CANopen

Page

C00 General information about CANopen

CANopen is based on the Controller Area Network (CAN) Protocol, which was originally developed for the automotive manufacturing industry. However, CANopen has become increasingly established as an industry standard.

CANopen is an open, multi-vendor network protocol corresponding to the OSI Reference Model. The layers in CANopen are defined in the standard ISO 11 898.

CANopen is made up of a family of profiles, including the following:

- The application layer
- The communication profile
- Different frameworks and application profiles

and

- Several standardised device profiles

Amongst other, CANopen is based on the following standards*:

Standard	*Designation*	*Remark*
ISO 11 898	Physical und Data Link Layer	Layers 1 and 2 of the ISO/OSI Communication Model
CiA DS-102	CAN Physical Layer for Industrial Applications	General industrial use in field area applications (connectors and bit rates based on ISO 11 898)
CiA DS-301	Application Layer and Communication Profile	CANopen Communication Profile
CiA DS-302	Framework for Programmable CANopen Devices	CANopen Network Management NMT
CiA DRP-303-1	Cabling and Connector Pin Assignment	Cabling and Connector Pin Assignment
CiA DSP-306	Electronic Data Sheet Specification for CANopen	EDS Files Specifications
CiA DS-401	Device Profile for I/O modules	CANopen Device Profile for I/O-Modules
CiA DS-406	Device Profile for Encoders	CANopen Device Profile for Counter Modules
CiA DSP-420	Device Profile for Extruder Downstream Devices	CANopen Device Profile for Extruder

* This overview is not exhaustive. Standards for CANopen are continuously being extended.

CANopen offers numerous advantages, for example:

- Multi-vendor standards
- Open structure
- Real-time capable communication for process data without protocol overheads
- Automatic configuration of CAN networks
- Uniform access to device parameters
- Cyclic and event-controlled communication

C00.1 Data transmission

CANopen is a multi-master system. That means that all stations on the bus (so-called 'nodes') have the same rights and can (theoretically) transmit messages at any time.

This has the following advantages and disadvantages when compared with the deterministic bus access process.

Advantages	*Disadvantages*
• Transmission is initiated only when required	• No defined response time
• Low bus loads	• No guaranteed bus access at desired point in time
• High priority telegrams are given precedence	• Low priority telegrams can be transmitted with a long delay.
• Less latency	

Address configuration for the fieldbus

Every active node is assigned an address in the CANopen structure. Each address must be assigned only once within the whole bus structure; this applies only to the respective bus structure.

The address 000 must not be assigned. It is reserved for telegrams intended for all stations on the bus.

The principle of bus arbitration (CSMA/CA)

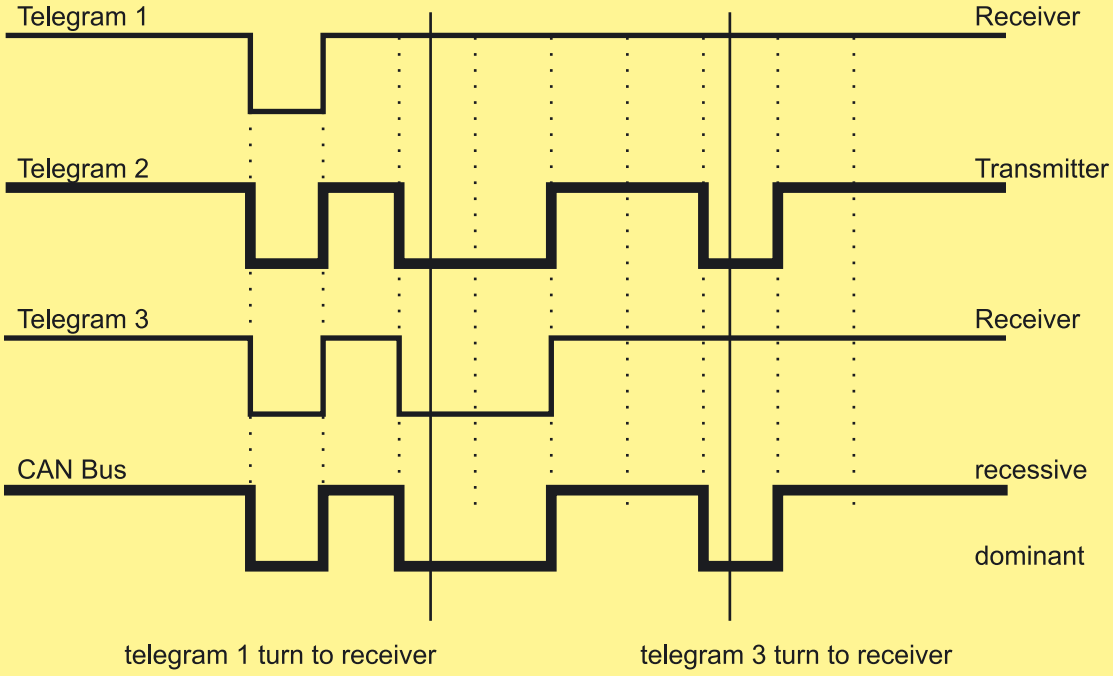
The principle of bit-by-bit arbitration is used to avoid data collision. The arbitration field consists of a message identifier and the RTB bit (Remote Transmission Request bit), which serves to differentiate between the transmitter and the receiver.

Each node in a CANopen network observes the bus level, which can take on two physical statuses.

- Dominant (conforming) value 0-level
- Recessive value 1-level

If the bus is idle (no communication is taking place), then the level is recessive. As soon as a node begins to transmit on the bus, a dominant bit is sent (SOF bit). During the arbitration phase, each transmitting node monitors and compares its transmitted bus level with the actual level of the bus. Nodes with the dominant level overwrite the recessive level. Nodes with the recessive level stop transmitting immediately and release the bus. These make a further attempt at communication when an idling bus is detected.

The node whose message identifier has the lowest value is given the highest priority to communicate on the bus and continues transmitting without any hindrance.



Principle of bit-by-bit arbitration

The bit-by-bit arbitration process means that a message can neither be damaged nor lost.

With a predetermined data transmission rate, the bit-by-bit arbitration process restricts the maximum possible network expansion.

Response times

Theoretically, it is possible for each active bus node to access the bus at any time. For this reason, a guaranteed latency time can only be given for the message with the highest priority. This is the waiting time that passes until the message being sent is completed. The maximum waiting time is determined by the maximum length of the last telegram; for example, this can amount to 134 µs at a transmission rate of 1 Mbaud.

Communication

Communication between the individual nodes is carried out object-orientated by means of sending telegrams (messages).

There are 4 different types of message defined for CANopen:

- Network Management Messages
- Service Data Objects
- Process Data Object
- Predefined Messages

Network management messages are used to control the nodes and their operating statuses within the network. It is possible, for example, with this type of message to configure the data transmission mechanism of a node.

Service data objects (SDOs) are used for acyclic data transmissions with a low priority. SDOs are typically used to configure CANopen nodes, set device parameters and download programmes. Here, the communications profile determines how these objects are set and which services they can carry out in accordance with CAL (CAN Applications Layer). Using a so-called 'segmented transfer' allows the SDOs to transmit data of any length. An SDO can only be formed between two nodes. SDO transfer makes possible acknowledgement operations.

Process data objects (PDOs) are used for fast data transmissions with a high priority. PDOs are unconfirmed services containing no protocol overheads. Consequently, they represent an extremely fast and flexible method of transmitting data from one node to any number of other nodes. PDOs can contain a maximum of 8 data bytes that can be specifically compiled and configured by the user to suit his requirements. PDOs can be used by several devices simultaneously.

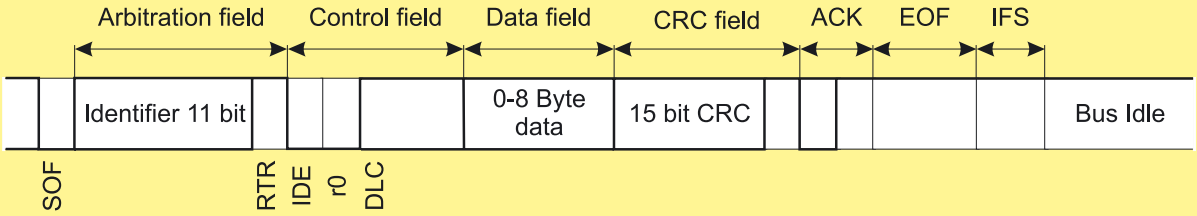
Predefined messages are predetermined in CANopen for certain procedures such as synchronised read/write operations of several I/O modules, for example.

Furthermore, there are different transmission types available for process data.

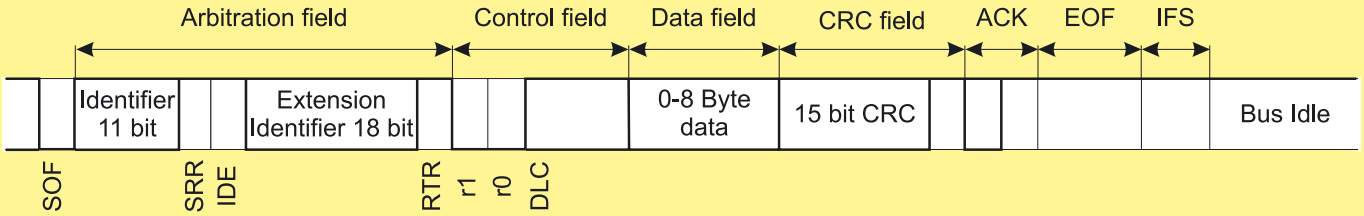
Telegrams transmitted via a network are prioritised by means of their identifier (low ID = high priority). The arbitration process guarantees that the important telegrams are delivered quickly when the network is being utilised at a high capacity.

The message identifier can have two different lengths:

- 11 bits in the CANopen standard format
- 29 bits in the extended format



Structure of a telegram, CANopen with standard format (identifier 11 bit)



Structure of a telegram, CANopen with extended format (identifier 29 bit)

Individual objects are described in the various CANopen specifications. As well as a number of objects with fixed definitions and a permanently assigned index, there are user and manufacturer-dependent objects that can be defined relatively freely.

All the objects used for a device are contained in its EDS file.

Device profile

Standards used by CANopen also contain definitions of so-called device profiles, which exactly describe all of the communication parameters for the devices. In principal, the device profiles are composed of two descriptive components:

- Functional description
  The functionality of a device is described by means of function blocks and data flows. The parameters are stored in a so-called object dictionary. This object dictionary has a predefined profile, which means that the parameters for a certain type of device (for example, an I/O module, encoder ...) are always to be found at the same place in the object dictionary. The corresponding entries are classified as mandatory, optional and manufacture-specific data.
- Description of performance characteristics
  The performance characteristics of a device are described in a state transition diagram.

Descriptions of the device profiles are contained in the 'Device Profiles CiA DSP 40x'. These include, for example:

- CiA DSP 401 Device Profile for I/O Modules
- CiA DSP 402 Device Profile for Drives and Motion Control
- CiA DSP 406 Device Profile for Encoder
- CiA DSP 420 Device Profile for Extruder Downstream Devices

Electronic data sheet – EDS file

Every CANopen device is embedded in a CANopen structure with the help of a standardised EDS file (Electronic Data Sheet).

The EDS file contains all of the objects for the respective device with their sub-indices and corresponding entries as well as their default values.

Using the EDS file, the user can create a Device Configuration File, which can be specially adapted to suit the respective application.

C00.2 Topology

CANopen uses a line topology structure.

A bus line is made up of at least two active nodes. Incoming and outgoing cables can be connected by means of a Sub-D connector/socket or by direct wiring. Each active node occupies an address on the bus.

CANopen nodes can be included at any point in a bus structure.

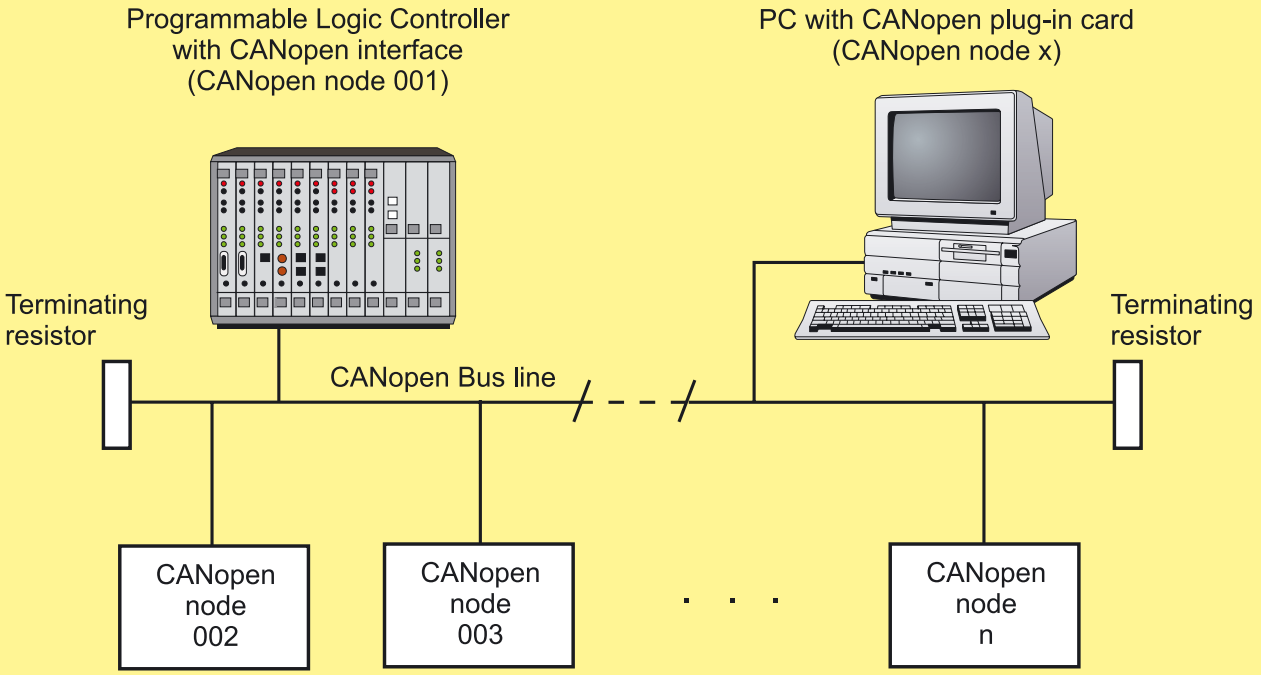
If a device is used as the first or last node, it is necessary to terminate the CAN bus with an active terminating resistor (integrated or switchable) in order to guarantee an error-free communication across the whole bus.

Maximum system extension

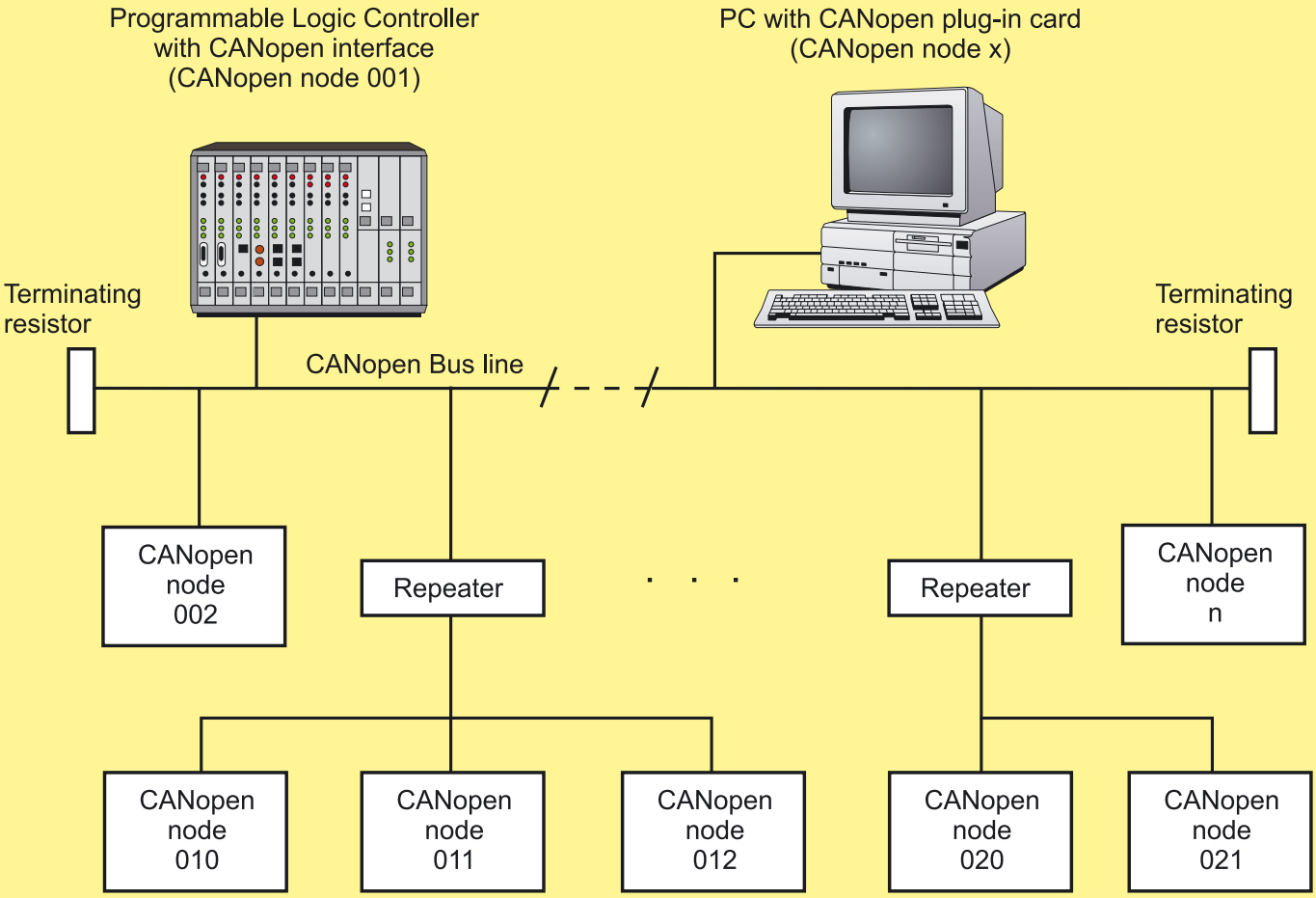
The maximum possible number of nodes in a CANopen structure depends on the performance of the drivers for the bus.

Repeaters can be used to segment the bus cable if it is required to increase the number of active nodes. The maximum number of nodes per segment is restricted to 64.

It is not possible to increase the total length of the bus due to the arbitration mechanism.



Topology of a CANopen network without repeaters



Topology of a CANopen network with repeaters

Maximum length of the bus

The maximum length of a bus for CANopen depends on the transmission rate used. The following table offers an overview of the possible transmission rates and the equivalent maximum possible length of cable.

Baudrate	maximum cable length	Nominal bit time
10 kBit/s*	1000 m	100 µs
20 kBit/s**	1000 m	50 µs
50 kBit/s	1000 m	20 µs
100 kBit/s***	650 m	10 µs
125 kBit/s	500 m	8 µs
250 kBit/s	250 m	4 µs
500 kBit/s	100 m	2 µs
800 kBit/s	50 m	1.25 µs
1000 kBit/s	40 m	1 µs

* Minimum transmission rate
** Supported by all nodes
*** Not recommended for new devices

Additionally, the maximum length of the cable depends on the number of nodes and the cross-section of the cable used. The following table offers an overview:

Cross-section in mm²	Maximum length in meters		
	n = 32	n = 64	n = 100
0.25[1)]	200	170	150
0.25[2)]	230	200	170
0.50[1)]	360	310	270
0.50[2)]	420	360	320
0.75[1)]	550	470	410
0.75[2)]	640	550	480

[1)] Factor for safety = 20%
[2)] Factor for safety = 10%
n Number of nodes

C00.3 Types of cables

Twisted and shielded two-wire cables are predominantly used as a medium for transmissions. These are suitable for use with the modified transmission standard RS485.

The DIN ISO 11 898-2 should be observed to avoid any possible incompatibility.

The following key data is to be observed for the cable:

- Characteristic cable impedance: 120 Ω
- Specific signal delay (nominal) 5 ns/m

Observing this key data, and depending on the length of the bus, results in the following values for the cable to be used and the required terminator:

Length of bus in meters	Bus cable		Terminating resistor in Ω
	Resistance in mΩ/m in relation to length	Cross-section in mm²	
0 … 40	70	0.25 … 0.34	124
40 … 300	< 60	0.34 … 0.60	150 … 300
300 … 600	< 40	0.50 … 0.60	150 … 300
600 … 1000	< 26	0.75 … 0.80	150 … 300

Recommended resistance values and terminating resistors based on length of bus

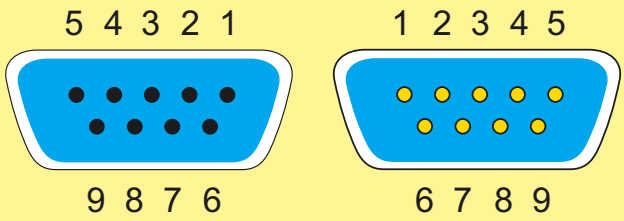
C00.4 Connectors

Fundamentally, connections in CANopen are possible using the following connector variants:

- Via D-Sub connectors
- Via Han-Quintax®
- Via direct wiring

In practice, the nine-pole D-Sub connector to DIN 46 912 has become the established solution. The plug-in connection is composed of male and female connectors.

The following figure depicts the pin assignment for a female and a male D-Sub connector.



Pin assignment for female and male D-Sub connectors

Pin	Signal	Description
1	-	Reserved
2	CAN_L	CAN_L bus cable (dominant level is Low)
3	CAN_GND	CAN ground potential, D-Sub
4	-	Reserved
5	CAN_SHLD	CAN shielding (optional)
6	GND	Ground potential (optional)
7	CAN_H	CAN_H bus cable (dominant level is High)
8	-	Reserved
9	CAN_V+	Forward voltage to supply the transceivers and optocouplers (optional)

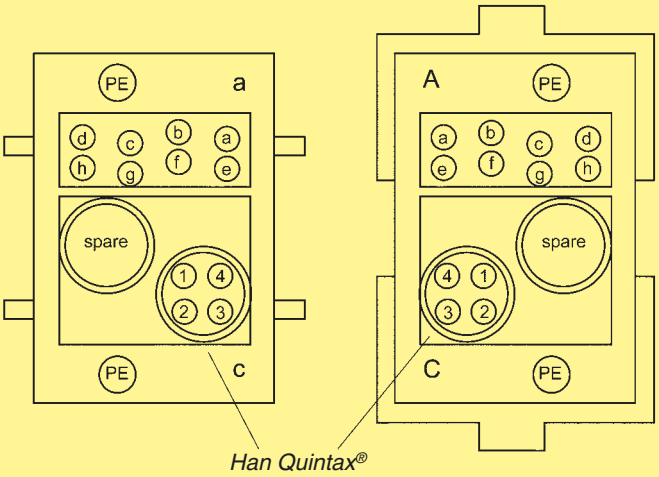
Pin assignment for D-SUB

It is recommended that the pins 3 and 6 be connected within the CANopen devices.

Han-Modular® connectors

Consisting of Han-Quintax® and a Han® EE module (see chapter “Connectors”).

Han-Quintax® connectors are verified by ‘Euromap’, the European Committee of Machinery Manufacturers for the Plastics and Rubber Industries. The pin assignment is defined as follows:



Pin assignment for Han Quintax® male and female connectors

Pin	Signal	Description
1	CAN_H	CAN_H bus cable (dominant level is High) (yellow wire)
2	CAN_L	CAN_L bus cable (dominant level is low) (green wire)
3	CAN_GND	CAN ground potential (brown wire)
4	+24 V DC	Forward voltage to supply the transceivers and optocouplers (white wire)

Pin assignment for Han Quintax®

Further pin assignment configurations for plug-in connectors are available in the CANopen guideline, CiA DR 303-1. In principle, the pin assignments can be defined separately for each connector. However, there are recommended pin assignments for certain applications.

The pin assignment for circular connectors and screw terminals are defined in CiA DR-303-1.

Han® D-Sub Module

Number of contacts

9

Identification	Part No. Male insert (M)	Part No. Female insert (F)	Drawing	Dimensions in mm
D-Sub Module Crimp insert Crimping contacts order separately	**09 14 009 3001**		M	
		09 14 009 3101	F	
Adapter Module without D-Sub insert for one cable	**09 14 000 9930**		M	
		09 14 000 9931	F	

Identification	Size	Part No. Male insert (M)	Part No. Female insert (F)	Drawing	Dimensions in mm
Hinged Frames*	6 B	**09 14 006 0303**	**09 14 006 0313**		
	10 B	**09 14 010 0303**	**09 14 010 0313**		
	16 B	**09 14 016 0303**	**09 14 016 0313**		
	24 B	**09 14 024 0303**	**09 14 024 0313**		
Locking element for hinged frame 20 pieces on block please order separately	–	**09 14 000 9960**	**09 14 000 9960**	Ideal to pre-assemble the hinged frame	

* other hinged frames, hoods and accessories for Han-Modular® please find in chapter “Connectors”

Stock items in bold type

Features:

- ❏ 9pin D-Sub connector of the Han-Modular® system
- ❏ for crimping, solder or IDC terminals
- ❏ crimping contacts for: 0.09 - 0.5 mm² AWG 28 - 20
- ❏ to combine with all Han® modules
- ❏ ideal for transmission of sensitive signals
- ❏ suitable for industrial applications as all Han® B as well as Han-Modular® Compact hoods and housings can be used
- ❏ suitable for turned or stamped crimping contacts acc. to DIN 41 652 or MIL-C-24 308
- ❏ guiding pins are recommended
- ❏ 15pins High Density D-Sub insert is suitable

Description of the Han-Modular® System

The Han-Modular® series is a new system of inserts designed to meet the soecific requirements of individual customers. In close cooperation with potential users a range of modular inserts have been developed allowing the simple assembly of custom designed complete connectors which meet the diverse requirements encountered by designers today.

Han-Modular® is a logical development of the Han-Com® series which already offers the combination of power and signal circuits in one connector. The individual modules of the series now allow the integration of electrical, optical and gaseous signal and power connections in one connector assembly.

The individual contacts use in this system are all from existing well proven ranges and it is possible to use combinations of 1 to 12 modules depending on the size of the hoods and housings chosen.

The basic modules snap into a mounting frame and can be exchanged separately at any time.

The advantages are obvious: The connector can be designed to meet very specific requirements. Thus optimum solutions for a great variety of applications can be reached.

Specifications	DIN VDE 0627 DIN VDE 0110 DIN EN 61 984

D-Sub Module

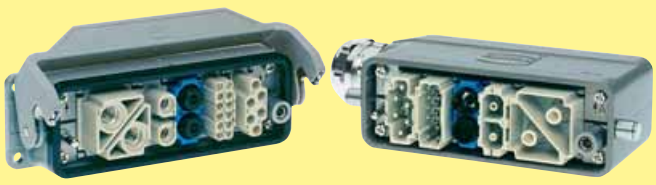
Number of contacts	9
Rated current	5 A max.
Rated voltage	50 V
Rated impulse voltage	0.8 kV
Degree of pollution	3
Insulation resistance	≥ 10^{10} Ω
Material: – insert – screening element	polycarbonate zinc alloy
Temperature range	-40 °C... +125 °C
Flammability acc. to UL 94	V 0
Surface screening element	Ni
Mechanical working life mating cycles	≥ 500

Hinged Frame

Number of modules	2, 3, 4, 6
PE conductor cross section	
– power side	4 - 6 mm² AWG 12 - 10
– control side	1 - 2.5 mm² AWG 18 - 14
Material	zinc die cast alloy
Temperature range	-40 °C... +125 °C
Mechanical working life mating cycles	≥ 500

Locking element

Number per Block	20
Material	polycarbonate
Temperature range	-40 °C... +125 °C
Flammability acc. to UL 94	V 0



4 contacts + screening
+ 2 power contacts
For use in Han® 3 A hoods with metric cable gland

Description

The Han-Brid® series combines a data and power interface for industrial communication in the smallest possible space.

The components in this hybrid connector family all contain the facility to load power contacts rated at 50 V 10 A to provide a power supply for distributed devices. This means that a power supply can be provided to all devices in a bus structure via a single connector.

Han-Brid® Quintax 3 A for 4-wire bus systems with continuous screen connection.

The contact inserts can be used either in the standard plastic housing or the metal housing from the Han® 3 A series. The protection level of the housings corresponds to DIN EN 60 529, IP 65.

Power supply

- Standard Han D® male and female crimp contacts
- Rated current: 10 A
- Rated voltage: 50 V
- Connection range: 0.14 to 2.5 mm² stranded
- Approval: UL

Data interface

- Can be connected to screened 4-wire cables
- Can be used for all 4-wire bus systems
- Accepts screened cable with a diameter from 3 to 9.5 mm
- Continuity of screen is independent of housing potential
- Cable connection in accordance with DIN EN 50 173, Category 5

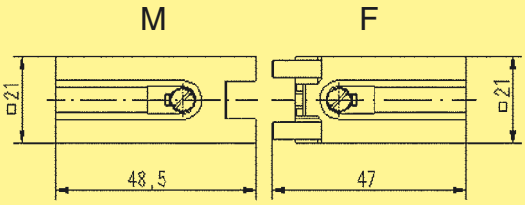
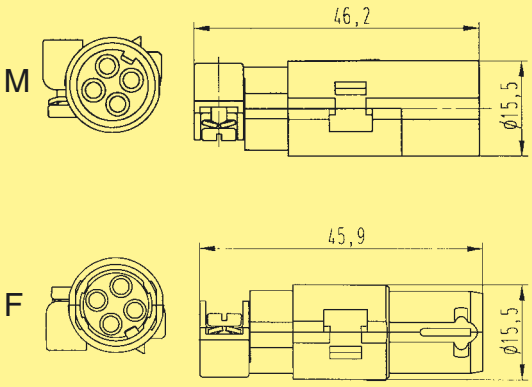
Technical characteristics

Transmission properties in accordance with Category 5 ISO/IEC 11 801:2002 and EN 50 173-1

Protection level	IP 65
Wire gauge data:	0.14 - 2.5 mm² stranded AWG 26 - 14
Wire gauge power supply:	0.14 - 2.5 mm² stranded AWG 26 - 14
Temperature range:	-40 °C … +70 °C
Cable sheath diameter:	3 mm - 9.5 mm
Mating cycles:	≥ 500

Han-Brid® Quintax 3 A

4 contacts + screening
+ 2 power contacts
For use in Han® 3 A hoods with metric cable gland

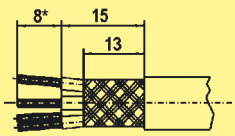
Identification	Cable-Ø mm	Part No. Male insert (M)	Part No. Female insert (F)	Drawing	Dimensions in mm
Quintax insert 	–	**09 15 003 3001**			
	–		**09 15 003 3101**		
Quintax Z contact Zinc alloy Order crimp contacts separately see page C70.05  Cable clamp for cable diameter 3 - 6 and 6 - 9.5 mm is supplied with the inserts	3 - 9.5	**09 15 004 3013**	**09 15 004 3113**		

Assembling manual

Quintax contact

1. Strip cable acc. to drawing 1 and fold the shielding over the cable.
2. Crimp Han D®contacts onto the wires.
3. Insert Han D® contacts into the corresponding cavities of insulator until they are snapped in.
4. Fit the insert including the cable into the opened shielded bushing. The coding pin of the shielded bushing has to meet the groove of the insulator.
5. Clamp the tilt over the shielding onto the cable by means of the special clamp (small opening for cable diameter of 3 - 6 mm, large opening for cable diameter of 6 - 9.5 mm).
6. Check the wiring.
7. Close the shielded bushing with the cover and insert it into corresponding cavaty of the Quintax module as usual.

1.



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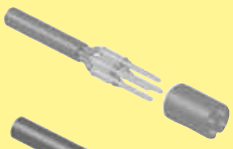

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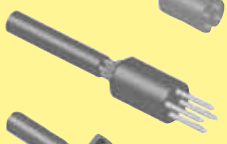

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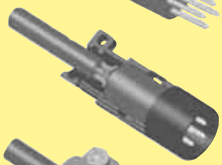
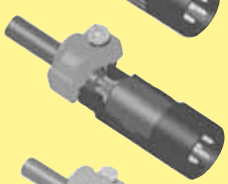
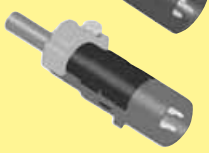


5.

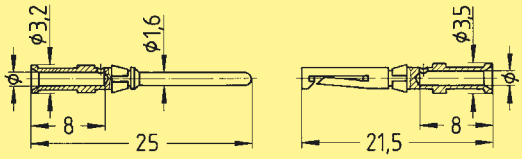


6.



Stock items in bold type

Identification	Wire gauge (mm²)	Part No. Male contacts	Part No. Female contacts	Drawing	Dimensions in mm
Crimp contacts					
silver plated	0.14-0.37	**09 15 000 6104**	**09 15 000 6204**		
	0.5	**09 15 000 6103**	**09 15 000 6203**		
	0.75	**09 15 000 6105**	**09 15 000 6205**		
	1.0	**09 15 000 6102**	**09 15 000 6202**		
	1.5	**09 15 000 6101**	**09 15 000 6201**		
	2.5	**09 15 000 6106**	**09 15 000 6206**		
gold plated	0.14-0.37	**09 15 000 6124**	**09 15 000 6224**		
	0.5	**09 15 000 6123**	**09 15 000 6223**		
	0.75	**09 15 000 6125**	**09 15 000 6225**		
	1.0	**09 15 000 6122**	**09 15 000 6222**		
	1.5	**09 15 000 6121**	**09 15 000 6221**		
	2.5	**09 15 000 6126**	**09 15 000 6226**		



Wire gauge (flexible)		Ø	Stripping length
0.14-0.37 mm²	AWG 26-22	0.90 mm	8 mm
0.5 mm²	AWG 20	1.10 mm	8 mm
0.75 mm²	AWG 18	1.30 mm	8 mm
1 mm²	AWG 18	1.45 mm	8 mm
1.5 mm²	AWG 16	1.75 mm	8 mm
2.5 mm²	AWG 14	2.25 mm	6 mm

Stock items in bold type

Accessories




Hoods

- Han® 3 A hood with integral sealing – Protection level: IP 65
  IP 67
- Plastic versions
- Metal versions
- EMC versions
- Han® HPR (pressure tight and EMI protected)
- Han-Brid® Quintax can be fitted exclusively in hoods with metric threads

Further information please find in our catalogue “Heavy Duty Han® connectors”

Identification		Part No.	Drawing	Dimensions in mm
Hood				
straight, metric	Plastic grey	**19 20 003 0423**[1)]		
	Plastic black	**19 20 003 0426**[1)]		
	Metal	**19 20 003 1443**[1)]		
Housing				
	Plastic grey	**09 20 003 0320**		
	Plastic black	**09 20 003 0327**		
	Metal	**09 20 003 0301**		
Cable to cable hood				
metric	Plastic grey	**19 20 003 0720**		
	Plastic black	19 20 003 0727		
	Metal	**19 20 003 1750**		
Cable gland				
metric, M20,				
cable-Ø 5 - 9 mm	Plastic grey, IP 65	**19 00 000 5180**		
cable-Ø 5 - 9 mm	Metal, IP 65	**19 00 000 5080**		
cable-Ø 6 - 12 mm	Plastic black, IP 65	19 00 000 5132		
Protection cover Han® 3 A				
	Plastic black	09 20 003 5409[1)]		
	Metal	**09 20 003 5425**[1)]		

[1)] with integral sealing

Stock items in bold type

Features

- ❏ 4 Han D® contacts per Han Quintax® contact
- ❏ 2 Han Quintax® contacts per Quintax module
- ❏ Modular Assembly (double module)
- ❏ Suitable for shielded cables with diameters of: • 3 – 6 mm
  • 6 – 9.5 mm
- ❏ Several independent cables can be integrated in one housing without interruption of shielding
- ❏ Polarized connection of Quintax contacts is only possible when mounted in a Quintax module
- ❏ Ideal for the transmission of very sensitive signals (BUS signals)

Technical characteristics

Specifications	DIN VDE 0627 DIN VDE 0110 DIN EN 61 984
Approvals	c UL us

Module

Number of contacts	2
Electrical data acc. to DIN EN 61 984	**10 A 50 V 0.8 kV 3**
Rated current	
Rated voltage	
Rated impulse voltage	
Pollution degree	
Insulation resistance	≥ 10^{10} Ω
Material	polycarbonate
Temperature range	- 40 °C … + 125 °C
Flammability acc. to UL 94	V 0
Mechanical working life	
- mating cycles	≥ 500

Quintax Contacts

	Z version
Number of contacts	4 + Shielding
Material: – Insulator	polycarbonate
– Outer conductor	zinc alloy
Contact resistance	≤ 4 mΩ
Temperature range	- 40 °C … + 70 °C
Flammability acc. to UL 94	V 0
Outer surface finish	Ni
Cable diameter	3 - 9.5 mm

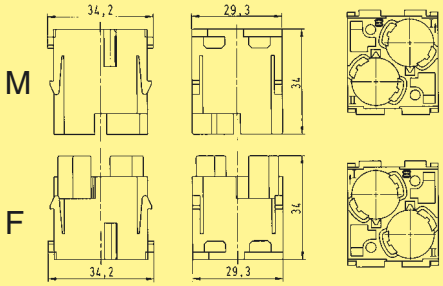
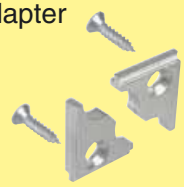
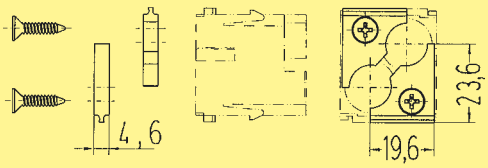
Han D® Contacts

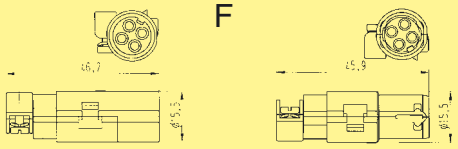
Material	Copper alloy
Surface	
- gold plated	2 µm Au over 3 µm Ni
Contact resistance	≤ 3 mΩ
Crimp termination	
- mm²	0.14 - 2.5 mm²
- AWG	26 - 14

Number of contacts

4 + Shielding
per Quintax Contact

2 Quintax Contacts
per Han Quintax® Module

Identification	Part No. Male contact (M)	Part No. Female contact (F)	Drawing	Dimensions in mm
Module 	**09 14 002 3001**	**09 14 002 3101**	 M F Contact arrangement View from the termination side	
Quintax metal adapter (option) 	**09 14 000 9915**	**09 14 000 9915**		

Identification	Cable diameter mm	Part No. Male contact (M)	Part No. Female contact (F)	Drawing	Dimensions in mm
Quintax Z Contact  Order contacts separately	3 - 9.5	**09 15 004 3013**	**09 15 004 3113**	M F  Special clamp for cable diameter 3 - 6 and 6 - 9.5 mm included in delivery range	

Identification	Wire gauge (mm²)	Part No. Male contacts	Part No. Female contacts	Drawing	Dimensions in mm
Crimp contacts gold plated 	0.14-0.37 0.5 0.75 1.0 1.5 2.5	**09 15 000 6124** **09 15 000 6123** **09 15 000 6125** **09 15 000 6122** **09 15 000 6121** **09 15 000 6126**	**09 15 000 6224** **09 15 000 6223** **09 15 000 6225** **09 15 000 6222** **09 15 000 6221** **09 15 000 6226**		

Wire gauge		ø	Stripping length
0.14-0.37 mm²	AWG 26-22	0.90 mm	8 mm
0.5 mm²	AWG 20	1.10 mm	8 mm
0.75 mm²	AWG 18	1.30 mm	8 mm
1 mm²	AWG 18	1.45 mm	8 mm
1.5 mm²	AWG 16	1.75 mm	8 mm
2.5 mm²	AWG 14	2.25 mm	6 mm

Stock items in bold type

Features

- ❏ 8 contacts (16 A) for power circuits
- ❏ Male insert with protection collar
- ❏ Polarization of module
- ❏ Crimp termination
- ❏ Contacts with silver and gold plated surface
- ❏ Both male and female modules may be mounted in the same frame

Technical characteristics

Specifications

DIN VDE 0627
DIN VDE 0110
DIN EN 61 984

Inserts

Number of contacts	8
Electrical data acc. to DIN EN 61 984	**16 A 400 V 6 kV 3**
Rated current	
Rated voltage	
Rated impulse voltage	
Pollution degree	
– Pollution degree 2 also	16 A 400/690 V 6 kV 2
Rated voltage according to UL/CSA	600 V
Insulation resistance	≥ 10^{10} Ω
Material	Polycarbonate
Temperature range	- 40 °C … + 125 °C
Flammability acc. to UL 94	V 0
Mechanical working life - mating cycles	≥ 500

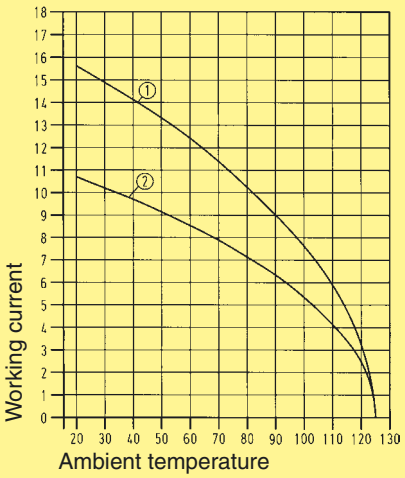
Contacts

Material	copper alloy
Surface	
- hard-silver plated	3 µm Ag
- hard-gold plated	2 µm Au over 3 µm Ni
Contact resistance	≤ 1 mΩ
Crimp terminal	
- mm²	0.5 - 4.0 mm²
- AWG	20 - 12

Current carrying capacity

The current carrying capacity is limited by maximum temperature of materials for inserts and contacts including terminals. The current capacity-curve is valid for continuous, not interrupted current-loaded contacts of connectors when simultaneous power on all contacts is given, without exceeding the maximum temperature.

Control and test procedures according to DIN IEC 60 512-3.



① 24 B hood/housing with 6 modules; wire gauge: 2.5 mm²
② 24 B hood/housing with 6 modules; wire gauge: 1.5 mm²

Han® EE-module

Number of contacts

8

Identification	Part No. Male insert (M)	Part No. Female insert (F)	Drawing	Dimensions in mm
Crimp terminal Order contacts separately	**09 14 008 3001**	**09 14 008 3101**	M F Profile for contact removal M F Contact arrangement View from termination side	

Identification	Wire gauge (mm²)	Part No. Male contacts	Part No. Female contacts	Drawing	Dimensions in mm
Crimp contacts Power contacts silver plated	0.5	**09 33 000 6121**	**09 33 000 6220**	Operating contact Identification Relay contact	
	0.75	**09 33 000 6114**	**09 33 000 6214**		
	1.0	**09 33 000 6105**	**09 33 000 6205**		
	1.5	**09 33 000 6104**	**09 33 000 6204**		
	2.5	**09 33 000 6102**	**09 33 000 6202**		
	3	**09 33 000 6106**	**09 33 000 6206**		
	4	**09 33 000 6107**	**09 33 000 6207**		
gold plated	0.5	**09 33 000 6122**	**09 33 000 6222**		
	0.75	**09 33 000 6115**	**09 33 000 6215**		
	1.0	**09 33 000 6118**	**09 33 000 6218**		
	1.5	**09 33 000 6116**	**09 33 000 6216**		
	2.5	**09 33 000 6123**	**09 33 000 6223**		
	4.0	**09 33 000 6119**	**09 33 000 6221**		
Relay contact silver plated	0.75-1	**09 33 000 6109**			
	1.5	**09 33 000 6110**			
	2.5	**09 33 000 6111**			
Coding Pin			**09 33 000 9954**		

Crimp contact identification

Identification	Wire gauge		Stripping length
no grrove	0.5 mm²	AWG 20	7.5 mm
1 groove*	0.75 mm²	AWG 18	7.5 mm
1 groove	1 mm²	AWG 18	7.5 mm
2 grooves	1.5 mm²	AWG 16	7.5 mm
3 grooves	2.5 mm²	AWG 14	7.5 mm
wide groove	3.0 mm²	AWG 12	7.5 mm
no groove	4 mm²	AWG 12	7.5 mm

* on the back crimp collar

Stock items in bold type

Identification	Wire gauge (mm²)	Part No.	
HARTING Crimping Tool with locators for all Han D® contacts 0.14 - 1.5 mm²		**09 99 000 0021**	
BUCHANAN Crimping Tool for all Han D® contacts 0.14 - 4.0 mm²		**09 99 000 0001**	
Locator		**09 99 000 0311**	
Crimping tool depth adjustment gauge	0.14-0.25 0.37 0.5-1.0 1.5 2.5	**09 99 000 0203** **09 99 000 0125** **09 99 000 0007** **09 99 000 0008** **09 99 000 0007**	
Removal tool for Han D® contacts		**09 99 000 0012**	 . . 0012

A removal tool is necessary if contacts are to be replaced in the insert. It is inserted from the mating face and pushed over the contact until a stop is noticeable. Additional pressure unlocks the contact and pushes it out of the wiring side.