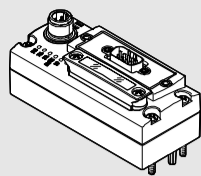


Universal bus node CTEU-DN

FESTO



Description
Original instructions
Installation and interfaces

Bus node, type CTEU-DN
DeviceNet fieldbus protocol

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CE 1703a

1 Installation

1.1 General remarks

This description contains information for mounting the Bus node on a suitable device (e.g. valve terminal) from Festo and for installation of this combination in a higher-level control system.

1.2 General instructions

The bus node type CTEU-DN documented in this description manual has been designed exclusively for use as a slave on the DeviceNet fieldbus. It may only be used in its original status without unauthorised modifications and only in perfect technical condition. The bus node is intended for use in industrial areas. Outside of industrial environments, e.g. in commercial and mixed residential areas, actions to suppress interference may have to be taken. The target group for this description consists of trained specialists in control and automation technology who have experience with installation of stations on the DeviceNet fieldbus.

1.3 Mounting

Information on mounting the bus node on the decentralised electrical connection box type CAPC... can be found in the assembly instructions that accompany the sub-base. For H-rail mounting, you also need the mounting kit CAFM... (CAPC and CAFM).

For mounting the bus node, a valve terminal from Festo or an adapter with I-port interface is required.

1. Inspect the seals and sealing surfaces on bus node and valve terminal.
2. Plug the bus node onto the valve terminal in the right position and without tilting.
3. At first, lightly screw in the three self-tapping screws with a TORX screwdriver (size T10): Use available threads, if applicable.
4. Tighten the screws with 1.0 Nm.

1.3 Mounting

Danger of injury through uncontrolled movements of connected equipment. Make sure that electrical and pneumatic equipment are in a de-energised and pressureless state.

Before working on the pneumatic components:

- Switch off compressed air supply
- Exhaust valve terminal

Before working on the electrical equipment, e.g. before installation or maintenance work:

- Switch off power supply

In this way, you can avoid:

- uncontrolled movements of loose tubing.
- unexpected and uncontrolled movements of the connected actuators
- undefined switching states of the electronic components

1.3 Mounting

The bus node contains electrostatically sensitive devices.

- Do not touch any electrical or electronic components.
- Observe the handling specifications for electrostatic sensitive devices.

They will help you avoid damage to the electronics.

1.3 Mounting

Use protective caps or blanking plugs to seal unused connections. You will then comply with protection class IP65/IP67.

1.3 Mounting

CAN®, DeviceNet® and TORX® are registered trademarks of the respective trademark owners in certain countries.

For all available product documentation
→ www.festo.com/pk

1.3 Mounting

→ Note

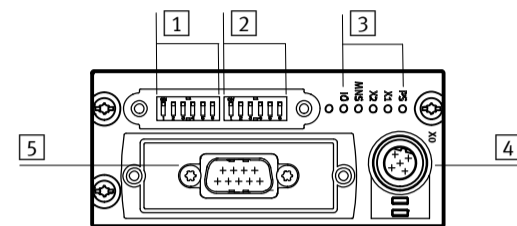
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4. Tighten the screws with 1.0 Nm.

2 Connection and display components

The following electrical connection and display elements can be found on the bus node:



- 1 DIL switch 1 (→ chap. 5)
- 2 DIL switch 2 (→ chap. 5)
- 3 **Status LEDs:**
Bus status LEDs, CTEU-specific LEDs;
Status display and diagnostics (→ chap. 6)
- 4 **Power supply connection** for bus node and connected devices, if applicable, e.g. valve terminal (→ chap. 3); M12, 5-pin, B-coded, pin plug connector
- 5 **Fieldbus connection (fieldbus interface):**
D-sub, 9-pin, pin plug connector, DE-9 (→ chap. 4)

3 Power supply

The bus node has separate operation and load voltage supplies. The bus node also supplies voltage to equipment connected via the I-port interface.

→ Note

- Use only PELV (protective extra-low voltage) circuits as per EN 60204-1 for the electric power supply.
- Observe also the general requirements for PELV power circuits as per EN 60204-1.
- Use only voltage sources which guarantee reliable electrical isolation of the operating voltage as per EN 60204-1.
- Always connect both circuits for operating and load voltage supply.

Through the use of PELV circuits, protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with EN 60204-1.

→ Note

Fieldbus stations of different manufacturers have different tolerances regarding the power supply to the bus (V+, also designated as CAN_V+ or CAN+).
– Tolerance range of the power supply to the bus of the fieldbus interface CTEU-DN:
11 ... 30 V DC, polarity-safe
Observe this fact when placing the power supply unit and designing the fieldbus length.

Power supply connection (M12, B-coded)	Pin	Allocation
	1	24 V _{EL} /SEN (PS)
	2	24 V _{VAL} /OUT (PL)
	3	0 V _{EL} /SEN (PS)
	4	0 V _{VAL} /OUT (PL)
	5	FE ¹⁾

¹⁾ Connection to functional earth must be secured over the connected device of the electrical connection box CAPC...

For the connection to power supply units or the power supply, use cables with M12 coupling (socket plug connector), B-coded, in accordance with IEC 61076-2 (→ accessories → www.festo.com/catalogue).

→ Note

Functional test:
– The LED **PS** is illuminated green when the power supply is present at both circuits.
– The LEDs **X1** or **X2** are lit green when a device is connected (→ chap. 6).

4 Connecting the fieldbus

→ Note

Faulty installation or high transmission rates may cause data transmission errors as a result of signal reflections and attenuations.

- Always use a terminating resistor (121 Ω ± 1%, 0.25 W) at both ends of the fieldbus between the wires for CAN_H and CAN_L.
- Connect the screening continuously to all fieldbus cables and earth the screening only once (star-shaped) to avoid ground loops.
- Observe the specifications in the manuals of your control system, in particular regarding the bus lines, cable type, max. length of branch lines and branches as well as the connection technology (network plug, adapter).
- In calculating the max. effective data rate, also take into account the length of branch lines and branches (→ section 5.2 → Note on the maximum data rate/ baud rate).

Sub-D plug connector at the bus node

There is a 9-pin sub-D pin plug connector (DE-9) on the bus node for connection to the fieldbus.

Fieldbus connection (fieldbus interface; sub-D, DE-9)

Pin	Allocation (bus signal)	Typical wire colour	Signal description
1	n.c.	n.a.	Not connected
2	CAN_L	Blue	DeviceNet bus low (CAN bus low) ¹⁾
3	V ₋ ("CAN_GND")	Black	Power supply to bus (0 V), connected with pin 6 ²⁾
4	n.c.	n.a.	Not connected
5	Drain ("CAN_SHLD")	Screening, housing	Screening (shield), functional earth (FE) ³⁾
6	GND	n.a.	Ground, connected to pin 3 ⁴⁾
7	CAN_H	White	DeviceNet bus high (CAN bus high) ¹⁾
8	n.c.	n.a.	Not connected
9	V ₊ ("CAN_V+")	Red	Power supply for bus (24 V DC) ²⁾

- ¹⁾ Received/transmitted data
- ²⁾ The bus power supply is not used by the bus node, but is required for the correct functioning of the DeviceNet bus system
- ³⁾ Also connect screening to the plug connector housing
- ⁴⁾ Optional; the ground connection is not used

Cable specification

For fieldbus communication, Festo recommends the use of a two-pair, screened cable.

- You need at least a screened 4-wire line (CAN_H/CAN_L as well as V₊/V₋).
- Preferably use cable with twisted and screened wire pairs.
- Connect the screening of the fieldbus cable to the fieldbus plug.
- Make sure that the connected fieldbus equipment or the decentralised adapter is earthed.

Connection technology

With fieldbus plugs or fieldbus adapters from Festo (→ subsequent table), you can separate the fieldbus connection from the bus node without interrupting the communication of the remaining fieldbus stations.

Fieldbus adapter (bus connection/plug-adapter) for continued fieldbus communication

You can use the following fieldbus adapters for forwarding the fieldbus connection.

Fieldbus adapter	Pin	Allocation
Bus connection, Type FBA-2-M12-5POL ¹⁾ 	1	Functional earth FE
	2	Power supply for bus (24 V DC)
	3	Power supply for bus (0 V)
	4	CAN_H
	5	CAN_L
Bus connection, type FBA-1-SL-5POL with type FBSD-KL-2X5POL ²⁾ 	1	Power supply for bus (0 V)
	2	CAN_L
	3	Functional earth FE
	4	CAN_H
	5	Power supply for bus (24 V DC)
Fieldbus adapter, type FBA-CO-SUB-9-M12 ³⁾		→ Assembly instructions FBA-CO-SUB-9-M12
Fieldbus adapter, type FBS-SUB-9-BU-2x5POL-B		→ Assembly instructions FBS-SUB-9-BU-2x5POL-B

- ¹⁾ Protective cap or plug with bus termination resistor required if connection remains unused
- ²⁾ Use cables with a minimum cross-section of 0.34 mm²
- ³⁾ If standard plugs D-sub are used in IP20: Connecting screws with UNC female thread required for mounting (type UNC 4-40/M3x6)

5 Basic setting for fieldbus communication

5.1 Removal of the DIL switch cover

To set the DIL switches, you must remove the cover:

1. Switch off the power supply.
2. Unscrew the two mounting screws of the transparent cover and remove the cover.

5.2 Setting the DIL switches

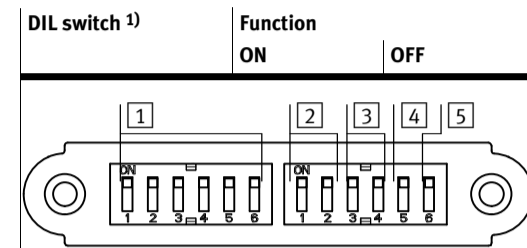
Proceed as follows:

1. Assign to the bus node a station number that has not been allocated yet → see subsequent adjustment examples.

Adjustment examples

for setting the binary-coded station numbers through DIL switch group 1 → see following table "DIL switches":

Example 1: Station number 05	Example 2: Station number 38



DIL switch group 1

1 1 ... 6: DeviceNet address (station number), 0 ... 63, binary-coded (factory setting: 63)

DIL switch group 2

DIL switch group 1	DIL switch group 2		
2 1 ... 2: reserved (OFF)	3 3 ... 4: Data rate/ baud rate ²⁾		
	<table border="1"> <tr> <td> 4 Reserved 3 500 kBaud DIL 2.4: ON DIL 2.3: ON </td> <td> 4 125 kBaud 3 250 kBaud DIL 2.4: OFF DIL 2.3: ON </td> </tr> </table>	4 Reserved 3 500 kBaud DIL 2.4: ON DIL 2.3: ON	4 125 kBaud 3 250 kBaud DIL 2.4: OFF DIL 2.3: ON
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4 5: Diagnostics	<table border="1"> <tr> <td> Diagnostics activated: Transmission of diagnostic information in the process data </td> <td> Access to Diagnostics only through explicit messaging (factory setting) </td> </tr> </table>	Diagnostics activated: Transmission of diagnostic information in the process data	Access to Diagnostics only through explicit messaging (factory setting)
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5 6: Fail-state and idle mode ³⁾	<table border="1"> <tr> <td>Hold last state</td> <td>Reset (factory setting)</td> </tr> </table>	Hold last state	Reset (factory setting)
Hold last state	Reset (factory setting)		

- ¹⁾ Switch setting "ON", switch is to the left or on top
Switch setting "OFF", switch is to the right or underneath
- ²⁾ Factory setting: 125 kBaud
- ³⁾ If the PLC is in the stop-mode (idle mode) or the fieldbus connection is interrupted (fail state); applies for all outputs
Note: The fail-state mode is designated "fail-safe mode"

2. Set the baud rate: When setting the baud rate, take into account the length of the network lines (main bus line, branch lines and branches) → see subsequent note.

→ Note

Maximum effective data rate (baud rate)

The setting of the baud rate depends on the length of all network lines.

- Consider the length of the fieldbus line between the PLC and bus node (main bus line) as well as the length of possibly available branch lines and branches (for continued fieldbus configuration).
- Also consider the overall length (sum) of all branch lines.
- The subsequent table supplies reference values for the maximum baud rate, dependent on the line lengths. The baud rates named here are not supported by all controllers.
- Observe possibly deviating specifications in the manual of your control system or network scanner. Further information can be found in the specifications of the ODVA → www.odva.org.

Max. data rate (baud rate) dependent on the line length (reference values)

Main bus line ¹⁾	Branch line ²⁾		Baud rate
	Individual branch line	All branch lines (sum)	
Max. 100 m	Max. 6 m	Max. 39 m	500 kBaud
Max. 250 m	Max. 6 m	Max. 78 m	250 kBaud
Max. 500 m	Max. 6 m	Max. 156 m	125 kBaud

- ¹⁾ Trunk line
- ²⁾ Drop line

3. Set the diagnostics and fail-state mode.

→ Note

Functional test:

- The LED **MNS** flashes green or is lit green (if configured via the network, i.e. in case of correct communication with the PLC → chap. 6).
- Die LED **IO** is off, flashes green or is lit green (if configures via the network).

5.3 Mounting of the DIL switch cover

- Place the cover carefully on the bus node. Make sure that the seal is seated correctly!
- Tighten the two mounting screws at first hand-tight and then with max. torque 0.4 Nm.

6 Status display/diagnostics via LEDs



Note

You will find additional information on the LEDs as well as on diagnostics and error elimination in the description "Universal bus node CTEU-DN – function and maintenance" in the Internet under → www.festo.com
→ Support portal → User documentation.

PS – Status of operating voltage supply (power system)

LED display	Status and significance
	LED illuminated green: – Normal operating status – Operating voltage applied (in the approved range) – Load voltage present (in the approved range) ¹⁾
	LED flashes green (flashing frequency: 1 Hz) – Operating voltage is below the required voltage – Load voltage is below the required voltage ¹⁾ – Short circuit at the I-port ¹⁾
	LED is off: – Operating voltage not applied

¹⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node

X1 or X2 ¹⁾ – Internal communication between bus node and device 1 or 2 ¹⁾

LED display	Status and significance
	LED illuminated green: – Normal operating status – Device is correctly connected to the bus node – Operating and load voltage present (in the approved range) ²⁾
	LED flashes green: – Connected device reports diagnostics status – Undervoltage at system or additional power supply – Connection between bus node and device is OK
	LED illuminated red: – Device is connected correctly to the bus node, but internal communication is faulty – After commissioning, incorrect device connected (non-I-port-compatible device recognised) – Device was removed after initialization of the bus node
	LED flashes red: – During commissioning, incorrect device connected (non-I-port-compatible device recognised) – If only LED X1 flashes red: error in the bus node – If X1 and X2 flash red simultaneously: no device connected to the bus node (at least one device is required)
	LED is off: – No device is connected to the bus node

¹⁾ Separate accessory with two interfaces for connection of an additional device required
²⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node

MNS – Module status/network status (combined module/network status)

LED display	Status and significance
	LED illuminated green: – Normal operating status ("online") – Communication with the fieldbus is OK
	LED flashes green: – Fieldbus communication available ("online"), but not configured
	LED illuminated red: – No fieldbus communication (not available, failed or invalid bus address) – No power supply to bus → chap. 4
	LED flashes red: – Communications error (fieldbus communication faulty, bus time-out or no power supply to bus → chap. 4)
	LED is off: – No network or fieldbus connection (not "online", MAC-ID test "DUB_MAC_ID" did not run successfully or no power supply to bus → chap. 4)

IO= I/O status, connection status

LED display	Status and significance
	LED illuminated green: – Normal operating status, communication with the controller (PLC) OK – IOs are controlled through the fieldbus
	LED flashes green: – Operating status in preparation – IOs are in the idle status
	LED illuminated red: – Inputs/outputs are in the fail-state mode; cause is an unrecoverable fault (e.g. no bus voltage)
	LED flashes red: – Failure or stop of PLC, fieldbus interruption or telegram failure – IOs are in the fail-state status – Incorrect station number in the PLC or bus node (incorrect DIL-switch position)
	LED is off: – Commissioning of the bus node not complete or not successful – Fieldbus not connected

7 Technical data

General properties	
Protection class through housing (as per EN 60529)	IP65/67 ^{1) 2)}
Protection against electric shock (protection against direct and indirect contact acc. to EN 60204-1)	Through the use of PELV circuits
Galvanic isolation	All bus signals, including V – ("CAN_GND") and V + ("CAN_V+"), are galvanically isolated
Vibration and shock resistance (as per EN 60068) ³⁾ – Vibration (part 2 – 6) – Shock (part 2 – 27) – Continuous shock (part 2 – 29)	Severity level (SL) ³⁾ for wall or H-rail mounting – Wall: SL2; H-rail: SL1 – Wall: SL2; H-rail: SL1 – Wall and H-rail: SL1
Temperature range – Storage/transport – Environment/operation	- 20 ... + 70 °C - 5 ... + 50 °C
Materials – Housing – Fibre-optic cable, DIL switch cover – Threaded sleeve M12 – Threaded bush M3 – Seals – Screws	RoHS-compliant PA, reinforced PC Brass, galvanically nickel-plated Brass NBR Steel, galvanized

¹⁾ Requirement: bus node mounted completely, plug connector plugged in or provided with protective cap
²⁾ Observe that connected equipment (devices) may fulfil a lower protection class or lower temperature range
³⁾ Explanation of the severity level → following table "Explanation on vibration and shock – severity level"

Power supply

Power supply to bus node/equipment ¹⁾ – Operating voltage (nominal value/tolerance range, polarity-safe) – Load voltage (maximum value/typical tolerance range, device-dependent) ²⁾	24 V DC ± 25% (18 ... 30 V DC) Max. 30 V DC (18 ... 30 V DC) ²⁾
Bus power supply (fieldbus interface) – Tolerance range, polarity-safe – Current consumption, interface electronics	11 ... 30 V DC Max. 50 mA
Intrinsic current consumption of bus node at 24 V – Bus node electronics – Bus node on device (e.g. valve terminal) – Bus node on electrical connection box, type CAPC... (X ₁ and X ₂)	Max. 65 mA Max. 120 mA Max. 175 mA
Load capacity of the operating and load voltage supply ^{1) 3)} – Bus node on device (e.g. valve terminal) – Bus node on electrical connection box, type CAPC... (X ₁ and X ₂)	Max. 4 A Max. 2 A
Mains buffering time	10 ms

¹⁾ Separate, external fuses are required for operating and load voltage supply
²⁾ Dependent on the connected equipment/devices (e.g. valve terminal)
³⁾ Load capacity with regard to the connected equipment, e.g. the valve terminal, including the bus node



Note

Technical data of the connected equipment can be found in the respective program documentation.

Explanation on vibration and shock – severity level

Severity level 1 (SL1, as per EN 60068, part 2 – 29)	Vibration: 0.15 mm path at 10 ... 58 Hz; 2 g acceleration at 58 ... 150 Hz Shock: ± 15 g with 11 ms duration; 5 shocks per direction Continuous shock: ± 15 g with 6 ms duration; 1000 shocks per direction
Severity level 2 (SL2, as per EN 60068, part 2 – 27)	Vibration: 0.35 mm path at 10 ... 60 Hz; 5 g acceleration at 60 ... 150 Hz Shock: ± 30 g with 11 ms duration; 5 shocks per direction Continuous shock: n. a.