



# blue PiraT2 / 5E User Guide

Version 2.4.1 / 21.09.2016



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### 3 Overview

This user guide describes the administration of the second generation of blue PiraT data logger of the Telemotive AG, called **blue PiraT2**, as well as for the newest, for Ethernet recording optimized generation, the **blue PiraT2 5E**.

In all functions which are equal to both devices we use the name **blue PiraT2** in this user guide. If there are differences in the handling they are mentioned separately.

This user guide describes hardware and interfaces as well as the general functions of the **blue PiraT2 / blue PiraT2 5E**. The configuration and converting of the logged traces is described in the user guide of the **Telemotive System Client**.

This document refers to **firmware version 02.04.01** and the **Telemotive System Client** from **version 2.4.1**. Some features depending on model and feature license or may not be available in older versions.

Software updates and user guides for other, optional, licensed enhancements are available in the Telemotive ServiceCenter. *(Please find the address under Contact at the last page.)*

To ensure the most reliable operation of your system as possible, please make sure to use always current firmware and software versions.

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## 4 System requirements

### Control Unit

A Windows based Laptop or PC is needed to configure the devices of Telemotive AG by **Telemotive System Client**. It also allows to save the recorded data and to use them offline later.

### Telemotive System Client

The software client is used for configuring the data logger as well as downloading the recorded data or convert these into your needed file format. An firmware update can be performed by the **Telemotive System Client** too to ensure that your devices are always up to date.

### blue PiraT2 / blue PiraT2 5E

The communication between bus systems and control units is monitored and relevant data can be recorded very precisely with the data logger of Telemotive AG. The collected data are stored to the logger and can be downloaded via Ethernet to a PC.

The **blue PiraT2** is our top-class all-in-one data logger. Seven models cover a wide range of interfaces.

Additionally, the **blue PiraT2 5E** offers improved power management and power backup, five integrated Ethernet ports and super-fast start-up behavior. The blue PiraT2 can be flexibly expanded via [Telemotive System Link](#).

### Remote Control Touch (optional)

Operate your blue PiraT Mini or blue PiraT2 data loggers safely and comfortably from the driver's or passenger seat. Via Telemotive System Link our new remote control becomes part of your logger network. One remote control can handle all connected loggers.

### blue PiraT Remote (optional)

While Remote Control Touch is just a control unit for handling unique devices or a TSL network, the blue PiraT Remote additional has logger functionality by offering internal storage and some interfaces.

### License

For some additional features an installed license is required. Settings for licensed features can be performed with a valid license only.

If you need a license for your logger, please contact our sales department (please find the address under contact at the last page).

## 4.1 Further manuals

Beside this user guide we offer the main manuals for our client as well as for the different data logger generations in our ServiceCenter at <https://sc.telemotive.de/bluepirat>.

### User manual for the Telemotive System Client

[https://sc.telemotive.de/4/uploads/media/TelemotiveSystemClient\\_UserManual.pdf](https://sc.telemotive.de/4/uploads/media/TelemotiveSystemClient_UserManual.pdf)

### User manual for blue PiraT2 / blue PiraT2 5E

[https://www.telemotive.de/4/uploads/media/blue\\_PiraT2\\_UserManual.pdf](https://www.telemotive.de/4/uploads/media/blue_PiraT2_UserManual.pdf)

### User manual for blue PiraT Mini

[https://www.telemotive.de/4/uploads/media/blue\\_PiraT\\_Mini\\_UserManual.pdf](https://www.telemotive.de/4/uploads/media/blue_PiraT_Mini_UserManual.pdf)

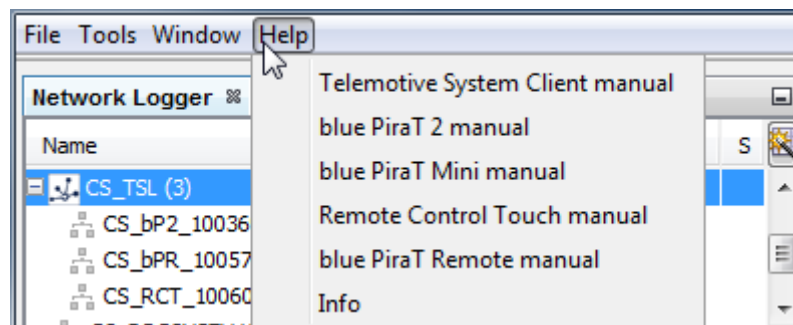
### User manual for Remote Control Touch

[https://sc.telemotive.de/4/uploads/media/RCTouch\\_UserGuide.pdf](https://sc.telemotive.de/4/uploads/media/RCTouch_UserGuide.pdf)

### User manual for blue PiraT Remote

[https://sc.telemotive.de/4/uploads/media/blue\\_PiraT\\_Remote\\_UserGuide.pdf](https://sc.telemotive.de/4/uploads/media/blue_PiraT_Remote_UserGuide.pdf)

For having an easy access if necessary, the most important manuals are linked in the client under the menu item **[Help]** and are reachable easily from there.



**Figure 4.1: links to the manuals**

Our licensed enhancements have own manuals which are stored in the ServiceCenter too. You will find a list of these enhancements in the user manuals in the chapter **Additional features by optional licenses**.

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## 4.2 Additional features by optional licenses

Additional features can be activated by purchasing and installing licenses. Licenses can be ordered at our sales team. You find the user guides for these additional features in the Telemotive ServiceCenter. Currently the following licensed features are available.

Feature	Description
<b>Complex Triggers</b>	Certain events (e.g., conditions on CAN-signals) can be programmed to be a trigger for certain actions (e.g., display of a message on the Remote Control or send a CAN message). The standard configuration of the data logger contains 2 complex triggers. This license allows configuring up to 50 complex triggers.
<b>Remote Control Monitor</b>	display of configurable CAN, LIN, FlexRay, analog and digital signals at the Remote Control
<b>Diagnostic Log and Trace</b>	logging of Diagnostic Log and Trace (DLT) messages over Ethernet or serial (restricted) connections
<b>Camera Link</b>	video recording via video server or network cameras
<b>WLAN</b>	supporting wireless LAN (802.11, 802.11a, 802.11n), (802.11ac from FW 02.04.01)
<b>GPS logging</b>	tracking of GPS data
<b>Measurements with CCP</b>	CAN Calibration Protocol
<b>Measurements with XCP</b>	Universal Measurement and Calibration Protocol Currently the functionality for Ethernet (XCP on Ethernet) and the CAN-bus (XCP on CAN) are available.
<b>MOST150 Streaming</b>	logging MOST150 synchronous/isochronous data
<b>Signal Based Filtering</b>	The feature <b>Signal Based Filtering</b> provides the possibility to extract pre-configured signals directly from the recorded CAN, LIN, FlexRay, analog and digital messages with an adjustable sampling frequency. These filtered signals can be stored directly to the logger and extract automatically in a MDF, CSV or TMT file.
<b>Telemotive Live View</b>	showing CAN signals in a HTML-5 compatible browser on mobile devices like smartphones, tablets or laptops over Wi-Fi (licensed feature) or Ethernet The enhanced version has no limitation to mobile devices or signals which can be shown.
<b>BroadR-Reach logging</b>	recording of data over BroadR-Reach Ethernet. (Note: Just available for blue PiraT Mini)
<b>MLBevo</b>	The license <b>Connected-Gateway MLBevo</b> enables the recording of data of the ATOP control unit MLBevo via USB to the Telemotive data logger and convert these data with the Telemotive System Client. (from FW 02.03.01)
<b>Telemotive Download Terminal</b>	Telemotive Download Terminal allows an automatization of configured tasks for a defined group of devices. (from FW 02.03.01)
<b>TPE</b>	<b>TPE = Telemotive Performance Extension</b> Increasing the logging rate for Ethernet data up to 100Mbit/s (from FW 02.04.01)
<b>Test automatisaton</b>	Interface for connecting to test automation tools. At the moment, the sending of CAN messages is supported. (from FW 02.04.01)

**Table 4.1: Additional features by optional licenses**

## 5 The blue PiraT2 system

The **blue PiraT2 / blue PiraT2 5E** is a data logger for the following interfaces:



**Figure 5.1: Interface (overview)**

The data logger can be mounted in a vehicle and due to his large storage capacity of the hard drive of currently 100 GB or higher, the **blue PiraT2** is able to support extensive test runs. After the data has been gathered it has to be downloaded via Ethernet. For the download and the conversion of the logging data the Telemotive System Client is available.

For the available conversion options to various trace file formats please have a look at chapter Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden.. The blue PiraT2 is available with different features (see chapter 5.2).

The blue PiraT2 is designed to create minimum interference with the vehicle's bus systems and interfaces. The data logger listens to the data traffic without operating as a bus node.

Additionally to the data recording functionality, the blue PiraT2 provides online data processing functions:

- simple CAN- and MOST-filters
- custom-defined messages can trigger the setting of markers

### 5.1 Accessories

There are various accessories available for the **blue PiraT2 / blue PiraT2 5E** data logger:

- various adapter cables
- the Remote Control Voice, which additionally allows recording of voice note
- licenses which enhance the functionality of the blue PiraT2
- mounting bracket

Please contact Telemotive sales for more information about these accessories.

Manuals are available from the Telemotive ServiceCenter.

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## 5.2 Model versions of blue PiraT2 / blue PiraT2 5E

The blue PiraT2 supports a lot of bus systems which can be recorded by the data logger. This table shows which model of the blue PiraT2 supports which number of interfaces and channels.

Schnittstelle / Interface															
	MOST150 (150M)	MOST25 (25M)	ECL	HS-CAN (C)	LS-CAN (C)	RC I/F	LIN (L)	FlexRay a/b (FR)	RS232	Digital In	Digital Out	Analog In	USB	1 Gbit Ethernet	100 Mbit Ethernet
<b>blue PiraT2</b>															
<b>14C6S8L</b>	-	-	-	12	2	1	8	-	6	1	1	2	3	1	4
<b>25M24C8LFR</b>	-	1	-	22	2	1	8	2	6	5	3	10	3	1	4
<b>150M14C8LFR</b>	1	-	1	12	2	1	8	2	6	5	3	10	3	1	4
<b>blue PiraT2 5E</b>															
<b>14C5E6S</b>	-	-	-	12	2	1	8	-	6	1	1	2	2	5	-
<b>25M5E24C</b>	-	1	-	22	2	1	8	2	6	5	3	10	2	5	-
<b>150M5E14C</b>	1	-	1	12	2	1	8	2	6	5	3	10	2	5	-

Table 5.1: Model versions of blue PiraT2 / blue PiraT2 5E

The model name gives a hint to the integrated interfaces, e.g., blue PiraT2 150M14C8LFR: 1x MOST150, 12x HS-CAN, 2x LS-CAN, 8x LIN, 2x FlexRay a/b, 1x 1-Gbit-Ethernet and 4x 100-Mbit-Ethernet interfaces. Low Speed and High Speed CAN are counted only as CAN. The various interfaces are explained in later chapters.

**Attention:**

**Based on the specification of the hard drive, the data logger should always be fitted vertically or horizontally (upright or upside down).**

**Please avoid tight bending of the MOST150 fiber optic cables.**

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## 6 Control elements at the front side

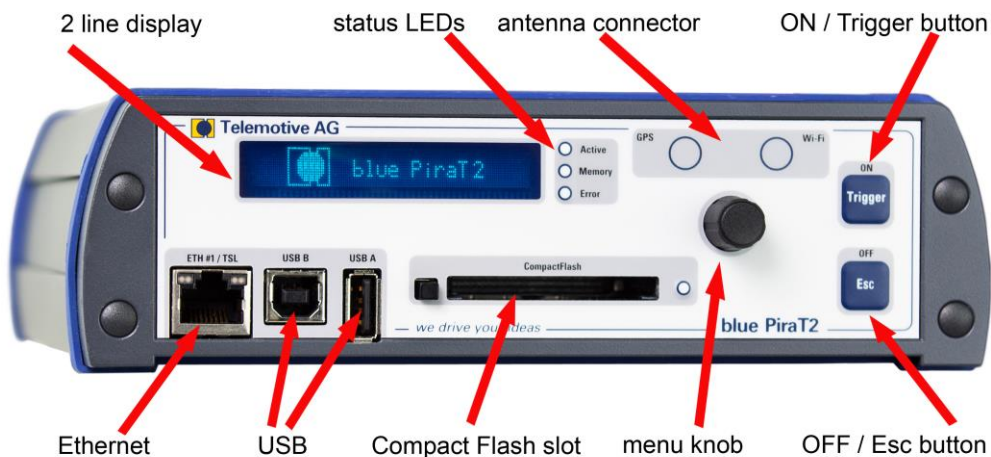
The next section describes the usage of the controls and connectors of the blue PiraT2 / 5E.



**Figure 6.1: Front side of the blue PiraT2**

**Attention:**

If you have ordered an external antenna, e.g., for GPS, the connector has to be bolt only by hand NOT with any tools.



**Figure 6.2: Front side of the blue PiraT2 5E**

**Attention:**

At blue PiraT2 ONLY the front Ethernet port is available for controlling the data logger and download data.

On the front side of the blue PiraT2 you will find the display and some control elements.

The blue PiraT2 is available with one 1-Gbit-Ethernet port on the front and also with four additional 100-Mbit-Ethernet ports, where an Ethernet switch is integrated. A mini switch is available with 4 RJ45 connectors.

## 6.1 ON / Trigger button

The **[ON / Trigger]** button is used to switch on the blue PiraT2 if the data logger is connected to the power and currently in sleep mode.

During operation, interesting points in time can be designated by the **[ON / Trigger]** button. When pressing this button, the data logger saves the current time to hard drive. It is possible to configure the data logger to send a CAN message as an acknowledgement of setting a marker. Additionally, it is possible to define a message that triggers a marker. In all cases, triggers are debounced, allowing only up to ten triggers in between every two seconds.

When downloading the data, the client displays all markers in an event overview. In this event overview, the client can be configured to transfer the data around the selected markers.

### 6.1.1 Resetting the network settings

#### **Important notice:**

**Due to a wrong network setting it might be impossible to reach the data logger any more. In this case the network configuration can be resetted by a long press on the [ON / Trigger] button for ca. 5 – 10 sec. to default settings: DHCP server with IP:192.168.0.233.**

**Afterwards the data logger can be reached again by using a direct connection with a PC/Laptop.**

## 6.2 OFF / Esc button

If the blue PiraT2 is operating and you hold the **[OFF / Esc]** button for longer time, the data logger will go into the standby mode.

If you only push the **[OFF / Esc]** button for short time you leave the current menu state.

## 6.3 Status LEDs

The blue PiraT2 has four LEDs on his front side: Active, Memory and Error to the right side from the display and CFAActive on the right side from the Compact Flash slot.

LED	Behavior
<b>Active</b>	on as long as the data logger is operating
<b>Memory</b>	active, if the data logger is not in the ring buffer mode blinking, if the storage capability exceeds 75 % continuous on, if the storage capability is used by 100 %
<b>Error</b>	on, if an error which has occurred is still active
<b>CFActive</b>	indicates that the blue PiraT2 has recognized the compact flash card

**Table 6.1: LED behavior**

## 6.4 External storage

External memory can be used to download trace data from the data logger, to update firmware and licenses or install a configuration. It can be used to download a bug report too.

The **blue PiraT2** offers additional the possibility to store data parallel to a removable media as SD card or USB device. The configuration of the feature **[Logging to External Storage]** is described in the Telemotive System Client user guide.

### 6.4.1 Compact Flash card (CF)

The CF card has to be formatted in the FAT32 file format. The card reader supports Compact Flash 4.1 (CF UDMA Modes 0-4, CF PIO Modes 0-6).

We recommend using the “SanDisk Extreme 16 GB CompactFlash” or the “STEC SLCF8GM2PUI CompactFlash”. For these are fully suitable for automotive requirements.

**Please note:**

- Datalogger with HW 1.x:

Insert the CF card with the label facing down in the CompactFlash Slot.

- Datalogger with HW 2.x:

Insert the CF card with the label facing up in the CompactFlash Slot.

The usage is described in chapter **6.6.7 Memory** .

## 6.4.2 USB storage

The USB storage has to be formatted in the FAT32 file format. You could connect USB flash drives and external hard drive up to a maximal supply current of 500 mA at blue PiraT2 and 800 mA at blue PiraT2 5E. External power supplies are not needed.

**Note:**

**Telemotive AG recommends the testing of every external storage before using it in a measurement. We suggest that especially USB devices with USB 3.0 are sometimes not recognized by the system.**

The usage is described in chapter **6.6.7 Memory** .

## 6.5 Menu knob

For control the menu of the logger the **[menu]** knob is used. The **[menu]** knob has a rotary/push controller function: rotate the button to the left equates to up and rotate it to the right equates to down. Pushing the button equates the OK function.

## 6.6 Display

The menu includes the two line display at the front. The **[menu]** knob is used for controlling the menu. Rotate the knob to the left equates to an “up” function. Rotate it to the right equates to a “down” function. Pushing the **[menu]** knob is equates to an “OK” or “Enter” function. By pushing the **[OFF / Esc]** button the current menu item will be left.

But holding the **[OFF / Esc]** button pressed for more than 5 seconds, the logger will switch into the standby mode without any confirmation.

## 6.6.1 Startup

During the Startup phase the display shows:  
**blue PiraT2**

After the Startup phase is finished, the display shows the status of the most important interfaces. For a MOST25 version the MOST25 and FlexRay will be displayed on the beginning:

**M25-**  
**FR NN--**

By rotating the **[menu]** knob you can navigate through the entire interfaces. On the following table you can find the abbreviation for the displayed interfaces and the possible status information.

Abbr.	Interface	- = Off	X = Not con-nected	N = No Traffic	T = Traffic	E = Error	S = Switch mode
CAN	CAN	x		x	x	x	
CCP/XCP	CCP/XCP	x	x	x	x	x	
ETH	Ethernet	x	x	x	x		x
FR	FlexRay	x		x	x		
LIN	LIN	x		x	x		
M25	MOST25	x	x	x	x		
M150	MOST150	x	x	x	x		
VID	Video	x	x		x		
SER	Serial	x		x	x		

**Table 6.2: Interface abbreviations and status information**

## 6.6.2 Menu mode

By pushing the **[menu]** knob you can enter the menu mode and you can see the following two lines.

**--- Menü ---**  
**[1] Info**

Currently the menu has five main categories:

1. Info
2. Licenses
3. Functions
4. Error Memory
5. Memory Device

The currently selected category is displayed inverted. By pushing the **[menu]** knob you can go into the selected main category.

**[1] Info 1/12**  
**Firmware: 02.02.01**

Usually in the first line, the main category number and the name will be displayed on the left side. If one line has not enough space to display the name and the value, the first line will be used for the name and the second for the value.

On the right side the sub category number and the total numbers of sub categories will be displayed (see above).



### 6.6.3 Info

This main category has currently twelve sub categories:

1. Firmware: current firmware of the logger
2. Hardware: mainboard version of the logger
3. SerialNr: Serial Number of the logger
4. Date/Time: Date and time of the logger
5. Storage: used / protected storage of the hard disc
6. Ext. Mem. Storage: used storage of the external memory / memory size
7. Ext. Mem. Dev: status of the external memory (e.g. CF Recordig)
8. DHCP ...: DHCP status (e.g. DHCP Server)
9. IP: IP address of the logger
10. TERM-IP: Terminal IP address
11. Config: name of the logger configuration
12. WLAN-IP: optional WLAN IP address

By rotating the **[menu]** knob you can navigate through the info list.

### 6.6.4 Licenses

By entering this main category the logger will list all installed licenses. The message <No Licenses> appears, if no license is installed. By rotating the **[menu]** knob you can navigate through the license list.

### 6.6.5 Functions

Currently there are zwei functions available:

#### Reset IP Config

If the logger has an unknown IP configuration and you have no access to the logger, there is a possibility implemented to reset the IP configuration back to the factory mode (DHCP Server and IP 192.168.0.233).

Rotate the **[menu]** knob till you see "Reset IP Config" and then push the knob to reset the IP configuration. After that, the message <IP Config reset to mode DHCP Server> will be displayed. To assume this setting, a restart is necessary.

#### Lock Keypad

If this function will be started by pressing the **[menu]** knob, the blue PiraT2 lock its control elements without any confirmation and the message <Keypad locked> appears.

By pressing the **[OFF / Esc]** button for more than 5 seconds the control elements will be unlocked and the message <Keypad unlocked> appears for a short time.

### 6.6.6 Error Memory

This main category lists all active errors. The message <No errors> appears, if no error is active. By rotating the **[menu]** knob you can navigate through the error messages.

## 6.6.7 Memory Device

This main category has currently eight sub categories. But these functions can only be executed, if an external memory device is installed. Otherwise the message <Error: No memory device attached > will be displayed.

Currently there is no difference made between memory card (CF) and USB stick.

**Note: Never remove the external memory before pressing „Safely remove ext. Mem.“.**

### 6.6.7.1 Copy to memory device

In order to copy the recorded data to an external memory you have to perform the following steps:

1. In the Telemotive System Client under General / External Storage set [Logging on External Storage] to [Off]
2. Click on the button [Write to logger]
3. Restart the logger.

There are five options available in this sub category:

1. Copy all data
2. Copy data of last 60min
3. Copy data of last 12 hours
4. Copy data of last 24 hours
5. Copy data of last 48 hours

By selecting one of the options and pressing the **[menu]** knob the copy function will be executed. The progress of the save operation will be displayed on the display. After the copy process is finished the message < Memory Device success: Data copied > will be displayed for a short time.

The folder name of the offline data has the format "Offline\_bp2\_ext\_FW-\*current firmware of the logger\*\_\*serial number of the logger\*\_\*start time of data\*\_\*end time of data\*". The times are recorded in the time standard UTC like this: `yyyymmdd_hhmmss`.

### 6.6.7.2 Erase memory device

After pressing the **[menu]** knob a verification message will be displayed. With the **[OFF / Esc]** button the process can be aborted, with the **[menu]** knob the blue PiraT2 begins to erase the memory of the memory device. After completion the message <Memory card successfully erased> will be displayed.

### 6.6.7.3 Format memory device

After pressing the **[menu]** knob a verification message will be displayed. With the **[OFF / Esc]** button the process can be aborted, with the **[menu]** knob the blue PiraT2 begins to format the memory device. After completion the message <Memory device successfully formatted> will be displayed.

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### 6.6.7.4 Install license

On the external memory card has to be a directory **license** where only one license file has to be stored.

If the external memory is inserted, you can navigate to the point "Install license". Press the **[menu]** knob. Now a verification message will be displayed. By pressing the **[OFF / Esc]** button you abort the process or continue by pressing the **[menu]** knob. If you start the function, the message <install license> will be displayed. If the installation was successful, the message <Successful install of license file> will be displayed. Otherwise the message <install failed of license file> is shown.

### 6.6.7.5 Create bug report

By pressing the **[menu]** knob the logger begins to create the bug report. In the display appears the progress of the creation process. After the creation process is finished the message <Creating Bugreport done> will be displayed for a short time. The bug report will be stored on the external memory device as a zip file in the format „Bugreport\_bP2\_All\_\*IP address of the logger\*\_creation time\*“. The time is recorded in the time standard UTC like this: `yyyymmdd_hhmmss`.

### 6.6.7.6 Firmware update

On the external memory device a folder with the name **update** has to be created, in which the update file has to be stored.

There are two ways to update the firmware of the logger with a removable device.

#### 1) Over the device menu

- a) In the Telemotive System Client under General / External Storage: set **[Firmwareupdate via Removable Media (CF/SD/USB):]** to **[Selection by user via device menu]**
- b) After pressing the **[menu]** knob a verification message will be displayed. With the **[OFF / ESC]** button the process can be aborted. With the **[menu]** knob the blue PiraT2 begins to update his firmware. The message <Updating firmware please wait..> will be displayed for a short time. The update progress appears on the display. If the update is completed <success: Firmware updated> is shown on the display. A restart will be initiated after the update process.

#### 2) Automatically when plugged in or on startup

- a) In the Telemotive System Client under General / External Storage: Set **[Firmwareupdate via Removable Media (CF/SD/USB):]** to **[Automatic detection on startup / plugin]**.
- b) After inserting the removable device or after logger startup with plugged removable device the firmware will be updated automatically and a restart will be initiated.

#### Attention:

**Please note, that after you updated the firmware you should also update the client. Please refer to chapter 7.1 Download and installation of the Telemotive System Client.**

### 6.6.7.7 Install configuration

On the external memory device a folder with the name configuration has to be created, in which only one configuration file has to be stored.

There are two ways to update the firmware of the logger with a removable device.

#### 1) Over the device menu

- a) In the Telemotive System Client under General / External Storage: Set **[Configuration via Removable Media (CF/SD/USB):]** to **[Selection by user via device menu]**

- b) After pressing the **[menu]** knob a verification message will be displayed. With the **[OFF / ESC]** button the process can be aborted. With the **[menu]** knob the blue PiraT2 begins to install the configuration. If the installation was successful, the message <Config updated> will be displayed. Otherwise the message <install failed of Config file> is shown.

## 2) Automatically when plugged in or on startup

- a) In the Telemotive System Client under General / External Storage: Set **[Configuration via Removable Media (CF/SD/USB):]** to **[Automatic detection on startup / plugin]**.
- b) After inserting the removable device or after logger startup with plugged removable device the configuration will be installed automatically. If the installation was successful, the message <Config updated> will be displayed. Otherwise the message <install failed of Config file> is shown.

### 6.6.7.8 Safely remove ext. Mem.

If you want to remove the external memory device, you have to select this sub category and press the **[menu]** knob. After that the message <Mem. Device clear to remove now> appears in the display and you can safely remove the external memory device from the data logger.

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## 7 Starting the blue PiraT2

Connect the blue PiraT2 via the power harness (red/+/clamp 30 and black/GND/-/clamp 31) with the vehicle battery or a power supply.



Figure 7.1: Power connection of the blue PiraT2

Note: blue PiraT2 5E has a separate power cable which is separated from the main cable set!



Figure 7.2: Power connection of the blue PiraT2 5E

### Attention:

If you have ordered an external antenna, e.g., for GPS, the connector has to be bolt only by hand, NOT with any tools!

Switch the blue PiraT2 on by pressing the **[ON / Trigger]** button and wait until the logger is ready. The logger shows available bus ports.



Figure 7.3: Switching on

For switching off the blue PiraT2 later please press the **[OFF / Esc]** button for a few seconds until the message <----- Shutdown -----> is displayed.

Pressing down the **[menu]** knob will enter the menu mode. Now select the main category “[1] Info”, then choose the sub category “9/12” with the IP in the display. This IP address is required for the next step.

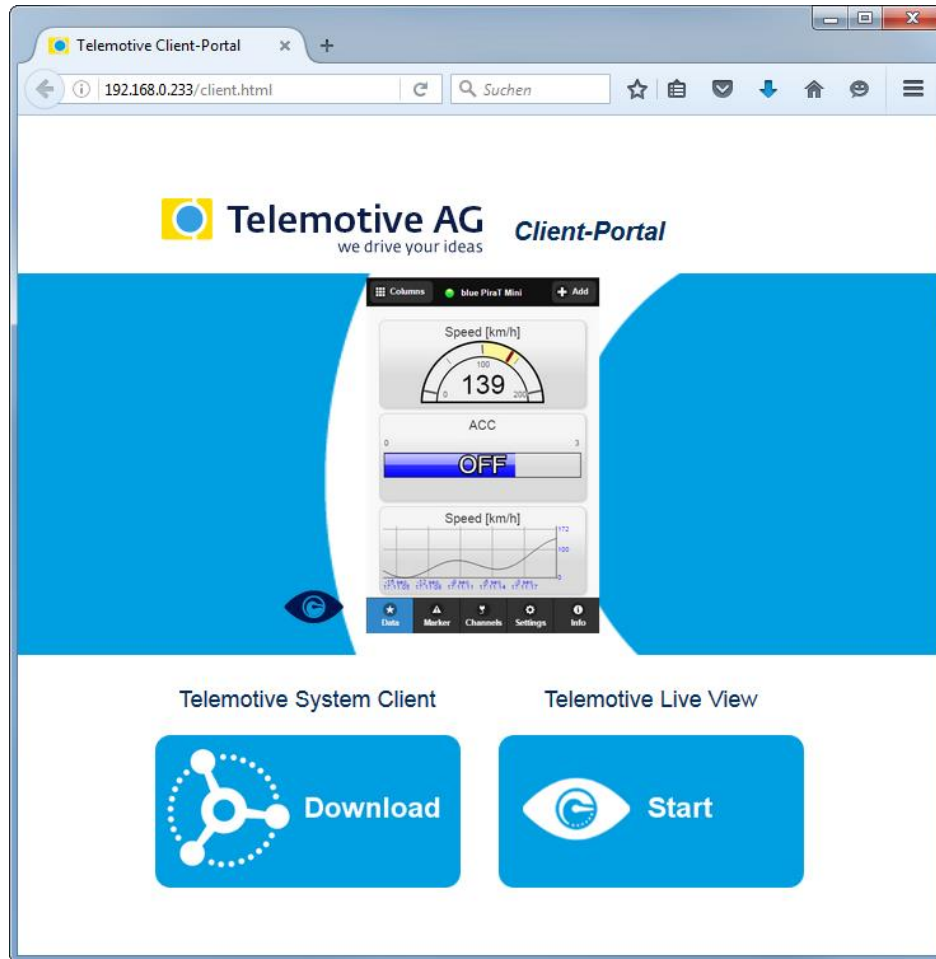


**Figure 7.4: Info screen IP address**

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## 7.1 Download and installation of the Telemotive System Client

Open your internet browser, enter the IP address of the logger (Default setting: **192.168.0.233**) and press **[Enter]**.



**Figure 7.5: Telemotive Client Portal**

The connection between the logger and your computer system will be established. Please take care that the network settings of your network adapter are set to **Obtain IP address automatically**.

Click **[Download]**, to download the Telemotive System Client directly from the logger.

Follow these steps, depending on your browser:

Browser	Proceeding
Internet Explorer	Click <b>[Save]</b> , to locally save the file on your system. Click <b>[Accomplish]</b> .
Mozilla Firefox	Click <b>[Save file]</b> , to locally save the file on your system. Click the arrow on the right top of the browser menu and select the downloaded application in the appearing context menu.

In the dialog that opens select the desired software language from the dropdown menu. Click **[OK]**.

Follow the instructions in the next dialog and select an installation directory. Click **[Install]**.

After successful installation you will find the **Telemotive System Client** icon on your desktop. Double-click the icon to start the application.



**Figure 7.6: Desktop icon**

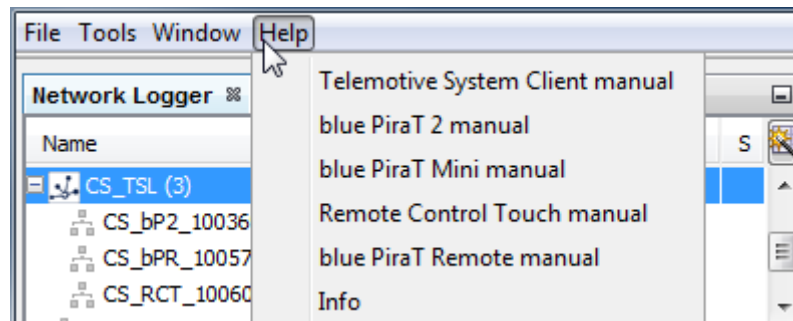
You can download the entire **manual for the Telemotive System Client** in our ServiceCenter. In the manual, the following operations are described extensively:

- detailed description of the Telemotive System Client
- configuration of the data logger
- download of the recorded data
- conversion of the recorded data
- Firmware-/ License update
- creating a bug report

You can open the manual directly via this link:

[https://sc.telemotive.de/4/uploads/media/TelemotiveSystemClient\\_UserManual.pdf](https://sc.telemotive.de/4/uploads/media/TelemotiveSystemClient_UserManual.pdf)

For having an easy access if necessary, the most important manuals are linked in the client under the menu item **[Help]** and are reachable easily from there.

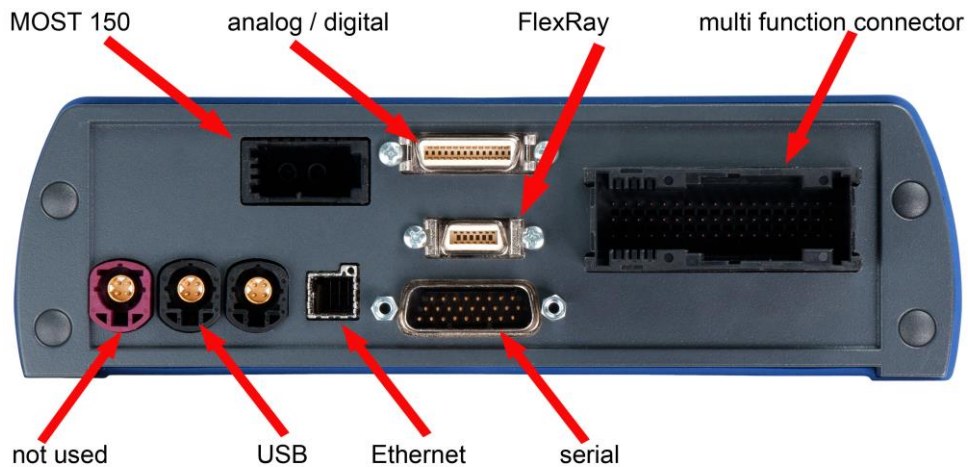


**Figure 7.7: links to the manuals**

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## 7.2 Interfaces at the rear side



**Figure 7.8: Rear side of the blue PiraT2 with MOST150**

On the various data logger types are the following connectors possible:

- multi function connector: This connector contains the remaining lines for power, High Speed CAN 1-12, Low Speed CAN 12-13, Remote Control Voice, LIN 1-8. The pin assignment of this connector is described in the chapter 14.1.

### Warning:

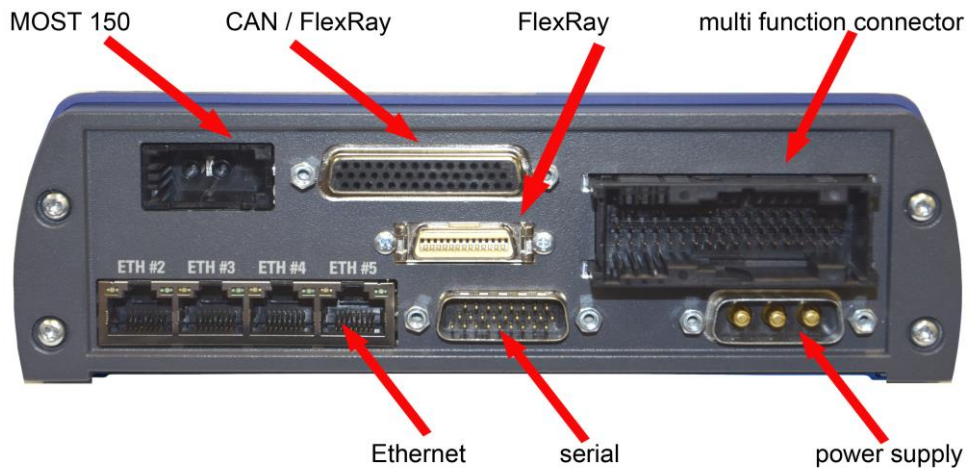
**It is possible that devices connected to the data logger might be damaged in case of an incorrect polarity of the data logger power supply.**

- MOST: A standard 2+0 connector for MOST fiber optic.

### Important:

**If the MOST connector is not used, the jack must be covered with a terminating plug. This prevents the sensitive fiber optic contacts from getting dirty. It also makes sure that the data logger does not start up unintentionally when, e.g., strong sunlight falls onto the optical contacts.**

- serial: This connector is described in the chapter 10.3.
- analog/digital: This connector is described in the chapter 14.4.
- FlexRay: One connector for two interfaces with a/b. The pin assignment of this connector is described in the chapter 14.6.
- Ethernet: connector for optional Ethernet-Kit
- USB: not used in the moment



**Figure 7.9: Rear side of the data logger blue PiraT2 5E MOST150**

**Important:**

**In contrast to the blue PiraT2 the blue PiraT2 5E has a separate power supply (see at the right side below)**



**Figure 7.10: new power supply connector with reverse polarity protection**

The newly delivered loggers are equipped with a reverse polarity protected power supply connector.

The power supply integrated into the MQS plug is used only for supplying an optional connectable RCV / RC.

At blue PiraT2 5E the connection for the external Ethernet switch is replaced by an integrated 4 ports switch at the rear side directly into the device.

The other connectors are the same like at blue PiraT2.

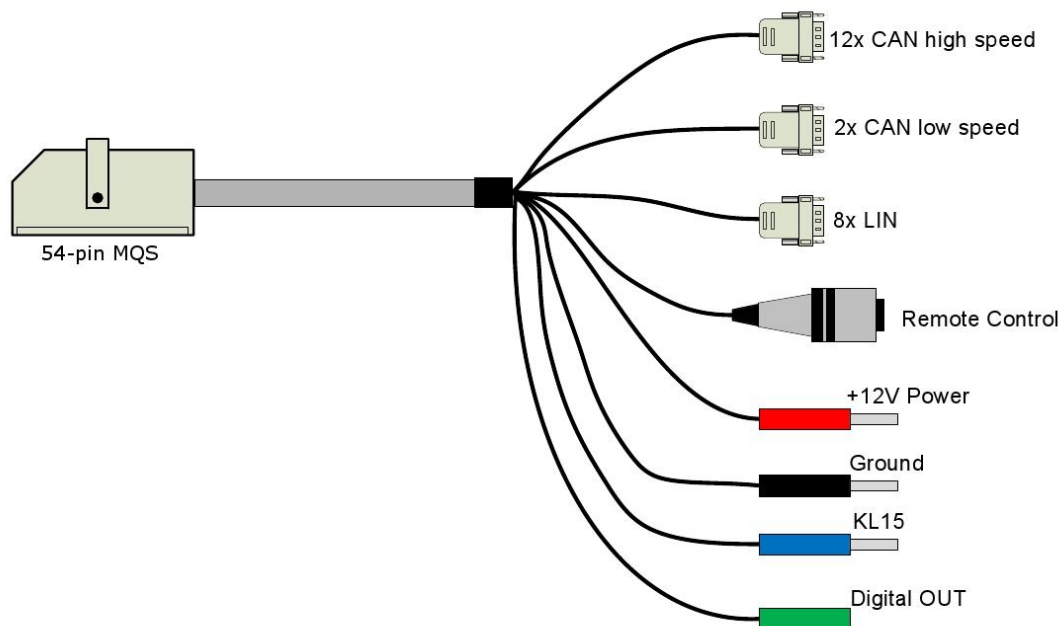
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## 8 Adapter cables

This section describes which adapter cables are available for the **bluePiraT2** and **blue PiraT2 5E**.

### 8.1 Universal adapter cable

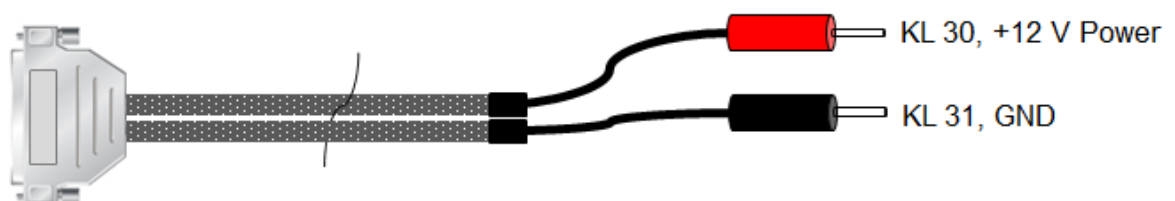
Telemotive AG offers adapter cables that connect to the multi function connector and split up its lines to separate connectors.



**Figure 8.1: Connecting the blue PiraT2 via the universal adapter cable**

When the universal cable set is used at a **blue PiraT2 5E** +12V Power and Ground are needed for an optional Remote Control Voice only!

### 8.2 Power cable for blue PiraT2 5E (Art. 103 614)



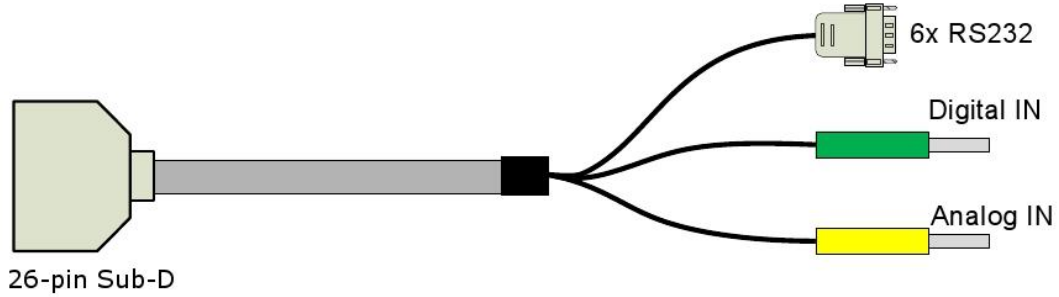
SUB-D 3W3C

Length: ~ 105cm

**Figure 8.2: Power cable for blue PiraT2 5E**

### 8.3 Adapter cable Serial/RS232, Analog/Digital

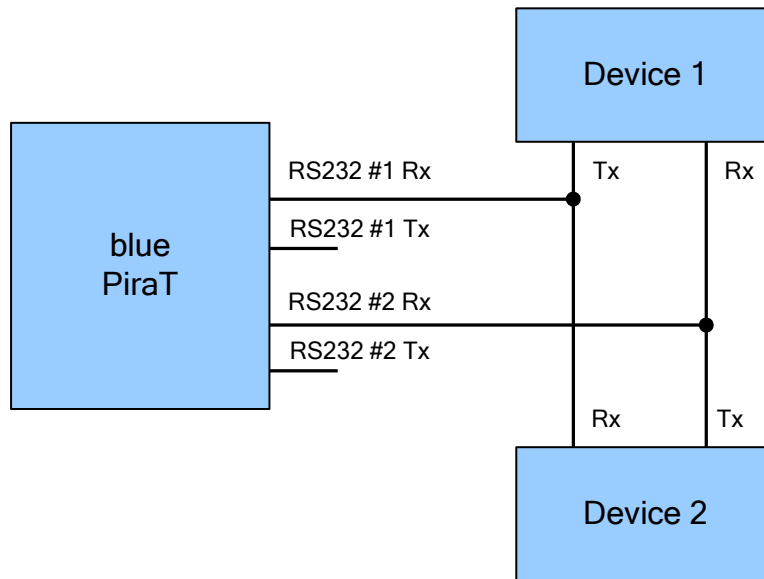
The following figure shows the adapter cables for 6x RS232, one digital IN and one analog IN.



**Figure 8.3: RS232/digital/analog adapter cable**

**Note:**

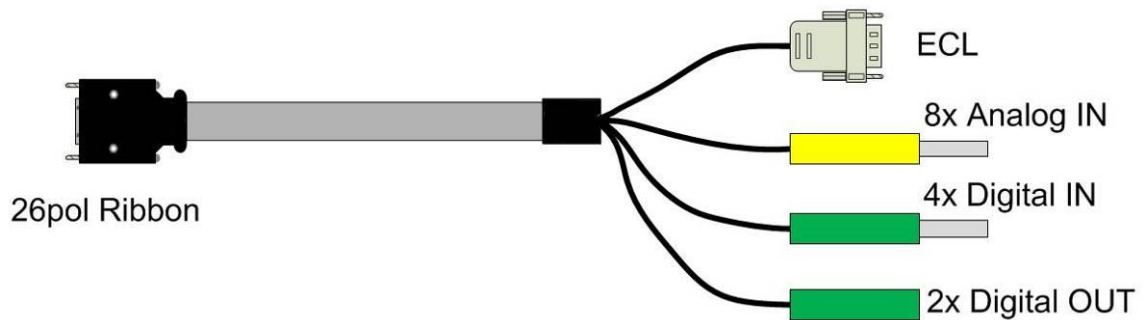
The blue PiraT2 actively sends data on the “Tx” line if a protocol for the serial port is configured. The “Tx” line must only be connected to special devices that support those protocols. If the application is listening to a bidirectional serial communication of two devices, two serial ports of the blue PiraT2 have to be used. The “Tx” lines must not be connected in this case.



**Figure 8.4: Listening to a bidirectional serial communication**

## 8.4 Adapter cables for Analog/Digital

The following figure shows the adapter cables for ECL, 4x digital IN, 8x analog IN and 2x digital OUT.

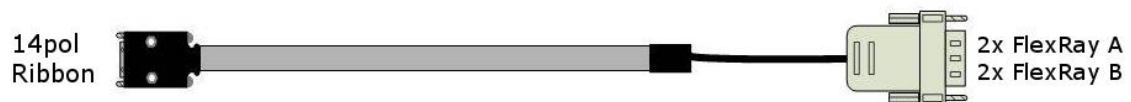


**Figure 8.5: Adapter cables for digital/analog**

This adapter cable is only available for the logger types 150M14C8LFR and 25M24C8LFR.

## 8.5 Adapter cable FlexRay

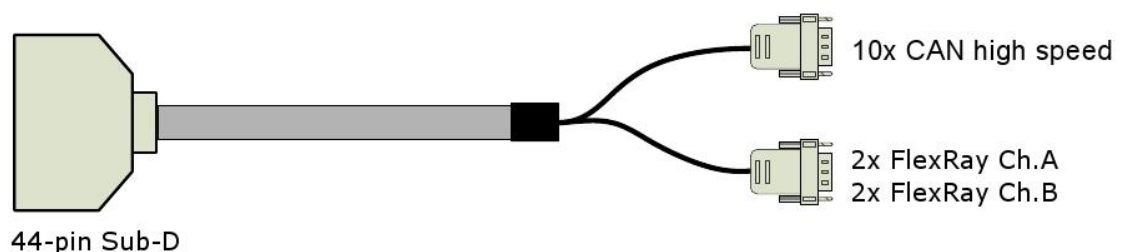
The following figure shows the adapter cables for FlexRay (only for blue PiraT2 150M14C8LFR).



**Figure 8.6: Adapter cables for FlexRay**

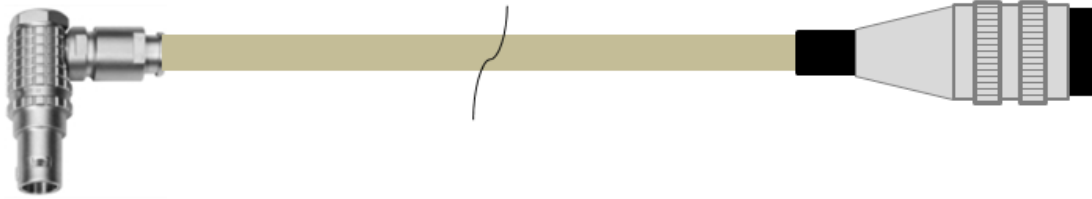
## 8.6 Adapter cables for CAN/FlexRay

The following figure shows the adapter cables for 10x High Speed CAN and FlexRay (only for blue PiraT2 25M24C8LFR).



**Figure 8.7: Adapter cables for CAN/FlexRay**

## 8.7 Adapter cable for Remote Control Voice (RCV)



Lemo – Stecker / plug  
FGH.1B.308.CLAD42

Lumberg – Stecker / plug  
SV81-8 DIN8

Length: ~ 500cm

**Figure 8.8: Adapter cable for Remote Control Voice (RCV)**

### **Please note:**

**When using a blue PiraT2 5E the power connector of the universal cable set has to be connected too although this device has an own power cable because this connection is needed for the RCV/RC.**

## 8.8 Ethernet kit for blue PiraT2

The following figure shows the Ethernet box with four interfaces. This would be connected with a FCI-cable to the blue PiraT2.

This kit is available only for blue PiraT2 because blue PiraT2 5E has an integrated 4-port switch.



**Figure 8.9: Ethernet kit for blue PiraT2**

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## 9 Logging data

### 9.1 Setting markers

Interesting points in time can be designated by the **[ON / Trigger]** button at the front panel or at the Remote Control. When pressing this button, the data logger saves the current time to hard drive.

It is possible to configure the data logger to send a CAN message as an acknowledgement of setting a marker.

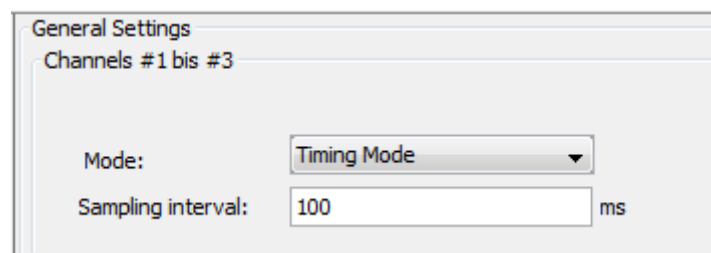
Besides using the **[ON / Trigger]** button, it is also possible using the digital inputs and **Complex triggers** function to realize an external marker button (have a look at the **Complex Triggers** user guide).

Additionally, it is possible to define a message that triggers a marker. In all cases, marker triggers are debounced.

When downloading the data, the client displays all markers in a data in the data overview. The client can be configured to transfer the data close around selected markers.

#### 9.1.1 Setting marker with an extern push button

Besides using the **[ON / Trigger]** button, it is also possible using the digital inputs and **Complex triggers** function to realize an external Marker button. Important is to set the used interface active and set the „Timing Mode“ under general settings to a <Sampling interval> to at least 100 ms.



**Figure 9.1: Sampling interval**

**Figure 9.2: Setting triggers using digital Input**

The setting for the <Sampling interval> is needed to debounce the external push button and be sure that only one trigger is set. The external push button can be connected to the power supply of the car and the Digital In mentioned above.

## 9.2 Time stamp

The recorded messages and status messages are provided with a time stamp at the conclusion of the reception, i.e., at the time at which a receiver could receive the message. Usually the recorded messages will get a time stamp at the end of each received message. Only for the serial interface (RS232) the time of the start of the transfer will be used.

Trace Data	Accuracy	Start	End
MOST25	1 µs		x
MOST150	1 µs		x
ECL	1 µs		x
CAN	1 µs		x
LIN	1 µs		x
FlexRay	1 µs		x
Ethernet	100 ms		x
RS232	1 ms	x	

**Table 9.1: Accuracy of marker**



### 9.3 Standby mode

The table below shows, which busses or signals are monitored for keeping the logger alive and which busses or signals are able to wake up the logger.

Schnittstelle / Interface	Wachhalten / Keep alive	Aufwecken / Wake up	Konfigurierbar / configurable	Konfigurierbar / configurable	Kommentar / comment
			W = wake up A = keep alive	W = wake up A = keep alive	
			bP2	bP2 5E	
MOST25	✓	✓	W / A: Ein / Aus W / A: On / Off	W / A: Ein / Aus W / A: On / Off	Licht an / light on
MOST150	✓	✓	W / A: Ein / Aus W / A: On / Off	W / A: Ein / Aus W / A: On / Off	Licht an / light on
ECL	✓	✓	W / A: Ein / Aus W / A: On / Off	W / A: Ein / Aus W / A: On / Off	
High Speed CAN	✓	✓	W / A: Ein / Aus W / A: On / Off  CAN 1-10,11,12,15-24	W / A: Ein / Aus W / A: On / Off  CAN 1,2,... - 12,	bP2: gruppiert / combined bP2 5E: einzeln / single
Low Speed CAN	✓	✓	W / A: Ein / Aus W / A: On / Off CAN 13-14	W / A: Ein / Aus W / A: On / Off CAN 13, CAN 14	bP2: gruppiert / combined bP2 5E: einzeln / single
LIN	✓	✓	W / A: Ein / Aus W / A: On / Off LIN 1-2, 3-4, 5-6, 7-8	W / A: Ein / Aus W / A: On / Off LIN 1, 2, 3, 4, 5, 6, 7, 8	bP2: gruppiert / combined bP2 5E: einzeln / single
FlexRay	✓	✓	W / A: Ein / Aus W / A: On / Off W: FlexRay 1a-2b	W / A: Ein / Aus W / A: On / Off W: FlexRay 1a-2b	
Seriell RS232	✓	-	A: Ein / Aus A: On/ Off	W / A: Ein / Aus W / A: On / Off	
Ethernet 1 Gbit	✓	-	A: Ein / Aus, Alive time A: On/ Off, Alive time	A: Ein / Aus, Alive time A: On/ Off, Alive time	Zeit: General/Standby
Ethernet 100 Mbit	✓	-	A: Ein / Aus A: On/ Off	A: Ein / Aus A: On/ Off	
Analog In	-	-	-	-	
Digital In 1	-	✓	W: Ein / Aus W: On/ Off	W: Ein / Aus W: On/ Off	schaltet bei 9,5 V ± 0,3 V ein
Digital In 2	-	✓	W: Ein / Aus W: On/ Off	W: Ein / Aus W: On/ Off	Schwellwert einstellbar Threshold adjustable
Digital In 3-5	-	-	W: On/ Off	-	
USB	-	-	-	-	
Remote Control	-	✓	-	-	via [ON / Trigger] -Taste/ via [ON / Trigger] -button
[ON / Trigger] -Taste/ [ON / Trigger] -button	-	✓	-	-	
WLAN / WiFi	-	-	-	-	

**Table 9.2: Standby mode – [W= wake up A= keep alive]**

## 9.4 Memory space and level

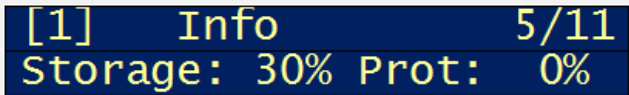
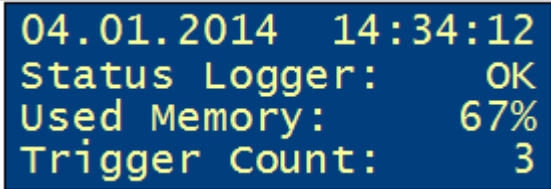
About the ring buffer and other options, such as the protection of areas around markers, the characteristics of the logger can be configured what to do, when the internal memory is full.

The following status messages can occur during operation of the data logger. It will also be displayed on the optional Remote Control (RC) / Remote Control Voice (RCV).

### 9.4.1 Status Logger: OK

Everything is OK

On the internal memory is enough free space to record all incoming data.

<b>blue PiraT2</b>	Memory-LED is off.
<b>blue PiraT2 display</b>	On the info page the display of blue PiraT2 shows the storage level and the amount of protected data. 
<b>RCV</b>	

**Table 9.3: Status Logger: OK**

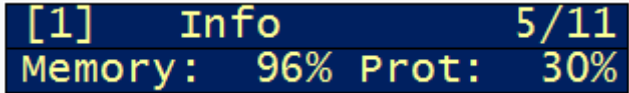
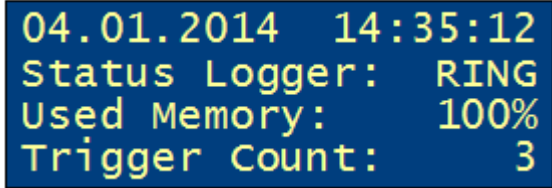
### 9.4.2 Status Logger: WARN

Warning, which does not affect the data recording

### 9.4.3 Status Logger: RING

Memory is full, buffer mode is active

The buffer is active and the storage filled more than 95 %. Older data will be deleted to save space for newer data.

<b>blue PiraT2</b>	Memory-LED is off.
<b>blue PiraT2 display</b>	
<b>RCV</b>	Line three shows the level of the ring buffer on the internal memory. 

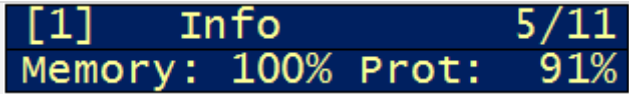
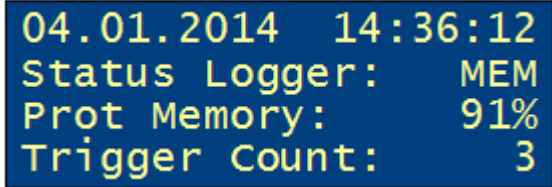
**Table 9.4: Status Logger: RING**

### 9.4.4 Status Logger: MEM

Internal memory is nearly full, no more data will be stored soon

**Case 1:** The ring buffer is enabled and more than 95 % full (as Status RING), in addition over 90 % of the trace files are protected.

**Case 2:** The ring buffer is disabled and filled to more than 95 %. When ring buffer mode is disabled all trace files are implicitly protected.

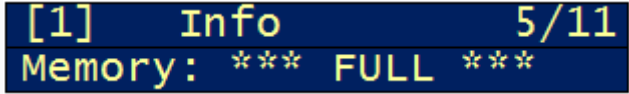
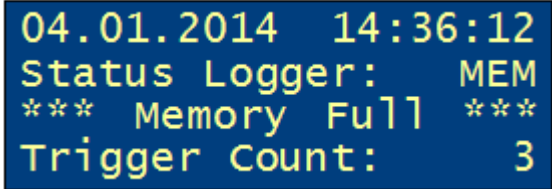
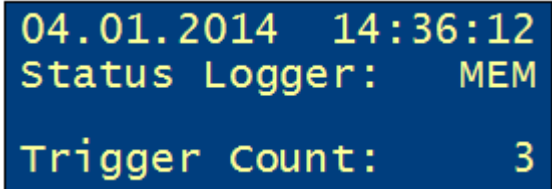
<b>blue PiraT2</b>	Memory-LED is off.
<b>blue PiraT2 display</b>	
<b>RCV</b>	Line three now shows the level of the ring buffer with protected files. In the display below we see that the ring buffer is filled to 91 % with protected and to 9 % with non-protected files. Till now the oldest unprotected files will be cleared to make way for new space. 

**Table 9.5: Status Logger: MEM**

**Case 3:** The ring buffer is disabled and the memory to 100 % full.

**Case 4:** The ring buffer is enabled and the memory to 100 % full with protected files.

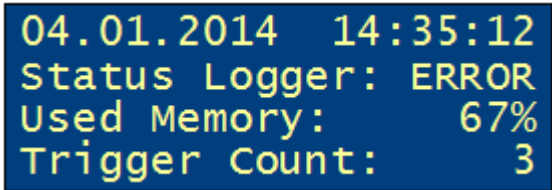
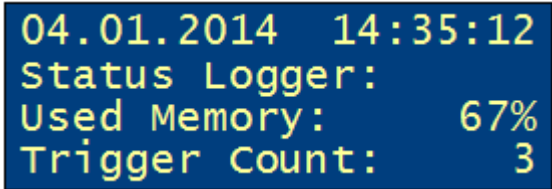
In both cases, the data recording is stopped because no files can be deleted to make way for new space.

<b>blue PiraT2</b>	Memory-LED switches on.
<b>blue PiraT2 display</b>	The following message is displayed, when recording medium is full (Memory: 100% Prot: 100%). 
<b>RCV</b>	The third line shows flashing that the storage medium is full. For this, the third line is faded in and out every second.  

**Table 9.6: Status Logger: Memory Full**

### 9.4.5 Status Logger: ERROR

Error in the logger, the data record is not guaranteed

<b>blue PiraT2</b>	Memory-LED is on.
<b>blue PiraT2 display</b>	
<b>RCV</b>	In the second line of the status "ERROR" flashes every second.  

**Table 9.7: Status Logger: ERROR**

## 10 Interfaces

The different interfaces of the blue PiraT2 supported bus systems are described in this chapter in more detail.

### 10.1 CAN

The blue PiraT2 is able to record data in compliance with the CAN specification 2.0a (11 Bit identifier) and 2.0b (29 Bit identifier).

#### 10.1.1 High Speed and Low Speed operating modes

Depending on the model, the blue PiraT2 has different numbers of High Speed (HS) and Low Speed (LS) CAN interfaces. It is not possible to change a CAN interface from Low to High Speed or vice versa. Each type is using different transceivers.

The electrical behavior of the Low Speed and the High Speed CAN is different, hence, the Low Speed CAN port of the blue PiraT2 must not be connected to a High Speed CAN bus and vice versa.

Both operating modes use differential signals (CANH, CANL). For the correct data recording, all nodes of the bus must have a common reference potential. The blue PiraT2 uses the connection “**clamp 31**” as a reference potential. The lines of the High Speed CANs are terminated with a high resistance.

	Low Speed CAN	High Speed CAN
<b>Transceiver chip</b>	Philips TJA1054	Philips TJA1041
<b>Terminating resistor</b>	12k	2k6
<b>Baud rate</b>	50 kbit/s - 125 kbit/s	50 kbit/s - 1 Mbit/s
<b>Supported identifiers (SW)</b>	11 and 29 Bit	11 and 29 Bit
<b>Disabling acknowledge</b>	possible	possible
<b>Time stamps</b>	at the end of the telegram	at the end of the telegram

**Table 10.1: CAN**

#### 10.1.2 CAN data with 29 Bit identifiers

The blue PiraT2 can also log CAN data with 29 Bit identifiers. You don't have to configure anything. All the CAN data will be logged as they are available on the CAN bus. It is also possible to log CAN messages mixed with 11 Bit and 29 Bit identifiers.

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### 10.1.3 Recording contents

The blue PiraT2 is able to record the following error states of the CAN bus:

- Stuff error
- Format error
- Acknowledge error
- Bit 0/1 error
- CRC error
- Overrun

These error states are only included in the Telemotive file formats. After reaching a certain number of errors (50 errors), the recording of error states is interrupted until reception of the next successful CAN message to avoid an overload of the recorded data.

### 10.1.4 Sending CAN messages

If the blue PiraT2 sends a CAN message, it is shown twice in the trace: The first message indicates the transmit request of the data logger and the second message indicates the actual transmission of the message.

In the CANoe file format these messages are indicated as “TxRq” and “Tx”, respectively. The transmit request messages are not included in file format that don't support them.

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## 10.2 LIN

The blue PiraT2 is able to record data compliant to the LIN specification V1.3, V2.0 and V2.1. The data logger does not actively appear as a bus member. Sending LIN messages is currently not supported.

<b>Channels</b>	Up to 4
<b>Transmission rate</b>	1200, 2400, 4800, 9600, 19200, 20000 Baud
<b>Transmitter</b>	TJA1020
<b>State</b>	Parity BITS, format Check for Header, Checksum for Header and Payload
<b>Terminating resistor</b>	30 kOhm

**Table 10.2: LIN**

### 10.2.1 LIN data blocks and time stamps

Each LIN message receives a time stamp, which marks the end of the message. If the data logger receives LIN data without a valid header, it creates blocks containing the erroneous data. The maximum block size is 10 bytes. A block is also concluded after a timeout, which is three times the transmission time of a LIN character.

### 10.2.2 LIN transceiver

The blue PiraT2 uses the LIN transceiver TJA1020 by NXP (former Philips Semiconductor). Supported baud rates are in the range from 1200 to 20000 Baud. Automatic baud rate detection is currently not supported. The LIN interface is configured as a slave device with a terminating resistor of 30 kΩ.

### 10.2.3 Special frames and states

Additionally to the normal frame data, the following information is recorded:

- Wake-Up Frames
- Checksum Errors

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## 10.3 Serial (RS232)

<b>Channels</b>	6x RS232
<b>Data bits</b>	5, 6, 7, 8
<b>Stop bits</b>	1, 2, 1.5
<b>Parity</b>	None, odd, even

**Table 10.3: Serial interface**

The blue PiraT2 supports only the RS232 specification.

### 10.3.1 Segmentation of the serial data

The received serial data are clustered into data blocks separately for each channel. Each block is finalized after a certain time or when it reaches a certain maximum size. The time is 30 to 60 ms depending on the channel. The maximum size is 49 to 80 bytes. A time stamp is assigned to each block when it is finalized.

### 10.3.2 RS232 transceiver

The threshold voltages for data reception are the usual RS232-defined values. A logical "1" is recognized for input voltages smaller 0 Volts, a logical "0" for input voltages higher than 3 Volts.

## 10.4 FlexRay

The blue PiraT2 is able to record FlexRay bus data according to the FlexRay specification 2.1A. The data logger records all valid and invalid, static and dynamic frames of the two FlexRay channels, including "a" and "b", independently if the FlexRay bus is in a synchronous or asynchronous state.

<b>Channels</b>	2x (a + b)
<b>Max. bit rate</b>	10 Mbit/s
<b>Frames</b>	Static, Dynamic, Null Sync, Startup
<b>Transceiver</b>	AS8221

**Table 10.4: FlexRay**

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## 10.5 Ethernet

All versions of the blue PiraT2 data logger are able to log Ethernet data. All data loggers have a 1-Gbit-Ethernet port with RJ45 connector on the front. On the rear side there is a FCI connector which provides four 100 Mbit Ethernet interfaces. An Ethernet kit is available for breaking off this four Ethernet ports to RJ45 plugs.

The **blue PiraT2 5E** has 4 integrated 1-Gbit-Ethernet ports at the rear side.

For connecting the the data logger with a PC only the 1-Gbit port at the front can be used.

From here you'll find a list of the supported protocols. When a protocol requires a license, this will be marked.

### 10.5.1 GNLogger

For connecting a standard TCP (open socket connection) is used. Therefore the blue PiraT2 is a TCP slave device.

GNLogger is a proprietary serial protocol used for some ECU diagnosis.

### 10.5.2 UTF8

The blue PiraT2 will initiate a TCP connection to a TCP server by using an open socket connection (you can configure IP/Port of server via client software).

By using UTF8 data transmission the logger will write a timestamp after every detected Linefeed (LF) from the incoming data.

If the connection is getting lost, it will take about 5 seconds to build up a new connection for logging data again.

### 10.5.3 Raw

When using the raw data transmission over TCP the blue PiraT2 will be a TCP slave device. Therefore the blue PiraT2 will initiate a TCP connection to a TCP server by using an open socket connection (you can configure IP/Port of server via client software).

When using raw data transmission, every data package up to 40 Kbytes is getting a time stamp and will be written on the logger.

If the connection is getting lost, it will take about 5 seconds to build up a new connection for logging data again.

### 10.5.4 UDPServer

The blue PiraT2 can be configured as a UDP server by setting up an IP address and port number.

There is an adjustable timeout. The connection will be terminated if no data arrives. This appears as a message in the trace file. There is no configurable debug level. The blue PiraT2 as a UDP server accepts UDP data packets, UDP multicast and UDP broadcast packets.

If the connection is getting lost, it will take about 5 seconds to build up a new connection for logging data again.

### **10.5.5 TCPServer**

The blue PiraT2 can be configured as a TCP server by setting up an IP address and port number.

There is an adjustable timeout. The connection will be terminated if no data arrives. This appears as a message in the trace file. There is no configurable debug level. The blue PiraT2 as a TCP server accepts TCP data packets, TCP multicast and TCP broadcast packets.

If the connection is getting lost, it will take about 5 seconds to build up a new connection for logging data again.

### **10.5.6 SpyMode**

By using the Ethernet Spy mode it is possible to log all Ethernet data (promiscuous mode).

More information can be found in the **Telemotive System Client User Guide**.

### **10.5.7 EsoTrace**

By using the EsoTrace mode it is possible to log data in the EsoTrace protocol.

More information can be found in the **Telemotive System Client User Guide**.

### **10.5.8 Camera (license required)**

If you use a camera license on the data logger, it is possible to connect up to four Ethernet webcams to the blue PiraT2. After connecting the blue PiraT2 is able to log MPEG4 video streams.

More information can be found in the **Camera User Guide**.

### **10.5.9 DLT (license required)**

If you use a DLT license on the data logger, it is possible to connect up to 16 ECU for logging their DLT messages.

More information can be found in the **DLT-logging User Guide**.

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## 10.6 MOST25

The **blue PiraT2 MOST25** data logger is able to log messages from the MOST25 bus of the following types.

<b>Status</b>	MPR (Maximum Position Register), SBC, Light on, MOST Lock Flag
<b>Control</b>	Control Messages
<b>Packet</b>	MDP (MOST Data Packet)
<b>Filter</b>	Control Messages on/off, Packet on/off, MDP on/off, Status on/off, MDP Transmit and Receive Address, Packet Length

**Table 10.5: MOST25 data logging**

The SMSC SpyNIC MOST25 is used to provide the MOST25 traffic data. The data logger is not an active part of the bus system because it is working in a spy mode. The device is able to log messages immediately after wake up.

Before the logging data are saved on the hard disk, they are buffered in a ring buffer. In the case of a data rate peak, which exceeds the storage rate of the hard disk, storage of data is still possible.

If the MOST25 data rate is permanent higher than the maximum storage rate, the data logger will stepwise deactivate channels: first the MDP channel, then the control channel and at last the status messages.

To ensure logging of maximum continuous data blocks a hysteresis is implemented. Before logging MDP messages again, the ring buffer data has to be fully stored on the hard disk. Before starting the logging of the MDP messages again the system sends a "Lost Message". This message contains information about how many messages of which type were rejected.

## 10.7 MOST150

The **blue PiraT2 MOST150** data logger is able to log messages from the MOST150 bus of the following types.

<b>Status</b>	MPR (Maximum Position Register), MDC (MOST Data Channel), Light On, System Lock Flag, Shut Down Flag, Ring Lock Flag, Open Ring/Multi Master Flag, Node Position Changes of the states are only logged when the state is changing.
<b>Control</b>	Control Messages
<b>Packet</b>	MDP (MOST Data Packet), MEP (MOST Ethernet Packet)
<b>Filter</b>	Control Messages on/off, Packet on/off, MDP on/off, MEP on/off, Status on/off, MDP Transmit and Receive Address, Packet Length, MEP Receive Address, Message Length

**Table 10.6: MOST150 data logging**

The SMSC SpyNIC MOST150 is used to provide the MOST150 traffic data.

The data logger is not an active part of the bus system because it is working in a spy mode. The device is able to log messages immediately after wake up.

Before the logging data are saved on the internal memory, they are buffered in a ring buffer. In the case of a data rate peak, which exceeds the storage rate of the internal memory, storage of data is still possible.

If the MOST150 data rate is permanent higher than the maximum storage rate, the data logger will stepwise deactivate channels: first the MEP and MDP channel, then the control channel and at last the status messages.

To ensure logging of maximum continuous data blocks a hysteresis is implemented. Before logging MEP and MDP messages again, the ring buffer data has to be fully stored on the hard disk. Before starting the logging of the MEP and MDP messages again the system sends a "Lost Message". This message contains information about how many messages of which type were rejected.

## 10.8 ECL

Currently the ECL (Electrical Control Line) is only supported in conjunction with MOST150. In general, the ECL is a slow LIN bus. The following ECL messages will be recorded:

- EWU (Electrical Wake-Up)
- STWU (System Test Wake-Up)
- STP (System Test Parameters)
- STR (System Test Results)
- Undefined Pulse

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## 11 Conversion of recorded traces

All trace data will be recorded internally in the proprietary Telemotive TMT format (\*.tmt). If the recorded trace data will be downloaded and sorted, the data will be converted to an Extended TMT format (\*.xtmt).

The client provides the possibility to convert the internal format in other formats, to make the data readable or to prepare them for available analyzing tools.

More information about the file formats and a detailed manual for conversion can be found at the **Telemotive System Client User Guide**.

### 11.1 Conversion format overview

The table below shows which data of the interfaces can be converted to other formats.

Tracedaten / Trace data	Format / format																											
	*.txt APN ASCII	*.txt ASCII Hexadecimal	*.dit Autosar DLT	*.bif Binary Logging	*.CANORDER.asc CANORDER	*.asc CANoe ASCII	*.esotrace Eso Trace file	*.raw Ethernet Raw	*.xtmt Extended Telemotive	*.xjaaa GN-Log	*.gpx GPS Exchange	*.kml KML Google Maps	*.kntz KMZ comp. Google Maps	*.log MDF Logging	*.mdf MDF Signal v3.3	*.mf4 MDF Signal v4.1	*.img MOST Data Analyser	*.mpeg4 MPEG-4	*.ts MPEG Isochron raw file	*.nmea NMEA - ASCII GPS	*.op2 Oplotyzer	*.RAW.txt RAW Serial	*.txt Serial Debug	*.txt Serial Trace Analyser	*.pcap TCPdump	*.txt Telemotive ASCII	*.trc Trace Client	
Analog IN					X	X		X																			X	
CAN				X	X	X		X						X	X	X											X	
CCP_XCP								X							X	X											X	
Digital IN								X																			X	
ECL								X										X									X	
Ethernet		X	X				X	X	X	X															X	X	X	
- Ethernet - DLT			X					X	X																		X	
- Ethernet - EsoTrace							X	X	X																		X	
- Ethernet - GN Log								X	X	X																	X	
- Ethernet - RAW								X	X																		X	
- Ethernet - Spy Mode/MII				X				X	X																X	X	X	
- Ethernet - TCP Server								X	X																		X	
- Ethernet - UDP Server								X	X																		X	
- Ethernet - UTF8								X	X																		X	
FlexRay				X	X			X																			X	
GPS								X		X	X	X								X							X	
Kamera/Video																			X									
LIN				X	X			X																			X	
MOST150 CTRL				X				X										X									X	
MOST150 MDP				X				X										X									X	
MOST150 MEP				X				X										X							X	X		
MOST150 Streaming				X				X										X		X								
MOST25 CTRL				X	X			X										X				X					X	
MOST25 MDP				X	X			X										X									X	
Serial RS232	X	X	X				X	X	X														X	X	X		X	
Signal based filter (Format wird beibehalten / keeps the used format)								X																			X	
USB / Conn.-Gateway MLBevo																							X	X			X	
<b>Marker</b>				<b>P</b>	<b>M</b>	<b>P</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>P</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>	
<b>Konvertierung / converting</b>	<b>1</b>	<b>1</b>	<b>m</b>	<b>m</b>	<b>m</b>	<b>m</b>	<b>1</b>	<b>1</b>	<b>m</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>m</b>	<b>m</b>	<b>1</b>	<b>m</b>	<b>1</b>	<b>m</b>	<b>1</b>	<b>m</b>	<b>1</b>	<b>m</b>	<b>1</b>	<b>m</b>	<b>1</b>		
<b>Marker</b>	<b>M</b>	Marker kann in Trace geschrieben werden																										
	<b>P</b>	Marker kann nur als CAN / MOST Pseudonachrichten in die Datei geschrieben werden																										
<b>Konvertierung / converting</b>	<b>m</b>	eine Datei für mehrere Kanäle																										
	<b>1</b>	einzelne Datei pro Kanal																										

**Table 11.1: Conversion options (overview)**

## 12 Service and safety instructions

### **Note according to standard EN55011:2009**

The data logger is used in an industrial environment. Due to the behavior of conducted as well as radiated disturbances it possibly can be difficult to ensure electromagnetic compatibility in other environments.

### **Cleaning**

The data logger should only be cleaned with a clean, slightly dampened cleaning cloth with water. Other cleaning supplies such as petrol, alcohol etc. may not be used.

### **Maintenance**

The data logger is maintenance-free. The customer is not allowed to open the housing. Unauthorized modifications will void the warranty.

### **Fuse**

In case of an error the customer may change only the fuse on the harness or externally accessible fuses. The fuse may be replaced only with a fuse of the same type and current rating.

### **Disposal**

The disposal of the device must be in accordance to statutory provisions.

## 12.1 Safety advice

### **Installation instructions**

The data logger should only be installed in the six axes.

### **Operating temperature**

The device must not be operated outside of the specified temperature range. It is important to ensure adequate ventilation. The data logger must not be placed too close to walls or other equipment. The data logger must not be stacked together with other components on each other, unless proper ventilation is ensured and the device should be used in ambient temperatures of more than 77 °F.

### **Storage conditions**

The data logger must be stored only in the range of - 22 °F to + 158 °F.

### **Condensation**

The device must not be switched on directly, if it is brought from a cold environment into a room with normal ambient conditions.

### **Environmental conditions**

The device must not be used outdoors or in adverse environmental conditions such as moisture, high humidity or dust. Furthermore, an operation of the device is not allowed in fire hazardous or explosive gases.

### **Cable sets**

When inserting the cable sets only a small effort may be applied. When you feel an increased resistance while inserting the cable set, the correct alignment of the pins should be checked.

It may only be used the original Telemotive components. Other components such as special cable sets have to be prepared strictly according to the pin assignment in the user guide. You should always spare an extra fuse in the wiring harness.

Three pins with the names clamp 30 and clamp 31 are interconnected for the voltage supply of the data logger. **Caution: A short circuit between the clamp 30 and clamp 31 on the plug may lead to the destruction of the data logger.**

The maximum value of the power supply must not exceed 32 V. In case of overvoltage the device can be destroyed and will void the warranty.

### **Mounting**

The data logger has to be fixed in laboratory setups and especially in automobiles, so that it is secured against falling, slipping and skidding around.

### **Positioning of the antenna**

During operation of the data logger in an automobile the antennas which are connected to the data logger must not be located outside the vehicle.

### **Mechanical action**

+++++ Operation environment +++++

Height: - 300 to 5500 m

Shock at 2 ms half sinusoidal wave                      300 G

Vibration sinusoidal wave                                      3 G (10 – 50 Hz)

2.5 G (50 – 2000 Hz)

2 G (200 – 5000 Hz)

+++++ Out of operation environment +++++

Height: - 300 to 12000 m

Shock at 1 ms half sinusoidal wave                      800 G

Vibration sinusoidal wave                                      up to 5 G (10 - 500 Hz)

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## 13 Data sheet

General data	blue PiraT2	blue PiraT2 5E
<b>Nominal power supply voltage</b>	13.8 V	13.8 V
<b>Power supply voltage</b>	6.5 to 32 V (at system start up logger needs > 8.5 V)	5 to 32 V (at system start up logger needs > 8.5 V)
<b>Reverse polarity protection of the supply voltage</b>	Yes	Yes
<b>Resistance to short-circuiting</b>	Yes	Yes
<b>Power consumption / operating (typ.)</b>	1.8 A (@ 13.8 V)	1.8 A (@ 13.8 V)
<b>Power consumption / operating (peak.)</b>	10 A (start up current, max. 5 ms)	10 A (start up current, max. 5 ms)
<b>Power consumption / standby</b>	< 10 mA up to HW 1.4 < 3 mA from HW 1.5	< 4 mA
<b>Operating temperature</b>	- 22 °F to + 140 °F	with HD: - 22 °F to 140 °F with SSD: - 40 °F to 140 °F
<b>Storage temperature</b>	- 22 °F to + 158 °F	- 22 °F to 158 °F
<b>Weight (ca.)</b>	2.4 Kg	2,8 Kg
<b>Power backup</b>	No	Yes, > 30 ms (starter curve)

Power Management	blue PiraT2	blue PiraT2 5E
<b>Startup time from standby to full operation</b>	< 30 s	with HD: typ. 29s with SSD: typ. 19s
<b>Start of logging</b>	CAN, LIN, Serial, Analog (#1, #2), Digital (#1) < 25 ms	CAN, LIN, Serial, Analog (#1, #2), Digital (#1) < 25 ms
	FlexRay, MOST, Digital (#2 to #5) < 45 ms	like blue PiraT2
	Analog (#3 to #10) < 53 ms Ethernet < 18 s	like blue PiraT2
<b>Standby Mode</b>	Configurable time without bus load	like blue PiraT2
<b>Wake</b>	MOST, HS-CAN, LS-CAN, LIN, FlexRay, Digital (#1, #2), KL 15, [ON / Trigger] button	like blue PiraT2 + Serial, where every port is configurable
<b>Data loss by power loss</b>	If the device is switched off due to sudden power loss, up to 60 sec. of data may be lost.	If the device is switched off due to sudden power loss, up to 60 sec. of data may be lost.

Case	blue PiraT2	blue PiraT2 5E
<b>Size (ca.)</b>	10,83" x 7,48" x 2,36" (275 mm x 190 mm x 60 mm)	like blue PiraT2
<b>Operating controls</b>	Push-button to start data logger and set markers Push-button to shut down Menu button	like blue PiraT2
<b>Display</b>	two line display Active-LED (green): Displays data logger activity Memory-LED (yellow): Displays memory warnings Error-LED (red): Displays internal errors CFActive (green): Displays the detecting of memory card	like blue PiraT2



Connectors	blue PiraT2	blue PiraT2 5E
<b>Connectors (front)</b>	Gbit Ethernet, Wi-Fi 802.11 b/g/n (optional), GPS (optional), CF-Flash, USB 2.0 type A	like blue PiraT2 + USB 2.0 type B
<b>BP2 150M14C8LFR (back)</b>	Power supply, 12x HS-CAN, 2x LS-CAN, 8x LIN, 4x ETH, 6x Serial, 10x Analog In, 5x Digital In, 3x Digital Out, 2x (a/b) FlexRay, MOST150, Rosenberger (2x USB 2.0 type A, 1x USB 2.0 type B)	like blue PiraT2 without Rosenberger (USB) + 4x RJ45 (Ethernet), power supply in separate cable
<b>BP2 25M24C8LFR (back)</b>	Power supply, 22x HS-CAN, 2x LS-CAN, 8x LIN, 4x ETH, 6x Serial, 10x Analog In, 5x Digital In, 3x Digital Out, 2x (a/b) FlexRay, MOST25, Rosenberger (2x USB 2.0 type A, 1x USB 2.0 type B)	like blue PiraT2 without Rosenberger (USB) + 4x RJ45 (Ethernet), power supply in separate cable
<b>BP2 14C6S8L (back)</b>	Power supply, 12x HS-CAN, 2x LS-CAN, 8x LIN, 4x ETH, 6x Serial, 2x Analog In, 1x Digital In, 1x Digital Out, Rosenberger (2x USB 2.0 type A, 1x USB 2.0 type B)	like blue PiraT2 without Rosenberger (USB) + 4x RJ45 (Ethernet), power supply in separate cable

Data recording	blue PiraT2	blue PiraT2 5E
<b>Storage type (external)</b>	CF card USB flash drive	like blue PiraT2 like blue PiraT2
<b>Storage type (internal)</b>	Hard drive 2.5" 100 GB (new: 320 GB) SSD 128/265/480 GB	like blue PiraT2 like blue PiraT2
<b>Recording modes</b>	Normal, ring buffer	like blue PiraT2
<b>Timestamp accuracy</b>	1 µs (MOST, CAN, LIN, FlexRay) 1 ms (Serial) 100 ms (Ethernet)	like blue PiraT2

MOST150 recording BP2 150M14C8LFR	blue PiraT2	blue PiraT2 5E
<b>Channel</b>	MDP MOST data packets, MEP MOST Ethernet packets, control channel, network status, MOST streaming (synchronous/isochronous) (optional)	like blue PiraT2
<b>Status recording</b>	Light on/off, Lock on/off	like blue PiraT2
<b>Filter</b>	MDP filter (source address, target address), MEP filter (target MAC address)	like blue PiraT2

MOST25 recording BP2 25M24C8LFR	blue PiraT2	blue PiraT2 5E
<b>Channel</b>	MDP MOST data packets, control channel, Network Status,	like blue PiraT2
<b>Status recording</b>	Light on/off, Lock on/off	like blue PiraT2
<b>Filter</b>	MDP filter (source address, target address)	like blue PiraT2

<b>CAN recording All types</b>	<b>blue PiraT2</b>	<b>blue PiraT2 5E</b>
<b>Channel</b>	BP2 150M14C8LFR: 12 High Speed, 2 Low Speed BP2 25M24C8LFR: 22 High Speed, 2 Low Speed	like blue PiraT2
<b>Baud rate</b>	Up to 1000000 Baud at HS-CAN up to 125000 Baud at LS-CAN	like blue PiraT2
<b>Transceiver</b>	TJA1041A, TJA1054A	TJA1041A, TJA1055T
<b>Filter</b>	CAN ID filter	like blue PiraT2
<b>Status recording</b>	Error frames	like blue PiraT2
<b>First frame mode</b>	No	Yes

<b>Serial recording All types</b>	<b>blue PiraT2</b>	<b>blue PiraT2 5E</b>
<b>Type</b>	RS232	like blue PiraT2
<b>Channel</b>	6	like blue PiraT2
<b>Baud rate</b>	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 Baud	like blue PiraT2
<b>Data bits</b>	5,6,7,8	like blue PiraT2
<b>Stop bits</b>	1,1.5,2	like blue PiraT2
<b>Parity</b>	None, odd, even	like blue PiraT2

<b>LIN recording All types</b>	<b>blue PiraT2</b>	<b>blue PiraT2 5E</b>
<b>Channel</b>	8	like blue PiraT2
<b>Baud rate</b>	1200, 2400, 4800, 9600, 10400, 19200, 20000 Baud	like blue PiraT2
<b>Transceiver</b>	TJA1021	like blue PiraT2

<b>FlexRay recording not in BP2 14C6S8L</b>	<b>blue PiraT2</b>	<b>blue PiraT2 5E</b>
<b>Channel</b>	2x (a/b)	like blue PiraT2
<b>Bit rate</b>	Up to 10 Mbit/s	like blue PiraT2
<b>Transceiver</b>	AS8221B	like blue PiraT2
<b>Recording</b>	Null frames, Startup Phase, Trailer CRC, Symbol	like blue PiraT2

<b>Ethernet recording</b>	<b>blue PiraT2</b>	<b>blue PiraT2 5E</b>
<b>Port</b>	5	like blue PiraT2
<b>Speed</b>	1x 1 Gbit/s (front side) 4x 100 Mbit/s (rear side)	like blue PiraT2, Ethernet port at the rear side has 1000 Mbit/s too
<b>Recording</b>	GNLog, Raw, UTF8, UDP, DLT (optional), EsoTrace (optional)	like blue PiraT2

Analog recording (#1 and #2) All types	blue PiraT2	blue PiraT2 5E
Channel	1x Ubat (internal), 1x external	like blue PiraT2
Range of measurement	0 V to + 20 V	like blue PiraT2
Resolution	7 mV	like blue PiraT2
Accuracy	3 %	like blue PiraT2
Sampling interval	1 ms to 100 s	like blue PiraT2

Digital input (#1) All types	blue PiraT2	blue PiraT2 5E
Channel	1	like blue PiraT2
Switching threshold	9.5 V ± 0.2 V	like blue PiraT2
Hysteresis	0.3 V ± 0.2 V	like blue PiraT2
Sampling interval	1 ms to 100 s	like blue PiraT2

Digital output (#1) All types	blue PiraT2	blue PiraT2 5E
Channel	1	like blue PiraT2
Output voltage	~ Ubat	like blue PiraT2
Output current	Up to 1 A (continuous load)	like blue PiraT2

Analog recording (#3 to #10) not in BP2 14C6S8L	blue PiraT2	blue PiraT2 5E
Channel	8	like blue PiraT2
Range of measurement	- 10 V to + 20 V	like blue PiraT2
Resolution	8 mV	like blue PiraT2
Accuracy	3 %	like blue PiraT2
Sampling interval	1 ms to 100 s	like blue PiraT2

Digital input (#2 to #5) not in BP2 14C6S8L	blue PiraT2	blue PiraT2 5E
Channel	4	like blue PiraT2
Switching threshold	Configurable from 0 V to 12 V	like blue PiraT2
Hysteresis	3 V ± 1 V	like blue PiraT2
Sampling interval	1 ms to 100 s	like blue PiraT2

Digital output (#2 to #3) not in BP2 14C6S8L	blue PiraT2	blue PiraT2 5E
Channel	2	like blue PiraT2
Output voltage	~ Ubat	like blue PiraT2
Output current	Up to 0.5 A (continuous load) BP2 150M14C8LFR	like blue PiraT2
	Up to 1.0 A (continuous load) BP2 25M24C8LFR	like blue PiraT2

**Table 13.1: Datasheet**

## 14 Pin assignments and harnesses

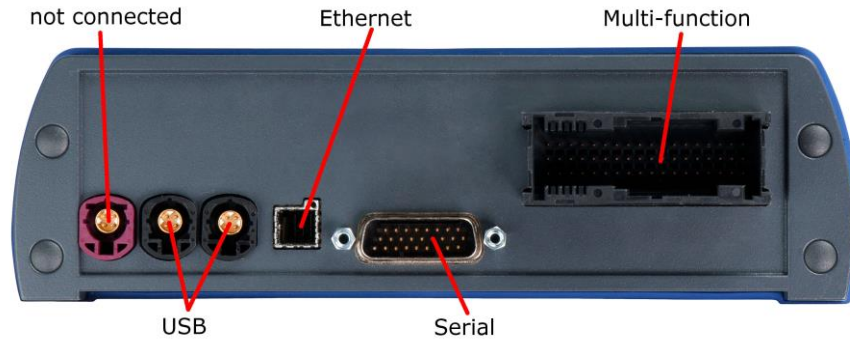
Cable	Interfaces	blue PiraT2			blue Pirat2 5E		
		150M14C8LFR	25M24C8LFR	14C6S8L	150M5E14C	25M5E24C	14C5E6S
<b>blue PiraT2 / blue PiraT2 5E</b> universal harness see chapter: 14.1 Data logger: Multi function connector	Power, GND, Wake						
	12x High Speed CAN						
	2x Low Speed CAN	✓	✓	✓	✓	✓	✓
	8x LIN						
	1x Digital Out						
	Remote Control I/F						
<b>blue PiraT2 5E</b> power supply see chapter: 14.2 blue PiraT2 5E – power harness	Power, GND	-	-	-	✓	✓	✓
<b>blue PiraT2 / blue PiraT2 5E</b> Serial/UART extension harness see section: 14.3 Serial connector (D-Sub 26)	6x RS232						
	1x Analog In	✓	✓	✓	✓	✓	✓
	1x Digital In						
<b>blue PiraT2 / blue PiraT2 5E</b> Analog/Digital extension harness see chapter: 14.4 Analog/Digital connector (26-pin) (not at 14C6S8L)	8x Analog In						
	4x Digital In	✓	✓	-	✓	✓	-
	2x Digital Out						
	1x ECL						
<b>blue PiraT2 / blue PiraT2 5E</b> FlexRay extension harness see chapter: 14.6 FlexRay connector	2x FlexRay a	✓	-	-	✓	-	-
	2x FlexRay b						
<b>blue PiraT2 / blue PiraT2 5E</b> CAN/FlexRay extension harness see chapter: 14.7 CAN/FlexRay (D-Sub 44) (25M24C8LFR only)	10x High Speed CAN						
	2x FlexRay a	-	✓	-	-	✓	-
	2x FlexRay b						
<b>blue PiraT2</b> Ethernet extension kit see chapter: 14.8 Pinning of the FCI connector for the Ethernet-Kit	4x Ethernet RJ45	✓	✓	✓	-	-	-

**Table 14.1: Extension harness (overview)**

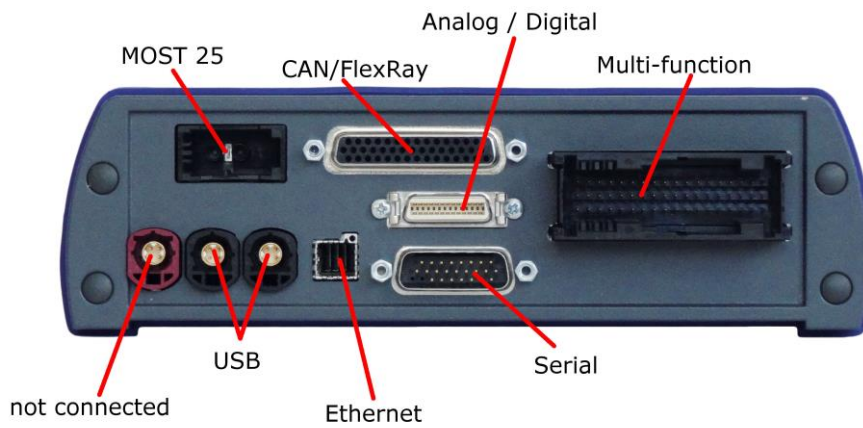
[Index](#)

**Warning:**

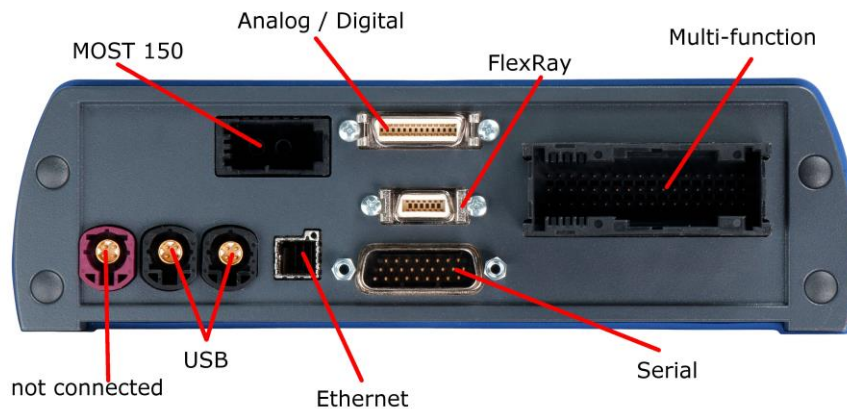
**Clamp 31 should be the only ground connection between the data logger and connected devices. Connecting signal ground lines is limited to special cases in which one can guarantee that ground loops cannot occur.**



**Figure 14.1: Rear side blue PiraT2\_14C6S8L**



**Figure 14.2: Rear side blue PiraT2\_25M24C8LFR**



**Figure 14.3: Rear side blue PiraT2\_150M14C8LFR**

## 14.1 Data logger: Multi function connector

Name	Type	Manufacturer-Nr.	Manufacturer
ELO 54pin	Shield	1-1355928-2	Tyco
	Housing	1355929-2	Tyco
	Housing	1355930-2	Tyco
	Contact	2-1411550-1	Tyco

Table 14.2: MQS 54pin

### 14.1.1 Pin assignment of the blue PiraT2 multi-function connector

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
MQS 54pin	Signal		Type	Pin
1	KL15_Wake	Wakeup from KL 15	banana plug <b>blue</b>	----
2	HSCAN_L_11	High Speed CAN #11 LOW	DSUB-9 / male	2
3	HSCAN_L_10	High Speed CAN #10 LOW	DSUB-9 / male	2
4	HSCAN_L_9	High Speed CAN #09 LOW	DSUB-9 / male	2
5	HSCAN_L_8	High Speed CAN #08 LOW	DSUB-9 / male	2
6	HSCAN_L_7	High Speed CAN #07 LOW	DSUB-9 / male	2
7	HSCAN_L_6	High Speed CAN #06 LOW	DSUB-9 / male	2
8	HSCAN_L_5	High Speed CAN #05 LOW	DSUB-9 / male	2
9	HSCAN_L_4	High Speed CAN #04 LOW	DSUB-9 / male	2
10	HSCAN_L_3	High Speed CAN #03 LOW	DSUB-9 / male	2
11	HSCAN_L_2	High Speed CAN #02 LOW	DSUB-9 / male	2
12	HSCAN_L_1	High Speed CAN #01 LOW	DSUB-9 / male	2
13	LSCAN_L_1	Low Speed CAN #13 LOW	DSUB-9 / male	2
14	LIN_CON_7	LIN #7	DSUB-9 / male	7
15	TOUT_BAT	NA (rfu)	open	----
16	NA	Not connected	-----	----
17	NA	Not connected	-----	----
18	DIG_OUT_1	Digital OUT #01	banana jack <b>green</b>	----
19	HSCAN_H_12	High Speed CAN #12 HIGH	DSUB-9 / male	7
20	HSCAN_H_11	High Speed CAN #11 HIGH	DSUB-9 / male	7
21	HSCAN_H_10	High Speed CAN #10 HIGH	DSUB-9 / male	7
22	HSCAN_H_9	High Speed CAN #09 HIGH	DSUB-9 / male	7
23	HSCAN_H_8	High Speed CAN #08 HIGH	DSUB-9 / male	7
24	HSCAN_H_7	High Speed CAN #07 HIGH	DSUB-9 / male	7
25	HSCAN_H_6	High Speed CAN #06 HIGH	DSUB-9 / male	7
26	HSCAN_H_5	High Speed CAN #05 HIGH	DSUB-9 / male	7
27	HSCAN_H_4	High Speed CAN #04 HIGH	DSUB-9 / male	7
28	HSCAN_H_3	High Speed CAN #03 HIGH	DSUB-9 / male	7
29	HSCAN_H_2	High Speed CAN #02 HIGH	DSUB-9 / male	7
30	HSCAN_H_1	High Speed CAN #01 HIGH	DSUB-9 / male	7
31	LSCAN_H_1	Low Speed CAN #13 HIGH	DSUB-9 / male	7
32	LIN_CON_8	LIN #08	DSUB-9 / male	7
33	RIN_BAT	NA (rfu)	open	----
34	NA	Not connected (rfu)	-----	----
35	KL 30	Please combine pins 35, 37, 39 for the KL 30	banana plug <b>red</b>	----
36	NA	Not connected (rfu)	-----	----

37	KL 30	Please combine pins 35, 37, 39 for the KL 30	banana plug <b>red</b>	----
38	HSCAN_L_12	High Speed CAN #12 LOW	DSUB-9 / male	2
39	KL 30	Please combine pins 35, 37, 39 for the KL 30	banana plug <b>red</b>	----
40	TT_OUT_CON	Clock_Out for cascading device	Lumberg KV81-8	4
41	TT_IN_CON	Clock_In for cascading device	Lumberg KV81-8	5
42	LIN_CON_1	LIN #01	DSUB-9 / male	7
43	LIN_CON_2	LIN #02	DSUB-9 / male	7
44	LIN_CON_3	LIN #03	DSUB-9 / male	7
45	LSCAN_L_2	Low Speed CAN #14 LOW	DSUB-9 / male	2
46	LSCAN_H_2	Low Speed CAN #14 HIGH	DSUB-9 / male	7
47	LIN_CON_4	LIN #04	DSUB-9 / male	7
48	LIN_CON_5	LIN #05	DSUB-9 / male	7
49	LIN_CON_6	LIN #06	DSUB-9 / male	7
50	LSCAN_L_RC	CAN RemoteControl	LUMBERG KV81-8	1
51	LSCAN_H_RC	CAN RemoteControl	LUMBERG KV81-8	3
52	KL 31	Please combine pins 52, 53, 54 for the KL 31	banana plug <b>black</b>	----
53	KL 31	Please combine pins 52, 53, 54 for the KL 31	banana plug <b>black</b>	----
54	KL 31	Please combine pins 52, 53, 54 for the KL 31	banana plug <b>black</b>	----

**Table 14.3: Pin assignment of the blue PiraT2 multi-function connector**

## 14.1.2 Pin assignment of the blue PiraT2 5E multi-function connector

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
MQS 54pin	Signal		Type	Pin
1	KL15_Wake	Wakeup from KL 15	banana plug <b>blue</b>	----
2	HSCAN_L_11	High Speed CAN #11 LOW	DSUB-9 / male	2
3	HSCAN_L_10	High Speed CAN #10 LOW	DSUB-9 / male	2
4	HSCAN_L_9	High Speed CAN #09 LOW	DSUB-9 / male	2
5	HSCAN_L_8	High Speed CAN #08 LOW	DSUB-9 / male	2
6	HSCAN_L_7	High Speed CAN #07 LOW	DSUB-9 / male	2
7	HSCAN_L_6	High Speed CAN #06 LOW	DSUB-9 / male	2
8	HSCAN_L_5	High Speed CAN #05 LOW	DSUB-9 / male	2
9	HSCAN_L_4	High Speed CAN #04 LOW	DSUB-9 / male	2
10	HSCAN_L_3	High Speed CAN #03 LOW	DSUB-9 / male	2
11	HSCAN_L_2	High Speed CAN #02 LOW	DSUB-9 / male	2
12	HSCAN_L_1	High Speed CAN #01 LOW	DSUB-9 / male	2
13	LSCAN_L_1	Low Speed CAN #13 LOW	DSUB-9 / male	2
14	LIN_CON_7	LIN #7	DSUB-9 / male	7
15	TOUT_BAT	NA (rfu)	open	----
16	NA	Not connected	-----	----
17	NA	Not connected	-----	----
18	DIG_OUT_1	Digital OUT #01	banana jack <b>green</b>	----
19	HSCAN_H_12	High Speed CAN #12 HIGH	DSUB-9 / male	7
20	HSCAN_H_11	High Speed CAN #11 HIGH	DSUB-9 / male	7
21	HSCAN_H_10	High Speed CAN #10 HIGH	DSUB-9 / male	7
22	HSCAN_H_9	High Speed CAN #09 HIGH	DSUB-9 / male	7
23	HSCAN_H_8	High Speed CAN #08 HIGH	DSUB-9 / male	7
24	HSCAN_H_7	High Speed CAN #07 HIGH	DSUB-9 / male	7
25	HSCAN_H_6	High Speed CAN #06 HIGH	DSUB-9 / male	7
26	HSCAN_H_5	High Speed CAN #05 HIGH	DSUB-9 / male	7
27	HSCAN_H_4	High Speed CAN #04 HIGH	DSUB-9 / male	7
28	HSCAN_H_3	High Speed CAN #03 HIGH	DSUB-9 / male	7
29	HSCAN_H_2	High Speed CAN #02 HIGH	DSUB-9 / male	7
30	HSCAN_H_1	High Speed CAN #01 HIGH	DSUB-9 / male	7
31	LSCAN_H_1	Low Speed CAN #13 HIGH	DSUB-9 / male	7
32	LIN_CON_8	LIN #08	DSUB-9 / male	7
33	RIN_BAT	NA (rfu)	open	----
34	NA	Not connected (rfu)	-----	----
35	NA	Not connected (rfu)	-----	----
36	NA	Not connected (rfu)	-----	----
37	NA	Not connected (rfu)	-----	----
38	HSCAN_L_12	High Speed CAN #12 LOW	DSUB-9 / male	2
39	NA	Not connected (rfu)	-----	----
40	TT_OUT_CON	Clock_Out for cascading device	Lumberg KV81-8	4
41	TT_IN_CON	Clock_In for cascading device	Lumberg KV81-8	5
42	LIN_CON_1	LIN #01	DSUB-9 / male	7
43	LIN_CON_2	LIN #02	DSUB-9 / male	7
44	LIN_CON_3	LIN #03	DSUB-9 / male	7
45	LSCAN_L_2	Low Speed CAN #14 LOW	DSUB-9 / male	2



46	LSCAN_H_2	Low Speed CAN #14 HIGH	DSUB-9 / male	7
47	LIN_CON_4	LIN #04	DSUB-9 / male	7
48	LIN_CON_5	LIN #05	DSUB-9 / male	7
49	LIN_CON_6	LIN #06	DSUB-9 / male	7
50	LSCAN_L_RC	CAN RemoteControl	LUMBERG KV81-8	1
51	LSCAN_H_RC	CAN RemoteControl	LUMBERG KV81-8	3
52	NA	Not connected (rfu)	-----	----
53	NA	Not connected (rfu)	-----	----
54	NA	Not connected (rfu)	-----	----

**Table 14.4: Pin assignment of the blue PiraT2 5E multi-function connector**
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## 14.2 blue PiraT2 5E – power harness

Name	Type	Manufacturer-Nr.	Manufacturer
SUB-D 3pol male	Connector	303W3CSXX43A10X	CONEC
	Housing	10070163-01LF	FCI

**Table 14.5: blue PiraT2 5E – power harness**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
SUB-D 3-pol	Signal		Type	Pin
A1	KL 31	KL 31 power supply (-)	banana plug <b>black</b>	1
A2	NA	Not connected		
A3	KL 30	KL 30 power supply (+) 15A fused	banana plug <b>red</b>	1

**Table 14.6: Pin assignment of the blue PiraT2 5E – power harness**

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## 14.3 Serial connector (D-Sub 26)

The 26-pin-D-Sub-connector combines RS232 digital and analog interfaces.

Name	Type	Manufacturer-Nr.	Manufacturer
DSUB 26pin	Connector	HD 26F	(Reichelt)
	Shell	1-1478762-5	Tyco

**Table 14.7: D-Sub 26pin**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
D-SUB 26pin	Signal		Type	Pin
1	RS232_TOUT_1	RS232 #1 Tx	DSUB-9 / male	3
2	RS232_ROUT_1	RS232 #1 Rx	DSUB-9 / male	2
3	RS232_TOUT_2	RS232 #2 Tx	DSUB-9 / male	3
4	RS232_ROUT_2	RS232 #2 Rx	DSUB-9 / male	2
5	NA	Not connected	-----	----
6	NA	Not connected	-----	----
7	NA	Not connected	-----	----
8	NA	Not connected	-----	----
9	NA	Not connected	-----	----
10	RS232_TOUT_3	RS232 #3 Tx	DSUB-9 / male	3
11	RS232_ROUT_3	RS232 #3 Rx	DSUB-9 / male	2
12	RS232_TOUT_4	RS232 #4 Tx	DSUB-9 / male	3
13	RS232_ROUT_4	RS232 #4 Rx	DSUB-9 / male	2
14	NA	Not connected	-----	----
15	NA	Not connected	-----	----
16	TT_CASCADE_CON	NA (rfu)	-----	----
17	NA	Not connected	-----	----
18	ANA_IN_GND_2	Please connect ANA_IN_GND_2 to KL 31	banana plug <b>yellow</b>	----
19	RS232_TOUT_5	RS232 #5 Tx	DSUB-9 / male	3
20	RS232_ROUT_5	RS232 #5 Rx	DSUB-9 / male	2
21	RS232_TOUT_6	RS232 #6 Tx	DSUB-9 / male	3
22	RS232_ROUT_6	RS232 #6 Rx	DSUB-9 / male	2
23	SYNC_CASCADE_CON	NA (rfu)	-----	----
24	DIG_IN_1	Digital IN #01 is referenced to KL 31 with internal Pull down, Threshold $9,2 \pm 0,1$ Volts, Hysteresis $0,4 \pm 0,1$ Volt DIG_IN_1 might be used as a Marker (with a push-button to positive Supply Voltage KL 30)	banana jack <b>green</b>	----
25	NA	Not connected	-----	----
26	ANA_INSGNL_2	Analog Interface #02 SIGNAL IN	banana plug <b>yellow</b>	----

**Table 14.8: Pin assignment of the Digital/Analog connector**

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## 14.4 Analog/Digital connector (26-pin) (not at 14C6S8L)

Name	Type	Manufacturer-Nr.	Manufacturer
Ribbon 26pin	Plug Connector	10126-3000PE	3M
	Shell	10326-52F0-008	3M

**Table 14.9: Mini D Ribbon 3M 26pin**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
3M 26pin	Signal		Type	Pin
1	DIG_IN_2	Digital IN #02 (Referenced to KL 31)	banana plug <b>green</b>	----
2	DIG_IN_3	Digital IN #03 (Referenced to KL 31)	banana plug <b>green</b>	----
3	DIG_IN_4	Digital IN #04 (Referenced to KL 31)	banana plug <b>green</b>	----
4	DIG_IN_5	Digital IN #05 (Referenced to KL 31)	banana plug <b>green</b>	----
5	DIG_OUT_2	Digital OUT #02	banana jack <b>green</b>	----
6	DIG_OUT_3	Digital OUT #03	banana jack <b>green</b>	----
7	SHIELD	NA	-----	----
8	SHIELD	NA	-----	----
9	ANA_IN_SGNL_3	Analog Interface #03 SIGNAL IN	banana plug <b>yellow</b>	----
10	ANA_IN_SGNL_4	Analog Interface #04 SIGNAL IN	banana plug <b>yellow</b>	----
11	ANA_IN_SGNL_5	Analog Interface #05 SIGNAL IN	banana plug <b>yellow</b>	----
12	ANA_IN_SGNL_6	Analog Interface #06 SIGNAL IN	banana plug <b>yellow</b>	----
13	ANA_IN_SGNL_7	Analog Interface #07 SIGNAL IN	banana plug <b>yellow</b>	----
14	ANA_IN_SGNL_8	Analog Interface #08 SIGNAL IN	banana plug <b>yellow</b>	----
15	ANA_IN_SGNL_9	Analog Interface #09 SIGNAL IN	banana plug <b>yellow</b>	----
16	ANA_IN_SGNL_10	Analog Interface #10 SIGNAL IN	banana plug <b>yellow</b>	----
17	ANA_IN_GND_3	Analog Interface #03 GROUND	banana plug <b>yellow</b>	----
18	ANA_IN_GND_4	Analog Interface #04 GROUND	banana plug <b>yellow</b>	----
19	ANA_IN_GND_5	Analog Interface #05 GROUND	banana plug <b>yellow</b>	----
20	ANA_IN_GND_6	Analog Interface #06 GROUND	banana plug <b>yellow</b>	----
21	ANA_IN_GND_7	Analog Interface #07 GROUND	banana plug <b>yellow</b>	----
22	ANA_IN_GND_8	Analog Interface #08 GROUND	banana plug <b>yellow</b>	----
23	ANA_IN_GND_9	Analog Interface #09 GROUND	banana plug <b>yellow</b>	----
24	ANA_IN_GND_10	Analog Interface #10 GROUND	banana plug <b>yellow</b>	----
25	SHIELD	NA	-----	----
26	ECL_IN	Electrical Control Line (SMSC)	DSUB-9 / male	7

**Table 14.10: Pin assignment of the Analog/Digital connector**

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## 14.5 Ethernet connector

Name	Type	Manufacturer-Nr.	Manufacturer
FCI	Cable Assembly	10054999-R0050Aulf	FCI

**Table 14.11: FCI-Connector (Cable assembly 50 cm)**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
3M 26pin	Signal		Type	Pin
A1	TX-	ETH1 Tx-	RJ45	2
B1	Tx+	ETH1 Tx+	RJ45	1
C1	GND			----
D1	RX+	ETH1 Rx+	RJ45	3
E1	RX-	ETH1 RX-	RJ45	6
A2	TX-	ETH2 Tx-	RJ45	2
B2	Tx+	ETH2 Tx+	RJ45	1
C2	GND			----
D2	RX+	ETH2 Rx+	RJ45	3
E2	RX-	ETH2 RX-	RJ45	6
A3	TX-	ETH3 Tx-	RJ45	2
B3	Tx+	ETH3 Tx+	RJ45	1
C3	GND			----
D3	RX+	ETH3 Rx+	RJ45	3
E3	RX-	ETH3 RX-	RJ45	6
A4	TX-	ETH4 Tx-	RJ45	2
B4	Tx+	ETH4 Tx+	RJ45	1
C4	GND			----
D4	RX+	ETH4 Rx+	RJ45	3

**Table 14.12: Pin assignment of the Ethernet connector**

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## 14.6 FlexRay connector

Name	Type	Manufacturer-Nr.	Manufacturer
Ribbon 14pin	Plug Connector	10114-3000PE	3M
	Shell	10314-52F0-008	3M

**Table 14.13: Mini D Ribbon 3M 14pin**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
3M 14pin	Signal		Type	Pin
1	FR_BP_1	FlexRay+ Channel 1a	DSUB-9 / male	7
2	NA	Not connected	-----	----
3	FR_BP_2	FlexRay+ Channel 1b	DSUB-9 / male	7
4	NA	Not connected	-----	----
5	FR_BM_2_2	FlexRay- Channel 2b	DSUB-9 / male	2
6	NA	Not connected	-----	----
7	FR_BM_2_1	FlexRay- Channel 2a	DSUB-9 / male	2
8	FR_BM_1	FlexRay- Channel 1a	DSUB-9 / male	2
9	NA	Not connected	-----	----
10	FR_BM_2	FlexRay- Channel 1b	DSUB-9 / male	2
11	NA	Not connected	-----	----
12	FR_BP_2_2	FlexRay+ Channel 2b	DSUB-9 / male	7
13	NA	Not connected	-----	----
14	FR_BP_2_1	FlexRay+ Channel 2a	DSUB-9 / male	7

**Table 14.14: Pin assignment of the FlexRay connector**

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## 14.7 CAN/FlexRay (D-Sub 44) (25M24C8LFR only)

Name	Type	Manufacturer-Nr.	Manufacturer
DSUB 44pin	Connector	17EHD-044-P-AA-0-00	Amphenol
	Shell	17E-1726-2	Amphenol

**Table 14.15: D-SUB 44pin**

@ Logger		comment / depiction / signal name	@ Vehicle Interface	
D-SUB 44pin	Signal		Type	Pin
1	HSCAN_L_15	High Speed CAN #15 LOW	DSUB-9 / male	2
2	HSCAN_L_16	High Speed CAN #16 LOW	DSUB-9 / male	2
3	HSCAN_L_17	High Speed CAN #17 LOW	DSUB-9 / male	2
4	HSCAN_L_18	High Speed CAN #18 LOW	DSUB-9 / male	2
5	HSCAN_L_19	High Speed CAN #19 LOW	DSUB-9 / male	2
6	HSCAN_L_20	High Speed CAN #20 LOW	DSUB-9 / male	2
7	HSCAN_L_21	High Speed CAN #21 LOW	DSUB-9 / male	2
8	HSCAN_L_22	High Speed CAN #22 LOW	DSUB-9 / male	2
9	HSCAN_L_23	High Speed CAN #23 LOW	DSUB-9 / male	2
10	HSCAN_L_24	High Speed CAN #24 LOW	DSUB-9 / male	2
11	NA	Not connected	-----	----
12	FR_BM_1	FlexRay- Channel 1a	DSUB-9 / male	2
13	FR_BM_2	FlexRay- Channel 1b	DSUB-9 / male	2
14	FR_BM_2_1	FlexRay- Channel 2a	DSUB-9 / male	2
15	FR_BM_2_2	FlexRay- Channel 2b	DSUB-9 / male	2
16	HSCAN_H_15	High Speed CAN #15 HIGH	DSUB-9 / male	7
17	HSCAN_H_16	High Speed CAN #16 HIGH	DSUB-9 / male	7
18	HSCAN_H_17	High Speed CAN #17 HIGH	DSUB-9 / male	7
19	HSCAN_H_18	High Speed CAN #18 HIGH	DSUB-9 / male	7
20	HSCAN_H_19	High Speed CAN #19 HIGH	DSUB-9 / male	7
21	HSCAN_H_20	High Speed CAN #20 HIGH	DSUB-9 / male	7
22	HSCAN_H_21	High Speed CAN #21 HIGH	DSUB-9 / male	7
23	HSCAN_H_22	High Speed CAN #22 HIGH	DSUB-9 / male	7
24	HSCAN_H_23	High Speed CAN #23 HIGH	DSUB-9 / male	7
25	HSCAN_H_24	High Speed CAN #24 HIGH	DSUB-9 / male	7
26	NA	Not connected	-----	----
27	FR_BP_1	FlexRay+ Channel 1a	DSUB-9 / male	7
28	FR_BP_2	FlexRay+ Channel 1b	DSUB-9 / male	7
29	FR_BP_2_1	FlexRay+ Channel 2a	DSUB-9 / male	7
30	FR_BP_2_2	FlexRay+ Channel 2b	DSUB-9 / male	7
31	NA	Not connected	-----	----
32	NA	Not connected	-----	----
33	NA	Not connected	-----	----
34	NA	Not connected	-----	----
35	NA	Not connected	-----	----
36	NA	Not connected	-----	----
37	NA	Not connected	-----	----
38	NA	Not connected	-----	----
39	NA	Not connected	-----	----

40	NA	Not connected	-----	----
41	NA	Not connected	-----	----
42	NA	Not connected	-----	----
43	NA	Not connected	-----	----
44	NA	Not connected	-----	----

**Table 14.16: Pin assignment of the CAN/FlexRay connector**

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## 14.7.1 Connection to Remote Control Voice

Connector KV81-8 for Remote Control / Remote Control Voice is connected to Pins 40, 41, 50, 51 of MQS54. Clamp 30 and clamp 31 are directly connected to the cable harness.

@ Logger		comment / depiction / signalname	@ Vehicle Interface	
MQS 54pin	Signal		Type	Pin
50	LSCAN_L_RC	CAN RemoteControl	Lumberg KV81-8	1
-----	NA	Not connected	Lumberg KV81-8	2
51	LSCAN_H_RC	CAN RemoteControl	Lumberg KV81-8	3
40	TT_OUT_CON	Clock_Out for cascading device	Lumberg KV81-8	4
41	TT_IN_CON	Clock_IN for cascading device	Lumberg KV81-8	5
-----	KL 31	KL 31	Lumberg KV81-8	6
-----	KL 30	KL 30	Lumberg KV81-8	7
-----	NA	Not connected	Lumberg KV81-8	8
-----	NA	Not connected	Lumberg KV81-8	9

**Table 14.17: Contacts of the DIN plug**

MQS 54pin	Lumberg KV81-8 Pin	Lemo Pin	Bananaplug Pin	Signal
40	4	-	-	TT_OUT_CON
41	5	-	-	TT_IN_CON
50	1	6	-	LSCAN_L_RC
51	3	3	-	LSCAN_H_RC
54 / 52 / 53	6	7	black	KL 31 (ground, -)
54 / 52 / 53	7	2	red	KL 31 (power,+)

**Table 14.18: Contacts of the angeled Lemo plug**

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### 14.7.2 Contacts of the Remote Control Voice cable

These two drawings show the pinout of the Remote Control Voice cable.

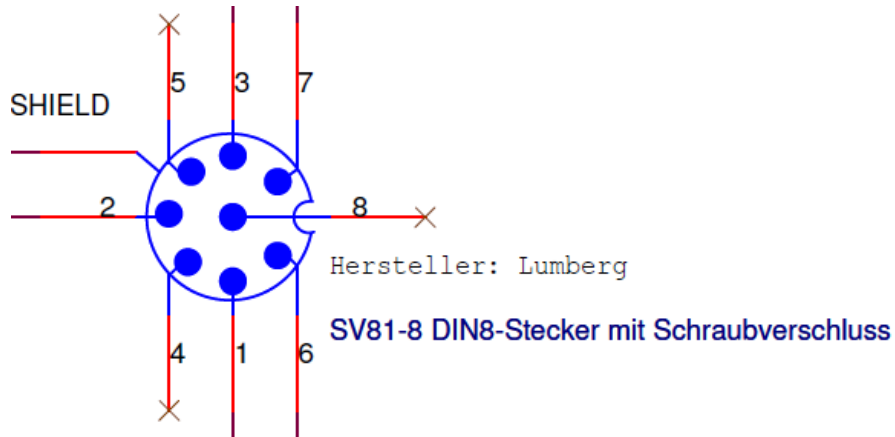


Figure 14.4: Pins des DIN-Steckers (Lumberg SV81-8 DIN8)

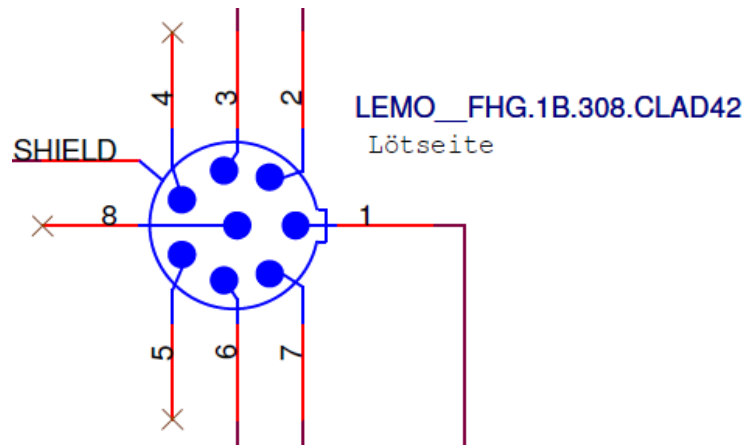


Figure 14.5: Pins des gewinkelten LEMO-Steckers (FGH.1B.308.CLAD42)

### 14.8 Pinning of the FCI connector for the Ethernet-Kit

RJ45-Jack Pin(Signal)	1 (Tx+)	2 (Tx-)	3 (Rx+)	4	5	6 (Rx-)	7	8
FCI-Jack Pin	B1	A1	D1			E1		
	B2	A2	D2			E2		
	B3	A3	D3			E3		
	B4	A4	D4			E4		

Table 14.19: Pinning of the FCI connector for the Ethernet-Kit

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## 15 Abbreviations

Kürzel / abbreviation	Bedeutung / meaning
<b>blue PiraT</b>	<b>P</b> rocessing <b>I</b> nformation <b>R</b> ecording <b>A</b> nalyzing <b>T</b> ool
<b>bP</b>	<b>blue PiraT</b>
<b>bP2</b>	<b>blue PiraT2</b>
<b>bP2 5E</b>	<b>blue PiraT2 5E</b>
<b>bPMini</b>	<b>blue PiraT Mini</b>
<b>RC Touch</b>	<b>R</b> emote <b>C</b> ontrol <b>T</b> ouch
<b>bP Remote</b>	<b>blue PiraT Remote</b>
<b>A2L</b>	<b>A</b> SAM <b>M</b> CD-2 <b>M</b> C <b>L</b> anguage
<b>AE</b>	<b>A</b> utomotive <b>E</b> lectronics
<b>ACK</b>	<b>A</b> C <b>K</b> nowledged
<b>CAN</b>	<b>C</b> ontroller <b>A</b> rea <b>N</b> etwork
<b>CCP</b>	<b>C</b> AN <b>C</b> alibration <b>P</b> rotocol
<b>CF</b>	<b>C</b> ompact <b>F</b> lash
<b>CRO</b>	<b>C</b> ommand <b>R</b> eceive <b>O</b> bject
<b>DAQ</b>	<b>D</b> ata <b>A</b> cquisition
<b>DTO</b>	<b>D</b> ata <b>T</b> ransmission <b>O</b> bject
<b>ECL</b>	<b>E</b> lectrical <b>C</b> ontrol <b>L</b> ine
<b>ECU</b>	<b>E</b> lectronic <b>C</b> ontrol <b>U</b> nit
<b>FIBEX</b>	<b>F</b> ield <b>B</b> us <b>E</b> xchange <b>F</b> ormat
<b>FW</b>	<b>F</b> irmware
<b>GMT</b>	<b>G</b> reenwich <b>M</b> ean <b>T</b> ime
<b>INCA</b>	<b>I</b> N <b>T</b> egrated <b>C</b> alibration and <b>A</b> pplication <b>T</b> ool
<b>LAN</b>	<b>L</b> ocal <b>A</b> rea <b>N</b> etwork = Netzwerk
<b>LIN</b>	<b>L</b> ocal <b>I</b> nterconnect <b>N</b> etwork
<b>MAC</b>	<b>M</b> edia <b>A</b> ccess <b>C</b> ontrol
<b>MCD</b>	<b>M</b> easure <b>C</b> alibrate <b>D</b> iagnose
<b>MDX</b>	<b>M</b> eta <b>D</b> ata <b>E</b> Xchange <b>F</b> ormat
<b>MEP</b>	<b>M</b> OST <b>E</b> thernet <b>P</b> acket
<b>MOST</b>	<b>M</b> edia <b>O</b> riented <b>S</b> ystems <b>T</b> ransport ( <a href="http://www.mostnet.de">www.mostnet.de</a> )
<b>ODT</b>	<b>O</b> bject <b>D</b> escriptor <b>T</b> able
<b>ODX</b>	<b>O</b> pen <b>D</b> ata <b>E</b> Xchange
<b>OEM</b>	<b>O</b> riginal <b>E</b> quipment <b>M</b> anufacturer

<b>PHY</b>	<b>PHY</b> sical Bus Connect
<b>PW</b>	<b>Pass</b> wort
<b>RX</b>	<b>Recei</b> ver Data
<b>SD</b>	<b>Secure Digital</b>
<b>SFTP</b>	<b>Secure File Transfer Protocol</b>
<b>SHA</b>	<b>Secure Hash</b>
<b>SSL</b>	<b>Secure Sockets Layer</b>
<b>TCP/IP</b>	<b>Transmission Control Protocol/Internet Protocol</b>
<b>TLS</b>	<b>Transport Layer Security</b>
<b>TMP</b>	<b>Telemotive Packetformat</b>
<b>TSL</b>	<b>Telemotive System Link</b>
<b>UDP</b>	<b>User Datagram Protocol</b>
<b>USB</b>	<b>Universal Serial Bus</b>
<b>UTC</b>	<b>Universal Time, Coordinated</b>
<b>Wi-Fi</b>	<b>Wireless Fidelity</b>
<b>WLAN</b>	<b>Wireless Local Area Network</b>
<b>XCP</b>	<b>Universal Measurement and Calibration Protocol</b>

**Table 15.1: Abbreviations**
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