Positioning Unit with Parallel
Sequence Control

WDP3-31X

Compact Unit
with Power Controller for
3-phase Stepping Motors
for Wall Mounting

Doc. no. 212.984/DGB

Ident. no.: 00441109800

Edition: d156 08.03

Software version: 03.0XX

Safety requirements

Please read the following safety requirements prior to installation, operation, maintenance and repair of the device.

- The intended use of the device is described under “Purpose” and must be observed.

- Installation, maintenance and repair of the device shall be performed by a qualified electrician. National regulations concerning
  - accident prevention
  - installation of electrical and mechanical systems
  - radio interference suppression

  shall be observed.

- The technical data of the device, particularly the ambient conditions, shall be observed.

- The device shall only be operated by trained personnel.

- The warranty is invalidated in case of unauthorized modification or opening of the device.

- Please ask your BERGER LAHR technical consultant prior to installing accessories not listed in the chapter “Description of accessories”.

- The safety symbols and notes on the device and in the manual shall be observed.

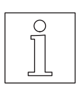
Explanation of symbols

ATTENTION
Reference to a danger for the device or components, possibly resulting in the endangering of human life.
DANGER
Reference to a direct endangering of human life.

DANGER
High voltage at component, do not touch.

DANGER
High temperature at component, do not touch.

ATTENTION
Warning against electrostatic discharge (ESD).
Only touch the PC board or component in an electrostatically protected environment.



NOTE
Important or additional information concerning the device or the manual.

   Berger Lahr GmbH & Co. KG Breslauer Str. 7 Postfach 1180 D-77901 Lahr	**Proposals** **Improvements** **WDP3-31X** Edition: d156 08.03 Doc. no. 212.984/DGB
Sender: Name: Company/department: Address: Telephone no.:	Please inform us, using this form, if you have discovered any errors when reading this document. We should also appreciate any new ideas and proposals.

Proposal and/or improvements:

Table of contents

Table of contents

Table of contents

1 General description

1.1 Structure and characteristics

The WDP3-31X positioning unit (fig. 1-1) is used for controlling a BERGER LAHR wall mounting 3-phase stepping motor which moves predefined paths with a high positioning accuracy at an exactly defined speed. A power controller and a processor unit are integrated in the unit. The power controller for controlling the stepping motor is supplied directly from the mains. The unit has been designed for wall mounting in a control cabinet.

Inputs/outputs

The unit features 20 freely assignable inputs (inputs I 16 to I 20 are pre-assigned) and 10 freely assignable outputs. The optional RS 485 HS interface can be used for addressing up to 10 additional MP 926 input/output cards with 16 inputs and 16 outputs each.

Options

A variety of extension options are available, e.g. an additional serial or analog interface, an additional encoder connection for an electronic gear or a field bus interface (e.g. Interbus-S or Profibus-DP).

Programmable controller

The unit has the characteristics of a programmable controller with integral movement programming. Sequence programming is possible in the same way as with NC controllers.

IEC 1131-3

Programming is effected in accordance with IEC 1131-3 using a PC as the programming device and the BPRO3 programming system or with the ProOED3 programming interface if the OED3 software is installed on the unit.

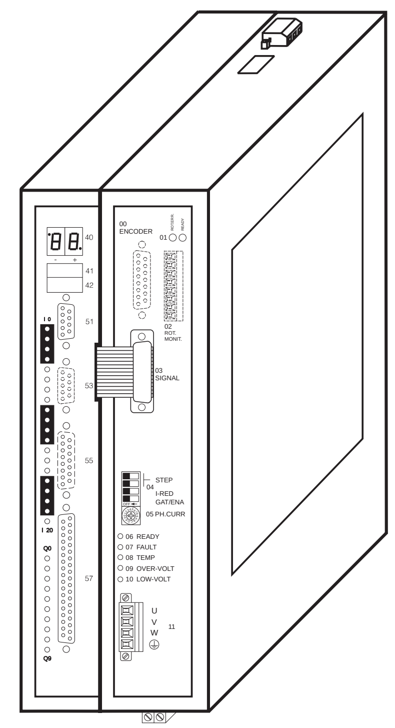


Fig. 1-1 WDP3-31X positioning unit

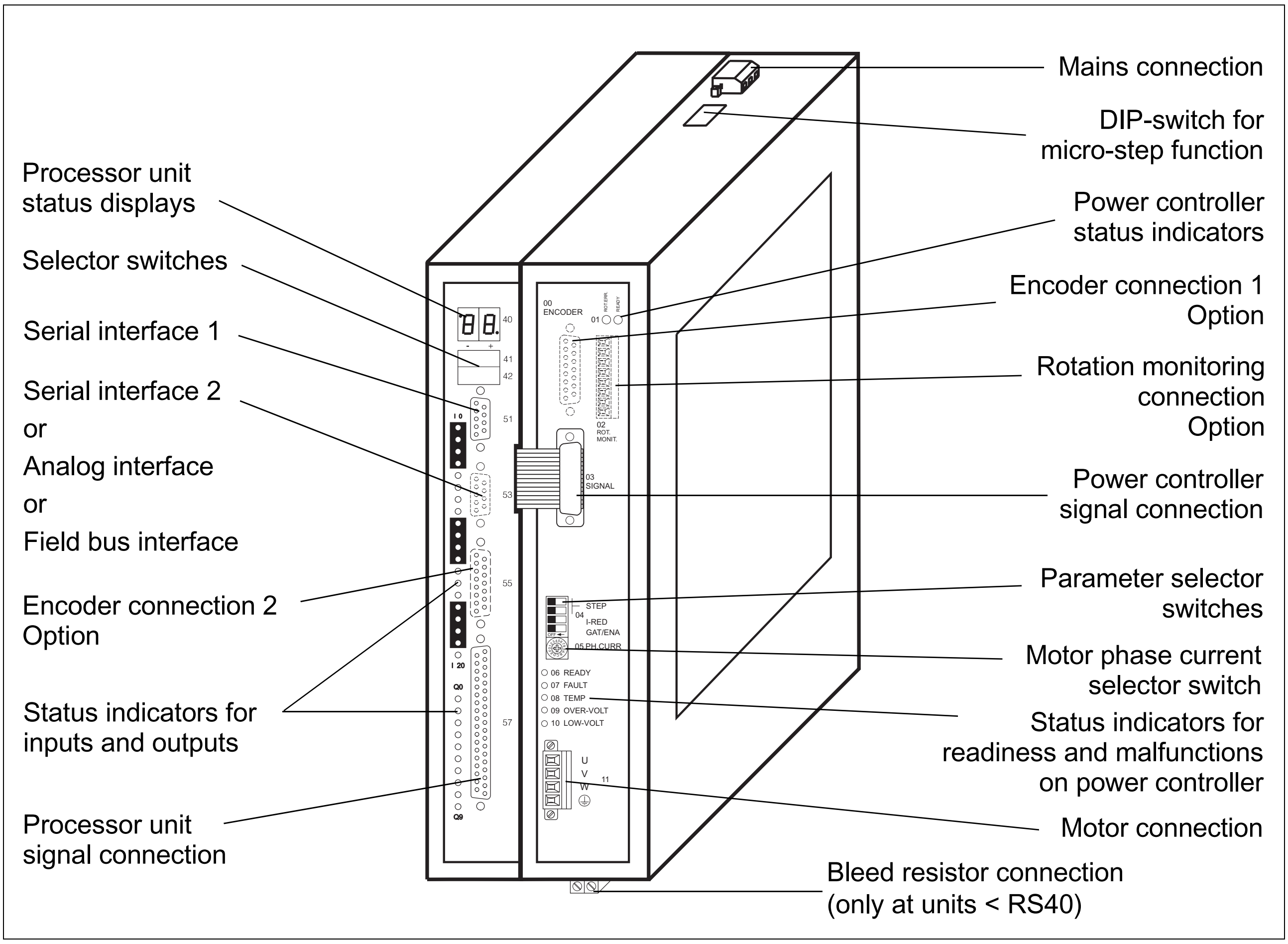


Fig. 1-2 WDP3-31X front panel

The following controls, indicators and connectors are arranged on the front panel (fig. 1-2):

00	Encoder connection 1 for rotation monitoring (option)
01	Status indicators for rotation monitoring (option)
02	Rotation monitoring connection (option)
03	Signal connection for power controller (pre-wired)
04	Four parameter selector switches for number of steps, current reduction and gate/enable (set at the factory)
05	Selector switch for motor phase current
06-10	Status indicators for readiness and malfunctions on power controller
11	Motor connection for a 3-phase stepping motor

40 Processor unit status displays
Two seven-segment displays for operating status and malfunction indication

41 Selector switch
In application mode:
STOP (position –) or RUN (position +) the application program
In manual mode:
CCW rotation (position –) or CW rotation (position +) of the motor

42 Selector switch
for setting the ADR network address and the MOD operating mode;
in the central position, operating states and malfunctions are indicated;
for error message acknowledgement

51 Serial interface 1, RS 232 or RS 485 LS,
for programming or communication

53 Serial interface 2 (option) as an

RS 232 or RS 485 LS	for communication
RS 485 HS	for the input/output card MP 926, for the Lauer operating panel

or

53 Field bus interface (option) as

CAN	CAN bus interface for network integration
IBS	Interbus-S slave interface for network integration
PBDP	Profibus-DP interface for network integration
RS 485 HS	SUCONET interface

or

53 Analog interface (option)
for input and output of analog values

55 Encoder connection 2 (option)
e.g. for rotation monitoring or electronic gear

57 Signal connection
for signal inputs/outputs and processor unit voltage supply

I 0 to I 20
Status indicators for the inputs

Q 0 to Q 9
Status indicators for the outputs

NOTE
The interfaces installed in the unit are indicated on the type plate.

ANOZ	*Analog interface*
CAN	*CAN bus interface*
IBS	*Interbus-S interface*
PBDP	*Profibus-DP interface*
RS 232	*Serial interface RS 232*
LRS 422-IN	*Encoder interface RS 422*
RS 485 LS	*Serial interface RS 485*
RS 485 HS	*Serial interface for MP 926 input/output card, Lauer operating panel or SUCONET (without OED3)*

1.2 Purpose

The WDP3-31X positioning unit is used for controlling a BERGER LAHR wall mounting 3-phase stepping motor with a 325 V coil (see 3-phase stepping motor catalog, doc. no. 04.203).

The unit has been designed for wall mounting in a control cabinet.

1.2.1 System environment

An IBM PC/AT (or 100 % compatible computer) with the BERGER LAHR BPRO3 programming system installed is used as the programming device (fig. 1-3); for more information, refer to the BPRO3 documentation.
If the OED3 software is installed on the controller, programming is effected with the ProOED3 programming interface.

Up to 62 BERGER LAHR Series 300 controllers (e.g. WDP3-31X) can be programmed and operated via two serial PC interfaces. Each serial interface can be used for programming 31 controllers.

Programming features

The WDP3-31X positioning unit has the following programming features:

– Parallel processing of PLC and movement functions
– Direct or indirect control of parallel inputs and outputs
– Individual programming of the serial interfaces

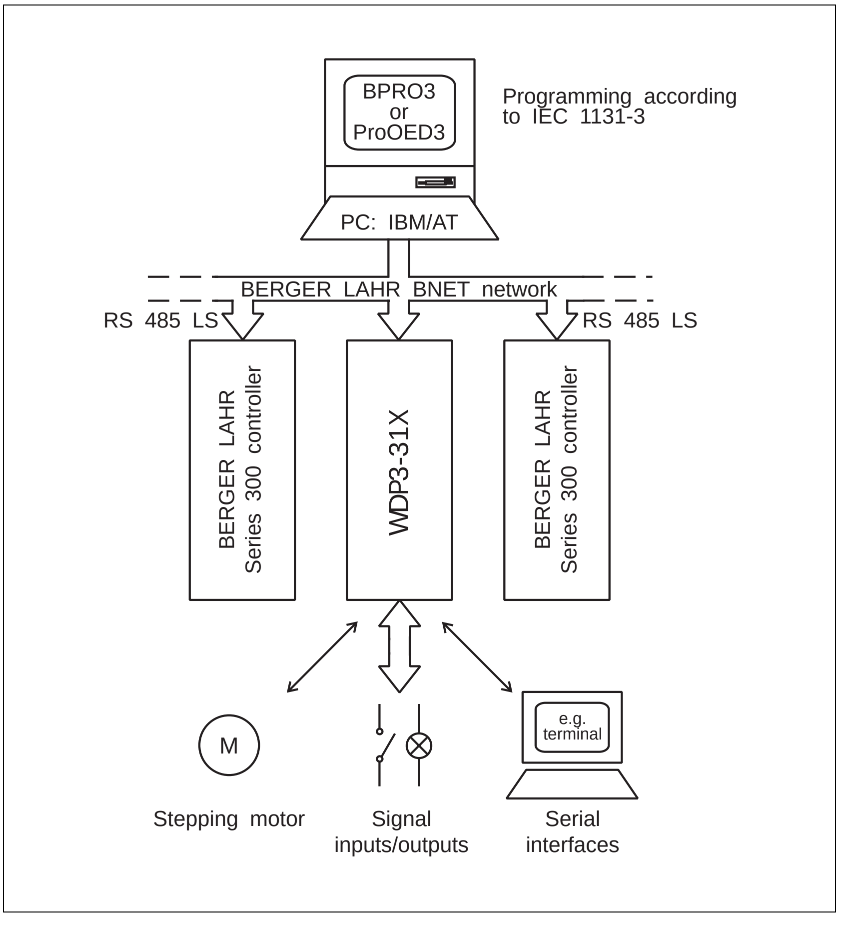


Fig. 1-3 System environment

1.3 Function

1.3.1 Hardware components

Printed circuit boards of Eurocard format with type size 6 HU are installed in the unit for accommodating the power electronic system and the microprocessor control. The most important function blocks of the unit are evident in the block diagram (fig. 1-4).

Signal interface

Optocouplers at the signal interface are used for isolating the input and output signals between the external controller and the internal electronic circuits.

DC/DC power supply unit

A DC/DC power supply unit generates various voltage levels for supplying the internal electronic circuits.

NOTE
The electronic circuitry of the processor unit consists of PELV circuits as defined in the VDE 0160 DIN standard.

Serial interface 1, 2

The serial interfaces can be used for establishing links to external programming and control units or operating terminals.

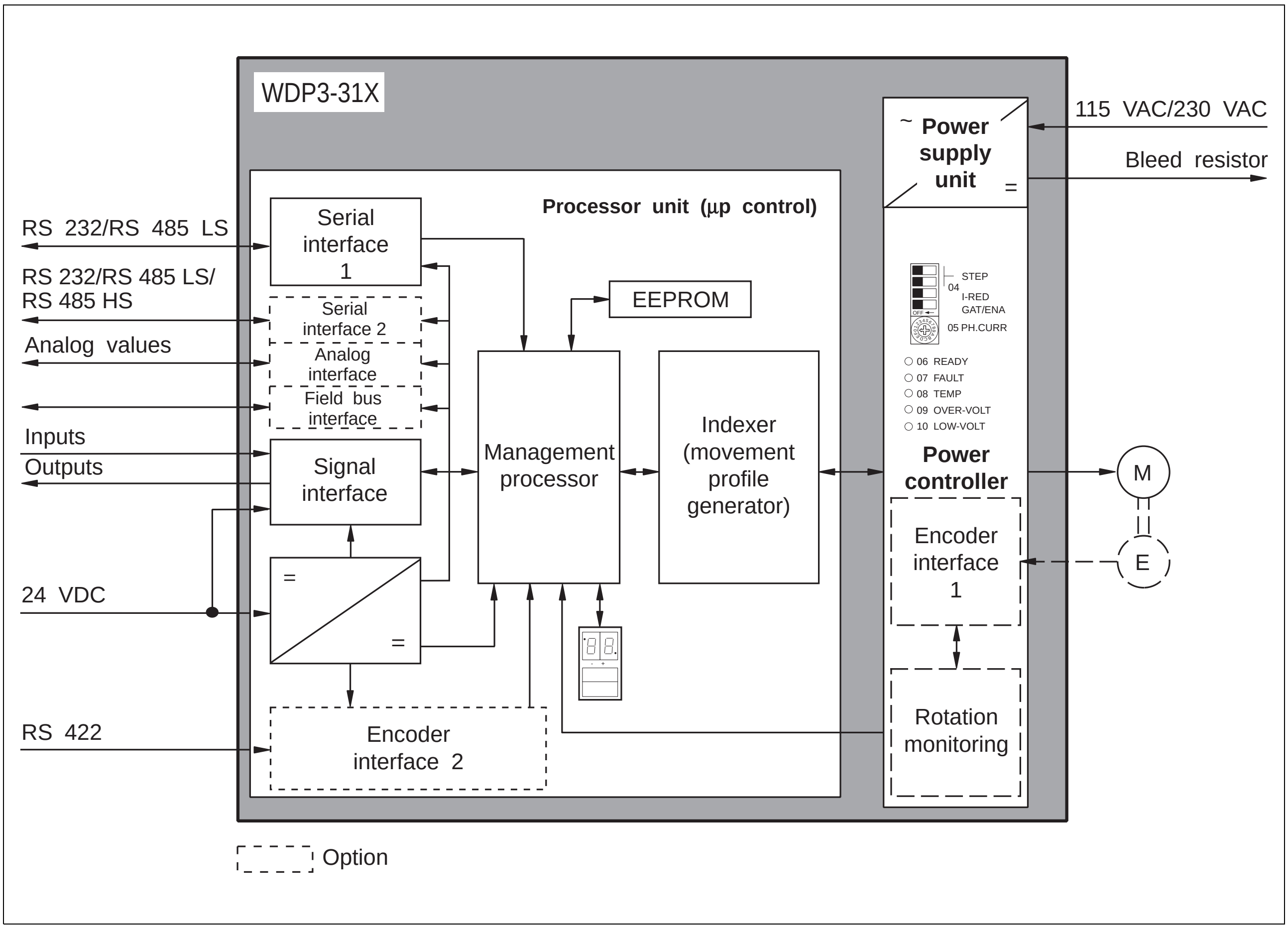


Fig. 1-4 Block diagram

Analog interface The analog interface can be used for processing analog values by application programs. The analog interface has five ±10 V inputs and one +10 V output.

Field bus interface The controller can be equipped with a standardized field bus interface (e.g. Interbus-S or Profibus-DP). This enables the controller to receive and execute commands from a master unit.

Management processor The management processor runs the application program and passes movement commands to the indexer. The application program is stored in a battery-buffered RAM. The application program can be stored in an EEPROM in addition.

Status displays and selector switches The selector switches can be used for setting the operating mode, the network address as well as the interface parameters. The seven-segment displays indicate operating states and malfunctions.

Indexer The indexer (movement profile generator) generates pulse/direction signals for controlling the power controller from the movement command parameters (travel, speed, acceleration).

Encoder interface 1 and rotation monitoring connection The encoder interface 1 can be used for rotation monitoring. The rotation monitoring feature compares the set and actual positions of the motor and reports a rotation monitoring error if the difference between set and actual position exceeds a certain limit value (following error limit). The rotation monitoring error can be reset with a 24 V signal on the rotation monitoring connection. For rotation monitoring via the encoder interface 1 to be enabled, the stepping motor must be equipped with a type 1000 encoder. The encoder interface 1 is supplied with power from an external 24 VDC power supply unit via the rotation monitoring connection.

Encoder interface 2 The encoder interface 2 can be used for rotation monitoring or for reference variable input for an electronic gear. With an electronic gear, A/B signals from a type 500 or type 1000 encoder or pulse/direction signals can be input. On the encoder interface 2, the application program can retrieve the encoder position at any time. The encoder interface 2 is supplied from the processor unit.

Power supply unit The power supply unit is a high-performance AC/DC converter and must be supplied with 230 VAC or 115 VAC voltage. The energy produced by the stepping motor during braking can be temporarily stored in this unit up to a certain amount.

Bleed resistor To dissipate a higher amount of braking energy, an external bleed resistor must be connected.

Power controller The power controller transfers the energy provided by the power supply unit in a suitable way to the connected stepping motor. The motor phase current can be set on the selector switch. The signals of a rotation monitoring encoder which may be installed on the motor can be evaluated. A seven-segment display indicates any malfunctions.

1.3.2 Operating modes

1.3.2.1 Application mode

In application mode, the WDP3-31X positioning unit can run a program.

Programming may be effected either with a PC with the BPRO3 programming software installed or with the ProOED3 programming interface (if the OED3 software is installed on the controller).

Programming with BPRO3 or ProOED3 can be effected independently of the WDP3-31X positioning unit, i.e. off-line. Both programming systems feature sophisticated debugging options.

1.3.2.2 Manual mode

Manual mode is an auxiliary mode for setting up and testing the system.

In manual mode, the selector switch (item 41) on the unit front panel can be used for moving the stepping motor in a clockwise (CW) or counter-clockwise (CCW) direction.

The limit switches and the STOP input must be wired.

1.3.2.3 On-line command processing

The on-line command processing mode is active if the controller is provided with a serial interface and MODE is set to 60 or 70, or if the controller is provided with a field bus interface. In this mode, single movement commands and other commands are transmitted to the controller and executed immediately. A comprehensive command set for programming is available for on-line command processing. This operating mode is described in a separate documentation for each appropriate interface.

RS 485 LS network

Several controllers with RS 485 LS interfaces can be operated from a single master controller or from a PC. The controller's network address is set by MODE 61 or 71 on the front panel. The master controller must use a polling command to specify the unit with which it wants to communicate (see separate documentation).

Communication via field bus network

A standardized field bus interface, e.g. Interbus-S (see fig. 1-6) or Profibus-DP, can be used for transmitting movement and other commands from a master unit to the controller for execution; see on-line command processing.
Communication via a field bus interface is described in a separate documentation for each appropriate interface.

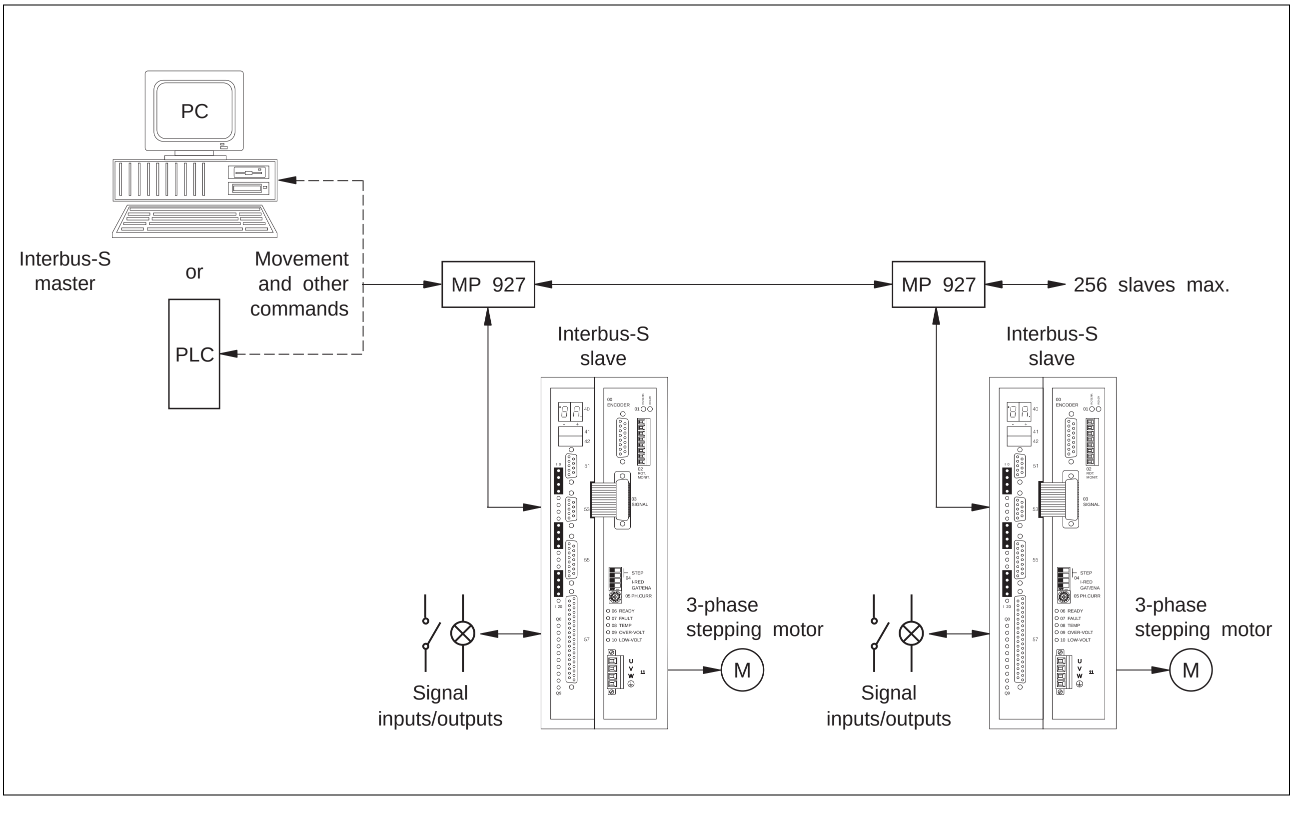


Fig. 1-5 Interbus-S network configuration

1.4 Technical data

1.4.1 General data

Application program memory		128 Kb battery-buffered RAM and EEPROM
Storage space		for approx. 12000 BPRO3 instructions
	with OED3 vers. 1.XX	approx. 1500 OED3 instructions
	with OED3 vers. 2.XX	approx. 3000 OED3 instructions
Time for a logic instruction with BPRO3		approx. 1.5 µs
	with OED3 vers. 1.XX	approx. 2 ms
	with OED3 vers. 2.XX	approx. 0.5 ms
Max. number of BPRO3 user blocks		150
Max. number of BPRO3 data block types		100

1.4.2 Electrical data

1.4.2.1 Mains connection

Supply voltage, selectable		115 VAC 230 VAC to 240 VAC
Starting current		70 A max.
Leakage current (IEC60990)	Motor cable <5m	: <10mA
	Motor cable 5-50m	: <50mA
External fuse		6 A at 230 VAC
	(“K” characteristic)	10 A at 115 VAC
Mains frequency		50 to 60 Hz
Mains error protection		one period
Nominal power consumption		
	DWP3-314	3.6 A at 115 VAC 2.0 A at 230 VAC
	WDP3-318	8.0 A at 115 VAC 4.5 A at 230 VAC
Power loss		
	WDP3-314	45 W
	WDP3-318	80 W

NOTE
The devices may only be operated with the fuses specified above. If necessary, use r.c.c.b. protection according to DIN VDE 0664, part 1/10.85.

1.4.2.2 Motor connection

Short-circuit protected		
Motor cable		
	Length	maximum 50 m
	Cross-section	0.75 mm^2 at cable length ≤ 30 m ≥ 1.5 mm^2 at cable length > 30 m
Shield connection		On both ends
Motor voltage		3 x 325 VDC (connected to mains)
Phase current		
	WDP3-314	0.6 to 2.5 A
	WDP3-318	1.7 to 6.8 A

1.4.2.3 Other supply voltages

Processor unit

Supply voltage	24 VDC
Min. operating voltage (on unit)	20 VDC
Max. operating voltage (on unit)	30 VDC
Power consumption	1 A max.
Ripple voltage	<2 Vpp

NOTE
The 24 V voltage supply must fulfil the requirements of DIN VDE 0160 concerning safety extra-low voltages.

1.4.2.4 Analog interface

Internal leakage resistance towards ground	1 Mohm

Electrical characteristics of the inputs

Five signal inputs, opto-isolated	±10 V
Precision	±0.25%, ±25 mV
A/D converter resolution	minimum of 3700 steps
Input resistance	>10 kohms

Electrical characteristics of the outputs

One signal output, opto-isolated, short-circuit protected	10 V (30 mA max.)
Precision	±0.5%, ±50 mV
D/A converter resolution	minimum of 200 steps

1.4.2.5 Serial interfaces

RS 232 interface

Internal leakage resistance towards ground	1 Mohm

RS 485 LS four-wire interface (option)

Supply voltage output	12 VDC (9 VDC min., 18 VDC max.)
Short-circuit protected	150 mA max.
Internal leakage resistance towards ground	1 Mohm

RS 485 HS interface for MP 926 input/output card (option)

Two-line remote bus	
Maximum number of input/output cards	10
Maximum cable length	400 m
Compatible with BPRO3 programming system	Version 3.11 or higher
Compatible with ProOED3 programming interface	OEDversion 1.05 or higher

1.4.2.6 Field bus interfaces

All field bus interfaces are opto-isolated and have an internal resistance towards ground of 1 Mohm.

Interbus-S slave interface (option IBS)

Two-line remote bus

4 data words

Transmission route	500 kbauds
Distance to adjacent station	400 m max.

Profibus-DP slave interface (option PBDP)

The transmission rate is set by the master (12 Mbauds max.)

Line length	see Profibus-DP specification

CAN bus interface (option CAN)

Transmission rate	10 kbauds to 500 kbauds
Line length	
at 10 kbauds	7000 m max.
at 125 kbauds	570 m max.
at 500 kbauds	80 m max.

SUCONET slave interface (RS 485 HS option, on controllers without OED3)

Bus interface	RS 485 HS
Bus cable	Shielded twisted-pair cable
Transmission speed	187.5 kbauds and 375 kbauds

1.4.2.7 Encoder connections

RS 422 IN signal level

Short-circuit protected

Maximum cable length	
for encoder connection 1	50 m
for encoder connection 2	100 m
Wire cross-section	
for signals	0.25 mm^2
for power supply	0.5 mm^2
Shield connection	On both ends
Voltage output	
for encoder connection 1	5.25 V ±5% (200 mA max.)
for encoder connection 2	5 V ±5% (300 mA max.)
Additionally for encoder connection 2	12 VDC (9 VDC min., 18 VDC max., 200 mA max.)
Internal leakage resistance towards ground	1 Mohm

1.4.2.8 Rotation monitoring connection

Supply voltage	24 VDC
Power consumption	100 mA
Polarity reversal protection	

1.4.2.9 Signal connection

Shield connection	On both ends
Internal leakage resistance towards ground	1 Mohm

Electrical characteristics of the inputs

Opto-isolated, polarity reversal protection, hardware debounce

Typical signal voltage level	24 V
Maximum input voltage	30 V
Typical input current at 24 V	7 mA
Turn-on voltage	>15 V
Turn-off voltage	<5 V
Settling time t_E	
Inputs I 0 to I 19	1.0 to 1.5 ms
Trigger input I 20	0.1 to 0.15 ms

Electrical characteristics of the outputs

Opto-isolated, inductive loadability, short-circuit protected

Maximum voltage	30 V
Maximum switching current	400 mA
Voltage drop at 400 mA	<2 V

DANGER
The signal inputs and the 24 VDC supply voltages at the signal connection must be definitely isolated from mains. The maximum voltage towards ground must not exceed 60 VDC or 25 VAC.

1.4.2.10 Device protection

Protection and monitoring circuits: Power amplifier overtemperature, short-circuit between motor leads (no ground fault protection), under-voltage and overvoltage

Type of protection	IP 20 acc. to EN 60529: 1991

1.4.3 Mechanical data

Dimensions	see fig. 1-6
Weight	approx. 4800 g

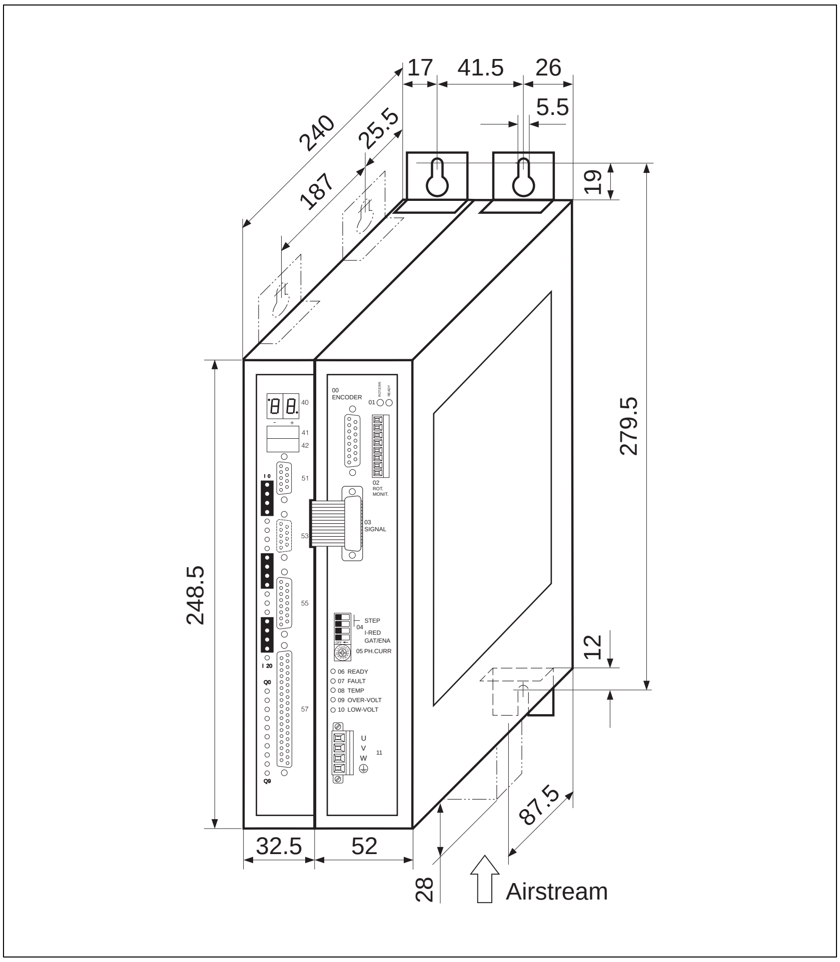


Fig. 1-6 Dimensions

1.4.4 Ambient conditions

Ambient temperature	0°C to +50°C
Storage temperature	-25°C to +70°C
Relative humidity	15% to 85% (non-condensing)

1.4.5 Regulations

Machinery directive

Insofar as the machinery corresponds to the machinery directive 89/392/EEC and the configuration meets the EMC test conditions specified by BERGER LAHR, conformity with the machinery directive is hereby certified.

EMC directive

In a configuration which meets the EMC test conditions specified by BERGER LAHR, conformity with the following standards can be certified in accordance with the EMC directive 89/336/EEC:

Radio interference suppression (when using a mains filter, see Accessories)	according to EN 50081-2: 1993
Static discharge	according to EN 60801-2: 1993, class 3
Burst	according to IEC 801-4: 1988, class 4

BERGER LAHR EMC test requirements

- Use a BERGER LAHR motor lead.
  Length of motor lead is 10 m.
- Insert a BERGER LAHR mains filter into the mains supply line.
- Install the device into the control cabinet.
- Use BERGER LAHR signal cables and wire them according to the documentation.
- Run signal, mains and motor cables separately (non-parallel) and ensure a large surface area contact between the cable shield and ground on both ends.
- Install the mains filter directly at the device. If this is not possible, use a shielded connection line (1 m max.) between filter and device.
- Ensure a large surface area contact between filter, device and ground (mount on a grounded metal plate or on control cabinet rear panel, or use a ground strap).

Low-voltage equipment directive

Pursuant to the low-voltage equipment directive 73/23/EEC, the products are in conformity with the following standards:

Protection class	1 acc. to prEN 50178: 1994
Overvoltage	Category III acc. to prEN 50178: 1994
Contamination	Grade 2 acc. to prEN 50178: 1994

1.4.6 Approvals

prEN 50178 classification VDE 0160/11.94

EN 60950 classification VDE 0805: 1993 + A2: 1994

UL 508 file no. 153 659

2 Installation

2.1 Scope of supply

The delivery must be checked for completeness.

The scope of supply (fig. 2-1) comprises:

Qty.	Designation
1	WDP3-31X positioning unit
1	Product insert
4	Mounting bracket
1	Ground strap
1*	Diskette with device master file for setup with Profibus-DP interface
1	Fan for WDP3-318

* If the appropriate interface is installed.

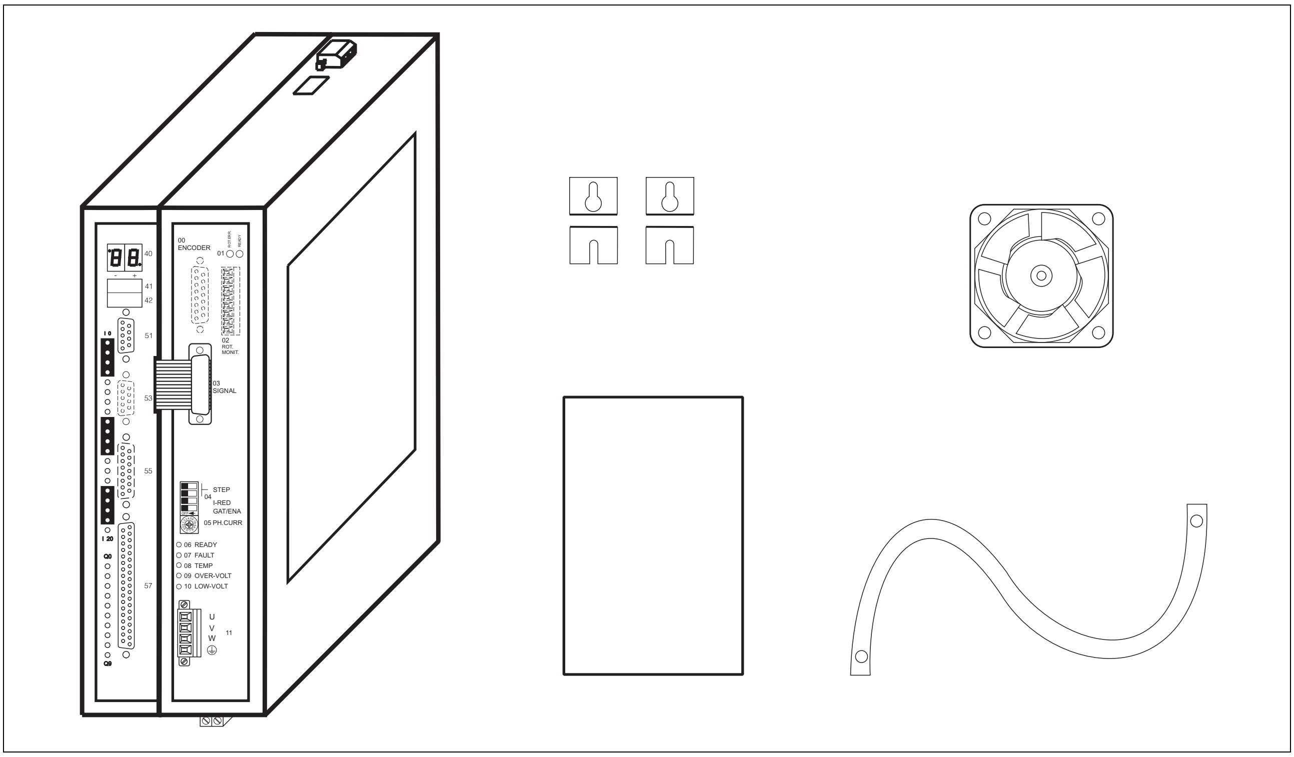


Fig. 2-1 Scope of supply

2.2 Accessories

The following accessories are available and must be ordered separately (for a description of accessories, see chapter 6.2):

- Battery for wall mounting units
- FT 2000 operating terminal
- On-line Command Processing via Serial Interface documentation (Doc. no. 212.986)
- MP 926 input/output card (16 inputs/16 outputs)
- MP 927 Interbus-S interface adapter
- Fan
- Mains filter
- BPRO3 programming system or ProOED3 programming interface for device variants with OED3 operating system software (appropriate documentation and diskettes)
- MP 923 interface converter (RS 485 LS/RS 232)
- MP 924 interface distributor
- WDP3-31X set of connectors (all sub-D connectors)
- Crossover adapter for master/slave operation via RS 485 LS interface
- 3-phase stepping motor
- Encoder cable
- Interbus-S/MP 927 signal cable
- Electronic gear cable
- Motor cable
- RS 485 LS interface cable, male/female
- RS 485 LS interface cable, male/male
- Signal cable

NOTE
Refer to the WDP3-31X positioning unit sales documentation for the accessory order numbers.

2.3 Mounting

DANGER
The supply voltage must be disconnected whenever assembly work is carried out.

NOTE
When installing the unit, a minimum clearance of 10 cm must be ensured above and below the unit or to the adjacent unit. Leave 15 cm free in front of the unit to give room for fitting the cable connections.

The unit should be installed in a control cabinet and may have to be ventilated externally (see fig. 2-3).
You can use the mounting brackets to install the unit on the rear or on the left (fig. 2-2).

Fasten the ground strap supplied at the bottom front of the unit with screws and connect it to a grounded part of the control cabinet.

ATTENTION
Clean air supply must be ensured in the control cabinet.

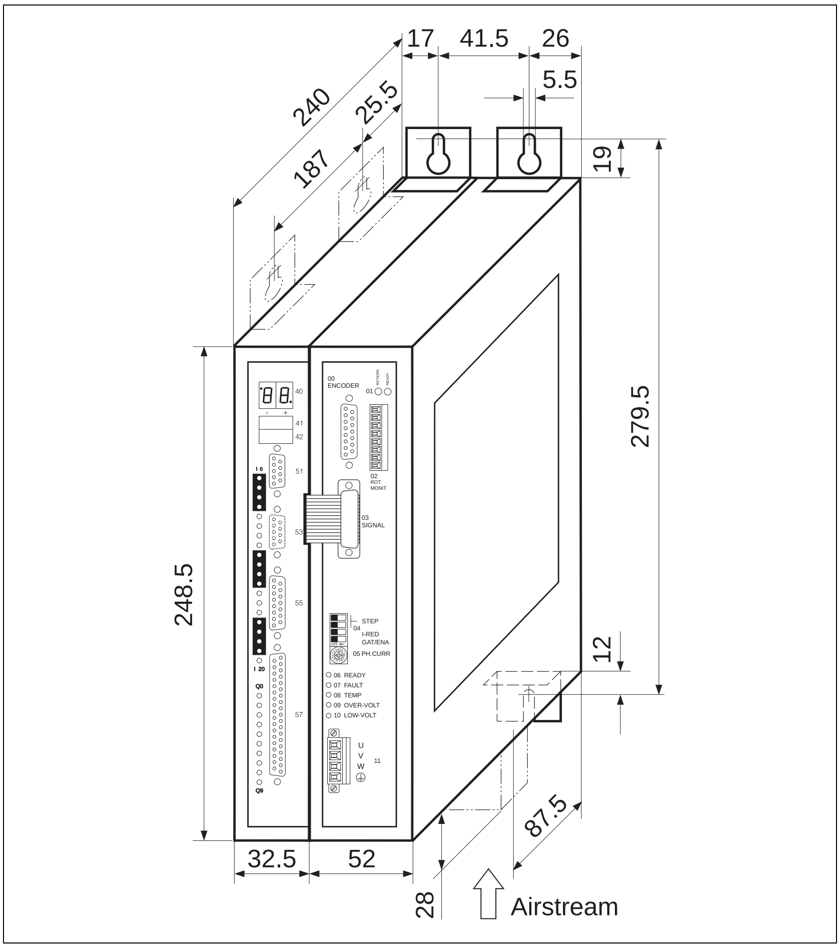


Fig. 2-2 Mounting

Ventilation

The WDP3-314 positioning controller can be operated without ventilation, if the minimum clearances (10 cm) are observed.

The WDP3-318 positioning controller can be operated without ventilation up to a phase current of 3.7 A and an ambient temperature of 50°C.
If these values are exceeded, or if overtemperature is indicated repeatedly by LED “08”, the unit must be ventilated (fig. 2-3).

Accessory fan

The fan on the WDP3-318 unit must be mounted at the bottom. The airstream must pass through the unit from bottom up (see fig. 2-2). The arrow on the fan indicates the direction of the airstream if the fan is connected correctly (red = 24 VDC, black = 24 VGND).
Fasten the fan with four screws at the bottom of the unit after having cut out the grille (see chapter 6.2.1). Connect the fan to the external 24 VDC voltage supply.

NOTE
Ensure that the airstream in and around the unit is unobstructed.

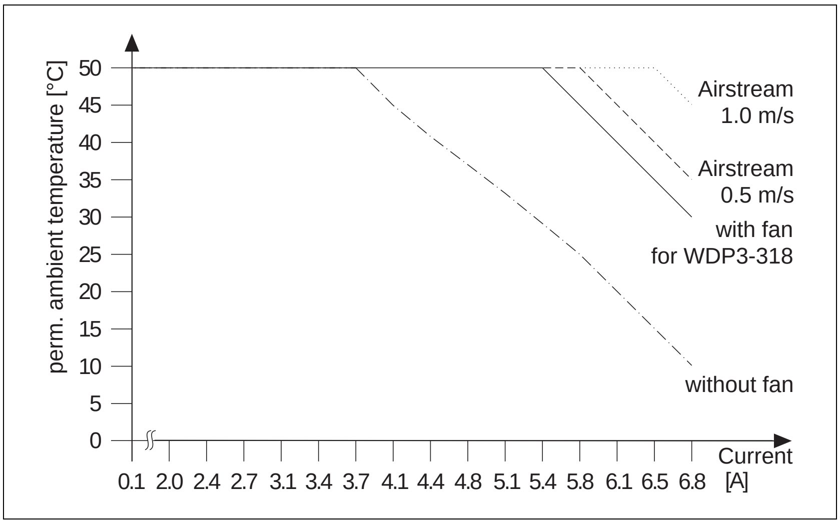


Fig. 2-3 Temperature – phase current – ventilation

2.4 Wiring

DANGER
The supply voltage must be disconnected whenever wiring work is carried out.

DANGER
The motor connection is internally linked to the supply connection (325 V).

ATTENTION
Wiring work may only be carried out in accordance with VDE 0105 by trained personnel.

ATTENTION
Run and shield power, motor and signal cables separately.

ATTENTION
Free, unassigned pins must not be wired.

ATTENTION
The unit must have external fuse protection (see chapter 1.4).

ATTENTION
Good heat dissipation must be ensured when installing a bleed resistor (accessory).

NOTE
See chapter 1.4 for the technical data of the individual connections and interfaces.

NOTE
The interfaces installed in the unit are indicated on the type plate.

NOTE
The ground connections of the interfaces in adapter slots 51, 53 and 55 are internally interconnected.

NOTE
Shield connection on both ends ensures optimum protection against interference for digital systems. However, it must be noted that differential potentials (in particular in case of supply from different sources) may cause inadmissible currents in the shields. Such interfering currents can be avoided by using suitable bonding conductors. The following cross-sections should be used for bonding lines:

16 mm^2 Cu for bonding lines up to 200 m
25 mm^2 Cu for bonding lines exceeding 200 m

Wiring layout Figure 2-4 illustrates the connection diagram of the positioning controller with the available interfaces.
Communication between PC and positioning controller is effected either through the RS 232 or RS 485 LS serial interface or the field bus interface (e.g. Interbus-S), depending on the actual interface configuration.

NOTE
If the controller is provided with an RS 485 LS interface and the PC with an RS 232 interface, an interface converter (e.g. MP 923, see chapter 6.2.4) must be used.

NOTE
With an RS 485 LS interface, the MP 924 interface distributor can be used for implementing a network (see chapter 6.2.5).

NOTE
With an RS 232 interface, networking is not possible.

NOTE
With an Interbus-S interface, the MP 927 Interbus-S interface adapter must be used (see separate Interbus-S documentation).

NOTE
With a Profibus-DP interface, e.g. a bus terminal must be used.

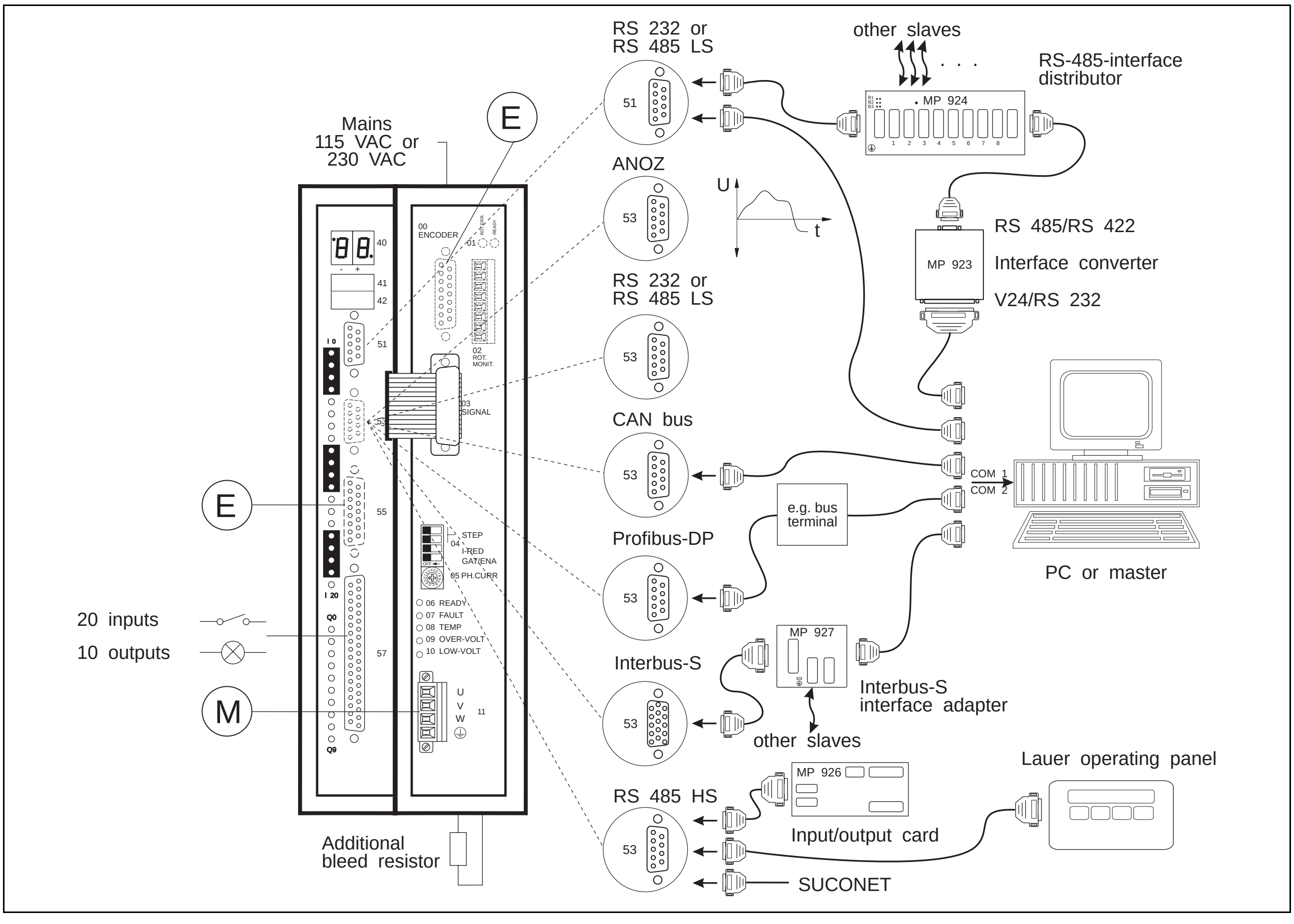


Fig. 2-4 Wiring layout

2.4.1 Mains connection

1. Set the 115 V or 230 V mains voltage on the selector switch at the unit top.

ATTENTION
The setting must correspond to the actual mains voltage available.

2. Mount wire end ferrules on the device end of the mains power cable.

3. Fasten three litz wires (fig. 2-5) with screws:

L	Phase (115 VAC or 230 VAC)
N	Neutral
PE	Protective conductor

NOTE
A mains filter can be inserted in order to shield the unit against interference (see chapter 6.2.2).

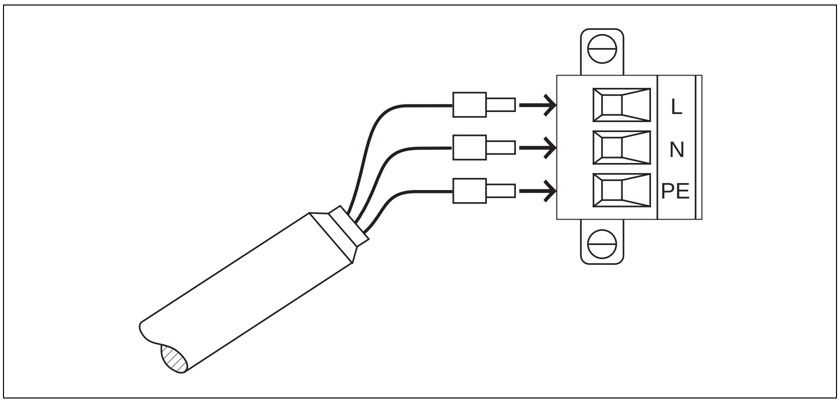


Fig. 2-5 Mains connector – device end

2.4.2 Motor connection

1. Release the two screws and remove the connector (fig. 2-7) from the unit.
2. Préparation le câble moteur (fig. 2-6), equiper le câble moteur côte appareil d‘embouts de conducteurs.
3. Visser les brins.
4. Visser le connectuer sur la face avant (pos. 24).

Preparation the motor cable

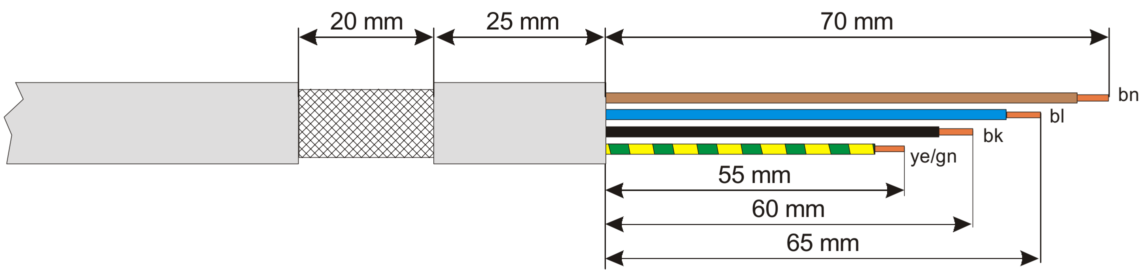


Fig. 2-6 Preparing the motor cable

Motor connection

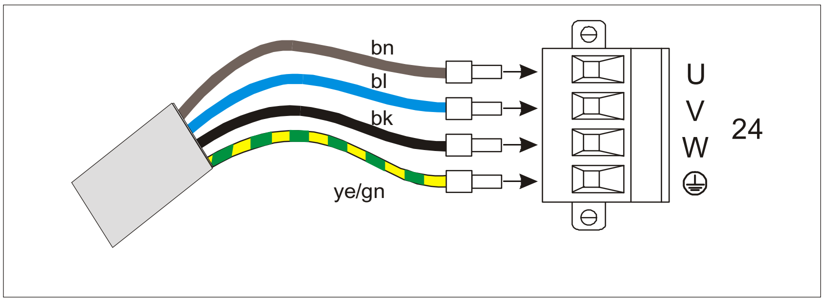


Fig. 2-7 connexion moteur

NOTE
The sense of rotation of the motor can be inverted by interchanging two motor leads. In this case, also the limit switch inputs $\overline{LIMP}$ and $\overline{LIMN}$ as well as the A and $\overline{A}$ signals of any rotation monitoring encoder connected must be interchanged.

ATTENTION
Connect the shield of the motor cable after the following assembly instruction!

Installing the motor cable

The following items required for installing the motor cable on the side of the device are included in the accessory bag:

Qty.	Designation
1	Terminal angle
1	Shield terminal
1	Screw M4 x 8
2	Screw M3 x 8 with serrated washer
1	Serrated washer M4

Installing the terminal angle

DANGER
Electric shock from high voltage!
If longer screws are used, they may contact live parts. This may result in fatal injury.

The terminal angle is fastened to the bottom of the device with the screws and serrared washers supplied with the device. Correct installation of the terminal angle is extremely important for grounding the motor cable shield and for strain relief.

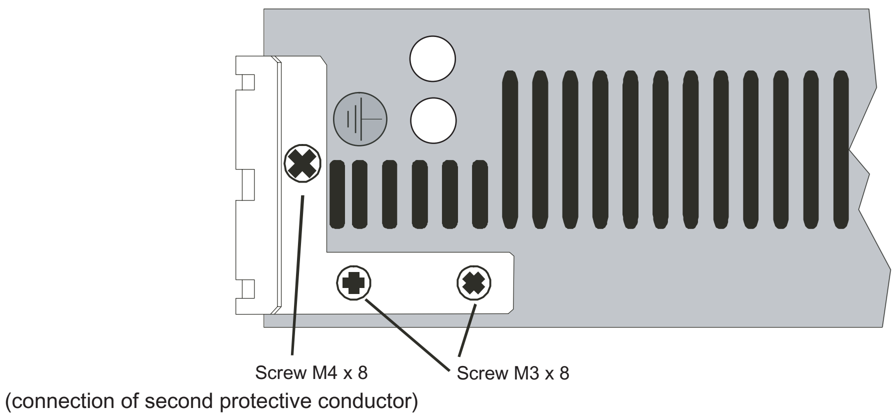


Fig. 2-8 Installing the terminal angle

DANGER
Electrical device with higher deflection current > 3,5mA.
Connection of a second protective conductor absolutely necessary.
Please note minimum cross-section according to IEC 60364-5-54.

Fastening the shield terminal

The left position is provided for fastening the cable tothe fastening brak- ket.

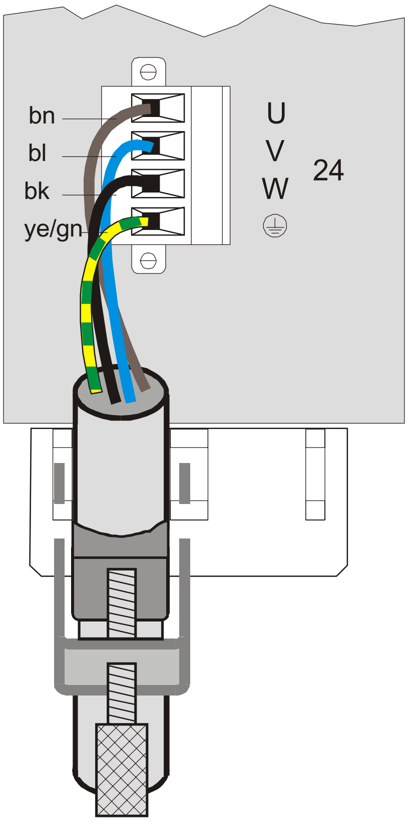


Fig. 2-9 Fastening the shield terminal

The shield angle is suspended on the bracket from below. The motor cable is not subject to strain and securely grounds shield when installed in this way.

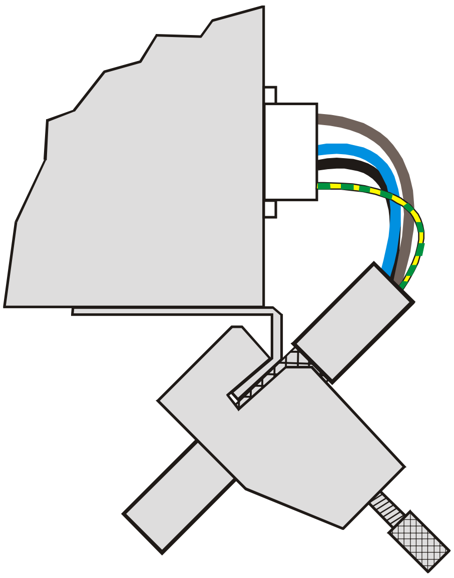


Fig. 2-10 Installed motor cable

2.4.3 Rotation monitoring connection

1. Mount wire end ferrules on the device end of the cable.

2. Fasten the litz wires with screws on the connector of the rotation monitoring connection as illustrated in figure 2-7.

3. Plug the connector into the front panel (item 02).

WARNING
Connect the shield on both ends.

Rotation monitoring signals

The rotation monitoring connection is installed if the device features electronic circuitry for rotation monitoring.

24-V-supply

The electronic circuitry for rotation monitoring must be supplied with 24 VDC power via the rotation monitoring connection.

RM_RESET

The RM_RESET input (24 V optocoupler input) is used for resetting any rotation monitoring error.

RM_FAULT

The RM_FAULT output is used for indicating a rotation monitoring error (“ROT.ERR.” LED lights).

TEMP_MOT

The TEMP_MOT output is used for indicating motor overtemperature. The RM_FAULT and TEMP_MOT outputs are connected to 24 VDC under normal conditions. The max. output current is 50 mA. In case of an error, the corresponding output is set to high resistance and the unit reports “not ready”.

The RM_FAULT and TEMP_MOT signals are sent through the power controller signal connection.

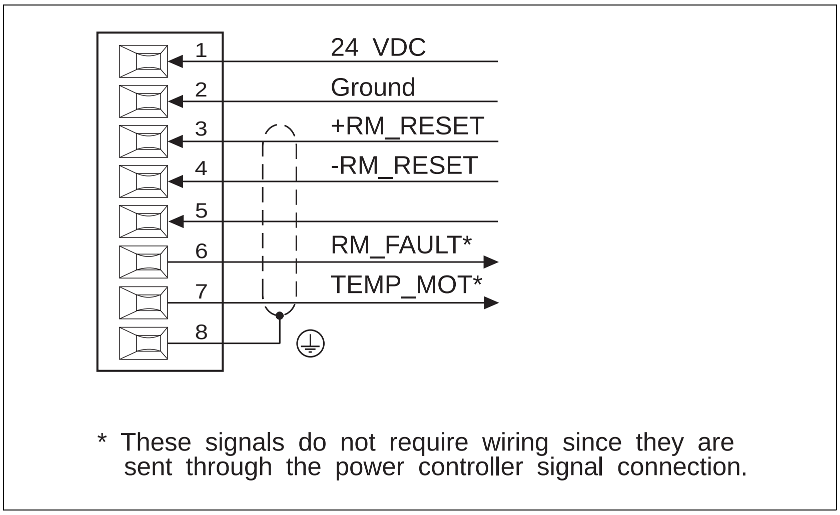


Fig. 2-7 Rotation monitoring connection

2.4.4 Encoder connections

Encoder connection 1

The encoder connection 1 (slot 00 in the power controller) can be used for rotation monitoring. For this purpose, the stepping motor must feature a type 1000 encoder (1000 increments per revolution). The encoder interface 1 is supplied with power from an external 24 VDC power supply unit via the rotation monitoring connection.

NOTE
Rotation monitoring must be reset after a rotation monitoring error via the RM_RESET input on the rotation monitoring connection.

ATTENTION
The encoder connection 1 does not feature sense regulation. Therefore, an additional power supply line must be wired for cable lengths exceeding 30 m (see fig. 2-8).

Encoder connection 2

The encoder connection 2 (slot 55 in processor unit) can be used for rotation monitoring or for reference variable input for an electronic gear. With an electronic gear, A/B signals from a type 500 or type 1000 encoder or pulse/direction signals can be input. The encoder interface 2 is supplied with power from the processor unit.

ATTENTION
When using 5 V encoders on encoder connection 2, -SENSE must be connected to 5VGND and +SENSE to 5VDC on the encoder end of the cable. The 5 VDC encoder supply voltage is only available if the sense lines are properly connected.

Wiring

1. Solder the litz wires to the connector as illustrated in fig. 2-8.
2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head screws into the connector shell (fig. 2-9).
4. Place the connector into the connector shell.
5. Fasten the cable and the shield to the connector shell with screws, providing for strain relief.

ATTENTION
Ensure good electrical contact between the shield and the connector shell on both cable ends.

6. Insert two caps into the unused cable entries.
7. Assemble the two parts of the connector shell with two screws.
8. Fasten the connector to the front panel with screws.
9. Twist the encoder cable wires in pairs as illustrated in fig. 2-10.
10. Establish the connection on the motor end.

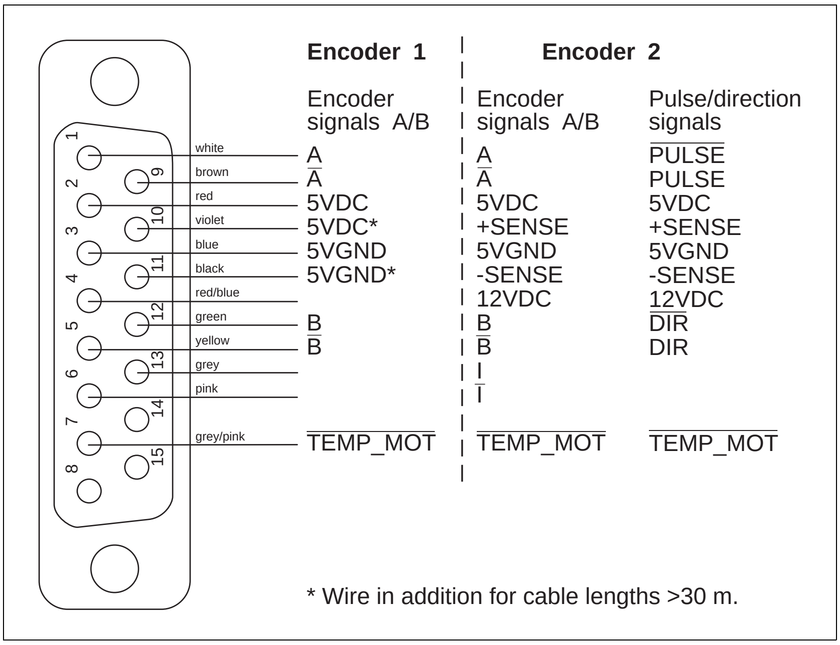


Fig. 2-8 Encoder connector – device end

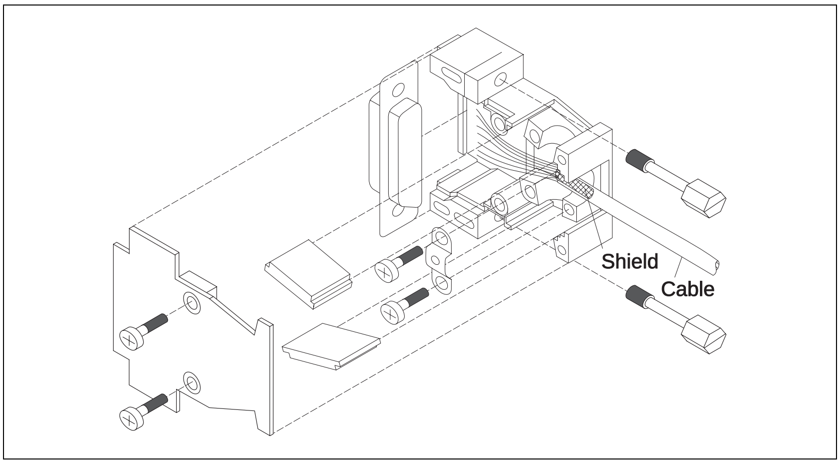


Fig. 2-9 Encoder connector assembly – device end

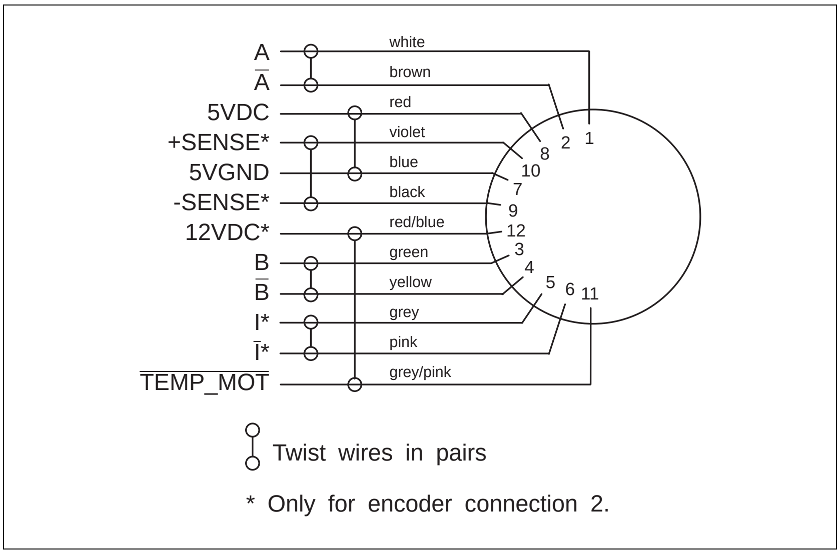


Fig. 2-10 Encoder connector termination – motor end

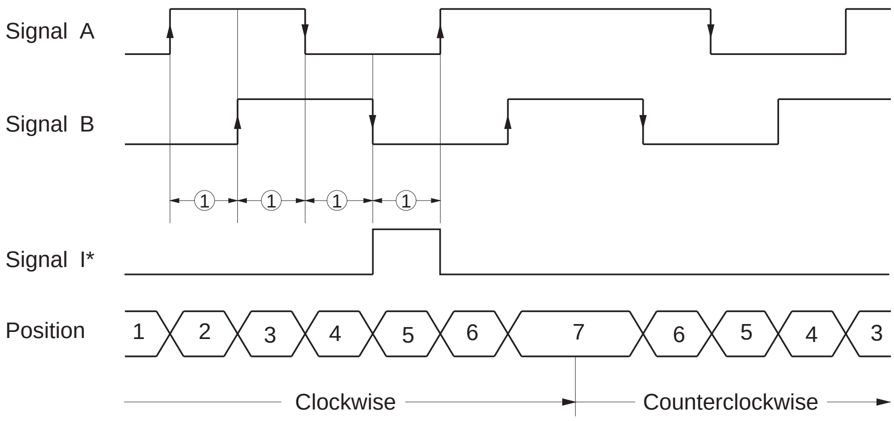
Encoder signal type A/B

Pin	Abbreviation	Assignment	
1	A	Encoder signal A	←
2	5VDC	Sensor supply voltage	→
3	5VGND	Sensor supply voltage ground	→
4	12VDC*	Sensor supply voltage	→
5	$\overline{B}$	$\overline{\text{Encoder signal B}}$	←
6	$\overline{I}$*	$\overline{\text{Encoder signal I}}$	←
7	$\overline{\text{TEMP\_MOT}}$	Motor temperature prewarning, line interruption	←
8	–	–	
9	$\overline{A}$	$\overline{\text{Encoder signal A}}$	←
10	+SENSE*	Sense regulator 5VDC	←
11	–SENSE*	Sense regulator 5VGND	←
12	B	Encoder signal B	←
13	I*	Encoder signal I	←
14	–	–	
15	–	–	

* Only for encoder connection 2.

$\overline{\text{active low}}$ signal ← Input → Output

ATTENTION
$\overline{\text{TEMP\_MOT}}$ must be connected to 5VDC when using third-party sensors.



Counting on every pulse edge

CW rotation on rising/falling A edge before rising/falling B edge.
CCW rotation on rising/falling B edge before rising/falling A edge.

* Only for encoder connection 2.

① Setup time ≥ 350 ns

f_{max}(A or B) = 400 kHz

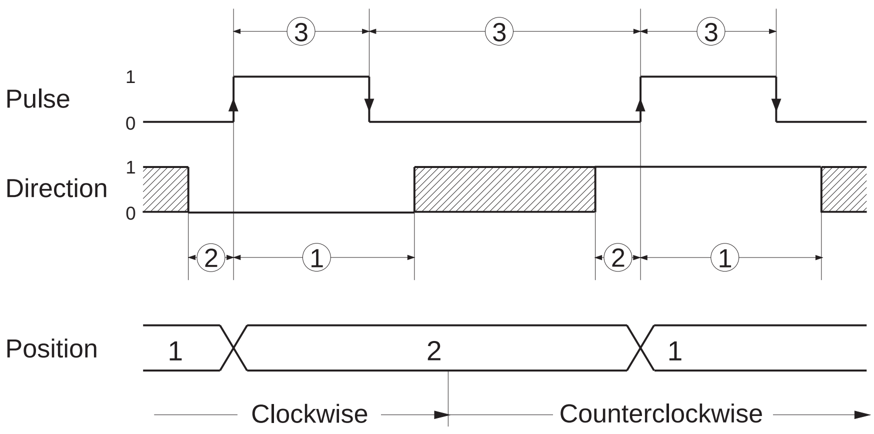
Fig. 2-11 Timing diagram – encoder signals A/B

Pulse/direction signal type (only for encoder connection 2)

Pin	Abbreviation	Assignment	
1	$\overline{\text{PULSE}}$	$\overline{\text{Pulse}}$	←
2	5VDC	Sensor supply voltage	→
3	5VGND	Sensor supply voltage ground	→
4	12VDC	Sensor supply voltage	→
5	DIR	Direction	←
6	–	–	
7	$\overline{\text{TEMP\_MOT}}$	Line interruption	←
8	–	–	
9	PULSE	Pulse	←
10	+SENSE	Sense regulator 5VDC	←
11	–SENSE	Sense regulator 5VGND	←
12	$\overline{\text{DIR}}$	Direction	←
13	–	–	
14	–	–	
15	–	–	

$\overline{\text{active low}}$ signal ← Input → Output

ATTENTION
$\overline{\text{TEMP\_MOT}}$ must be connected to 5VDC.



Counting in case of positive pulse edge

Direction = 0 ⇒ CW rotation of motor
Direction = 1 ⇒ CCW rotation of motor

Undefined area

① Hold time ≥ 300 ns
② Setup time ≥ 100 ns
③ Minimum pulse width ≥ 250 ns

f_{max}(pulse) = 2 MHz

Fig. 2-12 Timing diagram – pulse/direction signals

2.4.5 Signal connection

The signal inputs and outputs can be freely assigned. The signal inputs I 16 to I 20 are pre-assigned ex works, however, they can also be used freely (see “ensig” control function in BPRO3 programming manual).

1. Solder the litz wires to the connector as required for the desired assignment (see chapter 2.4.5.1).

NOTE
Connect system supply voltage ground to protective ground.

2. Push the shield back and fix with a cable tie.

3. Insert two hexagon head screws into the connector shell (fig. 2-13).

4. Place the connector into the connector shell.

5. Fasten the cable and the shield to the connector shell with screws, providing for strain relief.

ATTENTION
Ensure good electrical contact between the shield and the connector shell on both cable ends.

6. Insert two caps into the unused cable entries.

7. Assemble the two parts of the connector shell with two screws.

8. Fasten the connector to the front panel (item 57) with screws.

DANGER
All signal connections must be definitely isolated from mains. The voltage towards ground must not exceed 60 VDC or 25 VAC. All signal circuits are internally grounded via a 1 Mohm bleed resistor.

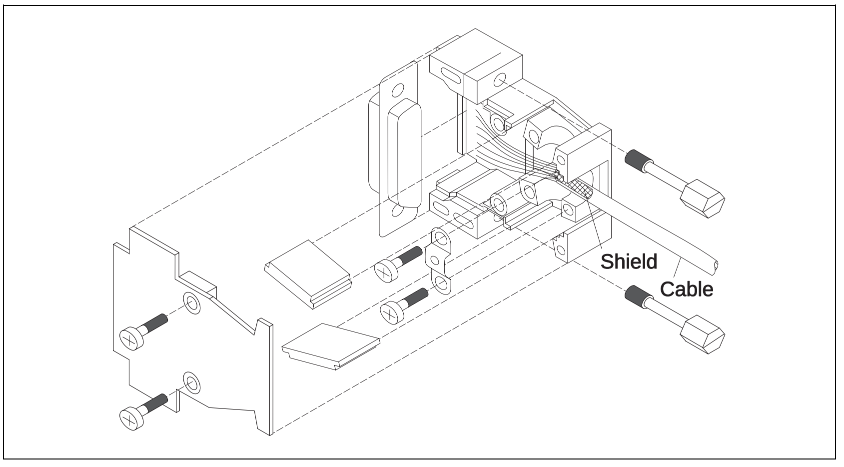


Fig. 2-13 Signal connector assembly – device end

2.4.5.1 Signal connector assignment

The appropriate assignment of the inputs and outputs may be entered into the following table.

NOTE
Input I 15 is not available.

Pin	Abbreviation	Meaning	Assignment
1	I 17: $\overline{\text{LIMN}}$	CCW limit switch	
2	I 20: TRIG	Trigger	
3	I 13		
4	I 11		
5	I 10		
6	I 18: $\overline{\text{REF}}$	Additional reference switch	
7	I 7		
8	I 5		
9	I 3		
10	I 1		
11	Q 9		
12	Q 7		
13	Q 5		
14	Q 3		
15	Q 1		
16	24VDC	System supply voltage	
17	24VDC	System supply voltage	
18	IO24VDC	I/O supply voltage	
19	IO24VDC	I/O supply voltage	
20	I 16: $\overline{\text{LIMP}}$	CW limit switch	
21	I 14		
22	I 12		
23	I 19: $\overline{\text{STOP}}$	Stop	
24	I 9		
25	I 8		
26	I 6		
27	I 4		
28	I 2		
29	I 0		
30	Q 8		
31	Q 6		
32	Q 4		
33	Q 2		
34	Q 0		
35	24VGND	System supply voltage ground	
36	24VGND	System supply voltage ground	
37	IOGND	I/O supply voltage ground	

$\overline{\text{active low}}$ signal I = Input Q = Output

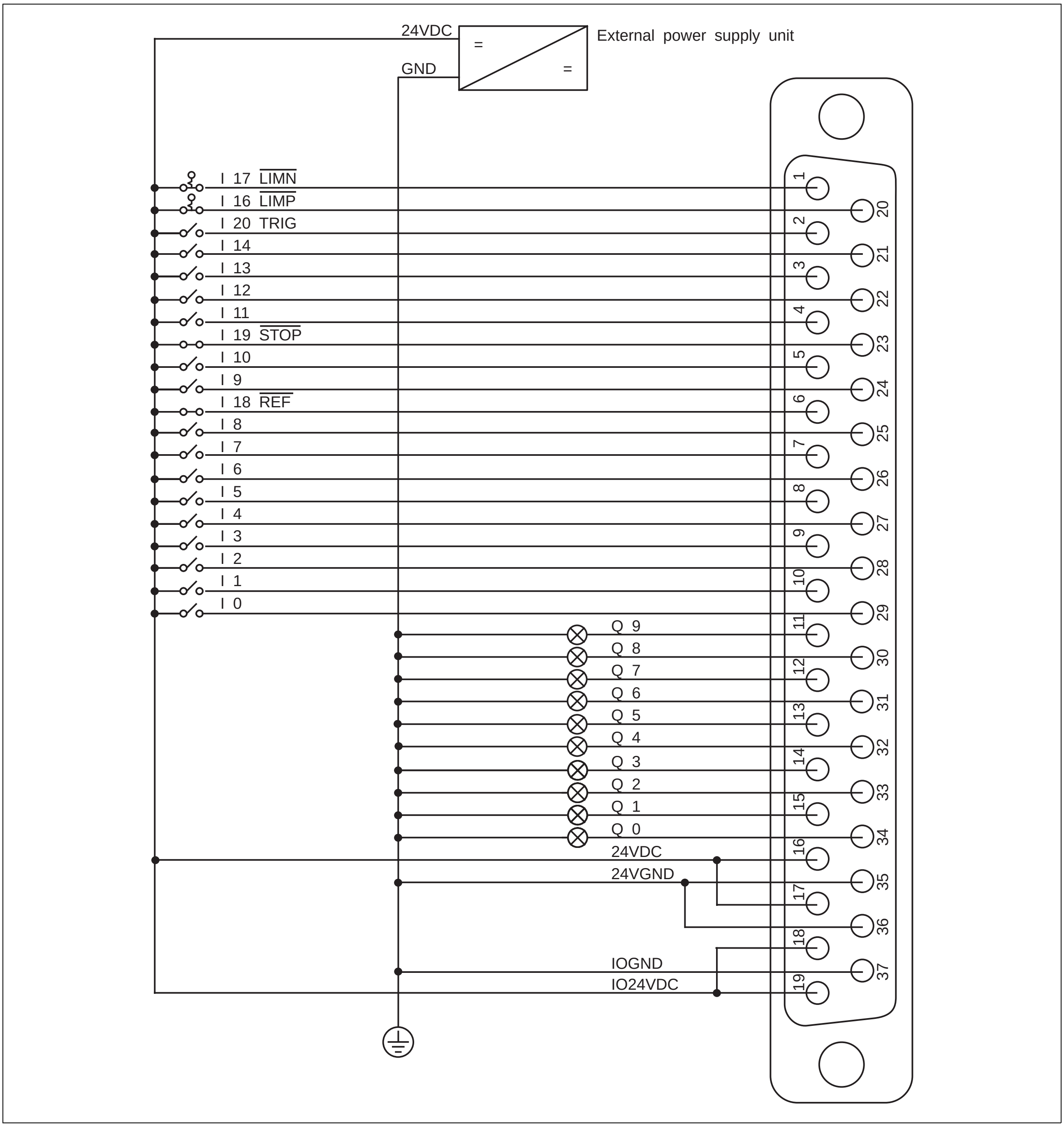


Fig. 2-14 Wiring example

NOTE
With the manufacturer-defined function or the command “brake”, any output Qx can be used for controlling a brake; see the documentation on the programming software or on-line command processing via field bus systems (e.g. Interbus-S or Profibus-DP) or via serial interface.

2.4.6 RS 232 serial interface

NOTE
The RS 232 serial interface may be located either in slot 51 or 53; see type plate.

1. Solder the litz wires to the connector in accordance with fig. 2-15 and fig. 2-16.

Pin	Signal	Meaning
1	–	–
2	RXD	Received data ←
3	TXD	Transmitted data →
4	–	–
5	GND	Ground
6	–	–
7	–	–
8	–	–
9	–	–

← Input → Output

2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head screws into the connector shell (fig. 2-17).
4. Place the connector into the connector shell.
5. Fasten the cable and the shield to the connector shell with screws, providing for strain relief.

ATTENTION
Ensure good electrical contact between the shield and the connector shell.
Connect the shield on both ends.

6. Insert two caps into the unused cable entries.
7. Assemble the two parts of the connector shell with two screws.
8. Fasten the connector to the front panel with screws.

ATTENTION
For reasons of noise immunity, the RS 232 cable should be as short as possible (15 m max.)!

NOTE
The attachment screws of the connector shells must have M3 thread on the device end and UNC thread on the PC end.

NOTE
For master/slave operation via the serial interface (e.g. PC as the master, controller as the slave), the transmit and receive lines must be crossed over between the units.

NOTE
With an RS 232 interface, networking is not possible.

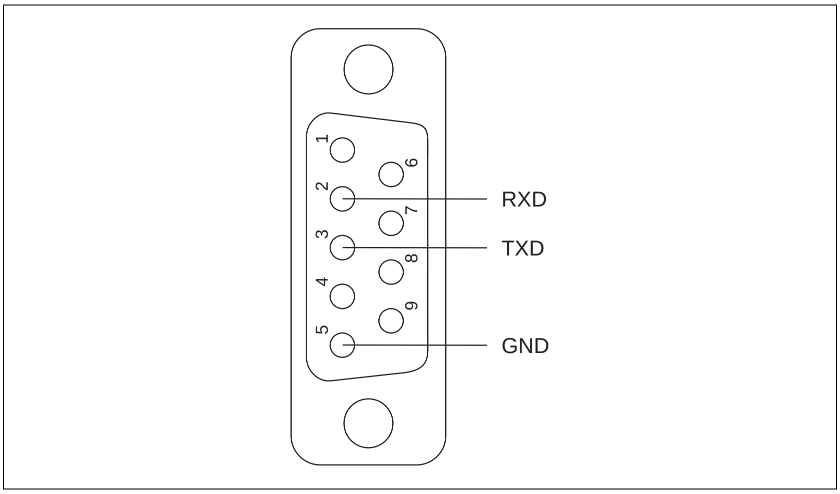


Fig. 2-15 Interface connector – device end

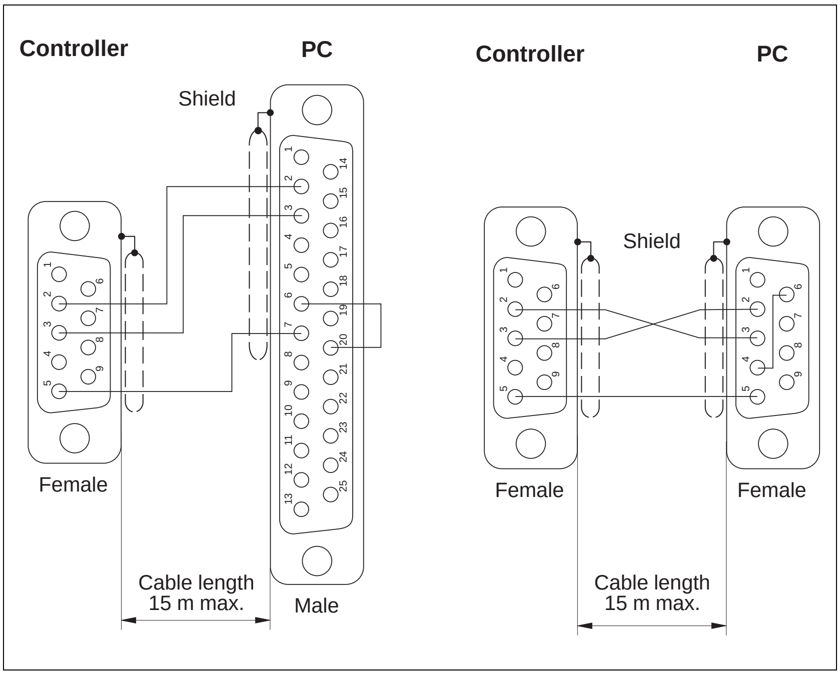


Fig. 2-16 Controller/PC wiring

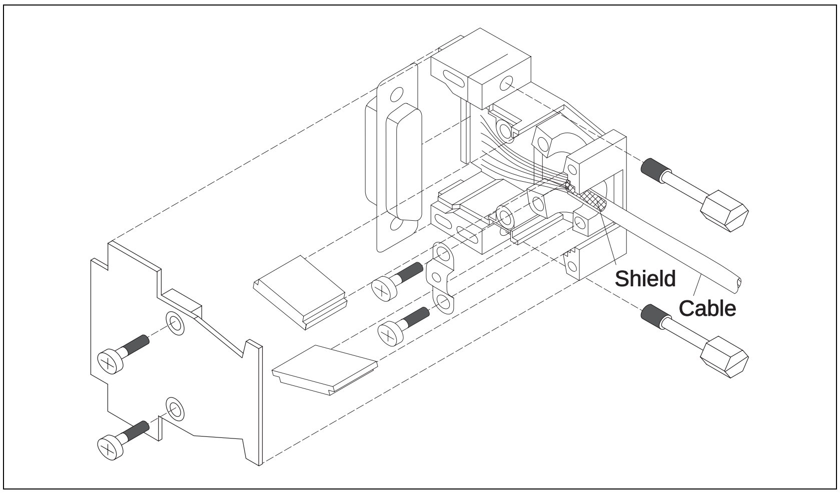


Fig. 2-17 Interface connector assembly

2.4.7 RS 485 LS serial interface

NOTE
The RS 485 LS serial interface may be located either in slot 51 or 53; see type plate.

NOTE
The serial interface is a four-wire interface.

1. Solder the litz wires to the connector as illustrated in fig. 2-18.

Pin	Signal	Meaning	
1, 6	12VDC	MP 923 supply voltage	→
2, 7	GND	MP 923 supply voltage ground	→
3	$\overline{\text{TXD}}$	Inverted transmitted data	→
4	$\overline{\text{RXD}}$	Inverted received data	←
5	SGND	Signal ground	
8	TXD	Transmitted data	→
9	RXD	Received data	←

← Input → Output

2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head screws into the connector shell (fig. 2-19).
4. Place the connector into the connector shell.
5. Fasten the cable and the shield to the connector shell with screws, providing for strain relief.

ATTENTION
Ensure good electrical contact between the shield and the connector shell.
Connect the shield on both ends.

6. Insert two caps into the unused cable entries.
7. Assemble the two parts of the connector shell with two screws.
8. Fasten the connector to the front panel with screws.

NOTE
For a computer with an RS 232 interface, the MP 923 interface converter can be used; see chapter 6.2.4.

NOTE
The MP 924 interface distributor can be used for controlling eight units (see chapter 6.2.5).

NOTE
For master/slave operation via the RS 485 LS interface (e.g. controller as the master, operating terminal as the slave), the transmit and receive lines must be crossed over between the units. For this purpose, a crossover adapter can be used; see chapter 6.2.6.

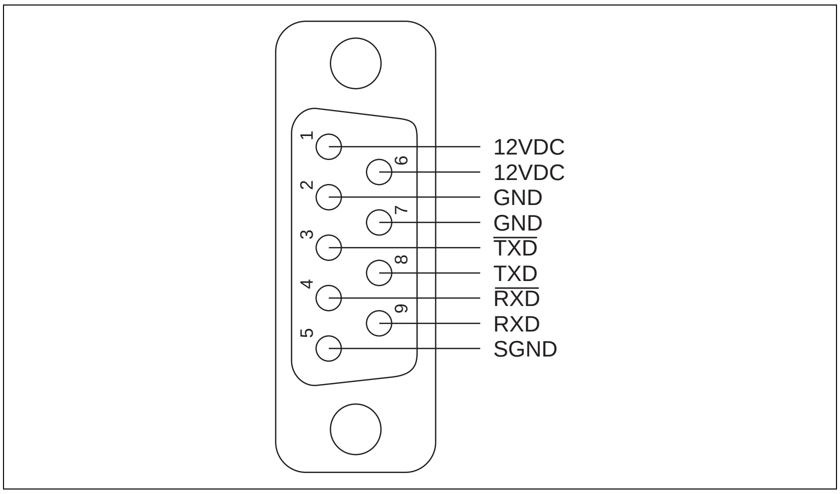


Fig. 2-18 Interface connector – device end

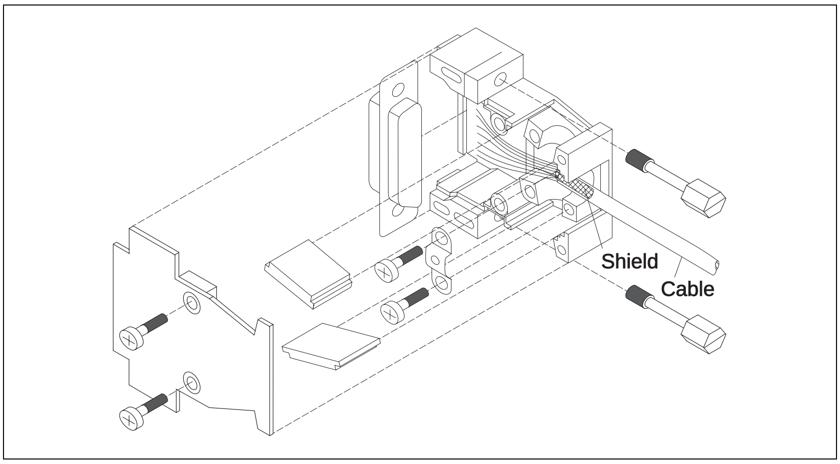


Fig. 2-19 Interface connector assembly

2.4.8 RS 485 HS serial interface

NOTE
The serial interface RS 485 HS is installed in adapter slot 53; see type plate. In controllers without OED3, the RS 485 HS interface can be used as a SUCONET field bus interface. In controllers with OED3, an MP 926 input/output card or a Lauer operating panel can be connected to the RS 485 HS interface.

NOTE
Wiring and setup of the RS 485 HS interface are described in the SUCONET and MP 926 documentation as well as in the ProOED3 documentation (for the Lauer operating panel).

2.4.9 Field bus interface

NOTE
The field bus interface (e.g. Interbus-S or Profibus-DP) is installed in adapter slot 53; see type plate.

NOTE
Wiring and setup of the field bus interface is described in a separate documentation for the respective interface.

2.4.10 Analog interface

NOTE
The analog interface is installed in adapter slot 53; see type plate.

1. Solder the litz wires to the connector as illustrated in fig. 2-20.

Pin	Signal	Meaning	
1	ANA_OUT	Voltage output (0 to 10 V, 30 mA max.)	→
2	ANA_OUT GND	Voltage output ground	→
3	ANA_IN21	Analog input 21 (-10 V to +10 V)	←
4	ANA_IN20	Analog input 20 (-10 V to +10 V)	←
5	ANA_IN2 GND	Ground for analog input 20 and 21	←
6	ANA_IN12	Analog input 12 (-10 V to +10 V)	←
7	ANA_IN1 GND	Ground for analog inputs 10 to 12	←
8	ANA_IN11	Analog input 11 (-10 V to +10 V)	←
9	ANA_IN10	Analog input 10 (-10 V to +10 V)	←

← Input → Output

NOTE
ANA_OUT GND is the ground for the internal voltage supply. The reference potential of the ANA_IN1 GND and ANA_IN2 GND inputs must not deviate from the reference potential of ANA_OUT GND by more than ±0.5 V.

2. Push the shield back and fix with a cable tie.

3. Insert two hexagon head screws into the connector shell (fig. 2-21).

4. Place the connector into the connector shell.

5. Fasten the cable and the shield to the connector shell with screws, providing for strain relief.

ATTENTION
Ensure good electrical contact between the shield and the connector shell.
Connect the shield on both ends.

6. Insert two caps into the unused cable entries.

7. Assemble the two parts of the connector shell with two screws.

8. Fasten the connector to the front panel (item 53) with screws.

ATTENTION
The ground connections of the interfaces in adapter slots 51, 53 and 55 are internally connected. In the case of multiple ground connections, this may cause ground loops with resulting interference at the analog inputs. Such interference can be reduced by means of bonding lines.

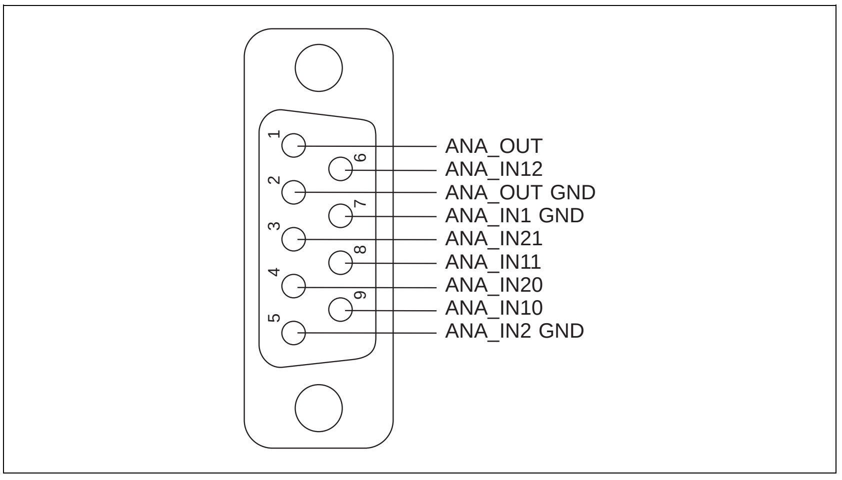


Fig. 2-20 Interface connector – device end

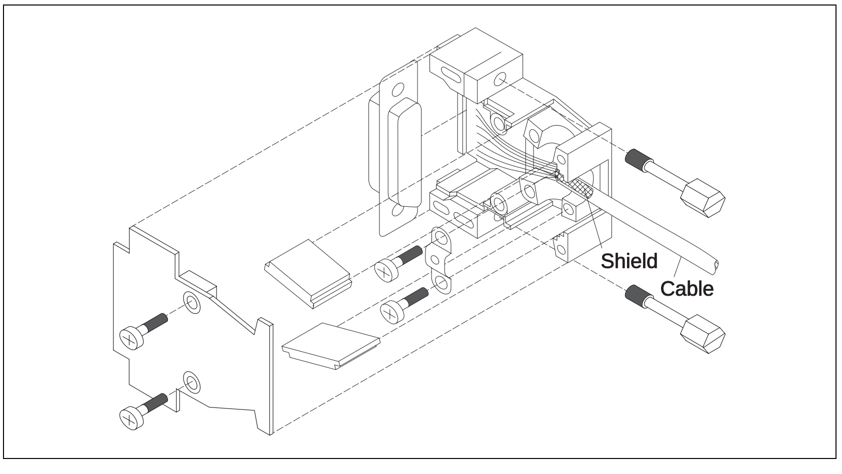


Fig. 2-21 Interface connector assembly

2.5 Setup

2.5.1 Defaults

After switching on, and after program start, the unit is set to the following default parameters:

Parameter	**Default**	
Axis operating mode	Point-to-point	
Motor position	Not defined	
Step angle	Half step	
Maximum system speed	32767 Hz	
Set speed	1000 Hz	
Start speed	200 Hz	
Safety distance for reference movement	10 steps	
Acceleration	10 Hz/ms (ramp 1)	
	Ramp	Linear acceleration
	1	10 Hz/ms
	2	50 Hz/ms
	3	100 Hz/ms
	4	200 Hz/ms
	5	300 Hz/ms
	6	400 Hz/ms
	7	500 Hz/ms
	8	600 Hz/ms
	9	700 Hz/ms
	10	800 Hz/ms
Signal evaluation	limp, limn, stop, ref, ampnotready, swstop	
Normalizing factors for position for speed for acceleration for electronic gear for encoder (position, indexer)	 Numerator 1; denominator 1; half-steps Numerator 256; denominator 1; Hz (steps/second) Numerator 1000; denominator 1; Hz/ms Numerator 0; denominator 1; gear ratio 0 Numerator 1; denominator 1	
Motor current at standstill during acceleration/deceleration at constant speed	 50% 100% 80%	
Power controller	Not ready	
Encoder	Not linked to axis; single evaluation of encoder signals; contouring error limit = 18 encoder units; encoder position = 0	

NOTE
For parameters which can be changed, see BPRO3 programming manual or ProOED3 documentation.

Make the following adjustments before connecting the supply voltage:

1. The unit's supply voltages must not be switched on.

2. Set the mains voltage to 115 V or 230 V on the power supply unit.

ATTENTION
The setting must correspond to the actual mains voltage available.

DANGER!
Electrical shock from high voltage!
Observe safety instructions for work on electrical equipment.
Disconnect voltage from device before setting the switch.

3. Set the motor phase current on the selector switch "05 PH.CURR" in accordance with the motor type plate.

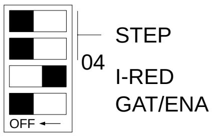
WDP3-314		WDP3-318	
Position	**Phase current [A]**	**Position**	**Phase current [A]**
0*	0.6	0*	1.7
1	0.8	1	2.0
2	0.9	2	2.4
3	1.0	3	2.7
4	1.1	4	3.1
5	1.3	5	3.4
6	1.4	6	3.7
7	1.5	7	4.1
8	1.6	8	4.4
9	1.8	9	4.8
A	1.9	A	5.1
B	2.0	B	5.4
C	2.1	C	5.8
D	2.3	D	6.1
E	2.4	E	6.5
F	2.5	F	6.8

* Default

ATTENTION
The set phase current must be equal to or less than the nominal phase current specified on the motor type plate (the lower the set phase current, the lower the motor torque).

ATTENTION
The admissible phase current is represented in fig. 2-3 as a function of the ambient temperature and the motor cable length.

DANGER!
Electrical shock from high voltage!
Observe safety instructions for work on electrical equipment.
Disconnect voltage from device before setting the switch.



4. Check the parameter switch 04 settings on the power controller:

STEP 1 and 2	= OFF	= 1000 steps/revolution
I-RED	= ON	= Current reduction OFF (current controlled by processor unit)
GAT/ENA	= OFF	= Enable signal from processor unit

ATTENTION
These settings must not be changed.

ATTENTION
Before switching on, check that the signal inputs for the limit switches, for the reference switch and stop are properly wired; see fig. 2-14.

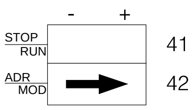
5. Check that all connectors are properly connected.

6. Plug in the mains connector and switch on the supply voltage for the power controller and the processor unit; see chapter 3.2.

7. Press the selector switch (item 41) in STOP position.
   → The controller assumes RESET status.

MODE settings

Perform the subsequent MODE settings as follows:



– Keep the selector switch (item 42) pressed in MOD position. After 2 seconds, the seven-segment displays (item 40) start flashing.
– Select the desired number by pressing + or – on the selector switch (item 41).
– Release the selector switch (item 42).
  → The latest selection appears flashing in the seven-segment displays.
– Press + or – on selector switch (item 41) to select the desired setting.
– Press the selector switch (item 42) again to accept the setting.

8. Set the operating mode (see description above).

MODE	Operating mode	Setting
01	Application mode	–
60	On-line command processing via serial interface in adapter slot 51	00 = OFF* 01 = ON
63	On-line command processing via CAN bus in adapter slot 51 – Simple CAN bus protocol – CAL protocol	 01* 02
70	On-line command processing via serial interface in adapter slot 53	00 = OFF* 01 = ON
73	On-line command processing via CAN bus in adapter slot 53 – Simple CAN bus protocol – CAL protocol	 01* 02
91	Manual mode	–

* Default

9. Set the network address for the serial interface, Profibus-DP or CAN bus (see description above).

MODE	Network address	Setting
61	Address for operation via interface adapter slot 51	01* to 31 with RS 485 LS serial interface; 00 to 126* with Profibus-DP or CAN bus
71	Address for operation via interface adapter slot 53	

* Default
The hundred's digit of the address is identified by the superscript dot, e.g. ˙26 = address 126.

NOTE
The network address for operation via interface adapter slot 51 can also be set with the selector switch (item 42) in ADR position.

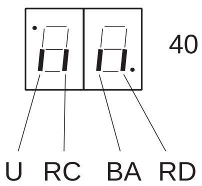
NOTE
With an RS 232 interface, the network address is set to 1 and cannot be changed.

10. Set the baud rate for on-line command processing via serial interface or CAN bus (see description above).

MODE	Baud rate	in kbauds for serial interface	in kbauds for CAN bus
62	Baud rate for operation via slot 51	01 = 9.6* 02 = 19.2 03 = 38.4	01 = 500 02 = 250 03 = 125* 04 = 100 05 = 50 06 = 20 07 = 10
72	Baud rate for operation via slot 53		

* Default

11. Set the Interbus-S diagnostics (for a description, see separate Interbus-S documentation). This is not applicable to controllers with the OED3 software installed.



MODE	Interbus-S diagnostics	Setting
65	Diagnosis via adapter slot 51	–
75	Diagnosis via adapter slot 53	–

U Operating voltage
RC Interbus-S link o.k.
BA Interbus-S transmission active
RD No further Interbus-S slave available

2.5.2 Test

A manual movement should be executed as described in chapter 3.3 in order to check the motor wiring and the basic settings.

A program test can be effected with the BPRO3 programming system or the ProOED3 programming interface; see BPRO3 operating manual or ProOED3 documentation.

3 Operation

3.1 Controller operating modes

Processor unit status display	Operating mode	Function	Reference
01	Application mode	Programming with BPRO3 or ProOED3 software, program execution, program test	See chapter 3.4
60	On-line command processing	Setting the on-line command processing mode via the serial interface, adapter slot 51	See chapter 3.5
63	On-line command processing	Setting the on-line command processing mode via the CAN bus interface, adapter slot 51	See chapter 3.5
70	On-line command processing	Setting the on-line command processing mode via the serial interface, adapter slot 53	See chapter 3.5
73	On-line command processing	Setting the on-line command processing mode via the CAN bus interface, adapter slot 53	See chapter 3.5
91/M	Manual mode	Setting up and testing the drive	See chapter 3.3

NOTE
Further operating modes with OED3 are described in the ProOED3 documentation.

3.2 Switching on

ATTENTION
The set supply voltage for the power controller must correspond to the required supply voltage (see type plate).

DANGER
Live parts of the device or system may never be touched by persons or come into contact with electrically conductive objects.

DANGER
The movement range of the system must be kept clear of persons and objects.

ATTENTION
The unit must be grounded with a protective conductor.

ATTENTION
The basic settings of the unit must conform to the actual requirements; see chapter 2.5.

The following requirements must be fulfilled before switching on the unit:

Requirement	**Reference**
Ambient conditions in line with the technical data?	See chapter 1.4
Sufficient space for ventilation available?	See chapter 1.4
Wiring of the unit (in particular signal inputs for limit switches, reference switch and stop) carried out properly?	See chapter 2.4
Motor phase current set correctly?	See chapter 2.5.1

1. Switch on the supply voltage for the power controller (115 VAC or 230 VAC).

ATTENTION
If the controller was in RUN status when switching off, it will automatically assume RUN status again when switching on and start the program.
This can be prevented by actuating the STOP selector switch (item 41) while switching on.

2. Switch on the supply voltage for the processor unit (24 VDC).
   After power-on, the controller performs a self-test with the hardware and software components. Fig. 3-1 shows the power-on sequence of the controller.

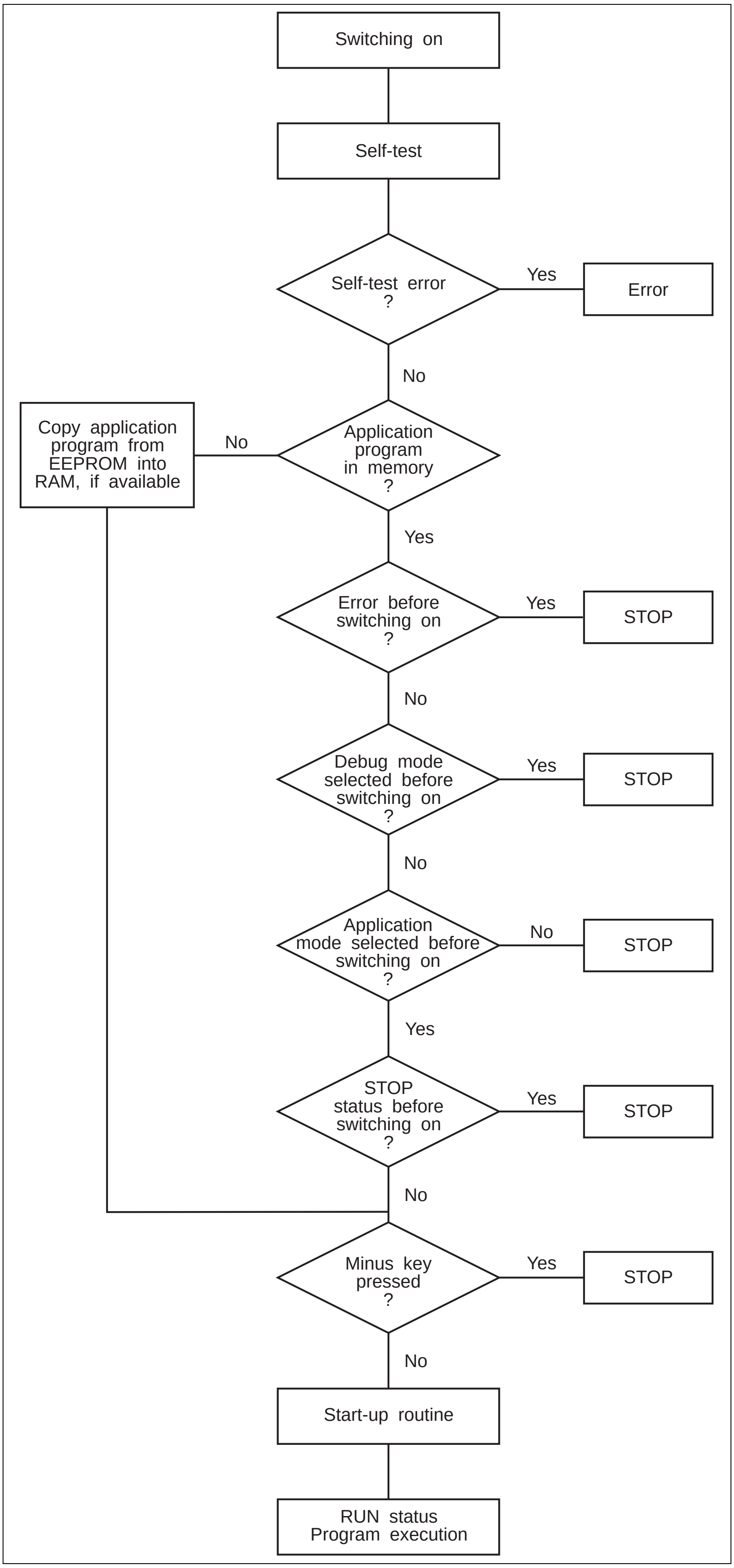
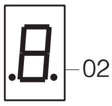


Fig. 3-1 Power-on sequence

Self-test

If an error occurs during the self-test, the controller assumes error status and indicates the error; see chapter 4.
If no error occurs, the controller assumes the status and mode it had before switching off.

The operating mode can be changed in STOP status.
In STOP status, no application program is active, i.e. no program is executed.



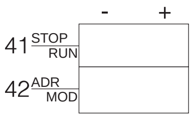
3. The power controller is “ready” when the dot on the seven-segment display for the power controller (item 02) lights up.
   In STOP status, the seven-segment displays for the processor unit (item 40) indicate the number of the set operating mode.

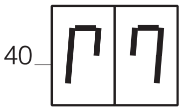
After power-on and self-test, the controller configuration is as follows:

– Operating mode: Application mode
– Serial interface 1 parameters: BNET, 9600 bauds, network address 1
– Serial interface 2 not configured
– 1000 flag words (0 remanent flag words)
– Process image for local I/O modules
– Default axis parameters
– Maximum number of program objects

The controller configuration can be modified using the programming device.

3.3 Manual mode





Manual mode can only be used for rotating the stepping motor to the left or right at a speed of 1 kHz.

1. Use the selector switch (item 41) to set STOP.

2. Keep the selector switch (item 42) pressed in MOD position. After 2 seconds, the seven-segment displays (item 40) start flashing. Set no. 91 for manual mode by pressing + or – on the selector switch (item 41).
   Release the selector switch (item 42) to accept the setting.
   A flashing “M” appears in the seven-segment displays (item 40) to indicate manual mode.

3. The motor can be run in single steps or in continuous operation.

– Single step: Press the selector switch (item 41) briefly.
– Continuous operation: Keep the selector switch (item 41) pressed.

– Clockwise motor rotation: Press the selector switch (item 41) in + position.
– Counterclockwise motor rotation: Press the selector switch (item 41) in – position.

NOTE
In manual mode, all limit switches are monitored.

4. Exit manual mode by pressing selector switch (item 42) in MOD position.

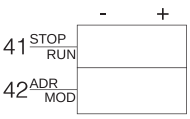
3.4 Application mode

In this mode, an application program can be executed which was developed using the BPRO3 programming system or the ProOED3 programming interface.

Program start with BPRO3

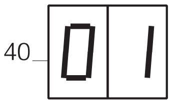
As a prerequisite, an application program must have been loaded from the programming device into the WDP3-31X; see BPRO3 operating manual.

NOTE
An application program can also be started, stopped or tested (“debugged”) from the programming device (“on-line”).

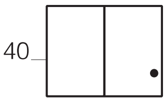


1. Use the selector switch (item 41) to set STOP.

2. Keep the selector switch (item 42) pressed in MOD position. After 2 seconds, the seven-segment displays (item 40) start flashing.
   Set no. 01 for application mode by pressing + or – on the selector switch (item 41).
   Release the selector switch (item 42) to accept the setting.



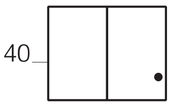
3. Start a loaded program by pressing the selector switch (item 41) in RUN position.



– Keep the selector switch pressed for at least **2 s**.
– The program is always executed from program start.
  → A dot appears in the status display (item 40).

NOTE
The functions of the selector switches (items 41 and 42) and the status displays for the processor unit (item 40) can be determined by the application program; see BPRO3 programming manual.

Program start with ProOED3



If an application program was created with ProOED3, the program is automatically activated at power-on.
→ A dot appears in the status display (item 40).

NOTE
Refer to the ProOED3 documentation for more information.

3.4.1 Controller states in application mode with BPRO3

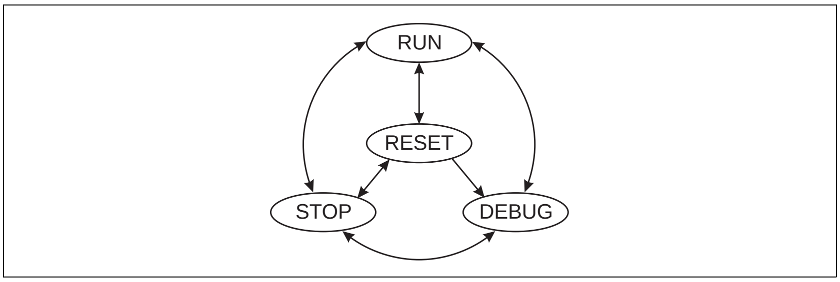
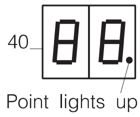
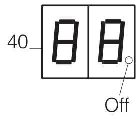


Fig. 3-2 Status changes

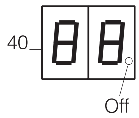
In application mode, the controller can assume the following states (the current state is indicated by the dot on the right of the seven-segment displays (item 40):



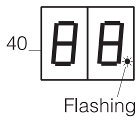
RUN
In RUN status, the application program is executed. RUN status is activated by pressing the selector switch (item 41) on the front panel or by selecting the BPRO3 menue option “Cont. contr.”.



STOP
In STOP status, the application program is stopped and the drive inactive, or no application program has been loaded. The outputs are disabled.
STOP status is activated by selecting the BPRO3 menue option “Stop controller” or after an error of error class 0 to 3 occurred (see chapter 3.4.2, “Error handling”).
Program execution can be resumed by selecting the BPRO3 menue option “Cont. contr.”.



RESET
In RESET status, the application program is stopped and reset.
The program can only be restarted at the program start. The outputs are reset.
In RESET status, the controller operating mode can be changed.
RESET status is activated by pressing the selector switch (item 41) on the front panel or by selecting the BPRO3 menue option “Reset controller”.



DEBUG
In DEBUG status, the application program can be tested.
DEBUG status is activated by selecting any of the following BPRO3 menue options:

– “Set breakpoint”
– “Continue task, Stop task, Reset task”
– “Single cycle”
– “View on”
– “Disable, set/reset inputs/outputs”, “Disp./change var.”

NOTE
The “debug” function of the controller library can be used for defining the characteristics of the drive and the outputs in DEBUG status after stopping the application program (see BPRO3 programming manual).

DEBUG status can only be exited by selecting the BPRO3 menue option "Reset controller" or by switching off the controller.

NOTE
If the link between the programming system and the controller is disrupted, the controller changes to RESET status. In this case, the drive is stopped and the outputs are reset.

The behaviour of the controller depends on whether operation is via the BPRO3 programming system or via the front panel.

Operation via BPRO3:

Action	Effect
"Stop controller"	The application program is stopped. The serial and encoder interfaces remain functional. Subsequent status: STOP, if RUN was active. ***ATTENTION*** ***In electronic gear mode, positions continue to be processed.*** *NOTE* *In DEBUG status, the characteristics of the drive and the outputs can be determined with the "debug" function.*
"Reset controller"	The application program is reset. The drive is initialized and the outputs are reset. If DEBUG status was active, it is disabled, (all breakpoints are deleted, viewing is deactivated). All error messages are deleted from the controller error memory (except class 0 errors). Subsequent status: RESET
"Cont. contr."	The stopped application program is resumed if no class 0 error occurred. The drive and the outputs are enabled. Outputs disabled after STOP will have the same status as before disabling. Subsequent status: RUN, if STOP was active. ***ATTENTION*** ***Any stopped movements are resumed.***

Operation via front panel:

Action	**Effect**
RUN key pressed	"Reset controller", then "Cont. contr."; see Operation via BPRO3. Subsequent status: RUN *NOTE* *In DEBUG status, the application program is resumed.*
STOP key pressed	"Reset controller"; see operation with BPRO3. Subsequent status: RESET

NOTE
For operation with a controller with the OED3 software installed, see ProOED3 documentation.

3.4.2 Troubleshooting with BPRO3

Error classes

Runtime errors are structured according to error classes. Error classes are distinguished by the error type and the effect on the controller.

Error class **Significance**	**Controller response**	**Rectification**
Error class 0 System error	STOP status, RUN status not available. The error is stored in the error memory and can only be cleared by booting.	Call BERGER LAHR
Error class 1 Fatal error in application program	STOP status, RUN status available. The error is stored in the error memory.	Modify and reload application program
Error class 2 Non-fatal error in application program	STOP status, RUN status available. The error is stored in the error memory.	See troubleshooting table, chapter 4.2.2
Error class 3 Setting error	STOP status, RUN status available. The error is stored in the error memory.	See troubleshooting table, chapter 4.2.2
Error class 4 Programming error	The application program continues to execute. The error is stored in the error memory and registered in the resource error word. The resource error word can be read from the application program with the “geterror_sr” function; see BPRO3 programming manual.	See troubleshooting table, chapter 4.2.2
Error class 5 Signal monitoring	The application program continues to execute. Drive movement is stopped, depending on the active signal. Any active signal is registered in the resource signal word and can be read from the application program with the “getsig_sr” function; see BPRO3 programming manual. The error is stored in the error memory.	Can be determined by the user

Error memory and error display

Class 0 to 4 errors are displayed as a flashing number in the processor unit status displays (item 40) and stored in the error memory of the controller.
A maximum of 16 errors can be stored in the controller error memory (the first 8 and the last 8 errors occurred). The errors stored in the error memory can be sequentially displayed in the processor unit status displays (item 40) by pressing the selector switch (item 42) in the ADR position.
With the BPRO3 programming system, the contents of the error memory, the error class and a detailed description of the errors can be displayed; see BPRO3 operating manual.
The errors stored in the error memory are cleared when “Reset controller” is selected or the application program is restarted, with the exception of system errors (error class 0).

NOTE
Errors occurring during programming or debugging with the BPRO3 programming system are displayed as messages on the PC screen.

3.5 On-line command processing

This mode is available if the unit has a serial interface RS 232 or RS 485 LS installed in adapter slot 51 or 53 or a field bus interface (e.g. Interbus-S or Profibus-DP) installed in adapter slot 53.

In this mode, single movement commands and other commands are transmitted to the controller and executed immediately. A comprehensive command set is available for this purpose.

NOTE
The following parameters must have been set (see chapter 2.5):
- *For a serial interface, operating mode with MODE 60 or 70*
- *For CAN bus interface, operating mode with MODE 63 or 73*
- *Network address with MODE 61 or 71 (only for RS 485 LS, Profibus-DP or CAN bus)*
- *Baud rate with MODE 62 or 72 (not necessary for Profibus-DP)*

In controller application mode (see chapter 3.4), on-line command processing is enabled.
Start by activating the power controller with the INITDRIVE command before executing any movement commands.

ATTENTION
Any transmitted values will be lost when switching off.

Reference documentation

On-line command processing mode is described in the following documentations:
- On-line Command Processing and Upload/Download via Serial Interface
- On-line Command Processing via CAN bus
- On-line Command Processing via Interbus-S
- On-line Command Processing via Profibus-DP

The following table contains a summary of the available read and write commands.

Write command	Meaning
BRAKE	Define output for brake
CLRERROR	Clear error information
CLRSIG_SR	Clear temporarily stored axis signals
CONT	Continue interrupted shaft movement
ENSIG	Enable or disable axis signals
INITDRIVE	Initalize axis
MOVE	Incremental (relative) positioning operation
POS	Absolute positioning operation
RAMP_EXP	Set exponential ramp
RAMP_LIN	Set linear ramp
RAMP_SIN	Set sine square ramp

Write command	Meaning
REF_OUT_DISTANCE	Set maximum allowed distance from limit switch for reference movement
REFPOS_LIMN	Reference movement towards CCW limit switch
REFPOS_LIMP	Reference movement towards CW limit switch
REFPOS_REF	Reference movement towards reference switch
ROTMON_DISABLE	Disable rotation monitoring or blocking detection
ROTMON_ENABLE	Enable rotation monitoring or blocking detection
ROTMON_RESET	Reset rotation monitoring or blocking detection
SETCURRENT	Set motor current
SETENCODER	Set encoder signal type
SETHARDWARE	Set hardware settings
SETMODE	Set operating mode
SETNORM_GEAR_DEN	Set gear ratio denominator
SETNORM_GEAR_NUM	Set gear ratio numerator
SETOFFSET	Set reference variable offset
SETPOS	Set current position
SETSIG_ACTIV_H	Set active state of axis signals
SETVEL_START	Set start/stop speed
SETVEL_SYS	Set maximum system speed
STOP_AXIS	Stop shaft movement
TIMEOUT*	Set or disable timeout monitoring
VEL	Set the set speed
WRITE_OUTPUT	Set outputs directly

* Not available for units with Profibus-DP interface.

Read command	Meaning
GETCURRENT	Read electrical current values
GETENSIG	Read enabled or disabled axis signals
GETERROR	Read error
GETMODE	Read operating mode
GETPOS	Read position values
GETSIG	Read current axis signal states
GETSIG_ACTIV_H	Read active state of axis signals
GETSIG_SR	Read temporarily stored axis signals
GETSTATE	Read error status of an axis
GETVEL	Read speed value
READ_INPUT	Read inputs directly

3.6 Programming

Programming of the unit can be effected using the BPRO3 programming system or the ProOED3 programming interface.

3.6.1 Programming with BPRO3

Programming of the unit with BPRO3 is effected in application mode using a PC as the programming device.

Reference documentation

Three documentation manuals are supplied with the BPRO3 programming software:

– BPRO3 programming manual
contains all information required for developing a control program using the BPRO3 programming system.

– BPRO3 operating manual
contains information on installation and operation of the BPRO3 programming system.

– BPRO3 library
describes the sample programs and the user library included in the BPRO3 software package.

3.6.2 Programming with ProOED3

Programming of the unit is effected using the ProOED3 programming interface and a PC. For this purpose, OED3 must be installed on the positioning unit.

Reference documentation

Programming an application program with ProOED3 is described in the ProOED3 documentation.

3.7 Switching off

1. It may be necessary to press STOP before switching off so that the controller assumes STOP status after switching on again.
   If RUN status is active before switching off, the application program is executed after switching on again.

NOTE
When switching on the supply voltages, the controller always assumes the status which was active before switching off.

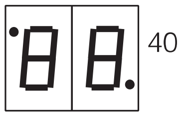
ATTENTION
The connected motor is deenergized after disconnecting the power controller supply voltage, i.e. it does not have any holding torque. Before disconnecting the supply voltage, ensure that any vertical loads are prevented from falling down (e.g. use motor with brake).

2. Switch off the supply voltages for the power controller and the processor unit.

NOTE
When disconnecting the power controller supply voltage, the encoder connection 1 is no longer supplied with power, and the information is lost. This is not the case with encoder connection 2.

4 Malfunctions

4.1 Status indicators



Processor unit status displays

The two seven-segment displays (item 40) indicate operating states and any malfunctions on the processor unit if the selector switch (item 42) is in the central position; see chapter 4.2.2 for a troubleshooting table.

Luminous displays

The luminous displays 00 to 99 indicate the following operating modes:

Display	Meaning
01	Application mode
60, 70	On-line command processing via serial interface
63, 73	On-line command processing via CAN bus
91/M	Manual mode

NOTE
The display can also be modified from the application program (in the range from 00 to 99); see the “display” function in the BPRO3 programming manual.

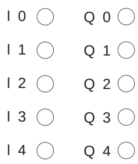
Flashing displays

Flashing displays indicate any errors and malfunctions on the processor unit; see chapter 4.2.2.

The dots on the right and left of the processor unit's seven-segment displays (item 40) indicate the following states:

L.h. dot	**R.h. dot**	**Meaning**
–	–	STOP or RESET status
–	lights	Program execution (RUN status)
–	flashes	Program execution (DEBUG status)
lights	lights/flashes	Selector switch functions (items 41 and 42) according to application program (RUN status/DEBUG status)

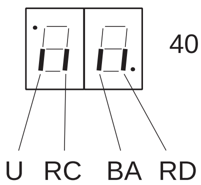
NOTE
The meanings of other displays during operation with OED3 are described in the ProOED3 documentation.



Input and output status indicators

The LEDs I 0 to I 20 show the status of the signal inputs and Q 0 to Q 9 show the status of the signal outputs.
The input I 15 is not available.

Interbus-S diagnostics



The following four indications are used for diagnostic purposes on units with Interbus-S interface.

U Operating voltage
RC Interbus-S link o.k.
BA Interbus-S transmission active
RD No further Interbus-S slave available

The diagnosis settings are made as follows:

1. Press the selector switch (item 42) in MOD position.
   → After 2 seconds, the seven-segment displays (item 40) start flashing.

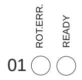
2. Select the desired number by pressing + or - on the selector switch (item 41).

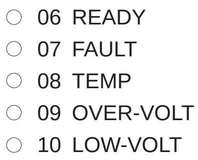
MODE	**Interbus-S diagnostics**
65	Diagnosis via adapter slot 51
75	Diagnosis via adapter slot 53

→ Release the selector switch (item 41) to accept the setting.

Refer to the Interbus-S documentation for a detailed description.

Power controller status indicators





01 The green LED “READY” indicates that rotation monitoring is ready for operation. It lights up when the rotation monitoring feature is connected to the 24 V supply.
The yellow LED “ROT.ERR.” indicates a rotation monitoring error. When a rotation monitoring error occurred, rotation monitoring can be reset with the RM_RESET signal.

06 Lights up if the power drive is operating properly (signal connection indicates readiness). The supply voltage is in the rated range; see Technical data.

07 Lights up in case of a short-circuit between two motor phase leads.

08 Lights up in case of overtemperature (> 75°C) at the heat sink.

09 Lights up in case of overvoltage (> 410 V).

10 Lights up in case of undervoltage (< 200 V).

09 + 10 Light up in case the enable input is not activated.

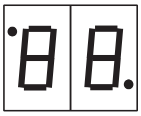
ATTENTION
If a malfunction occurs (LED “07” to LED “10”), the motor is deenergized and the power drive status changes to “Not ready” (LED “06” goes out).
When the motor is deenergized, it does not have any holding torque. This may lead to undesirable effects.

ATTENTION
If the LED “09” lights up, one or more external bleed resistors must be connected to the bleed resistor connection.

NOTE
The fault condition can be cleared after eliminating the cause of the fault by switching the supply voltage off (for at least five seconds) and on again or by deenergizing and reenergizing the enable input.

4.2 Troubleshooting tables

4.2.1 Processor unit malfunctions


40

Runtime errors are displayed as a flashing number in the processor unit status displays (item 40) and stored in the controller error memory. With the BPRO3 programming system, the contents of the error memory and a detailed description of the errors can be displayed; see BPRO3 operating manual.
The following table summarizes the possible errors, their causes and methods for rectification.

NOTE
Error messages occurring during operation with OED3 are also described in the ProOED3 documentation.

Display	Cause	Rectification
04	Power controller not ready	See power controller troubleshooting table
	Line interruption	Disconnect the unit and check the cable
07	Power controller overtemperature	Let the power controller cool down while the motor is at a standstill.
		Install a fan set; see chapter 6.2.1
08	Error on encoder for electronic gear Line broken	Check encoder wiring
09	Motor overtemperature	Reduce the phase current
		Reduce the load
12	Rotation monitoring active, contouring error	Check mechanical components for ease of movement
16	Short-circuit on one output Q	Check signal connector wiring
20	Incorrect limit switch LIMP or limit switch malfunction	Check wiring and function of the limit switch or the sense of rotation of the motor; see chapter 2.5. LIMP must be approached with CW rotation of the motor.
21	Incorrect limit switch LIMN or limit switch malfunction	Check wiring and function of the limit switch or the sense of rotation of the motor; see chapter 2.5. LIMN must be approached with CCW rotation of the motor.
22	CW limit switch LIMP actuated	Move out of the limit switch range
23	CCW limit switch LIMN actuated	Move out of the limit switch range
30	STOP input active	Disable STOP input

Display	Cause	Rectification
40 41 42	Error in application program: 40 = Error in INIT task 41 = Error in SEQUENCE task 42 = Error in PLC task	A detailed description of the error can be displayed by selecting the BPRO3 menue option “Error memory”
		For controller errors, see ProOED3 documentation
48	No application program loaded or OED3 operating system not available	Load application program or install OED3 operating system on the positioning unit
51	Admissible PLC cycle time exceeded due to endless loop in application program	Perform debugging with BPRO3
	Admissible PLC cycle time exceeded due to application program too long	Shorten the application program; consider transferring program parts to the SEQUENCE or INIT task
		Change the admissible cycle time (see “cycletime” function in BPRO3 programming manual)
		Disable cycle time monitoring (see “cycletime” function in BPRO3 programming manual)
52	No link via RS 485 HS interface	Check wiring
		Specify correct number of input/output cards
53	Revision levels of controller and BPRO3 programming system do not match	Check the revision levels: The revision level of BPRO3 is displayed on the screen after invoking BPRO3. The revision level of the controller can be determined via the BPRO3 menue option “Controller status”.
		Use matching revision levels
54	Programming error: Invalid address for input or output	Check application program
	When programming with BPRO3, an incorrect controller configuration was specified	Input the application program with the actual “Controller config.”
55	System faulty	Call Technical Services department.
56	No EEPROM available	Call Technical Services department.
57	EEPROM write error	Call Technical Services department.

Display	Cause	Rectification
80	Battery voltage low, battery used up ***ATTENTION*** ***After switching off the controller, data or the application program may be lost!***	Replace the battery; see chapter 5.1
97	OED3 version of controller and ProOED3 version do not match	Use the same software versions of OED3 and ProOED3, e.g. OED3 version 3 and ProOED3 version 3
Other error indications	System error	Call Technical Services department.

DANGER
The mains supply voltage must be disconnected for any check on the mains, motor, or bleed resistor wiring.

Other malfunctions

The following table lists possible malfunctions which are not indicated.

<table>
<tr><th>Malfunction</th><th>Cause</th><th>Rectification</th></tr>
<tr><td>Motor does not move even with current available</td><td>Motor is mechanically blocked</td><td>Release motor brake, if available.</td></tr>
<tr><td>No motor torque</td><td rowspan="2">One or more motor leads interrupted</td><td rowspan="3">Check motor wiring; see chapter 2.4.</td></tr>
<tr><td>Motor does not move</td></tr>
<tr><td rowspan="2">Motor does not follow control</td><td>Motor leads interchanged, or one or more motor leads interrupted</td></tr>
<tr><td>Motor and positioning controller do not match</td><td>Use the proper motor type.</td></tr>
</table>

DANGER
The mains supply voltage must be disconnected for any check on the mains, motor, or bleed resistor wiring.

4.3 Repair work

ATTENTION
Any necessary repair work must not be carried out except by BERGER LAHR!

Mark all connections when disassembling the unit.

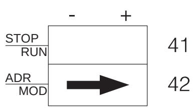
The set parameters and the mounting location number of the old unit must be transferred to the new one when replacing a unit.

4.4 Booting the controller

After replacing or installing an interface or a memory module, the controller must be re-booted. An application program stored in the EEPROM or PROM is then loaded into the controller memory.

To boot the controller, proceed as follows:

1. Switch off the 24 V supply voltage of the unit.



2. Press and hold the selector switch (item 42) in MOD position.

3. Switch on the 24 V supply voltage.
   → The seven-segment displays show “A1” to “A4”.

4. When “A4” is constantly displayed, press the selector switch (item 41) in – position first, then in + position.

5. Release the selector switch (item 42).
   → The seven-segment displays start flashing. An application program stored in the EEPROM or PROM is loaded into the controller memory and executed.

4.5 Storage, shipment

The following requirements apply when storing units or PC boards:

– The maximum air humidity must not be exceeded (see chapter 1.4).
– The storage temperature specification must be observed (see chapter 1.4).
– Stored parts must be protected against dust and dirt.
– Units or PC boards marked with the symbol

may only be unpacked, stored and installed in an electrostatically protected environment.
– The original packing material should be kept for later use.

The following requirements apply when shipping units or PC boards:

– Units or PC boards must be shipped in their original packing material.
– PC boards without batteries or accumulators must be packed in wrapping which is electrically conductive on both sides (use original wrapping, if possible).
– PC boards with batteries or accumulators must be packed in wrapping which is electrically conductive on the outside and antistatic on the inside (use original wrapping, if possible).
– Units or PC boards marked with the symbol

may only be packed in an electrostatically protected environment.

5 Maintenance

5.1 Replacing the battery

NOTE
The battery should be replaced at least every 2 years in order to avoid the risk of data loss.

DANGER
Disconnect the mains connector before replacing the battery.

1. Dismount the unit.

2. Disconnect the ribbon cable leading from the processor unit to the power controller.

3. Unscrew two screws each at the top and the bottom of the unit.

4. Separate the processor unit and the power controller.

ATTENTION
CMOS circuits are sensitive to touching!

5. Connect the terminals of the new battery to the 2nd battery connection.

6. Disconnect the terminals of the used battery.

7. Remove the used battery and install the new battery.

8. Reassemble the processor unit and power controller and fix with screws.

9. Reconnect the ribbon cable leading from the processor unit to the power controller.

10. Remount the unit.

NOTE
Used-up lithium batteries are toxic waste and must be disposed of properly.

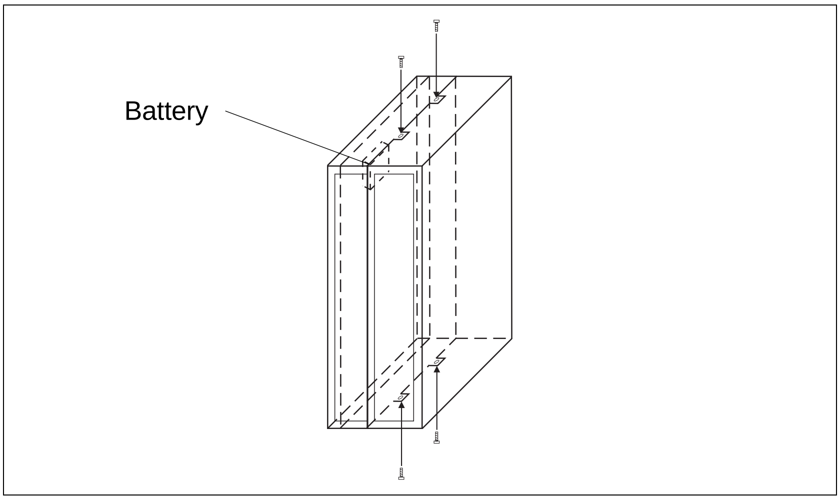


Fig. 5-1 Replacing the battery

5.2 Customer service

The Technical Services department offer the following services under the phone numbers given:

– **Spare part information** by direct line

  Phone: +49 (0) 7821 - 946 - 606

  Express spare part shipment from Lahr;
  reaches most destinations in Europe within 24 hours.

– **Technical advice in case of failures** by hotline

  Phone: +49 (0) 7808 - 943 - 226

  Fax: +49 (0) 7808 - 943 - 499

  Internet e-mail: hotline@berger-lahr.com

Of course, the Technical Services department also offer the following services:

– **On-site maintenance** and

– **direct communication with your service specialist.**

6 Appendix

6.1 Device variants

The following device variants are available, depending on the interface configuration and the operating system software used. Please refer to the sales documentation of the controller for the available device variants.

Interface 1 (slot 51)	**Interface 2 (slot 53)**	**Encoder interface (slot 55)**	**Software**
RS 232 RS 485 LS	RS 232 RS 485 LS RS 485 HS ANOZ IBS PBDP CAN SUCONET	LRS 422 IN	– For programming software ProOED3 – For programming software BPRO3 or on-line command processing via field bus or serial interface

NOTE
The interfaces installed in the unit are indicated on the type plate.

ANOZ	*Analog interface*
CAN	*CAN bus interface*
IBS	*Interbus-S interface*
PBDP	*Profibus-DP interface*
RS 232	*Serial interface RS 232*
LRS 422-IN	*Encoder interface RS 422*
RS 485 LS	*Serial interface RS 485*
RS 485 HS	*Serial interface for MP 926 input/output card, Lauer operating panel or SUCONET (without OED3)*

*Type: WDP3-31X.XXX**OED3***
Operating system software for ProOED3

Type: WDP...not specified
Operating system software for BPRO3 or on-line command processing

NOTE
An additional encoder interface for rotation monitoring can be installed on the above listed device variants on the power controller.

The standard unit is provided with an EEPROM for storing the application program.

6.2 Description of accessories

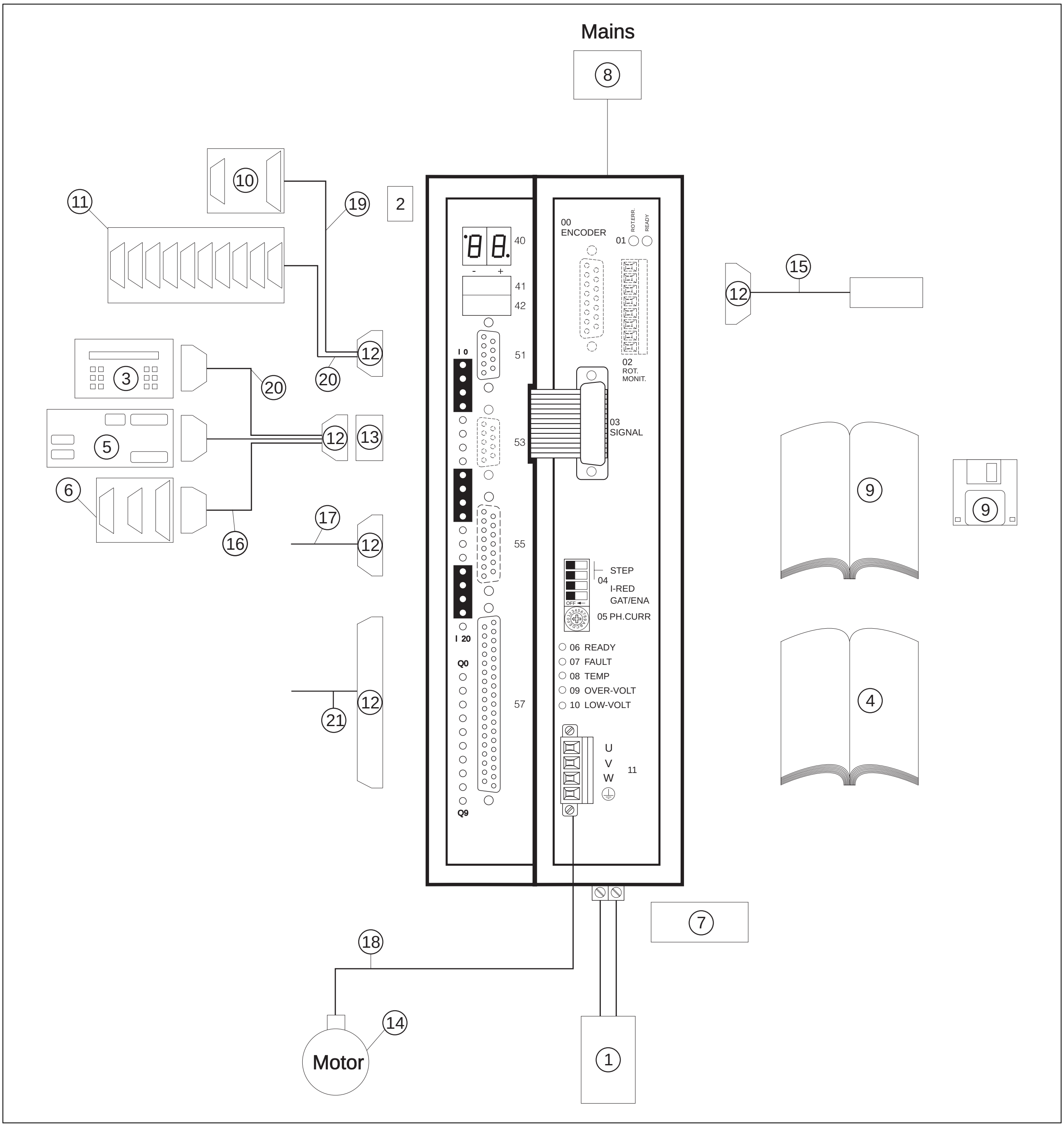


Fig. 6-1 Accessories

The following accessories are available and may be ordered separately (see fig. 6-1):

<table>
<tr><th>Item no.</th><th>Designation</th><th>Reference</th></tr>
<tr><td>1</td><td>Bleed resistor for WDP3-31X</td><td>See chapter 6.2.7</td></tr>
<tr><td>2</td><td>Battery for wall mounting units</td><td>–</td></tr>
<tr><td>3</td><td>FT 2000 operating terminal</td><td>See chapter 6.2.3</td></tr>
<tr><td>4</td><td>On-line Command Processing via Serial Interface documentation</td><td>Doc. no. 212.986</td></tr>
<tr><td>5</td><td>MP 926 input/output card (16 inputs/16 outputs)</td><td>MP 926 documentation</td></tr>
<tr><td>6</td><td>MP 927 Interbus-S interface adapter</td><td>Interbus-S documentation</td></tr>
<tr><td>7</td><td>Fan</td><td>See chapter 6.2.1</td></tr>
<tr><td>8</td><td>Mains filter</td><td>See chapter 6.2.2</td></tr>
<tr><td>9</td><td>BPRO3 programming system or ProOED3 programming interface for device variants with OED3 operating system software (appropriate documentation and diskettes)</td><td>–</td></tr>
<tr><td>10</td><td>MP 923 interface converter (RS 485 LS/RS 232)</td><td>See chapter 6.2.4</td></tr>
<tr><td>11</td><td>MP 924 interface distributor</td><td>See chapter 6.2.5</td></tr>
<tr><td>12</td><td>WDP3-31X set of connectors (all sub-D connectors)</td><td>–</td></tr>
<tr><td>13</td><td>Crossover adapter for master/slave operation via RS 485 LS interface</td><td>See chapter 6.2.6</td></tr>
<tr><td>14</td><td>3-phase stepping motor</td><td rowspan="8">See sales documentation</td></tr>
<tr><td>15</td><td>Encoder cable</td></tr>
<tr><td>16</td><td>Interbus-S/MP 927 signal cable</td></tr>
<tr><td>17</td><td>Electronic gear cable</td></tr>
<tr><td>18</td><td>Motor cable</td></tr>
<tr><td>19</td><td>RS 485 LS interface cable, male/female</td></tr>
<tr><td>20</td><td>RS 485 LS interface cable, male/male</td></tr>
<tr><td>21</td><td>Signal cable</td></tr>
</table>

NOTE
Refer to the WDP3-31X positioning unit sales documentation for the accessory order numbers.

6.2.1 Fan

The unit can be provided with a fan in order to improve heat dissipation (see chapter 2.3).

The fan (fig. 6-2) must be mounted at the bottom of the unit.
The airstream must pass through the unit from bottom up (see fig. 2-2).
The arrow on the fan indicates the direction of the airstream if the fan is connected correctly (red = 24 VDC, black = 24 VGND).

1. Cut out the grille on the unit.

2. Fasten the fan to the bottom of the unit with four screws.

3. Connect the fan to the external 24 VDC voltage supply.

NOTE
Ensure that the airstream in and around the unit is unobstructed.

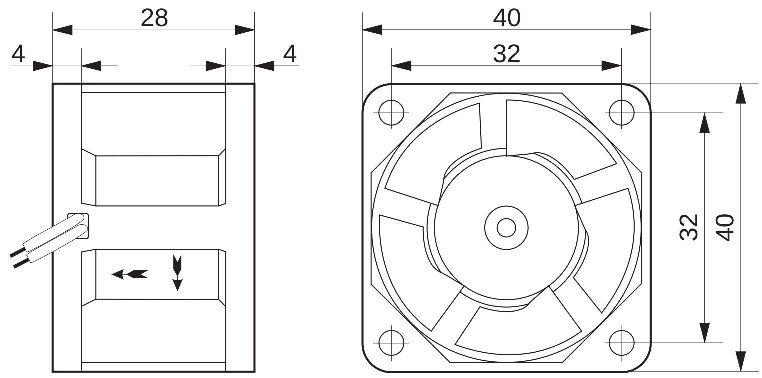


Fig. 6-2 Fan

6.2.2 Mains filter

A mains filter (fig. 6-3) can be inserted into the mains supply line for radio interference suppression.

NOTE
When connecting the mains filter, the EMC testing specifications of BERGER LAHR must be observed.

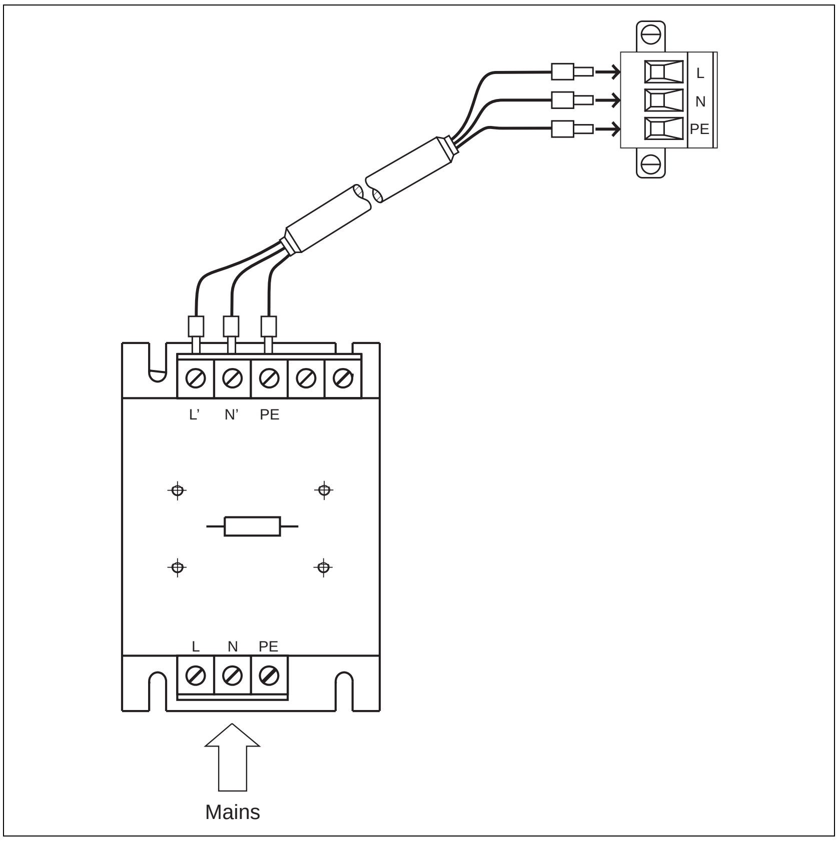


Fig. 6-3 Mains filter

6.2.3 FT 2000 operating terminal

The FT 2000 operating terminal is a straightforward data input and display terminal which is used for BERGER LAHR controllers. It has eight parallel inputs and eight parallel outputs which can be addressed in master/slave operation (fig. 6-4).

The unit has been designed for installation into an operating panel or a front panel.

The FT 2000 operating terminal can be configured for master/slave or terminal operation. In terminal mode, the parallel inputs and outputs cannot be addressed.

NOTE
The transmit and receive lines between the operating terminal and the controller must be crossed over between the units. For this purpose, a crossover adapter can be used; see chapter 6.2.6.

Connection to the positioning unit is made via an RS 485 LS serial interface.

Operating terminal	Order number
FT 2000 German	62512000003
FT 2000 English	62512000004
FT 2000 French	62512000005

For more information, refer to the FT 2000 operating terminal documentation.

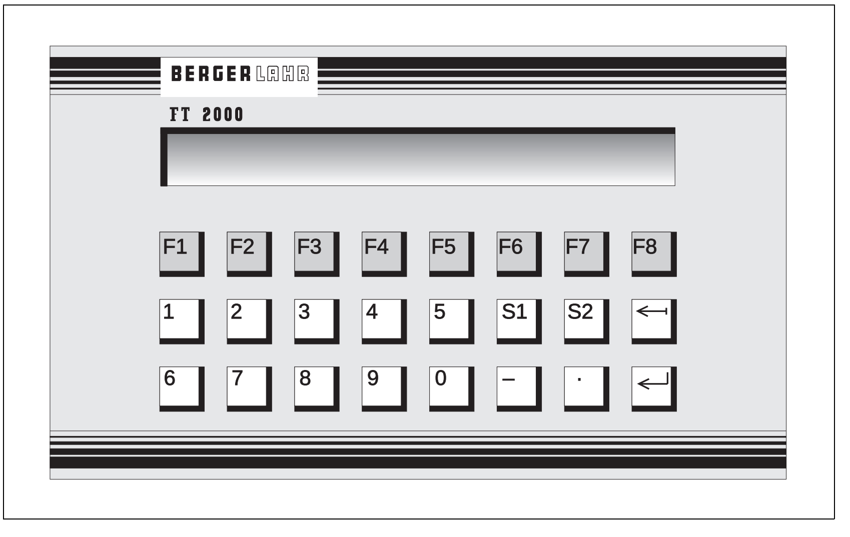


Fig. 6-4 FT 2000 operating terminal

6.2.4 MP 923 interface converter

6.2.4.1 General description

The MP 923 interface converter is used for data transmission from an RS 485 LS (RS 422) interface to a V24 (RS 232) interface and vice versa. The interface converter must be powered with 12 VDC either via the power supply unit connection (2-pin female diode connector) or via the RS 485 LS (RS 422) connector. With BERGER LAHR positioning units (e.g. WDP5), power is supplied via the RS 485 LS (RS 422) connection.

6.2.4.2 Technical data

Electrical data

Voltage supply	9.6 to 15 VDC/150 mA
Interfaces	RS 485 LS (RS 422) V24 (RS 232)

Mechanical data

Dimensions	97 x 65 x 30 mm
Weight	approx. 130 g

Ambient conditions

Storage temperature	-25°C to +70°C
Operating temperature	0°C to +55°C
Humidity class, components	F acc. to DIN 40 040
Humidity class, tested to IEC 68 part 2-3 at:	
Air temperature	+40°C, +2°C
Relative humidity	93%, +2%, -3%
non-condensing	

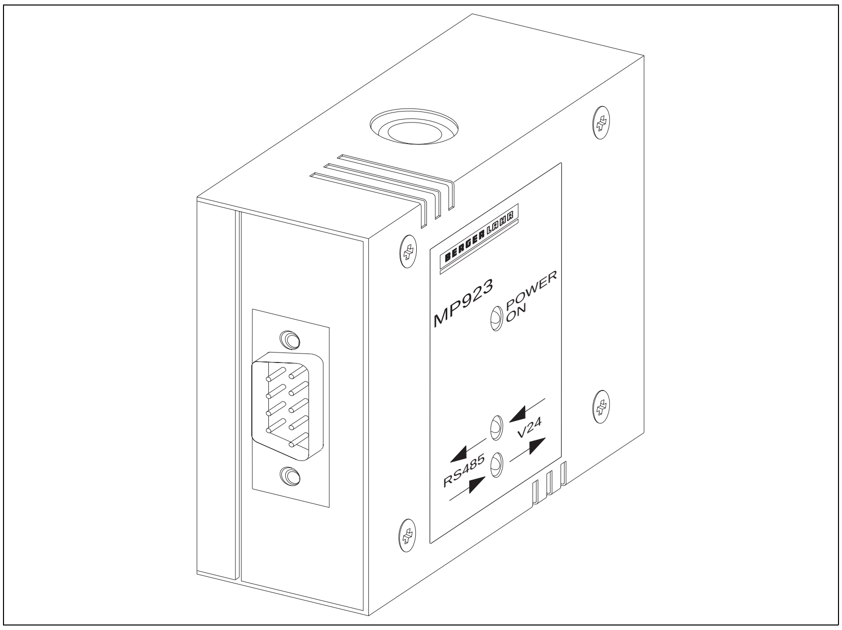


Fig. 6-5 MP 923 interface converter

6.2.4.3 Setup

1. Wire the MP 923 interface converter in accordance with fig. 6-6.

NOTE
The 12 VDC voltage for the MP 923 is supplied either via the power supply unit connection or via the RS 485 LS (RS 422) connection (e.g. for BERGER LAHR WDP5 positioning units).

ATTENTION
The interface cables must be shielded on both ends via the connector shells!

ATTENTION
For reasons of noise immunity, the V24 (RS 232) cable should be as short as possible (15 m max.)!

2. Switch on the mains voltage.
   → The LED “POWER ON” lights up. The two other LEDs remain dark.

3. Start data transmission.
   → Either the LED marked “RS 485 LS → V24” or the LED marked “RS 485 LS ← V24” flashes depending on the sense of the data transmission.

6.2.4.4 Status indicators

The status indicators show the operating status or any malfunction.

LED	**Lit**	**Not lit**	**Flashing**
“POWER ON”	Supply voltage available	Supply voltage not available,	
“RS 485 LS → V24”	RS 485 LS (RS 422) interface incorrectly wired (signal lines TXD ($\overline{\text{TXD}}$) and RXD ($\overline{\text{RXD}}$) interchanged)	No data transmission from RS 485 LS (RS 422) to V24 (RS 232)	Data transmission from RS 485 LS (RS 422) to V24 (RS 232)
“RS 485 LS ← V24”	V24 (RS 232) interface incorrectly wired (pins 2 and 3 interchanged)	No data transmission from V24 (RS 232) to RS 485 LS (RS 422)	Data transmission from V24 (RS 232) to RS 485 LS (RS 422)

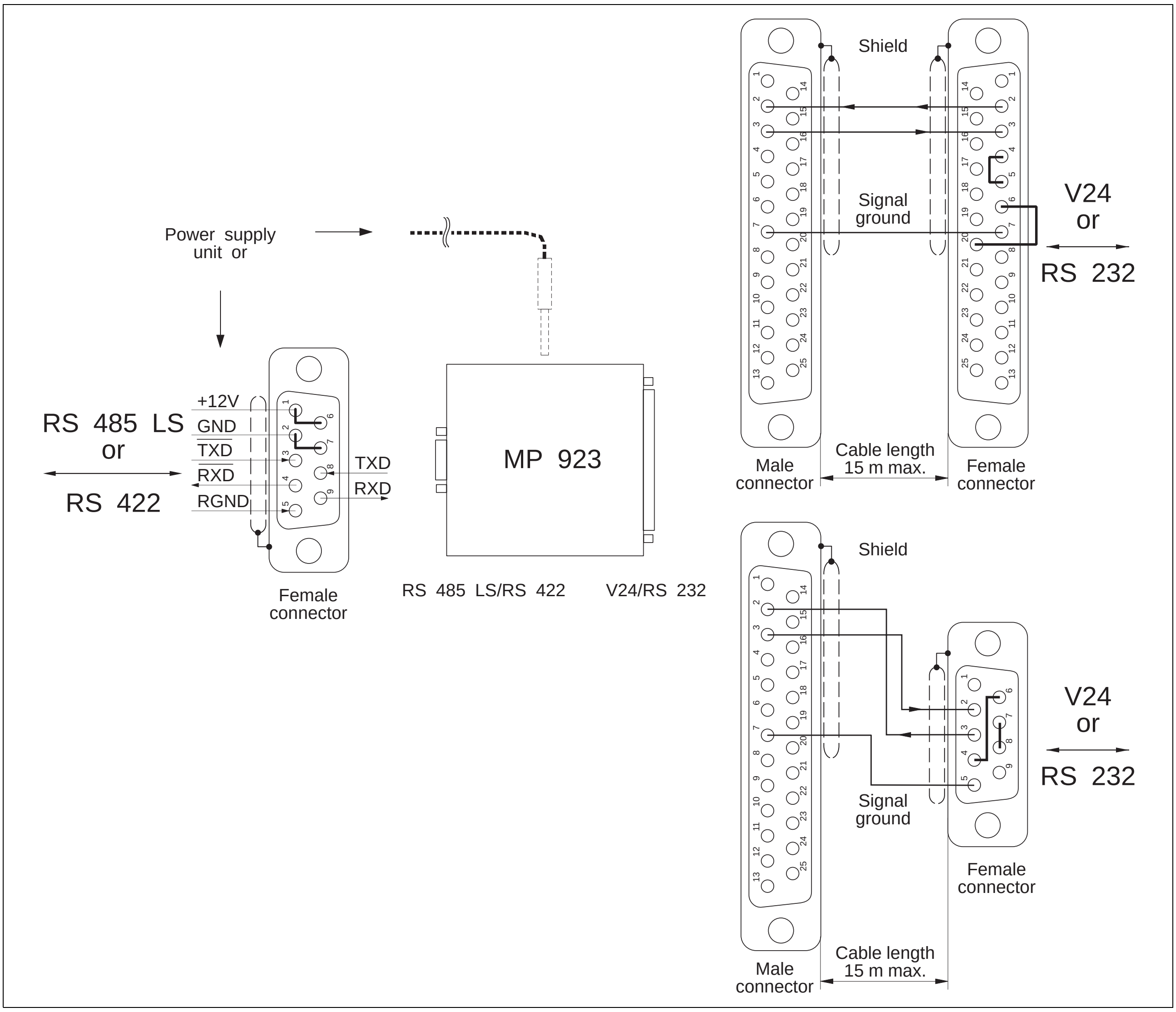


Fig. 6-6 Interface converter wiring

6.2.5 MP 924 interface distributor

6.2.5.1 General description

Up to nine networkable BERGER LAHR units can be controlled from one PC when using an MP 924 interface distributor. If more than nine units are planned to be used in a network, several MP 924 interface distributors must be combined.

6.2.5.2 Technical data

Electrical data

10 serial interfaces	RS 485 LS (RS 422)

Mechanical data

Dimensions	approx. 205 x 80 x 32 mm
Weight	approx. 260 g

Ambient conditions

Storage temperature	-25°C to +70°C
Operating temperature	0°C to +55°C
Humidity class, components	F acc. to DIN 40040
Humidity class, tested to IEC 68 part 2-3 at:	
Air temperature	+40°C, +2°C
Relative humidity	93%, +2%, -3%
non-condensing	

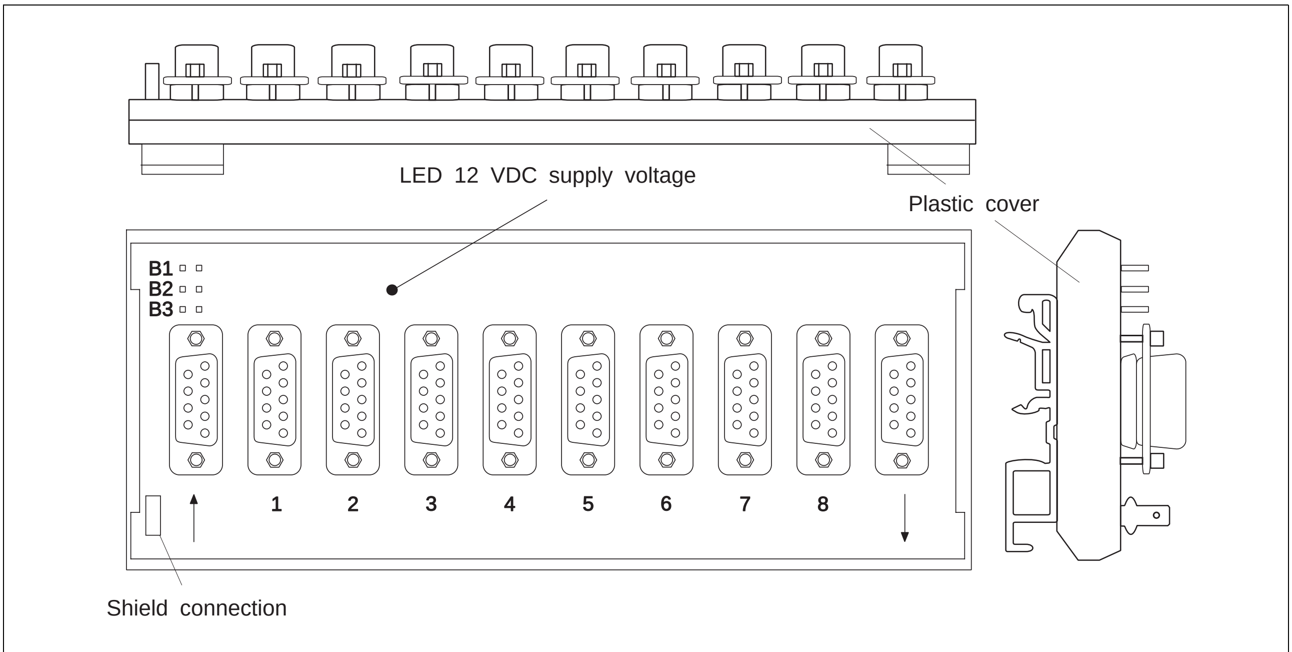


Fig. 6-7 MP 924 interface distributor

6.2.5.3 Setup

1. Wire the MP 924 interface distributor in accordance with fig. 6-7. For interface conversion RS 232 ↔ RS 485 LS (RS 422), use the MP 923 interface converter (see chapter 6.2.4).

ATTENTION
The interface cables must be shielded on both ends (connect shield on MP 924 to protective ground).

ATTENTION
For reasons of noise immunity, the RS 232 cable should be as short as possible (15 m max.)!

ATTENTION
Never connect a terminator.

2. If several MP 924 interface distributors are used, combine them as illustrated in fig. 6-8.

3. Set the connected units to network mode and switch them on.

ATTENTION
The same baud rate must be set on all units for network mode.

ATTENTION
When using an MP 923 interface converter, at least one unit attached to the first MP 924 interface distributor must be switched on in order to ensure that power is supplied to the MP 923.

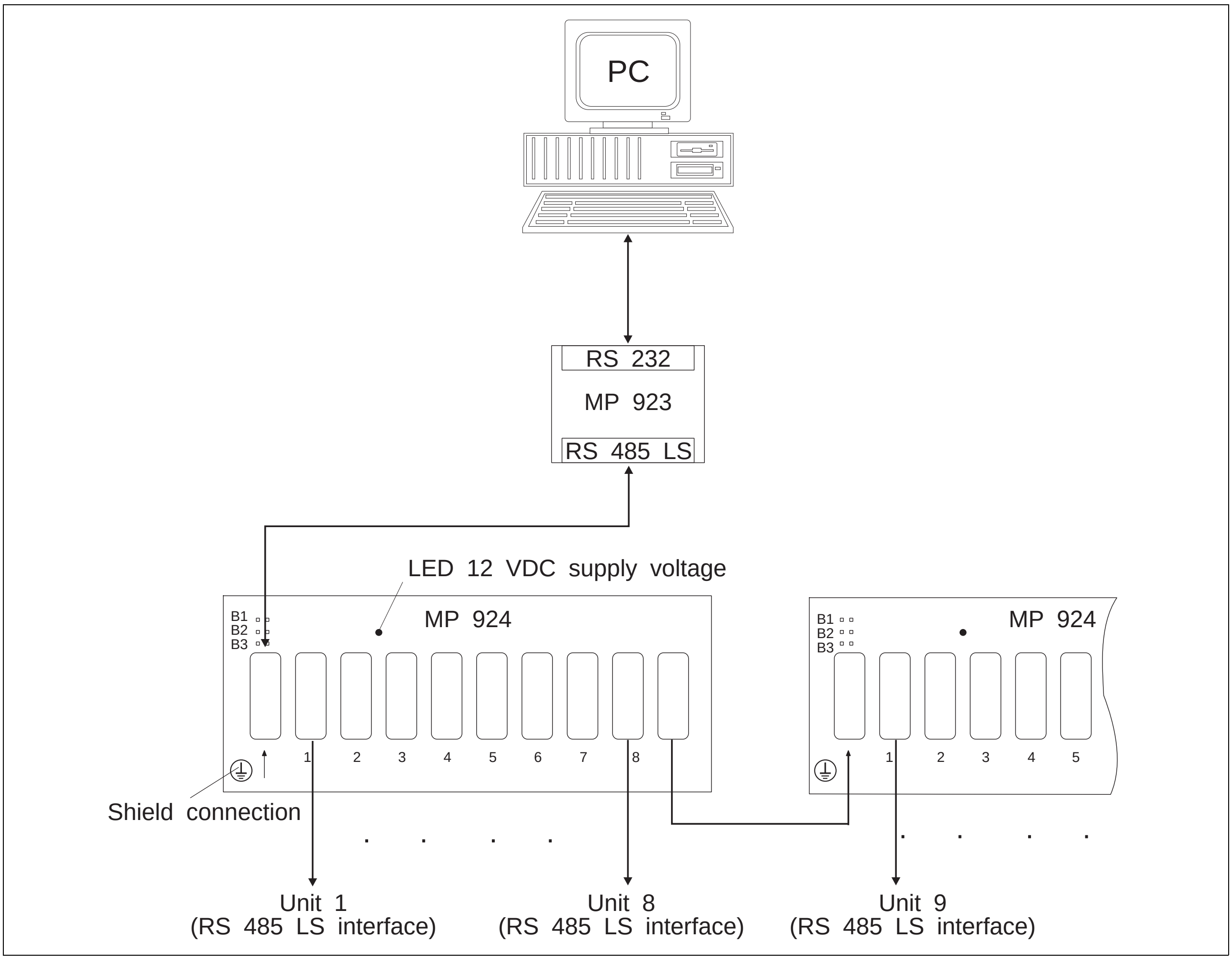


Fig. 6-8 MP 924 interface distributor cabling

6.2.6 Crossover adapter

The 9-pin crossover adapter is used for interchanging the transmit and receive lines for master/slave operation via the RS 485 LS interface.

6.2.7 Additional bleed resistor (only at units < RS40)

The additional bleed resistor FZP 200 (180 ohms, 150 W) can be used for dissipating a larger amount of braking energy (fig. 6-9).

DANGER
High voltages are present at the bleed resistor connections (approx. 325 VDC).

DANGER
The bleed resistor heats up when a great amount of braking energy is produced.

ATTENTION
Good heat dissipation must be ensured when installing the bleed resistor.

1. Switch the mains voltage OFF.
2. Provide the two bleed resistor leads with wire end ferrules on the device end.
3. Connect the two litz wires to the terminals at the bottom of the unit.

NOTE
An external bleed resistor is required if the cyclic kinetic energy to be dissipated (W_{kin}) exceeds the following value (t_{brake} = deceleration time): $W_{kin} \geq 100\ W \times t_{brake} + 7\ Ws$

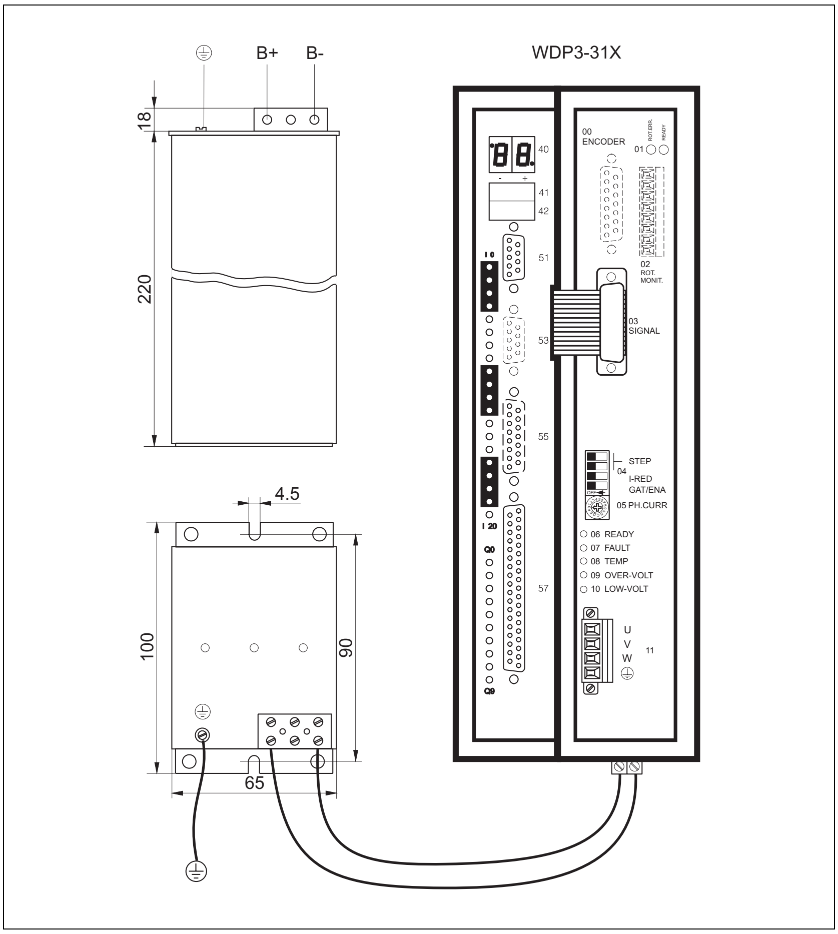


Fig. 6-9 Additional bleed resistor

6.3 Glossary

Additional reference switch
An additional travel switch for reference movements.

CCW (counterclockwise) rotation, negative or left direction
Sense of rotation of the motor in a counterclockwise direction (as seen from front towards the motor shaft).

Contouring error
The difference between set and actual position.

CW (clockwise) rotation, positive direction
Sense of rotation of the motor in a clockwise direction (as seen from front towards the motor shaft).

Gear ratio
Multiplication factor for positioning operations, which is composed of a numerator and a denominator (step-down gearing or step-up gearing).

Incremental encoder
Incremental encoders have a specific number (N) of marks on a disk which are used for determining changes in position.

Limit switch
Switch for limiting the travel and for reference movements.

Network mode
An operating mode used for a network of positioning units. Several units are connected to a host via a physical link. Selection of the units to be addressed is effected by a device polling command.

Phase current
The current flowing through the winding of a stepping motor.

Phase sensor
Incremental encoders only are flanged to the motor shaft as a position sensing system.

Power control card
An electronic card for controlling the motor.

Reference movement
Motor movement towards the r.h. or l.h. limit switch or additional reference switch for setting a reference point for the system of dimensions.

Reference movement frequency
Speed of the motor when moving towards the limit or reference switch and when moving from the limit or reference switch to the reference point.

Reference position
Position value after a reference movement or after setting the reference point.

Remanent flag
A flag which retains the programmed status after disconnecting the supply voltage.

RS 485 LS interface
Serial interface for a network configuration.

Settling time
The time that an input signal status must be stable so that the positioning unit is able to recognize it.

Step angle
The angle of rotation by which the motor shaft turns with each control pulse.

6.4 Abbreviations

AC	Alternating current
AF	Width across flats
ASCII	American Standard Code for Information Interchange
CAL	CAN Application Layer
CAN	CAN bus interface
CMOS	Complementary Metal-Oxide Semiconductor
DC	Direct current
Doc. no.	Documentation number
E	Encoder
HU	Height unit
LED	Light Emitting Diode
M	Motor
N	Number of encoder marks
PC	Personal Computer
PELV	Protected Extra Low Voltage
PLC	Programmable Logic Controller
r.c.c.b.	Residual-current operated circuit breaker

7 Index

8 Corrections and amendments

At present there are no corrections or amendments.