BAUMÜLLER

Compact Unit
BUM 618/619

Technical description and operation manual

E 5.93025.17

Edition January 1997

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READ AND COMPLY WITH THE OPERATION MANUAL AND THE SAFETY NOTES BEFORE COMMISSIONING

This manual contains the necessary information for normal opteration of the products described therein. The drives may only be used, maintained and repaired by personnel familiar with the operation manual and the applicable regulations on working safety and accident prevention. The devices are manufactured to a high technical specification and are operationally safe. Provided that all safety instructions habe been adhered to, there will be no personal danger during the installation and commissioning stages.

The commisioning is prohibited until it has been positively determined that the machine, into which these components are to be incorporated, complies with EC machine regulations.

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

Manufacturer and Supplier's address: Baumüller Nürnberg GmbH
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Germany
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Country of origin: Made in Germany

Date of manufacture: Determined from the serial number on the machine/motor.

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ABBREVIATIONS

AC	Alternation current
AI	Function module analog inputs
AM	Asynchronous motor
AO	Function module analog outputs
BASS	Baumüller drive serial interface
BSA	Analog reference potential
BSD	Digital reference potential
BUM	Baumüller converter mono unit
CPU	Central prozessing unit
CT	Function module coordinate transformation
DA	Digital/analog
DC	Direct current
DI	Function module digital inputs
DO	Function module digital outputs
DSM	Function module data set management
EA	Function module motor potentiometer
EMC	Elektromagnetic compatibility
Ext	Function module current monitoring
FI	Function module feed in
I	Function module current controller
I2t	Function module overload monitoring
ID no.	Identification number
IE	Function module incremental encoder
Inc	Position counter
Ink	Graduation mark number inkremental encoder
M	Function module drive manager
Mot	Function module motor temp. monitoring
MT	Motor temperature
N	Function module speed controller
OS	Function module operating system
PC	Function module position controller
PD	Process data
PIV	Parameter information value
PU	Function module power unit
PWM	Function module pulse width modulation
Res	Function module resolver evaluation
RF	Pulse enabling
RFG	Function module ramp function generator
RO	Function module relay output
S	Function module service interface
SM	Synchronous motor
SWG	Function module specified value generator
TM	Temperature motor
USS	Function module USS protocol
ZK	Intermediate circuit

1 SAFETY NOTES

Preliminary Remarks

During operation, the principles on which the power converter and the motor work lead to leakage currents to earth that may be 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.
This means that connecting the power converter to the mains using only the current-operated e.l.c.b. is prohibited (preliminary standard EN 50178/VDE 0160/11.94, Sections 5.2.11 and 5.3.2.1).

The units are protected from direct contact by being installed in commercially available switching cabinets that meet the minimum protection requirements of preliminary standard EN 50178/VDE 0160/11.94, Section 5.2.4.

Sheets of plastic covering the equipment connection act as additional guards preventing accidental contact at commissioning and in the case of casual use of control elements located close to the equipment (DIN VDE 0106 Part 100, Accident Prevention Regulation VBG4 "Electrical Systems and Equipment").

At routine testing of this equipment, a high-voltage test is carried out that conforms with preliminary standard EN 50178/VDE 0160/11.94, Section. 9.4.5.

The protective measures and safety regulations according to DIN/VDE are binding for personal security.

Neglecting to fit PE connections on the equipment or the motor will result in serious personal injury and/or considerable damage to property.

The equipment may only be run on grounded supply networks.

Sections carrying current take more than one minute to discharge.

The equipment is conditionally shortcircuit-proof.

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/system 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 below is followed.

WARNING

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

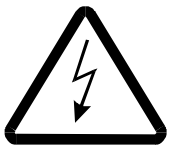
Ignoring these safety instructions and warnings may result in serious personal injury and/or damage to property.

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 considerable 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.

Appropriate use also includes observing the operating instructions and complying with the conditions of inspection and maintenance.

2 TECHNICAL DATA

2.1 General

BUM 618 and BUM 619 are digital single-axis controllers for the operation of 0.5 kW, 0.75 kW or 1.5 kW servo motors.

Special attention has been given to ergonomics, compact size and simple assembly in the development of these units. It goes without saying that they have all the advantages of digital controllers, such as smoothness and speed exactness, drift resistance, communications facilities and high-quality control capability.

Features

The single-axis controllers are supplied in 2 different housings:

BUM 619 as a slide-in unit for the 19" system and BUM 618 as a compact unit in its own housing.

Feed in / power supply

- Connection via transformer 3 x 230 V secondary, or single-phase via line reactor, to the 230 V mains
- Main contactor and and charging circuit are integrated into the unit and are administered by the controller
- Starting current peaks are prevented by the charging circuit
- The power unit is protected against short-circuit, short to earth and overvoltage
- 4-quadrant operation with internal (optional) or external ballast resistance
- The control electronics are isolated from the power unit
- Integrated switched-mode power supply for the controller

Control

- Synchronous motor control
- Controller structure is set out for speed control with subordinated current control and master position control or synchronisation control (optional)
- Digital control via 16 bit microprocessor
- The digital controller
  - drift-free operation
  - excellent smoothness characteristics
  - good control response and rigidity throughout the speed range
  - control range 1 : 500 in respect to nominal speed with digital value selection
    1 : 250 in respect to nominal speed with analog value selection
- According to requirements, the controller can be operated via
  - analog specified value selection and switching inputs
  - serial interface RS 485 for drive networking via USS protocol
  - serial interface RS 232 for PC operation, parameter assignment, commissioning and servicing, as well as archiving the control parameters on disk
- Outputs:
  - relay contacts "ready for use" message
    programmable functions
- Inputs:
  - enable main contactor
  - enable pulse
  - 3 programmable function inputs
  - analog inputs (0 .... ± 10 V)
  - RS 232 with potential-free voltage supply
  - RS 485 with potential-free voltage supply
- Service- and operation software PCBASS

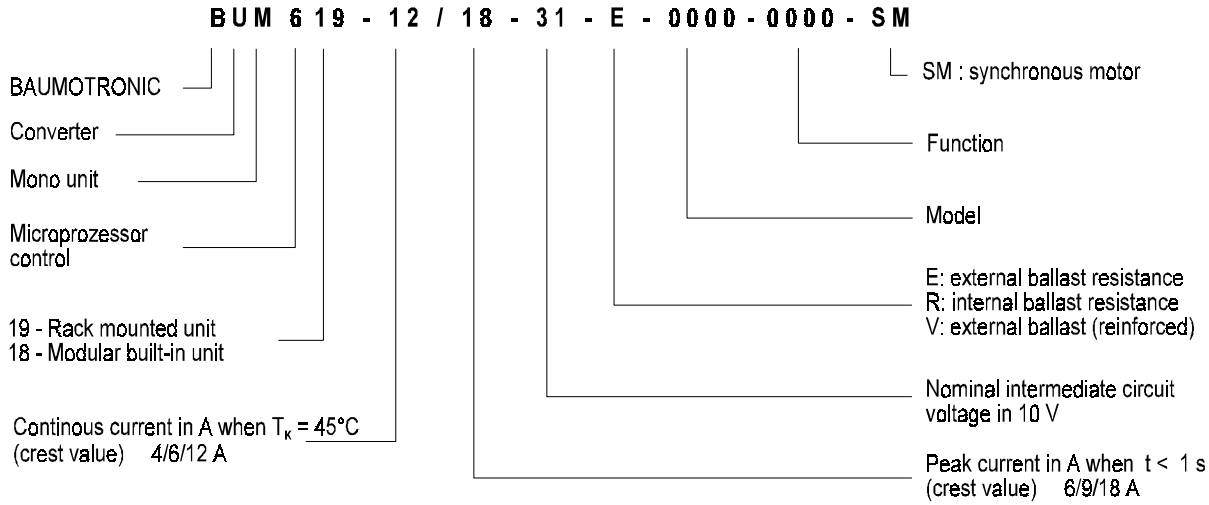
Options

- Either internal or external ballast restistor
- Incremental encoder input
- Incremental encoder emulation
- 2 additional analog output
- Positioning software
- Synchronisation control software

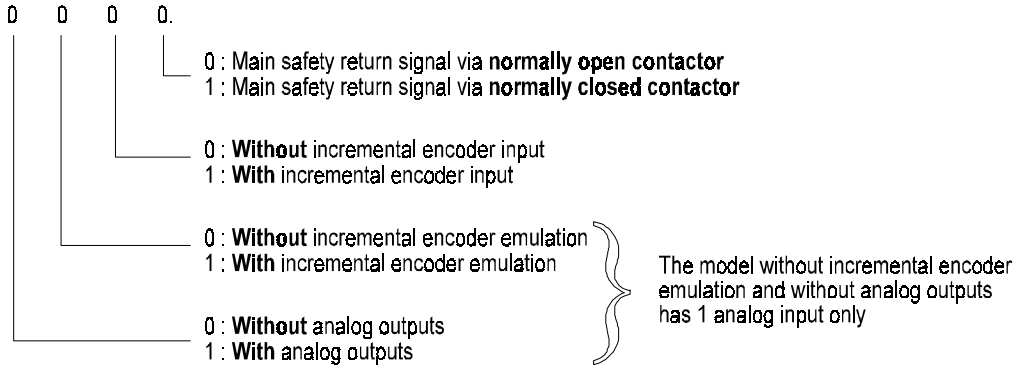
2.2 Electrical Data

		BUM 618/619 - 4 / 6	BUM 618/619 - 6 / 9	BUM 618/619 - 12 / 18
Connection voltage		1 x 230 V bzw. 3 x 230 V + 6 % / - 10 % 50 / 60 Hz		3 x 230 V + 6 % / - 10 % 50 / 60 Hz
Fusing		10 A slow fuse		
Nominal intermediate circuit voltage		310 V DC		
Output voltage		0 ... connection voltage		
Output performance		1.1 kVA	1.7 kVA	3.4 kVA
Output nominal current $\hat{I}_N$ (I_{eff}) when T_K = 45 °C		4 A (2.8 A_{eff})	6 A (4.2 A_{eff})	12 A (8.5 A_{eff})
Output peak current $\hat{I}_S$ (I_{eff}) (t < 1s) when T_K = 45 °C		6 A (4.2 A_{eff})	9 A (6.4 A_{eff})	18 A (12.7 A_{eff})
Permitted transistor clock frequency		8 kHz		
Typical motor performance		0.5 kW	0.75 kW	1.5 kW
External reactance (with 1 x 230 V)		4 % u_k	4 % u_k	-
Low voltage supply Connection to		connection voltage 230 V ~ L1 and L3 before main contactor K1		
Main contactor K1 Coil		3 x 12 A / 250 V AC 15 V 80 mA (minimum life span > 800 000 switching cycles)		
Integrated earth leakage circuit-breaker		hesitation approx. 1 s minimum pause time approx. 5 s		
Earth fault monitoring		set to 2 A		
Ballast resistance, internal Ballast resistance, external		R_R = 47 Ω / 50 W peak performance (t ≤ 1s) 3 kW R_B > 47 Ω		
Initialising time		max. 20 s		
Power loss P_V, without ballast		in nominal use 100 W in stand-by 40 W		
Operating ambient temp. T_B	single phase	0 ... 45 °C (with a power reduction of 2 %/°C, up to 55 °C)		0 ... 45 °C (with a power reduction
	3 phase	0 ... 55 °C		of 2 %/°C, up to 55 °C)
Use > 1000 m above sea level		power reduction by 1 % per 100 m over 1000 m above sea level		
Relative air humidity		15 % ...95 % no dew		
Storage temperature range		- 30 °C ... + 70 °C		
Weight		1 kg		

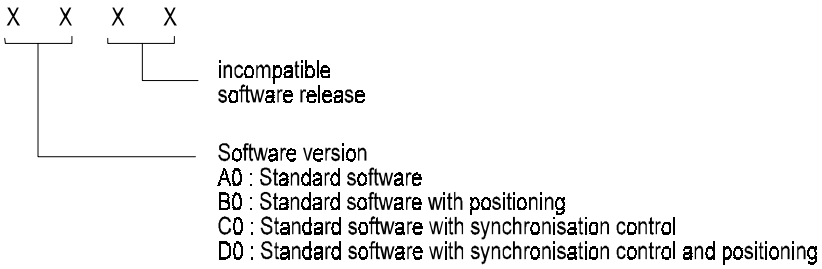
2.3 Type code



Model:



Function:



NOTE

In models 0000, 0001, 0010 and 0011 (all types, which neither allow installation via icremental encoder nor analog outputs) only one analog input is available.
All other types allow installation via 2 analog inputs.

3 TRANSPORT, REMOVAL OF THE PACKAGING

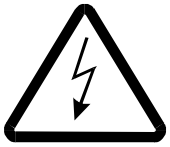
The devices are packed in the manufacturer´s works in accordance with ordering instructions.

Severe vibrations during transport are to be avoided.

Once packaging is removed and the devices are checked for their completeness, assembly can follow.

Packaging material consists of cardboard, corrugated caroboard and/or wood. It can be disposed of in accordance with local disposal regulations.

Any transport damage should be reported.



DANGER

In the event of damage being sustained in transit, the device should no be connected to a supply without prior (high voltage) testing trained personnel.

Death, serious injury or considerable damage to equipment may result should this warning fail to be heeded.

4 ASSEMBLY

WARNING

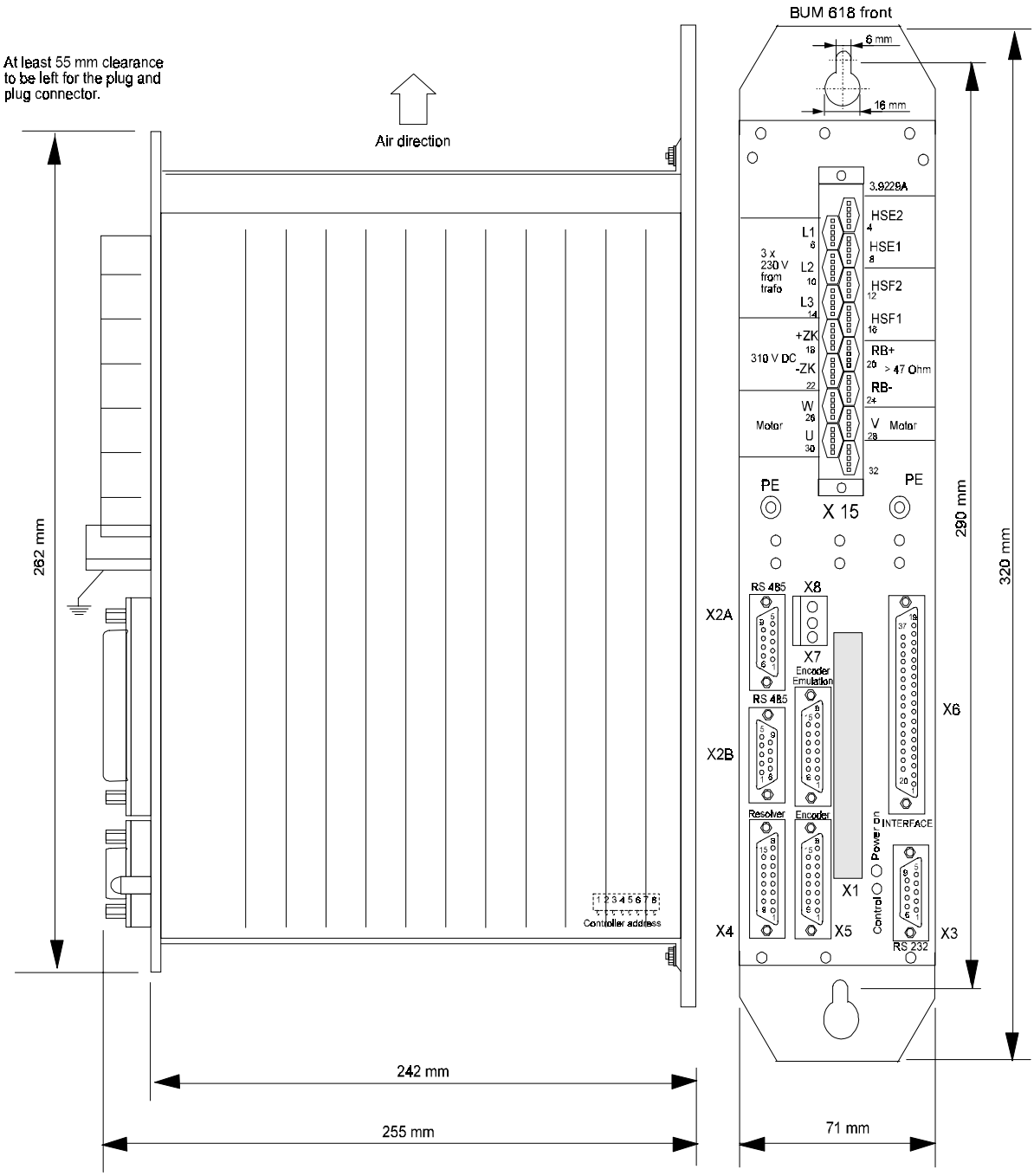
The user is responsible for the assembly of the converter power unit, the motor, the transformer and the other components according to applicable safety standards (e.g. DIN, VDE) and all other relevant national or local regulations regarding conductor dimensions and fusing, earthing, circuit breakers, overcurrent protection etc.

It must be ascertained that unrestricted cooling air access and outlet is available. There must be free space between units of 150 mm above and at least 200 mm below. Otherwise they can overheat.

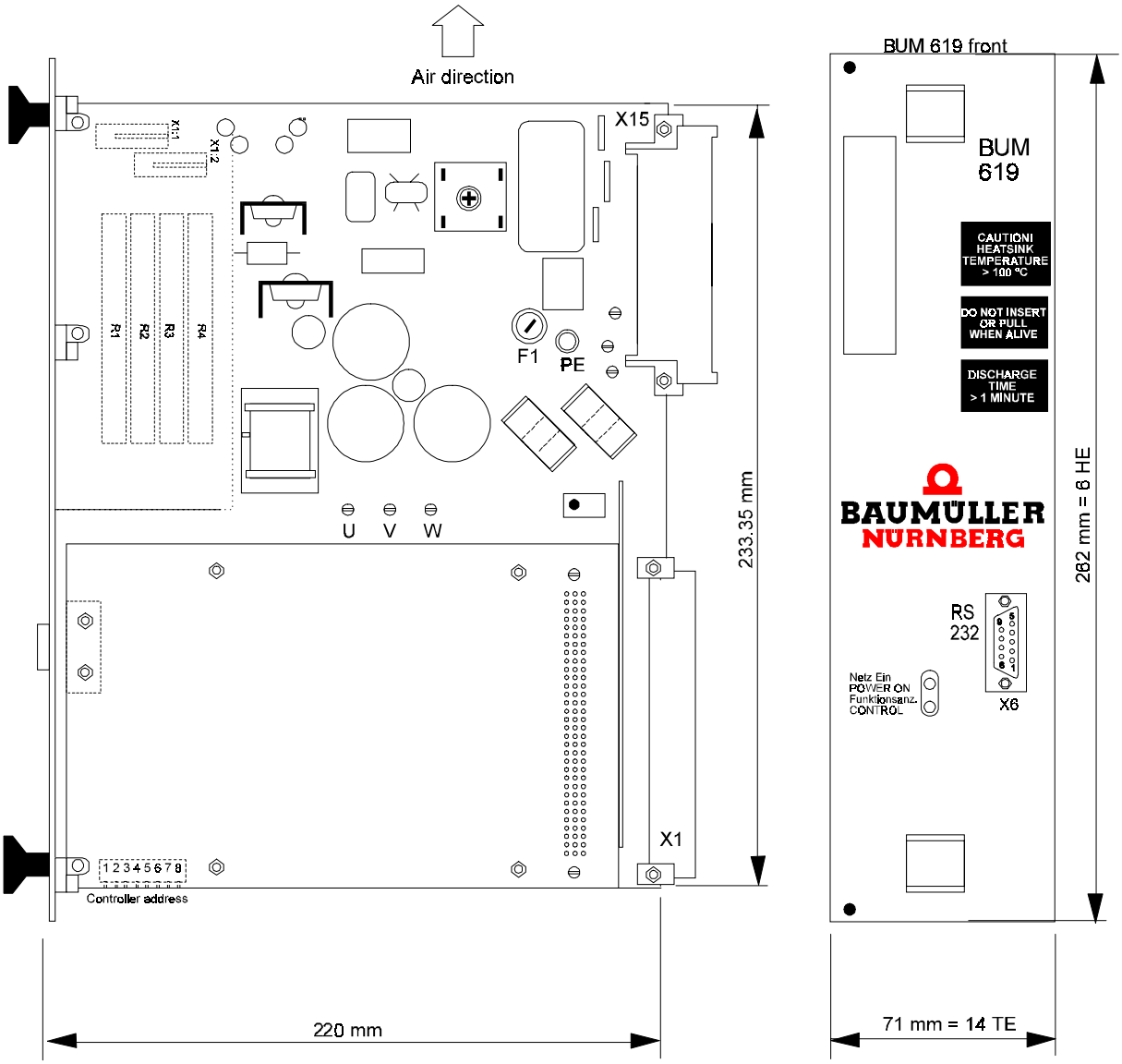
In operation, the apparatus is protected against direct touching in such a way that it is suitable for installation in enclosed electrical operating areas (DIN VDE 0558 part 1, sect. 5.4.3.2.4).

4.1 Dimensions

BUM 618



BUM 619


Air direction
X15
X1:1
X1:2
R1
R2
R3
R4
F1
PE
U
V
W
233.35 mm
X1
1 2 3 4 5 6 7 8
Controller address
220 mm
BUM 619 front
BUM
619
CAUTION!
HEATSINK
TEMPERATURE
> 100 °C
DO NOT INSERT
OR PULL
WHEN ALIVE
DISCHARGE
TIME
> 1 MINUTE
BAUMÜLLER
NÜRNBERG
RS
232
Netz Ein
POWER ON
Funktionsanz.
CONTROL
X6
282 mm = 6 HE
71 mm = 14 TE

4.2 Assembly notes

The units are to be mounted vertically in a control cabinet, and are suitable for connection to an industrial mains circuit. Ensure unrestricted air access.

Free room of 150 mm above and 200 mm below the unit must be available.

The units can be mounted alongside each other.

NOTE

The drive address must be set via the DIP switch, S40, before installation (for its location, see "dimensions" diagram).

Ventilation must be in the specified direction, i.e. from bottom to top. Coolant temperature 50 mm under the units, up to 45 °C.

In the event of temperatures over 45°C (up to max. 55 °C) the unit's power must be reduced by 2 % per °C. Additional ventilators in the switching cabinet are only required if heat concentration arises, caused by sources of heat near the unit, or if the units are installed too close together.

VDE 0160 soiling grades 3 and 4 must be prevented.

The units are suitable for use in enclosed working areas (VDE 0558 part 1a), as long as they are protected from indirect touch during use.

5 INSTALLATION

5.1 Hazard notes

WARNING

This unit carries dangerous voltage and contains dangerous rotating machine parts (ventilators). This means that death, serious injury or considerable material damage can occur if the safety and warning notes are not heeded.

The user is responsible for the assembly of the converter power unit, the motor, the transformer and the other components according to applicable safety standards (e.g. DIN, VDE) and all other relevant national or local regulations regarding conductor dimensions and fusing, earthing, circuit breakers, overcurrent protection etc.

Relatively high leakage to earth occurs in the converter and the motor, i.e. the drive may be incompatible with residual current protective devices (corresponding to DIN VDE 0160, sect. 5.5.3.4 and sect. 6.5.2.1).

The intermediate circuit carries electrical potential: it is imperative that the provided cover is used.

Variable-speed drives may only be used if they conform to valid VDE regulations.

With equipment where speed is of critical importance, speed monitoring in the unit must be supplemented by autarchic monitoring of the motor. This speed check, independent from the control, can be carried out by inductive, optical or yield force-dependant encoders. See the operation and maintenance manual for the applicable motor.

Special care is needed when touching the drive shaft, directly or indirectly (by hand). This should only be done in a voltage-free state and whilst the drive is stationary.

Safety equipment must under no circumstances be shut down.

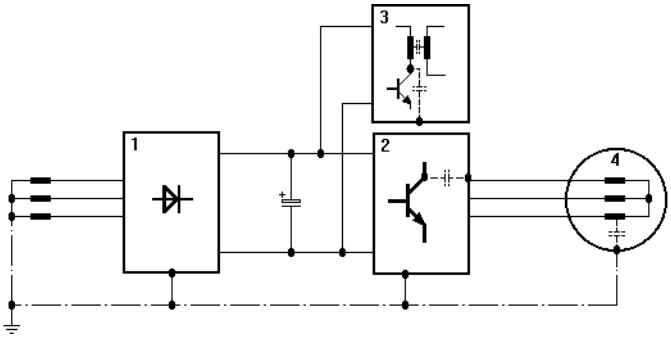
5.2 EMC Information

General Information about Converters

Modern semiconductor technologies such as MCTs and IGBTs are intended to minimize the power loss in the converter by switching more quickly and, with this, to continually reduce the size of the power section. As a result, when running converters you must meet specific conditions to avoid electromagnetic influences caused by switching operations.

Disturbances can occur due to:

- capacitive fault currents caused by high rates of voltage rise when bipolar transistors and IGBTs switch.



1 Feed
2 Power section
3 Switching power supply
4 Motor

- high currents and high rates of current rise in the motor lines. The disturbance energy bound in magnetic fields reaches frequencies of between a few Hertz and about 30 MHz. Due to the high rates of current rise, additional electromagnetic fields occur with frequencies of up to approximately 600 MHz.
- high clock rates and fast logic circuits (electromagnetic field/16 MHz...1 GHz).
- system perturbation and harmonics caused by commutations and non-sinusoidal network loading, in particular with line-commutated converters (100 Hz ... 20 kHz).

German EMC Law (EMVG)

This converter complies with Paragraph 5, Section 5, Sentence 3 of the German EMC Law (EMVG) dated 09.11.92.

"Devices that are exclusively manufactured or stocked as vendor parts or spare parts for further processing by industrial companies or craftsmen or by other specialists in the field of electromagnetic compatibility do not need to comply with the protective requirements of Paragraph 4, Section 1, nor do they need EU conformity certification and marking, assuming that the devices in question cannot be run automatically."

This does justice to the fact that EMC is heavily dependent on the individual subassemblies and components in the switching cabinet. With regard to the total costs of the machine, it is preferable to troubleshoot an entire system rather than each of its individual components.

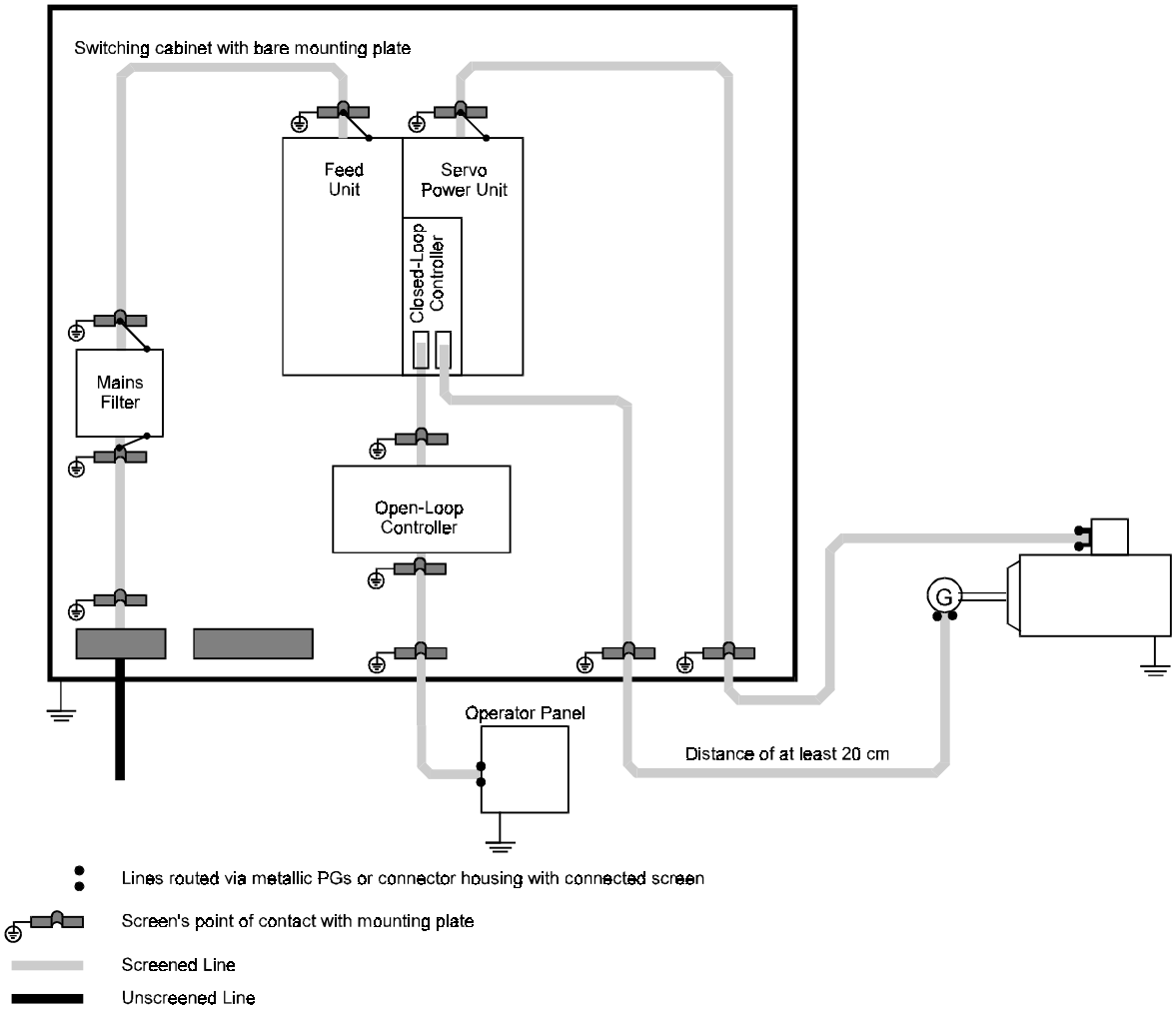
The information on the next few pages is intended to allow you to configure your system on the basis of the latest knowledge in the field of EMC and to comply with legal regulations.

Measures for Ensuring EMC

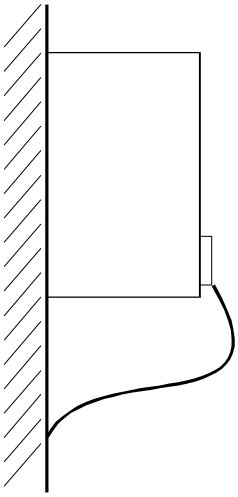
To ensure EMC, you must observe the configuration information below.

Cabling

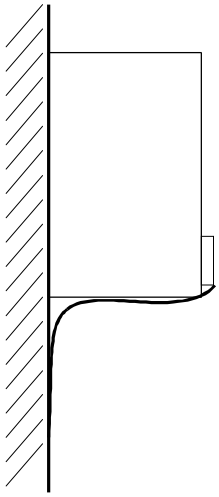
- To suppress radiated noise outside the converter, you should screen **all** the connected cabling. Also observe the topics in the section entitled "Screening".



- You achieve the lowest possible effective antenna height by routing the cable directly on the ground of the metallic rack.

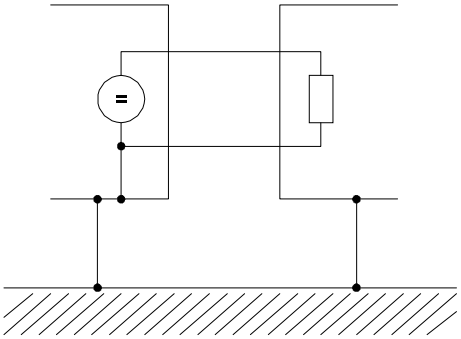


Wrong

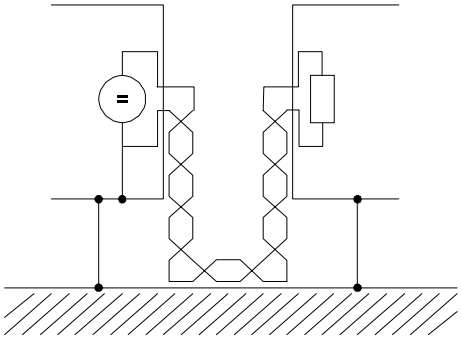


Right

- You should route all lines as close as possible to the conductors of the ground system to reduce the effective loop area for magnetic coupling.



Wrong



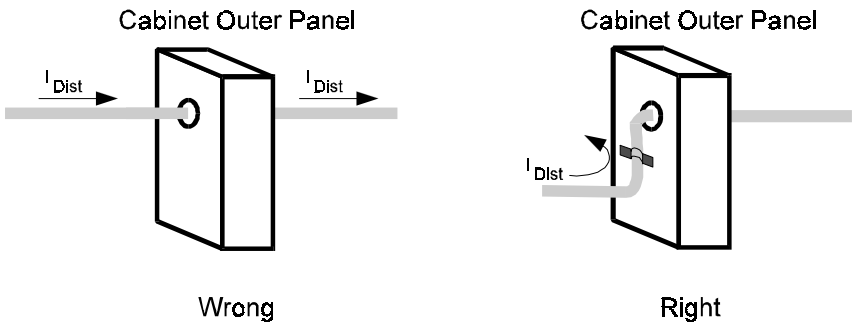
Right

- When parallel-routing signal and control lines across power cables, the conductors must be at least 20 cm apart.
- Lines of different EMC categories should only cross at an angle of 90°.
- In the case of symmetrical signal transfer (e.g. differential amplifier inputs for the speed specified value), twist the conductors of each pair of wires together and twist the pairs of wires together.
- The converter to ground plate earth connection should be as short as possible (less than 30 cm). Use large cross-sections (more than 10 mm²).
- Sources of interference such as fuses, transformers and chokes and modules that are sensitive to interference like µPs, bus systems, etc. should be located at least 20 cm away from the converter and its cabling.

- Avoid reserve loops on overlong cables.
- You **must** ground reserve lines at both ends (this has an additional screening effect, avoids capacitively coupled, dangerous touch voltages).

Grounding

- From an EMC point of view, classical star grounding is no longer adequate for reducing the influence of disturbances at relatively high frequencies that occur as a result of converter operation. Better results can be achieved by a reference surface that must be linked to the devices' frame grounds over a wide area (e.g. a bare, metallic mounting plate and parts of the housing).
  If it is not possible to use a broad reference place, it is sensible to mount the main equipotential busbar directly next to the converter, since this device generates the greatest potential jumps, compared with the other components in the switching cabinet, due to the steep switching edges (the ground connection should be less than 30 cm long if possible).
- Route all earth conductors and screens as closely as possible above the frame ground to prevent earth circuits.
- If it is possible to earth the controller reference voltage, make this connection with cabling that has as large a cross-section as possible and is less than 30 cm long.
- Remove insulating layers, such as varnish, adhesives, etc., from the frame ground connections. If necessary, use DIN 6798 serrated lock washers or similar to ensure a permanent, conductive contact. To prevent corrosion of frame ground connections, use suitable pairs of metals (electrochemical displacement series), and keep conductive electrolytes away from the connection by means of a protective coating (e.g. grease).
- Always connect screens at both ends to the frame ground; the connection should be over a wide area and conductive. This is the only way to suppress the effects of magnetic or high-frequency noise interference fields. If there are problems with earth circuits (e.g. double earth fault of the specified value conductor screen), the receive side should be galvanically connected and the transmit side capacitively connected.
- When routing cable screens through panels that separate different EMC areas, the cables must be in contact with the panel.
  Cables that are routed through the outer panels of screening housings without special measures (e.g. filtering), can have an adverse effect on the screening capability of the housing. For this reason, you must make a conductive connection of the cable screens to the screening outer panel at the point at which the cable enters the housing.
  The distance of the last screen contact point to the exit from the cabinet must be as short as possible.

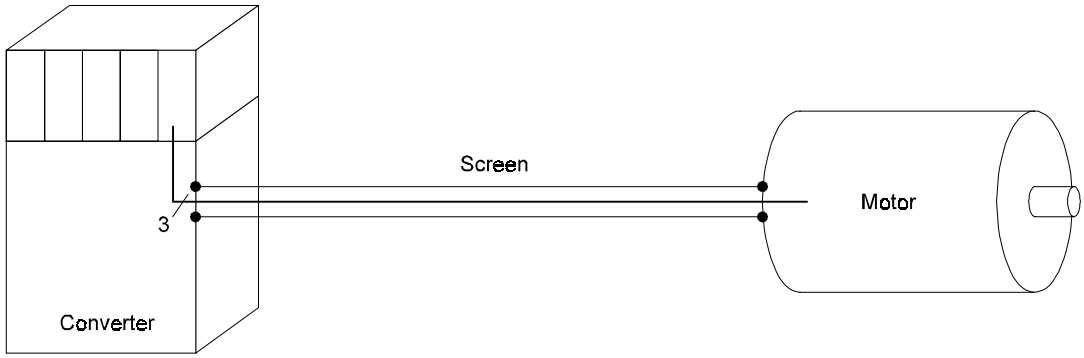


Screening

- The screen is effective against magnetic fields if it is connected to frame ground at both ends.

  With electrical fields, the screen is effective when it is connected to frame ground at one end.

  However, in the case of (electrical or magnetic) fields with high frequencies (depending on the length of the line), you must always connect the screen at both ends due to the linkage (electromagnetic field).



  Connecting the screen to frame ground at both ends ensures that the conductor does not leave the screening "system housing".

- Frame-grounding of conductor screens on both sides does not entirely rule out the influence of earth circuits (potential differences on the frame ground system). However, this is very rare if you carry out the measures described in the previous sections entitled "Cabling" and "Grounding".
  You can also make a capacitive RF connection of a screen to frame ground. This prevents low-frequency interference due to earth circuits.
  Screened cables that pass through different EMC areas must not be separated at terminals, since screen damping would otherwise be considerably reduced. The cables should be routed to the next module without interruption.

- Make the screen connection low-impedance and over a wide surface area. Cable tails that are only three centimetres long (1 cm of wire = 10 nH) reduce the screening effect in the megahertz range by up to 30 dB!

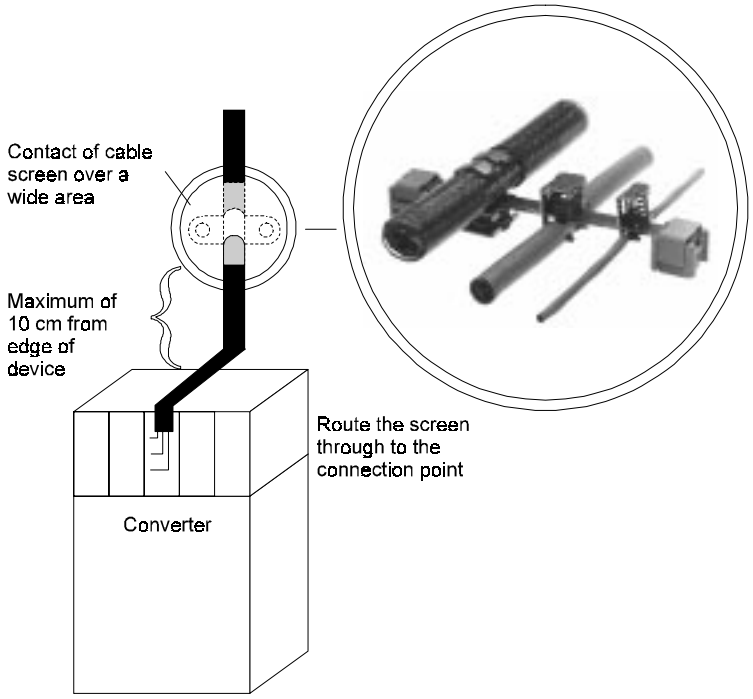
NOTE

The braided screen must have a coverage of at least 85%.

The following lines have particularly high levels of interference potential:

- the motor line
- the line to the external ballast resistors
- the line between the mains filter and the converter

- Suggestion for screen connection:



Filtering

No filters are needed for the converter to function. However, under some circumstances, filters may be needed on the input or the output side to comply with EMC regulations.

If you have any queries about filter design, please ask for the description entitled Baumüller Filters for Network Applications, BFN.

Filter Assembly

- Mount the filter directly next to the converter. With lines that are more than 30 cm long, you must screen the mains line between the converter and the filter (frame-ground on both sides).
- Physically separate the filter's input and output lines by more than 30 cm.
- Make a broad connection between the filter housing and frame ground.

Discharge Currents

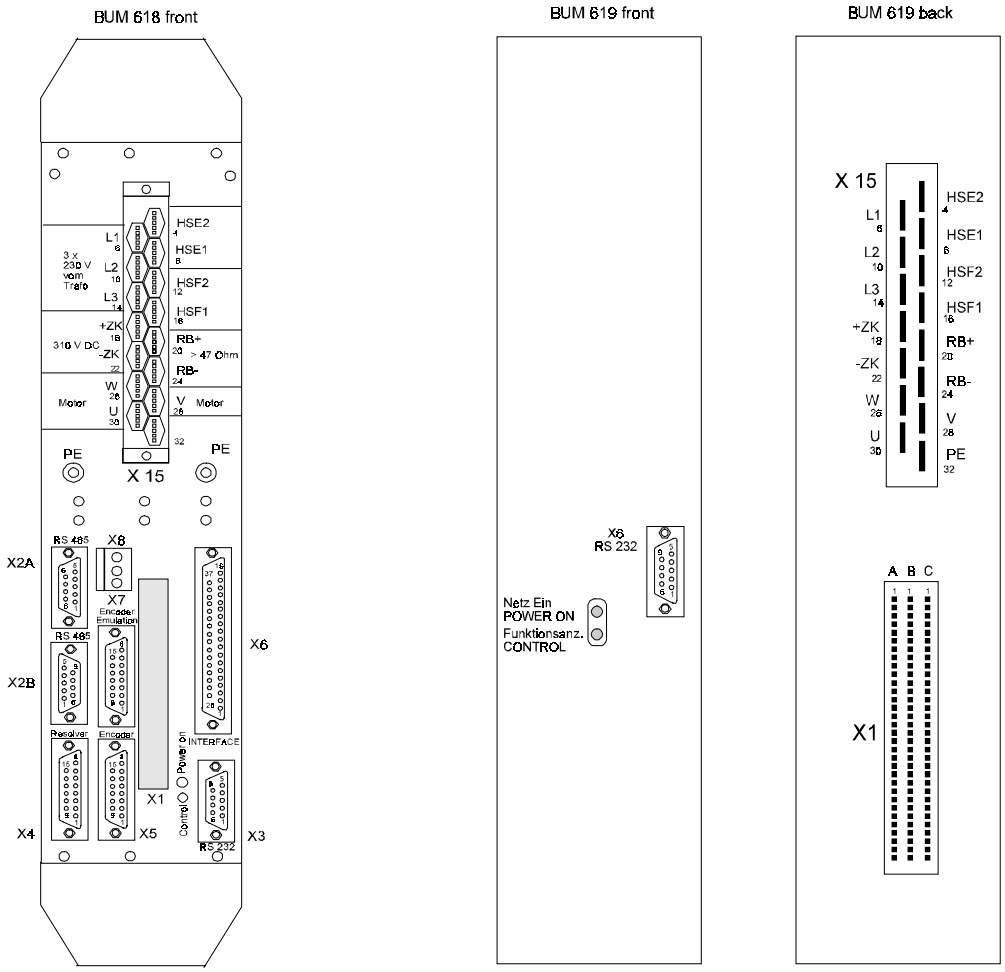
Due to the principle of operation, parasitic capacities in the filter, the mains unit, the motor cable and the motor winding cause discharge currents of around 100 mA and higher.

This means that converters with earth leakage circuit-breakers may be incompatible!

In this context, you should observe the safety information in provisional standard EN 50178:1994 Section 5.2.11.2.

5.3 Checks prior to installation

- Note down the type and no. of the unit and motor
- Check the terminals by means of the terminal diagram, in particular the motor windings terminal
- Check the mains lead connection:



- PC connection via RS 232
  Setting of the drive address in binary code via DIP-switch on front plate.

NOTE

DIP swicht cann´t be set from outside!

5.4 LED displays

Located on the front of the device are 2 LEDs which display its operating condition.

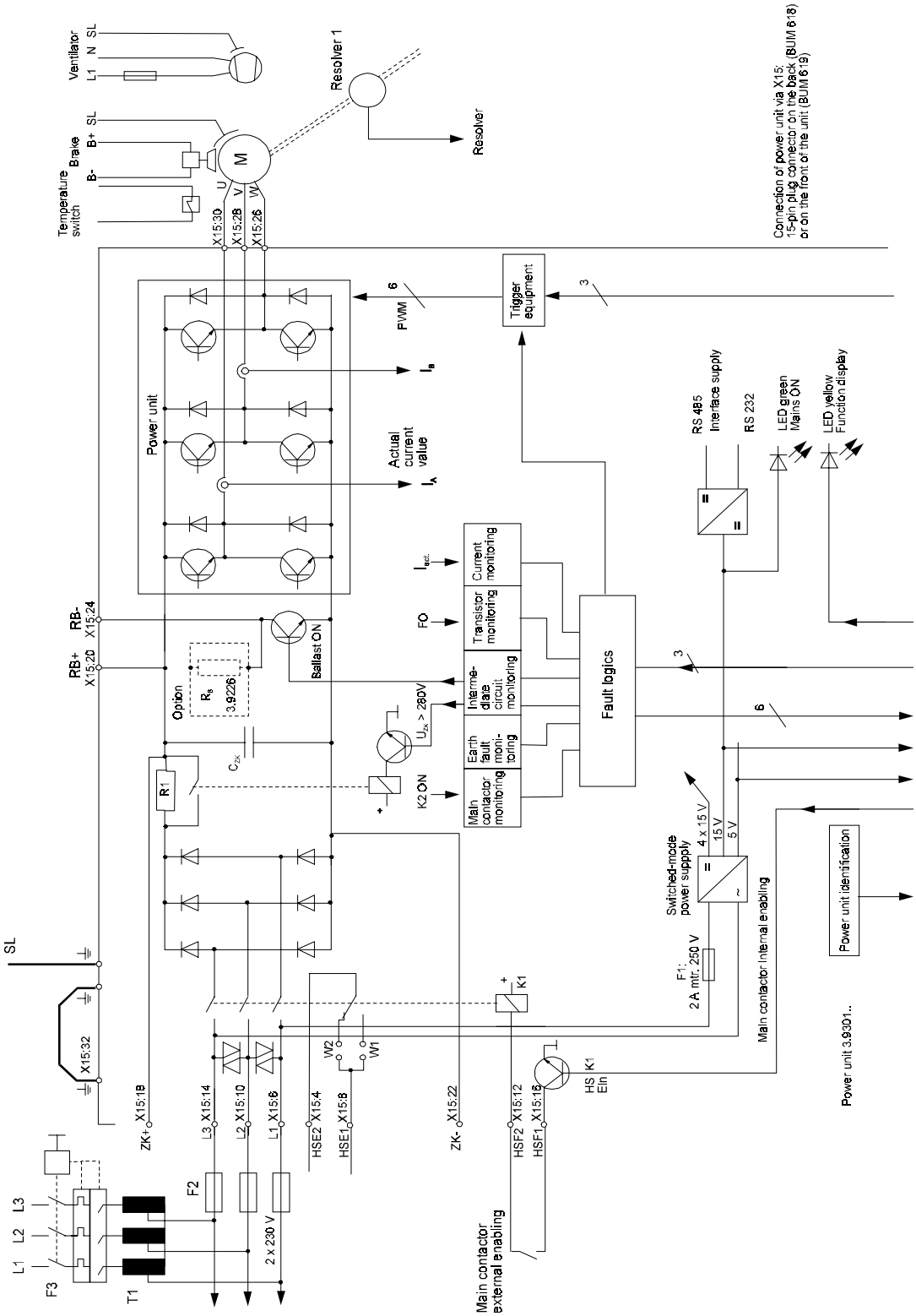
LED green

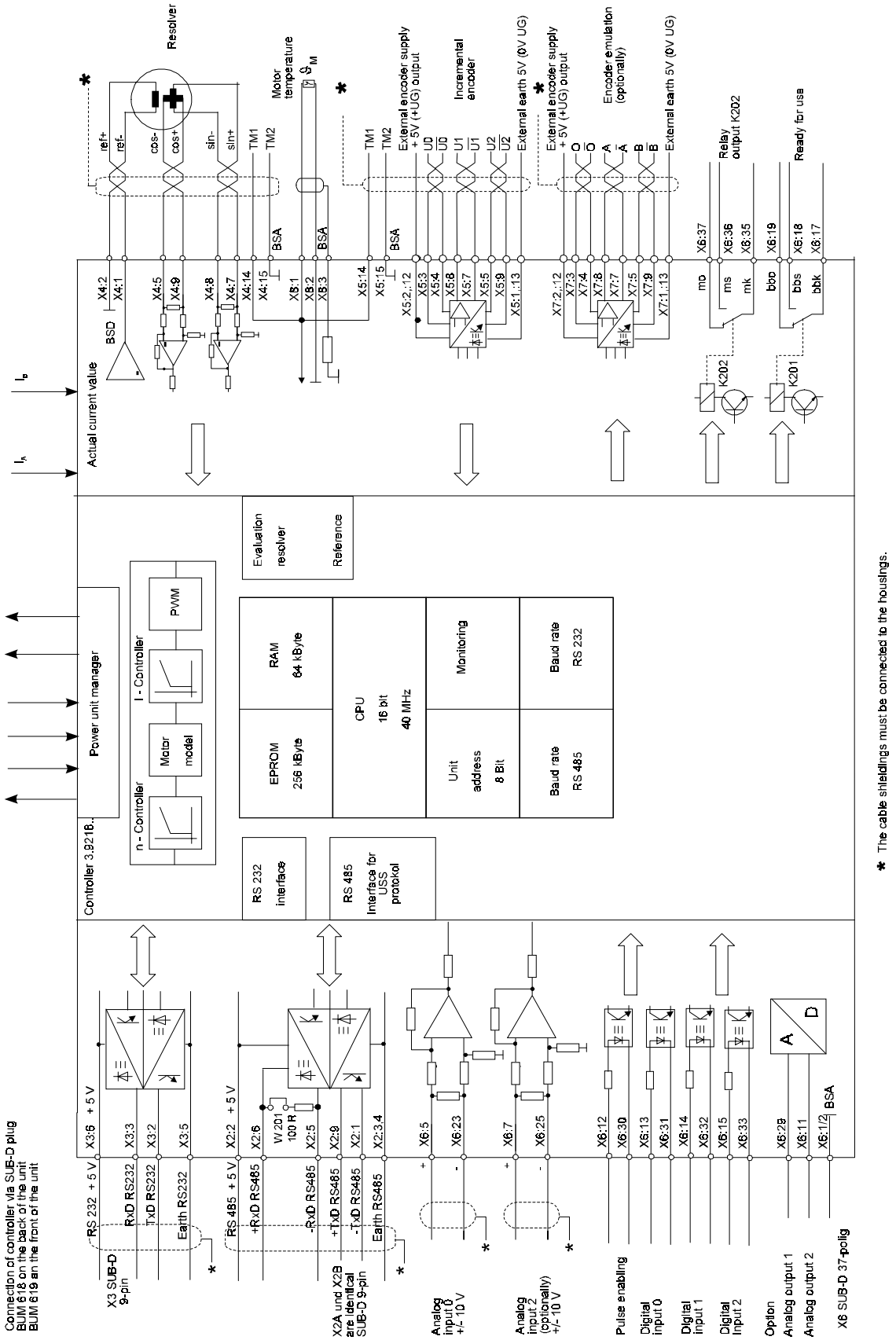
- Supply on
- LED is directly connected to the 5 V supply of the power module.

LED yellow

- flashing rapidly: Initialisation stage
- flashing slowly: normal operation
- Perpetually lit: fault

5.5 Terminal diagram




Resolver
Motor temperature
External encoder supply + 5V (+UG) output
Incremental encoder
External earth 5V (0V UG)
External encoder supply + 5V (+UG) output
Encoder emulation (optionally)
External earth 5V (0V UG)
Relay output K202
Ready for use
Actual current value
Controller 3.8218.
Power unit manager
n - Controller
Motor model
I - Controller
PWM
Evaluation resolver
Reference
RAM 64 kByte
EPROM 256 kByte
CPU 16 bit 40 MHz
Monitoring
Unit address 8 Bit
Baud rate RS 485
Baud rate RS 232
RS 232 interface
RS 485 Interface for USS protokol
Connection of controller via SUB-D plug
BUM 618 on the back of the unit
BUM 619 on the front of the unit
X3 SUB-D 9-pin
X2A und X2B are identical SUB-D 9-pin
Analog input 0 +/- 10 V
Analog input 2 (optionally) +/- 10 V
Pulse enabling
Digital input 0
Digital input 1
Digital Input 2
Option
Analog output 1
Analog output 2
X6 SUB-D 37-polig
* The cable shieldings must be connected to the housings.

Terminal notes

Earth leakage circuit-breaker	Relatively high leakage to earth occurs in the converter and the motor, i.e. the drive may be incompatible with residual current protective devices. Reference should be made to VDE 0160, sect. 5.5.3.4 and sect. 6.5.2.1 before configuration.
K1	Line contactor (internal) with auxiliary contact for controller enabling.
HSE1 HSE2	"Main contactor on" message (contact closed) Contact can be loaded to a minimum of 50 mA, and a maximum of 1 A
HSF1 HSF2	Main contactor enabling by closing an external make contact; Loading, approx. 80 mA. After enabling the main contactor, the intermediate circuit is charged via a charging circuit. Charging contactor K2 picks up after approx. 1 s. The power unit, or drive, is ready for use after this hesitation.
K2,R1	The charging circuit prevents the permitted non-repetitive peak current I_{ON} of the supply from being exceeded. After approx. 1 second, charging contactor K2 bridges charging resistor R1. The power unit, or drive, is ready for use after this hesitation.
RB+, RB-	External ballast resistor connection. The value of the external ballast resistance is RB > 47Ω. The ballast resistor rating complies with the expected braking energy and the cycle time.
RB	Internal ballast resistor RB is only fitted to the BUM619-12/18-31-**R**-XXX version (option 3.9226). An additional external ballast resistor can **not** be connected to units with internal ballast.
Switched-mode power supply	The switched-mode power supply supplies the controller with 5 V and 15 V, and is not designed for external loading. The switched-mode power supply is protected by a miniature 2A/medium time-lag/250V fuse. This fuse can only be accessed after dismounting the unit.

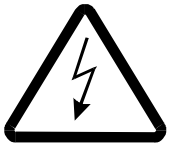
ZK+, ZK-

The terminals may not be connected to the intermediate circuits of other units. They are for checking the intermediate circuit voltage or for earthing if an isolating transformer is used, or for rapid discharging of the intermediate circuit.

Specified value of the intermediate circuit: U_{ZK} = 310 V ± 10 %

Discharging the intermediate circuit in t > 1 minute.

Rapid discharge of the intermediate circuit via resistor R = 22Ω / 50W, if necessary.



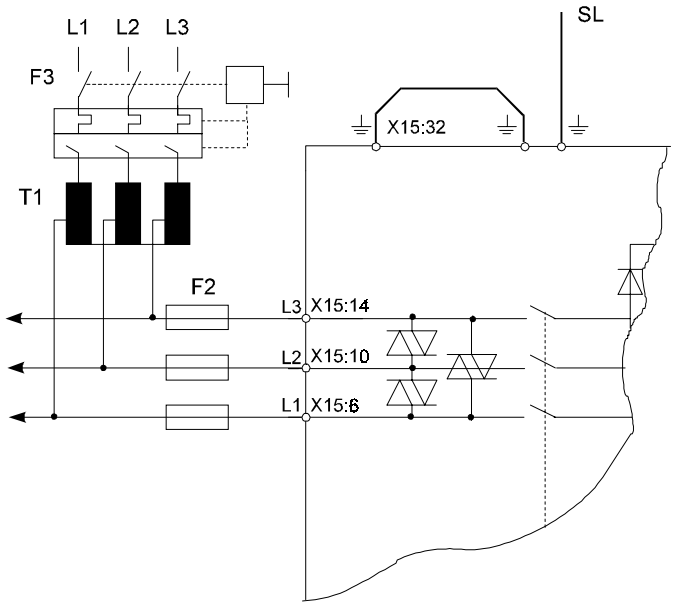
DANGER

The intermediate circuit is potential-charged when using auto-transformers.
The intermediate circuit is to be earthed to ZK- when using isolating transformers.

U, V, W

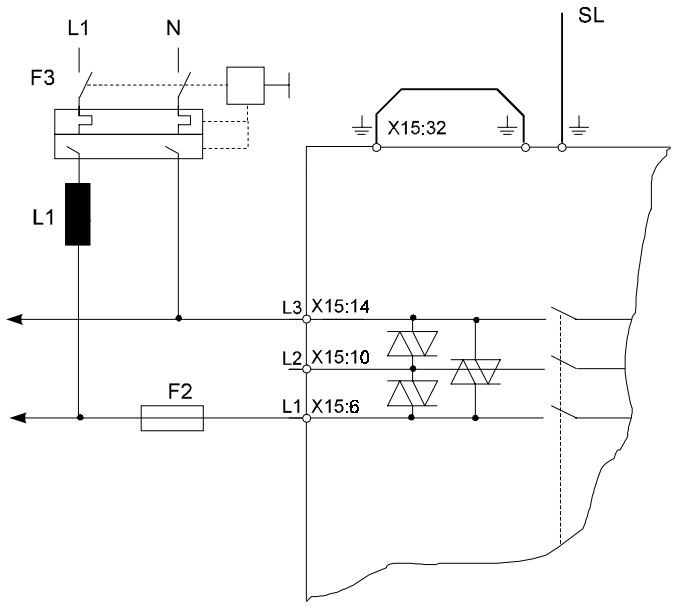
Motor terminals profile, according to VDE 0113/0298.
The cables are to be twisted and laid separately from the signal and control cables.
They need only be shielded if it is not possible to keep them separated from the signal cables, or when faults in the communication equipment are to be expected. In these cases, the motor cables are to be laid out shielded on both sides, and with low impedance. See EMC notes

3-phase terminal



F3	Cable protection according to VDE 0100. Slow fuse, 2..3 x transformer nominal current or motor circuit breaker (advantage: switch-off of all phases is always guaranteed)
F2	10 A slow fuses are provided for cable protection and protection of the input diodes.
T1	Transformer YNO or isolating transformer YNyO. On connection via transformer it should be noted that the intermediate circuit must not be earthed, and that potential is to be found in both the intermediate circuit and the motor. Connection voltage BUM 618/619: 230 V, + 6% ... -10%, 50/60Hz. Do not connect the star-point of the transformer to the mains neutral conductor "N". Short circuit voltage: auto-transformer $u_K \geq 2$ % isolating transformer $u_K \geq 4$ %
L1, L2, L3, ⏚	Connections to transformer T1. Profile according to VDE 0113/0298 To be laid separate from signal and control cables.

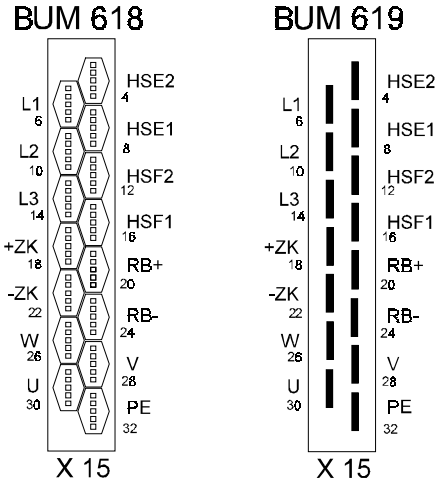
1-phase terminal



F3	Cable protection according to VDE 0100. Slow fuse, 2..3 x transformer nominal current or motor circuit breaker
F2	10 A slow fuses are provided for cable protection and protection of the input diodes.
L1	The transformer is not used when working with a single phase, thus a line reactance must be implemented as a filter.

5.6 Connector pin assignment

5.6.1 Power terminals



Isolated 6,3 mm tab connector.

- **L1, L2, L3, PE**

L1	X15:6
L2	X15:10
L3	X15:14
PE	X15:32

Transformer connections. The controller supply (switched-mode power supply) is connected directly to terminals L1 and L3 before the main contactor K1.

- **ZK+, ZK-**

ZK+	X15:18
ZK-	X15:22

These terminals are for checking the intermediate circuit voltage or for earthing if an isolating transformer is used, or for rapid discharging of the intermediate circuit.

- These terminals may not be connected to the intermediate circuits of other units.
- Rapid discharging of the intermediate circuits is only permissible via R ³ 22 Ω / 50 W.
- Discharge time of the intermediate circuit without rapid discharge t > 1 minute.
- The intermediate circuit is potential-charged when using auto-transformers.
  The intermediate circuit is to be earthed to ZK- when using isolating transformers.

Specified value of the intermediate circuit voltage: U_{ZK} = 310 V ± 10 %

- **U, V, W**

U	X15:30
V	X15:28
W	X15:26

The cables are twisted and laid separately from the signal and control cables.
See EMC notes.

- **RB+, RB-**

RB+	X15:20
RB-	X15:24

External ballast resistor connection. The ballast resistance value must be $\mathbf{R_B > 47\ \Omega}$. The ballast resistance rating complies with the expected braking energy.
An additional external ballast resistor can **not** be connected to units with internal ballast.

- **HSF 1 and HSF 2**

HSF 1	X15:16
HSF 2	X15:12

Main contactor enable: contact load 15 V 80 mA
ON: close external contact for enable
OFF: open external contact

- **HSE 1 and HSE 2**

HSE 1	X15:4
HSE 2	X15:8

Main contactor ON message: contact load 250 V_{AC} 125 V_{DC} 1 A (min. 50 mA)

5.6.2 BUM 618 control terminals

NOTE

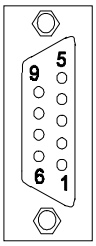
The insulation of the control terminals against power terminals is implemented according prEN 50178 and compies in the complete path with the demands of basic insulation.

The connection of SELV- and PELV-circiuts isn't allowed without an additional potential separation (basic insulation e.g. transformer, interface converter).

The control panels of connected potentiometers, switches etc. must have at least basic insulation against the electrical function parts.

- **RS 232 interface**

X3 SUB-D socket 9-pin

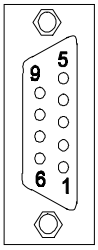


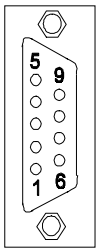
Pin no.	Assignment
1	not assigned
2	TxD RS232
3	RxD RS232
4	not assigned
5	earth RS232
6	+5 V RS232
7	reserved*
8	not assigned
9	not assigned

* do not assign

- **RS 485 interface**

X2 A SUB-D socket 9-pin **X2 B SUB-D plug 9-pin**

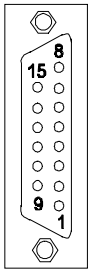




Pin no.	Assignment
1	-TxD RS485
2	+5V RS485
3	earth RS485
4	earth RS485
5	-RxD RS485
6	+RxD RS485
7	earth RS485
8	earth RS485
9	+TxD RS485

- **Resolver**

X4 SUB-D socket 15-pin



Pin no.	Assignment
1	resolver ref+
2	resolver ref-
3	not assigned
4	not assigned
5	resolver cos-
6	not assigned
7	resolver sin+
8	resolver sin-
9	resolver cos+
10	reserved*
11	reserved*
12	not assigned
13	not assigned
14	motor temperature TM1
15	motor temperature TM2

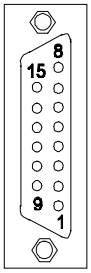
* do not assign !

NOTE

Connection for motor temperature (Pin no. 14, 15) see plug X8 motor temperature.

- **Incremental encoder**

X5 SUB-D socket 15-pin



Pin no.	Assignment
1	earth incremental encoder
2	+5V encoder voltage
3	RS422 incremental encoder +U0
4	RS422 incremental encoder -U0
5	RS422 incremental encoder +U2
6	not assigned
7	RS422 incremental encoder -U1
8	RS422 incremental encoder +U1
9	RS422 incremental encoder -U2
10	reserved*
11	reserved*
12	reserved*
13	reserved*
14	motor temperature TM1
15	motor temperature TM2

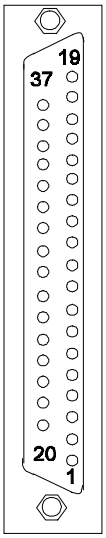
* do not assign !

NOTE

Connection for motor temperature (Pin no. 14, 15) see plug X8 motor temperature.

- **Analog/digital interface analog/digital**

X6 SUB-D socket 37-pin



Pin no.	Assignment
1	BSA analog reference potential
2	BSA analog reference potential
3	supply voltage + 5 V
4	supply voltage + 15 V
5	analog input 0 (pos)
6	reserved*
7	analog input 2 (pos)
8	BSA analog reference potential
9	BSA analog reference potential
10	BSA analog reference potential
11	analog output 2
12	pulse enable (pos)
13	digital input 0 (pos)
14	digital input 1 (pos)
15	digital input 2 (pos)
16	not assigned
17	bbo change-over relay contact, ready for use
18	bbk make relay contact, ready for use
19	bbs break relay contact, ready for use

Pin no.	Assignment
20	BSD digital reference potential
21	BSD digital reference potential
22	BSD digital reference potential
23	analog input 0 (neg)
24	reserved*
25	analog input 2 (neg)
26	BSA analog reference potential
27	reserved*
28	BSA analog reference potential
29	analog output 1
30	pulse enable (neg)
31	digital input 0 (neg)
32	digital input 1 (neg)
33	digital input 2 (neg)
34	not assigned
35	mo change-over relay contact message 1
36	mk make relay contact message 1
37	ms break relay contact message 1

* do not assign !

- **1 or 2 analog inputs (depend on model, see type code)**

Voltage range	- 10 V ... + 10 V
Type	differential input
Input resistance	approx. 60 kΩ
Resolution	10 bit

- **4 potential-free digital inputs**

Low-level	0 V (0V ... +5V)
High-level	+ 24 V (+11V ... +35V)
Input resistance	> 5 kΩ
Max. potential to electronic earth	50 V

- **2 analog output (optional)**

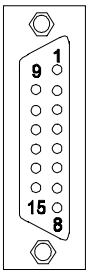
Voltage range	- 10 V ... + 10 V
max. output current	1 mA
Resolution	12 bit

- **Ready for use relay and programmable relay**

Contact can be loaded with	24 V DC / 1 A
Max. potential to electronic earth	50 V

- **Incremental encoder emulation -optional-**

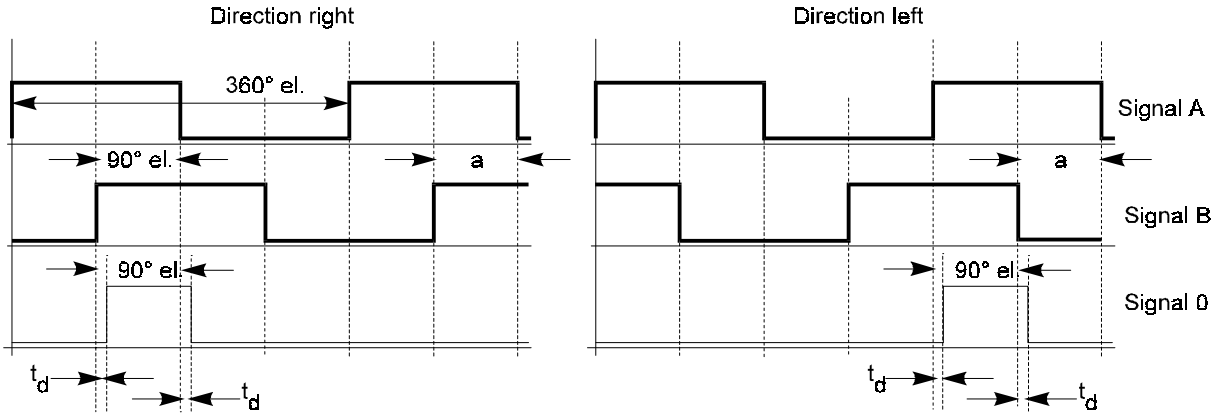
X7 SUB-D plug 15-pin



Pin no.	Assignment
1	earth inc. emulation
2	+ 5 V inc. emulation
3	inc. emulation 0
4	inc. emulation $\overline{0}$
5	inc. emulation B
6	not assigned
7	inc. emulation $\overline{A}$
8	inc. emulation A
9	inc. emulation $\overline{B}$
10	not assigned
11	not assigned
12	+ 5 V inc. emulation
13	earth inc. emulation
14	not assigned
15	not assigned

Supply voltage	5 V ± 5 %
Output signals Incremental encoder signals Reference signal	Generated via 1024 increments per revolution TTL rectangle impulses, A, B and theirs inverted impulses $\overline{A}$, $\overline{B}$ direction right impulse interval a ≥ 0.45 µs 1 rectangle impulse 0 per revolution and its inverted impulse $\overline{0}$ impulse 0 is delayed to signal A and B $t_d \leq 40$ ns
Signal level	$U_{High} \geq 2.5$ V if $-I_{High} = 20$ mA $U_{Low} \leq 0.5$ V if $I_{Low} = 20$ mA
Maximum load	$-I_{High} \leq 20$ mA $I_{Low} \leq 20$ mA $C_{Last} \leq 1000$ pF
Switching times	Rise time $t_+ \leq 100$ ns Delay time $t_- \leq 100$ ns

Output signal

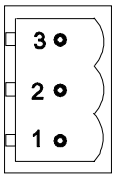


NOTE

Signals are valid after ready for use signal!

- **Motor temperature**

X8 Phoenix sub-unit terminal 3-pin RM 5

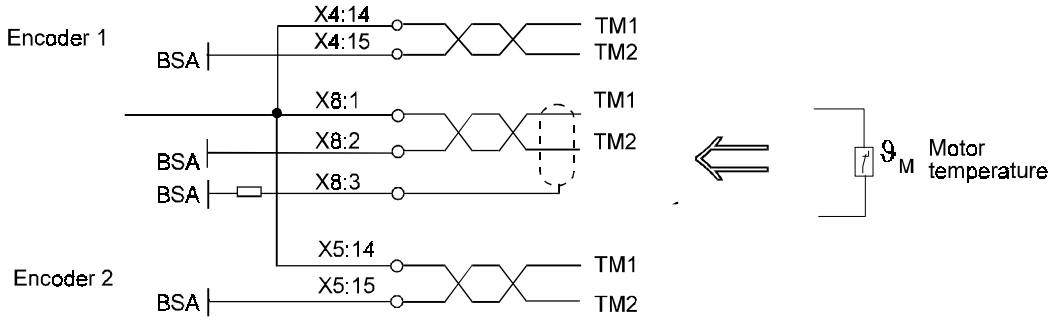


Pin no.	Assignment
1	motor temperature TM1
2	motor temperature TM2 (BSA)
3	BSA analog reference potential

The motor temperature connector X8 pin no. 1/2 is internally connected witch pin no. 14/15 of the encoder connectors X4/X5.

It is possible to use for the temperature monitoring 3 inputs (plug X4, X5 or X8). Only one input is allowed to be connected. The other inputs **must** be in any case not connected. The temperature sensor´s signals cann´t be used for an additional, external monitoring. This would be lead to a incorrect measurement or to the damage of internal components.

Check the temperature sensor:
The cable of the motor temperature monitoring must be disconnected. If the motor is cold (winding temperature < 80 °C) the resistance between the 2 connections must be lower than 1 kΩ.



5.6.3 BUM 619 control terminals BUM 619

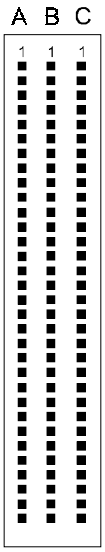
NOTE

The insulation of the control terminals against power terminals is implemented according prEN 50178 and compies in the complete path with the demands of basic insulation.

The connection of SELV- and PELV-circiuts isn't allowed without an additional potential separation (basic insulation e.g. transformer, interface converter).

The control panels of connected potentiometers, switches etc. must have at least basic insulation against the electrical function parts.

- **X1 push-on terminal strip 96-pin**



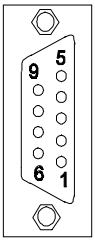
Pin no.	Assignment	Pin no.	Assignment	Pin no.	Assignment
A1	mk make relay contact message 1	B1	ms break relay contact message 1	C1	mo change-over relay contract message 1
A2	bbk make relay contact ready for use	B2	bbs break relay contact ready for use	C2	bbo change-over relay ready for use
A3	inc.-emulation $\overline{B}$	B3	inc.-emulation $\overline{0}$	C3	inc.-emulation B
A4	earth RS232	B4	TxD RS232	C4	RxD RS232
A5	+5 V RS232	B5	+TxD RS485	C5	+RxD RS485
A6	earth RS485	B6	-TxD RS485	C6	-RxD RS485
A7	+5 V RS485	B7	digital input 2 (pos)	C7	digital input 2 (neg)
A8	digital input 1 (pos)	B8	digital input 1 (neg)	C8	digital input 0 (pos)
A9	digital input 0 (neg)	B9	pulse enable (pos)	C9	pulse enable (neg)

Pin no.	Assignment	Pin no.	Assignment	Pin no.	Assignment
A10	inc. emulation A	B10	inc. emulation $\overline{A}$	C10	inc. emulation 0
A11	not assigned	B11	reserved*	C11	reserved*
A12	not assigned	B12	RS422 incremental encoder +U1	C12	RS422 incremental encoder -U1
A13	not assigned	B13	RS422 incremental encoder +U2	C13	RS422 incremental encoder -U2
A14	not assigned	B14	RS422 incremental encoder +U0	C14	RS422 incremental encoder -U0
A15	not assigned	B15	BSD digital reference potential	C15	+5V supply voltage
A16	not assigned	B16	+5V inc. emulation	C16	reserved*
A17	not assigned	B17	reserved*	C17	earth inc. emulation
A18	not assigned	B18	BSD digital reference potential	C18	reserved*
A19	not assigned	B19	reserved*	C19	reserved*
A20	not assigned	B20	resolver ref-	C20	resolver ref+
A21	not assigned	B21	resolver cos+	C21	resolver cos-
A22	not assigned	B22	resolver sin+	C22	resolver sin-
A23	not assigned	B23	reserved*	C23	reserved*
A24	not assigned	B24	reserved*	C24	reserved*
A25	not assigned	B25	temperature motor TM1	C25	reserved*
A26	BSA analog reference potential	B26	analog input 2 (pos)	C26	analog input 2 (neg)
A27	BSD digital reference potential	B27	reserved*	C27	reserved*
A28	BSA analog reference potential	B28	BSA analog reference potential	C28	analog input 0 (pos)
A29	supply voltage +15 V	B29	supply voltage +15 V	C29	analog input 0 (neg)
A30	supply voltage +5 V	B30	BSD digital reference potential	C30	reserved*
A31	supply voltage +5 V	B31	BSD digital reference potential	C31	analog output 2
A32	supply voltage +5 V	B32	BSD digital reference potential	C32	analog output 1

* do not assign!

- **RS 232 interface**

X6 SUB-D socket 9-pin



Pin no.	Assignment
1	not assigned
2	TxD RS232
3	RxD RS232
4	not assigned
5	earth RS232
6	+5 V RS232
7	reserved*
8	not assigned
9	not assigned

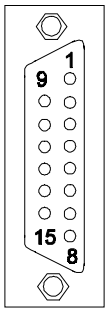
* do not assign!

5.7 Connection cable

5.7.1 Connection cables for the resolver/incremental encoder

Prepared cables are available for the connection of the resolver and the incremental encoder.
Item no. 1901 8001 (lengths on request).

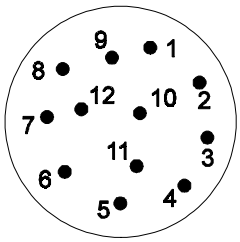
Unit



View of mating side

SUB-D plug connector, 15-pin

Motor



View of mating side

Metal round plug, 12-pin,
socket contact (manufacturer: Interconnectron)

Cable: LiYCY 5x(2x0.14)+2x0.5mm²; cores twisted in pairs, total shielding via copper braiding.

The cable shielding is connected to the casing of the round connector and with the shielding of the SUB-D plug connector.

Pin no.	Connection	Pin no.
1	blue Æ 0.5mm²	10
2	red Æ 0.5mm²	12
3	violet	3
4	grey/pink	4
5	brown	8
6		
7	grey	6
8	yellow	5
9	green	1
10		
11		
12	pink	2
13	blue	11
14	red	9
15	black	7

5.7.2 Serial PC connection cable

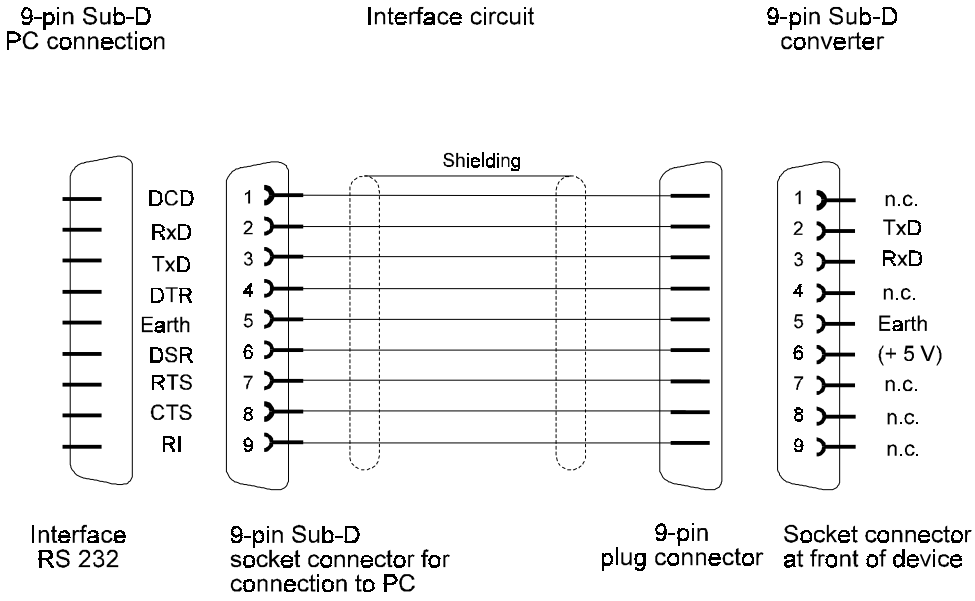
NOTE

Connect PC in cabinet or on isolation transformer.

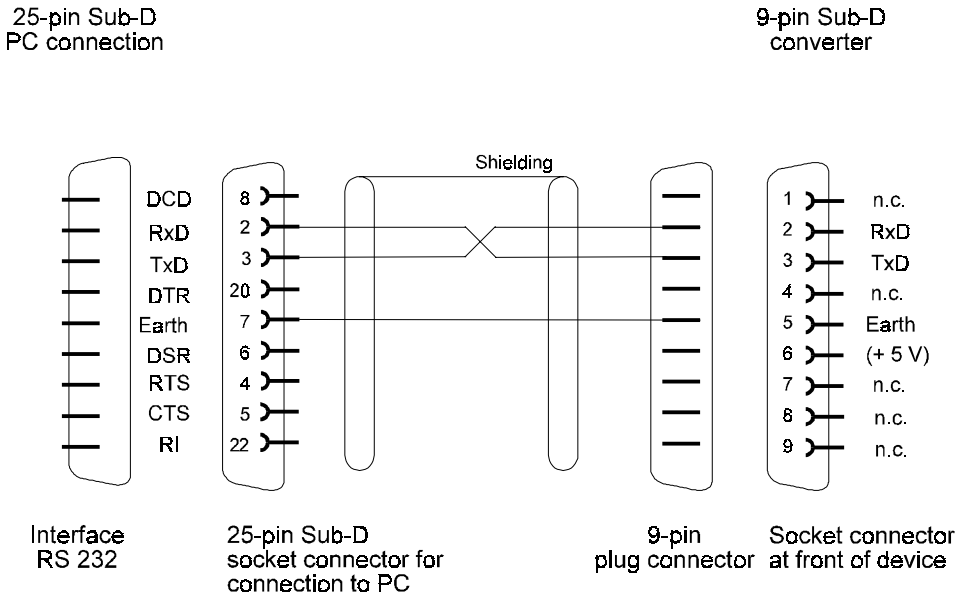
Description of operation software see operation manual operation software.

Description of transmission protocol see operation manual communication software.

- 9-pin PC connection (Part no. 1901 8006)



- 25-pin PC connection (not available)



5.7.3 Connection cable RS485

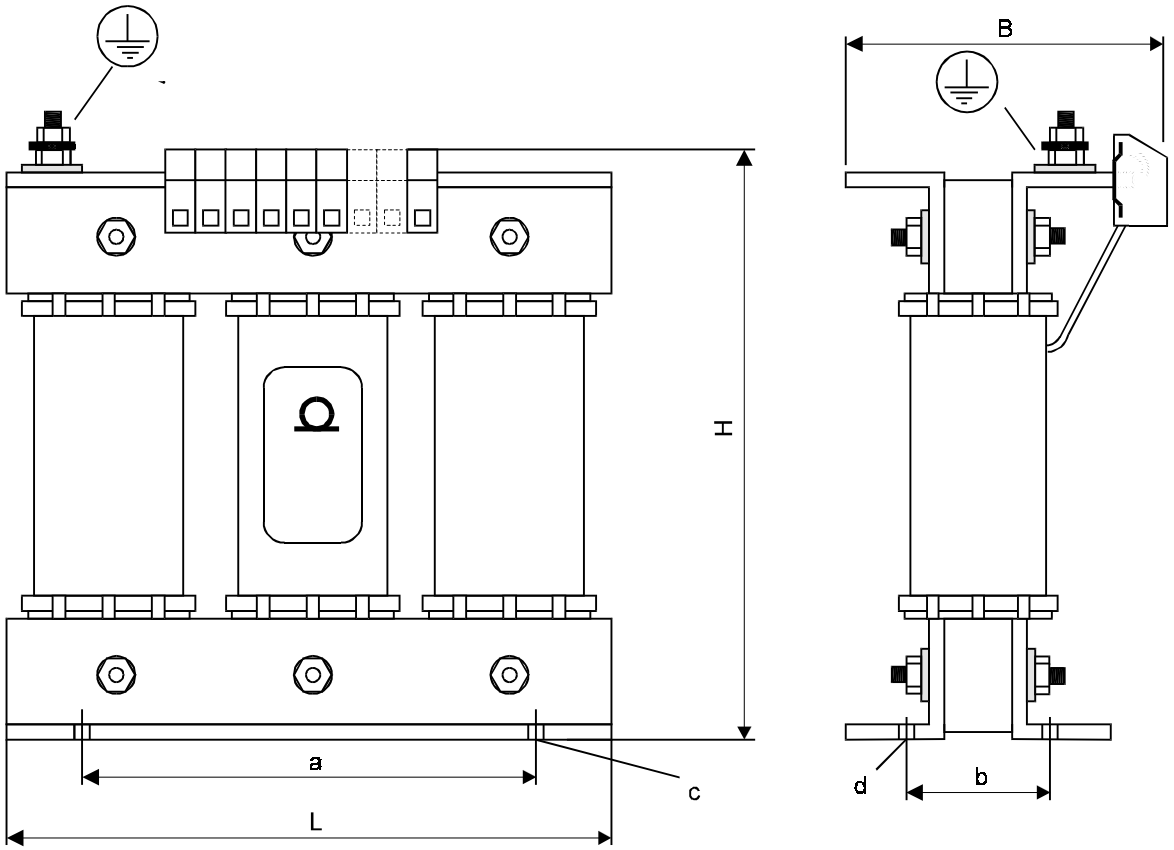
Connection cable and protocol see technical description and operation manual communication software.

5.8 Mains transformer technical data

Following transformers are recommended for the 3-phase operation on 400 V main.

Unit BUM 618/619 -	Auto-transf. part no.	Power (kVA)	Length L (mm)	Breadth B (mm)	Height H (mm)	Weight W (kg)	Attachment/hole a x b / c x d (mm)
4 / 6	19007159	0,4	150	75	130	4,2	113x48 5,8x11
6 / 9	19007160	1,0	180	110	175	7,5	136x56 7,0x14
12 / 18	19007161	2,5	204	140	200	15,0	175x85 7,0x14

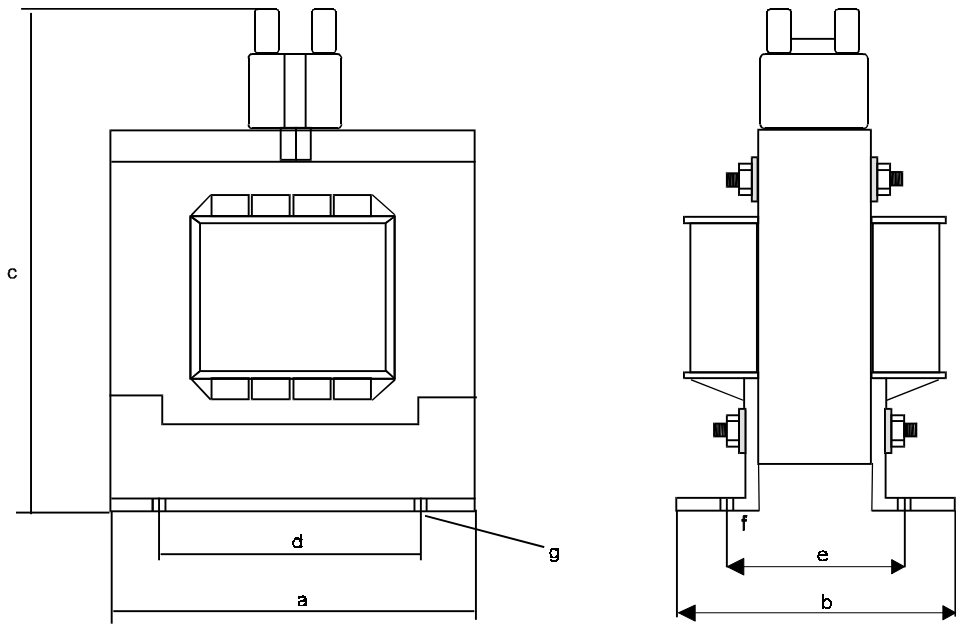
Unit BUM 618/619 -	Auto-transf. part no.	Power (kVA)	Length L (mm)	Breadth B (mm)	Height H (mm)	Weight W (kg)	Attachment/hole a x b / c x d (mm)
4 / 6	19007154	0,4	180	110	155	7,5	136x55 7x14
6 / 9	19007155	1,0	204	140	175	15,0	175x85 Æ 8,5
12 / 18	19007156	2,5	240	160	205	22,5	200x100 Æ 8,5



5.9 Line reactor technical data

For the single phase operation of the units BUM 618/619 - 4 / 6 und BUM 618/619 - 6 / 9 the following reactance is recommended.

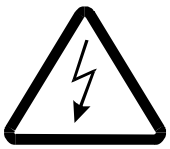
Part no. 1900 7461	**Single-phase line reactor DR1-22-3-0008**
Mains voltage	230 V
Nominal current	8.8 A
Frequency	50 / 60 Hz
Nominal voltage u_N	3 / 3.6 %
Max. Ambient temperature	55 °C
Weight	0.75 kg
Terminal type	terminal blocks
Dimensions	a = 67 mm b = 55 mm c = 81 mm d = 55 mm e = 41 mm f = 6 mm g = 4.5 mm



5.10 Accessories

			Part no.
• Encoder cable 12/15-pin (other lengths on request)			
X4 / X5 Resolver / incremental encoder			1901 8001
• PC cable (3 mtr.)			
X3	RS 232		1901 8006
• Bus cable			
X2	RS 485		1901 8026
• Plug set			1900 5512
containing:			
X6	SUB-D plug	Socket connector 37-pin Housing	
X15	15 flat terminal sockets	DIN 46247-6.3-2.5	
• Phoenix sub-unit terminal			
X8	Motor temperature recording	3-pin RM 5	1901 7596

6 COMMISSIONING



DANGER

Due to the nature of electrical equipment, certain parts of this unit carry dangerous voltage during operation. Serious injury and/or damage to property can result from non-compliance with these safety notes and warnings.

Only qualified personnel familiar with the safety instructions, and instructions regarding assembly, maintenance and operation are to work on this unit.

The user is responsible for the assembly of the converter power unit, the motor, the transformer and the other components according th applicable safety standards (e.g. VDE, DIN) and all other relevant national or local regulations regarding conductor dimensions and fusing, earthing, circuit breakers, overcurrent protection etc.

Relatively high leakage to earth occurs in the converter and the motor, i.e. the drive may be incompatible with residual current protective devices.
In operation, the unit is protected against direct handling in such a way that it is suitable for installation in enclosed electrical operating areas (DIN VDE 0558 part 1a, sect. 5.4.3.2.1 and 5.4.3.2.2).

Behaviour of the drive in the event of error
Faulty or uncontrolled drive and machine element movement can not be ruled out during initial commissioning. Hence special care must be taken.
Prior to activation of the drive, all safety features should be checked through in order to avoid personal injury. Particular care should be taken with direct or indirect handling of the drive-shaft. This is only permissible if the shaft is perfectly static and the current converter is in a voltage-free condition. Freelyy-accessible machine parts (shafts, blowert etc.) must be covered once in operation.

Whilst in use, electrical potential is present in the power circuit, the intermediate circuit and in the motor windings. Do not touch these components during operation. Only connect measuring equipment when no voltage or current is present.

Handling protection according to §4 Para. 4 VBG 4
Protection against direct handling encompasses all measures against hazards which can result from the handling of active electrical parts. It is essential that such acitve parts are protected against direct handling via insulation, type of construction, position and arrangement, or via sturdy reinforcement. This refers to the fact that covers, seals and procedure should ensure that personnel are not able to handle parts subjected to voltage.

WARNING

Control cabinets must be furnished with emergency stop buttons by which all potentially dangerous voltages may be de-activated. Excluded from this are operating media, through whose de-activation a new hazard may arise. The trigger for the emergency stop should be incorporated in such a way that, in the event of an emergency, it may be reached as soon as possible. Procedures involving a conderably greater danger necessitate the precence of an additional person.

The user is to ensure that no unauthorised persons work on the machine.

The user is obliged to immediately report any changes which may affect the safety of the machine.

On dismantling safety equipment during commissioning, repair and maintenance, the machine is to be shut down exactly according to instructions. After completion of commissioning, repair and maintenance work the safety equipment is to be reinstalled immediately.

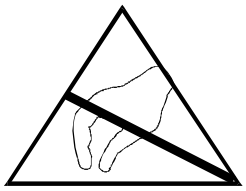
This list does not cover all necessary measures for the safe operation of the unit. If further information is required or if special problems arise, please contact BAUMÜLLER NÜRNBERG ar a retail outlet.

Comply with the warning notes in chapter 1 of the operational manual.

NOTE

The operator must be electrostatically discharged directly before handling the modules, to protect them from high voltages which result from electrostatic charge. This can be achieved by simply touching a conductive, earthed object.

Equipment with components or modules likely to be damaged by electrostatic charge are marked by a sticker in a visible spot.



6.1 Initial commissioning of the drive system

NOTE

Pay attention to following note before initial commissioning:

- Note down the type and no. of the unit and motor
- Check the terminals by means of the terminal diagram, in particular the motor windings terminal
- Setting of the drive address in binary code via DIP-switch on front plate.

Before the drive can be started with a specified speed value, activation of the external pulse enabling is required.

For this reason, it should be ascertained before commencing initial commissioning that the external pulse enabling is inhibited, and avoid uncontrolled starting of the motor.
It is assumed that the factory controller parameter settings are sufficiently accurate to give controlled, if not optimum, motor operation. Optimisation of these parameters will not be covered here.

Parameter settings can be made with a PC via the user program PCBASS.
A description of the user program PCBASS can be found in the separate operation manual operation software, the protocol is explained in the manual communication software.

To connect the PC and drive use the serial connection cable for PC (see accessories).

NOTE

Initialisation time of the controller is 20 s.

The following parameters are to be set, or checked:

1. Set ***M communication source*** to BASS protocol.
   M communication source = 1 ID no. 126

2. Match the number of motor ***pole pairs*** to the motor (see technical data motor).
   Mot no. of pole pairs ID no. 33

3. Match the ***motor nominal speed*** to the motor (see type code motor).
   Res nom. Speed parameter [rpm] ID no. 19
   or INC encoder nominal speed [rpm] ID no. 247

   NOTE

   Resolver pole pair number of the applied resolver must be 1.

4. Match the ***speed controller modulation limits*** to the motor nominal current (see type code motor).
   N M limiter parameters ID no. 53 bzw.
   [% of nominal current] ID no. 54, 55

5. If not known, set ***locating angle deviation*** (ID no. 35),
   taking heed of the "parameters" description, ID no. 122:

   - M control word = 0 ("inhibit voltage" command) ID no. 120
   - M spec. mode = -1 (locating angle reference point setting) ID no. 122
   - M control word = 6 ("shutdown" command) ID no. 120
   - M control word = 7 ("switch on" command) ID no. 120
   - M control word = 15 ("enable operation" command) ID no. 120

   If the external pulse enable is given at this point, the rotor sets itself to the locating position and the locating angle deviation is set automatically.

   NOTE

   The motor must be able to attain its locating position mechnanically free!

   Locating angle deviation setting is quit via:
   - *M control word* = 0 ("inhibit voltage" command) ID no. 120
   - *M spec. mode* = -3 (speed control) ID no. 122

   External pulse disable.
   In addition, save the determined locating angle - see data set administration.

6. Match ***EMF factor*** to the nominal speed
   CT EMF factor parameter ID no. 39.

$$\text{ID}-\text{Nr. } 39 = \frac{k_E\left[\frac{V}{1000\ \text{rpm}}\right] \bullet n_{nom}\left[1000\ \text{rpm}\right] \bullet 1.21 \bullet 100\ \%}{U_{zk}\left[V\right]}$$

$k_E\left[\frac{V}{1000\ \text{rpm}}\right]$ = to 1000 rpm refered EMF (see data of the motor)

$n_{nom} = \frac{\text{ID no. } 19}{1000}$ (see data of the motor)

$U_{ZK} = 310\ V$

   EMF factor can be checked with the help of parameter ID no. 52 (N M specified value).

   If the motor is driven with nominal speed and with no load, then:

   a) the polarity of ID no. 52 and ID no. 51 (N actual value) should be the same
      (otherwise reduce ID no. 39) and

   b) do not exceed the value of ID no. 52 5 % ± 3 %
      (otherwise adjust ID no. 39).

7. ***Current controller*** setting :
   - I P gain = 1 ID no. 80
   - I integral action time = 1.5 ms ID no. 81

8. Parameter assignment to the ***ramp function generator***:
   - RFG input selection = 0 ID no. 13
   - RFG ramp-up time 1 e.g. set to 1 s ID no. 3
   - RFG ramp-down time 1 e.g. set to 1 s ID no. 10

9. Set the ***set speed value*** to 0:
   - RFG Input 1 = 0 ID no. 2

10. Enable **drive manager**:
    - M control word = 0 ("inhibit voltage" command) ID no. 120
    - M spec. mode = -3 (speed control) ID no. 122
    - M control word = 6 ("shutdown" command) ID no. 120
    - M control word = 15 ("release mode" command) ID no. 120

13. Switch on external pulse enable and set ***speed value***:
    - RFG input 1 e.g. 10 % nominal speed ID no. 2

14. Correct communication source
    - M communication source ID no. 126

      The communication source must be set to the active communication source. If there is no communication (stand-alone mode), the parameter must be set to "= 0".

15. Save parameter settings ***(data set management)***
    - DSM command = 0 ID no. 190
    - DSM command = 5 ID no. 190

After external pulse enabling and input of a set speed value the motor runs according to the set acceleration slope.

6.2 Commissioning the set value generator

The set value generator creates a specified speed value for each of 4 time intervals. Both time and speed can be selected.
After expiry of the last time zone the first one starts again.

Apart from the external enabling of the main contactor and pulse enabling, corresponding parameter assignment of the unit with the help of the operation software is required for commissioning the set value generator. This setting can be saved in the unit.

1. Parameter assignment to the ***drive manager***:
   - M control word = 0 ("inhibit voltage" command) ID no. 120
   - M spec. mode = -3 (speed control) ID no. 122
   - M control word = 6 ("shutdown" command) ID no. 120
   - M control word = 15 ("enable operation" command) ID no. 120

2. Parameter assignment to the ***set value generator***:
   - Enter SVG target ID no. ID no. 140
   - Enter SVG amplitudes ID no. 142 - 145
   - Enter SVG times ID no. 146 - 149

3. Match ***input selection***:
   - Match the SVG *input selection* with the input set to ID no. 140 ID no. 13

4. Save parameter settings ***(data set management)***
   - DSM command = 0 ID no. 190
   - DSM command = 5 ID no. 190

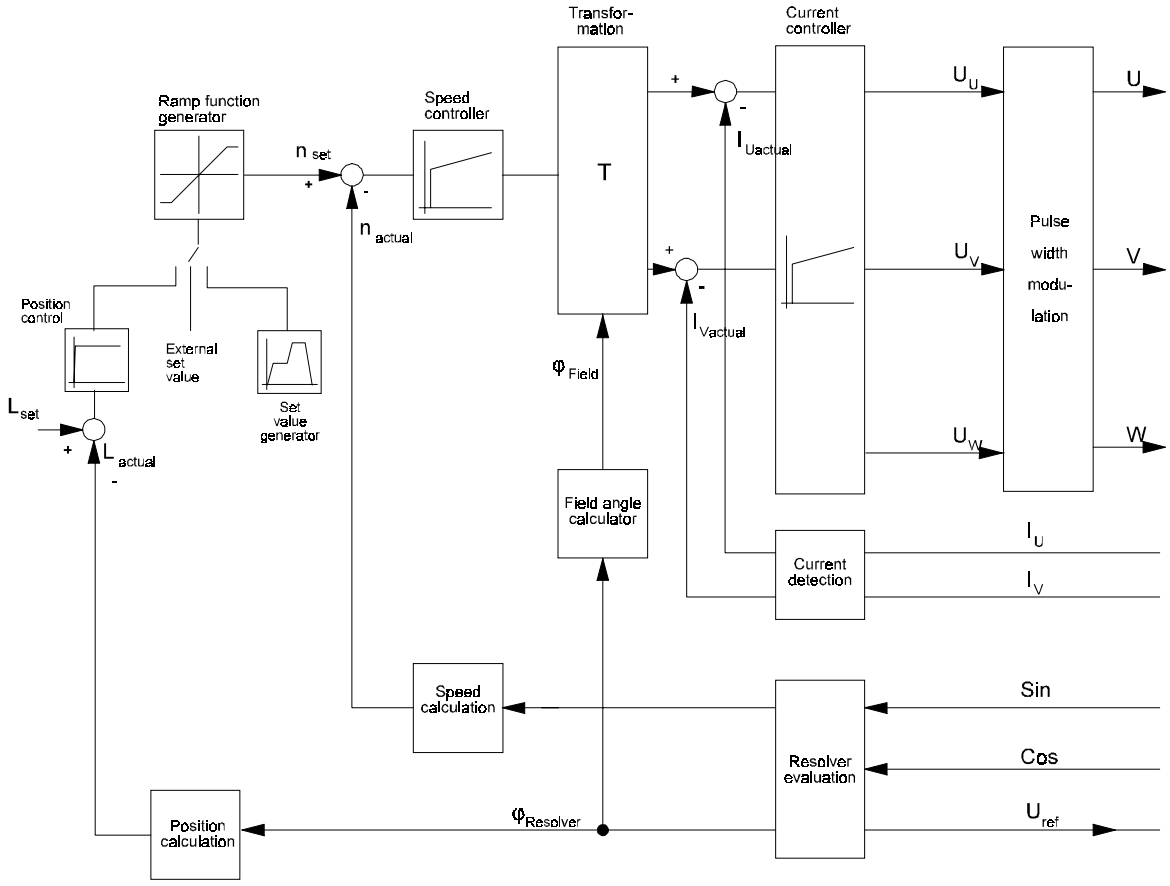
If the controller is enabled, it begins to process the specified speed values and their corresponding times cyclically.

7 PARAMETERS

NOTE

All important parameters for commissioning are to be located in grey boxes of the parameter overview section. Parameters, which are stored during an Init auto (see additional description operation software) and are not refered to here, serve only internal functions.

7.1 Function diagram



Overview of the individual function modules

Ramp function generator	RFG	ID no. 1 - 17	Resolver evaluation	Res	ID no. 19 - 29
Field angle calculation	Mot	ID no. 30 - 36	Transformation of coordinates	CT	ID no. 39 - 46
Speed controller	N	ID no. 50 - 62	Current control	I	ID no. 70 - 87
Overlaod monitoring	I2t	ID no. 88 - 93	Current monitoring	Ext	ID no. 94 - 99
Pulse width modulation	PWM	ID no. 100 - 103	Power supply	PS	ID no. 110
Power unit	PU	ID no. 115 - 117	Drive manager	M	ID no. 120 - 133
Specified value generator	SVG	ID no. 140 - 150	Motor temperature	MT	ID no. 151 - 152
Operation system	OS	ID no. 160 - 163	Service interface	S	ID no. 170 - 171
Link to USS protocol	USS	ID no. 180 - 186	Data set management	DSM	ID no. 190 - 196
Position control	L	ID no. 200 - 213	Incremental encoder	IE	ID no. 240 - 248
Analog inputs	AI	ID no. 277 - 304	Analog outputs	AO	ID no. 330 - 341
Digital inputs	DI	ID no. 370 - 382	Relay output	RO	ID no. 393 - 396

Explanation of the module state

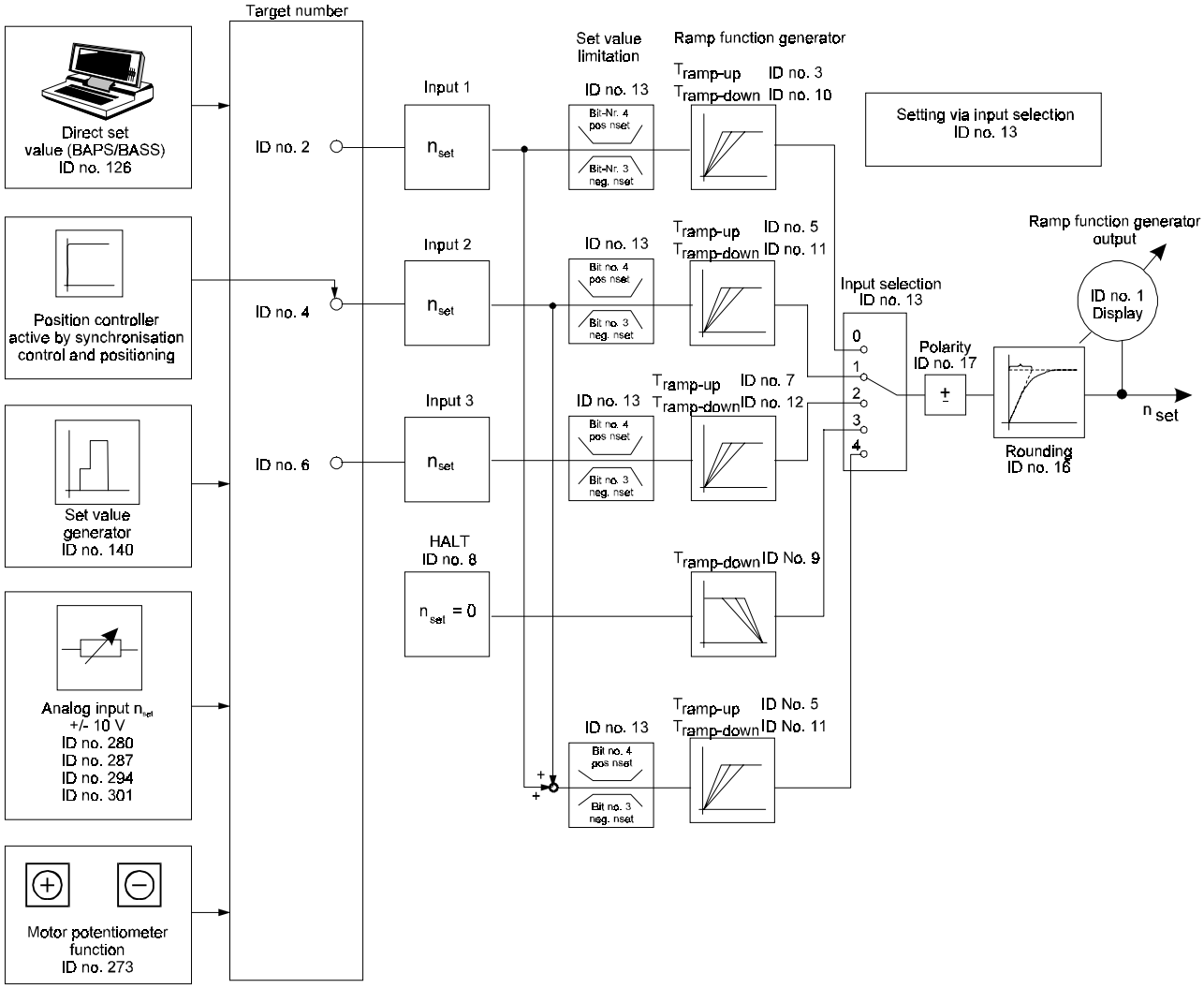
The status (bit no. 0 ... 2) displays the operational mode of the function modules

STOP	Function module swiched off
RUN	Function module swiched on
LINE	Function module switched through (i.e. the input is written directly to the output)
STAND_BY	Function module is ready to use (e.g. calibrations active, internal specified values of the function module are only actualized but not operated with)

7.2 Ramp function generator (ID no. 1 - 17)

Function:

The ramp function generator manages the 4 set value inputs, which can alternatively be switched to the output. The ramp-up and ramp-down times can be set separately for each input.
All inputs and the ramp function generator output are standardised to the nominal speed as relative variables (± 100 %), where the nominal speed is set via ID no. 19.
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.
With the exception of the fourth set speed value, which is programmed to zero, every input can have a speed value between -100 % and + 100 %. 100 % corresponds to the nominal speed.



Parameter overview:

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
1	RFG **output**	-100.00 ... 100.00	%		5
2	RFG **input 1**	-100.00 ... 100.00	%	0.00	
3	RFG **ramp-up time 1**	0.001 ... 60.000	s	0.001	
4	RFG **input 2**	-100.00 ... 100.00	%	0.00	
5	RFG **ramp-up time 2**	0.001 ... 60.000	s	0.001	
6	RFG **input 3**	-100.00 ... 100.00	%	0.00	
7	RFG **ramp-up time 3**	0.001 ... 60.000	s	0.001	
8	RFG **input halt**	0.00	%	0.00	5
9	RFG **time halt**	0.001 ... 60.000	s	2.000	
10	RFG **ramp-down time 1**	0.001 ... 60.000	s	0.001	
11	RFG **ramp-down time 2**	0.001 ... 60.000	s	0.001	
12	RFG **ramp-down time 3**	0.001 ... 60.000	s	0.001	
13	RFG **input selection**	0000 ... 001C		0000	
14	RFG **status**	0000 ... FFFF			5
15	RFG **halt**	0 ... 1		0	
16	RFG **rounding**	0 ... 60000	ms	0	
17	RFG **polarity**	0 ... 1		0	

Parameter description

1 RFG **output**
The parameter "RFG output" displays the current output value of the ramp function generator.

2 RFG **input 1**
4 RFG **input 2**
6 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.

8 RFG **input halt**
Input 4 has the special function HALT, i.e. its value is always 0 %. This input is used to control the function HALT (i.e. speed = 0). Hence only the ramp-down time can be set.

3 RFG **ramp up time 1**
5 RFG **ramp up time 2**
7 RFG **ramp up time 3**

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

10 RFG **ramp-down time 1**
11 RFG **ramp-down time 2**
12 RFG **ramp-down time 3**
9 RFG **time halt**

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

13 RFG **input selection**

One of the four inputs of the ramp function generator can be selected via input selection. Additionally a set value limitation is possible.

Bit no.	Meaning
0 ... 2	000: input 1 001: input 2 010: input 3 011: halt 100: input 1 + input 2
3	1: negative set values not permitted
4	1: positve set values not permitted
5 ... 15	reserved

14 RFG **status**

Displays the internal function module state.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in function module, error code see M error code (ID no. 124)
4	1: RFG output is set internally to 0 (RFG_LOCKED)
5	1: RFG was stopped on the ramp (RFG_STOP)
6	1: RFG input is set internally to set value 0 (RFG_ZERO)
7	1: rapid-halt ramp is active (RFG_RHALT)
8	1: ramp-up procedure is active
9	1: ramp-down procedure is active
10	See bit no. 5
11	See bit no. 7
12	1: RFG output = RFG input (set value reached)
13 ... 15	reserved

15 RFG **halt**

On activation of "halt", the motor decelerates to speed 0 according to the ramp set for the input "halt".

Value	Meaning
0	inactive
1	active

16 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.

17 RFG **polarity**

A polarity reversal of the set value can be set via this parameter.

Value	Meaning
0	no polarity reversal
1	polarity reversal

7.3 Resolver evaluation (ID no. 20 - 29)

Function

This module calculates the current speed and the rotor angle of the motor from the resolver input signals.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
19	Res **nominal speed**	1000 ... 4000	rpm	3000	
20	Res **sine**	- 1.0000 ... + 1.0000			5
21	Res **cosine**	- 1.0000 ... + 1.0000			5
22	Res **phi mechanical**	0.0 ... 360.0	degrees		5
23	Res **N actual value**	-4000 ... 4000	rpm		5
24	Res **no. of pole pairs**	1 ... 1		1	5
25	Res **status**	0000 ... FFFF			5
26	Res **offset sine**	- 10000 ... 10000			5
27	Res **offset cosine**	- 10000 ... 10000			5
28	Res **phase reference**	- 45.0 ... 45.0	degrees		5
29	Res **compensation status**	0000 ... FFFF			5
107	Res **N = 0**	0.5 ... 20.0	%	0.5	
108	Res **N > Nx ON**	0.00 ... 200.00	%	0.00	
109	Res **N > Nx OFF**	0.00 ... 200.00	%	0.00	

Parameter description

19 Res **nominal speed**

The nominal speed of the motor is set via this parameter. The value entered here corresponds of 100 % speed. This parameter cannot be changed in the state OPERATION ENABLED.

20 Res **sine**

21 Res **cosine**

These parameters display the current sine/cosine trace values of the resolver.

22 Res **phi mechanical**

23 Res **N actual value**

The current mechanical rotor angle and the motor speed are calculated from the resolver signals.

24 Res **no. of pole pairs**

The number of resolver pole pairs are set here.

25 Res **status**

This parameter shows the internal status of the module.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in module, for error code see M error code (ID no. 124)
4 ... 9	reserved
10	0: | N acutal value | ≠ 0 1: | N acutal value | = 0 (speed lower than ID no. 107)
11	0 → 1: | N acutal value |>Nx ON (ID no. 108) 1 → 0: | N acutal value |<Nx OFF (ID no. 109)
12	reserved
13	Limit value reached
14, 15	reserved

26 Res **offset sine**

27 Res **offset cosine**

An asymmetry in the recording of resolver output signals can be compensated for by these values.

They are calculated automatically on switching on the unit.

28 Res **phase reference**

The phase shift between the resolver oscillator frequency and the sampling time for the resolver outputs can be set via this parameter.

The measured value transfer must always be maximum. Compensation takes place automatically during use.

29 Res **compensation status**

The internal status of the resolver compensation is displayed via this parameter.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in module
3 ... 15	reserved

107 Res **N = 0**

Bit no. 10 at function module status is set if the N actual value is lower than limitation N = 0 (ID no. 7), independent of rotational direction.

108 Res **N > Nx ON**

109 Res **N < Nx OFF**

If the |actual value of N| (ID no. 51) is greater than ID no. 108, bit 11 in the Res status (ID no. 25) is set and only erased when the actual value of N becomes smaller than ID no. 109 (independent of rotational direction).

7.4 Field angle calculation (ID no. 30 - 36)

Function

The electrical field angle is calculated in this module from the no. of motor pole pairs and the angle precontrol as well as the mechanical rotor angle (see resolver evaluation).

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
30	Mot **phi mechanical**	0.0 ... 360.0	degrees		5
32	Mot **phi electrical**	0.0 ... 360.0	degrees		5
33	Mot **no. of pole pairs**	1 ... 3		3	
34	Mot **rotating field**	0 ... 1		1	
35	Mot **locating angle**	0.0 ... 360.0	degrees	330	
36	Mot **status**	0000 ... FFFF			5

Parameter description

30 Mot **Phi-mechanisch**
Displays the mechanical rotor angle determined from the resolver evaluation module.

32 Mot **phi electrical**
Displays the calculated electrical field angle.

33 Mot **no. of pole pairs**
Setting of the no. of pole pairs of the applied motor.

34 Mot **rotating field**
This parameter matches the control to the rotating field of the motor.

Value	Meaning
0	motor with anti-clockwise rotating field
1	motor with clockwise rotating field

35 Mot **locating angle**

This parameter displays the locating angle deviation calculated in the locating position reference point setting mode.

This correction value is included in the calculation so that an angle of 90 degrees results electrically in the locating position.

36 Mot **status**

This parameter displays the module status.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3 ... 15	reserved

7.5 Transformation of coordinates (ID no. 39 - 46)

Function

Transformation of a current vector into a three-phase system.
Depending on the value and angle input data, three phase-current set values, shifted by 120 degrees, are created.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
39	CT **EMF factor**	0.00 ... 100.00	%	65.00	
40	CT **M set value**	- 100.00 ... + 100.00	%		5
41	CT **phi electrical**	0.0 ... 360.0	degrees		5
42	CT **I set value U**	- 2048 ... + 2048			5
43	CT **I set value V**	- 2048 ... + 2048			5
44	CT **I set value W**	- 2048 ... + 2048			5
45	CT **I controller adaptation**	1.00 ... 1.30		1.00	
46	CT **status**	0000 ... FFFF			5

Parameter description

39 CT **EMF factor**

This parameter displays the EMF value of the motor.

$$\text{ID no. 39} = \frac{k_E\left[\frac{V}{1000\ rpm}\right] \bullet n_{nom}\,[1000\ rpm] \bullet \sqrt{2} \bullet 100\ \%}{U_{zk}\,[V]}$$

$k_E\left[\frac{V}{1000\ rpm}\right]$ = to 1000 rpm related EMF (see technical data of the motor)

$n_{nom} = \frac{\text{ID no. 19}}{1000}$ (see technical data of the motor)

U_{ZK} = 310 V

EMF factor can be checked with the help of parameter ID no. 52 (N M set value).

If the motor is driven with nominal speed and with no load, then:

a) the polarity of ID no. 52 and ID no. 51 (N actual value) should be the same (otherwise reduce ID no. 39) and

b) do not exceed the value of ID no. 52 5 % ± 3 % (otherwise adjust ID no. 39).

Example

Motor DS45S-3000 (Data see appendix 9.1 Suitable 3-phase servo motors)

$k_E \left[\frac{V}{1000\ rpm}\right] = 45.0 \left[\frac{V}{1000\ rpm}\right]$

$n_{nom} = 3\ [1000\ rpm]$

$U_{ZK} = 310\ V$

$$ID-Nr.\ 39 = \frac{45.0 \left[\frac{V}{1000\ rpm}\right] \bullet 3\ [1000\ rpm] \bullet 1.21 \bullet 100\ \%}{310\ [V]} = 52.7\ \%$$

40 CT **M set value**

The parameter displays the amplitude of the set torque value (speed controller output).

41 CT **phi electrical**

The parameter displays the electrical field angle of the rotating field determined from the field angle calculation module.

42 CT **I set value U**

43 CT **I set value V**

44 CT **I set value W**

These parameters display the calculated present set current values of the respective phases.

45 CT **I controller adaption**

These parameters can be used for optimizing the tarque constant.

46 CT **status**

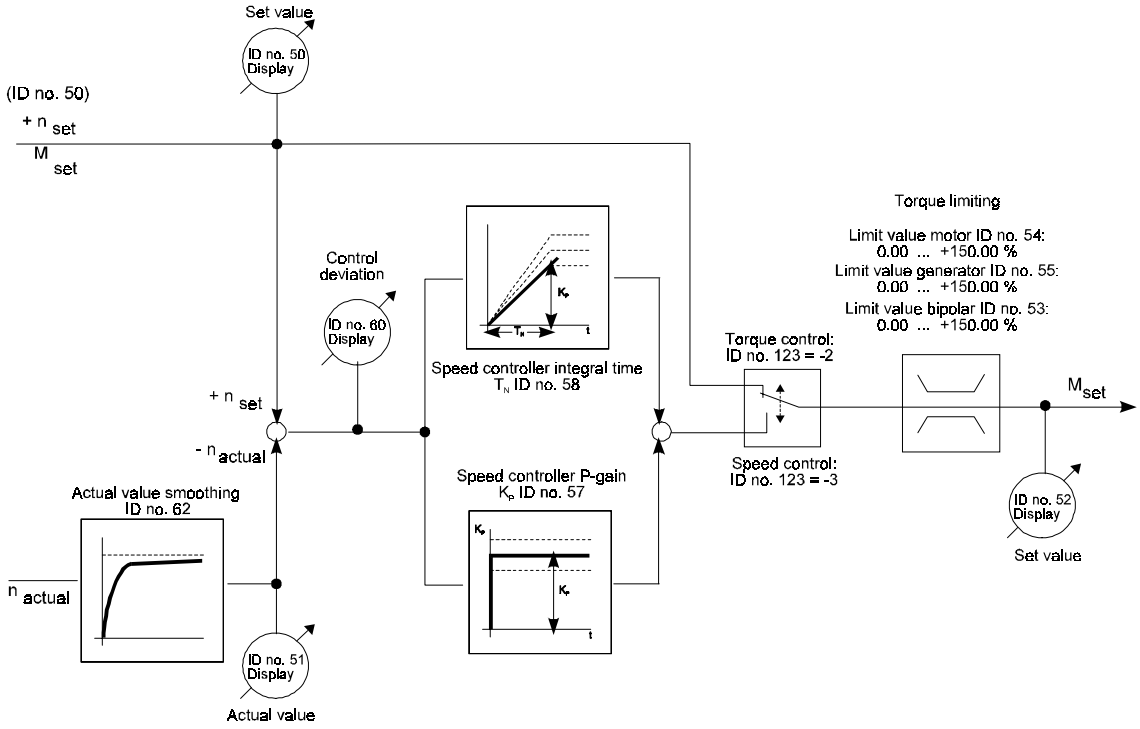
This parameter displays the internal function module status.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3 ... 15	reserved

7.6 Speed controller (ID no. 50 - 62)

Function

The speed controller takes the form of a PI-controller. The control variable limits and a configurable filter for the actual speed value are contained in the function module.



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
38	N **M limiter type**	0 ... 1		0	
50	N **set value**	-100.00 ... +100.00	%	0.00	
51	N **actual value**	-200.00 ... +200.00	%		5
52	N **M set value**	-150.00 ... +150.00	%		5
53	N **M limiter bipolar**	0.00 ... +150.00	%	70.00	
54	N **M limiter Mot/MR1**	0.00 ... +150.00	%	100.00	
55	N **M limiter Gen/MR2**	0.00 ... +150.00	%	100.00	
56	N **cycle time**	125 ... 6000	µs		
57	N **P-Gain**	1 ... 127		5	
58	N **integral action time**	1.0 ... 250.0	ms	50.0	
59	N **status**	0000 ... FFFF			5
60	N **control deviation**	-200.00 ... +200.00	%		5
61	N **limiter control deviation**	0.00 ... 200.00	%	100.00	
62	N **actual value smoothing**	0 ... 20	ms	1	

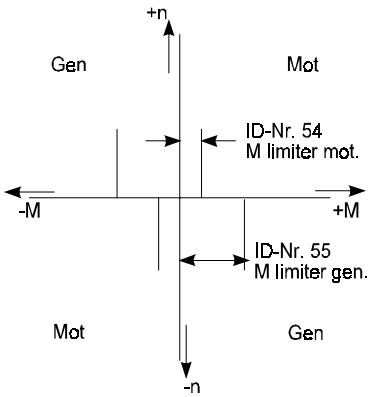
Parameter description

38 N **M limiter type**

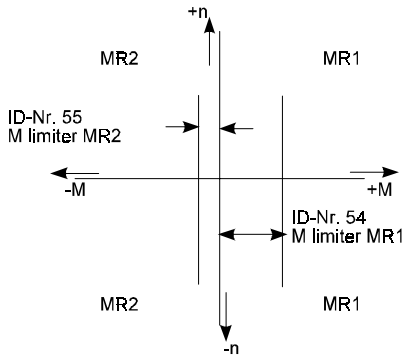
The type of torque limiter can be switched between motor/generator and torque direction MR1/MR2 via this parameter.

Value	Meaning
0	torque limiter mot/gen
1	torque limiter MR1/MR2

Torque limiter mot/gen



Torque limiter MR1/MR2



50 N **set value**

This parameter displays the standardised set speed value of the motor, in rpm, which was calculated by the ramp module. Alternatively, a set speed value can be entered directly.

51 N **actual value**

The speed controller actual value is the filtered speed signal from the resolver evaluation module. The filter is assigned parameters via the parameter "filter for the actual speed value".

52 N **M set value**

The torque set value displays the speed controller output (+100 % ⇔ output nominal current $\hat{i}_N$).

53 N **M limiter bipolar**
54 N **M limiter mot/MR1**
55 N **M limiter gen/MR2**

The control value is symmetrically limited with the bipolar limiter. From the bipolar, mot/MR1 and gen/MR2 limiters, the respective smaller value is valid. If the I²t power unit monitoring operates, the torque limiters are internally restricted to 100 %. During the limitation bit no. 13 in N status is set.

56 N **cycle time**

This parameter displays the cycle time of the speed controller.

57 N **P-gain**

This parameter sets the proportional gain (K_p) of the speed controller.

58 N **integral action time**

These parameters set the integral action time (T_N) of the speed controller.

59 N **status**

This parameter displays the speed controller status.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in module, error code see ID no. 124
4 ... 9	reserved
10	0: motor mode 1: generator mode
11	0: torque direction MR1 1: torque direction MR2
12	1: set value reached (control deviation < limiter control deviation (ID no. 61))
13	1: control value reached
14 ... 15	reserved

60 N **control deviation**
This parameter displays the present speed control deviation.

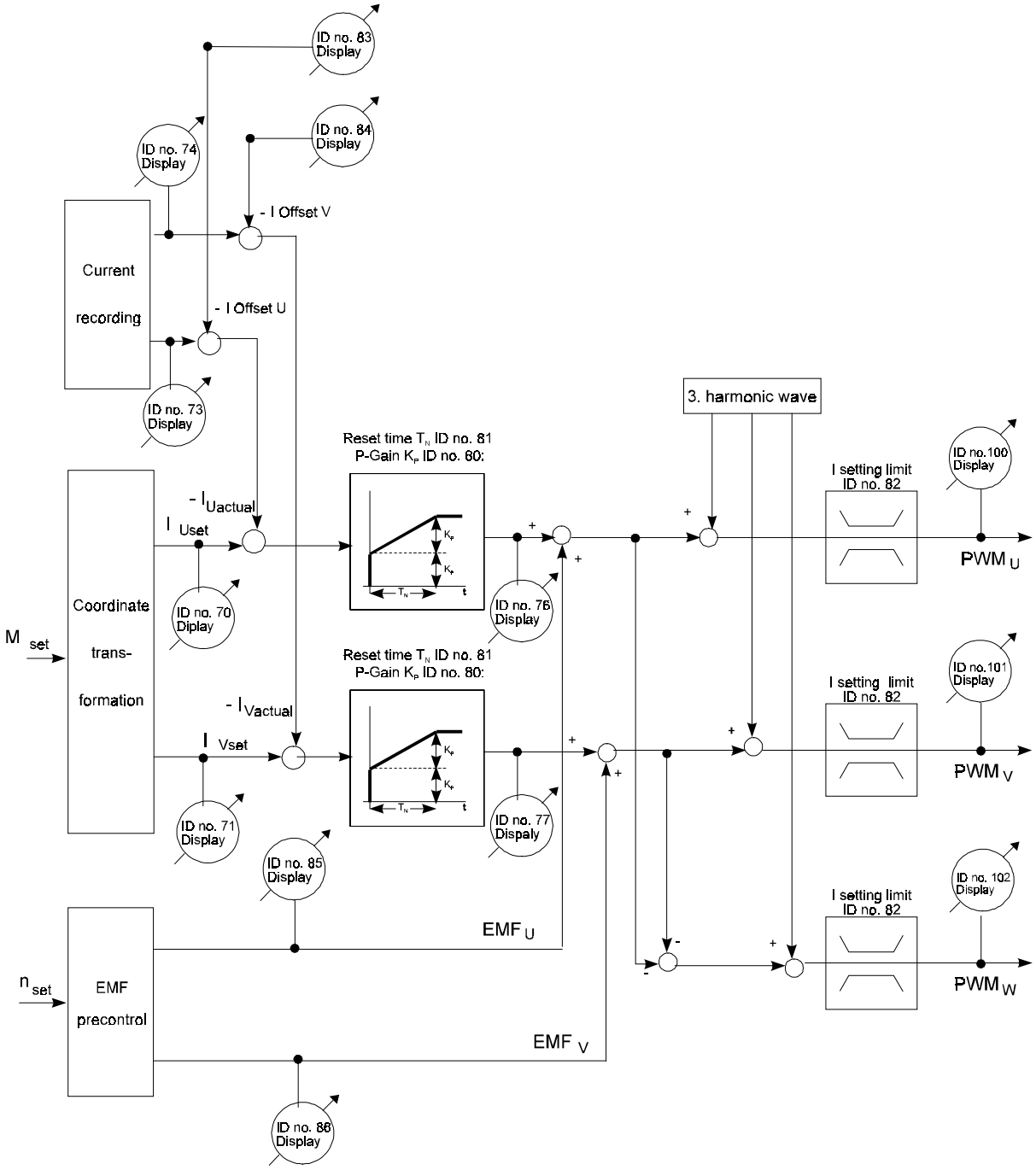
61 N **limiter control deviation**
If the value falls below the maximum control deviation set by this parameter, the module transmits a message (set in bit no. 12 in N status, ID no. 59).

62 N **actual value smoothing**
To prevent disturbance of the actual speed value, a smoothing feature can be introduced via this parameter.

7.7 Current controller (ID no. 70 - 87)

Function

The current controller sets the predetermined coordinate transformation current by controlling the Pulse Width Modulation.



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
70	I **set value U**	- 2048 ... + 2048			5
71	I **set value V**	- 2048 ... + 2048			5
72	I **set value W**	- 2048 ... + 2048			5
73	I **actual value U**	- 4096 ... + 4096			5
74	I **actual value V**	- 4096 ... + 4096			5
75	I **actual value W**	- 4096 ... + 4096			5
76	I **control value U**	- 2048 ... + 2048			5
77	I **control value V**	- 2048 ... + 2048			5
78	I **control value W**	- 2048 ... + 2048			5
79	I **status**	0000 ... FFFF			5
80	I **P gain**	0.1 ... 13.8		0.5	
81	I **integral action time**	0.3 ... 890.0	ms	3.0	
82	I **control limiter**	0.0 ... 100.0	%	100.0	
83	I **offset U**	- 256 ... + 256			5
84	I **offset V**	- 256 ... + 256			5
85	I **EMF offering U**	- 2048 ... + 2048			5
86	I **EMF offering V**	- 2048 ... + 2048			5
87	I **EMF offering W**	- 2048 ... + 2048			5

Parameter description

70 I **set value U**
71 I **set value V**
72 I **set value W**

I set value U and I set value V display the set current values calculated by coordinate transformation. I set value W results from the sum of all current equal to 0.

$I_{set\ value\ W} = -(I_{set\ value\ U} + I_{set\ value\ V})$.

Calibration:
+2048 ⇔ 100 % nominal output current $\hat{I}_N$
0 ⇔ 0 % nominal output current $\hat{I}_N$
-2048 ⇔ -100 % nominal output current $\hat{I}_N$

73 I **actual value U**
74 I **actual value V**
75 I **actual value W**

I actual value U and I actual value V display current recorded by the current converters. I set value W results from the sum of all current equal to 0,
$I_{set\ value\ W} = - (I_{set\ value\ U} + I_{set\ value\ V})$. Calibration see set value calibration.

76 I **control value U**
77 I **control value V**
78 I **control value W**

I control value U and I control value V display the current controller output of phases U and V. I control value W is calculated from $I_W = - (I_U + I_V)$.

79 I **status**

This parameter displays the internal module status.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3 ... 15	reserved

80 I **P gain**

The proportional gain (k_p) of the current controllers is set by this parameter.

81 I **integral action time**

This parameter sets the integral action time (T_N) of the current controllers.

82 I **control limiter**

The parameter displays the maximum modulation of the Pulse Width Modulation.

83 I **offset U**
84 I **offset V**

In order to compensate for the offset of the applied current converter, the current converter is balanced to zero after every pulse inhibit and the offset value is displayed under this parameter.

85 I **EMF offering U**
86 I **EMF offering V**
87 I **EMF offering W**

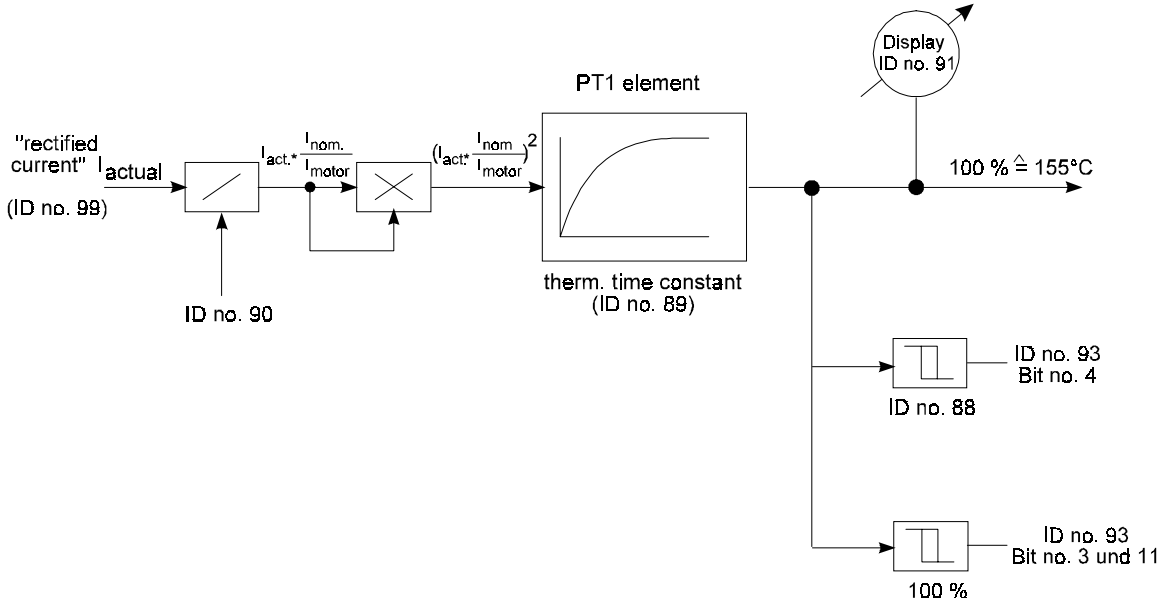
These parameters display the set voltage value under consideration of an EMF factor (see parameter ID no. 39).

7.8 Overload monitoring (ID no. 88 - 93)

Function

The overload monitor protects the power unit/motor from thermal overloading. The temperature of the power unit/motor is imitated and monitored by an I²t model.

Motor model:



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
88	I2t **motor warning limit**	0.00 ... 100.00	%	100.00	
89	I2t **motor time constant**	0 ... 1800	s	300	
90	I2t **I_motor/I_nominal**	0.25 ... 1.0		1.00	
91	I2t **value motor**	0.00 ... 150.00	%		5
92	I2t **PU control**	0 ... 1		1	
93	I2t **status**	0000 ... FFFF			5

Parameter description

88 I2t **motor warning limit**
If this value is exceeded the bit "motor overload warning" (bit no. 4, ID no. 93) is set.

89 I2t **motor time constant**
The thermal time constant of the motor T_t [s] (see technical data motor) must be entered in sec..
If motor time constant = 0 the overload monitoring is turned off.

90 I2t **I_motor/I_nominal**
This parameter displays the overload factor between nominal motor current and nominal unit current.

$$\text{ID - Nr 90} = \frac{I_{nom\ (motor)}}{I_{nom\ (power\ unit)}}$$

91 I2t **value motor**
The output of the PT1 element unit is displayed here (100 % ⇔ 155 °C).

92 I2t **PU control**
This parameter switches the power unit overload monitoring on and off .

Value	Meaning
0	overload monitoring off
1	overload monitoring on

I²t power unit monitoring is set so that the power unit in use cannot be overloaded. The magnitude and the duration of the overload depends on the power unit.
The current limiter is limited to 100 % if the overload monitoring responds.

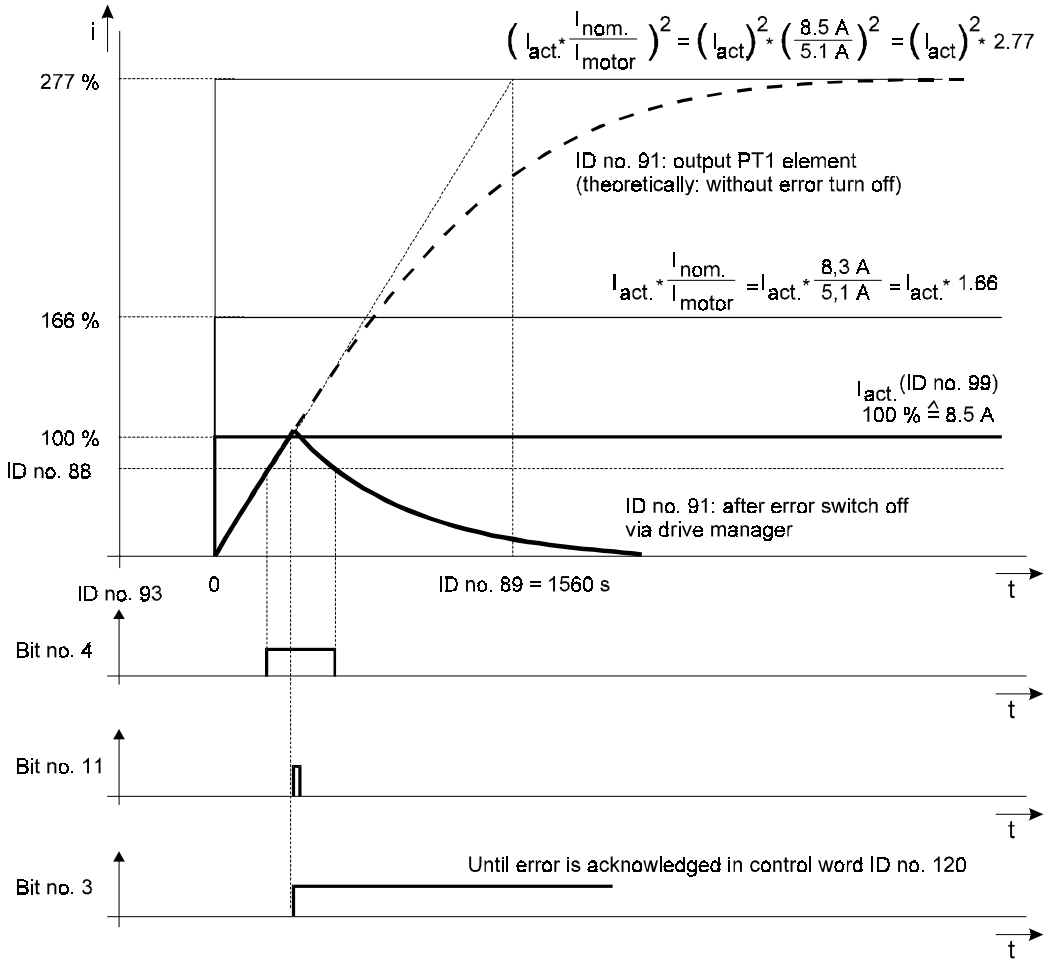
93 I2t **status**
The status shows the function module status..

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in module, for error code see Merror code (ID no. 124)
4	1: warning: motor I²t value > motor limiter value (ID no. 88)
5	1: warning: power unit I²t value > 110% (current limiter reduced to 100%)
6 ... 10	reserved
11	1: motor I²t value error > 100 %
12 ... 15	reserved

- Example

  Unit: BUM 61x - 12 / 18: $I_{nom.} = 8.5\ A_{eff}$
  Motor: DS 56 L - 3000; $I_{nom.} = 5.1\ A_{eff}$;
  $T_t = 26$ min = 1560 s (see 9.1 Suitable servo motors)

  ID no. 88: 80 % (warning limitation)
  ID no. 89: 1560 s
  ID no. 90: $\text{ID - Nr 90} = \frac{I_{nom.\ (motor)}}{I_{nom.\ (power\ unit)}} = \frac{5.1\ A}{8.5\ A} = 0.6$
  ID no. 99: 0 % to 100 % $I_{nom.}$ of power unit



7.9 Extended current monitoring (ID no. 94 - 99)

Function

By means of extended current monitoring the actual current value of the motor can be compared with various limiters. Depending on the type of limiter, a message is shown in the current monitoring status display either on exceeding a limit or after having exceeded a set time length.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
94	Ext **I > I_x2**	0.00 ... 150.00	%		
95	Ext **time I > I_x2**	0.0 ... 1000.0	s		
96	Ext **I > I_x1**	0.00 ... 150.00	%		
97	Ext **time I > I_x1**	0.00 ... 1000.00	s		
98	Ext **status**	0000 ... FFFF			5
99	Ext **current actual value**	0.00 ... 150.00	%		5

Parameter description

98 Ext **status**

This parameter displays the function module status.

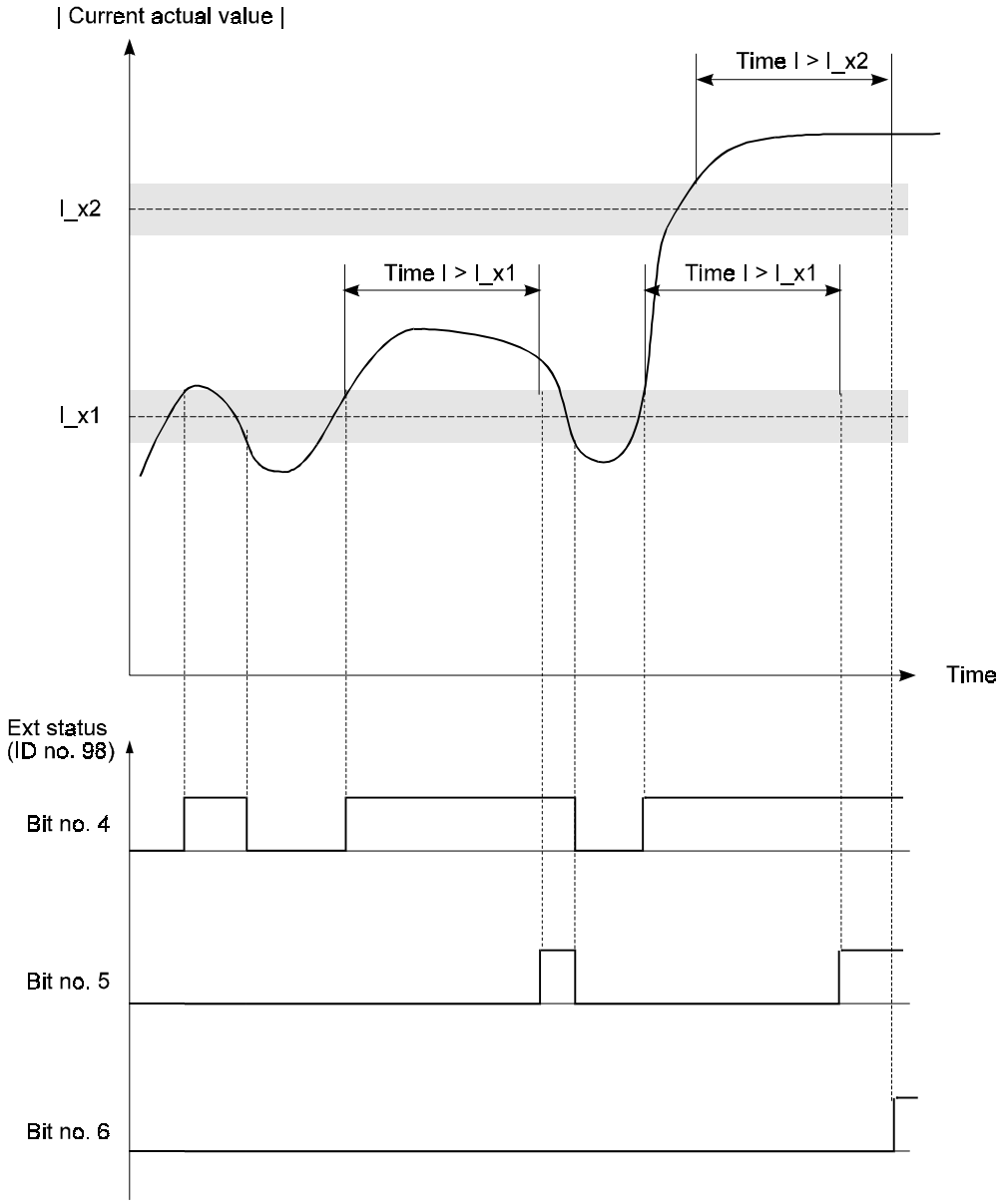
Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3 ... 7	reserved
4	Warning I_x1 for time I_x1 exceeded
5	Warning I_x1 exceeded
6	Warning I_x2 for time I_x2 exceeded
11 ... 15	reserved

99 Ext **current actual value**

This parameter shows the total actual value as a percentage of nominal unit current. Calibration: +100.00 % ⇔ output nominal current $\hat{I}_N$.

94 Ext **I > I_x2**
95 Ext **time I > I_x2**
96 Ext **I > I_x1**
97 Ext **time I > I_x1**

These parameters define the characteristic curve of the extended current monitoring . I_x2 must be above I_x1. Hysteresis is ± 3 % for each parameter.



7.10 Pulse Width Modulation (ID no. 100 - 103)

Function

The parameters of the Pulse Width Modulation module only serve to display the values supplied by the current controller.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
100	PWM **phase U**	- 2048 ... + 2048			5
101	PWM **phase V**	- 2048 ... + 2048			5
102	PWM **phase W**	- 2048 ... + 2048			5
103	PWM **frequency**	1000 ... 20000	Hz	8012	5

Parameter description

100 PWM **phase U**
101 PWM **phase V**
102 PWM **phase W**

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

This means:
+2048 to a regulation angle of α = +100 %
0 to a regulation angle of α = 0 %
-2048 to a regulation angle of α = -100 %

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

$$\bar{U}_{uv} = U_{ZK} \bullet \frac{\text{PWM phase U - PWM phase V}}{4096} = \text{ID no. 111} \bullet \frac{\text{ID no. 100 - ID no. 101}}{4096}$$

$$\bar{U}_{VW} = U_{ZK} \bullet \frac{\text{PWM phase V - PWM phase W}}{4096} = \text{ID no. 111} \bullet \frac{\text{ID no. 101 - ID no. 102}}{4096}$$

$$\bar{U}_{WU} = U_{ZK} \bullet \frac{\text{PWM phase W - PWM phase U}}{4096} = \text{ID no. 111} \bullet \frac{\text{ID no. 102 - ID no. 100}}{4096}$$

Whereby U_{ZK} is the intermediate circuit voltage which is indicated via ID no. 111. Due to the underlying cycle frequency this voltage cannot be measured on universal devices.

DANGER

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

103 PWM **frequency**

The frequency of the power unit is 8012 Hz. This parameter has a display-only function.

7.11 Power supply (ID no. 110 - 112)

Function

The function module power supply indicates the status of the power supply unit and the intermediate circuit.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
110	ES **status**	0000 ... FFFF			5

Parameter description

110 ES **status**

This parameter indicates the present power supply status.

Bit no.	Meaning
0 ... 2	000 : STOP 001 : RUN
3	1 :error in funktion module, error code see M error code (ID no. 124)
4	1 : main contactor switched on
5	1: charging contactor switched on
6 ... 7	reserved
8 ... 11	0000 : ready for use: main contactor off, charging resistor cold 0001 : ready for use: main contactor on, charging resistor cold 0010 : error occurred 0011 : ready for use: main contactor off, charging resistor cooling off 0100 : ready for use: main contactor on, charging resistor cooling off 0101 : charging the intermediate circuit 0110 : undervoltage Uzk (charging resistor overloading)
12 ... 15	reserved

7.12 Power unit (ID no. 115 - 117)

Function

The power unit module indicates the status the power unit.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
115	PU **status**	0000 ... FFFF			5
117	PU **version**	0 ... 65535			5

Parameter description

115 PU **status**

This parameter shows the status of the power unit.

Bit no.	Meaning
0 ... 2	000 : STOP 001 : RUN
3	1 : error in function module, error code see M error code (ID no. 124)
4	1 : power unit reset active
5	1 : pulses enabled, power unit active
6 ... 15	reserved

117 PU **version**

The power unit type is given.

7.13 Drive manager (ID no. 120 - 133)

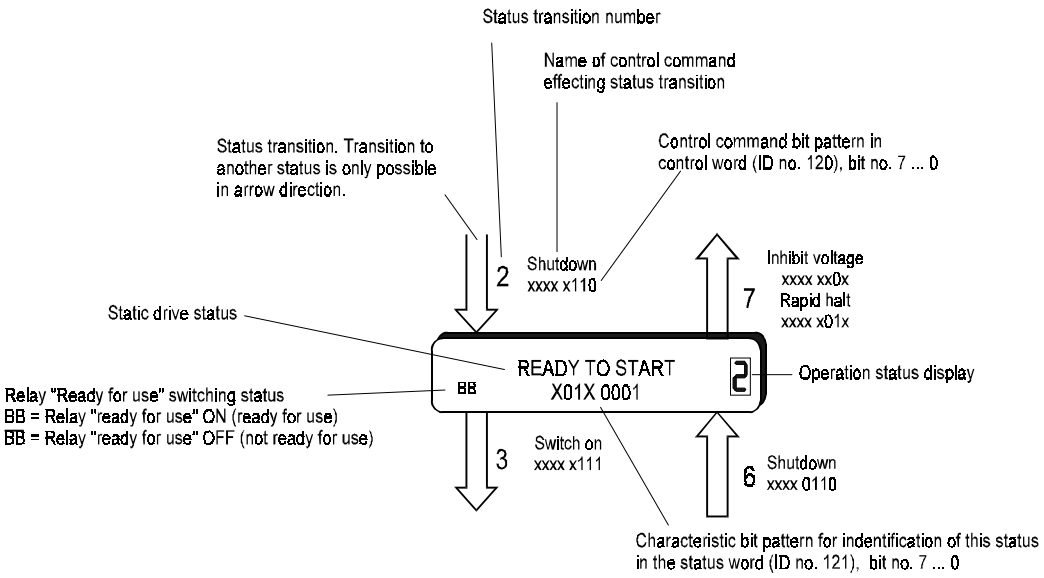
Function

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.

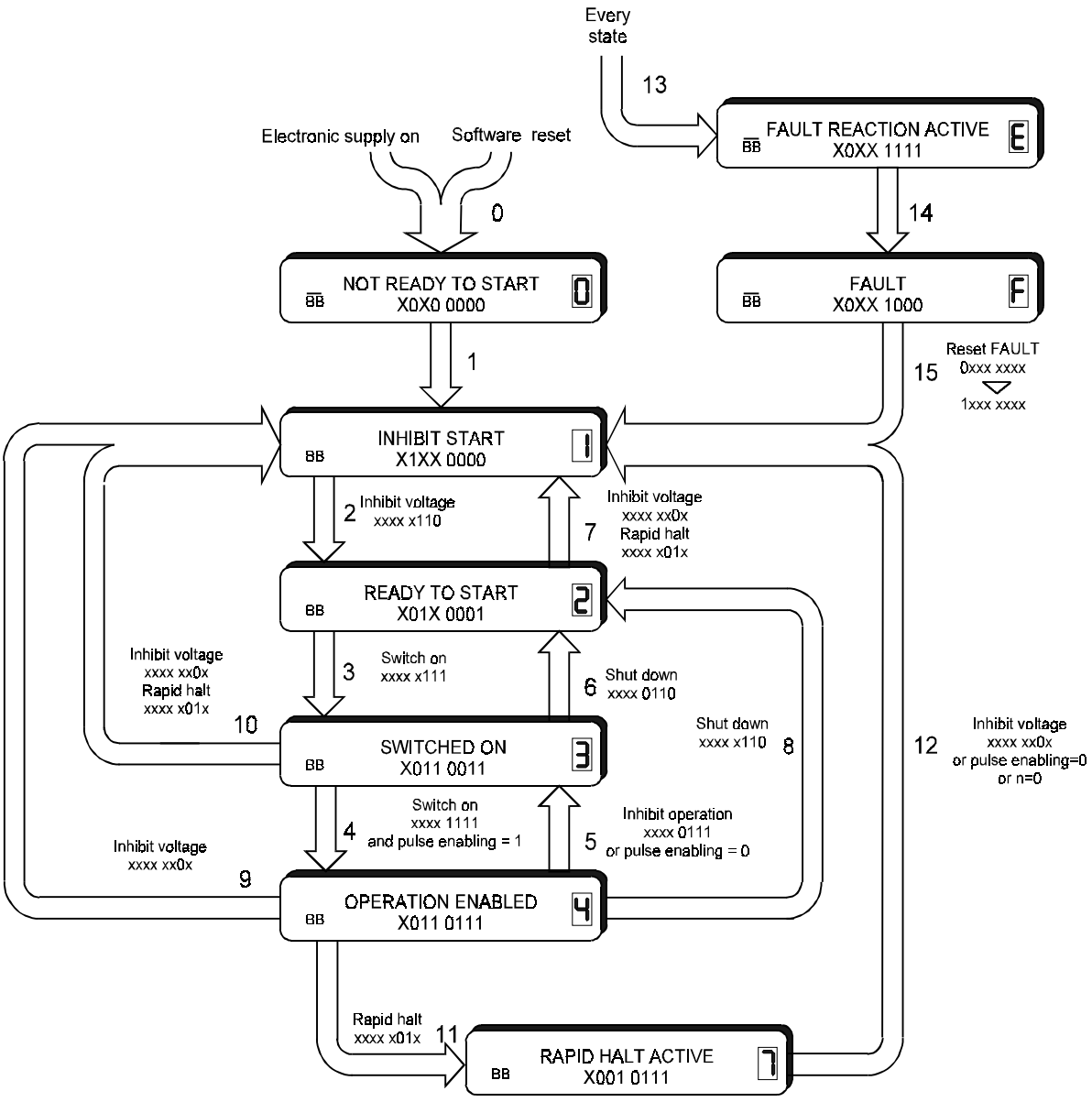
Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
120	M **control word**	0000 ... FFFF		0000	
121	M **status word**	0000 ... FFFF			5
122	M **desired operating mode**	-5 ... 6		-3	
123	M **actual operating mode**	-5 ... 6			5
124	M **error code**	0000 ... FFFF			5
125	M **error index**	0 ... 31			5
126	M **communication source**	0000 ... 000F		0000	
127	M **communication monitoring**	0000 ... 000F		0000	
128	M **monitoring time**	0 ... 60 000	ms	0	
129	M **monitoring code**	-2 ... 3		0	
130	M **HALT code**	0 ... 4		1	
131	M **RAPID HALT code**	0 ... 4		1	
132	M **INHIBIT code**	0 ... 1		1	
133	M **SHUTDOWN code**	0 ... 1		1	

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



- **Unit control state machine**



The binary bits 7 ... 0 of the static drive status (ID no. 121) are figured XXXX XXXX. The status transition bit pattern of the control word (ID no. 120) is figured xxxx xxxx (bit no. 7 ... 0).

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

- **Unit control statuses**

0 NOT READY TO START

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

1 INHIBIT START

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

2 READY TO START

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

3 SWITCHED ON

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

4 ENABLE OPERATION

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

7 RAPID HALT ACTIVE

- application parameters can be redefined
- rapid halt function is carried out (parameter assignment via M rapid halt Code, ID no. 131)
- drive function enabled
- relay „ready for use“ is on (drive ready for use)

E FAULT REACTION ACTIVE

- application parameters can be redefined
- an fault-dependant action is carried out
- drive function may be enabled
- relay „ready for use“ is off (drive not ready for use)

F FAULT

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

- **Unit control status transition**

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

event: - hardware reset
or - software reset
or - switch on operating voltage

action: - switch off relay „read for use“
- start self-test
- start initialisation

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

event: - error-free self-test
- error-free completion of initialisation

action: - activate communication monitoring and process data monitoring
- switch on relay „ready for use“

2 INHIBIT START 1 ➔ **READY TO START** 2

event: - command "shutdown"

action: - none

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

event: - command "switch on"

action: - switch on power unit if not on yet

4 SWITCHED ON 3 ➔ **OPERATION ENABLED** 4

event: - command "enable operation"

action: - enable drive function

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

event: - command "inhibit operation"

action: - inhibit drive function

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

event: - command "shutdown"

action: - the power unit can be switched off

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

event: - command "rapid halt"
or - command "inhibit voltage"

action: - none

8 OPERATION ENABLED 4 ➔ **READY TO START** 2

event: - command "shutdown"

action: - inhibit drive function (parameter assignment via M shutdown Code ID no. 133)
- the power unit can be switched off

9 OPERATION ENABLED [4] ➔ **INHIBIT START** [1]
event: - command "inhibit voltage"
action: - inhibit drive function
- power unit can be switched off

10 SWITCHED ON [3] ➔ **INHIBIT START** [1]
event: - command "inhibit voltage"
or - command "rapid halt"
action: - the power unit can be switched off

11 OPERATION ENABLED [4] ➔ **RAPID HALT ACTIVE** [7]
event: - command "rapid halt"
action: - trigger rapid halt function

12 RAPID HALT ACTIVE [7] ➔ **INHIBIT START** [1]
event: - command "inhibit voltage"
or - rapid halt completed
action: - inhibit drive function
- the power unit can be switched off

13 all status types ➔ **FAULT REACTION ACTIVE** [E]
event: - drive fault detected
action: - switch off „ready for use“ relay
- trigger error-dependant fault reaction

14 FAULT REACTION ACTIVE [E] ➔ **FAULT** [F]
event: - fault reaction completed
action: - inhibit drive function
- the power unit can be switched off

15 FAULT [F] ➔ **INHIBIT START** [1]
event: - command "error reset"
condition: - error no longer present
action: - fault reset is carried out
- switch on „ready for use“ relay

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

- **„Ready for use“ relay**

The state of the relay „ready for use“ changes on the following control transitions.

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

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

Parameter description

120 M **control word**

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

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

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

NOTE

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

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

Command	Bit no. 15 write protection	Bit no. 7 reset error	Bit no. 3 enable operation	Bit no. 2 * rapid halt	Bit no. 1 * inhibit voltage	Bit no. 0 switch on	Tran-sitions
Shut down	5	5	5	1	1	0	2,6,8
Switch on	5	5	5	1	1	1	3
Inhibit voltage	5	5	5	5	0	5	7,9,10,12
Rapid halt	5	5	5	0	1	5	7,10,11
Inhibit operation	5	5	0	1	1	1	5
Enable operation	5	5	1	1	1	1	4
Error reset	5	0 ∏ 1	5	5	5	5	15
Enable operation straight	1	5	1	1	1	1	2

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

* low active

NOTE

The command „enable operation straighly“ has only in state INHIBIT OPERATION an effect. This command does not correspond to the DRIVECOM specification because the function INHIBIT OPERATION is disabled temporarily.
After this command is taken in state INHIBIT OPERATION the drive manager run through the transitions 2, 3 and 4, if the hardware signals (pulse enabling and main contactor) are given. The manager remains in state „OPERATION ENABLED.

Control word: total overview for all modes

Bit no.	Speed specifica-tion 1	Current control -3	Speed control -2	Speed specifica-tion 1 2	Position control -4	Manual mode 5	Synchroni-sation control -5	Reference run mode 6	Target position specifica-tion 1
0	switch-on (unit control state machine)								
1	inhibit voltage (unit control state machine) *								
2	rapid halt (unit control state machine) *								
3	enable operation (unit control state machine)								
4	5	5	RFG inhibit	RFG * inhibit	5	5	5	starting reference run	new set value
5	5	5	RFG stop	RFG * stop	5	5	5	5	5
6	5	5	RFG zero	RFG * zero	5	5	5	5	5
7	errror reset (unit control state machine)								
8	5	5	5	5	5	5	5	5	5
9	5	5	5	5	5	5	5	5	5
10	5	5	5	5	5	5	5	5	5
11	5	5	5	5	5	inching forwards	5	5	start of positioning
12	5	5	5	5	5	inching backwards	5	5	5
13	5	5	5	5	5	5	5	5	5
14	5	5	5	5	5	5	5	5	5
15	write protection								

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

* low active

121 M **status word**

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

Bit	Name	Comments
0	ready to start	unit control state machine
1	switched on	unit control state machine
2	operation enabled	unit control state machine
3	fault	unit control state machine
4	voltage inhibited	0: the "inhibit voltage" requirement is present (command or main contactor contact)
5	rapid halt	unit control state machine
6	inhibit start	unit control state machine
7, 8	reserved	reserved
9	remote	bit 9 = 1: parameters can be assigned via the selected communication source
10	set value reached	bit 10 = 1: depending on the active mode it is indicated whether the preset set value is reached
11	reserved	reserved
12, 13, 14, 15	mode-dependant	see table "total overview for all modes"

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

	State of the unit control	Bit in status word					
		Bit no. 6 inhibit start	Bit no. 5 * rapid halt	Bit no. 3 error	Bit no. 2 operation enabled	Bit no. 1 switched on	Bit no. 0 ready to start
0	NOT READY TO START	0	5	0	0	0	0
1	INHIBIT START	1	5	0	0	0	0
2	READY TO START	0	1	0	0	0	1
3	SWITCHED ON	0	1	0	0	1	1
4	OPERATION ENABLED	0	1	0	1	1	1
F	FAULT	0	5	1	0	0	0
E	FAULT REACTION ACTIVE	0	5	1	1	1	1
7	RAPID HALT ACTIVE	0	0	0	1	1	1

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

* low active

Status word: total overview for all modes

Bit no.	Speed specification 1	Current control -3	Speed control -2	Speed specification 1 2	Position control -4	Manual mode 5	Synchronisation control -5	Reference run mode 6	Target position specification 1
0	ready to start (unit control state machine								
1	switched on (unit control state machine)								
2	enable operation (unit control state machine)								
3	error (unit control state machine)								
4	voltage inhibited (unit control state machine) *								
5	rapid halt (unit control state machine) *								
6	inhibit ready (unit control state machine)								
7	5	5	5	5	5	5	5	5	5
8	5	5	5	5	5	5	5	5	5
9	remote								
10	5	5	set value speed set value	reached speed set value	position set value	5	position set value	reference speed	set value acknow-ledgement
11	5	5	5	5	5	5	5	5	5
12	5	5	5	5	5	5	5	reference run finished	set value acknow-ledgement
13	5	5	5	5	5	5	5	reference run error	5
14	5	5	5	5	5	5	5	5	5
15	5	5	5	5	5	5	5	5	5

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

* low active

Bit no. 10: "Set value reached" is actualised only in state OPERATION ENABLED.

122 M **desired operation mode**

This parameter corresponds to DRIVECOM object 6060hex and specifies the mode for the drive.

Selection code	Mode	Comments
-5	synchronisation control	option
-4	position control	standard
-3	speed control	standard
-2	current control	standard
-1	locating position reference point setting	standard
1	target position specification	option
2	speed specification 1	standard
5	manual mode	option
6	reference run mode	option

The modes can be switched when the controller is inhibited (offline), but sometimes also when the controller is enabled (online). For further details see the table under ID no. 123 M actual mode.

For the below-mentioned modes it is imperative that the following parameter settings are carried out:

Selection code	Mode	Ramp function generator input selection ID no. 13
-5	synchronisation control	1
-4	position control	1
-3	speed control	any
-2	current control	any
-1	locating position reference point setting	any
1	target position specification	1
2	speed specification 1	any
5	manual mode	1
6	reference run mode	1

A separate description is available for the optional modes.

123 M **actual mode**

This parameter corresponds to DRIVECOM object 6061hex and indicates the currently active drive mode (see also set mode table).

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

Mode switching

Mode switching	from -5	-4	-3	-2	-1	2	6	5	1
to	synchroni-sation control	position control	speed control	current control	locating position	speed specification 1	reference run mode	manual mode	target position specifi-cation
synchroni-sation control	5	2	2	2	1	2	2	2	2
position control	2	5	2	2	1	2	2	2	2
speed control	2	2	5	2	1	2	2	2	2
current control	2	2	2	5	1	2	2	2	2
locating position	1	1	1	2	5	1	1	1	1
speed speci-fication 1	2	2	2	2	1	5	2	2	2
reference run mode	2	2	2	2	1	2	5	2	2
manual mode	2	2	2	2	1	2	2	5	2
target position specification	2	2	2	2	1	2	2	2	5

When 1:

mode switching is only possible offline in the INHIBIT READY, READY TO START and SWITCHED ON status types.

When 2:

mode switching is possible offline in the INHIBIT READY, READY TO START and SWITCHED ON status types as well as online in the OPERATION ENABLED status.

NOTE

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

124 M **error code**

In case of error, the corresponding error code can be found here. This error is acknowledged if the bit "error reset" in the control word (ID no. 120) is set from 0 to 1. If several errors are present, the next error is displayed immediately after acknowledgement.

List of error codes:

Module	Error code	Error text
drive manager	0001h 0002h 0003h 0004h 0005h 0010h	timeout BASS protocol timeout USS protocol timeout dual port RAM (cyclic data) timeout dual port-RAM (working data) system boot error switch (program error)
power supply	0102h 0103h 010Ch	error load contactor voltage too low U_{ZK} ballast resistor current too high
power unit	0201h 0202h 0207h	overvoltage Uzk overcurrent transistor error (group error)
resolver compensation	0301h	resolver cable open circuit
overload monitoring	0401h	I^2t monitoring motor
motor temperature	0501h	temperature motor too high
position controller	0601h 0602h 0603h 0605h 0604h 0606h	deviation dynamic deviation static positive actual value is missing negative actual value is missing wrong sign positive actual value wrong sign negative actual value
speed controller	0701h	set/actual value monitoring speed controller
resolver	0801h	speed too high
data set management	0901h 0902h 0903h	copy error EEPROM boot data set not available check sum error in boot data set
incremental encoder	0A01h	speed too high

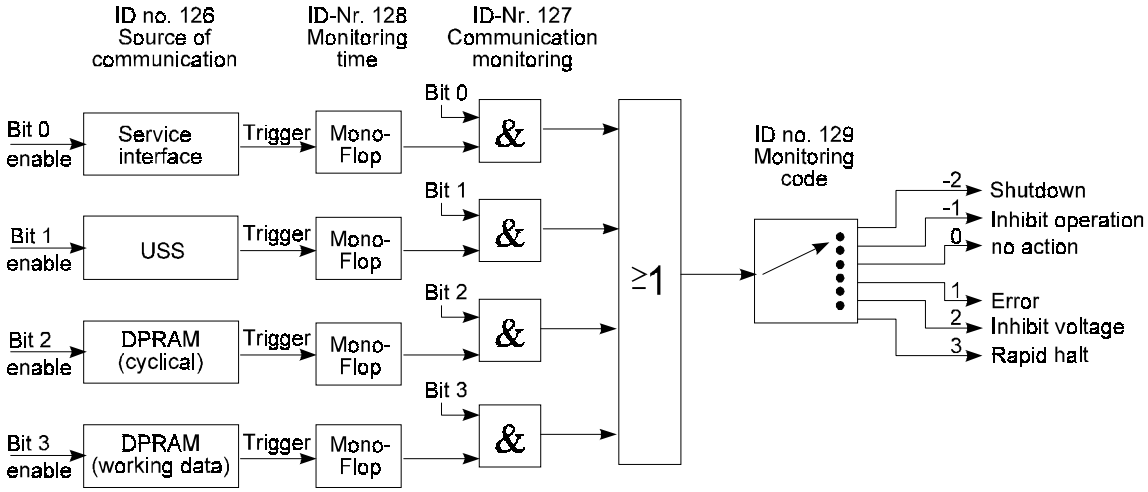
For detailed error description and trouble-shooting see error notes in the chapter "Maintenance".

125 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.

126 M **communication source**

The access rights of the various sources of communication are managed via this parameter. Sources of communication are all program modules which exchange data with a master control via a communication protocol. As several of these program modules can be implemented in the drive, but not all modules can have simultaneous access to all parameters (particularly the drive manager's status word (ID no. 120)), write-access must be managed correspondingly.



Depending on the parameter "communication source" the drive manager activates and DI-activates the various communication modules. Each communication module has a status parameter where the current status (RUN/STOP) is displayed.

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

The BASS protocol is the only communication source which is allowed to write on these two parameters even if it is not enabled. This is to ensure that changing the parameter "communication source" (ID no. 126) and saving this alteration in the EEPROM via parameter DSM command (ID no. 190) is always possible.

The reason for this exception is that the BASS protocol is always implemented in the drive.

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

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

If the parameter "communication source" is set to 0, the drive can only be controlled via pulse enabling. As no master control is available, the drive manager itself can set the corresponding control commands. The following table shows the status transitions and their relevant manipulations:

Transition	Condition	Action
2	pulse enabling = 0	command "shutdown" is given
3	main contactor = 1	command „switch on“ is given
4	pulse enabling = 1	command "enable operation" is given
5	pulse enabling = 0	command "inhibit operation" is given
9, 10, 12	main contactor = 0	command „inhibit voltage“ is given
15	pulse enabling = 0	command "fault reset" is given

Moreover, the drive manager's control word can also be manipulated via the freely programmable digital inputs (see function module "digital inputs").

127 M **communication monitoring**

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

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

Note: In general monitoring a communication source only makes sense if it has been enabled via ID no. 126.
For test purposes, however, it is also possible to activate monitoring of sources of communication which have not been enabled. Monitoring responds immediately.

128 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 (ID no. 126 = 0), monitoring time must be set to 0 ms.

129 M **monitoring code**

This parameter corresponds to DRIVECOM object 6004hex and determines the drive reaction in the event of the communication monitoring time being exceeded. It is not important which communication source caused the timeout.

Selection code	Function
-2	unit control command "shutdown" is updated
-1	unit control command "inhibit operation" is updated
0	no action
1	transition to fault status
2	unit control command "inhibit voltage" is updated
3	unit control command "rapid halt" is updated

130 M **HALT code**

This parameter corresponds to DRIVECOM object 605Dhex and determines the drive reaction in the unit control state machine in the OPERATION_ENABLED status. The HALT function is only implemented in the speed control and speed specification 1 modes.

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

Speed control mode:	Inhibit RFG = 1:	HALT function active
	Inhibit RFG = 0:	HALT function inactive
Speed specification 1 mode:	Inhibit RFG = 1:	HALT function inactive
	Inhibit RFG = 0:	HALT function active

Selection code	Function
0	inhibit drive function
1	shutdown procedure at shutdown procedure ramp
2	shutdown procedure at rapid halt ramp
3	shutdown procedure at current limit
4	shutdown procedure at voltage limit

131 M **RAPID HALT code**

This parameter corresponds to DRIVECOM object 605Ahex and determines the drive reaction in the unit control state machine in the RAPID HALT ACTIVE status.

Selection code	Function
0	inhibit drive function
1	shutdown procedure at shutdown procedure ramp
2	shutdown procedure at rapid halt ramp
3	shutdown procedure at current limit
4	shutdown procedure at voltage limit

132 M **INHIBIT code**

This parameter corresponds to DRIVECOM object 605Chex and determines the drive reaction in the unit control state machine during transition 5 and in the FAULT REACTION ACTIVE status.

Selection code	Function
0	inhibit drive function
1	shutdown procedure at shutdown procedure ramp, then inhibit drive function

133 M **SHUTDOWN code**

This parameter corresponds to DRIVECOM object 605Bhex and determines the drive reaction in the unit control state machine during transition 8.

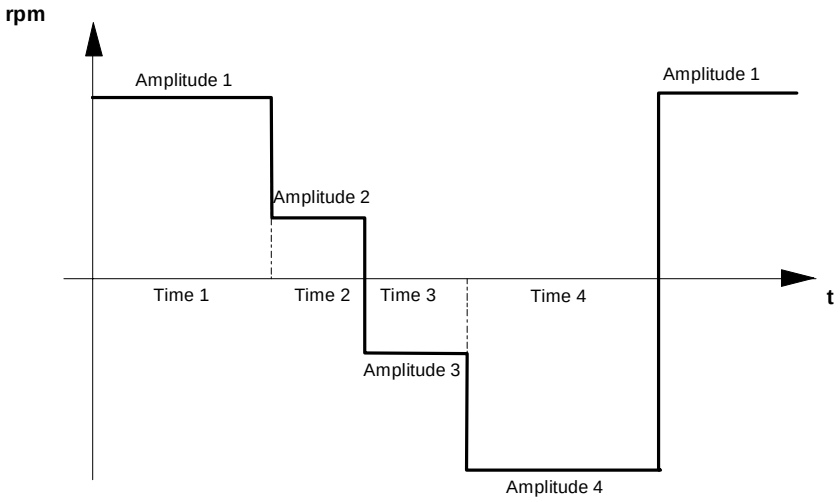
Selection code	Function
0	inhibit drive function
1	shutdown procedure at shutdown procedure ramp, then inhibit drive function

7.14 Set value generator (ID no. 140 - 150)

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 destandardised 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 status "operation enabled" (ID no. 121), the set value generator is stopped.

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



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard Values	Display only
140	SVG **target ID no.**	0 ... 500		0	
141	SVG **output**	- 100.00 ... + 100.00	%		5
142	SVG **amplitude 1**	- 100.00 ... + 100.00	%	30.00	
143	SVG **amplitude 2**	- 100.00 ... + 100.00	%	-60.00	
144	SVG **amplitude 3**	- 100.00 ... + 100.00	%	100.00	
145	SVG **amplitude 4**	- 100.00 ... + 100.00	%	0.00	
146	SVG **time 1**	0.001 ... 60.000	s	1.000	
147	SVG **time 2**	0.064 ... 60.000	s	1.000	
148	SVG **time 3**	0.064 ... 60.000	s	1.000	
149	SVG **time 4**	0.064 ... 60.000	s	1.000	
150	SVG **status**	0000 ... FFFF			5

Parameter description

140 SVG **target ID no.**
This parameter contains the input parameter number of the receiver module (e.g. parameter ID no. 2 of input 1 in the ramp function generator). The set value generator's output value is written to the receiver with the corresponding address.

141 SVG **output value**
The current output value is displayed here.

142 SVG **amplitude 1**
143 SVG **amplitude 2**
144 SVG **amplitude 3**
145 SVG **amplitude 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.

146 SVG **time 1**
147 SVG **time 2**
148 SVG **time 3**
149 SVG **time 4**
Values between 64 ms and 60 s can be assigned to these time parameters. The corresponding amplitudes are switched to the output value during these time intervals.

150 SVG **status**
The internal status of the set value generator is displayed here.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3 ... 15	reserved

7.15 Motor temperature monitoring (ID no. 151 - 152)

Function

This module protects the motor from thermal overloading.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard Value	Display only
151	MT **status**	0000 ... FFFF			5
152	MT **recording system**	0 ... 12		0	

Parameter description

151 MT **status**

The module status is displayed here.

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1:error in module, error code see M error Code (ID no. 124)
4 ... 6	reserved
7	1: shutdown: temperature switch response
8 ... 15	reserved

152 MT **recording system**

This parameter sets the motor temperature recording type.

Value	Meaning
0	motor temperatur recording disabled
1	reserved
2	temperature switch (normally closed) with error shutdown
3 ... 9	reserved
10	temperature switch (normally closed) without error shutdown
11 ... 12	reserved

7.16 Operating system (ID no. 160 - 163)

Function

The parameters of the operating system module are used for the display of the operating system software version and its settings.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
160	OS **version**	0.00 ... 99.99	4 / 94		5
161	OS **sampling time**	124.8 ... 4000.0	µs		5
162	OS **message**	0 ... 9999			5
163	**Program version**	0.00 ... 9999.99			5

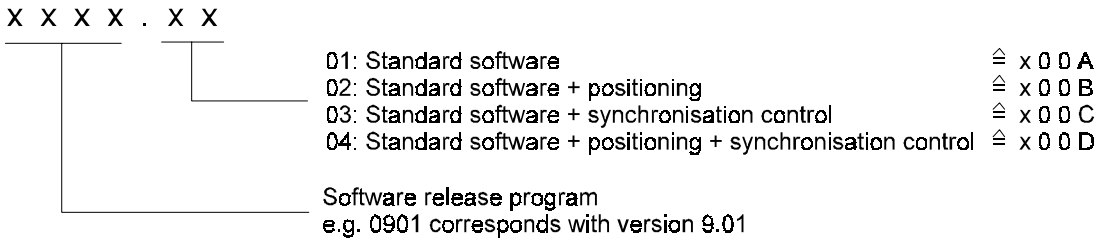
Parameter description

160 OS **version**
Shows the version number of the operating system software.

161 OS **sampling time**
The system clock shows the call interval of the shortest time segment.

162 OS **message**
This parameter shows the number of operating system errors.

163 **Program version**
This parameter shows the software version and the implemented technology functions of the program.



7.17 Service interface (ID no. 170 - 171)

Function

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

NOTE

Communication between drive and PC via the RS 232 interface is described in more detail in the communication software documentation.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
170	S **status**	0000 ... FFFF			5
171	S **baud rate**	50 ... 19200	Baud	9600	5

Parameter description

170 S **status**

Write-access to the drive parameters is managed via parameter M communication source (ID no. 126) 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 0. 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 (ID no. 126)

Bit no.	Meaning
0 ... 3	status of function module 0001: RUN (all parameters can be read and write) 0000: STOP (all parameters can be read)
4 ... 11	drive address 0 ... 255 (representation of the DIP switch S20)
12 ... 15	reserved

171 S **baud rate**

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

7.18 Link to USS protocol (ID no. 180 - 186)

Function

The module link to USS protocol allows the user to carry out communication between master and slave with a fixed message length.

NOTE

Communication via the link to USS protocol is described in more detail in the communication software documentation.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
180	USS **state**	0000 ... FFFF			5
181	USS **mode**	0000 ... FFFF		0000	
182	USS **baud rate**	150 ... 19200	baud	9600	
183	USS **PIV number**	0 ... 4	words	3	
184	USS **PD number**	0 ... 3	words	2	
185	USS **set value ID no.**	0 ... 500			5
186	USS **actual value ID no.**	0 ... 500			5

Parameter description

180 USS **status**

Displays the internal status of the module.

The module function is set via parameter M communication source (ID no.126) of the drive manager. For further details, see the relevant chapter.

Bit	Meaning
0 - 3	0000: module in status STOP. Incoming messages are not answered. 0001: module in status RUN. Message evaluation is active.
4	1: no message received at own address for longer than 1 s
5	1: no message traffic on the bus for longer than 5 s
6	reserved
7	1: faulty module initialisation
8	1: format error on actual value transfer (see ID no. 186)
9	1: format error on set value transfer (see ID no. 185)
10	1: error on reading actual value
11	1: error on writing set value
12 - 15	reserved

181 USS **mode**

This parameter sets the USS protocol mode.

Bit no.	Meaning
0	1: set/actual value standardisation active 0: set/actual value standardisation inactive
1	1: Broadcast coding activated 0: Broadcast coding not activated
2	1: answer delay active 0: answer delay inactive
3 ... 15	reserved, always 0

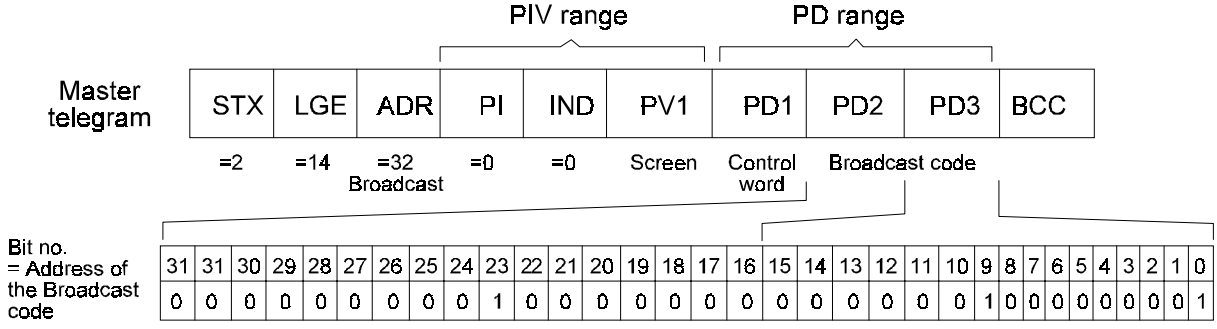
Set and actual value standardisation is selected with bit no. 0.

Apart from set and actual position values, all set and actual value parameters are represented as relative sizes. With deactivated set/actual value standardisation these parameters are represented in original standardisation in the message (±100.00%, ±2048 etc.), with active standardisation they are referred to 4000h.

Broadcast coding is activated by bit no. 1.

In normal circumstances all of the maximum 32 bus participants are addressed when the broadcast-message is activated. By means of the Broadcast coding one can select for which drive this Broadcast message is set; only those specific drives react to the control word contained in the Broadcast message. The masking of this control word (with the masking of this control word (with the mask transmitted in the PV1 (PIV-range)) remains effective.

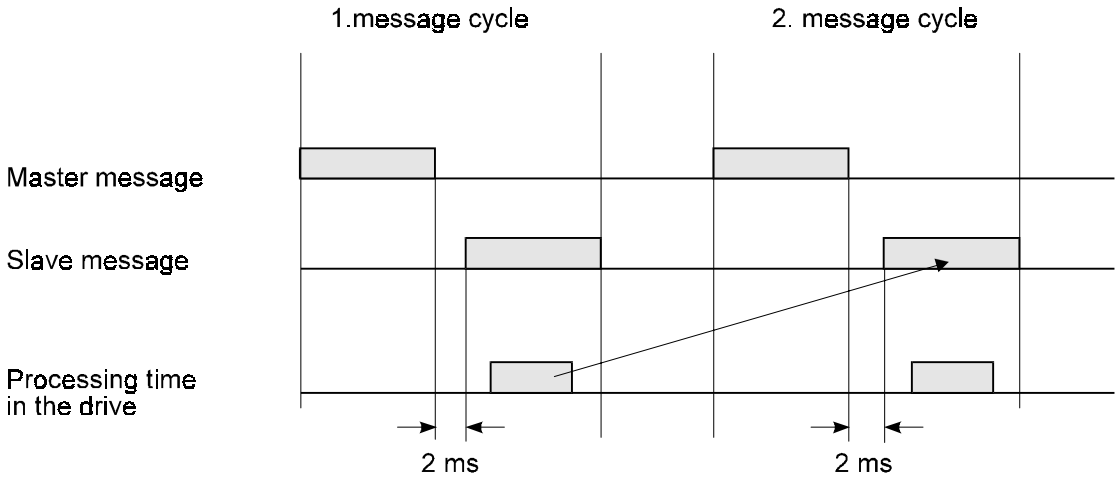
- Following requirements must be satisfied for the use of Broadcast coding:
  - USS PIV number (ID no. 183) must be set ≥ 3
  - USS PD number (ID no. 184) must be set ≥ 3
  - USS mode (ID no. 181) bit no. 1 must be set =1.
- The significance of the Broadcast coding is indicated by the following example:
  Assuming: PD number = 3, PIV number = 3



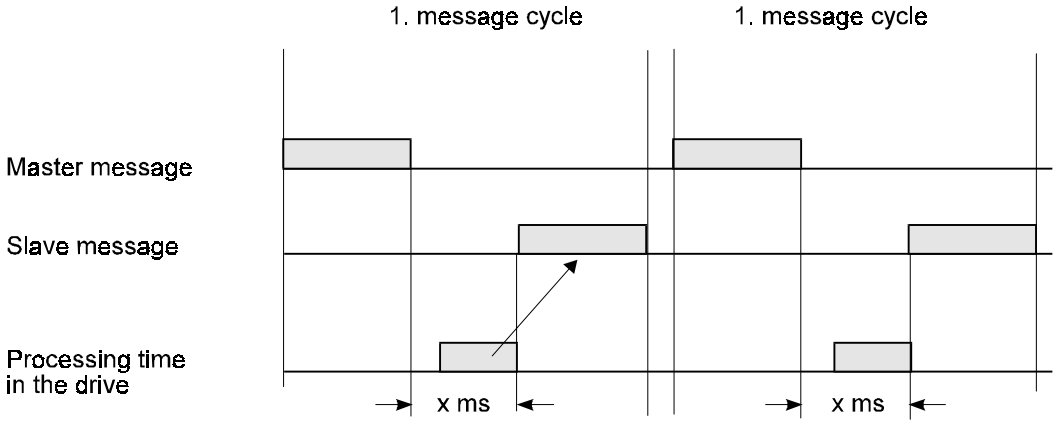
The Broadcast code is set in PD2 (low-word) and PD3 (high-word) and signifies, in this example, that the control word in PD1, masked with the value in PV1, must be accepted and executed by the bus participants with the address 0, 9 and 23. All other bus participants must disregard this information.

The answer delay is selected via bit no. 2

According to the specification of the USS protocol the drive will transmit, after the reception of the master message, ist answer message with a maximum delay of 2 ms. Within this short time span a thorough processing of the information contained in the master message will not always be possible (e.g. in PD range). Consequently a prepared answer message (with an incomplete content) is sent back to the master. The correct return answer is only then transmitted to the master in the next message-cycle.



In activating the answer-delay the information contained within processed, after the reception of the master message (and straight after the answer message has been transmitted back to the master (see arrow). A message-cycle is thus saved, however, uncertainty occurs as to exactly when the answer message is transmitted. If the answer-delay is activated then the message timing will o longer correspond to the specification.



182 USS **baud rate**

This parameter sets the baud rate for the RS485 interface.

183 USS **PIV number**

This parameter sets the number of PIV elements available in the PIV range of the net data block. The specification always refers to PIV elements of word length.

Value	Meaning
0	0 words (no parameter assignment possible)
3	constantly 3 words (word parameters)
4	constantly 4 words (double word parameters)

184 USS **PD number**

The amount of process data contained in the user data block can be influenced by this parameters. The entry is always PD elements with word length.

Value	Meaning
0	no process data
1	control word/status word is transmitted in PD1
2	control word/status word and 16 bit set/actual values
3	control word/status word and 32 bit set/actual values

185 USS **set value ID no.**

This parameter allows the selection of that drive parameter whose value is to be transmitted as the actual value in the reply message (PD2, PD3). The following stipulation applies to the data exchange:

PD number	Actual value parameter format	Comments
0	16 / 32 bit	set value channel switched off
1	16 / 32 bit	set value channel switched off
3	16 bit	set value transmitted in PD2
3	32 bit	data transmission not possible, bit 8 is set in USS status
4	16 bit	set value transmitted in PD3
4	32 bit	hi-word of the set value transmitted in PD2, lo-word of the set value transmitted in PD3

186 USS **actual value ID no.**

This parameter allows the selection of that drive parameter which is to be written with the set value from the master message (PD2, PD3). The following stipulation applies to the data exchange:

PD number	Actual value parameter format	Comments
0	16 / 32 bit	actual value channel switched off
1	16 / 32 bit	actual value channel switched off
3	16 bit	actual value transmitted in PD2
3	32 bit	data transfer not possible bit 9 is set in USS state
4	16 bit	actual value transmitted in PD3
4	32 bit	hi-word of the actual value transmitted in PD2 lo-word of the actual value transmitted in PD3

7.19 Data set management (ID no. 190 - 196)

Function

Data set management is a universal module for loading and saving parameters

Data sets can be loadad from the memory areas RAM and EEPROM, saving is possible in RAM and EEPROM (non-volatile). Several data sets can be managed.

- **After switching on**
  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
  status 0003: STAND_BY (ID no. 191)
  message 0000: no error (ID no. 192).

  If no boot data set has been created yet, the DSM is in
  status 000B: STAND_BY with error (ID no. 191)
  message 0002: data set not available (ID no. 192).
  In addition to the drive managers state changes to F fault and parameter M error code (ID no. 124) displays the error code 0902.

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

  NOTE
  Prior to any new action the DSM must first be reset by the command 0: Reset (ID no. 190).

  This measure sets all DSM parameters to value 0. This also refers to data set name (ID no. 193) and data set version (ID no. 194), which in this status represent the boot data set.

  It must now be set via the command 5: write data set into EEPROM (ID no. 190) 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.

  Only in the case of message 0000: no error (ID no. 192) and DSM status 0003: STAND_BY has the data set been written correctly.

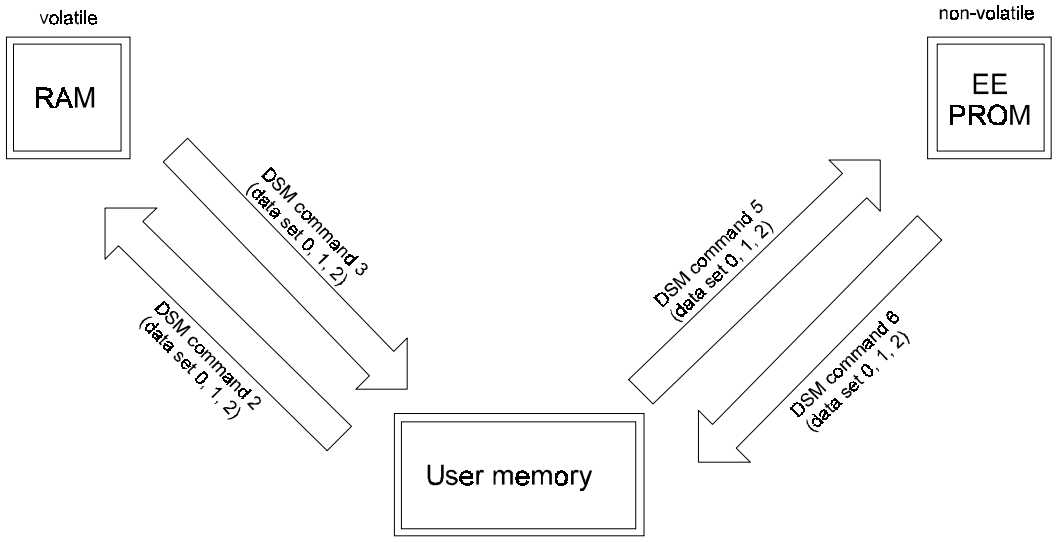
- **Creating and updating other data sets**
  The procedure is identical to that of creating and updating a boot data set except that the parameter data set name (ID no. 193) can now be selected from numbers 1 to 2.

  The command 2: write data set into RAM (ID no. 190) is to be used for creating and updating RAM data sets.

  These data sets are lost if the unit is switched off. However they can be useful for commissioning.

  Data sets can be transmitted to the working memory with
  command 3: read data set from RAM ID no. 190)
  command 5: read data set from EEPROM (ID no. 190).

  Only in the case of DSM message 0000: no error (ID no. 192) and DSM status 0003: STAND_BY has the data set been written correctly.



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
190	DSM **command**	0 ... 8	0	0	
191	DSM **status**	0000 ... FFFF			5
192	DSM **message**	0000 ... FFFF			5
193	DSM **data set name**	0 ... 2		0	
194	DSM **data set version**	00.00 ... 99.99			5
195	DSM **message ID-no.**	0 ... 500			5
196	DSM **load data set**	0 ... 2		0	

Parameter description

190 DSM **command**

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

NOTE

This parameter is indepentent of the parameter M communication source (ID no. 126) always changeable.

Command	Meaning
0	reset of the data set management The parameter ID no. 191 till 195 are set automatically to 0.
2	save data set from user memory to RAM.
3	load data set from RAM to the user memory
5	save data set from user memory to EEPROM
6	load data set from EEPROM to the user memory
7	delete EEROM data set

191 DSM **status**

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 occured in the data set management. Error code see ID no. 124, M error code
4 ... 15	reserved

192 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

193 DSM **data set name**

A maximum of 3 data sets can be managed in each memory area. They are selcted via the parameter „data set name“.

The boot data set is always EEPROM data set 0.

Value	Memory area	
	EEPROM (non-volatile)	RAM (volatile)
0	boot data set	data set 0
1	data set 1	data set 1
2	data set 2	data set 2

194 DSM **data set version**

The verison indicates the data set management´s state of development.

195 DSM **message ID no.**

In the case of a appearing message (ID no. 192 ≠ 0) this parameter displays the ID no. of the involved parameter.

196 DSM **load data set**

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

The following procedure should be adhered to:

- Firstly, ensure that the status of the data set management (ID no. 191) is either set to 0 (STOP) or to 0003 (STAND_BY).
- Next enter the number of the required data set in the parameter, ID no. 196 (DSM load data set).
- All further steps follow independently:
  - The number of the required data set is displayed in parameter ID no. 193.
  - The command 6 „load data set from EEPROM into user memory“ is visible in the parameter ID no. 191 (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.)

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

NOTE

This parameter may be employed to switch over data sets via the digital inputs.

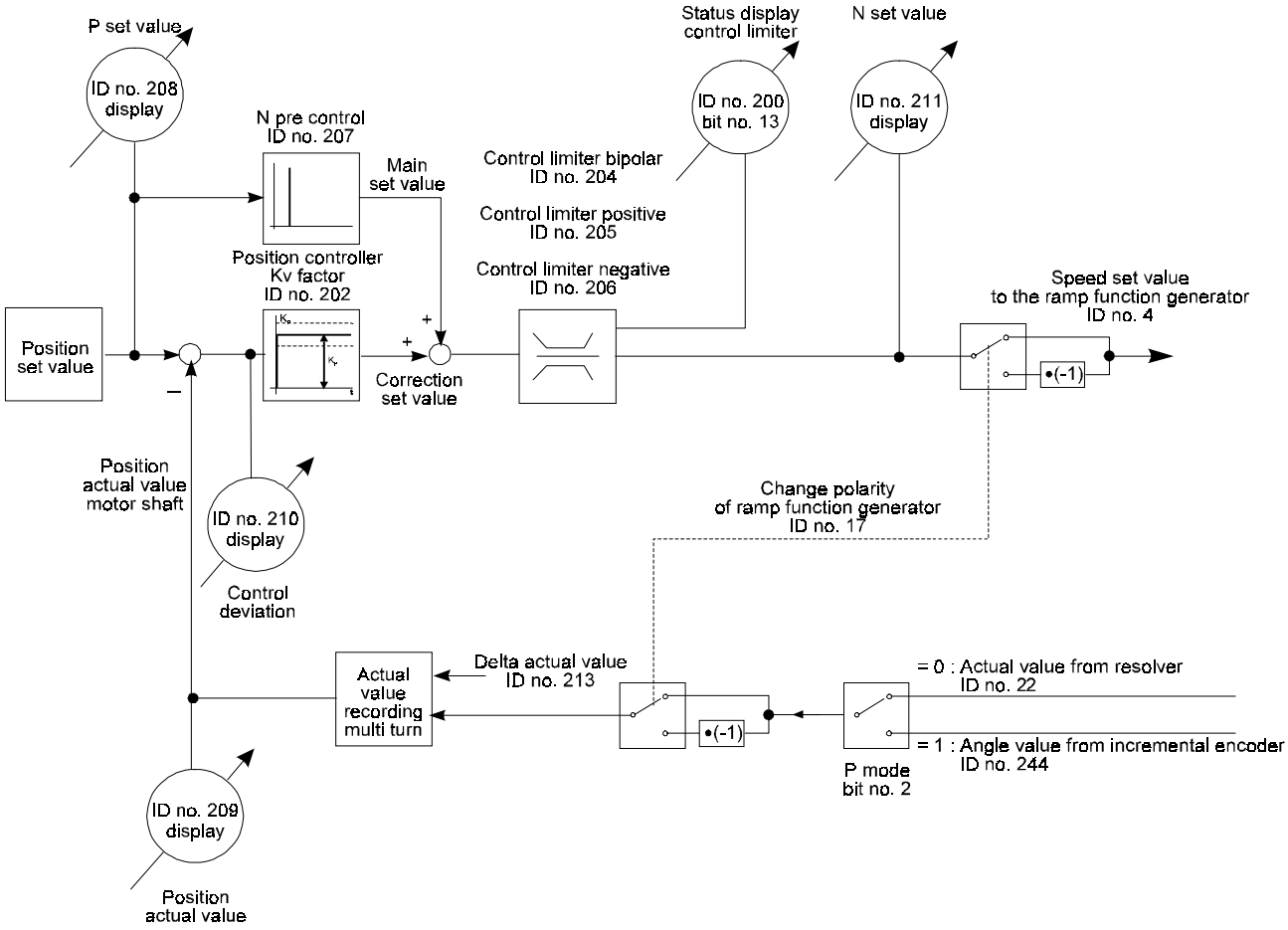
7.20 Position controller (ID no. 200 - 213)

Function

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

NOTE

The efficency of the position control is directly dependend upon the efficency of the speed control.



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
200	P **status**	0000 ... FFFF			5
201	P **mode**	0000 ... 0003		0001	
202	P **Kv factor**	0 ... 500	1/s	10	
203	P **deviation limit dynamic**	0 ... 2147483647	Inc	2000	
204	P **N limiter bipolar**	0.00 ... + 100.00	%	100.00	
205	P **N limiter positive**	0.00 ... + 100.00	%	100.00	
206	P **N limiter negative**	0.00 ... + 100.00	%	100.00	
207	P **N precontrol**	0.00 ... + 200.00	%	75.00	
208	P **set value**	00000000 ... FFFFFFFF	Inc		
209	P **actual value**	00000000 ... FFFFFFFF	Inc		5
210	P **deviation**	-2147483647 ... +2147483647	Inc		5
211	P **N set value**	-100.00 ... +100.00	%		5
212	P **deviation limit static**	0 ... 2147483647	Inc	200	
213	P **delta actual value**	-32767 ... +32767	Inc	0	
214	L **SF time**	0.000 ... 60.000	s	1.000	
215	L **IW active**	0.01 ... 20.00	%	1.00	
216	L **IW time**	0.000 ... 60.000	s	1.000	
217	L **IW threshold**	1 ... 30000	Inc/Ta	65	

Parameter description

200 P **status**

Indicates the position controller´s current operational status.

Bit no.	Meaning
0 ... 2	000 : STOP 001 : RUN 010 : LINE 011 : STAND_BY
3	1 : error in position controller
4	1 : dynamic deviation limiter exceeded
5	1 : static deviation limiter exceeded
6	1 : timeout dynamic deviation
7	1 : timeout static deviation
8	1 : actual value monitoring expects positve change
9	1 : actual value monitoring expects negative change
10	1 : missing actual value
11	1 : wrong polarity of actual value change
12	1 : set value reached (bit no. 4 and 5 not set)
13	1 : position controller on limiter
14 ... 15	reserved

201 P **mode**

This parameter sets the position controller´s operational mode. (see ID no. 203 and 212)

Bit no.	Meaning
0	1 : enabling error dynamic deviation
1	1 : enabling error static deviation
2	1 : incremental encoder for position control 0 :resolver for position control
3 ... 15	reserved

See P deviation limit dynamic (ID no. 203) and P deviation limit static (ID no. 212).
The change between incremental encoder and resolver (bit no. 2) is only possible before the first pulse enabling of the controller. After that the bit is protected against change. A change is only possible after the switching off and on of the controller´s power supply. For further notes to the incremental encoder see function module incremental encoder.

208 P **set value**

Set value input of the position controller. After the first pulse enabling of the controller the position set value is initialisized on angle of resolver or incremental encoder. For further pulse enabling the position actual value (ID no. 209) is taken over.

209 P **actual value**

This parameter displays the position actual value.

Past the first pulse enabling of the controller the position set value is initialisized on the resolver or incremental encoder angle after that independent from the actual M desired operation mode (ID no. 122) and independent from the status of the state machine (ID no. 121) the actual value is permanent actualized
It is possible to write to the position actual value in every operation mode.

Calibration of position set and actual value:
One motor revolution corresponds with internal **65536** incrementens. The low word represents the motor angle the high word counts the whole revolutions.

210 P **deviation**

The difference between position set value and actual value is termed deviation.
Because of the position control model (P controller) the deviation cannot be regulated entirely. of. Reasons for large deviations could be: blocked motor, not achieveable set speed or wrong inputs of controller parameters (e.g. speed controller).
The calibration corresponds to the position set/actual value calibration.

202 P **Kv factor**

The position controller's gain is set here.
When Kv = 0 only speed precontrol is active, i.e. position control is switched off.

207 L **N precontrol**

The speed precontrol is implemented as D element. The changes in position set value are differentiated and multiplied with parameter N precontrol. Therefore if N precontrol = 0% no value is added to the P N set value (ID no. 211).
With N precontrol = 100 % and constant changes in position set value per time unit the N precontrol generates exactly the needed speed set value. In this case the position control only generates the correcting set value for the angle adjustment.

211 P **N set value**

The speed set value contains the speed specifed value of the position control and of the speed precontrol. The smallest respective value is valid for the bipolar, positive and negative limiters (ID no. 204 - 206). As long the set value is limited the bit no. 13 in P status is set (ID no. 200). The N set value is written to the ramp function generator input 2 (ID no. 4).

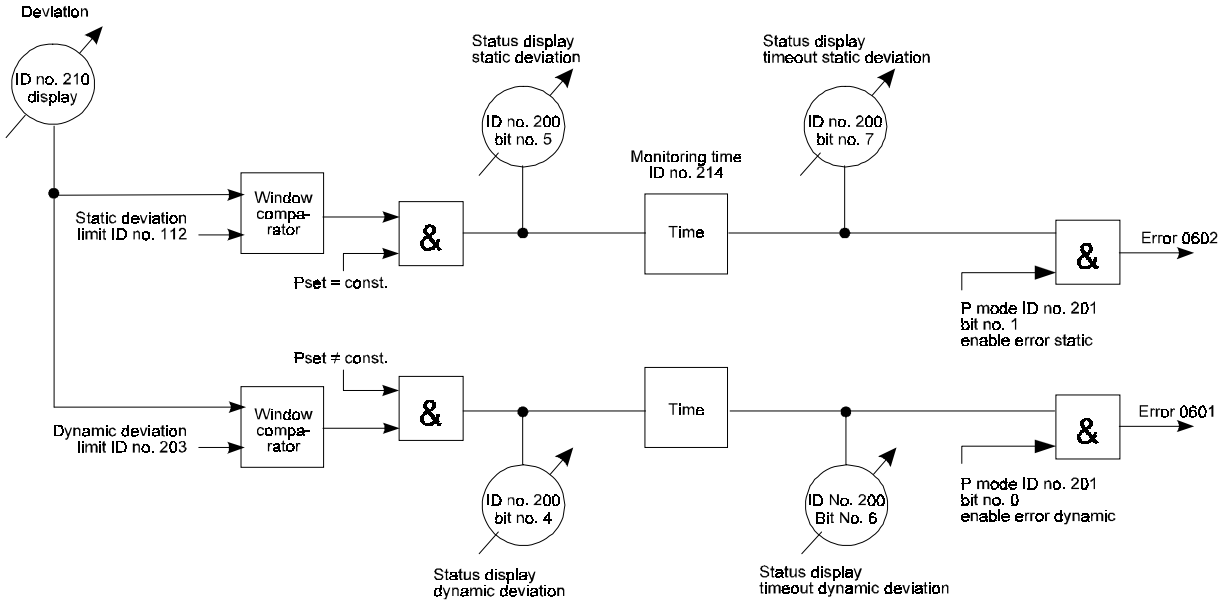
204 L **N limiter bipolar**
205 L **N limiter positive**
206 L **N limiter negative**

The bipolar limiter symmetrically limits the control variable (speed set value) of the position controller. The smallest respective value is valid for the bipolar, positive and negative limiters. Bit no. 13 is set in P status (ID no. 200) as long as the set value limiter is active.

213 P **delta actual value**

This parameter shifts the position actual value up to ± 32767 increments per writing action (internal calibration = ± 1/2 motor revolution).
The parameter P delta actual value is added exacly one time per writing action to the position actual value (ID no. 209).
The relation to the reference point is lost through writing on this parameter.

Deviation monitoring



212 P **deviation limiter static**

The static deviation limiter is active if the position controller within 100 ms no position set value received or the position set value doesn´t change (see diagram ID no. 203).

The static deviation limiter symmetrically limits the set position value.

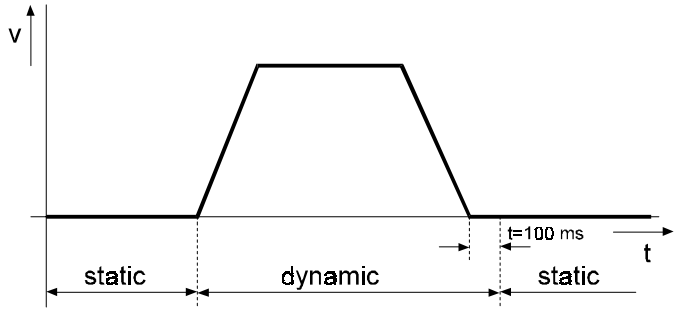
If the actual deviation is greater than the entered dynamic deviation limiter, bit no. 5 is set in P status (ID no. 200).

After the monitoring time (SF time, ID no. 214) the bit no. 7 is additionally set and the error code 0602h (see ID no. 124 M error code) is generated. The drive changes to the state inhibit start if in parameter P mode (ID no. 201) the error dynamic deviation is enabled (Bit no. 1 = 1).

203 P **deviation limiter dynamic**

The dynamic deviation limiter symmetrically limits the set position value. If the actual deviation greater than the entered dynamic deviation limiter, bit no. 4 is set in P status (ID no. 200). After the monitoring time (SF time, ID no. 214) the bit no. 6 is additionally set and the error code 0601h (see ID no. 124 M error code) is generated. The drive changes to the state inhibit start if in parameter P mode (ID no. 201) the error dynamic deviation is enabled (Bit no. 0 = 1).

Example: positioning
Switch over between dynamic and static deviation control



204 P **SF time**

This parameter sets the time window of the deviation monitoring.

Actual value monitoring

The set speed value from the position controller must change the position actual value after a set time. Moreover the change of the actual value and the set speed value must have an identical sign.

215 P **IW active**
This parameter specifies, at which N set value (ID no. 211) the actual value monitoring is enabled.

215 P **IW time**
This parameter sets the time window of the actual value monitoring.

215 P **IW threshold**
This parameter sets the threshold of the actual value monitoring (unit increments per cycle). Actual value changes below this threshold are ignored.

The monitoring is always active independent on the chosen encoder system (P mode, bit no. 2).

A response of this monitoring could except of adverse settings of ID no. 215, 216, 217 have various causes, e.g.

- The position control system is open respectively the position actual value is missing because

  1. the input selection of the ramp function generator is not set to RFG input 2
  2. the encoder is not connected
  3. the encoder is damaged electrically or mechanically
  4. slip or interlock has happened

- The actual value change has the wrong sign because
  1. the encoder is connected mechanically or electrically incorrectly
  2. the parameter actual value polarity is set wrongly
  3: the load sinks down before the torque is built up

Further notes see chapter maintenance.

7.21 Incremental encoder (ID no. 240 - 248)

Function

The incremental encoder serves for position recording in synchronisation control.

Parameter description

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
240	IE **status**	0000 ... FFFF			5
242	IE **graduation mark number**	250 ... 5000	Ink	1024	
243	IE **N actual value**	- 3000 ... 3000	U/min		5
244	IE **phi mechnical**	0.0 ... 360.0	Grad		5
245	IE **position actual value**	00000000 ... FFFFFFFF	Inc		
246	IE **polarity**	0 ... 1		0	
247	IE **nominal speed**	500 ... 4000	U/min		
248	IE **increment adding**	-32767 ... +32767	Inc	0	
104	IE **N = 0**	0.5 ... 20.0	%	0.5	
105	IE **N > Nx on**	0.00 ... 200.00	%	0.00	
106	IE **N > Nx off**	0.00 ... 200.00	%	0.00	

Parameter description

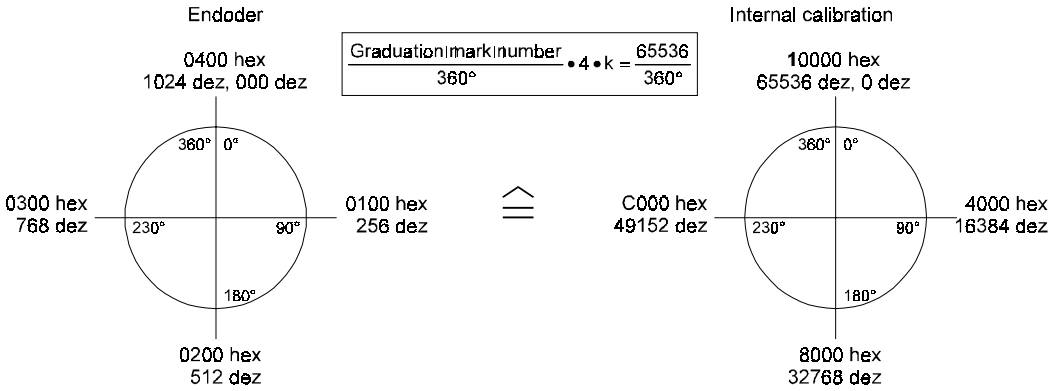
240 IE **status**

Display of internal module status

Bit no.	Meaning
0 ... 2	000: STOP 001: RUN 010: LINE 011: STAND_BY
3	1: error in function module, error code see M error code (ID no. 124)
4	logic level of zero trace
5	toggle bit of zero trace: changes at every zero impulse
6 ... 9	reserved
10	0: $\|n\| \neq 0$ 1: $\|n\| = 0$ speed lower than n = 0 (ID no. 104)
11	$0 \rightarrow 1$: $\|n\|$>Nx on (ID no. 105) $1 \rightarrow 0$: $\|n\|$<Nx off (ID no. 106)
12	reserved
13	$\|n\|$ > nominal speed (ID no. 247)
14 ... 15	reserved

242 IE **graduation mark number**

The number of encoder increments/revolution is entered here. Preferably encoders with binary graduation mark numbers should be (e.g. 256, 512, 1024, 2048, 4096), because only then can the encoder evaluation ensure a reliable angular relationship between the incremental encoder and the internal calibration. The encoder´s graduation mark is mulitplied via a 4-fold evaluation. The re-calibration of the increments from encoder to internal calibration is clarified by means of the following illustrations:
e.g. incremental encoder with 1024 increments

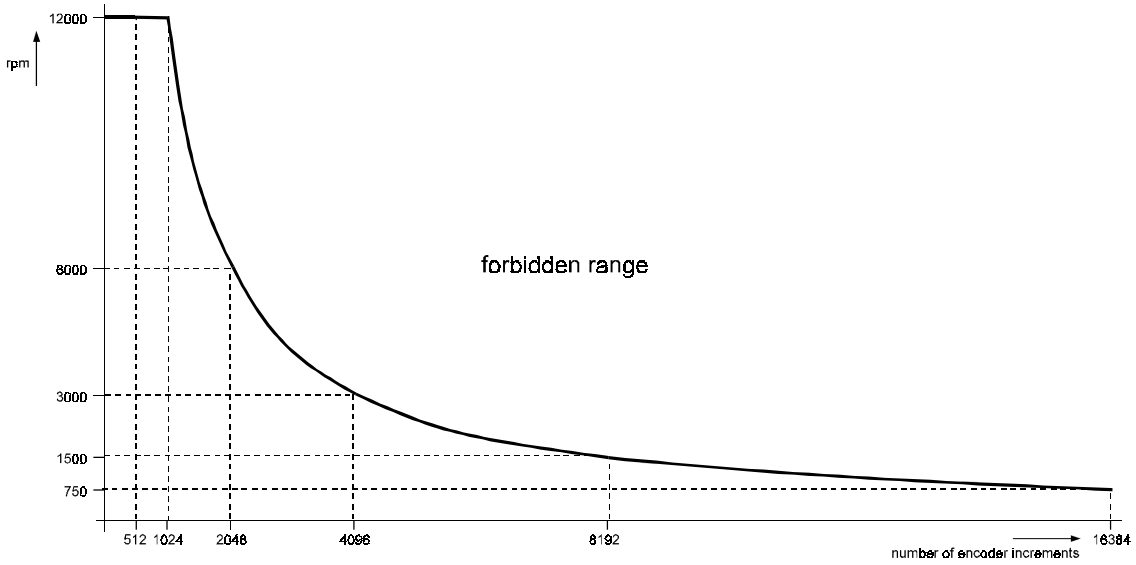


Motor shaft turning clockwise (A-side) ⇔ positive angular alteration

graduation mark number Ink	Factor 4-fold-evaluation	Calibration factor k	Effective resolution per revolution Inc
256	4	64	1024
512	4	32	2048
1024	4	16	4096
2048	4	8	8192
4096	4	4	16384
8192	4	2	32768
16384	4	1	65536

The actual maximum speed multiplied with the number of encoder increments must be lower than 205 kHz. If the frequency is higher than 205 kHz the controller recognizes a stoped encoder!

$$f = \frac{\text{number of encoder increments per revolution} * \text{speed}}{60} < 205\ \text{kHz}$$



243 IE **N actual value**

The motor speed is calculated from the incremental encoder signals. If the N actual speed value is greater than 100 % of the nominal speed (ID no. 247) the bit no. 13 (ID no. 240) will be set. If N actual speed is greater than 115 % of the nominal speed the overspeed monitoring generates an error and the bit no. 3 is set in IE status.

244 IE **Phi mechanical**

The current mechanical rotor angle is calculated from the incremental encoder signals.

245 IE **position actual value**

This parameter indicates the position actual value determined from the incremental encoder signals in motor increments. Here **65536** increments are added for one incremental encoder revolution (see also standardisation of set and actual position values in the position controller).

NOTE

The position actual value can be changed always through writing on!

246 IE **polarity**

The incremental encoder output sign can be changed via this parameter.

Value	Meaning
0	no polarity reversal: encoder turning clockwise supplies positive N actual value, changes in angle and position
1	polarity reversal: encoder turning clockwise supplies negative N actual value, changes in angle and position

247 IE **nominal speed**

The nominal speed of the applied motor is set via this parameter. This speed corresponds to 100 % in all other speed specification. Moreover this parameter sets the speed of the overspeed monitoring.

Example: nominal speed = 3000 rpm

$\Rightarrow$ overspeed monitoring speed = 1.15 x nominal speed = 3450 rpm

248 IE **increment adding**

When write-accessing this parameter the set increments (±32767 inc. correspond to ± 1/2 revolution) are added to the position actual value (ID no. 245) once.

104 IE **N = 0**

Bit no. 10 at function module status is set if the N actual value is lower than limitation N = 0 (independent of rotational direction).

105 IE **N > Nx ON**
106 IE **N < Nx OFF**

If the |actual value of N| (ID no. 243) is greater than ID no. 105, bit 11 in the Res status (ID no. 25) is set and only erased when the actual value of N becomes smaller than ID no. 106 (independent of rotational direction).

7.22 Motor potentiometer (ID no. 270 - 276)

Function

The motor potentiometer allows the alteration of all parameter values which can be written via the function inputs. Therefore it is necessary to program two digital inputs on the parameter EA motor potentiometer + (ID no. 271) and EA motor potentiometer - (ID no. 272). The cycle time of the function module is 32 ms.

Parameter description

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
270	EA **mode**	0 ... 1		0	
271	EA **motor potentiometer +**	0 ... 1		0	
272	EA **motor potentiometer -**	0 ... 1		0	
273	EA **motor potentiometer ID no.**	0 ... 500		2	
274	EA **motor potentiometer dynamics**	0 ... 2		1	
275	EA **motor potentiometer increment**	0.01 ...20.00	%	0.01	
276	EA **motor potentiometer value**	- 100.00 ... + 100.00	%		5

Parameter description

270 EA **mode**

Value	Meaning
0	no function
1	motor potentiometer function active

271 EA **motor potentiometer +**

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

272 EA Motorpoti - (EA motor potentiometer -)

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

273 EA motor potentiometer ID no.

The inching function target no. serves to specify the receiver address (= target parameter) of the output value.

NOTE

No target parameter number check is carried out.

274 EA motor potentiometer dynamics

The setting dynamics for key operation can be set here.

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

275 EA motor potentiometer increment

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

276 EA motor potentiometer value

This parameter describes the inching key module output.

7.23 Analog inputs (ID no. 277 - 304)

Function

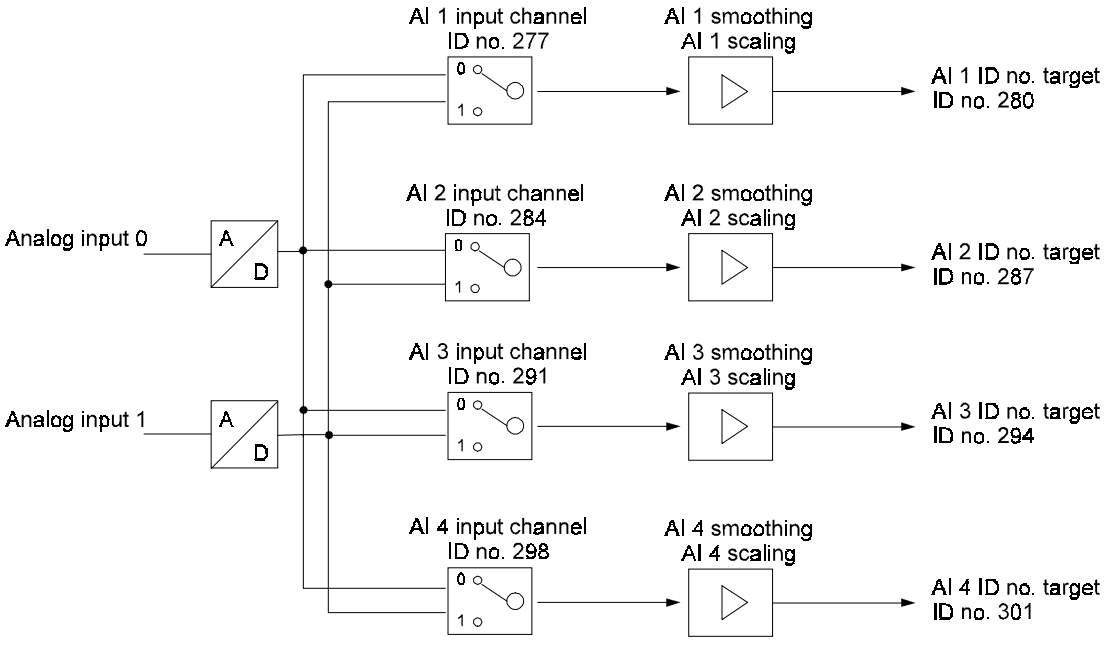
This module and the available 1 or 2 analog inputs enable parameters of 2 byte length to be programmed.

NOTE

In case of the following models 0000, 0001, 0010 and 0011 is only one analog input channel available (analog input 0).

Seven 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 ID no.:* target parameter number entry.
- *AI value*: current output value.



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
277	AI **1 input channel**	0 ... 3		0	
278	AI **1 smoothing**	1 ... 30	ms	1	
279	AI **1 scaling**	-2.00 ... 2.00		1.00	
280	AI **1 target ID no.**	0 ... 500		0	
281	AI **1 offset**	-100.00 ... +100.00	%	0.00	
282	AI **1 threshold value**	0.00 ... 100.00	%	0.00	
283	AI **1 value**	-100.00 ... +100.00	%		5
284	AI **2 input channel**	0 ... 3		0	
285	AI **2 smoothing**	2 ... 60	ms	2	
286	AI **2 scaling**	-2.00 ... 2.00		1.00	
287	AI **2 target ID no.**	0 ... 500		0	
288	AI **2 offset**	-100.00 ... +100.00	%	0.00	
289	AI **2 threshold value**	0.00 ... 100.00	%	0.00	
290	AI **2 value**	-100.00 ... +100.00	%		5
291	AI **3 input channel**	0 ... 3		0	
292	AI **3 smoothing**	4 ... 120	ms	4	
293	AI **3 scaling**	-2.00 ... 2.00		1.00	
294	AI **3 target ID no.**	0 ... 500		0	
295	AI **3 offset**	-100.00 ... +100.00	%	0.00	
296	AI **3 threshold value**	0.00 ... 100.00	%	0.00	
297	AI **3 value**	-100.00 ... +100.00	%		5
298	AI **4 input channel**	0 ... 3		0	
299	AI **4 smoothing**	4 ... 120	ms	4	
300	AI **4 scaling**	-2.00 ... 2.00		1.00	
301	AI **4 target ID no.**	0 ... 500		0	
302	AI **4 offset**	-100.00 ... +100.00	%	0.00	
303	AI **4 threshold value**	0.00 ... 100.00	%	0.00	
304	AI **4 value**	-100.00 ... +100.00	%		5

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 ID no.* is deactivated or newly set, the parameter "*AI offset*" is additionally set to zero.

Cycle times of analog inputs:

Depending on the hardware used the analog inputs have the following cycle times:

AI 1 Input :	1 ms
AI 2 Input :	2 ms
AI 3 Input :	4 ms
AI 4 Input :	4 ms

Parameter description

277 AI **1 input channel**
284 AI **2 input channel**
291 AI **3 input channel**
298 AI **4 input channel**

Entry of the analog input for respective channel.

278 AI **1 smoothing**
285 AI **2 smoothing**
292 AI **3 smoothing**
299 AI **4 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.

279 AI **1 scaling**
286 AI **2 scaling**
293 AI **3 scaling**
300 AI **4 scaling**

These parameters enable scaling of the analog input variable.

The output values (see parameters ID no. 283, 290, 297, 304) of unsigned parameters are 0 till +100% and of signed parameters are -100 bis +100%. Which analog input voltage this maximum values achieved depends on the scaling factor.

280 AI **1 target ID no.**
287 AI **2 target ID no.**
294 AI **3 target ID no.**
301 AI **4 target ID no.**

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

NOTE

No target parameter number check is carried out.

281 AI **1 offset**
288 AI **2 offset**
295 AI **3 offset**
302 AI **4 offset**

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

282 AI **1 threshold value**
289 AI **2 threshold value**
296 AI **3 threshold value**
303 AI **4 threshold value**

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

283 AI **1 value**
290 AI **2 value**
297 AI **3 value**
304 AI **4 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

Analog input voltage: U_{in} { -10.....+10 V };
U_{inmax} = +10V;

Equation:

Unsigned parameters:

$$AE\_value\,[\%] = \frac{Uin\,[V] + 10\ V}{2 * Uinmax\,[V]} * scaling * 100\ \% + offset\,[\%]$$

if $AE\_value > 100\%$ $\Rightarrow$ $AE\_value = 100\%$

Signed parameters:

$$AE\_value\,[\%] = \frac{Uin\,[V]}{Uinmax\,[V]} * scaling * 100\ \% + offset\,[\%]$$

if $AE\_value > 100\%$ $\Rightarrow$ $AE\_value = 100\%$
$AE\_value < -100\%$ $\Rightarrow$ $AE\_value = -100\%$

Both for signed and unsigned parameters:

$$|AE\_value\,[\%]| < threshold\,[\%]$$

$AE\_value = 0\%$
Written to the target parameter:

$$Value\ target = \frac{AE\_value\,[\%]}{100\ \%} * MAX$$

Examples:

Input voltage Û AI-value [%] * MAX
Þ Value target

Scaling = 1; offset = 0%; threshold = 0%;
Unsigned target parameter:

10 V	Û	100 %	* MAX
5 V	Û	75 %	* MAX
0 V	Û	50 %	* MAX
- 5 V	Û	25 %	* MAX
- 10 V	Û	0 %	* MAX

Signed target parameter:

10 V	Û	100 %	* MAX
5 V	Û	50 %	* MAX
0 V	Û	0 %	* MAX
- 5 V	Û	-50 %	* MAX
- 10 V	Û	-100 %	* MAX

Scaling = 2; offset = -100%; threshold = 0%;
Unsigned target parameter:

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

Signed target parameter:

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

Scaling = 1; offset = 0; threshold = 10.1%;
Unsigned target parameter:

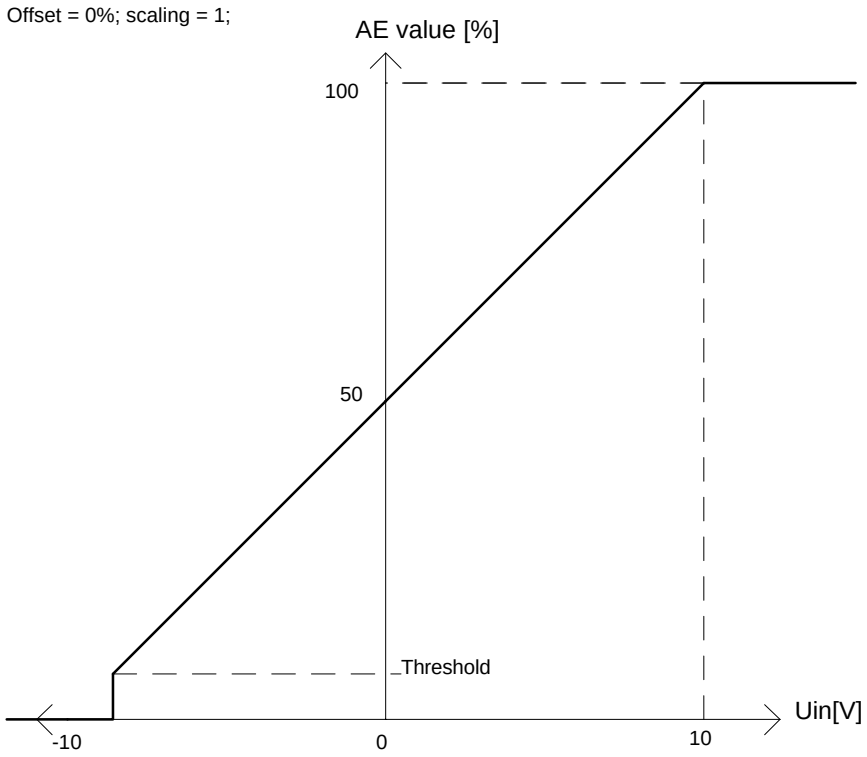
10 V	Û	100 %	* MAX	
5 V	Û	75 %	* MAX	
0 V	Û	50 %	* MAX	
-5 V	Û	25 %	* MAX	
- 9 V	Û	0 %	* MAX	(threshold !)
- 10 V	Û	0 %	* MAX	

Signed target parameter:

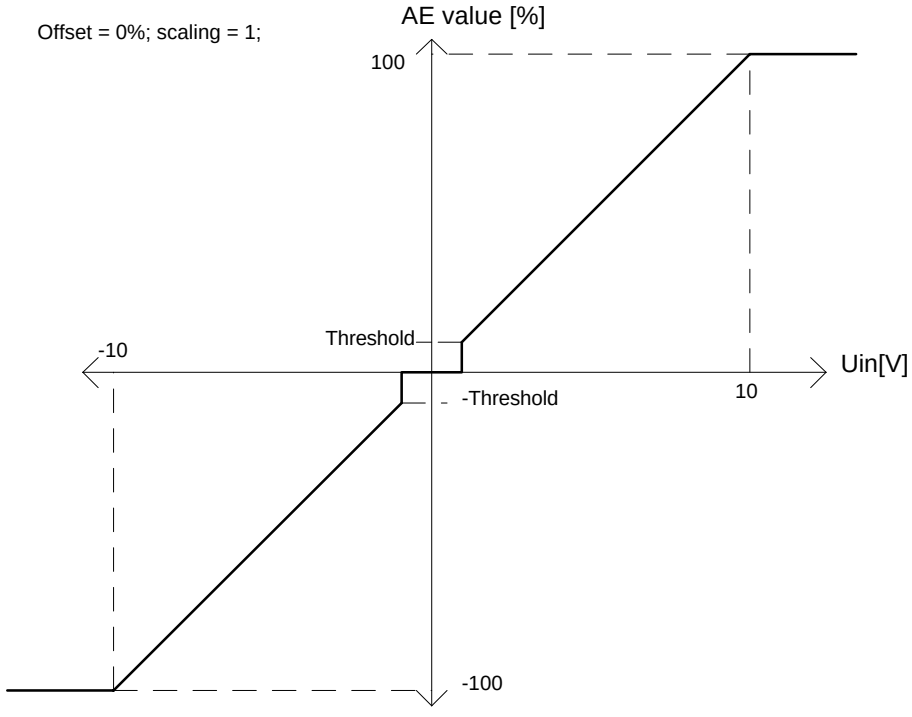
10 V	Û	100 %	* MAX	
5 V	Û	50 %	* MAX	
1 V	Û	0 %	* MAX	(threshold !)
- 1 V	Û	0 %	* MAX	(threshold!)
- 5 V	Û	-50 %	* MAX	
- 10 V	Û	-100 %	* MAX	

Examples of characteristic curves:

Unsigned target parameter:



Signed target parameter:



7.24 *Option*: Analog outputs (ID no. 330 - 341)

Function

The module "analog outputs" transmits freely selectable (and scalable) parameter values to an analog output, within the range ± 10 V, via a 12-bit digital-to-analog converter. The output current should not exceed 1 mA.

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
330	AO **ID no. channel 1**	0 ... 500		0	
331	AO **offset C 1**	-100000 ... +100000	Dig	0	
332	AO **scaling C 1**	-25000 ... +25000	Dig/V	0	
334	AO **ID no. channel 2**	0 ... 500		0	
335	AO **offset C 2**	-100000 ... +100000	Dig	0	
336	AO **scaling C 2**	-25000 ... +25000	Dig/V	0	
337	AO **test value**	-10.000 ... +10.000	V		
338	AO **status**	0 ... FFFF	-		5

Parameter description

330 AO **ID no. channel 1**
334 AO **ID no. channel 2**
The output parameter numbers are entered here.
The respective channel is switched off, if this parameter is equal 0.

331 AO **offset channel 1**
335 AO **offset channel 2**
Corresponding parameter offset is set via these parameters.

332 AO **scaling channel 1**
336 AO **scaling channel 2**
A scaling factor can also be selected for optimum parameter output.
The respective channel is switched off, if this parameter is equal 0.

337 AO **test value**

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

z.B. AO ID no. channel 1 ID no. 330 = 337

AO test value ID no. 337 = +10

⇒ analog output 1 = + 10 V

AO scaling C 1 ID no. 332 = -2000

⇒ analog output 1 = - 5 V

AO offset channel 1 ID no. 331 = 14000

⇒ analog output 1 = + 2 V

338 AO **status**

Display of internal module status

Bit no.	Meaning
0	0: STOP 1: RUN Analog output 1
1 ... 3	reserved
4	Analog output 1 at negative threshold (-10V)
5	Analog output 1 at positive threshold (+10V)
8	0: STOP 1: RUN Analog output 2
9...11	reserved
12	Analog output 2 at negative threshold (-10V)
13	Analog output 2 at positive threshold (+10V)
14 ... 15	reserved

7.25 Digital inputs (ID no. 370 - 382)

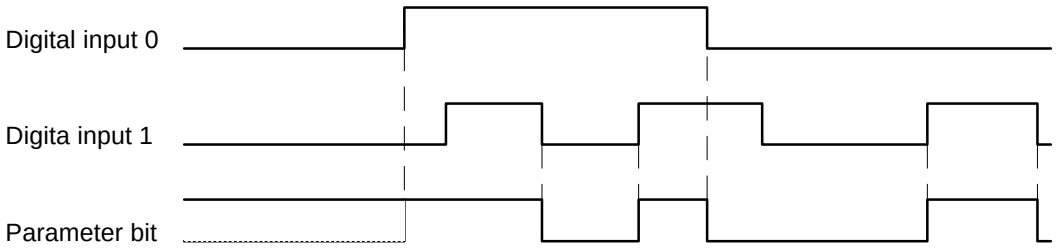
The module and the three available digital inputs enable parameter programming.

Four parameters are assigned to each input:

- *DI input ID no.*: Input of target parameter number.
- *DI bit selection:* Selection of the target parameter bits which are to be altered.
- *DI LOW pattern:* Bit pattern which is written into the target parameter if switch is OFF.
- *DI 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 three inputs are sampled every 2 ms at an interval of approx. 20 µs. In the event of simultaneous status change of two signals the signal with the higher weight is taken over (digital input 0 has the lowest weight, digital input 2 the highest).

NOTE

The sequence of the parameter setting is irrelevant. Switching takes place only after all parameters of one input have been set.
Um die Durchschaltung zu erreichen, ist auch bei einem DI LOW- und DI HIGH-Muster von 0000 die Eingabe erforderlich!
In order to deactivate an input either the *DI input ID no.* or the *DI bit selection* must be set to 0. The input can be re-activated by setting the relevant parameter again.

Example of programming procedure:

1) Enter target parameter number in *DI input ID no.* of the desired input.
⇒ Has no effect on the target parameter yet.

2) Enter *DI LOW and HIGH patterns* of the above-mentioned input.
⇒ Has no effect on the target parameter yet.

3) Enter *DI bit selection*:
⇒ all bits which have not been selected are set to 0 in the *LOW* and *HIGH patterns;*
the selected bits are set to 0 in the target parameter and are replaced by the corresponding bit pattern (according to switch position).

Examples:

1) Switch 1 low ⇔ parameter ID no. 13 = 0,
Switch 1 high ⇔ parameter ID no. 13 = 1

Set
DI ID no. input 0 (ID-Nr. 370) to 13,
DI LOW pattern 0 (ID-Nr. 372) to 0000,
DI HIGH pattern 0 (ID-Nr. 373) to 0001,
DI bit selection 0 (ID-Nr. 371) to FFFF

2) Through programming of a further input the values 2 and 3 should adjusted in parameter ID no. 13. Following sequence is necessary:

Set
DI ID no. input 0 (ID-Nr. 370) to 13,
DI LOW pattern 0 (ID-Nr. 372) to 0000,
DI HIGH pattern 0 (ID-Nr. 373) to 0001,
DI bit selection 0 (ID-Nr. 371) to FFFD

DI ID no. input 1 (ID-Nr. 374) to 13,
DI LOW pattern 1 (ID-Nr. 376) to 0000,
DI HIGH pattern 1 (ID-Nr. 377) to 0002,
DI bit selection 1 (ID-Nr. 375) to FFFE.

⇒ The digital input 0 effects bit no. 0 and 2 till 15;
the digital input 1 effects bit nol 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 ID no. 13	1	1	1	1	0	0	0	0	1	1	1	1	0	1	0	1
Input 0 ⇒ HIGH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Input 1 ⇒ HIGH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Input 0 ⇒ LOW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Input 1 ⇒ LOW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3) The digital input 2 should effect bit no. 4 and 11 of parameter ID no. 120.

Set
DI ID no. input 2 (ID-Nr. 378) to 120,
DI LOW pattern 2 (ID-Nr. 380) to 0800,
DI HIGH pattern 2 (ID-Nr. 381) to 0010,
DI bit selection 2 (ID-Nr. 379) to 0810

Bit no..	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Start value ID no. 120	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

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
370	DI **ID no. input 0**	0 ... 500		0	
371	DI **bit selection 0**	0000 ... FFFF		0000	
372	DI **LOW pattern 0**	0000 ... FFFF		0000	
373	DI **HIGH pattern 0**	0000 ... FFFF		0000	
374	DI **ID no. input 1**	0 ... 500		0	
375	DI **bit selection 1**	0000 ... FFFF		0000	
376	DI **LOW pattern 1**	0000 ... FFFF		0000	
377	DI **HIGH pattern 1**	0000 ... FFFF		0000	
378	DI **ID no. input 2**	0 ... 500		0	
379	DI **bit selection 2**	0000 ... FFFF		0000	
380	DI **LOW pattern 2**	0000 ... FFFF		0000	
381	DI **HIGH pattern 2**	0000 ... FFFF		0000	
382	DI **status**	0000 ... FFFF			5

Parameter description

370 DI **ID no. input 0**
374 DI **ID no. input 1**
378 DI **ID no. input 2**
This parameter indicates the ID no. of the target parameter for inputs 1, 2 or 3..

371 DI **bit selection 0**
375 DI **bit selection 1**
379 DI **bit selection 2**
The bits to be altered are selected in the target parameter.

372 DI **LOW pattern 0**
376 DI **LOW pattern 1**
380 DI **LOW pattern 2**
Bit pattern which is written into the selected target parameter bits when digital input is LOW.

373 DI **HIGH pattern 0**
377 DI **HIGH pattern 1**
381 DI **HIGH pattern 2**
Bit pattern which is written into the selected target parameter bits when digital input is HIGH.

382 DI **Status**
This parameter indicates the status of input programming

Bit no.	Meaning	Note
0	1: ID no. input 0 active	If bit no. 0 till 3 is set
1	1: bit selection 0 active	input 0 is active
2	1: LOW pattern 0 active	
3	1: HIGH pattern 0 active	
4	1: input ID no. active	If bit no. 4 till 7 is set
5	1: bit selection 1 active	input 0 is active
6	1: LOW pattern 1 active	
7	1: HIGH pattern 1 active	
8	1: input ID no. active	If bit no. 8 till 11 is set
9	1: bit selection 2 active	input 0 is active
10	1: LOW pattern 2 active	
11	1: HIGH pattern 2 active	
12	1 : state input 0 active	The actual state of the three.
13	1 : state input 1 active	inputs and the pulse enabling is
14	1 : state input 2 active	displayed here
15	1 : state pulse enabling active	

7.26 Relay output (ID no. 393 - 396)

Function

The module enables programming of the available relay output. Three parameters are assigned to the output:

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

NOTE

The sequence in which the parameters are set is irrelevant. Switching takes place only after all three have been set.
In order to deactivate the output either *RO output ID no.* or *RO bit selection* must be set to 0. The last switch status, 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 *RO output ID no.* of the output of your choice.
⇒ has no effect on the output yet.

2) Enter *RO bit pattern* of the above-mentioned output.
⇒ has no effect on the output yet.

3) Enter *RO bit selection*:
⇒ all bits which have not been selected are set to 0 in the *RO bit pattern*;
the selected source parameter bits are compared to the *RO bit pattern.*
If the pattern corresponds to the source parameter number the output is set to HIGH.

Example:

- First set *RO output ID no. 0* to 13,
- *RO bit pattern 0* to 0001,
- and *RO bit selection 0* to 0003.

⇒ If bit no. 1 and bit no. 2 of parameter 13 result in "1" the relay output is switched to HIGH.

Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RO bit selection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
RO bit pattern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ID no. 13	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0	1

Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Display only
393	RO **output ID no.**	0 ... 500		0	
394	RO **bit selection**	0000.....FFFF		0000	
395	RO **bit pattern**	0000.....FFFF		0000	
396	RO **status**	0000 ... FFFF			5

Parameter description

393 RO **output ID no.**

This parameter indicates the source parameter ID no.

394 RO **bit selection**

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

395 RO **bit pattern**

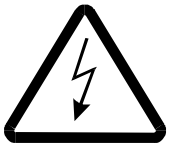
Bit pattern which corresponds to the source parameter bit pattern.

396 RO **status**

This parameter indicates the status of output programming.

Bit no.	Meaning	Note
0	1: RO output active ID no.	Only if bit no. 0 and 2 is set
1	1: RO bit selection active	the output is active
2	1: RO bit pattern active	
3 ... 15	reserved	

8 MAINTENANCE



DANGER

This unit carries dangerous voltage and contains dangerous rotating machine parts (ventilators). This means that death, serious injury or considerable material damage can occur if the safety and warning notes are not heeded.

Maintenance work on the equipment may only be carried out in a voltage-free state.

Work on the power unit, intermediate circuit and motor terminals may only be undertaken when it is ascertained that there is neither potential nor voltage (remainder) present.

Wait at least 2 minutes after switching off until the intermediate circuit is completely discharged.

On dismantling safety equipment during commissioning, repair and maintenance, the machine is to be shut down exactly according to instructions. After completion of commissioning, repair and maintenance work the safety equipment is to be reinstalled immediately.

After all work on the drive, the machine operator must inspect the machine and document all work in the machine log chronologically, irrespective of whether it was on the motor, actual value recording or converter. In cases of non-compliance the operator carries full legal responsibility for the consequences.

Motors or devices may have components which contain dangerous substances for technical reasons.

Only manufacturer-approved spare parts may be used.

8.1 Maintenance notes

The delivered equipment is maintenance-free.

Prohibition of unauthorised conversion

Unauthorised conversion and alteration of the drive are prohibited for safety reasons. In cases of doubt, contact the manufacturer.

8.2 Error messages

If an error occurs the parameter "M error code" (ID no. 124) displays the corresponding error code. This error is acknowledged if the bit "error reset" in the M control word (ID no. 120) is set from 0 to 1. If several errors are present, the next error is displayed immediately after acknowledgement.

- **Function module drive manager (error code 00xx)**

Error identification	Error text	Meaning	Remedy
0001h	timeout BASS protocol	The communication source set in ID no. 124 has not responded for a period exceeding the one set in ID no. 128	Check communication (cables, supplementary card etc.)
0002h	timeout USS protocol		
0003h	timeout dual port RAM (cyclic data)		
0004h	timeout dual port RAM (working data)		
0005h	system boot	Reading the boot data set form the EEPROM has generated an error. Further information to the error see parameter DSM message (ID no. 192). This error mostly appears if the controller firmware was exchanged with an incompatible controller firmware.	Check the data set in user memory and additionally program it as boot data set to the EEPROM.
0010h	error switch (program error)	Only relevant to the software developer	

- **Function module power supply (error code 01xx)**

Error identification	Error text	Meaning	Remedy
0110h	error load contactor	Discharging the intermediate circuit capacitor lasts too long	Remove additional intermediate circuit capacitors
0103h	U_{ZK} too low	The intermediate circuit voltage is lower than a minimum value	Check main power supply
010Ch	current at ballast resistor too high		Check ballast resistor (minimum value 47 Ω)

- **Function module power unit (error code 02xx)**

Error identification	Error text	Meaning	Remedy
0201h	overvoltage Uzk	The intermediate voltage U_{ZK} is greater than 800 V $\pm$ 1 % .	Check ballast restistance
0202h	excess current, fault current	At least one of three phase currents has exceeded $2 \cdot \hat{I} = 2 \cdot$ maximum current power unit	Check the adjustment of the current controller
0207h	transistor error (group error)	The U_{CE} monitoring of at least one power transistor occurs, e.g. because of a short circuit, earth circuit or a transistor defect	Check motor connections, leave power unit to cool down, change power unit if error does not disappear
0210h	undefined error	The power unit´s ready for use signal is missing although no error message is generated.	

- **Function module resolver compensation (error code 03xx)**

Error identification	Error text	Meaning	Remedy
0301h	open circuit Resolver	The resolver's measurement signals cannot be used for evaluation	Check encoder cable at motor and unit end

- **Funktion module overload monitoring (error code 04xx)**

Error identification	Error text	Meaning	Remedy
0401h	I²t motor monitoring	Calculated I²t actual motor value exceeds 100 %.	Leave drive in inhibited status until I²t actual value (ID no. 91) has fallen below 100 %.

- **Function module motor temperature (error code 05xx)**

Error identification	Error text	Meaning	Remedy
0501h	temperature motor too high	ID no. 152 = 3 (NTC) Motor temperature has risen so mach that the resistance have reached a high ohmic condition. ID no. 152 = 1 (Sensor) The motor temperature has exceeded the switch off threshold (ID no. 156). This fault can arise if, during operation, the motor temperature monitoring is interrupted	Leave motor to cool down until motor temperature has sunk below the limiting value

- **Function module position controller (error code 06xx)**

Error identification	Error text	Meaning	Remedy
0601h	deviation dynamic	The deviation (ID no. 210) has exceeded the dynamic deviation limiter (ID no. 203) during movement (e.g. positioning, synchronisation control) Während der Fahrt	Check the settings of the dynamic deviation. Disable error for dynamic deviation in mode parameter ID no. 201 (bit no. 0).
0602h	deviation static	The deviation (ID no. 210) has exceeded the static deviation limiter (ID no. 212) during stop (e.g. target position reached, n=0)	Check the settings of the dynamic deviation. Disable error for dynamic deviation in mode parameter ID no. 201 (bit no. 1).
0603h	positive actual value missing	A change of the actual value with a positive sign hasn´t happend, the position control system is open	Check the ramp function generator´s input selection (ID no. 13 = 2)
0605h	negative actual value missing	A change of the actual value with a negative sign hasn´t happend, the position control system is open	Check connection of the encoder and exclude mechanically and electrically defect Check setting of the monitoring
0604h	sign error positive actual value	A change of the actual value which was expected with positive sign has a negative sign	Check connection of the encoder and exclude mechanically and electrically defect
0606h	sign error negative actual value	A change of the actual value which was expected with negative sign has a positive sign	Check the parameter ID no. 246 IE polarity. Check setting of the monitoring

- **Function module speed controller (error code 07xx)**

Error identification	Error text	Meaning	Remedy
0701h	monitoring set/actual value	The controller deviation (ID no. 60) has exceeded the set threshold (ID no. 61) for more than 200 ms.	Check threshold and enlarge if need be. Check settings of the speed controller.

- **Function module resolver (error code 08xx)**

Error identification	Error text	Meaning	Remedy
0801	speed too high	The resolver evaluation has a speed actual value (ID no. 23) greater than 115 % of the preset nominal speed (ID no. 19). This fault can also occur if during operation the resolver lead is interrupted.	Check resolver lead. Check settings of speed controller.

- **Function module data set management (error code 09xx)**

Error identification	Error text	Meaning	Remedy
0901h	copy error EEPROM	During the EEPROM´s initialisation copy the data set management has detected an error.	This error cann´t be acknowledged. Switch the electronic power supply off and on again. Appears this error more frequently could this caused through a defect in controller hardware.
0902h	boot data set missing	No boot data set (DS no. 0) is available in the EEPROM.	The boot data set has to be generated and after that stored in the EEPROM.
0903h	check sum error in boot data set	The boot data set is available but because of a data fault not valid.	The boot data set has to be generated and after that stored in the EEPROM.

- **Function module incremental encoder (error code 0Axx)**

Error identification	Error text	Meaning	Remedy
0A01h	speed too high	The incremental encoder evaluation has a speed actual value (ID no. 243) greater then 115 % of the preset nominal speed (ID no. 247). This fault can also accur if, during operation, the resolver lead is interrupted.	Check incremental encoder lead. Check settings of speed controller

8.3 Disposal

The units consist essentially of the following components and materials

Components	Material
Housing, various intermediate plates, fan coil, support plates	Steel plate
Heat sinics in power unit	Aluminium
Various distance bolts	Steel
Various distance bolts, current converter hausing and fan housing	Plastic
Power unit rails	Copper
Cable looms	PVC insulated calbe leads
Power electronics	Metal base plate: Semiconductor chip, plastic housing, various insulation material.
Cunductor plates, accomodating the complete control and regulation electronic	Base material: EPOXY resin (filled with GRP). Copperplated on both sides and with interconnected channels. Various electronic components such as capacitors, resistors, relays and semi-conductor components, etc.

The electronic components can, on account of technical demands, contain dangerous materials.

In normal use the various components da not represent a danger to humans or environment.

In the event of fire dangerous materials may be released

The electrical components should not be opened since, for the purpose of internal insulation, (e.g. on various power semi-conductor) beryllium oxide has been used. The beryllium dust caused by opening represents a health hazard.

The disposal of the units should conform to the recycling regulations of the country und region in which they are disposed.

9 APPENDIX

9.1 Suitable 3-phase servo-motors

Servo-motors with 3-phase supply can be driven via BUM 6 single-axle controllers with nominal current up to 12 A (peak) in the S1 range. The single-axle controller BUM 618/619 can briefly deliver current up to 18 A for dynamic procedures, e.g. acceleration and braking.
As a result of their design and development - in relation to the intermediate circuit voltage (310 V), 50 % overloading is possible at the nominal point, i.e. at nominal torque and maximum speed.
The stated current values are peak values.

DS-Servo type		Torque				Current					
	n_N (rpm)	M_0 (Nm)	M_N (Nm)	$M_{S3\ 40\%}$ (Nm)	M_{0max} (Nm)	I_0 (A)	I_N (A)	$I_{S3\ 40\%}$ (A)	I_{0max} (A)	m (kg)	J_M ($kgcm^2$)
DS36S	6000	0.4	0.33	0.5		1.9	1.7	2.4			0.35
DS36M	6000	0.7	0.6	0.9		3.3	3.0	4.1			0.6
DS36L	6000	1.0	0.88	1.2		4.7	4.2	5.8			0.9
DS45S -	3000	0.85	0.65	0.95	3.4	2.3	2.1	2.8	9.2	4.9	1.5
DS45S -	4000		0.6	0.9		3.1	2.8	3.7	12.0		
DS45M -	3000	1.7	1.5	2.3	6.8	3.7	3.7	5.3	19.2	5.9	2.1
DS45M -	4000		1.4	2.2		5.1	4.9	7.1	20.4		
DS45L -	3000	3.2	2.6	4.1	12.8	6.1	5.5	8.2	24.4	6.9	3.4
DS45L -	4000		2.4	3.8		8.6	7.4	11.0	34.0		
DS56S -	2000	3.8	3.6	4.1	19.0	4.9	4.7	5.4	23.5	6.6	4.9
DS56S -	3000		3.4	4.5		7.3	6.8	8.8	35.5		
DS56S -	4000		3.2	5.1		10.2	9.0	13.8	49.5		
DS56M -	2000	7.0	6.2	9.1	35.0	8.5	7.7	11.2	41.5	8.5	8.7
DS56M -	3000		5.6	9.0		13.0	10.8	17.0	63.0		
DS56M -	4000		4.8	8.6		16.6	12.2	21.0	81.0		
DS56L -	2000	10.0	8.4	13.0	50.0	12.4	10.6	16.2	61.0	10.8	12.5
DS56L -	3000		7.2	12.2		17.2	12.8	21.5	84.0		
DS71K -	2000	10.5	9.3	13.5	47.0	13.4	12.2	17.4	59.0	12.2	17.5
DSO56S -	2000	4.8	4.1	4.1	19.0	6.1	5.3	5.3	23.5	8.3	4.9
DSO56S -	3000		4.4	4.4		9.2	8.6	8.6	35.5		
DSO56S -	4000		4.5	5.1		12.8	12.2	14.0	49.5		
DSO56M -	2000	9.2	8.7	8.8	35.0	11.2	10.8	10.8	41.5	10.2	8.7
DS56A -	2000	1.9	1.8	2.6	9.5	3.1	3.1	4.3	15.0	5.5	2.4
DS56A -	3000		1.8	2.5		4.5	4.3	6.0	21.0		
DS56A -	4000		1.7	2.4		5.6	5.4	7.1	26.5		
DS56B -	2000	3.7	3.5	4.1	19.0	4.8	4.5	5.4	23.5	6.7	4.3
DS56B -	3000		3.3	4.5		7.1	6.5	8.9	35.5		
DS56B -	4000		3.0	4.9		9.9	8.6	13.4	49.5		
DS71B -	2000	7.0	6.4	9.6	31.5	10.2	9.6	14.2	45.0	10.3	10.9
DS71B -	3000		5.9	9.5		14.4	12.6	19.6	63.0		
DS71C -	2000	10.0	8.7	13.3	47.0	12.8	11.4	17.2	59.0	12.4	16.0
DS100B -	1200	12.5	12.0	17.7	50.0	12.8	12.4	18.2	50.0	18.9	36.5

DS-Servo type		Motor constants				Windings		Time constants	
	n_N	K_E	K_T	K_D	M_R	L_d	R_1	t_H	T_t
	rpm	V/1000 rpm	Nm/A	Nm/1000 rpm	Nm	mH	W	ms	rpm
DS36S	6000	19.6	0.31	0.003	0.016				
DS36M	6000	19.9	0.31	0.005	0.019				
DS36L	6000	19.7	0.31	0.008	0.021				
DS45S -	3000	45.0	0.430	0.040	0.127	17.9	7.800	18	21
DS45S -	4000	33.7	0.320			10.1	4.400	26	
DS45M -	3000	51.1	0.490	0.060	0.131	10.6	3.400	12.3	24
DS45M -	4000	37.8	0.360			5.8	1.850	17	
DS45L -	3000	57.2	0.550	0.090	0.140	5.1	1.440	11	26
DS45L -	4000	41.2	0.390			3.3	0.820	15	
DS56S -	2000	84.7	0.809	0.030	0.154	16.5	2.631	8.3	21
DS56S -	3000	56.5	0.540			7.3	1.169	13	
DS56S -	4000	40.6	0.388			3.8	0.604	17	
DS56M -	2000	88.3	0.843	0.062	0.181	8.2	0.984	8.2	24
DS56M -	3000	59.1	0.555		0.180	3.6	0.426	13	
DS56M -	4000	45.3	0.433		0.181	2.2	0.259	18	
DS56L -	2000	86.7	0.828	0.094	0.208	5.1	0.543	8.4	26
DS56L -	3000	62.4	0.596		0.207	2.7	0.277	13	
DS71K -	2000	83.5	0.797	0.082	0.231	6.1	0.483	11	27
DSO56S -	2000	84.7	0.809	0.030	0.154	16.5	2.631	8.3	14
DSO56S -	3000	56.5	0.540			7.3	1.169	13	
DSO56S -	4000	40.6	0.388			3.8	0.604	17	
DSO56M -	2000	88.3	0.843	0.062	0.181	8.2	0.984	8.2	15
DS56A -	2000	67.7	0.646	0.014	0.141	24.4	5.323	8.1	22
DS56A -	3000	47.9	0.457		0.140	12.2	2.658	12	
DS56A -	4000	37.9	0.362		0.141	7.6	1.669	16.3	
DS56B -	2000	84.7	0.809	0.030	0.154	16.5	2.631	7.5	23
DS56B -	3000	56.5	0.540			7.3	1.169	12	
DS56B -	4000	40.6	0.388			3.8	0.604	16	
DS71B -	2000	73.6	0.703	0.054	0.206	7.4	0.710	10	26
DS71B -	3000	52.4	0.500			3.8	0.359	16	
DS71C -	2000	83.5	0.797	0.082	0.231	6.1	0.483	11	27
DS100B -	1200	104.8	1.001	0.094	0.310	10.8	0.591	11	37

Characteristics of 3-phase motors

- Maintenance-free
- Well-protected
- Can be briefly overloaded
- High power density, therefore low motor capacity
- Good acceleration due to low inertia and high torque
- Nominal torque from 0.6 Nm to 6 Nm with single-axle controller BUM 6
- Normal, short and ventilated models

Options

- Hand brake built into drive-end shield in closed-circuit connection (24 $V_{=}$)
- Incremental encoder integrated or built-on
- Plug terminals instead of terminal box
- Shaft seal at drive-end

9.2 Manufacturer Declaration

Manufacturer Declaration in Accordance with the EC-Machine Guidelines 89/392/EEC, Appendix II B

We herewith declare that this delivery includes the following specified machine component and that its putting into operation is prohibited until the declaration is made that the machine, in which this component is built in, complies with the regulations of the EC-machine guideline 89/392/EWG, appendix II B.

Specification of the machine component:	**Type:**
Compact Unit	BUM 618 - 4 / 6 - 31 - E - .... - ....- SM BUM 619 - 4 / 6 - 31 - E - .... - ....- SM BUM 618 - 6 / 9 - 31 - E - .... - ....- SM BUM 619 - 6 / 9 - 31 - E - .... - ....- SM BUM 618 - 12 / 18 - 31 - E - .... - ....- SM BUM 619 - 12 / 18 - 31 - E - .... - ....- SM

Date/Signature of the Manufacturer:

Information regarding the Undersigned: Head Division Electronics

9.3 Declaration of Conformity

EG Declaration of conformity of equipment regarding low voltage directive 73/23/EWG

Specification of the machine component:	**Type:**
Compact Unit	BUM 618 - 4 / 6 - 31 - E - .... - ....- SM BUM 619 - 4 / 6 - 31 - E - .... - ....- SM BUM 618 - 6 / 9 - 31 - E - .... - ....- SM BUM 619 - 6 / 9 - 31 - E - .... - ....- SM BUM 618 - 12 / 18 - 31 - E - .... - ....- SM BUM 619 - 12 / 18 - 31 - E - .... - ....- SM

Conformity of the significated product with the guidelines will be proved by following rules:

pr EN 50178: 1994 (VDE 0160/11.94)
"Equipment of power installation concerned electronic operating materials"

Nürnberg, 8. January 1997

Signature of the Manufacturer

Dr.–Ing. P. Kreisfeld

Head Division Electronics

Dipl.–Ing. (FH) R.–A. Geller

CE–Agent Electronic

9.4 Conditions of Business and Delivery

1. Scope

1.1 Deliveries and performance provided by Baumüller and offers made by Baumüller are exclusively and completely subject to these general terms and conditions (from now on referred to as "these terms"). Unless a mutual agreement has been made which differs from this statement, these terms also apply to future business relationships.

1.2 If a customer places an order with Baumüller, this implies that these terms are accepted. Any counterconfirmations made by persons or legal persons placing an order with Baumüller with reference to their own general terms and conditions or their terms and conditions of purchase are thereby objected to.

1.3 Supplements or modifications to these terms require written consent from Baumüller in order to take effect.

2. Offer and Copyright

2.1 Offers made by Baumüller are subject to confirmation and not binding. Supplements, modifications or ancillary agreements require written consent from Baumüller in order to take effect.

2.2 Any pictures, drawings, measures, weights or other performance specifications are only binding if this is explicitly stipulated in writing. Drawings, dimensional drawings and descriptions of projects are subject to the copyright of Baumüller and must neither be copied nor revealed to third parties without prior written consent from Baumüller. Baumüller reserves the right to demand that these objects are immediately returned to Baumüller if they are not used for orders to Baumüller.

2.3 The purchaser must not use any process engineering knowledge revealed to him in his business relationship with Baumüller for his own purposes and must not reveal that knowledge to third parties. Any violation of this condition makes the purchaser (violator) liable for damages of an amount of DM 70,000.

3. Scope and Term of Delivery

3.1 The deadlines and terms specified by Baumüller are not binding unless explicitly specified otherwise in a written agreement.

3.2 The delivery term begins at one of the points in time listed below:

- Date of confirmation of order
- Date on which the purchaser meets all of the technical, commercial or other prerequisites he is obliged to meet
- Date on which a downpayment or security required prior to delivery of the merchandise is furnished by the purchaser
- If the stipulated downpayments to Baumüller are made delayed, the delivery term is extended proportionally.

3.3 Baumüller has the right to make partial deliveries and provide partial performance and to issue partial invoices for these deliveries or performance at any time of their choice. Excess volume or short deliveries up to 5% of the delivery quantity are permitted. The amount charged is calculated according to the delivery quantity.

3.4 Baumüller is not responsible for delayed delivery or performance or the inability to deliver or perform due to acts of god or force majeure or other events which make it impossible or more difficult for Baumüller to deliver - e.g. war, problems in the provision of materials which arise after the time the offer has been made, malfunctions, strike, lockout, personnel shortage, shortages of means of transportation, instructions issued by the authorities etc. which occur at suppliers of Baumüller or their sub-suppliers. Therefore, Baumüller has the right to postpone deliveries or performance by the duration of the problem plus an appropriate startup time and Baumüller also has the right to withdraw from the contract partially or completely. If the problems persist for more than 3 months the purchaser has the right to withdraw from that part of the contract which has not yet been fulfilled after having fixed an appropriate extension of the time limit.

3.5 The deadline is considered to have been met if the object to be delivered leaves the storage facility on the fixed date or if the purchaser is informed of its availability for shipment on the fixed date.

3.6 Baumüller or subcontractors of Baumüller will install and assemble the delivered objects exclusively subject to conditions and terms separately agreed upon not later than 4 weeks before delivery.

4. Passage of risk, acceptance, packing

4.1 Delivery is made free carrier (FRC, INCOTERM 1980). The goods are packed at the discretion of Baumüller at the costs of the customer. The risk is passed to the customer as soon as the consignment has been handed over to the person carrying out the transport or has left the store.

4.2 If the shipment is delayed or becomes impossible due to reasons for which Baumüller is not responsible, the risk is passed to the customer with the notification of readiness for shipment if the delivery is stipulated to be carried out upon call-forward notice, the goods are regarded as called off at the latest one year after the date of order.

4.3 Special acceptance conditions must be defined at conclusion of the contract at the latest. The acceptance test has to take place in the works of Baumüller. The costs for the acceptance test will be charged to the customer. If the customer omits the acceptance test, the goods are regarded as delivered as stipulated when they leave our works.

5. Prices and terms of payment

5 1 The prices stipulated by Baumüller in the order confirmation plus the respective legal value added tax apply. Additional deliveries and services will be separately invoiced. The prices are valid ex works or store excluding packing.

5 2 If not otherwise agreed upon, the prices stipulated in the order confirmation are binding for 30 days only.

5 3 Payments shall be made in cash without any deductions free paying office of the vendor in the currency agreed upon. Bills of exchange and checks are only accepted on account of payment. The customer has to bear any costs and bank charges arising thereof.

A payment is regarded as made only, if the amount is available to Baumüller. In case of payment by check, the payment is regarded as made when the check has been irrevocably cashed.

5 4 Invoices are to be paid without deductions within 30 days from the date of issue. Baumüller is entitled to enter payments of the customer on older open invoices in spite of deviating instructions by the customer. If costs and interests have ahead arisen. Baumüller is entitled to enter the payment first on the costs, then on the interests and last on the main service.

5.5 The customer is entitled to offset, to retain or reduce the payment - independent of notices of complaint or possible counterclaims - only, if Baumüller has explicitly agreed or if the counterclaims have been legally verified.

5.6 If payments are delayed, Baumüller is entitled to charge interest on arrears at a rate corresponding to the interest rate for open credits in current account, however, at least corresponding to the current discount rate of the Deutsche Bundesbank.
This does not affect the assertion of another damage caused by delayed payment.

5 7 If the customer fails to meet his payment obligations, especially if he does not cash a check or stops his payment or if Baumüller is informed of other circumstances making the credit worthiness of the customer uncertain. Baumüller is entitled to demand advance payments or securities before delivery or to invoice the total remaining amount in the case that instalments had been previously agreed upon.

6. Retention of ownership

6 1 Until all claims for present or future relations have been satisfied, Baumüller can at any time demand securities from the customer. Baumüller will arbitrarily release provided securities if the value of the securities continuously exceeds the claims by more than 20%.

6.2 Any goods delivered remain property of Baumüller until payment has been made in full (= delivery under proviso). Goods delivered under proviso are processed or reconfigured at the purchaser's for Baumüller as the manufacturer but without additional obligations. If Baumüller ownership rights are nullified because the goods are integrated into or assembled to other objects, a portion of the ownership rights of the purchaser to that object covering the amount in question is transferred to Baumüller. The purchaser keeps the property of Baumüller in custody for no charges.

6.3 The purchaser has - unless he is in delay of payment - the right to process and sell the goods delivered under proviso in normal business. However, he must not distress or transfer ownership of the goods delivered under proviso by way of security. The purchaser transfers any receivables arising from the selling of the goods or from another legal reason completely to Baumüller when the goods are received. Baumüller revocably entitles the purchaser to collect the receivables transferred to Baumüller on the account of Baumüller under his own name. Upon request by Baumüller, the purchaser will reveal the transfer.

6.4 If third parties access the goods delivered under proviso, the purchaser will inform them about the ownership rights of Baumüller and will immediately inform Baumüller. Any expenses and damages are paid for by the purchaser.

6.5 If the purchaser violates any of the terms of the contract - in particular if he is in delay of payment - Baumüller has the right to reposes the goods delivered under proviso at the cost of the purchaser or Baumüller has the right to require transfer of the restitution title the purchaser has against third parties. If Baumüller repossesses or distresses the goods delivered under proviso, this does not mean that Baumüller withdraws from the contract. The right to receive payment for damages remains unaffected by this.

7. Warranty

7.1 If the delivered products are faulty or fail to have properties guaranteed by Baumüller or if the products become defective during the warranty period because of faults which occurred or were caused during the process of manufacturing or in case of material defects Baumüller supplies - excluding any other warranty claims by the purchaser, in particular excluding any direct or indirect secondary claims for damages from the purchaser - replacement parts of their own choice or rectifies defects. Multiple rectification is permitted. For essential products and parts not manufactured by Baumüller - in particular if the purchaser has made specifications - the liability of Baumüller is limited to the transfer of the claims for damages Baumüller has against the supplier of these products or parts.

7.2 The warranty period is 12 months and starts on the day the goods are shipped to the purchaser or - if the delivery scope is installed and assembled by Baumüller - the warranty period starts on the day the installation is complete.

7.3 The purchaser is obliged to inspect the delivered goods for damages or defects immediately or at least within two weeks after receiving the goods or - if the product is installed - within two weeks after completion of the installation process. In addition, he is obliged to inform Baumüller of any damages, defects or losses immediately by sending a report created by the carrier or a corresponding report in the form of a statement in lieu of an oath which must have been signed by two witnesses and by the purchaser. In addition, Baumüller must be informed in writing of obvious defects or shortcomings immediately or at least within two weeks after delivery. If shortcomings and defects cannot be detected in thorough tests within two weeks and are found at a later time, Baumüller must be informed of these problems immediately after they are detected. Defective products must be submitted to Baumüller for testing on request in the condition in which the defect was detected. Defective products must not be returned to Baumüller unless Baumüller requests in writing that the products are returned. Failure to observe any of the regulations specified above nullifies all warranty claims against Baumüller.

7.4 If rectification or replacements are not successful within an appropriate period of time, the purchaser may either request reduction of the purchase price or cancellation of the delivery contract.

7.5 If Baumüller manufactures a product based on design specifications, drawings, models or other specifications provided by the purchaser, Baumüller is responsible only for the fact that the manufactured product meets the specifications. Baumüller is not responsible for the usability of the product for the purposes the purchaser intends to use it for.

7.6 Excluded from warranty are shortcomings or defects caused by instructions/and or assembly not effected by Baumüller, insufficient equipment of the customer, overload of the components exceeding the capacity specified by Baumüller, negligent and improper treatment and utilization of unsuitable operating materials at the customer. This also applies to shortcomings or defects arising due to material provided by the customer. The warranty does not apply to damages caused by third parties, atmospheric discharges, overvoltages and chemical influences or to the replacement of parts which are exposed to natural wear.
The warranty is void if the customer or a third party changes or repairs the units delivered without written permit by Baumüller.

7.7 In case of guarantee and/or warranty claims, the motor, the spare part or the unit shall be shipped free of duty and with free packing after prior agreement with Baumüller. Baumüller is freed of any warranty, if the customer returns the defective products without prior agreement or without observing the arrangements.

7.8 Baumüller is entitled to install spare parts and units into the plants of the customer for warranties to be fulfilled within the warranty period, in order to replace the defective products so that the efficiency of the customer's parts is affected as little as possible. The warranty period for installed spare parts and units is 6 months from the date of replacement at the customer. Taking into account the service time for the delivered products, the warranty period of 12 months from date of delivery acc. to item 7.2 remains unchanged.

8. Liability

8.1 Baumüller is liable for information and consulting activities on the utilization of the ordered and delivered products only with written confirmation in accordance with the below regulations. Verbal statements and information are not binding.

8.2 Claims for damages due to impossibility of performance, nondelivery, positive breach of obligations, culpa in contrahendo and unlawful act to Baumüller as well as to the persons employed in performing an obligation are excluded, if the damage has not been caused deliberately or grossly negligent or Baumüller is liable according to the product liability law.

9. Lump-sum damages in case of withdrawal
If the customer withdraws from the written order due to reasons for which Baumüller is not responsible, Baumüller is entitled to charge lump-sum damages of 50% of the net order amount. This applies also, if Baumüller withdraws from the contract due to reasons for which the customer is responsible.

10. Miscellaneous

10.1 Place of fulfilment and jurisdiction is Nuremberg. However, Baumüller is entitled to advance claims at the legal place of jurisdiction of the customer.

10.2 The legal regulations applicable in the Federal Republic of Germany are applicable to these conditions and terms of sales and delivery. The regulations or the UN law of sales are excluded.

10.3 If one or several regulations of these conditions and terms of sales and delivery are or become ineffective or if any arising situation and circumstances are not covered by this contract text, jurisdiction will replace or supplement the ineffective or incomplete stipulations by appropriate regulations corresponding to the economic purpose of the intended regulation to the largest possible extent. The validity of the other regulations remains unchanged.

9.5 Index

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