

CAN-Bridge

CAN Communications Module for CAN 2.0 A/B,
CAN Layer 2

700-660-2AA01

Manual

Version 1/26.01.2011 from HW 1 & FW 1.00



Manual order number 700-660-2AA01/en

All rights including translation, reprint or reproduction of this manual or parts thereof reserved. No part of this manual may be reproduced, edited, copied or distributed in any form (photocopy, microfilm or any other method) without the written consent of Systeme Helmholtz GmbH, not even for the purpose of teaching or by use in electronic systems. All rights in the event that a patent is granted or a utility-model patent is registered are reserved.

Copyright © 2011 by

Systeme Helmholtz GmbH

Hannberger Weg 2, 91091 Grossenseebach

Note:

We have checked the contents of this manual for conformity with the specified hardware and software, but, as differences cannot be ruled out, we do not guarantee total conformity. However, the contents of this manual are updated regularly, therefore, before starting to use the purchased products, please download or view the latest version of this manual from www.helmholtz.com.

Our customers are very important to us. We always welcome your suggestions for improvements and other feedback.

Changes in this document:

Status	Date	Change
1	2011-02-22	1st version

Table of contents

1	Safety instructions	7
1.1	General	7
1.2	Access restriction	8
1.3	User instructions	8
1.4	Intended use	8
1.5	Avoid improper use!	8
2	Installation and Assembly	9
3	Overview of the System	10
3.1	CAN Bus	10
3.2	CAN cabling	10
3.3	Application and functional description	11
3.4	Connections	11
3.5	LED indicators	12
3.6	DIL switches	12
3.7	Included in Delivery	13
3.8	Accessories	13
4	Configuring the Module	13
4.1	Overview	13
4.2	Installing the USB interface driver	14
4.3	Creating a Project	18
4.3.1	Setting the CAN bus baud rate.	18
4.3.2	Setting the protocol type.	18
4.3.3	Setting the Filter Type	19
4.3.4	Mask	19
4.3.5	Filter	19
4.4	Upload	21
4.5	Download	21
4.6	Diagnosis/Debug	21
4.6.1	Debug display	21

5	Appendix	23
5.1	Specification	23
5.2	Plug pin assignments	23
5.3	Further documentation	23
	Notes	24

1 Safety instructions

For your own safety and the safety of others, please observe the safety instructions listed below. The safety instructions illustrate potential dangers and how to avoid these dangerous situations.

The following pictograms are used in this manual:



Caution, draws attention to dangers and sources of error



Provides information



Danger in general or specifically



Danger of electric shock

1.1 General

The CAN-Bridge module is only used as a component of a total system.



The owner of a machine system is responsible for the observance of the safety and accident prevention regulations applicable to the special use.



Pay attention to the usage-specific safety and accident prevention regulations during project planning.



Emergency-off equipment in accordance with EN 60204/IEC 204 must remain active in all operating modes of the machine system. There must not be an undefined restart of the system.



Errors occurring in the machine system that could cause property damage or personal injury must be intercepted by additional external equipment. This external equipment must guarantee a safe operating state, even in the case of an error. Such equipment may be, for example electromechanical safety switches, mechanical locks etc. (see EN 954-1, Risk assessment).



Never initiate or perform safety-relevant functions via the operating terminal.



*Access to the modules
only for authorized
personnel!*

1.2 Access restriction

The modules are open operating equipment and may only be installed in electrical service rooms, cabinets or housings. Electrical service rooms, cabinets or housings must only be accessible by means of a tool or key, and access only permitted to trained or approved personnel. See also Chapter 2.

1.3 User instructions

This manual is intended for project planners and installers of the CAN-Bridge module.

It is intended to serve the project planner as the programming and reference manual. All data necessary for installation is to be provided to the installer.

The owner of the automation system is responsible for compliance with these regulations.

1.4 Intended use

The CAN-Bridge module may only be used as a communications system as described in the manual.

1.5 Avoid improper use!

Safety-relevant functions must not be controlled solely by means of the CAN-Bridge module.

2 Installation and Assembly

The CAN-Bridge module must be installed in compliance with VDE 0100 IEC 364.

Ambient temperature: 0°C – 60°C.



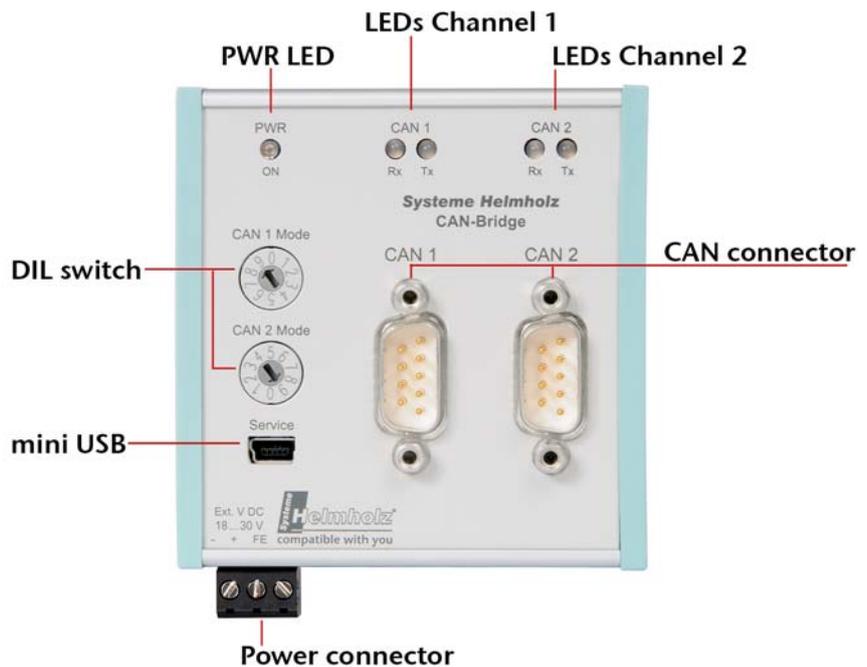
All system components must be completely switched off before commencing installation work.



Danger of electric shock



The usage-specific safety and accident prevention regulations must be observed during assembly (e.g. protection against static discharge).



The CAN-Bridge module is suitable for mounting on a DIN rail.

The CAN-Bridge module is intended for use with CAN plugs. The SUB-D connectors are arranged so that the CAN cable is routed downwards the housing, hence space must be available there.

3 Overview of the System



3.1 CAN Bus

The CAN bus (Controller Area Network) is an international, open fieldbus standard for applications in building, manufacturing and process automation.

The comprehensive fault detection measures combine to make the CAN bus one of the most secure bus systems available currently, with a residual error probability of less than 4.7×10^{-11} .

3.2 CAN cabling

A CAN bus segment requires at least three wires: CAN high, CAN low and CAN ground. Only a linear structure is allowed. 120 ohm termination resistors must be inserted at either end of the CAN bus segment, between CAN high and CAN low. The CAN-Bridge module does not have termination resistors built in.

The maximum cable length depends primarily on the baud rate used.



Termination resistors are not integrated into the CAN-Bridge module.

Bit rate	Bus length	Bit time
1 Mbps	30 m	1 µsek.
800 kbps	50 m	1.25 µsek.
500 kbps	100 m	2 µsek.
250 kbps	250 m	4 µsek.
125 kbps	500 m	8 µsek.
20 kbps	2500 m	50 µsek.

The lengths given are only guidelines. The maximum cable length also depends on the number of connected devices and the type of cable.

3.3 Application and functional description

Systeme Helmholtz GmbH's CAN-Bridge module enables two separate CAN bus systems to be connected together. The module can be fitted on a DIN rail.

Delivered with the software package is the Windows parameterisation tool "CAN-Bridge Param v1.x", used for setting the CAN bus communication parameters.

The CAN-Bridge module supports ISO 11898-2 CAN 2.0A (11 Bit) and CAN 2.0B (11/29 Bit) telegrams with baud rate freely selectable between 20kbps and 1Mbps.

Using a multi step acceptance mask, the frame IDs relevant for the automation device can be pre-filtered. Only those CAN telegrams required are accepted, thus reducing the load on the automation device.

3.4 Connections

The CAN-Bridge module has one 9 pole SUB-D plug per channel for the CAN bus, a mini USB connector for configuration and diagnosis and a power connector for 18V - 30V.



There is no 24V voltage feed provided on the CAN bus plug.

Plug pin assignments

Pin	CAN SUB-D plug
1	-
2	CAN Low
3	CAN GND
4	-
5	-
6	-
7	CAN High
8	-
9	-

3.5 LED indicators

The LEDs on the front face of the module provide information about the operating status.



All LEDs have a fade-out time of 100 msec. They blink when showing slower results.



LED "PWR" (green):

Indicates that the module is being supplied with the correct voltage and the operating system is running.

Blinks when a dataset has an error (e.g. when a device has not yet been allocated its parameter set).

LED „RX“ (Green):

CAN bus receiver active: indicates the correct reception of a CAN telegram.

LED „RX“ (Red):

Indicates a fault in the receive processing of a CAN telegram (e.g. FiFo overflow).

LED „TX“ (Orange):

CAN bus send active: indicates that a CAN telegram is being sent correctly.

LED „TX“ (Red):

Indicates a fault in the send processing of a CAN telegram (e.g. with an offset error).

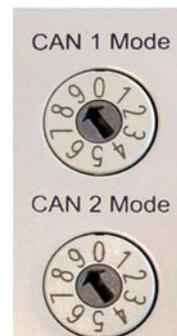
Note: "TX and "RX" will both be red when the error counter has reached 255; the controller then changes to passive mode. Afterwards the CAN-Bridge will attempt, independently, to reactivate the controller.



In Automode, "TX" and "RX" will both remain red until a baud rate has been identified.

3.6 DIL switches

The ten way DIL switches on the front face of the housing are used to set the CAN baud rate.



Baud rates:

0	1	2	3	4	5	6	7	8	9
Auto	-	20k	50k	100k	125k	250k	500k	800k	1M

3.7 Included in Delivery

CAN-Bridge module, mini USB cable,
CD with Parameterisation software „CAN-Bridge Param“ and
drivers

800-600-1AA11

3.8 Accessories

Manual, German/English

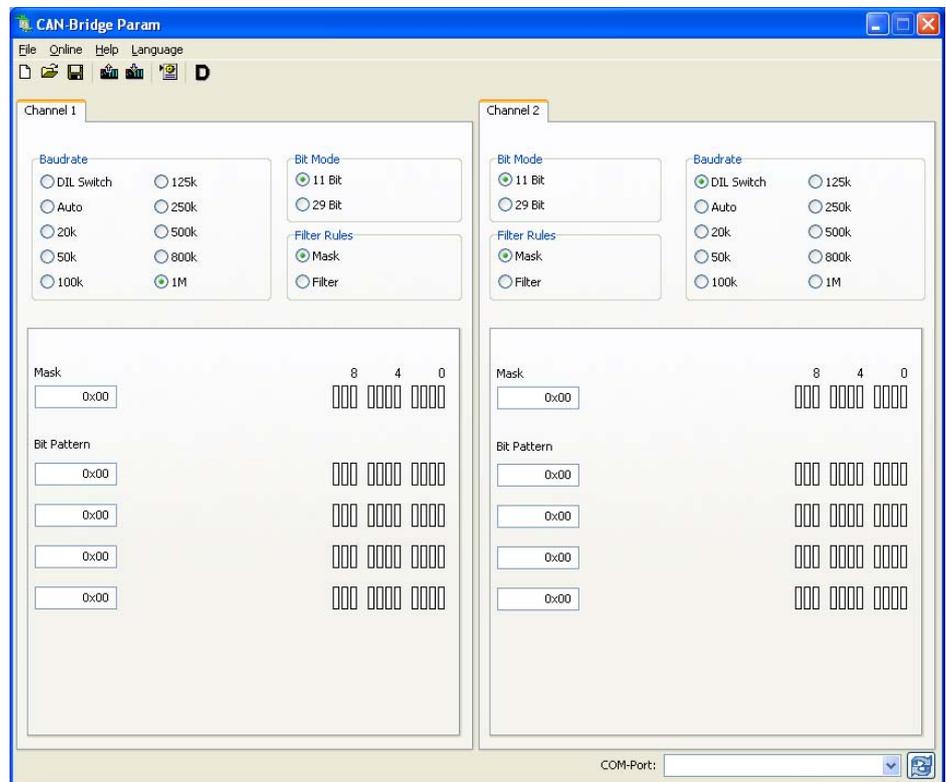
900-660-2AA01

4 Configuring the Module

4.1 Overview

The CAN-Bridge module is configured from a PC running the "CAN-Bridge Param v1.x" software. This software is delivered with the module but is also downloadable from www.helmholz.com.

The software can be run on any Microsoft Windows 2000 or XP based computer.



The configuration details of the module can be stored in a project file on the PC.

A standard mini USB cable can be used to connect the PC to the CAN-Bridge module.

4.2 Installing the USB interface driver

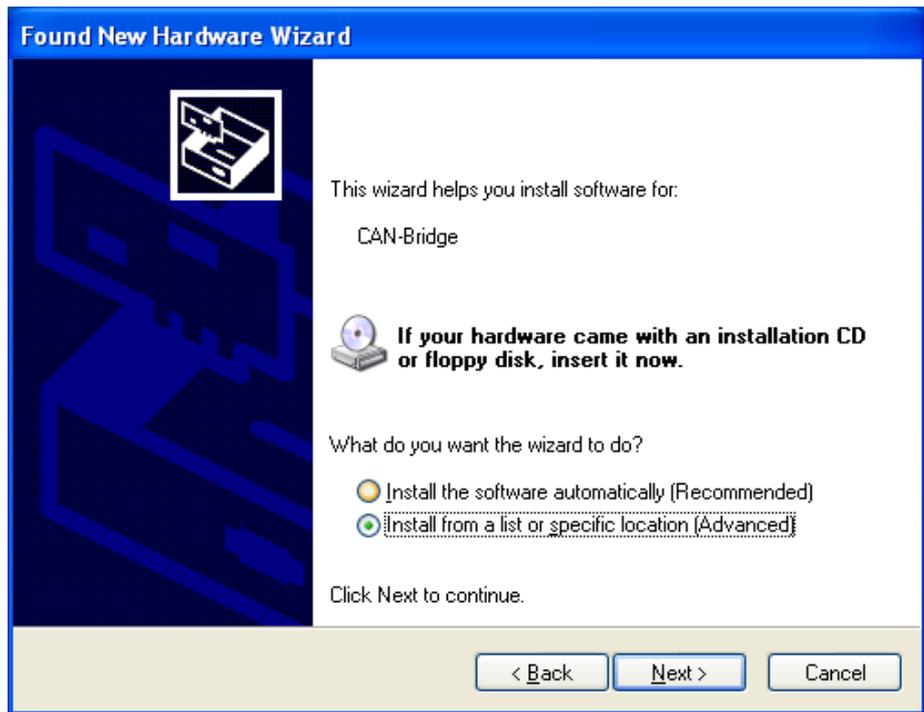
When a CAN-Bridge module is connected to a PC for the first time, the operating system will attempt to install the appropriate driver. This driver provides the interface between the USB interface and the operating system.

This first-time initialisation can take some time and proceeds as follows:

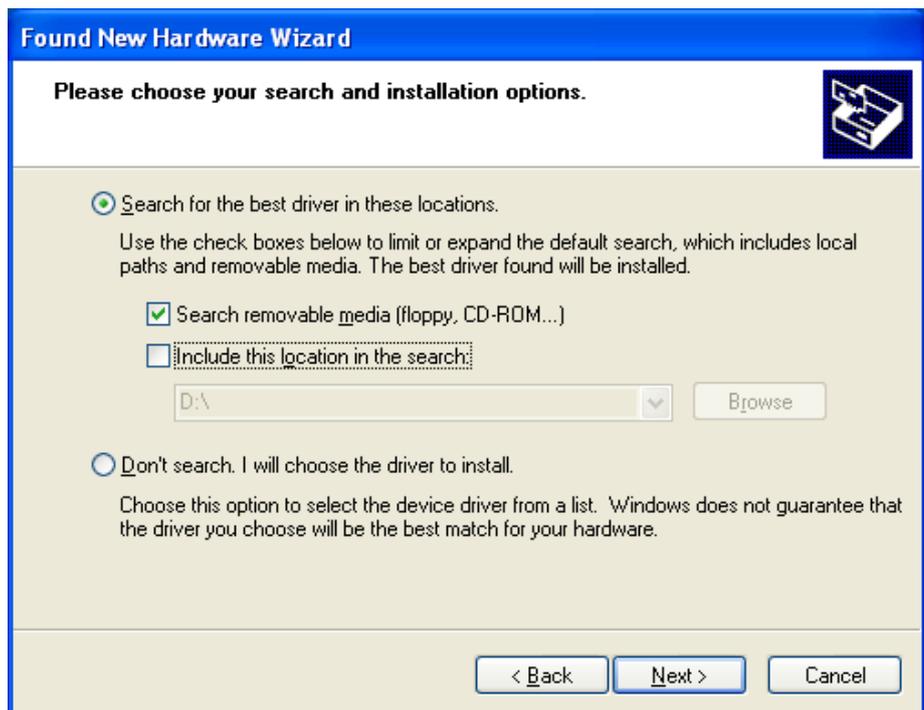
- The operating system starts an installation assistant which guides you through the largely automatic installation. The first step is used to define whether the driver should be searched for locally or online. As the driver is available on the CD delivered, select the option "No, not this time".



- In order to be able to enter the search path for the driver (usually the CD delivered) select the "Install from a list" option and press "Next".



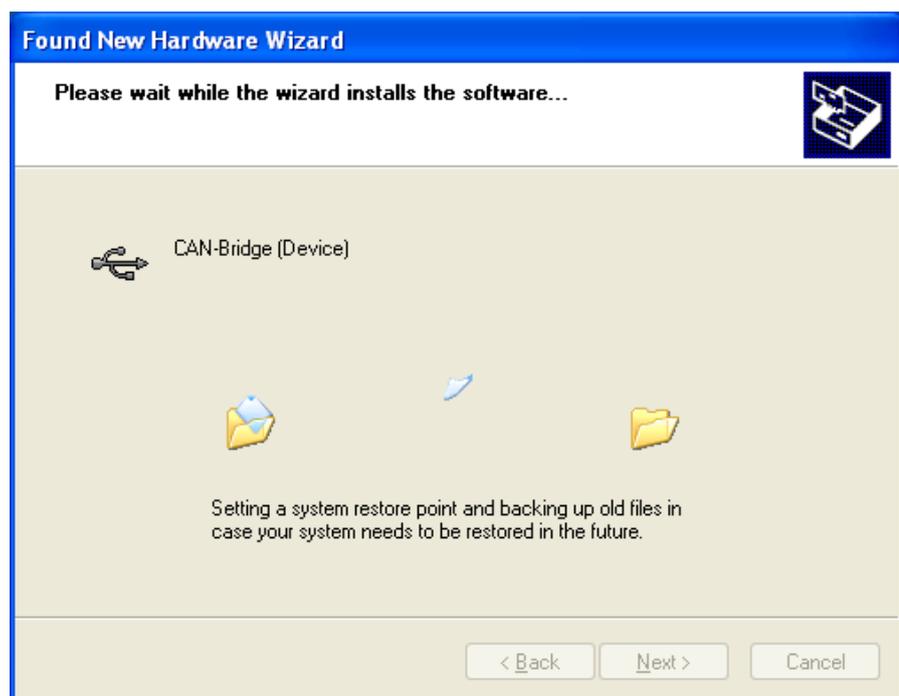
- A prompt follows for specifying the location of the driver. In general it is sufficient to select "Search removable media" and press "Next".



- If the CAN-Bridge CD is inserted in a local drive, the search for a driver is performed at this stage.
- If the driver is found a Windows XP-Logo compatibility check question is displayed.



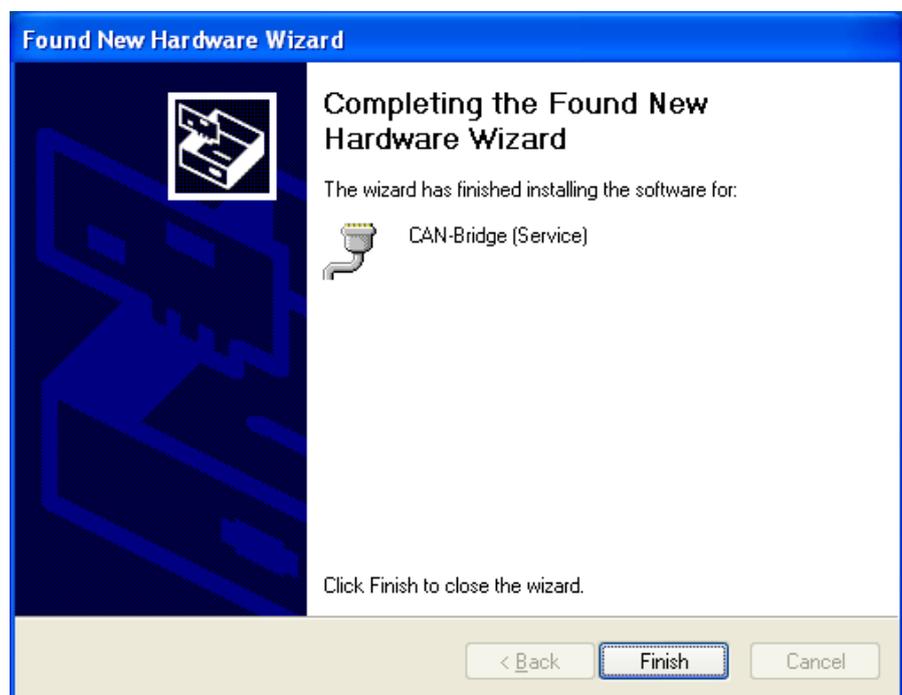
- Confirm this by pressing "Continue installation", after which the driver is installed.



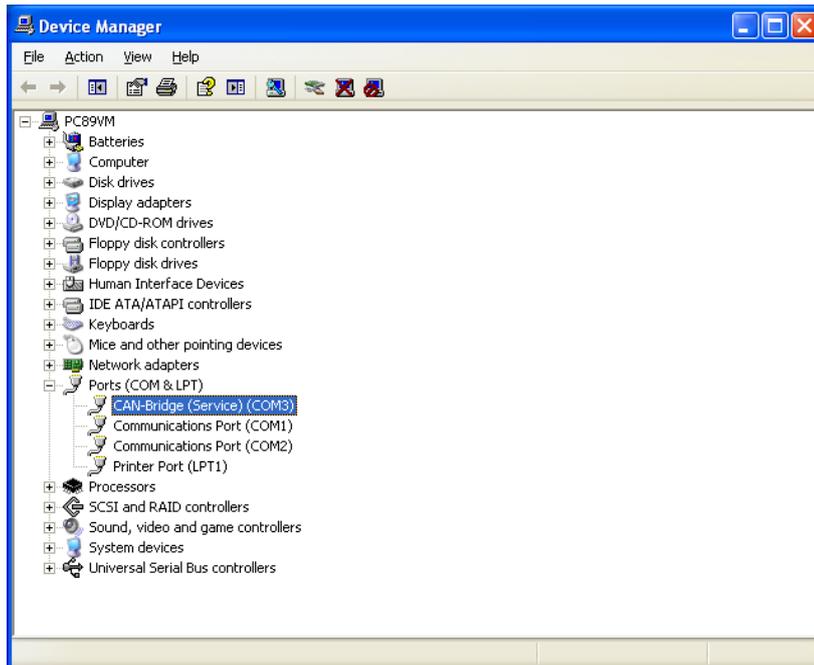
- Following a successful installation the process is terminated by pressing "Finish".



- The operating system starts the installation assistant a second time, in order to also install the virtual COM port driver. The install process is the same as previously described.



- A new COM port is inserted into the device manager. This COM port is automatically selected in the CAN-Bridge Param software in order to enable communication with the CAN-Bridge module.

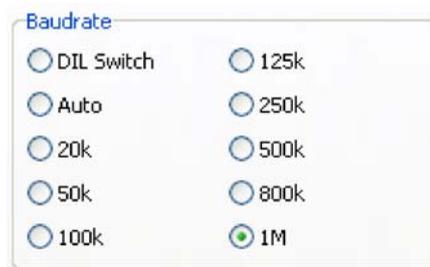


4.3 Creating a Project

A new project can be created via the menu item "File / New" or via the "New" icon.

4.3.1 Setting the CAN bus baud rate.

The CAN baud rate of the current channel can be selected between 20kbps and 1Mbps.



Alternatively it can be set by "Autobaud" or via the DIL switches.

Note: with Autobaud, up to 10 frames must be transferred over the CAN bus. Thus it is expected that a communication between two devices already exists.

The baud rate is determined for, starting at 1Mbps.

4.3.2 Setting the protocol type.

The CAN-Bridge Module supports both CAN 2.0A (11 Bit) and CAN 2.0B (29 Bit) protocol formats.



4.3.3 Setting the Filter Type

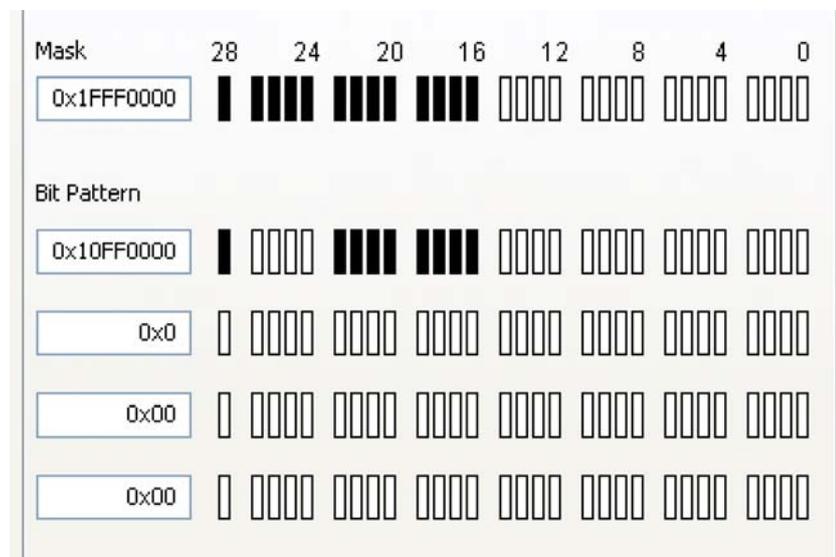
In CAN-Bridge Param, two different filter types can be selected which are then available for both CAN 2.0 A (11 bit) and CAN 2.0 B (29 bit).



4.3.4 Mask

In the CAN-Bridge module one mask and up to four bit patterns are available. Using this mask and the bit patterns, reception of certain telegram IDs can be enabled or disabled.

i
The default setting of the mask (0) enables reception of all telegrams.



In order to receive any CAN telegrams the CAN identifier bits are first filtered with a mask and then compared with a predefined value (bitmap). If this comparison succeeds the CAN telegram is transferred to the other channel and forwarded to the CAN bus.

28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CAN identifier received																												
Mask													(e.g.. 1111111111110000000000000000)															
Bit Pattern													(e.g. 1000011111110000000000000000)															

The mask 1111111111110000000000000000 (=536805376) filters out the upper 13 bits of the CAN-identifier. The bit pattern 1000011111110000000000000000 (=285147136) defines which telegrams should be accepted after the filtering.

In this example this would mean the CAN telegrams with any address between 0x10FF0000 to 0x10FFFFFF.

4.3.5 Filter

As an alternative to the masks, the received CAN telegrams can also be filtered on a range of frame IDs.

Different filters can be used for each protocol.

11 bit mode: 0 - 255 filter

29 bit mode: 0 - 127 filter

Using the filter settings, different frame IDs can be either enabled or blocked.

Filter#:	Activ	Begin	End	Offset	
1	<input checked="" type="checkbox"/>	<input type="text" value="0x0"/>	<input type="text" value="0x7FF"/>	<input type="text" value="0"/>	<input type="button" value="X"/>

4.4 Upload

The current project can be uploaded to the CAN-Bridge module.



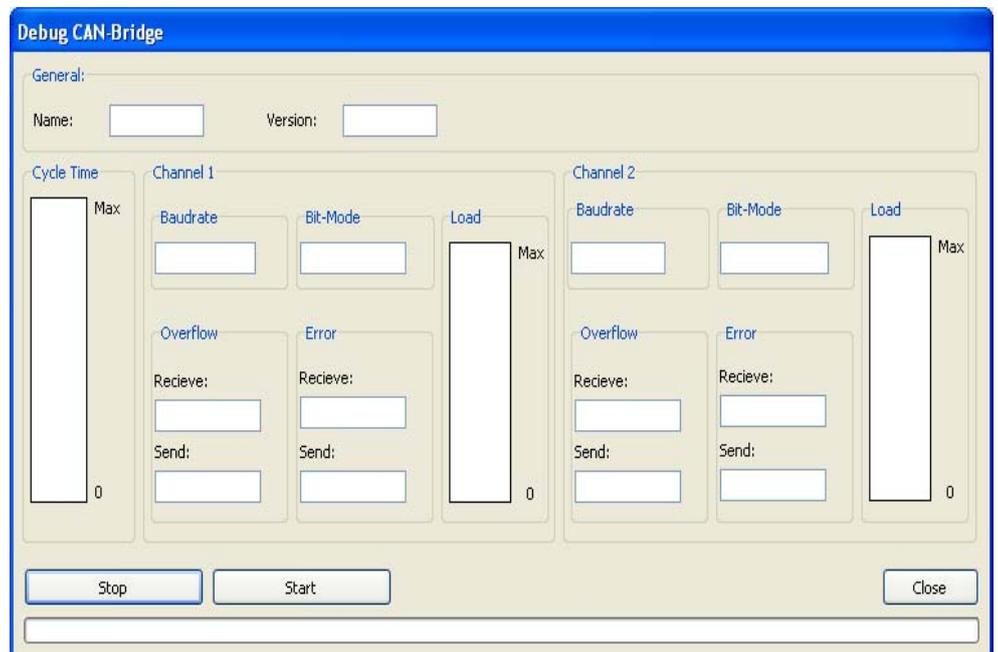
4.5 Download

A project currently saved in the module can be downloaded into the CAN-Bridge Param software for further modification.

4.6 Diagnosis/Debug

Using the "Debug" menu item, the state of the CAN-Bridge module can be queried. Debug mode requires a USB connection to the module.

4.6.1 Debug display



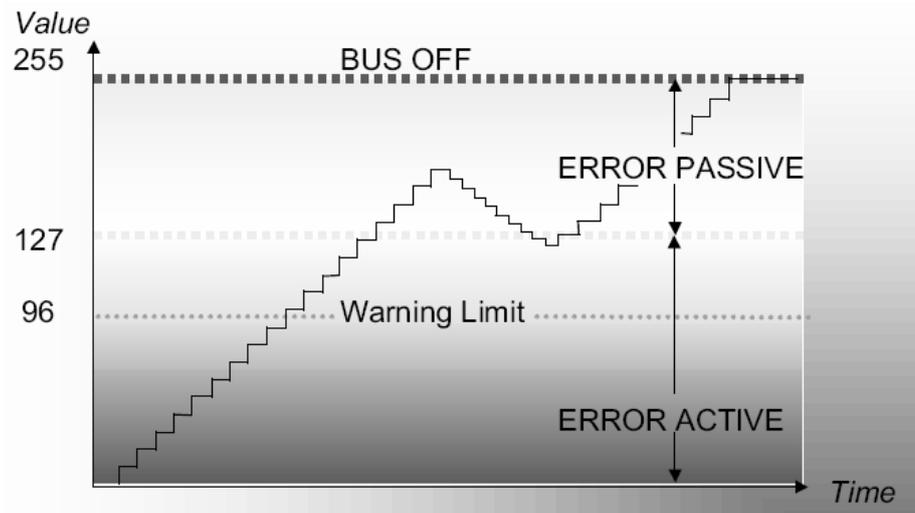
Press the "Start" button to start the debugging and press the "Stop" button to close the debugging connection.

The debug dialogue displays the following information:

Name	name of the operating system
Version	firmware version of the operating system
Protocol	CAN protocol (11Bit/29Bit) configured per channel
Baud rate	current CAN baud rate per channel
FiFo	load on the FiFo memory, per channel
Receive error	CAN receive error count per channel
Send error	CAN send error per channel
Receive overrun	CAN receive overrun counter per channel
Send overrun	CAN send overrun counter per channel
Cycle time	duration of a transfer cycle on the CAN-Bridge

!
The error count must be at "0" otherwise the data transfer on the CAN bus will be corrupted.

Note: the send and receive error counters are incremented by the CAN controller if the transmission or reception of a telegram fails with an error. As soon as a telegram is transmitted or received correctly the corresponding counter is decremented again. In a correctly functioning CAN bus, these counters should always be at zero.



FiFo display the count of received CAN telegrams in the CAN-Bridge buffer that could not be forwarded.

Note: the CAN-Bridge module has receive and send buffers of 16 telegrams each in either direction (32 in both directions).

There should never be a large difference between the Rx / Tx counter pairs. If, however, this is the case, the CAN telegrams are being transmitted too quickly or not retrieved quickly enough.

When a FiFo is full but further telegrams are sent or received, this results in a buffer overflow and the oldest telegram in the FiFo is deleted.

5 Appendix

5.1 Specification

Order number	CAN-Bridge	700-660-2AA01
Dimensions	31 x 74 x 75 mm (LxBxH)	
Weight	approx. 130 g	

CAN interface

Type:	2 x ISO/DIN 11898-2, CAN high speed physical Layer
Transfer rate:	20kbps to 1Mbps
Protocol:	CAN 2.0A (11 Bit) CAN 2.0B (29 Bit)
Connector:	2 x plugs, SUB-D 9-pole
Status display:	5 LEDs

Configuration interface

Type:	USB 1.1
Connector:	mini USB socket

Supply

Voltage:	18 – 30 V DC
Power consumption:	35 mA (typ.) / 60 mA (max.)

5.2 Plug pin assignments

Pin	SUB-D plug CAN
1	-
2	CAN Low
3	CAN GND
4	-
5	-
6	-
7	CAN High
8	-
9	-

5.3 Further documentation

Internet: www.can-cia.org

CAN Specification 2.0, Part A & Part B

Holger Zeltwanger: "CANopen[®]", VDE Verlag, ISBN 3-8007-2448-0

Notes