

Multi-axis Positioning Unit  
with Parallel Sequence Control

# **WPM-311**

4-axis Compact Unit  
without Power Controller

Doc. no. 212.967/DGB 08.97

Ident. no.: 00441109140

Edition: d132 August 97

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 suppressionshall 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.*

**SIG Positec BERGERLAHR GmbH&Co.KG**

Breslauer Str. 7  
Postfach 1180

D-77901 Lahr

**Proposals  
Improvements**

**WPM-311**

Edition: d132 August 97  
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# 1 General description

## 1.1 Structure and characteristics

### Four-axis control

The WPM-311 multi-axis positioning unit can be used for controlling up to four power controllers for stepping motors (e.g. WD5-008). The power controllers are controlled by pulse/direction signals.

The WPM-311 is available in two housing variants:

- WPM-311 in 3-phase housing (fig. 1-1), matching the 3-phase stepping motor product family
- WPM-311 in 5-phase housing (fig. 1-2), matching the 5-phase stepping motor product family

### PLC and movement programming

The unit has the characteristics of a programmable logic controller (PLC) with many features for movement programming. For example, you can use interpolated movements for two axes and move the two other axes independently. 40 freely assignable inputs and 10 freely assignable outputs are available for controlling sequential operations simultaneously with movements.

### Programming according to IEC 1131

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. 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.

### Options

A variety of extension options are available, e.g. an additional serial or analog interface, an encoder interface or a field bus interface.

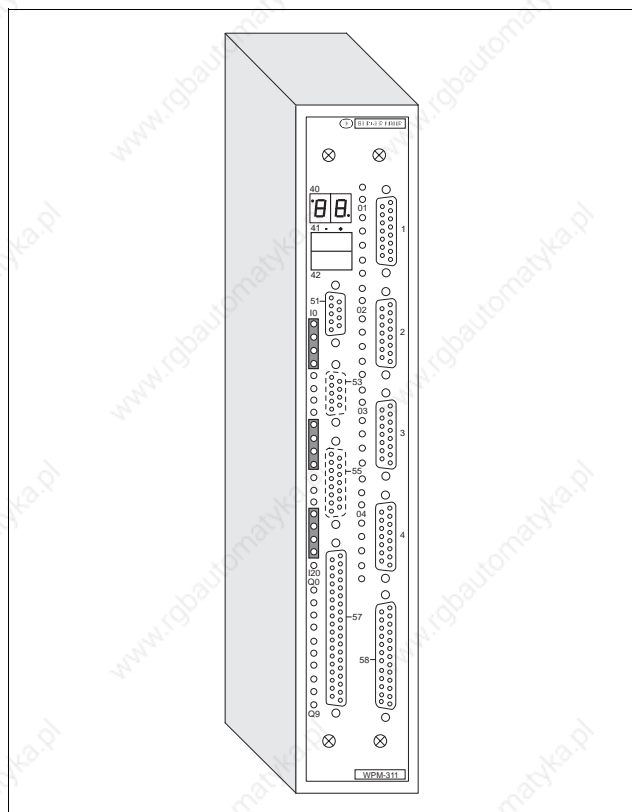


Fig. 1-1 WPM-311 in 3-phase housing

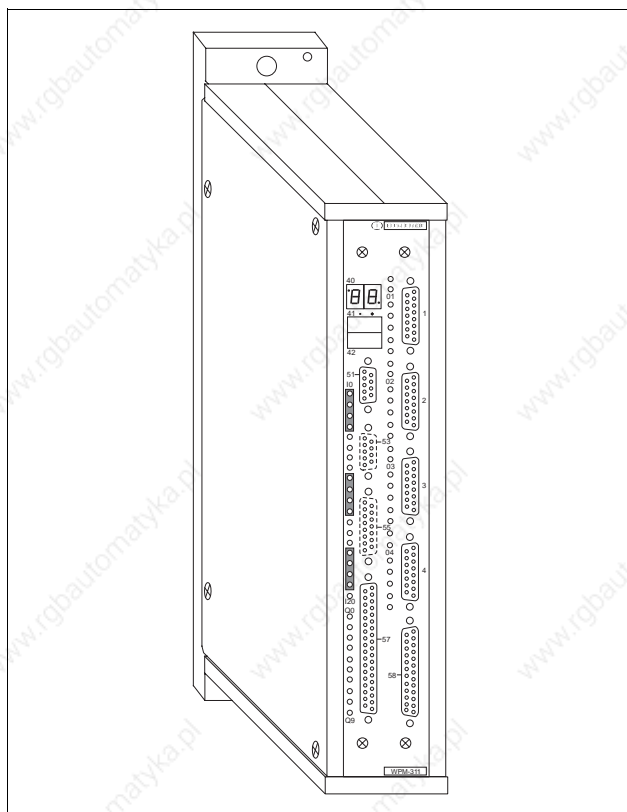


Fig. 1-2 WPM-311 in 5-phase housing

## General description

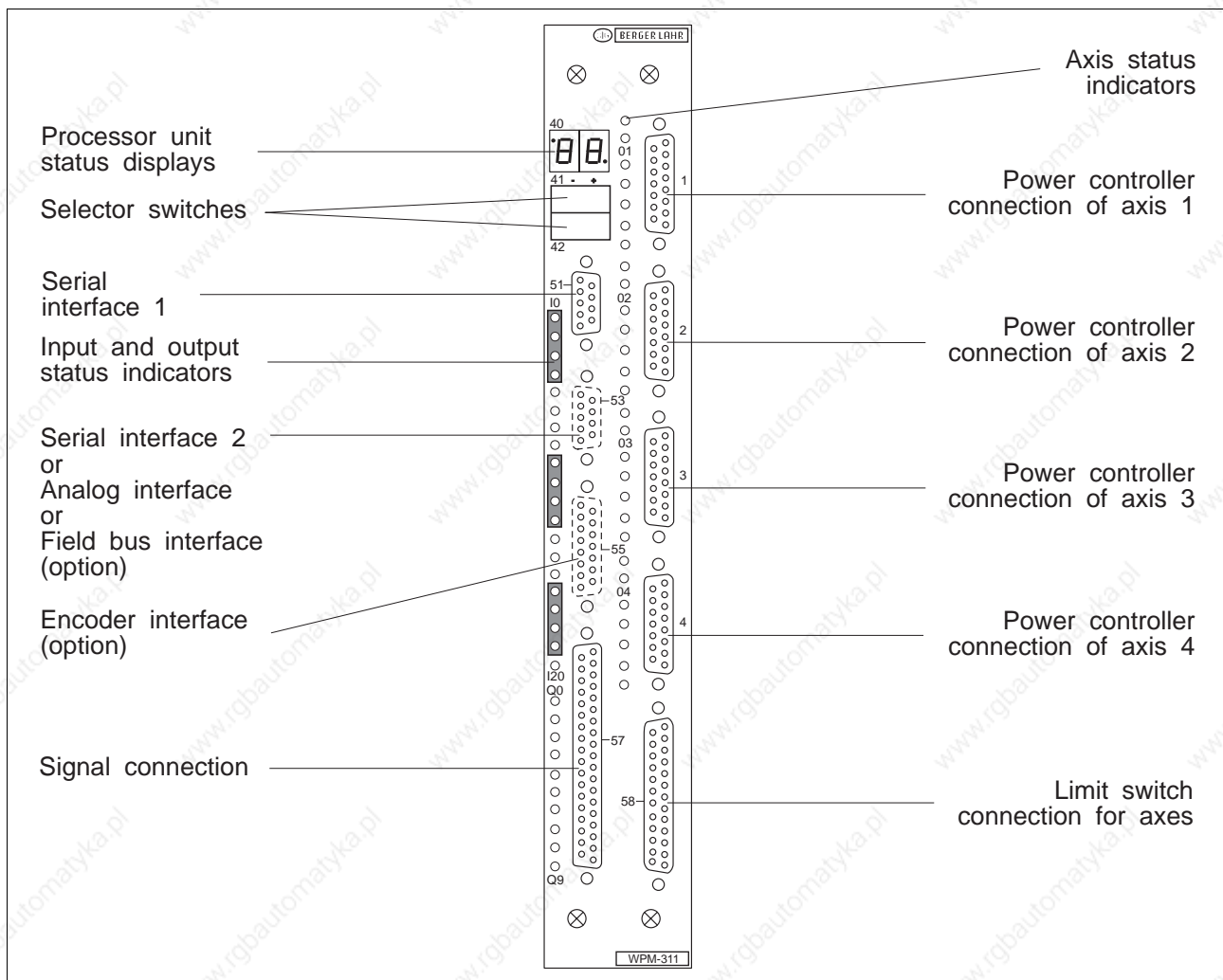


Fig. 1-3 WPM-311 front panel

The following controls, indicators and connectors are arranged on the front panel (fig. 1-3):

- 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 a motor
- 42 Selector switch  
for setting the network address (position –) and the operating mode (position +); 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 MP 926 input/output card,  
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 interface (option)  
e.g. for rotation monitoring, electronic gear
- 57 Signal connection  
for the signal inputs and outputs (I 0 to I 20 and Q 0 to Q 9) and  
the voltage supply
- I 0 to I 20  
Status indicators for the inputs
- Q 0 to Q 9  
Status indicators for the outputs
- 1 to 4  
Power controller connections for controlling axes 1 to 4
- 01 to 04  
Axis status indicators  
for the outputs of the power controller connections READY and  
ERROR as well as for the inputs of the limit switch connection  
LIMP, LIMN, REF, STOP and TRIG
- 58 Axis limit switch connection  
20 signal inputs (I1.0 to I1.19) for the limit switches of the four  
axes (inputs are freely assignable)



### NOTE

The interfaces installed in the unit are indicated on the type plate as follows:

ANOZ	Analog interface
CAN	CAN bus interface
IBS	Interbus-S interface
PBDP	Profibus-DP interface
MP 962	Encoder interface
RS 232	RS 232 serial interface
RS 485 LS	RS 485 serial interface
RS 485 HS	Serial interface for MP 926 input/output card, Lauer operating panel or SUCONET (without OED3)

## General description

### 1.2 Purpose

The WPM-311 multi-axis positioning unit is used for controlling external power controllers, e.g. WD5-008.

The unit can be used in conjunction with up to four external power controllers as a drive unit for a variety of applications.

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

#### 1.2.1 System environment

A PC (IBM AT or 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 operating manual. If the OED3 software is installed on the controller, its programming interface ProOED3 is used for programming.

Up to 62 BERGER LAHR Series 300 controllers (e.g. WPM-311) can be programmed and operated via two serial PC interfaces. Each serial interface can be used for programming 31 controllers.

#### Programming features

The WPM-311 multi-axis 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

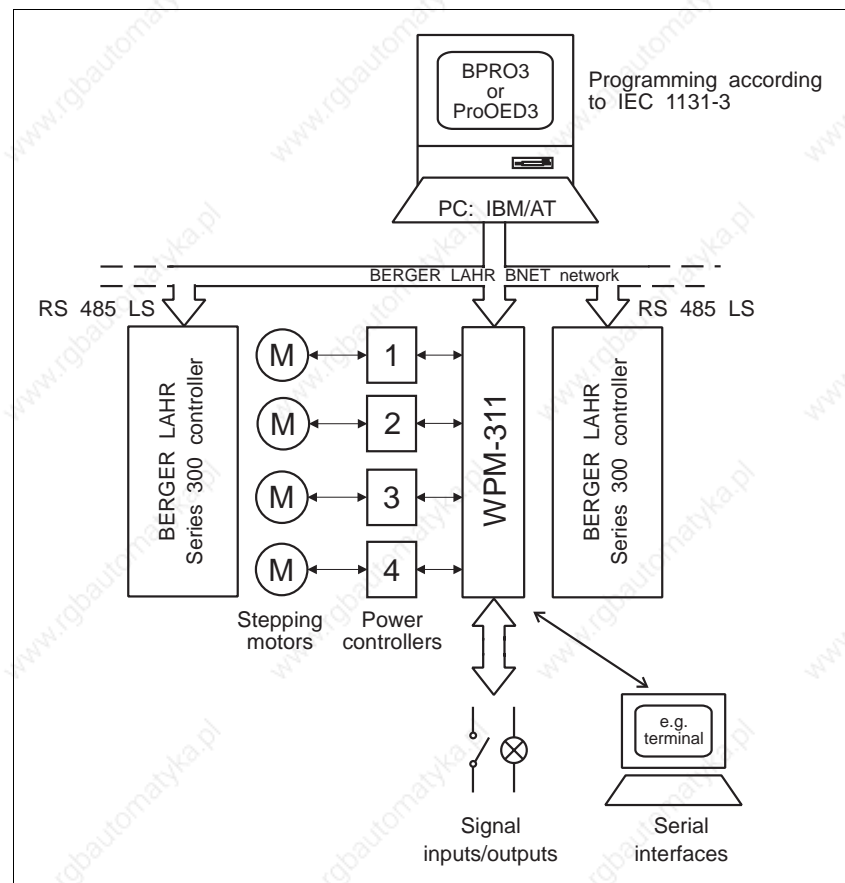


Fig. 1-4 System environment

## 1.2.2 Connection diagram

Figure 1-5 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 6.2.2) must be used.



### NOTE

With an RS 485 LS interface, the MP 924 interface distributor can be used for implementing a network (see chapter 6.2.3).



### 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.

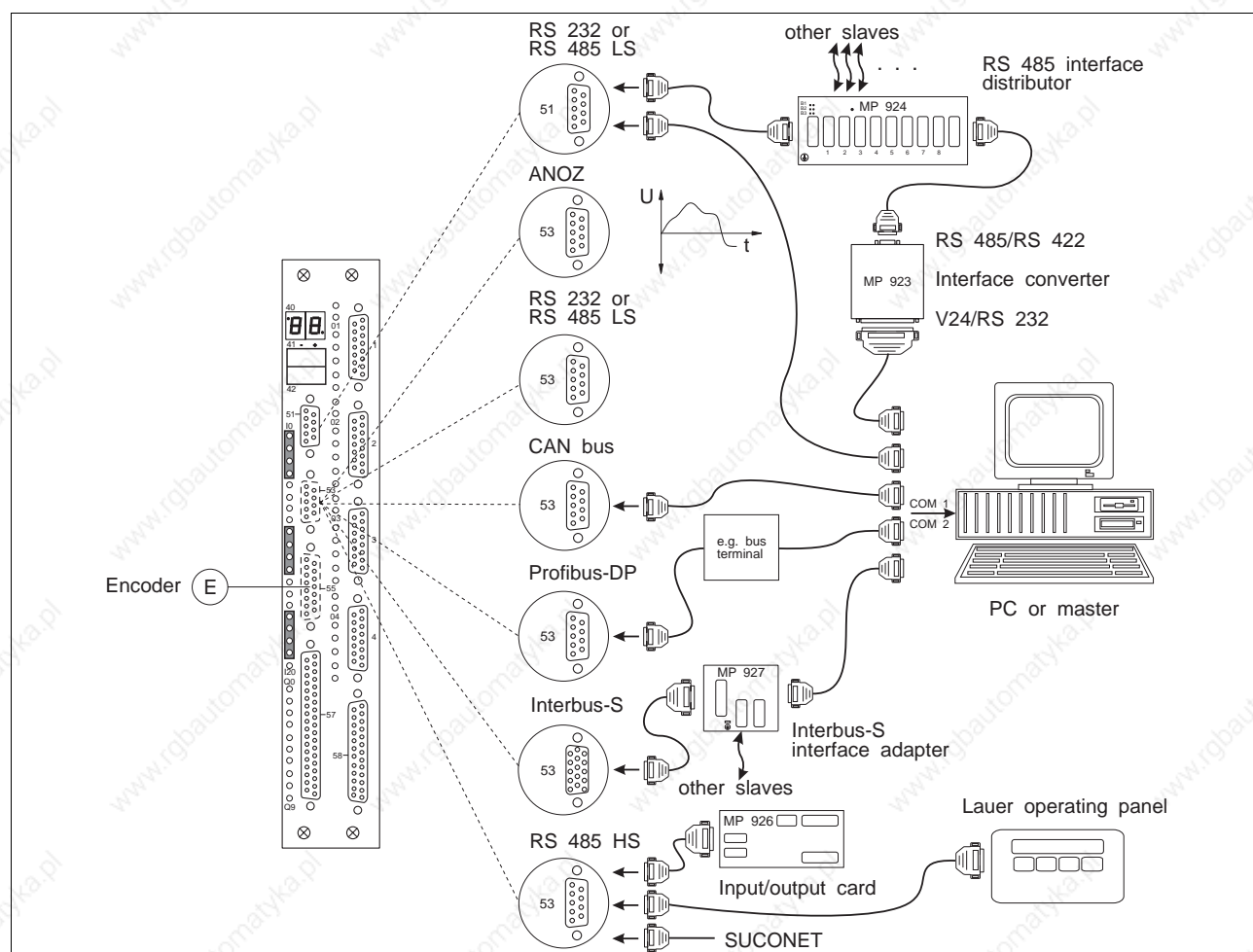


Fig. 1-5 Connection diagram



## General description

### 1.3 Function

#### 1.3.1 Hardware components

Two printed circuit boards of Eurocard format with type size 6 HU are installed in the unit for accommodating the drive card and the microprocessor control. The most important function blocks of the unit are evident in the block diagram (fig. 1-6).

##### 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 according to DIN VDE 0160.

##### Serial interface 1, 2

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

##### Analog interface

The analog interface can be used for processing analog values from application programs. The analog interface has five  $\pm 10$  V inputs and one 10 V output.

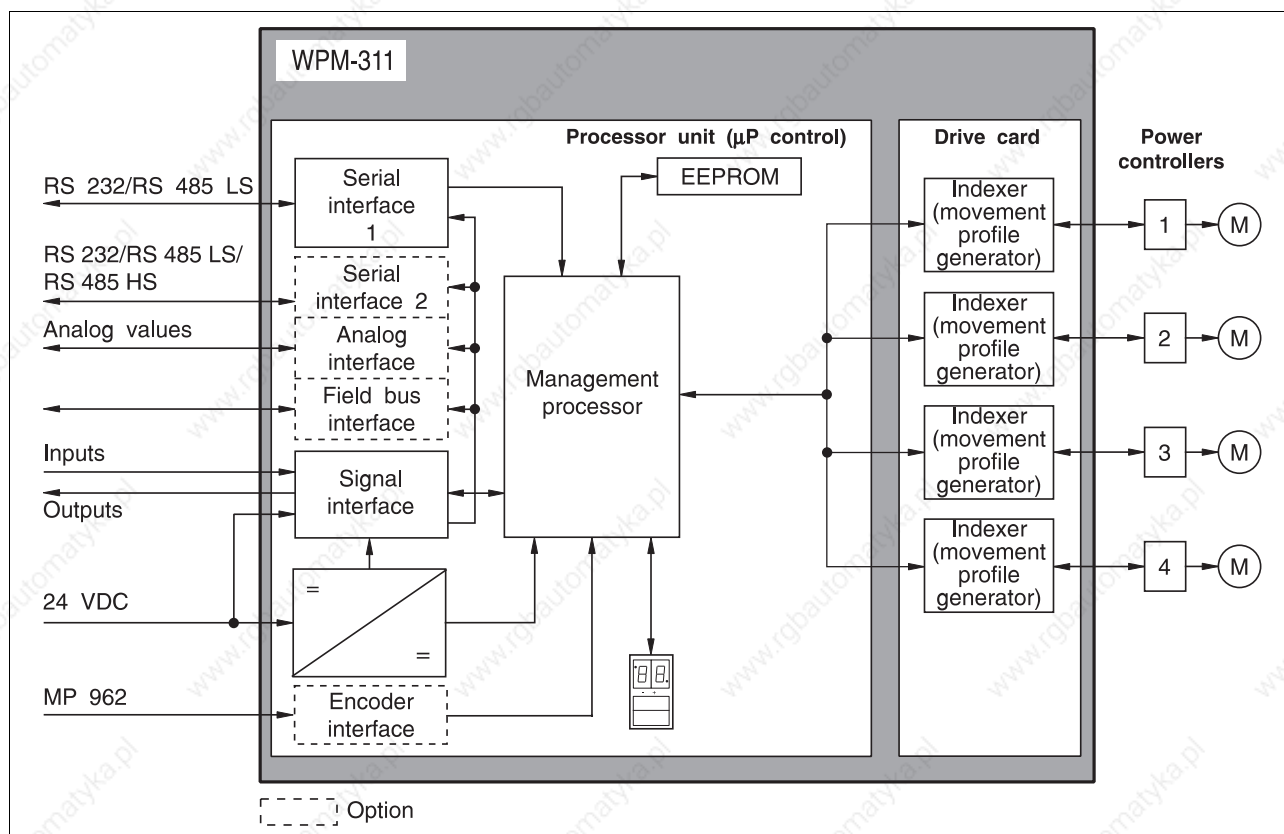


Fig. 1-6 Block diagram

<i>Field bus interface</i>	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.
<i>Management processor</i>	The management processor runs the application program and passes movement commands to the indexers of the individual axes. The application program is stored in a battery-buffered RAM. The application program can be stored in an EEPROM in addition.
<i>Indexer</i>	The indexers (movement profile generators) generate pulse/direction signals for controlling the external power controllers from the movement command parameters (travel, speed, acceleration).
<i>Encoder interface</i>	The encoder interface is an option and can be used for rotation monitoring of an axis or for reference variable input for an electronic gear involving one or two axes. With an electronic gear, A/B signals of an encoder or pulse/direction signals can be supplied. The encoder position can be determined by the application program at any time. The encoder interface is supplied from the processor unit.
<i>Status displays and selector switches</i>	The status displays and the selector switches are linked to the management processor. 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.

## General description

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### 1.3.2 Operating modes

#### 1.3.2.1 Application mode

In application mode, a program can be loaded into the WPM-311 multi-axis positioning unit and executed.

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 is possible without being linked to the WPM-311 multi-axis positioning unit, i.e. off-line. The programming device can be used for directly programming and testing the controller.

#### 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. 1-7) 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.

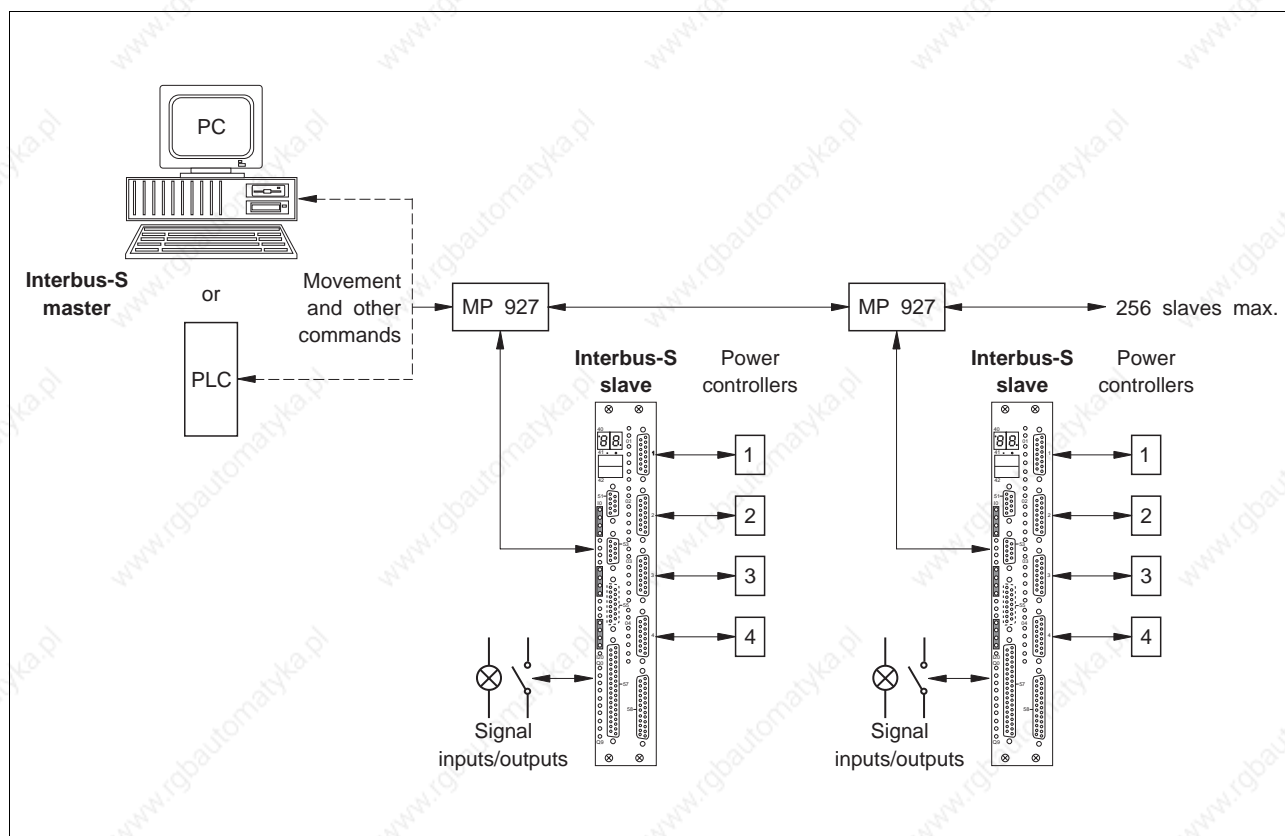


Fig. 1-7 Interbus-S network operating

## General description

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### 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 for approx. 1500 OED3 instructions with OED3 vers. 2.XX for approx. 3000 OED3 instructions
Time for a logic instruction	
with BPRO3	approx. 1.5 $\mu$ s
with OED3 version 1.XX	approx. 2.0 ms
with OED3 version 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 Supply voltage

###### Processor unit

Supply voltage	24 VDC
Min. operating voltage (on unit)	20 VDC
Max. operating voltage (on unit)	30 VDC
Power consumption	1.2 A max.
Ripple voltage	<2 V <sub>pp</sub>



###### NOTE

The 24 V voltage supply must fulfil the requirements of DIN VDE 0160 concerning protected extra low voltages (PELV).

##### 1.4.2.2 Analog interface

Internal leakage resistance towards ground	1 Mohm
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###### Electrical characteristics of the inputs

Five signal inputs, opto-isolated	$\pm 10$ V
Precision	$\pm 0.25\%$ , $\pm 25$ 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 (max. 30 mA)
Precision	$\pm 0.5\%$ , $\pm 50$ mV
D/A converter resolution	minimum of 200 steps

### 1.4.2.3 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 from version 3.11  
Compatible with ProOED3 programming interface  
from OED3 version 1.05

### 1.4.2.4 Field bus interfaces

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

#### Interbus-S slave interface (option IBS)

Two-line remote bus  
4 data words  
Transmission rate 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 specifications

#### 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

## General description

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### 1.4.2.5 Power controller connections

Opto-isolated

#### Inputs

Turn-on voltage	0 V to +2 V, 8 mA max.
Turn-off voltage	4.5 V or open input
Transmission frequency	1 kHz max.

#### Outputs, short-circuit protected

Push-pull acc. to RS 422A

Pulses	500 kHz max.
Shield connection	On both ends

### 1.4.2.6 Encoder interface

#### Option MP 962

RS 422 signal level	
Short-circuit proof	
Maximum cable length	100 m
Wire cross-section	0.25 mm <sup>2</sup> for signals 0.5 mm <sup>2</sup> for supply
Shield connection	On both ends
Voltage output	5 V $\pm$ 5% (300 mA max.) or 12 VDC, 9 VDC min., 18 VDC max. (200 mA max.)
Internal leakage resistance towards ground	1 Mohm

### 1.4.2.7 Limit switch connection

Opto-isolated, polarity reversal protection, hardware debounce	
Shield connection	On both ends
Internal leakage resistance towards ground	1 Mohm
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 $t_E$	
all inputs	1.0 to 1.5 ms
except trigger input	0.1 to 0.15 ms

### 1.4.2.8 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 $t_E$	
all inputs	1.0 to 1.5 ms
except 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.**

### 1.4.2.9 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 according to EN 60529: 1991
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## General description

### 1.4.3 Mechanical data

WPM-311 dimensions

with 3-phase housing  
with 5-phase housing

See fig. 1-8

See fig. 1-9

WPM-311 weight

with 3-phase housing  
with 5-phase housing

approx. 1.6 kg

approx. 1.8 kg

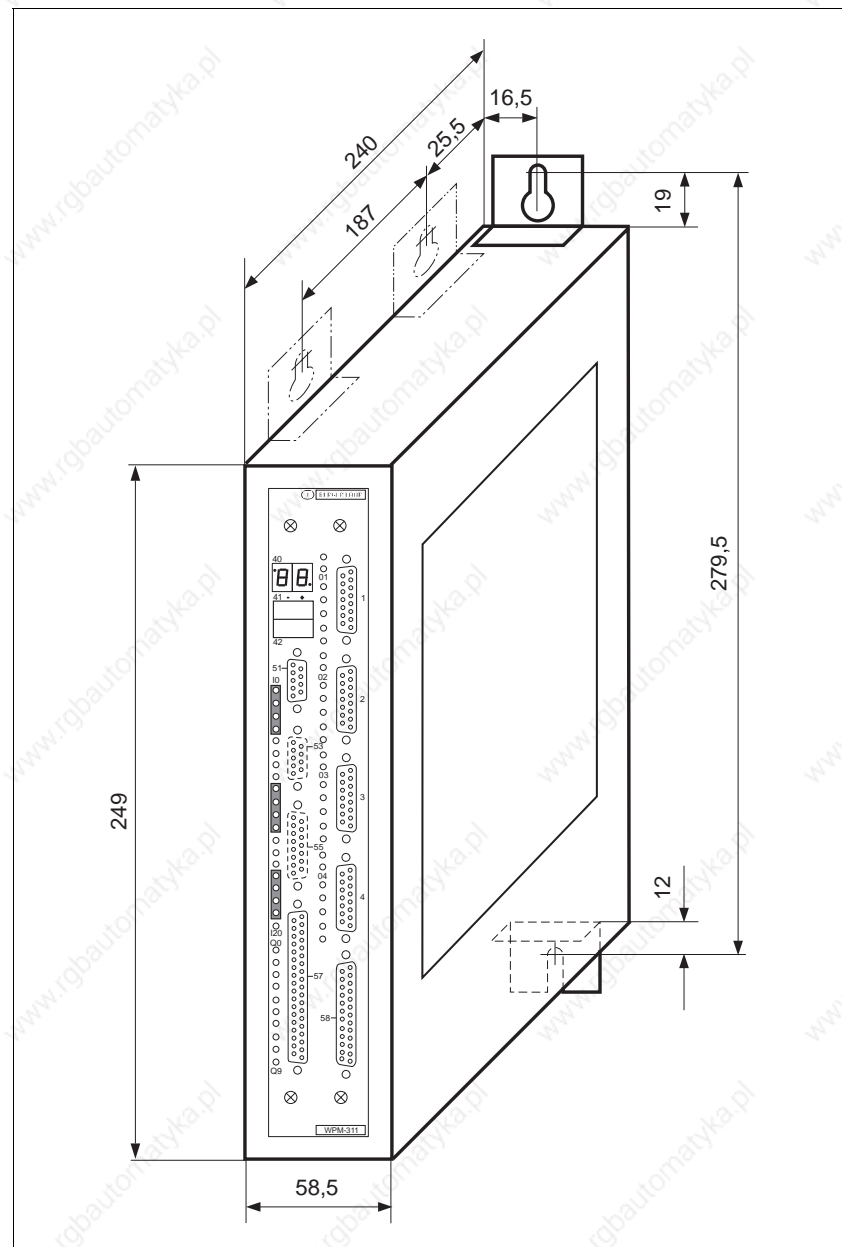


Fig. 1-8 WPM-311 dimensions  
with 3-phase housing

## 1.4.4 Ambient conditions

Ambient temperature	0°C to +50°C
Storage temperature	-25°C to +70°C
Noise immunity	
acc. to IEC 801-2	Severity 2
acc. to IEC 801-4	Severity 4
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	

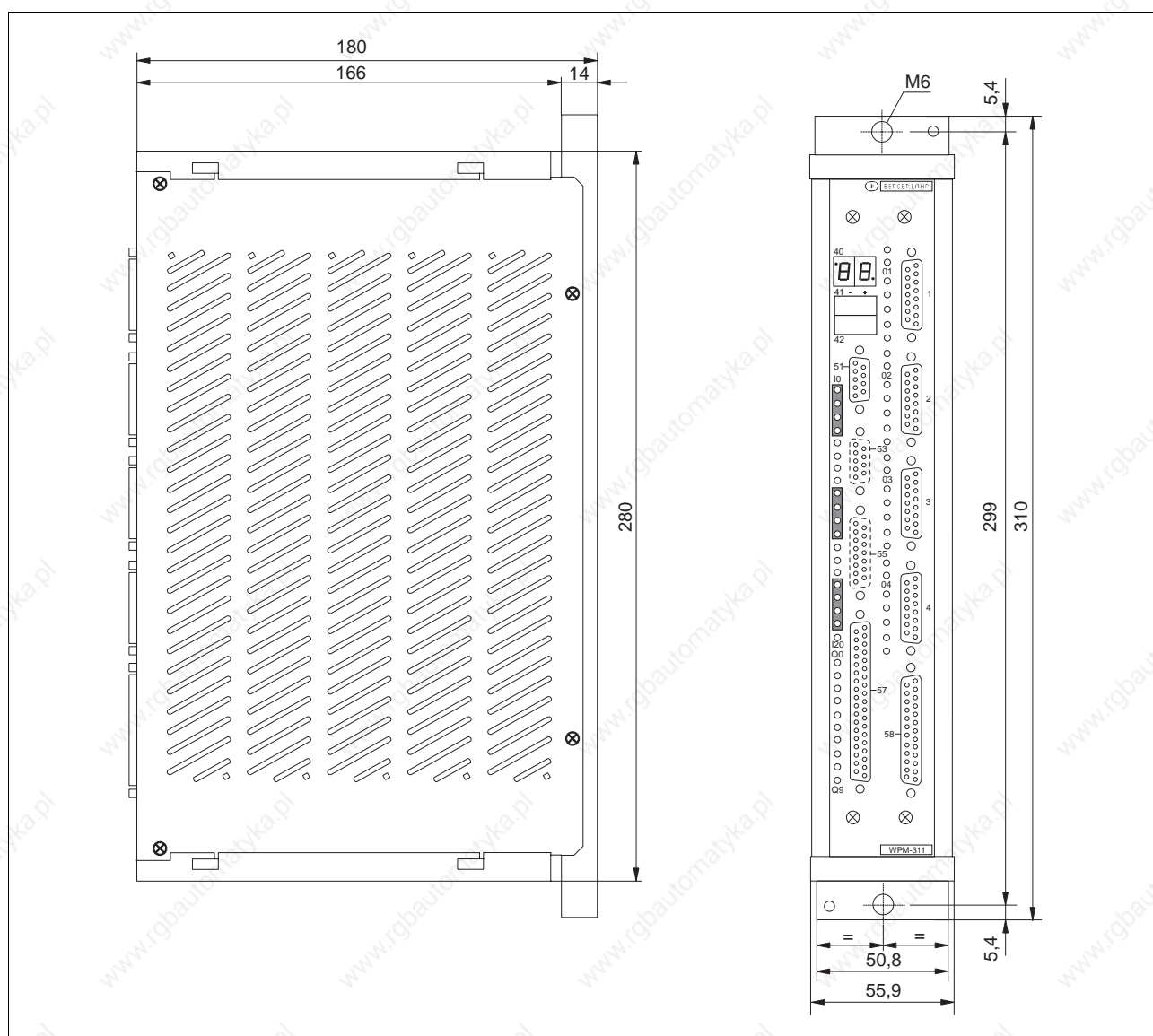


Fig. 1-9 WPM-311 dimensions with 5-phase housing

## General description

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### 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 according to EN 50081-2: 1993  
(when using a mains filter, see Accessories)

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	WPM-311 multi-axis positioning unit
1	WPM-311 documentation
4	Mounting bracket (for 3-phase housing)
1	Ground strap (for 3-phase housing)
1*	On-line Command Processing via CAN Bus documentation or On-line Command Processing via Interbus-S documentation or On-line Command Processing via Profibus-DP documentation
1*	Diskette with device master file for setup with Profibus-DP interface

\* If the appropriate interface is installed.

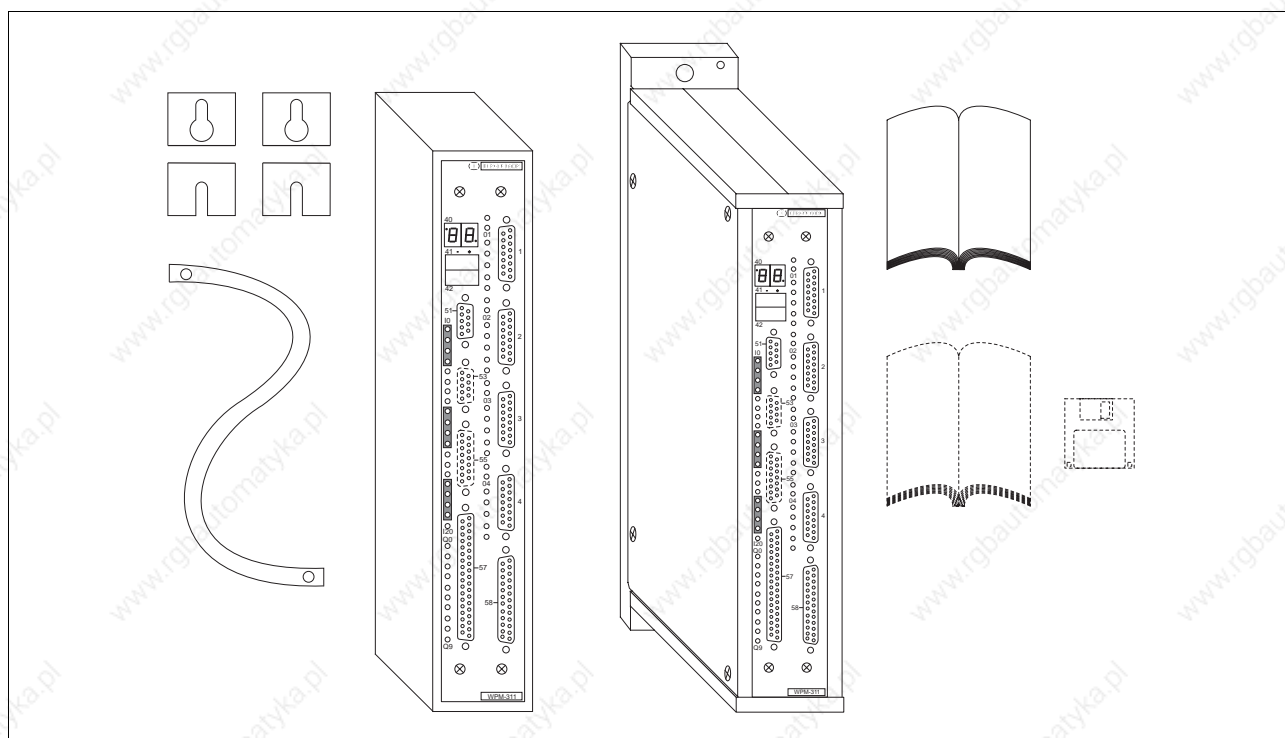


Fig. 2-1 Scope of supply

### 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
- Power controller, e.g. WD5-008 or WDM3-004
- BPRO3 programming system  
or  
ProOED3 programming interface for device variant with OED3 operating system software (appropriate documentation and diskettes)
- MP 923 interface converter (RS 485 LS/RS 232)
- MP 924 interface distributor
- WPM-311 set of connectors (all sub-D connectors)
- Crossover adapter for master/slave operation via RS 485 LS interface
- Encoder cable
- Interbus-S/MP 927 signal cable
- RS 485 LS interface cable, male/female
- RS 485 LS interface cable, male/male
- Signal cable
- Signal cable for power controller



#### NOTE

*Refer to the sales documentation of the WPM-311 positioning unit for the accessory order numbers.*

## 2.3 Mounting



### **DANGER**

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

The unit must be installed in a control cabinet.



### **ATTENTION**

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

*Mounting the WPM-311 with 5-phase housing*

A fork wrench is required for installing the WPM-311 with 5-phase housing; special tools are not required.

1. Drill two holes into the mounting panel; see fig. 1-9 for the dimensions.
2. Fasten the unit with two M6 screws.



### **NOTE**

*For unit combinations, observe the units' central axis distances; see table (dimensions given in mm).*

<b>Central axis distances (mm) for device combinations</b>	<b>WD5-008</b>	<b>WDP5-118</b>	<b>WDP5-228</b>	<b>WDP5-318</b>	<b>WP-311</b>	<b>WPM-311</b>
WD5-008	87	87	87	87	74	74
WDP5-118	87	87	87	87	74	74
WDP5-228	87	87	87	87	74	74
WDP5-318	87	87	87	87	74	74
WP-311	74	74	74	74	61	61
WPM-311	74	74	74	74	61	61

*Mounting the WPM-311 with 3-phase housing*

You can use the mounting brackets to install the WPM-311 with 3-phase housing on the rear or on the left (fig. 1-8).



### **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.*

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.

### 2.4 Wiring



#### **DANGER**

**Whenever wiring work is carried out, the mains connector must be disconnected.**



#### **ATTENTION**

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



#### **NOTE**

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



#### **NOTE**

The ground connections of the interfaces in adapter slots 51 and 53 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<sup>2</sup> Cu for bonding lines up to 200 m

25 mm<sup>2</sup> Cu for bonding lines exceeding 200 m

#### 2.4.1 Power controller connections

1. Solder the litz wires to the connector as illustrated in fig. 2-2.
2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head bolts (fig. 2-3) into the connector shell.
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 (items 1, 2, 3 and 4) with screws.
9. Establish the connection on the power controller end; see fig. 2-4.

Pin	Abbreviation	Assignment	
1	PULSE	Pulse	→
2	DIR	Direction	→
3	ENABLE	Power controller enable	→
4	PWM	Current control	→
5	GND	Ground	→
6	–	Spare	
7	TEMP_MOT	Motor temperature prewarning, line interruption	←
8	READY	Power controller ready	←
9	$\overline{\text{PULSE}}$	Inverted pulse	→
10	$\overline{\text{DIR}}$	Inverted direction	→
11	$\overline{\text{ENABLE}}$	Inverted power controller enable	→
12	$\overline{\text{PWM}}$	Inverted current control	→
13	RM_FAULT	Rotation monitoring error	←
14	TEMP_INT	External power controller temperature prewarning	←
15	GND	Ground	→

active low signal   ← Input   → Output

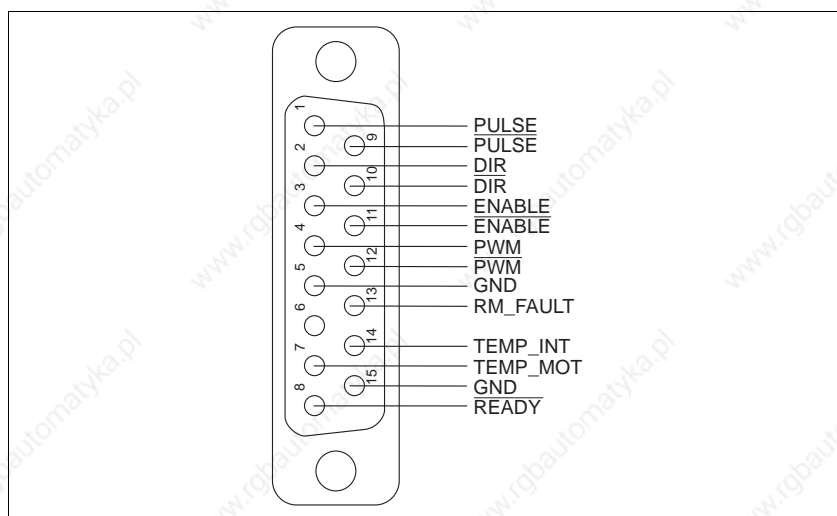


Fig. 2-2 Power controller connection - device end

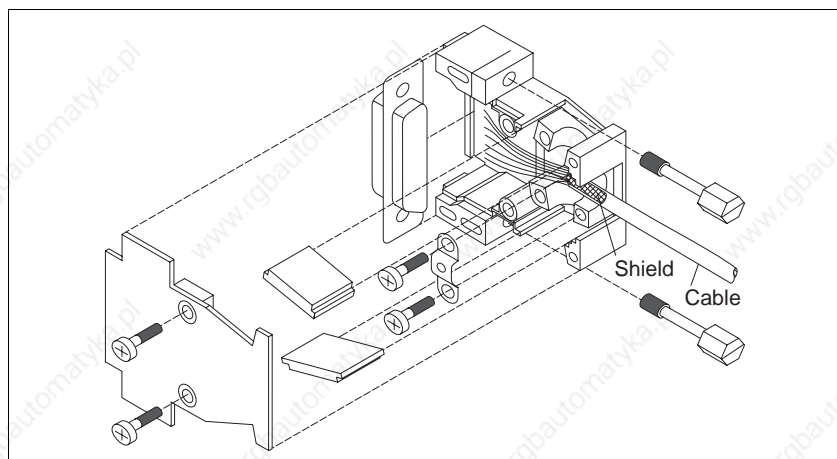


Fig. 2-3 Power controller connector assembly

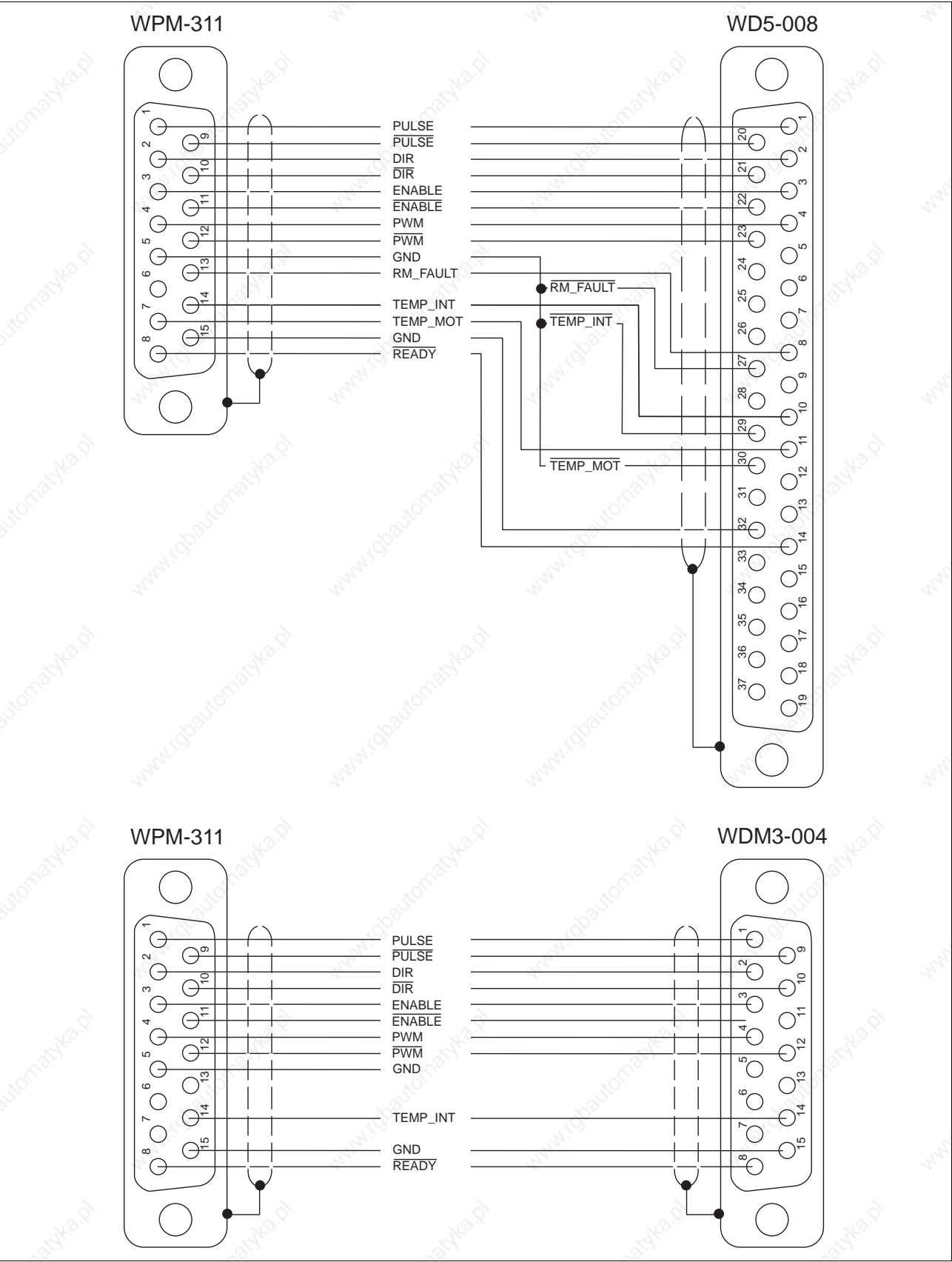


Fig. 2-4 Wiring example



## 2.4.1.1 Pulse and direction signals

The indexer must generate pulses in order to set the drive shaft of the stepping motor into rotation. These pulses are output to the power controller with the pulse signal (fig. 2-5). Each positive pulse edge initiates one stepping motor step. The direction of the step is determined by the direction signal.

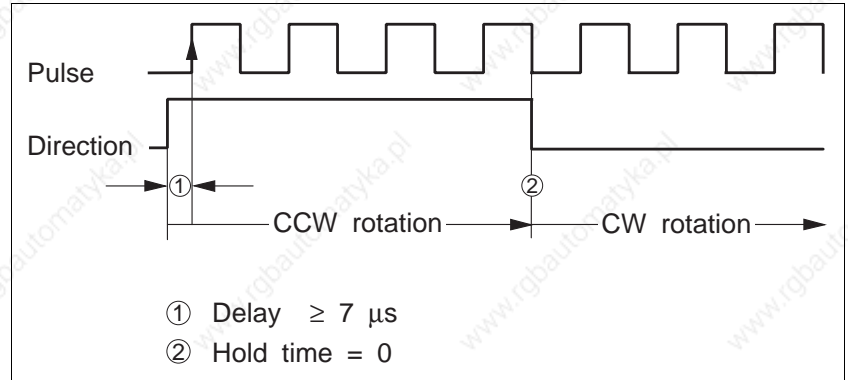


Fig. 2-5 Pulse and direction signals

## 2.4.1.2 ENABLE and READY signals

When the processor unit enabled the power controller with the ENABLE signal, the power controller sends READY to indicate readiness (fig. 2-6).

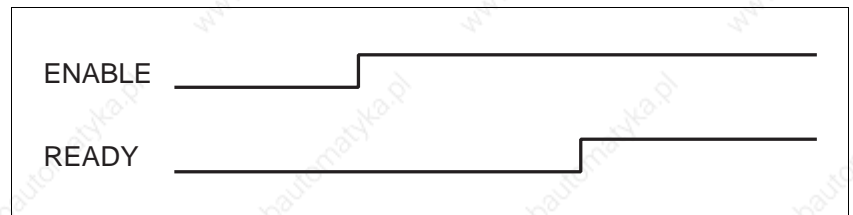


Fig. 2-6 ENABLE and READY signals

## 2.4.1.3 PWM signal

The pulse width modulation signal (PWM) can be used for setting the motor current in a range from 0 to 100% (100% = nominal current as set on power controller).

## 2.4.1.4 TEMP\_MOT, TEMP\_INT and RM\_FAULT signals

If any of the signals TEMP\_MOT, TEMP\_INT or RM\_FAULT is active, the ERROR LED indicates an error.

If a stepping motor is operated without encoder, rotation monitoring must be disabled on the corresponding power controller.

The RM\_FAULT and TEMP\_MOT signal inputs on the power controller connections (items 1 to 4) should be bridged to ground: Pins 7, 13 and 15. If these bridges are not made, the ERROR LED lights continuously, although without affecting controller operation.

## Installation

### 2.4.1.5 Input circuits

The TEMP\_MOT,  $\overline{\text{READY}}$ , RM\_FAULT and TEMP\_INT input circuit principle is illustrated in fig. 2-7.

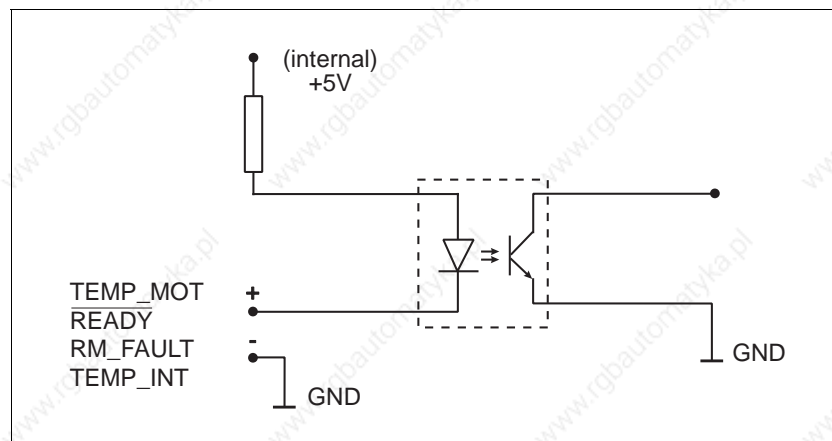


Fig. 2-7 Input circuit principle



## 2.4.2 Limit switch connection

1. Solder the litz wires to the connector as illustrated in fig. 2-8.



### NOTE

The 20 signal inputs of the limit switch connection are preassigned as listed in the following table, however, their assignment may also be changed (see “ensig” controller function in the programming manual).



### NOTE

Direct access (using @) or indirect access (via process image, using %) to limit switch connection inputs (IX0.32 to IX0.51) is only possible with BPRO3 version 3.2 and higher.

Pin	Abbreviation	Assignment
1	$\overline{\text{LIMP1}}$ (IX0.32)	CW (positive) limit switch of axis 1
2	$\overline{\text{REF1}}$ (IX0.34)	Additional reference switch of axis 1
3	$\overline{\text{TRIG1}}$ (IX0.36)	Trigger of axis 1
4	$\overline{\text{LIMN2}}$ (IX0.38)	CW (negative) limit switch of axis 2
5	$\overline{\text{STOP2}}$ (IX0.40)	Stop for axis 2
6	$\overline{\text{LIMP3}}$ (IX0.42)	CW (positive) limit switch of axis 3
7	$\overline{\text{REF3}}$ (IX0.44)	Additional reference switch of axis 3
8	$\overline{\text{TRIG3}}$ (IX0.46)	Trigger of axis 3
9	$\overline{\text{LIMN4}}$ (IX0.48)	CW (negative) limit switch of axis 4
10	$\overline{\text{STOP4}}$ (IX0.50)	Stop for axis 4
11	–	–
12	GND	Ground
13	–	–
14	$\overline{\text{LIMN1}}$ (IX0.33)	CW (negative) limit switch of axis 1
15	$\overline{\text{STOP1}}$ (IX0.35)	Stop for axis 1
16	$\overline{\text{LIMP2}}$ (IX0.37)	CW (positive) limit switch of axis 2
17	$\overline{\text{REF2}}$ (IX0.39)	Additional reference switch of axis 2
18	$\overline{\text{TRIG2}}$ (IX0.41)	Trigger of axis 2
19	$\overline{\text{LIMN3}}$ (IX0.43)	CW (negative) limit switch of axis 3
20	$\overline{\text{STOP3}}$ (IX0.45)	Stop for axis 3
21	$\overline{\text{LIMP4}}$ (IX0.47)	CW (positive) limit switch of axis 4
22	$\overline{\text{REF4}}$ (IX0.49)	Additional reference switch of axis 4
23	$\overline{\text{TRIG4}}$ (IX0.51)	Trigger of axis 4
24	–	–
25	GND	Ground

$\overline{\phantom{x}}$  active low signal

2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head bolts (fig. 2-9) into the connector shell.
4. Place the connector into the connector shell.

## Installation

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 58) with screws.

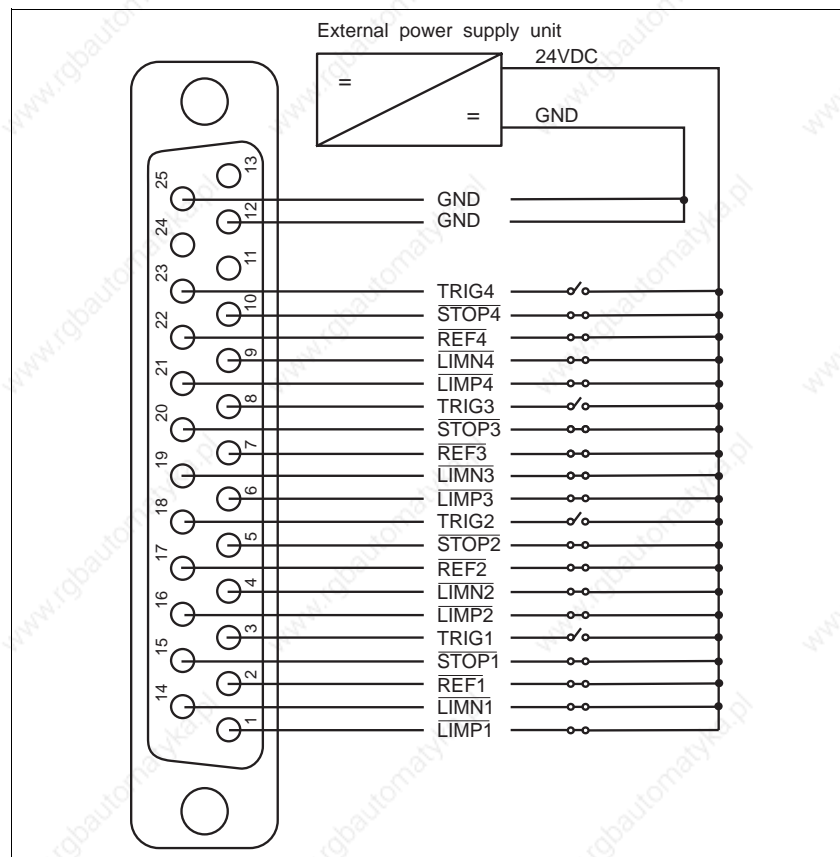


Fig. 2-8 Limit switch connection  
- device end

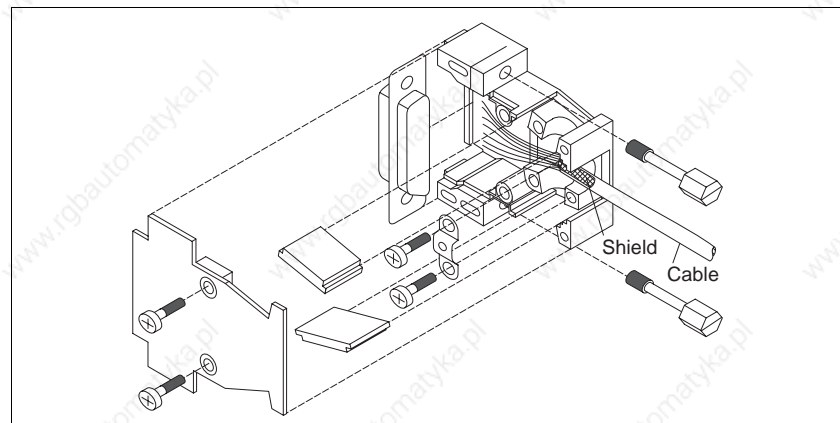


Fig. 2-9 Limit switch connector  
assembly - device end

## 2.4.3 Signal connection

The signal inputs and outputs of the signal connection can be freely used.

1. Solder the litz wires to the connector as required for the desired assignment (see chapter 2.4.3.1).



### 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 bolts (fig. 2-10) into the connector shell.
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.**

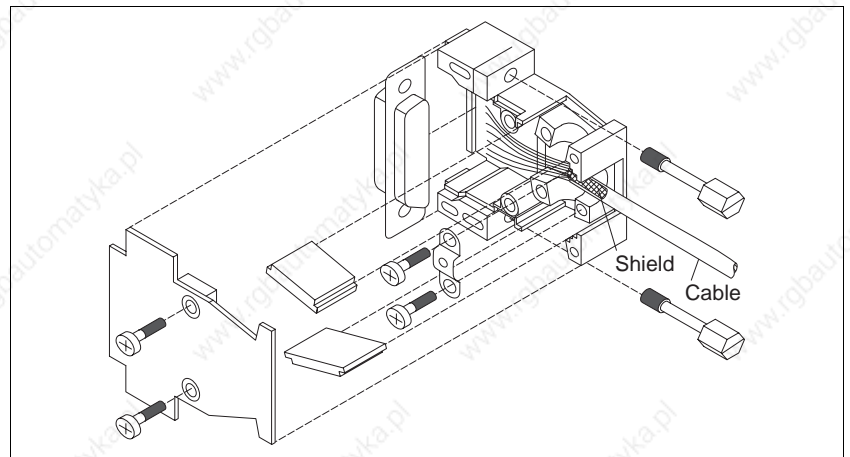


Fig. 2-10 Signal connector assembly - device end

## Installation

### 2.4.3.1 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.



#### NOTE

Direct access (using @) or indirect access (via process image, using %) to signal connection inputs I 16 to I 20 (IX0.16 to IX0.20) is only possible with BPRO3 version 3.2 and higher.

Pin	Abbreviation	Assignment
1	I 17 (IX0.17)	
2	I 20 (IX0.20)	
3	I 13 (IX0.13)	
4	I 11 (IX0.11)	
5	I 10 (IX0.10)	
6	I 18 (IX0.18)	
7	I 7 (IX0.7)	
8	I 5 (IX0.5)	
9	I 3 (IX0.3)	
10	I 1 (IX0.1)	
11	Q 9 (QX0.9)	
12	Q 7 (QX0.7)	
13	Q 5 (QX0.5)	
14	Q 3 (QX0.3)	
15	Q 1 (QX0.1)	
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 (IX0.16)	
21	I 14 (IX0.14)	
22	I 12 (IX0.12)	
23	I 19 (IX0.19)	
24	I 9 (IX0.9)	
25	I 8 (IX0.8)	
26	I 6 (IX0.6)	
27	I 4 (IX0.4)	
28	I 2 (IX0.2)	
29	I 0 (IX0.0)	
30	Q 8 (QX0.8)	
31	Q 6 (QX0.6)	
32	Q 4 (QX0.4)	
33	Q 2 (QX0.2)	
34	Q 0 (QX0.0)	
35	24VGND	System supply voltage ground
36	24VGND	System supply voltage ground
37	IOGND	I/O supply voltage ground

I = Input Q = Output

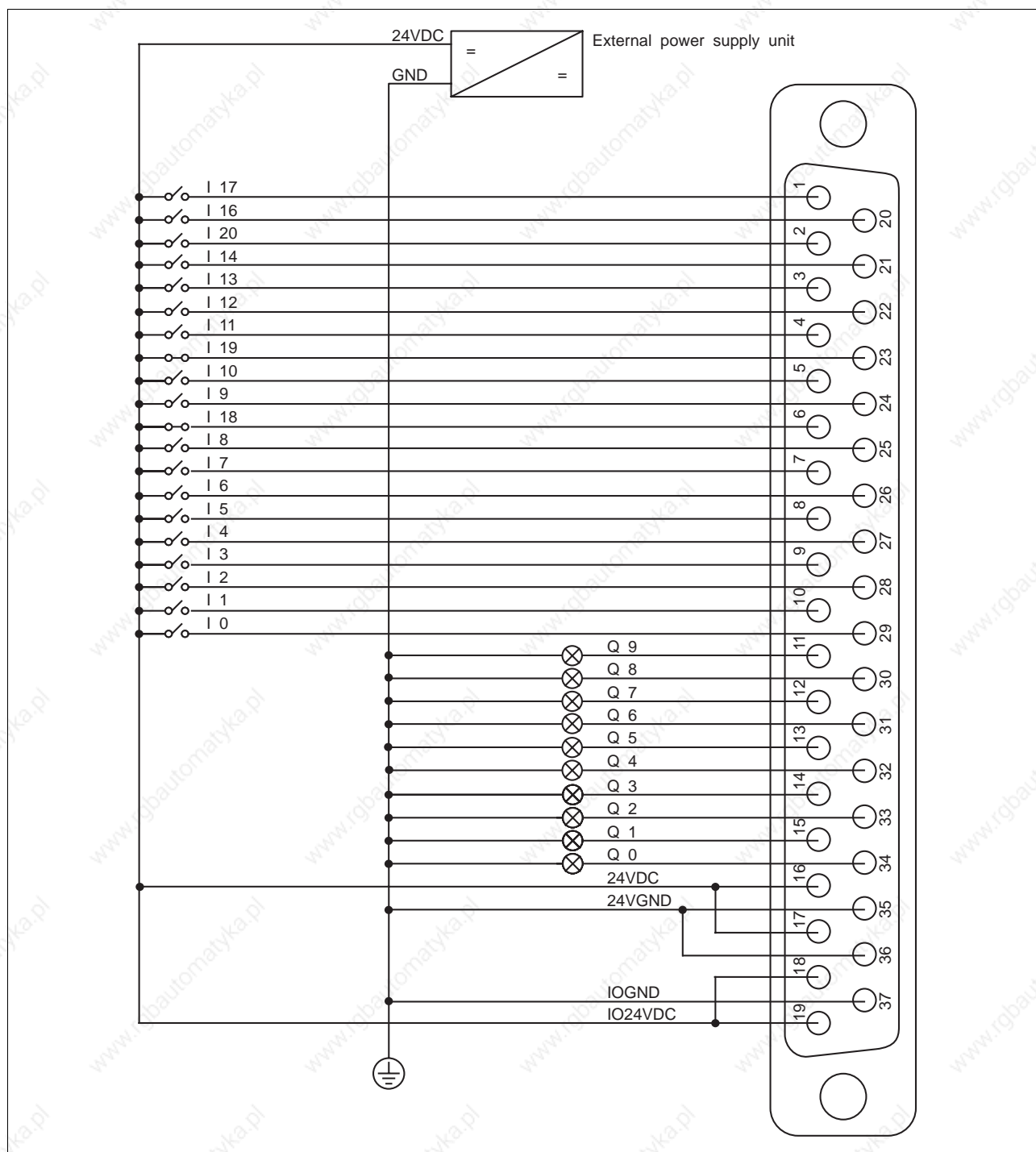


Fig. 2-11 Wiring example



## 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.

### 2.4.4 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 as illustrated in fig. 2-12 and fig. 2-13.

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 bolts (fig. 2-14) into the connector shell.
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 RS 232 interface (e.g. PC as the master, controller as the slave), the transmit and receive lines must be crossed over between the units.

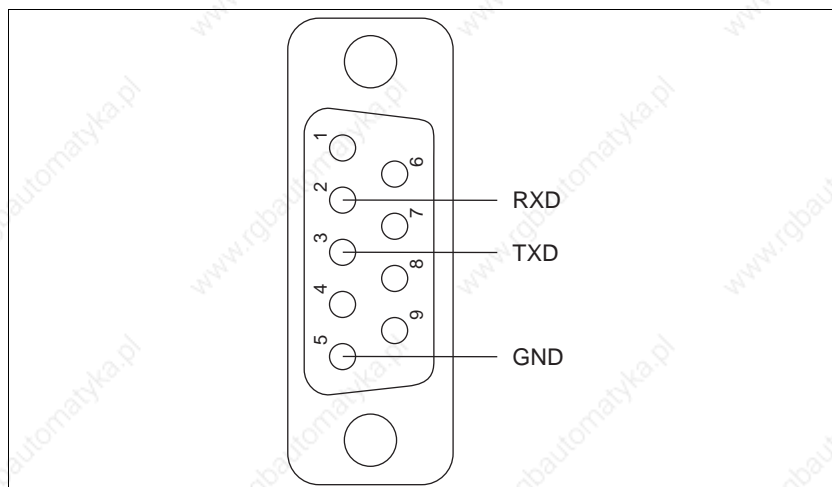


#### NOTE

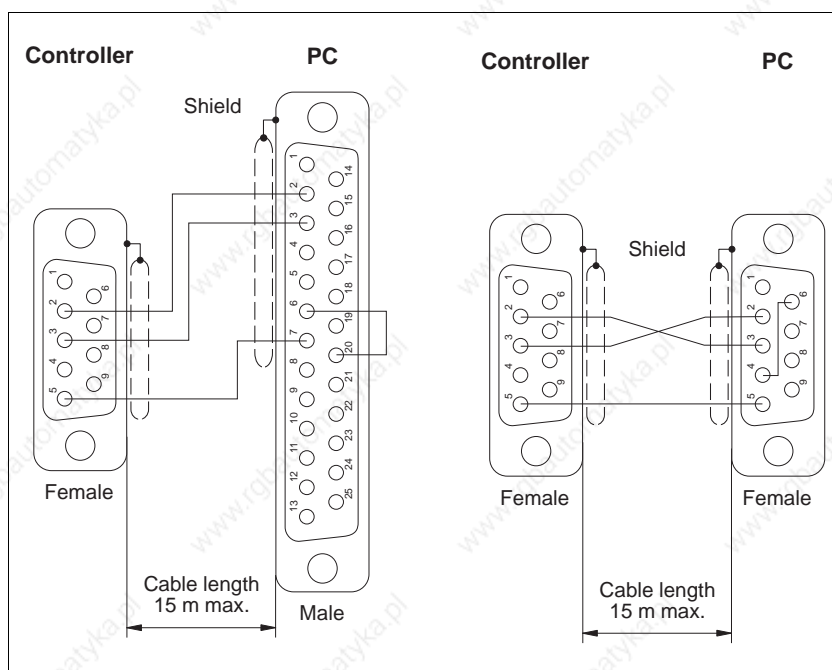
With an RS 232 interface, networking is not possible.



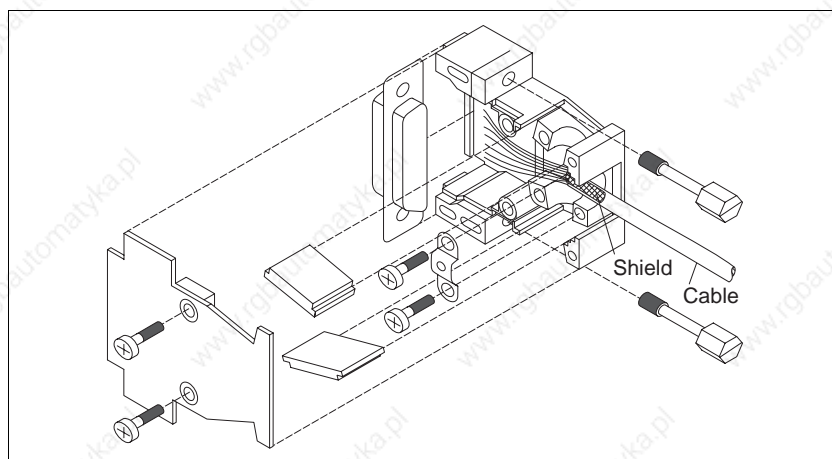
**Fig. 2-12** Interface connection - device end



**Fig. 2-13** Controller/PC wiring



**Fig. 2-14** Interface connector assembly



### 2.4.5 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. 2-15.

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 bolts (fig. 2-16) into the connector shell.
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 6.2.2.



**NOTE**

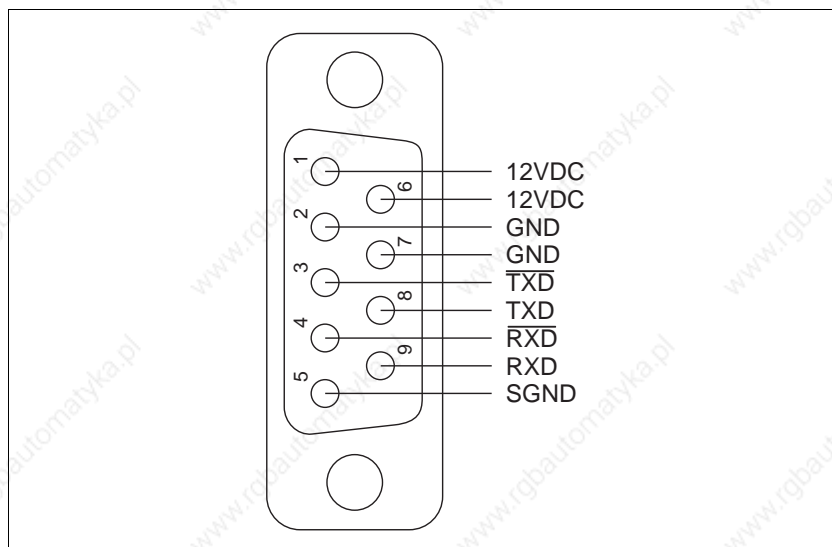
The MP 924 interface distributor can be used for controlling eight units (see chapter 6.2.3).



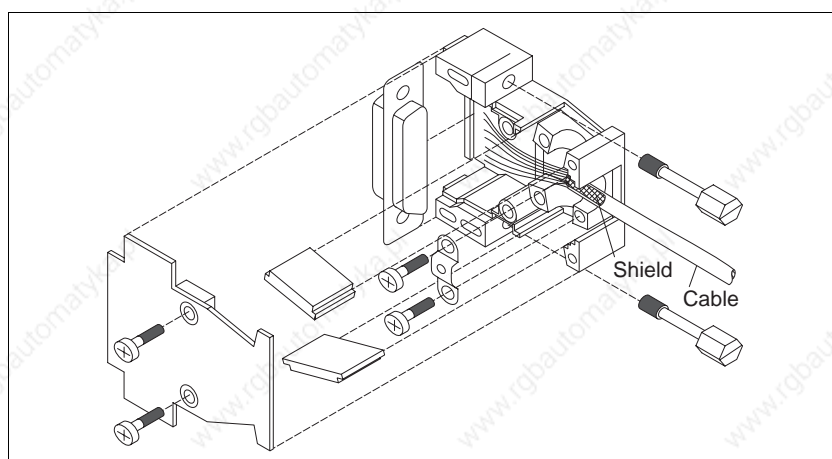
**NOTE**

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 6.2.4.





**Fig. 2-15** Interface connection - device end



**Fig. 2-16** Interface connector assembly

## Installation

### 2.4.6 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).

### 2.4.7 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.

### 2.4.8 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. 2-17.

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 21 and 20 ←
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 internal voltage ground. The reference potential of the ANA\_IN1 GND and ANA\_IN2 GND inputs must not differ from the ANA\_OUT GND reference potential by more than  $\pm 0.5$  V.

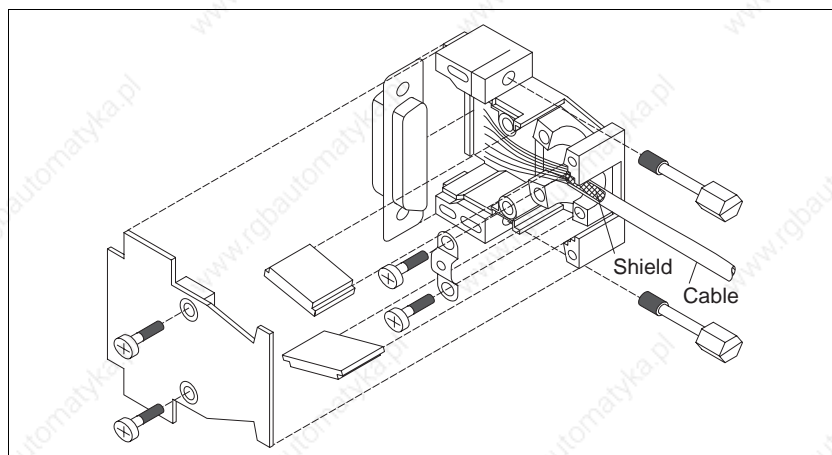
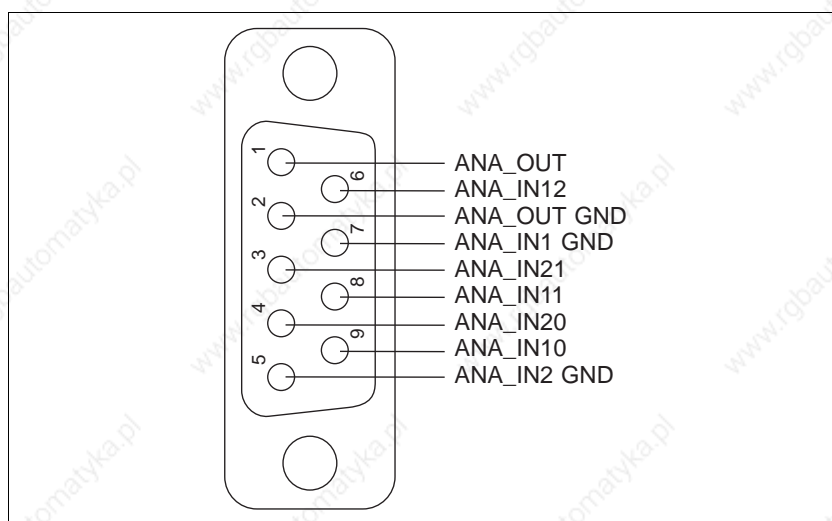
2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head bolts (fig. 2-18) into the connector shell.



**Ensure good electrical contact between the shield and the connector shell.**



***The ground connections of the interfaces in adapter slots 51 and 53 are internally interconnected. 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. 2-18 Interface connector assembly*

### 2.4.9 Encoder interface



#### NOTE

*The encoder interface is installed in adapter slot 55; see type plate. Power is supplied independently of the power controller.*

1. Solder the litz wires to the connector as illustrated in fig. 2-19.
2. Push the shield back and fix with a cable tie.
3. Insert two hexagon head bolts (fig. 2-20) into the connector shell.
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.  
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 55) with screws.
9. Twist the encoder cable wires in pairs as illustrated in fig. 2-21.
10. Establish the connection on the motor end.



#### ATTENTION

***When using 5 V encoders, -SENSE must be connected to 5VGND and +SENSE to 5VDC on the encoder end of the cable.***

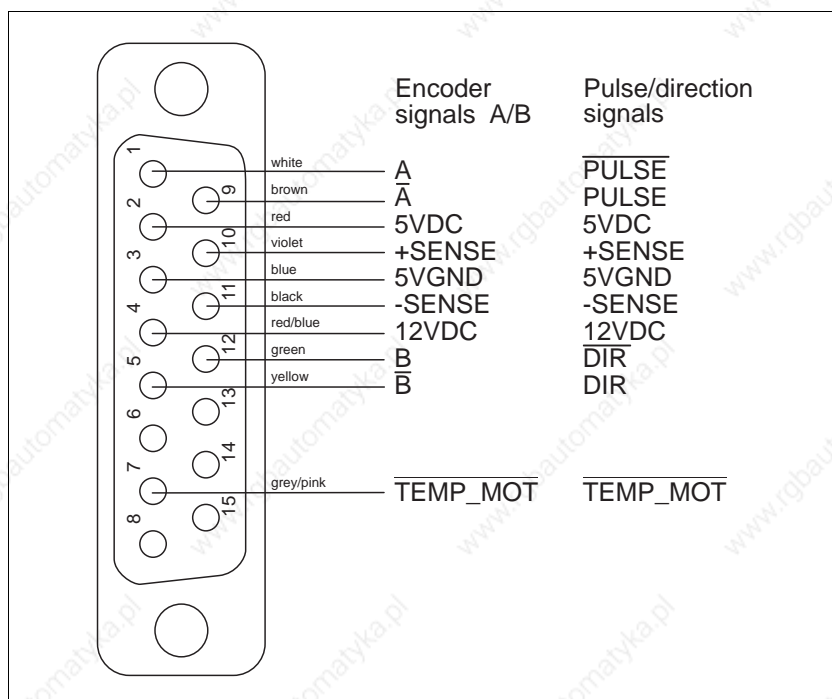


Fig. 2-19 Encoder connector – device end

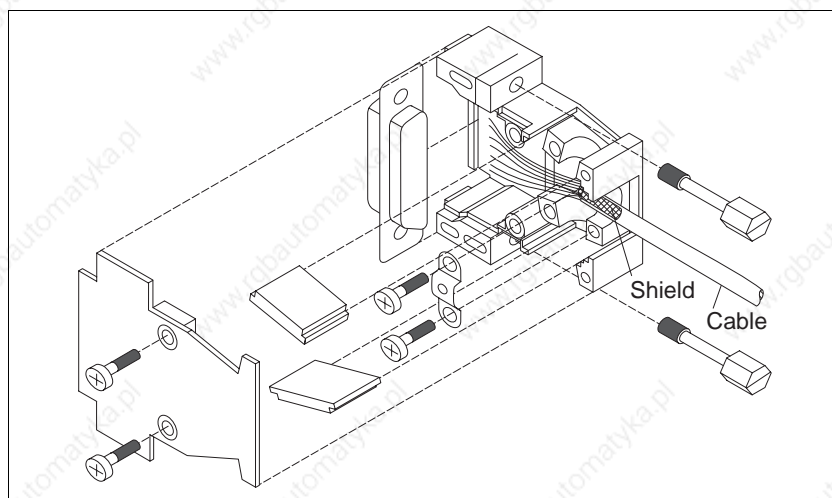


Fig. 2-20 Encoder connector assembly – device end

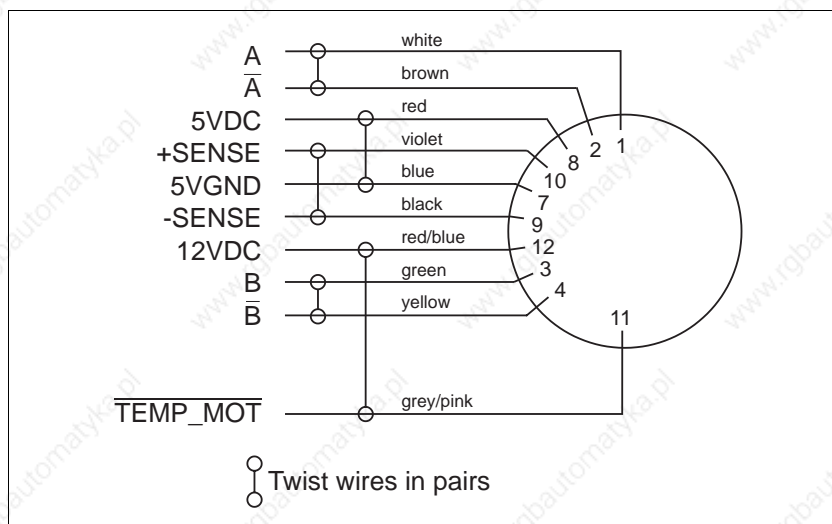


Fig. 2-21 Encoder connector – motor end

## Installation

### 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	$\overline{B}$	Encoder signal $\overline{B}$ ←
6	–	–
7	$\overline{TEMP\_MOT}$	Motor temperature prewarning, line interruption ←
8	–	–
9	$\overline{A}$	Encoder signal $\overline{A}$ ←
10	+SENSE	Sense regulator 5VDC ←
11	–SENSE	Sense regulator 5VGND ←
12	B	Encoder signal B ←
13	–	–
14	–	–
15	–	–

active low signal   ← Input   → Output

The encoder can be supplied with 12 V or from a 5 V sense regulator.



#### ATTENTION

**When using 5 V encoders, -SENSE must be connected to 5VGND and +SENSE to 5VDC on the encoder end of the cable.**



#### ATTENTION

**The  $\overline{TEMP\_MOT}$  input is used for detecting a line interruption. For this purpose,  $\overline{TEMP\_MOT}$  must be connected to 5VDC on the encoder.**

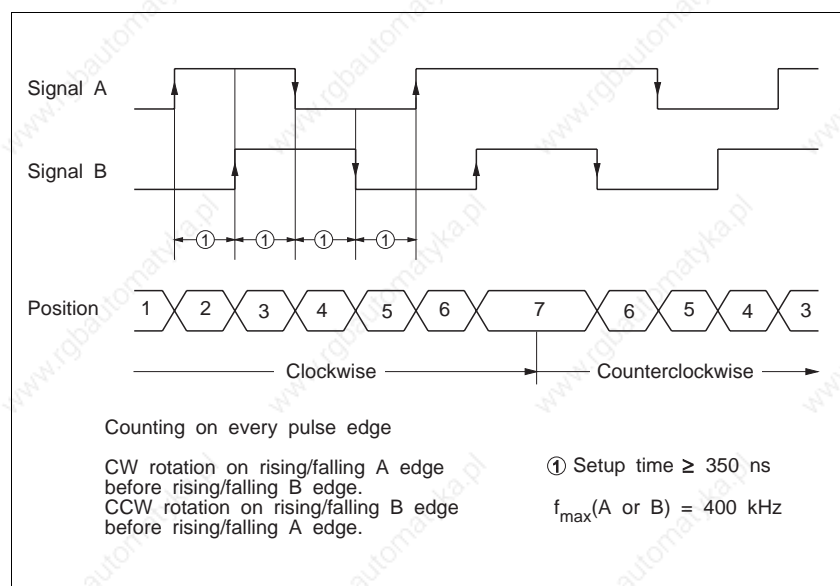


Fig. 2-22 Timing diagram – encoder signals A/B



## Pulse/direction signal type

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

active low signal ← Input → Output

The encoder can be supplied with 12 V or from a 5 V sense regulator.



### ATTENTION

**When using 5 V encoders, -SENSE must be connected to 5VGND and +SENSE to 5VDC on the encoder end of the cable.**



### ATTENTION

**The TEMP\_MOT input is used for detecting a line interruption. For this purpose, TEMP\_MOT must be connected to 5VDC on the encoder.**

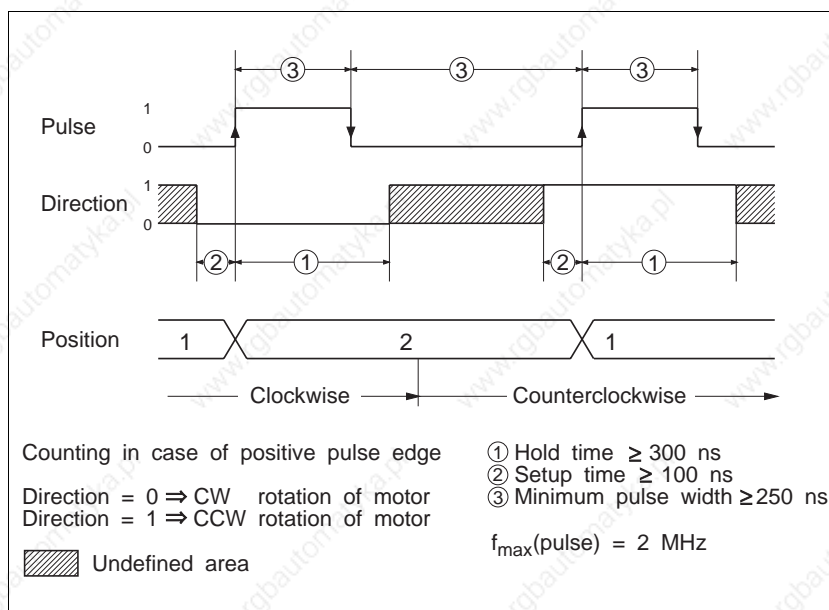


Fig. 2-23 Timing diagram – pulse/direction signals

## Installation

### 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	
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	Numerator 1; denominator 1;	
for speed	half-steps	
for acceleration	Numerator 256; denominator 1;	
for electronic gear	Hz (steps/second)	
for encoder (position, indexer)	Numerator 1000; denominator 1;	
	Hz/ms	
	Numerator 0; denominator 1;	
	gear ratio 0	
	Numerator 1; denominator 1	
Motor current at standstill	50%	
during acceleration/deceleration	100%	
at constant speed	80%	
Encoder	Not connected to axis; single evaluation of encoder signals; contouring error limit = 18 encoder units; encoder position = 0	



#### NOTE

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



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

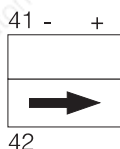


## ATTENTION

**Before switching on, check that the signal inputs for the limit switches, for the reference switch and stop are properly wired; see fig. 2-8.**

2. Check that all connectors are properly connected.
3. Deactivate the current reduction for BERGER LAHR power controllers, since current reduction is performed by the controller (see PWM signal, chapter 2.4.1).
4. Plug in the mains connector and switch on the supply voltage; see chapter 3.2.
5. Use the selector switch (item 41) to set STOP. Press –.  
→ The controller assumes RESET status.

## MODE settings



Perform the subsequent MODE settings as follows:

- Keep the selector switch (item 42) pressed in + 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.

6. 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 92 93 94	Manual mode of axis 1 Manual mode of axis 2 Manual mode of axis 3 Manual mode of axis 4	–

\* Default

7. 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 – position.



### NOTE

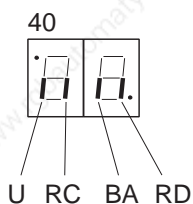
With an RS 232 interface, the network address is set to 1 and cannot be changed.

8. 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*
72	Baud rate for operation via slot 53		04 = 100 05 = 50 06 = 20 07 = 10

\* Default

9. Set the Interbus-S diagnostics (for a description, see separate Interbus-S documentation). This is not applicable for 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 other 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 in application mode with the BPRO3 programming system or the ProOED3 programming interface; see BPRO3 operating manual or ProOED3 documentation.

## **Installation**

---

## 3 Operation

### 3.1 Operating modes of the controller

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
M 91 92 93 94	Manual mode for axes 1 to 4	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



**DANGER**

*Live parts of the device or system may never be touched by persons or with electrically conductive objects.*



**DANGER**

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



**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
Wiring of the unit (in particular signal inputs for limit switches, reference switch and stop) carried out properly?	See chapter 2.4



**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 pressing the selector switch (item 41) in – position while switching on.*

1. Connect the supply voltage.  
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.

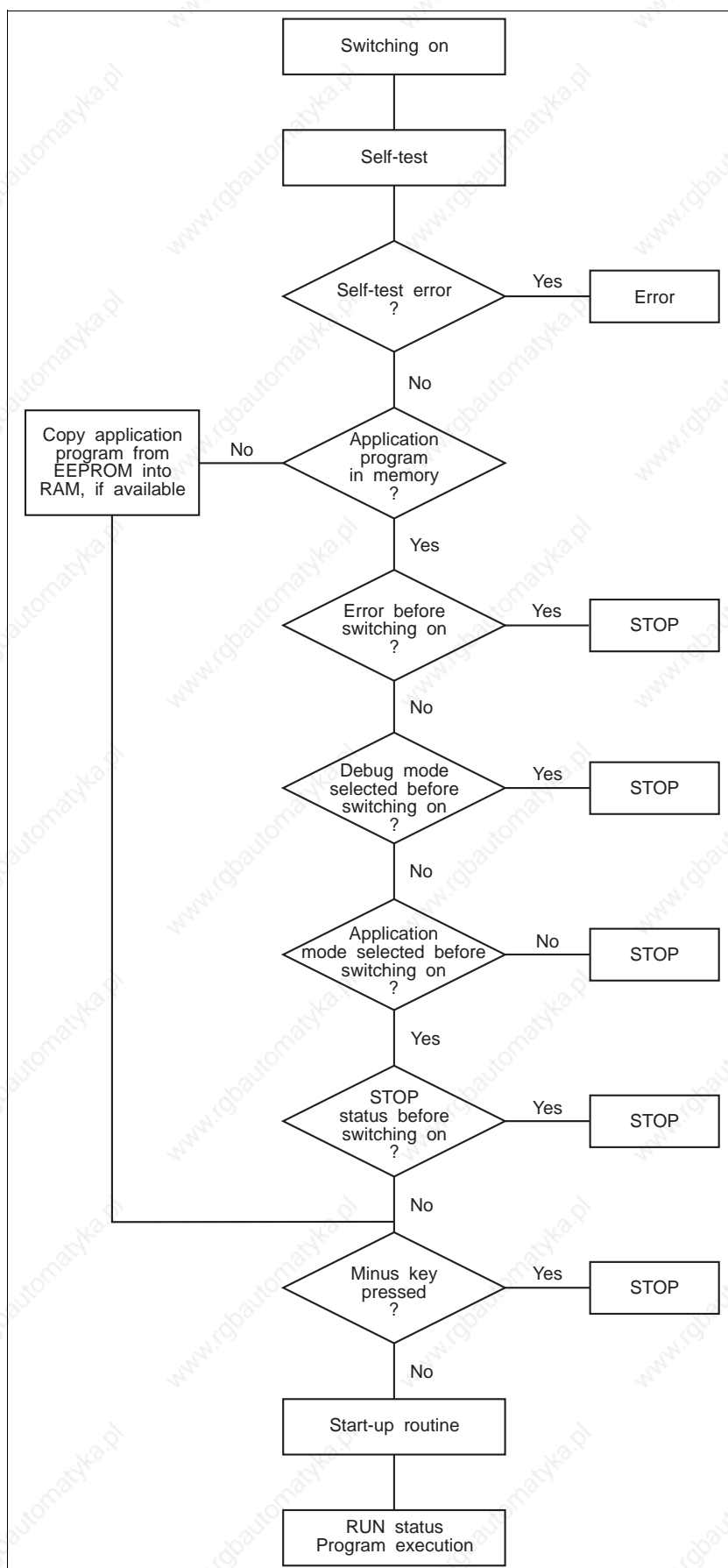


Fig. 3-1 Power-on sequence



**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.

READY	○	○	○	○
ERROR	○	○	○	○
	01	02	03	04
LIMP	○	○	○	○
LIMN	○	○	○	○
REF	○	○	○	○
STOP	○	○	○	○
TRIG	○	○	○	○

2. If the READY LEDs (items 01, 02, 03 and/or 04) light up, the power controllers are “ready”.  
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:

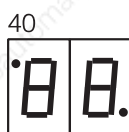
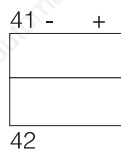
- Operating mode: Application mode
- Serial interface 1 parameters: BNET, 9600 bauds, network address 1
- Serial interface 2 not configured
- 1000 flag words (0 remanent flag words)
- Process image for local I/O modules
- Default axis parameters
- Maximum number of program objects

The controller configuration can be modified using the programming device.



### 3.3 Manual mode

Manual mode only permits rotating the stepping motors to the left or right at speed 1 kHz.



1. Use the selector switch (item 41) to set STOP: Press –.
2. Press and hold the selector switch (item 42) in + position. After 2 seconds, the seven-segment displays (item 40) start flashing. Set the number for manual mode for the appropriate axis by pressing + or – on the selector switch (item 41).

Axis	Number
1	91
2	92
3	93
4	94

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 + 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 WPM-311; 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: Press –.
2. Press and hold the selector switch (item 42) in + 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 + position (RUN).
  - 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.*

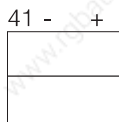
#### Program start with ProOED3

If an application program was created with ProOED3, the program is automatically activated at power-on.

→ Two dots appear in the status display (item 40).

##### NOTE

*Refer to the ProOED3 documentation for more information.*

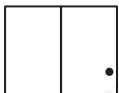


42

40



40

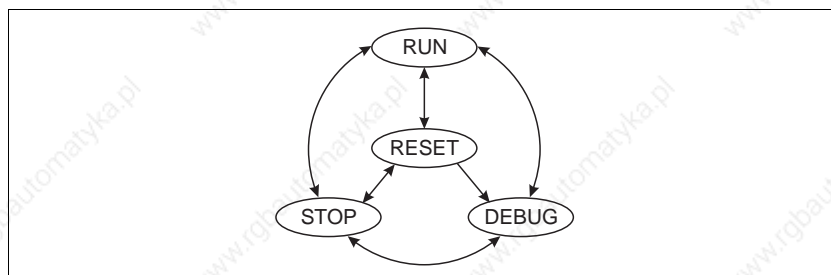


40

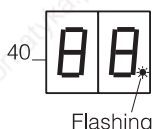
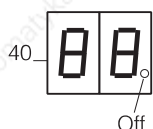
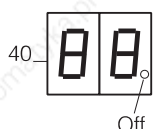
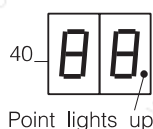


### 3.4.1 Controller states in application mode with BPRO3

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 display (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 menu 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 menu 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 menu 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 menu option “Reset controller”.

#### DEBUG

In DEBUG status, the application program can be tested.

DEBUG status is activated by selecting any of the following BPRO3 menu 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 menu 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"	<p>The application program is stopped. The serial and encoder interfaces remain functional.</p> <p>Subsequent status: STOP, if RUN was active.</p> <div><b>ATTENTION</b> <i>In electronic gear mode, positions continue to be processed.</i></div> <div><b>NOTE</b> <i>In DEBUG status, the characteristics of the drive and the outputs can be determined with the "debug" function.</i></div>
"Reset controller"	<p>The application program is reset. The drive is initialized and the outputs are reset.</p> <p>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).</p> <p>Subsequent status: RESET</p>
"Cont. contr."	<p>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.</p> <p>Subsequent status: RUN, if STOP was active.</p> <div><b>ATTENTION</b> <i>Any stopped movements are resumed.</i></div>

### Operation via front panel:

Action	Effect
Selector switch (item 41) pressed in + position	<p>“Reset controller”, then “Cont. contr.”; see Operation via BPRO3.</p> <p>Subsequent status: RUN</p> <div> <b>NOTE</b> <i>In DEBUG status, the application program is resumed.</i></div>
Selector switch (item 41) pressed in – position	<p>“Reset controller”; see operation with BPRO3.</p> <p>Subsequent status: RESET</p>



#### NOTE

For operation via OED3, see ProOED3 documentation.

## Operation

### 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 the 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 4.2.1
Error class 3 Setting error	STOP status, RUN status available. The error is stored in the error memory.	See troubleshooting table, chapter 4.2.1
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 4.2.1
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 – 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 a 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	Initialize 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

<b>Write command</b>	<b>Meaning</b>
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
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.

<b>Read command</b>	<b>Meaning</b>
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.

## Notes on BPRO3 versions lower than 3.2

NOTE Direct access (using @) or indirect access (via process image, using %) to signal connection inputs I 16 to I 20 (IX0.16 to IX0.20) and limit switch connection inputs (IX0.32 to IX0.51) is only possible with BPRO3 version 3.2 and higher.

With BPRO3 versions lower than 3.2, inputs can only be accessed indirectly by flags. For this purpose, the "wpm\_iw\_1\_to\_3" function must first be copied from the "Library" project into the current project and called at the start of the PLC program.

Input/flag assignment with "wpm\_iw\_1\_to\_3" function

Input	Flag	Input	Flag	Input	Flag
%IW0.1	%MW1001	%IW1.0	%MW1002	%IW1.1	%MW1003
%IX0.16	%MX1001.0	%IX0.32	%MX1002.0	%IX0.48	%MX1003.0
%IX0.17	%MX1001.1	%IX0.33	%MX1002.1	%IX0.49	%MX1003.1
%IX0.18	%MX1001.2	%IX0.34	%MX1002.2	%IX0.50	%MX1003.2
%IX0.19	%MX1001.3	%IX0.35	%MX1002.3	%IX0.51	%MX1003.3
%IX0.20	%MX1001.4	%IX0.36	%MX1002.4		
		%IX0.37	%MX1002.5		
		%IX0.38	%MX1002.6		
		%IX0.39	%MX1002.7		
		%IX0.40	%MX1002.8		
		%IX0.41	%MX1002.9		
		%IX0.42	%MX1002.10		
		%IX0.43	%MX1002.11		
		%IX0.44	%MX1002.12		
		%IX0.45	%MX1002.13		
		%IX0.46	%MX1002.14		
		%IX0.47	%MX1002.15		

## PLC programming example

Network 1  
wpm\_iw\_1\_to\_3

```
ld    %MX1001.0
st    %QX0.5
ld    %MX1002.0
st    %QX0.6
```

### 3.6.2 Programming with ProOED3

Programming of the unit is effected with 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 use the selector switch (item 41) to set STOP (press –) 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 voltage, 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. Disconnect the supply voltage.

## 4 Malfunctions

### 4.1 Status indicators

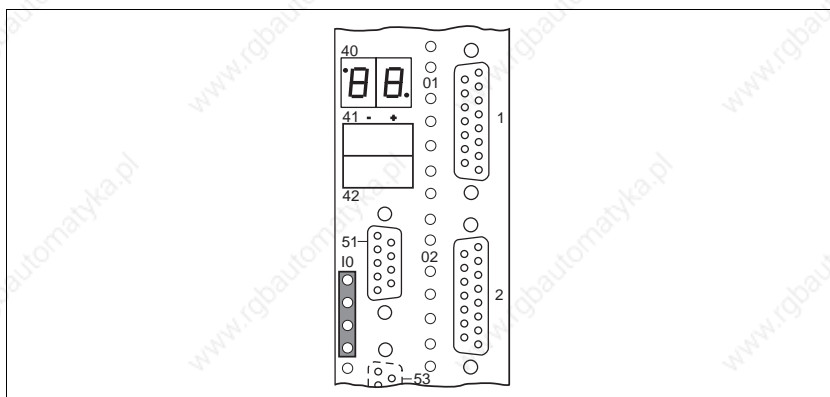


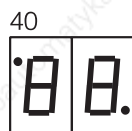
Fig. 4-1 Status indicators

#### 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 4.2.1 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 interface
M	Manual mode of an axis
91	Manual mode of axis 1
92	Manual mode of axis 2
93	Manual mode of axis 3
94	Manual mode of axis 4



#### 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.

## Malfunctions

### Flashing displays

Flashing displays indicate any errors and malfunctions on the processor unit; see chapter 4.2.1.

Error messages can be acknowledged by pressing the selector switch (item 42).

The dots on the right and left of the 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 is described in the ProOED3 documentation.

I0 Q0  
○ ○  
○ ○  
⋮ ⋮  
○ ○  
○ ○  
I20 Q9

### Status indicators for inputs and outputs

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.

### Status indicators for axes

The axis states are indicated by LED groups (items 01 to 04) with seven LEDs each.

The two upper LEDs (READY and ERROR) indicate the states of the corresponding power controller, the five lower LEDs (LIMP, LIMN, REF, STOP and TRIG) indicate the states of the axis signals.

READY ○  
ERROR ○  
LIMP ○  
LIMN ○  
REF ○  
STOP ○  
TRIG ○  
○ ○ ○ ○  
01 02 03 04  
○ ○ ○ ○  
○ ○ ○ ○  
○ ○ ○ ○  
○ ○ ○ ○



#### NOTE

The ERROR LED lights when the power controller generates an error.

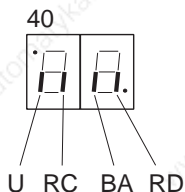
The seven LEDs have the following meanings:

READY	Power controller ready ( $\overline{\text{READY}}$ signal)
ERROR	Motor temperature prewarning (TEMP_MOT signal); Power controller temperature prewarning (TEMP_INT signal); Rotation monitoring error (RM FAULT signal)
LIMP	CW (positive) limit switch (LIMP signal)
LIMN	CCW (negative) limit switch (LIMN signal)
REF	Reference switch ( $\overline{\text{REF}}$ signal)
STOP	Axis in STOP status ( $\overline{\text{STOP}}$ signal)
TRIG	Trigger (TRIG signal)



### 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 + 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

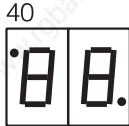
→ Release the selector switch (item 41) to accept the setting.

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

## Malfunctions

### 4.2 Troubleshooting tables

#### 4.2.1 Processor unit malfunctions



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 on the power controller
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 menu 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 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 menu 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 SIG POS/TEC, Technical Services department. Phone (07821) 946-257
56	No EEPROM available	Call SIG POS/TEC, Technical Services department. Phone (07821) 946-257
57	EEPROM write error	Call SIG POS/TEC, Technical Services department. Phone (07821) 946-257

## Malfunctions

Display	Cause	Rectification
	Battery voltage low, battery used up   <b>ATTENTION</b> <b>After switching off the controller, data or the application program may be lost!</b>	Replace the battery; see chapter 5.1
	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 errors indications	System error	Call SIG POS/TEC, Technical Services department. Phone (07821) 946-257

### 4.2.2 Axis errors

The following table summarizes possible errors, their causes and methods for rectification.

Indication	Cause	Rectification
LED ERROR lights up	Rotation monitoring error	See power controller troubleshooting table
	Power controller temperature prewarning	
	Motor temperature prewarning	
	Line interruption in motor cable	

### 4.3 Repair work



#### ATTENTION

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

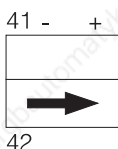
Mark all connections when disassembling the unit.

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 + 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 must 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. For WPM-311 in 3-phase housing:  
Unscrew two screws each at the top and bottom of the unit and remove the side panel.  
For WPM-311 in 5-phase housing:  
Unscrew four screws on the right side and push the side panel out towards the front.



**ATTENTION**

**CMOS circuits are sensitive to touching!**

3. Connect the terminals of the new battery to the 2nd battery connection.
4. Disconnect the terminals of the used battery.
5. Remove the used battery and install the new battery.
6. Fasten the side panel with the four screws.
7. Remount the unit.

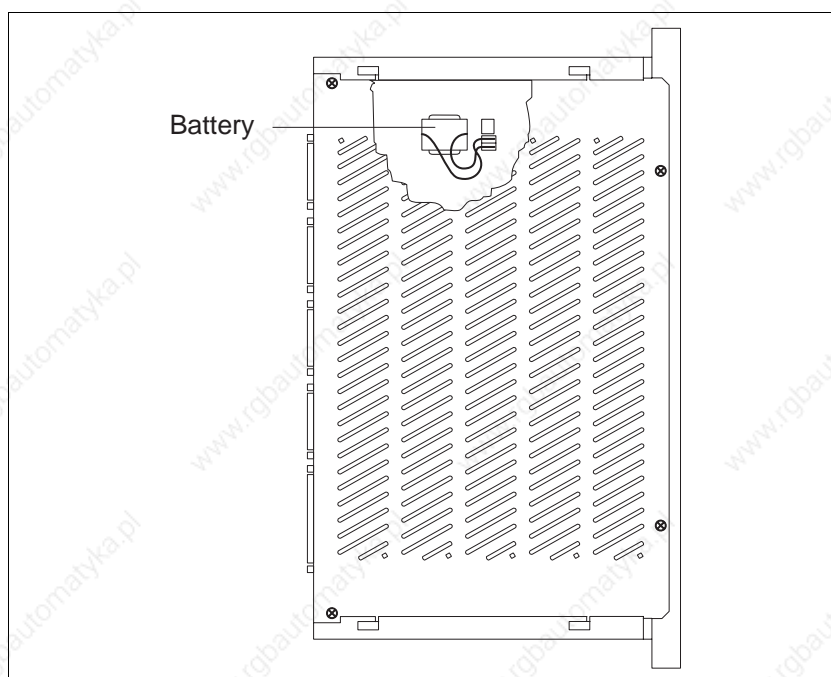


Fig. 5-1 Battery in 5-phase housing of WPM-311



### **5.2 Customer service**

The Technical Services department of SIG POS/TEC offer the following services under the phone numbers given:

- **Spare part information** by direct line

**Phone: (07821) 946-606**

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

- **Technical advice in case of failures** by direct line

**Phone: (07821) 946-257**

- **Fax hot-line** by

**Fax (07821) 946-202**

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	MP 962	<ul style="list-style-type: none"> <li>– For programming software ProOED3</li> <li>– For programming software BPRO3 or on-line command processing via field bus or serial interface</li> </ul>



#### 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
MP 962	Encoder interface
RS 232	Serial interface RS 232
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: WPM-311.XXX**OED3**

Operating system software for ProOED3

Type: WPM...not specified

Operating system software for BPRO3 or on-line command processing

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

6.2 Description of accessories

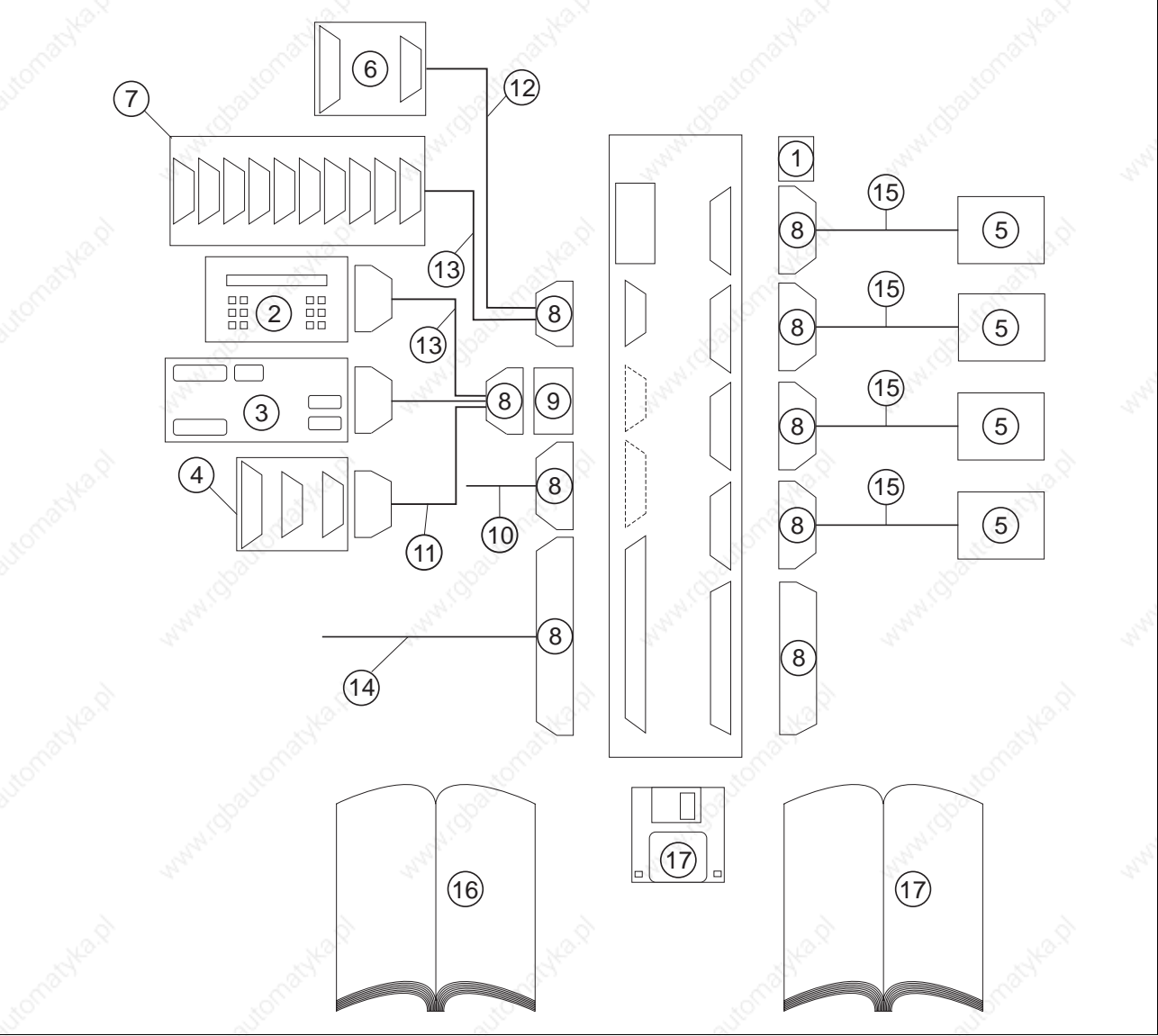


Fig. 6-1 Accessories

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

Item no.	Designation	Reference
1	Battery for wall mounting units	–
2	FT 2000 operating terminal	See chapter 6.2.1
3	MP 926 input/output card (16 inputs/16 outputs)	MP 926 documentation
4	MP 927 Interbus-S interface adapter	Interbus-S documentation
5	Power controller, e.g. WD5-008 or WDM3-004	See sales documentation
6	MP 923 interface converter (RS 485 LS/RS 232)	See chapter 6.2.2
7	MP 924 interface distributor	See chapter 6.2.3
8	WPM-311 set of connectors (all sub-D connectors)	–
9	Crossover adapter for master/slave operation via RS 485 LS interface	See chapter 6.2.4
10	Encoder cable	See sales documentation
11	Interbus-S/MP 927 signal cable	
12	RS 485 LS interface cable, male/female	
13	RS 485 LS interface cable, male/male	
14	Signal cable	
15	Signal cable for power controller	Doc. no. 212.986
16	On-line Command Processing via Serial Interface documentation	
17	BPRO3 programming system or ProOED3 programming interface for device variant with OED3 operating system software (appropriate documentation and diskettes)	–



## NOTE

Refer to the sales documentation of the WPM-311 positioning unit for the accessory order numbers.

### 6.2.1 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. 6-2).

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 6.2.4.*

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.

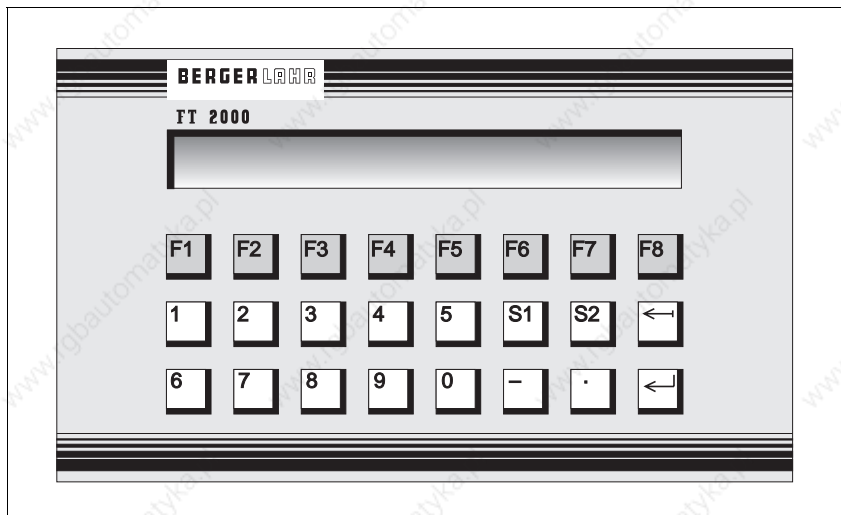


Fig. 6-2 FT 2000 operating terminal

## 6.2.2 MP 923 interface converter

### 6.2.2.1 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 (RS 422) connection.

### 6.2.2.2 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	

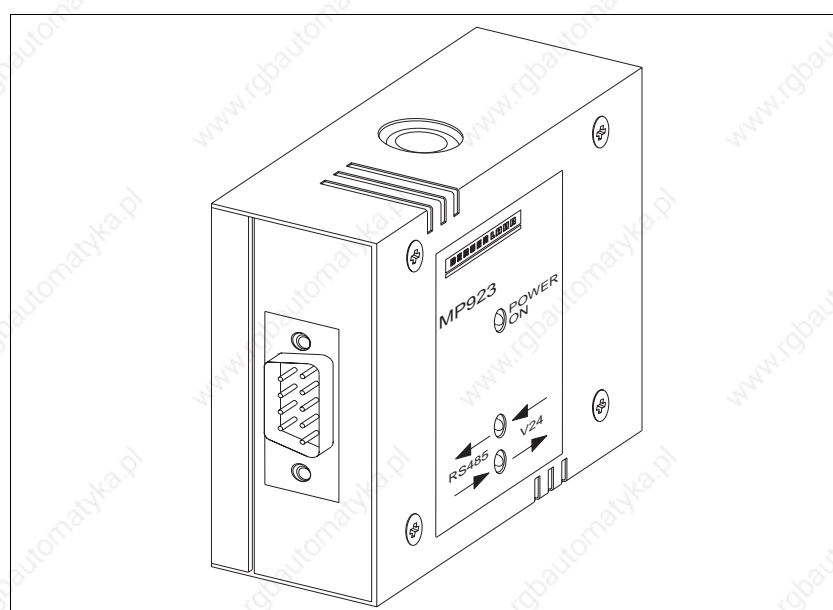


Fig. 6-3 MP 923 interface converter

## Appendix

### 6.2.2.3 Setup



#### 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.

### 6.2.2.4 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 (TXD) and RXD (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)



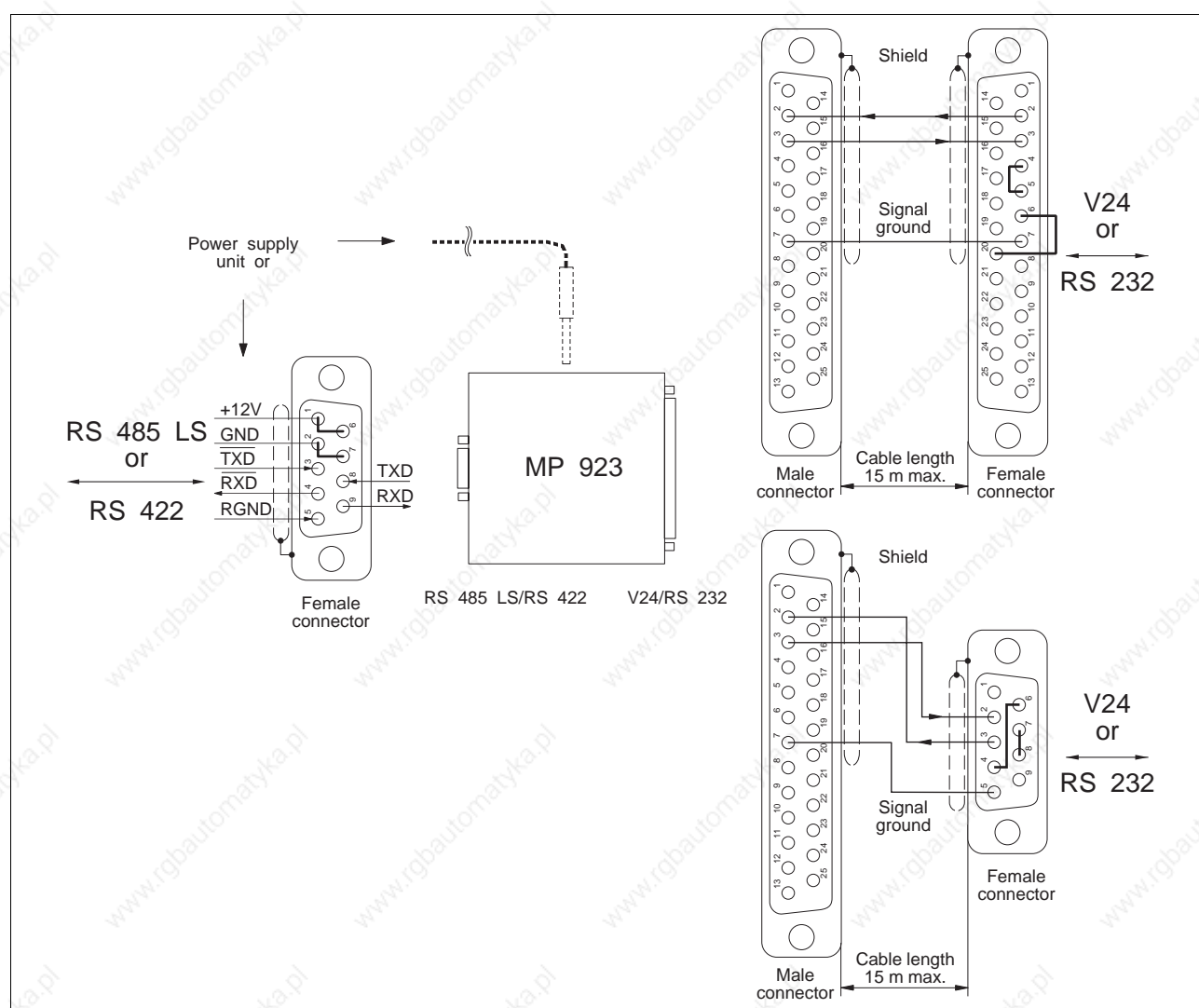


Fig. 6-4 MP 923 interface converter wiring

6.2.3 MP 924 interface distributor

**6.2.3.1 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.

<b>6.2.3.2 Technical data</b>	<b>Electrical data</b>	
	10 serial interfaces	RS 485 LS (RS 422)
	<b>Mechanical data</b>	
	Dimensions	approx. 205 x 80 x 32 mm
	Weight	approx. 260 g
<b>Ambient conditions</b>		
	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	

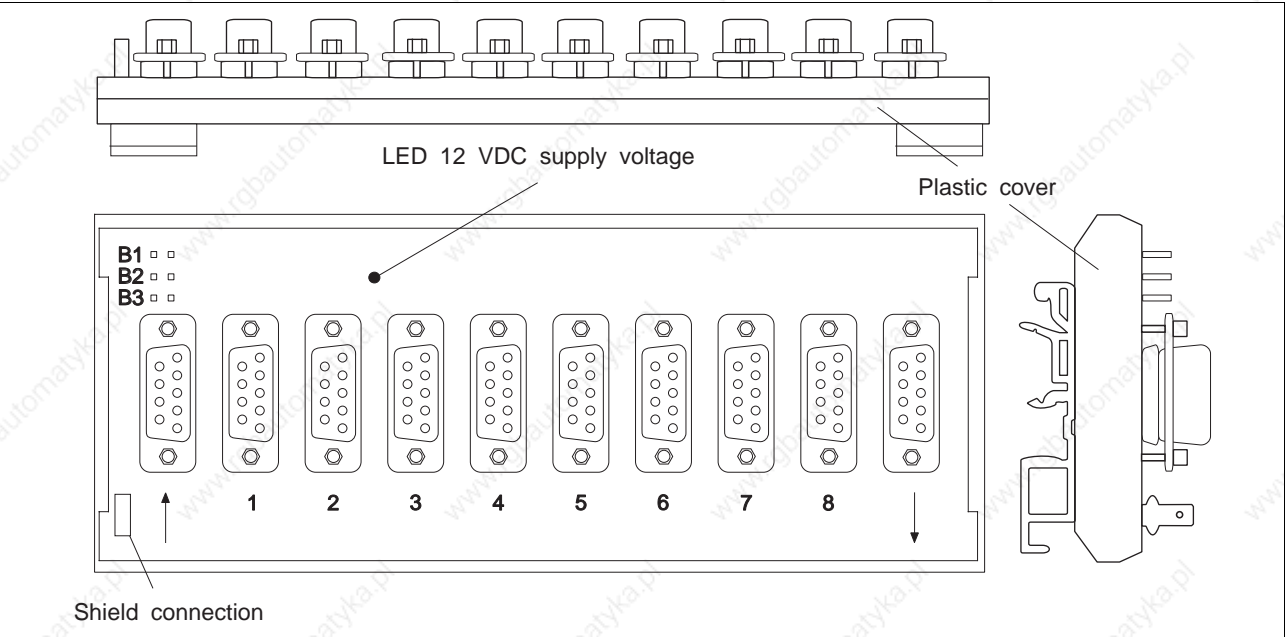


Fig. 6-5 MP 924 interface distributor

### 6.2.3.3 Setup

1. Wire the MP 924 interface distributor in accordance with fig. 6-6. For interface conversion RS 232 ↔ RS 485 LS (RS 422), use the MP 923 interface converter (see chapter 6.2.2).



#### **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. 6-6.

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.***

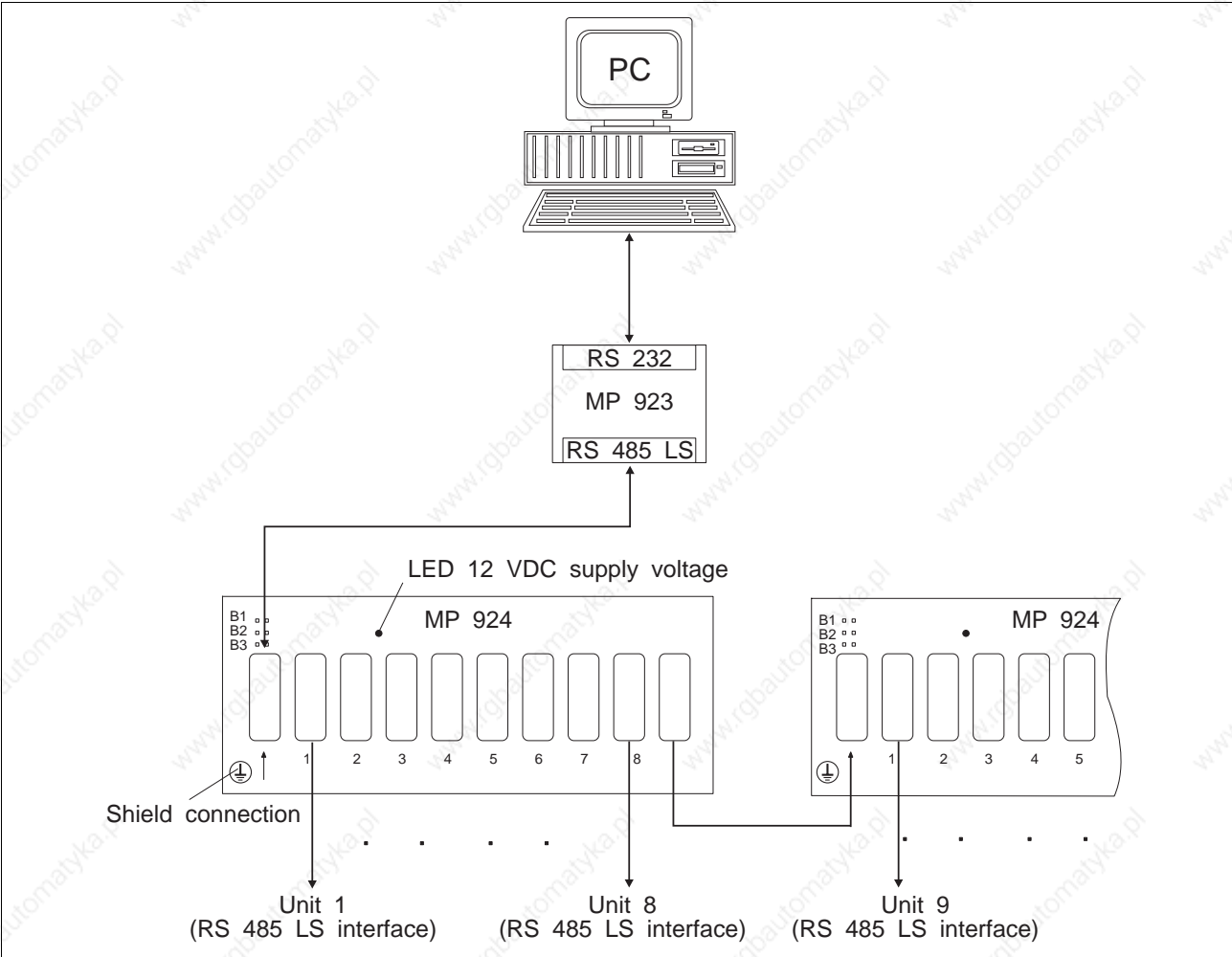


Fig. 6-6 MP 924 interface distributor wiring

6.2.4 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.

## 6.3 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.

### *Controller configuration*

The controller configuration describes the type and the hardware components of the controller which is to execute the program. This enables the programming system to check the compatibility of program and controller.

### *CW (clockwise) rotation, positive direction*

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

### *Electronic gear*

Externally supplied pulses are counted as A/B encoder signals or pulse/direction signals and multiplied with a gear ratio. These pulses are used as the reference variable for stepping motor positioning.

### *Encoder*

Sensor for motor position detection (actual position detection) or for set value presetting for an electronic gear.

### *Encoder signals A/B*

Pulse signals of an encoder. For one motor revolution, a defined number of pulse signals (e.g. 1000) is generated by the encoder. The encoder signals are subjected to single, double or quadruple evaluation.

### *Error class*

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

### *Error memory*

Runtime errors are written to the controller's error memory and indicated in the controller's status display. A maximum of 16 errors can be stored in the controller error memory (the first 8 and the last 8 errors occurred).

### *Gear ratio*

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

### *Indexer (movement profile generator)*

An electrical module or software which generates signals for controlling a motor from the acceleration, speed and travel (position) parameters.

### *Input/output*

The controller is provided with a certain number of inputs and outputs through which sequential operations are controlled.

### *Interpolation*

Simultaneous co-ordinated movement of several axes (at least two) along a straight line (linear interpolation), a circular arc (circular interpolation) or any curve (spline interpolation).

### *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.

### *Power control card*

An electronic card for controlling the motor.

### *Pulse/direction signal*

Signals for reference variable input for an electronic gear.

### *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
HU	Height unit
I	Input
LED	Light Emitting Diode
M	Motor
PC	Personal Computer
PELV	Protected Extra Low Voltage
PLC	Programmable Logic Controller
Q	Output

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### **8 Corrections and additions**

At present there are no corrections or additions.

**Corrections and additions**

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