ETK-S5.1
Emulator Probe for Serial Debug Interfaces
Data Sheet

Copyright

The data in this document may not be altered or amended without special notification from ETAS GmbH. ETAS GmbH undertakes no further obligation in relation to this document. The software described in it can only be used if the customer is in possession of a general license agreement or single license. Using and copying is only allowed in concurrence with the specifications stipulated in the contract.

Under no circumstances may any part of this document be copied, reproduced, transmitted, stored in a retrieval system or translated into another language without the express written permission of ETAS GmbH.

© Copyright 2007 ETAS GmbH, Stuttgart

The names and designations used in this document are trademarks or brands belonging to the respective owners.

Document QH110528 R1.0.2 EN   TTN

Contents

1 Introduction

This section contains general safety instructions, information about the basic features and applications of the ETK-S5.1 ETK Interface Board (ETK = Emulator Test Probe), and hints to system requirements.

1.1 General Safety Instructions

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.

Please be aware that this board interacts with the application system. These interactions alter the application system behavior. Failures or unexpected operational results may be critical to the application system behavior.

> ⚠️ **WARNING!**
>
> *Using the board is only allowed in application systems with additional safe or redundant systems (e.g. emergency stop, backup system).*
> *Using the board in any way other than described in this documentation is not permissible and can lead to connected products being damaged or destroyed.*
> *The safety instructions must be heeded at all times!*

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.*

1.2 Applications

The ETK-S5.1 is an emulator probe for 2.5 V, 3.3 V and 5 V systems with a non break debug (NBD) interface for the NEC V850E-GP1 microcontroller.

This ETK is compatible with the new ETAS calibration and development system interface (e.g. ES690, ES590, ES591 and ES1000.2/ES1000.3 with ES1232-A). Earlier systems (e.g. MAC2, ES1000.1 with ES1201 board) are not supported.

1.3　Features

- Debug interface clock speed: up to 10 MHz
- MCU capability of internal Flash emulation can be used (Tuning RAM)
- Special startup protocol for ETK recognition and trigger activation
- Coldstart functionality is supported
- Serial interface with 100 MBit/s for application system
- Permanent storage of configuration in E²PROM
- Updates (programming of logic devices) through software; removal of ETK or ECU not necessary
- High flexibility
- Mounting possibilities inside or on top of ECU
- Power supply: 4.3 to 18 V DC
- Temperature range: - 40 °C ... + 110 °C
- Dimensions: 63 x 40 x 10 mm
- Permanent storage of multiple configurations for different microcontroller types
- Selectable 2.5 V, 3.3 V and 5 V ECU interface voltage levels

1.4　Supported Microcontroller

Type	Supported Controller
ETK-S5.1	NEC V850E-GP1 with Tuning RAM

Note

Please contact ETAS for further microcontroller support of the NEC V850 family.

1.5　System Requirements

This section tells you which hardware and software are needed to operate your ETK-S5.1.

Note

Carefully check the software version numbers and cable names. Wrong software versions and cables could impair the proper functionality of your ETK-S5.1, damage the ETK-S5.1 and the connected devices.

1.5.1 Hardware

Required ETAS Hardware

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

Compact Hardware: ES690 and ES59x

Not supported ETAS Hardware

MAC2

ES1000.1 with ES1111 and ES1200/ES1201

ES1000.2/ES1000.3 with ES1120 and ES1200/ES1201

ES1000.2/ES1000.3 with ES1120 and ES1231

1.5.2 Software Support

You need following software versions to support the ETK-S5.1:

| Software	Version (or higher)
HSP (Firmware)	5.0
INCA	5.4
ASCET-RP	5.4.1
INTECRIO	1.1

2   Hardware Description

In this chapter, the individual function blocks of the ETK-S5.1 hardware are explained in detail.

2.1   Architecture

The ETK-S5.1 is an emulator probe for calibration and data measurement via the debug interface by using the capabilities and resources of the microcontroller. Fig. 2-1 on page 9 shows the block diagram which illustrates the ETK-S5.1 functional blocks. The ETK-S5.1 is connected to the ECU via an adapter cable with up to 26 pins (depending on the application and microcontroller type).
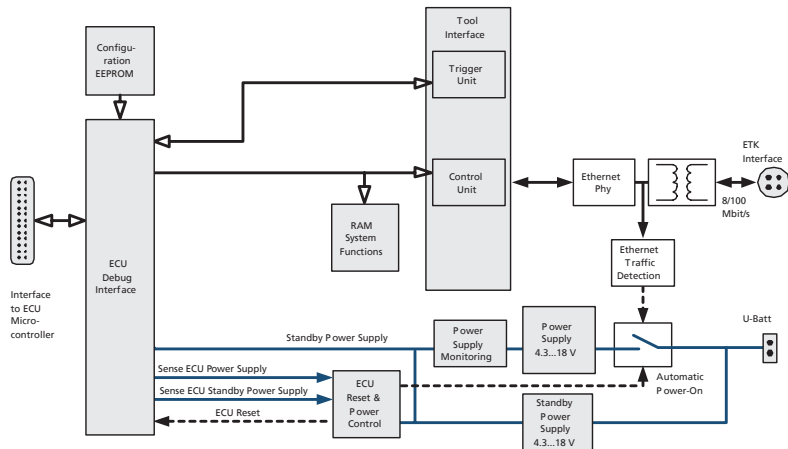
Fig. 2-1   ETK-S5.1 Architecture

The ETK-S5.1 consists of the blocks listed below. For a more detailed description of each block the user is referred to the corresponding chapters:

- for ECU Interface see section 2.2 on page 10
- for Configuration EEPROM see section 2.3 on page 10
- for Power Supply and ECU Voltage Supervisor see section 2.4 on page 11
- for Serial Interface see section 2.6 on page 11

Additionally the user is referred to the following chapter:

- for ETK Recognition and Data Acquisition see section 2.7 on page 11

The System Functions RAM are neither visible for the ECU nor for the software user. These blocks are reserved for internal use of the ETK-S5.1.

> **Note**
>
> *For integrating a serial ETK within the ECU please refer ETAS document "Application notes for serial ETKs".*

2.2 ECU Interface

The ETK-S5.1 is connected to the ECU via an adapter cable with up to 26 pins, where the pin definition depends on the application and the microcontroller type. In general the ECU interface consists of

- 2 ECU voltage lines, which are not used for ETK power supply but only for detection of the ECU status, therefore the power consumption on these lines is negligible (for a more detailed description the user is referred to section 2.4 on page 11)

- 2 Data Acquisition Interupt lines (DAI lines) which are used for ETK recognition at startup and for Data Acquisition (for a more detailed description the user is referred to section 2.7 on page 11)

- 2 Reset pins which allow the ETK to control and monitor the system reset of the ECU

- Up to 9 Debug Interface lines for the communication between the ETK-S5.1 and the microcontroller

- 12 ground lines for a proper shielding of the ECU interface lines

The ECU interface can be flexibly configured for several applications. For a firmware update, it is not necessary to unmount or disconnect the ETK-S5.1 from the ECU.

2.3 Configuration EEPROM

The Configuration E^2PROM of the ETK is for the permanent storage of ETK-related and project-related data. For example if the MCU is capable of internal flash emulation the emulation parameters are stored in the Configuration E^2PROM. 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 of the "ETK Configuration Tool" is supported by a graphical interface.

If an ECU description database (ASAM-MCD-2MC) with the corresponding input exists, this information can be downloaded from the database. If necessary, a plausibility check is performed.

The "ETK Configuration Tool" can create the following output:

1. Direct ETK configuration
2. Storage of the configuration in a data file

2.4 Power Supply

The ETK-S5.1 is directly powered from the vehicle battery (permanent power supply, connector C0102 in Fig. 3-1 "Connector Layout").

The input voltage can vary from 4,3 V to 18 V. In case of higher input voltages (e.g. HGV) to the ETK, an additional voltage converter is required. The required ETK-voltages are generated by a switching power supply which minimizes heat build-up and power consumption. The power supply of the ECU is not affected by the ETK-S5.1. An automatic power save mode ensures that the power consumption during standby is reduced considerably.

2.5 ECU Voltage Supervisor

The ECU voltage (U_{SG}) is monitored by the ETK to recognize whether the ECU is switched on or off. Typically, the ECU RAM standby voltage (U_{SG*}) is also monitored to determine if the RAM content is still valid. The NEC V850E-GP1 with tuning RAM does not have a standby voltage available. Therefore, the U_{SG*} voltage signal on the ETK should be tied to the USG signal (ignition on/off signal on the ECU). The U_{SG} and U_{SG*} signals are only used for monitoring, therefore the load current is negligible.

2.6 Serial ETK Interface

The serial ETK interface creates the link to the application device (connector C0103 in Fig. 3-1 "Connector Layout").

This interface utilizes a 100Base-TX transmission to achieve an outstanding transmission performance of 100 MBit/s. The compact modules ES690, ES590, and ES591 as well as the ES1232 ETK Interface Board (ES1000.2/ES1000.3 high-end system) support this interface.

The interface requires a double-shielded twisted-pair cable (maximum length: 30m).

2.7 ETK Recognition and Data Acquisition

The 2 DAI lines are used for data acquisition interrupts (also called triggers) and ETK recognition. Immediately after power-up or an ECU reset the ETK-S5.1 notifies the ECU of the presence of an ETK. The ECU then acknowledges the

notification and the ETK returns to standard mode where the DAI lines are used for data acquisition interrupts. The details of this startup protocoll are microcontroller-specific.

> **Note**
>
> *If it is intended that the ECU code runs independent from whether an ETK is present or not, the ECU code may also ignore the startup procedure.*

2.8   Status LEDs

There are three LEDs (ETK On: red; Flash Data: green; 100 MBit/s: yellow) displaying the operating status of the ETK-S5.1 (Fig. 2-2 on page 13).

LED	State	Meaning
Red	On	ETK-S5.1 is supplied with power and either the ECU and/or the calibration and development system (ES1232, ES590, ES591 or ES690) is connected and ready to communicate with the ETK-S5.1
Green	Off	Working page accessible
	On	Power supply of the ECU was disturbed with following consequences: - ECU RAM content is damaged - ECU is running from the reference page (ECU - flash), switching to the working page about the calibration software INCA is not possible
	Flashing	- ETK-S5.1 is in configuration mode (ex-factory state) - After first initialization with the calibration software INCA blinking stops
Yellow	On	ETK-S5.1 is using the 100 MBit/s interface protocol
	Off	ETK-S5.1 is using the 8 MBit/s interface protocol
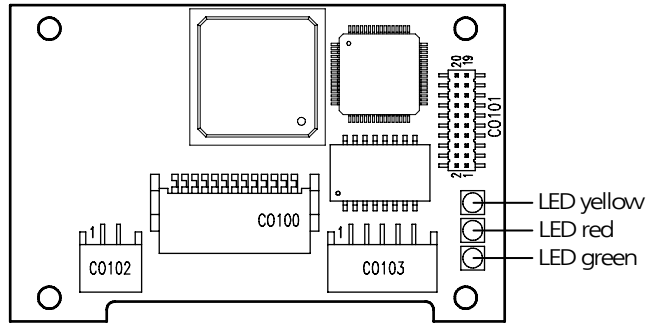
Fig. 2-2 Location of Status LEDs

3 Technical Data

3.1 Power Supply

Parameter	Sym-bol	Condition	Min	Typ	Max	Unit
Permanent Power Supply from car battery	U_{Batt}		4.3	12	18	V
Standby Current	I_{STBY}	U_{Batt1} = 12 V; ECU off; T = 20 °C		2	10	mA
Supply Current	I_{Batt}	U_{Batt1} = 12 V; ECU on; T = 20 °C		90		mA

Parameter	Sym-bol	Nominal	Threshold off → on	Threshold on → off
Power Supply from ECU (sense)	U_{SG}	5 V 3.3 V 2.5 V	3.57 V 2.41 V 2.11 V	3.42 V 2.32 V 2.02 V
Permanent Power Supply from ECU (sense)	U_{SG*}	3.3 V 2.5 V	2.65 V 1.83 V	2.56 V 1.73 V

3.2 Input/Output Pins - Operating Conditions

Type	Parameter	Conditions	Min	Max
Input	V_{IH}		2.0 V	5.3 V
	V_{IL}		-0.3 V	0.8 V
Output*	V_{OH} 5 V	I_{OH} = -24 mA	4.4 V	
	V_{OL} 5 V	I_{OL} = 24 mA		0.5 V
	V_{OH} 3.3 V	I_{OH} = -24 mA	2.4 V	
	V_{OL} 3.3 V	I_{OL} = 24 mA		0.5 V

> **Note**
>
> *Resetin: opendrain FET; I_{Dmax} = 0.2 A*

3.3 Serial ETK Interface

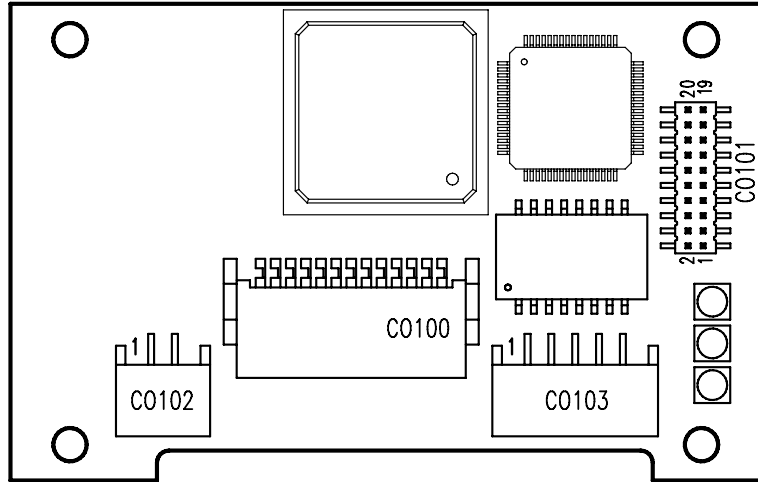| Item	Characteristics
Transmission performance	8/ 100 MBit/s
Cable type	double-shielded twisted-pair
Cable length	max. 30 m / 100 ft
Serial Interface	DC decoupling

3.4 Environmental Conditions

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

3.5 Interface Connectors

3.5.1 Connector Layout

Fig. 3-1   Connector Layout

Connector	Interface
C0100	ECU
C0101	Factory Test
C0102	ETK Power Supply
C0103	ETK Serial Interface

3.5.2   ECU Connector C0100 Pinout
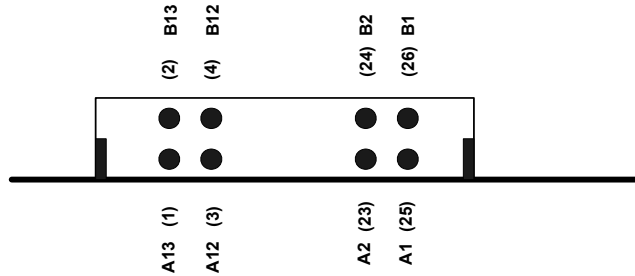
Fig. 3-2   ECU Connector Pinout, View to Pins

Adapter Pin #	ERNI Pin #	Signal	Description	Direction
1	A13	USG	Switched ECU Power Supply	I (Sense)
2	B13	USG*	Permanent ECU Power Supply	I (Sense)
3	A12	DAI2	Data Acquisition Interrupt 2	I/O
4	B12	GND	Ground	-
5	A11	DAI1	Data Acquisition Interrupt 1	I/O
6	B11	GND	Ground	-
7	A10	NBD SYNC	NBD SYNC Signal	O
8	B10	GND	Ground	-
9	A9	NBD SDI	NBD Interface Serial Data In	I
10	B9	GND	Ground	-
11	A8	DIRN	Direction pin for ECU transceiver	O
12	B8	GND	Ground	-
13	A7	NBD Clock	NBD Interface Clock	O
14	B7	GND	Ground	-

Adapter Pin #	ERNI Pin #	Signal	Description	Direction
15	A6	Resetout	ECU Reset signal for Reset Detection	I
16	B6	GND	Ground	-
17	A5	Resetin	ECU Reset signal for Reset Assertion	O
18	B5	GND	Ground	-
19	A4	NBD Data0	NBD Interface Data0	I/O
20	B4	GND	Ground	-
21	A3	NBD Data1	NBD Interface Data1	I/O
22	B3	GND	Ground	-
23	A2	NBD Data2	NBD Interface Data2	I/O
24	B2	GND	Ground	-
25	A1	NBD Data3	NBD Interface Data3	I/O
26	B15	GND	Ground	-

Tab. 3-1   ECU Interface Connector Pin Description

Note

For Pin 11 "DIRN": Signal = "1" NBD data flows from ETK---> ECU; Signal ="0" NBD data flows from ECU--> ETK. If transceiver is not used on ECU, leave pin un-connected.

3.5.3   ETK Power Supply Connector C0102 Pinout
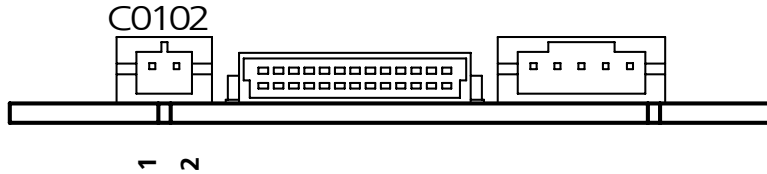
Fig. 3-3   Power Supply Connector C0102

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

Tab. 3-2   ETK power supply connector C0102 pin description

3.6 Mechanical Dimensions
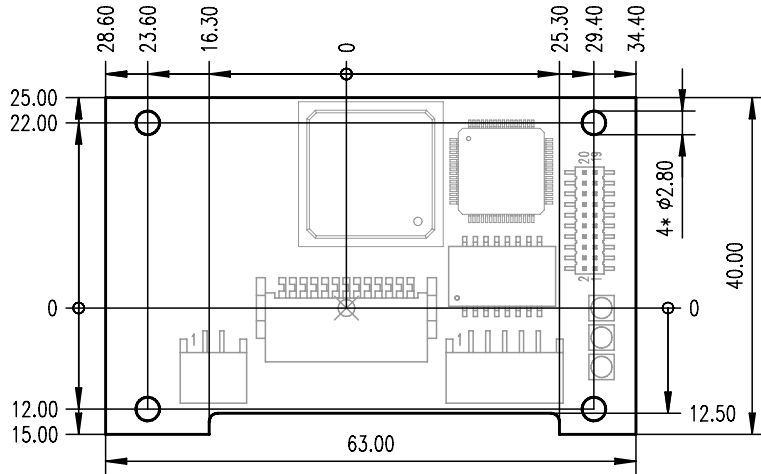
Fig. 3-4   ETK-S5.1 Dimensions - Top View

Dimensions	Millimeters	Inches
Length	63.0	2.481
Width	40.0	1.575
Height	max. 10.0	max. 0.394
Thickness of PCB	max. 1.7	max. 0.067
Height of components (upper side)	max. 6.0	max. 0.236
Height of components (lower side)	max. 2.0	max. 0.079

4 Cables

4.1 Interface Cables

4.1.1 Cable KA54 with PG-screwing

Cable KA54 with PG-screwing, Proposal 1

Fig. 4-1   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

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

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

Cable KA54 with PG-screwing, Proposal 2
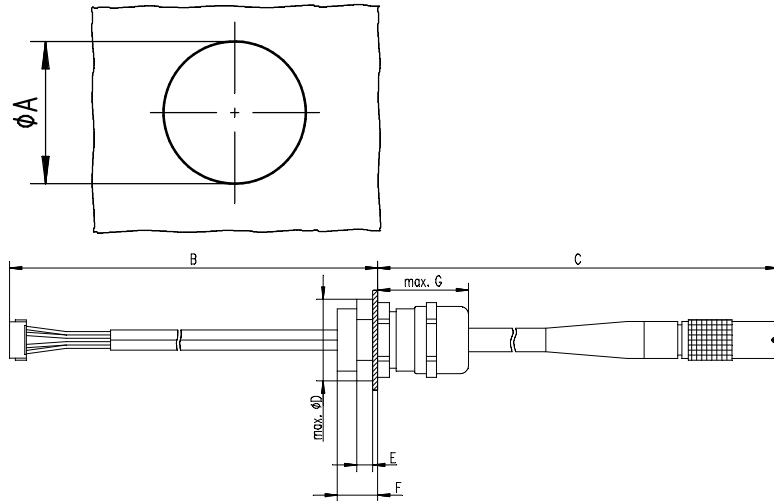
Fig. 4-2   Cable KA54, Prop. 2 (long thread)
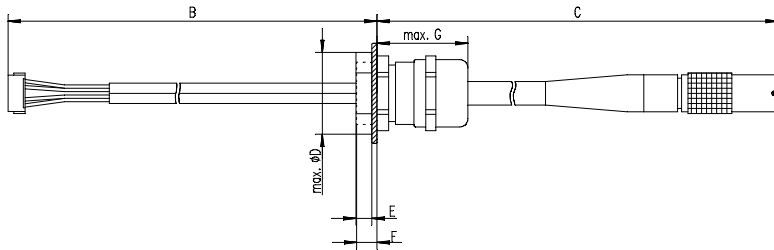
Fig. 4-3   Cable KA54, Prop. 2 (short thread)

Dim	Millimeters	Inches	Dim	Millimeters	Inches
A	18.80	0.740	E	4.70	0.185
B	160.00	6.299	F_{Long}	12.00	0.472
C	400.00	15.748	F_{Short}	6.00	0.263
D	24.25	0.955	G	27.00	1.063

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

4.1.2   Cable KA55
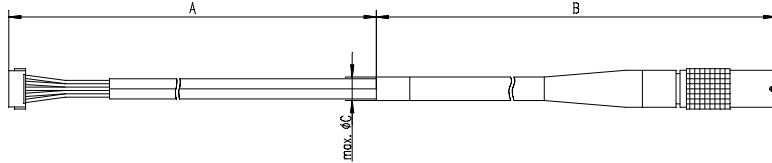
Fig. 4-4   Interface Cable KA55

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

4.1.3   Cable CBAM200-0m38
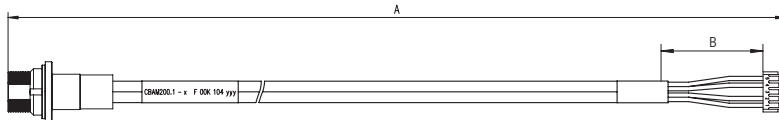
Fig. 4-5   Interface Cable CBAM200-0m38

Dim	Millimeters	Inches
A	380.00	14.96
B	30.00	1.18

4.1.4 Cable CBAM200-0m130

Fig. 4-6   Interface Cable CBAM200-0m130

Dim	Millimeters	Inches
A	130.00	5.12
B	30.00	1.18

Note

The cable shield is electrically connected to the ECU housing, allows for ECU housing flush mounting.
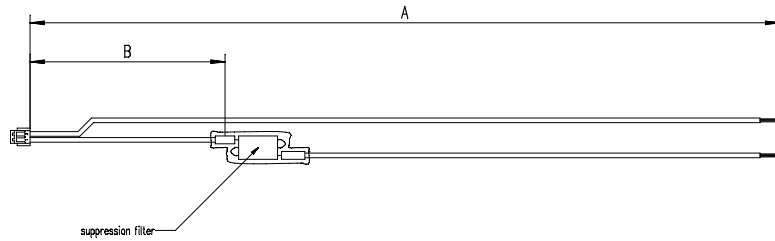
4.2 Power Supply Cables

4.2.1 Cable ETV
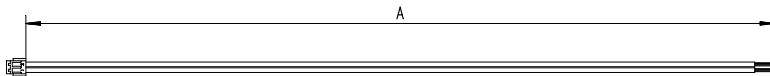
Fig. 4-7   Power Supply Cable ETV

Dim	Millimeters	Inches
A	190.00	7.480

4.2.2   Cable with Filtercoil ETV2

Fig. 4-8   Power Supply Cable with Filtercoil ETV2

Dim	Millimeters	Inches
A	190.00	7.480
B	50.00	1.969

4.3   Adapters

4.3.1   ETK - ECU Adapter ETAF1
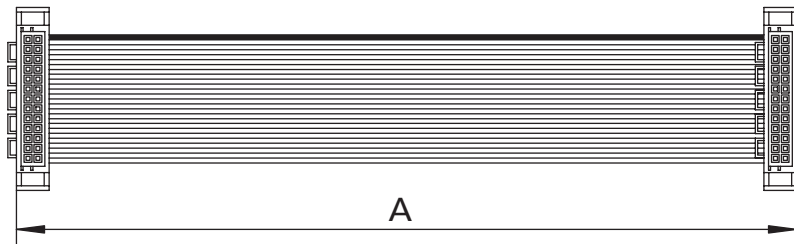
Fig. 4-9   ETK - ECU Adapter ETAF1

Dim	Millimeters	Inches
A	100.00	3.94

5   Ordering Information

5.1   ETK-S5.1

Type	Order-No.	Note
ETK-S5.1	F 00K 103 866	ETK-S5.1 for NEC NBD Interface

5.2   Accessories

5.2.1   Cables

Note

The cables shown in chapter "Cables" on page 23 are not included in the ETK-S5.1 delivery. They need to be ordered separately. For order numbers refer to chapter 5 on page 29.

Interface Cables

Type	Order-No.	Note
KA41, Ver. 1 / Ver. 2	Y 261 A23 729	
KA54	F 00K 001 302	see note below
KA55	F 00K 001 303	
CBAM200-0m38	F 00K 104 330	
CBAM200-0m130	F 00K 104 852	

Note

The screws for mounting cables KA54 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.

Power Supply Cables

Type	Order-No.	Note
ETV	Y 261 A24 446	
ETV2	F 00K 000 593	

5.2.2   Adapters

Type	Order-No.	Note
ETAF1	F 00K 001 373	

6 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.

3021 Miller Road	Phone:	+1 888 ETAS INC
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

Great Britain

ETAS Ltd.

Studio 3, Waterside Court	Phone:	+44 1283 54 65 12
Third Avenue, Centrum 100	Fax:	+44 1283 54 87 67
Burton-upon-Trent	E-mail:	sales@etas-uk.net
Staffordshire DE14 2WQ	WWW:	www.etasgroup.com
Great Britain		

France

ETAS S.A.S.

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
France	WWW:	www.etasgroup.com

Korea

ETAS Korea Co. Ltd.

4F, 705 Bldg. 70-5	Phone:	+82 2 57 47-016
Yangjae-dong, Seocho-gu	Fax:	+82 2 57 47-120
Seoul 137-889	E-mail:	sales@etas.co.kr
Korea		www.etasgroup.com

China

ETAS (Shanghai) Co., Ltd.

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

List of Figures

Index