# ETKP4.0
# Emulator Probe for MPC561/562 and MPC563/564

Data Sheet

## Copyright



Document QH110515 R2.0.0 EN TTN

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# 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 following safety instructions to avoid injury to yourself and others as well as damage to the device.

### 1.1.1 Product liability

This manual addresses qualified personnel working in the fields of automobile control unit development and calibration. Specialized knowledge in the areas of measurement and control unit technology is required.

**WARNING!**

*Integrating this module in your system changes the application system's response!*
*If an error or unexpected operation results occur, the response of your application system can be critical!*
*Only use the module in application systems equipped with additional safety or redundant systems (e.g. an emergency or backup system)!*

Liability cannot be accepted for damage caused by non adherence to the instructions contained in this document!

**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.*

### 1.1.2 Correct Use

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

### 1.1.3 Labeling of Safety Instructions

The safety instructions contained in this manual are shown with the standard safety symbol shown in Fig. 1-1.

**Fig. 1-1** Standard Safety 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.*

## 1.2 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 Recycling Program, contact the ETAS sales and service locations (see chapter 10 on page 53).

## 1.3 About This Manual

This manual describes the startup and technical data of the ETKP4.0 Emulator Test Probe.

### 1.3.1 Described ETKP4.0 Hardware State

A sticker on the top of the ETKP4.0 allows you to indicate the ETKP4.0 PCB revision, if you use the hardware state syntax.

| Hardware state syntax | Meaning |
|---|---|
| aabccc/dd | "b" indicates the PCB revision |

**Note**

*This manual describes the ETKP4.0, PCB revision "E" and up.*

### 1.3.2 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 ETKP4.0 Interface Board (ETK = Emulator Test Probe), hints to system requirements for operating the ETKP4.0, and other details.

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

  In the "Hardware Description" chapter the function blocks and the interfaces of the ETKP4.0 are explained in detail.

- **Chapter 4: “Installation”**

  The “Installation” chapter describes the hardware installation of the ETKP4.0.

- **Chapter 5: “ETK Configuration”**

  The “ETK Configuration” chapter includes a description of important ETKP4.0 configuration parameters.

- **Chapter 6: “Technical Data”**

  The “Technical Data” chapter contains a summary of all technical data and pin assignments of the ETKP4.0.

- **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.

- **Chapter 9: “Version History”**

  The “Version History” chapter contains a summary of the changes in this document version.

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

### 1.3.3 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 general safety instructions, information about the basic features and applications of the ETKP4.0 Interface Board (ETK = Emulator Test Probe), hints to system requirements, and delivery scope.

## 2.1 Applications

The ETKP4.0 is an emulator probe especially for the Freescale MPC561/562 and MPC563/564 microcontrollers.

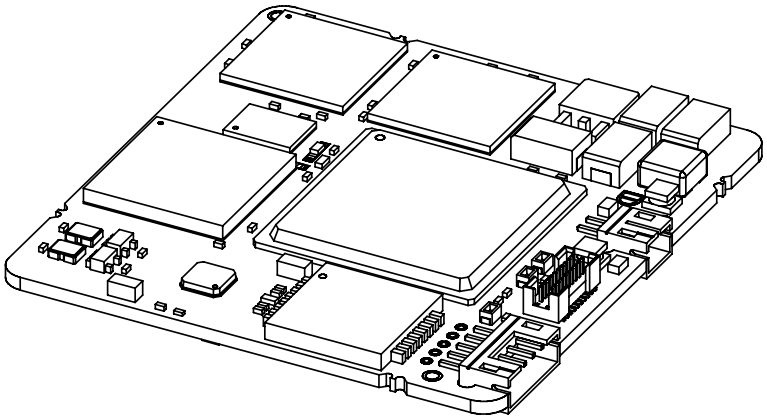


**Fig. 2-1** ETKP4.0

It is compatible with the ETAS calibration and development system interface (e.g. ES690, ES590, ES591 and ES1000.2/ES1000.3 with ES1232-A).

## 2.2 Features

- Applicable for an external Freescale 16-bit microcontroller bus
- Supports 16- and 8-bit access to the data emulation memory
- Usable in 3.3 V systems (no 5 V tolerant data bus)
- Two pages of data emulation/measurement data memory available, each with 256 kByte
- Permanent storage of emulation data in FLASH memory
- Serial interface with 8/100 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.
- Power supply: 4.3 V to 18 V DC
- Temperature range: -40 °C to +110 °C
- Dimensions: ca. 61 mm x 64 mm x 10 mm

For more technical data on the ETKP4.0 and for system requirements refer the chapter "Technical Data" on page 31.

## 2.3 Supported Microcontrollers

| Type | Supported microcontrollers |
|---|---|
| ETKP4.0 | Freescale MPC561/562, MPC563/564 |

# 3 Hardware Description

This section contains information about the basic features and applications of the ETKP4.0 Interface Board (ETK = Emulator Test Probe), hints to system requirements for operating the ETKP4.0, and other details.

## 3.1 Architecture

Fig. 3-1 "ETKP4.0 Architecture" shows the blockdiagram of the ETKP4.0. The connection to the ECU is made by an BGA connector.

The microcontroller can read directly 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.Through the BGA connector the microcontroller can communicate with other external memories or peripheral components too. All microcontroller signals are accessible on the BGA connector.

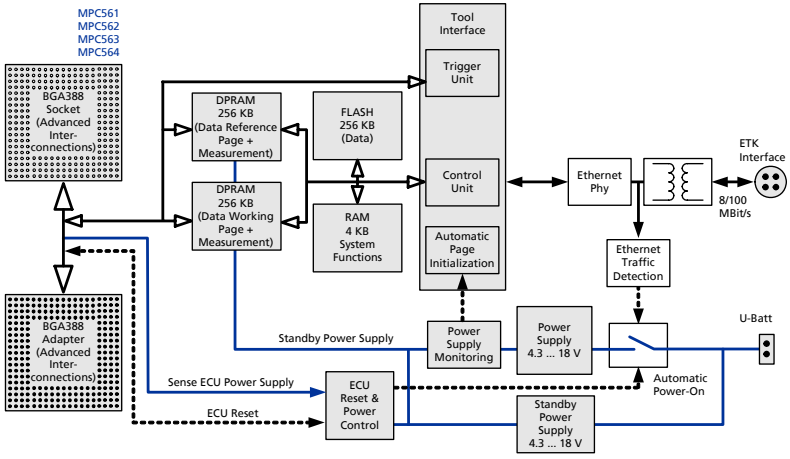



**Fig. 3-1** ETKP4.0 Architecture

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 8/100 Mbit/s serial interface provides communication with the calibration and development system.

The ETKP4.0 uses a 3.3 V technology. The power supply for the ETKP4.0 is provided by a switch mode power supply, to minimize power dissipation.

## 3.2 Microcontroller Interface

The whole microcontroller interface to the calibration and development system memories 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. 3-2 "System with internal and external Memory" shows an overview of the system with "on chip" Flash and RAM and external Flash and RAM memory.

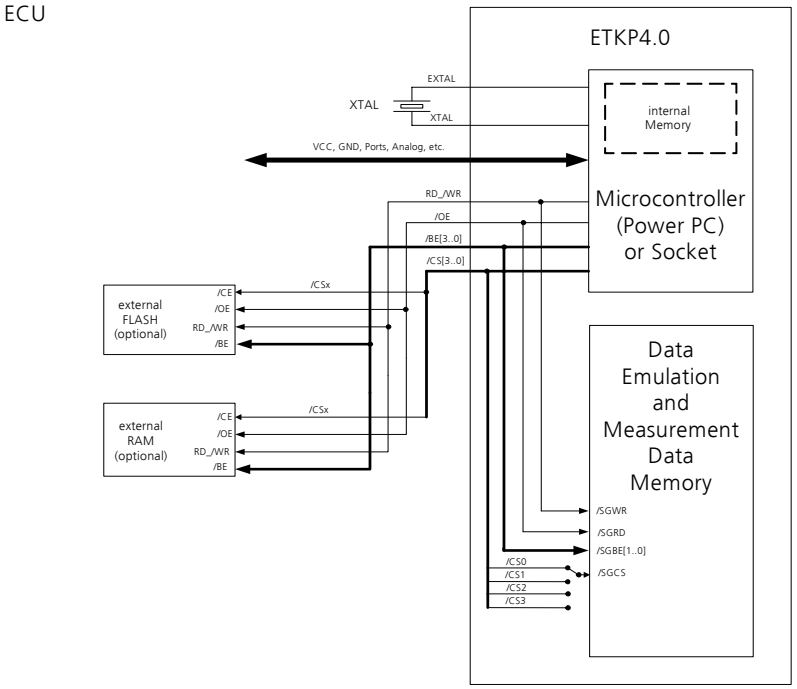



**Fig. 3-2** System with internal and external Memory

It also shows the possibilities to access the different memories with its chip selects. The chip select of the data emulation and measurement data memory can be choosen (/CS0, /CS1, /CS2 or /CS3) by soldering the respective bridge on the PCB (see chapter 3.10 "Chip Select Configuration Bridge").

## 3.3 BGA Connector

The BGA connector interfaces the microcontroller with the ECU. All signals of the microcontroller are directly connected to the BGA connector. Also the clock signal must be provided through the connector to the microcontroller.

## 3.4 Data Emulation and Measurement Data Memory

The complete data emulation and measurement data memory consists of two 256 kByte pages (Fig. 3-3 "Data Emulation and Measurement Data Memory: 2 Pages with 256 kByte each"). The address range of the used chip select to address the data emulation and measurement memory must be 256 kByte and it must be defined at a 256 kByte limit.

Data emulation memory and measurement data memory must be located inside this 256 kByte address range. The segmentation of this address range between both memory parts is variable. So the measurement data memory and data emulation memory can have variable size and offset addressses inside this fixed address range.

### 3.4.1 Data Emulation Memory

During operation of an ECU, only program data, not program code, can be modified by using the data emulation memory. Modification of program code would inevitably lead to a system crash. The program code is continuously processed out of the internal or external memory. Freescale controllers support this concept.

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.

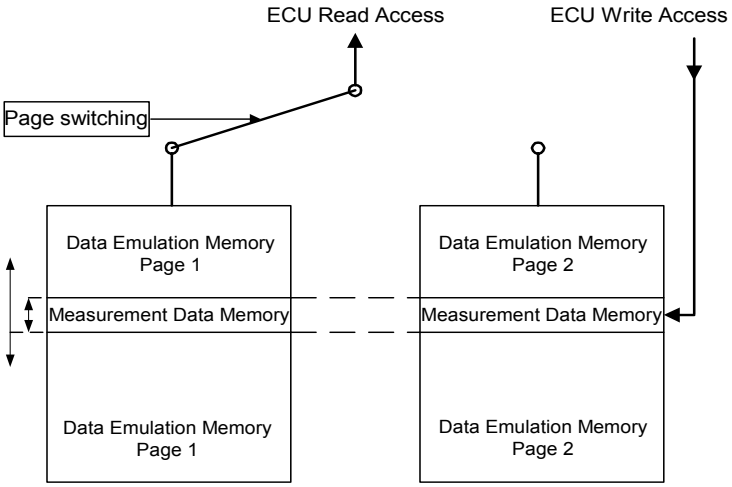



**Fig. 3-3** Data Emulation and Measurement Data Memory: 2 Pages with 256 kByte each

### 3.4.2 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 development 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.*

### 3.4.3 Triggering of Measurement Data Capture

The exact procedure for capturing measured data is explained in the documentation Display Tables 12 and 13; only the hardware-specific features are mentioned here. The ETKP4.0 contains a trigger comparator which selects a segment of 64 Byte out of the measurement data memory address space (at a

64 Byte limit). This limit is known as the trigger segment address. Fig. 3-4 "Division of the 64 Byte Trigger Segment" shows the configuration of the 64 Byte trigger segment.

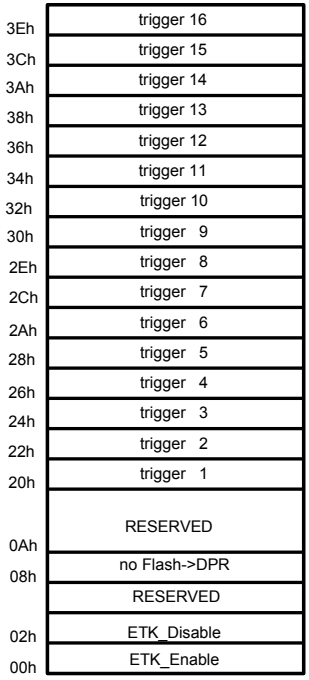



**Fig. 3-4** Division of the 64 Byte Trigger Segment

Within the basic and the compatibility trigger mode are only two trigger addresses available: trigger B and trigger A. The ES1232 board for the ES1000.2 system and the ES690 module will support several triggers. To achieve downward compatibility, odd-numbered triggers have been put into group trigger B and the even-numbered triggers into group trigger A. Within the advanced trigger mode 16 hardware triggers will be available.

**Note**

*The unused address areas are reserved for future applications and must not be used for other purposes.*

### 3.4.4 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. For brief power interruptions, e.g. during a cold start procedure, buffering is guaranteed through capacitors for several milliseconds.

### 3.4.5 ETKP4.0 Deactivation

It can be necessary that the ETK does not respond to read or write accesses of the microcontroller. Therefore the microcontroller can switch off the ETKP4.0 chip select. To indicate to the calibration and development system that the microcontroller has "switched on" or "switched off" the ETK a write access before switching off the ETK and after switching on the ETK to the trigger segment (see Fig. 3-4 "Division of the 64 Byte Trigger Segment") must occur.

Through writing to the address ETK_Disable (trigger segment address + 0x02h) the "switching off" will be indicated. Through writing to the address ETK_Enable (trigger segment address) the reactivation of the ETK will be indicated. The data used during the write accesses are meaningless.

**Note**

*These two addresses are not protected against accidental write access. Due to the fact that they belong to the trigger segment, they are allocated in the address space of the measurement data memory.*

## 3.5 Data Flash Memory

Flash memory is provided on the ETKP4.0 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 ETKP4.0 has a circuit which recognizes and stores power failures. If this circuit detects a longer power failure, and therefore a possible inconsistency of the emulation data, the ETK controller initiates a copying procedure Flash memory → DPR upon restart. The Flash memory data is copied to both emulation pages. A green LED on the ETK displays the procedure. The operating software announces the procedure by a message in the status line.

If the ETKP4.0 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 + 0x08h, see Fig. 3-4 "Division of the 64 Byte Trigger Segment"). The green LED on the ETK will be switched off.

**Note**

*The Flash memory on the* ETKP4.0 *only stores data which exists in the data emulation and measurement data memory of the* ETKP4.0*. The program code is stored only in the ECU Flash memory.*

## 3.6 Code Flash Memory

The program code is not emulated by the ETKP4.0. The program code is stored in the ECU Flash memory ("on chip" and/or external) and is not modified by the ETKP4.0. Only the accessible emulation data areas are emulated by the ETKP4.0. The ECU Flash memory can be programmed with the normal Flash memory programming tools.

## 3.7 Power Supply

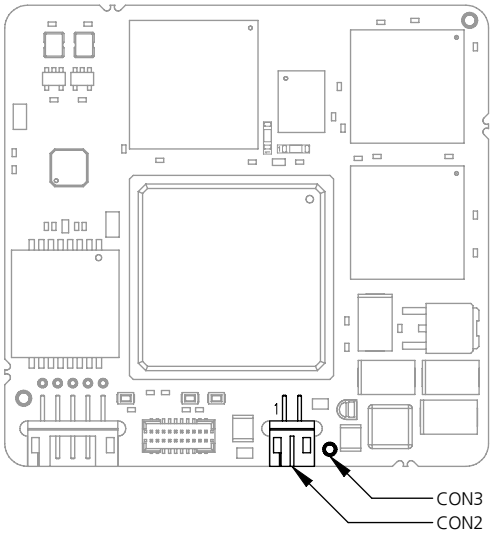



**Fig. 3-5** Power Supply Connectors

The ETKP4.0 is powered directly from the car battery (permanent supply). The input voltage varies between 4.3 V and 18 V.

In case of higher input voltages to the ETK an additional voltage converter is required.

All necessary voltages are created through switch mode power supplies which minimizes heat build-up. The power supply of the ECU is not affected by the ETKP4.0.

An automatic switch ensures that the power supply of the ETKP4.0 is automatically switched on and off.

The ETKP4.0 can be supplied with power through the 2-pin power supply connector and additionally through CON3 a through-hole solder pad to connect a power supply $U_{Batt2}$. The power supply on CON3 must use the GND of CON2.

The ECU voltage (U_VDD2_6) is monitored by the ETK to recognize whether the ECU is switched on or off.

## 3.8 Serial ETK Interface

The serial 8/100 Mbit/s ETKP4.0 interface creates the link to the calibration and development system. The ES1232 plug-in board for the ES1000 high-end system will support the 100 Mbit/s interface.

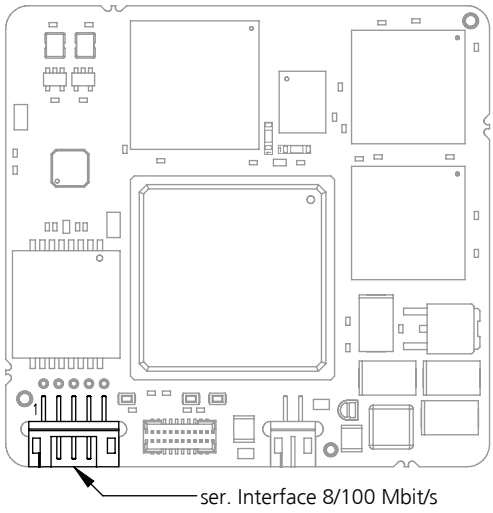



**Fig. 3-6** Location of the Serial ETK Interface

The interface utilizes a 100Base-TX transmission to achieve an outstanding transmission performance of 100 Mbit/s. The ETK interface is also able to handle the 8 Mbit/s interface of "old" calibration and development systems. The new interface requires a new 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. The new interface cable can be used with the old interface.

## 3.9 Status LEDs

There are three LEDs displaying the operating status of the ETKP4.0 (Fig. 3-7 on page 22).

| LED | State | Meaning |
|---|---|---|
| Red | On | ETKP4.0 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 ETKP4.0) |
| 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. |
| | 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 |

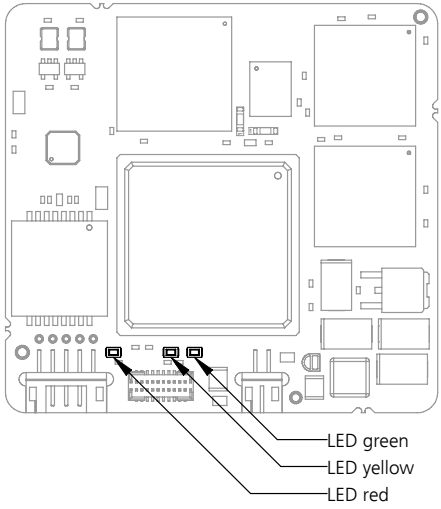



**Fig. 3-7** Status LEDs

## 3.10 Chip Select Configuration Bridge

BR100 and BR101 are solder bridges to configure the used chip select.

| BR100 | BR101 | Chip Select | Default |
|---|---|---|---|
| 1 - 2 shortened | Open | /CS0 | - |
| 2 - 3 shortened | Open | /CS1 | - |
| Open | 1 - 2 | /CS2 | ETKP4.0-A,<br>ETKP4.0-B,<br>ETKP4.0-K |
| Open | 2 - 3 | /CS3 | - |

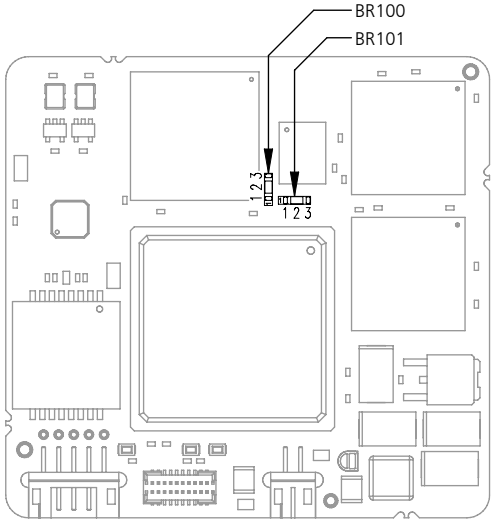



**Fig. 3-8** Chip Select Configuration Bridge

# 4 Installation

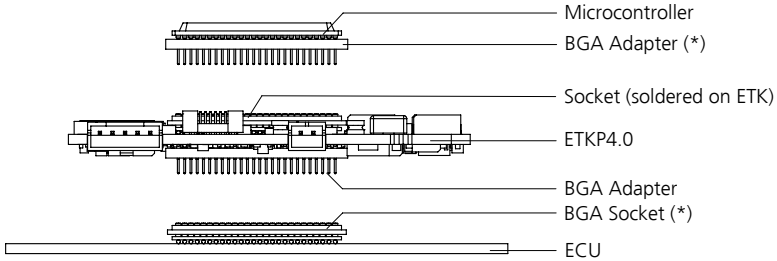
In this chapter, the hardware installation of the ETKP4.0 is described.

**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

For mounting the ETKP4.0 on the ECU an Advanced Interconnect socket is required. It need to be ordered seperately (refer chapter "Ordering Information" on page 47).




(*) Not delivered with ETK

**Fig. 4-1** ETKP4.0 Connection to the ECU

The ETKP4.0 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. 4-1).

## 4.2 Connecting to the Power Supply

The ETKP4.0 needs a permanent power supply (refer chapter "Power Supply" on page 20). There are different versions to ensure it.

**Note**

*Filter coils for EMC reduction are added to power supply of ETKP4.0 (on board). It means that the ETV2 cable is not required for this and following ETKP4.0 hardware versions.*

### 4.2.1 Permanent Power Supply inside ECU available

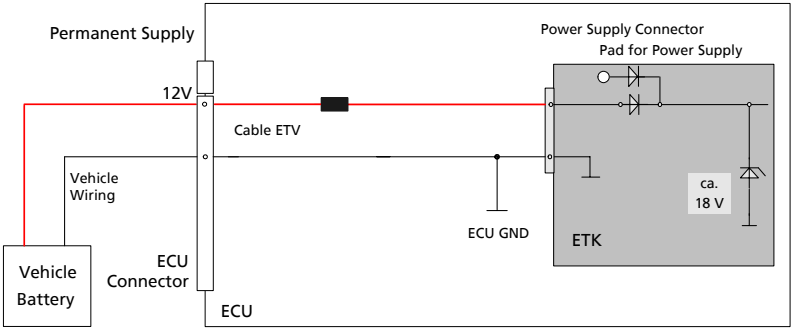



**Fig. 4-2** Permanent Power Supply inside ECU available

### 4.2.2 Permanent Power Supply inside ECU not available

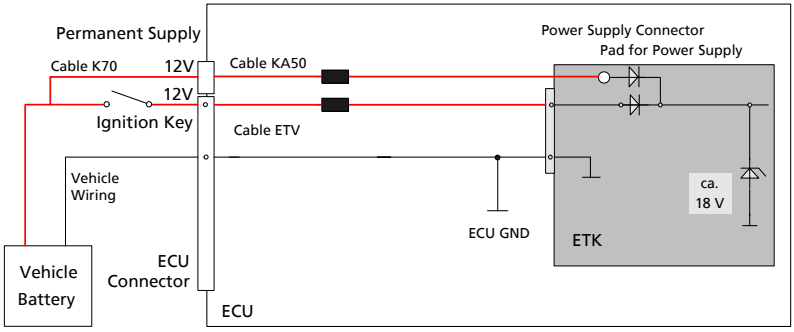



**Fig. 4-3** Permanent Power Supply inside ECU not available

### 4.2.3 Isolated Power Supply inside ECU

The ETKP4.0 does not require a galvanically isolated power supply. For special applications ETAS offers the isolated power supply ETP2.

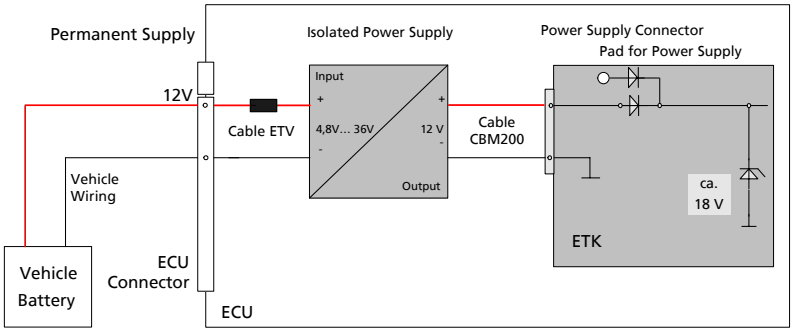



**Fig. 4-4** Isolated Power Supply inside ECU

# 5 ETK Configuration

In this chapter, the configuration parameters of the ETKP4.0 are described.

## 5.1 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.

## 5.2 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.

## 5.3 Configuration Parameter

The configuration of the ETKP4.0 is possible with the "ETK Configuration Tool". Not all combinations of parameters make sense. The "ETK Configuration Tool" provides support concerning the configuration parameters.

# 6 Technical Data

## 6.1 General Information

### 6.1.1 Described ETKP4.0 Hardware State

A sticker on the top of the ETKP4.0 allows you to indicate the ETKP4.0 PCB revision, if you use the hardware state syntax.

| Hardware state syntax | Meaning |
|---|---|
| aabccc/dd | "b" indicates the PCB revision |

**Note**

*This manual describes the ETKP4.0, PCB revision "E" and up.*

### 6.1.2 Measurement Conditions

**Note**

*The electrical characteristics of this ETKP4.0 version are unchanged to previous ETKP4.0 versions. The values of the electrical characteristics differ because of different measurement conditions.*

## 6.2 System Requirements

### 6.2.1 Software Support

You need following software versions to support the ETKP4.0:

| Software | Version (or higher) |
|---|---|
| HSP (Firmware) | 1.0.1 |
| INCA | 3.1.0 |
| ASCET-SD | 4.1.2 and TIPExp V4.3.0<br>(INCA V4.0.2 is required when RP and MC runs parallel) |
| INTECRIO | 1.0 |

### 6.2.2 Hardware

*Required ETAS Hardware*

Following ETAS hardware with ETK interface supports the ETKP4.0:

| Hardware | Boards/Modules |
|---|---|
| VME-Hardware | ES1000.1 with ES1111 and ES1200/ES1201 |
| | ES1000.2/ES1000.3 with ES1120 and ES1200/ ES1201 |
| | ES1000.2/ES1000.3 with ES1120 and ES1231 |
| | ES1000.2/ES1000.3 with ES1232 |
| Compact Hardware | ES690 |
| | ES590, ES591 |
| | ES910.2 |
| | MAC2F |

*Not supported ETAS Hardware*

All ETAS hardware with ETK interface supports the ETKP4.0.

## 6.3 Supported Microcontroller

| Item | Characteristics |
|---|---|
| Supported microcontrollers | Freescale MPC561/562, MPC563/564 |

## 6.4 Configuration

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

## 6.5 Serial ETK Interface

| Item | Characteristics |
|---|---|
| Transmission performance | 8 Mbit/s, 100 Mbit/s |
| Cable type | Shielded twisted-pair |
| Cable length | max. 30 m / 100 ft |
| Serial Interface | DC decoupling |

## 6.6 Power Supply

| Parameter | Symbol | Condition [1] | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Permanent Power Supply | $U_{Batt1}$, $U_{Batt2}$ | | 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, 100 Mbit/s | 20 | 75 | 100 | mA |
| ECU Power Supply Supervision Voltage | U_VDD2_6 | U_VDD2_6 ↑ | 1.91 | 2.01 | 2.11 | V |
| | | U_VDD2_6 ↓ | 1.86 | 1.96 | 2.06 | V |
| | I_VDD2_6 | | | | 100 | µA |

[1]: U_VDD2_6 ↑: ECU Power Supply off → ECU Power Supply on
U_VDD2_6 ↓: ECU Power Supply on → ECU Power Supply off

## 6.7 Testcharacteristics

| Parameter | Symbol | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| Reset delay 1 | $t_{Reset1}$ | $U_{Batt1}$=12 V<br>U_VDD2_6 = 0 V ↑ 2.6 V<br>without transferring Flash | 15 | 35 | ms |
| Reset delay 2 | $t_{Reset2}$ | $U_{Batt1}$ = 12 V<br>U_VDD2_6 = 0 V ↑ 2.6 V<br>with transferring Flash | 28 | 48 | ms |
| Reset delay 3 | $t_{Reset3}$ | $U_{Batt1}$ = 0 V ↑ 12 V<br>transfer FPGA and Flash | 228 | 518 | ms |

$t_{Reset1}$: Delay of ECU reset through ETK without transferring the Flash
($U_{Batt1}$ present, U_VDD2_6 will be switched on)
$t_{Reset2}$: Delay of ECU reset through ETK with transferring the Flash
($U_{Batt1}$ present, transfer active, U_VDD2_6 will be switched on)
$t_{Reset1}$: Max. delay of ECU reset through ETK
($U_{Batt1}$ and U_VDD2_6 will be switched on

## 6.8 Electrical Characteristics

| Signal | Pin Type | $V_{OL}$ (max) [V] | $V_{OH}$ (min) [V] | $V_{OH}$ (max) [V] | $V_{IL}$ (max) [V] | $V_{IH}$ (min) [V] | $V_{IH}$ (max) [V] | Leakage current [µA] | Additional Load by ETK (typ) [pF] [3] |
|---|---|---|---|---|---|---|---|---|---|
| ADDR[30..13] | I | - | - | - | 0.8 | 2 | 3.45 | -30/ +30 | 40 |
| DATA | I/O | 0.4 | 2.4 | 3.3 | - | - | 3.45 | -20/ +20 | 30 |
| RD_/WR | I | - | - | - | 0.8 | 2 | 3.45 | -30/ +30 | 35 |
| /OE | I | - | - | - | 0.8 | 2 | 3.45 | -570/ -520 | 45 |
| /WE_AT[1..0] | I | - | - | - | 0.8 | 2 | 3.45 | -30/ +30 | 35 |
| /CS[3..0] | I | - | - | - | 0.8 | 2 | 3.45 | 0 [1] -30/ +30 [2] | 0.8 [1] 35 [2] |
| /HRESET | I | - | - | - | 0.8 | 1.7 | 5.75 | -10/ +10 | 15 |
| /PORESET | I/O | 0.4 | - | - | 0.8 | 1.7 | 5.75 | -10/ +10 | 35 |

[1] /CS[3..0] not used
[2] /CS[3..0] used
[3] BGA connector not considered; PCB 1pF/cm

**Note**

**:/PORESET: opendrain FET; $I_{Dmax}$ = 0.2 A*
*Capacitance only with ETK-logic, without microcontroller, PCB and BGA socket.*

## 6.9 Switching Characteristics

The following diagrams show the timings the ETKP4.0 can process.

| Para. | Description | Min | Max | Unit |
|---|---|---|---|---|
| $t_4$ | Access Cycle Time | 20 | | ns |
| $t_6$ | Chip Select Valid to Data Valid | | 20 | ns |
| $t_9$ | Address Valid to Data Valid | | 20 | ns |
| $t_{10}$ | Read Low to Data Valid | | 12 | ns |
| $t_{11}$ | Read Low Z-Time | 3 | | ns |
| $t_{12}$ | Read High Z-Time | | 12 | ns |
| $t_{16}$ | Chip Select Setup Time | 0 | | ns |
| $t_{17}$ | Chip Select Hold Time | 0 | | ns |
| $t_{21}$ | Address Valid to End of Write | 16 | | ns |
| $t_{22}$ | Data Setup Time | 12 | | ns |
| $t_{23}$ | Data Hold Time | 0 | | ns |
| $t_{24}$ | Read/Write Setup Time | 0 | | ns |
| $t_{25}$ | Read/Write Hold Time | 0 | | ns |
| $t_{31}$ | Byte Enables Setup Time | 0 | | ns |
| $t_{32}$ | Byte Enables Width | 17 | | ns |
| $t_{33}$ | Byte Enables Hold Time | 0 | | ns |
| $t_{46}$ | Chip Select Invalid to High Z-Time | | 12 | ns |
| $t_{47}$ | Byte Enables Valid to Data Valid | | 20 | ns |
| $t_{48}$ | Byte Enables Invalid to High Z-Time | | 12 | ns |

**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.*

### 6.9.1 Read Timing: Data Emulation and Measurement Data DPR

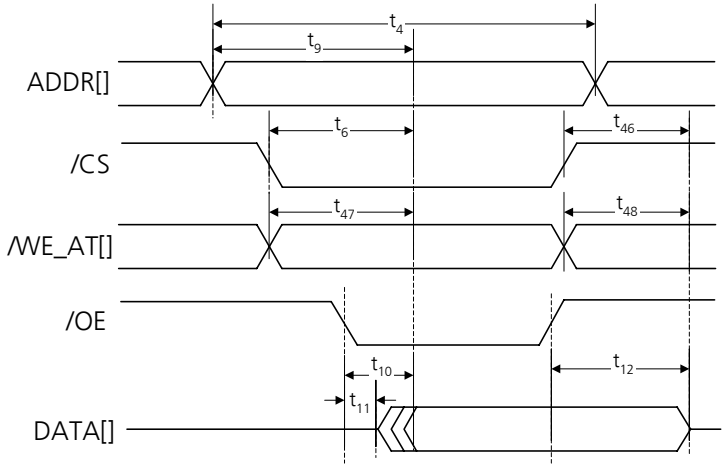



**Fig. 6-1** Read Cyle: Data Emulation and Measurement Data DPR

### 6.9.2 Write Timing: Data Emulation and Measurement Data DPR

.

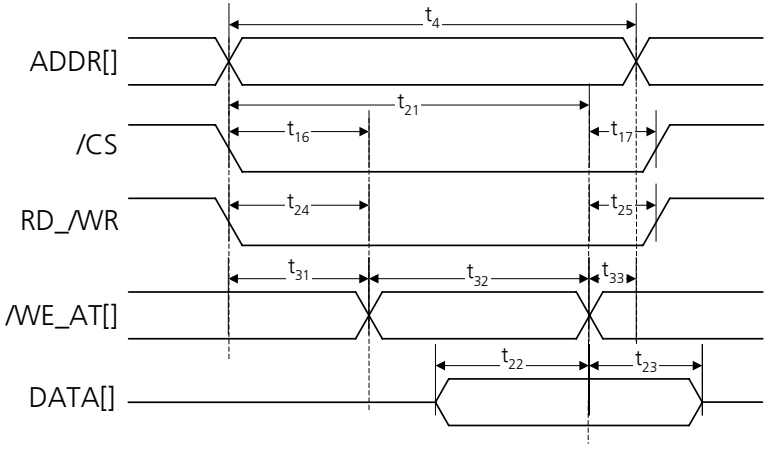



**Fig. 6-2** Write Cycle: Data Emulation and Measurement Data DPR

## 6.10 Environmental Conditions

| Item | Characteristics |
|---|---|
| Temperature range | - 40 °C to +110 °C<br>- 40 °F to +230 °F |

## 6.11 Pin Assignment

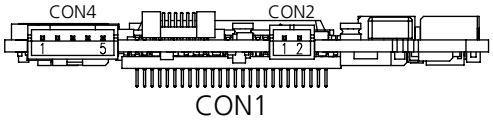



**Fig. 6-3** Power Supply Connector CON2

| Pin CON2 | Signal | Description |
|---|---|---|
| 1 | $U_{Batt1}$ | Battery Supply Voltage for ETK |
| 2 | GND | Ground |

## 6.12 Mechanical Dimensions

### 6.12.1 General Dimensions

The reference measure for all drawings is millimeter.

| Dimensions | Millimeters | Inches |
|---|---|---|
| Length | 64.00 | 2.520 |
| Width | 61.00 | 2.402 |
| Thickness of PCB | 1.70 | 0.067 |
| Height of component (upper side) | 3.00 | 0.118 |
| Height of component (lower side) | 2.00 | 0.079 |

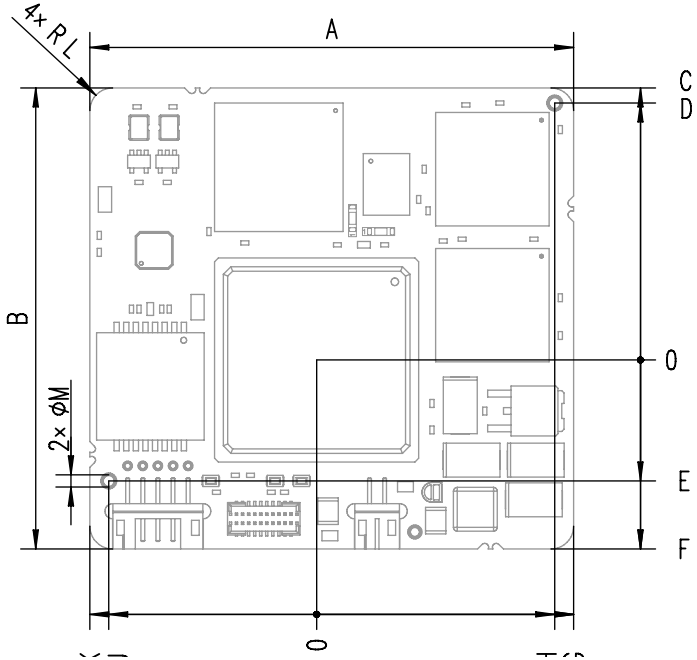



**Fig. 6-4** ETKP4.0 Dimensions - Top View

| Dim | Millimeters | Inches | Dim | Millimeters | Inches |
|---|---|---|---|---|---|
| **A** | 64.00 | 2.520 | **G** | 34.00 | 1.339 |
| **B** | 61.00 | 2.402 | **H** | 31.00 | 1.240 |
| **C** | 36.00 | 1.417 | **J** | 27.50 | 1.083 |
| **D** | 34.00 | 1.339 | **K** | 30.00 | 1.181 |
| **E** | 16.00 | 0.630 | **L** | 3.00 | 0.118 |
| **F** | 25.00 | 0.984 | **M** | 1.50 | 0.059 |

### 6.12.2 Microcontroller with BGA Adapter and Socket mounted

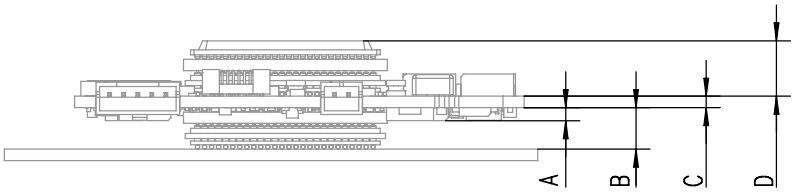



**Fig. 6-5** Microcontroller with BGA Adapter and Socket mounted

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 2.00 | 0.079 |
| **B** | 5.77 | 0.227 |
| **C** | 1.70 | 0.067 |
| **D** | 7.71 | 0.303 |

### 6.12.3 Microcontroller soldered on ETK

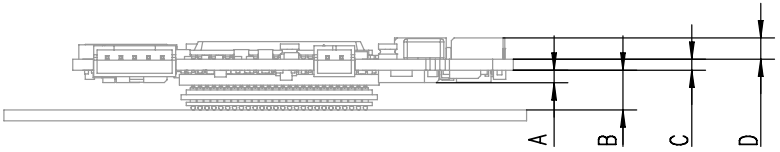



**Fig. 6-6** Microcontroller soldered on ETK

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 2.00 | 0.079 |
| **B** | 5.77 | 0.227 |
| **C** | 1.70 | 0.067 |
| **D** | 3.00 | 0.118 |

# 7 Cables

## 7.1 Interface Cables

### 7.1.1 Interface Cable KA54 with PG Cable Gland

**Note**

*The screws for mounting cables KA54 showed in chapter "Interface Cable KA54 with PG Cable Gland" on page 41 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.*

*Interface Cable KA54 with PG Cable Gland, Proposal 1*

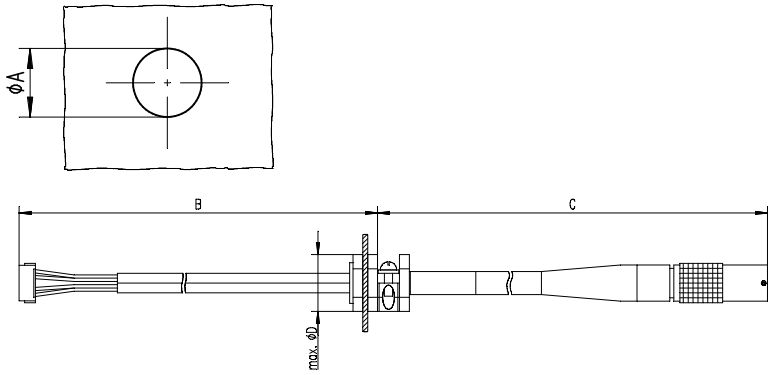



**Fig. 7-1** Interface Cable KA54, Prop. 1

| 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*

*Interface Cable KA54 with PG Cable Gland, Proposal 2*

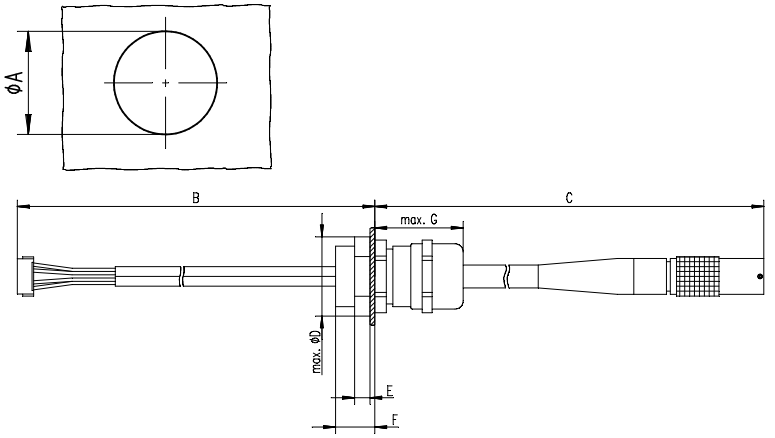



**Fig. 7-2** Interface Cable KA54, Prop. 2 (long thread)

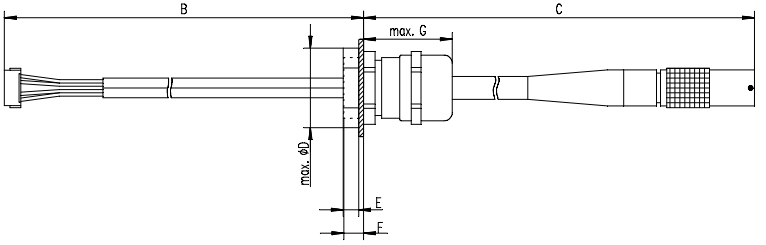



**Fig. 7-3** Interface Cable KA54, Prop. 2 (short thread)

| Dim | Millimeters | Inches | Dim | Millimeters | Inches |
|---|---|---|---|---|---|
| **A** | 18.80 | 0.740 | **E** | 4.70 | 0.185 |
| **B** | 160.00 | 6.299 | $\mathbf{F}_{Long}$ | 12.00 | 0.472 |
| **C** | 400.00 | 15.748 | $\mathbf{F}_{Short}$ | 6.00 | 0.263 |
| **D** | 24.25 | 0.955 | **G** | 27.00 | 1.063 |

**Note**

*Shield connected to ECU housing.*

***SKINTOP** compact screwing; **Manufacturer:** Lapp; **Description:** MS-SC 11 ; **Order-No.:** 5311 2320 (long thread) or 5311 2220 (short thread)*

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

### 7.1.2 Interface Cable KA55

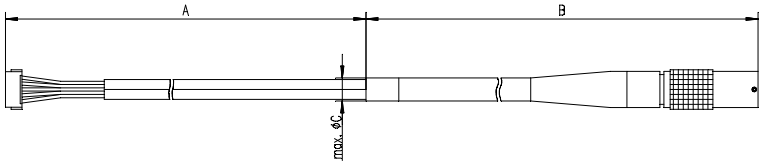



**Fig. 7-4** Interface Cable KA55

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 160.00 | 6.299 |
| **B** | 400.00 | 15.748 |
| **C** | 7.50 | 0.295 |

**Note**

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

## 7.2 Power Supply Cables

### 7.2.1 Cable ETV

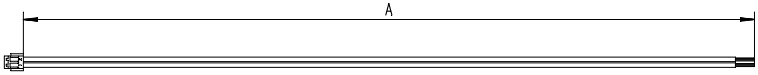



**Fig. 7-5** Power Supply Cable ETV

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 190.00 | 7.480 |

### 7.2.2 Cable K70

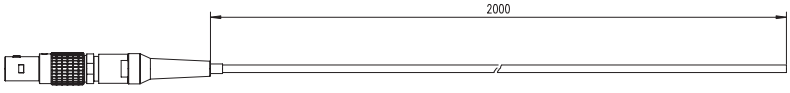



**Fig. 7-6** Power Supply Cable K70

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 2000 | 78.74 |

### 7.2.3 Cable KA50

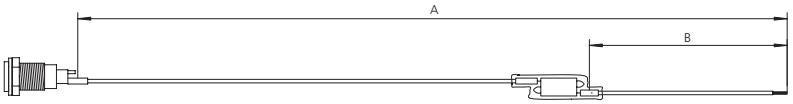



**Fig. 7-7** Power Supply Cable KA50

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 200 | 7.87 |
| **B** | 50 | 1.97 |

### 7.2.4 Cable CBM200

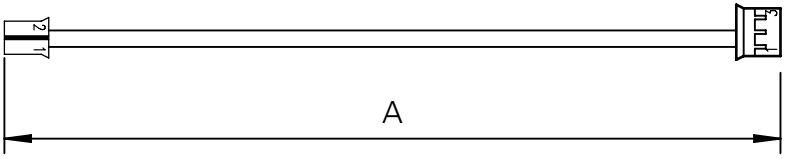



**Fig. 7-8** Power Supply Cable CBM200

| Dim | Millimeters | Inches |
|---|---|---|
| **A** | 100 | 3.94 |

# 8 Ordering Information

## 8.1 ETKP4.0

| Type | Order-No. | Note |
|---|---|---|
| ETKP4.0-A | F 00K 102 930 | ETKP4.0 for MPC561/ MPC562 (microcontroller to be supplied by customer) |
| ETKP4.0-B | F 00K 102 978 | ETKP4.0 for MPC563/ MPC564 (microcontroller to be supplied by customer) |
| ETKP4.0-K | F 00K 102 610 | ETKP4.0 with socket for MPC561, MPC562, MPC563 and MPC564 |

**Note**

*Some of the BGA sockets and adapters are not included in* ETKP4.0 *delivery(refer to "Connection to the ECU" on page 25).*
*They need to be ordered seperately (refer chapter "Ordering Information" on page 47).*

## 8.2 Sockets

**Note**

*For mounting the ETK on the ECU, one of the following Advanced Interconnect Sockets must be used. Please do not use other sockets.*

| Type | Note |
|---|---|
| Advanced Interconnect Socket (7112TR) | Available from local Advanced Interconnect distributors |
| Advanced Interconnect BGA Socket for MPC5xx (1FHS388-716GG) | Available from local Advanced Interconnect distributors |

## 8.3 Adapters

**Note**

*For mounting the microcontroller on the ETK the following Advanced Interconnect Adapter must be used. Please do not use other adapters.*

| Type | Note |
|---|---|
| Advanced Interconnect BGA Adapter for MPC5xx (1FHA388-715G) | Available from local Advanced Interconnect distributors |

## 8.4 Isolated Power Supply

| Type | Order-No. | Note |
|---|---|---|
| ETP2 | F 00K 104 010 | |

## 8.5 Cables

**Note**

*The cables showed in chapter "Cables" on page 41 are not included in the* ETKP4.0 *delivery. They need to be ordered separately.*

### 8.5.1 Interface Cables

| Type | Order-No. | Note |
|---|---|---|
| KA41, Prop. 1 / Prop. 2 | Y 261 A24 729 | |
| KA54, Prop. 1 / Prop. 2 | F 00K 001 302 | Delivery without PG Cable Gland |
| KA55 | F 00K 001 303 | |

### 8.5.2 Power Supply Cables

| Type | Order-No. | Note |
|---|---|---|
| ETV | Y 261 A24 446 | |
| K70 | Y 261 A24 942 | External power supply for ETKs (connector) |
| KA50 | F 00K 000 940 | External voltage supply cable with jack and filter coil |
| CBM200-0m1 | F 00K 900 052 | Cable JST PH - JST PH (2fc-3fc, 0M1) |

# 9 Version History

| Document Revision | Description |
|---|---|
| R2.0.0 EN | New chapters:<br>"General information", "Installation", "Configuration" |
| | Fig. 3.2 on page 14 is changed (/CS1 and /CS3 added) |
| | Yellow LED is added to display the ETKP4.0 operating status "100 Mbit/s communication to calibration system is established" (see chapter 3.9 on page 22) |
| | /CS1 and /CS3 added; new solder bridge to configure the used chip select (see chapter 3.10 on page 23) |
| | Filter coils for EMC reduction are added to power supply of ETKP4.0 (on board). ETV2 cable is not required for this hardware version.<br>ETV2 cable is deleted in chapters "Cable" and Ordering Informations". |
| | New measurement conditions for the electrical data (see chapter 6 on page 31). |

# 10 ETAS Contact Addresses

*ETAS HQ*

**ETAS GmbH**

| | | |
|---|---|---|
| Borsigstraße 14 | Phone: | +49 711 89661-0 |
| 70469 Stuttgart | Fax: | +49 711 89661-105 |
| Germany | E-mail: | sales@etas.de |
| | WWW: | www.etasgroup.com |

*North America*

**ETAS Inc.**

| | | |
|---|---|---|
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| Ann Arbor, MI 48103 | Fax: | +1 734 997-9449 |
| USA | E-mail: | sales@etas.us |
| | WWW: | www.etasgroup.com |

*Japan*

**ETAS K.K.**

| | | |
|---|---|---|
| Queen's Tower C-17F | Phone: | +81 45 222-0900 |
| 2-3-5, Minatomirai, Nishi-ku | Fax: | +81 45 222-0956 |
| Yokohama 220-6217 | E-mail: | sales@etas.co.jp |
| Japan | WWW: | www.etasgroup.com |

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**ETAS Ltd.**

| | | |
|---|---|---|
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| Burton-upon-Trent | E-mail: | sales@etas-uk.net |
| Staffordshire DE14 2WQ | WWW: | www.etasgroup.com |
| Great Britain | | |

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| 1, place des Etats-Unis | Phone: | +33 1 56 70 00 50 |
| SILIC 307 | Fax: | +33 1 56 70 00 51 |
| 94588 Rungis Cedex | E-mail: | sales@etas.fr |
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| | | |
|---|---|---|
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| Seoul 137-889 | E-mail: | sales@etas.co.kr |
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| | | |
|---|---|---|
| 2404 Bank of China Tower | Phone: | +86 21 5037 2220 |
| 200 Yincheng Road Central | Fax: | +86 21 5037 2221 |
| Shanghai 200120, P.R. China | E-mail: | sales.cn@etasgroup.com |
| | WWW: | www.etasgroup.com |

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