

# CANbridge

CAN-to-CAN Gateway

## USER MANUAL

4.01.0120.20000 3.0 en-US ENGLISH



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# Important User Information

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# 1 User Guide

Please read the manual carefully. Make sure you fully understand the manual before using the product.

## 1.1 Related Documents

Document	Author
Installation Guide <i>VCI Driver</i>	HMS

## 1.2 Document History

Version	Date	Description
2.0	October 2016	Revised and edited in new design.
2.1	June 2019	Layout changes, new disclaimer
3.0	October 2021	Removed obsolete DIN rail device variant

### 1.2.1 Trademark Information

Ixxat® is a registered trademark of HMS Industrial Networks. All other trademarks mentioned in this document are the property of their respective holders.

## 1.3 Conventions

Instructions and results are structured as follows:

- ▶ instruction 1
- ▶ instruction 2
  - result 1
  - result 2

Lists are structured as follows:

- item 1
- item 2

**Bold typeface** indicates interactive parts such as connectors and switches on the hardware, or menus and buttons in a graphical user interface.

```
This font is used to indicate program code and other
kinds of data input/output such as configuration scripts.
```

This is a cross-reference within this document: [Conventions, p. 4](#)

This is an external link (URL): [www.hms-networks.com](http://www.hms-networks.com)

Safety advice is structured as follows:



Cause of the hazard!  
Consequences of not taking remediate action.  
How to avoid the hazard.

Safety signs and signalwords are used dependent on the level of the hazard.



*This is additional information which may facilitate installation and/or operation.*



This instruction must be followed to avoid a risk of reduced functionality and/or damage to the equipment, or to avoid a network security risk.



### Caution

This instruction must be followed to avoid a risk of personal injury.



### WARNING

This instruction must be followed to avoid a risk of death or serious injury.

## 2 Safety Instructions

### 2.1 Information on EMC



Risk of interference to radio and television if used in office or home environment!

Use exclusively included accessories. Use exclusively shielded cables.

Make sure that the shield of the interface is connected with the device plug and the plug on the other side.

- ▶ Make sure, that the CAN bus that is connected to the CANbridge has a shielded lead.
- ▶ Make sure, that the shield braiding is laid flat on the connector housing.

Shield connections of CAN 1, CAN 2, serial interface RS232 and power supply are connected with one another in the device.

### 2.2 General Safety Instructions

- ▶ Protect product from moisture and humidity.
- ▶ Protect product from too high or too low temperature (see [Technical Data, p. 20](#)).
- ▶ Protect product from fire.
- ▶ Do not paint the product.
- ▶ Do not modify or disassemble the product. Service must be carried out by HMS Industrial Networks.
- ▶ Store products in dry and dust-free place.

## 3 Scope of Delivery

Included in scope of delivery:

- CANbridge
- User Manual
- CD with download tool *CANBcfg.exe* and *VCI Installation Guide*
- configuration cable
- power supply cable

## 4 Product Description and Features

The CANbridge is a universal, intelligent CAN topology component, that allows the coupling of two CAN networks, also with different bit rates or frame formats. CAN messages are received by one network and transmitted in the other network, according to filter and implementation rules.

The CAN messages can be filtered based on CAN identifiers. Certain CAN messages can be forwarded and others discarded. With this mechanisms the bus load can be reduced in the associated network by transmitting only the messages that are of interest.

The baud rates of the CAN busses are freely configurable. Additionally the CANbridge provides automatic baud rate detection. To configure the CANbridge a configuration file is used. The configuration is created in ASCII code and loaded on the CANbridge with a download tool via the serial interface.

### Features and highlights:

- galvanically isolated
- configuration via serial interface (RS232, optional RS485)
- CAN ID filtering
- aluminium housing

### Versions

- Industrial: 2 x CAN high-speed connection (ISO 11898-2)
- Automotive: 2 x CAN high-speed connection (ISO 11898-2)
- Automotive: 1 x CAN high-speed and 1 x CAN low-speed connection (ISO 11898-3)

## 5 Installation

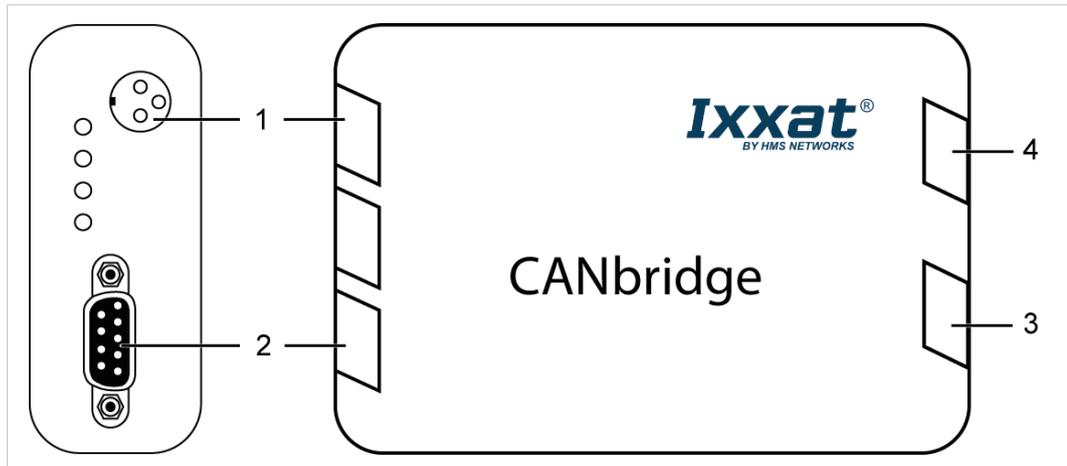


Fig. 1 Aluminium version

1	Power supply
2	Serial interface RS232
3	CAN 1
4	CAN 2

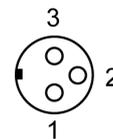
### 5.1 Power Connector

The CANbridge is protected against polarity reversal, under- and over-voltage.

- polarity reversal, under-voltage: device is switched off
- over-voltage: internal fuse is triggered

**Pin Allocation**

Pin no.	Signal	Lead color
1	PWR + (industrial: 9 V to 36 V DC, automotive: 7 V to 16 V)	White
2	GND -	Brown
3	Shield	Shield



- ▶ Connect the power supply cable with the power connection and the power supply.

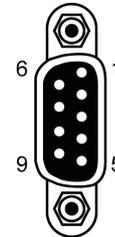
## 5.2 CAN Connectors

The signals of CAN 1 and CAN 2 are connected to D-Sub 9 connectors. In automotive version CAN 2 is available as CAN low speed.

Pin Allocation D-Sub 9 Connector

Pin no.	Signal
1	—
2	CAN low
3	GND
4	—
5	—
6	—
7	CAN high
8	—
9	—

CAN connector, D-Sub 9



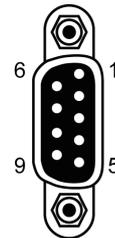
## 5.3 Configuration Connector

The serial interface RS232 is used to configure the CANbridge. The signals are connected to a D-Sub 9 connector.

Pin Allocation D-Sub 9 Connector

Pin no.	Signal
1	DCD
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

Serial interface RS232, D-Sub 9



## 5.4 Ground Connections

- GND of CAN 1 and CAN 2 isolated from rest of circuit
- GND of serial interface RS232 connected to GND of power supply
- shield connections of CAN 1, CAN 2, serial interface RS232 and power supply connected with each other

## 6 Configuration

The Windows console program *CANBcfg.exe* is available for the configuration the CANbridge (included on delivery CD).

### 6.1 Starting and Operating the Download Tool *CANBcfg*

The program is operated via call parameters.

- ▶ Make sure that *CANBcfg.exe* is installed locally with writing permission.
- ▶ Open Windows **Start menu** and start the command line.
- ▶ Go to the directory where *CANBcfg.exe* is stored.
- ▶ Start *CANBcfg.exe*.
  - List of parameters is shown.

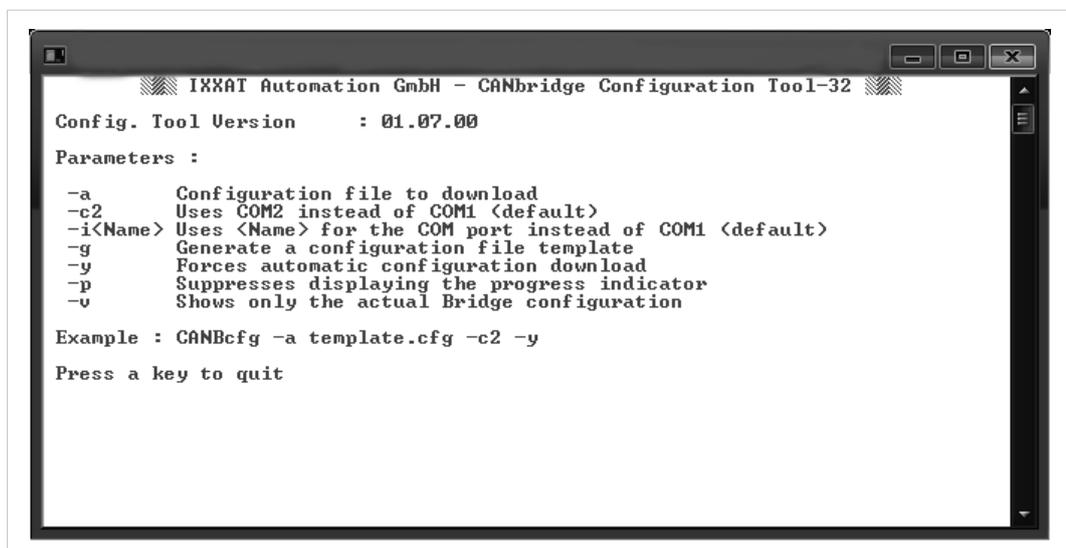


Fig. 2 List of parameters in *CANBcfg*

- ▶ Define the COM port in use with **Windows device manager**.



If a USB serial adapter is used, the COM port in use can be changed by plugging in and off the adapter or rebooting the computer.

- ▶ Execute *CANBcfg.exe* with the required parameters.

#### Parameters

Parameter	Description
-a <filename>	Downloads the configuration file <filename>.
-c2	Uses COM port 2 instead of COM port 1 (default).
-i<Name>	Uses COM port <Name> instead of COM port 1 (default) (e.g. -iCOM7 if COM port 7 in use).
-g	Generates a configuration file template.
-y	Forces automatic configuration download.
-v	Shows the current Bridge configuration.

#### Example

Download the file *template.cfg* automatically to device via COM port 7:

```
CANBcfg -a template.cfg -iCOM7 -y
```

## 6.2 Creating the Configuration

### 6.2.1 Creating a Template with Download Tool

- ▶ Start *CANBcfg.exe* (see [Starting and Operating the Download Tool CANBcfg, p. 9](#)).
- ▶ Enter parameter `-g` (*CANBcfg -g*).
  - File *template.clg* is created.
- ▶ Open the file *template.clg* with the text editor.
- ▶ Save the file under a different name to prevent overwriting when generating a new template.
- ▶ Adjust the configuration settings in the template with the text editor.
- ▶ Make sure, that the frame format is always set.



*In repeater mode both formats are received and transmitted, but the frame format must be defined.*

- ▶ Terminate the last configuration line in the configuration file with **Return**. Otherwise the instruction is not executed.
- ▶ Load the configuration on the device (see [Load Configuration to Device, p. 15](#)).

#### Template of Configuration File

```
[General]
ProductName = CANbridge           ;! DO NOT CHANGE THIS LINE !
TemplateVersion = 01.01.00       ;! DO NOT CHANGE THIS LINE !
RepeaterFunctionality = yes      ;yes, no
AutoBaudAttemptTimeout = no      ;no, 1 ... 600 (in seconds)
CANBusOffRecovery = no           ;no, 1 ... 60 (in seconds)

[User]
ConfigAlias = "Repeater + Auto Baud (no Tx)"

[CANBus1]
BaudRate = Auto                   ;Auto, 1000, ..., 20, 0x00/0x0)
FrameFormat = std                 ;std, ext
UseGatewayTable = no              ;yes, no

[CANBus2]
BaudRate = Auto                   ; Auto, 1000, ..., 20, 0x00/0x0C
FrameFormat = std                 ; std, ext
UseGatewayTable = no              ; yes, no

[CAN1GatewayTable]
0x0 = 0x0                         ;normal id retransmission with the
0x1 = 0x1                         ;same identifier on both sides
0x3 = 0x3                         ;all possible entries are listed
0x4 = 0x4
...

[CAN2GatewayTable]
0x0 = 0x0                         ;normal id retransmission with the
0x1 = 0x1                         ;same identifier on both sides
0x3 = 0x3                         ;all possible entries are listed
0x4 = 0x4
...
```

## 6.2.2 Adjusting the General Settings [General]

The `TemplateVersion` shows the version number of the ASCII file structure, used for compatibility check and must not be changed.

### Repeater Mode

Parameter	Description
<code>RepeaterFunctionality = no</code>	Repeater Mode deactivated.
<code>RepeaterFunctionality = yes</code>	Messages are transmitted unchanged. Entries in <code>FrameFormat</code> and <code>CANGatewayTable</code> are ignored.

### Autobaud Timeout Detection

It is possible to set a timeout for the automatic baud rate detection. When a baud rate is detected on one bus the timeout time starts. When this time expires and no baud rate is detected on the second bus, the detected baud rate is adopted to the second bus. Transmitting is attempted. If an error occurs during transmission, the device is switched off.

The parameter is only relevant if automatic baud rate detection is set for at least one CAN bus.

Parameter	Description
<code>AutoBaudAttemptTimeout = no</code>	Default configuration, no timeout is set, device remains in automatic baud rate detection until baud rate is detected on both busses.
<code>AutoBaudAttemptTimeout = &lt;value in seconds&gt;</code>	Value: maximally 600 seconds

### Bus Off Recovery

Defines the behavior of the CANbridge when a CAN bus goes into *bus off* state. With a restart CAN message buffers of both CAN busses are cleared.

Parameter	Description
<code>CANBusOffRecovery = no</code>	Bus stays in <i>bus off</i> , until device is switched off.
<code>CANBusOffRecovery = &lt;value in seconds&gt;</code>	Device is restarted after specified time is expired. Value: 1 to 60 seconds

## 6.2.3 Adjusting the User Settings [User]

Sets the name of the configuration, stored in device. Can be read with download tool.

Parameter	Description
<code>ConfigAlias = &lt;name&gt;</code>	Character chain of up to 31 characters Default value: "Repeater + Auto Baud (No Tx) "

## 6.2.4 Adjusting the CAN Bus Settings [CANBus1] , [CANBus2]

Settings can be adjusted for CAN 1 and CAN 2 separately.

### Baud Rate

Parameter	Description
BaudRate = Auto	Automatic baud rate detection activated, for more information see <a href="#">Automatic Baud Rate Detection, p. 12</a>
BaudRate = <CiA baud-rate>	Set predefined CiA baud rate. The following values (in kBit/s) are possible: 20, 50, 100, 125, 250, 800, 1000
BaudRate = <BTR0/BTR1>	Set baud rate via bus timing register, for more information see <a href="#">Setting of Bus Timing Register, p. 12</a>

### Automatic Baud Rate Detection



Automatic baud rate detection is exclusively possible if at least two nodes per bus are active.

#### Possible Baud Rates

Baud rate (CiA)	BTR0 (hex)	BTR1 (hex)
1000 kBit/s	0x00	0x14
800 kBit/s	0x00	0x16
500 kBit/s	0x00	0x1C
250 kBit/s	0x01	0x1C
125 kBit/s	0x03	0x1C
100 kBit/s	0x04	0x1C
50 kBit/s	0x09	0x1C
20 kBit/s	0x18	0x1C

It is possible to set a timeout for the automatic baud rate detection (see [Autobaud Timeout Detection, p. 11](#)). For information about automatic baud rate detection sequence indicated by LEDs see [Automatic Baud Rate Detection Sequence, p. 18](#).

### Setting of Bus Timing Register



*HMS Industrial Networks recommends using the predefined standard baud rates. If user defined baud rates are used, make sure that the entered values are valid.*

If the baud rate is set with the bit timing register BTR0 and BTR1 of the controller, baud rates that are not defined by CiA can be used.

Values for the bit timing register BTR0 and BTR1 are determined according to the specifications for the CAN controller SJA 1000 with 16 MHz clock frequency (for more information see datasheet of SJA 1000).

### Example

For 200 kBit/s:

```
BaudRate = 0x04/0x14
```

**Frame Format**

Parameter	Description
FrameFormat = std	Standard (11 bit identifier)
FrameFormat = ext	Extended (29 bit identifier)

**Mapping Table**

Parameter	Description
UseGatewayTable = yes	Mapping tables of [CAN1GatewayTable] resp. [CAN2GatewayTable] are used.
UseGatewayTable = no	Mapping tables are not used, all messages are transmitted unchanged.

**6.2.5 Setting Mapping Tables [CAN1GatewayTable] , [CAN2GatewayTable]**

For each CAN bus a different mapping table is available. The CAN 1 and CAN 2 mapping tables define if a message is forwarded or filtered out. If a message is forwarded the identifier can be changed. The data of the message remains unchanged.

```
0x0 = 0x0
0x100 = 0x200
```

- ▶ Enter the identifier of the message to be received on the left.
- ▶ Enter the identifiers to be used when transmitting to the other CAN bus on the right.



Identifiers that are not listed or do not have an entry on the left are not forwarded.



Make sure that repeater mode is off (`RepeaterFunctionality = no`) and mapping tables are enabled for CAN 1 and CAN 2 (`UseGatewayTable = yes`).



Data is interpreted differently depending on the setting of the frame format.

If both CAN busses are set to frame format standard:

- 11 bit identifiers left and right
- 2048 entries possible

If frame format standard is translated in extended:

- 11 bit identifiers on the left
- 29 bit identifiers on the right
- 2048 entries possible

If both CAN busses are set to frame format extended:

- 29 bit identifiers left and right
- 128 entries possible

If frame format extended is translated in standard:

- 29 bit identifiers on the left
- 11 bit identifiers on the right
- 128 entries possible

All possible identifiers are listed in the template, mapped 1 to 1:

- ▶ If configuration with only 128 possible entries is used, delete surplus entries.

#### Example

- Standard frames set for CAN 1.
- Extended frames set for CAN 2.

```
[CAN1GatewayTable]
0x0=0x0          ; These messages are forwarded to the
0x1=0x1          ; other segment (CAN2) with the
0x2=0x2          ; same identifiers
...
0x100=0x200      ; These messages are forwarded to CAN2
0x101=0x1005abc ; with the identifiers given
0x102=0x202      ; on the right side
...
0x7fa=           ; The identifiers that are not listed
0x7fb=no         ; or that do not have a
0x7fc=           ; numerical value on the right side
0x7fd=           ; are not forwarded to CAN2
```

### 6.3 Load Configuration to Device

- ▶ Connect the serial interface RS232 of the CANbridge and the serial interface of the computer with a null modem cable.
- ▶ Call *CANBcfg.exe* with parameter `-a <filename> -i<name>` (e.g. `CANBcfg -a myconfig.cfg -iCOM7`).
  - Program starts.
- ▶ To confirm the question to carry out the download, press key **y**.
  - Download is started via specified serial interface.
- or
- ▶ To automate the download add parameter `-y` when calling *CANBcfg.exe* (e.g. `CANbcfg -a myconfig.cfg -iCOM7 -y`).
  - Configuration is directly downloaded to the CANbridge.

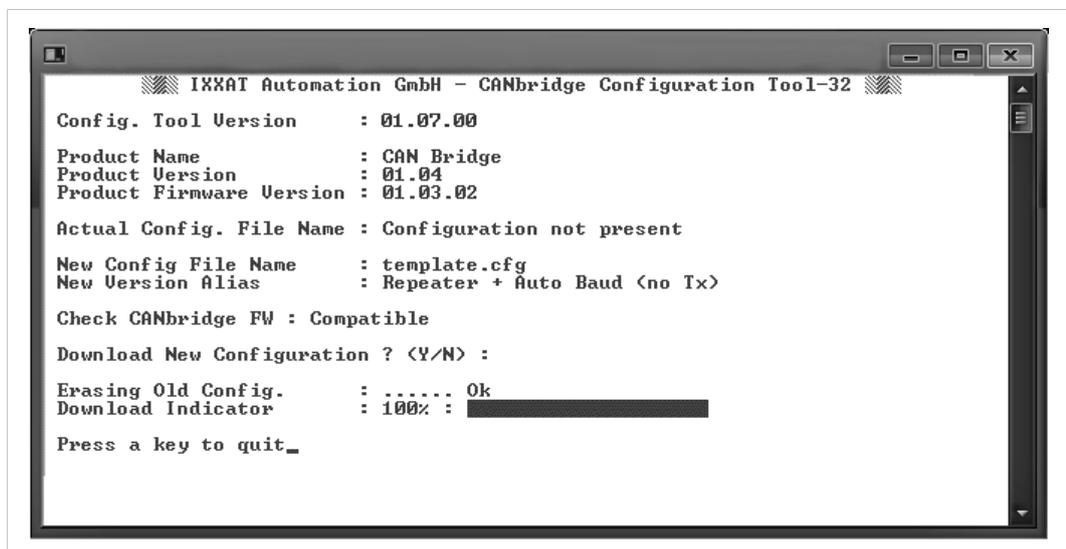


Fig. 3 Load configuration to device

## 6.4 Show Current Configuration

- ▶ To read the current configuration, add parameter `-v` (e.g. `CANbcfg -v`).
  - File and configuration name are displayed.

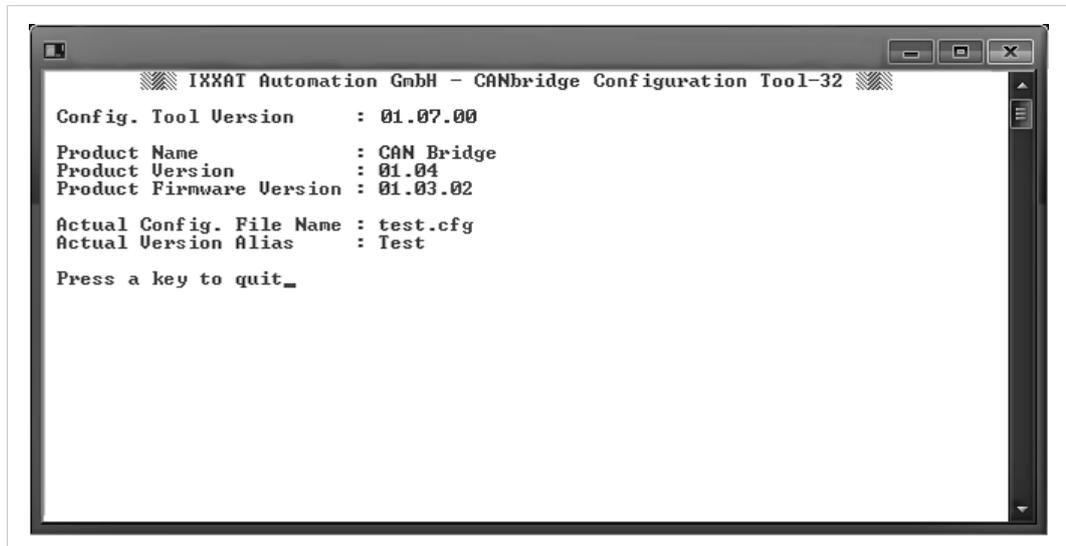


Fig. 4 Show configuration

## 6.5 Standard Configuration

Standard configuration of CANbridge:

- automatic baud rate detection activated
- repeater mode activated
- both frame formats (standard and extended) are processed simultaneously

```
[General]
TemplateVersion = 01.01.00      ;!Do not change this!
RepeaterFunctionality = yes
AutoBaudAttemptTimeout = no
CANBusOffRecovery = no

[USER]
ConfigAlias = "CAN-Bridge AutoBaud Repeater"

[CANBus1]
BaudRate = Auto
FrameFormat = std      ;FrameFormat is ignored
UseGatewayTable = no ;UseGatewayTable is ignored

[CANBus2]
BaudRate = Auto
FrameFormat = ext      ;Frameformat is ignored
UseGatewayTable = no ;UseGatewayTable is ignored

[CAN1GatewayTable]      ;Gatewaytable is ignored

[CAN2GatewayTable]      ;Gatewaytable is ignored
```

## 6.6 Configuration Example

The example has the following configuration:

- CAN 1 has standard frame format.
- CAN 1 baud rate is 800 kBit/s.
- CAN 1 and CAN 2 mapping tables are used.
- CAN 2 has extended frame format.
- CAN 2 baud rate is defined by bit timing register.
- bus off recovery is set to 10 seconds.

```
[General]
TemplateVersion = 01.01.00      ;!Do not change this!
RepeaterFunctionality = no
AutoBaudAttemptTimeout = no
CANBusOffRecovery = 10

[USER]
ConfigAlias = "CAN-Bridge std/ext/Filter"

[CANBus1]
BaudRate = 800
FrameFormat = std
UseGatewayTable = yes

[CANBus2]
BaudRate = 0x01/0x0c
FrameFormat = ext
UseGatewayTable = yes

[CAN1GatewayTable]
0x000 = 0x000      ;normal id retransmission with the
0x001 = 0x001      ;same identifier on both sides
...
0x100 = 0x1234567  ;modify the id and
0x101 = 0x1005201  ;translate to Extended Frame
...

[CAN2GatewayTable]
0x004 = 0x004      ;normal id retransmission with the
0x006 = 0x006      ;same identifier on both sides
...
0x1234567 = 0x210  ;modify the id and
0x2345678 = 0x211  ;translate to Standard Frame
```

## 7 Operation

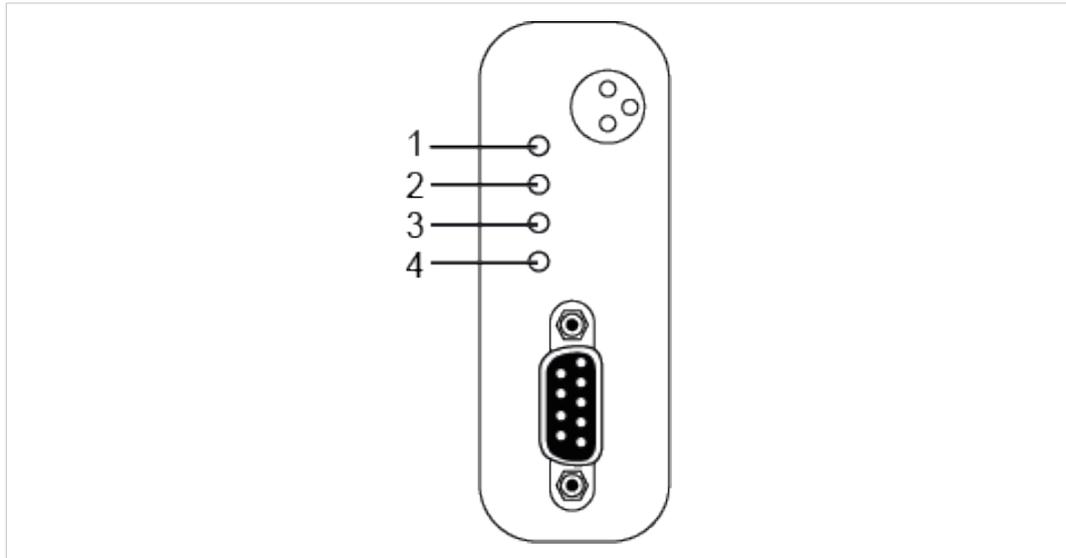


Fig. 5 LED arrays industrial rail version and automotive version

1	Power LED
2	CAN 1 LED
3	CAN 2 LED
4	COM LED

### 7.1 Automatic Baud Rate Detection Sequence

During the automatic baud rate detection CAN 1 LED (3), CAN 2 LED (4) and PWR LED (1) indicate the status.

Status	CAN 1 LED	CAN 2 LED	PWR LED
Automatic baud rate detection active on both channels	Red flashing	Red flashing	Red flashing
Baud rate detected on CAN 1, baud rate detection on CAN 2 active	Green flashing	Red flashing	Red flashing
Baud rate on CAN 2 detected or adopted from CAN 1, communication present	Green flashing	Green flashing	Green

### 7.2 Power LED (PWR)

LED state	Description	Comments
Green	Connected to power supply, microcontroller installed	Device is ready to use.
Red	Watchdog reset	-
Red flashing (1 Hz)	Automatic baud rate detection	If no baud rate detected, permanently red.

### 7.3 CAN 1/CAN 2 LED

LED state	Description	Comments
Green	Message received or transmitted without errors	-
Red flashing	Message received or transmitted, <i>error warning</i> level reached	-
Red	<i>Bus off</i>	No communication possible

### 7.4 COM LED

LED state	Description	Comments
Green flashing	Message received or transmitted without errors	-
Red flashing	Message received or transmitted with errors	-

## 8 Additional Components

### 8.1 CAN Bus Termination

In the device is no bus termination resistor for the CAN bus integrated. Ixxat offers a bus termination resistor as a feed through connector.



Fig. 6 CAN bus termination resistor

- For ordering information see [www.ixxat.com](http://www.ixxat.com).

## 9 Technical Data

CAN controller	16 bit microcontroller,, 2xCAN on-chip, CAN 2.0A, 2.0B
CAN transceiver (high-speed)	Texas Instruments SN65HVD251
CAN transceiver (low-speed)	NXP (Philips) TJA1054
Microcontroller	Fujitsu MB90F543, 16 MHz
RAM/Flash	6 kByte/128 kByte
Max. number of CAN bus nodes	120 (high-speed), 32 (low-speed)
CAN bus termination resistor	none (high-speed) RTH = RTL = 4.7 k $\Omega$ (low-speed)
CAN baud rates	20 kBit to 1 MBit (high-speed) 20 kBit to 125 kBit (low-speed)
Dimensions	100 x 85 x 32 mm
Weight	Approx. 250 g
Operating temperature	-20 °C to 70 °C
Storage temperature	-40 °C to 85 °C
Power supply	Industrial: 9 V to 36 V DC Automotive: 7 V to 16 V DC
Power consumption	Approx. 1.5 W
Relative humidity	10 to 95 %, non-condensing
Housing material	Aluminium
Galvanic isolation	CAN bus to internal logics 1000 V DC/1 sec, 800 V DC/1 min, 700 V AC/1 sec, 500 V AC/1 min
Delay galvanic isolation	Typ. 50 ns
CAN pass through delay	Approx. 70 $\mu$ s with standard frame format Approx. 150 $\mu$ s with extended frame format
CAN message buffer	100 messages per CAN bus
Protection class	IP 40

## 10 Support/Return Hardware

### 10.1 Support

- ▶ To contact support, go to [www.ixxat.com/technical-support/contact-technical-support](http://www.ixxat.com/technical-support/contact-technical-support).
- ▶ Scroll down and click button **mysupport.hms.se** to register a support case.

### 10.2 Return Hardware

- ▶ On [www.ixxat.com/support/product-returns](http://www.ixxat.com/support/product-returns) click button **Portal** to access the support portal.
- ▶ In the support portal select **Submit Product Return (RMA)**.
- ▶ Read the information and click **Create RMA Case**.
- ▶ Register a support account and sign in.
- ▶ Fill in the form for warranty claims and repair.
- ▶ Print out the Product Return Number (PRN resp. RMA).
- ▶ Pack product in a physically- and ESD-safe way, use original packaging if possible.
- ▶ Enclose PRN number.
- ▶ Observe further notes on [www.ixxat.com](http://www.ixxat.com).
- ▶ Return hardware.

## 11 Disposal

- ▶ Dispose of product according to national laws and regulations.
- ▶ Observe further notes about disposal of products on [www.ixxat.com](http://www.ixxat.com).

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## A Regulatory Compliance

### A.1 EMC Compliance (CE)



The product is in compliance with the Electromagnetic Compatibility Directive. More information and the Declaration of Conformity is found at [www.ixxat.com](http://www.ixxat.com).

### A.2 FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

<b>Product name</b>	CANbridge
<b>Responsible party</b>	HMS Industrial Networks Inc
<b>Address</b>	35 E. Wacker Dr, Suite 1700 Chicago , IL 60601
<b>Phone</b>	+1 312 829 0601



Any changes or modifications not expressly approved by HMS Industrial Networks could void the user's authority to operate the equipment.



This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

### A.3 Disposal and recycling



You must dispose of this product properly according to local laws and regulations. Because this product contains electronic components, it must be disposed of separately from household waste. When this product reaches its end of life, contact local authorities to learn about disposal and recycling options, or simply drop it off at your local HMS office or return it to HMS.

For more information, see [www.hms-networks.com](http://www.hms-networks.com).

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