ETAS M-ETK

Modular ECU Access Device

User Guide

www.etas.com

M-ETK I User Guide R02 EN I 06.2026

Contents

1 Introduction

The M-ETK offers a highly versatile and adaptable solution specifically designed for ECU (Electronic Control Unit) developers and calibration engineers in the automotive industry. It facilitates efficient and effective measurement, calibration, and reprogramming of ECU software, standing out due to its modular architecture, compact size, and high performance. The M-ETK will support a wide range of microcontroller variants and interfaces, ensuring seamless integration with existing systems and future use cases.

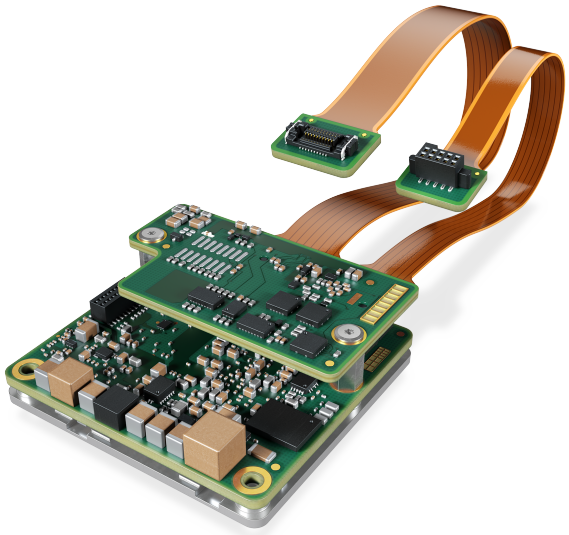
1.1 About M-ETK

The M-ETK provides the access to internal memory of a µC and allows for measurement of variables during runtime of the system as well as parameter modification.

In general, there are three main drivers for choosing an M-ETK as ECU access device for measurement and calibration tasks, instead of a pure SW solution like XCP on CAN/ETH.

- Minimized impact on the µC/SoC runtime and memory consumption.
- Support of very short raster times down to 10 µs (cf. XCPonCAN with 1 ms).
- Support of high number of variables, e.g. > 100.000 (cf. XCPonCAN with some 100 variables).

For more technical data on the M-ETK see "Technical specifications" on page 37



1.2 Target audience and intended use

1.2.1 Target Audience

For the safe and efficient use of the product, the user is expected to have comprehensive expertise and practical experience in the following automotive domains:

- Electrical and electronic system architectures in motor vehicles
- Sensor technology and control engineering
- Bus systems and communication protocols
- Electronic control unit (ECU) development and calibration
- Safety guidelines and regulatory requirements for the development and validation of vehicle systems

1.2.2 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 a measurement and calibration tool (e.g. INCA).

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.

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.
- Do not operate the product in in high voltage areas.

1.3 Safety instructions and classification

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).

1.3.1 Classification of Safety Messages

Safety messages 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 physical property.

ATTENTION

ATTENTION indicates a situation that, if not avoided, could result in damage to digital property like data loss, data corruption and system vulnerability.

1.3.2 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.

1.3.3 Operation

Only operate the product approved 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.

1.3.4 Electrical connection

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.

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 specifications" on page 37).
- The power supply for the product must be safely disconnected from the mains power. For example, use a vehicle 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

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.
- Remove all cables from the product.

1.3.5 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.

For detailed information about Cables, see "Cables, Adapters and Accessories" on page 53.

Accessories

Use ETAS accessories, accessories recommended by ETAS or other accessories certified for the application. For detailed information about accessories, see see "Cables, Adapters and Accessories" on page 53.

1.4 Unpacking

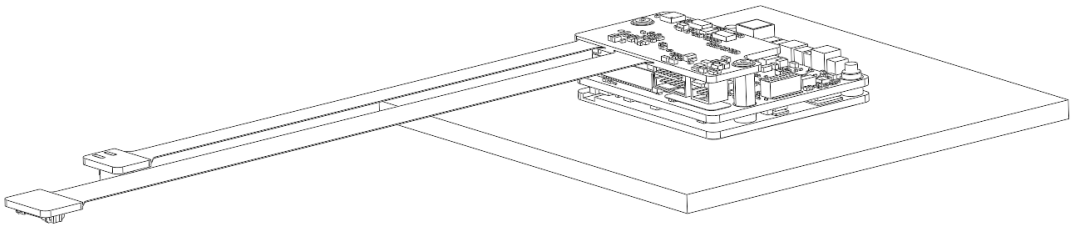
1. Prepare workspace
   Unpack in a clean, dry, well-lit area with enough space for the equipment and avoid static damage or physical harm.
2. Open package
   Use appropriate tools to carefully open the box without damaging the contents.
3. Verify contents
   Compare the items with the packing list "Contents of Package" to ensure all components are present.
4. Inspect for damage
   Visually check each item for physical damage. If found, document and report it on www.etas.com/hotlines.

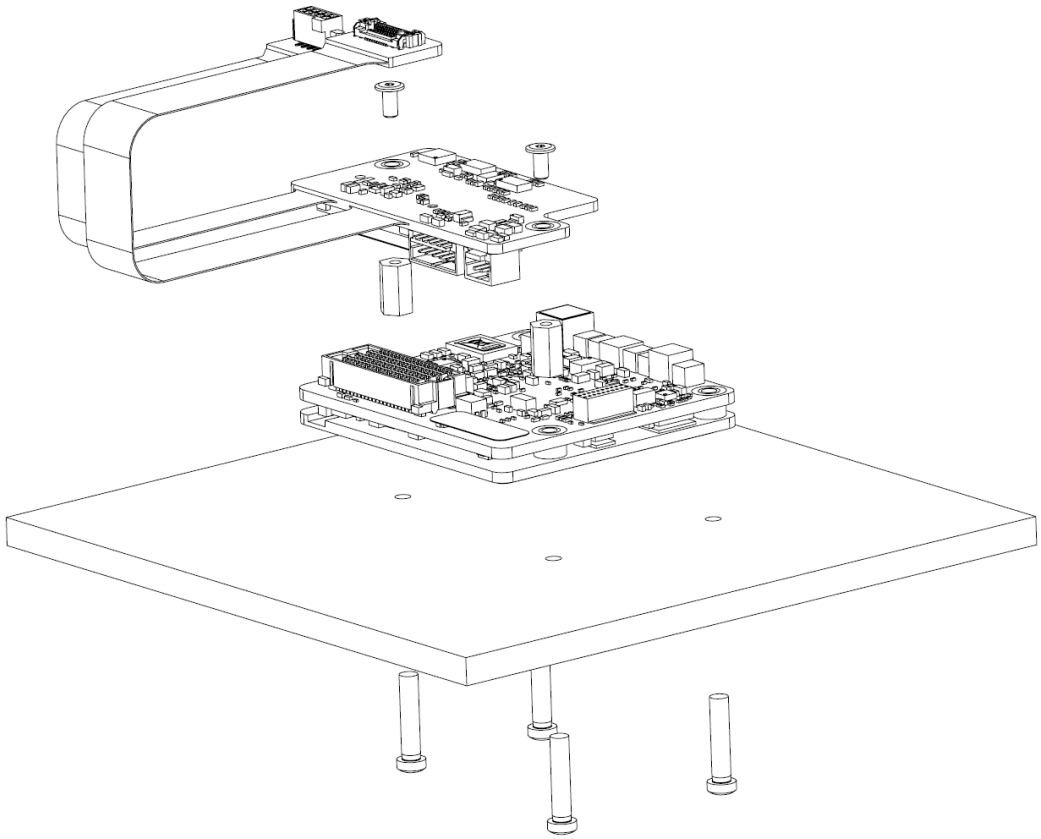
2 Product Overview

2.1 Graphical overview of elements

The M-ETK system includes:

- **M-ETK Device**: The core hardware unit to be used with the M-ETK Adapterboard and the required SW Service Pack.
- **µC Specific Base License**: Essential software component dedicated to specific microcontroller families.
- **M-ETK Adapterboard**: Provides the specific hardware interfaces of the ECU, the XCP interface connection and the power supply of the emulation device.
- **Feature Licenses (Example)**: M-ETK Feature License Trace2PIN: Support of AURORA Trace interface





For more technical data on the M-ETK see the chapter "Technical specifications" on page 37.

2.1.1 Licensing

The M-ETK provides a feature licensing approach.

- **Feature Upgrades**: Additional features can be added at any time during the maintenance period of the device.
- **License Management**: A web portal allows customers to manage their licenses and bind them to a specific HW device.

2.1.2 Configuration

The configuration of the M-ETK can be done directly with INCA or by using the XCT tool provided by ETAS.

INCA Configuration

- This configuration is designed to work seamlessly with ETAS INCA (Integrated Calibration and Application Tool) and is designed for optimized functionality.

XCT Configuration

- XCT (X-ETK Configuration Tool) configures the ETK to use the standardized XCP (Universal Measurement and Calibration Protocol) on Ethernet.

– This configuration allows the M-ETK to communicate with third-party tools, that supports the XCP standard.

2.2 Compatibility

Device	Data Rate	Time Sync	Cable	Adapter	M-ETK-AB	M-ETK Type
ES160.1 (1Gb/s Media Converter)	1Gb/s	PTP	CBEB130	CBAM435 (no power)	M-ETK-AB1.0	M-ETK Type-T
ES162.1 (1Gb/s Media Converter)	1Gb/s	PTP	CBEB130	CBAM435 (no power)		
ES165.1 (100Mb/s Media Converter)	100Mb/s	PTP	CBEB130	CBAM435 (no power)		

3 Hardware Setup

3.1 Transportation and packaging

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

3.2 Mounting and placement

3.2.1 Mounting the M-ETK into the ECU Housing

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.

3.2.1.1 Thermal Connection Requirements

To ensure proper operation of the M-ETK over the specified temperature range, the M-ETK must be mounted to the ECU metal housing. This enables thermal dissipation of the electronic components used on the M-ETK to the ECU housing.

Note

To avoid overheating of the M-ETK the connection to the ECU housing following requirements for thermal resistance must be met:

- ECU housing thermal resistance at the M-ETK mounting position shall be less than 0.64 W/K. This shas to be guaranteed by size and material of the ECU housing as well as of the heat conductive material.

If the value of ECU housing thermal conductivity cannot be achieved, additional cooling structures, e.g. heat sinks, should be applied.

For additional details on thermal dissipation, see chapter "Technical specifications" on page 37.

3.2.1.2 Mounting Material

To mount the M-ETK + M-ETK-AB1.0 to the ECU housing several materials are required:

- M-ETK
- METK-AB1.0 Adapter
  incl. M2 x 7 Spacers
  incl .M2 x 4 cylinder head screws
- ECU metal housing
- Heat conductive paste (or foil)
- Four screws M2
  - cylinder head, countersunk-, self-sealing screw
  - length depending on the ECU project:
    min. 7.95mm + wall thickness ECU housing
    max. 9.6mm + wall thickness ECU housing
- Two nuts M2
- Thread locking fluid
- Screwdriver T4, T6

3.2.1.3 Mounting Steps

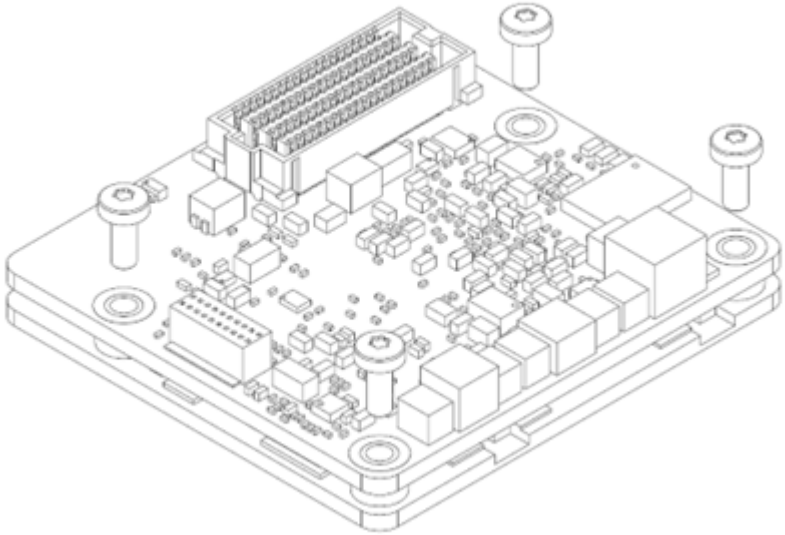
To mount the M-ETK into the ECU housing several mounting steps are required:

Preparing the ECU Housing

1. Drill four holes in the ECU housing.

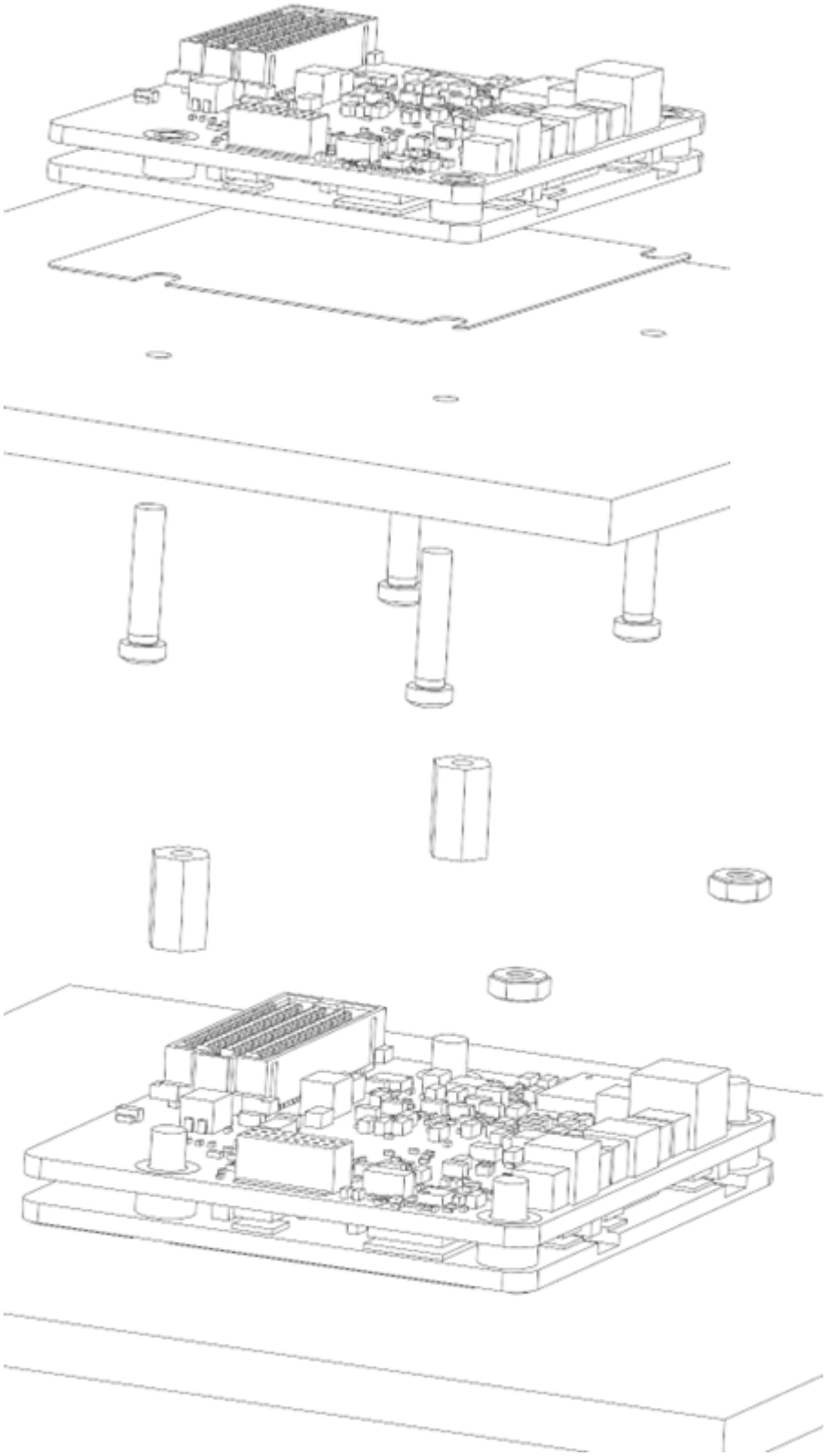
   For further information on the dimensions of the drill holes, see "Technical specifications" on page 37.
2. Add the opening for the Cable gland for the CBAM435 cable.

Preparing the M-ETK



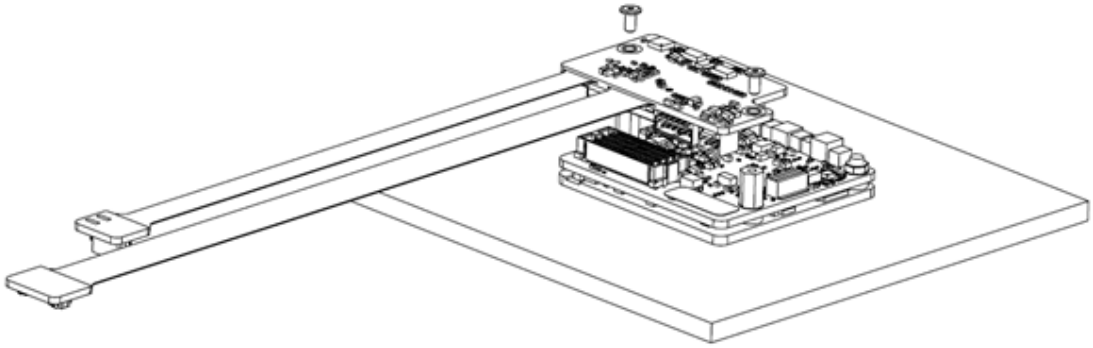
1. Remove the four screws from the M-ETK. The screws are only a transport lock for the heat spreader.
2. Apply a thin layer of heat conductive paste (or foil) to the bottom side of the M-ETK heat spreader.

Attaching the M-ETK to the ECU Housing



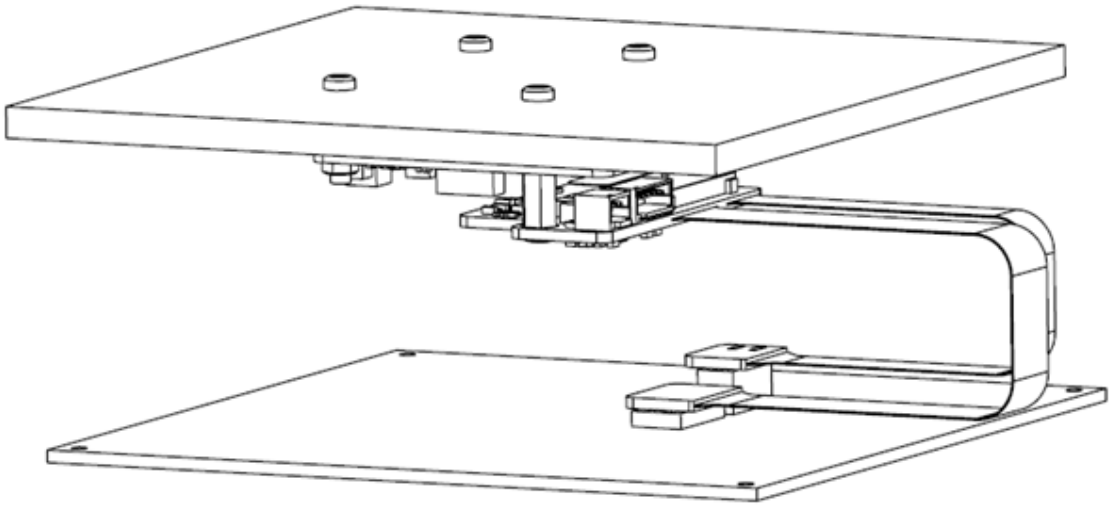
1. Place the M-ETK with the thermal paste (or foil) into the ECU housing and fasten it from the outside using four M2 screws, length depending on the metal housing.
2. Insert the screws into the holes in the ECU housing.
3. Add the M2 nuts and spacers. Use thread locking fluid.

Connect the adapter



1. Connect the METK-AB1.0 Adapter into the M-ETK.
2. Screw it in place with the two M2 x 4 screws. Use thread locking fluid.

3.2.2 Connection to the ECU



1. Plug the two connectors onto the ECU circuit board.
2. Connect the powercable and CBAM435 cable.
3. Close the ECU housing. Heatspreader Screws.

3.3 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.

NOTICE

Damage to the electronics due to potential equalization

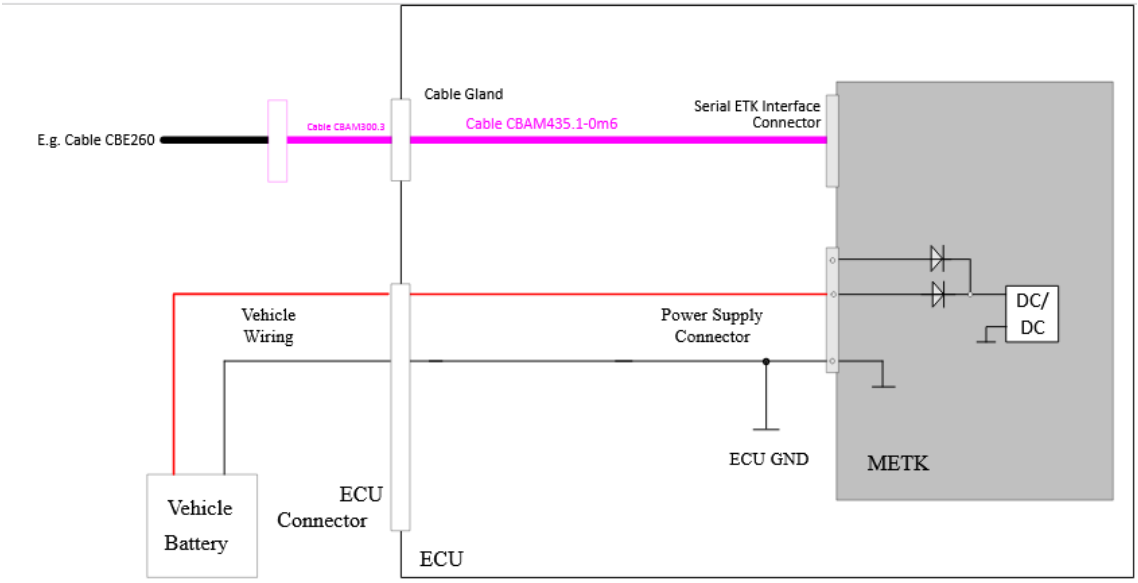
The cables' shield may be connected to the housing, the ground or the ground for the product's power supply. If there are different ground potentials in the test setup, equalizing currents can flow between the products via the cables' shield.

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

3.3.1 De-energizing the product

- Disconnect the product from the power supply.
- Switch off the laboratory power supply for the test setup.
- Disconnect the test setup's connection to the vehicle battery.
- Remove the power cord.

3.3.2 Permanent Power Supply inside ECU available


E.g. Cable CBE260
Cable CBAM300.3
Cable Gland
Cable CBAM435.1-0m6
Serial ETK Interface Connector
Vehicle Wiring
Power Supply Connector
DC/ DC
ECU GND
METK
Vehicle Battery
ECU Connector
ECU

4 Basic operation

Adapterboard Connection

- Align the M-ETK Adapterboard variant with the designated connector on the M-ETK-T Device.
- Gently push until it is securely seated.

Physical Integration into ECU

The M-ETK is desig ned for on-premise integration. This typically involves connecting the M-ETK Device and its Adapter board to the development ECU's hardware interfaces. Please consider, that the M-ETK has to be mounted in the area of low voltage of the ECU.

Power Connection

Connect the M-ETK to the ECU's low voltage power supply or a suitable external power source according to its specified voltage requirements.

Software Integration

The required M-ETK software components (e.g., Distab, 2-page calibration handling, handshake mechanisms) need to be integrated into the ECU's software. This is typically performed by a HW/SW Integrator.

Network Connection

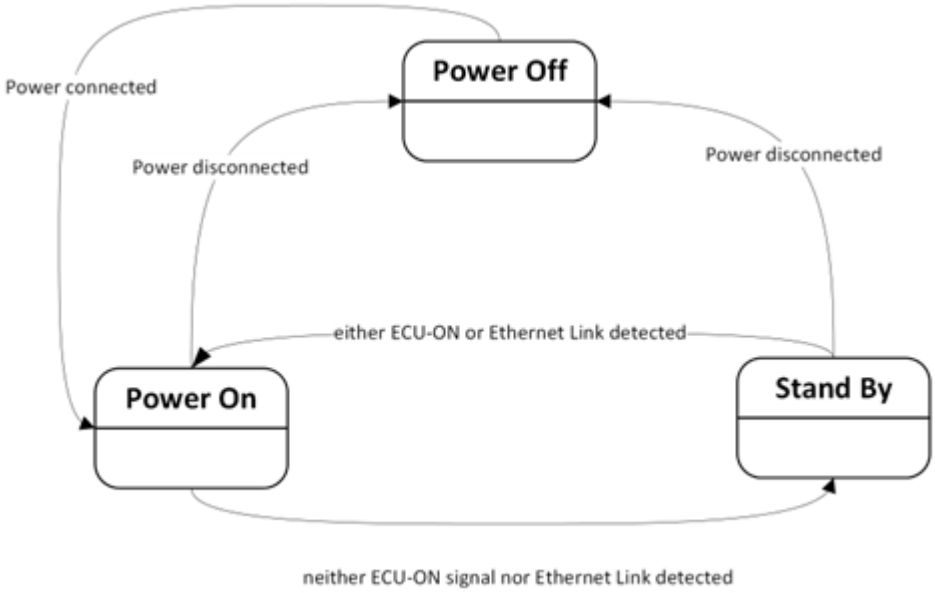
Connect the M-ETK's Automotive Ethernet XCP interface to your development network.

Feature License Activation

Activate any purchased feature licenses (e.g., Trace2Pin) through the provided software tools.

4.1 Status indicator

4.1.1 M-ETK State Machine



4.1.1.1 Power-On

When the M-ETK is powered up, a compatibility check of the M-ETK adapter is performed. In case of incompatibility, a recommendation will be made to change to an appropriate HSP version.

A handshake with the ECU will be made early in the boot process (Startup Time 1). The complete system boot will occur in parallel (Startup Time 2). For more information, see "Hardware specifications" on page 37.

4.1.1.2 Stand-By (Sleep)

If for a period of 500ms (or approx. 4.5 seconds after initial power on), there is no link on the network interface and no ECU-ON signal detected the system will change into a low power “standby” mode in the following manner.

- The FPGA changes to a standby mode.
- The Ethernet PHY is set to a standby mode; link detection is still possible.

For more information, see "Hardware specifications" on page 37.

4.1.1.3 Wake Up

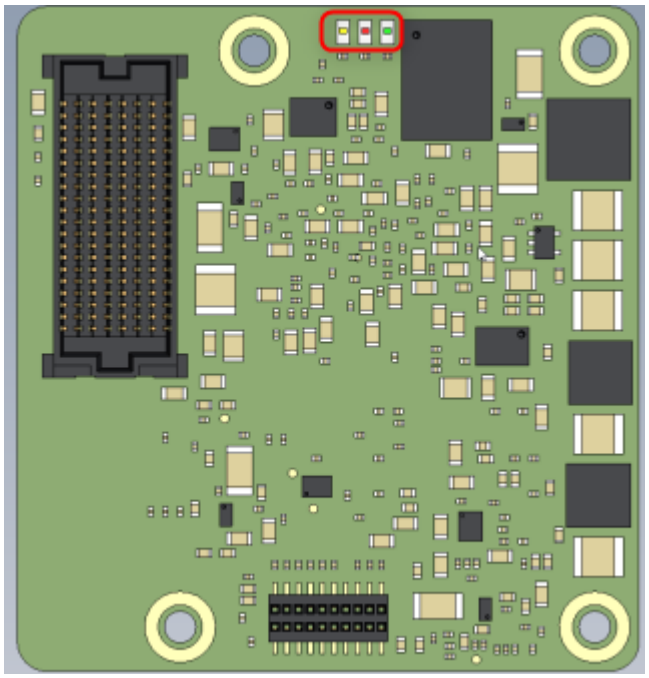
When in Stand-By (Sleep) mode, the M-ETK will wake up when either one or both of the following occurs:

- Voltage is detected on the ECU-ON connection.
- A link/ traffic is detected on the Ethernet connection.

After waking, the M-ETK will boot as per the “Power On” mode.

4.1.2 LED Specification

There are three LEDs displaying the operating mode M-ETK:



LED	State	Definition
Red	On	M-ETK is supplied with power and active.
	Flashing	Incompatible Adapter detected. Please refer to the HSP Tool or M-ETK Web-UI.
Green	Off	The Working Page is valid.
	Flashing	Incompatible Adapter detected. Please refer to the HSP Tool or M-ETK Web-UI.
	On	The Working Page is invalid.
Yellow	Off	ETK: Link Down.
	On	ETK: Link Up.
	Flashing	Incompatible Adapter detected. Please refer to the HSP Tool or M-ETK Web-UI.

5 Overview of functions

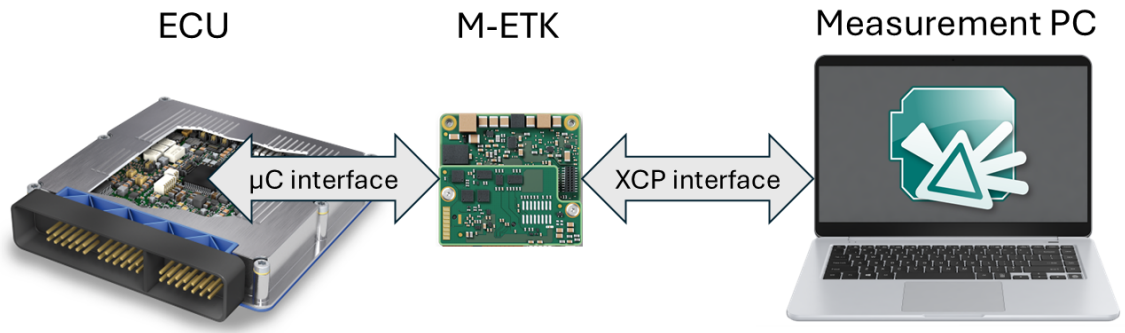
5.1 Measurement

The M-ETK provides comprehensive capabilities for real-time measurement of internal ECU variables (signals, parameters, memory contents). This is crucial for understanding the ECU's behavior, validating software functions, and supporting calibration activities. The system supports various measurement techniques to cater to different microcontroller architectures, debug interfaces, and performance requirements.

5.1.1 Core Concepts of Data Acquisition

All measurement involves two fundamental steps:

- **Data Sampling (µC interface)**: The point in time when a signal's value is captured from the ECU's memory.
- **Data Transmission (XCP interface)**: The process of sending the captured data from the ECU/M-ETK to your computer.



There are two primary modes for sampling this data:

- **Polling Mode**: The measurement tool continuously requests data from the ECU. This is simple to implement but is less efficient, as each data point requires a separate request. It can create a high load on the serial interface and the data may not be consistent, because it is not measured synchronous to it's creation time within the ECU.

- **Event-Triggered / DAQ Mode**: The ECU is configured to autonomously sample and transmit data when a specific event occurs (a "trigger"). This is highly efficient as it allows for blocks of data (known as DAQ lists) to be sent in bursts, significantly reducing bus load and improving performance. This is the preferred mode for most measurement tasks.

5.1.2 Data Acquisition Methods

The M-ETK supports several data acquisition methods, each with different characteristics, benefits, and resource requirements.

Method	Description	Key Advantages	Key Considerations
Timer-Triggered Polling	The M-ETK periodically reads signal values directly from the ECU's RAM at a user-defined interval.	Very easy to set up. - Requires no changes to the ECU software.	No signal consistency; as values can change while being read. - Inefficient for high signal counts.
Triggered Direct Measurement (TDM)	The ECU's software sends a trigger to the M-ETK, which then reads the required signals directly from their memory addresses.	Low impact on ECU runtime. - Simple triggered mechanism.	Signal consistency is not guaranteed if timing is not managed carefully. - Performance is limited by the µC interface speed.
Display Table (DISTAB)	When triggered, the ECU copies a predefined list of signals into a dedicated, consistent data block. The M-ETK reads this entire block in a single operation.	Guaranteed data consistency for all signals within the block. - Efficient use of the communication interface.	Requires a small amount of ECU CPU time and RAM to copy the data. - M-ETK supports Dynamic DISTAB (DISTAB17), a flexible version that allows measurement lists to be changed on-the-fly from the tool.

Method	Description	Key Advantages	Key Considerations
Trace-Based Measurement (T2R/T2P)	A hardware trace unit on the microcontroller automatically captures every data change in a monitored memory window. This provides the most detailed measurement possible.	Perfect data consistency. - No ECU runtime overhead for measurement. - Capable of very high data rates.	T2P offers the highest performance by streaming data directly over a fast dedicated interface, while T2R writes the data to a µC internal buffer memory and provides it via the debug interface

5.1.3 The Role of Triggers and Interfaces

- **Triggers**: A trigger is an event that initiates a data measurement. Triggers are highly configurable and can be based on timers (e.g., every 10ms), software events within the ECU code, or specific hardware signals. This ensures that data is captured at the precise moment it is needed. To ensure data validity even when the ECU is off, the uC supports a standby supply for the RAM used for the Working Page from the M-ETK.
- **Interfaces**: The measurement performance heavily depends on the physical connection between the M-ETK and the ECU. The M-ETK supports a wide range of microcontroller interfaces, from standard serial interfaces (like JTAG or DAP) for basic measurement to high-speed trace interfaces (like Aurora) for the most demanding data acquisition tasks. This versatility allows the M-ETK to be a cost-effective and high-performance solution for a variety of use cases.

5.2 Calibration

Calibration is the process of adjusting and optimizing the parameters in an Electronic Control Unit (ECU) to fine-tune its behavior.

The M-ETK is a high-performance hardware interface that acts as a bridge between your computer, running a calibration software like ETAS INCA, and the vehicle's ECU. It provides a fast and reliable communication link, enabling you to not only read measurement data from the ECU but also to write new values to it.

The M-ETK uses standardized XCP (Universal Measurement and Calibration Protocol) for all functionalities.

The effect of the changes can be observed in real-time by monitoring the measurement data in parallel.

5.2.1 Advanced Calibration: The Two-Page Concept with Overlay Memory

To allow for safe and flexible calibration, the M-ETK supports the "Two-Page" memory concept, which relies on a feature in the microcontroller (µC) called "Overlay Memory."

Imagine you have two identical sets of calibration data:

- **Reference Page (RP)**: This is the original, safe set of parameters. It is stored in the ECU's non-volatile Flash memory. Think of this as your "factory settings" or the last known good configuration.
- **Working Page (WP)**: This is a copy of the parameters stored in a fast, volatile RAM area. This is the page you actively modify during a calibration session.

This provides two major benefits:

- **Safety**: You can experiment freely in the Working Page. If a change leads to undesirable behavior, you can simply switch back to the stable Reference Page.
- **Persistence**: The changes made in the Working-Page are temporary because they are in RAM. Once you are satisfied with your new calibration, you can permanently save the data from the Working Page back into the Flash memory if the ECU flashing feature is available for the M-ETK.

The Overlay Memory functionality is a hardware feature of the µC that allows the ECU to seamlessly switch between these two pages. When you start a calibration session with a tool like INCA, the system activates the overlay memory. Any time the ECU's software tries to read a calibration parameter from the non-volatile Flash memory (the Reference Page), the overlay memory feature intervenes. It redirects the request automatically to the corresponding address in the RAM (the Working Page). This allows you to make changes in the Working Page and see their effect instantly without altering the original, safe data in the Flash.

Overlay Memory Descriptor (OMD)

To setup the overlay memory feature in the µC an OMD is used. The OMD contains the memory regions used as working page, reference page, and the respective sizes. This allows you to make changes in the Working Page and see their effect instantly without altering the original, safe data in the Flash.

One Page Concept

If no overlay controller is available a single page concept can be used for calibration or an ECU SW supported pointer-based calibration method.

5.3 ECU Flashing

ECU flashing is the process of programming selected internal or external non-volatile memory (NVM) of an Electronic Control Unit (ECU).

5.3.1 ECU Flashing with INCA

The M-ETK is prepared for this process and provides an infrastructure for ECU flashing to implement and realize a fast and reliable solution for flashing ECU software directly in the vehicle, using the ETAS INCA software environment.

Compared to ECU flashing via XCP on CAN or FlexRay, using the M-ETK offers significantly shorter programming times and provides powerful recovery options. The entire process is typically automated and managed by a ProF script within INCA.

There are two primary methods for flashing an ECU with the M-ETK.

Bootstrap Flashing (BSF): This is the recommended M-ETK ECU flashing solution if possible to realize. For this solution the control of the micro-controller unit will be taken over by using the debug interface. All active tuning protections and watchdog timers, which could interrupt this process must be disabled beforehand. After halting all active and running cores, an ETAS proprietary flashing application will be downloaded. It will be executed out of the internal RAM. This application manages the programming of the non-volatile memory.

> **Note**
>
> Bootstrap flashing does not support the flashing of security protecteded areas in the µC.

ECU-backed Flashing (EBF): The ECU-backed flashing is an alternative solution, if the Bootstrap Flashing solution cannot be realized. Reason for this might be limitations caused by tuning protection, watchdog timer or debug interface limitations of the micro-controller unit. To realize this flashing solution ETAS proprietary interfaces must be implemented in the ECU software.

In general we differentiate between 2 possible variants:

- ECU software does the non-volatile memory programming. Therefore the full ETAS proprietary communication interface must be supported by the ECU software. In this case the ECU software can continue serving tuning protections and watchdog timers.

– An ETAS proprietary flashing application performs the non-volatile memory programming after being executed by the ECU software. The ECU software cannot serve tuning protection and watchdog timers during the process on the other side only a minimal ETAS proprietary communication. On the interface must be implemented.

Feature	Use Case	ECU's Role
Bootstrap Flashing (BSF)	Programming of selected internal or external non-volatile memory. Tuning protection and watchdog timers must be disabled for this process beforehand.	**Passive**: The control of the mirco-controller is taken over via the debug interface by the M-ETK.
ECU-backed Flashing (EBF)	Depending on the ECU software execution, selected internal or external non-volatile memory can be programmed.	**Active**: The ECU software performs the non-volatile memory flashprogramming and is able to handle active tuning protections and watchdog timers during this process.

Note

As the ECU flashing procedure and options depend strongly on the Microcontroller system context (e.g. tuning protection, watchdog behavior, NVM type) ETAS support should be contacted in an early project phase for the appropriate solution.

5.3.2 ECU Flashing with 3rd Party XCP Tools

It is also possible to use 3rd-party tools (from vendors other than ETAS) to flash an ECU through the M-ETK. The M-ETK can act as a universal bridge, allowing other software to communicate with the ECU.

Note

When using a 3rd-party tool, you are restricted to only the functions available through mandatory XCP commands. (PGM commands). Contact the ETAS support.

5.4 ECU Debugging

ECU software debugging is the process of finding and resolving errors, or "bugs," within the ECU (Electronic Control Unit) software. This is a critical task for ECU developers, allowing them to interactively step through code, inspect memory, and analyze the software's behavior in real-time.

A common challenge during development is that the measurement and calibration tool (like ETAS INCA) and a software debugger (from vendors like Lauterbach or PLS) both require access to the same physical debug interface on the microcontroller (µC). The M-ETK provides a solution to this by enabling parallel access.

This is accomplished through a method called arbitration, where the M-ETK manages access to the shared µC debug port.

Software Debug Arbitration

This is a software-based solution for enabling parallel debugging. In this mode, the third-party debugger communicates with the ECU indirectly via an XCP backend provided by the debugger tool supplier. The M-ETK, in conjunction with INCA, arbitrates the access to the debug interface. This allows you to run your debugger and measurement tools at the same time through a single M-ETK connection.

Key Features:

- ETAS standard solution supported by the M-ETK.
- Enables simultaneous use of INCA and a debugger.
- Requires an XCP backend from the debugger tool supplier.
- Software Debugging over XCP, Version 1.1.0.

5.5 Rapid Prototyping

Rapid Prototyping (RP) is a powerful technique that allows developers to test new or modified software functions on a real Electronic Control Unit (ECU) without the need to reprogramming (flash) the ECU's memory for every change. The M-ETK facilitates this process by using an "external bypass" method in conjunction with dedicated ETAS prototyping hardware (i.e. ES910/ES830) and software (i.e., INTECRIO). The M-ETK's external bypass solution provides a robust framework for rapid prototyping by ensuring that critical tasks are prioritized, and that the overall latency of the bypass loop is low and predictable, making it suitable for even the most time-sensitive automotive applications.

5.6 Time Synchronization

In modern vehicle systems, data are collected from multiple Electronic Control Units and additional measurement devices at the same time. To accurately analyze this data, it's crucial to know the precise time at which every single event occurred. Time Synchronization is the process that ensures all components in your measurement system, including multiple M-ETK modules and the INCA software, share a single, unified timeline.

M-ETK supports the standardized PTP (a profile of IEEE 1588) to create a robust, high-precision time synchronization network where a master device provides a common clock for synchronized modules.

5.7 ECU start up

To fully utilize the M-ETK's potential, e.g., for triggered measurement, the ECU start-up sequence should include coordination steps between the Electronic Control Unit (which requires ETK driver integration) and the M-ETK. It ensures that both systems are synchronized and ready for measurement and calibration tasks. The process involves several key stages, some of which are optional depending on the configuration and the connected tool.

5.7.1 ETK-Handshake

The ETK-Handshake is the foundational step where the ECU and M-ETK establish communication. It uses specific, shared memory locations (registers) for communication, which are specific to the microcontroller (µC). Simulate the handshake when no ETK driver is implemented, and measure it via timer trigger. Use this simulation to check the physical connection initially and verify access to RAM and FLASH.

5.7.2 Advanced Code Check

With Advanced Codecheck, the ECU SW can check whether the code and data in the ECU match, and INCA can check whether the data in INCA matches to the ECU SW.

5.7.3 Start on any page

This feature provides flexibility in selecting the source of calibration data at start-up. Based on Data Validity information exchanged during the handshake, the ECU decides which memory page to use for its operational parameters (optional, calibration only).

5.7.4 Cold Start Measureemnt

A "cold start" (optional) is essential for capturing measurement data from the very beginning of the ECU's boot process. This is particularly useful for analyzing engine start-up behavior or other initial ECU functions.

5.7.5 Calibration Wake-Up

The calibration wake-up function is a special function. It allows new parameters for the ECU software to be written to the ECU. This can happen while the vehicle or control unit network is still in sleep mode. For example, this can be done in a cold chamber before a cold start measurement.

5.8 Support of 3rd party XCP Tools

The M-ETK is designed for flexible integration into diverse and existing toolchains. It provides a standardized XCP on Ethernet interface. This enables users to connect various 3rd-party software tools for measurement, calibration, and software debugging.

Supported Use Cases:

- **Measurement and Calibration**: Third-party measurement and calibration tools that utilize the XCP protocol can connect directly to the M-ETK. This allows engineers to continue using their preferred tools for testing and system optimization.
- **Data logging**: XCP datalogger are supported in parallel to interactive measurement and calibration.

For more information, see "ECU Debugging" on page 33

5.9 M-ETK Web Interface

Device Status and Inventory Information

- Device information, e.g., type, HW revision or serial number of the base board and the connected adapter
- Versions of the installed servicepack and its components (e.g. FW, FPGA)

Operating History

- Total hours of operation
- Hours of operation per temperature range
- Temperature extremes
- Achievable via log files

License Management

The Web Interface allows you to monitor, configure, and maintain the M-ETK device by navigating to its IP address (192.168.40.16 configurable via XCT)in a web browser. It exposes a range of functions, provided by an underlying REST API.

- Display active licenses
- Upload and activate a license file

Time Synchronization

- Show time synchronization status
- Switch synchronization with a time master ON and OFF

Maintenance and Support

- Download log files for debugging purposes
- Servicepack update
- Reboot device

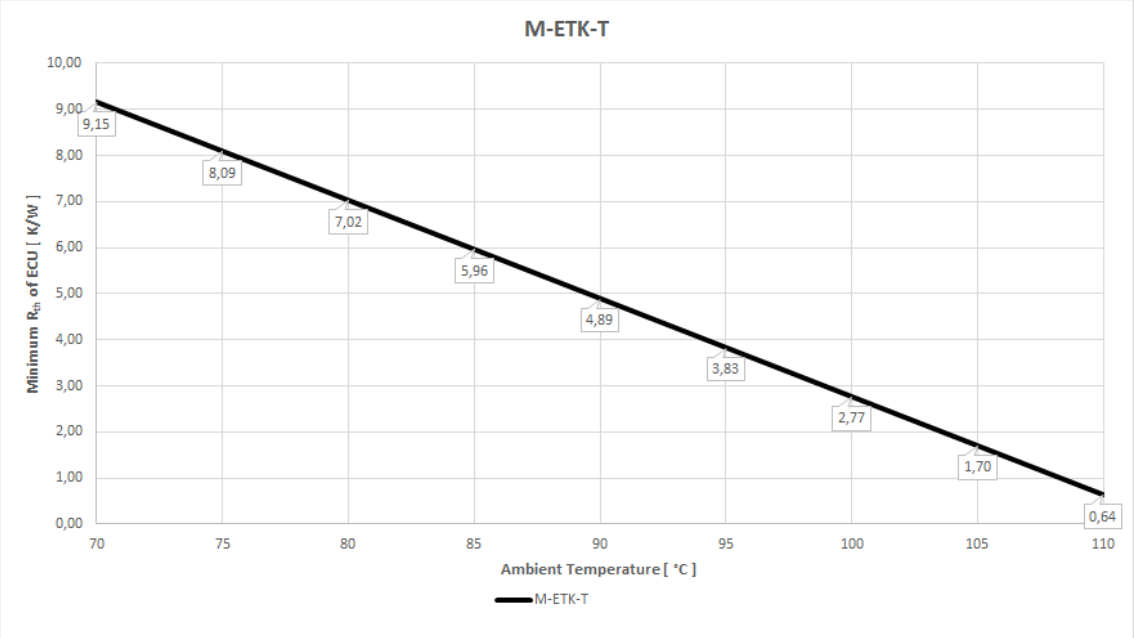
6 Technical specifications

6.1 Hardware specifications

6.1.1 Ambient 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	max. 5000 m/ 16400 ft
Degree of contamination (IEC 60664-1, IEC 61010-1)	2
Protection rating (IEC 60529)	Determined by installation in ECU

Inside the ECU housing the max. temperature is specified with 110 °C, still air. Outside of the ECU the max. ambient temperature is assumed to be 85 °C at 1 m/s airflow. The power dissipation of the M-ETK is typically 5 Watt.



T ambiente (°C)	Minimum Rth Heatspreader Ambient [K/W]
70	9,15
75	8,09
80	7,02
85	5,96
90	4,89
95	3,83
100	2,77
105	1,70
110	0,64

6.1.2 Power Supply Specs

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply (vehicle battery)	U_{Batt}	Vehicle usage [1)]	6	12	36	V
			[all values ±0%]			
Cranking voltage	U_{Batt}	< 3 seconds	3			V
Standby current	I_{STBY}	U_{Batt} = 12 V; ECU off; no load from ECU; T = 20 °C	8	24	40	mA
Operating current	I_{Batt}	U_{Batt} = 12 V; no load from ECU; T = 20 °C	150	250	350	mA
Power dissipation	P_{Batt}	U_{Batt} = 12 V; I=0mA at pin VDDSTBY ECU_SBRAM; T = 20 °C	1.8	3	4.2	W

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power dissipation	P_{Batt}	U_{Batt} = 12 V; I = 500 mA at pin VDDSTBY; I = 80 mA at pin VDDPSTBY; T = 20 °C	2.8	4	5.2	W
Fuse in the ETK Ubatt supply line. Only required if the power supply or ECU is not protected accordingly.			MINI, 2 A 58 V DC (Littelfuse 0997002.WXN)			
Overvoltage category (AC mains supply)		II				

[1] The M-ETK 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 M-ETK will accept power supply voltage dips (for additional details of 3 V low voltage operation, see ISO standard 16750).

Maximum Inrush Current

It is highly recommended that the M-ETK be connected to a permanent power supply. When this is not possible, or the M-ETK must be powered off and back on in short intervals, time is required to reactivate the inrush limiting circuit of the M-ETK.

If the time between powering the ETK off and on is less than 40 seconds a high current peak can occur. If the above-mentioned fuse is used, this inrush current will not trigger the fuse. If other protection mechanisms are in place, the inrush current must be considered in the ECU design.

Time Between Powering Off and On	Inrush Current Pulse (U_{Batt} = 12 V)
> 40 s	700 mA / 5 ms
< 40 s	18 A / 60 µs

6.1.2.1 Power Supply Pin Assignment

Pin	Signal	Direction	Comment
1	VDDSTBY (3.3 V supply)	Output	Permanent power supply of ECU DAP Interface, 3.3 V
2	VDDPSTBY (1.30 V supply)	Output	Permanent power supply of ECU EDRAM, 1.30 V
3	GND	Input	Power Ground
4	CAL_WAKEUP	Output	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
5	Ubatt2	Input	Vehicle battery
6	Ubatt1	Input	Vehicle battery

6.1.3 Microcontroller Interface (adapter dependent)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
ECU Standby RAM Output Voltage	VDDSTBY	max 500 mA load	0.94	1	1.04	V
VDDPSTBY Output Voltage	VDDPSTBY	max 80 mA load	3.14	3.3	3.46	V
Cal_Wakeup Output Voltage	CAL_ WAKEUP	U_{Batt} = 6 - 36 V; load = 0 - 50 mA	U_{Batt}- 1V		U_{Batt}	V
ECU Power Supply Supervision Voltage	VDDP	ECU on	2.67	2.77	2.89	V
		ECU off	2.44	2.56	2.89	V
		abs. max.			5.50	
	IDDP	VDDP 3.3 V			800	µA
ECU Standby RAM Supervision Voltage	VDDSTBY /VDDSTBY_ SENSE	VDDSTBY	0.86	0.89	0.92	V
		VDDSTBY ↓	0.85	0.88	0.91	V
	IDDSTBY	VDDSTBY 1.0 V			50	µA

6.1.4 Test Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Start Up Time 1 [1)]	t_{Reset1}	U_{Batt} = 12 V VDDP = 0 V 3.3 V/5.0 V without transferring FPGA	0	5	10	ms
Start Up Time 2 [1)]	t_{Reset2}	U_{Batt} = 0 V 12 V transfer BOO FPGA+SoC		20		s

[1)] PORESET is not pulled low during M-ETK start up time.

6.1.5 Automotive Ethernet Interface

Item	Characteristics
Connection	Automotive Ethernet 1000 Base-T1
Protocol	XCP on TCP/IP or UDP/IP
IP address	Dynamic (standard, for INCA) or Static (e.g. for Rapid Prototyping) by using the M-ETK Configuration Tool (default IP address: 192.168.40.14)
Cable length	max. 8 m
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 Automotive Ethernet interface is not compatible with the standard Ethernet interface of ETAS modules. A 1000 Base-T1 Automotive Ethernet Media Converter is needed to connect the M-ETK + M-ETK-AB1.0 to the PC.

6.1.6 SWD Timing Characteristics

The M-ETK supports the 2-pin SWD mode: one data pin (direction via protocol), one clock pin.

Parameter	Symbol	Value SR6X7[ns]	Value SR6P7 [ns]	Comment
SWCLK Clock Period (typ.)	tCLK	14.3[1)]	8.0[2)]	ETK --> Target
SWDIO Set-Up Time	tSU	4.0	2.3	ETK --> Target
SWDIO Hold Time	tH	1.5	2.3	ETK --> Target
SWDIO Clock-to-Out Time	tCO	12.4	11.5	Target --> ETK
SWDIO Output Hold Time	tOH	4.3	3	Target --> ETK
SWDIO data unstable window			3	

[1)] : @ 70 MHz SWD Clock Frequency

[2)]: @ 125 MHz SWD Clock Frequency

6.1.7 Aurora Trace Timing Parameter

Parameter	Value	Unit	Signal Impedance [Ohm]
Clock	100	MHz	100 (differential)
Data rate DATA[3...0] (max)	3.125	Gbit/s	100 (differential)

6.1.8 Electrical Characteristics

6.1.8.1 ECU Interface Connector SWD Interface

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 (min) / (max) [µA]**	**Additional load by ETK [1] (typ) [pF]**
SWCLK (TCK)	XO[1]	0.4	2.8	3.3	-	-	5.5	+705 / +495	35
SWDIO (TMS)	IXO[1]	0.4	2.8	3.3	0.8	2	5.5	-43 / -18	35
RESERVED (TDO)	IXO[1]	0.4	2.8	3.3	0.8	2	5.5	+10 / -10	35
RESERVED (TDI)	XO[1]	0.4	2.8	3.3	-	2	5.5	+10 / -10	35
/TRST	XO[2]	0.6	2.4	3.3	-	-	5.5	-705 / -569	21
/RESETOUT	IXOD[3]	0.7	-	-	0.8	2	5.5	+21 / -20	21
/PORESET	IXOD[3]	0.7	-	-	0.8	2	5.5	+21 / -20	25
WDGDIS	XO[2])	0.5	2.4	3.3	-	-	5.5	+10 / -10	21
Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain									

[1] max 16mA
[2] max 24 mA
[3] max 0.2 A

6.1.8.2 ECU Interface Connector JTAG Interface

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 (min) / (max) [µA]	Additional load by ETK [1] (typ) [pF]
SWCLK (TCK)	XO[1]	0.4	2.8	3.3	-	-	5.5	+705 / +495	35
SWDIO (TMS)	IXO[1]	0.4	2.8	3.3	0.8	2	5.5	-43 / -18	35
RESERVED (TDO)	IXO[1]	0.4	2.8	3.3	0.8	2	5.5	+10 / -10	35
RESERVED (TDI)	XO[1]	0.4	2.8	3.3	-	2	5.5	+10 / -10	35
/TRST	XO[2]	0.6	2.4	3.3	-	-	5.5	-705 / -569	21
/RESETOUT	IXOD[3]	0.7	-	-	0.8	2	5.5	+21 / -20	21
/PORESET	IXOD[3]	0.7	-	-	0.8	2	5.5	+21 / -20	25
WDGDIS	XO[2])	0.5	2.4	3.3	-	-	5.5	+10 / -10	21
Pin Type: I: Input, X: Tristate, O: Output, OD: Open Drain									

[1] max 16mA
[2] max 24 mA
[3] max 0.2 A

6.1.8.3 ECU Interface Connector Pin Assignment

Pin	JTAG Mode	SWD Mode	Direction	Comment
1	GND	GND	Power	Signal Ground
2	TCK	SWCLK	Output	depending interface mode
3	/TRST	/TRST	Output	depending interface mode
4	TDO	RESERVED (TDO)	Bidir	depending interface mode
5	TMS	SWDIO	Bidir	depending interface mode
6	TDI	RESERVED (TDI)	Bidir	depending interface mode
7	WDGDIS	WDGDIS	Output	Watchdog disable Signal
8	VDDP (Sense)	VDDP (Sense)	Input	Sense for Switched power supply of ECU (ignition)
9	/RESETOUT	/RESETOUT	Bidir	ECU Reset signal (open drain) for Reset assertion and supervision
10	/PORESET	/PORESET	Bidir	ECU Power On Reset signal (open drain) for Reset assertion and supervision

6.1.8.4 ECU Interface Connector Aurora Trace

Signal	Pin Type	V_{ID} (min) [mV]	V_{ID} (max) [mV]	V_{OD} (max) [mV]
Clock-P/-N	XO	-	-	490
DATA[3...0]	I	140	1250	-

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

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 (min / max) [µA]	Additional load by ETK [1] (typ) [pF]
	AUR_RESERVED	XO [1]	0.6	2.4	3.1	-	-	6.5	+159 / +99	24

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

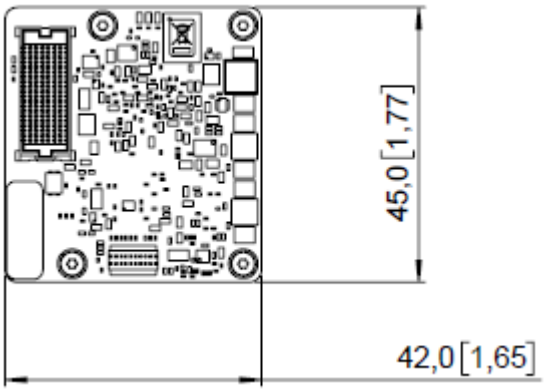
[1] max 24 mA

6.1.8.5 ECU Interface Connector Aurora Trace Pin Assignment

Pin	Signal	Direction	Comment
1	GND	-	Signal Ground
2	GND	-	Signal Ground
3	Data1-N	Input	Aurora Data Lane 1
4	Data0-P	Input	Aurora Data Lane 0
5	Data1-P	Input	Aurora Data Lane 1
6	Data0-N	Input	Aurora Data Lane 0
7	GND	-	Signal Ground
8	GND	-	Signal Ground
9	Data2-P	Input	Aurora Data Lane 2
10	GND	-	Signal Ground
11	Data2-N	Input	Aurora Data Lane 2
12	Clock-N	Output	Aurora Clock
13	GND	-	Signal Ground
14	Clock-P	Output	Aurora Clock
15	Data3-N	Input	Aurora Data Lane 3
16	GND	-	Signal Ground

Pin	Signal	Direction	Comment
17	Data3-P	Input	Aurora Data Lane 3
18	-	-	not connected
19	GND	-	Signal Ground
20	AUR_Reserved	Output	do not use

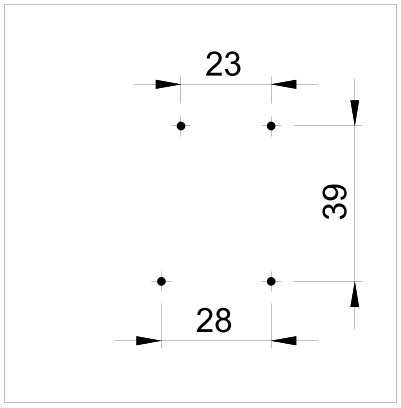
6.1.9 Mechanical Dimensions and weight



The reference measure for all drawings is millimeters.

Item	Dimension [Millimeters]	Dimension [Inches]
Length	45.00	1.77
Width	42.00	1.65
Height	10.85	0.43

6.1.9.1 Hole/Drilling Pattern for the ECU-housing



Four screws M2

Recommended drilling diameter for the M2 screws is 2.2 mm.

Dimension [mm]	Tolerance [mm]	Dimension [in]	Tolerance [in]
23	+/- 0.20	0.91	0.07874
28	+/- 0.20	1.11	0.07874
39	+/- 0.20	1.54	0.07874

6.1.9.2 Weight

Item	Weight [g]
M-ETK-T1 (incl Heatspreader)	30
M-ETK-AB1.0	10
Total	**40**

6.2 Product markings

Symbol	Description
	Please read the user manual before starting up the product.
SN: xxxxxxx	Serial number
F 00K xxxxxxx	Order number
x-xx V	Operating voltage range DC
	
xxx mA	Max. current consumption

Symbol	Description
	**China RoHS** With the China RoHS identification attached to the product or its packaging, ETAS confirms that the product meets the guidelines of the “China RoHS” (Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation) applicable in the People's Republic of China.
	**CE Conformity** With the CE mark attached to the product or its packaging, ETAS confirms that the product corresponds to the applicable, product-specific Directives of the European Union. The CE Declaration of Conformity for the product is available upon request. **European Union** The EU Directive 2011/65/EU limits the use of certain dangerous materials for electric and electronic devices (RoHS conformity). This product does not contain any of the prohibited substances listed in EU Directive 2011/65/EU and does not exceed the maximum authorized concentrations specified. There are currently no equivalent alternative substances for individual electronic components used in our products. We are therefore making use of exemptions 7.a (for accessory, cables and hardware) in Annex III of this Directive. ETAS confirms that the product meets this directive applicable in the European Union.
	**UKCA Conformity** With the UKCA mark attached to the product or its packaging, ETAS confirms that the product meets the applicable, product-specific British standards and directives. The UKCA Declaration of Conformity for the product is available upon request.

Symbol	Description
	**KCC Conformity** With the KC mark attached to the product or its packaging, ETAS confirms that the product has been registered in accordance with the applicable, product-specific KCC guidelines of the Republic of Korea.
	**CMIM conformity** With the CMIM mark attached to the product or its packaging, ETAS confirms that the product corresponds to the product-specific, applicable directives of the Kingdom of Morocco. The CMIM Declaration of Conformity for the product is available upon request.
	**Product Return and Recycling** The European Union (EU) released the Directive for Waste Electrical and Electronic Equipment - WEEE to ensure the setup of systems for collecting, treating and recycling electronic waste in all countries of the EU. This ensures that the devices are recycled in a resource-friendly way that does not represent any risk to personal health and the environment. The WEEE symbol (see Fig.4-2) on the product or its packaging identifies that the product may not be disposed of together with the remaining trash. The user is obligated to separately collect old devices and provide them to the WEEE return system for recycling. The WEEE Directive applies to all ETAS devices, but not to external cables or batteries. Additional information about the recycling program of ETAS GmbH is available from the ETAS sales and service locations.

7 Maintenance

7.1 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.

7.2 Repair service

If repairs are required, send the product to ETAS.

8 Return form

You can find the return form and information about this process on the ETAS website: www.etas.com/en/support/hw_return_form.php.

9 Accessories and order information

9.1 Ordering Information M-ETK

Order Name	Short Name	Order Number
Preconfigured M-ETK-T1.0	M-ETK-T-ST-01B	F 00K 118 536
Package Contents		
M-ETK-T1.0, 1, M-ETK _Base_MCU_ST_01, M-ETK_ Feature_Trace2PIN		
Preconfigured M-ETK-T1.0	M-ETK-T-ST-01A	F 00K 118 535
Package Contents		
M-ETK-T1.0, M-ETK _Base_MCU_ST_01		
Adapterboard for M-ETK-T1.0	M-ETK-AB1.0A	F 00K 117 316

9.2 Cables, Adapters and Accessories

9.2.1 Overview and Classification

This chapter contains information about the following cables and accessory.

Note

See "Mounting and placement" on page 17 for details on wiring the ECU interface adapters.

9.2.2 Cables and Adapter Requirements for fail safe Operation

Note

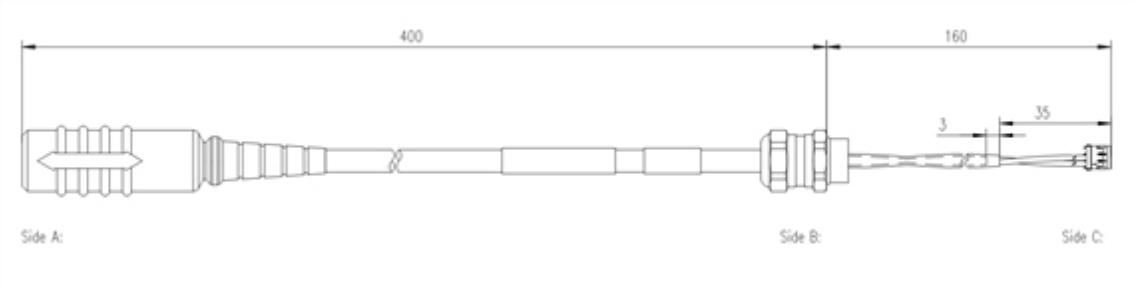
We recommend to use ETAS cables or any other cables certified by the standards for the application. Adhere to the maximum permissible cable lengths!

Note

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

Please contact your local ETAS representative for further cable information.

9.2.3 CBAM435 (Automotive Ethernet)



9.2.3.1 Usage

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

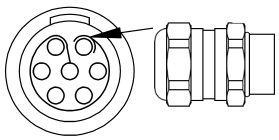
9.2.3.2 Mechanical Dimensions

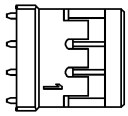
For thin walled housings, use a through boring with 10.2 mm in the housing and mount the cable with a nut (not included) (Ordernumber 8000.10.1 from AGRO).

For wall thickness more than 2.5 mm cut a thread into the housing.

9.2.3.3 Connectors and Positions

LEMO-Socket	AGRO Cable Gland	Molex Pico-SPOX
	Messing 1080.12.91.075	Receptacle housing: 87439-0300





View to solder side

Side A	Side D
Pin: **Label**	

LEMO-Socket	AGRO Cable Gland	Molex Pico-SPOX
	Messing 1080.12.91.075	Receptacle housing: 87439-0300
Housing: Shield	Housing: Shield	
1: BR+		
6: BR-		

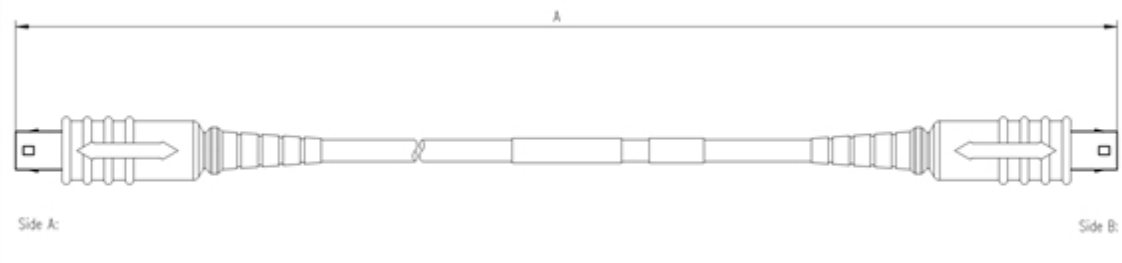
9.2.3.4 Temperature Range

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

9.2.3.5 Order Information

Order Name	Short Name	Length [m]	Order Number
M-ETK ECU Adapter Cable, pre-assembled into M10 screwing, shield on ECU-Housing, Lemo 1B PHI - MOLEX (7fc-3fc), 0m60	CBAM435.1-0m6	0.6	F 00K 117 318

9.2.4 CBEB130 (Automotive Ethernet)



9.2.4.1 Usage

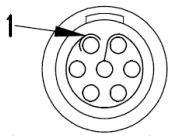
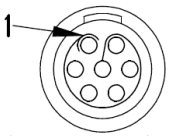
> **Note**
>
> It is recommended for safety reasons to connect the external permanent voltage and the switched voltage inside the ECU!

9.2.4.2 Mechanical Dimensions

For thin walled housings, use a through boring with 12.2 mm in the housing and mount the cable with a nut (not included) (Ordernumber 8000.12 from AGRO).

For wall thickness more than 2.5mm cut a thread into the housing.

9.2.4.3 Connectors and Positions

LEMO-Socket	**LEMO-Socket**
	LEMO FGI.1B.512.CTA
	
View to solder side	View to solder side
Side A	**Side B**
Pin: Label	**Pin: Label**
Housing: Shield	
1: BR+	1: BR+
6: BR-	6: BR-

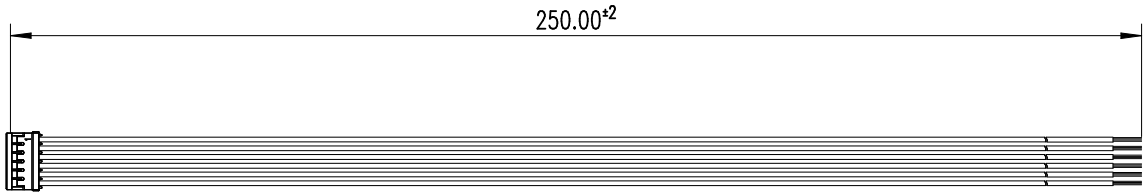
9.2.4.4 Temperature Range

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

9.2.4.5 Order Information

Order Name	**Short Name**	**Length [m]**	**Order Number**
1000Base-T1 Automotive Ethernet Cable for M-ETK, Lemo 1B PHI - Lemo 1B FGI (7mc-7mc), 3m	CBEB130.1-3	3	F 00K 117 319
1000Base-T1 Automotive Ethernet Cable for M-ETK, Lemo 1B PHI - Lemo 1B FGI (7mc-7mc), 8m	CBEB130.1-8	8	F 00K 117 320

9.2.5 ETAM2 Adapter



9.2.5.1 Pin Assignment ETAM2 Connector

9.2.5.2 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	Ground	Power ground
4	Green	Cal_Wakeup	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
5	Red	SGUBATT2	Vehicle battery
6	Red	SGUBATT1	Vehicle battery

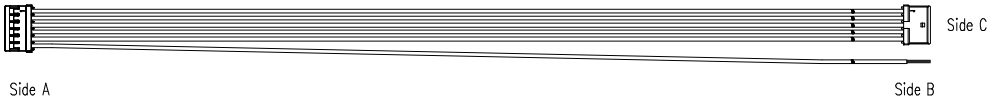
9.2.5.3 Temperature Range

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

9.2.5.4 Ordering

Order Name	Lenght	Order Number
ETAM2	0.25m	F 00K 109 306

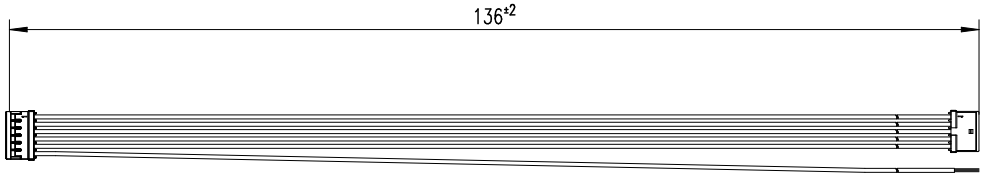
9.2.6 ETAM5 ECU Adapter (Power)



9.2.6.1 Usage

The ETAM5 adapts the X-ETK power signals (Molex 6 pin connector) to an ECU with a 5 pin Molex Pico Spox connector. The ECU connector is available as Vertical SMT Header [87437-0543] or Right Angle SMT Header [87438-0543]. The red open wire cable is an additional F-ETK Ubatt input. This wire can connect to an CBAM435 cable with Ubatt input or to a K50 Ubatt adapter.

9.2.6.2 Mechanical Dimensions



9.2.6.3 Connectors and Positions

Molex Housing	**Wire**	**5 mm stripped and signed**	**Molex Housing**
87439-0600	PTFE-5Y		87439-0500
Molex Terminal			
87421-0000			
Side A		**Side B**	**Side C**
			
1	Blue		1
2	Yellow		2
3	Brown		3
4	Green		4
5	Red		5
6	Red	Open wire	

9.2.6.4 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	SGUBATT1	Vehicle battery

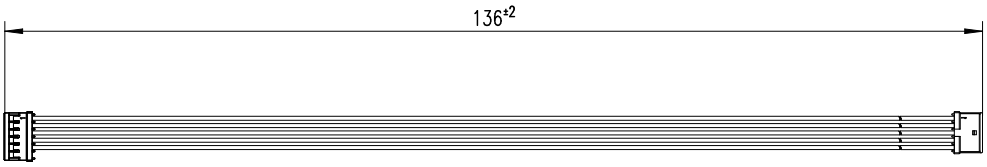
9.2.6.5 Temperature Range

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

9.2.6.6 Ordering Information

Order Name	Short Name	Order Number
ETAM5 M-ETK/F-ETK ECU Adapter, MOLEX - MOLEX (6fc - 5fc+1c), 0m136	ETAM5	F 00K 110 101

9.2.7 ETAM9 ECU Adapter (Power)



9.2.7.1 Usage

The ETAM9 adapts the M-ETK/F-ETK/ X-ETK 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].

9.2.7.2 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	Vehicle battery
6	-	-	No Connect

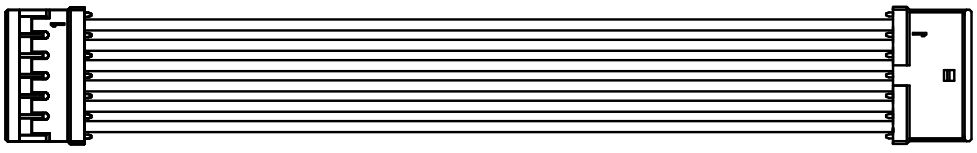
9.2.7.3 Temperature Range

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

9.2.7.4 Ordering Information

Order Name	Short Name	Order Number
ETAM9 F/XETK-S ECU Adapter, MOLEX - MOLEX (6fc - 5fc), 0m136	ETAM9	F 00K 111 043

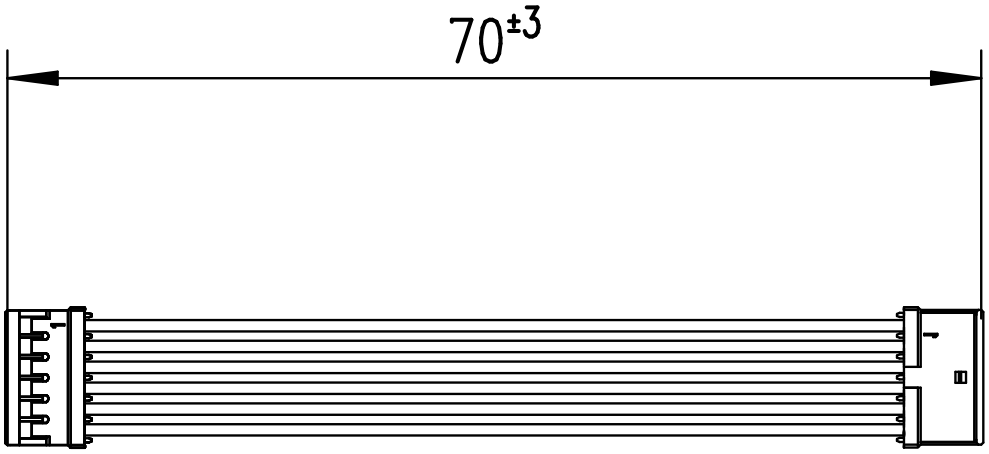
9.2.8 ETAM10 ECU Adapter (Power)



9.2.8.1 Usage

The ETAM10 adapts the ETK power signals (Molex 6 pin connector) to an ECU with an 6 pin Molex Pico Spox connector. The ECU connector is available as Vertical SMT Header [87437-0643] or Right Angle SMT Header [87438-0643].

9.2.8.2 Mechanical Dimensions



9.2.8.3 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	Vehicle battery
6	Red	SGUBATT1	Vehicle battery

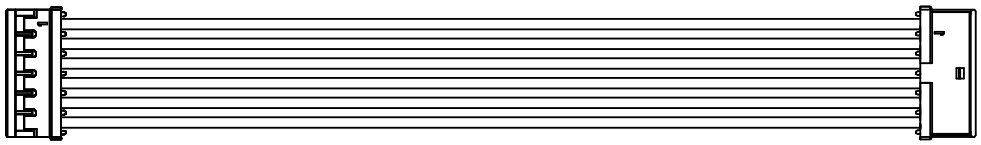
9.2.8.4 Temperature Range

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

9.2.8.5 Ordering Information

Order Name	Short Name	Order Number
ETAM10 F / X-ETK-S ECU Adapter, MOLEX - MOLEX (6fc - 6fc), 0m07	ETAM10	F 00K 111 814

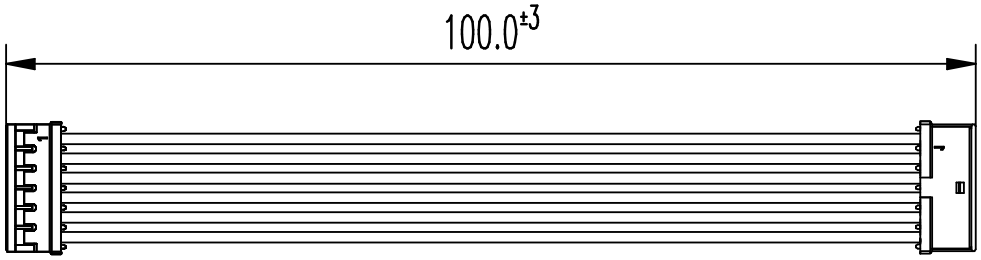
9.2.9 ETAM12 ECU Adapter (Power)



9.2.9.1 Usage

The ETAM12 adapts F-ETK and X-ETK power signals (Molex 6 pin connector) to an ECU with an 6 pin Molex connector.

9.2.9.2 Mechanical Dimensions



9.2.9.3 ECU Signals

The ETAM12 adapts the ETK power signals (Molex 6pin connector) to an ECU with an 6 pin Molex Pico Spox connector. The ECU connector is available as Vertical SMT Header [87437-0643] or Right Angle SMT Header [87438-0643].

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	Vehicle battery
6	Red	SGUBATT1	Vehicle battery

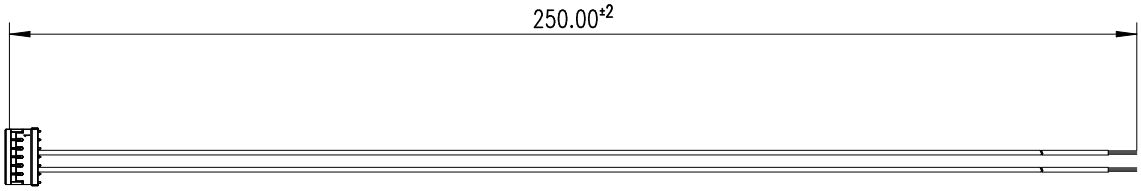
9.2.9.4 Temperature Range

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

9.2.9.5 Ordering Information

Order Name	Short Name	Order Number
MOLEX - MOLEX (6fc - 6fc) adapter cable ETAM12 (0,1 m / 0,33 ft) for connecting an F-/X-ETK to the ECU	ETAM12	F 00K 112 457

9.2.10 ETV5 Cable



9.2.10.1 Usage

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

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

9.2.10.2 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

9.2.10.3 Temperature Range

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

9.2.10.4 Ordering

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

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/hotlines

ETAS offers trainings for its products:
www.etas.com/academy

ETAS Headquarters

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Germany	Internet:	www.etas.com

11 Legal information

11.1 Use of Open Source Software

The product might use Open Source Software (OSS). This software is installed on the product at shipment and does not need to be installed or updated by the user. If OSS is used, see the accompanying "OSS Attributions Document" for more information.

11.2 Certification and conformity

11.2.1 Declarable Substances

European Union

Some products from ETAS GmbH (e.g. modules, boards, cables) use com-pon-ents with materials that are subject to declaration in accordance with the REACH regulation (EC) no.1907/2006. The REACH Declaration is available online at www.etas.com/reach and is continuously updated.

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