PNC

PNC with PC control panel, BT155/BT205, IPC300 Connectivity Manual

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Edition
101

Rexroth
Bosch Group

PNC

PNC with PC control panel, BT155/BT205, IPC300 Connectivity Manual

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1   Safety Instructions

Before you start working with the PNC numerical control, we recommend that you thoroughly familiarize yourself with the contents of this manual. Keep this manual in a place where it is always accessible to all users.

1.1   Intended use

This manual contains information required for the proper use of this product. However, for reasons of structural clarity, the manual cannot provide exhaustive details regarding all available combinations of functional options. Similarly, it is feasible to consider every conceivable integration or operating scenario within the confines of this manual.

The PNC is used to

- activate feed drives, spindles and auxiliary axes of a machine tool via SERCOS interface for the purpose of guiding a processing tool along a programmed path to process a workpiece (CNC). Furthermore, I/O components for the integrated PLC are required which – in communication with the actual CNC – controls the machine processing cycles holistically and acts as a technical safety monitor.
- program contours and the processing technology (path feedrate, spindle speed, tool change) of a workpiece.

Any other application is deemed improper use!

The products described hereunder

- have been developed, manufactured, tested and documented in compliance with the safety standards. These products 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.

    In residential environments, in trade and commerce as well as small enterprises class A equipment may only be used if the following warning is attached:

☞ **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.

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 NC project engineers and NC specialists. Besides they require special knowledge of PC technology.

Programming, start and operation as well as the modification of program parameters is reserved to properly trained personnel! This personnel must be able to judge potential hazards arising from programming, program changes and in general from the mechanical, electrical, or electronic equipment.

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

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.de 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.

1.3   Safety markings on products

Warning of dangerous electrical voltage!

DANGER! Corrosive battery acid!

Electrostatically sensitive components!

Hazardous light emissions
(optical fibre cable emitters)!

Disconnect mains power before opening!

Lug for connecting PE conductor only!

Connection of shield conductor only

1.4 Safety instructions in this manual

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

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

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

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

★ This symbol is used if user activities are required.

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
Risk of personal injury and equipment damage!
Always subject new programs to initial tests while inhibiting axis
movements. For this purpose, as a function of the AUTOMATIC
mode, the controller provides the option to block axis movements or
auxiliary functions by means of special softkey commands.

DANGER
Incorrect or undesired control unit response!
Rexroth accepts no liability for damage resulting from the execution
of an NC program, an individual NC block or the manual movement
of axes!
Furthermore, Rexroth accepts no liability for consequential damage
which could have been avoided by programming the PLC appropri-
ately!

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.

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

Measuring or test activities on the live system are reserved to quali-
fied electrical personnel!

DANGER
Tool or axis movements!
Feed and spindle motors generate very powerful mechanical forces and can accelerate very quickly due to their high dynamics.

- **Always stay outside the danger area of an active machine tool!**
- **Never deactivate safety-relevant functions!**
- **Report any malfunction of the unit to your servicing and repairs department immediately!**

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.

1.6   Documentation, software release and trademarks

Documentation

This manual contains details of technical data, operation and configuration of the PNC in association with the PC control panel, BT155/ BT205 and IPC300.

Overview of available documentation	Part no.	
	German	English
PNC − Connectivity Manual	1070 073 880	1070 073 881
BF2xxT/BF3xxT Control Panel Connectivity Manual	1070 073 814	1070 073 824
PNC − Software Installation	1070 073 882	1070 073 883
Function Description	1070 073 870	1070 073 871
MACODA Operation and configuration of the machine parameters	1070 073 705	1070 073 742
Operating Instructions Standard operator interface	1070 073 726	1070 073 739
Operating Instructions − Diagnostics Tools	1070 073 779	1070 073 780
Error Messages	1070 073 798	1070 073 799
PLC project planning manual, Software interfaces of the integrated PLC	1070 073 728	1070 073 741
iPCL system description and programming manual	1070 073 874	1070 073 875
ICL700 system description (Typ3 osa only), Program structure of the integrated PLC ICL700	1070 073 706	1070 073 737
DIN Programming Manual for programming to DIN 66025	1070 073 725	1070 073 738
CPL Programming Manual	1070 073 727	1070 073 740
CPL Debugger Operating Instructions	1070 073 872	−
Tool Management − Parameterization	1070 073 782	1070 073 793
Software PLC Development environment for Windows NT	1070 073 783	1070 073 792
Measuring cycles for touch-trigger switching probes	1070 073 788	1070 073 789
Universal Milling Cycles	−	1070 073 795

☞ **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>

Release

The current release number of the individual software modules can be viewed by selecting the 'Control-Diagnostics' softkey in the 'Diagnostics' operating mode.

The software version of Windows 95 or Windows NT may be displayed as follows:

1. Click the right mouse button on the **My Computer** icon on your desktop.

2. Select **Properties**.

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.

MS-DOS® and Windows™ are registered trademarks of Microsoft Corporation.

PROFIBUS® is a registered trademark of the PROFIBUS Nutzerorganisation e.V. (user organization).

SERCOS interface™ is a registered trademark of the SERCOS interface Joint VDW/ZVEI Working Committee.

2   System Overview

The PNC controller is a system consisting of:

- **PC mainframe**
  (several models are available to choose from, see page 2–2)
- **PNC plug-in card**
  (CNC controller with integrated PLC)
- **PNC high speed I/O (option)**
  (additional plug-in card with a direct connection to the PNC plug-in card. For details see page 6–8)
- **Machine control panel osa switch (option)**
  (adjusted to the PC control panel. For details see page 7–8)

2.1   PNC plug-in card

The PNC is a CNC controller including PLC on a highly-integrated PCI plug-in card with its own CPU.

The PNC plug-in card occupies a PCI slot in the PC mainframe and has:

- Optical fibre connection for the SERCOS interface
- PROFIBUS DP master
- Ready contact
- 1 RESET button
- 3 LEDs as status indicators

LED (green): active TCP/IP communication

LED (green): READY active (H1)

LED (red): Error

RESET button (S1)

Ready contact (X10)

SERCOS interface (X73, X74)

Interface for PROFIBUS DP master (X71)
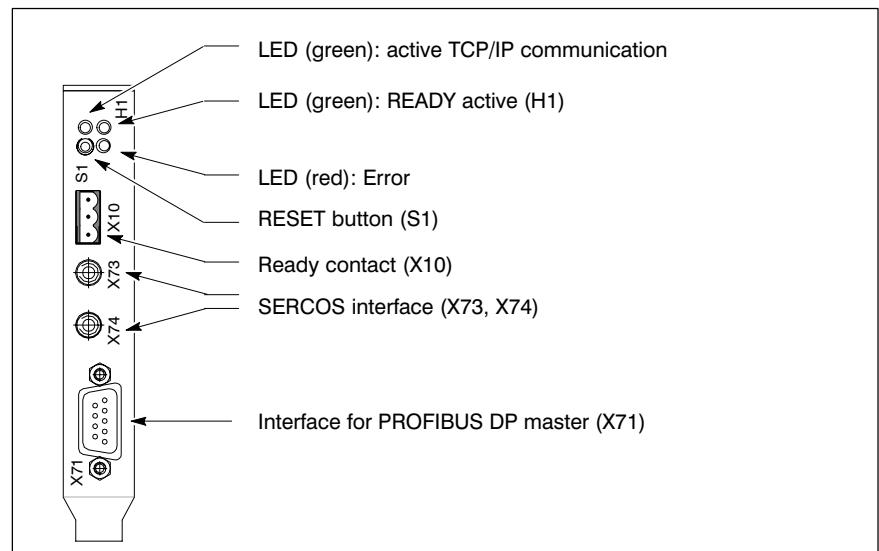
For details of the ports see chapter 6.

The PNC is delivered together with a PC mainframe. If the expansion slot is changed, then it must be selected so that the requisite cooling from its own CPU fan is not impaired.

☞ **The mainframe power supplies are currently configured to accept only one PNC plug-in card.**

2.2   PC mainframe

The PNC plug-in card can be supplied with the following PC mainframes:

- PC control panel (osa display pc with osa keyboard)
- Control terminals BT155 and BT205
- IPC 300 with separate control panel BF3xx

The compact design and service-friendly construction excels with regard to the following:

- **High degree of failure resistance** (e.g. shock and vibration-proof cush-ioned hard disk, UPS uninterruptible power supply), and
- **simple maintenance**

Windows NT4.0 as operating system and appropriate PNC applications software are installed (see section 11.5).

2.2.1   PC control panel

PC control panel with PNC   Front (display)
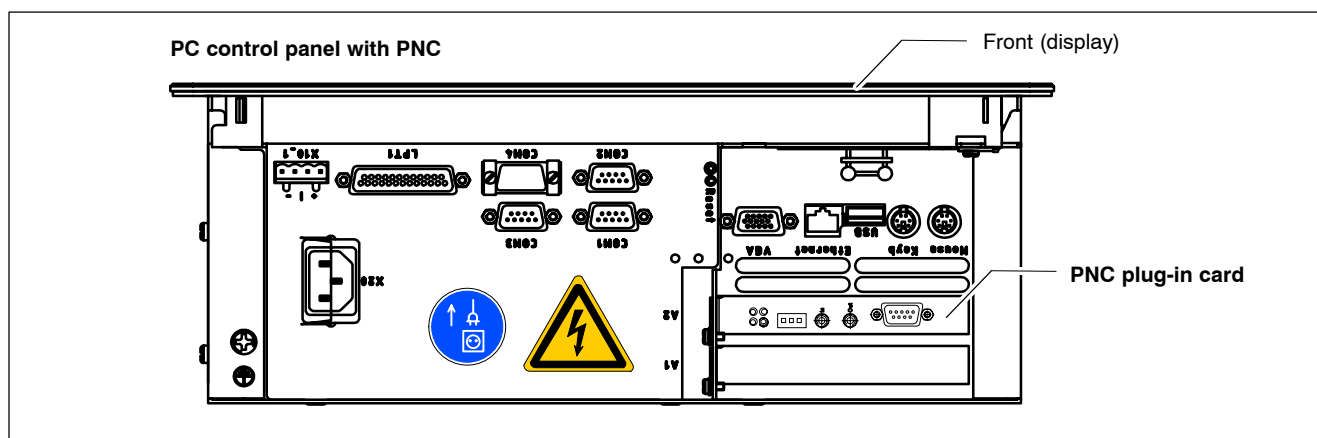
PNC plug-in card

The PC control panel consists of:

- **osa display pc**
  (Flat-panel display with industrial PC, at rear of housing)
- **osa keyboard**
  (separate keyboard with LED status indicators)
- PNC plug-in card

As an optional feature the machine control panel **osa switch** can be added.

osa display pc
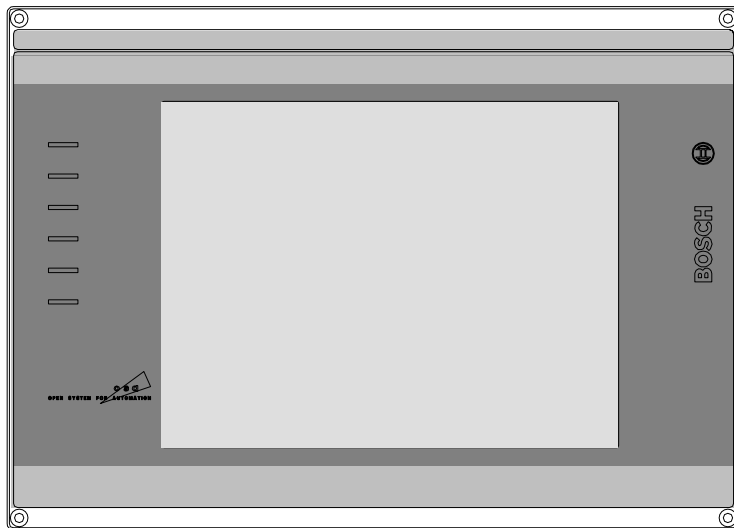
osa keyboard
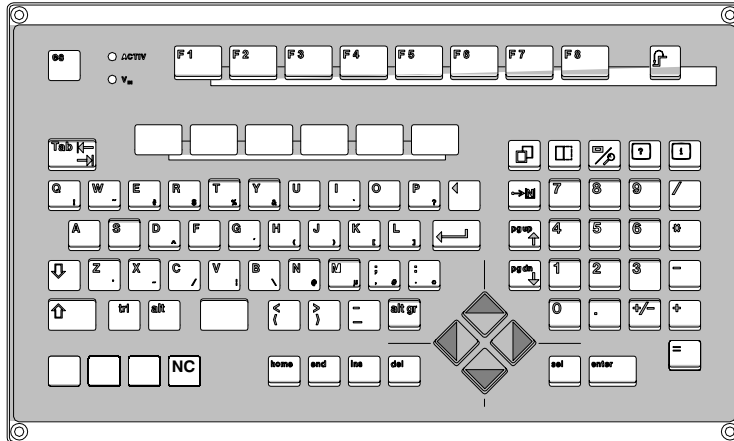
osa switch (optional)

2.2.2   Control terminals BT155 and BT205

BT155, BT205 with PNC (with 6 expansion slots)   Front (display)
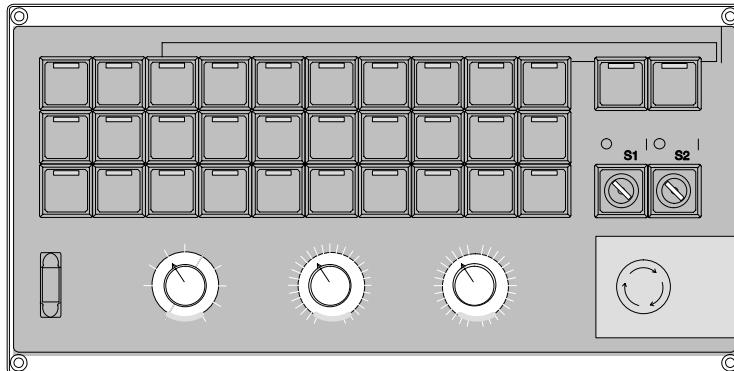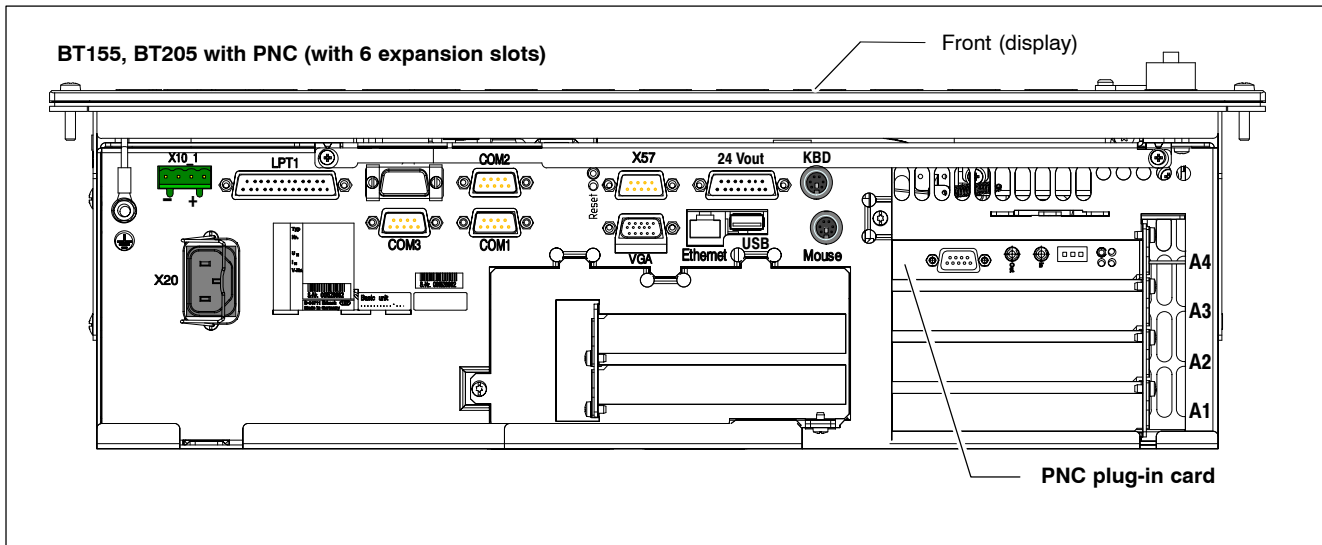
PNC plug-in card

A mainframe consists of:

- Flat-panel display with integrated keyboard
- Industrial PC, at rear of housing
- PNC plug-in card
- LED status indicators

Control terminal BT155 (with 10.4" display)
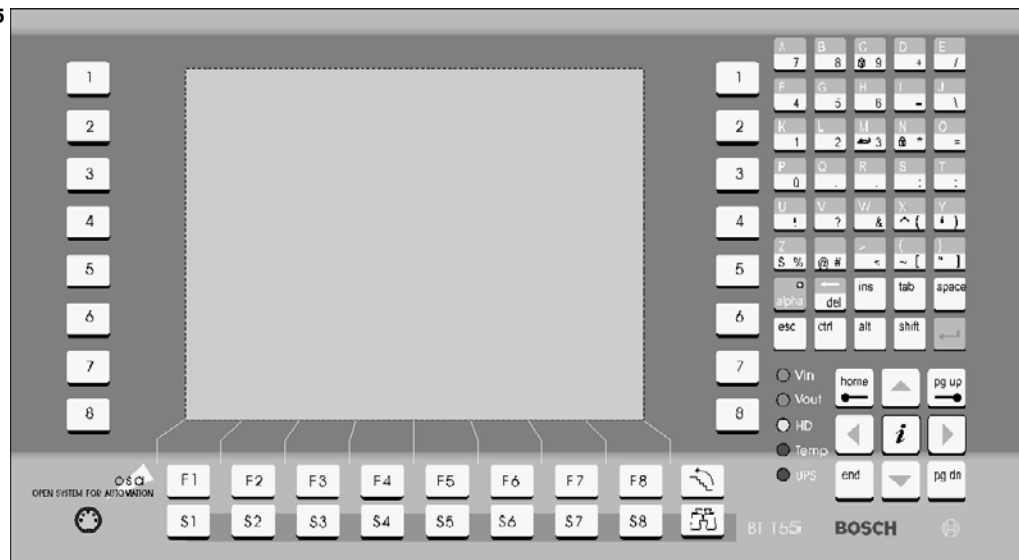
**Control terminal BT205
(with 12.1" display)**

2.2.3   IPC300

IPC300 with PNC   **PNC plug-in card**
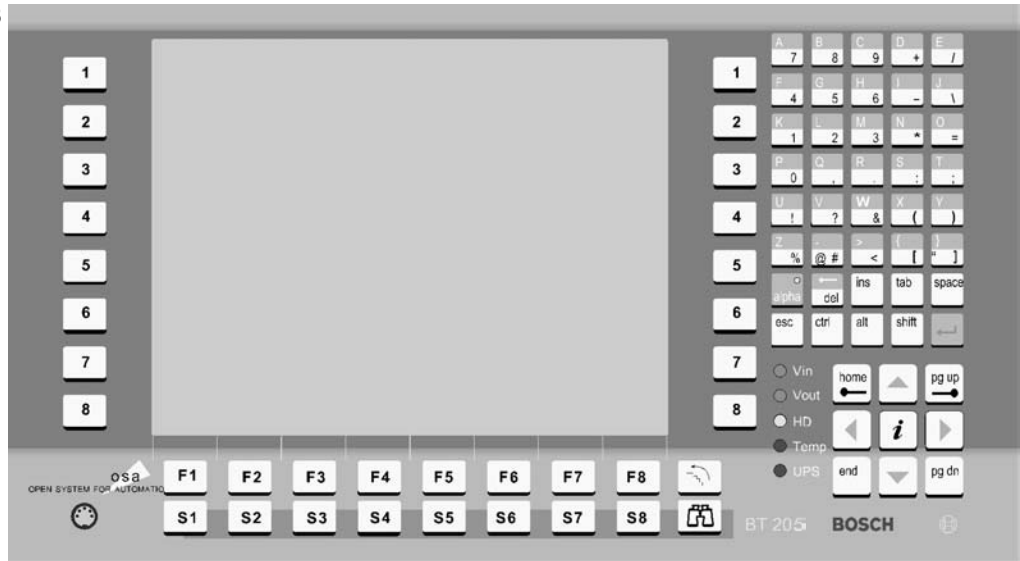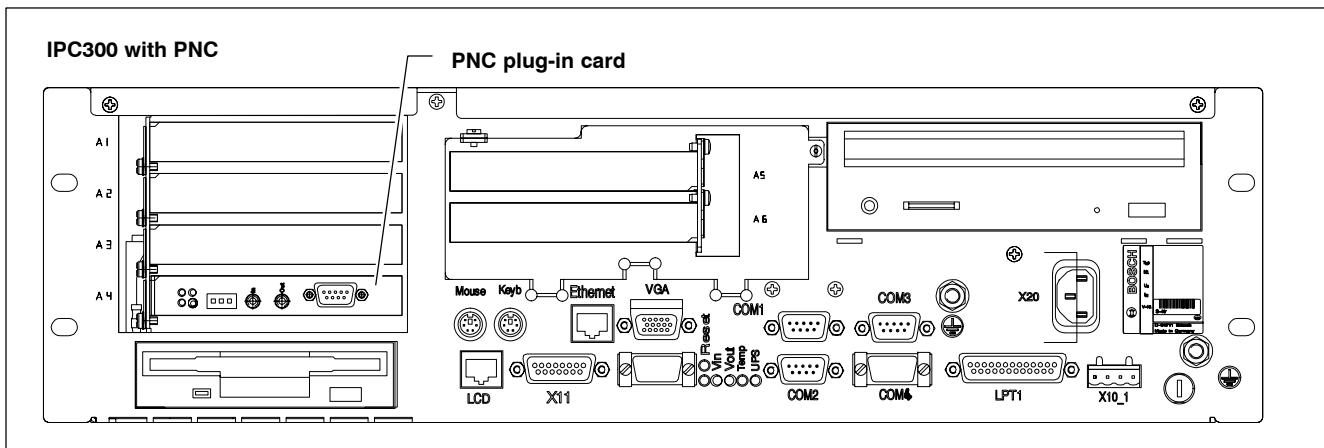
A mainframe consists of:

- Industrial PC
- PNC plug-in card
- LED status indicators
- Separate control panel BF3xxT

Separate control panels

The control panels BF312T or BF315T with flat-panel display and gigabit port in their diverse versions may be operated on the IPC300:

- BF312T: 12.1" flat-panel display (touch-screen)

BF312T
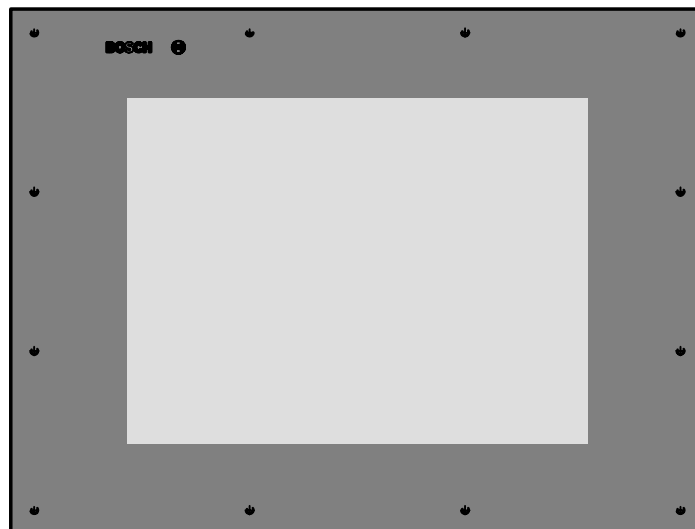
● BF315T: 15" flat-panel display of various models
(see manual "Control Panel BF2xxT/BF3xxT Connectivity Requirements")

BF315T TA
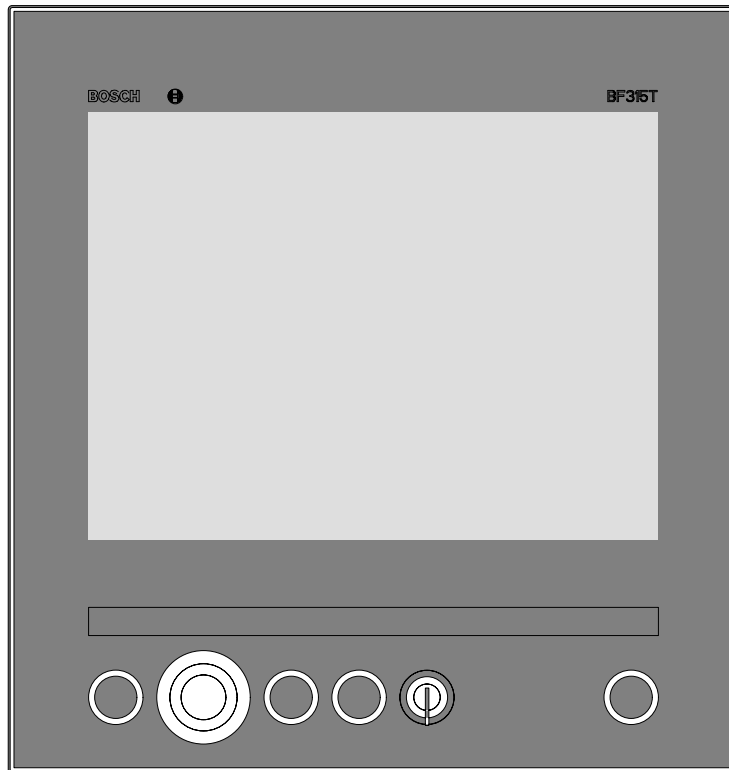
The control panels BF3xxT have ports for a PS/2 keyboard and a PS/2 mouse.

☞ **For more details regarding control panels see the manual "Control Panel BF2xxT/BF3xxT Connectivity Requirements".**
For order number, refer to page 1–7.

2.3   Technical data (PC mainframes with PNC)

Feature	Characteristic	PC control panel with PNC	BT155 with PNC	BT205 with PNC	IPC300 with PNC
Processor	Intel Pentium CPU (socket 7) or compatible	≥ 266 MHz with MMX™ technology Optional: 400 MHz Pentium™ III			
RAM (SIMM modules)	min. 64 MB max. 256 MB (DRAM or EDO)	64 MB or 128 MB (with 266 MHz processor) 128 MB or 256 MB (with 400 MHz processor)			
Hard disk	IDE	>5 GB capacity			
Display	10.4" TFT (640x480 pixels, 64k colors)	●	●	–	–
	12.1" TFT (640x480 pixels, 64k colors)	–	–	●	● (with BF312T)
PNC plug-in card	NC/MC and PLC function	1 plug-in card in the PC mainframe			
Free expansion slots	With 2 expansion slots	1 ISA slot	1 PCI/ISA combi-slot		–
	With 6 expansion slots	–	2 PCI slots, 2 ISA slots, 1 PCI/ISA combi-slot		2 PCI, 2 ISA, 1 PCI/ISA
Floppy disk drive	High density 3.5" 1.44 MB (Floppy connection)	External, optionally via cable (alternative to LS120 drive)			Internal
LS120 drive	3.5", 120 MB (IDE connection)	–	Optional, externally to housing in the package with CD-ROM drive (alternative to 3.5" drive)		–
CD-ROM drive	min. 32 times (IDE connection)	–	Optional, externally to housing in the package with LS120 drive		Internal
UPS (Uninterruptible power supply)	Via internal battery	–	● (with 6-slot housing)	● (with 6-slot housing)	●
	Via external battery	●	● (with 2-slot housing)	● (with 2-slot housing)	–
Temperature monitoring	(For details, refer to chapter 6)	With warning function & safe shutdown of the operating system			
PNC ports	(For details, refer to chapter 6)	SERCOS interface, PROFIBUS-DP master			
PC ports	(For details, refer to chapter6)	● 4 x serial ● 1 x parallel ● USB ● PS/2 keyboard and PS/2 mouse ● Ethernet			● 4 x serial (of that 1x RS485/422 se-lectable) ● 1 x parallel ● USB ● PS/2 keyboard and mouse ● Ethernet

Feature	Characteristic	PC control panel with PNC	BT155 with PNC	BT205 with PNC	IPC300 with PNC
Extended ports	(For details, refer to chapter6)	–	● DP-Slave, ● 24Vout (key codes via PROFIBUS-DP and 24Vout)		● LCD: Gigabit picture transmission including touch screen signals ● Power supply for mouse and keyboard for BF3xxT
Power supply	230/115 VAC, 50/60Hz	Alternative to 24 VDC			
	24 VDC	Alternative to 230/115 VAC			
Weight		Approx. 5 kg (with 2 expansion cards & rechargeable battery pack)	Approx. 8 kg (with 2 expansion cards, no external battery pack)	Approx. 10 kg (with 6 expansion cards & rechargeable battery pack)	Approx. 8 kg (with 6 expansion cards & rechargeable battery pack)
Dimensions (WxHxD in mm) (without external battery and external drives)	PC housing with 2 expansion slots	–	448 x 215 x 101		–
	PC housing with 6 expansion slots	–	448 x 244 x 138		448 x 132 x 256
	Control panel	Display 350 x 250 x 121 Keyboard: 350 x 210 x30	482.6 x 267 x 5 (19" x 6 HE x 5)		With BF312: 370 x 280 x 53
Operating system	PC mainframe	Windows NT 4.0 with SP5			

● = available

– = not available

☞   **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.**

2.4 Expansion slots

The expansion slots in the PC mainframe are fitted with a PNC plug-in card at the factory.

For additional expansion slots there remain (depending on the size of the housing) a maximum of **1** or **5 slots** free:

- PC control panel
  - 1 ISA slot

- BT housing with 2 expansion slots:
  - 1 PCI/ISA combi-slot

- Housing with 6 expansion slots:
  - 2 PCI slots
  - 2 ISA slots
  - 1 PCI/ISA combi-slot

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 9.7.

2.5 Rechargeable battery pack

The PC mainframes with PNC controller are driven by one rechargeable battery pack (2 in series 6V batteries).

In the event of a power failure, the 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 prevented.

- **PC control panel**:
  The battery pack must be ordered separately:
  - Battery pack with cable (90 cm.) for cabinet installation
    (Order no.: 1070 083 446)

- **BT155, BT205, IPC300** in the housing with **6** expansion slots:
  Battery pack is integrated.

- **BT155, BT205** in the housing with **2** expansion slots:
  The battery pack must be ordered separately:
  - Rechargeable battery pack with cable (20 cm.) for rear-panel installation on the control terminal, order no.: 1070 081 653)
  - Battery pack with cable (200 cm.) for cabinet installation
    (Order no.: 1070 081 652)

The battery pack has a limited service life and must be exchanged if it cannot be properly charged any more.
Refer to section 9.6.

2.6   Disk drives

Depending on the PC mainframe, various disk drives are available

	PC control panel	BT155	BT205	IPC300
CD-ROM drive with IDE port	–	LS120/CD-ROM drive unit externally to housing		Integrated
LS120 drive with IDE connection	–			–
CD-ROM drive with parallel connection	Externally via cable to X61 of the osa display pc	Externally if no LS120/CD-ROM drive available		–
3,5"floppy disk drive	Externally via cable to X75 of the osa display pc (720 kB; 1.44 MB; 2.88 MB)	Externally if no LS120/CD-ROM drive available		Integrated (720 kB; 1.44 MB)

LS120/CD-ROM drive unit

The CD-ROM drive and the LS120 drive are mounted as a single unit on the rear of the BT155, BT205. The LS120 drive supports the following 3.5" diskette types:

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

For more information on installing the LS120/CD-ROM drive unit refer to section 9.4.

CD-ROM drive with parallel connection (external)

An external CD-ROM drive can be attached via the parallel port LPT1. For connector pin assignments, refer to section 6.5.

Ensure that the CD-ROM drive is installed in accordance with the installation instructions provided by the respective manufacturer. This may also necessitate changes to the existing BIOS or operating system settings.

☞ **The simultaneous use of several devices on a single parallel port is not possible because the drivers cause mutual interference. In the event that a software protection device (dongle) is inserted in LPT1, the port will not allow a CD-ROM to be attached to it.**

3.5" floppy disk drive (external)

The optional 3.5" floppy disk drive is attached to the floppy port (see section 9.4). The integrated floppy disk controller supports the following storage devices:

- Double density (720 kB)
- High Density (1.44 MB), **factory setting**
- Enhanced floppy mode (2.88 MB)

For ordering information refer to section 12.1.

2.7   Operating conditions

2.7.1   PC mainframes

The PC mainframes are designed for continuous (24 hour/day) operation. The display backlight can be switched off.
Unless stated otherwise in specific sections, the following specifications apply:

Temperatures

Storage temperature:

- −20°C to +60°C

Ambient temperature:

- +5°C to +45°C

Ambient temperatures apply to the installation conditions described in chapter 4.
Temperature fluctuations of up to 3°C per minute are permitted.

CAUTION
Excessive operating temperature!
Do not expose the PC to direct sunlight or 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

Front panel: IP 65, otherwise IP 00

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 pollutants (e.g. acids, alkalis, corrosives, salts, metallic vapor, etc.).

Operating vibration resistance

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.

2.7.2   PNC plug-in card

The PNC plug-in card is designed for continuous (24 hour/day) operation. Unless stated otherwise in specific sections, the following specifications apply:

Temperatures

Storage temperature:

● –20°C to +70°C

Ambient temperature:

● +5°C to +45°C

CAUTION
Excessive operating temperature!
Do not expose the PC to direct sunlight or 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

IP 00

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 pollutants (e.g. acids, alkalis, corrosives, salts, metallic vapor, etc.).

Operating vibration resistance

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.

2.8   Standards compatibility

2.8.1   PC mainframes

The system components of the PC mainframes comply with 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   Requirements with respect to 24 V outputs
- 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 60068-2-27   Impact test
- .IS.114   X-ray radiation directive, as per Official Federal Gazette

☞ **All PC mainframes with PNC shipped from the factory comply fully with CE requirements.**
However, the subsequent insertion of additional expansion cards will necessitate a supplementary CE certification.

2.8.2   PNC plug-in card

The PNC plug-in card complies with 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 418   Machine safety, emergency STOP devices
- EN 60 529   Protection categories (incl. housings and installation compartments)
- EN 60 068-2-6   Vibration test
- EN 60068-2-27   Impact test

2.8.3   PNC high speed I/O (option)

The plug-in card "PNC high speed I/O" complies with the following standards:

- EN 60 742   Tranformer for 24V power supply, protective separation
- EN 61 131   Requirements with respect to 24 V outputs
- EN 61 131-2   24 V power supply requirements

3   Safety Functions

Every PC mainframe is equipped with temperature monitoring and an uninterruptible power supply (UPS). It will only operate in conjunction with a rechargeable battery pack.

3.1   Temperature monitoring function

The ambient air temperature must not exceed +45°C (see section 2.7). To ensure operational reliability, a temperature monitoring function measures the internal housing temperature.

At **temperatures exceeding 50°C** in the internal housing a warning is issued as follows:

● by the LED "Temp" flashing (on BT155, BT205, IPC300)

● by a monitoring window in the windows NT operating system.
  All application programs must be capable of accepting and handling this message. Rexroth application software meets this requirement.

The temperature warning message can be disabled via 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 by 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.

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 5 (refer to section 3.1, above), the UPS logic integrated in the power supply is activated, effecting a safe operating system shutdown procedure backed up by the internal rechargeable battery.

Power interruptions of shorter duration are bridged by the battery pack. Power interruptions of up to 5 seconds in length are permissible in the PC before the UPS logic circuit is activated.

Please note:

- To allow the rechargeable battery pack to attain its full charge capacity, the PC 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 a rapid discharge of the battery pack. You should never cycle the power more often than 4 times in succession. Thereafter the battery pack must be fully recharged again.
- 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! Loss of data may result.
Each time the PC is booted up, observe UPS program messages indicating that the battery pack may be discharged. This test is run during each PC boot phase.

Power interruptions below 800 ms in duration

Power interruptions below 800 ms in duration are bridged by the battery pack, and do not trigger the UPS logic circuit.
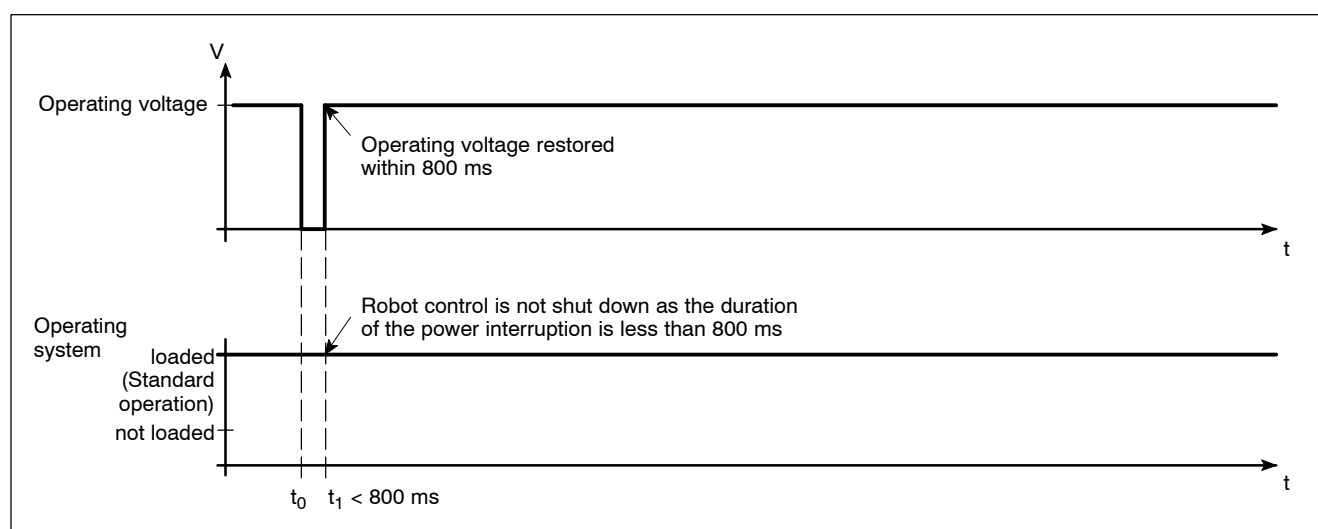
Power interruption between 800 ms and 60 s (with short break)

A power failure interval exceeding 800 ms causes the PC operating system to be shut down after a pre-selected interval (delay time).

- If the mains power is restored within 5 seconds (short break), the UPS will remain disabled (with the 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 restart the operating system again.
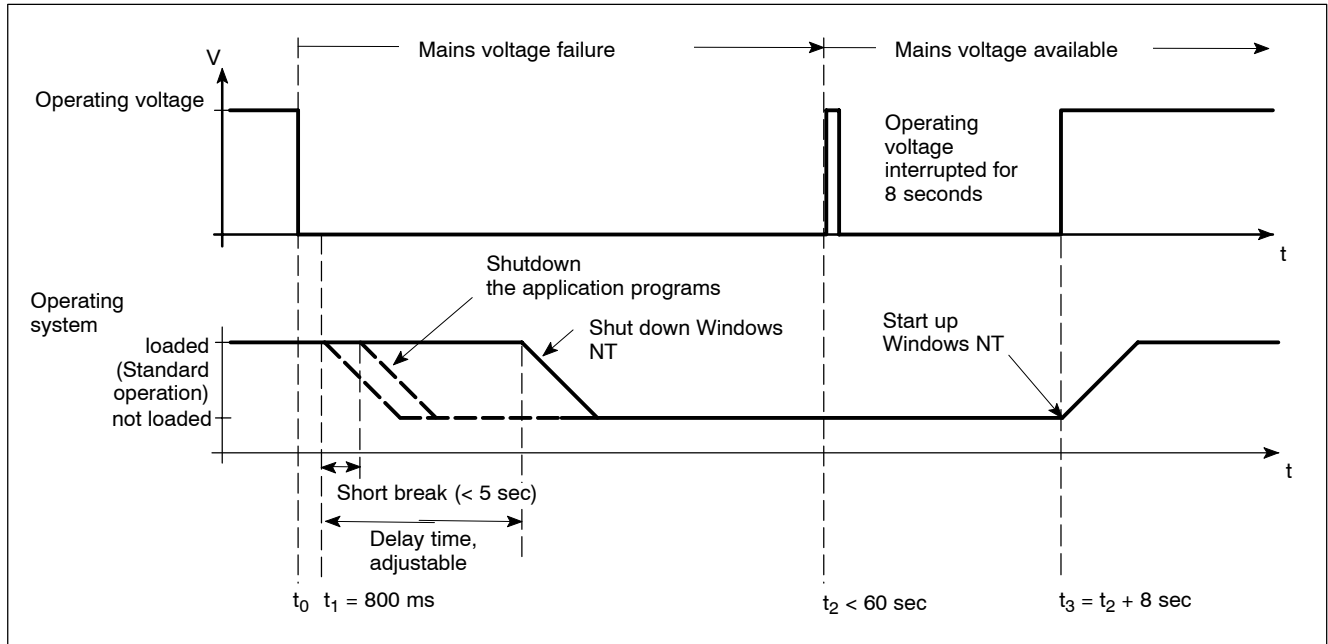
Power interruption > 60 s (without short break)

After approx. 60 sec the UPS internally switches off the power supply.
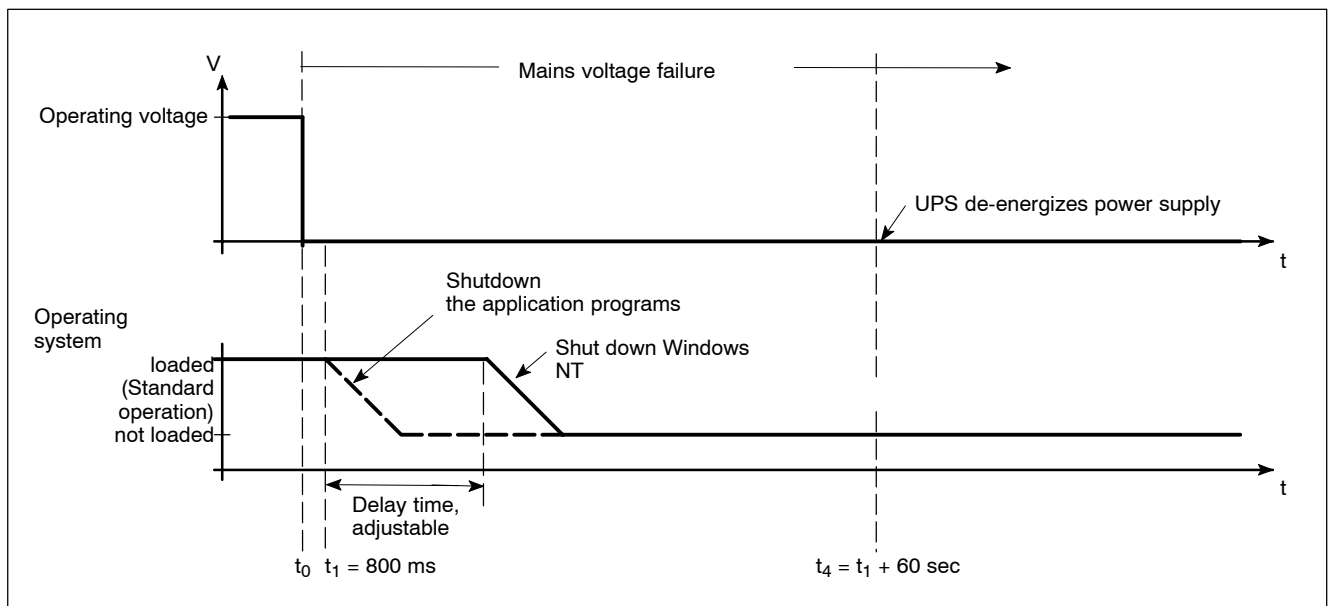
☞ **Set the delay time in the supplementary software "UPS$_{NT}$" (from page 3–5).**

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 state of the rechargeable battery and controls the system temperature monitoring function.
In the IPC300 with Pentium I, 266 MHz the housing fan is also monitored.
In the BT155, BT205 and IPC300 with Pentium III, 400 MHz the operation of the fan and internal supply voltage are also monitored.

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

In the event of a power failure it is the task of the UPS program to:

- send a message to all active applications so that they can be shut down using application routines and

- to shut down the operating system after the delay time has elapsed. Once the 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 control terminal (refer to shutdown conditions in section 3.2).

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

During standard operations the operator cannot access the UPS$_{NT}$ program . 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 parameters set in UPS$_{NT}$ must not be undertaken without consulting Rexroth first.**

3.3.2 Operation and configuration

☞ **UPS$_{NT}$ is delivered properly configured and must not be changed without consulting Rexroth first.**

For service and control purposes 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 privileges is neither able to terminate the program nor stop the monitoring function.**
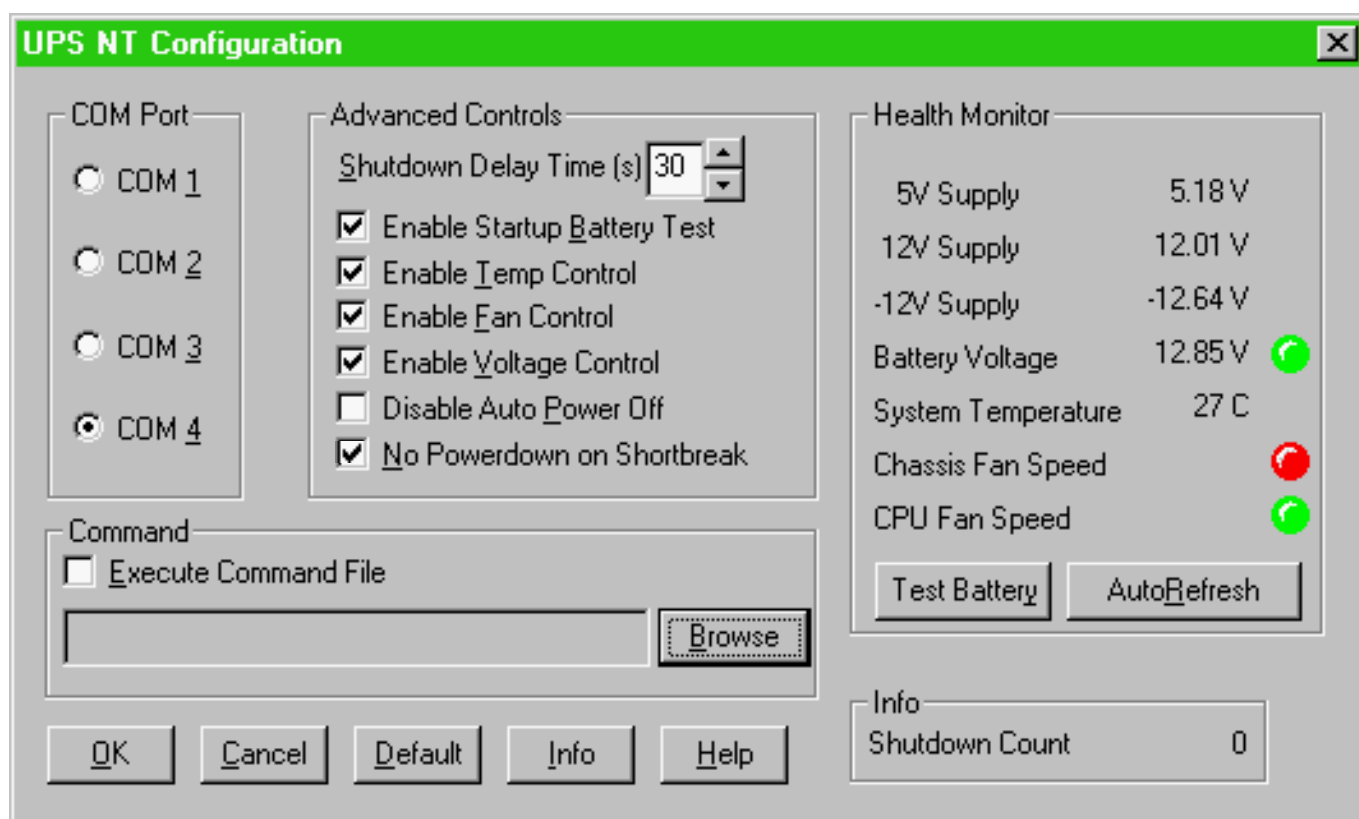
☞ **To allow new parameter values to take effect subsequent to their modification, the UPS is automatically stopped and restarted.
No monitoring function is enabled during this interval (5 to 10 sec).**

COM port

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

Advanced controls

Shutdown delay time

Here a time between 0 and 45 sec (default: 30 seconds) is specified. During this period the applications are shut down and application data are saved. Upon expiry of this time, all remaining application programs will be terminated without prior security query!

In the period between the expiry 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 make backups). 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. In the event of an error, the red LED "UPS" (BT155, BT205, IPC300) will flash 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, automatic test repetition in 12-hour intervals ensues.
- If an error is detected:
    - an error dialog is generated
    - a message is distributed throughout the system
    - the UPS program is shut down and the red LED "UPS" starts to flash. No further battery test is carried out.
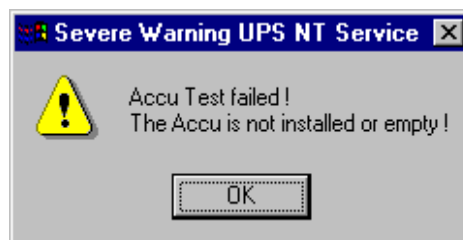
Enable Temp Control

When this checkbox is checked, the ambient temperature is monitored on a continuous basis. Excessive temperatures will produce the following warning message:
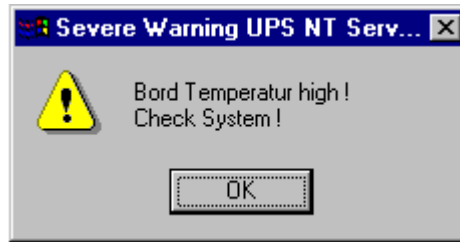
The power monitoring function is retained even after a temperature warning. In the event of an error the red LED "Temp" will flash (BT155, BT205, IPC300).

Enable Fan Control

When this checkbox is checked, in the IPC300 with Pentium I/266 MHz the housing fan is monitored and in the BT155, BT205, IPC300 with Pentium III/400 MHz the housing and CPU fans are monitored. In the event of an error the red LED "Temp" will flash and a corresponding message is displayed and distributed throughout the system.
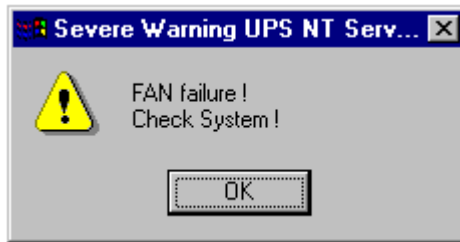
Enable Voltage Control

When this checkbox is checked, internal supply voltages are monitored. In the event of an error, the green LED "Vout" goes out (BT155, BT205, IPC300), a corresponding message is displayed and distributed throughout the system.
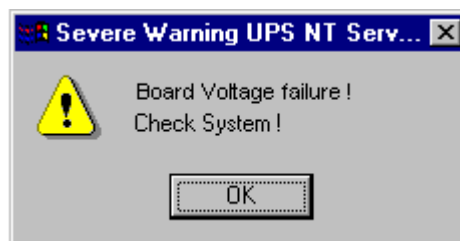
Disable Auto Power Off

☞ **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 option shortens the wait interval for startups and software installations. For normal operations it must always be deactivated!

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 Setting

Selecting this button returns all settings to their **default values**.

These are:
● COM port: COM4
● Shutdown Delay Time: 30 sec
● Enable Startup Battery Test: enabled
● Enable Temp Control: enabled
● Enable Fan Control: enabled
● 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 too 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 a 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 measurements and the legend on the button changes to <AutoRefresh>. Pressing the <AutoRefresh> button again enables automatic measurement updating and the legend on the button changes to <StopAutoRefresh>.

Info

Shutdown Count

The value displayed here indicates the number of times that UPS has already shut down the system. The maximum number of charging cycles permitted depends on the ambient temperature. See details in section 9.6.

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

Notes:

4 Installation

With respect to installation, observe the information about applicable standards and operating conditions in sections 2.8 and 2.7.

CAUTION
Conditions hazardous to the product!The ambient air must be free of electrically conductive pollutants (e.g. acids, alkalis, corrosives, salts, metallic vapors, 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 operate and use the device only while 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.**

4.1   Installed positions and clearances

Housing:	Front: Protection category IP 65 PC housing: Protection category IP 00
Weight:	BT155, BT205 small housing without battery pack: approx. 8 kg BT155, BT205 small housing with battery pack: approx. 10 kg PC control panel: osa display pc: approx. 4 kg 　　　　　　　　osa keyboard: approx. 1 kg 　　　　　　　　osa switch: approx. 1.7 kg IPC300 with battery pack: approx. 8 kg
Installed position:	BT155/BT205, PC control panel:　0° up to max. ±45° incline IPC300:　　　　　horizontal osa keyboard:　　0° up to max. 90° incline centered under the osa display pc (max.100 mm away). osa switch:　　　0° up to max. 90° incline centered under the osa keyboard (max. 300 mm away).
Installation type:	In console frame or hinged frame, sealed as per IP54

☞ **Remember that the devices may become dirty more quickly if installed at an angle, instead of being installed vertically.**

PC control panel

osa display

Allow at lease 50 mm clearance on all sides

Max. 100mm

osa keyboard

Max. 45°

Max. 90° (osa keyboard)
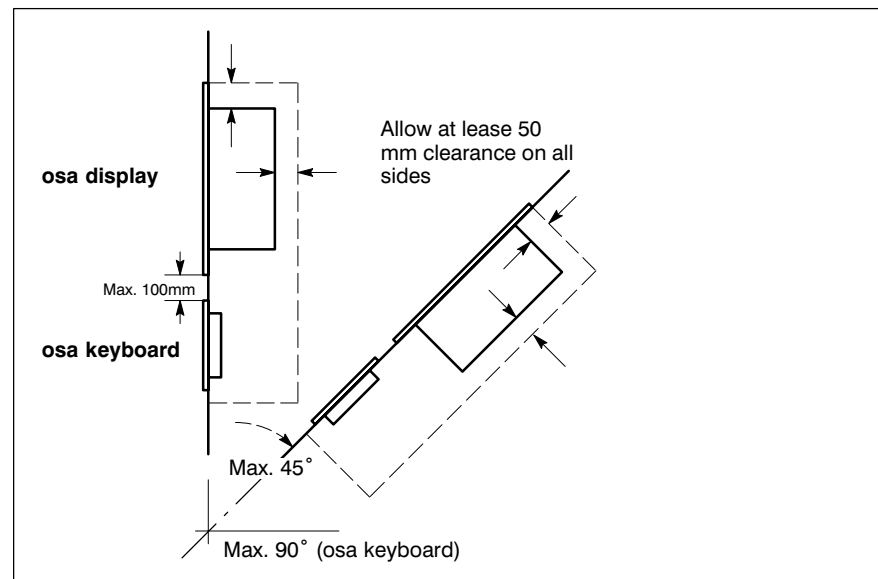
BT155, BT205
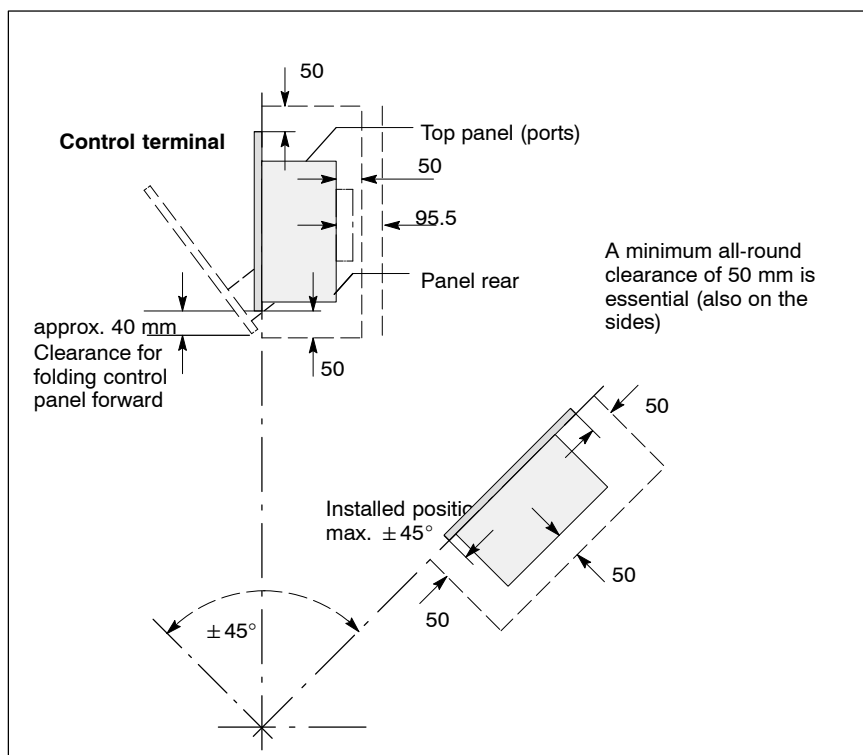
☞ **If an LS120/CD-ROM drive unit is installed a rear clearance of 50 mm + 45.5 mm to the upper surface of the housing cover is required.**

IPC300
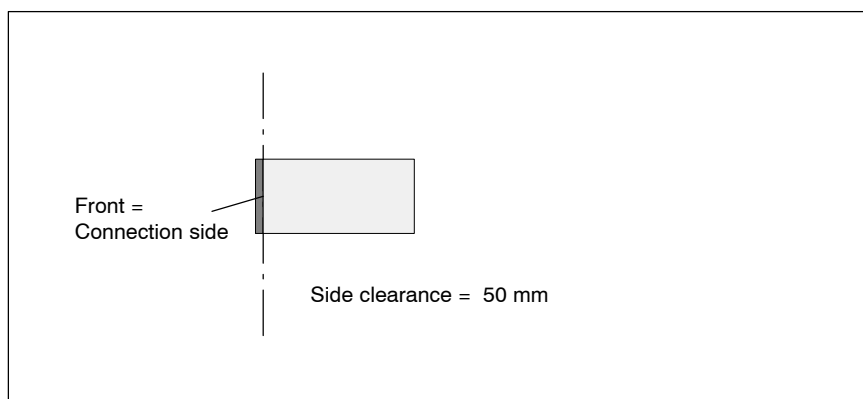
☞ **Please note that the integrated CD-ROM drive may only be operated in a horizontal position. For this reason the IPC must be installed in a horizontal position.**

Installation:

● Install the device ensuring that it can be operated ergonomically. 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 mainframe in a manner ensuring easy access to the connector panel at the top.

- The LED indicators 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).
- Allow for connecting loops in all cable routings and provide strain relief for all cables.
- Maintain a suitably large distance from sources of interference.

4.1.1   Dimensioned drawings

PC control panel

Distance to the rear panel of the housing cover: min. 50 mm
(if the hard disk frame is extended: min. 150 mm)

Circumferential edge seal (rear side)

osa display pc

osa keyboard

11 circumferential

3   128

338.5
350

238.5   250

∅ 4.5

198.5   210

Direct adjoining of the
osa keyboard possible

Direct adjoining of the
osa switch possible

Circumferential edge seal (rear side)

Circumferential edge seal (rear side)

Direct adjoining of
the osa keyboard
possible

osa switch dp

S1   S2

40

5

163   175

338.5

350

3

50 mm
clearance

BT155, BT205

BT155, BT205	Depth
Small housing (2 expansion slots)	101
with external battery pack	150
with LS120/CD-ROM drive unit	147

190.5

15,5

5

13,5

Stud bolt M4

9 or: 15

Circumferential edge seal

206

214,5

Stud bolt M4 (not visible from front)

Front panel mounting screws

BOSCH

BT 155

482,6 (= 19")

465,9

PC housing: 448

8,35

265.9 (=6HE)

BT155, BT205	Depth
Large housing (6 expansion slots)	136
with LS120/CD-ROM drive unit	181.5

13,5

190.5

37.7

15,5

5

Circumferential edge seal

Stud bolt M4

11.8

18.1

154.2

215.0

255.7

Stud bolt M4 (not visible from front)

Front panel mounting screws

BOSCH

BT 155

482,6 (= 19")

465,9

PC housing: 448

8,35

265.9 (=6HE)

IPC300

4.1.2   Installation cutout

★   Please make an installation cut-out with 4 holes $\varnothing$ 5 mm in accordance with the following diagrams.

★   Insert the PC mainframe into the cut-out from the front while inserting the M4 stud bolts into the drilled holes.

★   Fasten the PC mainframe by starting and tightening M4 nuts on the mounting studs protruding at the rear of the control panel.

PC control panel (osa display pc)

Drilled hole $\varnothing$ 5 mm
(for M4 stud bolts)

338.5

230   330   238
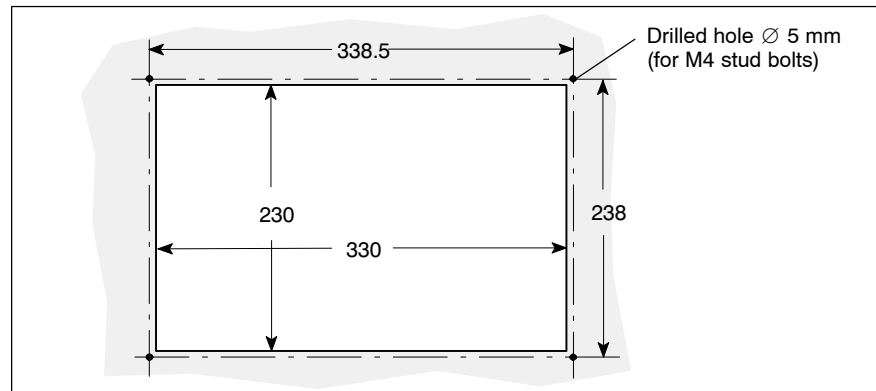
PC control panel (osa keyboard)

Drilled hole $\varnothing$ 5 mm
(for M4 stud bolts)

338.5

190   330   198

PC control panel (osa switch dp)

Drilled hole $\varnothing$ 5 mm
(for M4 stud bolts)

338.5

155   330   163

BT155, BT205

Dimensions:
- 465.9
- 30
- 250.5
- 190.5
- 454.9
- 30
- 5.5
- 5.5

Drilled hole ∅ 5 mm (for M4 stud bolts)
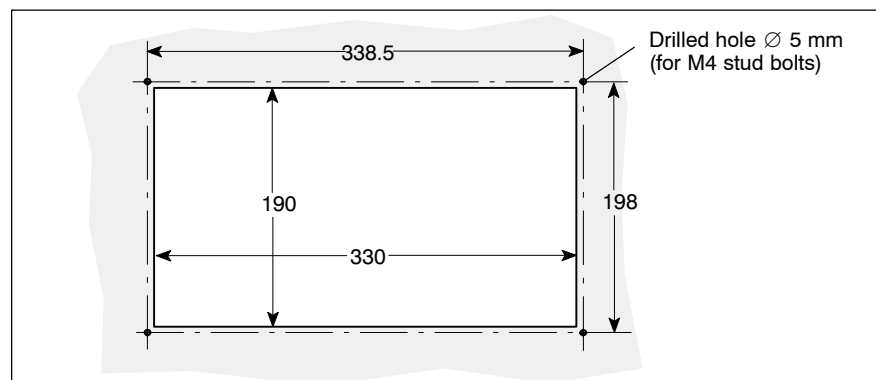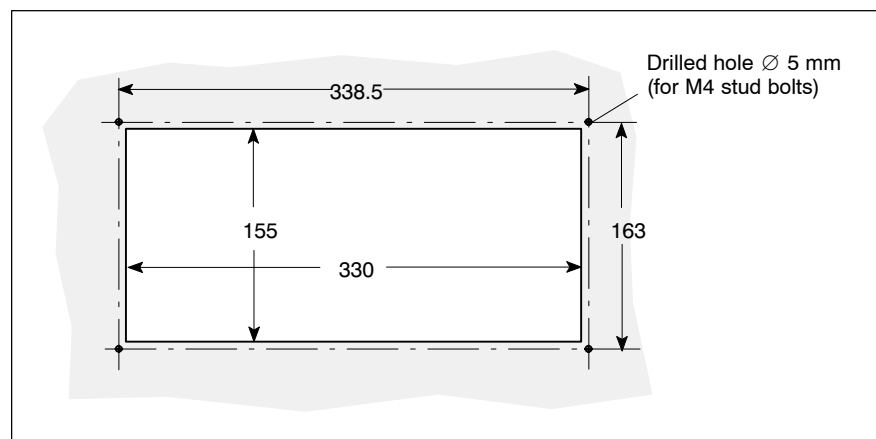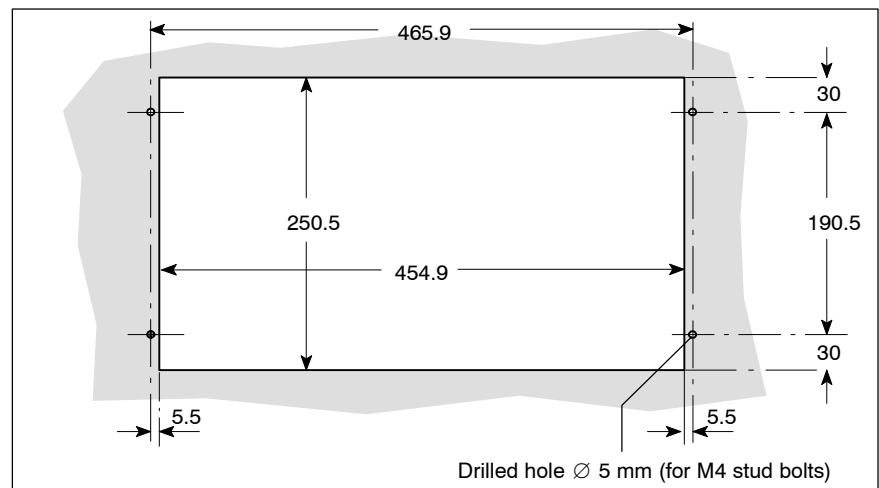
IPC300

★ Construct a 19 in. mounting frame with fasteners for the 4 holes in the front panel of the IPC300.

★ Insert the IPC300 into the mounting frame from the front.

★ Using 4 suitable mounting screws, attach the unit to the mounting frame.

Notes:

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 isolated 24 VDC and 0 V terminal bars inside the control cabinet. With regard to cable routing, maintain a minimum distance of 10 cm.. (4 in.) from all power cables.
- Design the system control circuits in such a way that the PC and other industrial components are always switched on together.

5.1 Protective Earth conductor (PE) & screening information

DANGER
Dangerous conditions, functional failures and equipment damage to the system can be caused by substandard potential equalization or defective screening between individual components!

Potential equalization currents must not flow across the screening of interface cables.

★ The protective earthing conductors (earthing connections) 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 lines / PE lines of all system components should be kept as short as possible, thus providing low-resistance connections.

★ Install the PE lines, preferably electro-conductivity, 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 rails 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 to both ends of a cable.

★ Ensure that potential equalization currents do not flow across the interface signal lines via the shielded conductors. Therefore, before switching on for the first time , ensure that the potential equalization between devices which are to be connected is correct. Do not forget the interfaces which connect devices to each other at different 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. Connections must be permanent and tight.

5.2 Interference suppression information

When designing the system, 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 to the system can be caused by electromagnetic interference!

Install signal voltage cables only 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 interference suppression **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, for example.
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.
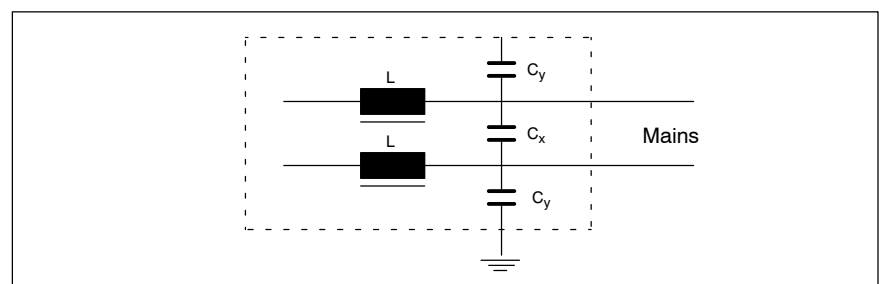
Interference suppression examples:

Suppression of **contacts**:

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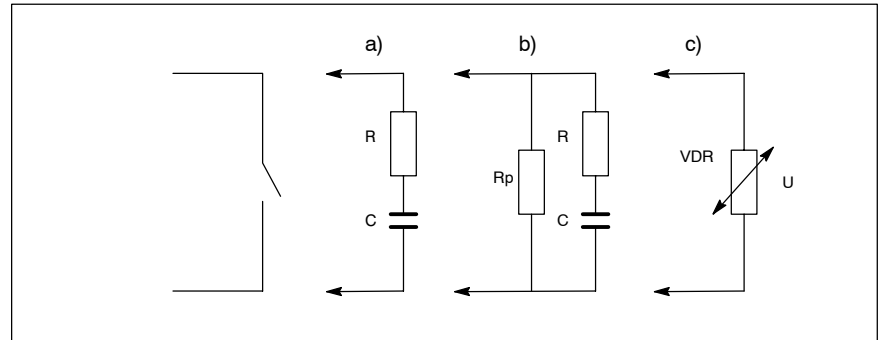
to b)   For sensitive contacts, residual current when contact open!

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

Suppression of an **inductive load**

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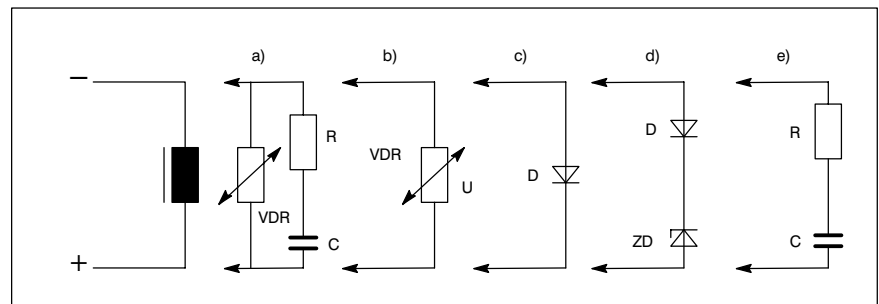
to c)   For relay, drop-off delay.

to d)   For relay, defined drop-off delay

to e)   Must be optimized for inductance!

Suppression example – mains input:
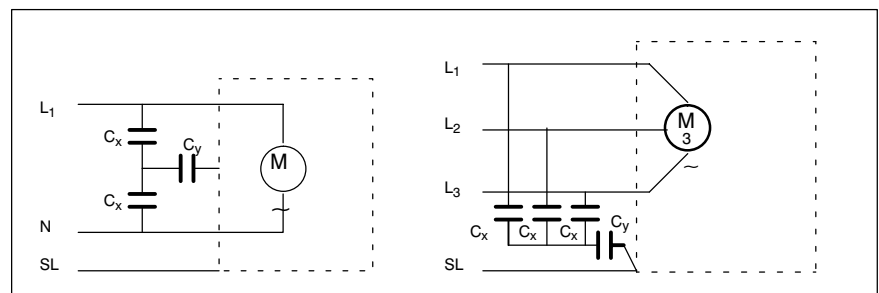
5.3   Power supply

5.3.1   24 VDC power supply

X10_1   **24 VDC power connection (with integrated 24 VDC power supply)**

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

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

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

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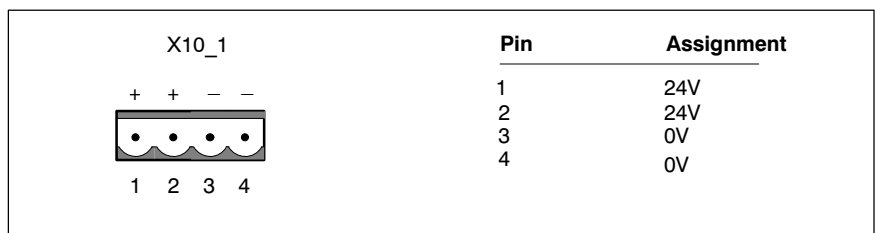
Rated voltage U_N:	24 VDC ; +20%, −15%
Residual ripple at U_N:	see diagram on next page
Interference / surge immunity:	U_{max}= 35 V (for t < 100 ms)
Current draw at U_N:	max. 5 A
Input fuse:	6.3A (5x20) medium time-lag
Reverse polarity protection:	Via decoupling diode. Polarity reversal will blow input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

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

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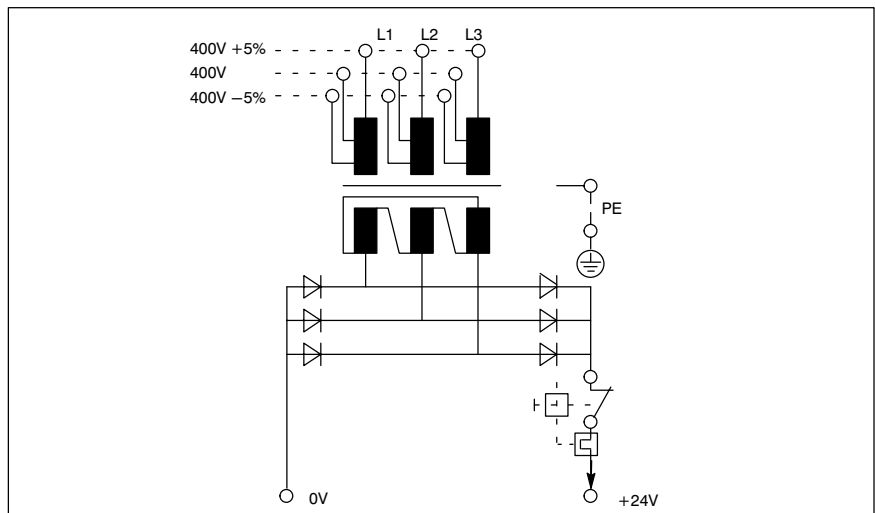
Offset AC components of the type produced by an unregulated rotary current bridge circuit without smoothing, with a ripple factor of 5% (refer to DIN 40110/10.75, Section 1.2), are permissible. As an upper voltage limit, this produces a maximum absolute value of 30.2 V and, as a minimum voltage limit,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

$1,05 \cdot 28.8 V = 30.2 V$

Upper limit   28.8 V

$0,866 \cdot 30.2 V = 26.1 V$

30° el

$\cos(30°) = 0.866$

$1,05 \cdot 21.4 V = 18.5 V$
Lower limit   20.4 V

$0,866 \cdot 21.4 V = 18.5 V$

Control terminals BT155 and BT205

L1 L2 L3 PE   PE

Power supply with safety transformer as per EN 60742

10^2 (green/yellow)

24 VDC

Cross-sections dependent on current drawn, but min. 4 mm². For greater current drawn, use 2 x 4 mm²

Max. length 4 m

6^2 (1) (blue)

A   A   B

10^2 (green/yellow)(2)

24 V load   **0 V load**   **Earth bar**

Control terminal (24-VDC version)

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

Display with front keyboard and PC

Power supply

Cross-sections dependent on current drawn, but min. 0.5 mm² (3)

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 insulated PE 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 supply cable.

(3) 0.5 mm², up to 4 m
0.75 mm², up to 6 m
1.5 mm², up to 10 m
Over 10 m a separate local power supply is required.

PC control panel

L1 L2 L3   PE   **PE**

10^2 (green/yellow)

**Power supply with
safety transformer
as per EN 60742**

24 VDC

Cross-sections
dependent on current
drawn, but min. 4
mm^2. For greater
current drawn,
use 2 x 4 mm^2

Max. length 4 m 6^2 (1)(blue)

| ⌀ | A | | A | | B | | ⌀ |

10^2 (green/yellow)(2)

24 V load   0 V load   Earth bar

A = Terminal block 4^2
B = Terminal block 10^2

☐ : Terminals in isolated arrangement

PC control panel
(24-VDC version)

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

osa display PC

| **Power
supply** | X10_1 |

PE ⏚   X1

Max. 1.5m

osa keyboard

PE ⏚   X1

(1) Easily visible and removable.

(2) Preferred installation of PE terminal bars, i.e. electrically
conductive on the mounting plate. Both ends of insulated PE
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 supply 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!

IPC300

Cross-sections dependent on current drawn, but min. 4 mm^2. For greater current drawn, use 2 x 4 mm^2

Power supply with safety transformer as per EN 60742

24 VDC

PE

10^2 (green/yellow)

Max. length 4 m

6^2 (1) (blue)

A   **A**   **B**

10^2 (green/yellow) (2)

24 V load   **0 V load**   **Earth bar**

A = Terminal block 4^2
B = Terminal block 10^2

: Terminals in isolated arrangement

IPC300 (24-VDC version)

Power supply (protective separation to EN 60950)

PE

X10_1
X11
LCD

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

Control panel BF3xxT

Fan

PE

LCD
X33
X10_1
X10_2

Fan power

(1) Easily visible and removable.

(2) Preferred installation of PE terminal bars, i.e. electrically conductive on the mounting plate. Both ends of insulated PE 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 supply 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!

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 over-voltage category II. Otherwise, the integrated power supply may be destroyed.
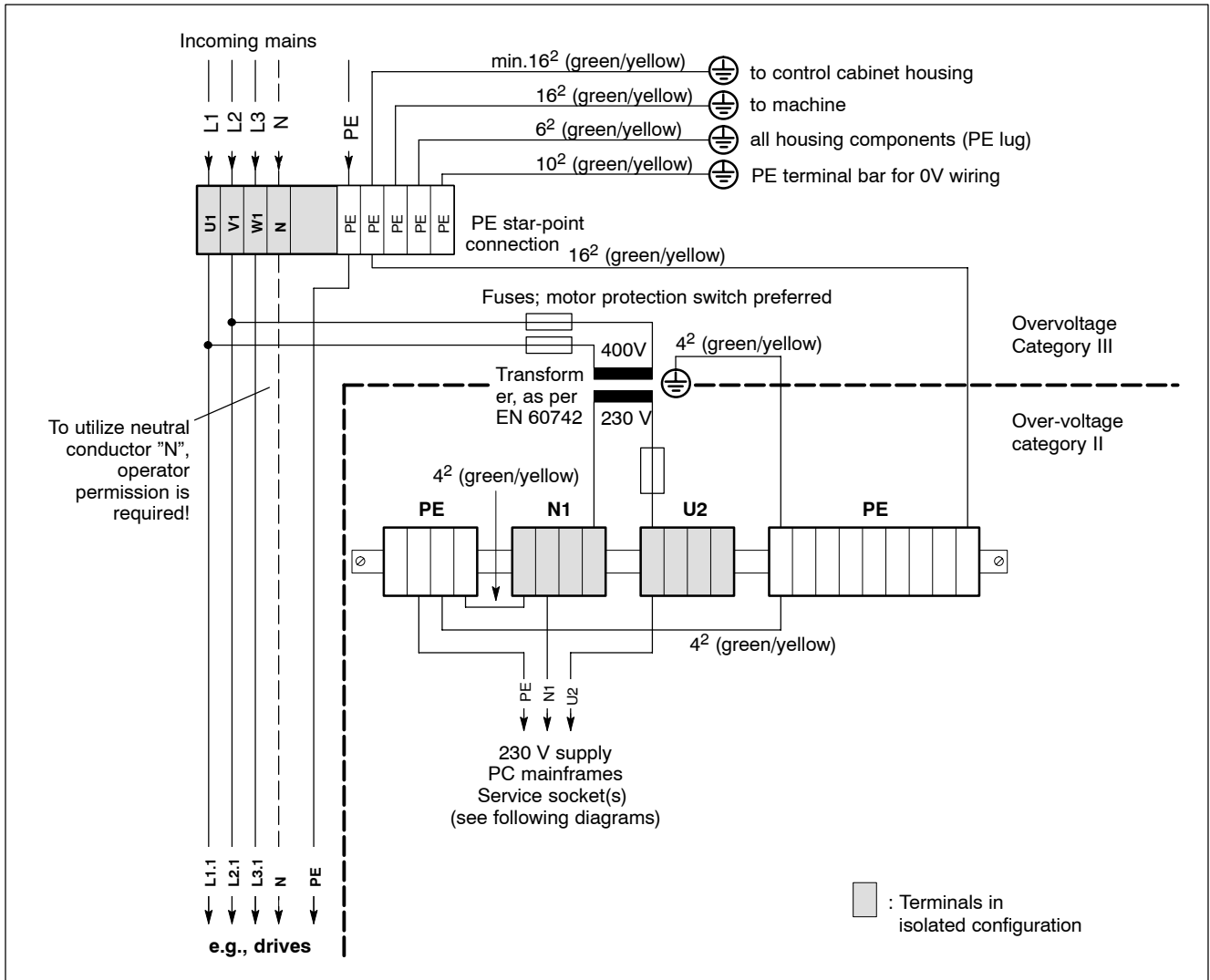**Use a separation transformer to generate the 230/115 VAC (refer to next page).**

Connector for non-heating apparatus,
3-pin

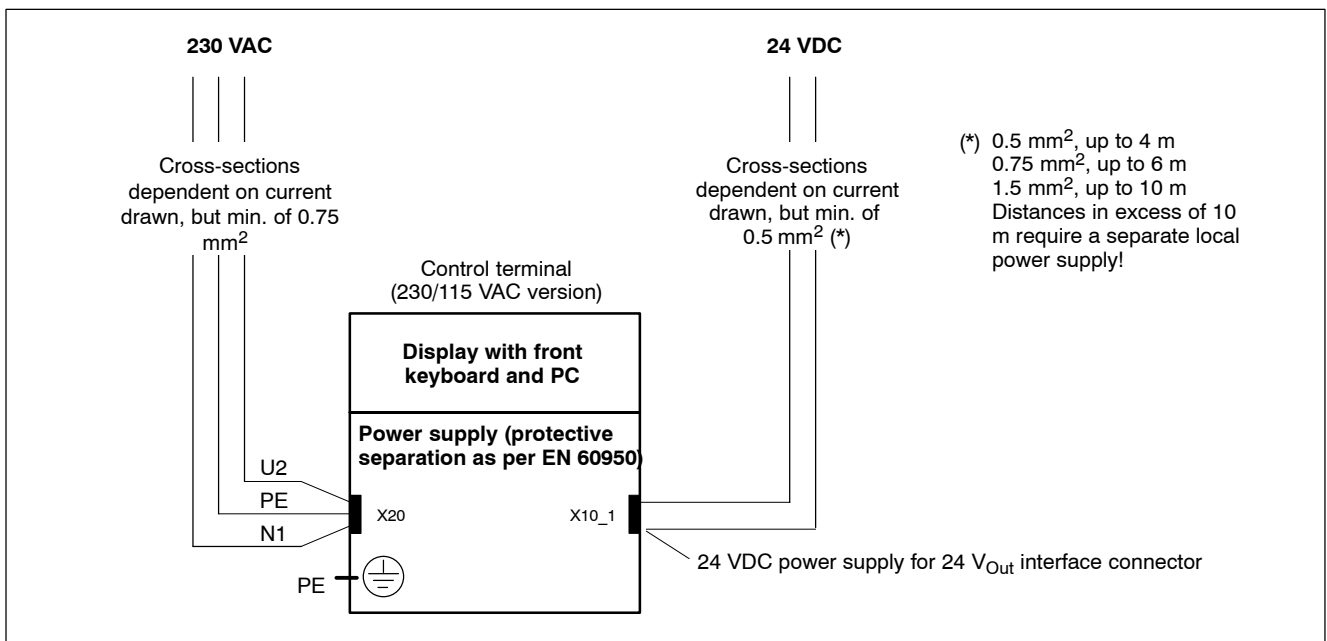Max. conductor cross-section: 1.5 mm^2

X20	Assignment
PE	N1
	PE
	U2

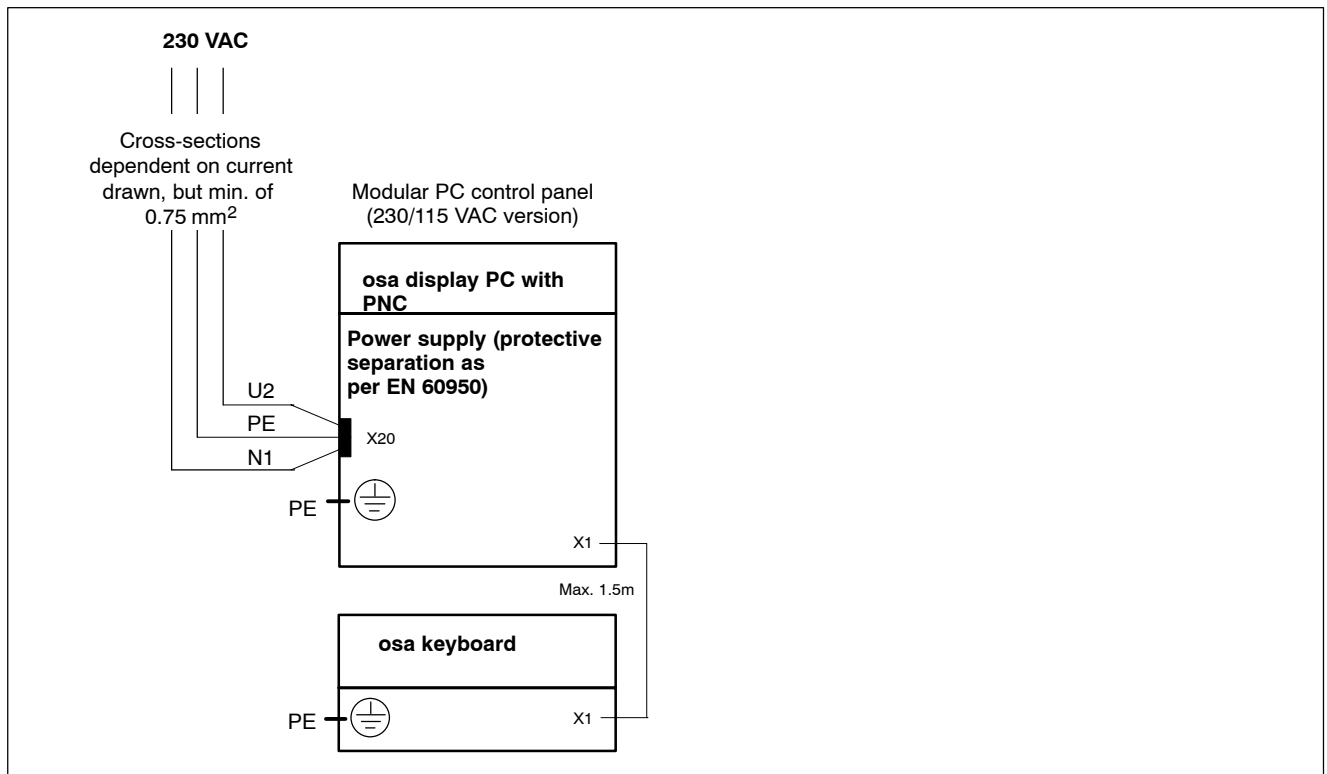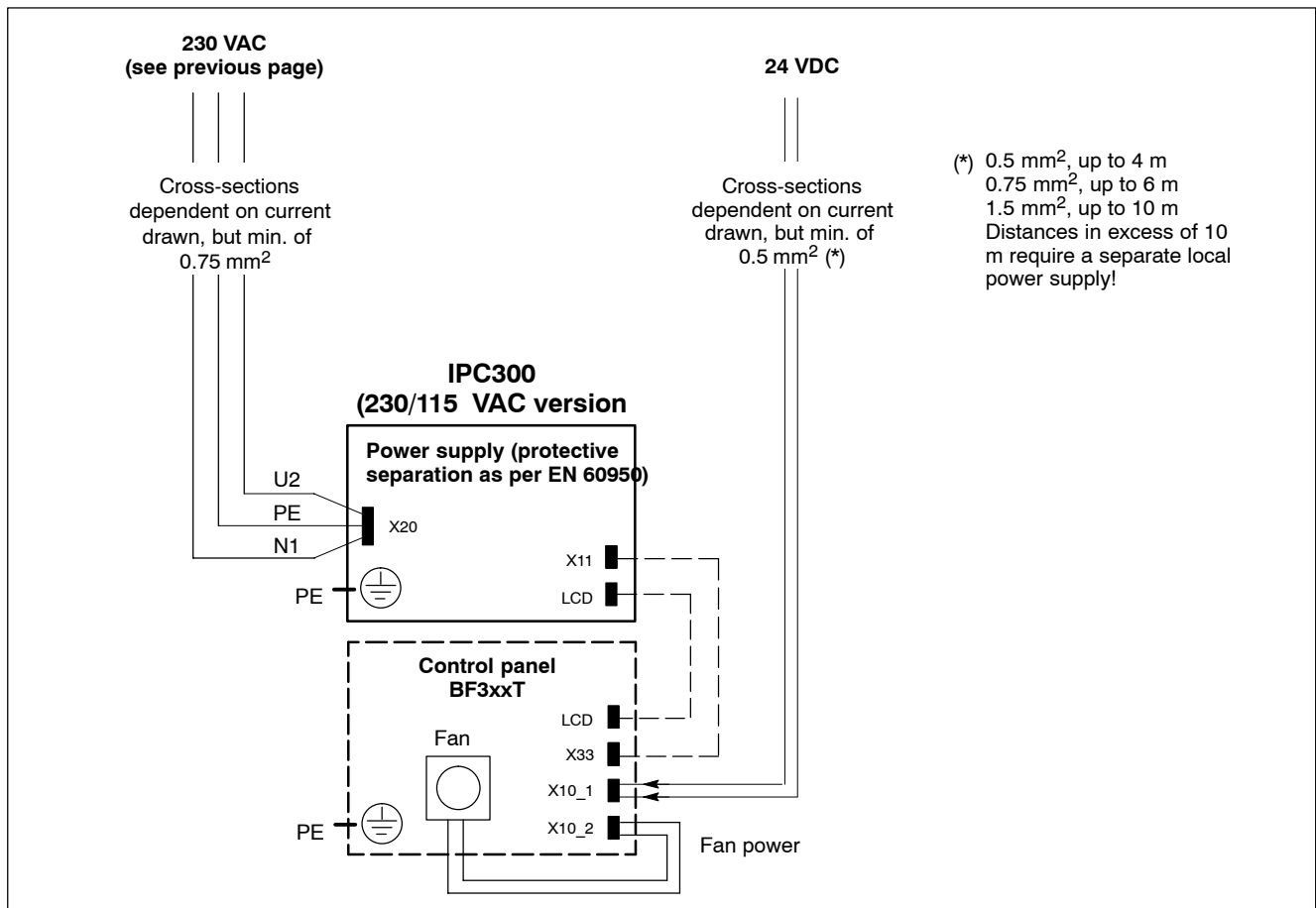|	
Rated voltage:	85 VAC ... 264 VAC; Extended-range input
Current draw at U_N = 230 VAC:	0.7 A
Current draw at U_N = 115 VAC:	1.4 A
Inrush current at 230 VAC:	30 A, cold start, 25 °C
at 115 VAC:	15 A, cold start, 25 °C
Input fuse:	1.25 A (5x20)

Power connection 230 VAC via separation transformer

Incoming mains

min.16² (green/yellow) ⏚ to control cabinet housing
16² (green/yellow) ⏚ to machine
6² (green/yellow) ⏚ all housing components (PE lug)
10² (green/yellow) ⏚ PE terminal bar for 0V wiring

| U1 | V1 | W1 | N | | PE | PE | PE | PE | PE |

PE star-point connection

16² (green/yellow)

Fuses; motor protection switch preferred

400V

4² (green/yellow) ⏚

Overvoltage Category III

Transformer, as per EN 60742

230 V

Over-voltage category II

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

4² (green/yellow)

PE **N1** **U2** **PE**

4² (green/yellow)

∅ ∅

PE N1 U2

230 V supply
PC mainframes
Service socket(s)
(see following diagrams)

: Terminals in isolated configuration

L1.1 L2.1 L3.1 N PE

e.g., drives

Control terminals BT155 and BT205

230 VAC

24 VDC

Cross-sections dependent on current drawn, but min. of 0.75 mm²

Cross-sections dependent on current drawn, but min. of 0.5 mm² (*)

(*) 0.5 mm², up to 4 m
0.75 mm², up to 6 m
1.5 mm², up to 10 m
Distances in excess of 10 m require a separate local power supply!

Control terminal
(230/115 VAC version)

Display with front keyboard and PC

Power supply (protective separation as per EN 60950)

U2
PE   X20   X10_1
N1

PE ⏚

24 VDC power supply for 24 V_{Out} interface connector

PC control panel

230 VAC

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

Modular PC control panel
(230/115 VAC version)

osa display PC with PNC

Power supply (protective separation as per EN 60950)

U2
PE
N1

X20

PE

X1

Max. 1.5m

osa keyboard

PE

X1

IPC300

230 VAC (see previous page)

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

24 VDC

Cross-sections
dependent on current
drawn, but 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!

IPC300 (230/115 VAC version

Power supply (protective separation as per EN 60950)

U2
PE
N1

X20

PE

X11

LCD

Control panel BF3xxT

Fan

LCD

X33

X10_1

X10_2

PE

Fan power

Notes:

6 Interfaces

6.1 Overview

PNC plug-in card

	Designa-tion	Connection	Connector type (built-in)	Mating connector or cable	
o	X10	Ready contact	Weidmüller push-lock terminal, MSTB 1.5, 3-pin	Female Weidmüller terminal, MSTB 1.5, 3-pin	
o	X73 and X74	SERCOS interface	Optical fibre connector (OFC)	OFC cable	
o	X71	PROFIBUS DP master	Female DB, 9 connector	Male DB IP20, 9 connector	

PNC high speed I/O plug-in card

	Designa-tion	Connection	Connector type (built-in)	Mating connector or cable	
o	X10	Power supply 24 VDC	Weidmüller push-lock terminal, MSTB 1.5, 4-pin	Female Weidmüller terminal, MSTB 1.5, 4-pin	
o	X11	Digital Out	Weidmüller push-lock terminal, MSTB 1.5, 8-pin	Female Weidmüller terminal, MSTB 1.5, 8-pin	
o	X12	Digital In	Weidmüller push-lock terminal, MSTB 1.5, 8-pin	Female Weidmüller terminal, MSTB 1.5, 8-pin	

PC mainframes

	Designa-tion	Connection	Connector type (built-in)	Mating connector or cable (external)	BT 155	BT 205	PC control panel	IPC 300
o	COM1	Serial port: RS-232, free assignment (IPC300: alternative to X57)	Male DB, 9 connector	Female DB, 9 connector	●	●	●	●
o	X57	RS-485/422, alternative to COM1	Male DB, 9 connector	Female DB, 9 connector	–	–	–	●
o	COM2	Serial port: RS-232 for touchscreen or free assignment	Male DB, 9 connector	Female DB, 9 connector	●	●	●	●
o	COM3	Serial port: RS-232 for download key codes or free assignment	Male DB, 9 connector	Female DB, 9 connector	●	●	●	●
o	COM4	Serial port: RS-232 for UPS logic	Male DB, 9 connector	Covered by a cap	●	●	●	●
o	LPT1	Parallel port: supports SPP, EPP, ECP modes	Female DB, 25 connector	Male DB, 25 connector (e.g. printer cable)	●	●	●	●
o	Ethernet	Ethernet network connection	Female RJ45 connector, 8-pin.	Male RJ45 connector, 8-connector, twisted pairs	●	●	●	●
o	VGA	VGA connection for external CRT monitor	Female VGA DB 15-pin	Monitor cable with male VGA HD connector 15-pin	●	●	●	●
o	DP slave	PROFIBUS-DP keyboard code output (slave)	Female DB, 9 connector	Male DB IP20, 9 connector	●	●	–	–
o	24 Vout	Keyboard code output	Female DB, 15 connector	Male DB, 15 connector	●	●	–	–
o	LCD	Gigabit for BF3xxT: Video transmission and RS-422 for touchscreen controller (COM2)	Female RJ45 connector, 8-pin.	Male RJ45 connector, 8-connector, twisted pairs, CAT7	–	–	–	●

	Designa-tion	Connection	Connector type (built-in)	Mating connector or cable (external)	BT 155	BT 205	PC control panel	IPC 300
o	X11	BF3xxT: Power supply, mouse & keyboard	Female DB, 15 connector	Male DB, 15 connector	–	–	–	●
o	KBD, Keyb	PS/2 mini DIN keyboard	Female mini DIN PS/2, 6-pin	Keyboard cable with male PS/2 mini DIN, 6-pin	●	●	●	●
o	Mouse	PS/2 mini DIN mouse	Female mini DIN PS/2, 6-pin	Male mini DIN PS/2, 6-pin	●	●	●	●
o	USB	USB port	USB female RJ45 con-nector, 4-pin.	USB male RJ45 connector, 4-pin.	●	●	●	●
u	X76	Power supply for 3.5" floppy disk drive or LS120/CD-ROM drive unit	Female FDD mains con-nector, 4-pin	Power supply with 4-pin male plug	●	●	●	–
u	X75	Data connection 3.5" floppy disk drive	Male terminal strip, 34-pin (IDC)	Female connector, 34-pin (IDC) (data cable)	●	●	●	–
h	IDE2	Data connection for LS120/CD-ROM drive unit	Male terminal strip, 44-pin	Female connector, 44-pin (IDE data cable)	●	●	–	–
u	X19	Rechargeable battery	Male terminal strip, 2-pin	Female connector, 2-pin Cable to internal/external bat-tery	●	●	●	●
f	KBD	MF2 keyboard, front	MF2, female socket 5-pin	MF2 keyboard male DIN plug, 5-pin	●	●	–	–
Power supply connections (already described in section 5.3)								
o	X20	PC power supply: 230/115 VAC, alternative to X10_1	Non-heating appliance connector, male	Power cord with female non-heating appliance connector	●	●	●	●
o	X10_1	PC power supply: 24 VDC, alternative to X20. Supply from 24Vout	Weidmüller push-lock ter-minal, MSTB 1.5, 4-pin	Female Weidmüller terminal, MSTB 1.5, 4-pin	●	●	●	●
osa keyboard								
r		Keyboard connection to osa display	Cable with MF2 male DIN plug, 5-pin	PS/2 adapter with DIN female connector, 5-pin	–	–	●	–
osa switch dp (option)								
r		EMERGENCY OFF	EMERGENCY OFF block, 4-pin	–	–	–	●	–
r	St2	PROFIBUS-DP to PNC X71	Male DB, 9 connector	Female DB, 9 connector	–	–	●	–
r	St3	Connection to digital hand wheel	Female DB, 25 connector	–	–	–	●	–
r	St4	EMERGENCY OFF connection for hand wheel with EMER-GENCY OFF key	Lock terminal 2-pin	–	–	–	●	–
r	St5	Connection of external addi-tional keys	Weidmüller push-lock ter-minal, MSTB 1.5, 6-pin	Female Weidmüller terminal, MSTB 1.5, 6-pin	–	–	●	–
r		D-Sub lead-through with cover, free assignment	Male DB, 9 connector	Female DB, 9 connector	–	–	●	–

The 4 last columns show the availability of the port for the relevant mainframe: ● = available
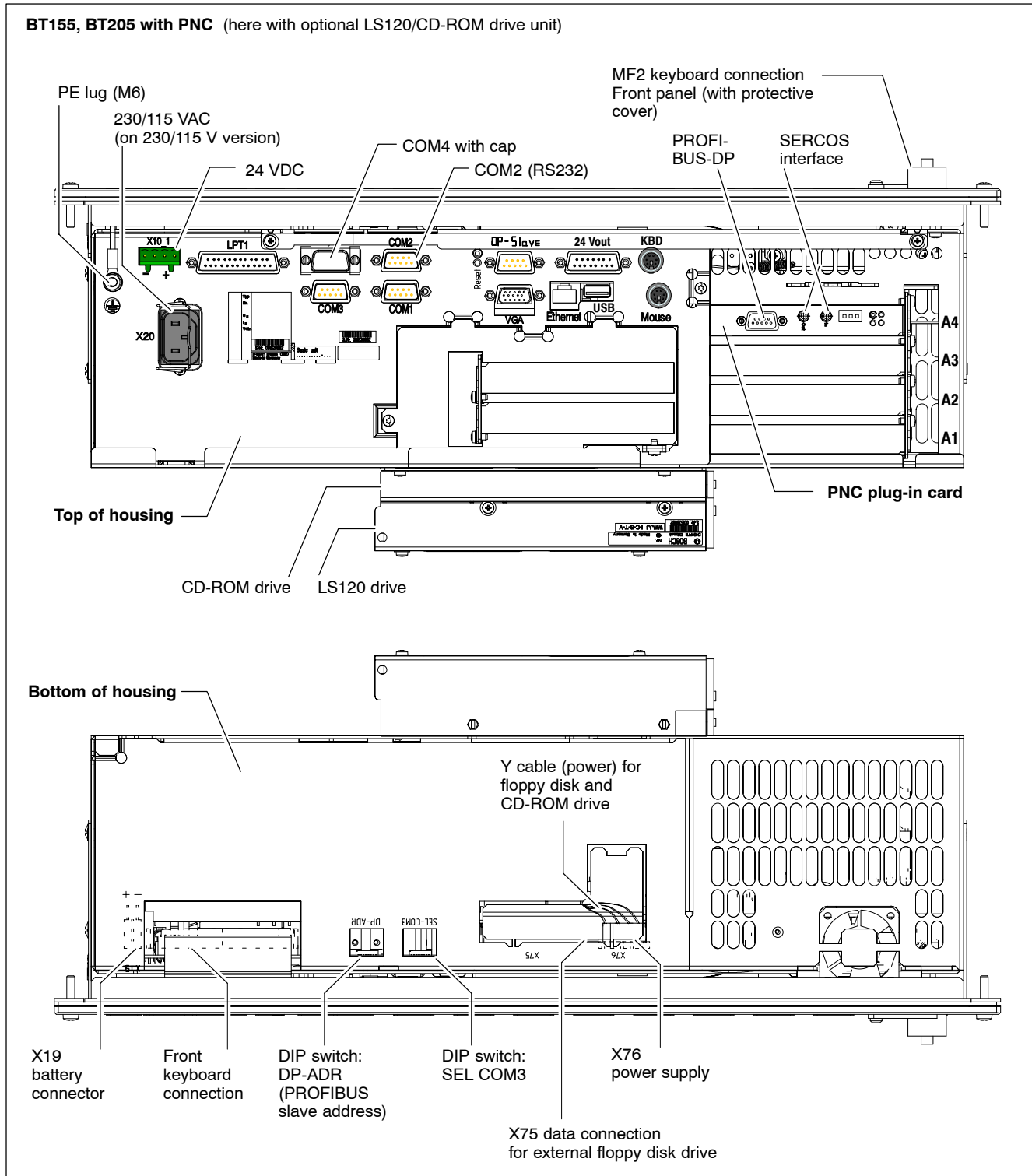
    – = not available

Connector   o = top of housing,   u = bottom of housing (on carrier board),
location: f = control panel front   m = on main board,
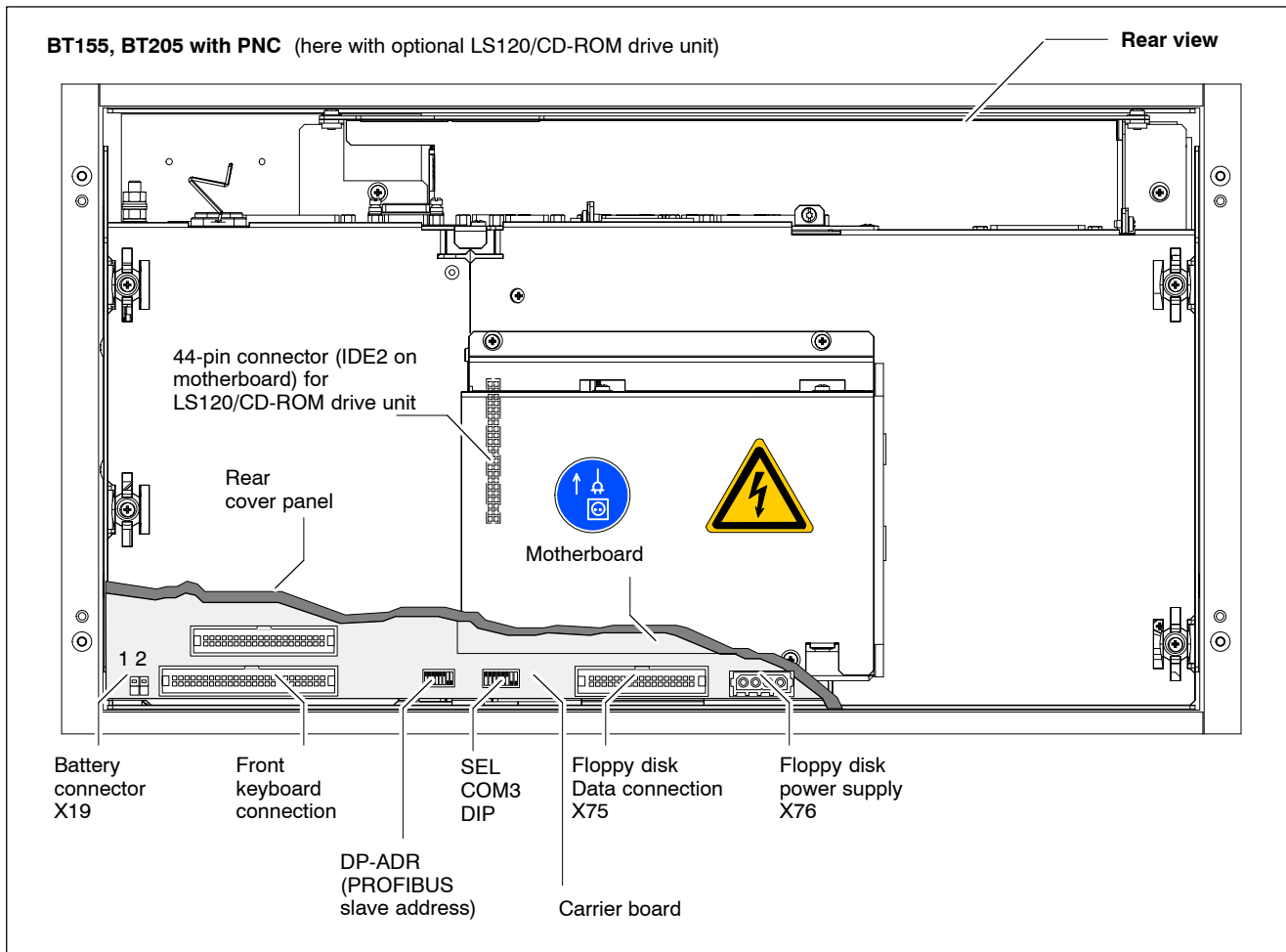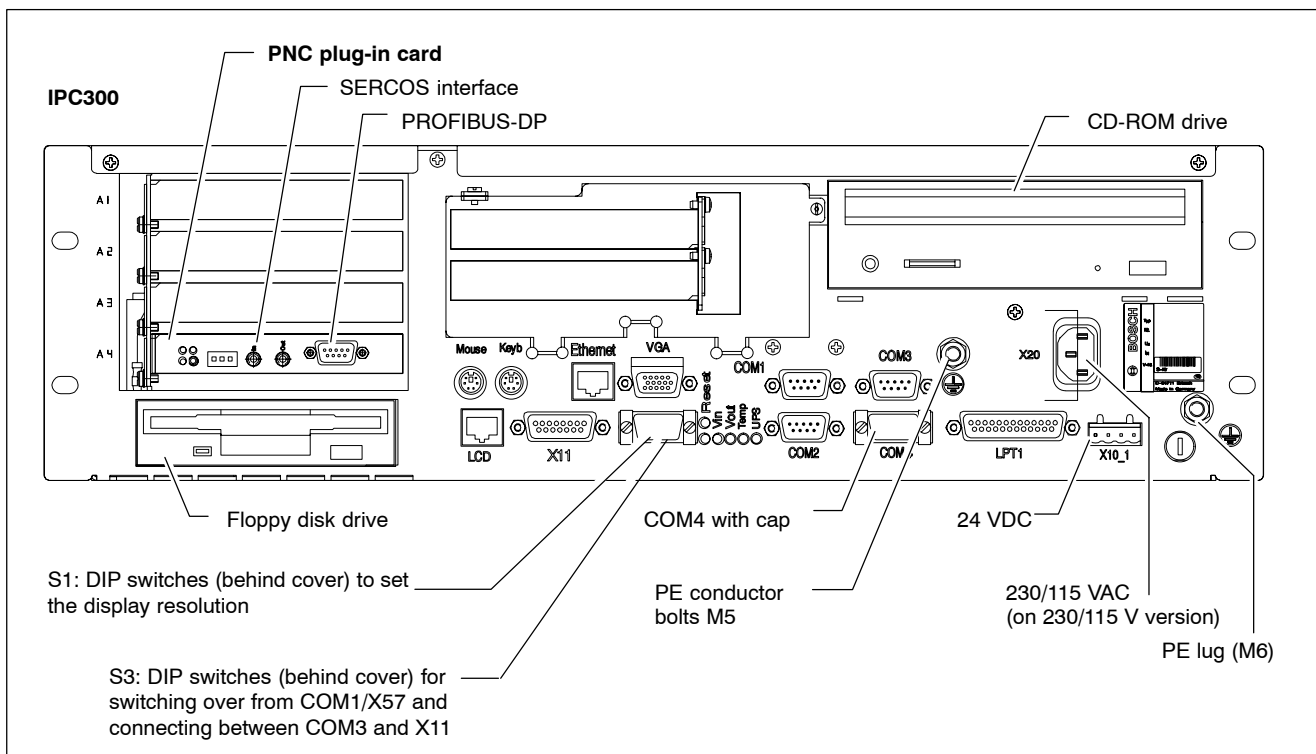   r = rear

PC control panel interfaces

osa display with PNC

24 VDC   LPT1   COM4 with cap   Ethernet   Connection to osa keyboard (via PS/2 adapter)

PE lug M5

PNC plug-in card

Top of housing

230/115 VAC (on 230/115 V version)   SERCOS interface   PROFIBUS-DP

Bottom of housing

Battery connector (X19)   Floppy disk data interface (X75)   Floppy disk power supply (X76)

---

osa switch dp, rear view

Digital manual operating device / hand wheel   PROFIBUS-DP   24 V power supply   E.g.: connection for V.24

13   1

25   14   St3

X10

St2

Rotary switches for PROFIBUS-DP address

For EMERGENCY OFF of a digital manual operating field

St5

1 2

St4

Discrete additional keys

11   12

EMERGENCY OFF key

21   22

1   5

6   9

Address ___ ___ (hex)

Interfaces BT155 and BT205

BT155, BT205 with PNC (here with optional LS120/CD-ROM drive unit)

PE lug (M6)

230/115 VAC
(on 230/115 V version)

24 VDC

COM4 with cap

COM2 (RS232)

MF2 keyboard connection
Front panel (with protective
cover)

PROFI-
BUS-DP

SERCOS
interface

X10_1

LPT1

COM2

DP-Slave

24 Vout

KBD

Reset

COM3

COM1

X20

VGA

Ethernet

USB

Mouse

A4

A3

A2

A1

PNC plug-in card

Top of housing

CD-ROM drive

LS120 drive

Bottom of housing

Y cable (power) for
floppy disk and
CD-ROM drive

DP-ADR

SEL-COM3

X75

X76

X19
battery
connector

Front
keyboard
connection

DIP switch:
DP-ADR
(PROFIBUS
slave address)

DIP switch:
SEL COM3

X76
power supply

X75 data connection
for external floppy disk drive

BT155, BT205 with PNC (here with optional LS120/CD-ROM drive unit)   **Rear view**

44-pin connector (IDE2 on
motherboard) for
LS120/CD-ROM drive unit

Rear
cover panel

Motherboard

1 2

Battery
connector
X19

Front
keyboard
connection

SEL
COM3
DIP

Floppy disk
Data connection
X75

Floppy disk
power supply
X76

DP-ADR
(PROFIBUS
slave address)

Carrier board

IPC300 interfaces

PNC plug-in card

IPC300

SERCOS interface

PROFIBUS-DP

CD-ROM drive

A 1
A 2
A 3
A 4

Mouse   Keyb.   Ethernet   VGA   COM1   COM3   X20

Reset
Vin
Vout
Temp
UPS

LCD   X11   COM2   COM   LPT1   X10_1

Floppy disk drive

COM4 with cap

24 VDC

S1: DIP switches (behind cover) to set
the display resolution

PE conductor
bolts M5

230/115 VAC
(on 230/115 V version)

S3: DIP switches (behind cover) for
switching over from COM1/X57 and
connecting between COM3 and X11

PE lug (M6)

6.2 PNC plug-in card

LED (green): active TCP/IP communication

LED (green): READY active (H1)

LED (red): Error

RESET button (S1)

Ready contact (X10)

SERCOS interface (X73, X74)

PROFIBUS-DP master (X71)

X10 Ready contact

Weidmüller push-lock terminal, MSTB 1.5, 3-pin

Max. conductor cross-section:	1.5 mm^2
Relay contact:	Opener
Loading capacity:	24 V, 1000 mA

X10	Pin	Assignment
1	1	Relay contact, opener
2	2	
3	3	not used

The Ready contact closes (green Ready LED illuminates) if:

● PNC has started up

● iPCL has started up and is not in Stop state

● no error occurred.

The Ready contact opens (green Ready LED goes out) if:

● iPCL goes into Stop state

● a watchdog error occurs
(the red Error LED also illuminates here).

X71   PROFIBUS-DP Master

Connection to the optional machine control panel osa switch, plug St2.

Female DB, 9 connector

Cable length:	depending on baud rate (as per EN 19245, Part 3):

500 kbps	400 metres
1500 kbps	200 metres
3000 kbps	100 metres
6000 kbps	100 metres
12000 kbps	100 metres

Cable type: Screened, min. cross-section $0.14 \ mm^2$
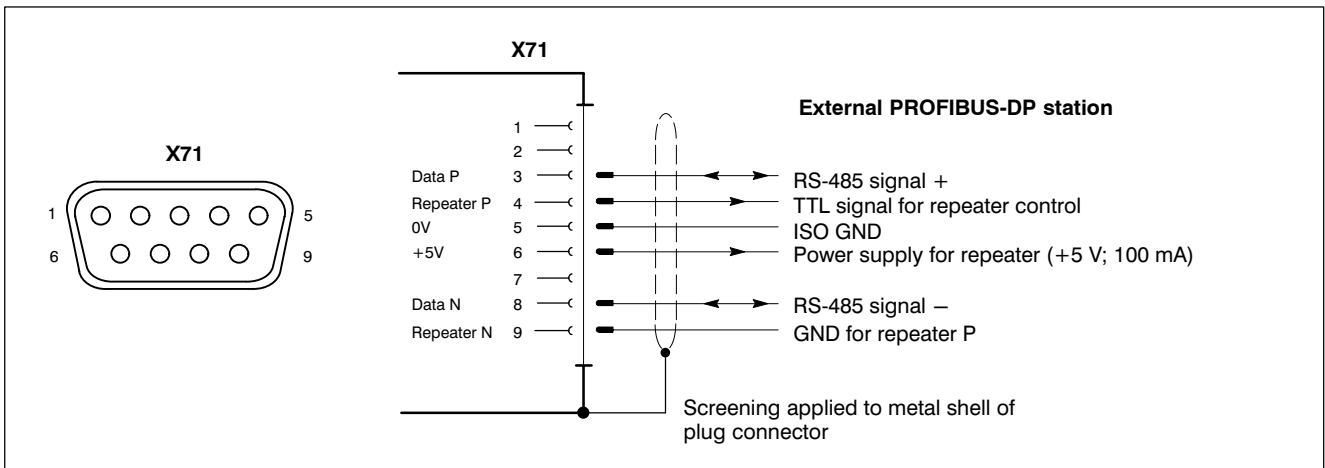
X73, X74   SERCOS interface

Connection of digital drives with SERCOS interface via optical fibre connector (OFC).

2 plug connectors for optical fibre connectors (OFC)

Type:	OFC as per SERCOS interface specification
Cable length:	max.10 m
Cable type:	Optical fibre cable made of plastic with step index profile, plug connector according to F-SMA standard as per IEC 874-2

SERCOS OFC	OFC	Assignment
X74	X73 (IN)	Data from drive (digital)
X73	X74 (OUT)	Data from drive (digital)

The number of drives on the SERCOS interface depends on the required cycle time and the accrued data volume per drive (maximum of 4 megabaud).

☞ **Measurement devices are attached to the drive modules.**

6.3   PNC high speed I/O (option)

The "PNC high speed I/O" plug-in card provides 8 fast inputs and outputs for the PNC. The plug-in card takes up one slot in the PC mainframe, but does not have a PCI bus connection. The connection to the PNC plug-in card is established directly via two ribbon cables.

☞ **For retrofits please observe that, due to the ribbon cables, the PNC high speed I/O may only be fitted to the right of the PNC plug-in card (equipping side).**

X10   Power connection 24 VAC

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

Max. conductor cross-section:	1.5 mm^2 The pins 1 and 2 as well as 3 and 4 are connected to each other on the circuit board. Approx. 5 A at 70 °C can be conducted per contact.
2 LEDs green:	LEDs are illuminated when 24 VDC exists.
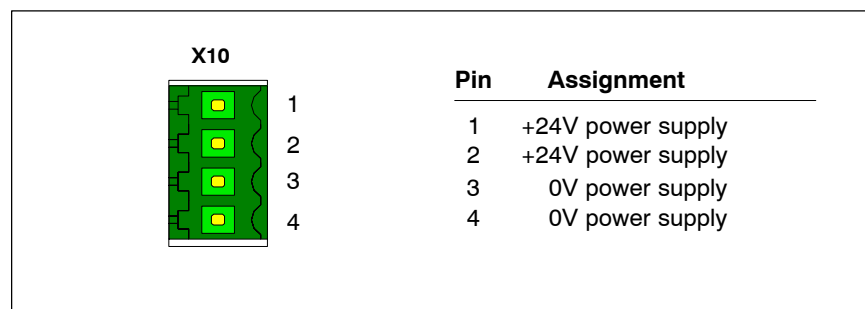
Pin	Assignment
1	+24V power supply
2	+24V power supply
3	0V power supply
4	0V power supply

The connection is constructed to be safe from polarity reversals.

Voltage range:	24 VDC (−15 % / +20 %)
Fuse protection:	5 A delay fuse

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

X11 **Digital Out**

Weidmüller push-lock terminal, MSTB 1.5, 8-pin

8 LEDs green: LED is illuminated when high level is generated at the relevant output.
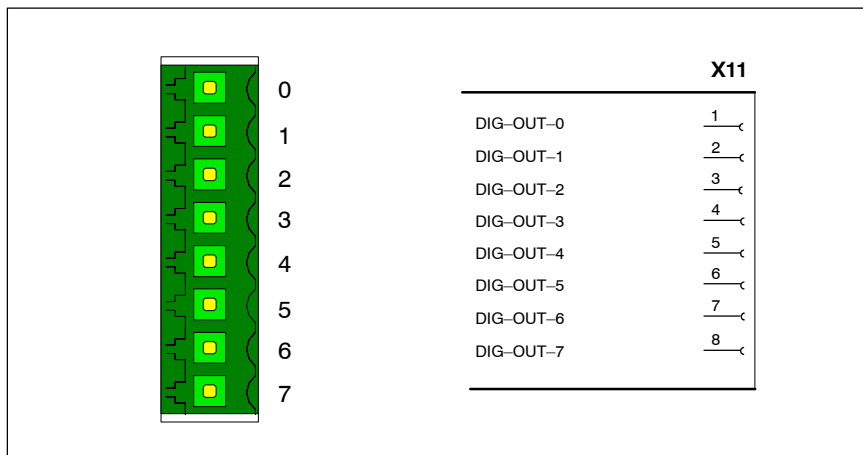
Working ranges of the digital outputs:

Current range at 1 signal at 24 V (continuous)	max. 500 mA
Voltage decline at 600 mA	max. 3 V
Leakage current (0 signal) with VN340SP	max. 2 mA
Short-circuit current with excessive temperature	max. 2.5 A
Switching time	max. 300 µs

Measured switching times without load:
- Switch on delay   48 µs
- Switch off delay   700 µs

Measured switching times with 0.5 A load
- Switch on delay   50 µs
- Switch off delay   135 µs

X12   Digital In

Weidmüller push-lock terminal, MSTB 1.5, 8-pin

8 LEDs green: LED is illuminated when high level exists at the relevant input.
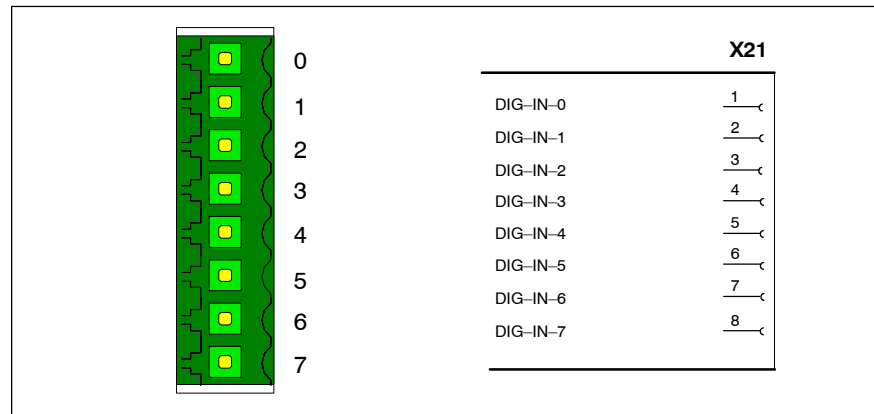
Working ranges of the digital inputs:

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

Switching time: max. 100 µs

☞ **The interfaces of the PC mainframes (from chapter 6.4) are, depending on availability, identified as follows:**

BT155	BT205	PC control panel	IPC300
●	●	–	●

available: ●

not available: –

6.4   Serial PC ports COM1 ... COM4, X57, USB

6.4.1   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**

BT155	BT205	PC control panel	IPC300
●	●	●	● (alternative to X57)

Male DB-9 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

COM1

RS-232

Pin	Signal
1	DCD
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

to peripheral devices

Screening applied to metal shell of plug connector
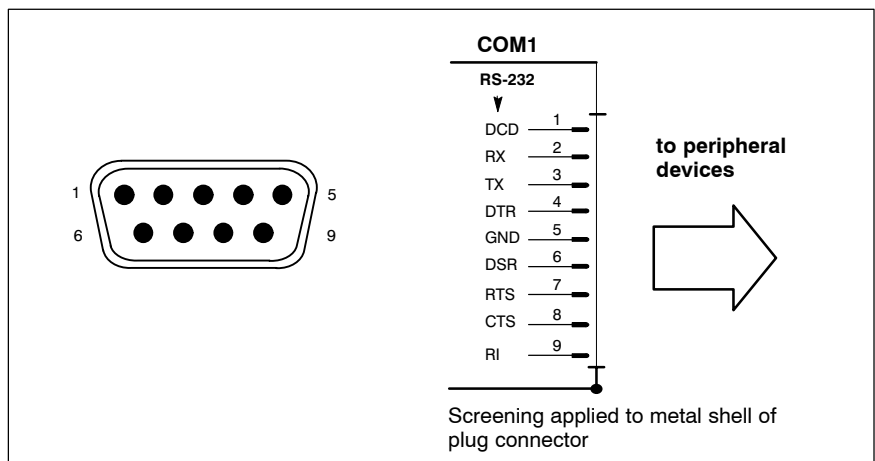
Pin assignment of an RS-232 (COM1):

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.

DTR
: Data Terminal Ready. Transmission channel used by the PC to signal to a connected peripheral device that its interface is switched on and initialized.

DSR
: Data Set Ready. Receive channel used by the connected peripheral device to inform the PC that it is switched on and initialized.

GND
: Signal Ground

RTS
: Request to Send. Receive channel used by the connected peripheral device to signal to the PC that is wishes to transmit data.

CTS
: Clear to Send. Transmission 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.

X57   Serial port RS-485/422

BT155	BT205	PC control panel	IPC300
–	–	–	● (alternative to COM1)

This port can only be assigned if COM1 **is not** being used. Parallel operation is not possible.

Male DB, 9 connector
Type: RS-485/422
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 (X_{ON}, X_{OFF})
Interrupt (IRQ):   4 (IPC300)
I/O address: 3F8H (IPC300) or AUTO (recommended)
BIOS preset: COM1:   Enabled
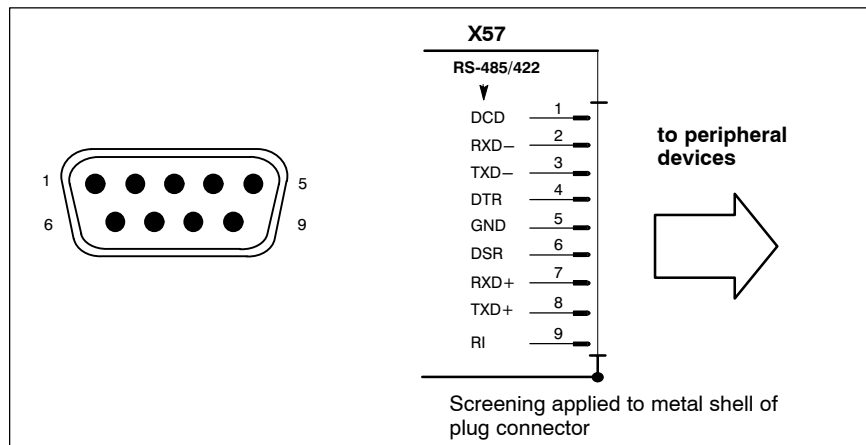
Assignment as an RS-485/422:

(For more information on pin assignment, see page 6–12)

DCD	as for RS-232
RXD–, RXD+	Receive Data. Line on which data is received.
TXD–, TXD+	Transmit Data. Line on which data is transmitted to peripherals.
DTR	as for RS-232
DSR	as for RS-232
GND	as for RS-232
RI	as for RS-232
Screen	as for RS-232

Setting X57 in the IPC300:

The S3 DIP switch can be used to configure the X57 interface as an RS-485 or RS-422:

- X57 as RS-485:   Switch 3 to ”**ON**”: TXD is controlled via RTS. Also, for 2-wire operation, TXD+ must be bridged with RXD+, and TXD– with RXD–.

- X57 as RS-422:   Switch 3 to ”**ON**”: TXD is always switched on.
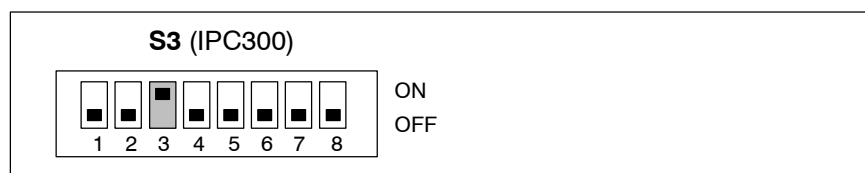
Position of S3: accessible from the outside in the IPC300 (see diagram on page 6–5).

COM2   Serial port

BT155	BT205	PC control panel	IPC300
●	●	●	assigned

COM 2 is freely assignable with the following exception:

COM2 is assigned to the connected control panel BF3xxT in the **IPC300** , because then over this the touch screen controller signals are exchanged. They are transmitted via the gigabit cable. COM 2 is always assigned as the controller is always occupied.

Male DB, 9 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

COM2

DCD	1
RX	2
TX	3
DTR	4
GND	5
DSR	6
RTS	7
CTS	8
RI	9

to peripheral devices (without touch screen)

Screening applied to metal shell of plug connector
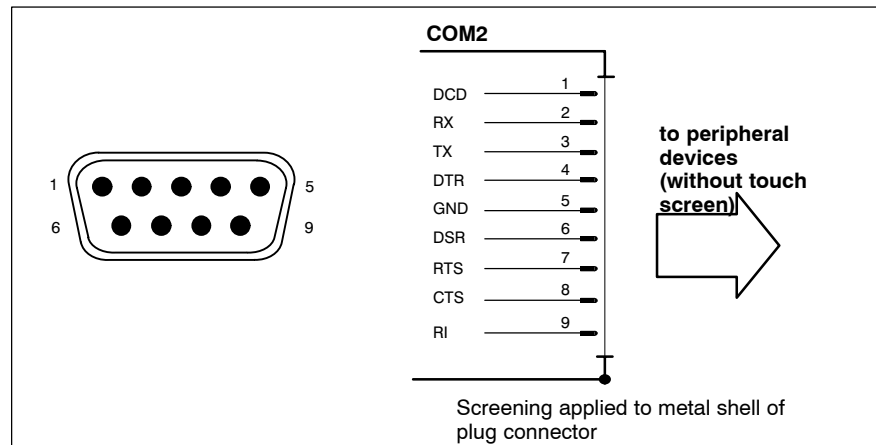
Refer to page 6–12 for explanations on pin assignments.

COM3   **Serial port**

BT155	BT205	PC control panel	IPC300
● Key code from the MBF, or ● SW download of new key codes		● empty	● empty, or ● connected to control panel

- In the **BT155**/**BT205** the COM3 is connected to the keyboard controller. For applications that require a software download of new key codes, see page 7–19.

  For applications not requiring a machine control panel or software download, the port can be factory-equipped to make it freely assignable.

- In the **IPC300** the COM3 port can, if required, be connected via X11 to a BF3xxT. This access is set by the DIP switch **S3** on the IPC300, see page 6–27.

Male DB-9 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):   10
I/O address: 3E8H
BIOS preset: COM3: Enabled
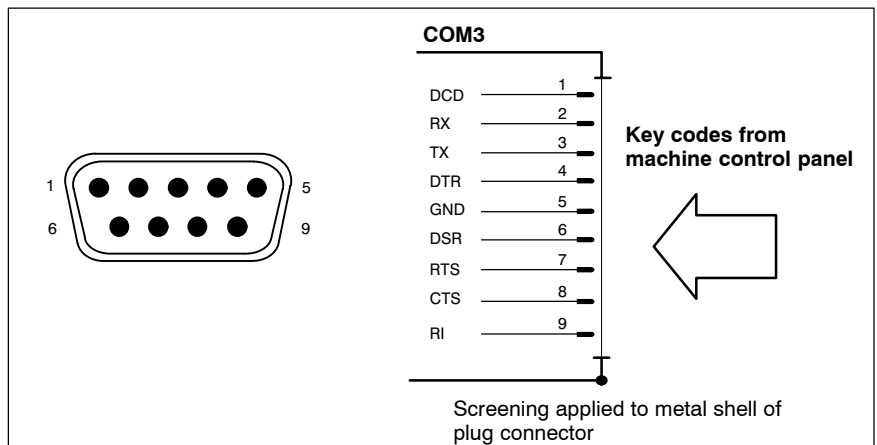
Refer to page 6–12 for explanations on pin assignments.

COM4 **Serial port, internal UPS logic connection**
(refer to section 3.2)

BT155	BT205	PC control panel	IPC300
●	●	●	●

COM4 is always assigned to the uninterruptible power supply (UPS). The interface plug is covered by a cap at the factory.

Male DB, 9 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
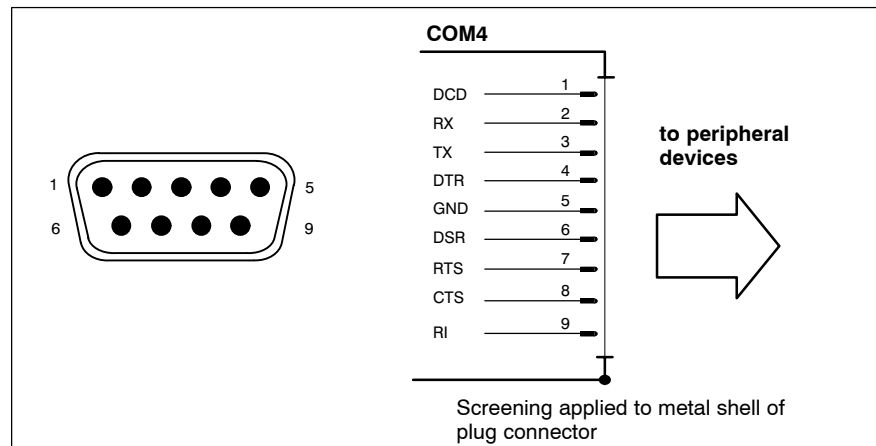
Refer to page 6–12 for explanations on pin assignments.

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

BT155	BT205	PC control panel	IPC300
●	●	●	●

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

USB female connector, 4-pin.

BIOS preset: USB controller: Disabled
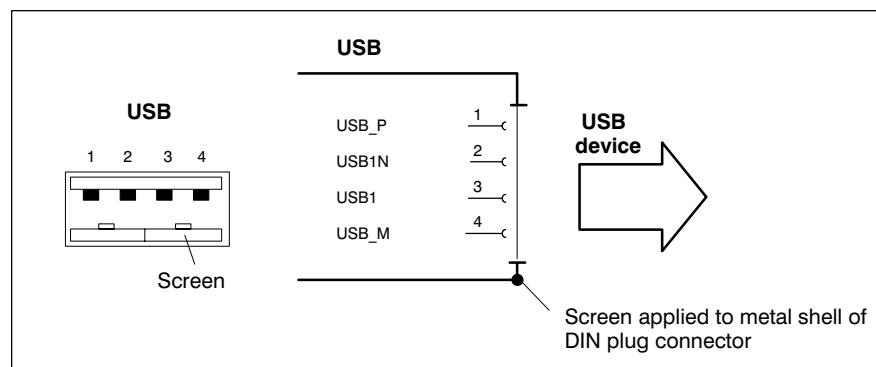
PIN	Function
1	USB power supply (max. 500 mA)
2	File
3	File
4	USB Ground

6.4.2   Settings COM1...COM4

System control

For information about setting the communication parameters for serial inter-faces, please refer to the manual supplied with the Windows NT operating system. Go to "Start / 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 parameter assignment, you should adopt the following settings:

- COM1 = 3F8H
- COM2 = 2F8H

COM3 and COM4 are set at the factory as "existing" **(Enabled)**.

CAUTION
Interrupt (IRQ) and I/O address must correspond to BIOS settings.

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.

6.5   LPT1 parallel port

LPT1   **Parallel port for printer, scanner, CD-ROM, etc.**

BT155	BT205	PC control panel	IPC300
●	●	●	●

Male DB, 25 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: 378H (recommended)
BIOS preset: AUTO
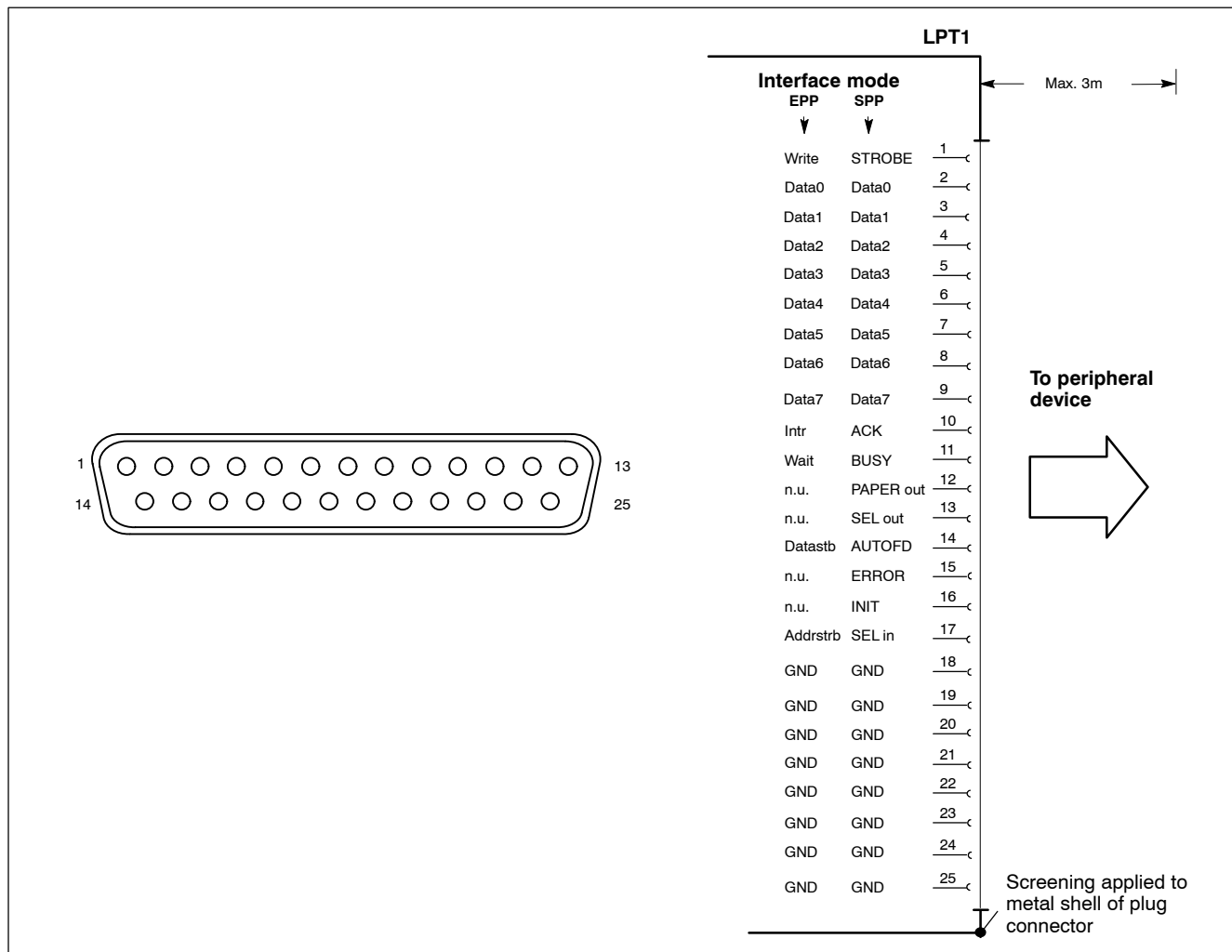
The parallel port normally runs in the default SPP mode. Provided that suitable peripheral devices are present, it can also be operated in EPP (Enhanced Parallel Port) or ECP (Extended Capabilities Port) mode. The operating mode is changed in the BIOS settings.

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

6.6   Ethernet interface

Ethernet network connection

BT155	BT205	PC control panel	IPC300
●	●	●	●

The Ethernet interface allows the PC to be connected to an Ethernet net-work. 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/100-Base-X
Cable length:	Max. 100 m
Cable type:	Screened, twisted pair
Transmission rate:	10 Mbit/s and/or 100Mbit/s
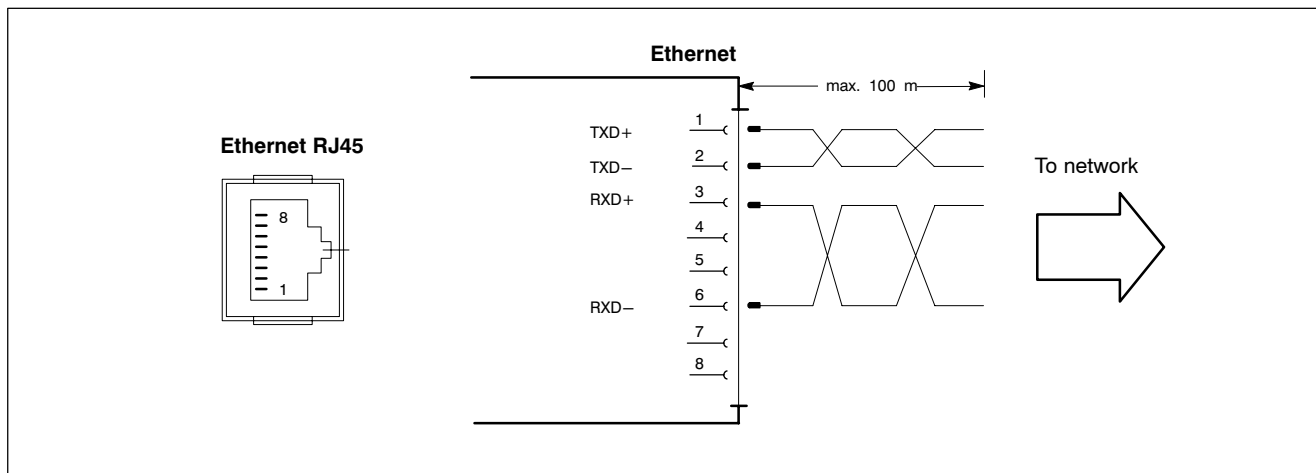
The driver configuration functions for the network connection can be accessed in the task bar or in the "Control Panel" under the "Network Card" symbol. A dialog box provides selections of data transmission speed, e.g. 10 Mbit/s and/or 100 MBit/s.

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

6.7   DP Slave Interface

DP-Slave   PROFIBUS-DP connector

BT155	BT205	PC control panel	IPC300
●	●	–	–

The key 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 7−18.

Female DB, 9 connector

Cable length: depending on baud rate
                        (as per EN 19245, Part 3):

500 kbps	400 metres
1500 kbps	200 metres
3000 kbps	100 metres
6000 kbps	100 metres
12000 kbps	100 metres

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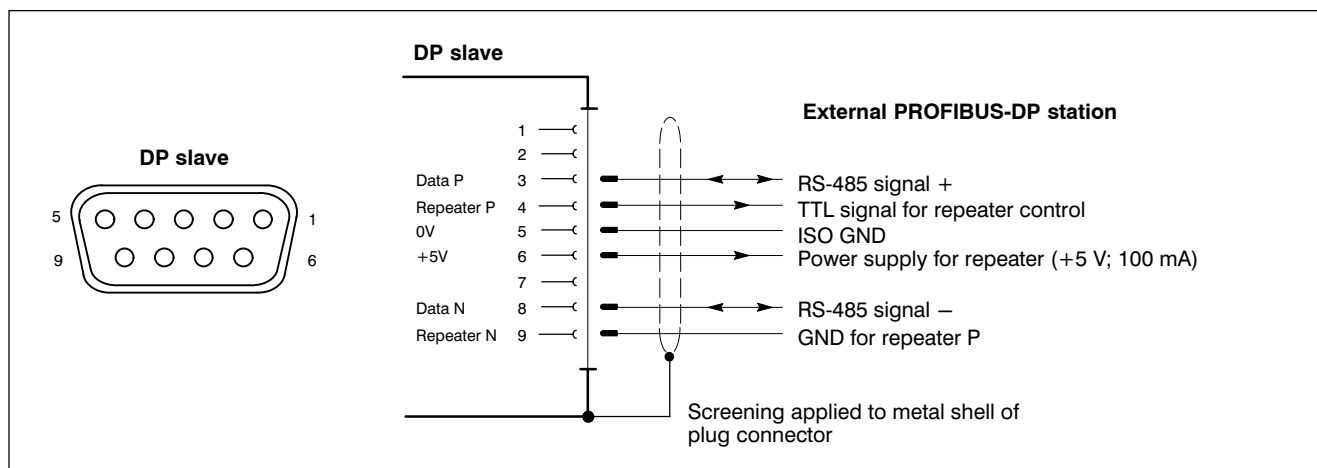
PROFIBUS slave address

The switch segments of the DP-ADR DIP switch (for location, refer to page6−4) are used to select the address for the DP-Slave connection.
A total of 7 switch segments are reserved for this purpose.
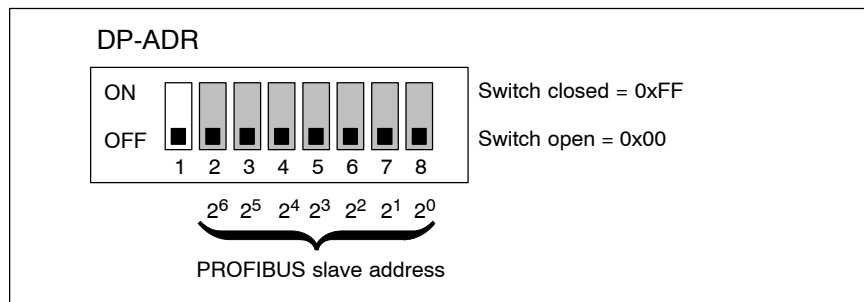
☞ **DIP switch segment 1 must remain in the "OFF" position; it controls the keyboard controller.**

6.8   24 VOut-interface

24 Vout   output key codes

BT155	BT205	PC control panel	IPC300
●	●	–	–

The key codes of the movement keys and softkeys on the control panel are transferred to eight outputs of the 24 Vout interface. From there the key codes can, for example, be transferred via an external InterBus-S-node for further processing.
For key codes see page 7–19.

Female DB, 15 connector

Cable length:	Max. 20 m
Cable type:	Screened, min. cross-section 0.14 mm^2

Working ranges of the digital outputs:

Design current (1 signal):	250 mA
Current range at 1 signal at 24 V (continuous))	max. 300 mA
Voltage decline at 600 mA	max. 3 V
Leakage current (0 signal) with VN340SP	max. 2 mA
Short-circuit current with excessive temperature	max. 2.5 A
Switching time	max. 300 μs
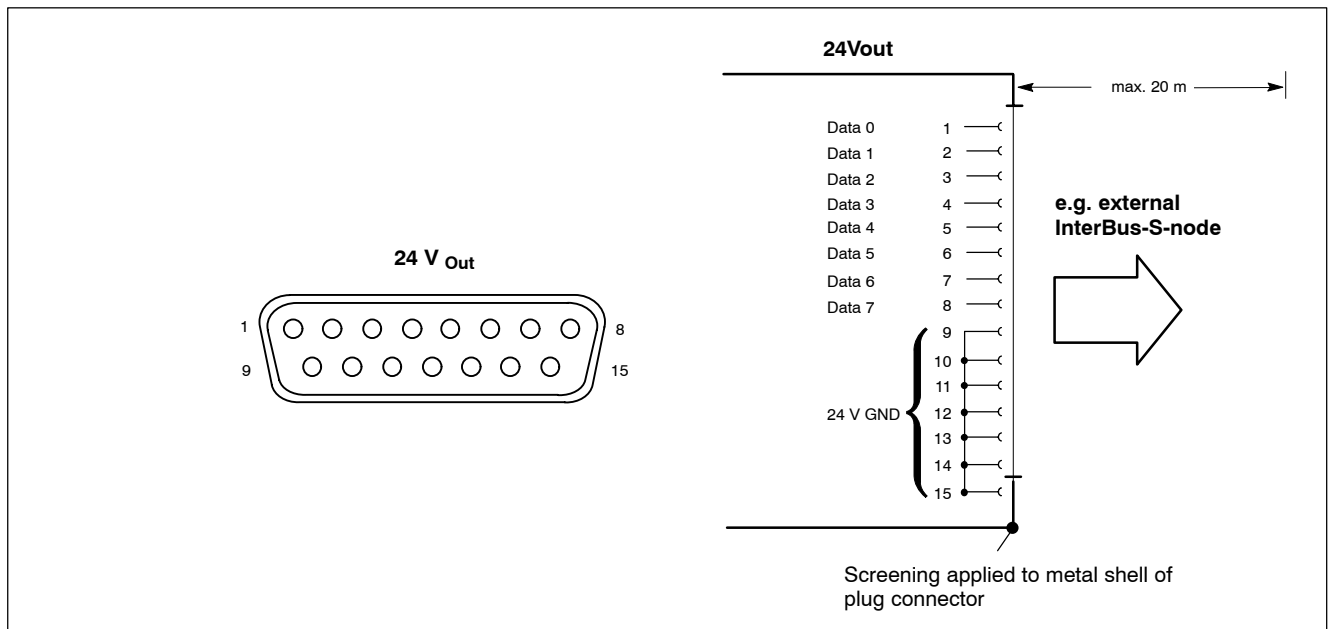
☞ **The 24 Vout interface is supplied with 24 VDC power via the X10_1 connector.**
X10_1 on the BT155 and BT205 must also be connected to a 230 VAC power supply.

6.9   External monitor

VGA   External monitor connection

BT155	BT205	PC control panel	IPC300
●	●	●	●

The VGA port accepts an external monitor (CRT) for operation via the built-in video adapter. The external monitor may be operated concurrent with the integrated flat panel display.

● Video RAM: 2 MB

☞ **Please note that the external monitor must be connected up before the control terminal is booted up as otherwise the VGA interface will not be initialized by the BIOS.**

☞ **The insertion of a graphics card disables the integrated video adapter. The BIOS setting must also be changed.**

HD female connector,
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 colors
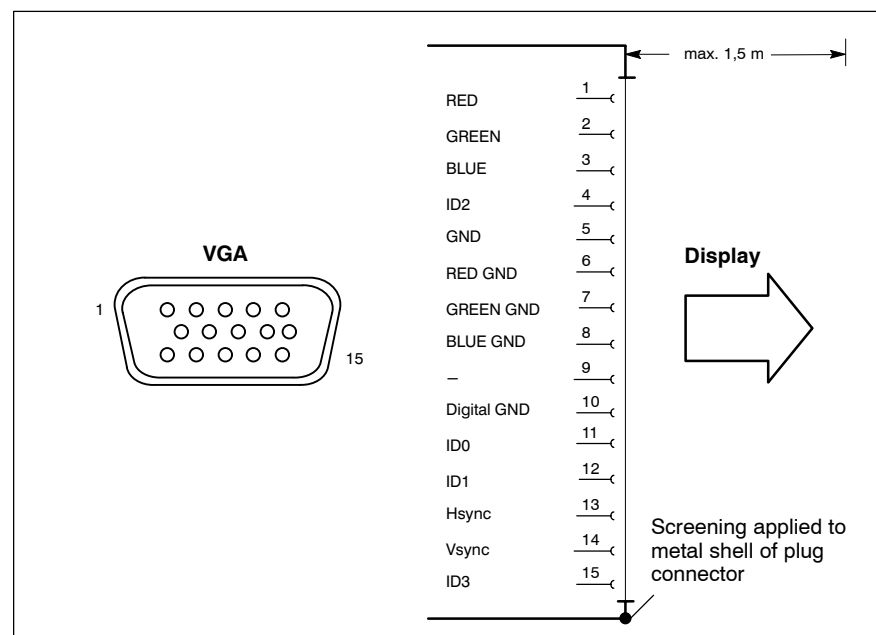
CRT monitor resolution

After the system is started up, the monitor resolution of the VGA connection always corresponds to the setting of the LCD interface of the display:

● BT155, BT205 see chapter 7.3.1

● Modular PC control panel see chapter 7.2.1

● IPC300: LCD see chapter 7.4

It should be noted that it is technically possible to make different resolution and colour settings by changing them in the Control Panel while the PC is running. However, such changes would again be overwritten during a subsequent system start:

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

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

In the **IPC300** the VGA connection can be set to a particular resolution that does not correspond to the range of settings allowed on the LCD interface (see chapter 6.10). For this the connection between the LCD and VGA must be severed via DIP switch:

- with DIP switch **S1**:

VGA resolution	Segment 5 :	”OFF”
as per BIOS:	Segment 6 :	”OFF”
	Segment 7 :	”OFF”
	Segment 8 :	”OFF”
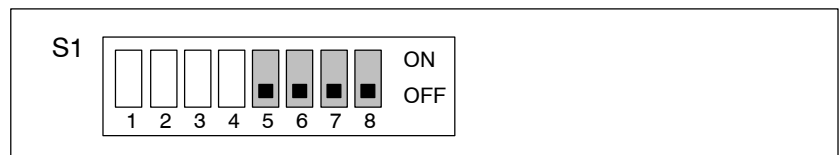
☞ **With these settings, connecting a control panel is no longer possible!**

Monitor requirement

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.

6.10   Gigabit interface

LCD   **Gigabit interface**
(video transmission and RS-422 for touch screen controller)

BT155	BT205	PC control panel	IPC300
–	–	–	●

The Gigabit interface simultaneously handles the transfer of video signals and control communications for the touch screen controller (RS-422). On the IPC300 the controller signals are internally connected to COM2.
The Gigabit interface has been specifically designed for longer transmission routes and interference-free transmission, and can only be connected to the Gigabit interface on the BF312T and B315T control panels.

Female RJ45 connector,
8-pin.

Cable length: Max. 15 m, with repeater max. 75 m

Cable type: Twisted pair, 8-pin, screened

See also information on pre-fabricated connecting cables in section 12.1.
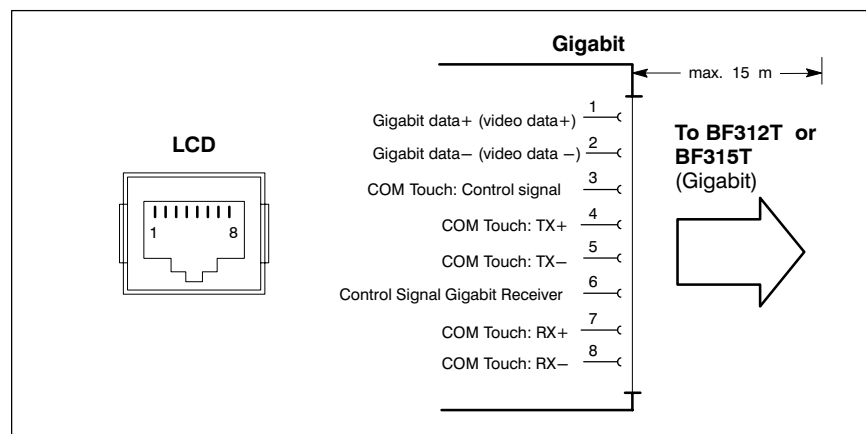
Repeater GBIT

The use of a Gigabit repeater extends the reach of required connections between the IPC300 and BF3xxT (LCD and X33) by 15 metres per repeater, to a maximum of 75 metres achieved with 4 repeaters. Installation via M4 press-in nuts. Using standard mounting clamps, snap-on installation on a standard DIN rail is also possible. Instructions for setting the resolution can be found on page 6–26.

For ordering information refer to section 12.1.
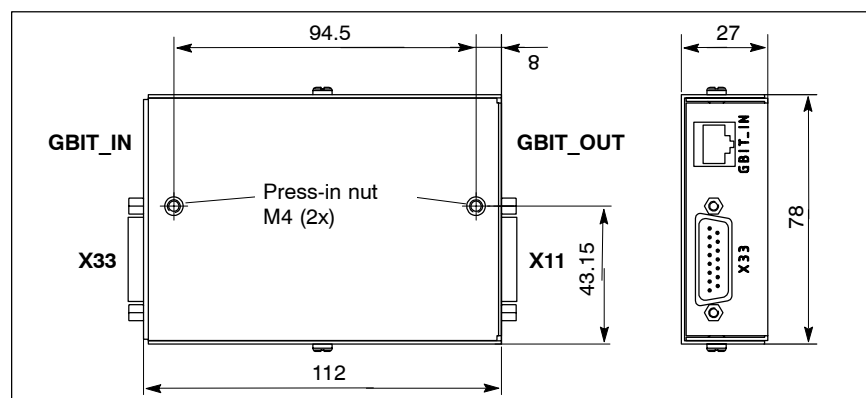
Setting the resolution for BF3xxT

The display resolution must be set using the S1 DIP switch (refer to diagram below):

- BF312T (12.1 in. color display):   800 x 600 pixels
- BF315T (15 in. color display):   1024 x 768 pixels **(factory setting)**

IPC300

S1   S3

(behind the cover)   ⌷⌷⌷⌷⌷⌷⌷⌷   ⌷⌷⌷⌷⌷⌷⌷⌷   (behind the cover)
                     1   8   1   8
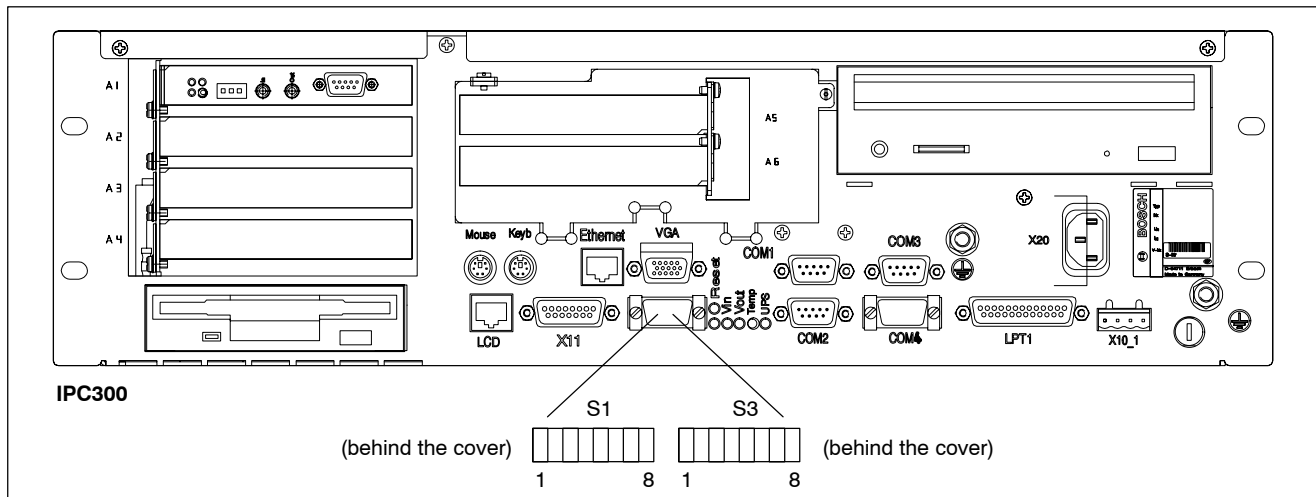
Changes are made on the externally accessible switch segments 1 through 8 of the S1 DIP switch:

- 800 x 600 pixels

- 1024 x 768 pixels
  (IPC300 with Pentium I / 266 MHz)

   (factory setting)
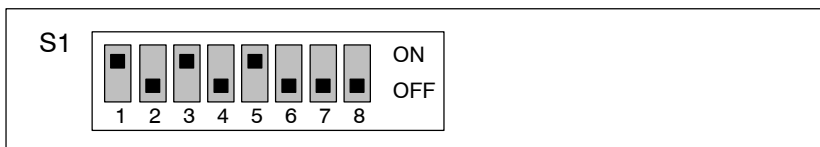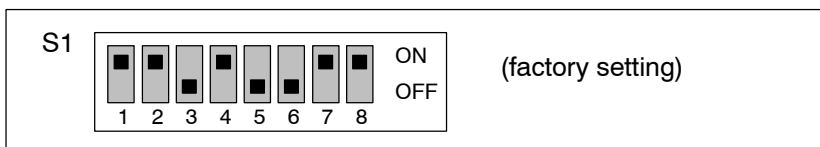
- 1024 x 768 pixels
  (IPC300 with Pentium I / 400 MHz)

   (factory setting)
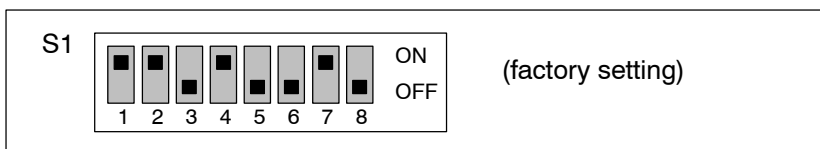
☞ **For more details regarding BF3xxT control panels see the manual "Control Panel BF2xxT/BF3xxT Connectivity Requirements". For order number, refer to page 1–7.**

If **Gigabit repeaters** are used, then the DIP switch in the repeater housing must be set as follows, depending on the control panels that are attached:

- 800 x 600 pixels (BF312T)

S1

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | ON / OFF |

(factory setting)
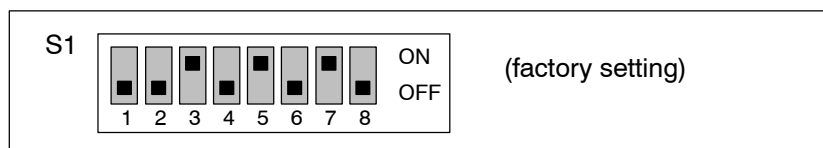
- 1024 x 768 pixels (BF315T)

S1

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | ON / OFF |
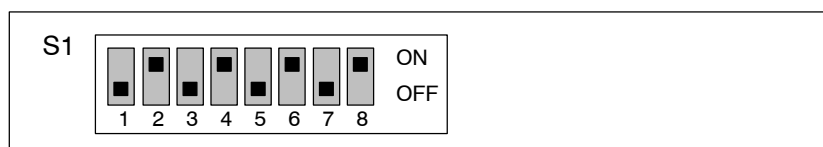
6.11   X11 power supply interface

X11   **Power supply, backlight power, mouse and keyboard signals from control panel BF3xxT**

BT155	BT205	PC control panel	IPC300
–	–	–	●

The X11 power supply interface ensures **reliable operation** of the control panel and other components even **over extended physical distances**. For distances up to 1.5 m, mouse and keyboard can also be directly connected to the PC.

The X11 connection provides the following services:

● the control panel is supplied with 24 VDC

● power required for the backlight

● transmission of mouse and keyboard signals
(refer also to sections 6.12 and 6.13)

● connection between COM3 and control panel as required. The connection is achieved using the S3 DIP switch.

COM3 connected to X11: S3 switch segments 1 and 2: "ON"

☞ **Only for IPC300 with PIII/400 MHz:
Close S3.4 to activate automatic backlight timer in the BF3xx.**
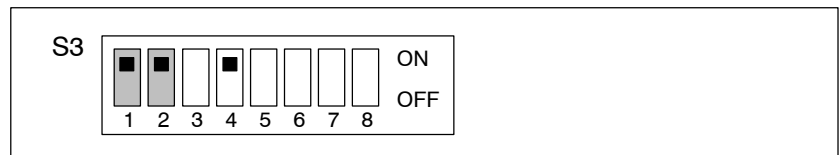
Female DB, 15 connector

Cable length: Max. 15 m, can be extended to 75 m via repeaters in conjunction with Gigabit interface (refer to page 6–24)

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

See also information on pre-fabricated connecting cables in section 12.1.
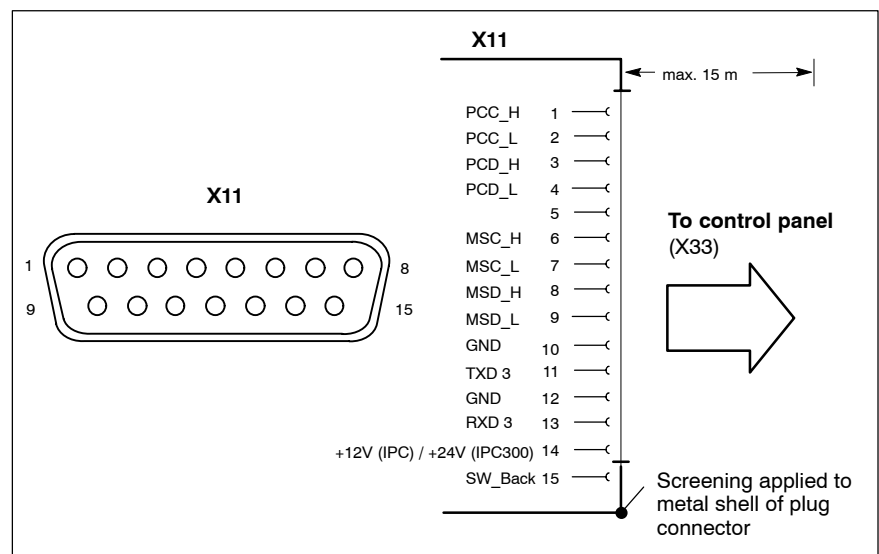
6.12 Keyboard ports

KBD **MF2 front-panel keyboard port**

BT155	BT205	PC control panel	IPC300
●	●	–	–

MF2 female DIN connec-
tor, 5-pin.

Cable length: Max. 1.5 m

Cable type: Screened, min. cross-section 0.14 mm^2
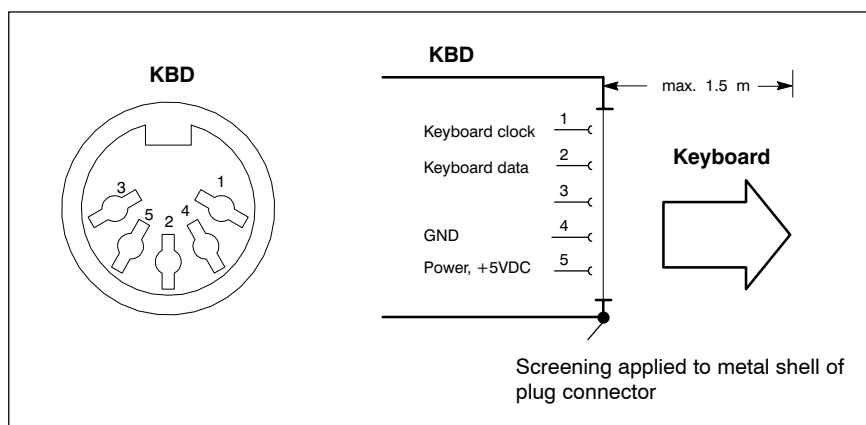
KBD, Keyb **PS/2 Mini-DIN keyboard port**

BT155	BT205	PC control panel	IPC300
●	●	● (Keyb)	●

Female mini DIN PS/2, 6-pin

Cable length: Max. 1.5 m

Cable type: Screened, min. cross-section 0.14 mm^2
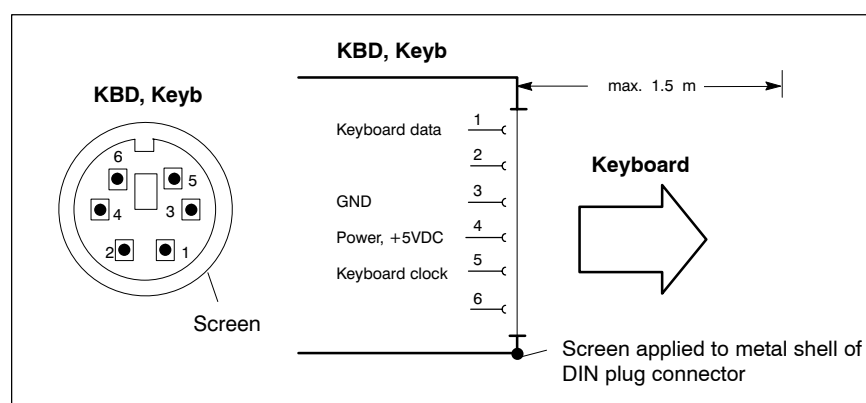
☞ **Only one of the two connectors may accommodate an external key-
board. Otherwise, proper functioning cannot be guaranteed.**

In attaching an osa keyboard to the PC control panel adjustments may be
made via a DIP switch on the osa keyboard, see page 7–6.

Keyboard adapter

In the event that the MF2 keyboard is equipped with a standard 5-pin 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 on 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   **Standard**
DIN connector (male)   **DIN connector (female)**

Mini DIN keyboard   **MF2**
port on PC   **keyboard port**

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

Screen applied to metal shell of   Screen applied to metal shell of
DIN plug connector   DIN plug connector

max. 0.2 m
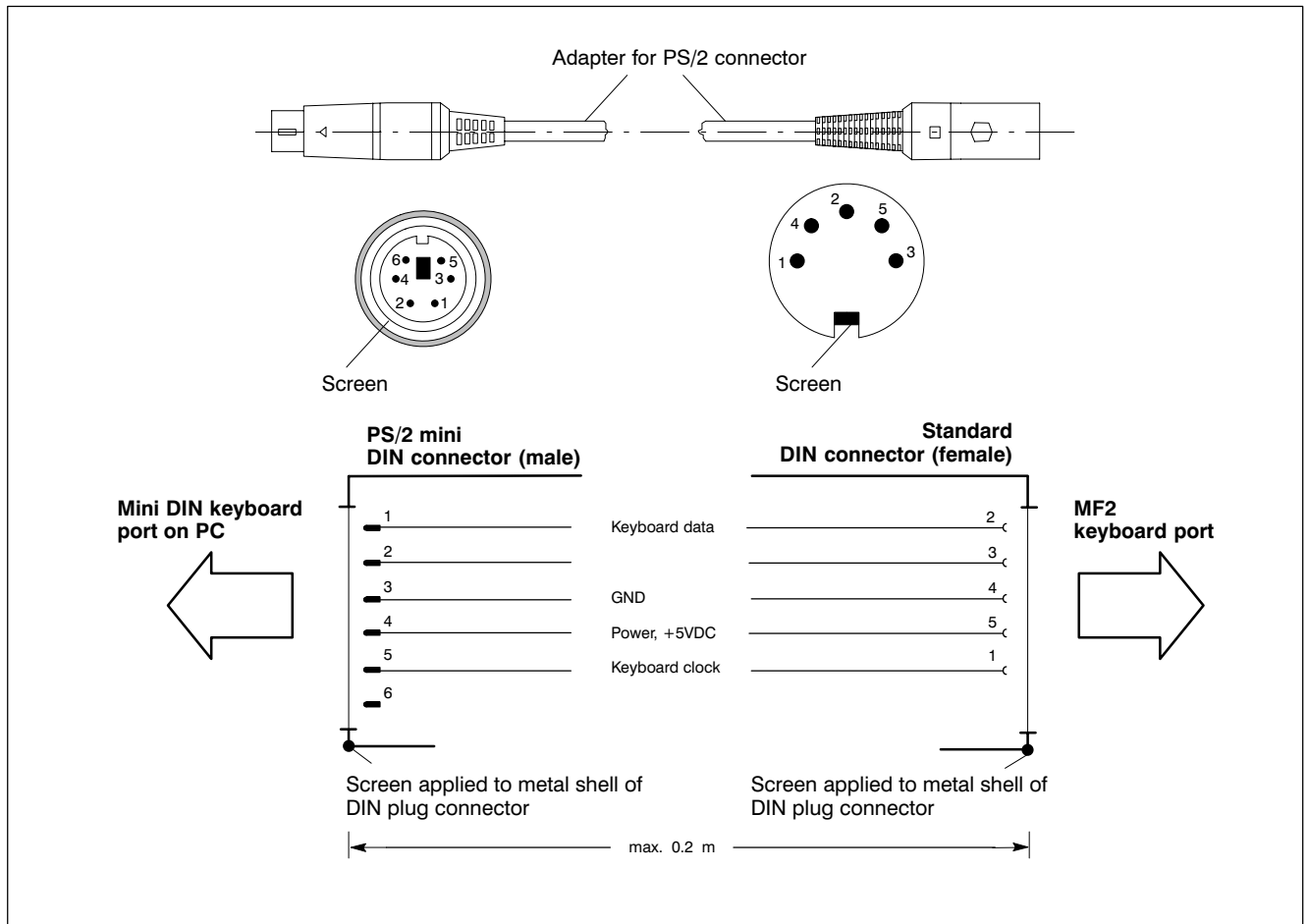
6.13 Mouse port

Mouse **PS/2 mouse port**

BT155	BT205	PC control panel	IPC300
●	●	●	●

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:	PS/2 mouse: Autodetect
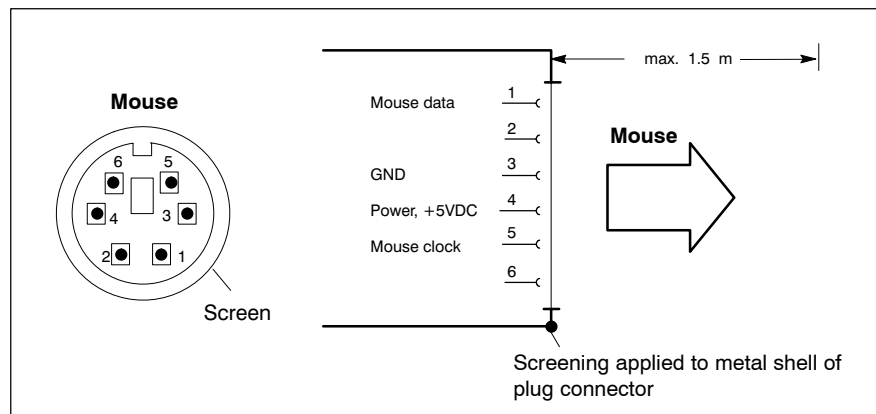
The operating system will not recognize the insertion of an external mouse after completed startup because the mouse initialization occurs during the boot phase.

☞ **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.

6.14   3,5" Floppy disk drive power supply

X75   **Drive "A" connector**

BT155	BT205	PC control panel	IPC300
●	●	●	–
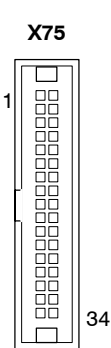
Connector for an external floppy disk drive. The integrated floppy disk adapter supports the following types of drives:

- 5.25 in. and/or 3.5 in.
- Double density (360 KB and/or 720 KB)
- High density (1.2 MB and/or 1.44 MB)
- Enhanced floppy mode (2.88 MB)

☞ **Only one type of drive can be connected at a time.**

Male terminal strip, 34-pin

Type:	3.5 in. HD (standard)
Cable length:	Max. 0.5 m
Cable type:	34-conductor ribbon cable, screened
Interrupt (IRQ):	empty
I/O address:	Primary (=3F0h)
BIOS settings	Floppy disk controller: Enabled
BIOS settings	Legacy diskette A: 1.44/1.25 MB, 3.5" or 2.88 MB, 3.5" or 720 kB, 3.5"

Pin	Assignment	Pin	Assignment
1	GND	2	Density Select
3	GND	4	N/C
5	GND	6	N/C
7	GND	8	Index
9	GND	10	Motor Enable A
11	GND	12	Drive Sel B
13	GND	14	Drive Sel A
15	GND	16	Motor Enable B
17	GND	18	Direction
19	GND	20	Step
21	GND	22	Write Data
23	GND	24	Floppy Write Enable
25	GND	26	Track 0
27	GND	28	Write Protect
29	GND	30	Read Data
31	GND	32	Head Select
33	GND	34	Disk Change

X75 — pin 1 ... 34

☞ **This connector must not be used for the LS120/CD-ROM drive unit.**

X76 **Power supply for 3.5" floppy disk drive or LS120/CD-ROM drive unit**
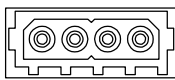
BT155	BT205	PC control panel	IPC300
●	●	● (only for floppy disk)	–

Power supply for:

- external 3.5" floppy disk drive (optional) or
- LS120/CD-ROM drive unit (optional only for BT155, BT205).
  For connection procedure see section 9.4.

Female connector, 4-pin, internal on carrier board

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

X76, socket	Pin	Assignment
1 2 3 4	1	+12 V
	2	GND
	3	GND
	4	+5 V

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

Two floppy disk drive versions are available:

- Order no.: 1070 081 617
  3.5" floppy disk drive with carrier plate for fitting to the rear of BT155 and BT205 (not possible for the PC control panel).
- Order no.: 1070 081 614
  3.5" floppy disk drive with mounting frame and protective flap for in-cabinet installation and connection via a special, screened cable.

6.15   LS120/CD-ROM connector

IDE2   **LS120/CD-ROM drive unit connector**

BT155	BT205	PC control panel	IPC300
●	●	–	–

LS120 and CD-ROM drives are connected to the IDE2 port by **one** ribbon cable.
The ribbon cable is equipped with one socket for attachment to the IDE2 and two sockets for attaching the two drives.

Female terminal strip, 44-pin, internal on the motherboard

Cable length: Max. 0.5 m

Cable type: 40-conductor ribbon cable, screened

BIOS preset: Local bus IDE adapter: Both
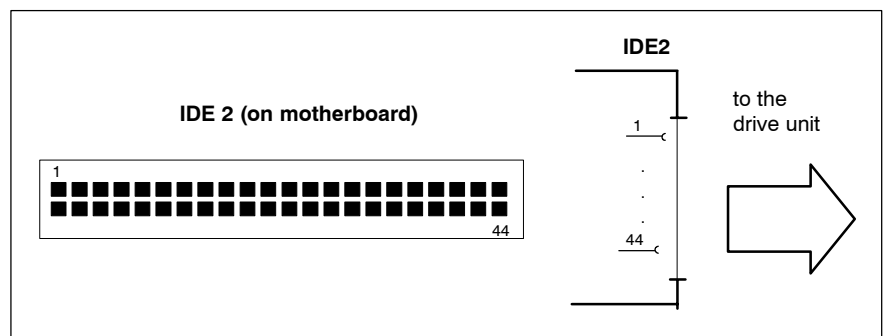
X76   **Power supply for 3.5" floppy disk drive or
LS120/CD-ROM drive unit**

BT155	BT205	PC control panel	IPC300
●	●	● (only for floppy disk)	–

Power supply for:

- external 3.5" floppy disk drive (optional) or
- LS120/CD-ROM drive unit (optional only for BT155, BT205).
  For connection procedure see section 9.4.

The drive unit is connected by a Y-power cable. It is equipped with one plug for attachment to the X76 and with two sockets for attachment to the LS120 drive and the CD-ROM drive. For more information on installing the LS120/CD-ROM drive unit refer to section 9.4.

Female connector, 4-pin, internal on carrier board
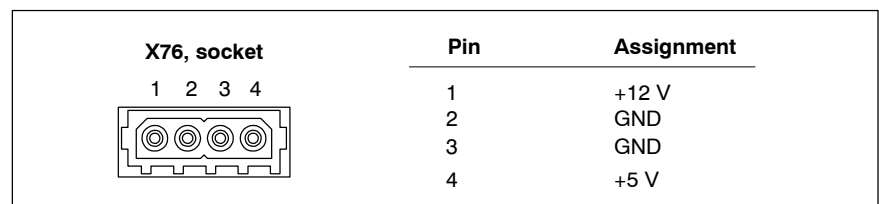
Supply voltages: +5 V, +12 V / 0.9 A max.

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

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

6.16 osa switch dp (MBF, option)

X10 **24 VDC power supply**

24 V supply for PROFIBUS-DP. The connection is constructed to be safe from polarity reversals.

Voltage range: 24 VDC (−15 % / +20 %)

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

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

Max. conductor cross-section: 1.5 mm^2
The pins 1 and 2 as well as 3 and 4 are connected to each other on the circuit board.

osa switch dp, rear view
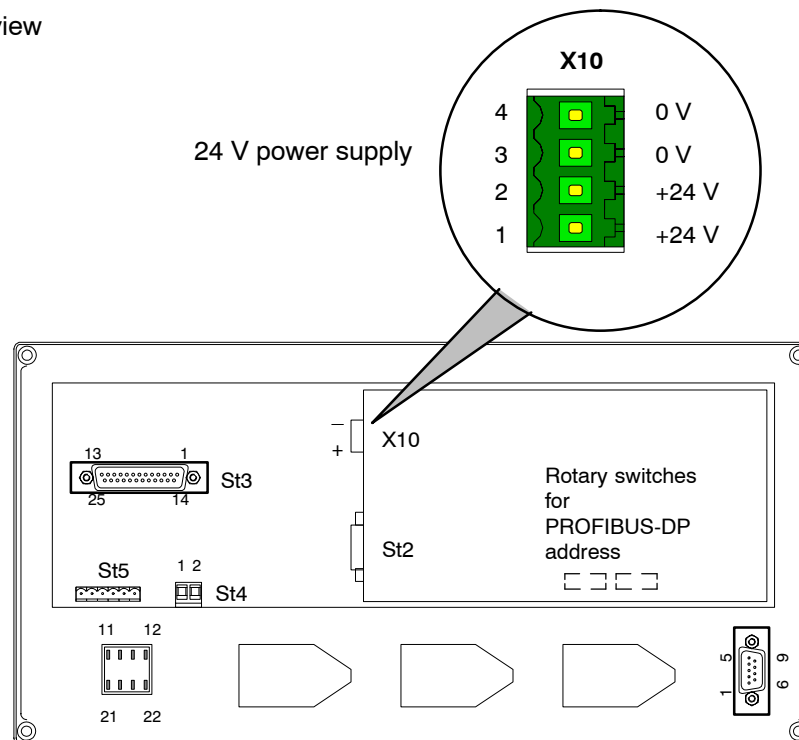
St2   PROFIBUS-DP

The machine control panel osa switch dp is connected via St2 to the PNC plug-in card X71. The PROFIBUS-DP address is set using two rotary switches, see the diagram on page 6–3.

Female DB, 9 connector

Cable length:	depending on baud rate (as per EN 19245, Part 3):	
	500 kbps	400 metres
	1500 kbps	200 metres
	3000 kbps	100 metres
	6000 kbps	100 metres
	12000 kbps	100 metres
Cable type:	Screened, min. cross-section 0.14 mm^2	
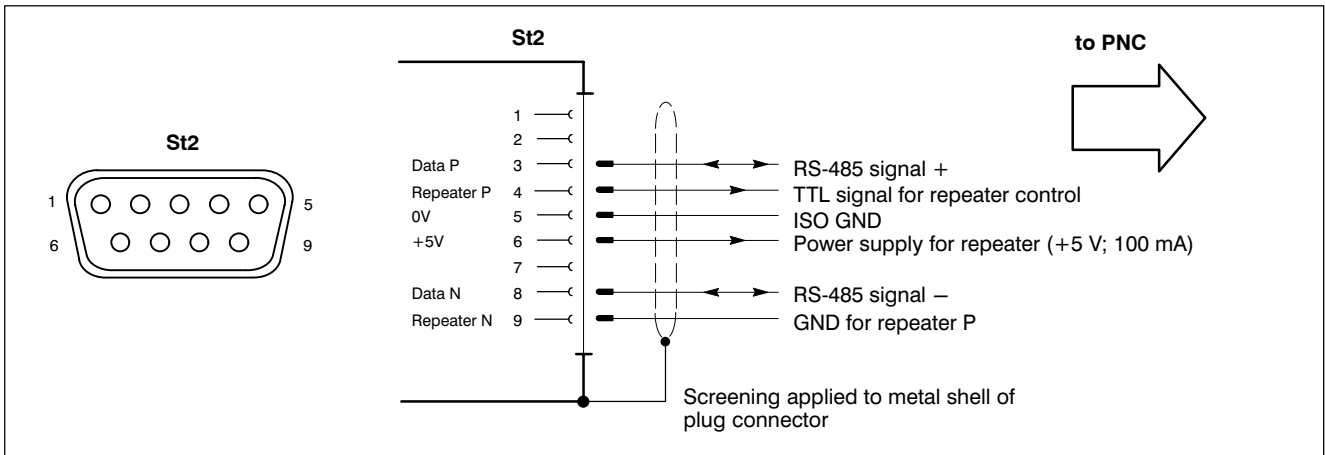
St3   Data connection

Female DB, 25 connector

Connection type:	As per RS422 A
Cable length:	Max. 3.5 m

Signal	Pin
(Connection to St4) EMERGENCY OFF	1
D7	2
D5	3
GND	4
Scan9	5
D6	6
D4	7
D2	8
D0	9
A'	10
B'	11
12V	12
GND	13
(Connection to St4) EMERGENCY OFF	14
D6	15
Scan8	16
Scan9	17
D7	18
D5	19
D3	20
D1	21
A	22
B	23
5V	24
GND	25

St3

1 ... 13
14 ... 25

**Connection to hand wheel
or operating device**

Screening applied to metal shell of
plug connector
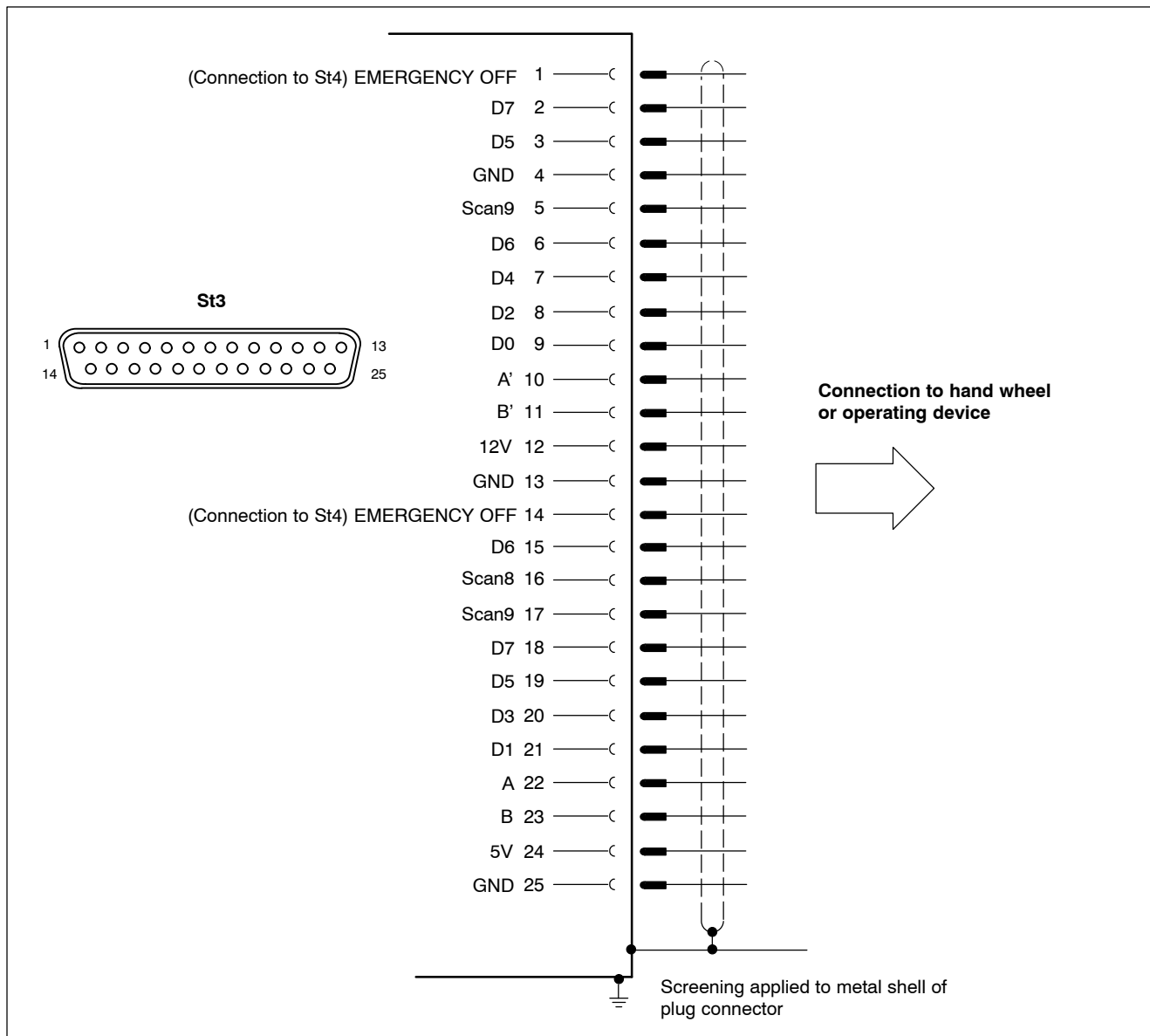
St5   additional discrete keys

Weidmüller plug, 6-pin

St5		discrete keys
Scan8	1	(for marker M8.xx)
D0	2	M8.7
D1	3	M8.6
D2	4	M8.5
D3	5	M8.4
D4	6	M8.3

1 2 3 4 5 6

1070 073 881-101 (02.09) GB
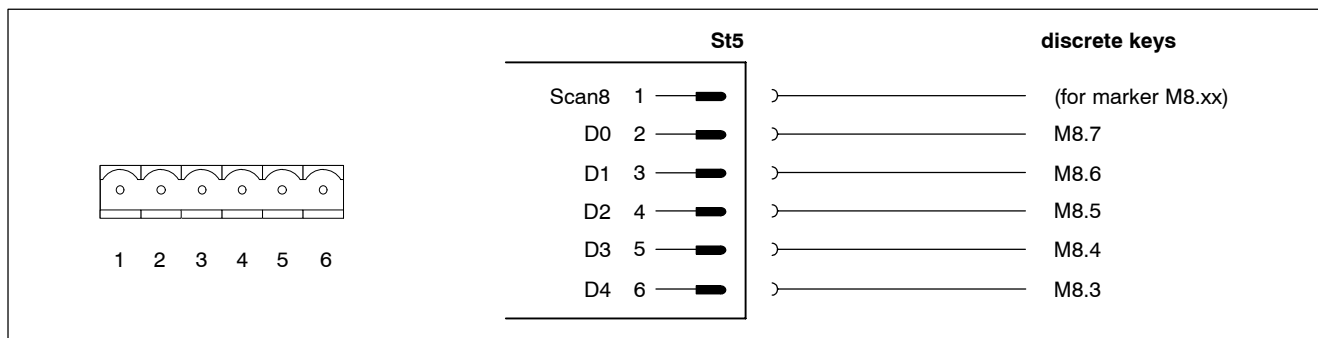
A manual operating device may be attached via the St3 and St5 plugs.
A comprehensive scope of operation is provided, for example, by the manual
operating device HBA-079827 supplied by the Euchner company, with:

● Hand wheel 2 x 100 impulses, magnetic catch

● EMERGENCY STOP as per EN 418, 2-channel

● 2 enabling switches, 2-step

● 2 selector switches, each 5-position

● 3 push buttons
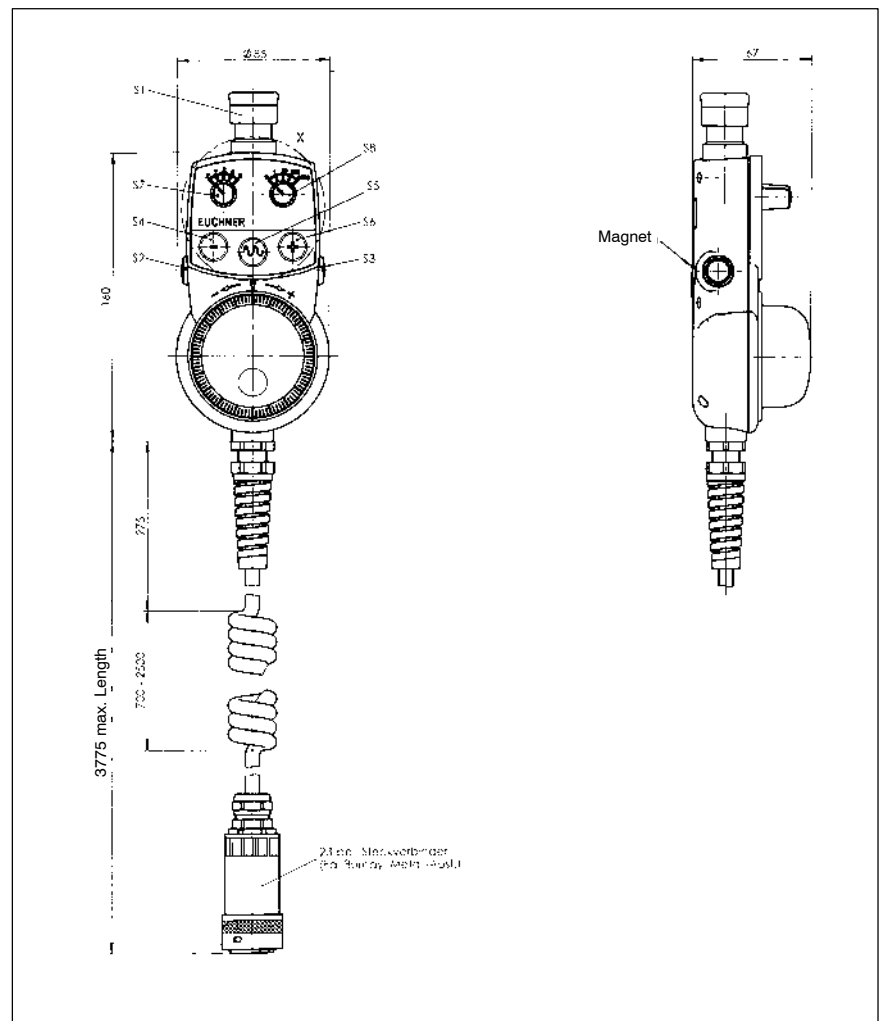
Connection diagram for the Euchner manual operating device type HBA-079827

Screening applied to metal shell of plug connector
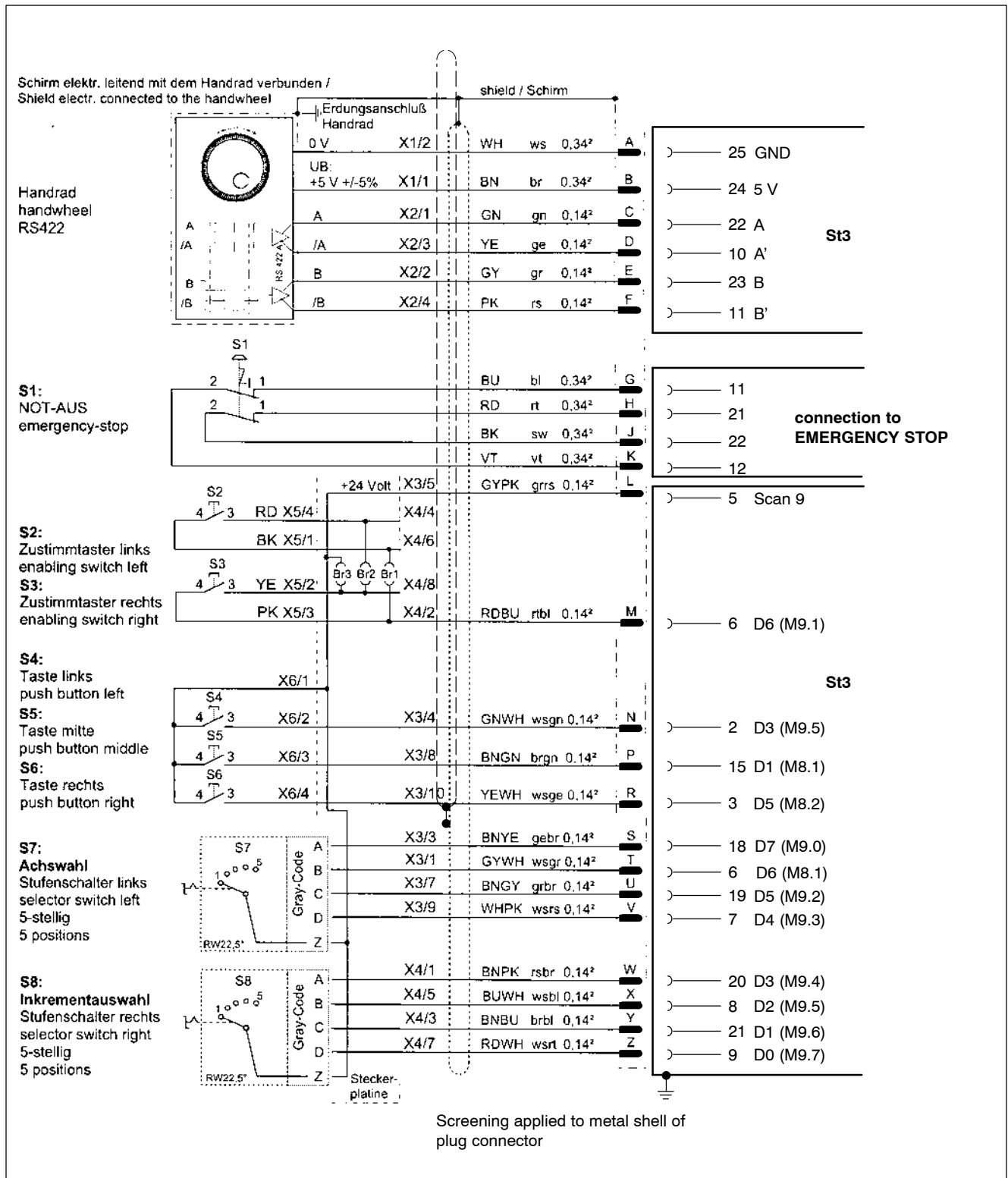
EMERGENCY STOP   **EMERGENCY STOP button**

The EMERGENCY STOP button on the osa switch complies with EN 60204. It must be connected to the EMERGENCY STOP circuit.

Plug, 4-pin

Type: 2-channel: 2 openers

Loading capacity: 24 V, 2 A
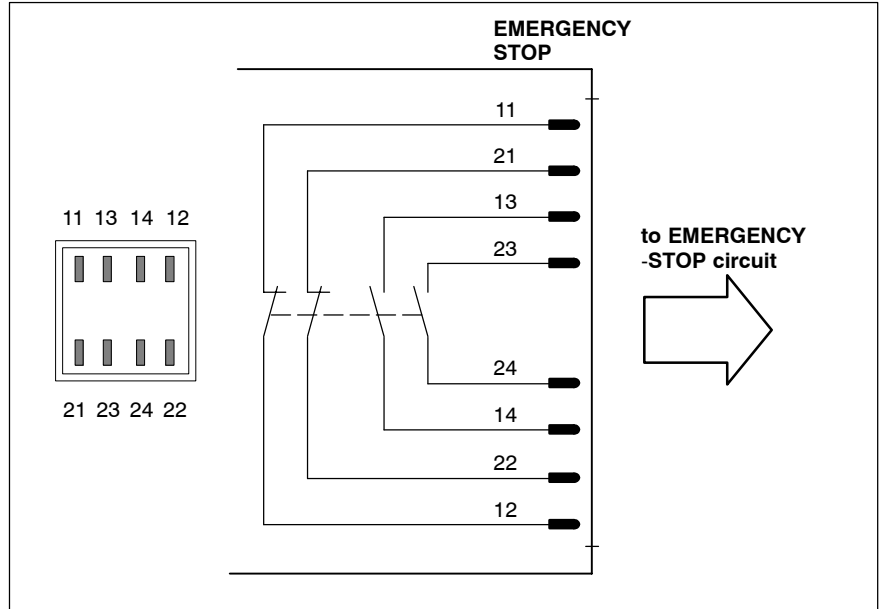
Notes:

7　　Display Components and Control Elements

The display and control elements for the PNC and PC mainframes are equipped differently:

- **PNC plug-in card** with LEDs and RESET button (see section 7.1)
- **PC control panel** with display and separate operating unit (see section 7.2)
- **BT155, BT205** with integrated display and operating unit (see section 7.3)
- **IPC300** with external display unit (BF3xxT) and separate keyboard (see section 7.4)

7.1　　Display components and control elements PNC

The PNC plug-in card has:

- 3 LED's for "TCP/IP", "READY active" and "Error"
- 1 RESET button

LED (green): active TCP/IP communication

LED (green): READY active (H1)

LED (red): Error

RESET button (S1)
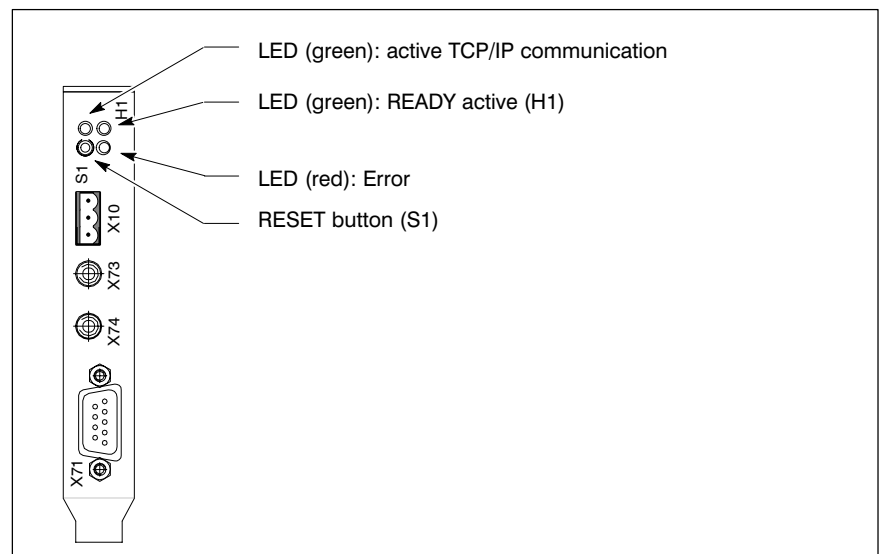
LED	Display	Explanation	Remedial measure
TCP/IP	LED flashes green	• active TCP/IP communication	–
	LED off	• currently no TCP/IP data traffic	–
		• TCP/IP communication not possible due to error	• check whether PNC is running • check PNC IP address
READY active	LED green	• READY active, PNC running	–
	LED off	• READY inactive,	–

LED	Display	Explanation	Remedial measure
Error	LED flashes red (rapidly)	● PNC carrying out RE-SET	● start PNC via PNC control
	LED flashes red (slowly)	● Error on PNC plug-in card	● re-boot PC
	LED red	● READY error	● initiate hardware RE-SET of PNC via PNC control, or ● initiate RESET by button on the PNC plug-in card ● if READY error occurs again, report software error and carry out problem resolution, if required
	LED off	● no error	–

Button	Display	Explanation	Remedial measure
RESET	–	Initiates reboot of PNC	Start PNC after reboot via PNC control

7.2   Display components and control elements PC control panel

The PC control panel incorporates the following display components and control elements:

● osa display

● osa keyboard

● osa switch

● LED indicators and RESET button

7.2.1   osa display

The PC control panel is equipped with a flat-panel display using LCD technology. For the best legibility please observe the following recommendations:

Type	Size	Resolution	Number of colors
PC control panel	10.4"	640 x 480 pixels (factory setting)	65000

Brightness and contrast are preset at the factory. The display colors can be adapted to operating requirements via the operating system or by means of the application software.
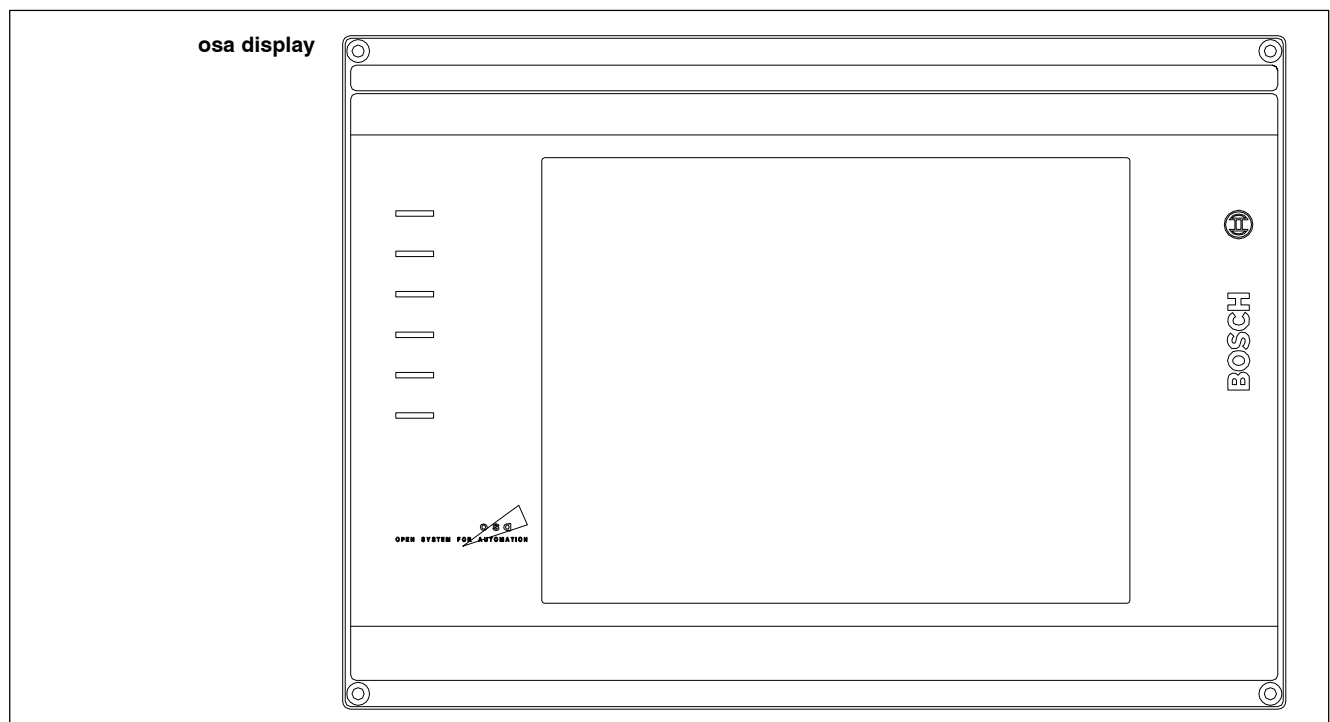
To carry out maintenance on the display, the PC control panel has to be removed. For a detailed description of the display removal procedure, refer to section 9.5.

Backlight timer function

The fluorescent backlight tube provides the background lighting for the TFT display. Since it has a limited service life, after approx. 15000 operating hours, the tube will produce only 50% of its original brightness.
Refer to section 8.5 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 keyboard or mouse action 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.

Pressing a key or moving the mouse again activates the backlight, making the display visible once more.

☞ **If in the darkened state pressing a key, moving the mouse or touching the screen does not cause the screen to re-illuminate, then generally pressing the key combination <CTRL> + <Tab> will force the backlight to re-illuminate.**

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 that will switch the display to a black signal ("Blank Screen" for example, 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.

☞ **Note that the time interval set for activating the screen saver must be less than the period for activating backlight darkening. Otherwise, in certain circumstances, there may be problems with re-illumination.**

7.2.2　　osa keyboard

The keyboard is a part of the PC control panel. With the keyboard you operate both the NC (PNC, type 3 osa) and the PC mainframe.
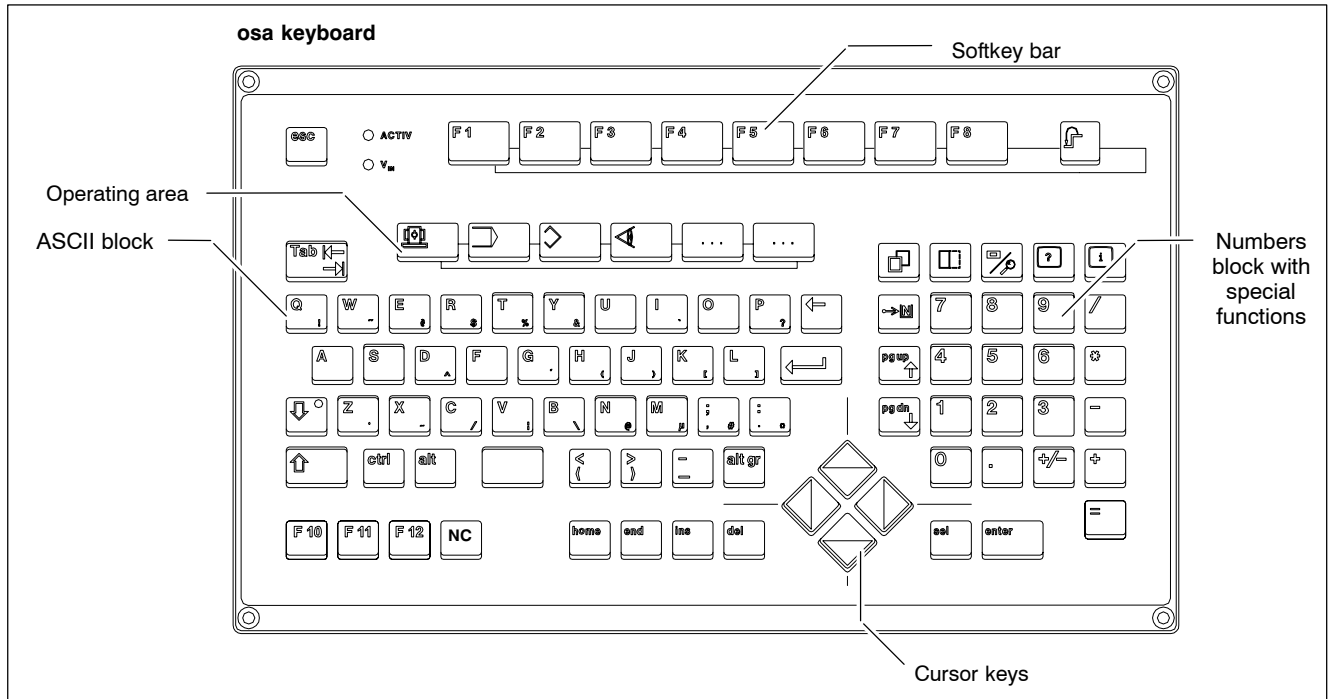
Key blocks

The keyboard is divided up into various functional blocks:

ASCII and number block:

- ASCII characters and various special characters
- del　　　　Delete
  - ←　　　　Backspace
  - ins　　　Insert
  - tab　　　Tabulator
  - space　　Space
  - esc　　　Escape
  - ctrl　　　Control
  - alt　　　Alternate
  - shift　　Upper / lower case
  - ←┘　　　Return
  - pg up　　to top of page
  - pg dn　　to bottom of page
- Special function keys for NC operating interface (BOF)

Cursor and function block:

- Cursor keys: Right Arrow, Left Arrow, Up Arrow, Down Arrow keys
- Function keys F10 – F12
  - home　　to Home pos.
  - end　　　to End pos.
  - ins　　　Insert
  - del　　　Delete
  - sel　　　Select
  - enter　　Return

Operating area:

- Operating area keys for NC operating interface (BOF)

Softkey bar:

● Softkeys for NC operating interface (BOF)
Levels Return key

☞ **There is a detailed description of the keys in the "PNC/Type3 osa Operating Instructions".**

Special key functions

By pressing the key <CAPS Lock> ⬇ you switch between two keyboard modes:

● **Yellow LED** in <CAPS Lock> illuminates:
Access to upper case letters or special characters at the top left of every key has been set.

● **Yellow LED** in <CAPS Lock> is **not** illuminated:
Access again to lower case letters or to characters shown at the bottom left of each key.

Keyboard connection

The keyboard is equipped as a standard feature with a 1.5 m cable and an MF2 connector. The keyboard is connected to the PS/2 "Keyb" interface on the PC control panel by means of the MF2 → PS/2 adapter (see page 6–29) .

On the rear of the keyboard there is a circuit board with a DIP switch to allow the keyboard to be adjusted to the PC control panel.
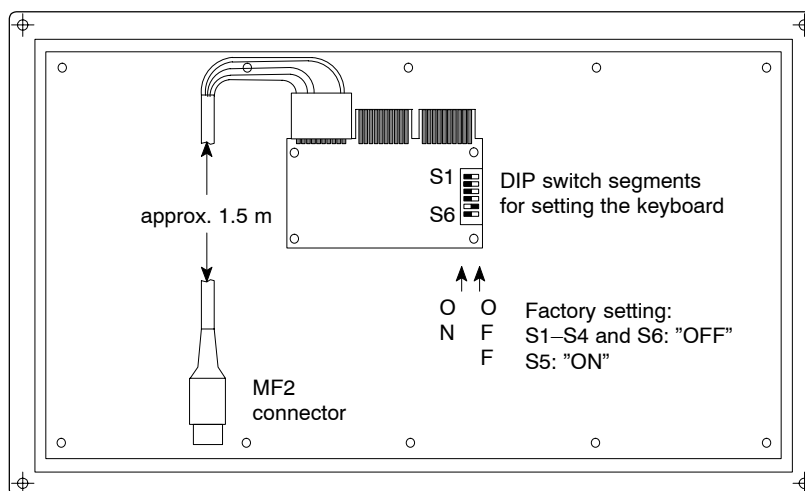
Explanation of the DIP switches:

Switch	Setting: OFF	Setting: ON
S1	autom. adjustment XT/AT	XT
S2	reserved. Reach through free	reserved. Reach through blocked
S3	Autorepeat normal	Autorepeat off
S4	Key click on	Key click off
S5	n-key Rollover	2-key Rollover
S6	not used	not used

CAUTION
Functional failures!

If you do not use the standard Rexroth cable, make sure that the maximum cable length of 2.5 m between the PC and keyboard is not exceeded.

The DIP switch settings are pre-set for standard applications at the factory. Changes to these settings should only be carried out by appropriately skilled persons.

7.2.3   osa switch dp (machine control panel)

In the dimensions appropriate for the PC control panel there is the machine control panel osa switch dp with the following control elements:

32 illuminated keys   2 key switches

Optional interface
(covered by a cap at the front)
E.g.: connection for V.24

Advance switch

Digital potentiometers for advance override

Digital potentiometers for spindle override

EMERGENCY OFF
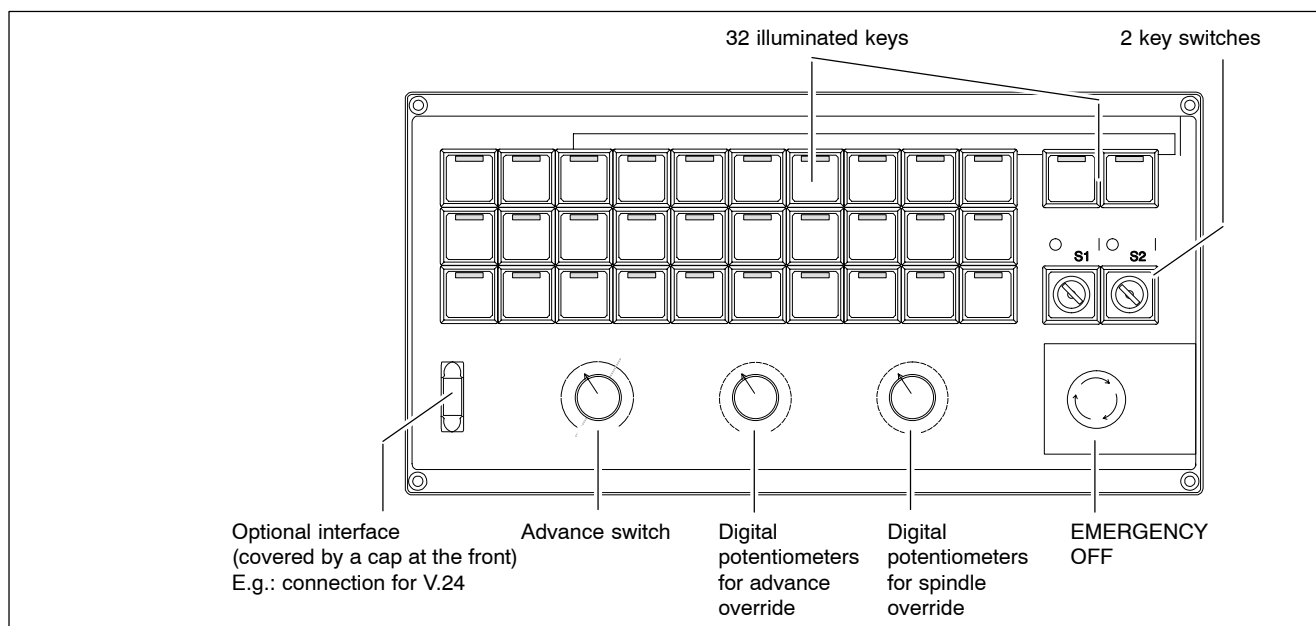
Control elements and interfaces:

Control elements	Number	Steps	Ranges	Comment
Keys	32			Illuminated, free choice of legend
Key switches	2	2		
Advance selection switch	1	Max. 11		
Digital selector switch for advance in %	1	Max. 28	• 0 to 10%: (step size: 2.5%) • 10 to 80%: (step size:10%) • 80 to 120%: (step size: 2.5%)	Ranges and step sizes may be changed by MACODA parameter (7030 00010) but do then no longer correspond to the characters printed on them.
Digital selector switch for spindle rotation in %	1	Max. 31	From 0 to 150% in 5% steps	Range and step size may be changed by MACODA parameter (1040 00041) but do then no longer correspond to the characters printed on them.
EMERGENCY OFF	1		2-channel	Loading capacity: 24 V, 2 A (safe as per EN 418)
Empty DB, 9 connector (optional)	1			This permits the V24 interface X35 from the osa master to be lead to the front of the osa switch, for example.

The logical states of all keys, switches and potentiometers as well as the data from the connected hand wheel are transmitted cyclically via the PROFIBUS-DP to the PNC and are mapped directly on the inputs and outputs of the PLC.

The functionality of the individual control elements must be done by appropriate evaluation of the inputs by the PLC. By setting outputs the keys, including their illumination, may be activated individually.

For more information regarding the assignment of control elements ↔ I/O areas, please refer to the manual "PLC Project Planning", for order number see page 1–7.

7.2.4　　　LED displays

osa display

On the plug side of the osa display housing there is a RESET button with LED:

LED	Control unit / display	Explanation	Remedial measure
RESET	Button	Initiates reboot of PC control panel	–
	LED red	RESET button has been pressed.	–

osa keyboard

LED on the osa keyboard
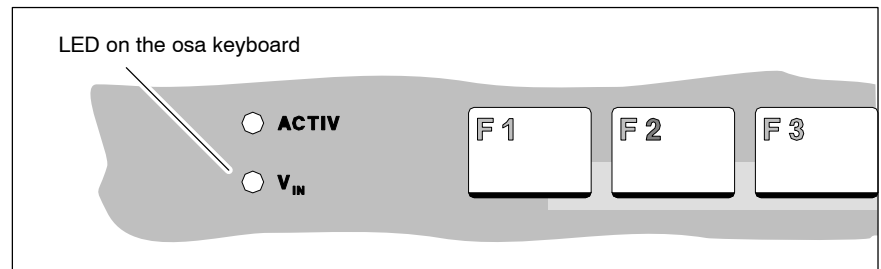
The LED V_{in} is on the osa keyboard:

LED	Display	Explanation	Remedial measure
V_{in}	LED green	In operation	–
	LED off	No 230/115 VAC or 24 VDC power supply	Check power supply at the mains input to the PC control panel.

7.3   Display components and control elements BT155, BT205

The control terminal incorporates the following display components and control elements:

- Display
- Keyboard, keyboard mouse, DIN keyboard connector
- Front panel legends
- Keyboard controller
- DIP switch for various settings
- LED displays on the front and rear of the control panel, RESET button

7.3.1   Display

The control terminals are equipped with a flat-panel display of various sizes using LCD technology (see diagram on page 7−12).

For the best legibility please observe the following recommendations:

Type	Size [inches]	Resolution	Number of colors
BT155	10.4"	640 x 480 pixels (factory setting)	Max. 256,000
BT205	12.1"	800 x 600 pixels (factory setting)	Max. 256,000

Brightness and contrast are preset at the factory. The display colors 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 out toward the front while still installed. For a detailed description of the display removal procedure, refer to section9.5.

Backlight timer function

The fluorescent backlight tube provides the background lighting for the TFT display. Since it has a limited service life, after approx. 15000 operating hours, the tube will produce only 50% of its original brightness.
Refer to section 9.5 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 keyboard or mouse action 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.

Pressing a key or moving the mouse again activates the backlight, making the display visible once more.

☞ **If in the darkened state pressing a key or moving the does not cause the screen to re-illuminate, then generally pressing the key combination <CTRL> + <Tab> will force the backlight to re-illuminate.**

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 that will switch the display to a black signal ("Blank Screen" for example, 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.

☞ **Note that the time interval set for activating the screen saver must be less than the period for activating backlight darkening. Otherwise, in certain circumstances, there may be problems with re-illumination.**

7.3.2   Keyboard

Function key blocks

All function keys can be programmed via the application program:

- 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 normal softkey functionality used in the industry)

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

The legend on all the function keys may also be changed, see section 7.3.3.

BT155

Function keys   Function keys   Function keys

BT205

Function keys
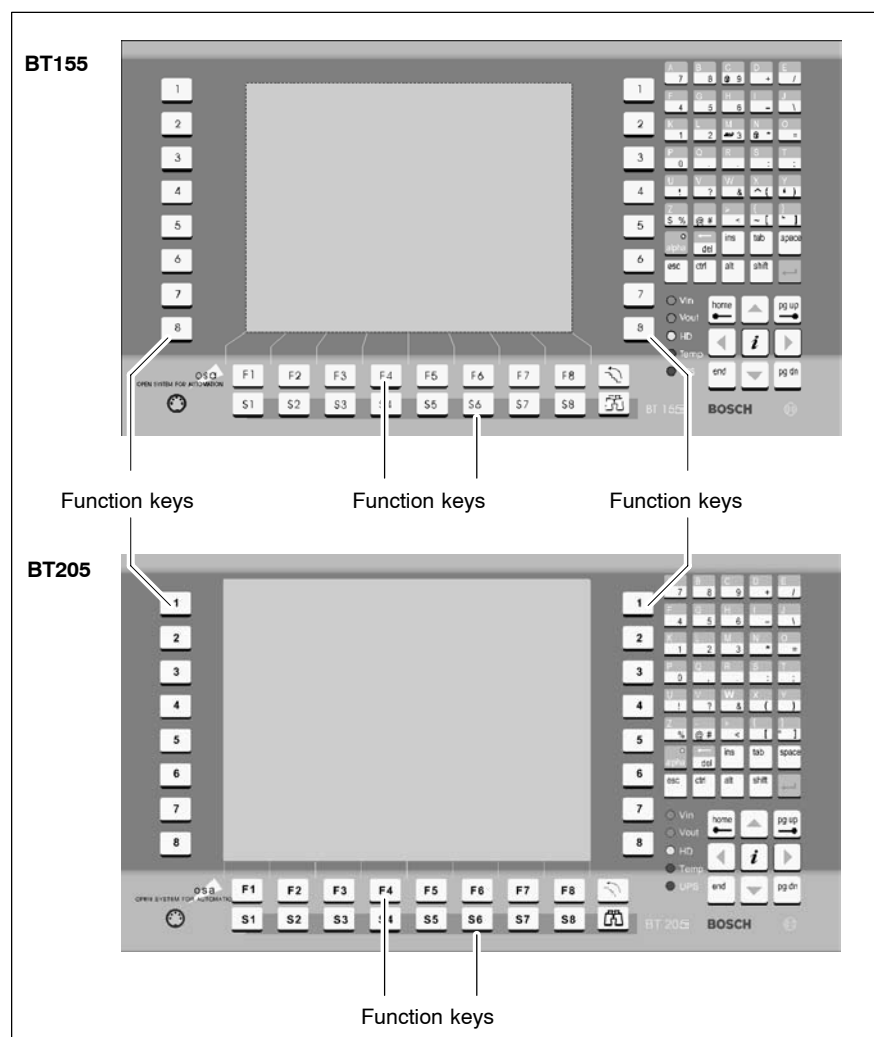
ASCII and number blocks, cursor control block

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

- **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)

ASCII and number block

Cursor keys
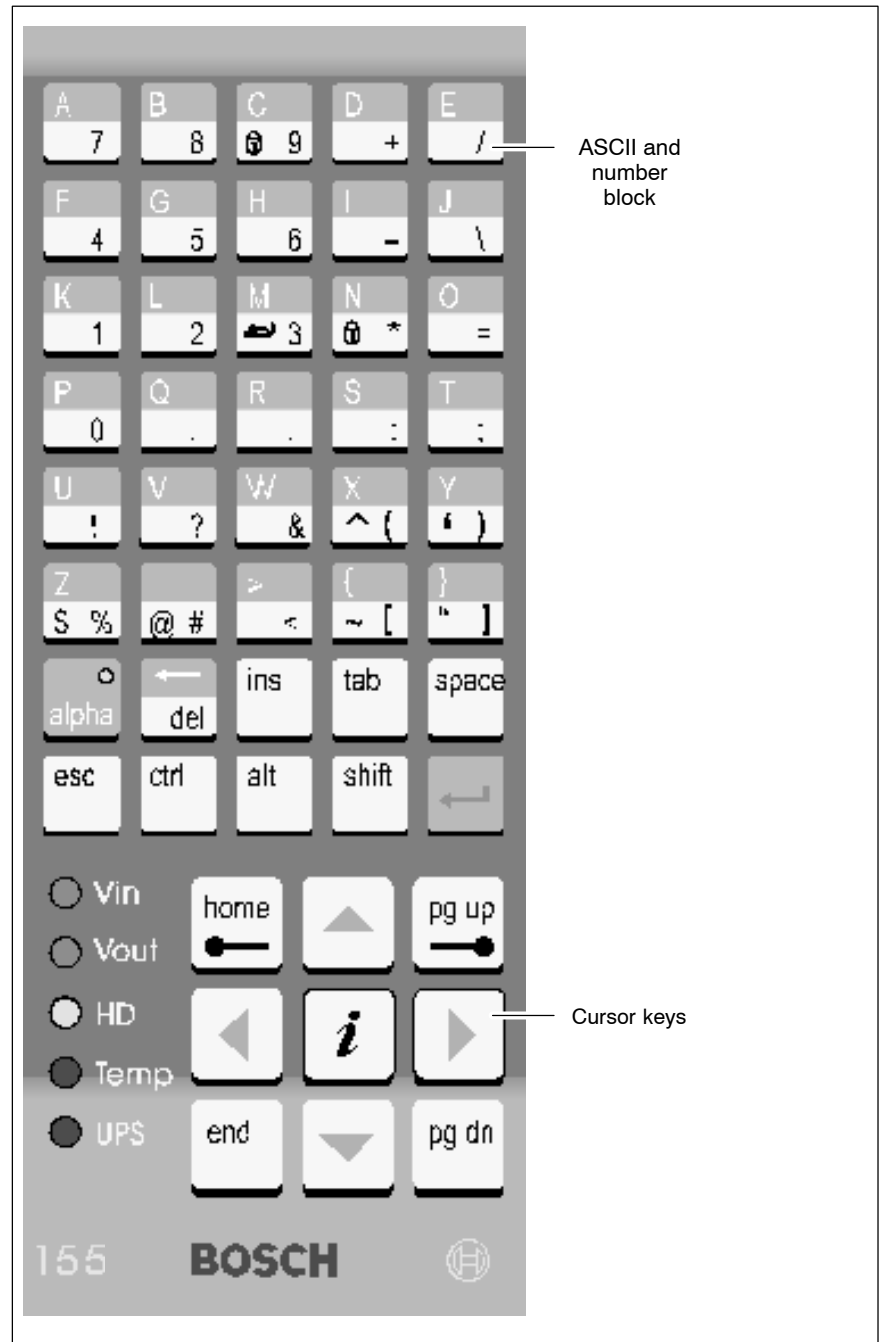
ASCII and number block assignments:

- ASCII characters and various special characters

- alpha   access to special characters and special functions,
               refer to section 7–14
  del   Delete
  ←   Backspace
  ins   Insert
  tab   Tab
  space   Space
  esc   Escape
  ctrl   Control
  alt   Alternate
  shift   Upper / lower case
  ←⏎   Return

Cursor block key assignments:

- 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

Special key functions

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

- **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.
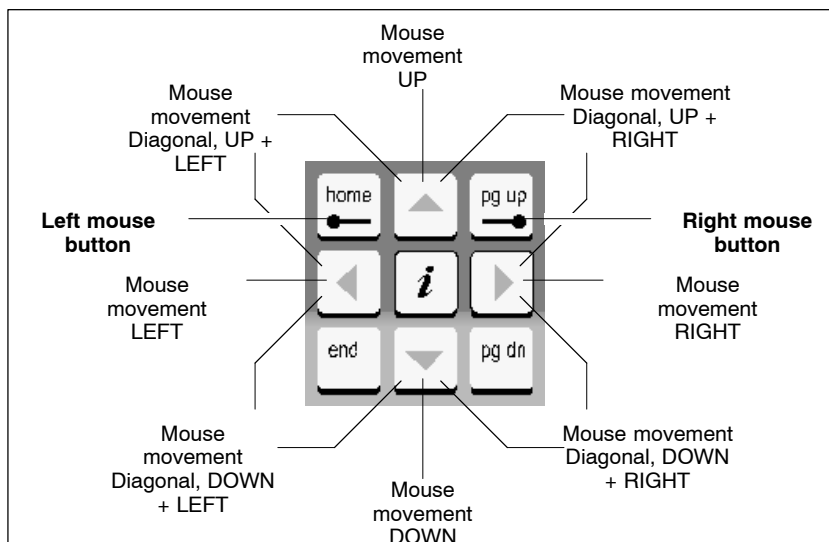
The active keyboard mouse is indicated by the LED of the alpha key in the following manner:

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: **Long 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 is disabled. It will then not be possible to re-enable the keyboard mouse, not even by removing the external mouse. The PC must 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 deselected.
Pressing the <shift> key deselects 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.

7.3.3   Front panel legends

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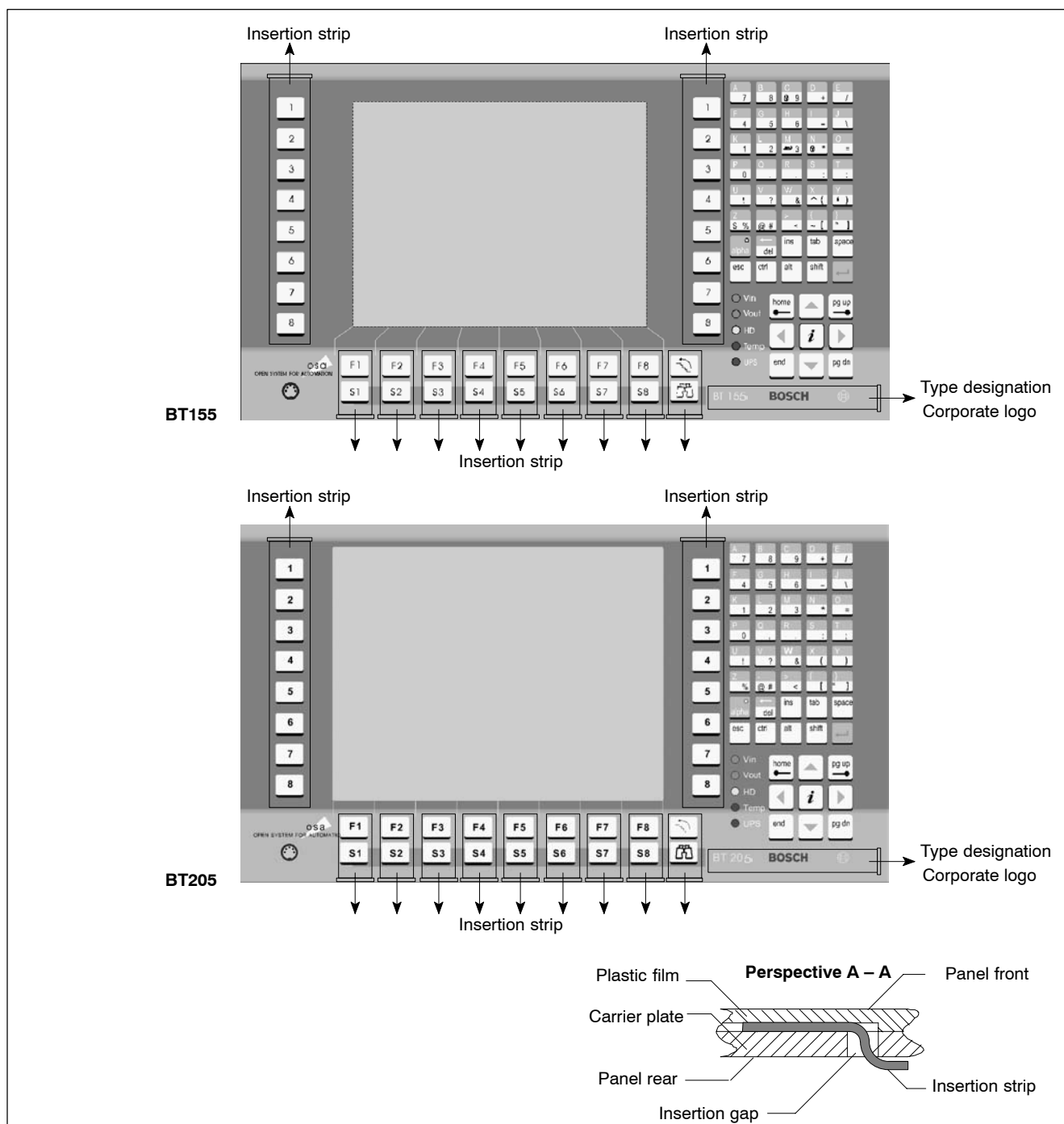
The insertion strips/labels are inserted and pushed through an insertion gap at the rear of the front panel.

☞ **When preparing to insert a label, it will be 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 strip after installation of the insertion label.**

The dimensions of the different insertion strips can be seen in the following table:

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 device.

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 removal 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 operating faults on the connected machine!**
Check and verify the legends on the insertion labels correctly match the function of the labelled keys.

7.3.4   Keyboard controller

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

Scanning of 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 information 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 version):

Keys BT155, BT205	MF2 key code
Overview:	shift + space
Display basic screen:	ctrl + home
Info:	shift + return
Softkeys F1–F8:	F1 – F8
Softkeys S1–S8:	shift + F1 – shift + F8
Movement keys 1–4 left of display:	F9 – F12
Movement keys 5–8 left of display:	shift + F9 – shift + F12
Movement keys 1–4 right of display:	ctrl + F9 – ctrl + F12
Movement keys 5–8 right of display:	ctrl + shift + F9 – 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:	Alpha active: Alt + ...

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

Transferring key codes to the PROFIBUS slave station and to the 24 Vout outputs

By default, the codes of the following keys are transferred:

- Movement (motion) keys
- Softkeys

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

PROFIBUS slave station

The keys codes are transferred via 8 input bytes to the PROFIBUS slave.

24 Vout outputs

The key codes are transferred to 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.

Special case of simultaneously pressed keys

When keys are pressed simultaneously, the key code output is supported by special processing logic.
Simultaneous key actuation is only not supported in the case of movement keys; 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 first: No code is output

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

Software download for the keyboard controller

☞ **Application-specific key codes can be downloaded by Rexroth upon request and by arrangement.**

The BT uses the COM3 serial port to download new key codes into the keyboard controller.
In the event that there are problems with the download, first check the switch positions of the SEL COM3 DIP switch.

The SEL COM3 DIP switch is located on the bottom panel of the control terminal (refer to page 6–4). Switch segments 1 an 2 must be in the "ON" position.

SEL COM3

ON

OFF

1 2 3 4 5 6 7 8

Switch closed = 0xFF

Switch open = 0x00
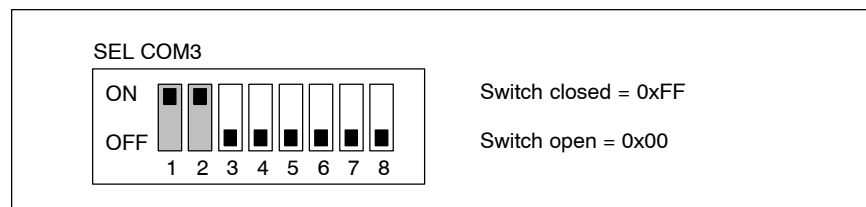
If the download should still prove to be impossible, then a forced download can be carried out. For this the keyboard controller is explicitly switched into download mode by using the DIP switch DP-ADR, which is also located on the bottom panel of the control terminal. Set switch 1 to "ON" and re-boot the control terminal in order to activate download mode.

DP-ADR

ON

OFF

1 2 3 4 5 6 7 8

Switch closed = 0xFF

Switch open = 0x00
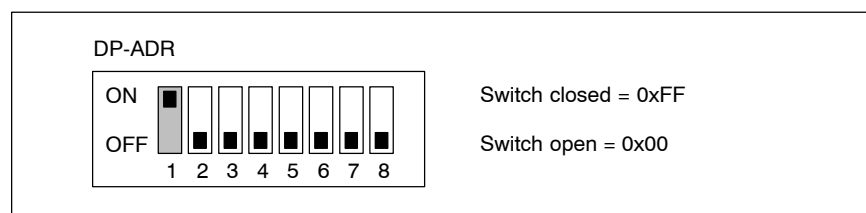
After a successful download, reset switch segment 1 of the DP-ADR back to "**OFF**" again.

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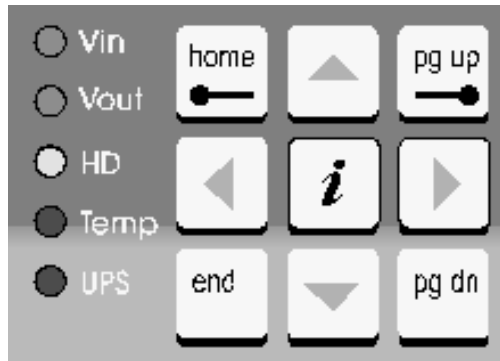
On the front panel there are 5 LEDs with the following meaning:

LED	Display	Meaning	Remedial measure
V_{in}	LED green	Standard operation	–
	LED off	No 230/115 VAC or 24 VDC power supply	Check mains power input on power supply.
VOut	LED green	Standard operation	–
	LED off	No internal +5 V and +12 V power present	Check mains power input on power supply.
HD	LED yellow	Hard disk access	–
Temp	LED off	Standard operation	–
	LED flashes red	Internal housing temp. 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 currently operating in battery mode, i.e. no mains power present!	Restore power supply. Initiate 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-in side:

LED	Control unit / display	Meaning	Remedial measure
RESET	Key	Initiate reboot.	–
	LED red	RESET button has been pressed.	–

7.4   Display components and control elements IPC300
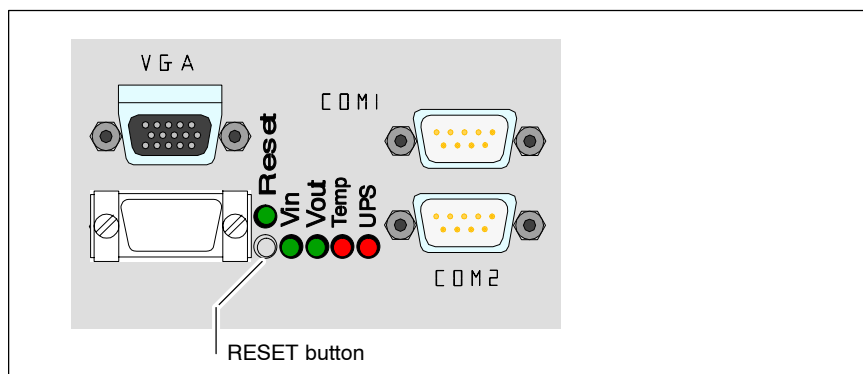
RESET button

On the rear panel there is a RESET button and 5 LEDs with the following meaning:

LED	Display	Meaning	Remedial measure
V_{in}	LED green	Standard operation	–
	LED off	No 230/115 VAC or 24 VDC power supply	Check mains power input on power supply.
V_{Out}	LED green	Standard operation	–
	LED off	No internal +5 V and +12 V power present	Check mains power input on power supply.
Temp	LED off	Standard operation	–
	LED flashes red	Internal housing temp. 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 currently operating in battery mode, i.e. no mains power present!	Restore mains power, initiate a controlled PC restart.
	LED flashes red	Battery pack discharged, defective or not connected	Check battery charge level! Maintain 5 hour charging cycle.

	Control unit / display	Meaning	Remedial measure
RESET	Key	Initiate reboot.	–
	LED red	RESET button has been pressed.	–

8   PC Control Panel Maintenance

The PC control panel is maintenance-free. However, some components are subject to wear and must be replaced.

CAUTION
Loss of data!
Service repairs of devices returned by customers do not entail bak-kup of user data. Repaired units are returned with formatted hard disk and newly installed software.

8.1   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 thoroughly 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 "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. To safeguard application data, and to avoid the necessity of time-consuming new installations of operating system (OS) and application programs following a hard disk replacement, the functional program and OS data on the hard disk should be backed up at regular intervals by using the "Backup Package for Industrial PC" supplied by Rexroth. This process writes an image of the hard disk to the medium in the Iomega "Jaz" drive supplied with the package; if a hard disk replacement is required, this image must simply be copied back to the newly installed hard disk. Refer to chapter 12.1 for ordering information.

8.2   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!

☞   **To safeguard application data, and to avoid the necessity of time-intensive new installation of operating system (OS) and application programs following a hard disk replacement, the functional program and OS data on the hard disk should be backed up at regular intervals by using the "Backup Package for Industrial PC" supplied by Rexroth. This process writes an image of the hard disk to the medium in the Iomega "Jaz" drive supplied with the package; if a hard disk replacement is required, this image must simply be copied back to the newly installed hard disk.**
Refer to chapter 12.1 for ordering information.

1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

Upper surface

Rear view

Closure screw

Installation frame (closed)

4. Unscrew the closure screw on the installation frame.

5. Swing the installation frame out of the housing by about 90 degrees and pull it a little way out of the opening of the PC housing in order to be able to reach the female connector of the ribbon cable attached to the hard disk.

Side view — Ribbon cable

2 glue spots for securing the plug

Installation frame with hard disk
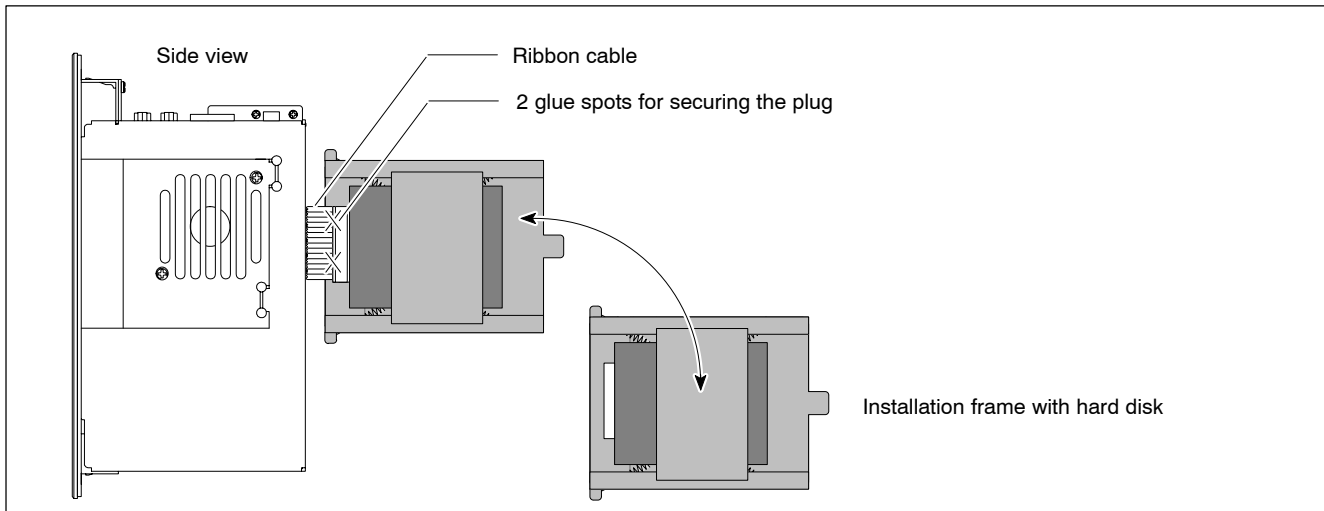
6. The ribbon cable is secured by two spots of hot glue which must be broken (cut) for de-installation. Disconnect the IDE ribbon cable **from the hard disk** . Unless this cable is defective, disconnecting it from the main board will not be required.

7. The new hard disk is always installed complete with installation frame, and in reverse sequence to that described above.

☞ **Secure the hard disk connector by applying spots of "hot glue" again. In the course of installation, ensure that cables are not pinched or caught between hard edges.**

Testing the new component:

8. The BIOS will automatically recognize the hard disk.

9. 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.

10. 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.

11. Restore the **Image** created with the data backup tool to partition "C".
    In the event that an image of the old partition "C" was not created, once the PC has booted up properly, the application data and operating system settings required for standard operation must be restored as follows:

-   Install Windows NT
-   Install PNC software
-   Install other application software
-   Enter host name
-   Enter IP address
-   Load application data

8.3   3.5" floppy disk drive

As an optional feature an external floppy disk drive with mounting frame and shutter for installation in a control cabinet is available, cable length 1.2 m (Order no.: 1070 081 614)

☞ **For in-cabinet installation, both connections must be shielded, and the shield must be connected to housing potential at both end.**

Installation

1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Connect the ribbon cable to floppy disk connection X75, and the power supply cable to connection X76. Observe the red marking on the ribbon cable, which must always connect to pin 1 of the devices to be connected.
   In most cases, notches in the mating inline connectors prevent improper connection.

☞   **The default setting in the BIOS is for a 3.5" floppy disk drive, HD 1.44 MB.**

5. In the event that the user has installed another type of floppy disk, (e.g. 3.5" HD 2.88 MB), then this drive must be declared in the BIOS. While the system is booting, the BIOS menu of the PC is accessed by pressing the <DEL> key.

    In the "Main Menu" select the menu item "Legacy Diskette A". Select the new floppy disk type. Exit the BIOS via F10 "**Save Settings and Exit**" (saves the hard disk parameters).
    To do this, press the <Y> key (= Yes).

6. If the floppy disk cannot be accessed check the cables for:

    ● Proper connection between controller cable and floppy disk drive.
    ● Proper seating of all cables and connectors
    ● Presence of operating power.

8.4   Replacing the power supply

The 230/115 VAC power supply for the PC control panel is located beside the fan inside the housing.
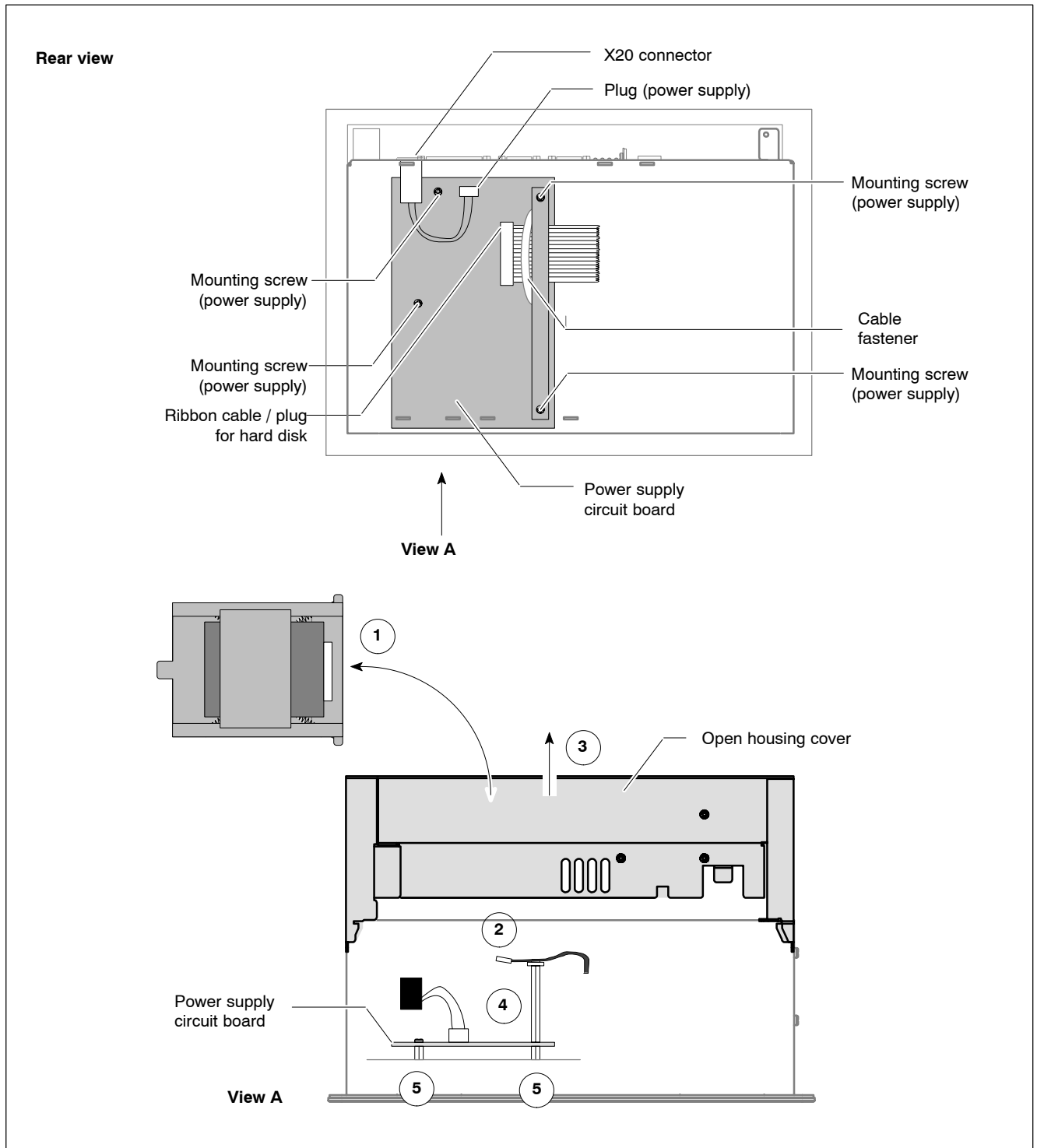
1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

☞ **Prior to opening the PC housing cover, the IDE ribbon cable must de disconnected from the hard disk.**
The ribbon cable is secured by two spots of hot glue which must be broken (cut) for de-installation.

4. Remove the installation frame with the hard disk in accordance with the instructions in section 8.2 (positions 1 and 2).

5. Unscrew the mounting screws from the PC housing cover and remove the cover (pos. 3)

6. Remove the plug connector (pos. 4) for mains power from the power supply circuit board.

7. As shown in pos. 5, remove the 3 mounting screws holding the power supply circuit board. The power supply module can now be taken out.

8. Installation is in reverse sequence to removal described above.

☞ **Secure the hard disk connector by applying spots of "hot glue" again. In the course of installation, ensure that cables are not pinched or caught between hard edges.**

Testing the new component:

9. If the PC system fails to boot up, check the connection for the following:

- Positive connection of all plugs and cables attached to the PC
- Proper seating of the ribbon cable plug on the hard disk and on the power supply circuit board.

8.5   Display and backlight

A fading backlight causes a progressive deterioration of LCD display readability, making a backlight replacement advisable.
Display and backlight can only be replaced if the PC control panel has been de-installed.

1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the PC control panel (unscrew 4 screws).

☞   **Prior to opening the PC housing cover, the IDE ribbon cable must de disconnected from the hard disk.**
The ribbon cable is secured by two spots of hot glue which must be broken (cut) for de-installation.

5. Remove the hard disk installation frame in accordance with the instructions in section 8.2.

6. Unscrew the mounting screws from the PC housing cover and remove the cover.

7. Remove the front plate of the PC control panel (4 mounting nuts) in order to be able to reach the TFT display from the front.
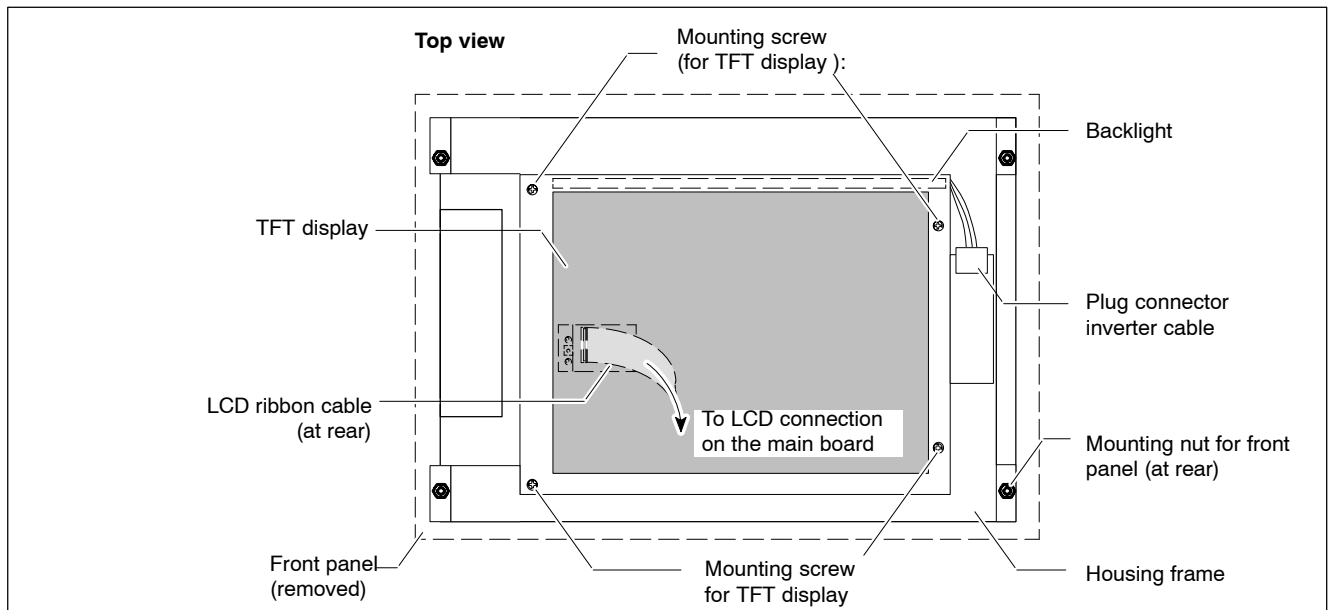
8. Remove the plug connector for the inverter cable at the right of the display.

9. Remove the 4 mounting screws from the TFT display.

10. Remove the LCD ribbon cable from the rear of the display. Then the display can be removed.

11. The replacement of the backlight is carried out to the side at the top of the TFT display.

12. The replacement of the display is always complete with backlight.

CAUTION
Use only the same type of displays!
Ensure that the backlight is compatible with the display!

13. Installation is in reverse sequence to removal described above.

14. 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.

8.6   Rechargeable battery pack

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

The rechargeable battery pack must be replaced in the following cases:

● The battery test fails on system start-up

● The number of charging cycles (which depends on the ambient temperature) exceeds the figure stated below ("Shutdown count" in the UPS program, see section 3.3.2).

A charging cycle is defined by switching the PC power supply on and off. The number of charging cycles that may be carried out on the battery pack, and thus also its useful service life, is dependent on the ambient temperature at which the battery is used. Ambient temperature is defined as the temperature at which the battery pack is used e.g. the device internal temperature or the control cabinet internal temperature.

The following table serves as a guide:

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

☞ **The battery packs used are recyclable and can be returned to Rexroth after replacement. They must not be disposed of in standard residential refuse.**

X19   Battery connection

Male terminal strip, 2-pin

Cable length: Max. 2.0 m

Cable type: Unscreened, min. cross-section 1.5 mm^2

For the PC control panel the external battery pack for installation in a control cabinet with a 0.9 m cable is used. For order number, see section 12.2.

Replacing the external battery pack

The battery pack connector X19 is inside the PC housing.
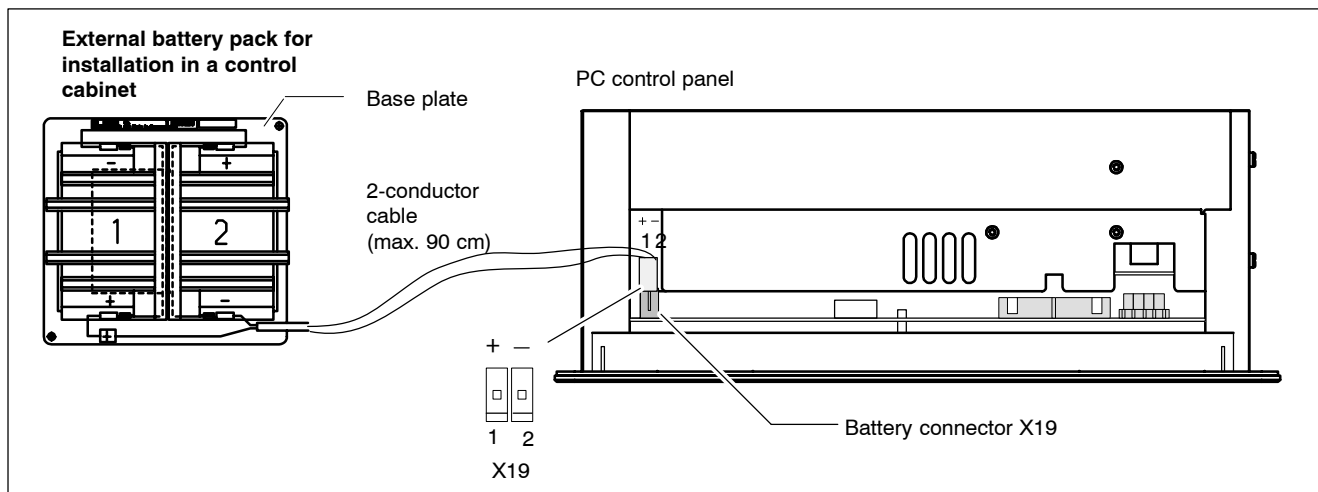
1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

4. To remove the 2-connector battery pack cable from the X19, open the housing cover of the PC control panel.

5. Remove the two screws holding the battery pack.

6. Attach the new battery packs with 2 screws.

7. Insert the 2-connector cable from the outside to the X19 connector.

CAUTION
Ensure correct polarity of the batteries.
Polarity reversal of the rechargeable battery pack will result in an F10A (5x20) fuse being triggered on the power supply module. Further damage may also result. The UPS operating cycle will then no longer be possible.

8. Close the cover again.

☞ **In the course of installation, ensure that cables are not pinched or caught between hard edges.**

Testing the new component

9. Restore power to the system.

☞ **If the new rechargeable battery pack has not been charged, there will not be sufficient 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.**

10. The batteries are fully charged if the battery test does not fail on system start-up. You can also test the state of charge of the batteries with the program **UPS$_{NT}$** (see section 3.3.2).

8.7 Expansion cards

There are slots for PCI BUS and ISA BUS expansion cards:

- 1 PCI BUS card   (max. length 180 mm)
- 1 PCI or ISA BUS card (combination slot) (max. length 180 mm)

☞ **One PCI slot is taken up at the factory by the PNC plug-in card.
To replace the PNC plug-in card please also see the following sections.**

**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.**

8.7.1 Installing an expansion card

1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the mounting screw holding the slot cover.

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

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

Arrangement of expansion slots in the housing

If the card is Plug-and-Play (PnP) compatible, it is automatically recognized and integrated in the system, provided 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 driver software 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.

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

8.7.2 BIOS settings

☞ **IRQ 3, 4, 5, 7, 10, 11, 14 are already occupied, and are therefore no longer available for PCI and ISA expansion cards!**

PCI slot

You can assign an IRQ address to each PCI slot in the BIOS sub-menu "The Advanced Menu / PCI Configuration sub menu". At the same time, the number of the IRQ address also defines the priority.
If only PnP cards are used, the "**AUTO**" setting must be maintained.

BIOS selection: PCI IRQ line 1, PCI IRQ line 2, PCI IRQ line 3, PCI IRQ line 4

Option: Disabled, Auto, IRQ: 3, 4, 5, 7, 9, 10, 11, 12, 14, 15,

Default: AUTO

ISA slot (IRQ)

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA IRQ Resource Exclusion / IRQx" the IRQ address for non-Plug-and-Play compatible ISA cards (so-called legacy ISA cards) must be **permanently** set.

BIOS selection: IRQ:3, 4, 5, 7, 9, 10, 11, 15

Option: Available, Reserved

Default: Available

ISA slot (UMB)

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA UMB Region Exclusion" a specific block is reserved in upper memory for legacy ISA cards.

BIOS selection: C800 - CBFF, CC00 - CFFF, D000 - D3FF, D400 - D7FF, D800 - DBFF, DC00 - DFFF

Option: Available, Reserved

Default: Available

8.8   Backup battery on PC main board

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

The backup battery on the PC main board has a service life of approx. 9 years. It provides backup power for the setup data and real-time clock. It must only be replaced if the main board is not connected to a power supply.

Battery type: **Varta Lithium CR2032** (180 mAh).

1. Switch off the power supply.

2. Wait until the power supply, after operation under UPS, switches off by itself.

3. Remove the power supply cable from the X20 or X10_1 connector.

☞ **Prior to opening the PC housing cover, the IDE ribbon cable must de disconnected from the hard disk.**
The ribbon cable is secured by two spots of hot glue which must be broken (cut) for de-installation.

4. Remove the hard disk installation frame in accordance with the instructions in section 8.2.

5. Unscrew the mounting screws from the PC housing cover and remove the cover.

6. The battery is located adjacent to the VGA port on the main board . Slide the holding bail off the battery, and remove the battery.

7. Insert the new battery. Ensure that positive contact between holding bail and battery is restored.

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

☞ **In the course of installation, ensure that cables are not pinched or caught between hard edges.**

9   BT155, BT205 Maintenance

The BT155, BT205 control terminals are maintenance-free. However, some components are subject to wear and must be replaced.

CAUTION
Loss of data!
Service repairs of devices returned by customers do not entail bak-kup of user data. Repaired units are returned with formatted hard disk and newly installed software.

9.1   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 thoroughly 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 "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. To safeguard application data, and to avoid the necessity of time-consuming new installations of operating system (OS) and application programs following a hard disk replacement, the functional program and OS data on the hard disk should be backed up at regular intervals by using the "Backup Package for Industrial PC" supplied by Rexroth. This process writes an image of the hard disk to the medium in the Iomega "Jaz" drive supplied with the package; if a hard disk replacement is required, this image must simply be copied back to the newly installed hard disk. Refer to chapter 12.1 for ordering information.

9.2   Hard disk replacement

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!

☞ **To safeguard application data, and to avoid the necessity of time-intensive new installation of operating system (OS) and application programs following a hard disk replacement, the functional program and OS data on the hard disk should be backed up at regular intervals by using the "Backup Package for Industrial PC" supplied by Rexroth. This process writes an image of the hard disk to the medium in the Iomega "Jaz" drive supplied with the package; if a hard disk replacement is required, this image must simply be copied back to the newly installed hard disk.**
Refer to chapter 12.1 for ordering information.

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the 4 Phillips head screws holding the control panel. Pull out the control panel by approx. 3 cm and tilt forward (refer to diagram on page 9–4).

5. The ribbon cable is secured by two spots 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.

PE lug

Control panel,
installed position

Control panel mounting screws

View A

Control panel tilted forward

Display
ribbon cable

Holding device

View A: Control terminal with control panel folded down

Clamping gaps for holding
device

PC housing   Interfaces

Hard disk

PE lug

Controller ribbon cable with female inline connector (hard disk)

Hard disk spring suspension

Hard disk holding bracket

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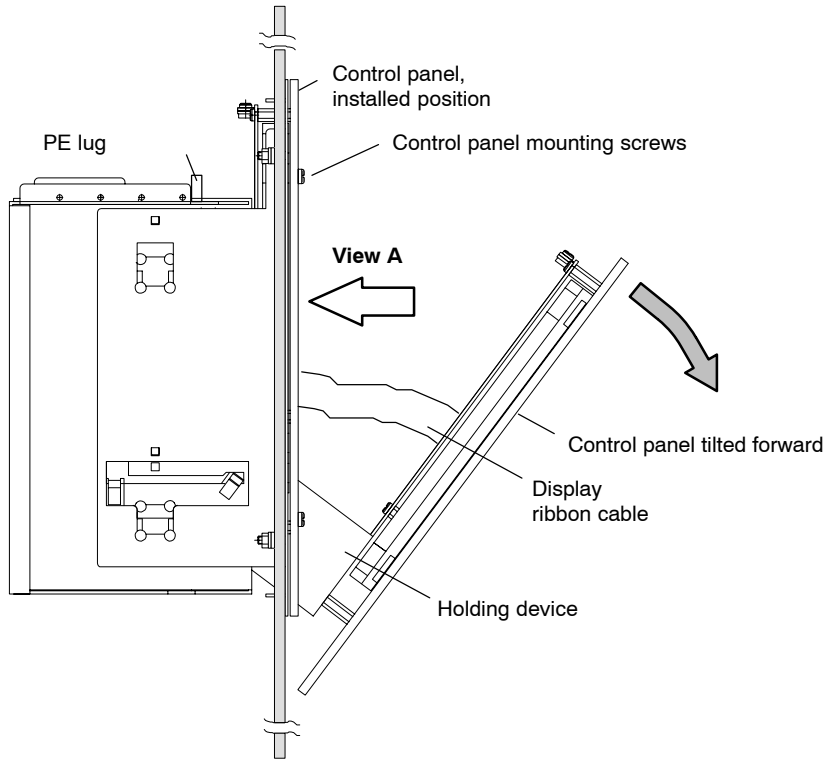
control terminal installation
frame
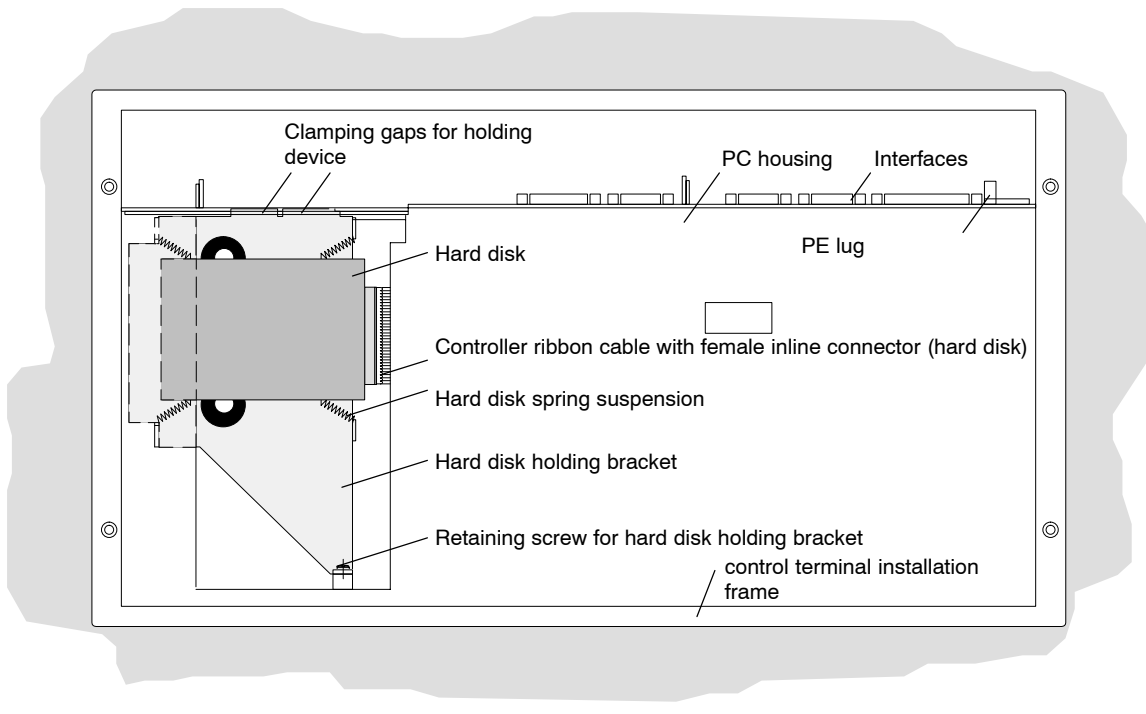
6. A **retaining screw** holding the installation frame in place is located below the hard disk. Loosen the retaining screw and pivot the installation frame slightly to the top right at its base (near the retaining screw). The pivoting motion releases the installation frame from the clamping gaps at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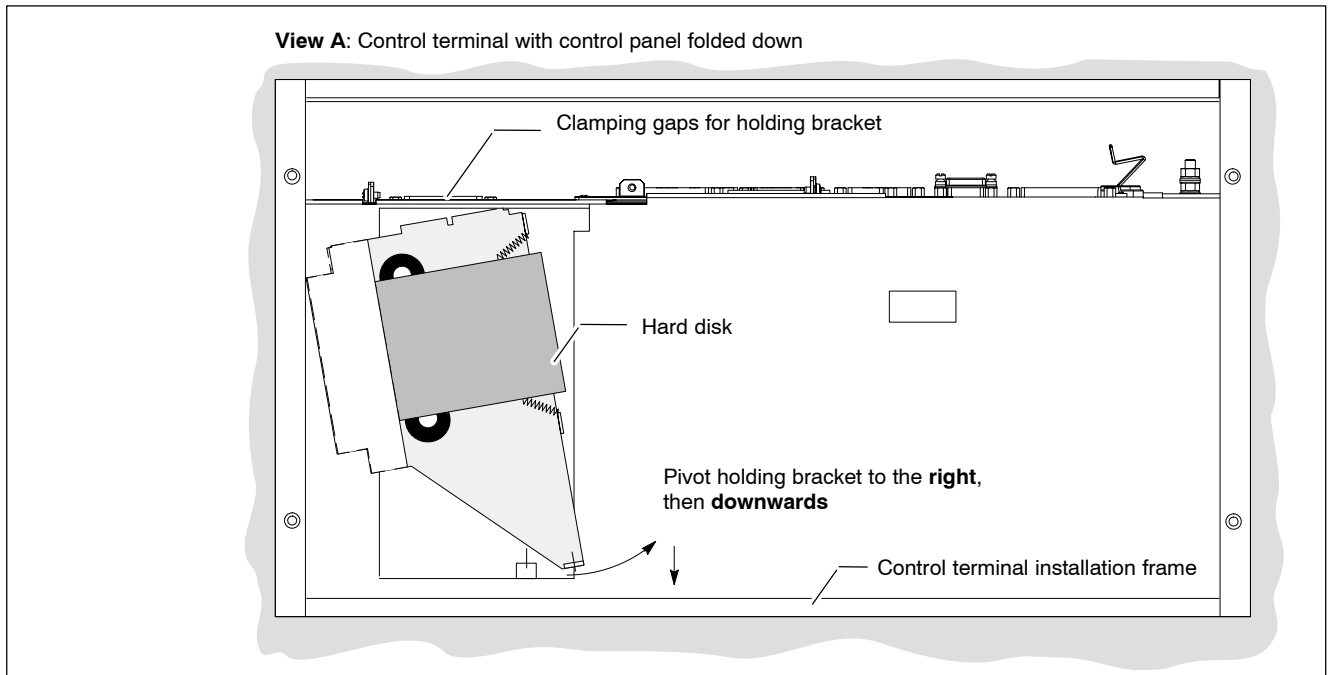
View A: Control terminal with control panel folded down

Clamping gaps for holding bracket

Hard disk

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

Control terminal installation frame

7. The new hard disk is always installed complete with installation frame, and in reverse sequence to that described above.

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

Testing the new component:

8. The new hard disk must be identified to the BIOS. When booting the system, press the <F2> key to access the BIOS menu of the PC.

   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. Leave BIOS via the Exit menu with F10 "**Exit Saving Changes**" to save the hard disk parameters.
   To do this, press the <Y> key (= Yes).

9. 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.

10. 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.

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

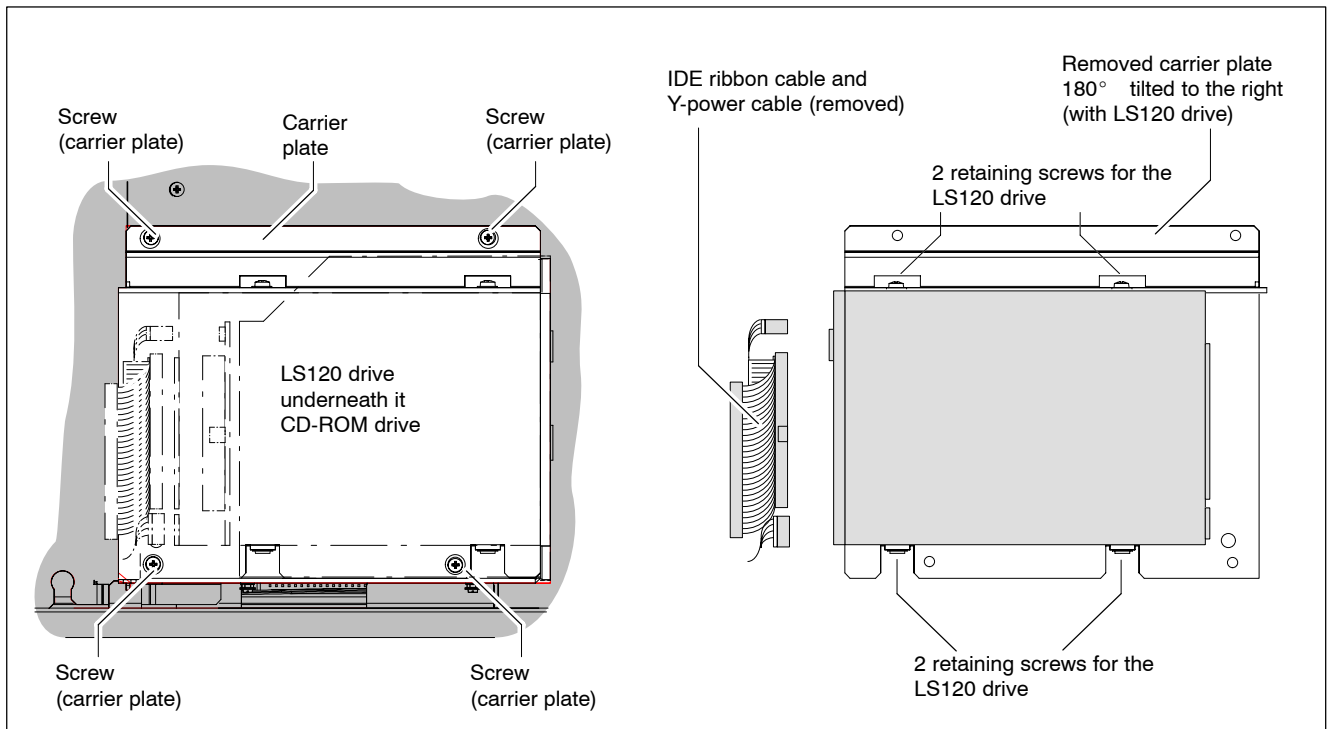## 9.3   LS120/CD-ROM drive unit

9.3.1   Replace entire unit

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the 4 mounting screws from the housing cover. It will be replaced by a split cover contained in the installation kit.

5. Now proceed as directed by the installation instructions contained in the kit.

Control terminals BT155 and BT205 (rear view)

Mounting screw

Mounting screw

Mounting screw

Mounting screw

Housing cover
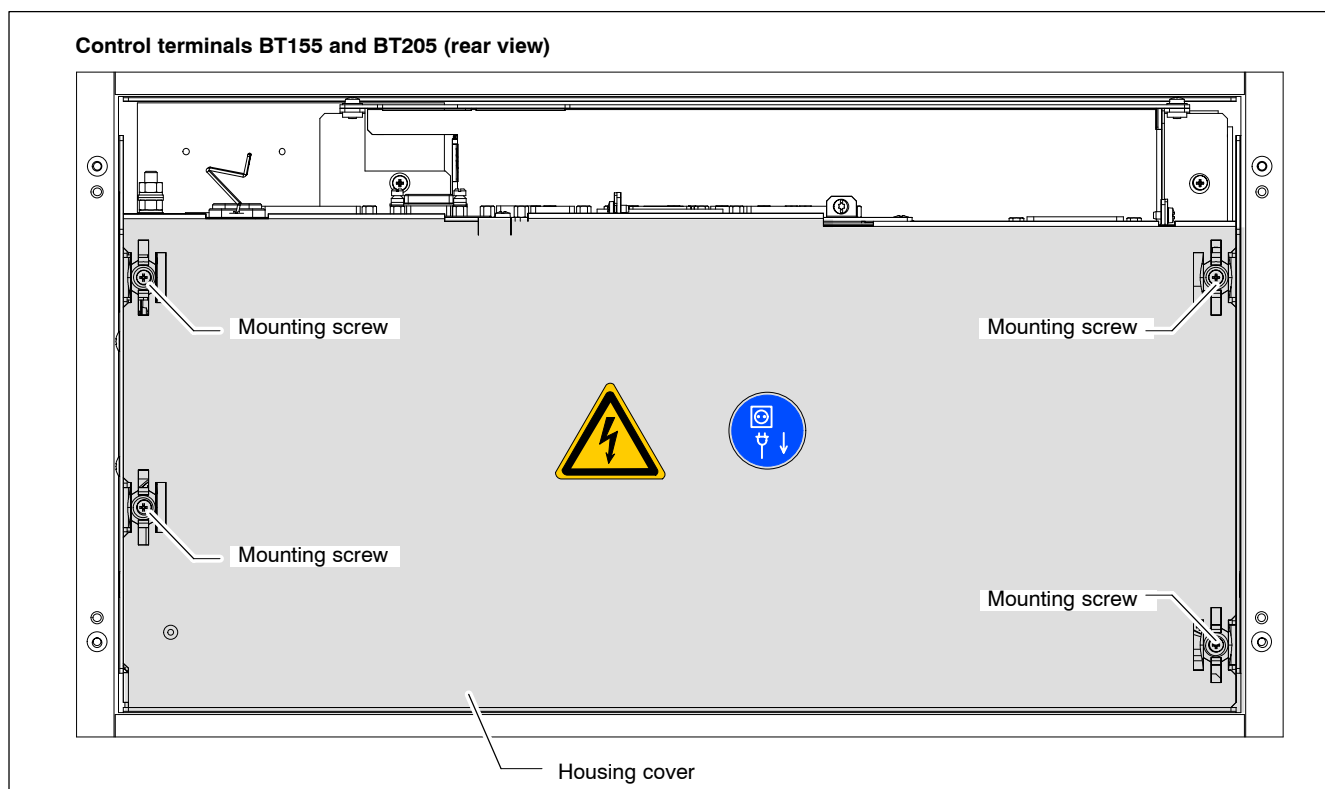
Testing the new component:

6. 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.

7. If the system still fails to start, check for the following:

    ● Positive connection of hard disk controller cable to the LS120 and CD-ROM drives

    ● Proper seating of all cables and connectors

    ● Proper seating of Y-power cable

    ● Presence of operating power.

8. Once the robot controller has properly completed its boot process, the user data and operating system configuration must again be restored for standard operation, if necessary.

9.3.2   Replace entire unit

The drive unit, including holding bracket, may be replaced while the control terminal remains installed.

☞ **In order to replace the drive unit while the control terminal remains installed, the rear clearance as measured from the cover surface must be at least 400 mm to allow the covers to be removed.**

The rear of the control terminal housing is closed off with a small and a large cover. The covers are inter-connected by rotating joints so that they can be folded out separately. The covers are fastened to the control terminal housing by 2 screws and 2 brackets each. The brackets are attached under a cant in the housing (underneath the rotating joints).

A carrier plate for the LS120 drive is attached to the larger cover with 4 screws. Underneath it is the CD-ROM drive, which is attached to the cover with 4 screws.

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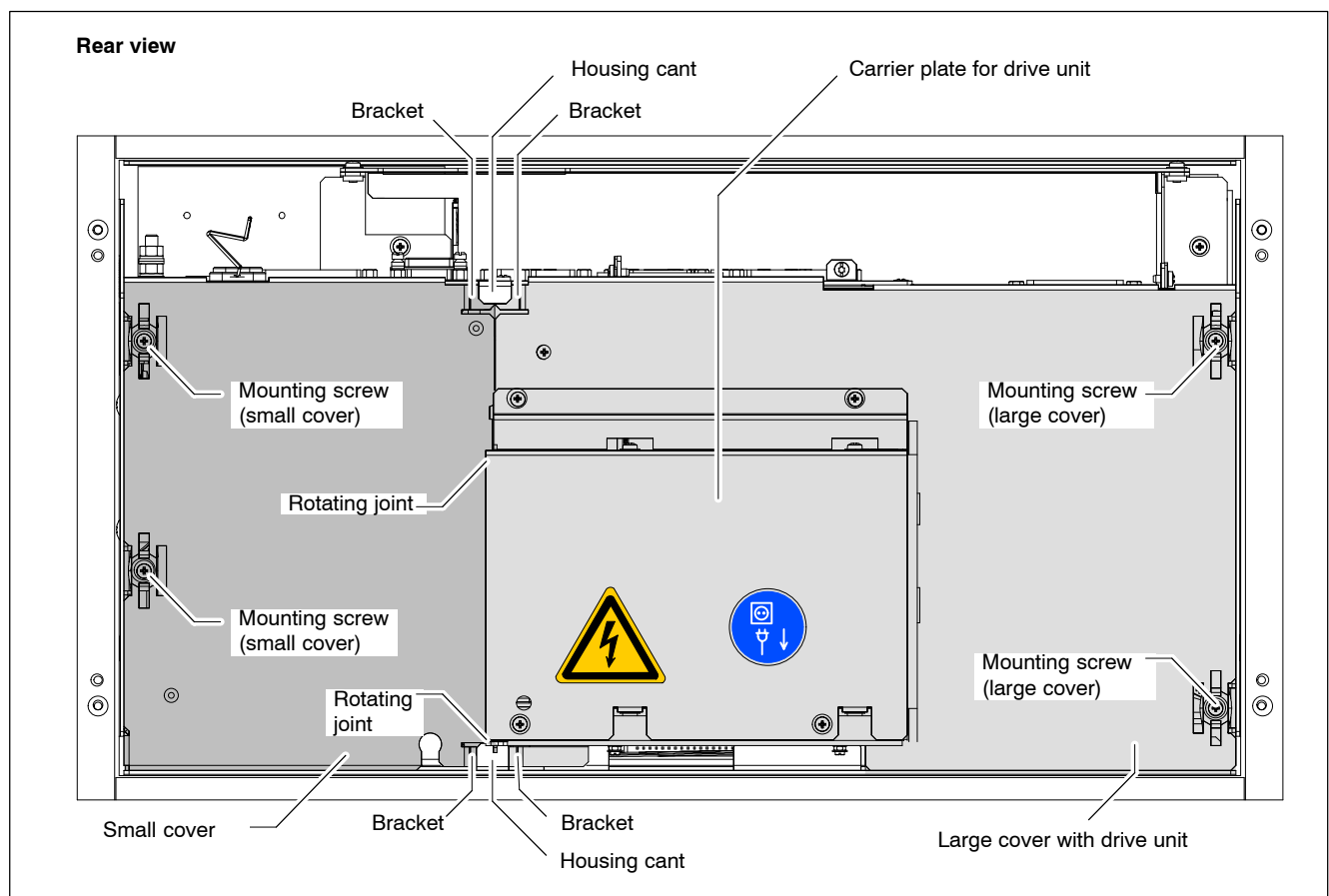
Rear view

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the two screws from the large cover and fold it out by approx. 170°.

Rear view: large cover folded out

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

Ribbon cable for LS120 and CD-ROM drives

Pin 1

IDE2

Power connection for LS120 drive

44-pin IDE connection for LS120 drive

Pin 1

44-pin IDE connection for CD-ROM drive

Power connection for CD-ROM drive

CD-ROM drive

Large cover (folded out)
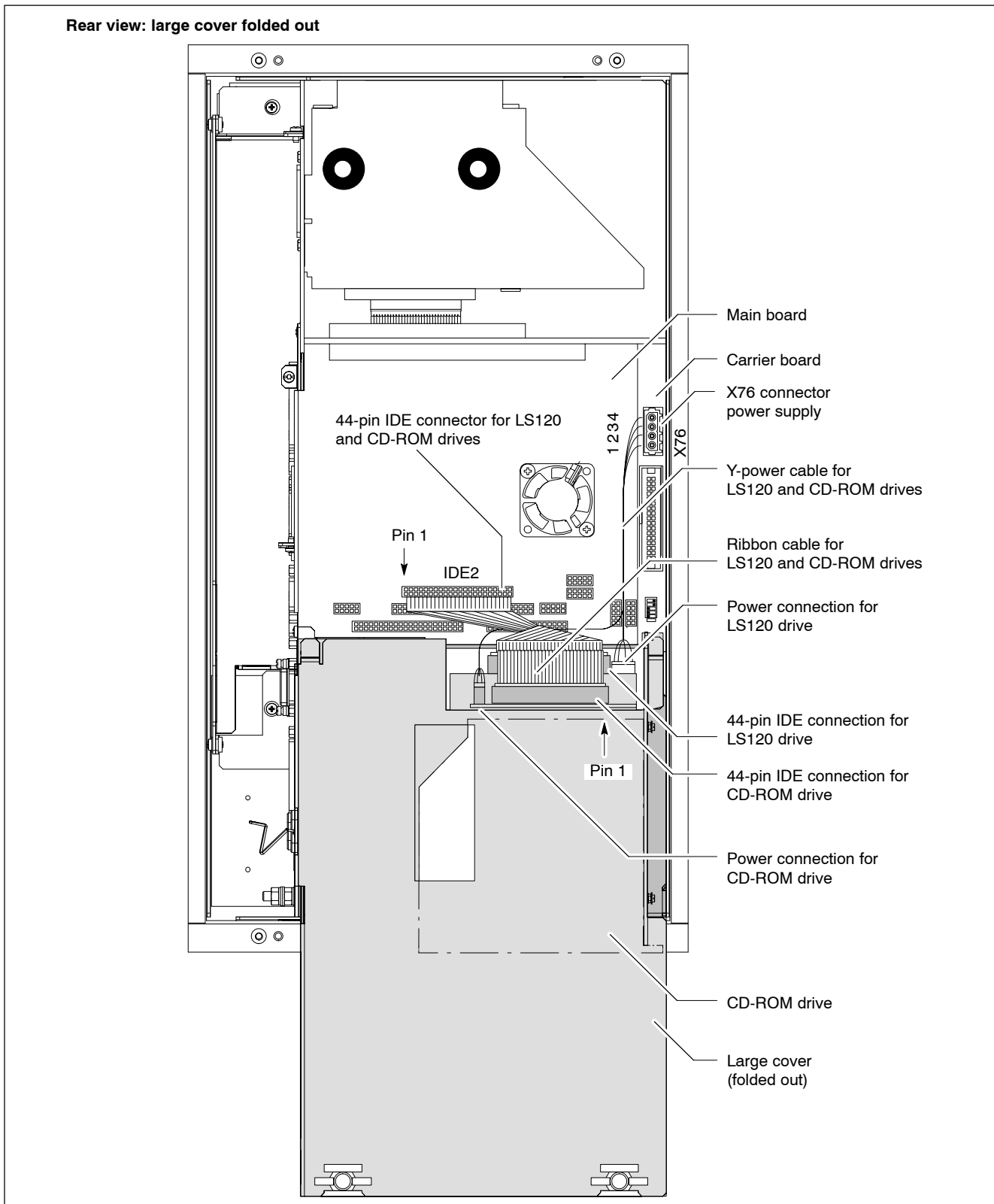
5. Remove the IDE ribbon cable from the main board and the plug for the power supply from the carrier board. Separate the cable fastener that holds the ribbon cable. Fold the large cover back into its original position.

Cover (tilted forward)

Rotating joint

Installation clearance min. 400 mm
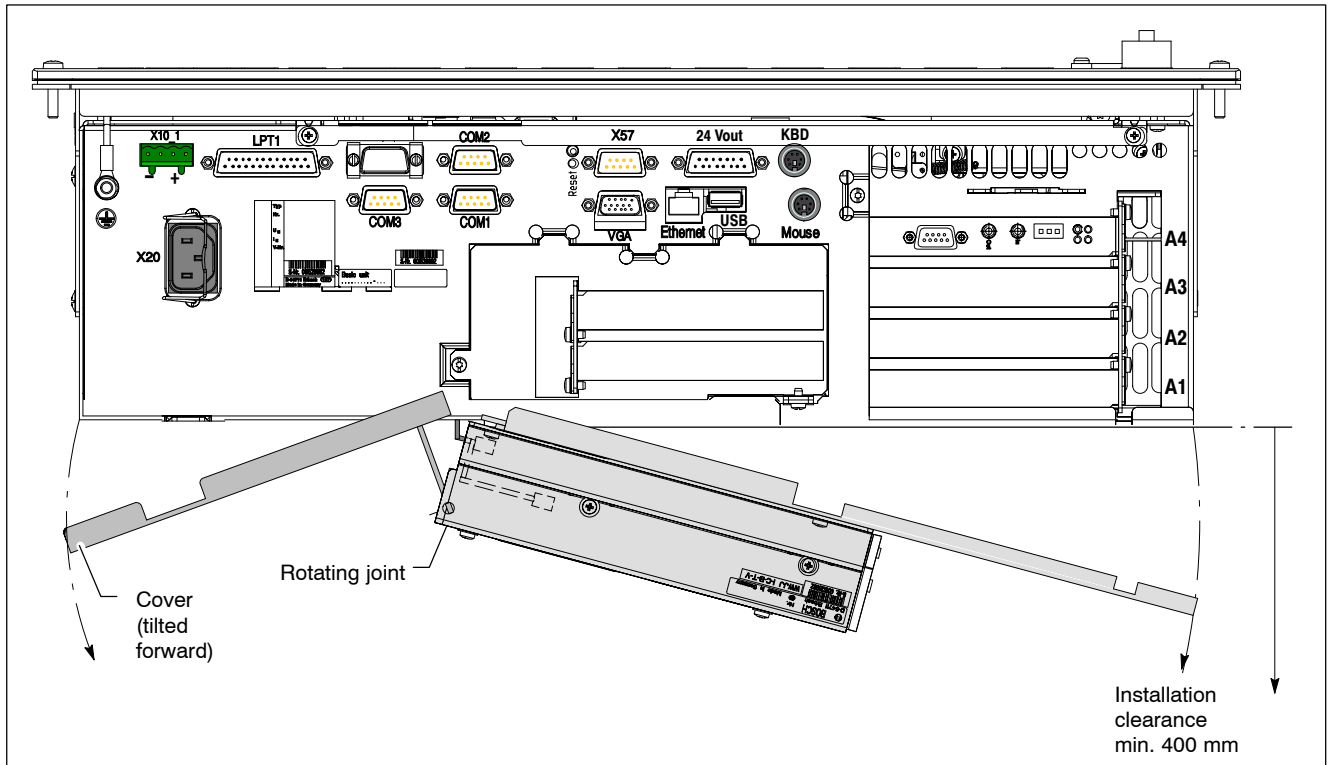
6. Now remove the two screws in the small cover. Be sure to hold on to the large cover!
   Tilt the small cover with its brackets under the cant of the housing a small amount until it is free. Now both covers may be removed.

7. Insert the new drive unit, including the covers, in the reverse sequence to that described above.
   In re-fitting the covers, make sure that the cover brackets are pushed under the cant of the housing.

Testing the new component:

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 to the LS120 and CD-ROM drives

   ● Proper seating of all cables and connectors

   ● Proper seating of Y-power cable

   ● Presence of operating power.

10. Once the PC has properly completed its boot process, the user data and operating system configuration must again be restored for standard operation, if necessary.

9.3.3   Replacing individual drives

The LS120 and CD-ROM drives may also be replaced individually.
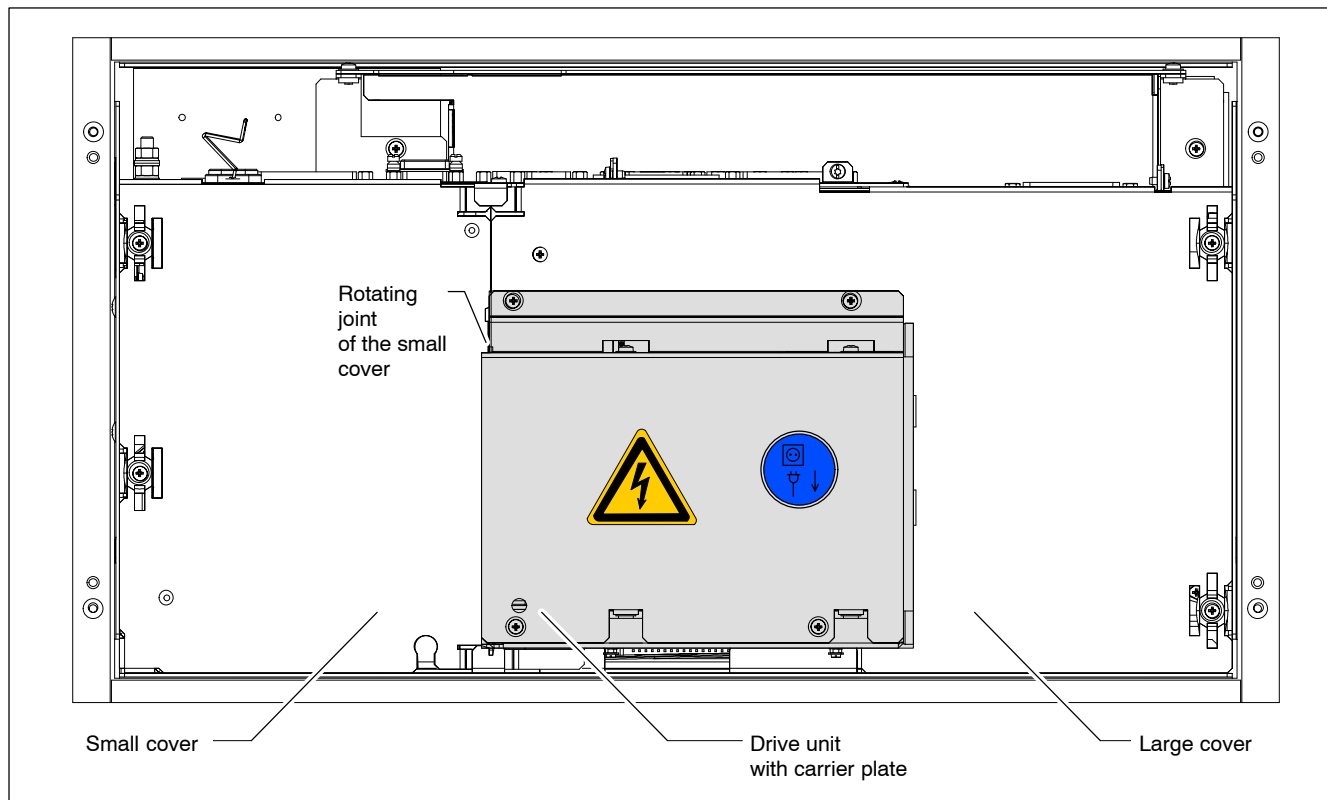
Rotating joint of the small cover

Small cover

Drive unit with carrier plate

Large cover

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

LS120 drive

4. Remove the two screws from the large cover and fold it out by approx. 170°, so that you can remove the ribbon cable and power supply from the LS120 drive (see diagram on page 9–8). Fold the large cover back into its original position.

☞ **For the subsequent installation, remember how the ribbon cable plug was attached to the drive (generally pin 1 on the data cable marked in red is positioned on the right edge of the plug of pin 1 on the data connector).**
The power supply connections can be dealt with in a similar manner, as the cables are also colour-coded.

5. Unscrew the 4 screws from the carrier plate. Draw them out of the rotating joint of the small cover and then lift the carrier plate complete with the LS120 drive off.

6. Unscrew the 4 retaining screws holding the LS120 drive to the carrier plate and lift off the drive.

7. Install the new LS120 drive in the reverse sequence to that described above.
    In re-fitting the covers, make sure that the cover brackets are pushed under the cant of the housing.

CD-ROM drive

4. After carrying out steps 1 to 3 above, remove the two screws from the large cover and fold 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 9–8). Fold the large cover back into its original position.

☞ **For the subsequent installation, remember how the ribbon cable plug was attached to the drive (generally pin 1 on the data cable marked in red is positioned on the right edge of the plug of pin 1 on the data connector).**
   The power supply connections can be dealt with in a similar manner, as the cables are also colour-coded.

Retaining screws of the
CD-ROM drive

IDE ribbon cable and
Y-power cable (removed)

Retaining screws of the
CD-ROM drive

5. Unscrew the 4 screws from the carrier plate. Draw them out of the rotating joint of the small cover and then lift the carrier plate complete with the LS120 drive off.

6. Unscrew the 4 retaining screws that fasten the CD-ROM drive to the large cover and remove the drive.

7. Install the new CD-ROM drive in the reverse sequence to that described above.
In re-fitting the covers, make sure that the cover brackets are pushed under the cant of the housing.

CAUTION
The CD-ROM drive may be damaged if wrongly installed or screws that are too long are used.
It is imperative that the spacer washers of the connecting screws (4x) are used as otherwise the screws will penetrate too far into the drive housing and cause damage to the mechanism.

Testing the new component:

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 to the LS120 and CD-ROM drives
   - Proper seating of all cables and connectors
   - Proper seating of Y-power cable
   - Presence of operating power.

10. Once the PC has properly completed its boot process, the user data and operating system configuration must again be restored for standard operation, if necessary.

9.4 3.5" floppy disk drive

Two floppy disk drives are available as optional accessories:

- External unit for installation on the rear panel of the PC housing (Order no.: 1070 081 617) or

- External unit with mounting frame and shutter for in-cabinet installation; cable length 1.2 m (Order no.: 1070 081 614)

Connection for rear-panel installation

Rechargeable battery

Floppy disk

Diskette insertion slot

Carrier plate with floppy disk drive (at rear panel of BT housing)

34-conductor ribbon cable for connection to X75

4-wire cable for power supply for connection to X76

X75

X76

Connection for installation in a control cabinet

Rechargeable battery

34-conductor ribbon cable for connection to X75

4-wire cable for power supply for connection to X76

Earthing clip

Earthing clip

X75

X76

X75

X76

Floppy disk (external version)

Diskette insertion slot

Mounting frame with shutter

☞ **For in-cabinet installation, both connections must be shielded, and the shield must be connected to housing potential at both end.**

Installation

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Connect the ribbon cable to floppy disk connection X75, and the power supply cable to connection X76. Observe the red marking on the ribbon cable, which must always connect to pin 1 of the devices to be connected.
In most cases, notches in the mating inline connectors prevent improper connection.

☞ **The default setting in the BIOS is for a 3.5" floppy disk drive, HD 1.44 MB.**

5. In the event that the user has installed another type of floppy disk, (e.g. 3.5" HD 2.88 MB), then this drive must be declared in the BIOS. While the system is booting, the BIOS menu of the PC is accessed by pressing the <DEL> key.

   In the "Main Menu" select the menu item "Legacy Diskette A". Select the new floppy disk type. Exit the BIOS via F10 "**Save Settings and Exit**" (saves the hard disk parameters).
   To do this, press the <Y> key (= Yes).

6. If the floppy disk cannot be accessed check the cables for:

   ● Proper connection between controller cable and floppy disk drive
   ● Proper seating of all cables and connectors
   ● Presence of operating power.

9.5 Display and backlight

☞ **Backlight replacement is only possible with the BT155.**

A fading backlight causes a progressive deterioration of LCD display readability, 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 power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Remove the 4 Phillips head screws holding the control panel. Pull out the control panel by approx. 3 cm and tilt forward (refer to diagram on page 9–16).

5. Remove the 2 display mount retaining screws. You can now pull the display including its display mount from the cut-out, as far as the display ribbon cable will allow.

6. Remove the 4 display retaining screws.

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

8. To replace the backlights (2): Remove the backlights from the retainer, and replace with new backlights.

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

9. The installation is performed in the reverse order of the removal procedure.

10. 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.

PE lug

Control panel, installed position

Control panel mounting screws

View A

Control panel tilted forward

Display ribbon cable

Holding device
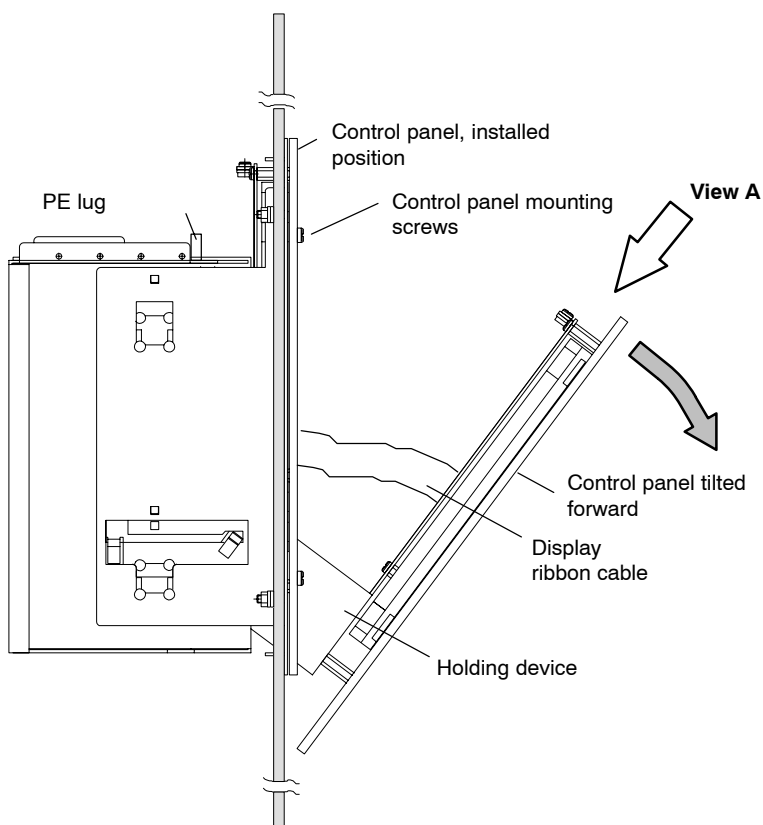
View A: Control terminal with display

Holding device

Display ribbon cable

Touch screen ribbon cable (optional)

Display mount retaining screws

Display mount
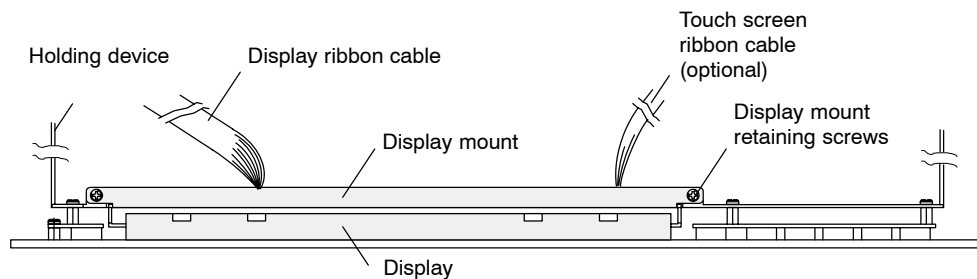
Display

Front view with mount
(with display mount removed)

Display mount

Display

Display mount retaining screws

9.6　　Rechargeable battery pack

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

The rechargeable battery pack must be replaced in the following cases:

●　The battery test has failed

●　The number of charging cycles (which depends on the ambient temperature) exceeds the figure stated below ("Shutdown count" in the UPS program, see section 3.3.2)

●　The red LED "UPS" on the front panel flashes for more than 8 hours (see page 7–21).

A charging cycle is defined by switching the PC power supply on and off. The number of charging cycles that may be carried out on the battery pack, and thus also its useful service life, is dependent on the ambient temperature at which the battery is used. Ambient temperature is defined as the temperature at which the battery pack is used e.g. the device internal temperature or the control cabinet internal temperature.

The following table serves as a guide:

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

☞　**The battery packs used are recyclable and can be returned to Rexroth after replacement. They must not be disposed of in standard residential refuse.**

X19　　**Battery connection**

Male terminal strip, 2-pin

Cable length:　　　　　　　　　　　Max. 2.0 m

Cable type:　　　　　　　　　　　　Unscreened, min. cross-section 1.5 mm^2

Internal rechargeable battery pack

The battery pack consists of 2x3 batteries connected to each other and that must be replaced as a single unit.

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Opening the rear housing cover:

   ● If there is no LS120 / CD-ROM drive unit, unscrew the 4 screws holding the housing cover and remove it.

   ● With an LS120 / CD-ROM drive unit, open the rear small cover (2 screws) and fold it out.

BT155, BT205

Small cover
(tilted forward)
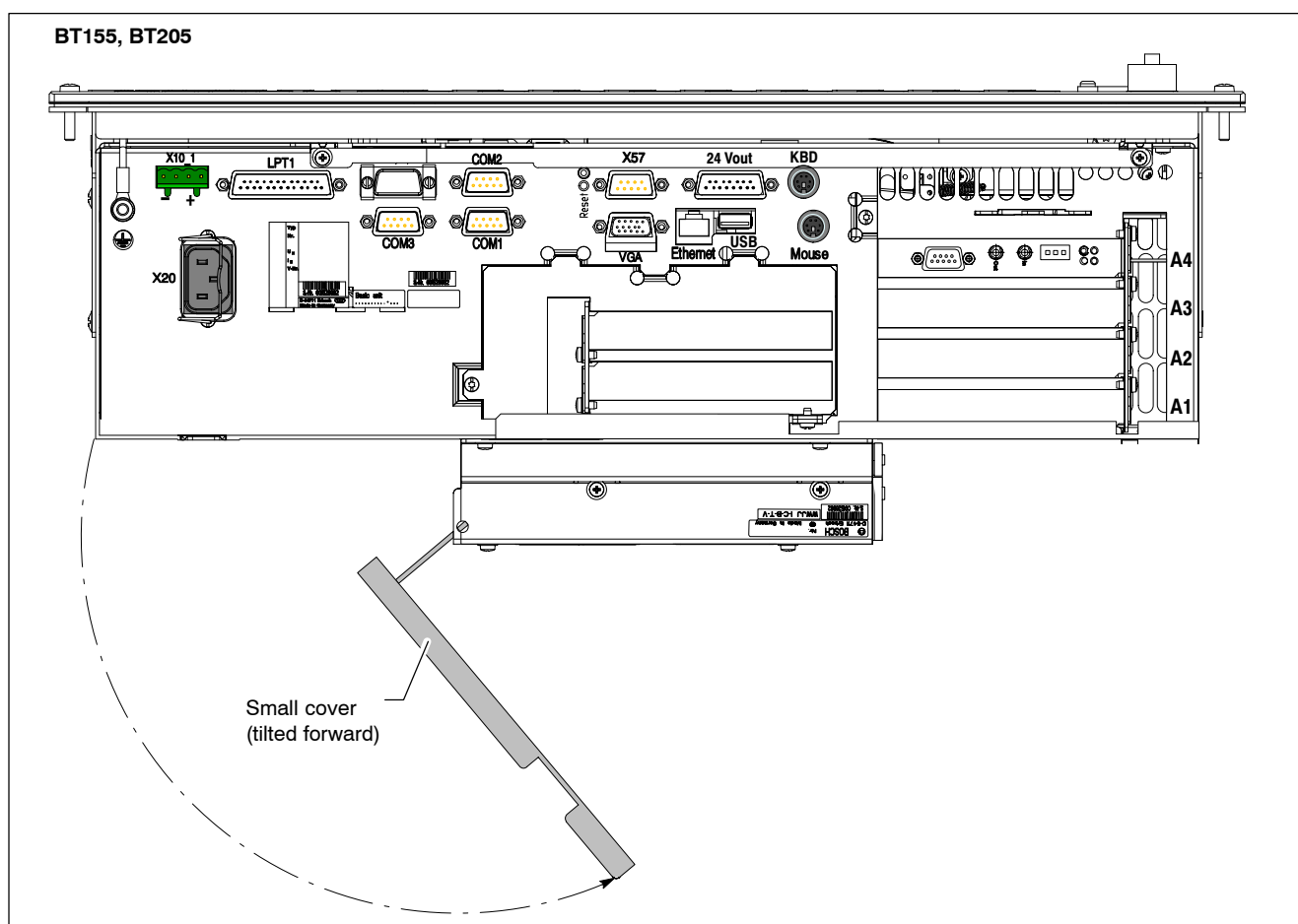
5. Lift up the battery pack carrier plate.

6. Pull off the cables with the plugs in positions ① and ②   on the battery pack (see diagram below).
   Make a careful note of which cable goes to the plus and which to the minus terminal of the battery pack.
   If the cables have to be changed over, then pull the plug to the X19 connector out first.

X19

Battery connector   + −
                           1 2

Battery pack

Carrier plate for battery pack
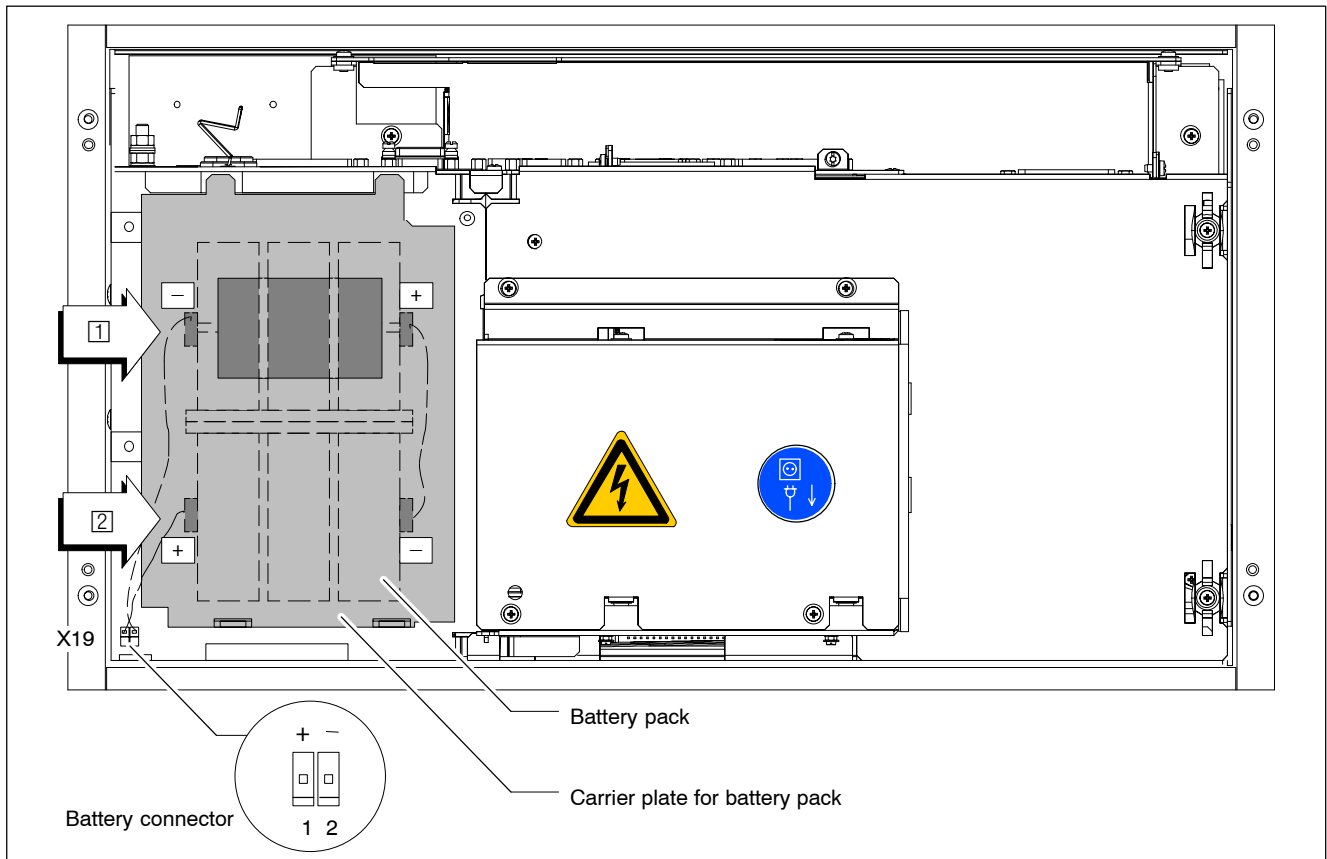
7. Replace the battery pack and re-connect the cables.

CAUTION
Ensure correct polarity of the batteries.
Polarity reversal of the rechargeable battery pack will result in an F10A (5x20) fuse being triggered on the power supply module. Further damage may also result. The UPS operating cycle will then no longer be possible.

8. Re-insert the carrier with the battery pack. Close the small cover.

☞ **If the new rechargeable battery pack has not been charged, there will not be sufficient 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

9. see page 9–21.

External rechargeable battery pack

The external rechargeable battery pack is used for control terminals featuring a small housing:

● For rear panel installation, with short 20 cm cable, on control terminals, Order no.: 1070 081 653

● For in-cabinet installation, with long cable (200 cm), Order no.: 1070 081 652
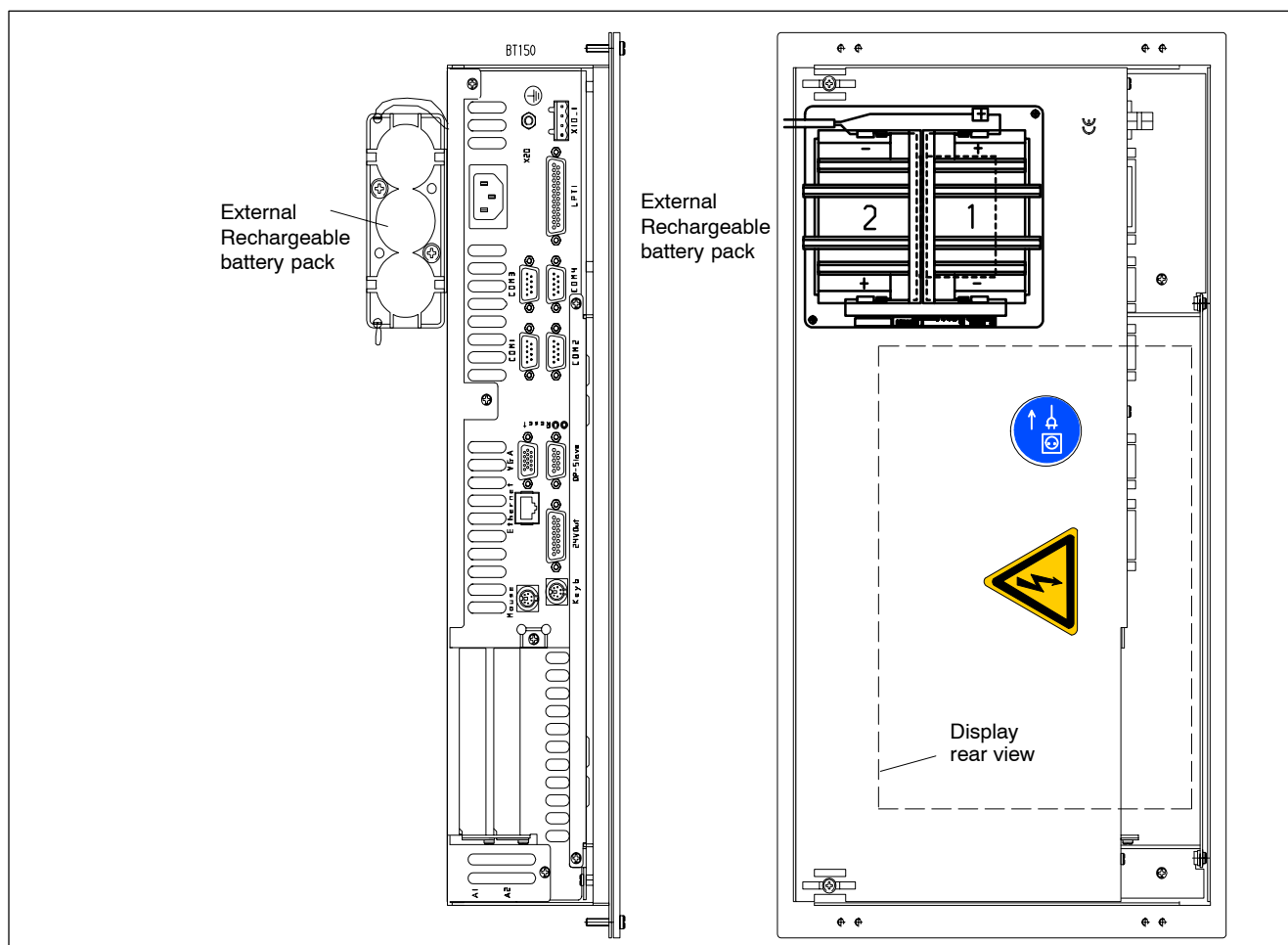
1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. To remove the 2-wire cable from the X19 connector open the housing cover, if necessary.

5. Remove the two battery pack mounting screws and fasten the new battery pack to the housing cover or in the control cabinet, depending on the model used.

CAUTION
Ensure correct polarity of the batteries.
Polarity reversal of the rechargeable battery pack will result in an F10A (5x20) fuse being triggered on the power supply module. Further damage may also result. The UPS operating cycle will then no longer be possible.

6. Insert the 2-connector cable from the outside to the X19 connector.

7. Close the cover again.

☞ **If the new rechargeable battery pack has not been charged, there will not be sufficient 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 rechargeable batteries have been recharged and the "UPS" LED **extinguishes**.

9.7 Expansion cards

Depending on the size of the PC housing, a different number of expansion slots for PCI bus and ISA bus are available:

- Small housing with **2 expansion slots** for
  - 1 PCI BUS card   (max. length 180 mm)
  - 1 PCI or ISA BUS card (combination slot) (max. length 180 mm)

- Large housing with **6 expansion slots** for
  - 3 PCI BUS cards   (max. length 180 mm)
  - 2 ISA BUS cards   (max. length 175 mm)
  - 1 PCI or ISA BUS card (combination slot)   (max. length 180 mm)

☞ **One PCI slot is taken up at the factory by the PNC plug-in card.**
To replace the PNC plug-in card please also see the following sections.

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.

9.7.1 Installing an expansion card

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. On small-housing control terminals, remove the X19 connector at the bottom of the control terminal. In this way, when removing the rear housing panel, damage to the X19 male connector is prevented.

5. Opening the rear housing cover:
   - If there is no LS120 / CD-ROM drive unit, unscrew the 4 screws holding the housing cover and remove it.
   - With an LS120 / CD-ROM drive unit, open the rear small cover (2 screws) and fold it out.

6. Remove the mounting screw holding the slot cover.

7. Insert the expansion card and secure it with the mounting screw.

8. Reinstall the rear housing panel, and re-connect the rechargeable battery packs with X19.

CAUTION
Ensure proper polarity of the rechargeable battery packs (refer to diagram on page 9–19).
Polarity reversal of the rechargeable battery pack will result in an F10A (5x20) fuse being triggered on the power supply module. Further damage may also result. The UPS operating cycle will then no longer be possible.

Arrangement of expansion slots in the large housing

ISA/PCI slot
(ISA) A1

ISA slot A5

ISA slot A6

ISA/PCI slot
(PCI) A1

PCI slot A2

PCI slot A3

PNC plug-in card
in slot A4
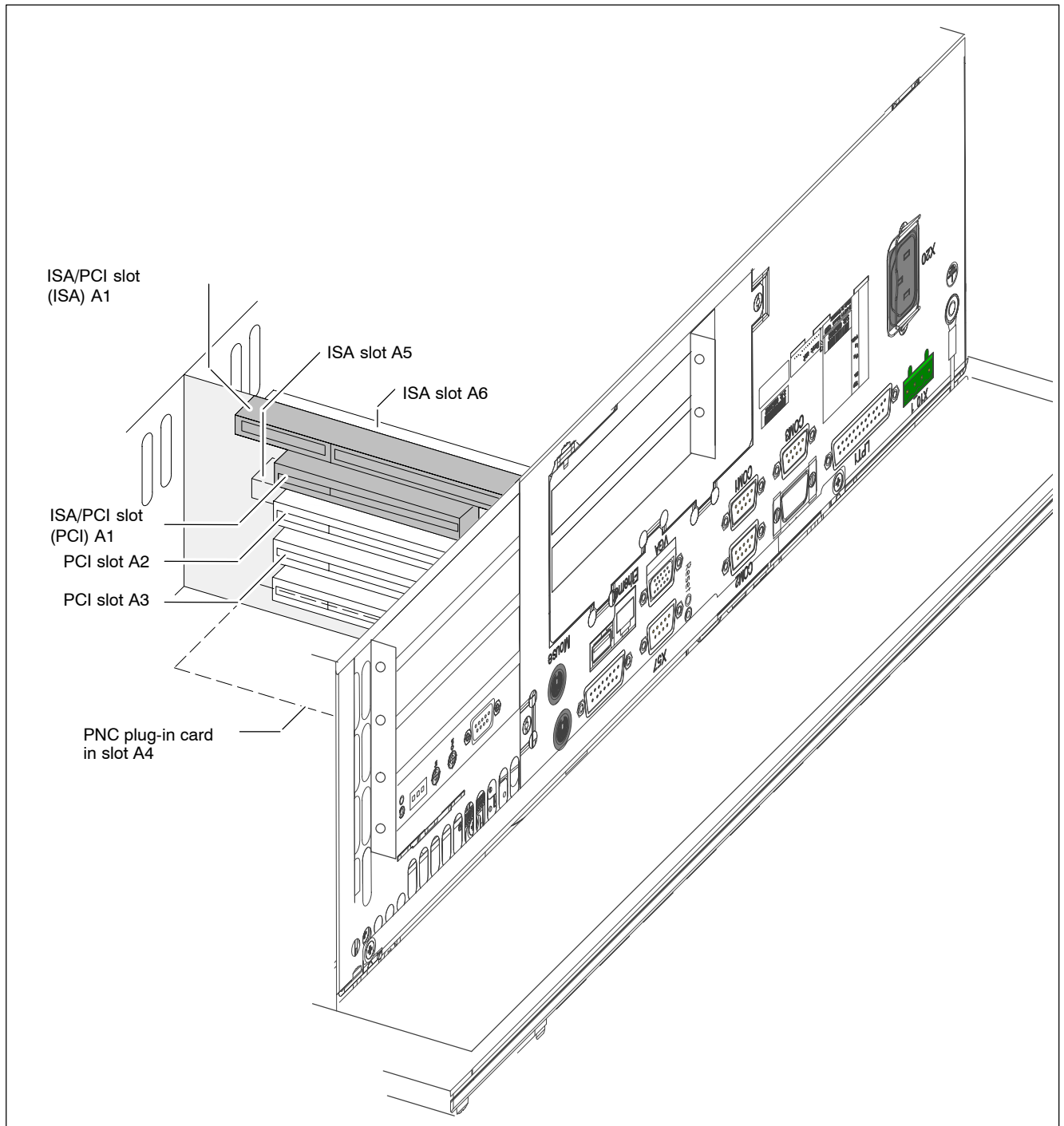
Arrangement of expansion slots in the small housing
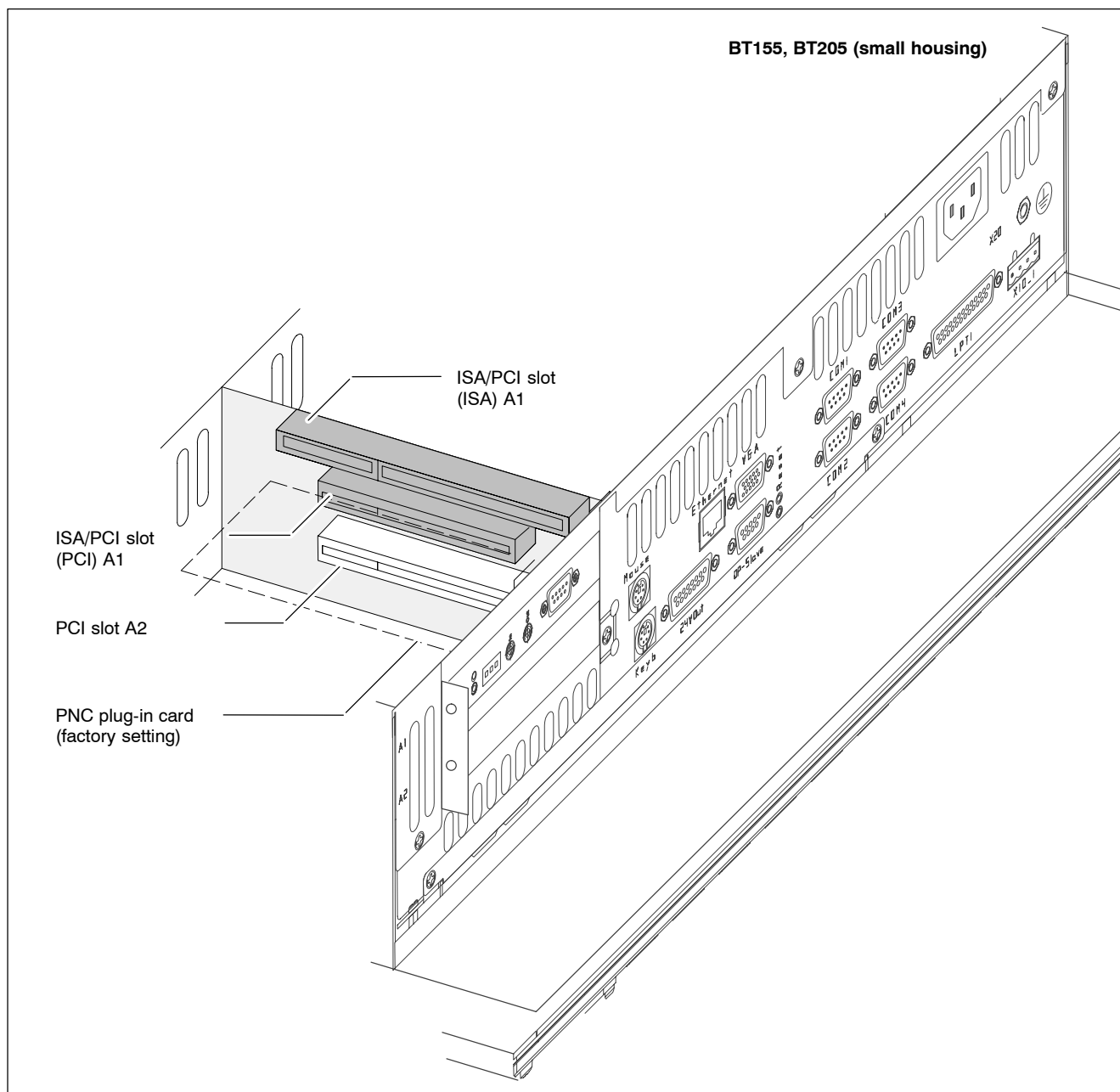
BT155, BT205 (small housing)

ISA/PCI slot
(ISA) A1

ISA/PCI slot
(PCI) A1

PCI slot A2

PNC plug-in card
(factory setting)

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

If the card is Plug-and-Play (PnP) compatible, it is automatically recognized and integrated in the system, provided 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 driver software 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.

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

9.7.2 BIOS settings

☞ **IRQ 3, 4, 5, 7, 10, 11, 14 are already occupied, and are therefore no longer available for PCI and ISA expansion cards!**

PCI slot

You can assign an IRQ address to each PCI slot in the BIOS sub-menu "The Advanced Menu / PCI Configuration sub menu". At the same time, the number of the IRQ address also defines the priority.
If only PnP cards are used, the "**AUTO**" setting must be maintained.
BIOS selection: PCI IRQ line 1, PCI IRQ line 2, PCI IRQ line 3, PCI IRQ line 4
Option: Disabled, Auto, IRQ: 3, 4, 5, 7, 9, 10, 11, 12, 14, 15,
Default: AUTO

ISA slot (IRQ)

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA IRQ Resource Exclusion / IRQx" the IRQ address for non-Plug-and-Play compatible ISA cards (so-called legacy ISA cards) must be **permanently** set.
BIOS selection: IRQ:3, 4, 5, 7, 9, 10, 11, 15
Option: Available, Reserved
Default: Available

ISA slot (UMB)

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA UMB Region Exclusion" a specific block is reserved in upper memory for legacy ISA cards.
BIOS selection: C800 - CBFF, CC00 - CFFF, D000 - D3FF, D400 - D7FF, D800 - DBFF, DC00 - DFFF
Option: Available, Reserved
Default: Available

Notes:

10   IPC300 Maintenance

The IPC 300 is maintenance-free. However, some components are subject to wear and must be replaced.

CAUTION
Loss of data!
Service repairs of devices returned by customers do not entail bak-kup of user data. Repaired units are returned with formatted hard disk and newly installed software.

10.1   Maintenance schedule

Include the following tasks in your maintenance schedule:

● 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 thoroughly 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 "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. To safeguard application data, and to avoid the necessity of time-consuming new installations of operating system (OS) and application programs following a hard disk replacement, the functional program and OS data on the hard disk should be backed up at regular intervals by using the "Backup Package for Industrial PC" supplied by Rexroth. This process writes an image of the hard disk to the medium in the Iomega "Jaz" drive supplied with the package; if a hard disk replacement is required, this image must simply be copied back to the newly installed hard disk. Refer to chapter 12.1 for ordering information.

10.2   Fuse protection

The IPC300 is equipped with a replaceable power supply fuse accessible from the front of the unit:

● 6.3 A (5x20), medium time-lag for 24 VDC power supply

● 1.25 A (5x20), medium time-lag for 230 VAC power

Refer to fuse ordering information in Section 12.2.

☞ **In the event that the power supply remains faulty after replacing the power supply fuse, this indicates a defect in another 10A fuse. In this case, please contact Rexroth Service: Telephone: +49 (0) 60 62-78-888.**

IPC300

Fuse

10.3   Hard disk replacement

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!**

☞ **To safeguard application data, and to avoid the necessity of time-con-
suming new installations of operating system (OS) and application
programs following a hard disk replacement, the functional program
and OS data on the hard disk should be backed up at regular intervals
by using the "Backup Package for Industrial PC" supplied by Rexroth.
This process writes an image of the hard disk to the medium in the Io-
mega "Jaz" drive supplied with the package; if a hard disk replacement
is required, this image must simply be copied back to the newly
installed hard disk.
Refer to chapter 12.1 for ordering information.**

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Open the housing.

5. The ribbon cable is secured by two spots 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. This ribbon cable also connects the CD-ROM drive.

6. Loosen the mounting screw on the rear of the housing and remove the hard disk installation frame complete with hard disk.

7. The new hard disk is always installed complete with installation frame, and in reverse sequence to that described above.

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

8. The new hard disk must be identified to the BIOS. To access the BIOS menu, press the <F2> key while the system is booting up.

    To enable automatic recognition of the new hard disk parameters by the system, go to the main menu, select the "**Primary Master**" menu option, followed by the "Type" = AUTO option. Select "Exit Saving Changes" (saving new parameter settings) to exit the BIOS menu.

    Restart the operating system, and again access the BIOS menu. In the **"Primary Master"** menu option, set the "Type" option to "User" and the "Transfer Mode" option to "Fast PIO 3".
    Select "Exit Saving Changes" (saving new parameter settings) to exit the BIOS menu.

9. 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.

10. If the system still does not start up, check for:
    - Proper connection between controller cable and hard disk.
    - Proper seating of all cables and connectors
    - Presence of operating power.

11. Once the PC has started up properly, the user data and operating system settings for standard operation must be restored.

10.3.1   CD-ROM drive
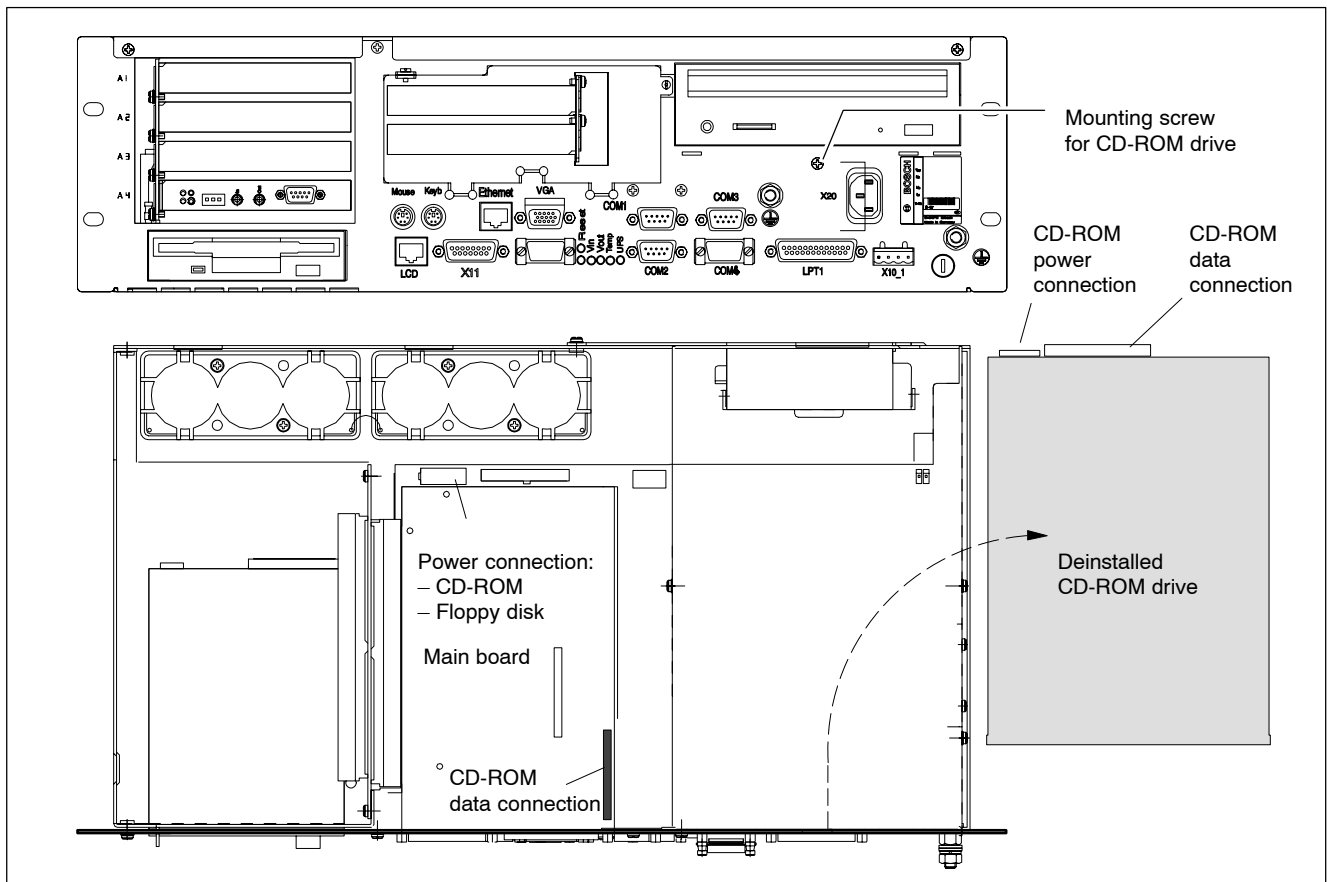
1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Open the housing.

5. Unplug the female connector together with the controller ribbon cable and the female connector for the power supply from the CD-ROM drive. Unless this cable is defective, disconnecting it from the main board will not be required.

6. Unscrew the mounting screw on the front panel and remove the CD-ROM drive including the carrier plate.

7. Loosen the mounting screws and replace the drive.

8. Installation is in reverse sequence to removal described above.

9. When the PC has started up, the CD-ROM drive should be recognized again by the operating system if the drive is of the same type. If another type is installed, the relevant driver software should also be installed, if required. In this case follow the installation instructions of the CD-ROM manufacturer and the Windows NT 4.0 installation routine.

10. If the CD-ROM drive still cannot be accessed, check for:
    - Proper connection between controller cable and CD-ROM drive
    - Proper seating of all cables and connectors
    - Presence of operating power.

10.3.2   3.5" Floppy disk drive replacement
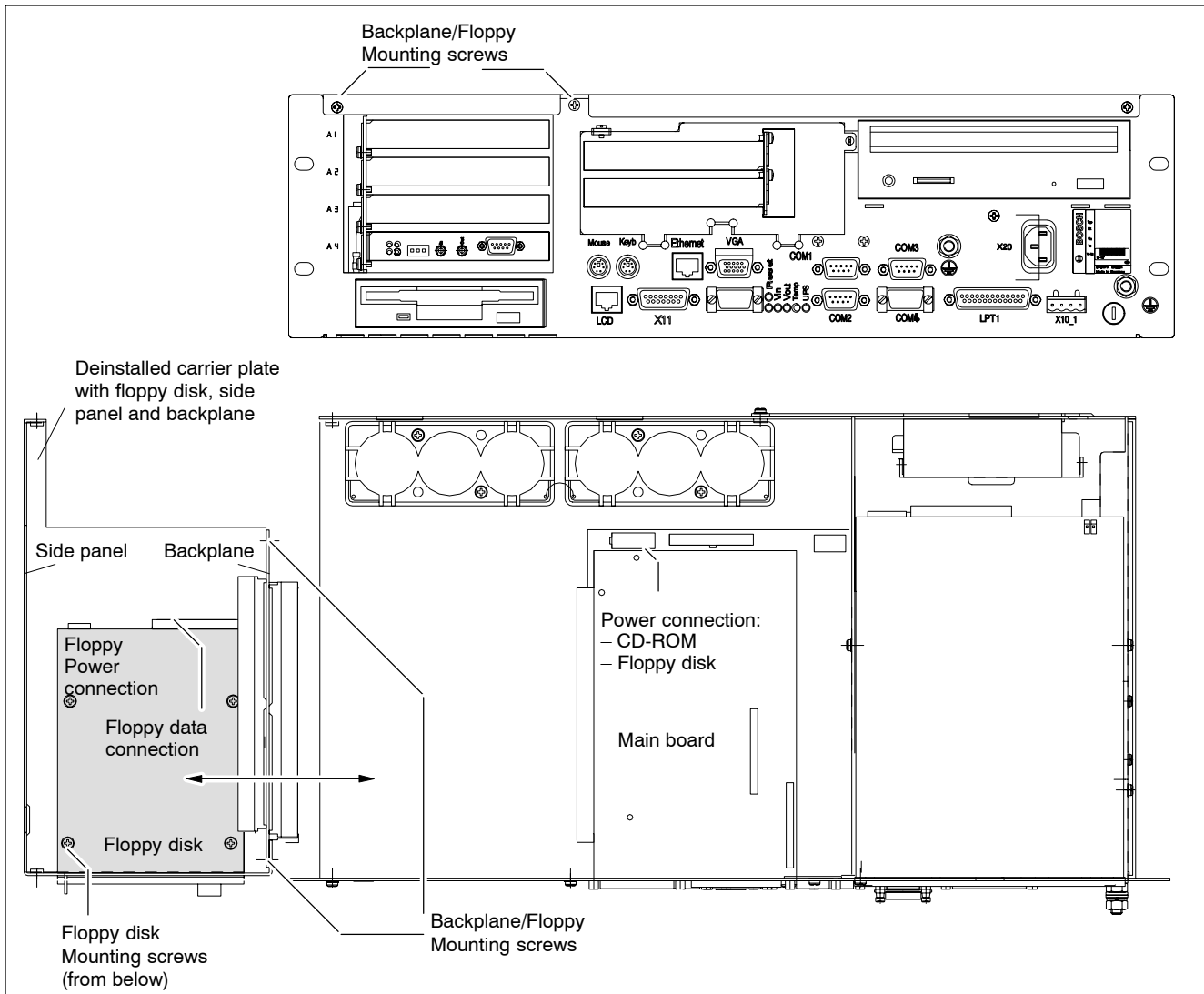
1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Open the housing.

5. Remove all expansion cards and cables that are connected to these cards.

6. Unplug the female connector together with the controller ribbon cable (data cable) and the female connector for the power supply from the floppy disk. Only a defective cable must be disconnected from the mother board.

7. Loosen the two mounting screws on the front panel. Loosen the 4 backplane mounting screws and pull the floppy disk drive, together with the side panel, backplane and holding bracket, sideways out of the housing. As the mother board is plugged into one of the slots in the backplane, the backplane must be moved to and fro very carefully in order to loosen this connection.

8. Loosen the 4 mounting screws on the underside of the floppy disk holder and insert the new drive.

9. Installation is in reverse sequence to removal described above.

10. If you have installed another type (e.g. 3.5" HD 2.88 MB), this must be declared to the IPC BIOS. To access the BIOS menu, press the <F2> key while the system is booting up.

    Go to the "Main Menu" and select "**Diskette 1**". Select the new floppy disk type. Select "Exit Saving Changes" (saving new parameter settings) to exit the BIOS menu.

11. If the floppy disk cannot be accessed check the cables for:
    ● Proper connection between controller cable and floppy disk drive
    ● Proper seating of all cables and connectors
    ● Presence of operating power.

10.3.3   Replacing the rechargeable battery pack

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

The rechargeable battery pack must be replaced in the following cases:

- The battery test has failed
- The number of charging cycles (which depends on the ambient temperature) exceeds the figure stated below ("Shutdown count" in the UPS program, see section 3.3.2)
- The red LED "UPS" on the front panel flashes for more than 8 hours (see page 7−21).

A charging cycle is defined by switching the PC power supply on and off. The number of charging cycles that may be carried out on the battery pack, and thus also its useful service life, is dependent on the ambient temperature at which the battery is used. Ambient temperature is defined as the temperature at which the battery pack is used e.g. the device internal temperature or the control cabinet internal temperature.

The following table serves as a guide:

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

The battery pack consists of 2x3 batteries connected to each other and that must be replaced as a single unit.

☞ **The battery packs used are recyclable and can be returned to Bosch after replacement. They must not be disposed of in standard residential refuse.**

X19   Battery connection

Male terminal strip, 2-pin

Cable length: Max. 0.5 m

Cable type: Unscreened, min. cross-section 1.5 mm^2
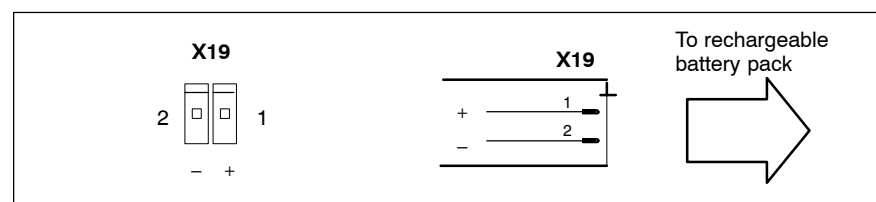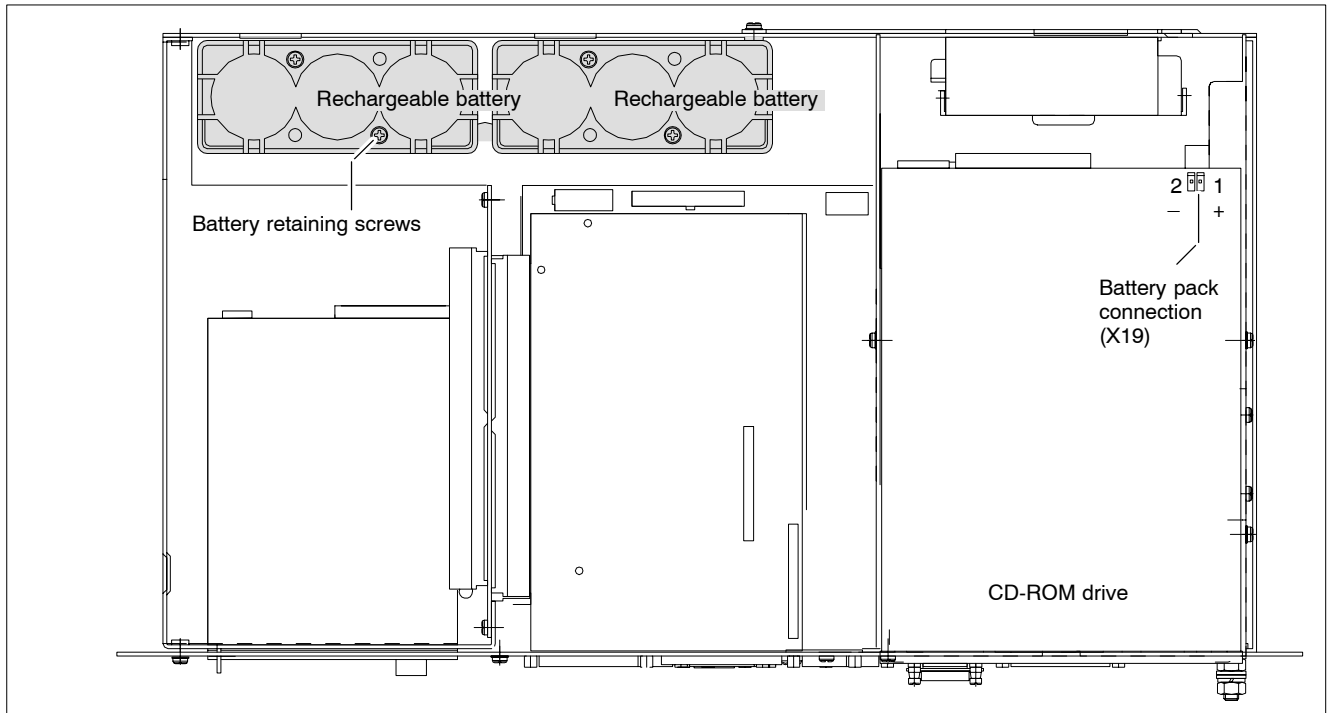
1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Open the housing cover.

5. Remove the connector with the bipolar cable from battery terminal X19 below the CD-ROM.

6. The battery pack can be replaced when the 4 mounting screws have been removed.

7. Plug the connector with the bipolar cable back onto terminal X19. Ensure correct polarity of the batteries.

CAUTION
Ensure correct polarity of the batteries.
Polarity reversal of the rechargeable battery pack will result in an F10A (5x20) fuse being triggered on the power supply module. Further damage may also result. The UPS operating cycle will then no longer be possible.

8. Close the housing cover.

9. Restore power to the system. 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**.

☞ **If the new rechargeable battery pack has not been charged, there will not be sufficient 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.**

10.4 Expansion cards

The unit provides 5 slots for PCI BUS and ISA BUS expansion cards:

- 2 PCI BUS cards   (max. length 180 mm)
- 2 ISA BUS cards   (max. length 175 mm)
- 1 combination slot (PCI or ISA BUS)   (max. length 180 mm)

☞ **One PCI slot is taken up at the factory by the PNC plug-in card.
To replace the PNC plug-in card please also see the following sections.**

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

10.4.1 Installing an expansion card

1. Switch off the power supply.

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

3. Remove the power supply cable from the X20 or X10_1 connector.

4. Open the housing.

5. Remove the mounting screw holding the slot cover.

6. Insert the expansion card and secure it with the mounting screw.

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

Arrangement of expansion slots in the housing

If the card is Plug-and-Play (PnP) compatible, it is automatically recognized and integrated in the system, provided 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 driver software 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.

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

10.4.2   BIOS settings

☞ **IRQ 3, 4, 5, 7, 10, 11, 14 are already occupied, and are therefore no longer available for PCI and ISA expansion cards!**

PCI slot:

You can assign an IRQ address to each PCI slot in the BIOS sub-menu "The Advanced Menu / PCI Configuration sub menu". At the same time, the number of the IRQ address also defines the priority.
If only PnP cards are used, the "**AUTO**" setting must be maintained.

BIOS selection: PCI IRQ line 1, PCI IRQ line 2, PCI IRQ line 3, PCI IRQ line 4

Option: Disabled, Auto, IRQ: 3, 4, 5, 7, 9, 10, 11, 12, 14, 15,

Default: AUTO

ISA slot (IRQ):

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA IRQ Resource Exclusion / IRQx" the IRQ address for non-Plug-and-Play compatible ISA cards (so-called legacy ISA cards) must be **permanently** set.

BIOS selection: IRQ:3, 4, 5, 7, 9, 10, 11, 15

Option: Available, Reserved

Default: Available

ISA slot (UMB):

In the BIOS menu "The Advanced Menu / PCI Configuration sub menu / PCI/PNP ISA UMB Region Exclusion" a specific block is reserved in upper memory for legacy ISA cards.

BIOS selection: C800 - CBFF, CC00 - CFFF, D000 - D3FF, D400 - D7FF, D800 - DBFF, DC00 - DFFF

Option: Available, Reserved

Default: Available

11   Software

Depending on the intended use, the system is shipped from the factory with a variety of preinstalled software:

- BIOS
- Operating system (mainframe)
- Operating system (PNC)
- Utilities
- Application software (options)

11.1   BIOS software

The BIOS software is licensed from the company **Phoenix**. 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.

11.2   Operating system

The PC mainframe is equipped and tested with the operating system Windows NT 4.0 form Microsoft Corp.

11.3   Utility programs

The following utility programs, which are not included in the Windows NT operating system software are installed at the factory:

- UPS Charging Cycles

11.4   PNC software

The software on the PNC plug-in card in the PC mainframe is pre-installed. It includes:

- CNC control software
- CNC user interface (BOF)
- PLC control software.

11.5   Application software

The following application software can be obtained:

Application software		BT155	BT205	PC control panel	BT205
WinSPS	PLC programming software	●	●	●	●
WinDP	Field bus parameterization for PROFIBUS-DP	●	●	●	●
MADAP Studio	System service and diagnosis software	●	●	–	●

●= available   O/R = on request

☞ **The new software package MADAP Studio uses our hardlock so that, for example, MADAP Studio and WinSPS can be licensed in parallel on one hardlock. To use the new software package a new hardlock is also required. An update from MMI-MADAP is therefore not possible.**

12   Order numbers

For the order numbers of mainframe options, the available operating systems and the PNC hardware expansion levels, please see "Price list control technology".

12.1   Accessories

Designation		Order no.:
Power cord 230 V	Length 2.5 m, non-heating appliance socket offset	1070 048 937
Non-heating appliance socket	Offset for do-it-yourself installation	1070 912 881

PC control panel (osa display pc):

Designation		Order no.
osa keyboard pc	Keyboard suitable for the osa display pc	1070 917 943
osa switch dp	Machine control panel suitable for the osa display pc	1070 085 972
3.5" Floppy disk	For installation in control panel, with connecting cable	1070 081 614

BT155, BT205:

Designation		Order no.
3.5" Floppy disk drive	For installation at the rear of the control terminal housing, with connecting cable	1070 081 617
	For installation in control panel, with connecting cable	1070 081 614

IPC300:

Designation		Order no.
Passive control panels for IPC300 (without connecting cables)	BF312T, 12.1"	1070 079 484
	BF315T TA, 15" with additional control devices for IPC300 with Pentium I	1070 083 215
	BF315T P3, 15" for IPC300 with Pentium III	1070 084 845
	BF315T TA, 15" with additional control devices for IPC300 with Pentium III	1070 085 388
	BF315T TA, 15" with preparation for additional control devices for IPC300 with Pentium III	1070 084 844

Connecting cables for IPC300 with Pentium I to BF312T	LCD, rigid mounting length 2.5 m
	    5 m
	    10 m
	    15 m
		1070 920 456
		1070 921 385
		1070 921 384
		1070 921 070

	X11, length 2.5 m
	    5 m
	    10 m
	    15 m
		1070 083 120
		1070 083 119
		1070 080 744
		1070 079 383

Connecting cables for IPC300 with Pentium I to BF315T TA	LCD, rigid mounting length 2.5 m
	    5 m
	    10 m
		1070 920 456
		1070 921 385
		1070 921 384

	X11, length 2.5 m
	    5 m
	    10 m
		1070 083 120
		1070 083 119
		1070 080 744

Connecting cables IPC300 with Pentium III to
− BF315T P3
− BF315T P3 TA
− BF315T P3 OTA
	LCD, rigid mounting length 2.5 m
	    5 m
	    10 m
		1070 920 456
		1070 921 385
		1070 921 384

	LCD, hi-flex cable length 2.5 m
	    5 m
	    10 m
		1070 922 022
		1070 922 021
		1070 921 891

	X11, length 2.5 m
	    5 m
	    10 m
		1070 083 120
		1070 083 119
		1070 080 744

Repeater for IPC300	Cable extension for LCD and X11 by 15 m	1070 079 423
Backup package for industrial PC	including 2 GB Iomega "Jaz" drive	1070 084 267

12.2   Spare parts

PC control panel

Designation		Order no.
Fuse protection	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
Battery pack for UPS	External for control cabinet installation (cable: 0.9 m)	1070 083 446
Hard disk	>5 GByte, with installation frame	1070 084 208
LCD display	TFT 10.4" including backlight	1070 920 900
Power supply	For 220 VDC power	1070 080 219
	For 24 VDC power	1070 080 220
RAM modules	64 MB	1070 920 827
	128 MB	1070 920 459

BT155, BT205:

Designation		Order no.
Fuse protection	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
Battery pack for UPS	External for control terminal housing installation (cable: 0.2 m)	1070 081 653
	External for control cabinet installation (cable: 2 m)	1070 061 652
	Internal, $1/2$ battery pack for large housing (always order 2 off)	1070 919 399
Hard disk	>5 GByte, with installation frame	1070 084 208
LS120/CD-ROM drive unit	Installation kit for rear mounting	1070 084 233
CD-ROM drive including IDE40 adapter	Individual unit from installation kit	1070 920 530

Designation		Order no.
LS120 drive	Individual unit from installation kit	1070 920 410
Male terminal strip, 44-pin IDE-LS120-CD-ROM		1070 084 101
Power supply	For 220 VDC power	1070 080 219
	For 24 VDC power	1070 080 220
RAM modules	64 MB 128 MB 256 MB	1070 920 827 1070 920 459 1070 921 869

IPC300:

Designation		Order no.
Fuse protection	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
Battery pack	For UPS	On request
	Connecting cable for battery pack	1070 080 517
Hard disk	>5 GByte, with installation frame	1070 920 880
CD-ROM drive	Internal	1070 919 420
3.5" Floppy disk drive	Internal	1070 920 192
Power supply	For 220 VDC power	1070 080 219
	For 24 VDC power	1070 080 220
RAM modules	64 MB 128 MB 256 MB	1070 920 827 1070 920 459 1070 921 869

A   Appendix

A.1   Abbreviations

Abbreviation	Description
BIOS	Basic input/output system; software program required for PC hardware startup
CD–ROM	Optical storage medium
COM x	Serial port x
CRT	Monitor with cathode ray tube
EPP	Enhanced Parallel Port (bidirectional)
FD	Floppy disk
GB	Gigabyte
HD	Hard disk
ISA	"Industry Standard Architecture", PC bus system
IDE	Integrated Device Electronics, denotes an interface for hard disks, disk drives, and CD–ROM, etc. in which the controller electronics are integrated in the device itself
KBD	Abbreviation for "keyboard"
LCD	Liquid Crystal Display (flat–panel display)
LPT	Line Printer Terminal
MB	Megabyte
MBF	Machine Control Panel
PCI	Peripheral Component Interconnect, PC bus system
RAM	Random Access Memory
SPP	Standard Parallel Port
Slot	PC expansion slot
TFT	Thin Film Transistor (active matrix technology, used in high–quality flat–panel displays)
UPS	Uninterruptible Power Supply
VGA	Video Graphics Array (graphics standard)

A.2   Index

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