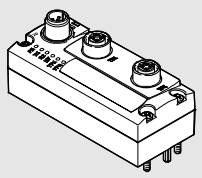
Bus node
CTEU-PN



FESTO

Operating instructions
Original instructions
Network protocol PROFINET

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CE
1703a

1 Intended use

The bus node CTEU-PN is intended exclusively for use as a participant (“I/O device”) in a PROFINET network.
The bus node may only be used in its original status without unauthorised modifications and only in perfect technical condition.
The specified limit values must be observed here.
The product is intended for use in industrial environments. Outside of industrial environments, e.g. in commercial and mixed-residential areas, actions to suppress interference may have to be taken.

➔ ..... **Note**

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

➔ ..... **Note**

Detailed information on commissioning is provided in the documentation provided for the primary control system.
Information about PROFINET:
➔ www.profinet.com
Information about products from Festo:
➔ www.festo.com/sp

➔ ..... **Note**

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

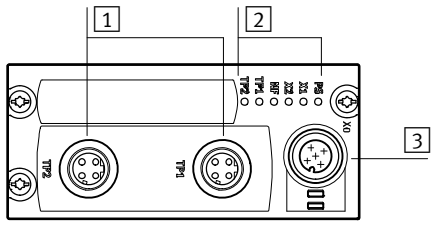
Qualified personnel
The product may only be commissioned by trained control and automation technology professionals, who are familiar with:
– the assembly, installation, operation and diagnosis of control systems, networks and field bus systems
– the applicable regulations for accident prevention and industrial safety
– the documentation for the product.

Service
Consult your local Festo repair service if you have any technical problems.

2 Safety instructions

- Prior to any assembly or installation work, switch off power supplies, disconnect the compressed air supply and vent the pneumatics.
- For the electrical power supply, only use PELV circuits in accordance with IEC 60204-1.
- Observe the handling specifications for electrostatically sensitive devices.
- Use cover caps to seal unused connections to achieve the required degree of protection.
- Use connection technology with the required degree of protection.

3 Connections and displays

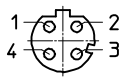


1 **Netzwork connections (network ports TP1/TP2, field bus interface)**
➔ Section 3.1
2 **Status LEDs**
➔ Section 3.2, Section 7
3 **Power supply connection (X0)**
➔ Section 3.1.

I-port interface
The I-port interface is located on the underside of the bus node.

3.1 Ports

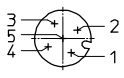
Network connections[1)]
Pin allocation



1	TD+	Transmitted data (Transmit Data) +
2	RD+	Received data (Receive Data) +
3	TD–	Transmitted data –
4	RD–	Received data –
housing	Shield/ FE	Shield/functional earth[2)]

1) 2 x socket, M12, 4-pin, D-coded, according to IEC 61076-2; installation guidelines, line specification ➔ Section 4.4
2) Connection to functional earth must be secured over the connected product ➔ Section 4.3, “Equipotential bonding”

Power supply connection[1)]
Pin allocation

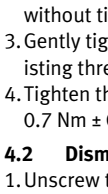


1	24V	Operating voltage Electronics/sensors (power system)	PS	$U_{EL/SEN}$
2	24V	Load voltage Valves/outputs (Power Load)	PL	$U_{VAL/OUT}$
3	0V	Operating voltage	PS	$U_{EL/SEN}$
4	0V	Load voltage	PL	$U_{VAL/OUT}$
5	FE	Functional earth[2)]	FE	

1) Plug, M12, 5-pin, A-coded, according to IEC 61076-2
2) Connection to functional earth must be secured over the connected product ➔ Section 4.3, “Equipotential bonding”

3.2 Indicators

Status LEDs[1)]
Function



PS	Status of the operating voltage supply (power system)
X1	Status of the internal communication between the bus node and the connected product (“I-Port Device” 1 and/or “I-Port Device” 2)[2)]
X2	
NF	Network status/network failure (Network Failure)
TP1	Connection status (“Link” 1 and/or “Link” 2)
TP2	

1) Other information➔ Section 7
2) Accessories with two I-port interfaces required to connect up two products, e.g. the decentralised electric sub-base CAPC ➔www.festo.com/catalogue

4 Assembly, disassembly, installation

⚠ ..... **Warning**

Uncontrolled movement of the actuators, loose tubing, undefined switching states of the electronics.
Injury caused by moving parts, damage to machine and to system.
Before mounting and installation work:
- Switch off the power supply
- Switch off the compressed air supply.
- Vent the pneumatics.

4.1 Mounting the bus node

For mounting the bus node, a product with I-port interface is required (“I-port device”), e.g. valve terminal with I-port interface or the decentralised electrical connection box, type CAPC-... .

➔ ..... **Note**

Assembly of the bus node on the decentralised electric sub-base **CAPC** ➔ Assembly instructions CAPC-...

1. Check seal and sealing surfaces of the bus node and the product with the I-port interface. Replace damaged parts.
2. Push the bus node onto the product carefully and without tilting and press up to the stop.
3. Gently tighten down the self-tapping screws, using existing threads.
4. Tighten the screws with tightening torque: 0.7 Nm ± 0.1 Nm.

4.2 Dismantling the bus node

1. Unscrew the screws.
2. Pull the bus node off without tilting it.

4.3 Connecting the power supply

⚠ ..... **Warning**

Electrical voltage
Injury caused by electric shock, damage to machine and to system.
- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements IEC 60204-1 of the PELV power circuits.
- Only use power sources that guarantee reliable electrical isolation of the operating and load voltage in accordance with IEC 60204-1.
- Always connect all circuits for operating and load voltage supplies $U_{EL/SEN}$ and $U_{VAL/OUT}$.

Fuse protection
The bus node also supplies operating and load voltage to products connected via the I-port interface.
- Secure operating voltage $U_{EL/SEN}$ and load voltage $U_{VAL/OUT}$ separately.
- Take due account of the current consumption of connected products during design and protection of the power supply.
- Observe power rating of power supply (no bus node-internal overload protection for the connected products) ➔ Section 10.
- Ensure correct polarity (no bus node-internal reverse polarity protection for the connected products).

Potential equalisation (earthing measures)
- Connect the functional earth (FE) connections of the connected products to the earth potential with a short conductor with the greatest possible cross section (≥ 4 mm² Cu).

➔ ..... **Note**

Functional test
– The **PS** LED lights up when operating voltage is applied (within permitted range).
– LED **X1** or **X2** lights up green if a product with an I-port interface is connected up correctly (➔ Section 7).

4.4 Connecting to the network

Installation guidelines

⚠ ..... **Warning**

Electrical voltage
Injury caused by electric shock, damage to machine and to system.
- For the electrical power supply to **all PROFINET network participants** (“IO Devices”) and other network components (e.g. on switches and routers) only use PELV circuits in accordance with IEC 60204-1.

➔ ..... **Note**

Data transmission errors
Malfunction:
If installation has not been carried out correctly and if high baud rates are used, data transmission errors may occur, e.g. as a result of signal reflections and attenuations.
- Connect screening to all network cables
- Wherever possible, only ground screening once (“star topology”) to prevent ground loops
- Observe installation guidelines for the PROFINET user organisation (PNO):
  ➔ www.profinet.com
  ➔ www.profibus.com/download/
  ➔ PROFINET installation guidelines
  (“PROFINET Installation Guide”,
  “Installation Guideline PROFINET Part 2...”)
- Observe port and cable specifications:
  ➔ PROFINET installation guidelines
  ➔ Documentation relating to the control system
  ➔ Section 3.1, table “network connections”
  ➔ Table “Line specification”.

➔ ..... **Note**

Unauthorised access to the product can cause damage or malfunctions.
When connecting the product to a network:
- Protect the network from unauthorised access.

Measures for protecting the network include:
– Firewall
– Intrusion Prevention System (IPS)
– Network segmentation
– Virtual LAN (VLAN)
– Virtual private network (VPN)
– Security at physical access level (Port Security).

Further information:
➔ Guidelines and standards for security in information technology, e.g. IEC 62443, ISO/IEC 27001.

An access password protects only against accidental changes.

Use of switches and routers
When using the PROFINET function “Fast Start-up” (FSU):
- Only use switches and routers that support the “Fast Start-up” function.
- Connect up network participants (“IO devices”) and network components via LAN (“wire-bound”) (no support of “Fast Start-up” by Industrial Wireless LAN Access Points, IWLAN).

Use of crossover cables
When using patch cables and crossover cables in the same network:
- Ensure that the crossover detection (“Crossover Detection”, “Auto-MDI” or “Autocrossover/Autonegotiation”) is enabled in the control system.

➔ ..... **Note**

When using the PROFINET function “Fast Start-up” (FSU), crossover detection is not available.
- Observe notice relating to “Fast Start-up” ➔ Section 5.10.

Cable specification

Cable	Ethernet twisted pair cable, shielded (Shielded Twisted Pair, STP)
Transmission class (Link Class)	Category Cat 5
Cable diameter[1)]	6 ... 8 mm
Core cross section	0.14 ... 0.75 mm²; 22 AWG required for max. connection length between network participants (End-to-end-Link)
Connection length[2)]	max. 100 m PROFINET-End-to-end-Link

1) When using plug NECU-M-S-D12G4-C2-ET
2) In accordance with specification for PROFINET networks (PROFINET installation guideline), based on ISO/IEC 11801, ANSI/TIA/EIA-568:
➔ www.profinet.com
➔ www.profibus.com/download/

Strain relief
When mounting on a moving part of a machine:
- Provide the network cable with strain relief.

4.5 Ensuring the protection class

➔ ..... **Note**

Short circuit
Malfunction or damage to the electronics
- Use connection technology (interconnecting cables, push-in connectors, adapters) with the required degree of protection, e.g. plug NECU-M-S-D12G4-C2-ET.
- Use cover caps to seal unused connections, e.g. cover cap ISK-M12:
  ➔ Accessories
  ➔ www.festo.com/catalogue
- Do **not** remove sealing plug from underside of bus node.
- Only when mounting bus node on the decentralised electric sub-base **CAPC**: Replace sealing plug on underside fo bus node ➔ Assembly instructions CAPC-...

5 Commissioning, configuration and parameterisation

Commissioning, configuration and parametrisation of the bus node is dependent on the primary control system used. The basic approach and required configuration data are explained in the following sections.

⚠ ..... **Warning**

Uncontrolled movement of the actuators, loose tubing, undefined switching states of the electronics.
Injury caused by moving parts, damage to machine and to system.
- Before commissioning, ensure that the connected products do not perform any uncontrolled movements.
- Observe commissioning notices in the control system documentation.

No automatic checking of configuration and parameterisation: The bus node and the connected products also go into operation if configuration is incorrect.

5.1 Switching on the power supply

If the control system and network participants have separate voltage supplies, the devices must be switched on in the following sequence:
1. Switch on power supply to all network participants (“IO Devices”).
2. Switch on power supply to control system.

5.2 Addressing

PROFINET uses module-oriented addressing, i.e. each network participant is addressed separately (in contrast to block-oriented addressing of other fieldbus systems).
The controller uses the following for addressing:
– Fieldbus device names, short form “Device Names” ➔ Section 5.6
– IP addresses ➔ Section 5.7
– Input/output addresses (I/O addresses) ➔ Section 5.9.

➔ ..... **Note**

Addressing errors
Incomplete faulty configuration, malfunction, fault indication
The address space of the bus node is limited (➔ Section 10, Technical data).
- Determine the number of assigned inputs and outputs prior to commissioning.

Basic rules for addressing
– Addressing: **Module-oriented, byte-by-byte**. Modules with less than 8 bits occupy 8 bits of address space and/or 1 byte of address space, but which do not use all this space.
– The address assignment of the inputs does **not depend** on the address assignment of the outputs.

5.3 Import device master file (GSDML file)

A device master file (GSD) in XML format (GSDML) is needed for configuration, parameterisation and programming of the bus node. The GSDML contains all information required to connect into the hardware configuration of the control system, e.g. Siemens SIMATIC STEP 7.

Download of the GSDML file
➔ www.festo.com/sp
1. Enter search term: “GSDML”.
2. Click “Firmware and drivers” tab.
3. Click “File and language versions” link.
4. Transmit file “GSDML-V...-Festo-CTEU-...zip” to the control system and unpack it.
   The file contains:
   – one or more GSDML files (GSDML-V...-Festo-CTEU-...xml)
   – a symbol file (GSDML-...-...-CTEU.bmp)
   – optionally a “Read Me” file with notes on the current GSDML versions.
- Observe comments in the “Readme” file.

Installation of the GSDML file
➔ Documentation of the control system
After installation of the GSDML file, all available network participants (“IO devices”, bus nodes) and field devices (“Field devices”), e.g. products with an I-port interface appear in the hardware directory of the control system (“Catalog”).
Example of Siemens SIMATIC S7-1200, TIA portal:
- Install GSDML file (“Install general station description file (GSD)”).

5.4 Setting up control system, creating automation project

➔ Documentation of the control system
Example of Siemens SIMATIC S7-1200, TIA portal:
1. Open device and network view:
   View ➔ Double click “Devices & networks”.
2. Open “Network view”.
3. Open hardware catalog (“Catalog”).
4. Open “System control” (“PLC”) directory.
5. Drag system control (PCL/“CPU”) into the network view.

5.5 Insert PROFINET station (“Station”)

➔ Documentation of the control system
Example of Siemens SIMATIC S7-1200, TIA portal:

1. Open “Devices & networks” view ➔ Section 5.4).
2. Open “Network view”.
3. Open hardware catalog (“Catalog”).
4. Open “Other field devices” directory:
   ➔ “PROFINET IO” ➔ “Valves” ➔ “Festo SE & Co. KG” ➔ “Festo CTEU-PN”.
5. Select the symbol for the PROFINET station, i.e. of bus node CTEU-PN and drag it into the network view.
6. Open “Connections” view.
7. Connect bus node CTEU-PN to the control system: Click bus node symbol, press and hold down button and drag mouse pointer to system control symbol.
8. Select connection: “Connections” ➔ “PROFINET IO system”.

5.6 Assigning a “Device Name”

➔ Documentation of the control system
With the device name, you can address the bus node and the connected product (“I-port device”) directly, e.g. in your automation program.

5.7 Assigning or changing IP address

➔ Documentation of the control system
In most cases, the control system handles the assignment of an IP address.

➔ **Note**

- Observe the basic addressing rules for the allocation of the IP address, e.g. with respect to the use of private or public address ranges.
- Check that the IP address can be used in the automation network.
- Ensure that there is no duplication of IP addresses in use.

5.8 Configuring field devices (“I-port devices;)

➔ Documentation of the control system
Example of Siemens SIMATIC S7-1200, TIA portal:
1. Open “Devices & networks” view ➔ Section 5.4).
2. Open “Network view”.
3. Open hardware catalog (“Catalog”).
4. Open “Other field devices” directory.
5. Configure field devices:
   Drag the symbols for the connected products (“I-port devices”) into the “Device overview”.

5.9 Changing start addresses of inputs/outputs

➔ Documentation of the control system
In most cases, the control system handles the assignment of the input/output addresses and the diagnosis addresses.

5.10 Setting up PROFINET “Fast Start-up” function

➔ Documentation of the control system

➔ **Note**

When using the PROFINET “Fast Start-up” function (FSU), “Crossover Detection”, “Auto-MDI” and “Autocrossover/Autonegotiation” are **not** available.
- Crossover detection - **disable**:
  – in the hardware configuration of **all** network participants
  – in the hardware configuration of the network neighbor (“Partner Port”).

Deactivation of the crossover detection changes changes the pin allocation of the next network port TP2 to “crossover”.
- Select interconnecting cable dependent on pin assignment of network connection of product connected to TP2:
  – Crossover cables with **identical** assignment of ports
  – Patch cables with **different** assignment of ports.

Example of Siemens SIMATIC S7-1200, TIA portal:
1. Call up “Device overview” :
   Open “Project navigation” window ➔ Devices ➔ Device view ➔ Device overview ➔ Module ➔ CTEU-PN.
2. Click “PN-IO Interface” module.
3. Call up interface options:
   Window for “PN-IO Interface [Module]” ➔ Properties ➔ General ➔ Advanced options ➔ Interface options.
4. Enable interface option “Prioritized start-up (tick boxes).
5. Call up port options:
   Window “PN-IO Interface [Module]” ➔ Properties ➔ General ➔ Advanced options ➔ “Port 1 [X1 P1 R]” and/or “Port 2 [X1 P2 R]” ➔ Port options.
6. Under “Connection”, **disable** crossover detection (“Autonegotiation”) on network ports TP1 **and** TP2.

5.11 Set parameterisation

➔ Documentation of the control system
You can set the characteristics of connected products individually using parameterisation (“Module parameterisation”), e.g. input debounce time, signal extension time, product monitoring, (forwarding of diagnostic messages), settings for error situations (“Fail-state” mode). Parameterisation for “I-port device” 1 (X1) and “I-port device” 2 (X2) can be set separately.

Parameter[1]	Function
Port settings[2] Example “Universal device 256DIO”	
Tool Change Mode	Tool change mode: – “Tool Change Mode” enabled: The process data image rigidly assigns address spaces for input and output data (addressed) – regardless of which product is connected (“I-port device”), meaning that the connected products (e.g. tools) can be interchanged without the need for any configuration changes. – “Tool Change Mode” disabled: The “I-port device” detected at start-up is adopted by the PROFINET configuration. The assignment (addressing) of input and output data in the process data image depends on the connected product.
Suppress all diagnostic messages	No forwarding of diagnostic messages via the network
Suppress diagnostic message “No load voltage”	No forwarding of diagnostic message “No load voltage”[3] via the network[4] (“Suppress missing load voltage diagnostic messages”)
Fail-state	The “Fail-state” mode governs the characteristics of the bus node and the connected products in the event of any communication errors arising: – Reset outputs (“Outputs reset”): The outputs are reset. – Outputs “Hold last state” (“Outputs Hold last state”): The outputs hold their last state. The selected setting applies to all outputs. The “Fail-state” setting also applies to the “Idle state” operating state: – The “Idle state” is adopted by the control system on request. At this point, the control system is in “Stop mode”. – Input data continue to be transmitted while the system is in “Idle state”.
I-port device parameter[2] Example “Universal device 256DIO”	
Byte 0 ... Byte 7	Tunneling of product-specific parameters ➔ Documentation about the connected product

1) Siemens SIMATIC S7-1200, TIA portal: Module parameter(s)
2) The available parameters depend on the connected product.
3) Monitoring for undervoltage of load voltage power supply to outputs/valves $U_{OUT/VAL}$ (“Undervoltage $U_{OUT/VAL}$”)
4) Diagnostic messages “No load voltage” are only generated once, whenever the connected product is monitoring load voltage and reports this status to the bus node.

➔ **Note**

Functional test
– The LED **NF** is OFF (subject to fault-free communication between control system and bus node).
– The LED **TP1** or **TP2** lights up green (➔ Section 7).
– Siemens SIMATIC S7-1200, TIA portal: In the columns for “I address” and “O address” respectively, the address entries are located (start addresses for the inputs/outputs).
– Check availability of the network participants: Menu “online” ➔ “Accessible devices” ➔ Check listing of available network participants for completeness (“Accessible devices in target subnet”).

6 “Identification and Maintenance”

➔ Documentation of the control system
The “Identification and Maintenance” (I&M) function offers uniform, manufacturer-independent access to product-specific information.

➔ **Note**

Manually updated I&M details, e.g. about the firmware and software state of the bus node can differ from the details on the product nomenclature.

7 Diagnostics

PS – Status of the operating voltage supply (power system)

LED display	Status and significance
☼	LED illuminated green: – normal operating status – Operating voltage is ON (within permitted range) – Load voltage is ON (within permitted range)[1]
◐	LED flashes green (flashing frequency: 1 Hz) – Operating voltage is below the required voltage – Load voltage is below the required level[1] – Short circuit at the I-port[1]
○	LED is off: – Operating voltage not present – Operating voltage is below the voltage required for diagnostic functions

1) This display only relates to the status of the load voltage if the the connected product is monitoring the load voltage and reports its status to the bus node.

X1 and X2 – Status of internal communication between the bus node and the connected product (“I-port device” 1 or “I-port device” 2)[1]

LED display	Status and significance
☼	LED illuminated green: – normal operating status – “I-port device” 1 or 2 is connected up correctly – Operating and load voltage are connected (within permitted range)[2]
◐	LED flashing green: – Status of diagnostics – Undervoltage at system or additional power supply – Connection between the bus node and the “I-port device” is OK
☼	LED illuminated red: – “I-port device” is connected up correctly, but the internal communication is in a fault state – After start-up, wrong “I-port device” is connected up (not the “I-port device” specified in the control system hardware configuration, or a product not compatible with I-port)
◐	LED flashing red: – During commissioning, incorrect I-port device connected (non-I-port-compatible device) – If only LED X1 flashes red: error in the bus node – If X1 and X2 flash red simultaneously: no product connected to the bus node (at least one I-port device is required)
○	LED is off: – No product connected to the bus node

1) Accessory with two I-port interfaces required to connect up two products
2) This display only relates to the status of the load voltage if the the connected product is monitoring the load voltage and reports its status to the bus node.

NF – Network status/network failure

LED display	Status and significance
◐	LED flashing red: – Communication error – Communication between control system and bus node is malfunctioning or interrupted.
○	LED is off: – normal operating status – Communication between control system and bus node is OK

TP1/TP2 – Connection status (“Link” 1 or “Link” 2)

LED display	Status and significance
☼	LED illuminated green: – normal operating status – Network connection is OK
◐	Both LEDs, TP1 and TP2 flash green: – To locate the connected product (“module location”), e.g. during hardware configuration of control system or for troubleshooting
○	LED is off: – No network connected

8 Maintenance

No specific measures

9 Glossary

Term/abbreviation	Function
FSU	PROFINET function “Fast Start-up” also known as “Prioritized Start-up” or “Fast reboot”; operating mode of bus node, assures fast rebooting of network participants (“IO devices”)
PROFIenergy	PROFIenergy facilitates energy management settings
PROFINET	Network and field bus system based on Industrial Ethernet for data interchange between a primary control system (industry PC, PCL or “IO controller”), network participants (“IO devices”) and field devices (“Field Devices”), e.g. valve terminals or drives ➔ www.profinet.com ➔ www.profibus.com/download/ ➔ PROFINET System Description, Technology and Application
PLC	Programmable logic controller, also referred to as system controller or controller for short (PLC)

10 Technical data

➔ **Note**

Technical data for the connected products can be obtained from the product documentation.

Electrical properties

Protection class through housing (in accordance with IEC/EN 60529/EN 60529)	IP65/IP67[1)2)]
Protection against electric shock (protection against direct and indirect contact to IEC 60204-1/EN 60204-1)	through the use of PELV circuits (Protected Extra-Low Voltage)
Separation Network connections for operating voltage power supply $U_{EL/SEN}$	Galvanically separated through transformer (up to 500 V)
Electromagnetic compatibility (EMC)[3] – Emitted interference – Resistance to interference	See declaration of conformity ➔ www.festo.com

1) Requirement: Bus node mounted completely, plug connector in the plugged-in status or provided with cover cap.
2) Connected products may only satisfy a lower degree of protection.
3) The product 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.

General mechanical attributes

Vibration and shock resistance (in accordance with IEC/EN 60068)[1] – Vibration (part 2-6) – Shock (part 2-27) – Continuous shock (part 2-27)	Severity level (SL)[1] for wall or H-rail mounting – Wall: SG2; H-rail: SG1 – Wall: SG2; H-rail: SG1 – Wall and H-rail: SG1
Temperature range[2] – Storage/transport – Operation	 –20 ... +70 °C –5 ... +50 °C
Corrosion protection	The product is intended for indoor application in typical industrial atmosphere: Avoid condensation.
Materials – housing – fibre-optic cable – Threaded sleeve M12 – Threaded bush M3 – Seals – Screws	RoHS-compliant Reinforced polyamide Polycarbonate Brass, galvanically nickel-plated brass, Nitrile rubber Galvanised steel
Dimensions – Width – Length – Height	 40 mm 91 mm 50 mm
Weight (bus node without cables and sub-assembly)	94 g

1) Explanation of the severity level ➔ Table “Explanation on vibration and shock – severity level”
2) Connected products may only satisfy a less extensive temperature range.

Power supply

Operating voltage for bus node and connected products[1] – Nennwert – tolerance range	 24 V DC 18 ... 30 V DC[2]
Load voltage for bus node and connected products[1] – Tolerance range	 18 ... 30 V DC[2]
Intrinsic current consumption at nominal operating voltage 24 V DC from operating voltage supply for electronics/sensors ($U_{EL/SEN}$)	Typically 80 mA (internal electronics)
Power rating of operating and load voltage power supplies[1)3)] – Bus node on the connected product (e.g. valve terminal) – Bus node on the decentralised electric sub-base CAPC	 max. 4 A max. 2 A per “I-port device”[4]
Power failure buffering	10 ms

1) Separate and external fuses are required for the operating and load voltage power supplies (no bus node-internal overload and polarity reversal protection for the connected products).
2) The tolerance range is dependent on the connected products.
3) Total power rating of operating and load voltage power supplies PS and PL (residual current), maximum permitted current consumption of bus node and connected products
4) Total power rating of operating and load voltage power supplies PS and PL (residual current), maximum permitted current consumption for each “I-port device”

Network-specific characteristics

Network protocol	PROFINET IO: – based on Industrial Ethernet – based on the standard Ethernet protocol (IEEE 802.3)
Supported protocol characteristics and protocol functions (selection)	– Cyclical data exchange “in real time”, without cycle synchronicity (Real-Time, RT) or with cycle synchronicity (Isochronous Real Time, IRT)[1] – Link Layer Discovery Protocol (LLDP) – Simple Network Management Protocol (SNMP) – Fast Start-up (FSU) – PROFIenergy – Shared device – Media Redundancy Protocol (MRP)
System-specific functions	– Diagnosis information (system diagnosis, undervoltage, communication errors) – Web server (status of bus node and connected products, serial number, configuration)
Specification	Selection of directives and norms regarding PROFINET: – PROFINET installation guidelines (“PROFINET Installation Guide”, “Installation Guideline PROFINET Part 2...”). – IEC 61158 – IEC 61784 – IEC 61918 For additional information: ➔ www.profinet.com ➔ www.profibus.com/download/
Transmission technology	Switched Fast EtherCat; Version 100BaseTX acc. to IEEE 802.3
Transmission rate	100 Mbit/s
Network connections	2 x socket, M12, D-coded, 4-pin
Crossover detection, auto-negotiation	Auto-MDI
Max. address volume inputs/outputs	64 bytes E, 64 bytes A, independent of operating mode

1) IRT is only available via LAN

Explanation on vibration and shock – severity level

Vibration load

Frequency range [Hz]		Acceleration [m/s²]		Displacement [mm]	
SL1	SL2	SL1	SL2	SL1	SL2
2 ... 8	2 ... 8	–	–	±3.5	±3.5
8 ... 27	8 ... 27	10	10	–	–
27 ... 58	27 ... 60	–	–	±0.15	±0.35
58 ... 160	60 ... 160	20	50	–	–
160 ... 200	160 ... 200	10	10	–	–

Shock load

Acceleration [m/s²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5

Continuous shock load

Acceleration [m/s²]	Duration [ms]	Shocks per direction
±150	6	1000