

CAN-CBM Repeater

Hardware Manual

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|---------------------|---------|
| PCB version: | XREPD01 |
|---------------------|---------|

Changes in the chapters

The changes in the user's manual listed below affect changes in the *hardware* as well as changes in the *description* of the facts only.

| Chapter | Changes versus previous version |
|----------------|--|
| - | Description of the x-repeater removed |
| - | - |

Technical details are subject to change without notice.

NOTE

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esd electronic system design gmbh

Vahrenwalder Str. 207
30165 Hannover
Germany

Phone: +49-511-372 98-0
Fax: +49-511-372 98-68
E-mail: info@esd-electronics.com
Internet: www.esd-electronics.com

USA / Canada:

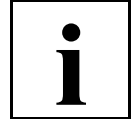
esd electronics Inc.

12 Elm Street
Hatfield, MA 01038-0048
USA

Phone: +1-800-732-8006
Fax: +1-800-732-8093
E-mail: us-sales@esd-electronics.com
Internet: www.esd-electronics.us

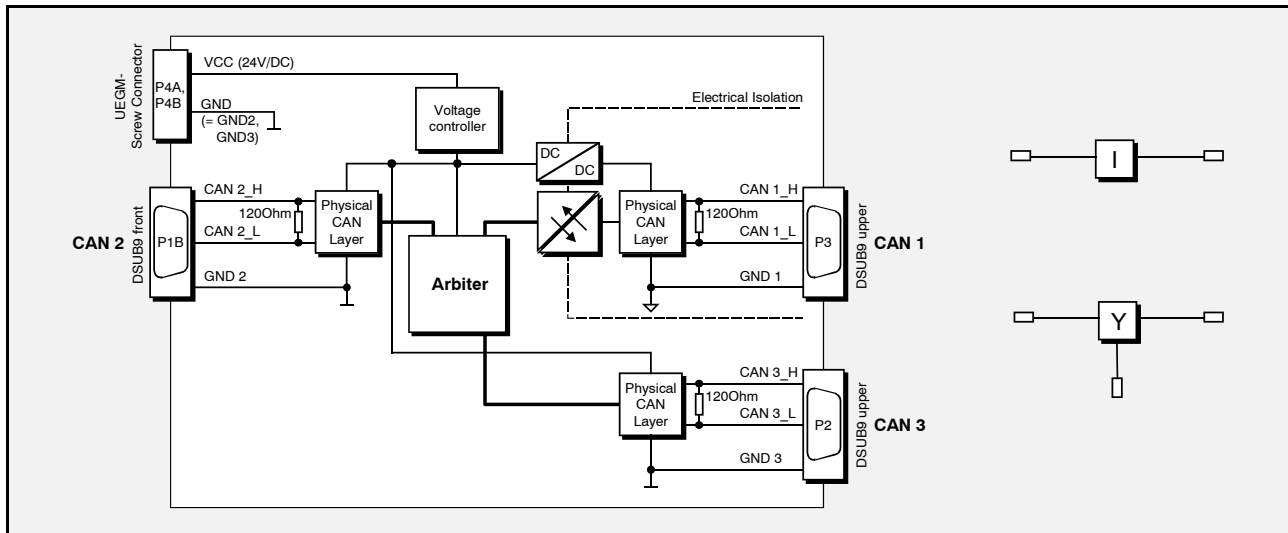
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1. Overview

1.1 Block-Circuit Diagram



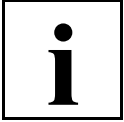
The I-Repeater can be used to improve the user capacity of the CAN, or to add an electrical isolation (only with '-Opto' design). The Y-Repeater branches from one to two CAN lines.

All CAN interfaces of the repeaters are in accordance with ISO 11898. Each repeater is available without electrical isolation or with an electrically isolated interface. The maximum transmission rate is 1 Mbit/s. The bit timing has to be the same for all connections. Each CAN interface has a terminating impedance of 120 Ω in the repeater.

The total extension and therefore the maximum bit rate of the complex CAN network is determined from the sum of the maximum lengths of subnetworks and the reduction of the total line length by inserting the repeater. Only one repeater can be used per network.

The CAN-Repeater is supplied with an external voltage in the range of 8 V...30 V.

The integrated quick logic guarantees a total transparency and the perfect arbitration of CAN objects in all networks connected.



1.2 Front View with Connectors and LEDs

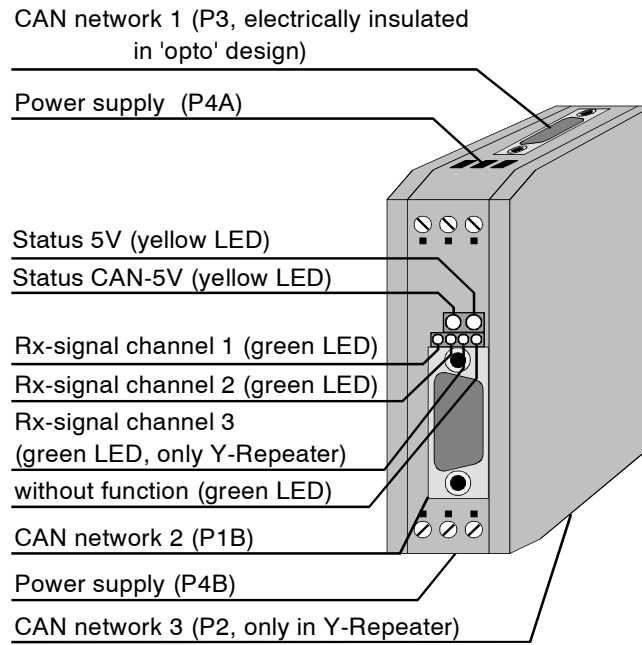


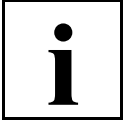
Fig. 1.2.1: Front view I- and Y-Repeaters



1.3 LEDs

| LED | Meaning of LED status | |
|---|-----------------------|-----------------------------|
| | LED off | LED on |
| status 5V - supply voltage of all local units except the electrically isolated CAN network 1 | no supply voltage | supply voltage |
| status CAN-5V - supply voltage of electrically isolated CAN network 1 - off, if network 1 does not have an electrical isolation | no supply voltage | supply voltage |
| Rx-signal channel 1...3 | no Rx-signal | Rx-signal has been received |

Table 1.3.1: Function of LEDs

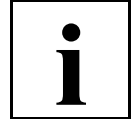


1.4 Technical Data

1.4.1 General Technical Data

| | |
|--------------------------------|--|
| Supply Voltage | nominal voltage: 24 V/DC permissible range: 8 V ... 30 V current (at 20°C): ca. 50 mA/24 V (I-Repeater-Opto) ca. 40 mA/24 V (I-Repeater) ca. 60 mA/24 V (Y-Repeater-Opto) ca. 40 mA/24 V (Y-Repeater) |
| Connectors | P1B (DSUB9, male) - CAN network 2 P2 (DSUB9, male) - CAN network 3 P3 (DSUB9, male) - CAN network 1 (electrically isolated in '-opto' design) P4A, P4B (2x 3-pin connector UEGM) - 24V power supply |
| Temperature range | 0...50 °C ambient temperature |
| Humidity | max. 90%, non-condensing |
| Housing dimensions (W x H x D) | - I- and Y-Repeater: width: 25 mm, height: 85 mm, depth: 83 mm |
| Weight | I-Repeater: approx. 100 g Y-Repeater: approx. 110 g |

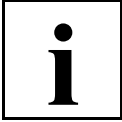
Table 1.4.1: General Technical Data



1.4.2 Technical Data of CAN Interfaces

| | |
|---|---|
| Number of CAN interfaces | - I-Repeater: 2 - Y-Repeater: 3 (in '-opto' design network 1 is electrically isolated from the other units, network 2...3 share reference potential to 24 V power supply) |
| Arbiter | PLD |
| CAN termination | integrated in repeater, 120 Ω each! |
| Physical Layer CAN | Physical Layer in accordance with ISO 11898, transmission rate up to 1 Mbit/s |
| Reduction of attainable total line length by inserting the repeater | versions with optical coupler: approx. 14 m versions without optical coupler: < 14 m |

Table 1.4.2: Data of CAN interfaces

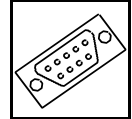


1.5 Order Information

| Type | Features | Order No. |
|-------------------------|--|-----------|
| CAN-CBM-Repeater-I | Repeater for 2 CAN networks in hat-rail housing, without electrical isolation | C.1330.02 |
| CAN-CBM-Repeater-Y | Repeater for 3 CAN networks in hat-rail housing, without electrical isolation | C.1330.03 |
| CAN-CBM-Repeater-I Opto | Repeater for 2 CAN networks in hat-rail housing, one CAN interface electrically isolated | C.1330.06 |
| CAN-CBM-Repeater-Y Opto | Repeater for 3 CAN networks in hat-rail housing, one CAN interface electrically isolated | C.1330.07 |
| CAN-CBM-Repeater-ME | English manual ^{1*)} | C.1330.21 |

^{1*)}... If ordered together with the module, the manual is free of charge.

Table 1.5.1: Order information

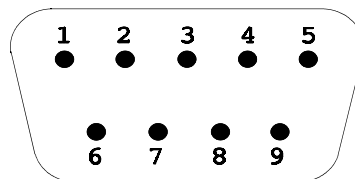


2. Connector Assignment

2.1 CAN Network 1 (P3, DSUB9 male)

In repeater design ‘-opto’ network 1 is electrically isolated from the other networks. The signal assignment for this case is represented below. For modules without electrical isolation the assignment of network 1 resembles networks 2...3 (see the following chapter).

Pin Position:



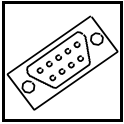
Pin Assignment:

| Signal | Pin | | Signal |
|----------------|-----|---|--------|
| GND 1 | 6 | 1 | - |
| | | 2 | CAN1_L |
| CAN1_H | 7 | 3 | GND 1 |
| - | 8 | 4 | - |
| (CAN-VCC-ext.) | 9 | 5 | - |

9-pin DSUB connector,
threaded bolt with internal thread UNC 4-40

Signal description:

| | |
|-------------------|---|
| CAN1_H, CAN1_L... | data lines of electrically isolated CAN network 1 |
| GND 1... | reference potential of physical interface of CAN network 1 |
| CAN-VCC-ext. ... | optional supply line for CAN interface In repeater versions C.1330.02, C.1330.03, C.1330.06 and C.1330.07, this line is fed through between the interfaces without electrical isolations. Apart from the connectors it is not connected locally anywhere! It is used to feed through the optional supply voltage of external CAN interfaces in accordance with CiA DS 102 Rev. 2.0. This signal is not assigned in repeaters with electrical isolation. |

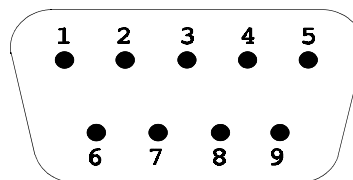


Connector Assignment

2.2 CAN-Networks 2 and 3 (P1B, DSUB9 male)

| CAN network | Connector |
|-------------------------------|-----------|
| 1 (without '-opto' design) | P3 |
| 2 | P1B |
| 3 | P2 |

Pin Position:



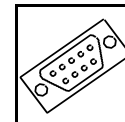
Pin Assignment:

| Signal | Pin | Signal |
|--------------|-----|--------|
| GND x | 6 | 1 |
| | | 2 |
| CANx_H | 7 | CANx_L |
| - | 8 | GND x |
| CAN-VCC-ext. | 9 | 4 |
| | | 5 |

9-pin DSUB connector, threaded bolt with internal thread UNC 4-40

Signal description:

| | |
|-------------------|--|
| CANx_H, CANx_L... | data lines of not electrically isolated CAN networks 2 and 3 |
| GND x... | reference potential of physical interfaces of Can networks 2 and 3 and the 24 V supply voltage (x = 2, 3) |
| CAN-VCC-ext. ... | optional supply line for CAN interface In repeater versions C.1330.02, C.1330.03, C. 1330.06 and C.1330.07, this line is fed through between the interfaces without electrical isolations. Apart from the connectors it is not connected locally anywhere! It is used to feed through the optional supply voltage of external CAN interfaces in accordance with CiA DS 102 Rev. 2.0. This signal is not assigned in repeaters with electrical isolation. |



2.3 Power Supply (P4A, P4B, UEGM)

Power is supplied by means of UEGM connectors integrated in the housing. The connectors are suitable for lines with a cross section of up to 2.5 mm².

The connectors have been assigned in the same way on both sides of the housing. They can be used alternatively. The middle contact has been designed for +24 V and the two outer contacts for GND.

Note: It is **not permissible** to feed through the supply voltage, i.e. to use one side as a 24 V input and the other side as a 24 V output in order to supply further devices, for instance!

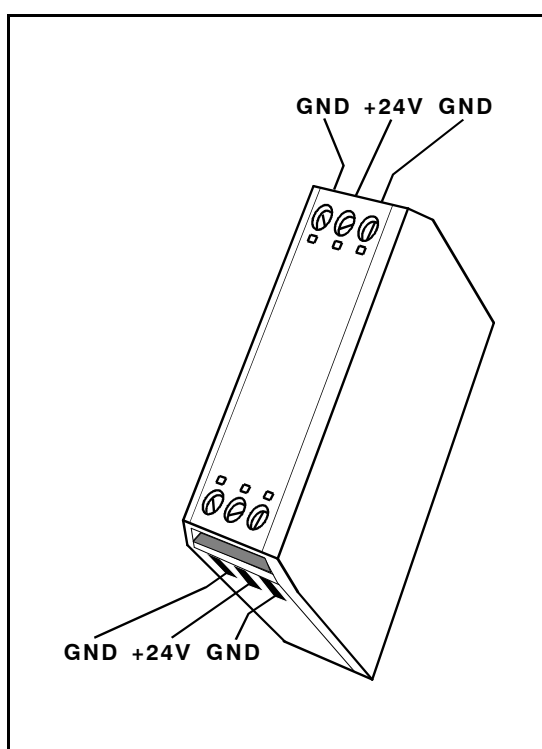
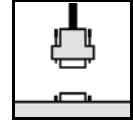


Fig 3.1.1: Power supply

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3. 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. |

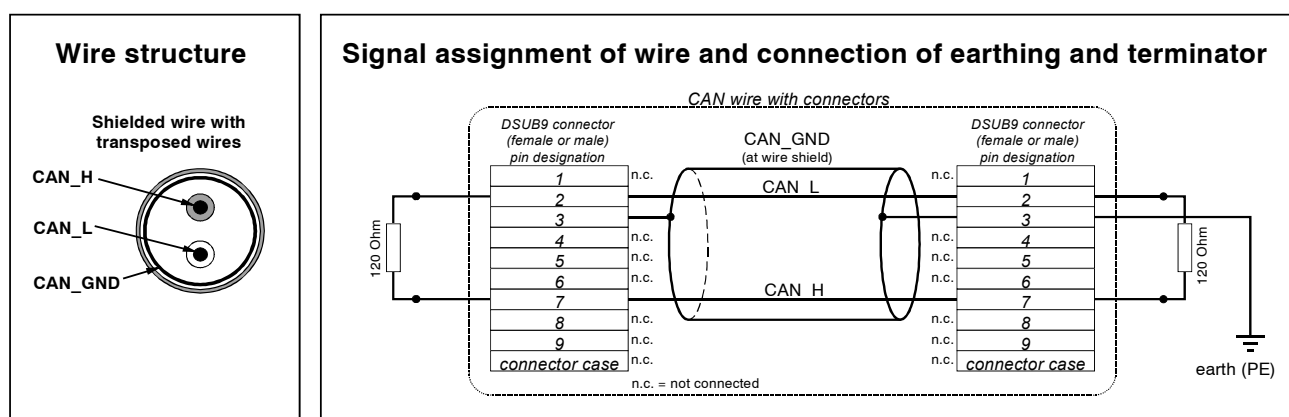
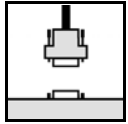


Figure: Structure and connection of wire



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)

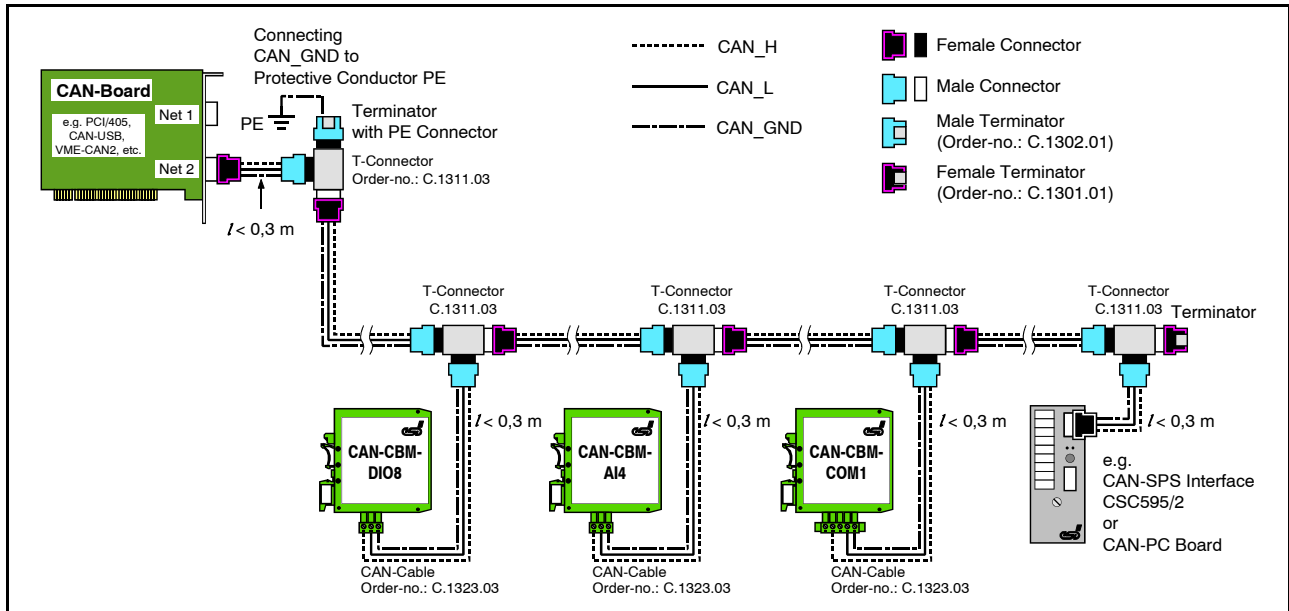


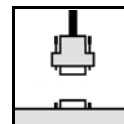
Figure: Example for correct wiring (when using single shielded wires)

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

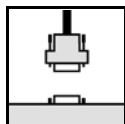


Wire Length

- 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**.

EG-KONFORMITÄTSERKLÄRUNG DECLARATION OF CONFORMITY



Adresse
Address

esd electronic system design gmbh
Vahrenwalder Str. 205
30165 Hannover
Germany

esd erklärt, daß das Produkt
esd declares, that the product

CAN-Repeater-I Opto

Typ, Modell, Artikel-Nr.
Type, Model, Article No.

C.1330.06

die Anforderungen der Normen
fulfills the requirements of the standards

DIN EN 50081-1 (03.1993)
DIN EN 50082-2 (1996)

gemäß folgendem Prüfbericht erfüllt.
according to test certificate.

1682.1407.99

Das Produkt entspricht damit den EG-Richtlinien
Therefore the product corresponds to the EU-Directives

89/336/EWG (23.05.1989),
92/31/EWG (28.04.1992)

Diese Erklärung gilt für alle Exemplare, die das CE-Zeichen tragen und verliert ihre Gültigkeit, wenn Veränderungen am Produkt vorgenommen werden.
This declaration is valid for all units with the CE label on it and it lose its validity if a modification is done on the product.

Name / *Name*
Funktion / *Title*
Datum / *Date*

Dr. Ing. Werner Schulze
Geschäftsführer
Hannover, den 20.06.2000

Rechtsgültige Unterschrift / *authorized Signature*