Rexroth
Bosch Group

Rexroth Rho 4.0
Connectivity manual

1070072365
Edition 04

Project planning

Title	Rexroth Rho 4.0 Connectivity manual
Type of Documentation	Project planning
Document Typecode	DOK-RHO*4*-RHO4.0*ANBE-PR04-EN-P
Purpose of Documentation	The present manual informs about: ● technical data, operation and ● configuration of the rho4.0

Record of Revisions

Description	Release Date	Notes
DOK-RHO*4*-RHO4.0*ANBE-PR03-EN-P	10.2003	Valid from VO07
DOK-RHO*4*-RHO4.0*ANBE-PR04-EN-P	01.2005	Valid from VO08

Validity   The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

Overview of all manuals

Overview of all manuals

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Overview of all manuals

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	4	Variables
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Overview of all manuals

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PHG2000	2	Hand-held programming unit PHG2000
	3	PHG2000 system variables
	4	Selection of PHG functions
	5	Info function of the PHG
	6	Controlling the PHG2000 output
	7	Define/Teach
	8	SRCAN functions
	9	File and User Memory Functions
	10	File list
	11	Process info
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Connection conditions Rho 4.1/IPC 40.2	2	System Overview
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Overview of all manuals

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Overview of all manuals

Notes:

Contents

Contents

Contents

Safety Instructions

1   Safety Instructions

Please read this manual before you startup the rho4.
Store this manual in a place to which all users have access at any time.

1.1   Intended use

This instruction manual presents a comprehensive set of instructions and information required for the standard operation of the described products. The described products are used for the purpose of operating with a robot control rho4.

The products described

● have been developed, manufactured, tested and documented in compliance with the safety standards. These products normally pose no danger to persons or property if they are used in accordance with the handling stipulations and safety notes prescribed for their configuration, mounting, and proper operation.

● comply with the requirements of
  ● the EMC Directives (89/336/EEC, 93/68/EEC and 93/44/EEC)
  ● the Low-Voltage Directive (73/23/EEC)
  ● the harmonized standards EN 50081-2 and EN 50082-2

● are designed for operation in industrial environments, i.e.
  ● no direct connection to public low-voltage power supply,
  ● connection to the medium- or high-voltage system via a transformer.

The following applies for application within a personal residence, in business areas, on retail premises or in a small-industry setting:

  ● Installation in a control cabinet or housing with high shield attenuation.
  ● Cables that exit the screened area must be provided with filtering or screening measures.
  ● The user will be required to obtain a single operating license issued by the appropriate national authority or approval body. In Germany, this is the Federal Institute for Posts and Telecommunications, and/or its local branch offices.

☞ **This is a Class A device. In a residential area, this device may cause radio interference. In such case, the user may be required to introduce suitable countermeasures, and to bear the cost of the same.**

The faultless, safe functioning of the product requires proper transport, storage, erection and installation as well as careful operation.

Safety Instructions

1.2   **Qualified personnel**

The requirements as to qualified personnel depend on the qualification profiles described by ZVEI (central association of the electrical industry) and VDMA (association of German machine and plant builders) in:
Weiterbildung in der Automatisierungstechnik
edited by: ZVEI and VDMA
MaschinenbauVerlag
Postfach 71 08 64
D-60498 Frankfurt.

The present manual is designed for RC technicans. They need special knowledge on handling and programming robots.

Interventions in the hardware and software of our products, unless described otherwise in this manual, are reserved to specialized Rexroth personnel.

Tampering with the hardware or software, ignoring warning signs attached to the components, or non-compliance with the warning notes given in this manual may result in serious bodily injury or damage to property.

Only electrotechnicians as recognized under IEV 826-09-01 (modified) who are familiar with the contents of this manual may install and service the products described.

Such personnel are

● those who, being well trained and experienced in their field and familiar with the relevant norms, are able to analyze the jobs being carried out and recognize any hazards which may have arisen.

● those who have acquired the same amount of expert knowledge through years of experience that would normally be acquired through formal technical training.

With regard to the foregoing, please note our comprehensive range of training courses. Please visit our website at
http://www.boschrexroth.com
for the latest information concerning training courses, teachware and training systems. Personal information is available from our Didactic Center Erbach,
Telephone: (+49) (0) 60 62 78-600.

Safety Instructions

1.3   Safety markings on products

Warning of dangerous electrical voltage!

Warning of danger caused by batteries!

Electrostatically sensitive components!

Warning of hazardous light emissions
(optical fiber cable emissions)!

Disconnect mains power before opening!

Lug for connecting PE conductor only!

Functional earthing or low-noise earth only!

Connection of shield conductor only

Safety Instructions

1.4   Safety instructions in this manual

DANGEROUS ELECTRICAL VOLTAGE
This symbol is used to warn of a **dangerous electrical voltage.** The failure to observe the instructions in this manual in whole or in part may result in **personal injury**.

DANGER
This symbol is used wherever insufficient or lacking compliance with instructions may result in **personal injury**.

CAUTION
This symbol is used wherever insufficient or lacking compliance with instructions may result in **damage to equipment or data files**.

☞   This symbol is used to draw the user's attention to special circumstances.

★   This symbol is used if user activities are required.

Safety Instructions

1.5   Safety instructions for the described product

DANGER
Danger of life through inadequate EMERGENCY-STOP devices!
EMERGENCY-STOP devices must be active and within reach in all system modes. Releasing an EMERGENCY-STOP device must not result in an uncontrolled restart of the system!
First check the EMERGENCY-STOP circuit, then switch the system on!

DANGER
Danger for persons and equipment!
Test every new program before starting up a system!

DANGER
Retrofits or modifications may adversely affect the safety of the products described!
The consequences may include severe injury, damage to equipment, or environmental hazards. Possible retrofits or modifications to the system using third-party equipment therefore have to be approved by Rexroth.

DANGER
Do not look directly into the LEDs in the optical fiber connection. Due to their high output, this may result in eye injuries.
When the inverter is switched on, do not look into the LED or the open end of a short connected lead.

DANGEROUS ELECTRICAL VOLTAGE
Unless described otherwise, maintenance works must be performed on inactive systems! The system must be protected against unauthorized or accidental reclosing.

Measuring or test activities on the live system are reserved to qualified electrical personnel!

Safety Instructions

CAUTION
Danger to the module!
Do not insert or remove the module while the controller is switched ON! This may destroy the module. Prior to inserting or removing the module, switch OFF or remove the power supply module of the controller, external power supply and signal voltage!

CAUTION
use only spare parts approved by Rexroth!

CAUTION
Danger to the module!
All ESD protection measures must be observed when using the module! Prevent electrostatic discharges!

The following protective measures must be observed for modules and components sensitive to electrostatic discharge (ESD)!

- Personnel responsible for storage, transport, and handling must have training in ESD protection.
- ESD-sensitive components must be stored and transported in the prescribed protective packaging.
- ESD-sensitive components may only be handled at special ESD-workplaces.
- Personnel, working surfaces, as well as all equipment and tools which may come into contact with ESD-sensitive components must have the same potential (e.g. by grounding).
- Wear an approved grounding bracelet. The grounding bracelet must be connected with the working surface through a cable with an integrated 1 MΩ resistor.
- ESD-sensitive components may by no means come into contact with chargeable objects, including most plastic materials.
- When ESD-sensitive components are installed in or removed from equipment, the equipment must be de-energized.

Safety Instructions

1.6   Documentation, software release and trademarks

Documentation

The present manual provides the user with comprehensive information about technical data, operation and configuration of the rho4.0.

Overview of available documentation	Part no.	
	German	English
Rho 4.0 Connectivity Manual	1070 072 364	1070 072 365
Rho 4.0 System description	1070 072 366	1070 072 367
Rho 4.1/IPC 40.2 Connectivity Manual	R911308219	R911308220
Rho 4.1/BT155, Rho 4.1/BT155T, Rho 4.1/BT205 Connectivity manual	1070 072 362	1070 072 363
Rho 4.1, Rho 4.1/IPC300 Connectivity manual	1070 072 360	1070 072 361
Control panels BF2xxT/BF3xxT, connection	1070 073 814	1070 073 824
Rho 4.1 System description	1070 072 434	1070 072 185
ROPS4/Online	1070 072 423	1070 072 180
BAPS plus	1070 072 422	1070 072 187
BAPS3 Short description	1070 072 412	1070 072 177
BAPS3 Programming manual	1070 072 413	1070 072 178
Control functions	1070 072 420	1070 072 179
Signal descriptions	1070 072 415	1070 072 182
Status messages and warnings	1070 072 417	1070 072 181
Machine parameters	1070 072 414	1070 072 175
PHG2000	1070 072 421	1070 072 183
DDE-Server 4	1070 072 433	1070 072 184
DLL-Library	1070 072 418	1070 072 176
Rho 4 available documentation on CD ROM	1070 086 145	1070 086 145

☞ **In this manual the floppy disk drive always uses drive letter A:, and the hard disk drive always uses drive letter C:.**

Special keys or key combinations are shown enclosed in pointed brackets:
- Named keys: e.g., <Enter>, <PgUp>, <Del>
- Key combinations (pressed simultaneously): e.g., <Ctrl> + <PgUp>

Safety Instructions

Release

☞ **This manual refers to the following versions:**
Hardware version: rho4
Software release: ROPS4

Trademarks

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are the property of the respective manufacturer.

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may only be reproduced with the approval of Rexroth or in accordance
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nisation e.V. (user organization).

MOBY® is a registered trademark of Siemens AG.

AS-I® is a registered trademark of AS-International Association.

SERCOS interface™ is a registered trademark of Interessengemein-
schaft SERCOS interface e.V. (Joint VDW/ZVEI Working Committee).

INTERBUS-S® is a registered trade mark of Phoenix Contact.

DeviceNet® is a registered trade mark (TM) of ODVA (Open DeviceNet
Vendor Association, Inc.).

System Overview

2   System Overview

The rho4.0 is a robot, handling and movement control in which the whole processor is available for the real time part since it can run without Windows. VxWorks is used as Task Scheduler.

The hardware core of the rho4.0 is PC-based and extended by the hardware required for a real-time control.

8 axes and 8 kinematics can be controlled in the basis function scope.

The rho4.0 is composed of a power supply unit, a carrier board, a PC board and a PCI plug point in which one of the 3 BOSCH field bus cards (CAN, INTERBUS-S and PROFIBUS-DP) can be operated.

CAUTION
Damage to the PC or the application software can be caused by using extension cards that are not released.
Install only released extension cards and have them only by authorized qualified personnel installed.

Installation of extension cards, see section 7.1.

The PC Board is available optional with a 266- or a 400-MHz processor and 64-MB-SO-DIMM. A Compact-Flash card is used as hard disk.

The rho4.0 is provided with an internal 3,6 V-Lithium battery of size AA with a capacity of 1,75 Ah. It buffers the SRAM components and the RTC on the ETX Board and should be changed every 3 years for security reasons. See section 7.2.

System Overview

There are 2 types of housing: one in the form of a drive module and one as 19" rack.

The drive housing is located vertically near a drive module. The 19" housing is 44mm high and is located horizontally in a 19" control cabinet.

Dimensions:

rho4.0 19" housing (horizontal)	H: 43,6 mm	B: 482,6 mm	T: 222 mm
rho4.0LR*,rho4.0LRX* 19" housing (horizontal)	H: 43,6 mm	B: 482,6 mm	T: 303,99 mm
rho4.0 Drive housing (vertical)	H: 445 mm	B: 43,6 mm	T: 250 mm
Weight:	approx. 3,5 kg		

The protection type of both housing types is IP20.

* LR = large remanence
   X = 400 MHz variant

System Overview

19"-housing   **Drive housing**
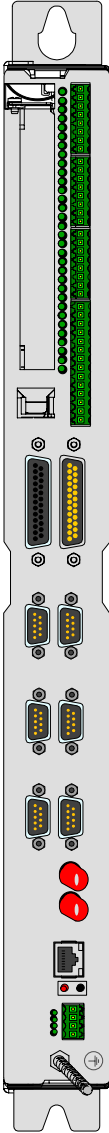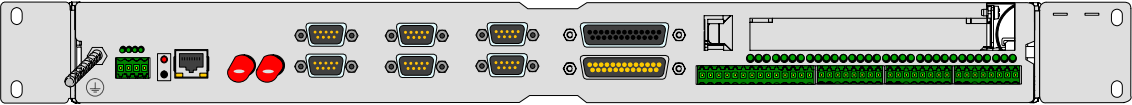
System Overview

2.1 Modular mimic display

CLOCK PLL

Pentium 266MHz , resp. 400MHz

5V–>3,3V

Power supply
24V –> 5V/ 5A
12V/1A
–12V/150mA

Host Bus

512K SRAM
Cache

ALI

DRAM 64 MB on SO-DIMM

32*8 TAG

PCI-Bus

Dev2   Dev3   Dev1

Compact Flash Disk

IDE-Bus

PCI__ISA Interface PIIX3

LAN 10/100 BaseT

PLX PCI9050

PCI Slot

COM1 / V24

COM2 / V24

2/4MB SRAM buffered

Battery

Floppy-interface

Transformer

CAN   CAN   Motion

CAN   CAN   Panel

Interrupt

CAN   CAN   Decentral I/O

VP

Timer

16 digital inputs
8 digital outputs

Flash 256 kB BIOS

RTC

Sercos Interface

EPLD with Watchdog and Ready Logic

LWL

UART   PHG2000

V24/20mA

System Overview

2.2   Versions

There are two basic variants of the rho4.0 (in the 19" or drive housing):

● rho4.0 L (Maximum extension)

The full hardware extent is available, i.e. 4 MB SRAM and 3 CAN interfaces.
This variant is also available with extended remanence (only in the 19" housing)

● rho4.0 S (Minimum extension)

The SRAM is reduced to 2 MB and only 2 CAN interfaces are available.

By using a BOSCH field bus card in the PCI slot, the following other variants result:

● rho4.0 L(R) with PCI_BM-DP in the 19" housing
● rho4.0 L(R) with PCI_BM-DP in the drive housing
● rho4.0 L(R) with PCI_BM-CAN in the 19" housing
● rho4.0 L(R) with PCI_BM-CAN in the drive housing
● rho4.0 L(R) with PCI_BM-IBS in the 19" housing
● rho4.0 L(R) with PCI_BM-IBS in the drive housing
● rho4.0 S with PCI_BM-DP in the 19" housing
● rho4.0 S with PCI_BM-DP in the drive housing
● rho4.0 S with PCI_BM-CAN in the 19" housing
● rho4.0 S with PCI_BM-CAN in the drive housing
● rho4.0 S with PCI_BM-IBS in the 19" housing
● rho4.0 S with PCI_BM-IBS in the drive housing

☞ **All variants are also available as 400 MHz version:**
The names are:

● rho4.0 SX   400 MHz variant minimum extension
● rho4.0 LX   400 MHz variant maximum extension
● rho4.0 LRX   400 MHz variant maximum extension with extended
                   remanence

rho4.0
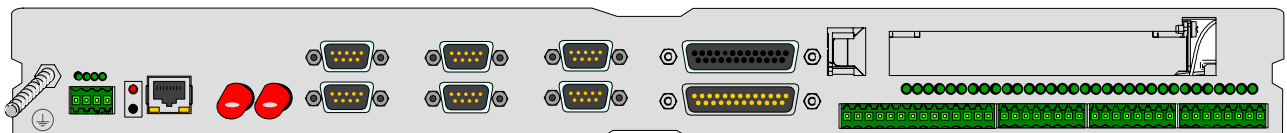
System Overview

2.3   Specifications

Technical data	
housing	Design as drive module or 19" module 44 mm high, aerated
location	• vertically near a drive module • horizontally in the 19" cabinet
Pentium-Prozessor with Intel MMX™ Technologie	266-, resp. 400-MHz Pentium with MMX
Second Level Cache	512 K L2 Cache
DRAM	64 MB DIMM- SOII
SRAM	max. 4MB SRAM buffered (central through battery)
Harddisk	64 MB IDE Compact-Flash card (can be internally plugged)
V24_1/X31 V24_2/X32	ESD solid up to 15 KV
EMV-steadiness	meets all requirements set, see chapter 1.1
power consumption from 24V current consumption from 24V	approx. 48 W approx. 2 A
Buffer	centrally buffered through battery Battery monitoring Battery change every 3 years
CAN-interfaces	2 or 3 (only rho4.0 L)
LAN-interface	10/100 Mbit, RJ45 (Twisted Pair) ☞ **Cables of class 5 at least must be used**
16 digital inputs	X21, X22, 8-pin 3,5 mm Weidmüller terminal strip
8 digital outputs	X11, 8-pin 3,5 mm Weidmüller terminal strip
Status-LEDs	8, to display the most important operations states
V24_3/X33 (V24/20 mA-interface)	9-pol. D-SUB, not separated galvanically
Sercos-interface	In/Out
Floppy-interface	25-pin D-Sub for external floppy
PHG-interface	14-pin safety terminal 25-pin D-Sub für PHG2000 connection

System Overview

Technical data	
Potential-free Ready contact	2-channel, triggered through: • power supply monitoring • Watchdog • Temperature monitoring
Setting	DIP-switch for component number (LAN-Addressing), without function at present, resp. for service purposes
Temperatur e operation	ambient temperature 5 to 55 ˚C, monitored
Temperature storage	–25 to +70 ˚C
Protection type	IP20 acc. to DIN VDE 0470
Resistance to jamming	meets all set requirements acc. to DIN EN 61131-2, DIN EN 50081-2 and DIN EN 50082-2
Air pressure	Operation from sea level to 2000 m acc. to DIN EN 61131-2
Protection class	1
Humidity class	RH-2 acc. to DIN EN 61131-2
Degree of soiling	acc. to DIN EN 61131-2

2.4   Operating conditions

The rho4.0 is designed for continuous operation (24 hours/day).
Unless stated otherwise in specific sections, these specifications apply:

Temperatures

Storage temperature:
● –25 °C to +70 °C

Ambient temperature
● +5 °C to +55 °C, monitored

Ambient temperatures apply to installation described in chapter 3.

**Safety function
Temperature monitoring**

The ambient air must not excess +55 ˚C. For the safety, a temperature monitoring measures the temperature in the housing. At an ambient temperature of +58 ˚C, the rho4.0 is brought into a safe state and shut down.

System Overview

Humidity

Humidity class RH-2 acc. to DIN EN 61131-2, thawing not authorized.

Air pressure

In operation up to 2000 m above mean sea level acc. to DIN EN 61131-2

Protection type

IP20 acc. to DIN VDE 0470-1, installed in the housing

For the rho4.0, dust-free air is required. Housing and installation frames in which the rho4.0 is installed, must satisfy the minimum protection type IP 54 acc. to DIN VDE 0470-1.

Resistance to vibrations in operation

Frequency range:	10 to 57 Hz	
Deviation:	0,075 mm	at 10 to 57 Hz
Acceleration acc. to DIN 61131-2:	1 g	at 57 to 150 Hz

Resistance to thermal shocks

15 g acc. to DIN 61131-2, no disturbance of the function

2.5   Standards compatibility

The rho4.0 conforms to the following standards:

- VDE 0470-1   Protection type
- EN 50 081–2   Basic specification for interference emission (industrial environment)
- EN 60 204–1   Electrical systems on machines
- EN 50 082–2   Basic technical standard, interference resistance (industrial environment)
- EN 60 742   Tranformer for 24 V power supply, protective separation
- EN 60 950   Overvoltage category II
- EN 61 131   Requirements w/ respect to 24 V outputs
- EN 61 131–2   Requirements w/ respect to 24 V power supply
- EN 60 529   Protection categories (incl. housings and installation compartments)
- EN 60 068–2–6   Vibration test
- EN 60 068–2–27   Impact test

System Overview

☞ **As shipped from the factory, the rho4.0 comply with the require-ments for the CE mark of conformity.**
However, installing additional expansion cards will require a sup-plementary CE approval.

System Overview

Notizen:

Installation

3   Installation

When installing the Bosch rho4.0, refer to the information on standards
compatibility and operating conditions in sections 2.4 and 2.5.

3.1   Installed positions and clearances

Housing	:	19"-housing (horizontal) or drive housing (vertical)
Weight	:	approx. 3,5 kg
Position	:	horizontal or vertical
Type	:	Installation places must at least satisfy the protection type IP54.

★   Plan the following minimum clearances for sufficient ventilation and wi-
ring arrangement:

19"-housing (horizontal): 50 mm left and right

drive housing (vertical): 50 mm above and below

★   Install the rho4.0 in such a way that a free access to the connection side
is ensured.

The LED displays should not be covered to be able to check the opera-
tion state at any time.

★   Arrange all connection line in loops and use for all lines strain reliefs.

★   Keep as large distances as possible to sources of interference.

Installation

3.2   Dimension diagram 19" housing

mounting bore hole
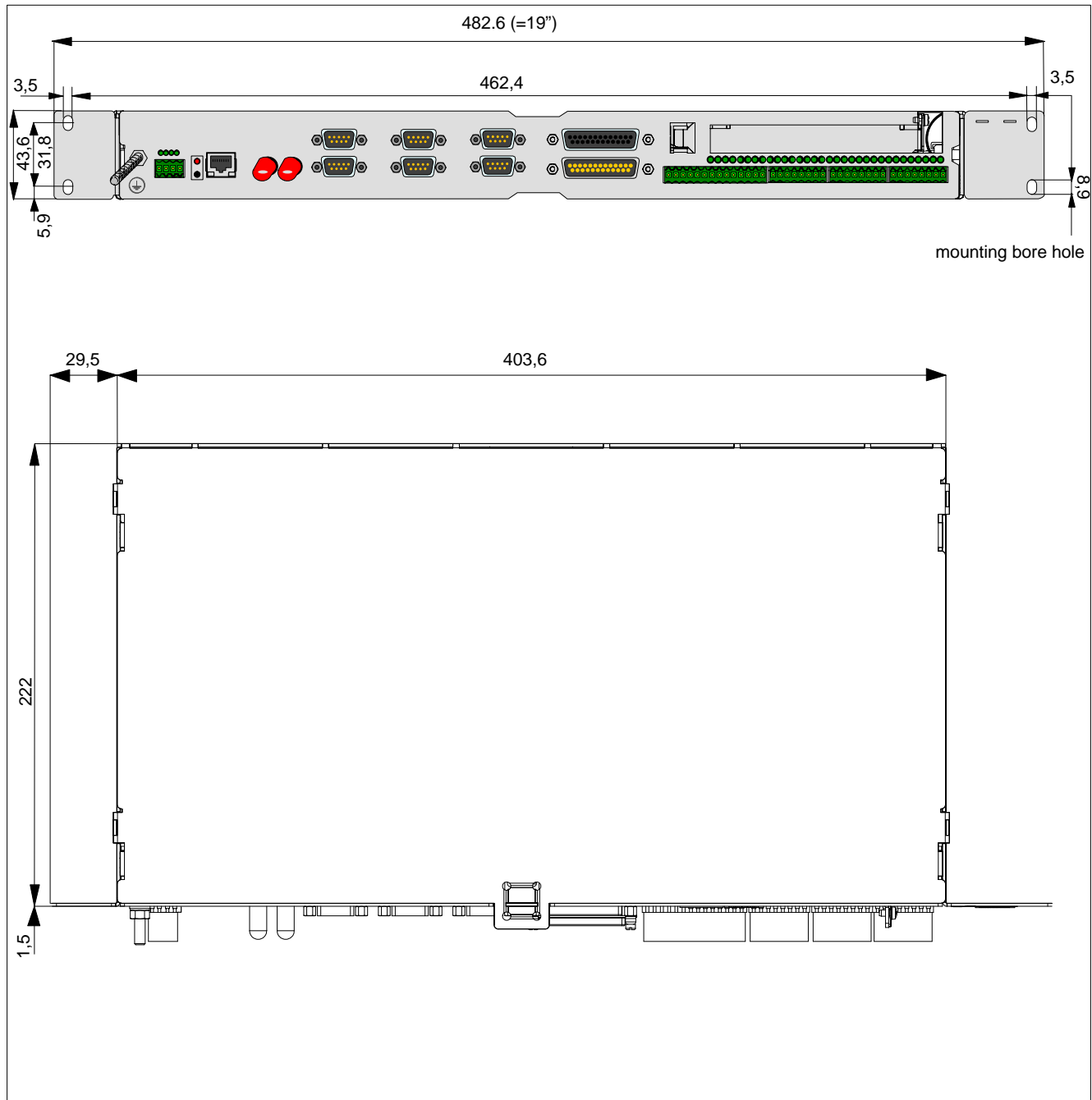
Installation

3.3   Dimension diagram 19" housing with extended remanence (LR)
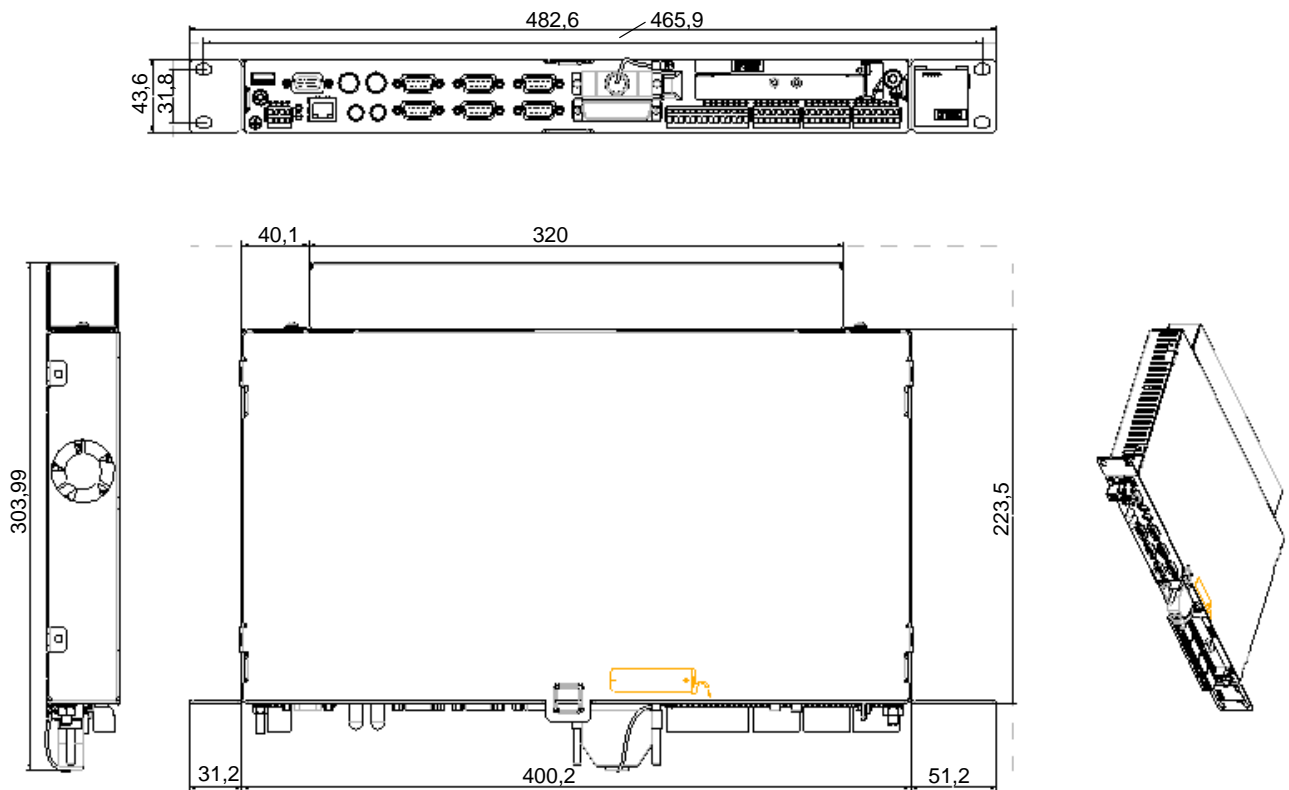
Installation

3.4   Dimension diagram drive housing
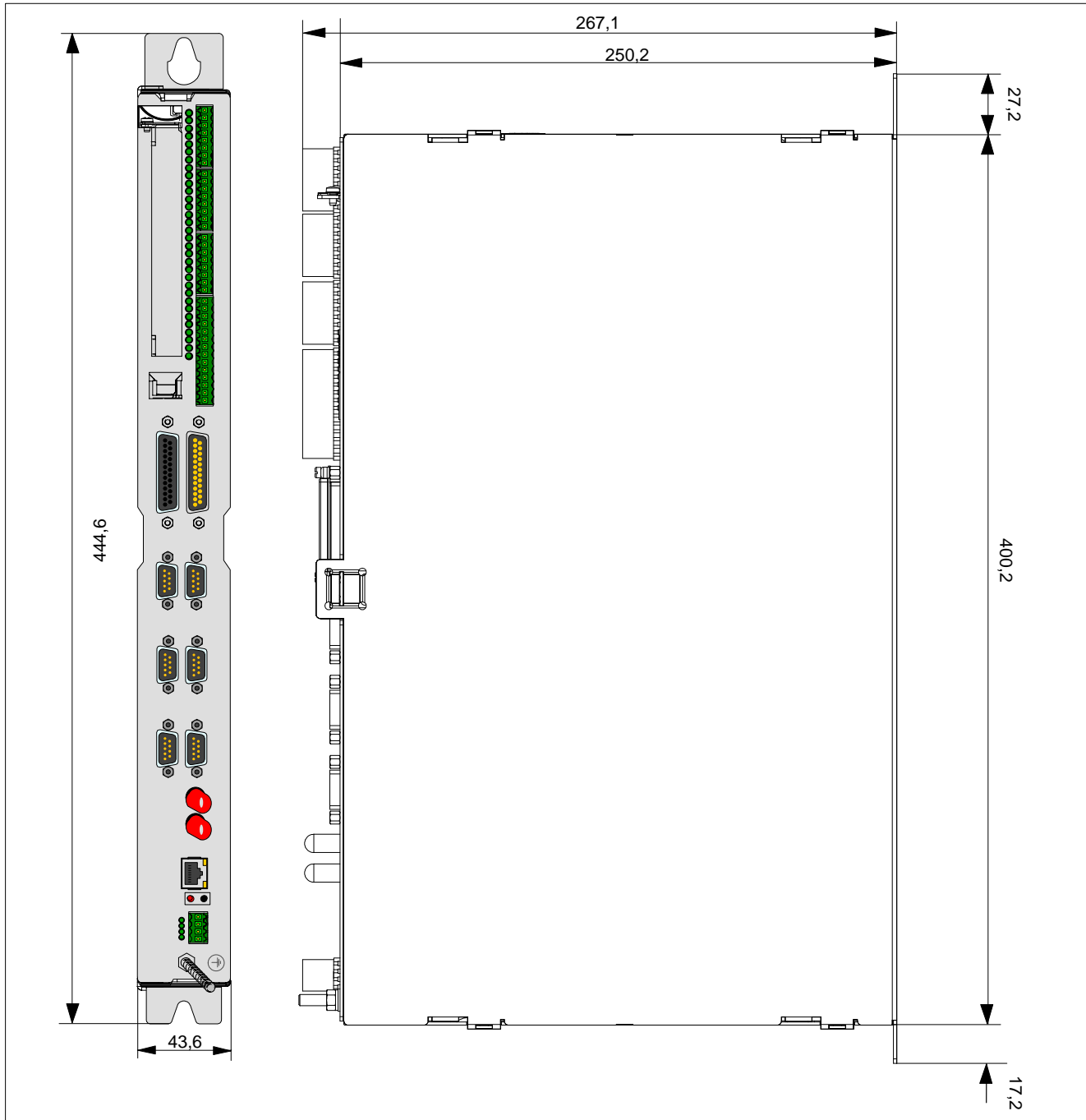
Electrical Connections

4   Electrical Connections

Please note that, with respect to all electrical connections, the terminal connection plans and work instructions provided by the machine manufacturer shall always be binding!

The system planner is also charged with providing and planning for the integration and implementation of required components, such as Emergency-STOP circuits, mains switches, etc., in accordance with the current state of the art and at the highest level of safety attainable.

CAUTION
Risk of damage to system components through by insertion or removal of plug connectors on energized circuits!
Connections must be made only while the system is switched off.

Observe the following to prevent functional failures:

- Provide isolated 24 VDC and 0 V terminal bars inside the control cabinet. With regard to cable routing, maintain a minimum distance of 10 cm (4 in.) from all power cables.
- Ensure that machine plant circuits and shutdown sequence are designed to power up control terminals and other industrial-duty components, e.g., CNC and PLC, simultaneously.

Electrical Connections

4.1   Protective Earth (PE) conductor & screening information

DANGER
**Dangerous conditions, functional failures and equipment da-
mage on machine plant caused by substandard potential
equalization or screening properties between system compo-
nents!**

**Potential equalization currents may not flow across the scree-
ning of interface cables.**

★   The protective earthing conductors (earthing connections) of the system
must be arranged in a tightly meshed grid. All components, control cabi-
net housings and doors, including the mounting plate, must be earthed.

★   The potential equalization lines / PE lines of all system components shall
be kept as short as possible, thus providing low-resistance connections.

★   Install the PE lines, preferably electroconductively, on the mounting
plate in the control cabinet. Both sides of the insulated installed PE rails
must be connected to the mounting plate with max. 20 cm long, adequa-
tely dimensioned copper bands.
Position the PE lines so that the length of the outgoing protective earth
conductor connections to the individual modules in the control cabinet
does not exceed 1 m.

★   When specifying the PE wiring, ensure cross-sections that are suffi-
ciently dimensioned. In this regard, also observe EN 60204, Part 1 (max.
electrical resistance and testing PE wiring installations).

★   If at all possible, apply screening connections on both ends of a cable.

★   Ensure that equipotential equalization currents do not flow across inter-
face signal lines via the shielded conductors. Therefore, prior to swit-
ching on the IPC for the first time, ensure correct potential equalization
between devices that are to be interconnected. Do not forget the interfa-
ces interconnecting devices at different locations (regardless of distance
or power supply).

DANGER
Dangerous shock currents due to poor PE connections!
**The effectiveness of PE connections must not be impeded by
mechanical, chemical or electrochemical influences. Connec-
tions must be permanent and tight.**

Electrical Connections

4.2   Interference suppression information

When designing the machine plant, observe and comply with governing regulations and statutory law with regard to interference suppression on individual components. This will increase the operational safety of the entire system.

⚠️ **DANGER**
Dangerous conditions, functional failures and equipment damage on the machine plant caused by substandard EMC measures or line transient interference!
Install signal voltage cables at a sufficient distance from high-voltage cables (e.g., motor power cables). If this is not possible, separate metallic cable channels must be used.

The following sections are designed to provide you with a brief overview of possible interference suppression measures in the control cabinet. Among these are, for example:

- Filter
- Spark quenching circuits
- Damping of inductive switching peaks
- Limitation of switching voltage of high-speed semiconductors
- Screening

To ensure optimum suppress interference, all of the above components should be taken into consideration because they are most effective when working in combination. In principle, interference suppression should be implemented as follows:

- Apply suppression measures as close to the source of interference as possible
- Use only components that are identified as interference suppressors
- Limit leakage currents in accordance with safety regulations
- Provide touch guards
- Prevent vibration fatigue breakage by providing secure mechanical support for interference suppressors.

To ensure that interference suppression measures are successful, electrical symmetry or asymmetry must also be taken into consideration.
Besides symmetrical components of interference voltage that occur between the mains connection cables, asymmetrical interference voltages occur as well. They are caused by capacitive coupling of the interference source with the mains network.
The following diagram shows a standard interference suppression circuit. Here, the asymmetrical interference voltages are discharged to the housing via C_y. By contrast, C_x dampens the symmetrical interference.

Electrical Connections
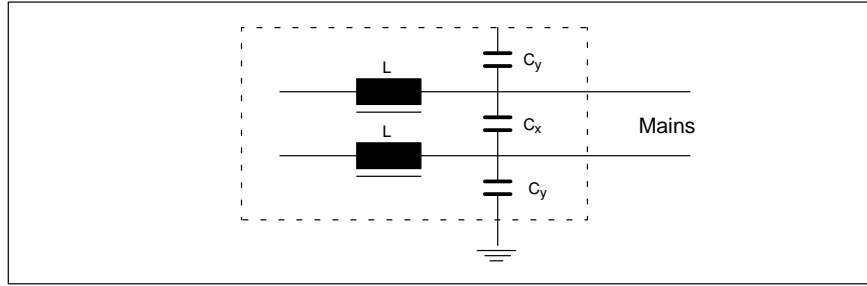
Interference suppression examples

Suppression of **contacts**
(Alternating current, direct current, offset DC current)
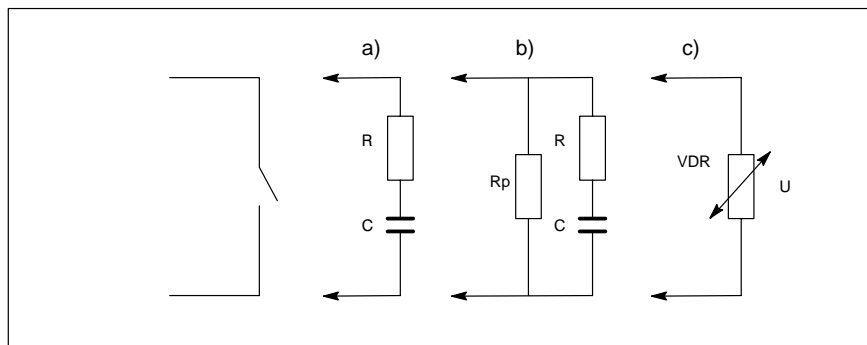
to b)   For sensitive contacts, residual current when contact open!

to c)   Voltage-dependent resistance, residual current when contact open!

Suppression of an **inductive load**
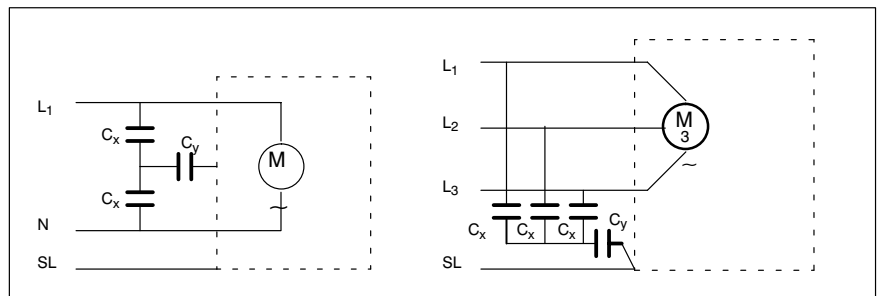(Motors, solenoid, relay and contactor coils)
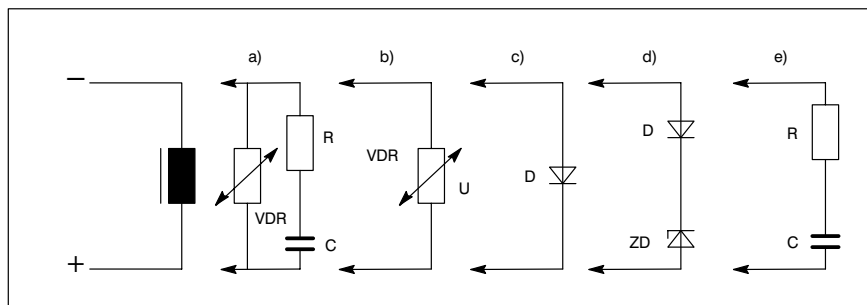
to c)   For relay, drop-off delay.

to d)   For relay, defined drop-off delay

to e)   Must be optimized for inductance!

Electrical Connections

Suppression example – mains input:

Electrical Connections

4.3   24 VDC power connection

X10   **24 VDC power connection**

At the X10 plug, the 24 Volt industrial voltage is fed, filtered and applied to the power supply unit.

The power supply unit transforms the 24 V into different voltages.

X10	Pin	Assignment
− − + +	1	0V distribution voltage
	2	0V distribution voltage
	3	+24V distribution voltage
1 2 3 4	4	+24V distribution voltage
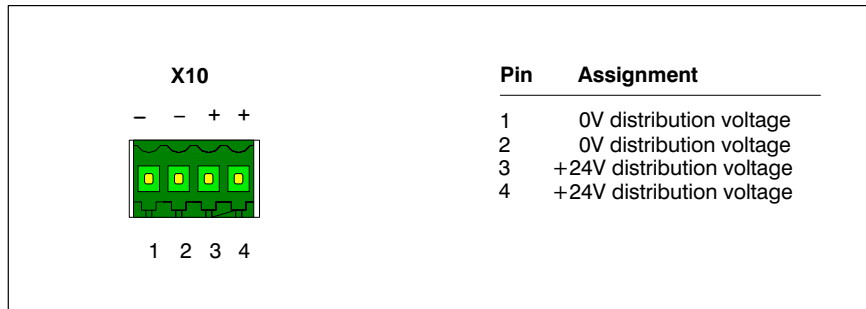
The pins 1 and 2 or 3 and 4 are connected with each other on the printed board. Per contact, approx. 5 A at 70 °C can be transmitted.

Fuse: 5 A neutral

The connection is executed with reverse battery protection.

The rho4.0 is provided with a DC/DC converter with galvanic separation (insulation resistance 500 V_{DC}) which produces from a 24-V power supply unit all required voltages.

working range: 24 V (−15 % / +20 %)

monitoring: The +24 V are checked for undervoltage.

When the monitoring threshold of 17 V ±5 % is exceeded, the ready relay contact opens.

Besides the voltage tolerances, a whole alternating voltage component with a peak value of 5 % of the nominal value is allowed.

Absolute limits: +30 V/19,2 V

Holding time of the system voltages in case   >10 ms and
of power failure: 24 V − 15 %

DANGEROUS ELECTRICAL VOLTAGE
The 24 VDC input voltage must comply with the requirements of "protective separation"!

Electrical Connections

Safety transformer, as per EN 60742:
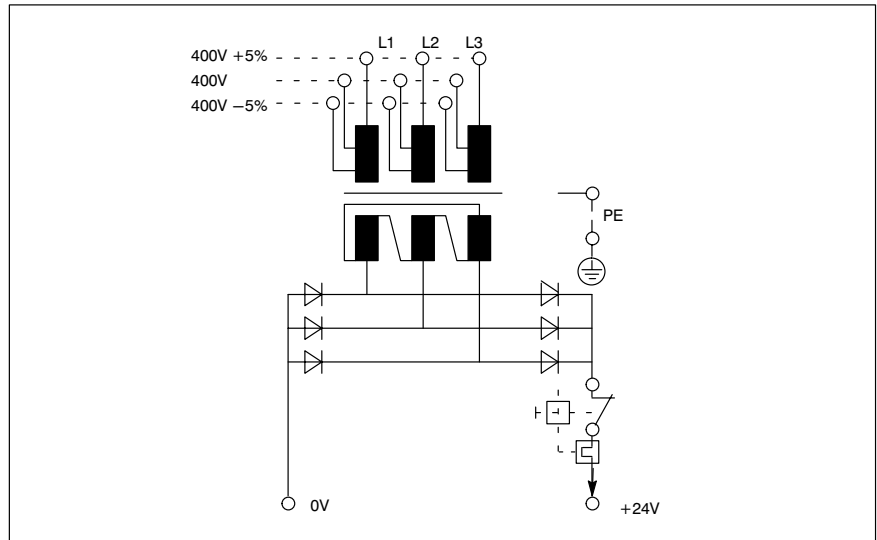
Offset AC components of the type produced by an unregulated rotary
current bridge circuit without smoothing, with a ripple factor of 5% (refer
to DIN 40110/10.75, section 1.2), are permissible. As an upper voltage
limit, this produces a maximum absolute value of 30.2 V and, as a mini-
mum voltage limit, the minimum absolute value of 18.5 V.

Electrical Connections

L1 L2 L3   PE   **PE**

10^2 (green/yellow)

**Power supply W/
safety transformer
as per EN 60742**

24 V$_{DC}$

Cross-sections
dependent on current
draw, but MIN of 4
mm^2. For higher
current draw, use 2 x 4
mm^2

Max. length 4 m

6^2 (1)(blue)

A   A   **B**

24 V Load   **0 V Load**

Earth bar

10^2 (green/yellow)(2)

A = Terminal strip 4^2

B = Terminal strip 10^2

= Terminals in isolated arrangement

rho4.0

Cross-sections
dependent on current
draw, but MIN of
0,5 mm^2 (3)

X10

PE

X10s

(1) Easily visible and removable.

(2) Preferred installation of PE terminal bars, i.e., electrically
conductive on the mounting plate. Both ends of PE terminal bars
must be connected to mounting plate by means of copper straps
of a length not exceeding 200 mm.
At minimum, cross-section of copper straps must match that of
incoming mains cables.

(3) 0.5 mm^2, up to 4 m
0.75 mm^2, up to 6 m
1.5 mm^2, up to 10 m
Distances in excess of 10 m necessitate
a separate power supply at the machine!

Electrical Connections

4.3.1   Power connections

All system voltages have potential reference under each other and are connected to a place with housing potential.

system voltages	voltage	max. current	tolerance	Undervolt. detection	Overvolt. protection
Logik	+5 V	5 A	±3 %	+4,6 V	+6 V
Floppy + PCI plug place	+12 V	1 A	±5 %	+10,5 V	+13 V
PCI-plug place	−12 V	150 mA	±5 %	−10,5 V	−13 V

system voltages	voltage	max. current	tolerance	Undervolt. detection	Overvolt. protection
IO-voltage	24 V	10 A		reverse batt. protection	

12-V-power supply unit

For the floppy and the PCI bus, a 12-V voltage power supply is required. It is produced by a controller and supplies 1 A. The voltage is coupled galvanically with the 5-V- and the −12-V- power supply unit.

−12-V-power supply unit

For the PCI-Bus plug, a −12-V voltage power supply is required. sversorgung benötigt. It is produced by a controller and supplies 150 mA. The voltage is coupled galvanically with the 5-V- and the −12-V- power supply unit.

4.4   Monitoring of the system voltage

When a undervoltage error is detected, the ready contact opens and the DC/DC converter is switched off. The converter can be then only switched on through switching off and on the 24-V voltage power supply or through the RESET key.

When a overvoltage error is detected, the DC/DC converter is switched off. The ready contact opens indirectly through the arising undervoltage error.

Electrical Connections

4.5   Monitoring of the temperature and the CPU ventilator

The temperature of the power supply unit is monitored. When the ambient temperature of 58 °C is exceeded, a pre-warning appears. When the rho4.0 software recognizes this warning, the rho4.0 is shut down, the error cause is stored and the power supply unit is switched off. If a PHG is connected to the rho4.0 during the shut-down, the message '**Overheated**' appears at the display. This message remains displayed until the rho4.0 is switched off or the reset actuated.

When the rho4.0 software does not shut down the control unit on time and the ambient temperature rises further to 62 °C, the power supply unit switches off automatically. The ready contact opens.

When the rho4.0 is switched on, the status LEDs H41 and H43 display the error cause (see chapter 6).

The CPU-ventilator speed is monitored via the tacho signal of the ventilator. If the speed drops heavily or the ventilator stops completely, the rho4.0 is shut down. If a PHG is connected to the rho4.0 during the shut-down, the message '**CPU-Fan failed**' appears at the display. This message remains displayed until the rho4.0 is switched off or the reset actuated.

Interface Ports & Connectors

5 Interface Ports & Connectors

5.1 Overview

The following table specifies the installed IPC connector types, as well as their mating connectors.

Designation at the housing	Connection type	Plug typ e(installed)	Socket/connector
X10	power supply	4-pin, 3,5 mm Weidmüller	terminal strip
V24_1 / X31	RS232	9-pin D-SUB	connector
V24_2 / X32	RS232	9-pin D-SUB	connector
V24_3 / X33	RS232/20 mA active	9-pin D-SUB	connector
CAN1 / X51	CAN1	9-pin D-SUB	connector
CAN2 / X52	CAN2	9-pin D-SUB	connector
CAN3 / X53	CAN3	9-pin D-SUB	connector
Eth.	Ethernet / LAN	RJ45	socket
PHG / X34	PHG2000/20 mA active	25 pin D-SUB	socket
Ext. Floppy	external floppy drive	25 pin D-SUB	connector
In	SERCOS	beam wave guide receiver	beam wave guide
Out	SERCOS	beam wave guide transmitter	beam wave guide
X10s	PHG2000 Safety	14-pin, 3,5mm Weidmüller	terminal strip
X21 Input 0-7	inputs 0-7	8-pin, 3,5mm Weidmüller	terminal strip
X22 Input 8-15	inputs 8-15	8-pin, 3,5mm Weidmüller	terminal strip
X11 Output 0-7	outputs 0-7	8-pin, 3,5mm Weidmüller	terminal strip

Interface Ports & Connectors

Port and connector panel layout

On the front panel, there are all interfaces accessible to the outside. All interfaces are marked.
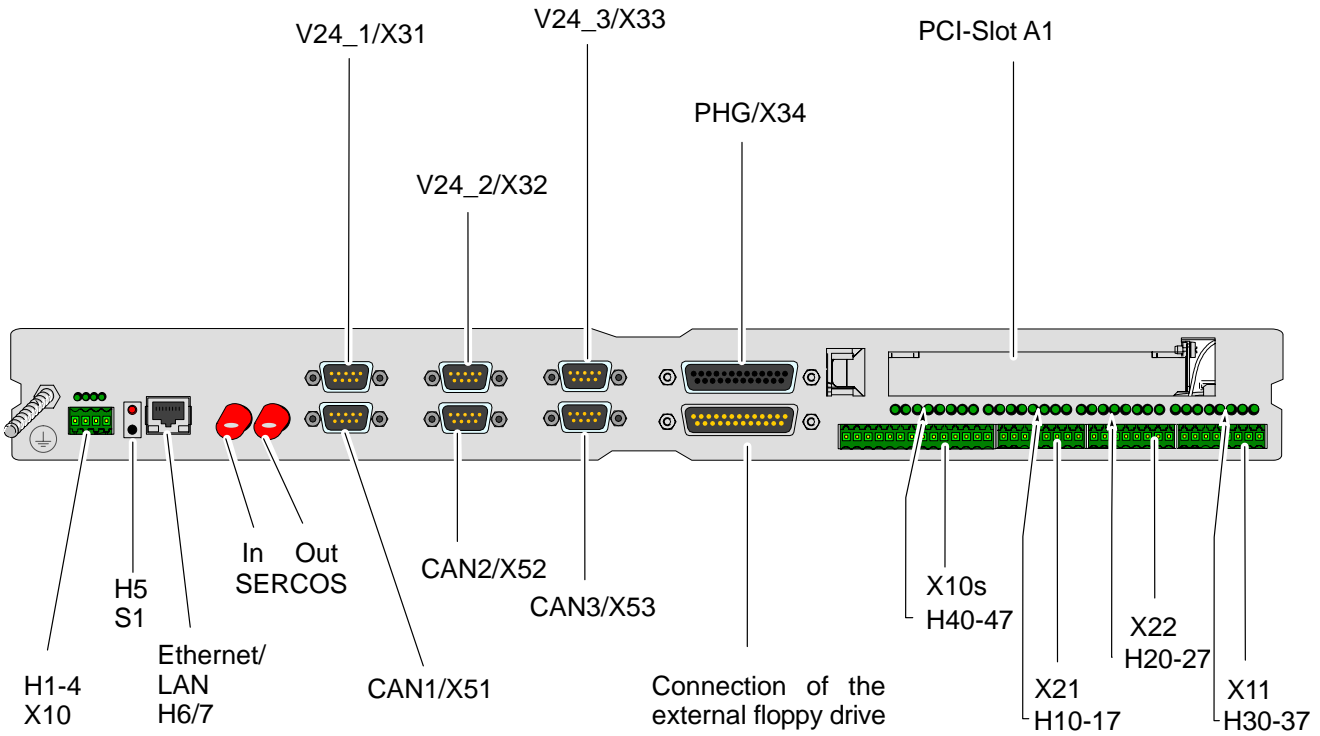
Interface Ports & Connectors

5.2   V24_1/X33 through V24_3/X33 serial PC ports

5.2.1   Pin assignment

👉
CAUTION
Functional failures caused by poor shielding!
Use only metallic or conductive connector/coupling shells
providing large-area shield contact.

V24_1/X31, V24_2/X32   **Serial interfaces, freely available**

D-Sub connector, 9-pin
Type: RS232 compatible
Length of line: maximal 15 m
Type of line: shielded, cross section min. $0.14\ mm^2$
Rate of transmission   38,4 kBaud
Handshake: Hardware and software handshake
                             (XON/XOFF)
ESD protection: 15 kV
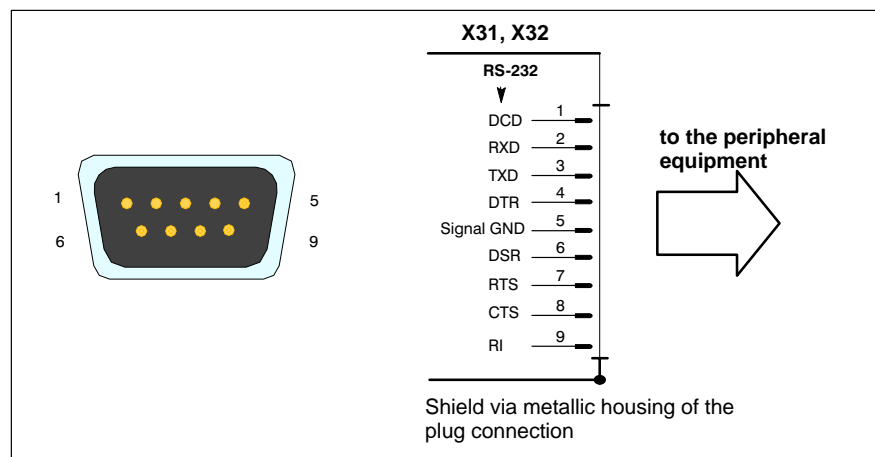
Assignement as RS-232:

DCD   Data Carrier Detect; receiving line, on which for in-
             stance a connected device informs the rho4.0 that it
             is receiving a carrier signal (existing connection).

RXD   Receive Data; Data receiving line

TXD   Transmit Data; Data transmitting line to the
             peripheral equipment

DTR   Data Terminal Ready; transmitting line, on which the
             rho4.0 informs a connected peripheral device that
             its interface is switched on and initialized.

Interface Ports & Connectors

GND	Signal Ground
DSR	Data Set Ready; receiving line, on which the connected peripheral device informs the rho4.0 that it is switched on and initialized.
RTS	Request to Send; receiving line, on which the connected peripheral device informs the rho4.0 that it wishes to send data.
CTS	Clear to Send; transmitting line, on which the rho4.0 informs the connected peripheral device that it wishes to send data..
RI	Ring Indicator; receiving line, on which a connected modem informs the rho4 that there is a call.
Shield	Via metallic housing of the D-Sub-plug connection contact to the housing frame.

V24_3/X33   **Serial interfaces V24/20 mA,   freely available**

Switching over to 20 mA through a bridge in the connection from pin 2 to pin 4.

D-Sub connector, 9-pin
Type:	RS232/20 mA
Length of line:	maximal 15 m
Type of line:	shielded, cross section min. 0.14 mm^2
Rate of transmission	max. 19,2 kBaud
Handshake:	none

X33

	V24	20 mA		
	free	DTR 20 mA	1	to the peripheral equipment
	RXD	RXD	2	
	TXD	TXD	3	
	DTR	DTR	4	
	GND	GND	5	
	free	DSR	6	
	RTS	RTS/RXD 20 mA	7	
	free	free	8	
	free	TXD 20 mA	9	

Shield via metallic housing of the plug connection
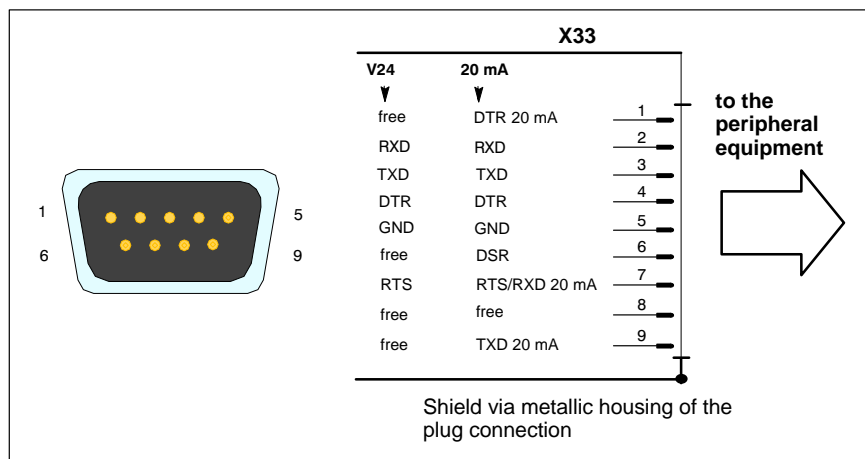
Interface Ports & Connectors

Assignment as RS-232:

DTR20-mA-Signal (Pin1)	statical 20-mA source
V24-RTS-Signal (Pin7)	always active (statically on high); therefore an operation is also possible with a participant requiring hardware control (DSR inquired)
TXD	Transmit Data; data transmitting line to the peripheral device
20-mA interface	purely active, has no 20-mA handshake signals

Connecting cable between X31..X33 connectors and an external PC (e.g., for ROPS4 coupling).

2 x female DB-9 connector

Cable length: max. 20 m, with internal power supply and 350 mA max. current
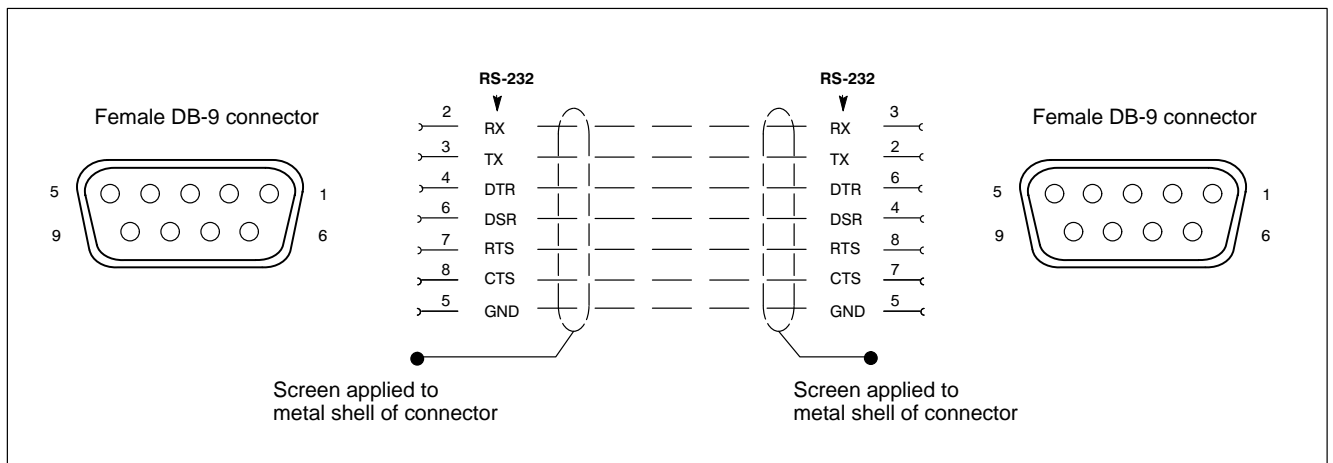
Interface Ports & Connectors

5.3   Floppy interface

The external floppy drive 1070 085 274 can be connected to the 25-Pin-Floppy interface. It consists of a 1 m lang cable, a 1.44 Mb 31/2" floppy drive and an installation frame.

☞ **Only the allowed floppy type (Object No. 1070 085 274) may be used.**

The connection is laid out as plug to avoid a wrong connection with the PHG.

Pin	Signal
1	READWR
2	–
3	MOTA
4	DRVA
5	DIR
6	WDATE
7	TRKO
8	RDATA
9	DSKCHG
10	GND
11	GND
12	GND
13	+12 V
14	–
15	INDEX
16	DRVB
17	MOTB
18	STEP
19	WGATE
20	WPT
21	SIDE1
22	GND
23	GND
24	GND
25	+5 V

Ext. Floppy

to the floppy drive

Shield via metallic housing of the plug connector
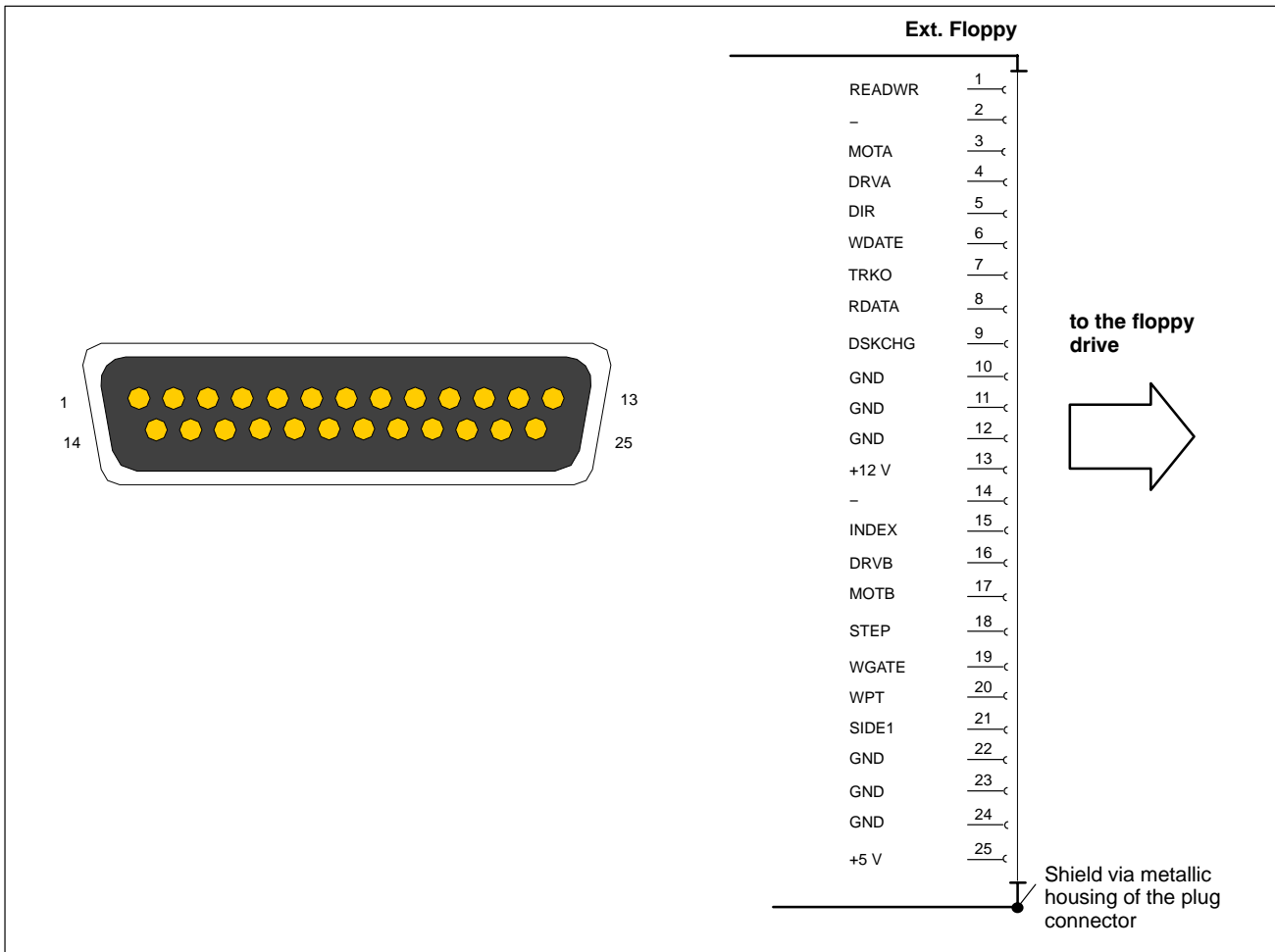
CAUTION
Malfunctions through insufficient shielding!
Use only metalllic or conductive plug or coupling housings with large-surface shielding seat.

Interface Ports & Connectors

5.4 X34 PHG2000

☝ **CAUTION**
The connection of a rho4.1 floppy at this interface leads to the destruction of the floppy and the interface.

The PHG2000 interface lays on a 25-pin DSUB socket. If the permanent load of EMERGENCY STOP and confirmation key is < 0,5A/30VDC, no additional adapter cable is required because these connector pins of the PHG2000 (inclusive 24-V power supply of the PHG2000) are available at the 14-pin Weidmüller terminal X10s.

X34 PHG2000

Signal	Pin
Emergency stop channel 2	25
Emergency stop channel 2	24
confirmation key channel 2	23
free	22
SGND	21
free	20
free	19
free	18
PHG present	17
RS 20 mA+	16
confirmation key channel 1	15
confirmation key channel 2	14
TXD 20 mA+	13
RXD 20 mA+	12
confirmation key channel 1	11
free	10
free	9
PHG present	8
Emergency stop channel1	7
free	6
Emergency stop channel1	5
24-V-IO feeding	4
GND 24-V feeding	3
free	2
free	1

to the PHG2000

☝ **CAUTION**
If the permanent load is > 0,5A/30VDC per channel, the signals must be taped by an according adapter cable and wired in the periphery.

With Part–No. 1070 077 245 a suited adapter cable is available.

Interface Ports & Connectors

X34 / rh4.0

Male connector
Sub−D 25 pin

Cable ∅

Female connector
Sub−D 25 pin

RX+	19	19	0,19 wh	12	RX
TX+	18	18	0,19 br	13	TX
RS+	20	20	0,19 gn	16	RS+
PGND	16	16	0,19 bl	21	PGND
+12V Out	17	17	0,19 rd	10	+12V
+12V In	10	10			

Screening via connector housing

0,50 mm²	3	Power supply PHG 2000
0,50 mm²	4	GND
		+24V
0,50 mm²	11	Confirmation key channel 1
0,50 mm²	15	
0,50 mm²	14	Confirmation key channel 2 only with PHG 2000
0,50 mm²	23	
0,50 mm²	5	EMERGENCY STOP channel 1
0,50 mm²	7	
0,50 mm²	24	EMERGENCY STOP channel 2 only with PHG 2000
0,50 mm²	25	

open leads for wiring to the EMERGENCY STOP and confirmation key

◄─────── 3,00 m ───────►

Pin assignment adapter cable Part No. 1070077245

Interface Ports & Connectors

5.4.1　X10s safety relevant signals and 24-V power supply for digital outputs and PHG

X10s　**Real time interface**

Connection for READY contacts, Emergency-stop contacts and confirmation keys and feeding the 24V power supply for digital outputs and PHG. Before connecting the Emergency–stop and confirmation key signals of the PHG2000 to the periphery, read chapter 5.4, X34 PHG2000.

The voltage input is protected against reverse poling and secured with a 5A neutral fuse. The LED H40 is on when the 24-V-power supply is connected and the fuse is all right.

CAUTION
The 24 V are not buffered in case of a power failure.

Weidmüller plug-in terminal,　MSTB 1.5, 14-pin (3.5 mm)
Line type:　　　　　　　　　shield, cross section min. 0,14 mm^2
Ready contact:　　　　　　　two-channel
Relay characteristic:
- breaking capac. 0,5 A/30 V$_{DC}$
- rise time　　　　4 ms
- releasing time　3 ms
- bouncing time　2 ms
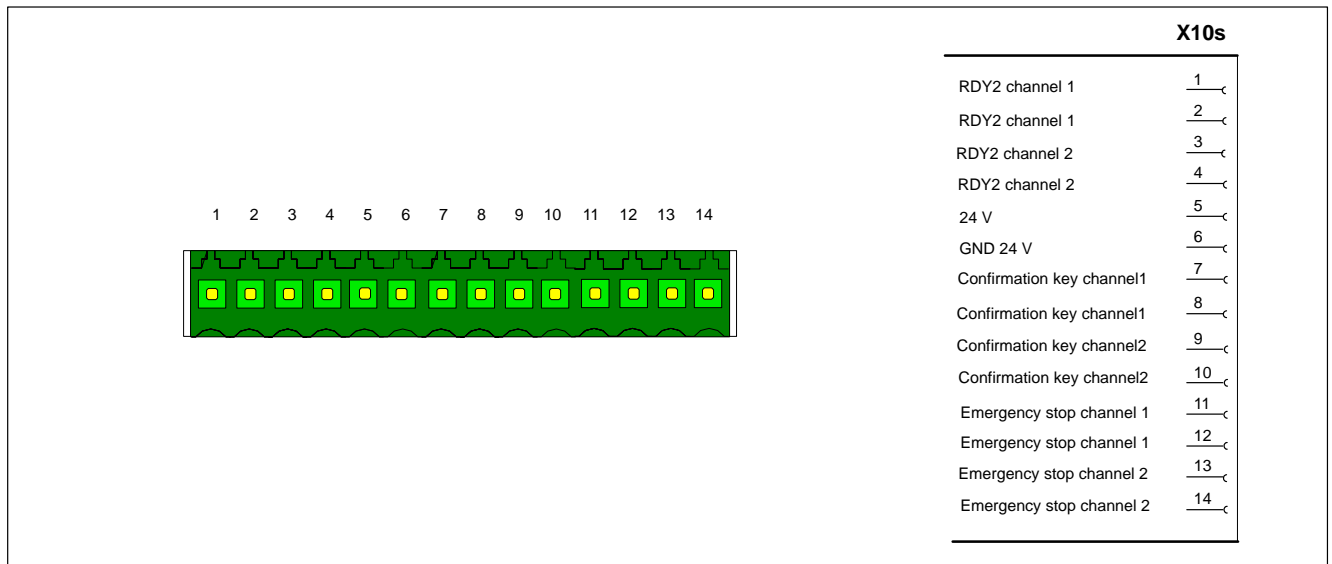
The Ready Relay is designed so that it is opened in the idle state. The ready contact closes after the rho4.0 startup and opens in the following cases:

- The 24-V power supply falls below the permissible limit.
- One of the monitored voltages is outside the permissible range.

Interface Ports & Connectors

- The temperature of the rho4.0 rises beyond the permissible limit.
- The Ready Watchdog has run out.
- The RESET key has been actuated.
- The software recognizes an error, e.g. wrong machine parameters, measuring system alarm etc.

5.5   Ethernet-interface

Ethernet   network connection

Via the ethernet interface, the rho4.0 can be connected with a ethernet network.

The ethernet connection is made via a 'Twisted Pair' line with RJ45 connector. The connection conditions are those defined in IEEE 802.3 for 100BaseT:

RJ45, socket, 8pin

Type:	Ethernet 100BaseT
Length of line:	max. 100 m
Type of line:	100 Ω. Twisted-Pair cable
Transmission velocity:	max. 10/100 Mbit/s
Coding:	manchester-coded data transmission
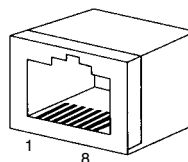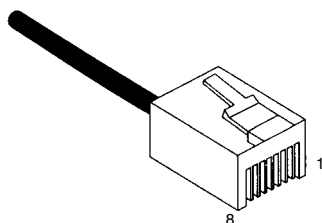
Interface Ports & Connectors

The metallic housing of the 100BaseT socket is set above the front shield on the control housing resp. the shield. The cable shield is set above the connector housing on the socket shield.
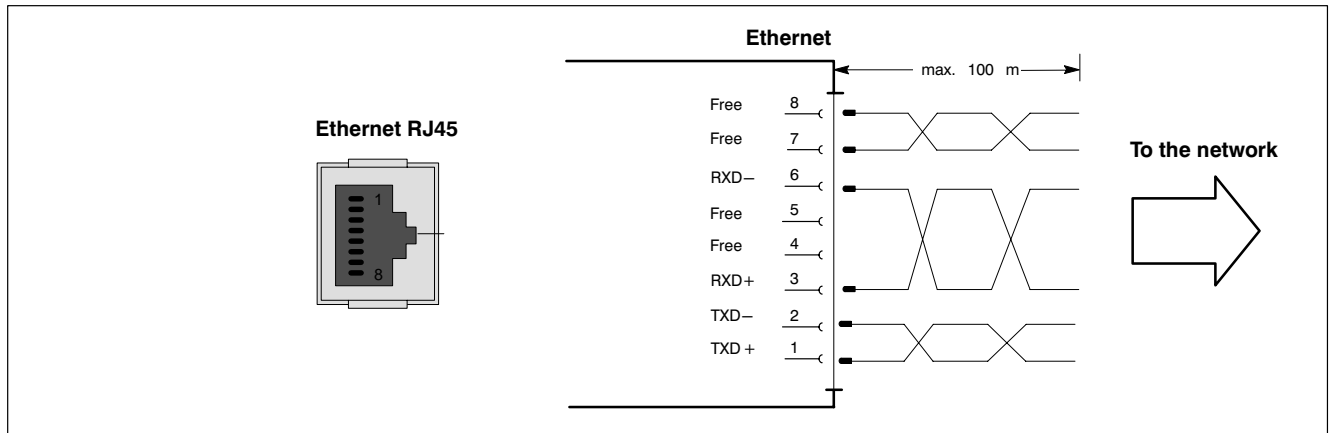
The line should have:
- a cross section of 0.08 mm^2 to 0.34 mm^2
- 100-Ω-impedance
- 12 to 45 twists per meter

Special cables for this use can be obtained under the following designation:
- STP cable, category 5 (**STP** = **S**hielded **T**wisted **P**air)
- STP cable, category 6 (increasing category number means better cable properties)

☞ **We recommend to use STP cables of category 5.**

5.5.1   Ethernet (MAC)- and IP address

Ethernet Address

The rho4.0 has a fixed set ethernet address. This address is allocated once in the world.

The ethernet address consists of 6 address bytes and has the following structure:

Fixed part			Components specific		
0xXX	0xXX	0xXX	Xx	yy	zz

The address is entered in HEX.

Interface Ports & Connectors

Fixed part: Manufacturer code,
                                              identifies clearly the type of the
                                              ethernet card and its manufacturer

Components with specific part: is defined by the manufacturer

☞ **The ethernet address cannot be modified by the customer. It is filed in the EEPROM on the ETX Board.**

IP address

The rho4.0 is delivered with the set IP-address 192.168.4.1. Via the PHG, mode 9.1.19, the IP-address can be changed by the user at any time.

Transmission mode

The transmission mode of the rho4.0 can be set under PHG–Mode 9.1.19.
The following modes can be set:

– Auto–Negotiation *
– 10MBps half duplex
– 10MBps full duplex
– 100MBps half duplex
– 100MBps full duplex

* default setting

5.6   SERCOS interface

In   Out
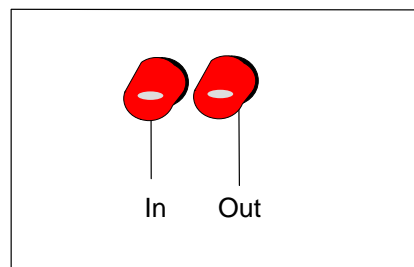
On the rho4.0 a complete SERCOS channel is present. Via the SERCOS interface the connection is established to the digital drives. SERCOS is a normed serial beam wave guide ring system. The SERCOS interface is designed for a maximum transmission speed of 4 MBauds.

For available beam wave guides in different lenghts, see chapter 8.1 'Accessories' or the manual 'Indramat Verbindungstechnik LWL-Handling', DOK-CONNEC-CABLE*LWL***AW02-DE-P.

Interface Ports & Connectors

5.7   X51, X52, X53 CAN-drives, CAN-transmitter, SR-CAN-module, CAN-user-I/O

Three Full CAN Controllers of type 82527 (Intel) are integrated, which are operated with a 16-MHz clock.

The three buses are laid separately each on one 9-pin D-SUB connector. Each bus is supplied with or without a 120-Ω bus connection – depending on the connection of the connector (see connection examples, paragraph 5.7.1).
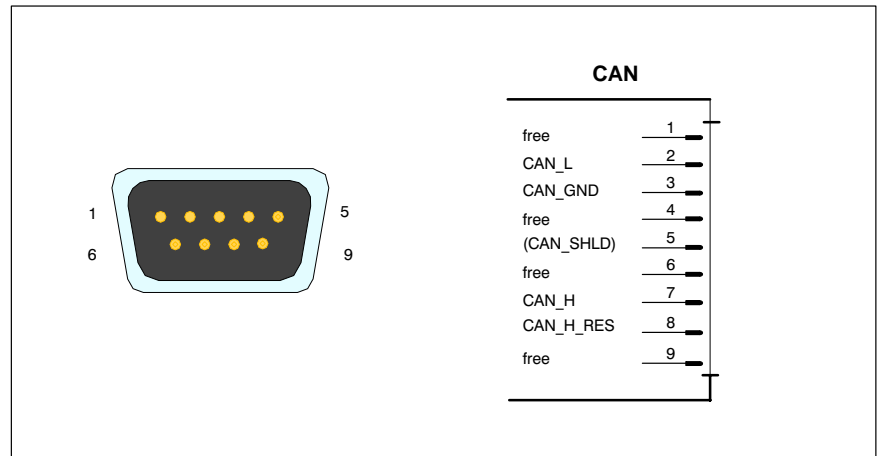
Pin	Signal name	Signification	Signification acc. to CIA
1	–		Reserved
2	CAN_L	CAN_L (dominant low)	CAN_L
3	CAN_GND	CAN Ground	CAN Ground
4	–		Reserved
5	(CAN_SHLD)		Opt. CAN Shield
6	–		Opt. CAN GND
7	CAN_H	CAN_H (dominant high)	CAN-H
8	CAN_H_RES	CAN_H Resistor 120-Ω Bus connection	Reserved
9	–		(CAN_V+) Opt. pos. Power supply

Interface Ports & Connectors

5.7.1   Connection examples for the CAN interfaces

rho4.0 as CAN-intermediate device

Two cables, without bus connection
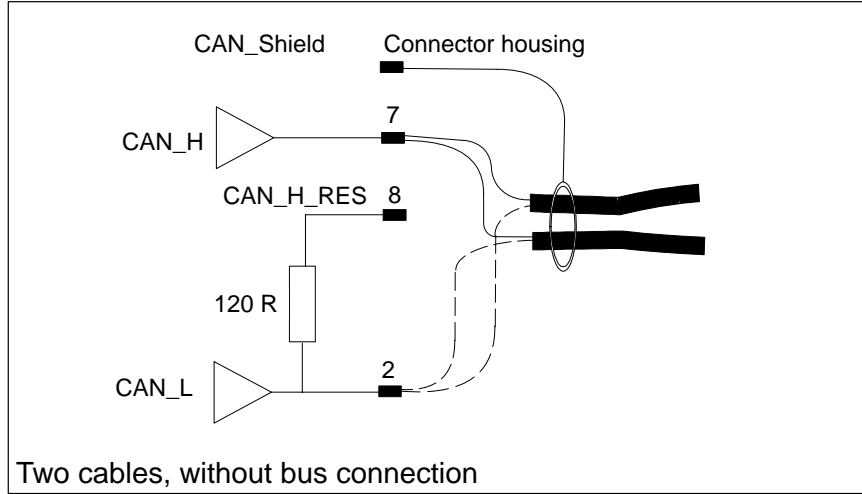
★   Connect at the plug the incoming and outgoing CAN cable respectively
to pin 2 and 7.

★   Connect shield of the cable to the metallic connector housing.

★   Do not wire bus connection resistance.

rho4.0 as CAN final device

One cable, with bus connection
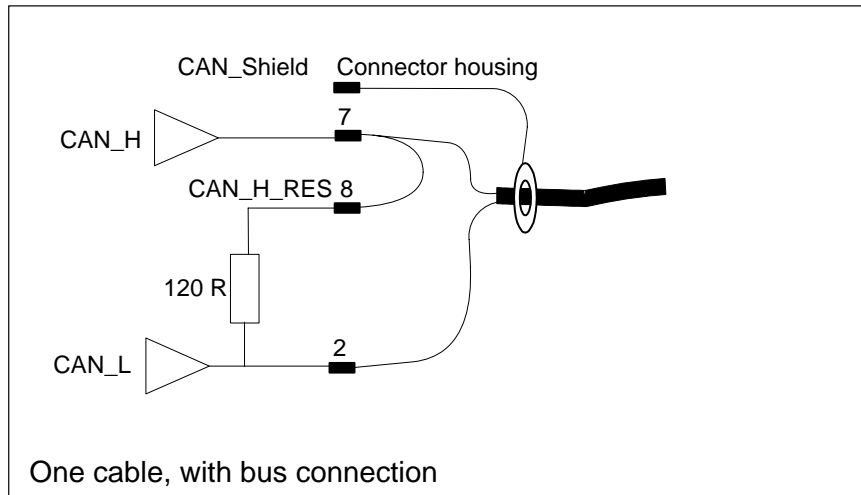
★   When the rho4.0 is connected at the end of a CAN bus, activate bus con-
nection.

★   Connect CAN cable at connector at pin 2 and pin 7.

★   Insert between pin 7 and pin 8 a bridge activating the bus connection.

Interface Ports & Connectors

★ Connect shield of the cable to the metallic connector housing.

☞ **It is possible to interconnect 2 or 3 CAN interfaces and operate them at the same CAN bus. It must be ensured that the bus connection is activated only at the last participant.**

5.8   X21 and X22 Digital In (24 V)

The rho4.0 has 16 digital inputs separated galvanically.

X21   Digital In

Pin series, 8-pin
LEDs: green, connected in series
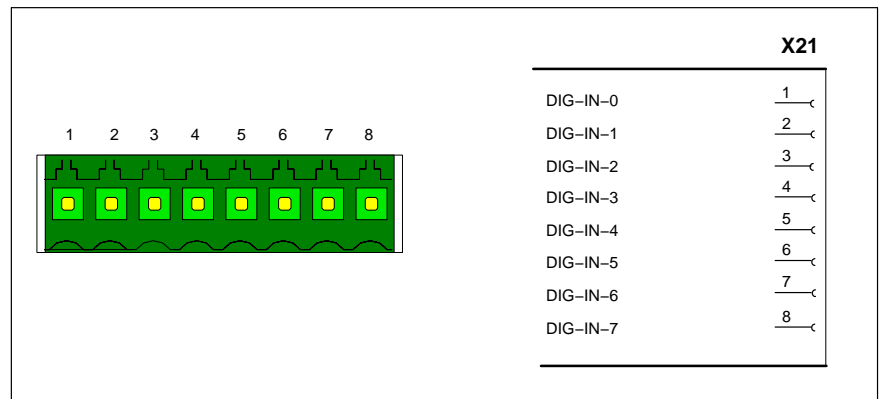
X22   Digital In

Pin series, 8-pin
LEDs: green, connected in series
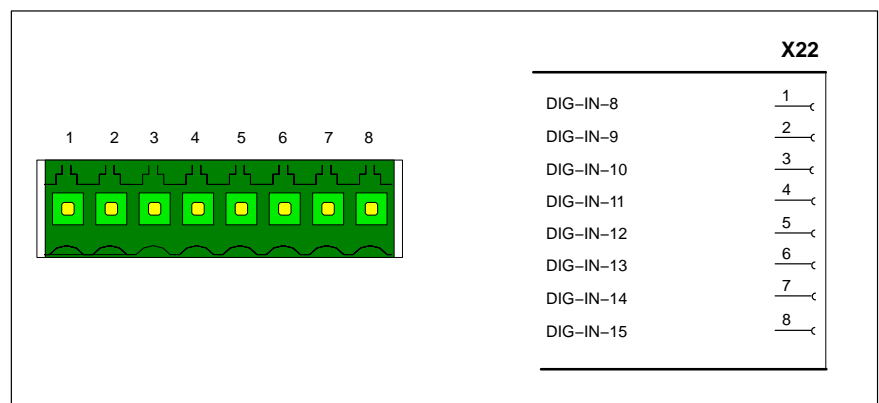
Interface Ports & Connectors

Working range of the digital inputs:

limit value	0-state		transition range		1-state	
	UL/V	IL/mA	UT/V	IT/mA	UH/V	IH/mA
Max.	5	30	11	30	30	30
Min.	−3	ND	5	2	11	5,0

Switching time: max. 100 μs

When a 1-state is created, the green LED of the corresponding input turns on.

5.9 X11 Digital Out (24 V)

The rho4.0 has 8 digital outputs separated galvanically.

pin series, 8-pin
LEDs: green, parallel connected
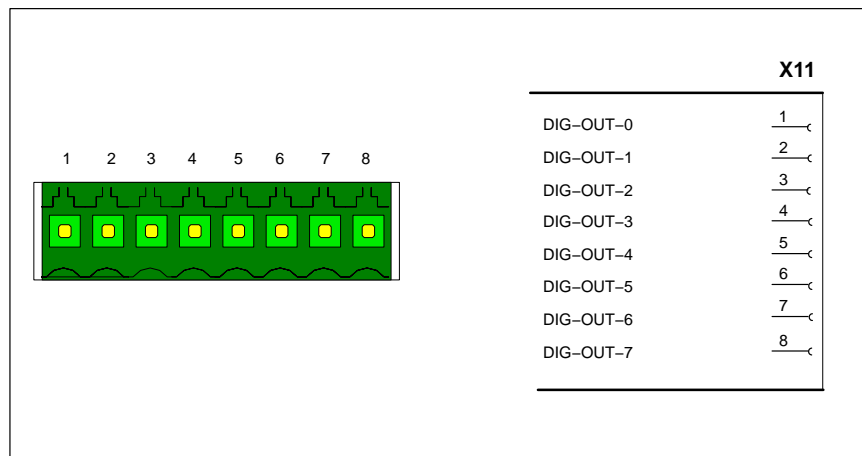
Working range of the digital outputs:

Nominal current (1-Signal)	500 mA
Voltage drop at 600 mA	max. 3V
Leak current (0-Signal) / with VN340SP	max. 2 mA
Short-circuit current with overtemperature	max. 2,5 A
Switching time	max. 300 μs

Measured switching time without load:
- rise–delay time   48 μs
- disconnect delay time   700 μs

Measured switching time under 0.5 A load:
- rise–delay time   50 μs
- disconnect delay time   135 μs

Interface Ports & Connectors

5.10   PCI-Slot A1

The PCI-Slot A1 corresponds to a 32-Bit-PCI-bus Slot in a PC. One of the BOSCH field bus cards (CAN, INTERBUS-S and PROFIBUS-DP) can be plugged in it.

At the PCI-Slot, the following voltages are available:
- +5 V   up to max. 1,2 A
- +12 V   up to max. 1 A
- –12 V   up to max. 150 mA

These voltages are not secured separately but are subject to the general monitoring of the power supply. Exceeding the current limits or a short circuit leads to a power failure of the device and therefore to the switch-off.

CAUTION
The PCI–Slot does not meet all requirements of the PCI bus specification.

Interface Ports & Connectors

5.11 Expansion Card Interfaces

5.11.1 PCI_BM-xxx Card

This busmaster expansion card is the interface of the software PLC. The PLC signals are transmitted over the integrated system bus.

Depending on model, X71 has been assigned one of the following **bus systems**:

Name	Bus system
PCI_BM–CAN	CAN bus
PCI_BM–IBS	InterBus-S
PCI_BM–DP	PROFIBUS-DP

X71 CAN-Bus "PCI_BM-CAN"

Male DB-9 connector

Type: CANopen bus
Cable length: depending on baud rate
max. 25 m with 1 Mbit/s
Cable type: Screened, min. cross-section 0.14 mm^2
Transmission rate: up to 1 Mbit/s
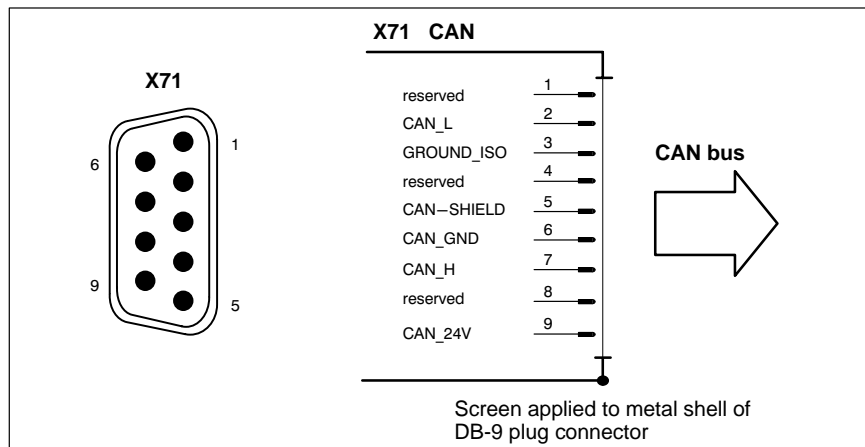
X72 This interface is curently not supported by the rho4.0

Interface Ports & Connectors

X71   Interbus S "PCI_BM-IBS"

Female DB-9

Type : InterBus-S Remote (as per EN 50178)

Screen applied to metal shell of
DB-9 plug connector
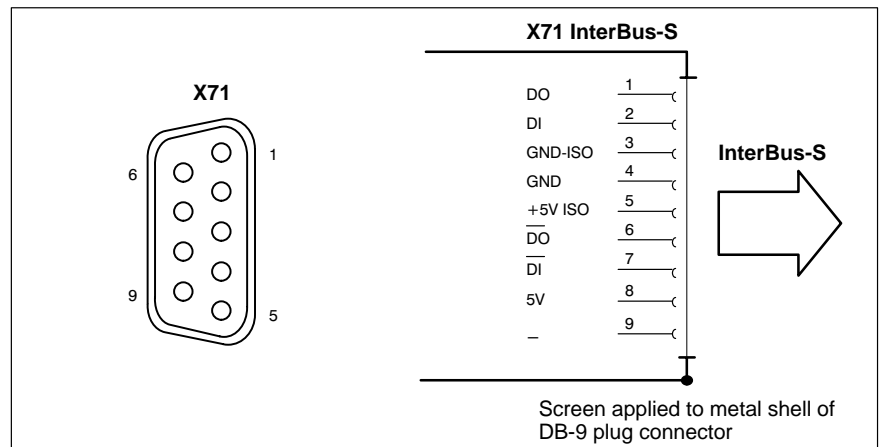
☞ **Please comply with the installation instructions and recommenda-
tions of Phoenix-Contact, e.g. IBS SIG Part 1 UM or the IBS SYS
INST UM installation manual.**

X72   **This interface is curently not supported by the rho4.0**

Interface Ports & Connectors

X71   PROFIBUS DP "PCI_BM-DP"

Female DB-9

Max. cable length	500 kbit/s	400 m
depending on baud rate	1500 kbit/s	200 m
(as per DIN EN 19245 Part	3000 kbit/s	100 m
3):	6000 kbit/s	100 m
	12000 kbit/s	100 m

Cable type: Screened, min. cross-section 0.14 mm^2
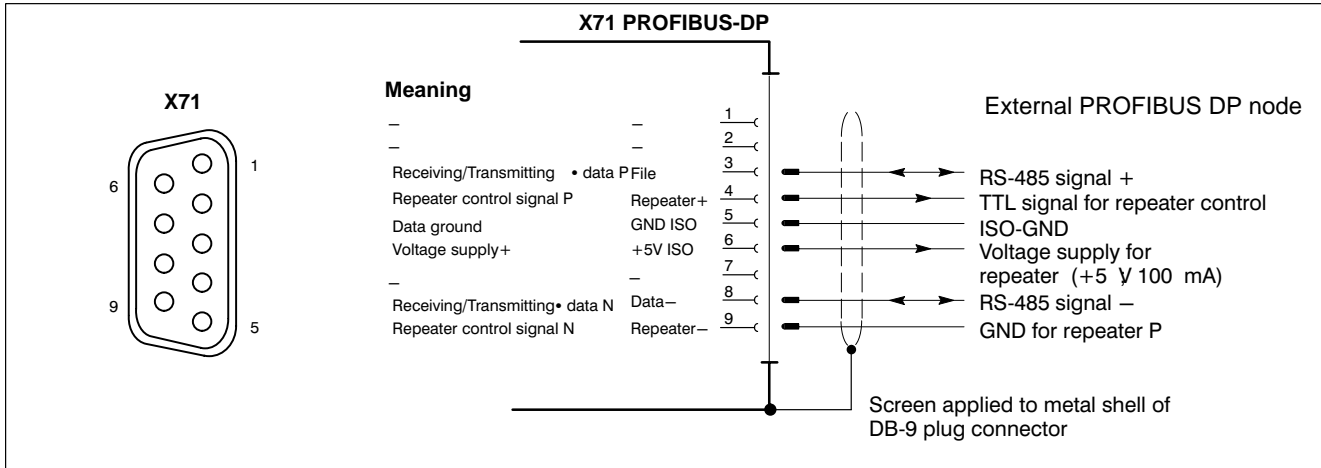
X72   This interface is curently not supported by the rho4.0

Interface Ports & Connectors

5.11.2   PCI_CAN Card

This interface is a second CAN bus for fast transmission of measured data to the PC.

X71   CAN bus

Male DB-9 connector

Type:	CAN-Bus
Cable length:	depending on baud rate
	max. 25 m with 1 Mbit/s
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	up to 1 Mbit/s
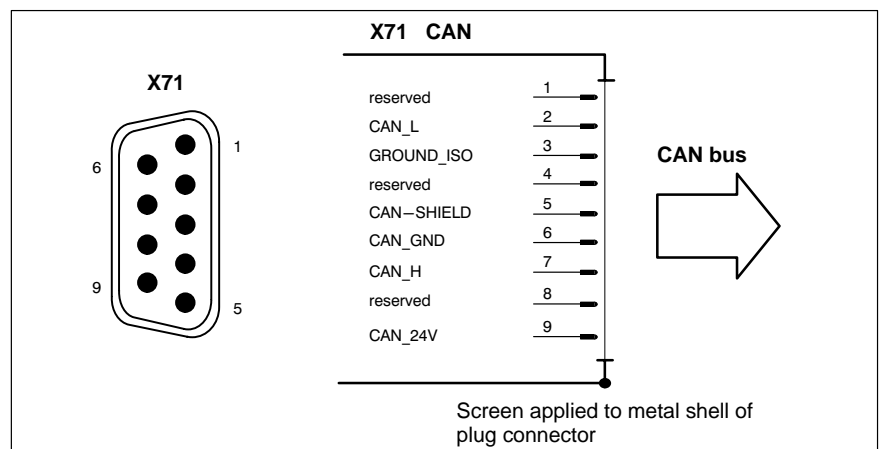
Interface Ports & Connectors

Notes:

LED Display

6   LED Display

The rho4.0 has LEDs to display the current states.
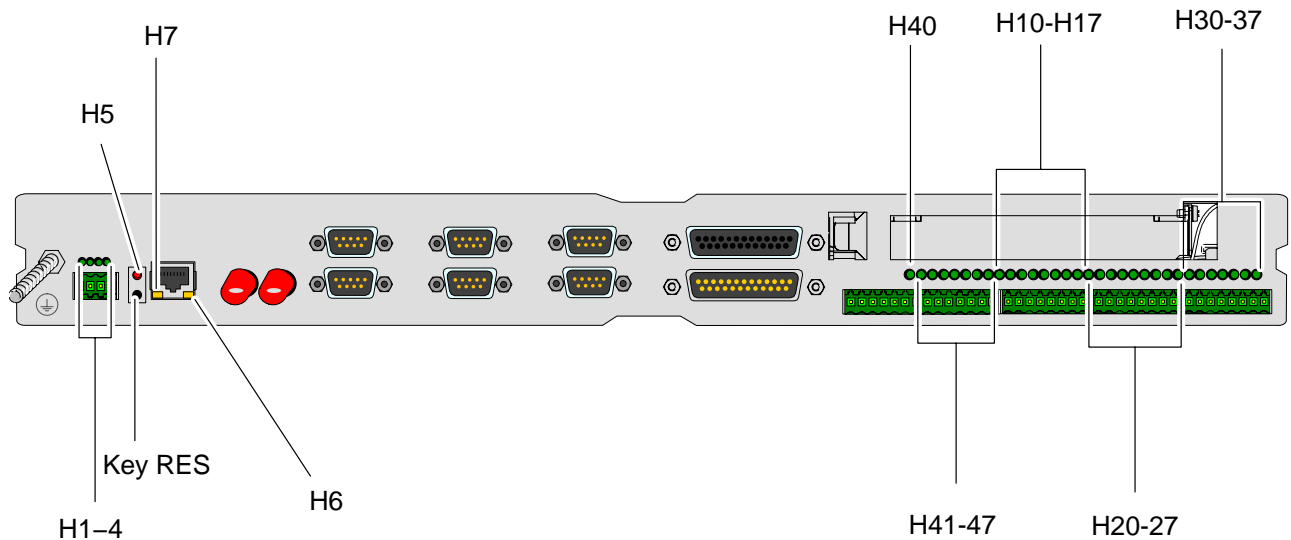
LED	Designation	Color	Function
● H1	V24	green	24-V power supply present
● H2	5V	green	5 V present, power supply running
● H3	RDY	green	READY contact closed, no error
● H4	HD	yellow	Flashdisk active (accesses to the flash disk)
● H5	Battery Error	red	Battery error Battery voltage below limit value
● H6		yellow	active, Link from LAN controller
● H7		yellow	SPEED-LED from LAN controller
● H10-17	E0-7	green	digital inputs 0 to 7
● H20-27	E8-15	green	digital inputs 8 to 15
● H30-37	A0-7	green	digital outputs 0 to 7
● H40	24 V IO	green	Status-LED for 24-V-IO voltage and fuse
● H41-47	Status	green	Status messages

LED Display

Status LEDs

The status LEDs monitor the 24-V power supply and the internal fuse for the digital outputs and the PHG.

When the power supply of the rho4.0 is switched off, the LEDs H2 to H4 and H41 to H47 turn off, H1 remains permanently on.

☞ **When the power supply of the rho4.0 has been switched off through voltage error, system voltage or temperature sensor (see 4.4, 4.5), the rho4.0 can be restarted by actuating the RESET key S1 or by switching on and off the 24-V power supply. The 24 V must remain switched off until the LED H40 has turned off (approx. 5 s).**

LED		
H 40	24V Power supply for PHG and I/O:	
	Power is connected and the internal fuse is ok	LED is permanently on
H 41	rho4.0 in normal operation:	
	● running time error	LED is permanently on
	● System error	LED flashes slowly
	rho4.0 Startup:	
	● Invalid data in SRAM in the range of the boot parameters. It is assumed that the buffering has not functioned. The whole SRAM range including the stored cause of the switch-off is deleted and the default boot parameters are available	LED flashes quickly during the startup
	● Power supply has detected short circuit of a supply voltage and switched off the rho4.0	LED flashes slowly during the next startup
	● Power supply has detected over-temperature and switched off the rho4.0	LED flashes slowly during the next startup
H 42	rho4.0 Startup:	
	● startup ok	LED flashes slowly
	● startup failure	LED is permanently on Check S201; the value "254" may not be assigned (S201/1 OFF, S201/2–8 ON)
	rho4.0 Shutdown:	
	● shutdown	LED flashes quickly

LED Display
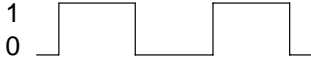
LED		
H 43	rho4.0 Startup:	
	• at startup, the CPU fan does not run or there is a temperature warning	LED flashes for 3 s, then the rho4.0 switches off
	• startup after a shut-down has been produced through 'CPU fan not running'	LED flashes quickly
	• startup after a shut-down has been produced through 'Temperature warning'	LED flashes slowly
	• startup after the rho4.0 has been switched off by the power supply through 'Overtemperature'	LED is permanently on
H 44	not assigned	
H 45	active fixing of the PCLrho4.0	LED is permanently on
H 46	Error at peripheral bus	LED is permanently on
H 47	PCLrho4.0 at stop	LED is permanently on

Examples   **Possible status-LED displays at startup**

Graphic representation of the LED displays:

0 ——————————   LED display is off

1 ⎍⎍⎍   LED display flashes slowly
0

1 ⎜⎜⎜⎜⎜⎜⎜⎜⎜⎜⎜⎜   LED display flashes quickly
0

        LED display is on permanently
0 ⎩
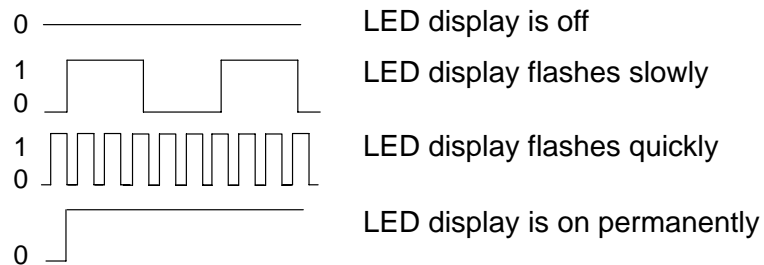
rho4.0 notices at startup invalid data in the SRAM:

• H40 is permanently on (24-V power supply for digital outputs and PHG are present)
0

• H41 flashes quickly
1
0

• H42 flashes slowly
1
0

• H43 off
0 ——————————

• H44 off
0 ——————————

• H45 off
0 ——————————

• H46 off
0 ——————————

• H47 off
0 ——————————

LED Display

rho4.0 has been shut down through temperature warning:

- H40 is permanently on (24-V power supply for digital outputs and PHG are present)
- H41 off
- H42 flashes slowly
- H43 flashes slowly
- H44 off
- H45 off
- H46 off
- H47 off
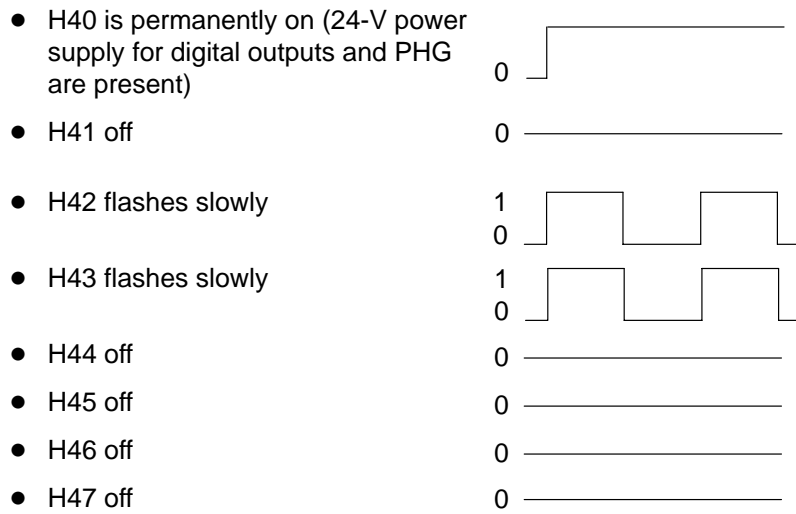
rho4.0 has been switched on through overtemperature:

- H40 is permanently on (24-V-power supply for digital outputs and PHG are present)
- H41 flashes slowly
- H42 flashes slowly
- H43 is on permanently
- H44 off
- H45 off
- H46 off
- H47 off
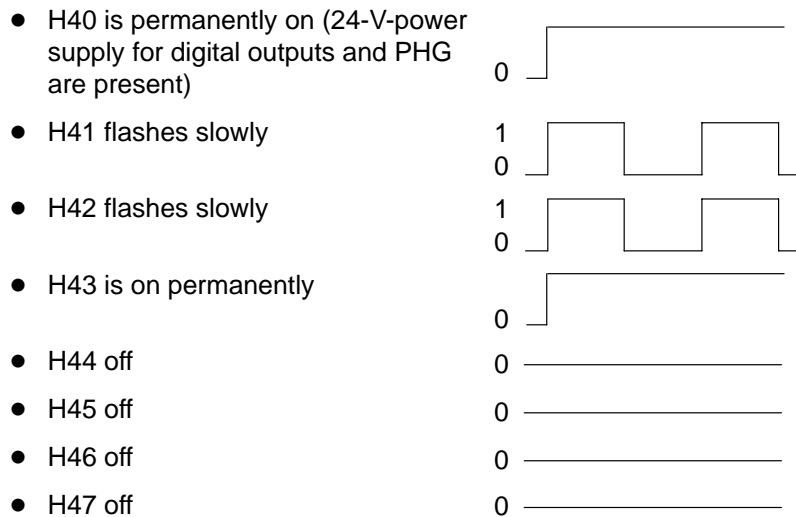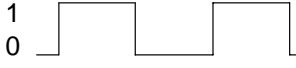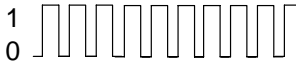
rho4.0 has been switched on through short circuit:

- H40 is permanently on (24-V-power supply for digital outputs and PHG are present)
- H41 flashes slowly
- H42 flashes slowly
- H43 off
- H44 off
- H45 off
- H46 off
- H47 off
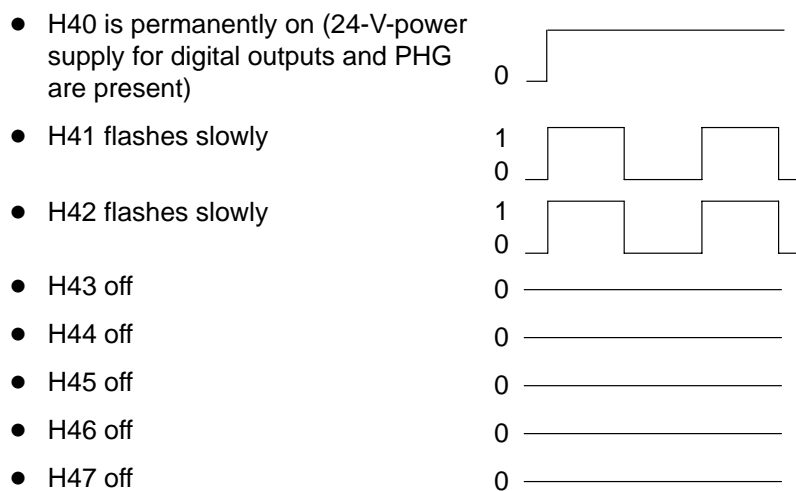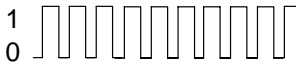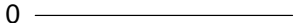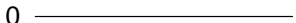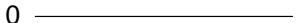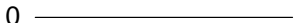
LED Display
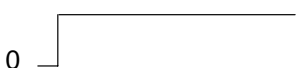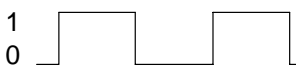
rho4.0 has been shut down through 'CPU fan is not running':

- H40 is permanently on (24-V-power supply for digital outputs and PHG are present)

- H41 off

- H42 flashes slowly

- H43 flashes quickly

- H44 off

- H45 off

- H46 off

- H47 off

CPU fan does not run at startup

- H40 is permanently on (24-V power supply for digital outputs and PHG are present)

- H41 off

- H42 off

- H43 flashes approx. 3 s quickly, then the rho4.0 switches off

- H44 off

- H45 off

- H46 off

- H47 off

Temperature warning occurs at startup:

- H40 is permanently on (24-V-power supply for digital outputs and PHG are present)

- H41 off

- H42 off

- H43 flashes approx. 3 s slowly, then the rho4.0 switches off

- H44 off

- H45 off

- H46 off

- H47 off

LED Display

Key

Key	Designation	Function
S1	RES	Reset and restart of the rho4.0 Key on the front screen

Switch

S201	Component number (placed below the case–ventilator) default bootline, DIP–Switch 2=Off	8-DIP switch for the setting of the compontent number, resp. for service purposes If the DIP–Switch 2 is set to the Off position (value 253), the rho4.0 boots with the default bootline. LED H41 flashes during startup fast for a short time. If a PHG is connected during startup to the rho4.0, the following text is displayed: "Bosch Rexroth AG rho4.0 DIP=253 sets default bootline... IP: 192.168.4.1"

Maintenance and Replacement

7   Maintenance and Replacement

The rho4.0 is maintenance-free. It is however possible that the CF card and the battery must be changed.

Maintenance schedule

Include in your maintenance plan the following activites:

- Check all plug-type connections and terminal connections of the components at least once a year for correct fixture and damage. Check lines for rupture or pinch. Have damaged parts immediately replaced.
- Check fan at least once a year.

DANGER
Risk of injury through rotating fan impeller!
Keep hands and fingers clear, and do not insert any items into the fan impeller.

7.1   CF card

A CF card with a ATA (IDE) interface is used. In the card, a flash component is combined with a IDE controller. The card behaves as a IDE harddisk.

Compact Flash Slot
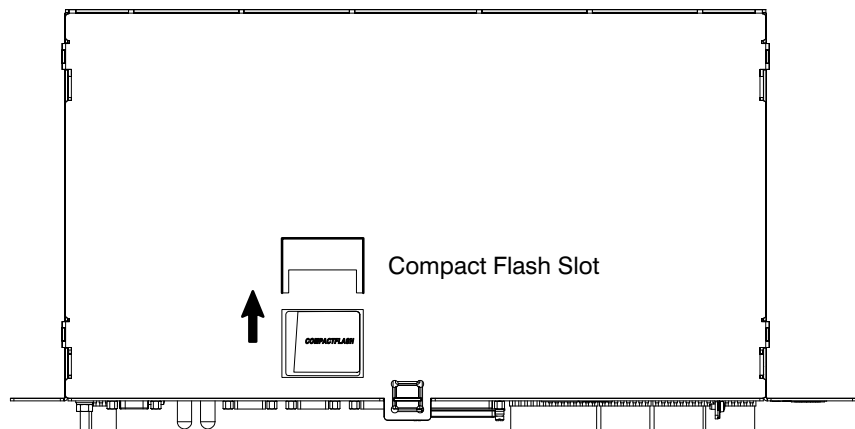
The CF card contains the operating system, the firmware and the PLC program.

☞ **The CF card is always plugged and only accessible by opening the device.**

Maintenance and Replacement

7.2   Battery

The installed battery buffers the SRAM components and the RTC on the ETX board when the 24-V power supply unit is not switched on.

The battery is located directly behind the plugs of the front screen and can be changed by pulling the printed board out of the housing. The cables must be removed.

☞   **CAUTION**
Before opening the device, switch off the power supply.
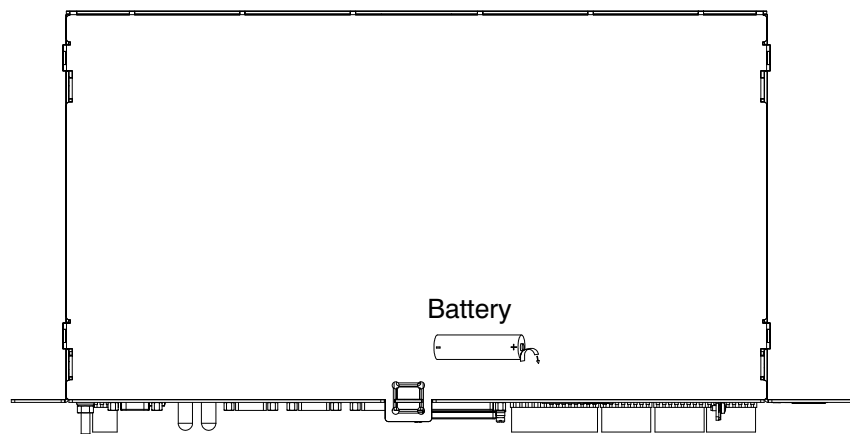
Battery

A 3.6-Volt lithium battery of size AA is used with a capacity of 1,75 Ah (order No. 1070 914 446).

GOLD CUP

To replace the battery, the device must be opened. A GOLD CUP ensures the buffering of the data. The operation must be finished within approx. 10 min.

Monitoring

The battery is permanently checked by a monitoring system. If it is detected that the voltage drops below a certain limit, an error message (BATT_ERR) is sent to the CPU.

Additionally, the BATT_ERR signal is displayed – in operation through the LED H5.

Buffer time

The main consumers are the SRAM components. They need 20 µA max. at 70 °C.

Maintenance and Replacement

Since the experience has shown that the components only draw a frac-
tion of the given buffer current and when the device is switched off (as in
the buffer case) there is only a temperature of 30 to 45 °C inside the de-
vice, a buffer current of 8 µA per component can be assumed.

Add to this the effect that the installed GOLD CUP takes over the buffe-
ring of the components for a certain time each time the device is switched
off.

Examples:
- with 2 Mbytes (4 components) = 32 µA (8 µA per component)
- with 4 Mbytes (8 components) = 64 µA (8 µA per component)
- The RTC requires approx. 5 µA of buffer current

     $\rightarrow$ To be buffered are 69 µA resp. 37 µA.

Buffer time per year:
    365 days * 24 hours = 8760 hours
    200 working days with 8 hours a day (a shift) = 1600 hours

    $\rightarrow$Device is switched off 7140 hours/year and must be buffered.

Capacity of the battery:
    Type AA has 1,75 Ah $\rightarrow$ 1.750.000 µAh

    $\rightarrow$Whole buffer time: 1.750.000/69 µA = 25362 hours
    $\rightarrow$Buffer years: 25362/7.140 h   = 3,5 years

☞ **The battery should be replaced every 3 years for security reasons.**

Maintenance and Replacement

Notes:

Order numbers

8   Order numbers

Order numbers of the variants of the basic device and additional software functions, see price list rho3, rho4 (1070 073 902, German).

8.1   Accessories

Designation		Order no.
Counterplug X10	PHG2000 power supply and signals, 14 pin	1070 916 914

Ethernet cable 100/10 Base T	crossed lines:
	 length 0,15 m
	            2,5 m
	            5,0 m
	           10,0 m
	           25,0 m
	
	 non-crossed lines (connection via switch):
	 length 2,5 m
	            5,0 m
	           10,0 m
	           25,0 m
		1070 919 187
		 1070 919 188
		 1070 919 257
		 1070 918 795
		 1070 918 797
		
		 1070 918 793
		 1070 919 258
		 1070 921 384
		 1070 918 796

Programming units	PHG2000 with cable, length 8 m	1070 918 443
	PHG2000EL with cable, length 8 m	1070 919 860
	Extension cable in meter lengths, min. 20 m to max. total length 60 m	1070 919 062
	Project engineering cable (Connection PHG ⇔ PC), 5m	1070 918 830
PCI bus master	PCI_BM_DP (PROFIBUS-DP)	1070 078 905
	PCI_BM_CAN (CANopen)	1070 080 381
	PCI_BM_IBS (INTERBUS-S)	1070 080 379
External floppy disk drive	3,5", for installing in the control cabinet, with connecting cable	1070 085 274

Order numbers

Premanufactured fibre optic cable, male connectors on both sides :

Length	Designation	Order no.
23 cm	DM 4A bis DM 85B (without strain relief)	1070 917 886
33 cm	DM 140D (no strain relief)	1070 917 884
43 cm	DM W290F (no strain relief)	on request
2 m 5 m 10 m	Connection to the master (with strain relief)	1070 917 885 1070 917 887 1070 918 956

8.2   Spare parts

Designation		Order no.
SMD–Fuse	5 A , neutral	1070 920 773
Battery	3,6 V Lithium Size AA 1,75 Ah	1070 914 446
Ventilator, ready-made		1070 075 943

Appendix

A   Appendix

A.1   Abbreviations

Abbreviation	Meaning
BAPS3	Movement and sequence programming language, version 3
C:	Drive designation, here drive C (hard disk drive)
CAN	Controller Area Network
DDE	Dynamic Data Exchange
DLL	Dynamic Link Library
EGB	Subassemblies at risk from electrostatic discharge
ESD	Electrostatic discharge Abbreviation for all terms concerning electrostatic discharges, eg ESD protection, ESD hazard
I/O	Input / Output
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MMI	Man-Machine-Interface
OEM	Original Equipment Manufacturer
PCL	PC-programmable logic control
PE	Protective Earth
PHG	Hand-held programmer (Programmier Handgerät)
PLC	Programmable logic controller
ROPS4	Robot programming system for rho4
TCP/IP	Transmission Control Protocol / Internet Protocol
UPS	Uninterruptible Power Supply

Appendix

A.2   Index

Appendix

Notes:

Rexroth
Bosch Group

1070072365