

FRC-EP170

Automotive Platform





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1 Introduction

1.1 Overview

The FlexRay FRC-EP170 is a powerful platform for the analysis, diagnostics, and simulation of FlexRay, CAN, LIN, and K-Line networks.

This manual should help you make optimum use of your device. Please read this manual before starting installation.

1.2 Features of the basic unit

- Measurement and analysis platform
- Up to two FlexRay interfaces
- Up to four high-speed CAN interfaces
- Up to one low-speed CAN interfaces
- One LIN interface
- One K-Line interface
- Up to four digital inputs/outputs (5 V TTL Level)
- One USB 2.0 device interface
- One USB 2.0 host interface
- One 10/100 Base-T Ethernet interface
- One RS232 interface
- Eight LEDs, of which 7 are freely configurable
- Real-time clock
- SDHC card slot
- Up to 32 Gbyte SD card support for logging data
- Two internal expansion slots
- 6-36 VDC power supply range with overvoltage and polarity protection
- Standby/hibernate modes
- Working temperature range -40 to +80 °C
- Remote control (optional)

2 Connections

The device has user interfaces (Ethernet, USB, SD Card, LEDs, etc.) on the front side and field bus interfaces (FlexRay, CAN, LIN, etc.) on the back.

The front of the device is equipped with the following connectors.



Figure 2-1: Front of the FRC-EP170

2.1 Power plug (6-36 VDC)

The unit is supplied with a DC voltage from 6 V to 36 V. The power supply input is protected against polarity reversal and against overvoltage.

| Pin | Signal | Description |
|-----|---------|------------------------|
| 1 | +VDC | Power supply voltage + |
| 2 | - (GND) | Power supply ground |
| 3 | KL15 | Digital input clamp 15 |

Table 2-1: Pinouts of the 6-36 VDC power plug

Please use the power supply cable provided with the device. This cable is also available separately as an accessory.

The power supply cable has the following colors on the individual lines.

| Pin | Color | Signal | Description |
|-----|----------------|-------------|---|
| 1 | white ws/WT | VDC + | Power supply +6 to +36 V with 4 mm red laboratory plug |
| 2 | brown br/BN | Ground - | Power supply ground with 4 mm black laboratory plug |
| 3 | green gn/GN | KL15 | Digital input clamp15 with 4 mm green laboratory plug |

Table 2-2: Pinouts of the power cable

The type of connector on the FRC-EP 170 is a 3-pin Binder male panel mount connector, 710 series, 09-0977-00-03.

The type of connector on the cable is a 3-pin Binder female cable connector, 710 series, 99-0976-10x-03.

Clamp 15 (KL15) function

Clamp 15 on the power connector has multiple functions. First, KL15 can be used as a wake-up from hibernate mode, and KL15 is also used when the system is turned on or booted to inform the software whether a software update procedure should be carried out.

A software command can cause the FRC-EP 170 to switch from normal mode into hibernate mode. If KL15 is activated in hibernate mode, that is, a voltage of over 6 V is applied, then the device is waked up, the system reboots, and it is then ready for operation. Before the command for hibernate mode, KL15 must be switched to ground (0 V).

KL15 is equipped with a pull-up resistor to +VDC (~80 kOhms). If KL15 is left open, the system behaves as though KL15 were still connected to power. This is the normal case and the system works in normal mode. In this case, hibernate mode is not possible, since the system would be immediately wakened again after the command for hibernate mode was issued.

If the system needs to be updated to a new software version, it is possible to signal this with KL15. If KL15 is connected to ground (0 V) and the device then turned on, the software enters update mode.

2.2 Ethernet connector (ETHERNET)

The Ethernet interface is implemented as a standard Ethernet RJ45. The Ethernet interface is galvanically isolated from the other interfaces.

2.3 USB device connector (USB-B)

The USB connector is used as a USB device interface to a PC. It is implemented as a standard USB B type.



The USB interface is not galvanically isolated due to system constraints, so this interface must be used with corresponding care. Always provide a grounded connection between your test object and the FRC-EP170 before connecting the PC to the FRC-EP170 via USB. Otherwise, a compensation current can flow between the test object and the PC through the USB connection, which under some circumstances can damage the PC.

2.4 USB host connector (USB-A)

The USB connector is used to connect USB devices to the FRC-EP170. It is implemented as a standard USB A type.

2.5 SD card slot

The SD card slot can work with all current SD and SDHC cards. The SD card slot has a push-push mechanism. To insert the card, push the card until it stops, at which point you hear and feel a click. The card is then held on its own. To remove the card, press the card to the stop again. The holding mechanism releases and the card can be pulled out.

2.6 Displays

On the front of the unit there are eight LEDs that can be used to read off the device and communications status.

| | |
|-----|-----|
| 4 ● | 8 ● |
| 3 ● | 7 ● |
| 2 ● | 6 ● |
| 1 ● | 5 ● |

LED 1 is implemented as a power LED and indicates the device status.

| Status | Description |
|------------------|--|
| "off" | The FRC-EP170 is not supplied with power (pin 1, power connector) |
| "Flashing green" | The FRC-EP170 is in hibernate mode and waits for a waking condition that can be configured via the software. |
| "Red" | The FRC-EP170 is in boot mode and the operating system is starting. |
| "green" | The FRC-EP170 has ended boot mode. Applications can be started or are being started. |

Table 2-3: Power LED display description

The notification of LEDs 2 through 8 can be configured via the software and are therefore application-dependent. Please see their functionality in the specific software manual or the software's online help.

2.7 Remote/debug interface (REMOTE)

The function of the remote/debug interface depends on the application executing. In general, however, there are three application options:

- If the software application in use supports remote control, the remote control provided by IXXAT as an accessory can be connected here.
- If the software application in use supports debugging or control functions via RS232, the cable available from IXXAT as an accessory can be used to connect to a PC.
- If the software application in use supports extended I/O functions, additional inputs/outputs can be used through this interface.

Please see the exact function of this interface in the specific software manual or the software's online help.

| Pin | Signal | Description |
|-----|-----------|--|
| 1 | +5 V | +5 V power supply for remote control, maximum current 20 mA |
| 2 | REM1 / TX | REMOTE1 digital output RS232 TX transmission signal to PC |
| 3 | REM2 / RX | REMOTE2 digital output RS232 RX received signal from PC |
| 4 | REM3 | REMOTE3 digital output |
| 5 | WKUP | Wake-up option through remote |
| 6 | GND | |
| 7 | - | Not used |

Table 2-4: Pinouts of the REMOTE connector

The type of connector on the FRC-EP 170 is a 7-pin Binder female panel mount connector, 710 series, 09-9478-00-07.

The type of connector on the cable is a 7-pin Binder male cable connector, 710 series, 99-9475-10x-07.

The back of the device is equipped with the following connectors:



Figure 2-4: Back of the FRC-EP170

The connectors are provided as DSUB HD15 (High Density 15-polig).

2.8 Connector X1 (D-SUB HD15 male)

| Pin Nr. | Signal | Kommentar |
|---------|-------------|--------------------------|
| 1 | CAN1 HS H | Hi-Speed CAN 1 Hi Signal |
| 6 | CAN1 HS L | Hi-Speed CAN 1 Lo Signal |
| 2 | CAN2 HS H | Hi-Speed CAN 2 Hi Signal |
| 7 | CAN2 HS L | Hi-Speed CAN 2 Lo Signal |
| 3 | GND | Common Ground |
| 4 | K-Line | K-Line Signal |
| 9 | LIN | LIN Signal |
| 5 | - | Provisioning |
| 10 | - | Provisioning |
| 11 | CAN1 LS L | Lo-Speed CAN 1 Lo Signal |
| 12 | CAN1 LS H | Lo-Speed CAN 1 Hi Signal |
| 13 | GND | Common Ground |
| 14 | - | Provisioning |
| 15 | Vbat (KL30) | Power Supply |
| 8 | - | Provisioning |

Table 2-5: Pinout of connector X1

CAN1 Hi-Speed and Lo-Speed are using the same CAN-Controller and thus the both interfaces can't be used at the same time.

2.9 Connector X2 (D-SUB HD15 female)

| Pin Nr. | Signal | Kommentar |
|---------|--------------------------------|---------------------------------|
| 1 | FR1A BP ^(*) | FlexRay channel 1 A, bus plus |
| 6 | FR1A BM ^(*) | FlexRay channel 1 A, bus minus |
| 2 | FR1B BP/FR2A BP ^(*) | Switchable via multiplexer |
| 7 | FR1B BM/FR2A BM ^(*) | Switchable via multiplexer |
| 3 | GND | Common Ground |
| 4 | CAN3 HS H | Hi-Speed CAN 3 Hi Signal |
| 9 | CAN3 HS L | Hi-Speed CAN 3 Lo Signal |
| 5 | CAN4 HS H | Hi-Speed CAN 4 Hi Signal |
| 10 | CAN4 HSL | Hi-Speed CAN 3 Lo Signal |
| 11 | DIG_IO1 | Digital input/output, channel 1 |
| 12 | DIG_IO2 | Digital input/output, channel 2 |
| 13 | GND | Common Ground |
| 14 | DIG_IO3 | Digital input/output, channel 3 |
| 15 | DIG_IO4 | Digital input/output, channel 4 |
| 8 | - | Provisioning |

Table 2-6: Pinout of connector X2

^(*) Only available on variants supporting FlexRay. In all other cases "Reserved"

2.10 Connector X1/2 Signal Details

2.10.1 FlexRay

The FRC-EP170 provides a FlexRay interface with two independent FlexRay communication controllers. Both controllers work on a shared FlexRay bus that is divided into channels A and B. However, via software they can be switched to work on individual FlexRay buses. In this case two times the channel A is brought to the connector. There is no bus termination resistor integrated into the device. If a bus termination resistor is required, it must be connected to the cable and/or to the connector. Always use suitable measurement leads for the device.



The device is also available as a CANonly variant. In that case the FlexRay controllers are built in but deactivated by software.

2.10.2 CAN Hi/Lo-Speed

For ISO 11898-2 high-speed CAN there are no bus termination resistances integrated into the device. If a bus termination resistance is required, it must be connected to the cable and/or to the connector. Suitable CAN measurement lines are available from IXXAT as accessories.

The ISO 11898-3 low-speed CAN coupling is connected through two integrated termination resistors of 2 kOhms each (RTH, RTL).

2.10.3 LIN

The interfaces can be used either as masters or slaves. In master mode, a 1 kOhm resistor is used on VBAT for LIN. In slave mode, this resistor is not connected.

2.10.4 K-LINE

For the K-Line interface, there is only one "K" line available. The interfaces can be used either as masters or slaves. In master mode, a 1 kOhm resistor is used on VBAT for K-Line. In slave mode, this resistor is not connected.

2.10.5 Digital I/O

The direction of the digital I/O's can be selected by software.

When used as digital output, a maximum level of 5V is reached when switched on. The output level voltage is dependent on the load. At the maximum load of 20mA a voltage level of 2.4V is reached (TTL High-Level). A protection for long lasting shortcuts or connections higher voltages is not implemented.

When used as input, the voltage level for detecting a logical '1' is typically 2,4V. The inputs are implemented by using Schmitt-Triggers, i.e. threshold for the level transition is provided.

The actual status of a digital output can be read back by the corresponding input.

2.10.6 VBat

At VBat the voltage of the power supply connected to +VDC of the power-plug (refer to chapter 2.1) is provided i.e. the power supply can also be supplied via this pin.

3 Software

The FRC-EP190 is a Linux platform which is able to work without any connected PC. For this so called „standalone function“ an application/configuration is needed, which is created and downloaded to the device by means of a PC based tool (Automotive Configuration Tool).

3.1 Automotive Configuration Tool

The ACT tool can be downloaded from the HMS homepage (<http://www.ixxat.com/support>). There's only one software variant existing, whose functional range is determined by a USB license dongle. Actually, there are three different license stages available:

1. Freeware: For this purpose no license dongle is needed. In this stage all data logging functions are available.
2. Gateway: The main difference compared to stage (1) is, that in this case data can't only be received but also be sent from/to all fieldbuses. Hence also CAN2CAN gateways are possible.
3. Full version: In this stage all functions of the ACT are activated. Therefore it is as an example also possible to create residual bus simulations.

A detailed list of the corresponding function contents can also be found on the homepage.

3.2 Installation

After the download, the ACT tool is available as a ZIP container. In a first step, this container should be unpacked in a user defined folder on a local drive. Within the ZIP container a executable installation file ACT-w.x.yyy.z-CM.exe can be found. Upon execution of this installation file, the ACT setup assistant is started. Please follow the given instructions. At the end of the process the ACT tool is made available on your PC.

3.3 Working with the ACT

The function content of the ACT tool is dependent on the used license stage. To find out which functions are provided in your specific case, please refer to the ACT online help. After having started the ACT application you can find it under the menu item "Help" in the main menu.

3.4 Basic data logging configuration

As a basic configuration of the ACT tool, an easy data logger writing all messages of the CAN busses 1..4 (500kBit/s) in ASCII format to the SD card is provided. To download this configuration to your device please follow the steps below:

1. Power-up your device
2. Connect it via USB to the PC
3. Start the IxAdmin tool
4. Select menu item „File→Connect New Device“
5. Now choose your specific device type out of the list and select “USB”
6. Pressing „OK“ will establish the connection to the device

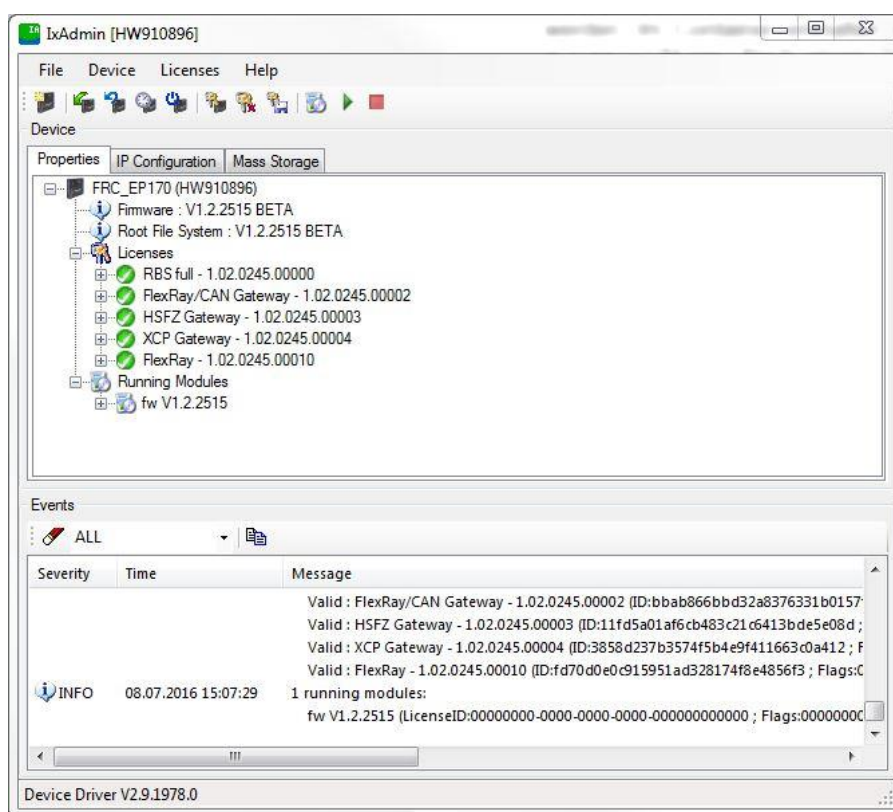


Figure 3-1: IxAdmin example device connect dialog

7. Now choose „Device→Add/Remove Application“
8. Open the device configuration „Basic_Logger.sdcfg“ in directory „<c:\Users\Public\Documents\IXXAT\ACT\Projects\BasicLogger\DeviceConfig>“

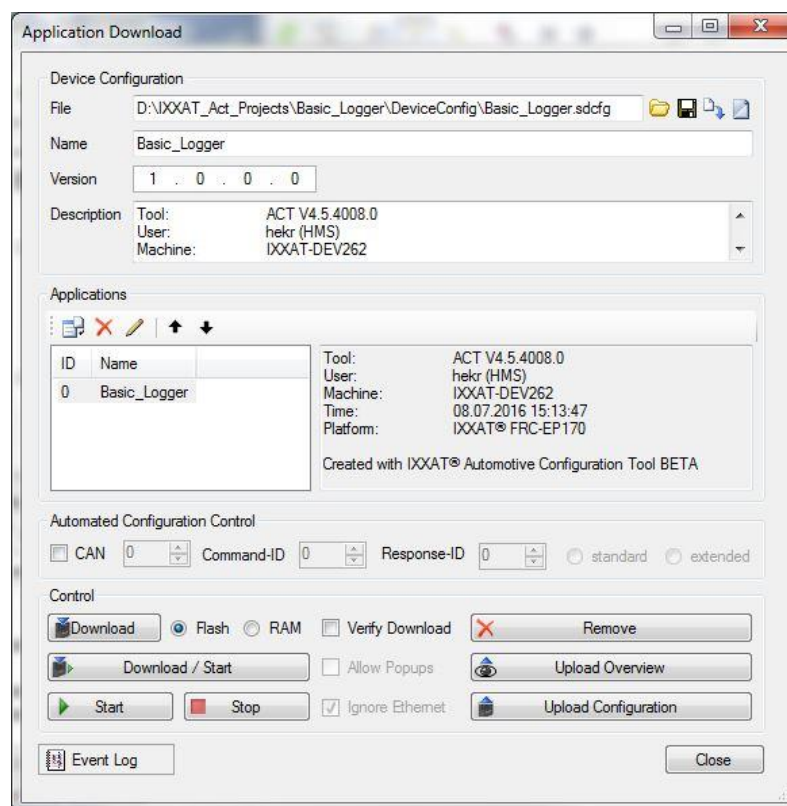


Figure 3-2: IxAdmin example application download dialog

9. By pressing the button „Download/Start“ the application will be loaded to the device and started

For more information about the possibilities to change the CAN baudrate, to start/stop the logger and to upload the logged data please refer to the online help of the IxAdmin.

4 Accessories

The following accessories are available:

| Interface | Description | Item no. |
|-----------|--|-----------------|
| POWER | Cable with 3 banana plugs; 2.0 m | 1.04.0089.00001 |
| REMOTE | Debugging cable with D-SUB 9 for RS232 for connection to a PC | 1.04.0089.00301 |
| X1 | Cable with D-SUB 15 HD female and open ends, 1,5m | 1.04.0089.00100 |
| X1 | Cable with D-SUB 15 HD female and open ends, 0.5m | 1.04.0089.00103 |
| X1 | Breakout box with D-SUB 15 HD female and five D-SUB 9, 0.5m | 1.01.0081.00200 |
| X2 | FlexRay-1A cable with D-SUB 15 HD and one D-SUB 9, 1.5m | 1.04.0089.00102 |
| X2 | D-SUB 15 HD male gender changer to adapt the X1 accessories and the FlexRay-1A cable to X2 | 1.04.0075.04000 |

Table 4-1: Accessories

5 Appendix

5.1 Technical data

The following data refer to the basic equipment of the device.

| | |
|-----------------------------------|--|
| Dimensions: | 140 x 110 x 40 mm (L x W x H) |
| Weight: | approx. 390 g |
| Housing material: | aluminum |
| Working temperature range: | -40 °C up to +80 °C |
| Storage temperature range: | -40 °C up to +85 °C |
| Relative humidity | 10 - 95 %, no condensation |
| Power supply: | 6 - 36 V DC |
| Current consumption: | Typically at 12 V, 320 mA |
| Host system: | Power PC 256 MByte RAM 256 MByte Flash |
| Ethernet | 10/100 MBit/s, RJ45 |
| USB | 2.0 High Speed Device, USB-B |
| USB | 2.0 High Speed Host , USB-A |
| FlexRay Communication Controller: | 2 x Freescale MFR 4310 |
| FlexRay transceiver: | NXP TJA1080 |
| CAN transceiver high-speed: | Texas Instruments SN65HVD251 |
| CAN transceiver low-speed: | NXP TJA1054T |
| CAN bus terminating resistor: | None (high-speed), RTH=RTL=2 kΩ (Low-Speed) |
| LIN Transceiver: | NXP TJA1020 |
| K-LINE transceiver: | Vishay SI9243AEY |
| System startup time: | < 5 seconds from power-on |

5.2 Cable for FlexRay-1A

A preassembled cable (order number 1.04.0089.00102) is available that can be used to bring the FlexRay-1A interface from device connector X2 to a standard D-SUB 9 connector. The FlexRay termination resistor is integrated into the connector housing on the device side.

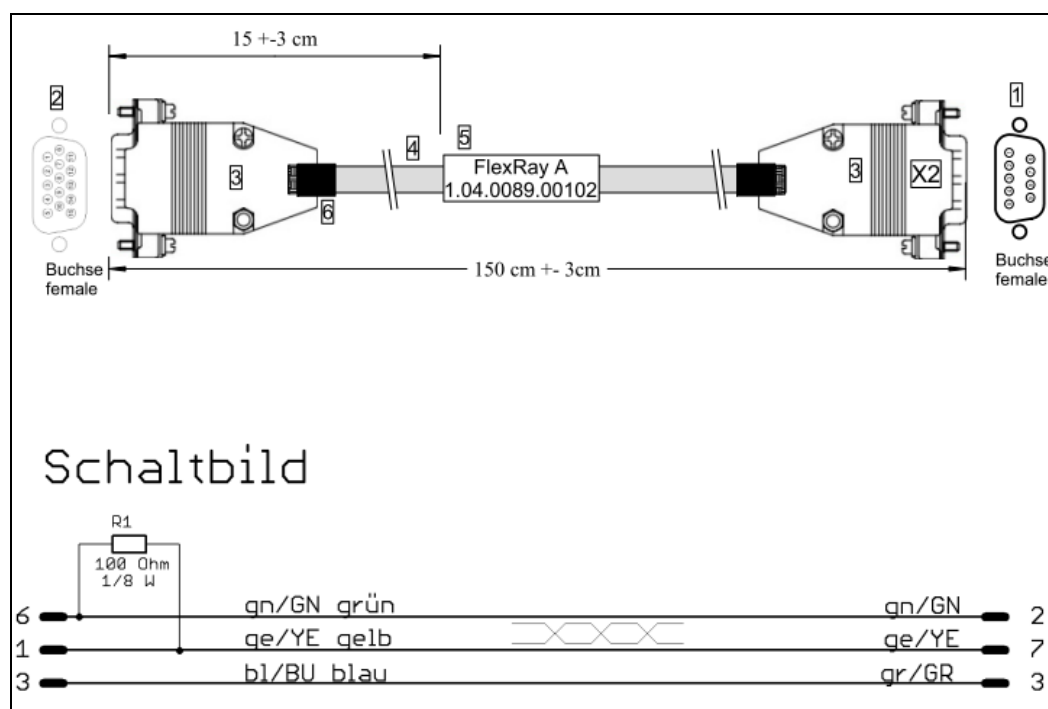


Bild 5-2: FlexRay-A Cable

5.3 Breakout box for X1/2

Connector X1/2, do provide several interfaces. To make each of these interfaces available on a single connector, there is a breakout box (order number 1.01.0081.0020) available with a cable length of 50cm:



Figure 5-3: X1/2 breakout box

| Connector | Interface | Pinouts on D-Sub 9 | |
|-----------|------------|--------------------|--------------|
| | | Pin | Signal |
| Y1 | CAN 1 HS | 2 | CAN L |
| | | 7 | CAN H |
| | | 3,6 | GND |
| Y2 | CAN 2 | | Like Y1 |
| Y3 | K-Line/LIN | 2 | LIN |
| | | 7 | K-Line |
| | | 3,6 | GND |
| Y4 | - | | Provisioning |
| Y5 | CAN 1 LS | 1 | CAN L |
| | | 2 | CAN H |
| | | 4 | VBat |
| | | 6 | GND |

Table 5-3: X1 breakout box connector pinouts

| Connector | Interface | Pinouts on D-Sub 9 | |
|-----------|---------------|--------------------|------------|
| | | Pin | Signal |
| Y1 | FlexRay 1A | 2 | FR BM |
| | | 7 | FR BP |
| | | 3,6 | GND |
| Y2 | FlexRay 1B/2A | | Like Y1 |
| Y3 | CAN 3 | 2 | CAN L |
| | | 7 | CAN H |
| | | 3,6 | GND |
| Y4 | CAN 4 | | Like Y3 |
| Y5 | Digital I/O | 1,2,3,4 | DIG_IO1..4 |
| | | 6 | GNDIO |

Table 5-3: X2 breakout box connector pinouts

5.4 Breakout cable for X1/2

Connector X1/2 can provide any of several interfaces. For the simple manufacture of specific adapters, breakout cables (order number 1.04 0089.00100/00103) are available in different lengths:

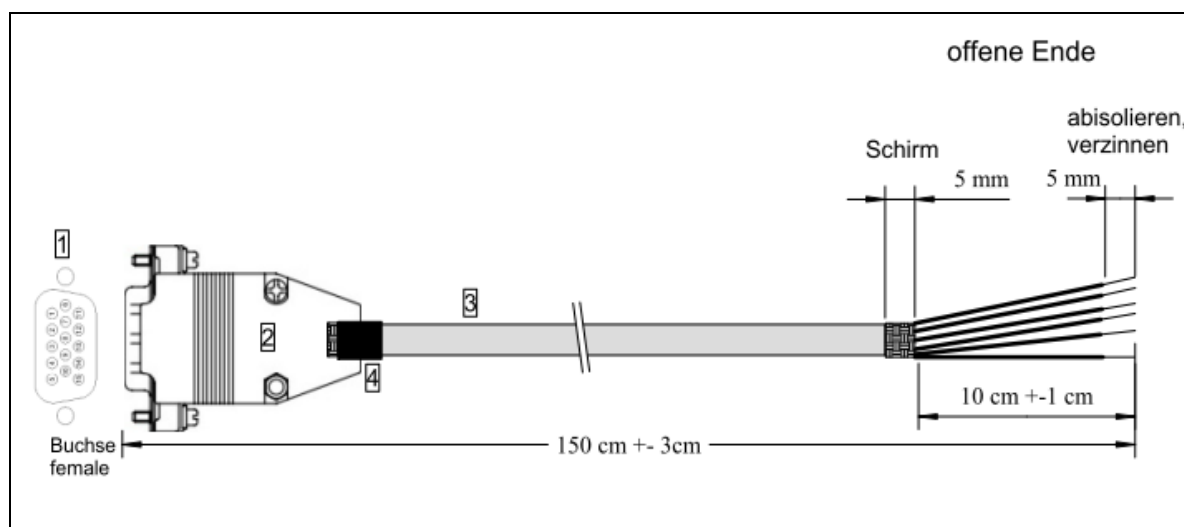


Figure 5-4: X5 breakout cable

| Pin | Color | Pin | Color |
|-----|-------|-----|-------|
| 1 | WT | 9 | PK |
| 2 | GN | 10 | RD |
| 3 | SW | 11 | GY-PK |
| 4 | GY | 12 | RD-BU |
| 5 | BU | 13 | WT-YE |
| 6 | BN | 14 | WH-GN |
| 7 | YE | 15 | BN-GN |
| 8 | VT | | |

Table 5-4: X1/2 breakout cable pinouts

5.5 Support

For more information on our products, FAQ lists and installation tips, please refer to the support area on our homepage (www.hms-networks.de). There you will also find information on current product versions and available updates.

5.6 Returning hardware

If it is necessary to return hardware to us, please download the relevant RMA form from our homepage and follow the instructions on this form.

5.7 Disposing of old equipment

This product is covered by ElektroG (WEEE) and has to be disposed according to ElektroG (WEEE) separately. Products of HMS, which are covered by ElektroG, are exclusively for commercial use and marked with the symbol of the crossed-out garbage can.

According to the B2B regulations, the disposal in accordance with § 10 para. 2 clause 3 Electrical and Electronic Equipment act in the version of 16.03.2005 is regulated separately in the General Terms and Conditions and its supplements of HMS. The terms and conditions, its supplements and other information on disposal of old equipment can be downloaded at www.hms-networks.de.