Ixxat® BY HMS NETWORKS

ENGLISH

CAN/FD Repeater Standard

USER MANUAL

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HMS

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. Target Audience

This manual addresses trained personnel who are familiar with CAN, CAN FD, LIN, and the applicable national standards. Only ESD trained staff is authorized to install the interface. The contents of the manual must be made available to any person authorized to use or operate the product.

1.2. Document History

Version	Date	Description
1.0	April 2025	First release

1.3. 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.

1.4. Conventions

Instructions, Results and Lists

Instructions and results are structured as follows:

1. instruction 1
2. instruction 2
   - result 1
   - result 2

Lists are structured as follows:

- item 1
- item 2

Code

This font is used to represent program code and other types of data input and output such as configuration scripts.

```
Code
```

User Interaction Elements

User interaction elements (buttons etc.) are indicated with bold text.

Cross-References and Links

Cross-reference within this document: Link example

External link (URL): www.hms-networks.com/ixxat

Safety Symbols

DANGER
Instructions that must be followed to avoid an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Instructions that must be followed to avoid a potential hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION
Instruction that must be followed to avoid a potential hazardous situation that, if not avoided, could result in minor or moderate injury.

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

Information Symbols

NOTE
Additional information which may facilitate installation and/or operation.

TIP
Helpful advice and suggestions.

2. Safety Instructions

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

Use exclusively included accessories. Use exclusively shielded cables.

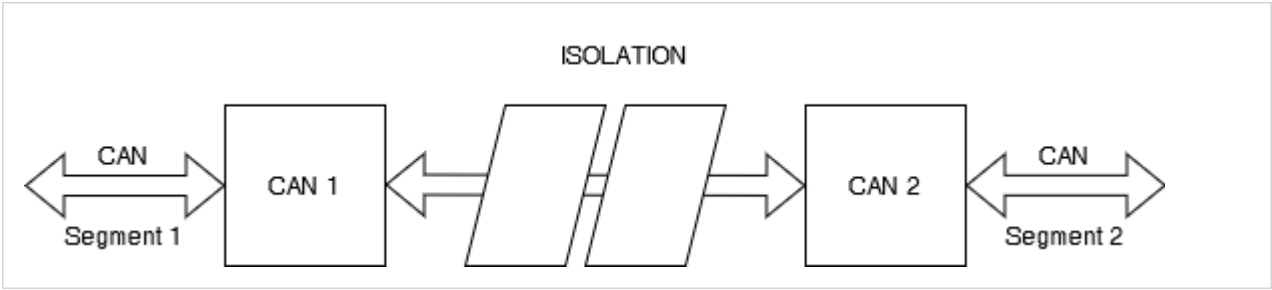
Make sure, that the shield of the interface is connected with the device plug and the plug on the other side.

2.1. General Safety Instructions

- Protect product from moisture and humidity.
- Protect product from too high or too low temperature (see Technical Data, p. 14).
- 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.
- Only use indoors (without corrosive gas, flammable gas, dust and dirt etc.).

2.2. Intended Use

The devices are used to physically couple two segments of a CAN or CAN FD bus system. Using an galvanically isolated repeater, you can galvanically decouple network segments.



The maximum length of a CAN bus is limited and decreases as the transmission rate increases due to the arbitration mechanisms used with CAN/CAN FD.

CAN repeaters cannot be used to extend the length of the CAN bus, as CAN repeaters correspond to a line with a measurable delay time with regard to signalling.

The CAN/FD Repeater Standard has a transit time of 175 ns. This corresponds to a cable length of approx. 35 m with an assumed propagation speed of the electrical signal of 5 ns/m. The maximum achievable distance between two devices connected to the CAN repeater is reduced by this value.

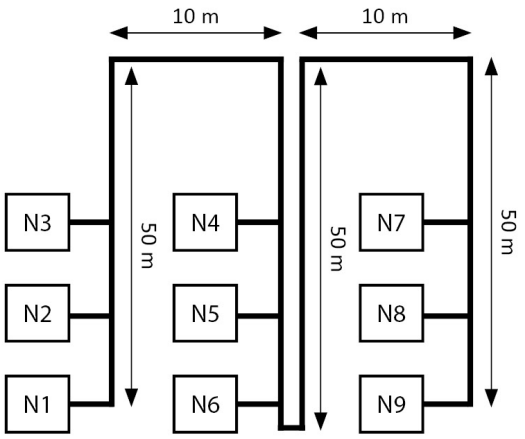
The table below shows calculated values for the maximum distance with and without the Standard CAN/FD Repeater.

Baud rate	Maximum distance between two devices	Maximum distance with 1 repeater
1 Mbit/s	40 m	5 m
500 kBit/s	110 m	75 m
250 kBit/s	280 m	245 m
125 kBit/s	620 m	insignificant
100 kBit/s	790 m	insignificant
50 kBit/s	1640 m	insignificant

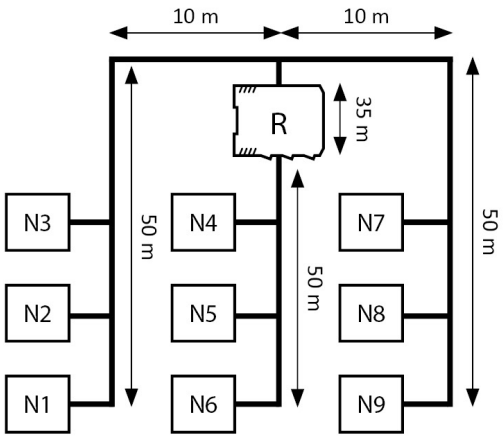
IMPORTANT
Due to the boundary conditions described above, the maximum CAN bus length cannot be extended using CAN repeaters.

In certain applications, the CAN bus topology can be optimised using a star topology as shown below.

Conventional bus structure
The distance between the two nodes furthest apart (1/9) is 220 meters.



Extended structure with drop line
The distance between the two nodes furthest apart (1/6 or 6/9) is 145 meters.



3. Scope of Delivery

Included in scope of delivery:

- CAN/FD Repeater Standard
- Plugs

Connectors

CAN plug	4-Pin Spring Push-In FKC 2,5/ 4-ST GY
Power plug	3-Pin Spring Push-In FKC 2,5/ 3-ST GY

4. Product Description

4.1. Features

CAN/FD Repeater Standard

- 2 x CAN/CAN FD interfaces in accordance with ISO 11898-2
- ISO CAN-FD and non-ISO CAN-FD
- Separately switchable bus termination resistors
- Insulation voltage: see Technical Data, p. 14

4.2. Automatic Error Detection

The CAN/FD Repeater Standard automatically disconnects a defective segment from the network, allowing the remaining network to continue working. After successful troubleshooting the segment is automatically reconnected.

A segment is detected as defect and therefore disconnected if a dominant bus level is detected on the channel for more than 1.4 ms. If a recessive level is detected again on the channel, the segment is reconnected automatically.

5. Configuration

To operate the CAN/FD Repeater Standard no software installation is required. The CAN repeater is configured via DIP switches (**1**).

5.1. Bus termination resistor

The bus termination resistors prevent reflections at the line ends and ensure a current path for discharge of the dominant level to the recessive level. To achieve optimum signal quality, each electrical CAN segment must be terminated at both ends with the characteristic impedance of the line. Bus termination resistors are present on the repeater and can be activated/deactivated via DIP switches. Both termination resistors are activated upon delivery.

5.2. Configuring the Lock Time

The CAN transceiver transmits data and receives this data again after a certain delay time, the so-called loop delay. For example, if the transceiver sends a dominant bit and then a recessive bit, the transceiver only sees the recessive bit in its receive output after the loop delay. The size of the loop delay depends on several factors, such as the number and capacity of CAN nodes in the network. The higher the capacitive load, the higher the loop delay. To avoid bit errors caused by this delay, the configured blocking time must be higher than the loop delay.

1. Use a screwdriver or similar tool to set the DIP switches.
2. Observe, that the lock time setting depends on the bit rate and capacitive load (the higher the capacitive load, the higher the value).
3. Configure the lock time with DIP switches 1 and 2.

4. Observe the following reference values:
   - for networks with less than 32 nodes the lock time is about 200 ns
   - for networks between 32 and 64 nodes the lock time is about 400 ns
   - for networks with more than 64 nodes the lock time is about 800 ns and with this setting the bit rate is limited to a maximum of 500 kbit/s

Valid Lock Time Combinations

DIP switch 1	DIP switch 2	Lock time
Off	Off	200 ns (default)
On	Off	400 ns
Off	On	800 ns
On	On	1600 ns

5.3. Extending the Recessive Bit

Due to the internal structure the CAN transceiver shortens recessive bits on the network, and thus dominant bits are extended. At high bit rates this might cause errors. To extend the recessive bits may improve the error rate, as the bits then are closer to their nominal value on the network. If the recessive bits are extended with the DIP switches, the extension is made independently of the bit rate, also at low bit rates.

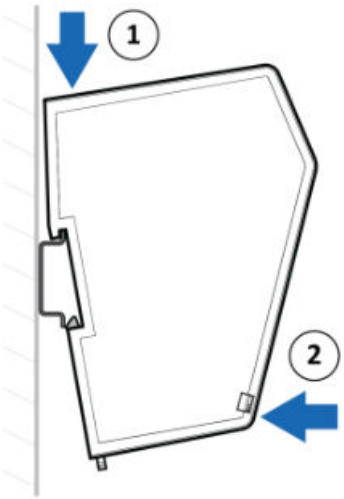
1. Use a screwdriver or similar tool to set the DIP switches.
2. Set the recessive bit with DIP switch 3.

Valid Combinations

DIP switch 3	Recessive bit extension
Off	0 ns (default)
On	15 ns

6. Installation

6.1. Mounting the Device



1. Make sure, that the device is not connected to power supply.
2. Hook the device onto the upper lip of the rail and push downwards (**1**).
3. Push the device towards the rail until it snaps into place (**2**).

6.2. Connectors

1	CAN 1
2	CAN 2
3	Power

The connection plugs can be plugged in or unplugged. The plugs have a spring clip mechanism. The lines are inserted directly in the spring terminals without screws and can be removed again (push-in type).

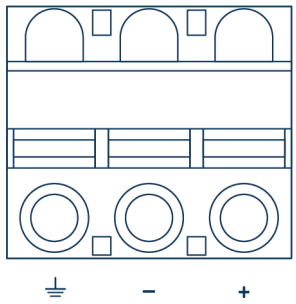
IMPORTANT
The spring clip plugs should only be inserted and operated within a temperature range of –5 °C to +70 °C.

Connection capacity of the plugs

Rigid wire cross-section	0.2 mm^2 ... 2.5 mm^2
Flexible wire cross-section	0.2 mm^2 ... 2.5 mm^2
AWG wire cross-section	24 ... 12
Flexible wire cross-section, with end ferrule, without plastic sleeve	0.25 mm^2 ... 2.5 mm^2
Flexible wire cross-section, with end ferrule, with plastic sleeve	0.25 mm^2 ... 2.5 mm^2
Stripping length	10 mm

6.3. Power Supply

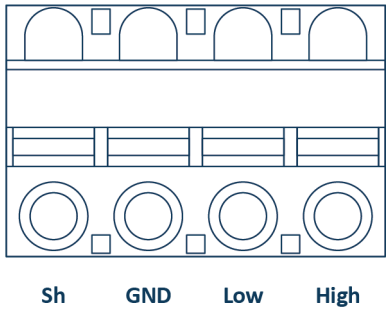
Pin Allocation



Pin	Data
⍰	Functional Earth
-	Ground GND
+	10-30 VDC

6.4. CAN Connector

Pin Allocation



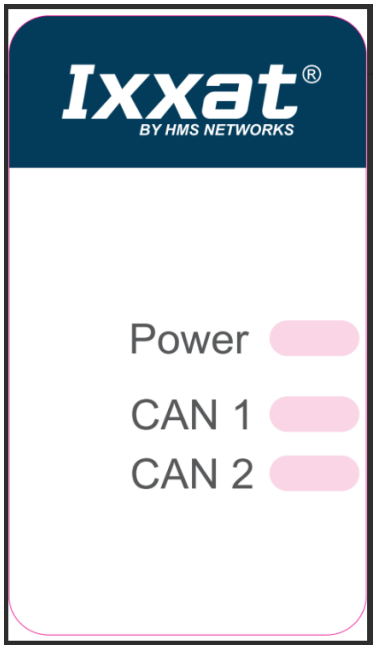
Pin no.	Signal
Sh	Shield (SHLD)
GND	CAN GND (GND)
Low	CAN low (L)
High	CAN high (H)

The shield of the CAN connector is connected to the functional earth via a 4.7 nF capacitor and 10 MOhm resistor in parallel (RC circuit). The functional earth of the device is connected to the top-hat rail if the device is mounted to a top-hat rail. The earth of the CAN connector (CAN-GND) is connected to the functional earth of the device via a 10 MOhm resistor.

NOTE
For best noise immunity, ground the shields of the CAN cables.

7. Operation

7.1. LEDs



7.2. Power LED

Power LED indicates the status of the power supply.

LED state	Description	Comments
Off	No power	Device not connected to power supply, or fuses of device or internal power supply damaged
Green	Power ok	Device fully functional
Red	Device is reset	After power-up the device is set into reset, LEDs are red during reset (normal duration: about 200 ms). Or power supply is damaged, internal voltage is below necessary level.

7.3. CAN LEDs

With the CAN/FD Repeater Standard the LEDs **CAN 1** and **2** indicate the status of the CAN connections.

LED state	Description	Comments
Off	No CAN communication	No CAN communication, device not connected to CAN
Green or green flashing	CAN communication	LED is triggered when a dominant bit is received at the respective CAN port.
Red flashing	CAN communication, but errors	Each CAN circuit transmits and reads back the transmitted bits. An error occurs, if the repeater transmits a dominant bit, but measures a recessive bit.
Red	Dominant-lock	External device applies a permanent dominant level to the CAN.

8. Technical Data

Display	3 x LEDs: Power and 2 x CAN
CAN FD/CAN channels	2
CAN bus interface	Removable push-in spring connectors
CAN bit rates	14 k to 8000 kbit/s
CAN bus termination resistors	For each CAN/CAN FD channel; separately switchable by piano switches
CAN/CAN FD transceiver	TCAN1044 or compatible
Galvanic isolation	CAN-CAN and CAN-Power - at least 5 kV DC for 1 Minute; CAN-Shield to Earth and Power to Earth - at least 2 kV DC for 1 Minute
Power supply	10-30 VDC +-0 %
Power consumption	< 1 W
Operating temperature	-25°C up to +70°C
Length	108 mm
Height	149 mm
Width	27 mm
Net weight	135 g
Storage temperature	-40°C up to +80°C
Protection class	IP20
Relative humidity	0-90%, non-condensing
Certification	CE, FCC
Housing material	PC ABS, UL 94 VO
Maximum permissible operating altitude	2000 m above sea level

9. Support/Return Hardware

Support

To contact support, go to https://support.hms-networks.com/hc/en-us.

Return Hardware

Please follow the instructions underhttps://www.hms-networks.com/support/product-returns.

10. Regulatory Compliance

10.1. CE Compliance

The product is in compliance with the Electromagnetic Compatibility Directive. More information and the Declaration of Conformity is found at www.hms-networks.com/.

Enter the article number in the search field. The CE Declaration of Conformity can be found in the 'Support and Downloads' section.

10.2. 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.

Product name	CAN/FD Repeater Standard
Responsible party	HMS Industrial Networks Inc
Address	35 E. Wacker Dr, Suite 1700 Chicago , IL 60601
Phone	+1 312 829 0601

IMPORTANT

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

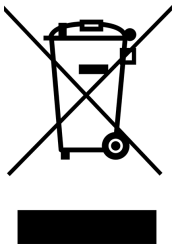
IMPORTANT

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.

10.3. RoHS Directive

The product is in compliance with the RoHS Directive (Restriction of the use of certain hazardous substances in electrical and electronic equipment). See CE Compliance.

10.4. 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.