

CAN-Bluetooth

Intelligent CAN-Bluetooth-Interface



Hardware Installation, Configuration and Technical Data

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Changes in the chapters

The changes in the document listed below affect changes in the hardware as well as changes in the description of facts only.

Chapter	Changes as compared to previous version
4.1, 4.4	Permitted range of power supply voltage changed. Note on usage of power supplies with stabilized output voltage added.

Technical details are subject to change without further notice.

NOTE

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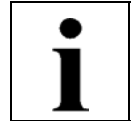
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1. Overview

1.1 Module Description

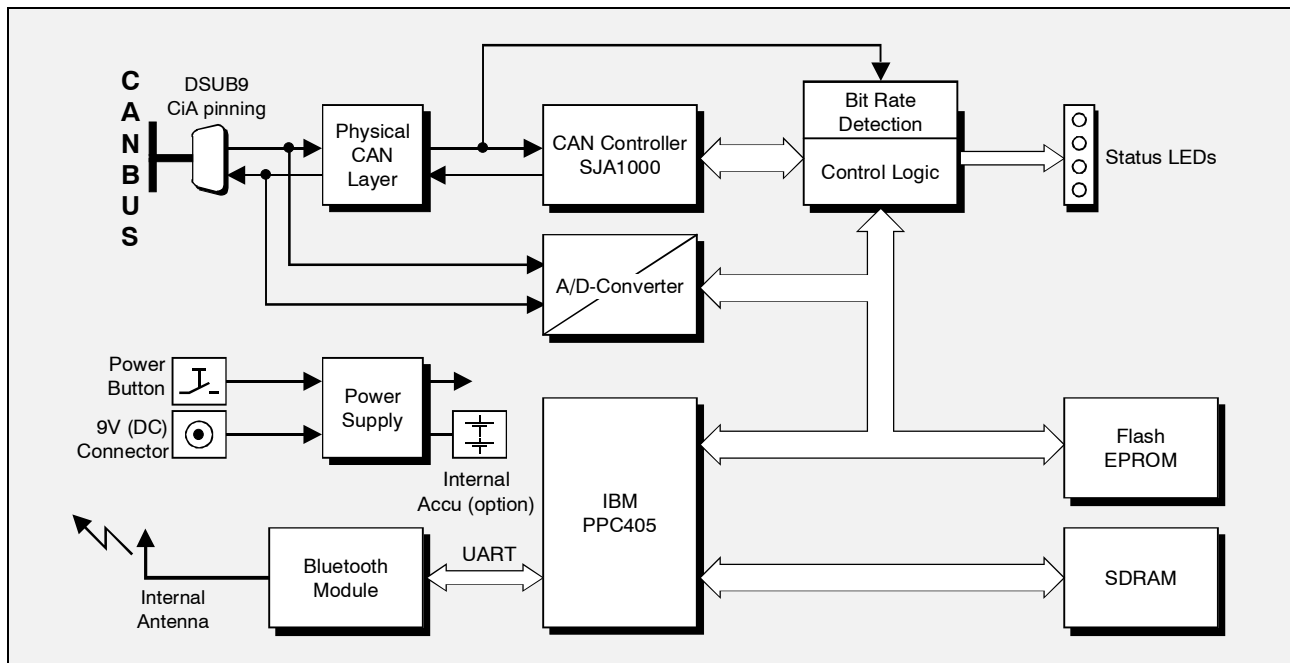


Fig. 1.1: Block-circuit diagram of the CAN-Bluetooth module

CAN Bluetooth is an intelligent CAN-interface with a PowerPC-micro controller for local data management. CAN Bluetooth enables a wireless transmission of fieldbus data across a range of up to 10 metres.

The CAN-interface is ISO 11898-compatible and permits a maximum data-transfer rate of 1 Mbit/s. Like many other features of the CAN-module the bit rate can be configured via software.

Via the optionally available charging battery (accumulator) CAN-Bluetooth can be operated without stationary power supply. You can operate the CAN-Bluetooth module also via a 9 V-power pack, however.

Four LEDs in the front panel signal the wireless and CAN activities and the state of charge for the accumulator. In order to prevent the accumulator from deep discharging the module automatically switches off when the red LED has blinked for five minutes.



Bluetooth-CAN modules can be used in two ways:

1. Wireless CAN-interface for PDAs and notebooks

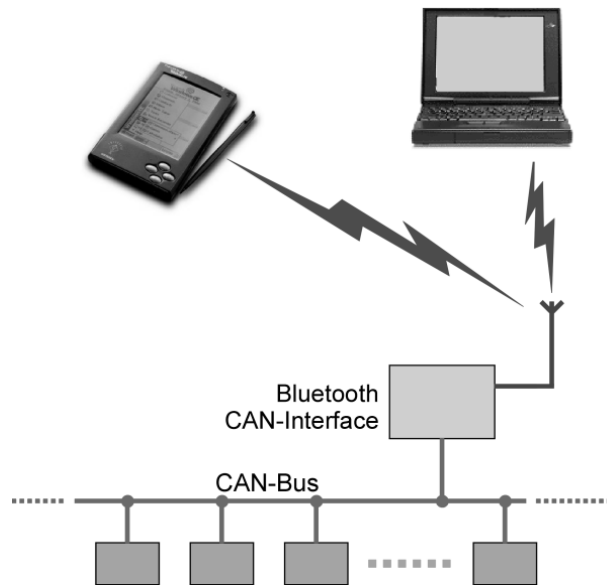


Fig. 1.2: Wireless CAN interface

2. Wireless CAN-to-CAN-Bridge (two devices are required)

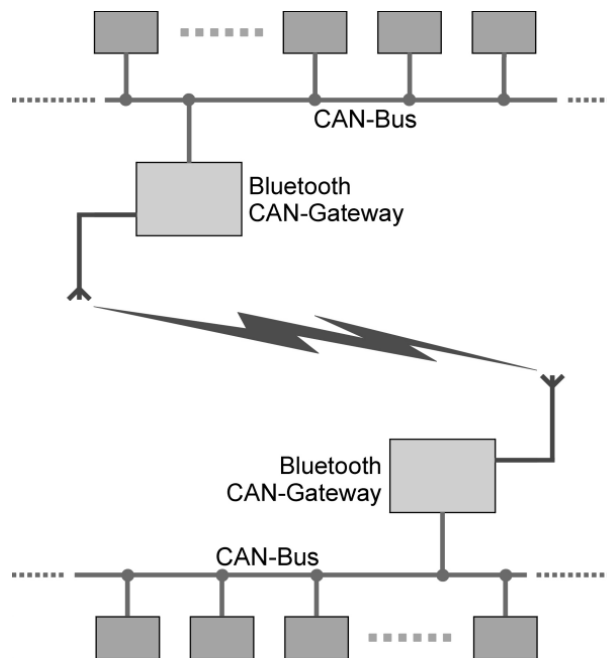
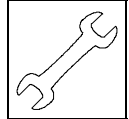


Fig. 1.3: Wireless CAN-to-CAN bridge



2. Display and Operating Elements

2.1 Front View with LED-Display

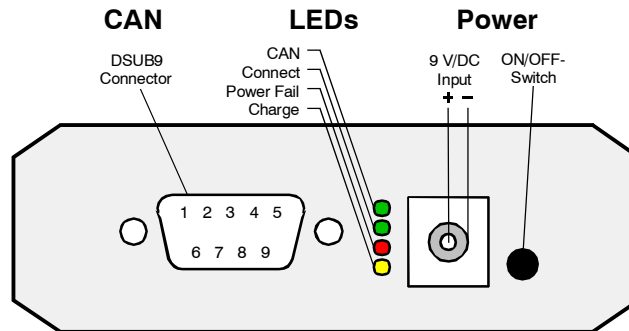
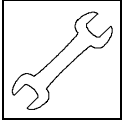


Fig. 2.1: Front-panel view

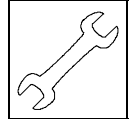
LED	Colour	Function	Status	Meaning
LED100D	green	CAN-Traffic	on	device ready
			flashing	transmission of CAN-data
LED100C	green	Bluetooth-Connect	on	Bluetooth connection ready
			flashing	transmission of Bluetooth data
			off	no Bluetooth connection
LED100B	red	Power-Fail/ Low Batt/ Msg-Lost	off	power supply OK
			flashing	Akkumulator discharged in about five minutes. Device will switch off automatically. <i>Switch off device and charge accumulator or operate via power pack.</i>
			short flashes	CAN-data cannot be transmitted completely. Messages are lost. <i>Use acceptance filter.</i>
LED100A	yellow	Charge	on	accumulator is being charged
			off	accumulator is charged



Installation

2.2 Switching On/Off

Switching on	Module version with internal accumulator (order no. C.2065.02): Keep power switch pressed until the upper green CAN-LED switches on. When the other three LEDs have flashed in sequence the device is ready for operation. Module version without internal accumulator (order no. C.2065.04): Connect to power supply (power switch is insignificant).
Operating display	The upper green LED is on.
Switching off	Module version with internal accumulator (order no. C.2065.02): Keep power switch pressed until the red LED switched on and off again. Module version without internal accumulator (order no. C.2065.04): Switch off power supply/disconnect power supply (power switch is insignificant).



3. Hardware Installation and Configuration

3.1 Configuration

You can configure the CAN-Bluetooth module from your PC or laptop via any web browser. Doing this you can set a bit rate for CAN, the IP-address and the network mask for accessing the web surface as well as the Bluetooth-device name. Additionally you can configure a wireless CAN-bridge.

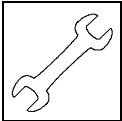
The module status when delivered is represented below:

IP-address	192.168.1.1
Network mask	255.255.255.0
Default CAN-bit rate	125 kbit
Device name	esd_Bluetooth_CAN <serial number>
Bluetooth Passkey	1234
CAN-bridge	switched off

Procedure:

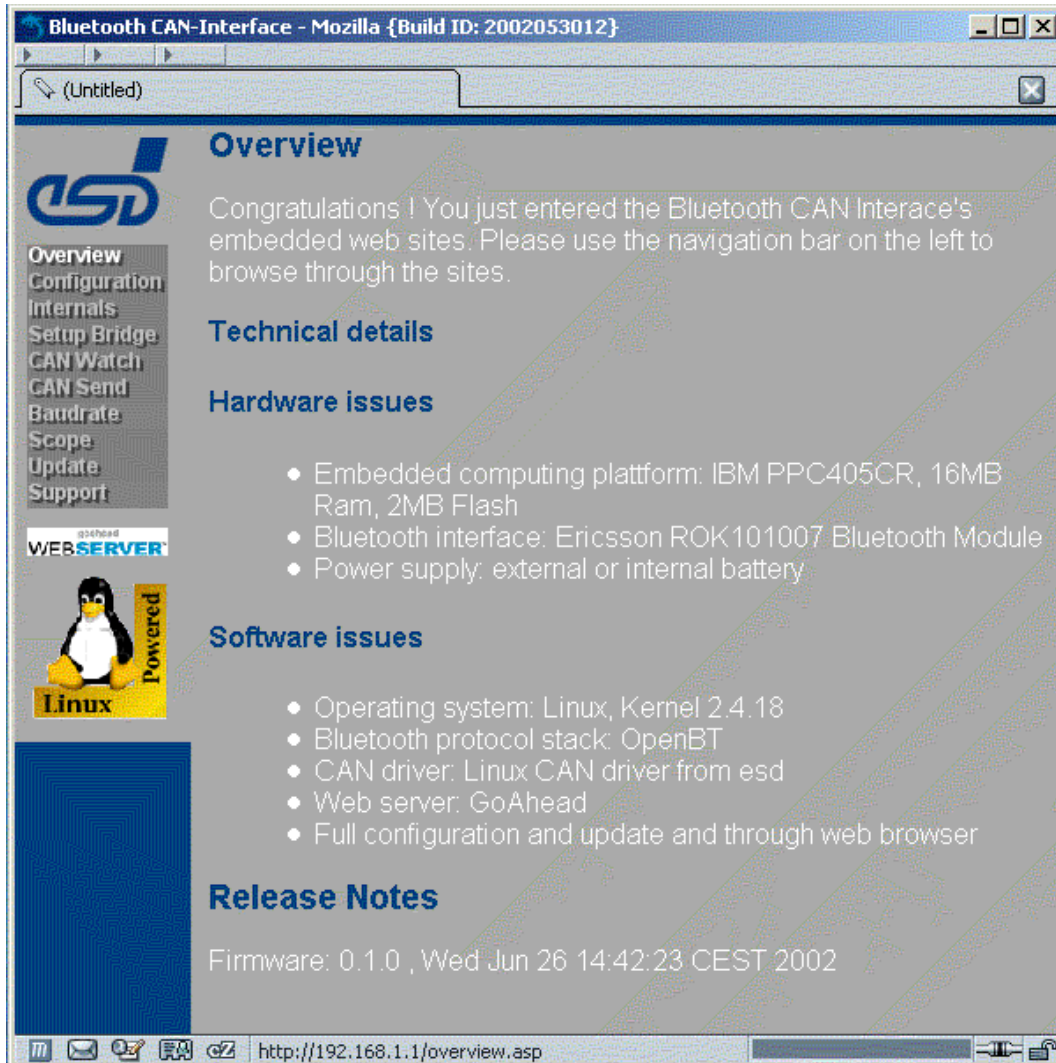
1. Switch your PC or laptop on.
2. Switch the Bluetooth module on (refer to page 5)
3. Search for Bluetooth devices in your environment via your Bluetooth software. You will be shown a selection menu with all available Bluetooth devices in your environment. The list contains the esd-Bluetooth module.
4. Now establish a LAN-Access or Dial-Up-Networking connection to the CAN-Bluetooth module. If a user name and pass word will be requested when establishing this connection, you can enter any combination of characters you like. Just enter a '0' as Dial-Up telephone number. If a Bluetooth Passkey will be requested, please enter '1234' (default).
5. Start your web browser again and go to page: 192.168.1.1 (IP-address):

`http://192.168.1.1`



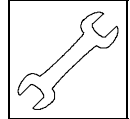
Installation

6. Via a navigation menu (links) you reach individual configuration and application pages. Please always refer to the information on of the according pages. A detailed description of the web interface will be given on page 9.



3.2 Connecting a CAN-Network

1. Switch off the CAN-devices to whose network the CAN-module is to be connected.
2. Connect the CAN-bus to the 9-pin DSUB-connector.
Please remember that the CAN-bus must be terminated at both ends. You can order T-connectors and terminations from esd, if required. Furthermore, the CAN-GND signal must be grounded at *exactly one* point in the CAN-network. Therefore the termination connectors have got a ground contact. A CAN-device whose CAN-interface is not electrically isolated equals a grounding of CAN-GND.



3. Switch the other CAN-bus devices on again.
4. Hardware installation finished.
For the installation of Windows-98/ME software please refer to the 'CAN-API, Monitor Program CAN-Scope and Installation' manual.

3.3 Software Support

Driver software for Windows 2000/XP, Windows 98/ME and Linux is available for the CAN-Bluetooth module. The software requires a Bluetooth support of the respective operating system. Especially virtual serial interfaces, provided by common Bluetooth PC-cards or USB-adapters, are required.

The module can be configured, as described on page 7, via common web browsers. In addition to using the web interface the device can be accessed like a conventional CAN-interface via the esd-CAN-API. The CAN-Monitor program "CANscope" can also be used.

3.3.1 Web Interface

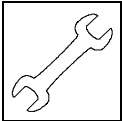
The esd-Bluetooth-CAN module can be operated and configured via a web interface by means of a normal web browser (such as Netscape, IE, Opera, Konqueror).

In order to do this please establish a LAN-Access or Dial-Up-Networking connection from your Bluetooth notebook or PC to the device. After the connection has been established successfully you can reach the entry page under URL: `http://192.168.1.1` (you can change this address later if desired).

Please pay attention to the *Release Notes* on the entry page. On the left hand side of the page you can find a navigation menu via which you can reach the various configuration and application pages:

- Overview - entry page
- Configuration - configuration of basis parameters
- Setup Bridge - configuration of a CAN-Bridge
- CAN Watch - simple CAN-monitor
- CAN Send - sending a CAN-message
- Baudrate - bit rate detection
- Scope - analog recording of CAN-signals
- Update - firmware update
- Support - support information

In the following abstracts the individual pages/menu points will be explained in detail.



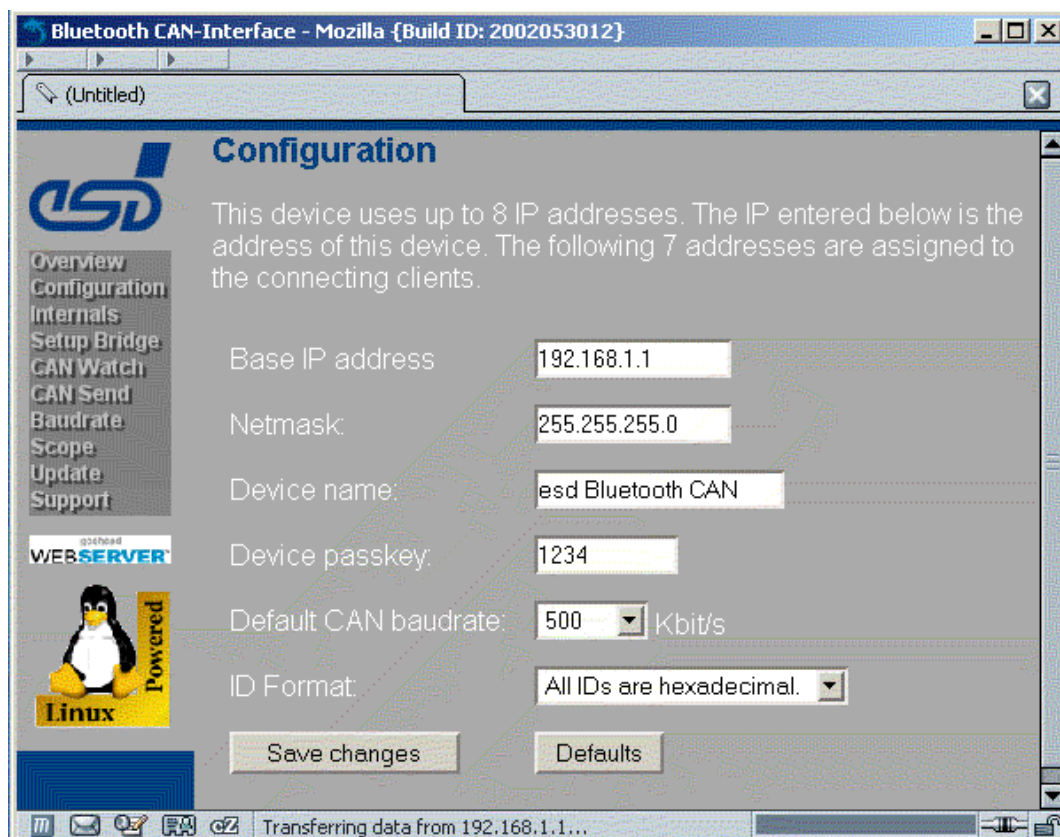
Installation

3.3.1.1 Menu Point: Overview

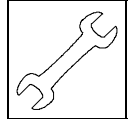
The *Overview* page is the entry page of the web interface. Here you can find general information about the device and the firmware used. For support requests please state the firmware version shown on this page.

3.3.1.2 Menu Point: Configuration

Via the page *Configuration* several basic device parameters can be configured.

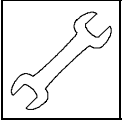


After you have made changes on the page they will be stored in the device-internal configuration memory by clicking the *Save changes*-button and will be valid from then on. Via the *Defaults*-button you can cancel your changes again.



In detail the options have got the following meaning:

Option	Meaning
Base IP-address	IP-address of the device while using the web interface. The clients are assigned with the next highest addresses (192.168.1.2 etc.).
Netmask	IP-network mask which is to be used.
Device name	Bluetooth device name. This name is represented by your Bluetooth software on your laptop or PC when searching for Bluetooth devices. The serial number of the device (such as AB067) is added to the name you specify here.
Device Passkey	When a connection is being established to the web interface a pass key will frequently be requested from you. In this case specify the value of this field. The default value is: '1234'
Default CAN baudrate	Default-bit rate of the CAN-interface. This bit rate is used by all pages of the web interface which access the CAN-bus. In addition this bit rate is used during CAN-bridge operation.
ID format	By means of this option the number format for the CAN-IDs is determined. If you use hexadecimal IDs you do not have to use a prefix (0x...). This option is adopted by all pages of the web interface.



Installation

3.3.1.3 Menu Point: Setup Bridge

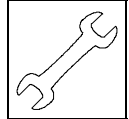
Via this page you can configure a wireless CAN-to-CAN bridge with two Bluetooth CAN modules. Both devices of a bridge have to be configured first.

The screenshot shows a web browser window titled "Bluetooth CAN-Interface - Mozilla {Build ID: 2002053012}". The page content is titled "CAN Bridge" and includes a navigation menu on the left with options: Overview, Configuration, Internals, Setup Bridge, CAN Watch, CAN Send, Baudrate, Scope, Update, and Support. The main content area contains the following configuration options:

- Mode: Slave (dropdown)
- Slave Address: 00 00 00 00 00 00 (input fields)
- Filter Mask (11 bit): 0000 (input field)
- Filter IDs (11 bit): 0000 (input field)
- Filter Logic: Normal (dropdown)
- 29 Bit Support: Disabled (dropdown)
- Table for ID translation rules:

Enable Rule	Local ID(11bit)	Remote ID(11bit)
<input type="checkbox"/>	0000	0000
<input type="checkbox"/>	0000	0000
<input type="checkbox"/>	0000	0000

Generally there is a Bluetooth CAN-to-CAN bridge consisting of a master and a slave device (These terms have nothing in common with the master and slaves of the Bluetooth radio technology.). In bridge operation the master establishes a connection to the slave. Therefore the Bluetooth address of the slave has to be stored in the master device of a bridge. You can find the Bluetooth address on the serial number label or the search function of your Bluetooth software.

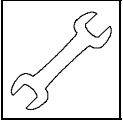


In order to reduce the required bandwidth on the radio interface you can configure an acceptance filter on the basis of CAN-IDs. The acceptance filtering determines which locally received CAN-messages are to be transmitted to the bridge remote station.

In addition to a filtering it is possible to determine up to eight rules for a transition of local IDs to remote IDs.

The individual configuration options:

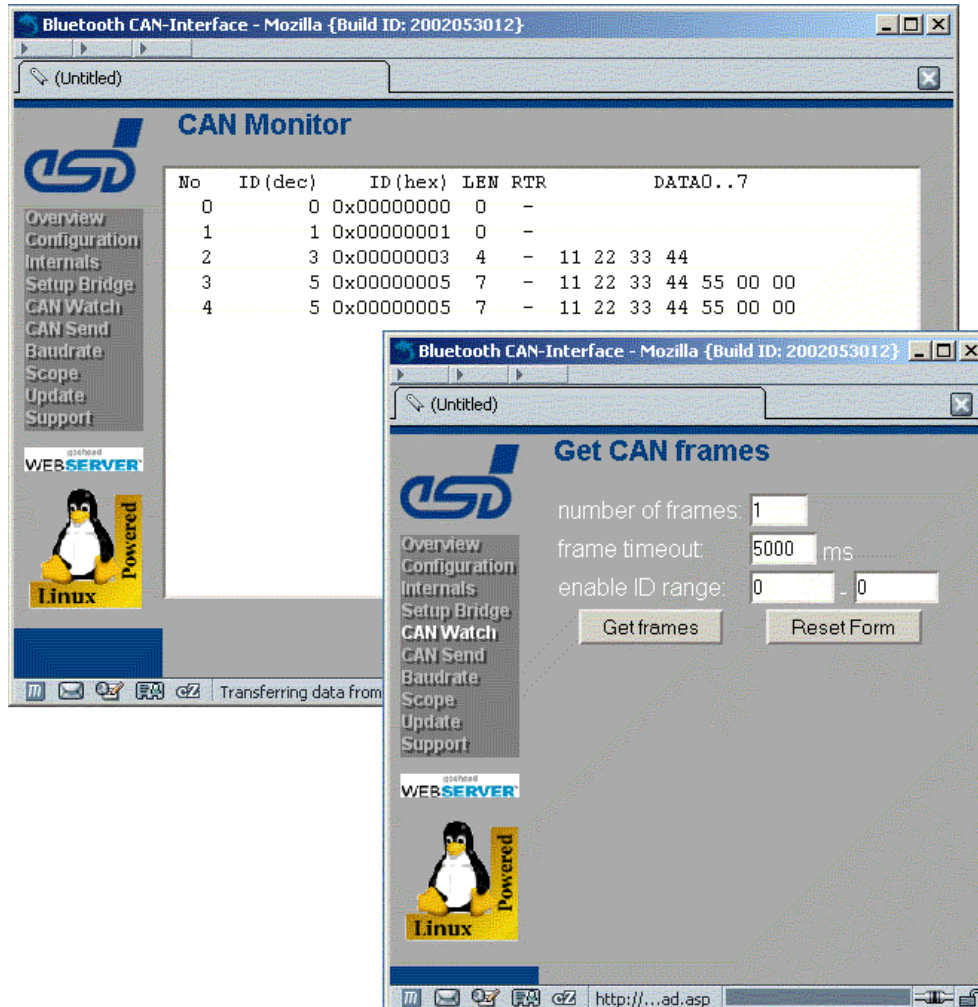
Option	Description
Mode	Determines the role of master or slave in bridge operation.
Slave Address	For the bridge master this field represents the Bluetooth address of the slave. It can be ignored for the Bluetooth slave.
Filter Mask	These three options configure an acceptance filtering. The IDs of locally received CAN-messages are AND-linked to the <i>Filter mask</i> bit by bit. The result of this link is compared to the <i>Filter-ID</i> . If the comparison results in a value unequal 0, the message is transmitted - otherwise it is not transmitted. If the <i>Filter logic</i> is configured to <i>reverse</i> , the transmission behaviour is negated.
Filter-ID	
Filter Logic	
Filter Rules(1-8)	The filter rules translate locally received IDs.
Enable	The check boxes enable or disable a rule.
Local ID	A locally received CAN-message with the ID 'localID' is transmitted as message with the ID 'remoteID'. These rules have exclusively been implemented for 11-bit IDs.
Remote ID	



Installation

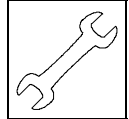
3.3.1.4 Menu Point: CAN-Watch

This page provides a simple CAN-monitor. CAN-messages received are represented on the web page.



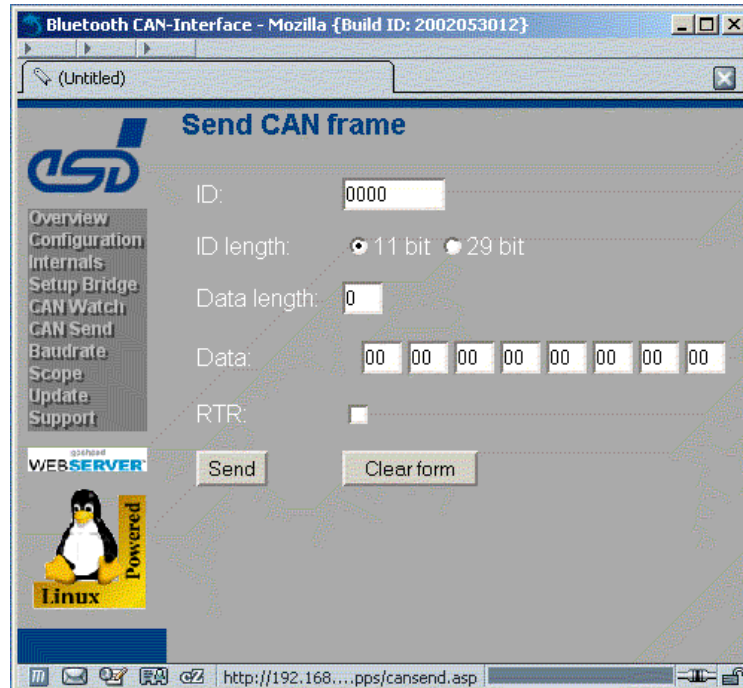
When activating this menu point you first reach a configuration page (in the foreground of the figure). Specify the number of messages which you desire to wait for. The *Frame Timeout* specifies the time to be waited for each individual message. The parameters 'enable ID range' specify the messages which are to be received.

The messages received will only be displayed after the specified number of messages has been received by the device.



3.3.1.5 Menu Point: CAN-Send

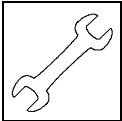
By means of this menu an individual CAN-message can be transmitted manually.



Via the entry fields on this page a CAN-message can be assembled in accordance with CAN-Specification 2.0A or 2.0B. By clicking the button 'Send' the message is transmitted to the connected CAN-bus. The bit rate is determined by means of menu point 'Configuration' (see page 10).

The individual fields have got the following meaning:

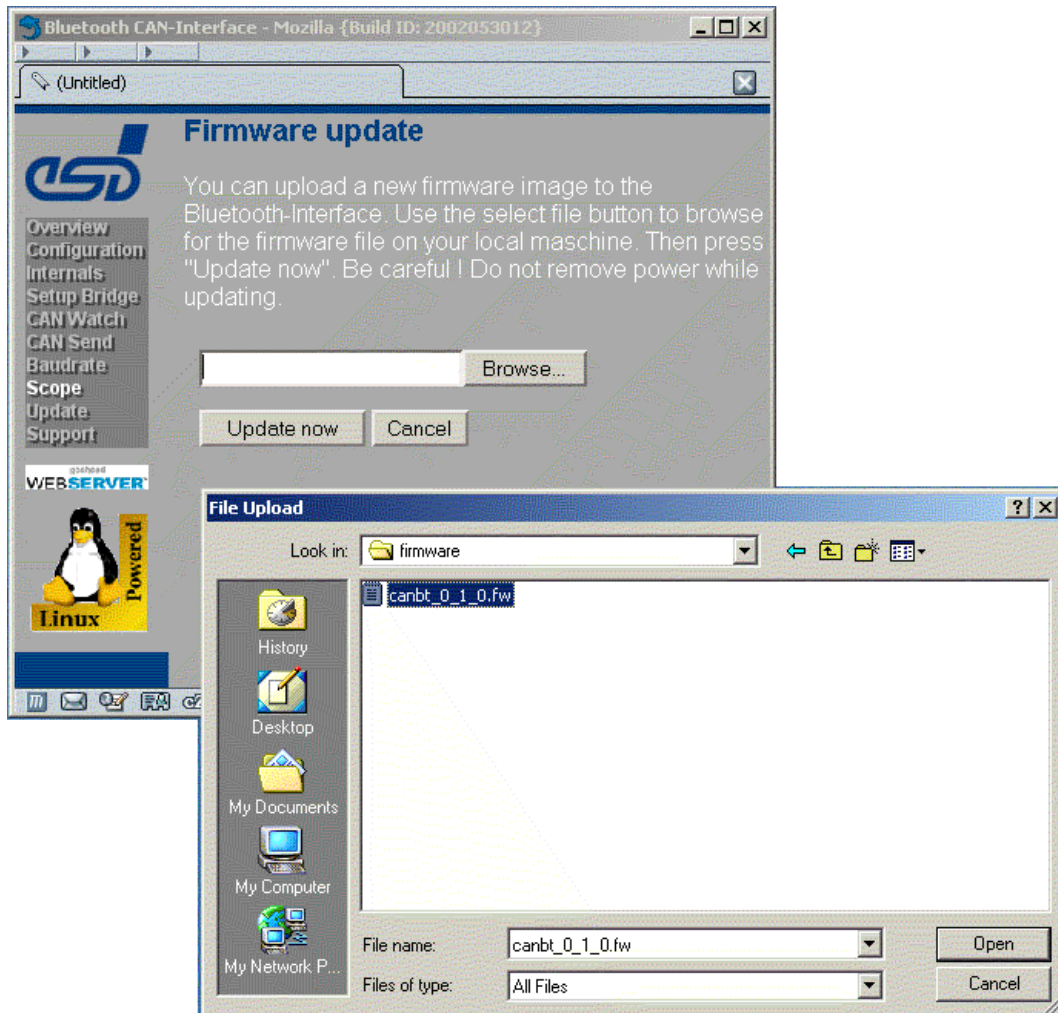
Option	Description
ID	Identifier of the CAN-message. The number format (hex./dec.) is determined in menu point "Configuration".
ID length	The radio buttons decide about the number of identifier bits (11 bits - in accordance with CAN 2.0A or 29 bits - in accordance with CAN 2.0B)
Data length	This field determines the number of data bytes to be transmitted. Possible values are 0...8.
Data (field)	In the data field the reference data bytes of the CAN-message are specified. They have to be entered as hexadecimal value (00-FF).
RTR	This button determines whether the RTR-bit of the CAN-message is to be set or not. The data field will be ignored in this case.



Installation

3.3.1.6 Menu Point: Update

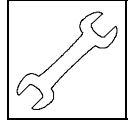
If you received a new firmware by esd in form of an update file, you can transfer this into the flash memory of the device via menu point “Update”.



By clicking the *Browse...*-button a file-selection dialog is opened. Select the firmware file and click *Open*. Now the file name appears in the text entry line of the web-interface page. Now click on *Update now*. The file is being transferred now.

As soon as the file has been transferred completely you have to acknowledge the update procedure again. The entire update procedure can take several minutes.

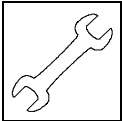
Attention! Do not disconnect the power supply to the device in any case during the update procedure. A failing update can cause problems to the device which cannot be used anymore then and has to be sent in!



3.3.1.7 Menu Point: Baudrate

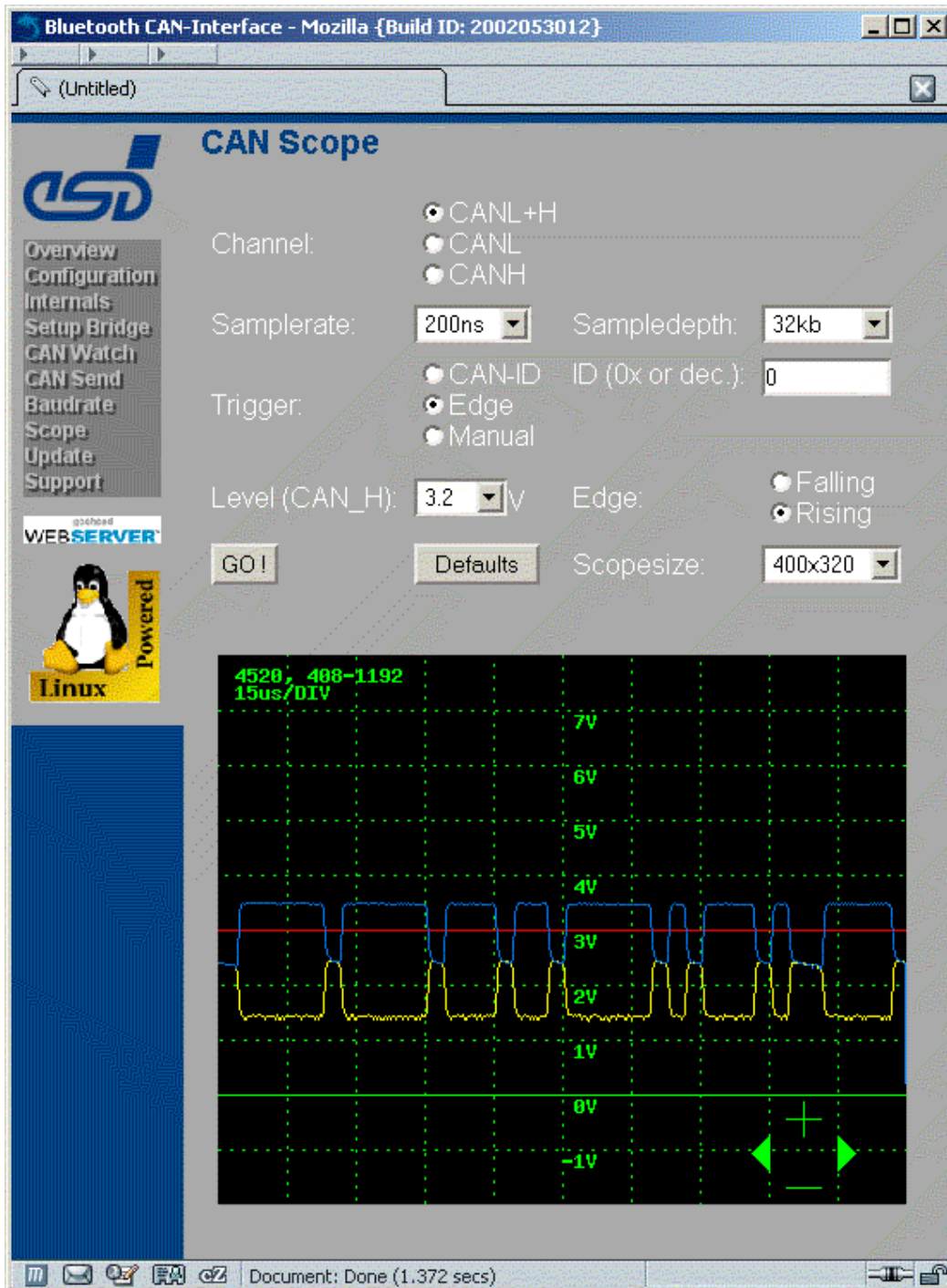
The menu point *Baudrate* provides the option to automatically recognize the bit rate on the CAN-bus.

This function will only be available from firmware version 0.2.0 .

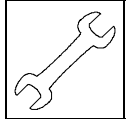


Installation

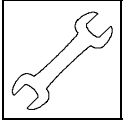
3.3.1.8 Menu Point: Scope



Menu point “Scope” provides an analog memory oscilloscope for both CAN-bus lines (CAN_H and CAN_L). Via the upper section of the page the recording is configured. After it has successfully been triggered an oscillogram of the CAN-lines appears in the lower page section. The configuration buttons in the upper section of the page have got the following meaning:



Button	Description
Channel	These buttons determine the channel which is to be recorded and displayed.
Sample rate	Represents the sample interval for the recording. The setting 100 ns will only be available from firmware version 0.2.0.
Sample depth	Size of the recording memory in samples.
Trigger (-condition)	It is possible to trigger on a special CAN-identifier, a signal edge or manually. The first possibility will only be available from firmware version 0.2.0.
Level (CAN_H)	Represents the trigger voltage on CAN_H line. In addition the trigger edge is selected.
Scope size	Here the size of the scope display is represented in pixel.
Button: Go	Starts the recording.



3.3.2 Special Features of the CAN-API

The esd-Bluetooth CAN-module can be used like a conventional esd CAN-module. The driver software provides a documented CAN-API by means of which it is possible to create new CAN-applications. The function scope of the API essentially corresponds to the usual esd-CAN-API so that applications which have been created, for example, for a PCI-CAN-board, can also work with the wireless Bluetooth CAN-module.

Deviations from the behaviour of conventional CAN-modules:

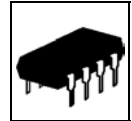
1) **canopen(...)**

MS Windows operating systems have no integrated Bluetooth support yet. Therefore the Bluetooth functionality is usually provided through additional software (normally in connection with the Bluetooth hardware). The connection from your notebook or PDA is therefore not established via one defined way. It might be necessary to establish the Bluetooth connection manually first. Only when this connection does exist the CAN-API can be used. If no Bluetooth connection is available, calling `canopen()` will fail.

2) **Data rate**

The Bluetooth radio interface is not able to transmit the maximum data incidence transparently on a CAN-bus. This effect can be minimized by skilfully selecting an acceptance filtering.

The Bluetooth CAN-interface can transmit 100% to CAN-bus at 125kBit/s. Deviations are possible and depend strongly on the Bluetooth hardware used (PC-card, USB-Dongle, etc.) and the environmental conditions.



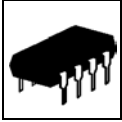
4. Summary of Technical Data

4.1 General Technical Data

Ambient temperature	0...50 °C
Humidity	90 %, non-condensing
Wall plug style power supply	input voltage: 110 ... 240 V/AC frequency: 50 ... 60 Hz output voltage: 9 V/DC
Power supply of the module	input voltage of the module *) without internal accu: 9 ... 12 V/DC, option: 24 V/DC (20...30 V/DC) with internal accu: 9 ... 12 V/DC current consumption: 400 mA (at 9 V/DC) accu capacity: 1200 mAh *) Attention! Use only power supplies with stabilized output voltage, because others may have a secondary voltage that is much higher than the nominal voltage !
Connector	X0100 (power connector 2.1 mm) - power supply X1000 (DSUB9/male) - CAN
Dimensions	160 mm x 83 mm x 30 mm
Weight	ca. 180 g

accu = charging battery

Table 4.1: General module data



4.2 Bluetooth-Interface and Micro Controller

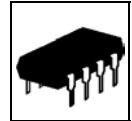
Bluetooth Chip Set	Ericsson ROK 101007
Bluetooth Specification	Bluetooth Specification 1.1
Profiles supported	Serial Port Profile, LAN Access Profile, Dial-Up-networking Profile (DUP) (LAN and DUP for WEB browser-based configuration)
Micro controller	IBM PPC405CR
Memory	16 MB DRAM 2 MB Flash-EPROM 1 KB EEPROM as configuration memory

Table 4.2: Data of the Bluetooth interface and micro controller

4.3 CAN-Interface

Number	1
CAN-controller	SJA1000
CAN-protocol	CAN 2.0A/B
Physical interface	Physical Layer in accordance with ISO 11898, transfer rate programmable from 10 kbit/s to 1 Mbit/s
Bus termination	has to be set externally
Additional functions	- automatically recognition of bit rate - sampling of analog CAN-bus signals
max. CAN-bit rate via wireless connection	125 kbit/s at 100 % bus performance on CAN (higher bit rates are possible at accordingly lower bus performance)
Latent period	ca. 5 ...10 ms

Table 4.3: Data of CAN-interface



4.4 Order Information

Type	Features	Order No.
CAN-Bluetooth-BAT	1 x CAN 2.0A/B, ISO11898, power supply 9...12 V/DC ^{1*)} , with internal accumulator, with wall plug style power supply 110 ... 230 V/AC	C.2065.02
CAN-Bluetooth	1 x CAN 2.0A/B, ISO11898, power supply 9...12 V/DC ^{1*)} , without internal accumulator, with wall plug style power supply 110 ... 230 V/AC	C.2065.03
CAN-Bluetooth-24	1 x CAN 2.0A/B, ISO11898, power supply 24 V/DC ^{1*)} , without internal accumulator, without power supply	C.2065.04
CAN-DRV-LCD	Object licence for Windows and Linux	C.1101.02
CAN-Bluetooth-Co	CANopen master/slave	C.2065.12
CAN-Bluetooth-ME ^{2*)}	English manual for C.2065.02/04	C.2065.21
CAN-API-ME ^{2*)}	English manual for C.1101.02	C.2001.21

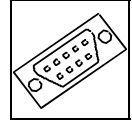
^{1*)} **Attention!** Use only power supplies with stabilized output voltage, because others may have a secondary voltage that is much higher than the nominal voltage!

Other power supply input voltage ranges for modules without accumulator on request.

^{2*)} If you order the manual together with the module, the manual is free of charge.

Table 4.4: Order information

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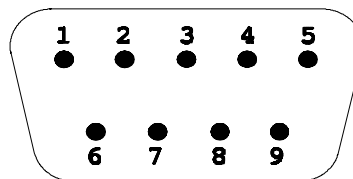


5. Connector Assignment

5.1 CAN-Interface at DSUB9-Connector

The connector is a male 9-pin DSUB-connector.

Pin Position:



Pin Assignment:

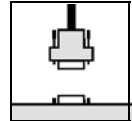
Signal	Pin		Signal
(CAN_GND)	6	1	reserved
		2	CAN_L
CAN_H	7	3	CAN_GND
reserved	8	4	reserved
reserved	9	5	shield

9-pin DSUB-connector

Signal Description:

CAN_L, CAN_H...	CAN-signal lines
CAN_GND ...	reference potential of local CAN-physical layer
(CAN_GND) ...	optional reference potential of local CAN-physical layer
shield...	shield (connected to case of 9-pin DSUB-connector)
reserved ...	reserved for future applications

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6. Correctly Wiring Electrically Isolated CAN Networks

Generally all instructions applying for wiring regarding an electromagnetic compatible installation, wiring, cross sections of wires, material to be used, minimum distances, lightning protection, etc. have to be followed.

The following **general rules** for the CAN wiring must be followed:

1.	A CAN net must not branch (exception: short dead-end feeders) and has to be terminated by the wave impedance of the wire (generally $120\ \Omega \pm 10\%$) at both ends (between the signals CAN_L and CAN_H and not at GND)!
2.	A CAN data wire requires two twisted wires and a wire to conduct the reference potential (CAN_GND)! For this the shield of the wire should be used!
3.	The reference potential CAN_GND has to be connected to the earth potential (PE) at one point. Exactly one connection to earth has to be established!
4.	The bit rate has to be adapted to the wire length.
5.	Dead-end feeders have to kept as short as possible ($l < 0.3\ \text{m}$)!
6.	When using double shielded wires the external shield has to be connected to the earth potential (PE) at one point. There must be not more than one connection to earth.
7.	A suitable type of wire (wave impedance ca. $120\ \Omega \pm 10\%$) has to be used and the voltage loss in the wire has to be considered!
8.	CAN wires should not be laid directly next to disturbing sources. If this cannot be avoided, double shielded wires are preferable.

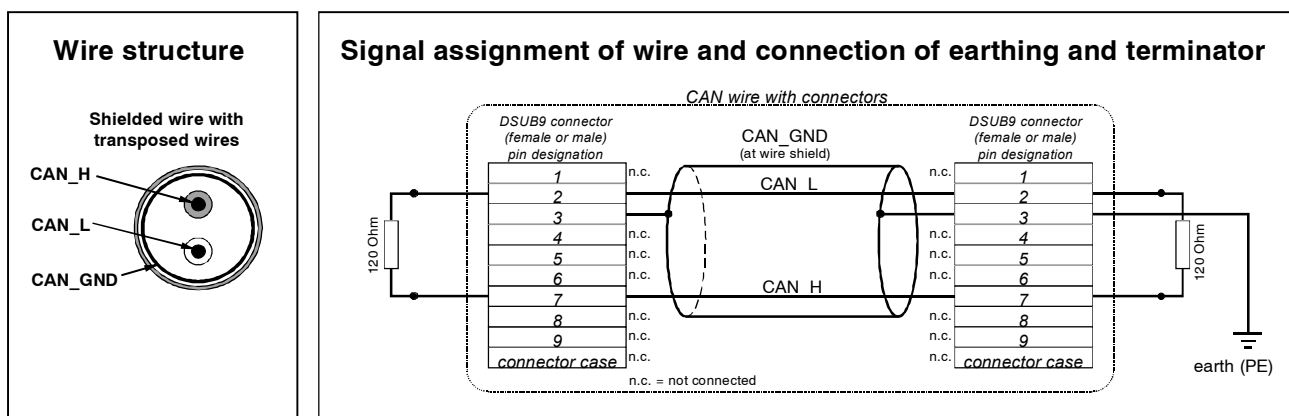
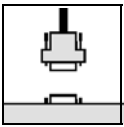


Figure: Structure and connection of wire



Wiring

Cabling

- for devices which have only one CAN connector per net use T-connector and dead-end feeder (shorter than 0.3 m) (available as accessory)

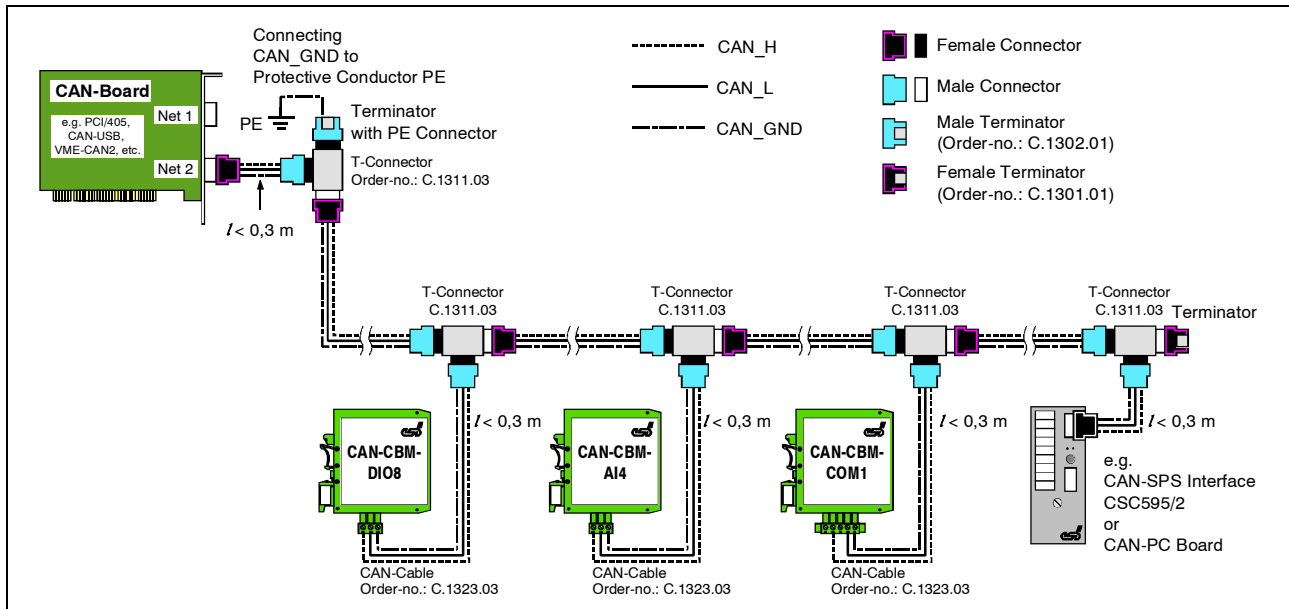


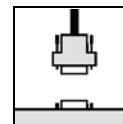
Figure: Example for correct wiring (when using single shielded wires)

Terminal Resistance

- use **external** terminator, because this CAN later be found again more easily!
- 9-pin DSUB-terminator with male and female contacts and earth terminal are available as accessories

Earthing

- CAN_GND has to be conducted in the CAN wire, because the individual esd modules are electrically isolated from each other!
- CAN_GND has to be connected to the earth potential (PE) at **exactly one** point in the net!
- each CAN user without electrically isolated interface works as an earthing, therefore: do not connect more than one user without potential separation!
- Earthing CAN e.g. be made at a connector

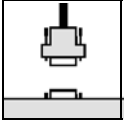


Wire Length

- Optical couplers are delaying the CAN signals. By using fast optical couplers and testing each board at 1 Mbit/s, however, esd CAN guarantee a reachable length of 37 m at 1 Mbit/s for most esd CAN modules within a closed net without impedance disturbances like e.g. longer dead-end feeders. (Exception: CAN-CBM-DIO8, -AI4 and AO4 (these modules work only up to 10 m with 1 Mbit/s))

Bit rate [Kbit/s]	Typical values of reachable wire length with esd interface l_{\max} [m]	CiA recommendations (07/95) for reachable wire lengths l_{\min} [m]
1000	37	25
800	59	50
666.6	80	-
500	130	100
333.3	180	-
250	270	250
166	420	-
125	570	500
100	710	650
66.6	1000	-
50	1400	1000
33.3	2000	-
20	3600	2500
12.5	5400	-
10	7300	5000

Table: Reachable wire lengths depending on the bit rate when using esd-CAN interfaces



Wiring

Examples for CAN Wires

Manufacturer	Type of wire
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.de	e.g. UNITRONIC ®-BUS CAN UL/CSA (UL/CSA approved) UNITRONIC ®-BUS-FD P CAN UL/CSA (UL/CSA approved)
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e.g. BUS-PVC-C (1 x 2 x 0,22 mm ²) Order No.: 93 022 016 (UL appr.) BUS-Schleppflex-PUR-C (1 x 2 x 0,25 mm ²) Order No.: 94 025 016 (UL appr.)
SAB Bröckskes GmbH&Co. KG Grefrather Straße 204-212b 41749 Viersen Germany www.sab-brockskes.de	e.g. SABIX® CB 620 (1 x 2 x 0,25 mm ²) Order No.: 56202251 CB 627 (1 x 2 x 0,25 mm ²) Order No.: 06272251 (UL appr.)

Note: Completely configured CAN wires can be ordered from **esd**.