Bus node
CTEU-EP

FESTO

Operating instructions
Original instructions
Network protocol EtherNet/IP or
Modbus TCP

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1 Intended use
The bus node type CTEU-EP is intended exclusively for use as a participant in EtherNet/IP or Modbus TCP networks.
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 for the higher-order control system.
Information on EtherNet/IP:
➜ www.odva.org
Information on Modbus TCP:
➜ www.modbus.org
Information about products from Festo:
➜ www.festo.com/sp

➜ .... **Note**

EtherNet/IP®, MODBUS®, ROCKWELL AUTOMATION®, STUDIO 5000® are registered trademarks of the respective trademark owners in certain countries.

📖 For all available product documentation
➜ www.festo.com/pk

Training of specialized personnel
The product may only be commissioned by trained specialists in control and automation technology who are familiar with:
– mounting, installation, operation and diagnostics of control systems, networks and fieldbus systems
– the applicable regulations for accident prevention and occupational 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/EN 60204-1.
• Observe the handling specifications for electrostatically sensitive devices.
• Use cover caps to seal unused connections to achieve the required degree of protection.
• Always ensure that the connection technology being used has the required degree of protection.

3 Ports and displays

1 Network connections (network ports TP1/TP2, fieldbus interface) ➜ 3.1
2 DIL switch (with transparent cover) ➜ 5.2
3 Status LEDs ➜ 3.2, 7
4 Power supply connection (X0) ➜ 3.1.

I-Port-interfaces
The I-Port interfaces (X1/X2) are located on the underside of the bus node.

3.1 Ports
Power supply connection[1)]
Pin allocation

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

1) Plug connector M12, 5-pin, A-coded
2) Secure connection to functional earth over the connected product ➜ 4.3 ➜ Potential equalisation

Network connections[1)]

Pin allocation		TP1 [2)]	TP2 [2)]
	1	TX+	RX+
	2	RX+	TX+
	3	TX–	RX–
	4	RX–	TX–
	Housing	Screening/functional earth (Shield/Functional Earth) [3)]	

TX = transmitted data, RX = received data
1) 2 sockets M12, 4-pin, D-coded; observe installation guidelines and line specification ➜ 4.5
2) Pin activation with deactivated crossover detection
3) Secure connection to functional earth over the connected product ➜ 4.3 ➜ Potential equalisation

3.2 Indicators
Status LEDs[1)]
Significance

PS ◯	PS	Status of the operating voltage supply (Power System)
X1 ◯	X1	Status of the internal communication between the bus node and the connected product "I-Port Device 1" or "I-Port Device 2"[2)]
X2 ◯		
NS ◯	X2	
TP1 ◯	NS	Network status
TP2 ◯	TP1	Connection status "Link 1" or "Link 2"
	TP2	

1) Additional information ➜ 7
2) Accessories with two I-Port interfaces required to connect two products, e.g. the decentralised electrical connection box CAPC ➜ www.festo.com/catalogue

4 Mounting, dismantling, installation

⚠ .... **Warning**

Uncontrolled movement of the actuators, loose tubing, undefined switching statuses 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 compressed air supply.
• Vent the pneumatics.

4.1 Mounting the bus node
To mount the bus node, a product with I-Port interface is required ("I-Port Device"), e.g. a valve terminal with I-Port interface or the decentralised electrical connection box CAPC.

➜ .... **Note**

Mounting of the bus node on the decentralised electrical connection box ➜ CAPC assembly instructions

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. Tightening torque: 0.7 Nm ± 10 %.

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**

Electric 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/EN 60204-1 (Protective Extra-Low Voltage, PELV).
• Observe the general requirements IEC 60204-1/ EN 60204-1 of the PELV power circuits.
• Use only voltage sources that ensure a reliable electric separation from the mains network in accordance with IEC 60204-1/EN 60204-1.
• Always connect all circuits for operating and load voltage supplies $U_{EL/SEN}$ and $U_{VAL/OUT}$.

Fuse protection
The bus node supplies operating and load voltage to the connected products via the I-Port interfaces X1 and X2.
• 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 the power supply (no bus node-internal overload protection for the connected products) ➜ 11.
• 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 products connected via X1 and X2 to the earth potential with a short conductor with the greatest possible cross section (≥ 4 mm² Cu).

4.4 Check the power supply

➜ .... **Note**

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

4.5 Connecting to the network
Installation guidelines

⚠ .... **Warning**

Electric voltage
Injury caused by electric shock, damage to machine and to system
• For the electrical power supply to **all network participants** and other network components (e.g. switches and routers), use only PELV circuits IEC 60204-1/EN 60204-1.

➜ .... **Note**

Data transmission errors
Malfunction
If installation has not been carried out correctly and high transmission 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-shaped) to prevent ground loops
• Observe installation guidelines of the EtherNet/IP user organisation (ODVA): ➜ www.odva.org ➜ EtherNet/IP installation guidelines
• Observe port and cable specifications:
  ➜ EtherNet/IP installation guidelines
  ➜ Documentation on the control system
  ➜ 3.1, table of network connections
  ➜ Table of line specifications

➜ .... **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 a 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
With use of the EtherNet/IP function "QuickConnect":
• Use only switches and routers that support "QuickConnect".
• Use only patch cable.

Use of crossover cables
When using patch cables and crossover cables in the same network:
• Ensure that the crossover detection "Auto-MDI/MDI-X" is activated in the control system
  ➜ Deactivate EtherNet/IP function "QuickConnect"
  ➜ 5.8.

Cable specification

Cable	Ethernet twisted pair cable, shielded (Shielded Twisted Pair, STP)
Transmission class (Link Class)	Category 5
Cable diameter[1)]	6 ... 8 mm
Wire 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 End-to-end-Link

1) When using plug NECU-M-S-D12G4-C2-ET
2) Corresponding to the specification for EtherNet/IP networks (EtherNet/IP installation guideline) ➜ www.odva.org

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

4.6 Ensuring the degree of protection

➜ .... **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 connector NECU-M-S-D12G4-C2-ET.
• Use cover caps to seal unused connections, e.g. cover cap ISK-M12 ➜ Accessories
• Mount cover of the DIL switches: Check seal, place cover and push it down, tighten screws. Tightening torque: 0.4 Nm ± 20 %.
• Do **not** remove sealing plug from underside of bus node.
• Only when mounting the bus node on the decentralised electrical connection box **CAPC**: Replace sealing plug on underside of bus node ➜ Assembly instructions CAPC.

5 Commissioning, configuration and parameterisation
Commissioning, configuration and parameterisation of the bus node depends on the higher-order control system. The basic approach and required configuration data are explained in the following sections.

⚠ .... **Warning**

Uncontrolled movement of the actuators, loose tubing, undefined switching statuses 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 Switch on the power supply
If the control system and network participants have separate voltage supplies, the following sequence is recommended for switch-on:
1. Switch on the power supply to all network participants.
2. Switch on power supply to control system.

5.2 Setting the DIL switch
1. Setting IP address ➜ 5.3.
2. Perform additional settings ➜ Table, item ③ ... ⑤.

Item	DIL switch [1)]	Function	
		ON	**OFF**
DIL switch 1:			
①	1 ... 6: Host ID of the IP address, bit 0 ... 5 [2)]		
DIL switch 2:			
①	1 ... 2: Host ID of the IP address bit 6 and 7 [2)]		
②	3: Reserved		
③	4: Network protocol	Modbus TCP	EtherNet/IP[3)]
④	5: Status bytes ➜ 5.5 ➜ Table "Connection Parameters"	Status information in the input image	No status information in the input image[3)]
⑤	6: Behaviour in case of communication errors and for control in the Idle-Mode	All outputs retain their last switching status	All outputs are reset[3)]

1) Switch setting "ON" = ON, switch is to the left or on top switch setting "OFF" = OFF, switch is to the right or underneath
2) Binary coding in ascending order from left to right 2^0, 2^1, 2^2, ...
3) Factory setting

5.3 Setting IP address
➜ Documentation of the control system

➜ .... **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.
• Use DIL switches ① for setting the addressing type or for setting the host ID of the bus node.

ℹ The change of IP addressing in the bus node requires a corresponding update in the higher-order control system.

Examples

Host ID = 05	Host ID = 38
$2^0 + 2^2 = 1 + 4 = 5$ Set IP address: 192.168.1.**005**	$2^1 + 2^2 + 2^5 = 2 + 4 + 32 = 38$ Set IP address: 192.168.1.**038**

Dynamic addressing
1. Make sure there is a DHCP server (e.g. BOOTP DHCP server from Rockwell Automation) in the network.
2. Set all switch elements for address setting DIL1 (1...6) and DIL2 (1...2) to "OFF".
3. With Festo Field Device Tool (FFT) or EtherNet/IP Object, activate the "DHCP" option.
4. Switch bus node off and back on.

Saved addressing
1. Set all switch elements for address setting DIL1 (1...6) and DIL2 (1...2) to "OFF".
2. Set the IP address with the Festo Field Device Tool (FFT) or EtherNet/IP Object.
3. Switch bus node off and back on.

Static addressing
1. Set the first three octets of the IP address with the Festo Field Device Tool (FFT) or EtherNet/IP Object.
2. With all switch elements for address setting DIL1 (1...6) and DIL2 (1...2), set the fourth octet (Host-ID) of the IP address.
3. Switch bus node off and back on.

5.4 Resetting IP addresses to the factory setting

1. Set all switch elements for address setting DIL1 (1...6) and DIL2 (1...2) to "ON".
2. Switch bus node off and back on.
3. Set IP address via dynamic addressing ➔ 5.3.

5.5 Configuration with "Generic Ethernet Module"

Integrate participants into the project and configure them

➔ Documentation of the control system
Example with software STUDIO 5000 from ROCKWELL AUTOMATION:

i Integration and configuration of the bus node can only take place as long as there is **no** online connection to the controller ➔ Menu "Communications" ➔ "Go Offline"

1. In the "Controller Organizer" window in the "I/O Configuration" area, open the dialogue window "Select Module Type" with a click of the right mouse button on "Ethernet" and with the context command "New Module".
2. In the "Catalog", select the module "Generic Ethernet Module" from the table. To simplify the search, limit the selection with the text filter.
3. Click on "Create" to confirm the selection.

The "Module Properties" dialogue window opens.

4. In the "Name" text field, enter a designation for the bus node.
5. In the "Comm Format" list field, select the data format:
   - "Data - SINT" (standard)
   - "Data - SINT - With Statusbyte" with use of status bytes over a separate connection
   - "Data - INT" with usage of Word-based devices, e.g. analogue module
6. Calculate the total size of the assigned address space.
7. Dependent on the I/O assignment for "**Input**" and "**Output**", input the following connection parameters.

Connection Parameters	Instance	Size[1][2]
Variable Assembly Length Inputs[4]	101	Assigned address space
Variable Assembly Length Outputs	100	
Single Port Inputs	111	8 [3]
Single Port Outputs	110	8
Dual Port Inputs	121	16 [3]
Dual Port Outputs	120	16
Dual Port Inputs	131	32 [3]
Dual Port Outputs	130	32
Dual Port Inputs	141	64 [3]
Dual Port Outputs	140	64

1) Calculate the total size in bytes of the assigned address space
2) For "Data - INT": Cut value in half
3) Increase value by 2 prefixed status bytes only if DIL switch 2.5 = **ON** ➔ 5.2

8. Optional: To use status bytes over a separate connection, input the following parameters.

Connection Parameters	Instance	Size
Status Input	103	2
Status Output (Heartbeat)	254	–

9. For "Configuration", enter the following values: "Assembly Instance" = 102 and "Size" = 0
10. Enter IP address of the bus node.
11. Click on "Apply" to accept the inputs.
12. Close the dialogue window with "OK".

In the "Controller Organizer" window in the "I/O Configuration" area, the bus node appears under "Ethernet" as a newly integrated participant.

Using participant properties
➔ Documentation of the control system

Characteristic	Feature
Vendor Name	Festo Corporation
Vendor ID	26 = 1A$_h$
Device Type	12 = 0C$_h$
Product Code	6001 = 1771$_h$
Major Revision	1
Status	Current status of the bus node is displayed
Serial Number	
Product Name	CTEU-EP
Input Size/Output Size	0 ... 64 bytes
Assembly Instance	➔ Table "Connection Parameters"
Extended EtherNet/IP participant properties	
Min. bus cycle time (Requested Packet Interval, RPI)	1 ms
Connections	
Total of all connections	Max. 32
Exclusive Owner	Max. 1
Input only	Max. 32
Listen only	Max. 31 [1]

1) Only with simultaneous connection "Exclusive Owner" or "Input only"

5.6 Configuration with device master file (EDS file)

To simplify set-up of the CTEU-EP bus node, Festo makes a device description file (EDS) available ➔ www.festo.com/sp.
The EDS file contains all information required to integrate the CTEU-EP into the hardware configuration of your control system.

➔ ································· **Note**

Requirements
The software for configuration of your control system supports import of EDS files.

5.7 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 diagnostic addresses.

5.8 Setting up "QuickConnect" (QC) EtherNet/IP function

➔ Documentation of the control system
- Activate "QuickConnect" in the control system.
- Activate "QuickConnect" via attribute 12 of the TCP/IP interface object (factory setting: deactivated).

➔ ································· **Note**

With use of the EtherNet/IP function "QuickConnect", Auto-Negotiation and Crossover detection (Auto-MDI/MDI-X) are **not** available. Assignment of the pins for transmitted and received data at the TP2 connection is crossed.
- Deactivate Crossover detection in the hardware configuration of the network neighbour ("Partner Port").
- Set baud rate to 100 Mbit/s.
- Activate full-duplex mode.
- Select interconnecting cable dependent on pin assignment of network connection of product connected to TP2:
  - Crossover-cable with **identical** pin assignment of the ports
  - Patch-cable with **different** pin assignment of the ports

5.9 Check network communication

➔ ································· **Note**

Functional test
- The LED **NS** is illuminated green (with faultless communication between control system and bus node).
- The LEDs **TP1** or **TP2** flash green (➔ 7).

6 EtherNet/IP Objects

Object-class	Instance	Name	Type
1$_h$	1	Identity Object	CIP
4$_h$	➔ 5.5	Assembly Object ➔ "Connection Parameters"	
47$_h$	1	Device Level Ring Object	EtherNet/IP
48$_h$	1	QoS Object	
F5$_h$	1	TCP/IP-Interface Object	
F6$_h$	1...2	Ethernet Link Object	
64$_h$	1...64	Discrete Output Byte Object	CTEU
65$_h$	1...64	Discrete Input Byte Object	
67$_h$	1...2	Diagnostics Object (Status bytes)	
68$_h$	1...2	Slave Information Object	
69$_h$	1	System Object	
6A$_h$	1...2	I-Port Module Parameter Object	
6B$_h$	1...2	Port Configuration Object	
300$_h$	1...2	ISDU Access Object[1]	

1) ISDU = Indexed Service Data Unit

For detailed information on the objects ➔ www.festo.com/sp ➔ User documentation: "CTEU-EP" ➔ Appendix to operating instructions.

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 present (within the permissible range) – Load voltage is present (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 is 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 connected product is monitoring the load voltage and reports its status to the bus node.

X1 and X2 – Status of the internal communication between the bus node and the connected product "I-Port Device 1" or "I-Port Device 2"[1]

LED indicator	Status and significance
	LED illuminated green: – Normal operating status – I-Port Device 1 or 2 is connected 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 correctly, but the internal communication is malfunctioning – After commissioning, I-Port Device removed
	LED flashing red: – Error in the bus node
	Both LEDs illuminated orange: – Firmware update active
	Both LEDs flash orange – To locate the bus node ("module location"), e.g. during hardware configuration in the control system or for troubleshooting
○	LED is off: – No product connected to the bus node

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

NS – Network status

LED display	Status and significance
	LED illuminated green: – Normal operating status ("online") – Communication with the network is OK
	LED flashing green: – Communication with the network is OK – IP address is assigned – Connection is not configured
	LED illuminated red: – No communication to the network ("offline"), e.g. through invalid bus address (example: address conflict) or baud rate
	LED flashing red: – Communication with the network disrupted, time-out detected (Bus time-out)
	LED flashes orange: – To locate the connected product ("module location"), e.g. during hardware configuration in the control system or for troubleshooting
○	LED is off: – No network connection

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: – Data traffic
○	LED is off: – No network connected

8 Maintenance

No special measures.

9 Accessories

➔ www.festo.com/catalogue

10 Glossary

Term/abbreviation	Significance
QuickConnect	Operating mode of the bus node, guarantees a fast connection after restart of the network participants.
EtherNet/IP	Network protocol in automation technology based on Industrial Ethernet (TCP/IP) for data interchange between a higher-order control system (industry PC, PLC or IO Controller), network participants and field devices (Field Devices/Modules), e.g. valve terminals or drives ➔ www.odva.org
Modbus TCP	➔ www.modbus.org
PLC	Programmable logic controller, also designated system controller or controller for short (Programmable Logic Controller, PLC)

11 Technical data

➔ ································· **Note**

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

Electrical characteristics

Degree of protection through housing	IP65/IP67[1][2]
Protection against electric shock (protection against direct and indirect contact)	through the use of PELV circuits (Protective Extra-Low Voltage)
Disconnection of network connections for operating voltage power supply U$_{EL/SEN}$	Galvanically separated through transformer (up to 500 V)
CE mark[3] (see declaration of conformity) ➔ www.festo.com	In accordance with EU EMC Directive

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 characteristics

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 use in a typical industrial atmosphere. • Avoid condensation.
Materials – Housing – Cover – Fibre-optic cables – Threaded bushing M12 – Threaded bushing M3 – Seals – Screws	RoHS-compliant PA reinforced PA PC Brass, nickel-plated Brass NBR Steel, galvanized
Dimensions – Width – Length – Height	 40 mm 91 mm 39 mm
Weight (bus node without cables and sub-assembly)	98 g

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

Power supply

Operating voltage for bus node and connected products[1] – Nominal value – Tolerance range	 24 V DC 18 ... 30 V DC[2]
Load voltage for bus nodes 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$_{EL/SEN}$)	Typ. 65 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 electrical connection box CAPC	 Max. 4 A Max. 2 A per I-Port Device[4]
Power failure buffering	10 ms

1) Separate, external fuses are required for the operating and load voltage power supplies (no bus node-internal overload and polarity reversal protection for the products connected via X1 and X2).
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 per I-Port Device

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

Network-specific characteristics

Network protocol	EtherNet/IP or Modbus TCP
Supported protocols	– Cyclic data exchange – Simple Network Management Protocol (SNMP)
Supported functions	– QuickConnect (QC) – Device Level Ring (DLR) – Acyclic data access via Explicit Messaging – Address Conflict Detection (ACD) – Firmware update – Integrated Switch – System status via image table
System-specific functions	– Diagnostics information (system diagnosis, undervoltage, communication errors) – Web server (status of bus node and connected products, serial number, configuration)
Transmission technology	Switched Fast Ethernet; Design 100BaseTX
Transmission rate	10/100 Mbit/s, full-duplex/half-duplex
Bus cycle time (Requested Packet Interval, RPI)	≥ 1 ms
Network connections	2 x socket, M12, D-coded, 4-pin
Crossover detection	Auto-MDI/MDI-X[1]
Max. address volume inputs/outputs	– 64 bytes I, 64 bytes O, – 66 bytes I (with status bytes)

1) Only if QuickConnect is **not** active