ETK-S21.0
Emulator Probe for MPC57xx/ EMU57xx MCU Family
User's Guide

Copyright

ETK-S21.0 - User's Guide R09 EN - 08.2014

Contents

1 General Information

The introductory chapter provides you with information on the basic safety instructions, returning the product and recycling, and how to use this manual.

1.1 Basic Safety Instructions

Please adhere to the safety instructions to avoid injury to yourself and others as well as damage to the device.

1.1.1 Correct Use

ETAS GmbH cannot be made liable for damage which is caused by incorrect use and not adhering to the safety instructions.

1.1.2 Labeling of Safety Instructions

The safety instructions contained in this manual are shown with the standard danger symbol shown in Fig. 1-1 on page 7:

Fig. 1-1 Standard Danger Symbol

The following safety instructions are used. They provide extremely important information. Please read this information carefully.

WARNING!

indicates a possible medium-risk danger which could lead to serious or even fatal injuries if not avoided.

CAUTION!

indicates a low-risk danger which could result in minor or less serious injury or damage if not avoided.

1.1.3 Demands made re the Technical State of the Product

The following requirements are made to ensure safe operation of the module:

- Ensure you observe the notes on environmental conditions (see section 6.7 on page 33).
- Ensure you adhere to the port and setting values (see section 6.8 on page 33).

CAUTION!

The ETK can be damaged or destroyed!
Some components of the ETK board may be damaged or destroyed by electrostatic discharges. Please keep the ETK in its storage package until it is installed.
The board should only be taken from its package, configured, and installed at a work place that is protected against static discharge.

CAUTION!

Risk of short circuiting the internal signals of the ETK!
When you mount the ETK to the ECU, you must ensure that the screws and washers used will not penetrate the ETK printed circuit board.

CAUTION!

Potential equalization in the vehicle over the shield of the Ethernet connecting cables of modules may occur!
Mount the modules only to components with the same electrical potential or insulate the modules from the components.

1.2 RoHS Conformity

1.2.1 European Union

The EU Directive 2002/95/EU limits the use of certain dangerous materials for electrical and electronic devices (RoHS conformity).

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

1.2.2 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.

1.3 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. 1-2 WEEE-Symbol

The WEEE symbol (see Fig. 1-2 on page 8) 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, contact the ETAS sales and service locations (see chapter 9 on page 59).

1.4 About this Manual

This manual describes the startup and technical data of the ETK-S21.0 module.

1.4.1 Structure

This manual consists of nine chapters and an index.

- **Chapter 1: “General Information”**

  The “General Information” (this chapter) provides you with information on the basic safety instructions, returning the product and recycling, and how to use this manual.

- **Chapter 2: "Introduction"**

  The chapter "Introduction" contains information about the basic features and applications of the ETK-S21.0 Interface Board.

- **Chapter 3: “Hardware Description”**

  In the "Hardware Description" chapter the function blocks and the interfaces of the ETK-S21.0 are explained in detail.

- **Chapter 4: “Installation”**

  The “Installation” chapter describes the hardware installation of the ETK-S21.0.

- **Chapter 5: “ETK Configuration”**

  The “ETK Configuration” chapter includes a description of important ETK-S21.0 configuration parameters.

- **Chapter 6: “Technical Data”**

  The “Technical Data” chapter contains a summary of all technical data, pin assignments and hints to system requirements for operating the ETK-S21.0.

- **Chapter 7: “Cables and Accessories”**

  The “Cables and Accessories” chapter contains an overview of the available cables and accessories.

- **Chapter 8: “Ordering Information”**

  The “Ordering Information” chapter contains the ordering information on the available cables and accessories.

The final chapter, “ETAS Contacts”, gives you information on ETAS’ international sales and service locations.

1.4.2 Using this Manual

Typographic Conventions

The following typographic conventions are used:

Bold	Device labels
Italics	Crucial text

Important notes for the user are shown as follows:

Note

Important note for the user.

2 Introduction

This section contains information about the basic features and applications of the ETK-S21.0 Interface Board (ETK = Emulator Test Probe), hints to system requirements for operating the ETK-S21.0, and other details.

2.1 Applications

The ETK-S21.0 is an emulator probe for the Freescale MPC57xx and for the STMicroelectronics EMU57xx microcontroller family. It is a typical serial ETK with a specific JTAG interface. This serial ETK can be used for measurement and calibration applications.

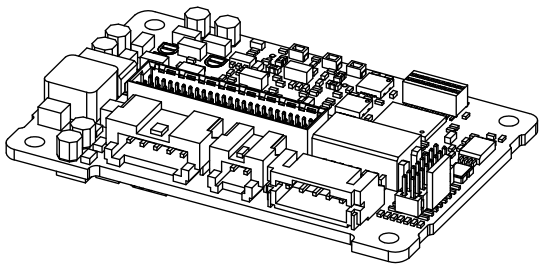

Fig. 2-1 ETK-S21.0

It is compatible with the ETAS calibration and development system interface (e.g. ES590, ES591, ES592, ES593-D, ES595, ES910 and ES1000.2/ES1000.3 with ES1232-A). Earlier systems (e.g. MAC2, ES1000.1 with ES1201 board, ES1120.1, ES690) are not supported.

2.2 Features

- Measurement interface
  - Serial ETK interface with 100 Mbit/s to the calibration and development system
- ECU interface
  - JTAG interface clock speed configurable: 20 MHz, 30 MHz, 40 MHz

Note

The max. allowed JTAG clock depends on the core frequency of the microcontroller. Max. clock speed is 1/4 of the core frequency.

  - 3.3 V ECU interface voltage level
  - ETK powers Emulation Device RAM
  - 50 pin ERNI plus 5 pin JST
- Trigger interface
  - Pinless trigger via JTAG (32 total measurement rasters)
  - 4 triggers generated by internal timers
- Debugger interface
  - additional connector for external debug hardware
  - ETK hardware is prepared to be used simultaneously with a debugger

- Startup protocoll for ETK/ ECU synchronization
  - via JTAG pins
  - via JTAG Data Communication (JDC) feature
- 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
- Permanent storage of configuration in EEPROM
- Configuration of ETK via XCT Configuration Tool
- ETK firmware update (update of the ETK hardware definition code [HDC]) supports by service software HSP
- Mounting possibilities inside or on top of ECU
- Temperature range suitable for automotive applications

For more technical data on the ETK-S21.0 consult the chapter "Technical Data" on page 31.

3 Hardware Description

In this chapter, the function blocks of the ETK-S21.0 are explained in detail.

3.1 Architecture

Fig. 3-1 shows the block diagram of the ETK-S21.0.

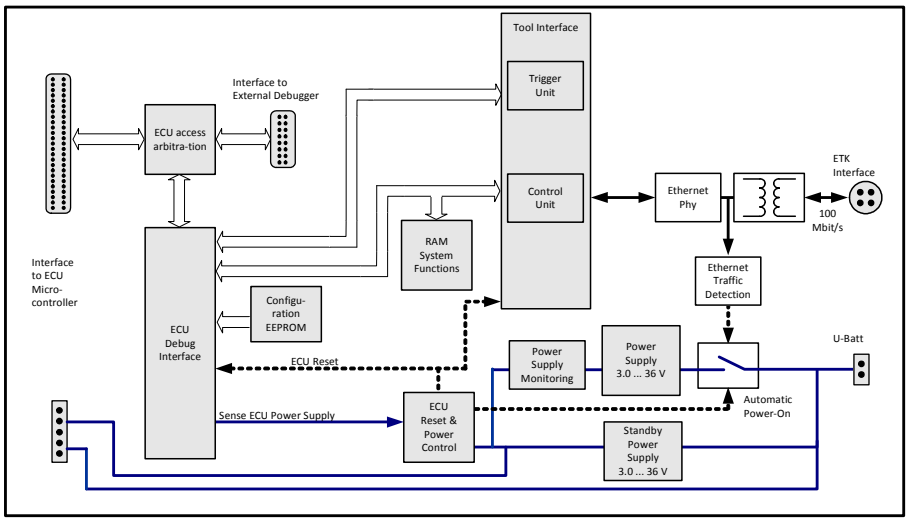

Fig. 3-1 ETK-S21.0 Architecture

The microcontroller can communicate with the memories or peripheral components of the development ECU. The ETK-S21.0 is connected to the serial debug and test interface of the microcontroller (JTAG). It converts these interface to the 100 MBit/s serial ETK interface and extends in this way the length of the connection line.

While the microcontroller accesses the data out of the data emulation memory, the content of the data emulation memory can simultaneously be modified by the calibration and development system through the serial ETK interface. This process enables adjustments of parameters, characteristic lines and maps through the calibration and development system. Using an additional measurement data memory area, the ECU microcontroller can send data to the calibration and development system which receives, buffers and processes this measured data (e.g. DISTAB13).

The 100 Mbit/s serial interface provides communication with the calibration and development system.

The power supply for the ETK-S21.0 is provided by a switch mode power supply, to minimize power dissipation.

3.2 ECU Interface

The ECU interface can be flexibly configured for several applications. For a HDC update, it is not necessary to unmount or disconnect the ETK-S21.0 from the ECU.

For currently supported microcontrollers refer to chapter 6.1.2 on page 31.

The ETK-S21.0 is connected via CON1 and CON2 to the ECU with two adapter cables (refer to Fig. 3-2 on page 14). The pin definition depends on the application and the microcontroller type. In general the ECU interface consists of

- 1 ECU voltage line, which is not used for ETK power supply but only for detection of the ECU status, therefore the power consumption on these line is negligible (refer to chapter 3.5 on page 16)
- 1 Reset line to control the system reset
- 1 Reset line to detect e.g. a Softreset
- 7 Debug Interface lines for the communication between the ETK-S21.0 and the microcontroller
- 2 ground lines for a proper shielding of the ECU interface lines.

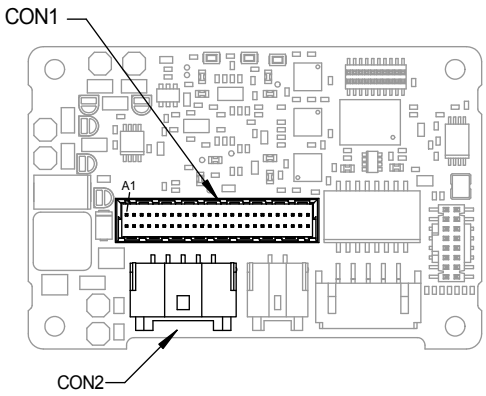

Fig. 3-2 Location of the ECU Interfaces (ETK-S21.0)

3.3 Serial ETK Interface

The interface utilizes a 100Base-TX transmission to achieve a transmission performance of 100 Mbit/s.

Note

To ensure stable communication only 100 Mbit cables delivered by ETAS shall be used.

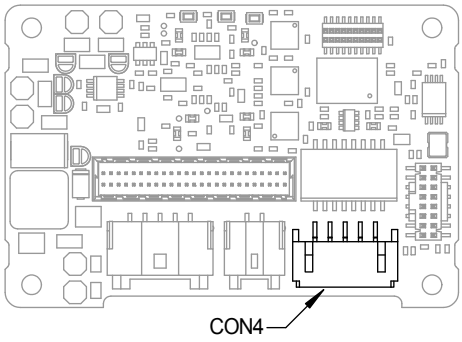

Fig. 3-3 Location of the Serial ETK Interface (ETK-S21.0)

3.4 Debug Interface

The ETK-S21.0 features a JTAG debugging interface connector CON5 (Samtec 16 pin). This connector can be used to attach debug tools (e.g. Lauterbach or PLS debugger, if available). We recommend to use ETAS Debug - Adapter (e.g. ETAF11) to connect the debugger to the ETK (refer to chapter 4.3 on page 28).

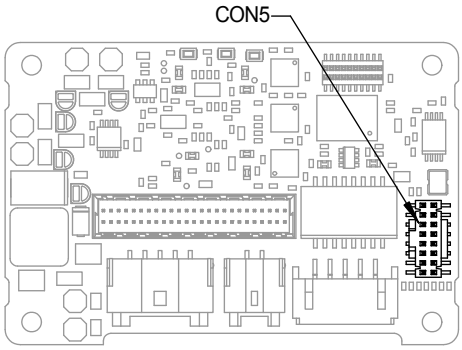

Fig. 3-4 Location of the Debugger Interface (ETK-S21.0)

By using the debug interface at the ECU board for serial ETK connection, it is not available for debugging tools anymore. Arbitration mechanisms are required to simultaneously work e.g. with measurement and calibration tools as well as with debugging tools. The ETK-S21.0 supports a hardware arbitration unit for the JTAG interface. This enables parallel use of tools for debugging and ETAS tools for measurement and calibration.

3.5 Power Supply

The ETK-S21.0 needs a permanent power supply. It is powered directly from the car battery. The input voltage may vary between 5 V and 36 V (3 V drops for 3 seconds). In case of higher input voltages to the ETK an additional voltage converter is required.

All necessary voltages are created through switching power supplies which minimizes power dissipation. The power supply of the ECU is not affected by the ETK-S21.0. An automatic switch ensures that the power supply of the ETK-S21.0 is automatically switched on and off when the ETK enters and leaves its sleep mode.

The ETK-S21.0 can be supplied with power through five pins connector CON7. The 2 pin JST connector CON3 can be used additionally to connect a power supply U_{Batt2}. The power supply on CON3 must use the GND of CON2 (refer to chapter 4.2.2).

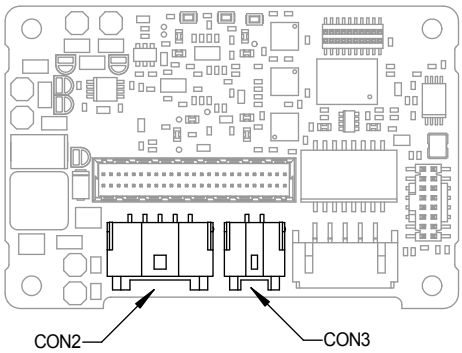

Fig. 3-5 Location of the Power Supply Connectors (ETK-S21.0)

3.6 ECU Voltage Supervisor

The ECU voltage (VDDP) is monitored by the ETK to recognize whether the ECU is switched on or off. The ETK-S21.0 supplies the ECU EDRAM and monitores this voltage.

Note

The ETK-S21.0 allows switching between reference page and working page only, if there is a valid voltage at the sense pin detected.

3.7 Status LEDs

There are three LEDs displaying the operating status of the ETK-S21.0 (Fig. 3-6 on page 17).

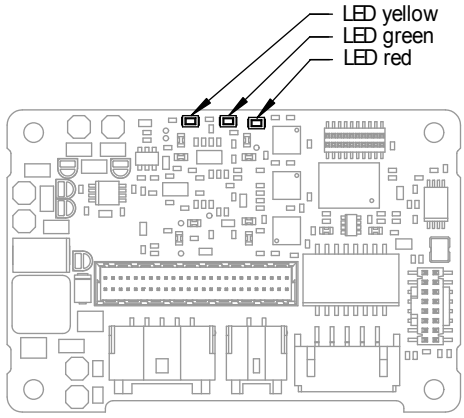

Fig. 3-6 Status LEDs (ETK-S21.0)

LED	State	Definition
Red	On	ETK-S21.0 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 ETK-S21.0)
Green	Off	Working Page contains data and is accessible from INCA
	Flashing	ETK-S21.0 is in boot configuration mode: - measurement and calibration are not possible, - after first initialization with INCA flashing stops
	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 ETK-S21.0 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	ETK-S21.0: no link to calibration system established
	On	100 Mbit/s communication to calibration system established

3.8 Data Emulation and Data Measurement

In the case of a serial ETK the measurement RAM is part of the ECU and is not accessible until the ECU is powered up and the basic initialization has been performed. The goal must be to perform the download into the ECU after the ETK's startup message was sent.

All serial ETKs have a system of Reference and Working Page (ETAS two pages ETK concept). The Reference Page is located in the ECU flash and can not be modified by a simple write access. As with all serial ETK's this change must be done via Flash programming.

The Working Page is implemented with internal RAM overlaying the flash by using microcontroller internal mechanisms. The overlay RAM used for the emulation of calibration data must not be used by the ECU software directly. The ETK/INCA has the complete control over this RAM and it's contents. When enabling a data emulation or after power loss INCA establishes a basic start-up configuration of the data in the RAM by copying the corresponding data in the Flash to the emulation space.

In contrast to a parallel ETK no flash memory for permanent storage of the adjusted parameters (program data) is available on the ETK.

The switching between Reference and Working Page is performed by switching the data emulation on and off. It is done by modifying overlay registers of the microcontroller, which are dedicated only to the ETK. The microcontroller must change the values of these registers after the startup handshake with the ETK has been performe and after the INCA request.

The page switching is performed via a communication method with the ECU software. A small software protocol between the ECU and the host is needed to get the current page status and perform the switching. The access to the micro controller registers and the real page switching is completely under the control of the ECU software.

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

Note

If the Boot Mode Header is not valid or program flash which contains the Boot Mode Header is erased completly it is not possible to access the microcontroller neither via ETK nor via debugger. In this case a Boot Mode Header must be programmed over ASC or CAN interface. For detailed information see the "MPC57x Microcontroller Reference Manual".

3.9 JTAG Interface

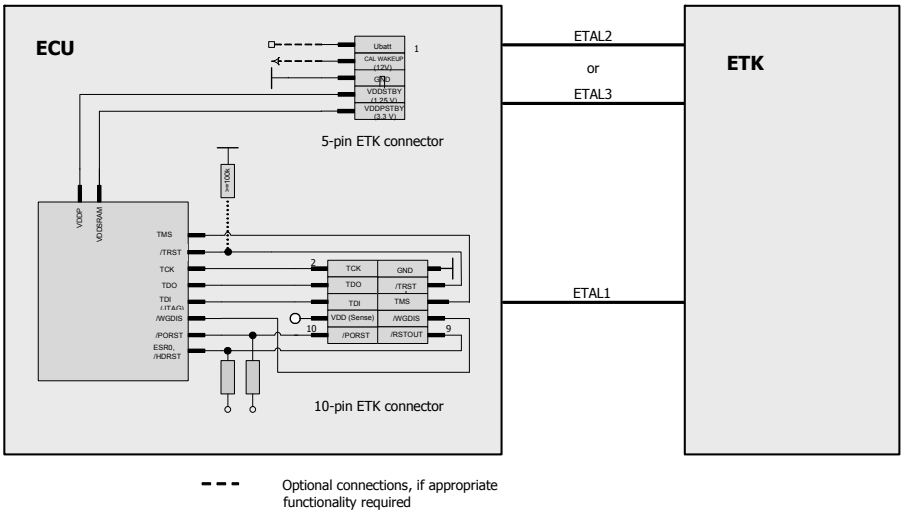

Fig. 3-7 Equivalent Circuitry of the ECU JTAG Interface (ECU)

The ETK-S21.0 supports the JTAG mode for debugger arbitration, test and calibration. The JTAG mode can be configured in the ECU.

3.10 Trigger Modes: Overview

The ETK-S21.0 supports the following trigger modes:

- Pinless triggering
- Timer triggering

The trigger mode "Pinless Triggering" uses an internal Development Trigger Semaphore (DTS) for register triggerring (see also chapter "Pinless Triggering" on page 19).

The trigger mode "Timer Triggering" uses four internal timers of the ETK for triggering (see also chapter "Timer Triggering" on page 20).

3.11 Pinless Triggering

3.11.1 Startup Handshake

The JTAG Data Communication .(JDC) feature is used for the ETK startup handshake. The ECU must ensure that all memory ECC initializations have been completed prior to the start-up handshake.

3.11.2 ETK Trigger Generation

For generating triggers, the ECU software write index in the trigger register "DTS_SEMAPHORE" by writing the index of the trigger in the trigger setting register "DTS_SEMAPHORE".

Note

The selective setting of trigger bits is accomplished in hardware by the microcontroller and requires no Read-Modify-Write sequence by the ECU software.

The first 32 indexes of the trigger setting register "DTS_SEMAPHORE" corresponds to an index in the same position in the trigger register "DTS_SEMAPHORE", each of them corresponding to an ETK hardware trigger.

Note

Only the index 0 to 31 corresponding to the first 32 triggers are supported by ETK-S21.0.

The ETK periodically polls the trigger register "DTS_SEMAPHORE". The ETK sends a corresponding trigger message e.g. to the ES590 which starts acquisition of appropriate measurement data. The polling rate is determined by the fastest measurement raster and is configurable in a 10 µs to 50 ms range with a 50 µs default.

Active bits in trigger register "DTS_SEMAPHORE" are automatically cleared by CPU when register is read by ETK.

3.12 Timer Triggering

The trigger mode "Timer Triggering" uses four internal timers of the ETK for triggering. The trigger period of these timers is configurable by the user.

If trigger mode "Timer Triggering" is used handshake will be not executed. The handshake is operated by an timeout defined in the A2L file.

The time intervals between trigger events are in accordance with the configured timer values. The period of the time trigger has to be defined in the A2L file. The maximum period duration is 1 second.

The timers works in an asynchronous manner to the ECU.

If variables are measured from ECC protected memories the ECU software must ensure the proper initialization of these locations. A time-out period can be set in the ETK configuration to allow for the ECU to initialize the memories before the measurement begins.

3.13 Reset

The requirement for ETK reset mechanism is to ensure that power-up and power-down behavior of ECU is clean and smooth. The ETK-S21.0 normally drives / PORST low during ECU power up or upon INCA request.
The signal /HDRST of the microcontroller is used by the ETK-S21.0 to detect when the ECU is in reset.

The ETK-S21.0 senses the switched ECU power supply. This allows it to detect when the ECU is off and forward this information to INCA. In addition, it allows the ETK to enter the power save mode with the calibration system (ES590/ES591) unplugged.

3.14 Pull CalWakeUp until Startup Handshake

The ETK has the ability to wake up the ECU by applying voltage to the CalWakeUp pin of the ECU connector. This allows 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 pulled until the microcontroller core voltage (VDDP) is high or the pin should be kept on high state until the start-up handshake between ECU and ETK signals the ETK that the ECU has finished its initialisation.

4 Installation

In this chapter, the hardware installation of the ETK-S21.0 is described.

CAUTION!

Some components of the interface board may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.
The board should only be taken from its package, configured, and installed at a work place that is protected against static discharge.

4.1 Connection to the ECU

CAUTION!

Risk of short circuiting the internal signals of the ETK!
When you mount the ETK to the ECU, you must ensure that the screws and washers used will not penetrate the ETK printed circuit board.

For connecting the ETK-S21.0 to the ECU the ETK two adapters are recommended:

- at CON1 adapter ETAL1 and
- at CON2 adapter ETAL2 or ETAL3.

Note

The ETAL1 adapter and the ETAL2/ ETAL3 adapter need to be ordered separately (refer chapter "Ordering Information" on page 55).

The suitable connector SAMTEC bit "TMF-105" should have been populated onto the ECU PCB for adapter ETAL1.

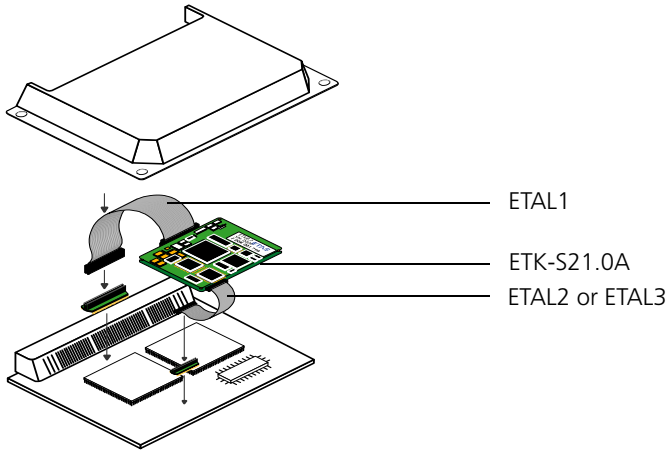

Fig. 4-1 ETK-S21.0 Connection to the ECU

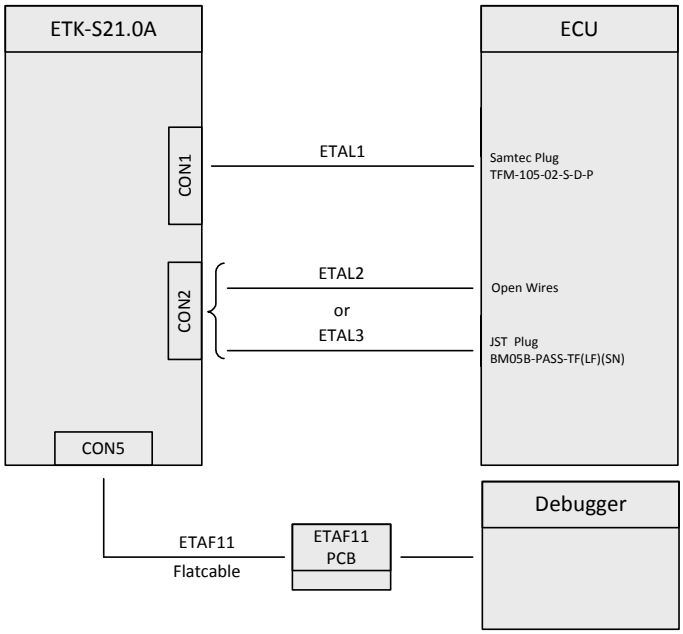

Fig. 4-2 ETK-S21.0 Connection to the ECU and to the Debugger

4.2 Connecting to the Power Supply

Note

The ETK-S21.0 needs a permanent power supply (refer chapter "Power Supply" on page 16). There are different versions to ensure it.

4.2.1 Permanent Power Supply inside ECU available

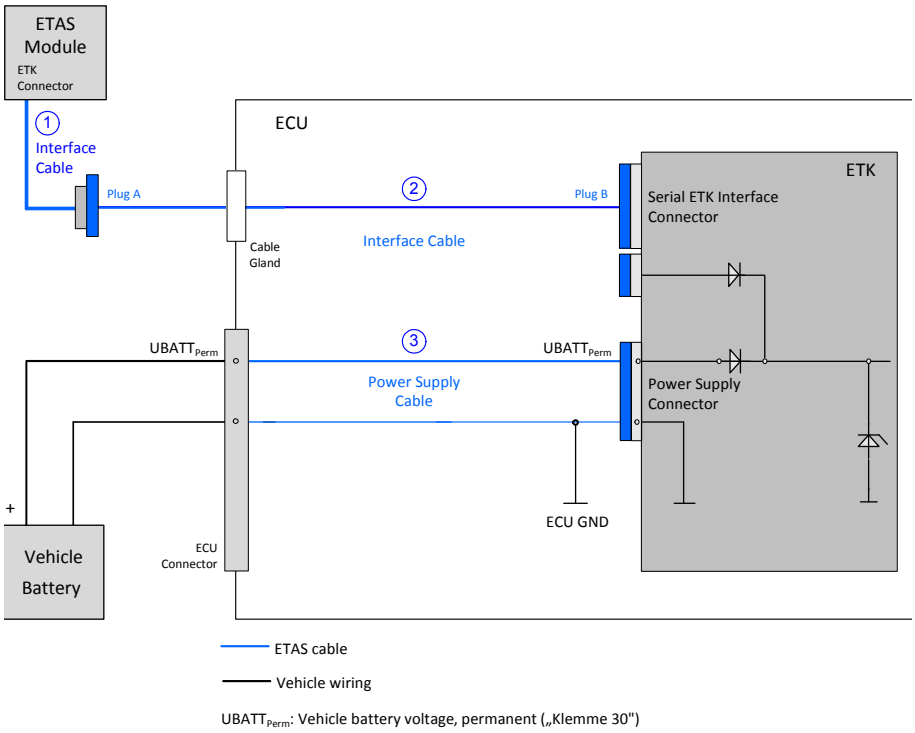

Fig. 4-3 Permanent Power Supply inside ECU available

Cable in Fig. 4-3	Function	Short name
1	Interface cable	CBM150
2	Interface cable	KA55
	Interface cable (screwed in ECU case)	KA54, CBAM200
	Interface cable (used with ETKS_C3 case)	CBAM261
3	Power supply cable (ETK - ECU adapter)	ETAL2, ETAL3, ETV3

4.2.2 Permanent Power Supply inside ECU not available

Wiring with Interface Cable and Power Supply Cable

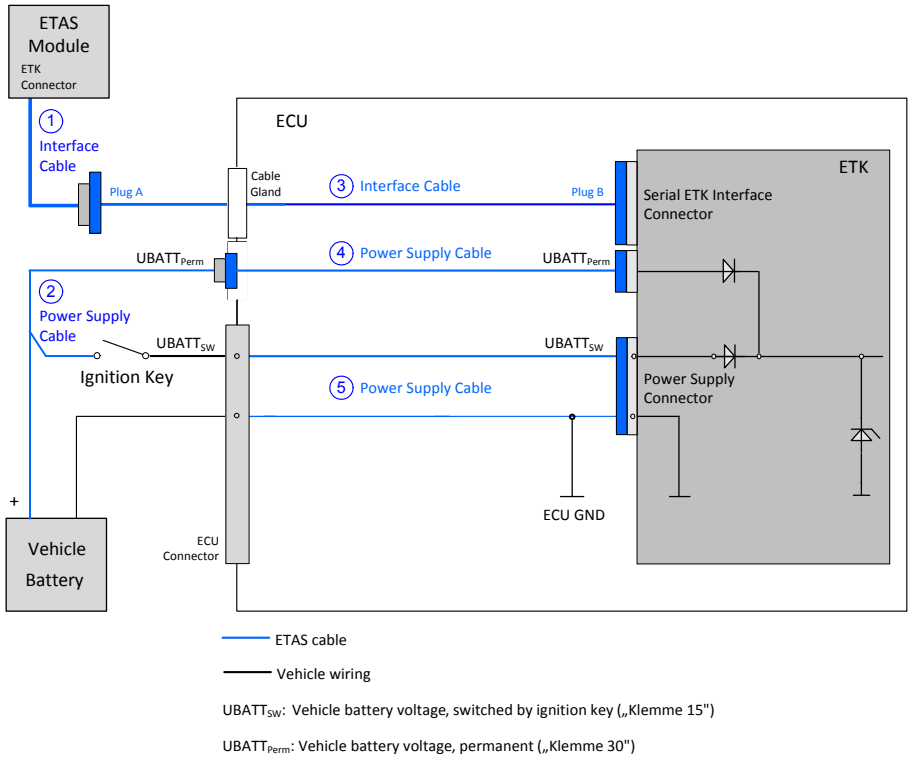

Fig. 4-4 Permanent Power Supply inside ECU not available

Cable in Fig. 4-4	Function	Short name
1	Interface cable	CBM150
2	Power supply cable	K70.1
3	Interface cable	KA55
	Interface cable (screwed in ECU case)	KA54, CBAM200
	Interface cable (used with ETKS_C3 case)	CBAM261
4	Power supply cable (screwed in ECU case)	KA50
5	Power supply cable (ETK - ECU adapter)	ETAL2, ETAL3, ETV3

Wiring with combined Interface and Power Supply Cable

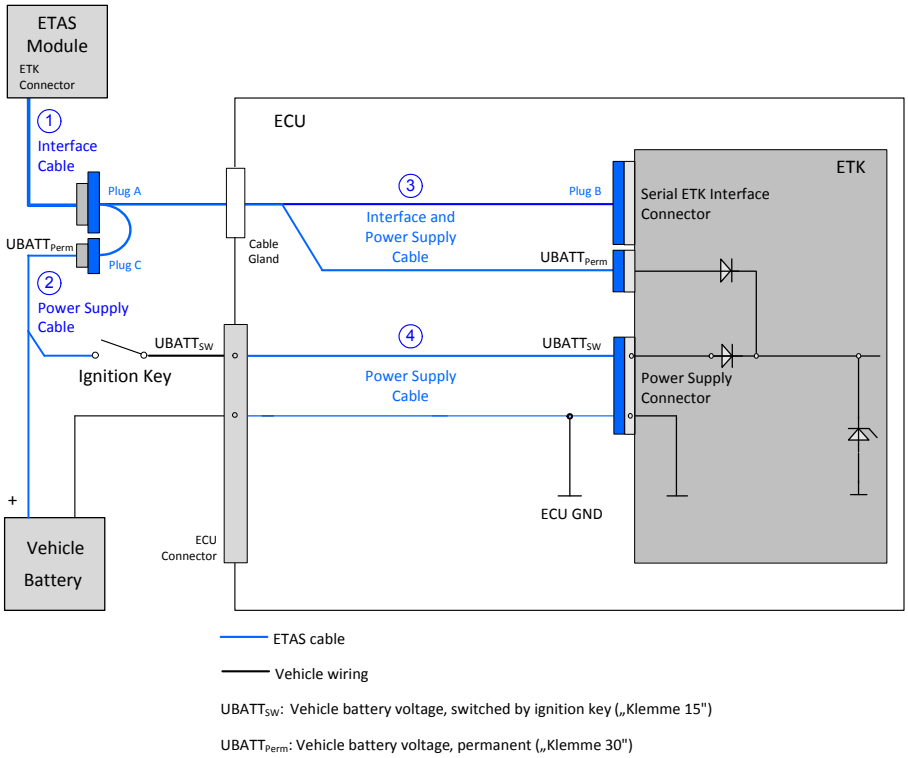

Fig. 4-5 Permanent Power Supply inside ECU not available

Cable in Fig. 4-5	Function	Short name
1	Interface cable	CBM150
2	Power supply cable	K70.1
3	Combined interface and power supply cable	CBAM210, CBAM220
	Combined interface and power supply cable (used with ETKS_C3 case)	CBAM260
4	Power supply cable (ETK - ECU adapter)	ETAL2, ETAL3, ETV3

4.3 Connection to the Debugger

For connecting the ETK-S21.0 to the debugger the ETK adapter ETAF11 (including ETAF11 PCB and ETAF11 flatcable) is required. Its needs to be ordered seperately (refer chapter "Ordering Information" on page 55). A debugger specific cable has to be used to connect the debugger with the ETAF11 PCB.

Note

If automatic debugger detection and watchdog disable features are required an ETAF11 must be used.

For connecting the ETK-S21.0 to the debugger refer to Fig. 4-2 on page 24.

5 ETK Configuration

The "ETK Configuration" chapter describes the ETK-S21.0 hardware configuration.

5.1 Overview

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

Generating a valid configuration data set is supported by the "(X)ETK Configuration Tool" (XCT). The "(X)ETK Configuration Tool" contains information on all available XETKs and ETKs like ETK-S20 and ETK-S21. 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 to the ECU.

   The ECU hardware developer defines the connection of the ETK 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 "(X)ETK Configuration Tool" can create the following output:

1. Direct ETK configuration
2. Storage of the configuration in a data file
3. The corresponding ASAP2 input

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

- Overlay Region definitions
- Memory Segment definitions
- ETK configuration features
- Raster definitions

If this parameters are entered correctly in the corresponding ECU description file, it guarantees that every time the calibration system is started, the ETK is checked for the appropriate configuration. If necessary, the ETK will be configured appropriately to the corresponding project.

5.2 Configuration Parameter

The "(X)ETK Configuration Tool" provides support concerning hardware configuration parameters and their possible values.

They are described for the different ETK types in the help document of the "(X)ETK Configuration Tool".

Starting the "(X)ETK Configuration Tool" help

- Start the "(X)ETK Configuration Tool".

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

  The "(X)ETK Configuration Tool" help window opens.
- Choose **Reference to User Interface** → **(X)ETK Hardware Configuration Parameters**.
- Choose the topic **ETK-S21.0**.

  The topic **ETK-S21.0** contains information about the ETK-S21.0 hardware configuration parameters and their possible values.

6 Technical Data

6.1 System Requirements

6.1.1 ETAS Hardware

VME Hardware: ES1000.2/ES1000.3 with ES1120.2/1120.3 and ES1232 (ES1120.1 is not supported)

Compact Hardware: ES590, ES591, ES592, ES593-D, ES595, ES910 (ES690 is not supported)

6.1.2 Software Support

You need following software versions to support the ETK-S21.0:

Micro-controller	HSP	INCA	ETK Drivers and Tools	ASCET-RP	INTECRIO
MPC5746M-ED	V9.9.1	V7.0	V3.8.0	V6.1.3	V4.2
EMU57EM80xy	V9.9.1	V7.0	V3.8.0	V6.1.3	V4.2
MPC5744K-ED	V10.0.0	V7.0	V3.9.0	V6.1.3	V4.2
EMU574K72xy	V10.0.0	V7.0	V3.9.0	V6.1.3	V4.2
MPC5777M-ED	V10.1	V7.0	V3.10.0	V6.1.3	V4.2
EMU57HM90	V10.1	V7.0	V3.10.0	V6.1.3	V4.2
MPC5746R-ED	V10.3.0	V7.1.3	V3.12.0	V6.1.3	V4.2
PPC57xx_Generic_Cfg1	V10.4.0	V7.1.4	V4.0.0	V6.1.3	V4.2

As of INCA 7.1.4, a generic A2L configuration for several microcontroller families and ETKs is available.

This generic configuration *<[microcontroller family]_Generic_Cfg[index]>* enables measurement, calibration and bypass tasks immediately after the release of a microcontroller. Most likely, an update of the ETAS tool chain is not mandatory after the initial release of an ETK. Please contact the INCA Hotline for this configuration file and additional hints.

Operating the ETK-S21.0 with older software versions is not possible.

EMU57xx: STMicroelectronics microcontroller device

MPC57xx: Freescale microcontroller device

6.2 ETK Firmware (HDC) Update

The ETK firmware update (update of the ETK hardware definition code [HDC]) is supported by the service software HSP instead of ETK Configuration Tool. Removal of ETK or ECU is not necessary. The service software HSP is running on the connected PC.

6.3 Data Emulation Memory and Microcontroller Support

The ETK-S21.0 uses the internal overlay RAM of all in the table listed microcontrollers to emulate data in internal flash.

Microcontroller	Max. RAM [1)]	Standby powered
MPC5746M-ED	1 Mbyte	Yes
EMU57EM80xy	1 Mbyte	Yes
MPC5744K-ED	1 Mbyte	Yes
EMU574K72xy	1 Mbyte	Yes
MPC5746R-ED	1 Mbyte	Yes
MPC5777M-ED	2 Mbyte	Yes
EMU57HM90	1 Mbyte	Yes

[1)]: Max. RAM as working page (kByte)

6.4 Measurement Data Memory

Item	Characteristics
Location	Within the emulation memory when using DISTAB hooks

6.5 Configuration

Item	Characteristics
Configuration	Project-specific configuration for - different microcontrollers or - memory configurations stored in EEPROM
Update	Logic devices updated through software

6.6 Serial ETK Interface for Application System

Item	Characteristics
Transmission speed	100 Mbit/s
Cable length	max. 30 m / 100 ft
Serial Interface	DC decoupling

6.7 Environmental Conditions

Item	Characteristics
Temperature range (operation)	- 40 °C to +110 °C - 40 °F to +230 °F

6.8 Power Supply

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply (car battery)	U_{Batt}	only for 12 V vehicle	5	12	36	V
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	10	28	35	mA
Operating current	I_{Batt}	U_{Batt} = 12 V; no load from ECU; T = 20 °C	50	100	220	mA
Power dissipation	P_{Batt}	U_{Batt} = 12 V; I = 0 mA at pin ECU_SBRAM; T = 20 °C		1.2		W
Power dissipation	P_{Batt}	U_{Batt} = 12 V; I = 500 mA at pin VDDSTBY; I = 80 mA at pin VDDPSTBY; T = 20 °C		2.6		W

6.9 Microcontroller Interface

	Symbol	Condition	Min	Typ	Max	Unit
VDDSTBY Output Voltage	VDDSTBY	max 500 mA load	1.19	1.25	1.31	V
ECU ED-RAM Power Supply Supervision Voltage. 1.3 V nominal	VDDSTBY	Powerfail	1.13			
VDDPSTBY Output Voltage	VDDPSTBY	max 130 mA load	3.14	3.3	3.46	V
CalWakeup Output Voltage	CALL-WAKEUP	U_{Batt} = 6 - 36 V; load = 0 - 50 mA	U_{Batt} - 1V		Ubatt	V
ECU Power Supply Supervision Voltage 3.3 V / 5 V nominal	VDDP	ECU on	2.46	2.56	2.66	V
	VDDP	ECU off	2.29	2.39	2.49	V
	IDDP	Sense current at 5 V			150	µA

6.10 Test Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Reset delay 1 [1)]	t_{Reset1}	U_{Batt} = 12 V VDDP = 0 V ↑ 3.3 V/ 2.5 V without transferring FPGA	29		40	ms
Reset delay 2 [2)]	t_{Reset2}	U_{Batt} = 0 V ↑ 12 V transfer FPGA	360		440	ms

[1)] Delay of ECU reset through ETK without transferring the FPGA (U_{Batt} present, VDDP will be switched on)

[2)] max. delay of ECU reset through ETK (U_{Batt} and VDDP will be switched on)

6.11 JTAG Timing Characteristics

The following diagrams show the timings the ETK-S21.0 can process.

Note

JTAG timing parameters in this chapter refer to the JTAG interface (CON1/ CON6) of the ETK-S21.0. The JTAG wiring to the ECU (ETAF1/ ETAL1) 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.

6.11.1 JTAG Timing Diagram

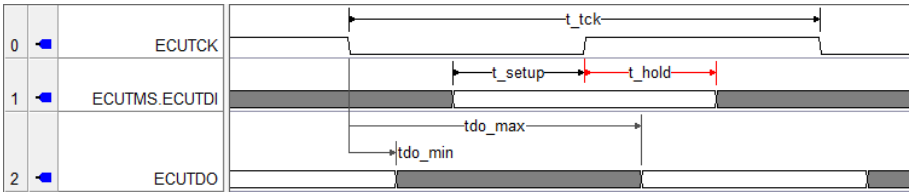

Fig. 6-1 JTAG Timing Diagram

6.11.2 JTAG Timing Parameter

Parameter	Symbol	Value [ns]	Comment
Nexus Clock Period (ETK --> Target)	t_{tck}	50	20 MHz Nexus JTAG Clock Frequency
		33.3	30 MHz Nexus JTAG Clock Frequency
		25	40 MHz Nexus JTAG Clock Frequency
TMS/TDI setup time (ETK --> Target)	t_{setup}	7 (min.)	Minimum 5 ns required for microcontroller
TMS/TDI hold time (ETK --> Target)	t_{hold}	7 (min.)	Minimum 5 ns required for microcontroller
TDO clock-to-out time (Target --> ETK)	t_{do_min}	2.25 (min.)	Minimum 2.25 ns required by microcontroller specification
	t_{do_max}	16 (max)	Minimum 12.5 ns required by microcontroller specification

6.11.3 Debugger Arbitration Timing Diagram

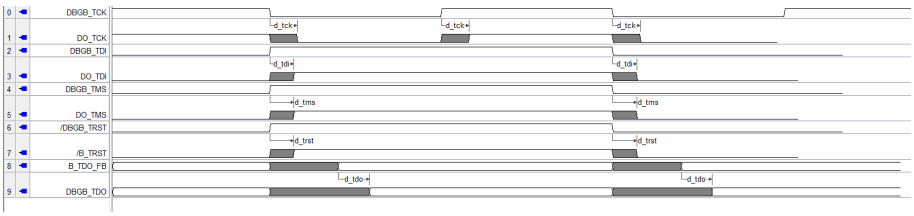

Fig. 6-2 Debugger Arbitration Timing Diagram

6.11.4 Debugger Arbitration Parameter

Parameter	Value [ns]
d_tck (Debugger --> Target)	9
d_tdi (Debugger --> Target)	7
d_tms (Debugger --> Target)	7
d_trst (Debugger --> Target)	7
d_tdo (Target --> Debugger)	9

6.12 Electrical Characteristics

6.12.1 Debugger Interface Connector CON5

Signal	**Pin Type**	**V_{OL} (min) [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 ETK (typ) [pF]** [1]
VREF	XO [2]	-	2.3	3.3	-	-	-	-	-
TCK	I	-	-	-	0.8	2	5.5	+350 [3]/ +220 [4]	8
TMS	I	-	-	-	0.8	2	5.5	+370 [3]/ +200 [4]	15
TDO	XO [2]	0.7	2.3	3.3	-	-	-	-370 [3]/ -195 [4]	15
JCOMP; RSV1; TDI; /BREQ	I	-	-	-	0.8	2	5.5	-350 [3]/ -215 [4]	8
/RESETOUT; RSV2; /BGRANT	XO [2]	0.7	2.3	3.3	-	-	-	-350 [3]/ -215 [4]	12
/STCON	I	-	-	-	0.8	2	3.6	-340 [3]/ -225 [4]	15
WGDIS	I	-	-	-	0.8	2	5.5	+350 [3]/ +220 [4]	8
/PORST	connected to /PORST ECU connector								

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

[1] Adapter cable and Samtec connector not considered; PCB 1 pF/cm
[2] max 12 mA
[3] max
[4] min

6.12.2 ECU Interface Connector CON1

Signal	Pin Type	V_{OL} (min) [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 ETK (typ) [pF][1]
TCK	XO [2]	0.7	2.3	3.3	-	-	-	+3340 [3]/ +2360 [4]	8
TMS	XO [2]	0.7	2.3	3.3	-	-	-	+3340 [3]/ +2360 [4]	20
TDO	I	-	-	-	0.8	2	5.5	-370 [3]/ -195 [4]	18
/JCOMP; TDI	XO [2]	0.7	2.3	3.3	-	-	-	+3320 [3]/ +2380 [4]	15
/RSTOUT	I	-	-	-	0.8	2	5.5	+20 [3]/ -20 [4]	10
/PORST	IXOD [5]	0.7	-	-	0.8	2	5.5	+25 [3]/ -20 [4]	22
WGDIS	XO [2]	0.7	2.3	3.3	-	-	-	+20 [3]/ -20 [4]	10
RSV1	I	-	-	-	0.8	2	5.5	-335 [3]/ -230 [4]	10
AUTODETECT	I	-	-	-	0.8	2	3.6	-540 [3]/ -475 [4]	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] max 12 mA
[3] max
[4] min
[5] max 0.2 A

6.13 Pin Assignment

6.13.1 ECU Interface Connector CON1

Pin	Signal	Direction	Comment
B11	TCK	Output	JTAG Signal
A5	TMS	Output	JTAG Signal
B4	TDO	Input	JTAG Signal
B3	JCOMP	Output	JTAG Signal
A15	/RSTOUT (Sense)	Input	ECU Reset signal for supervision
A16	/PORST	Bidir	ECU Power On Reset signal (open drain) for Reset assertion and supervision
B16	WGDIS	Output	Watchdog disable Signal
B17	RSV1	Input	Reserved Input
B15	VDDP (Sense)	Input	Sense for Switched power supply of ECU (ignition)
B5	TDI	Output	JTAG Signal
B18	Autodetect	Input	Detect ETK Adapter
A1; A2; A3; A4; A7; A8; A9; A10; A12; A13; B1; B2; B7; B8; B12; B13	Do not use		Do not connect this pin
A17; A19; A20; A22; A23; A24; A25; B9; B10; B22; B23; B24; B25	Reserved		Not connected
B6; B14	3.3 V Permanent	Power	Do not connect this pin
A6; A11; A14; A18; A21; B19; B20; B21	GND	Power	Signal Ground

6.13.2 ECU Power Connector CON2

Pin	Signal	Direction	Comment
1	Ubatt	Input	Car Battery
2	Cal_Wakeup	Output	Switch to Ubatt. ECU wake-up signal (for measurement preparation)
3	GND	Input	Power GND
4	VDDSTBY (1.25 V Supply)	Output	Permanent power supply of ECU EDRAM, 1.25 V
5	VDDPSTBY (3.3 V Supply)	Output	Permanent power supply of ECU JTAG interface, 3.3 V

6.13.3 Power Connector CON3

Pin	Signal	Direction	Comment
1	Ubatt	Input	Additional Car Battery Input
2	Reserved		not connected

6.13.4 Debugger Interface Connector CON5

Pin	Signal	Direction	Comment
11	TCK	Input	JTAG Signal
1	TMS	Input	JTAG Signal
3	TDO	Output	JTAG Signal
7	TDI	Input	JTAG Signal
9	JCOMP	Input	JTAG Signal
8	/PORST	Bidir	Directly connected to ECU /PORST
10	BRKOUT	Output	N.C.
12	/STCON	Input	Debugger Detect Signal
16	RSV1	Input	Reserved Input
5	RSV0	Output	N.C.
13	BRKIN	Input	N.C.
14	/BREQ	Input	Bus Request
15	/BGRANT	Output	Bus Grant
2	VREF	Output	Target supply for sensing
4; 6	GND	Power	Signal Ground

6.14 Mechanical Dimensions

The reference measure for all drawings is millimeter.

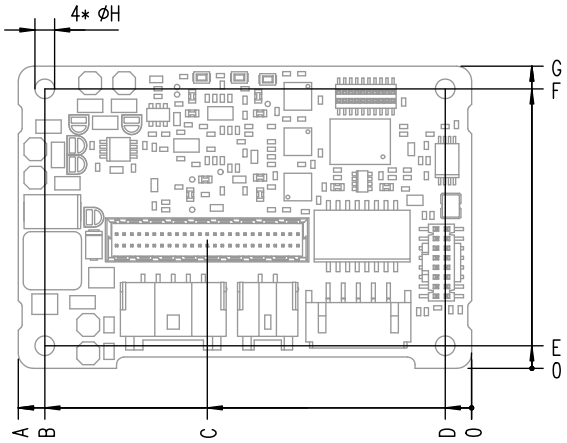

Fig. 6-3 ETK-S21.0 Dimensions - Top View

Item	Dimension [Millimeters]	Tolerance [Millimeters]	Dimension [Inches]	Tolerance [Inches]
A	60.00	+0.2/-0.2	2.362	+0.008/-0.008
B	56.50	+0.1/-0.1	2.224	+0.004/-0.004
C	35.00	+0.2/-0.2	1.380	+0.008/-0.008
D	3.50	+0.1/-0.1	0.138	+0.004/-0.004
E	3.00	+0.1/-0.1	0.118	+0.004/-0.004
F	37.00	+0.1/-0.1	1.457	+0.004/-0.004
G	40.00	+0.2/-0.2	1.575	+0.008/-0.008
H	2.60	+0.1/-0.0	0.102	+0.004/-0.000

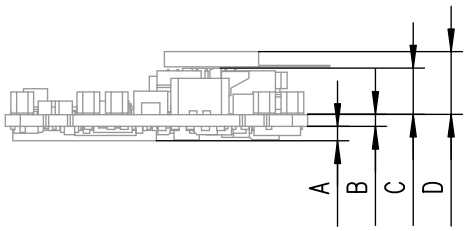

Fig. 6-4 Mechanical Dimensions ETK-S21.0: Microcontroller with Socket Adapter mounted

Item	Dimension [Millimeters]	Tolerance [Millimeters]	Dimension [Inches]	Tolerance [Inches]
A	2.10	+0.1/-0.1	0.083	+0.004/-0.004
B	1.60	+0.16/-0.16	0.063	+0.006/-0.006
C	6.00	+0.1/-0.1	0.236	+0.004/-0.004
D *)	8.00	+0.1/-0.1	0.315	+0.004/-0.004

*) including ETAL1 adapter

7 Cables and Accessories

7.1 Interface Cables

7.1.1 Cable KA54

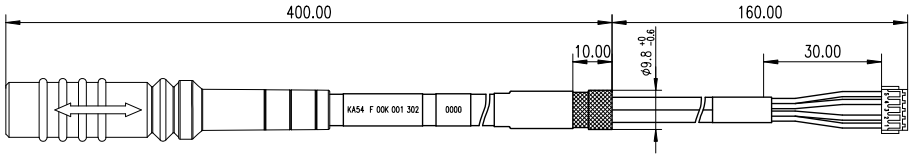

Fig. 7-1 Interface Cable KA54

Note

Cable glands are not included in the delivery. Refer to the cable descriptions for manufacturers and order numbers.

Cable KA54 with PG Cable Gland, Proposal 1

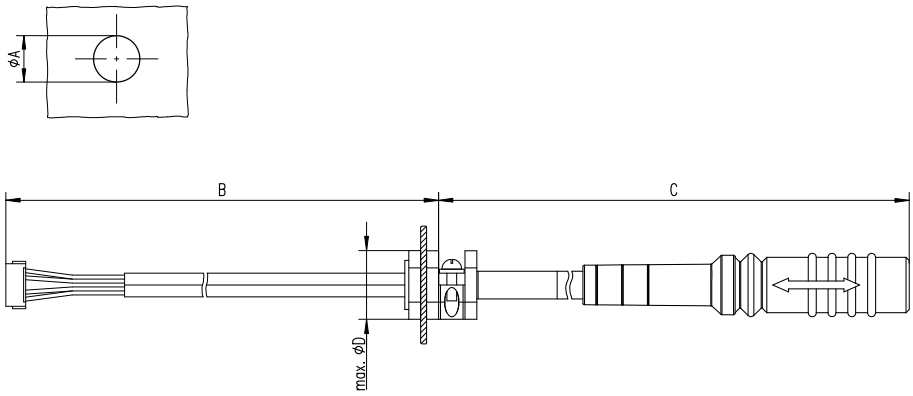

Fig. 7-2 Interface Cable KA54, Proposal 1

Dim	Millimeters	Inches	Dim	Millimeters	Inches
A	12.50	0.492	**C**	400.00	15.748
B	160.00	6.299	**D**	19.00	0.748

Note

*Shield **connected** to ECU housing.*

***SKINDICHT** compact screwing; **Manufacturer**: Lapp; **Description**: SH7; **Order-No.**: 5200 0830*

*Nut for compact screwing; **Manufacturer:** Lapp; **Description:** SM7; **Order-No.:** 5200 3490*

Cable KA54 with PG Cable Gland, Proposal 2

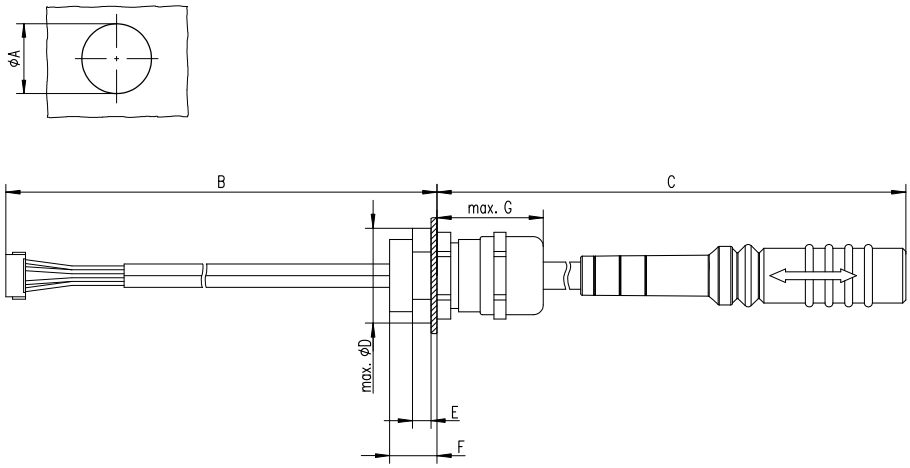

Fig. 7-3 Interface Cable KA54, Proposal 2

Dim	Millimeters	Inches
A	18.80	0.740
B	160.00	6.299
C	400.00	15.748
D	24.25	0.955
E	4.70	0.185
F	12.00	0.472
G	27.00	1.063

Note

*Shield **connected** to ECU housing.*

***SKINTOP** compact screwing; **Manufacturer:** Lapp; **Description:** MS-SC 11 ; **Order-No.:** 5311 2320*

*Nut for compact screwing; **Manufacturer:** Lapp; **Description:** SM-PE 11 ; **Order-No.:** 5210 3220*

7.1.2 Cable KA55

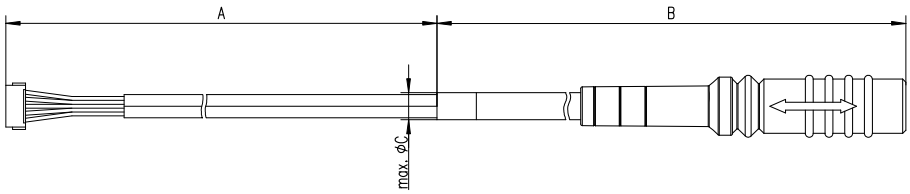

Fig. 7-4 Interface Cable KA55

Dim	Millimeters	Inches
A	160.00	6.299
B	400.00	15.748
C	9.00	0.3543

Note

*Strain relief on ECU cover necessary. Shield **not connected** to ECU housing.*

7.1.3 Cable CBAM200

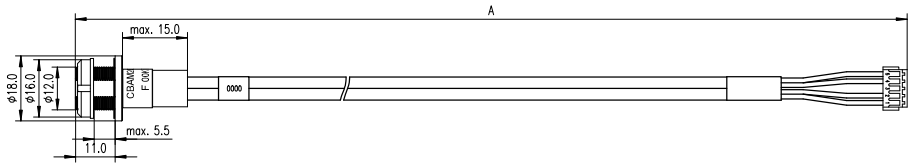

Fig. 7-5 Interface Cable CBAM200-0m38

Dim	Millimeters	Inches
A	380.00	14.96
B	30.00	1.18

Note

Shield connected to ECU housing, allows for ECU housing flush mounting.

7.1.4 Cable CBAM261

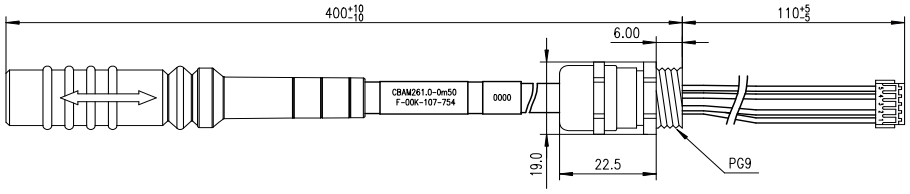

Fig. 7-6 Interface Cable CBAM261

ETK interface cable (100 MBit) for the ETKS_C3 water proofed case with shield pre-mounted in PG9 screwing.

Note

*Shield **connected** to ECU housing.*

7.2 Power Supply Cables

7.2.1 Cable K70.1

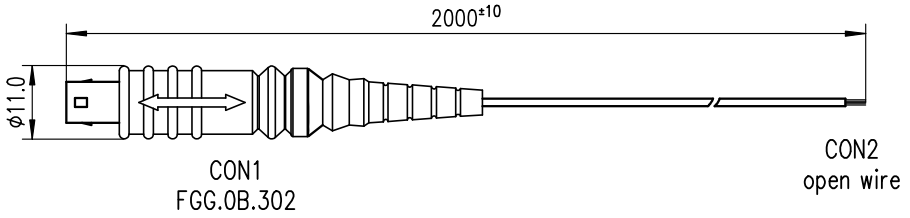

Fig. 7-7 Power Supply Cable K70.1

Dim	Millimeters	Inches
A	2000	78.74

7.2.2 Cable KA50

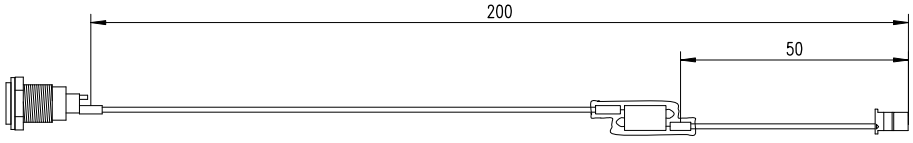

Fig. 7-8 Power Supply Cable KA50

Dim	Millimeters	Inches
A	200	7.87
B	50	1.97

7.2.3 Cable ETV3

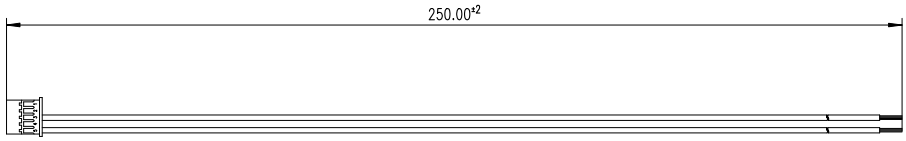

Fig. 7-9 Power Supply Cable ETV3

Dim	Millimeters	Inches
A	250	

7.3 Combined Interface and Power Supply Cables

7.3.1 Cable CBAM210

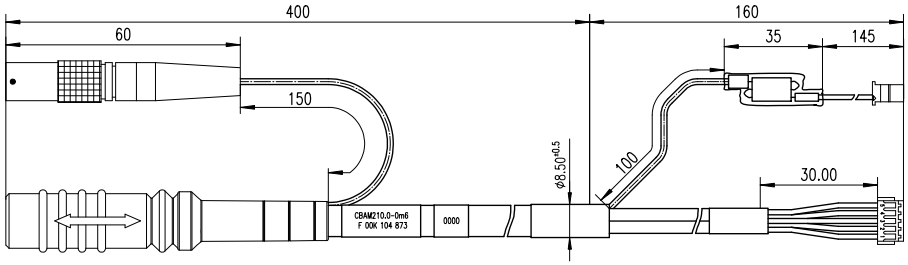

Fig. 7-10 Combined Interface and Power Supply Cable CBAM210

Note

*Shield **not connected** to ECU housing.*

7.3.2 Cable CBAM220

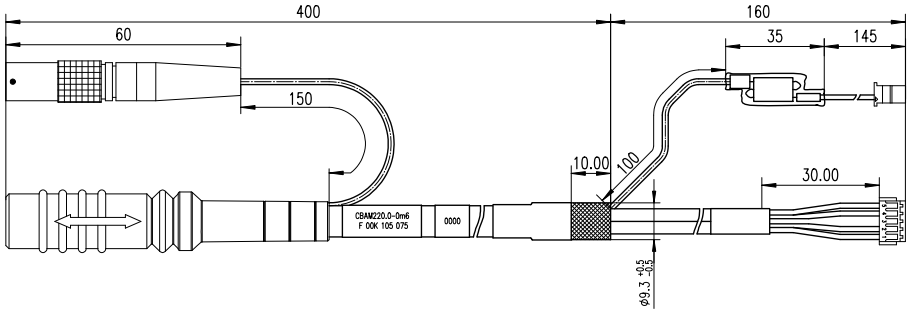

Fig. 7-11 Combined Interface and Power Supply Cable CBAM220

Note

*Shield **connected** to ECU housing.*

7.3.3 Cable CBAM260

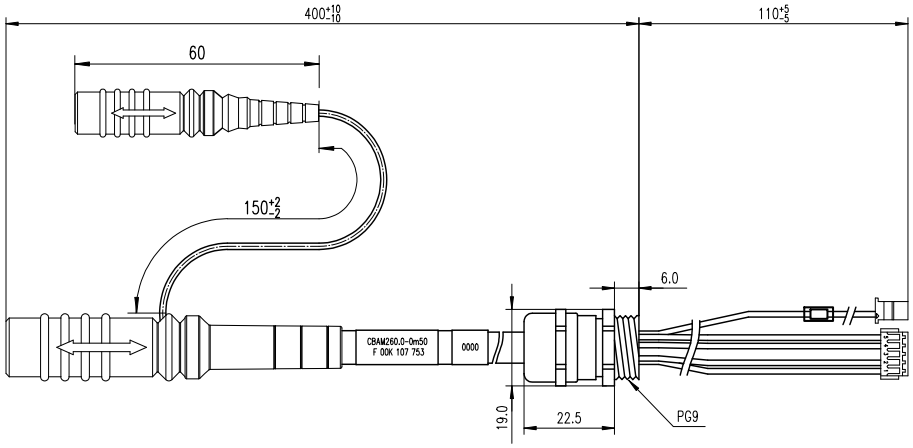

Fig. 7-12 Combined Interface and Power Supply Cable CBAM260

Combined ETK interface and power supply cable (100 Mbit/s) for the ETKS_C3 water proofed case with shield pre-mounted in PG9 screwing.

Note

*Shield **connected** to ECU housing.*

7.4 Adapters

7.4.1 ETK - ECU Adapter ETAL1

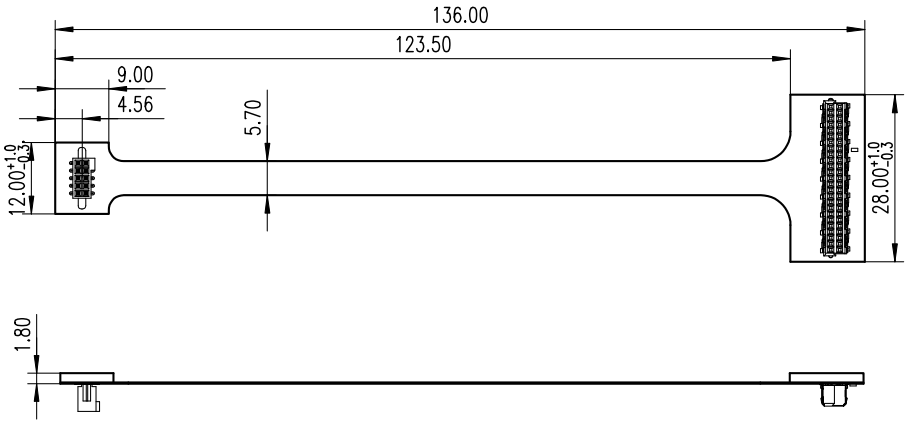

Fig. 7-13 ETK - ECU Adapter ETAL1

In order to be able to use the ETK adapter ETAL1 in the ECU, a 10 pin SAMTEC connector (e.g. TFM-105-02-S-D-P) must be available on the ECU.

7.4.2 ETK - ECU Adapter ETAL2

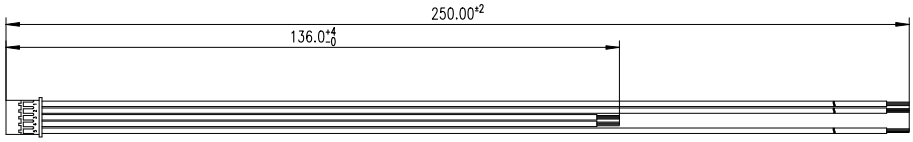

Fig. 7-14 ETK - ECU Adapter ETAL2

The ETAL2 is an open wire adapter to connect the ETK power signals to several points at the ECU PCB. GND and VDDSTBY are shorter to minimize the voltage drop.

7.4.3 ETK - ECU Adapter ETAL3

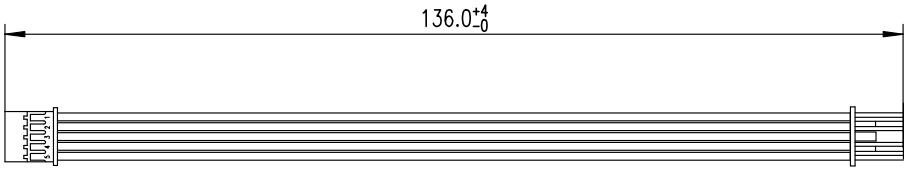

Fig. 7-15 ETK - ECU Adapter ETAL3

The ETAL3 is an 5 pin JST 1:1 cable to adapt ETK-S21.0 power signals to an ECU. To fit with the ETAI3 adapter cable in the ECU an 5 pin JST connector (order number BM05B-PASS-TB(LF)(SN) or a similar type must be installed.

7.4.4 ETK - ECU Adapter ETAL5

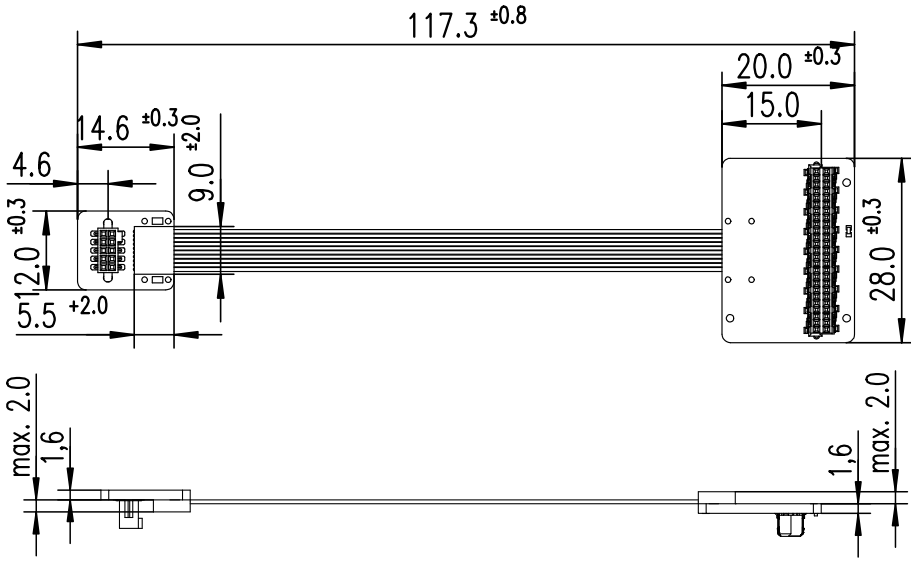

Fig. 7-16 ETK - ECU Adapter ETAL5

7.4.5 ETK - ECU Adapter ETAL6

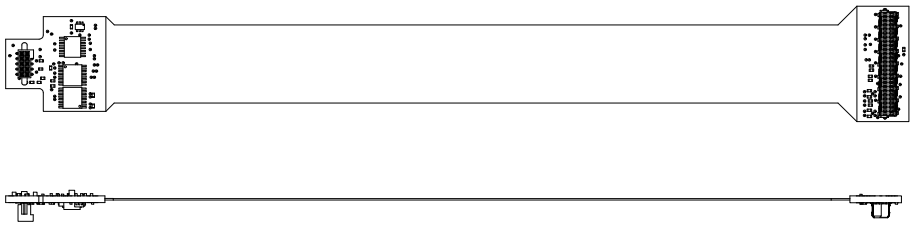

Fig. 7-17 ETK - ECU Adapter ETAL6

7.4.6 Debug Adapter ETAF11

The ETAF11.0 adapts OCDS1 or Unified Automotive Debug Cable for debugger connection. The ETAF11 bottom side is isolated (no parts and vias).

There are two specific applications:

- adapt the ECU-ETK connector to the Debugger
- adapt the ETK-Debugger conector to the Debugger

ETAF11 Flatcable

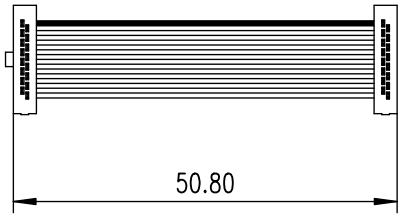

Fig. 7-18 ETAF11 Flatcable

ETAF11 Component Placement

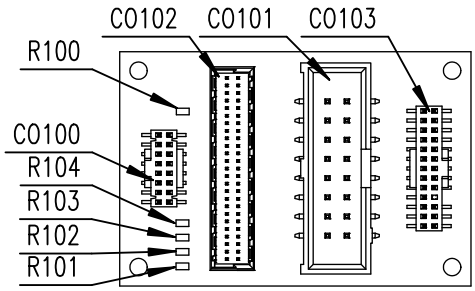

Fig. 7-19 ETAF11 Component Placement

ETAF11 PCB

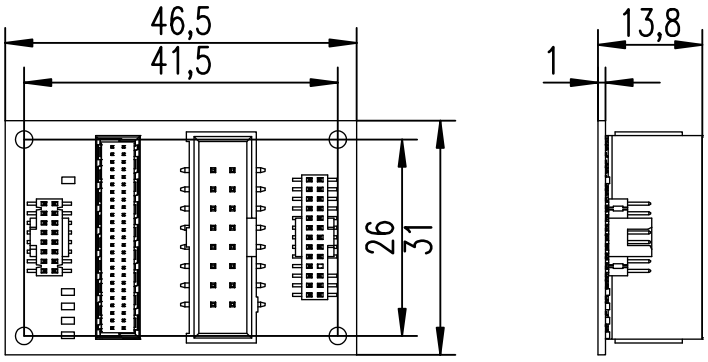

Fig. 7-20 ETAF11 - Mechanical Dimensions and Component Placement

7.5 Water proofed case ETKS_C3

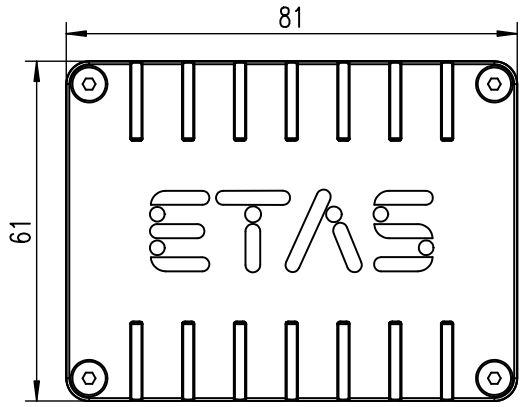

Fig. 7-21 ETKS_C3 Top View

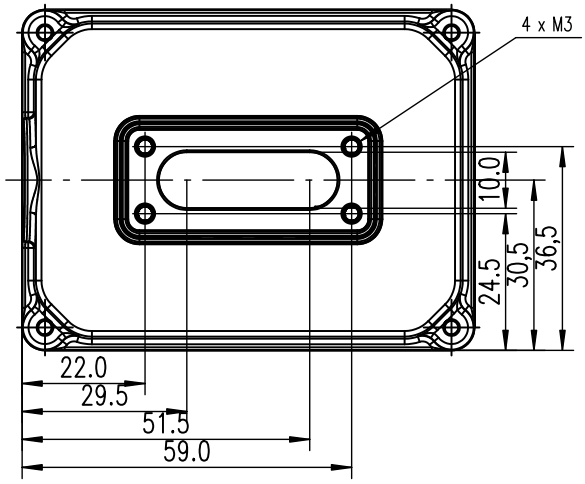

Fig. 7-22 ETKS_C3 Bottom View

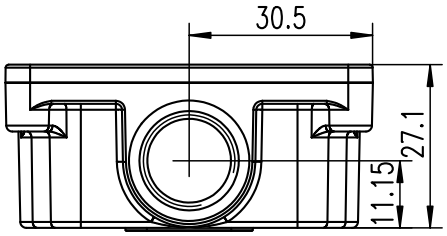

Fig. 7-23 ETKS_C3 Side View

8 Ordering Information

8.1 ETK-S21.0

Type	Order Number	Note
ETK-S21.0A	F00K 107 678	ETK-S21.0 Emulator Probe for the MPC57xx microprocessor family, ECU adaption via 10 SAMTEC 5 pin JST plug

8.2 ETK - ECU Adapter

Order Name	Short Name	Order Number
ETAL1 ETK ECU Adapter, Erni - Samtec (50fc - 10fc), 0m136	ETAL1	F00K 107 679
ETAL2 ETK ECU Adapter with short ED supply and GND lines, JST PAP - open wires (5fc - 2c+3c), 0m136 / 0m25	ETAL2	F00K 107 680
ETAL3 ETK ECU Adapter, JST PAP - JST PAP (5fc - 5fc), 0m136	ETAL3	F00K 107 681
ETAL5 ETK ECU Adapter, Erni - SAMTEC (50fc - 10fc), 0m1	ETAL5	F00K 109 414
ETAL6 ETK ECU LFAST Adapter, Erni - SAMTEC (50fc - 10fc), 0m21	ETAL6	F00K 109 558

8.3 Debug Adapter

Order Name	Short Name	Order Number
Debug Adapter from Debugger to ETK-S2x	ETAF11	F00K 107 682

8.4 Cables

Please contact your local ETAS representative for further cable information.

Note

The cables showed in chapter "Cables and Accessories" on page 45 are not included in the ETK-S21.0 delivery.

Note

The screws for mounting ECU adapter cables are not included in the cable delivery. They need to be ordered separately.

8.4.1 Interface Cables

Order Name	Short Name	Order Number
ETK ECU Adapter Cable, Shield on ECU-Housing, Lemo 1B PHG JST PHR (4fc-5fc), 0m6 [1)]	KA54	F 00K 001 302
ETK ECU Adapter Cable, Lemo 1B PHG JST PHR (4fc-5fc), 0m6 [2)]	KA55	F 00K 001 303
ETK ECU Adapter Cable, Shield on ECU-Housing, Lemo 1B HMG – JST PHG (4fc-5fc), 0m085	CBAM200.2-0m085	F 00K 104 312
ETK ECU Adapter Cable, Shield on ECU-housing, Lemo 1B HMG – JST PHG (4fc-5fc), 0m130	CBAM200-0m130	F 00K 104 852

[1)]: ETK grounded via ECU housing
[2)]: ETK grounded via cable

8.4.2 Combined Interface and Power Supply Cables

Order Name	Short Name	Order Number
ETK ECU Adapter and Power Supply Cable, Lemo 1B PHG - JST PHR (4fc-5fc) / Lemo 0B PHG - open wires (2fc-2c), 0m6	CBAM210-0m6	F 00K 104 873
ETK ECU Adapter and Power Supply Cable, Shield on ECU-Housing, Lemo 1B PHG - JST PHR (4fc-5fc) / Lemo 0B PHG - open wires (2fc-2c), 0m60	CBAM220-0m6	F 00K 105 075
ETK ECU Adapter and Power Supply Cable, pre-assembled into PG9 screwing, shield on ECU-Housing, Lemo 1B PHG - JST PHR (4fc-5fc) / Lemo 0B PHG - JST PAP (2fc-2fc), 0m50	CBAM260-0m5	F 00K 107 753
ETK ECU Adapter Cable, pre-assembled into PG9 screwing, shield on ECU- Housing, Lemo 1B PHG - JST PHR (4fc-5fc), 0m50	CBAM261-0m5	F 00K 107 754

8.4.3 Power Supply Cables

Order Name	Short Name	Order Number
ETK Power Supply Cable, JST PAP – open wires (5fc-2c), 0m25	ETV3	F 00K 109 141
External Power Supply Cable fo ETKs, Lemo 0B - FGG open wires (2fc-1c), 2m	K70.1	F 00K 109 270
ETK Power Supply Cable for External Supply, with Filter Coil, Lemo 0B EGG - open wire (2fc-1c), 0m2	KA50	F 00K 000 940

8.5 Waterproof Case

Order Name	Short Name	Order Number
Water proofed case, designed for ETK-S4.x, ETK-S6.x and ETK-S2x	ETKS_C3	F 00K 107 683

9 ETAS Contact Addresses

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