load back to the drive. After pressing **OK** the parameter download will start automatically. At the end the system returns to the main menu.

If an error occurred during the download, you can check its code from the main menu using the Up / Down Error command (see below).

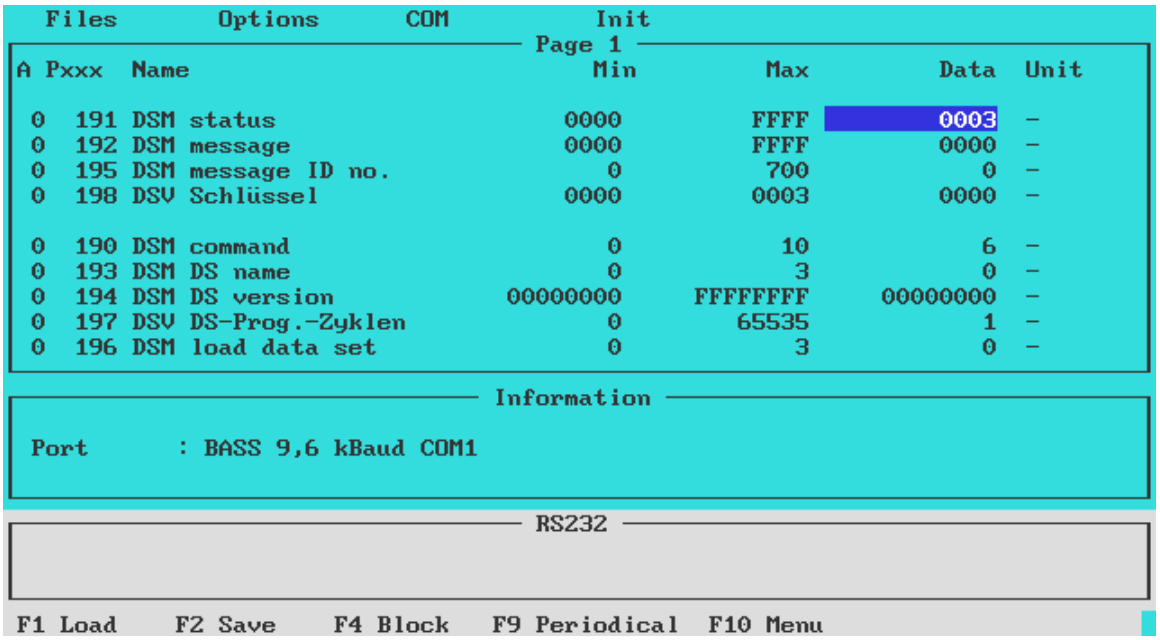
PCBASS Interface – Up / Download Error

If there is an error signal at the end of an Upload or Download procedure, the description of the error type is saved in the *filename.*ERR file. You can display this file by pressing the [**E**] key and then print it with [**F1**] **Print**. You have to read these errors and then check them with PCBASS. The [**Alt**] [**F3**] **– Close** command brings you back to the main menu.

PCBASS Interface – PCBass

PCBASS is the environment allowing you real-time monitoring and modification of the parameter values used by the drive. These parameters can be read and in part be changed on the fly so that you can quickly set-up the machine in a hands-on manner.

You issue the PCBASS command by pressing [**B**] from the main menu, which opens the “PCBass” window with the list of the *filename*.DAT files residing on the PC. Select one in the usual way and confirm with **OK**. The first parameter page will appear.



PCBASS main screen

The *filename*.DAT files represent masks for reading the drive's memory area and may be different for different drive software releases; therefore in order to display all drive parameters correctly and completely you should select the *filename*.DAT which is consistent with the drive release. If you do not know the release number you only have to select any .DAT file, connect to the drive and read the values in the following two parameters (which are always visible with any .DAT version) on page 24:

P174	release type	This parameter indicates the release type (nn). Example: 00 = official standard release 9x = pre-release
P163	release number	release number in the format x.yy (example 3.08)

The name of the file to use is composed as: nn0xyy.DAT.

Now you have to leave PCBASS ([**ESC**] + [**ALT**]-[**F**] + **Quit**) and re-enter (**B**) selecting the appropriate *filename*.DAT.

Example:

suppose, you have read the following values in the parameters indicated above:

P174 00

P163 3.08

then you have to activate PCBASS by selecting the 000308.DAT file.

Once you are in the PCBASS environment, you can use a number of features as described below. The first line at the top of this page contains some commands (**F**iles, **O**ption, **C**OM, **I**nit) which you can launch by pressing [**F10**] and then [**ALT**] plus, for each command, the letter highlighted in red.

[**ALT**]-[**F**] offers the following choice:

Info	provides information on the PCBASS software release
Quit	leaves PCBASS and returns to the main menu

[**ALT**]-[**O**] offers the following choice:

Errors	enables/disables error display
D**i**splay	enables/disables the display of the RS232 window in the lower part
Colours	changes the screen colours
Languages	selects the language

[**ALT**]-[**C**] offers the following choice:

Repeat	enables/disables retry on the serial communication line
COM**1**	selects COM1
COM**2**	selects COM2

Still in the PCBASS main screen but in the central frame the system lists the drive parameters. These are not shown in the order of their indices but grouped in logic units and presented on subsequent pages. The same parameter may also appear on several pages. The page number is displayed in the centre at the top of the frame. You can move between pages using [**Page Up**] and [**Page Down**] or [**ALT**]-[**n**] where **n** is the number of the page you want to see. Then the following information appears in the frame:

- in the second column “Pxxx”: the ID number of the parameter
- in the third column “Name”: the symbolic name for the parameter
- in the fourth column “Min” and the fifth “Max”: the minimum and maximum value this parameter can take
- in the sixth column “Data”: the current value of the parameter which can be updated in real time (after enabling communication with the [**F9**] command)
- in the seventh column “Unit”: the measurement unit for expressing the parameter

The frame below called “Information” shows some information concerning the serial line configuration.

The “RS232” frame contains the communication strings exchanged between the PC and the drive. They give a visual impression of the communication underway.

The last line at the bottom contains the following commands:

F1 Load	
F2 Save	
F4 Block	When pressing this key, the Data Block window is opened containing all information for the currently selected parameter Pxxx.
F9 Periodical	enables the serial communication with the drive. The values shown in the “Data” column are updated in real time. When pressing the key again, the communication is interrupted.
F10 Menu	moves to the PCBASS "Menu" screen. Alternatively you can use the [**ESC**] key.

Modifying parameters

If you position the cursor on the Data column for a certain parameter Pxxx and press [**Enter**], a red window called Input opens, where you can enter the value you want to give to this parameter. After pressing [**Enter**] this value becomes effective immediately. If you press [**ESC**] the change is ignored.

Of course, you cannot change the value of the drive-internal parameters which are read-only.

Saving parameters

After having changed all the parameters you want (which are active in the RAM area of the controller), you have to save them in the EEPROM area in order to make them permanent and effective also at the next start of the drive. This is done with the following procedure:

- P 193: select the memory for saving (0 ... 2)
- select the parameter P190 of the first page
- input the value 0
- input the value 5
- wait until the P191 parameter in the same page assumes the value 3
- switch off and on the drive's 24 V power supply

Commissioning with PCBASS

The following procedure describes the various steps for commissioning an axis drive with analog control using PCBASS.

Connect the PC with the drive via a serial RS232 cable. Supply the drive with 24 Vdc.

Under MS DOS select the directory where the PCBASS communication software is stored, and issue a UDL command

Check the communication configuration ([**Alt**]-[**O**])

- recommended values:
  - Com = 1
  - Drive Address = 0
  - ID Start = 1
  - ID End = 700
  - Comm Tries = 5
  - Language = 2
  - Time out = 1000
- Exit and return to the main menu with [**ESC**]

Downloading a standard set-up file from the PC to the drive

- Issue the Download command
  - Select the RAM memory from the menu with the [**Up Arrow**] and [**Down Arrow**] keys.
  - Enter into the Files area with the [**Tab**] key.
  - Select the directory and the configuration file (*.UDL) to be downloaded to the drive.
  - Press the Enter key to start the transfer. The PC monitor displays the number of the pages transferred.
  - Normally the download ends with the message *Download error free!*
  - Press the Enter key to return to the main menu.
- If the download finishes with an error message, select the Up/Down Error command. Record the parameters displayed by this command.

- Issue the PCBass command from the main menu.
- Enter into the Files area using the [**Tab**] key.
- Select the DAT file corresponding to the drive's firmware version. (This is found in the P174 and P163 parameters, entering at first with any DAT file.)
  - Press [**F9**] for enabling the link to the drive.
  - If the Download finishes with an error message, check and correct the parameters listed with the Up/Down Error command.
  - Save the parameters in the EEPROM:
    - In page 1, ensure that P193 is 0.
    - In P190 input firstly 0 and then 5. When the save has finished (after some seconds) P191 contains 3.
  - Return to the main menu using[**F9**], [**F10**], [**ALT**]-[**F**], [**Q**].
- Switch the drive off and after some seconds on again (you can do this by unplugging and re-inserting the X5 connector on DAM 60 drives).
- At this point the drive should not display any error if an encoder and a temperature probe are connected.

Preparing a drive for analog control:

Issue the PCBass command from the main menu and execute the following steps:

- P126 = 1
- P120 = 0
- P120 = 6
- P120 = 7
- P120 = 15
- P126 = 0
- Save in the EEPROM.
- Switch off and on again.

Configuring the drive parameters depending on motor, NC and application:

- In order to characterise the motor you have to set the following parameters:
  - P261, nominal current
  - P268, electric constant (K_E)
  - P262, nominal speed
  - P89, termal time constant (in seconds!)
  - P116, current limit (normally equal to the drive's peak current)

- Characterisation for the CNC
  - Check that P279 (AI 1 scaling) is 1
  - P19 (max. application speed): has to be the result of the formula $\frac{Nmax \bullet 10}{Vmax}$, where
  - Nmax: max motor speed in RPM, at max. axis speed characterised in AMP.
  - Vmax: max. voltage in AMP
  - P281, offset
  - The offset is adjusted with the drive completely connected. Connect power and enable without feed. Minimise positioning error so that its average value is as close as possible to 0.
  - P19 (fine adjustment of the speed scale)
  - Set a cyclical axis feed at constant speed with V_{FF}=0. Calculate the theoretical tracking error. Watch the actual positioning error at constant speed and vary the value of P19, until you obtain an error equal to the theoretical one.
- Adjustments for the application
  - P80, P_I, proportional gain of the current loop
  - P81, I_I, integrative gain time constant of the current loop
  - P57, P_N, proportional gain of the speed loop
  - P58, I_N, integrative gain time constant of the speed loop
  - P238, filter for the speed calculation (typically 1ms)
  - P116, current limit. Normally one uses the drive's peak current. If the value of this parameter is drastically reduced, it may also be necessary to reduce the value of P80. Current limitation is indicated by the LED in position H21.2.

You can set the parameters for gain of the speed and current loops by displaying the speed and current signals searching with linear ramps with step command but without instability and excessive overshoot.

NOTE:

If the changes have to be kept, save the parameters in the EEPROM before switching off!

DRIVES WITH SERCOS INTERFACE

Parameters

For the SERCOS drives the following parameters have to be configured differently to those with analog control.

Base parameters

P492		length of the fibre optic cable connected to the drive's “OUT” connector (in meters, default 15m)
P133	3	shutdown code
P126	0x000D	communication source
P353 P354 P355	166 0x0010 0x0010	LED H22.2 (red, second position in the lower row on the controller board), it lights up when the control processor is synchronised with the SERCOS cycle (important for telegram 4)
P127	4	enables monitoring of the communication between the control processors and SERCOS
P128	10 x cycle time	monitoring time-out) (e.g.: 2 ms x 10 = 20 ms)
P129	3	monitoring code (rapid halt)
P226	1	disables encoder emulation
P330 P334	0 0	disables the analog outputs
P202	20 ... 100	Kv factor, proportional gain of the position loop
P207	0 ... 100	N precontrol, Vff of the position loop
P213	1 ... 5	N precontrol smoothing,
P201	0 1	measured position of the motor encoder (default value for axes without external encoder) position measured by external encoder on X24

NOTE:
The analog outputs can be enabled for drive tests (setting of the response for speed, current, etc.). Thereafter they have to be disabled and stay disabled during normal machine operations.

The SERCOS address of the drive has to be selected via the rotary switch S48 on the drive's front panel.

The values for the parameters P202, 207 and 213 depend on the application: the numbers in the table are those normally used. The correct value can be determined during installation.

Telegram type

During start-up the CNC has to tell the drive which telegram type is used; default is telegram type 4.

NOTE:
The two green LEDs on the SERCOS board indicate when the drive is in phase 4. Initialisation has only been completed when both are on.

The values of some of the drive parameters depend on the telegram type:

Telegram 4 (positioning control - mode used by the OSAI controllers):

P122	-5	operation mode: synchronisation (positioning control)
P251	3	synchronisation mode: positioning command
P255	1	transmission ratio
P256	1	transmission ratio
P167		SERCOS cycle time in microseconds
P159	1	parameter for the operating system
P168	0	synchronisation offset, operating system
P470	258	pointer 1 for the positioning command
P472	6	
P486	218	pointer 1 for the measured position
P488	219	pointer 2 for the measured position

Telegram 3 (speed control):

P122	-3	operation mode: speed control
P470	2	pointer 1 for the speed reference value
P013	1	selection of the ramp generator channel
P003		upward ramp time, in seconds
P010		downward ramp time, in seconds
P472	6	
P486	218	pointer 1 for the measured position
P488	219	pointer 2 for the measured position

NOTE:
The value of parameter P167 has to correspond to the contents of the parameter *Position loop clock* in AMP of the NC for the same axis (the measurement units differ!).

Volatile parameters

There are some parameters the drive cannot memorize and so lose the set value when power is not supplied. These parameters can be automatically written into the drive at start-up using the DSILOAD.CMD file in the E:\USD directory. The parameters for the roll-over axis and rotation inversion belong to this group.

Reading the error code

If there is an error in the SERCOS drive, it will be periodically cancelled by the SERCOS interface. Therefore, the error code inside the drive cannot be seen and the error message cannot be read on the H20 display.

By using the service channel the SERCOS interface allows to read the error code via the (IDN) SERCOS parameter S129. If there is an error the error code will be stored in this IDN according to the code table in the Programming Manual.

The code in the IDN S129 can be cancelled with the command issued via IDN S099.

Drive programming

In order to initialise the SERCOS drive parameters you should follow the same procedure used for drives with analog control. This mainly consists in downloading a configuration file derived from a former application into the drive to be installed. The configuration file may also be loaded from the CNC. However, it is important that the file has been previously saved with the CNC. The files saved with the PC and those saved with the CNC are not compatible between each other. Concerning the parameter for motor and application, the set-up of the drives is the same as for analog drives. Also here you can use the CNC or the serial line (in this instance regardless of the file type - save with the PC or the CNC).

Regarding analog drives, the following set-ups have to be carried out:

- configuring the axes homing cycle
- feed reverse, if necessary
- configuring the external encoder, if used
- configuring the probe, if used
- configuring the roll-over axis, change of the electric pitch

Configuring the axis homing cycle

For the SERCOS drive the whole homing cycle is under the drive's control. The CNC issues only the start command, follows the axis position and waits for the end of the cycle. In order to execute this operation the following parameters have to be configured:

P413:	acceleration
P442:	deceleration
P412:	micro search speed
P443:	marker search speed
P414:	homing type
P434:	micro type (NC, NO)
P374 - 375 - 376 - 377:	programming Digital Input 2

NOTE:
After the SERCOS drive has finished a homing cycle, the message on the CNC indicating *Axis homed ...*, always shows zero as the distance of the marker signal from the home micro: *Distance home – marker: 0.00000.*

Acceleration and speed

You have to calculate the values for acceleration, deceleration, speed during micro search and speed during marker search, convert them into the used measurement units and input them into the respective parameters. The measurement units are [number of pulses /ms] for speed and [number of pulses /ms^2] for acceleration. There are 65,536 pulses per one motor turn (regardless of the encoder actually used for measuring the position).

NOTE:
For a correct execution of the homing cycle, the following condition has to be fulfilled:

[P412] / [P443] > 8 !

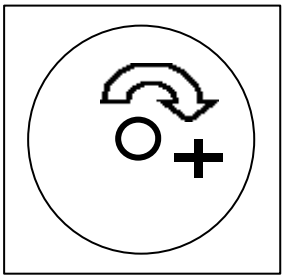
Example for calculating values for speed and acceleration:

mechanical pitch:	12	mm/motor turn	
micro search speed:	5	m/min	
	417	RPM	
	27,306,667	pulses/min	
	455	pulses/ms	(to be written into **P412**)
marker search speed:	**46**	pulses/ms	(to be written into **P443**)
acceleration/decel.:	1,500	mm/s^2	
	125	turns/s^2	
	8,192,000	pulses/s^2	
	8.19	pulses/ms^2	(to be written into **P413**)
	8.19	pulses/ms^2	(to be written into **P442**)

Homing type

The homing type code has to be entered into the P414 parameter. You determine its value by taking into account the following data:

- feed during homing:
  - search for home micro
  - feed reversal
  - search for marker
- the transducer type used for homing may be:
  - SinCos encoder (mounted on the motor) connected to the X25 connector
  - incremental encoder (mounted on the axis) connected to the X24 connector
- rotation sense of the motor during micro search interpreted according to the following figure (motor shown from the shaft side)



Encoder (type and connector)	micro search direction	value of P414
SinCos, X25	negative sense	2001
SinCos, X25	positive sense (+)	2002
Extern, X24	negative sense	1101
Eastern, X24	positive sense (+)	1102

NOTE:
If you use the base configuration (without external encoder), the value depends only on the rotation sense and is 2001 or 2002.

Home micro type

The home sensor can be normally closed or normally open, and this has to be stated in parameter P434:

for a normally closed micro: P434 = 3

for a normally open micro : P434 = 0

Digital Input 2

For handling the signal from the home micro connected to the programmable Digital Input 2 you have to set the relative parameters as follows:

P374 = 433

P375 = 3

P376 = 0

P377 = 3

NOTE:
If necessary, you can use Digital Input 3 or Digital Input 4 for connecting the micro. Then configure the relative parameters as described in the Programming Manual.

(The Digital Input 1 is reserved for the probe signal!)

Feed reversal

If there is an axis run-away during the first feed or the direction is wrong, you can use the SERCOS (IDN) S055 *Position polarity parameters*. These are part of the volatile parameters. Therefore, you have to send the correct feedback and reference direction values via the CNC.

On the bit level the IDN 55 is structured as follows:

bit 0: invert the positioning command sent by the CNC

bit 2: invert the drive's feedback

In order to change the direction of an axis, set both bits to 1 i.e. the parameter value will be 5.

If the axis starts a run-away because the polarity is inverted, you must set only one bit: either the command (IDN 55 = 1) or the feedback (IDN 55 = 4) depending on the requirements.

Application of an external encoder

If the application requires a higher level of positioning precision, you can use an external encoder electrically linked to the drive. In this case the drive has to be configured for position management with an external encoder by programming the following parameters:

P201=4: indicates position recording by external encoder

P040=0x0020: interface configuration for external encoder

P024: number of pulses from the external encoder

You have to calculate how many pulses the encoder generates for one complete turn of the motor. Normally this encoder is mounted directly on the mechanical part and due to the transmission ratio between encoder and motor this number of pulses may not be an integer, whereas the P024 parameter accepts only integers. The rounding of this number causes an axis positioning error during feeds. In order to compensate for this error you have to alter the mechanical pitch of the CNC. The complete procedure is as follows:

- Calculate the number of pulses the encoder generates for a full turn of the motor (Nimp)
- If this is an integer, write it directly into the P024 parameter (end of procedure).
- If the result is not an integer, round to the nearest integer (Nint).
- Calculate the value $Pmc = Pm \bullet \frac{Nint}{Nimp}$, where Pm is the mechanical pitch of the axis
- Write Pmc into the CNC (AMP, *AXIS CHARACT* \ *mechanical pitch*).

Probing

Drives with the SERCOS interface are equipped with the probing cycle function. The probe's trigger signal output has to be connected to Digital Input 1.

The probing mode is configured with the P221 parameter of the drive and the AMP of the controller:

Encoder used for the probe	active trigger	value of parameter P221
Extern	positive front	0x0001
SinCos of the motor	positive front	0x0011

The parameter *Probing configuration* in the AMP has to be set to a value of 2.

NOTE:
minimum time between 2 trigger pulses: 1 ms.

Roll-over axis, electrical pitch

If you want to manage an axis in roll-over mode or change the electrical pitch, you have to configure the following parameters:

S076: position data scaling

S079: rotational position resolution

S103: rollover modulo

These parameters are initialised by downloading a file from the CNC during start-up.

S076 – position data scaling type

Bit no.	meaning
0 … 2	010: rotational scaling type
3	0: preferred scaling 1: parameter scaling
4 … 6	always 0
7	0: absolute format 1: modulo format

This serves to change the electrical pitch and to define the axis as roll-over. The default value is 2, which means the default resolution of 3,600,000 pulses/turn is to be used.

Other possible values:

0xA: bit 3 set to 1 to indicate that a resolution other than the default one is to be used. The new resolution is passed in the IDN 79.

0x82: bit 7 set to 1 to indicate that you want the axis modulo (roll-over axis). The modulo value is passed in the IDN 103.

0x8A: both bits (3 and 7) set to 1. In this case you have a roll-over axis with user defined resolution.

S079 – rotational position resolution

If you have set bit 3 = 1 in parameter S076 - in this parameter you have to state the number of pulses per turn which are different from the default value 3,600,000. In this case the same value also has to be written into the *electrical pitch* parameter in AMP.

The value set has to comply with the following rule:

Range		**the set value has to be a multiple of**
1 … 2^{15}-1	(1 ... 32,767)	-
2^{15} … 2^{16}-1	(32,768 ... 65,535)	2
2^{16} … 2^{17}-1	(65,536 ... 131,071)	4
2^{17} … 2^{18}-1	(131,072 ... 262,143)	8
2^{18} … 2^{19}-1	(262,144 ... 524,287)	16
2^{19} … 2^{20}-1	(524,288 ... 1,048,575)	32
2^{20} … 2^{21}-1	(1,048,576 ... 2,097,151)	64
2^{21} … 2^{22}-1	(2,097,152 ... 4,194,303)	128

S103 – modulo value

For roll-over axes this parameter contains the number of pulses after which the position is reset to zero. This is the same value as stated in the *Rollover pitch* parameter in AMP, converted and expressed in number of pulses. You calculate it as follows:

[S103] = ([*rollover pitch*] / [*mechanical pitch*]) * [*electrical pitch*],

where *rollover pitch*, *mechanical pitch* and *electrical pitch* are the AMP parameters.

NOTE:

At start-up the Sxxx parameters listed above have to be automatically initialised by the CNC using the file E:\USD\DSILOAD.COM (for details see the Software Characterization Manual for the AMP).

Start-up Sequence

The drive is enabled (the H20 display shows "4") and the axis can be moved by CNC commands, when:

- the drive electronics are supplied with +24 Vdc
- the Rapid Halt and Enable inputs are connected to +24 Vdc
- power (400 Vac) is connected
- the enable command has been issued via SERCOS

In order to reach the enable state during machine start-up you have to stick to the following timing:

- The Rapid Halt signal has to be connected to +24 Vdc before or at the same time the power is inserted.
- After inserting the power, you have to wait until the internal capacitor has been charged. This is the case, when the H20 display shows "2" and can be recognised by the CNC reading the drive's Status Word (bit15=1, bit14=0 in the drive's Status Word). Only then the SERCOS enable command may be issued.
- A standard sequence could be as follows:
  - switching-on +24 Vdc
  - inserting +24 Vdc to the Rapid Halt input
  - switching on power
  - waiting for status 2
  - inserting +24 Vdc to the enable input
  - issuing the SERCOS enable command (for details see the Software Characterization Manual for the AMP)

NOTE:

If the drive has to be disabled temporarily, the corresponding SERCOS command must be used. The signal on the enable input must be left active. (If the drive is disabled with that signal, any axis movement will create an error which is not reset after subsequently re-enabling the axis.)

Calculating the Following Error

When using a SERCOS drive, the following error displayed by the CNC does not take account of the delay in the position information transmission, hence the value read on the CNC is greater than the actual one.

You calculate the theoretical error out of the known axis speed and position loop gain inside the drive:

ε(theoretical) = speed / (60 * Kv)

The actual error of the axis is calculated out of the error read on the CNC taking into account the errors caused by the transmission:

ε(actual) = ε(read) - 4 * T(scanning) * speed / 60,000

The measurement units for the physical entities are:

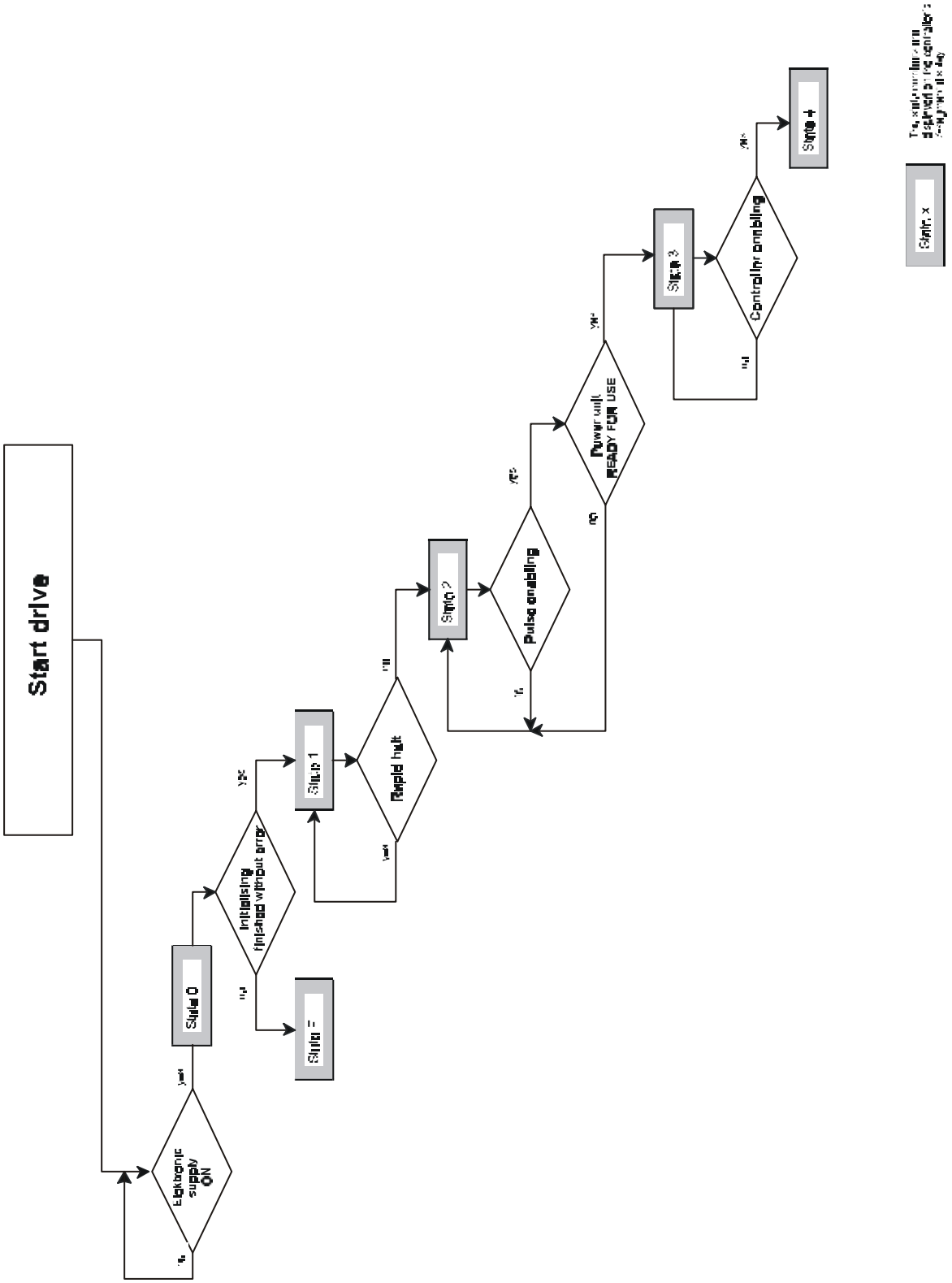
[ε] = mm

[speed] = mm/min

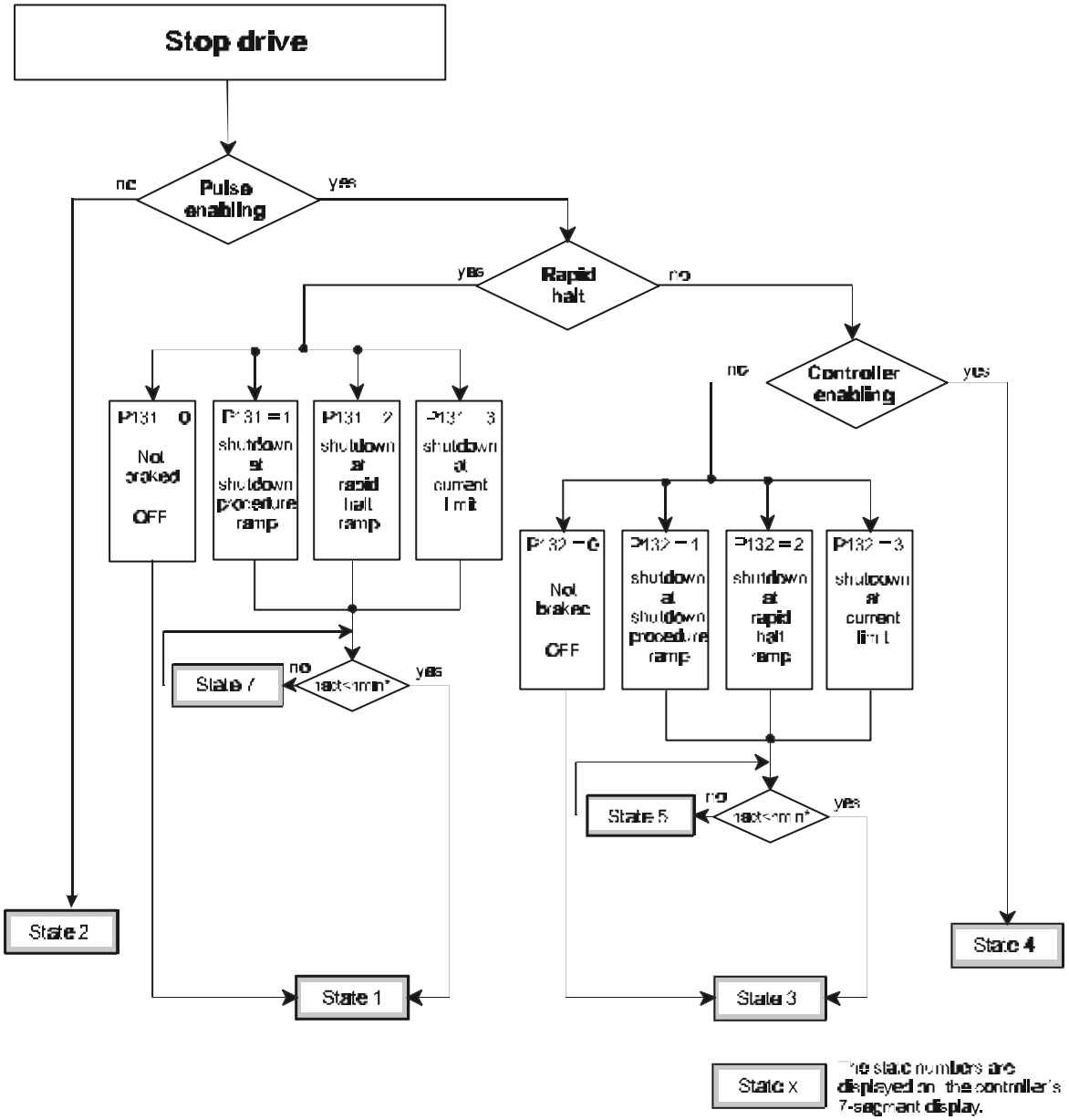
[T scanning] = ms

[Kv] = 1/s

COMMANDS TO START THE DRIVE



COMMANDS TO STOP THE DRIVE

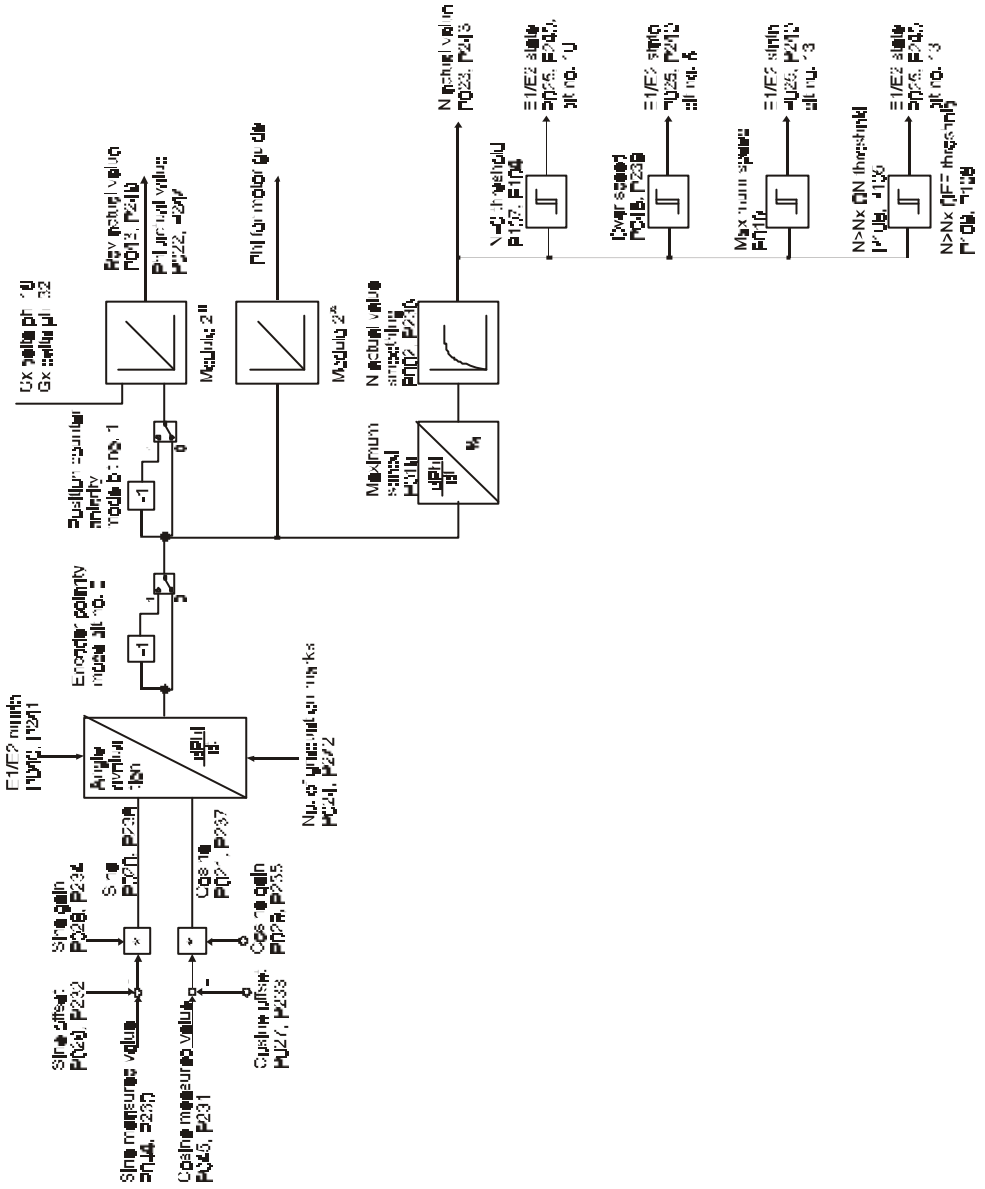


END OF CHAPTER

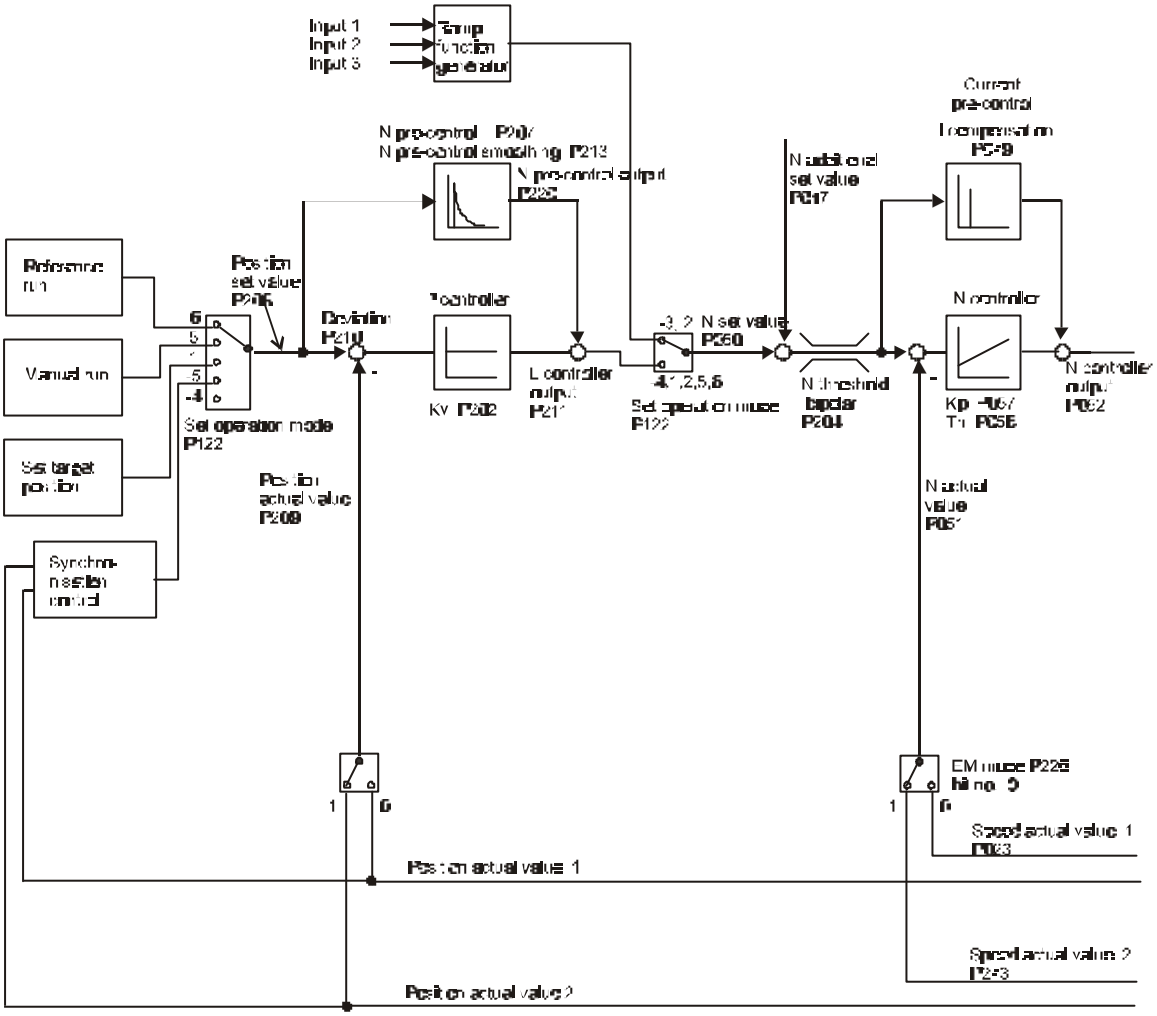
PARAMETER

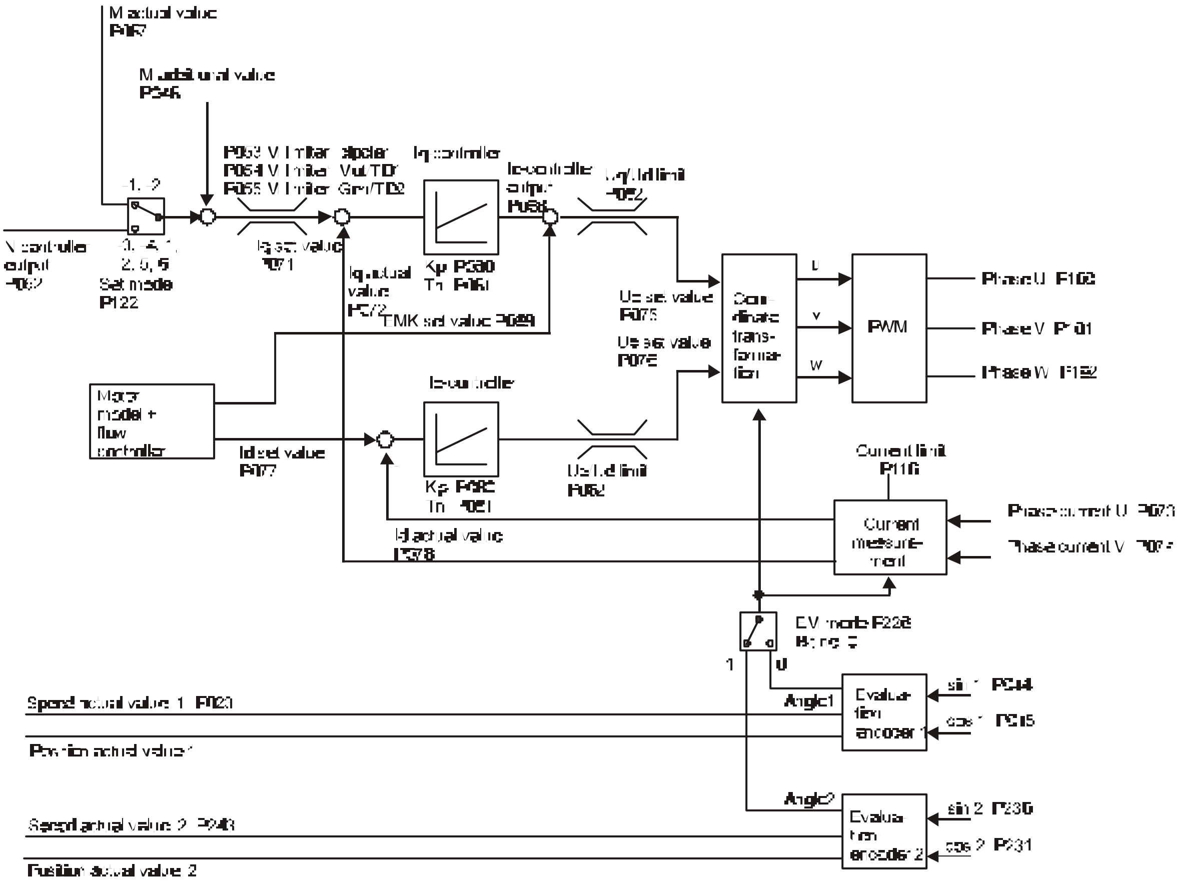
FUNCTION DIAGRAMS

Encoder Evaluation

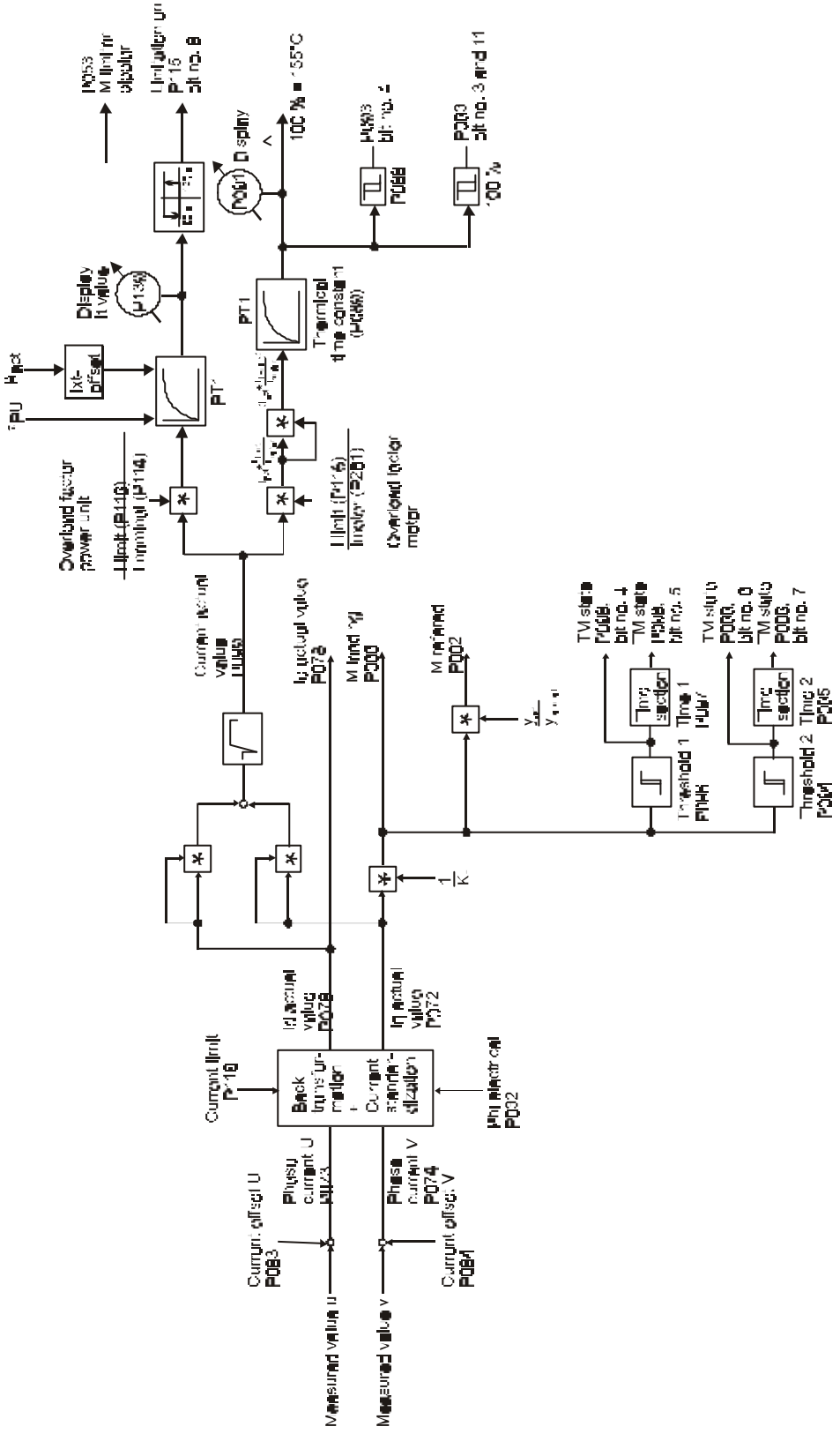


Overview DSV-6 Controller




Set mode
P122
Motor
model +
flux
controller
Id set value
P077
Kp P330
Current limit
P116
Current
measure-
ment
Co-
ordinate
trans-
forma-
tion
PWM
u
v
w
Angle1
Angle2
sin 2 P230
cos 2 P231
1
0
Position actual value 2

Current Measurement and Monitoring



POWER SUPPLY

Function

The function module indicates the status of the power supply unit and the intermediate circuit. Moreover the function voltage failure compensation and intermediate circuit monitoring is implemented.

Parameter description

Parameter	Name	Range min. ... max.	Unit	Display only
P110	PS state	0000 ... FFFF		X
P087	PS U_{ZK} nominal	280 ... 1000	V	
P111	PS voltage Uzk	97 ... 1000	V	X
P112	PS voltage failure time	0 ... 6	s	

Parameter description

P110 PS **state**

This parameter indicates the present power supply state.

Bit no.	Meaning
0 ... 2	0 : STOP Ready for use signal power supply is not monitored 1 : RUN Ready for use signal power supply is monitored 3: STAND BY State after status transition 3 in drive manager. The time to load the intermediate circuit is considered. After maximal 10 s the ready for use signal of the power supply must be available, otherwise the fault 0110 is created.
3	1 : Fault in function module, fault code see M fault code (P124)
4	1 : Main contactor is on
5	1 : Warning voltage failure
6	1 : Ready for use signal of power supply is available
7 .. 15	reserved

P087 PS **Uzk nominal**

This parameter sets the nominal intermediate circuit voltage of the power unit.

$$U_{ZK} = U_{Mains} \cdot \sqrt{2}$$

UMains: voltage between lines

P111 PS **voltage Uzk**

This parameter displays the actual intermediate voltage in V.

P112 PS **voltage failure time**

Within this time an automatic restart of the drive after a voltage failure is possible.

Value	Meaning
= 0	automatic start not possible
> 0	automatic start possible

For a voltage failure the following sequence will arise:

The voltage failure is acknowledged by the power supply unit and its disabled status is relayed to the controller by means of the ready for use signal.

The function module power supply recognises this and relays it via bit no. 5 = 1 (warning voltage failure) to the drive manager, and starts a timer, set with the mentioned time.

The drive manager changes form the status OPERATION ENABLED to the status SWITCHED ON, whereby the method by which this is achieved (see function module drive manager) is set via the parameter M INHIBIT code (P132).

The drive manager remains in the state READY TO START until:

either

the set voltage failure time has expired. After which the function module power supply registers a fault and the drive manager changes to the status FAULT.

or:

the main voltage returns before the end of the voltage failure time . If this occurs the power supply unit resets the signal ready for use (see documentation on power supply unit). The function module power supply acknowledges the new status and reacts by setting bit no. 5 to 0 (warning disabled). The drive manager returns again to the status OPERATION ENABLED and the drive ramps-up automatically.

It is assumed that the controller electronics are supplied with voltage during the voltage failure time!

POWER UNIT

Parameter description

Parameter	Name	Range min. ... max.	Unit	Display only
P115	PU **state**	0000 ... FFFF		X
P090	PU **mode**	0000 ... 0001		
P117	PU **type**	0.1 ... 2500.0		X
P114	PU **I nominal**	0.1 ... 2500.0	A	X
P113	PU **I max**	0.0 ... 2000.0	A	X
P119	PU **overload time**	0.00 ... 600.00	s	X
P116	PU **I limit**	The range depends on the PU. Permitted range: $\frac{PUInom}{4} \leq PUIlimit \leq PUImax$	A	
P118	PU **temperature**	-80 ... 130	°C	X
P139	PU **Ixt value**	0.00 ... 200.00	%	X

Parameter description

P115 PU **state**

This parameter displays the state of the power unit.

Bit no.	Meaning
0 ... 2	0 : STOP 1 : RUN
3	1 : Error in function module, error code see M error code (P124)
4	1 : Power unit reset is active
5	1 : Pulses are enabled, power unit is active
6	1 : Power unit temperature > 80 °C
7	1 : Power unit ready for use
8	1 : PU monitoring is active, current reduction to 100% I_{nom} power unit, after overload
9 ... 15	reserved

P090 PU **mode**

The parameters P114, P113 and P119 can only be changed, if PU Mode 0001hex and the password is correct..

Bit no.	Meaning
0	0 : Read the power unit´s characterisation, data is set according to the characterisation 1 : Characterization is not read, PU data is read from EPROM
1 ... 15	reserved

P117 PU **type**

The parameter displays the type of the power unit. The value 0 characterizes an unknown power unit.

Version	Power unit	Nominal/peak current effective	
		PWM: 8kHz	PWM: 4kHz
6211	DSM621	10 A / 15 A	12.5 A / 15 A
622	DSM622	14.7 A / 22 A	18.3 A / 22 A
623	DSM623	20 A / 30 A	25 A / 30 A
6240	DSM624	38 A / 57 A	47.5 A / 57 A
6241	DSM624	45 A / 67.5 A	56 A / 67 A
600	DAM60	12 A / 24 A	15 A / 24 A
601	DAM60	6 A / 12 A	7.5 A / 12 A
602	DAM60	3 A / 6 A	3.7 A / 6 A
62	DAM62	57.7 A / 75 A	75 A / 97.5 A
6201	DSK62	75 A / 97.5 A	90 A / 97.5 A
6301	DSK63	150 A / 195 A	180 A / 195 A

How to change the power unit data, see below:

PU mode = 0001hex P090

DSM command = 0 P190

DSM command = 8 P190

Enter password 1

Parameter P013, P114 and P119 can now be set and the PU characterization is not be read at booting.

Values for peak current (P113), nominal current (P114) and overload time (P119) see table above.

PU I max = set table value	P113
PU I nominal = set table value	P114
PU overload time = set table value	P119
PU I limit = set value	P116
DSM command = 0	P190
DSM command = 5	P190

→ Values are stored in the EEPROM

The data of the power unit is available now on every switch on.

NOTE

After each change of parameter P103 (PWM) the data must be saved, the controller switched off and booted new to set the new power unit parameters.

P114 PU **I nominal**

This parameter displays the power unit´s nominal current. This current can be supplied for an unlimited time.

P113 PU **I max**

This Parameter shows the power unit´s peak current. The peak current is greater or equal power unit nominal current.

P119 PU **overload time**

During the overload time the power unit can supply the peak current. After that the nominal current (P114) is limited. The bit no. 8 in PU state (P115) displays the limitation.

P116 PU **I limit**

This parameter sets the standardization of the current controlling.

Standardization

100 % « I limit

The limits of this parameter depend on the power unit used.

Example: PU type = 6211 « BUS 621 (10 A / 15 A)

P118 PU **temperature**

This parameter displays the power unit´s temperature.

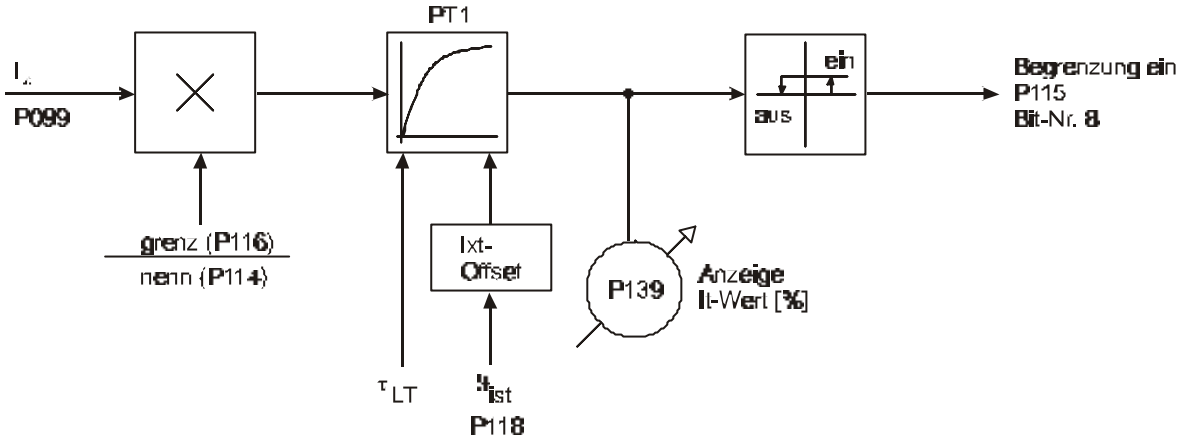
A temperature over 80 °C enables the bit no. 6 in PU state (P115). Exceeds the power unit´s temperature 85 °C the error 0205_{hex} appears.

P139 PU **Ixt value**

This parameter displays the actual I*t value of the overload monitoring. At a value equal 100 % follows a current limitation to nominal current (P114). Drops the I*t value below 95% the current value is set to PU I limit (P116).

Function of the power unit´s overload monitoring

This monitoring protects the power unit from thermic overload. The temperature of the power unit is imitated and monitored by a I*t model.



Current set value	(I_{act}) [A_{eff}]	P099
PU nominal current	(I_{nom}) [A_{eff}]	P114
PU maximum current	(I_{max}) [A_{eff}]	P113
PU limit current	(I_{limit}) [A_{eff}]	P116
PU overload time	(t_O) [s]	P119
PU temperature	(ϑact) [°C]	P118
PU Ixt value	(Ixt) [%]	P139
PU overload factor max	(u_{max}) [%]	
PU overload factor actual	(u) [%]	
PU thermic time constant	(τ_{PU}) [s]	
PU reaction time	(t_{rea}) [s] time till the limitation of I_{nom}	
PU Ixt offset	(Ixt offset) [%]	

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

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

$$\tau_{PU} = -\frac{t_0}{\ln\left(\frac{u_{max} - 100}{u_{max}}\right)} \quad [s]$$

– for power unit temperature > 45 °C

$$\text{Ixtoffset} = \frac{\vartheta_{act} - 45°\,C}{85°\,C - 45°\,C} \cdot 100 \qquad [\%]$$

– otherwise

Ixt offset = 0 %

$$t_{rea} = \tau_{PU} \cdot \ln\left(\frac{u - 100}{u - \text{Ixtoffset}}\right)$$

Example:

I_{nom} = 10 A_{eff} (DSM 621)

I_{max} = 15 A_{eff} (DSM 621)

t_u = 1 [s] (DSM 621)

I_{act} = 12 A_{eff}

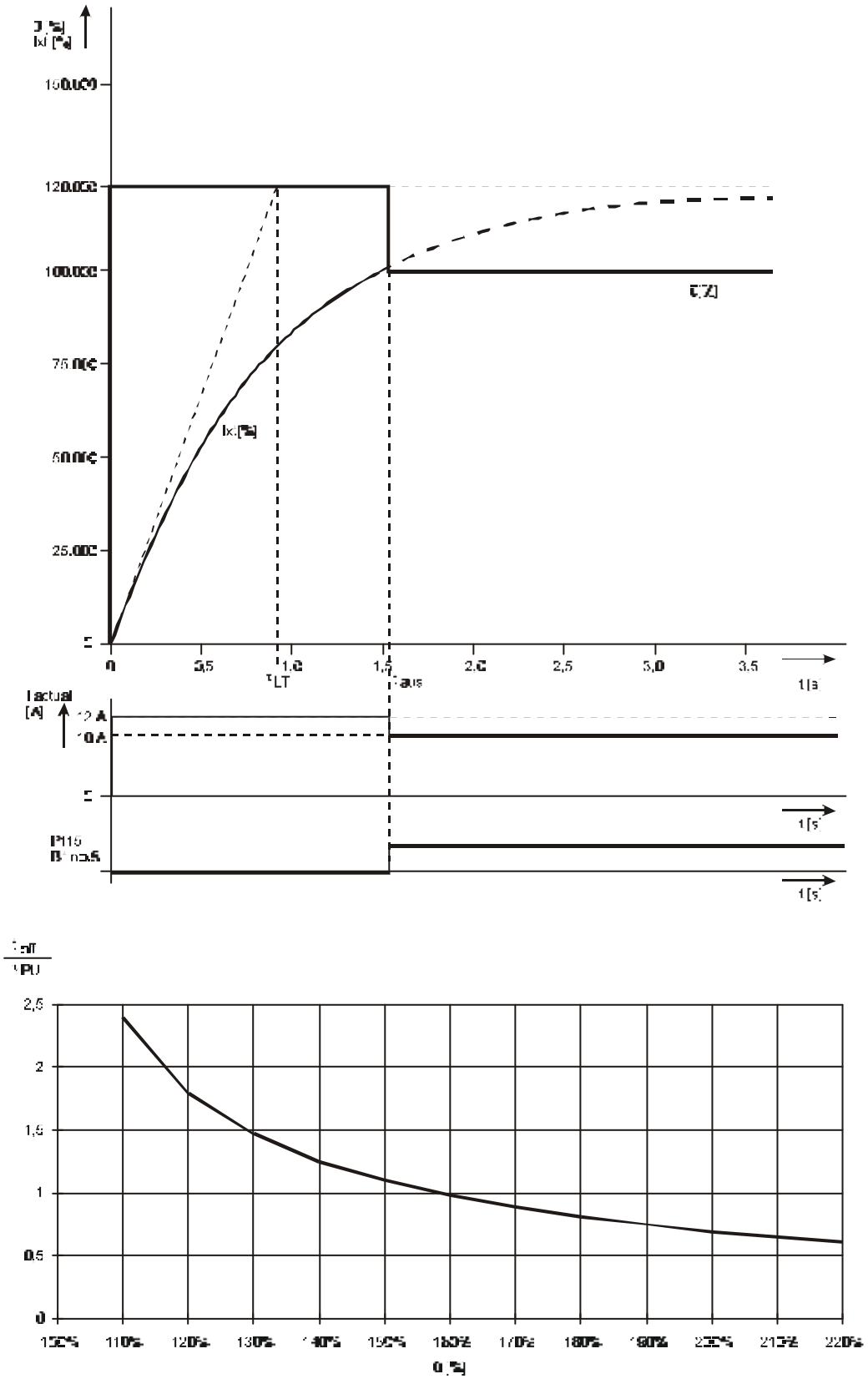
ϑ_{act} = 35 °C

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

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

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

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



This characteristic curve refers to a “cold” power unit (Ixt Offset = 0%; ϑ_{ist} < 45°C).

PULSE WIDTH MODULATION

Function

The parameters of the pulse width modulation module only serve to display the values supplied by the current controller.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P100	PWM **phase U**	-100.00 ... +100.00	%	X
P101	PWM **phase V**	-100.00 ... +100.00	%	X
P102	PWM **phase W**	-100.00 ... +100.00	%	X
P103	PWM **frequency**	4.0 ... 8.0	kHz	

Parameter description

P100 PWM **phase U**

P101 PWM **phase V**

P102 PWM **phase W**

These parameters display the angle α of the relative power transistors for the individual phases. The sum of these 3 parameters is always 0.

This means:	+100.00 %	to a regulation angle of	α = +100 %
	0	to a regulation angle of	α = 0 %
	-100.00 %	to a regulation angle of	α = -100 %

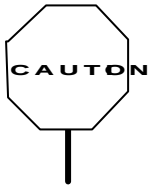
The resultant voltage (middle values) at the power supply terminals can be calculated as follows:

$$\overline{U_{UV}} = U_{ZK} \cdot \frac{\text{PWM phase U} - \text{PWM phase V}}{\text{maximum total range}} = P111 \cdot \frac{P100 - P101}{200{,}00\%}$$

$$\overline{U_{VW}} = U_{ZK} \cdot \frac{\text{PWM phase V} - \text{PWM phase W}}{\text{maximum total range}} = P111 \cdot \frac{P101 - P102}{200{,}00\%}$$

$$\overline{U_{WU}} = U_{ZK} \cdot \frac{\text{PWM phase W} - \text{PWM phase U}}{\text{maximum total range}} = P111 \cdot \frac{P102 - P100}{200{,}00\%}$$

Whereby U_{ZK} is the intermediate circuit voltage which is indicated via P111. Due to the underlying cycle frequency this voltage cannot be measured on universal devices.



Even with an output voltage close to zero, the pulsed intermediate circuit voltage is detectable at the terminals. In addition a potential of > 300 V to earth may be detected at the terminals.

P103 PWM **frequency**

The frequency of the power unit is normally 8.0 kHz and can be changed to 4.0 kHz (values between are not possible).

MOTOR MODEL

Function

This function module sets the parameters for synchronous and asynchronous machine.

Parameter overview synchronous machine

Parameter	Name	Range min. ... max.	Unit	Display only
P260	MM **magnetizing current Id**	0.0 ... P116	A	
P261	MM **motor nominal current**	•	A	
P268	MM **Ke factor**	0 ... 400	V/1000	

Parameter overview asynchronous machine

Parameter	Name	Range min. ... max.	Unit	Display only
P260	MM **magnetizing current Id**	0.0 ... P116	A	
P261	MM **motor nominal current**	•	A	
P268	MM **Ke factor**	0 ... 400	V/1000	
P264	MM **Kp flux controller**	0.2 ... 15.9		
P265	MM **Tn flux controller**	0.0 ... 1000.0	ms	
P293	MM **Tr rotor actual value**	0 ... 1000	ms	X
P266	MM **flux set value**	0 ... 100	%	X
P267	MM **flux actual value**	0 ... 100	%	X
P269	MM **mode**	0000 ... FFFF		
P262	MM **nominal speed**	1 ... 11500	rpm	
P294	MM **frequency temperature 1**	10 ... P263	Hz	
P295	MM **temperature 1**	-30 ... P296	°C	
P263	MM **nominal frequency**	P294 ... 600.0	Hz	
P296	MM **temperature 2**	P295 ... 230	°C	
P297	MM **frequency = f (temp)**	10.00 ... 600.00	Hz	X
P291	MM **MGen1 Nnominal**	0 ... 100	%	
P292	MM **MGen2 12000 rpm**	0 ... P291	%	

- Minimal value = 1/10 * nominal current of the power unit
  Maximum value = peak current of the power unit (see parameter P117 LT version)

Parameter description for synchronous and asynchronous machines

P260 MM **magnetizing current I_d**

This parameter sets the difference between synchronous and asynchronous machine.

SM: $I_d = 0$

AM: See I_d from motor data sheet

If I_d is not known, it can be calculated approximately

$$I_d = |I| \cdot \sqrt{1 - (k \cdot \cos\varphi_n)^2}$$

It is: |I| = motor nominal current (P261)

cos φn = cosφ motor in nominal load (see type code)

k = 1.0 ... 1.3

NOTE

You must check that the locating angle (P035) is set correctly at switching of asynchronous and synchronous machines.

P261 MM **motor nominal current**

This parameter sets the motor nominal current. Moreover it is used to calculate the overload factor of the motor I^2t monitoring.

$$\text{Overloadfactor} = \frac{\text{Motor nominal current (P261)}}{\text{Ilimit (P116)}}$$

P268 MM **Ke factor**

Here, you set the motor EMF, relative to 1,000 RPM (voltage constant), of the synchronous or asynchronous machine.

If no value is available for the Ke factor, you can proceed as follows:

- Set a speed specified value that corresponds to the motor's rated speed (P262)
- Enable the drive and run it at no-load
- By changing Ke (P268), bring the Iq controller output (P068) down to approximately 0%

Parameter description for asynchronous machines

P264 MM **Kp flux controller**

This parameter sets the gain (Kp) of the flux controller.

Kp = 3 ... 6.

P265 MM **Tn flux controller**

This parameter sets the integral action time (Tn) of the flux controller.

Tn ≈ 1/2 * P293.

P293 MM **Tr rotor actual value**

This parameter displays the rotor time constant (Tr) of the asynchronous machine.

NOTE

When there is a pulse and controller enable at the same time, the torque specified value does not become effective until 3 x Tr has expired. This ensures that torque build-up is based on an existing magnetic field.

P266 MM **flux set value**

P267 MM **flux actual value**

This parameter shows the flux actual and set value of the asynchronous machine.

P269 MM **mode**

Bit no.	Meaning
0	0 : Follow-up of temperature is switched off 1 : Follow-up of temperature is active
1	0 : Generatoric torque limiting is switched off 1 : Generatoric torque limiting is active
2 ... 15	reserved

P262 MM **nominal speed**

The nominal speed can be read on the type label / motor data sheet of the motor.

P263 MM **nominal frequency**

The nominal frequency at nominal torque can be read on the type label / motor data sheet of the motor. This nominal frequency results in the thermic state of the machine - P296 MM temperature 2 (warm).

P294 MM **frequency temperature 1**

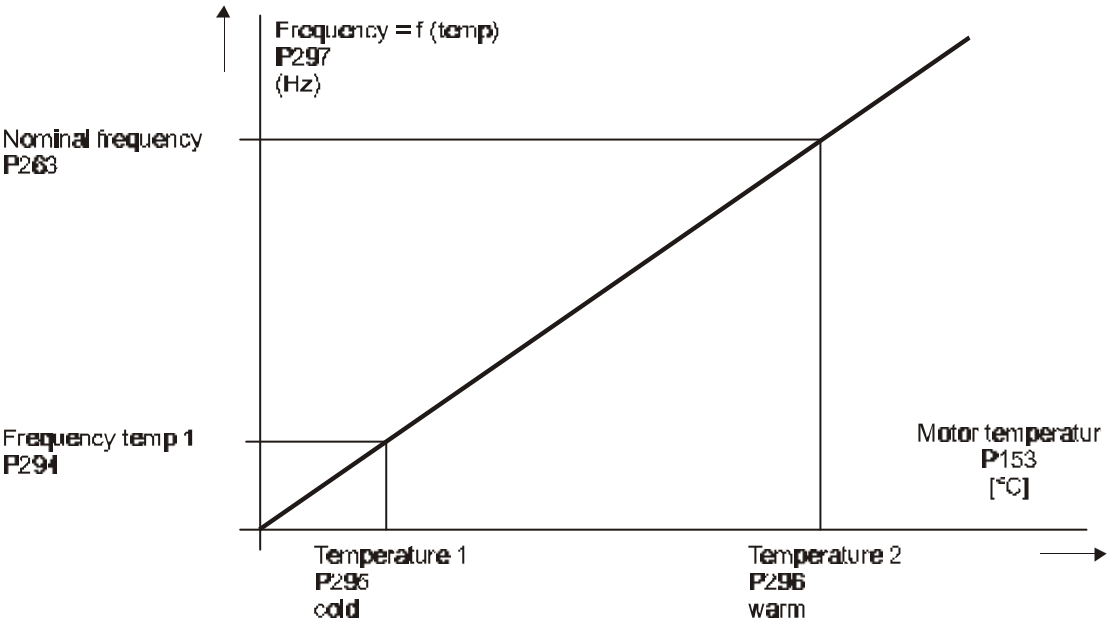
P295 MM **temperature 1**

P296 MM **temperature 2**

P297 MM **frequency = f (temp)**

The asynchronous motor's rated frequency is changed; this change is linear in dependence on the motor temperature (P153). As a result of this, there is constant torque across the motor temperature, assuming that the cross current is constantly regulated.

It is:	10.0 Hz	≤	P294	≤	P263	≤	600.0 Hz
	-30°C	≤	P295	≤	P296	≤	230°C



As a good approximation, you can expect for the slip while the machine – P295 MM temperature 1 – is cold, approximately 75% of the rated slip under thermic loading.

This results in the frequency that has to be set for temperature 1:

$$\text{P294 MM frequency temp 1} = \frac{\text{P263} + \dfrac{\text{P262}}{60\,\dfrac{\text{s}}{\text{min}}} \cdot \text{P033} \cdot 0{,}3}{1{,}3}$$

Example:

P263	MM nominal frequency	=	53,6 Hz
P295	MM temperature 1	=	20 °C
P296	MM temperature 2	=	80 °C
P262	MM nominal speed	=	1500 rpm
P033	Mot no. of pole pairs	=	2

$$\text{P294 MM frequency temp 1} = \frac{53{,}6\,\text{Hz} + \dfrac{1500\text{rpm}}{60\,\dfrac{\text{s}}{\text{min}}} \cdot 2 \cdot 0{,}3}{1{,}3} = 52{,}8\,\text{Hz}$$

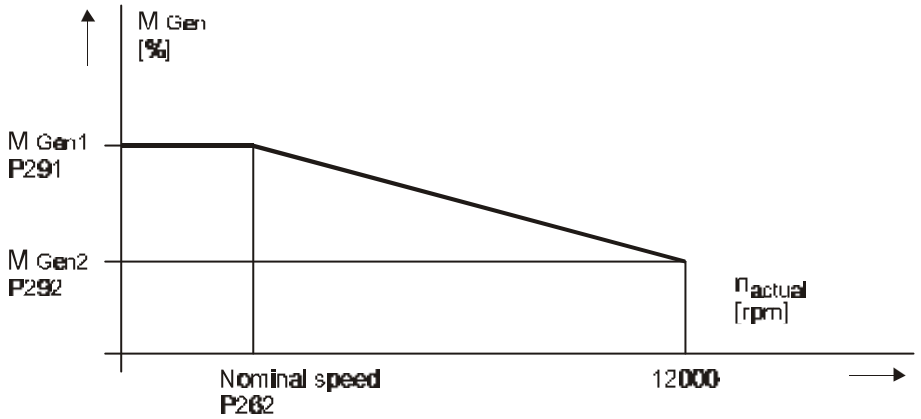
P291 MM **MGen1 Nnominal**

P292 MM **MGen2 12000 rpm**

This parameter sets the torque limiting at generator-operation of the asynchronous machine.

This results in identical torque in motor as well as generator terms.

It is 0 % ≤ P292 ≤ P291 ≤ 100 %



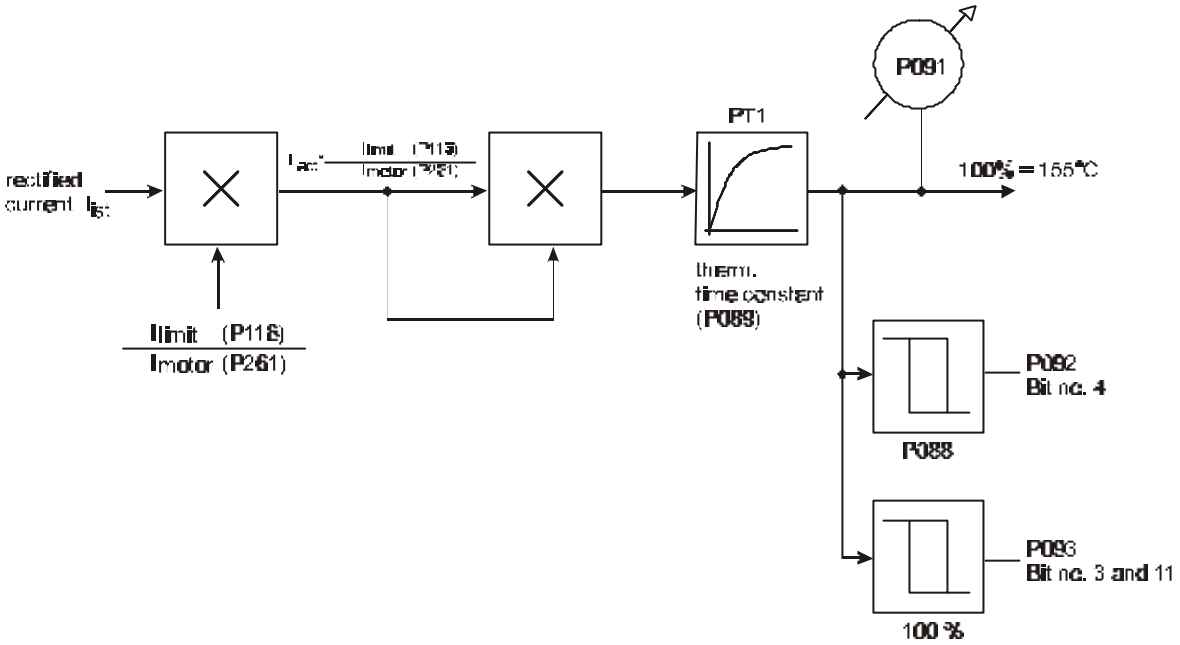
As a good approximation, you can expect around 95% for P291 M_{Gen1} N_{nom} and approximately 60% for P292 M_{Gen2} 12,000 RPM.

OVERLOAD MONITORING

Function

The overload monitor protects the power unit/motor from thermal overloading. The temperature of the power unit/motor is imitated and monitored by an I_t model.

Motor model:



The motor temperature is measured in state NOT READY TO START (if motor temperature sensor is available).

The PT1 element is initialized on this motor temperature. Following calibration is valid 40_C ´ 0 % and 155_C ´ 100 % of P091. Because of that, the error “overload monitoring” can appear in spite of low current or in the start phase.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P093	I2t **state**	0000 ... FFFF		X
P089	I2t **time constant motor**	0 ... 3600	s	
P088	I2t **warning limit motor**	0.00 ... 100.00	%	
P091	I2t **value motor**	0.00 ... 40000.00	%	X

Example

Power unit: BUS 621 I_{nom} = 10 A_{eff}

Motor: DS 56 L - 3000; (P065) I_{nom} = 5.1 A_{eff};
T_t = 26 min. = 1560 s

NOTE

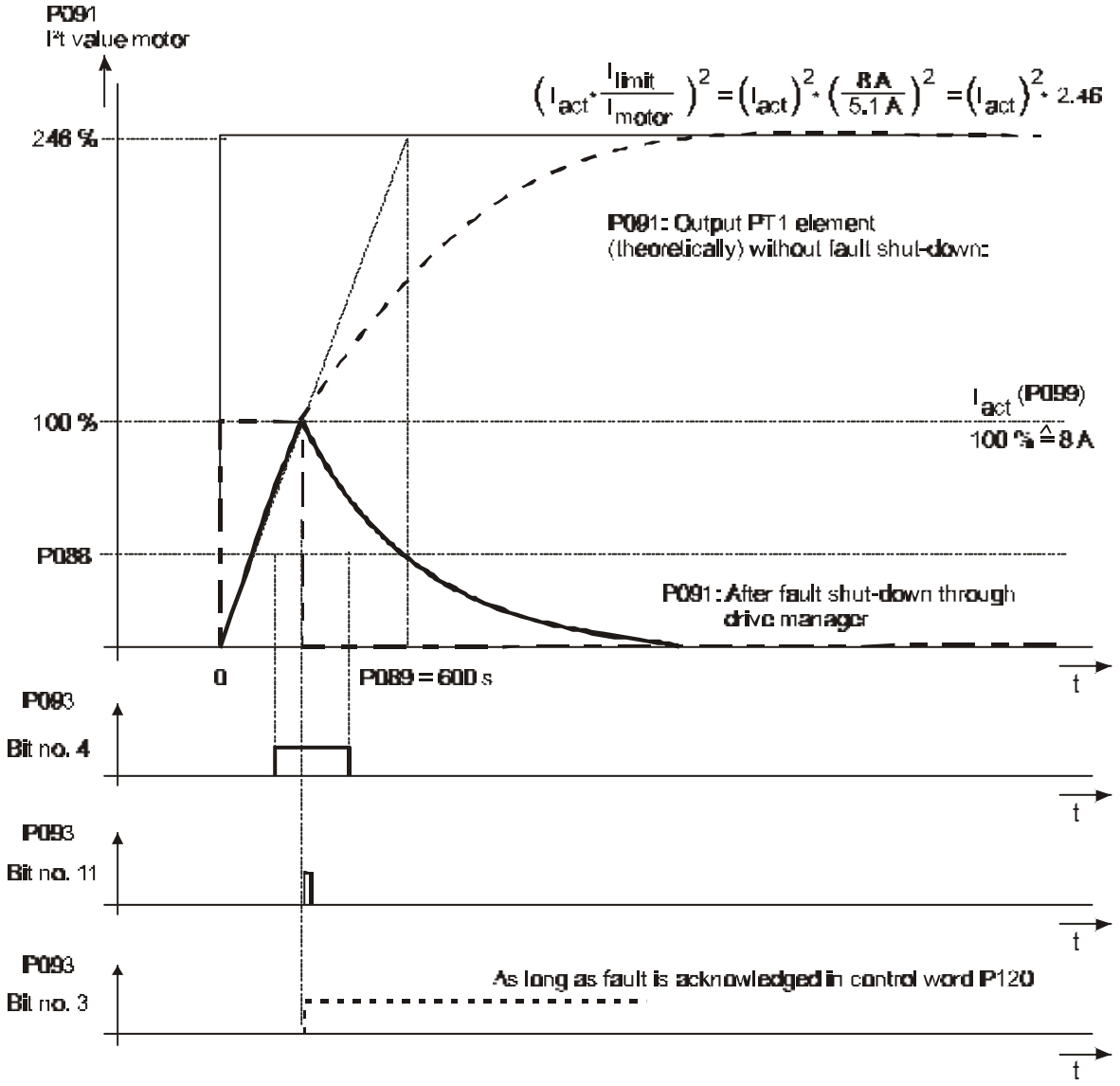
The motor nominal current is set in parameter MM motor nominal current (P261).

P116: Set current I_{limit} (maximum current e.g. at acceleration) e. g. I_{limit} =8 A)

P088: 80 % (warning limit)

P089: 1560 s

P099: Level change from 0 % to 100 % I_{nom} of power unit



Parameter description

P093 I2t **state**

The state shows the function module state.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: Error in function module, error code see M error code (P124)
4	1: Warning: I^2t value motor > limit motor (P088)
5 ... 10	reserved
11	1: I^2t value motor > 100 %
12 ... 15	reserved

P089 I2t **time constant motor**

The thermal time constant of the motor Tt [s] (see technical data motor) must be entered in sec.

If motor time constant = 0 the overload monitoring is turned off.

P088 I2t **warning limit motor**

If this value is exceeded the bit “motor overload warning” (bit no. 4, P093) is set.

Standardization

100 % ↔ 155 °C

P091 I2t **value motor**

This parameter shows the output of the PT1 element.

Standardization

100 % ↔ 155 °C

MOTOR TEMPERATURE MONITORING

Function

This module protects the motor from thermal overloading.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P151	MT **state**	0000 ... FFFF		X
P152	MT **mode**	0000 ... 0029		
P153	MT **temperature**	-40 ... 250	°C	X
P154	MT **threshold 1**	-40 ... 250	°C	
P155	MT **threshold 2**	-40 ... 250	°C	
P156	MT **shutdown threshold**	-40 ... 250	°C	
P157	MT **hysteresis**	0 ... 5	°C	

Parameter description

P151 MT **state**

The module state is displayed here.

Bit no.	Meaning
0 ... 2	000: STOP Motor temperature monitoring is switched off 001: RUN Motor temperature monitoring is active
3	1: Error in function module, error code see M error code (P124)
4	1: Motor temperature has exceeded threshold 1
5	1: Motor temperature has exceeded threshold 2
6	1: Motor temperature has exceeded shutdown threshold
7	1: shutdown switch / PTC thermistor responses
8 ... 15	reserved

P152 MT **mode**

This parameter sets the motor temperature recording type..

Bit no.	Meaning
0 … 2	Sensor type 000: No sensor, temperature monitoring is switched off 001: Temperature sensor KTY 84 010: reserved 011: reserved 100: reserved 101: reserved 110: reserved 111: reserved
3	0: If the shutdown threshold P156 is exceeded, the error bit in MT state is enabled and a shutdown follows. 1: If the shutdown threshold P156 is exceeded, the warning bit no. 6 in MT state is enabled and no shutdown follows.
4 … 5	Input mode 00: The temperature is monitored with connector X26, pin no. 9 and 10 01: The temperature is monitored with connector X24, pin no. 14 and 15 (interface encoder 1) 10: The temperature is monitored with connector X25, pin no. 14 and 15 (interface encoder 2) 11: reserved
6 ... 15	reserved

P153 MT **temperature**

This parameter indicates the measured motor temperature if a temperature sensor is used.

P154 MT **threshold 1**

P155 MT **threshold 2**

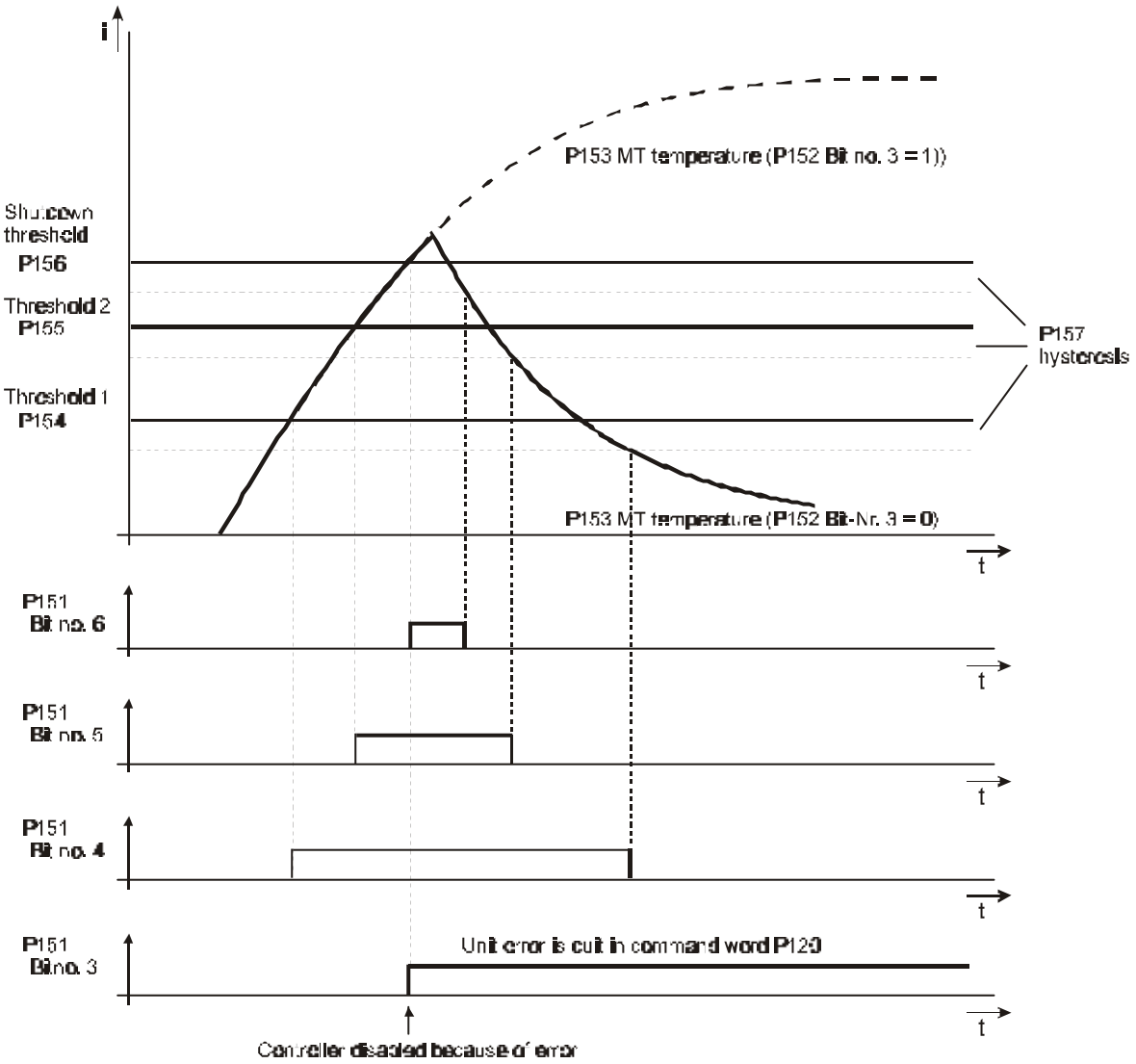
P156 MT **shutdown threshold**

The temperature ascertained by the temperature sensor is compared to these parameters and the relevant bits are set in the status word.

P157 MT **hysteresis**

On exceeding a threshold the relevant set and it is reset only after falling below the threshold minus hysteresis.

Example:


i
P153 MT temperature (P152 Bit no. 3 = 1))
Shutdown threshold P156
Threshold 2 P155
Threshold 1 P154
P157 hysteresis
P153 MT temperature (P152 Bit-Nr. 3 = 0)
t
P151 Bit no. 6
P151 Bit no. 5
P151 Bit no. 4
P151 Bit no. 3
Unit error is cut in command word P120
Controller disabled because of error

FIELD ANGLE CALCULATION

Function

In this function module, the electrical field angle is calculated from the number of pole pairs of the motor and the mechanical rotor angle. Apart from this, the module contains the algorithms for determining the locating position and the rotor position, which play a significant part in the operation of synchronous machines.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P036	Mot **state**	0000 ... FFFF		X
P031	Mot **mode**	0 ... 4		
P033	Mot **no. of pole pairs**	1 ... 120		
P034	Mot **rotating field**	0 ... 1		
P037	Mot **delta I**	1 ... 50		
P039	Mot **delta Rho**	1 ... 50		
P035	Mot **locating angle**	0.0 ... 360.0	degrees	
P030	Mot **phi mechanical**	0.0 ... 360.0	degrees	X
P032	Mot **rho electrical**	0.0 ... 360.0	degrees	X

Parameter description

P036 Mot **state**

This parameter shows the status of the function module.

Bit No.	Meaning
0 ... 2	0: STOP 1: RUN Normal operation 3: STAND_BY Optimization algorithms are running
3	1: Error in module; for error code, refer to P012
4	1: Locating point found (method 0, 1) 0: Locating point still unknown
5	1: Rotor position found (method 2, 3, 4) 0: Rotor position still unknown
6 ... 15	Reserve

NOTE

Before the controller can be enabled, following parameters must be set:

- Motor model
- Limit current
- Encoder
- Current controller
- Operation mode

→ Controller enabling

P031 Mot **mode**

Selection of the optimization method for Location Point Reference Setting mode.
With all the optimization methods, the controller sets its own current specified value using parameter P067 M specified value. This means that the system must not write to this parameter during optimization (e.g. via the communications interfaces, digital inputs, etc.).

Value	Meaning
0	Set reference to encoder's installation position (location point) (method 0)
1	Set reference to encoder's installation position (location point) (method 1)
2	Set reference to rotor position of synchronous machine (method 2)
3	Start up a clockwise-rotating synchronous machine (method 3)
4	Start up a counterclockwise-rotating synchronous machine (method 4)

To 0: Mode Set reference to encoder's installation position (location point) is intended for operation of a synchronous machine with an absolute value encoder or a resolver. You **must** dismount the motor when carrying out this optimization. The current specified value increases in a linear way from 0% to 100%; after this, the system determines the current values and sets bit number 4, Locating position found, in Mot Status.

To 1: Mode Set reference to encoder's installation position (location point) is intended for operation of a synchronous machine with an absolute value encoder or a resolver. You **must not necessarily** dismount the motor when carrying out this optimization. However, the motor shaft must be able to move load-free in both directions by about one or two degrees. After completing optimization, the system sets bit number 4, Locating position found, in Mot Status.

To 2: Mode Set reference to rotor position is intended for operation of a synchronous machine with an incremental encoder. This means that before commissioning a drive of this type, you must carry out this optimization function first. You **must not necessarily** dismount the motor when carrying out this optimization. However, the motor shaft must be able to move load-free in both directions by about one or two degrees. After completing optimization, the system sets bit number 5, Rotor found, in Mot Status.

To 3 and 4: These modes are intended for operation of a synchronous machine with an incremental encoder. The system keeps moving the synchronous machine with a clockwise- or counterclockwise-rotating electrical angle until the incremental encoder's zero pulse has been measured. After this, the system sets bit number 5, Rotor found, in Mot Status.

P033 Mot **no. of pole pairs**

Pole pairs of the used motor.

P034 Mot **rotating field**

This parameter matches the control to the rotating field of the motor.

Value	Meaning
0	motor with anti-clockwise rotating field (phase V and W changed)
1	motor with clockwise rotating field

NOTE

After making changes to Mot rotating field, you must save data set 0 (the boot data set) and reboot the controller!

P037 Mot **delta I**

Using this parameter, you can specify the setting for the current rise per unit of time $\frac{di}{dt}$.

This is only necessary for Mot Modes 1 and 2. The value 1 means that the current rise per second is 3.05% of the limit current (P116 PU I lim).

P039 Mot **delta rho**

This parameter sets the angular velocity of the electrical angle $\frac{dRho}{dt}$. This is only necessary for Mot Modes 1 and 2. The value 1 means that the angular change per second is 2.75° electrical.

P035 Mot **locating angle**

This parameter shows the locating angle that was determined in mode Set reference to locating point. This offset value is included in calculation of the electrical angle such that an angle of 90° electrical results in the location position.

P030 Mot **phi mechanical**

This parameter displays the mechanical rotor angle.

P032 Mot **rho electrical**

This parameter displays the calculated electrical field angle.

ENCODER MANAGER

Function:

The module manages the classification of encoder 1 (X24) and 2 (X25) to motor control, speed controller and synchronisation control as well as incremental encoder emulation.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P225	EM **state**	0000 ... FFFF		X
P228	EM **encoder types**	0000 .....00FF		X
P226	EM **mode**	0000 ... 003F		
P227	EM **no. of graduation marks**	128 ... 32767	Inc	
P229	EM **offset zero impulse**	0000 ... FFFF	Inc	
P019	EM **maximum speed**	500 ... 120000	rpm	
P224	EM **kp**	0 ... 32767		

Parameter description

P225 EM **state**

Display of the internal module state

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN
3	1: Error in function module, error code see M error code (P124)
4 ... 6	reserved
7	Absolute position of the encoder for motor control is not known
8, 9	reserved
10	Copy of N=0 message from state encoder 1 (P025), if EM mode, bit no. 0 = 0 or copy of N=0 message from state encoder 2 (P240) , if EM mode, bit no. 0 = 1
11 ... 15	reserved

P228 EM **encoder types**

Shows the really equipped encoder modules (see type code).

Bit no.	Meaning
0 … 3	Encoder type at connection 2 (X24) 0: no encoder A: resolver B: sinus incremental encoder 5 V C: absolute value encoder with asynchronous serial interface 8 V D: absolute value encoder with synchronous serial interface 5 V E: rectangle incremental encoder 5 V
4 ... 7	Encoder type at connection 2 (X25) 0: no encoder A: resolver B: sinus incremental encoder 5 V C: absolute value encoder with asynchronous serial interface 8 V D: absolute value encoder with synchronous serial interface 5 V E: rectangle incremental encoder 5 V
8 ... 15	reserved

P226 EM **mode**

Bit no.	Meaning
0	0: Rotor angle and speed is measured by encoder 1 1: Rotor angle and speed is measured by encoder 2 This bit can only be changed if the position controller´s state is STOP.
1	0: Incremental encoder emulation is connected with position actual value G1/G2. 1: Incremental encoder emulation is connected with position actual value.
2	0: Incremental encoder emulation is switched off 1: Incremental encoder emulation is active
3	0: Incremental encoder emulation is connected with encoder 1 1: Incremental encoder emulation is connected with encoder 2
4	Change polarity of incremental encoder emulation: 0: With a clockwise-rotating encoder (depending on bit number 3) the system outputs a clockwise-rotating signal pattern on connector X 27. 1: With a clockwise-rotating encoder (depending on bit number 3) the system outputs a counterclockwise-rotating signal pattern on connector X 27.
5	0: The no. of graduation marks is multiplied by 1 1: The no. of graduation marks is multiplied by 8
6	0: Smoothing of incremental encoder emulation is inactive 1: Smoothing of incremental encoder emulation is active

7 ... 15	reserved

NOTE

After setting the mode parameter the data set 0 (boot data set) should be saved and the controller should be booted new.

The incremental encoder emulation can be used in combination with following encoders (see type code, too):

Incremental encoder emulation	Encoder 1 X24	Encoder 2 X25
not active bit no. 2 = 0	SCM 70, SCS 70 rectangle inc. 5 V sine inc. 5 V resolver	SCM 70, SCS 70 rectangle inc. 5 V sine inc. 5 V resolver
active bit no. 2 = 1	resolver 2 pole pairs or no encoder	SCM 70, SCS 70 rectangle inc. 5 V sine inc. 5 V resolver

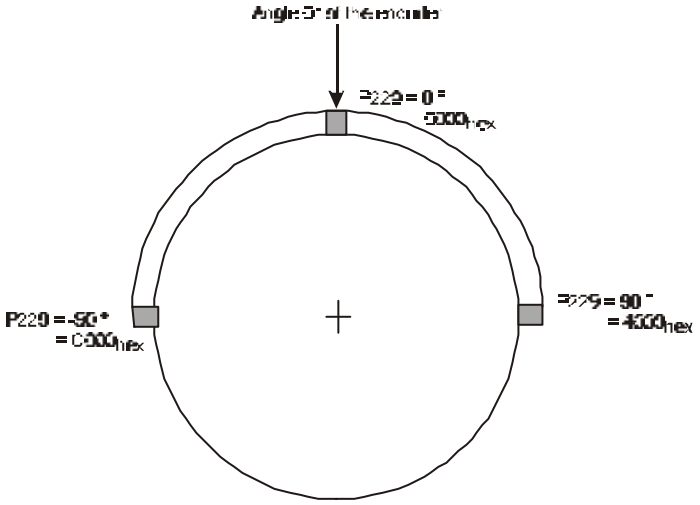
The internal delay time between getting the encoder signals (encoder 1 (X24) and encoder 2 (X25)) and the output through the incremental encoder emulation X27 is maximal 90 µs.

P227 EM **no. of graduation marks**

This parameter sets the no. of graduation marks of the incremental encoder emulation. The no. of graduation marks refers to 1 revolution of encoder chosen with P226 EM mode bit no. 3. Bit no. 5 of EM mode selects the multiplicands for the number of graduation marks. The limit frequency is 2,4 MHz.

P229 EM **offset zero impulse**

This parameter sets the angle offset between the zero angle of encoder chosen with P226 and zero impulse of incremental encoder emulation.



P019 EM **maximum speed**

This parameter sets the maximum speed. This speed corresponds to 100 % in all other speed specifications e.g. speed set values, speed actual values and monitoring thresholds of both encoders.
e.g.: 100 % n_{set} ↔ 2800 rpm, if maximum speed is set to 2800 rpm.

P224 EM **kp**

This parameter sets the P gain of the incremental encoder emulation.

EVALUATION ENCODER 1 AND ENCODER 2

Parameter overview encoder 1

Parameter	Name	Range min. ... max.	Unit	Display only
P025	G1 **state**	0000 ... FFFF		X
P040	G1 **mode**	0000 ... 1133		
P024	G1 **no. of graduation marks**	1 ... 32767	Inc	
P062	G1 **N smoothing actual value**	0.0 ... 50.0	ms	
P023	G1 **N actual value**	-199.99 ... +199.99	%	X
P043	G1 **rev actual value**	00000000 ... FFFFFFFF		X
P022	G1 **phi actual value**	00000000 ... FFFFFFFF		X
P041	G1 **delta Phi 16**	8001 ... 7FFF		X
P042	G1 **delta Phi 32**	80000001 ... 7FFFFFFF		X
P044	G1 **sine measured value**	-1.0000 ... +1.000		X
P045	G1 **cosine measured value**	-1.0000 ... +1.000		X
P026	G1 **sine offset**	-0.2500 ... +0.2500		
P027	G1 **cosine offset**	-0.2500 ... +0.2500		
P028	G1 **sine gain**	0.500 ... 2.000		
P029	G1 **cosine gain**	0.500 ... 2.000		
P020	G1 **sine**	-1.0000 ... +1.000		
P021	G1 **cosine**	-1.0000 ... +1.000		
P107	G1 **N=0 threshold**	0.01 ... 25.00	%	
P108	G1 **N>Nx ON threshold**	0.00 ... 150.00	%	
P109	G1 **N>Nx OFF threshold**	0.00 ... 150.00	%	
P046	G1 **over speed**	0.00 ... 199.99	%	

Parameter overview encoder 2

Parameter	Name	Range min. ... max.	Unit	Display only
P240	G2 **state**	0000 ... FFFF		X
P241	G2 **mode**	0000 ... 1133		
P242	G2 **no. of graduation marks**	1 ... 32767	Inc	
P238	G2 **N smoothing actual value**	0.0 ... 50.0	ms	
P243	G2 **N actual value**	-199.99 ... +199.99	%	X
P249	G2 **rev actual value**	00000000 ... FFFFFFFF		X
P244	G2 **phi actual value**	00000000 ... FFFFFFFF		X
P247	G2 **delta Phi 16**	8001 ... 7FFF		X
P248	G2 **delta Phi 32**	80000001 ... 7FFFFFFF		X
P230	G2 **sine measured value**	-1.0000 ... +1.000		X
P231	G2 **cosine measured value**	-1.0000 ... +1.000		X
P232	G2 **sine offset**	-0.2500 ... +0.2500		
P233	G2 **cosine offset**	-0.2500 ... +0.2500		
P234	G2 **sine gain**	0.500 ... 2.000		
P235	G2 **cosine gain**	0.500 ... 2.000		
P236	G2 **sine**	-1.0000 ... +1.000		
P237	G2 **cosine**	-1.0000 ... +1.000		
P104	G2 **N=0 threshold**	0.01 ... 25.00	%	
P105	G2 **N>Nx ON threshold**	0.00 ... 150.00	%	
P106	G2 **N>Nx OFF threshold**	0.00 ... 150.00	%	
P239	G2 **over speed**	0.00 ... 199.99	%	

Parameter description

P025 G1 **state**

P240 G2 **state**.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 101: INIT
3	1: Error in function module, error code see M error code (P124)
4	logic level or zero trace
5	toggle bit for zero trace: changes at every zero impulse
6	1: |N actual value| > overspeed threshold (P046 or P239) If this encoder controls the motor, the exceeding leads to a error message and disables the controller.
7	1: Absolute position of encoder is not known.
8 ... 9	Reserve
10	0: |N actual value| ≠ 0 1: |N actual value| = 0 (below N = 0 threshold)
11	0 → 1: |N actual value| > Nx ON (P108, P105) 1 → 0: |N actual value| > Nx OFF (P109, P106)
12	reserved
13	1: limit value reached; |N actual value| > maximum speed P019
14 ... 15	reserved

NOTE

The bit no. 4 and 5 are specially destined for the adjustment of encoders. Incremental encoders with high no. of graduation marks can be fast adjusted, if this bits are connected with the free programmable LEDs.

P040 G1 **mode**

P241 G2 **mode**

This parameter sets the encoder evaluation.

NOTE

After setting the mode parameter the data set 0 (boot data set) should be saved and the controller should be new booted.

Bit no.	Meaning
0	**Encoder polarity:** 0: No sign reversal, turning clockwise encoder supplies positive speed actual value. 1: Sign reversal, turning clockwise encoder supplies negative speed actual value.
1	**Polarity position counting:** 0: Positive speed actual value effects positive position change 1: Positive speed actual value effects negative position change .
2	0: The multiplier for no. of graduation marks is 1. 1: The multiplier for no. of graduation marks is 8.
3	reserved
4 ... 7	**Encoder type:** 0000: no encoder 0001: resolver 0010: rectangle encoder 0011: sine encoder
8 ... 11	**Communication protocol:** 0000: no protocol 0001: Protocol for SinCos encoder from Fa. Stegmann (SCM70 or SCS70)
12	1: Standardization algorithm for offset and gain is active.
13 ... 15	reserved

Permitted setting for encoder mode and no. of graduation marks:

Letter for encoder in type code (P228)	Mode (P040, P241)	No. of graduation marks (P024, P242)	Comment
0	0000_{hex}	X	no encoder evaluation
A	0010_{hex}	16384	resolver
B	0030_{hex}	number of sine periods	incremental encoder sine with 5 V supply
C	0130_{hex}	512	sine absolute value encoder with asynchronous serial interface and 8 V supply SCS 70 and SCM 70 from Fa. Stegmann
D	-	-	sine absolute value encoder with synchronous serial interface and 5 V supply
E	0020_{hex}	no. of graduation marks	rectangle incremental encoder with 5 V supply

P024 G1 **no. of graduation marks**

P242 G2 **no. of graduation marks**

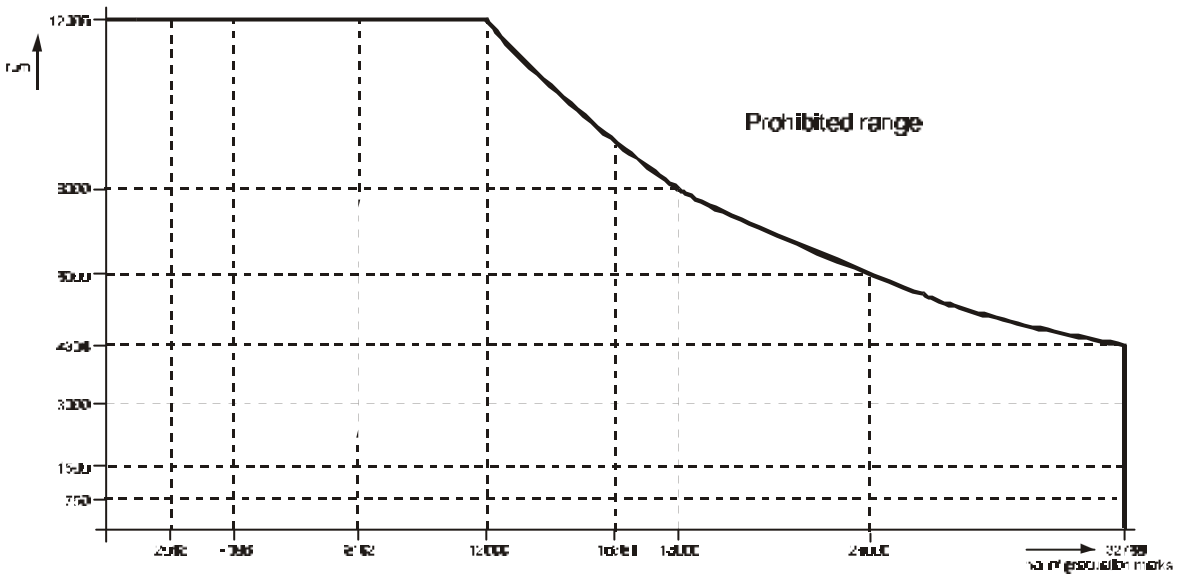
No. of graduation marks or number of periods of connected encoder.

NOTE

The no. of graduation marks of 2 pole resolvers must be set to 16384.

The multiplier for the no. of graduation marks is set by bit no. 5 in G1/G2 mode. The no. of graduation marks and the maximum really speed must not be greater than 2,4 MHz.

$$f = \frac{\text{No. of graduation marks} * \text{Multiplier} * \text{Speed}}{60} < 2{,}4\ \text{MHz}$$



P062 G1 **N smoothing actual value**

P238 G2 **N smoothing actual value**

This parameter sets the time constant to smooth the speed actual value.

P023 G1 **N actual value**

P243 G2 **N actual value**

N actual value at encoder 1 or encoder 2, referring to maximum speed (P019).

100 % correspond with set maximum speed in P019.

P043 G1 **Rev actual value**

P249 G2 **Rev actual value**

Part of the position actual value: number of whole revolutions.

P022 G1 **phi actual value**

P244 G2 **phi actual value**

Part of the position actual value: the angle within one rotation, left-justified with encoder-dependent resolution.

The entire position actual value is 64-bits-long and consists of the following:

63	32	31	0
31 Rev actual value	0	31 Phi actual value	0

The system zeroes the entire position actual value after you switch on the power to the electronics. If an absolute value encoder is connected, the system reads it out and enters the information in accordance with the format shown above. The position actual value can be overwritten at any time.

NOTE

Every error that occurs in the encoder module (error code 08xx/0Axx) results in the absolute position of the encoder evaluation being lost. This means that if you use this encoder to acquire the rotor position of a synchronous machine, this position information is also lost and it is no longer possible to safely control the motor. Every time an encoder error occurs, you must therefore reinitialize the controller electronics (by turning the power off and on again).

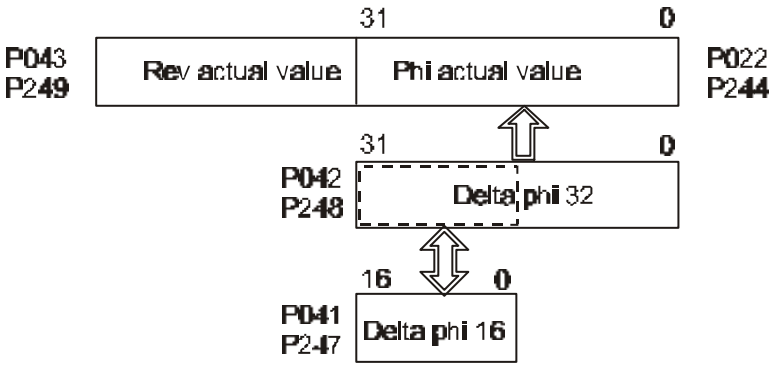
P041 G1 **delta phi 16**

P247 G2 **delta phi 16**

P042 G1 **delta phi 32**

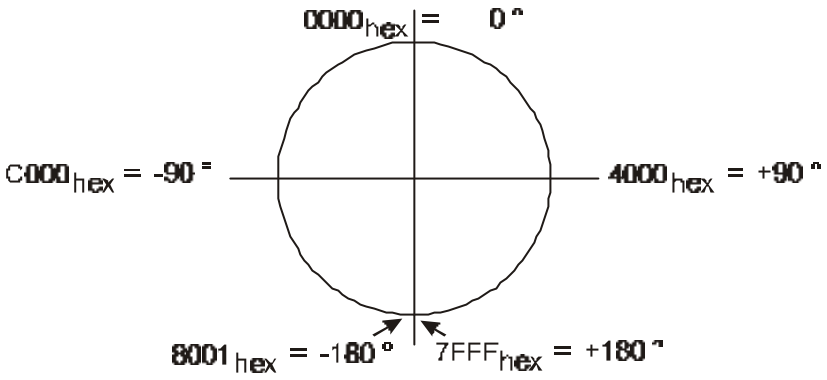
P248 G2 **delta phi 32**

When writing this parameter the system adds once the specified angular differences with 16- or 32-bit resolution onto the position actual value (relative angular change).



Positive and negative carries to whole revolutions (Rev actual value) are taken into account.

8001_{hex} = -180 °
0000_{hex} = 0 °
$7FFF_{hex}$ = +180 °



P044 G1 **sine measured value**
P045 G1 **cosine measured value**
P230 G2 **sine measured value**
P231 G2 **cosine measured value**

Measured values of connected encoder. M

P026 G1 **sine offset**
P027 G1 **cosine offset**
P028 G1 **sine gain**
P029 G1 **cosine gain**
P232 G2 **sine offset**
P233 G2 **cosine offset**
P234 G2 **sine gain**
P235 G2 **cosine gain**

This parameter can compensate offset and gain faults of the analog actual value measurement.

P020 G1 **sine**
P021 G1 **cosine**
P236 G2 **sine**
P237 G2 **cosine**

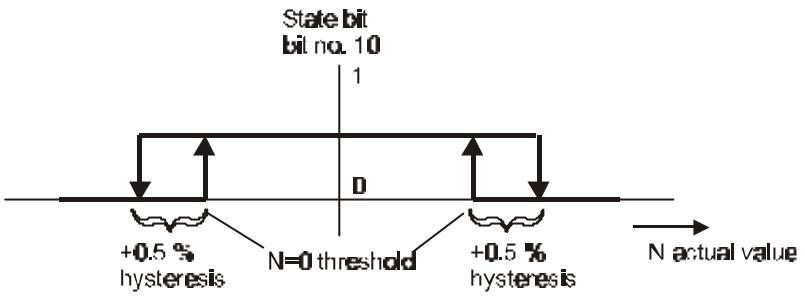
Corrected measured values.

P107 G1 **N=0 threshold**

P104 G2 **N=0 threshold**

Bit no. 10 in function module state is enabled, if the absolute value of N actual value is below the threshold N=0 (P107 encoder 1 or P104 encoder 2).

The input value is related to P019 maximum speed.



P108 G1 **N>Nx ON threshold**

P109 G1 **N>Nx OFF threshold**

P105 G2 **N>Nx ON threshold**

P106 G2 **N>Nx OFF threshold**

Freely programmable speed thresholds to set the corresponding bits in G1 or G2 state. If |N actual value| (P051) is greater than N>Nx ON threshold, then bit no. 11 is enabled and disabled if |N actual value| falls below N>Nx OFF threshold.

The input value is related to P019 maximum speed.

P046 G1 **overspeed**

P239 G2 **overspeed**

Threshold value for overspeed monitoring.

The input value is related to P019 maximum speed..

If the set value is exceeded the bit no. 6 is enabled in G1 or G2 state (P025 or P240, resp.). The bit is disabled if the speed drops below the threshold (no hysteresis).

CURRENT CONTROLLER

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P079	**I state**	0000 ... FFFF		X
P080	**I P gain**	0.1 ... 15.9		
P081	**I integral action time**	0.0 ... 1000.0	ms	
P082	**I U_q/U_d- limit**	0.00 ... 100.00	%	
P067	**I M set value**	-100.00 ... 100.00	%	
P048	**I M additional set value**	-100.00 ... 100.00	%	
P071	**I I_q set value**	-100.00 ... 100.00	%	
P072	**I I_q actual value**	-199.99 ... 199.99	%	X
P068	**I I_q controller output**	-100.00 ... 100.00	%	X
P069	**I EMC set value**	-100.00 ... 100.00	%	X
P075	**I U_q set value**	-100.00 ... 100.00	%	X
P077	**I I_d set value**	-100.00 ... 100.00	%	
P078	**I I_d actual value**	-199.99 ... 199.99	%	X
P076	**I U_d set value**	-100.00 ... 100.00	%	X
P070	**I phase voltage U**	-100.00 ... 100.00	%	X
P086	**I phase voltage V**	-100.00 ... 100.00	%	X
P073	**I phase current U**	-100.00 ... 100.00	%	X
P074	**I phase current V**	-100.00 ... 100.00	%	X
P083	**I current offset U**	-25.00 ... 25.00	%	X
P084	**I current offset V**	-25.00 ... 25.00	%	X
P099	**I current actual value**	0.00 ... 100.00	%	X

Parameter description

P079 I state

This parameter indicates the status of the internal function module.

Bit No.	Meaning	
0 ... 2	000: STOP	(controller inhibited)
	001: RUN	(controller enabled)
	011: STAND_BY	(direct-axis current controller inhibited, field has been set-up)
	101: INIT	(direct-axis current controller enabled, field is being set-up)
3	Error in module	
4	0: Current control on synchronous machine 1: Current control on asynchronous machine	
5	0: No field available 1: Field is available In the case of the asynchronous machine, after 3 x P293 (rotor time constant Tv) has expired, the direct-axis current, P078, must be at least 80% of the direct-axis current P077. After this, the system does not continuously monitor the in-phase regulator.	
6 ... 15	Reserve	

P080 I P gain

This parameter sets P gain (k_p) for the direct axis current controller and the wattless current controller.

P081 I integral action time

This parameter sets the integral action time (T_N) of the direct-axis current controller and the wattless current controller.

P082 U_q-/U_d limit

This parameter sets the limit of the direct-axis current controller and the wattless current controller.

$$\text{Standardization} \quad 100\% \leftrightarrow \frac{U_{ZKnom\,(P087)}}{\sqrt{2}}$$

P067 I M set value

Set value input for current control mode (P122 = -2)

Standardization: 100 % ↔ PU I limit (P116)

P048 I **M additional set value**

Additional set value for all modes. .

Standardization: 100 % ↔ PU I limit (P116)

The effective torque set value is the sum of M set value and M additional set value.

NOTE

When there is a pulse and controller enable at the same time, the torque specified value does not become effective until 3 x Tr has expired. This ensures that torque build-up is based on an existing magnetic field.

P071 I I_q **set value**

P072 I I_q **actual value**

Standardization: 100 % ↔ PU I limit (P116)

P068 I I_q **controller output**

Manipulated variable of wattless current controller.

$$\text{Standardization} \quad 100\% \leftrightarrow \frac{U_{ZKnom\ (P087)}}{\sqrt{2}}$$

P069 I **EMC set value**

Voltage set value from motor model, corresponds with machine´s EMC.

$$\text{Standardization} \quad 100\% \leftrightarrow \frac{U_{ZKnom\ (P087)}}{\sqrt{2}}$$

P075 I **U_q set value**

Sum of P068 Iq controller output and P069 EMC set value..

Standardization $100\% \leftrightarrow \frac{U_{ZKnom\ (P087)}}{\sqrt{2}}$

P077 I **I_d set value**

P078 I **I_d actual value**

The direct-axis current set value / actual value is displayed here.

Standardization: 100 % ↔ PU I limit (P116)

P076 I **U_d set value**

Manipulated variable of direct-axis controller.

Standardization $100\% \leftrightarrow \frac{U_{ZKnom\ (P087)}}{\sqrt{2}}$

P070 I **phase voltage U**

P086 I **phase voltage V**

This parameter displays the voltage set value of phase U or V.

Standardization $100\% \leftrightarrow \frac{U_{ZKnom\ (P087)}}{\sqrt{2}}$

P073 I **phase current U**

P074 I **phase current V**

Standardization: 100 % ↔ PU I limit (P116)

P083 I **current offset U**

P084 I **current offset V**

To compensate the offset of the current transformer, the current transformer is set to 0 at every pulse enabling. This parameter shows the offset value.

Standardization: 100 % ↔ 2^{11}

P099 I **current actual value**

Standardization: 100 % ↔ PU I limit (P116)

SPEED CONTROLLER

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P059	N **state**	0000 ... FFFF		X
P057	N **P gain**	0.1 ... 1000.0		
P058	N **integral action time**	1.0 ... 2000.0	ms	
P049	N **J compensation**	0 ... 30000		
P050	N **set value**	-100.00 ... 100.00	%	
P047	N **additional set value**	-100.00 ... 100.00	%	
P051	N **actual value**	-199.99 ... 199.99	%	X
P052	N **controller output**	-100.00 ... 100.00	%	
P038	N **M limiter mode**	0 ... 1		
P053	N **M limiter bipolar**	0.00 ... 100.00	%	
P054	N **M LIMITER MOT/TD1**	0.00 ... 100.00	%	
P055	N **M limiter Gen/TD2**	0.00 ... 100.00	%	
P060	N **deviation**	-199.99 ... 199.99	%	X
P061	N **limiter deviation**	0.00 ... 199.99	%	
P056	N **block time**	0.0 ... 360.0	s	

Parameter description

P059 N **state**

This parameter shows the speed controller´s state.

Bit no.	Meaning
0 ... 2	000: STOP, N controller disabled 001: RUN, N controller enabled 011: STAND_BY, N disabled, block monitoring enabled
3	1: Error in module. error code see P124
4	1: Drive is blocked (block monitoring time P056 active)
5 ... 9	reserved
10	0: motor-operated mode 1: generator-operated mode
11	0: torque direction 1 active 1: torque direction 2 active
12	1: set value reached (|Deviation P060| < limiter deviation (P061)
13	1: limiter set value reached (current limiter)

14 ... 15	reserved

P057 N **P gain**

P gain (K_p) of speed controller.

P058 N **integral action time**

Integral action time (TN) of speed controller.

P049 N **J compensation**

Moment of inertia compensation.

P047 N **additional set value**

P050 N **set value**

Set value inputs for speed controller. The effective set value is the limited sum from P047 and P050.

Standardization: 100 % ↔ GM maximum speed (P019)

P051 N **actual value**

Speed actual value of encoder 1 or encoder 2 (depends on P226 EM mode bit no. 1).

Standardization: 100 % ↔ EM maximum speed (P019)

P052 N **controller output**

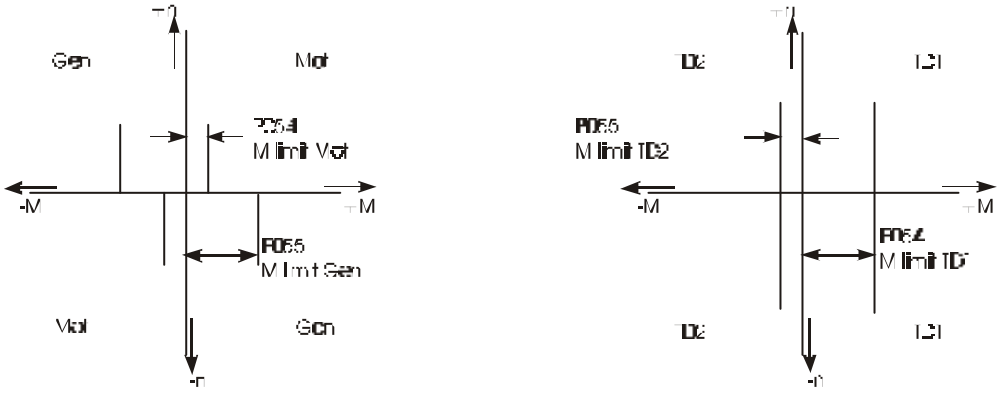
This parameter shows the set value of speed controller.

Standardization: 100 % ↔ PU I limiter (P116)

P038 N **M limiter mode**

This parameter switches between torque limiter motor-operated/generator-operated and torque direction TD1/TD2.

Value	Meaning
0	torque limiter Mot/Gen
1	torque limiter TD1/TD2



P053 N **M limiter bipolar**

P054 N **M limiter Mot/TD1**

P055 N **M limiter Gen/TD2**

The control value is symmetrically limited with the bipolar limiter. From the bipolar, Mot/TD2 and Gen/TD2 limiter, the respective smaller value is valid. If the I^2t power unit monitoring operates, the torque limiter are internally restricted to 100 %. During the limitation bit no. 13 in N state is set.

Standardization: 100 % ↔ PU I limiter (P116)

P060 N **deviation**

This parameter displays the actual speed controller deviation.

Standardization: 100 % ↔ EM maximum speed (P019)

P061 N **limiter deviation**

If the value falls below the maximum deviation set by this parameter, the function module transmits the message set value reached (bit no. 12 in N state P059 is set).

Standardization: 100 % ↔ EM maximum speed (P019)

P056 N **block time**

This parameter sets the time of the block monitoring.

The block monitoring is active, if the speed controller is on the current limit (N state, bit no. 13 = 1) and simultaneously the N = 0 message (EM state, bit no. 10 = 1) is active. During this state is active, the bit no. 4 in N state is set.

After the block monitoring time is over, the controller is disabled with error message 0702_{hex}.

TORQUE MONITORING

Function

This function module compares the current actual value with different limits.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P098	TM **state**	0000 ... FFFF		X
P096	TM **M > Mx1**	0.00 ... 100.00	%	
P097	TM **time 1**	0.000 ... 60.000	s	
P094	TM **M > Mx2**	0.00 ... 100.00	%	
P095	TM **time 2**	0.000 ... 60.000	s	
P066	TM **M loading**	0.00 ... 100.00	%	X
P092	TM **Mact / Mn**	0.00 ... 100.0	%	

Parameter description

P098 TM **state**

This parameter shows the function module´s state.

Bit no.	Meaning
0 … 2	001: RUN, monitoring active
3	reserved
4	M loading (P066) > threshold 1 (P096)
5	time 1 is expired
6	M loading (P066) > threshold 2 (P094)
7	time 2 is expired
8 ... 15	reserved

P096 TM **M > M1**

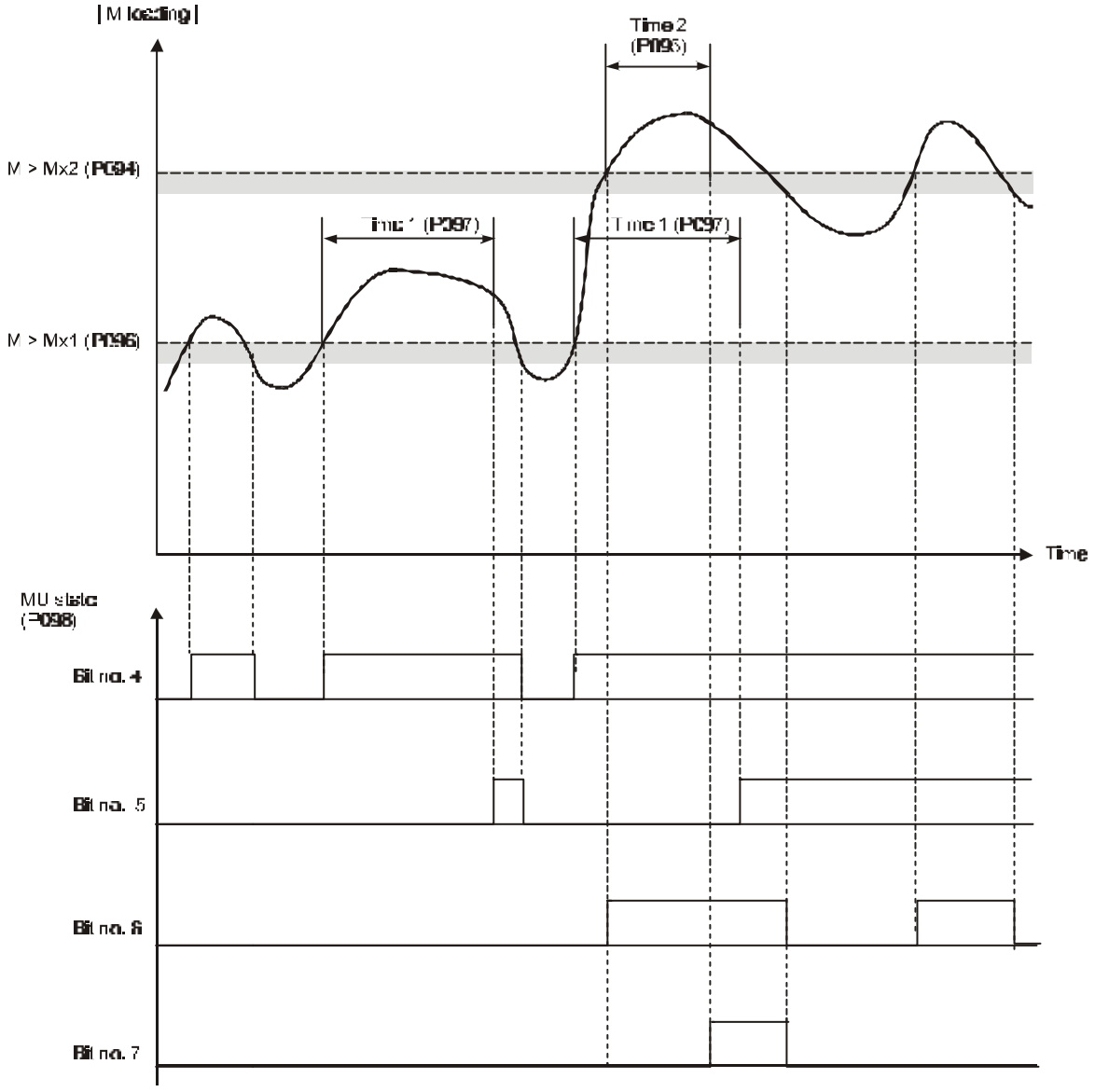
P097 TM **time 1**

P094 TM **M > M2**

P095 TM **time 2**

This parameters define the function

The hysteresis is each time -3 % of set threshold.



P066 TM **M loading**

P092 TM **Mact / Mn**

POSITION CONTROLLER

Function

The position controller module is a P-Controller for position control of the unit. The module contains multi-turn evaluation of the motor position encoder, the set value interpolator, speed precontrol as well as control variable limiting and the dynamic and static deviation.

NOTE
The efficiency of the position control is directly dependent upon the efficiency of the speed control.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P200	P **state**	0000 ... FFFF		X
P201	P **mode**	0000 ... 0007		
P202	P **Kv factor**	0 ... 32000	1/s	
P207	P **N precontrol**	0.00 ... 125.00	%	
P213	P **N precontrol smoothing**	0.0 ... 50.0	ms	
P220	P **N precontrol output**	-100.00 ... 100.00	%	
P211	P **controller output**	-100.00 ... 100.00	%	X
P208	P **set value**	00000000 ... FFFFFFFF	Inc	
P209	P **actual value**	00000000 ... FFFFFFFF	Inc	
P210	P **deviation**	80000001 ... 7FFFFFFF	Inc	X
P205	P **rev set value**	00000000 ... FFFFFFFF		
P206	P **phi set value**	00000000 ... FFFFFFFF		
P218	P **rev actual value**	00000000 ... FFFFFFFF		
P219	P **phi actual value**	00000000 ... FFFFFFFF		
P204	P **N limit bipolar**	0.00 ... 100.00	%	
P212	P **deviation limit static**	00000000 ... 7FFFFFFF	Inc	
P203	P **deviation limit dynamic**	00000000 ... 7FFFFFFF	Inc	
P214	P **deviation time**	0.000 ... 65.000	s	
P215	P **active**	0.01 ... 25.00	%	
P216	P **time**	0.000 ... 65.000	s	
P217	P **threshold**	0.01 ... 25.00	%	

Parameter description

P200 P **state**

This parameter shows the actual position controller´s mode.

Bit no.	Meaning
0 … 2	000 : STOP, Position controller disabled 001 : RUN, Position controller enabled
3	1 : Error in position controller, error code see P124
4	1 : Dynamic deviation limiter exceeded
5	1 : Static deviation limiter exceeded
6	1 : Timeout dynamic deviation limiter
7	1 : Timeout static deviation limiter
8	1 : Actual value monitoring expects positive change
9	1 : Actual value monitoring expects negative change
10	1 : Missing actual value
11	1 : Wrong polarity of actual value change
12	1 : Set value reached (bit no. 4 and 5 are not set)
13	1 : Position controller on limit
14 ... 15	reserved

P201 P **mode**

This parameter sets the position controller´s operational mode.

Bit no.	Meaning
0	1 : Enabling error dynamic deviation
1	1 : Enabling error static deviation
2	1 : Position measurement on load 0 : Position measurement on motor The bit can only be changed, if the position controller´s state is STOP
3 ... 15	reserved

See P deviation limiter dynamic (P203) and P deviation limiter static (P212).

The change of position actual value monitoring (bit no. 2) is only possible if controller is disabled. For further notes see function module encoder 1 and encoder 2 as well as encoder manager.

P202 P **Kv factor**

The position controller is implemented as P controller. The k_v factor is the gain of the position controller. If k_v = 0 the position controller is inactive, because each controller deviation is multiplied with the k_v factor.

P207 P **N precontrol**

P213 P **N precontrol smoothing**

The speed precontrol is implemented as DT1 element. Each changes of position set value are differentiated with respect to time, multiplied by parameter N precontrol and than smoothed with the time constant in P213. If N precontrol = 0% the speed precontrol has no effect in the speed set value (P050).

If N precontrol = 100 % and position set value change is constant per time unit, the speed precontrol supplies the exact needed speed set value. The position controller supplies in this case only the correcting set value to follow the angle.

P220 P **N precontrol output**

Output value of N precontrol.

Standardization: 100 % ↔ Maximum speed (P019)

P211 P **controller output**

Output value of position controller.

Standardization: 100 % ↔ Maximum speed (P019)

The speed set value P050 is put together from controller output P211 and the speed precontrol P220.

It is limited to the value in P204. As long as the set value is limited, the bit no. 13 in state P200 is set.

P208 P **set value**

The position set value is initialized to the angle of chosen encoder system at first pulse enabling. At further pulse enabling the position actual value (P209) is set.

P209 P **actual value**

This parameter displays the position actual value.

Past the first pulse enabling of the controller the position set value is initializes on the resolver or incremental encoder angle after that independent from the actual M desired operation mode (P122) and independent from the status of the state machine (P121) the actual value is permanent actualized

It is possible to write to the position actual value in every operation mode.

Calibration of position set and actual value:

One motor revolution corresponds with internal **65536** increments. The low word represents the motor angle the high word counts the whole revolutions.

P210 P **deviation**

The difference between position set value (P208) and actual value (P209) is termed deviation. Reasons for large deviations could be: blocked motor, not achievable set speed or wrong inputs of controller parameters (e.g. speed controller).

The calibration corresponds to the position set/actual value standardization.

P205 P **rev set value**

P206 P **phi set value**

64 bit position set value. 32 bit for whole revolutions (P205) and 32 bit for angle (P206).

P218 P **rev actual value**

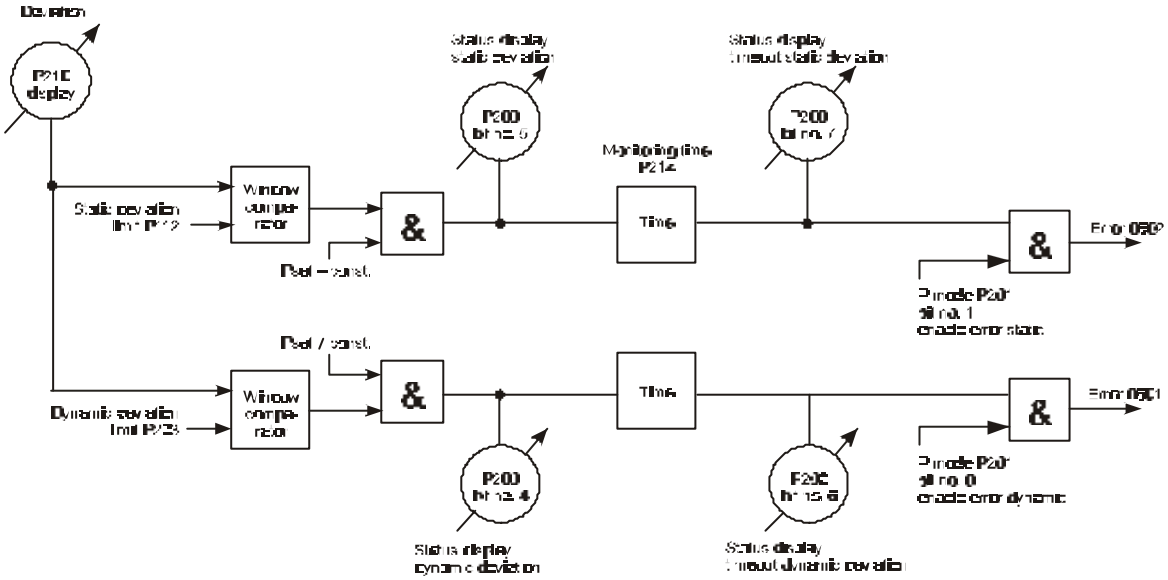
P219 P **phi actual value**

Copy of 64 bit position actual value from encoder 1 respectively encoder 2 (select P Mode P201 bit no. 2)

P204 P **N limiter bipolar**

This parameter limits symmetrically the position control set value (speed set value) . As long as the set value limitation is active, the bit no. 13 in state (P200) is set.

Deviation monitoring



P212 P **deviation limiter static**

The static deviation limiter is active, if the position controller no position set value received or the position set value doesn't change (see diagram P203).

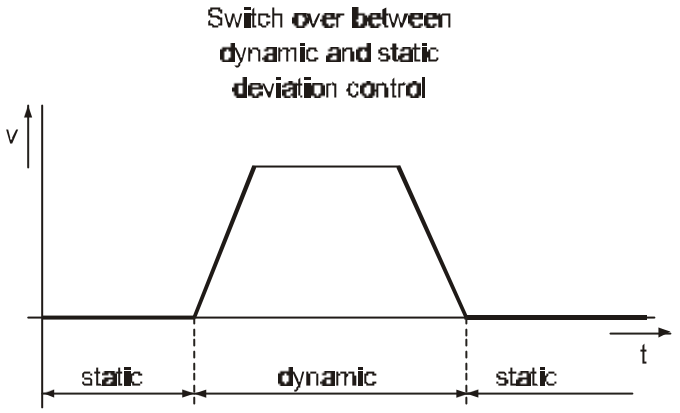
The static deviation limiter symmetrically limits the set position value.

If the actual deviation is greater than the entered static deviation limiter, bit no. 5 is set in P state (P200).

After the monitoring time (P time, P214) the bit no. 7 is additionally set and the error code 0602_{hex} (see P124 M error code) is generated. The drive changes to the state inhibit start if in parameter P mode (P201) the error dynamic deviation is enabled (Bit no. 1 = 1).

P203 P **deviation limiter dynamic**

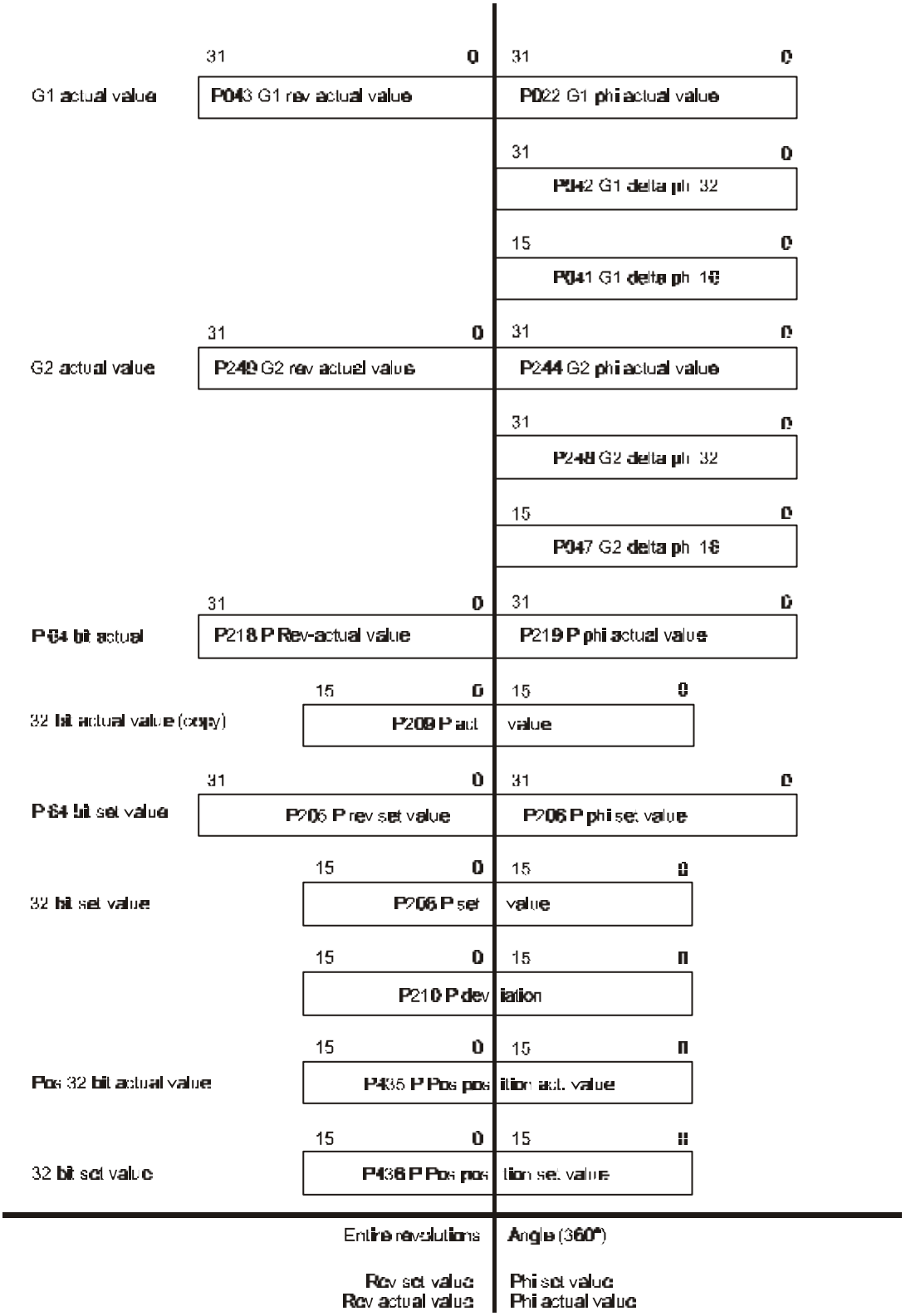
The dynamic deviation limiter symmetrically limits the set position value. If the actual deviation greater than the entered dynamic deviation limiter, bit no. 4 is set in P state P200). After the monitoring time (P time, P214) the bit no. 6 is additionally set and the error code 0601_{hex} (see P124 M error code) is generated. The drive changes to the state inhibit start if in parameter P mode (P201) the error dynamic deviation is enabled (bit no. 0 = 1).



P214 P **time**

This parameter sets the time window of the deviation monitoring. The delay time is only active, if bit no. 6 and 7 in P state is set.

Position data formats overview



DRIVE MANAGER

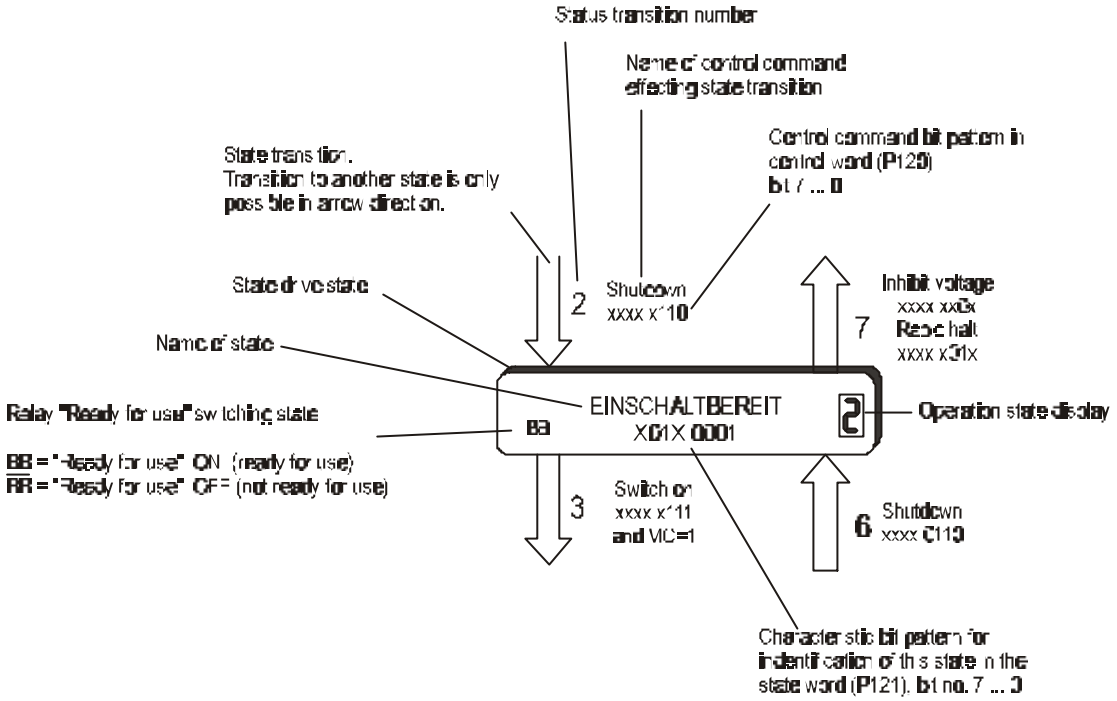
Function

The drive manager administrates the essential system resources of the drive. These include among others complete unit control in various modes, switching between the different modes, the management of all communication interfaces, error treatment etc.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P120	M **control word**	0000 ... FFFF		
P121	M **state word**	0000 ... FFFF		X
P122	M **desired operation mode**	-5 ... 6		
P123	M **actual operation mode**	-5 ... 6		X
P124	M **error code**	0000 ... FFFF		X
P125	M **error index**	0 ... 31		X
P136	M **mode**	0000 ... 0001		
P126	M **communication source**	0000 ... 000F		
P127	M **communication monitoring**	0000 ... 000F		
P128	M **monitoring time**	0 ... 60 000	ms	
P129	M **monitoring code**	-2 ... 3		
P130	M **HALT code**	0 ... 4		
P131	M **RAPID HALT code**	0 ... 4		
P132	M **INHIBIT no. code**	0 ... 4		
P133	M **SHUTDOWN code**	0 ... 4		
P134	M **state bit no. 14**	0000 ... FFFF		X
P135	M **state bit no. 15**	0000 ... FFFF		X
P137	M **state 1**	0000 ... FFFF		X

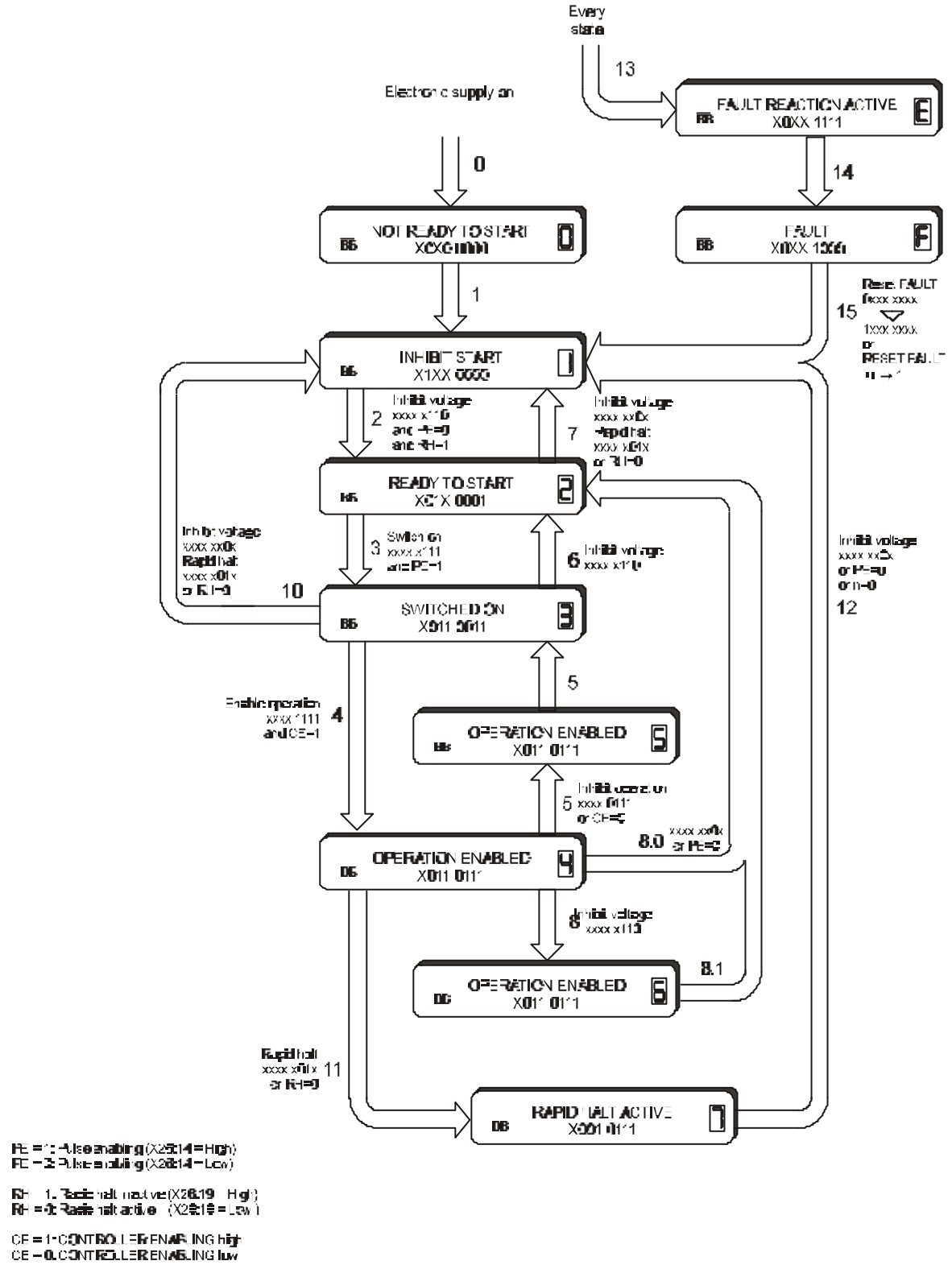
- **Introduction to the representation of unit control**



The binary bits 7 ... 0 of the static drive state (P121) are figured XXXX XXXX. The state transition bit pattern of the control word (P120) is figured xxxx xxxx (bit no. 7 ... 0).

The bits designated with X or x have no effect on the unit state.

- **Unit control state machine**



PE = 1: Pulse enabling (X25:14 = High)
PE = 0: Pulse inhibiting (X25:14 = Low)

RH = 1: Rapid halt inactive (X26:19 = High)
RH = 0: Rapid halt active (X26:19 = Low)

CE = 1: CONTROLLER ENABLING high
CE = 0: CONTROLLER ENABLING low

- Unit control states

  0 **NOT READY TO START**

  – electronics supplied with voltage
  – self-test running
  – initialisation running
  – drive function inhibited
  – relay “ready for use” is off (drive not ready for use)

  1 **INHIBIT START**

  – software/hardware initialisation completed
  – parameter assignment completed
  – drive function inhibited
  – switch-on inhibited
  – relay “ready for use” is on (drive ready for use)

  2 **READY TO START**

  – application parameters can be redefined
  – drive function inhibited
  – switch-on enabled
  – relay “ready for use” is on (drive ready for use)

  3 **SWITCHED ON**

  – application parameters can be redefined
  – drive function inhibited
  – power unit ready for use
  – relay “ready for use” is on (drive ready for use)

  4 **ENABLE OPERATION**

  – application parameters can be redefined
  – drive function enabled
  – relay “ready for use” is on (drive ready for use)

  5 **OPERATION ENABLED**

  – application parameters can be redefined
  – drive function enabled
  – command “Inhibit operation” is active (can be set in M shutdown code P132)
  – relay “ready for use” is on (drive ready for use)

6 OPERATION ENABLED

- application parameters can be redefined
- drive function enabled
- command “Shutdown” is active (can be set in M shutdown code P132)
- relay “ready for use” is on (drive ready for use)

7 RAPID HALT ACTIVE

- application parameters can be redefined
- rapid halt function is carried out (parameter assignment via M rapid halt code, P131)
- drive function enabled
- relay “ready for use” is on (drive ready for use)

E FAULT REACTION ACTIVE

- application parameters can be redefined
- a fault-dependant action is carried out
- drive function may be enabled

F FAULT

- application parameters can be redefined
- drive function inhibited
- relay “ready for use” is off (drive not ready for use)

- **Unit control state transitions**

0 State machine input **Þ NOT READY TO START 0**

event: - hardware reset
or - software reset
or - switch on operating voltage
action: - switch off relay “ready for use”
- start self-test

1 NOT READY TO START **0** **Þ INHIBIT START 1**

event: - error-free completion of initialisation and self-test
action: - activate communication and process data monitoring
- switch on relay “ready for use”

2 INHIBIT START **1** **Þ READY TO START 2**

event: - command “shutdown”
condition: - rapid halt input X26:13 = high
action: - none

3 READY TO START **2** **Þ SWITCHED ON 3**

event: - command “switch on”
condition: - rapid halt input X26:13 = high
action: - switch on power unit, if not on yet
- monitoring “ready for use” signal of power supply

4 SWITCHED ON **3** **Þ OPERATION ENABLED 4**

event: - command “enable function”
condition: - CONTROLLER ENABLING input = high
action: - enable drive function

5 OPERATION ENABLED **4** **Þ SWITCHED ON 3**

event: - command “inhibit operation”
or - CONTROLLER ENABLING input = low
action: - inhibit drive function

6 SWITCHED ON **3** **Þ READY TO START 2**

event: - command “shutdown”
- pulse enabling input X26:14 = low
action: - the power unit can be switched off
- monitoring “ready for use” signal of power supply is switched off

7 READY TO START **2** **Þ INHIBIT START 1**

event: - command “rapid halt”
or - command “inhibit voltage”
or - rapid halt input X26:19=low
action: - none

8.1 OPERATION ENABLED 4 Þ **READY TO START** 2

event: - command “shutdown”

action: - inhibit drive function (parameter assignment via M shutdown code P133)
- the power unit can be switched off
- monitoring “ready for use” signal of power supply is switched off

8.2 OPERATION ENABLED 4 Þ **READY TO START** 2

event: - command “inhibit voltage”

or - pulse enabling input X26:14 = low

action: - shutdown drive function
- the power unit can be switched off
- monitoring “ready for use” signal of power supply is switched off

10 SWITCHED ON 3 Þ **INHIBIT START** 1

event: - command “inhibit voltage”

or - command “rapid halt”

or - rapid halt input X26:19=low

action: - power unit can be switched off

11 OPERATION ENABLED 4 Þ **RAPID HALT ACTIVE** 7

event: - command “rapid halt”

or - rapid halt input X26:19=low

action: - trigger rapid halt function

12 RAPID HALT ACTIVE 7 Þ **INHIBIT START** 1

event: - command “inhibit voltage”

or - rapid halt completed (n=0)

or - pulse enabling input X26:14 = low

action: - inhibit drive function
- power unit can be switched off
- monitoring “ready for use” signal of power supply is switched off

13 all state types Þ **FAULT REACTION ACTIVE** F

event: - drive fault detected

action: - “ready for use” relay is switched off
- trigger error-dependant fault reaction

14 FAULT REACTION ACTIVE E Þ **FAULT** F

event:		- fault reaction completed
action:		- inhibit drive function
		- monitoring “ready for use” signal of power supply is switched off
		- power unit can be switched off

15 FAULT F Þ **INHIBIT START** 1

event:		- command “reset fault”
	or	- RESET ERROR input = low Æ high
condition:		- error no longer present
action:		- fault reset is carried out
		- switch on “ready for use” relay

The status only changes if all the actions have been carried out. The sequence of actions corresponds to the sequence of processing during status change. After carrying out all the actions the next status is reached, and new commands are accepted.

- **“Ready for use” relay**

  The state of the relay “ready for use” changes on the following control transitions:

Transition	Action “ready for use” relay	Comment
0	switch off	start of drive initialisation
1	switch on	end of drive initialisation
13	switch off	error occurred
15	switch on	all errors are acknowledged, drive without faults

State	“Ready for use” relay
NOT READY TO START	OFF
INHIBIT START	ON
READY TO START	ON
SWITCHED ON	ON
OPERATION ENABLED	ON
RAPID HALT ACTIVE	ON
FAULT REACTION ACTIVE	OFF
FAULT	OFF

- **Monitoring “ready for use” signal power supply**

  The monitoring state is changed only at following states.

Transition	Action	Comment
3	switch on	The time to load the intermediate circuit is considered internally
6 8 9 10 12, 13	switch off	

State	“Ready for use” relay
NOT READY TO START	OFF
INHIBIT START	OFF
READY TO START	OFF
SWITCHED ON	ON
OPERATION ENABLED	ON
RAPID HALT ACTIVE	ON
FAULT REACTION ACTIVE	OFF
FAULT	OFF

P120 M **control word**

This parameter is the input word of the control unit state machine.

Bit no.	Name	Comment
0	switch on	unit control state machine
1	inhibit voltage	unit control state machine
2	rapid halt	unit control state machine
3	enable operation	unit control state machine
4, 5, 6	mode-dependant	see table “total overview of control words”
7	reset fault	unit control state machine
8, 9, 10	reserved	must always be set = 0
11, 12, 13, 14	mode-dependant	see table “total overview of control words”
15	write protection	

The drive managers control word is write protected if the write protection bit (bit no. 15) is set in the control word. After the processing of the write protected control word the drive manager resets the write protection bit to 0.

NOTE

The controller can reach the state “operation enabled” immediately after the switch on of the electronic power supply, if the control word (see function module drive manager) is manipulated by digital inputs (see function module digital inputs) and the hardware enable is active.

During the programming of digital inputs this option must be considered and protective measures have to be ensured on machine-side.

The write protection must be used if the control word is manipulated by digital inputs and a communication source writes simultaneously on the control word.

The unit control commands are defined in the control word via the following bit combinations:

Command	Bit no. 15 write protection	Bit no. 7 reset fault	Bit no. 3 operation enabled	Bit no. 2 * rapid halt	Bit no. 1 * inhibit voltage	Bit no. 0 switch on	Transitions
Shutdown	X	X	X	1	1	0	2,6,8
Switch on	X	X	X	1	1	1	3
Inhibit voltage	X	X	X	X	0	X	7,9,10,12
Rapid halt	1	X	X	0	1	X	7,10,11
Inhibit operation	X	X	0	1	1	1	5
Enable operation	X	X	1	1	1	1	4
Reset fault	X	0 → 1	X	X	X	X	15
Enable operation straight	1	X	1	1	1	1	2

The bits designated with 5 have no effect on the unit control state.

* low active

Control word: total overview for all modes

Bit no.	Locating position -1	Current control -2	Speed control -3	Speed specification 1 2	Position control -4	Manual mode 5	Synchronisation control -5	Reference run mode 6	Target position specification 1
0	SWITCH ON (state machine)								
1	INHIBIT VOLTAGE (state machine) *								
2	RAPID HALT (state machine) *								
3	ENABLE OPERATION (state machine)								
4	X	X	RFG inhibit	RFG- * inhibit	X	X	X	starting reference run	new set value
5	X	X	RFG stop	RFG * stop	X	X	X	X	X
6	X	X	RFG-zero	RFG * zero	X	X	X	X	X
7	reset fault (state machine)								
8	X	X	X	X	X	X	X	X	X
9	X	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X	X
11	X	X	X	X	X	inching forward	X	X	start of positioning
12	X	X	X	X	X	inching backwards	X	X	X
13	X	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X	X
15	write protection								

The bits designated with X have no effect on the unit control state.

* low active

P121 M **state word**

This parameter is the output word of the unit control state machine.

Bit no.	Name	Comment
0	READY TO START	state machine
1	SWITCHED ON	state machine
2	OPERATION ENABLED	state machine
3	FAULT	state machine
4	INHIBIT VOLTAGE	bit no. 4 = 0: The “inhibit voltage” requirement is present (command or main contactor contact)
5	RAPID HALT	state machine
6	INHIBIT START	state machine
7, 8	reserved	reserved
9	remote	bit no. 9 = 1: Parameter can be assigned via the selected communication source
10	set value reached	bit no. 10 = 1: Depending on the active mode it is indicated whether the present set value is reached.
11	reserved	reserved
12, 13	mode dependant	see table “total overview for all modes”
14, 15	state bits	see P134, P135

The unit state is represented by the following bit combinations in the state word:

	Bit in state word						
	State of the unit control	**Bit no. 6 INHIBIT START**	**Bit no.5 * RAPID HALT**	**Bit no. 3 FAULT**	**Bit no. 2 OPERATION ENABLED**	**Bit no. 1 SWITCHED ON**	**Bit no. 0 READY TO START**
0	**NOT READY TO START**	0	X	0	0	0	0
1	**INHIBIT START**	1	X	0	0	0	0
2	**READY TO START**	0	1	0	0	0	1
3	**SWITCHED ON**	0	1	0	0	1	1
4	**OPERATION ENABLED**	0	1	0	1	1	1
F	**FAULT**	0	X	1	0	0	0
E	**FAULT REACTION ACTIVE**	0	X	1	1	1	1
7	**RAPID HALT ACTIVE**	0	0	0	1	1	1

The bits designated with X have no effect on the unit control state.

* low active

State word: total overview for all modes

Bit no.	Locating position -1	Current control -2	Speed control -3	Speed specifi-cation 1 2	Position control -4	Manual mode 5	Synchro-nisation control -5	Referenc e run mode 6	Target position specifi-cation 1
0	READY TO START (state machine)								
1	SWITCHED ON (state machine)								
2	ENABLE OPERATION (state machine)								
3	FAULT (state machine)								
4	VOLTAGE INHIBITED (state machine) *								
5	RAPID HALT (state machine) *								
6	INHIBIT START (state machine)								
7	X	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X	X
9	remote								
10	X	X	set value speed set value	reached speed set value	position set value	X	position set value	reference speed	position reached
11	X	X	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X	reference run finished	set value acknowle dgement
13	X	X	X	X	X	X	X	reference run error	X
14	state bit see P134, M state bit 14								
15	state bit see P135, M state bit 15								

The bits designed with X are reserved and have to be set 0.

* low active

Bit no. 10: “set value reached” is actualised only in state OPERATION ENABLED.

P122 M **desired operation mode**

This parameter specifies the mode for the drive.

Selection code	Mode	Comment
-5	Synchronisation control	optional
-4	Position control	standard
-3	Speed control	standard
-2	Current control	standard
-1	Locating position reference point setting	standard
1	Target position specification	optional
2	Speed specification 1	standard
5	Manual mode	optional
6	Reference run mode	optional

The operation modes can be changed with controller disabled (off-line), but partly with enabled controller (on-line).

See table M actual mode (P123), too.

P123 M **actual operation mode**

This parameter indicates the currently active drive mode (see also set mode table).

For switching from the current mode to the desired actual mode the following schematic diagram applies:

Mode switching

Mode switching	**from**								
to	-5 Synchro-nisation control	-4 Position control	-3 Speed control	-2 Current control	-1 Locating position	2 speed specifica-tion 1	6 Reference run mode	5 Manual mode	1 Target position specifi-cation
Synchronisa-tion control	X	2	2	2	1	2	2	2	2
Position control	2	X	2	2	1	2	2	2	2
Speed control	2	2	X	2	1	2	2	2	2
Current control	2	2	2	X	1	2	2	2	2
Locating position	1	1	1	2	X	1	1	1	1
speed spe-cification 1	2	2	2	2	1	X	2	2	2
Reference run mode	2	2	2	2	1	2	X	2	2
Manual mode	2	2	2	2	1	2	2	X	2
Target position specification	2	2	2	2	1	2	2	2	X

When 1 mode switching is only possible off-line in the INHIBIT START, READY TO START and SWITCHED ON state types.

When 2 mode switching is possible off-line in the INHIBIT START, READY TO START and SWITCHED ON state type as well as on-line in the OPERATION ENABLED state.

NOTE

Switching to possibly non-implemented optional modes is not prevented.

P124 M **error code**

In case of a fault, the corresponding error code can be found here. This error is acknowledged if the bit “reset fault” in the control word (P120) is set from 0 to 1 or the input "error reset" is enabled (see P136 M mode).

If several errors are present, the next error is displayed immediately after acknowledgement.

Error codes see chaper maintenance, error messages.

P125 M **error index**

This parameter indicates the number of errors which are present. On acknowledgement of each error the displayed value is decreased. The parameter contains the number 0 after acknowledging all errors.

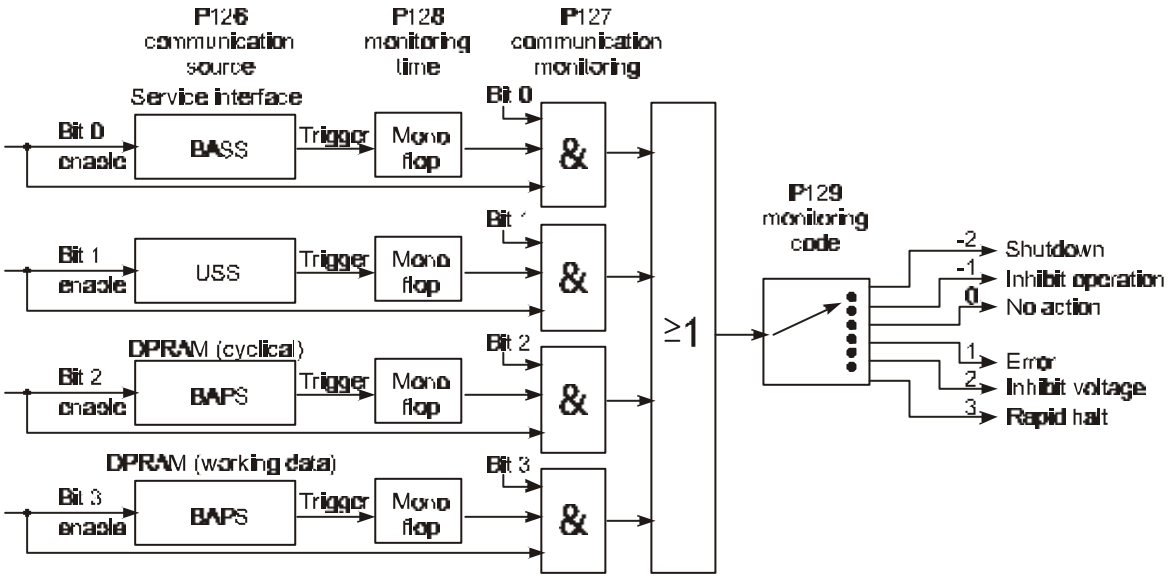
P136 M **mode**

This parameter chooses the different options to acknowledge an error message (see connection of function inputs in chapter installation).

P126 M **communication source**

The access rights of the various sources of communication are managed via this parameter.

Sources of communication are all program modules which exchange data with a master control via a communication protocol. As several of these program modules can be implemented in the drive, but not all modules can have simultaneous access to all parameters (particularly the drive manager's status word P120), write-access must be managed correspondingly.



Depending on the parameter “communication source” the drive manager activates and deactivates the various communication modules. Each communication module has a state parameter where the current state (RUN/STOP) is displayed.

A communication module is only allowed to write-access drive parameters when in the RUN status. In the STOP status no write-access is allowed. Reading the drive parameters is possible in any state.

The parameters M communication source (P126) and DSM command (P190) can be changed always with service interface and dual port RAM interface (BASS protocol, operation program).

According to the unit configuration, the following sources of communication are possible:

Bit no.	Meaning
0	1: BASS protocol via RS 232 enabled
1	1: USS protocol via RS 485 enabled
2	1: dual port RAM (cyclic data)
3	1: dual port RAM (working data)
4 ... 15	reserved

If the parameter “communication source” is set to 0, the drive can only be controlled via pulse enabling (PE), rapid halt (RH) and CONTROLLER ENABLING. As no master control is available, the drive manager itself can set the corresponding control commands.

P127 M **communication monitoring**

Monitoring of the sources of communication can be activated via this parameter.

Bit no.	Meaning
0	1: BASS protocol via RS 232 enabled
1	1: USS protocol via RS 485 is enabled
2	1: dual port RAM (cyclic data)
3	1: dual port RAM (working data)
4 ... 15	reserved

P128 M **monitoring time**

This parameter sets the time constant of communication monitoring. It is valid for all sources of communication.

If no information from the current communication source is received within the period set in the parameter “monitoring time”, e.g. as a result of an open circuit on an interface cable or defective communication card, the action selected in the parameter “monitoring selection code” is carried out. Monitoring time can be up to one minute with the representation unit being 1 ms. If the time 0 ms is entered, monitoring is switched off.

If the controller is operated without communication (P126 = 0), monitoring time must be set to 0 ms.

P129 M **monitoring code**

This parameter determines the drive reaction in the event of the communication monitoring time being exceeded. It is not important which communication source caused the timeout.

Selection mode	Function
-2	command SHUTDOWN is updated
-1	command INHIBIT OPERATION is updated
0	no action
1	transition to fault state
2	command INHIBIT VOLTAGE is updated
3	command RAPID HALT is updated

P130 M **HALT code**

This parameter determines the drive reaction in the unit control state machine in the OPERATION_ENABLED status. The HALT function is only implemented in the speed control and speed specification 1 modes.

Depending on control bit no. 4 “ inhibit RFG” the HALT function selected by the HALT code is carried out.

Code	Function
0	inhibit drive function
1	shutdown procedure at ramp-down ramp of ramp function generator
2	shutdown procedure at RAPID HALT ramp (set at P009)
3	shutdown procedure at current limit

P131 M **RAPID HALT code**

This parameter determines the drive reaction in the unit control state machine in the RAPID HALT ACTIVE state.

Code	Function
0	inhibit drive function
1	shutdown procedure at ramp-down ramp of ramp function generator
2	shutdown procedure at RAPID HALT ramp (set at P009)
3	shutdown procedure at current limit

P132 M **INHIBIT code**

This parameter determines the drive reaction in the unit control state machine during transition 5.

Code	Function
0	inhibit drive function
1	shutdown procedure at ramp-down ramp of ramp function generator
2	shutdown procedure at RAPID HALT ramp (set at P009)
3	shutdown procedure at current limit

P133 M **SHUTDOWN code**

This parameter and determines the drive reaction in the unit control state machine during transition 8.

Code	Function
0	inhibit drive function
1	shutdown procedure at ramp-down ramp of ramp function generator
2	shutdown procedure at RAPID HALT ramp (set at P009)
3	shutdown procedure at current limit

P134 M **state bit no. 14**

P135 M **state bit no. 15**

These parameters guide the bit no. 14 and 15 in state word (P120). From arbitrary 16 bit parameters a single bit can copied to the state word.

Bit no.	Meaning	
0... 10	1 .. 2047: 0	no. of parameter, binary code state bit is not updated
11	reserved	
12 ... 15	0 ... 15:	bit no., binary code

Examples:

1. The N=0 signal from encoder 1 (P025, bit no. 19) should be connected with state bit no. 14:
   P134 must be set to $A019_{hex}$.
2. Exceeding the dynamic deviation (P200, bit no. 4) should be connected with state bit no. 15.
   P135 must be set to $40C8_{hex}$.

P137 M **state 1**

This parameter displays the state (7-segment display) of the controller.

Bit no.	Meaning
0 ... 3	Shows the state number displayed in the 7 segment display
4 ... 15	Reserve

DATA SET MANAGEMENT

Function

Data set management is a universal module for loading and saving parameters
Data sets can be loaded from EPROM, changed and saved. 4 data sets can be managed at every time.

- **After switching on (booting)**

  Directly after switching on the operating voltage supply the DSM (data set management) automatically loads the boot data set (data set 0) into the drive's user memory.

  After successful execution of this command the DSM stops in

  state 0003: STAND_BY (P191)
  message 0000: no error (P192).

  If no boot data set has been created yet, the DSM is in

  state 000B: STAND_BY with error (P191)
  message 0002: data set not available (P192).

  In addition to the drive managers state changes to “F” fault and parameter M error code (P124) displays the error code 0902hex.

- **Creating and updating a boot data set**

  NOTE
  Prior to any new action the DSM (data set management) must first be reset by the command 0: Reset (P190)

  This measure sets all DSM parameters to value 0. This also refers to data set name (P193) and data set version (P194), which in this state represent the boot data set.

  It must now be set via the command 5: write data set into EEPROM (P190) how the boot data set is to be created for the first time in EEPROM or how an existing boot data set is to be updated. [1)]

  Only in the case of message 0000: no error (P192) and DSM state 0003: STAND_BY is the data set been written correctly.

  [1)] The counter “DS program cycle” (P197) is increased by 1.

- **Creating and updating other data sets**

  The procedure is identical to that of creating and updating a boot data set except that the parameter data set name (P193) can now be selected from numbers 1 to 3.

  Data sets can be transmitted to the working memory with

  command 6: read data set from EEPROM (P190).

- Only in the case of DSM message 0000: no error (P192) and DSM state 0003: STAND_BY has the data set been written correctly.

- **Source load of the parameters**

  If a source load is carried out the standard values of the parameter list are set and therefore a defined state is reached.

  The procedure of the source load is mentioned below:

  1. P190 = 0 — command reset data set management
  2. P190 = 7 — command delete data set
  3. Wait until P191 = 0003
  4. Switch off power supply of controller
  5. Switch on power supply of controller
  6. Now is displayed: P191 = 000B — stand-by with error; P192 = 0002 — data set not available; P124 = 0902; The controller´s state is fault
  7. P190 = 0 — command reset data set management
  8. P190 = 5 — command store data set
  9. Wait until P191 = 000B

- **Store the write protected data set**

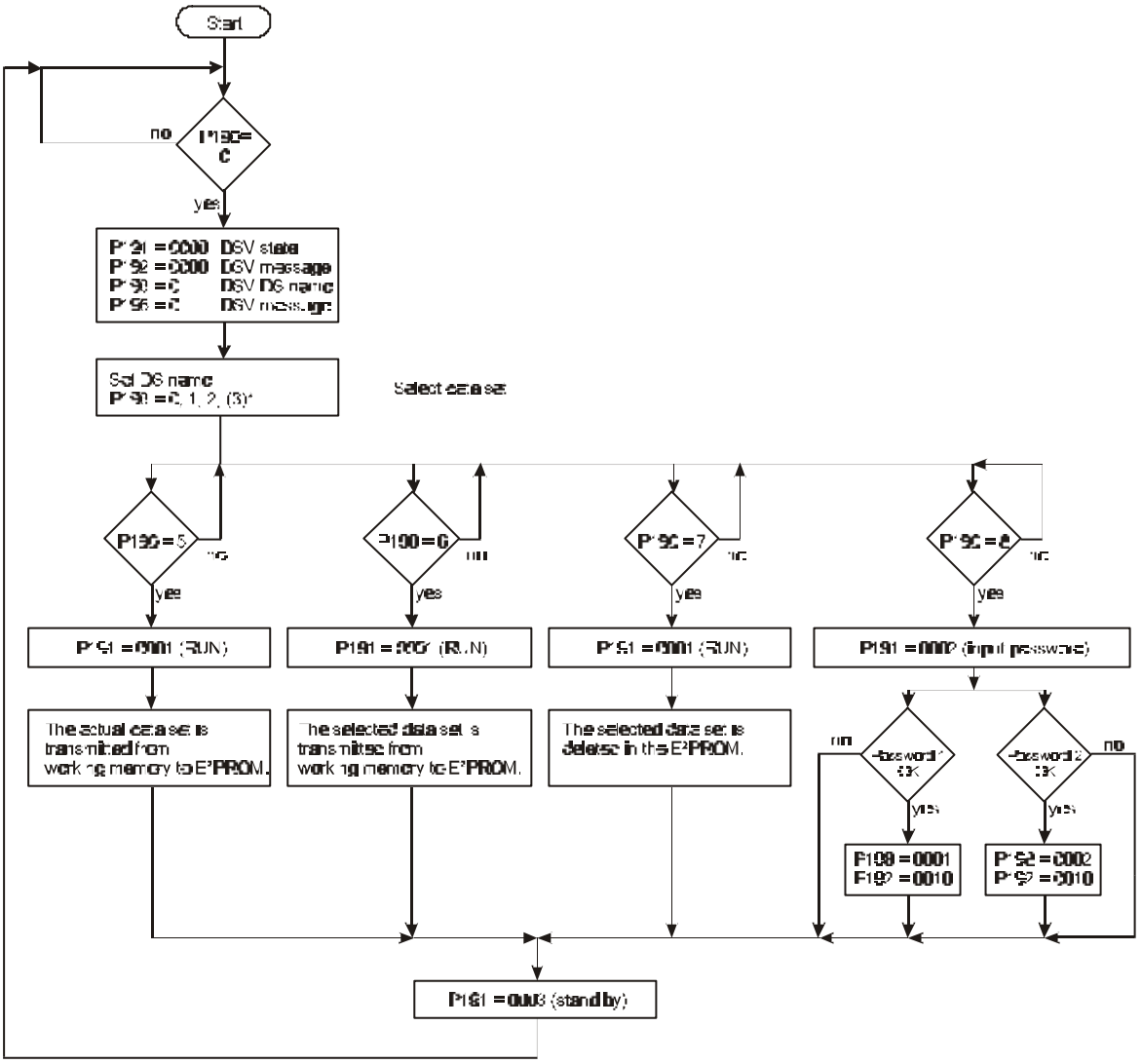
  1. P190 = 0 — command reset data set management
  2. P190 = 8 — command input password
  3. P190 = password 1
  4. P190 = 0 — command reset data set management
  5. P193 = 3 — DS no. write-protected data set
  6. P190 = 5 — command store data set

- **Change article no. of data set**

  1. P190 = 0 — command reset data set management
  2. P190 = 8 — command input password
  3. P190 = password 2
  4. P190 = 0 — command reset data set management
  5. P193 = 0, 1, 2, (3)* — data set no.
  6. P194 = new article no. — hexadecimal number
  7. P190 = 5 — command store data set

* only possible, if password 1 was already given

Overview of the commands



Parameter overview

Parameter	name	Range min. ... max.	Unit	Display only
P190	DSM **command**	0 ... 8	0	
P191	DSM **state**	0000 ... FFFF		X
P192	DSM **message**	0000 ... FFFF		X
P195	DSM **message Pxxx**	0 ... 700		X
P193	DSM **DS name**	0 ... 3		
P194	DSM **DS article no.**	0000 0000 ... FFFF FFFF		X
P197	DSM **DS program cycles**	0 ... 65536		X
P196	DSM **load data set**	0 ... 3		
P198	DSM key	0000 ... 0003		X

Parameter description

P190 DSM **command**

This command instructs the data set management to load, save or delete an existing data set.

NOTE
This parameter is independent of the parameter M communication source (P126) always changeable.

Command	Meaning
0	reset of data set management The parameter P191 till P195 are set automatically to 0.
5	save data set from user memory to EEPROM
6	load data set from EEPROM to user memory
7	delete EEPROM data set
8	input password

P191 DSM **state**

Bit no.	Meaning	
0 ... 2	000 : STOP	Data set management is ready for a command or for changing data sets.
	001 : RUN	Data set management is processing a command.
	011 : STAND_BY	Data set management has finished a command.
3	1 : An error has occurred in the data set management. Error code see P124, M error code and P192, DSM message	
4 ... 15	reserved	

P192 DSM **message**

If a message occurs during the implementation of a command, it is displayed in this parameter.

Bit no.	Meaning
0	1: undefined command
1	1: data set not available
2	1: wrong check sum
3	1: parameter not changeable
4	reserved
5	1: memory full
6	1: error in configuration list
7	1: undefined parameter format

P195 DSM **message Pxxx**

If a message has occurred (P192 ≠ 0), this parameter shows the parameter no. involved.

P193 DSM **DS name**

A maximum of 4 data sets can be managed in each memory area. They are selected via the parameter “data set name”.

The boot data set is always EEPROM data set 0

Value	Memory range EEPROM (non-volatile)
0	data set 0 (boot data set)
1	data set 1
2	data set 2
3	data set 3 (write-protected data set)

P194 DSM **DS article no.**

Article no. of a data set ex factory.

P197 DSM **DS program cycles**

Number of write actions on this data set.

P196 DSM **load data set**

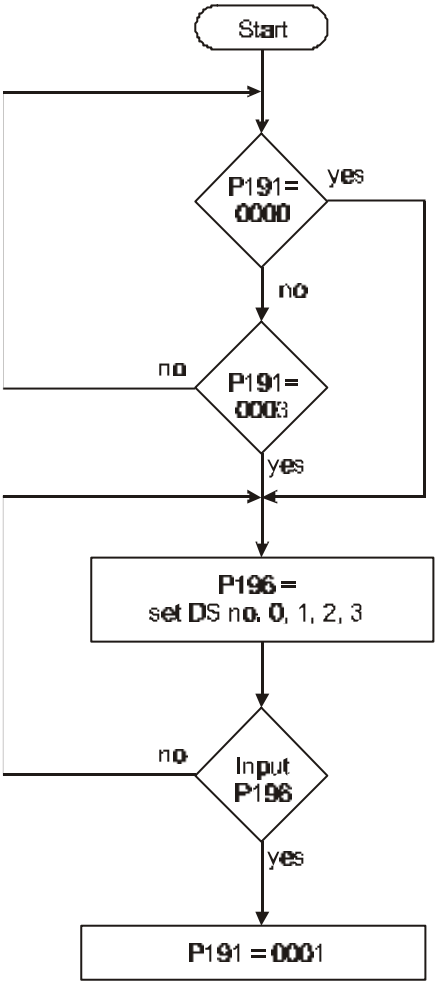
The data set with the corresponding number (0...3) can be loaded from the EEPROM into the working memory via this parameter.

The following procedure should be adhered to:

- Firstly, ensure that the status of the data set management (P191) is either set to 0 (STOP) or to 0003 (STAND_BY).
- Next enter the number of the required data set in the parameter, P196 (DSM load data set).
- All further steps follow independently:
  - The number of the required data set is displayed in parameter P193.
  - The command 6 “load data set from EEPROM into user memory” is visible in the parameter P190 (DSM command).
  - The data set is loaded.
- The procedure is completed once the DSM status displays again state 0003 (STAND_BY).
  (Incidentally entered numbers should be ignored.)

- **Change data set via P196**

The time in which this procedure is carried out will differ according to the loading of the microprocessor.



NOTE

This parameter can be used to change data sets via digital inputs. A change over must not be executed if controller is enabled!

P198 DSM **key**

Bit no.	Meaning
0	0: Data set 3 is write-protected 1: Data set 3 is write-enabled (only after input of password 1)
1	0: The article no. of all data sets is write-protected 1: The article no. of all data sets is write-enabled (only after input of password 2)
2 ... 15	reserved

OPERATION SYSTEM

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P166	OS **state**	0000 ... FFFF		
P162	OS **message**	0 ... 9999		X
P161	OS **sampling time**	124.8 ... 4000.0	ms	X
P167	OS **sync. slot**	0 ... 8000	ms	
P168	OS **sync. offset**	0 ... 8000	ms	
P169	OS **sync. tolerance**	0.2 ... 80.0	ms	
P174	OS **user software**	0.00 ... 99.99		X
P163	OS **DSV-6 SW release**	0.00 ... 99.99		X
P160	OS **selection**	0 ... 1000		
P159	OS **value**	0 ... 65535		

Parameter description

P166 OS **state**

This parameter displays the state of the function module operation systems.

Bit no.	Meaning
0 ... 3	1: operation system runs
4	1: controller is synchronized to sync. signal
5 ... 11	reserved
12	1: main program cycle time exceeds maximum value
13	1: task calculation time has exceeded maximum value
14	1: sync. IR calculation time has exceeded maximum value
15	reserved

P162 OS **message**

This parameter shows the number of operation system errors.

P161 OS **sampling time**

The system clock shows the run interval of the shortest operation system time slot.

P167 OS **sync. slot**

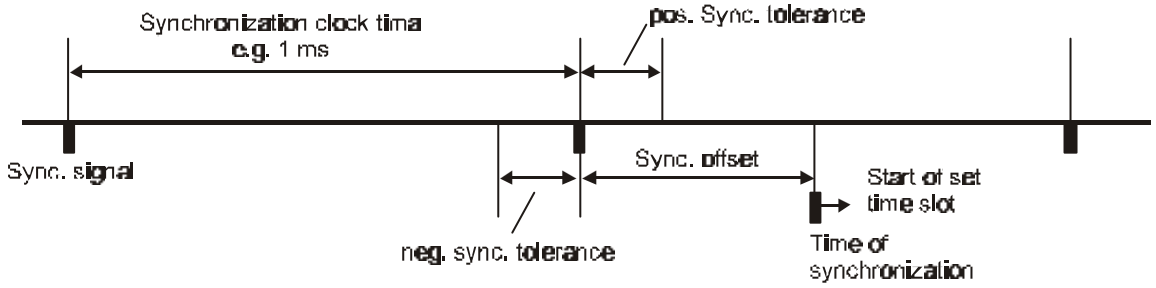
Value	Meaning
0	operation system synchronisation is not active
500 µs	controller synchronisation in 0.5 ms clock time
1000 µs	controller synchronisation in 1 ms clock time
2000 µs	controller synchronisation in 2 ms clock time
4000 µs	controller synchronisation in 4 ms clock time
8000 µs	controller synchronisation in 8 ms clock time

P168 OS **sync. offset**

The synchronisation time point can be moved within the chosen synchronization clock.

P169 OS **sync. tolerance**

Within the set tolerance range the sync. signal is allowed to differ from nominal value for a short time.



P174 OS **user SW**

Value	Meaning
0	production run software
>0	user fitted software

P163 OS **DSV-6 SW release**

This parameter displays the software release of the controller.

P160 OS **selection**

P159 OS **value**

With this parameter different measured values can be read from operation system.

Selection P160	Value P159	Unit
4	Maximum value of main program cycle time (The maximum value memory can be reset through writing on)	ms
40	Actual measured values of main program cycle time	ms

5	16 bit counter for main program cycles	

RAMP FUNCTION GENERATOR

Function:

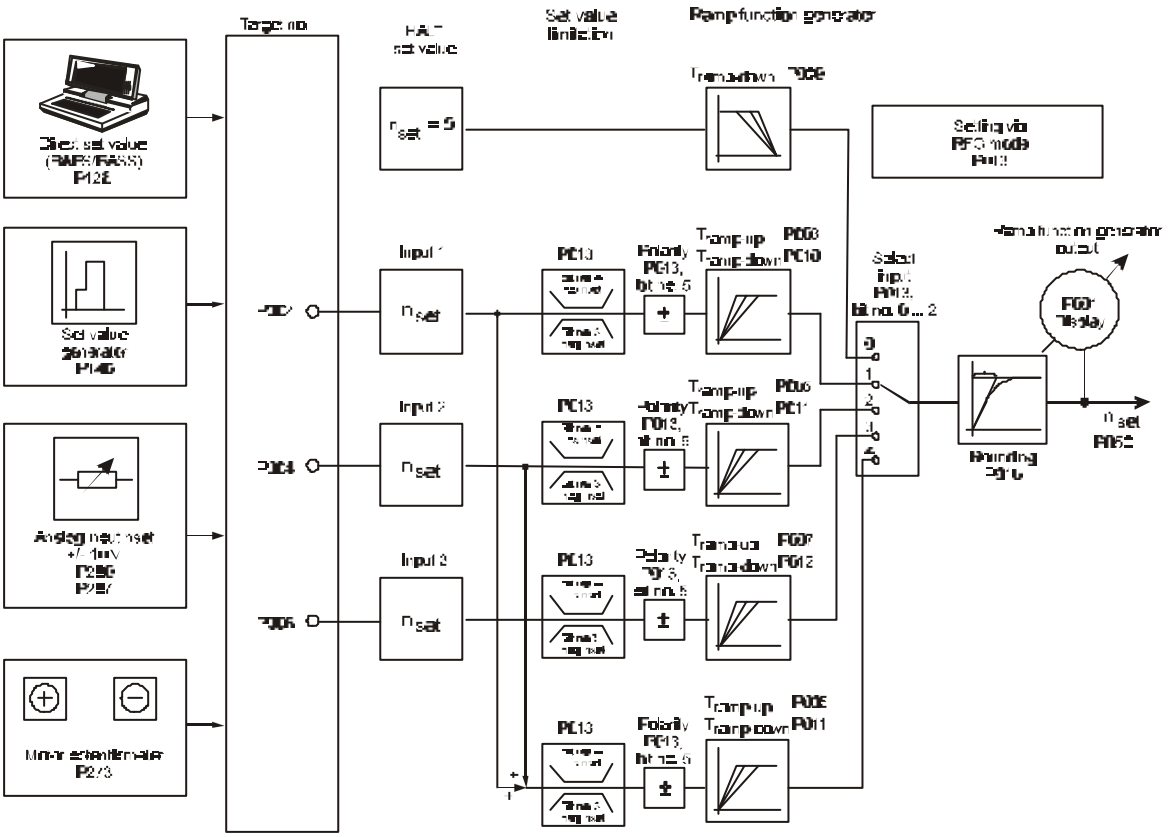
The ramp function generator (RFG) manages the 4 set value inputs, which can alternatively be switched to the output. The ramp-up and ramp-down times can be set separately for each input.

All inputs and the output of the ramp function generator are relative parameters (± 100 %) and standardized to maximum speed (P019).

The ramp stepness for the acceleration and braking procedures are determined by the ramp-up and ramp-down times. The times thus refer to 100 % set value alteration.

With exception of the fourth set speed value, which is programmed to zero, every input can take speed values between -100 % and +100 %. 100 % corresponds with maximum speed (P019).

The ramp function generator is only active in mode speed control (P122 = -3) and speed precontrol 1 (P122 = 1), as well as the different braking procedures initiated by the drive manager (transitions 5, 8 and 11).



Parameter overview:

Parameter	Name	Range min. ... max.	Unit	Display only
P014	RFG **state**	0000 ... FFFF		X
P013	RFG **mode**	0000 ... 007F		
P002	RFG **input 1**	-100.00 ... 100.00	%	
P004	RFG **input 2**	-100.00 ... 100.00	%	
P006	RFG **input 3**	-100.00 ... 100.00	%	
P003	RFG **ramp-up time 1**	0.00 ... 650.00	s	
P010	RFG **ramp-down time 1**	0.00 ... 650.00	s	
P005	RFG **ramp-up time 2**	0.00 ... 650.00	s	
P011	RFG **ramp-down time 2**	0.00 ... 650.00	s	
P007	RFG **ramp-up time 3**	0.00 ... 650.00	s	
P012	RFG **ramp-down time 3**	0.00 ... 650.00	s	
P009	RFG **time halt**	0.000 ... 60.000	s	
P016	RFG **rounding**	0 ... 60000	ms	
P001	RFG **output**	-100.00 ... 100.00	%	X

Parameter description

P014 RFG **state**

Displays the function module´s state.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN
3	1: error in function module, error code see M error code (P124)
4	1: RFG output is set internally to 0 (RFG_LOCKED)
5	1: RFG was stopped on the ramp (RFG_STOP)
6	1: RFG input is set internally to set value 0 (RFG_ZERO)
7	1: rapid-halt ramp is active (RFG_RHALT)
8	1: ramp-up procedure is active
9	1: ramp-down procedure is active
10	See bit no. 5
11	See bit no. 7
12	1: RFG output = RFG input (set value reached)
13 ... 15	reserved

P013 RFG **mode**

The input selection chooses one out of four inputs of the ramp function generator and activates the set value limitation.

Bit no.	Meaning
0 ... 2	000: halt 001: input 1 010: input 2 011: input 3 100: sum of input 1 and input 2
3	1: negative set values are disabled
4	1: positive set values are disabled
5	1: change polarity of actual set value
6	1: If halt is activated, the motor brakes to speed 0 with set ramp. The controller is active after N = 0.
7 ... 15	reserved

P002 RFG **input 1**

P004 RFG **input 2**

P006 RFG **input 3**

All 3 inputs are balanced and can be written via the serial interface, position controller and the set value generator as well as the analog set value input.

P003 RFG **ramp-up time 1**

P005 RFG **ramp-up time 2**

P007 RFG **ramp-up time 3**

The acceleration assigned to the inputs can be set via the ramp-up times. The time selected here correspond to a set value alteration of 100 %.

P010 RFG **ramp-down time 1**

P011 RFG **ramp-down time 2**

P012 RFG **ramp-down time 3**

P009 RFG **time halt**

The deceleration assigned to the inputs can be set via the ramp-down times. The time selected here correspond to a set value alteration of 100 %.

P016 RFG **rounding**

A first-order time delay element is implemented in order to round off ramp corners. The time constants of the PT1 device can be set by this parameter.

P001 RFG **output**

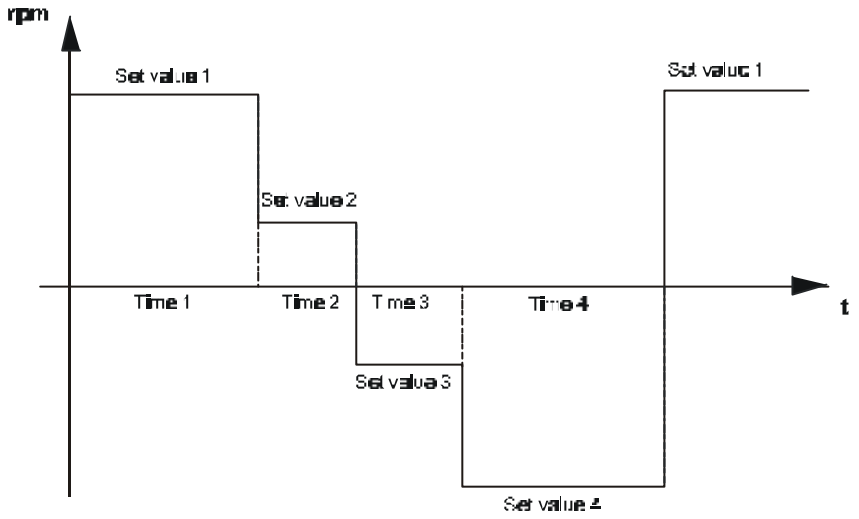
This parameter displays the actual output value.

SET VALUE GENERATOR

Function

The module creates a plateau set value for each of the 4 time zones. Both the plateau amplitude and the output time interval per zone can be allocated parameters. The amplitudes are relative and are standardised by means of the min./max. receiver values. On termination of the last time zone the first time zone starts again. Each time the controller is enabled the set value generator is newly started in zone 1. When leaving the state “operation enabled” (P121), the set value generator is stopped.

Thus e.g. the following speed set value graph can be created:



Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P150	SVG **state**	0000 ... FFFF		X
P140	SVG **target Pxxx**	0 ... 700		
P141	SVG **output**	- 100.00 ... + 100.00	%	X
P142	SVG **set value 1**	- 100.00 ... + 100.00	%	
P143	SVG **set value 2**	- 100.00 ... + 100.00	%	
P144	SVG **set value 3**	- 100.00 ... + 100.00	%	
P145	SVG **set value 4**	- 100.00 ... + 100.00	%	
P146	SVG **time 1**	0.001 ... 60.000	s	
P147	SVG **time 2**	0.001 ... 60.000	s	
P148	SVG **time 3**	0.001 ... 60.000	s	
P149	SVG **time 4**	0.001 ... 60.000	s	

Parameter description

P150 SVG **state**

This parameter displays the internal function module state.

Bit no.	Meaning
0 … 2	000: STOP 001: RUN
3 ... 15	reserved

P140 SVG **target Pxxx**

To this parameter no. the output value is written (e.g. parameter P002, input 1 ramp function generator).

P141 SVG **output value**

The actual set value is displayed here.

P142 SVG **set value 1**

P143 SVG **set value 2**

P144 SVG **set value 3**

P145 SVG **set value 4**

Parameter values between -100 % and +100 % can be assigned to these 4-amplitude-parameters. The amplitudes are connected to the output value according to the time assigned to them.

P146 SVG **time 1**

P147 SVG **time 2**

P148 SVG **time 3**

P149 SVG **time 4**

Values between 8 ms and 60 s can be assigned to these time parameters. The corresponding amplitudes are switched to the output value during these time intervals.

MOTOR POTENTIOMETER

Function

The motor potentiometer allows the alteration of all parameter values which can be written via the function inputs. Therefore it is necessary to program two digital inputs on the parameter EA motor potentiometer + (P271) and EA motor potentiometer - (P272).
The cycle time of the function module is 32 ms.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P270	EA **mode**	0 ... 1		
P271	EA **motor potentiometer +**	0 ... 1		
P272	EA **motor potentiometer -**	0 ... 1		
P273	EA **motor potentiometer Pxxx**	0 ... 700		
P274	EA **motor potentiometer dynamics**	0 ... 2		
P275	EA **motor potentiometer increment**	0.01 ...20.00	%	
P276	EA **motor potentiometer value**	- 100.00 ... + 100.00	%	5

Parameter description

P270 EA **mode**

Value	Meaning
0	no function
1	motor potentiometer function active

P271 EA **motor potentiometer +**

Value	Meaning
0	inching + off
1	inching + on (“motor potentiometer output value” is increased)

P272 EA **motor potentiometer -**

Value	Meaning
0	inching - off
1	inching - on (“motor potentiometer output value” is decreased)

NOTE

The motor potentiometer output value is not changed, if EA motor potentiometer + and EA motor potentiometer - equal 1.

P273 EA **motor potentiometer Pxxx**

The inching function target Pxxx serves to specify the receiver address (= target parameter) of the output value, e.g. input ramp function generator.

NOTE

No target parameter number check is carried out.

P274 EA **motor potentiometer dynamics**

The setting dynamics for key operation can be set here.

Value	Meaning
0	Step-by-step increment, on every LO/HI transition the output value is changed by the value “increment” with the correct polarity
1	Linear increment, during the HI signal the output value is changed by the value “increment” at every cycle
2	Square-law increment, during the HI signal the output value is changed with the right polarity at every cycle with square-law “increment”

P275 EA **motor potentiometer increment**

The value by which the output value is altered on key operation can be set via this parameter.

P276 EA **motor potentiometer value**

This parameter describes the inching function module output.

SYNCHRONISATION CONTROL

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P250	SC **state**	0000 ... FFFF		X
P251	SC **mode**	0000 ... 0013		
P255	SC **following axis rpm**	-30000 ... +30000		
P256	SC **leading axis rpm**	1 ... 30000		
P252	SC **compensation factor**	1 ... 1000		
P253	SC **tolerance**	0020 ... 7FFF	Inc	
P257	SC **position set value**	00000000 ... FFFFFFFF		
P258	SC **phi set value**	00000000 ... FFFFFFFF		
P254	SC **sync. delta**	80000001 ... 7FFFFFFF		
P259	SC **tolerance time**	0.000 ... 60.000	s	
P324	SC **N P gain**	0.1 ... 1000.0		
P325	SC **N integral action time**	1.0 ... 2000.0	ms	
P323	SC **d_ref 0**	0000 ... FFFF	Ink	

Parameter description

P250 SC **state**

This parameter gives the state of the synchronisation control..

Bit no.	Meaning
0 ... 3	0: STOP synchronisation control switched off 1: RUN synchronisation control active
4	1: synchronisation is finished (only in mode synchronisation, P251 = 2)
5	1: The reference run to zero impulse of the leading axis has set tolerance threshold reached. (only in mode reference run to zero impulse P251 = 1)
6	1: reference run to zero impulse of leading axis is finished (only in mode reference run to zero impulse P251 = 1)
7	reserved
8	1: synchronous set value is initialized (only in mode set synchronous set value)
9	1: an actual synchronous set value available
10	0: synchronous interpolation active 1: synchronous extrapolation active
11 ... 15	reserved

P251 SC **mode**

Bit no.	Meaning
0 ... 3	0000: speed synchronisation control or relative angle synchronisation control 0001: absolute angle synchronisation control 0010: reserved 0011: synchronisation control with synchronous set value
4	0: transparent mode: all alternations take immediate effect 1: The parameter following axis rpm and leading axis rpm can be changed. The transmission ratio remains unaltered. 1 → : The altered leading/following axis rpm parameters are taken over simultaneously.
5 ... 15	reserved

P255 SC **following axis rpm**

Numerator of the quotient which determines the transmission ratio in the electronic gearing.

P256 SC **leading axis rpm**

Denominator of the quotient which determines the transmission ratio in the electronic gearing.

The transmission ratio of the electronic gearing is calculated according to the following equation:

$$i = \frac{\text{Following axis rpm}}{\text{Leading axis rpm}} = \frac{P255}{P256}$$

Denominator and numerator of transmission ratio are integers. The numerator can be negative, too.

Several transmission ratios and their respective parameter values are displayed in the following table.

i	Leading axis rpm	Following axis rpm
0.2	10	2
- 0.78	- 100	78
1.15	100	115
9.452	1000	9452
0.3333	10	3

Example:
Change transmission ratio from 0.8 to 1.15

edit mode = 0 (transparent mode)

leading axis rpm	following axis rpm	edit mode	transmission ratio i
10	8	0	0.8
10 → 100	8	0	0.8 → **0.08**
100	8 → 115	0	0.08 → 1.15

or

leading axis rpm	following axis rpm	edit mode	transmission ratio i
10	8	0	0.8
10	8 → 115	0	0.8 → **11.5**
10 → 100	115	0	11.5 → 1.15

NOTE
The transparent mode can lead to undesired transmission ratios!

edit mode = 1

leading axis rpm	following axis rpm	edit mode	transmission 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

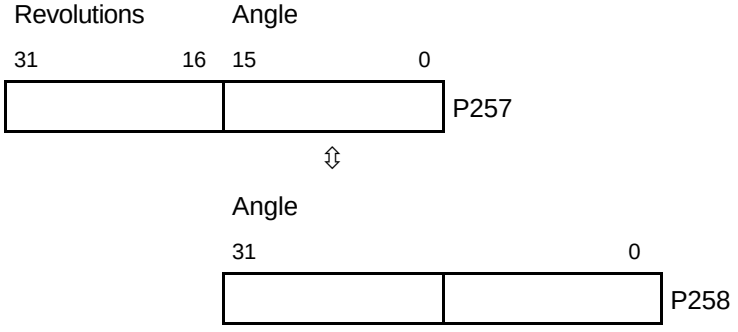
Undesired transmission ratios do not appear with edit mode = 1!

P257 SC **position set value**

P258 SC **phi set value**

These parameters are used in operation mode “synchronisation control with synchronous set value setting” as set value inputs.

Standardization:



P254 SC **sync delta**

P252 SC **compensation factor**

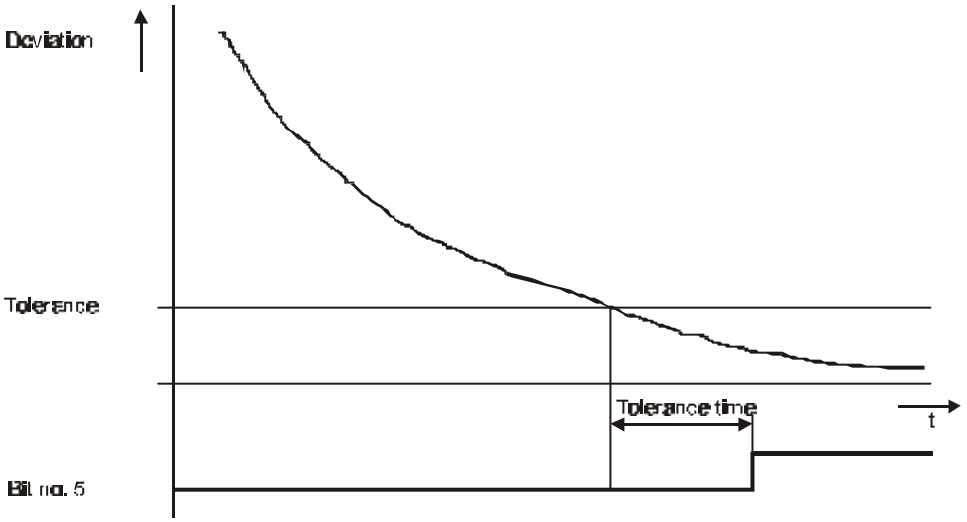
In operation mode “absolute angle synchronisation” this parameter sets the compensation speed.

P253 SC **tolerance**

P259 SC **tolerance time**

In operation mode “absolute angle synchronisation” these parameters set the tolerance threshold and the delay time to enable state bit no. 5.

Standardization: 1 ↔ 1 encoder increment



Description of Synchronous Operating Modes

- Mode 0, synchronous operation (standard function)
- If the drive controller is enabled in mode synchronous operation with electronic transmission or switched online to this mode, the system uses the position actual values of the leading axis and of the position controller, which are valid at this time, as the basis of calculation for the electronic transmission. This means that from this time onwards, the rotating shaft (leading axis) and the motor (following axis) have a fixed, non-defined angular relationship with one another.

  During operation, the system multiplies all the leading axis position changes by the transmission factor $i = \frac{P255}{P256}$ and transfers them to the position controller.

  In the case of a controller inhibit or a change to the other operating mode, the angular relationship, which may exist between the leading and following axiss, is lost.
- Mode 1, synchronous operation with reference run to the leading axis’s zero pulse

NOTE

Incremental encoders with an identical number of increments must be present on the leading and following axiss.

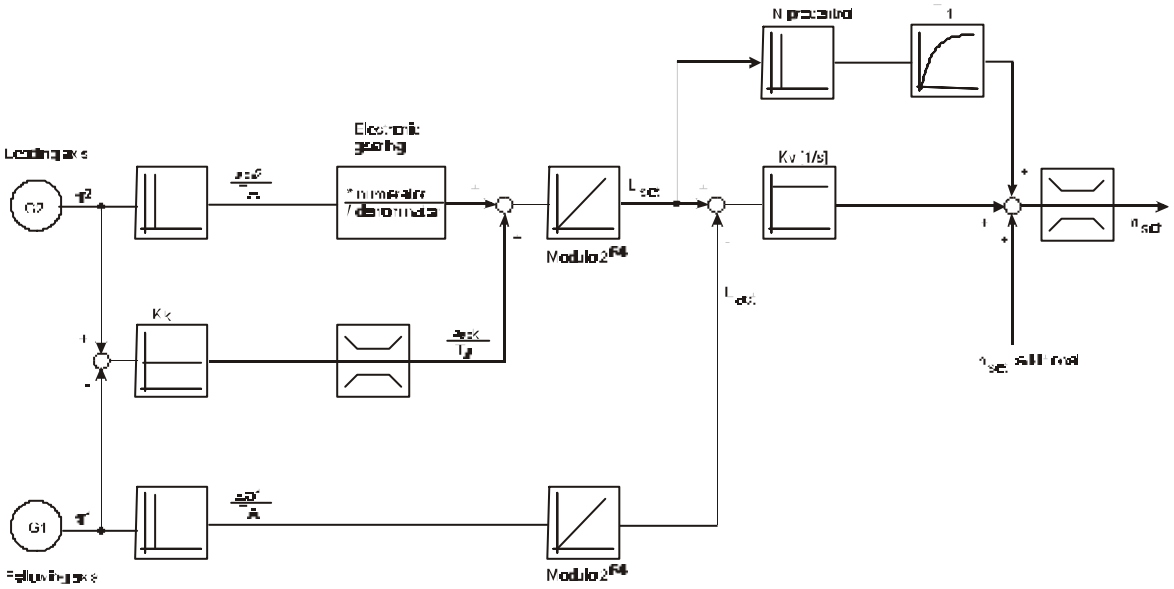
Each time the controller is enabled or switched online to this operating mode, the system synchronizes the following axis's zero pulse to the leading axis's zero pulse. This is only possible when the leading axis is rotating.

On conclusion of the synchronization procedure, the system sets bit number 5 in SC Status.

- Mode 2, synchronous operation with path compensation
- When this mode is first activated, the drive responds in a similar way as with the synchronous operation standard function (Mode 0).
- Mode 3, synchronous operation with synchronous specified value specification

Overview of synchronous operation modes

Operating Mode of P251	Kv P202	N Preset P207	Electron. Transmission	Reference to Leading Axis's Zero Pulse	Reference to Leading Axis's Absolute Position	Encoder Type
Speed synchronous operation	= 0	= 100%	i = 5	No	No	All
Relative angular synchronous operation	> 0	= 100%	i = 5	No	No	All



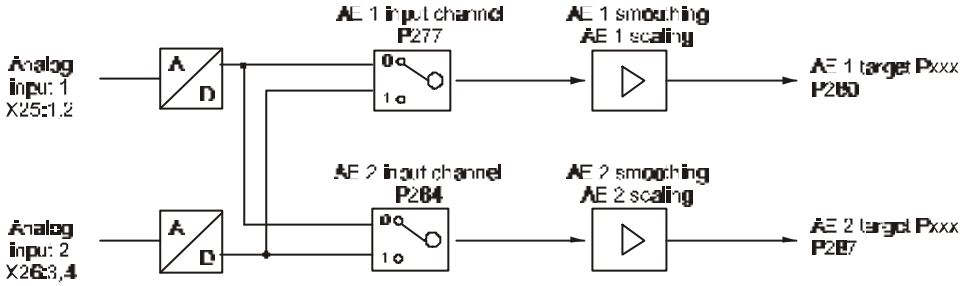
ANALOG INPUTS

Function

The function module in combination with the 2 analog inputs enable the programming of 2 byte length parameters.

Six parameters are assigned to each input:

- *AI input channel:* input channel entry
- *AI smoothing*: smoothing time constant [ms].
- *AI scaling*: scaling factor entry
- *AI offset*: offset entry
- *AI threshold value*: sensitivity of inputs
- *AI target Pxxx*: target parameter number entry
- *AI value*: current output value.



Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P277	AI **1 input channel**	0 ... 1		
P278	AI **1 smoothing**	1 ... 30	ms	
P279	AI **1 scaling**	-2.00 ... 2.00		
P280	AI **1 target Pxxx**	0 ... 700		
P281	AI **1 offset**	-100.00 ... +100.00	%	
P282	AI **1 threshold value**	0.00 ... 100.00	%	
P283	AI **1 value**	-100.00 ... +100.00	%	X
P284	AI **2 input channel**	0 ... 1		
P285	AI **2 smoothing**	1 ... 30	ms	
P286	AI **2 scaling**	-2.00 ... 2.00		
P287	AI **2 target Pxxx**	0 ... 700		
P288	AI **2 offset**	-100.00 ... +100.00	%	
P289	AI **2 threshold value**	0.00 ... 100.00	%	
P290	AI **2 value**	-100.00 ... +100.00	%	X

NOTE

The sequence of the parameter setting is irrelevant. Switching is carried out as soon as the target parameter number has been set.

The target parameter number must be reset to zero in order to deactivate an input. However, the target parameter still contains the last output value. If AI target Pxxx is deactivated or newly set, the parameter “AI x offset” is additionally set to zero.

Cycle time of analog inputs: 1 ms

Parameter description

P277 AI **1 input channel**

P284 AI **2 input channel**

Entry of the analog input for respective channel.

The two hardware implemented analog inputs 1 and 2 can be connected with each input channels. It is further possible to connect an analog input with different input channels.

P278 AI **1 smoothing**

P285 AI **2 smoothing**

In order to smooth interference on the analog input signal a smoothing time constant can be entered in ms. Smoothing is switched off if the respective parameter is set to its minimum value.

P279 AI **1 scaling**

P286 AI **2 scaling**

These parameters enable scaling of the analog input variable.

The output values (see parameters P283, P290, P297, P304) of unsigned parameters are 0 till +100% and of signed parameters are -100 till +100%. Which analog input voltage this maximum values achieved depends on the scaling factor.

P280 AI **1 target Pxxx**

P287 AI **2 target Pxxx**

The receiver address for the output value can be set via this parameter.

NOTE
No target parameter number check is carried out.

P281 AI **1 offset**

P288 AI **2 offset**

These parameters can compensate for a possibly existing input voltage offset.

P282 AI **1 threshold value**

P289 AI **2 threshold value**

The sensitivity of the inputs can be set via the threshold values.

P283 AI **1 value**

P290 AI **2 value**

The AI value displays the respective current output value taking scaling and offset compensation into consideration.

Basics of equation:

Maximum target parameter value:	MAX_value
Analog input voltage:	U_{in} { -10 ... +10 V };
	U_{inmax} = +10V;

Equation:

- Unsigned parameters:

$$AI\_\ value[\%] = \frac{U_{in}[V] + 10V}{2 \cdot U_{in\,max}[V]} * Scaling * 100\% + Offset$$

if AI-value > 100 % → AI-value = 100 %

- Signed parameters:

$$AI\_\ value[\%] = \frac{U_{in}[V]}{2 \cdot U_{in\,max}[V]} * Scaling * 100\% + Offset$$

if AI-value > 100 % → AI-value = 100 %

if AI-value < -100 % → AI-value = -100 %

Both for signed and unsigned parameters

|AI_value [%]| < threshold value [%] then AI_value = 0 %

Written to the target parameter:

$$\text{Value target} = \frac{\text{AI\_value}[\%]}{100\%} \cdot \text{MAX value}$$

Examples:

Input voltage « AI-value [%] * MAX_value
® target parameter value

scaling = 1; offset = 0%; threshold value = 0%;

Unsigned target parameter:					Signed target parameter:				
10 V	↔	100 %	* MAX_value		10 V	↔	100 %	* MAX_value	
5 V	↔	75 %	* MAX_value		5 V	↔	50 %	* MAX_value	
0 V	↔	50 %	* MAX_value		0 V	↔	0 %	* MAX_value	
- 5 V	↔	25 %	* MAX_value		- 5 V	↔	-50 %	* MAX_value	
- 10 V	↔	0 %	* MAX_value		- 10 V	↔	-100 %	* MAX_value	

scaling = 2; offset = -100%; threshold value = 0%;

Unsigned target parameter:					Signed target parameter:				
10 V	(	100 %	* MAX_value		10 V	(	100 %	* MAX_value	
5 V	(	50 %	* MAX_value		5 V	(	0 %	* MAX_value	
0 V	(	0 %	* MAX_value		0 V	(	-100 %	* MAX_value	
- 5 V	(	0 %	* MAX_value	(limitation !)	- 5 V	(	-100 %	* MAX_value	(limitation !)
- 10 V	(	0 %	* MAX_value	(limitation !)	- 10 V	(	-100 %	* MAX_value	(limitation !)

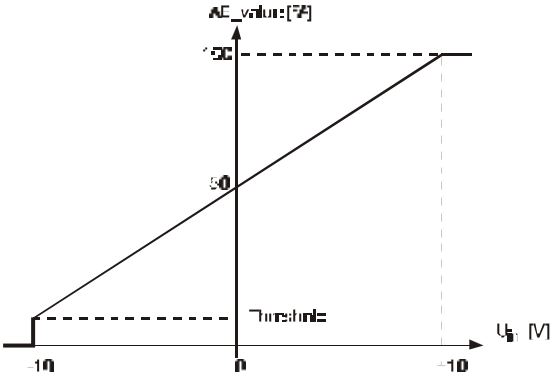
scaling = 1; offset = 0; threshold value = 10.1%;

Unsigned target parameter:					Signed target parameter:				
10 V	(	100 %	* MAX_value		10 V	(	100 %	* MAX_value	
5 V	(	75 %	* MAX_value		5 V	(	50 %	* MAX_value	
0 V	(	50 %	* MAX_value		1 V	(	0 %	* MAX_value	(threshold !)
-5 V	(	25 %	* MAX_value		- 1 V	(	0 %	* MAX_value	(threshold !)
- 9 V	(	0 %	* MAX_value	(threshold !)	- 5 V	(	-50 %	* MAX_value	
- 10 V	(	0 %	* MAX_value		- 10 V	(	-100 %	* MAX_value	

Examples of characteristic curves:

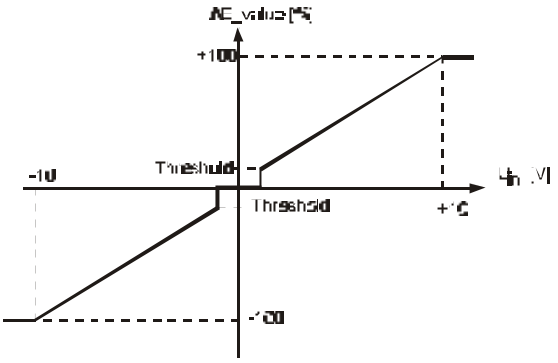
Unsigned target parameter

Offset = 0 %; scaling = 1



Signed target parameter

Offset = 0 %; scaling = 1



ANALOG OUTPUTS

Function

The module “analog outputs” transmits freely selectable (and scalable) parameter values to an analog output via a 12-bit digital-to-analog converter. It is possible transmitting 32-bit parameter either the low word to one channel or to channel 1 the low word and to channel 2 the high word of the 32 bit parameter. At a voltage range of ± 10 V the output current should not exceed 1 mA.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P338	AO **state**	0 ... FFFF	-	X
P337	AO **test value**	-10.000 ... +10.000	V	
P330	AO **1 source Pxxx**	0 ... 700		
P331	AO **1 offset**	-100000 ... +100000	Dig	
P332	AO **1 scaling**	-25000 ... +25000	Dig/V	
P334	AO **2 source Pxxx**	0 ... 700		
P335	AO **2 offset**	-100000 ... +100000	Dig	
P336	AO **2 scaling**	-25000 ... +25000	Dig/V	

Parameter description

P338 AO **state**

Display of internal function module state.

Bit no.	Meaning
0	0: STOP, analog output 1 switched off 1: RUN, analog output 1 is active
1 ... 3	reserved
4	analog output 1 at negative threshold (-10V) (X26:7)
5	analog output 1 at positive threshold (+10V) (X26:7)
8	0: STOP, analog output 2 switched off 1: RUN, analog output 2 is active
9...11	reserved
12	analog output 2 at negative threshold (-10V) (X26:8)
13	analog output 2 at positive threshold (+10V) (X26:8)
14 ... 15	reserved

P337 AO **test value**

The analog output (DA converter) can be tested via this parameter.

e.g.

AO 1 source Pxxx	P330 = 337
AO test value	P337 = +10
	→ analog output 1 = + 10 V
AO 1 scaling	P332 = -2000
	→ analog output 1 = - 5 V
AO offset channel 1	P331 = 14000
	→ analog output 1 = + 2 V

P330 AO **1 source Pxxx**

P334 AO **2 source Pxxx**

The output parameter numbers are entered here.

The respective channel is switched off, if this parameter is equal 0.

If a 32 bit parameter is programmed on one channel, the low word of this parameter is transmitted. To transmit the high word, both channels (P330 and P334) must be programmed to the same parameter. As a result channel 1 transmits the low word and channel 2 the high word of the 32 bit parameter. If channel 1 programmed to another parameter then channel 2 transmits the low word. That means that the high word of a parameter can´t be transmitted separately without the low word. Channel 1 transmits always the low word and channel 2 transmits always the high word.

P331 AO **1 offset**

P335 AO **2 offset**

The offset of the analog outputs is set here.

P332 AO **1 scaling**

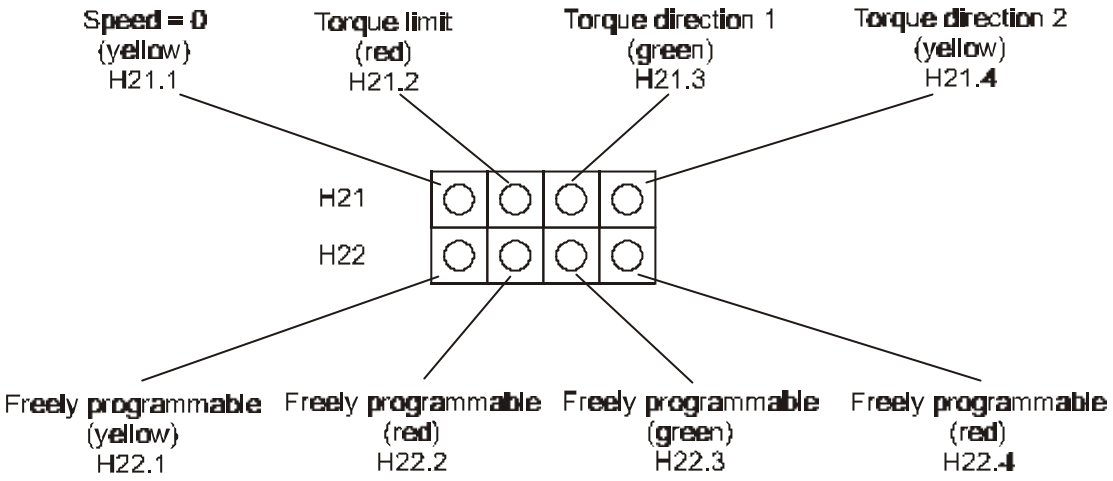
P336 AO **2 scaling**

A scaling factor can also be selected for optimum parameter output. The respective channel is switched off, if this parameter is equal 0.

LED DISPLAY

Function

The module enables programming of the four available freely programmable LEDs of the LED display H22.



- *LED x source Pxxx*: Input of source parameter number.
- *LED x bit selection*: Selection of source parameter bits to which bit pattern must correspond.
- *LED x bit pattern*: If this bit pattern and the selected parameter bit pattern correspond to each other, the output is switched to high.

NOTE:

The sequence of the parameter setting is irrelevant. Switching takes place only after all three parameters have been set.
In order to deactivate an LED output, either the LED source Pxxx or the LED bit selection must be set to zero. The last switch state, however, remains stored in the output. The output can be programmed again by setting the relevant parameter again.

Example of programming procedure:

1. Enter source parameter number in *LED x source Pxxx* of your choice.

   → Has no effect on the LED output yet.

2. Enter *LED x bit pattern* of the above mentioned parameter.

   → Has no effect on the LED output yet.

3. Enter *bit selection:*

   → All bits which have not been selected are set to 0 in the LED bit pattern, the bits selected from the source parameter are compared to the LED bit pattern. If one of the two patterns corresponds to the source parameter pattern, the output is set to HIGH.

Example:

1. First set LED 1 *source Pxxx* to 13,
   LED 1 *bit pattern* to 0001,
   and *LED 1 bit selection* to 0003.

   → if bit no. 1 and bit no. 2 of parameter 13 result in “1”, the LED H22.1 is switched to high.

2. Then set LED 2 *source Pxxx* to 13,
   LED 2 *bit pattern* to 0003,
   and LED 2 *bit selection* to 0003.

   → If bit no. 1 and bit no. 2 of parameter 13 result in “3”, the LED H22.2 is set to high.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P362	LED **state**	0000 ... FFFF		X
P350	LED **1 source Pxxx**	0 ... 700		
P351	LED **1 bit selection**	0000 ... FFFF		
P352	LED **1 bit pattern**	0000 ... FFFF		
P353	LED **2 source Pxxx**	0 ... 700		
P354	LED **2 bit selection**	0000 ... FFFF		
P355	LED **2 bit pattern**	0000 ... FFFF		
P356	LED **3 source Pxxx**	0 ... 700		
P357	LED **3 bit selection**	0000 ... FFFF		
P358	LED **3 bit pattern**	0000 ... FFFF		
P359	LED **4 source Pxxx**	0 ... 700		
P360	LED **4 bit selection**	0000 ... FFFF		
P361	LED **4 bit pattern**	0000 ... FFFF		

Parameter description

P362 LED **state**

This parameter display the state of the function module.

Bit no.	Meaning
0	1: LED 1 completely programmed
1	1: LED 2 completely programmed
2	1: LED 3 completely programmed
3	1: LED 4 completely programmed
4 ... 7	reserved
8	actual state of LED H22.1
9	actual state of LED H22.2
10	actual state of LED H22.3
11	actual state of LED H22.4
12 ... 15	reserved

P350 LED **1 source Pxxx**
P353 LED **2 source Pxxx**
P356 LED 3 **source Pxxx**
P359 LED **4 source Pxxx**

The parameter number of the source parameter for LED display is entered.

P351 LED **1 bit selection**
P354 LED **2 bit selection**
P357 LED **3 bit selection**
P360 LED **4 bit selection**

The bits to be compared are selected in the source parameter.

P352 LED **1 bit pattern**
P355 LED **2 bit pattern**
P358 LED **3 bit pattern**
P361 LED **4 bit pattern**

Bit pattern which is compared to the source parameter pit pattern.

DIGITAL INPUTS

The module and the four available digital inputs enable parameter programming.

NOTE
The controller can reach the state “operation enabled” immediately after the switch on of the electronic power supply, if the control word (see function module drive manager) is manipulated by digital inputs (see function module digital inputs) and the hardware enable is active.

During the programming of digital inputs this option must be considered and protective measures have to be ensured on machine-side.

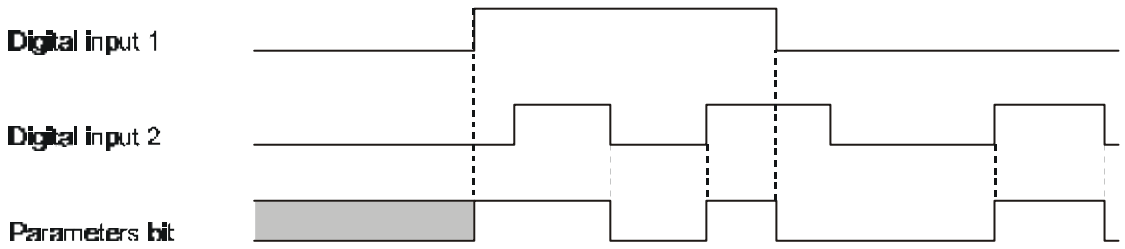
Four parameters are assigned to each input:

- *DI x target Pxxx*: Input of target parameter number
- *DI* x *bit selection* : Selection of the target parameter bits which are to be altered.
- *DI x LOW pattern* : Bit pattern which is written into the target parameter if switch is OFF.
- *DI x HIGH pattern* : Bit pattern which is written into the target parameter if switch is ON.

The inputs only evaluate the transitions

Hence it is possible to manipulate the same parameter via several inputs.

Example:
Two inputs act on the same parameter bit



The four inputs are sampled every 4 ms at an interval of approx. 20 µs. In the event of simultaneous status change of two signals the signal with the higher weight is taken over (digital input 1 has the lowest weight, digital input 4 the highest).

NOTE

The activation of a digital input results in setting all parameters of the selected input.

Following order must be observed:

1. DI x target Pxxx
2. DI x LOW pattern
3. DI x HIGH pattern
4. DI x bit selection

In order to deactivate an input the DI target Pxxx must be set to 0.

Example of programming procedure:

1. Enter target parameter number in *DI x target Pxxx* of desired input.

   ⇒ Has no effect on the target parameter yet.

2. Enter *DI x LOW-* and *HIGH pattern* of the above mentioned input.

   ⇒ Has no effect on the target parameter yet.

3. Enter DI x bit selection:

   ⇒ all bits which have not been selected are set to 0 in the LOW and HIGH patterns; the selected bits are set to 0 in the target parameter and are replaced by the corresponding bit pattern (according to switch position).

Examples:

1. Input 1 should set parameter P013 to 0 (switch is LOW) and to 1 (switch is HIGH).

   Set

   DI 1 target Pxxx (P370) to 13,

   DI 1 LOW pattern (P372) to 0000,

   DI 1 HIGH pattern (P373) to 0001,

   DI 1 bit selection (P371) to FFFF.

2. Through programming of a further input the values 2 and 3 should adjusted in parameter P013. Following sequence is necessary:

   Set

   DI 1 target Pxxx (P370) to 13,

   DI 1 LOW pattern (P372) to 0000,

   DI 1 HIGH pattern (P373) to 0001,

   DI 1 bit selection (P371) to FFFD

   DI 2 target Pxxx (P374) to 13,

   DI 2 LOW pattern (P376) to 0000,

   DI 2 HIGH pattern (P377) to 0002,

   DI 2 bit selection (P375) to FFFE.

   → The digital input 1 effects bit no. 0 and. 2 till 15;
   the digital input 2 effects bit no. 1 till 15.

Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Example for start value P013	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

3. The digital input 3 should effect bit no. 4 and 11 of parameter P120.

   Set

   DI 3 target Pxxx (P378) to 120,

   DI 3 LOW pattern (P380) to 0800,

   DI 3 HIGH pattern (P381) to 0010,

   DI 3 bit selection (P379) to 0810

Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Start value P120	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

Parameter overview

parameter	Name	Range min. ... max.	Unit	Display only
P382	DI **state**	0000 ... FFFF		X
P370	DI **1 target Pxxx**	0 ... 700		
P371	DI **1 bit selection**	0000 ... FFFF		
P372	DI **1 LOW pattern**	0000 ... FFFF		
P373	DI **1 HIGH pattern**	0000 ... FFFF		
P374	DI **2 target Pxxx**	0 ... 700		
P375	DI **2 bit selection**	0000 ... FFFF		
P376	DI **2 LOW pattern**	0000 ... FFFF		
P377	DI **2 HIGH pattern**	0000 ... FFFF		
P378	DI **3 target Pxxx**	0 ... 700		
P379	DI **3 bit selection**	0000 ... FFFF		
P380	DI **3 LOW pattern**	0000 ... FFFF		
P381	DI **3 HIGH pattern**	0000 ... FFFF		
P342	DI **4 target Pxxx**	0 ... 700		
P343	DI **4 bit selection**	0000 ... FFFF		
P344	DI **4 LOW pattern**	0000 ... FFFF		
P345	DI **4 HIGH pattern**	0000 ... FFFF		

Parameter description

P382 DI **state**

This parameter indicates the state of input programming.

Bit no.	Meaning
0	1: input 1 completely programmed
1	1: input 2 completely programmed
2	1: input 3completely programmed
3	1: input 4 completely programmed
4 ... 7	reserved
8	actual state input 1 (X26:15)
9	actual state input 2 (X26:16)
10	actual state input 3 (X26:17)
11	actual state input 4 (X26:18)
12 ... 13	reserved
14	actual state rapid halt input (X26:19)

15	actual state pulse / controller enabling (X26:14)

P370 DI **1 target Pxxx**
P374 DI **2 target Pxxx**
P378 DI **3 target Pxxx**
P342 DI **4 target Pxxx**

This parameter indicates the parameter number of the target parameter for input 1 till 4.

P371 DI **1 bit selection**
P375 DI **2 bit selection**
P379 DI **3 bit selection**
P343 DI **4 bit selection**

The bits to be altered are selected in the target parameter.

P372 DI **1 LOW pattern**
P376 DI **2 LOW pattern**
P380 DI **3 LOW pattern**
P344 DI **4 LOW pattern**

Bit pattern which is written into the selected target parameter bits when digital input is LOW.

P373 DI **1 HIGH pattern**
P377 DI **2 HIGH pattern**
P381 DI **3 HIGH pattern**
P345 DI **4 HIGH pattern**

Bit pattern which is written into the selected target parameter bits when digital input is HIGH.

DIGITAL OUTPUTS

Function

The module enables programming of the three available digital outputs. Three parameters are assigned to each output:

DO output ID no.:	Input of source parameter number (only 2-byte parameters admissible)
DO bit selection:	Selection of source parameter bits to which bit pattern must correspond.
DO bit pattern	If this bit pattern and the selected parameter bit pattern correspond to each other, the output is switched to HIGH.

NOTE:
The sequence of the parameter setting is irrelevant. Switching takes place only after all three parameters have been set.

In order to deactivate an output either DI source Pxxx or DI bit selection must be set to 0. The last switch state, however, remains stored in the output. The output can be programmed again by setting the relevant parameter again.

Example of programming procedure:

1. Enter source parameter number in *DO x source Pxxx* of your choice.

   → Has no effect on the output yet.

2. Enter *DO x bit pattern* of the above mentioned parameter.

   → Has no effect on the output yet.

3. Enter *bit selection:*

   → All bits which have not been selected are set to 0 in the DO bit pattern, the bits selected from the source parameter are compared to the DO bit pattern. If one of the two patterns corresponds to the source parameter pattern, the output is set to HIGH.

Example:

1. First set *DO 1 source Pxxx* to 13,
   DO 1 *bit pattern to* 0001,
   and *DO 1 bit selection* to 0003.

   → if bit no. 1 and bit no. 2 of parameter P013 result in “1”, the output 1 is switched to high.

2. Then *set DO 2 source Pxxx* to 13,
   DO *2 bit pattern to* 0003,
   and DO *2 bit selection* to 0003.

   → If bit no. 1 and bit no. 2 of parameter 13 result in “3”, the output 2 is set to high.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P383	DO **1 source Pxxx**	0 ... 700		
P384	DO **1 bit selection**	0000 ... FFFF		
P385	DO **1 bit pattern**	0000 ... FFFF		
P386	DO **2 source Pxxx**	0 ... 700		
P387	DO **2 bit selection**	0000 ... FFFF		
P388	DO **2 bit pattern**	0000 ... FFFF		
P389	DO **3 source Pxxx**	0 ... 700		
P390	DO **3 bit selection**	0000 ... FFFF		
P391	DO **3 bit pattern**	0000 ... FFFF		
P392	DO **state**	0000 ... FFFF		X

Parameter description

P383 DO **1 source Pxxx**

P386 DO **2 source Pxxx**

P389 DO **3 source Pxxx**

This parameter indicates the parameter number of the source parameter for outputs 1, 2 or 3.

P384 DO **1 bit selection**

P387 DO **2 bit selection**

P390 DO **3 bit selection**

The bits to be compared are selected in the source parameter.

P385 DO **1 bit pattern**

P388 DO **2 bit pattern**

P391 DO **3 bit pattern**

Bit pattern which is compared to the source parameter bit pattern.

P392 DO **state**

This parameter shows the state of the function module..

Bit no.	Meaning
0	1: output 1completely programmed
1	1: output 2 completely programmed
2	1: output 3 completely programmed
3 ... 7	reserved
8	actual state output 1 (X26:21)
9	actual state output 2 (X26:22)
10	actual state output 3 (X26:23)
11 ... 15	reserved

SERVICE INTERFACE

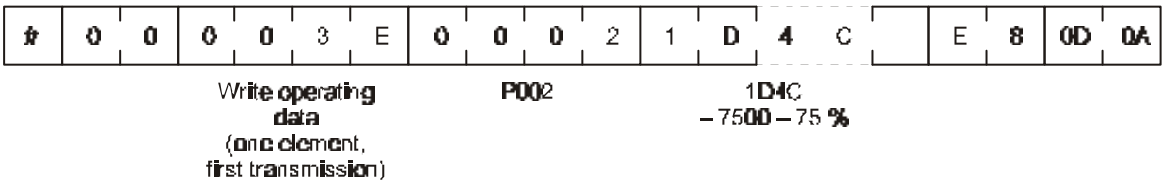
Function

The service interface allows communication with the PC operating program. The BASS protocol is operated via the RS 232 interface.
The address of each drive is set in binary code at the controller front via DIP switch S 20. Bit no. 0 thus corresponds to switch 1, bit no. 1 to switch 2 etc.
The RS 232 interface is constructed potential-free, the operating mode is full-duplex.

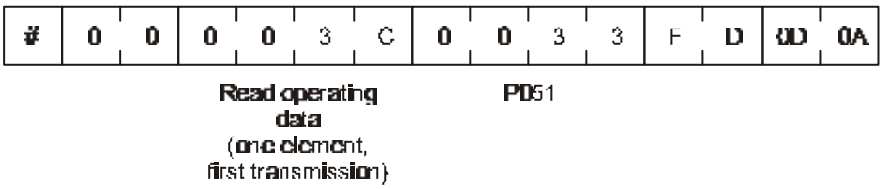
Data format:	8 data bits, 1 stop bit, no parity
Transmission speed:	9600 baud
Transmission format:	ASCII

Communication PC Þ drive

Example 1: Set P002 to 75%



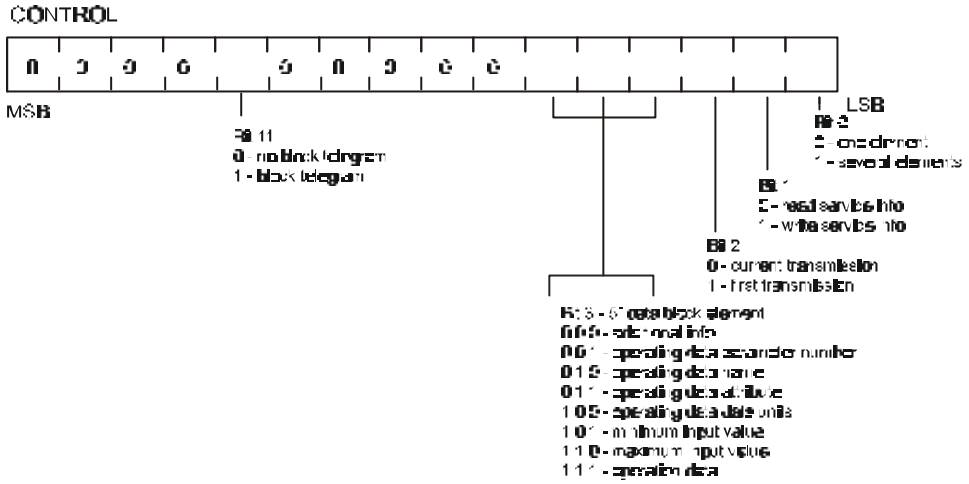
Example 2: Read P051



BOF # (23_{hex})

Address of the drive 0_{dec} to 255_{dec} (00_{hex} to FF_{hex})

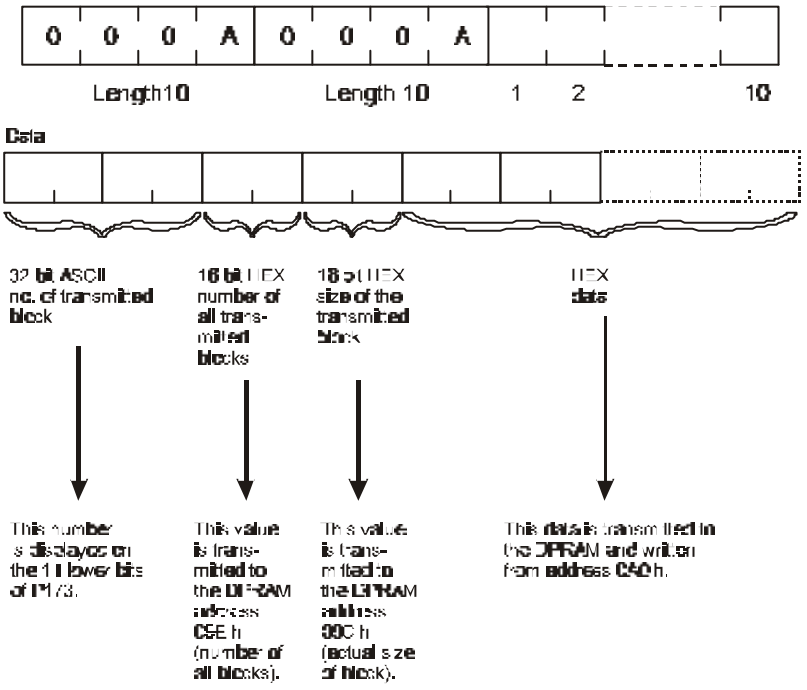
Control



Parameter number Hexadecimal value of the parameter number as an ASCII character

Data Element, error type

- Number are given as hexadecimal numbers and are transmitted as ASCII characters
- The half-byte with the highest value is transmitted first
- Really text begins with two words following one after another which contains the length of the text:

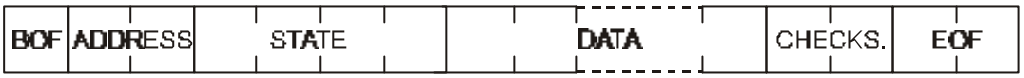


Checksum Sum of the hexadecimal values of all ASCII characters without BOF and EOF. Any overflow is also added ($234_{hex} \rightarrow 36_{hex}$)

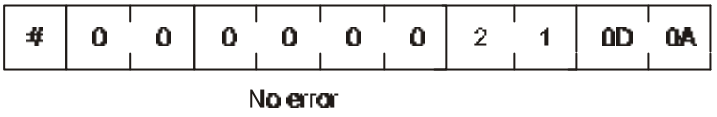
EOF <CR> <LF> ($0D_{hex}$, $0A_{hex}$)

Communication drive Þ PC

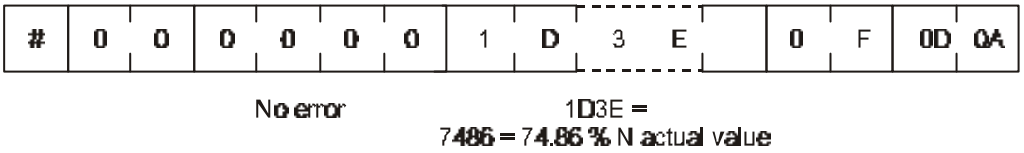
Before the drive answered the echo telegram is sended from drive to pc!



Example 1: Set P002 to 75%



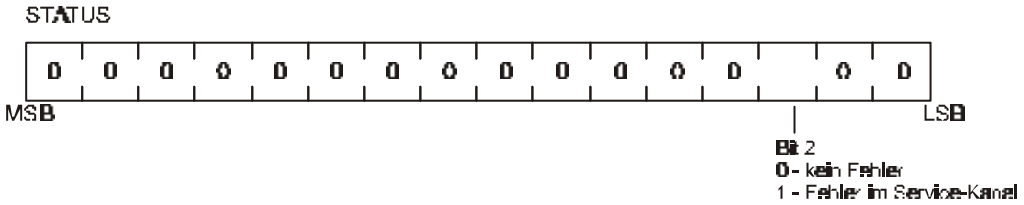
Example 1: Read P051



BOF # (23_{hex})

Address of the drive 0_{dec} to 255_{dec} (00_{hex} to FF_{hex})

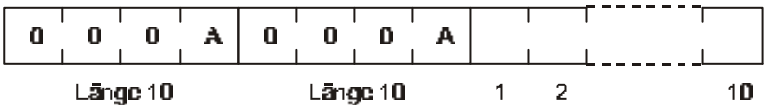
State



Parameter number Hexadecimal value of the parameter number as an ASCII character

Data Element, data state, error type

Really text begins with two words following one after another which contains the length of the text:



Checksum Sum of the hexadecimal values of all ASCII characters without BOF and EOF. Any overflow is also added ($234_{hex} \rightarrow 36_{hex}$)

EOF <CR> <LF> ($0D_{hex}$, $0A_{hex}$)

Error table

Error number	Meaning
0	No fault
1	Element is not available
2	Data is too short
3	Data is too long
4	Data is not alterable
5	Parameter is write protected
6	Data is smaller than minimum value
7	Data is greater than maximum value
8	Data is invalid
9	Obtaining of parameter is invalid

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P170	SI **state**	0000 ... FFFF		X
P171	SI **baud rate**	50 ... 19200	Baud	X
P172	SI **mode**	0000 ... 0003		
P173	SI **array state**	0000 ... FFFF		X

Parameter description

P170 SI **state**

Write-access to the drive parameters is managed via parameter M communication source (P126) in the drive manager. The drive parameter can only be altered via the service interface when bit no. 0 of this parameter is set to 1. If the bit is set to 0 write-access is inhibited and only read-access to the parameter values granted.

See also M communication source (P126)

Bit no.	Meaning
0 ... 3	status of function module 0001: RUN (all parameters can be read and write)0000: STOP (all parameters can be read)
4 ... 11	drive address 0 ... 255 (representation of the DIP switch S20)
12 ... 15	reserved

P171 SI **baud rate**

The service baud rate can only be displayed and is set to a fixed value of 9600 baud.

P172 SI **mode**

Bit no.	Meaning
0	1: Standard setting All set and actual values are standardized in % 0: All set and actual values are transferred in internal standardization
1	1: Standard setting 0: Service mode
2 ... 15	reserved

P173 SI **array state**

Bit no.	Meaning
0 ... 3	Number of actual transferred block
4	Data in RAM buffer valid
5	Block is just written to RAM buffer

POSITIONING

Global parameters

Parameter list

Parameter	Name	Value min. ... max.	Unit	Read-only
P400	POS **module state**	0000 ... FFFF		X
P401	POS **current set number**	1 ... 2		
P402	POS **norm position Z**	1 ... 65535	I	
P403	POS **norm position N**	1 ... 32768	UU	
P406	POS **mode**	0000 ... FFFF		
P408	POS **rapid halt deceleration**	0.25 ... 650.00	I / ms^2	
P409	POS **inching speed**	1 ... 13200	I / ms	
P410	POS **inching acceleration**	0.25 ... 650.00	I / ms^2	
P411	POS **inching deceleration**	0.25 ... 650.00	I / ms^2	
P412	POS **reference speed**	50 ... 13200	I / ms	
P413	POS **reference acceleration**	0.25 ... 650.00	I / ms^2	
P414	POS **reference run mode**	-2199 ... 2199		
P429	POS **position tolerance range**	0 ... FFFF FFFF	UU	
P430	POS **position tolerance range time**	1 ... FFFF	ms	
P432	POS **reference point**	0 ... FFFF FFFF	UU	
P433	POS **state switch**	0 ... FFFF		X
P434	POS **mode switch**	0 ... FFFF		
P435	POS **encoder offset**	0 ... FFFF	I	
P436	POS **position set value**	0 ... FFFF FFFF	UU	X
P437	POS **position actual value**	0 ... FFFF FFFF	UU	X
P438	POS **set speed**	-13200 ... +13200	I / ms	X
P439	POS **SW end switch 1**	0 ... FFFF FFFF	UU	
P440	POS **SW end switch 2**	0 ... FFFF FFFF	UU	
P441	POS **rounding**	0 ... 8191	ms	
P442	POS **reference deceleration**	0.25 ... 650.00	I / ms^2	
P443	POS **reference terminal speed**	1 ... 50	I / ms^2	

P444	POS **clip tolerance**	1 ... FFFFFFFF	UU	

I = Increments

UU = User unit

Scale for speed and acceleration:

1 motor turn ↔ 65,536 increments

Parameter description

P400 POS **module state**

This parameter indicates the state of the Positioning module. Not all bits are used in all modes.

Bit no.	Meaning	Target position specification mode	Manual mode	Reference run
0	0: STOP 1: RUN	X	X	X
4	1: SW end switch 1 active	X	X	
5	1: SW end switch 2 active	X	X	
6	1: Initialization error	X	X	X
7	1: Function completed	X		
8	Reserved	X		
9	Reserved	X		
10	1: Norm position Z < norm position N	X	X	X
11	1: Traversing range will be exceeded	X	X	
12	1: Set value reached	X		X
13	1: Clip tolerance reached	X		

NOTES:

- Bit no. 11 is 1, when the stroke end position is overrun
- If there is a rapid halt, all bits are set to zero and the positioning is disabled
- Bit no. 12:
  - indicates the position reached in “Target position specification”
  - indicates the position reached in the homing cycle

P401 POS **current set number**

You can select 2 data tables for positioning:

Value	Meaning
1	Positioning data set 1 active
2	Positioning data set 2 active

P402 POS **norm position Z**

P403 POS **norm position N**

These 2 parameters define the ratio between the user's unit and the internal unit taking into account that 1 motor turn always corresponds to 65,536 internal increments (pulses).

The conversion uses the following formula:

$$Input\_Parameter[I] = Input\_parameter[UU] \bullet \frac{P402}{P403}$$

NOTES:

- Condition 1:

  POS norm position Z ≥ POS norm position N

  If this condition is FALSE, the parameter is kept at the last written value and bit 10 is set in the status parameter (P400).

  This bit is only reset and a new value accepted if one of the 2 parameters is changed so that the condition is satisfied.

- Condition 2:

  The value limit for the application parameters for the position is reduced by the factor $\frac{POS\_norm\_position\_N}{POS\_norm\_position\_Z}$. The drive does not control that this new limit is not exceeded; the user is responsible for this check.

- Condition 3: POS norm position Z + POS norm position N ≤ 65536

  This condition is controlled by the drive.

- By default the result of the conversion of the application parameter from user units to internal units is rounded. The positioning is carried out with the possible calculation precision. However, potential position errors will be compensated with the next relative positioning.

  An extension of the conversion factor does not result in a greater resolution:

  $$\frac{20{,}000}{1{,}000} = \frac{20}{1}$$

P406 POS **mode**

This parameter enables or disables the software end switches.

Bit no.	Meaning
0	1: Software end switches active
1 - 15	Reserved

NOTE:
The software end switches have to be set before the first positioning attempt.

P408 POS **rapid halt deceleration**

This parameter only has an effect in manual mode. It defines the deceleration for rapid halts when the axis overruns the hardware end switches. The axis decelerates to zero but remains enabled.

P409 POS **inching speed**

This parameter specifies the speed in manual mode.

P410 POS **inching acceleration**

This parameter specifies the max. acceleration in manual mode.

P411 POS **inching deceleration**

This parameter specifies the max. deceleration in manual mode.

P412 POS **reference speed**

This parameter specifies the speed for searching the zero point switch.

P413 POS **reference acceleration**

This parameter specifies the max. acceleration during the homing cycle.

P414 POS **reference run mode**

This parameter specifies the sequence for axes homing, the feed direction and the type of zero point switch.

NOTE:
The encoder connector types for the methods –3, -4, -5 are of no relevance, therefore the parameter value only contains the method number.

Method	Meaning
-6	Move to the next encoder zero angle
-5	Move to the positive end switch
-4	Move to the negative end switch
-3	Set reference point
-2	Move to the encoder zero angle or zero impulse with left turn
-1	Move to the encoder zero angle or zero impulse with right turn
1	Move to the negative end switch with setting encoder zero angle or zero impulse
2	Move to the positive end switch with setting encoder zero angle or zero impulse
3	Move to the positive zero point transfer switch with setting encoder zero angle or zero impulse
4	Move to the positive zero point transfer switch with setting encoder zero angle or zero impulse
5	Move to the negative zero point transfer switch with setting encoder zero angle or zero impulse
6	Move to the negative zero point transfer switch with setting encoder zero angle or zero impulse

NOTES:

Normally method 1 or 2 is used. (Zero point switch search, inversion, marker search.)

Positive end switch: in order to find the zero point, switch the motor turn clockwise as seen from the shaft side.

Encoder, type	Encoder connected to connector ...	Method	Parameter, value (P414)
Absolute value encoder	1	-6	- 1 0 06
Absolute value encoder	1	-2	- 1 0 02
Absolute value encoder	1	-1	- 1 0 01
Absolute value encoder	1	1	1 0 01
Absolute value encoder	1	2	1 0 02
Absolute value encoder	1	3	1 0 03
Absolute value encoder	1	4	1 0 04
Absolute value encoder	1	5	1 0 05
Absolute value encoder	1	6	1 0 06
Absolute value encoder	2	-6	- 2 0 06
Absolute value encoder	2	-2	- 2 0 02
Absolute value encoder	2	-1	- 2 0 01
Absolute value encoder	2	1	2 0 01
Absolute value encoder	2	2	2 0 02
Absolute value encoder	2	3	2 0 03
Absolute value encoder	2	4	2 0 04
Absolute value encoder	2	5	2 0 05
Absolute value encoder	2	6	2 0 06
Incremental encoder	1	-2	- 1 1 02
Incremental encoder	1	-1	- 1 1 01
Incremental encoder	1	1	1 1 01
Incremental encoder	1	2	1 1 02
Incremental encoder	1	3	1 1 03
Incremental encoder	1	4	1 1 04
Incremental encoder	1	5	1 1 05
Incremental encoder	1	6	1 1 06
Incremental encoder	2	-2	- 2 1 02
Incremental encoder	2	-1	- 2 1 01
Incremental encoder	2	1	2 1 01
Incremental encoder	2	2	2 1 02
Incremental encoder	2	3	2 1 03
Incremental encoder	2	4	2 1 04
Incremental encoder	2	5	2 1 05
Incremental encoder	2	6	2 1 06

not relevant	not relevant	-5	-5
not relevant	not relevant	-4	-4
not relevant	not relevant	-3	-3

NOTES:
Incremental encoder can only be specified, if the marker signal is generated by the encoder.

Connector 1: X24

Connector 2: X25

P429 POS **position tolerance range**

When the axis enters the tolerance zone around the new position, the bit "Target position reached“ in the status word is set. The “Position tolerance range” is symmetrical to the target position and its size is given by this parameter.

P430 POS **position tolerance range time**

This parameter defines the time after which the “Drive in position” status bit is set if the axis is found in position within the tolerance range.

P432 POS **reference point**

This parameter specifies the absolute value of the axis at the set point. After homing this value is copied into the “position set value” and “position actual value” parameters. The value of this parameter has to be within the positions allowed by the parameters defining the software end switches (P439 and P440).

P433 POS **state switch**

This parameter represents the status of the zero point switch. If the bit is set, the corresponding sensor is active

Bit no.	Meaning
0	state end switch positive
1	state end switch negative
2	state zero point transfer switch
3 - 15	reserved

Example:
Programming the digital input 1 for a positive end switch (method 2)

DE *input 1 Pxxx* = 433 P370

DE *bit selection 1* = 1 = 0001hex P371

DE *LOW pattern 1* = 0 = 0000hex P372

DE *HIGH pattern 1* = 1 = 0001hex P373

Programming the digital input 1 for a negative end switch (method 1)

DE *input 1 Pxxx*= 433	P370
DE *bit selection 1* = 2 = 0002 hex	P371
DE *LOW pattern 1* = 0 = 0000 hex	P372
DE *HIGH pattern 1* = 2 = 0002 hex	P373

Programming the digital input 1 for a zero point transfer switch (method 3 - 6)

DE *input 1 Pxxx* = 433	P370
DE *bit selection* 1 = 4 = 0004 hex	P371
DE *LOW pattern 1* = 0 = 0000 hex	P372
DE *HIGH pattern 1* = 4 = 0004 hex	P373

NOTE:
The drive also controls the bits no. 0 and no. 1 as stroke end indicators in manual mode!

P434 POS **mode switch**

Each sensor can be separately declared as normally open or normally closed.

Bit no.	Meaning
0	mode end switch positive
1	mode end switch negative
2	mode zero point transfer switch
3 - 15	reserved

Bit = 0: normally open
Bit = 1: normally closed

For safety reasons one should generally use normally closed sensors.

P435 POS **encoder offset**

During homing an offset value may be added to the current transducer value. This allows to shift the zero point. Thus, you can set the zero point a long way from the switching zone of the zero micro.

P436 POS **position set value**

This parameter shows the positioning command in UU (see P208 Position set value in increments).

P437 POS **position actual value**

This parameter shows the current position in UU (see P209 Position set value in increments).

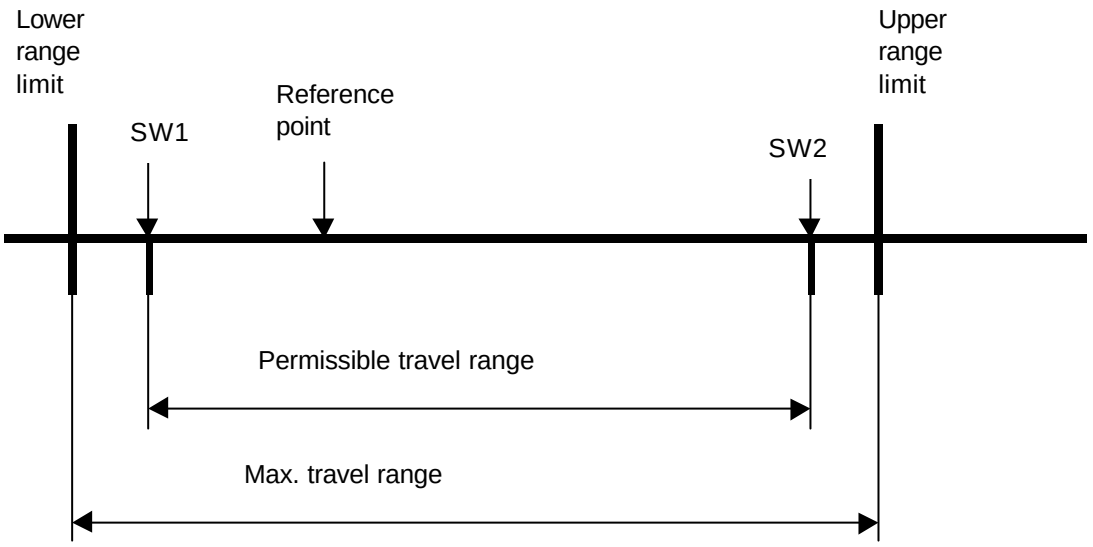
P438 POS **set speed**

This parameter shows in I/ms during positioning.

P439 POS **SW end switch 1**

P440 POS **SW end switch 2**

These 2 parameters limit the field of action during positioning and in manual mode.



Lower limit range = 0000 0000 hex;

$$Upper\_limit\_range = 0xFFFFFFFF \bullet \frac{POS\_norm\_position\_N\_(P403)}{POS\_norm\_position\_Z\_(P402)}$$

For a correct functioning of the software limit switches the following criteria have to be satisfied:

- Bit no. 0 has to be set in the POS mode parameter (P406)
- The axis has to be homed before enabling positioning or manual mode. During homing the software limit switches are not enabled!
- 0 < SW end switch 1 < Reference point < SW end switch 2 < Upper limit range.
- The max. travel range must not be exceeded (except during homing).

Function of the software end switches:

- In the Target position specification mode (P122 = 1)
  In this mode a check is made to see if the new positioning target is outside the operation limits. If this is the case the axis is moved to the end switch which would have been overrun by moving into the new position. At the same time bit no. 4 is set for SW end switch 1 or bit no. 5 for SW end switch 2 in Module state (P400).
- If the value of a SW end switch is modified after homing of the axis, it may result outside the operations limits. The contents of Module state as well as the new value will be updated at the next data transfer. The axis is then moved to the relative SW end switch if the next positioning command exceeds the software limits.
- In manual mode (P122 = 5):

  When the axis arrives at a SW end switch, the drive stops with the deceleration declared in the parameter P408 and the relative bits in Module are updated. Then the axis can only be moved in the opposite direction.
- If the value of a SW end switch is modified after homing of the axis, it may result outside the operations limits. The contents of Module state will be updated at the next feed command.

Only after complete installation and set-up of the positioning the drive has two software end switches in the operation modes Target position and Manual, so that no physical stroke end device is required for safe and correct functioning in these operation modes. However, in order to be able to brake and stop the moving mechanical parts at any moment, use of stroke end sensors acting directly on the power unit are indispensable.

P441 POS **rounding**

Integration time for smoothing the acceleration ramps.

A value 0 disables the function.

P442 POS **reference deceleration**

This parameter specifies the maximum acceleration during a homing cycle.

P443 POS **reference terminal speed**

The speed of the marker search at the end of a homing cycle.

P444 POS **clip tolerance**

When the actual position value reaches a window around the target position, the system sets the Clip tolerance reached bit (bit no. 13 in P400). This window is symmetrical around the target position. Its width is defined by this parameter.

Positioning Data Set Parameters

With the Actual data set number (P401) you can select between 2 data tables for positioning.

Parameter list

Parameter	Name	Value min. ... max.	Unit	Read-only
P415	POS **target position 1**	0 ... FFFF FFFF	UU	
P416	POS **target input 1**	-2 ... +2		
P417	POS **positioning speed 1**	1 ... 13200	I / ms	
P418	POS **terminal velocity 1**	0	I / ms	
P419	POS **positioning acceleration 1**	0.25 ... 650.00	I / ms^2	
P420	POS **positioning deceleration 1**	0.25 ... 650.00	I / ms^2	
P421	POS **dwell time 1**	0 ... 65535	ms	
P422	POS **target position 2**	0 ... FFFF FFFF	UU	
P423	POS **target input 2**	-2 ... +2		
P424	POS **positioning speed 2**	1 ... 13200	I / ms	
P425	POS **terminal velocity 2**	0	I / ms	
P426	POS **positioning acceleration 2**	0.25 ... 650.00	I / ms^2	
P427	POS **positioning deceleration 2**	0.25 ... 650.00	I / ms^2	
P428	POS **dwell time 2**	0 ... 65535	ms	

Parameter description

P415 POS **target position 1**

P422 POS **target position 2**

The position in UU the axis has to reach

P416 POS **target input 1**

P423 POS **target input 2**

This parameter specifies whether the target position is absolute or relative.

Value	Meaning
-2	relative to the current position in decremental direction (on-the-fly)
-1	relative to the target position in decremental direction (normal)
0	absolute – limited by Max. travel range
1	relative to the target position in incremental direction (normal)
2	relative to the current position in incremental direction (on-the-fly)
3	absolute in the direction of the shortest path to the target. Max. travel range may be exceeded. (Condition: SW end switch disabled!)

P417 POS **positioning speed 1**

P424 POS **positioning speed 2**

These parameters define the maximum axis speed during positioning.

P418 POS **terminal velocity 1**

P425 POS **terminal velocity 2**

not implemented

P419 POS **positioning acceleration 1**

P426 POS **positioning acceleration 2**

These parameters define the maximum axis acceleration during positioning.

P420 POS **positioning deceleration 1**

P427 POS **positioning deceleration 2**

These parameters define the maximum axis deceleration during positioning.

P421 POS **dwell time 1**

P428 POS **dwell time 2**

not implemented

PARAMETER LIST

	Parameter	Page	Standard value	Internal standardization
	P001 RFG **output**	3-85		
X	P002 RFG **input 1**	3-85	0.00 %	
X	P003 RFG **ramp-up time 1**	3-85	0.00 s	
X	P004 RFG **input 2**	3-85	0.00 %	
X	P005 RFG **ramp-up time 2**	3-85	0.00 s	
X	P006 RFG **input 3**	3-85	0.00 %	
X	P007 RFG **ramp-up time 3**	3-85	0.00 s	
X	P009 RFG **time halt**	3-85	0.00 s	
X	P010 RFG **ramp-down time 1**	3-85	0.00 s	
X	P011 RFG **ramp-down time 2**	3-85	0.00 s	
X	P012 RFG **ramp-down time 3**	3-85	0.00 s	
X	P013 RFG **mode**	3-85	0001	
	P014 RFG **state**	3-84		
X	P016 RFG **rounding**	3-85	0 ms	
X	P019 EM **maximum speed**	3-31	3000 U/min	
	P020 G1 **sine**	3-38		
	P021 G1 **cosine**	3-38		
	P022 G1 **phi actual value**	3-37		
	P023 G1 **N actual value**	3-36		
X	P024 G1 **no. of graduation marks**	3-36	512 Inc	
	P025 G1 **state**	3-34		
	P026 G1 **sine offset**	3-38	0.0000	
	P027 G1 **cosine offset**	3-38	0.0000	
	P028 G1 **sine gain**	3-38	1.0000	
	P029 G1 **cosine gain**	3-38	1.0000	
	P030 Mot **phi mechanical**	3-28		
X	P031 Mot **mode**	3-27	0	
	P032 Mot **rho electrical**	3-28		
X	P033 Mot **no. of pole pairs**	3-28	3	

	Parameter	Page	Standard value	Internal standardization
X	P034 Mot **rotating field**	3-28	1	
X	P035 Mot **locating angle**	3-28	240.0°	
	P036 Mot **state**	3-26		
X	P037 Mot **delta I**	3-28	5	
X	P038 N **M limiter mode**	3-45	0	
X	P039 Mot **delta rho**	3-28	5	
X	P040 G1 **mode**	3-35	0000	
	P041 G1 **delta phi 16**	3-37	0000 Inc	
	P042 G1 **delta phi 32**	3-37	0000 0000	
	P043 G1 **Rev actual value**	3-36		
	P044 G1 **sine measured value**	3-38		
	P045 G1 **cosine measured value**	3-38		
X	P046 G1 **overspeed**	3-39	115.00 %	
X	P047 N **additional set value**	3-45	0.00 %	
X	P048 I **M additional set value**	3-42	0.00 %	
X	P049 N **J compensation**	3-45	0.00 %	
	P050 N **set value**	3-45		
	P051 N **actual value**	3-45		
	P052 N **controller output**	3-45		
X	P053 N **M limiter bipolar**	3-46	100.00 %	
X	P054 N **M limiter Mot/TD1**	3-46	100.00 %	
X	P055 N **M limiter Gen/TD2**	3-46	100.00 %	
X	P056 N **block time**	3-46	60.0 s	
X	P057 N **P gain**	3-45	10.0	
X	P058 N **integral action time**	3-45	25.0 ms	
	P059 N **state**	3-44		
	P060 N **deviation**	3-46		
X	P061 N **limiter deviation**	3-46	99.99 %	
X	P062 G1 **N smoothing actual value**	3-36	1.0 ms	
	P066 TM **M loading**	3-48		

	Parameter	Page	Standard value	Internal standardization
X	P067 I **M set value**	3-41	0.00 %	
	P068 I **I_q controller output**	3-42		
	P069 I **EMC set value**	3-42		
	P070 I **phase voltage U**	3-43		
	P071 I **I_g set value**	3-42		
	P072 I **I_g actual value**	3-42		
	P073 I **phase current U**	3-43		
	P074 I **phase current V**	3-43		
	P075 I **U_q set value**	3-43		
	P076 I **U_d set value**	3-43		
	P077 I **I_d set value**	3-43		
	P078 I **I_d actual value**	3-43		
	P079 I **state**	3-41		
X	P080 I **P gain**	3-41	1.0	
X	P081 I **integral action time**	3-41	2.5 ms	
X	P082 **U_q-/U_d limit**	3-41	100.00 %	
	P083 I **current offset U**	3-43		
	P084 I **current offset V**	3-43		
	P086 I **phase voltage V**	3-43		
X	P087 PS **Uzk nominal**	3-5	540 V	
X	P088 I2t **warning limit motor**	3-22	100.00 %	
X	P089 I2t **time constant motor**	3-22	0	
X	P090 PU **mode**	3-8	0000	
	P091 I2t **value motor**	3-22	0.00 %	
	P092 TM **Mact / Mn**	3-48		
	P093 I2t **state**	3-22		
X	P094 TM **M > M2**	3-48	90.00 %	
X	P095 TM **time 2**	3-48	0.000 s	
X	P096 TM **M > M1**	3-48	90.00 %	
	P097 TM **time 1**	3-48	0.000 s	

	Parameter	Page	Standard value	Internal standardization
	P098 TM **state**	3-47		
	P099 I **current actual value**	3-43		
	P100 PWM **phase U**	3-13		
	P101 PWM **phase V**	3-13		
	P102 PWM **phase W**	3-13		
X	*P103* PWM **frequency**	3-14	8.0 kHz	
X	*P104* G2 **N=0 threshold**	3-39	1.00 %	
X	*P105* G2 **N>Nx ON threshold**	3-39	100.00 %	
X	*P106* G2 **N>Nx OFF threshold**	3-39	95.00 %	
X	*P107* G1 **N=0 threshold**	3-39	1.00 %	
X	*P108* G1 **N>Nx ON threshold**	3-39	100.00 %	
X	*P109* G1 **N>Nx OFF threshold**	3-39	95.00 %	
	P110 PS **state**	3-5		
	P111 PS **voltage Uzk**	3-6		
X	*P112* PS **voltage failure time**	3-6	3.000 s	
	P113 PU **I max**	3-9	2.5 A	
	P114 PU **I nominal**	3-9	2.5 A	
	P115 PU **state**	3-7		
X	*P116* PU **I limit**	3-9	2.5 A	
	P117 PU **type**	3-8		
	P118 PU **temperature**	3-9		
X	*P119* PU **overload time**	3-9	0 s	
	P120 M **control word**	3-64		
	P121 M **state word**	3-67		
X	*P122* M **desired operation mode**	3-69	-3	
	P123 M **actual operation mode**	3-70		
	P124 M **error code**	3-71		
	P125 M **error index**	3-71		
X	*P126* M **communication source**	3-71	0000	
X	*P127* M **communication monitoring**	3-72	0000	

	Parameter	Page	Standard value	Internal standardization
X	P128 M **monitoring time**	3-72	0 ms	
X	P129 M **monitoring code**	3-73	0	
X	P130 M **HALT code**	3-73	1	
X	P131 M **RAPID HALT code**	3-73	2	
	P132 M **INHIBIT code**	3-74	3	
X	P133 M **SHUTDOWN code**	3-74	3	
X	P134 M **state bit no. 14**	3-74	0000	
X	P135 M **state bit no. 15**	3-74	0000	
X	P136 M **mode**	3-71	0001	
	P137 M **state 1**	3-74		
X	P139 PU **Ixt value**	3-9	0	
	P140 SVG **target Pxxx**	3-87		
	P141 SVG **output value**	3-87		
X	P142 SVG **set value 1**	3-87	100.00 %	
X	P143 SVG **set value 2**	3-87	0.00 %	
X	P144 SVG **set value 3**	3-87	-100.00 %	
X	P145 SVG **set value 4**	3-87	0.00 %	
X	P146 SVG **time 1**	3-87	1.000 s	
X	P147 SVG **time 2**	3-87	1.000 s	
X	P148 SVG **time 3**	3-87	1.000 s	
X	P149 SVG **time 4**	3-87	1.000 s	
	P150 SVG **state**	3-87		
	P151 MT **state**	3-23		
X	P152 MT **mode**	3-24	0000	
X	P153 MT **temperature**	3-24		
X	P154 MT **threshold 1**	3-24	125 °C	
X	P155 MT **threshold 2**	3-24	125 °C	
X	P156 MT **shutdown threshold**	3-24	150 °C	
X	P157 MT **hysteresis**	3-24	5 °C	
	P159 OS **value**	3-82		

	Parameter	Page	Standard value	Internal standardization
	P160 OS **selection**	3-82		
	P161 OS **sampling time**	3-81		
	P162 OS **message**	3-81		
	P163 OS **DSV-6 SW release**	3-82		
	P166 OS **state**	3-81		
X	*P167* OS **sync. slot**	3-82	0 µs	
X	*P168* OS **sync. offset**	3-82	0 µs	
X	*P169* OS **sync. tolerance**	3-82	0	
	P170 SI **state**	3-115	0	
	P171 SI **baud rate**	3-116	9600 Baud	
X	*P172* SI **mode**	3-116	3	
	P173 SI **array state**	3-116		
	P174 OS **user SW**	3-82		
	P190 DSM **command**	3-78		
	P191 DSM **state**	3-78		
	P192 DSM **message**	3-78		
	P193 DSM **DS name**	3-79		
	P194 DSM **DS article no.**	3-79		
	P195 DSM **message Pxxx**	3-79		
	P196 DSM **load data set**	3-79		
	P197 DSM **DS program cycles**	3-79		
	P198 DSM **key**	3-80		
	P200 P **state**	3-50		
X	*P201* P **mode**	3-50	0000	
X	*P202* P **Kv factor**	3-50	10 1/s	
X	*P203* P **deviation limiter dynamic**	3-53	0000 0800 Inc	
X	*P204* P **N limiter bipolar**	3-52	100.00 %	
	P205 P **rev set value**	3-52		
	P206 P **phi set value**	3-52		
X	*P207* P **N precontrol**	3-51	100.00 %	

	Parameter	Page	Standard value	Internal standardization
	P208 P **set value**	3-51		
	P209 P **actual value**	3-51		
	P210 P **deviation**	3-51		
	P211 P **controller output**	3-51		
X	*P212* P **deviation limiter static**	3-52	0000 0100 Inc	
X	*P213* P **N precontrol smoothing**	3-51	1.0 ms	
X	*P214* P **time**	3-53	1.000 s	
	P218 P **rev actual value**	3-52		
	P219 P **phi actual value**	3-52		
	P220 P **N precontrol output**	3-51		
	P224 EM **kp**	3-31		
	P225 EM **state**	3-29		
X	*P226* EM **mode**	3-30	000D	
X	*P227* EM **no. of graduation marks**	3-31	1024	
	P228 EM **encoder types**	3-30		
X	*P229* EM **offset zero impulse**	3-31	0000 Inc	
	P230 G2 **sine measured value**	3-38		
	P231 G2 **cosine measured value**	3-38		
	P232 G2 **sine offset**	3-38		
	P233 G2 **cosine offset**	3-38		
	P234 G2 **sine gain**	3-38		
	P235 G2 **cosine gain**	3-38		
	P236 G2 **sine**	3-38		
	P237 G2 **cosine**	3-38		
X	*P238* G2 **N smoothing actual value**	3-36	1.0 ms	
X	*P239* G2 **overspeed**	3-39	115.00 %	
	P240 G2 **state**.	3-34		
X	*P241* G2 **mode**	3-35	0000	
X	*P242* G2 **no. of graduation marks**	3-36	512 Inc	
	P243 G2 **N actual value**	3-36		

	Parameter	Page	Standard value	Internal standardization
	P244 G2 **phi actual value**	3-37		
	P247 G2 **delta phi 16**	3-37	0000 Inc	
	P248 G2 **delta phi 32**	3-37	0000 0000	
	P249 G2 **Rev actual value**	3-36		
	P250 SC **state**	3-90		
X	*P251* SC **mode**	3-91	0000	
X	*P252* SC **compensation factor**	3-93	1	
X	*P253* SC **tolerance**	3-93	1.000 s	
X	*P254* SC **sync delta**	3-93	0000 0000	
X	*P255* SC **following axis rpm**	3-91	1000	
X	*P256* SC **leading axis rpm**	3-91	1000	
	P257 SC **position set value**	3-92	0000 0000 Inc	
	P258 SC **phi set value**	3-92	0000 0000	
X	*P259* SC **tolerance time**	3-93	1.000 s	
X	*P260* MM **magnetizing current I_d**	3-16	0.0 A	
X	*P261* MM **motor nominal current**	3-16	2.5 A	
X	*P262* MM **nominal speed**	3-17	1500 U/min	
X	*P263* MM **nominal frequency**	3-17	52.6 V	
X	*P264* MM **Kp flux controller**	3-17	1.0	
X	*P265* MM **Tn flux controller**	3-17	30 ms	
	P266 MM **flux set value**	3-17		
	P267 MM **flux actual value**	3-17		
X	*P268* MM **Ke factor**	3-16	0 V/1000	
X	*P269* MM **mode**	3-17	0	
X	*P270* EA **mode**	3-88	0	
X	*P271* EA **motor potentiometer+**	3-88	0	
X	*P272* EA **motor potentiometer-**	3-89	0	
X	*P273* EA **motor potentiometer Pxxx**	3-89	2	
X	*P274* EA **motor potentiometer dynamics**	3-89	1	

	Parameter	Page	Standard value	Internal standardization
X	P275 EA **motor potentiometer increment**	3-89	1 %	
	P276 EA **motor potentiometer value**	3-89		
X	P277 AI **1 input channel**	3-96	0	
X	P278 AI **1 smoothing**	3-96	1 ms	
X	P279 AI **1 scaling**	3-96	1.00	
X	P280 AI **1 target Pxxx**	3-97	0	
X	P281 AI **1 offset**	3-97	0.00 %	
X	P282 AI **1 threshold value**	3-97	0.00 %	
	P283 AI **1 value**	3-97		
X	P284 AI **2 input channel**	3-96	1	
X	P285 AI **2 smoothing**	3-96	1 ms	
X	P286 AI **2 scaling**	3-96	1.00	
X	P287 AI **2 target Pxxx**	3-97	0	
X	P288 AI **2 offset**	3-97	0.00 %	
X	P289 AI **2 threshold value**	3-97	0.00 %	
	P290 AI **2 value**	3-97		
X	P291 MM **MGen1 Nnominal**	3-19	95 %	
X	P292 MM **MGen2 12000 rpm**	3-19	30 %	
X	P293 MM **Tr rotor actual value**	3-17	10 ms	
X	P294 MM **frequency temperature 1**	3-18	52.0 Hz	
X	P295 MM **temperature 1**	3-18	20	
X	P296 MM **temperature 2**	3-18	80 °C	
	P297 MM **frequency = f (temp)**	3-18		
X	P330 AO **1 source Pxxx**	3-100	0	
X	P331 AO **1 offset**	3-100	0 Dig	
X	P332 AO **1 scaling**	3-100	1 Dig/V	
X	P334 AO **2 source Pxxx**	3-100	0	
X	P335 AO **2 offset**	3-100	0	
X	P336 AO **2 scaling**	3-100	1 Dig/V	

	Parameter	Page	Standard value	Internal standardization
	P337 AO **test value**	3-100	0.000 V	
	P338 AO **state**	3-99		
X	P342 DI **4 target Pxxx**	3-108	120	
X	P343 DI **4 bit selection**	3-108	0008	
X	P344 DI **4 LOW pattern**	3-108	0008	
X	P345 DI **4 HIGH pattern**	3-108	0008	
X	P350 LED **1 source Pxxx**	3-103	0	
X	P351 LED **1 bit selection**	3-103	0	
X	P352 LED **1 bit pattern**	3-103	0	
X	P353 LED **2 source Pxxx**	3-103	0	
X	P354 LED **2 bit selection**	3-103	0	
X	P355 LED **2 bit pattern**	3-103	0	
X	P356 LED 3 **source Pxxx**	3-103	0	
X	P357 LED **3 bit selection**	3-103	0	
X	P358 LED **3 bit pattern**	3-103	0	
X	P359 LED **4 source Pxxx**	3-103	0	
X	P360 LED **4 bit selection**	3-103	0	
X	P361 LED **4 bit pattern**	3-103	0	
	P362 LED **state**	3-103		
X	P370 DI **1 target Pxxx**	3-108	0	
X	P371 DI **1 bit selection**	3-108	0	
X	P372 DI **1 LOW pattern**	3-108	0	
X	P373 DI **1 HIGH pattern**	3-108	0	
X	P374 DI **2 target Pxxx**	3-108	0	
X	P375 DI **2 bit selection**	3-108	0	
X	P376 DI **2 LOW pattern**	3-108	0	
X	P377 DI **2 HIGH pattern**	3-108	0	
X	P378 DI **3 target Pxxx**	3-108	120	
X	P379 DI **3 bit selection**	3-108	0080	
X	P380 DI **3 LOW pattern**	3-108	0000	

	Parameter	Page	Standard value	Internal standardization
X	P381 DI **3 HIGH pattern**	3-108	0080	
	P382 DI **state**	3-107		
X	P383 DO **1 source Pxxx**	3-110	0	
X	P384 DO **1 bit selection**	3-110	0	
X	P385 DO **1 bit pattern**	3-110	0	
X	P386 DO **2 source Pxxx**	3-110	0	
X	P387 DO **2 bit selection**	3-110	0	
X	P388 DO **2 bit pattern**	3-110	0	
X	P389 DO **3 source Pxxx**	3-110	0	
X	P390 DO **3 bit selection**	3-110	0	
X	P391 DO **3 bit pattern**	3-110	0	
	P392 DO **state**	3-111		
	P400 POS **module state**	3-118		
X	P401 POS **current set number**	3-119	1	
X	P402 POS **norm position Z**	3-119	1I	
X	P403 POS **norm position N**	3-119	1 UU	
X	P406 POS **mode**	3-120	0001	
X	P408 POS **rapid halt deceleration**	3-120	5,00 I/ms^2	
X	P409 POS **inching speed**	3-120	480 I/ms^2	
X	P410 POS **inching acceleration**	3-120	2,00 I/ms^2	
X	P411 POS **inching deceleration**	3-120	2,00 I/ms^2	
X	P412 POS **reference speed**	3-120	480 I/ms^2	
X	P413 POS **reference acceleration**	3-120	5,00 I/ms^2	
X	P414 POS **reference run mode**	3-120	1001	
X	P415 POS **target position 1**	3-127	0000 0000 UU	
X	P416 POS **target input 1**	3-127	0	
X	P417 POS **positioning speed 1**	3-128	100 I/ms	

	Parameter	Page	Standard value	Internal standardization
X	P418 POS **terminal velocity 1**	3-128	0 l/ms	
X	P419 POS **positioning acceleration 1**	3-128	5,00 l/ms^2	
X	P420 POS **positioning deceleration 1**	3-128	1,00 l/ms^2	
X	P421 POS **dwell time 1**	3-128	1 ms	
X	P422 POS **target position 2**	3-127	0000 0000 UU	
X	P423 POS **target input 2**	3-127	0	
X	P424 POS **positioning speed 2**	3-128	100 l/ms	
X	P425 POS **terminal velocity 2**	3-128	0 l/ms	
X	P426 POS **positioning acceleration 2**	3-128	5,00 l/ms^2	
X	P427 POS **positioning deceleration 2**	3-128		
X	P428 POS **dwell time 2**	3-128	1 ms	
X	P429 POS **position tolerance range**	3-123	000 1000 UU	
X	P430 POS **position tolerance range time**	3-123	2 ms	
X	P432 POS **reference point**	3-123	0001 0000 UU	
	P433 POS **state switch**	3-123	-	
X	P434 POS **mode switch**	3-124	0000	
X	P435 POS **encoder offset**	3-124	0 l	
	P436 POS **position set value**	3-124	-	
	P437 POS **position actual value**	3-124	-	
	P438 POS **set speed**	3-124	-	
X	P439 POS **SW end switch 1**	3-125	0000 0000 UU	
X	P440 POS **SW end switch 2**	3-125	FFFF FFFF UU	
X	P441 POS **rounding**	3-126	0 ms	
X	P442 POS **reference deceleration**	3-126	5,00 l/ms^2	
X	P443 POS **reference terminal speed**	3-126	10 l/ms	
X	P444 POS **clip tolerance**	3-126	0001 0000 UU	

X: parameter is saved in data set

END OF CHAPTER

MAINTENANCE

The equipment carries a dangerously high voltage and has dangerous rotating parts (fans). Ignoring the safety and warning information may result in death, severe personal injury or damage to property.

You may only carry out maintenance when the unit is deenergized.

Do not begin work on the power stage and the intermediate circuit until you have made sure that the unit is not carrying potential or a voltage (remanent charge).

When dismounting safety devices during commissioning, repair and maintenance work, you must ensure that the machine is taken out of commission exactly as specified. You must remount and check safety equipment immediately after completing commissioning, repair and maintenance work.

After carrying out any work involving intervention in the machine – regardless of whether this involves the motor, the actual value acquisition or the power converter – the owner must carry out acceptance testing and document it chronologically in the machine log. Failure to do this may result in the owner being faced with consequences relating to liability legislation.

Do not start work on the power unit, intermediate circuit until you have made sure that the unit is not carrying potential or a voltage (remanent charge).

We cannot guarantee the product documentation is completely error-free.

MAINTENANCE INFORMATION

The units supplied are maintenance-free.

Prohibition of unauthorized modifications

For safety reasons, unauthorized additions or modifications to the drive are not allowed.

ERROR MESSAGES

In the event of an error, parameter M error code (P124) indicates the appropriate error code. This error is acknowledged when bit Reset fault in M control word (P120) is set from 0 to 1. If there is more than one error, the system shows the next one immediately after acknowledgement.

- **Drive Manager Function Module**

Error ID	Error Text	Meaning	Remedy
0001_{hex}	BASS protocol timeout	The communications source set in P124 has not responded for longer than the timeout set in P128.	Check communications (cables, daughterboard, etc.)
0002_{hex}	USS protocol timeout		
0003_{hex}	Dual-Port RAM timeout (cyclical data)		
0004_{hex}	Dual-Port RAM timeout (working data)		
0005_{hex}	System boot procedure	An error was determined while reading the boot data set from the EEPROM. You can get more information about the type of error by referring to parameter DSM Message (P192). This disturbance usually occurs if you replaced the controller firmware with firmware that is incompatible.	You should carefully check the data set in the controller's RAM and then program it in the EEPROM as the boot data set.
0010_{hex}	Error switch (program error)	Only meaningful for software developers	

- **Power Supply Function Module**

Error ID	Error Text	Meaning	Remedy
0110_{hex}	Disturbance in power supply unit	No ready for use signal from supply unit.	Check the power supply.
		Average braking power too high	Reduce speed before braking Increase time between two brakes Reduce braking time Use external braking resistance
		DAM 61: power phase interruption	Increase P112 (max 6s)
		Power supply too small	Reduce required current Use a bigger power supply
0006_{hex}	Response time-out	In case of (non fatal) error the drive could not stop the motor in the time specified in P188	Check the reason for the long braking. If necessary increase the response time in P188

- **Power unit Function Module**

Error ID	Error Text	Meaning	Remedy
0201_{hex}	Overvoltage Uzk	The bus voltage, UZK, has exceeded a value of 800 V ± 1%	Check the integrity of the brake resistance
0202_{hex}	Overcurrent	At least one of the three phase currents of the power group has exceeded the value of 1.3xImax (1.3xP113)	Check the current controller's setting Reduce the current gain (P89) Copy P111 into P87 Reduce acceleration
0203_{hex}	Error current	An error current was determined in the power unit that exceeded a specific amount. (For more detailed information, refer to the power unit description.)	Check the motor cables for a ground fault
0204_{hex}	Disturbance in auxiliary voltage supply	There is no power supply for transistor control in the power unit.	Check control of the safety relay
0205_{hex}	Overtemperature of power unit	The temperature of the power unit has risen above 85 °C.	The disturbance cannot be acknowledged until the power unit temperature shown in P118 has fallen below 85 °C.
0206_{hex}	Disturbance in safety relay	The safety relay in the power unit is OFF even though it should be ON. This means that the auxiliary voltage supply for transistor control is deactivated.	Check control of the safety relay
0207_{hex} 0208_{hex} 0209_{hex} $020A_{hex}$ $020B_{hex}$ $020C_{hex}$ $020D_{hex}$	Transistor error (group message) Phase U top Phase U bottom Phase V top Phase V bottom Phase W top Phase W bottom	UCE monitoring of one or more power transistors has tripped due, for example, to a short circuit or ground fault or because of defects in the transistor.	Check the motor cables for a short circuit or ground fault. Allow the power unit to cool down. If the disturbance keeps occurring, replace the power unit.
$020E_{hex}$	Power unit ID unknown	The control unit does not know the read identifier	Read off the power unit version from the rating plate and compare it with the list in P117. The error cannot be acknowledged.
$020F_{hex}$	Wrong power unit type	The stored power unit type does not match the one the system read, e.g. because no data set has been stored yet or you plugged the control unit into another power unit.	Check the power group version and compare it with P117. The error cannot be cancelled.

Error ID	Error Text	Meaning	Remedy
0210_{hex}	Disturbance in power unit	The ready signal from the power group is missing because of:	
		Excessive braking power	Modify the machining cycle Use an external braking resistance
		Interruption of a mains phase	
		Noise	Check the connections of the shielding of the power and motor encoder cables
$OD01_{hex}$	Temperature of the power unit under –40°C	Probably a short circuit of the heat sensor in the power unit	Repair the drive

- **Encoder Manager Function Module**

Error ID	Error Text	Meaning	Remedy
0301_{hex}	Overspeed of encoder 1	Evaluation has determined a speed actual value (P023) that is greater than the overspeed value (P046)	Check the encoder cable. Check the speed controller settings.
0302_{hex}	Overspeed of encoder 2	Encoder has determined a speed actual value (P243) that is greater than the overspeed value (P239)	Check the encoder cable. Check the speed controller settings.
0303_{hex}	Absolute position encoder 1 unknown (rotor position)	The error occurs in conjunction with operation of synchronous control on these encoders in the following cases: 1. At initialization of the encoder, it was not possible to read the absolute position from the encoder (e.g. due to the encoder adaptor module, lack of communication). 2. The encoder has no absolute position information (e.g. incremental encoders with sinus or square wave signals).	
0304_{hex}	Absolute position encoder 2 unknown (rotor position)		

- **Overload Monitoring Function Module**

Error ID	Error Text	Meaning	Remedy
0401_{hex}	I^2t monitoring of motor	Calculated I^2t (P091) is greater than 100%	Leave the drive in the inhibited status until the I^2t actual value (P091) drops below 100%.

- **Motor Temperature Function Module**

Error ID	Error Text	Meaning	Remedy
0501_{hex}	Overtemperature of motor	P152 = 3 (PTC thermistor) The motor temperature has risen to such an extent that the PTC thermistor has become highly resistant. P152 = 1 (sensor) The motor temperature has exceeded the shutdown threshold (P156). This disturbance can also occur if motor temperature acquisition is interrupted during operation.	Allow the motor to cool down until the motor temperature has dropped below the limit value. Check the encoder cable and the temperature sensor (see motor temperature connector X28)
0502_{hex}	Motor temperature < -40°C	Probably a short circuit of the heat sensor of the motor	Check the sensor connection Check the sensor for short circuit

- **Position Controller Function Module**

Error ID	Error Text	Meaning	Remedy
0601_{hex}	Deviation, dynamic	In motion, e.g. positioning, synchronous operation, the deviation (P210) has become greater than the dynamic deviation error limit (P203).	Check the settings of the dynamic deviation limit and, if necessary, correct them. Reset the error enable for the dynamic deviation in mode parameter P201, bit number 0.
0602_{hex}	Deviation, static	At standstill (e.g. target position reached, n=0), the deviation (P210) has become greater than the static deviation error limit (P212).	Check the settings of the static deviation limit and, if necessary, correct them. Reset the error enable for the dynamic deviation in mode parameter P201, bit number 1.

- **Speed Controller Function Module**

Error ID	Error Text	Meaning	Remedy
0702_{hex}	Blocking monitoring	During the blocking time set in P056, the drive was stationary with maximum torque of N = 0.	Check the drive machine for blocking

- **Encoder 1 Function Module**

Error ID	Error Text	Meaning	Remedy
0801_{hex} *)	Invalid module code	The adapter module's code is not known	The adapter module is either not fitted or not supported in this version of the firmware
0802_{hex} *)	Wrong adapter module	The encoder adapter in the unit is not suitable for the desired encoder type and communications protocol settings.	Change the settings in the encoder mode or use another adapter
0803_{hex} *)	No communication with the encoder	Reading the absolute position from the encoder did not function.	Check the encoder cable, on the motor and unit sides.
0804_{hex} **)	Wire break encoder 1	The encoder signals are useless for evaluation.	Check the encoder cable, on the motor and unit sides.
0805_{hex}	Wrong address in the response		Check the electro-magnetic compatibility. If the problem persists repair the motor.
0806_{hex}	Error message from the encoder	The encoder has detected an internal error during autodiagnostics	
0807_{hex}	Wrong command in the response		
0808_{hex}	Wrong checksum in the response		
0809_{hex}	Wrong positioning correction		Check the connection with the encoder
$080A_{hex}$	Unknown encoder code	The encoder returns a non existing ID code	
$080B_{hex}$	Communication time-out	The encoder did not send a response within 50 ms	

*) Errors cannot be acknowledged.

**) After acknowledgement, the encoder is reinitialized; in this connection, the reference to a reference point can be lost.

- **Data Set Management Function Module**

Error ID	Error Text	Meaning	Remedy
0901_{hex}	EEPROM copy error	A data difference was determined at copying of the EEPROM during initialization of data set management	This error cannot be acknowledged and you can only eliminate it by switching the electronics supply off and on again. If the error occurs repeatedly, this indicates that there is a defect in the controller hardware.
0902_{hex}	Missing boot data set	There is no boot data set (DS no. 0) in the EEPROM	You must create the boot data set in RAM and then save it to the EEPROM.
0903_{hex}	Checksum error in boot data set	At checking of the boot data set, the system calculated a different checksum than the one that was expected, i.e. a boot data set is present but it is invalid due to data corruption.	You must create the boot data set in RAM and then save it to the EEPROM.

- **Encoder 2 Function Module**

Error ID	Error Text	Meaning	Remedy
$0A01_{hex}$ *)	Invalid module code	The adapter module's code is not known	The adapter module is either not fitted or not supported in this version of the firmware
$0A02_{hex}$ *)	Wrong adapter module	The encoder adapter in the unit is not suitable for the desired encoder type and communications protocol settings.	Change the settings in the encoder mode or use another adapter
$0A03_{hex}$ *)	No communication with the encoder	Reading the absolute position from the encoder did not function.	Check the encoder cable, on the motor and unit sides.
$0A04_{hex}$ **)	Wire break encoder 1	The encoder signals are useless for evaluation.	Check the encoder cable, on the motor and unit sides.
$0A05_{hex}$	Wrong address in the response		Check the electro-magnetic compatibility. If the problem persists repair the motor.
$0A06_{hex}$	Error message from the encoder	The encoder has detected an internal error during autodiagnostics	
$0A07_{hex}$	Wrong command in the response		
$0A08_{hex}$	Wrong checksum in the response		
$0A09_{hex}$	Wrong positioning correction		Check the connection with the encoder
$0A0A_{hex}$	Unknown encoder code	The encoder supplies a non existing ID code	
$0A0B_{hex}$	Communication time-out	The encoder did not send a response within 50 ms	

*) Errors cannot be acknowledged.

**) After acknowledgement, the encoder is reinitialized; in this connection, the reference to a reference point can be lost.

- **Operating System Function Module**

Error ID	Error Text	Meaning	Remedy
0B01hex	Main program computing time exceeded		P160 selection = 0, P169 value = 0, Save again the parameters and cancel the error. If necessary disable dispensable features such as programming of digital and analog I/Os.
0B02hex	Task computing time exceeded		
0B03hex	Sync. IR computing time exceeded		
0B04hex *	DSP computing time exceeded		

*) Errors cannot be acknowledged.

- **Microprocessor Errors**

Error ID	Error Text	Meaning	Remedy
$0B05_{hex}$	Program modules link error		Switch off and on again. If the error persists or is systematic, replace the drive
$0B06_{hex}$	Time segment system config error		
$0C01_{hex}$	Illegal external bus access		
$0C02_{hex}$	Illegal instruction access		
$0C03_{hex}$	Illegal word operand access		
$0C04_{hex}$	Protection fault		
$0C05_{hex}$	Undefined opcode		
$0C06_{hex}$	Stack underflow		
$0C07_{hex}$	Stack overflow		
$0C08_{hex}$	External non maskable interrupt		
$0C09_{hex}$	Watchdog time out		

END OF CHAPTER