

FlexRay CCM / FRC-EP150

PC Interface for FlexRay and CAN



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1 Introduction

1.1 Overview

The FlexRay CCM/FRC-EP150 is a powerful PC interface for the analysis, diagnostics and stimulation of FlexRay and CAN networks.

This manual is intended to help you make full use of your interface. Please read this manual before beginning with installation.

1.2 Features

- Measuring and analysis platform for FlexRay and CAN networks
- FlexRay connection via plug-in boards. Upgradeable to future protocol versions
- Current FlexRay protocol support via Freescale MFR4310
- FlexRay Dual Channel 2 x 10 MBit/s
- FlexRay Dual Communication Controller option available
- FlexRay bus connection via the Physical-Layer-Chip Philips TJA1080
- 2 x CAN bus connection in accordance with ISO 11898-2 and 11898-3 switchable via software
- 2 x CAN bus connection in accordance with ISO 11898-2 (FRC-EP150 only)
- Fast Ethernet 100 MBit/s
- Trigger interfaces: 4 x output, 2 x input
- Powerful microprocessor Power PC 866 with 133 MHz, 64 MByte RAM and 32 MByte FLASH
- Highly integrated FPGA with one million gates for FIFO-memory, time stamp and extended routing
- Two microcontrollers HCS12 for FlexRay and CAN communication
- All interfaces galvanically isolated
- Power supply from 6 to 50 V DC with overvoltage and reverse battery protection
- Housing and connectors suitable for use in automotive environment
- Open FlexRay and CAN PC driver interface (VCI) for Windows XP, Windows 2000 and Windows Vista

Fig. 1-1/1-2 shows the block diagram of the basic board with all main interfaces and Fig. 1-3/1-4 the block diagram of the FlexRay plug-in board. Depending on the version of the FlexRay plug-in board, the architecture can be differently designed.

1.3 Block diagram

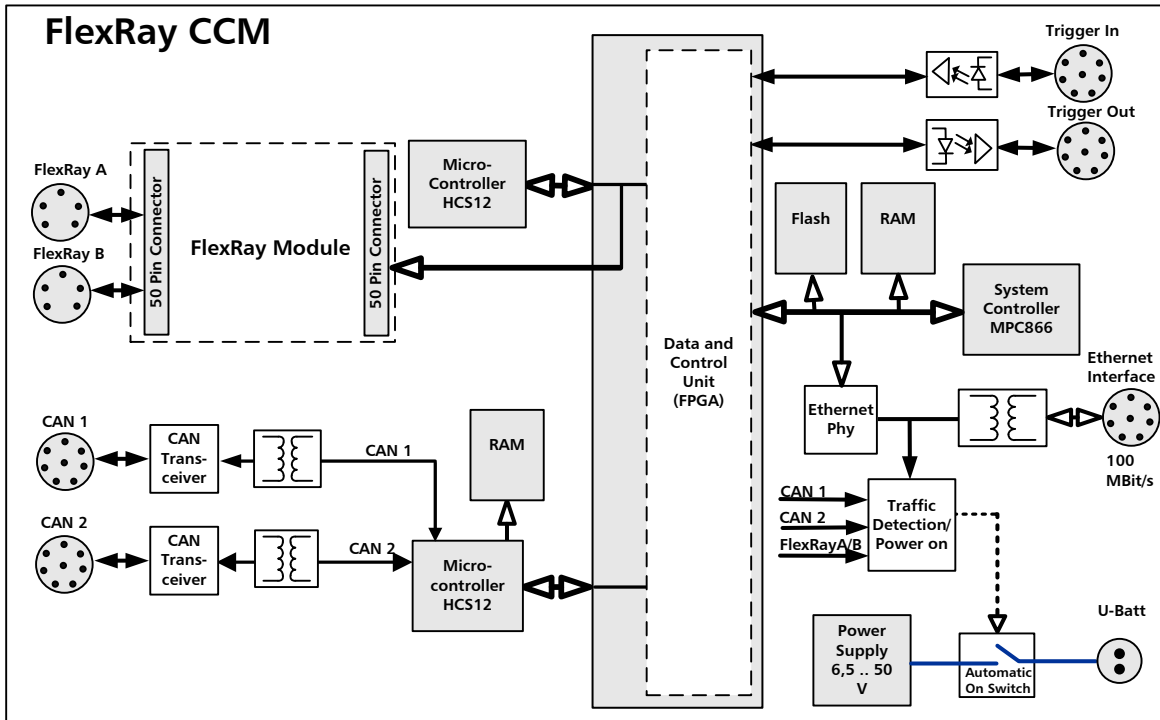


Fig. 1-1: Block diagram of the FlexRay CCM

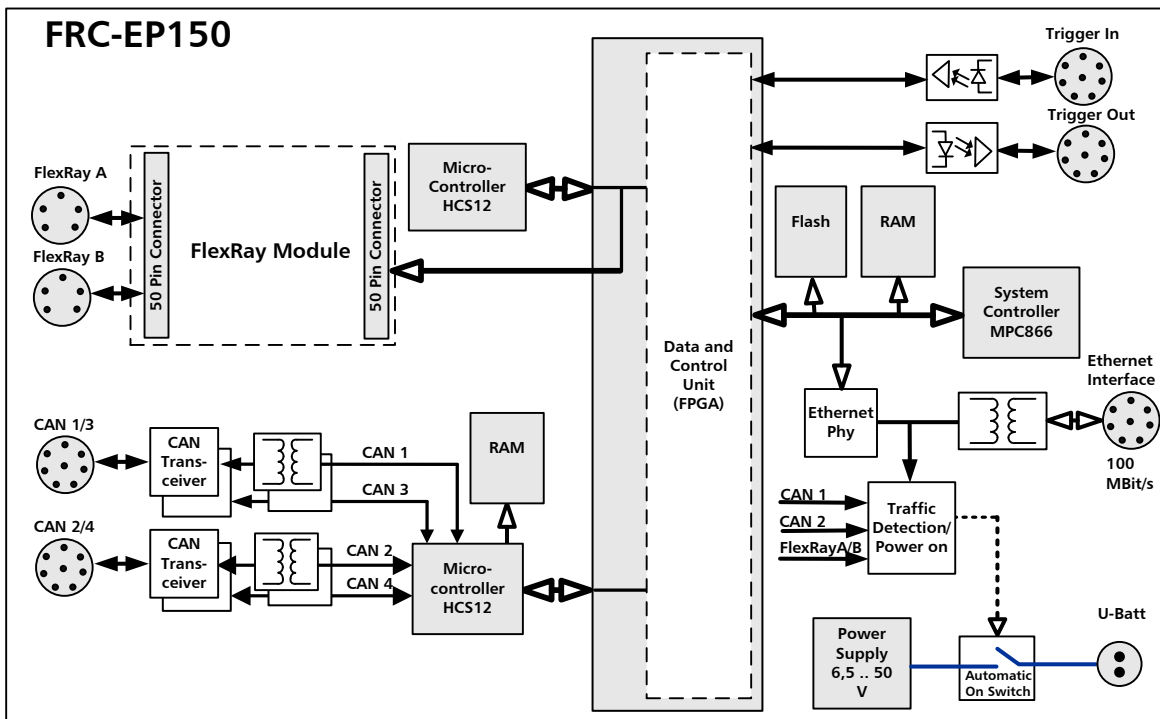


Fig. 1-2: Block diagram of the FRC-EP150

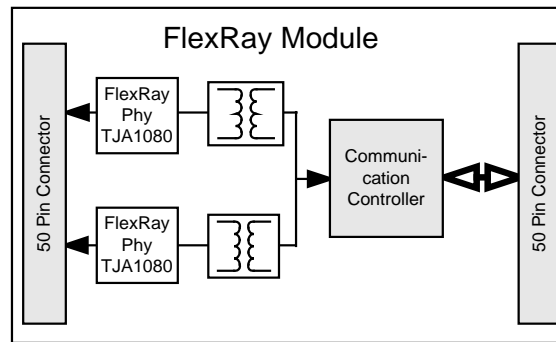


Fig. 1-3: Block diagram of the FlexRay plug-in module

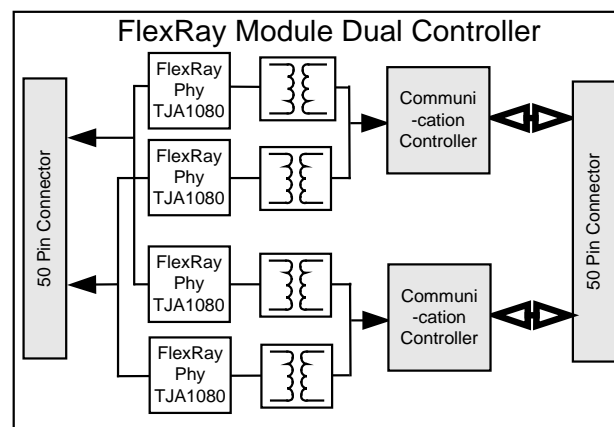


Fig. 1-4: Block diagram of the FlexRay plug-in module

1.4 Support

For more information on our products, FAQ lists and installation tips, please refer to the support section of our website (<http://www.ixxat.de>), which also contains information on current product versions and available updates.

If you have any further questions after studying the information on our website and the manuals, please contact our support department. The support section on our website contains the relevant forms for your support request. In order to facilitate our support work and enable a fast response, please provide precise information on the individual points and describe your question or problem in detail.

If you would prefer to contact our support department by phone, please also send a support request via our website first, so that our support department has the relevant information available.

1.5 Returning hardware

To enable fast, correct processing, please apply for an RMA number before returning hardware using our on-line "RMA form", which you will find in the Support section on our website.

After applying for the RMA number, you will receive a return delivery note from us, which you should enclose with the return delivery. If returns are made without an RMA number or a return delivery note, we reserve the right to return the delivery at your expense. A detailed description of the RMA procedure can be found in the Support section on our website.

2 Installation

2.1 Hardware installation

Connect the device to the supply voltage and connect it to a PC via Ethernet. Only the cables of IXXAT may be used to operate the FlexRay CCM, see section "Accessories".

2.2 Software installation

A PC driver is required to operate the device. For installation of the VCI driver under Windows 2000/XP/Vista, please refer to the VCI installation manual.

3 Connections

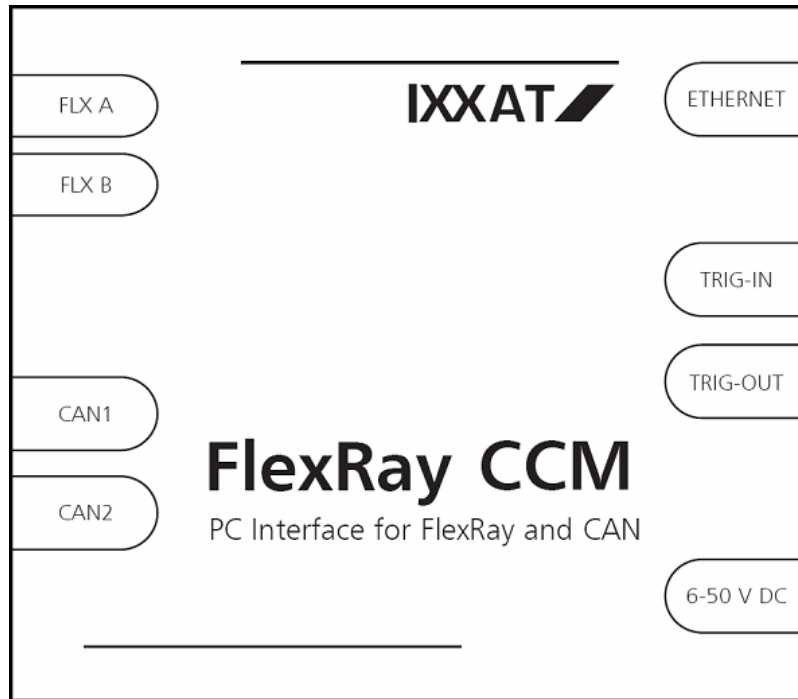


Fig. 3-1: View of FlexRay CCM

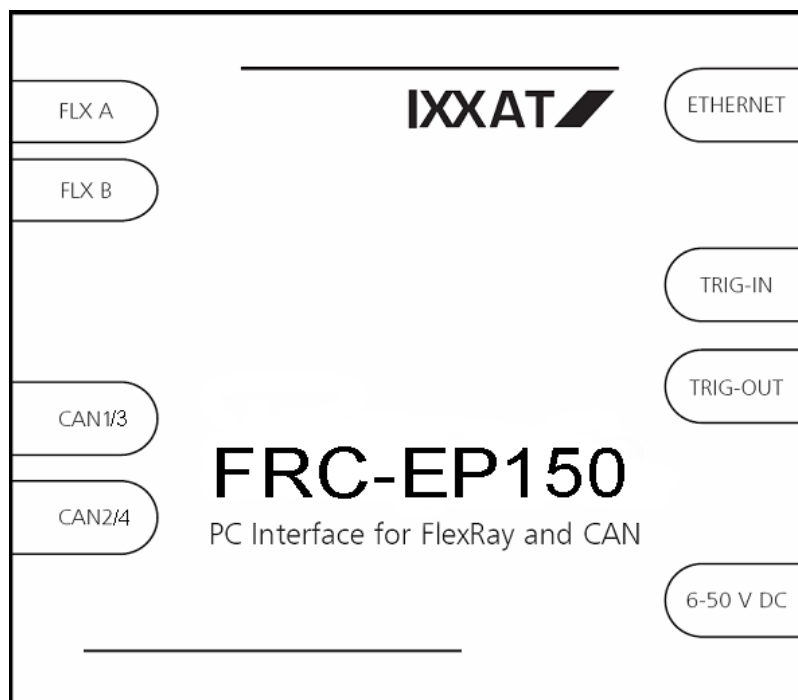


Fig. 3-2: View of FRC-EP150

3.1 Pin assignment

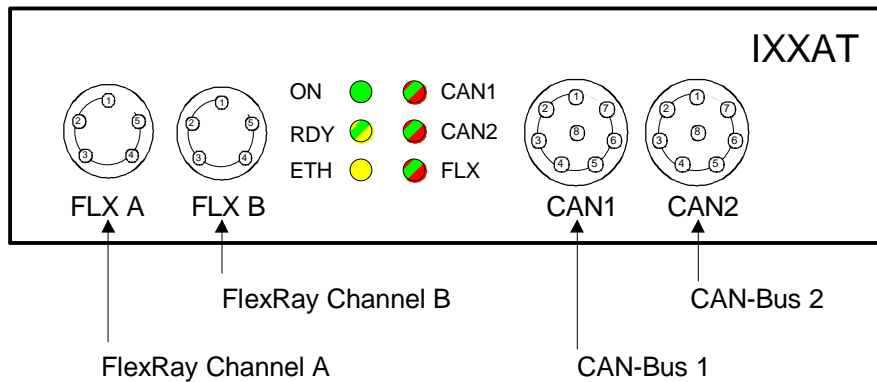


Fig. 3-3: Connectors and LEDs on the front of the device (FR-CCM)

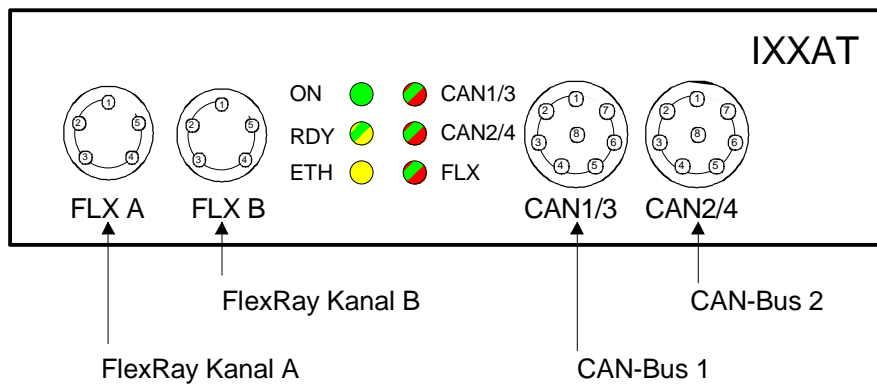


Fig. 3-4: Connectors and LEDs on the front of the device (FRC-EP150)

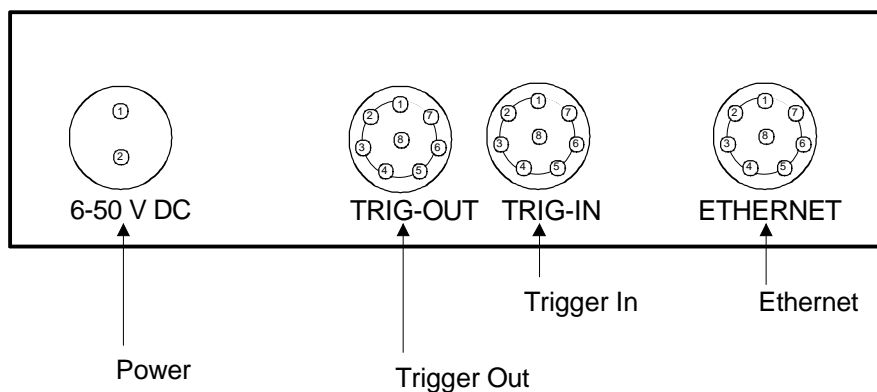


Fig. 3-5: Connectors on the back of the device

The following table provides an overview of the connectors used by the device.

Interface	Vendor	Type / remark
Power supply	Lemo	EPJ.1B.302.HLD
Ethernet	Lemo	EPD.1B.308.YLN
2 x CAN	Lemo	EPC.1B.308.HLN
2 x FlexRay	Lemo	EPB.0B.305.HLN
Trigger-In / Trigger-Out	Lemo	EPB.1B.308.HLN

Table 3-1: Connectors of the FlexRay CCM used

The interfaces are galvanically isolated from each other. In case of the FRC-EP150, the CAN1/3- and CAN2/4-Interfaces do reside on the same potential. A more detailed description is given in the relevant section. For shielding, please refer to section 3.2.

3.1.1 FlexRay connector (FLX A & FLX B)

The differential signal pairs (BM and BP) for the FlexRay bus channels A and B are connected to the FlexRay connectors. The connection assignment is listed in Table 3-2.

Pin	Signal
1	Ground (FlexRay)
2	FlexRay Bus Minus (BM)
3	FlexRay Bus Minus (BM)
4	FlexRay Bus Plus (BP)
5	FlexRay Bus Plus (BP)

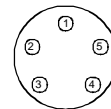


Table 3-2: Pin assignment of the FlexRay connector

The signal BM is connected to pin 2 and 3. These pins are connected with each other in the device. The signal BP is connected to pin 4 and 5. These pins are connected with each other in the device.

No bus terminal resistor is integrated in the device. If a bus terminal resistor is required, it must be connected to the cable or connector. FlexRay cables with integrated terminal resistor are available as accessories.

The signal pair of the cable can be connected to pin 2 and pin 5. A bus terminal resistor can be connected between pin 3 and pin 4.

With a Y-cable, the signal pair of cable 1 is connected to pin 2 and pin 5. The signal pair of cable 2 is connected to pin 3 and pin 4. A suitable Y-cable is available as accessories.

Always use cables suitable for the device, which are available in various versions, see section "Accessories".

Connections

The FlexRay bus is isolated galvanically from the other interfaces. Channels A and B are connected to the same potential.

3.1.2 FlexRay CCM CAN connector (CAN1 & CAN2)

The CAN bus connection supports the physical bus access in accordance with ISO 11898-2 and ISO 11898-3. It is switched over via software.

The differential signal pair (CAN-low and CAN-high) and the ground are connected to the CAN-connector.

Pin	Signal
1	Reserved
2	CAN-low
3, 6	Ground (CAN)
4, 5	Reserved
7	CAN-high
8	CAN VBAT

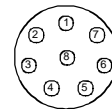


Table 3-3: Pin assignment of the CAN connector

No bus terminal resistor is integrated for high-speed CAN ISO 11898-2. If a bus terminal resistor is required, it must be connected to the cable or connector. FlexRay instrument leads with integrated terminal resistor are available as accessories.

The low-speed CAN connection according to ISO 11898-3 is terminated via two integrated terminal resistors of 2.2 kOhm each (RTH,RTL).

CAN VBAT is used to supply the terminal resistors of the CAN low-speed connection(RTH). This is necessary when the device is not supplied with voltage via the Power connector or the device is in Sleep mode. A voltage of 5 V to 24 V can then be supplied.

The two CAN buses are isolated galvanically from each other and from all other interfaces.

3.1.3 FRC-EP150 CAN connector (CAN1/3 & CAN2/4)

The connections of the CAN-Interfaces CAN1 and CAN2 are equivalent as described in chapter 3.1.2.

The CAN bus connection of the CAN-Interfaces CAN3 and CAN4 does support the physical bus access in accordance with ISO 11898-2 only. The differential signal pair (CAN-low and CAN-high) and the ground are connected to the CAN-connector.

Pin	Signal
1	CAN3/4-Low
2	CAN1/2-low
3, 6	Ground (CAN)
4	CAN3/4-High
5	Reserved
7	CAN1/2-high
8	CAN VBAT

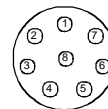


Table 3-4: Pin assignment of the CAN connector

No bus terminal resistor is integrated for high-speed CAN ISO 11898-2. If a bus terminal resistor is required, it must be connected to the cable or connector. FlexRay instrument leads with integrated terminal resistor are available as accessories.

The two CAN busses CAN1/3 and CAN2/4 are isolated galvanically from each other and from all other interfaces.

3.1.4 Power connector (6 - 50 V DC)

The FlexRay CCM is supplied with direct current voltage of 6 V to 50 V. The power supply input is protected against pole reversal and overvoltage.

Pin	Signal
1	Supply voltage +
2	Ground

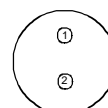


Table 3-5: Pin assignment of the power connector

Use the appropriate power supply cable for the device. This is also available separately as an accessory.

3.1.5 Ethernet connector (ETHERNET)

The Ethernet connector connects the signals for 10/100 base Ethernet.

Pin	Signal
1	Connected with pin 2
2	Connected with pin 1
3	Connected with pin 7
4	RX+
5	TX-
6	RX-
7	Connected with pin 3
8	TX+

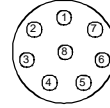


Table 3-6: Pin assignment of the ETHERNET connector

Ethernet is galvanically isolated from other interfaces.

Only use the appropriate Ethernet cable together with the device. This cable is also available as an accessory.

3.1.6 Trigger/Digital-Out connector (TRIG-OUT)

The 4 Trigger/Digital-Output signals are connected to the Trigger-Out connector.

Pin	Signal
1	Trigger 1
2	Ground (Trigger out)
3	Trigger 2
4	Ground (Trigger out)
5	Trigger 3
6	Ground (Trigger out)
7	Trigger 4
8	Ground (Trigger out)

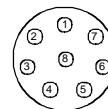


Table 3-7: Pin assignment of the TRIG-OUT connector

The Trigger output is galvanically isolated from the other interfaces. A suitable trigger cable is available for the Trigger outputs. See section "Accessories".

3.1.7 Trigger-In connector (TRIG-IN)

The 2 Trigger input signals are connected to the Trigger-In connector.

Pin	Signal
1	Trigger 1
2	Ground (Trigger in)
3	Trigger 2
4	Ground (Trigger in)
5-8	Not used

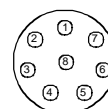


Table 3-8: Pin assignment of the TRIG-IN connector

The Trigger-In is galvanically isolated from the other interfaces. A suitable cable is available for the Trigger inputs. See section "Accessories".

3.2 Shielding

The device distinguishes between the signal ground (CANx_GND, FLX_GND, TRGx_GND), the supply ground (GND) and the housing ground (PE). Each interface has its own ground potential, as the interfaces are galvanically isolated from each other. Fig. 3-6 shows an overview of the shields and of the potentials of the individual interfaces.

The shields of CAN1, CAN2, FlexRay, Trigger-input, Trigger-output and Ethernet are connected to the housing ground (PE) via RC-circuits and a varistor (VDR). The shield is connected to the individual grounds via RC-circuits. Fig. 3-7 shows the schematic of these RC-circuits

The isolation voltage of the shield to the PE is max. 50 V DC.

The isolation voltage of the signal ground against the shield and against the supply ground as well as against other interfaces is max. 100 V DC.

The shielding of the power connector is connected directly to PE. The ground of the power connector is only connected to the housing (PE) via RC-circuits

PE is designed as a closed ring around the PCB and connected to the housing via the screw points and with EMC spring contacts.

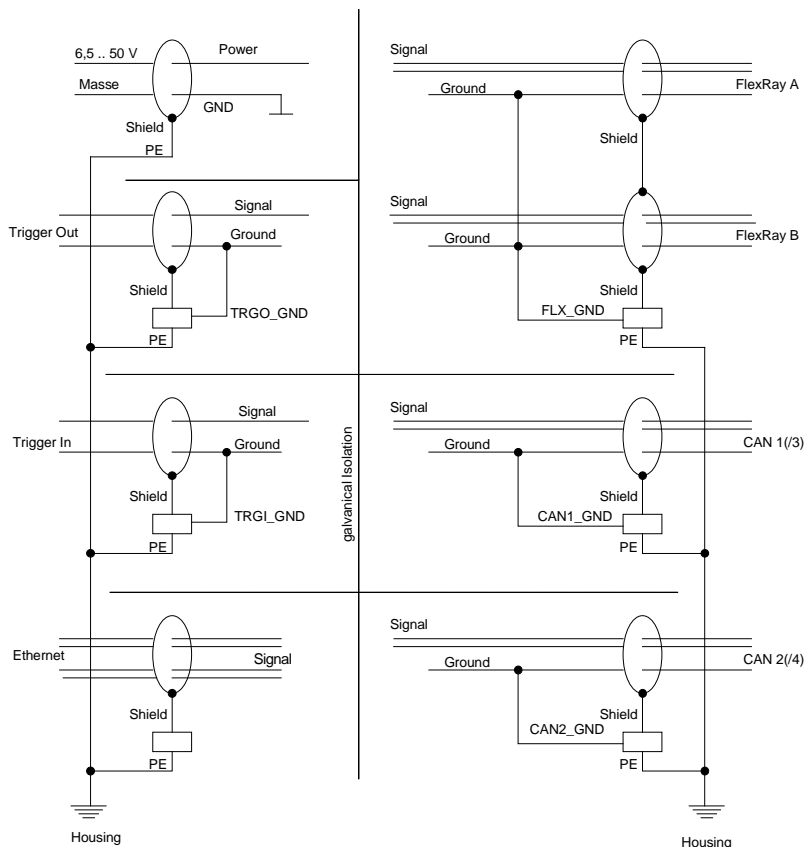


Fig. 3-6: Shielding concept

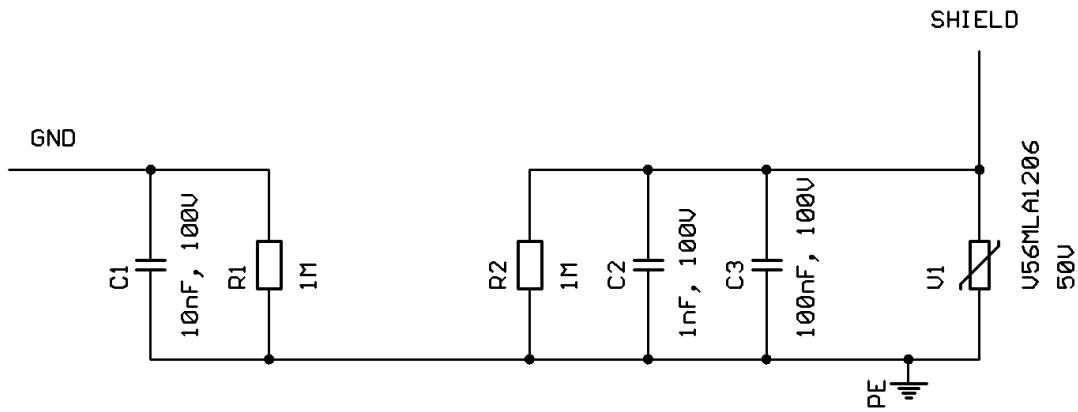


Fig. 3-7: Shielding connected with PE and ground

3.3 Trigger/Digital output

The functionality of each individual output can be defined via the FPGA register “MPC866 Trigger Control Register”. Two different modes of operation can be selected:

The Trigger mode is used for analysis and measurement of the real-time behavior of the buses. Trigger conditions can be set via the software. When the configured trigger condition is fulfilled, a voltage pulse appears on the trigger output. This voltage pulse is generated in the device with an optocoupler and a transistor output (see Fig. 3-9) and can be made visible, for example, with an oscilloscope.

Connections

The following Fig. 3-8 shows the timing relation with the output signal. The trigger pulse is an internal signal generated in the FlexRay CCM. The Trigger output is connected externally to the Trigger-Out connector.

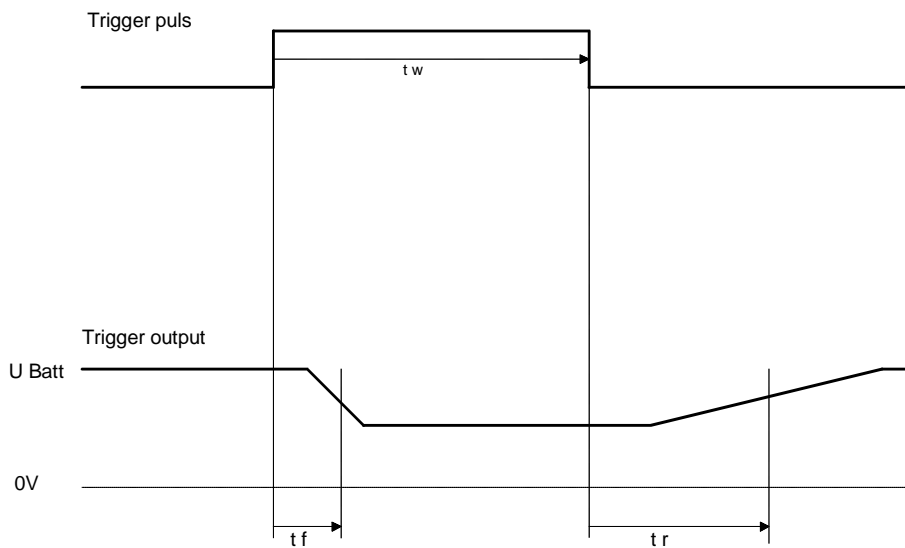


Fig. 3-8: Trigger-Out timing

The voltage and timing parameters for the Trigger output are listed in the following table.

Parameter	Designation	Value	Unit of measurement
U Batt	Battery voltage	1.5	V
U Batt max*	Maximum battery voltage*	60	V
t w	Pulse width (width)	typically 1	us
t f	Fall time (fall)	typically 5	us
t r	Rise time (rise)	typically 50	us

Table 3-9: Trigger-Out parameters

* The maximum operating voltage results from the electric strength of the optocoupler. The maximum power loss on the optocoupler and on the pre-resistor in the device is restricted by the pulse-interval ratio.

The digital mode is used as user defined output. In this mode, the software is able to switch the outputs into a defined state ("High" or "Low"). With a appropriate adaptation circuit, external loads (i.e. signal lamps, relays) can be switched by software.

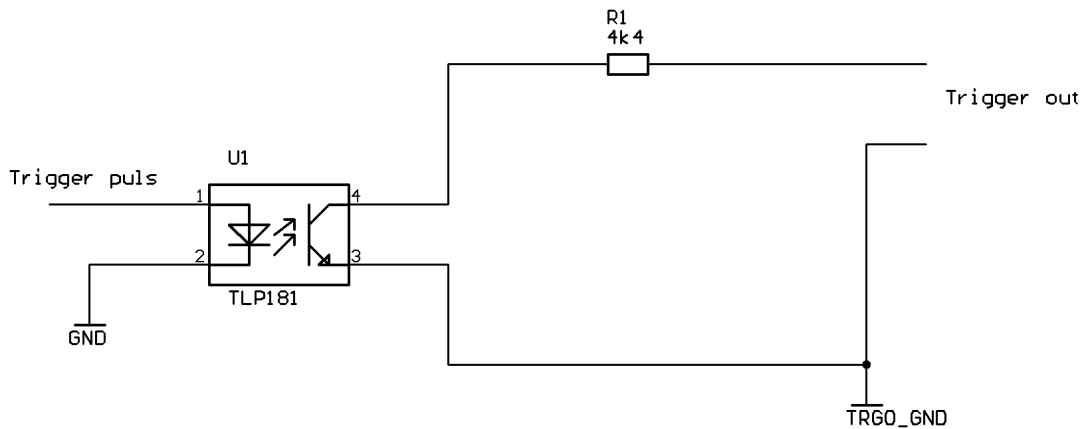


Fig. 3-9: Internal Trigger/Digital-Out circuit

This output must be supplied with an external voltage via a resistor. The following circuit (Fig. 3-10) can be connected to a Trigger output.

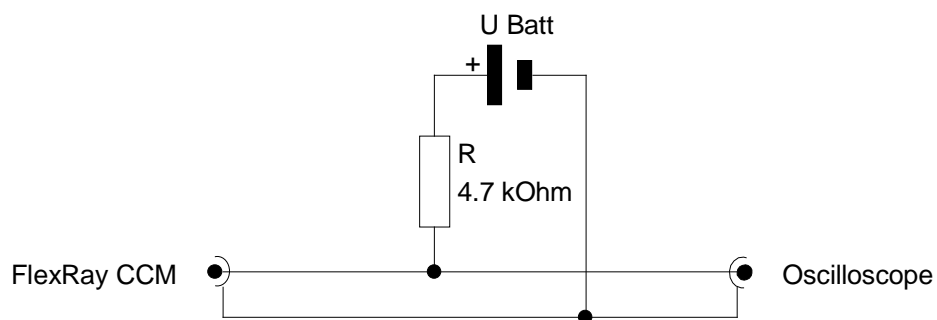


Fig. 3-10: Connection of an oscilloscope to Trigger-Out

3.4 Trigger input

The device software provides stimulation functions via the Trigger input. The trigger actions are configured via software. If a voltage pulse is supplied on the Trigger input, the configured trigger action is executed. The supplied voltage pulse is analyzed in the device via an optocoupler.

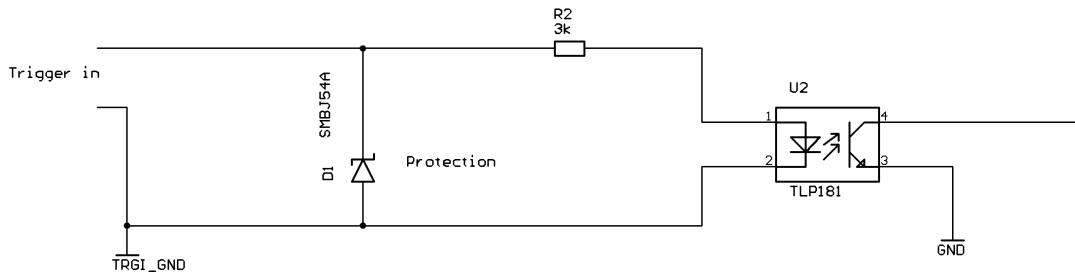


Fig. 3-11: Internal Trigger-In circuit

The voltage and timing parameters for the Trigger-In are given in Fig. 3-12 and Table 3-10.

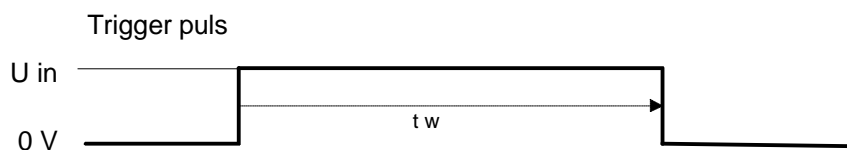


Fig. 3-12: Trigger-In timing

Parameter	Designation	Value	Unit of measurement
U in min	Minimum voltage	4	V
U in max	Maximum voltage	42	V
t w min	Pulse width	10	us

Table 3-10: Trigger-In parameters

4 Displays

There are six LEDs on the front of the device via which the device and communication status can be read off.

ON  CAN1
 RDY   CAN2
 ETH  FLX

LED	Color / type	Function
ON Power	OFF	Device is off, no power supply
	GREEN flashing (const. frequency)	Device is in Standby mode (wake-up with activity on Ethernet or bus)
	GREEN	Device is in active state
RDY OS Ready	OFF	Boot loader not running (error)
	YELLOW flashing (const. frequency)	Boot loader running, the device is being initialized or is waiting for an Ethernet connection
	YELLOW	Application running, no Ethernet-Link pulse
	GREEN flashing (const. frequency)	Application running, with Ethernet-Link pulse
	GREEN	Application running, Ethernet connection to PC was set up
	YELLOW/GREEN blinking	Stand-alone application running
ETH Ethernet	OFF	No Ethernet data
	YELLOW flickering (data frequency)	Ethernet data
CAN (2 LEDs)	OFF	During start or boot-up: boot manager or application not running (error) In operation: waiting for CAN data (no CAN data traffic)
	RED flashing (const. frequency)	CAN controller is not configured (boot manager or application running)
	RED/GREEN flash alternately	FLASH loader for CAN running
	GREEN flashing (const. frequency)	CAN controller is configured and waiting for start.
	GREEN flickering (data frequency)	Normal CAN operation, CAN data traffic running
	RED flickering (data frequency)	Faulty operation (CAN Error-Warning bit is set)
	RED	Communication failure (Bus Off)
FLX FlexRay	OFF	Boot manager or application not running (error)
	RED flashing (const. frequency)	FlexRay Communication Controller is not configured (boot manager or application running)

Firmware updates

	RED/GREEN flash alternately	FLASH loader for FlexRay running
	GREEN flashing (const. frequency)	FlexRay Communication Controller is configured
	RED	FlexRay Communication Controller: No Normal Active Operation
	GREEN	FlexRay Communication Controller: Normal Active Operation

The FRC-EP150 comes with the same count of status LED's like the FlexRay-CCM. Thus, the status of two CAN interfaces is shown by a single LED. As soon as a CAN controller is configured, it's error condition is dominating the the LED status. Are for example CAN1 and CAN3 configured and CAN1 recognizes a communication failure, the corresponding CAN1/3 LED is lid red. The status of the other, error free operating CAN interface is in this case dominated by this condition.

5 Firmware updates

Starting with version 2.4, the update of the firmware, the readout of the existing runtime licenses and the download of new licenses is done with the "FlexAdmin tool". This PC tool is part of the scope of delivery and is installed during the VCI installation on the PC. For more information please refer to the online help of the FlexAdmin tool.

Appendix

Technical specifications

The following data refers to the standard equipment of the device.

Dimensions:	158 mm x 140 mm x 36 mm (L x B x H)
Weight:	approx. 650 g
Housing material:	Aluminium
Working temperature range:	-40 °C to +70 °C
Storage temperature range:	-40 °C to +85 °C
Relative humidity	10 - 95 %, non-condensing
Power supply:	6,5 - 50 V DC (start-up voltage over entire working temperature range) 6 - 50 V DC after start-up
Power consumption:	typically with 12 V 400 mA
Host system:	Freescale MPC866P 133MHz 64 MByte RAM 32 MByte Flash
FlexRay Communication Controller:	Freescale MFR 43x0 or 2x Freescale MFR 43x0 (see Orderingcode)
FlexRay Transceiver:	Philips TJA1080
FlexRay MC-System:	Freescale MC9S12DP256 12 kByte internal RAM 256 kByte Flash
CAN MC-Controller:	Freescale MC9S12DP256 12 kByte internal RAM 1 MByte external RAM 256 kByte Flash
CAN Transceiver high-speed:	Texas Instruments SN65HVD251
CAN Transceiver low-speed:	Philips TJA1054T
CAN bus terminal resistor:	none (high speed), RTH=RTL=2.2 k Ω (low-speed)
CAN and FlexRay signal delay due to galvanic isolation:	typically 27 ns
Isolation voltage:	50 V DC

Appendix

Reaction times on FlexRay and CAN:
measured under Windows 2000 SP4 or Windows XP SP2, AMD Athlon processor with 1 GHz.

Time difference on the PC:

from the moment of transmission of a message to the FlexRay bus
to the moment of reception of the echo (echo after 5 ms) from the FlexRay bus

Minimum	Average	Maximum
15 ms	19 ms	26 ms

Time difference on the PC:

from the moment of transmission of a message to the CAN bus
to the moment of reception of the echo (instantaneous echo) from the CAN bus

Minimum	Average	Maximum
1 ms	1 ms	2 ms

Ordering codes

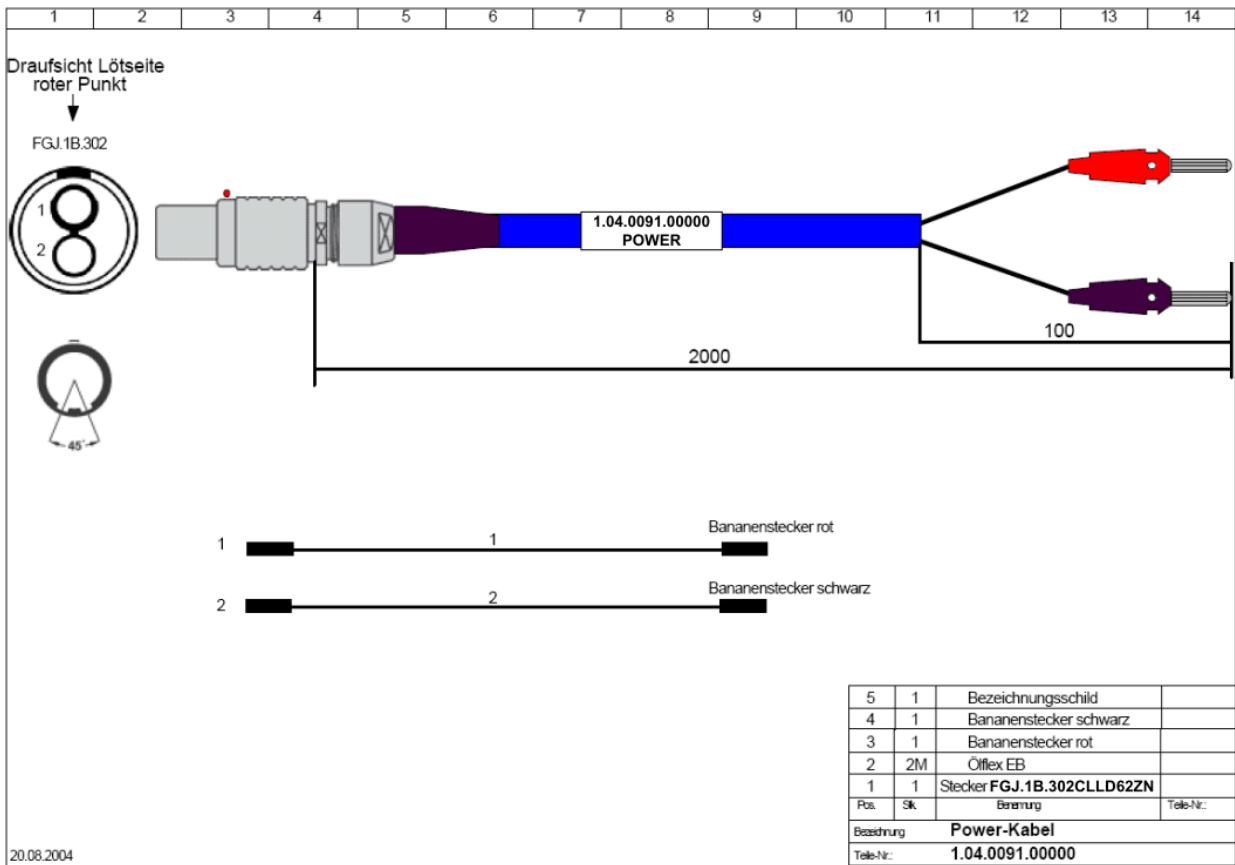
The following options are available:

Description	Article no.
FlexRay CCM	1.01.0100.00011
FlexRay CCM Dual Chip	1.01.0100.00014
FlexRay CCM-E (blues, stackable housing)	1.01.0100.00016
FlexRay Dual Chip Upgradekit	1.01.0101.00012
FRC-EP150	1.01.0102.00011
FRC-EP150 Dual Chip	1.01.0102.00014

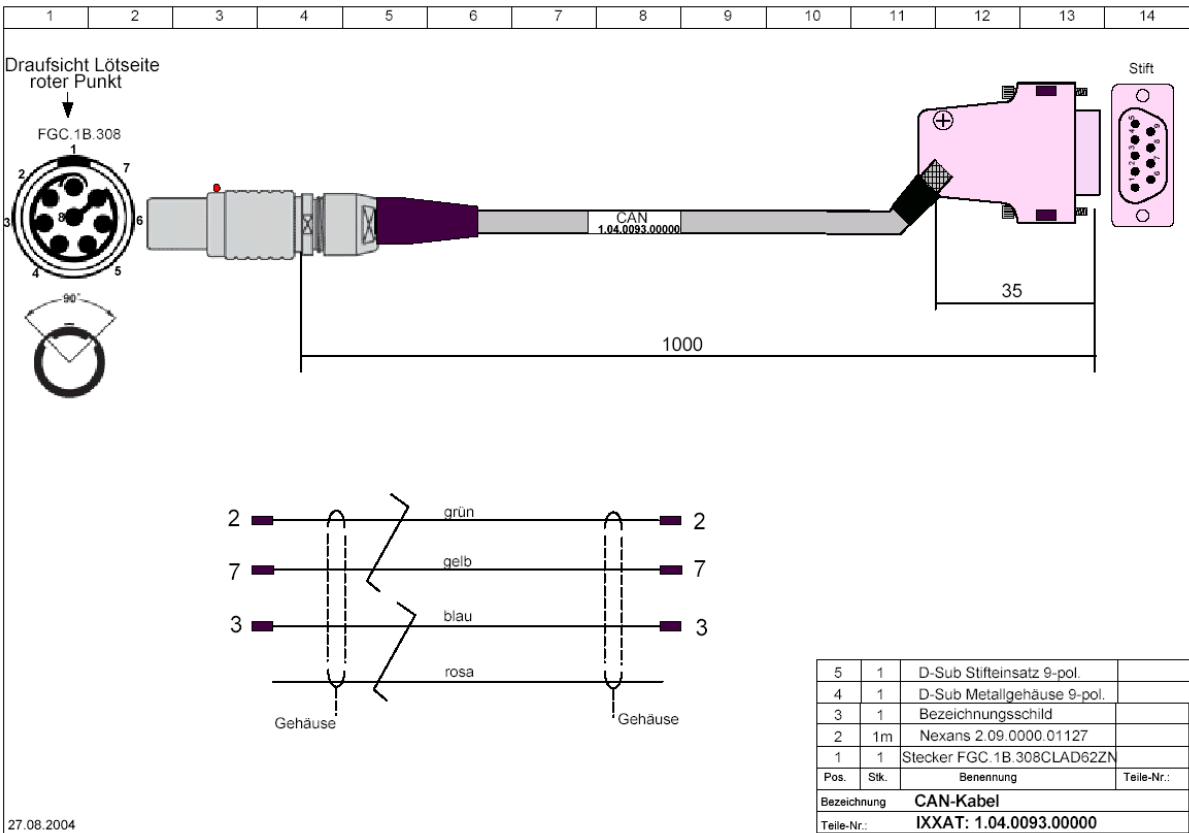
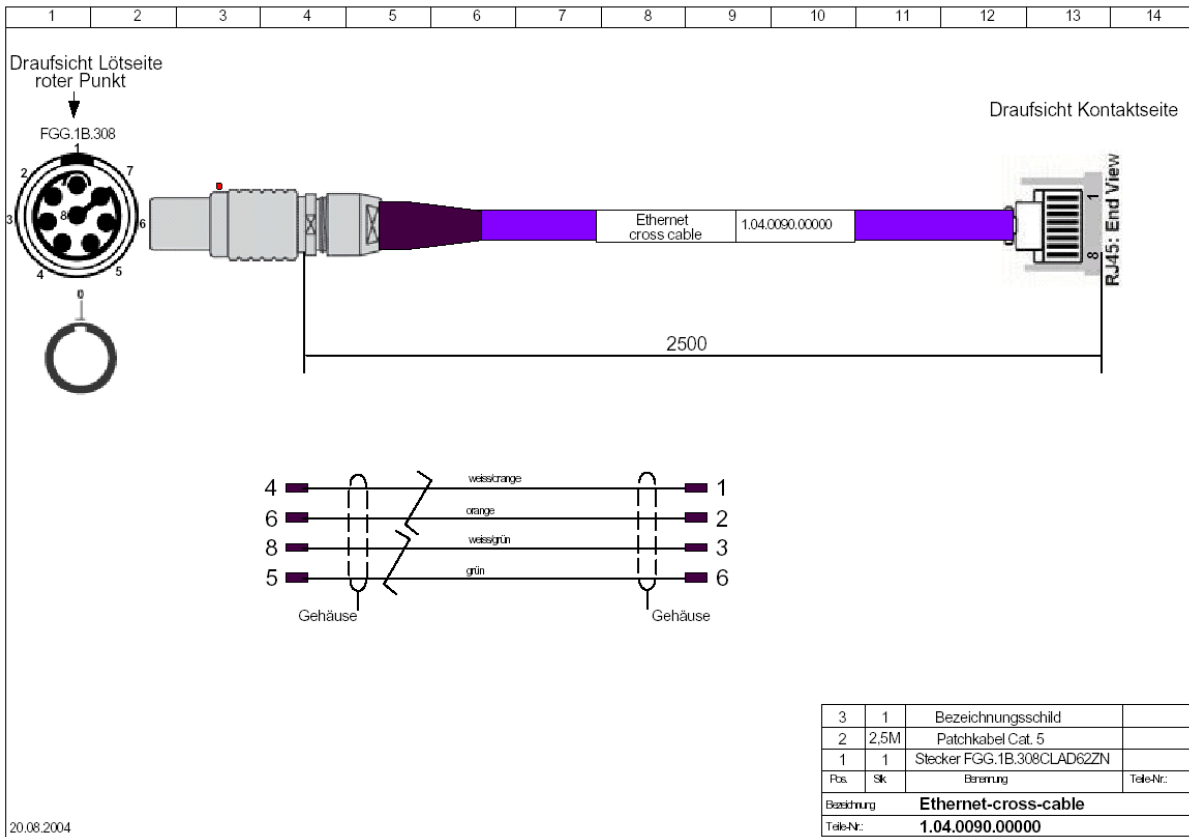
Accessories

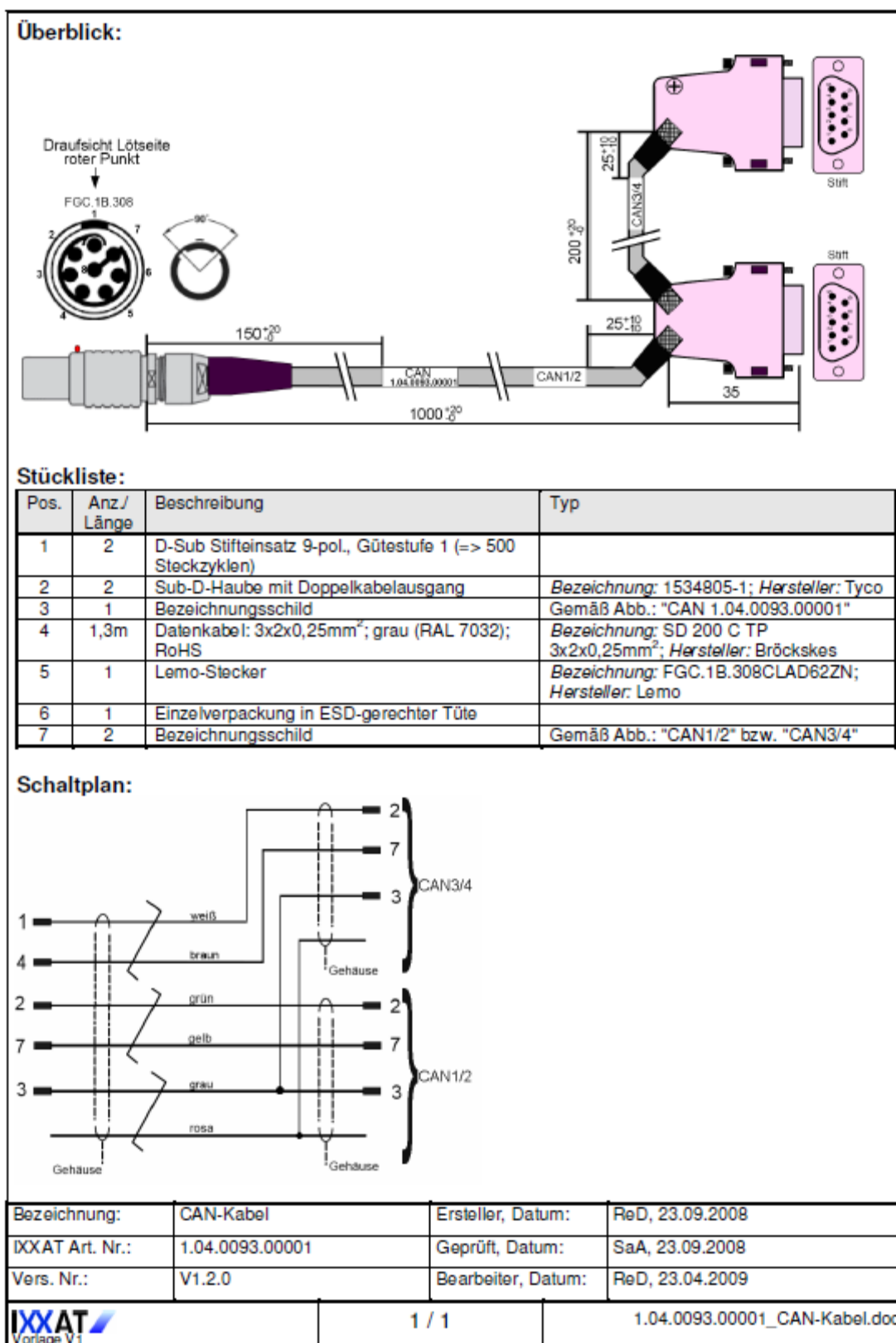
The following accessories are available:

Interface	Description	Article no.
Power supply	Cable with 2 banana connectors; length 2.0 m	1.04.0091.00000
Ethernet	Ethernet cable for connection to the PC (crossover) with RJ45-connector; length 2.0 m	1.04.0090.00000
CAN	CAN cable with SUB-D9-connector; length 1.0 m	1.04.0093.00000
CAN	CAN cable with two SUB-D9 connectors as "Y-cable"; length 1.0 m (for FRC-EP150 only)	1.04.0093.00001
FlexRay	FlexRay cable with SUB-D9 connector and integrated terminal resistor; length 2.0 m	1.04.0092.00000
FlexRay	FlexRay cable with two SUB-D9 connectors as "Y-cable"; length 2.0 m	1.04.0092.00001
Trigger	Trigger cable with 4 BNC connectors; length 2.0 m	1.04.0094.00000

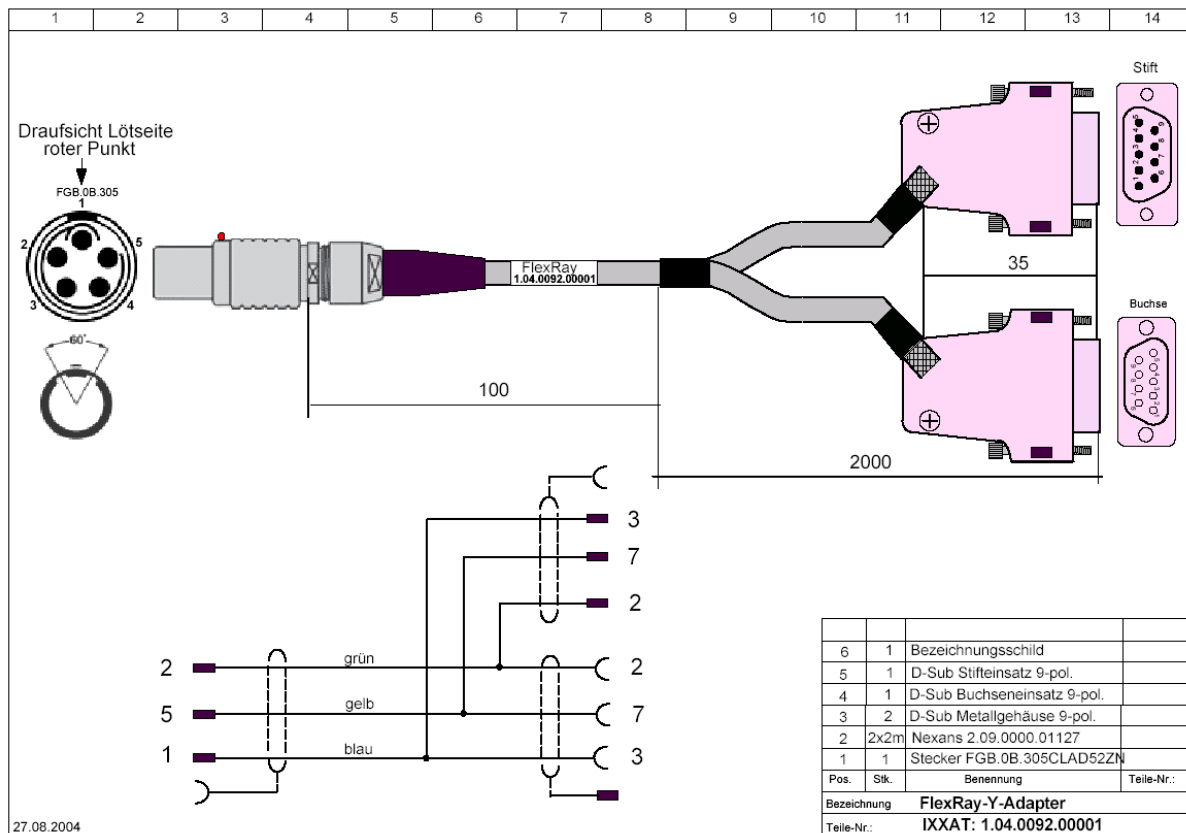
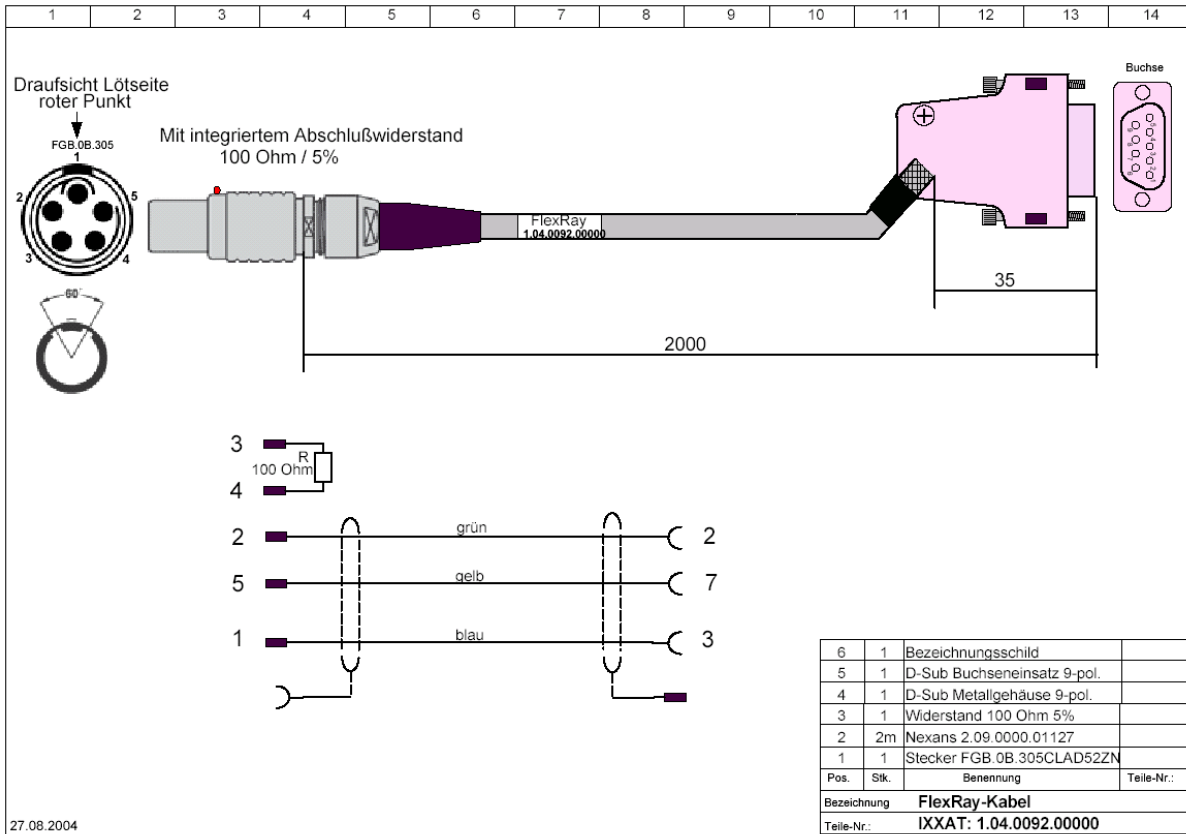


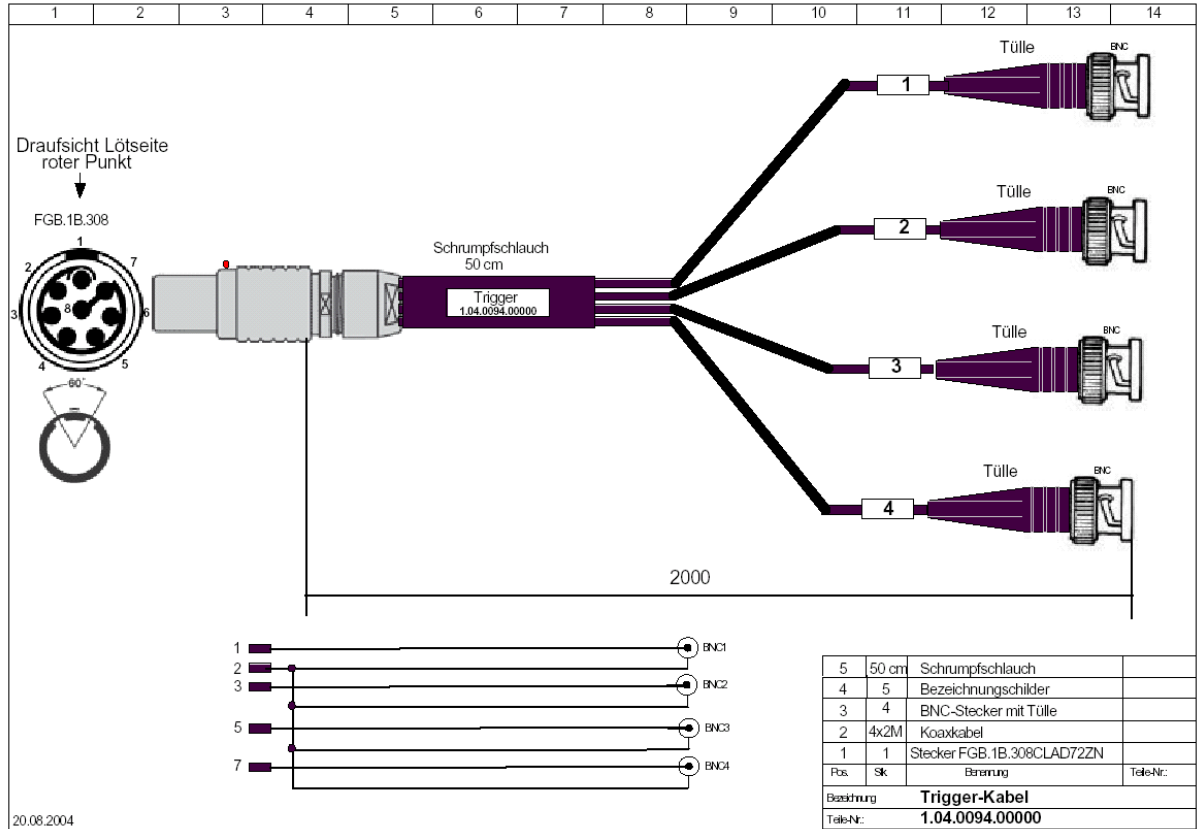
Appendix





Appendix





Information on disposal of waste equipment

This product is subject to the Electrical and Electronic Equipment Act (ElektroG) and is to be disposed of separately in accordance with the ElektroG. The products of IXXAT that are subject to the ElektroG are devices for exclusive commercial use and are marked with the symbol of a waste bin with a cross through it.



In accordance with the B2B regulation, disposal is governed separately according to § 10 para. 2 clause 3 Electrical and Electronic Equipment Act (ElektroG) in the edition of March 16 2005 in the General Terms and Conditions of Business of IXXAT and its supplements.

Accordingly, when the products supplied by IXXAT are no longer used, customers are obliged to dispose of these products at their own expense. It is to be noted that in contrast to privately used equipment (B2C), they may not be disposed of at the state-owned collection centers of disposal organizations (e.g. municipal recycling centers). The statutory regulations for disposal are to be observed.

If delivered products are passed on to third parties, customers are obliged to take back the delivered products when no longer used at their own expense and dispose of them correctly in accordance with the statutory regulations or to impose these obligations on third parties.

The General Terms and Conditions of Business and their supplements as well as further information on disposal of waste electrical and electronic equipment can be downloaded at www.ixxat.de.

Information on EMC

The FlexRay CCM/FRC-EP150 is a class A device. This means that it has been constructed for industrial use and that it meets the EMC requirements for industrial devices.

If the device is used in office or home environment radio interference might occur under extreme conditions.

To ensure faultless operation of the device, the following instructions must be followed due to technical requirements of EMC:

- use only the included accessories and cables
- the FlexRay, CAN, Trigger and Ethernet cables must be shielded
- the shield of the above mentioned interfaces must be connected at the Lemo connector and at the subscriber

If problems arise during operation of the device despite the instructions above, the distance between potential sources or drains of interference (e. g. motors, frequency inverters) and the device should be incremented.

Declaration of conformity

IXXAT Automation declares that the product:

FlexRay CCM/FRC-EP150
PC Interface for FlexRay and CAN

model: FlexRay CCM
FRC-EP150

with the article numbers: 1.01.0100.00011
1.01.0100.00014
1.01.0100.00016
1.01.0102.00011
1.01.0102.00014

do comply with the EC directives 2004/108/EC.

Applied harmonized standards in particular:

EN 55022: 2006
EN 55024: 1998 + A1: 2001 + A2: 2003

12-08-2009, Dipl.-Ing. Christian Schlegel, CEO



IXXAT Automation GmbH
Leibnizstraße 15
88250 Weingarten

FCC Compliance

Declaration of conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- this device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

Class A digital device instructions:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

