CiA Draft Recommendation 303

Additional specification

Part 1: Cabling and connector pin assignment

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CAN in Automation e. V.
Kontumazgarten 3
DE - 90429 Nuremberg, Germany
Tel.: +49-911-928819-0
Fax: +49-911-928819-79
Url: www.can-cia.org
Email: headquarters@can-cia.org

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1 Scope

This document recommends cabling and pin assignment of bus connectors for CANopen-based systems. It specifies also the naming conventions for the bus lines, ground lines and shield connections.

2 References

2.1 Normative references

/ISO11898-2/	ISO 11898-2, Road vehicles - Controller area network (CAN) - Part 2: High-speed medium access unit
/DIN41652/	DIN 41652, Steckverbinder für die Einschubtechnik
/IEC60130-9/	IEC 60130-9:1989, Connectors for frequencies below 3 MHz – Part 9: Circular connectors for radio and associated sound equipment
/IEC60947-5-2/	IEC 60947-5-2:1997, Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – Proximity switch
/ANSI/B.93.55M/	ANSI/B.93.55M:1981, (R1988) Hydraulic fluid power solenoid piloted industrial valves – Interface dimensions for electrical connectors
/CiA103/	CiA 103, CANopen intrinsically safe capable physical layer specification
/CiA301/	CiA 301, CANopen application layer and communication profile
/CiA413-1/	CiA 413, CANopen device profile for truck gateways – Part 1: General definitions
/CiA420-1/	CiA 420, CANopen profiles for extruder downstream devices – Part 1: General definitions
/CiA425-1/	CiA 425, CANopen application profile for medical diagnostic add-on modules – Part 1: General definitions
/CiA434-1/	CiA 434, CANopen profiles for laboratory automation systems – Part 1: General definitions
/CiA447-1/	CiA 447, CANopen application profile for special-purpose car add-on devices – Part 1: General definitions

2.2 Informative references

/AN96116/	AN 96116, Application note PCA82C250/251 CAN Transceiver, NXP (formerly: Philips Semiconductors)

3 Abbreviations and definitions

3.1 Abbreviations

AC	Alternating current
CAN	Controller area network
DC	Direct current
EMI	Electromagnetic interference
GND	Ground
Jr.	Junior
SJW	Resynchronization jump width
SHLD	Shield

3.2 Definitions

Bus cable
The bus cable is terminated at both ends by termination resistors.

Stub cable
The stub cable is an un-terminated cable, and should be as short as possible.

Socket connector
The socket connector may be powered.

Plug connector
The plug connector should be not powered; this is the reason why most devices are equipped with plug connectors.

T-connector
The T-connector provides a point of attachment onto the bus cable. Devices may be connected to the network either directly to the T-connector or with a stub cable. T-connectors also provide easy removal of a device without disrupting network operation.

4 Naming convention

If connectors are used that are not mentioned in this document, the pins shall be named (either in the accompanying manual or directly on the device) using the terminology shown in Table 1.

Table 1 – Terminology for connectors

Signal description	Notation
CAN_L bus line (dominant low)	CAN_L or CAN_{low} or CAN-
CAN_H bus line (dominant high)	CAN_H or CAN_{high} or CAN+
CAN ground	CAN_GND or CAN_{GND} or Ground or GND
Optional CAN shield	CAN_SHLD or CAN_{SHIELD} or Shield or SHLD
Optional CAN external positive supply	CAN_V+ or CAN_{V+} or V+ or UC or U_{CAN}
Optional ground	OPT_GND or GND_{opt} or V- or 0 V

5 AC and DC parameters

5.1 Bus cable and termination resistors

The cables, connectors and termination resistors used in CANopen networks shall meet the requirements defined in /ISO11898-2/. In addition, here are given some guidelines for selecting cables and connectors.

Table 2 shows some standard values for DC parameters for CANopen networks with less than 64 nodes.

Table 2 – Standard values for DC parameters for CANopen networks

Bus length [m]	Bus cable (1)		Termination resistance [Ω]	Bit-rate [kbit/s]
	Length-related resistance [mΩ/m]	Cross-section [mm^2]		
0 to 40	70	0,25 to 0,34	124	1000 at 40 m
40 to 300	<60	0,34 to 0,6	150 to 300	>500 at 100 m
300 to 600	<40	0,5 to 0,6	150 to 300	>100 at 500 m
600 to 1000	<26	0,75 to 0,8	150 to 300	>50 at 1 km

(1) Recommended cable AC parameters: 120-Ω impedance and 5-ns/m specific line delay

For drop cables a wire cross-section of 0,25 to 0,34 mm^2 may be an appropriate choice in many cases.

Besides the cable resistance, there shall be considered the real resistance of the connectors, if calculating the voltage drop. The transmission resistance of one connector should be in the range of 2,5 to 10 mΩ.

With the assumed values for

minimum dominant value	$V_{diff.out.min}$	= 1,5 V
minimum differential input resistance	$R_{diff.min}$	= 20 kΩ
requested differential input voltage	$V_{th.max}$	= 1,0 V
minimum termination resistance	$R_{T.min}$	= 118 Ω

Table 3 defines the maximum wiring length is given for different bus cables and different number of connected bus nodes.

Table 3 – Maximum wiring length

Wire cross-section [mm^2]	Maximum length [m] (1)			Maximum length [m] (2)		
	n = 32	n = 64	n = 100	n = 32	n = 64	n = 100
0.25	200	170	150	230	200	170
0.5	360	310	270	420	360	320
0.75	550	470	410	640	550	480

(1) safety margin of 0,2 (2) safety margin of 0,1

NOTE: If driving more than 64 nodes and/or more than 250 m bus length the accuracy of the V_{CC} supply voltage for the /ISO11898-2/ transceiver is recommended to be 5 % or better. You also have to consider the minimum supply voltage of at least 4,75 V when driving 50 Ω load, i.e. 64 bus nodes, and at least 4,9 V when driving 45 Ω load, i.e. 100 bus nodes.

5.2 Un-terminated stub cable

As a rule of thumb, the following relation may be considered for a single stub cable length L_u:

$$L_u < \frac{t_{PROPSEG}}{50 * t_p}$$

with the specific line delay per length unit

$$t_p = 5 \frac{ns}{m}$$

and the time of the propagation segment

$$t_{PROPSEG} = (time\ segment 1) - (length\ of\ SJW).$$

But also the cumulative drop length L_{ui} should be considered, which is given by the following relation:

$$\sum_{i=1}^{n} L_{ui} < \frac{t_{PROPSEG}}{10 * t_p}$$

This effectively leads to a reduction of the maximum trunk cable length by the sum of the actual cumulative drop cable length at a given bit rate. If the above recommendations are met, then the probability of reflection problems is considered to be fairly low.

5.3 CAN ground and galvanic isolation

In complete galvanically isolated CANopen networks CAN ground signal is carried in the cable line. It is connected at only one point with the CAN ground potential. If one CAN device with not galvanically isolated interface is connected to the network, the connection with the CAN ground potential is given. Therefore only one device with not galvanically isolated interface may be connected to the network.

The user is responsible to guarantee that the common mode rejection of the transceivers has still reached the upper limit.

5.4 External power supply

The recommended output voltage at the optional power supply is +18 V_{DC} < V+ < +30 V_{DC} in order to enable the use of standard power supplies (24 V_{DC}).

6 General purpose connectors

6.1 9-pin D-sub connector

Figure 1 shows the 9-pin D-sub connector.

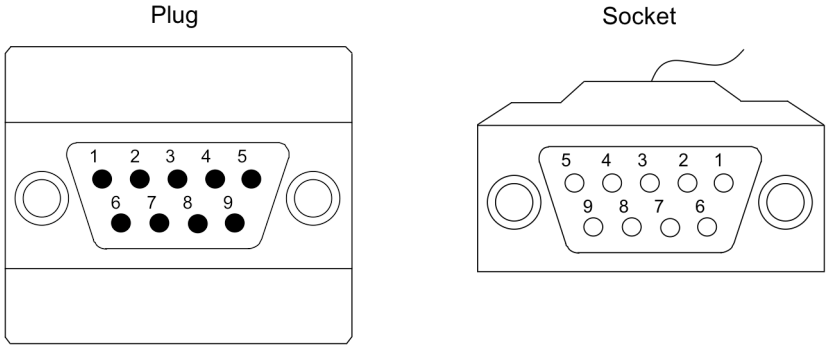

Figure 1 – 9-pin D-sub connector

It is recommended to use a 9-pin D-sub connector (/DIN41652/ or corresponding international standard) with the pinning according to Table 4.

Table 4 – Pinning for 9-pin D-sub connector

Pin	Signal	Description
1	-	Reserved
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN ground
4	-	Reserved
5	(CAN_SHLD)	Optional CAN shield
6	(GND)	Optional ground
7	CAN_H	CAN_H bus line (dominant high)
8	-	Reserved
9	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4

If 9-pin D-sub connector is supported, a plug connector meeting the above specification shall be provided by the device. Within the modules, pin 3 and pin 6 shall be interconnected. Inside of such modules providing two bus connections, and inside the T-connectors, all the pins (including the reserved ones) shall be connected. The intention is that there shall be no interruption of any of the wires in the bus cable, assuming a future specification of the use of the reserved pins.

By using the pin V+ for supplying transceivers in case of galvanic isolation, the necessity of extra local power isolation (e.g. DC/DC-converter) is avoided.

If an error line is needed within a system, then pin 8 shall be used for this purpose.

6.2 Multipole connector

Figure 2 shows the multipole connector.

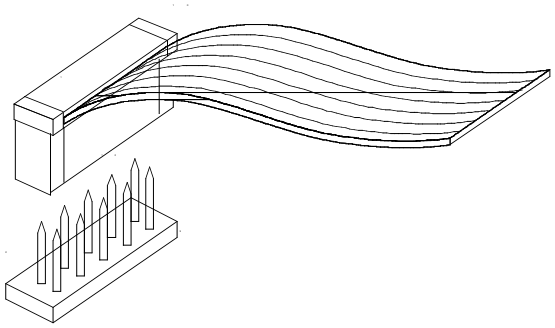

Figure 2 – Multipole connector

If (5 x 2) multipole connectors are used (e.g. inside EMI protected housings) the pinning shown in Table 5 is recommended, as it supports direct connection of the flat cables to 9-pin D-sub connectors.

Table 5 – Pinning for multipole connector

Pin	Signal	Description
1	-	Reserved
2	(GND)	Optional ground
3	CAN_L	CAN_L bus line (dominant low)
4	CAN_H	CAN_H bus line (dominant high)
5	CAN_GND	CAN ground
6	-	Reserved
7	-	Reserved
8	(CAN_V+)	Optional CAN external positive supply NOTE For recommended range of external power supply see clause 5.4
9	-	Reserved
10	-	Reserved

6.3 RJ10 connector

Figure 3 shows the RJ10 connector.

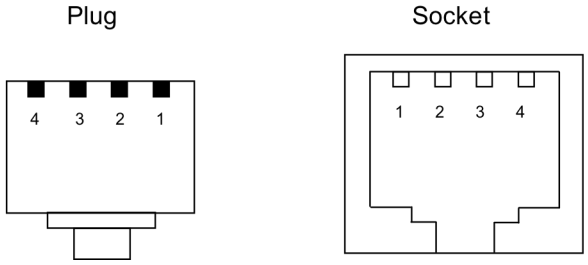

Figure 3 – RJ10 connector

The pinning for RJ10 connector is given in Table 6.

Table 6 – Pinning for RJ10 connector

Pin	Signal	Description
1	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2	CAN_H	CAN_H bus line (dominant high)
3	CAN_L	CAN_L bus line (dominant low)
4	CAN_GND	Ground / 0 V / V-

6.4 RJ45 connector

Figure 4 shows the RJ45 connector.

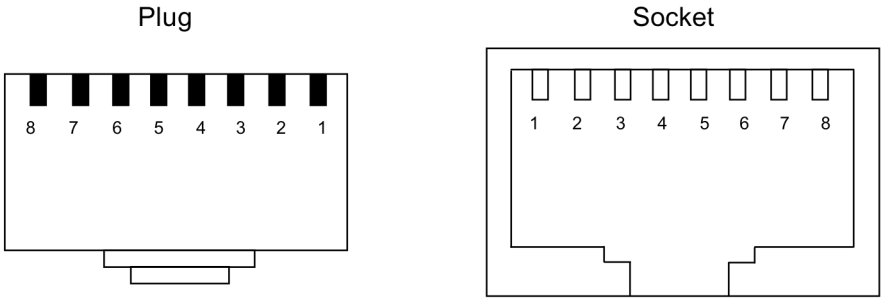

Figure 4 – RJ45 connector

The pinning for RJ45 connector is given in Table 7.

Table 7 – Pinning for RJ45 connector

Pin	Signal	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground / 0 V / V-
4	-	Reserved
5	-	Reserved
6	(CAN_SHLD)	Optional CAN Shield
7	(GND)	Optional ground
8	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4

The device shall provide the socket connector. Often used with 4 and 8 twisted pair cabling. By using this cables pin 3-6 and 1-2 are twisted pairs.

6.5 Open style connector

Figure 5 shows the open style connector.

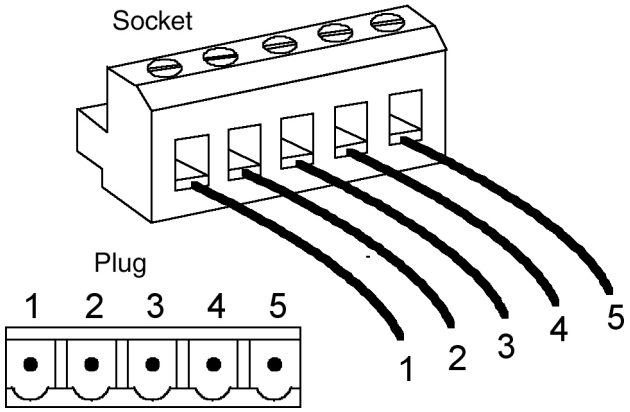

Figure 5 – Open style connector

If open style connectors are used the pinning shown in Table 8 is recommended.

Table 8 – Pinning for open style connector

Pin	Signal	Description
1	CAN_GND	Ground / 0 V / V-
2	CAN_L	CAN_L bus line (dominant low)
3	(CAN_SHLD)	Optional CAN shield
4	CAN_H	CAN_H bus line (dominant high)
5	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4

4-pin open style connectors either use pins 1-4 (version A) or pins 2-5 (version B). 3-pin open style connectors use pins 2-4. The device provides the plug connector.

6.6 em069A-3 connector

The connector described in this clause is called "em069A-3“ and is manufactured by Embedor, Beijing (CN).

Figure 6 shows the "em069A-3“connector.

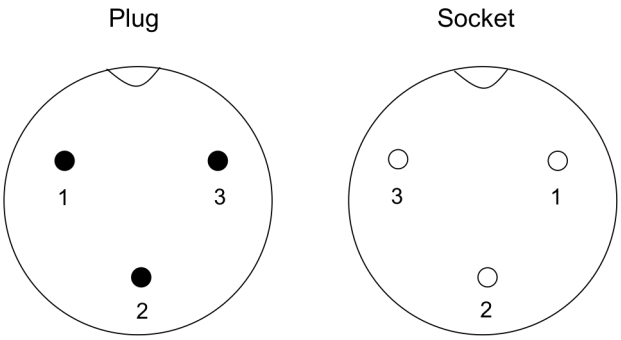

Figure 6 – "em069A-3“connector

The pinning for the "em069A-3“ connector is shown in Table 9.

Table 9 – Pinning for "em069A-3“ connector

Pin	Signal	Description
1	CAN_L	CAN_L bus line (dominant low)
2	CAN_GND	CAN ground
3	CAN_H	CAN_H bus line (dominant high)

7 Industrial connectors

7.1 5-pin “mini” style connector

Figure 7 shows the 5-pin “mini” style connector.

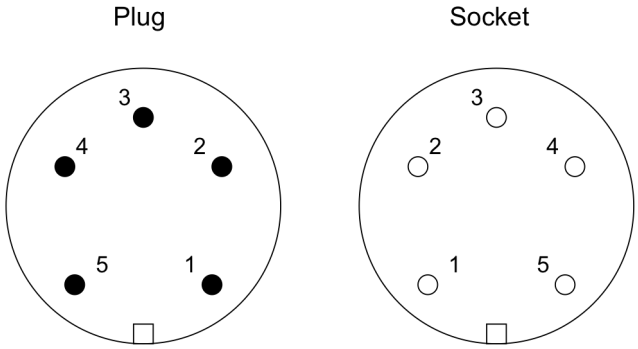

Figure 7 – 5-pin “mini” style connector

The recommended pinning for the so-called 5-pin “mini” style connectors (/ANSI/B.93.55M/) is shown in Table 10.

Table 10 – Pinning for 5-pin “mini” style connector

Pin	Signal	Description
1	(CAN_SHLD)	Optional CAN shield
2	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
3	CAN_GND	Ground / 0V / V-
4	CAN_H	CAN_H bus line (dominant high)
5	CAN_L	CAN_L bus line (dominant low)

The device shall provide the plug connector. The plug contacts shall meet 7/8-16 UN2A connection thread. The socket contacts shall meet 7/8-16 UN2B connection thread.

7.2 5-pin “micro” style connector

Figure 8 shows the 5-pin “micro” style connector.

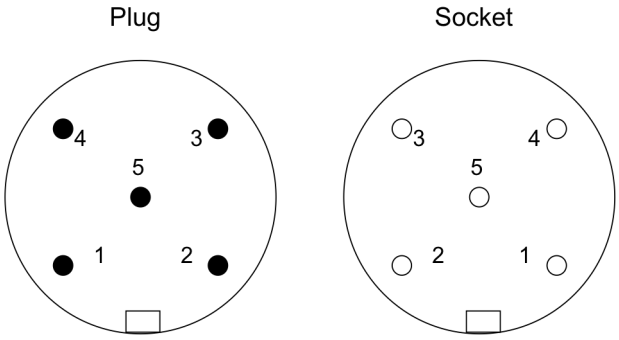

Figure 8 – 5-pin “micro” style connector

The recommended pinning for the so-called 5-pin “micro” style connector (M12) is shown in Table 11.

Table 11 – Pinning for 5-pin “micro” style connector

Pin	Signal	Description
1	(CAN_SHLD)	Optional CAN shield
2	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
3	CAN_GND	Ground / 0V / V-
4	CAN_H	CAN_H bus line (dominant high)
5	CAN_L	CAN_L bus line (dominant low)

The device shall provide the plug connector /IEC 60947-5-2/. The plug connector shall mate with Lumberg RST5-56/xm. The socket connector shall mate with Lumberg RKT5-56/xm or equivalent.

7.3 5-pin “pico” style connector

For definition and pinning profile of the 5-pin “pico” style connector see /CiA103/.

7.4 Han Quintax

The connector described in this clause is called “Han Quintax“ and is manufactured by Harting. For definition and pinning profile see /CiA420-1/.

8 Special purpose connectors

8.1 Round connectors

8.1.1 7-pin round connector

Figure 9 shows the 7-pin round connector.

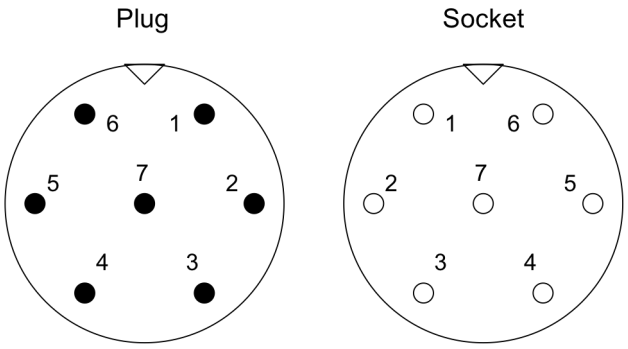

Figure 9 – 7-pin round connector

The pinning for 7-pin round connector is shown in Table 12.

Table 12 – Pinning for 7-pin round connector

Pin	Signal	Description
1	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2	CAN_GND	Ground / 0 V / V-
3	CAN_H	CAN_H bus line (dominant high)
4	CAN_L	CAN_L bus line (dominant low)
5	DIL-1	DIP switch 1 connected with CAN_V+
6	DIL-2	DIP switch 2 connected with CAN_V+
7	DIL-3	DIP switch 3 connected with CAN_V+

The device shall provide the socket connector. This type is well known as “DIN” connector, e.g. manufacturer Binder Series 680.

8.1.2 8-pin round connector

Figure 10 shows the 8-pin round connector.

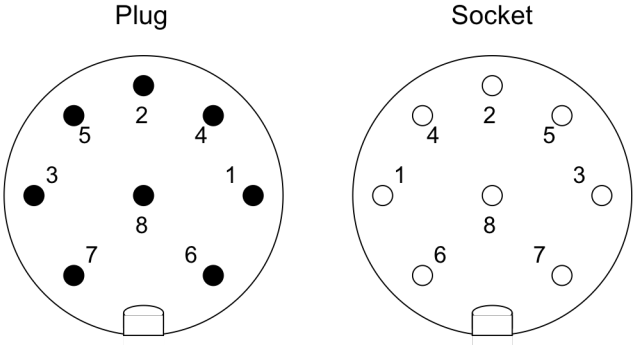

Figure 10 – 8-pin round connector

The pinning for 8-pin round connector is shown in Table 13.

Table 13 – Pinning for 8-pin round connector

Pin	Signal	Description
1	CAN_V+	CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2	GND	0 V
3	CAN_H	CAN_H bus line (dominant high)
4	CAN_L	CAN_L bus line (dominant low)
5	CAN_GND	Ground
6	-	Reserved
7	-	Reserved
8	-	Reserved

The device shall provide the socket connector. This type corresponds with /IEC60130-9/, e.g. manufacturer Binder Series 723 or equivalent.

8.1.3 9-pin round connector

Figure 11 shows the 9-pin round connector.

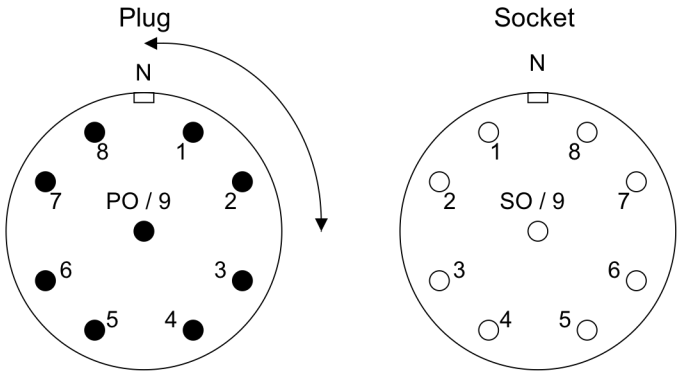

Figure 11 – 9-pin round connector

The pinning for 9-pin round connector is shown in Table 14.

Table 14 – Pinning for 9-pin round connector

Pin	Signal	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground / 0 V / V-
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
8	(GND)	Optional ground
9	-	Reserved

The socket connector type is RC-09S1N and the plug connector type is RC-09P1N provided by Coninvers or similar manufacturers.

8.1.4 10-pin round connector

For definition and pinning profile see /CiA425-1/.

8.1.5 Mini-snap 10-pin round connector

For definition and pinning profile see /CiA425-1/.

8.1.6 12-pin round flange connector

Figure 12 shows the 12-pin round flange connector.

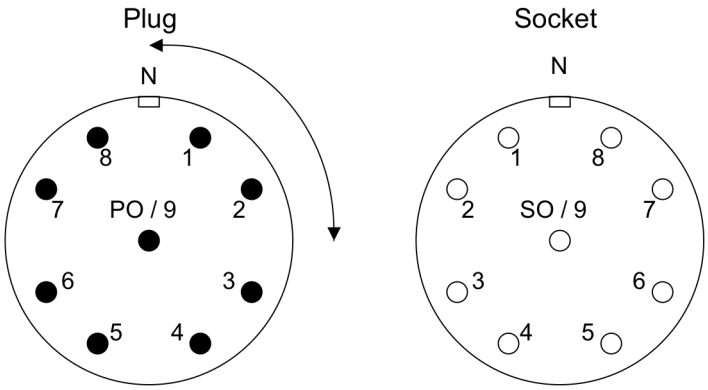

Figure 12 – 12-pin round flange connector

The pinning for 12-pin round flange connector is shown in Table 15.

Table 15 – Pinning for 12-pin round flange connector

Pin	Signal	Description
1	-	Reserved
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground / 0 V / V-
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	CAN_H	CAN_H bus line (dominant high)
8	-	Not used
9	-	Reserved
10	(GND)	Optional ground
11	-	Reserved
12	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4

The socket connector type is RC12S1N121 and the plug connector type is RC-12P1N121 provided by Coninvers or similar manufacturers.

8.1.7 9-pin flange round T-connector with ID-switch

Figure 13 shows the 9-pin flange round T-connector with ID-switch.

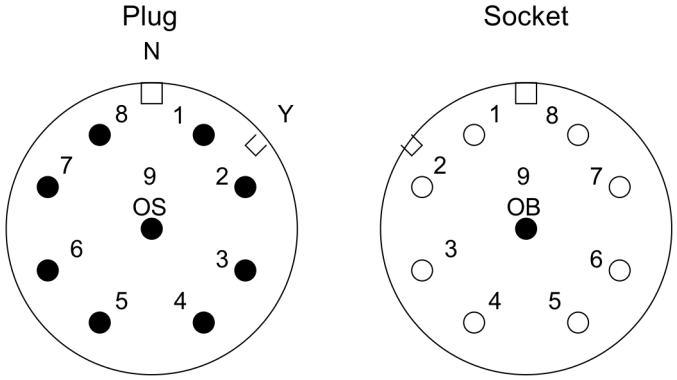

Figure 13 – 9-pin flange round T-connector with ID-switch

The pinning for 9-pin flange round T-connector with ID-switch is shown in Table 16.

Table 16 – Pinning for 9-pin flange round T-connector with ID-switch

Pin	Signal	Description
1	(CAN_V+)	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2	CAN_H	CAN_H bus line (dominant high)
3	DIL-1	DIP switch 1 connected with CAN_V+
4	DIL-2	DIP switch 2 connected with CAN_V+
5	DIL-3	DIP switch 3 connected with CAN_V+
6	DIL-4	DIP switch 4 connected with CAN_V+
7	CAN_L	CAN_L bus line (dominant low)
8	CAN_GND	Ground / 0 V / V-
9	-	Reserved

This type is called “Zylin series R2.5” and is manufactured by LAPP Kabel/Contact Connectors.

The hardware setting of up to 16 node-IDs is overwritable by CANopen services. This T-connector is designed for using a 4-wire bus cabling. The diameter of this T-connector is about 25 mm.

8.2 Han-Brid® CU

The connector described in this clause is called “Han-Brid® CU” and is manufactured by Harting.

8.2.1 Housing-side

Figure 14 shows the housing-side of “Han-Brid® CU”.

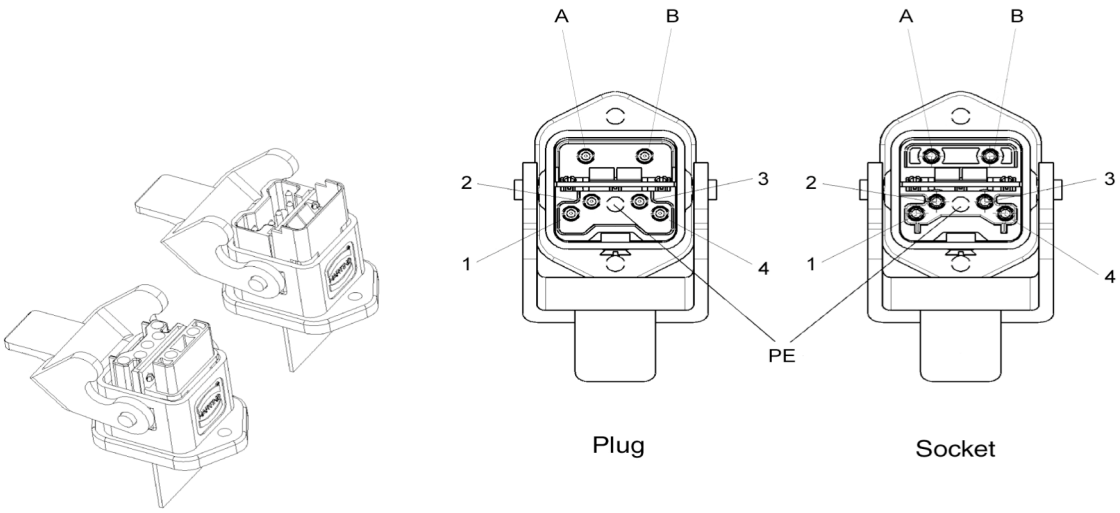

Figure 14 – Housing-side of “Han-Brid® CU”

Table 17 shows the pinning for the housing-side of “Han-Brid® CU”.

Table 17 – Pinning for housing-side of “Han-Brid® CU”

Pin	Signal	Description
1	CAN_V+	Optional unswitched CAN external positive supply NOTE For recommended range of external power supply see clause 5.4
2	CAN_GND	Optional unswitched CAN ground
3	CAN_GND	Optional switched CAN ground
4	CAN_V+	Optional switched CAN external positive supply NOTE For recommended range of external power supply see clause 5.4
A	CAN_L	CAN_L bus line (dominant low)
B	CAN_H	CAN_H bus line (dominant high)
PE	PE	Optional PE

8.2.2 Cable-side

Figure 15 shows the cable-side of “Han-Brid® CU”.

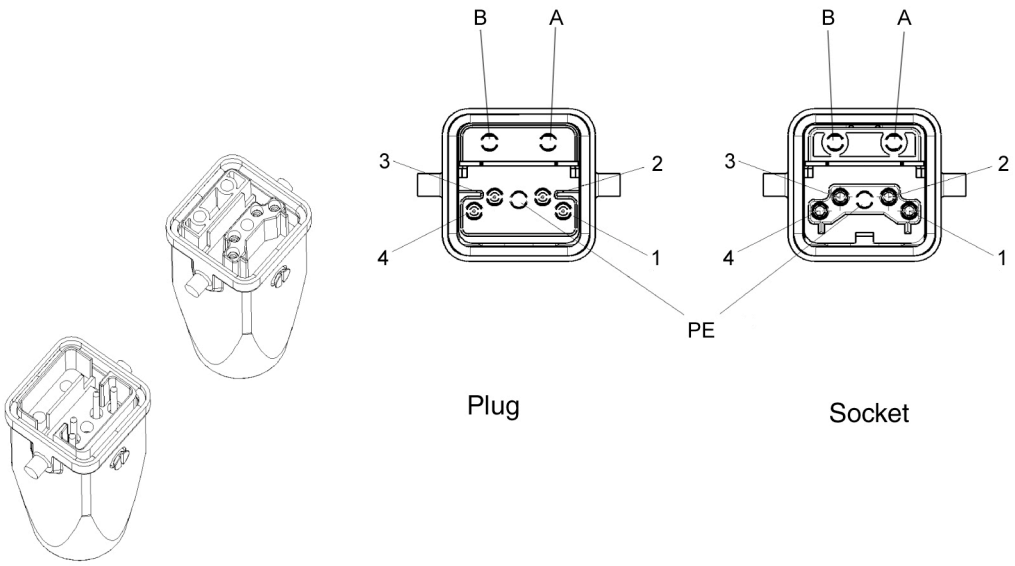

Figure 15 – Cable-side of “Han-Brid® CU”

Table 18 shows the pinning for the cable-side of “Han-Brid® CU”.

Table 18 – Pinning for cable-side of “Han-Brid® CU”

Pin	Signal	Description
1	CAN_V+	Optional unswitched CAN external positive supply NOTE For recommended range of external power supply see clause 5.4
2	CAN_GND	Optional unswitched CAN ground
3	CAN_GND	Optional switched CAN ground
4	CAN_V+	Optional switched CAN external positive supply NOTE For recommended range of external power supply see clause 5.4
A	CAN_L	CAN_L bus line (dominant low)
B	CAN_H	CAN_H bus line (dominant high)
PE	PE	Optional PE

8.3 IEEE1394/Firewire connector with shielding

8.3.1 Chaining of the bus on the node

Figure 16 to Figure 18 show the chaining of the bus on the node for IEEE1394/Firewire connector with shielding.

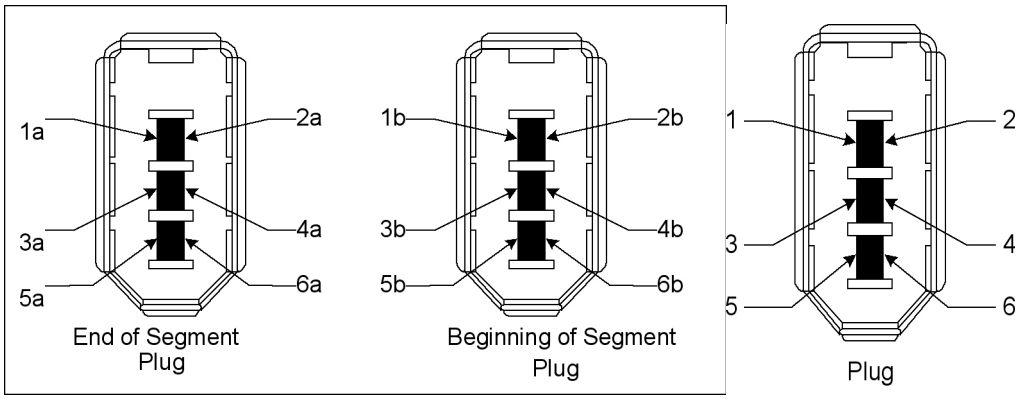

Figure 16 – IEEE1394/Firewire plug connector with shielding

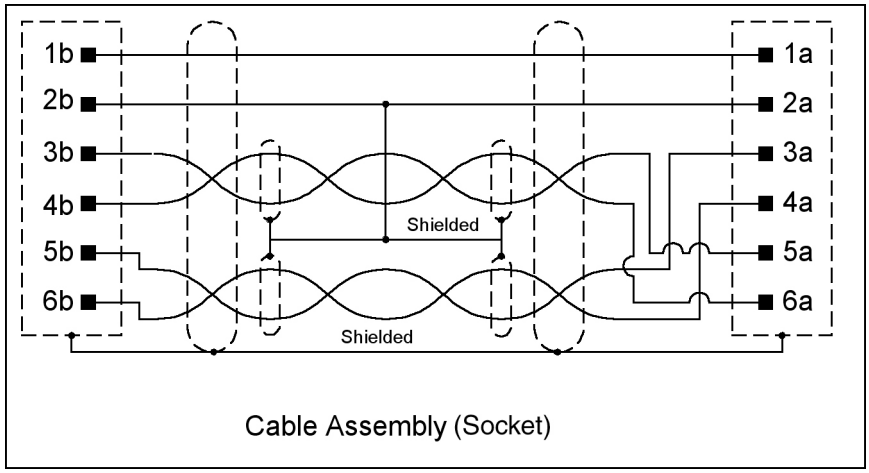

Figure 17 – Interconnection of the bus segments

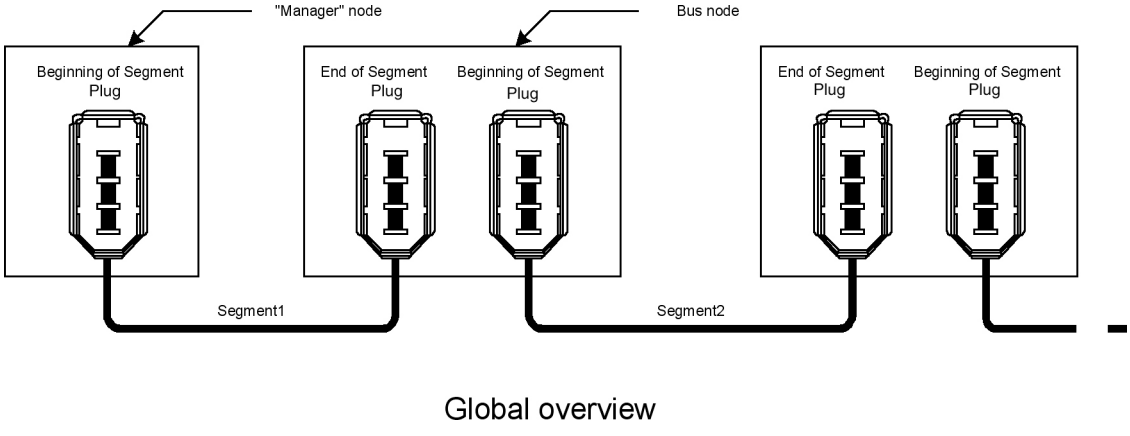

Figure 18 – Global overview

The pinning for IEEE1394/Firewire connector with shielding with chaining of the bus on the node is recommended in Table 19.

Table 19 – Pinning for IEEE1394/Firewire connector with shielding with chaining of the bus on the node

End of segment Pin	Beginning of segment Pin	Signal	Description
1a	1b	(CAN_V+)	CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2a	2b	CAN_GND	0 V
3a	5b	CAN_H	CAN_H bus line (dominant high)
4a	6b	CAN_L	CAN_L bus line (dominant low)
5a	3b	-	Reserved
6a	4b	-	Reserved
Shield	Shield	(CAN_SHLD)	Optional CAN shield

The cable shall provide the socket connector and changes the terminals of the two twisted shielded pairs.

The device shall provide two plug connectors with pairs switching according the IEEE1394 mechanical specification to allow usage of standard cables.

A master node may provide only the plug corresponding to *beginning of segment*.

8.3.2 No chaining of the bus on the node

Figure 19 shows the IEEE1394/Firewire socket and plug connector with shielding without chaining of the bus on the node.

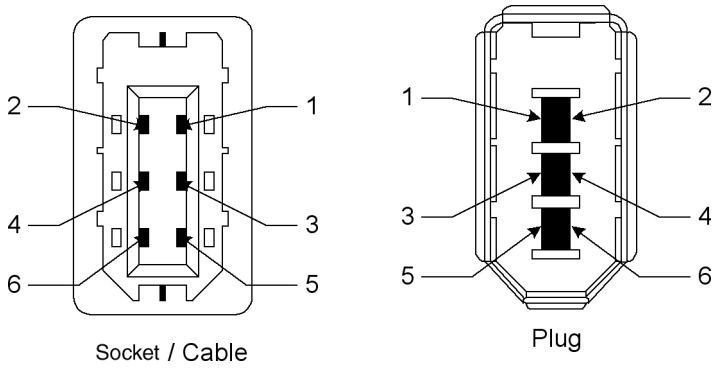

Figure 19 – IEEE1394/Firewire socket and plug connector with shielding without chaining of the bus on the node

The pinning for IEEE1394/Firewire connector with shielding without chaining of the bus on the node is recommended in Table 20.

Table 20 – Pinning for IEEE1394/Firewire connector with shielding without chaining of the bus on the node

Pin	Signal	Description
1	(CAN_V+)	CAN external positive supply (dedicated for supply of transceiver and optocoupler, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
2	CAN_GND	0 V
3	CAN_H	CAN_H bus line (dominant high)
4	CAN_L	CAN_L bus line (dominant low)
5	-	Reserved
6	-	Reserved
Shield	(CAN_SHLD)	Optional CAN shield

The device shall provide the plug connector. The cable shall provide the socket connector.

Therefore it is possible to connect a device with one plug at *end of a segment* provided by a device with two plugs according clause 8.3.1.

8.4 Lift connectors

8.4.1 Mini-Fit Jr. connector

The connector described in this clause is called "Mini-Fit Jr.“ and is manufactured by Molex.

Figure 20 shows the "Mini-Fit Jr.“ connector.

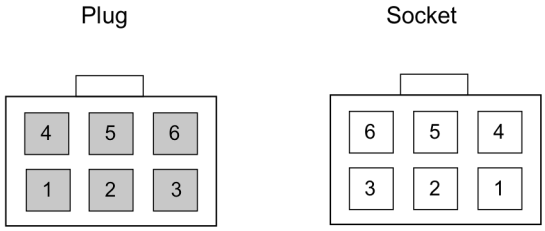

Figure 20 – "Mini-Fit Jr.“ connector

The pinning for the "Mini-Fit Jr.“ connector is shown in Table 21.

Table 21 – Pinning for "Mini-Fit Jr.“ connector

Pin	Signal	Description
1	CAN_SHLD	Optional CAN shield
2	CAN_H	CAN_H bus line (dominant high)
3	CAN_L	CAN_L bus line (dominant low)
4	-	Reserved
5	CAN_GND	CAN ground
6	CAN_V+	Optional CAN external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4

8.5 Automotive/Vehicle connectors

8.5.1 7-pin socket connector

Definition and pinning profile of the 7-pin socket connector are provided in /CiA413-1/.

8.5.2 9-pin socket connector

Definition and pinning profile of the 9-pin socket connector are provided in /CiA413-1/.

8.5.3 18-pin VDA interface connector

Definition and pinning profile of the 18-pin VDA interface connector (e.g. micro quadlok system 0.64 from Tyco Electronics) are provided in /CiA447-1/.

8.5.4 2-pin power connector

Definition and pinning profile of the 2-pin power connector (e.g. AMP926474-1 from Tyco Electronics) are provided in /CiA447-1/.

8.6 Laboratory automation connectors

8.6.1 Header 10-pin plug connector

Definition and pinning profile of the header 10-pin plug connector are provided in /CiA434-1/.

8.7 Connectors for medical applications

8.7.1 15-pin D-sub connector

Definition and pinning profile of the 15-pin D-sub connector are provided in /CiA425-1/.

8.8 Connectors for redundant communication

8.8.1 15-pin D-sub connector

Figure 21 shows the 15-pin D-sub connector.

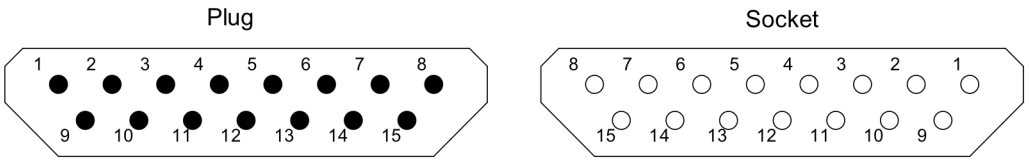

Figure 21 – 15-pin D-sub connector

The pinning for 15-pin D-sub connector is given in Table 22.

Table 22 - Pinning for 15-pin D-sub connector

Pin	Signal	Description
1	CAN1_L	CAN1 low
2	CAN1_GND	CAN1 ground
3	CAN2_L	CAN2 low
4	CAN2_GND	CAN2 ground
5	Parity	Adjustment “odd parity”
6	NODENO_3	*See NODENO_x*
7	NODENO_1	*See NODENO_x*
8	GND	Logic ground
9	CAN1_H	CAN1 high
10	CAN1_HR	Termination resistor
11	CAN2_H	CAN2 high
12	CAN2_HR	Termination resistor
13	NODENO_4	*See NODENO_x*
14	NODENO_2	*See NODENO_x*
15	NODENO_0	*See NODENO_x*

NODENO_x: Adjustment of the node ID ext. CAN

8.8.2 8-pin Ampseal connector

The connector described in this clause is called 8-pin Ampseal connector and is manufactured by Tyco Electronics. The CAN1 line (pin 1 to 4) shall be used if only one CAN line is used. If two CAN lines are used, then the CAN1 line shall be considered as the default line and the CAN2 line (pin 5 to 8) as the redundant line.

Figure 22 shows the 8-pin Ampseal connector (header assembly).

Header assembly

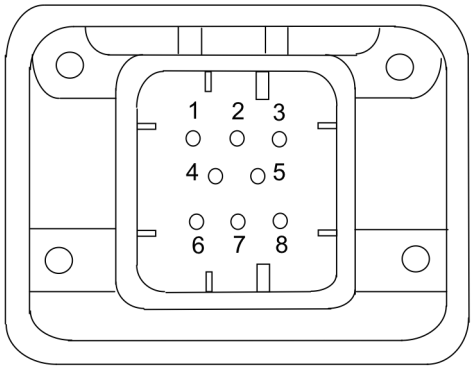

Figure 22 – 8-pin Ampseal connector

The pinning for the 8-pin Ampseal connector is shown in Table 23.

Table 23 – Pinning for 8-pin Ampseal connector

Pin	Signal	Description
1	CAN1_L	CAN1_L bus line (dominant low)
2	CAN1_H	CAN1_H bus line (dominant high)
3	CAN1_V+	Optional CAN1 external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
4	CAN1_GND	CAN1 ground
5	CAN2_GND	CAN2 ground
6	CAN2_V+	Optional CAN2 external positive supply (dedicated for supply of transceiver and optocouplers, if galvanic isolation of the bus node applies) NOTE For recommended range of external power supply see clause 5.4
7	CAN2_L	CAN2_L bus line (dominant low)
8	CAN2_H	CAN2_H bus line (dominant high)

