

FRC-EP 190

Automotive Platform





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1 Introduction

1.1 Overview

The FRC-EP190 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 four high-speed CAN interfaces
- Up to two low-speed CAN interfaces
- Level and error frame monitoring on up to two CAN interfaces
- Two LIN interfaces
- Two K-Line interfaces
- Up to four differential analog inputs with 12 bits resolution, 0-10 V
- Up to four digital inputs (max. 34 V)
- Up to four digital outputs (max. 34 V, 1 ampere)
- One USB 2.0 device 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 (FlexRay, CAN, EtherCAT)
- 6-36 VDC power supply range with overvoltage and polarity protection
- Standby/hibernate modes
- Wakeup on Clamp15, CAN traffic, digital inputs, real-time clock
- Working temperature range -40 to +80 °C
- All interfaces galvanically isolated (optional)
- Remote control (optional)

1.3 Device variants available

The basic unit has a total of two internal expansion slots. By combining a basic unit with a corresponding expansion card, the device can be functionally extended. The following device variants are currently available:

Item number	Description	Features (*)
1.01.0094.0000x	FRC-EP190 Standard	No FlexRay
1.01.0094.0001x	FRC-EP190 FlexRay	Two FlexRay channels of up to 10 Mbit/sec Cold start capability with two FlexRay nodes Two differential analog inputs (12 bits, 0-10V) Four digital inputs/outputs (max. 34 V, 1 ampere)
1.01.0094.0003x	FRC-EP190 FlexRay Plus	Like 1.01.0094.0001x but with 6 CAN interfaces
1.01.0094.0004x	FRC-EP190 EtherCAT	Like 1.01.0094.0003x but with EtherCAT-Slave
1.01.0094.10010	FRC-EP190 FlexRay	Like 1.01.0094.00010 but with an additional USB-Host interface
1.01.0094.10030	FRC-EP190 FlexRay Plus	Like 1.01.0094.00030 but with an additional USB-Host interface
1.01.0094.10040	FRC-EP190 EtherCAT	Like 1.01.0094.00040 but with an additional USB-Host interface

(*) Features deviate from section 1.2

,x' = 0 – galvanic isolation

,x' = 1 – no galvanic isolation

The list of available device variants above is continually being extended. Naturally, this manual represents a snapshot at the time of printing. The current list can be found on the IXXAT home page or directly upon request from IXXAT Support.

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.

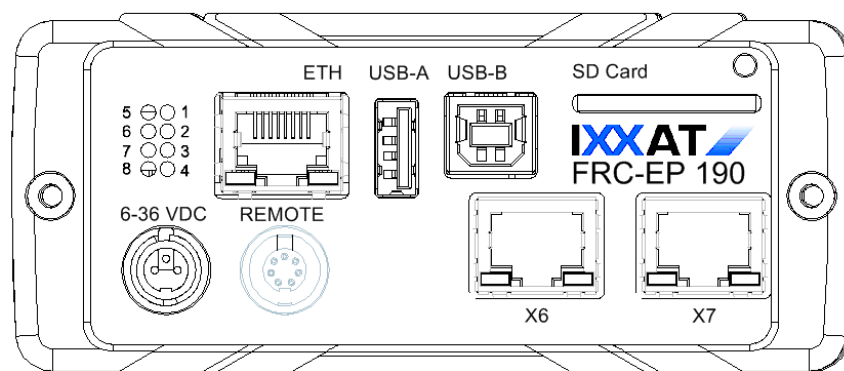


Figure 2-1: Front of the FRC-EP190

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 190 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 190 to switch from normal mode into hibernate mode. In hibernate mode, the FRC-EP 190 only requires very little power. 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 (ETH)

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

2.3 EtherCAT connector (X6/X7)

These connectors are only available for the device variants with EtherCAT. They are intended for the connection to a EtherCAT network. The device represents a EtherCAT slave. The connector X6 does provide the EtherCAT-Slave-IN function and X7 the EtherCAT-Slave-OUT function. In case that the FRC-EP190 is connected to a EtherCAT master solely, only X6 is used. In that case X7 remains unconnected. The EtherCAT interfaces are galvanically isolated from the other interfaces.

2.4 USB-B connector

This USB connector is used as a USB device interface to a PC.



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-EP190 before connecting the PC to the FRC-EP190 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.

2.5 USB-A connector

This USB connector is used as a USB host interface to another USB device (i.e. USB memory stick).



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-EP190 before connecting a USB device to the FRC-EP190 which itself is connected to the test object (i.e. a USB based analog input extension). Otherwise, a compensation current might flow between the test object and the FRC-EP190 through the USB connection, which under some circumstances might damage the FRC-EP190.

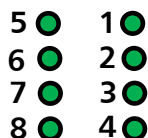
2.6 SD card slot

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.

2.7 Displays

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



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

Status	Description
"off"	The FRC-EP190 is not supplied with power (pin 1, power connector)
"Flashing green"	The FRC-EP190 is in hibernate mode and waits for a waking condition that can be configured via the software.
"Red"	The FRC-EP190 is in boot mode and the operating system is starting.
"green"	The FRC-EP190 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.

2.8 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 input and output RS232 TX transmission signal to PC
3	REM2 / RX	REMOTE2 digital input and output RS232 RX received signal from PC
4	REM3	REMOTE3 digital input and 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 190 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:

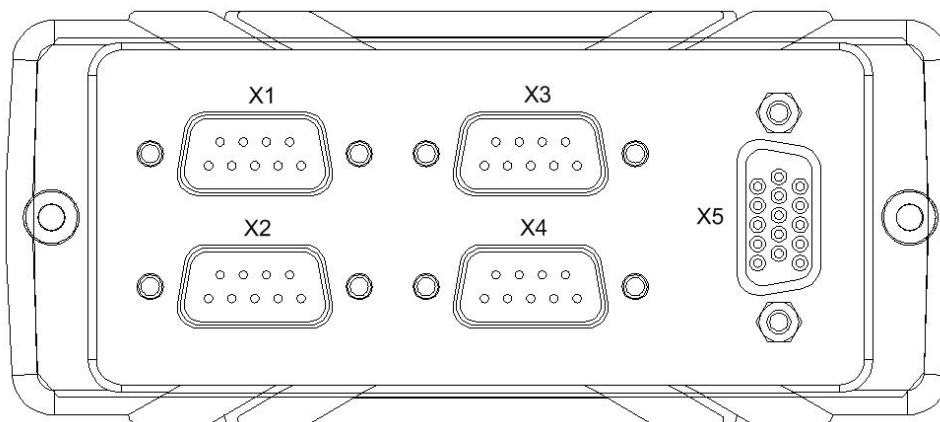


Figure 2-2: Back of the FRC-EP190

2.9 CAN

The FRC-EP190 has four interface islands on D-SUB connectors X1 through X4. Each of these four islands is galvanically isolated from the others on device versions that provide galvanic isolation. Within an island, the interfaces for high-speed CAN, low-speed CAN, LIN, and K-Line are galvanically connected to one another. The shielding of the cable and/or the metal collar of a D-SUB connector is directly connected to the housing.

2.9.1 Connectors X1 and X2

Connectors X1 and X2 provide CAN high-speed, CAN low-speed, and LIN interfaces, each with channels 1 and 2. The following table provides the pinouts of connectors X1 and X2.

Pin	Signal	Description
1	CAN LS L	Low-Speed CAN 1/2 Low Signal
2	CAN HS L	High-Speed CAN 1/2 Low Signal
3	GND	Ground for CAN and LIN
4	CAN LS H	Low-Speed CAN 1/2 High Signal
5	-	Free
6	-	Free
7	CAN HS H	High-Speed CAN 1/2 High Signal
8	LIN	LIN signal (1/2)
9	VBAT / V-LIN	Power supply for CAN low-speed and LIN

Table 2-5: Pinouts of connectors X1 and X2

For ISO 11898-2 high-speed CAN, there is no bus termination resistance 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).

VBAT is used to supply the termination resistors of the CAN low-speed coupling (RTH). This is required if the device is not supplied with power through the power cable, power is turned off to the individual CAN island (configured through the software), or the device is in hibernate/sleep mode. A voltage of 5 V to 24 V can then be supplied on VBAT. The LIN driver is also powered with the VBAT connection.

The X1/2 connectors are provided as D-SUB 9 connectors with pins (male).



For high-speed CAN and low-speed CAN, only two CAN controllers are provided. Switching is done in software. However, only two CAN interfaces can be operated at the same time.

2.9.2 Connectors X3 and X4

Connectors X3 and X4 provide CAN high-speed channels 3 and 4 and K-Line interfaces channels 1 and 2. The following table provides the pinouts of connectors X3 and X4.

Pin	Signal	Description
1	CAN HS L	High-speed CAN 5/6 Low Signal
2	CAN HS L	High-Speed CAN 3/4 Low Signal
3	GND	Ground for CAN and K-Line
4	CAN HS H	High-speed CAN 5/6 High Signal
5	-	Free
6	-	Free
7	CAN HS H	High-Speed CAN 3/4 High Signal
8	K-LINE 1/2	K-LINE 1/2 signal
9	VBAT	Power supply for K-Line

Table 2-6: Pinouts of connectors X3 and X4

The CAN bus coupling of CAN interfaces CAN3/4 and CAN5/6 (optional and only for device versions that support this) only supports physical bus connection as defined in ISO 11898-2. The differential signal pair (CAN-Low and -High) and ground are connected at the CAN connector. As another interface,

connectors X3 and X4 also each supply one K-Line interface.

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

The CAN buses are galvanically isolated from one another and from all other interfaces.

The X3/4 connectors are provided as D-SUB 9 connectors with pins (male).

2.10 LIN

If LIN is used, the VBAT connection must have a voltage of 12-24 V applied.

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.



Only two serial controllers are implemented for the two LIN and two K-Line interfaces. Switching is done in software. However, only two interfaces can be operated at the same time.

2.11 K-LINE

For the K-Line interface, there is only one "K" line available. If K-Line is used, the VBAT connection must have a voltage of 12-24 V applied.

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.



Only two serial controllers are implemented for the two LIN and two K-Line interfaces. Switching is done in software. However, only two interfaces can be operated at the same time.

2.12 Connector X5

Connector X5 has no fixed pinouts, but rather depends on the device variant. X5 is primarily used for FlexRay, digital I/O, and analog IN interfaces. In future device variants, however, a device-internal adapter card could also permit any other pinouts.

Connector X5 is implemented as a D-SUB HD15 (high-density 15-pin) connector with pins (male).

2.12.1 Connector X5 – pinouts on 1.01.0094.0000x devices

Pin	Signal	Description
1	ANA_IN3_P	Analog input, channel 3, differential plus
6	ANA_IN3_M	Analog input, channel 3, differential minus
2	ANA_IN4_P	Analog input, channel 4, differential plus
7	ANA_IN4_M	Analog input, channel 4, differential minus
3	GND-ANA	Analog ground
4	ANA_IN1_P	Analog input, channel 1, differential plus
9	ANA_IN1_M	Analog input, channel 1, differential minus
5	ANA_IN2_P	Analog input, channel 2, differential plus
10	ANA_IN2_M	Analog input, channel 2, differential minus
11	DIG_IO1	Digital input/output, channel 1
12	DIG_IO2	Digital input/output, channel 2
13	GNDIO	Ground for digital inputs/outputs
14	DIG_IO3	Digital input/output, channel 3
15	DIG_IO4	Digital input/output, channel 4
8	VBAT	Power supply for digital I/O

Table 2-7: Pinouts of connector X5

2.12.2 Connector X5 – pinouts on 1.01.0094.y001x devices

Pin	Signal	Description
1	FR1A BP	FlexRay channel 1 A, bus plus
6	FR1A BM	FlexRay channel 1 A, bus minus
2	FR1B BP	FlexRay channel 1 B, bus plus
7	FR1B BM	FlexRay channel 1 B, bus minus
3	GND-FR	FlexRay ground
4	ANA_IN1_P	Analog input, channel 1, differential plus
9	ANA_IN1_M	Analog input, channel 1, differential minus
5	ANA_IN2_P	Analog input, channel 2, differential plus
10	ANA_IN2_M	Analog input, channel 2, differential minus
11	DIG_IO1	Digital input/output, channel 1
12	DIG_IO2	Digital input/output, channel 2
13	GNDIO	Ground for digital/analog inputs/outputs
14	DIG_IO3	Digital input/output, channel 3
15	DIG_IO4	Digital input/output, channel 4
8	VBAT	Power supply for digital I/O

Table 2-8: Pinouts of connector X5

2.12.3 Connector X5 – pinouts on 1.01.0094.y0030/y0040 devices

Pin	Signal	Description
1	FR1A BP	FlexRay channel 1 A, bus plus
6	FR1A BM	FlexRay channel 1 A, bus minus
2	FR1B BP	FlexRay channel 1 B, bus plus or FlexRay channel 2 A, bus plus (*)
7	FR1B BM	FlexRay channel 1 B, bus minus or FlexRay channel 2 A, bus minus (*)
3	GND-FR	FlexRay ground
4	ANA_IN1_P	Analog input, channel 1, differential plus
9	ANA_IN1_M	Analog input, channel 1, differential minus
5	ANA_IN2_P	Analog input, channel 2, differential plus
10	ANA_IN2_M	Analog input, channel 2, differential minus
11	DIG_IO1	Digital input/output, channel 1
12	DIG_IO2	Digital input/output, channel 2
13	GNDIO	Ground for digital/analog inputs/outputs
14	DIG_IO3	Digital input/output, channel 3
15	DIG_IO4	Digital input/output, channel 4
8	VBAT	Power supply for digital I/O

Table 2-9: Pinouts of connector X5

(*) Depending on the software version on the device

2.12.4 FlexRay

The FRC-EP190 (variant 1.01.0094.0001x) has 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. Variant 1.01.0094.0003x/0004x also has two independent FlexRay controllers. However, the software can switch them to work on individual FlexRay buses.

The FlexRay interface is brought out on connector X5. 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 FlexRay bus is galvanically isolated from the other interfaces. Channels A and B are at the same potential.

2.12.5 Digital I/O

Depending on the device variant, the FRC-EP190 has up to four digital I/O channels. Each digital I/O channel has an output with a high-side switch (FET) and a comparator input with a Schmitt trigger function. For the function of the digital I/O channels, the power supply VBAT for digital I/O must be supplied with power.

The high-side switch on the outputs is supplied with VBAT. So on the output there is a voltage from 0 to VBAT. For example, if a TTL level must be generated, a voltage of 5 V must be connected to VBAT. The output power per channel is limited to 1 A. The total current on all four channels should also not exceed 1 A. The outputs should always be operated with a load against ground. However, the GNDIO connection cannot be used as the return for this ground. The return for the digital loads must be a separate line for power supply.

Each input is equipped with a comparator with a Schmitt trigger function. The switching threshold is half the voltage on VBAT. For example, if a voltage of 12 V is connected to VBAT, then vehicle voltages can be monitored directly. The switching threshold in that case is about 6 V. The ground connection GNDIO serves as the reference. All voltages on the digital inputs thus are relative to this ground connection GNDIO. It must always be connected to the test object.

Only one VBAT connection is provided for all digital outputs and inputs. All channels work with the same VBAT voltage. The mixture of different voltages (for example TTL and 12 V) is not possible at the same time.

The power input 6-36 VDC on the power connector and voltage VBAT for digital I/O are internally not connected and can be operated independently of one another.

The maximum voltage on VBAT is 34 V.

All four digital I/O channels, including VBAT and GNDIO, are galvanically isolated from the remainder of the circuit.

2.12.6 Analog input

Depending on the device variant, the FRC-EP190 has up to four analog inputs with differential signal pairs. The analog/digital converter has a resolution of 12 bits and the voltage input is 0 to 10 V. Negative voltages cannot be measured. The common mode range of the signal pairs is up to 20 V.

The measured voltage is calculated according to the following formula from the digital value (AD value):

$$\text{Voltage} = \frac{\text{AD-value}}{4095} * 2,50 \text{ V} * 4$$

Figure 2-3: Conversion raw/physical value

The analog inputs are not galvanically isolated. The ground GND-ANA on HD15 of connector X5 is used as the reference ground. This ground is connected to the power supply on the 6-36 VDC connection (- GND).

The voltage to be measured is always between the signal pairs (P and M). The reference ground on the power supply should not exceed the common mode range of up to 20 V for the voltage to be measured. This can be achieved by connecting the analog ground GND-ANA or the ground of the power supply 6-36 VDC connection (- GND) to the ground of the test object. If the signal pair (M) is not needed, this connection (M) must be connected to the ground of the test object.

2.13 Galvanic isolation

There are two device variants, with and without galvanic isolation.



In the variants without galvanic isolation (1.01.0094.xxxx1), all grounds on the individual interfaces and the ground of the power supply on the 6-36 VDC connection are connected together. Be careful when using the individual grounds. Compensation currents can flow between the power supply and the connected test objects which can falsify measurements or under some circumstances can even lead to damage the test objects. IXXAT cannot assume liability for any damages due to incorrect connections and the compensation currents they cause.

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

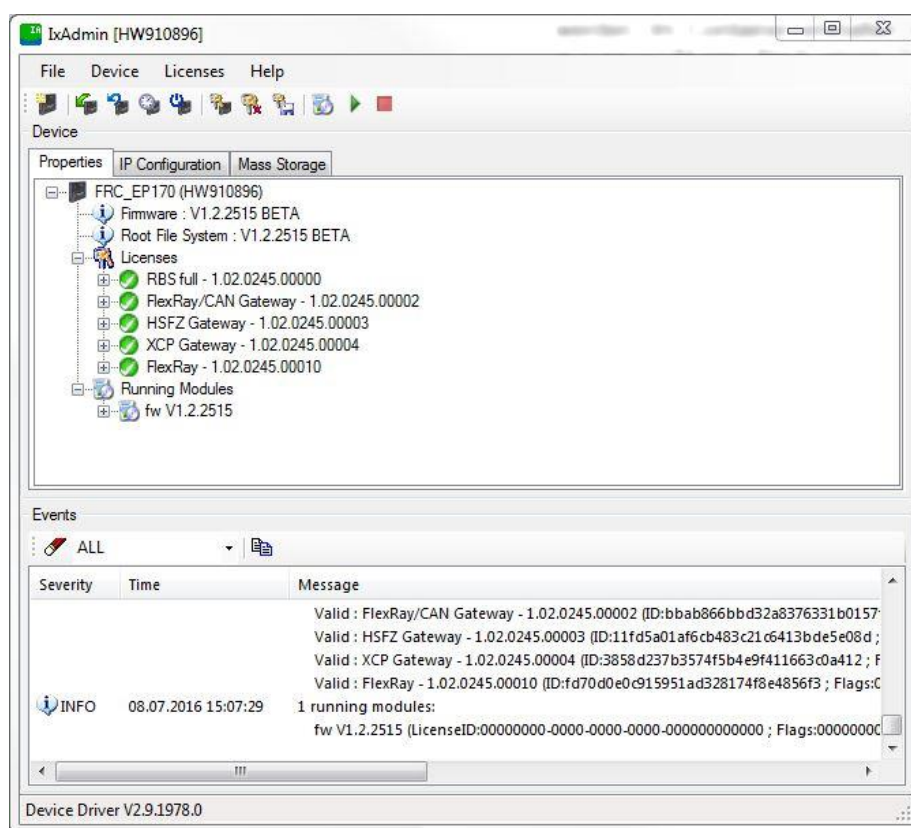


Figure 3-1: IxAdmin example device connect dialog

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“](c:\Users\Public\Documents\IXXAT\ACT\Projects\BasicLogger\DeviceConfig)

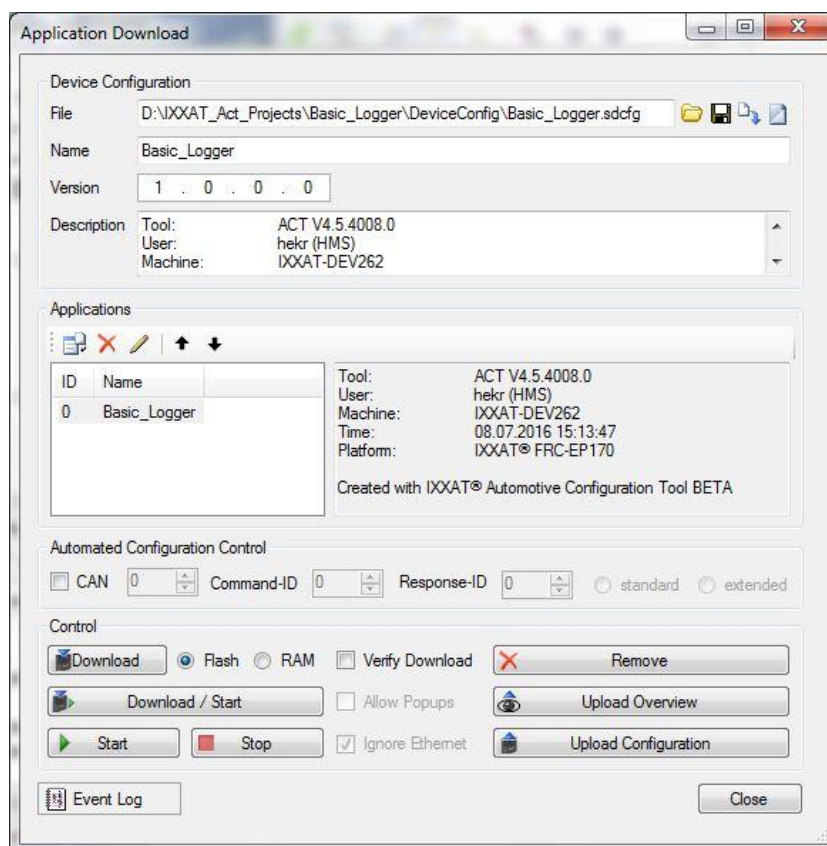


Figure 3-2: IxAdmin example application download dialog

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-X4	Dual-CAN cable with D-SUB 9 and two D-SUB 9, 1.5m	1.04.0089.00201
X1-X4	CAN, LIN, and K-Line cable with D-SUB 9 and open ends, 1.5m	1.04.0089.00200
X1-X4	CAN, LIN, and K-Line cable with D-SUB 9 and open ends, 0.5m	1.04.0089.00203
X1-X4	CAN/LIN/K-Line breakout box with D-SUB 9 and three D-SUB 9, 0.5m	1.01.0081.00100
X5	FlexRay-1A cable with D-SUB 15 HD and one D-SUB 9, 1.5m	1.04.0089.00102
X5	FlexRay/IO cable with D-SUB 15 HD and open ends, 1.5m	1.04.0089.00100
X5	FlexRay/IO cable with D-SUB 15 HD and open ends, 0.5m	1.04.0089.00103
X5	FlexRay/IO breakout box with D-SUB 15 HD and five D-SUB 9, 0.5m	1.01.0081.00200

Table 4-1: Accessories

4.1 Cable for FlexRay-1A

A preassembled cable (order number 1.04.0089.00102) is available that can be used on FlexRay device variants to bring the FlexRay-1A interface from device connector X5 to a standard D-SUB 9 connector. The FlexRay termination resistor is integrated into the connector housing on the device side.

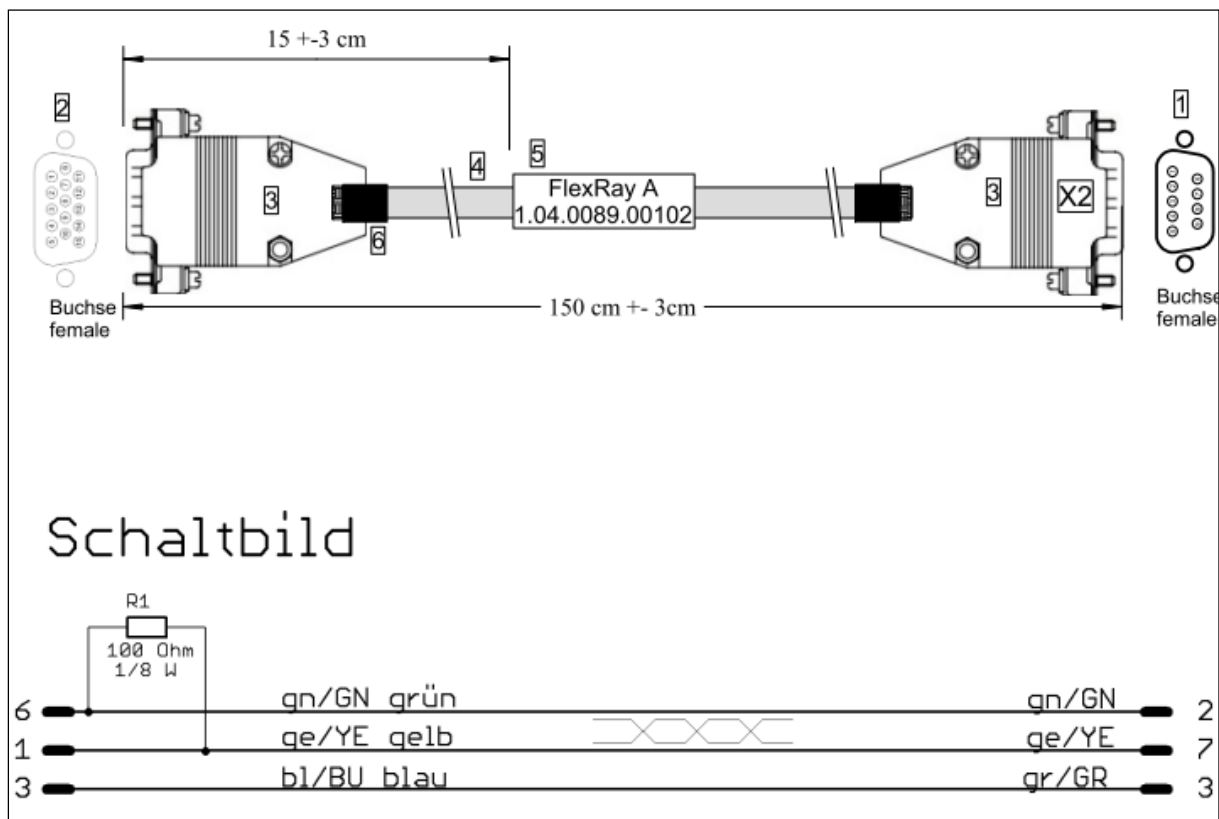


Figure 4-1: FlexRay-A cable

4.2 Breakout box for X5

Connector X5, depending on the device variant, can provide any of several interfaces. To make each of these interfaces available on a single connector, there is a breakout box (order number 1.01.0081.00200) available with a cable length of 50cm:



Figure 4-2: X5 breakout box

Connector	Variant 1.01.0094.0000x	Variant 1.01.0094.y001x 1.01.0094.y003x 1.01.0094.y004x	Pinouts on D-Sub 9	
			Pin	Signal
Y1	Analog-IN 3	FlexRay 1A	2	FR BM or ANA M
			7	FR BP or ANA P
			3	GND-FR
			6	GND-IO
Y2	Analog-IN 4	FlexRay 1B/2A		Like Y1
Y3	Analog-IN 1	Analog-IN 1		Like Y1
Y4	Analog-IN 2	Analog-IN 2		Like Y1
Y5	Digital I/O	Digital I/O	1,2,3,4	DIG_IO1..4
			5	VBAT
			6	GNDIO

Table 4-2: X5 breakout box connector pinouts

4.3 Breakout cable for X5

Connector X5, depending on the device variant, 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:

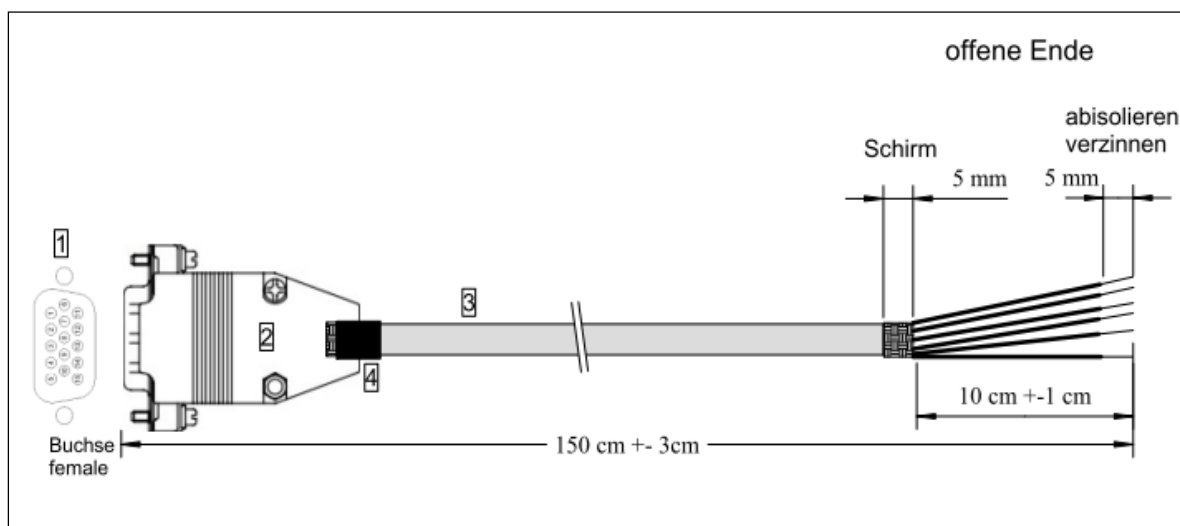


Figure 4-3: X5 breakout cable

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 4-3: X5 breakout cable pinouts

4.4 Dual-CAN cable

A preassembled cable is available with order number 1.04.008900201 that can be used to separate the two different CAN interfaces. Depending on the device variant, these then execute different interfaces.

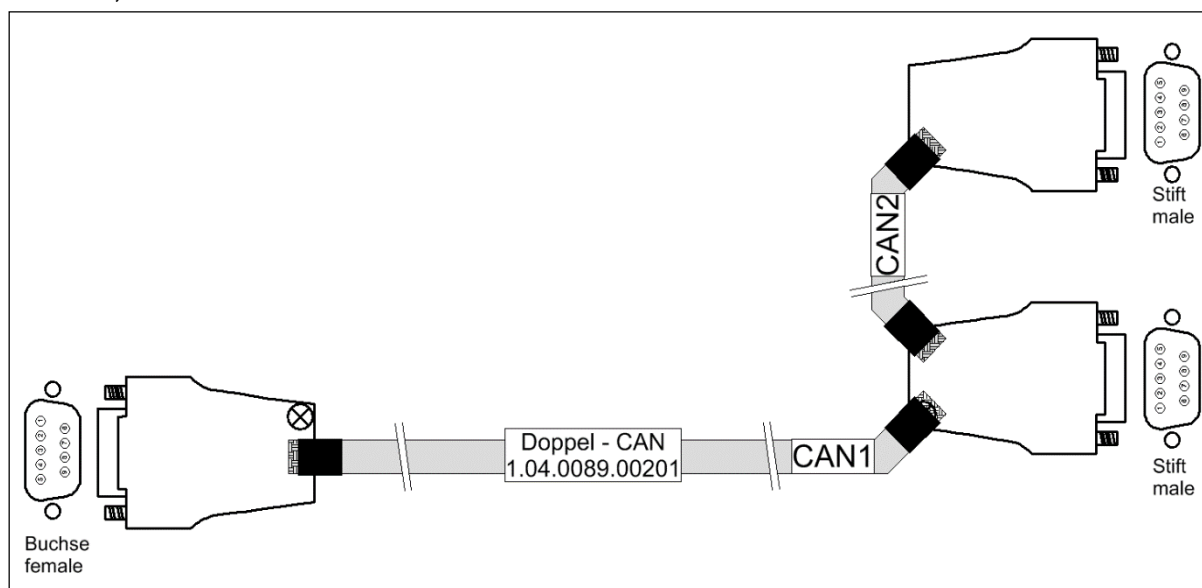


Figure 4-4: Dual-CAN cable

FRC-EP190 Connector	Cable connectors CAN1	Cable connectors CAN2
X1	HS-CAN1	LS-CAN1
X2	HS-CAN2	LS-CAN2
X3	HS-CAN3	HS-CAN5 (*)
X4	HS-CAN4	HS-CAN6 (*)

(*) Only for FRC-EP190 variants with 6 CAN interfaces

Table 4-4: Pinouts of the cable connector on the FRC-EP190

Pin	CAN1	CAN2 (standard)	CAN2 (6 CAN variants)
2	CAN HS L	CAN LS L	CAN HS L
7	CAN HS H	CAN LS H	CAN HS H
3	GND	GND	GND
9	-	VBAT	-

Table 4-5: Pinouts of the cable connector on the CAN cable

4.5 Breakout box for X1..X4

Connectors X1 through X4, depending on the device variant, can provide any of 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 4-5: X1..X4 breakout box

FRC-EP190 Connector	BOB connector Y1	BOB connector Y2	BOB connector Y3
X1, X2	HS-CAN1/2	LS-CAN1/2	LIN1/2
X3,X4	HS-CAN3/4	HS-CAN5/6 (*)	K-Line1/2

(*) Only for FRC-EP190 variants with 6 CAN interfaces

Table 4-6: X1..X4 breakout box connector pinouts

BOB connector	Pinouts on D-Sub 9	
	Pin	Signal
Y1	2	CAN HS/LS L
	7	CAN HS/LS H
	3	GND
Y2		Like Y1
Y3	8	LIN/K-Line
	9	VBAT
	3	GND

Table 4-7: X1..X4 Breakout box pinouts

4.6 Breakout cables for X1..X4

Connectors X1 through X4, depending on the device variant, can provide any of several interfaces. For the simple manufacture of specific adapters, breakout cables (order number 1.04.0089.00200/00203) are available in different lengths:

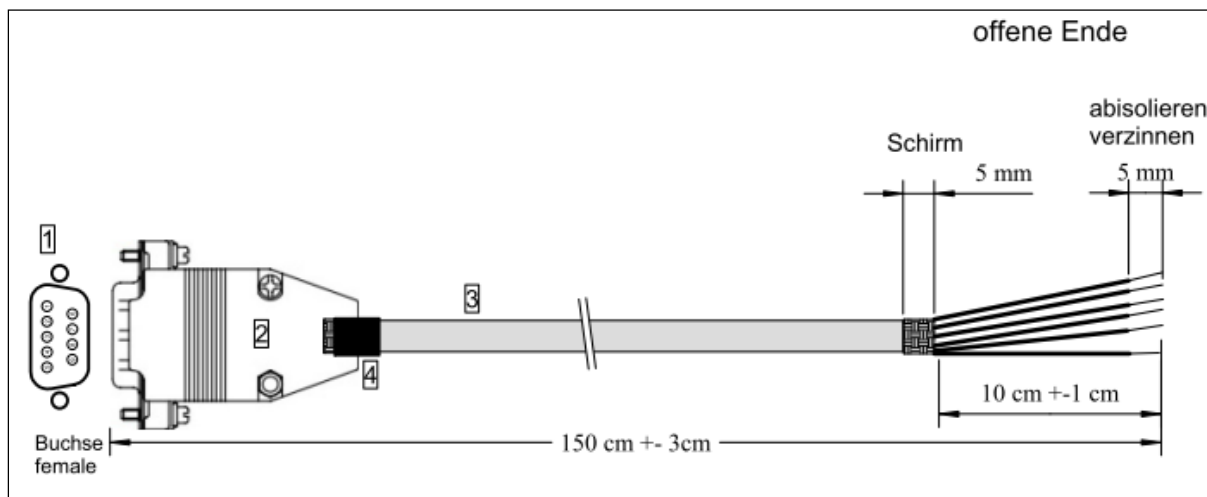


Figure 4-6: X1..X4 breakout cables

Pin	Color	Pin	Color
1	WT	6	PK
2	GN	7	YE
3	BU	8	GY
4	BN	9	RD
5			

Table 4-8: X1..X4 breakout cable pinouts

5 Appendix

5.1 Technical data

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

Dimensions:	180 x 110 x 55 mm (L x W x H)
Weight:	approx. 630 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, 420 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
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)
CAN and FlexRay signal delay With galvanic isolation:	Typically 27 ns
LIN Transceiver:	NXP TJA1020
K-LINE transceiver:	Vishay SI9243AEY
Insulation voltage of the galvanic isolation:	50 V DC
System startup time:	< 5 seconds from power-on

5.2 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.

5.3 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.

5.4 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.

5.5 EC Declaration of Conformity

EMC compliance testing has been conducted to the Electromagnetic Compatibility Directive 2004/108/EC. For more information please consult the EMC compliance document on the support pages on IXXAT website.