

Universal bus node CTEU-DN



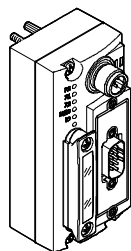
FESTO

Description, functions and maintenance

Bus nodes

Type CTEU-DN

DeviceNet fieldbus
protocol



Description

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en 1206NH
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Contents and general safety instructions

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Internet: <http://www.festo.com>

E-Mail: service_international@festo.com

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Designated use

The bus node type CTEU-DN documented in this description manual has been designed exclusively for use as a participant (slave-device) on the DeviceNet fieldbus.

The bus node may only be used as follows:

- As intended in industrial environments; outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.
- in original status without unauthorised modifications; only the conversions or modifications described in the documentation supplied with the product are permitted.
- in perfect technical condition

The limit values specified for pressures, temperatures, electrical data, torques etc. must be observed.

Comply with the legal rules and regulations and standards, rules of the testing organisations and insurance companies and national specifications applicable for the location.



Warning

- Use only PELV circuits for the electrical power supply in accordance with IEC/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe also the general requirements for PELV circuits in accordance with IEC/EN 60204-1.
- Use only voltage sources that ensure a reliable electric separation of operating voltage in accordance with IEC/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 ensured in accordance with IEC/EN 60204-1.

Range of application and certifications

The product fulfils the requirements of EU directives and is marked with the CE marking.



Standards and test values which the product must comply with and fulfil can be found in the section “Technical appendix”. The product-relevant EU directives can be found in the declaration of conformity.



Certificates and declarations of conformity for this product can be found online at:

→ www.festo.com

Information on DeviceNet can be found online at:

→ www.odva.org

The bus node has been certified by the Open Device Vendor Association (ODVA):



Target group

This description is intended exclusively for technicians trained in control and automation technology, who have experience in installation, commissioning, programming and diagnostics of programmable logic controllers (PLC) and fieldbus systems.

Service

Please contact your local Festo service centre if you have any technical problems.

Instructions on this description

This manual is Part II of the product documentation and contains specific information about the configuration, parameterisation, commissioning, programming and diagnostics of the bus node with the DeviceNet fieldbus protocol.



Information relating to installing the bus node can be found in Part I of the product documentation entitled “Universal bus node CTEU-DN - Installation and Interfaces”, which is supplied with the bus node.

All information on installation and the interfaces can also be found in Section 2.1 of this description.

Information for mounting the bus node on the CAPC electrical connection box can be found in the assembly instructions supplied with the electrical connection box.

Information about other bus nodes and components of the CTEU... product family can be found in the user documentation for the respective product.

All documents can also be found online at:

➔ www.festo.com ➔ Support Portal: Enter search term, e.g. “CTEU” ➔ User documentation

Important user instructions

Danger categories

This description includes instructions on the possible dangers which can occur if the product is used incorrectly. These instructions are marked with a signal word (Warning, Caution, etc.), printed on a shaded background and marked additionally with a pictogram.

A distinction is made between the following danger warnings:



Warning

... means that failure to observe this instruction may result in serious personal injury or material damage.



Caution

... means that failure to observe this instruction may result in personal injury or material damage.



Note

... means that failure to observe this instruction may result in material damage.



In addition, the following pictogram marks passages in the text which describe activities with electrostatically sensitive devices:

Electrostatically sensitive devices: Incorrect handling may cause damage to devices.

Marking special information

The following pictograms mark passages in the text which contain special information.

Pictograms



Information:
Recommendations, tips and references to other information sources.



Accessories:
Specifications on necessary or useful accessories for the Festo product.



Environment:
Information on the environmentally friendly use of Festo products.

Text designations

- Bullet points denote activities that may be carried out in any sequence.
- 1. Numerals denote activities that must be carried out in the sequence specified.
- Arrowheads indicate general lists.

The table below contains all the essential product and network-specific terms and abbreviations that are used in this description.

An overview of all terms and abbreviations can be found
➔ in the Appendix A.2.

Abbreviation/term	Significance
EDS	Electronic Data Sheets contain product-specific data, e.g. the bus node characteristics ➔ see also “DCF” ➔ Appendix A.2
EDS library	Manages the characteristics of the various fieldbus/network participants
Fail state	Bus node function, also referred to as “fail safe” function; defines the state assumed by outputs or valves following network or communication errors, activates for example a reset of the outputs - or alternatively holds the last state
I-port	I-port is a Festo-specific interface for transmitting communication data (process data, sensor signals, pilot signals) and supply voltages. The I-port communication protocol is based on the IO link protocol. The electrical and mechanical link between bus nodes and I-port device is standardised.
Object Directory	Makes all important fieldbus/network participant parameters accessible in a standardised manner
ODVA	Open Device Vendor Association, DeviceNet umbrella organisation
PLC	Programmable logic controller, also referred to as system controller or controller for short
RSNetWorx	Configuration, parameterisation, commissioning and diagnostics software for DeviceNet from Rockwell Automation/Allen-Bradley

Tab. 0/1: System-specific terms and abbreviations (extract)

Introduction

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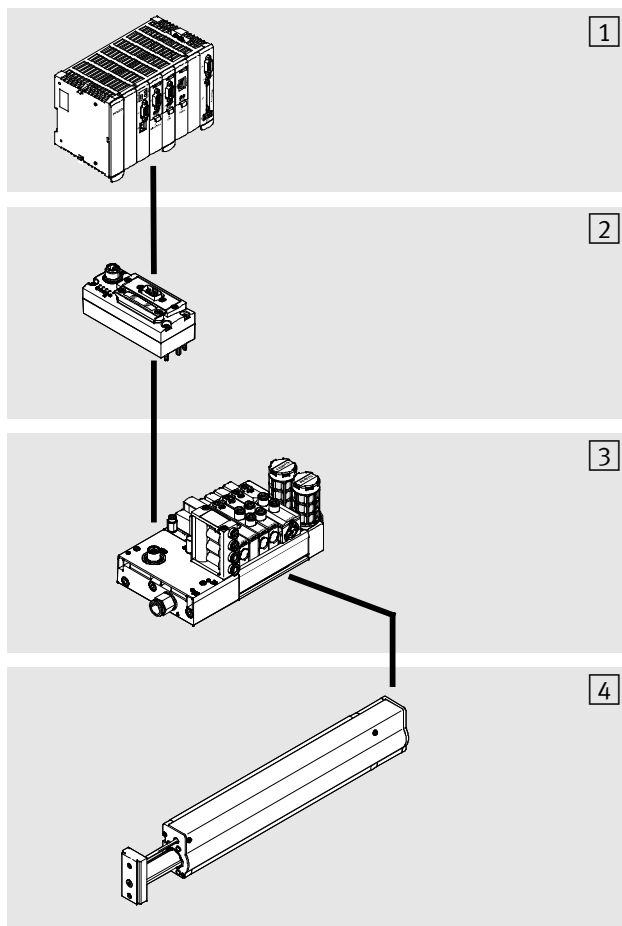
1. Introduction

1.1 General information on the CTEU product family

The CTEU... product family enables the creation of a decentralised automation system in a DeviceNet fieldbus system (network).

1.1.1 Hardware components

- 1 Higher-order controller (Host system/Master/PLC/IPC)
- 2 Fieldbus level: bus node CTEU-DN
- 3 Device level: e.g. valve terminal VTUB-12
- 4 Drive level: e.g. Linear module HME



1. Introduction

1.1.2 I-port interface

I-port is a Festo-specific interface for transmitting communication data (process data, sensor signals, pilot signals) and supply voltages.

The I-port communication protocol is based on the IO link protocol. The electrical and mechanical link between bus nodes and I-port device is standardised.

The bus node has separate operating and load voltage supplies. It also supplies voltage to the devices connected via the I-port interface.

Located at the bottom of the bus node is the I-port interface for connection to an I-port-compatible device, e.g. valve terminal or decentralised electrical connection box.

1. Introduction

1.1.3 CTEU-DN function range on the DeviceNet (brief overview)

- Object-based fieldbus system
- Master-Slave system architecture
- Process synchronisation in accordance with the Producer/Consumer method
- Connection-based communication procedure: point-to-point connection (peer-to-peer messaging), where applicable as Multicast connection and/or Master/slave I/O connection
- Predefined master/slave connection set for the simplified transmission of I/O data between the master and the PLC and the slave and the bus node
- Real-time operation: Exchange of I/O data in “real-time”
- Message types supported for the Master/slave I/O connection:
 - Polled communication (“I/O polling”)
 - Change of state / Cyclic communication
- Supports the QuickConnect feature and the Automatic Device Replacement (ADR) function: guarantees faster reconnection between DeviceNet-Scanner and bus nodes, e.g. after replacing the bus nodes
- Application-specific process data transmission based on the Common Industrial Protocol (CIP):
 - Time-critical I/O data via “I/O messages” (I/O messaging or implicit messaging)
 - Data required for configuration, diagnostics and management via explicit messaging
- Module-specific parameterisation via manufacturer-specific objects

1. Introduction

1.2 General information on the fieldbus protocol DeviceNet

1.2.1 Central component of the fieldbus protocol

Participant features

A DeviceNet participant is configured based on product-specific data and characteristics, which the manufacturer provides in the form of electronic datasheets (EDS). These EDS files contain the product code, revision data and the available address space (input/output size).

The configuration program of the DeviceNet Master manages the EDS files of all fieldbus participants in a list or an EDS library.

Special Device Configuration Files contain additional project data over and above the content and scope of the EDS file.

Communication protocol

According to the layer model of the International Organisation for Standardisation (Open Systems Interconnection Reference Model - OSI), DeviceNet uses the principles of the Controller Area Network (CAN) Protocol at security layer level (Data Link Layer), as well as the Common Industrial Protocol (CIP) for the upper communication level.

The DeviceNet protocol therefore represents a conversion from CIP based on CAN principles.

Message types

The following message types are available for master/slave networks (predefined master/slave connection set):

- Polled communication (“I/O polling”)
- or
- Change of state / Cyclic communication

Object directories

DeviceNet devices have an object directory which makes all important participant parameters accessible in a standardized manner. A DeviceNet system is essentially configured by accessing the objects in the object directory of the individual fieldbus participants.

1.2.2 DeviceNet specifications

Further Information on DeviceNet can be found in the Internet:

DeviceNet specifications	
ODVA	Open Device Vendor Association ➔ http://www.odva.org

Tab. 1/1: DeviceNet specifications

1.2.3 DeviceNet Conformance

The CTEU-DN bus node conforms to the specifications of the Open Device Vendor Association (ODVA).

1. Introduction

Installation and interfaces

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2.1 Installation

This chapter contains information for mounting the Bus node CTEU on an I-port-compatible device (e.g. valve terminal with I-port interface) and for installing this combination in a higher-level field bus system (network).

2.1.1 Safety regulations



Warning

Danger of injury through uncontrolled movements of connected equipment.

Make sure that electrical and pneumatic equipment are in a de-energised and pressureless status.

Before working on the pneumatics:

- Switch off the compressed air supply
- Vent the valve terminal

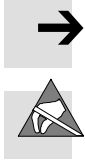
Before working on the electrical components, e.g. before installation or maintenance work:

- Switch off power supply

In this way, you can avoid:

- uncontrolled movements of loose tubing
- accidental and uncontrolled movements of the connected actuators
- undefined switching states of the electronics

2. Installation and interfaces



Note

The bus node includes electrostatically sensitive devices.

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

They will help you avoid damage to the electronics.



Note

Use protective caps to seal unused connections. This is how you achieve protection class IP65/IP67.

2.1.2 Mounting the bus node

A valve terminal with I-port interface or an electrical connection box, type **CAPC-...**, is required to mount the bus node.



Note

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

1. Inspect the seals and sealing surfaces on bus node and valve terminal.

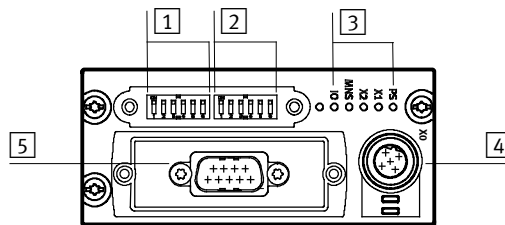
2. Installation and interfaces

2. Plug the bus node onto the valve terminal in the right position and without tilting.
3. First, lightly screw in the three self-tapping screws with a TORX screwdriver (size T10): use existing threads, if applicable.
4. Tighten the screws with 1.0 Nm.

2.2 Interfaces

2.2.1 Connection and display components

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



- 1 DIL switch group 1 (→ Section 2.2.6)
- 2 DIL switch group 2 (→ Section 2.2.6)
- 3 **Status LEDs:**
bus status LEDs, CTEU-specific LEDs;
status indicator and diagnostics (→ Section 3.2.2)
- 4 **Power supply connection**
for bus node and any connected equipment,
e.g. valve terminal (→ Section 2.2.2);
M12, 5-pin, B-coded, pin plug connector
- 5 **Field bus connection (field bus interface):**
sub-D, 9-pin, pin plug connector, DE-9
(→ Section 2.2.3)

On the bottom of the bus node is the I-port interface for connection to an I-port-compatible device, e.g. valve terminal or decentralised electrical connection box.

2. Installation and interfaces

2.2.2 Power supply

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



Note

- Use only PELV circuits for the electrical power supply in accordance with IEC/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements in accordance with IEC/EN 60204-1 for PELV circuits.
- Use only voltage sources that guarantee a reliable electric separation of operating and load voltage in accordance with IEC/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 ensured in accordance with IEC/EN 60204-1.



Note

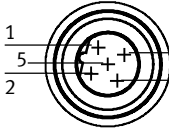
Fieldbus participants of different manufacturers have different tolerances regarding the power supply to the bus (V+, also designated as CAN_V+ or CAN+).

- Tolerance range of the power supply to the bus of the fieldbus interface CTEUDN: DC 11 ... 30 V, reverse polarity protected

Observe this fact when placing the power supply unit and designing the fieldbus length.

2. Installation and interfaces

2.2.3 Power supply connection

Power supply connection (M12, B-coded)	Pin	Assignment ¹⁾
	1	24 V _{EL} /SEN (PS)
	2	24 V _{VAL} /OUT (PL)
	3	0 V _{EL} /SEN (PS)
	4	0 V _{OUT} /VAL (PL)
	5	FU ²⁾
¹⁾ V_{EL}/SEN: Operating voltage for electronics/sensors (Power System, PS) V_{OUT}/VAL: Load voltage for outputs/valves (Power Load, PL) FE: Earth terminal (functional earth) ²⁾ The connection to functional earth must be ensured via the connected device or electrical connection box CAPC-...		

Tab. 2/2: Power supply connection

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.

2.2.4 Functional test - no network connection

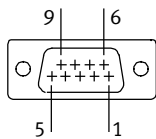
Check the operating status of the bus node using the status LEDs **PS** and **X1** and/or **X2**:

- The LED **PS** is illuminated green when the power supply is present at both circuits.
- The LEDs **X1** and/or **X2** illuminate green when an I-port device is connected.

2. Installation and interfaces

2.2.5 Fieldbus connection

Fieldbus interface - connection technology and pin allocation



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 to 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 to bus (DC 24 V) 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			

Tab. 2/3: Fieldbus connection (**fieldbus interface; sub-D, DE-9**) – pin allocation

Fieldbus connecting cable – Specification and configuration

For fieldbus communication, Festo recommends the use of a two-pair, screened fieldbus connecting cable (network 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.
- Always use a terminating resistor ($121\Omega \pm 1\%$, 0.25W) at both ends of the fieldbus between the wires for CAN_H and CAN_L.
- Connect the screening of the fieldbus cable to the fieldbus plug.
- Connect the screening continuously to all fieldbus cables and earth the screening only once (star-shaped) to avoid ground loops.
- Make sure that the connected fieldbus equipment or the decentralised adapter is earthed.
- 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 2.2.6, “Setting the DIL switches”
 - ➔ Information on maximum usable data rate (baud rate).

2. Installation and interfaces



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

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

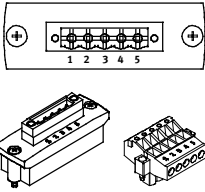
With fieldbus adapters from Festo (➔ Tab. 2/4 below), you can separate the fieldbus connection from the bus node without interrupting the communication of the remaining fieldbus participants.

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

Fieldbus adapter	Pin	Allocation
Bus connection FBA-2-M12-5POL ¹⁾	1	Functional earth (FE)
	2	Power supply to bus (DC 24 V)
	3	Power supply to bus (0 V)
	4	CAN_H
	5	CAN_L

Tab. 2/4: Fieldbus adapter (bus connection/plug-adapter) - Part 1

2. Installation and interfaces

Fieldbus adapter	Pin	Allocation
Bus connection FBA-1-SL-5POL with FBSD-KL-2X5POL ²⁾ 	1	Power supply to bus (0 V)
	2	CAN_L
	3	Functional earth (FE)
	4	CAN_H
	5	Power supply to bus (DC 24 V)
Fieldbus adapter FBA-CO-SUB-9-M12 ³⁾		➔ Assembly instructions FBA-CO-SUB-9-M12
Fieldbus adapter FBS-SUB-9-BU-2x5PIN-B		➔ Assembly instructions FBS-SUB-9-BU-2x5PIN-B
Fieldbus adapter FBS-SUB-9-WS-CO-K		➔ www.festo.com ➔ Support Portal
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 mm ² ³⁾ When using standard sub-D plugs to IP20: Connecting screws with UNC female thread required for mounting (type UNC 4-40/M3x6)		

Tab. 2/5: Fieldbus adapter (bus connection/plug-adapter) - Part 2

2.2.6 Basic settings for fieldbus communication

The following basic settings for fieldbus communication must be made using the DIL switches on the bus node (➔ Sections below):

- DeviceNet address (“Station number”)
- Data rate (baud rate)

2. Installation and interfaces

- Diagnostic functionality (transmission of diagnostic information to the process data or access to diagnostic information exclusively via Explicit Messaging)
- Fail state and idle state mode

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

Removal of the DIL switch cover

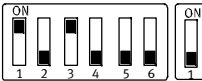
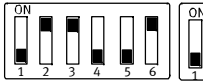
Proceed as follows:

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

Setting the DIL switches

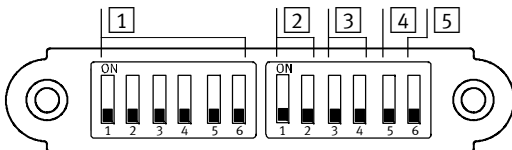
Proceed as follows:

1. Assign to the bus node a station that has not yet been allocated → see examples below for setting the binary-coded DeviceNet address (“Station Numbers”) per DIL switch group 1 → Tab. 2/6.

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

Tab. 2/6: Setting example for DeviceNet address (“Station number”, DIL switch group 1)

2. Installation and interfaces

DIL switch 1)		Function	
			
DIL switch group 1			
1	1 ... 6:	DeviceNet address (Station Number), 0 ... 63, binary-coded (factory setting: 63)	
DIL switch group 2			
2	1 ... 2:	reserved (OFF)	
3	3 ... 4:	Data rate/ baud rate ²⁾	
		125 kB   DIL 2.3: OFF DIL 2.4: OFF 250 kB   DIL 2.3: ON DIL 2.4: OFF	
		500 kB   DIL 2.3: OFF DIL 2.4: ON Reserved   DIL 2.3: ON DIL 2.4: ON	
4	5: Diagnostics mode	ON: Diagnostics activated: Transmission of diagnostic in- formation to the process data	OFF: Access to diagnostic in- formation only through explicit messaging (factory setting)
5	6: Fail-state and idle mode ³⁾	ON: Hold last state	OFF: Reset (factory setting)
1) Switch setting “ON”: (marked on DIL switch accordingly, shown in Fig. at top) Switch setting “OFF”: (shown in Fig. at bottom) 2) Factory setting: 125 kBaud 3) The setting for the fail state mode and the idle mode apply for all inputs and outputs – Fail state: no fieldbus connection (connection aborted) – Idle state: PLC is in stop mode ➔ Note Fail state mode is also referred to as “Fail safe mode”			

Tab. 2/7: Setting the DIL switch (DIL switch group 1 and 2)

2. Installation and interfaces

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 note below.



Note
Maximum effective data rate (baud rate)
The setting of the baud rate depends on the length of all fieldbus connecting cables (network lines).

- Consider the length of the fieldbus line between the PLC and bus node (main bus line) as well as the length of any existing branch lines and branches for continued fieldbus configuration.
- Also consider the overall length (sum) of all branch lines.
- The table below contains reference values for the maximum baud rate, depending on the line lengths. The baud rates named here are not supported by all controllers.
- Observe any 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 (Trunk line)	Branch line (Drop line)		Baud rate
	Individual branch line	All branch lines (total)	
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

Tab. 2/8: Maximum data rate (baud rate)

2. Installation and interfaces

3. Set the diagnostics and fail-state mode.

Mounting of the DIL switch cover

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

Functional test after making the DIL switch setting - with network connection

Check the operating status of the bus node:

- 1. Connect the bus node to the fieldbus.
- 2. Check the network connection to the PLC using the status LEDs **MNS** and **IO** → Tab. 2/9 below (additional information can be found in Section 3.2.2).

Function check With network connection	Bus node and network connection not configured	Bus node and network connection configured		Status Operating status of bus node (test result)
		PLC in Stop mode	PLC in Run mode	
LED MNS	Flashes green	Illuminates green	Illuminates green	OK
LED IO	Is off	Flashes green	Illuminates green	OK

Tab. 2/9: Functional test using the status LEDs MNS and IO - after making the DIL switch setting

2.3 Device replacement

To avoid connection and start-up errors, observe the following instructions for replacing the bus node, the electrical connection box CAPC... and the connected I-port device.

2.3.1 Replacing the bus node

The configuration and parameterisation of the bus node and the I-port device are **not** automatically restored when the bus node is replaced, e.g. for a service event. Observe the following instruction.

1. Check before replacement whether the PLC or the higher-order system has saved the settings and the settings have been downloaded.
2. If not, verify which settings are required before replacement, and restore these settings after replacement.
3. Switch off the power supply to the bus node.
4. Dismounting / mounting the bus node → Section 2.1.
5. Connect all devices prior to switching on the CTEU bus node, otherwise there will be no process data (→ see also Section 3.1.2 regarding the requirements for start-up).
6. Switch the power supply to the bus node back on.
7. Download the settings or restore the required settings.

2. Installation and interfaces

2.3.2 Replacing the I-port device – identical device type

Observe the following instructions to make sure that the configuration and parameterisation of the I-port device are retained in case of a replacement, e.g. service event.

1. Do **not** switch off the power supply to the bus node. This ensures that the parameters for the I-port device saved in the bus node are retained.

Do **not** isolate the connecting cables. The configuration of connected devices is lost as soon as the operating voltage supply of the bus node is interrupted.

2. Remove the bus node from the I-port device (Dismantling/Installation → Section 2.1).
3. Replace the I-port device.

To mount/dismount the I-port device, observe the corresponding product documentation → www.festo.com → Support Portal: Enter search term, e.g. “I-port” or “IO-Link” → User documentation.

4. Mount the bus node to the I-port device (Mounting/Dismounting → Section 2.1).

The bus node detects the connected I-port device and transfers the saved configuration and parameterisation to the I-port device. Transmission of process data starts automatically.

2.3.3 Replacing the I-port device – different device type (change)

The parameterisation of an I-port device is not automatically restored if the device type is changed.

If the I-port device is connected to the bus node via the electrical connection box, there are three distinctly different applications:

- **One I-port device** is connected to the electrical connection box:

In this case, switch off the voltage supply to the bus node and change the I-port device.

To mount/dismount the I-port device, observe the corresponding product documentation → www.festo.com
→ Support Portal: Enter search term, e.g. “I-port” or “IO-Link” → User documentation.

Then switch the voltage supply back on and carry out the required configuration and parameterisation procedures.

- **Two I-port devices** are connected to the electrical connection box, **both devices** are replaced:

In this case, switch off the voltage supply to the bus node and change both I-port devices - as described in the previous application.

- **Two I-port devices** are connected to the electrical connection box, only **one device** is changed:

Do **not** switch off the voltage supply to the bus node. This ensures that the configuration and parameterisation for the I-port devices stored in the bus node are retained.
→ Observe the following instruction.

2. Installation and interfaces

If two I-port devices are connected to the bus node via the CAPC-... electrical connection box, but only one device is changed, the following instruction must be observed:

1. Do **not** switch off the power supply to the bus node. This ensures that the parameters for the I-port device saved in the bus node are retained.

Do **not** isolate the connecting cables. The configuration of connected devices is lost as soon as the operating voltage supply of the bus node is interrupted.

2. Replace the I-port device to be changed.

To mount/dismount the I-port device, observe the corresponding product documentation → www.festo.com
→ Support Portal: Enter search term, e.g. "I-port" or "IO-Link" → User documentation.

The bus node detects the connected I-port device and records the corresponding configuration data.

3. Carry out the required configuration and parameterisation procedures.

2.3.4 Replacing the CAPC-... electrical connection box

Observe the following instructions to make sure that the parameterisation of the I-port device is retained in case the electrical connection box is replaced, e.g. service event.

1. Do **not** switch off the power supply to the bus node. This ensures that the parameters for the I-port device saved in the bus node are retained.

Do **not** isolate the connecting cables of the bus node. The configuration of connected devices is lost as soon as the operating voltage supply of the bus node is interrupted.

2. Installation and interfaces

2. Remove the bus node from the electrical connection box:
Dismantling/Installation → Section 2.1.
3. Replace the electrical connection box.

To mount/dismount the electrical connection box, observe the corresponding product documentation (assembly instructions) CAPC-F1-E-M12-D2

→ www.festo.com → Support Portal: Enter search term, e.g. “CAPC-F1-E-M12-D2” → User documentation.

4. Install the bus node on electrical connection box.

The bus node detects the connected I-port device and transfers the saved configuration and parameterisation to the I-port device. Transmission of process data starts automatically.

2. Installation and interfaces

Preparing for commissioning

Chapter 3

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3. Preparing for commissioning

3.1 Preparing to commissioning a PLC

The following sections contain fundamental instructions on commissioning the bus node on the DeviceNet.



Detailed instructions and further information can be found in the documentation or online help for the controller or control program.

3.1.1 General instructions



Note

- Bus node CTEU-DN can be used on all DeviceNet controllers.
- This chapter describes the configuration and commissioning procedure using the example of Rockwell/Allen-Bradley controllers (PLC) via the RSNetWorx and RSLogix software platform.
- Higher-order controller (PLC) is also called DeviceNet Master or Host System.
- The DeviceNet fieldbus system is referred to below as network.

3. Preparing for commissioning

3.1.2 Prerequisites for commissioning

- Installation of the CTEU-DN bus node complete



Note

Information on installing and mounting and the basic setting for the bus node can be found in the description “Universal bus node CTEU-DN – Installation and interfaces” (P.BE-CTEU-DN-INSTALL, Part 1 of the product documentation on the bus node):

➔ www.festo.com ➔ Support Portal

➔ Anwenderdokumentation (Techn. Dokumentation).

- Make sure that the DIL switches of the bus node are set correctly.

Basic setting for fieldbus communication checked:

- DeviceNet address or station number
- Baud rate

Optional settings checked:

- Diagnostics
- Fail state and idle mode

- Make sure that all DeviceNet connecting cables are connected and checked:
 - Host system (controller) and bus node connected to the network
 - Network connections checked

3. Preparing for commissioning

3.2 Switching on

3.2.1 Switching on the power supply



Warning

- Prior to switch on: make sure that the requirements for commissioning have been met. Also observe Section 3.1.2, especially regarding the DIL switch setting.
- During operation: do not alter the DIL switch setting during operation. This will prevent accidental and uncontrolled movements of the connected actuators and undefined switching states of the electronics.



Note

- Please observe the switching-on instructions in the manual for your controller.

No specific sequence needs to be followed when switching on separate voltage supplies. You can connect the voltage supply to the individual system components, e.g. the host system and/or the higher-order controller, as well as the operating and load voltage supply to the field bus system in any order you wish.

3. Preparing for commissioning

3.2.2 Normal operating status (fieldbus communication functional test)

After the switch on procedure, the status LEDs indicate the operating status and correct function of the bus node and the fieldbus communication.

- Tab. 3/10 shows the status of the LEDs **without** configuration of the bus node
- Tab. 3/11 shows the status of the LEDs **with** configuration of the bus node, i.e. following error free commissioning (PLC is in stop mode)
- Tab. 3/12 shows the status of the LEDs **with** configuration of the bus node, i.e. following error free commissioning and during normal operation (PLC is in run mode)



Note

Information on diagnostics using the LED displays can be found → in section 5.2.

3. Preparing for commissioning

LED display	Status and significance
	PS illuminates green: – Voltage supply (Power System, PS) is OK – Operating voltage applied (in the approved range) – Load voltage present (in the approved range) ¹⁾
	X1/X2 illuminates green: – Device is correctly connected to the bus node – Internal communication between bus node and device 1 or device 2 is error free ²⁾ – Operating and load voltage present (in the approved range) ¹⁾
	MNS flashes green: – Fieldbus communication present (“online” operating status), but not configured (in this case OK because bus node not configured)
	IO is off: – Commissioning of the bus node and fieldbus connection not complete or not successful (OK because in this case the bus node is not yet configured, i.e. the configuration of the bus node via the PLC has not yet been executed)
¹⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node ²⁾ Separate accessory with two interfaces for connection of an additional device required	

Tab. 3/10: Status LEDs after switch on – bus node **not configured**

3. Preparing for commissioning

LED display	Status and significance
	PS illuminates green: – Voltage supply (Power System, PS) is OK – Operating voltage applied (in the approved range) – Load voltage present (in the approved range) ¹⁾
	X1/X2 illuminates green: – Device is correctly connected to the bus node – Internal communication between bus node and device 1 or device 2 is error free ²⁾ – Operating and load voltage present (in the approved range) ¹⁾
	MNS illuminates green: – Module status/network status (MNS) is error free (“online” operating status) – Communication with the fieldbus and with the PLC is OK
	IO flashes green: – I/O status, connection status is error free – Communication with the controller (PLC) OK
¹⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node ²⁾ Separate accessory with two interfaces for connection of an additional device required	

Tab. 3/11: Status LEDs after switch on – bus node **configured**, PLC in **stop** mode

3. Preparing for commissioning

LED display	Status and significance
	PS illuminates green: – Voltage supply (Power System, PS) is OK – Operating voltage applied (in the approved range) – Load voltage present (in the approved range) ¹⁾
	X1/X2 illuminates green: – Device is correctly connected to the bus node – Internal communication between bus node and device 1 or device 2 is error free ²⁾ – Operating and load voltage present (in the approved range) ¹⁾
	MNS illuminates green: – Module status/network status (MNS) is error free (“online” operating status) – Communication with the fieldbus and with the PLC is OK
	IO illuminates green: – I/O status, connection status is error free – Communication with the controller (PLC) OK – IOs are controlled via the fieldbus, as soon commissioning of the fieldbus communication is completed successfully and the bus node is controlled by the PLC
¹⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node ²⁾ Separate accessory with two interfaces for connection of an additional device required	

Tab. 3/12: Status LEDs after switch on – bus node **configured**, PLC in **run** mode

3. Preparing for commissioning

3.2.3 DeviceNet participant features (EDS file)

To configure the CTEU-DN bus node, an Electronic Data Sheet (EDS) containing all product-specific data and characteristics of the bus node accessible via the network is available: The EDS is therefore also referred to as the device description file.

The characteristics and functions described in the EDS file are summarised under the term DeviceNet participant characteristics.

DeviceNet participant characteristics can also be configured manually, without installing an EDS file ("enter").

All characteristics of the DeviceNet participants are usually contained in an EDS library in the controller software.

EDS variants

The individual network participants are configured via a standard EDS or a modular EDS:

- A standard EDS contains all the required information across the entire installation system e.g. the bus node and corresponding valve terminal.
- A modular EDS provides a separate EDS file for every system component, every module (bus node, I/O module, valve terminal etc.) as well as individual functions.

EDS for CTEU-DN

To configure the CTEU-DN bus node or the CTEU installation system, a standard EDS file is available → Section 3.2.4.

3. Preparing for commissioning

3.2.4 Downloading and installing an EDS file

The current EDS file can be found on the Festo website
→ www.festo.com → Support Portal → Enter search term:
“CTEU-DN” → Firmware and driver: “DeviceNet EDS file for
CTEU-DN”.

File type	File name
EDS download file (archive file)	Festo_CTEU-DN_EDS_...zip
EDS file	Cteu-dn.eds
Icon file	CTEU-DN.ico

Tab. 3/13: Configuration files (Standard EDS) for CTEU-DN

EDS file

Install the EDS file using the configuration software of the higher-order controller (PLC). Please refer to the manuals or the Online Help for the PLC software for procedures.



Note

The old EDS file is overwritten when a new EDS file is loaded (installed).

Icon files

Depending on the configuration program used, you can assign an icon to the bus node. This icon appears at the configuration program user interface and represents the bus node or the CTEU installation system.

Most configuration programs install the icon automatically. Manual installation is not usually required.

3. Preparing for commissioning

3.2.5 Entering participant properties manually

When an EDS file is installed, the following information about the DeviceNet participant is added to the EDS library. This information can also be entered manually.

Information	Description
Vendor name	Festo SE & Co. KG
Vendor ID	26 _d / (0x1A)
Device type	12 _d / (0xC)
Product code	6000 _d / (0x1770)
Major revision / Minor revision	1/1
Input size / output size	Dependent on the connected I-port device
Product name	CTEU-DN

Tab. 3/14: Participant characteristics of the CTEU-DN bus node

When the EDS library has been extended, the valve terminal is entered in the participant list as a possible DeviceNet participant. It can now be added to the DeviceNet network
➔ Section 4.1 and 4.2.

Commissioning

Chapter 4

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4.1 Commissioning on the DeviceNet - Overview

When the participant characteristics have been configured (e.g. by installation of the EDS file), the following steps are required for starting up the bus node:

1. Insert the CTEU-DN bus node (“participant”) into the project/network (online or offline).

If the participant is inserted offline, for example, it will be selected from the participant list and added to the network.

2. Assign the participant to a scanner.
 - A network may contain several scanners.
 - The participant must be uniquely assigned to a scanner.
3. Define the I/O parameters of the participant.

The following details are required here:

- Number of the I/O bytes to be transmitted

For the CTEU-DN bus node or the CTEU installation system, the number depends on the connected I-port devices.

- Message type

For the CTEU-DN bus node:

- Polled communication (“I/O polling”)
or
- Change of state / Cyclic communication

4. Commissioning



Note

The following applies when using an Allen-Bradley SLC 500 PLC in conjunction with an Allen-Bradley scanner type 1747-SDN:

- “Change of state / Cyclic communication” can only be used in conjunction with the diagnostics via Strobed I/O starting from software version V4.015 of the scanner.
- Assign the I/O addresses of the participant to the PLC operands.
- Diagnostic bytes (for I-port 1 and I-port 2) to the PLC operands, insofar as diagnostic mode has been activated via the DIL switch.



Note

The specification of diagnostic mode (assignment of diagnostic bytes) must correspond to the DIL switch setting
➔ Section 2.2.6.

4. Load the configuration into the scanner.

4.2 Network configuration and bus node parameterisation



Note

This section describes the startup procedure with an Allen-Bradley-Scanner 1756-DNB (Revision 4.005) and Rockwell RSNetWorx-Software for DeviceNet, Version 10.00.00 (CPR 9 SR 2).

The fundamental aspects of this description also apply for other control systems.

4.2.1 Insert the participant in the project/network

1. Install the EDS file: Use the EDS Wizard in RSNetWorx, which guides you through the installation process.

- Download: → Section 3.2.4
- Installation: → RSNetWorx → EDS Wizard

Once the EDS file has been installed, the CTEU-DN participant will appear in the hardware directory of the user interface (“hardware” list) → 1 in Fig. 4/1.

2. Drag the CTEU-DN participant with the mouse into the network display on the right-hand side of the user interface → 2 in Fig. 4/1.

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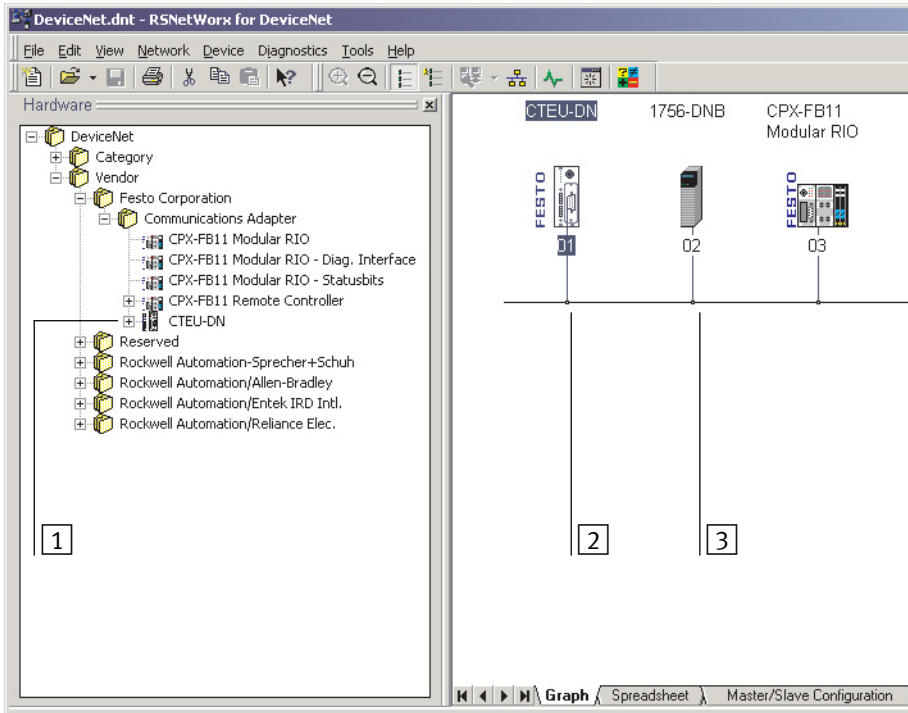


Fig. 4/1: Hardware list and network display in RSNetWorx for DeviceNet

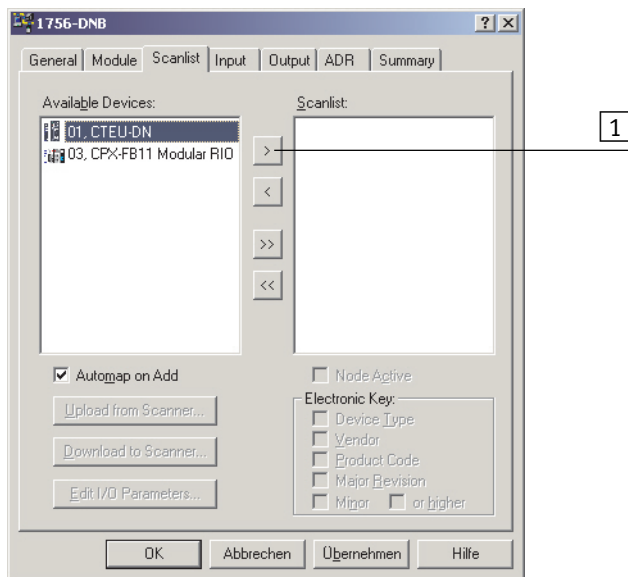
4.2.2 Assign the participant to a scanner

1. Double click the network scanner (in this case Automation/Allen-Bradley 1756-DNB → **3** in Fig. 4/1).

The dialogue box for assigning the participant is displayed → Fig. 4/2.

2. Select the “Scanlist” tab and assign the available participant to the scanner:

4. Commissioning



1 Button for assigning the participant

Fig. 4/2: “Scanlist” tab - assign the network participant to a scanner (example)

4.2.3 Set the I/O parameters of the participant (Standard EDS)

1. Select a participant from the “Scanlist” (Fig. 4/2). After double clicking the selection, the dialogue box for setting the I/O parameters is displayed.
2. Set the I/O parameters of the participant in the “Polled” field. Confirm with OK.



Note

After displaying the dialogue box, parameter values are already entered which however do not necessarily have to match your configuration.

Therefore, always input your own parameter values in the dialogue box. The corresponding values can be found in the RX-size or TX-size parameters once the current parameter values have been loaded.

Note that I-port 1 and I-port 2 must be parameterised separately.

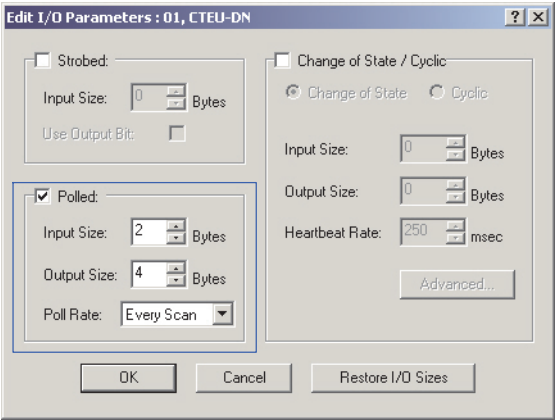


Fig. 4/3: Dialogue box for defining the I/O parameters of the participant

4. Commissioning

4.2.4 Assign the I/O addresses of the participant (Standard EDS)

You can assign the I/O addresses of the CPV Direct to the PLC operands using the “Input” and “Output” tabs.

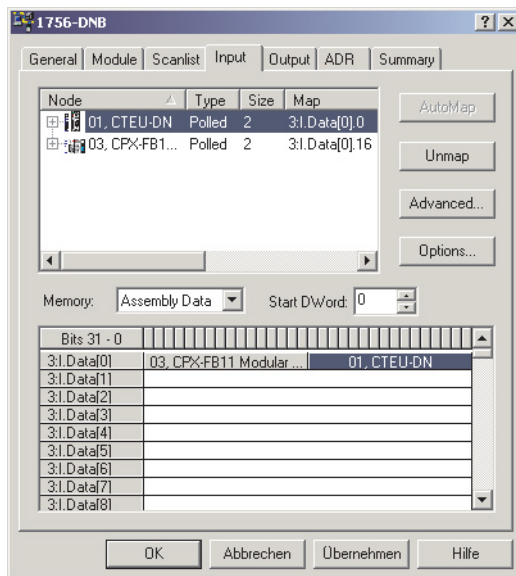


Fig. 4/4: Address assignment of the input (example)

CTEU-DN appears in the input data with two separate communication connections:

- A “Strobed” connection for transmitting the 8 status bits (diagnostic information).
- A “Polled” or “Change of State” connection for transmitting the physical input data.

4. Commissioning

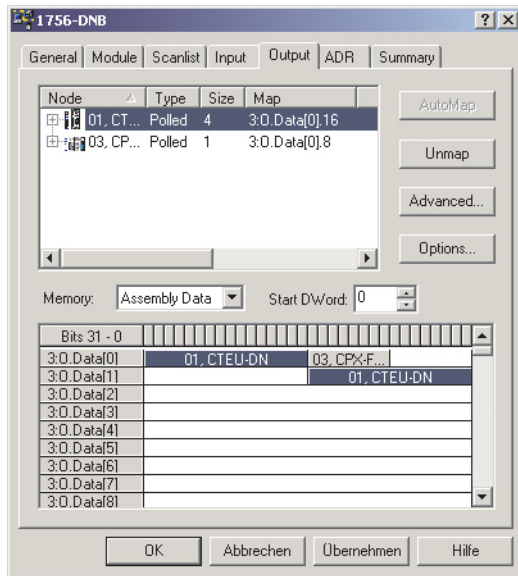


Fig. 4/5: Address assignment of the output (example)

4.2.5 Loading the configuration into the scanner.

Finally, load the configuration data into the scanner. Further information can be found in the documentation for your scanner.

4.3 Parameterisation



Note

Observe the subsequent sections to ensure that the parameterisation required for your application is automatically restored at switch-on, after a restart or after a device replacement.

Check which settings are required, especially before a device replacement. Make sure that these settings are retained or restored (e.g. by the higher-order controller/PLC) → Section 2.3.

4.3.1 Methods of parameterisation

CTEU-DN can be parameterised as follows (→ Tab. 4/15):

- via the configuration program
- via the scanner
- via the user program



Use the QuickConnect and Automatic Device Replacement (ADR) DeviceNet functions or communication and programming via Explicit Messaging, in order to set the required parameters.

In this case, the PLC automatically transmits the programmed parameters to the bus node after switch-on. The settings will then be retained even after a restart or device replacement.



Note

The last parameterisation received in the CTEU-DN is always valid.

4. Commissioning

Method	Description	Benefits	Disadvantages
Parameterisation via the configuration program (e.g. RSNetWorx)	Parameters set via the configuration program and direct transmission to the DeviceNet participant, local saving in the bus node CTEU-DN	Fast, simple parameterizing during commissioning for testing the parameters	Parameters (locally saved data) are lost after a restart or device replacement (For information on device replacement → Section 2.3)
Parameterisation via the scanner (automatic restore after restart, Configuration Recovery via QuickConnect and ADR)	Parameters set via the configuration program and transmission to the scanner: The parameters are transmitted from the scanner to the DeviceNet participant after every restart (“Power On”).	Parameters are reloaded automatically after every restart and are therefore also retained if the device replaced	Requirement: The scanner must support ADR
Parameterisation via the user program (communication and programming via explicit messaging)	Parameterisation via explicit messaging, parameters are saved in the PLC	Parameters are reloaded automatically after every restart and are therefore also retained if the device replaced	Requirement: User program required

Tab. 4/15: Methods of parameterisation

4.3.2 Parameterisation with RSNetWorx (with standard EDS)

RSNetWorx enables you to parameterise using the “Parameters” tab of the DeviceNet participant.



This requires the EDS file of the DeviceNet participant to be contained in the EDS library → see Section 3.2.4.

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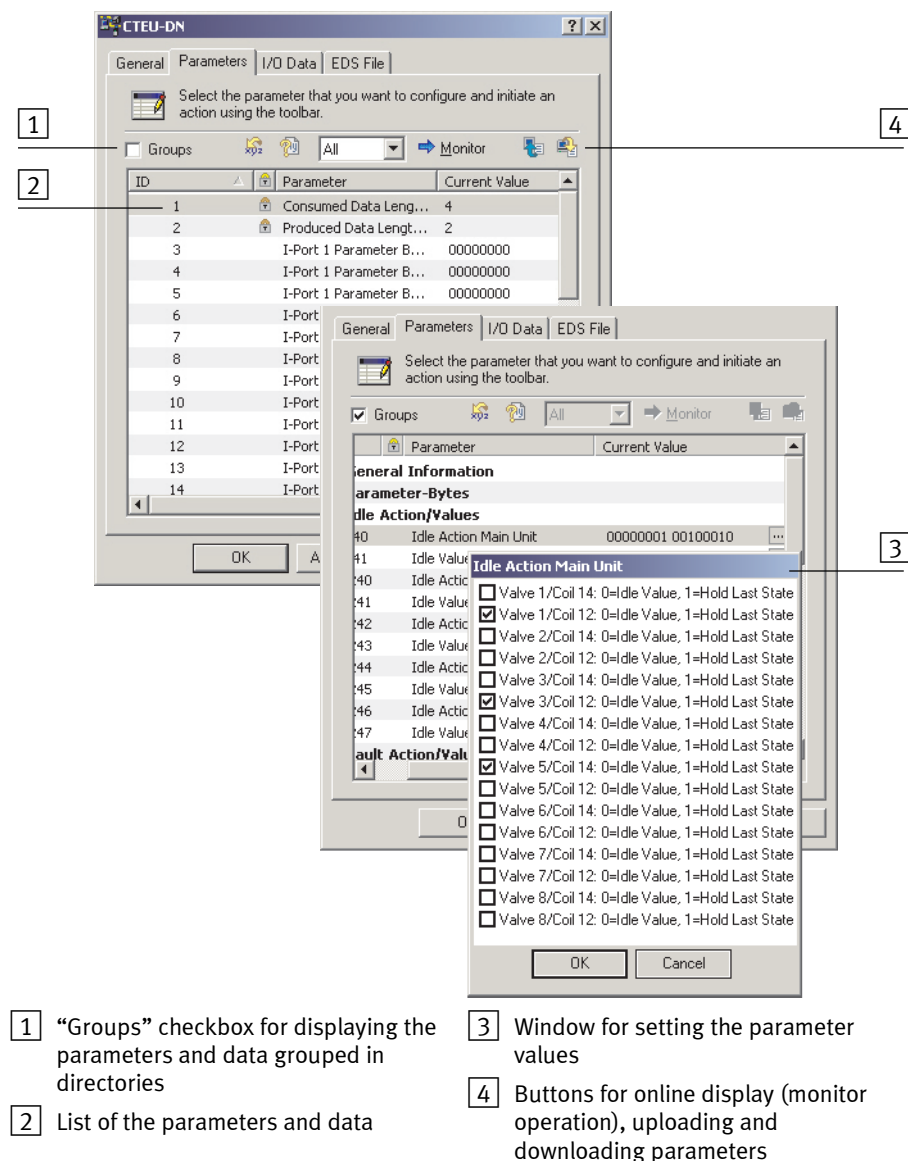


Fig. 4/6: Parameterisation examples

4. Commissioning

Changing parameters

Click on a value (Current Value) and change it in the list field or in a window that opens separately.



The settings saved in the project are displayed in offline mode.

Transmitting parameters

In online mode, you can transmit the required parameters (“upload”) and then display them (“download”).

Please note:

- The displayed parameters are not automatically updated.
- In online mode too, only the settings and parameter values that are current when called will be displayed. (It takes a certain amount of time to transmit and display the values).
- Values that are continuously current are displayed only in monitor mode, although not with details (no sub-groups or detailed values).



You can find notes about the specific CTEU-DN parameters in DeviceNet in section 4.3.3.

4.3.3 Device-specific parametrisation

The CTEU-DN bus node has device-specific parameters, referred to as parameter objects, e.g. for setting the behaviour of the connected I-port devices or for activating certain status signals. These parameters can be set in the configuration program (“network configurator” → “Parameters”).

The type and scope of the parameter objects available in CTEU-DN depends on the connected I-port device.



Use the QuickConnect and Automatic Device Replacement (ADR) DeviceNet functions or communication and programming via Explicit Messaging, in order to set the required parameters (→ Section 4.3.1 and Tab. 4/15).

In this case, the controller (PLC) automatically transmits the programmed parameters to the bus node after switch-on. The settings will then be retained even after a restart or device replacement.

To use explicit messaging programming, you need the object descriptions and addresses of the DeviceNet object model
→ Appendix A.4.

4.3.4 Behaviour of the inputs and outputs in fail state mode

In case of a control or communication interference, the network participants, i.e. the bus nodes and the I-port devices, assume fail state mode.

Possible causes of fail state mode:

- Interference in the control system (PLC/scanner)
- Network/fieldbus interruption (e.g. communication interference, broken cable)
- Interference to data telegrams.

4. Commissioning

Depending on the DIL switch setting, the inputs and outputs hold the last state or reset to the basic state → Tab. 2/7.

The selected setting applies for all outputs. (Factory setting: “reset”).

4.3.5 Behaviour of the inputs and outputs in idle state mode

Idle mode is assumed by the network participants when this is requested by the controller or scanner. The controller is then in stop mode.

Depending on the DIL switch setting, the outputs hold the last state or reset to the basic state → Tab. 2/7.

The inputs of the network participants continue to be transferred to idle state mode.

The selected setting applies for all inputs and outputs and is coupled to the setting for the fail state mode. (Factory setting: “reset”).

4.3.6 Parameterisation via a user program (explicit messaging)

Parameter values can also be read and written by the controller. To do so, communicate and program via “Explicit Message”. The required parameter values are specified in a user program.

For this parameterisation method, you require device-specific parameter objects and/or the corresponding object descriptions → Tab. 4/16 and Tab. 4/17. Note that these tables specify only the frames for using parameterisation via explicit messaging.

Detailed object descriptions and addresses of the DeviceNet object model can be found in → Appendix A.4.

4. Commissioning

Object class	Instance	Attribute ¹⁾	Name
1 _d	1	-	Identity object
2 _d	1	-	Message router
3 _d	1	-	DeviceNet object class
4 _d	101, 104	-	Assembly object
5 _d	1	-	Connection object class
15 _d	1...16	-	Parameter object class
43 _d	1	-	Acknowledge handler class
100 _d	1...16	-	Festo output byte object
101 _d	1...16	-	Festo input byte object
103 _d	1...2	-	Festo diagnostics object
104 _d	1...2	-	Festo module object
105 _d	1...2	-	Festo system object ²⁾
106 _d	1...2	-	Festo parameter object ³⁾
¹⁾ Information on "Attribute" → Tab. 4/17 or Appendix A.4 ²⁾ System information (device-specific data on the bus node) ³⁾ This object is device-specific and therefore not contained in the EDS file.			

Tab. 4/16: DeviceNet object model for CTEU-DN

4. Commissioning

Attribute	Access	Name	Type	Description ¹⁾
Class attributes				
1	Get	Revision	UINT	Revision of the object = 1
2	Get	Max instance	UINT	Max. instance ²⁾ of the CIP object = 2
Instance attributes ²⁾				
1	Get/Set	Parameter byte 1	BYTE	
2	Get/Set	Parameter byte 2	BYTE	
3	Get/Set	Parameter byte 3	BYTE	
4	Get/Set	Parameter byte 4	BYTE	
5	Get/Set	Parameter byte 5	BYTE	
6	Get/Set	Parameter byte 6	BYTE	
7	Get/Set	Parameter byte 7	BYTE	
8	Get/Set	Parameter byte 8	BYTE	
Note Write access to these objects and instances is possible only if an I-port-compatible device is connected to the corresponding I-port. ¹⁾ The specific contents (description, “parameters” and “values”) of the objects and instances depend on the connected I-port device. ²⁾ Instance 1 refers to the module identity of Device 1; Instance 2 to module identity of Device 2.				

Tab. 4/17: DeviceNet object relating to CTEU-DN for the device-specific parameterisation (Festo parameter object) – Class code 106_d



Further information on parameter programming with a user program (via explicit messaging) can be found in the data on your controller.

4.4 Checklist for commissioning

Observance of the following points helps you to avoid errors during commissioning on DeviceNet.

- Finally check the DIL switch settings again.
- Check the address assignment of the inputs and outputs. Check the configured address range (process data and assigned input and output bytes).
- Test the inputs and outputs if necessary.
- Check the parameterisation, via the configuration program for example.
- Make sure that the desired parameterisation is restored after a restart or after fieldbus interruptions.

4. Commissioning

Diagnostics

Chapter 5

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5.1 Summary of diagnostics options

The following options are available for diagnostics and error elimination, depending on the bus node configuration:

Diagnostic possibility	Brief description	Benefits	Detailed description
Diagnostics via LED display	Bus node LEDs indicate configuration errors, hardware errors, bus errors, etc. immediately	Fast “on-the-spot” recognition of errors	Section 5.2
Diagnostics via fieldbus	Detailed diagnostics via the DeviceNet network, transmission of diagnostic information to the process data	Detailed fault recognition	Section 5.3

Tab. 5/1: Diagnostics options

- 1
- DIL switch settings:
– OFF:
Diagnostic information only via explicit messaging (factory setting)
– ON:
Diagnostics activated

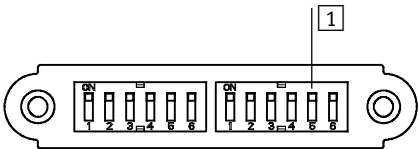


Fig. 5/7: DIL switches for diagnostic information



Further information relating to the DIL switches on the bus node can be found in Part I of the product documentation entitled “Installation and Interface manual”, which is supplied with the bus node.

5.2 Diagnostics via LED display

LEDs are located on the bus node for diagnosing the bus node and any connected I-port devices → Fig. 5/1.

The LEDs can assume the following states (sometimes in different colours):

 illuminates  flashes  off

5.2.1 Normal operating status display

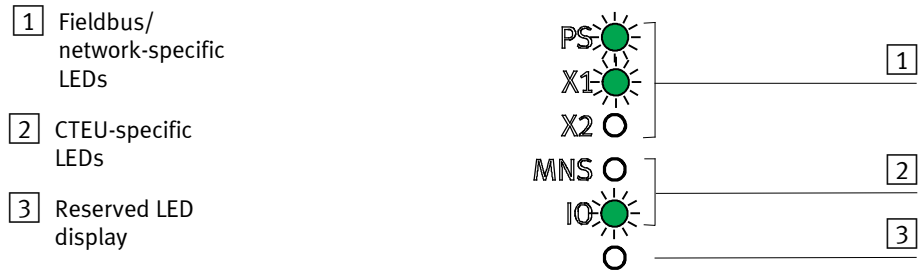


Fig. 5/1: LEDs on the bus node

5. Diagnostics

5.2.2 PS-LED status display

PS status - Operating and load voltage supply (Power System, Power Load)		
LED display	Status/significance	Error handling
 LED illuminated green	– Normal operating status – Operating voltage applied (in the approved range) – Load voltage present (in the approved range) ¹⁾	–
 LED flashes green (1 Hz)	– Operating voltage is below the required voltage – Load voltage is below the required voltage ¹⁾ – Short circuit at the I-port ¹⁾	• Eliminate short circuit on the bus node • Eliminate undervoltage on the connected I-port device
 LED is off	– Operating voltage not applied	• Check the power supply
¹⁾ Display depends on whether the connected device monitors the load voltage and reports to the bus node		

Tab. 5/2: Status displays of the device-specific “PS” LED

5. Diagnostics

5.2.3 Status display X1-/X2-LEDs

X1 or X2 ¹⁾ – Internal communication between bus node and I-port device 1 or 2 ¹⁾		
LED display	Status/significance	Error handling
 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 (1 Hz)	– Connected I-port device reports diagnostics status – Diagnostics is running and/or diagnostic data are being transferred. – Undervoltage at system or additional power supply – Connection between bus node and device is OK	• Read device diagnostics via fieldbus communication (if activated via DIL switches on the bus node) • Eliminate undervoltage
 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	• Check connection to fieldbus/network: Connecting cable, plug connector, signal transmission, bus node, PLC/scanner • Check error counter for overflow • Restart the bus node (switch voltage on/off)
1) Separate accessory with two interfaces for connecting another device is required, e.g. electrical connection box CAPC-... 2) Display depends on whether the connected device monitors the load voltage and reports to the bus node		

Tab. 5/3: Status displays of the device-specific LED “X1” and/or “X2” for connected I-port devices – Part 1

5. Diagnostics

X1 or X2 ¹⁾ – Internal communication between bus node and I-port device 1 or 2 ¹⁾		
LED display	Status/significance	Error handling
 LED is flashing 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 I-port device connected to the bus node (at least one device is required)	• Use an I-port compatible device (e.g. valve terminal) from Festo • Replace bus node • If X1 and X2 flash red simultaneously: connect I-port device
 LED is off	– No device connected to the bus node – Connection is being established	• Connect I-port device
1) Separate accessory with two interfaces for connecting another device is required, e.g. electrical connection box CAPC-... 2) Display depends on whether the connected device monitors the load voltage and reports to the bus node		

Tab. 5/4: Status displays of the device-specific LED “X1” and/or “X2” for connected I-port devices – Part 2

5. Diagnostics

5.2.4 Status display MNS-LED

MNS – Module status/network status (Combined Module/Network Status)		
LED display	Status/significance	Error handling
 LED illuminated green	– Normal operating status (“online”) – Communication with fieldbus/network is OK	–
 LED flashes green (1 Hz)	– Fieldbus/network communication available (“online”), but not configured	• Check/configure fieldbus/network communication
 LED illuminated red	– No fieldbus/network communication (not available, “offline”, failed or invalid bus address or baud rate) – No voltage supply to bus	• Fieldbus/network is offline: Establish connection • Fieldbus/network error: Check connection to fieldbus/network; connecting cable, plug connector, signal transmission, bus node, PLC/scanner • Check the setting of the DIL switches • Check voltage supply to bus → Section 2.2.3
 LED is flashing red	– Communication error: Fieldbus/network communication disrupted, bus timeout detected or no voltage supply to bus	• Fieldbus/network error: Check connection to fieldbus/network; connecting cable, plug connector, signal transmission, bus node, PLC/scanner • Check the setting of the DIL switches • Check voltage supply to bus → Section 2.2.3
 LED is off	– No fieldbus/network connection: not “online”, MAC-ID test “DUB_MAC_ID” did not run successfully or no power supply to bus	• Establish/check fieldbus/network connection • Correct MAC-ID setting • Check the setting of the DIL switches • Check voltage supply to bus → Section 2.2.3

Tab. 5/5: Status displays of the network-specific “MNS” LED

5. Diagnostics

5.2.5 I/O-LED status display

IO= I/O status, connection status		
LED display	Status/significance	Error handling
 LED illuminated green	– Normal operating status – Communication with the controller (PLC) OK – Bus node is in operational mode and is controlled by the PLC – IOs are controlled via the PLC via fieldbus/network	–
 LED flashes green (1 Hz)	– Operating status in preparation – Bus node is in pre-operational mode – Inputs/outputs (IOs) are in idle state mode	–
 LED illuminated red	– Inputs/outputs (IOs) are in fail state mode – Typical cause: usually an unrecoverable software fault, e.g. no bus voltage	• Check voltage supply to bus → Section 2.2.3 • Read device diagnostics via fieldbus communication (if activated via DIL switches on the bus node) • Eliminate displayed faults
 LED is flashing red	– Inputs/outputs (IOs) are in fail state mode – PLC failure or stop – Incorrect station number in the PLC or on the bus node (incorrect DIL switch position) – Fieldbus/network interruption or message failure	• Check PLC • Check station number Note Station number (Node ID) 0 is not permissible! • Check fieldbus/network connection
 LED is off	– Fieldbus/I-port device not connected – Commissioning of the bus node not complete or not successful	• Connect fieldbus/I-port device • Check fieldbus connection • Restart

Tab. 5/6: Status displays of the fieldbus/network-specific “IO” LED

5.3 Reaction to malfunctions in the control system

The reaction of outputs and valves to control and communication malfunctions can be set via device-specific parameterisation → Section 4.3.4.

In case of a malfunction, the network participants, i.e. the bus nodes and the I-port devices, assume the parameterised fail state mode.

Depending on the DIL switch setting, the inputs and outputs hold the last state or reset to the basic state → Tab. 2/7.

The selected setting applies for all outputs. (Factory setting: “reset”).



Note

Please note the following valve reaction if the outputs are reset after PLC stop, network/fieldbus interruption or other malfunction:

- Monostable valves move to the basic position
- Double-solenoid valves remain in the current position
- Mid-position valves move to mid-position (pressurized, exhausted or closed, depending on valve type).



Warning

Danger of injury.

- Make sure that outputs and valves are moved to a safe state when malfunctions occur.

Incorrect output and valve states can cause dangerous situations!

5.4 Diagnostics via network/fieldbus

The following diagnostic functions are available:

- Diagnostics via the DeviceNet scanner
- Diagnostics via the configuration software (e.g. RSNetWorx)
- Diagnostics via a user program

5.4.1 Diagnostics via configuration software

1. Make sure that the bus node is “online”.
2. Double-click the CTEU-DN symbol in the configuration software (e.g. RSNetWorx).
3. Click on the “Parameters” tab.
4. Double click on the “Status Byte” parameter line.

Detailed information is displayed ➔ Fig. 5/2.

Additional information can be found in ➔ Tab. 5/7.

5. Diagnostics

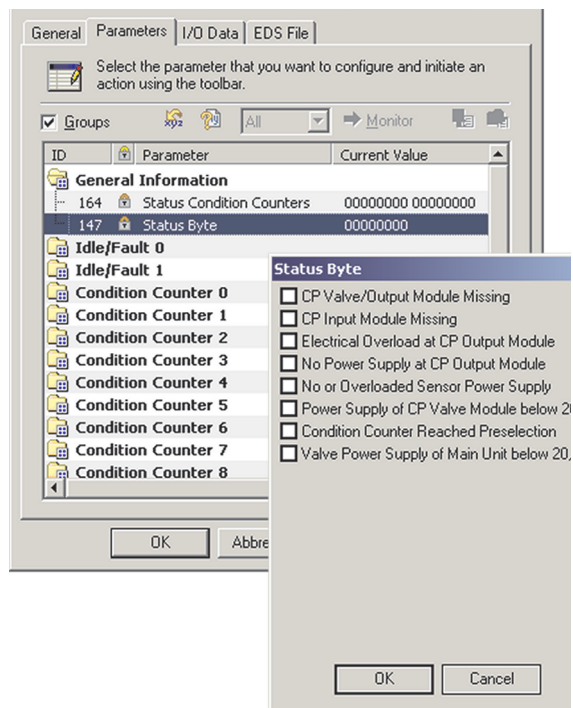


Fig. 5/2: Display of detailed diagnostics information
(example – explanations → Tab. 5/7)

5. Diagnostics

The table below shows the composition of the diagnostic information (status byte). Additional information can be found in the Appendix.

Bit	Significance	Explanation
0	I-Port Module Error	I-port device/module reports diagnostics status
1	I-Port Configuration Error	– Connected device/module is not compatible with I-port – I-port device/module interchanged during operation – I/O data length not reached/exceeded
2	Communication Error	I-port communication error during operation, e.g. if the I-port device/module was unplugged
3	Undervoltage PS	Undervoltage in the power supply
4	Undervoltage PL	I-port device/module reports undervoltage in the load supply
5	Overload/Short Circuit Module	I-port device/module reports short circuit or overload
6	Overload/Short Circuit I-Port	Short circuit or overload at I-port
7	Other Error	Other faults:

Tab. 5/7: Explanation on the diagnostic information (significance of I-port status byte – Festo diagnostic object – Class code 103_d)

5.4.2 Short circuit/overload



Short circuit or overload monitoring depends on the connected I-port device: When the I-port device monitors the load voltage and I-port connection for short circuit and overload, corresponding error messages are generated and forwarded to the PLC. On the bus node, the “PS” LED flashes green, showing a malfunction in the operating and load voltage supply (➔ Tab. 5/2).
More extensive information can be found in the product documentation on the I-port device.

5. Diagnostics

Error handling

Chapter 6

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6.1 Fault finding and error elimination

This section is meant as a checklist to help you inspect your installation and commissioning steps if an error occurs. You will find information on fault finding and error elimination, as well as references to the respective chapters of the two-part product documentation on the bus node.

Eliminate individual sources of error by running the following checks in the specified order.

6.1.1 Check installation

- Check the mechanical and electrical installation of the bus node on the I-port device or the electrical connection box and the correct earthing of all of the components involved.
- Check whether all the required connection lines and connecting cables are fitted correctly.
- Carefully check potentially faulty lines and cables.
- Replace any visibly damaged lines and cables.



Information relating to installing the bus node can be found in Part I of the product documentation entitled “Installation and Interface manual”, which is supplied with the bus node. Information for mounting the bus node on the electrical connection box CAPC-... can be found in the assembly instructions supplied with the electrical connection box.

6. Error handling

6.1.2 Check the power supply



Warning

- Use only PELV circuits for the electrical power supply in accordance with IEC/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe also the general requirements for PELV circuits in accordance with IEC/EN 60204-1.
- Use only voltage sources that ensure a reliable electric separation of operating voltage in accordance with IEC/EN 60204-1.
- Always connect both circuits for operating and load voltage supply.

- Check to make sure **both** power supplies for the operating and load voltage are connected.

Note

The devices connected to the bus node are powered exclusively via the load voltage connection.

- Check the pin assignment of self-assembled cables.



Information relating to installing the bus node can be found in Part I of the product documentation entitled “Installation and Interface manual”, which is supplied with the bus node.

Normal status LED

PS-LED illuminates green and the X1-LED and/or X2-LED illuminate green.

Error status 1

The operating voltage supply for the bus node exhibits under-voltage:

- PS-LED flashes green

6. Error handling

Error status 2	The load voltage supply for the connected device is missing or exhibits undervoltage: – PS-LED flashes green - and – X1 and/or X2-LED flash green Note Requirement for diagnostics via LED display: The connected device must support this diagnostic function. (Additional information can be found in the respective device description).
----------------	--

6.1.3 Restart communication between the bus node and the device

Problem description: X1 and X2 flash red simultaneously. The check of the mechanical connection between bus node and device (dismantling/installing) effected no change. The fault cannot be eliminated in this way.

Remedy	Proceed as follows: 1. Disconnect the operating voltage. 2. Check, sever and re-establish the electrical connection between the bus node and connected devices. 3. Restore voltage. X1 and/or X2 illuminate or flash green.
--------	---

6.1.4 Check fieldbus communication

- Compare the desired baud rate with the baud rate set on the bus node (DIL switch setting).
- Compare the desired station number (NodeID) with the station number set on the bus node (DIL switch setting).

6. Error handling



Information relating to installing the bus node can be found in Part I of the product documentation entitled “Installation and Interface manual”, which is supplied with the bus node.

- Compare your cable lengths with the technical data in the Attachment and the recommendation in the CiA specification (➔ Tab. 2/8).
- Test the fieldbus communication using the object directory (➔ Appendix A.4).

Normal status LED

MNS-LED is off and I/O-LED illuminates green (in operational mode).

MNS-LED is off and I/O-LED is off (if no fieldbus communication).

6.1.5 Check DeviceNet configuration

Problem description: Process data are defective.

Remedy Proceed as follows:

1. Check whether the I/O mapping matches the controller settings (➔ Appendix A.4).
2. Check whether the bus node status, e.g. operational mode, matches the controller settings (➔ Section 5.2.5).

Problem description: Outputs do not switch to the desired state if fieldbus communication is disrupted.

Remedy Proceed as follows:

1. Check whether fail state mode or idle state mode is activated in the controller.

This ensures that the bus node can detect disrupted fieldbus communication and that the outputs are set to a defined state after fieldbus communication is restored (network communication).

6. Error handling

2. Check whether Fail State is activated on the bus node (DIL switch position).

Fail state mode off (reset):

The outputs are reset to “0” after fieldbus communication is restored.

Fail state mode on (hold last state):

Once fieldbus communication is restored, the outputs resume their state prior to failure.

6.1.6 Read out diagnostic messages via DeviceNet

Problem description: The previous checks are “fruitless”, i.e. provide no information about the cause of the fault.

Remedy: Read out diagnostic messages via DeviceNet.

Requirement: The I-port devices connected to the bus nodes can offer advanced diagnostic options.

Additional prerequisites:

- Diagnostic mode is activated:
Check the DIL switch setting.
- Network connection to the connected I-port device is available:
X1 or X2-LED flashes green.

Proceed as follows:

Evaluate the diagnostic information in the process data (see Section 5.3).

6. Error handling

Technical appendix

Appendix A

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A.1 Technical data

A.1.1 General properties

General properties	
Protection class through housing To IEC/EN 60529, bus node fully mounted, plug connector inserted or provided with protective cap	IP65/67 ^{1) 2)} With corresponding connecting cable from the Festo range of accessories
Protection against electric shock Protection against direct and indirect contact in accordance with IEC/EN 60204-1	through the use of PELV circuits
Separation Bus signals, DeviceNet interface to U _{EL/SEN} ³⁾	All bus signals, including V– (“CAN_GND”) and V+ (“CAN_V+”), are galvanically isolated
Electromagnetic compatibility (EMC) ²⁾ – Emitted interference – Resistance to interference	See declaration of conformity ➔ www.festo.com
Temperature range Ambient temperature – Operation – Storage/transport	–5 ... +50 °C –20 ... +70 °C
Relative air humidity To IEC 60770	93 % at 40 °C
Corrosion protection	Intended for indoor application in typical industrial atmosphere. Condensation may occur.
¹⁾ Note that the connected devices may conform to a lower protection class or a lower temperature range etc. ²⁾ The bus node is intended for use in an industrial environment. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken. ³⁾ U _{EL/SEN} is also designated in other technical documentation as V _{EL/SEN}	

Tab. A/1: General characteristics (Part 1)

General properties	
Vibration and shock resistance to IEC/EN 60068 ¹⁾ – Vibration (part 2 - 6) – Shock (part 2 - 27) – Continuous shock (part 2 – 29)	Severity level (SG) ¹⁾ Wall or H-rail mounting – Wall: SG2; H-rail: SG1 – Wall: SG2; H-rail: SG1 – Wall: SG1; H-rail: SG1
Materials – Housing – Housing cover, fibre-optic cable, DIL switch cover – Threaded sleeve M12 – Threaded bush M3 – Seals – Screws	RoHS-compliant Polyamide (PA), reinforced Polycarbonate (PC) Brass, galvanically nickel-plated Brass Nitrile rubber (NBR) Galvanised steel
Dimensions – Width – Height – Length	40 mm 50 mm 91 mm
Weight Bus node without connecting cable and sub-structure	90 g
¹⁾ Explanation of the severity level → Tab. A/3 below “Explanation of vibration and shock - severity level”	

Tab. A/2: General characteristics (Part 2)

Explanation on vibration and shock – severity level	
Severity level 1 (SG1, to IEC/EN 60068, Part 2 – 29)	Vibration: 0.15 mm path at 10 ... 58 Hz; 2 g acceleration at 58 ... 150 Hz
	Shock: ±15 g at 11 ms duration; 5 shocks per direction
	Continuous shock: ± 15 g at 6 ms duration; 1000 shocks per direction
Severity level 2 (SG2, to IEC/EN 60068, Part 2 – 27)	Vibration: 0.35 mm path at 10 ... 60 Hz; 5 g acceleration at 60 ... 150 Hz
	Shock: ±30 g at 11 ms duration; 5 shocks per direction
	Continuous shock: n. a.

Tab. A/3: Explanation on vibration and shock resistance (severity level)

A.1.2 Power supply

Power supply	
Operating voltage (reverse polarity protected) for bus nodes and connected I-port devices ¹⁾ – Nominal value – Tolerance range	DC 24 V ± 25 % DC 18 ...30 V
Load voltage (reverse polarity protected) for connected I-port devices ¹⁾ – Maximum value – Typical tolerance range (device-dependent) ²⁾	max. DC 30 V DC 18 ...30 V ²⁾
Voltage supply to the bus (fieldbus interface, reverse polarity protected) – Tolerance range – Current consumption, interface electronics	DC 11 ...30 V max. 50 mA
Bus node own-current consumption from operating voltage supply for electronics/ sensors (U _{EL} /SEN)	max. 65 mA at 24 V (internal electronics)
Load capacity of the operating and load voltage supply ^{1) 3)} – Bus node on I-port device (e.g. valve terminal) – Bus node on electrical connection box, type CAPC-...	max. 4 A max. 2 A per connection (X ₁ / X ₂)
Mains buffering time	10 ms
¹⁾ Separate, external fuses are required for operating and load voltage supply ²⁾ Dependent on the connected I-port devices (e.g. valve terminal) ³⁾ Load capacity for the connected I-port devices, e.g. the valve terminal, including the bus node	

Tab. A/4: Power supply

A.1.3 Signal transmission

I-port interface signal transmission			
– Internal cycle time		1 ms per 1 byte of user data	
Maximum effective data rate (baud rate) dependent on the line length (reference values)			
Main bus line ¹⁾	Branch line ²⁾		baud rate ³⁾
	Individual branch line	All branch lines (total)	
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) 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.			

Tab. A/5: Signal transmission (technical data)



Note

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

A.2 Terms and abbreviations

The following product and network-specific terms and abbreviations are used in this description:

Abbreviation/term	Significance
Bus nodes	Create the connection to certain fieldbuses or networks, pass on control signals to the connected devices or modules and monitor their functionality
COB-ID	Communication Object Identifiers comprise the function code and address of the activated fieldbus/network participant (station number, node ID)
DIL switches	Miniature switches; dual-in-line switches usually comprise several switch elements that can be used to make hardware settings
DCF	Device Configuration Files contain additional project data over and above the content and scope of an Electronic Data Sheet (EDS) → see also “EDS”
EDS	Electronic Data Sheets contain product-specific data, e.g. the bus node characteristics → see also “DCF”
EDS library	Manages the characteristics of the various fieldbus/network participants
FO _h	Hexadecimal numbers are identified by a subscript “H”
Fail state	Bus node function, also referred to as “fail safe” function; defines the state assumed by outputs or valves following network or communication errors, activates for example a reset of the outputs - or alternatively holds the last state
I	Input
I/O	Input/output, also designated “I/O”

Tab. A/6: System-specific terms and abbreviations (General overview – Part 1)

A. Technical appendix

Abbreviation/term	Significance
I/O diagnostics interface	Diagnostic interface at I/O level, which enables access to the internal data of the bus node and the connected devices or modules
IPC	Industrial PC
I-port	I-port is a Festo-specific interface for transmitting communication data (process data, sensor signals, pilot signals) and supply voltages. The I-port communication protocol is based on the IO link protocol. The electrical and mechanical link between bus nodes and I-port device is standardised.
Load voltage	Comprises the voltage supply for connected devices and outputs, e.g. I-port devices, electrical analogue or digital outputs, solenoid coils of valves etc. (load voltage supply → see also “Operating voltage”: Voltage supply for electronics and sensors)
O	Output
Object Directory	Makes all important fieldbus/network participant parameters accessible in a standardised manner
ODVA	Open Device Vendor Association, DeviceNet umbrella organisation
Operating voltage	Also referred to as signal voltage; comprises the voltage supply for the electronics/sensors (power supply → see also “Load voltage”: voltage supply for outputs)
PDO	Process Data Objects facilitate the fast transmission of process data via Multicast connection and are transmitted by simple DeviceNet messages without protocol overhead; PDOs can be transmitted event-controlled, synchronised with a system cycle or on request; a distinction is drawn between → “TPDOs” and → “RPDOs”
PELV (Protective Extra-Low Voltage)	Protective Extra-Low Voltage

Tab. A/7: System-specific terms and abbreviations (General overview – Part 2)

Term/abbreviation	Significance
PLC	Programmable logic controller, also referred to as system controller or controller for short, equivalent to “Programmable Logic Controller” (→ PLC)
Power supply	Umbrella term for operating and load voltage supplies
RPDO	Receive PDO
RSNetWorx	Configuration, parameterisation, commissioning and diagnostics software for DeviceNet from Rockwell Automation/Allen-Bradley
SC/O, SCS, SCO, SCV	Short circuit/overload, short circuit/overload sensor supply or outputs or valves
SDO	Service Data Objects predominantly form point-to-point connections between the server and client for the exchange of parameters for device configuration. permit write and read access for every entry in the → Object directory of a bus node → see also “PDO”
Station number	Address of the fieldbus/network participant, as referred to as Node ID
TPDO	Transmit PDO

Tab. A/8: System-specific terms and abbreviations (General overview – Part 3)

A.3 Fail state behaviour

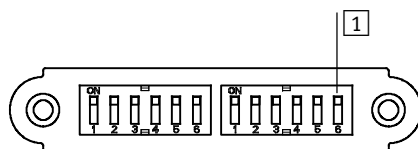
The parameterisation of the fail state mode regulates the behaviour of the bus node and the connected I-port devices in the event of communication errors (➔ Section 4.3.4 and 5.3).



Note
The fail state mode requires the corresponding DeviceNet function to be activated in the PLC.

Behaviour		Settings	Processing	Diagnostics
of the bus node/field-bus	of the connected I-port device	of the fail state mode (DIL switches)	of the incoming PLC control signals for OUT/VAL	
OK	Timeout	OFF	I/Os are reset	– Bus nodes LED X1 and/or LED X2 illuminate/illuminate red – Master controller reports a connection fault
		ON	I/Os remain set (“Hold last state”)	
Timeout	OK	OFF	I/Os are reset	– Bus node LED MNS illuminates red
		ON	I/Os remain set (“Hold last state”)	
	Timeout	OFF	I/Os are reset	– Bus nodes LED X1 and/or LED X2 illuminate/illuminate red – Bus node LED MNS illuminates red
		ON	I/Os remain set (“Hold last state”)	

Tab. A/9: Fail state behaviour in dependence of bus nodes/field bus, I-port device and fail state mode setting



- 1 DIL switch settings:
- OFF = reset (factory setting)
 - ON = Hold last state

Fig. A/3: DIL switches for Fail state function



The DIL switch setting applies for all outputs.

Further information relating to the DIL switches on the bus node can be found in Part I of the product documentation entitled “Installation and Interface manual”, which is supplied with the bus node.

A.4 DeviceNet object model

This chapter describes the representation of the CTEU-DN within the DeviceNet Object model. This DeviceNet-specific information is provided primarily in English to enable a unique reference to be made to DeviceNet specifications and other technical documentation.

A.4.1 DeviceNet Object model for CTEU-DN – overview

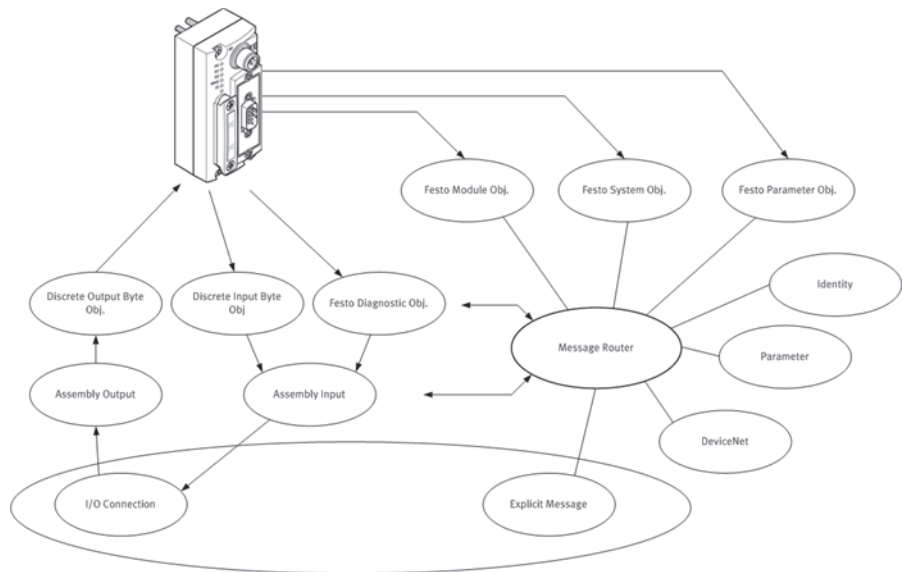


Fig. A/1: DeviceNet Object model for CTEU-DN

Object model, object classes

The following object classes are supported in the DeviceNet object model for CTEU-DN:

Object class	Instance	Attribute 1)	Name
1 _d	1	-	Identity object
2 _d	1	-	Message router
3 _d	1	-	DeviceNet object class
4 _d	101, 104	-	Assembly object
5 _d	1	-	Connection object class
15 _d	1...16	-	Parameter object class
43 _d	1	-	Acknowledge handler class
100 _d	1...16	-	Festo output byte object
101 _d	1...16	-	Festo input byte object
103 _d	1...2	-	Festo diagnostics object
104 _d	1...2	-	Festo module object
105 _d	1...2	-	Festo system object 2)
106 _d	1...2	-	Festo parameter object 3)
1) Information on “Attribute” → Tab. 4/17 2) System information (device-specific data on the bus node) 3) This object is device-specific and therefore not contained in the EDS file.			

Tab. A/10: DeviceNet Object model for CTEU-DN – Object classes

Class services, Instance services

CTEU-DN supports the following Class services and Instance services:

Service code	Service name
05 _d (0x05)	Reset
14 _d (0x0E)	Get Attribute Single
16 _d (0x10)	Set Attribute Single

Tab. A/11: Class services

Communication options

The following message types are supported by CTEU-DN in DeviceNet:

- Change of state / Cyclic communication
- Polled communication (“I/O polling”)

A.4.2 Participant features (Identity object)

Object class: 1_d
Instances: 1

The Identity object identifies and describes the DeviceNet participant CTEU-DN.

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. instance ²⁾ of the CIP object	1
Instance attributes					
1	Get	Vendor ID	UINT	Vendor identifica- tion	Festo SE & Co. KG 26 _d (0x1A)
2	Get	Device type	UINT	General type of the product	Communication interface 12 _d (0xC)
3	Get	Product code	UINT		6000 _d (0x1770)
4	Get	Revision	STRUCT	Firmware revision	
		Major revision	USINT		
		Minor revision	USINT		
5	Get	Status	WORD	Summary status of the device	(according to CIP specification)
6	Get	Serial number	UDINT		
7	Get	Product name	SHORT_ STRING		CTEU-DN
8	Get	State	USINT	Current state of device	(according to CIP specification)

Tab. A/12: Participant features (Identity object) – Class code 1_d

A.4.3 DeviceNet object

Object class: 3_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	2
Instance attributes					
1	Get	MAC ID	USINT	“MAC address” (DeviceNet address/station number/Node ID)	0 ... 63
2	Get	Baud rate	USINT	Baud rate	
3	Get/Set	Bus off interrupt (BOI)	BOOL	Communication interruption (Event, optional)	
4	Get/Set	Bus off counter	USINT	Number of communication interruptions (Event counter, optional)	
6	Get	MAC ID switch changed	BOOL	Significance: The setting of the “MAC-ID” DIL switch (station number) has changed since last being started	
7	Get	Baud rate switch changed	BOOL	Significance: The setting of the baud rate DIL switch (data rate) has changed since last being started	
8	Get	MAC ID switch value	USINT	Current value of the “MAC-ID” switch	
9	Get	Baud rate switch value	USINT	Current value of the baud rate switch	
10	Get/Set	Quick connect	BOOL		

Tab. A/13: DeviceNet object – Class code 3_d

A.4.4 Assembly Object

Object class: 4_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	2
2	Get	Number of Instances	UINT	Max. instance of the CIP object	2
Instance 100 - Attributes					
	Get/Set	Data	ARRAY OF BYTE	Contains all output data, refers to Class 100, Instance 1...n, Attribute 3 (n = number of output bytes)	
	Get	Size	UINT	Number of bytes in Attribute 3	
Instance 101 - Attributes					
3	Get	Data	ARRAY OF BYTE	Contains all input data and optional diagnostic information. If diagnostics activated (DIL-switches): – Class 103, Instance 1, Attribute 1 (status byte I-port 1) – Class 103, Instance 2, Attribute 1 (status byte I-port 2) – Class 101, Instance 1...n, Attribute 3 (n = number of input bytes) If diagnostics not activated: – Class 101, Instance 1...n, Attribute 3 (n = number of input bytes)	
4	Get	Size	UINT	Number of bytes in Attribute 3	

Tab. A/14: Assembly object – Class code 4_d

A.4.5 Discrete output byte object

Object class: 100_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	2
2	Get	Max instances	UINT	Max. instance of the CIP object	32
8	Get/Set	All outputs	ARRAY OF BYTE	All outputs	2
Instances					
1 ... 8 9 ... 16 17 ... 32				Instances 1 ... 8: Outputs, 8 bytes (4 words) Instances 9 ... 16: Reserved for max. 128 outputs at I-port Instances 17 ... 32: Reserved Note The channels of I-port 1 are assigned first, then the channels of I-port 2.	
Instance attributes					
3	Get/Set	Value	BYTE	Output value of the outputs	

Tab. A/15: Discrete output byte object – Class code 100_d

A.4.6 Discrete input byte object

Object class: 101_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instances	UINT	Max. instance of the CIP object	34
8	Get	All inputs	ARRAY OF USINT	All inputs	
Instances					
1 ... 8 9 ... 16 17 ... 32				Instances 1 ... 8: Inputs, 8 byte (4 words) Instances 9 ... 16: Reserved for max. 128 inputs at I-port Instances 17 ... 32: Reserved Note The channels of I-port 1 are assigned first, then the channels of I-port 2.	
Instance attributes					
3	Get	Value	BYTE	Input value for the inputs	

Tab. A/16: Discrete input byte object – Class code 101_d

A.4.7 Festo diagnostic object (I-port status byte)

Object class: 103_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instances	UINT	Max. instance of the CIP object	2
Instances					
1				Instance 1: Module diagnostics – I-port device 1 ("Device 1")	
2				Instance 2: Module diagnostics – I-port device 2 ("Device 2")	
Instance attributes					
1	Get	I-port status byte	BYTE	I-port status byte: Significance/explanation → Tab. A/18	
2	Get	Diagnostic byte 1	BYTE	Transmission of diagnostics information from the I-port device - byte 1	
3	Get	Diagnostic byte 2	BYTE	Transmission of diagnostics information from the I-port device - byte 2	

Tab. A/17: Festo diagnostic object (I-port status byte) – Class code 103_d

Bit	Significance	Explanation
0	I-Port Module Error	I-port device/module reports diagnostics status
1	I-Port Configuration Error	– Connected device/module is not compatible with I-port – I-port device/module interchanged during operation – I/O data length not reached/exceeded
2	Communication Error	I-port communication error during operation, e.g. if the I-port device/module was unplugged
3	Undervoltage PS	Undervoltage in the power supply
4	Undervoltage PL	I-port device/module reports undervoltage in the load supply
5	Overload/Short Circuit Module	I-port device/module reports short circuit or overload
6	Overload/Short Circuit I-Port	Short circuit or overload at I-port
7	Other Error	Other faults

Tab. A/18: I-port status byte – Significance and explanation of the diagnostics information (Festo diagnostic object – Class code 103_d)

A.4.8 Festo module object

Object class: 104_d

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instances	UINT	Max. instance of the CIP object	2
3	Get	Total input length	USINT	Process data: input length of all ports	
4	Get	Total output length	USINT	Process data: output length of all ports	
Instances					
1				Access to connected I-port devices: – Instance 1: Module identity – I-port device 1 – Instance 2: Module identity – I-port device 2	
2					
Instance attributes					
1	Get	Product name	SHORT_STRING		
2	Get	Device ID	UDINT	(Value = 0, if no I-port device connected)	
3	Get	Process data input	USINT	Number of inputs I in byte	
4	Get	Process data output	USINT	Number of outputs O in byte	
5	Get	Serial number	UDINT		

Tab. A/19: Festo module object – Class code 104_d

A.4.9 Festo system object

Object class: 105_d
Instances: 1

Attribute	Access	Name	Type	Description	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instances	UINT	Max. instance of the CIP object	1
Instance					
1				Access to system information (Data in the bus node)	
Instance attributes					
1	Get	Product name	SHORT_STRING		CTEU-DN
2	Get	Process data input	USINT	Total number of inputs I in byte (Device 1 + 2)	
3	Get	Process data output	USINT	Total number of inputs I in byte (Device 1 + 2)	
4	Get	Serial number	UDINT		

Tab. A/20: Festo module object – Class code 105_d

A.4.10 Festo parameter object

Object class: 106_d

The Festo parameter object is a DeviceNet object relating to CTEU-DN for the device-specific parameterisation.

Attribute	Access	Name	Type	Description ¹⁾	Value
Class attributes					
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. instance ²⁾ of the CIP object	2
Instance attributes ²⁾					
1	Get/Set	Parameter byte 1	BYTE		
2	Get/Set	Parameter byte 2	BYTE		
3	Get/Set	Parameter byte 3	BYTE		
4	Get/Set	Parameter byte 4	BYTE		
5	Get/Set	Parameter byte 5	BYTE		
6	Get/Set	Parameter byte 6	BYTE		
7	Get/Set	Parameter byte 7	BYTE		
8	Get/Set	Parameter byte 8	BYTE		
Note Write access to these objects and instances is possible only if an I-port-compatible device is connected to the corresponding I-port. ¹⁾ The specific contents (description, “parameters” and “values”) of the objects and instances depend on the connected I-port device. ²⁾ Instance 1 refers to the module identity of Device 1; Instance 2 to module identity of Device 2.					

Tab. A/21: Festo parameter object – Class code 106_d

A. Technical appendix

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Appendix B

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