Rexroth
Bosch Group

Rexroth Rho 4.1/BT155, BT155T
Rexroth Rho 4.1/BT205
Connectivity manual

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Edition 04

Project planning

Title   Rexroth Rho 4.1/BT155 BT155T
Rexroth Rho 4.1/BT205
Connectivity manual

Type of Documentation   Project planning

Document Typecode   DOK-RHO*4*-RHO*BT*ANBE-PR04-EN-P

Purpose of Documentation   The present manual informs about:
- specifications, configuration and
- operation of the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 robot control

Record of Revisions

Description	Release Date	Notes
DOK-RHO*4*-RHO*BT*ANBE-PR03-EN-P	10.2003	Valid from VO07
DOK-RHO*4*-RHO*BT*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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Signal descriptions	2	rho4 interface description
	3	Signal description of PCL inputs
	4	Signal description of PCL outputs
Status messages and warnings	2	rho4 status messages
	3	Warnings
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ROPS4/Online	2	General information
	3	Activation and functions of Online
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DLL library	2	Library functions
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PHG2000	2	Hand-held programming unit PHG2000
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	9	File and User Memory Functions
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Overview of all manuals

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Overview of all manuals

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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 in-
structions may result in **personal injury**.

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

☞   This symbol is used to draw the user's attention to special circum-
     stances.

★   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 information about specifications, configuration and operation of the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 robot control.

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 072361
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

All trademarks of software installed on Rexroth products upon delivery are the property of the respective manufacturer.

Upon delivery, all installed software is copyright-protected. The software may only be reproduced with the approval of Rexroth or in accordance with the license agreement of the respective manufacturer.

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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 Interessengemeinschaft 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 robot controllers rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 consist of:

- A powerful industrial PC, at rear of housing
- Flat-panel display, some with touch screen
- Operator panel with keyboard and LED status displays
- CD-ROM- and LS120-drives
- Additionally integrated UPS, temperature monitoring, safe operating system shutdown, 3 expansion slots for PCI- and ISA-cards.

The construction is very compact and easy to service. It is distinguished by **its high fault tolerance** (e.g. schock and vibration resistant mounted hard disk, uninterruptible power supply UPS) and **easy maintenance.**

The operating system used is Windows NT4.0 and associated Rexroth application software is installed (see section 9.3).

System Overview

Robot controller with control terminal BT155 or BT155T with 10.4" display
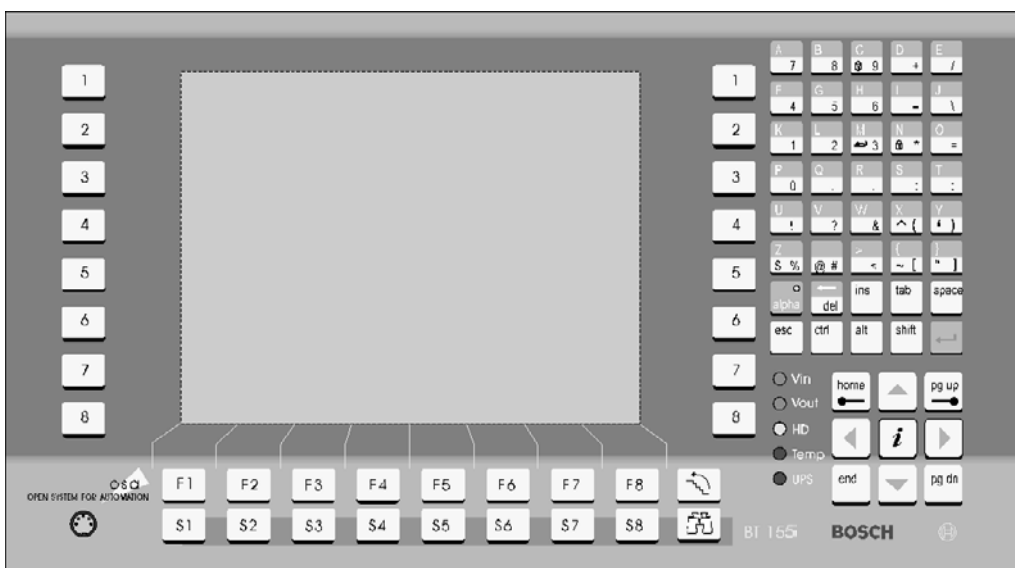
Robot controller with control terminal BT205 with 12.1" display
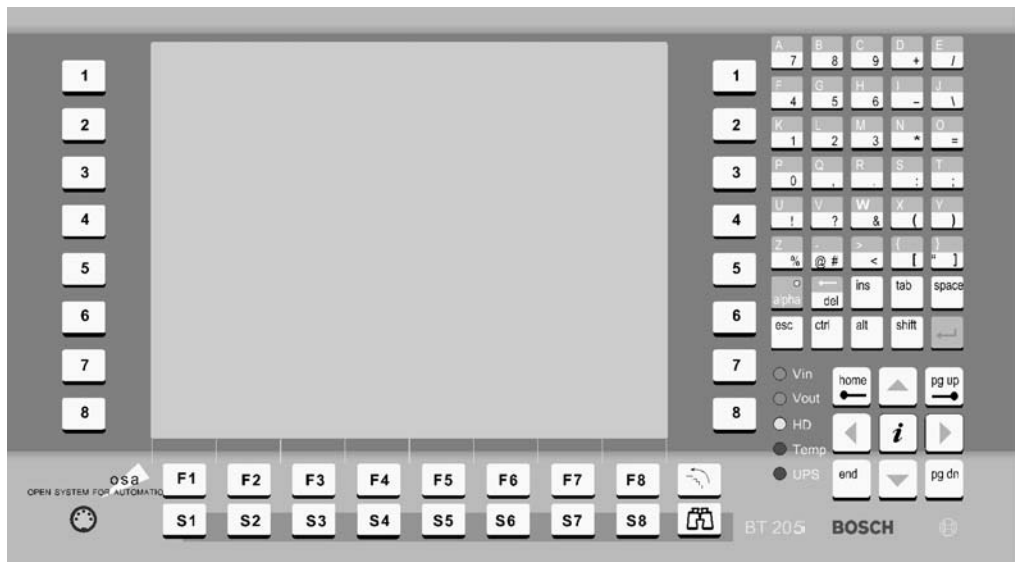
System Overview

2.1   Variants

Every one of the basic devices rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 may be equipped with one of the following real–time cards (PCI_rho expansion cards):

- **PCI_rho_CAN**
  CAN-Bus for drive and I/O with incremental measuring system input
- **PCI_rho_CAN2**
  CAN-Bus for drive and I/O without incremental measuring system input
- **PCI_rho_SERCOS**
  SERCOS interface for drive, CAN for drive and I/O with incremental measuring system input
- **PCI_rho_SERCOS2**
  SERCOS interface for drive, CAN for drive and I/O without incremental measuring system input

System Overview

Versions with different power supplies (examples)
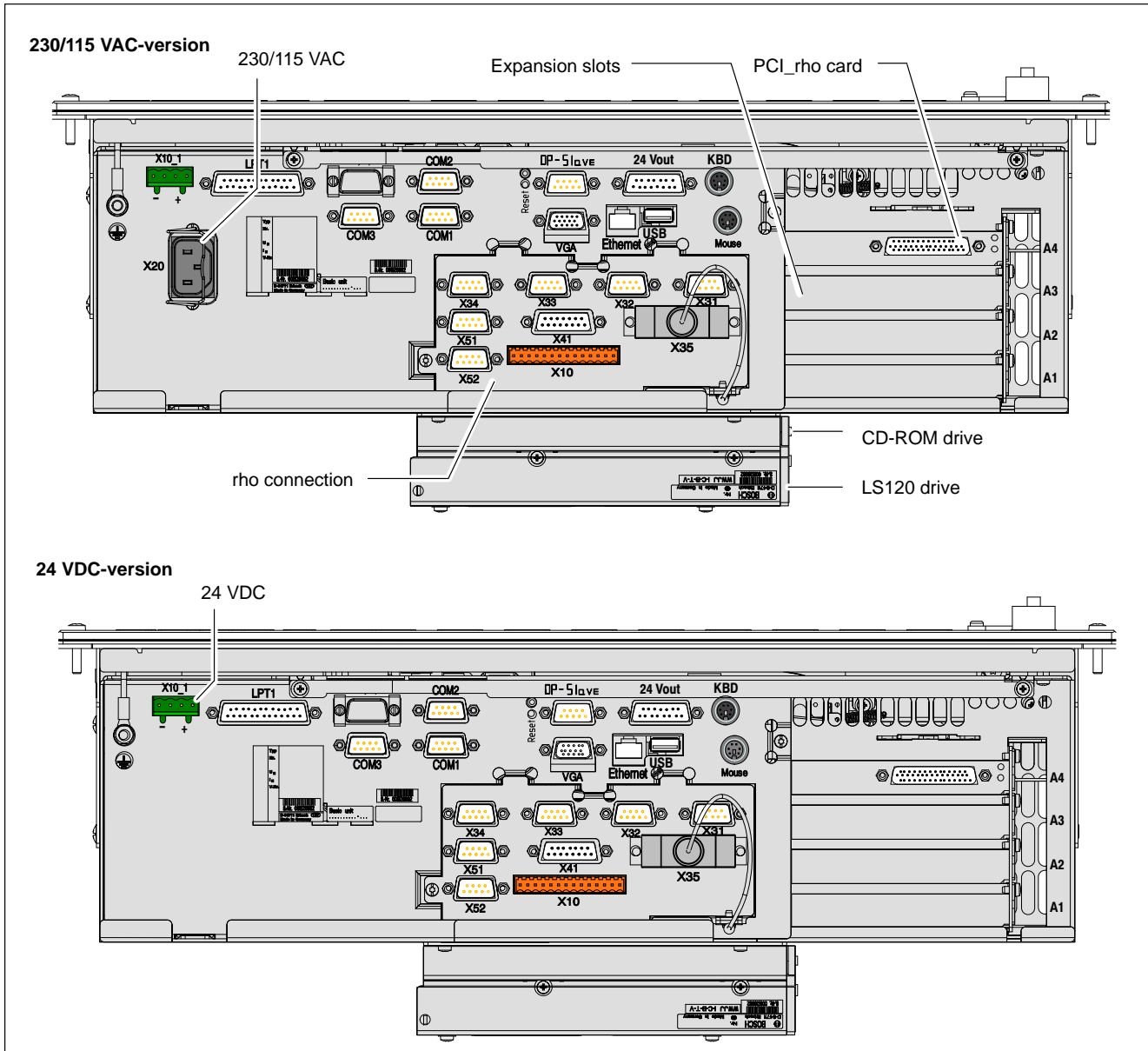
☞ **In the 230/115 VAC-version the 24 VDC-input (X10_1) has no function.**

System Overview

2.2   Technical data

Feature	rho4.1/BT155T	rho4.1/BT155	rho4.1/BT205
Display (TFT): Size	10.4"	10.4"	12.1"
Touch screen Touch–sensitive screen for operations without keyboard and mouse	Yes	No	No
Intel Pentium processor or compatible CPU (socket 7) with Intel MMX™ technology	≧ 266 MHz, optional 400 MHz Pentium™ III		
RAM	64 MB or 128 MB (with 266 MHz processor) 128 MB or 256 MB (with 400 MHz processor)		
Hard disk	> 5 GB IDE (spring suspension with Autopark feature)		
CD-ROM drive	32times (minimum)		
LS120 drive	3.5"drive with the following diskette capacity: 120 MB, 1.44 MB or 720 KB		
Free expansion slots	2 PCI expansion slots, 1 PCI/ISA combi–expansion slot		
Power supply (alternative to)	230/115 VAC, 50/60 Hz		
	24 VDC		
UPS (uninterruptible power supply)	Via internal rechargeable battery pack		
Temperature monitoring	With warning function & safe shutdown		
5 LED's at the front 1 LED at the back	Display of essential operating statuses		
Standard interfaces	2 x serial, freely usable 1 x USB, 1x parallel PS/2 keyboard, PS/2 mouse, VGA Ethernet	3 x serial, freely usable 1 x USB, 1x parallel PS/2 keyboard, PS/2 mouse, VGA Ethernet	
Real–time interfaces	V24/20 mA, PHG connection, CAN-Bus, incremental transducer, measuring sensor		
Weight:	Approx. 9 kg		
Dimensions	Housing: 448 x 195 x 98 mm		
Operating system	Microsoft Windows NT4.0		

☞ **All specifications are subject to change as a result of technological developments. This also means that components providing higher than the specified performance (e.g. a faster processor) may be integrated in the devices without explicit reference in this documentation.**

System Overview

2.3   Expansion slots

There are 3 slots available for expansion cards (a1 to A3):

- 2 PCI bus cards
- 1 PCI or ISABUS card (combination slot)

The A4 slot is taken by the PCI_rho insertion card.

☞   **CAUTION**
            Damage to PC or application software through unauthorized
            expansion cards.
            Use only approved expansion cards, and have them installed
            by a specialist.

For more information on installing expansion cards, refer to section 8.5.

2.4   Rechargeable battery pack

The robot controllers rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205
are equipped with an internal battery pack (2 in series connected 6 V bat-
teries).

In case of a power failure, the rechargeable battery pack facilitates a
controlled and safe shutdown of the PC operating system, as described
in section 3.2 (**UPS Functions**). Loss of data held in PC RAM is thus pre-
vented.

The rechargeable battery pack has a limited useful life and must be re-
placed if it cannot be charged up adequately any more.
Refer also to section 8.4.

2.5   LS120/CD-ROM drive unit

All basic devices are equipped with a drive unit consisting of an LS120
drive and CD-ROM drive. The LS120 drive suports the following 3.5" dis-
kette types:

- LS120 (120 MB)
- Double density (720 kB)
- High density 3.5 in. (1.44 MB)

Both drives are at the back of the housing. During installation please
make sure that the drive bays remain accessible.

For the installation of the LS120/CD-ROM drive unit see section 8.2.

System Overview

2.6   Operating conditions

The PC basic devices are designed for continuous, 24 hour/day opera-
tion. The display backlight can be switched off.
Unless stated otherwise in specific sections, these specifications apply:

Temperatures

Storage temperature:

● –20°C   to +60°C

Ambient temperature:

● +5°C   to +45°C

Ambient temperatures apply to installation conditions described in sec-
tion 4.
Temporary temperature fluctuations of up to 3°C per minute are permit-
ted.

CAUTION
Excessive operating temperature!
Do not expose to direct sunlight or any other sources of heat
radiation!

Relative humidity

Climate class 3K3, as per EN 60529; condensation not permitted.

Atmospheric pressure

To DIN 60204, when operating at altitudes up to 2000 m above sea level.

Protection category ratings

Front panel: IP65, otherwise IP00

Control cabinets and installation compartments must conform to IP 54
rating (dust filters upstream of air intake and exhaust).

CAUTION
Conditions hazardous to the product!
The ambient air must be free of electrically conductive pollu-
tants (e.g. acids, alkalis, corrosives, salts, metallic vapours,
etc.).

System Overview

Vibration–resistant operation

Frequency range: 10 to 150 Hz
Amplitude: 0.075 mm   at 10 to 57 Hz
Acceleration: 1 g   at 57 to 150 Hz
to EN 60068-2-6

Impact resistance

15 g as per DIN IEC 68-2-27, no functional impediment.

System Overview

2.7   Standards compatibility

The robot controllers rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 conform to the following standards:

- EN 60,204–1   Electrical systems on machines
- EN 50,081–2   Basic specification for interference emission (industrial environment)
- 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   24 V output requirements
- EN 61 131–2   24 V power supply requirements
- EN 418   Machine safety, Emergency-STOP devices
- EN 60,529   Protection categories (incl. housings and installation compartments)
- EN 60 068–2–6   Vibration test
- EN 60 068–2–27   Impact test
- .IS.114   X-ray Radiation" Directive, as per Official Federal Gazette

☞ **As shipped from the factory, robot controllers conform to the requirements of the CE mark of certification.**
However, the subsequent insertion of additional expansion cards will necessitate a supplementary CE certification.

System Overview

Notes:

Security Functions

3   Security Functions

3.1   Temperature monitoring function

The ambient air temperature must not exceed +45°C (see section 2.6). To ensure operational reliability, a temperature monitoring function measures the internal housing temperature.

A temperature warning, occurring at internal housing temperatures **exceeding 50°C**, manifests itself as follows:
- via the flashing "Temp" LED on the front panel of the housing.
- via a message window displayed by the operating system.
  This message must also be capable of interpretation by all application programs. The Rexroth application software meets this requirement.

This temperature warning can disabled by the program **UPS$_{NT}$ for Windows NT 4.0** (see section 3.3).

If temperatures in the housing **exceed 65°C,** the PC **will be shut down and switched off** via the UPS logic circuit (see section 3.2)**.**

DANGER
Inadvertent machine movements.
Always ensure that temperatures remain within the non-critical range. In the case of application sensitive procedures, ensure that machine movements are terminated in a controlled fashion in the event that the temperature monitoring function disables the PC.

Security Functions

3.2   Uninterruptible power supply (UPS)

In the event of a power failure exceeding 800 ms in duration, or of an internal housing temperature in excess of 65°C (refer to section 3.1, above), the UPS logic integrated in the power supply is activated, effecting a safe operating system shutdown procedure assisted by the rechargeable battery pack.

Power interruptions of shorter durations are bridged by the battery pack. In the robot controllers rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 with Windows NT power supply interruptions of up to 5 sec are permissible before the UPS logic cuts in.

Please note:
- To allow the rechargeable battery pack to attain its full charge capacity, the device must remain powered up for a minimum of 5 hours subsequent to initial start-up.
  Sufficient UPS protection cannot be ensured during this charging period.
- Frequent On/Off cycling of power tends to cause rapid discharge of the battery pack. You should never cycle the power more often than 4 times in succession. The battery pack must again be fully recharged thereafter.
- The UPS logic function requires hard disk capacity for intermediate data storage. Ensure that the hard disk never fills up completely.

CAUTION
If there are no batteries in the unit, or if the batteries are defective or discharged, the PC will RESET without warning after a voltage dip in excess of 20 ms! A possible consequence may be a loss of data.
Observe UPS program messages indicating that the battery pack may be discharged. This test is run during each PC boot phase.

Power dropouts below 800 ms duration

Voltage drops below 800 ms duration are bridged by the battery pack, and do not trigger the UPS logic circuit.

Security Functions
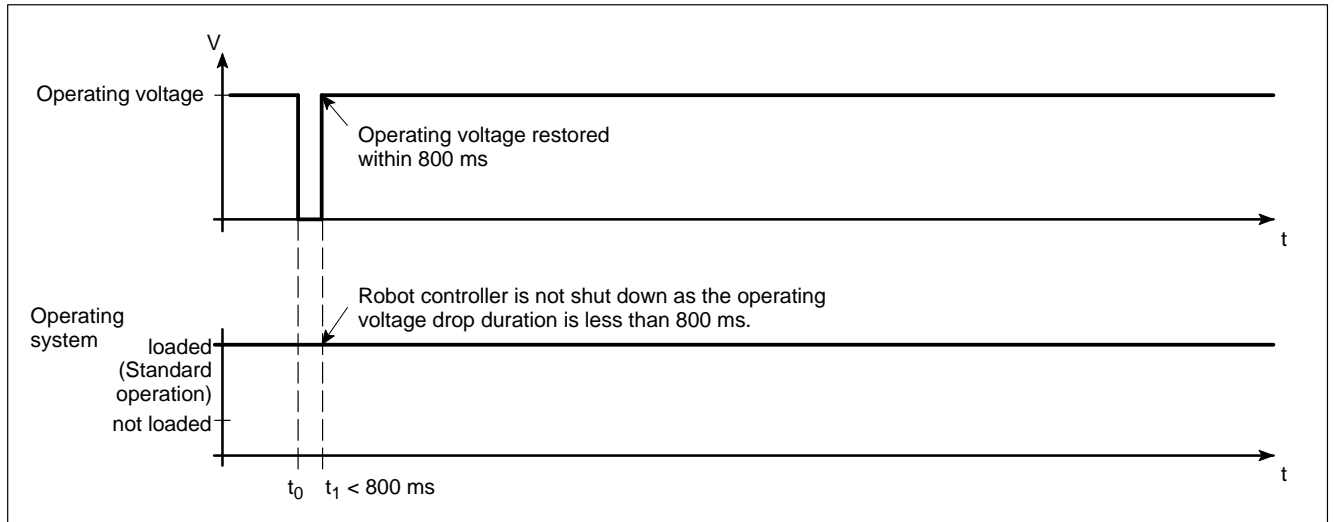
Power dropouts between 800 ms and 60 s

A voltage drop exceeding 800 ms in duration causes the PC operating system to be shut down $_{after}$ a selectable interval (delay time).

● If the voltage supply returns within 5 sec (short break), then the UPS does not cut in (for appropriate settings).

● If the mains power is restored within the next 60 seconds, the UPS will interrupt the operating voltage for another 8 seconds (up to t3), and then the operating system is restarted again.
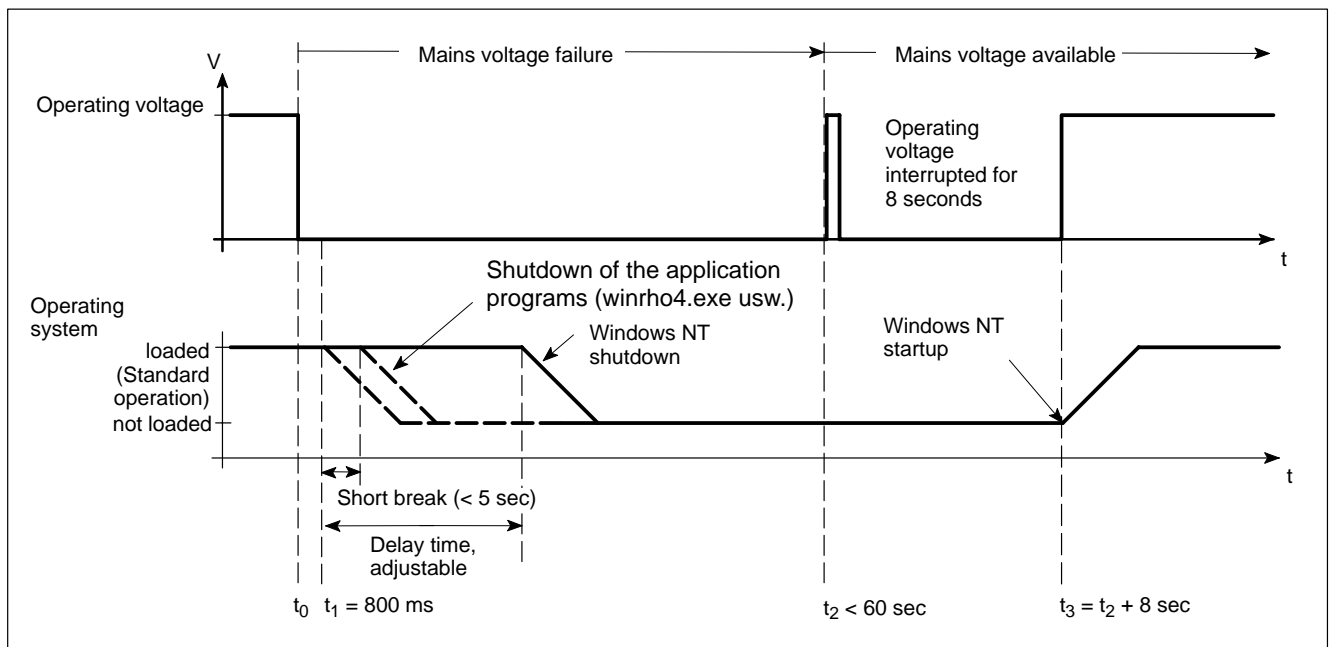
Security Functions

Power dropout > 60 s (without short break)

After approx. 60 sec the UPS internally switches off the power supply.
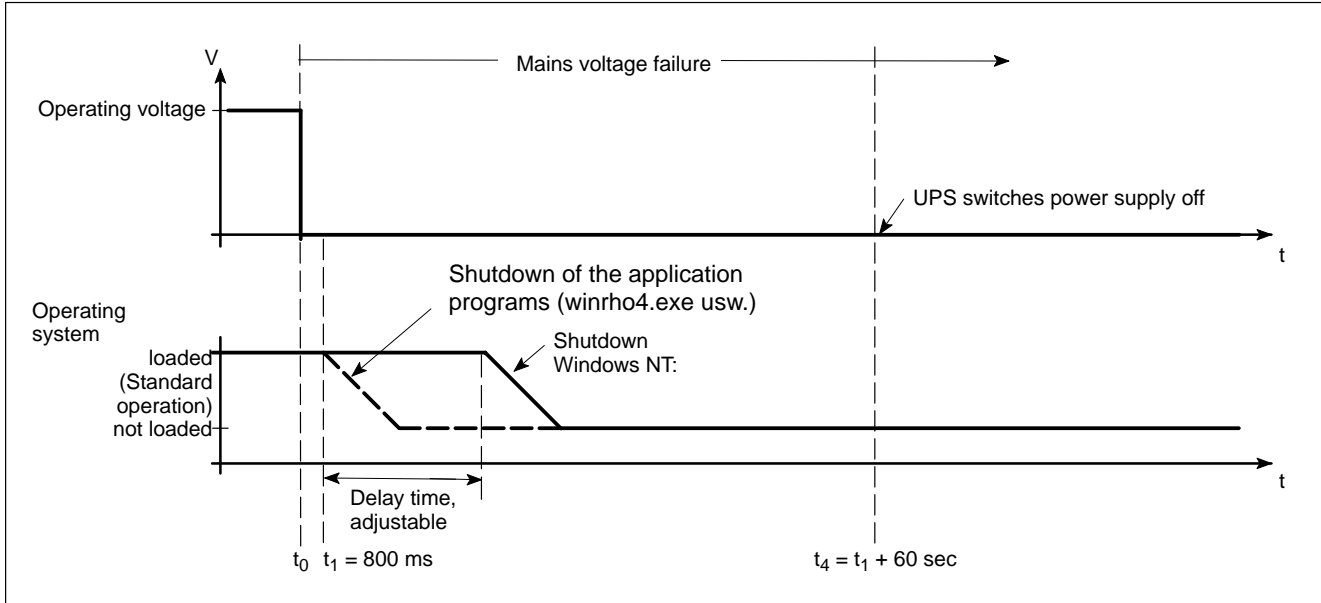
☞ **Setting the delay time is in the additional software "UPS$_{NT}$" for rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 (from page 3–6).**

Security Functions

3.3   UPS program

3.3.1   Functionality

The "UPS$_{NT}$" uninterruptible power supply program controls and monitors the integrated uninterruptible power supply (UPS). The program also checks the function of the rechargeable battery and controls the system temperature monitoring function.
In the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 with Pentium III, 400 MHz the operation of the fans and internal operating voltages are also monitored.

Communications between program and UPS are handled via the COM4 serial port.

In the case of a power supply failure it is the task of the UPS program to:
● To send a message to all active applications so that they can be shutdown by appropriate routines.
● To shut down the operating system after the delay time has elapsed. Once the UPS power monitoring function has been triggered, aborting the system shutdown routine is no longer possible.

Closing all active applications prevents data loss in the event of a sudden voltage interruption.
In the event that the mains power has not been restored after a maximum of 60 seconds, the UPS will switch off the power supply in the PC (refer to shutdown conditions in section 3.2).

CAUTION
Loss of data through manual restart!
Note that the UPS switches off the device in any case. For this reason, once the operating system has been shut down, the "Restart" dialog button must not be pressed.
In the case of voltage interruptions below 60 seconds, the operating system is restarted automatically.

The operator cannot access the UPS$_{NT}$ program during normal operation. Operation and settings can be effected only if the user possesses special access rights and only after the operating system has been restarted.

☞ **Changes to the UPS$_{NT}$ parameters must not be carried out without consulting Rexroth first.**

Security Functions

3.3.2   Operating and configuring

Configuration UPS$_{NT}$

☞ **UPS$_{NT}$ is properly configured when the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 are shipped from the factory and must not be changed without consulting Rexroth first.**

For the purposes of service and control select "UPS NT Control" in the control panel:
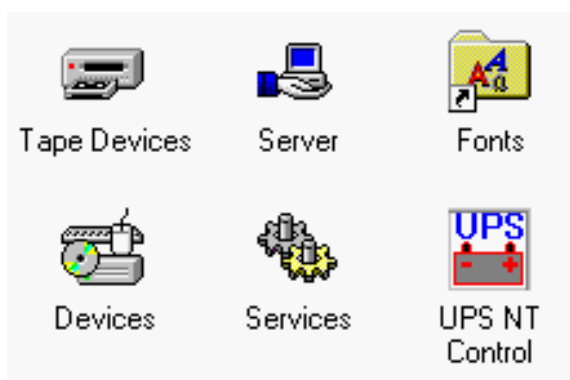
☞ **The UPS$_{NT}$ program always runs as a Windows NT service. Changing user logins have no influence on this characteristic. A user without Administrator authorization is neither able to terminate the program nor stop the monitoring function.**

Security Functions

```
┌─────────────────────────────────────────────────────────────────────┐
│ UPS NT Configuration                                            [×]   │
├─────────────────────────────────────────────────────────────────────┤
│ ┌─COM Port─┐  ┌─Advanced Controls──────────┐  ┌─Health Monitor─────┐  │
│ │          │  │ Shutdown Delay Time (s) │45│▲│  │                    │  │
│ │ ○ COM 1  │  │                         └──┘▼│  │  5V Supply    5.18 V│  │
│ │          │  │ ☑ Enable Startup Battery Test│  │ 12V Supply   12.01 V│  │
│ │ ○ COM 2  │  │ ☑ Enable Temp Control        │  │-12V Supply  -12.64 V│  │
│ │          │  │ ☑ Enable Fan Control         │  │Battery Voltage 12.85V│ │
│ │ ○ COM 3  │  │ ☑ Enable Voltage Control     │  │System Temperature 27C│ │
│ │          │  │ ☐ Disable Auto Power Off     │  │Chassis Fan Speed    │  │
│ │ ⦿ COM 4  │  │ ☑ No Powerdown on Shortbreak │  │CPU Fan Speed        │  │
│ └──────────┘  └──────────────────────────────┘  │                    │  │
│ ┌─Command──────────────────────────────────────┐│ [Test Battery][AutoRefresh]│
│ │ ☐ Execute Command File                       ││└────────────────────┘  │
│ │ ┌──────────────────────────────┐ ┌────────┐  ││┌─Info──────────────┐  │
│ │ │                              │ │ Browse │  ││ Shutdown Count   0 │  │
│ │ └──────────────────────────────┘ └────────┘  ││└────────────────────┘  │
│ └──────────────────────────────────────────────┘│                        │
│ [ OK ] [ Cancel ] [ Default ] [ Info ] [ Help ]  │                        │
└─────────────────────────────────────────────────────────────────────┘
```

☞ **To allow new parameter values to take effect subsequent to their modification, the UPS is automatically stopped and restarted. No monitoring function is enabled during this interval (5 to 10 sec).**

COM Port

The UPS program is always connected to the UPS via the COM4 serial port.

Advanced Controls

Shutdown Delay Time

A time of 45 seconds must be entered here. During this time period the rho4.1 application is closed and user data are saved. Upon expiry of the Delay Time, all application programs will be terminated without prior security query!

Security Functions

In the period between the end of the Delay Time and the expiry of the 60 seconds after the shutdown signal the operating system is shut down (close Windows system files and back them up). If the interval is too short, the shutdown process will be interrupted because the UPS disrupts the mains power. This may cause loss of data in some circumstances.

CAUTION
Upon expiry of the Delay Time, the operating system is shut down without prior security query. Unsecured data belonging to open applications will be lost.

Enable Startup Battery Test

When this check box is checked, the system performs a test of the battery pack during each restart. Upon detection of a fault the red LED "UPS" flashes and an error message is generated and distributed throughout the system. The UPS program continues to operate.

The battery test is automatically repeated after 12 hours:
- If no error is found, there is an automatic repetition of the test every 12 hours.
- If a fault is found:
  - an error dialog is created
  - a message is distributed throughout the system
  - the output E80.2 UPS_ACCU_RCA is set to "1"
  - the UPS program terminates and the red LED "UPS" begins to flash.
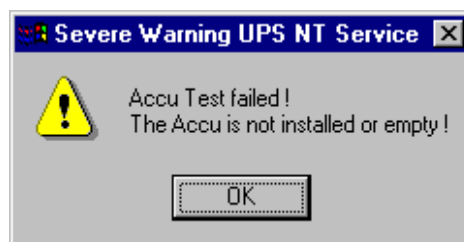
Security Functions

Enable Temp Control

When this checkbox is checked, the ambient temperature is monitored on a continuous basis. Excessive temperatures will produce the following warning message:
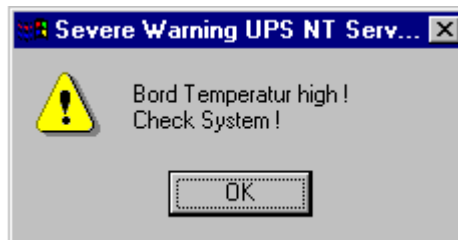

The power monitoring function is retained even after a temperature warning. Upon detection of a fault the red LED "Temp" flashes and the rho4.1 sets the output E80.1 UPS_TEMP_RCA to "1".

Enable Fan Control

When this checkbox is checked the housing and CPU fans are monitored in the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 with Pentium III, 400 MHz . In the event of a fault the red LED " Temp " flashes and a relevant message is displayed and distributed throughout the system.
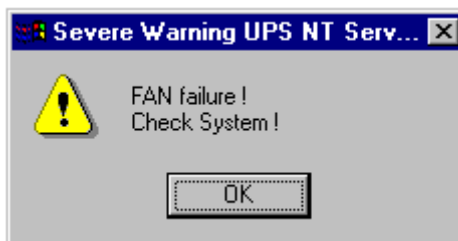
Enable Voltage Control

When this checkbox is activated, internal supply voltages are monitored. In the event of a fault the green LED "Vout" goes out and a relevant message is displayed and distributed throughout the system.

Security Functions
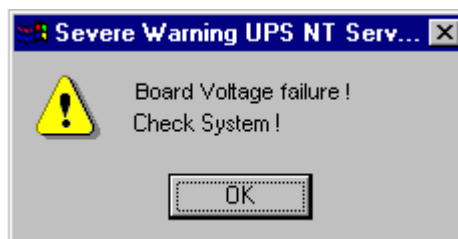
Disable Auto Power Off

☞ | **CAUTION**
Loss of data!
Activation of this checkbox no longer makes a safe shutdown
possible in the event of a power failure. The device switches
off instantly!

This option disables both the UPS monitoring function and the power-off delay for the power supply:

● A voltage interruption will cause the PC to shut down immediately.
● After a normal shutdown, the wait interval of approx. 60 seconds prior to the shutdown of the power supply is omitted.

This function shortens the wait times for startups and software installations. During normal operations it must always be disabled!

No Powerdown on Shortbreak

When this checkbox has been activated, interruptions in the power supply of up to 5 seconds are permitted without affecting ongoing operations. Only in the case of power interruptions lasting in excess of 5 seconds will the UPS logic be started and the safe shutdown of the system initiated.

Command

This dialog box provides for the linking and activation of an executable program (*.exe; *.bat) which is to be started and executed after the initialization of the shutdown. This is helpful in situations where applications failing to respond to the system–wide messages must be backed up and terminated. To this end, appropriate housekeeping and termination programs can be entered and activated in this dialog. If there are several programs, or if the programs require transfer parameters, they must be combined and entered in a batch file.

☞ **The entry itself may not contain any invocation parameters, and the declared program itself must not initiate a shutdown!**

Default Settings

Selecting the "Default" button returns all settings to their **default values**.

These are:
● COM port: COM4
● Shutdown Delay Time: 45 sec
● Enable Startup Battery Test: enabled
● Enable Temp Control: enabled
● Enable Fan Control: enabled

Security Functions

- Enable Voltage Control: enabled
- Disable Auto Power Off: disabled
- No Powerdown on Shortbreak: enabled
- Execute Command File: disabled

Health Monitor

This dialog section indicates the current readings for internal voltages, battery voltage, system temperature and fan functions.

The **Battery Voltage** reading is updated only after a battery test. The battery test occurs automatically after a system start, and in 12-hour intervals thereafter; it can also be initiated by pressing the $_{Test\ Battery}$ button.

- The LED illuminates red when the voltage reading of the battery voltage measured under load is low.
- The LED illuminates green when the battery pack is fully functional.

☞ **Excessive repetitions of the battery test will discharge the battery pack. Never perform more than 5 battery tests within a 24-hour period.**

The following applies to **Fan Speed monitoring**:

- Red LED: Fan at standstill, or fan speed is too low or too high.
- Green LED: Fan is working properly.

Pressing the <StopAutoRefresh> button disables the automatic updating of measured readings, and the legend on the button changes to <AutoRefresh>.

Pressing the <AutoRefresh> button again enables automatic measurement updating, again changing the legend on the button to <StopAutoRefresh>.

Info

Shutdown Count

The value displayed here indicates the number of times the UPS has already shut down the system. The number of maximum permissible load cycles depends on the ambient temperature, see the figures in section 8.4.

☞ **Windows NT stores all important events under the following: ADMINISTRATIVE TOOLS ▶ EVENT VIEWER ▶ LOG/APPLICATION**

Security Functions

Notes:

Installation

4   Installation

Before you start on the installation, refer to the information on applicable standards and operating conditions in sections 2.7 and 2.6.

CAUTION
Conditions hazardous to the product!
The ambient air must be free of electrically conductive pollutants (e.g. acids, alkalis, corrosives, salts, metallic vapours, etc.).

CAUTION
The operational reliability of components designed to be installed in housings or control cabinets will be severely impeded if they are used or operated without having first been installed.
Therefore, do not use or operate the robot controllers unless they have been properly installed.


☞ **Note**

- **The use of silicon-based sealing compounds, adhesives and insulating agents is prohibited.**
- **Ensure that the installation is maintenance friendly, i.e. that it provides unrestricted access to connections, cables and fuses.**
- **Precede all installation procedures by writing down the information on equipment rating plates. In the event that rating plates are hidden from view as a result of the installation, you will still have quick access to this information whenever required.**

Installation

4.1   Installed positions and clearances

Housing:	19"-Front panel, protection category IP 65, PC housing, protection category IP 00
Weight:	approx. 9 kg
Installed position:	0° to max. ±45° incline
Installation type:	In console frame or hinged frame, sealed as per IP54

☞ **Please consider that the control panel may become dirty more readily when installed at an angle.**
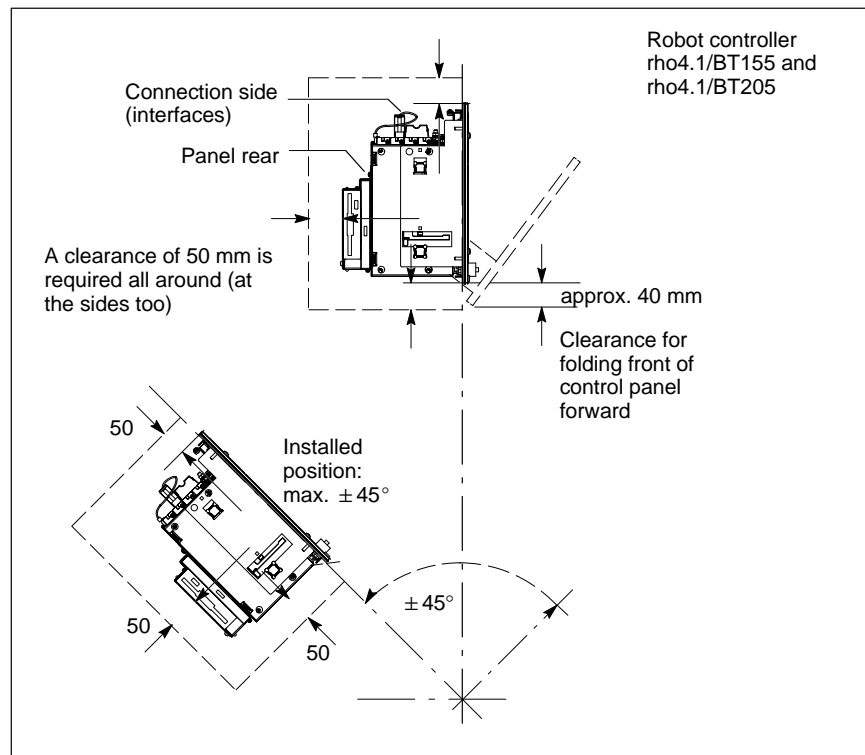
- Install the device in such a way that ergonomical operation is ensured. In addition, the operator must be provided with a permanent and unobstructed line of sight to moving machine components!
- To prevent reduced screen readability and additional thermal load, avoid installation locations that are exposed to direct sunlight.
- Install the device in a manner ensuring easy access to the connector panel side.
- The LED displays on the front panel must not be obstructed or concealed.
- To provide sufficient ventilation and cable routing space, allow an all-round minimum clearance of 50 mm (refer to diagram).

Installation

- Allow for connecting loops in all cable routings; provide strain relief for all cables.
- Maintain a suitably large distance from sources of interference.

4.1.1　Dimensioned drawings

The following diagrams show the dimensioned drawings of the robot controllers rho4.1/BT155(T) and rho4.1/BT205:
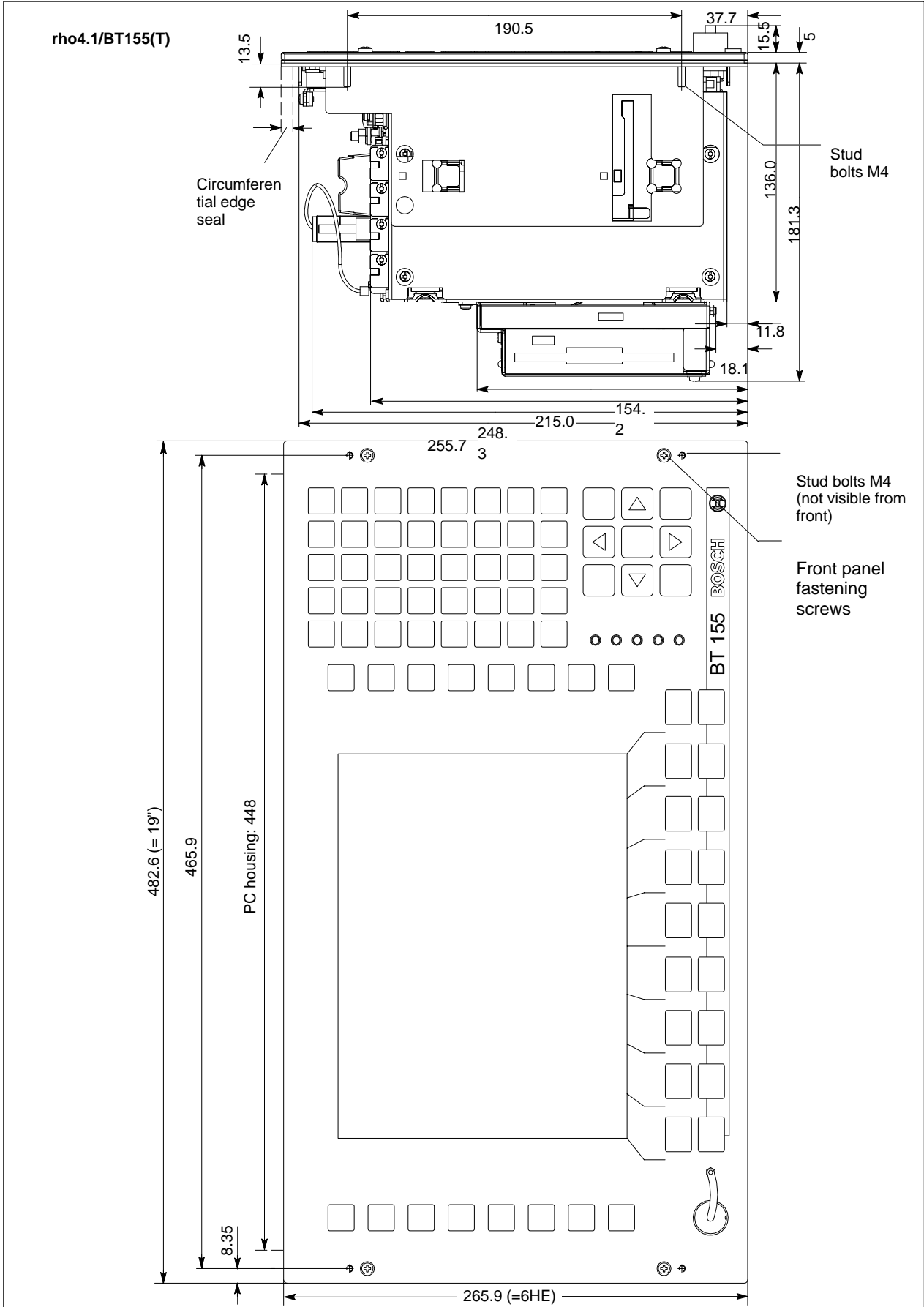
Installation

Installation

rho4.1/BT205

Circumferential edge seal

Stud bolts M4

Stud bolts M4 (not visible from front)

Front panel fastening screws

Installation
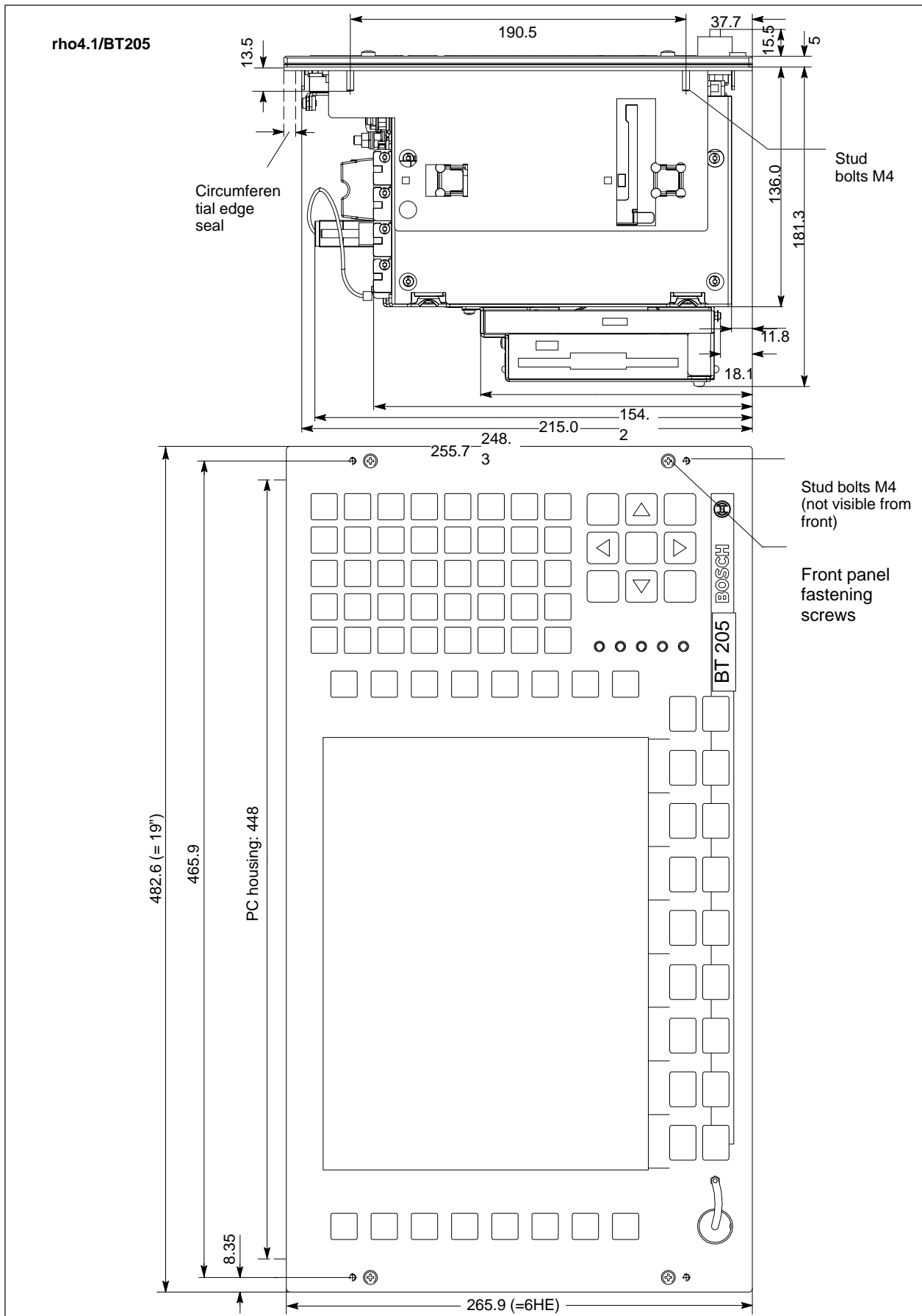
4.1.2   Installation cutout

Installation cutout for rho4.1/BT155(T), rho4.1/BT205:

★   Make an installation cutout with four holes ∅ 5 mm in accordance with the following diagram.

★   Insert the control panel of the robot controller into the cutout from the front while inserting the M4 stud bolts into the drilled holes.

★   Fasten the control panel by screwing M4 nuts on the stud bolts protruding at the rear of the control panel.

Drilled hole ∅ 5 mm (for stud bolts M4)
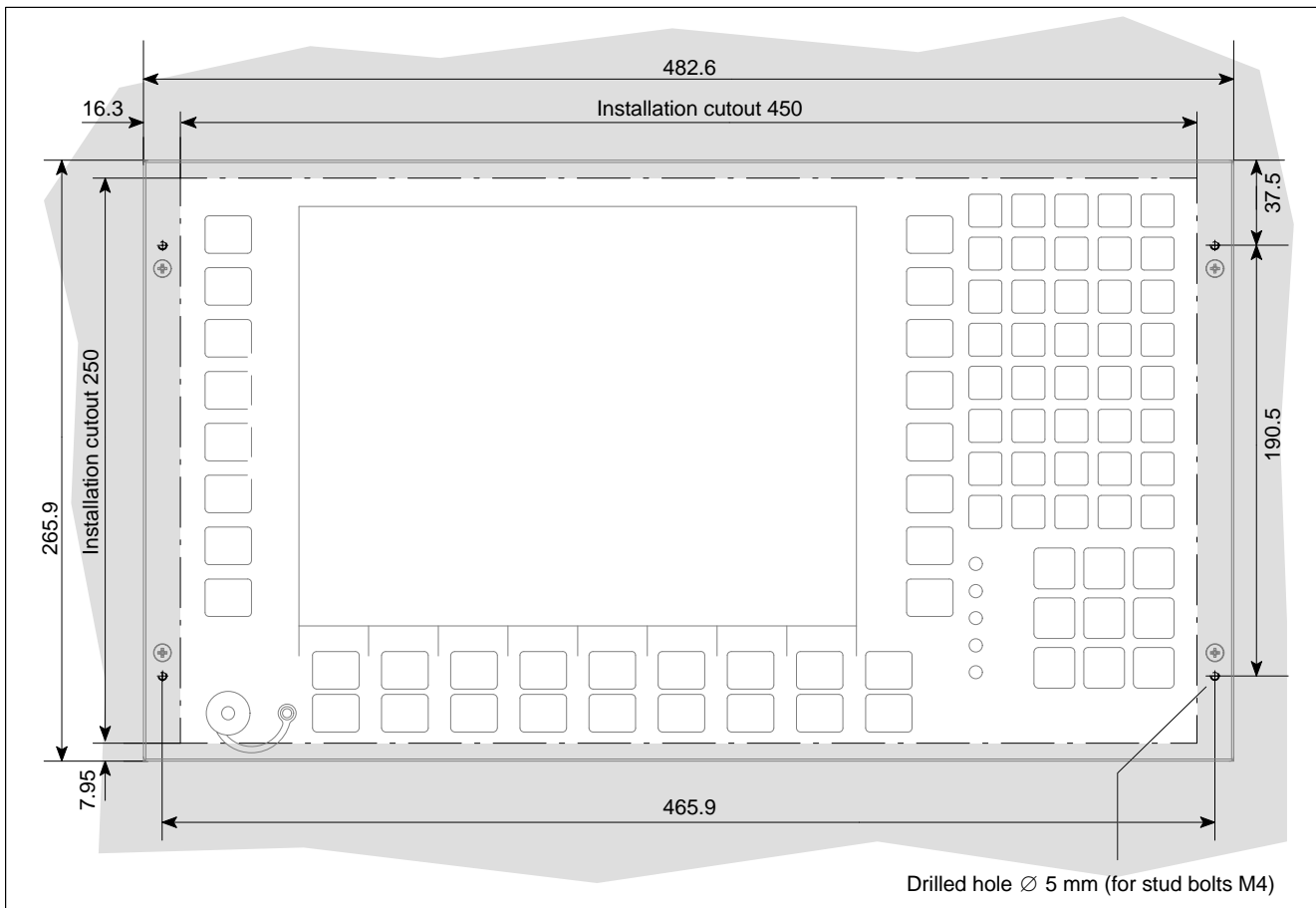
Electrical Connections

5   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 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 for insulated 24 VDC and 0 V terminal bars inside the control cabinet. When routing cables, maintain a minimum distance of 10 cm from all power cables.
- Design the system control circuits in a manner ensuring the simultaneous power up of PC and other industrial components, such as CNC and PLC.

Electrical Connections

5.1   Protective Earth conductor (PE) & 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 must not be allowed to flow across the screening of connecting cables.

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

★   The potential equalization conductors / PE conductors of all system components should be kept as short as possible, resulting in low-resistance connections.

★   Install the PE rails, preferably electrically conductive, 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, adequately 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 sufficiently dimensioned cross-section. 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 the in-terface signal lines via the shielded conductors. Therefore, even before taking a system into operation for the first time , ensure that there is pro-per potential equalization between devices which are to be connected. Do not forget the interfaces which connect devices to each other at diffe-rent locations (irrespective 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

5.2   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 only screened and 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:

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

To ensure optimum suppress interference, **all** of these 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. The asymmetrical interference voltages are discharged to the housing via C_y . C_x damps the symmetrical interference.

Electrical Connections
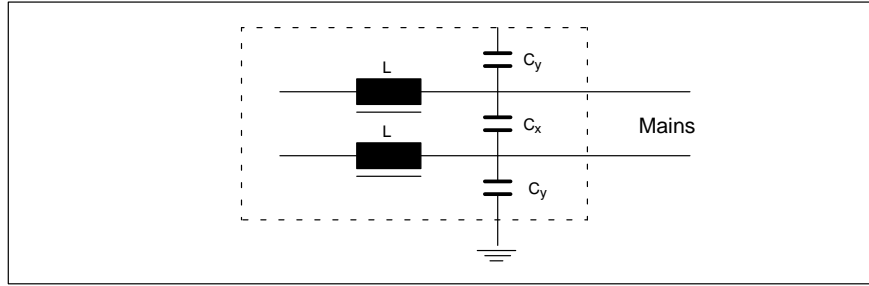
Interference suppression examples

Suppression of **contacts**

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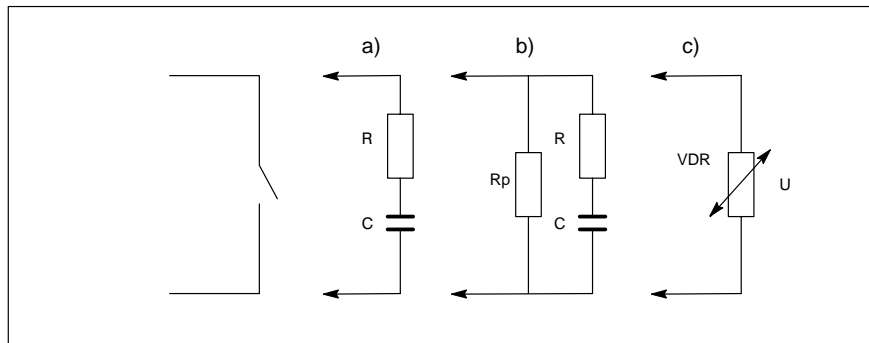
to b)   For sensitive contacts, residual current when contact
open!

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

Suppression of an **inductive load**

(Motors, solenoid, relay and contactor coils)
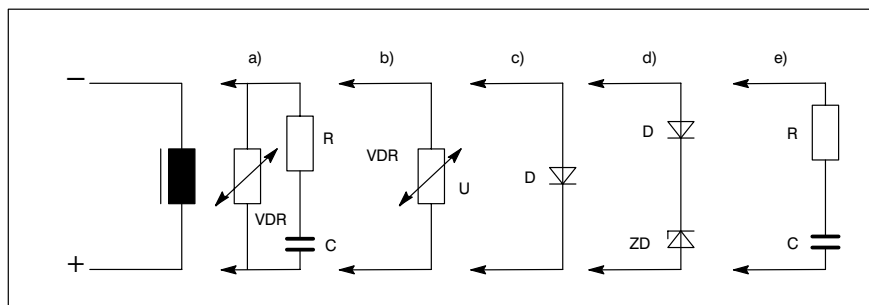
to c)   For relay, drop-off delay.

to d)   For relay, defined drop-off delay

to e)   Must be optimized for inductance!

Electrical Connections

Suppression example – mains input:

Electrical Connections

5.3   Power supply

5.3.1   24 VDC-power supply

X10_1   24 VDC power connection (with integrated 24 V-power supply)

Alternative to 230/115 VAC power connection. All internally required voltages are provided by a DC/DC converter.
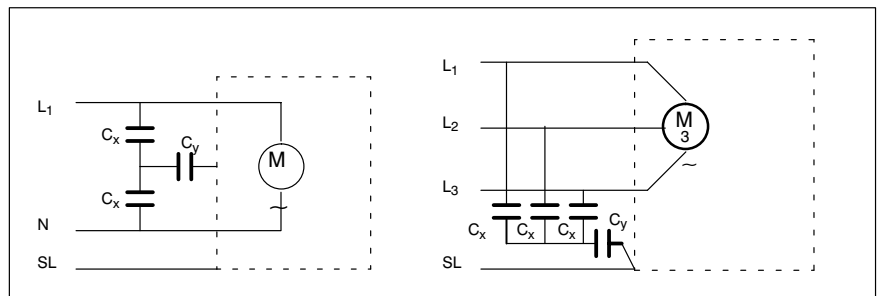Additionally the 24 Vout interface is powered via X10_1. In this case X10_1 must also be connected to a 230/115 VAC-supply.

Weidmüller push-lock terminal, MSTB 1.5, 4-pin

Max. conductor   1.5 mm^2 (see next page)
cross-section:

X10_1	Pin	Assignment
+ + – –	1	24V
• • • •	2	24V
1 2 3 4	3	0V
	4	0V
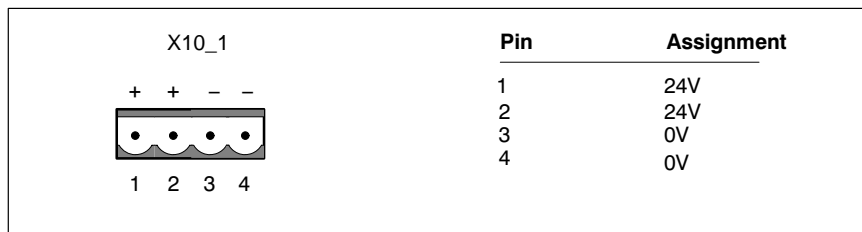
Rated voltage U_N:	24 VDC ; +20%, –15%
Residual ripple at U_N:	See diagram below
Interference / surge immunity:	U_{max}= 35 V (at t < 100 ms)
Current draw at U_N:	Max. 5 A
Input fuse:	6.3 A (5x20) medium time-lag
Reverse polarity protection:	Via decoupling diode. Polarity reversal will blow input fuse.

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

Electrical Connections

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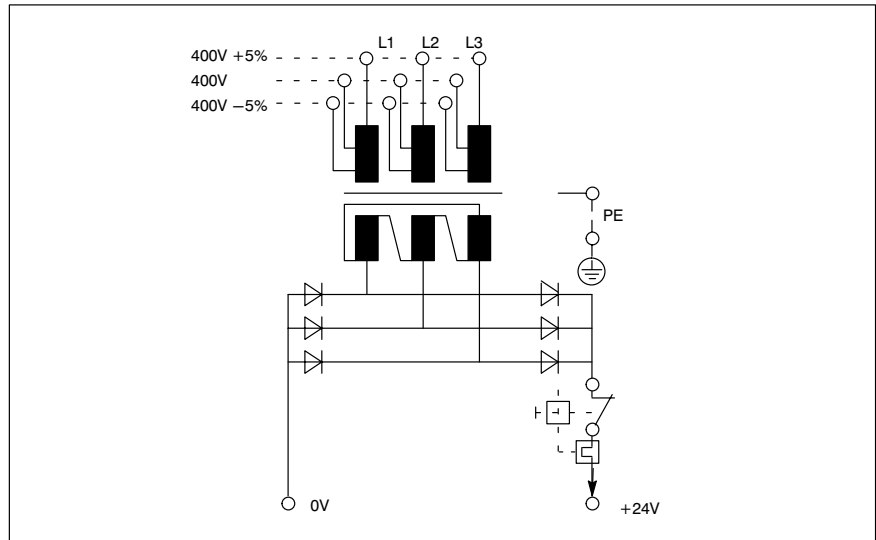
Offset AC components of the type produced by an unregulated rotary current bridge circuit without smoothing, with a ripple factor of 5% (refer to DIN 40110/10.75, section 1.2), are permissible. As an upper voltage limit, this produces a maximum absolute value of 30.2 V and, as a minimum voltage limit,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

Electrical Connections

L1 L2 L3   PE   PE

$10^2$2 (green/yellow)

Power supply with safety transformer as per EN 60742

24 VDC

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 | |

10^2 (green/yellow)(2)

Earth bar

24 V Load   **0 V Load**

A = Terminal block 4^2
B = Terminal block 10^2
: Terminals in isolated arrangement

Robot controller (24-VDC-Version)

Cross-sections dependent on current draw, but a min. of 0.5 mm^2 (3)

Display with front keyboard and PC

Power supply

X10_1

PE

(1) Easily visible and removable.

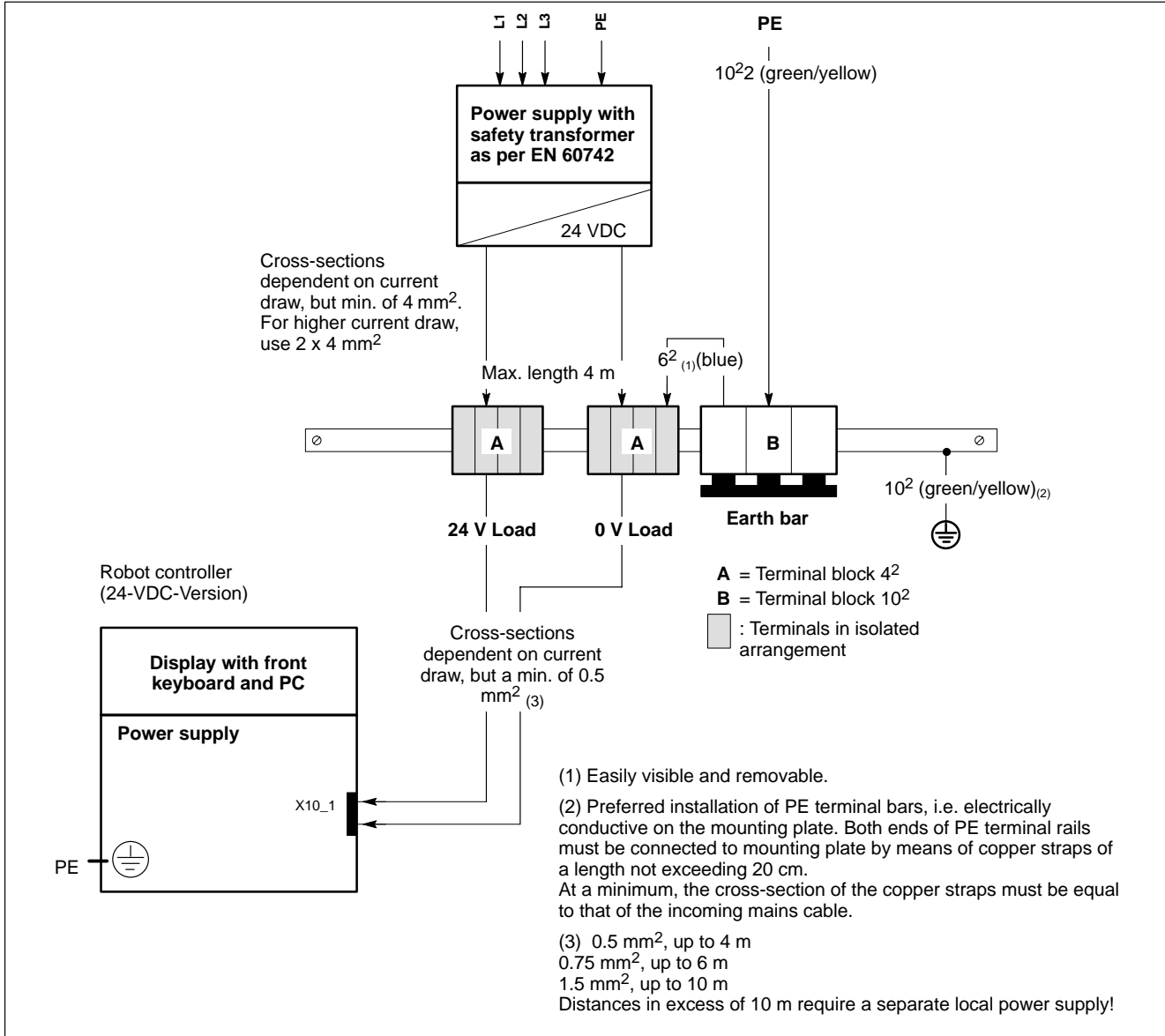(2) Preferred installation of PE terminal bars, i.e. electrically conductive on the mounting plate. Both ends of PE terminal rails must be connected to mounting plate by means of copper straps of a length not exceeding 20 cm.
At a minimum, the cross-section of the copper straps must be equal to that of the incoming mains cable.

(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 require a separate local power supply!

Electrical Connections

5.3.2   230/115 VAC power supply

X20   **230/115 VAC power connection (with integrated AC power supply)**

Alternative to the 24 VDC power connection.
All internally required voltages are produced by the integrated power supply.

CAUTION
The supply voltage must satisfy the requirements of Overvoltage Category II. Otherwise, the integrated power supply may be destroyed.
Use a separation transformer to generate the 230/115 VAC (refer to next page).

Coupler for non-heating apparatus,
3-pin

Max. conductor cross-section: 1.5 mm^2

X20	Assignment
PE	N1
	PE
	U2

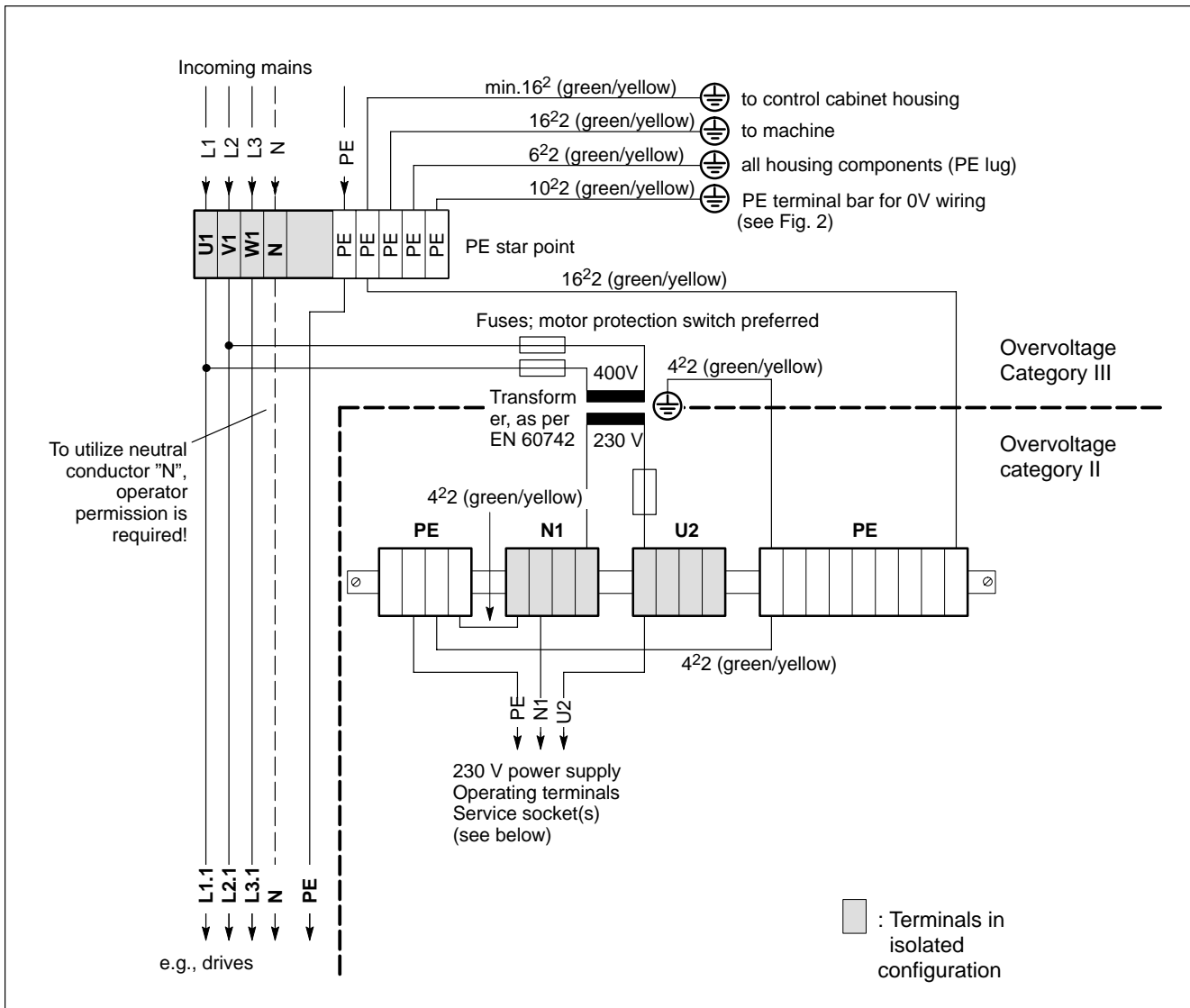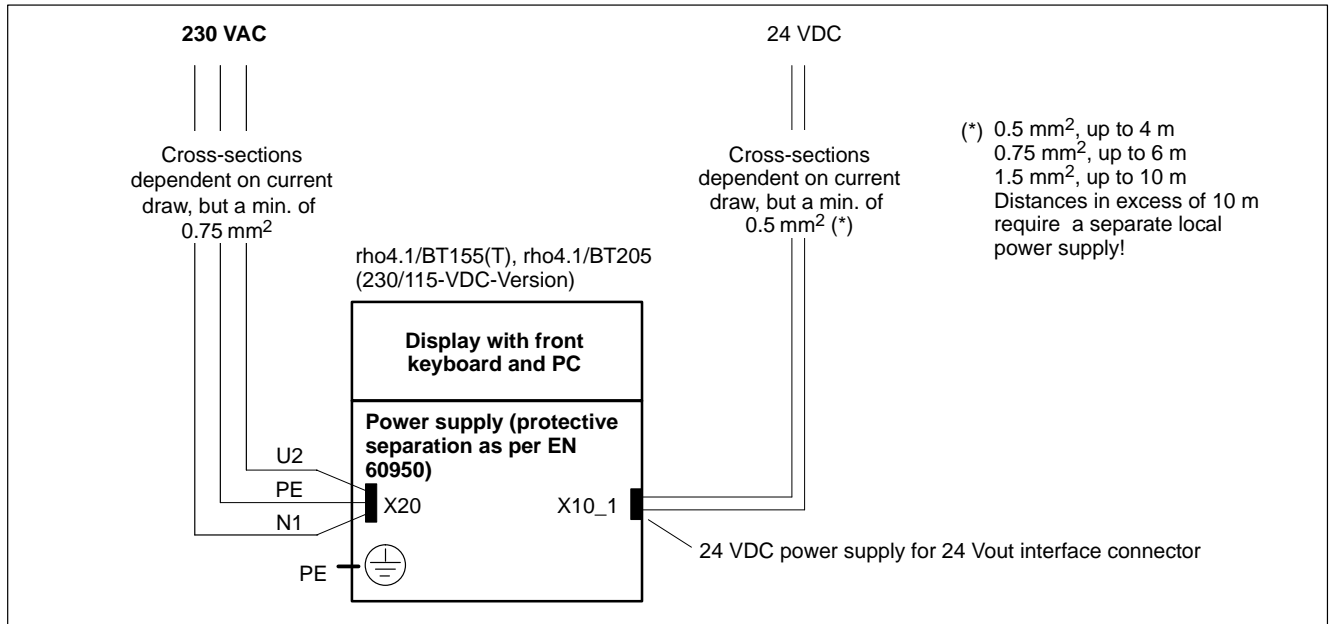|	
Rated voltage:	85VAC ... 264VAC; Extended-range input
Current draw at U_N = 230 VAC:	0.6 A
Current draw at U_N = 115 VAC:	1.2 A
Inrush current at 230 VAC:	30 A cold start 25 °C
at 115 VAC:	15 A cold start 25 °C
Input fuse:	1.25 A (5x20) medium time-lag

Electrical Connections

Power connection 230 VAC via separation transformer

Incoming mains

L1 L2 L3 N

PE

min.16^2 (green/yellow) — to control cabinet housing

16^{2}2 (green/yellow) — to machine

6^{2}2 (green/yellow) — all housing components (PE lug)

10^{2}2 (green/yellow) — PE terminal bar for 0V wiring (see Fig. 2)

U1 V1 W1 N   PE PE PE PE PE   PE star point

16^{2}2 (green/yellow)

Fuses; motor protection switch preferred

400V   4^{2}2 (green/yellow)

Overvoltage Category III

Transformer, as per EN 60742   230 V

Overvoltage category II

To utilize neutral conductor "N", operator permission is required!

4^{2}2 (green/yellow)

PE   N1   U2   PE

4^{2}2 (green/yellow)

PE N1 U2

230 V power supply
Operating terminals
Service socket(s)
(see below)

L1.1 L2.1 L3.1 N   PE

e.g., drives

: Terminals in isolated configuration

Electrical Connections

230 VAC   24 VDC

Cross-sections
dependent on current
draw, but a min. of
0.75 mm^2

Cross-sections
dependent on current
draw, but a min. of
0.5 mm^2 (*)

(*) 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
require a separate local
power supply!

rho4.1/BT155(T), rho4.1/BT205
(230/115-VDC-Version)

**Display with front
keyboard and PC**

**Power supply (protective
separation as per EN
60950)**

U2

PE

N1

X20

X10_1

PE

PE

24 VDC power supply for 24 Vout interface connector

Electrical Connections

Notes:

Interfaces

6 Interfaces

6.1 Overview

The table below describes the connector types integrated into the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 robot controllers and the required mating connectors.

	Label on housing	Interface service	Connector type (integrated)	Mating connector or cable
Connectors standard interfaces				
o	COM1	Serial port: RS-232, freely assignable	Male DB 9 pin	Female DB 9 pin
o	COM2	Serial port: R-232 – reserved for BT1555T with touch screen – freely assignable for BT155/205	Male DB 9 pin	Female DB 9 pin
o	COM3	Serial port: RS-232 – for kbd download or freely assignable	Male DB 9 pin	Female DB 9 pin
o	COM4	Serial port: RS-232 – for UPS logic, reserved	Male DB 9 pin covered	–
o	LPT1	Parallel port: Supports SPP, EPP, ECO modes	Female DB 25 pin	Male DB 25 pin (e.g. printer cable)
o	Ethernet	Ethernet Network connection:	Female RJ45 connector, 8 pin.	Male RJ45 connector, 8 conductor, twisted pairs
o	24 Vout	Keyboard code output	Female DB 15 pin	Male DB 15 pin
o	DP slave	PROFIBUS-DP Keyboard codeoutput (slave)	Female DB 9pin	Male DB bus IP20 9 pin
o	VGA	VGA connection for external CRT monitor	Female VGA HD connector, 15 pin	Monitor cable with male VGA HD connector, 15 pin
o	USB	USB port	USB socket 4 pin	USB plug 4 pin
o	KBD	PS/2 mini DIN keyboard	Female mini DIN PS/2, 6 pin	Keyboard cable with male mini-DIN PS/2, 6 pin
o	Mouse	PS/2 mini-DIN mouse	Female mini-DIN PS/2, 6 pin	Male mini-DIN PS/2, 6 pin
rho4.1connection				
o	X10	24 VDC, PHG-power supply, READY-contacts, acknowledgement button, Emergency STOP	Male Weidmüller push-lock terminal, MSTB 1.5, 14 pin	Female Weidmüller push-lock terminal, MSTB 1.5, 14 pin
o	X31	V24_1	Male DB 9 pin	Female DB 9 pin
o	X32	V24_2	Male DB 9 pin	Female DB 9 pin
o	X33	V24_3	Male DB 9 pin	Female DB 9 pin
o	X34	V24_4	Male DB 9 pin	Female DB 9 pin
o	X35	Connector PHG2000	Female DB 25 pin	Male DB 25 pin
o	X41	Ribbon connector (optional)	Female DB 15 pin	Male DB 15 pin
o	X51	CAN-Bus 1	Male DB 9 pin	Female DB 9 pin
o	X52	CAN-Bus 2	Male DB 9 pin	Female DB 9 pin

Interfaces

	Label on housing	Interface service	Connector type (integrated)	Mating connector or cable
PCI_rho4.1 card				
e	SERCOS interface	Light wave conductor (LWL)	LWL conductor	
e	Interface on the PCI_rho card (external)	Combi-connection for CAN, increm. encoder (optional), measuring sensor, serial IF, power supply, PHG, READY signals.	Female DB 44 pin	Male DB 44 pin
r	Interface on the PCI_rho card (internal)	Interface for connection AF:PCI rho	Male inline connector 44 pin	Female inline connector 44 pin
Connector power supply (already described in section 5.3)				
o	X20	PC power supply: 230/115 VAC, alternative to X10_1	PC power cable connector, male	Netzleitung mit Kaltgeräte-BuchsePower cord with female PC connector
o	X10_1	PC power supply 24 VDC, alternative to X20. Power supply of 24Vout	Male Weidmüller push-lock terminal, MSTB 1.5, 4 pin	Female Weidmüller push-lock terminal, MSTB 1.5, 4 pin
Other connectors				
c	X76	CD-ROM and floppy disk power supply	CD-ROM and FDD female mains connector 4 pin on carrier board	CD-ROM and FDD male mains connector 4 pin (Conductor Y-Power)
m	IDE2	IDE-data connector for 3.5" floppy disk drive and CD-ROM drive	Male inline connector 44 pin (IDC) on motherboard	Female inline connector 44 pin (IDC) (Ribbon cable floppy disk and CD-ROM drive)
c	X53	PS/2 mini-DIN keyboard	Female mini-DIN PS/2, 6 pin	Keyboard cable with male mini-DIN PS/2, 6 pin
c	–	Connector for LC display	Male inline connector, multi-polar	Female plug connector, multi-polar Cable to front panel LCD
c	–	Front panel keys	Male inline connector 50pin	Female inline connector 50 pin Cable to front keyboard card
c	X19	Battery	Male inline connector 2pin	Female inline connector 2 pin cable to int./ext. Battery
c	–	IDE hard disk	Male inline connector 44 pin (on carrier board)	Female inline connector 44 pin (data cable for IDE hard disk)
f	KBD	Keyboard (BT front LCD)	Female MF2, 5 pin	Male MF2 DIN, 5 pin

Connector location:
o= Top of housing
c= Bottom of housing (on carrier board),
f= Front of control terminal,
m= On mother board,
e = External cable connection,
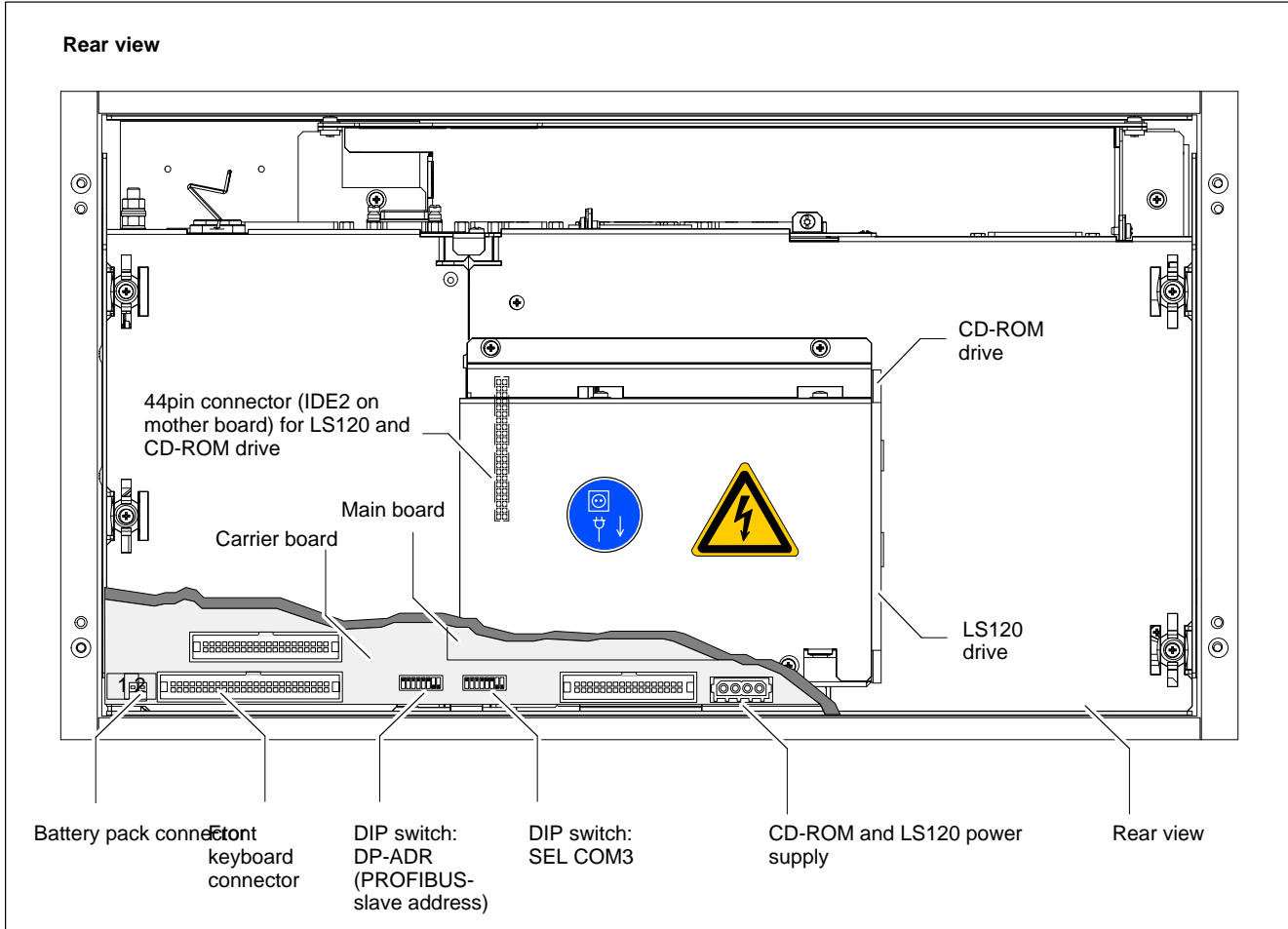r = rho4.1 connection (internal)

Interfaces

Port and connector layout

All externally accessed connectors are located on the top of the device.
All connectors are clearly labelled.
Additionally the DIP switches SEL COM3 and DP-ADR on the underside
can be set.

Interfaces

Rear view

CD-ROM
drive

44pin connector (IDE2 on
mother board) for LS120 and
CD-ROM drive

Main board

Carrier board

LS120
drive

Battery pack connector   Front
keyboard
connector

DIP switch:
DP-ADR
(PROFIBUS-
slave address)

DIP switch:
SEL COM3

CD-ROM and LS120 power
supply

Rear view
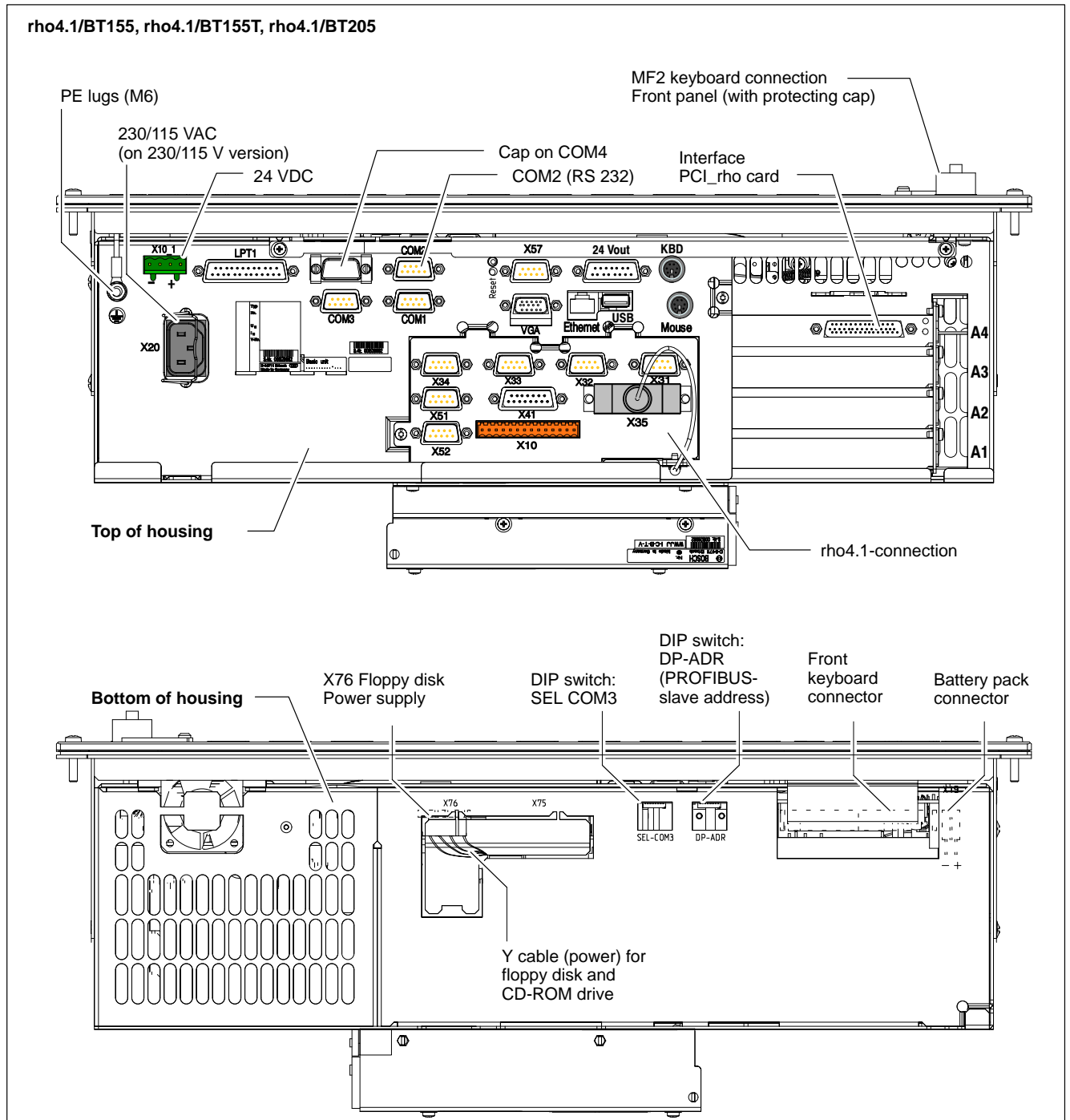
Interfaces

6.2 Serial PC ports COM1...COM4, USB

6.2.1 Pin assignment

☞   **CAUTION**
Functional failures caused by poor screening!
Use only metallic or conductive connector/coupling shells providing large-area screen contact.

COM1   **Serial port, freely assignable**

Male DB-9 pin connector

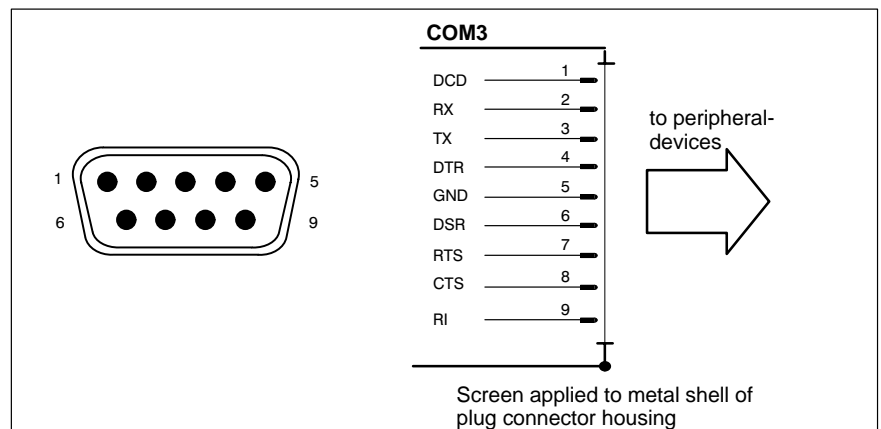|	
Type:	RS-232
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	Max. 115200 bps
Handshake:	Hardware and software handshake (XON, XOFF)
Interrupt (IRQ):	4
I/O address:	3F8H or AUTO (recommended)
BIOS preset:	COM1: Enabled
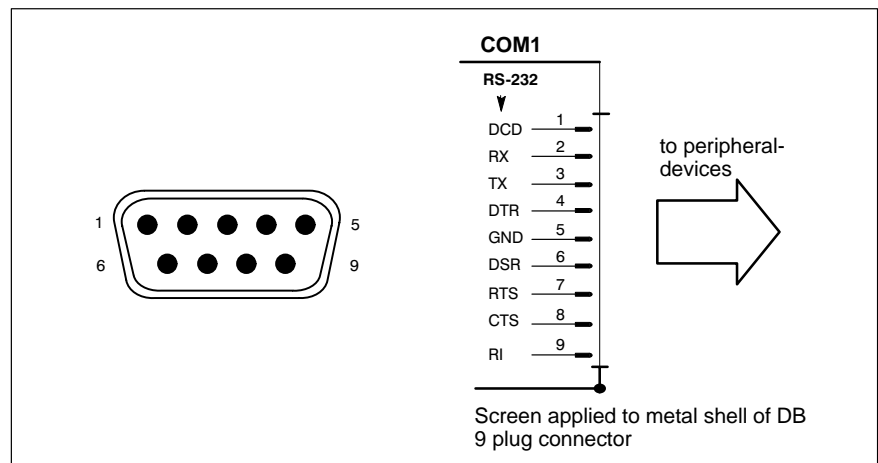
Assignment as an RS-232:

DCD	Data Carrier Detect. RCV channel used, for example, by a connected modem to inform the PC that it is receiving a carrier signal (active connection).
RX	Receive Data. Line on which data is received.
TX	Transmit Data. Line on which data is transmitted to peripheral.

Interfaces

DTR	Data Terminal Ready. XMIT channel used by the PC to signal to a connected peripheral device that its interface is switched on and initialized.
DSR	Data Set Ready. RCV channel used by the connected peripheral device to inform the PC that it is switched on and inilitalized.
GND	Signal Ground
RTS	Request to Send. RCV channel used by the connected peripheral device to signal to the PC that is wishes to transmit data.
CTS	Clear to Send. XMIT channel used by the PC to signal to the connected peripheral device that it is permitted to transmit data.
RI	Ring Indicator. Receive line on which a connected modem informs the PC of the presence of an active call.
Screen	Contact with housing frame via metallic shell of the D-Sub connector.

COM2   Serial port, assigned to touch screen

The COM2 on the rho4.1/BT155T is reserved for the connection to the touch screen controller.

☞ **For rho4.1/BT155 and rho4.1/BT205 without a touch screen the port
is freely available.**

Male DB-9 pin connector	
Type:	RS-232
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	Max. 115200 bps
Handshake:	Hardware and software handshake (XON, XOFF)
Interrupt (IRQ):	3
I/O address:	2F8H or AUTO (recommended)
BIOS preset:	COM2: Enabled

Interfaces
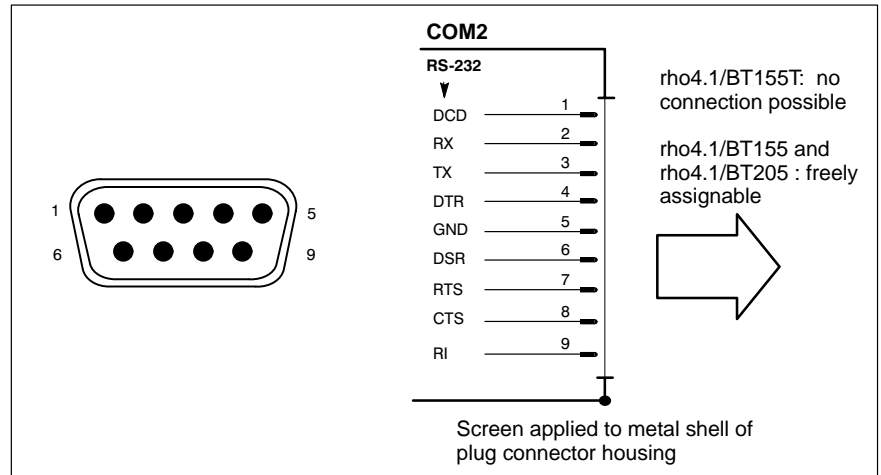
Refer to page 6–5 for explanations on pin assignments.

COM3 Serial port

For applications that require a software download of new key codes, COM3 is used internally. The software download is only possible if the COM3 port is connected to the keyboard controller by the DIP switch SEL COM3. In this case the download runs from the BT via COM3 (see section 7.5.3).

Male DB, 9 pin connector	
Type:	RS-232
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	Max. 115200 bps
Handshake:	Hardware/software handshake (XON, XOFF)
Interrupt (IRQ):	10
I/O address:	3E8H
BIOS preset:	COM 3: Enabled

Refer to page 6–5 for explanations on pin assignments.

Interfaces

COM4   **Serial port, assigned to UPS logic
(see section 3.2)**

COM4 is internally assigned to the Uninterruptible Power Supply (UPS).
The port connector is fitted with a cap at the factory.

Male DB, 9 pin connector	
Type:	RS-232
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	Max. 115200 bps
Handshake:	Hardware and software handshake (XON, XOFF)
Interrupt (IRQ):	11
I/O address:	2E8H (if equipped for free assignment)
BIOS preset:	COM4: Enabled
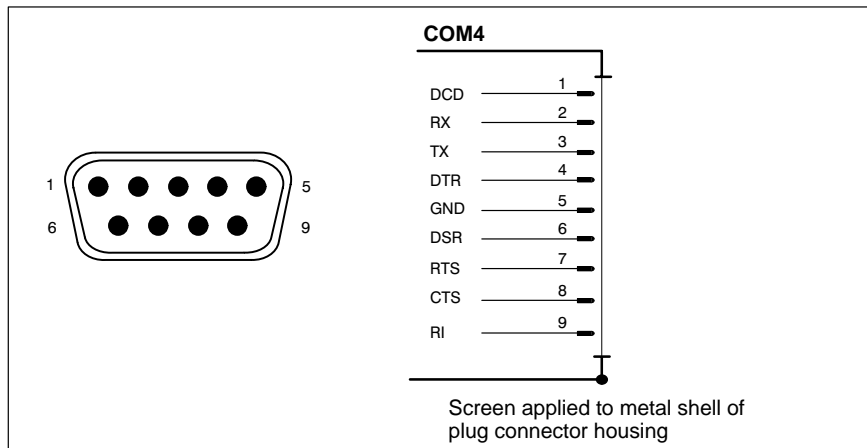
Refer to page 6–5 for explanations on pin assignments.

USB   **Serial interface (Universal Serial Bus), currently not supported**

The USB interface provides for the connection of up to 128 devices
equipped with USB functions.

USB socket, 4-pin
BIOS preset: USB controller: Disabled
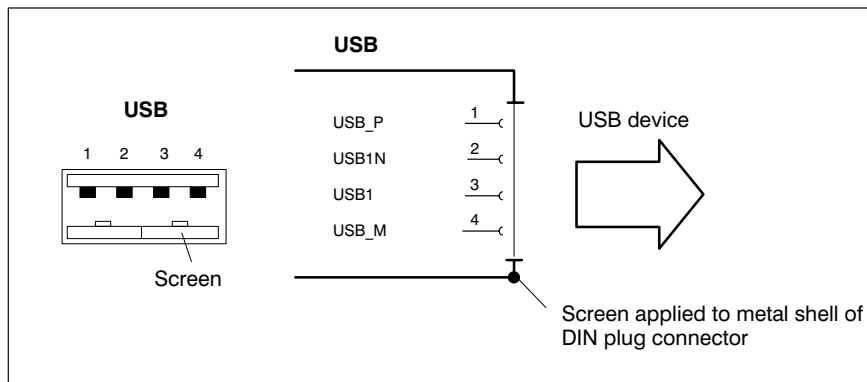
Interfaces

PIN	Function
1	USB power supply (max. 500 mA)
2	File
3	File
4	USB Ground

Interfaces

6.2.2   COM1...COM4 settings

Control Panel

Settings for the transfer parameters for the serial ports.
Please refer to the description contained in the installed Windows NT
operating system   under "Settings, Control Panel, etc."

BIOS

The default BIOS presets for COM1 (serial port A) and COM2 (serial port
B) are **AUTO** (automatic parameter assignment). If you desire direct pa-
rameter assignment, you should adopt the following settings:

- COM1 = 3F8H
- COM2 = 2F8H

COM3 and COM4 (serial ports C and D) are factory-set as "available",
i.e. **(Enabled)**.

CAUTION
**Interrupt (IRQ) and I/O address must correspond to BIOS set-
tings.**

**In the case of address conflicts regarding COM3/4, e.g. if IRQ
10 or 11 are already in use by other PC expansion cards, free
IRQs must be used instead.**

Interfaces

6.3 LPT1 parallel port

LPT1 **Parallel port for printer, scanner, etc.**

Female DB, 25 pin
connector

Type:	SPP (ex works), EPP, ECP
Cable length:	Max. 3 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Interrupt (IRQ):	7
I/O address:	AUTO or 378H (recommended)
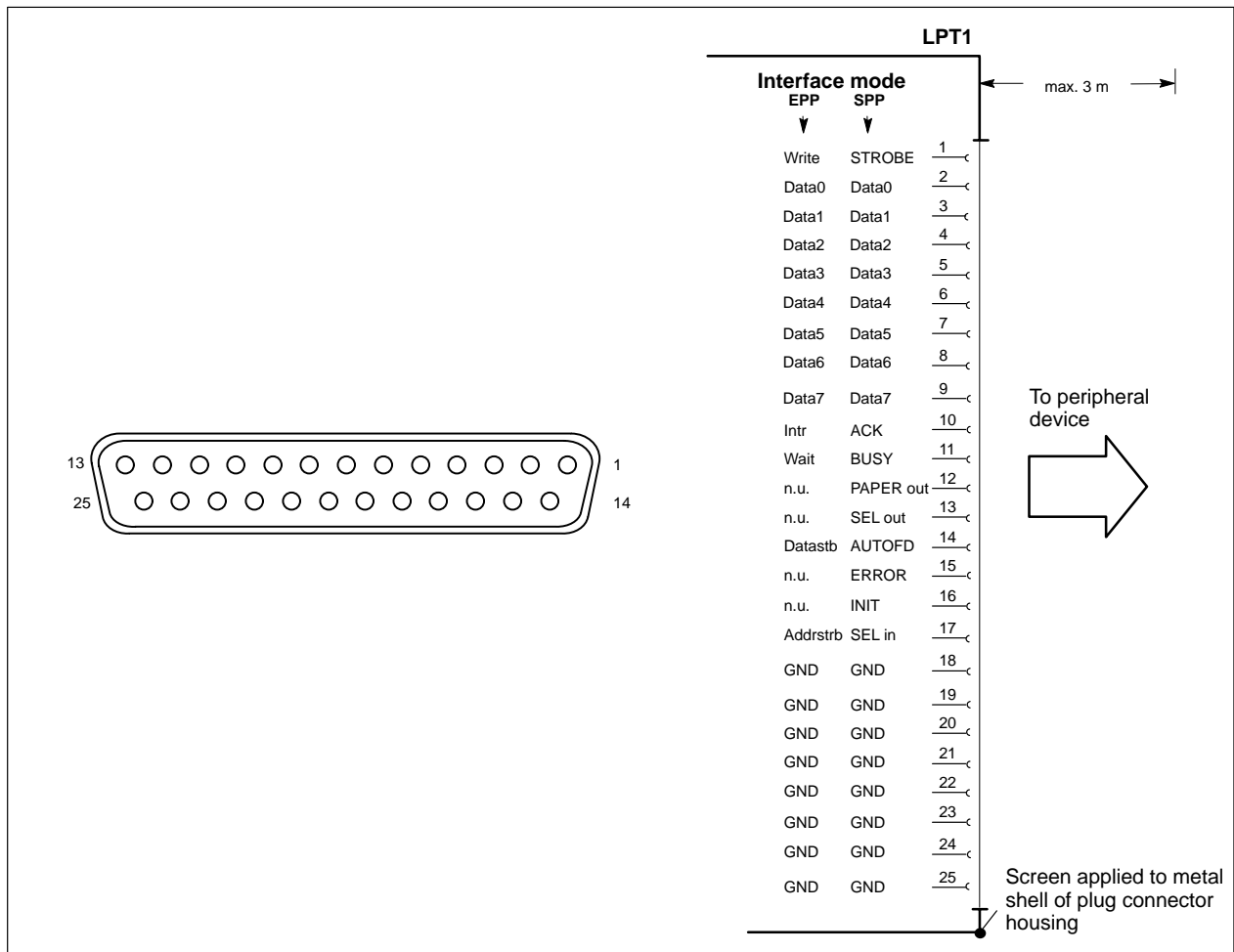
The parallel port normally runs in the default SPP mode. Provided that suitable peripheral devices are present, it can also be operated in EPP (Enhanced Parallel Port) or ECP (Extended Capabilities Port) mode. The operating mode is changed in the BIOS settings.

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

Interfaces

6.4   Ethernet-interface

Ethernet network connection

The Ethernet connection allows the PC to communicate on an Ethernet network. To facilitate data communications, the required network protocols (e.g. TCP/IP) must be recognized by the operating system and the network application programs running on the PC.

Female RJ45 connector, 8 pin.	
Type:	Ethernet 10 Base T
Cable length:	Max. 100 m
Cable type:	Screened, twisted pair
Transmission rate:	10 10Mbit/s or 100Mbit/s
Interrupt (IRQ):	5
I/O address:	340H
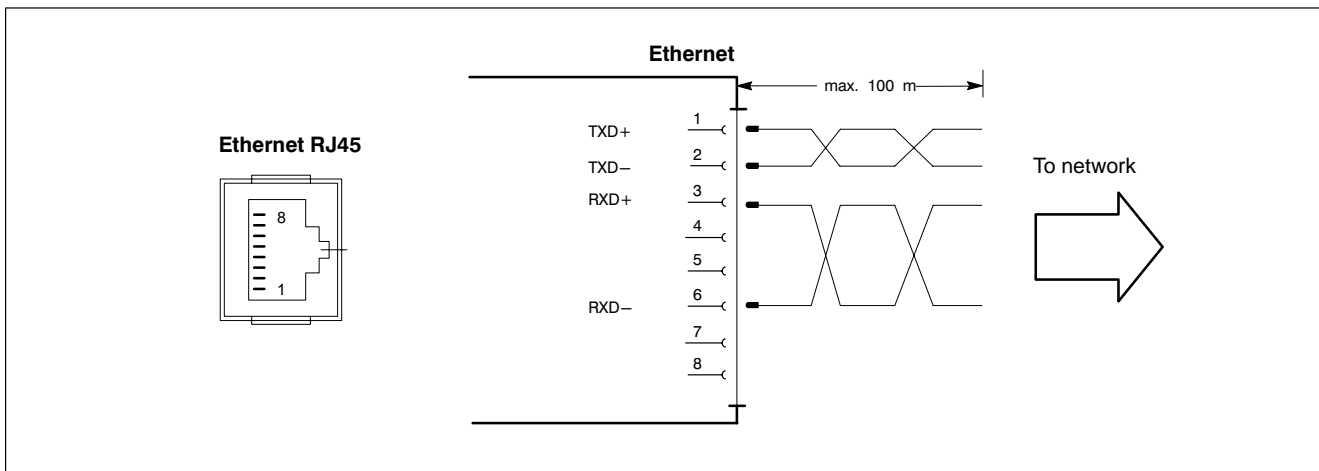
The driver configuration functions for the network connection can be accessed via the task bar or via the Control Panel under the Network Card symbol. A dialog box allows the selection of data transmission speed over the network e.g. 10 Mbit/s or 100 MBit/s.

☞ **Note that the network card of the remote communication partner must be able to handle the same data transfer rate.**

Interfaces

6.4.1 External monitor

VGA **External monitor port**

The VGA port accepts an external monitor (CRT) for operation via the built-in video adapter. The external monitor can be operated in parallel with the operator panel.
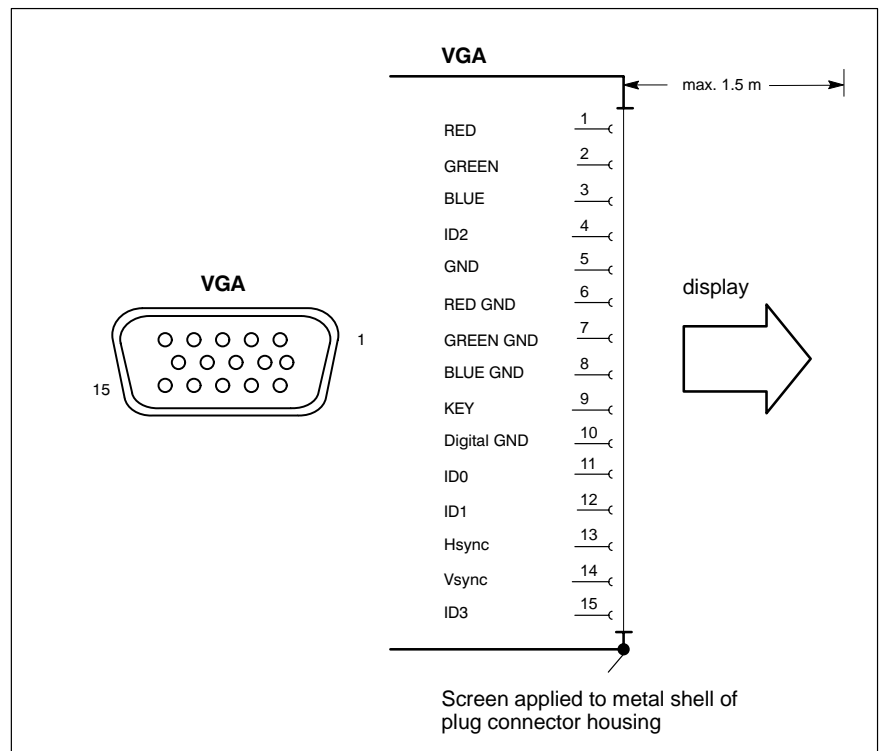
● Video RAM: 2 MB

☞ **The insertion of a graphics card disables the integrated video adapter.**

HD socket 15 pin

Cable length:	Max. 1.5 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Max. resolution:	1280 x 1024 pixels, max. 16 million colours

Interfaces

CRT monitor resolution

It should be noted that it is technically possible to bypass the stated resolution and colour settings by changing them in the Control Panel while the rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 are running. However, such changes would again be overwritten during a subsequent system start:

- VGA mode: 640 x   480 pixels, 72 Hz, 24 bit colours
- SVGA mode: 800 x   600 pixels, 72 Hz, 24 bit colours
- XGA mode: 1024 x   768 pixels, 72 Hz, 16 bit colours
- SXGA: 1280 x 1024 pixels, 72 Hz,   8 bit colours

CAUTION
Setting incorrect resolutions and colours can destroy your monitor!
Observe the specifications applying to your CRT or LCD monitor, and adapt the operating system parameters accordingly.

Recommended monitors for external use are low-radiation models to TCO99. In addition, you should achieve the desired display resolution at a refresh rate of no less than 72 Hz.

Interfaces

6.5   Keyboard ports

KBD   MF2 front-panel keyboard port

MF2 DIN socket, 5 pin

Cable length:	Max. 1.5 m
Cable type:	Screened, min. cross-section 0.14 mm^2
BIOS preset:	System Keyboard: Present
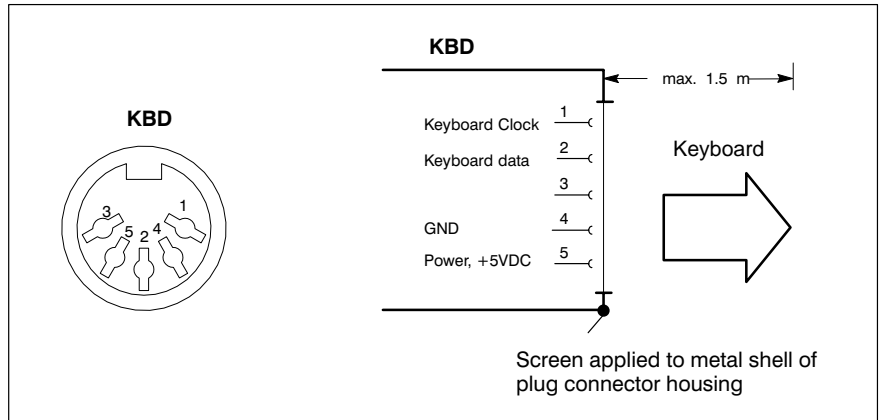
KBD and X53   PS/2 mini-DIN keyboard port

Female mini-DIN PS/2, 6 pin

Cable length:	Max. 1.5 m
Cable type:	Screened, min. cross-section 0.14 mm^2
BIOS preset:	System keyboard: Present
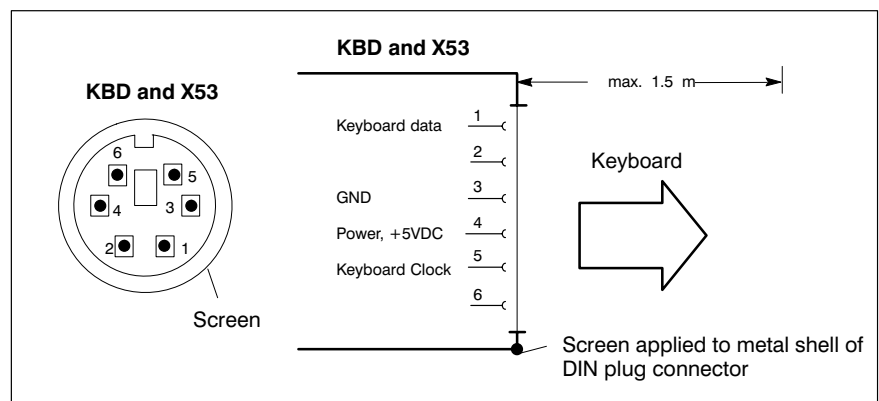
☞ **Only one of the two connectors may accommodate an external keyboard. Otherwise, proper functioning cannot be guaranteed.**

Interfaces

Keyboard adapter

In the event that the MF2 keyboard is equipped with a standard DIN plug, you will require a keyboard plug adapter to a female PS/2 mini-DIN connector.

A suitable adapter is approx. 20 cm in length with a DIN connector and a mini-DIN coupling at the ends. Connector assignment as per diagram below.
These pre-fabricated adapters are available from computer stores.

Adapter for PS/2 connector

Screen

Screen

PS/2 mini-DIN connector (male)   **Standard DIN connector (female)**

Mini-DIN keyboard port on PC

1		2
2	Keyboard data	3
3		4
4	GND	5
5	Power, +5VDC	1
6	Keyboard clock	

MF2 keyboard port

Screen applied to metal shell of plug connector housing

Screen applied to metal shell of plug connector housing

max. 0.2 m
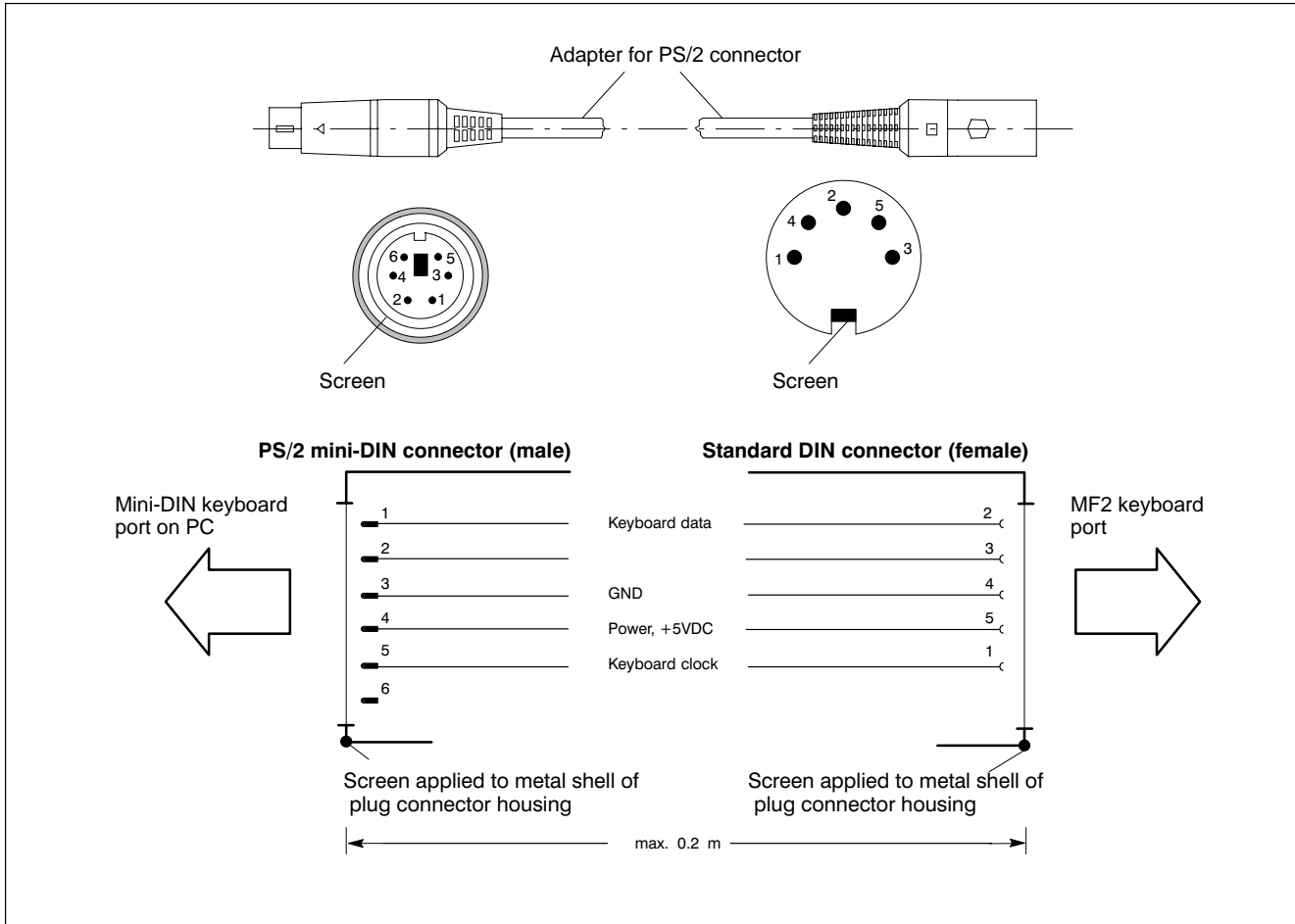
Interfaces

6.6   Mouse port

Mouse   **PS/2 mouse port**

Female mini-DIN PS/2, 6 pin

Cable length: Max. 1.5 m

Cable type: Screened, min. cross-section 0.14 mm^2

Interrupt (IRQ):   12

BIOS preset: Enabled
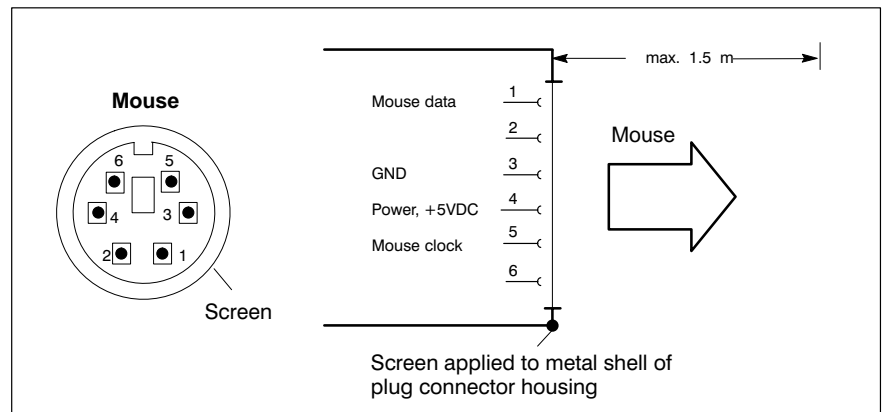
If the system fails to recognize the PS/2 mouse, it must be activated by setting the interface in the BIOS from "Disabled" to "Autodetect".
The operating system will not recognize the insertion of an external mouse after completed startup because the mouse initialization occurs during the boot phase.

☞ **The connected mouse must be PS/2-compatible.**
The BIOS normally reserves IRQ12 for the PS/2 mouse. If there are address conflicts, e.g. if IRQ 12 has already been occupied by another PC expansion card, you should change the IRQ of the expansion card to one that is still free.

Interfaces

6.7   DP slave interface

DP slave   PROFIBUS-DP connector

The keyboard codes of the movement keys and softkeys on the front panel are transferred to the DP slave connector. From there, the key codes can be copied via an external PROFIBUS-DP station for further processing. For keyboard codes see page 7–11.

Female DB 9 pin

Cable length: depending on baud rate
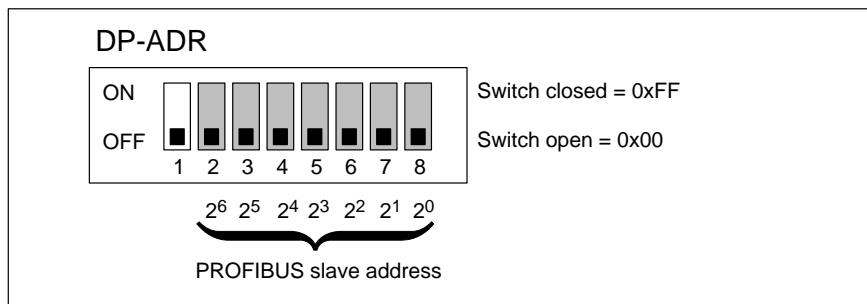   (as per EN 19245, part 3):
                                 500 kBit/s   400 m
                                 1500 kBit/s   200 m
                                 3000 kBit/s   100 m
                                 6000 kBit/s   100 m
                                 12000 kBit/s   100 m

Cable type: Screened, min. cross-section 0.14 mm^2
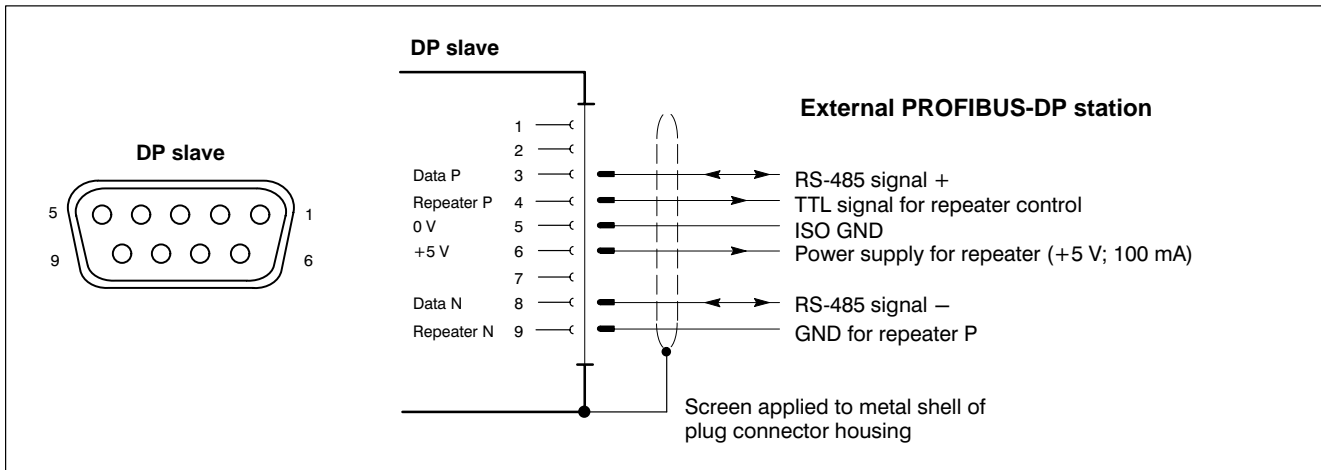
PROFIBUS slave address

The PROFIBUS slave address for the DP slave connection is set using the DP-ADR DIP switches (for location, refer to page 6–3).
A total of 7 switch segments are reserved for this purpose.

☞ **DIP switch 1 must reamin in the "OFF" position; it controls the keyboard controller.**

Interfaces

6.8   24 Vout connector

24 Vout   output key codes

The key codes of the movement keys and softkeys are transferred to eight outputs of the 24 Vout connector. From there, they can be copied via an external PROFIBUS-DP station for further processing.
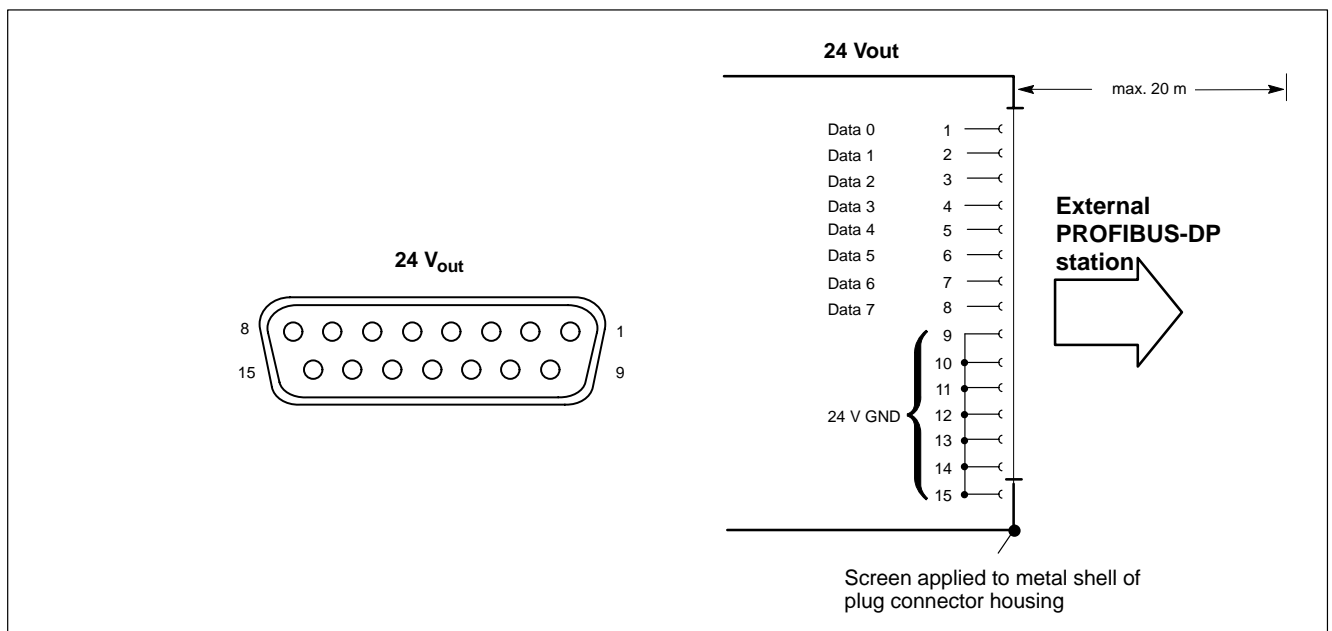For keyboard codes see page 7–12.

Female DB 15 pin

Cable length: Max. 20 m

Cable type: Screened, min. cross-section 0.14 mm^2

Screen applied to metal shell of plug connector housing

☞ **The 24 Vout connector receives 24 VDC power via the X10_1 connector.
X10_1 must also be connected to a control terminal equipped with a 230 VAC power supply.**

Interfaces

6.9   LS120/CD-ROM drive connector

IDE2   connector LS120/CD-ROM drive unit

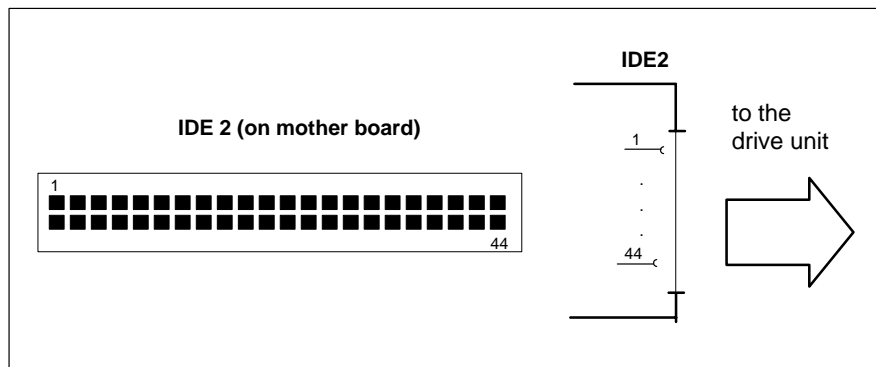LS120 and CD-ROM drive are connected to the IDE2 interface using a
ribbon cable.
The ribbon cable is equipped with one socket for connecting to the IDE2
and two sockets for attaching the two drives.

Male inline connector, 44 pin, internal on the mother board

Cable length: Max. 0.5 m

Cable type: 40-pin ribbon cable, unscreened

BIOS preset: Local Bus IDE adapter: Both

X76   power supply LS120/CD-ROM drive unit

The drives are connected using a Y-Power cable. It is equipped with a
plug for connecting to the X76 and with two sockets for connecting the
LS120 and CD-ROM drives.

Socket, 4 pin, internal on carrier board

Supply voltages: +5 V, +12 V, 0.9 A max.

Pin	Assignment
1	+12 V
2	GND
3	GND
4	+5 V

☞   **The +5 V and +12 V operating voltages are monitored for overvol-
tage and undervoltage conditions. The detection of a faulty voltage
causes the PC power supply to switch off immediately.**

For the installation of the LS120/CD-ROM drive unit see section 8.2.

Interfaces

6.10   rho4.1connection

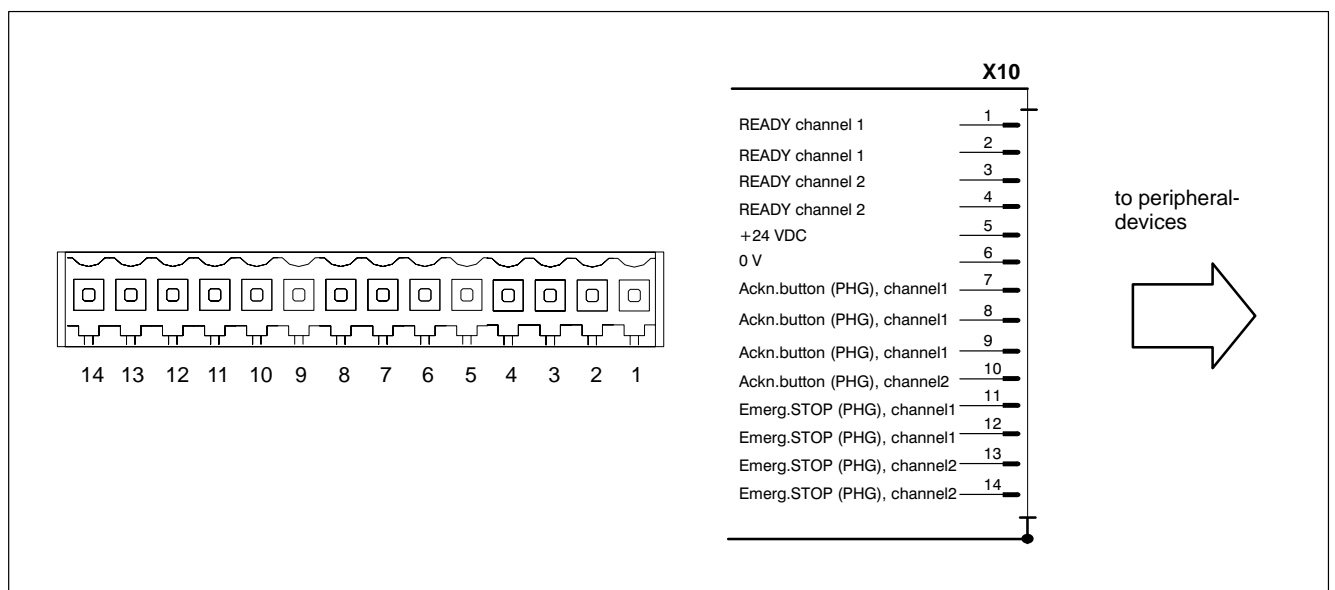**X10**   **PCI rho-interface**

X10 is a real-time interface. It provides:

- PHG power supply, 24 VDC
- Connection for READY-contacts, Emergency STOP contacts and acknowledgement buttons.

Weidmüller push-lock terminal:	MSTB 1.5, 14 pin
Cable type:	Screened, min. cross-section 0.14 mm^2

The mating connector must be ordered separately, see page 10–1.

READY2 relay:

Breaking capacity:	Maximum 32 W
Switching current:	Maximum 0.8 A
Switching voltage DC:	Maximum 40 V
Watch dog time, analogue WD:	50 ms ±22 %

Interfaces

X31, X32   Serial combi-interfaces V24_1 (channel 1), V24_2 (channel 2)

X31, X32 are real-time interfaces. Serial data transmission according to the standards V24 and 20 mA is made possible by the combi-interfaces.

Male DB, 9 pin
connector

### V24

Type:	V24
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Data driver:	Short-circuit resistant, no voltaic separation
Transmission rate:	Max. 19200 bps
Handshake signals:	DSR, DTR

20 mA

Type:	20 mA active
Cable length:	Max. 100 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Transmission rate:	Max. 19200 bps
Data driver:	Short-circuit resistant, no voltaic separation
	No-load voltage: 12 V
	Internal resistance: 464 Ω
	Maximum short-circuit current: 26 mA
Receiver:	up to 4.5 mA is recognised as low
	from 7.5 mA is recognised as high
Handshake signals:	Channel 1 has 20 mA control signal (RTS) for the connection of a PHG

For connecting cable see page 6–23.

☞ **Switching from V24 to 20 mA is achieved via a bridge in the plug from pin 4 to pin 2.**
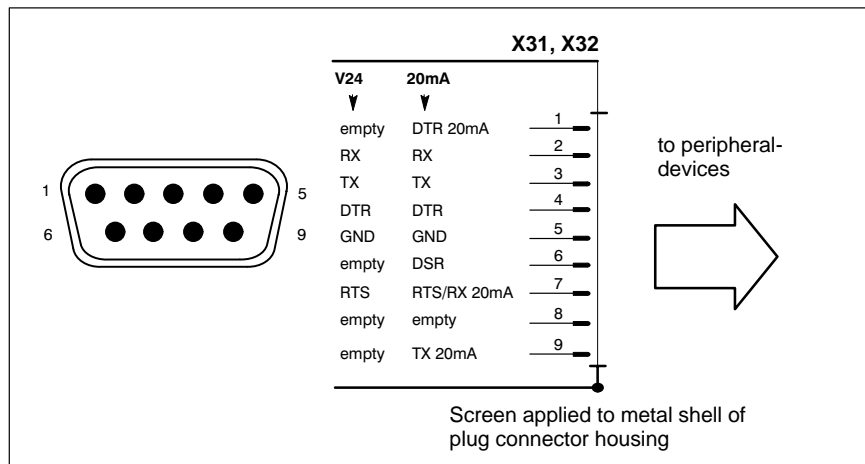
Screen applied to metal shell of
plug connector housing

☞ **The PHG connection X35 and the serial interface X31 must not be occupied simultaneously.**

Interfaces

### X33, X34   Serial interfaces V24_3 (channel 3), V24_4 (channel 4)

X33, X34 are real-time interfaces. Serial data transmission according to the standard V24 is achieved with these interfaces.

Male DB, 9 pin connector

Type:	V24
Cable length:	Max. 15 m
Cable type:	Screened, min. cross-section 0.14 mm^2
Data driver:	Short-circuit resistant, no voltaic separation
Transmission rate:	Max. 19200 bps
Handshake signals:	none
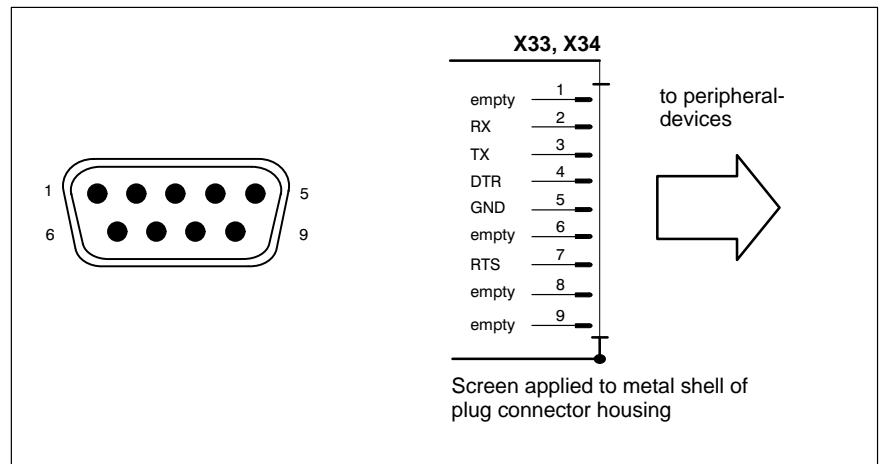
Connecting cable between interface X31..X34 and an external PC (e.g. for ROPS4 coupling):

2 x female DB 9 pin

Cable length: Max. 20 m with internal power supply and a maximum of 350 mA
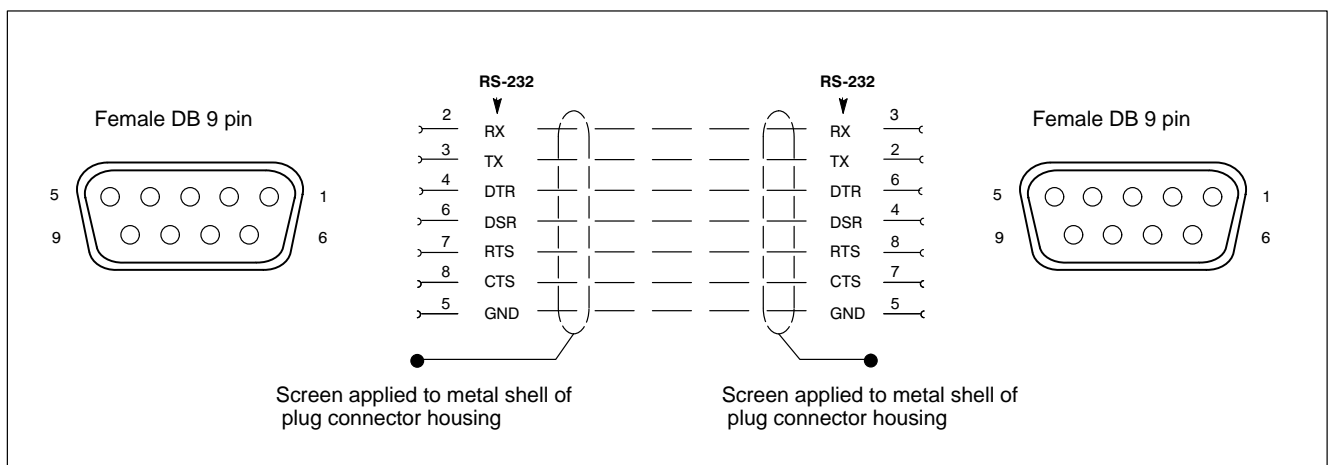
Interfaces

X35 PHG2000

To connect a manual programming unit PHG2000. Serial transmission, 24 V power supply, connection for Emergency STOP contacts and acknowledgement button.

☞ **In order to close the Emergency STOP circuit, the X35 is fitted with a dummy plug as long as no PHG is connected.**
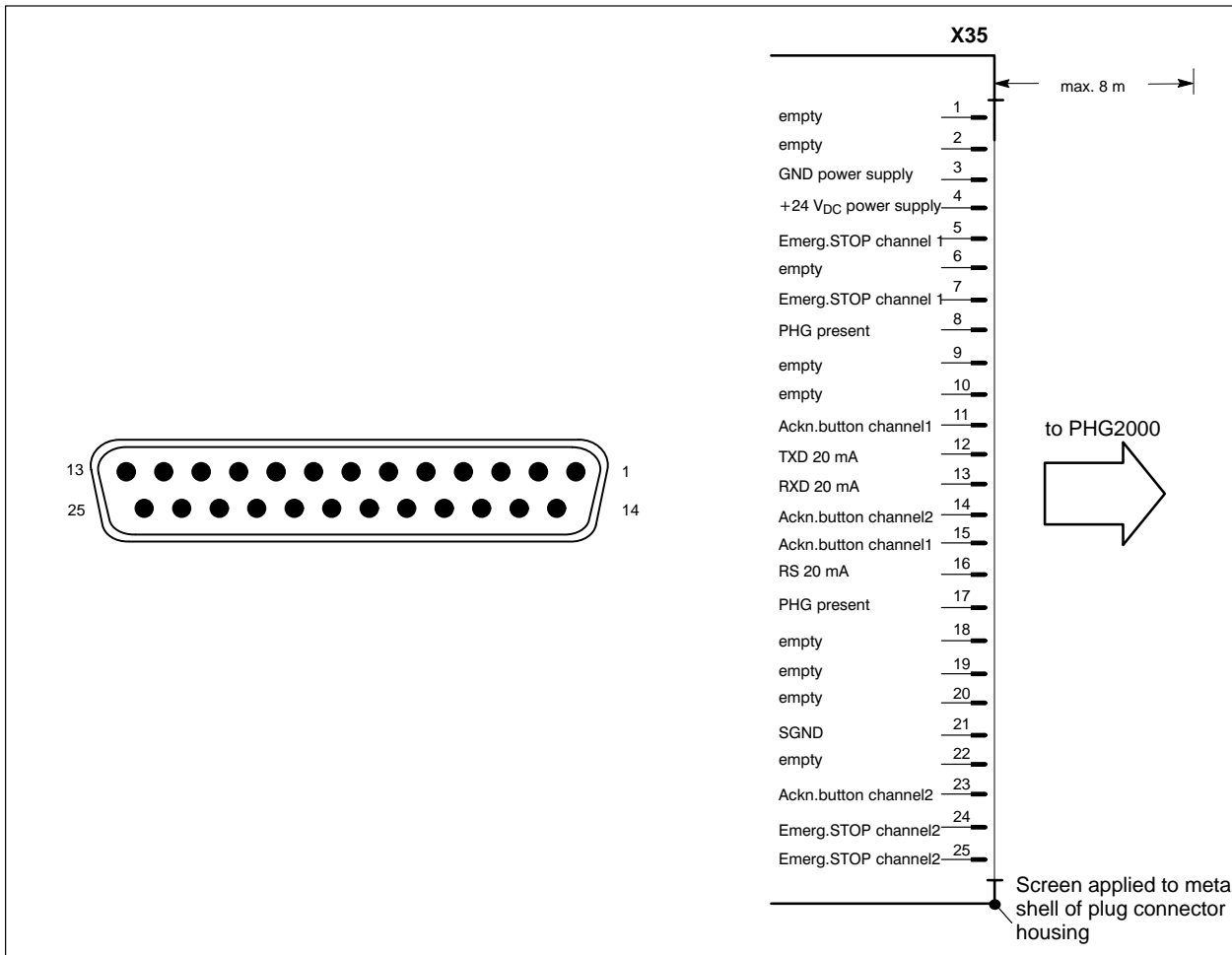
Male DB, 25 pin connector.

Type: Serial 20 mA , plus additional safety functions

Cable type: Screened, min. cross-section 0.14 mm^2

DANGER
In order for the PHG Emergency STOP to work, it must be connected. Otherwise it must not remain attached to the system! Remove a PHG that is not connected.

☞ **The PHG connection X35 and the serial interface X31 must not be occupied simultaneously.**

Interfaces

X41   Incremental interface, measuring sensor

X41 is only active in conjunction with a PCI_rho4 insertion card with in-cremental measurement system input. It contains:

● The incremental interface for encoder s

● The measuring sensor input.

Female DB 15 pin

Cable length:	Max. 20 m with internal power supply and a maximum of 350 mA. A longer cable is pos-sible with external power supply for the en-coder . A possible limitation depends only on the encoder specification.
Cable type:	Screened, min. cross-section 0.14 mm^2

Incremental interface

|	
Maximum input frequency:	800 kHz
Minimum edge separation between active count impul-ses:	≥ 250 ns
Input resistance:	120 Ω
Minimum voltage diffe-rence:	≥ 600 mV
Encoder power supply:	5 V±5 % maximum 0.35 A, 1.75 W. In the event of a short-circuit, the PC switches it-self off
Maximum permitted enco-der current draw:	350 mA

Measuring sensor input

Rapid 24-V-input for measuring sensor, voltaic separation, opto-coupler.

Voltage range 0:	–3 V to 5 V maximum 0.5 A
Voltage range 1:	11 V to 30 V, 4 mA to 30 mA
Switching time (delay):	Maximum 1.5 μs
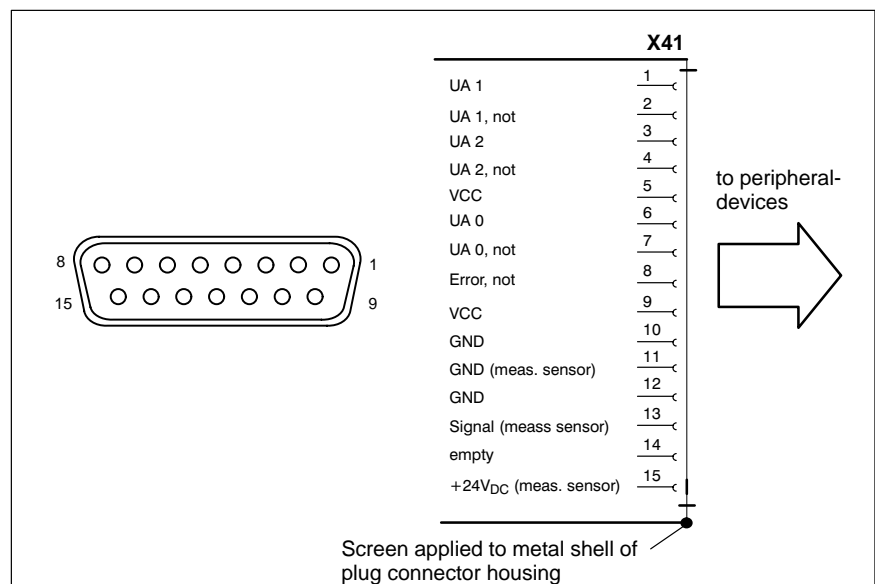
Interfaces

**X51, X52   CAN drives, CANopen encoder , SR-CAN module, CAN application
I/O**

X51 and X52 are two **separate** CAN bus interfaces for:

● Drives
● CANopen encoder
● Digital output module
● Digital input module
● SR-CAN module
● Several rho4 controllers for coupling with each other.

X51, X52 are real-time interfaces.

Male DB, 9 pin
connector
Type: CAN
Cable length: Max. 25 m at 1 MBit/s
                           Max. 200 m at 128 kBit/s
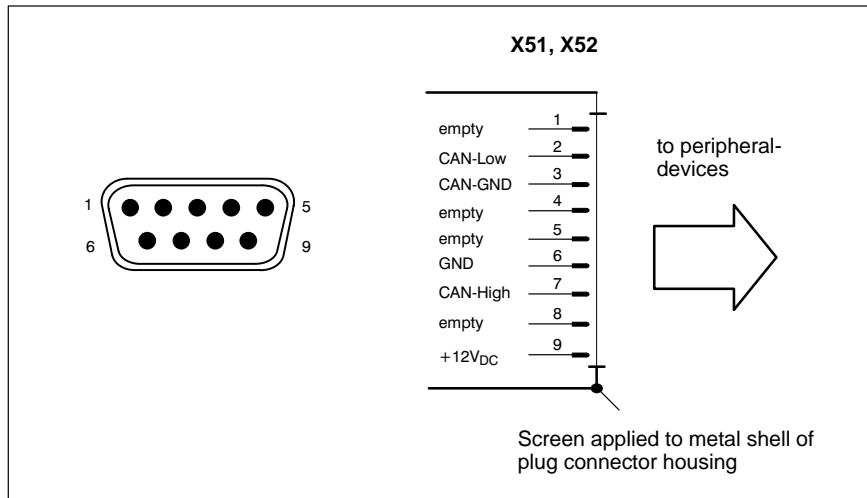Cable type: Screened, min. cross-section 0.14 mm^2
Transmission rate: Max. 1 MBit/s
Data driver: Short-circuit resistant, no voltaic separation
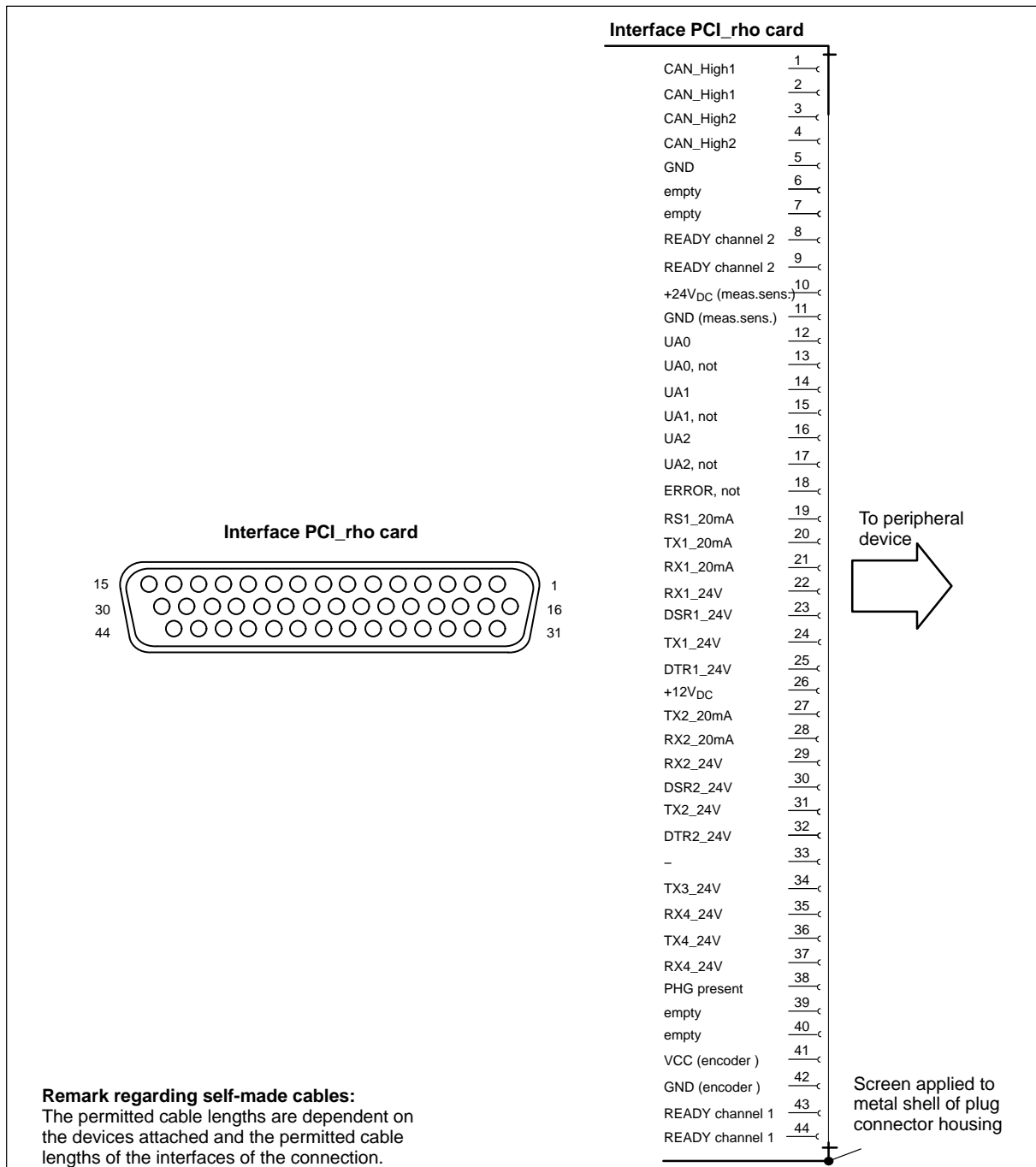Bus connection: 120 Ω internal, cannot be switched off

Interfaces

6.11   Interfaces on the PCI_rho card

The interfaces of the connection (X10, X31..X34, X35, X41, X51..X52) are lead out again to this external interface of the PCI_rho insertion card. The assignment is identical to the internal interface AF_PCI rho.
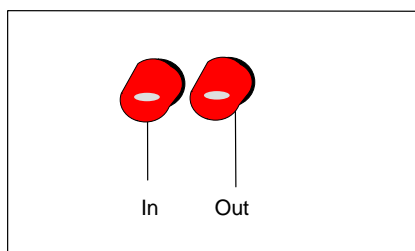
☞ **The interfaces of the connection (X10, X31..X34, X35, X41, X51..X52) and the external interface of the PCI_rho insertion card must not be operated in parallel.**

Female DB, 44 pin connector

Interface PCI_rho card

Pin	Signal
1	CAN_High1
2	CAN_High1
3	CAN_High2
4	CAN_High2
5	GND
6	empty
7	empty
8	READY channel 2
9	READY channel 2
10	+24V$_{DC}$ (meas.sens.)
11	GND (meas.sens.)
12	UA0
13	UA0, not
14	UA1
15	UA1, not
16	UA2
17	UA2, not
18	ERROR, not
19	RS1_20mA
20	TX1_20mA
21	RX1_20mA
22	RX1_24V
23	DSR1_24V
24	TX1_24V
25	DTR1_24V
26	+12V$_{DC}$
27	TX2_20mA
28	RX2_20mA
29	RX2_24V
30	DSR2_24V
31	TX2_24V
32	DTR2_24V
33	–
34	TX3_24V
35	RX4_24V
36	TX4_24V
37	RX4_24V
38	PHG present
39	empty
40	empty
41	VCC (encoder)
42	GND (encoder)
43	READY channel 1
44	READY channel 1

To peripheral device

Screen applied to metal shell of plug connector housing

Interface PCI_rho card

15   1
30   16
44   31

Remark regarding self-made cables:
The permitted cable lengths are dependent on the devices attached and the permitted cable lengths of the interfaces of the connection.

Interfaces

6.12 SERCOS interface

There is a complete SERCOS channel on the PCI_rho card. The connection to the digital drives takes place via the SERCOS interface. The SERCOS interface is a standard serial LWL ring system. The SERCOS interface is designed for a maximum transmission speed of 4 M baud.

For available light wave conductors in various lengths see chapter 10.2 'Accessories' or the manual 'Indramat Verbindungstechnik LWL-Handling', DOK-CONNEC-CABLE*LWL**-AW02-DE-P.
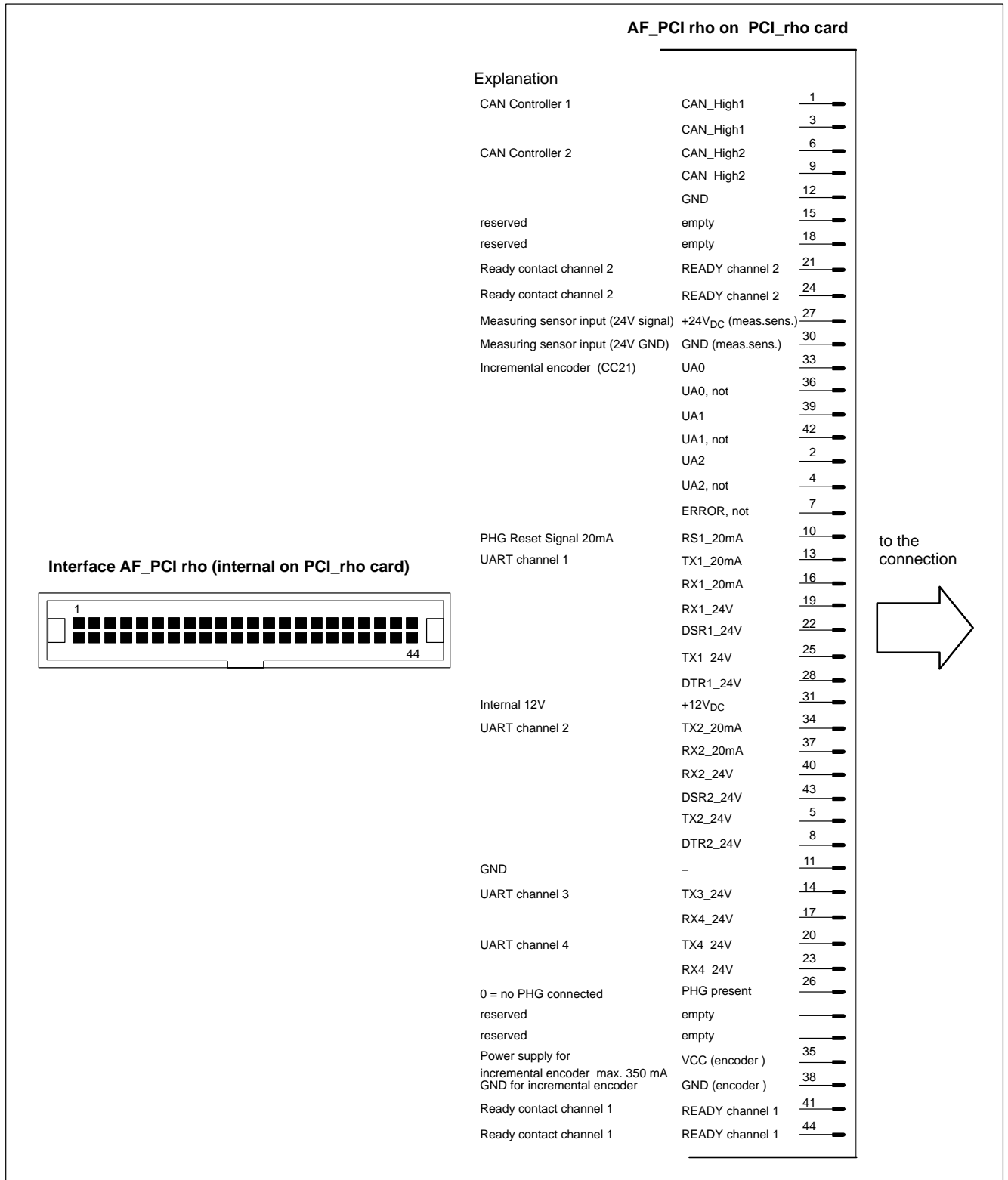
6.13 AF_PCI rho interface

This internal interface connects the rho4.1 connection (X10, X31..X34, X35, X41, X51..X52) to the PCI_rho insertion card.

Male inline connector, 44 pin

Cable type: Ribbon cable, unscreened

Interfaces

AF_PCI rho on PCI_rho card

Explanation

CAN Controller 1	CAN_High1	1
	CAN_High1	3
CAN Controller 2	CAN_High2	6
	CAN_High2	9
	GND	12
reserved	empty	15
reserved	empty	18
Ready contact channel 2	READY channel 2	21
Ready contact channel 2	READY channel 2	24
Measuring sensor input (24V signal)	+24V$_{DC}$ (meas.sens.)	27
Measuring sensor input (24V GND)	GND (meas.sens.)	30
Incremental encoder (CC21)	UA0	33
	UA0, not	36
	UA1	39
	UA1, not	42
	UA2	2
	UA2, not	4
	ERROR, not	7
PHG Reset Signal 20mA	RS1_20mA	10
UART channel 1	TX1_20mA	13
	RX1_20mA	16
	RX1_24V	19
	DSR1_24V	22
	TX1_24V	25
	DTR1_24V	28
Internal 12V	+12V$_{DC}$	31
UART channel 2	TX2_20mA	34
	RX2_20mA	37
	RX2_24V	40
	DSR2_24V	43
	TX2_24V	5
	DTR2_24V	8
GND	–	11
UART channel 3	TX3_24V	14
	RX4_24V	17
UART channel 4	TX4_24V	20
	RX4_24V	23
0 = no PHG connected	PHG present	26
reserved	empty	
reserved	empty	
Power supply for	VCC (encoder)	35
incremental encoder max. 350 mA GND for incremental encoder	GND (encoder)	38
Ready contact channel 1	READY channel 1	41
Ready contact channel 1	READY channel 1	44

to the
connection

Interface AF_PCI rho (internal on PCI_rho card)

1
44

Interfaces

6.14   Expansion Card Interfaces

6.14.1   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
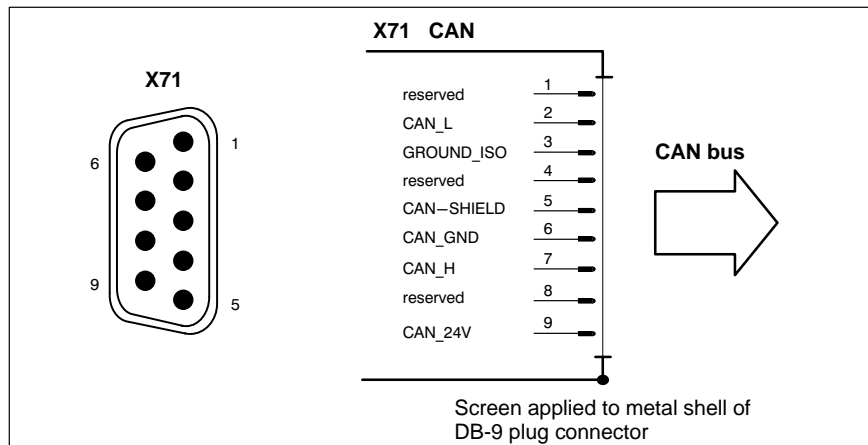
X72   This interface is curently not supported by the rho4.1

Interfaces

X71   Interbus S "PCI_BM-IBS"

Female DB-9

Type InterBus-S Remote (as per EN 50178)
:
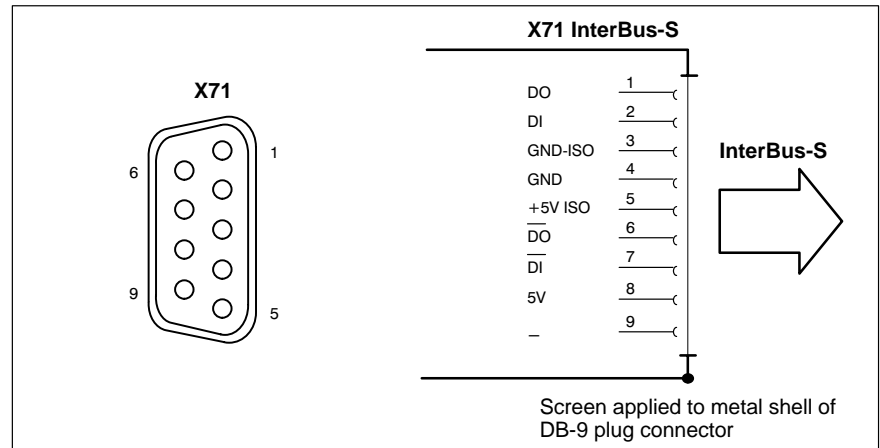
☞ **Please comply with the installation instructions and recommenda-
tions of Phoenix-Contact, e.g. IBS SIG Part 1 UM or the IBS SYS
INST UM installation manual.**

X72   This interface is curently not supported by the rho4.1

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

Interfaces
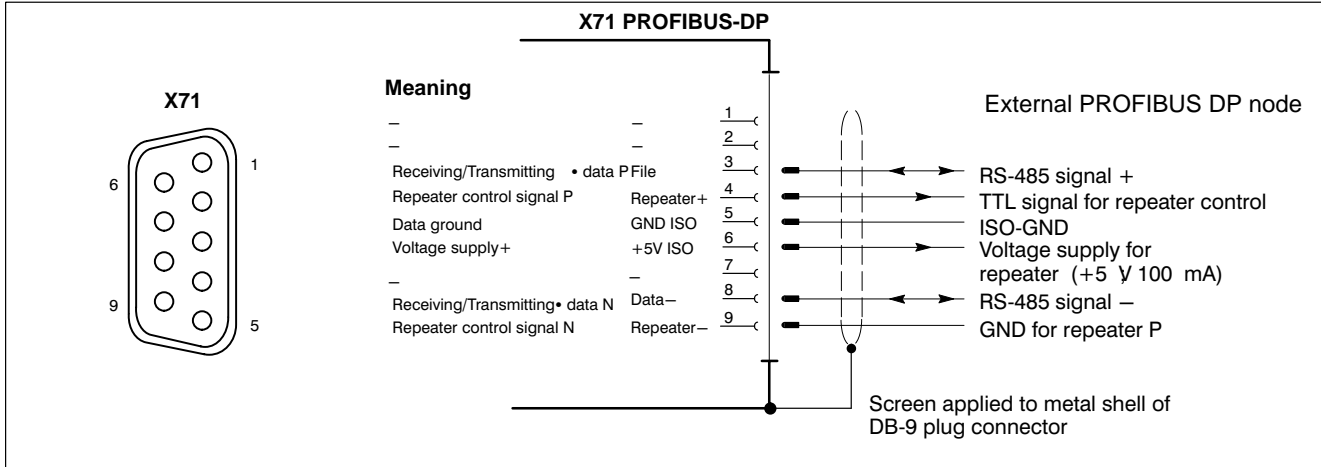
X72   **This interface is curently not supported by the rho4.1**

6.14.2   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
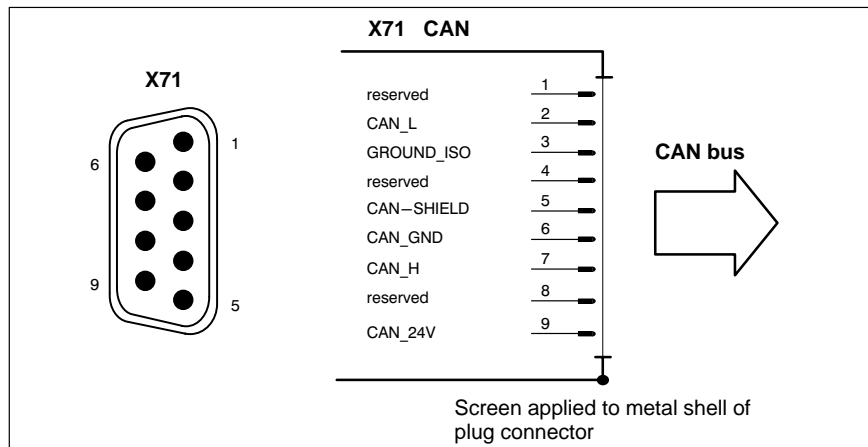
Displays and Operating Controls

7　　Displays and Operating Controls

The following displays and operating control elements are contained in the robot controllers rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205:

- Display, touch screen optional
- LED displays
- Keyboard, DIN keyboard connector
- Front panel legends
- Keyboard controller
- Keyboard mouse

7.1　　Display

All robot controllers are equipped with a flat screen display using LCD technology.

For optimum legibility the following is recommended:

Type	Display resolution	No. of colours
rho4.1/BT155 and rho4.1/BT155T	640 x 480 pixels (factory setting)	max. 256,000
rho4.1/BT205	800 x 600 pixels (factory setting)	max. 256,000

Brightness and contrast are preset at the factory. The display colours can be adapted to operating requirements via the operating system or by means of the application software.

For the purpose of maintenance procedures on the display, the front panel of the control terminal can be folded away toward the front while still installed. For a detailed description of the display removal procedure, refer to section 8.3.

Displays and Operating Controls

7.1.1   Backlight switch-off

The fluorescent backlight tube provides the background lighting for the TFT display. After approx. 15,000 operating hours, because the tube has a limited service life, it will produce only 50% of its original brightness. Refer to section 8.3 for information about replacing the backlight unit.

To extend the service life of both display and backlight tube, the flat screen display features a timer ("sleep") function for the backlight .
This function "darkens" the display when no operation has occurred on the control terminal for a defined period of time. The length of the defined interval can be selected in the PC BIOS and in the Windows Control Panel.

Any keyboard input, mouse movement or contact with the touch screen will again activate the backlight, and the display will again appear.

☞ **If when in the "darkened" state keyboard input, mouse movement or contact with the touch screen does not cause the backlight to be switched on, as a rule this can be achieved by pressing the key combination <CTRL> + <Tab>.**

Activating the backlight timer:

★   In the BIOS setup program, go to the "Power Management Setup" menu option. Select the "OnBoard LCD Backlight Timer OFF" submenu, and select a time interval between 28 seconds and 14 minutes.

★   In your operating system, install a screen saver such as "Blank Screen" that will switch the display to a "black signal" (blank screen, i.e. no objects visible on the display). Select the "Wait" period after which the screen saver will be activated. The interval selected here is added to the "Backlight Timer OFF" interval that was selected in the BIOS.

☞ **Ensure that the period set for screen saver activation is shorter than the time for activation of the backlight switch-off. If this is not the case, in certain circumstances it can lead to problems with display reactivation.**

Displays and Operating Controls

7.1.2   Touch screen

In the rho4.1/BT155T a touch screen is employed, that permits operation using the contact-sensitive surface of the display.
Mechanical considerations prohibit the installation of the touch screen in a control terminal featuring a 12.1 in. display.

The COM2 serial port is reserved for communications between the touch screen controller and the PC system. The external COM2 port connector must therefore not be used to connect any devices.

The operation of the touch screen requires appropriate software drivers for the respective operating system; these are preinstalled at the factory. Modifications can be made in the **Elo Touchscreen** application program in the "Control panel" in Windows.

Starting Elo Touchscreen opens a dialog box in which the following options and settings are available:

● Mouse pointer response to touch screen contact
  (Mouse Button Emulation Mode)

● Calibrating the touch screen by "tweaking" the touch screen coordinates to match the screen coordinates (Calibrate button).

● Setup button (COM port, etc.)
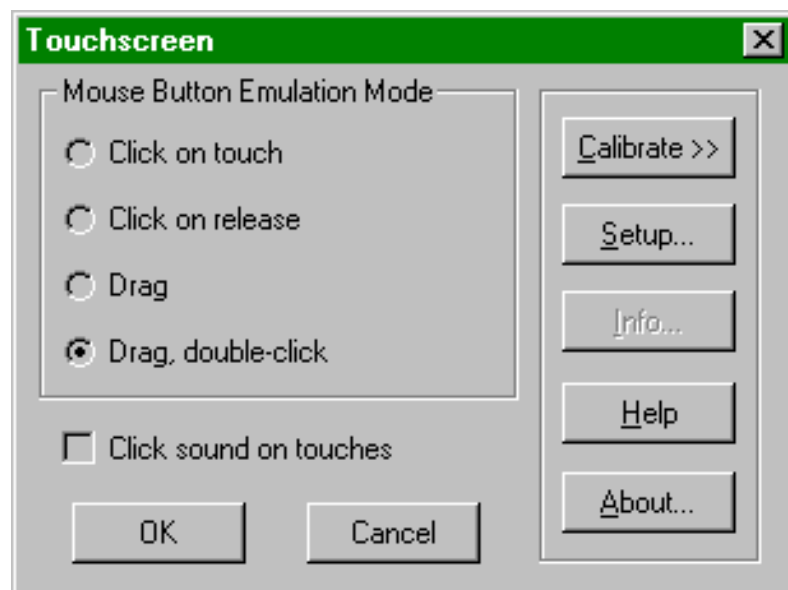
☞ **To obtain detailed online Help information, select the "Help" button in the "Touchscreen" dialog box.**

Displays and Operating Controls

7.2   **LED displays**
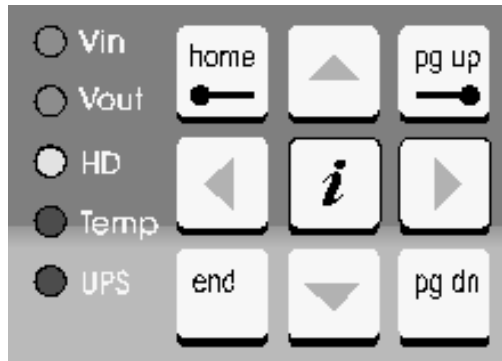
On the front panel there are 5 LEDs with the following meaning:

LED	Display	Explanation	Remedial measure
V_{in}	LED green	Standard operation	–
	LED Off	No 230/115 V AC or 24 V DC power supply	Check mains power input on power supply.
VOut	LED green	Standard operation	–
	LED Off	No internal +5 V/+12 V power available	Check mains power input on power supply.
HD	LED yellow	Hard disk access	–
Temp	LED Off	Standard operation	–
	LED flashes red	Internal housing temperature above 50°C, shutdown will occur if temperature continues to rise.	Lower ambient temperature. Check PC cooling fan.
UPS	LED Off	Standard operation	–
	LED red	Device is currently operating in battery mode i.e. no mains power available.	Restore power supply and inititate controlled PC restart.
	LED flashes red	Battery pack discharged, defective or not connected	Check battery charge level. Maintain 5 hour charging cycle.

There is also a RESET button with LED on the plug side:

LED	Operating panel/display	Explanation	Remedial measure
RESET	Button	Trigger a reboot.	–
	LED red	RESET button has been pressed.	–

Displays and Operating Controls

7.3   Keyboard

7.3.1   Blocks of function keys

All blocks of function keys can be programmed via the **application pro-gram**:

- 2 vertical rows of 8 keys each, to the right and left of the display.

  Key designations, left-hand key column: 1...8
  Key designations, right-hand key column: 1...8

- 2 horizontal rows of 9 keys each, below the display
  (e.g. for the common industrial softkey functionality)

  Key designations, row 1: F1...F8, level return
  Key designations, row 2: S1...S8, ZOOM

The labelling can also be changed for all function keys, see section 7.4.

Function keys   Function keys   Function keys

Function keys
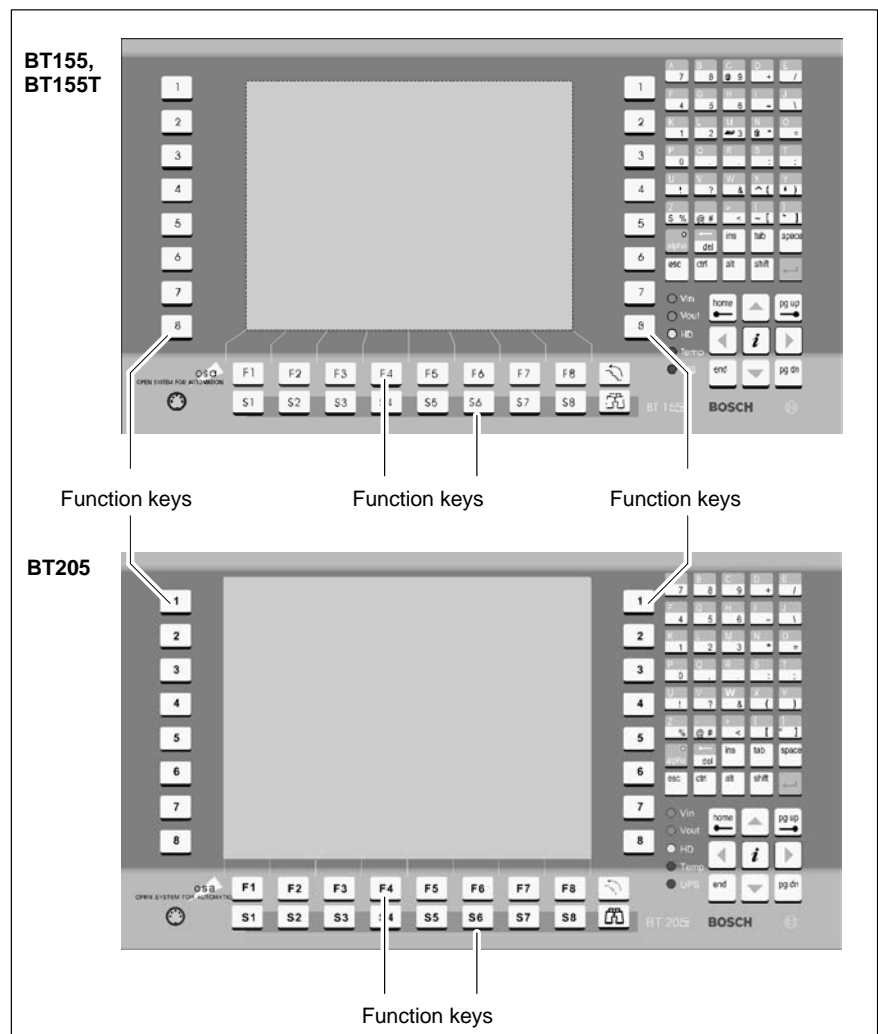
Displays and Operating Controls

7.3.2   ASCII, number and cursor control blocks

The following blocks of keys are permanently assigned. However, the assignment can be changed by Rexroth at customer request:

- **ASCII and number block** (block of 40 keys to the right of the display)
- **Cursor control block** (block of 9 keys, bottom right corner beside display)
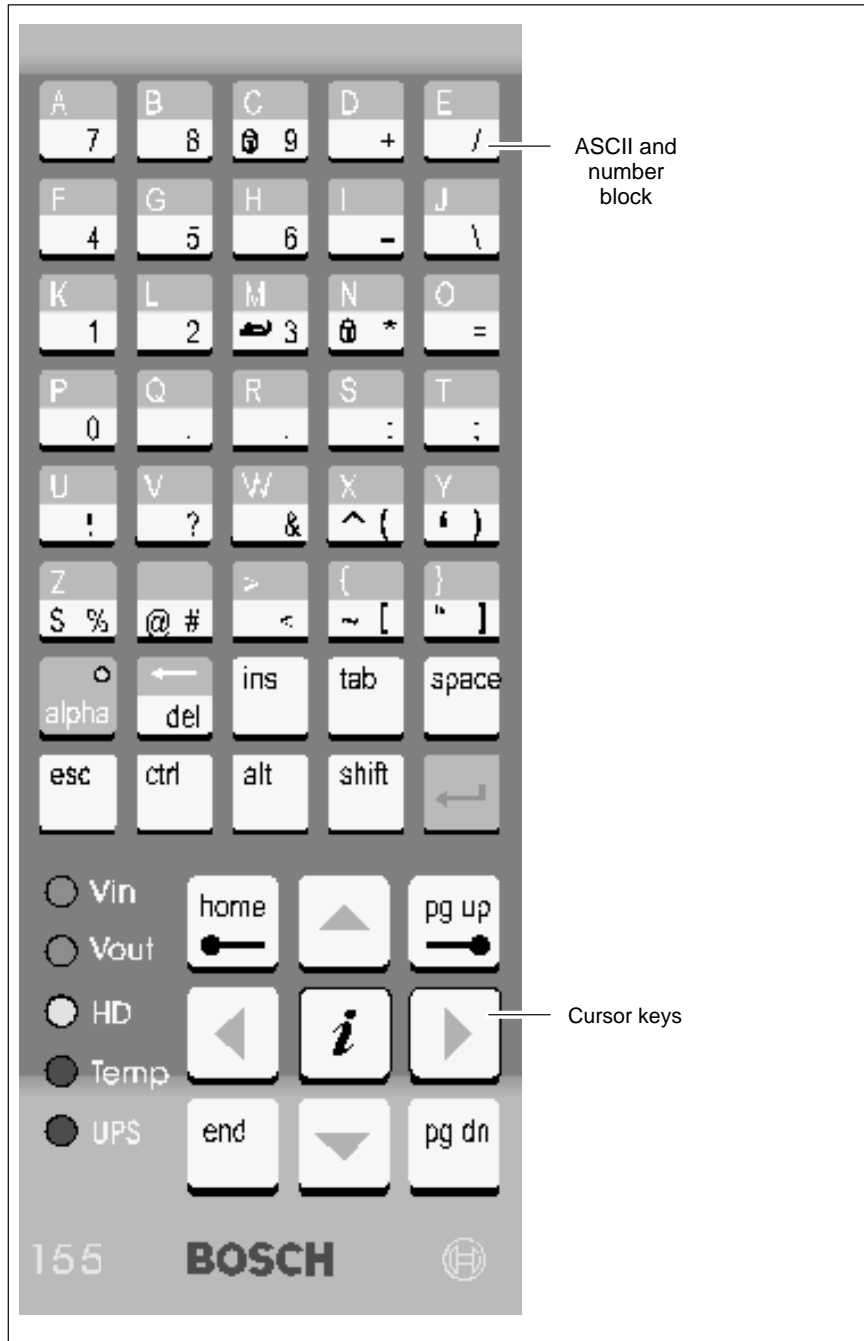
Displays and Operating Controls

ASCII and number block key assignments

- ASCII characters and various special characters
- alpha　　　(access to special characters and special functions, refer to section 7.3.3)

　　del　　　(Delete)

　←　　　　(Backspace)

　　ins　　　(Insert)
　　tab　　　(Tab)
　　space　　(Space)
　　esc　　　(Escape)
　　ctrl　　　(Control)
　　alt　　　(Alternate)
　　shift　　(Upper / lower case)

　↵　　　　(Return)

Cursor block key assignments

Covering the following key designations:

- Cursor keys: Right Arrow, Left Arrow, Up Arrow, Down Arrow keys
- home　　　(to Home pos.)

　　end　　　(to End pos.)
　　pg up　　(to Top of page)
　　pg dn　　(to End of page)

7.3.3　Special key functions

The alpha key can be used to invoke the following special functions:

- Keyboard mouse <Alpha> + <M>
- CAPS Lock　　　<Alpha> + <C>
- NUM Lock　　　<Alpha> + <N>

Keyboard mouse

<alpha> + <M> enables the keyboard mouse. This key function toggles back and forth.

When enabled, a keyboard mouse replaces the mouse movement by means of the **cursor-keys**. The cursor control block function is no longer available.

Displays and Operating Controls
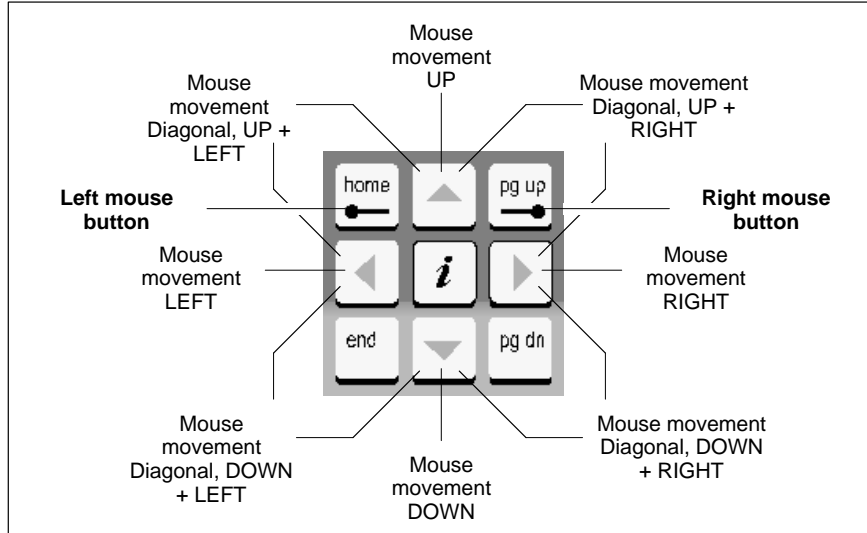
The active keyboard mouse is indicated by the LED of the alpha key in the following manner:

Keyboard mouse	Alpha key LED **prior to** activating the keyboard mouse	Keyboard mouse	Alpha key LED **after** activating the keyboard mouse
Disabled	Off	Enabled	Flashing: **Short On / long Off**
Disabled	On	Enabled	Flashing: L**ong On / short Off**

☞ **In the event that during startup or after a RESET an external mouse is inserted, it will be recognized automatically, and the keyboard mouse disabled. It will then not be possible to re-enable the keyboard mouse, not even by removing the external mouse. The PC has to be re-booted.**

CAPS-Lock

<alpha> + <C> activates CAPS-Lock. This key function toggles back and forth.
The function is confirmed by the "Caps " LED.
The CAPS-Lock function fixes the access to capital letters, special characters, etc., until it is again de-selected.
Pressing the <shift> key disables the CAPS-Lock function.

NUM-Lock

<alpha> + <N> activates NUM-Lock. This key function toggles back and forth.
Confirmation via "Num " LED.
The NUM-Lock function activates the numerical keypad on an external DIN keyboard.

Displays and Operating Controls

7.4   **Front panel legends**

Providing for customer-specific terminal legends, individual insertion labels can be inserted at the outside edges, and pushed under the plastic film of the front panel:

- Type designation and corporate logo
- Function key columns to the left and right of the display
- Function key rows below the display
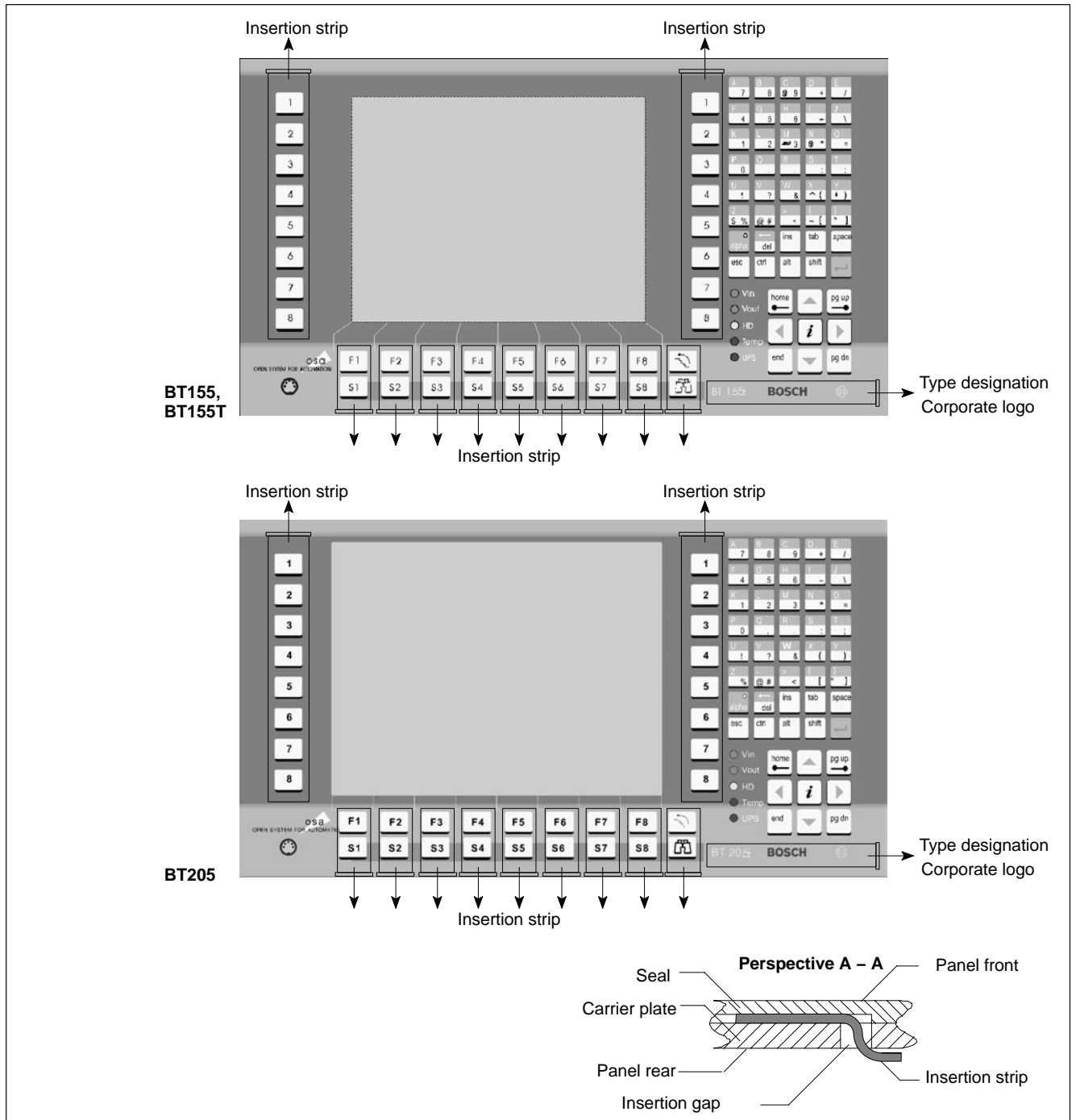
Displays and Operating Controls

The insertion strips/labels are inserted and pushed through an insertion gap at the rear of the front panel.

☞ **When preparing to insert a label, it is helpful to start by inserting a flexible plastic or metal strip of approx. 0.1 mm thickness that is slightly longer than the label. On this strip, the insertion label can be mounted more easily. Remove the plastic or metal strip after installation of the insertion label.**

The table below indicates the dimensions of the various insertion strips.

Type	Dimensions [mm]
Type designation, corporate logo	124.8 x 18
Keys 1 to 8	22 x 195
Function keys	22 x 44.2

Replacing insertion labels

1. The control terminal must be switched off and de-energized.

2. Remove the mounting screws holding the front panel on the installation frame.

3. If necessary, also remove all cable connections on the BT.

4. The insertion gaps for the insertion labels are located at the rear of the front panel. Replace the old insertion labels with new ones.

5. Installation is in reverse sequence to disassembly described above.

6. Restore power to the system. Ensure that the label is easily read, and that the keyboard labels correspond to the function indicated on the label.

☞ **In certain circumstances, faulty labelling may cause faulty operation of the connected machine!
Check and verify that the legends on the insertion labels correctly match the function of the labelled keys.**

Displays and Operating Controls

7.5   Keyboard controller

For many industrial applications it is important to determine the key sta-
tus (pressed/not pressed, key LED ON/OFF) of the front panel keybo-
ard.
To this end, a keyboard controller scans the front panel keyboard and
transfers the key codes to various interfaces.

7.5.1   Scanning front panel keyboard

The keyboard controller transfers the current status of the front panel
keyboard to various interfaces:

● to the PC via MF2
● to the PROFIBUS slave station
● to the 24 Vout outputs

Via these interfaces, the supplied codes can then be further processed
by the respective application program.

Transferring key codes to the PC via MF2

The 1st input byte contains the following values (in the standard ver-
sion):

BT155, BT155T, BT205	
Keys	**MF2 key code**
Overview:	shift + space
Display basic screen:	ctrl + home
Info:	shift + return
Softkeys F1 to F8:	F1 to F8
Softkeys S1 to S8:	shift + F1 to shift + F8
Movement keys 1 to 4 left of display:	F9 to F12
Movement keys 5 to 8 left of display:	shift + F9 to shift + F12
Movement keys 1 to 4 right of dis-play:	ctrl + F9 to ctrl + F12
Movement keys 5 to 8 right of dis-play:	ctrl + shift + F9 to ctrl + shift + F12
Standard ASCII character set	1,2,3,... a,b,c,...
Cursor block	Cursor: Left, Right, Up, Down, home, end, pgup, pgdn
'''',$', '|', '~', '''', '^', '@';, ''', are entered with the alpha key pressed down	Alpha active: Alt + ...

Displays and Operating Controls

☞ **The alpha key is a toggle function, which does not return a key code. It controls the keyboard controller. When the alpha key is active, the key LED illuminates.**

The alphanumerical keys, and the <ctrl>, <alt> and <shift> keys in particular, have the same effect as those on a standard PC keyboard.

Transfer to the PROFIBUS slave station / to the 24 Vout outputs

By default, the codes of the following keys are transferred:
- Movement (motion) keys
- Softkeys

BT155, BT155T, BT205	
Key	**Key code to:** **– PROFIBUS slave** **– 24 Vout output**
Softkeys F1 to F8:	0x20 to 0x27
Softkeys S1 to S8:	0x28 to 0x2F
Movement keys 1 to 8 (left of display):	0x10 to 0x17
Movement keys 1 to 8 (right of display):	0x18 to 0x1F
No key pressed:	0x00
Arrow keys:	0xFF
pg up, pg dn:	0xFF

PROFIBUS slave station

The key transfer uses codes via 8 input bytes sent to the PROFIBUS slave.

24 Vout outputs

The key codes are placed on the 24 Vout outputs in bit-encoded form. The value indicated in the preceding table corresponds to the 1st input byte.
The respective outputs can then be read via an external PROFIBUS station.

Displays and Operating Controls

7.5.2   Exceptions when keys are pressed simultaneously

When keys are pressed simultaneously, the key code output is suppor-
ted by special processing logic.
Only in the case of movement keys is simultaneous key actuation not
supported; only one key may be active at a time:

- 2 movement keys are pressed: Key code of first recognized key is
output

- Releasing key that was pressed   No code is output
first:

☞ **If a movement key is pressed, all other key actuations will be igno-
red until a movement key no longer remains pressed.**

7.5.3   Software download for keyboard controller

☞ **Customer-specific key codes can be downloaded by Rexroth upon
request and by appointment.**

The BT uses the COM3 serial port to download new key codes into the
keyboard controller.
In the event that problems occur during the download, the first step
should be to check the SEL COM3 DIP switch settings.

The SEL COM3 DIP switch is located on the bottom panel of the control
terminal (see page 6–3). Switch segments 1 and 2 must be in the ”ON”
position.
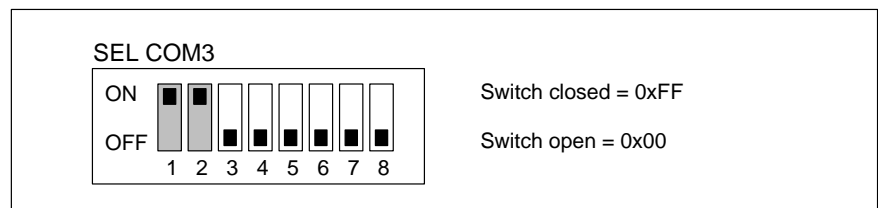
If the download continues to fail, a forced download may be initiated.
This entails explicitly switching the keyboard controller to download
mode by means of the DIP switch DP-ADR, which is also located under-
neath the control terminal.   Set switch segment 1 to ”ON” then reboot the
control terminal to activate the download mode.

Displays and Operating Controls

DP-ADR

ON

OFF

1 2 3 4 5 6 7 8

Switch closed = 0xFF

Switch open = 0x00
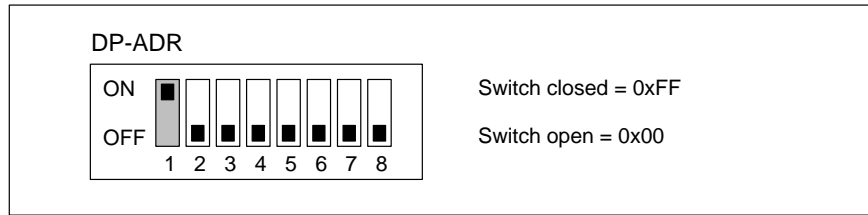
Once the download has been completed successfully, return switch seg-
ment1 of the DP-ADR to the **"OFF"** position.

Maintenance and Replacement

8 Maintenance and Replacement

rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205 are maintenance free. However, some components are subject to wear and must be replaced.

Maintenance schedule

Include the following tasks in your maintenance schedule

- Clean the surface of the screen at least once a week with an anti-static cloth or window cleaning agent containing denatured alcohol.

CAUTION
Dissolution of sealed key panel surface and display seal through contact with solvents!
Do not use any solvents (e.g. paint thinner)!

- At least once a year, check all plug and terminal connections of components for proper tightness and damage. Check that cables are not broken or crushed. Replace damaged parts immediately.
- Check fan and fan filter mats at least once a year.
  Clogged and contaminated filter mats reduce the air volumes required for proper ventilation and cooling. Therefore wash dirty filter mats in soapy water or replace with new mats. Allow washed filter mats to dry completely before reinstalling.

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

- Ensure that the rechargeable batteries (battery pack) are fully functional. Enable automatic testing of the rechargeable battery during each restart by activating the so-called "Accu Test" option of the UPS control program.

CAUTION
Loss of data!
Back up the data from the hard disk at regular intervals **.**

- Depending on temperature, vibration and daily operating hours, the service life of the hard disk may last anywhere between 2.5 and 10 years.
  Back up your data at regular intervals using the program ROPS4.

Maintenance and Replacement

8.1   Hard disk

The hard disk is replaced complete with installation frame.

CAUTION
Loss of data!
**Back up all required application data and operating system
settings to an external storage medium!**

1. Switch off the supply voltage. If required, unplug all connectors.

2. Wait until the power supply switches off automatically after UPS ope-
    ration (the **UPS LED** on the front illuminates **red**until the UPS swit-
    ches off the power supply).

3. Remove the 4 Phillips-head screws holding the control terminal. Pull
    out the control terminal by approx. 3 cm, and tilt forward (refer to dia-
    gram on page 8–3).

Maintenance and Replacement

View A: Control terminal with control panel folded down
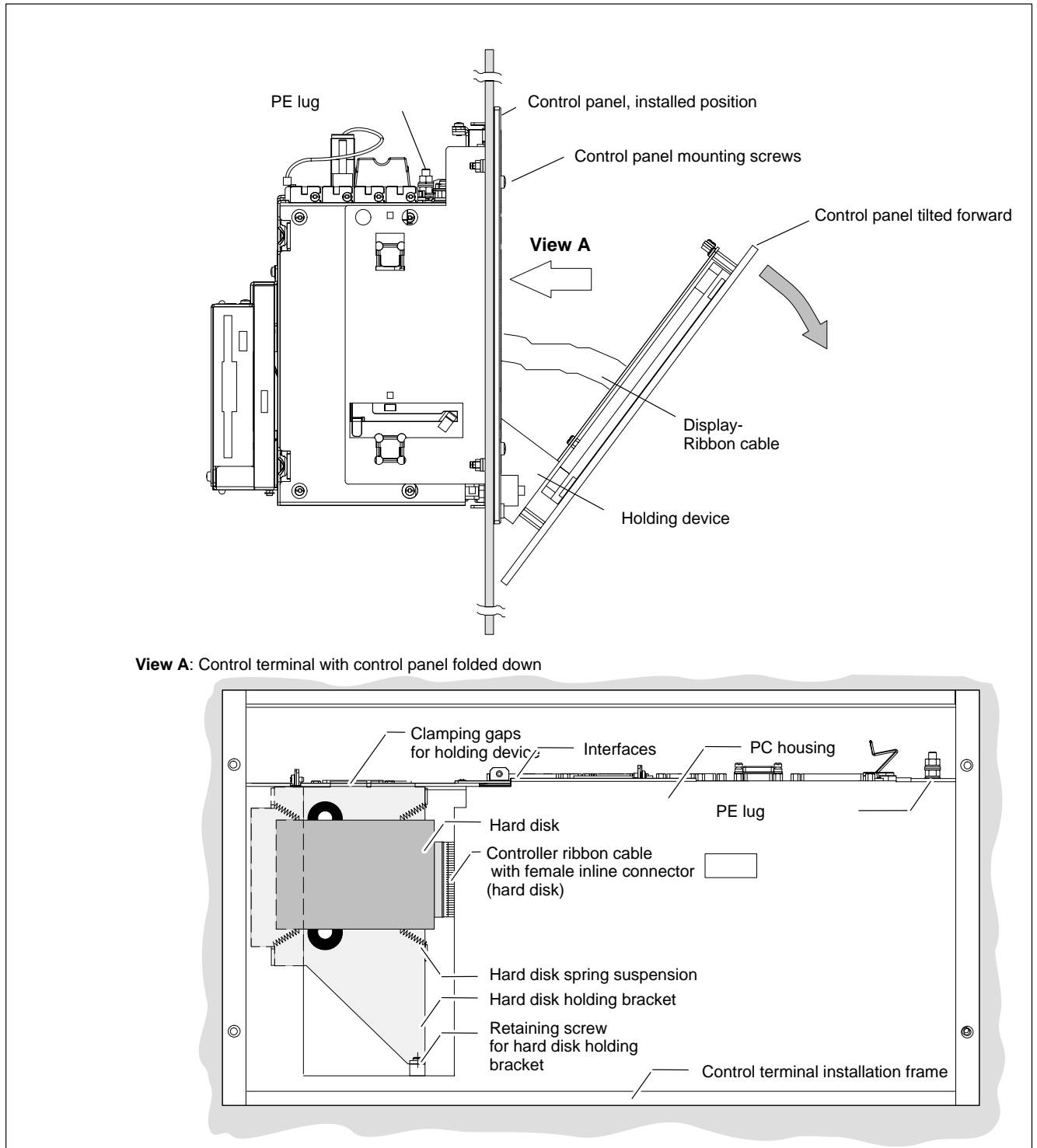
4. The ribbon cable is secured by a spot of hot glue which must be broken (cut) for de-installation. Disconnect the IDE ribbon cable **from the hard disk**. Unless this cable is defective, disconnecting it from the main board will not be required.

Maintenance and Replacement

View A: Control terminal with control panel folded down

Clamping gaps
for installation frame

Hard disk

Remove controller
ribboncable

Hard disk holding bracket

Retaining screw (with stud bolt)

Control terminal installation frame
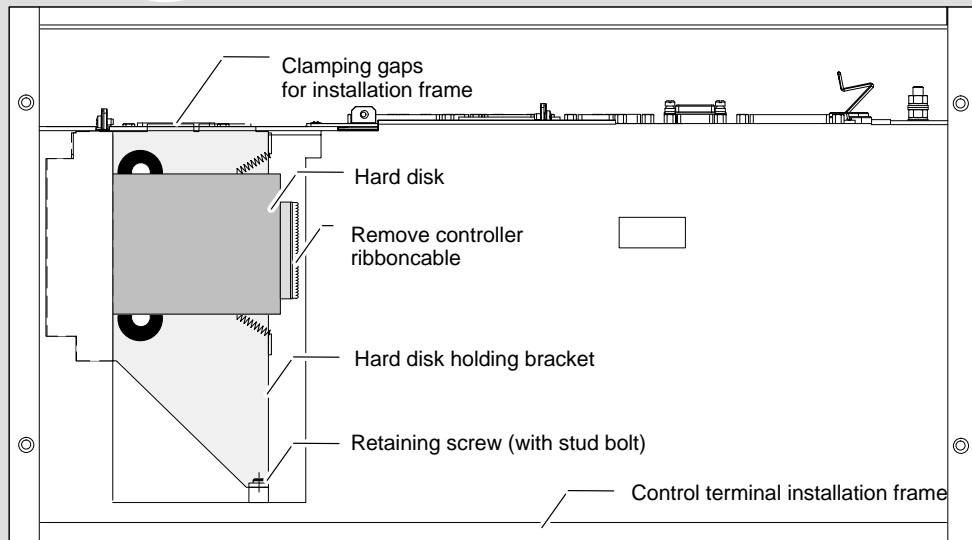
5. A **retaining screw** holding the installation frame in place is located below the hard disk. Loosen the retaining screw and pivot the installation frame slightly to the right at its base (near the retaining screw). The pivoting motion releases the installation frame from the clamping gaps at the top side of the housing. Now, pull the installation frame slightly downward in order to remove it toward the front.

View A: Control terminal with control panel folded down

Clamping gaps
for holding device

Hard disk

Pivot holding bracket to **right**,
then **downwards**

Control terminal installation frame
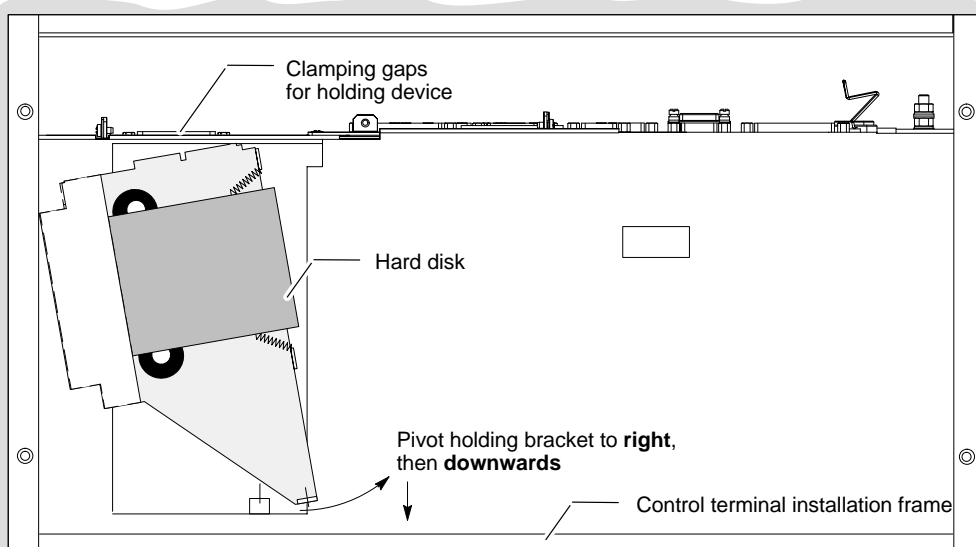
Maintenance and Replacement

6. The new hard disk is always installed in its installation frame and in reverse order from that described above.

☞ **Secure the hard disk connector again by applying a spot of "hot glue".**

Testing the new component:

7. The new hard disk must be declared in the BIOS. To access the BIOS menu of the PC, press the <F2> key during the booting up phase.

    In the main menu, select the **Primary Master**" menu command to enable automatic recognition of the new hard disk parameters by the system. In the Master submenu, go to the "Transfer Mode" menu option and select "Fast PIO 3" for the hard disk. Prior to leaving the BIOS, in the Exit menu, press F10, "**Exit Saving Changes**" to save the hard disk parameters.
    To confirm this, press the <Z> key (= interpreted as Y for Yes on German keyboards).

8. In the event that the operating system fails to start up, interrupt the power supply to the unit again for a minimum of 10 seconds, and then reboot.

9. If the system still fails to start, check for the following:
    ● Positive connection of hard disk controller cable
    ● Proper seating of all cables and connectors.
    ● Functioning power supply

10. Reset the entire system to the state it was in when delivered using the CD-ROM and boot diskette supplied.

11. Once the PC has completed its boot process and started properly, the user data and operating system settings must again be restored for standard operation.

Maintenance and Replacement

8.2   LS120/CD-ROM drive unit

8.2.1   Swap entire unit

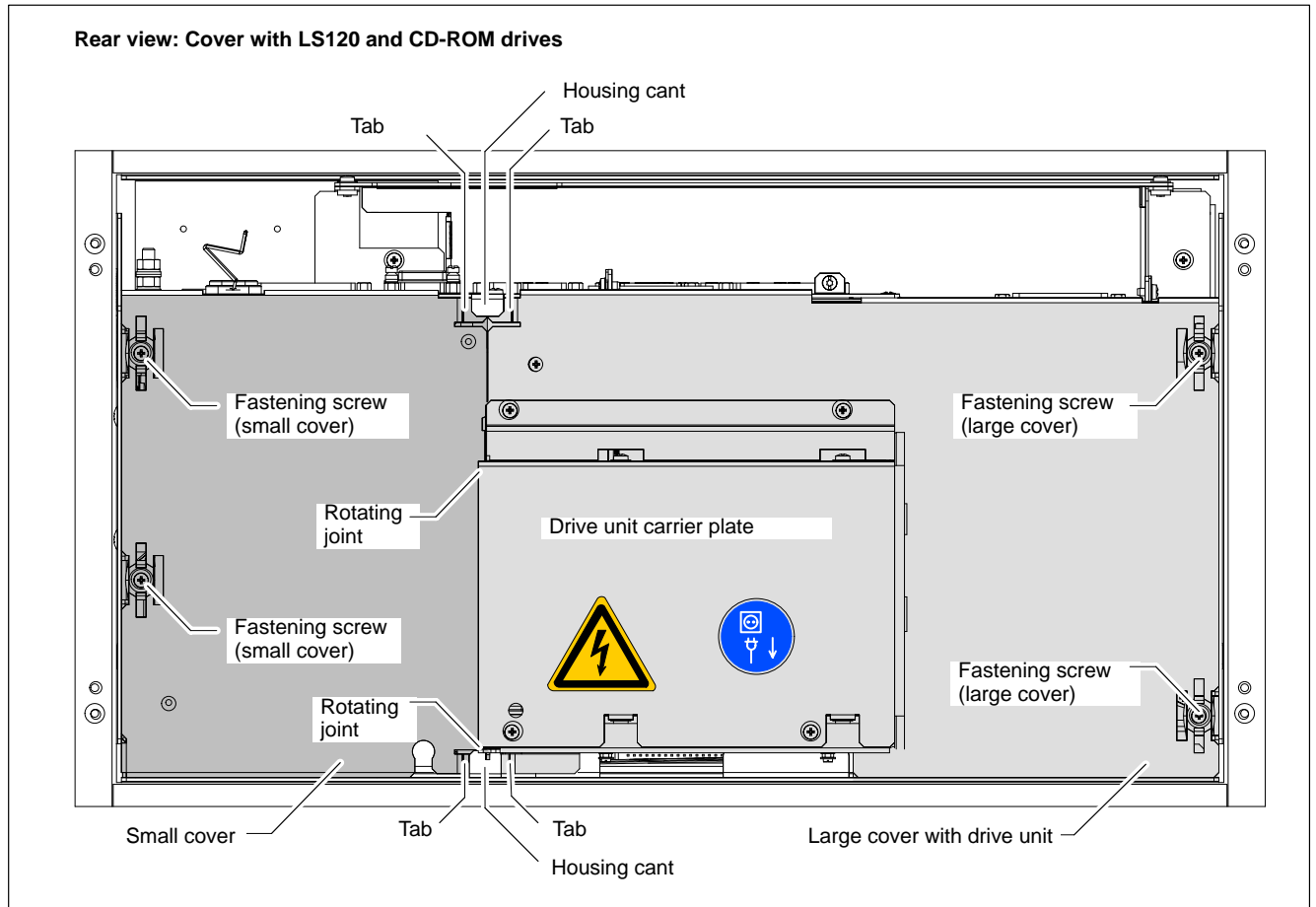The drive unit and holding bracket can be replaced in the installed control terminal.

☞ **In order to replace the drive unit whilst leaving the control terminal in place, the clearnace at the rear must be at least 400 mm, with respect to the cover surface, to be able to remove the covers.**

The rear of the control terminal housing is fitted with a large and a small cover plate. The covers are connected by rotating joints so that they can be removed separately. The covers are fastened to the control terminal housing by 2 screws and 2 tabs each. The tabs are located underneath a cant in the housing (beneath the rotating joints).

A carrier plate for the LS120 drive is fastened to the larger cover by four screws. Behind it is the CD-ROM drive, attached to the cover plate by 4 screws.

The ribbon cable (for data flow) and the Y-power cable (for power supply) are lead under the LS120/CD-ROM drive unit to the main board and to the carrier board.
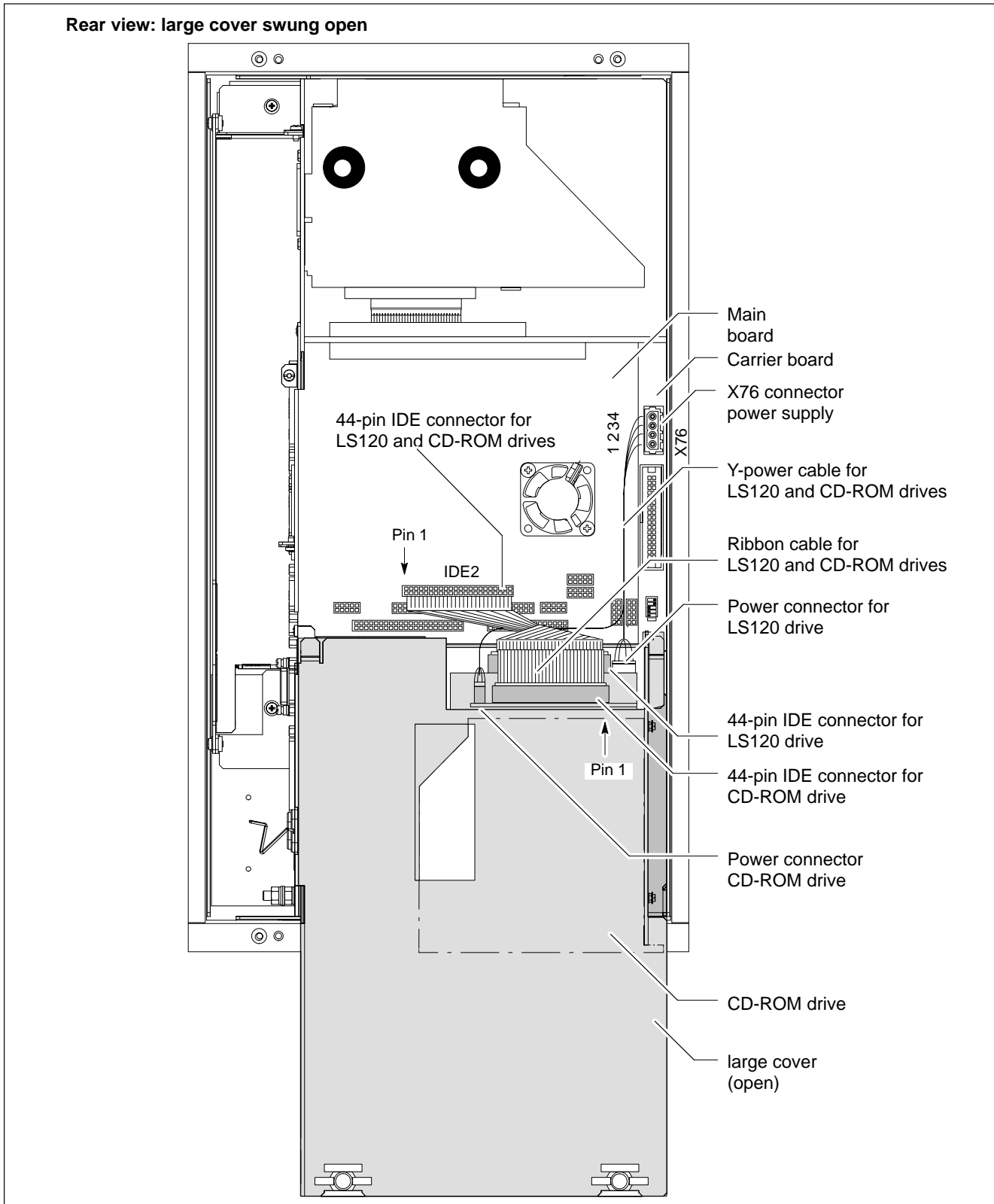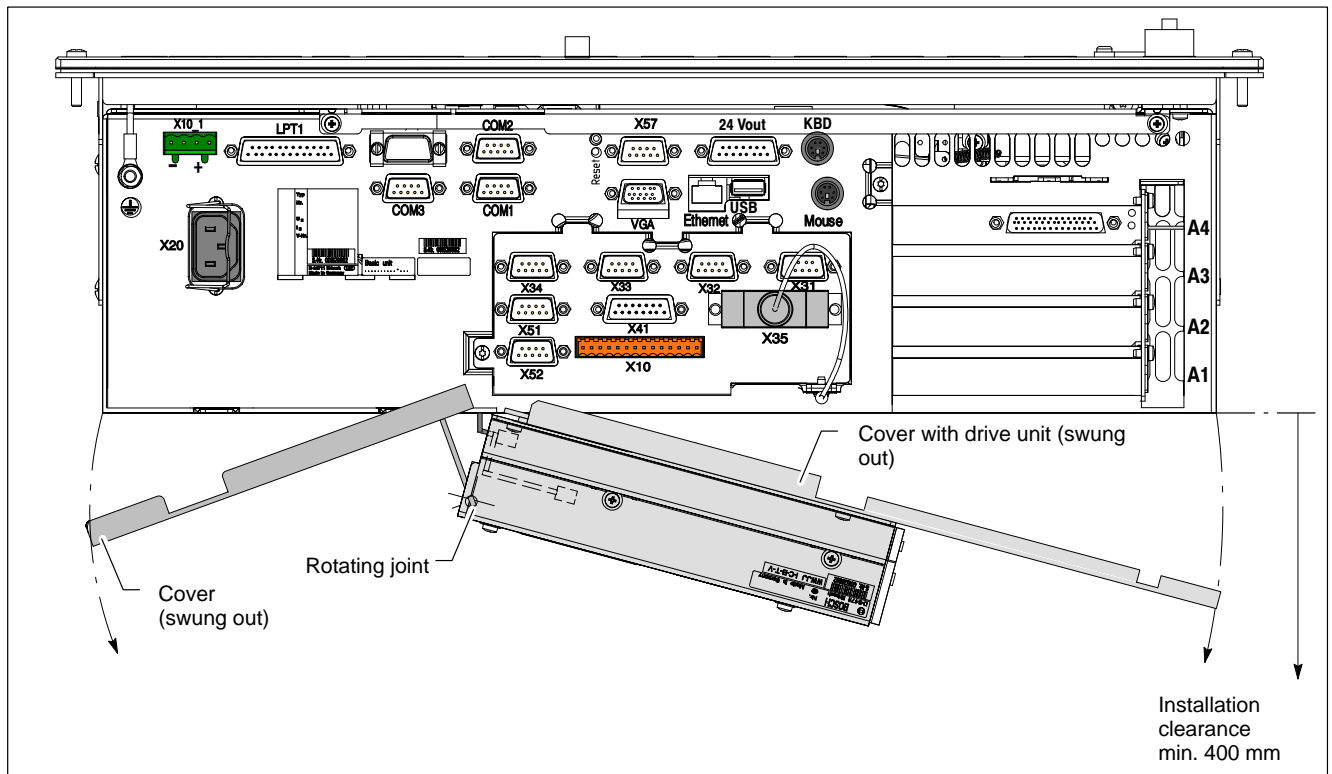
Maintenance and Replacement

Rear view: Cover with LS120 and CD-ROM drives

Housing cant

Tab   Tab

Fastening screw
(small cover)

Fastening screw
(large cover)

Rotating
joint   Drive unit carrier plate

Fastening screw
(small cover)

Fastening screw
(large cover)

Rotating
joint

Small cover   Tab   Tab   Large cover with drive unit
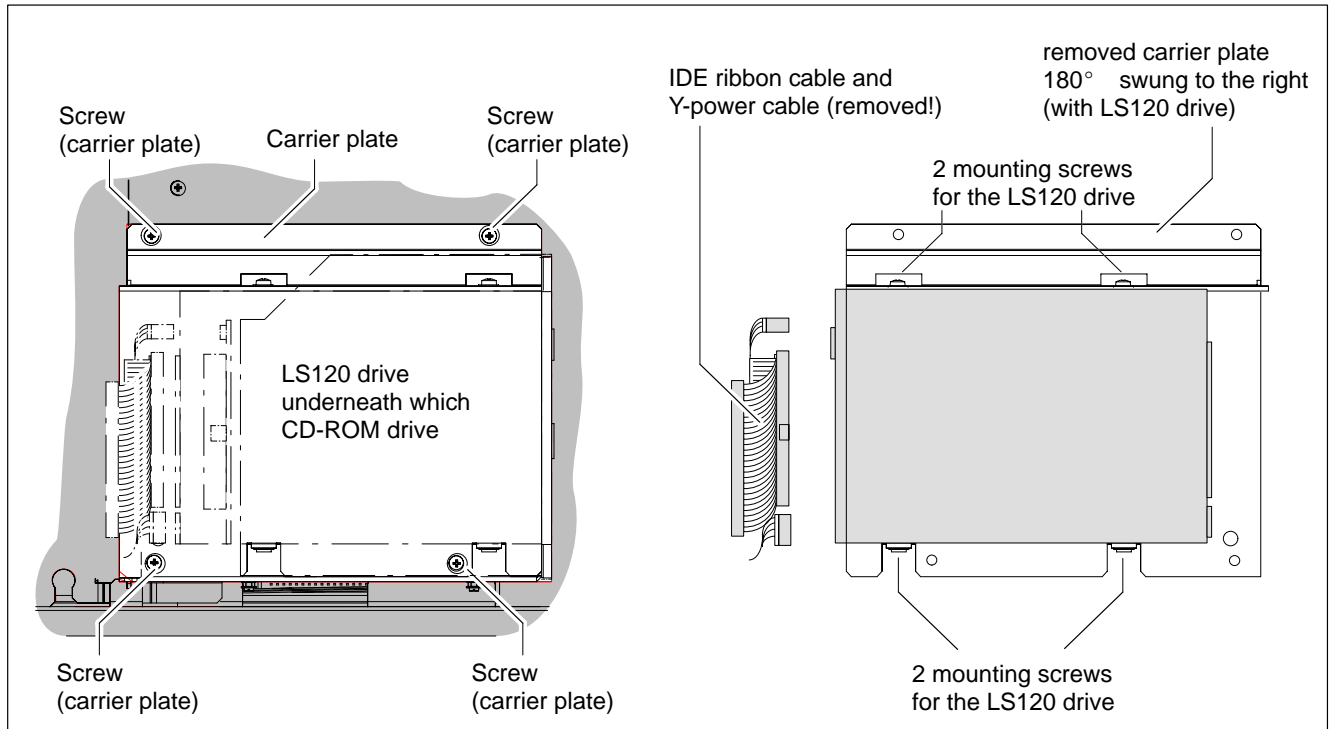
Housing cant

Replacement

1. Switch off the supply voltage. If required, unplug all connectors.
2. Wait until the power supply switches off automatically after UPS operation (the **UPS LED** on the front illuminates **red** until the UPS switches off the power supply).
3. Remove both screws from the large cover and swing it out by approx. 170°

Maintenance and Replacement

Rear view: large cover swung open

Main
board

Carrier board

X76 connector
power supply

44-pin IDE connector for
LS120 and CD-ROM drives

1 2 3 4

X76

Y-power cable for
LS120 and CD-ROM drives

Pin 1

IDE2

Ribbon cable for
LS120 and CD-ROM drives

Power connector for
LS120 drive

44-pin IDE connector for
LS120 drive

Pin 1

44-pin IDE connector for
CD-ROM drive

Power connector
CD-ROM drive

CD-ROM drive

large cover
(open)

4. Pull the IDE ribbon cable off from the main board and the plug for the
power supply from the carrier board. Remove the cable binding that
holds the ribbon cable. Swing the large cover back to its original posi-
tion.

Maintenance and Replacement

Cover with drive unit (swung out)

Rotating joint

Cover (swung out)

Installation clearance min. 400 mm

5. Now remove the two screws from the small cover. Hold on to the large cover while doing this!
   Swing the small cover with its tabs a little under the housing cant until it becomes free. Now both covers can be removed.

6. Insert the new drive unit including the covers in reverse order from that described above.
   Please make sure when replacing the covers that the tabs are pushed under the housing cant.

Testing the new components:

7. In the event that the operating system fails to start up, interrupt the power supply to the unit again for a minimum of 10 seconds, and then reboot.

8. If the system still fails to start, check for the following:
   - Proper seating of the controller cable to the LS120 and CD-ROM drives
   - Proper seating of all cables and connectors.
   - Proper seating of the Y-power cable
   - Functioning power supply.

9. Once the PC has completed its boot process and started properly, the user data and operating system settings must again be restored for standard operation.

Maintenance and Replacement

8.2.2   Replacing drives separately

The drives of the LS120/CD-ROM drive unit can also be replaced separately.
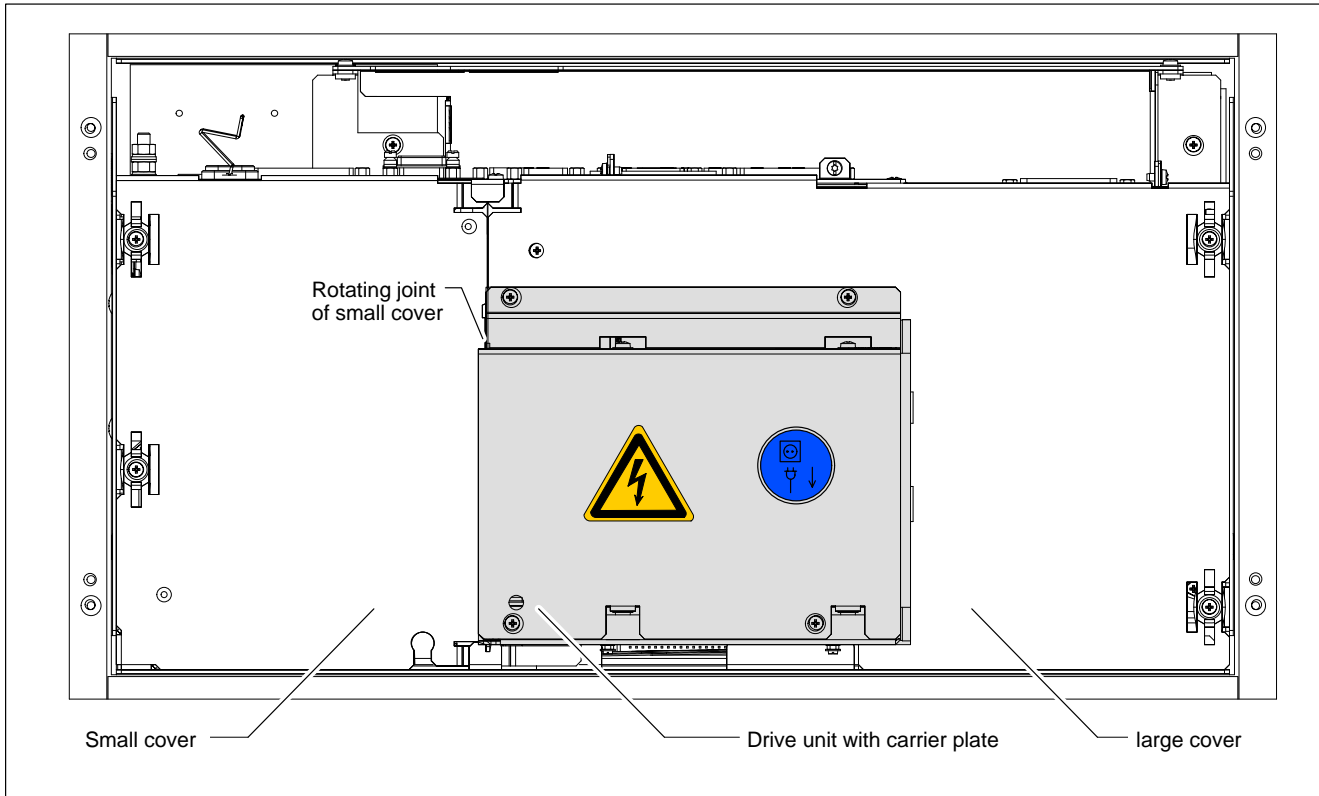
Rotating joint
of small cover

Small cover   Drive unit with carrier plate   large cover

1. Switch off the supply voltage. If required, unplug all connectors.

2. Wait until the power supply switches off automatically after UPS operation (the **UPS LED** on the front illuminates **red**until the UPS switches off the power supply).

LS120 drive

3. Remove the two screws from the large cover and swing it out by approx.170° so that you can remove the ribbon cable and power supply from the LS120 drive (see diagram on page 8–7). Swing the large cover back to its original position.

☞ **For the subsequent installation, make a note of how the ribbon cable plug was attached to the drive (as a rule pin 1 data cable marked in red is at the right-hand edge of the plug of pin 1 of the data connection).**
A similar process can be used for the power supply connections as the cables are colour coded.

Maintenance and Replacement

4. Remove the 4 screws from the carrier plate. Pull them out of the rotating joint of the small cover and lift the carrier plate complete with LS120 drive off.

5. Remove the 4 LS120 drive retaining screws from the carrier plate and take the drive off.

6. Install the new LS120 drive in the reverse order from that described above.
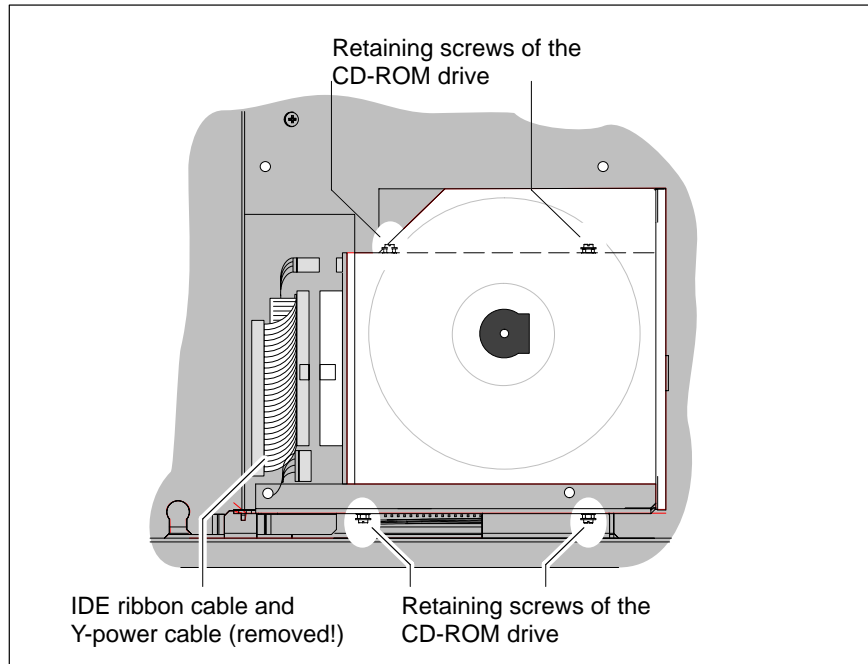   Please make sure when replacing the covers that the tabs are pushed under the housing cant.

CD-ROM drive

3. After steps 1 and 2 above remove the two screws from the large cover and swing it out by approx.170° so that you can remove the ribbon cable and power supply from the CD-ROM drive (see diagram on page 8–7). Swing the large cover back to its original position.

☞ **For the subsequent installation, make a note of how the ribbon cable plug was attached to the drive (as a rule pin 1 data cable marked in red is at the right-hand edge of the plug of pin 1 of the data connection).**
A similar process can be used for the power supply connections as the cables are colour coded.

Maintenance and Replacement

Retaining screws of the
CD-ROM drive

IDE ribbon cable and
Y-power cable (removed!)

Retaining screws of the
CD-ROM drive

4. Remove the 4 screws from the carrier plate. Pull them out of the rotating joint of the small cover and lift the carrier plate complete with LS120 drive off.

5. Remove the 4 retaining screws that are used to fasten the CD-ROM drive to the large cover and take the drive off.

6. Install the new CD-ROM drive in the reverse order from that described above.
Please make sure when replacing the covers that the tabs are pushed under the housing cant.

CAUTION
The CD-ROM drive may be destroyed by incorrect installation or screws that are too long!
It is imperative that the distance washers of the retaining screws (4x) are used as otherwise the screws may penetrate too far into the drive housing and destroy the device.

Testing the new components:

1. In the event that the operating system fails to start up, interrupt the power supply to the unit again for a minimum of 10 seconds, and then reboot.

2. If the system still fails to start, check for the following:
   - Proper seating of the controller cable to the LS120 and CD-ROM drives
   - Proper seating of all cables and connectors.
   - Proper seating of the Y-power cable
   - Functioning power supply.

Maintenance and Replacement

3. Once the PC has completed its boot process and started properly,
    the user data and operating system settings must again be restored
    for standard operation.

Maintenance and Replacement

8.3   Backlight and display panel

☞ **Backlight replacement is only possible for the rho4.1/BT155 and
     rho4.1/BT155T.**

A fading backlight causes a progressive deterioration of LCD display re-
adability, making a backlight replacement advisable.
Both the backlight source and the display panel can be replaced while
the control terminal remains in its installed position:

1. Switch off the supply voltage. If required, unplug all connectors.

2. Wait until the power supply switches off automatically after UPS ope-
    ration (the **UPS LED** on the front illuminates **red** until the UPS swit-
    ches off the power supply).

3. Remove the 4 Phillips-head screws holding the control terminal. Pull
    out the control terminal by approx. 3 cm, and tilt forward (refer to dia-
    gram on page 8–15).

4. Remove the 2 display mount retaining screws. You can now pull the
    display including its display mount from its retainer, as far as the dis-
    play ribbon cable will allow.

5. Remove the 4 display mounting screws.

6. To replace the display: Carefully remove ribbon cable connector from
    display. Replace old display with new display panel.

7. To replace the backlight source: Remove the 2 backlights from the
    retainer, and replace with new backlight unit.

☞ **CAUTION**
    Use only the same type of displays!
    Replace the backlight unit only with one matching the display!

---

8. The installation is performed in the reverse order of the removal pro-
    cedure.

9. In the event that, subsequent to the installation, the display does not
    produce an image, check for the following:
    ● Proper seating and positive contact of display ribbon cable
    ● Proper seating and positive contact of backlight unit

Maintenance and Replacement

PE lug

Control panel, installed position

Control panel mounting screws

View A

Control panel tilted forward

Display-Ribbon cable

Holding device

View A: Control panel with display

Holding device

Display ribbon cable

Touch screen-Ribbon cable (optional)

Display mount

Display mount retaining screws

Display

Front view:
Display with mount
(with display mount removed)

Display mount

Display

Retaining screws for display

Maintenance and Replacement

8.4   Rechargeable Battery Pack

CAUTION
**Before replacing the battery always back up important data. If
there is a voltage dip while the battery is being replaced, data
in the RAM may be lost.**

The rechargeable battery pack must be replaced in the following cases:
● The battery test fails during system startup.
● The number of completed charge cycles exceeds the number depen-
  ding on the ambient temperature stated below ("Shutdown count" in
  the UPS program, see section 3.3.2)
● The red UPS LED on the front panel flashes for longer than 8 hours
  (see page 7–4).

A charging cycle is determined by switching the PC power supply on and
off.
The number of battery pack charging cycles that can be carried out, and
so its useful life, is dependent on the ambient temperature in which the
battery pack is used.   Ambient temperature is defined as the tempera-
ture in which the battery pack is situated, e.g. the temperature within the
unit or the internal temperature of the control cabinet.

The following table can be used as a guide:

Ambient temperature	Charge cycles	Maintenance interval
+ 25 °C	4000 cycles	6 years
+ 35 °C	2000 cycles	3 years
+ 45 °C	1000 cycles	1.5 years

☞ **The rechargeable battery packs used are recyclable, and can be re-
turned to Rexroth after replacement. They must not be disposed of
in standard household refuse.**

X19   **Battery pack connector**

Male inline connector, 2 pin
Cable length: Max. 0.5 m
Cable type: Unscreened, min. cross-section 1.5 mm^2

Maintenance and Replacement

X19   **X19**   To rechargeable
                                                        battery pack
+ −   +   1
                                                       2
□ □
1 2   −
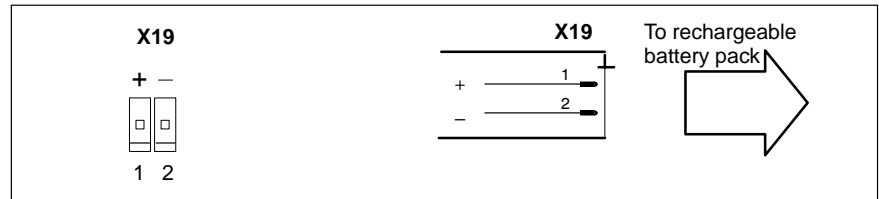
For rechargeable battery pack order number see section 10.3.

Replacements

The rechargeable battery pack consists of 2x3 batteries and is built into the device. The batteries are connected to each other and must be replaced as an entity:

1. Switch off the supply voltage. If required, unplug all connectors.

2. Wait until the power supply switches off automatically after UPS operation (the **UPS LED** on the front illuminates **red** until the UPS switches off the power supply).

3. Open the small cover at the rear (2 screws) and swing it open.

Small cover
(swung out)
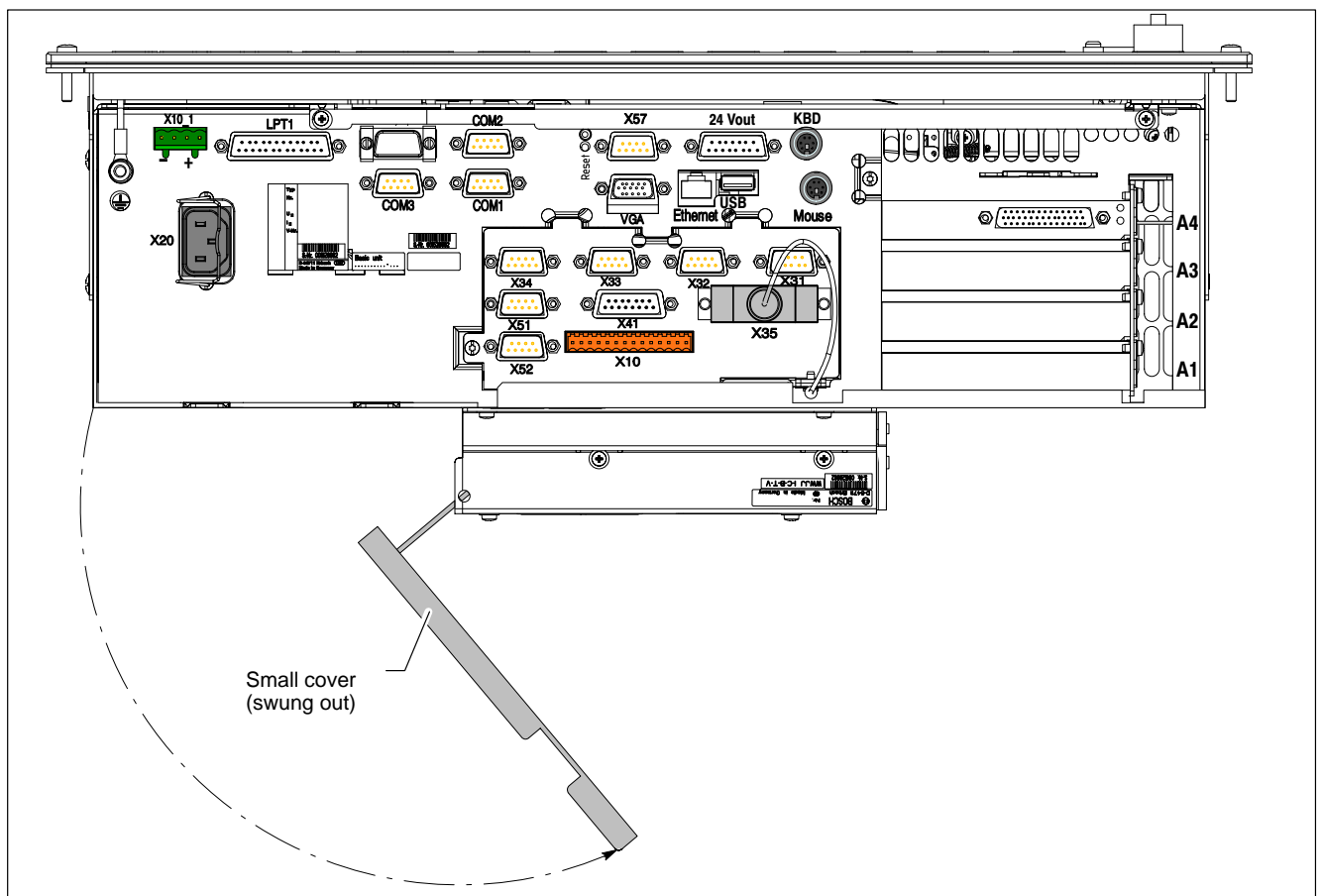
Maintenance and Replacement

4. Lift the battery pack carrier plate up.

5. Pull off the cables with the plugs in positions ① and ② on the battery pack (see diagram below).
   Take a note of which cables lead to the plus and minus poles of the battery pack.
   If the cables need to be changed over then also remove the plug from the X19 connector.

Battery pack

Carrier plate for battery pack

X19

Battery pack connector

+ −

1 2
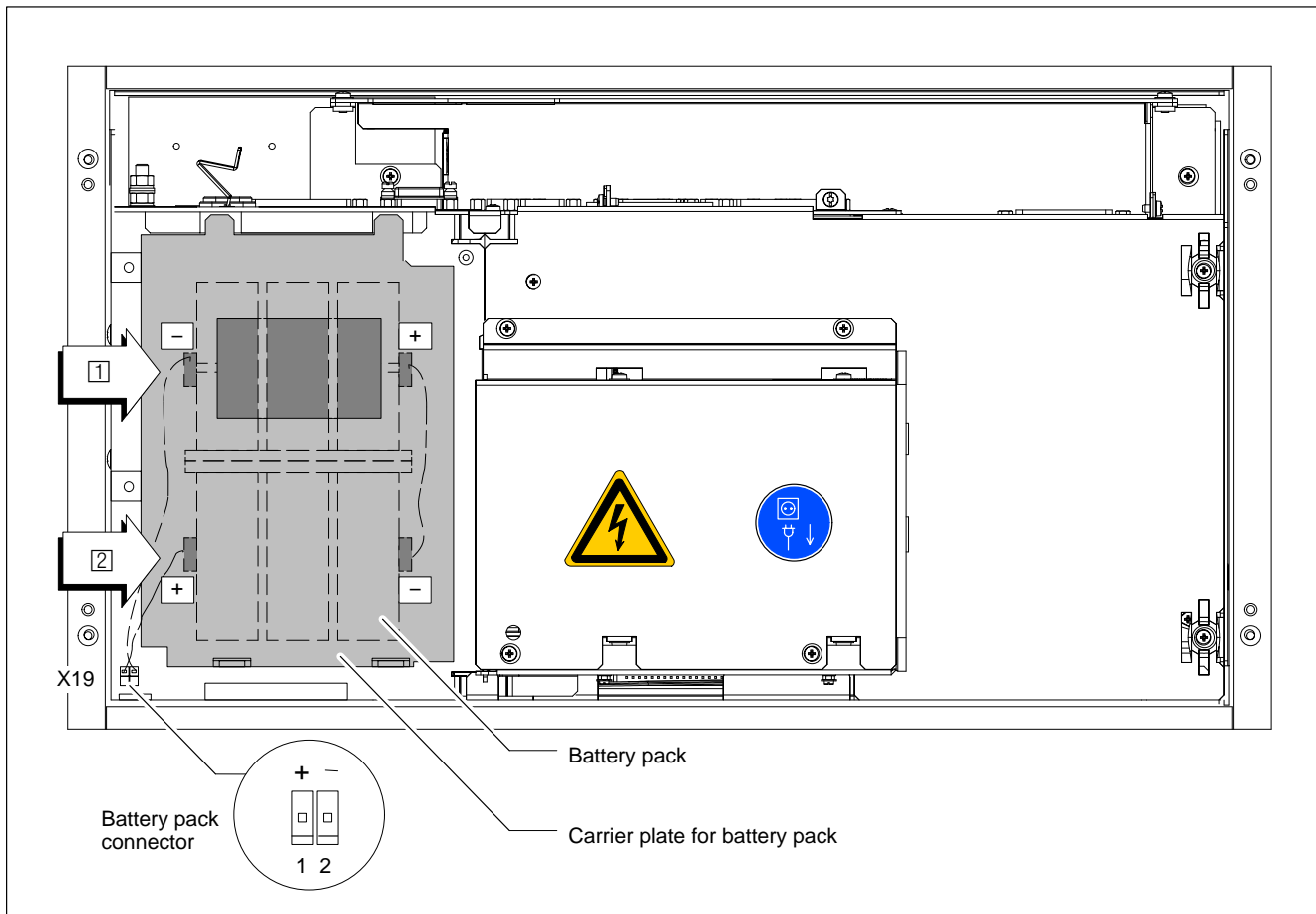
6. Replace the battery pack and re−connect the cables.

CAUTION
Ensure that the polarity of the batteries is correct.
Polarity reversal of the rechargeable battery packs will result in an F10A (5x20) fuse being blown on the power supply module. Further damage may also result. UPS operation will then no longer be possible.

7. Re-insert the carrier with the battery pack. Close the cover.

Maintenance and Replacement

☞ **If the new rechargeable battery pack is not yet charged up there will not be adequate UPS protection to effect a controlled shutdown of the PC during the approx. 5 hours required for charging to 2.5 Ah capacity. Therefore install fully charged batteries if at all possible.**

Testing the new component

8. Restore power to the system.

9. Observe the ”UPS” LED on the front panel:
    - Battery pack already charged: UPS LED **OFF**
    - Battery pack discharged: UPS LED **flashes red**
      Wait approx. 5 hours until the battery pack is fully charged and the UPS LED **extinguishes**.

Maintenance and Replacement

8.5   Expansion cards

The unit provides 2 slots for PCI bus and combined ISA/PCI bus expansion cards :

CAUTION
Risk of damage to the PC or corruption of application software due to the installation of non-approved expansion cards.
Use only approved expansion cards, and have them installed by a specialist.

8.5.1   Installing an expansion card

1. Switch off the supply voltage. If required, unplug all connectors.

2. Wait until the power supply switches off automatically after UPS operation (the **UPS LED** on the front illuminates **red** until the UPS switches off the power supply).

3. Remove both screws from the large cover and swing it out by approx. 170°

4. Remove the mounting screw holding the slot cover.

5. Insert the expansion card, and secure it with the mounting screw.

6. Return the large cover to its original position and fasten it with the two screws. Please make sure when replacing the covers that the tabs are pushed under the housing cant.

Maintenance and Replacement

Arrangement of expansion slots in the housing

rho4.1/BT155
rho4.1/BT155T
rho4.1/BT205

ISA/PCI slot A1

PCI slot A2

PCI slot A3

PCI_rho card
in the PCI slot A4)

Slot cover

PCI_rho card
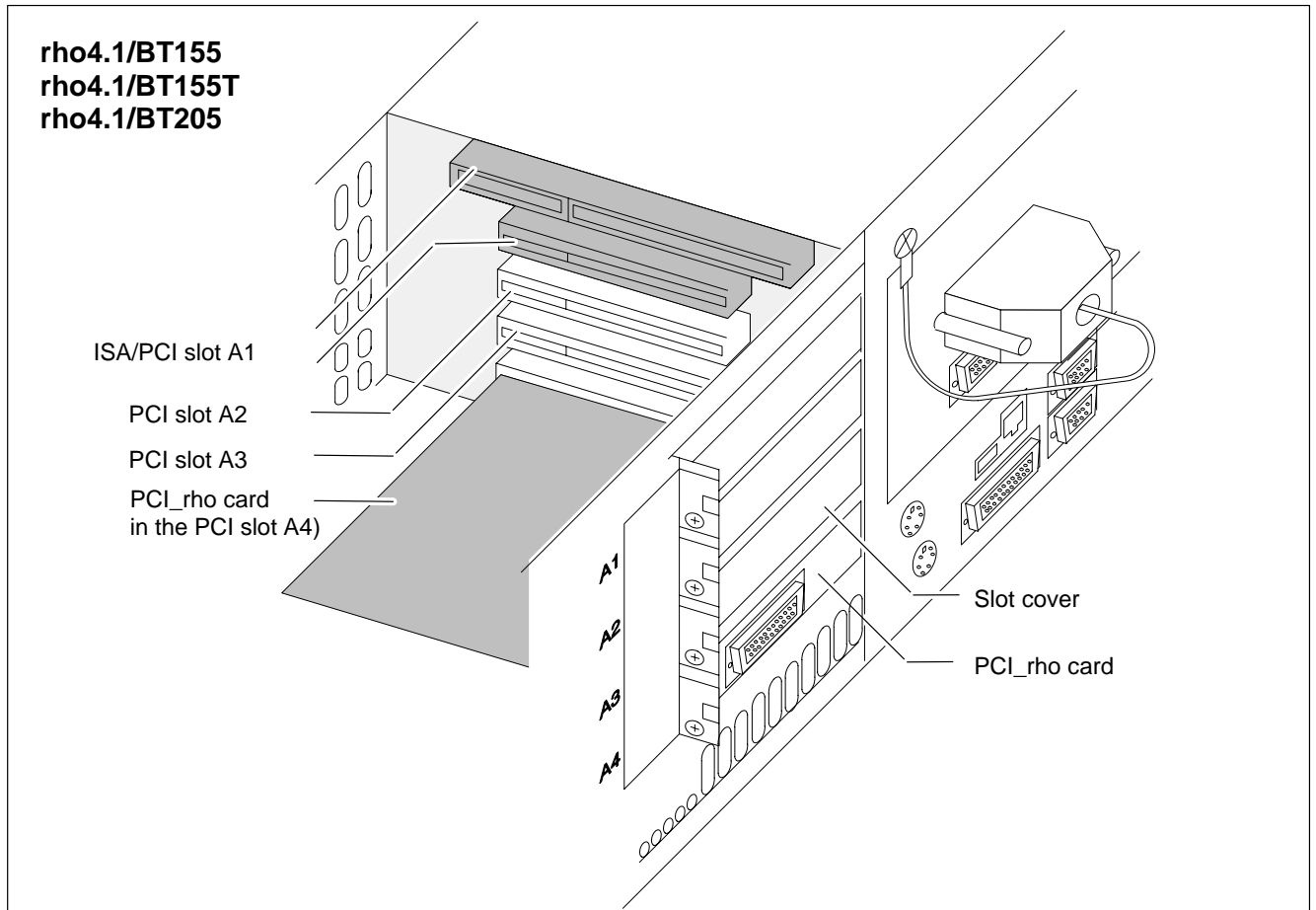
CAUTION
Destruction of expansion card or main board!
The PCI/ISA bus combination slot must never be populated
with a PCI board and an ISA board at the same time!

If the card is equipped with a Plug-and-Play (PnP) function, it is automatically recognized by and integrated into the system, provided that this creates no hardware conflicts (IRQ, etc.) with other expansion cards or connected devices.

In the event that subsequent to a system reboot the functions based on the newly added card are not available, there may be several reasons for this:

● The card is not properly seated in the PCI or ISA slot contacts.

● The software driver for the card has **not** been installed or its installation is **faulty**.

● IRQ (interrupt) conflict with other PC hardware components.

● The software for the card has not been installed.

Maintenance and Replacement

CAUTION
**Destruction of main board or ISA cards through address con-
flicts (IRQ, memory access, I/O address)!**
**Observe the information provided by the card manufacturer.
You may have try out new configuration settings in both BIOS
and operating system.**

Software

9   Software

For the purposes of software loading and data backup a CD-ROM drive
and a 3.5" floppy disk drive are required.
Please refer to the documentation of the particular operating system for
restoring backup files.

Depending on the intended application, a variety of software programs
are installed on the robot controller as shipped from the factory:

- BIOS
- Operating system
- Utilities
- Application software

9.1   BIOS software

The PC requires the BIOS software for its initial boot process to enable it
to find and start an operating system which provides a more user-friendly
and comfortable platform for running the application software.

The BIOS software on the devices is licensed from the Phoenix com-
pany.

9.2   Operating system and utilities

Software	rho4.1/BT155	rho4.1/BT155T	rho4.1/BT205
Operating system Windows NT4.0	●	●	●
UPS utility program UPS_{NT}	●	●	●
ELO touch screen	–	●	–

- = available

Software

9.3   Application software

The following Rexroth application software options are available:

Application	rho4.1/BT155 rho4.1/BT155T rho4.1/BT205
WinSPS PLC programming software	●
WinDP Field bus parameterization for PROFIBUS-DP	●
WinCan Field bus parameterization for CAN-bus	●

●= available

9.3.1   PCI field bus cards

A field bus can be connected with the following bus master expansion cards:

- for PROFIBUS-DP: PCI_BM-DP
- for CANrho or CANopen: PCI_BM-CAN
- for Interbus-S: PCI_BM-IBS

Example: PROFIBUS-DP
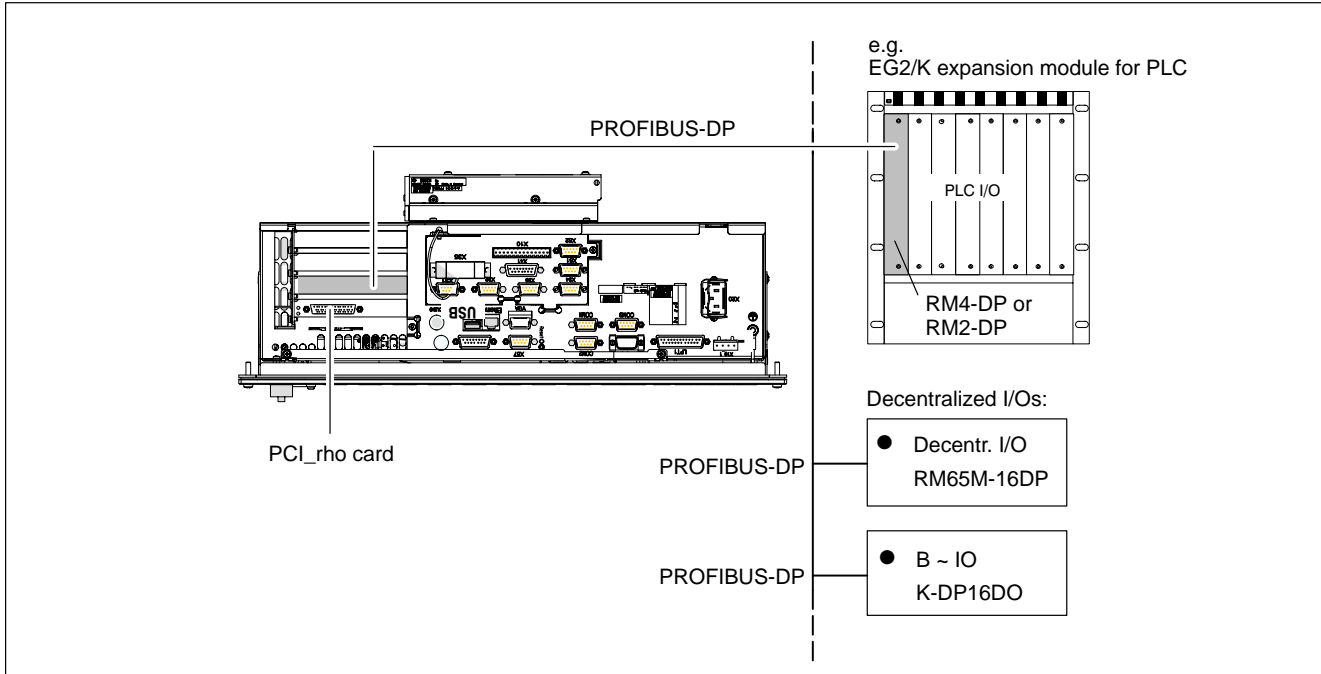
Order numbers

10   Order numbers

10.1   rho4.1/BT155, rho4.1/BT155T and rho4.1/BT205

Order numbers for the available options from:
- Various basic devices
- Various rho4.1 real-time cards
- PCI field bus cards

see "Price list rho3, rho4".

10.2   Accessories

Designation		Order no.:
Power cord 230 V	Length 2.5 m, PC power cable socket cranked	1070 048 937
PC power cable socket	Cranked for self-installation	1070 912 881
Mating connector X10	PHG2000 power supply and signals, 14 pin	1070 916 914
Ethernet cable for connection to programming unit	Crossed: 10BaseT, length 0.15 m 2.5 m 5 m 10 m 25 m	1070 919 187 1070 919 188 1070 919 257 1070 918 795 1070 918 797
	Uncrossed (connection via HUB): 10BaseT, length 2.5 m 5 m 10 m 25 m	1070 918 793 1070 919 258 1070 921 384 1070 918 796
Light wave conductor, pre-fabricated	23 cm without strain relief 33 cm without strain relief 43 cm without strain relief	1070 917 886 1070 917 884 on request
	2 m with strain relief 5 m with strain relief 10 m with strain relief	1070 917 885 1070 917 887 1070 918 956
Manual programming unit	PHG2000 incl. 8 m connecting cable	1070 918 443
	PHG2000EL incl. 8 m connecting cable	1070 919 860
	Extension cable, by the meter min. 20 m to max. 60 m	1070 919 062
	Download cable (connection PHG ↔ PC), 5 m	1070 918 830

Order numbers

Designation		Order no.:
PCI bus master	PCI_BM-DP (PROFIBUS-DP)	1070 078 905
	PCI_BM-CAN (CANrho, CANopen)	1070 080 381
	PCI_BM-IBS (InterBus-S)	1070 080 379
Operating block	Operating block without connecting cable	3842 405 602
	Connecting cable, 1 m	3842 405 555

10.3 Spare parts

Designation		Order no.:
Fuses	6.3 A (5x20), medium time-lag, for 24 VDC power	1070 900 850
	1.25 A (5x20), medium time-lag, for 230 VAC power	1070 900 839
	10 A (5x20), quick-blow, for battery pack	1070 904 575
Rechargeable battery pack	$1/2$ battery pack for UPS (always order 2 off)	1070 919 399
Hard disk 5 GB with installation frame (cassette)		1070 084 205
LS120/CD-ROM drive unit, kit		1070 084 233
CD-ROM drive incl. IDE40 adapter, single unit		1070 920 530
LS120 floppy disk drive (3.5 in.), single unit		1070 920 410
RAM modules	266 MHz: 64 MB 128 MB	1070 920 827 1070 920 459

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

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Appendix

Appendix