CPCI-CPU/5201

CompactPCI® PowerPC™ Board with CAN, ETHERNET and USB

Manual

to Product I.2404.02

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N O T E

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Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Revision	Chapter	Changes versus previous version	Date
1.0	-	First English version	2014-03-24
1.1	4.1, 4.2	Name and Description of LEDs L and R changed	2014-05-07
1.2	-	Safety Information revised, note on Data Safety added	2015-04-30
	14.	Declaration of Conformity updated	
	1.5	Order Information revised	
1.3	8.	NOR Boot FLASH address range corrected.	2017-11-24
1.4	-	Classification of Warning Messages inserted, Safety Instructions revised	2019-09-13
	1.	Block circuit diagram new	
	1.1	New chapter: “Customized options”	
	2.	Figure 2: Figure of standard product inserted	
	3.	Safety information revised	
	5.9	Chapter “Software Support” revised	
	14.	EU Declaration of Conformity updated	
	15.	Order information of software revised, CPCI-CPU/5201-emmc version deleted	

Technical details are subject to change without further notice.

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Classification of Warning Messages and Safety Instructions

This manual contains noticeable descriptions, warning messages and safety instructions, which you must follow to avoid personal injuries or death and property damage.

This is the safety alert symbol.
It is used to alert you to potential personal injury hazards. Obey all safety messages and instructions that follow this symbol to avoid possible injury or death.

DANGER, WARNING, CAUTION

Depending on the hazard level the signal words DANGER, WARNING or CAUTION are used to highlight safety instructions and warning messages. These messages may also include a warning relating to property damage.

DANGER
Danger statements indicate a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Warning statements indicate a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION
Caution statements indicate a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE

Notice statements are used to notify people on hazards that could result in things other than personal injury, like property damage.

NOTICE
This NOTICE statement indicates that the device contains components sensitive to electrostatic discharge.

NOTICE
This NOTICE statement contains the general mandatory sign and gives information that must be heeded and complied with for a safe use.

INFORMATION

INFORMATION
Notes to point out something important or useful.

Safety Instructions

- When working with the CPCI-CPU/5201 follow the instructions below and read the manual carefully to protect yourself from injury and the CPCI-CPU/5201 from damage.
- The device is a built-in component. It is essential to ensure that the device is mounted in a way that cannot lead to endangering or injury of persons or damage to objects.
- Do not use damaged or defective cables to connect the CPCI-CPU/5201 and follow the CAN wiring hints in chapter: "Correct Wiring of Electrically Isolated CAN Networks".
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and domestic animals and property.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The CPCI-CPU/5201 may only be driven by power supply current circuits, that are contact protected. A power supply, that provides a safety extra-low voltage (SELV) according to EN 60950-1, complies with this conditions.

- The device has to be securely installed in the control cabinet before commissioning.
- Protect the CPCI-CPU/5201 from dust, moisture and steam.
- Protect the CPCI-CPU/5201 from shocks and vibrations.
- The CPCI-CPU/5201 may become warm during normal use. Always allow adequate ventilation around the CPCI-CPU/5201 and use care when handling.
- Do not operate the CPCI-CPU/5201 adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.

DANGER

Risk of personal injury due to explosion or leakage of the battery!
Improper usage of the battery such as overheating, short-circuiting or mechanical damage may cause an explosion or leakage.

→ Do not replace the battery by an incorrect type.
→ Do not recharge the battery.
→ Insert the battery properly, with the +/- terminals correctly oriented.
→ Dispose used batteries according to the national instructions.

NOTICE

Electrostatic discharges may cause damage to electronic components.
To avoid this, perform the steps described on page 11 *before* you touch the CPCI-CPU/5201, in order to discharge the static electricity from your body.

Qualified Personnel

This documentation is directed exclusively towards personnel qualified in control and automation engineering.
The installation and commissioning of the product may only be carried out by qualified personnel, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity

The CPCI-CPU/5201 is an industrial product and meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.
Warning: In a residential, commercial or light industrial environment the CPCI-CPU/5201 may cause radio interferences in which case the user may be required to take adequate measures.

The CPCI-CPU/5201 is a sub-assembly intended for incorporation into an apparatus. The manufacturer of the final system must decide, whether additional EMC or EMI protection requirements are necessary.

Data Safety
This device is equipped with an Ethernet or other interface which is suitable to establish a connection to data networks. Depending on the software used on the device, these interfaces may allow attackers to compromise normal function, get illegal access or cause damage.
esd does not take responsibility for any damage caused by the device if operated at any networks. It is the responsibility of the device's user to take care that necessary safety precautions for the device's network interface are in place.

Intended Use
The intended use of the CPCI-CPU/5201 is the operation as CompactPCI® PowerPC™ Board with CAN, ETHERNET and USB. The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The CPCI-CPU/5201 is intended for installation in a CompactPCI system only.
- The operation of the CPCI-CPU/5201 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CPCI-CPU/5201 for medical purposes is prohibited.

Service Note
The CPCI-CPU/5201 does not contain any parts that require maintenance by the user. The CPCI-CPU/5201 does not require any manual configuration of the hardware, except the change of battery or the configuration via jumper. Unauthorized intervention in the device voids warranty claims.

Disposal
Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

Table of contents

1. Overview

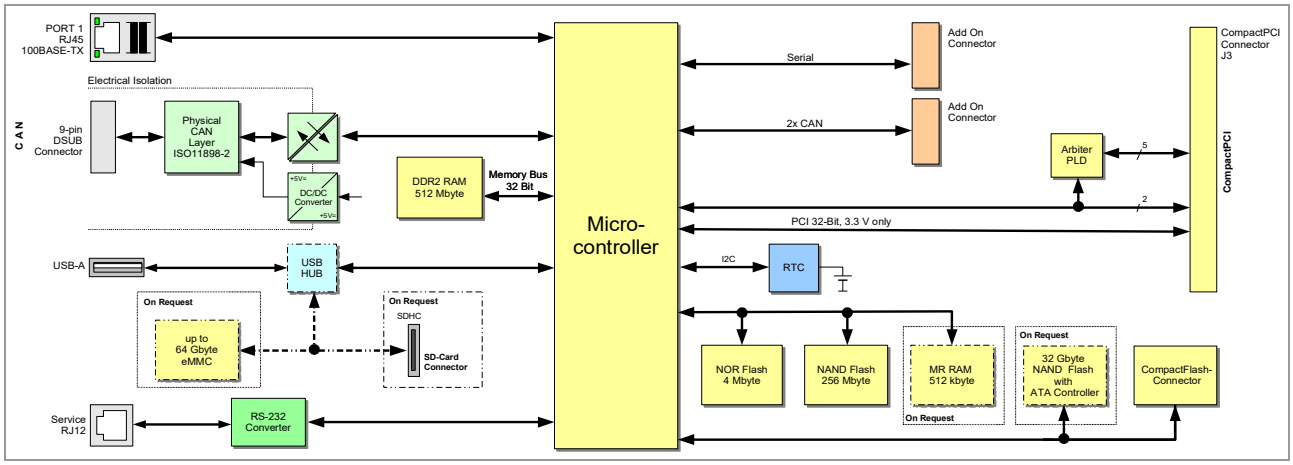


Figure 1: Block circuit diagram

The CPCI-CPU/5201 is specially designed for cost sensitive applications with low power consumption and a long product availability. The NXP® microcontroller MPC5121e with RISC core, FPU and fast flash memory support is best suited for data processing purposes. Flexible and fast storage is gained via a CompactFlash®-card slot and a USB connector.

Via the front panel an ETHERNET interface for 10/100 Mbit/s nets is accessible via an RJ45 connector and a serial interface (RS-232) is accessible via an RJ12 connector.
The ISO11898 compatible CAN interface is accessible via a DSUB9 connector in the front panel.
The CAN interface is electrically isolated and supports bit rates up to 1 Mbit/s.
Two additional CAN interfaces (CAN2, CAN3) and three additional serial interfaces (SER1-SER3) can be connected via a 3 U / 4 HP add-on card.

The MPC5121 CPU contains the e300 Power Architecture® technology processor core and operates with 400 MHz and up to 760 MIPS. It is equipped with 32-Kbyte instruction cache and 32-Kbyte data cache.
The superscalar processor core comes with instruction and data MMU and integrated double-precision floating-point unit. The CPU is included in the longevity program of NXP which guarantees enhanced availability.

The flash memory carries the standard ‘U-Boot’ program that enables the CPCI-CPU/5201 to boot various operating systems from network, on-board Flash or SD™ card. Thus Real-time OS like QNX® and VxWorks® are directly supported with full support of on-board drivers by esd, others on request. There is also a bunch of higher layer protocols like CANopen®, J1939 and ARINC 825 available, as well as an EtherCAT Master stack.

1.1 Customized Options

Customized options are for example:
- eMMC™ up to 64 Gbyte as on-board storage option
- Magnetoresistive RAM (MRAM) as on-board storage option, 512 kbyte
- NAND-Flash with ATA controller, 32 Gbyte
- SDHC slot: more than 10 MB/s (r/w) capable
- Adapter for CAN (CAN2, CAN3) and RS-232 (SER 1- SER3) interfaces, 3 U/ 4 HP front panel

Customized options are available for customized series production in reasonable quantities.
Please contact our sales team for detailed information.

2. PCB View with Connectors and Jumper

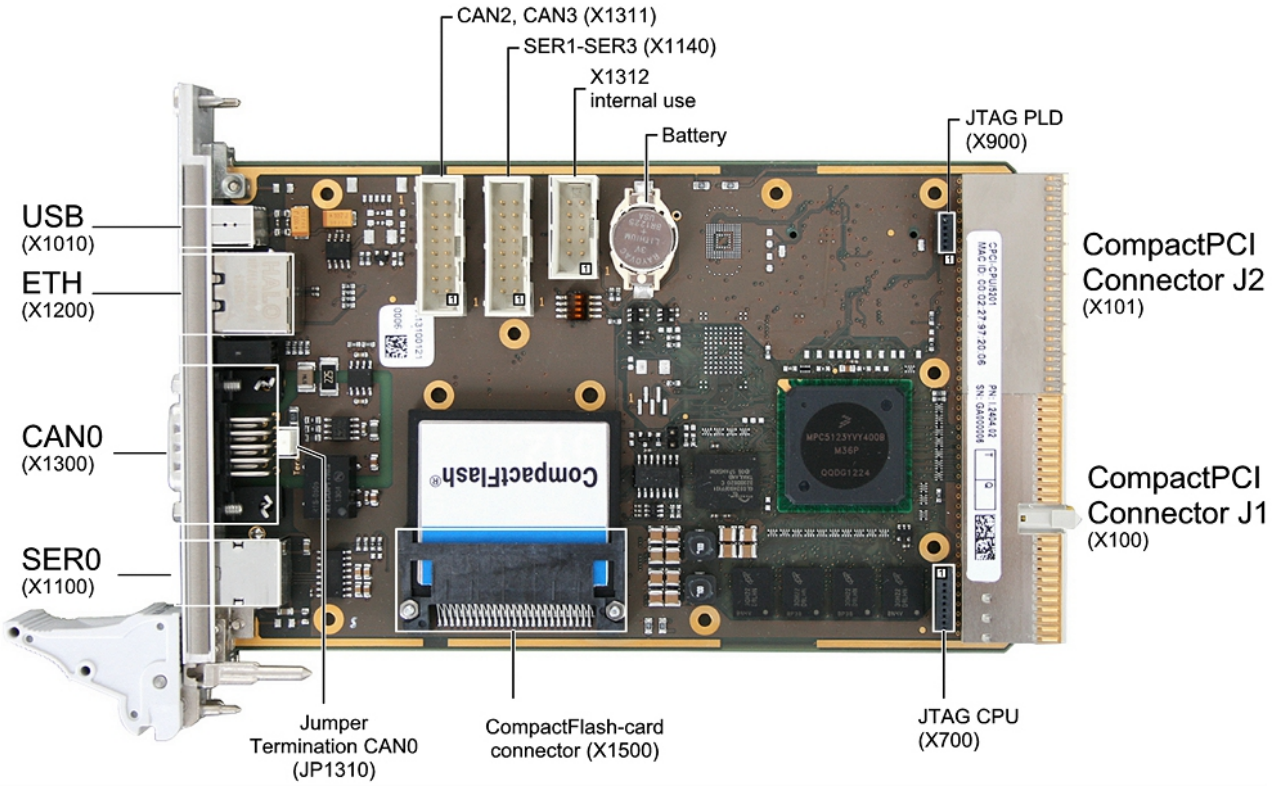


Figure 2: PCB top view of CPCI-CPU/5201

See also page 22 for signal assignment of the CAN connectors.

2.1 Termination of CAN0 via JP1310

An internal CAN termination for CAN0 can be set via the jumper JP1310 (see figure 2).

Jumper JP1310	Termination
not set	No internal termination of CAN0, CAN termination must be set externally.
set	Internal CAN0 termination via 120 Ω resistor.

3. Hardware Installation and Change of Battery

NOTICE
Read the safety instructions at the beginning of this document carefully, before you start with the hardware installation!

DANGER
Hazardous Voltage - **Risk of electric shock** due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the CPCI-CPU/5201 is to be integrated.
→ Disconnect all hazardous voltages (mains voltage) before opening the system.
→ Ensure the absence of voltage before starting any electrical work

NOTICE
Electrostatic discharges may cause damage to electronic components.

→ To avoid this, please discharge the static electricity from your body by touching the metal case of the CompactPCI system *before* you touch the CPCI-CPU/5201.
→ Furthermore, you should prevent your clothes from touching the CPCI-CPU/5201, because your clothes might be electrostatically charged as well.

3.1 Installation

Procedure:

1. Switch off the CompactPCI system and all connected peripheral devices (monitor, printer, etc.).
2. Discharge your body as described above.
3. Disconnect the system from the mains.

   DANGER
   Hazardous Voltage
   Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages.

   → Disconnect all hazardous voltages (mains voltage) before opening the system.
   → If the system does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).
   → Ensure the absence of voltage before starting any electrical work.
   → Cover or block off adjacent live parts.

4. Open the case if necessary.
5. Make sure that the jumper JP1310 for the termination of CAN0 is set according to your needs (see chapter “2.1 Termination of CAN0 via JP1310”) .
6. Make sure that the CompactPCI signalling voltage is set to 3.3V only.
7. Insert the CPCI-CPU/5201 board into the selected CompactPCI slot. Carefully push the board until it snaps into place. A coding key prevents from inserting into wrong signalling voltage (see chapter “5.3 CompactPCI Bus“).
8. Connect the interfaces via the connectors in the front panel of the CPCI-CPU/5201.

9. Please note that the CAN bus has to be terminated at both ends! See chapter “12. Correctly Wiring Electrically Isolated CAN Networks”
10. Close the CompactPCI system case again.
11. Connect the CompactPCI system to mains again (mains connector or safety fuse).
12. Switch on the CompactPCI system and the peripheral devices.
13. End of hardware installation.
14. Set the interface properties in your operating system. Refer to the documentation of the operating system.

3.2 Demounting

Procedure

A1. Switch off the CompactPCI system and if necessary other network participants. Disconnect the connectors in the front panel.

A2. Disconnect the CompactPCI system from the mains.
If the CompactPCI system does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).

DANGER
Hazardous Voltage
Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages.

→ Disconnect all hazardous voltages (mains voltage) before opening the system.
→ If the system does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).
→ Ensure the absence of voltage before starting any electrical work.
→ Cover or block off adjacent live parts.

A3. Discharge your body as described above.

A4. Unfasten the mounting screws in the front panel.

A5. Unfasten the CPCI-CPU/5201 by activating the eject lever and pull the module carefully out of the slot.

A6. Remove the PCI extension if necessary.

3.3 Change of Battery

The CPCI-CPU/5201 comes with a RTC (Real Time Clock), which is energised with a battery. The battery is plugged in a holder directly on the board.
Battery type: CR1225.

1. Demount the module as described in chapter: “3.2 Demounting”.

NOTICE
Electrostatic discharges may cause damage to electronic components.

→ To avoid this, please discharge the static electricity from your body *before* you touch the CPCI-CPU/5201.
→ Furthermore, you should prevent your clothes from touching the CPCI-CPU/5201, because your clothes might be electrostatically charged as well.

2. Remove the old battery carefully out of the holder (see figure 2).

DANGER
Risk of personal injury due to explosion or leakage of the battery!
Improper usage of the battery such as overheating, short-circuiting or mechanical damage may cause an explosion or leakage.

→ Do not replace the battery by an incorrect type.
→ Do not recharge the battery.
→ Insert the battery properly, with the +/- terminals correctly oriented.
→ Dispose used batteries according to the national instructions.

3. Carefully insert the new battery into the battery holder with the positive pole (+) facing up, see figure 2.
4. Install the module as described in chapter: “3.1 Installation”.

4. LEDs

4.1 Position of the LEDS

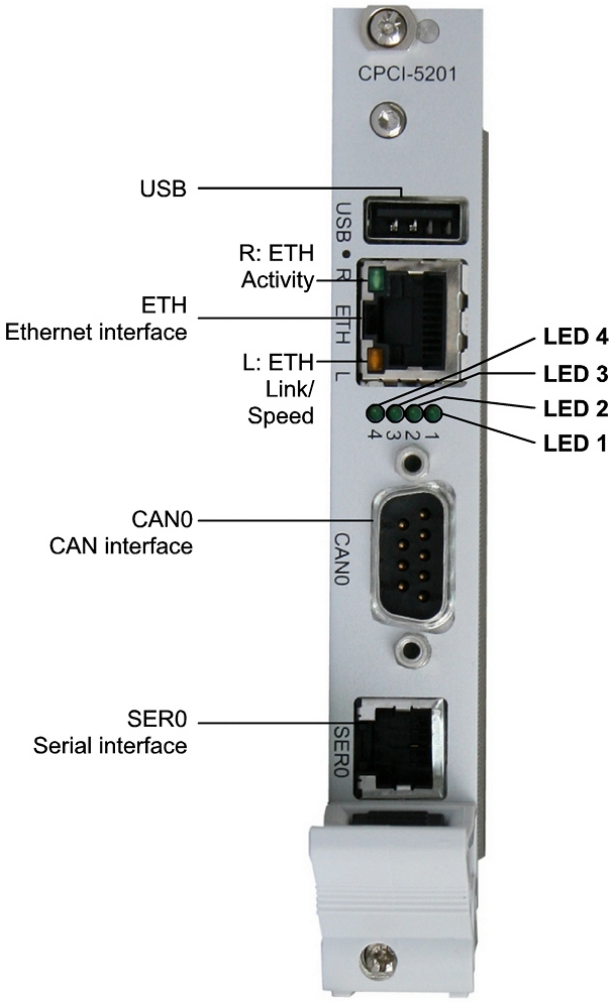


Figure 3: Connectors and LEDs

4.2 LED Indication LED 1-4

LED	Colour	Function	Indicator State	Description	LED name in schematic diagram
1	green	User-defined via API calls			LED1100D
2	green				LED1100C
3	green				LED1100B
4	green				LED1100A

Table 1: Description of LEDs 1-4

4.3 LED Indication Ethernet LEDs

LED	Colour	Function	Indicator State	Description
R	green	Activity (Receive)	Flickering	Ethernet activity (reception and transmission of Ethernet data)
L	yellow	Link/Speed	ON	Ethernet link is established, Ethernet bit rate: 100 Mbit/s
			OFF	Ethernet link is established, Ethernet bit rate: 10 Mbit/s

Table 2: Description of Ethernet LEDs

5. Technical Data

5.1 General Technical Data

Power supply voltage	nominal voltage:	3.3 V ($I_{3.3VMPMAX}$ = 400 mA), 5 V (I_{5VMAX} = 600 mA)
Connectors	J1	(110-pin CompactPCI connector, X100) - CompactPCI connector J1
	J2	(110-pin CompactPCI connector, X101) - CompactPCI connector J2
	USB	(USB connector type-A, X1010) - USB interface (USB1)
	ETH	(RJ45 socket with integrated LEDs, X1200) - Ethernet
	CAN0	(9-pin DSUB, male, X1300) - 4x CAN interface CAN0
	SER0	(8-pin RJ12, X1100)- Serial interface SER0
	CompactFlash	(CompactFlash connector, X1500) CompactFlash card connector
	Battery	(SMTU 1225 LF, X801) - Battery holder
	Only for internal use, test- and programming purposes:	
	X700 X900 X1140 X1311 X1312	(SAMTEC SMS-110-01-SS) - programming, debugging CPU (SAMTEC SMS-106-01-SS) - JTAG interface PLD (16-pin IDC-connector) - SER1-SER3 (16-pin IDC-connector) - CAN2, CAN3 (10-pin IDC-connector) - reserved
	On request only:	
	X1001	optional USB interface (USB2)
	SDHC	SDHC-connector
Temperature range	0...55 °C ambient temperature on request: -40 °C … +75 °C convection cooled	
Humidity	max. 90%, non-condensing	
Dimensions	100 mm x 160 mm, 3U / 4HP	
Weight	220 g	

Table 3: General data of the module

5.2 Microprocessor and Memory

CPU	NXP MPC5121e, 400 MHz, e300 core, cache: 32 KB / 32 KB, FPU
Memory	- SDRAM: 512 Mbyte DDR2, 200 MHz, - NOR Flash: 4 Mbyte; - NAND Flash: 256 Mbyte; - CF-card connector
Customized options on request only	- MRAM: 512 kbyte; - NAND-Flash with ATA controller, 32 Gbyte; - SDHC slot: more than 10 MB/s (r/w) capable, - eMMC: up to 64 Gbyte

Table 4: Microprocessor and Memory

5.3 CompactPCI Bus

Host bus	PCI-Bus according to PCI Local Bus Specification 2.2
PCI-data/address bus	32 Bit, 33/66 MHz
Board dimension	according to CompactPCI-Specification PICMG® 2.0 R 2.1
Connector	
Connector coding	Colour reference: 'Cadmium Yellow' coloured key Signalling voltage V(I/O): 3.3 V only, not 5V tolerant!

Table 5: Data of the CompactPCI bus

5.4 CAN Interface

Number of CAN interfaces	3
CAN controller	integrated in NXP MPC5212e, acc. to ISO 11898-1 (CAN 2.0 A/B)
Physical Layer	CAN 0: High-speed CAN interface according to ISO 11898-2, bit rate up to 1 Mbit/s CAN1, CAN2: TTL-level, connection to internal 16-pin connector
Electrical isolation	via digital isolator and DC/DC converter for CAN0
Bus termination	an integrated 120 Ω terminating resistor can be set via JP1310, if required for CAN0
Connector	CAN0: 1x DSUB9 in front panel, according to DS-303-1 CAN1, CAN2: 1x 16-pin internal IDC-connector, male X1311

Table 6: Data of the CAN interface

5.5 Serial Interfaces

Number	4 asynchronous serial interfaces
Controller	integrated in CPU
Bit rate	Value range: 9600 Baud ... 115200 Baud Default setting: 9600 Baud, 8 Bit, No Parity 1 Stop-Bit
Physical Interface	Serial 0: RS232 with RxD, TxD, RTS, CTS and TTL-level signals: Serial 1: RS232 with RxD, TxD Serial 2: RS232 with RxD, TxD Serial 3: RS232 with RxD, TxD, RTS, CTS
Connector	Serial0: 1x RJ12-socket in the front panel, Serial1-3: 1x 16-pin internal IDC-connector, male X1140

Table 7: Data of the serial interface

5.6 Ethernet Interface

Number of Ethernet interfaces	1
Bit rate	10BASE-T / 100BASE-TX, 10/100 Mbit/s
Connection	Shielded Twisted Pair (compatible to IEEE 802.3), 100BASE-TX,
Electrical isolation	via transformer
Connector	RJ-45-socket with integrated LEDs in the front panel

Table 8: Data of the Ethernet interface

5.7 USB Interface

Number	1x USB
Controller	integrated in NXP MPC5121e
USB interface	USB 2.0, High-Speed (400 Mbit/s)
Connector	USB type-A plug in the front panel

Table 9: Data of the USB interface

5.8 CompactFlash Interface

Number	1x
Controller	integrated in NXP MPC5121e
Connector	internal CompactFlash card connector X1500
Cards	To ensure a correct functionality of the CompactFlash interface CompactFlash cards with guaranteed SSD- properties should be used. esd therefore recommends to use one of the listed SLC-cards: - „Western Digital SiliconDrive II“ (e.g. 4GB: SSDC04G-4600) - Cactus CompactFlash 303 Series (e.g. 4GB: KC4GR-303) - Swissbit C-320 (e.g. 4GB: SFCF4096H1BO2TO-C-D1-523-SMA) Only for the usage of this CF-cards the correct function of the CF-card interface can be ensured and support for the units can be provided. esd will evaluate other CF-cards and release the usage on success.

Table 10: Data of the CompactFlash interface

5.9 Software

The flash memory carries the standard ‘U-Boot’ program that enables the CPCI-CPU/5201 to boot various operating systems from network, on-board Flash or SD™ card.
Thus Real-time OS like QNX® and VxWorks® are directly supported with full support of on-board drivers by esd, others on request.
There is also a bunch of higher layer protocols like CANopen®, J1939, ARINC 825 available as well as an EtherCAT Master Stack.

Bootloader	U-Boot
License information	The CPCI-CPU/5201 module uses the opensource bootloader *„Das U-Boot“*. The U-Boot source code is published in terms of the GNU public license (GPL). Please see esd's „3rd party licensor notice“ document that is part of the product's documentation for the full license text. You can contact esd for a copy of the full bootloader source code for the CPCI-CPU/5201. The U-Boot source is available from esd on request. The homepage of the U-Boot project is: http://www.denx.de/wiki/U-Boot.

Furthermore Board Support Packages for QNX and VxWorks operating systems are available. See “Order Information” on page 46 for further information.

6. Description of the Units

6.1 Serial Interface SER0

NOTICE
This interface may be used for service purposes only.
To comply with electromagnetic compliance and electromagnetic interference the interface must not be connected during regular operation!

6.1.1 Default Setting of SER0

The default setting of the serial interface is:

Bit rate:	9600 Baud
Data bits:	8
Parity:	no
Stop bits:	1
Handshake:	none

6.1.2 Configuration of SER0

The serial interface is controlled by the NXP MPC5121e. The bit rate of the interface can be configured per software. The SP3232ECN-L is used as the RS-232 driver of the interface and supports bit rates of up to 115.2 Kbit/s.

The procedure to change the bit rate depends on the operating system, it is therefore advisable to refer to the manual of the operating system.

6.1.3 Connection of the RS-232 Interface

The diagram is used to explain the short terms for signals as used in the chapter connector assignments. The signal terms are exemplary for the connection of the CPCI-CPU/5201 as a modem (DCE) via the adapter cable RJ12-DSUB9.

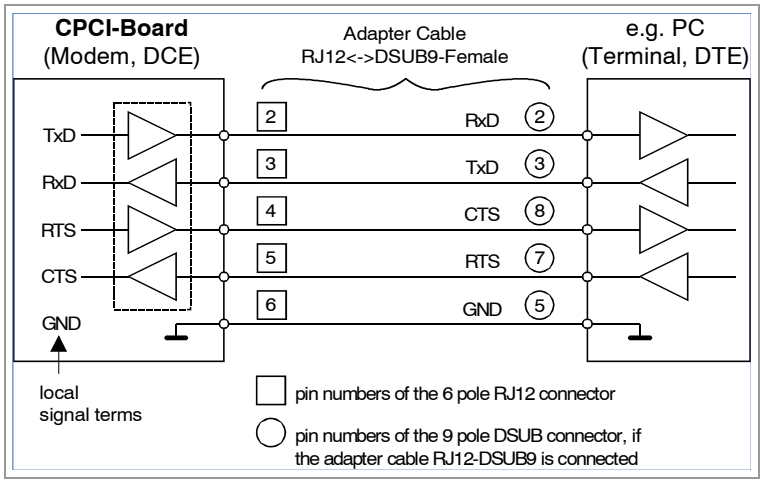


Figure 4: Connectors and LEDs

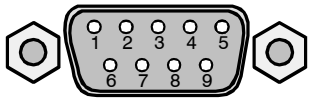
7. Connector Assignments

7.1 CAN

7.1.1 CAN0 via X1300 in the Front Panel

Device connector: 9-pin DSUB connector, male

Pin Position:



Pin Assignment:

Signal	Pin		Signal
		1	reserved
CAN_GND	6	2	CAN_L
CAN_H	7	3	CAN_GND
reserved	8	4	reserved
reserved	9	5	Shield

Signal Description:

CAN_L, CAN_H ...	CAN signal lines
CAN_GND ...	reference potential of the local CAN physical layer
Shield ...	shielding (connected with the case of the 9-pin DSUB connector)
reserved ...	reserved for future applications, do not connect!

7.1.2 CAN2, CAN3 via X1311

Device connector: 16-pin IDC connector, male

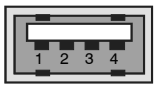
Signal	Pin	Pin	Signal
GND	16	15	GPIO27
CAN3_Rx	14	13	GPIO26
CAN3_Tx	12	11	I²C.2.SDA
CAN2_Rx	10	9	I²C.2.CLK
CAN2_Tx	8	7	3.3 V
SPI.MISO	6	5	SPI.MOSI
SPI.SSI#	4	3	SPI.SCLK
SPI.SS2#	2	1	SPI.SS3#

See Figure 2 for pin position.

7.2 USB

Device connector: USB receptacle, standard type A

Pin Position:



Pin Assignment:

Pin	Signal
1	V_{BUS}
2	D-
3	D+
4	GND

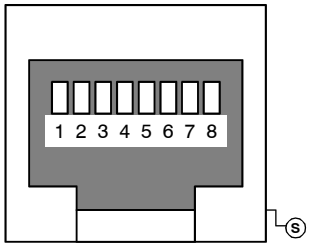
Signal Description:

V_{BUS}... +5 V power supply voltage
D+, D-... USB signal lines Data+, Data-
GND... Reference potential

7.3 Ethernet

Device connector: RJ45 socket, 8-pin

Pin Position:



Pin Assignment:

Pin	Signal	Meaning
1	Tx0+ (TxD+)	Transmit Data +
2	Tx0- (TxD-)	Transmit Data -
3	Rx0+ (RxD+)	Receive Data +
4	-	-
5	-	-
6	Rx0- (RxD-)	Receive Data -
7	-	-
8	-	-

S	Shield	

Signal Description:

Tx0+/-, Rx0+/- ...	Ethernet data lines
- ...	reserved for future applications, do not connect!
Shield...	case shield, connected with the front panel of the CPCI-CPU/5201.

NOTICE
Cables of category CAT5e or higher have to be used to grant the function in networks with 100 Mbit/s. esd grants the EC conformity of the product, if the wiring is carried out with shielded twisted pair cables.

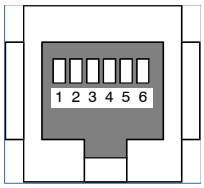
7.4 Serial Interface

NOTICE
This interface may be used for service purposes only.
To comply with electromagnetic compliance and electromagnetic interference the interface must not be connected during regular operation!

7.4.1 SER0 (RS-232) interface via RJ12

For details on the connection of serial interfaces please refer to chapter “Serial Interface SER0” on page 21. From the principle circuit diagrams represented in that chapter, you will be able to clearly determine the signal direction (Rx<->Tx).

Pin Position:



Cut-out for fastening lever

Pin Assignment:

Pin	Signal		Optional Pin Assignment on request only
1	GND		- SER0_VCC, - n.c. (not connected)
2	SER0_TxD	Data Output	
3	SER0_RxD	Data Input	
4	SER0_RTS	Handshake Output	- SER1_TxD
5	SER0_CTS	Handshake Input	- SER1_RxD
6	GND		

The data direction of the signals is given as viewed from the CPCI-CPU/5201 board.

7.4.2 SER1-3 via X1140

Device connector: 16-pin IDC connector, male

Signal	Pin	Pin	Signal
SER3_RTS#	16	15	SER3_CTS#
GND	14	13	SER3_Tx
SER3_Rx	12	11	3.3V
GND	10	9	SER2_Tx
SER2_Rx	8	7	3.3 V
GND	6	5	V_{BATT}
GND	4	3	SER1_Tx
SER1_Rx	2	1	3.3 V

See Figure 2 for pin position.

7.5 JTAG / Debug

7.5.1 JTAG Interface CPU(X700)

Device connector: 10-pin connector (SAMTEC SMS-110-01-SS)

Pin	Signal	Direction
1	CPU_TDO	Output
2	CPU_TDI	Input
3	COPTRST# (pulled up via 4.7 KΩ)	Input
4	V_{REF}+ (3.3V via 22Ω resistor)	Output
5	CPU_TCK	Input
6	CPU_TMS	Input
7	CPU_SRST# (pulled up via 4.7 KΩ)	Input
8	GND	Reference
9	COPHRST# (pulled up via 4.7 KΩ)	Input
10	GND	Reference

See Figure 2 for pin position.

7.5.2 JTAG, Programming Interface PLD (X900)

Device connector: 6-pin connector (SAMTEC SMS-106-01-SS)

Pin	Signal	Direction
1	+ 3.3 V	
2	PLD_TDI (pulled up via 3.3 KΩ)	In-/Output
3	PLD_TDO (pulled up via 3.3 KΩ)	In-/Output
4	PLD_TCK (pulled up via 3.3 KΩ)	In-/Output
5	PLD_TMS (pulled up via 3.3 KΩ)	In-/Output
6	GND	Reference

See Figure 2 for pin position.

8. Local Memory Map

Start-Address	End-Address	Function
0x0000.0000	0x1FFF.FFFF	DDR RAM (512 MB)
0x3000.0000	0x3001.FFFF	SRAM (128 KB, integrated into CPU)
0x8000.0000	0x803F.FFFF	IMMR (4 MB, integrated into CPU)
0x8100.0000	0x81FF.FFFF	CPCI-IO Space (16Mbyte)
0x8200.0000	0x8200.FFFF	PLD (64 KB)
0xA000.0000	0xAFFF.FFFF	CPCI-Memory Space
0xB000.0000	0xBFFF.FFFF	CPCI-Memory-Mapped IO Space
0xF800.0000	0xF81F.FFFF	MRAM (optional)
0xFFC0.0000	0xFFFF.FFFF	NOR Boot FLASH (4 MB)

9. CompactPCI Interrupt Handling

The level of the interrupts can be read on the GPIOs

GPIO	Device
GPIO28	PLD (INTA#)
GPIO29	PLD (INTB#)
GPIO30	PLD (INTC#)
GPIO31	PLD (INTD#)

Value	Interrupt
1	inactive
0	active

To enable or disable a CompactPCI interrupt access the address range 0x8200 0000 writing byte-wise.
The bits have the following meaning:

Bit	7	6	5	4	3	2	1	0
Meaning	reserved set to 0				Enable 1 = on, 0 = off	IRQ 0/1 (IRQ Input on CPU)	IRQ Number (0 = A, 1= B, 2 = C, 3 = D)	

10. PCI Configuration

The CPCI-CPU/5201 uses the following PCI identification:

CPCI-CPU/5201	
Class:	0x0b
Subclass	0x020
Vendor-ID:	0x1957
Device-ID:	0x580C

PCI base address register mapping:

- PCI-BAR1: default: 512MB local DDR-RAM

11. Bootloader

11.1 Configuration and Console Access (Serial Interface RS-232)

The default communication parameters are 9600 baud, 8N1 (8 data bits, no parity, 1 stopbit, no hardware handshake).
After the next power-on you will see the bootloader startup messages being output on the serial console. When you see the message 'Press SPACE ....', hit the space key to stop booting and to access the interactive bootloader console. At the prompt you can use an extensive command set to do configuration, debugging or testing tasks. Enter *help* (followed by hitting the RETURN key) to get a full list of all supported commands.

```
U-Boot 2011.12-00018-gaae5e2a-dirty (Jan 23 2014 - 14:07:33)MPC512X

CPU:   MPC5121e rev. 3.0, Core e300c4 at 400 MHz, CSB at 200 MHz (RSR=0x0000)
Board: CPCI_5121
I2C:   ready
DRAM:  512 MiB
Flash: 4 MiB
NAND:  1024 MiB
MMC:  MXC MCI: 0
PCI:   Clock is 66 MHZ
PCI:   Bus Dev VenId DevId Class Int
In:    serial
Out:   serial
Err:   serial
Net:   FEC
IDE:   Bus 0: OK
  Device 0: Model: CactusFlashCard Firm: 100511a Ser#: KC303       00106523
            Type: Hard Disk
            Capacity: 4002.9 MB = 3.9 GB (8198064 x 512)
  Device 1: Model: 8GB NANDrive Firm: D A004J0 Ser#: 00000000001R1PCCQGVh
            Type: Hard Disk
            Capacity: 7641.2 MB = 7.4 GB (15649200 x 512)

Welcome to MECP5123
Add painit to preboot command

Hit any key to stop autoboot:  0
=>
```

11.2 Flash Update

The bootloader resides at the top of the CPCI-CPU/5201 on-board NOR flash memory. Assuming a binary size of up to 512 kByte (0x7FFFF) the bootloader image must be programmed into the flash memory starting at 0xFFF00000. Please check that you are using the correct bootloader image that suits to your board!
The bootloader update process is very delicate. Any mistake may result in a board that is not usable anymore and which must be shipped back to be reprogrammed by esd using a JTAG debugger.
Here are step-by-step instructions for bootloader update at the serial console. The tftp command requires a correct U-Boot network configuration. That means the the bootloader environment variables *ipaddr, netmask, gatewayip* and *serverip* must be set up according to your network.
When any of the following step fail, do not proceed!

1. Upload the new bootloader binary image into RAM (e.g. at RAM address 0x1000000). The easiest way is to load the images from a TFTP-server.

```
=> tftp 1000000 /tftpboot/cpci5121/u-boot.bin
```

2. Remove flash write protection:

```
=> protect off FFF00000 FFF7FFFF
```

3. Erase the current bootloader. ***Attention:*** do not switch of the board from now on until a new bootloader has been written into the flash!

```
=> erase FFF00000 FFF7FFFF
```

4. Copy the new bootloader into flash:

```
=> cp.b ${fileaddr} FFF00000 ${filesize}
```

   This command copies 0x60000 bytes starting at RAM location `{filesize}` into flash memory starting at 0xFFF00000.
5. Enable flash write protection for bootloader address range:

```
=> protect on FFF00000 FFF7FFFF
```

6. When all the above commands succeeded reset the board.

```
=> reset
```

To simplify the bootloader update process two environment variables already contain the necessary commands. These variables can be executed using the *run* command:

1. Load binary image from a TFTP-server:

```
=> run load
```

2. When the previous command succeeded: unprotect, erase, flash and reset:

```
=> run update
```

Attention: Please double-check the content of the *load* and *update* variable before using them. This will prevent you from running into trouble.

11.3 BSP Commands

The following U-Boot BSP commands have been specially added to support the CPCI-CPU/5201 functions. Type *help <command>* at the bootloader prompt to get a short command reference.

11.3.1 painit Command

The *painit* command does all the setup in order to use the PCIAccess driver with a CPCI-CPU/5201. *painit* requires a correctly setup *pram* variable (see later chapter). *painit* is typically called by the *preboot* command:

```
=> setenv preboot painit
=> saveenv
```

The 'painit' command presets the reserved memory (see *pram* variable) in the following way:

1. The reserved memory is zero'd.
2. The bootloader's representation of the bootloader environment is copied at the beginning of the reserved memory.
3. The environment size (e.g. 0x00000800) is written to the last 32bit memory location (e.g. 0x3FFFFFC).
4. The reserved memory size (see 'pram') in units of bytes is written before the previous value (e.g. 0xFFFFFF8).
5. A CRC32 checksum is calculated over the two 32bit value and written at the third last memory location (e.g. 0xFFFFFF4).
6. A 32bit zero (0x00000000) is written to the fourth last memory location (e.g. 0xFFFFFF0).

11.4 Special Environment Variables

11.4.1 pcidelay Variable

The booloader variable *pcidelay* can be used to delay PCI enumeration through the bootloader. When *pcidelay* is not set, the bootloader on a CPCI-CPU/5201 starts PCI enumeration as soon as possible. When *pcidelay* is set to an amount of time in milliseconds of seconds, the bootloader waits for this period, checks EREADY and finally starts PCI enumeration.
Example:

```
=> setenv pcidelay 2000
=> saveenv
```

11.4.2 pram Variable

The *pram* variable is used to reserve RAM that is not used by the bootloader. When *pram* is set, the variable *mem* is automatically set to the amount of available RAM (total RAM – pram). The reserved RAM is used by the esd PCIAccess driver.
Pram must be set to the amount of reserved RAM in KiB.

```
=> setenv pram 4096
=> saveenv
```

12. Correctly Wiring Electrically Isolated CAN Networks

NOTICE
This chapter applies to CAN networks with bit rates up to 1 Mbit/s.
If you work with higher bit rates, as for example used for CAN FD, the information given in this chapter must be examined for applicability in each individual case.
For further information refer to the CiA® CAN FD guidelines and recommendations (https://www.can-cia.org/).

For the CAN wiring all applicable rules and regulations (EU, DIN), e.g. regarding electromagnetic compatibility, security distances, cable cross-section or material, have to be observed.

12.1 Standards concerning CAN Wiring

The flexibility in CAN network design is one of the key strengths of the various extensions and additional standards like e.g. CANopen, ARINC825, DeviceNet and NMEA2000 that have been built on the original ISO 11898-2 CAN standard. In using this flexibility comes the responsibility of good network design and balancing these tradeoffs.

Many CAN organizations and standards have scaled the use of CAN for applications outside the original ISO 11898. They have made system level tradeoffs for data rate, cable length, and parasitic loading of the bus.

However for CAN network design margin must be given for signal loss across the complete system and cabling, parasitic loadings, network imbalances, ground offsets against earth potential and signal integrity. **Therefore the practical maximum number of nodes, bus length and stub length are typically much lower.**

esd has concentrated her recommendations concerning CAN wiring on the specifications of the ISO 11898-2. Thus this wiring hints forgoes to describe the special features of the derived standards CANopen, ARINC825, DeviceNet and NMEA2000.

The consistent compliance to ISO 11898-2 offers significant advantages:

- Durable operation due to well proven design specifications
- Minimizing potential failures due to sufficient margin to physical limits
- Trouble-free maintenance during future network modifications or during fault diagnostics due to lack of exceptions

Of course reliable networks can be designed according the specifications of CANopen, ARINC825, DeviceNet and NMEA2000, **however it must be observed that it is strictly not recommended to mix the wiring guidelines of the various specifications!**

12.2 Light Industrial Environment (*Single* Twisted Pair Cable)

12.2.1 General Rules

NOTICE
esd grants the EU Conformity of the product, if the CAN wiring is carried out with at least single shielded **single** twisted pair cables that match the requirements of ISO 11898-2. Single shielded *double* twisted pair cable wiring as described in chapter 12.3. ensures the EU Conformity as well.

The following **general rules** for CAN wiring with single shielded *single* twisted pair cable should be followed:

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate conductor cross-section (≥ 0.22 mm²) has to be used. The voltage drop over the wire has to be considered.
2	For light industrial environment use at least a two-wire CAN cable. Connect • the two twisted wires to the data signals (CAN_H, CAN_L) and • the cable shield to the reference potential (CAN_GND).
3	The reference potential CAN_GND has to be connected to the functional earth (FE) at exactly **one** point.
4	A CAN net must not branch (exception: short cable stubs) and has to be terminated with the characteristic impedance of the line (generally 120 Ω ±10%) at both ends (between the signals CAN_L and CAN_H and **not** at CAN_GND).
5	Keep cable stubs as short as possible (l < 0.3 m).
6	Select a working combination of bit rate and cable length.
7	Keep away cables from disturbing sources. If this cannot be avoided, double shielded wires are recommended.

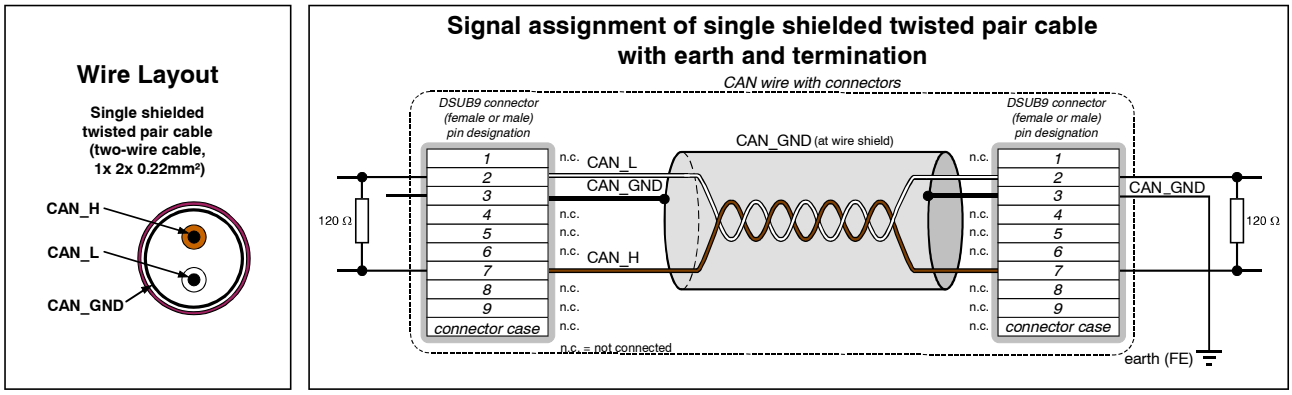


Figure 5: CAN wiring for light industrial environment

12.2.2 Cabling

- To connect CAN devices with just one CAN connector per net use a short stub (< 0.3 m) and a T-connector (available as accessory). If this devices are located at the end of the CAN network, the CAN terminator “CAN-Termination-DSUB9” can be used.

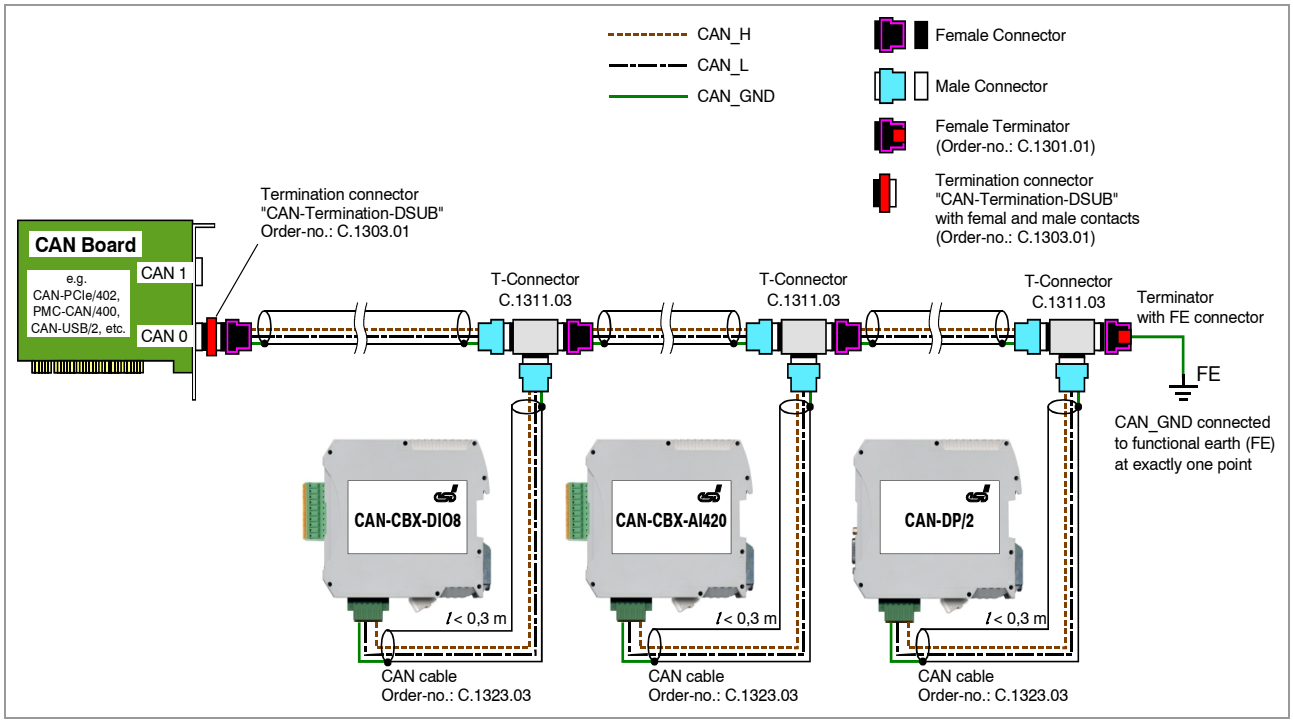


Figure 6: Example for proper wiring with single shielded single twisted pair wires

12.2.3 Branching

- In principle the CAN bus has to be realized in a line. The participants are connected to the main CAN bus line via short cable stubs. This is normally realised by so called T-connectors. esd offers the CAN-T-Connector (Order No.: C.1311.03)
- If a mixed application of single twisted and double twisted cables is unavoidable, take care that the CAN_GND line is not interrupted!
- Deviations from the bus structure can be realized by the usage of repeaters.

12.2.4 Termination

- A termination resistor has to be connected at both ends of the CAN bus.
  If an integrated CAN termination resistor which is equipped at the CAN interface at the end of the bus is connected, this one has to be used for termination instead of an external CAN termination plug.
- 9-pin DSUB-termination connectors with integrated termination resistor and male and female contacts are available from esd (order no. C.1303.01).
- DSUB termination connectors with male contacts (order no. C.1302.01) or female contacts (order no. C.1301.01) and additional functional earth contact are available, if CAN termination and grounding of CAN_GND is required.

12.3 Heavy Industrial Environment (*Double* Twisted Pair Cable)

12.3.1 General Rules

The following **general rules** for the CAN wiring with single shielded *double* twisted pair cable should be followed:

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate conductor cross-section (≥ 0.22 mm²) has to be used. The voltage drop over the wire has to be considered.
2	For heavy industrial environment use a four-wire CAN cable. Connect • two twisted wires to the data signals (CAN_H, CAN_L) and • the other two twisted wires to the reference potential (CAN_GND) and • the cable shield to functional earth (FE) at least at one point.
3	The reference potential CAN_GND has to be connected to the functional earth (FE) at exactly **one** point.
4	A CAN bus line must not branch (exception: short cable stubs) and has to be terminated with the characteristic impedance of the line (generally 120 Ω ±10%) at both ends (between the signals CAN_L and CAN_H and **not** to CAN_GND).
5	Keep cable stubs as short as possible (l < 0.3 m).
6	Select a working combination of bit rate and cable length.
7	Keep away CAN cables from disturbing sources. If this can not be avoided, double shielded cables are recommended.

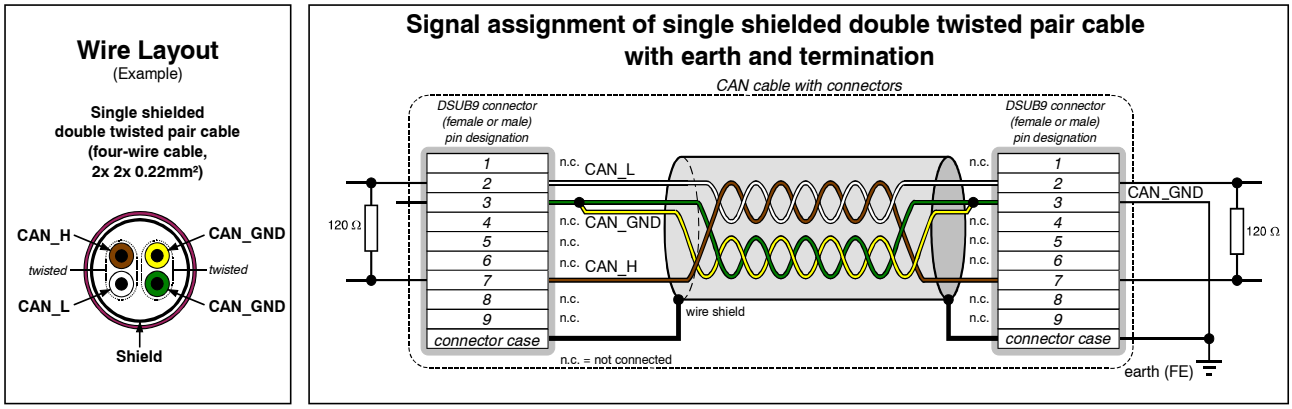


Figure 7: CAN wiring for heavy industrial environment

12.3.2 Device Cabling

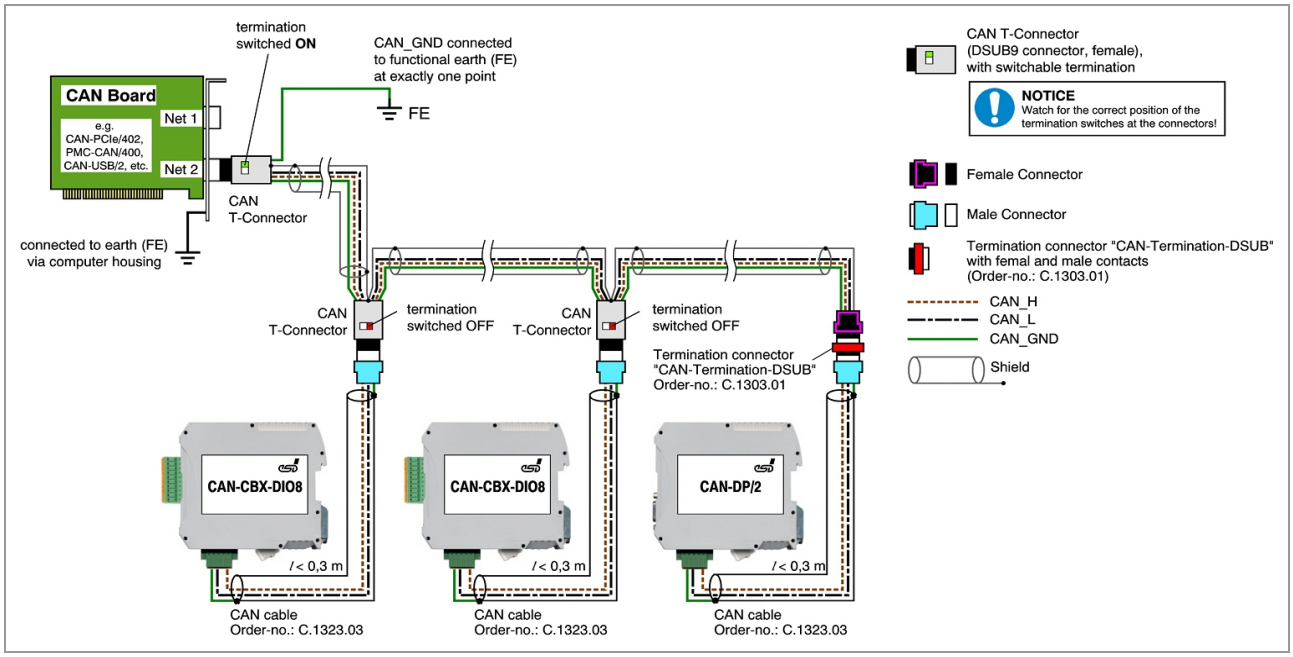


Figure 8: Example of proper wiring with single shielded double twisted pair cables

12.3.3 Branching

- In principle the CAN bus has to be realized in a line. The participants are connected to the main CAN bus line via short cable stubs. This is normally realised by so called T-connectors. When using esd's CAN-T-Connector (order no.: C.1311.03) it should be noted that the shield potential of the conductive DSUB housing is not looped through this T-Connector type. Thus the shielding is interrupted. Therefore you have to take adequate measures to connect the shield potentials, as described in the manual of the CAN-T-Connector. For further information on this read the CAN-T-Connector Manual (order no.: C.1311.21).
  Alternatively a T-connector can be used, in which the shield potential is looped through, e.g. the DSUB9 connector from ERNI (ERBIC CAN BUS MAX, order no.:154039).
- If a mixed application of single twisted and double twisted cables is unavoidable, take care that the CAN_GND line is not interrupted!
- Deviations from the bus structure can be realized by the usage of repeaters.

12.3.4 Termination

- A termination resistor has to be connected at both ends of the CAN bus.
  If an integrated CAN termination resistor which is equipped at the CAN interface at the end of the bus is connected, this one has to be used for termination instead of an external CAN termination plug.
- 9-pin DSUB-termination connectors with integrated termination resistor and male and female contacts are available from esd (order no. C.1303.01).
- 9-pin DSUB-connectors with integrated switchable termination resistor can be ordered e.g. from ERNI (ERBIC CAN BUS MAX, female contacts, order no.:154039).

12.4 Electrical Grounding

- For CAN devices with electrical isolation the CAN_GND must be connected between the CAN devices.
- CAN_GND should be connected to the earth potential (FE) at **exactly one** point of the network.
- Each *CAN interface with electrical connection to earth potential* acts as a grounding point. For this reason it is recommended not to connect more than one *CAN device with electrical connection to earth potential.*
- Grounding can be made e.g. at a termination connector (e.g. order no. C.1302.01 or C.1301.01).

12.5 Bus Length

NOTICE
Please note that the cables, connectors and termination resistors used in CANopen networks shall meet the requirements defined in ISO11898-2.
In addition, further recommendations of the CiA, like standard values of the cross section, depending on the cable length, are described in the CiA recommendation CiA 303-1 (see CiA 303 CANopen Recommendation - Part 1: „Cabling and connector pin assignment“, Version 1.8.0, Table 2).

Bit-Rate [kbit/s]	Theoretical values of reachable wire length **with esd interface** l_{max} [m]	**CiA recommendations** (07/95) for reachable wire lengths l_{min} [m]	Standard values of the cross-section according to CiA 303-1 [mm²]
1000	37	25	0,25 to 0,34
800 666,6̄ 500 333,3̄ 250	59 80 130 180 270	50 - 100 - 250	0,34 to 0,6
166 125	420 570	- 500	0,5 to 0,6
100 83,3̄ 66,6̄ 50	710 850 1000 1400	650 - - 1000	0,75 to 0,8
33,3̄ 20 12,5 10	2000 3600 5400 7300	- 2500 - 5000	not defined in CiA 303-1

Table 11: Recommended cable lengths at typical bit rates (with esd-CAN interfaces)

- Optical couplers are delaying the CAN signals. esd modules typically reach a wire length of 37 m at 1 Mbit/s within a proper terminated CAN network without impedance disturbances like e.g. caused by cable stubs > 0.3 m.

12.6 Examples for CAN Cables

esd recommends the following two-wire and four-wire cable types for CAN network design. These cable types are used by esd for ready-made CAN cables, too.

12.6.1 Cable for light industrial Environment Applications (Two-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (1x 2x 0.22) (UL/CSA approved) Part No.: 2170260 UNITRONIC ®-BUS-FD P CAN UL/CSA (1x 2x 0.25) (UL/CSA approved) Part No.: 2170272
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (1x 2x 0.22 mm²) Order No.: 93 022 016 (UL appr.) BUS-Schleppflex-PUR-C (1x 2x 0.25 mm²) Order No.: 94 025 016 (UL appr.)

12.6.2 Cable for heavy industrial Environment Applications (Four-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (2x 2x 0.22) (UL/CSA approved) Part No.: 2170261 UNITRONIC ®-BUS-FD P CAN UL/CSA (2x 2x 0.25) (UL/CSA approved) Part No.: 2170273
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (2x 2x 0.22 mm²) Order No.: 93 022 026 (UL appr.) BUS-Schleppflex-PUR-C (2x 2x 0.25 mm²) Order No.: 94 025 026 (UL appr.)

INFORMATION
Ready-made CAN cables with standard or custom length can be ordered from **esd**.

13. CAN Troubleshooting Guide

The CAN Troubleshooting Guide is a guide to find and eliminate the most frequent hardware-error causes in the wiring of CAN networks.

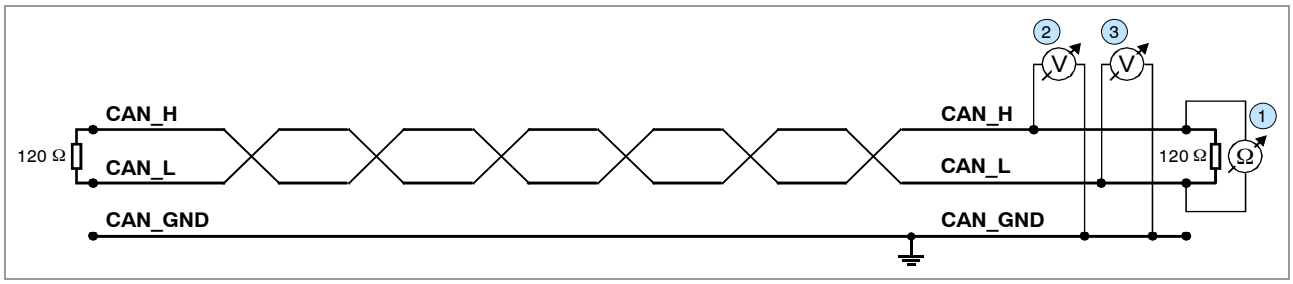


Figure 9: Simplified diagram of a CAN network

13.1 Termination

The termination is used to match impedance of a node to the impedance of the transmission line being used. When impedance is mismatched, the transmitted signal is not completely absorbed by the load and a portion is reflected back into the transmission line. If the source, transmission line and load impedance are equal these reflections are avoided. This test measures the series resistance of the CAN data pair conductors and the attached terminating resistors.

To test it ,please

1. Turn off all power supplies of the attached CAN nodes.
2. Measure the DC resistance between CAN_H and CAN_L at one end of the network ① (see figure above).

The measured value should be between 50 Ω and 70 Ω.

If the value is below 50 Ω, please make sure that:
- there is no **short circuit** between CAN_H and CAN_L wiring
- there are **not more than two** terminating resistors connected
- the nodes do not have faulty transceivers.

If the value is higher than 70 Ω, please make sure that:
- there are no open circuits in CAN_H or CAN_L wiring
- your bus system has two terminating resistors (one at each end) and that they are 120 Ω each.

13.2 Electrical Grounding

The CAN_GND of the CAN network should be connected to the functional earth potential (FE) at only **one** point. This test will check if the CAN_GND is grounded in several places.
To test it, please

1. Disconnect the CAN_GND from the earth potential (FE).
2. Measure the DC resistance between CAN_GND and earth potential (see figure on the right).
3. Reconnect CAN_GND to earth potential.

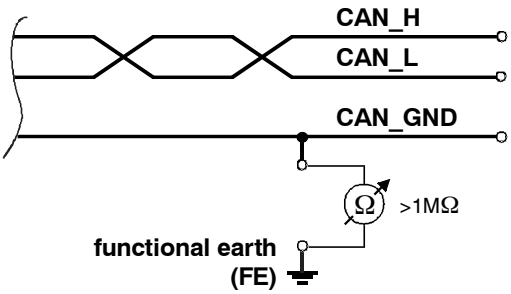


Figure 10: Simplified schematic diagram of ground test measurement

The measured resistance should be higher than 1 MΩ. If it is lower, please search for additional grounding of the CAN_GND wires.

13.3 Short Circuit in CAN Wiring

A CAN bus might possibly still be able to transmit data if there is a short circuit between CAN_GND and CAN_L, but generally the error rate will increase strongly. Make sure that there is no short circuit between CAN_GND and CAN_L!

13.4 CAN_H/CAN_L-Voltage

Each node contains a CAN transceiver that outputs differential signals. When the network communication is idle the CAN_H and CAN_L voltages are approximately 2.5 V measured to CAN_GND. Faulty transceivers can cause the idle voltages to vary and disrupt network communication.

To test for faulty transceivers, please

1. Turn on all supplies.
2. Stop all network communication.
3. Measure the DC voltage between CAN_H and CAN_GND (2) (see figure at previous page).
4. Measure the DC voltage between CAN_L and CAN_GND (3) (see figure at previous page).

Normally the voltage should be between 2.0 V and 3.0 V.

If it is lower than 2.0 V or higher than 3.0 V, it is possible that one or more nodes have faulty transceivers. For a voltage lower than 2.0 V please check CAN_H and CAN_L conductors for continuity.

To find the node with a faulty transceiver within a network please test the CAN transceiver resistance (see below) of the nodes.

13.5 CAN Transceiver Resistance Test

CAN transceivers have circuits that control CAN_H and CAN_L. Experience has shown that electrical damage of the circuits may increase the leakage current in these circuits.

To measure the current leakage through the CAN circuits, please use a resistance measuring device and:

1. Switch **off** the node and **disconnect** it from the network (4) (see figure below).

2. Measure the DC resistance between CAN_H and CAN_GND (5) (see figure below).

3. Measure the DC resistance between CAN_L and CAN_GND (6) (see figure below).

The measured resistance has to be about 500 kΩ for each signal. If it is much lower, the CAN transceiver it is probably faulty.
Another indication for a faulty transceiver is a very high deviation between the two measured input resistances (>> 200 %).

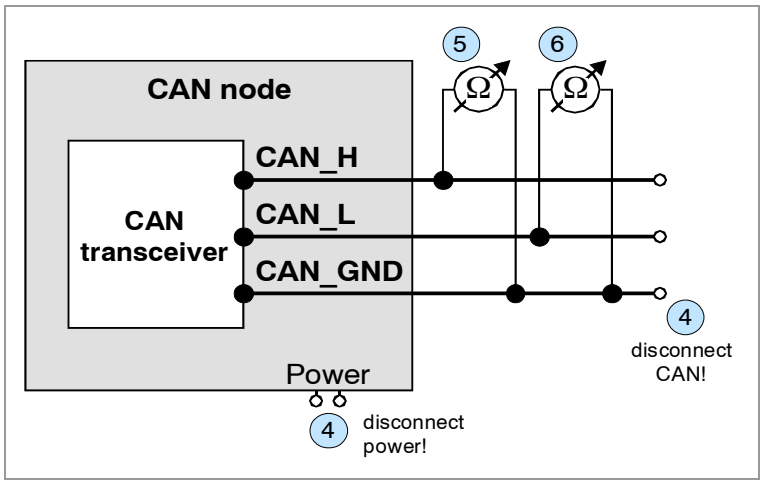


Figure 11: Measuring the internal resistance of CAN transceivers

13.6 Support by esd

If you have executed the fault diagnostic steps of this troubleshooting guide and you even can not find a solution for your problem our support department will be able to assist.
Please contact our support via email at **support@esd.eu** or by phone **+40-511-37298-130**.

14. EU Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG
EU DECLARATION OF CONFORMITY

Adresse / *Address*
esd electronics gmbh
Vahrenwalder Str. 207
30165 Hannover
Germany

esd erklärt, dass das Produkt *esd declares, that the product*	Typ, Modell, Artikel-Nr. *Type, Model, Article No.*
CPCI-CPU/5201-eMMC, **CPCI-CPU/5201**	**I.2404.01,** **I.2404.02**
die Anforderungen der Normen *fulfills the requirements of the standards*	**EN 61000-6-2:2005,** **EN 61000-6-4:2007/A1:2011**
gemäß folgendem Prüfbericht erfüllt. *according to test certificate.*	**H-K00-0531-14**
Das Produkt entspricht damit der EU-Richtlinie „EMV" *Therefore the product conforms to the EU Directive 'EMC'*	**2014/30/EU**
Das Produkt entspricht den EU-Richtlinien „RoHS" *The product conforms to the EU Directives 'RoHS'*	**2011/65/EU, 2015/863/EU**

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
This declaration loses its validity if the product is not used or run according to the manufacturer's documentation or if non-compliant modifications are made.

Name / *Name*	T. Bielert
Funktion / *Title*	QM-Beauftragter / *QM Representative*
Datum / *Date*	Hannover, 2019-04-01

Rechtsgültige Unterschrift / *authorized signature*

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15. Order Information

Type	Properties	Order No.
CPCI-CPU/5201	CompactPCI CPU board with MPC5121e, 400MHz, Interfaces via front panel: 1x100BASE-T, 1x CAN, 1x USB 2.0, 1x RS-232 and 4x LED, Additional interfaces onboard: 1x CompactFlash card holder, 2x CAN and 3x RS-232	I.2404.02
Software		
CPCI-CPU/5201-QNX-BSP (Bundle)	QNX-6 board support package Consists of: Board Support Package, 12 months hotline support and BSP updates. (I.2404.65)	I.2404.55
CPCI-CPU/5201-QNX-Support	Hotline support and BSP updates, for 12 months	I.2404.65
CPCI-CPU/5201-VxW-BSP (Bundle)	VxWorks board support package, Consist of: Board Support Package, 12 months hotline support and BSP updates. (I.2404.68)	I.2404.58
CPCI-CPU/5201-VxW-Support	Hotline support and BSP udates, for 12 months	I.2404.68

For detailed information about the driver availability of your special operating system, please contact our sales team.

Table 12: Order information

PDF Manuals
For availability of manuals see table below.
Please download the manuals as PDF documents from our esd website www.esd.eu for free.

Manuals		Order No.
CPCI-CPU/5201-ME	Hardware manual in English	I.2404.21
CAN-API-ME	NTCAN API manual Part 1: Application Developers Manual NTCAN API manual Part 2: Installation Guide	C.2001.21
CANopen-ME	CANopen manuals in English	C.2002.21

Table 13: Available manuals

Printed Manuals
If you need a printout of the manual additionally, please contact our sales team: sales@esd.eu for a quotation. Printed manuals may be ordered for a fee.