ETAS FETK-T3.0

Emulator Probe for Renesas RH850 MCU Family

User Guide

www.etas.com

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Contents

1 Safety Information

This chapter contains information about the following topics:

Refer to the following safety instructions and the technical documentation available to download from the ETAS website www.etas.com. Keep the information provided in a safe place.

Failure to comply with the safety instructions may lead to the risk of damage to life and limb or property. The ETAS Group and its representatives shall not be liable for any damage or injury caused by improper operation or use of the product.

Only use the product if you have read and understood the information concerning safe operation and have the required qualifications and training for this product. If you have questions about safe operation, contact ETAS:

- Technical Support: www.etas.com/hotlines
- ETAS contact partners by region: www.etas.com/contact

The product is only approved for the applications described in the technical documentation. When using and operating this product, all applicable regulations and laws must be observed.

ETAS products made available as beta versions or prototypes of firmware, hardware and/or software are to be used exclusively for testing and evaluation purposes. These products may not have sufficient technical documentation and not fulfill all requirements regarding quality and accuracy for market-released series products. The product performance may therefore differ from the product description. Only use the product under controlled testing and evaluation conditions. Do not use data and results from beta versions without prior and separate verification and validation and do not share them with third parties.

Before starting up the product, check whether there is a Known Issue Report (KIR) for that product version: www.etas.com/kir (password: KETASIR). Note the information given in the report.

Program codes or program control sequences that are created or changed via ETAS products, as well as all types of data obtained through the use of ETAS products, must be checked for their reliability and suitability prior to use or distribution. Only use these codes or sequences in public areas (e.g., in road traffic) if you have ensured that the application and product settings are safe through testing in self-contained and designated testing environments and circuits.

This ETAS product allows you to influence safety-relevant systems or data (e.g. in motor vehicles, vehicle components and test benches). In the event of a malfunction or a hazardous situation, it must be possible to put the system into a safe state (e.g., emergency stop or emergency operation).

1.1 Intended Use

The product was developed and approved for applications in the automotive sector. Only operate the product as per its specifications. If the product is used in any other way, product safety is no longer ensured.

An emulator probe (ETK) is an electronic assembly that is installed in a vehicle control unit (ECU) to exchange data with ECUs.

Application Areas

- The product is approved for use in the following areas:
  - ECUs
- Do not operate the product in a wet or damp environment.
- Do not operate the product in potentially explosive atmospheres.

Technical Condition

The product is designed in accordance with state-of-the-art technology. Only operate the product and its accessories if they are in perfect working order. Shut down a damaged product immediately. The product cannot be repaired. Dispose of the product properly. Do not open or alter the product. Only ETAS may make changes to the product.

1.2 Classification of Safety Messages

The safety messages used here warn of dangers that can lead to personal injury or damage to property.:

DANGER

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING

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

CAUTION

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

NOTICE

NOTICE indicates a situation that, if not avoided, could result in damage to property.

1.3 Safety Information

1.3.1 Assembly

The product must only be removed from the ESD packaging and installed in a workplace that is protected against static discharges.

Only install, connect, disconnect, and cable ETAS products and components when they are de-energized.

When installing the product, make sure that the fastening elements do not damage the product's printed circuit board or cause a short circuit.

Installation Location

NOTICE

Damage to the electronics due to potential equalization

The cables' shield may be connected to the housing, the ground or the ground for the product's power supply. If there are different ground potentials in the test setup, equalizing currents can flow between the products via the cables' shield.

Take account of different electric potentials in your test setup and take appropriate measures to prevent equalizing currents.

1.3.2 Operation

Only operate the product with the latest firmware. You can find information about updating the firmware in the user guide.

If the firmware update is not completed successfully, try it again. If a new firmware update is not possible and the product is not functional, send the product to ETAS.

1.3.3 Electrical Connection

Electrical Safety and Power Supply

- Only connect the product to electric circuits with safety extra-low voltage in accordance with IEC 61140 (devices of class III) within the voltage limits for accessible parts as per IEC 61010-1.
- Comply with the connection and setting values (see “Technical Data” on page 40).
- The power supply for the product must be safely disconnected from the mains power. For example, use a car battery or a suitable lab power supply.
- Only use lab power supplies with dual protection for the supply network (with double/reinforced insulation (DI/RI)).
- The power supply must be suitable for use according to the ambient conditions for the product.

- It is possible to discharge the vehicle battery in regular operation and long standby operation.
- Central load-dump protection is required for operation.

Connection to the power supply

DANGER

Undefined vehicle behavior due to an ECU reset

If the external power supply to the ETK is interrupted (e.g. cut, disconnected, etc.), this may lead to the ECU being reset.

- Connect the internal power supply of the ECU to the ETK in addition to the external power supply.
- If this is not possible, ensure that the external power supply to the ETK is not interrupted during operation.

WARNING

Risk to life from electric shock

If an unsuitable power supply is used, this may generate a hazardous electrical voltage.

- Use a power supply that is permitted for the product.

- Ensure that the connections of the power supply are easily accessible.

De-energizing the product

1. Disconnect the product from the power supply in one of the following ways:
   - Switch off the laboratory power supply for the test setup.
   - Disconnect the test setup's connection to the vehicle battery.
   - Remove the power cord.
2. Remove all cables from the product.

1.3.4 Cables and Accessories

Cables

- Only use ETAS cables, cables recommended by ETAS or other cables certified for the application.
- Route the cables such that they are protected against abrasion, damage, deformation and kinking.
- Do not place any objects on the cables.
- Do not use any damaged cables.
- The connector and connection must not be dirty.
- The connector and connection must be compatible.
- Correctly align the connector with the connection.
- Do not connect the connector and connection by force.

Accessories

Use ETAS accessories, accessories recommended by ETAS or other accessories certified for the application. For detailed information about accessories, see “Cables and Accessories” on page 60.

1.3.5 Transport

- Only transport and store the product in ESD packaging.
- Only transport the product individually.
- Do not transport the product by the connected cables.

1.3.6 Maintenance

The product is maintenance-free.

Cleaning

- Only clean the product when it is de-energized.
- Make sure that no moisture enters the product.
- Carefully vacuum off dust particles and loose foreign bodies.

1.4 Identifications on the Product

The following symbols are used for identifications of the product:

Symbol	Description
	The User Guide must be read prior to the startup of the product!
	Symbol for WEEE, see chapter 1.5 on page 12
	Symbol for CE conformity, see chapter 1.6.1 on page 12
	UKCA conformity symbol (Great Britain), see chapter 1.6.2 on page 12)
	Symbol for China RoHS, see chapter 1.7.2 on page 13
	Symbol for electrostatic sensitive components
XETK-S14.0A	Product designation (example)
F 00K 110 722	Order number of the product (example)
SN: yyxxxxx	Serial number (7-digit)
XXXX/YY	Product version
ZZZZ	Year of manufacture
ETAS GmbH,...	Manufacturer's address

> **NOTE**
>
> For symbols and product information one or several adhesive labels can be used.

1.5 Taking the Product Back and Recycling

The European Union has passed a directive called Waste Electrical and Electronic Equipment, or WEEE for short, to ensure that systems are setup throughout the EU for the collection, treating and recycling of electronic waste.

This ensures that the devices are recycled in a resource-saving way representing no danger to health or the environment.

Fig. 1-1 WEEE-Symbol

The WEEE symbol (see Fig. 1-1 on page 12) on the product or its packaging shows that the product must not be disposed of as residual garbage.

The user is obliged to collect the old devices separately and return them to the WEEE take-back system for recycling. The WEEE directive concerns all ETAS devices but not external cables or batteries.

For more information on the ETAS GmbH Recycling software, contact the ETAS sales and service locations.

1.6 Declaration of Conformity

1.6.1 CE Declaration of Conformity (European Union)

With the CE mark attached to the product or its packaging, ETAS confirms that the product corresponds to the applicable product-specific European Directives. The CE Declaration of Conformity for the product is available upon request.

1.6.2 UKCA Declaration of Conformity (Great Britain)

With the UKCA mark attached to the product or its packaging, ETAS confirms that the product corresponds to the product-specific, applicable standards and directives of Great Britain. The UKCA declaration of conformity for the product is available on request.

1.7 RoHS Conformity

1.7.1 European Union

The EU Directive 2011/65/EU limits the use of certain dangerous materials for electrical and electronic devices (RoHS conformity).

This product does not contain any of the restricted substances specified in the EU Directive 2011/65/EU or exceeds the maximum concentrations stipulated therein. For individual electronic components used in our products, there are currently no equivalent alternative substances, which is why we make use of the exceptions 7A and 7C-I in Annex III of this Directive.

ETAS confirms that the product corresponds to this directive which is applicable in the European Union.

1.7.2 People's Republic of China

ETAS confirms that the product meets the product-specific applicable guidelines of the China RoHS (Management Methods for Controlling Pollution. Caused by Electronic Information Products Regulation) applicable in China with the China RoHS marking affixed to the product or its packaging.

1.8 Declarable Substances

European Union

Some products from ETAS GmbH (e.g. modules, boards, cables) use components with substances that are subject to declaration in accordance with the REACH regulation (EU) no.1907/2006.
Detailed information is located in the ETAS download center in the customer information "REACH Declaration" (www.etas.com/Reach). This information is continuously being updated.

1.9 Use of Open Source Software

The product uses Open Source Software (OSS). This software is installed in the product at the time of delivery and does not have to be installed or updated by the user. Reference shall be made to the use of the software in order to fulfill OSS licensing terms. Additional information is available in the document "OSS Attributions List" at the ETAS website (www.etas.com).

2 Introduction

This chapter contains information about the following topics:

2.1 Applications

The FETK-T3.0 is an emulator probe for the Renesas RH850 microcontroller family. It is a serial FETK designed for use with the JTAG interface (IEEE 1149.1) and Aurora Trace interface.

> **NOTE**
>
> For supported Renesas RH850 microcontrollers, refer to chapter 7.1.3 on page 41.

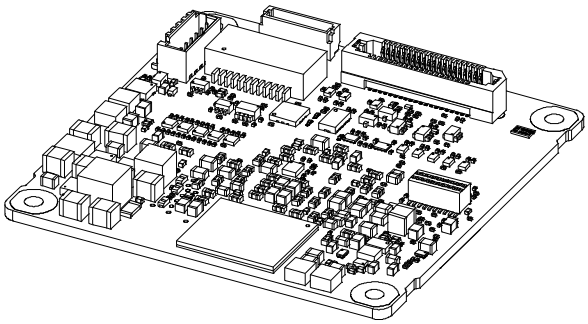


Fig. 2-1 FETK-T3.0

	FETK-T3.0
ECU JTAG & Aurora interface connector	40 pin SAMTEC
Debug & Trace interface connector	34 pin SAMTEC
Power supply connector	6 pin MOLEX
Power supply for FCC devices (VDDSTBY)	Configurable 1.09V or 1.25V
SBRAM sense	Yes, on board or external sense
Pinless triggering	Yes
Timer triggering	Yes
Trace Triggering	Yes

To access the ECU, the FETK-T3.0 must be connected via ES89x modules.

The system (ES89x, FETK-T3.0, cables) can be used for high speed Measurement, Calibration and ECU flash programming. Support of high speed and high band width applications e.g. functional prototyping - bypass depends on the functionality of the connected modules.

2.2 Features

General

- JTAG interface
  - Configurable JTAG output levels: 3.3 V or 5.0 V

  - Configurable JTAG interface clock speed: 10 MHz, 20 MHz, 25 MHz, or 40 MHz
  - JTAG signals available on the 40 pin Samtec connector
  - Pinless startup protocol for FETK recognition and data acquisition triggering
  - Measurement raster down to 50 µs
- Enables highest possible data throughput by utilizing the microcontroller "TRACE" interface e.g. AURORA trace for measurement purposes and the debug interface for configuration and prototyping
  - Support of Aurora interface clock speed for measurement: 1.25 GHz or 2.5 GHz
  - Aurora Trace Signals available on the 40 pin Samtec connector
  - Measurement raster down to 10 µs
- Gigabit Ethernet Interface:
  - Connection to PC via ES89x modules
  - Latency optimized proprietary Ethernet protocol for FETKs to ES89x
  - Supports a variety of standard applications
- "ETK Drivers and Tools" update to support ETAS software tools (INCA, XCT)
- Firmware update (programming of the logic device) through HSP software service packs; removal of FETK or ECU is not necessary
- Mounting possibilities inside or on top of ECU
- ECU flashing via FETK, Braindead flashing under ProF control
- Permanent storage of configuration in EEPROM
- Temperature range suitable for automotive applications
- Third party MC-tool support via ES89x module possible
- Supports "turnkey mechanism" - measurement start immediately after "Ignition on" and proceed measurement after ECU reset (only if serial debug interface is using for measurement)
- Hook-based (DISTAB) and hook-less measurement approaches

Calibration

- Concurrent use of calibration and measurement performed via microcontroller
- Working Page & Reference Page (2 page concept) realized by microcontroller overlay mechanism
- Direct access to parameters, curves, and maps in internal RAM
- Microcontroller capability of internal Flash emulation can be used
- FETK powers Emulation RAM (for calibration purpose)
- Supports “Start on Any Page”
- Supports special coldstart mechanism (“Calibration Wake Up”):
  - Calibration Wake Up: Wake up mechanism to wake up the power supply of the ECU via the Calibration Wake up pin
  - Pull CalWakeUp until Startup Handshake: duration of the Wake up mechanism is configurable

For more technical data on the FETK-T3.0 consult the chapter “Technical Data” on page 40.

3 Hardware Description

This chapter contains information about the following topics:

3.1 Architecture

Fig. 3-1 shows the block diagram of the FETK-T3.0.

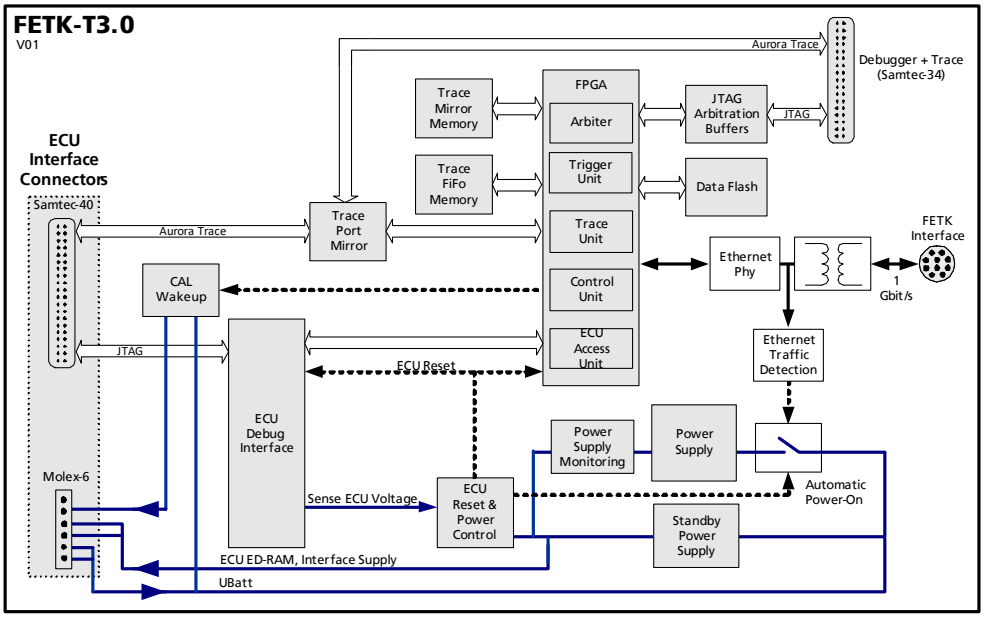


Fig. 3-1 FETK-T3.0 Architecture

While the microcontroller accesses the program data (not the program code) out of the data emulation memory provided by the microcontroller, the content of the data emulation memory can simultaneously be modified by the calibration and development system through the FETK-T3.0 interface. This process enables adjustments of parameters, characteristic lines and maps through the calibration and development system.

Using the Aurora trace interface, the FETK-T3.0 can acquire measurement data and send the measured data to the PC.

The 1 Gbit/s Ethernet interface provides communication with the ES89x module.

FETK Connector	Description
CON1	ECU interface JTAG + Aurora Trace
CON2	Power supply
CON3	Ethernet interface (ES89x module)
CON4	Debugger and Trace interface

3.2 ECU Interface

The FETK-T3.0 is connected via connectors CON1 and CON2 to the ECU with two adapter cables (refer to Fig. 3-2 on page 18). The pin definition depends on the application and the microcontroller type. In general, the ECU interface consists of

- 5 JTAG Debug line interfaces for the communication between the FETK-T3.0 and the microcontroller
- 4 differential Aurora lanes
- 1 differential clock
- 1 ECU voltage line, which is not used for FETK power supply, but only for detection of the ECU status, therefore the power consumption on this line is negligible (refer to chapter 3.4 on page 19)
- 1 Reset line which allows the FETK to control the system reset of the ECU
- 1 Reset line which allows the FETK to monitor the system reset of the ECU
- 1 Watchdog disable line
- 7 ground lines for proper shielding of the ECU interface lines

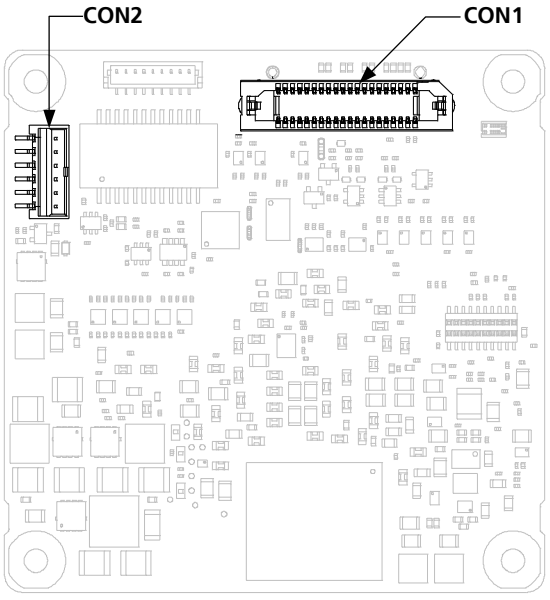


Fig. 3-2 Location of the ECU Interfaces CON1 and CON2

3.3 FETK Ethernet Interface

The FETK Ethernet interface utilizes a proprietary protocol. It must be connected to the PC via a ES89x ECU Interface Module at CON3 (refer to Fig. 3-3).

> **NOTE**
>
> The FETK Ethernet interface utilizes a proprietary Ethernet protocol and is compatible only with the Gigabit Ethernet interfaces of the ES89x ECU Interface Module.

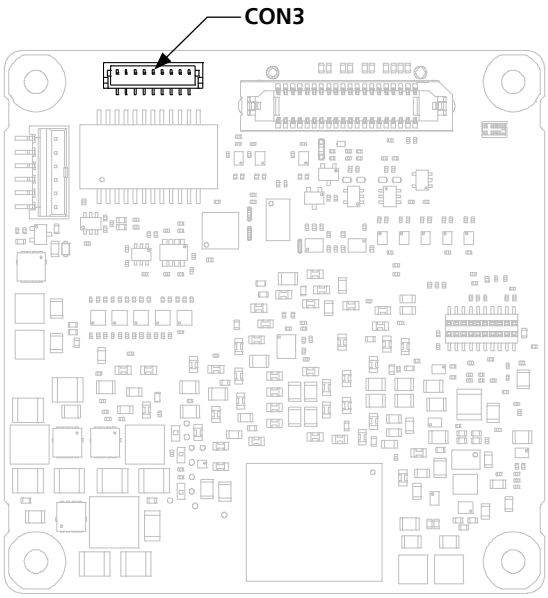


Fig. 3-3 Location of the FETK Ethernet Interface connector CON3

3.4 Power Supply

The FETK-T3.0 requires a permanent power supply. It is typically powered directly from the car battery. The input voltage may vary between 6.0 V and 36 V. In case of higher input voltages to the FETK, additional voltage protection is required.

The FETK is suitable for 12 V and 24 V systems. In 24 V systems the load dump capability is reduced.

The FETK-T3.0 will also accept voltage drops down to 3 V (for additional details of low voltage operation, see ISO standard 16750).

From the input battery voltage, switch-mode power supplies provide all necessary voltages on the FETK-T3.0. The power supply of the ECU is not affected by the FETK-T3.0. An automatic switch ensures that the power supply of the FETK-T3.0 is automatically switched on and off when the FETK enters and leaves its standby (sleep) mode.

The FETK-T3.0 is supplied with power through the connector CON2.

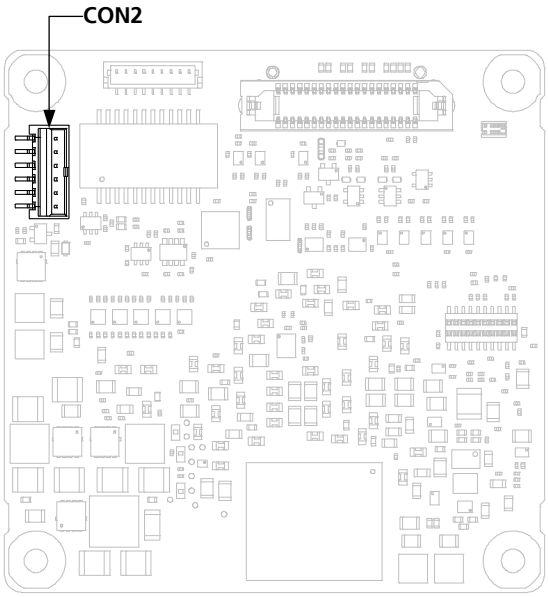


Fig. 3-4 Location of the FETK-T3.0 Power Supply Connector CON2

3.5 ECU Voltage Supervisor

The ECU voltage (VDD) is monitored by the FETK to recognize whether the ECU is switched on or off. Additionally, the ECU RAM standby voltage (VDDSTBY) is monitored to determine if the standby RAM content is still valid. These two signals are only used for monitoring therefore the load current is negligible.

> **NOTE**
>
> The FETK-T3.0 only allows switching between reference page and working page if there is a valid voltage at the sense pin and the working page has been initialized by the calibration and development system.

The FETK-T3.0 provides two opportunities to supply and supervise the ECU RAM standby voltage:

- The FETK-T3.0 monitors the VDDSTBY supply on board the FETK. The microcontroller's standby power supply pin must be connected to the FETK pin VDDSTBY.
- The FETK-T3.0 monitors the VSTBY pin, provided by the ECU connection. The microcontroller's standby power supply pin must be connected to the FETK pin VSTBY. The microcontroller's standby power supply may be provided by the ECU or by the FETK.

3.6 Debug and Trace Interface for 3rd Party Tools

The FETK-T3.0 features a JTAG and Aurora Trace interface connector CON4 (Samtec 34 pin). This connector can be used to attach a 3rd party debug and trace tool (e.g. Lauterbach or PLS debugger).

The FETK-T3.0 provides a hardware arbitration mechanism for sharing the JTAG interface. This arbitration mechanism enables the simultaneous use of tools for debugging and ETAS tools for measurement and calibration. The FETK-T3.0 also provides Aurora Port replication to both the Trace tool and the FETK, enabling simultaneous use of the Aurora Trace lanes for Program and Data trace.

The Debug and Trace tool is connected via the connector CON4.

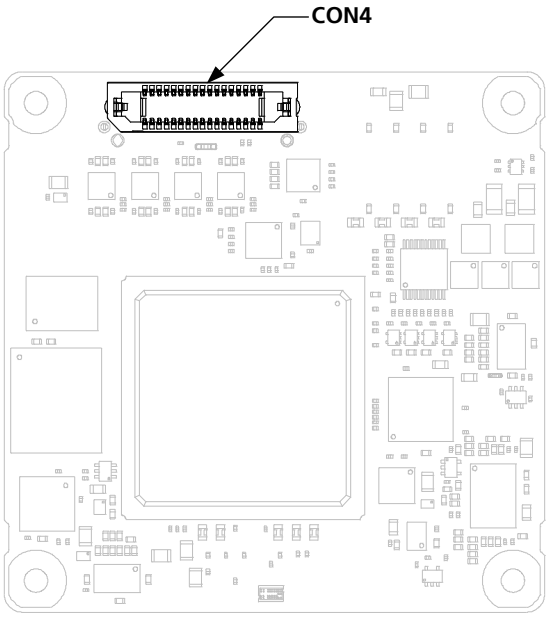


Fig. 3-5 Location of the FETK-T3.0 Debug and Trace Connector CON4

3.7 Status LEDs

There are three LEDs displaying the operating status of the FETK-T3.0 (Fig. 3-6 on page 22).

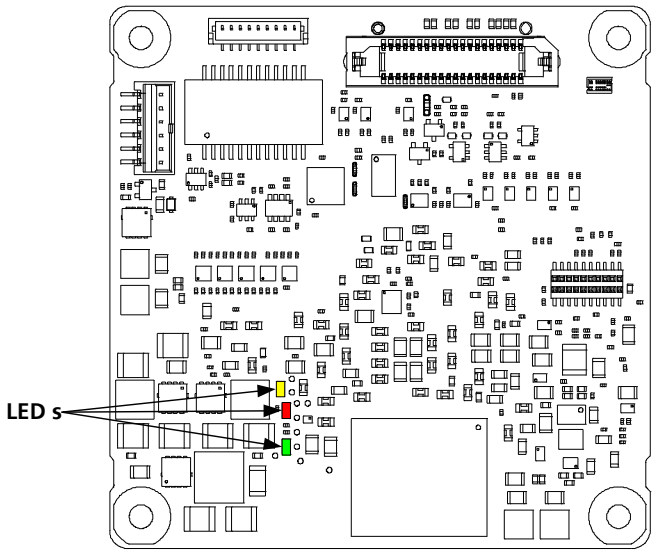


Fig. 3-6 Status LEDs (FETK-T3.0)

LED	State	Definition
Red	On	FETK-T3.0 is supplied with power and active (i.e. the ECU is switched on or the ETAS calibration and development system is connected and ready to communicate with the FETK-T3.0)
Green	Off	Working Page contains data and is accessible from INCA
	Flashing	FETK-T3.0 is in boot configuration mode: - measurement and calibration are not possible, - FETK-T3.0 update with HSP is required
	On	Power supply has dropped under selected threshold: - data retention of the calibration data manager in the ECU is no longer ensured - as soon as the FETK-T3.0 switches on again, the ECU switches to the Reference Page. Green LED stays lit until the calibration and development system downloads data into the calibration data memory. Otherwise switching to the Working Page is not possible.
Yellow	Off	FETK-T3.0: no link to calibration system established
	On	1 Gbit/s communication to calibration system established

3.8 Data Access

3.8.1 Calibration Data Access

The FETK-T3.0 is a serial FETK using JTAG and Aurora trace the microcontroller interface. Typical of all serial ETKs, XETKs and FETKs, the RAM used for data emulation and data measurement is not accessible by the FETK until the microcontroller is powered up and the startup handshake is performed.

Serial FETKs use the ETAS two page concept, consisting of both a Reference and a Working page.

The Reference Page is located in the ECU flash and cannot be modified by a simple write access. All changes to the Reference Page must be done via Flash programming.

The Working Page is located within the microcontroller's EMU RAM. The Working Page may be a portion of or the entire size of the EMU RAM. The EMU RAM used for the emulation of calibration data must not be used by the ECU software directly as general purpose RAM. It is recommended that the EMU RAM is permanently powered by the FETK-T3.0 or ECU and shall not be reset by the ECU, if the FETK-T3.0 signals a permanently powering of the EMU RAM during handshake.

The FETK / INCA has complete control over the RAM used as Working Page and its contents. When enabling data emulation, the FETK establishes a basic start-up configuration of the data in the Working Page by copying the corresponding data in the Flash to the emulation space.

To enable calibration, the Working Page must be activated. The process of switching from the Reference Page to the Working Page and vice versa is known as page switching.

The FETK-T3.0 supports Protocol Based page switching for all supported microcontrollers. Page switching is done in microcontroller software by switching the overlay memory on (Working Page) and off (Reference Page) using microcontroller overlay registers. The FETK-T3.0 does not directly control the microcontroller overlay registers. Instead, the FETK-T3.0 and microcontroller software use a simple communication method with a shared mailbox in RAM. The FETK-T3.0 uses this mailbox to request and monitor page switching; the microcontroller software is responsible to service this mailbox and perform the page switches. Using an overlay modification description, also in RAM, the FETK-T3.0 provides the necessary information.

The FETK-T3.0 can access both the Reference Page and the Working Page, regardless of which is active from the microcontroller's point of view.

Another important restriction is that no access to the memory is possible, while the ECU is not running. To enable a cold start measurement in spite of this restriction, the cold start measurement procedure is defined to give the user the feeling of a parallel FETK.

3.8.2 Measurement Data Access

The FETK-T3.0 is a serial FETK, so all data to be measured is located in the ECU memory. It can be read out by the FETK-T3.0 using the JTAG interface in two ways:

- Trace measurement using the Aurora trace interface
- Read accesses using the JTAG interface

Trace Measurement

The microcontroller's ability to send trace messages over the Aurora interface is used to forward any write access to measurement data to the FETK-T3.0. The FETK-T3.0 combines the processing of this data trace messages with an initial direct read of the configured measurement data to an always up to date mirror of the measurement data in the ECU.

The current values will be sent from the FETK to INCA every time the ECU software issues the corresponding trace trigger. For details on trace trigger (refer to chapter 3.10.2 on page 26). The FETK-T3.0 does the complete configuration of the microcontroller for trace based measurement. No ECU software is required for the configuration.

Direct Measurement

The FETK-T3.0 reads the measurement data through the JTAG interface.

The read action will be executed by the FETK-T3.0, when it is invoked by a hardware trigger (refer chapter 3.10.4 on page 27).

Due to the throughput limitations of the JTAG interface, this method is not as suitable for high speed measurement as the Trace Measurement.

3.9 JTAG and Aurora Interface

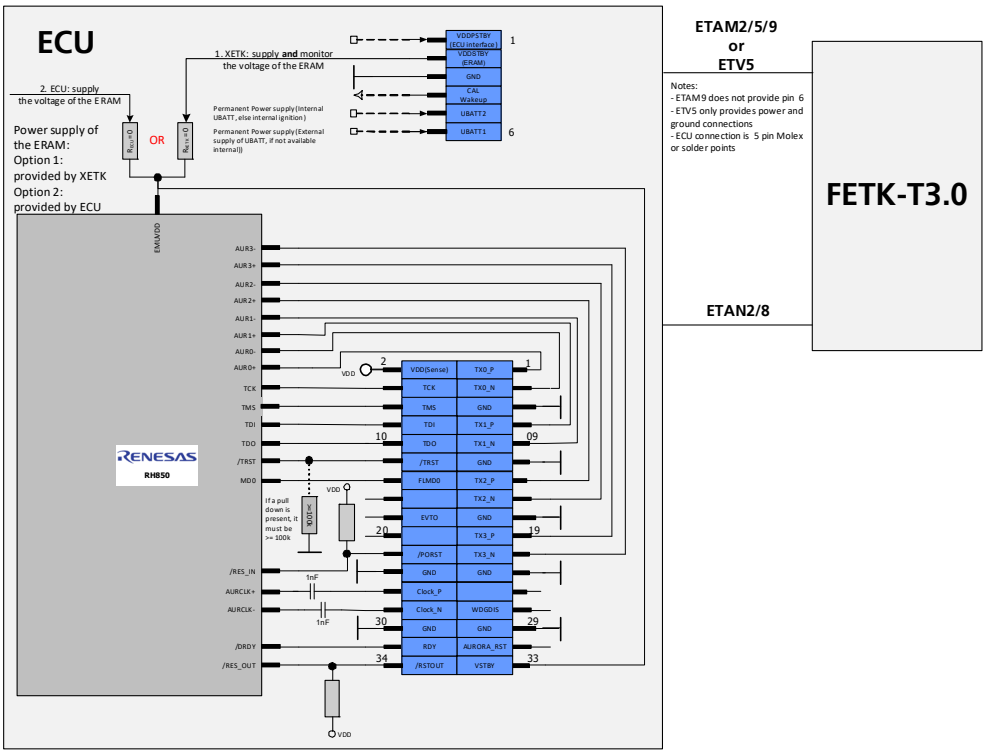


Fig. 3-7 Equivalent Circuitry of the ECU JTAG & Aurora Interface (ECU)

The ECU part of the JTAG and Aurora FETK interface is depicted in Fig. 3-7.

3.9.1 Interface Recommendations

The use of both JTAG and Aurora requires the ECU or Mezzanine board to use a 34 pin Samtec connector for interfacing to the FETK-T3.0.

The FETK-T3.0 incorporates 22 Ohm series resistors for the TMS, TCK, TDI and /TRST lines on the ECU interface. Hence, no additional termination resistors are required on the ECU for these signals.

It is recommended to use 1nF capacitors on the ECU PCB or Mezzanine board for the AURCLK+/- signals.

3.9.2 Design Recommendations

- Debug and trace connectors should be placed as close to the microcontroller as possible
- If a pull down resistor is present on the line /TRST, the ECU must use a value no smaller than 100K ohm as shown in Fig. 4-8 on page 26.
- PCB trace lengths should be as short as possible for the TMS, TRST, TCK, TDI & TDO signals
- If any JTAG signals are also routed to a 2nd connector (Forked/Split or T'd), It is recommended to add zero ohm jumpers in line so the signal T can be broken
- PCB trace lengths should be as short a possible for the TX0...3_P, TX0...3_N, ClockP, and ClockN signals
- PCB trace lengths should be matched for the differential pairs TX0...3_P and TX0...3_N. PCB trace lengths should also be matched for the differential pairs ClockP and ClockN
- It is not recommended to T (fork/split) any Aurora Trace PCB signals
- All signals on the ETAN2 cables are 50 ohm impedance except the Aurora Trace signals (1, 3, 7, 9, 13, 15, 19, 21, 26, 28), it is recommended to match the PCB impedance to the cable impedance
- Aurora Trace signals on the ETAN2 cables are 100 ohm differential pairs (1 & 3, 7 & 9, 13 &15, 19 & 21, 26 & 28), it is recommended to match the PCB impedance to the 100 ohm cable impedance

3.10 Trigger Modes

3.10.1 Overview

The FETK-T3.0 supports the following trigger modes:

- Trace triggering by value

  The trigger mode "Trace Triggering" uses defined values written into a defined Trace-address for triggering (see also chapter 3.10.2 on page 26).
- Pinless triggering

  The trigger mode "Pinless Triggering" uses the microcontroller's internal TRIG register for triggering (see also chapter 3.10.3 on page 26).
- Timer triggering

  The trigger mode "Timer Triggering" uses four internal timers of the FETK for triggering (see also chapter “Timer Triggering” on page 27).

3.10.2 Triggering via Trace Interface

The FETK-T3.0 provides support for up to 255 data trace triggers. The trace triggers are defined within a section of RAM covered by a trace window. Both the trace window and trace triggers are defined in the FETK's configuration and/or A2L file. A write by the microcontroller software to a trace trigger location causes a trace trigger.

The trace trigger events to the FETK-T3.0 are synchronous to the microcontroller software. Variables assigned to a measurement raster using a trace trigger are acquired using the trace interface, not via JTAG.

The FETK-T3.0 supports value based data trace trigger:

- triggers for different rasters/events have same address, but use different values
- up to 255 value based trace trigger are supported

3.10.3 Pinless Triggering

Startup Handshake

Microcontroller registers are used for FETK startup handshake. During this handshake, ECU software detects the connected FETK by reading and writing to specific registers and performing basic initializations based on the register values. When these initializations are done, the handshake is finished with success acknowledgment to FETK. Thereafter, if a success acknowledgment is received by FETK, it starts additional initialization processes (e.g. coldstart, checksum, downloads, etc.).

ECU software must ensure that all memory ECC initializations have been completed prior to the startup handshake. The DBG_MBIN and DBG_MBOUT registers are used to generate FETK startup handshake, please contact your local ETAS representative for further information about the handshake.

After the startup handshake and measure enabled, FETK waits for triggers from ECU software.

FETK Trigger Generation

To generate triggers, the ECU software sets bits by writing the associated trigger index in the microcontroller trigger registers (DBG_TRGx). Each bit of the trigger registers corresponds to an FETK hardware trigger.

> **NOTE**
>
> The selective setting of trigger bits is accomplished in hardware by the microcontroller and does not require a Read-Modify-Write sequence by the ECU software.

The FETK periodically polls (reads) the trigger registers via JTAG. The polling rate is configurable, with 50 µs default. The FETK then starts acquisition of appropriate measurement data based on which bits of the registers are set.

Active bits in trigger registers are automatically cleared by microcontroller when the registers are read by FETK.

3.10.4 Timer Triggering

The trigger mode "Timer Triggering" uses four internal timers of the FETK-T3.0 for triggering. A fixed configurable period is used for triggering.

The time intervals between trigger events are in accordance with the configured timer values. This values and their resolution have to be defined in the A2L file. Available settings are:

- Minimum time interval 100 µs
- Maximum period duration 1 s
- Timer resolution 1 µs

The timers work in an asynchronous manner to the ECU software.

3.11 Reset

The requirement for the FETK-T3.0 reset mechanism is to ensure that power-up and power-down behavior of ECU is clean and smooth. The FETK-T3.0 drives /PORESET low during XETK power up or upon INCA request.

The FETK-T3.0 senses the status of the /PORESET line to detect when the ECU is in reset. If configured, and the microcontroller has /RESETOUT, the FETK-T3.0 can also be used to sense the status for the ECU reset.

The FETK-T3.0 senses the switched ECU power supply, VDDP. This allows the FETK to detect when the ECU is off and forward the information to INCA. In addition, it allows the FETK to enter the power save mode when the calibration system is unplugged.

3.12 Pull CalWakeUp until Startup Handshake

The FETK has the ability to wake up the ECU by applying voltage to the CalWakeUp pin of the ECU connector. This allows the FETK to configure a measurement while the ECU is off.

When waking up the ECU via the CalWakeUp pin, it can be configured if the pin is driven high until the microcontroller core voltage (VDDP) is high or if the pin should be driven high until the start-up handshake between ECU and FETK is complete.

4 Installation

This chapter contains information about the following topics:

NOTICE

Damage to the electronics due to potential equalization

The cables' shield may be connected to the housing, the ground or the ground for the product's power supply. If there are different ground potentials in the test setup, equalizing currents can flow between the products via the cables' shield.

Take account of different electric potentials in your test setup and take appropriate measures to prevent equalizing currents.

4.1 Mounting the FETK-T3.0 to the ECU Housing

4.1.1 Thermal Connection Requirements

To ensure proper operation of the FETK-T3.0 over the specified temperature range, the FETK-T3.0 must be mounted to the ECU metal housing using the enclosed Gap Pad. This enables thermal dissipation of the electronic components used on the FETK-T3.0 to the ECU housing. This chapter describes an example for mounting the FETK-T3.0 to the ECU housing.

The ECU housing should be of a size and material (such as Aluminum), which gives a thermal conductivity of at least 150 $W/(m \cdot K)$ at the FETK-T3.0 mounting position. The typical power dissipation for the FETK-T3.0 at 12V, 110°C is 5.2W. For additional details on power dissipation, please see “Environmental Conditions” on page 42.

For all mounting methods of the FETK-T3.0 to the ECU housing, the thermal gap pad must be used.

NOTE

When you mount the FETK to the ECU, you must ensure that the screws and washers used will not penetrate the FETK printed circuit board.

4.1.2 Mounting Material

For mounting the FETK-T3.0 to the ECU housing, the following parts are recommended:

- Four screws M 2.5
- FETK-T3.0
- Gap Pad, as supplied with the FETK-T3.0 or available as a spare part.
- Four 3.0 mm height spacer, M2.5
- ECU metal housing with machined holes aligning with FETK-T3.0 hole pattern (see "Mechanical Dimensions" on page 62)
- Four nuts M2.5

See figure “FETK-T3.0 mounting materials” on page 31

4.1.3 Placing the Gap Pad on the FETK-T3.0

1. On the Gap Pad, remove the blue colored adhesive backing. This will expose a tacky surface of the Gap Pad that will enable the Gap Pad to adhere to the FETK-T3.0.
2. Place the Gap Pad (tacky surface side down) onto the FETK-T3.0 as depicted in the figures “FETK-T3.0 bottom side view” on page 29 and “FETK-T3.0 with properly positioned Gap Pad” on page 30.

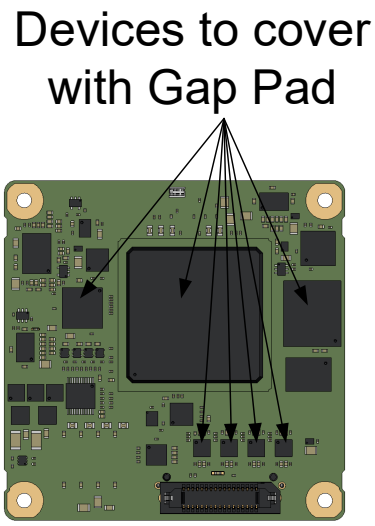


Fig. 4-1 FETK-T3.0 bottom side view

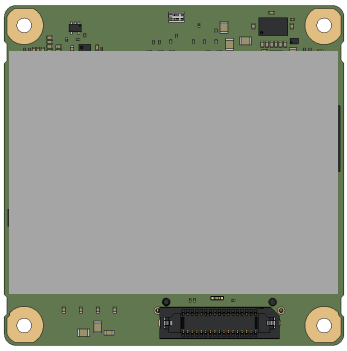


Fig. 4-2 FETK-T3.0 with properly positioned Gap Pad

> **NOTE**
>
> To ensure good thermal transfer between the FETK-T3.0 and the ECU housing, during the installation process, always use a new Gap Pad.
> Re-use of the Gap Pad during a re-installation or ETK recycling is not recommended. Additional Gap Pads are available as a standalone item (see “Mounting Material” on page 82 for ordering information).

4.1.4 Mounting the FETK-T3.0 to the ECU Metal Housing

On the Gap Pad, remove the second transparent backing material from the Gap Pad. Mount the FETK-T3.0 with attached Gap Pad to the ECU housing as depicted in figures “FETK-T3.0 mounting materials” on page 31 and “FETK-T3.0 mounted” on page 31.

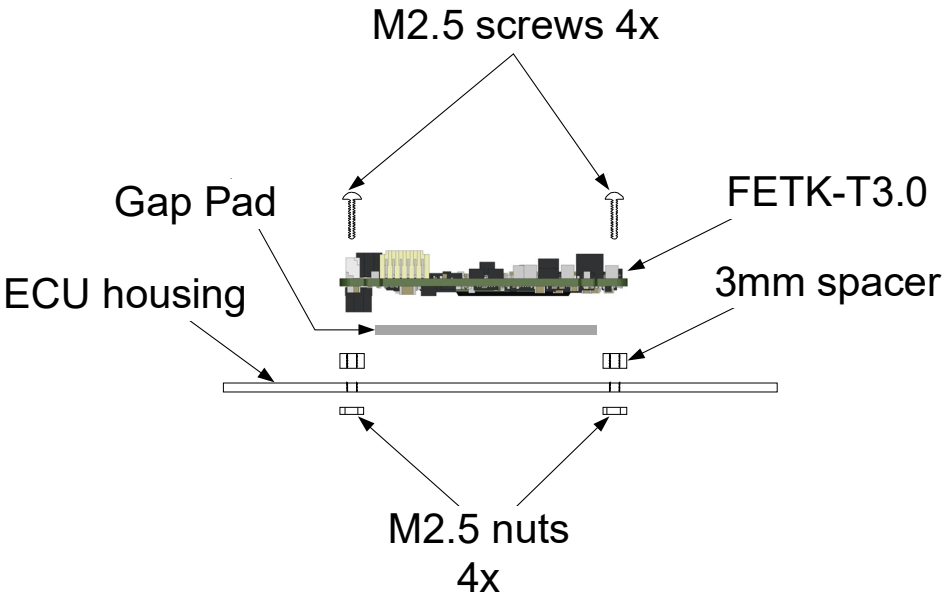


Fig. 4-3 FETK-T3.0 mounting materials

> NOTE
>
> Thermal transfer from the FETK-T3.0 to the ECU housing!
>
> When you mount the FETK-T3.0 to the ECU, you must ensure that a constant gap of 3 mm is maintained between the FETK-T3.0 PCB and the flat surface of the ECU housing.

Fig. 4-4 FETK-T3.0 mounted

> NOTE
>
> CON4 is on the bottom side (Gap Pad side) of the PCB!
>
> You must ensure that the ECU housing has an opening or cavity to ensure that the CON4 does not collide with the ECU housing (see Fig. 6-5 on page 58 and Fig. 6-6 on page 58 for mechanical dimensions).

4.2 Connection to the ECU

4.2.1 FETK-T3.0 Adapters

For connecting the FETK-T3.0 to the ECU two FETK adapter cables are recommended:

- at CON1 adapter cable ETAN2 or ETAN8
- at CON2 adapter cable ETAM2 or ETAM5 or ETAM9 or ETV5

For additional details to connect the FETK-T3.0 to the ECU with adapter cables see Fig. 4-6. The adapter cables can be ordered separately (refer chapter “Ordering Information” on page 80).

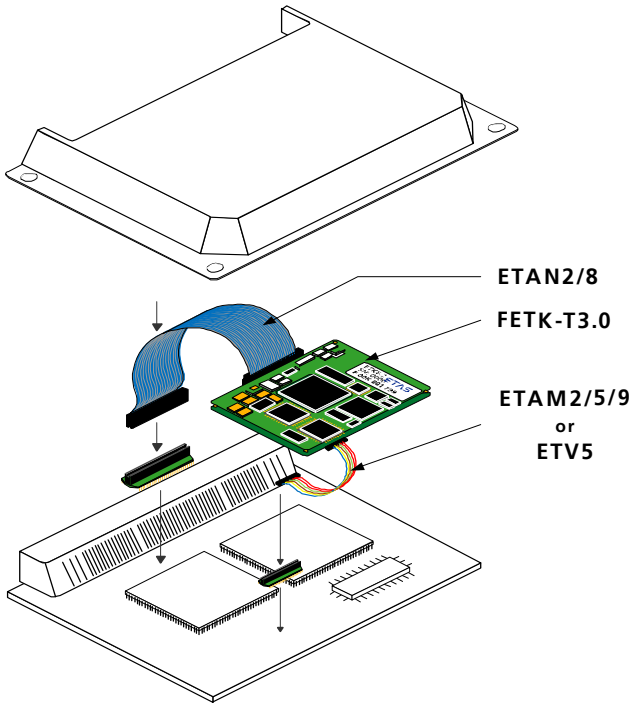


Fig. 4-5 FETK-T3.0 Connection to the ECU

4.2.2 Connection to the ECU and to the Debugger

The FETK-T3.0 provides a connector for connecting 3rd party debugger and trace tools. This connector (CON4) is located on the bottom side of the PCB. CON4 is a Samtec 34 pin interface, and the cable should be procured from the 3rd party tool supplier. For additional details to connect the FETK-T3.0 to a 3rd party debugger and trace tool, see Fig. 4-6.

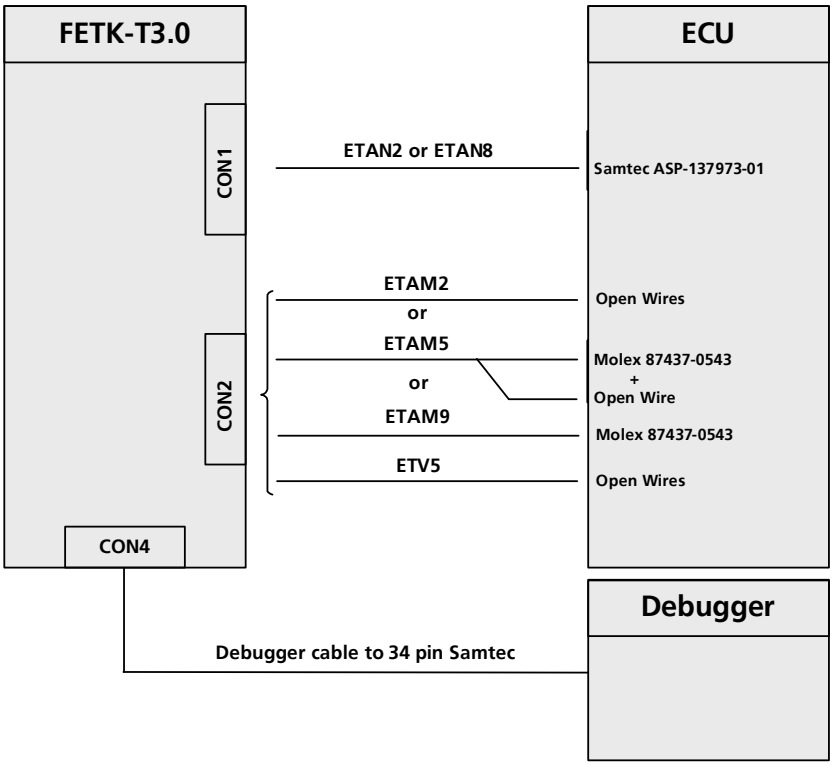


Fig. 4-6 FETK-T3.0 Connection to the ECU and to the Debugger

4.3 Wiring

4.3.1 FETK Ethernet Interface

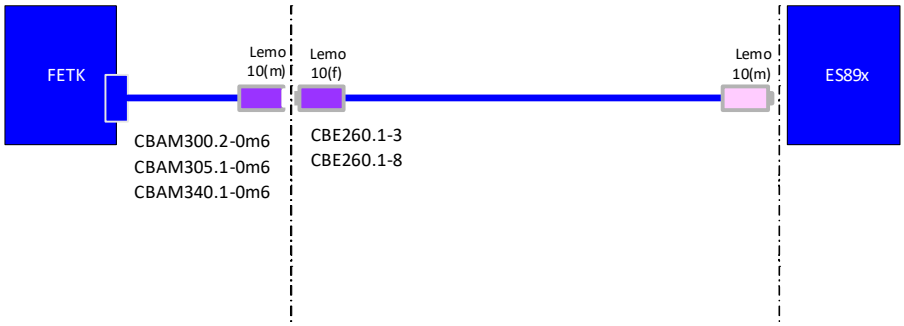


Fig. 4-7 Wiring - FETK Ethernet Interface

The FETK-T3.0 Ethernet interface can be connected to the ES89x ECU and Interface Module.

> **NOTE**
>
> The FETK Ethernet interface utilizes a proprietary Ethernet protocol and is compatible only with the Gigabit Ethernet interfaces of the ES89x ECU Interface Modules.

4.3.2 Power Supply

The FETK-T3.0 needs a permanent power supply.

> **DANGER**
>
> **Undefined vehicle behavior due to an ECU reset**
>
> If the external power supply to the ETK is interrupted (e.g. cut, disconnected, etc.), this may lead to the ECU being reset.
>
> - Connect the internal power supply of the ECU to the ETK in addition to the external power supply.
> - If this is not possible, ensure that the external power supply to the ETK is not interrupted during operation.

> **WARNING**
>
> **Risk to life from electric shock**
>
> If an unsuitable power supply is used, this may generate a hazardous electrical voltage.
>
> - Use a power supply that is permitted for the product.

Permanent Power Supply inside ECU available

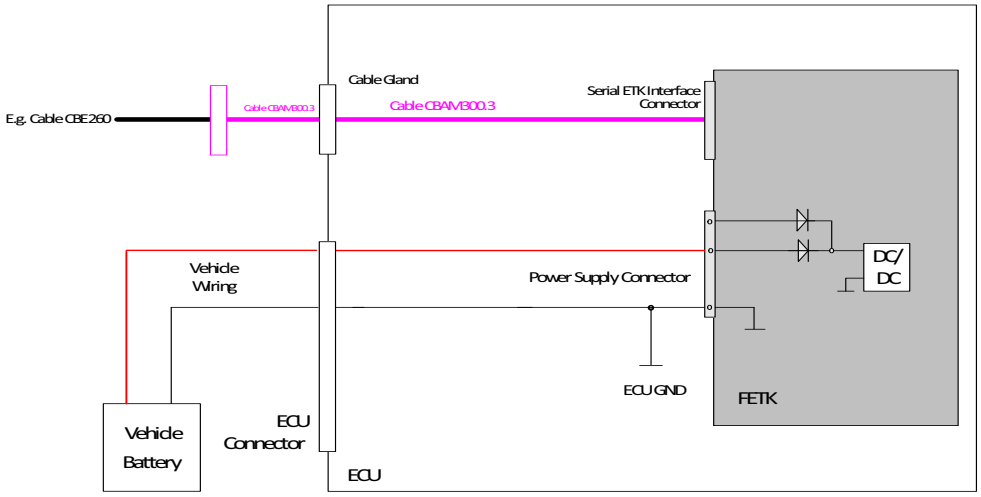


Fig. 4-8 FETK-T3.0 Power Supply wiring with CBAM300.3 Cable

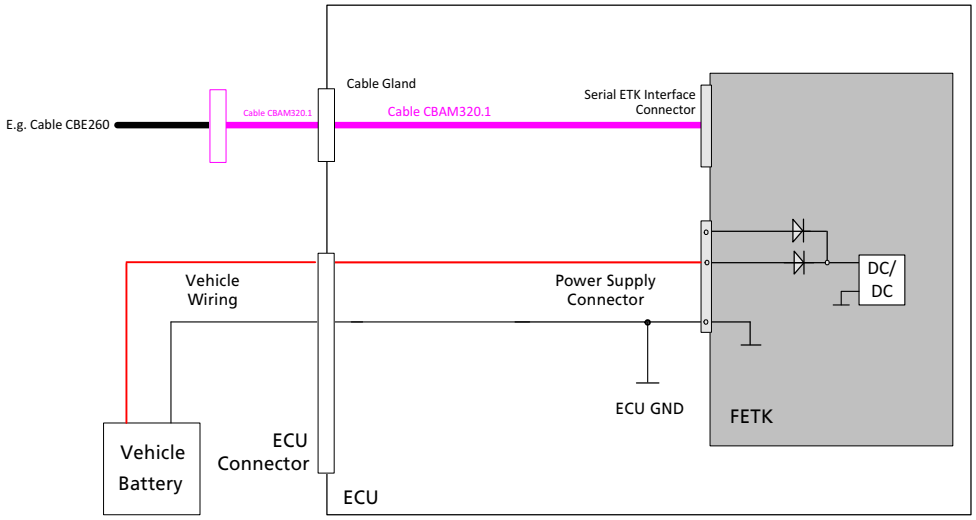


Fig. 4-9 FETK-T3.0 Power Supply wiring with CBAM320.1 Cable

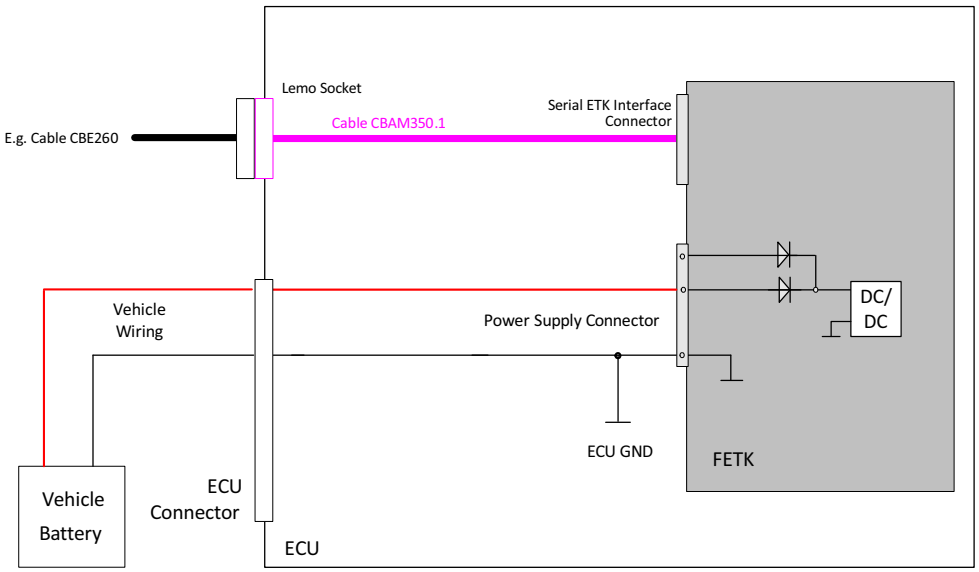


Fig. 4-10 FETK-T3.0 Power Supply wiring with CBAM350.1 Cable

Permanent Power Supply inside ECU not available

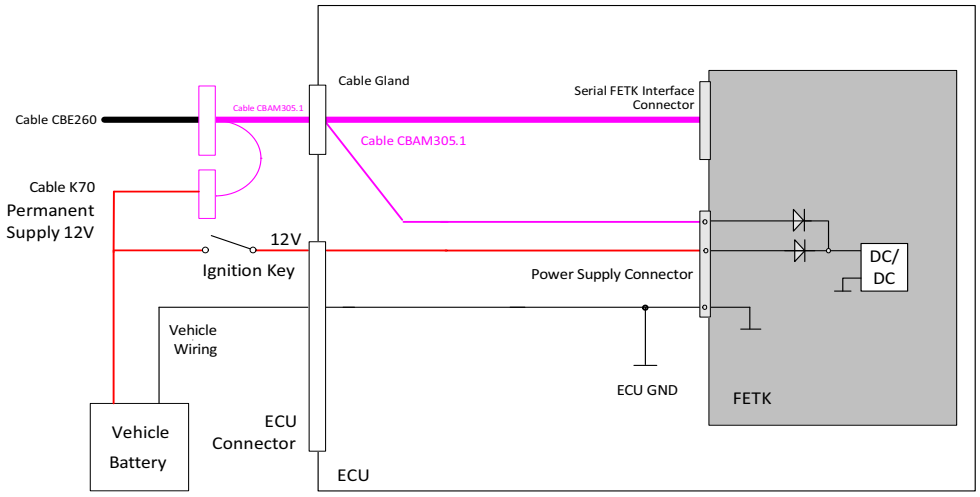


Fig. 4-11 FETK-T3.0 Power Supply wiring with CBAM305.1 Cable

Isolated Power Supply inside ECU ETP2

The FETK-T3.0 does not require a galvanically isolated power supply. For special applications ETAS can offer a isolated power supply unit.

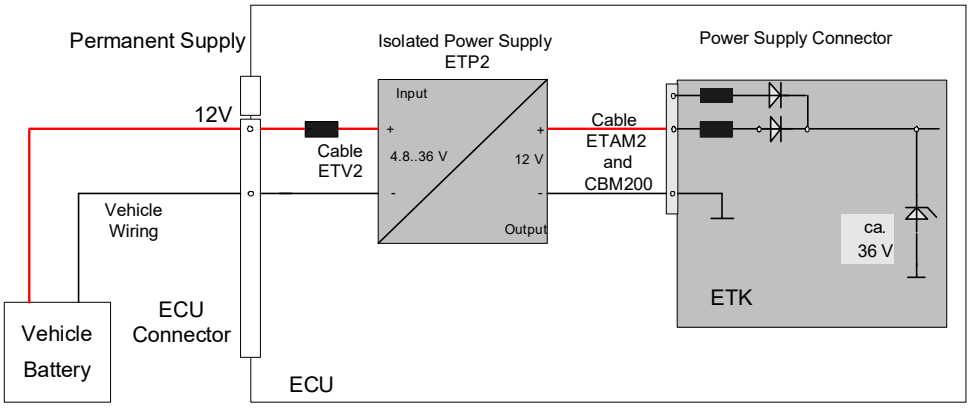


Fig. 4-12 Isolated Power Supply inside ECU

5 ETK / XETK / FETK Configuration

This chapter contains information about the following topics:

5.1 Overview

As already mentioned in previous chapters, some project-specific adjustments are necessary. Configuration data is stored permanently.

Generating a valid configuration data set is supported by the XETK Configuration Tool (XCT). The XCT contains infFETK+T3.0ormation on all available ETKs, XETKs, and FETKs. The user is supported through a graphical interface.

The configuration is done in two steps:

1. Generation of the special address offset for the emulation and measurement data memory.

   The location of data areas, measured data output areas, trigger segment addresses etc. are familiar to the ECU software developer, or can be generated automatically. If an ECU description database (ASAP, ...) with the corresponding input exists, these inputs can be downloaded from this database. If necessary, a plausibility check is performed.

2. Connection of the ETK / XETK / FETK to the ECU.

   The ECU hardware developer defines the connection of the ETK / XETK / FETK to the ECU. The corresponding signals usually have to be adjusted for each microcontroller. All inputs are checked for plausibility, to make sure that a valid configuration is generated.

The XCT can create the following output:

- Direct ETK / XETK / FETK configuration
- Storage of the configuration in a data file
- The corresponding ASAP2 input

The most important outputs are the entries for the ASAP2 file. All A2L definitions necessary for configuring an ETK / XETK / FETK will be created. These are e.g.:

- Overlay Region definitions
- Memory Segment definitions
- ETK / XETK / FETK configuration features
- Raster definitions

If these parameters are entered correctly in the corresponding ECU description file, it guarantees that every time the calibration system is started, the ETK / XETK / FETK is checked for the appropriate configuration.

If necessary, the ETK / XETK / FETK will be configured appropriately to the corresponding project.

5.2 Configuration Parameter

The XCT provides support concerning hardware configuration parameters and their possible values.

They are described for the different ETK / XETK / FETK types in the help document of the XCT.

Starting the XCT help

1. Start XCT.

   The main window of XCT opens.
2. Select in the menu bar **?** → **Contents**.

   The XCT help window opens.
3. Choose **Reference to User Interface** → **(X)ETK Hardware Configuration Parameters**.
4. Choose the topic **FETK-T3.0**.

   The topic **FETK-T3.0** contains information about the FETK-T3.0 hardware configuration parameters and their possible values.

6 Troubleshooting

6.1 Problems and Solutions

6.1.1 No communication between the ECU and ETK

Cause: No permanent powersupply at the FETK-T3.0.

It is possible, that if ECU and ETK are switched-on simultaneously, no communication between the ECU and ETK can be established.

Workaround: Trigger an ECU reset by application tool.

> NOTE
>
> The FETK-T3.0 requires a permanent power supply. It is typically powered directly from the car battery. Refer to chapter “Power Supply” on page 34.

7 Technical Data

This chapter contains information about the following topics:

7.1 System Requirements

7.1.1 ETAS Compatible Hardware

ETAS Hardware: ES89x ECU Interface Modules

7.1.2 PC with one Ethernet Interface

A PC with one open Ethernet interface (1 Gbit/s) with RJ45 connection is required to connect the ES89x module.

Requirement to ensure successful Initialization of the Module

> **NOTE**
>
> It is imperative you disable the function which automatically switches to power-saving mode on your PC network adapter when there is no data traffic on the Ethernet interface!

To deactivate the Power saving Mode

Choose in Windows System Control Center / Device Manager / Network Adapter the used network adapter by double-click. Deactivate the "Allow the computer to turn off this device to save power" option in the "Power Management" register. Confirm your configuration.

The manufacturers of network adapter have different names for this function.

Example:

- "Link down Power saving"
- "Allow the computer to turn off this device to save power"

7.1.3 Software Support

You need following software versions to support the FETK-T3.0. Operating the FETK-T3.0 with older software versions is not possible.

Use case: Measurement & Calibration, ECU Flash Programming

Microcontroller	INCA	INCA-MCE	HSP	ETK Tools
RH850_E2x FCC1	V7.2.13	V2.0	V11.13.0	V4.1.14
RH850_E2x FCC2	V7.2.13	V2.0	V11.13.0	V4.1.14
RH850_E1x FCC2	V7.2.13	V2.0	V11.13.0	V4.1.14
RH850_U2A EVA	V7.2.14	V2.0	V11.14.0	V4.1.15
RH850_U2B24 FCC	V7.4.1	V2.0	V13.1.0	V4.3.1

Use case: Rapid Prototyping

Microcontroller	INTECRIO	ASCET	HSP	Method
RH850_E2x FCC1	V4.6.2	V6.4.3	V11.13.0	SBB V2.1 HBB (DISTAB)
RH850_E2x FCC2	V4.6.2	V6.4.3	V11.13.0	SBB V2.1 HBB (DISTAB)
RH850_E1x FCC2	V4.6.2	V6.4.3	V11.13.0	SBB V2.1 HBB (DISTAB)
RH850_U2A EVA	V4.6.2	V6.4.3	V11.14.0	SBB V2.1 HBB (DISTAB)
RH850_U2B24 FCC	V4.6.2	V6.4.3	V13.1.0	SBB V2.1 HBB (DISTAB)

NOTE

Operating the FETK-T3.0A with older software versions is not possible.

The configuration instructions for the FETK-T3.0 in INCA and HSP are described in the relevant software documentation.

7.2 Data Emulation and Measurement Memory

7.2.1 Data Emulation Memory and Microcontroller Support

The FETK-T3.0 uses a portion of or up to the entire size of the EMU RAM, to emulate data in internal flash. The following table lists the supported microcontrollers, the size of the EMU RAM, and states if the EMU RAM is capable of being powered using a standby supply.

Microcontroller	Max. EMU RAM (MBytes)	Standby powered
RH850_E2x FCC1	2.5	Yes
RH850_E2x FCC2	5	Yes
RH850_E1x FCC2	1	Yes
RH850_U2A EVA	4	Yes
RH850_U2B24 FCC	7	Yes

7.2.2 Measurement Data Memory

Item	Characteristics
Location	Typically located within the emulation memory when using DISTAB17 hooks. Measurement data memory can be located in internal RAM if the entire ED RAM is needed for calibration.
Update	Logic devices updated using HSP software

7.2.3 Trace Memory

Item	Characteristics
Trace mirror size	4 MByte (phys.)

7.3 Environmental Conditions

Item	Characteristics
Operating temperature range	- 40 °C to +110 °C/ - 40 °F to +230 °F
Storage temperature range (without packaging)	0 °C to +50 °C/ + 32 °F to +122 °F
Max. relative humidity (non-condensing)	95%
Max. altitude	5000 m/ 16400 ft
Degree of contamination (IEC 60664-1, IEC 61010-1)	2
Protection rating (when closed)	Determined by installation in ECU

7.3.1 Power Consumption over Temperature

Inside the ECU housing, the max. temperature is specified at +110 °C, still air. The maximum power dissipation of the FETK-T3.0 will be 7.3 Watt. See Fig. 7-2 on page 43 for additional details on FETK-T3.0 power consumption. Depending on ECU design, this could be achieved with max. +105 °C outside temperature and 1 m/s airflow.

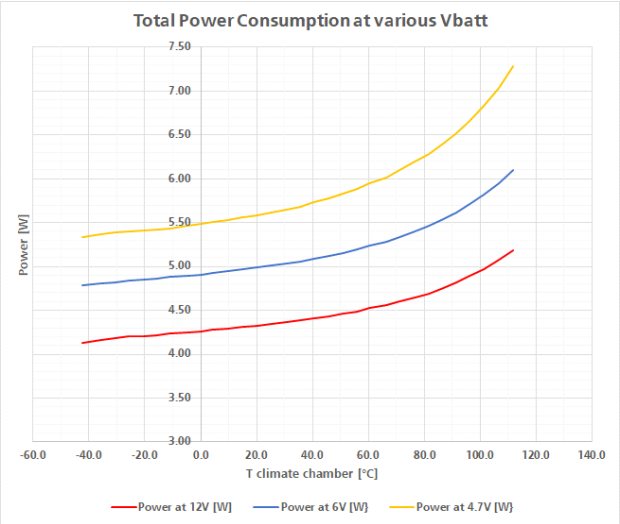


Fig. 7-1 FETK-T3.0 Power Consumption over Temperature

7.3.2 Maximal Thermal Resistance from Gap Pad Surface to Ambient

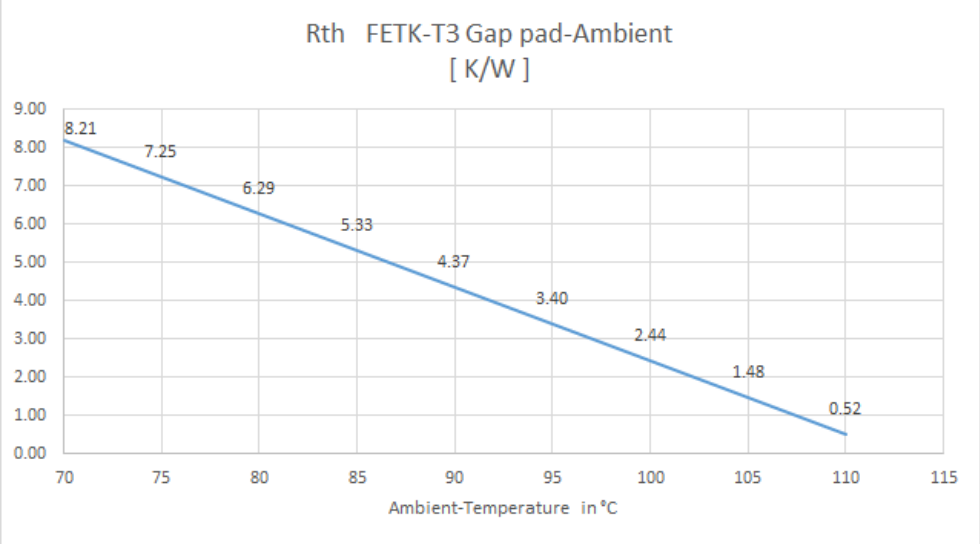


Fig. 7-2 Maximal Thermal Resistance from Gap Pad Surface to Ambient

$T_{Ambiente}$ [°C]	R_{th} FETK-T3.0 Gap Pad Surface-Ambient [K/W]
70	8.21
75	7.25
80	6.29
85	5.33
90	4.37
95	3.40
100	2.44

$T_{Ambiente}$ [°C]	R_{th} FETK-T3.0 Gap Pad Surface-Ambient [K/W]
105	1.48
110	0.52
Note: R_{th} = (125 - 12.3 - I T_{amb} I) / 5.2 K/W T_{jmax} = 125 °C	

7.4 Power Supply

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply	U_{Batt}	Vehicle usage [1)]	6.0 [all values +/-0%]	12	36	V
Cranking voltage	U_{Batt}	< 3 seconds	3			V
Deep standby current	I_{STBY1}	U_{Batt} = 12 V; ECU off; no load from ECU; T = 20 °C	1	3	5	mA
Standby current	I_{STBY2}	U_{Batt} = 12 V; ECU off; no load from ECU; T = 20 °C	50	78	110	mA
Operating current	I_{Batt}	U_{Batt} = 12 V; no load from ECU; T = 20 °C	230	330	420	mA
Power dissipation	P_{Batt}	U_{Batt} = 12 V; I = 0 mA at pin ECU_SBRAM; T = 20 °C	2.76	3.96	5.04	W
Power consumption on FETK-T3.0	P_{Batt}	U_{Batt} = 12 V; I = 500 mA at pin VDDSTBY [1.25 V]; I = 80 mA at pin VDDPSTBY; T = 20 °C	3.86	5.06	6.14	W
Fuse in the ETK Ubatt supply line. Only required if the power supply or ECU is not protected accordingly.			MINI vehicle blade-type fuse, fast-acting, 2 A 58V DC, e.g. Littelfuse 0997002.WXN			

[1)] The FETK-T3.0 implements reverse voltage protection in the same range and may be used only with central load dump protection.
24 V vehicles require U_{Batt} disturbing pulse reduction to 12 V vehicle system.
12 V vehicles don't require special disturbing pulse reductions.

NOTE

The values above are not including the power dissipation of the microcontroller EMU RAM part.

NOTE

The FETK-T3.0 will accept permanent power supply voltage dips (for additional details of 3 V low voltage operation, see ISO standard 16750).

7.5 FETK Ethernet Interface

Item	Characteristics
Connection	1 Gbit/s Ethernet
Cable length	max. 30 m / 100 ft
Ethernet Interface	DC decoupling Max. Isolation Voltage 60 V DC, according IEC 61010-1 ("Limit values for accessible parts" in normal, dry condition)

> **NOTE**
>
> The FETK Ethernet interface utilizes a proprietary Ethernet protocol and is compatible only with the Gigabit Ethernet interfaces of the ES89x ECU Interface Module.

7.6 Test Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Start Up Time 1 [1)]	$t_{startup1}$	U_{Batt} = 12 V Standby configured ECU_VDD goes high	0	6	10	ms
Start Up Time 1 [1)]	$t_{startup1}$	U_{Batt} = 12 V Deep Standby configured ECU_VDDP goes high	100	120	275	ms
Start Up Time 2 [1)]	$t_{startup2}$	U_{Batt} goes high	100	120	275	ms

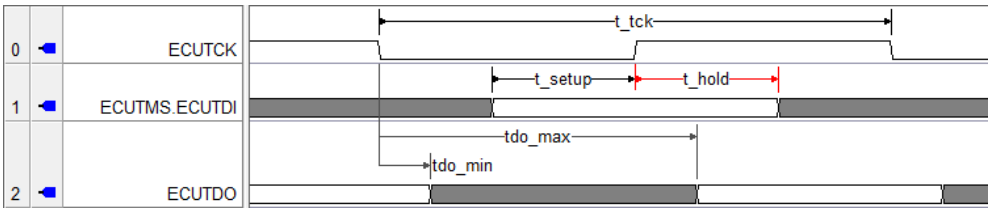
[1)] /PORESET is not pulled low until FETK start up time

7.7 JTAG Timing Characteristics

The following diagrams show the timings the FETK-T3.0 can process.

> **NOTE**
>
> JTAG timing parameters in this chapter refer to the JTAG interface (CON1) of the FETK-T3.0. The JTAG wiring to the ECU (including ETAN2 or ETAN8) must be taken account additionally.
> All timings are measured at a reference level of 1.5 V. Output signals are measured with 20 pF to ground and 50 Ω to 1.5 V.

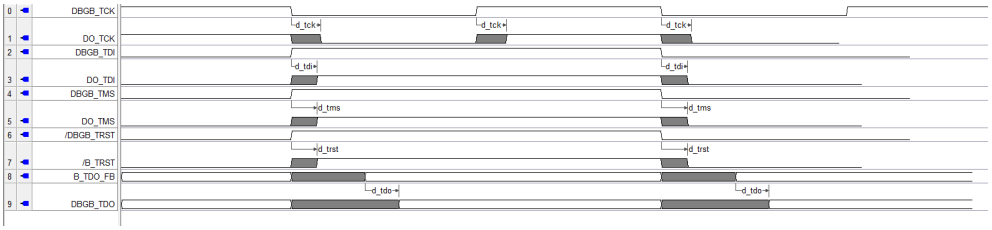
7.7.1 JTAG Timing Diagram



7.7.2 JTAG Timing Parameters

Parameter	Symbol	Value [ns]	Comment
JTAG Clock Period (ETK --› Target)	t_{tck}	100	10 MHz Nexus JTAG Clock Frequency
		50	20 MHz Nexus JTAG Clock Frequency
		40	25 MHz Nexus JTAG Clock Frequency
		25	40 MHz Nexus JTAG Clock Frequency
TMS/TDI Set-Up Time (ETK --› Target)	t_{setup}	8 (min.)	Minimum 5 ns required for microcontroller
TMS/TDI Hold Time (ETK --› Target)	t_{hold}	8 (min.)	Minimum 5 ns required for microcontroller
TDO clock-to-out time (Target --› ETK)	t_{do_min}	3.5 (min.)	Minimum 2.25 ns required by microcontroller specification
	t_{do_max}	14 (max)	Maximum 14 ns by microcontroller specification

7.8 Debugger Arbitration Timing Diagram



7.8.1 Debugger Arbitration Timing Parameters

Parameter	Value [ns]
d_tck (Debugger --> FETK)	15
d_tdi (Debugger --> FETK)	15
d_tms (Debugger --> FETK)	15
d_trst (Debugger --> FETK)	15
d_tdo (FETK --> Debugger)	20

7.9 Aurora Trace Timing Parameter

Aurora Baud Rate 1.25 Gbps selected

Parameter	Value	Unit	Signal Impedance
Clock	62.5	MHz	100 Ohm Differential
Data	1.25	Gbit/s	100 Ohm Differential

Aurora Baud Rate 2.5 Gbps selected

Parameter	Value	Unit	Signal Impedance
Clock	125	MHz	100 Ohm Differential
Data	2.5	Gbit/s	100 Ohm Differential

7.10 Electrical Characteristics

7.10.1 ECU Interface Characteristics

Parameter	Symbol	Condition [1]	Min	Typ	Max	Unit
CalWakeup Output Voltage	CALWAKEUP	U_{Batt} = 6.6 - 32 V; load 0 - 50 mA	U_{Batt} - 1 V		U_{Batt}	V
ECU Power Supply Supervision Voltage (3.3 V selected)	VDD (Sense)	VDD ↑	2.52	2.60	2.68	V
		VDD ↓	2.34	2.42	2.49	V
	I_{VDD}	VDD = 3.3 V			200	µA
ECU Power Supply Supervision Voltage (5.0 V selected)	VDD	VDD ↑	4.02	4.06	4.09	V
		VDD ↓	3.88	3.91	3.94	V
	I_{VDD}	VDD = 5.0 V			300	µA
ECU Standby RAM Supervision Voltage (1.25V selected)	VSTBY (Sense)	VSTBY ↑	1.13	1.14	1.15	V
		VSTBY ↓	1.11	1.12	1.13	V
	I_{VSTBY}	VSTBY = 1.25V / 1.09V			73	µA
ECU Standby RAM Supervision Voltage (1.09V selected)	VSTBY (Sense)	VSTBY ↑	1.03	1.06	1.09	V
		VSTBY ↓	0.97	1.00	1.03	V
	I_{VSTBY}	VSTBY = 1.25V / 1.09V				µA
ECU Standby RAM Output Voltage(1.09V) [2]	VDDSTBY	max. 500 mA load	1.07	1.11	1.14	V

Parameter	Symbol	Condition [1)]	Min	Typ	Max	Unit
ECU Standby RAM Output Voltage(1.25V) [2)]	VDDSTBY	max. 500 mA load	1.23	1.27	1.29	V
Power to supply ECU Interface (optional)	VDDPSTBY	max. 80 mA load	3.20	3.30	3.40	V

[1)]: VDD ↑: ECU Power Supply off → ECU Power Supply on; VDD ↓: ECU Power Supply on → ECU Power Supply off
VDDSTBY ↑: ECU Standby RAM Power off → ECU Standby RAM Power on
VDDSTBY ↓: ECU Standby RAM Power on → ECU Standby RAM Power off
[2)]: Current drawn from FETK VDDSTBY supply must not exceed 500 mA

7.10.2 ECU Interface Connector CON1 (5.0 V Interface selected)

Signal	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional load by FETK (typ) [pF] [1]
TDI	O	0.7	3.8	5.2	-	-	-	+/-10	8
/TRST	O	0.7	3.8	5.2	-	-	-	+/-10	12
TMS	O	0.7	3.8	5.2	-	-	-	+5200/+3830	8
TCK	O	0.7	3.8	5.2	-	-	-	+1135/+840	12
TDO	I	-	-	-	0.8	2	6.5	+/-30	12
/PORESET	XIOD [2]	0.7	-	-	0.8	2	6.5	+25/-20	16
/RESETOUT	I	0.7	-	-	0.8	2	6.5	+25/-20	16
/RDY	I	-	-	-	0.8	2	6.5	+/-13	12
FLMD0	O [3]	0.7	3.8	5.2	-	-	-	+/-10	20
AURORA_RST	O	0.7	3.8	5.2				+/-10	

Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain

[1] Adapter cable and Samtec connector not considered; PCB 1 pF/cm
[2] Open Drain FET; I_{Dmax} = 0.2 A
[3] Signals not connected to logic on FETK, pass through to debugger

Signal	Pin Type	V_{ID} (min) [mV]	V_{ID} (max) [mV]	V_{OD} (min) [mV]	V_{OD} (max) [mV]
TX0...3	I	110	2200		
Clock	XO			200	1100

Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain
Note: TX0...3 and Clock are 100 Ohm Differential Pairs

7.10.3 ECU Interface Connector CON1 (3.3 V Interface selected)

Signal	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Leakage current [µA]	Additional load by FETK (typ) [pF] 1)
TDI	O	0.55	2.4	3.45	-	-	-	+/-10	8
/TRST	O	0.55	2.4	3.45	-	-	-	+/-10	8
TMS	O	0.55	2.4	3.45	-	-	-	+3460/+2010	8
TCK	O	0.55	2.4	3.45	-	-	-	+704/+411	12
TDO	I	-	-	-	0.8	2	6.5	+/-30	12
/PORESET	XIOD 2)	0.7	-	-	0.8	2	6.5	+25/-20	16
/RESETOUT	I	0.7	-	-	0.8	2	6.5	+25/-20	16
/RDY	I	-	-	-	0.8	2	6.5	+/-13	12
FLMD0	O 3)	0.55	2.4	3.45	-	-	-	+/-13	20
AURORA_RST	O	0.55	2.4	3.45				+/-10	

Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain

1) Adapter cable and Samtec connector not considered; PCB 1 pF/cm
2) Open Drain FET; I_{Dmax} = 0.2 A
3) Signals not connected to logic on FETK, pass through to debugger

Signal	Pin Type	V_{ID} (min) [mV]	V_{ID} (max) [mV]	V_{OD} (min) [mV]	V_{OD} (max) [mV]
TX0...3	I	110	2200		
Clock	XO			200	1100

Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain
Note: TX0...3 and Clock are 100 Ohm Differential Pairs

7.10.4 Debugger Interface Connector CON4

Signal	Pin Type	V_{OL} (max) [V]	V_{OH} (min) [V]	V_{OH} (max) [V]	V_{IL} (max) [V]	V_{IH} (min) [V]	V_{IH} (max) [V]	Additional Load by FETK (typ) [pF][1)]
TDI	I	-	-	-	0.8	2	6.5	12
/TRST	I	-	-	-	0.8	2	6.5	12
TMS	I	-	-	-	0.8	2	6.5	17
TCK	I	-	-	-	0.8	2	6.5	12
TDO	O	0.7	2.4	3.45	-	-	-	17
/PORESET	IO[2)]	0.7	2.0	5.5	-	-	-	16
VREF	O	0.7	2.4	3.45	-	-	-	12
/WDGDIS	I	-	-	-	0.8	2	6.5	12
/RDY	O	0.7	2.0	2.5	-	-	-	12
FLMD0	I	-	-	-	0.8	2	6.5	12
/BREQ	I				0.8	2	6.5	12
/BGRANT	O	0.7	2.4	3.45	-	-	-	12
/RESETOUT	O	0.7	2.0	5.5	-	-	-	16

Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain

[1)] Adapter cable and Samtec connector not considered; PCB 1 pF/cm
[2)] Open Drain FET; I_{Dmax} = 0.2 A

7.11 Pin Assignment

> NOTE
>
> The following tables describes the pin assignment at the FETK side.

7.11.1 Connector Locations

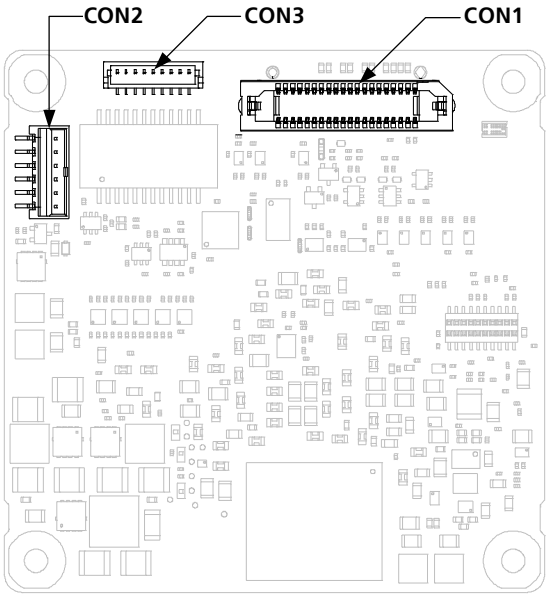


Fig. 7-3 Location of the FETK-T3.0 Interfaces (top)

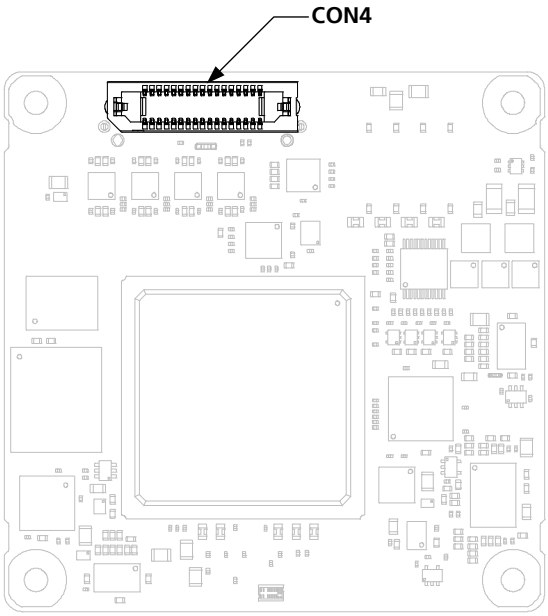


Fig. 7-4 Location of the FETK-T3.0 Interfaces (bottom)

7.11.2 FETK-T3.0 ECU Interface Connector CON1

Pin	Signal	Direction	Comment
1	TX0_P	In	Aurora Data 0+
2	VDD (Sense)	In	Sense for Switched power supply of ECU (ignition)
3	TX0_N	In	Aurora Data 0-
4	TCK	Out	JTAG Clock signal
5	GND		Signal Ground
6	GND		Signal Ground
7	TX1_P	In	Aurora Data 1+
8	TMS	Out	JTAG Mode Select signal
9	TX1_N	In	Aurora Data 1-
10	TDO	In	JTAG Data Out signal
11	GND		Signal Ground
12	GND		Signal Ground
13	TX2_P	In	Aurora Data 2+
14	TDI	Out	JTAG Data In signal
15	TX2_N	In	Aurora Data 2-
16	/RDY		JTAG Ready signal
17	GND		Signal Ground
18	/EVTO	In	Debugger event signal
19	TX3_P	In	Aurora Data 3+
20	/TRST	Out	JTAG Reset signal
21	TX3_N	In	Aurora Data 3-
22	WDGDIS	Out	Watchdog disable signal
23	GND		Signal Ground
24	CABLE_RST_CNTL		
25	ClockN	Out	Aurora Clock -
26	ETK_DETECT		
27	ClockP	Out	Aurora Clock +
28	/PORESET	BiDir	ECU Reset signal (open drain) for Reset assertion and supervision
29	GND		Signal Ground
30	/RESETOUT	In	ECU Internal Reset Status (sense)
31	AUDCLK		Not used on FETK-T3.0A
32	VSTBY (Sense)	In	Sense the supply of the standby (WP) RAM
33	AURORA_RST	Out	Aurora Reset
34	AUDDATA0		Not used on FETK-T3.0A
35	AUDRESET		Not used on FETK-T3.0A
36	AUDDATA1		Not used on FETK-T3.0A
37	FLMD0	Out	Flash Mode 0

Pin	Signal	Direction	Comment
38	AUDDATA2		Not used on FETK-T3.0A
39	AUDSYNC		Not used on FETK-T3.0A
40	AUDDATA3		Not used on FETK-T3.0A

7.11.3 Interface and Power Supply Connector CON2

Pin	Signal	Direc-tion	Comment
1	VDDPSTBY	Out	Permanent power to supply ECU Interface (3.3V)
2	VDDSTBY	Out	Permanent power to supply ECU EMU-RAM [2]
3	GND	-	Power Ground
4	CALWakeup	Out	Wakeup functionality (12 V output) [1]
5	UBATT2	In	Vehicle Battery
6	UBATT1	In	Vehicle Battery

[1] if not implemented, do not connect
[2] FETK can be configured to monitor it's supply of VDDSTBY; voltage is sensed on board FETK.

7.11.4 Debugger Interface Connector CON4

Pin	Signal	Direc-tion	Comment
1	TX0_P	Out	Aurora Data 0+
2	VDD (Sense)	Out	Sense for Switched power supply of ECU (igni-tion)
3	TX0_N	Out	Aurora Data 0-
4	TCK	In	JTAG TCK signal
5	GND		Signal Ground
6	TMS	In	JTAG TMS signal
7	TX1_P	Out	Aurora Data 1+
8	TDI	In	JTAG TDI signal
9	TX1_N	Out	Aurora Data 1-
10	TDO	Out	JTAG TDO signal
11	GND		Signal Ground
12	/TRST	In	JTAG /TRST signal
13	TX2_P	Out	Aurora Data 2+
14	FLMD0	In	Flash Mode 0
15	TX2_N	Out	Aurora Data 2-
16	N/C		No connection
17	GND		Signal Ground
18	/EVTO		Debugger event signal
19	TX3_P	Out	Aurora Data 3+
20	N/C		No connection
21	TX3_N	Out	Aurora Data 3-
22	/PORESET	BiDir	ECU Reset signal (open drain) for Reset asser-tion and supervision
23	GND		Signal Ground
24	GND		Signal Ground
25	N/C		No connection

Pin	Signal	Direc-tion	Comment
26	ClockP	Out	Aurora Clock +
27	WDGDIS	In	Watchdog disable signal
28	ClockN	Out	Aurora Clock -
29	GND		Signal Ground
30	GND		Signal Ground
31	/BREQ	In	Bus Request to FETK
32	/RDY	Out	JTAG Ready signal
33	/BGRANT	Out	Bus Grant from FETK
34	/RESETOUT	Out	ECU Internal Reset Status (sense)

7.12 Mechanical Dimensions

The reference measure for all drawings is millimeters. Please contact your local sales & support team for detailed 3D CAD model.

Item	Dimension [Millimeters]	**Dimension** [Inches]
Length	60	2.362
Width	60	2.362
Height [1)]	12.7	0.500

[1)]: without adapter connectors

7.12.1 Top View

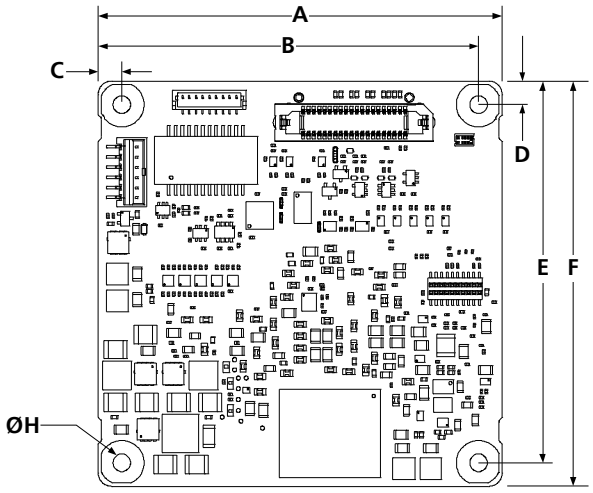


Fig. 7-5 FETK-T3.0 Dimensions - Top View

Item	Dimension [Millimeters]	Tolerance [Millimeters]	Dimension [Inches]	Tolerance [Inches]
A	60.00	+/- 0.2	2.362	+/- 0.008
B	56.50	+/- 0.20	2.224	+/- 0.008
C	3.50	+/- 0.10	0.138	+/- 0.004
D	3.50	+/- 0.10	0.138	+/- 0.004
E	56.50	+/- 0.20	2.224	+/- 0.008
F	60.00	+/- 0.2	2.362	+/- 0.008
H	2.60	+0.20/-0	0.102	+0.008/-0

7.12.2 Side View

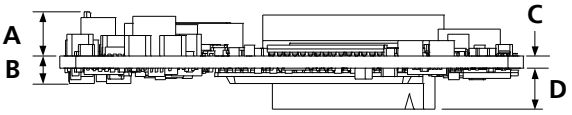


Fig. 7-6 FETK-T3.0 Dimensions - Side View

Item	Dimension [Millimeters]	Tolerance [Millimeters]	Dimension [Inches]	Tolerance [Inches]
A	5.75	+/- 0.20	0.226	+/- 0.008
B	3.60	+/- 0.20	0.142	+/- 0.008
C	1.60	+/- 0.16	0.063	+/- 0.006
D	5.34	+/- 0.20	0.210	+/- 0.008

8 Cables and Accessories

This chapter contains information about the following topics:

8.1 Requirements for failsafe Operation

> **NOTE**
>
> See chapter 4.2 on page 31 for details on wiring the ECU interface adapters.

> **NOTE**
>
> We recommend to use ETAS cables or any other cables certified by the standards for the application. Adhere to the maximum permissible cable lengths!

> **NOTE**
>
> Application-specific cables are available from ETAS. Please contact your ETAS contact partner or e-mail sales.de@etas.com.

8.2 CBAM300 Cable

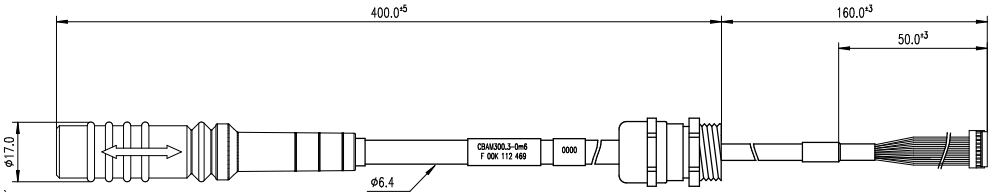


Fig. 8-1 CBAM300.3 Cable - Dimensions

8.2.1 Usage

The FETK ECU interface cable CBAM300 is pre-assembled into PG9 screwing, with a connected shield on screwing:

- For thin walled housings, use a through boring with 15.2 mm in the housing and mount the cable with a nut (not included) (SM-PE 9 order number 52103210 from Lapp).
- For wall thickness more than 4 mm cut a thread into the housing.

8.2.2 Connectors

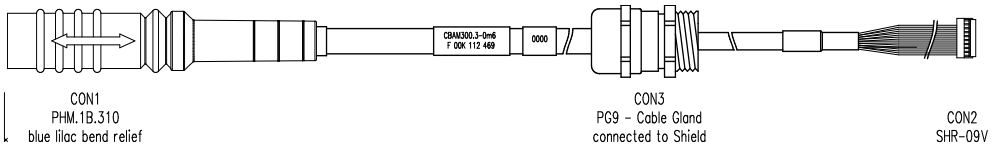


Fig. 8-2 CBAM300.3 Cable - Connectors

Connector	Color	Target
CON1	Blue purple	GBit Ethernet cable, e.g. CBE260
CON2	White	FETK
CON3	-	Shield ECU housing

8.2.3 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +125 °C

8.2.4 Tightness

Condition	IP Code
PG9 screwing	IP67

8.2.5 Ordering

Product	Length	Order Number
CBAM300.3-0m6	0.6 m	F 00K 112 469

8.3 CBAM320 Cable

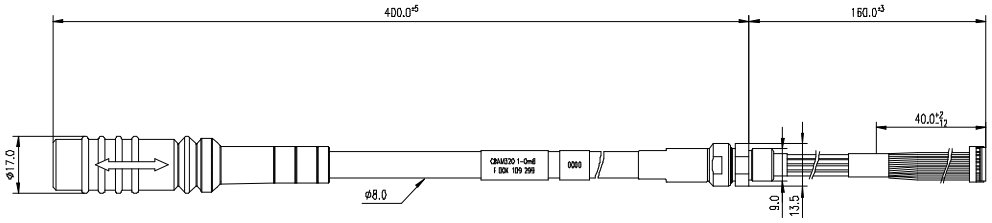


Fig. 8-3 CBAM320 Cable - Dimensions

8.3.1 Usage

The CBAM320.1-0m60 ETK interface cable is a 1 GBit/s cable adapter for FETKs. It is pre-assembled into M9 screwing, shield connected to the screwing:

- For wall thickness less than 4 mm, it is possible to use a through boring with 9.2 mm in the housing and mount the cable with a nut (included).
- For wall thickness more than 4 mm cut a thread into the housing. A special Lemo thread cutter M9 x 0.6 (Order Number: DTA.99.900.6Z is necessary.

8.3.2 Connectors

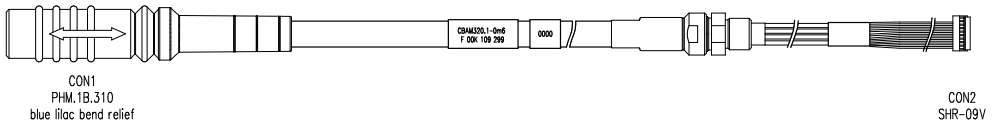


Fig. 8-4 CBAM320 Cable - Connectors

Connector	Color	Target
CON1	Blue purple	Gbit Ethernet cable, e.g. CBE260
CON2	White	FETK

8.3.3 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +125 °C

8.3.4 Tightness

Condition	IP Code
Cable gland M9 x 0.6	IP67

8.3.5 Ordering

Product	Length	Order Number
CBAM320.1-0m6	0.6 m	F 00K 109 299

8.4 CBAM340 Cable

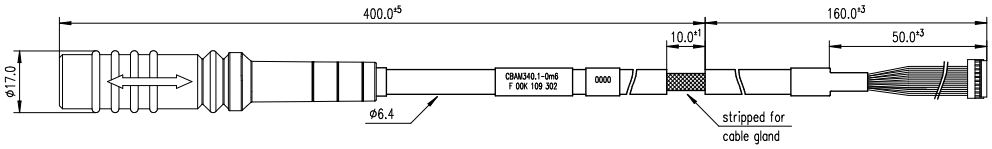


Fig. 8-5 CBAM340 Cable - Dimensions

8.4.1 Usage

The FETK interface cable CBAM340.1 is stripped for 10 mm, to mount the cable with a EMC safe cable gland into the ECU housing.

FETK ECU Adapter Cable, shield on ECU-Housing

> **NOTE**
>
> The hardware for mounting ECU adapter cables is not included in the cable delivery; they need to be ordered separately. For detailed information on mounting accessories contact ETAS technical support.

8.4.2 Connectors

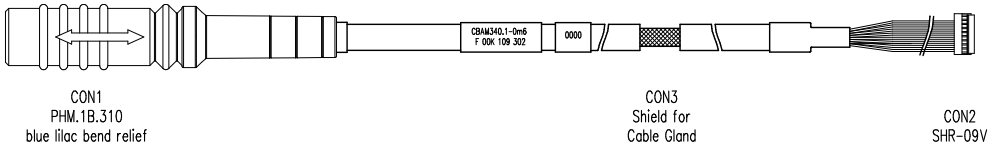


Fig. 8-6 CBAM340 Cable - Connectors

Connector	Color	Target
CON1	Blue purple	Gbit Ethernet cable, e.g. CBE260
CON2	White	FETK
CON3	-	Shield to ECU housing

8.4.3 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +125 °C

8.4.4 Ordering

Product	Length	Order Number
CBAM340.1-0m6	0.6 m	F 00K 109 302

8.5 CBAM350 Cable

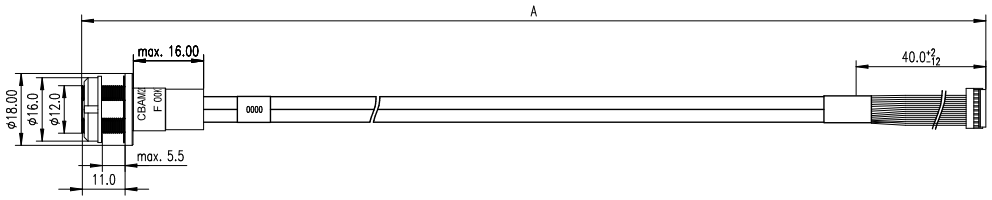


Fig. 8-7 CBAM350 Cable - Dimensions

8.5.1 Usage

The CBAM350.1-0 FETK interface cable is a 1 GBit/s cable adapter with a water tight socket. The cable shield is connected to socket. It is usable for ECUs with shielded housing.

8.5.2 Panel Cut-Out

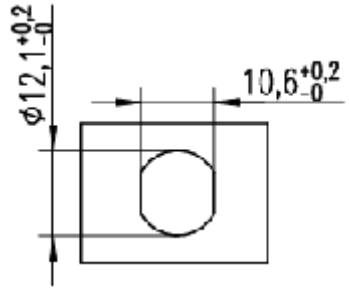
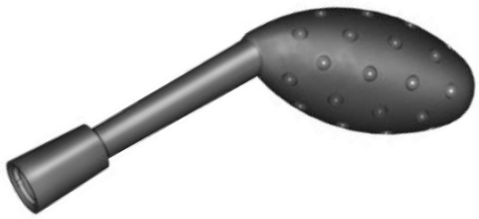


Fig. 8-8 Dimension Panel Cut-Out

8.5.3 Assembling



A Lemo tool, type “Lemo Spanner DCH.91.161.PA” is needed for assembling the connector (not included in the delivery).

> **NOTE**
>
> The Lemo Spanner DCH.91.161.PA is not included in the cable delivery; It need to be ordered separately. For detailed information on mounting accessories contact ETAS technical support.

8.5.4 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +125 °C

8.5.5 Ordering

Product	Length	Order Number
CBAM350.1-0m17	0.17 m	F 00K 111 439

8.6 CBAM305 Cable

8.6.1 Usage

The CBAM305.1 FETK cable is a 1 GBit/s Ethernet cable adapter with external power supply for FETKs.

Pre-assembled into PG9 screwing, shield connected to the screwing. It is usable for ECUs without permanent power supply inside. Depending on the version, there is a power plug on the ECU side or an open cable end on the power cable:

- For thin walled housings, use a through boring with 15.2 mm in the housing and mount the cable with a nut (not included) (SM-PE 9 Order number 52103210 from Lapp).
- For wall thickness more than 4mm cut a thread into the housing.

If the CBAM305.1-2m2 is used, a 2 pin Erni connector (214011 or compatible) must be available on the ECU as counterpart for the UBatt connector.

> **NOTE**
>
> It is recommended for safety reasons to connect the external permanent voltage and the switched voltage inside the ECU!

> **NOTE**
>
> For mounting the cable, cut a PG9 thread into the ECU housing. For thin walled housings use a nut SM-PE 9. It is available from Lapp (order number: 52103210).

8.6.2 Dimensions

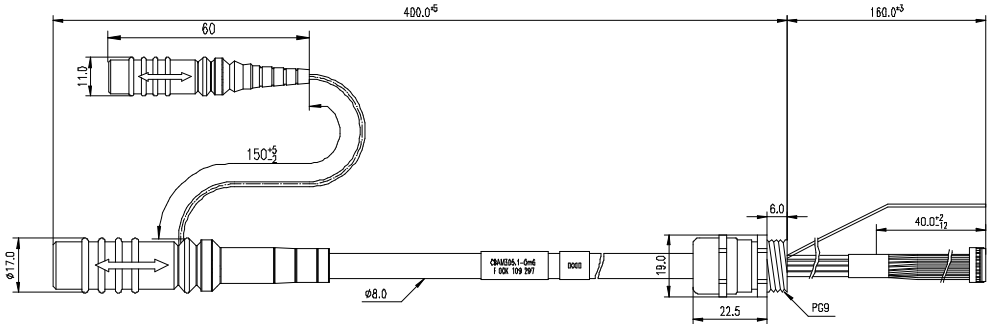


Fig. 8-9 CBAM305.1-0m6 Cable - Dimensions

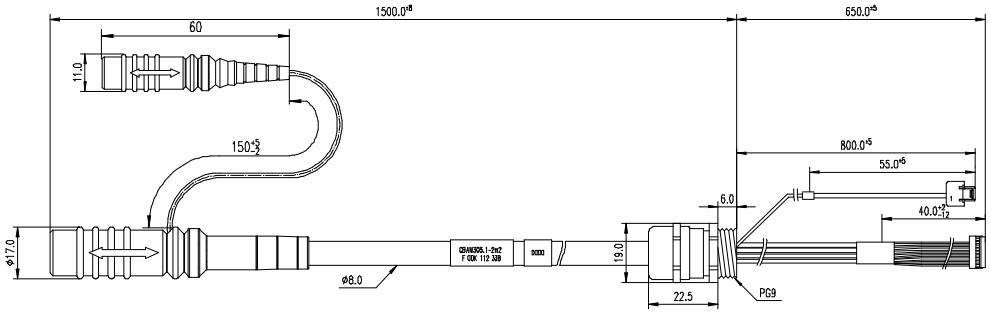


Fig. 8-10 CBAM305.1-2m2 Cable - Dimensions

8.6.3 Connectors

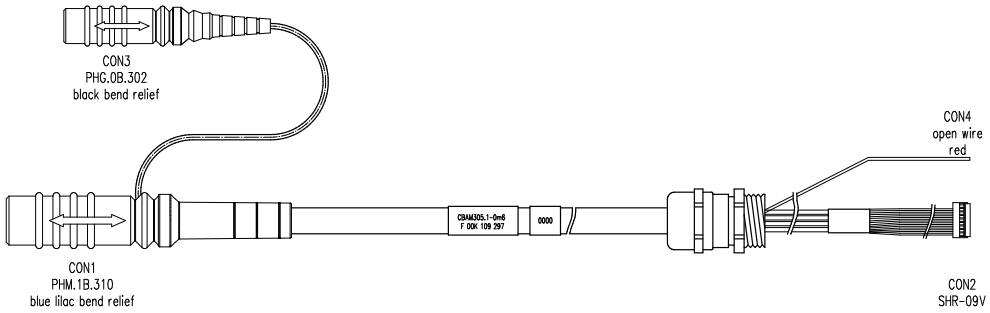
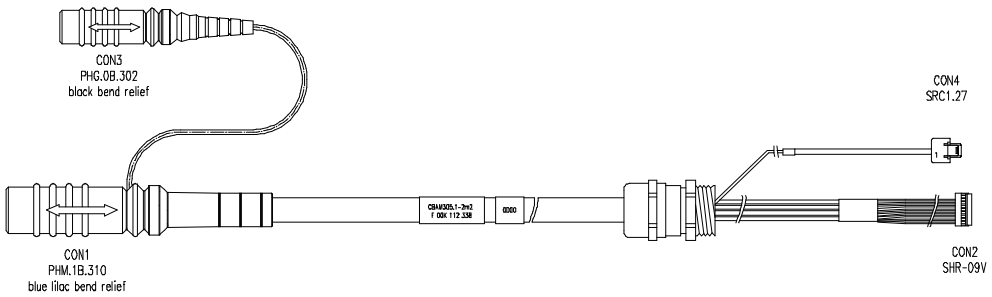


Fig. 8-11 CBAM305.1-0m6 - Connectors

Connector	Color	Target
CON1	Blue purple	Gbit Ethernet cable, e.g. CBE260
CON2	White	FETK
CON3	Black	Permanent power supply, K70.1 cable
CON4	Red	FETK UBATT



Connector	Color	Target
CON1	Blue purple	Gbit Ethernet cable, e.g. CBE260
CON2	White	FETK
CON3	Black	Permanent power supply, K70.1 cable
CON4	Red	2 pin ERNI power ECU connector

Fig. 8-12 CBAM305.1-2m2 - Connectors

8.6.4 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +125 °C

8.6.5 Tightness

Condition	IP Code
PG9 screwing	IP67

8.6.6 Ordering

Product	Length	Order Number
CBAM305.1-0m6	0.6 m	F 00K 109 297
CBAM305.1-2m2	2.2 m	F 00K 112 338

8.7 CBE260 Cable

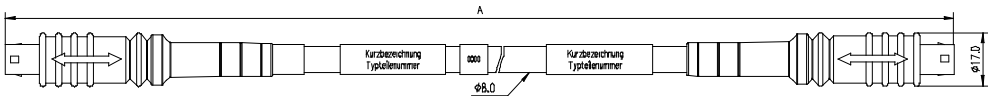


Fig. 8-13 CBE260 Cable

8.7.1 Usage

Gigabit Ethernet and Power Connection cable for FETK. Lemo connectors on both sides compliant to IP65. 3 m length.

The CBE260 cable is a Gigabit Ethernet cable to connect an ETAS ES device with an FETK or another ES device. The cable supports power propagation.

8.7.2 Dimensions

Short Name	Length A
CBE260.1-3	300 cm
CBE260.1-5	500 cm
CBE260.1-8	800 cm

8.7.3 Connectors

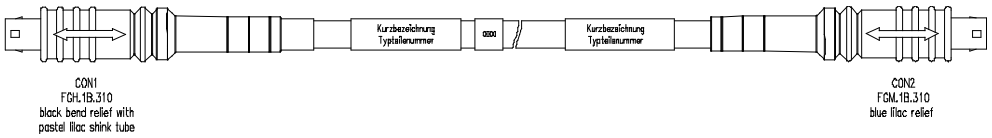


Fig. 8-14 CBE260 - Connectors

Connector	Color	Target
CON1	Pastel purple	ES8xx Downlink
CON2	Blue purple	ES8xx Uplink, FETK

8.7.4 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +120 °C

8.7.5 Ordering

Product	Length	Order Number
CBE260.1-3	3 m	F 00K 109 446
CBE260.1-5	5 m	F 00K 111 001
CBE260.1-8	8 m	F 00K 109 447

8.8 ETAN2A Adapter

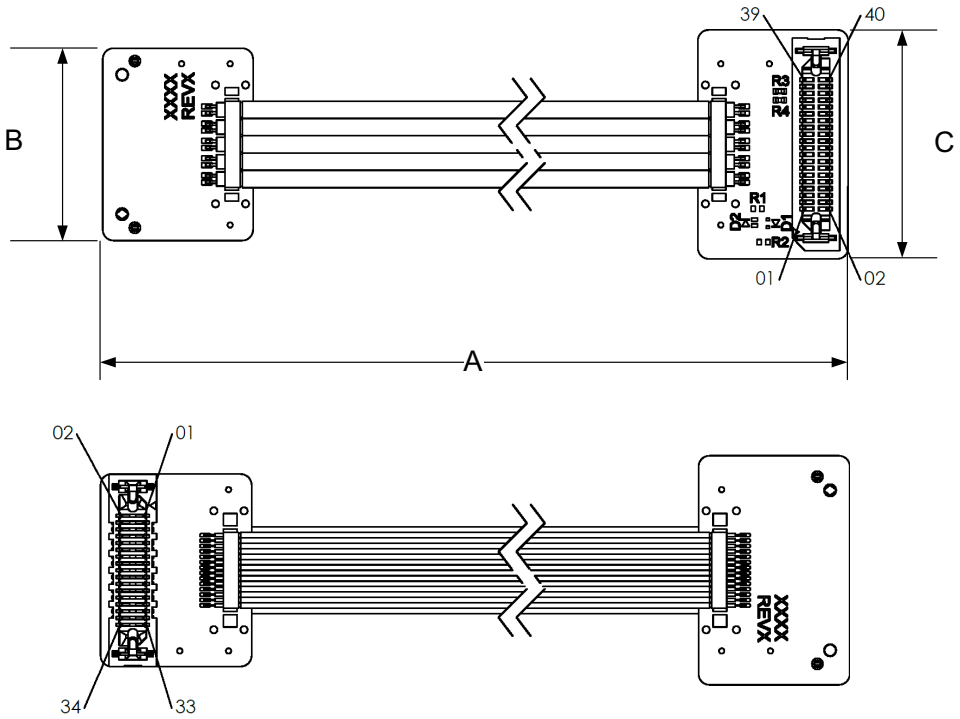


Fig. 8-15 FETK - ECU Adapter ETAN2A

8.8.1 Usage

The ETAN2A adapter is used for connecting an XETK-S22 or FETK-T3.0 over JTAG or AURORA to the ECU.

8.8.2 Dimensions

Dim	Millimeters	Inches
A	200	7.87
B	22.61	0.89
C	26.92	1.06

NOTE

See chapter "Installation" for details on mating connector to the ETAN2.

8.8.3 Pin Assignment

Pin	Signal	Description
1	TX0_P	Aurora Data 0+
2	VDD (Sense)	Sense for Switched power supply of ECU (ignition)
3	TX0_N	Aurora Data 0-
4	TCK	JTAG TCK signal
5	GND	Signal Ground
6	TMS	JTAG TMS signal
7	TX1_P	Aurora Data 1+
8	TDI	JTAG TDI signal
9	TX1_N	Aurora Data 1-
10	TDO	JTAG TDO signal
11	GND	Signal Ground
12	/TRST	JTAG /TRST signal
13	TX2_P	Aurora Data 2+
14	FLMD0	Flash Mode 0
15	TX2_N	Aurora Data 2-
16	N/C	No connection
17	GND	Signal Ground
18	/EVTO	Debugger event signal
19	TX3_P	Aurora Data 3+
20	N/C	No connection
21	TX3_P	Aurora Data 3-
22	/PORESET	ECU Reset signal (open drain) for Reset assertion and supervision
23	GND	Signal Ground
24	GND	Signal Ground
25	N/C	No connection
26	ClockP	Aurora Clock +
27	WDGDIS	Watchdog disable signal
28	ClockN	Aurora Clock -
29	GND	Signal Ground
30	GND	Signal Ground
31	AURORA_RST	Aurora Reset
32	/RDY	JTAG Ready signal
33	VSTBY (Sense)	Sense the supply of the standby (WP) RAM
34	/RESETOUT	ECU Internal Reset Status (sense)

NOTE

For additional details on the ETAN2A cable, please request the ETAN2 User Guide.

8.8.4 Ordering

Product	Length	Order Number
ETAN2A	0.136 m	F 00K 110 952
ETAN2A	0.1 m	F 00K 112 100

8.9 ETAN8A Adapter

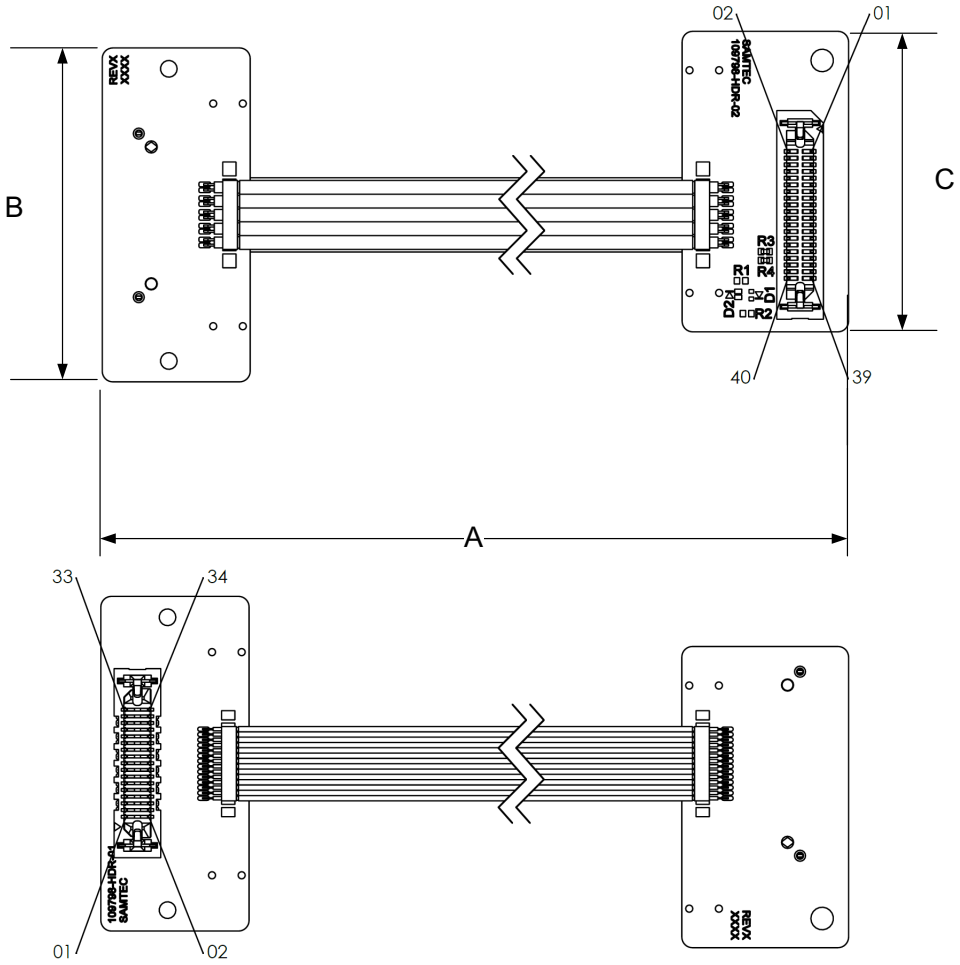


Fig. 8-16 FETK - ECU Adapter ETAN8A

8.9.1 Usage

The ETAN8A adapter is used for connecting a F/XETK over JTAG and AURORA interfaces to the ECU. The connector orientation is inverted and the PCBs have mounting holes for attachment of mezzanine board and FETK-T3. The ECU adapter holds the ECU in reset while the F/XETK is booting.

8.9.2 Dimensions

Dim	Millimeters	Inches
A	150	5.91
B	40.00	1.575
C	36.00	1.417

NOTE

See chapter "Installation" for details on mating connector to the ETAN8.

8.9.3 Pin Assignment

Pin	Signal	Description
1	TX0_P	Aurora Data 0+
2	VDD (Sense)	Sense for Switched power supply of ECU (ignition)
3	TX0_N	Aurora Data 0-
4	TCK	JTAG TCK signal
5	GND	Signal Ground
6	TMS	JTAG TMS signal
7	TX1_P	Aurora Data 1+
8	TDI	JTAG TDI signal
9	TX1_N	Aurora Data 1-
10	TDO	JTAG TDO signal
11	GND	Signal Ground
12	/TRST	JTAG /TRST signal
13	TX2_P	Aurora Data 2+
14	FLMD0	Flash Mode 0
15	TX2_N	Aurora Data 2-
16	N/C	No connection
17	GND	Signal Ground
18	/EVTO	Debugger event signal
19	TX3_P	Aurora Data 3+
20	N/C	No connection
21	TX3_P	Aurora Data 3-
22	/PORESET	ECU Reset signal (open drain) for Reset assertion and supervision
23	GND	Signal Ground
24	GND	Signal Ground
25	N/C	No connection
26	ClockP	Aurora Clock +
27	WDGDIS	Watchdog disable signal
28	ClockN	Aurora Clock -
29	GND	Signal Ground
30	GND	Signal Ground
31	AURORA_RST	Aurora Reset
32	/RDY	JTAG Ready signal
33	VSTBY (Sense)	Sense the supply of the standby (WP) RAM
34	/RESETOUT	ECU Internal Reset Status (sense)

NOTE

For additional details on the ETAN8A cable, please request the ETAN8 User Guide.

8.9.4 Ordering

Product	Length	Order Number
ETAN8A	0.2 m	F 00K 111 992

8.10 ETV5 Cable

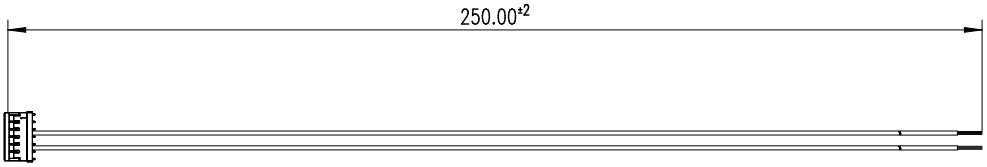


Fig. 8-17 Power Supply Cable ETV5

8.10.1 Usage

The ETV5 cable is an open wire power supply cable with one battery and GND connection.

The ETV5 cable is a variant of the ETAM2 adapter. If ETAM2 is mentioned in this document, ETV5 might be fit as well.

See chapter “ETAM2 Adapter” on page 76

NOTE

For better power integrity cut the cable to the shortest possible length.

8.10.2 Pin Assignment

Pin Number	Color	Signal	Description
1			Not connected
2			Not connected
3	Brown	GND	Power GND
4			Not connected
5	Red	SGUBATT1	Car Battery
6			Not connected

8.10.3 Temperature Range

Condition	Temperature
Operating temperature	-40 °C to +110 °C

8.10.4 Ordering

Product	Length	Order Number
ETV5	0.25 m	F 00K 111 701

8.11 ETAM2 Adapter

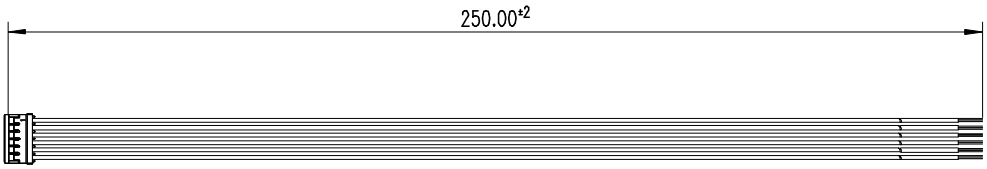


Fig. 8-18 FETK - ECU Adapter ETAM2

> **NOTE**
>
> See chapter "Installation" for details on mating connector to the ETAM2.

For variant ETV5 see also chapter “ETV5 Cable” on page 75.

For variant ETAM9 see also chapter “ETAM9 Adapter” on page 78.

8.11.1 Pin Assignment

Fig. 8-19 ETAM2 Connector

8.11.2 ECU Signals

Pin	Color	Signal	Description
1	Blue	VDDPSTBY (Supply)	Permanent power to supply ECU interface (optional)
2	Yellow	VDDSTBY (Supply)	Permanent power to supply ECU ED-RAM
3	Brown	GND	Power ground
4	Green	CAL_Wakeup	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
5	Red	SGUBATT2	Car battery
6	Red	SGUBATT1	Car battery

8.11.3 Ordering

Product	Length	Order Number
ETAM2	0.25 m	F 00K 109 306

8.12 ETAM5 Adapter

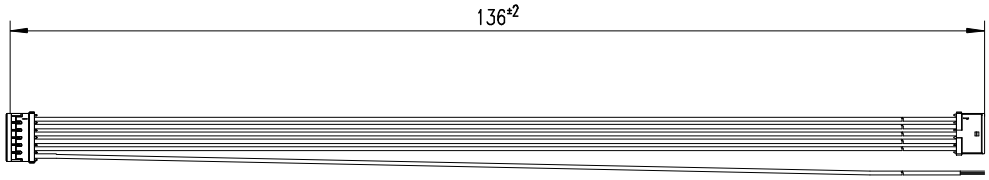


Fig. 8-20 FETK - ECU Adapter ETAM5

> **NOTE**
>
> See chapter "Installation" for details on mating connector to the ETAM5.

8.12.1 Pin Assignment

Molex Side A	Wire: Medi cable	5 mm stripped and tinned Side B	Molex Side C
Position	Color	Position	Position
1	Blue		1
2	Yellow		2
3	Brown		3
4	Green		4
5	Red		5
6	Red		

8.12.2 Ordering

Product	Length	Order Number
ETAM5	0.136 m	F 00K 110 101

8.13 ETAM9 Adapter

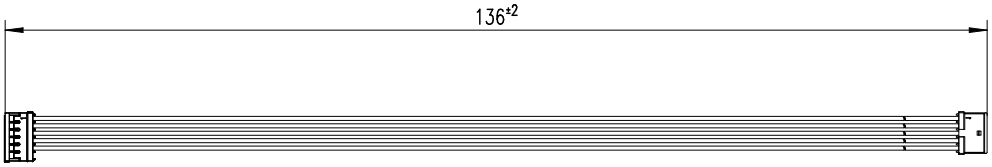


Fig. 8-21 FETK/ XETK - ECU Adapter ETAM9

8.13.1 Usage

The ETAM9 adapts the FETK/ XETK power signals (Molex 6 pin connector) to the ECU with an 5 pin Molex Pico Spox connector.

The ETAM9 cable requires on the ECU side an Vertical SMT Header connector [87437-0543] or an Right Angle SMT Header connector [87438-0543].

For variant ETV5 see also chapter “ETV5 Cable” on page 75.

8.13.2 ECU Signals

Pin	Color	Signal	Description
1	Blue	VDDPSTBY (Supply)	Permanent power supply of ECU interface
2	Yellow	VDDSTBY (Supply)	Permanent power supply of ECU ED RAM
3	Brown	GND	Power ground
4	Green	Cal_Wakeup	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
5	Red	SGUBATT1	Car battery
6	-	-	No Connect

8.13.3 Temperature Range

Condition	Temperature Range
Operating temperature	-40 °C to +110 °C

8.13.4 Order Information

Product	Length	Order Number
ETAM9 F/XETK-S ECU Adapter, MOLEX - MOLEX (6fc - 5fc), 0m136	0.136 m	F 00K 111 043

8.14 ETAM10 Adapter

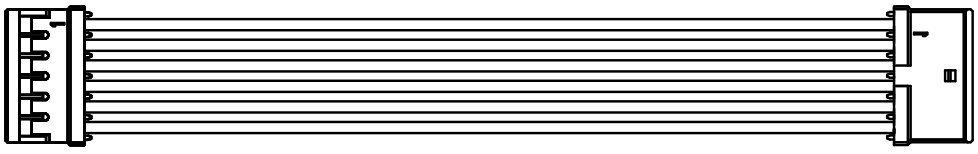


Fig. 8-22 FETK/ XETK - ECU Adapter ETAM10

MOLEX - MOLEX (6fc - 6fc) adapter cable for connecting an FETK or XETK to the ECU.

8.14.1 Usage

ETAM10 adapts the ETK power signals (Molex 6 pin connector) to an ECU with a 6 pin Molex PicoSpox connector.

The ECU connector is available as Vertical SMT Header [87437-0643] or Right Angle SMT Header [87438-0643].

8.14.2 Dimensions

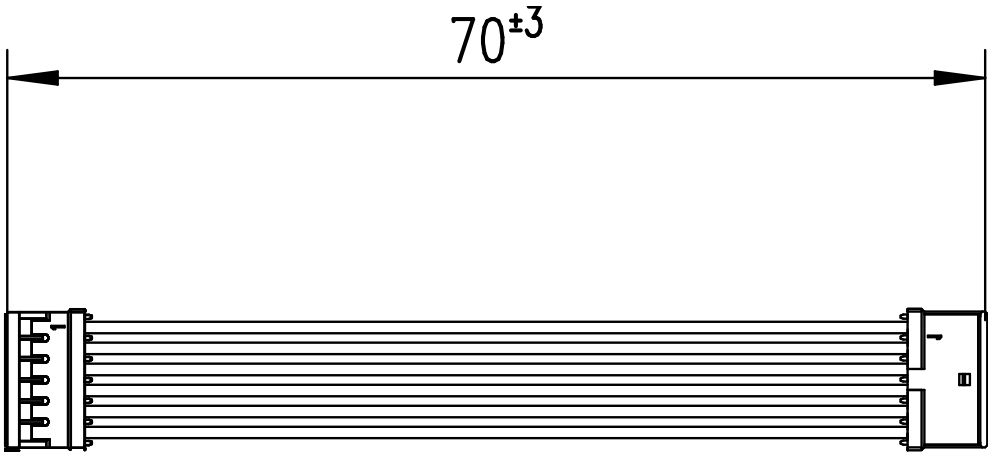


Fig. 8-23 ETAM10 Adapter Dimensions

8.14.3 ECU Signals

Pin	Color	Signal	Description
1	Blue	VDDPSTBY (Supply)	Permanent power supply of ECU interface
2	Yellow	VDDSTBY (Supply)	Permanent power supply of ECU ED RAM
3	Brown	Ground	Power ground
4	Green	Cal_Wakeup	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
5	Red	SGUBATT2	Car battery
6	Red	SGUBATT1	Car battery

8.14.4 Temperature Range

Condition	Temperature Range
Operating temperature	-40 °C to +110 °C

8.14.5 Order Information

Product	Length	Order Number
ETAM10 F/XETK-S ECU Adapter, MOLEX - MOLEX (6fc - 6fc), 0m07	0.07 m	F 00K 111 814

9 Ordering Information

9.1 FETK-T3.0

Order Name	Short Name	Order Number
FETK-T3.0A Emulator Probe for Renesas RH850 MCU Family	FETK-T3.0A	F 00K 111 436

Package Contents

- FETK-T3.0A Emulator Probe for Renesas RH850 MCU Family
- List "Content of this Package"
- ETK Safety Advice
- China-RoHS-leaflet_Compact_cn

9.2 Cable

NOTE

We recommend to use ETAS cables or any other cables certified by the standards for the application. Adhere to the maximum permissible cable lengths!

Please contact your local ETAS representative for further cable information.

NOTE

The cables shown in chapter “Cables and Accessories” on page 60 are not included in the FETK-T3.0 delivery.

9.2.1 ECU Adapter Cable

Order Name	Short Name	Order Number
FETK ECU Adapter Cable, pre-assembled into PG9 screwing, shield on ECU- Housing, Lemo 1B PHM - JST SHR (10mc-9fc), 0m60	CBAM300.3-0m6	F 00K 112 469
FETK ECU Adapter Cable, pre-assembled into GSC.1S screwing (M9x0,6), shield on ECU-Housing, Lemo 1B PHM - JST SHR (10mc-9fc), 0m60	CBAM320.1-0m6	F 00K 109 299
FETK ECU Adapter Cable, shield on ECU-Housing, Lemo 1B PHM - JST SHR (10mc-9fc), 0m60	CBAM340.1-0m6	F 00K 109 302
FETK adapter cable, 1 Gbit/s, shield is connected to ECU, Lemo 1B HMM - JST SHR (10mc-9fc), 0m17	CBAM350.1-0m17	F 00K 111 439

9.2.2 ECU Adapter and Power Supply Cable

Order Name	Short Name	Order Number
FETK ECU Adapter and Power Supply Cable, pre-assembled into PG9 screwing, shield on ECU-Housing, Lemo 1B PHM - JST SHR (10mc-9fc) / Lemo 0B PHG - open wire (2fc-1c), 0m60	CBAM305.1-0m6	F 00K 109 297
FETK ECU Adapter and Power Supply Cable, pre-assembled into PG9 screwing, shield on ECU-Housing, Lemo 1B PHM - JST SHR (10mc-9fc) / Lemo 0B PHG - Erni MiniBridge (2fc-2fc), 2m2	CBAM305.1-2m2	F 00K 112 338

9.2.3 GBit Ethernet and Power Supply Cable

Order Name	Short Name	Order Number
GBit Ethernet and Power Connection Cable for FETK, Lemo 1B FGM - Lemo 1B FGH (10fc-10mc), 3 m	CBE260.1-3	F 00K 109 446
GBit Ethernet and Power Connection Cable for FETK, Lemo 1B FGM - Lemo 1B FGH (10fc-10mc), 5 m	CBE260.1-5	F 00K 111 001
GBit Ethernet and Power Connection Cable for FETK, Lemo 1B FGM - Lemo 1B FGH (10fc-10mc), 8 m	CBE260.1-8	F 00K 109 447

9.2.4 ECU Adapter

Order Name	Short Name	Order Number
ETAN2A ETK ECU adapter, SAMTEC - SAMTEC (40fc - 34fc), 0m1	ETAN2A_0m1	F 00K 112 100
ETAN2A ETK ECU adapter, SAMTEC - SAMTEC (40fc - 34fc), 0m136	ETAN2A	F 00K 110 952
ETAN8A ETK ECU adapter with inverse connector orientation and mounting holes for FETK-T3, SAMTEC - SAMTEC (40fc - 34fc), 0m2	ETAN8A	F 00K 111 992

9.2.5 Power Supply Cable

Order Name	Short Name	Order Number
ETV5 F/XETK-S ECU Adapter, MOLEX - open wires (6fc - 2c), 0m25	ETV5	F 00K 111 701
ETAM2 XETK/FETK ECU Adapter, MOLEX - open wires (6fc - 6c), 0m25	ETAM2	F 00K 109 306
ETAM5 FETK ECU Adapter, MOLEX - MOLEX (6fc - 5fc+1c), 0m136	ETAM5	F 00K 110 101
ETAM9 F/XETK-S ECU Adapter, MOLEX - MOLEX (6fc - 5fc), 0m136	ETAM9	F 00K 111 043
ETAM10 F/XETK-S ECU Adapter, MOLEX - MOLEX (6fc - 6fc), 0m07	ETAM10	F 00K 111 814

9.3 Power Supply

For special applications ETAS can offer an Isolated Power Supply Unit. The cable CBM200 is included. The ETV2 cable must be ordered separately.

For detailed information contact ETAS technical support.

Type	Short Name	Order Number
Isolated Power Supply Interface for ETK	ETP2	F 00K 104 010
ETK Power Supply Cable with Filter Coil, JST PHR – open wires (2fc-2c), 0m19	ETV2	F 00K 000 593

9.4 Mounting Material

Type	Short Name	Order Number
Gap pad for heat dissipation as spare part for FETK-T3.0	FETK-T3_GP	F 00K 111 438

10 Contact Information

Technical Support

For details of your local sales office as well as your local technical support team and product hotlines, take a look at the ETAS website:

www.etas.com/en/hotlines.php

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