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be in motion be in motion

V-Controller (BUS 6 VC)

Specification:
Digital Control BUC
Manual

E	5.03047.01

BAUMÜLLER

Title	Manual
Product	**V-Controller (BUS 6 VC)**
Version	5.03047.01

Obligatory

These operating instructions are part of the equipment/machine. These operating instructions must be available to the operator at all times and must be in a legible condition. If the equipment/machine is sold or moved to a different location these operating instructions must be passed on by the owner together with the equipment/machine.
After any sale of the equipment/machine this original and all copies must be handed over to the buyer. After disposal or any other end of use this original and all copies must be destroyed.

When the present operating instructions are handed over, corresponding sets of operating instructions of a previous version are automatically invalidated. Please notice that specifications/data/information are **current values according to the printing date**. These statements are **not legally binding** according to the measurement, computation and calculations.
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No liability can be accepted concerning the correctness of the operating instructions unless otherwise specified in the General Conditions of Sale and Delivery.

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Hiermit zeigen wir an, dass die Baumüller Nürnberg Electronic GmbH & Co. KG im Wege der Verschmelzung mit Wirkung zum 01.12.2004 in der Baumüller Nürnberg GmbH aufgegangen ist. Ihr zukünftiger Ansprechpartner ist damit die

Baumüller Nürnberg GmbH, Ostendstrasse 80-90, 90482 Nürnberg.

Please notify that with effect from 01-12-2004 Baumüller Nürnberg Electronic GmbH & Co. KG merged with Baumüller Nürnberg GmbH. Your future business partner will be

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Par la présente, nous vous signalons qu'en voie de la fusion, la Baumüller Nürnberg Electronic GmbH & Co. KG a été intégrée à la Baumüller Nürnberg GmbH avec effet au 1 décembre 2004. Votre interlocuteur sera par conséquent la

Baumüller Nürnberg GmbH, Ostendstrasse 80 – 90, 90482 Nürnberg.

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ABBREVIATIONS

AC	Alternating current
ADR	Address byte
AI	Function module analog inputs
AM	Asynchronous motor
AO	Function module analog outputs
BAPS	Baumüller parallel interface
BASS	Baumüller serial interface
BCC	Block check character
BOF	Begin of file
BSA	Reference potential analog
BSD	Reference potential digital
BUM	Type of Baumüller converter
BUC	Type of Baumüller converter
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
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
LED	Light-emitting diode
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
SPM	Space vector modulation
STX	Start of text
SV	Function module service interface
SVG	Function module set value generator
TM	Temperature motor
USS®	Trademark Siemens, universal serial interface
ZK	Intermediate circuit

1 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 without problems if the safety information in these operating instructions is followed.

WARNING

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.

Danger Information

On the one hand, the information below is for your own personal safety and on the other to prevent damage to the described products or to other connected equipment.

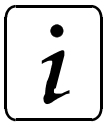
In the context of the operating instructions and the information on the products themselves, the terms used have the following meanings:

DANGER

This means that death, severe personal injury, or damage to property will occur unless appropriate safety measures are taken.

WARNING

This means that death, severe personal injury, or damage to property may occur unless appropriate safety measures are taken.



NOTE

This draws your attention to important information about the product, handling of the product or to a particular section of the documentation.

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, commissioning 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

WARNING

You may only use the equipment/system for the purposes specified in the operating instructions and in conjunction with the third-party equipment and components recommended or authorized by BAUMÜLLER NÜRNBERG GmbH.

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.

2 TECHNICAL DATA

2.1 General

This variant of the V-Controller is designed for the fully digital control of the Baumüller feed/feed back units BUC63 and BUC64. With this V-controller the intermediate circuit direct voltage Uzk is held on a constant value.

All other known V-Controller variants are designed for speed control of AC motors.

Closed-Loop Control Functions

- U_{zk} control at 62,5 µs
- Current control at 62,5 µs
  - The controller is operated by digital inputs. Via the serial interface RS232 serial port and a PC the parameterization, commissioning and service as well as archiving control parameter to floppy disk can be done.

Inputs/outputs

- Digital inputs (24 V):
  - Pulse enabling
  - 4 programmable function inputs
- Analog inputs:
  - 2 analog inputs (0 ... ±10 V), 12 bit resolution
- Serial interfaces:
  - RS232 with a transmission rate of 9600 baud, optical separated
- Digital outputs:
  - 1 relay contact message „ready for use“
  - 1 programmable function outputs
- Analog outputs
  - 2 analog outputs (0 ... ±10 V), 12 bit resolution

Operation Software

- Up-/Download with PCBASS (see, Technical Description No. 5.96079)
- PCBASS (see, Technical Description No. 5.94004)

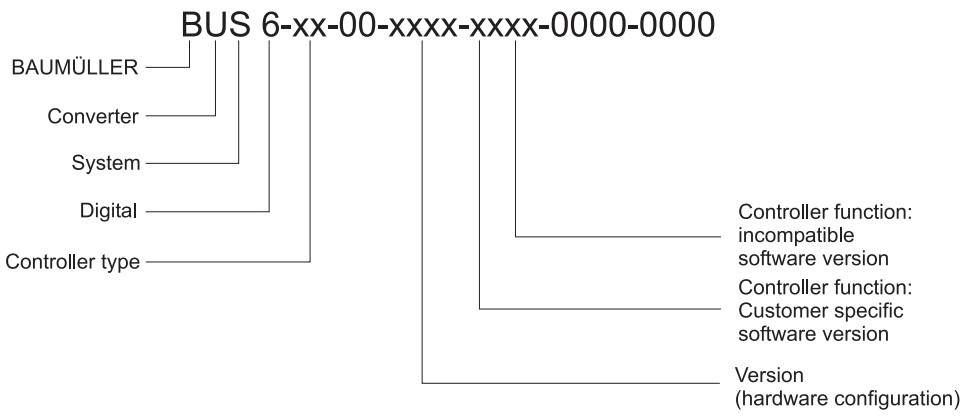
2.2 Electrical Data

Accuracy of whole system	Calculation accuracy 16 bit
Sampling rate of whole system	62,5 µs
2 analog inputs voltage range type input resistance resolution	 -10 V ... +10 V differential input ca. 40 kΩ 12 bit
5 potential free inputs low level high level input resistance	 0 V ... +7.5 V +13 V ... +30 V 2,5 mA
2 analog outputs voltage range maximum output current resolution	 -10 V ... +10 V 1 mA 12 bit
1 relay output maximum contact load maximum potential against electronic ground	 24 V DC / 1 A 50 V
3 potential free outputs joint supply voltage joint ground output current per output	 + 24 V / 150 mA ground of 24 V external 50 mA
Interfaces	RS232 service interface

Power Consumption

+5 V	1,2 A
+8 V	10 mA
+15 V	50 mA
-15 V	50 mA

2.3 Type Code



Type of Controller	VC	Vector controller
Version:	0100 etc.	V-Controller, digital control of BUC63 and BUC64
Closed-Loop Control Function:		
Customer-specific software version	00	No customer-specific software version
Incompatible software version	19	software version 19.xx

Example:

BUS6 - VC - 00 - 0100 - 0019 - 0000 - 0000

Controller type:	**VC**	**V**ector **c**ontroller
	00	without meaning
Version:	**0100**	V-controller; digital closed-loop control for BUC
Closed-loop control function		
Customer-spec. software version	00	No customer-specific software version
Incompatible software version	**19**	Software version 19.xx
	0000	without meaning
	0000	without meaning

3 TRANSPORTATION, UNPACKING

The units are packed at the factory in accordance with the order.

You should avoid jolting or dropping the package in transit, e.g. when putting the unit down.

You can start assembly after unpacking the equipment and checking that it is complete and undamaged .

The equipment is packed in cardboard, corrugated sheeting and/or wooden packaging that you should dispose of in accordance with local regulations.

Report any damage that has occurred in transit immediately.

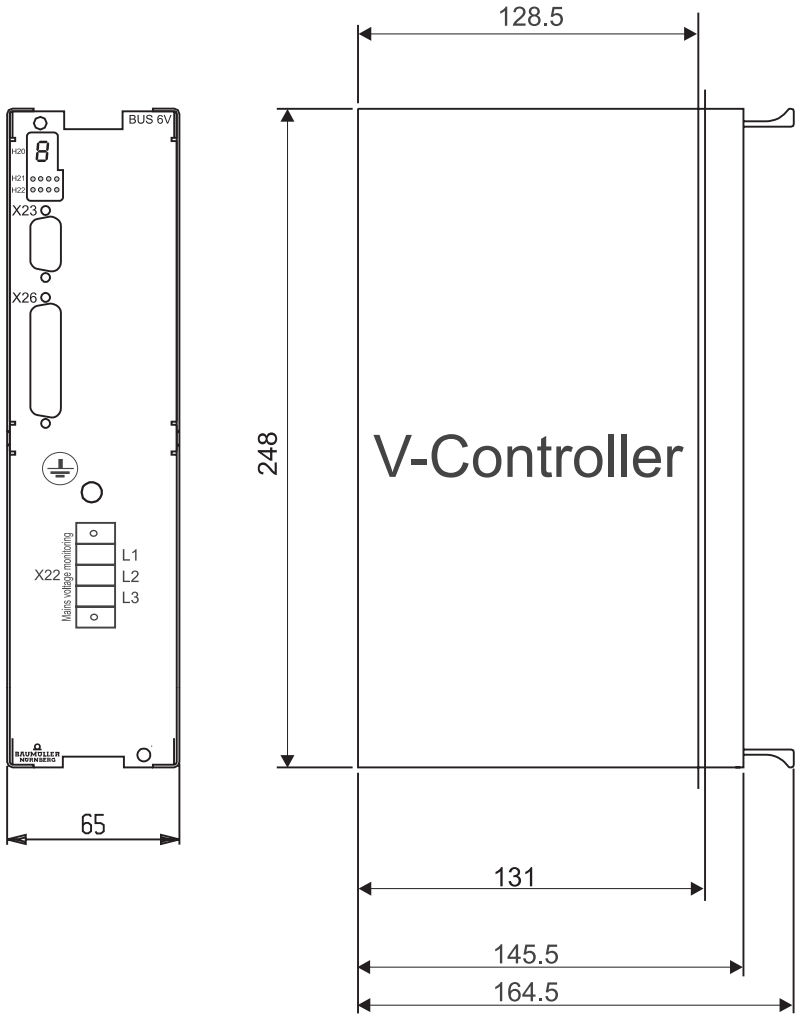
DANGER

If the unit was damaged in transit, a qualified person must check, repair and test it before it may be connected.

Ignoring this information can result in death, serious personal injury or considerable damage to property.

4 ASSEMBLY

4.1 Dimensions



Plug-in depth of cassette

- BUC 63/64: 131,0 mm

The total depth can only be determined in conjunction with the basic unit. In addition, it is necessary to take into account the dimensions of the connector to be used (approx. 40 mm).

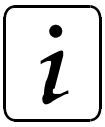
4.2 Assembly Note

WARNING

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

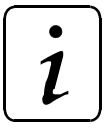
During operation, the unit is protected from direct contact such that it is suitable for use in enclosed electrical premises (DIN VDE 0558 Part 1/07.87, Section 5.4.3.2, provisional standard EN 50178/VDE 0160/ 11.94, Sections 5.2.6, 5.2.7).

Plug the controller cassette into the appropriate recess in the basic unit and secure it with the two screws attached to it.



NOTE

Do not plug in the cassette under voltage!



NOTE

The assembly of the basic unit BUC63 and BUC64 is described in following descriptions:

- **"BUC63S/A/F feed/feed back unit with digital control" (document no. 5.03046)**
- **"BUC64S/A/F feed/feed back unit with digital control" (document no. 5.03054)**

5 INSTALLATION

5.1 Danger Information

WARNING

You are responsible for mounting the controller 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, disconnectors, overcurrent protection, etc.

The power converter's power cables are energized!

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.

Speed monitoring systems in the equipment must not just be complemented by a stand-alone monitoring system on the motor in the case of speed-critical drives. You can implement this control of the RPM speed, which is independent of the controller, by means of inductive, optical or torque-dependent encoders. Refer to the appropriate motor's operating and maintenance instructions.

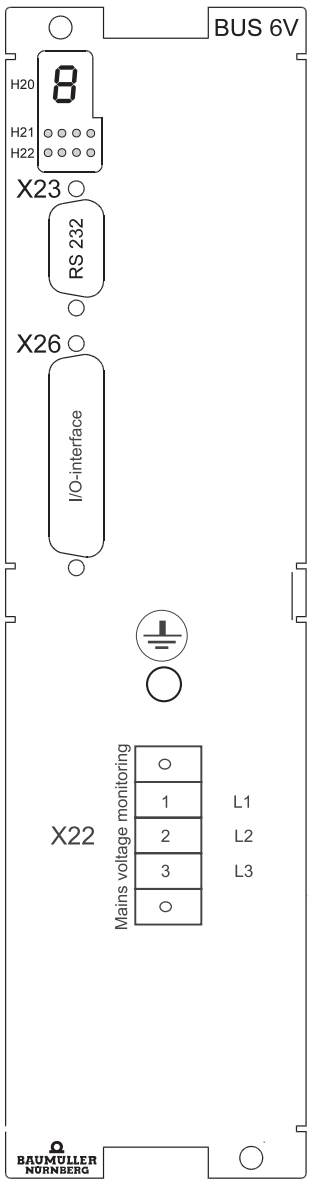
Be particularly careful before touching the drive shaft directly or indirectly with your hands. This is only allowed when the system is deenergized and the drive is stationary.

Safety devices must never be deactivated.

According to applicable regulations (EN 60204 Part 1 and VDE 0113 Part 1), stopping the drive using the enable inputs of the control electronics does not, on its own, represent a safe stop condition. A disturbance in the power converter's control electronics can lead to accidental starting of the motor.

5.2 Checks Prior to Installation

- Note down the type code of the unit and motor
- Check the connections by means of the terminal diagram
- Connection of the plugs:



5.3 Display

5.3.1 Seven-segment Display

A 7-segment display is attached to the front of the V-Controller, which shows the state in the drive manager's state machine (P120 - P133).

Display	Meaning
0	NOT READY TO START
1	INHIBIT START
2	READY TO START
9	SWITCHED ON, waiting for pulse inhibit
3	SWITCHED ON, waiting until the pre-control time (P602) is run-up
4	OPERATION ENABLED, ready-for-use relay is switched on
E	FAULT_REACTION_ACTIVE
F	FAULT

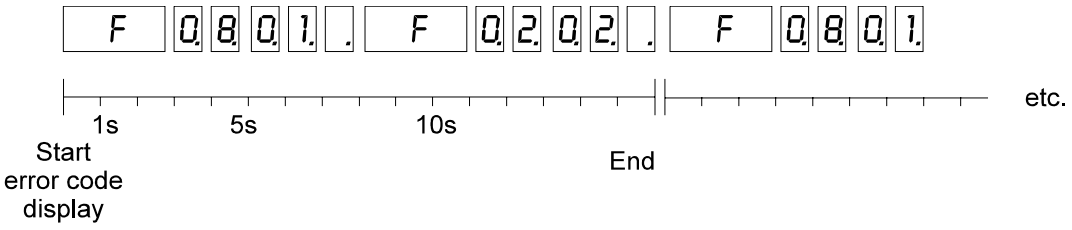
The following display mode is active **only** in the status FAULT:

Initially status identifier "F" is shown for three seconds to indicate the fault status. The "F" is followed by the four digits of the error code. The system outputs them with a decimal point, which clearly differentiates this status from the others in the device control. After the last digit, the system deactivates the display – apart from the decimal point – for one second. After this, the entire procedure is repeated.

If several errors are pending, the system, displays the entire list in this way.

If you acknowledge an error that is just being shown in display mode, the system still continues to display it until the end of this sequence. The next time the error list is processed, this error is no longer visible.

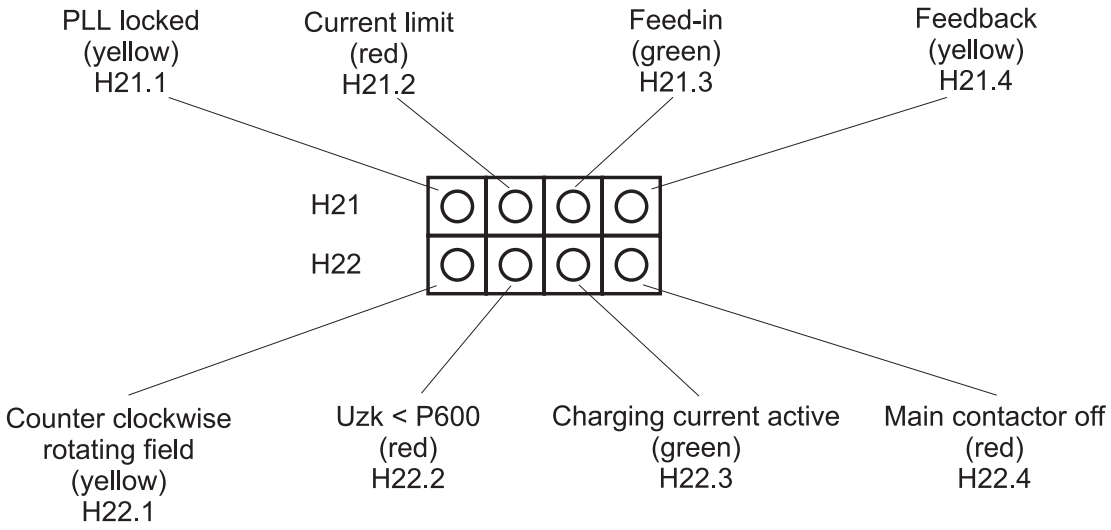
Example in the case of error codes 0801 and 0202:



Information on error codes: see Error Messages on page 92.

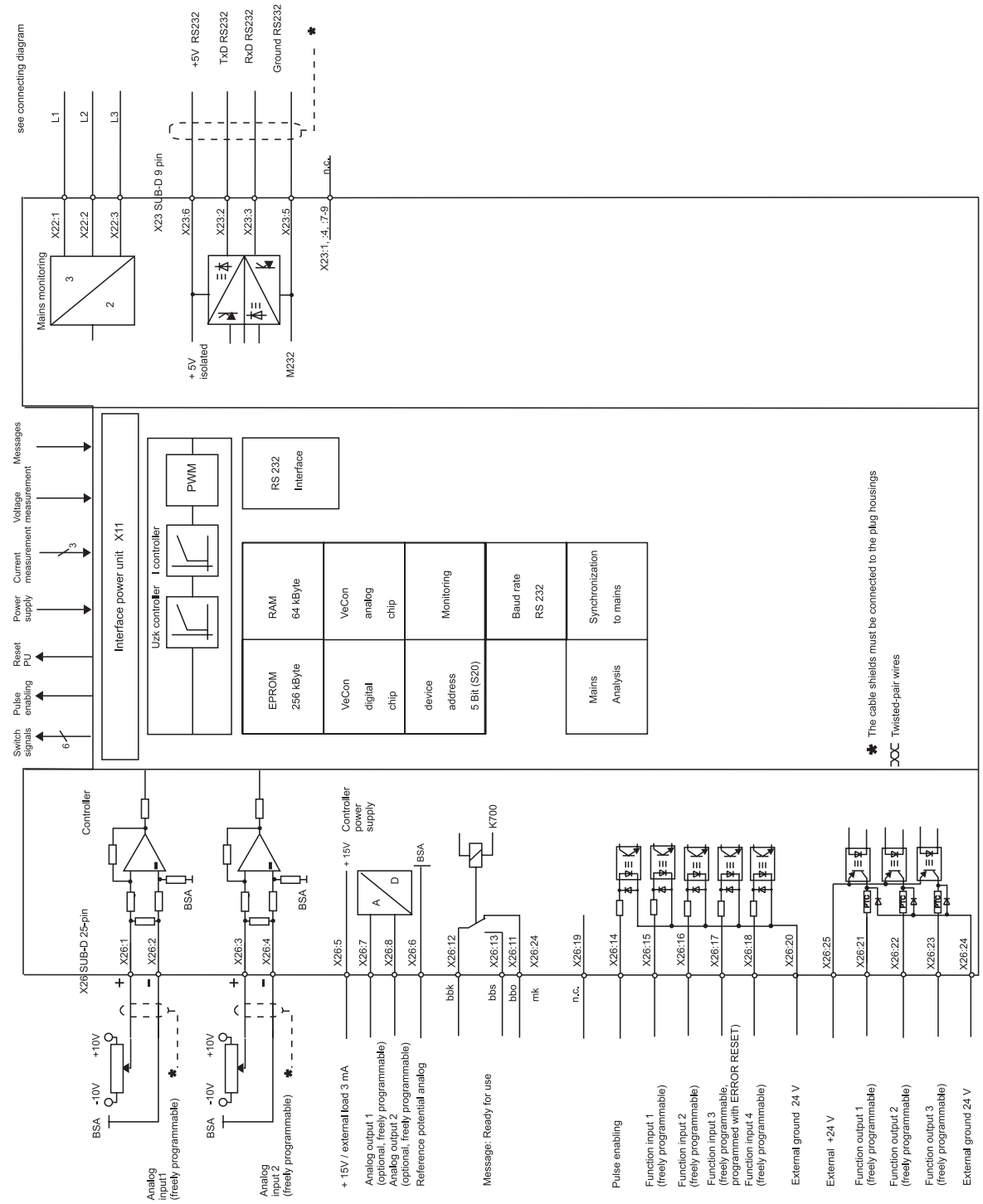
5.3.2 LED Display Element

An LED display, which gives additional information, is located below the 7-segment display.



see function module LED display

5.4 Terminal Diagram V-Controller (version: digital controlled BUC)

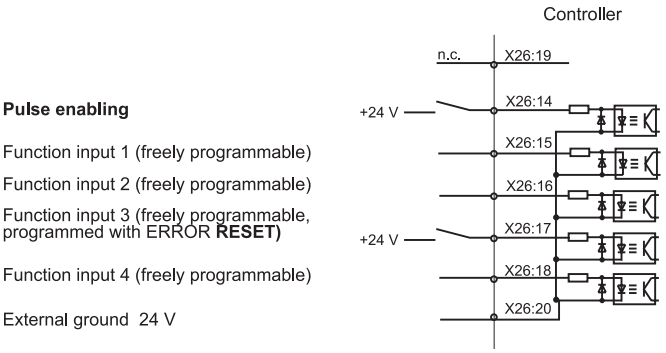


5.5 Connection of the Function Inputs

P136 M Mode = 0 or 4 (Errors are acknowledged separately)
P136 M Mode = 1 or 5 (All errors are acknowledged together, default setting)

The parameter of the module digital inputs **must** be programmed as follows:

Digital input 3
P378 = 120
P379 = 0080 hex
P380 = 0000 hex
P381 = 0080 hex

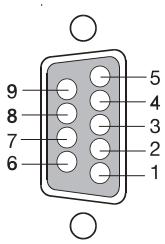


5.6 Connector Pin Assignment

RS232 Interface

X 23 SUB-D socket 9-pin

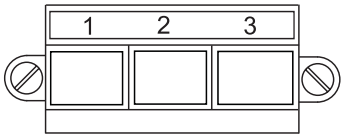
Socket



Pin no.	Assignment
1	not assigned
2	TxD RS232
3	RxD RS232
4	DTR, DSR
5	ground RS232
6	+5V RS232
7	RTS, CTS
8	RTS, CTS
9	not assigned

Measurement of the mains voltage

X22 plug 3-pin (see accessories)



Pin no.	Assignment
1	phase L1 mains voltage
2	phase L2 mains voltage
3	phase L3 mains voltage

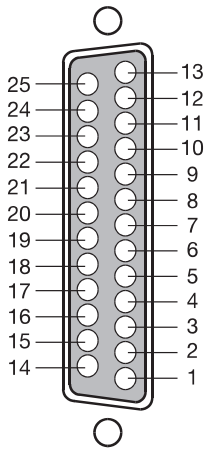
Analog/Digital Interface

X26 SUB-D socket 25 pin

NOTE

A secure separation must be ensured externally.

Buchse



Pin no.	Assignment
1	analog input 1, differential signal +
2	analog input 1, differential signal -
3	analog input 2, differential signal +
4	analog input 2, differential signal -
5	analog power supply, + 15 V
6	analog power supply, analog reference potential
7	analog output 1
8	analog output 2
9	**must not be connected !**
10	**must not be connected !**
11	bbo relay break contact ready for use
12	bbk relay changeover contact ready for use
13	bbs relay make contact ready for use
14	pulse enabling (24 V)
15	digital input 1 (24 V) (freely programmable)
16	digital input 2 (24 V) (freely programmable)
17	digital input 3 (24 V) (programmed with reset error)
18	digital input 4 (24 V) (freely programmable)
19	**must not be connected !**
20	ground for digital inputs 1 to 4
21	digital output 1 (24 V) (freely programmable)
22	digitaler output 2 (24 V) (ready for pulse enabling)
23	digitaler output 3 (24 V (main contactor on)
24	ground digital outputs 1 to 3
25	+24 V for digital inputs 1 to 4, pulse enabling and digital outputs 1 to 3

5.7 Connection Cables

5.7.1 Serial Connection Cable for PC

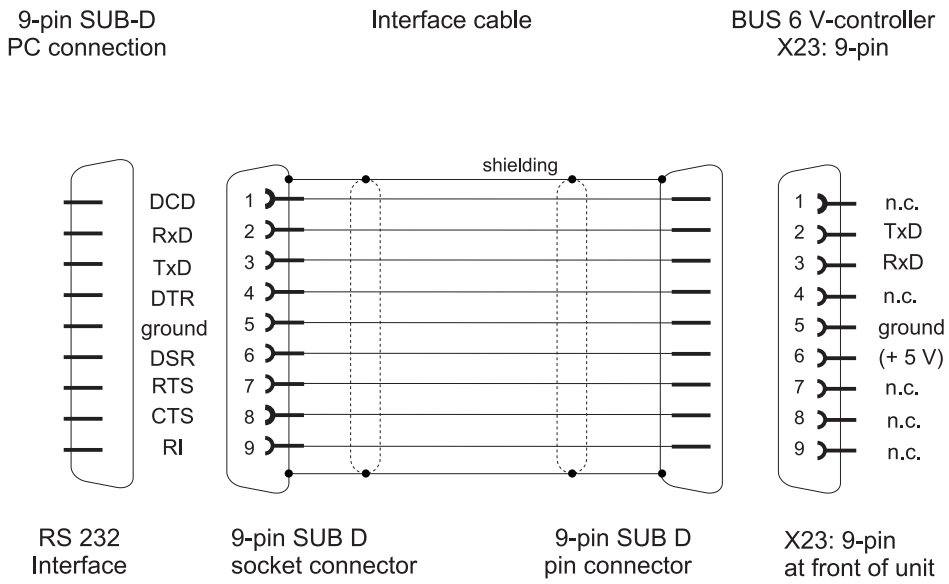
NOTE

Connect PC via isolating transformer.

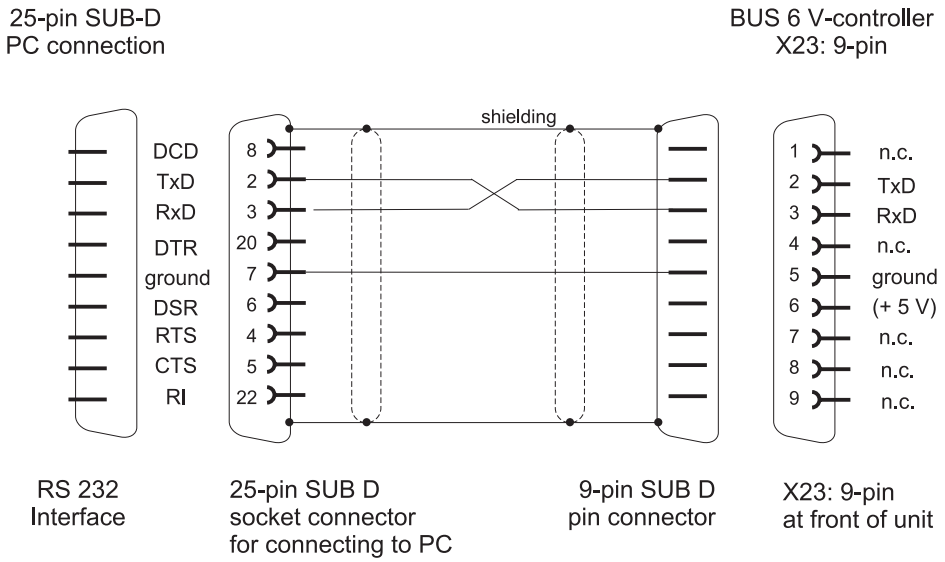
Description of the operational programmes refer to

- Up-/Download with PCBASS (see operation manual no. 5.96079)
- PCBASS (see operation manual no. 5.94004)

- 9-pin PC connection (interface cable PC, part no. 00213283



- 25-pin PC connection (not available)



5.8 Accessories

	Part no.
• Interface cable PC (3 m) X23 RS232	00213283
• Plug part with screw flange X22 3-pin RM 7,62mm	00362609

6 COMMISSIONING

6.1 Danger Information

WARNING

This equipment carries a dangerously high voltage and, depending on the version, may 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.

WARNING

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

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.

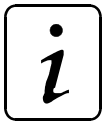
The machine minder must ensure that unauthorized people do not work at the machine.

WARNING

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

This list doesn't show the complete enumeration of the measures, which are necessary for the safe operation of the device. In case you require further information or if specific problems arise, please contact Baumüller Nürnberg Electronic GmbH & Co. KG or a subsidiary.

Pay attention to the safety instructions in chapter 1 of this operating manual.



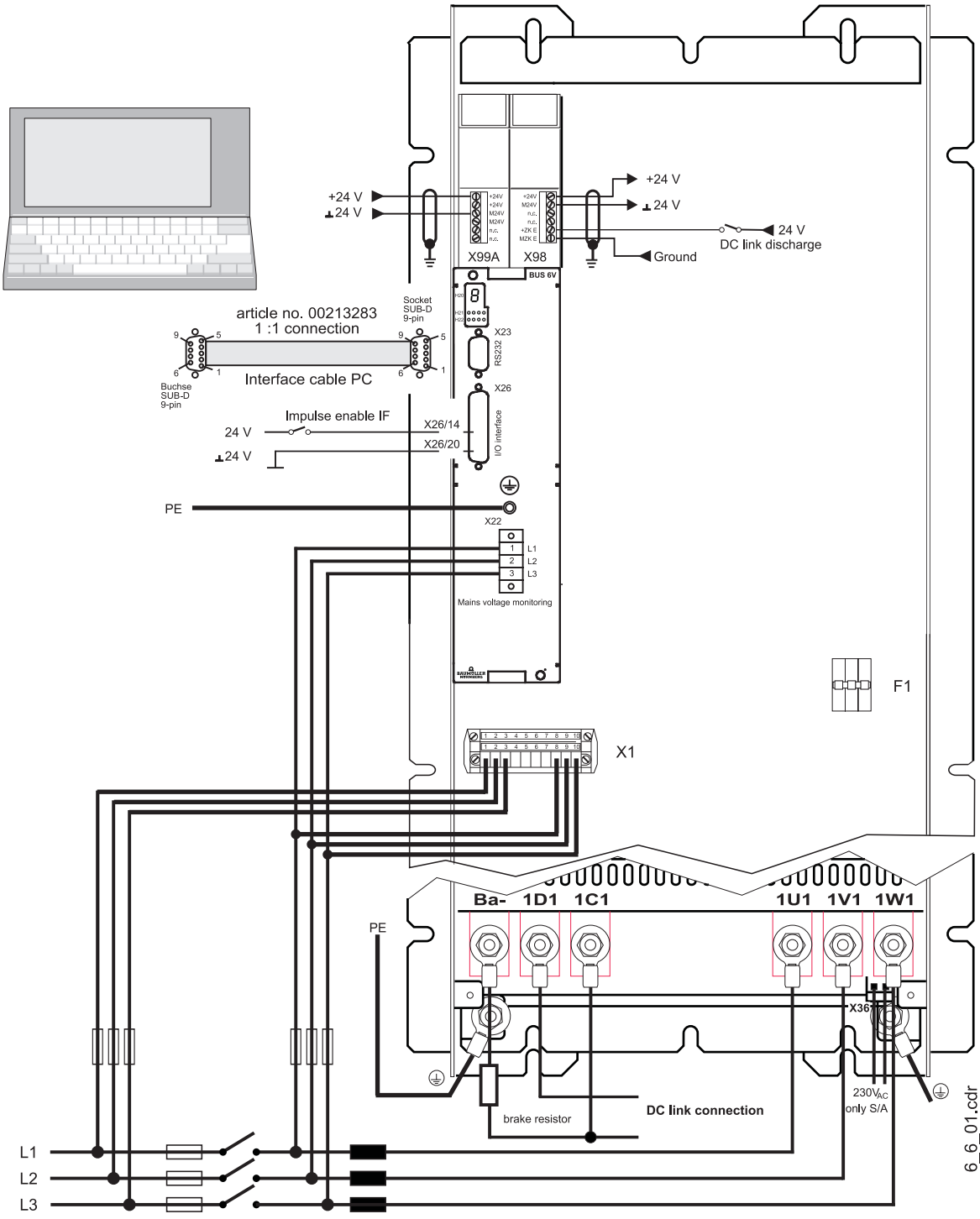
NOTE

The operator must electrostatically discharge himself before touching the modules, in order to protect against electronic modules of high voltage, which arise due to electrostatic charge. This can happen if a conductive earthed subject is touched shortly before.

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

6.2 Initial Commissioning of V-Controller

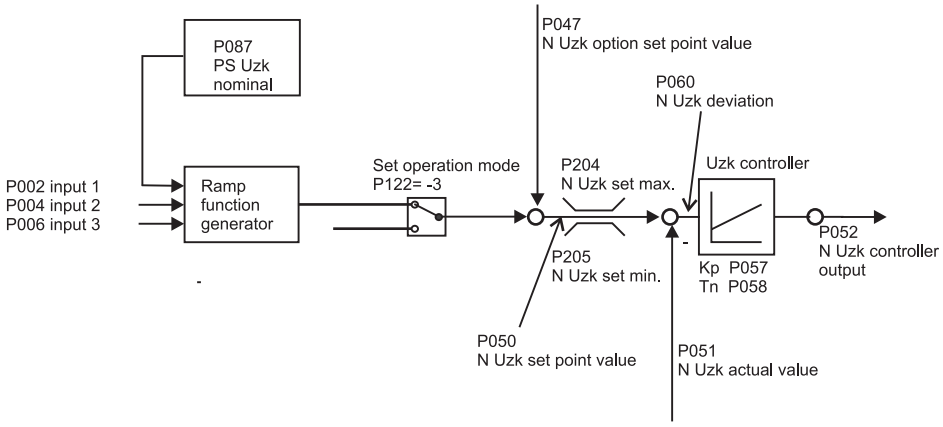
A certain minimum setup of the drive components is required to commision a drive. The following diagram shows how the components of a drive could be connected. Observe safety notes which are given in the manuals of every component. Please note for further commissioning the controller type and the type codes of the other components.

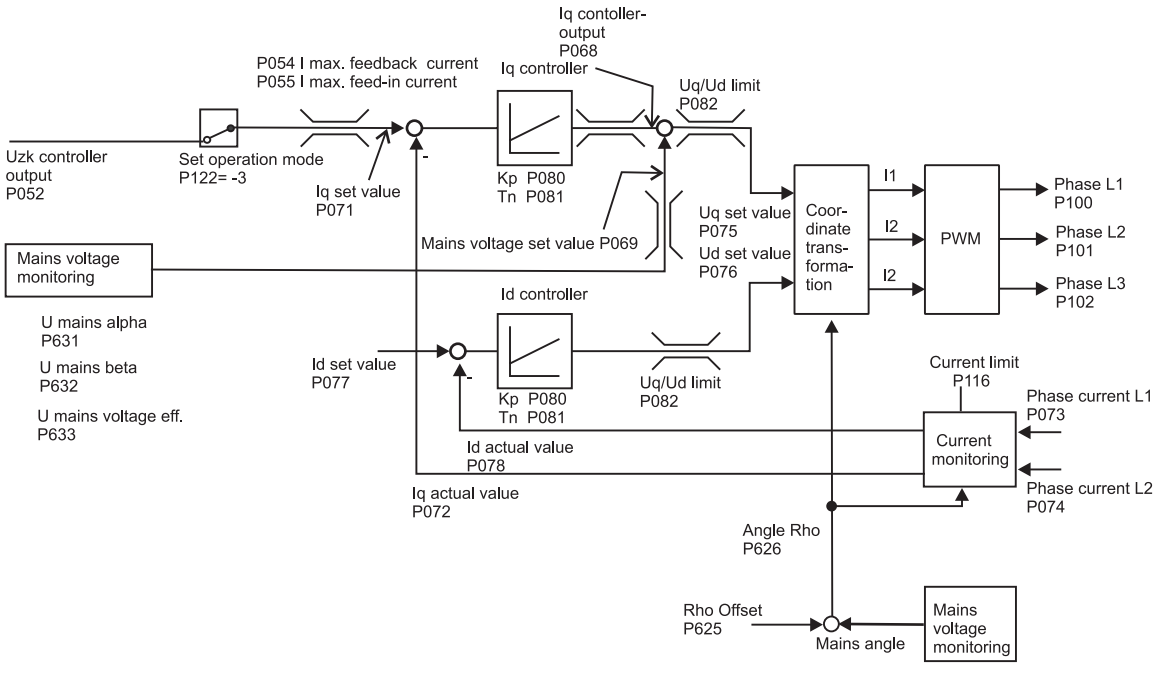


7 PARAMETERS

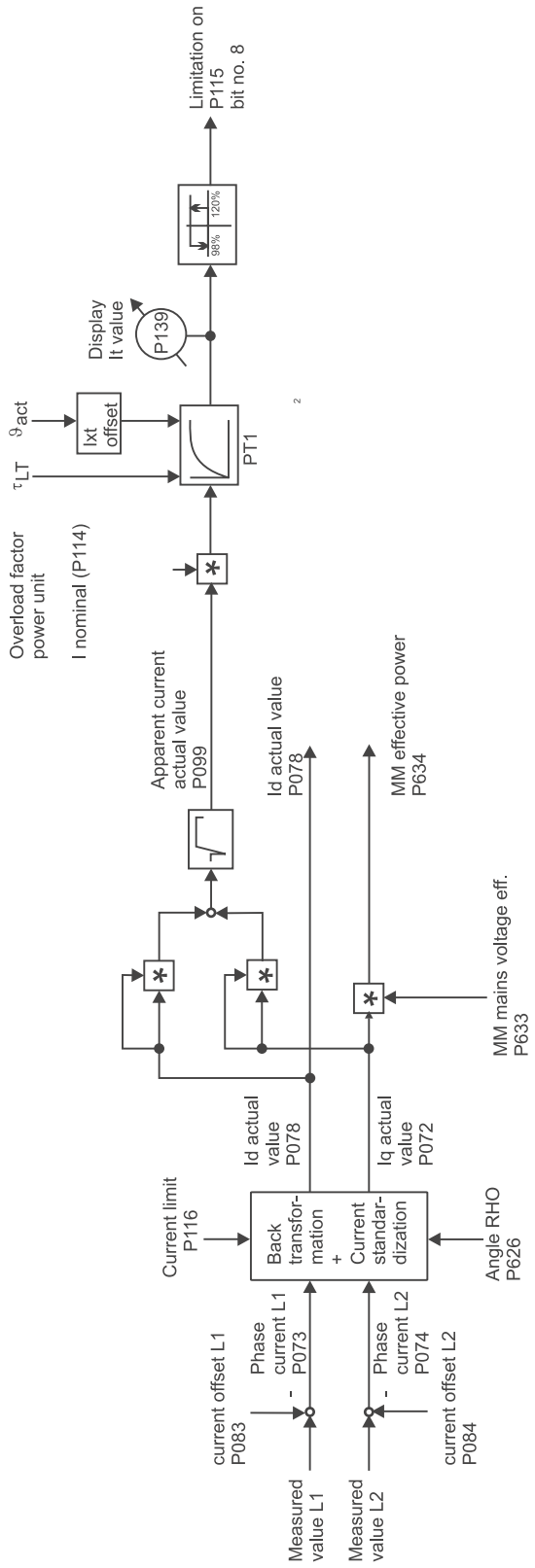
7.1 Function Diagrams

Overview V-Controller





Current Measurement and Monitoring



7.2 Power Unit

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P115	PU **state**	0000 ... FFFF		×
P090	PU **mode**	0000 ... 0007		
P117	PU **type**	0.1 ... 65535		×
P114	PU **I nominal**	0.1 ... 2500,0	A	×
P113	PU **I max**	0.1 ... 2500,0	A	×
P119	PU **overload time**	0.00 ... 600,00	s	×
P116	PU **I limit**	The range depends on the PU. Permitted range: $\frac{\text{PU Inom}}{4} \leq \text{PU I limit} \leq \text{PU I max}$	A	
P118	PU **temperature**	-80 ... 130	°C	×

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
9	1: Short circuit temperature sensor
10 ... 15	reserved

P090 PU **mode**

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

Bit no.	Meaning
0	0 : Read the power unit´s specifier, data is set according to the specifier 1 : Specifier is not read, PU data is read from EPROM
1	Short circuit monitoring temperature sensor 0 : If the temperature falls below the threshold value of -40°C the error bit in the PU status is set and the controller is disabled. 1 : If the temperature falls below the threshold value of -40°C only the warning bit No. 9 in the PU status is set. The controller is not disabled.
2 ... 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	PWM frequency P103 = 8 kHz nominal/peak current effective	PWM frequency P103 = 4 kHz nominal/peak current effective	Overload time in s
6210	BUS621	5 A / 7,5 A	6,3 A / 7,5 A	1
6211	BUS621	10 A / 15 A	12,5 A / 15 A	1
6212	BUS621	3 A / 3,7 A	3,1 A / 3,7 A	1
622	BUS622	15 A / 22 A	18,3 A / 22 A	1
623	BUS623	20 A / 30 A	25 A / 30 A	1
6240	BUS624	38 A / 57 A	47,5 A / 57 A	1
6241	BUS624	45 A / 67,5 A	56,3 A / 67,5 A	1
600	BUM60	12 A / 24 A	12 A / 24 A	1
601	BUM60	6 A / 12 A	6 A / 12 A	1
602	BUM60	3 A / 6 A	3 A / 6 A	1
612	BUM61	24 A / 45 A	30 A / 45 A	1
613	BUM 61	32 A / 60 A	40 A / 60 A	1
62	BUM62	57,7 A / 75 A	75 A / 97,5 A	120
6203	BUM62T	75 A / 97 A	100 A / 130 A	120
6201	BKH62	75 A / 97,5 A	90 A / 97,5 A	1
63	BUC63	115 A / 150 A	150 A / 195 A	120
6301	BKH63	150 A / 195 A	180 A / 195 A	1
64	BUC64	231 A / 300 A	300 A / 390 A	120

How to change the power unit data in case of an unknown power unit, see below:

PU mode = 0001_{hex}	P090
DSM command = 0	P190
DSM command = 8	P190

Enter password 1

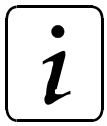
Parameter P013, P114 and P119 can now be set and the PU characterization is not be read at booting.

Values for peak current (P115), 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 must be switched off and must be 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 current is limited to the nominal current (P114). 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.

NOTE

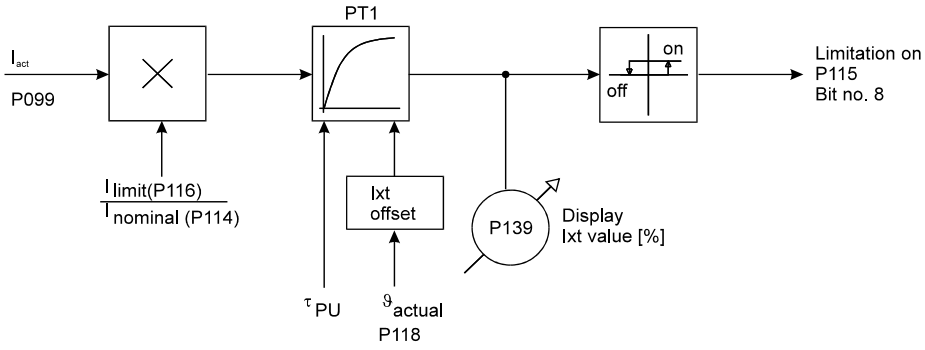
The standardization of the current controlling must not be changed if pulses are enabled.

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.

7.3 Overload Monitoring of Power Unit

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



Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P139	PU **Ixt value**	0,00 ... 400,00	%	×

Parameter description

P139 PU **Ixt value**

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

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) [%]	

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

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

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

– for power unit temperature > 45 °C

$$Ixtoffset = \frac{\vartheta_{act} - 45^{o}C}{85^{o}C - 45^{o}C} \cdot 100 \quad [\%]$$

– otherwise
Ixt offset = 0 %

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

Example:

I_{nom} = 150 A_{eff} (BUC 63)

I_{max} = 195 A_{eff} (BUC 63)

t_u = 120 [s] (BUC 63)

I_{limit} = 180 A_{eff}

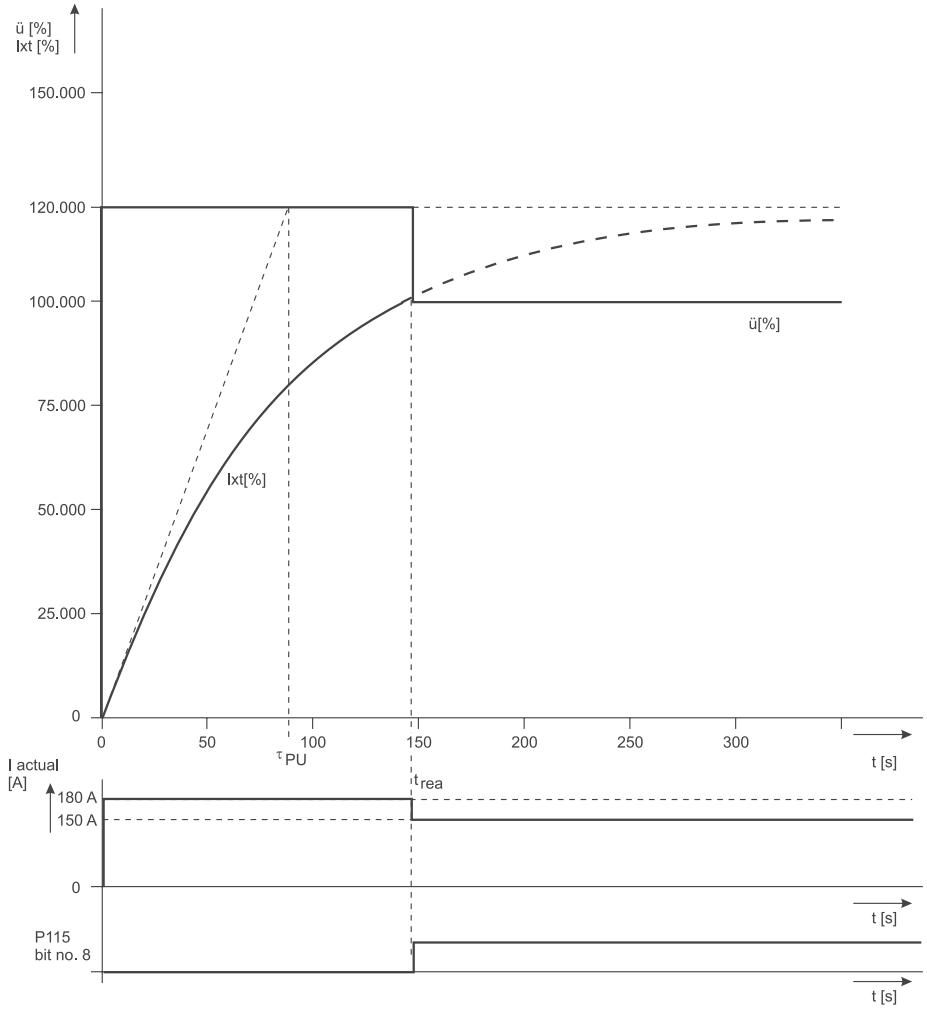
ϑ_{act} = 35 °C

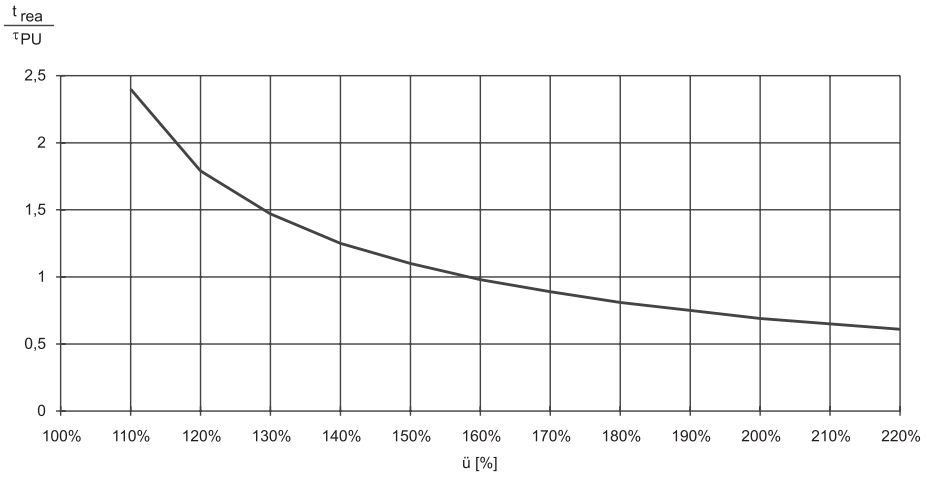
$$u_{max} = \frac{195}{150} \cdot 100 = 130 \quad [\%]$$

$$u = \frac{180}{150} \cdot 100 = 120 \quad [\%]$$

$$\tau_{PU} = -\frac{120}{\ln\left(\frac{130 - 100}{130}\right)} = 81,8 \quad [s]$$

$$t_{off} = -81,8 \cdot \ln\left(\frac{120 - 100}{120 - 0}\right) = 147 \quad [s]$$





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

7.4 Pulse Width Modulation

Function

The parameters of the pulse width modulation module serve to display the values supplied by the current controller und the change of the PWM frequency.

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P100	PWM **phase L1**	-100,00 ... +100,00	%	×
P101	PWM **phase L2**	-100,00 ... +100,00	%	×
P102	PWM **phase L3**	-100,00 ... +100,00	%	×
P103	PWM **frequency**	4,0 ... 8,0	kHz	

Parameter description

P100 PWM **phase L1**

P101 PWM **phase L2**

P102 PWM **phase L3**

These parameters display the angle α of the relative power transistors for the individual phases.

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:

$$\overline{U_{L12}} = U_{ZK} \cdot \frac{\text{PWM phaseL1} - \text{PWM phaseL2}}{\text{maximum total range}} = P610 \cdot \frac{P100 - P101}{200,00\ \%}$$

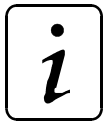
$$\overline{U_{L23}} = U_{ZK} \cdot \frac{\text{PWM phaseL2} - \text{PWM phaseL3}}{\text{maximum total range}} = P610 \cdot \frac{P101 - P102}{200,00\ \%}$$

$$\overline{U_{L31}} = U_{ZK} \cdot \frac{\text{PWM phase L3} - \text{PWM phase L1}}{\text{maximum total range}} = P610 \cdot \frac{P102 - P100}{200,00\ \%}$$

Whereby U_{ZK} the intermediate circuit voltage is displayed via parameter P610. Due to the underlying cycle frequency this voltage cannot be measured on universal devices.

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).



NOTE

A change of the frequency is only permitted when pulses are inhibited.

After change of the freqency the parameter must be stored and the controller has to be rebooted!

7.5 Current Controller

Parameter overview

Parameter	Name	Bereich min. ... max.	Einheit	nur Anzeige
P080	I **state**	0,1 ... 63,9		
P081	I **P gain**	0,0 ... 1000,0	ms	
P034	MM **clockwise rotating field**	0 ... 1		
P071	I **I_q set value**	-100,00 ... 100,00	%	
P072	I **I_q actual value**	-199,99 ... 199,99	%	×
P068	I **I_q controller output**	-100,00 ... 100,00	%	×
P069	I **U mains pre-control**	-100,00 ... 100,00	%	×
P075	I **U_q set value**	-100,00 ... 100,00	%	×
P077	I **I_d set value**	-100,00 ... 100,00	%	
P078	I **I_d actual value**	-199,99 ... 199,99	%	×
P076	I **U_d set value**	-100,00 ... 100,00	%	×
P070	I **phase voltage L1**	-100,00 ... 100,00	%	×
P086	I **phase voltage L2**	-100,00 ... 100,00	%	×
P073	I **phase current L1**	-100,00 ... 100,00	%	×
P074	I **phase current L2**	-100,00 ... 100,00	%	×
P083	I **current offset L1**	-25,00 ... 25,00	%	×
P084	I **current offset L2**	-25,00 ... 25,00	%	×
P099	I **apparent current actual value**	0,00 ... 100,00	%	×

Parameter description

P080 I **P gain**

P081 I **integral action time**

This parameters set the P gain (k_p) and the integral action time (T_N) of the direct-axis current controller and the wattless current controller.

Setting of the current controller:
If the motor parameter stator resistance and leakage inductance are known, the current controller can be set the following way:

- $T_n = T_s = \frac{l_s}{r_S}$ and $k_P = \frac{l_S}{3 \cdot T_{ab}} \cdot \frac{I_{max}(P113)}{\frac{U_{ZKnom}(P087)}{\sqrt{6}}}$

$$T_{ab} = 0,5 \cdot \frac{1}{f_S(P103)}$$

The current controller is set according the absolute value optimum.

P034 MM **clockwise rotating field**

This parameter adapts the control to the motor´s rotating field.

Value	Meaning
0	mains with counterclockwise rotating field (phase L2 and L3 changed)
1	mains with clockwise rotating field

NOTE

After changing the MM rotating field the data set 0 **must** be saved (boot data set) and the controller must be re-booted!

P071 I **Iq set value**

P072 I **Iq actual value**

The cross current specified/actual value (active current component of the vector control) is indicated here. 100 % corresponds to the value set in the LT I limit (P116).

P068 I I_q **controller output**

Manipulated variable of active current controller.

Standardization: 100 % $\leftrightarrow$ $\frac{U_{ZKnom}(P087)}{\sqrt{3} \cdot \sqrt{2}}$

P069 I **U mains pre-control**

Pre-control of mains voltage (corresponds with the EMF of the motor).

Standardization: 100 % $\leftrightarrow$ $\frac{U_{ZKnom}(P087)}{0,8 \cdot \sqrt{3} \cdot \sqrt{2}}$ (effective value)

P075 I U_q **set value**

Sum of P068 I_q controller output and P069 U mains pre-control.

Standardization: 100 % $\leftrightarrow$ $\frac{U_{ZKnom}(P087)}{0,8 \cdot \sqrt{3} \cdot \sqrt{2}}$ (effective value)

P077 I I_d set value

P078 I I_d actual value

The direct-axis current set value / actual value (reactive current component if the vector control) is displayed here.

Standardization: 100 % ↔ PU I limit (P116)

P076 I U_d set value

Manipulated variable of direct-axis controller

.

Standardization: 100 % ↔ $\frac{U_{ZKnom}(P087)}{0,8 \cdot \sqrt{3} \cdot \sqrt{2}}$ (effective value)

P070 I phase voltage L1

P086 I phase voltage L2

Voltage set values on unit's connection 1U1 and 1V1

Standardization: 100 % ↔ $\frac{U_{ZKnom}(P087)}{0,8 \cdot \sqrt{3} \cdot \sqrt{2}}$ (effective value)

P073 I phase current L1

P074 I phase current L2

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} (half of the measuring transducer range)

P099 I apparent current actual value

Standardization: 100 % ↔ PU I limit (P116)

7.6 Uzk Controller (Uzk value setting)

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P059	N **state**	0000 ... FFFF		×
P057	N **P gain**	0,1 ... 1000,0		
P058	N **integral action time**	0,0 ... 2000,0	ms	
P087	ES **U_{ZK} nominal value**	280 ... 1000	V	
P050	N **Uzk set value**	150,0 ... 999,9	V	
P047	N **Uzk additional set value**	-10,00 ... 10,00	V	
P204	N **Uzk set value max.**	550,0 ... 999,9	V	
P205	N **Uzk set value min.**	150,0 ... 950,0	V	
P051	N **Uzk actual value**	-1999,9 ... 1999,9	V	×
P052	N **Uzk controller output**	-100,00 ... 100,00	%	
P054	N **I max. feed back current/IR1**	0,00 ... 100,00	%	
P055	N **I max. feed-in current/IR2**	0,00 ... 100,00	%	
P060	N **Uzk control deviation**	-199,99 ... 199,99	%	×
P061	N **Uzk limit control deviation**	0,00 ... 199,99	%	

Parameter description

P059 N **state**

This parameter shows the Uzk controller´s state.

Bit no.	Meaning
0 ... 2	000: STOP, N Uzk controller is disabled 001: RUN, N Uzk controller is enabled 011: STAND_BY, N-Uzk controller is disabled
3	1: error in module, error code see P124
4	reserved
5 ... 9	reserved
10	reserved
11	0: current direction 1 active 1: current 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 Uzk controller.

P058 N **integral action time**

Integral action time (T_N) of Uzk controller.

P087 ES **Uzk nominal value**

This parameter sets the nominal intermediate circuit voltage set value of the BUC.

P047 N **Uzk additional set value**

P050 N **Uzk set value**

This parameter sets the intermediate circuit voltage.

P051 N **Uzk actual value**

Actual value of the intermediate circuit voltage.

P052 N **Uzk controller output**

This parameter displays the set value of the Uzk controller.

P054 I **max. feed back current**

Limiter of the maximum feed back mains current

P055 I **max. feed-in current**

Limiter of the maximum feed-in (supply) mains current.

P060 N **Uzk control deviation**

This parameter displays the control deviation of the Uzk controller at the moment.

P061 N **Uzk limiter control 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).

P204 N **Uzk set max.**

Limiter of the maximum intermediate circuit voltage set value.

P205 N **Uzk set min.**

Limiter of the maximum intermediate circuit voltage set value.

7.7 Drive Manager (Enable the Controller)

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		×
P122	M **set operation mode**	-6 ... 6		
P123	M **actual operation mode**	-6 ... 6		×
P124	M **error code**	0000 ... FFFF		×
P125	M **error index**	0 ... 31		×
P136	M **mode**	0000 ... 0007		
P126	M **communication source**	0000 ... 000F		
P127	M **communication monitoring**	0000 ... 000F		
P128	M **monitoring time**	0 ... 60 000	ms	
P137	M **state 1**	0000 ... FFFF		×

- **Unit control states**

  0 **NOT READY TO START**

  – electronics supplied with voltage
  – self-test running
  – initialisation running
  – Uzk control is disabled
  – relay „ready for use“ is OFF (relay is fallen off - BUC is not ready)

  1 **INHIBIT START**

  – software/hardware initialisation completed
  – Uzk control is disabled
  – main contactor is not enabled (internal contact between X1:6 and X1:7 open, see terminal diagram BUC)
  – charge circuit can be activated (power on - see terminal diagram BUC63), the intermediate circuit can be charged
  – relay „ready for use“ is OFF (relay is fallen off - BUC is not ready)

  2 **READY TO START**

  – intermediate circuit voltage has reached the value set in P600, no flow of charge current
  – Uzk controller is disabled
  – main contactor is enabled (internal contact between X1:6 and X1:7 closed, see terminal diagram BUC)
  – main contactor is activated
  – timer with set main contactor switching time (P601 MC switching time) is started
  – relay "ready for use" is OFF (relay is fallen off - BUC is not ready)

  9 **SWITCHED ON, wait for pulse enable**

  – intermediate circuit voltage has reached set value P600
  – Uzk control is disabled
  – main contactor switched, the main contactor switching time runs up (P601 MC switching time)
  – mains voltage lays on the BUC power unit, the controller is synchronous with the mains
  – signal "ready for pulse enable" is enabled (see X26:22, terminal diagram V-controller
  – relay "ready for use" is OFF (relay is fallen off - BUC is not ready)

  3 **SWITCHED ON, wait until pre-control time (P602)has run down**

  – pulses are enabled (see X26:14, terminal diagram V-controller)
  – Uzk control is enabled
  – timer with set pre-control time (P602) is started and the intermediate circuit voltage is increased to set Uzk nominal value (P087)
  – relay "ready for use" is OFF (relay is fallen off - BUC is not ready)

  4 **ENABLE OPERATION**

  – Uzk control is enabled
  – intermediate circuit voltage has reached Uzk nominal value (P087)
  – relay "ready for use" is ON (relay is closed - BUC is ready)

E FAULT REACTION ACTIVE

– Uzk control is disabled
– main contactor is switched off (BUC contact between X1:6/X1:7 is opened)
– relay "ready for use" is OFF (relay is fallen off - BUC is not ready)

F FAULT

– Uzk control is disabled
– main contactor is switched off (BUC contact between X1:6/X1:7 is opened)
– drive controller expects the error acknowledgement (see X26:17, terminal diagram V-controller)

Unit control states:

– content of control and state word
– switching state of the "ready for use" relay

Unit control state	P120 M control word	P121 M state word	Switching state "ready for use" relay
0	initialization phase	initialization phase	OFF
1	0x000A	0x0060	OFF
2	0x000E	0x0021	OFF
9	0x000E	0x0021	OFF
3	0x000E	0x0033	OFF
4	0x000F	0x0437	ON
E	0x000E	0x0028	OFF
F	0x000E	0x0028	OFF

P120 M **control word**

This parameter corresponds to DRIVECOM object 6040_{hex} and is the input word of the control unit state machine.

Bit no.	Name	Comment
0	switch on	
1	inhibit voltage	
2	wait for pulse enable (state "9")	
3	operation enabled, pulses enabled	
4.. 6	reserved	
7	reset error	
8...15	reserved	

NOTE

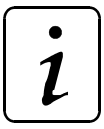
When P126 (comm. source) is **unequal** 0 the controller can only be enabled with a hardware pulse enable **first** (high signal on input X26:14, see terminal diagram V-controller) and **after** that the parameter P120 (state word) must be set to 0x000F.

The error memory is resetted by writing on the value 0x0080 on P120 (state word). This command is only executed **after** the hardware pulse enable is disabled (low signal on input X26:14, see terminal diagram V-controller).

P121 M **state word**

This parameter corresponds to DRIVECOM object 6041_{hex} and is the output word of the unit control state machine.

Bit no.	Name	Comment
0	READY TO START	
1	SWITCHED ON	
2	OPERATION ENABLED, pulses enabled	
3	FAULT	
4	Uzk control is enable	
5	**always 1**	
6	INHIBIT START	
7...9	reserved	
10	set value reached	
11...15	reserved	



NOTE

After enabling the controller the value of parameter P121 (state word) changes from 0x0021 to 0x0033. If the set voltage is reached the "ready for use" relay is enabled and the parameter P121 is set to 0x0437.

P122 M **set operation mode**

Operation mode	Mode	Comment
-3	Uzk controller	not changeable

P123 M **actual operation mode**

This parameter displays the active operation mode.

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 chapter 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 V-conttroller terminal diagram). The error acknoledgement can be done via digital input 3 X26:17 DELETE ERROR.

Bit no.	Meaning
0	0: errors are acknowledged individually with bit no. 7 $0 \rightarrow 1$ 1: errors are acknowledged in one go with bit no. 7 $0 \rightarrow 1$
1 ... 15	reserved

P137 M **state 1**

Bit no.	Meaning
0 ... 3	Shows the state number displayed in the 7 segment display
4, 5	00: drive displays no error 01: error has occurred, error reaction is set in P189
6 ... 15	reserved

P126 M **communication source**

This parameter sets the communication source.

Bit no.	Meaning
0	0: controlling the unit only by hardware signals (PE) 1: BASS protocol via RS 232 enabled
1 ... 15	reserved

If the parameter „communication source“ is set to 0, the drive can only be controlled via pulse enabling (PE).

If P126 = 1, the controller is only enabled when first the hardware pulse enable is given (high signal on input X26:14, see terminal diagram V-controller) and then P120 (state word) is set to value 0x000F.

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).

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 is monitored
1 ... 15	reserved

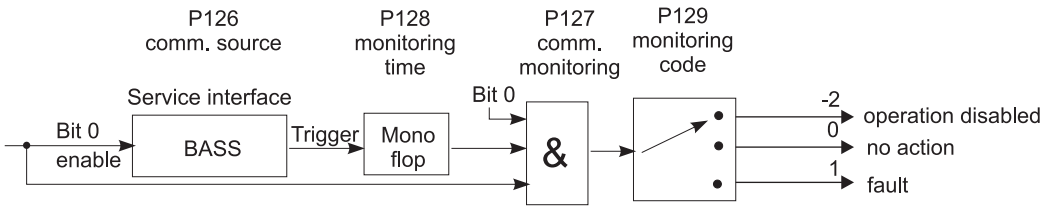
P128 M **monitoring time**

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.

Selection mode	Function
0	no action
-2	controller is disabled (controller state changes from state 4 to state 9)
1	controller changes to state FAULT (E/F)



7.8 New BUC Parameter

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P600	M **Uzk threshold**	117 1000	V	
P601	M **MC switching time**	10 ... 10000	ms	
P602	M **pre-control time**	1 ... 10000	ms	
P610	MM **Uzk actual**	117 ... 1000	V	×
P611	MM **Uzk actual smoothed**	117 ... 1000	V	×
P612	MM **Uzk filter time**	0,0 ... 200,0	ms	
P616	**BUC control word**	0000 ... FFFF	-	×
P617	MM **CC counter**	0 ... 65535	-	×
P618	MM **period time mains**	0,000 ... 65,535	ms	×
P619	MM **period smoothed**	0,000 ... 65,535	ms	×
P620	MM **PLL display smoothing**	0,000 ... 1000,0	ms	×
P621	MM **mains frequency**	0,00 ... 655,35	Hz	×
P622	MM **no. of mains faults**	-32767 ... 32767	-	×
P623	MM **mains jitter**	-180,0 ... 180,0	Grad	×
P624	MM **jitter limit**	0,0 ... 30,0	Grad	
P625	MM **Rho offset**	0,0 ... 200,0	ms	
P626	MM **Rho**	-32767 ... 32767	-.	×
P627	I **current delta_max**	-100,00 ... 100,00	%	
P628	I **delta ISQ**	-199,99 ... 199,99	%	×
P629	I **delta ISD**	-199,99 ... 199,99	%	×
P630	I **IQ set smoothing time**	0,0 ... 500,0	ms	
P631	MM **U mains alpha**	-199,99 ... 199,99	%	×
P632	MM **U mains beta**	-199,99 ... 199,99	%	×
P633	MM **mains voltage eff.**	0,0 ... 640,0	V	×
P634	MM **effective power**	-3276,7 ... 3276,7	kW	×

Parameter description

P600 M **Uzk threshold**

Reaches the intermediate circuit voltage the set value during the charging and P623 (mains jitter) < P624 (jitter limit), the main contactor is enabled (charging finished).

P601 M **MC switching time**

This time is started after the contactor is switched on. If this time is run up the digital output 2 (X26:22 ready for pulse enable) changes to high.

P602 M **pre-control time**

After the pulse enable is given this time is started. After this time is run up the "ready for use" relay is enabled. This is independent wether the intermediate circuit voltage has reached the desired Uzk set value (P087 Uzk nominal).

P610 MM **Uzk actual**

Actual value of the intermediate circuit voltage.

P611 MM **Uzk actual smoothed**

Actual value intermediate circuit voltage smoothed. The smoothing time constant of a digital PT1 can be set in parameter P612 (MM Uzk smoothing time).

P612 MM **Uzk smoothing time**

To reduce interferences on the intermediate circuit voltage actual value a smoothing constant of a digital PT1 can be set here.

P616 **BUC control word**

This parameter displays the state of the PLL.

Bit no.	Meaning
0	0 : PLL catch phase 1 : normal run after PLL caught
1	1 : set, when PLL not caught
2	1 : set, when no error
3	1 : error in current controller
4 ... 15	reserved

P617 MM **CC counter**

The no. of whole control periods (control tasks) are count here. The counter "CC counter" is incremented with each control period. While comparing with the last maximum mains period value, an exceed of the jitter limit is checked. In this case, the error counter increases and the previous mains period value is used. Therefore the internal value of the mains angle increases steadily.

P618 MM **period time mains**

The measured mains period is displayed.

P619 MM **period smoothed**

The smoothed value of the mains period is displayed. The smoothing can be set with P620 (MM PLL display filter).

P620 MM **PLL display filter**

The measured duration of the mains period is smoothed and displayed here.

P621 MM **mains frequency**

Display of the measured mains frequency.

P622 MM **no. of mains faults**

No. of not successful mains synchronisations because of faults. Reaches the error counter the value 5, the bit no. 1 in P616 (BUC control word) is set, the drive manager disables the controller and the error 0x0503 is generated.

P623 MM **mains jitter**

Set/actual deviation of 2 successive mains values (deviation of period length, display in degrees).

P624 MM **mains jitter limit**

If the absolute value of the phase deviation during synchronisation to the mains is below the set mains jitter limit, the period time is new calculated and therefore all angles until the next occurance are calculated. Moreover the error counter P622 (MM no. of mains faults) is decremented until min. zero. If the absolute value is higher than the mains jitter limit, the error counter is incremented (until max. 5) and when the controller is enabled (state 3 and 4) the error 0x0503 is generated. If the controller is disabled, the controller changes from state 9 to state 2. The signal of the function output 2 (X26:22, see chapter 4.4 - terminal diagram V-controller) "ready for pulse enable" changes from high to low.

P625 MM **Rho offset**

Because of the phase shift when measuring the "SYNC" signal a correction value is added thereby the transformation angle is mains synchron. The parameter must be set in this way, that P076 (Ud set value) is equal zero, when controller is enabled.

P626 MM **Rho**

Actual value of the mains angle (transformation angle).

Internal standardization: ± 180 degrees ↔ ± 32767

P627 I **current delta max**

Exceed the absolute value of the control deviation the value set with this parameter, bit no. 3 ist set in parameter P616 (BUC control word).

NOTE

No error is generated!

P628 I **delta ISQ**

This parameter displays the control deviation of the active current controller (IQ).

Standardization: 100 % ↔ P116 (PU I limit)

P629 I **delta ISD**

This parameter displays the control deviation of the reactive current controller (ID).

Standardization: 100 % ↔ P116 (PU I limit)

P630 I **IQ set smoothing time**

Active current set value (IQ) smoothing. The time constant of a digital PT1 can be set here.

P631 MM **U mains alpha (cos(ωt))**

U mains alpha = U_{L12}

The value of the mains phase to phase voltage is displayed.

Standardization: 100 % ↔ 1000 [V]

P632 MM **U mains beta (sin(ωt))**

U mains beta = $\frac{-2}{\sqrt{3}} U_{L13} + \frac{1}{\sqrt{3}} U_{L12}$

The value of the mains phase to phase voltage is displayed.

Standardization: 100 % ↔ 1000 [V]

P633 MM **mains voltage eff.**

The effective value of the mains phase to phase voltage is displayed.

P634 MM **effective power**

The smoothed value (265 ms) of the effective power ((+) taken from the mains or (-) feed back power).

7.9 Data Set Management

Function

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

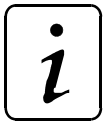
  state 0003: STAND_BY (P191)
  message 0000: no error (P192).

  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 0902.

- **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 2.

  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**

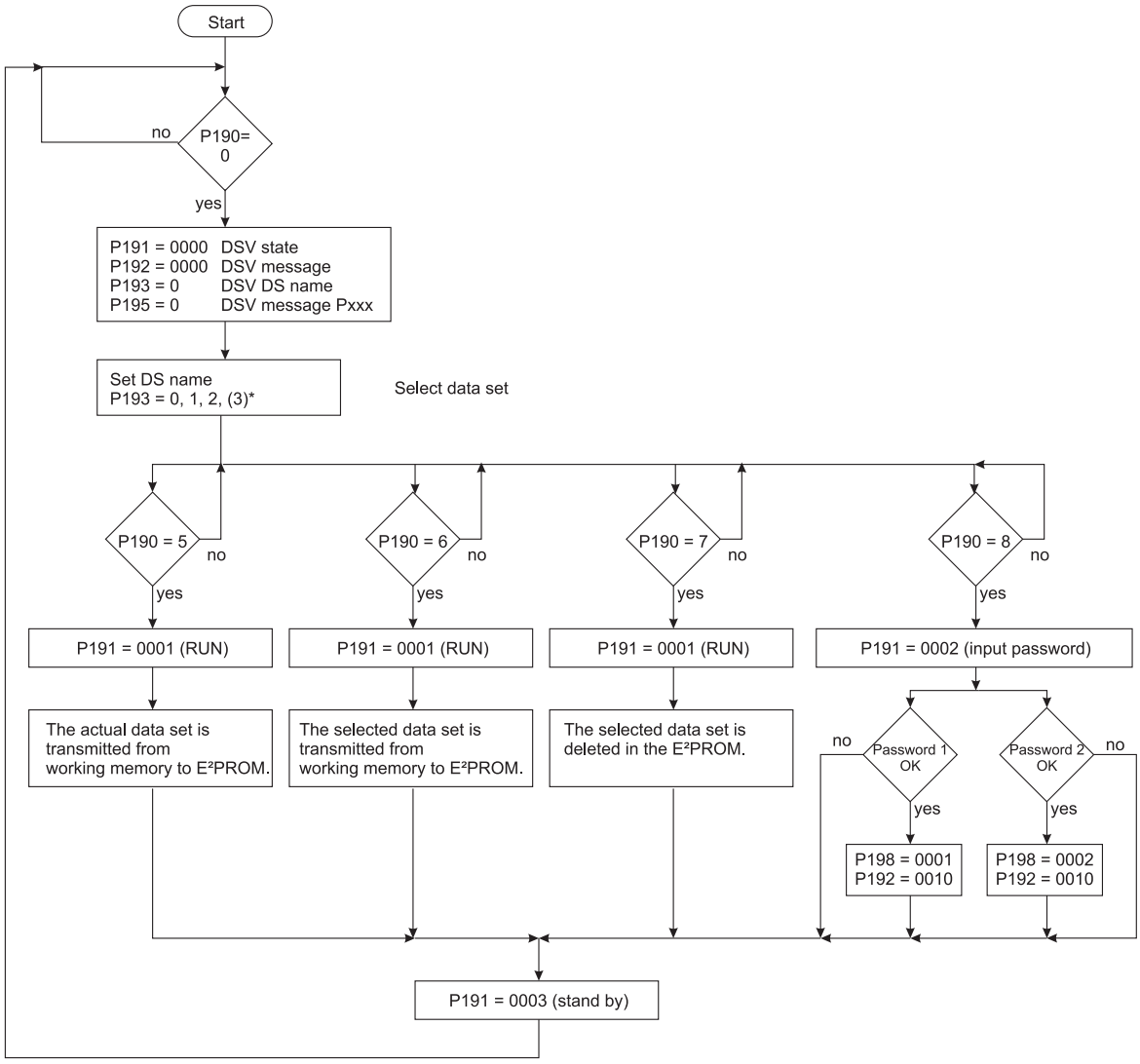
  1. P190 = 0 command reset data set management
  2. P190 = 8 command input password
  3. P190 = password 1
  4. P190 = 0 command reset data set management
  5. P193 = 3 DS no. write-protected data set
  6. P190 = 5 command store data set

- **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		×
P192	DSM **message**	0000 ... FFFF		×
P195	DSM **message Pxxx**	0 ... 700		×
P193	DSM **DS name**	0 ... 3		
P194	DSM **DS article no.**	0000 0000 ... FFFF FFFF		×
P197	DSM **DS program cycles**	0 ... 65536		×
P196	DSM **load data set**	0 ... 3		
P198	DSV **key**	0000 ... 0003		×

Parameter description

P190 DSM **command**

This command instructs the data set management to load, to save and to 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“.

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**

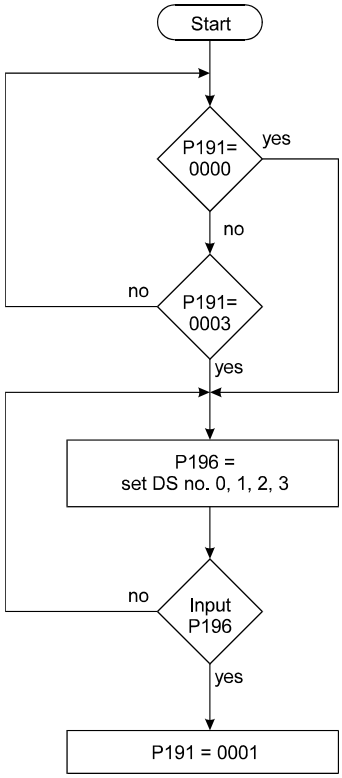
Number of write actions on this data set.

P196 DSM **load data set**

The data set with the corresponding number (0...2) 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 P191 (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

7.10 Operation System

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P138	**Language**	0 ... 4		
P166	OS **state**	0000 ... FFFF		
P162	OS **message**	0 ... 9999		×
P161	OS **sampling time**	124,8 ... 4000,0	µs	×
P174	OS **user software**	0 ... 99		×
P163	OS **BUS6-VC SW release**	0,00 ... 99,99		×
P160	OS **selection**	0 ... 1000		
P169	OS **value**	0 ... 65535		

Parameter description

P138 Language

Here you can set the language for parameter text.

Value	Language
1	German
2	English
3	reserved
4	reserved

P166 OS **state**

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

Bit no.	Meaning
0 ... 3	1: operation system runs
4 ... 11	reserved
12	1: main program cycle time exceeds maximum value
13	1: task calculation time has exceeded maximum value
14 ... 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.

P174 OS **user SW**

Value	Meaning
0	production run software
>0	user fitted software

P163 OS **BUS6-VC SW release**

This parameter displays the software release of the controller.

P160 OS **selection**

P169 OS **value**

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

Selection P160	Value P169	Unit
4	Maximum value of main program cycle time (The maximum value memory can be reset through writing on)	[1 ms]
40	Actual measured values of main program cycle time	[1 ms]
5	16 bit counter for main program cycles	[1]

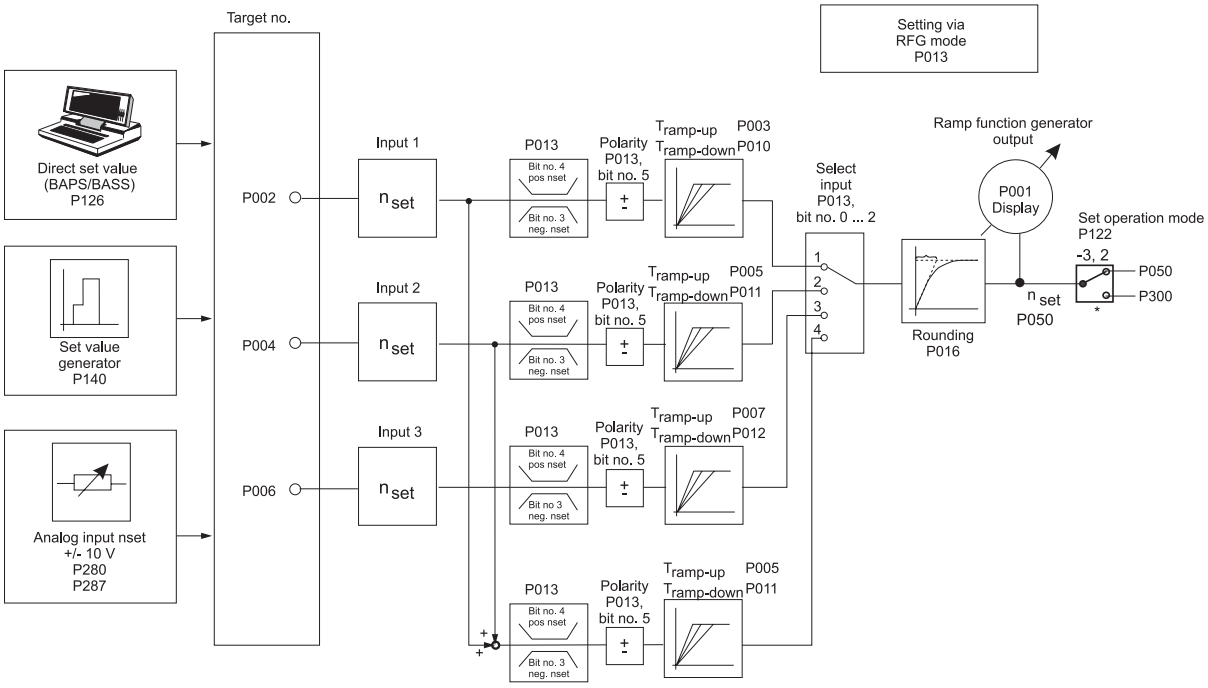
7.11 Ramp Function Generator

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.
(If set to STOP by means of P013, only the ramp-down time can be adjusted)
All inputs and the output of the ramp function generator are relative parameters (± 100 %) and standardized to maximum speed (P019).
The ramp steepness 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.

NOTE

If the inputs are used für intermediate circuit voltage 100 % ↔ 1000 V.



Parameter overview:

Parameter	Name	Range min. ... max.	Unit	Display only
P014	RFG **state**	0000 ... FFFF		×
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	
P016	RFG **rounding**	0 ... 60000	ms	
P001	RFG **output**	-100,00 ... 100,00	%	×

Parameter description

P014 RFG **state**

Displays the function module´s state.

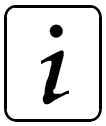
Bit no.	Meaning
0 ... 2	000: STOP 001: RUN
3	1: error in function module, error code see M error code (P124)
4	1: RFG output is set internally to 0 (RFG_LOCKED)
5	1: RFG was stopped on the ramp (RFG_STOP)
6	1: RFG input is set internally to set value 0 (RFG_ZERO)
7	reserved
8	1: ramp-up procedure is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

P002 RFG **input 1**



NOTE

The value of P002 (RFG input) is changed automatically, when writing on P087 (PS Uzk nominal).

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**

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 PT_1 device can be set by this parameter.

P001 RFG **output**

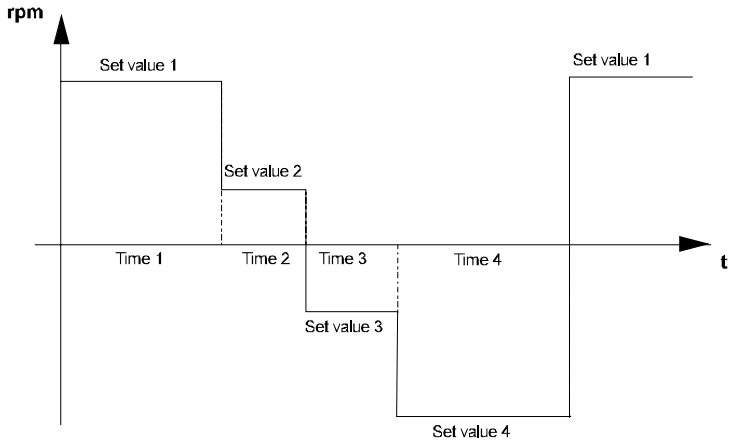
This parameter displays the actual output value.

7.12 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		×
P140	SVG **target Pxxx**	0 ... 700		
P141	SVG **output**	- 100,00 ... + 100,00	%	×
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.

7.13 Analog Inputs

Function

The function module in combination with the 2 analog inputs enable the programming of 2 byte length parameters. **Cycle time of analog inputs: 1 ms**

Six parameters are assigned to each input:

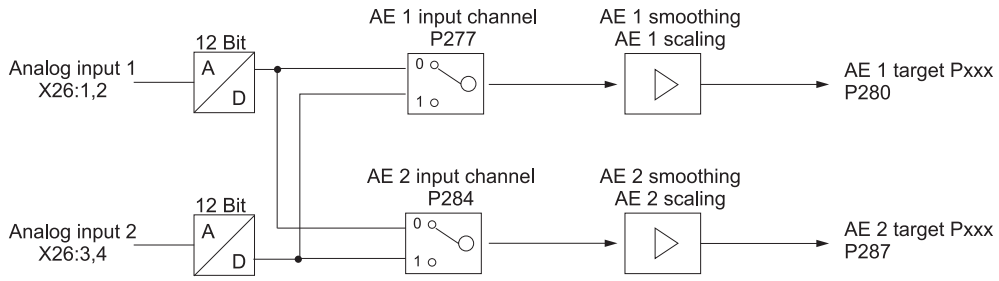
- *AI input channel:* input channel entry
- *AI smoothing*: smoothing time constant [ms].
- *AI scaling*: scaling factor entry
- *AI offset*: offset entry
- *AI threshold value*: sensitivity of inputs
- *AI target Pxxx*: target parameter number entry
- *AI value*: current output value

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.

.



Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P302	AI **state**	0000 ... FFFF		×
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	%	×
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	%	×

Parameter description

P302 AI **state**

This parameter indicates the status of the analog inputs module.

Bit No.	Meaning
0	0: Evaluation of analog input 1 disabled 1: Evaluation of analog input 1 enabled
1	0: Evaluation of analog input 2 disabled 1: Evaluation of analog input 2 enabled
2 ... 15	reserved

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**

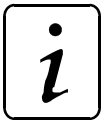
These parameters enable scaling of the analog input variable.

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:

$$AI\_value[\%] = \frac{U_{in}[V] + 10V}{2 \cdot U_{inmax}[V]} * Scaling * 100\% + Offset$$

if AI_value > 100 % → AI_value = 100 %

- Signed parameters:

$$AI\_value[\%] = \frac{U_{in}[V]}{U_{inmax}[V]} * Scaling * 100\% + Offset$$

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:

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

Examples:

Input voltage ↔ **AI-value [%] * MAX_value**
→ target parameter value

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

Unsigned target parameter:

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

Signed target parameter:

10 V	↔	100 %	* MAX_value	
5 V	↔	50 %	* MAX_value	
0 V	↔	0 %	* MAX_value	
- 5 V	↔	-50 %	* MAX_value	
- 10 V	↔	-100 %	* MAX_value	

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

Unsigned target parameter:

10 V	(	100 %	* MAX_value	
5 V	(	50 %	* MAX_value	
0 V	(	0 %	* MAX_value	
- 5 V	(	0 %	* MAX_value	(limitation !)
- 10 V	(	0 %	* MAX_value	(limitation !)

Signed target parameter:

10 V	(	100 %	* MAX_value	
5 V	(	0 %	* MAX_value	
0 V	(	-100 %	* MAX_value	
- 5 V	(	-100 %	* MAX_value	(limitation !)
- 10 V	(	-100 %	* MAX_value	(limitation !)

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

Unsigned target parameter:

10 V	(	100 %	* MAX_value	
5 V	(	75 %	* MAX_value	
0 V	(	50 %	* MAX_value	
-5 V	(	25 %	* MAX_value	
- 9 V	(	0 %	* MAX_value	(threshold !)
- 10 V	(	0 %	* MAX_value	

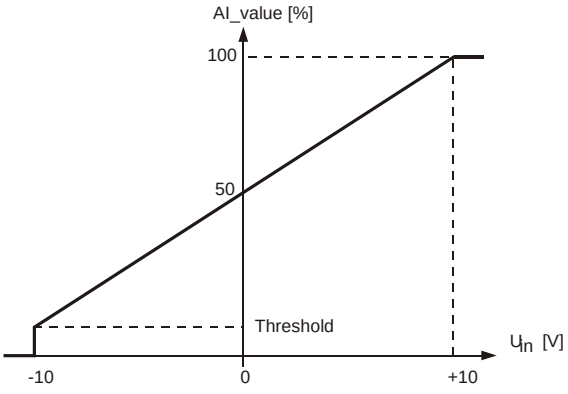
Signed target parameter:

10 V	(	100 %	* MAX_value	
5 V	(	50 %	* MAX_value	
1 V	(	0 %	* MAX_value	(threshold !)
- 1 V	(	0 %	* MAX_value	(threshold !)
- 5 V	(	-50 %	* MAX_value	
- 10 V	(	-100 %	* MAX_value	

Examples of characteristic curves:

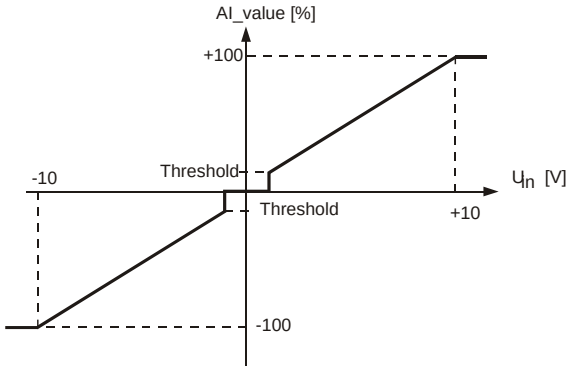
Unsigned target parameter

Offset = 0 %; scaling = 1



Signed target parameter

Offset = 0 %; scaling = 1



7.14 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.

NOTE

The following sequence must be observed for writing the parameters:

1. AA x source-Pxxx
2. AA x offset
3. AA x scaling

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P338	AO **state**	0 ... FFFF	-	×
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

P 3 3 8 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

P 3 3 7 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

P 3 3 0 AO **1 source Pxxx**

P 3 3 4 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. Is 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.

P 3 3 1 AO **1 offset**

P 3 3 5 AO **2 offset**

The offset of the analog outputs is set here.

P 3 3 2 AO **1 scaling**

P 3 3 6 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.

7.15 Digital Inputs

The module and the four available digital inputs enable 16 bit parameter programming.

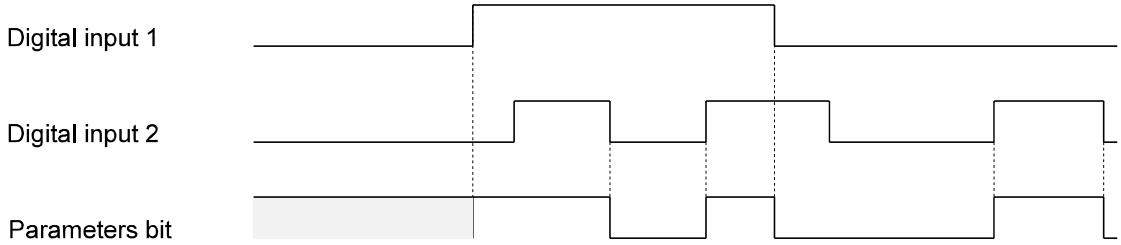
Four parameters are assigned to each input:

- *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 4 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 priority is taken over (digital input 1 has the lowest priority, 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. DO x target Pxxx
2. DO x bit selection
3. DO x LOW pattern
4. DO x HIGH pattern

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 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).

3. Enter *DI x LOW*- and *HIGH pattern* of the above mentioned input.

   ⇒ Has no effect on the target parameter yet.

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 bit selection (P371) to FFFF

   DI 1 LOW pattern (P372) to 0000,

   DI 1 HIGH pattern (P373) to 0001,

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 bit selection (P371) to FFFD

   DI 1 LOW pattern (P372) to 0000,

   DI 1 HIGH pattern (P373) to 0001,

   DI 2 target Pxxx (P374) to 13,

   DI 2 bit selection (P375) to FFFE,

   DI 2 LOW pattern (P376) to 0000,

   DI 2 HIGH pattern (P377) to 0002.

   → 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 bit selection (P379) to 0810,

   DI 3 LOW pattern (P380) to 0800,

   DI 3 HIGH pattern (P381) to 0010,

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		×
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 3 completely 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)

P 3 7 0 DI **1 target Pxxx**
P 3 7 4 DI **2 target Pxxx**
P 3 7 8 DI **3 target Pxxx**
P 3 4 2 DI **4 target Pxxx**

This parameter indicates the parameter number of the target parameter for input 1 till 4.

P 3 7 1 DI **1 bit selection**
P 3 7 5 DI **2 bit selection**
P 3 7 9 DI **3 bit selection**
P 3 4 3 DI **4 bit selection**

The bits to be altered are selected in the target parameter.

P 3 7 2 DI **1 LOW pattern**
P 3 7 6 DI **2 LOW pattern**
P 3 8 0 DI **3 LOW pattern**
P 3 4 4 DI **4 LOW pattern**

Bit pattern which is written into the selected target parameter bits when digital input is LOW.

P 3 7 3 DI **1 HIGH pattern**
P 3 7 7 DI **2 HIGH pattern**
P 3 8 1 DI **3 HIGH pattern**
P 3 4 5 DI **4 HIGH pattern**

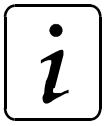
Bit pattern which is written into the selected target parameter bits when digital input is HIGH.

7.16 Digital Outputs

Function

The module enables programming of the three available digital outputs. Three parameters are assigned to each output:

- DI output ID no.: Input of source parameter number (only 2-byte parameters admissible)
- DI bit selection: Selection of source parameter bits to which bit pattern must correspond.
- DI bit pattern If this bit pattern and the selected parameter bit pattern correspond to each other, the output is switched to HIGH.



NOTE

The following sequence must be observed for writing the parameters:

1. DA x source-Pxxx
2. DA x bit selection
3. DA x bit pattern

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.

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		
P392	DO **state**	0000 ... FFFF		×

Parameter description

P383 DO **1 source Pxxx**

This parameter indicates the parameter number of the source parameter for outputs 1, 2 or 3.

P384 DO **1 bit selection**

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

P385 DO **1 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

7.17 Service Interface

Function

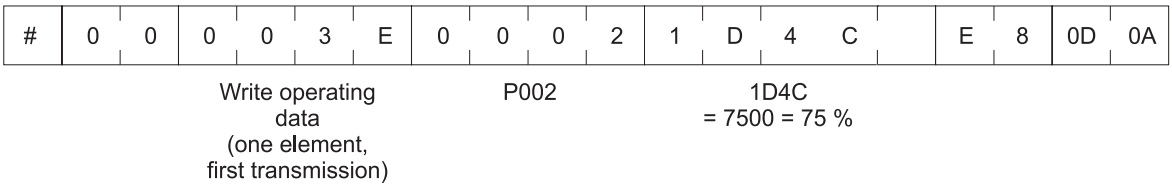
The service interface allows communication with the PC operating program. The BASS protocol is operated via the RS 232 interface X23.
The address of each drive is set in binary code at the controller front via DIP switch. Bit no. 0 thus corresponds to switch 1, bit no. 1 to switch 2 etc.

The RS 232 interface is constructed potential-free, the operating mode is full-duplex.

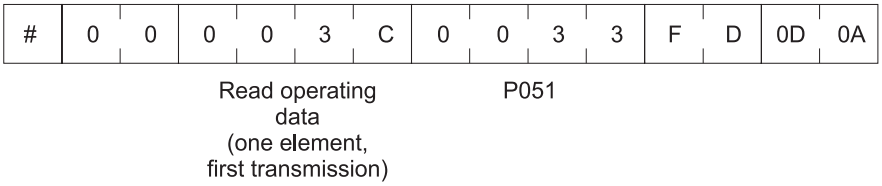
Data format:	8 data bits, 1 stop bit, no parity
Transmission speed:	9600 baud
Transmission format:	ASCII

Communication PC ⇒ drive

Example 1: Set P002 to 75 %



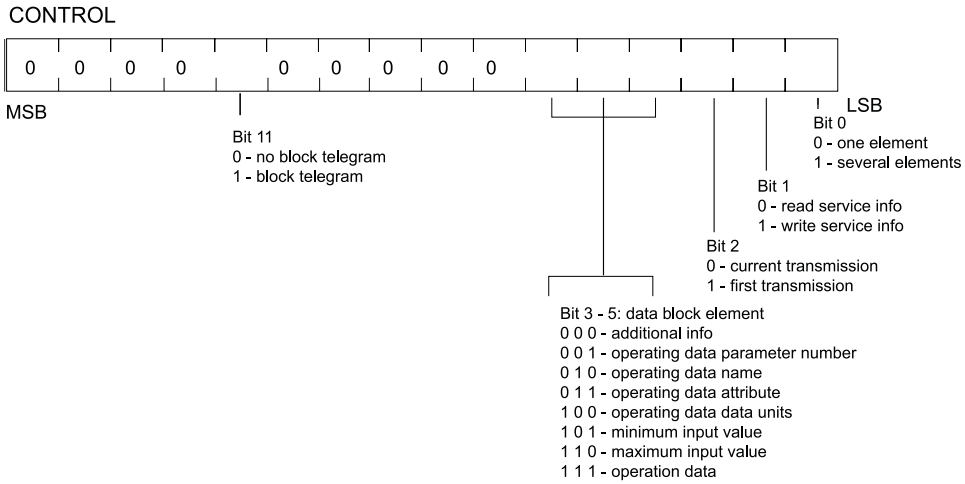
Example 2: Read P051



BOF # (23_{hex})

Address of the drive 0_{dec} to 255_{dec} (00_{hex} to FF_{hex})

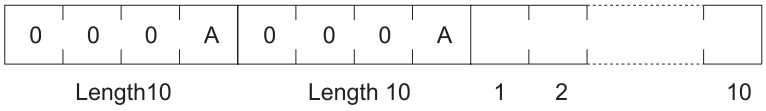
Control

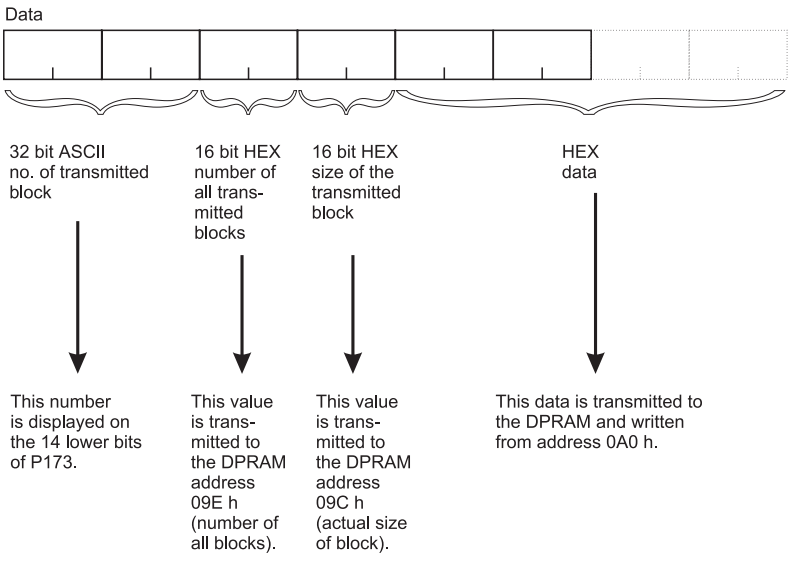


Parameter number Hexadecimal value of the parameter number as an ASCII character

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:



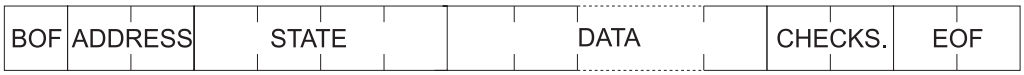


Checksum Sum of the hexadecimal values of all ASCII characters without BOF and EOF. Any overflow is also added ($234_{hex} \rightarrow 36_{hex}$)

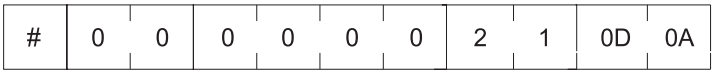
EOF <CR> <LF> ($0D_{hex}$, $0A_{hex}$)

Communication drive ⇒ PC

Before the drive answered the echo telegram is sended from drive to PC!

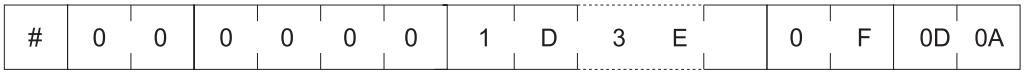


Example 1: Set P002 to 75 %



No error

Example 2: Read P051



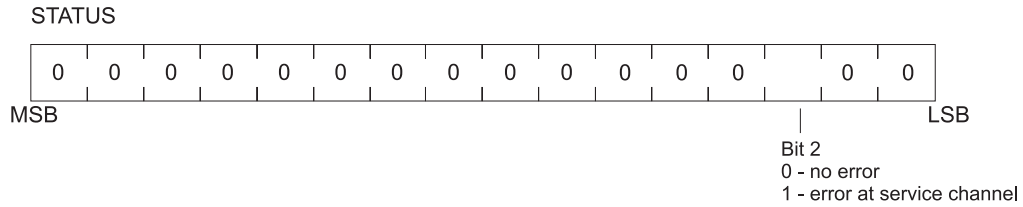
No error

1D3E =
7486 = 74,86 % N actual value

BOF # (23_{hex})

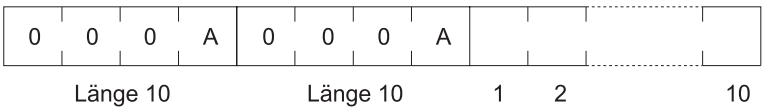
Address of the drive 0_{dec} to 255_{dec} (00_{hex} to FF_{hex})

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	Datum is too short
3	Datum is too long
4	Datum is not alterable
5	Parameter is write protected
6	Datum is smaller than minimum value
7	Datum is greater than maximum value
8	Datum is invalid
9	Obtaining of parameter is invalid

Parameter overview

Parameter	Name	Range min. ... max.	Unit	Display only
P170	SI **state**	0000 ... FFFF		×
P171	SI **baud rate**	50 ... 19200	Baud	×
P172	SI **mode**	0000 ... 0003		

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 only)
11 ... 15	reserved

P171 SI **baud rate**

The service baud rate can only be displayed and is set to a fixed value of 9600 baud.

8 MAINTENANCE

WARNING

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.

8.1 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.

8.2 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 disturbance 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 00xx)**

Error ID	Error Text	Meaning	Error reaction	Remedy
0001_{hex}	BASS protocol timeout	The communications source set in P124 has not responded for longer than the timeout set in P128.	Error reaction can be set in P189	Check communications (cables, daughterboard, etc.)
0003_{hex}	Dual-Port RAM time-out (cyclical data)			
0004_{hex}	Dual-Port RAM time-out (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.	Inhibit pulses immediately	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 for software development	Inhibit pulses immediately	

- **Power Unit Function Module (Error ID 02xx)**

see also Function Module Processor Error Recognition (Error ID 0Cxx) on page 95

Fehler-kennung	Fehlertext	Bedeutung	Fehlerreaktion	Störungsbeseitigung
0201_{hex}	Overvoltage Uzk	The bus voltage, U_{ZK}, has exceeded a value of 800 V ± 1%	Inhibit pulses immediately	Check the ballast resistor. If no ballast resistor is available check Uzk controller setting
0202_{hex}	Overcurrent	At least one of the power unit's three phase currents has overwritten the value of 1,3 x I_{max} (≙ 1,3 x P113)	Inhibit pulses immediately	Check the current controller's setting
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.)	Inhibit pulses immediately	Check the mains connection and the intermediate circuit connection for a ground fault
0204_{hex}	Disturbance in auxiliary voltage supply	There is no power supply for transistor control in the power unit.	Inhibit pulses immediately	Check control of the safety relay
0205_{hex}	Overtemperature of power unit	The temperature of the power unit has risen above 85° C.	Inhibit pulses immediately	The disturbance cannot be acknowledged until the power unit temperature shown in P118 has fallen below 85° C.
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	U_{CE} 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.	Inhibit pulses immediately	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	Inhibit pulses immediately	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.	Inhibit pulses immediately	Check the parameterization and, if necessary, change it. Save the data set and acknowledge the error.
0210_{hex}	Disturbance in power unit	The ready for use signal from the power unit is missing even though there are no other power unit disturbance messages.	Inhibit pulses immediately	Refer to the power units operating instructions.
$0D01_{hex}$	Short circuit temperature sensor	The power unit temperature is below the temperature threshold of -40°C. Normally, this disturbance occurs if there is a short circuit in the temperature detection during operation.	Inhibit pulses immediately	Temperature detection defective, the disturbance cannot be eliminated.

- **Power Supply Function Module (Error ID 05xx)**

Error ID	Error Text	Meaning	Error reaction	Remedy
0503_{hex}	Fault PLL	Mains jitter has exceeded the mains jitter limit	Inhibit pulses immediately	Check mains voltage X1:8/9/10 at BUC Gerät. Reset error memory.

- **Data Set Management Function Module (Error ID 09xx)**

Error ID	Error Text	Meaning	Error reaction	Remedy
0901_{hex}	EEPROM copy error	A data difference was determined at copying of the EEPROM during initialization of data set management	Inhibit pulses immediately	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	Inhibit pulses immediately	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.	Inhibit pulses immediately	You must create the boot data set in RAM and then save it to the EEPROM.

- **Operating System Function Module (Error ID 0Bxx)**

Error ID	Error Text	Meaning	Error reaction	Remedy
$0B01_{hex}$	Main program computing time exceeded		Inhibit pulses immediately	P160 selection = 0, P169 value = 0, Store the data set again and acknowledge the error. If necessary deactivate functions not needed for instance digital and analog I/O´s by parameterization
$0B02_{hex}$	Task computing time exceeded		Inhibit pulses immediately	
$0B03_{hex}$	Sync. IR computing time exceeded		Inhibit pulses immediately	
$0B04_{hex}$ *	DSP computing time exceeded		Inhibit pulses immediately	

*) Errors cannot be acknowledged.

- **Function Module Processor Error Recognition (Error ID 0Cxx)**

Error ID	Error Text	Meaning	Error reaction	Remedy
$0B05_{hex}$	Error in linking the program modules		Inhibit pulses immediately	Test the RAM
$0B06_{hex}$	Error in the time segment system configuration			
$0C01_{hex}$	illegal external bus access	Further information see memory 0xFA00 up to 0xFA0F.		re-boot controller
$0C02_{hex}$	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			

- **Function Module Power Unit continued (Error ID 0Dxx)**

Error identification	Error text	Meaning	Error response	Disturbance elimination
$0D01_{hex}$	Short circuit of the temperature sensor (power unit)		Inhibit pulses immediately	

8.3 Disposal

For the most part, the equipment consists of the following components and materials:

Component	Material
Various spacers, housing of current converter and unit fan, etc.	Plastic
PCBs on which all the open- and closed-loop electronics are mounted	Base material: Epoxy-resin fiberglass woven material, copper-coated on both sides and plated-through, various electronic components such as condensors, resistors, relays, semi-conductors, etc.

For technical reasons, electronic components might need to contain dangerous materials, so you should not open them.

If the components are used correctly, there is no danger to human beings or to the environment.

In case of fire, dangerous compounds may result or hazardous materials may be released.

You must dispose of or recycle equipment or components according to national regulations as well as any applicable local or regional ordinances.

9 APPENDIX

9.1 Declaration by Manufacturer

EG-Herstellererklärung

Declaration by Manufacturer

gemäß EG-Richtlinie 98/37/EG (Maschinen) vom 22.06.1998
geändert durch: 98/79/EG vom 27.10.1998

in accordance with EC directive 98/37/EG (machinery) dated 22.06.1998
changed by: 98/79/EC dated 27.10.1998

BUS 6 VC - 00 - 0100 - .... - .... - ....

Die Inbetriebnahme der Maschine, in die dieses Gerät eingebaut wird, ist untersagt bis die Konformität der Maschine mit der obengenannten Richtlinie erklärt ist.

The machinery into which this unit is to be incorporated must not be put into service until the machinery has been declared in conformity with the provisions of the directive mentioned above.

Bei der Entwicklung und Konstruktion des Geräts wurden folgende Normen beachtet:

The development and construction of the unit is complied with following standards:

Norm / standard

EN 60204-1	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen Safety of machinery - Electrical equipment of machines

Baumüller Nürnberg Electronic GmbH & Co. KG, Ostendstr. 80 - 90, D- 90482 Nürnberg

Nürnberg, 02.02.2004

Dr. Peter Kreisfeld
Geschäftsführer
Head Division

i.V. Dr. Peter Heidrich 4.2.2004

Dr. Heidrich
Entwicklungsleiter
Head of development

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9.2 General Conditions of Sale and Delivery

1. Obligation and Conclusion of Contract

a) Deliveries of goods and provision of services shall be effected exclusively based on these trading conditions. They are an essential component of the contracts for delivery and shall be considered as having been accepted by the placing of an order. In the case of constant business relations, they also apply for the future contracts.

b) Agreements diverging from the contract and verbal collateral agreements shall only be binding if they have been confirmed in writing by Baumüller Nürnberg GmbH(hereinafter referred to as Baumüller). Diverging trading conditions on the behalf of the purchaser shall be without obligation, even where these have not been expressly objected to. These General Conditions of Sale and Delivery shall be considered as having been accepted by the purchaser at the latest when the delivery is accepted.

c) In as far as deliveries of goods are subject to separate external obligations in accordance with the Law Concerning Foreign Trade and Payments with respect to the Federal Office for Economics, the purchaser has to observe the relevant conditions at his/her own responsibility.

2. Price and Offers

Offers are subject to confirmation, not binding and apply subject to material supply possibilities. Supplements and amendments require written confirmation. Prices are ex works and are subject to confirmation. Invoicing takes place in accordance with the prices valid on the date of delivery.

3. Extent of Delivery and Delivery Time

a) Specified delivery periods/dates are without obligation, in as far as nothing else to the contrary has been expressly agreed upon in writing. Delivery periods do not commence until the purchaser has fulfilled all duties of co-operation, in particular regarding details of performance. In the event that the agreed deposits for orders are delayed, then the delivery time shall be extended accordingly.

b) The purchaser is entitled, in particular in the event of a delay in delivery of longer than 3 months, to set an appropriate period of grace and after its expiry, to withdraw from the order. Claims to compensation due to non-fulfilment or delay shall be excluded, in as far as Baumüller is not responsible for intent or gross negligence.

c) Baumüller is entitled at any time to effect partial deliveries and partial services, as well as to invoice these accordingly.

4. Delivery Problems

a) Delays/preventions in the delivery of goods or the provision of services due to force majeure entitle Baumüller to delay the production and delivery by the duration of the obstruction plus an appropriate period of time or to withdraw in part or in whole from the order.

b) Industrial disputes or other circumstances which substantially impede or render impossible the delivery, such as, in particular, disturbances in the operating processes, problems in procuring materials, official directives also apply as force majeure, irrespective of whether they arise with regard to Baumüller or suppliers.

c) In these cases, Items 4 a), b), the purchaser shall have no claim to compensation due to non-fulfilment or delay of the delivery.

5. Packaging

Items for sale and delivery items are packaged and transport insurance policies are taken out according to the instructions of and at a cost to the purchaser. Upon demand, the packaging material has to be returned without delay, free of freight charges and expenses.

6. Dispatch and Passing of Risk

Deliveries shall be made ex works. The dispatch shall be effected at a cost to and at the risk of the recipient of the service/the purchaser. The risk passes to the recipient of the delivery/purchaser as soon as the delivery items leave the works. This shall apply at the latest, from the transferral of the delivery items to the person carrying out the transport, forwarding agent or carrier.

7. Warranty

a) The period of warranty amounts to 12 months from the day of dispatch.
In the event that a delivery item is defective, Baumüller shall deliver an additional replacement or make a subsequent improvement at its own choice. Multiple subsequent improvements are permissible. Other warranty claims on the behalf of the purchaser, in particular also due to direct or indirect consequential damage are excluded. The precondition for any warranty is the normal contractual use of the delivery items. In the event of the utilisation of warranty services, the motor, the replacement part or the device has to be sent in free of freight charges, packaging costs or customs duties after prior co-ordination with Baumüller. Baumüller is exempted from any warranty if the party ordering returns the goods complained about without prior co-ordination or contrary to agreement. Warranty claims expire one month after rejection of a defect on which notice is given, in as far as the purchaser remains silent in this respect.

8. Notification of Defects

a) The purchaser shall examine the subject matter of the contract and delivery items immediately and give notice of any defects without delay, however, no later than 7 days after receipt of the delivery. In case of non-obvious defects notice has to be given in writing without delay after their discovery, however, no later than 6 months from the point of delivery. In the event that the purchaser does not give notice of any defects in writing within this period of time, then the subject matter of the contract shall be considered as having been approved.

b) The purchaser shall allow Baumüller a suitable inspection of defects of which notice is given and shall place all necessary/requested technical information, in particular, inspection records and test reports at Baumüller's disposal. In the event that the purchaser fails to do so, then the delivery items shall be considered as not having been complained about and as being approved. In the event that the purchaser alters the delivery items, then he/she shall lose his/her warranty claims.

c) In the event of an established material defect or performance defect, Baumüller can eliminate the defect or supply a replacement. The purchaser can demand rescission or a reduction after the expiry of an appropriately set period of grace. Further claims on the behalf of the purchaser, in particular to the reimbursement of dismantling costs or installation costs are excluded. The same applies to damages which do not affect the delivery item itself.

d) Natural wear and tear and damage which arises after the transferral of risk, in particular also due to incorrect or negligent handling, excessive demands or other unsuitable use not in conformity with the contract are excluded from

the warranty. The same applies in particular for defects which are attributable to atmospheric discharges, overvoltages and chemical influences.

e) If no case of warranty is in existence or in the event that this subsequently turns out to be the case, the purchaser shall remunerate the utilisation or the use of an item or of a right, as well as services provided and expenses to an appropriate amount. Baumüller is entitled to a right of control as referred to in §§ 315 ff. BGB [German Civil Code].

9. Liability

Contractual or legal claims on the behalf of the purchaser against Baumüller are limited to intent and gross negligence. This does not apply in as far as claims from the ProdHaftG [Product Liability Act] have been enforced. Baumüller shall only be held liable to the amount of the damage foreseeable in accordance with the purpose of the contract. Material damage which exceeds the value of a delivery/service is not foreseeable in this sense. The liability is limited in terms of amount to the remuneration contractually owed.

10. Payments

a) Invoices are payable at the time agreed in the contract, at the latest within 30 days after the invoice date, in cash and without deductions. The purchaser can only offset with claims which are final and absolute or undisputed. The same applies to the exercising of rights of retention.

b) In the event of a delay in payment on the behalf of the purchaser, interest to the rate of 4 % above the respective minimum lending rate of the German Federal Bank, however at least 10 % has to be paid, without separate proof being required.

c) Failure to comply with the terms of payment or circumstances which endanger the credit worthiness of the purchaser result in all claims immediately becoming due. In these cases, deliveries shall only be made against payment in advance.

d) Cash payments, bank transfers or cheque and bill payments shall not be considered as payment/fulfilment of the obligation before the amount due for payment has been irrevocably received by Baumüller or credited to Baumüller's account.

e) Payments have to be made directly to Baumüller. The field staff are not entitled to accept payments or to issue extensions or waivers without separate written authority.

11. Reservation of Ownership

a) The ownership of delivery items remains reserved up to the fulfilment of all existing claims against the purchaser from the business relation. Any bundling with other items shall be effected by the purchaser for Baumüller. Then, the entire product shall be considered as reserved goods.

b) The purchaser is entitled to sell the reserved goods in orderly business transactions. All claims to which the purchaser is entitled from this sale or other legal grounds shall be assigned by him/her in advance to Baumüller. Baumüller shall accept the assignment. In the event that the reserved goods are bundled or sold with other items standing in the possession of third parties, then the assignment shall only apply to the amount of the invoice value of the reserved goods. The purchaser is authorised to collect these assigned claims. Upon request, he/she has to make notice of the assignment to the debtor.

c) The purchaser shall inform Baumüller without delay of impending and enforced access on the behalf of third parties to the reserved goods or to the assigned claims. The purchaser shall bear the costs incurred by this.

d) The authorisation on the behalf of the purchaser to dispose of the reserved goods and to collect assigned claims expires in the event that the terms of payment are not complied with, in particular, also in the case of bill and cheque protests. In this case, Baumüller is entitled to take possession of the reserved goods. The purchaser bears the costs incurred by this. The taking back of goods shall only represent a withdrawal from the contract when this is expressly stated.

e) In the event that the value of the securities granted exceeds the secured claims in terms of amount by more than 20 %, then Baumüller shall renounce the securities exceeding this value.

12. Drawings and Documentation

Baumüller is entitled to the exclusive property right and copyright to cost estimates, drawings and all other documentation. These documents may not be made accessible to third parties without prior written consent. In the event that a contract is not concluded, not implemented or otherwise ended, then all documents have to be returned immediately and unsolicited. There shall be no right to retention to these documents.

13. Copyright (in particular Software / Licence)

a) Baumüller is exclusively entitled to all rights to the software/edited versions, in particular property rights and copyrights to the relinquished software, in particular for the controlling of machines, systems and installations.

b) Baumüller grants the purchaser/buyer the non-exclusive, non-transferable right to use the relinquished software in the framework of the contractual purpose at the contractually intended location/on the places in existence at the time of purchase (single licence). The software shall only be used on the associated purchased contractual item. Any use extending beyond this is prohibited. In the event of a use extending beyond this, Baumüller shall have the rights referred to in Items 13 c), 13 d).

c) It is prohibited to make copies of the relinquished software, whether in whole or in part, in as far as the making of copies of the machine-readable material in the framework of the required data backup or as copies for internal company use has not separately been agreed upon with prior written consent from Baumüller. Processing of the relinquished software, in particular by means of alteration, translation or by bundling with other programs shall only be permitted after prior written consent from Baumüller. Protection notices from Baumüller on/in the software may not be removed and also have to be adopted onto copies and edited versions. Copies produced contrary to this condition shall come under the possession and copyright of Baumüller. Baumüller can prohibit the use of such copies and elect to demand the immediate surrender or complete destruction with proof of this destruction.

d) The buyer is not permitted to extend the licence in terms of location/work places/machines/machine types or to grant rights of utilisation or grant sub-licences. The extension of the licence shall be permitted by Baumüller exclusively against a separate remuneration which has to be agreed upon in writing.

14. Applicable Law

The law of the Federal Republic of Germany is authoritative for all rights and obligations from and in connection with this contract. The regulations of the UN Sales Convention (CISG) are excluded.

15. Place of Performance and Place of Jurisdiction

The place of performance for delivery and payment is the seat of Baumüller. The place of jurisdiction for all dispu-

putes from and in connection with this contract, in particular also for cheque and bill liabilities is the seat of Baumüller.

16. Miscellaneous

In the event that individual or several conditions of these Conditions of Sale and Delivery should be or become ineffective in part or in whole, then the validity of the remaining conditions shall remain unaffected by this. The parties shall complement/replace the ineffective or incomplete condition with an appropriate regulation which most extensively corresponds to the economic purpose of the contractually desired regulation. The same applies for the case of the presence of a gap in the regulations.

For the case that acceptance and installation are also agreed upon, then the following conditions, Items 17 and 18 shall also apply:

17. Acceptance

a) The inspection of the delivery items ready for acceptance shall take place in the Baumüller works. The purchaser shall bear the costs of this inspection. In the event that the purchaser fails to perform the inspection, then the delivery items shall be considered as having been delivered in conformity with the contract when they leave the works.

b) The purchaser is obliged to take delivery of goods and services from Baumüller without delay. Immaterial defects do not entitle the purchaser to refuse the acceptance.

c) In the event that the purchaser does not declare within 7 days after notification of the readiness for acceptance on the behalf of Baumüller or after receipt of the contractual service in writing and with exact, examinable specification of reasons that he/she refuses the acceptance, then the acceptance shall be considered as having been declared and the orderly performance of the contract as having been ascertained.

d) The agreed service shall be considered as having been accepted when the item delivered has been put into operation by the purchaser himself/herself or upon his/her instructions by third parties beyond the functional test required to carry out the acceptance. This also applies in the event that the purchaser refuses the functional test/the acceptance without sufficient cause.

e) Experts to be designated by both parties shall take part in the acceptance inspection. The result of the functional test shall be entered in a record to be signed by the purchaser in consideration of the technical specifications.

18. Erection and Installation

Erection and installation shall only be effected in the case of express agreement at the following further conditions:

a) The purchaser makes required workers and material available at his/her own expense.

b) Before the commencement of installation works the purchaser shall make available unsolicited all required specifications, in particular concerning the location of power lines which have been laid such that they are hidden and similar installations, as well as the required static specifications.

c) Before the commencement of the erection/installation, the delivery items required for the commencement of works have to be on site and all preliminary works progressed to the extent that the erection/installation can immediately begin and be completely carried out without interruption.

d) In the event that the erection, installation or putting into operation is delayed due to circumstances for which Baumüller is not responsible, then the purchaser shall bear the costs for idle time and journeys required on the behalf of the installation personnel.

e) The installation personnel working time has to be certified weekly by the purchaser. The purchaser shall present to the installation personnel a written certification regarding the ending of the erection/installation without delay.

f) Baumüller shall not be held liable for the installation personnel works, in as far as the works are not connected to the delivery and the erection or installation.

g) Trial runs on systems not supplied by Baumüller shall not be carried out by the installation personnel.

9.3 Parameter List

	Parameter	Default	Internal scaling	Page
-	P001 RFG output	-	±100,00 % = ±16383 dec	70
-	P014 RFG state	-	1:1	68
-	P034 MM clockwise rotating field	0	1:1	43
-	P047 N Uzk additional set value	-	-10,00 ... 10,00	46
-	P050 N Uzk set value	-	±100,00 % = ±16384 dez	46
-	P051 N Uzk actual value	-	±100,00 % = ±16384 dez	46
-	P052 N Uzk controller output	-	±100,00 % = ±16384 dez	46
-	P054 I max. feed back current	-	0,00 ... 100,00	46
-	P055 I max. output current	-	0,00 ... 100,00	46
-	P059 N state	-	1:1	45
-	P060 N Uzk control deviation	-	±100,00 % = ±16384 dez	46
-	P068 I Iq controller output	-	±100,00 % = ±16384 dec	43
-	P068 I U_mains pre-control	-	±100,00 % = ±16384 dec	43
-	P070 I phase voltage L1	-	±100,00 % = ±16384 dez	44
-	P071 I Id set value	-	±100,00 % = ±16384 dec	43
-	P072 I Id actual value	-	±100,00 % = ±16384 dec	43
-	P073 I phase current L1	-	±100,00 % = ±10922 dez	44
-	P074 I phase current L2	-	±100,00 % = ±10922 dez	44
-	P075 I Uq set value	-	±100,00 % = ±16384 dez	43
-	P076 I Ud set value	-	±100,00 % = ±16384 dec	44
-	P077 I Id set value	-	±100,00 % = ±16384 dec	44
-	P078 I Id actual value	-	±100,00 % = ±16384 dec	44
-	P083 I current offset U	-	±25,00 % = ±8188 dec	44
-	P084 I current offset V	-	±25,00 % = ±8188 dec	44
-	P086 I phase voltage L2	-	±100,00 % = ±16384 dez	44
-	P087 ES Uzk nominal value	-	550 ... 1000	46
-	P099 I apparent current actual value	-	±100,00 % = ±16384 dec	44
-	P100 PWM phase L1	-	±100,00 % = ±16384 dez	40
-	P101 PWM phase L2	-	±100,00 % = ±16384 dez	40
-	P102 PWM phase L3	-	±100,00 % = ±16384 dez	40
-	P113 PU I max	-	100,0 A = 1000 dez	35
-	P114 PU I nominal	-	100,0 A = 1000 dec	35
-	P115 PU state	-	1:1	33
-	P117 PU type	-	1:1	34
-	P118 PU temperature	-	80° C = 80 dec	36
-	P120 M control word	-	1:1	50
-	P121 M state word	-	1:1	51
-	P123 M actual operation mode	-	1:1	52
-	P124 M error code	-	1:1	52
-	P125 M error index	-	1:1	52
-	P137 M state 1	-	1:1	52
-	P138 Language	1	1:1	65
-	P139 PU Ixt value	-	±100,00 % = ±16384 dec	37
X: Parameter is saved in the data record				

	Parameter	Default	Internal scaling	Page
-	P141 SVG output value	-	±100,00 % = ±10000 dec	72
-	P150 SVG state	-	1:1	72
-	P160 OS selection	-	1:1	66
-	P161 OS sampling time	-	250,0 µs = 2500 dec	65
-	P162 OS message	-	1:1	65
-	P163 OS BUS6-VC SW release	-	e.g. 3.08 = 308 dec	66
-	P169 OS value	-	1:1	66
-	P170 SI state	-	1:1	89
-	P171 SI baud rate	9600 Baud	1:1	89
-	P174 OS user SW	-	1:1	66
-	P190 DSM command	-	1:1	62
-	P191 DSM state	-	1:1	62
-	P192 DSM message	-	1:1	62
-	P193 DSM DS name	-	1:1	63
-	P194 DSM DS article no.	-	1:1	63
-	P195 DSM message Pxxx	-	1:1	63
-	P196 DSM load data set	-	1:1	63
-	P197 DSM DS program cycles	-	1:1	63
-	P198 DSM key	-	1:1	64
-	P204 N Uzk set max.	-	550,0 ... 999,9	46
-	P205 N Uzk set min.	-	150,0 ... 950,0	46
-	P283 AI 1 value	-	±100,00 % = ±10000 dec	75
-	P290 AI 2 value	-	±100,00 % = ±10000 dec	75
-	P338 AO state	-	1:1	79
-	P382 DI state	-	1:1	82
-	P610 MM Uzk actual	-	117 ... 1000	56
-	P611 MM Uzk acutal smoothed	-	117 ... 1000	56
-	P616 BUC control word	-	0000 ... FFFF	56
-	P617 MM CC counter	-	0 ... 65535	56
-	P618 MM period time mains	-	0,000 ... 65,535	56
-	P619 MM period smoothed	-	0,000 ... 65,535	56
-	P621 MM mains frequency	-	0,00 ... 655,35	57
-	P622 MM no. of mains faults	-	-32767 ... 32767	57
-	P623 MM mains jitter	-	-180,0 ... 180,0	57
-	P626 MM Rho	-	-32767 ... 32767	57
-	P628 I delta ISQ	-	-199,99 ... 199,99	58
-	P629 I delta ISD	-	-199,99 ... 199,99	58
-	P631 MM U mains alpha (cos(wt))	-	-199,99 ... 199,99	58
-	P632 MM U mains beta (sin(wt))	-	-199,99 ... 199,99	58
-	P633 MM mains voltage eff.	-	0,0 ... 640,0	58
-	P634 MM effective power	-	-3276,7 ... 3276,7	58
X	P002 RFG input 1	0,00 %	±100,00 % = ±16383 dec	69
X	P003 RFG ramp-up time 1	0,00 s	1,00 s = 100 dec	69
X	P004 RFG input 2	0,00 %	±100,00 % = ±16383 dec	69
X	P005 RFG ramp-up time 2	0,00 s	1,00 s = 100 dec	69
X: Parameter is saved in the data record				

	Parameter	Default	Internal scaling	Page
X	P006 RFG input 3	0,00 %	±100,00 % = ±16383 dec	69
X	P007 RFG ramp-up time 3	0,00 s	1,00 s = 100 dec	69
X	P010 RFG ramp-down time 1	0,00 s	1,00 s = 100 dec	69
X	P011 RFG ramp-down time 2	0,00 s	1,00 s = 100 dec	69
X	P012 RFG ramp-down time 3	0,00 s	1,00 s = 100 dec	69
X	P013 RFG mode	0001	1:1	69
X	P016 RFG rounding	0 s	1000 ms = 1000 dec	69
X	P057 N P gain	10,0	10,0 = 100 dec	45
X	P058 N integral action time	25,0 ms	25,0 ms = 250 dec	46
X	P061 N limiter control deviation	99,99 %	100,00 % = 16384 dez	46
X	P080 I P gain	1,0	10,0 = 100 dec	42
X	P081 I integral action time	2,5 ms	1000,0 ms = 10000 dec	42
X	P090 PU mode	0000	1:1	34
X	P103 PWM frequency	8,0 kHz	8,0 kHz = 80 dec	41
X	P116 PU I limit	2,5 A	100,0 A = 1000 dec	36
X	P119 PU overload time	-	10,00 S = 1000 dec	35
X	P122 M set operation mode	-3	1:1	52
X	P125 M mode	0	1:1	52
X	P126 M communication source	0000	1:1	53
X	P127 M communication monitoring	0000	1:1	53
X	P128 M monitoring time	0 ms	1000 ms = 1000 dec	53
X	P129 M monitoring code	0	1:1	54
X	P140 SVG target Pxxx	0	1:1	72
X	P142 SVG set value 1	100,00 %	±100,00 % = ±10000 dec	72
X	P143 SVG set value 2	0,00 %	±100,00 % = ±10000 dec	72
X	P144 SVG set value 3	-100,00 %	±100,00 % = ±10000 dec	72
X	P145 SVG set value 4	0,00 %	±100,00 % = ±10000 dec	72
X	P146 SVG time 1	1,000 s	1,000 s = 1000 dec	72
X	P147 SVG time 2	1,000 s	1,000 s = 1000 dec	72
X	P148 SVG time 3	1,000 s	1,000 s = 1000 dec	72
X	P149 SVG time 4	1,000 s	1,000 s = 1000 dec	72
X	P166 OS state	-	1:1	65
X	P277 AI 1 input channel	0	1:1	74
X	P278 AI 1 smoothing	1 ms	1:1	74
X	P279 AI 1 scaling	1,00	±2,00 % = ±200 dec	75
X	P280 AI 1 target Pxxx	0	1:1	75
X	P281 AI 1 offset	0,00 %	±100,00 % = ±10000 dec	75
X	P282 AI 1 threshold value	0,00 %	+100,00 % = +10000 dec	75
X	P284 AI 2 input channel	1	1:1	74
X	P285 AI 2 smoothing	1 ms	1:1	74
X	P286 AI 2 scaling	1,00	±2,00 % = ±200 dec	75
X	P287 AI 2 target Pxxx	0	1:1	75
X	P288 AI 2 offset	0,00 %	±100,00 % = ±10000 dec	75
X	P289 AI 2 threshold value	0,00 %	±100,00 % = ±10000 dec	75
X	P302 AI state	-	1:1	74
X: Parameter is saved in the data record				

	Parameter	Default	Internal scaling	Page
X	P330 AO 1 source Pxxx	0	1:1	79
X	P331 AO 1 offset	0 Dig	1:1	79
X	P332 AO 1 scaling	1 Dig/V	1:1	79
X	P334 AO 2 source Pxxx	0	1:1	79
X	P335 AO 2 offset	0	1:1	79
X	P336 AO 2 scaling	1 Dig/V	1:1	79
X	P337 AO test value	0,000 V	1:1	79
X	P342 DI 4 target Pxxx	120	1:1	83
X	P343 DI 4 bit selection	0008	1:1	83
X	P344 DI 4 LOW pattern	0000	1:1	83
X	P345 DI 4 HIGH pattern	0008	1:1	83
X	P370 DI 1 target Pxxx	0	1:1	83
X	P371 DI 1 bit selection	0	1:1	83
X	P372 DI 1 LOW pattern	0	1:1	83
X	P373 DI 1 HIGH pattern	0	1:1	83
X	P374 DI 2 target Pxxx	0	1:1	83
X	P375 DI 2 bit selection	0	1:1	83
X	P376 DI 2 LOW pattern	0	1:1	83
X	P377 DI 2 HIGH pattern	0	1:1	83
X	P378 DI 3 target Pxxx	120	1:1	83
X	P379 DI 3 bit selection	0800	1:1	83
X	P380 DI 3 LOW pattern	0000	1:1	83
X	P381 DI 3 HIGH pattern	0080	1:1	83
X	P383 DO 1 source Pxxx	0	1:1	85
X	P384 DO 1 bit selection	0	1:1	85
X	P385 DO 1 bit pattern	0	1:1	85
X	P392 DO state	-	1:1	85
X	P600 M Uzk threshold	-	117 ... 1000	55
X	P601 M MC switching time	-	10 ... 10000	55
X	P602 M pre-control time	-	1 ... 10000	56
X	P612 MM Uzk smoothing time	-	0,0 ... 200,0	56
X	P620 MM PLL display filter	-	0,000 ... 1000,0	56
X	P624 MM mains jitter limit	-	0,0 ... 30,0	57
X	P625 MM Rho offset	-	0,0 ... 200,0	57
X	P627 I current delta max	-	-100,00 ... 100,00	58
X	P630 I IQ set smoothing time	-	0,0 ... 500,0	58
X: Parameter is saved in the data record				

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