

Wall-mounted
positioning unit
with power unit for
5-phase stepping motors

WDP5-118

Doc. no. 212.844/DGB 09.92

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Edition: c008 Sept. 92

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 in this manual in chapter "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. BERGER LAHR offers training courses.
- 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 address is to be found on the rear cover.
- 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.

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**Proposals
Improvements**

WDP5-118

Edition: c008 Sept. 92
Doc. no.: 212.844/DGB 09.92

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Please inform us, using this form, if you have discovered any printing errors when reading this document.

We should also appreciate any new ideas and proposals.

Proposals and/or improvements:

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1 General description

1.1 Structure and characteristics

The wall-mounted WDP5-118 positioning unit (fig. 1-1) is used to control 5-phase stepping motors moving along predefined paths with high positioning accuracy and at an exactly defined speed. One unit controls one axle.

The different operating modes allow various control configurations. The positioning units may be incorporated in a complex control system in a very versatile way.

A maximum of 124 positioning units (124 axles) may be operated with a PC via a network.

The unit is designed for wall-mounting in a control cabinet.

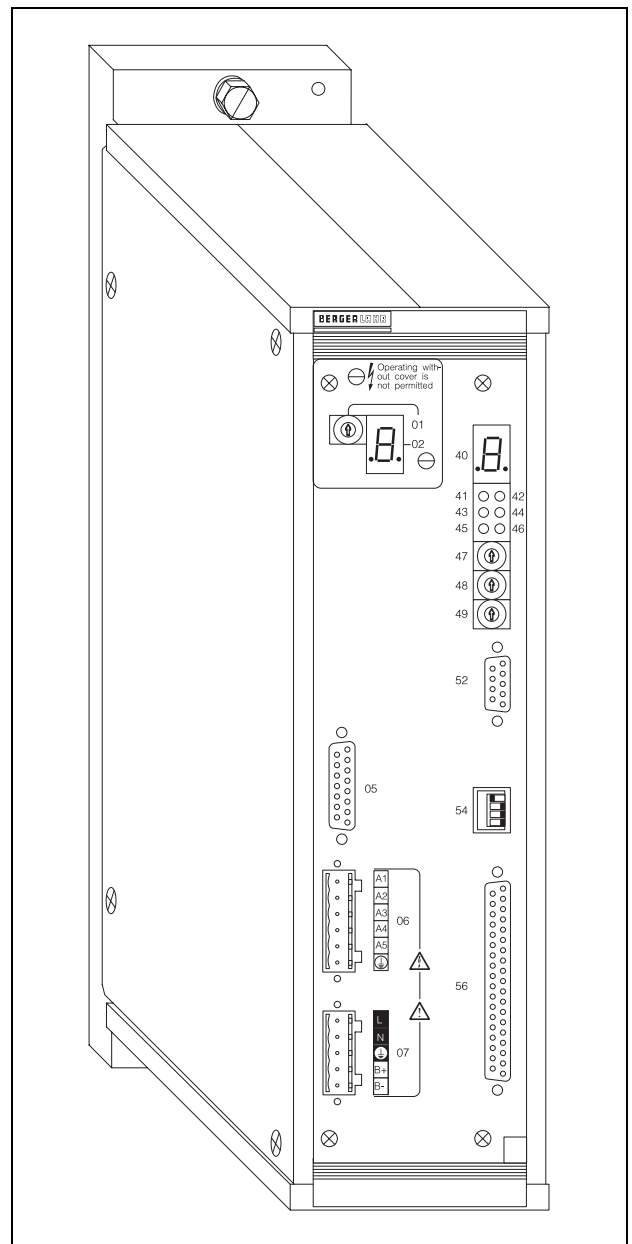


Fig. 1-1 WDP5-118 positioning unit

General description

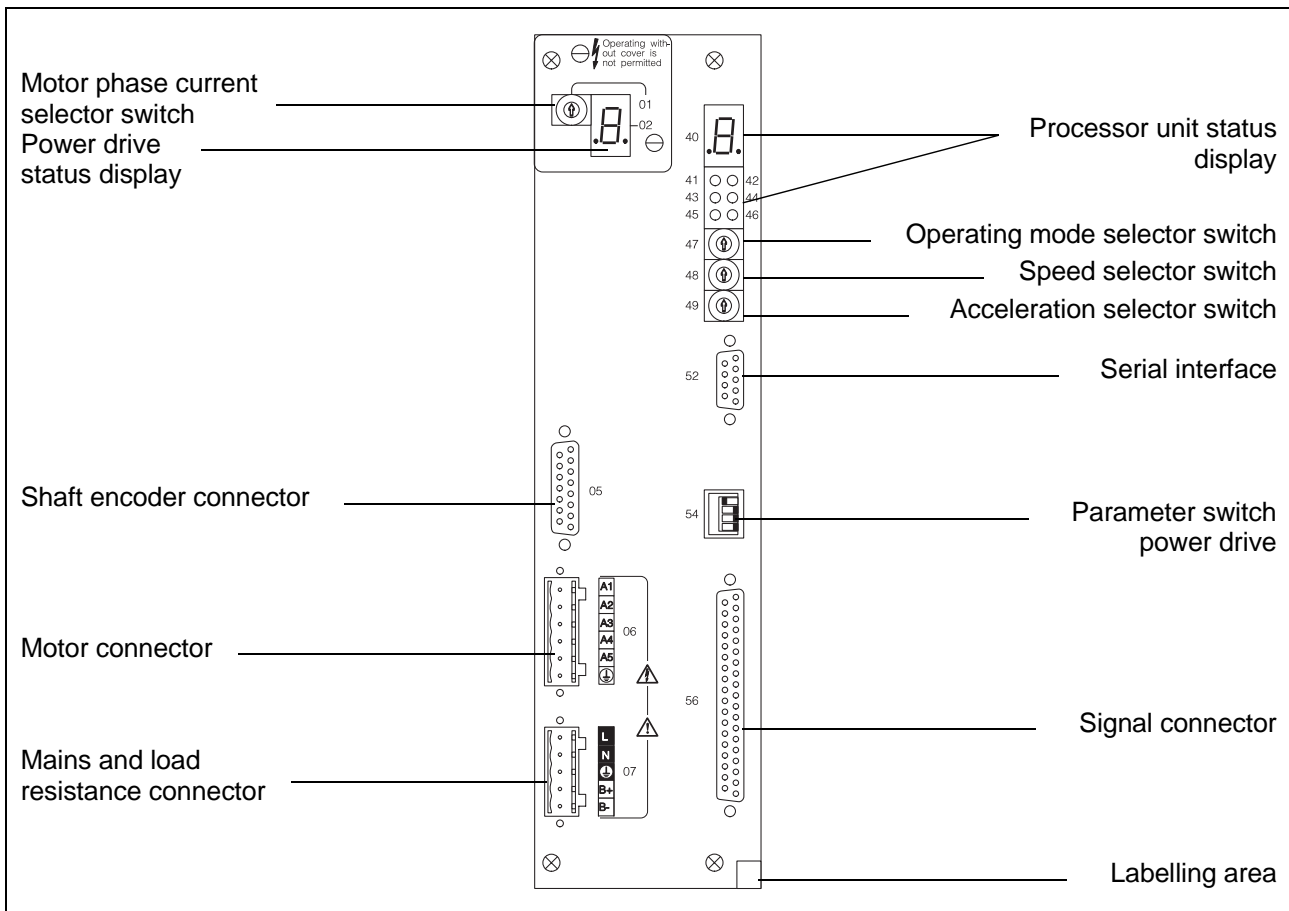


Fig. 1-2 WDP5-118 front panel

The following operating elements and displays are disposed on the front panel (fig. 1-2):

Motor phase current selector switch (01)
for setting the motor phase current

Power drive status display (02)
Seven-segment display for indication
of operating status and malfunctions

Shaft encoder connector (05)
for rotation monitoring

Motor connector (06)
for a wall-mounted 5-phase stepping motor

Mains and load resistance connector (07)
for supplying the power drive
and an external load resistor with voltage

Processor unit status displays (40 to 46)
Seven-segment display and LEDs for indication
of operating status and malfunctions

Operating mode selector switch (47)
for setting the operating modes

Speed selector switch (48)
for setting the frequency and network address

Acceleration selector switch (49)
for setting acceleration and network
address

RS 485 serial interface (52)
for data transfer of movement and setting
values

Power drive parameter switch (54)
for setting the rotation monitoring, step angle,
sense of rotation and power drive enable
functions

Signal connector (56)
for signal inputs and outputs and voltage
supply of the processor unit

Labelling area
for the mounting location number

1.2 Purpose

The wall-mounted WDP5-118 positioning unit is used to control 5-phase stepping motors (see 5-phase stepping motor catalogue, doc. no. 371). The unit can be employed as a drive unit in various applications.

Depending on the application, one of the operating modes described in chapter 1.3.3 can be set at the unit.

The unit is designed for wall-mounting in a control cabinet.

1.2.1 System configuration possibilities

Depending on the selected operating mode, the WDP5-118 positioning unit may be incorporated in a system in the following ways.

1.2.1.1 Storage mode

In storage mode (fig. 1-3), stored programs are selected and processed by a PLC or relay controller. Programming is effected with the MP 922 handheld programming unit (see MP 922 documentation) or a PC (see network mode).

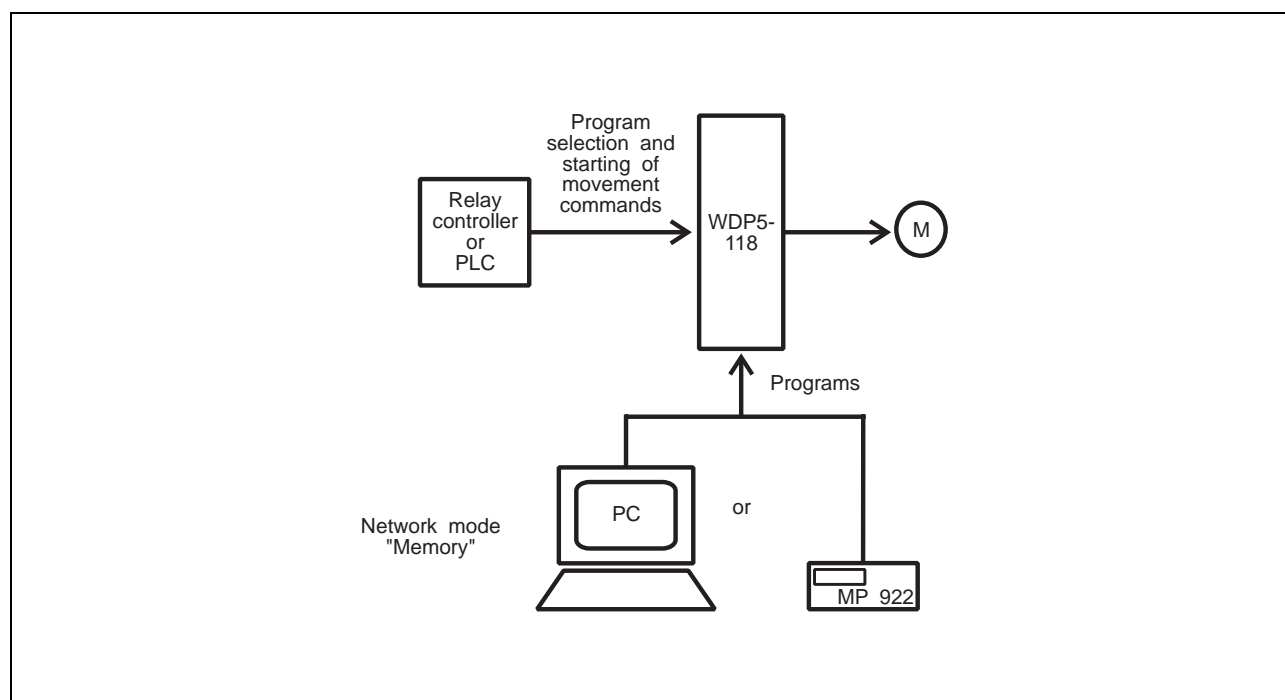


Fig. 1-3 Storage mode

General description

1.2.1.2 Serial mode

In serial mode (fig. 1-4), the individual movement commands are transferred serially and initiated via a PC or terminal (see also network mode).

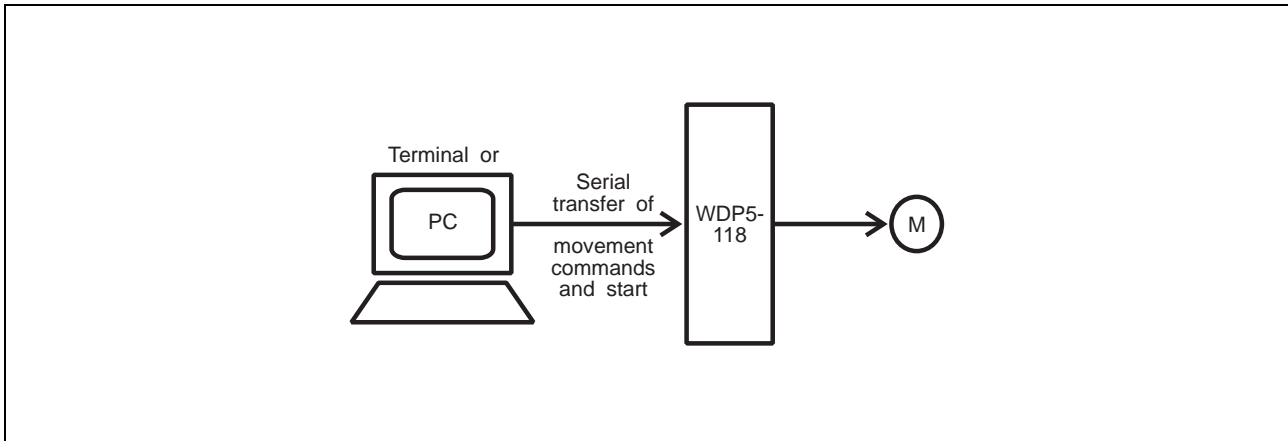


Fig. 1-4 Serial data transfer

1.2.1.3 Parallel mode

In parallel mode (fig. 1-5 and 1-6), the individual movement commands are transferred in parallel and initiated with a PLC or relay controller. The MP 940 decade switch interface can be used to enter the movement commands from a block of 8 decade switches.

A maximum of 16 decade switch interfaces can be connected.

Parameters can be modified, inputs tested or the position displayed with the MP 922 hand-held programming unit or a PC (see network mode).

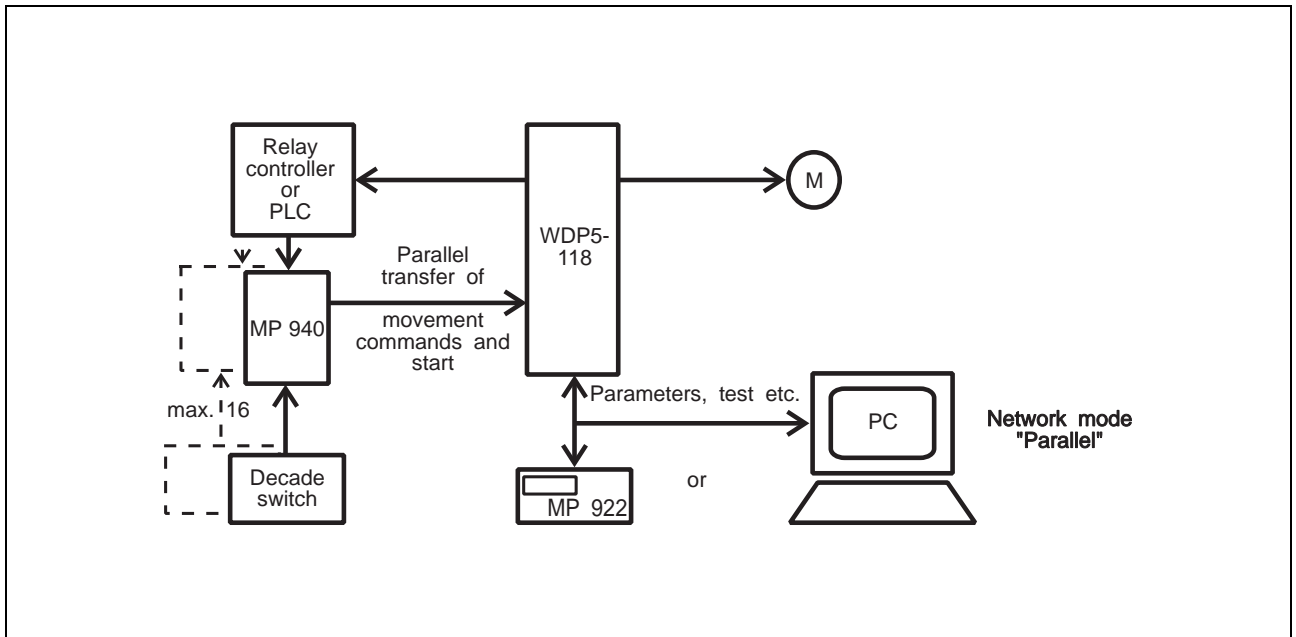


Fig. 1-5 Parallel data transfer with MP 940

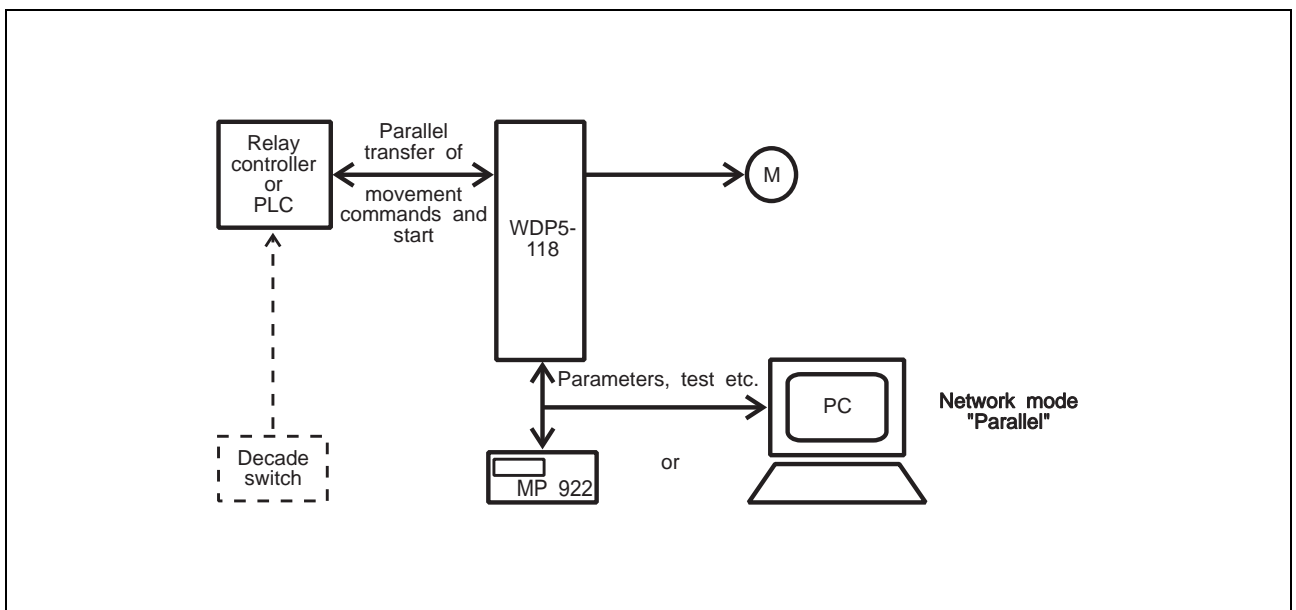


Fig. 1-6 Parallel data transfer without MP 940

General description

1.2.1.4 Network mode

In network mode (fig. 1-7), a maximum of 124 WDP5-118 units may be operated via a PC provided that 4 serial ports for 31 systems each are available.

For this, the PRO-SDP/PC1 software must be installed on the PC. The operating modes "Memory" (storage mode), "Serial" (serial mode) and "Parallel" (parallel mode) are provided. In network mode, the operating modes are selected on a PC.



NOTE

Programs and unit parameters can be written on the PC and loaded into one or several WDP5-118 units at a later time (off-line programming).

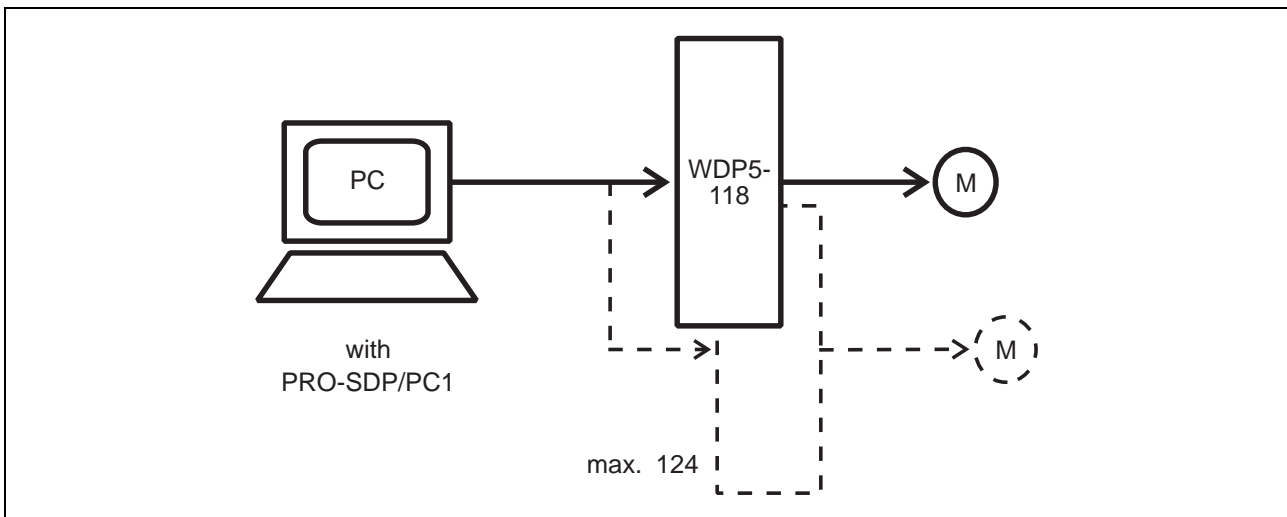


Fig. 1-7 Network

1.3 Function

1.3.1 Hardware components

Two pc-boards with a size of 6 HU in eurocard format accomodating the power electronic system and microprocessor control functions are installed in the unit. The most important function blocks of the unit are evident in the block circuit diagram (fig. 1-8):

The **signal interface** is used for opto-isolation of the input and output signals between the external controller and the internal electronic system.

A **DC/DC power supply unit** generates the different internal electronic operating voltages.

The **serial interface** allows connection to external programming and control units.

The **management processor** coordinates the movement commands as well as the input and output functions. A maximum of 16 programs are managed here in storage mode ("Memory").

The **status displays** and **selector block** communicate with the management processor. The operating mode, movement frequency, acceleration and network address are set at the selector switches. A seven-segment display indicates malfunctions.

The **indexer** calculates the movement commands based on the current parameter values. The resulting pulse sequence with the start and acceleration ramp is output to the power drive of the stepping motor.

The **power supply unit** is a sophisticated AC/DC converter. It must be supplied with a 230 VAC or 115 VAC voltage. The energy generated by the stepping motor when braking can be intermediately stored here up to a certain extent. An external **load resistor** must be connected for reducing surplus braking energy.

The **power drive** transfers the energy supplied by the mains module to the connected stepping motor in a suitable way. The selector switch is used for setting the motor phase current. A shaft encoder possibly provided in the motor for rotation monitoring can be evaluated. A seven-segment display indicates malfunctions.

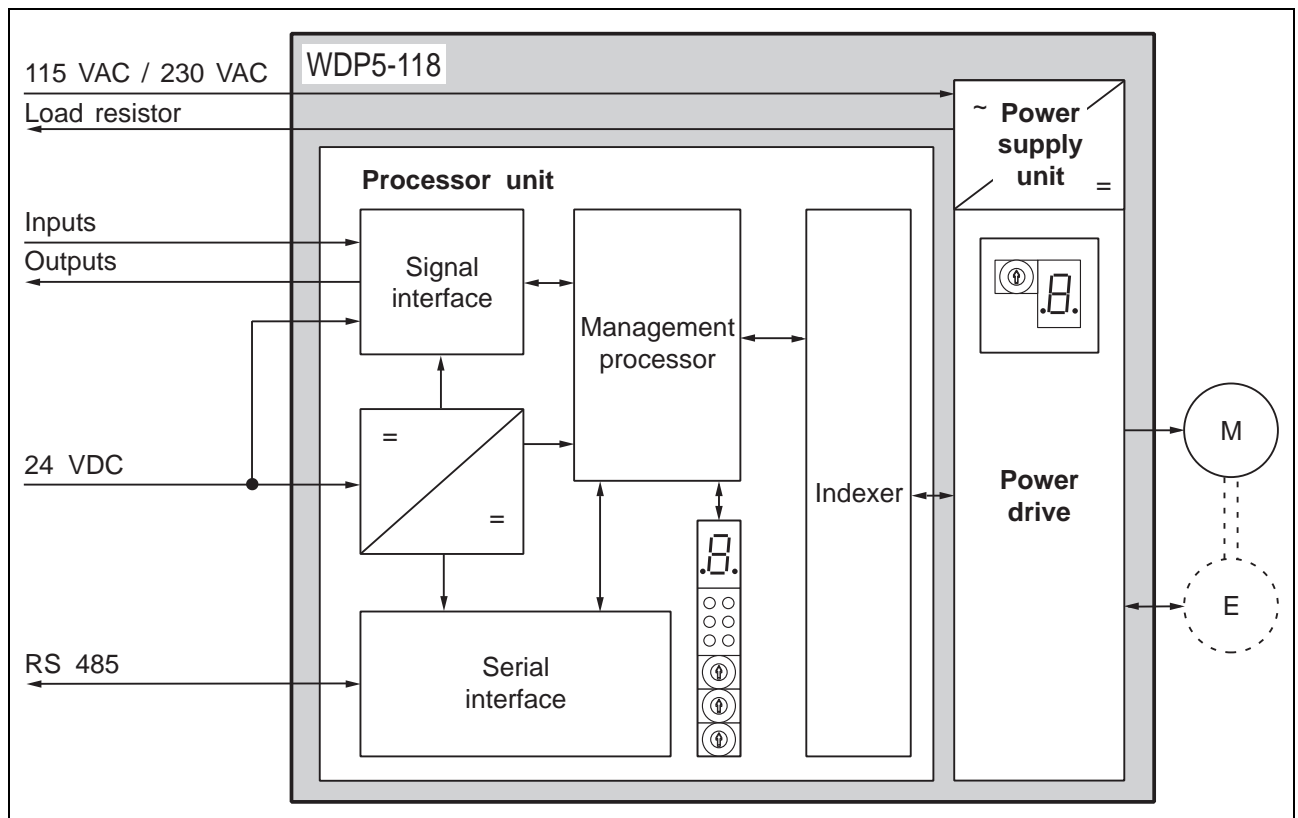


Fig. 1-8 Block circuit diagram

General description

1.3.2 Rotation monitoring

The rotation monitoring unit consists of a shaft encoder and the electronic evaluation system. The shaft encoder with 500 pulses/revolution is incorporated in the stepping motor.

The pulses issued by the shaft encoder are transferred from the stepping motor to the positioning unit via the shaft encoder connector.

The rotation monitoring unit permanently compares the set and actual positions during operation. The status display of the processor unit signals a rotation monitoring error, if the difference between the set and actual position exceeds the permissible limit value (motor disengages).

1.3.3 Operating modes

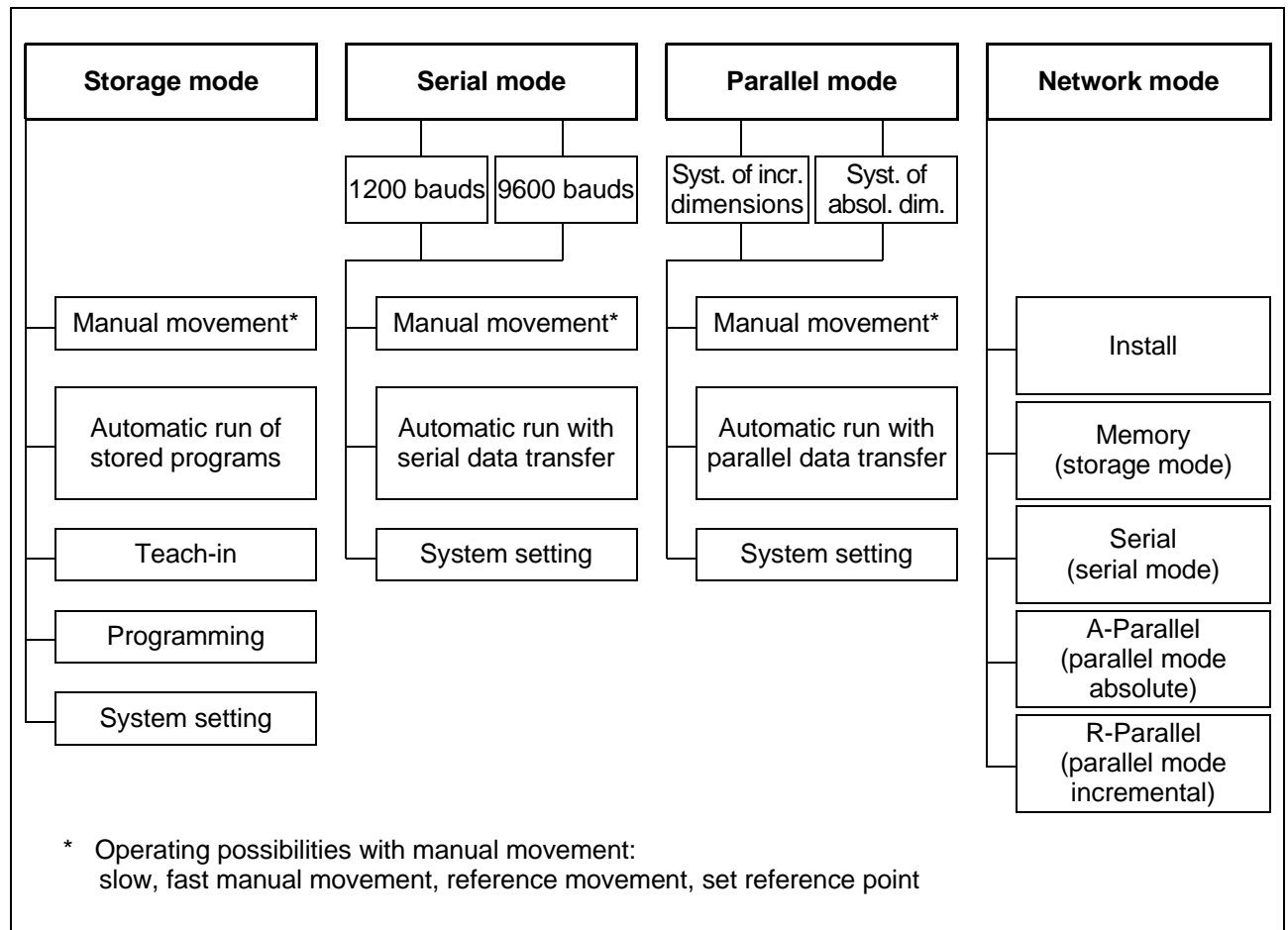


Fig. 1-9 Operating modes

Four operating modes are available with the WDP5-118 unit depending on the system configuration (fig. 1-9):

Storage mode

In storage mode, movement commands are stored and processed in the positioning unit.

The speeds "manual movement slow" and "manual movement fast" are possible. The motor will rotate at "manual frequency slow" or "manual frequency fast" as long as the input condition is fulfilled.

The manual reference movements serve to synchronize the mechanical zero point with the zero reference point of the positioning unit.

A reference point can be determined as a reference value for the system of dimensions.

In teach-in mode, the positions approached manually are stored as movement commands and executed automatically.

In automatic mode, the stored programs are executed in the WDP5-118. A maximum of 16 programs with approx. 1000 movement commands are possible. The individual programs are selected and the movement commands started via parallel signal inputs and outputs.

Programming and system setting is effected with the MP 922 hand-held programming unit or a PC equipped with the PRO-SDP/PC1 software. The latter permits the display of positions, display and modification of parameters, testing of inputs and outputs as well as management and printing of programs.

General description

Serial mode

The individual movement commands are transferred and started via the serial interface in serial mode.

The instructions are transferred to the positioning controller in ASCII format 7 bits, even parity bit and one stop bit. The transmission speed is 1200 or 9600 bauds.

Positioning is effected with absolute or incremental dimensions.

The speeds "manual movement slow" and "manual movement fast" are possible. The motor will rotate at "manual frequency slow" or "manual frequency fast" as long as the input condition is fulfilled.

The manual reference movements serve to synchronize the mechanical zero point with the zero reference point of the positioning unit.

In automatic mode, the individual movement commands are transferred serially and initiated.

System setting is effected with the PC. It permits displaying and modifying parameters, testing inputs and outputs, etc.

Parallel mode

In parallel mode, the individual movement commands are transferred and started via parallel inputs.

Positioning is effected with absolute or incremental dimensions.

The speeds "manual movement slow" and "manual movement fast" are possible. The motor will rotate at "manual frequency slow" or "manual frequency fast" as long as the input condition is fulfilled.

The manual reference movements serve to synchronize the mechanical zero point with the zero reference point of the positioning unit.

In automatic run, the individual movement commands are transferred in parallel and initiated.

The system setting allows displaying and modifying parameters, testing inputs and displaying positions.

Network mode

The operating modes "Memory" (storage mode), "Serial" (serial mode) and "Parallel" (parallel mode) are supported in network mode.

Programming and control is effected with the PRO-SDP/PC1 software.

Programming can be performed independently of the executing system, i.e. off-line. Operating mode setting and operation is effected via a PC. The transmission speed is 9600 bauds or 38.4 kbauds. The programs are saved and archived on hard disk or disk.

1.4 Technical data

1.4.1 Electrical data

1.4.1.1 Mains connection

Supply voltage, adaptable	115 VAC -20%/+15% 230 VAC -20%/+15%
Starting current	30 A
Fuse	6.3 A, slow-blow
Frequency	50 to 60 Hz
Power consumption	max. 1600 VA
Power loss	max. 120 W

1.4.1.2 Motor connection

Protected in case of short-circuit between motor phases	
Maximum cable length	
without motor cable filter	50 m
with motor cable filter	100 m
Wire cross-section	0.75 mm ²
Shield connection	on both sides
Motor voltage	325 VDC
Phase current in 16 steps	0.75 to 4.5 A

1.4.1.3 Further supply voltages

Processor unit

Supply voltage pitüit	24 VDC
Min. operating voltage (in the unit)	20 VDC
Max. operating voltage (in the unit)	30 VDC
Power consumption	max. 500 mA
Ripple voltage	< 500 mV _{SS}

Serial interface

4-wire RS 485 interface	
Supply voltage output	12 VDC
Min. operating voltage (in the unit)	9 VDC
Max. operating voltage (in the unit)	18 VDC
Power output	max. 150 mA

1.4.1.4 Shaft encoder connection

Maximum cable length	100 m
Wire cross-section	2 x 0.5/10 x 0.25 mm ²
Shield connection	on both sides

1.4.1.5 Signal connection

Maximum cable length	100 m
Wire cross-section	0.25 mm ²
Shield connection	on both sides

Electrical properties of the inputs

Opto-isolated, polarity reversal protection	
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	4 V

Electrical properties of the outputs

Opto-isolated, polarity reversal protection, inductive loadability, short-circuit protection	
Maximum voltage	30 V
Maximum switching current	400 mA
Voltage drop at 400 mA	2 V

General description

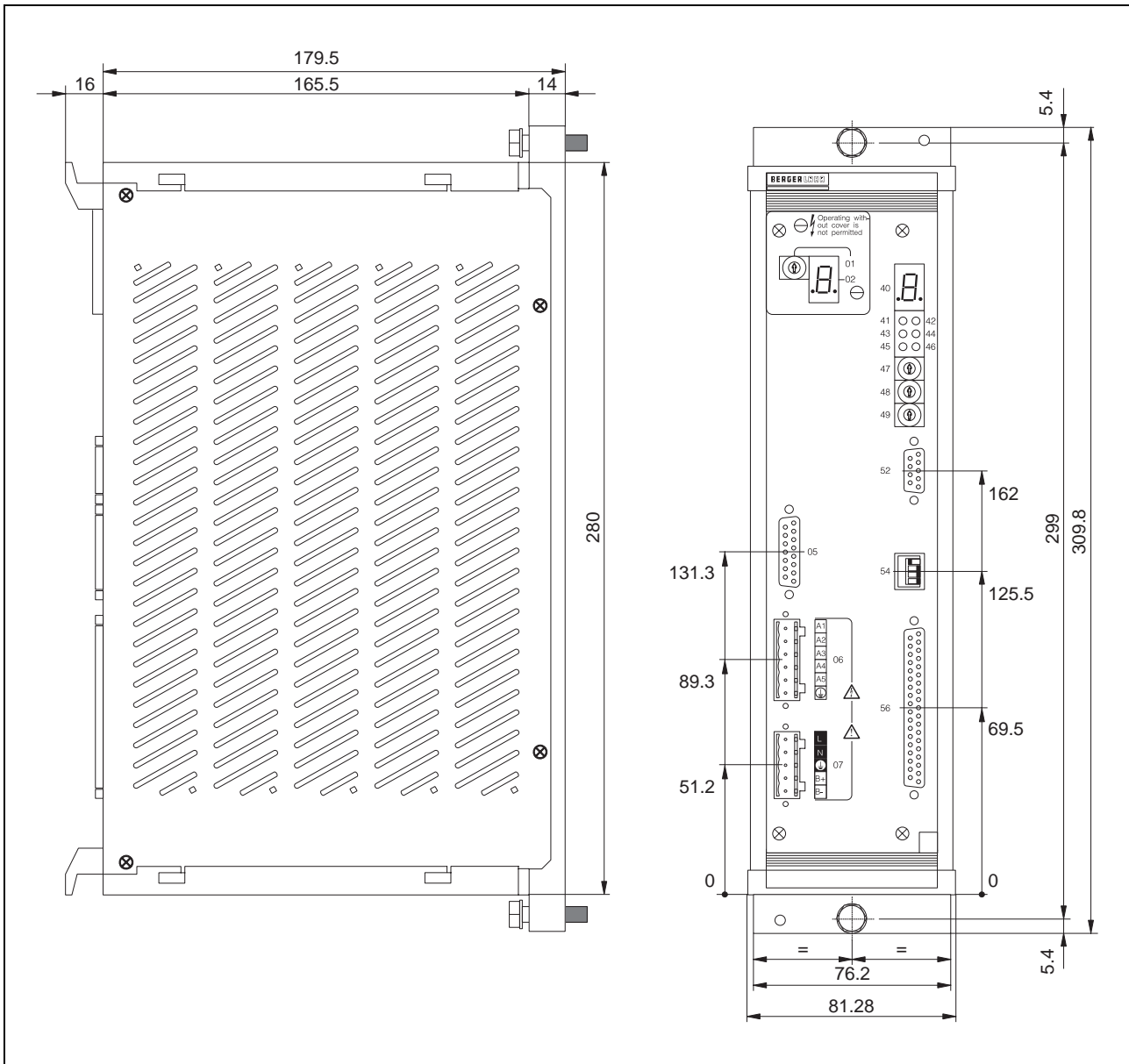


Fig. 1-10 WDP5-118 dimensions

1.4.1.6 Device protection

Type of protection	IP 20 in accordance with DIN 40050/IEC 529
Class of protection	1
Protective circuits	Overtemperature detection Short-circuit monitoring Undervoltage and overvoltage detection



ATTENTION
Separation of the signal inputs
and 24 VDC supply voltages at
the signal connector from the
mains must be ensured. The max.
voltage to ground must not exceed
60 VDC.

1.4.2 Mechanical data

Dimensions		see fig. 1-10
Weight	without heat sink	approx. 3.3 kg
	with heat sink	approx. 6.9 kg

1.4.3 Environmental conditions

Ambient temperature		0°C to 50°C
Storage temperature		-25°C to +70°C
Humidity class		F acc. to DIN 40040
Radio interference suppression when using additional power or motor cable filters (see accessories)		acc. to VDE 0871-B
Overvoltage protection		acc. to VDE 0160 class 2
Noise immunity		acc. to VDE 0843/IEC 801

General description

2 Installation

2.1 Delivered items

The delivery must be checked for completeness.

The delivered items include (fig. 2-1):

Qty.	Designation
1	WDP5-118.XX
1	Connector shell – mains connector
1	Connector shell – motor connector
1	Heat transfer compound
1	WDP5-118 documentation

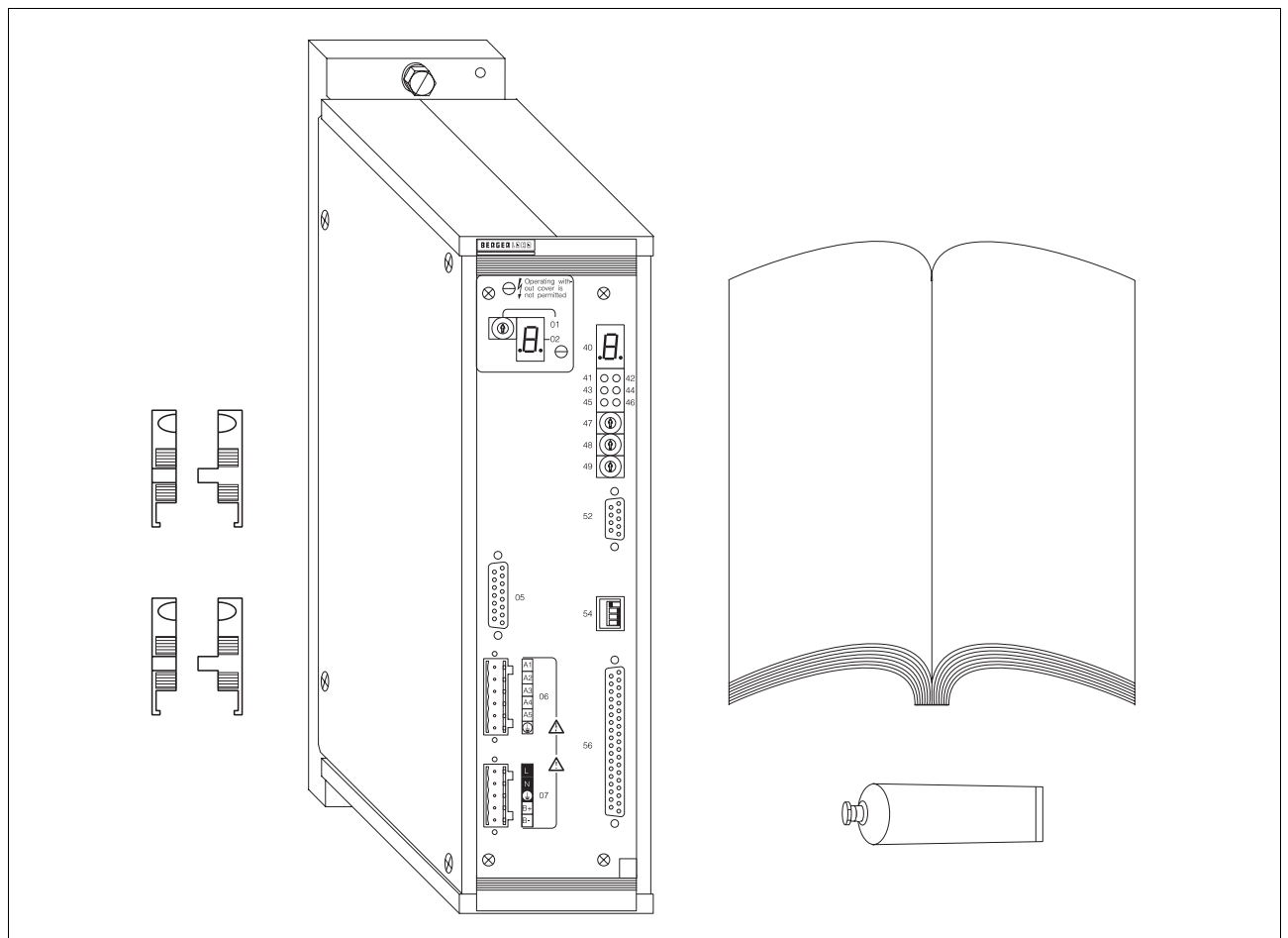


Fig. 2-1 Delivered items

Installation

2.2 Accessories

The following accessories (see chapter 6.2) must be ordered separately:

Designation	Order number
D 690 interface tester	62010690006
D 731 terminal adapter	62010731006
Heat sink	62500901000
Interface cable, male/female	see appendix
Interface cable, male/male	see appendix
Load resistor	62501100600
Mains filter	62501100200
ML 52 decade switch block	62300052000
Motor cable	see appendix
Motor cable filter	62501100100
MP 922 hand-held programming unit	62020922000
MP 923 interface converter (RS 485/RS 232)	62020923000
MP 924 interface distributor	62020924006
MP 940 decade switch interface	62020940000
PRO-SDP/PC1 software (version 2.01 or higher)	61700023010
Shaft encoder cable	see appendix
Signal cable	see appendix
Stepping motor	see catalogue doc. no. 371
Terminal program BTERM	61700040610
Ventilator set	62501201000
WDP5-118 set of connectors	62501000200

2.3 Mounting

The unit must be installed in a control cabinet and externally ventilated. The mounting panel should be heat-conducting and have a smooth mounting surface as heat losses of the unit are dissipated via the mounting flange.

The maximum power loss of the unit is 120 W.



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



NOTE
In case of insufficient heat dissipation, a heat sink and a ventilator set may be installed additionally, see chapter 6.2.7 and 6.2.8.

Proper temperature conditions can be achieved with the heat sinks and ventilators recommended by BERGER LAHR. If other solutions are used, temperature measurement must be effected by the user. The maximum permissible temperature at the mounting flange and the power loss is evident in fig. 2-2.

A fork wrench is required for mounting the unit, further special tools are not required.

1. Drill two holes in the mounting panel, dimensions see fig. 1-10.
2. Apply heat transfer compound between the rear panel and mounting panel.
3. Fasten the unit with two M6 screws.



NOTE
For combined units, take the distances between centre lines into account; see table (dimensions given in mm).

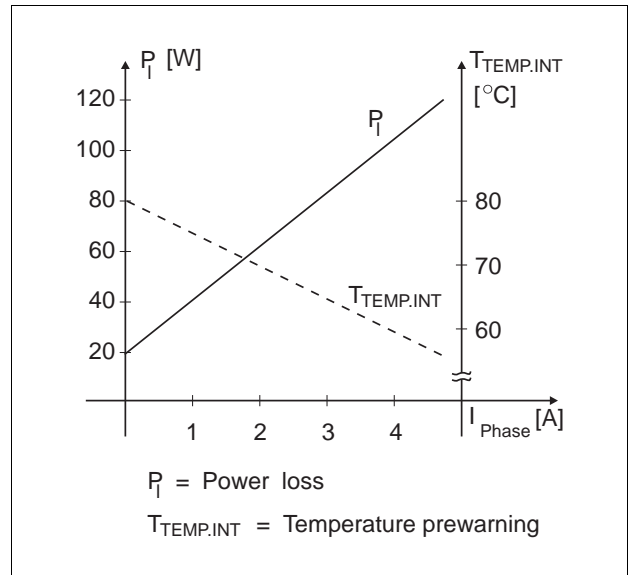


Fig. 2-2 Power loss diagramm

Distances between centre lines (mm) when using combined units	WD5-008	WDP5-118	WDP5-228	WDP5-318	WP-111	WP-231	WP-311
WD5-008	87	87	87	87	74	74	74
WDP5-118	87	87	87	87	74	74	74
WDP5-228	87	87	87	87	74	74	74
WDP5-318	87	87	87	87	74	74	74
WP-111	74	74	74	74	61	61	61
WP-231	74	74	74	74	61	61	61
WP-311	74	74	74	74	61	61	61



NOTE
The mounting procedure with heat sink and ventilator set is described in chapters 6.2.7 and 6.2.8.

Installation

2.4 Cabling



ATTENTION
Cabling may only be performed in accordance with VDE 0105 by specially trained personnel.




ATTENTION
The mains connector must be unplugged every time cabling is performed.



ATTENTION
Lay power, motor and signal cables in different ducts.

2.4.1 Mains connection

1. Loosen screws and remove mains connector (fig. 2-3).
2. Provide the power cable connector with wire end ferrules.
3. Fasten three litz wires with screws:

L	Phase (115 or 230 VAC)
N	Neutral
	Protective conductor
4. Screw cable to connector shell.
5. Put the two halves of the connector shell together.
6. Fasten the connector on the front panel (item 07).

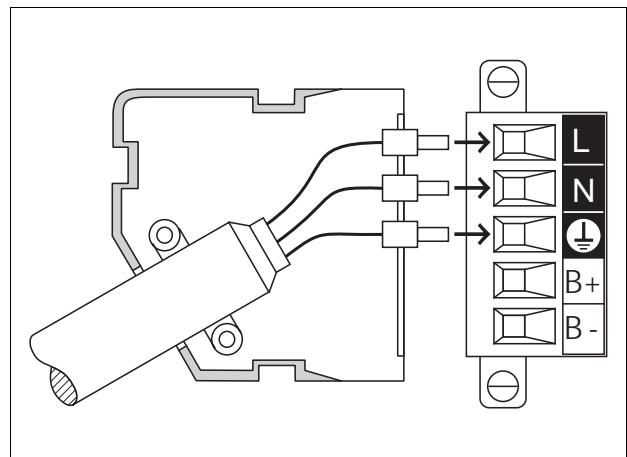


Fig. 2-3 Mains connection – unit side



ATTENTION
The mains connector must neither be plugged in, nor the supply voltages switched on.



NOTE
A mains filter can be inserted to avoid interference, see chapter 6.2.11.



NOTE
A load resistor must be connected to B+/B-, if status display "4" of the power drive lights up when braking in operation, see chapter 6.2.1.

2.4.2 Motor connection

1. Loosen screws and remove motor connector (fig. 2-4).
2. Provide motor cable connector with wire end ferrules.
3. Fasten six litz wires with screws:

Unit side	Wire	Motor side
A1	yellow	Connector 1
A2	blue	Connector 2
A3	pink	Connector 3
A4	grey	Connector 4
A5	brown	Connector 5
⊕		Shield connector

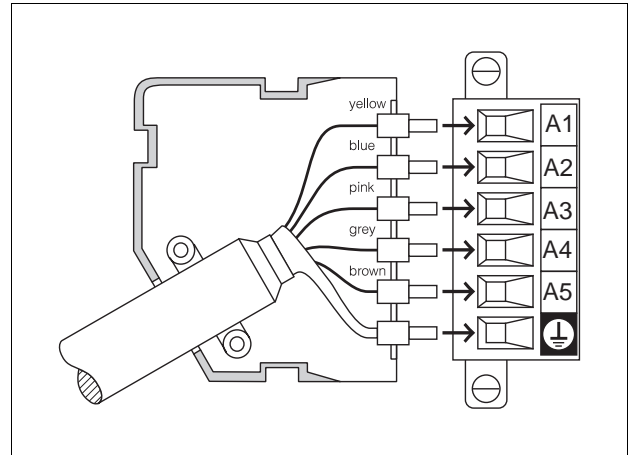


Fig. 2-4 Motor connector – unit side



ATTENTION
The cable must be screened on both sides.

4. Put the two halves of the connector shell together.
5. Fasten the connector on the front panel (item 06).



NOTE
A motor cable filter must be inserted in case of cables exceeding 50 m in length, see chapter 6.2.10.

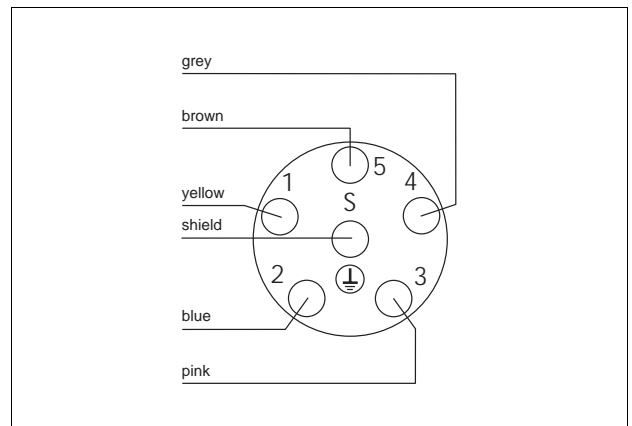


Fig. 2-5 Motor connector – motor side

Installation

2.4.3 Shaft encoder connection

1. Solder the litz wires to the connector according to fig. 2-6.
2. Push the shield back and fasten with cable tie.
3. Screw two hexagon head bolts (fig. 2-7) into the connector shell.
4. Put connector into connector shell.
5. Fasten cable and shield to the connector shell without strain.



ATTENTION

There must be a good electrical connection between the shield and the connector shell. The cable must be screened on both sides.

6. Insert two caps in unused cable entries.
7. Fix the two halves of the connector shell with two screws.
8. Fasten the connector on the front panel (item 05) with screws.
9. The litz wires of the shaft encoder cable must be twisted in pairs in accordance with fig. 2-8. Litz wires 7-9 and 8-10 must be connected on the motor side.
10. Establish the connection on the motor side.

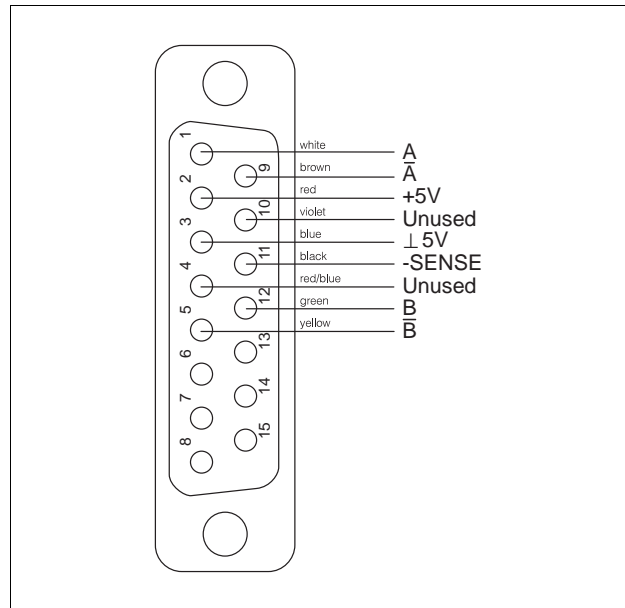


Fig. 2-6 Shaft encoder connection – unit side

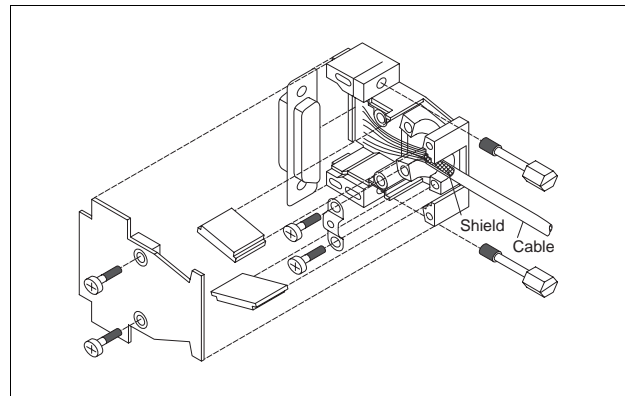


Fig. 2-7 Shaft encoder connector assembly – unit side

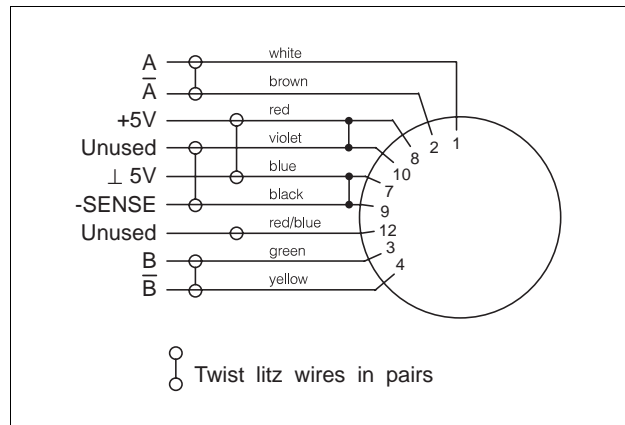


Fig. 2-8 Shaft encoder connection – motor side

2.4.4 Signal connection

1. Solder the litz wires to the connector in accordance with chapters 2.4.4.1 to 2.4.4.4 depending on the operating mode.



ATTENTION
Free, unassigned pins must not be wired.

2. Push the shield back and fix with cable tie.
3. Screw two hexagon head bolts (fig. 2-9) into the connector shell.
4. Put the connector into the connector shell.
5. Fasten the cable and shield to the connector shell without strain.



ATTENTION
A good electrical connection must be established between the shield and the connector shell.
Screen the cable on both sides.

6. Insert two caps in unused cable entries.
7. Fix the two halves of the connector shell with two screws.
8. Fasten the connector on the front panel (item 56).



ATTENTION
Separation of all signal connections from the mains must be ensured. The voltage to ground must not exceed 60 VDC. All signal circuits are connected to ground via a 1 Mohm leakage resistor.

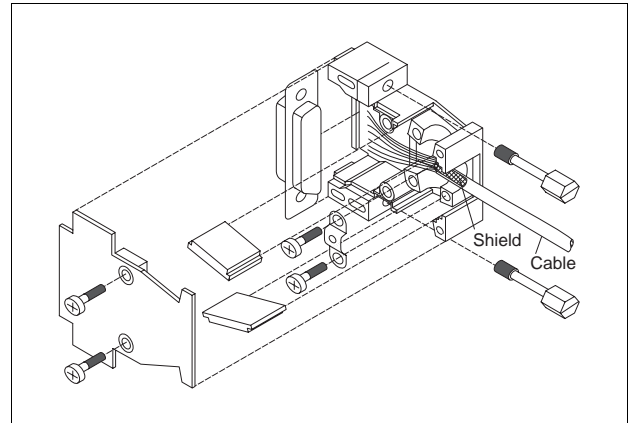


Fig. 2-9 Signal connector assembly – unit side

Installation

2.4.4.1 Signal connection in storage mode

Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	START	Start	←
5	LOAD	Store position	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	MAN.X-	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	DATA4	Program number 2^2	←
10	DATA1	Program number 2^0	←
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	RS/CL.A.	Program start	←
25	AUTOM	Automatic operation	←
26	MAN.X+	Manual movement, CW rotation	←
27	MAN.REF.	Manual reference movement	←
28	DATA8	Program number 2^3	←
29	DATA2	Program number 2^1	←
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	$\overline{\text{END/L.A.}}$	Program end	→
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

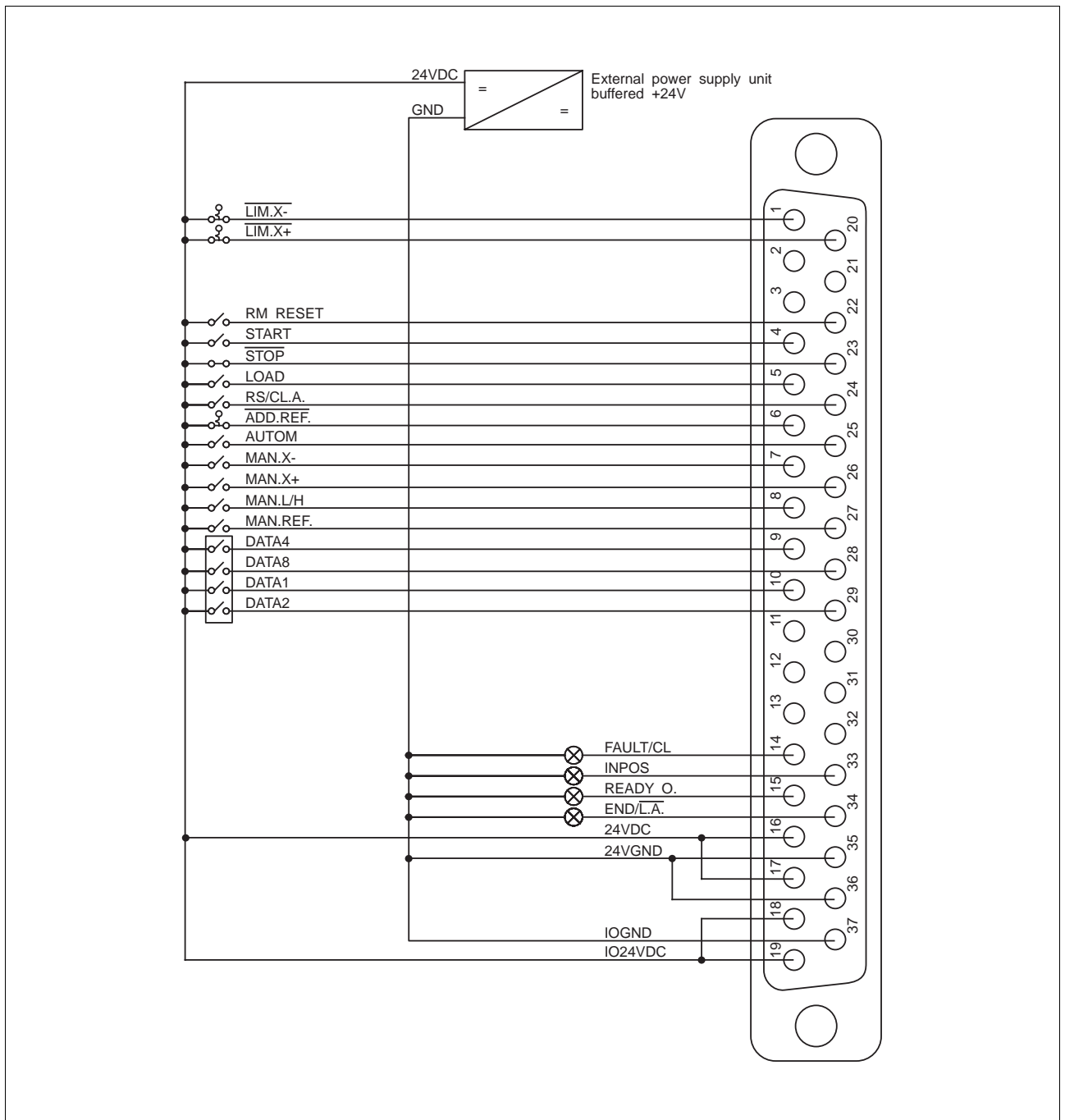


Fig. 2-10 Example of wiring for storage mode

Installation

2.4.4.2 Signal connection in serial mode

Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	-	-	
5	LOAD	Store position	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	MAN.X-	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	-	-	
10	-	-	
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	-	-	
25	AUTOM	Automatic operation	←
26	MAN.X+	Manual movement, CW rotation	←
27	MAN.REF.	Manual reference movement	←
28	-	-	
29	-	-	
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	-	-	
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

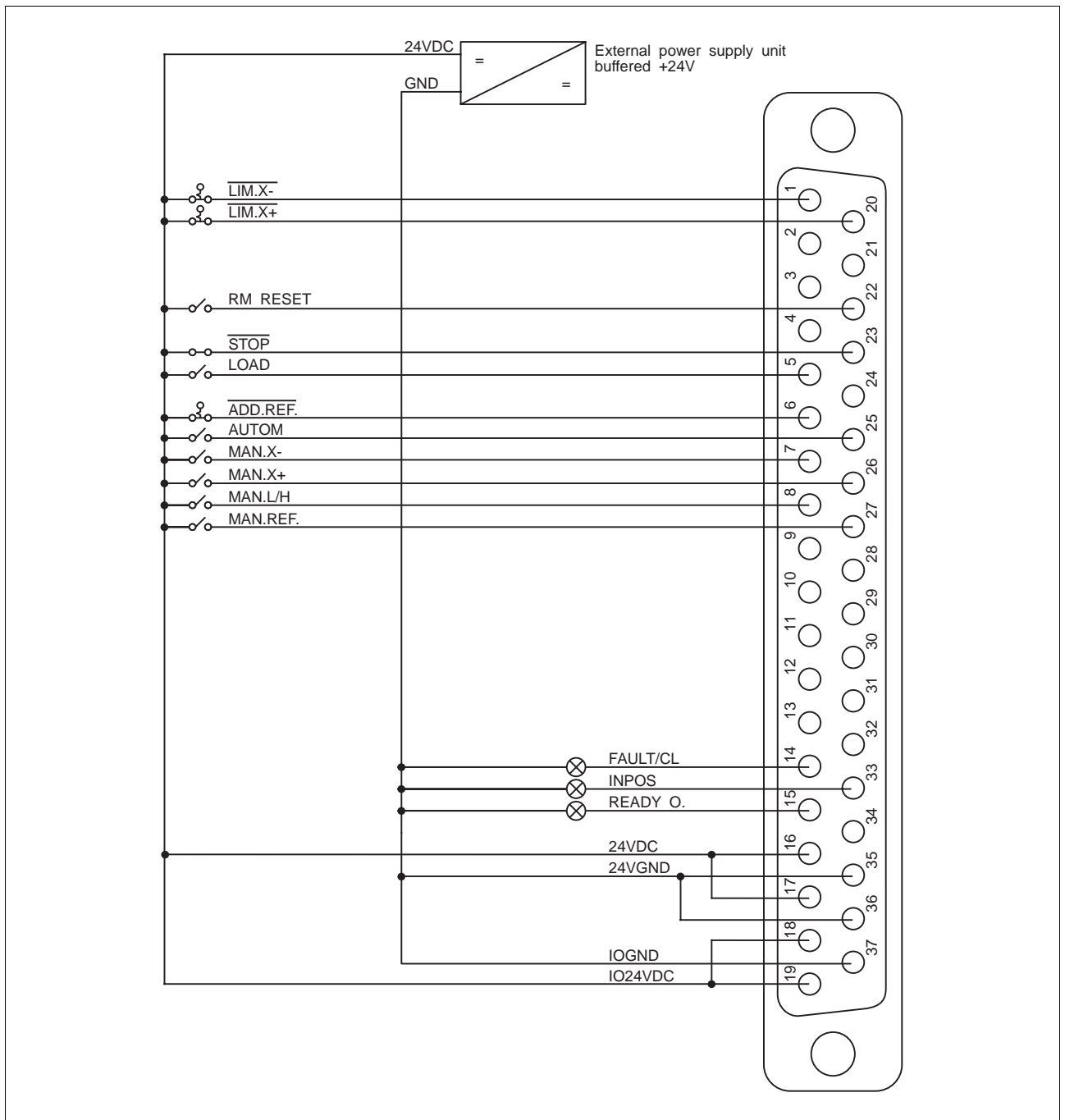


Fig. 2-11 Example of wiring for serial mode

Installation

2.4.4.3 Signal connection in parallel mode

Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	START	Start	←
5	LOAD	Load	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	$\overline{\text{MAN.X-}}$	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	DATA4	Decade value 2^2	←
10	DATA1	Decade value 2^0	←
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error and clock signal	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	RS/CL.A.	Clock acknowledge	←
25	AUTOM	Automatic operation	←
26	$\overline{\text{MAN.X+}}$	Manual movement, CW rotation	←
27	$\overline{\text{MAN.REF.}}$	Manual reference movement	←
28	DATA8	Decade value 2^3	←
29	DATA2	Decade value 2^1	←
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	$\overline{\text{END/L.A.}}$	Load acknowledge	→
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

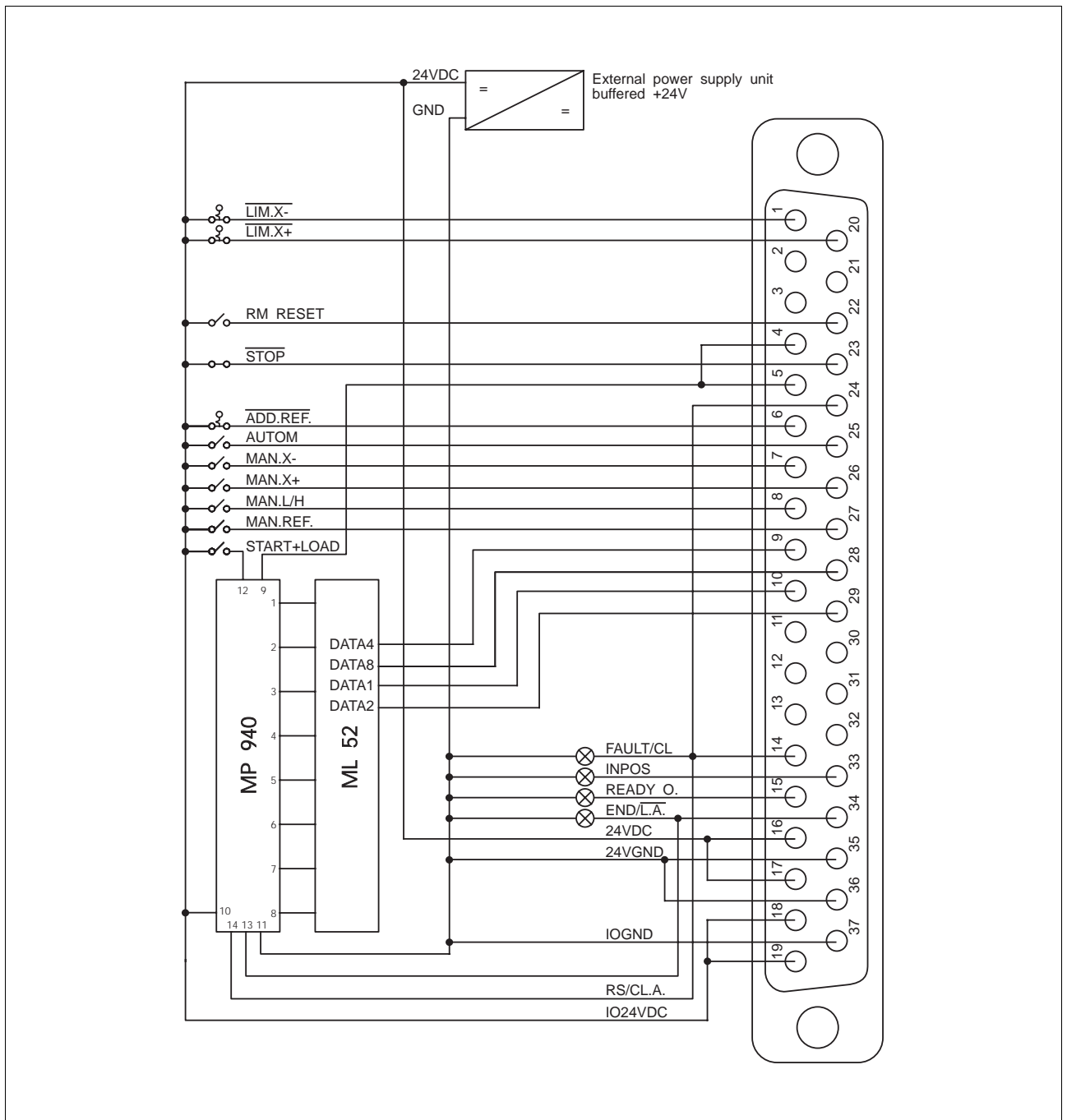


Fig. 2-12 Example of wiring for parallel mode with MP 940 decade switch interface



NOTE
Should a decade switch block other than ML 52 be used, wiring must be effected as per chapter 6.2.2.



NOTE
The MP 940 decade switch interface is described in chapter 6.2.3.

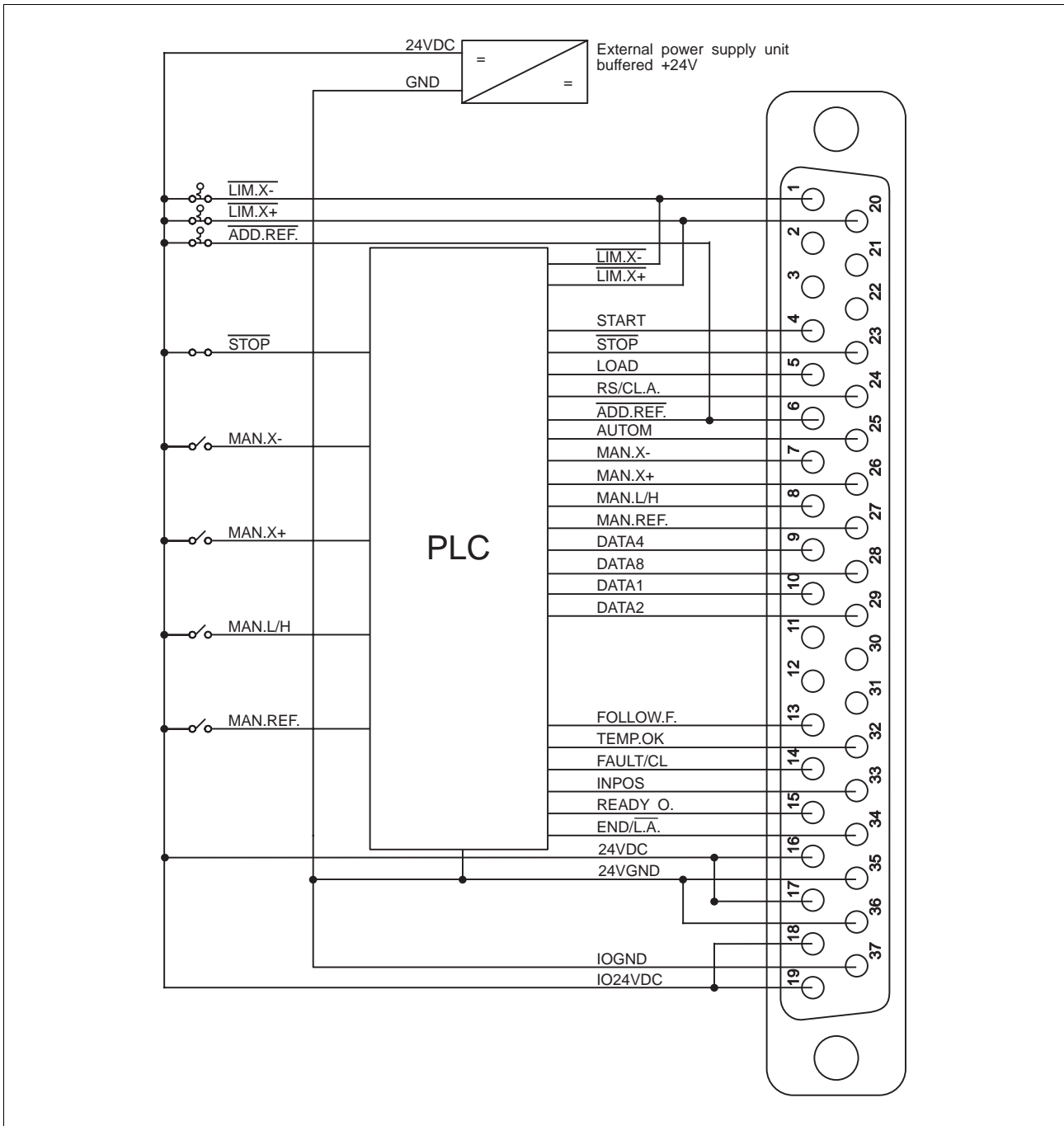


Fig. 2-13 Example of wiring for parallel mode without decade switch interface

2.4.4.4 Signal connection in network mode

The possibilities of signal connection in the network operating modes are contained in the following chapters:

"Memory"	Storage mode	see chapter 2.4.4.1
"Serial"	Serial mode	see chapter 2.4.4.2
"Parallel"	Parallel mode	see chapter 2.4.4.3

Installation

2.4.5 Serial interface (RS 485)



NOTE
The serial interface (RS 485) is operated as a four-wire interface.

- Solder litz wires to connector according to fig. 2-14.

Pin	Signal	Meaning	Direction
1, 6	+12V	MP 923 supply voltage	→
2, 7	GND	MP 923 supply voltage ground	→
3	$\overline{\text{TxD}}$	Transmit data inverted	→
4	$\overline{\text{RxD}}$	Receive data inverted	←
5	RGND	Signal ground	
8	TxD	Transmit data	→
9	RxD	Receive data	←

← input → output

- Push shield back and fix with cable tie.
- Screw two hexagon head bolts (fig. 2-15) into the connector shell.
- Put the connector into the connector shell.
- Fasten the cable and shield to the connector shell without strain.



ATTENTION
A good electrical connection must be established between the shield and the connector shell.
The cable must be screened on both sides.

- Insert two caps in unused cable entries.
- Fix the two halves of the connector shell with two screws.
- Fasten the connector on the front panel (item 52).



NOTE
The MP 923 interface converter may be used for a computer with a RS 232 interface in serial and network mode, see chapter 6.2.14.

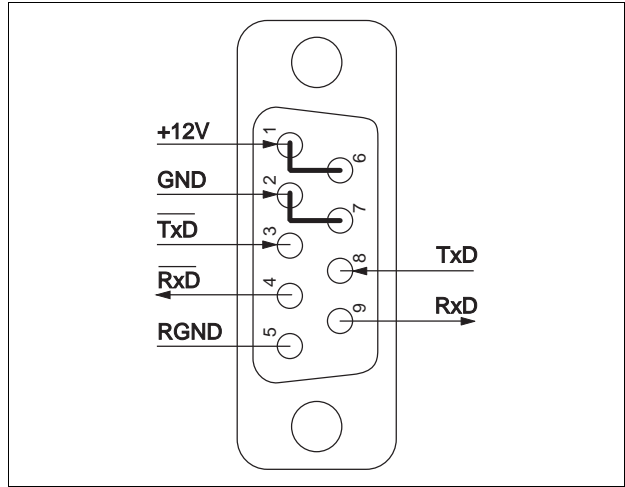


Fig. 2-14 Interface connector – unit side

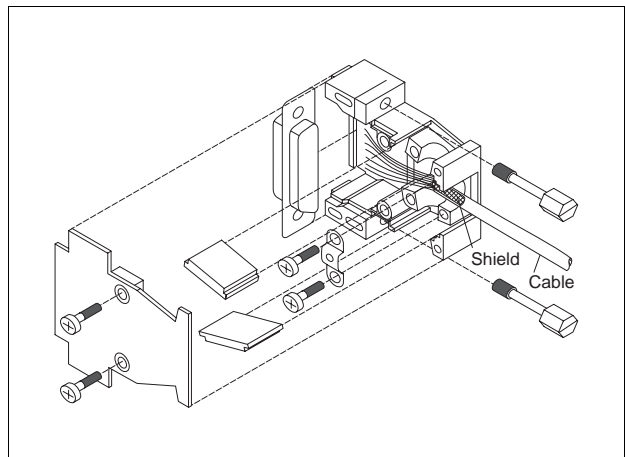


Fig. 2-15 Interface connector assembly



NOTE
The MP 924 interface distributor may be used in network mode to control eight units, see chapter 6.2.15.

2.5 Starting up

2.5.1 Defaults

The following table shows the standard parameter settings, ex works:

Parameter	Meaning	Range	Factory setting
"Manual frequency slow"	Step frequency (speed) for controlling the stepping motor in slow manual movement mode	32 to 20000 Hz	100 Hz
"Manual frequency fast"	Step frequency (speed) for controlling the stepping motor in fast manual movement mode	32 to 20000 Hz	1000 Hz
"Settling time" t_E	Time for detecting a stable input signal	1 to 255 ms	4 ms
"Gear ratio denominator"	Denominator value for calculating the gear ratio (speed reducer or speed-transforming transmission)	1 to 255	1
"Gear ratio numerator"	Numerator value for calculating the gear ratio (speed reducer or speed-transforming transmission)	1 to 255	1
Manual frequency "REF IN"*	Frequency for movement towards the limit or reference switch	32 to 20000 Hz	2000 Hz
Manual frequency "REF OUT"	Frequency for movement away from the limit or reference switch to the reference point	32 to 5000 Hz	300 Hz
"Readings"***	Number of reading repeats for detecting an 8-digit decade value	1 to 255	2
"Decade settling time"***	Number of reading repeats for detecting a decade value	5 to 255	5
"Reference position"***	Reference dimension after setting the reference point or switching the positioning unit on	± 8388607	0

* In serial mode, always the last set frequency

** In parallel mode only



NOTE

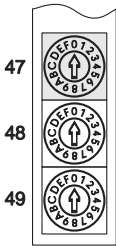
These parameters may be modified with the MP 922 hand-held programming unit (in storage or parallel mode) or with a PC (in serial or network mode).

Installation

1. The supply voltages of the unit must not be switched on.
2. Set the desired operating mode at the selector switch (47):



NOTE
The network address must be set before selecting network mode, see chapter 3.6.1.



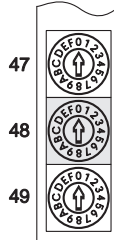
Position	Mode
0	Storage mode
1	Load operating program for MP 922
2	Serial mode with 1200 bauds (ASCII 7 bits, even parity bit, one stop bit)
3	Serial mode with 9600 bauds (ASCII 7 bits, even parity bit, one stop bit)
4	Parallel mode in system of absolute dimensions
5	Parallel mode in system of incremental dimensions
6	Network mode with 9600 bauds
7	Network mode with 38.4 kbauds
8	Set network address
9 to F	No function



NOTE
The operating modes "Install", "Memory", "Serial", "Parallel" are set via the PC in network mode, see PRO-SDP/PC1 documentation.

3. Verify that all connectors have been connected correctly.

4. Set the desired speed (frequency) for positioning in automatic run at selector switch (48):



Position	Frequency in Hz
0	32
1	100
2	500
3	1000
4	2000
5	3000
6	4000
7	5000
8	6000
9	8000
A	10000
B	12000
C	14000
D	16000
E	18000
F	20000

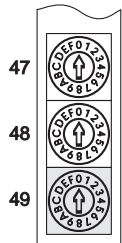
The set frequency is accepted, if input AUTOM is activated.



NOTE
The frequency may be modified in automatic run of the individual operating modes.

The value of tens of the network address: 0 to 3 is set at the selector switch (48) in network mode. The network address may range from 1 to 31.

5. Set the desired acceleration value for positioning in automatic run and for manual movement at the selector switch (49):



Position	Acceleration in Hz/ms
0	4
1	6
2	10
3	15
4	20
5	30
6	50
7	100
8	200
9	300
A	400
B	500
C	600
D	700
E	800
F	1000

The set acceleration value is accepted, if input AUTOM is activated.



NOTE
Acceleration may be modified in automatic run of the individual operating modes (except parallel mode).

The value of ones of the network address: 0 to 9 is set at the selector switch (49) in network mode. The network address may range from 1 to 31.

6. Set the parameters at switch (54):

	ON OFF	
Full step	1 <input type="checkbox"/>	Half step
CCW rot.	2 <input type="checkbox"/>	CW rot.
	3 <input type="checkbox"/>	Rotation monitoring
	4 <input type="checkbox"/>	Step angle
		Sense of rotation
		Power drive enable

Rotation monitoring:
Switch 1 must be in position ON. Position OFF causes an error message. Rotation monitoring may be disabled by activating signal RM RESET. If signal RM RESET is inactive, rotation monitoring may be disabled with the G36 command and enabled with the G37 command (see chapter 3).

Step angle:
Refers to the rotary angle, through which the stepping motor shaft rotates for each control pulse.
Full step: 500 steps/revolution (0.72°/step)
Half step: 1000 steps/revolution (0.36°/step)

Sense of rotation:
Front view to motor shaft when moving in positive direction
Clockwise rotation (CW): Sense of rotation in clockwise direction
Counterclockwise rotation (CCW): Sense of rotation in counterclockwise direction

Power drive enable:
Switch 4 must be in position OFF.

Installation

7. Set motor phase current at selector switch (01) in accordance with the motor type plate and the following diagram (fig. 2-16):



Position	Phase current in A
0	0.75
1	1.00
2	1.25
3	1.50
4	1.75
5	2.00
6	2.25
7	2.50
8	2.75
9	3.00
A	3.25
B	3.50
C	3.75
D	4.00
E	4.25
F	4.50

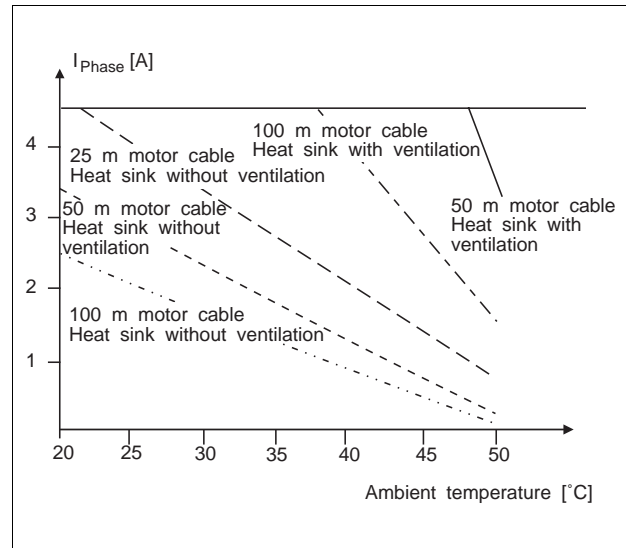


Fig. 2-16 Admissible phase current as a function of ambient temperature and motor cable length

2.5.2 Testing

A manual movement and/or a manual reference movement should be performed as per chapter 3 for checking cabling and settings.



ATTENTION

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



ATTENTION

The cover must be screwed back on after setting.

8. Plug in mains connector and switch on the supply voltage for the Power drive and processor unit. The seven-segment displays (items 02 and 40) indicate "readiness" by lighting of the point.

3 Operation

3.1 Operating possibilities

The operating possibilities of WDP5-118 depend on the position of the operating mode selector switch (47) and the AUTOM input signal:



NOTE

The unit recognizes the position of the operating mode selector switch only when switching the supply voltage on.

Operating mode selector switch position	Operating mode	Input signal AUTOM*	Operating possibility	Reference
0	Storage mode	0	Manual movement (fast, slow, reference movement, set reference point)	see chapter 3.3.1
			Teach-in	see chapter 3.3.1.5 and 3.3.1.6
		1	Operation with MP 922 hand-held programming unit	see chapter 3.3.3
		1	Automatic run of stored movement programs	see chapter 3.3.2
1	Load operating program for MP 922	random	Operation with MP 922 hand-held programming unit	see documentation MP 922
2	Serial mode with 1200 bauds	0	Manual movement (fast, slow, reference movement, set reference point)	see chapter 3.4.1
			Limited operation via terminal or PC	see chapter 3.4.3
3	Serial mode with 9600 bauds	1	Automatic run with operation via terminal or PC	see chapter 3.4.2
4	Parallel mode with absolute dimensions	0	Manual movement (fast, slow, reference movement, set reference point)	see chapter 3.5.1
			Operation with MP 922 hand-held programming unit	see chapter 3.5.3
5	Parallel mode with incremental dimensions	1	Automatic run with parallel data transfer (absolute or incremental dimensions)	see chapter 3.5.2
6	Network mode with 9600 bauds	0	Manual movement (fast, slow, reference movement, set reference point)	see chapter 3.6
			Teach-in (in network operating mode "Memory")	see chapter 3.6.3
			Limited operation via PC with PRO-SDP/PC1 software	see chapter 3.6
7	Network mode with 38.4 kbauds	1	Setting the network mode and operation via PC PRO-SDP/PC1 software	see chapter 3.6
8	Set network address	random		see chapter 3.6.1

* 0 = input inactive 1 = input active

3.2 Starting up



ATTENTION
The set supply voltage for the power drive must correspond with the stipulated supply voltage (see type plate).



ATTENTION
Do not touch live parts of the unit or system and avoid contact with electrically conducting objects.



ATTENTION
While positioning, no persons or objects must linger in the moving range of the system.



ATTENTION
The unit must be grounded by a protective conductor.



ATTENTION
The basic settings of the unit must meet the requirements, see chapter 2.5.

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

Condition	Reference
Do the environmental conditions correspond with the technical data?	see chapter 1.4
Is there sufficient space for air supply and discharge?	see chapter 1.4
Has the unit been cabled correctly?	see chapter 2.4
Has the desired operating mode been set at the selector switch?	see chapter 2.5.1
Have the desired speed and acceleration values been set at the selector switches in automatic run?	see chapter 2.5.1
Has the motor phase current been adjusted correctly?	see chapter 2.5.1
Have the desired power drive parameters been set?	see chapter 2.5.1



NOTE
The desired operating mode must have been set when switching on (see chapter 2.5.1). Modification of an operating mode is only recognized on switching the unit on again.

1. Switch on the supply voltage for the power drive (115 or 230 VAC).
2. Switch on the supply voltage for the processor unit (24 VDC).
3. The unit is "ready" when the point of the seven-segment displays (items 02 and 40) lights up.
4. Enable rotation monitoring.
Rotation monitoring is enabled, if signal RM RESET is deactivated. If this signal is deactivated, rotation monitoring may be disabled or enabled in serial mode with the G36 or G37 command, respectively. Rotation monitoring is disabled by activating signal RM RESET. The zero current feature may then be enabled or disabled with the

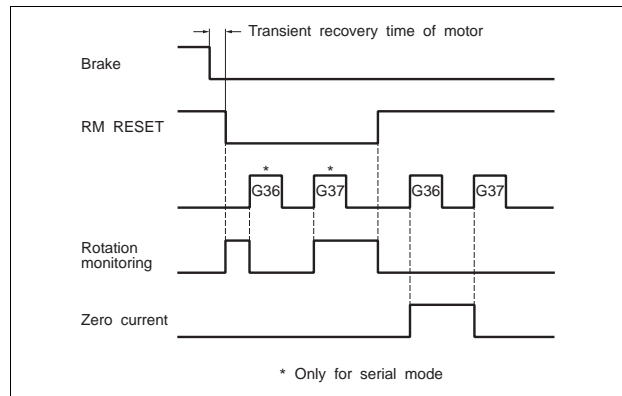


Fig. 3-1 Rotation monitoring

G36 or G37 command respectively. If the axle is provided with a brake, it must be ensured that the rotation monitoring feature is only enabled after venting the brake and if the motor is in a transient condition.



NOTE
The motor phase current is reduced to 75% during standstill (pulse frequency <10Hz). This causes the motor to cool down and the holding torque to be reduced to 75%.

3.3 Storage mode

The following operating possibilities are available in storage mode:

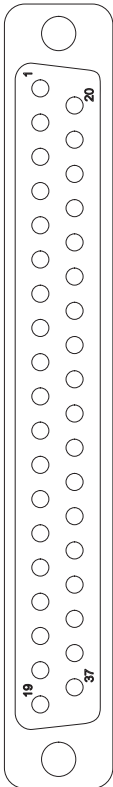
Manual movement

- Slow manual movement
The stepping motor rotates at "Manual frequency slow" which can be modified as a parameter. The parameter value is adjustable, factory setting 100 Hz.
- Fast manual movement
The stepping motor rotates at "Manual frequency fast" which may be modified as a parameter. The parameter value is adjustable, factory setting 1 kHz.
- Manual reference movement
The stepping motor keeps rotating at frequency "REF IN", which may be modified as a parameter, until it reaches either the right limit switch or additional reference switch. The parameter value "REF IN" is adjustable, factory setting 1 kHz.
On detecting the selected limit switch and braking, the stepping motor leaves the limit switch or reference switch at frequency "REF OUT", which may be modified as a parameter, and stops. This position serves as the reference point for the system of dimensions.
The parameter value "REF OUT" is adjustable, factory setting 300 Hz.
- Setting the manual reference point
The "reference position" (factory setting 0), which may be modified as a parameter, is accepted as the new reference value for the system of dimensions by activating two inputs. A reference movement is not required.
- Manually approached positions are stored as movement commands with teach-in.
Teach-in may be effected with or without the MP 922 hand-held programming unit in automatic run.

Automatic run

- Automatic run of stored programs

Control signals in storage mode



Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	START	Start	←
5	LOAD	Store position	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	MAN.X-	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	DATA4	Program number 2^2	←
10	DATA1	Program number 2^0	←
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	RS/CL.A.	Program start	←
25	AUTOM	Automatic operation	←
26	MAN.X+	Manual movement, CW rotation	←
27	MAN.REF.	Manual reference movement	←
28	DATA8	Program number 2^3	←
29	DATA2	Program number 2^1	←
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	$\overline{\text{END/L.A.}}$	Program end	→
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

3.3.1 Manual movement

3.3.1.1 Slow manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+.
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X-.
- The motor rotates at "Manual frequency slow" in the selected direction, as long as input MAN.X+ or MAN.X- is active and the limit switch is not reached.

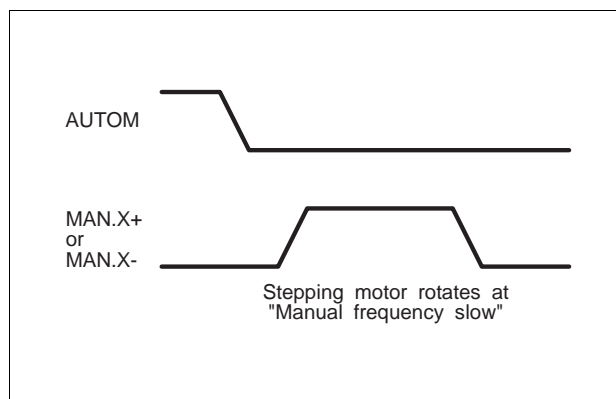


Fig. 3-2 Slow manual movement



NOTE

The effect of inputs MAN.X+ and MAN.X- may be modified with parameter switch (54).



NOTE

If input MAN.X+ or MAN.X- is activated only for a short time (<0.5 s), the motor performs a step.



NOTE

The motor accelerates/decelerates during manual movement according to the value set at the selector switch (49) before switching on.



NOTE

The parameter "Manual frequency slow" may be modified with the MP 922 hand-held programming unit or PC (in network mode) (factory setting 100 Hz).

3.3.1.2 Fast manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+ and MAN.L/H simultaneously (longer than settling time t_E).
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X- and MAN.L/H.
- The motor rotates at "Manual frequency fast" in the desired direction, as long as the inputs MAN.X- or MAN.X+ and MAN.L/H are active.

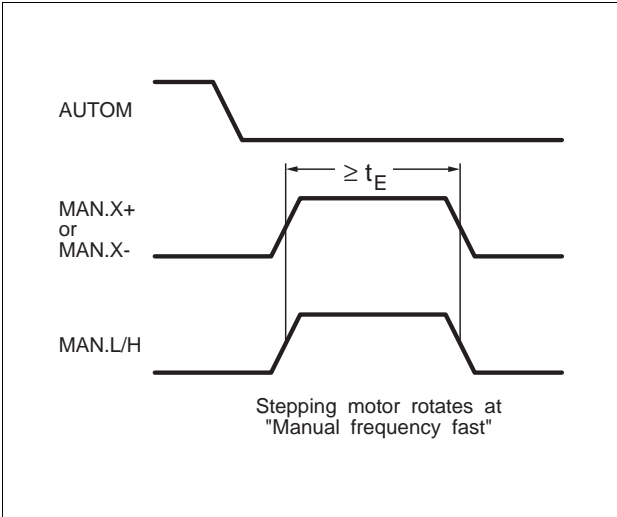


Fig. 3-3 Fast manual movement



NOTE
The effect of the inputs MAN.X+ and MAN.X- may be modified with parameter switch (54).



NOTE
The motor accelerates/decelerates during manual movement according to the value set at the selector switch (49) before switching on.



NOTE
The parameter "maximum manual frequency" may be modified with the MP 922 hand-held programming unit or PC (in network mode) (factory setting 1 kHz).

3.3.1.3 Manual reference movement



NOTE
Reference movement principle
see chapter 6.3.

1. Deactivate input AUTOM.
2. For performing a movement towards the limit switch in clockwise direction:
activate inputs MAN.X+ and MAN.REF simultaneously (longer than settling time t_E).
3. For performing a movement towards the limit switch in counterclockwise direction:
activate inputs MAN.X- and MAN.REF simultaneously (longer than settling time t_E).
4. For performing a movement towards the additional reference switch:
activate inputs MAN.L/H and MAN.REF simultaneously (longer than settling time t_E).

→ The motor keeps rotating at frequency "REF IN" in the selected direction until the limit switch or additional reference switch is detected. It then leaves the limit switch at frequency "REF OUT" and stops. This position serves as the reference point for the system of dimensions.



NOTE
A reference movement may be interrupted by activating input STOP.



NOTE
The effect of the inputs MAN.X+, MAN.X- and MAN.L/H may be modified with the parameter switch (54).



NOTE
The motor accelerates/decelerates during manual movement according to the value set at the selector switch (49) before switching on.



NOTE
The parameters "REF IN" and "REF OUT" may be modified with the MP 922 hand-held programming unit or PC (in network mode) (factory setting "REF IN" 1 kHz, "REF OUT" 300 Hz).

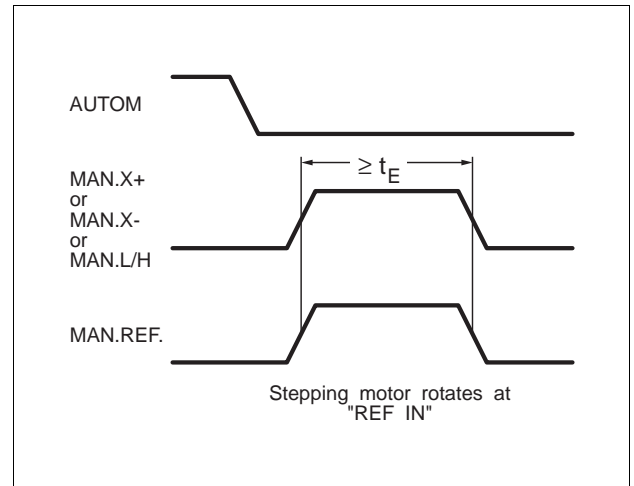


Fig. 3-4 Manual reference movement

3.3.1.4 Setting manual reference point

1. Deactivate input AUTOM.
 2. Activate inputs MAN.REF and LOAD simultaneously (longer than settling time t_E).
- The value of the "reference position" serves as the new reference value for the system of dimensions.



NOTE
The parameter "reference position" may be modified with the MP 922 hand-held programming unit or PC (in network mode) (factory setting 0).



NOTE
An example of wiring the function "Setting manual reference point" is shown in fig. 3-6.

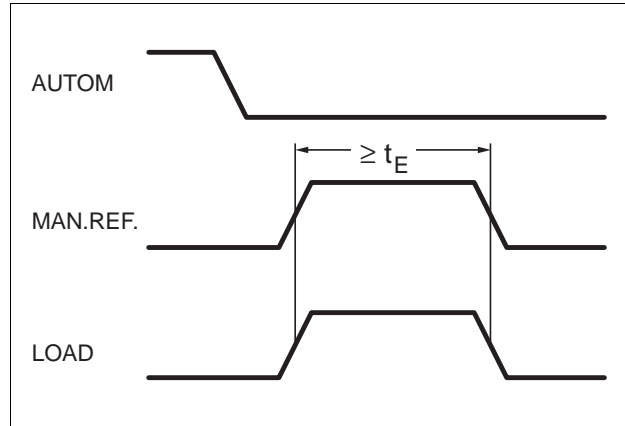


Fig. 3-5 Setting manual reference point

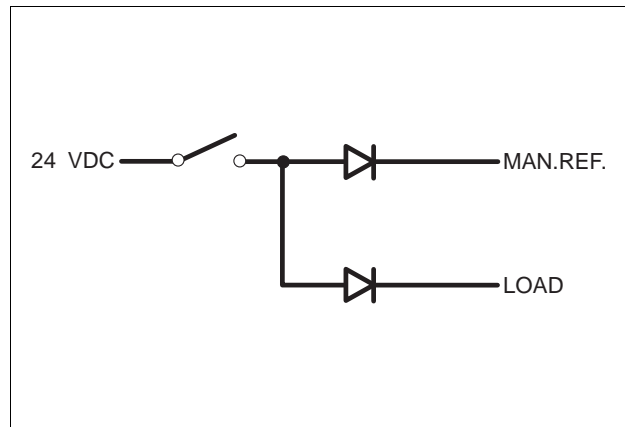


Fig. 3-6 Example of wiring "Setting manual reference point"

3.3.1.5 Teach-in with MP 922 hand-held programming unit

1. Switch off supply voltage for processor unit.
2. Connect MP 922 hand-held programming unit to the serial interface of the unit, see chapter 6.2.5.
3. Set operating mode selector switch (47) to "0".
4. Switch on supply voltage for processor unit.
→ LED 43 and LED 45 light up.
5. Deactivate input AUTOM.
6. Enter the program and line number with the "Edit" command of the hand-held programming unit, before which the teach-in positions must be stored, see MP 922 documentation.
7. Exit from the "Edit" command with the "." key of the hand-held programming unit.
8. Perform a manual reference movement (see chapter 3.3.1.3) or set a manual reference point (see chapter 3.3.1.4) after switching on for the first time or if a malfunction has occurred in the unit.



NOTE

The reference point for the system of dimensions must be the same as the one used during the automatic program run at a later time, as the teach-in positions are always stored as absolute positions.

9. Approach the desired position manually, see chapter 3.3.1.1 or 3.3.1.2.



NOTE

The position may be indicated with the "Pos" command on the hand-held programming unit.

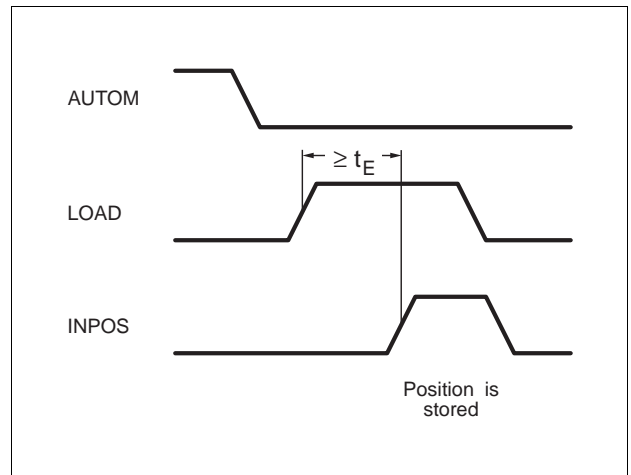


Fig. 3-7 Teach-in

10. Activate input LOAD temporarily (longer than settling time t_E).
→ The position is stored as an absolute position.
Acceptance is indicated by output INPOS.
11. Approach next position and store.



NOTE

The individual positions should be approached during the mechanical reversal in the same direction as in the automatic run later. The individual positions are always stored as absolute positions.

12. The program prepared in teach-in mode can be edited with the hand-held programming unit, see MP 922 documentation.

3.3.1.6 Teach-in without MP 922 hand-held programming unit

1. Wire teach-in connector according to fig. 3-8 (9-pole sub-D connector, female, DIN 41651, quality level 2).
2. Plug teach-in connector into serial interface connector.
3. Switch off supply voltage for processor unit.
4. Set operating mode selector switch (47) to "0".
5. Switch on supply voltage for processor unit.
→ LED 43 and LED 45 light up.
6. Deactivate input AUTOM.
7. Carry out reference movement or set reference point manually.
8. Define the desired program number under which the teach-in positions may be stored by activating or deactivating the four inputs DATA1 to DATA8 in accordance with the following principle:

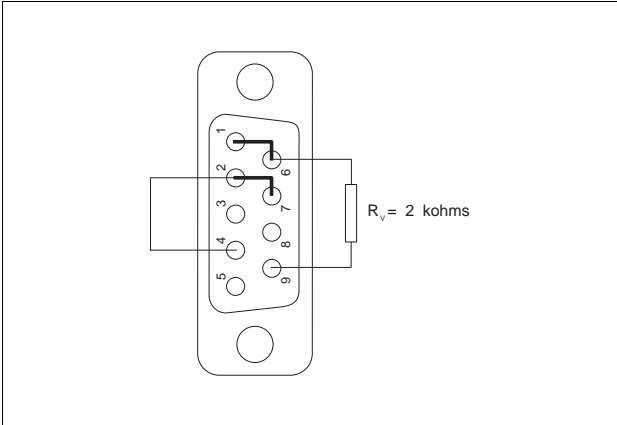


Fig. 3-8 Teach-in connector

DATA8	DATA4	DATA2	DATA1	Program number
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

0 = input inactive 1 = input active



NOTE
A program number under which no program has been stored yet should be selected, this program would otherwise be overwritten.

9. Activate inputs RS/CL.A. and LOAD simultaneously (longer than settling time t_E).
 - The program number has been selected.
 - LED 42 and LED 44 as well as the LED 3 on the seven-segment display of the processor unit light up.
 - The output signals FAULT/CL and INPOS are active.
 - The program has been selected.
10. Approach the desired position manually, see chapter 3.3.1.1 or 3.3.1.2.
11. Activate input LOAD temporarily (longer than settling time t_E).
 - The position is stored as an absolute position.
 - LED 44 lights up, output INPOS is active.
12. Approach and store the next position.

**NOTE**

The individual position should be approached during the mechanical reversal of the system in the same direction as in the automatic run later.
The individual positions are always stored as absolute positions.

13. The program prepared in teach-in mode can be edited with the hand-held programming unit or PC.

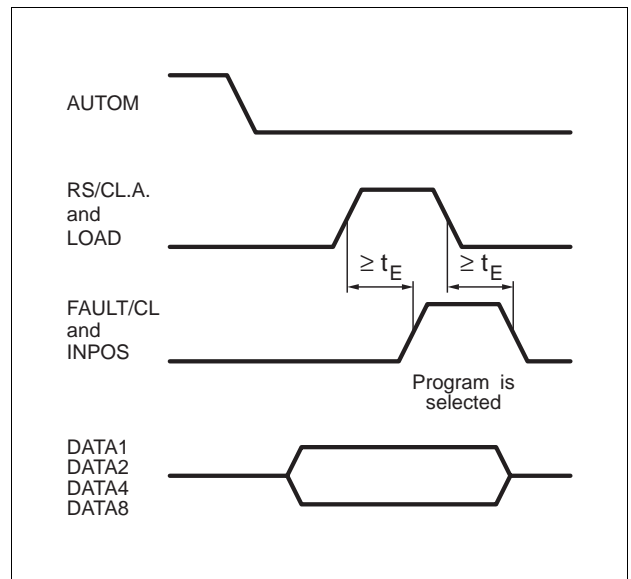


Fig. 3-9 Select program

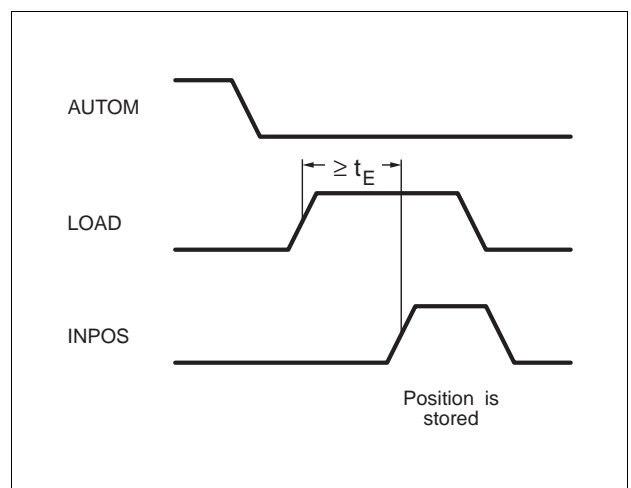


Fig. 3-10 Teach-in

**NOTE**

An example of wiring the function "Teach-in without hand-held programming unit" is shown in fig. 3-11.

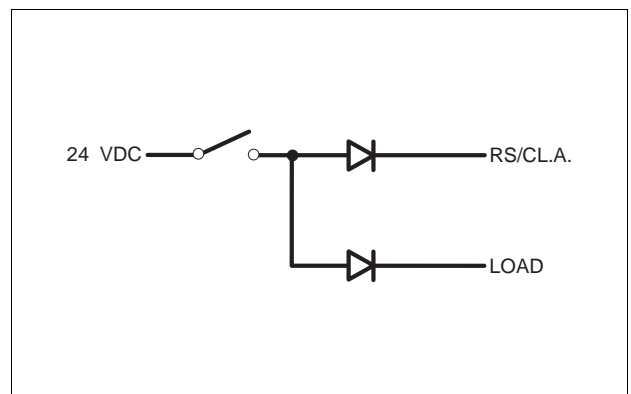


Fig. 3-11 Example of wiring teach-in without MP 922

3.3.2 Automatic run

1. Switch off supply voltage for processor unit.
2. Set operating mode selector switch (47) to "0".
3. Switch on supply voltage for processor unit.
→ LED 43 lights up.
4. Activate input AUTOM.

Storage mode permits automatic execution (e.g. with a PLC) of programs which were loaded into the positioning unit using the MP 922 hand-held programming unit or a PC or which were prepared in teach-in mode.

Programming is described in the MP 922 documentation (notes see chapter 3.3.4).

Communication with the subordinate controller (e.g. PLC) is effected via parallel inputs and outputs:

Inputs	Meaning
DATA1 DATA2 DATA4 DATA8	Selecting one out of 16 programs. The program selected via these inputs is executed.
START	Starting execution of a command group
RS/CL.A.	Resetting the program pointer to the program beginning

Outputs	Meaning
INPOS	Last command group has been executed and is ready for a new START.
END/L.A.	The last command group in the selected program has been executed.
FAULT/CL	A fault has occurred in the run.
READY O.	Unit is ready for operation.



NOTE
The inputs $\overline{\text{LIM.X+}}$, $\overline{\text{LIM.X-}}$, $\overline{\text{ADD.REF}}$ and $\overline{\text{STOP}}$ are also evaluated by the unit.

3.3.2.1 Program selection

1. Specify the desired program number by activating or deactivating the four inputs DATA1 to DATA8 in accordance with the following principle:

DATA8	DATA4	DATA2	DATA1	Program number
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

0 = input inactive 1 = input active

2. Select the 1st command group with the signal START or RS/CL.A.

The signal times which must be adhered to are evident in fig. 3-12.

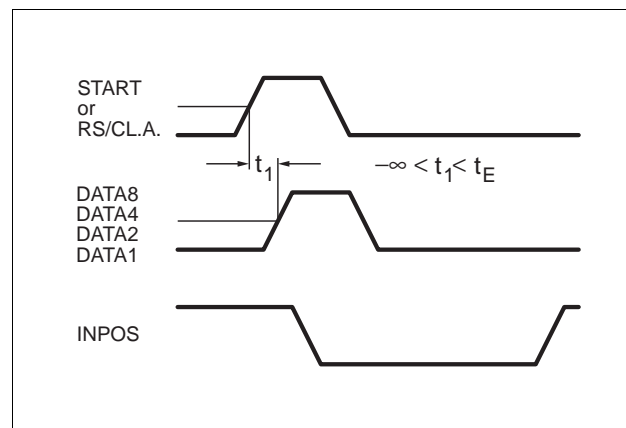


Fig. 3-12 Program selection

3.3.2.2 Setting program pointer to program beginning

Activate input RS/CL.A.

- The program pointer is set to the beginning of the selected program.

The signal times which must be adhered to are evident in fig. 3-13.



NOTE
The "M20" command has the same effect.

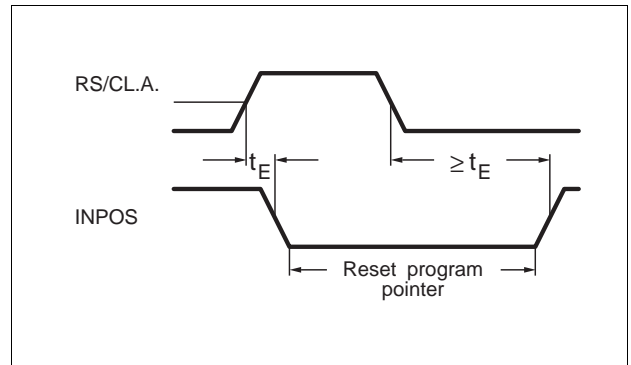


Fig. 3-13 Setting program pointer to program beginning

3.3.2.3 Starting movement commands

Activate input START.

- The output signal INPOS is not active.
- The next movement command is executed.
The output INPOS is set to 0V.

The signal times which must be adhered to are evident in fig. 3-14.

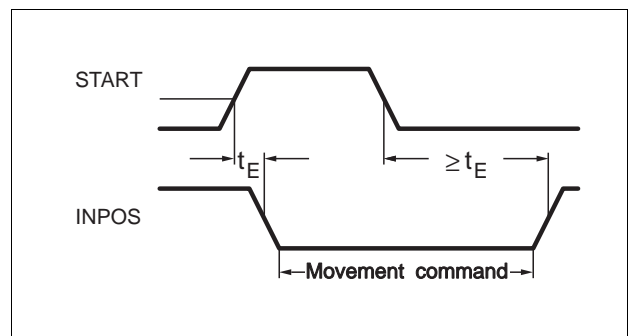


Fig. 3-14 Starting movement commands



NOTE
The signal times shown in fig. 3-15 must be observed at the end of the program or in case of errors.

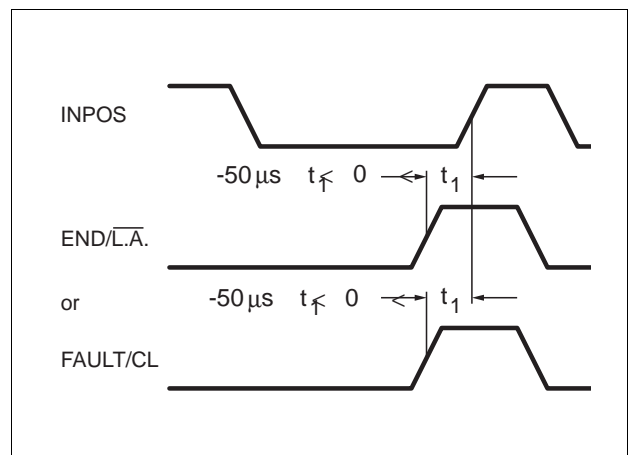


Fig. 3-15 Status message

3.3.2.4 Starting at program beginning

Activate inputs RS/CL.A. and START.

- The program pointer is set to the beginning of the selected program and the first movement command is executed.

The signal times which must be adhered to are evident in fig. 3-16.

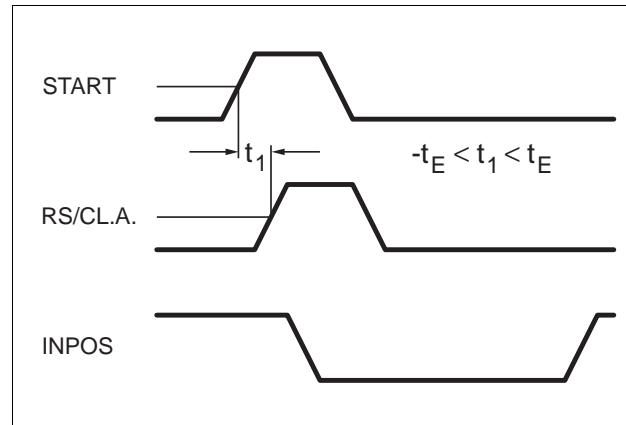


Fig. 3-16 Starting at program beginning

3.3.3 MP 922 hand-held programming unit

The MP 922 hand-held programming unit offers the following operating possibilities in storage mode:

- Writing, reading and editing programs
- Displaying the program directories
- Archiving and printing programs
- Displaying and changing parameters
- Displaying the travel position
- Testing inputs/outputs

**NOTE**

Connection of the hand-held programming unit is described in chapter 6.2.5.

**NOTE**

Operation of the hand-held programming unit is described in the MP 922 documentation.

3.3.4 Programming

The programs are prepared with the following commands. The commands are divided into action commands (A) and setting commands (S):

Command	Type	Meaning	Range
X=	A	Setpoint to be approached (depending on the system of dimensions)	±8388607
F=	S	Movement frequency (speed) for positioning	32 to 20000 Hz
L=	S	Positive or negative acceleration for positioning	4 to 1000 Hz/ms
M20	S	Set program pointer to program beginning	
M21=	S	Movement frequency for travelling away from the limit switch to the reference point	
G25	A	Reference movement towards negative limit switch	
G26	A	Reference movement towards positive limit switch	
G27	A	Reference movement towards additional reference switch	
G29=	S	Enter reference position and set reference point	±8388607
G36	A	Enable zero current if RM RESET is active.	
G37	A	Disable zero current if RM RESET is active.	
G90	S	Set system of absolute dimensions	
G91	S	Set system of incremental dimensions	

A program consists of command groups. A command group may consist of setting commands and one action command. There is always an action command at the end of a command group. The next command group is executed by activating the START signal. A program changeover is possible via the inputs DATA1 to DATA8 (see chapter 3.3.2.1). Here, program execution is continued at the position where it was interrupted.

Programming examples for MP 922:

Program 0

00:000 X=0	1st command group
00:001 X=1000	2nd command group
00:002 X=2000	3rd command group
00:003 X=3000	4th command group
00:004 X=4000	5th command group
00:005 X=5000	6th command group
00:006 X=6000	7th command group

Program 1

01:000 F=32	} 1st command group
01:001 L=4	
01:002 X=10000	
01:003 F=20000	} 2nd command group
01:004 L=1000	
01:005 X=0	
01:006 F=32	} 3rd command group
01:007 L=4	
01:008 X=10000	
01:009 M20	Pointer at program start

Program 3

03:000 F=10000	} Command group
03:001 L=200	
03:002 G90	
03:003 M21=50	
03:004 G26	



NOTE
Programming see MP 922 or PRO-SDP/PC1 documentation.

3.3.5 System setting

The following parameters may be modified within the specified ranges:

Parameter	Range	Factory setting
"Manual frequency slow"	32 to 20000 Hz	100 Hz
"Manual frequency fast"	32 to 20000 Hz	1000 Hz
"Settling time" t_E	1 to 255 ms	4 ms
"Gear ratio denominator"	1 to 255	1
"Gear ratio numerator"	1 to 255	1
Manual frequency "REF IN"	32 to 20000 Hz	2000 Hz
Manual frequency "REF OUT"	32 to 5000 Hz	300 Hz



NOTE
System setting see MP 922 or PRO-SDP/PC1 documentation.

3.4 Serial mode

Serial mode offers the following operating possibilities:

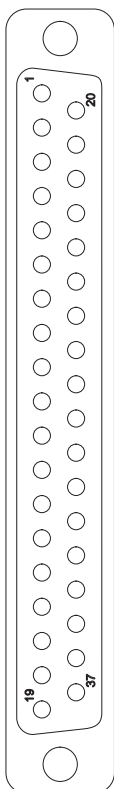
Manual movement

- Slow manual movement
The stepping motor rotates at "Manual frequency slow" which can be modified as a parameter. The parameter value can be set with the "M96=" command, factory setting 100 Hz.
- Fast manual movement
The stepping motor rotates at "Manual frequency fast" which may be modified as a parameter. The parameter value can be set with the "M97=" command, factory setting 1 kHz.
- Manual reference movement
The stepping motor keeps rotating at frequency "REF IN", which can be modified as a parameter, until either the left limit switch, the right limit switch or the additional reference switch is detected. The parameter value "REF IN" can be set at speed selector switch (48), factory setting 1 kHz.
On detecting the selected limit switch and when braking, the stepping motor leaves the limit switch or reference switch at frequency "REF OUT" and stops. This position serves as the reference point for the system of dimensions.
The parameter value "REF OUT" can be modified with the commands "U=" or "M21", factory setting 300 Hz.
- Set manual reference point
The "reference point position" (factory setting 0), which can be modified as a parameter, is accepted as the new reference value for the system of dimensions by activating two inputs. A reference movement is not required.

Automatic run

- Operation with a terminal or PC
at a transmission speed of 1200 bauds or 9600 bauds; ASCII 7 bits, even parity bit, one stop bit.

Control signals in serial mode



Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	-	-	
5	LOAD	Store position	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	MAN.X-	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	-	-	
10	-	-	
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	-	-	
25	AUTOM	Automatic operation	←
26	MAN.X+	Manual movement, CW rotation	←
27	MAN.REF.	Manual reference movement	←
28	-	-	
29	-	-	
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	-	-	
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

3.4.1 Manual movement

3.4.1.1 Slow manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+.
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X-.
- The motor keeps rotating at "Manual frequency slow" in the selected direction, until input MAN.X+ or MAN.X- are active and the limit switch is not detected.

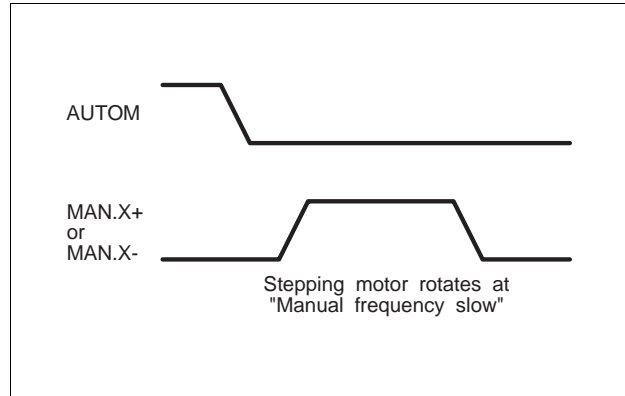


Fig. 3-17 Slow manual movement



NOTE
The effect of inputs MAN.X+ and MAN.X- may be modified with parameter switch (54).



NOTE
If input MAN.X+ or MAN.X- is only activated temporarily (<0.5 s), the motor performs a step.



NOTE
The motor accelerates/decelerates during manual movement according to the value set at selector switch (49) before switching on.



NOTE
The parameter "Manual frequency slow" may be modified with the "M96=" command (factory setting 100 Hz).

3.4.1.2 Fast manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+ and MAN.L/H simultaneously (longer than settling time t_E).
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X- and MAN.L/H simultaneously (longer than settling time t_E).
- The motor keeps rotating at "Manual frequency fast" in the desired direction, as long as the inputs MAN.X+ or MAN.X- and MAN.L/H are active.

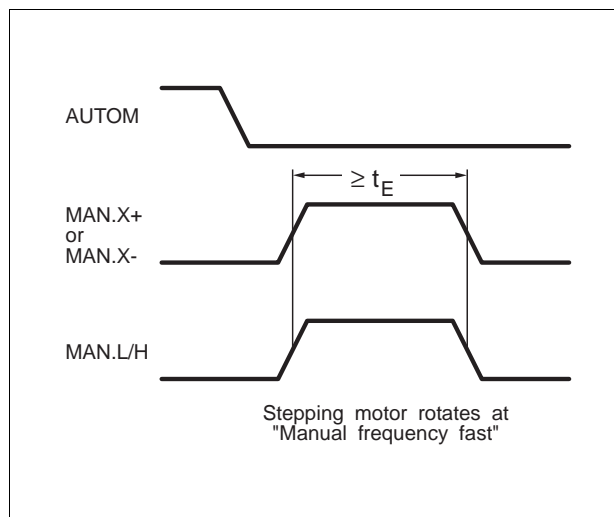


Fig. 3-18 Fast manual movement



NOTE

The effect of the inputs MAN.X+ and MAN.X- may be modified with parameter switch (54).



NOTE

The motor accelerates/decelerates during manual movement according to the value set at selector switch (49) before switching on.



NOTE

The parameter "Manual frequency fast" may be modified with the "M97=" command (factory setting 1 kHz).

3.4.1.3 Manual reference movement



NOTE
Reference movement principle
see chapter 6.3.

1. Deactivate input AUTOM.
2. For movement towards limit switch in the positive sense of rotation:
activate inputs MAN.X+ and MAN.REF. simultaneously (longer than settling time t_E).
3. For movement towards limit switch in the negative sense of rotation:
activate inputs MAN.X- and MAN.REF. simultaneously (longer than settling time t_E).
4. For movement towards the additional reference switch:
activate inputs MAN.L/H and MAN.REF. simultaneously (longer than settling time t_E).

→ The motor keeps rotating at frequency "REF IN" in the desired direction, until the limit switch or additional reference switch is detected. It then leaves the limit switch at frequency "REF OUT" and stops. This position serves as the reference point for the system of dimensions.

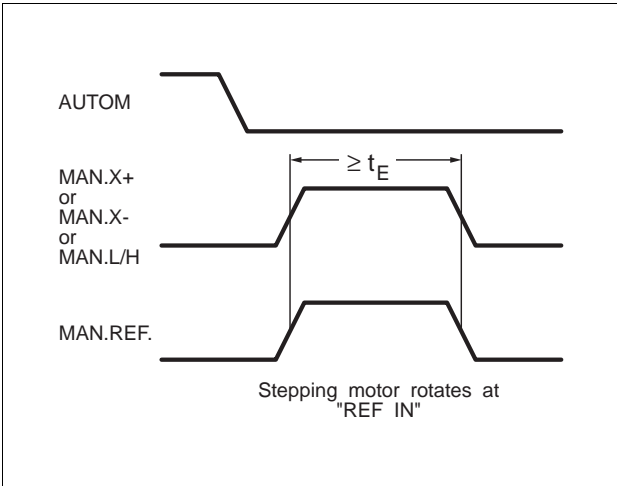


Fig. 3-19 Manual reference movement



NOTE
A reference movement can be interrupted by activating input STOP.



NOTE
The effect of inputs MAN.X+, MAN.X- and MAN.L/H can be modified with the parameter switch (54).



NOTE
The motor accelerates/decelerates during manual movement according to the value set at selector switch (49) before switching on.



NOTE
The parameter "REF IN" can be modified with the speed selector switch (48). "REF OUT" can be modified with the "U=" or "M21=" commands (factory setting 300 Hz).

3.4.1.4 Setting manual reference point

1. Deactivate input AUTOM.
2. Activate inputs MAN.REF. and LOAD simultaneously (longer than settling time t_E).
 → The value of the "reference position" serves as the new reference value for the system of dimensions.



NOTE

The parameter "reference position" can be modified with the "G28=" command (factory setting 0).

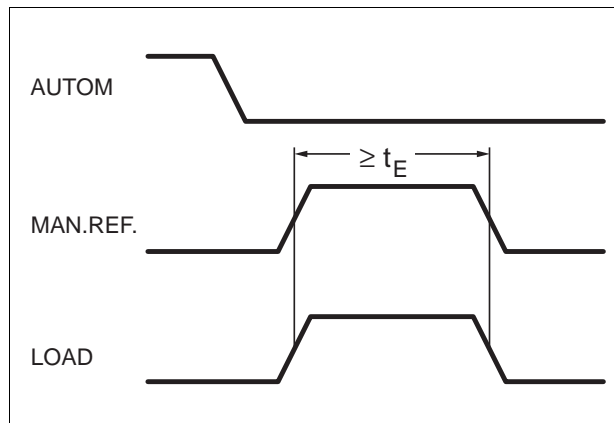


Fig. 3-20 Setting manual reference point

3.4.1.5 Manual movement (limited with PC)

Operation is effected with the commands marked in chapter 3.4.3 and all additional characters.

3.4.2 Automatic run

1. Switch off supply voltage for processor unit.
2. Set operating mode selector switch (47) to "2" for a transmission speed of 1200 bauds or to "3" for 9600 bauds.
3. Connect terminal or PC to serial interface.
4. Switch on supply voltage for processor unit.
→ LED 43 lights up, output READY O. is active.
5. Activate input AUTOM.
→ LED 44 lights up, output INPOS is active.
6. Transfer and starting of movement commands is triggered with commands and orders. Parameters may be modified.
7. Further operation is described in chapter 3.4.3.

3.4.3 Operation with a terminal or PC

Commands are instructions to the unit-internal operating system.

Command	Meaning	Range	Factory setting
M90*	Resetting M22, M92, M93, M98; activating transmission protocol 0		
M92*	Echo mode; activating transmission protocol 1		
M93*	Position acknowledgement on termination of movement	±8388607	
M98	Ready message B after ramp calculation		
M22*	Position and error messages are only transferred to host computer on request; activating transmission protocol 2		
P*	Outputting current position		
S*	Outputting status and error number		
FS*	Issuing fatal error in clear text		
E	Start		

* also during manual movement

Commands are classified into action commands (A) and setting commands (S). A command group consists of setting commands and one action command. The action command triggers an action after the start command (e.g. positioning).

Command	Type	Meaning	Range	Factory setting
X=	A	Setpoint to be approached (depending, on the system of dimensions)	±8388607	
F=	S	Movement frequency (speed) for positioning	32 to 20000 Hz	
L=	S	Positive and negative acceleration for positioning	4 to 1000 Hz/ms	
G25	A	Reference movement towards negative limit switch		
G26	A	Reference movement towards positive limit switch		
G27	A	Reference movement towards additional reference switch		
G28=	S	Enter reference position	±8388607	0
G29	A	Set reference point		
G36	S	Enable zero current feature, if RM RESET is active disable rotation monitoring, if RM RESET is inactive		
G37	S	Disable zero current feature, if RM RESET is active enable rotation monitoring, if RM RESET is inactive		
G90	S	Set system of absolute dimensions		
G91	S	Set system of incremental dimensions		

The following parameters may be modified.

Parameter	Meaning	Range	Factory setting
U= M21=	Movement frequency for moving to the reference point away from the limit switch	32 to 5000 Hz	
GZ=	"Gear ratio numerator"	1 to 255	1
GN=	"Gear ratio denominator"	1 to 255	1
M95=	"Gear ratio decimal"	0.1 to 100.0	
M96=	"Manual frequency slow"	32 to 20000 Hz	100 Hz
M97=	"Manual frequency fast"	32 to 20000 Hz	1000 Hz

Data record structure:

Instructions consist of commands, orders and parameters together with additional characters. Instructions are transmitted from the terminal or PC to the positioning unit.

The data record always starts with a colon at the line beginning and ends with <CR>:

```
:Instruction 1 ... Instruction n<CR>
```

Several instructions can be transmitted in one line, with a maximum of 80 characters per line. <BLANK>, <TAB> or comma may be used as separators between the instructions. An equal sign may be used between the instruction and the value in an instruction with a data transfer. There may only be one action command in a data record.



NOTE

If an order is entered several times in one line, it is overwritten. No error message will be issued. This allows e.g. correcting a faulty input by entering a new value once again.

Additional character	Meaning
:	Beginning of data record
<CR>	End of data record
<LF>	Line feed
,	Separator between instructions
=	Separator between instructions and the respective value
<BLANK>	Separator between instruction components
<TAB>	Separator between instruction components
	Deletes the last entered character of a record; the deleted character is output.
<BS>	Deletes the last entered character of a record; the deleted character is not output.
<CTRL>X	Deletes the entire record; it must be entered before <CR>.
<Break>	Any positioning process is immediately interrupted. The reference point must then be redefined.

The following feedback formats, status and error messages on the computer are possible amongst others:

```
X<CR><LF>          Position reached
B<CR><LF>          Ready message ramp
                    calculated
<XUUU10000><CR><LF> Position
<X -----><CR><LF> Motor positioning or
                    system has no
                    reference
```

Message	Meaning
(E 4)	Right limit switch actuated
(E 5)	Left limit switch actuated
(E 6)	Manual stop
(E14)	Undefined position
(E16)	Input value too low
(E17)	Input value too high
(E70)	Parity error
(E71)	Receiver overflow or break at input
(E73)	Input buffer full
(E74)	Inadmissible order
(E75)	Line does not begin with ":"
(E76)	No value specified or incorrect format
(E77)	Start attempt without valid data
(E78)	Internal counter overflow
(E81)	System error, request clear text message with FS
(E82)	Error detected by rotation monitoring feature
(E98)	Manual movement, no error occurred
(E99)	Automatic run, no error occurred

Programming examples:

```
:G28=2000, G29,E<CR>
:X=1000, E<CR>
```

or

```
:G28=2000<CR>
:G29<CR>
:E<CR>
```

Transmission protocol 0

Transmission protocol 0 is active after switching on the unit or called up using the "M90" command.

Input	Display	Comment
:G28=0 G29 E<CR>	- X<CR><LF>	Enter reference position and set reference point
:G91 F1000<CR>	-	Incremental dimensions/movement frequency
:X1000<CR>	-	Prepare movement command
:E<CR>	- - X<CR><LF>	Start movement command Motor performs positioning Positioning terminated
:F2000 X2000 E<CR>	- X<CR><LF>	Prepare new job and start Positioning terminated
:X100000 E<CR>	- - - (E 6)<CR><LF> X<CR><LF>	Prepare new job and start Motor is positioning Movement is interrupted by <u>STOP</u> ; motor stops
:P<CR>	- <XUUU65487><CR><LF>	Check current position
:S<CR>	- (E 6)<CR><LF>	Status/error number
:FS<CR>	- ff Kein fat F <CR><LF>	Fatal error message, if there was no status = E81 before
:M93<CR>	- - -	Initialization on position acknowledgement after terminating the movement
:G28=0 G29 E<CR>	- <XUUUUUUU0><CR><LF>	Enter reference position and set reference point
:X1000 E<CR>	- <XUUUU1000><CR><LF>	Position acknowledgement on terminating the movement
:X2000 E<CR>	- <XUUUU3000><CR><LF>	
:M98<CR>	- -	Ready message after ramp calculation
:F1000L200X1000<CR>	- B<CR><LF>	B (ready) after ramp calculation
:E<CR>	- <XUUUU4000><CR><LF>	Start movement Terminate positioning

Transmission protocol 1

Transmission protocol 1 is called up with the "M92" command.

It is used if the unit is operated via a terminal or from the host via a terminal program.

The essential difference from transmission protocol 0 consists in the fact that every character transmitted from the host to the WDP5-118 is immediately sent back from the WDP5-118 to the host (echo mode).

Input	Display	Comment
:M92<CR>	-	Activate echo mode
:P<CR>	:P<CR><LF> <X-----><CR><LF>	Check position Undefined position (no reference)
:S<CR>	:S<CR><LF> (E99)<CR><LF>	Status test Status AUTOM
:FS<CR>	:FS<CR><LF> ff Kein fat F <CR><LF>	Check error status

Transmission protocol 2

Transmission protocol 2 is called up with the "M22" command.
The unit only responds if it is prompted by the host.

The host immediately receives a positive acknowledgement (A<CR><LF>) or a negative acknowledgement (N<CR><LF>) followed by data for every instruction transferred.

Input	Display	Comment
:M22<CR>	- A<CR><LF>	Activate transmission protocol 2 A = positive acknowledgement
:G91 G28=0 G29 E<CR>	- A<CR><LF>	System of incremental dimensions, enter reference position and set reference point; positive acknowledgement without data
:P<CR>	- A<CR><LF> <X 0><CR><LF>	Position Positive acknowledgement without data
:Y<CR>	- N<CR><LF>	Inadmissible command Negative acknowledgement
:S<CR>	- A<CR><LF> (E 74)<CR><LF>	Status/error number
:F1000 X100000 E<CR>	- A<CR><LF>	Prepare new job and start
:P<CR>	- A<CR><LF> <X-----><CR><LF>	Motor is still positioning Code for "Position not yet reached"
:S<CR>	- A<CR><LF> (E 99)<CR><LF>	No error Status "Automatic mode active" !!! Movement interruption !!!
:S<CR>	- A<CR><LF> (E 6)<CR><LF>	Error message "Positioning interrupted by STOP"
:P<CR>	- A<CR><LF> <XUUUU4711><CR><LF>	Current motor position
:FS<CR>	- A<CR><LF> ff Kein fat F <CR><LF>	Testing after fatal error
:M98<CR>	- A<CR><LF>	Ready message after ramp calculation
:F1000L200X1000E<CR>	- A<CR><LF> B<CR><LF> -	B (ready) after ramp calculation Motor is positioning
:P<CR>	- A<CR><LF> <X-----><CR><LF> -	Motor stands still
:P<CR>	- A<CR><LF> <XUUUU5711><CR><LF>	Current motor position

3.5 Parallel mode

Parallel mode offers the following operating possibilities:

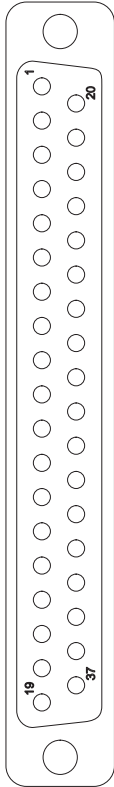
Manual movement

- Slow manual movement
The stepping motor rotates at "Manual frequency slow" which may be modified as a parameter. The parameter value is adjustable, factory setting 100 Hz.
- Fast manual movement
The stepping motor rotates at "Manual frequency fast" which may be modified as a parameter. The parameter value is adjustable, factory setting 1 kHz.
- Manual reference movement
The stepping motor keeps rotating at frequency "REF IN", which may be modified as a parameter, until it detects either the left limit switch, right limit switch or additional reference switch. The parameter value "REF IN" is adjustable, factory setting 1 kHz.
On detecting the selected limit switch and subsequent braking, the stepping motor leaves the limit switch or reference switch at frequency "REF OUT", which may be modified as a parameter, and stops. This position serves as the reference point for the system of dimensions.
The parameter value "REF OUT" is adjustable, factory setting 300 Hz.
- Setting the manual reference point
The "reference point position" (factory setting 0), which may be modified as a parameter, is accepted as the new reference value for the system of dimensions by activating two inputs. A reference movement is not required.

Automatic run

- Automatic run with parallel data transfer of stored programs in absolute or incremental dimensions.

Control signals in parallel mode



Pin	Abbreviation	Meaning	
1	$\overline{\text{LIM.X-}}$	Negative limit switch	←
2	-	-	
3	-	-	
4	START	Start	←
5	LOAD	Load	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	←
7	MAN.X-	Manual movement, CCW rotation	←
8	MAN.L/H	Slow/fast manual movement	←
9	DATA4	Decade value 2^2	←
10	DATA1	Decade value 2^0	←
11	-	-	
12	-	-	
13	-	-	
14	FAULT/CL	Error and clock signal	→
15	READY O.	Ready for operation	→
16	24VDC	System supply voltage	←
17	24VDC	System supply voltage	←
18	IO24VDC	I/O supply voltage	←
19	IO24VDC	I/O supply voltage	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	←
21	-	-	
22	RM RESET	Rotation monitoring reset	←
23	$\overline{\text{STOP}}$	Stop	←
24	RS/CL.A.	Clock acknowledge	←
25	AUTOM	Automatic operation	←
26	MAN.X+	Manual movement, CW rotation	←
27	MAN.REF.	Manual reference movement	←
28	DATA8	Decade value 2^3	←
29	DATA2	Decade value 2^1	←
30	-	-	
31	-	-	
32	-	-	
33	INPOS	Position reached	→
34	$\overline{\text{END/L.A.}}$	Load acknowledge	→
35	24VGND	System supply voltage ground	←
36	24VGND	System supply voltage ground	←
37	IOGND	I/O supply voltage ground	←

$\overline{\hspace{1cm}}$ active-low signal ← input → output

3.5.1 Manual movement

3.5.1.1 Slow manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+.
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X-.
- The motor rotates at "Manual frequency slow" in the selected direction, as long as input MAN.X+ or MAN.X- is active and the limit switch is not actuated.

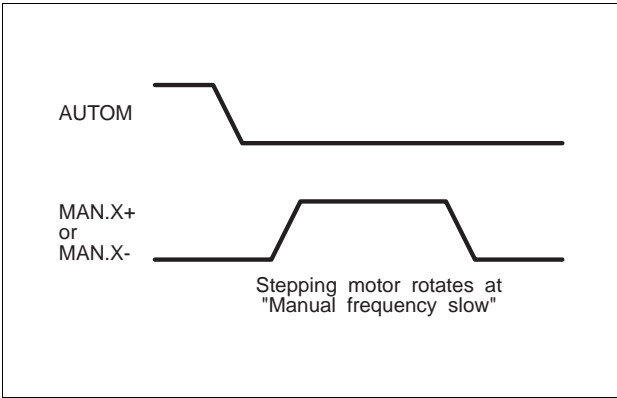


Fig. 3-21 Slow manual movement



NOTE
The effect of inputs MAN.X+ and MAN.X- may be modified with the parameter switch (54).



NOTE
If input MAN.X+ or MAN.X- is only activated temporarily (<0.5 s), the motor performs a step.



NOTE
The motor accelerates/decelerates during manual movement with the value set at the selector switch (49) before switching on.



NOTE
The parameter "Manual frequency slow" may be modified with the MP 922 hand-held programming unit or a PC (in network mode) (factory setting 100 Hz).

3.5.1.2 Fast manual movement

1. Deactivate input AUTOM.
 2. Select the sense of rotation:
 - For positive sense of rotation in clockwise direction viewed to motor shaft: activate input MAN.X+ and MAN.L/H simultaneously (longer than settling time t_E).
 - For negative sense of rotation in counter-clockwise direction viewed to motor shaft: activate input MAN.X- and MAN.L/H simultaneously (longer than settling time t_E).
- The motor keeps rotating at "Manual frequency fast" in the desired direction, as long as the inputs MAN.X+ or MAN.X- and MAN.L/H are active.

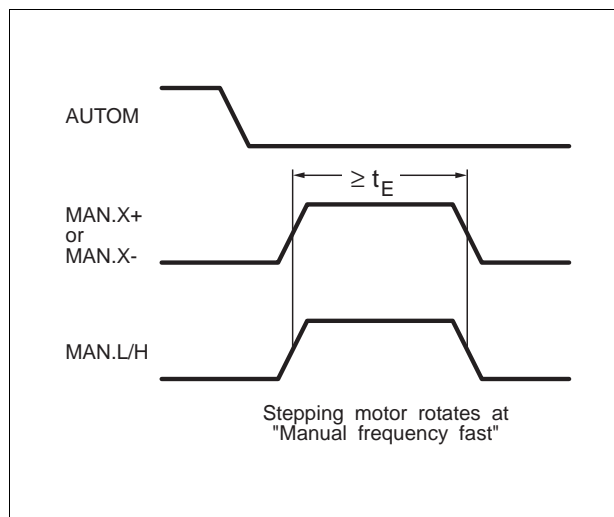


Fig. 3-22 Fast manual movement



NOTE

The effect of the inputs MAN.X+ and MAN.X- may be varied with the parameter switch (54).



NOTE

The motor accelerates/decelerates during manual movement according to the value set at selector switch (49) before switching on.



NOTE

The parameter "Manual frequency fast" may be modified with the MP 922 hand-held programming unit or a PC (in network mode) (factory setting 1 kHz).

3.5.1.3 Manual reference movement



NOTE
Reference movement principle see chapter 6.3.

1. Deactivate input AUTOM.
2. For movement towards limit switch in the positive sense of rotation: activate inputs MAN.X+ and MAN.REF. simultaneously (longer than settling time t_E).
3. For movement towards limit switch in the negative sense of rotation: activate inputs MAN.X- and MAN.REF. simultaneously (longer than settling time t_E).
4. For movement towards the additional reference switch: activate inputs MAN.L/H and MAN.REF. simultaneously (longer than settling time t_E).

→ The motor keeps rotating at frequency "REF IN" in the selected direction, until the limit switch or additional reference switch is detected. It then leaves the limit switch at frequency "REF OUT" and stops. This position serves as the reference point for the system of dimensions.



NOTE
A reference movement may be interrupted by activating input STOP.



NOTE
The effect of the inputs MAN.X+, MAN.X- and MAN.L/H may be modified with the parameter switch (54).



NOTE
The motor accelerates/decelerates during manual movement according to the value set at selector switch (49) before switching on.



NOTE
The parameters "REF IN" and "REF OUT" may be modified with the MP 922 hand-held programming unit or a PC (in network mode) (factory setting "REF IN" 1 kHz, "REF OUT" 300 Hz).

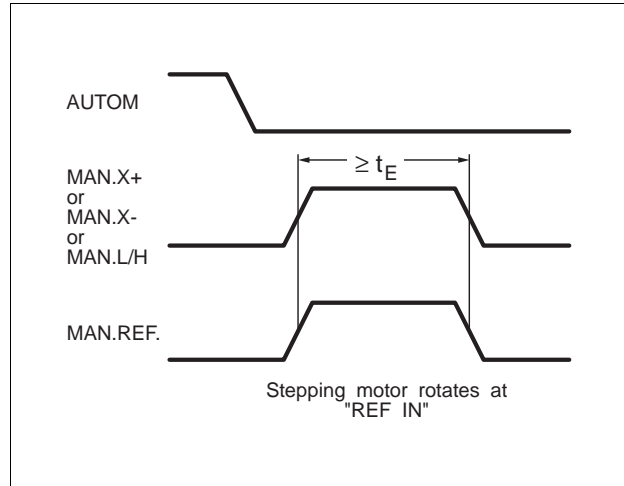


Fig. 3-23 Manual reference movement

3.5.1.4 Setting manual reference point



NOTE

A reference point is not required in the system of incremental dimensions.

1. Deactivate input AUTOM.
 2. Activate inputs MAN.REF. and LOAD simultaneously (longer than settling time t_E).
- The "reference position" value serves as the new reference value for the system of dimensions.



NOTE

The parameter "reference position" may be modified with the MP 922 hand-held programming unit or a PC (in network mode) (factory setting 0).

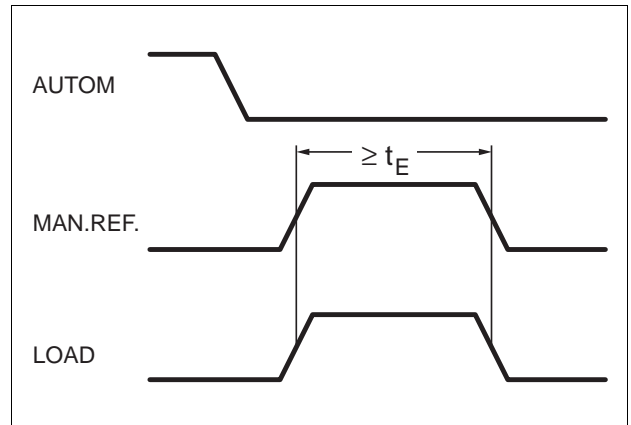


Fig. 3-24 Setting manual reference point

3.5.2 Automatic run

1. Switch off supply voltage for processor unit.
2. Set operating mode selector switch (47) to "4" for the system of absolute dimensions or "5" for the system of incremental dimensions.
3. Switch on supply voltage for processor unit.
→ LED 43 and LED 46 light up.



NOTE

A reference point must be set in the system of absolute dimensions, see chapter 3.5.1.4.

4. Activate input AUTOM.
→ LED 44 lights up, output INPOS is active.
5. Set the position and frequency value on the 8 block of decade switches, range:

Position: ±799999
(full or half step,
absolute or incremental dimensions)
Frequency: 00-99 (00=100%)
percentage of the value set
at the selector switch (48).



ATTENTION

The decade values must not be modified during the specified "readings". Otherwise, an error message will be issued.



ATTENTION

The signal times for the parallel data transfer stipulated in the table must be observed.



NOTE

The number of "readings" may be modified with the MP 922 handheld programming unit or PC (in network mode).
If a decade value is modified during the readings, an error message is issued (output FAULT/CL is active). Reading must be repeated completely in such a case.

6. Activate input LOAD.
→ The output signal $\overline{\text{END/L.A.}}$ is activated.
→ The output signal FAULT/CL is deactivated. (Any error message is deleted.)
7. Read in decade values with the control signals RS/CL.A. and FAULT/CL in accordance with the timing diagram (fig. 3-25).

→ Output signal $\overline{\text{END/L.A.}}$ is activated after entering the decade values.

The output FAULT/CL functions as a synchronization clock for the decade transfer. On every edge change, the unit prompts the PLC to send the next decade (1, 4). The PLC then applies the decade value to the unit. Afterwards, the PLC confirms existence of the decade (2, 5) via the RS/CL.A. signal. The unit accepts the decade value (3, 6). It must be noted that the unit queries every single decade at intervals of 100 μs. The number of queries per decade depends on the adjustable parameter value "decade settling time". The decade value must be applied for an appropriate period to ensure safe data transfer. On detection of inadmissible data, an error message is issued.

8. Activate input START.
 - The INPOS output signal is deactivated. The motor is positioning (acceleration in accordance with the selector switch (49) setting).
 - The output signal INPOS is activated again after terminating the movement.



NOTE
 The inputs START and LOAD may also be activated simultaneously for reading and starting immediately.
 The MP 922 hand-held programming unit or PC (in network mode) may be used to conduct an initial test (suitable for detecting wiring errors of the e.g. decade switches).

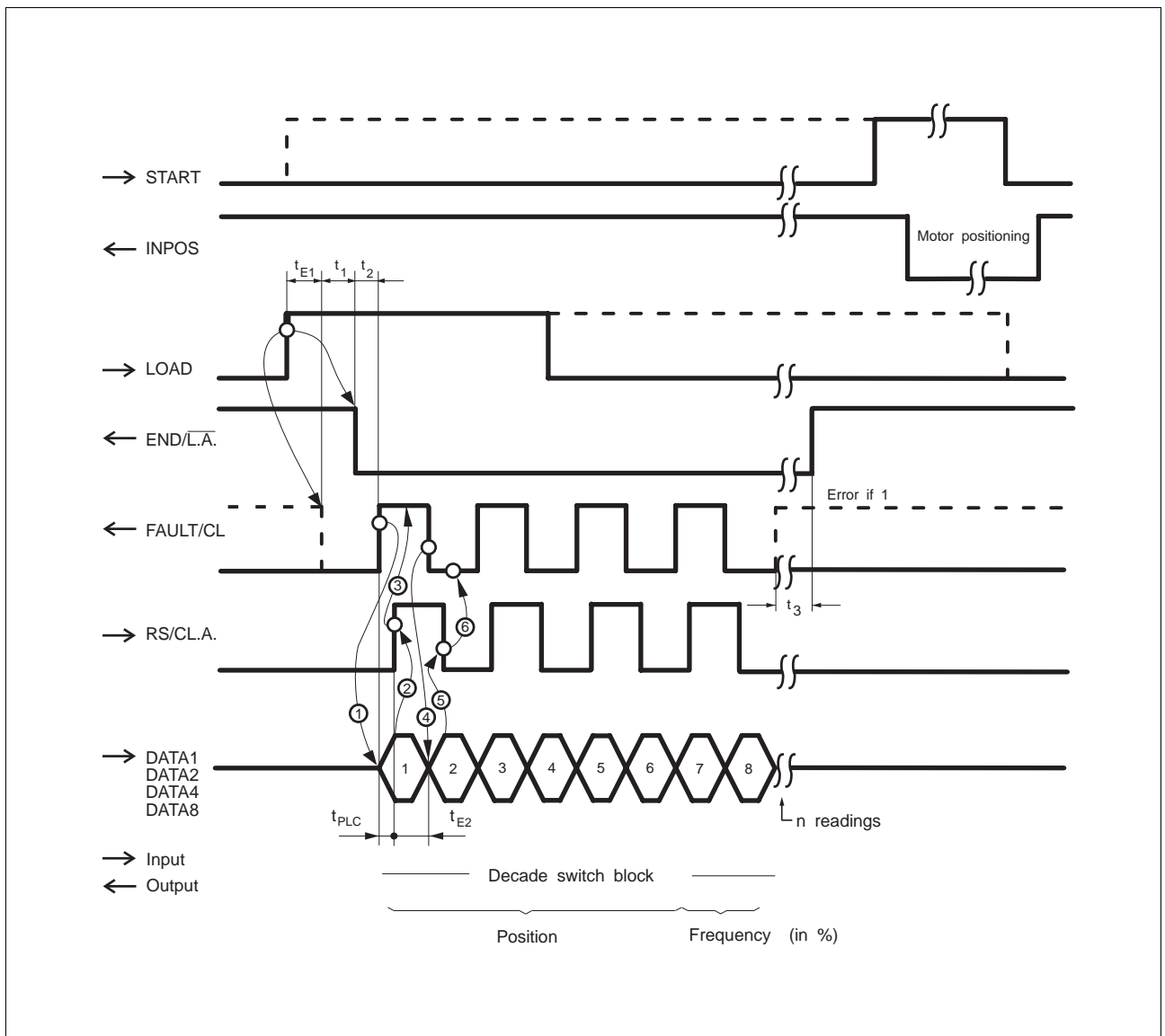


Fig. 3-25 Timing diagram for parallel data transfer

Abbreviation	Meaning	Minimum	Factory setting	Maximum	Unit
t _{E1}	"Settling time" (may be modified with the MP 922 hand-held programming unit)	1	20	255	ms
t ₁	Wait time if an error has occurred in the previous reading cycle		400		μs
t ₂	Time delay between END/L.A. = 0 and the first decade request with FAULT/CL = 1.		100		μs
t _{PLC}	Time delay between data request and validity acknowledgement		PLC-dependent		μs
t _{E2}	"Decade settling time" (may be modified with MP 922 hand-held programming unit).	5	5	255	x100 μs
t ₃	Wait time, if an error has occurred in the previous reading cycle		400		μs

3.5.3 MP 922 hand-held programming unit

3.5.4 System setting

The MP 922 hand-held programming unit offers the following operating possibilities in parallel mode:

- Displaying and modifying parameters
- Testing inputs
- Displaying travel position

The following parameters may be modified within the specified ranges:



NOTE
Connection of the hand-held programming unit is described in chapter 6.2.5.



NOTE
Operation of the hand-held programming unit is described in the MP 922 documentation.

Parameter	Range	Factory setting
"Manual frequency slow"	32 to 20000 Hz	100 Hz
"Manual frequency fast"	32 to 20000 Hz	1000 Hz
"Settling time" t _E	1 to 255 ms	4 ms
"Gear ratio denominator"	1 to 255	1
"Gear ratio numerator"	1 to 255	1
Manual frequency "REF IN"	32 to 20000 Hz	2000 Hz
Manual frequency "REF OUT"	32 to 5000 Hz	300 Hz
"Readings"	1 to 255	2
"Decade settling time"	5 to 255	5
"Reference position"	±8388607	0



NOTE
System setting see MP 922 or PRO-SDP/PC1 documentation.

3.6 Network mode

Network mode provides for all the operating possibilities which are also available in storage, parallel and serial mode. The following network modes are possible:

- "Install" Installation and diagnosis mode
- "Memory" Storage mode
- "Serial" Serial mode
- "A-Parallel" Parallel mode in the system of absolute dimensions
- "R-Parallel" Parallel mode in the system of incremental dimensions

Manual movement

- Slow manual movement
- Fast manual movement
- Manual reference movement
- Setting the manual reference point
- Teach-in
- Limited operation via PC

Automatic run

- Operation via PC with the PRO-SDP/PC1 or PRO-SDP/PC2 software at a transmission speed of 9600 bauds or 38.4 kbauds

Signal control in automatic run depends on the selected network mode:

"Memory"	see chapter 3.3	Storage mode
"Serial"	see chapter 3.4	Serial mode
"Parallel"	see chapter 3.5	Parallel mode

Operation and setting of the network operating modes is effected on the PC with the aid of the following software:

- PRO-SDP/PC1
Menue system (BPRO) for comfortable operation and networking of 1 to 124 units (4 interfaces x 31 units).



NOTE
Operation is described in the PRO-SDP/PC1 documentation.

3.6.1 Setting the network address

1. Switch off supply voltage for processor unit.
2. Set operating mode selector switch (47) to "8".

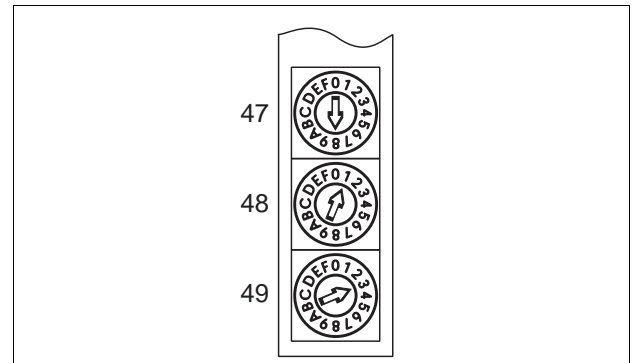


Fig. 3-26 Selector switches

3. Set the desired network address (range 1 to 31) on selector switches (48) and (49):

Selector switch (48) = value of tens
Selector switch (49) = value of ones
(e.g. "13", see fig. 3-26)

4. Switch on supply voltage for processor unit.
→ Network address is stored in the unit.
LED 43 and 46 light up.
5. Switch off supply voltage for processor unit.
6. Set operating mode selector switch (47) to "6" for a transmission speed of 9600 bauds or to "7" for 38.4 kbauds.
7. Switch on supply voltage for processor unit.
→ Network mode is active.
LED 43 and 46 light up.
8. Further operation in operating mode
 - "Memory", see also chapter 3.3
 - "Serial", see also chapter 3.4
 - "A-Parallel" or "R-Parallel", see also chapter 3.5

3.6.2 PLC request

A PLC request may be enabled in the unit in network mode "Memory".

This PLC request allows the PLC to inform the superior PC on the process status. Whether a PLC request exists can be checked via the PC.

The PLC request is set via inputs DATA1 to DATA8. Consequently, 16 different process states can be indicated to the PC,

e.g. PLC request number

- 0 deleting old program
- loading new programs
- 1 loading new parameters into the unit

Setting a PLC request

1. Activate network mode "Memory", see PRO-SDP/PC1 documentation.
2. Specify the desired PLC request number by activating or deactivating the four inputs DATA1 to DATA8 in accordance with the following table.

DATA8	DATA4	DATA2	DATA1	PLC request no.
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

0 = input inactive 1 = input active

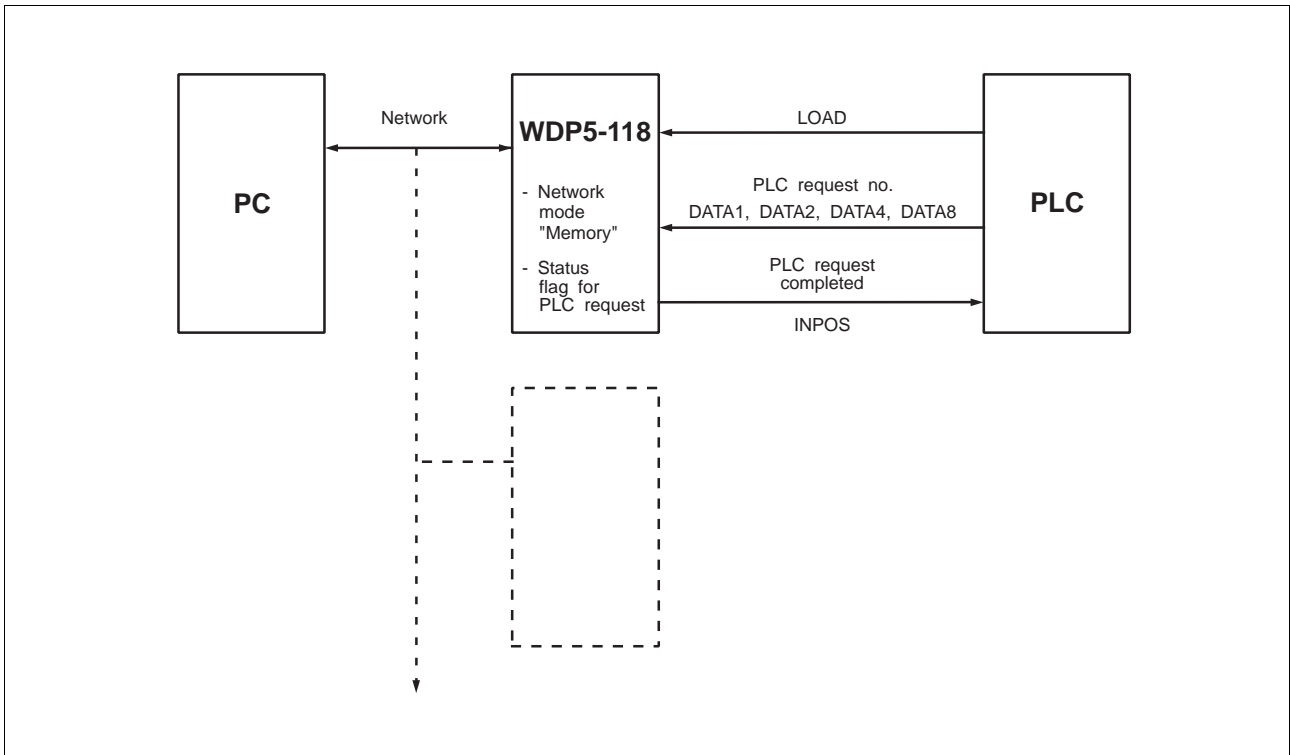


Fig. 3-27 PLC request

3. Activate input LOAD.
 - PLC request is stored in the unit.
 - The output signal INPOS is inactive.
4. After detecting a PLC request (check unit status) in network mode "Memory": activate network mode "Install", read PLC request no. and trigger the appropriate activities e.g. load new parameters or program) on the PC, see PRO-SDP/PC1 documentation.



NOTE

The program pointers are reset after exiting from network mode "Memory".

5. Activate network mode "Memory".
 - PLC request is deleted in the positioning unit.
 - The output signal INPOS is active.
6. The PLC subsequently controls process execution.



ATTENTION

The signal times evident in fig. 3-28 must be observed when setting a PLC request.

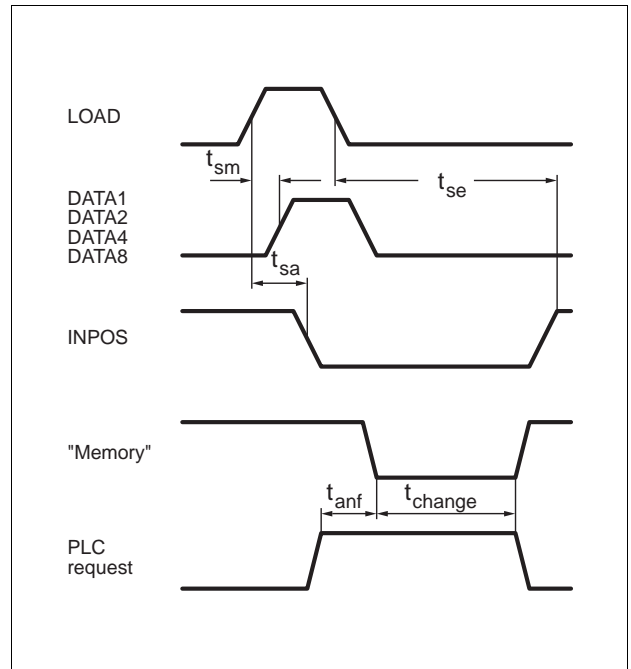


Fig. 3-28 PLC request

Abbreviation	Meaning	Minimum	Typical	Maximum
t _{sm}	Time delay between storage and modification of the PLC request number	-∞	0	t _E
t _{sa}	Time delay between storage and detection of the PLC request	t _E	t _E	
t _{se}	Time delay between termination of storage and PLC request modification completed	t _E	t _{anf} + t _{change}	
t _{anf}	The delay between detection of the PLC request and switching over to network mode "Install"			
t _{change}	The delay between switching over from network mode "Install" to "Memory" (modification time for PC)			

3.6.3 Teach-in

1. Switch off supply voltage for processor unit.
2. Set operating mode selector switch (47) to "6" for a transmission speed of 9600 bauds or to "7" for 38.4 kbauds.
3. Switch on supply voltage for processor unit.
→ LED 43 and LED 46 light up.
4. Activate input AUTOM.
→ LED 44 lights up.
5. Activate network mode "Memory".
6. Deactivate input AUTOM.
7. Perform reference movement or set manual reference point.
8. Specify the desired program number under which the teach-in positions must be stored by activating or deactivating the four inputs DATA1 to DATA8 in accordance with the following principle:

DATA8	DATA4	DATA2	DATA1	Program number
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

0 = input inactive 1 = input active



NOTE
Select a program number under which no program has been stored yet. This program would otherwise be overwritten.

8. Activate inputs RS/CL.A. and LOAD simultaneously (longer than settling time t_E).
 - The program number is selected.
 - LED 42 and LED 44 light up. The output signals FAULT/CL and INPOS are active.
9. Approach the desired position manually, see chapter 3.3.1.1 or 3.3.1.2.
10. Activate input LOAD temporarily (longer than settling time t_E).
 - The position is stored as an absolute position.
 - LED 44 lights up, output INPOS is active.
11. Approach next position and store.



NOTE

In the mechanical reversal of the system, the individual positions should be approached in the same direction as in the automatic run performed later. The individual positions are always stored as absolute positions.

12. The program prepared in teach-in mode can be edited with the PC, see PRO-SDP/PC1 documentation.

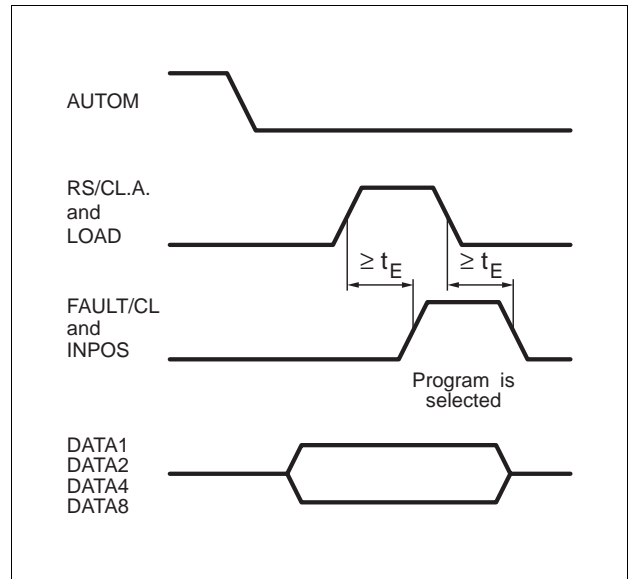


Fig. 3-29 Select program

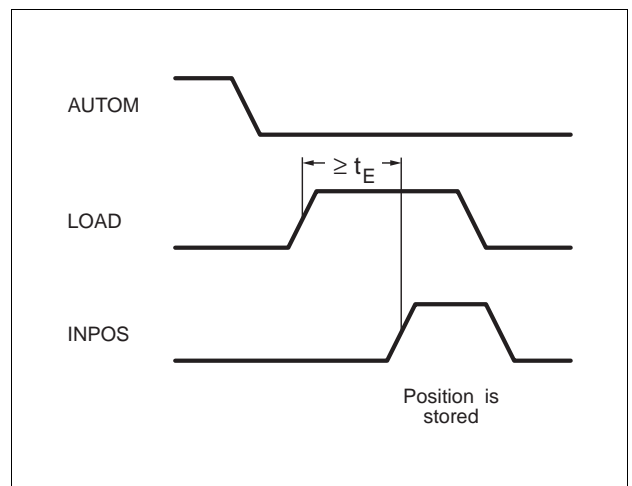


Fig. 3-30 Teach-in



NOTE

An example of wiring the function "Teach-in" is shown in fig. 3-31.

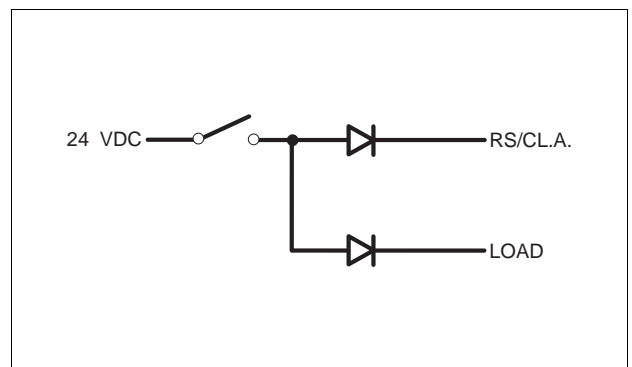


Fig. 3-31 Example of wiring "Teach-in"

3.7 Switching off

The connected motor is no longer supplied with current after switching off the supply voltage for the power drive, i.e. it has no holding torque.



ATTENTION

Make sure that vertical axle loads are prevented from dropping (e.g. motor with brake) before switching the supply voltage off.

Switch off supply voltages for the power drive and processor unit.

4 Malfunctions

4.1 Status displays

The seven-segment display (02) indicates malfunctions in the power drive.

The seven-segment display (40) indicates malfunctions of the processor unit.

LED 41 to 46 indicate operating states and malfunctions. They refer to the following signal outputs:

LED 41 (red)	Battery monitoring
LED 42 (red)	FAULT/CL (Fault/Clock)
LED 43 (green)	READY O. (Ready for operation)
LED 44 (green)	INPOS (Position reached)
LED 45 (green)	Several functions
LED 46 (green)	END/L.A. (Program end/load acknowledge)

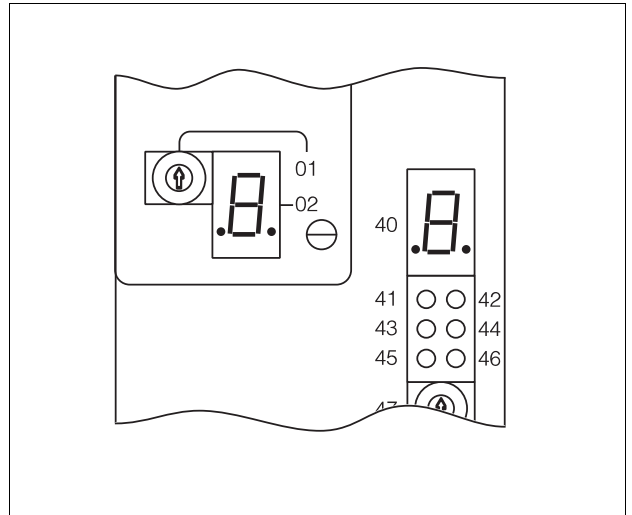


Fig. 4-1 Status display

The MP 922 hand-held programming unit can be used to deliver a clear text error message after an error message FAULT/CL is issued - LED 42 lights up.



NOTE
For error rectification see MP 922 documentation.

Malfunctions

4.2 Trouble-shooting tables

4.2.1 Power drive

The following table summarizes possible malfunctions, which are indicated by the seven-segment display of the Power drive as well as their causes and rectification .

Display	Cause	Rectification
■ Flashing	Internal error	Replace unit
0	Temperature at mounting flange >60°C Unit remains operable!	Reduce phase current
		Attach heat sink or enlarge existing heat sink, see chapter 6.2.7
		Provide existing heat sink with ventilator set, see chapter 6.2.7
2	Load circuit active	Choose lower acceleration value
3	Temperature at mounting flange too high	Reduce phase current
		Attach heat sink or enlarge existing heat sink, see chapter 6.2.7
		Provide existing heat sink with ventilator set, see chapter 6.2.8
4	Short-circuit in connector, cable or motor; Phase to phase, phase to ground	Switch off unit and remove short-circuit
		Replace motor
6	Braking energy of the motor too high; load resistor missing	Connect load resistor, see chapter 6.2.1
	Unit set to 230 VDC; input voltage 115 VDC Supply voltage outside the permissible tolerance range	Apply appropriate supply voltage
8	Processor unit not ready	See processor unit trouble-shooting table

4.2.2 Processor unit

4.2.2.1 Storage mode



The following table summarizes the malfunctions which are possible in storage mode as well as their causes and rectification.

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
□	Power drive failure	Restart system
	Travel too long	
	RAM or EPROM error (LED 45 flashes)	
/	On automatic run: Limit switch actuated	Check system; positioning may be terminated by repeated activation of input START
	On automatic run: Interference on limit switch line	
	On manual movement: Manual movement interrupted by signal at limit switch or $\overline{\text{STOP}}$	Move mechanical system away from limit switch range or deactivate STOP
	Input $\overline{\text{LIM.X-}}$, $\overline{\text{LIM.X+}}$, $\overline{\text{ADD.REF}}$ or STOP disconnected	Check cabling
2	Rotation monitoring error due to: – Encoder disconnected – Excessive load – Excessive acceleration – Excessive speed	– Check encoder line – Reduce load – Reduce acceleration – Reduce speed – Disable rotation monitoring (activate RM RESET signal)
3	Input $\overline{\text{STOP}}$ activated	Check system; Reactivate input START and terminate positioning
	Malfunction at input $\overline{\text{STOP}}$	
6	System has no reference point	Reform reference movement
		Set reference point
7	Input START activated, although program end reached	Set program pointer back to program beginning

Malfunctions

4.2.2.2 Serial mode

The following table summarizes the malfunctions which are possible in serial mode as well as their causes and rectification .

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
	Power drive failure	Restart system
	Travel too long	
	RAM or EPROM error (LED 45 flashes)	
/	On manual movement: Manual positioning interrupted by signal at limit switch or STOP	Move mechanical system away from limit switch range or deactivate STOP
	Input LIM.X-, LIM.X+, ADD.REF. or STOP disconnected	Check cabling
	Rotation monitoring error due to: <ul style="list-style-type: none">- Encoder disconnected- Excessive load- Excessive acceleration- Excessive speed	<ul style="list-style-type: none">- Check encoder line- Reduce load- Reduce acceleration- Reduce speed- Disable rotation monitoring (activate RM RESET signal)

4.2.2.3 Parallel mode

The following table summarizes the malfunctions which are possible in parallel mode as well as their causes and rectification.

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
□	Power drive failure	Restart system
	Travel too long	
	RAM or EPROM error (LED 45 flashes)	
/	Limit switch actuated	Check system; positioning may possibly be terminated by reactivating input START
	Interference on limit switch line	
	No reference point available	Perform manual reference movement Set reference point
2	Rotation monitoring error due to: <ul style="list-style-type: none"> – Encoder disconnected – Excessive load – Excessive acceleration – Excessive speed 	<ul style="list-style-type: none"> – Check encoder line – Reduce load – Reduce acceleration – Reduce speed – Disable rotation monitoring (activate RM RESET signal)
5	Start attempt without valid data	Effect read-in cycle
	Error while reading in the decade switch values	Read in again
	Manual positioning interrupted by signal at limit switch or STOP	Move mechanical system away from limit switch range or deactivate STOP
	Input LIM.X-, LIM.X+, ADD.REF. or STOP disconnected	Check cabling
7	Input STOP activated	Check system; Reactivate input START and terminate positioning
	Malfunction at input STOP	

Malfunions

4.2.2.4 Network mode

Network mode "Memory"

The following table summarizes the malfunctions which are possible in network mode "Memory" as well as their causes and rectification.

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
□	Power drive failure	Restart system
	Travel too long	
	RAM or EPROM error (LED 45 flashes)	
/	Limit switch actuated	Check system; positioning may possibly be terminated by reactivating input START
	Interference on limit switch line	
2	Rotation monitoring error due to: <ul style="list-style-type: none"> – Encoder disconnected – Excessive load – Excessive acceleration – Excessive speed 	<ul style="list-style-type: none"> – Check encoder line – Reduce load – Reduce acceleration – Reduce speed – Disable rotation monitoring (activate RM RESET signal)
3	Input $\overline{\text{STOP}}$ activated	Check system: Reactivate input START and terminate positioning
	Malfunction at input $\overline{\text{STOP}}$	
5	Manual movement interrupted by signal at limit switch or $\overline{\text{STOP}}$	Move mechanical system away from limit switch range or deactivate STOP
	Input $\overline{\text{LIM.X-}}$, $\overline{\text{LIM.X+}}$, $\overline{\text{ADD.REF.}}$ or $\overline{\text{STOP}}$ disconnected	Check cabling
6		Perform reference movement
		Set reference point
7	Input START activated, although program end reached	Set program pointer back to program beginning

Network mode "Serial"

The following table summarizes malfunctions which are possible in network mode "Serial" as well as their causes and rectification.

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
0	Power drive failure	Restart system
	Travel too long	
	RAM or EPROM error (LED 45 flashes)	
1 ¹ 5 ²	On automatic run: Limit switch actuated	Check system; positioning may possibly be terminated by reactivating input START
	On automatic run: Interference on limit switch line	
2	Rotation monitoring error due to: – Encoder disconnected – Excessive load – Excessive acceleration – Excessive speed	– Check encoder line – Reduce load – Reduce acceleration – Reduce speed – Disable rotation monitoring (activate RM RESET signal)
3 ¹ 7 ²	Input $\overline{\text{STOP}}$ activated	Check system: Reactivate input START and terminate positioning
	Malfunction input $\overline{\text{STOP}}$	
5	On manual movement: Manual positioning interrupted by signal at limit switch or $\overline{\text{STOP}}$	Move mechanical system away from limit switch range or deactivate STOP
	Input $\overline{\text{LIM.X-}}$, $\overline{\text{LIM.X+}}$, $\overline{\text{ADD.REF.}}$ or $\overline{\text{STOP}}$ disconnected	Check cabling

¹ Display, if output $\overline{\text{END/L.A.}} = 0$.

² Display, if output $\overline{\text{END/L.A.}} = 1$.

Malfunctions

Network mode "A/R Parallel"

The following table summarizes the malfunctions which are possible in network mode "Parallel" as well as their causes and rectification.

Display	Cause	Rectification
■ Flashing	Battery failure	Call BERGER LAHR
□	RAM or EPROM error (LED 45 flashes)	Restart system
	Power drive failure	
	Travel too long	
/	Limit switch actuated	Check system; positioning may possibly be terminated by reactivating input START
	Interference on limit switch line	
	No reference point available, limit switch actuated or malfunction on limit switch line	Perform manual reference movement Set reference point
2	Rotation monitoring error due to: <ul style="list-style-type: none"> – Encoder disconnected – Excessive load – Excessive acceleration – Excessive speed 	<ul style="list-style-type: none"> – Check encoder line – Reduce load – Reduce acceleration – Reduce speed – Disable rotation monitoring (activate RM RESET signal)
5	Start attempt without valid data	Effect read-in cycle
	Error while reading in the decade switch values	Read in again
	Manual positioning interrupted by signal at limit switch or \overline{STOP}	Move mechanical system away from limit switch range or deactivate STOP
	Input $\overline{LIM.X-}$, $\overline{LIM.X+}$, $\overline{ADD.REF.}$ or \overline{STOP} disconnected	Check cabling
7	Input \overline{STOP} activated	Check system; Reactivate input START and terminate positioning
	Malfunction at input \overline{STOP}	

4.2.3 Error messages

The following error messages may be issued during operation with a PC.

4.2.3.1 Error messages in all operating modes

The error numbers are encoded in hexadecimal format.

Error message	Possible cause	Rectification
Error 01 Power drive not ready	Positioning unit error	Call BERGER LAHR
Error 05 Stop signal detected	Stop triggered or STOP signal interference	
Error 07 Positive limit reached	Limit switch for positive sense of rotation triggered	
Error 08 Negative limit reached	Limit switch for negative sense of rotation triggered	
Error 18 Range exceeded in relative positioning	Calculated setpoint in relative positioning out of the permissible moving range: ± 8388607	Change parameter "reference position"
Error 43 Overflow caused by GF	Setpoint calculated with gear ratio (≥ 1) out of the permissible moving range: ± 8388607	Network mode "Memory"/Storage mode: Set new reference point in the program (command "G29=") Network mode "A-/R-Parallel"/Parallel mode: Enter new reference position and activate
Error 44 Overflow caused by GF	Manual movement with gear ratio (< 1) is out of the permissible moving range: ± 8388607	Network mode "Memory"/Storage mode: Set new reference point in the program (command "G29=")
Error 45 Movement command without reference point	No reference movement performed before first positioning	Perform manual or automatic reference movement (commands "G25", "G26", "G27") before positioning for the first time or set reference point (command "G29=") before the first positioning
Error 46 Basic initialization effected	Parameter setting ex works is accepted	Message is issued when switching the positioning unit on for the first time, work sequence is not interrupted
Error 47 Power drive not ready	Power drive failure	Check power drive
Error 48 Basic initialization after error in movement program	Positioning reinitialized after detecting an error in the movement program	Correct parameter setting
		Reload or edit programs

Malfunctions

Error message	Possible cause	Rectification
Error 4F Additional reference switch not found	The additional reference switch is not detected in the reference movement (command "G27)	Connected additional reference switch
		Check cabling
		Check additional reference switch
Error 5B Motor: loss. of synch.	Following error detected by rotation monitoring feature	Reduce acceleration value
	Shaft encoder disconnected, although rotation monitoring feature is active	Connect shaft encoder
	Shaft encoder or shaft encoder cable defective	Check shaft encoder and cable
Error 5D Bus error	Positioning unit fault	Call BERGER LAHR

4.2.3.2 Error messages in network mode

Error message	Possible cause	Rectification
Error 90 Inadmissible control byte	Control byte in protocol not permitted	Call BERGER LAHR
Error 92 Inadmissible command (code byte not defined)	Command not possible with this unit	
Error 93 Command in current network mode not permitted	Command with deactivated input AUTOM	Activate input AUTOM
	Command impossible in current network mode	Switch over to appropriate network mode
Error 94 Switching over between operating modes impossible (AUTOM inactive)	Switching over to network mode with input AUTOM inactive	Activate input AUTOM
Error 95 Stop command in current operating mode impossible	Stop command in network mode "Memory" and "A-/R-Parallel" triggered	
Error 96 Switching over from manual to network mode "Serial" (remaining data deleted)	Switching over to manual movement although not all the transferred jobs have been processed	Wait until all transferred jobs have been processed in network mode "Serial"
Error A0 Deletion of more than 16 programs	More than 16 programs have been transferred for deletion	Check data record for the deletion of programs
Error A2 Inadmissible number of bytes in parameter data record	Incorrect number of values in parameter set	Check parameter set
Error A3 Parameter error: Frequency manual slow	Entered value out of range	Enter admissible value
Error A4 Parameter error: Frequency manual fast	Entered value out of range	Enter admissible value
Error A5 Parameter error: Settling time	Entered value out of range	Enter admissible value
Error A6 Parameter error: Gear ratio numerator	Entered value out of range	Enter admissible value
Error A7 Parameter error: Gear ratio denominator	Entered value out of range	Enter admissible value
Error A8 Parameter error: Frequency REF IN	Entered value out of range	Enter admissible value
Error A9 Parameter error: Frequency REF OUT	Entered value out of range	Enter admissible value

Malfunctions

Error message	Possible cause	Rectification
Error AA Parameter error: Readings in parallel mode	Entered value out of range	Enter admissible value
Error AB Parameter error: Decade settling time	Entered value out of range	Enter admissible value
Error AC Parameter error: Reference point position	Entered value out of range	Enter admissible value
Error AF Overflow in customer positioning with new gear ratio	With a gear ratio <1, the customer position exceeds the admissible range of values ± 8388607	Set motor position to a lower value by setting the reference point (manual movement, "G29=")
Error B0 Program number already assigned	Program number in the unit used for loading a new program has already been assigned	Delete program number in the unit
Error B1 Program memory full	Program memory full	Delete programs in the unit
Error B2 Checksum error in the program	Checksum of movement program incorrect	Recompile program
Error B3 Too many programs in a data record	More programs transferred than selectable in the unit (max. 16)	Reduce the number of programs
Error B4 Number of transferred program bytes incorrect	Incorrect number of program bytes	Recompile program
Error B5 Timeout during reas-in cycle in parallel mode	Data transfer takes longer than 5 seconds	Check handshaking in network mode "A-/R-Parallel"
Error B6 Inadmissible number of programs to be stored	Number of programs to be stored = 0 to > 16	Correct number
Error B8 Program number not assigned	Selected program number not assigned in the unit	Correct program number
Error C0 Transferred data block too large	Data block > 64 bytes received	Correct length of data block
Error C1 Inadmissible command code	Command code in network mode "Serial" not permitted	Correct command code
Error C2 Inadmissible command format	Incorrect number of bytes of the command data record in network mode "Serial"	Check command data record
Error C4 No job prepared or prepared job deleted	Attempt to delete a prepared job, although no job has been prepared	
Error C5 More than one action command in the data record	More than one action command in the data record	Only transfer one action command per data record

Error message	Possible cause	Rectification
Error C6 Setting command several times or complementary commands in a data block	e.g. command "G90" and "G91" transferred in a data block (complementary commands)	Check commands in data block
Error C7 Movement frequency range exceeded	Entered value out of range	Enter admissible value
Error C8 Ramp gradient range exceeded	Entered value out of range	Enter admissible value
Error C9 Frequency range "M21" exceeded	Entered value out of range	Enter admissible value
Error CA Online-Execute not permitted, as job already prepared	Job transferred with "Prepare" not yet triggered with "Start"	Trigger previous job with "Start" or cancel with "Erase"
Error CB Online-Start without preparing a job	Attempt to start a prepared job although no job prepared	Prepare job with "Prepare" first
Error CC Online-Execute without data requires prior Online-Execute with data	Movement repeat triggered by Online-Execute although no Online-Execute with data previously triggered	Perform Online-Execute with data

4.3 Repair work



ATTENTION
Any repair work required may only be performed by BERGER LAHR!

Mark the respective connections when disassembling the unit.

The adjusted parameters as well as the mounting location number of the old unit must be transferred when replacing a unit.

4.4 Storage, shipment

The following must be noted when storing units or PC-boards:

- the maximum air humidity (see chapter 1.4) must not be exceeded.
- the storage temperature (see chapter 1.4) must be observed.
- protect the stored parts against dust and dirt.
- make sure that units or pc-boards provided with the symbol



are only unpacked, stored and installed in an electrostatically protected environment.

- it must be ensured that units or pc-boards equipped with accumulators are connected to the supply voltage at least once a month.
- the original packing material must not be thrown away.

When shipping units or pc-boards it must be ensured that

- units or pc-boards are shipped in their original packing.
- Pc-boards without batteries or accumulators are packed in wrapping electrically conducting on both sides (possibly original wrapping).
- Pc-boards equipped with batteries or accumulators are packed in wrapping electrically conductive on the outside which is antistatic on the inside (possibly original wrapping)
- units or pc-boards provided with the symbol



are only packed in an electrostatically protected environment.

5 Maintenance

5.1 Maintenance chart

Interval	Maintenance work	Reference
Every 2 years for units with battery-buffered memory	Replace battery	See chapter 5.2.1

5.2 Maintenance contract

5.2.1 Replacing the battery



DANGER
Disconnect mains power supply plug.

1. Dismount the unit.
2. Unscrew four screws on the right-hand side and remove side panel, pulling it towards the front.



ATTENTION
Avoid touching the sensitive CMOS circuits!

3. Connect the battery plug of the new battery to the 2nd terminal pair.
4. Disconnect the battery plug of the old battery.
5. Remove the old battery and insert the new battery.
6. Slide side panel into place and fix with the four screws.
7. Install the unit.

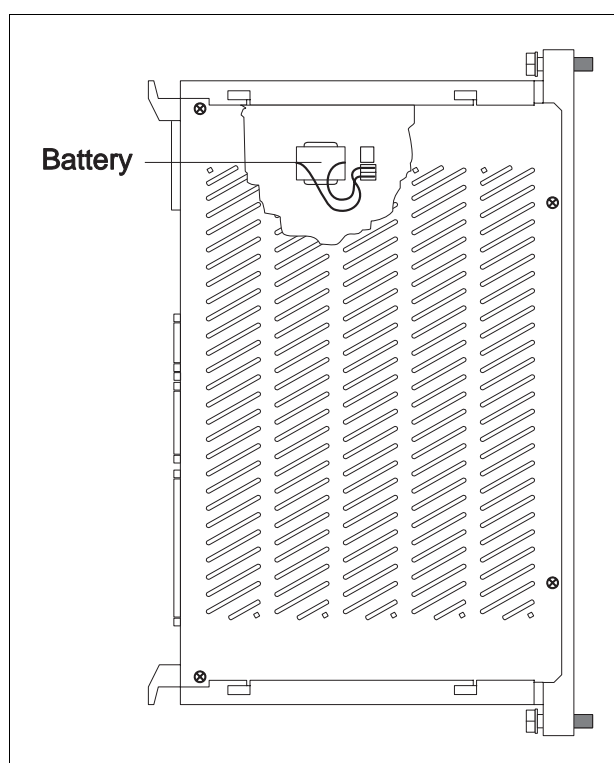


Fig. 5-1 Replacing the battery

5.3 Maintenance contract

In order to avoid times of standstill in case of unit failure, BERGER LAHR offer individual maintenance and service contracts.

For information on these contracts, contact the following address:

Berger Lahr GmbH & Co. KG
Abteilung Technische Dienste
Breslauer Str. 7

D-77933 Lahr

Telephone (07821) 946-02

6 Appendix

6.1 Unit variants

Unit	Supply voltage Power drive
WDP5-118.051-00	230 VAC
WDP5-118.061-00	115 VAC

6.2 Accessories

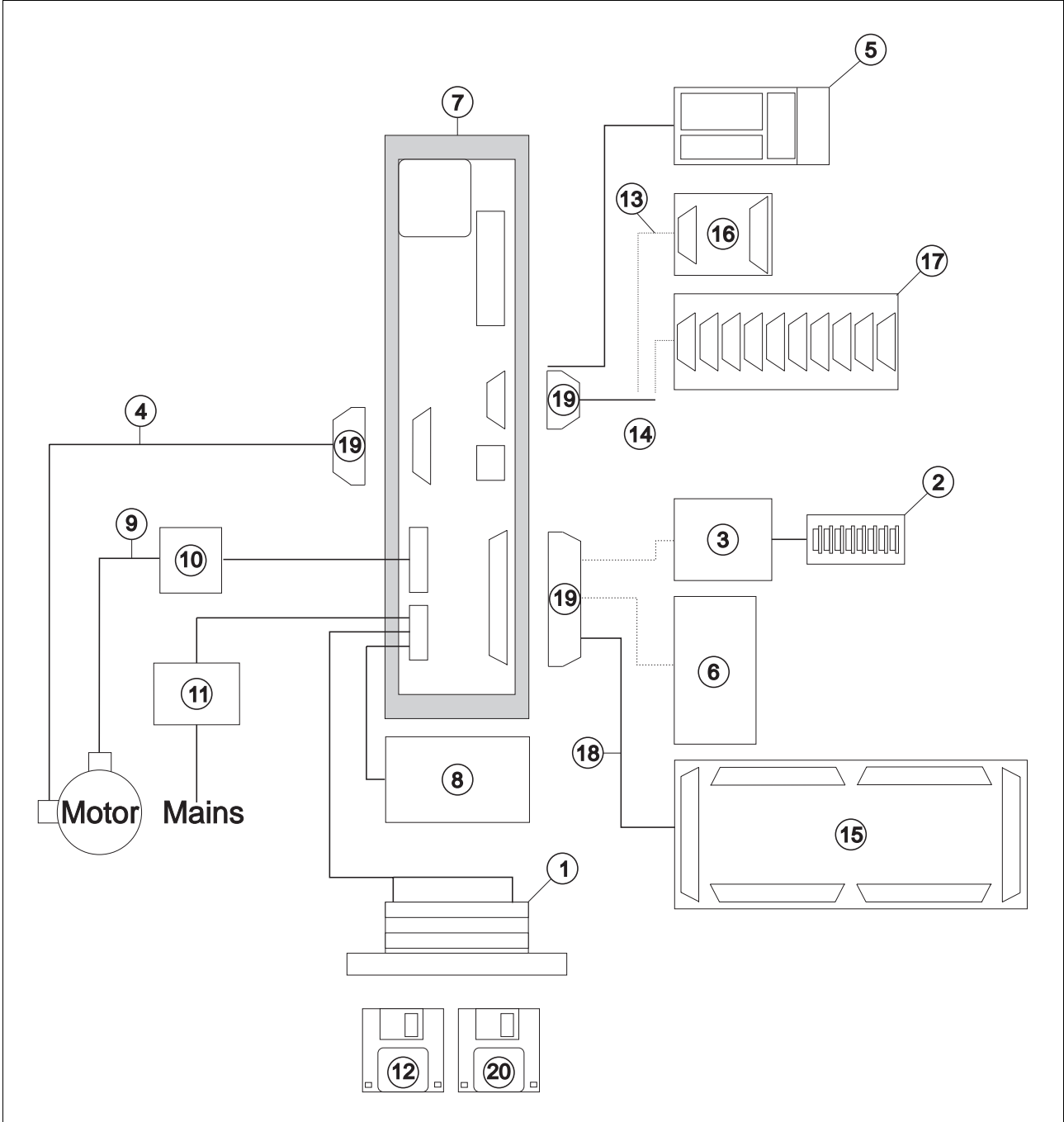


Fig. 6-1 Accessories

The following accessories may be ordered separately:

Item	Designation	Order no.	Reference
1	Load resistor	62501100600	see chapter 6.2.1
2	ML 52 decade switch block	62300052000	see chapter 6.2.2
3	MP 940 decade switch interface	62020940000	see chapter 6.2.3
4	Shaft encoder cable	62501404xxx	see chapter 6.2.4
5	MP 922 hand-held programming unit	62020922000	see chapter 6.2.5
6	D 731 terminal adapter	62010731006	see chapter 6.2.6
7	Heat sink	62500901000	see chapter 6.2.7
8	Ventilator set	62501201000	see chapter 6.2.8
9	Motor cable	62501301xxx	see chapter 6.2.9
10	Motor cable filter	62501100100	see chapter 6.2.10
11	Mains filter	62501100200	see chapter 6.2.11
12	PRO-SDP/PC1 network software (version 2.01 or higher)	61700023010	see documentation Doc. no. 212.599
13	Interface cable, male/female	62501412xxx	see chapter 6.2.12
14	Interface cable, male/male	62501405xxx	see chapter 6.2.12
15	D 690 interface tester	62010690006	see chapter 6.2.13
16	MP 923 interface converter	62020923000	see chapter 6.2.14
17	MP 924 interface distributor	62020924006	see chapter 6.2.15
18	Signal cable	6250140xxxx	see chapter 6.2.16
19	WDP5-118 set of connectors	62501000200	see chapter 6.2.17
20	Terminal program BTERM	61700040610	see documentation Doc. no. 212.926

Appendix

6.2.1 Load resistor

The HSD 70 load resistor is used to reduce surplus braking energy.



ATTENTION

Good heat dissipation must be ensured when mounting the load resistor.

1. Loosen screws and remove mains connector (fig. 6-2).
2. Remove the connector shell.
3. Prepare two load resistor connections by providing wire end ferrules on the connector side.
4. Fasten two litz wires B+ and B-.
5. Fasten the cable to the connector shell.
6. Put the two halves of the connector shell together.
7. Fasten the connector on the front panel (item 07).

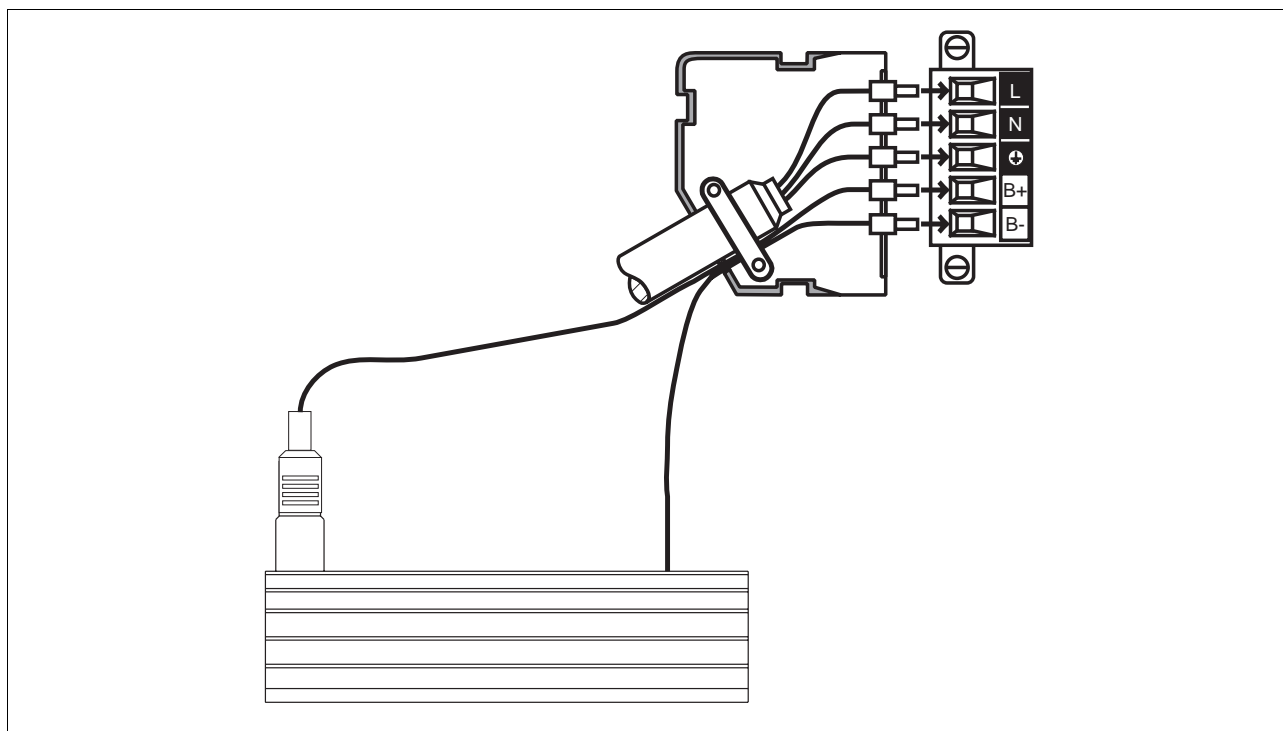


Fig. 6-2 Load resistor connection

6.2.2 ML 52 decade switch block

The desired position and speed are set on the ML 52 block of 8 decade switches and transferred to the positioning unit via the MP 940 decade switch interface (see chapter 6.2.3). Ranges:

- Position: ± 799999
(full/half step or increments, absolute or incremental dimensions)
- Frequency: 00 - 99
(percentage of the maximum frequency set on the positioning unit; 00=100%)

The decade switch block is wired and connected in the circuit as evident in figures 6-3 and 6-4.

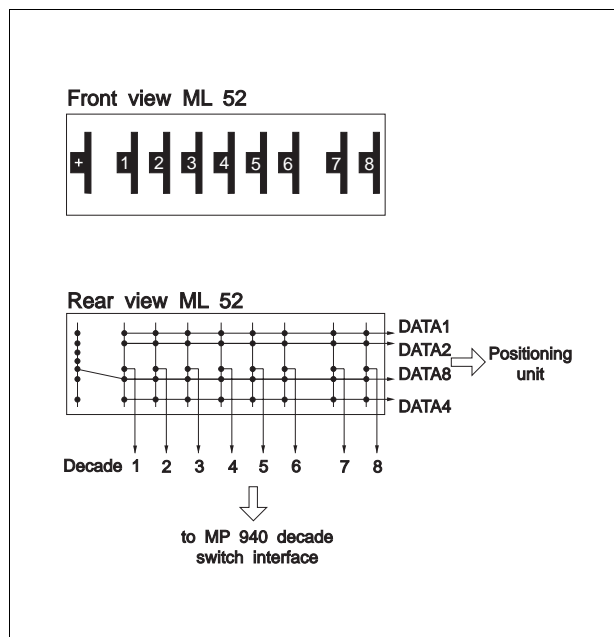


Fig. 6-3 ML 52 decade switch block wiring

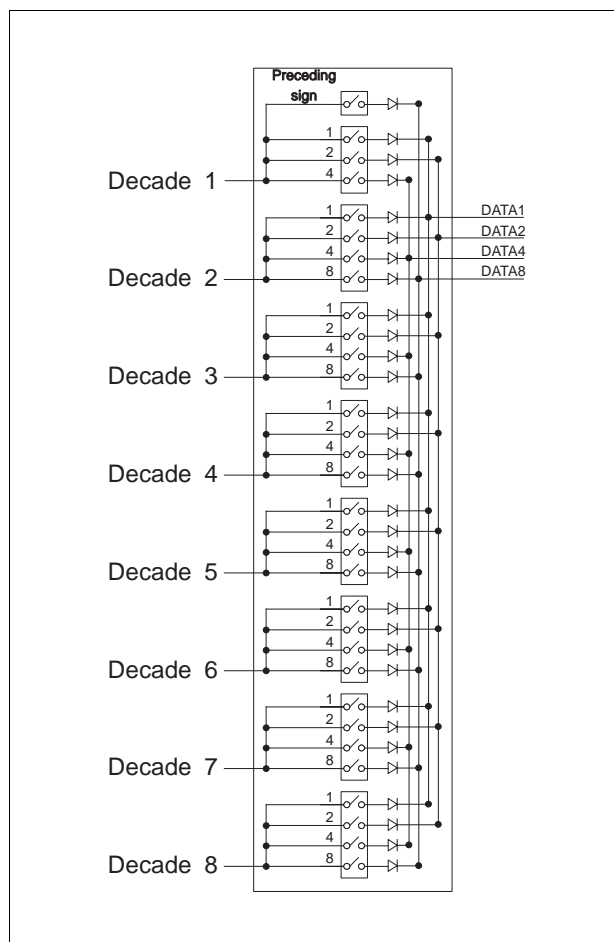


Fig. 6-4 ML 52 decade switch block assignment

6.2.3 MP 940 decade switch interface

6.2.3.1 General description

The MP 940 decade switch interface serves for parallel data transfer of the desired position and speed to a BERGER LAHR positioning unit (e.g. WDP5). The desired position and speed can be set on the block of 8 decade switches e.g. ML 52 (see chapter 6.2.2) and transferred to the positioning unit via the MP 940 decade switch interface. Data transfer is effected with the aid of 4 data lines and 3 handshaking lines. A maximum of 16 decade switch blocks can be switched in parallel, thus allowing presetting a maximum of 16 different values.

6.2.3.2 Technical data

Electrical data

Supply voltage	24 VDC \pm 10%
Current consumption	50 mA
Signal voltages	24 VDC \pm 10%

Mechanical data

Dimensions	67 x 77 x 40 mm
Weight	107 g

Environmental conditions

Storage temperature	-25°C to 70°C
Operating temperature	0°C to 55°C
Humidity class	F as per DIN 40 040

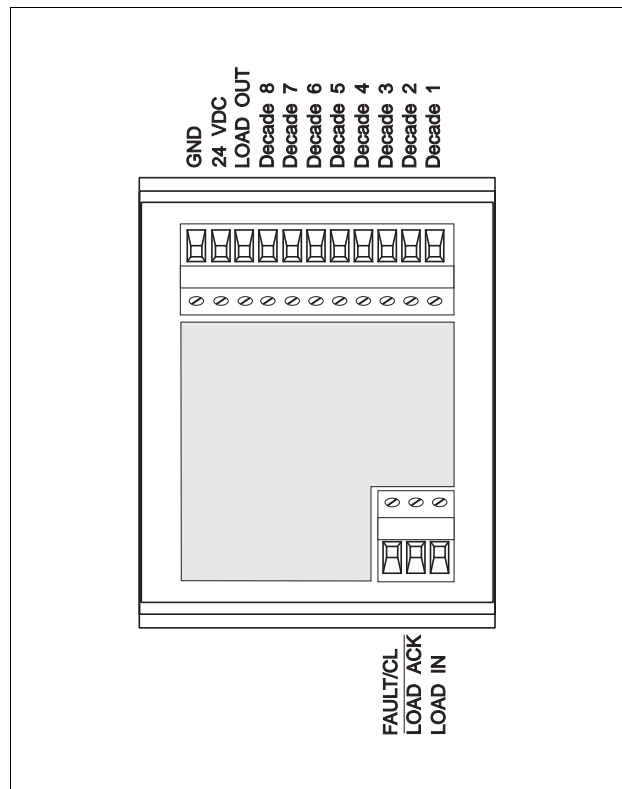


Fig. 6-5 MP 940 decade switch interface

6.2.3.3 System integration

The MP 940 decade switch interface (fig. 6-6) is integrated in a system with a BERGER LAHR positioning unit.

6.2.3.4 Delivered items

Qty.	Designation	Order no.
1	MP 940 decade switch interface	62020940000

6.2.3.5 Accessories

Qty.	Designation	Order no.
1	ML 52 decade switch block	62300052000

6.2.3.6 Mounting

The foot of the MP 940 decade switch interface snaps into position on EN 500 35 and DIN EN 500 22 mounting rails.

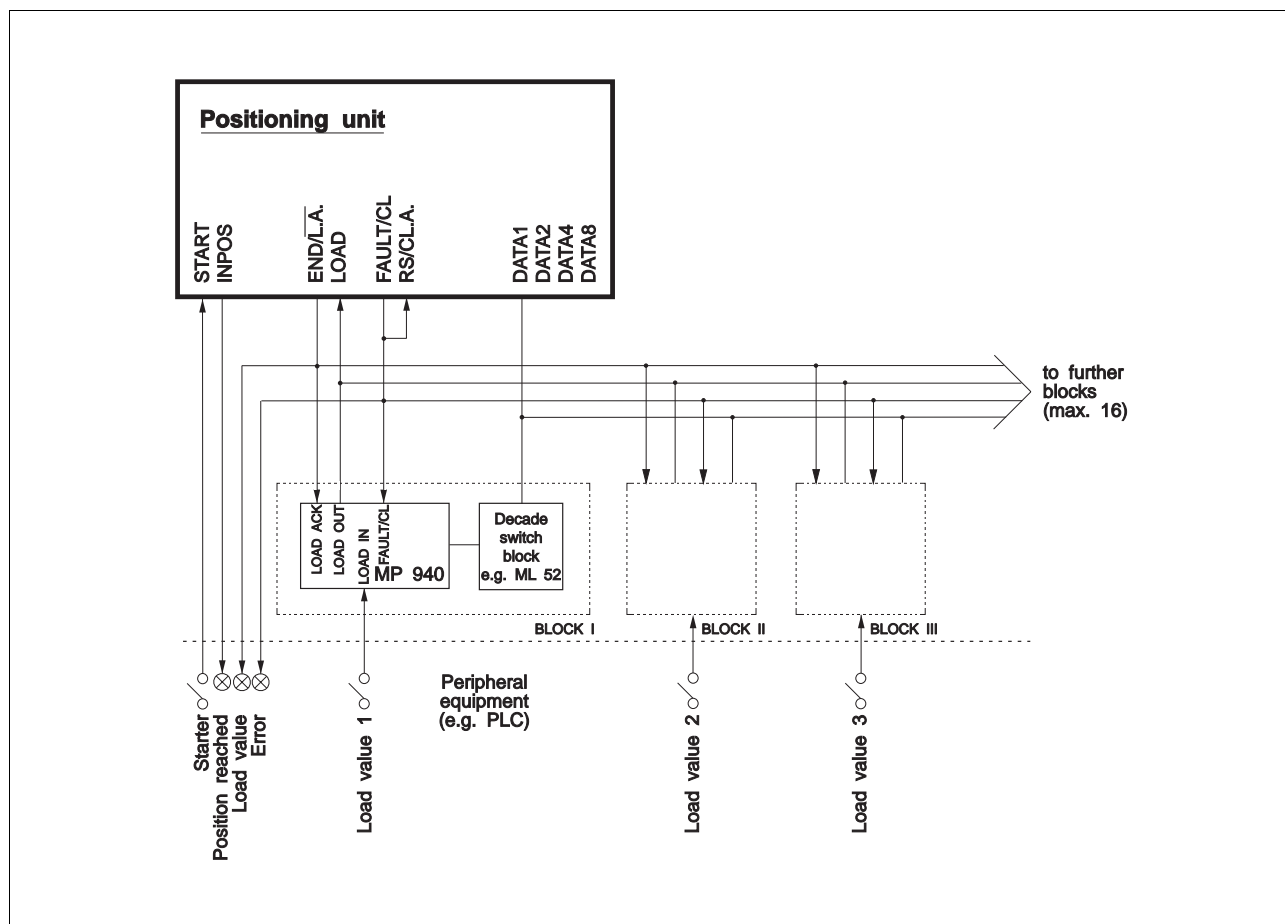


Fig. 6-6 System integration of MP 940 decade switch interface

6.2.3.7 Starting up

1. Switch off supply voltage and connect decade switch interface to the positioning unit and peripheral equipment (e.g. PLC) as shown in fig. 6-6.



NOTE
The inputs START and LOAD may be bridged for triggering an automatic start after loading has been completed.

2. In case the ML 52 decade switch block is used, this must be connected to the positioning unit and MP 940 as shown in fig. 6-3.



NOTE
The ML 52 decade switch block is switched as evident in fig. 6-4.

3. Set parallel mode (system of absolute and incremental dimensions) at the positioning unit.

4. Switch on supply voltage, set decade value on the decade switch block and read in according to the timing diagram (fig. 6-7).

Ranges:

Position: ± 799999
(full/half step or increments, absolute or incremental dimensions)

Frequency: 00 - 99
(percentage of the maximum frequency set on the positioning unit; 00=100%)



NOTE
On activation of the input signal LOAD IN, the decade switch interface transfers the decade value to the positioning unit.

A start may be triggered, if no error (FAULT/CL = 0) has occurred and output signal END/L.A. is active.

Loading must be repeated, if an error (FAULT/CL = 1) has occurred.

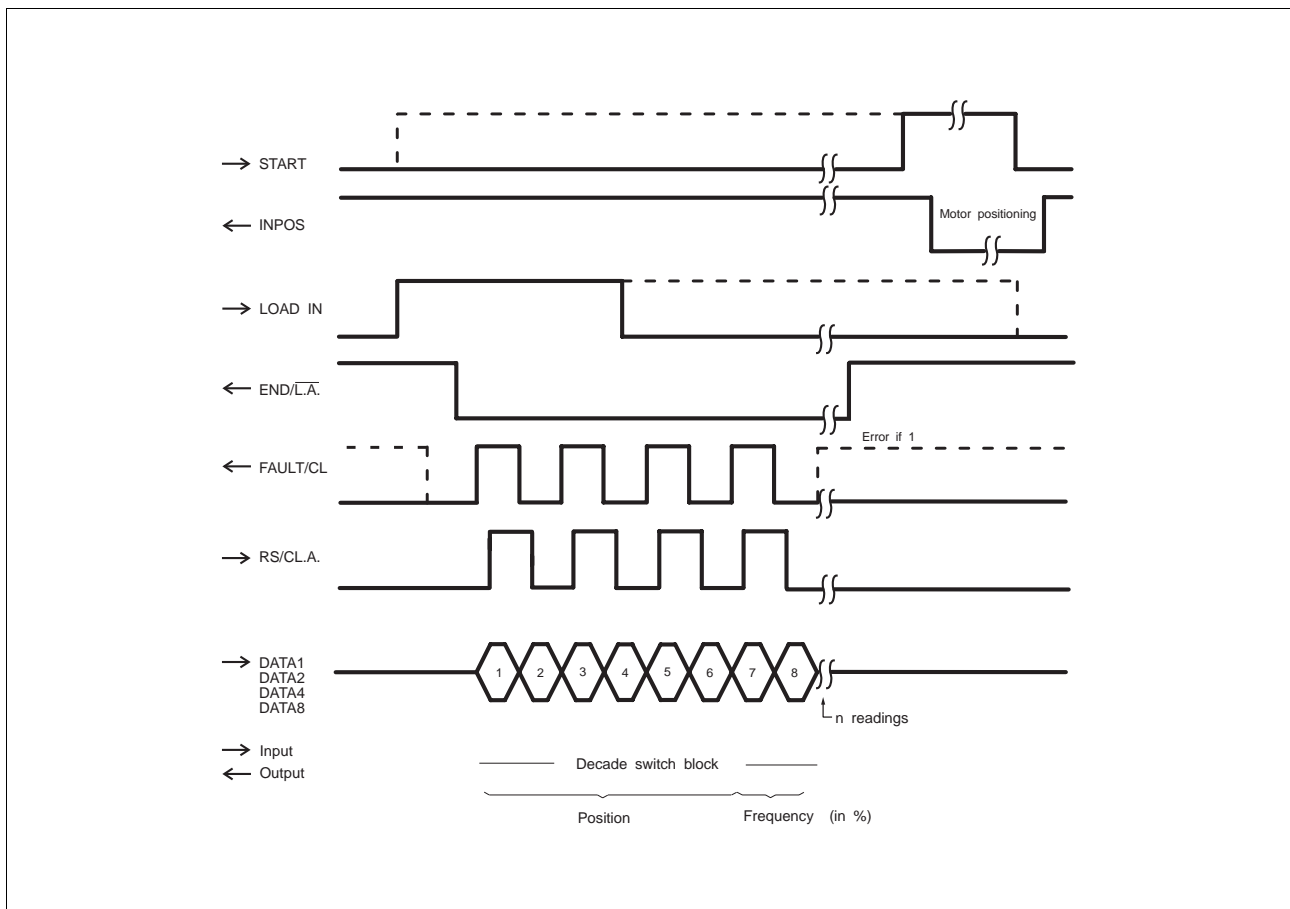


Fig. 6-7 Timing diagram for parallel data transfer

6.2.4 Shaft encoder cable

The following shaft encoder cable lengths are available:

Cable length	Order number
5 m	62501404050
10 m	62501404100
15 m	62501404150
20 m	62501404200
50 m	62501404500

The shaft encoder cable comprises:

Designation	Order no.
15-pole connector	N4-673-247
Connector shell (15-pole)	N4-673-237
12-pole female connector	N8-704-89
12 contacts	N8-704-90
Cable	H6-928-50

Shaft encoder connection is shown and described in chapter 2.4.3.

6.2.5 MP 922 hand-held programming unit

In storage or parallel mode of the positioning unit, the MP 922 hand-held programming unit (fig. 6-8) offers the following operating possibilities:

- Writing, reading and modifying programs (in storage mode only)
- Displaying the program directory (in storage mode only)
- Archiving and printing programs (in storage mode only)
- Displaying and modifying parameters (in storage and parallel mode)
- Indicating the travel position (in storage and parallel mode)
- Testing inputs/outputs (in storage and parallel mode)



NOTE
Operation of the hand-held programming unit is described in the MP 922 documentation, doc. no. 222.184.

6.2.5.1 Connecting the MP 922 hand-held programming unit

1. Switch off supply voltage for processor unit.
2. Connect MP 922 hand-held programming unit to the serial interface of the unit.
3. Set the desired operating mode on the operating mode selector switch (item 47).
4. Switch on supply voltage for processor unit.
→ LED 43 and LED 45 light up.
5. Deactivate input AUTOM.
6. Operation see MP 922 documentation.

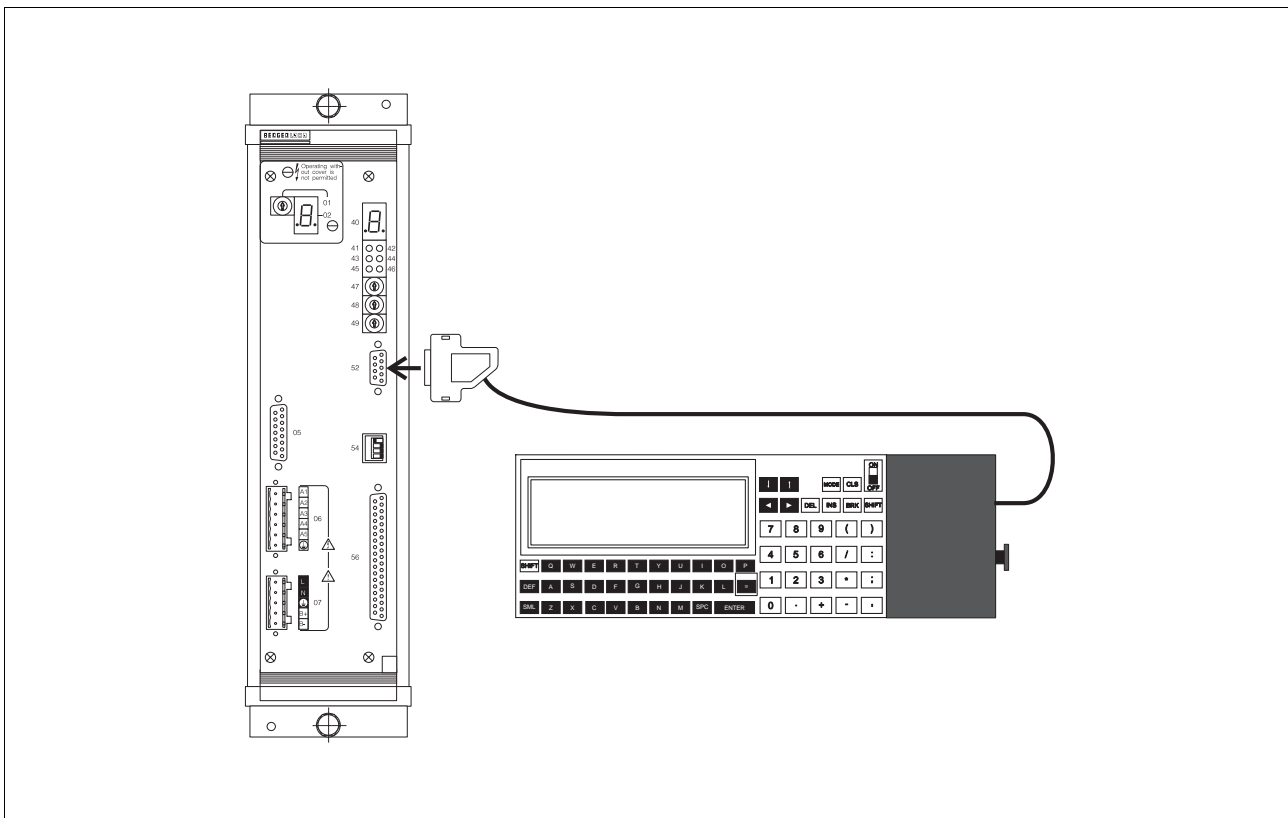


Fig. 6-8 MP 922 hand-held programming unit

6.2.6 D 731 terminal adapter

6.2.6.2 Technical data

6.2.6.1 General description

The D 731 terminal adapter serves to connect the following wall-mounted BERGER LAHR units to a controller e.g. PLC:

- WP-XXX (positioning unit)
- WDP5-XXX (positioning unit with power drive)

The D 731 terminal adapter mainly consists of a pc-board accommodating 1 sub-D connector, 32 LEDs and 2 terminal strips. The LEDs indicate the signal states of all inputs and outputs. The signal states of the outputs are indicated by yellow LEDs, the signal states of the inputs by green LEDs.

All inputs and outputs are connected to the terminal strips. The terminal pin assignment will be shown on the following page.

Connection of the WP/WDP signal connector is established with the aid of a cable and the sub-D connector.

An additional operating voltage does not have to be connected.

Electrical data

Signal voltage	24 V ±10%
Current consumption per LED	approx. 2 mA ±10%
Voltage drop at tester	< 0.1 V

Mechanical data

Dimensions	approx. 113 x 78 x 52 mm
Weight	approx. 180 g

Environmental conditions

Storage temperature	-25°C to 70°C
Operating temperature	0°C to 55°C
Humidity class	F according to DIN 40 040



NOTE

The unit is subject to the extra-low voltage safety regulations.

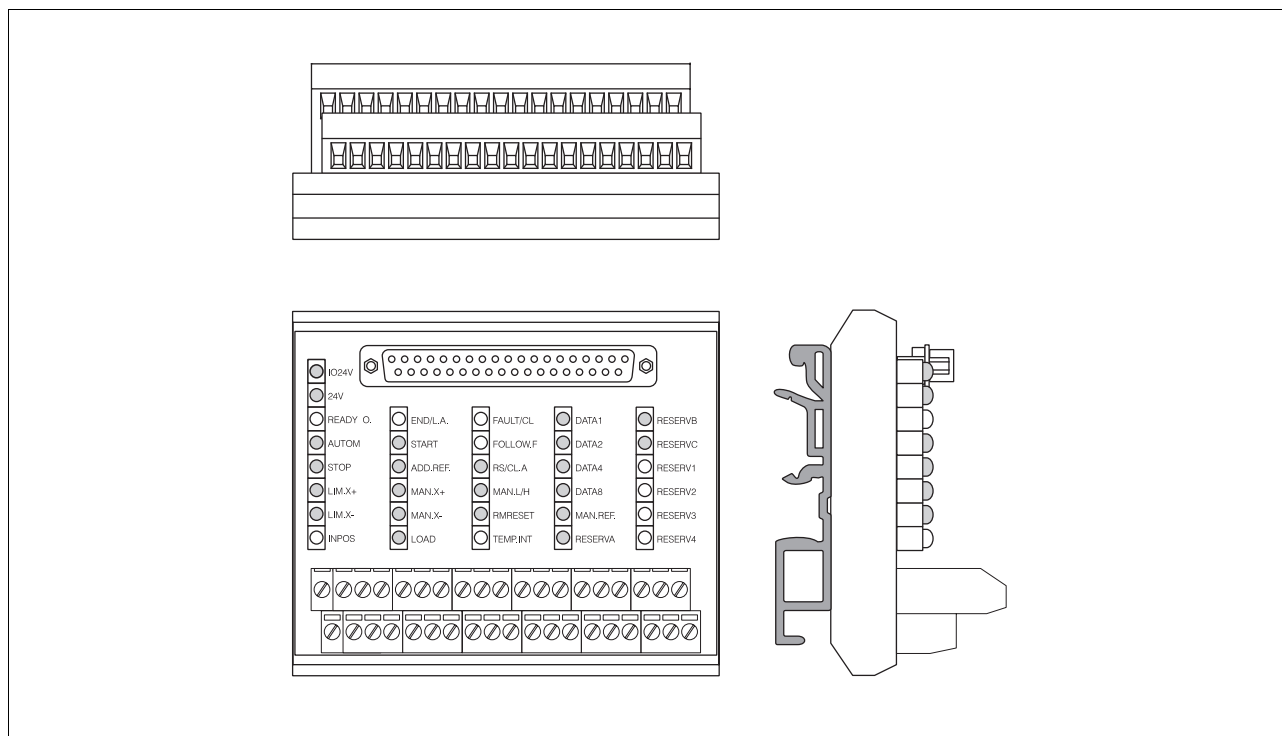


Fig. 6-9 D 731 terminal adapter

Appendix

Terminal pin assignment

Pin	Abbreviation	Meaning	Signal logic	← I/→ O
1	LIM.X ⁻	Negative limit switch	Active-low	←
2	RESERVE A			
3	RESERVE C			
4	START	Start	Active-high	←
5	LOAD	Store position	Active-high	←
6	ADD.REF.	Additional reference switch	Active-low	←
7	MAN.X ⁻	Manual movement, CCW rotation	Active-high	←
8	MAN.L/H	Slow/fast manual movement	Active-high	←
9	DATA4	Program number 2 ²	Active-high	←
10	DATA1	Program number 2 ⁰	Active-high	←
11	RESERVE 1			
12	RESERVE 3			
13	FOLLOW.F.	Following error limit	Active-high	→
14	FAULT/CL	Error/clock signal	Active-high	→
15	READY O.	Ready for operation	Active-high	→
16	24V	System supply voltage		←
17	24V	System supply voltage		←
18	IO24V	I/O supply voltage		←
19	IO24V	I/O supply voltage		←
20	LIM.X ⁺	Positive limit switch	Active-low	←
21	RESERVE B			
22	RM RESET	Rotation monitoring reset	Active-high	←
23	STOP	Stop	Active-low	←
24	RS/CL.A	Program start/Clock acknowledge	Active-high	←
25	AUTOM	Automatic operation	Active-high	←
26	MAN.X ⁺	Manual movement, CW rotation	Active-high	←
27	MAN.REF.	Manual reference movement	Active-high	←
28	DATA8	Program number 2 ³	Active-high	←
29	DATA2	Program number 2 ¹	Active-high	←
30	RESERVE 4			
31	RESERVE 2			
32	TEMP.INT.	Temperature monitoring - heat sink	Active-high	→
33	INPOS	Position reached	Active-high	→
34	END/L.A.	Program end/Load acknowledge	Active-high/low	→
35	24VGND	System supply voltage ground		←
36	24VGND	System supply voltage ground		←
37	IOGND	I/O supply voltage ground		←
38	–	Shield connection		

I = input O = output

6.2.6.3 Delivered items

Qty.	Designation	Order no.
1	D 731	62010731006

6.2.6.4 Accessories

Qty.	Designation	Order no.
1	Cable	62501408015

6.2.6.5 Mounting

The terminal adapter foot snaps into position on conventional DIN EN mounting rails.

6.2.6.6 Starting up

1. Switch off WP/WDP unit and controller.
2. Connect the D 731 terminal adapter cable to the WP/WDP unit, see fig. 6-10.



ATTENTION
Only use the original cable (see accessories) or a screened signal cable.

3. Tighten the fastening screws of the connector.
4. Connect the terminal adapter to the controller.
5. Switch on WP/WDP unit and controller.

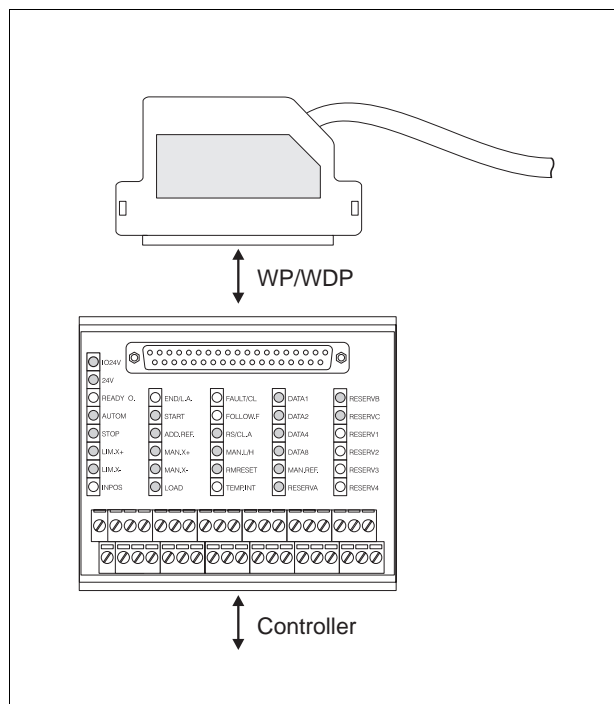


Fig. 6-10 Starting the D 731 terminal adapter

Appendix

6.2.7 Heat sink

6.2.7.1 BERGER LAHR heat sink

Proper cooling of the positioning unit is achieved with the BERGER LAHR heat sink.

The heat sink (fig. 6-11 and 6-12) can be attached inside the switch cabinet or on its outer surface.



NOTE

It must be noted that more space is required and that the distance between the center lines of the individual units must be observed when several units are combined, see table (stated in mm):

Distances between centre lines (mm) when using combined units	WD5-008	WDP5-118	WDP5-228	WDP5-318	WP-111	WP-231	WP-311
WD5-008	87	87	87	87	74	74	74
WDP5-118	87	87	87	87	74	74	74
WDP5-228	87	87	87	87	74	74	74
WDP5-318	87	87	87	87	74	74	74
WP-111	74	74	74	74	61	61	61
WP-231	74	74	74	74	61	61	61
WP-311	74	74	74	74	61	61	61

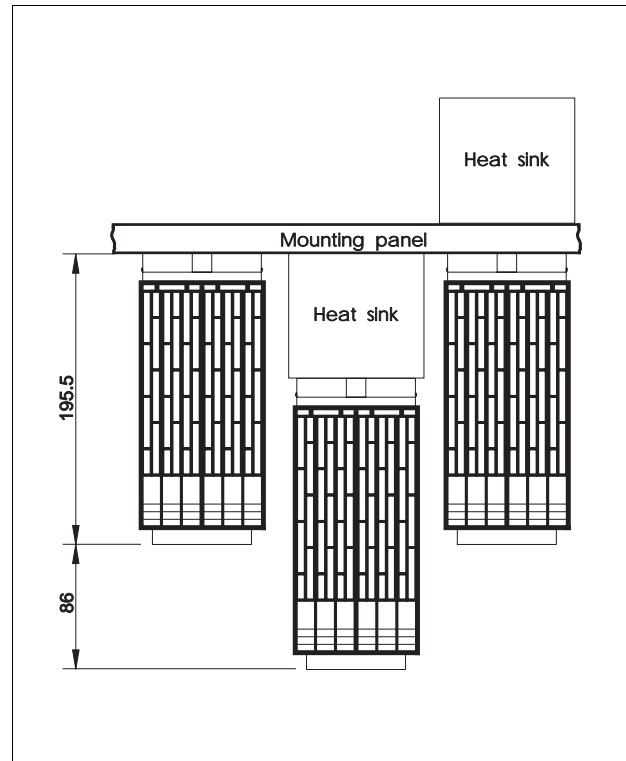


Fig. 6-11 Heat sink mounting

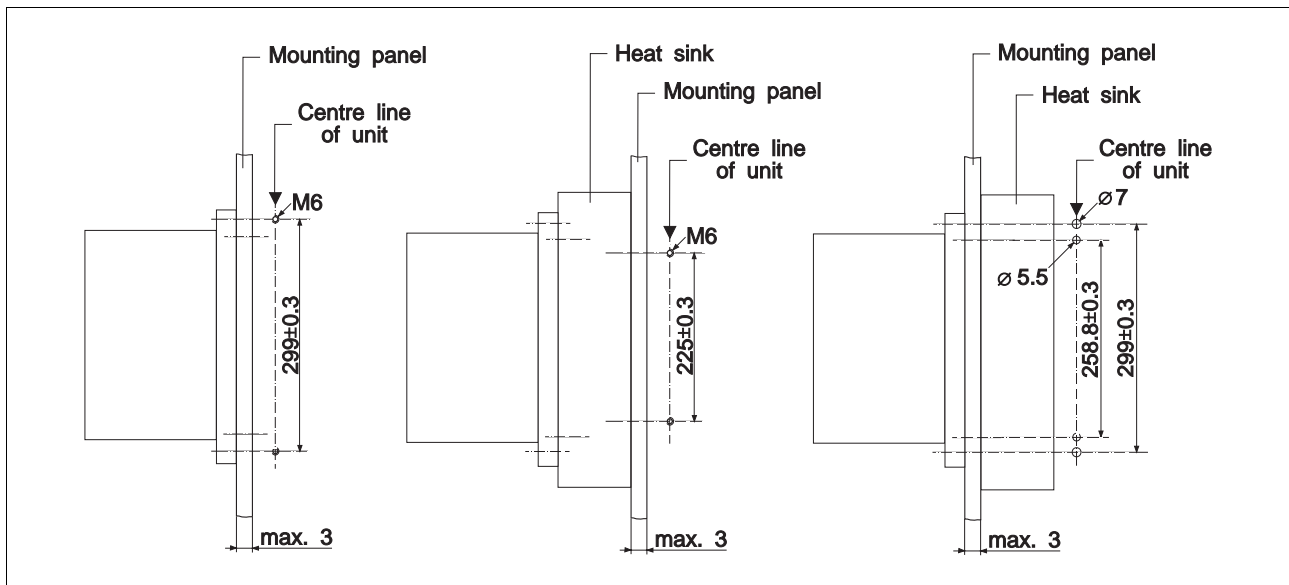


Fig. 6-12 Drilling pattern

Mounting the heat sink inside the cabinet

1. The heat sink is mounted inside the cabinet (fig. 6-11).
2. Drill two holes in the mounting panel (fig. 6-12) and cut a M6 thread.
3. Fasten the heat sink (fig. 6-13) to the mounting panel with two screws.
4. Apply the heat transfer compound between the unit's rear panel and the heat sink.
5. Put the unit down on two side bolts of the heat sink and tighten two screws (SW 10).



NOTE

In case of unit combinations, the gaps between the individual units (see table page 14) must be observed.

Mounting the heat sink outside the cabinet

1. The heat sink is mounted on the outer cabinet surface (fig. 6-11).
2. Drill four holes (fig. 6-12) in the mounting panel.
3. Remove the guide bolts from the heat sink.
4. Apply the heat transfer compound between the heat sink and mounting panel.
5. Fasten the heat sink (fig. 6-13) to the mounting panel with two bolts.
6. Apply the heat transfer compound between the unit's rear panel and mounting panel.
7. Lower the unit onto two bolts of the heat sink and tighten two screws (SW 10).

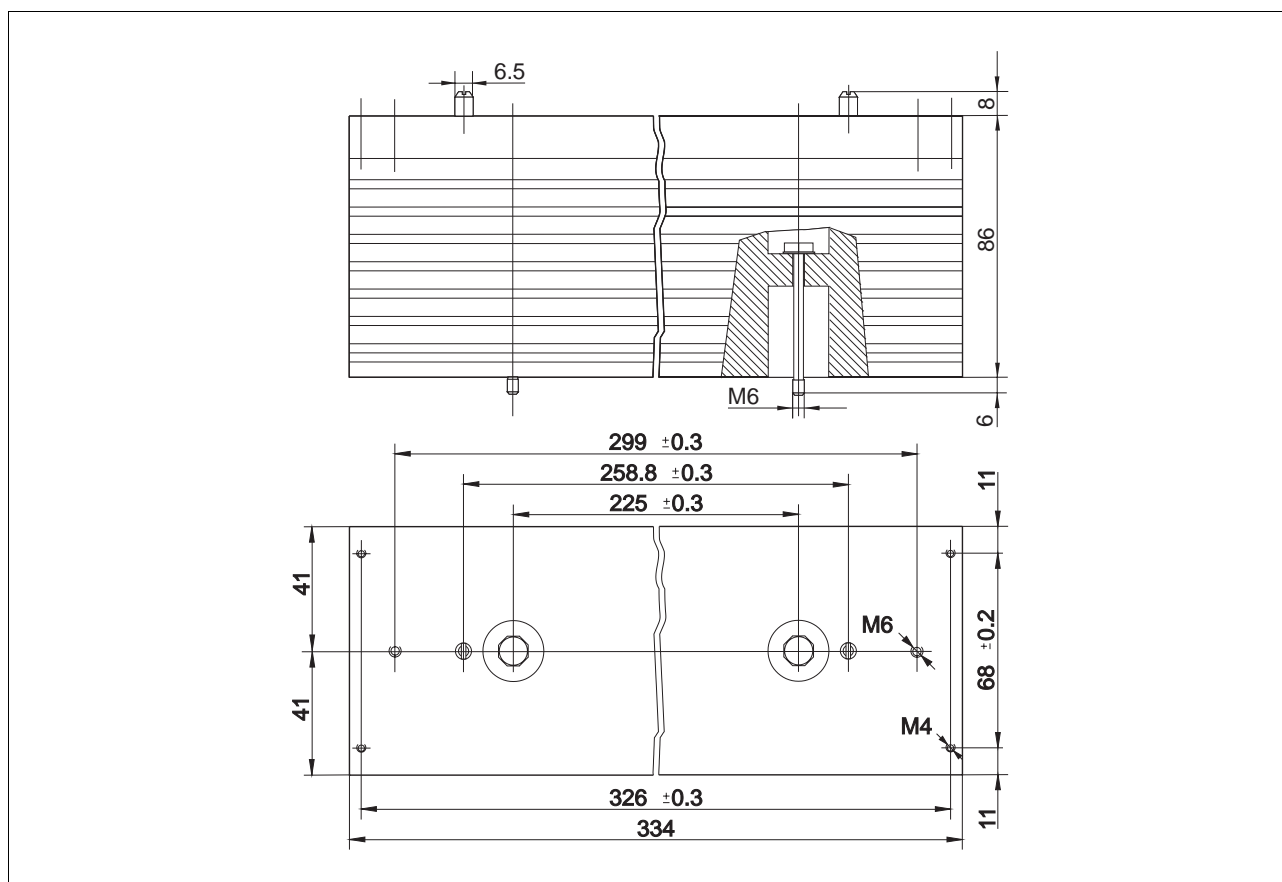


Fig. 6-13 Heat sink dimensions

Appendix

6.2.7.2 Heat sink dimensioning

If a non-BERGER LAHR heat sink is used, it must be sized for wall-mounting as described below. Determine the thermal resistance in order to be able to select a heat sink with adequate heat dissipation capacity. The following factors are required for calculating the thermal resistance R_{th} :

Power loss P_I of the unit

Ambient temperature T_{amb}

Prewarning temperature $T_{TEMP.INT}$ of the unit

1. Calculating the power loss P_I

As the first step, determine the power loss P_I to be dissipated by the heat sink. Essentially, P_I depends on the motor cable and the phase current. To calculate the power loss, use the following formula:

$$P_I = \frac{1+c.d.f.}{2} \times (k_1 C_c L_c + k_2 I_{Ph} + P_i)$$

$\frac{(1+c.d.f.)}{2}$ = Influence of cyclic duration factor with
c.d.f. = cyclic duration factor in %

$k_1 C_c L_c$ = Influence of motor cable with
 $k_1 = 0.04 \text{ W/nF}$
 C_c = Capacity of motor cable in nF at 100 m
 L_c = Motor cable length in m

$k_2 I_{Ph}$ = Influence of phase current with
 $k_2 = 23.5 \text{ W/A}$
 I_{Ph} = Phase current in A
 $P_i = 5 \text{ W}$ intrinsic loss

This results in the following general formula:

$$P_I = \frac{1 + c.d.f.}{2} \times \left(0.04 \frac{\text{W}}{\text{nFm}} \times C_c L_c + 23.5 \frac{\text{W}}{\text{A}} \times I_{Ph} + 5 \text{W} \right)$$

If the BERGER LAHR accessory motor cable is used, the following formula is applicable for calculating the power loss:

$$P_I = \frac{1 + c.d.f.}{2} \times \left(0.4 \frac{\text{W}}{\text{m}} \times L_c + 23.5 \frac{\text{W}}{\text{A}} \times I_{Ph} + 5 \text{W} \right)$$

The cable capacity C_c is 10 nF at 100 m.

2. Calculating the required thermal resistance R_{th}

Use the following basic formulae:

$$R_{th} = \frac{T_{TEMP.INT} - T_{amb}}{P_I}$$

$$T_{TEMP.INT} = T_{max} - k_0 I_{Ph}$$

$$T_{TEMP.INT} = 80^\circ\text{C} - 5 \frac{^\circ\text{C}}{\text{A}} \times I_{Ph}$$

to calculate the thermal resistance as follows:

$$R_{th} = \frac{80^\circ - 5 \frac{^\circ\text{C}}{\text{A}} \times I_{Ph} - T_{amb}}{P_I}$$

$T_{TEMP.INT}$ = Prewarning temperature
 T_{max} = Maximum admissible temperature at mounting flange
 $k_0 I_{Ph}$ = Influence of phase current on prewarning temperature
 I_{Ph} = Phase current
 T_{amb} = Ambient temperature
 P_I = Power loss

To check the heat sink size, a temperature measurement should be carried out at the mounting flange. The temperature at the mounting flange should be less than the prewarning temperature $T_{TEMP.INT}$ of the unit. See figure 6-13.

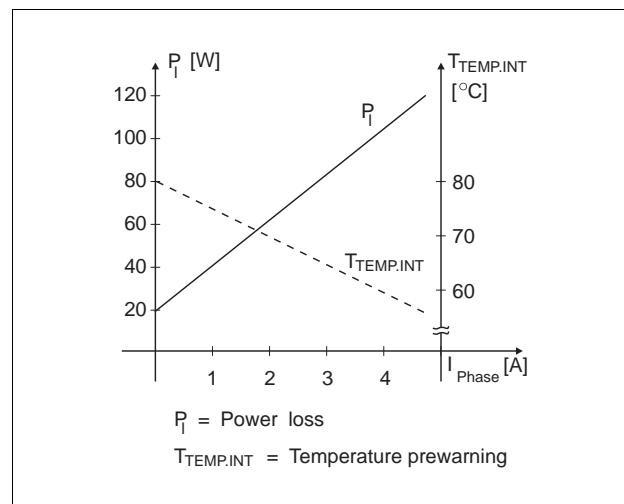


Fig. 6-14 Power loss diagramm



NOTE
The thermal resistance of the heat sink available from BERGER LAHR is 0.5 K/W without additional ventilation and 0.17 K/W when using a fan. It is also possible to ventilate the unit in-stead of the heat sink (1 m/s minimum airstream).

6.2.8 Ventilator set

The heat sink can be equipped with a ventilator set in order to improve heat dissipation.

The ventilator set (fig. 6-15) is attached to the bottom of the heat sink and fastened with two screws.

Connect ventilator set to external voltage supply 24 VDC.

Further ventilators can be connected in parallel using the 2nd terminal pair.

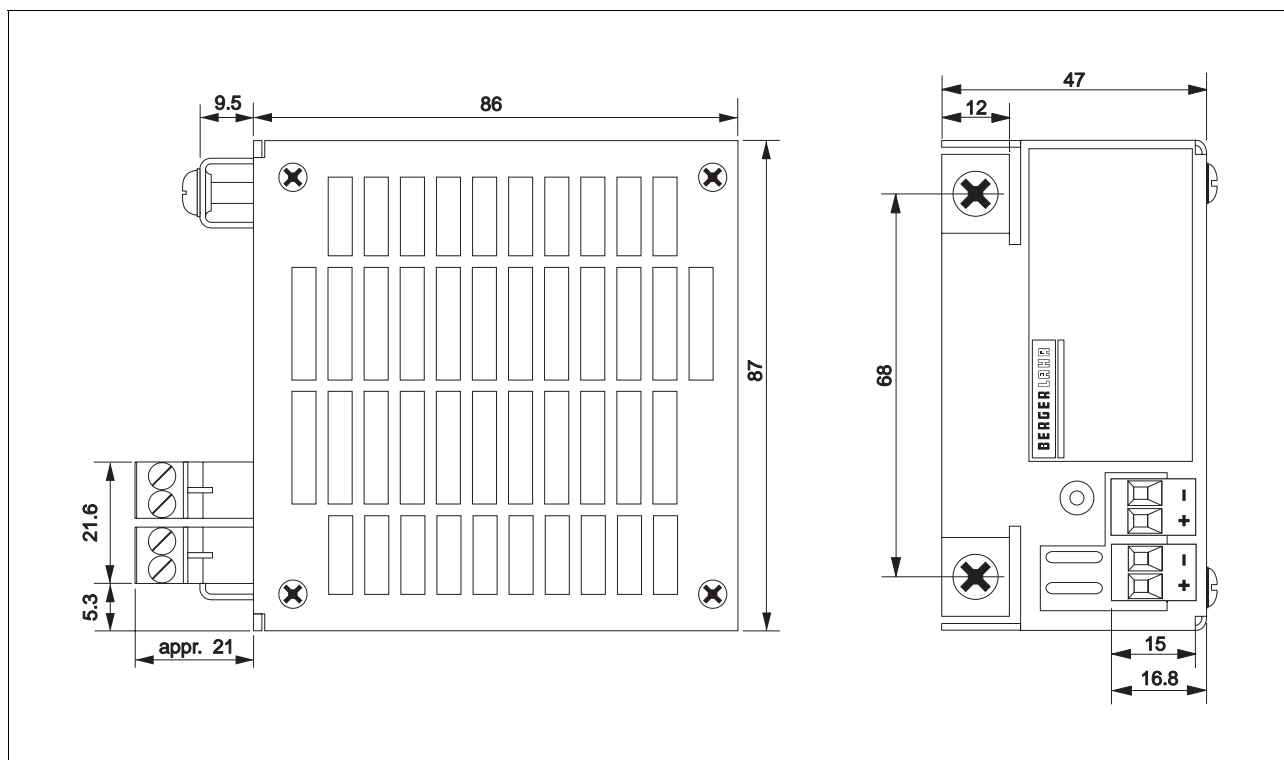


Fig. 6-15 Ventilator set dimensions

Appendix

6.2.9 Motor cable

The following motor cable lengths are available:

Cable length	Order number
5 m	62501301005
10 m	62501301010
15 m	62501301015
20 m	62501301020
50 m	62501301050

The motor cable comprises:

Designation	Order number
6-pole connector	N8-704-91
6 contacts	N8-704-92
Cable	H6-928-51

The motor connection is shown and described in chapter 2.4.2.

6.2.10 Motor cable filter

The motor cable filter is inserted in the motor line in case of motor cable lengths exceeding 50 m and for radio interference suppression (even below 50 m) in accordance with VDE 0871/limit class A. The filter must be installed in the switch cabinet near the device and provided with external ventilation.

Only use the motor cable approved by BERGER LAHR. Other cables could generate higher currents due to a higher capacity, which could lead to the destruction of the devices.

Ambient conditions

Storage temperature -25°C to +70°C

Operating temperature
 up to a phase current of 4 A 0°C to 50°C
 up to a phase current of 5 A 0°C to 40°C

Humidity class F acc. to DIN 40 040 (non-condensing)

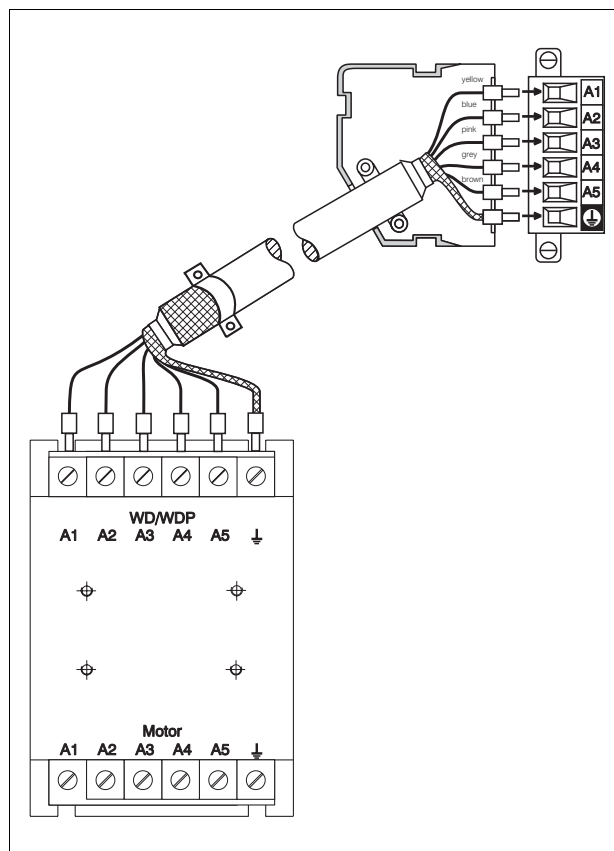


Fig. 6-16 Motor cable filter

Appendix

6.2.11 Mains filter

The mains filter is inserted in the supply line for radio interference suppression in accordance with VDE 0871/limit class A.

Ambient conditions

Storage temperature -25°C to +70°C

Operating temperature 0°C to +55°C

Humidity class 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

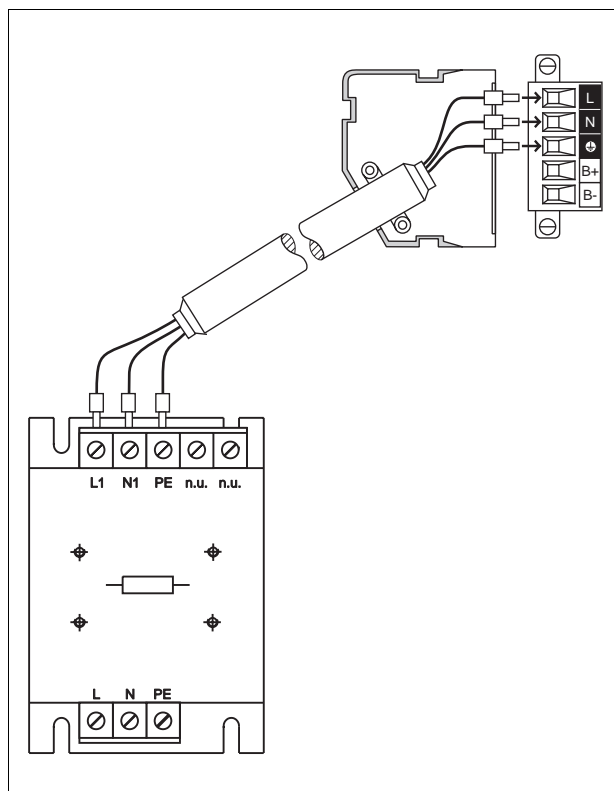


Fig. 6-17 Mains filter

6.2.12 Interface cables

Interface cable, male/female

The following interface cable lengths are available:

Cable length	Order number
1 m	62501412010
2 m	62501412020
5 m	62501412050
10 m	62501412100
25 m	62501412250

The interface cable comprises:

Qty.	Designation	Order number
1	9-pole connector, male	N4-673-246
1	9-pole connector, female	N4-673-001
2	Connector shells (9-pole)	N4-673-236
1	Cable	H6-928-30

Interface connection is shown and described in chapter 2.4.5.

Interface cable, male/male

The following interface cable lengths are available:

Cable length	Order number
1 m	62501405010
2 m	62501405020
5 m	62501405050
10 m	62501405100
25 m	62501405250

The interface cable comprises:

Qty.	Designation	Order number
2	9-pole connector, male	N4-673-246
2	Connector shells (9-pole)	N4-673-236
1	Cable	H6-928-30

Interface connection is shown and described in chapter 2.4.5.

6.2.13 D 690 interface tester

6.2.13.1 General description

The D 690 interface tester serves to test the signal states for the BERGER LAHR wall-mounted units:

- WD5-XXX (power drive)
- WP-XXX (positioning unit)
- WDP5-XXX (positioning unit with power drive)

The D 690 interface tester mainly consists of a pc-board accommodating 6 sub-D connectors or female connectors respectively and 43 LEDs. The meaning of the LED signals will be explained on the following page. The signal states of the outputs are indicated by yellow LEDs, the signal states of the inputs by green LEDs. The interface tester is divided into two halves. As evident in fig. 6-18, one half is intended for WD units and the second half for WP/WDP units. The interface tester is inserted in the signal line of the units.

Connection of an additional operating voltage is not required.

The diagnostic connectors disposed at the front of the pc-board can be used for measuring and testing purposes.

6.2.13.2 Technical data

Electrical data

Signal voltage WP/WDP section	24 V ±10%
Signal voltage WD section	3.5 to 24 V ±10%
Current consumption per LED	approx. 2 mA
Voltage drop at tester	0.1 V

Mechanical data

Dimensions	approx. 205 x 80 x 32 mm
Weight	approx. 150 g

Environmental conditions

Storage temperature	-25°C to 70°C
Operating temperature	0°C to 55°C
Humidity class	F according to DIN 40 040



NOTE

The unit is subject to the extra-low voltage safety regulations.

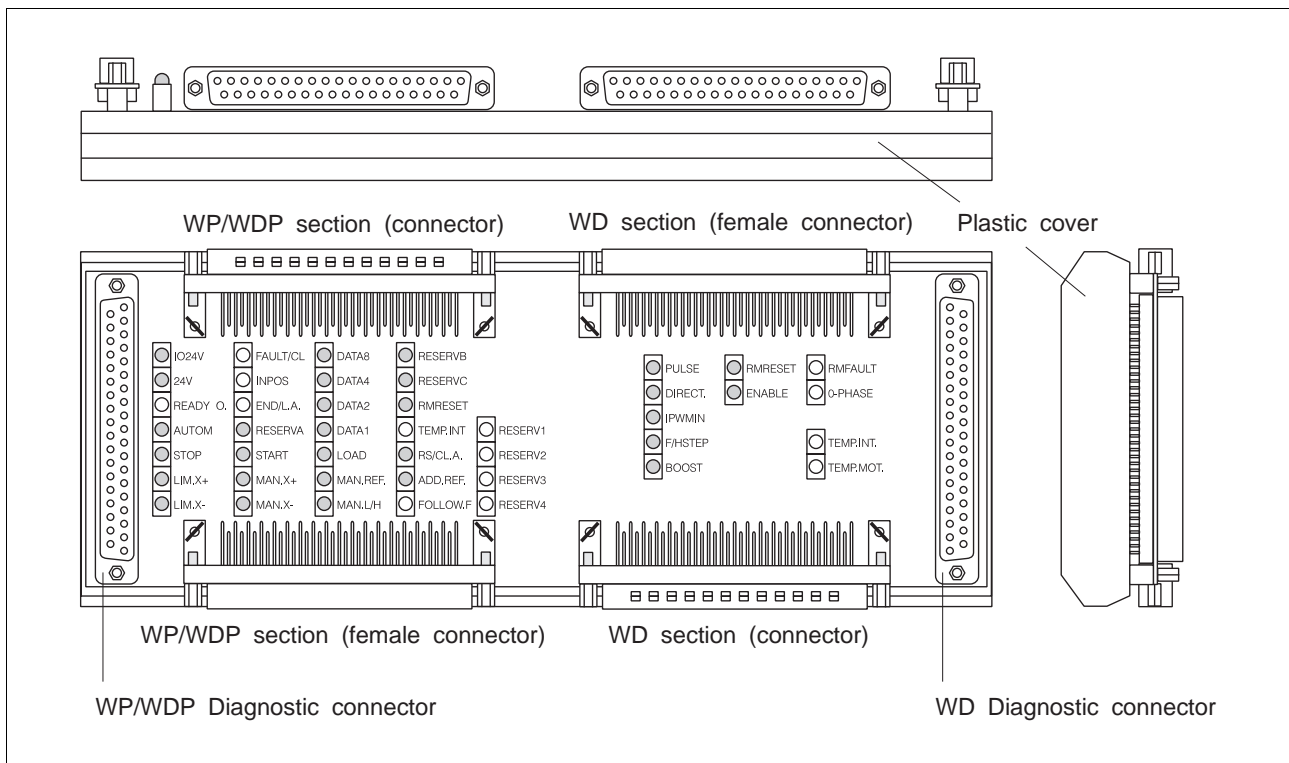


Fig. 6-18 D 690 interface tester

WD section

Pin	Abbreviation	Meaning	Signal logic	← I → O
1/20	PULSE	Pulse	Pulse	←
2/21	DIRECT.	Direction	Selectable	←
3/22	ENABLE	Power drive enable	Active-high	←
4/23	IPWMIN	PWM current control	Pulse	←
5/24	F/H STEP	Step angle full step/half step	Selectable	←
6/25	BOOST	Current increase	Active-high	←
7/26	RM RESET	Rotation monitoring reset	Active-high	←
8/27	RM FAULT	Rotation monitoring fault	Active-low	→
9/28	0-PHASE	Zero phase	Active-high	→
10/29	TEMP.INT.	Temperature monitoring - heat sink	Active-low	→
11/30	TEMP.MOT	Temperature monitoring - motor	Active-low	→

WP/WDP section

Pin	Abbreviation	Meaning	Signal logic	← I → O
18	IO24V	I/O supply voltage		←
19	IO24V	I/O supply voltage		←
16	24V	System supply voltage		←
17	24V	System supply voltage		←
15	READY O.	Ready for operation	Active-high	→
25	AUTOM	Automatic operation	Active-high	←
23	$\overline{\text{STOP}}$	Stop	Active-low	←
20	$\overline{\text{LIM.X+}}$	Positive limit switch	Active-low	←
1	$\overline{\text{LIM.X-}}$	Negative limit switch	Active-low	←
14	FAULT/CL	Error/Clock signal	Active-high	→
33	INPOS	Position reached	Active-high	→
34	$\overline{\text{END/L.A.}}$	Program end/Load acknowledge	Active-high/low	→
4	START	Start	Active-high	←
26	MAN.X+	Manual movement, CW rotation	Active-high	←
7	MAN.X-	Manual movement CCW rotation	Active-high	←
28	DATA8	Program number 2^3	Active-high	←
9	DATA4	Program number 2^2	Active-high	←
29	DATA2	Program number 2^1	Active-high	←
10	DATA1	Program number 2^0	Active-high	←
5	LOAD	Store position	Active-high	←
27	MAN.REF.	Manual reference movement	Active-high	←
8	MAN.L/H	Slow/fast manual movement	Active-high	←
22	RM RESET	Rotation monitoring reset	Active-high	←
32	TEMP.INT.	Temperature monitoring - heat sink	Active-high	→
24	$\overline{\text{RS/CL.A}}$	Program start/Clock acknowledge	Active-high	←
6	$\overline{\text{ADD.REF.}}$	Additional reference switch	Active-low	←
13	FOLLOW.F.	Following error limit	Active-high	→
35	24VGND	System supply voltage ground		←
36	24VGND	System supply voltage ground		←
37	IOGND	I/O supply voltage ground		←

I = input O = output

Appendix

6.2.13.3 Delivered items

Qty.	Designation	Order no.
1	D 690	62010690006

6.2.13.4 Accessories

Qty.	Designation	Order no.
1	Cable 1.5 m for WD	62501402015
1	Cable 1.5 m for WDP	62501408015
2	Feet	00050090045

6.2.13.5 Mounting

The interface tester foot snaps into position on the conventional DIN EN mounting rails.

6.2.13.6 Starting up

1. Switch off WP/WDP or WD unit.
2. Connect the D 690 interface tester between the WP/WDP or WD unit and the peripheral equipment with the cable, see fig. 6-19.



ATTENTION

Inserting the interface tester may impair noise immunity of the signal inputs. Only use the delivered cable or a screened signal cable.

3. Tighten the fastening screws of the connector.
4. Switch on WP/WDP or WD unit.
5. If desired, the signal states may be tested at the diagnostic connector with a measuring unit. Pin assignment of the diagnostic connector corresponds with the pin assignment of the signal connector.
6. Test interface.



NOTE

Only those outputs which are connected by the customer can be tested.

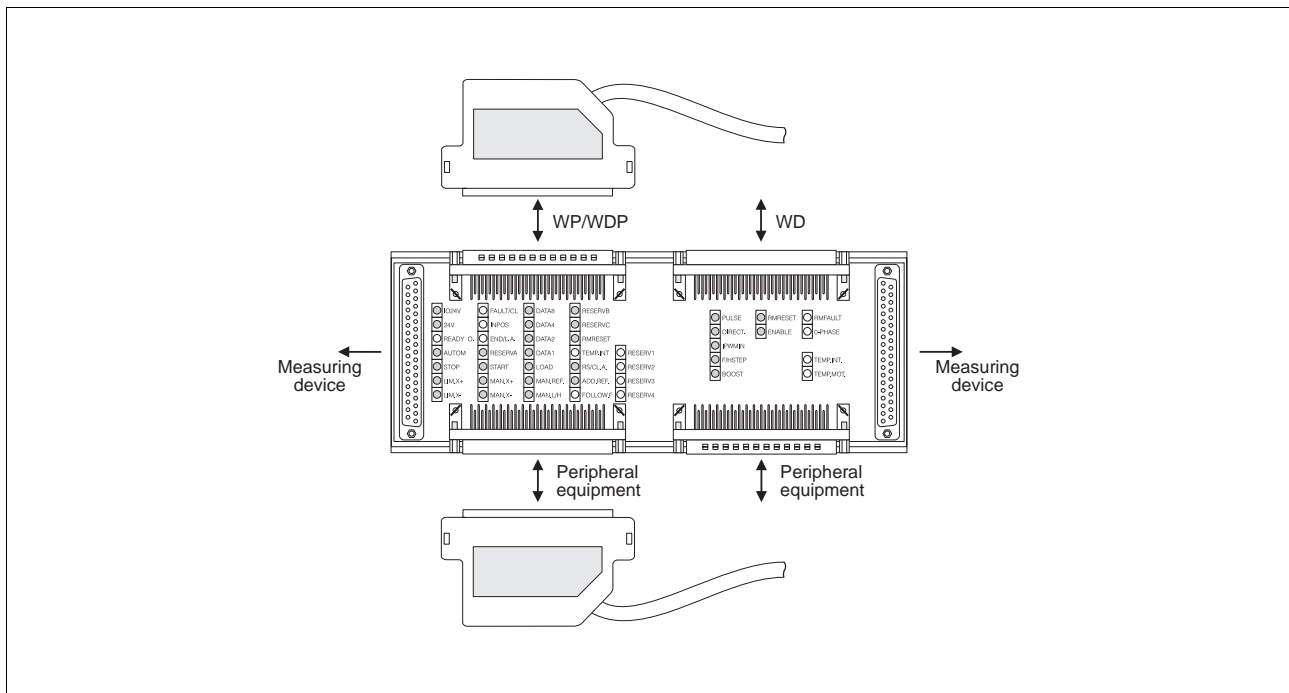


Fig. 6-19 Starting the D 690 interface tester

6.2.14 MP 923 interface converter

6.2.14.2 Technical data

6.2.14.1 General description

The MP 923 interface converter is used for the data transfer from one RS 485 (RS 422) interface to a V24 (RS 232) interface and vice-versa.

The interface converter must be supplied with 12 VDC via the power supply unit connector (2-pole diode connector, female) or the RS 485 (RS 422) connector. The BERGER LAHR positioning units (e.g. WDP5) are supplied via the RS 485 (RS 422) connector.

Electrical data

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

Mechanical data

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

Environmental conditions

Storage temperature	-25°C to 70°C
Operating temperature	0°C to 55°C
Humidity class	F according to DIN 40 040

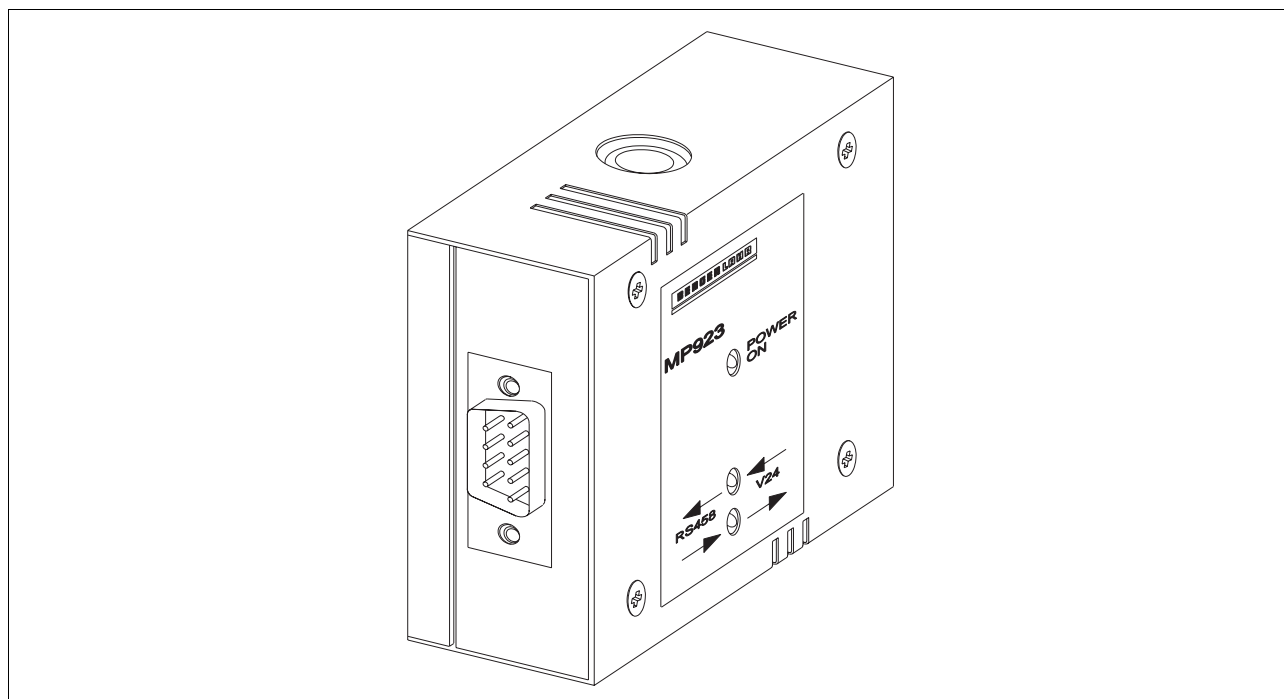


Fig. 6-20 MP 923 interface converter

6.2.14.3 Delivered items

Qty.	Designation	Order no.
1	MP 923	62020923000
1	9-pole female connector	N4-673-1
1	Connector shell (9-pole)	N4-673-236
1	25-pole connector	N4-673-248
1	Connector shell (25-pole)	N4-673-238
4	Locking screw	N4-673-158

6.2.14.4 Accessories

Qty.	Designation	Order no.
1	Interface cable, complete	see chapter 6.2.12

6.2.14.5 Starting up

1. Connect MP 923 interface converter as shown in fig. 6-21.



NOTE

The MP 923 is supplied with a 12 VDC voltage via the power supply unit connector or the RS 485 (RS 422) connector (e.g. with BERGER LAHR WDP5 positioning units).



ATTENTION

The interface cables must be screened on both sides via the connector shells!



ATTENTION

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

2. Switch on supply voltage.
→ The "POWER ON" LED lights up. The two other LEDs are out.
3. Start data transfer.
→ Depending on the direction in which data transfer is effected, one of the two LEDs "RS 485 → V24" or "RS 485 ← V24" flashes.

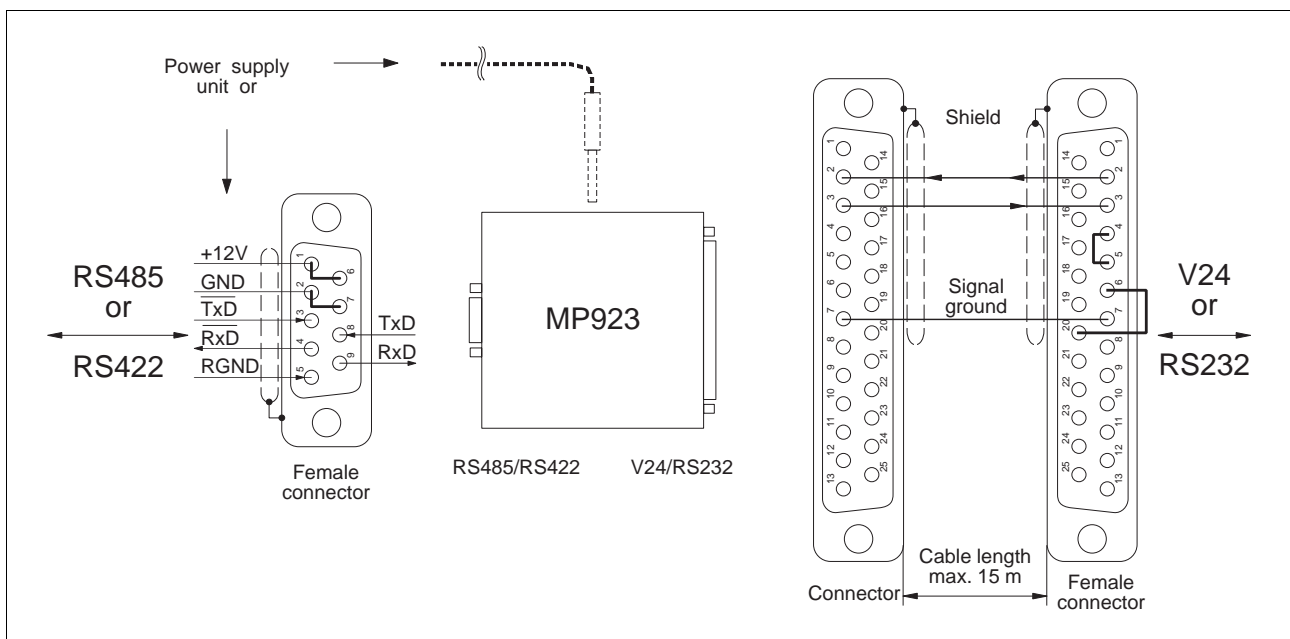


Fig. 6-21 Starting the MP 923 interface converter

6.2.14.6 Status displays

The status displays indicate the operating status or malfunctions.

LED	Lights up	Does not light up	Flashes
"POWER ON"	Supply voltage available	No supply voltage available	
"RS 485 → V24"	RS 485 (RS 422) interface incorrectly connected (signal connections Tx \overline{D} and Rx \overline{D} interchanged)	No data transfer from RS 485 (RS 422) to V24 (RS 232)	Data transfer from RS 485 (RS 422) to V24 (RS 232)
"RS 485 ← V24"	V24 (RS 232) interface incorrectly connected (pin 2 and 3 interchanged)	No data transfer from V24 (RS 232) to RS 485 (RS 422)	Data transfer from V24 (RS 232) to RS 485 (RS 422)

Appendix

6.2.15 MP 924 interface distributor

6.2.15.1 General description

The MP 924 interface distributor allows operating a maximum of 9 BERGER LAHR units linked in a network via a PC. In case more than 9 units (max. 124 units) must be operated in network mode, several MP 924 interface distributors must be connected.

6.2.15.2 Technical data

Electrical data

10 serial interfaces RS 485 (RS 422)

Mechanical data

Dimensions approx. 205 x 80 x 32 mm

Weight approx. 260 g

Environmental conditions

Storage temperature -25°C to 70°C

Operating temperature 0°C to 55°C

Humidity class F DIN 40040

6.2.15.3 Delivered items

Qty.	Designation	Order number
1	MP 924	62020924006

6.2.15.4 Accessories

Qty.	Designation	Order number
1	9-pole connector	N4-673-246
1	Connector shell (9-pole)	N4-673-236
1	Signal cable for RS 485 (RS 422)	H6-923-30
1	Interface cable, complete	see chapter 6.2.12

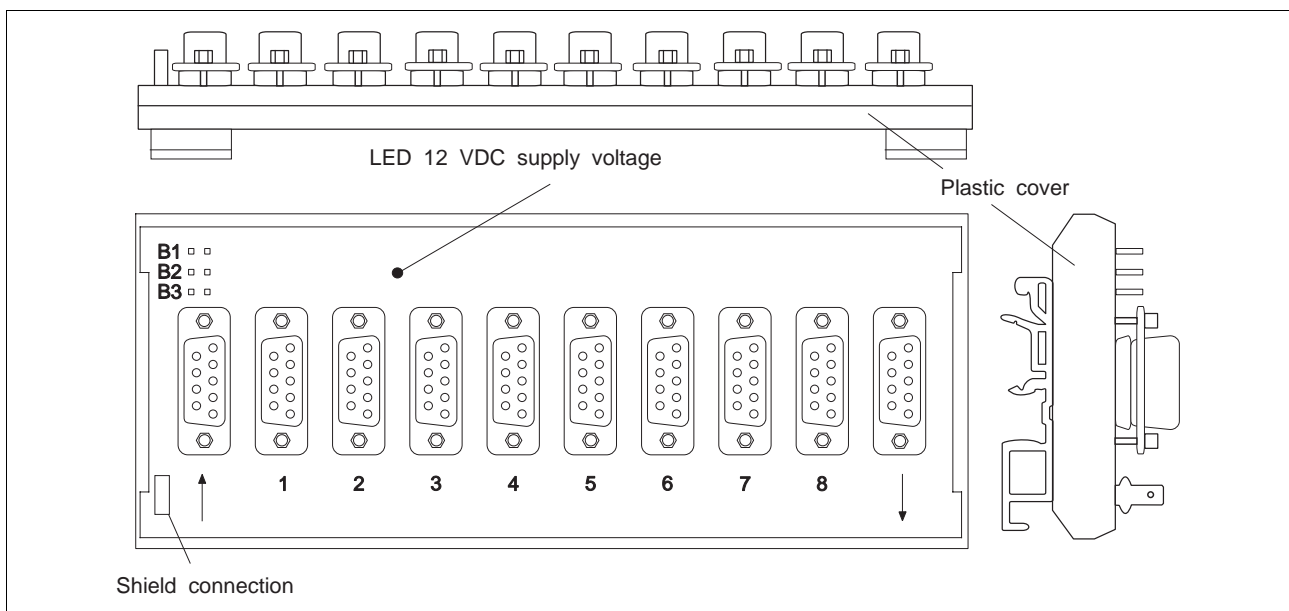


Fig. 6-22 MP 924 interface distributor

6.2.15.5 Starting up

1. Connect MP 924 interface distributor according to fig. 6-23. Use MP 923 interface converter for interface conversion RS 232 ↔ RS 485 (RS 422) (see chapter 6.2.14).
2. When several MP 924 interface distributors are used, they must be connected according to fig. 6-23.



ATTENTION
The interface cable must be screened on both sides (connect MP 924 shield connector to protective ground).



ATTENTION
The RS 232 cable must be kept as short as possible for reasons of noise immunity.



ATTENTION
Line terminal must never be connected.



ATTENTION
The same baud rate must be set at all units in network mode.



ATTENTION
When using the MP 923 interface converter, at least one unit at the MP 924 interface distributor must be switched on to ensure that MP 923 is supplied with voltage.

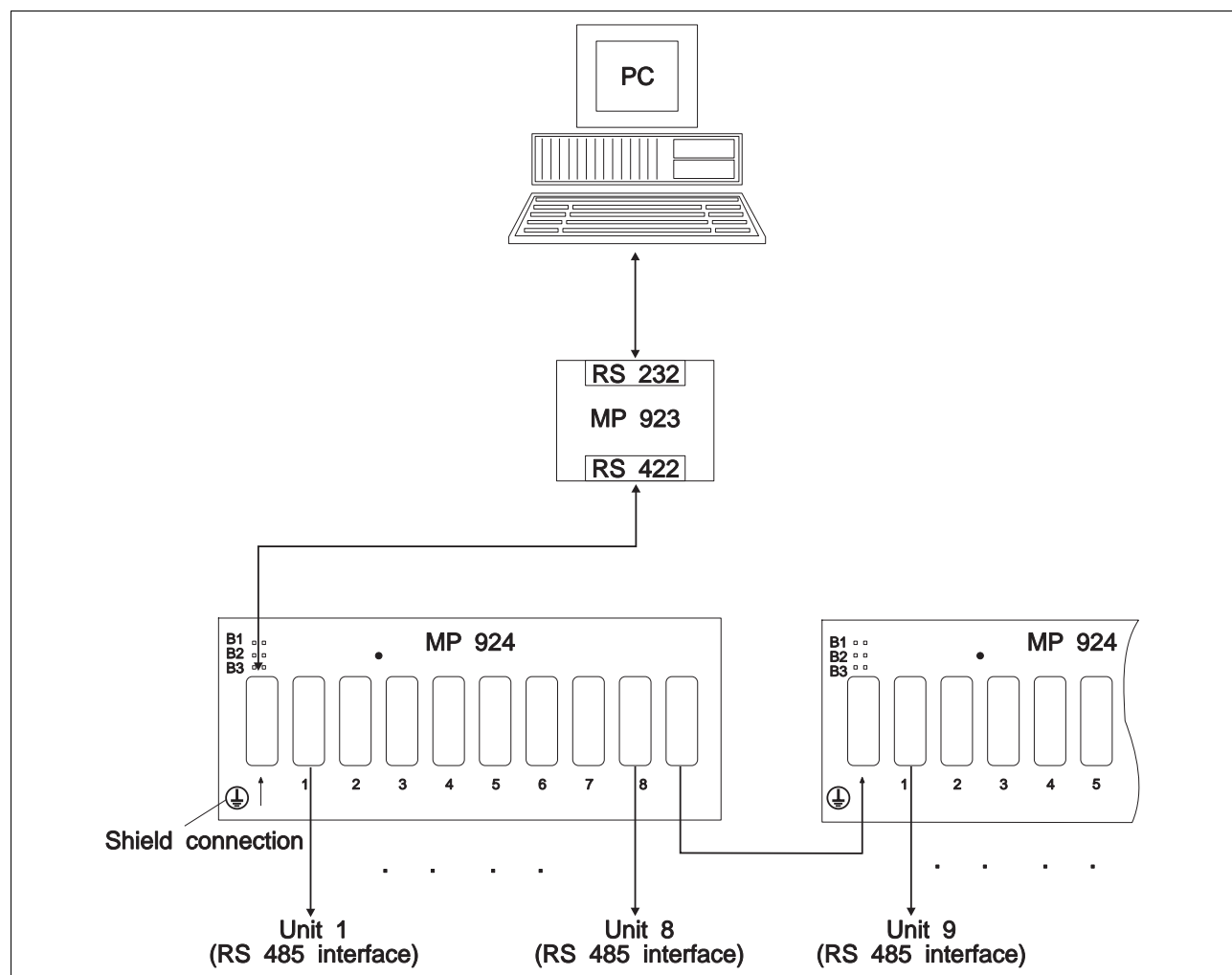


Fig. 6-23 Cabling of MP 924 interface distributor

6.2.16 Signal cables

There are two different signal cables:

- Signal cable with a connector on the controller side and no connector on the other end.
- Signal cable with a connector on the controller side and a 37-pole female connector on the other end.

The signal cable with a connector on the controller side is available with the following lengths:

Cable length	Order number
1 m	62501407010
2 m	62501407020
5 m	62501407050
10 m	62501407100

The signal cable consists of:

Qty	Designation	Order number
1	37-pole connector	N4-673-249
1	Connector shell	N4-673-239
1	Cable	H6-928-44

The signal cable which is provided with a 37-pole female connector on the other end is available with the following lengths:

Cable length	Order number
1 m	62501408010
2 m	62501408020
5 m	62501408050
10 m	62501408100

The signal cable consists of:

Qty	Designation	Order number
1	37-pole female connector	N4-673-203
1	37-pole connector	N4-673-249
2	Connector shell	N4-673-239
1	Cable	H6-928-44

Signal connection is shown and described in chapter 2.4.4.

6.2.17 WDP5-118 set of connectors

The connector set comprises:

Designation	Order no.
9-pole connector	N4-673-246
Connector shell (9-pole)	N4-673-236
15-pole connector	N4-673-247
Connector shell (15-pole)	N4-673-237
37-pole connector	N4-673-249
Connector shell (37-pole)	N4-673-239

6.3 Reference movement principle



ATTENTION
Do not move beyond limit switch ranges.

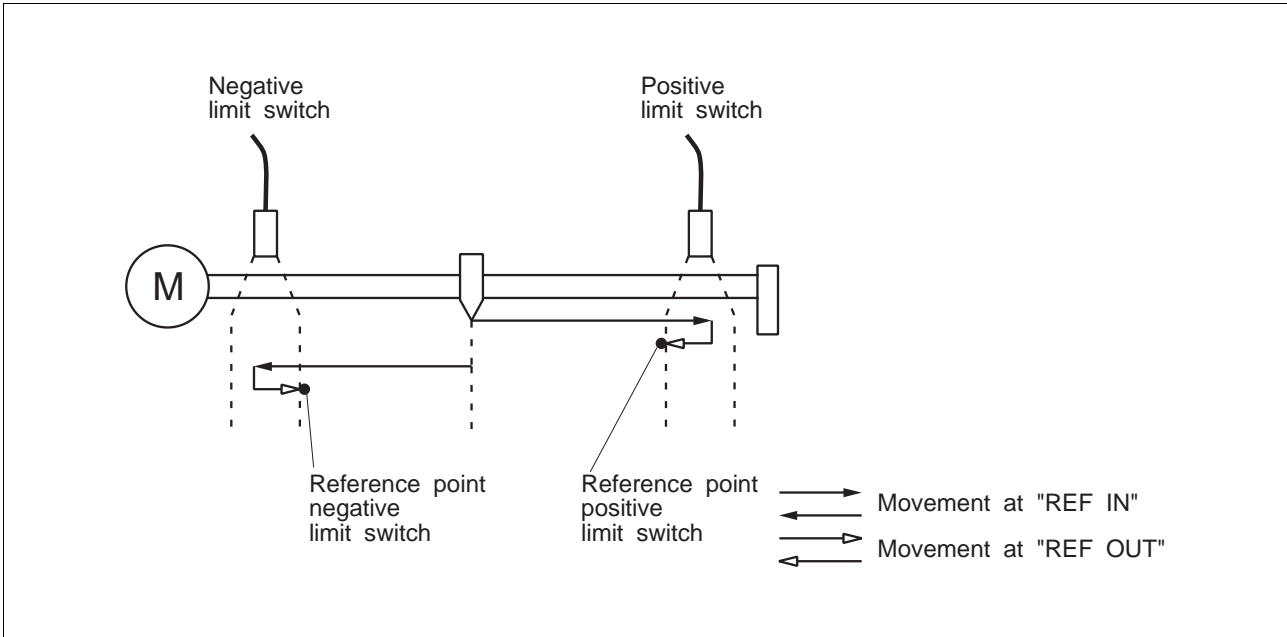


Fig. 6-24 Principle of reference movement towards the limit switch

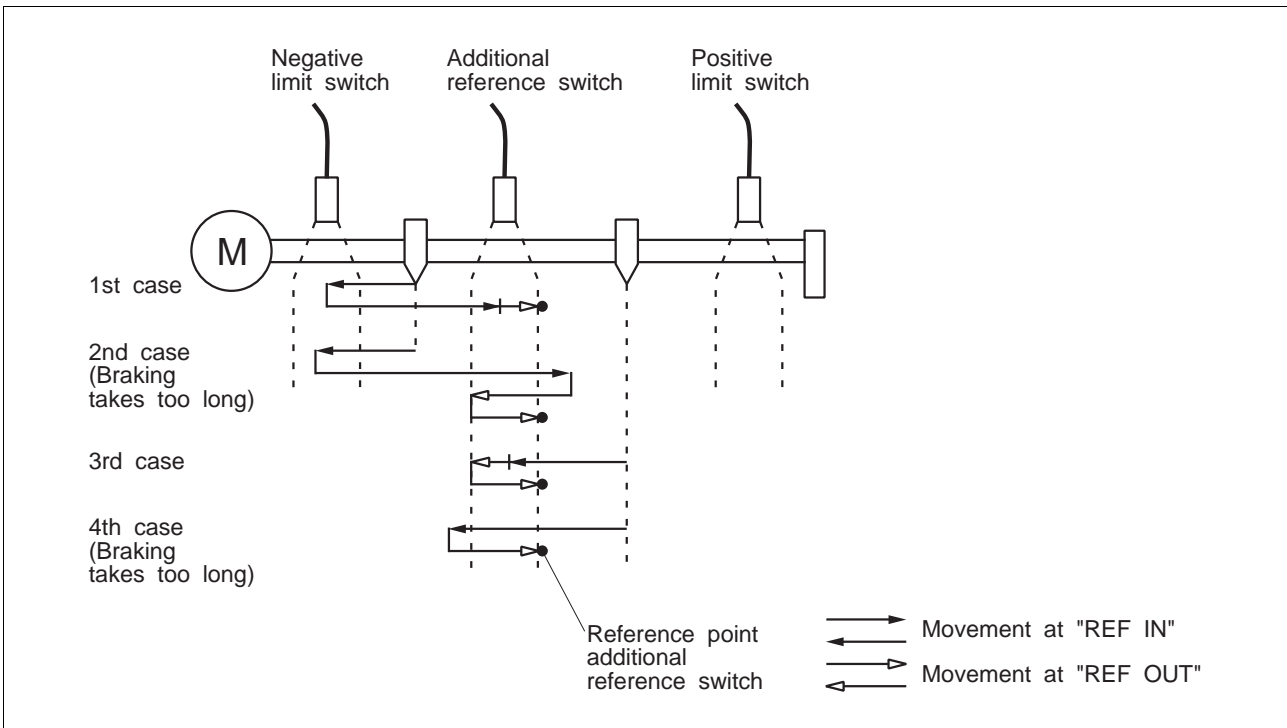


Fig. 6-25 Principle of reference movement towards the additional reference switch

6.4 Terminology

Absolute dimensions	Reference system of dimensions used in positioning. The reference point for positioning is the reference point of the system.
Additional reference switch	Additional switch for reference movement.
Clockwise rotation	Sense of rotation of the motor in clockwise direction (viewed from front to motor shaft).
Counterclockwise rotation	Sense of rotation of the motor in counterclockwise direction (viewed from front to motor shaft).
Decade settling time	Number of read-in repeats of a decade value with parallel data transfer.
Full step	500 steps/revolution; step angle = $0.72^\circ/\text{step}$.
Gear ratio	Multiplier used in positioning, which consists of the numerator and denominator (reduction gear or speed-transforming gear).
Half step	1000 steps/revolution; step angle = $0.36^\circ/\text{step}$.
Incremental dimensions	Reference system of dimensions for the positioning unit. The reference point is the current position.
Limit switch	Switch limiting the travel and reference movement.
Load resistor	Reduces the braking energy of the motor.
Manual frequency	Motor speed during slow ("manual frequency slow") or fast ("manual frequency fast") manual movement.
Network mode	Operating mode for executing programs in a network of positioning units.
Parallel mode	Operating mode of the positioning unit for parallel transfer of movement commands.
Phase current	Current flowing through a stepping motor coil.
Power control card	Card equipped with electronic system for driving the motor.

Appendix

Readings	Number of times a complete decade switch block is read in parallel data transfer.
Reference movement frequency	Motor speed at which a movement to the limit/reference switch ("REF IN") and a movement away from the limit/reference switch ("REF OUT") to the reference point is performed.
Reference movement	Movement of the motor towards the right or left limit switch or additional reference switch for setting a reference point for the system of dimensions.
Reference position	Position value after reference movement or reference point setting.
Rotation monitoring	The desired position is compared to the actual position of the drive, malfunction if limit value is exceeded
RS 485 interface	Serial interface for the network.
Serial mode	Operating mode of the positioning unit for serial transfer of movement commands.
Settling time	Time during which an input signal must be stable so that the positioning unit can recognize it.
Step angle	Angle of rotation through which the motor shaft rotates for each control pulse.
Storage mode	Operating mode of the positioning unit for storing and executing programs.
Zero current	Phase current reduction to zero (motor has no holding torque).

6.5 Abbreviations

ASCII	American Standard Code for Information Interchange
CMOS	Complementary metal-oxide semiconductor
Doc. no.	Documentation number
E	Encoder
HU	Height unit
LED	Light emitting diode
M	Motor
PC	Personal computer
PLC	Programmable logic controller
SW	Wrench size

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