ETAS

ETK-V1.1
Emulator Probe for VertiCal Base Board of Freescale
MPC55xx / MPC56xx and ST SPC56x
User's Guide

Copyright

Contents

1   About this Manual

This chapter contains information about the following topics:

- „Identification of Safety Notices" on page 6
- „Presentation of Information" on page 6
- „Scope of Supply" on page 7
- „Additional Information" on page 7

1.1   Identification of Safety Notices

The safety notices contained in this manual are identified with the danger symbol shown below:

The safety notices shown below are used for this purpose. They provide notes to extremely important information. Please read this information carefully.

DANGER!

indicates an immediate danger with a high risk of death or serious injury, if not avoided.

WARNING!

indicates a possible danger with moderate risk of death or (serious) injury, if not avoided.

CAUTION!

identifies a hazard with low risk that could result in minor or medium physical injuries or property damages if not avoided.

1.2   Presentation of Information

All activities to be performed by the user are presented in a "Use Case" format. That is, the goal to be accomplished is briefly defined in the heading, and the respective steps required for reaching this goal are then presented in a list. The presentation looks as follows:

Goal definition:

any advance information…

- Step 1

  Any explanation for step 1…

- Step 2

  Any explanation for step 2…

- Step 3

  Any explanation for step 3…

Any concluding comments…

Typographical Conventions

The following typographical conventions are used:

Bold	Labels of the device
Italic	Particularly important text passages

Important notes for the user are presented as follows:

> **<u>Note</u>**
>
> *Important note for the user.*

1.3 Scope of Supply

Prior to the initial commissioning of the module, please check whether the product was delivered with all required components and cables (see chapter "Ordering Information").

Additional cables and adapters can be obtained separately from ETAS. A list of accessories and their order designation is available in this manual and at the ETAS Home Page.

1.4 Additional Information

The configuration instructions for the product can be found in the corresponding software documentation.

2   Basic Safety Notices

This chapter contains information about the following topics:

- "General Safety Information" on page 8
- "Requirements for Users and Duties for Operators" on page 8
- "Intended Use" on page 8
- "Identifications on the Product" on page 11
- "Taking the Product Back and Recycling" on page 12
- "CE marking" on page 12
- "RoHS Conformity" on page 12
- "Declarable Substances" on page 13
- "Use of Open Source Software" on page 13

2.1   General Safety Information

Please observe the Product Safety Notices ("ETAS Safety Notice") and the following safety notices to avoid health issues or damage to the device.

> **Note**
>
> *Carefully read the documentation (Product Safety Advice and this User's Guide) that belongs to the product prior to the startup.*

ETAS GmbH does not assume any liability for damages resulting from improper handling, unintended use or non-observance of the safety precautions.

2.2   Requirements for Users and Duties for Operators

The product may be assembled, operated and maintained only if you have the necessary qualification and experience for this product. Incorrect operation or operation by users without sufficient qualification may lead to injuries or death or property damages.

General Safety at Work

The existing regulations for safety at work and accident prevention must be followed. All applicable regulations and statutes regarding operation must be strictly followed when using this product.

2.3   Intended Use

An ETK is an electronic component that is installed in a vehicle control unit (ECU) to read data from the ECU or write data to the ECU.

Application Area of the Product

This product was developed and approved for automotive applications. For use in other application areas, please contact your ETAS contact partner.

Requirements for Operation

The following requirements are necessary for safe operation of the product:

- Use the product only according to the specifications in the corresponding User's Guide. With any deviating operation, the product safety is no longer ensured.
- Observe the regulations applicable at the operating location concerning electrical safety as well as the laws and regulations concerning work safety!
- Do not apply any voltages to the connections of the product that do not correspond to the specifications of the respective connection.
- Connect only current circuits with safety extra-low voltage in accordance with EN 61140 (degree of protection III) to the connections of the product.
- The power supply for the product must be safely disconnected from the supply voltage. For example, use a car battery or a suitable lab power supply.
- Use only lab power supplies with double protection to the supply system.
- Ensure that the connections of the power supply are easily accessible.
- The module does not have an operating voltage switch.
  - Switch on the product by connecting the power supply cable with the power supply or by switching on the power supply.
  - Switch off the product by disconnecting it from the power supply or by switching off the power supply.

> ⚠ **DANGER!**
>
> **Connect the power cord only with a vehicle battery or with a lab power supply! A connection to power outlets is prohibited.**
> *- Route the power cord in such a way that it is protected against abrasion, damages, deformation and kinking. Do not place any objects on the power cord.*
> *- Never apply force to insert a plug into a socket. Ensure that there is no contamination in and on the connection, that the plug fits the socket, and that you correctly aligned the plugs with the connection.*
> *- Do not use the product in a wet or damp environment.*
> *- Do not use the product in potentially explosive atmospheres.*
> *- Keep the surfaces of the product clean and dry.*

Potential Equalization

> ⚠ **CAUTION!**
>
> **Danger from inadvertent current flow!**
> *Depending on the design, the shield of the Ethernet cables can be connected with the housing of the module. Install the products only on components with the same electrical potential or isolate the products from the components.*

Requirements for the technical State of the Product

The product is designed in accordance with state-of-the-art technology and recognized safety rules. The product may be operated only in a technically flawless condition and according to the intended purpose and with regard to safety and

dangers as stated in the respective product documentation. If the product is not used according to its intended purpose, the protection of the product may be impaired.

Maintenance and Cleaning

The product is maintenance-free. Use a lightly moistened, soft, lint-free cloth for cleaning the product. Ensure that no moisture can enter. Never spray cleaning agents directly onto the product. Do not user any sprays, solvents or abrasive cleaners which could damage the product.

Transport and Installation

> ⚠ **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!**
>
> *During installation and removal, ECU and ETK must be in a de-eenergized state!*

> ⚠ **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!**
>
> ***Differences in case ground potentials can cause high currents to flow through the shields of the cables that connect various system modules.***
> *Ensure that the module mounting surfaces are at the same electrical potential or insulate the modules from their mounting surfaces.*

Cabling

Use exclusively ETAS cables at the connections of the product! Adhere to the maximum permissible cable lengths! Observe the assignment of the cables to the connectors! Detailed information about cabling is located in the ETK User's Guides.

2.4   Identifications on the Product

Fig. 2-1   Adhesive Label (Example: Label for XETK-S14.0)

The following symbols are used for identifications of the product:

Symbol	Description
	The User's Guide must be read prior to the startup of the product!
	Symbol for WEEE, see chapter 2.5 on page 12
	Symbol for CE conformity, see chapter 2.6 on page 12
	Symbol for China RoHS, see chapter 2.7.2 on page 12
	Symbol for China RoHS, see chapter 2.7.2 on page 12
	Symbol for electrostatic sensitive components
XETK-S14.0A	Product designation (example)
F 00K 110 722	Order number of the product (example)
SN: yyxxxxx	Serial number (7-digit)
XXXX/YY	Product version
ZZZZ	Year of manufacture
ETAS GmbH, PO Box 300220, 70442 Stuttgart, Germany	Manufacturer's address

Note

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

2.5   Taking the Product Back and Recycling

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

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

Fig. 2-2   WEEE-Symbol

The WEEE symbol (see Fig. 2-2 on page 12) on the product or its packaging shows that the product must not be disposed of as residual garbage.

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

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

2.6   CE marking

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

2.7   RoHS Conformity

2.7.1   European Union

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

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

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

2.7.2   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.

2.8   Declarable Substances

European Union

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

2.9   Use of Open Source Software

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

3   Introduction

This section contains information about the basic features and applications of the ETK-V1.1 (ETK = Emulator Test Probe), hints to system requirements, and other details.

3.1   Applications

The ETK-V1.1 is an emulator probe especially for the Freescale MPC55xx/ MPC56xx microcontroller family, e.g. MPC5534, MPC5553, MPC5554 and MPC5674F as well as the ST SPC56x family. It is a typical parallel ETK with a 16 bit interface based on the modular Vertical interface concept from Freescale and ETAS.
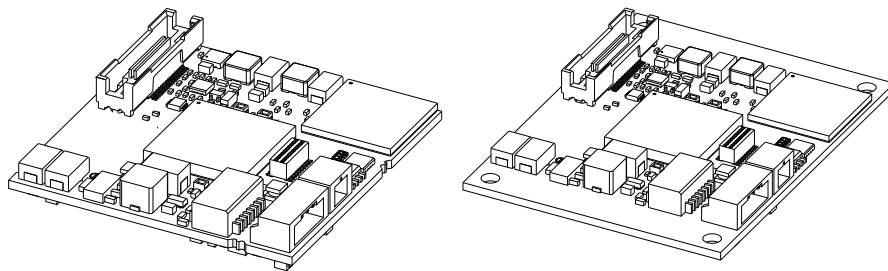
Fig. 3-1   ETK-V1.1 (left: ETK-V1.1A, right: ETK-V1.1B)

Note

The ETK-V1.1 can be shipped in two different mechanical versions (refer to chapter 7.12 on page 47 and to chapter 9.1 on page 56).

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

3.2   Features

- Applicable for an external Freescale 16-bit microcontroller bus
- Supports 16- and 8-bit access to the data emulation memory
- CPU bus interface voltage 2.5 V/ 3.3 V/ auto sense option
- Two pages of data emulation/measurement data memory available, each with 1 MByte
- Permanent storage of emulation data in flash memory
- RAM adaptor mode
- Can drive "Boot configuration" to configure the CPU
- ECU flashing via ETK
- Configurable ETK chip select
- Enable or disable the ETK by ECU software
- Braindead flashing under ProF control

- Serial interface with 100 Mbit/s to the calibration and development system
- Permanent storage of configuration in E²PROM
- Firmware update (programming of the logic device) through software; removal of ETK or ECU not necessary

For more technical data on the ETK-V1.1 consult the chapter "Technical Data" on page 36.

4   Hardware Description

In this chapter, the function blocks of the ETK-V1.1 are explained in detail.

4.1   VertiCal Interface Concept

4.1.1   Overview

The VertiCal interface is a new concept to connect the development ECU with an ETK. It uses a microcontroller in a chip scale package (CSP). This chip is fully compatible to the standard microcontroller.

ETKs with VertiCal interface concept can be designed with smaller mechanical dimensions than ETKs with standard interface.

In the VertiCal interface the microcontroller device of the ETK is not mounted on the ETK board, but on an additional board, the VertiCal base board.
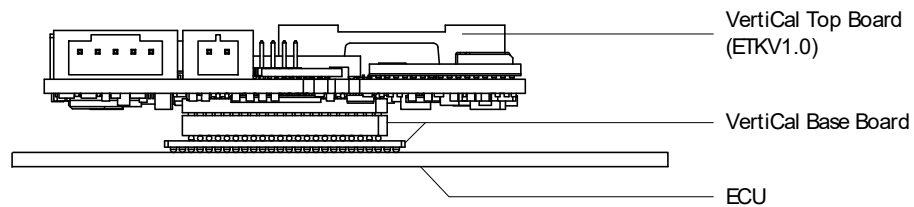
Fig. 4-1   VertiCal Interface Concept (Side View)

The ETK is mechanically "splitted" and its components are mounted on two different boards:

- the VertiCal base board with
  - a microcontroller in chip scale package (CSP)
  - VertiCal connector (provides access to the ECU microcontroller adapter and the VertiCal top board)
- the VertiCal top board (ETK-V1.1) with
  - ETK interface (converts microcontroller signals into tool interface)
  - Nexus interface.

4.1.2   VertiCal Base Board

The printed circuit board (PCB), one of the VertiCal base board components, is used as a base to mount the other components of the VertiCal base board.

Fig. 4-2   VertiCal Base Board

The upper side of the printed circuit board is fitted with

- the microcontroller device (packaged into the specified CSP package),
- the VertiCal connector (standardized 156-way connector).
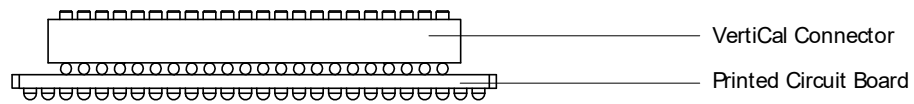
Fig. 4-3   VertiCal Base Board (fitted with Solder Balls, Side View)

The lower side of the printed circuit board has a footprint similar to that used by MPC5500 family devices in standard production packages.

The lower side of the board is fitted either

- with solder ball footprints for direct and permanent soldered connection to the development ECU PCB (see Fig. 4-3) or
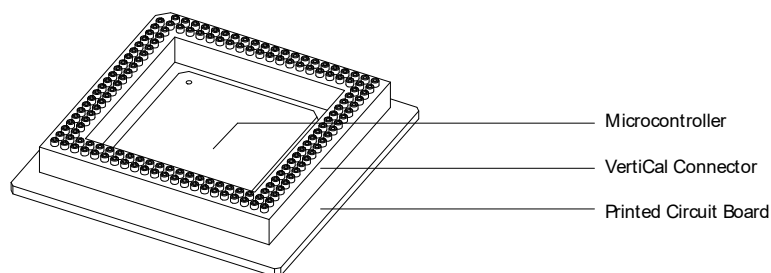- with a "BGA adapter" connector allowing connection and removal from an ECU development PCB which has been fitted with a compatible "BGA receiver" socket (see Fig. 4-4).
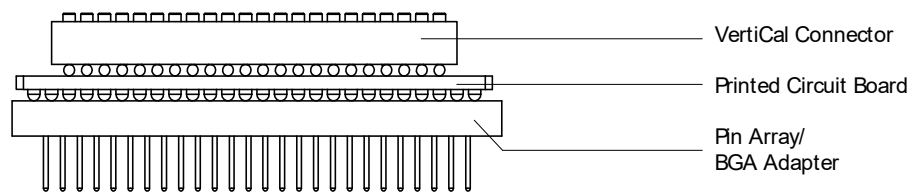
Fig. 4-4   VertiCal Base Board (fitted with Pin Array/ BGA Adapter, Side View)

4.1.3   Typical Usage

The standard ECU microcontroller is replaced by the VertiCal base board with the same dimensions and the same pinout.

The VertiCal base board connects the ECU with the ETK-V1.1.

4.2   Architecture

Fig. 4-5 "ETK-V1.1 Architecture" shows the blockdiagram of the ETK-V1.1.

The microcontroller can read via the VertiCal connector from one of the two pages of the data emulation memory and can write its data directly to the measurement data memory. These two memories (data emulation memory, measurement data memory) are using the same address space and are realized inside the same DPRs.
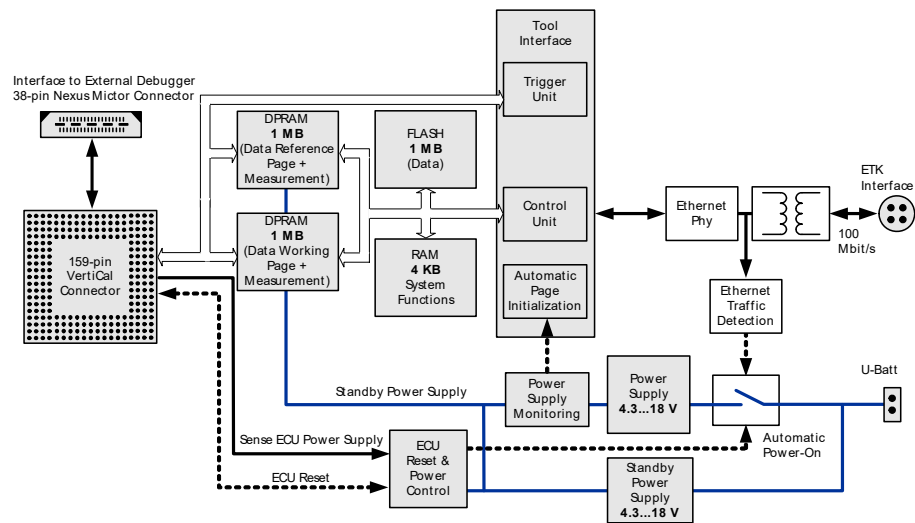
Fig. 4-5   ETK-V1.1 Architecture

Through the lower side of the base printed circuit board the microcontroller can communicate with other external memories or peripheral components of the development ECU.

While the microcontroller accesses the program data (not the program code) 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.

A flash memory is available for permanent storage of the adjusted parameters (program data).

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

The power supply for the ETK-V1.1 is provided by a switch mode power supply, to minimize power dissipation.

4.3   Microcontroller Interface

The whole microcontroller interface to the calibration and development system memory has a 16 bit wide data bus and uses only one chip select for read and write accesses.

The microcontroller can read and write its data directly from or to the data emulation and measurement data memory. Fig. 4-6 and Fig. 4-7 show an overview of a system with external Flash, RAM and additional data emulation and measurement memory (ETK memory). The microcontroller can read and write its data directly from or to the ETK memory. ETK memory chip select (/CS_ETK) can be configured to any of /CS[3:0][1]

[1.] /CS1 is not available for VertiCal base boards with MPC5553 microcontroller.

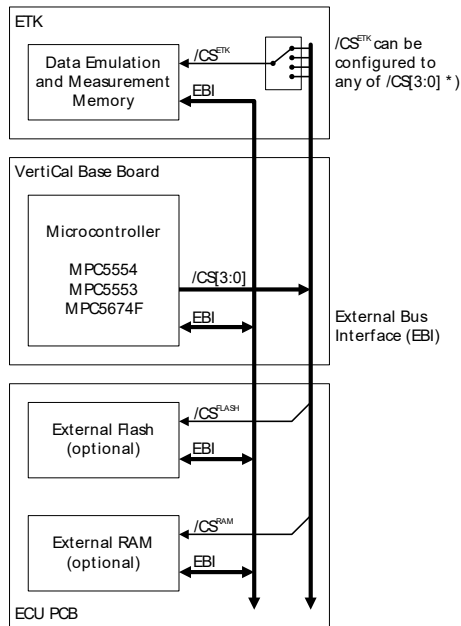**Fig. 4-6**   System with internal and external Memory (MPC5553, MPC5554, MPC5674F)
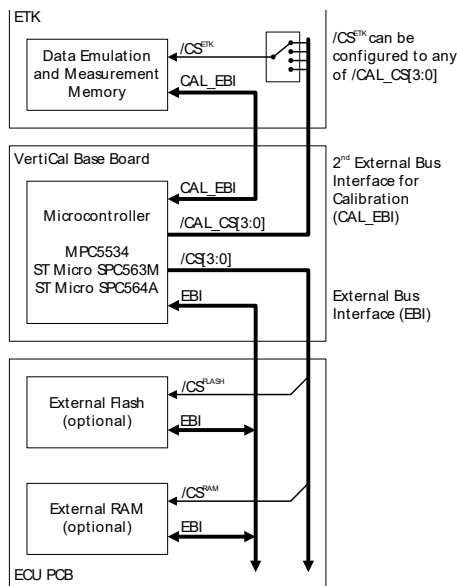

Fig. 4-7   System with internal and external Memory (MPC5534, ST SPC563M, ST SPC564A)

> **Note**
>
> *This chip select must not be used by another external memory (e.g. Flash or RAM).*

The MPC5534 microcontroller provides a separate second external bus interface which is exclusively routed to the VertiCal connector.

4.4   VertiCal Connector

The VertiCal connector interfaces the ETK-V1.1 with the ECU and provides access to the microcontrollers external bus and JTAG/Nexus interface.

4.5   Data Emulation and Data Measurement

The complete data emulation and measurement data memory consists of two 1 MByte pages (Fig. 4-8 "Data Emulation and Measurement Data Memory: 2 Pages with 1 MByte each"). The address range of the data emulation and measurement memory must be 1 MByte and it must be defined at a 1 MByte boundary.

Data emulation memory and measurement data memory must be located inside this 1 MByte address range. The segmentation of this address range between both memory parts is variable.

The measurement data memory and data emulation memory can have variable size and offset addresses inside this fixed address range.

4.5.1   Data Emulation Memory

During operation of the ECU, only program data, not program code, can be modified by using the data emulation memory. Modification of program code could lead to a system crash. The program code is continuously processed out of the internal or external memory.
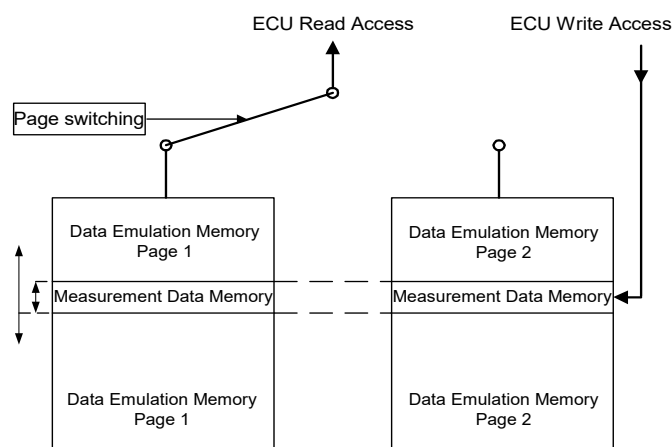
Fig. 4-8   Data Emulation and Measurement Data Memory: 2 Pages with 1 MByte each

Reference data can be stored on one page ("Reference page") while the data on the other page ("Working page") can be modified. It is possible to switch between the two pages during operation through the application software.

4.5.2   Measurement Data Memory

The measurement data memory must be located within the address space of the data emulation and measurement data memory. It can have variable size.

The measured data stored here can be transferred to the calibration and devel-
opment system via the serial ETK interface.

> **Note**
>
> *Because there is no write protection of the data emulation memory possible, it*
> *must be taken care not to override emulation data.*

4.5.3   Triggering of Measurement Data Acquisition

The exact procedure for capturing measured data is explained in the documen-
tation Display Table 13; only the hardware-specific features are mentioned here.
The ECU microcontroller initiates a data acquisition task by writing an arbitrary
value to the trigger address at the so called trigger segment. The software of the
ECU is able to start different data acquisition tasks by writing different trigger
addresses (trigger 1 to trigger 32).

Fig. 4-9   Division of the 256 Byte Trigger Segment

The ETK-V1.1 contains a trigger comparator which can be configured to select a
segment of 256 Byte out of the measurement data memory address space (at a
256 Byte limit). This limit is known as the trigger segment address. Fig. 4-9 "Divi-
sion of the 256 Byte Trigger Segment" shows the configuration of the 256 Byte
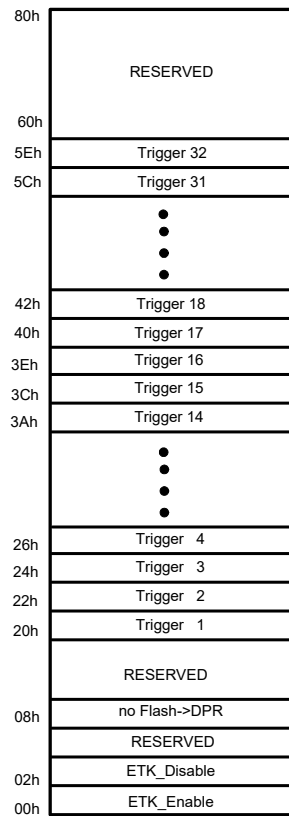trigger segment.

The ETK-V1.1 provides an extended trigger segment with up to 32 direct 16-bit hardware triggers.

Note

The unused address areas within the trigger segment are reserved for future applications and must not be used for other purposes.

For ECU setup and debugging purposes, the ETK-V1.1 can be disabled by writing an arbitrary value to the approriate address (ETK_Disable) in the trigger segment. When disabled, write accesses to the ETK data emulation and measurement memory are not performed (with exception to the trigger segment). The ETK-V1.1 data lines are in tristate mode, even during read accesses. Writing to ETK_Enable enables the ETK.

The disable/enable state is volatile, i.e. after power up, the ETK boots up in the state defined by the "ETK Configuration Tool" (ETK state after power up).

4.5.4 Data Retention in Data Emulation Memory

The data emulation and measurement data memory physically consists of a static Dual Port RAM and is permanently supplied with power from the car battery, to guarantee that data is preserved even when the ignition is switched off. If the ECU with ETK is isolated from the battery, all data will be lost.

4.6 Data Flash Memory

Flash memory is provided on the ETK-V1.1 for permanent storage of emulation data. Users can copy the contents of the data emulation and measurement data memory into the flash memory using the operating software. It is recommended that an updated data set is always stored in the flash memory.

The ETK-V1.1 has a circuit which recognizes and stores power failures. If this circuit detects power failures, and therefore a possible inconsistency of the emulation data, the ETK microcontroller initiates a copying procedure from Flash memory to DPR upon restart. The Flash memory data is copied to both emulation pages. A green LED on the ETK displays the status. The operating software announces the procedure by a message in the status line.

If the ETK-V1.1 is used as a normal RAM it may be useful that this copying procedure is switched off. This can be done by doing a write cycle to a dedicated address in the trigger segment (trigger segment address + 0x010h, see Fig. 4-9 "Division of the 256 Byte Trigger Segment"). The green LED on the ETK will be switched off.

4.7 Code Flash Memory

The program code is not emulated by the ETK-V1.1. The program code is stored in the ECU Flash memory ("on chip" and/or external) and is not modified by the ETK-V1.1. Only the accessible emulation data areas are emulated by the ETK-V1.1. The ECU Flash memory can be programmed with the normal Flash memory programming tools.

4.8   Power Supply
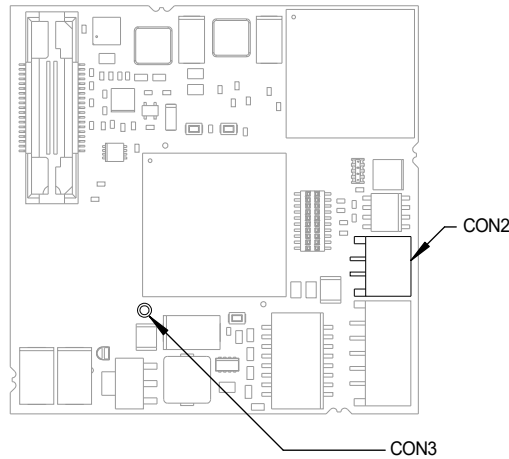
Fig. 4-10   Power Supply Connectors CON2 and CON3

The ETK-V1.1 needs a permanent power supply. It is powered directly from the car battery. The input voltage may vary between 4.3 V and 18 V.

The ECU voltage (VDDE2/3) is monitored by the ETK to recognize whether the ECU is switched on or off. 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 heat build-up. The power supply of the ECU is not affected by the ETK-V1.1. An automatic switch ensures that the power supply of the ETK-V1.1 is automatically switched on and off.
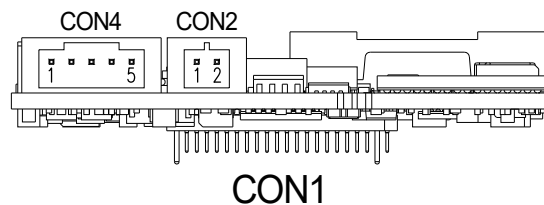
Fig. 4-11   Power Supply Connector CON2

The ETK-V1.1 can be supplied with power through the 2-pin power supply connector CON2.

Additionally the through-hole solder pad CON3 can be used to connect a power supply U_{Batt2}. The power supply on CON3 must use the GND of CON2 (refer to chapter 5.2.2).

Pin CON2	Signal	Description
1	U_{Batt}	Battery Supply Voltage for ETK
2	GND	Ground

4.9   Serial ETK Interface

The serial 100 Mbit/s ETK-V1.1 interface creates the link to the calibration and development system. The ES1232-A plug-in board for the ES1000 high-end system and the ES690 will support the 100 Mbit/s interface.

The interface utilizes a 100Base-TX transmission to achieve a transmission performance of 100 Mbit/s. This interface requires a double-shielded twisted-pair cable (maximum length: 30 m).

It is not possible to use the old interface cable (for 8 Mbit/s) with the new interface in the 100 Mbit/s mode.

CON4
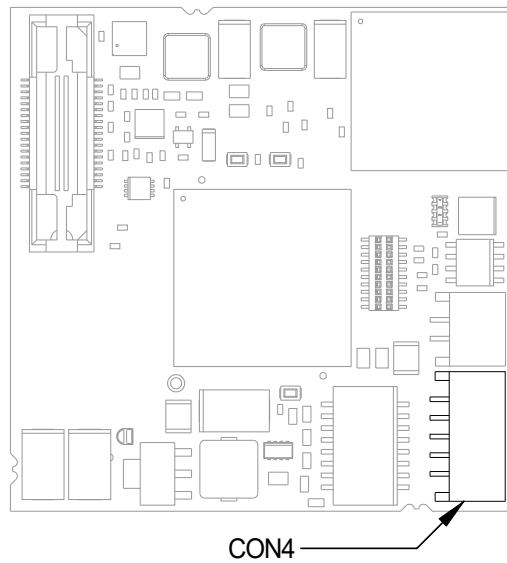
Fig. 4-12   Location of the Serial ETK Interface

4.10 Nexus Interface

The ETK-V1.1 features a JTAG/Nexus debugging interface connector (Mictor 38 pin) as specified in the "The Nexus 5001 Forum - Standard for a Global Embedded Processor Debug Interface, Version 2.0".
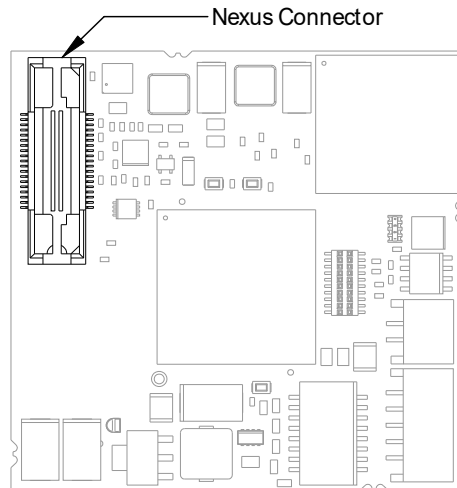
Fig. 4-13   Location of the Nexus Interface

This connector can be used to attach debug and trace tools (e.g. Lauterbach debugger for MPC55xx - LA7610). All JTAG and Mictor interface signals are directly connected to the corresponding signals on the VertiCal socket.
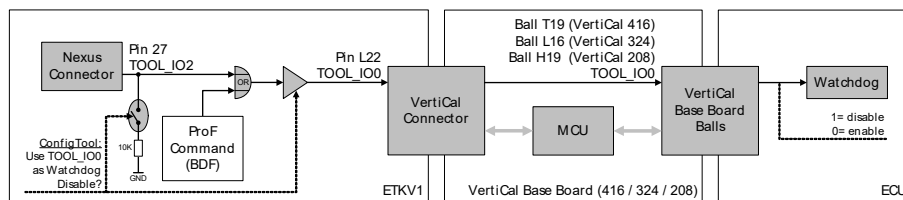
Fig. 4-14   Nexus TOOL_IO2 Signal Flow

The tool vendor specific signal TOOL_IO2 (TDET/WDT) can be used to control and disable an external watchdog circuit on the ECU.

When the configuration parameter "Use TOOL_IO0 as Watchdog Disable?" is set to "Yes" in the ETK Config Tool, the signal is driven from the Nexus connector to the signal TOOL_IO0 (Pin L22) of the VertiCal connector.

This signal is routed directly to a ball of the VertiCal base board, completely bypassing the microcontroller on the VertiCal base board. Additionally, a 10 KOhm pulldown resistor is enabled at the Nexus connector to ensure a valid signal level, even if no debugger is connected to the JTAG/Nexus connector of the ETKV1.0.

> **Note**
>
> *A base board with optional balls (see chapter 9.2) must be assembled when this feature is required.*

4.11   Status LEDs

There are three LEDs displaying the operating status of the ETK-V1.1 (Fig. 4-15 on page 26).
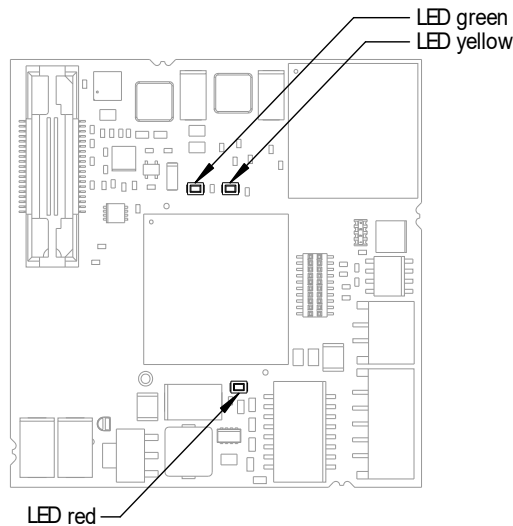
Fig. 4-15   Status LEDs

LED	State	Meaning
Red	On	ETK-V1.1 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-V1.1)
Green	On	When the power supply voltage drops below 3.5 V, the data retention of the DPRs is not longer ensured. As soon as the ETK is switched on again, the content of the ETK-Flash will be copied into reference and working page RAM. The green LED stays lit until the calibration and development system copies new data into RAM.
	Flashing	ETK-V1.1 is in RAM adapter mode. Measurement and calibration are not possible (in all "ETK usage as" modes except "ETK mode initialized")
	Off	Working page may be different to reference page. Working page and reference page may be different to the ETK-Flash.
Yellow	On	100 Mbit/s communication to calibration system established

4.12 Braindead Flashing

Braindead Flashing (BDF) means downloading program code to the non-volatile memory of the ECU (i.e. internal or external flash), regardless of the current memory contents. It is not required that a programming routine is present in the ECU - the memory may be empty or corrupted.

The ETK-V1.1 features Braindead Flashing with two methods:

- BDF via JTAG debug interface is supported for all MPC5500 family micro-controllers. It is recommended as standard method for all new projects.

- BDF via chip select remapping is available for MPC5554 microcontrollers only. It is supported for existing projects for compatibility reasons.

4.12.1 Braindead Flashing via JTAG Debug Interface

This method uses the JTAG interface of the MCU's microcontroller to enable the debug mode of microcontroller and to download a flash programming driver into the microcontroller's internal SRAM.

After download, the microcontroller is given a resume/go command. It executes the programming driver which receives data via the ETK mailbox and programs it into the microcontroller's flash. When flash programming is done, a reset is issued and the microcontroller executes the recently programmed code.

The following steps are sequenced by a ProF control flow:

- Put ECU's microcontroller into reset

- Disable external watchdog timer (optional, see chapter 4.12.3 on page 29)

- Initiate microcontroller's debug mode and halt state

- Initialize the MMU registers to a known state

- Initialize the Internal SRAM

- Download flash programming driver into the internal RAM region of the controller that contains communication and flash routines

- Set Program Counter to point to the beginning of the boot code

- Resume microcontroller code execution by issuing a go/resume command

- Program the new ECU software to the non-volatile memory (internal or external flash)

- Reset the CPU (release JTAG debug interface control)

Note

During BDF via JTAG, debugger access to the ECU's microcontroller is not possible. The ETK-V1.1 logic takes exclusive control over the microcontroller's JTAG interface. A debugger attached to the JTAG/Nexus connector (Mictor 38 pin) will not work until the final reset command is issued from the ProF command flow.

> **Note**
>
> *When flashing an MPC5534 microcontroller, please ensure that your flash pro-gramming driver sets the JTAG access priority to internal SRAM higher than the priority for opcode fetches from internal SRAM (MPC5534 Crossbar register* **XBAR_MPR3***). ETAS suggests to set* **XBAR_MPC3** *to the value* **0x00000213***. When using the default priority for JTAG accesses, the ProF flow may fail as the ETK does not always gets access to the microcontrollers SRAM. See the MPC5534 reference manual section XBAR for details.*

4.12.2   Braindead Flashing via Chip Select Remapping

BDF via chip select remapping is only supported for compatibility reasons. The following limitations apply:

1. Works only with MPC55554 microcontrollers.

2. /CS0 signal must not be used by any memory device on the ECU during BDF.

3. Boot configuration signals BOOTCFG[1:0], RSTCFG and PLLCFG[1..0] must be configured properly (see notes below).

For new projects, BDF via JTAG debug interface (see chapter 4.12.1 on page 27) shall be used instead.

When BDF via chip select remapping is initiated, the ETK-V1.1 forces the ECU's microcontroller into reset. The ETK memory is mapped to chip select signal /CS0. A flash programming driver is downloaded into the ETK memory. The ETK drives the BOOTCFG[1:0] inputs to configure the ECU's microcontroller to external boot. Upon reset is deasserted, the RSTCFG pin is driven low in order to force the microcontroller to accept the external reset configuration presented on BOOTCFG[1:0]. The ECU's microcontroller boots from /CS0 (which is now the ETK chip select) and executes the flash programming driver from the ETK mem-ory. The driver receives data via the ETK mailbox and programs it into the internal microcontroller flash. When flash programming is done, the microcontroller must be forced into reset again and the changes done before must be reverted. When reset is released next time, the microcontroller takes its reset configuration from the ECU and boots from the standard boot memory (i.e. internal Flash) to execute the recently programmed code.

> **Note**
>
> *To avoid bus contentions when the ETK drives the Reset Configuration the BOOTCFG[1:0] bus and the RSTCFG signal of the microcontroller must not be hard-wired to VCC or GND or driven by a strong driver. Instead, the bus must either be driven by a driver that is disabled when the ETK is driving the reset configuration or by weak pull-up or pull-down resistors.*

> **Note**
>
> *As the microcontroller's FMPLL mode selection signals PLLCFG[1:0] are not driven by the ETK-V1.1, they must be driven to appropriate voltage levels by the ECU during brain dead flashing. Refer to the microcontroller's reference manual for details.*

PLLCFG0	PLLCFG1	Clock Mode
0	0	Bypass Mode
0	1	External Reference (Oscillator)
1	0	Crystal Reference
1	1	1:1 Mode

4.12.3 External Watchdog disable

The ETK-V1.1 provides a method to disable an external watchdog circuit on the ECU during braindead flashing.

The watchdog disable control signal in available on the VertiCal connector on signal TOOL_IO0 (Pin L22). This signal is routed directly to a ball of the VertiCal base board, completely bypassing the microcontroller on the VertiCal base board.

When the ETK-V1.1 is configured to use this signal (Configuration parameter "Use VertiCal TOOL_IO0 as Watchdog" set to "Yes"), the signal TOOL_IO0 is set to logic high during brain dead flashing with the appropriate ProF command.

When "Use VertiCal TOOL_IO0 as Watchdog" is set to "No", the TOOL_IO0 pin is not driven by the ETK-V1.1 (high-Z).

See chapter "Nexus Interface" on page 25 for details about the disable watchdog logic circuit.

4.13 Reset

The requirement for ETK reset mechanism is to ensure that power-up and power-down behavior of ECU is clean and smooth and to prevent corruption of data stored in the ETK.

To accomplish this the ETK-V1.1 senses the VDDE2/3 of the ECU. 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 CAL tool (ES590/ES591) unplugged. In addition, the ETK-V1.1 senses the status of the /RESET and /RSTOUT lines to generate a write protect signal for its memory. Finally, the ETK-V1.1 generates a reset signal by pulling /RESET to keep the ECU in reset while the ETK is in power save mode and to prevent the µC from starting until the ETK is ready to work. The ETK is ready to work when it has has finished its initialization after leaving power save mode or after initial power-up. This feature allows it also to reset the ECU under tool control (required for INCA and ProF) and to perform an emergency stop of the ECU in case of ETK failure.

5   Installation

In this chapter, the hardware installation of the ETK-V1.1 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.*

5.1   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 mounting the ETK-V1.1 on the ECU accessories are required:

- a VertiCal base board
- an Advanced Interconnect socket, mounted on the ECU printed circuit board (only when using a VertiCal base board with pin array).

It need to be ordered seperately (refer chapter "Ordering Information" on page 56).

5.1.1   VertiCal Base Board soldered on ECU PCB

VertiCal Top Board (ETKV1.0)

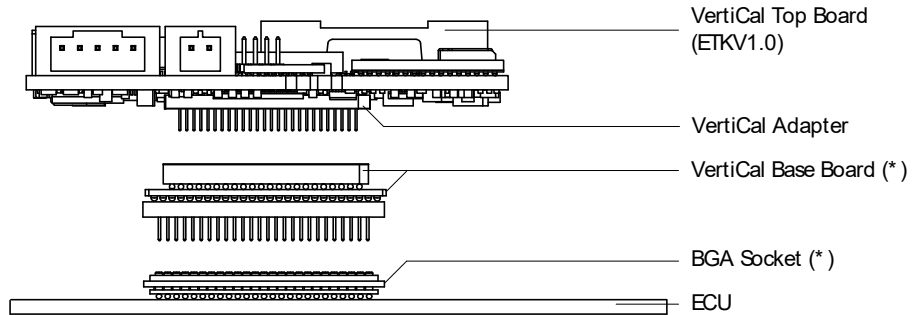VertiCal Adapter

VertiCal Base Board (*)

ECU
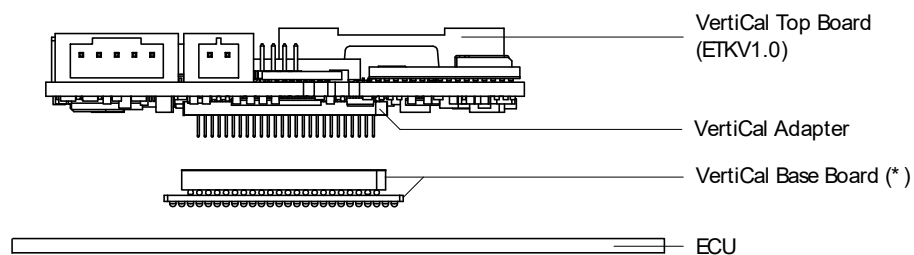
(*) Not delivered with ETKV1.0

Fig. 5-1   ETK-V1.1 soldered Connection to the ECU

The VertiCal base board fitted with solder ball footprints is used for direct and permanent connection to the development ECU (see Fig. 5-1).

5.1.2   VertiCal Base Board mounted on ECU PCB

VertiCal Top Board
(ETKV1.0)

VertiCal Adapter

VertiCal Base Board (*)

BGA Socket (*)

ECU

(*) Not delivered with ETKV1.0

Fig. 5-2   ETK-V1.1 Connection to the ECU with Socket/Adapter

The VertiCal base board fitted with a "BGA adapter" connector allows connection and removal from an ECU development PCB which has been fitted with a compatible "BGA receiver" socket (see Fig. 5-2).

5.2   Connecting to the Power Supply

The ETK-V1.1 needs a permanent power supply (refer chapter "Power Supply" on page 23). There are different versions to ensure it.

5.2.1   Permanent Power Supply inside ECU available
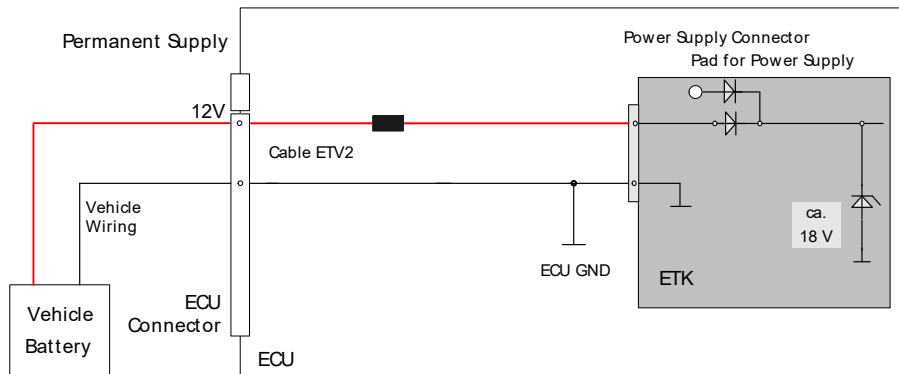
Permanent Supply

Power Supply Connector
Pad for Power Supply

12V

Cable ETV2

Vehicle
Wiring

ca.
18 V

ECU GND   ETK

Vehicle
Battery

ECU
Connector

ECU

Fig. 5-3   Permanent Power Supply inside ECU available

5.2.2   Permanent Power Supply inside ECU not available
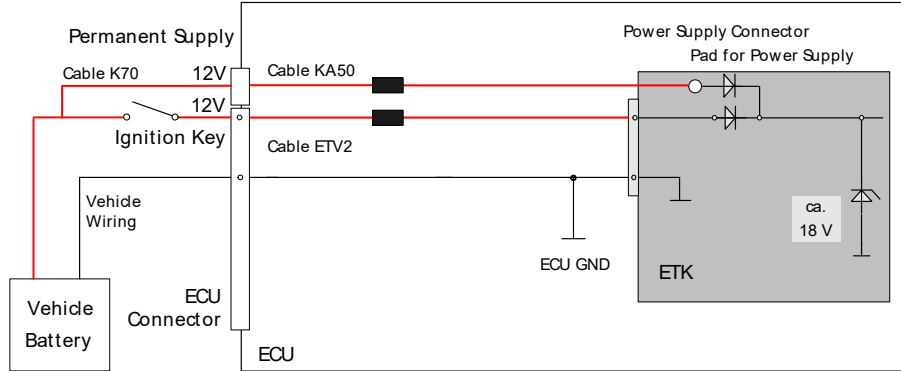

Fig. 5-4   Permanent Power Supply inside ECU not available

5.2.3   Isolated Power Supply inside ECU

The ETK-V1.1 does not require a galvanically isolated power supply. For special applications ETAS offers the isolated power supply ETP2.
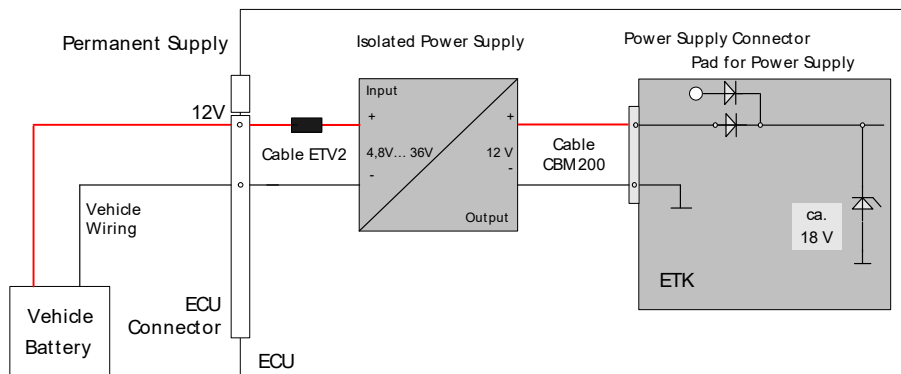

Fig. 5-5   Isolated Power Supply inside ECU

6   ETK Configuration

In this chapter, the configuration parameters of the ETK-V1.1 are described.

6.1   Overview

As already mentioned in previous chapters, some project-specific adjustments are necessary. Configuration data is stored permanently in a serial E²PROM. Generating a valid configuration data set is supported by the "ETK Configuration Tool". The "ETK Configuration Tool" contains information on all available ETKs. The user is supported through a graphical interface.

6.2   ETK Configuration Tool

Generating a valid configuration data set is supported by the "ETK Configuration Tool". The "ETK Configuration Tool" contains information on all available ETKs. 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 "ETK Configuration Tool" can create the following output:

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

The most important outputs are the entries for the ASAP file. The parameter ETK_CFG is created and contains the complete ETK configuration of the ECU interface in hex code. If this parameter is 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.

6.3 Configuration Parameter

The configuration of the ETK-V1.1 is possible with the "ETK Configuration Tool". Not all combinations of parameters make sense. The "ETK Configuration Tool" provides support concerning the configuration parameters. The following is a list with configuration parameters:

- **ETK Usage as** (ETK mode initialized, ETK mode not initialized, RAM adaptor not initialized, RAM adaptor initialized, ETK disabled)

  This feature allows it to use the ETK-V1.1 as a RAM extension. The possible states are

  – ETK mode initialized: The ETK is used in the normal way. When using the ETK together with INCA this mode gets set when an ASAM-2MC configuration is written to the ETK.

  – ETK mode not initialized: Normal ETK operation, but when a power fail occurs no data gets copied from the backup flash into the dual ported RAM pages.

  – RAM adaptor not initialized: The ETK is used as RAM extension.

  – RAM adaptor initialized: The ETK is used as RAM extension. If a power fail occurs the memory from the backup flash gets copied into the RAM.

  – ETK disabled: The ETK is invisible to the ECU.

  The default value is "ETK mode initialized".

  In all "ETK usage as" modes except "ETK mode initialized" the ETK-V1.1 is not in its normal operation mode, i.e. measurement and calibration are not possible.

  Note

  Do not use the ETK-V1.1 together with INCA with any another state than "ETK mode initialized". Always reconfigure the ETK after is was used as RAM adaptor to avoid unexpected behaviour of INCA.

- **Power-On State** (Active/Inactive)

  – Active: The ETK is enabled at ECU power on.

  – Inactive: The ETK is inactive when the ECU power on.

  The default value is "Active".

- **Chip Select for ETK** (/CS0, /CS1, /CS2, /CS3)

  Selects the ETK chip selects.

  The default value is "/CS2".

- **Use VertiCal TOOL_IO0 as Watchdog** (Yes, No)

  TOOL_IO0 (Pin L22) on the VertiCal connector is used as watchdog disable control signal.

  – "Yes": the pin is driven by the ETKV1.0 logic (see chapters 4.10 and 4.12.3 for details).

  – "No": the pin is not driven (high-Z).

  The default value is "No".

- **Boot mode** (Internal, Serial, External Single Master, External Multi Master, Selected by ECU)

  Selects from which memory the ECU boots.

  The default value is "Selected by ECU".

- **Nexus /JTAG bus voltage** (1.8V, 2.5 V, 3.3 V, Auto Detect)

  Selects the Nexus / JTAG bus voltage, or lets the ETK detect the voltage.

  The default value is "Auto Detect".

- **ECU bus voltage** (2.5 V, 3.3 V, Auto Detect)

  Selects the ECU bus voltage, or lets the ETK detect the voltage.

  The default value is "Auto Detect".

7   Technical Data

The "Technical Data" chapter contains a summary of all technical data, pin assignments and hints to system requirements for operating the ETK-V1.1.

7.1   System Requirements

7.1.1   ETAS Hardware

VME Hardware: ES1000.2/ES1000.3 with ES1120 and ES1232

Compact Hardware: ES590, ES591, ES592, ES595, ES910

7.1.2   Software Support

You need following software versions to support the ETK-V1.1:

Microcontroller		HSP	INCA	ETK Drivers and Tools	ASCET-RP	INTECRIO
Freescale	MPC5534	V4.1.0	V5.2.1	n. a.	V5.3.0	V1.1.0
	MPC5553	V4.1.0	V5.2.1	n. a.	V5.3.0	V1.1.0
	MPC5554	V4.1.0	V5.2.1	n. a.	V5.3.0	V1.1.0
	MPC5674F	V4.1.0	V6.2.1	V2.1.8	V6.0.0	V3.1.0
ST	SPC563M	V4.1.0	V6.2.1	V2.1.8	V6.0.0	V3.1.0
	SPC564A	V4.1.0	V6.2.1	V2.1.8	V6.0.0	V3.1.0

Operating the ETK-V1.1 with older software versions is not possible.

7.2   Microcontroller Interface

Item	Characteristics
Supported microcontrollers	VertiCal base board with Freescale MPC5534, MPC5553, MPC5554, MPC5674F
	VertiCal base board with ST SPC563M, SPC564A

7.3   Environmental Conditions

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

7.4 Configuration

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

7.5 Serial ETK Interface

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

7.6 Power Supply

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Permanent power supply (car battery)	U_{Batt}	Vehicle usage [1] [all values ±0%]	4.3	12	18	V
Standby Current	I_{STBY}	U_{Batt} = 12 V; ECU off; T = 20 °C	0.1	10	30	mA
Operating Current	I_{Batt}	U_{Batt} = 12 V; ECU on; T = 20 °C	30	70	100	mA

1) The ETK-V1.1 implements reverse voltage protection in the same range and may be used only with central load dump protection.

7.7 Microcontroller Bus Interface

Parameter	Symbol	Condition	Min	Typ	Max	Unit
ECU Bus Supply Voltage - Power Detect	$U_{VDDE2/3}$	ECU on	1.98			V
		ECU off			1.87	V
ECU Bus Supply Voltage - Level Detect	$U_{VDDE2/3}$	Level Detect: 2.5 V			2.9	V
		Level Detect: 3.3 V	3.0			V
ECU Bus Supply Voltage - Sense Current	$I_{VDDE2/3}$	$U_{VDDE2/3}$ = 2.5 V/ 3.3 V			0.1	mA

7.8 Testcharacteristics

Parameter	Symbol	Condition	Min	Max	Unit
Reset delay 1	t_{Reset1}	U_{Batt} = 12 V $U_{VDDE2/3}$ = 0 V ↑ 3.3 V/ 2.5 V without transferring Flash	29	40	ms
Reset delay 2	t_{Reset2}	U_{Batt} = 12 V $U_{VDDE2/3}$ = 0 V ↑ 3.3 V/ 2.5 V with transferring Flash	129	150	ms
Reset delay 3	t_{Reset3}	U_{Batt}=0 V ↑ 12 V transfer FPGA and Flash	200	400	ms

Note

t_{Reset1}: *Delay of ECU reset through ETK without transferring the Flash*
(U_{Batt} present, $U_{VDDE2/3}$ will be switched on)
t_{Reset2}: *Delay of ECU reset through ETK with transferring the Flash*
(U_{Batt} present, transfer active, $U_{VDDE2/3}$ will be switched on)
t_{Reset3}: *max. delay of ECU reset through ETK*
(U_{Batt} and $U_{VDDE2/3}$ will be switched on)

7.9 Electrical Characteristics

Signal	Pin Type	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][9]
C_ADDR[30...12][1]	I	-	-	0.69	1.61	4.6	-5/+5	10
C_ADDR[30...12][2]	I	-	-	0.9	2.1	4.6	-5/+5	10
C_DATA[1]	I/O	0.55[3]	1.75[5]	0.69	1.61	4.6	-5/+5	10
C_DATA[2]	I/O	0.70[4]	2.30[6]	0.9	2.1	4.6	-5/+5	10
RD_/WR, /OE, /WE[3..0], /CS[3..0]	I	-	-	0.7	1.6	4.1	-10/+10	10
/RESETOUT	I	-	-	0.7	1.7	5.5	-25/+25	25
/RESET	I/OD[7]	-	-	0.7	1.7	5.5	-25/+30	50
BOOTCFG[1..0], /RSTCFG	I/O	2.4[8]	3.3	0.7	1.7	5.5	-25/+25	20

Signal	Pin Type	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][9]
GPIO205	I	-	-	-	-	5.5	-25/+25	20
TDI, TMS, TCK, JCOMP, /EVTI	I	-	-	-	-	4.6	-10/+10	15
TDO, EVTO, MCKO, /RDY, MDO[11..0]	I	-	-	-	-	4.6	-5/+5	15
MDO[15..12]	I	-	-	-	-	4.6	-155/-75	10
TOOLIO[3..0]	I/O	2.4[8]	3.3	0.7	1.7	5.5	-25/+25	20
CLKOUT	-	-	-	-	-	-	-	5
VDDE2/3	-	-	-	-	-	-	-	0.1
VDDE7	-	-	-	-	-	-	-	0.1

[1] at VDDE2/3 = 2.3 V (VDDE2/3 configured on 2.5 V)
[2] at VDDE2/3 = 3.0 V (VDDE2/3 configured on 3.3 V)
[3] at -7 mA load
[4] at -12 mA load
[5] at -9 mA load
[6] at -12 mA load
[7] Open Drain FET; I_{Dmax} = 0.2 A
[8] at -8 mA load
[9] VertiCal plug and Mictor connector not considered; PCB 1 pF/cm

7.10 Switching Characteristics

The following diagrams show the timings the ETK-V1.1 can process.

Note

All timings are measured at a reference level of 1.5 V. Output signals are measured with 10 pF to ground and 50 Ω to 1.5 V.

7.10.1   Read Timing: Data Emulation and Measurement Data DPR
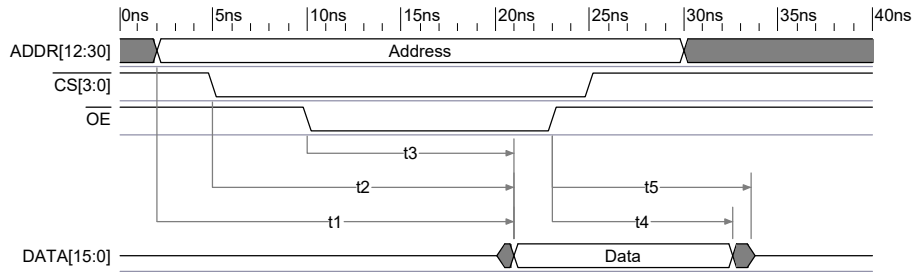
Fig. 7-1   Read Cyle: Data Emulation and Measurement Data DPR

Para.	Description	Min	Max	Unit
t_1	Address access time		19	ns
t_2	Chip select access time		23	ns
t_3	Output enable until valid data is driven to bus		22	ns
t_4	Valid data is driven to bus after output enable inactive	4	10	ns
t_5	Time after read until other device may drive bus		15	ns

7.10.2   Write Timing: Data Emulation and Measurement Data DPR

.
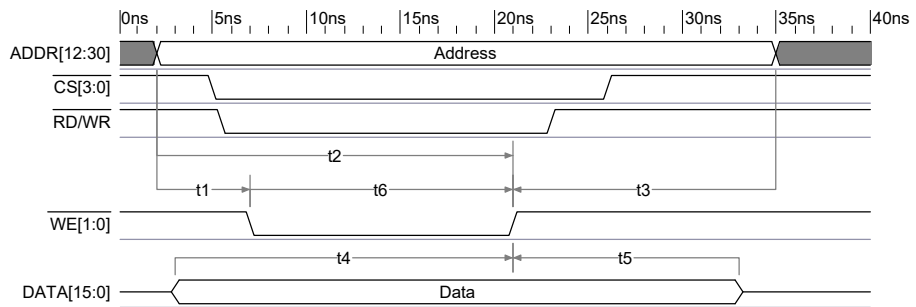
Fig. 7-2   Write Cycle: Data Emulation and Measurement Data DPR

Para.	Description	Min	Max	Unit
t_1	Address valid before write enable becomes active	0		ns
t_2	Address valid before end of write	5		ns
t_3	Address valid after end of write	5		ns
t_4	Data valid before end of write	3		ns
t_5	Data valid after end of write	5		ns
t_6	Write enable pulse width	9		ns

7.11   Pin Assignment

7.11.1   VertiCal Connector
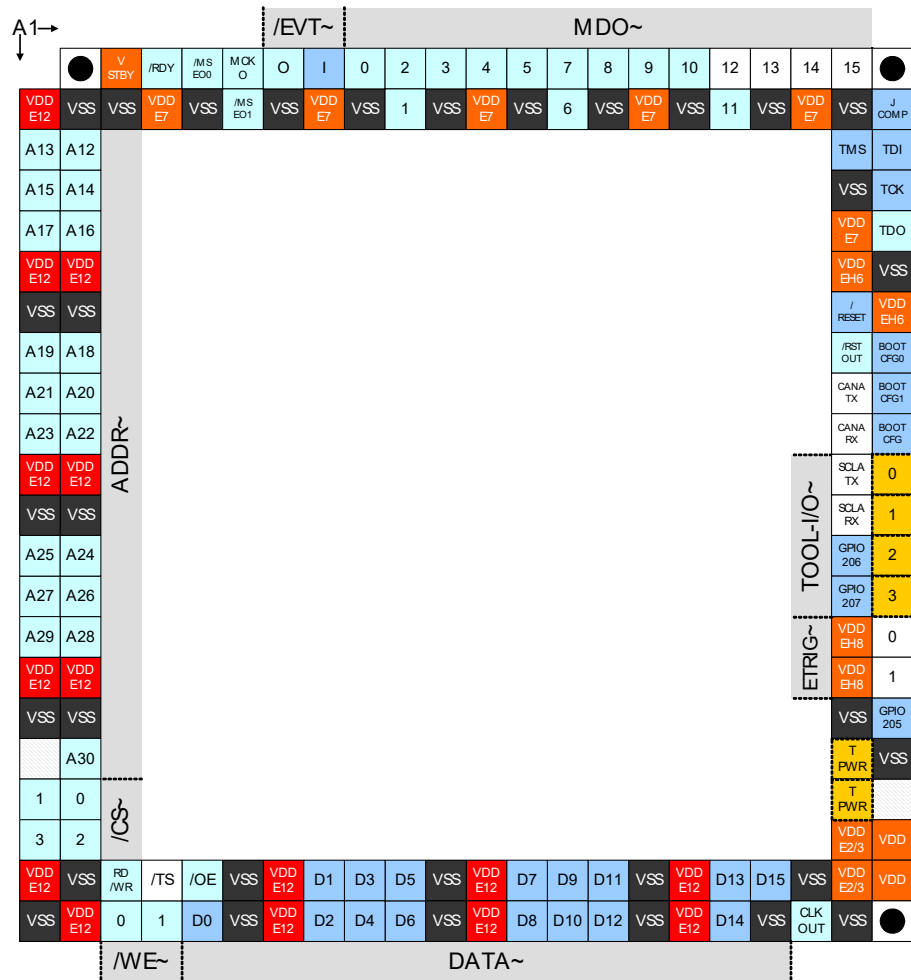
Fig. 7-3   VertiCal Connector

Pin(s)	Name	Description
C2	C_ADDR12	External Address Bus
C1	C_ADDR13	
D2	C_ADDR14	
D1	C_ADDR15	
E2	C_ADDR16	
E1	C_ADDR17	
H2	C_ADDR18	
H1	C_ADDR19	
J2	C_ADDR20	
J1	C_ADDR21	
K2	C_ADDR22	
K1	C_ADDR23	
N2	C_ADDR24	
N1	C_ADDR25	
P2	C_ADDR26	
P1	C_ADDR27	
R2	C_ADDR28	
R1	C_ADDR29	
V2	C_ADDR30	
W2	/C_CS0	Chip Select
W1	/C_CS1	Chip Select
Y2	/C_CS2	Chip Select
Y1	/C_CS3	Chip Select
AA3	C_RD/WR	Read/Write
AB3	/C_WE0	Write/Byte Enable
AB4	/C_WE1	Write/Byte Enable
AA5	/C_OE	Output Enable
AA4	/C_TS [2]	Transfer Start

Pin(s)	Name	Description
AB5	C_DATA0	External Data Bus
AA8	C_DATA1	
AB8	C_DATA2	
AA9	C_DATA3	
AB9	C_DATA4	
AA10	C_DATA5	
AB10	C_DATA6	
AA13	C_DATA7	
AB13	C_DATA8	
AA14	C_DATA9	
AB14	C_DATA10	
AA15	C_DATA11	
AB15	C_DATA12	
AA18	C_DATA13	
AB18	C_DATA14	
AA19	C_DATA15	
A6	MCKO	Nexus Message Clock Out
A9	MDO0	Nexus Message Data Out
B10	MDO1	
A10	MDO2	
A11	MDO3	
A12	MDO4	
A13	MDO5	
B14	MDO6	
A14	MDO7	
A15	MDO8	
A16	MDO9	
A17	MDO10	
B18	MDO11	
A18	MDO12 [1]	Nexus Message Data Out (reserved for future extension)
A19	MDO13 [1]	
A20	MDO14 [1]	
A21	MDO15 [1]	
A5	/MSEO0	Nexus Message Start/End Out
B6	/MSEO1	
A8	/EVTI	Nexus Event Input
A7	/EVTO	Nexus Event Output
A4	/RDY	Nexus Ready Output

Pin(s)	Name	Description
D22	TCK	JTAG Test Clock Input
C21	TMS	JTAG Test Mode Select Input
C22	TDI	JTAG Test Data Input
E22	TDO	JTAG Test Data Output
B22	JCOMP (/TRST)	JTAG Compliance Input (JTAG Reset)
G21	/RESET	External Reset Input/Sense
H21	/RSTOUT	External Reset Output
K22	RSTCFG	Reset Configuration Input
H22	BOOTCFG0	Reset Configuration 0
J22	BOOTCFG1	Reset Configuration 1
U22	GPIO205 [1]	General Purpose I/O
N21	GPIO206 [1]	General Purpose I/O
P21	GPIO207 [1]	General Purpose I/O
J21	CNTXA [2]	CAN A Transmit
K21	CNRXA [2]	CAN A Receive
L21	TXDA [2]	SCI A Transmit
M21	RXDA [2]	SCI A Receive
R22	ETRIG0 [2]	External Trigger 0
T22	ETRIG1 [2]	External Trigger 1
AB20	CLKOUT [1]	System Clock Output
L22	WDT_DIS	External Watchdog Disable (not connected to MCU)
M22	TOOLIO_1 [1]	VertiCal Tool I/O connection to ECU
N22	TOOLIO_2 [1]	
P22	TOOLIO_3 [1]	
B1, F1, F2, L1, L2, T1, T2, AA1, AA7, AA12, AA17, AB2, AB7, AB12, AB17	VDDE12	ECU Calibration Bus Supply Voltage (MPC5534)
A3	VSTBY	Microcontroller Internal RAM Supply Voltage
Y22, AA22	VDD [2]	Microcontroller Internal Logic Supply Voltage
Y21, AA21	VDDE2/3	ECU Bus Supply Voltage
B4, B8, B12, B16, B20, E21	VDDE7	Microcontroller Supply Voltage (Nexus)
F21, G22	VDDEH6 [2]	Microcontroller Supply Voltage (Reset)
R21, T21	VDDEH8 [2]	Microcontroller Supply Voltage (GPIO205 & ETRIG[1:0])
V21, W21	TPWR [2]	Unregulated Battery Voltage Input

Pin(s)	Name	Description
B2, B3, B5, B7, B9, B11, B13, B15, B17, B19, B21, D21, F22, G1, G2, M1, M2, U1, U2, U21, V22, AA2, AA6, AA1, AA16, AA20, AB1, AB6, AB11, AB16, AB19, AB21	VSS	Ground
V1, W22	Reserved [2]	Reserved for future extensions
A2, A22, AB22	Locating Pins	No electrical function

[1] = not used by ETK-V1.1
[2] = not connected

7.11.2   Nexus Connector

Mictor #	ETK-V1.1 (DS)	Comment
1	Reserved	Reserved for future functionality
2	Reserved	Reserved for future functionality
3	Reserved	Reserved for future functionality
4	Reserved	Reserved for future functionality
5	MDO9	
6	CLKOUT	
7	/IRQ3/GPIO212	
8	MDO8	
9	/RESET	
10	/EVTI	
11	TDO	
12	VDDE7	Nexus I/O voltage (sense only)
13	MDO10	
14	/RDY	
15	TCK	
16	MDO7	
17	TMS	
18	MDO6	
19	TDI	
20	MDO5	
21	JCOMP	= /TRST

Mictor #	ETK-V1.1 (DS)	Comment
22	MDO4	
23	MDO11	
24	MDO3	
25	/RSTOUT	
26	MDO2	
27	TDET/WDT	Watchdog disable input and tool detect output
28	MDO1	
29	GPIO207	MCU GPIO
30	MDO0	
31	UBATT	Optional ETK-V1.1 supply voltage, standard supply path is flying lead
32	/EVTO	
33	UBATT	Optional ETK-V1.1 supply voltage, standard supply path is flying lead
34	MCKO	
35	GPIO206	MCU GPIO
36	/MSEO1	
37	VSTBY	Power Supply for MCU internal RAM
38	/MSEO0	

Note

The specification of the NEXUS interface bases on the "Nexus 5001 Forum™ Standard for a Global Embedded Processor Debug Interface". This standard was adapted by Freescale (Freescale Semiconductor Application Note AN 2614).

7.12   Mechanical Dimensions

The reference measure for all drawings is millimeter.

7.12.1   ETK-V1.1-A
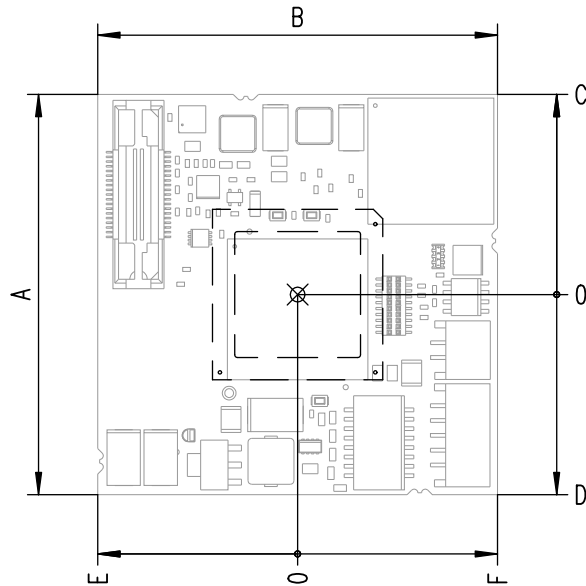
Fig. 7-4   ETK-V1.1-A Dimensions - Top View

Dimension	Millimeters	Inches
A	54.00	2.126
B	54.00	2.126
C	27.00	1.063
D	27.00	1.063
E	27.00	1.063
F	27.00	1.063
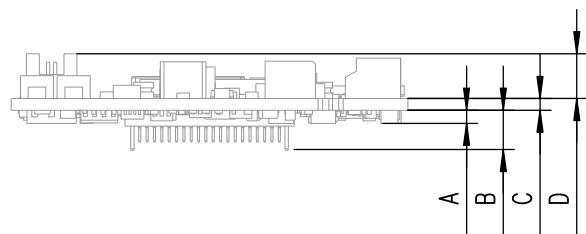
Fig. 7-5   Mechanical Dimensions ETK-V1.1-A: Microcontroller with Socket
Adapter mounted

Dimension	Millimeters	Inches
A	2.00	0.079
B	5.36	0.211
C	1.70	0.067
D	6.10	0.240

7.12.2   ETK-V1.1-B
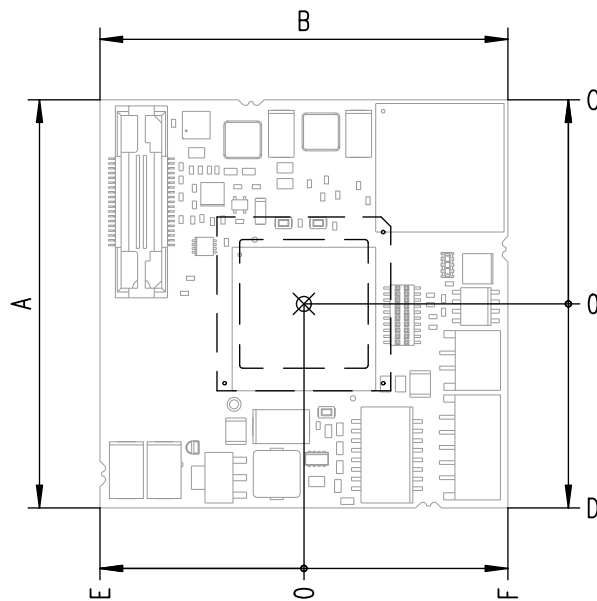
Fig. 7-6   ETK-V1.1-B Dimensions - Top View

Dimension	Millimeters	Inches
A	69.00	2.717
B	54.00	2.126
C	34.50	1.358
D	30.75	1.211
E	30.75	1.211
F	34.50	1.358
G	27.00	1.063
H	23.25	0.915

Dimension	Millimeters	Inches
J	23.25	0.915
K	27.00	1.063
L	3.50	0.138
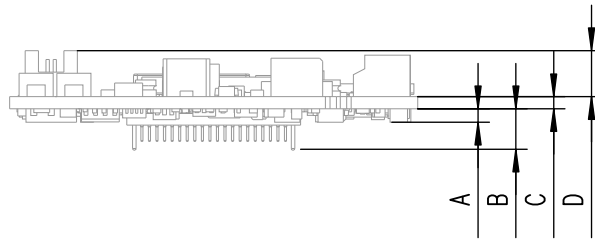
Fig. 7-7   Mechanical Dimensions ETK-V1.1-B: Microcontroller with Socket
Adapter mounted

Dimension	Millimeters	Inches
A	2.00	0.079
B	5.36	0.211
C	1.70	0.067
D	6.10	0.240

8   Cables and Accessories

8.1   Interface Cables

8.1.1   Cable KA54 (with PG Cable Gland)

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

Cable KA54, Proposal 1
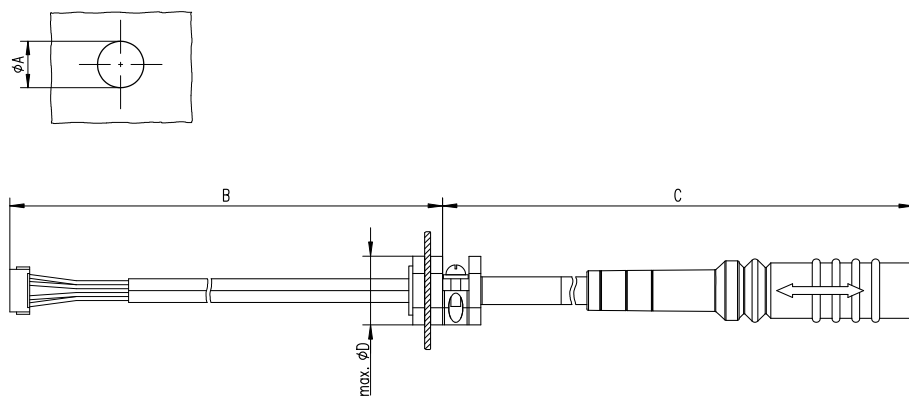
Fig. 8-1   Interface Cable KA54, Proposal 1

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, Proposal 2
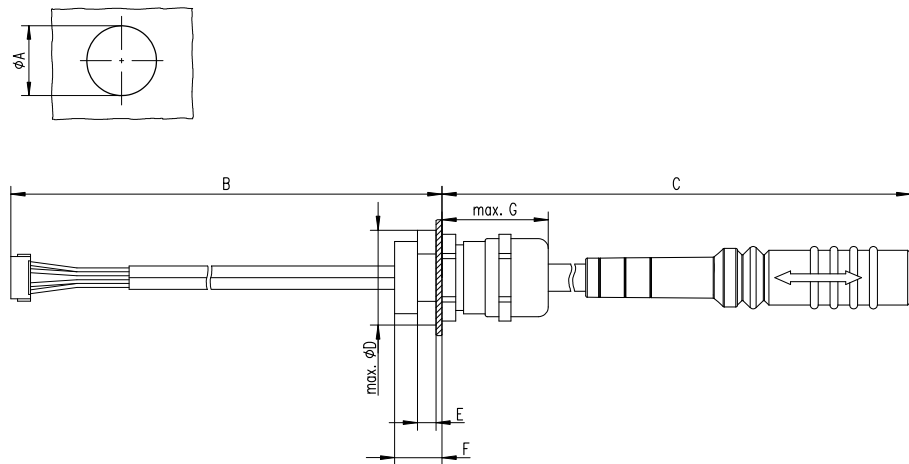
Fig. 8-2   Interface Cable KA54, Proposal 2

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*

8.1.2   Cable KA55
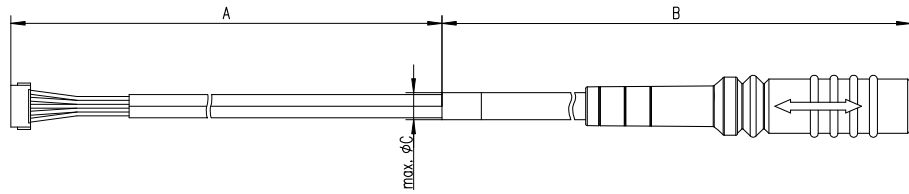
Fig. 8-3   Interface Cable KA55

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.*

8.1.3   Cable CBAM200
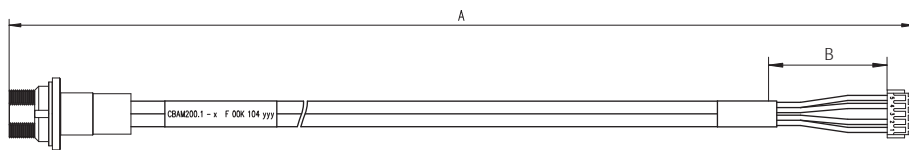
Fig. 8-4   Interface Cable CBAM200-0m38

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.

8.2   Power Supply Cables

8.2.1   Cable ETV
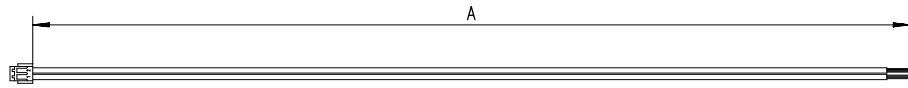
Fig. 8-5   Power Supply Cable ETV

Dim	Millimeters	Inches
A	190.00	7.480

8.2.2   Cable with Filtercoil ETV2
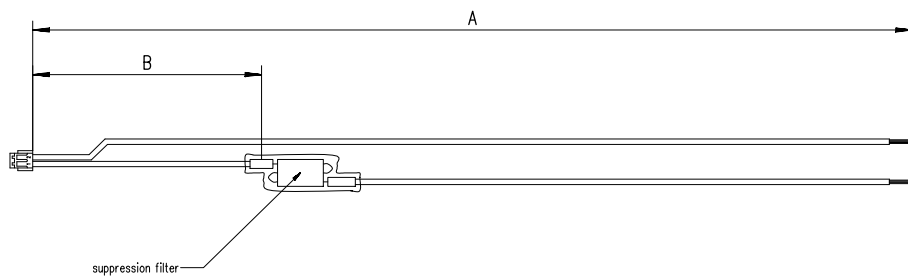
Fig. 8-6   Power Supply Cable with Filtercoil ETV2

Dim	Millimeters	Inches
A	190.00	7.480
B	50.00	1.969

8.2.3   Cable K70
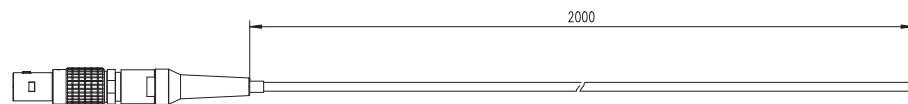
Fig. 8-7   Power Supply Cable K70

Dim	Millimeters	Inches
A	2000	78.74

8.2.4   Cable KA50
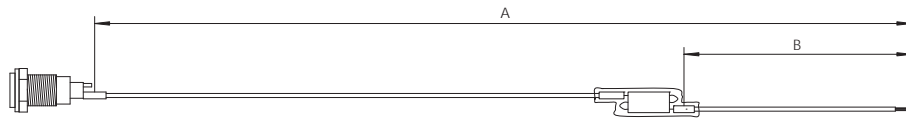
Fig. 8-8   Power Supply Cable KA50

Dim	Millimeters	Inches
A	200	7.87
B	50	1.97

8.2.5   Cable CBM200
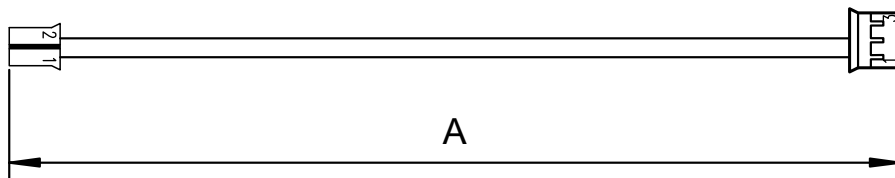
Fig. 8-9   Power Supply Cable CBM200

Dim	Millimeters	Inches
A	100	3.94

8.3   Combined Interface and Power Supply Cables

8.3.1   Cable CBAM210
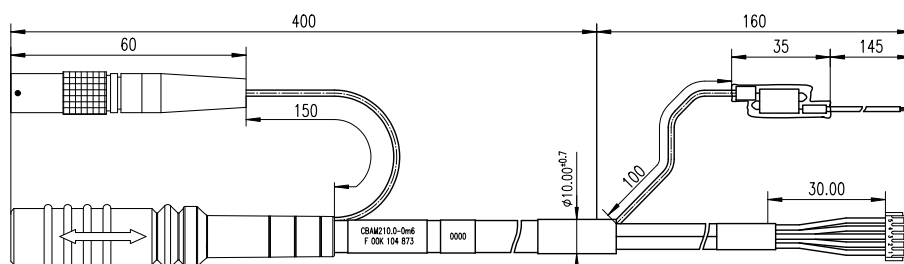
Fig. 8-10   Combined Interface and Power Supply Cable CBAM210

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

8.3.2   Cable CBAM220
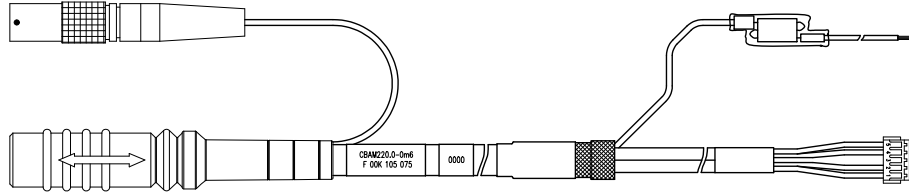
Fig. 8-11   Combined Interface and Power Supply Cable CBAM220

For cable CBAM220 dimensions refer to dimensions of cable CBAM210 in Fig. 8-10.

Note

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

9   Ordering Information

9.1   ETK-V1.1

Type	Order-No.	Note
ETK-V1.1-A	F-00K-107-242	ETK-V1.1 Emulator probe with 1 MByte EMU RAM for VertiCal Base Board of Freescale MPC55xx, MPC56xx and STMicro SPC56x, standard product variant
ETK-V1.1-B	F-00K-107-243	ETK-V1.1 Emulator probe with 1 MByte EMU RAM for VertiCal Base Board of Freescale MPC55xx, MPC56xx and STMicro SPC56x, with additional holes for mounting inside the ECU housing

9.2   VertiCal Base Boards

Note

VertiCal base boards are available from your local Freescale Semiconcuctor distributors.

Part Numbering Codes

Key						
1	**2**	**3**	**4**	**5**	**6**	**7**
XX	VBB		MXX	X	X	X

Key	Description	Option
1	Solder ball material	LF: Lead free SC: Lead (conventional)
2	VertiCal base board	VBB
3	Optional balls	O: Optional balls fitted
4	Fitted device	M34: MPC5534 M53: MPC5553 M54: MPC5554
5	Footprint	Q: 208 footprint U1: 324 footprint W: 416 footprint
6	Lower board side fitting	S: Solder Balls A: Pin Array
7	Shipping	RL: Tape and Reel T: Tray

Example: LFVBBOM54WA

Lead-Free VertiCal base with 416 Pin Array footprint fitted with optional balls
and MPC5554 silicon

> **Note**
>
> *Not all option variants may be available.*

9.3   Sockets ECU - VertiCal Base Board

For mounting a VertiCal base board with pin array, a socket must be used on the
ECU. Please contact your local Freescale Semiconcuctor distributor for further
information on required sockets.

9.4   Isolated Power Supply

Order Name	Short Name	Order Number
Isolated Power Supply Interface for (X)ETK	ETP2	F 00K 104 010

9.5   Cables

> **Note**
>
> *The cables showed in chapter "Cables and Accessories" on page 50 are not
> included in the ETK-V1.1 delivery.*

> **Note**
>
> *The screws for mounting cables KA54 showed in chapter 8.1.1 on page 50 are
> not included in the KA54 delivery. They need to be ordered separately. For
> screw manufacturers and order numbers refer to the description of the cables.*

9.5.1   Interface Cables

Order Name	Short Name	Order Number
ETK ECU Adapter Cable, Shield on ECU-Housing, Lemo 1B PHG JST PHR (4fc-5fc), 0m6	KA54	F 00K 001 302
ETK ECU Adapter Cable, Lemo 1B PHG JST PHR (4fc-5fc), 0m6	KA55	F 00K 001 303

9.5.2   Power Supply Cables

Order Name	Short Name	Order Number
Cable JST PHR - JST PHR (2fc-3fc), 0m1	CBM200-0m1	F 00K 900 052
ETK Power Supply Cable, JST PHR - open wires (2fc-2c) 0m19	ETV	Y 261 A24 446
ETK Power Supply Cable with Filter Coil, JST PHR open wires (2fc-2c), 0m19	ETV2	F 00K 000 593
External Power Supply Cable for ETKs, Lemo 0B FGG - open wires (2fc-1c), 2 m	K70	Y 261 A24 942
ETK Power Supply Cable for External Supply, with Filter Coil, Lemo 0B EGG - sopen wire (2fc-1c), 0m2	KA50	F 00K 000 940

9.5.3   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

10   ETAS Contact Addresses

ETAS HQ

ETAS GmbH

Borsigstraße 24	Phone:	+49 711 3423-0
70469 Stuttgart	Fax:	+49 711 3423-2106
Germany	WWW:	www.etas.com

ETAS Subsidiaries and 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:

ETAS subsidiaries	WWW:	www.etas.com/en/contact.php
ETAS technical support	WWW:	www.etas.com/en/hotlines.php

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