GB

Operating instructions

Remote I/O module 16 DI EtherNet/IP IP65 / IP66 / IP67

AL4022

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.ifm.com.

1.1 Legal and copyright information

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All product names, pictures, companies or other brands used are the property of the respective rights owners.

1.2 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
!	Important note Non-compliance may result in malfunction or interference.
i	Information Supplementary note

1.3 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:

WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.

CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

1.4 Safety symbol on the device

Safety symbol on the device:

▶ Adhere to the operating instructions for the safe operation of the device.

1.5 Change history

Issue	Subject	Date
00	New creation of the document	04 / 2022
01	• Removed: ifm IoT Core chapter • Added: Chapter IoT-Core Visualizer (→ 🗋 30)	11 / 2022
02	• Added: UL applications – Connection technology, Connection technology (→ 🗋 16) • Added: UL applications – Derating, Derating behaviour (→ 🗋 18)	10 / 2023
03	• Corrected: Description LLDP Management Object, LLDP Management Object (Class Code: 0x109) (→ 🗋 65) • Changed: Input assembly 102 Input Assembly (Instance 102) (→ 🗋 51) • Changed: Output assembly 150, Output Assembly (Instance 150) (→ 🗋 54) • Changed: Supported parameter setting software, Supported parameter setting software (→ 🗋 22) • Changed: Screenshots IoT Core Visualizer	11 / 2024

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.

2.1 Cyber security

ATTENTION

Operating the machine in an unprotected network environment

▷ Unauthorised read or write access to data is possible.

▷ Unauthorised manipulation of the device function is possible.

▶ Check and restrict access options to the device.

3 Intended use

The device may only be used for the following purposes:

- Gateway between digital sensors and a higher-level control system

The device is designed for use outside of a control cabinet.

4 Function

4.1 Visual indication

The device displays the following indications:

- Status and error indication of the gateway and the system
- Status and activity indication of the Ethernet connection
- Status display of the voltage supply
- Status, error and short circuit/overload indication of the sensor ports

4.2 Visual indication

The device displays the following indications:

- Status and error indication of the EtherNet/IP gateway and the system
- Status and activity indication of the Ethernet connections
- Status of the US voltage supply
- Status and error indication of the sensor ports

4.3 Parameter setting

The device can be configured using the following options:

- Parameter setting software
  - ifm moneo OS + ifm moneo|configure
  - ifm moneo|configure free
- ifm IoT Core
  - IoT-Core Visualizer
- EtherNet/IP
  - Projection software

4.4 Inputs

Ports X01...X08 each have 2 digital inputs (type 2 according to EN 61131-3).

The digital inputs are connected to pins 2 and 4 of the ports.

4.4.1 Sensor supply

The device has a total of 8 sensor supplies (1 sensor supply per port).

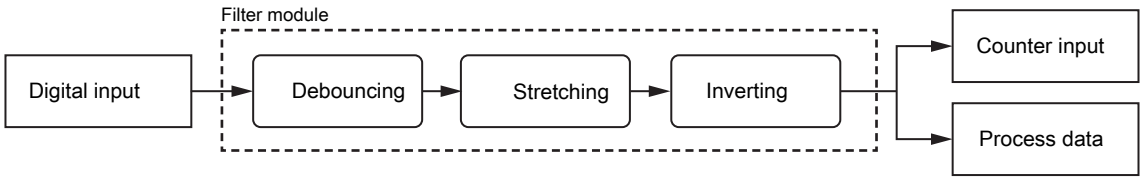
4.5 Digital input filters

The device pre-processes the digital input signals at ports X01...X08. The filter result is forwarded as a process value and as an input signal for a counter module.

The following filters can be applied to the digital input signals in the sequence specified.

1. Debounce

2. Hold
3. Invert



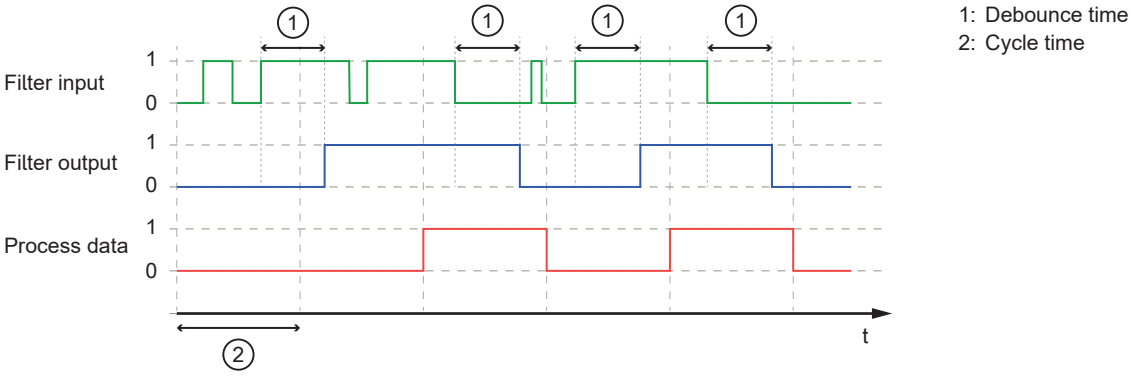
Each filter can be configured separately.

- Maximum input frequency: 4500 Hz
- Minimum detectable positive pulse width: 0.115 ms (+ positive edge)
- Minimum detectable negative pulse width: 0.115 ms (+ negative edge)

4.5.1 Debouncing

The filter suppresses noise signals. The filter provides the input signals at the filter output with a delay (debounce time). All signals shorter than the set debounce time are ignored by the filter.

Time diagram debounce filter:

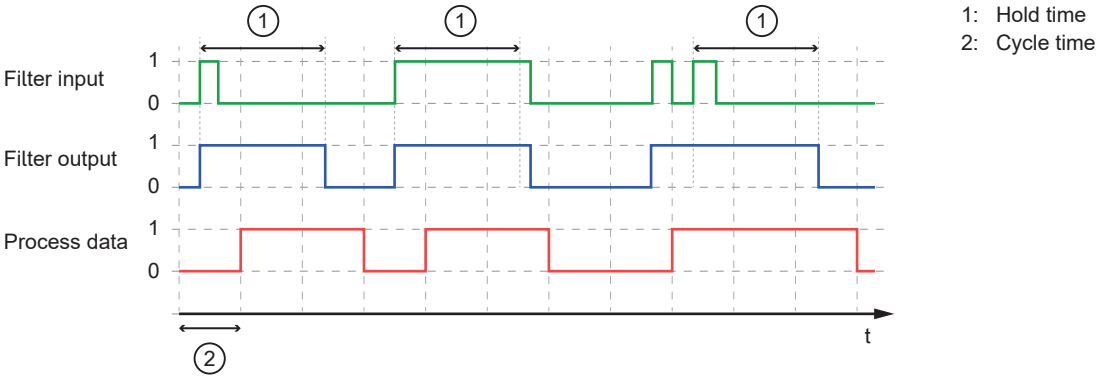


4.5.2 Stretching

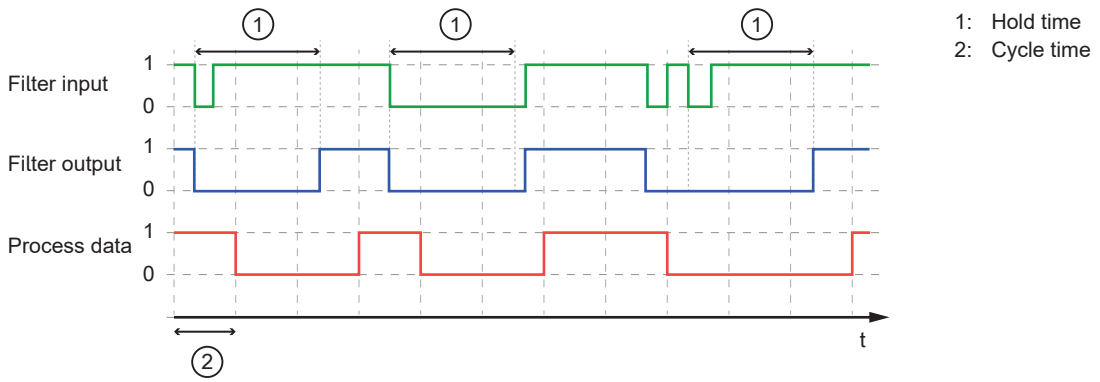
The filter stretches short input pulses. Level changes that occur during a stretching period are ignored. The filter is configured via the following parameters:

- Hold time: pulse duration to which short pulses are to be stretched. Pulses that are present for a longer time than the hold time are not stretched.
- Hold level: signal level to be stretched (HIGH or LOW)

Time diagram stretch filter (status HIGH):



Time diagram stretch filter (status LOW):



4.5.3 Inverting

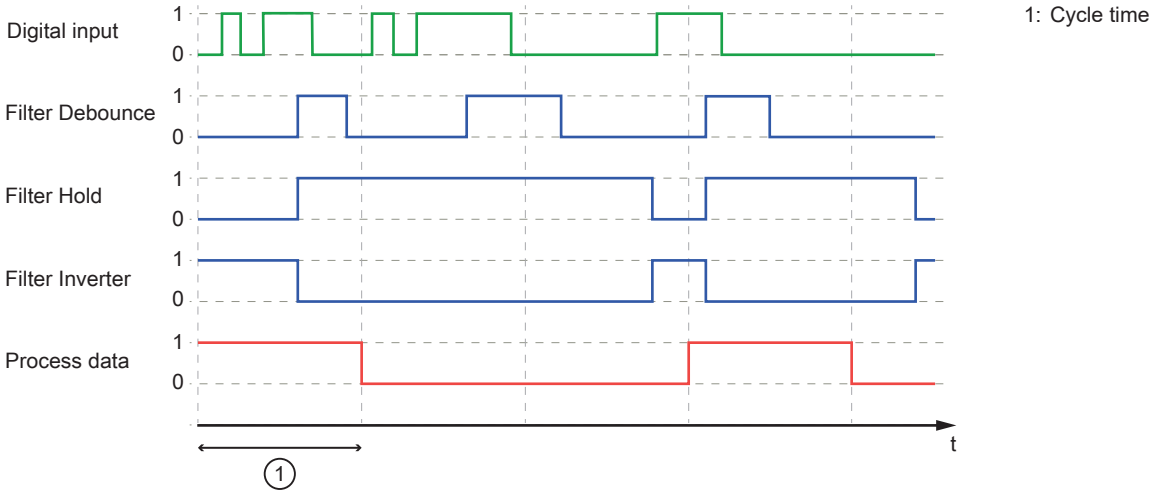
The filter inverts signals.

4.5.4 Filter combination

The filters can be combined.

Example: All 3 filters are activated

Time diagram:

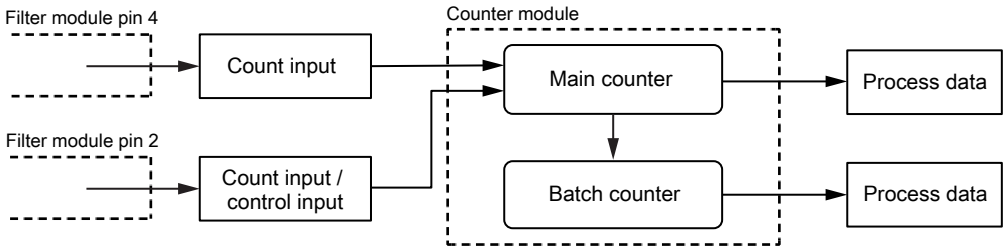


4.6 Counter

The device features one counter module per port.

A counter module consists of 2 separate counters:

- Main counter: The main counter counts the rising edges of the filtered digital input signals. The main counter has a value range that is defined by a threshold value. If the value range of the main counter is exceeded or not reached, an overflow or underflow signal is sent to the batch counter.
- Batch counter: The batch counter counts the overflow or underflow signals of the main counter.



A counter module can be operated in different operating modes. The following operating modes are available.

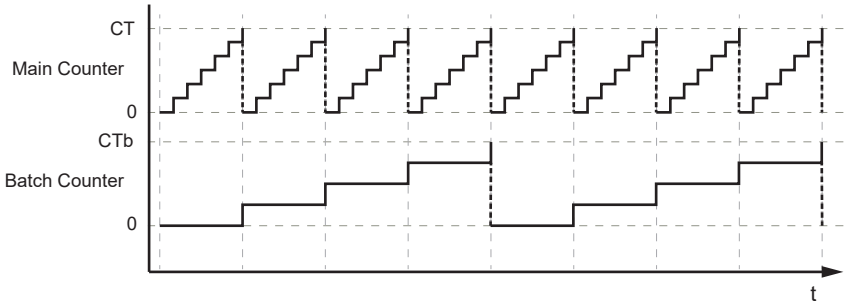
Maximum count frequency: 4500 Hz

4.6.1 Counter mode CTU

In CTU (Count Up) mode, the counter module operates as an up counter with overflow detection and overflow counter.

Behaviour:

- The initial value of the main counter is m = 0. The initial value of the batch counter is b = 0. The main counter has a threshold value CT. The batch counter has a threshold value CTb.
- If the counter module detects a positive edge at pin 4 of the port, the value of the main counter is incremented (m = m+1).
- If the main counter reaches the threshold value CT (m = CT), the counter value is reset (m = 0). Due to the overflow detection, the value of the batch counter is incremented (b = b+1).
- If the batch counter reaches the threshold value CTb (b = CTb), the counter value is reset (b = 0).

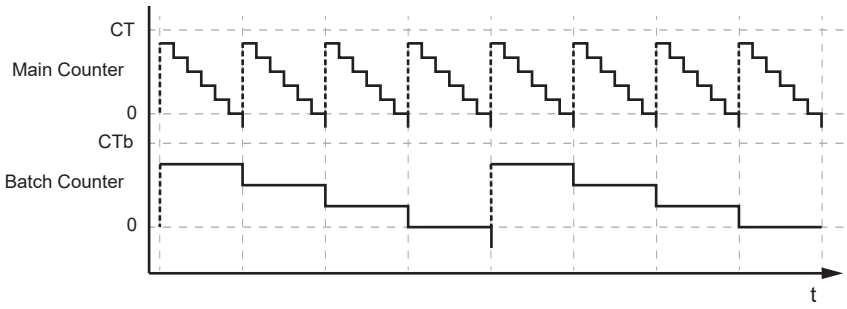


4.6.2 Counter mode CTD

In CTD (Count Down) mode, the counter module operates as a down counter with underflow detection and underflow counting.

Behaviour:

- The initial value of the main counter is m = 0. The initial value of the batch counter is b = 0. The main counter has a threshold value CT. The batch counter has a threshold value CTb.
- The first time a positive edge is detected at pin 4, the value of the main counter is set to the threshold value CT-1 (m = CT-1). At the same time, the value of the batch counter is set to the threshold value CTb-1 (b = CTb-1).
- If the counter module detects a positive edge at pin 4 of the port, the value of the main counter is decremented (m = m-1).
- If the main counter falls below 0, the counter value is reset to the threshold value (m = CT-1). Due to the underflow detection, the value of the batch counter is decremented (b = b-1).
- If the batch counter falls below 0, the counter value is reset to the threshold value (b = CTb-1).

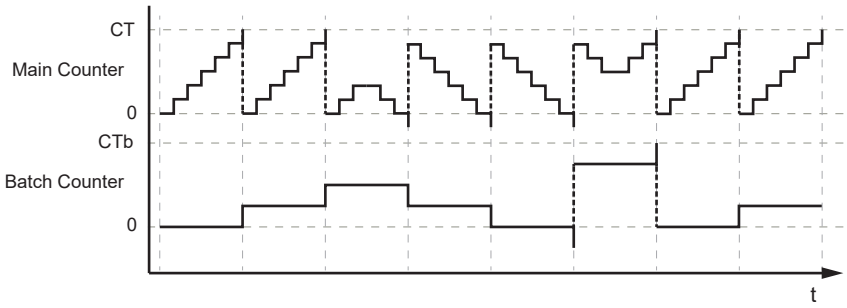


4.6.3 Counter mode CTUD

In CTUD (Count Up Down) mode, the counter operates as a simultaneous up and down counter with overflow and underflow detection.

Behaviour:

- The initial value of the main counter is m = 0. The initial value of the batch counter is b = 0. The main counter has a threshold value CT. The batch counter has a threshold value CTb.
- If the counter module detects a positive edge at pin 4 of the port, the value of the main counter is incremented (m = m+1).
- If the counter module detects a positive edge at pin 2 of the port, the value of the main counter is decremented (m = m-1).
- If the counter module simultaneously detects a positive edge at pin 4 and pin 2 of the port, the counter value of the main counter does not change.
- If the main counter reaches the threshold value CT (m = CT), the counter value is reset (m = 0). Due to the overflow detection, the value of the batch counter is incremented (b = b+1).
- If the main counter falls below 0, the counter value is reset to the threshold value (m = CT-1). Due to the underflow detection, the value of the batch counter is decremented (b = b-1).
- If the batch counter reaches the threshold value CTb (b = CTb), the counter value is reset (b = 0).
- If the batch counter falls below 0, the counter value is reset to the threshold value (b = CTb-1).



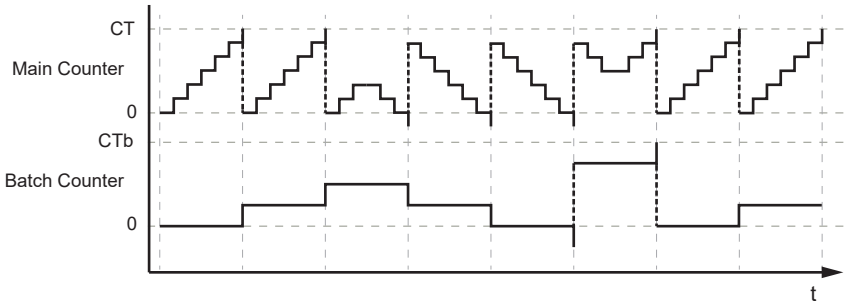
4.6.4 Counter mode CTDIR

In CTDIR (Count Direction) mode, the counter module operates either as an up counter with overflow detection or as a down counter with underflow detection. The counting direction can be set.

Behaviour:

- The initial value of the main counter is m = 0. The initial value of the batch counter is b = 0. The main counter has a threshold value CT. The batch counter has a threshold value CTb.
- The user can determine the counting direction. The counter module initially operates as an up counter with overflow detection.
- If the counter module detects a positive edge at pin 4 of the port and the counting direction of the port is set to “up”, the value of the main counter is incremented (m = m+1).

- If the main counter reaches the threshold value CT (m = CT), the counter value is reset (m = 0). Due to the overflow detection, the value of the batch counter is incremented (b = b+1).
- If the batch counter reaches the threshold value CTb (b = CTb), the counter value is reset (b = 0).
- If the counter module detects a positive edge at pin 4 of the port and the counting direction at pin 2 of the port is set to “down”, the value of the main counter is decremented (m = m-1).
- If the main counter falls below 0, the counter value is reset to the threshold value (m = CT-1). Due to the underflow detection, the value of the batch counter is decremented (b = b-1).
- If the batch counter falls below 0, the counter value is reset to the threshold value (b = CTb-1).



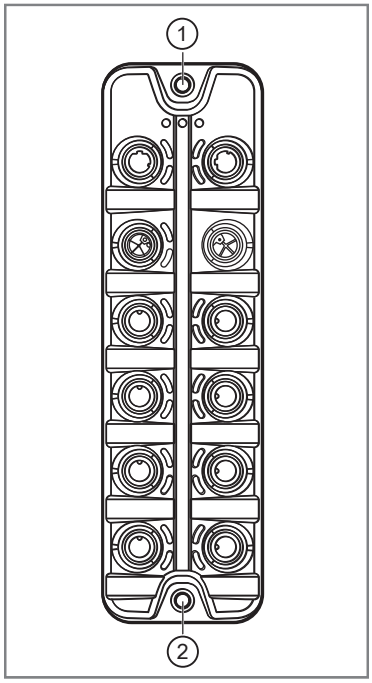
4.7 EtherNet/IP

The unit supports the following EtherNet/IP functions:

- Device type: EtherNet/IP adapter
- Device Level Ring (DLR) - Media Redundancy
- Address Conflict Detection (ACD)
- Quality of Service (QoS)

5 Installation

5.1 Overview



1: Upper mounting lug
2: Lower mounting lugs lug

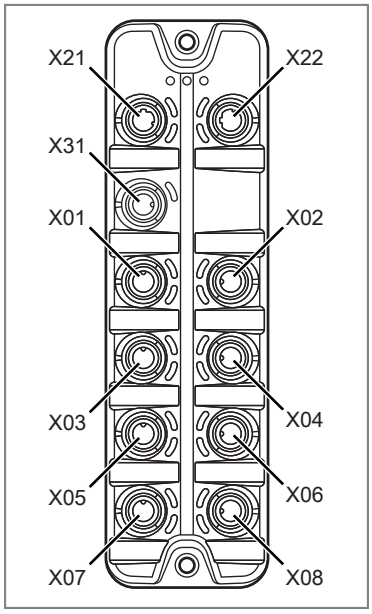
5.2 Install device

- ▶ Disconnect the power of the machine before installation.
- ▶ Use a flat mounting surface for installation.
- ▶ Please observe the maximum tightening torque.

Fasten the device onto the mounting surface using 2 M5 mounting screws and washers (tightening torque: 1.8 Nm).

6 Electrical connection

6.1 Overview



X21: Ethernet 1 (EtherNet/IP)
X22: Ethernet 2 (EtherNet/IP)
X31: Power IN
X01: Process connection 1 (sensor)
X02: Process connection 2 (sensor)
X03: Process connection 3 (sensor)
X04: Process connection 4 (sensor)
X05: Process connection 5 (sensor)
X06: Process connection 6 (sensor)
X07: Process connection 7 (sensor)
X08: Process connection 8 (sensor)

6.2 General wiring information

The device must be connected by a qualified electrician.

▶ Observe the national and international regulations for the installation of electrical equipment.

The device is only suitable for operation on SELV/PELV voltages.

This device contains components that may be damaged or destroyed by electrostatic discharge (ESD).

▶ Please observe the required precautions against electrostatic discharge!

The circuits are insulated from each other and from touchable surfaces of the device with basic insulation according to EN 61010-1.

The communication interfaces are insulated from each other and from touchable surfaces of the device with basic insulation according to EN 61010-1.

6.2.1 Connection technology

The threaded connections in the device correspond to the M12 standard. To ensure compliance with the specified protection rating, only cables that comply with this standard may be used. In the case of self-assembled cables, the system manufacturer is responsible for the protection rating.

▶ Use connectors with gold-plated contacts.

▶ During installation, place the connectors vertically so that the coupling nut will not damage the thread.

▶ Observe the coding of the connectors during installation.

▶ Cover unused connections with protective covers. Tightening torque: 1.3 ± 0.1 Nm

For UL applications:

To connect the device and the sensors, only use UL-certified cables belonging to category CYJV or PVVA with a minimum temperature of 80 °C verwenden (75 °C in case of a maximum ambient temperature of 40 °C).

6.3 Ethernet

The device is connected to the EtherNet/IP network via Ethernet ports X21 / X22 (e. g. EtherNet/IP control, additional EtherNet/IP device). In addition, the device can be connected to an IT network via the Ethernet ports. The user can access functions of the ifm IoT Core via the IT network (parameter setting software, IoT Core Visualizer).

Wiring:

1: TX+
2: RX+
3: TX-
4: RX-
5: n.c.

▶ Connect the device to the EtherNet/IP network via a free Ethernet port.

▶ Optional: Connect the device to the IT network via a free Ethernet port.

▶ For connection, use an M12 connector (minimum protection rating: IP65 / IP66 / IP67).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

6.4 Process connections

The sensors are connected to the device via the X01...X08 ports.

Maximum current rating of the ports: 3.6 A (for UL applications: 3.2 A).

The ports feature short-circuit / overload detection.

▶ Connect the sensors to the X01...X08 ports.

▶ For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67; max. cable length: 30 m).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

Wiring:

1: L+ (US)
2: IN2 DI2
3: L- (US)
4: IN1 DI1
5: FE

6.5 Voltage supply

The device is connected to the US supply voltage via the Power IN port.

The US supply voltage supplies the device and the sensors connected to the ports X01...X08.

The X31 port is equipped with overvoltage protection (US).

The X31 port is equipped with reverse polarity protection (US).

The X31 port is equipped with an inrush current limitation.

Wiring:

1: L+ (US)
2: n.c.
3: L- (US)
4: n.c.

▶ Disconnect power.

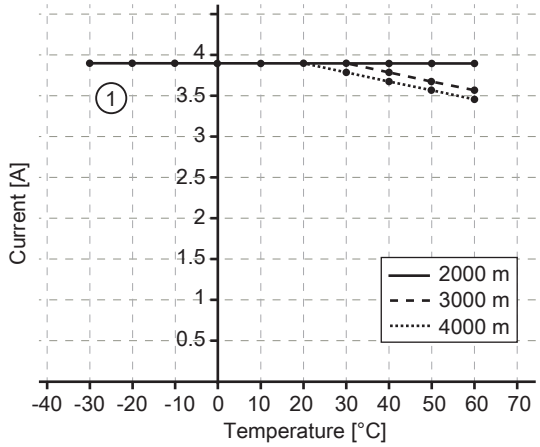
▶ Connect the device via the X31 port to 24 V DC (20...30 V SELV/PELV).

▶ For connection, use an A-coded M12 connector (with at least protection rating: IP65 / IP66 / IP67).

- ▶ Tighten the cable sockets according to the torque specifications indicated by the cable vendor. Maximum permissible tightening torque: 0.8 Nm
- ▶ Observe the derating behaviour of the device (→ Derating behaviour 🗋 18).

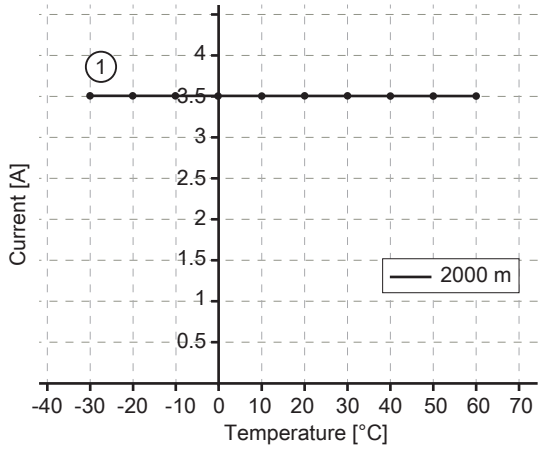
6.5.1 Derating behaviour

The current IUS available at ports X01...X08 depends on the ambient temperature of the device.



1: I_{US} at ports X01...X08

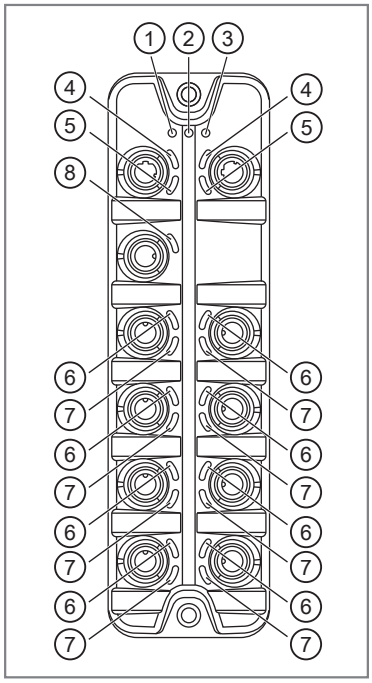
For UL applications:



1: I_{US} at ports X01...X08

7 Operating and display elements

7.1 LEDs



1: Status: RDY
2: Status: NET
3: Status: MOD
4: EtherNet/IP: LNK
5: EtherNet/IP: ACT
6: Process connection: DI1
7: Process connection: DI2
8: Power supply: US

7.1.1 Status

LED	Description	Colour	State	Description
RDY	Gateway status	-	Off	Not active or reboots
		Green	Flashes 3 s (1 Hz)	DCP signalling service initiated via fieldbus
			Flashes (5 Hz)	Error
			Flashes (200 ms on, 800 ms off)	Firmware update running
			On	OK
		Red	On	Error during firmware update (e.g. firmware not compatible)
NET	Network status	-	Off	Not powered, no IP address: device has no IP address or no voltage applied or voltage applied is too low
		Green / red / yellow	Flashes	Self test: Unit in self-test after start (→ MOD-LED)
		Green	Flashes (1 Hz)	No connection: no CIP connection established and no exclusive owner connection timeout
			On	Connected: device has IP address and at least one CIP connection established and no exclusive owner connection timeout
		Red	Flashes (1 Hz)	Connection timeout: device has IP address and exclusive owner connection timeout
			On	Duplicate IP: IP address used twice
MOD	EtherNet/IP status	--	Off	No power: no voltage is applied or the applied voltage is too low

LED	Description	Colour	State	Description
MOD	EtherNet/IP status	Green / red / yellow	Flashes	Self test: device in self-test during start
		Green	Flashes (2 Hz)	Standby: device is not configured
			On	Device operational: device functions reliably (normal operation)
		Red	Flashes (1 Hz)	Major recoverable fault: e.g. incorrect configuration
			On	Major unrecoverable fault: e.g. module failed

7.1.2 Ethernet

LED	Description	Colour	State	Description
LNK	Status of the connection	-	Off	No Ethernet connection
		Green	On	Ethernet connection established
ACT	Status of the data transmission	-	Off	No data transmission
		Yellow	Flashes	Data transmission

7.1.3 Voltage supply

LED	Description	Colour	State	Description
US	Power supply US status	-	Off	No supply voltage is applied or the applied supply voltage is too low (<4.5 V)
		Green	On	Supply voltage applied
		Red	On	Overvoltage, undervoltage, short circuit at sensor supply

7.1.4 Process connections

LED	Description	Colour	State	Description
DI1	Digital input signal level (pin 4)	Yellow	Off	Digital input - pin 4: LOW
			On	Digital input - pin 4: HIGH
DI2	Digital input signal level (pin 2)	Yellow	Off	Digital input - pin 2: LOW
			On	Digital input - pin 2: HIGH

8 Set-up

▶ Install the unit correctly.

▶ Establish a correct electrical connection with the device.

▷ Once connected to the supply voltage, the unit will start.

▷ The LEDs show status and error conditions.

▷ The unit is ready for operation.

▷ The device can be configured.

9 Settings

9.1 Parameter setting software

9.1.1 Supported parameter setting software

Supported parameter setting options:

- ifm moneo|IIoT Core On-Premises (art no. QM9112)
- ifm moneo|IIoT Core Cloud (art no. QCM100)
- ifm moneo|configure free

▶ For a correct installation: observe the installation instruction for ifm moneo.

▶ Install the desired parameter setting software.

▶ Activate the licences required for operation.

▷ The parameter setting software can be used for parameter setting of the device.

The configuration created with ifm moneo is overwritten when a Configuration Assembly Object is transferred to the device during connection to the EtherNet/IP PLC.

9.1.2 Establishing a connection to device

Requirements:

✓ The parameter setting software is correctly installed on the laptop / PC.

✓ The laptop / PC is connected to a free Ethernet port of the device.

▶ Start the parameter setting software.

▶ Scan the network for devices.

▷ The parameter setting software recognises the device.

▶ Optional: Configure the EtherNet/IP interface (→ 🗋 22)

▶ Establish a connection to the device.

▷ The parameter setting software can access the device parameters.

9.1.2.1 Configure the EtherNet/IP interface

The EtherNet/IP interface of the device can be configured using the following options:

- Manually: IP parameters are set by the user
- DHCP: IP parameters are set by a DHCP server in the network
- BOOTP: IP parameters are set via the Bootstrap Protocol

With the parameter setting software ifm moneo or ifm moneo|configure (SA), the IP parameters of the EtherNet/IP interface can only be set during the network scan. In the editor view of the device, the configuration of the EtherNet/IP interface is read-only.

▶ Start the parameter setting software.

▶ Configure the EtherNet/IP interface of the device.

▷ The device has a configured EtherNet/IP interface.

9.1.3 Fieldbus interface

The [fieldbus] menu provides access to the configuration of the fieldbus interface.

The fieldbus interface can only be configured via the fieldbus configuration software.

9.1.3.1 Reading the interface configuration

▶ Observe the notes on the configuration of the EtherNet/IP interface: Configure the EtherNet/IP interface (→ 🗋 22)

Available parameters:

Name	Description	Value range	Access
[dhcp]	Status of the DHCP client of the device	• Static IP: IP parameters are set by the user • DHCP: IP parameters are set by a DHCP server in the network • BOOTP: IP parameters are set via the Bootstrap Protocol	ro [1]
[ipaddress]	IP address of the EtherNet/IP interface	e.g. 192.100.0.10 192.168.1.250 (default)	ro [1]
[subnetmask]	Subnet mask of the network segment	e.g. 255.255.255.0 255.255.255.0 (default)	ro [1]
[ipdefaultgateway]	IP address of the network gateway	e.g. 192.100.0.1 0.0.0.0 (default)	ro [1]
[macaddress]	MAC address of the Ethernet interface	e.g. 00:02:01:0E:10:7F	ro [1]
[hostname]	Name of the device in the EtherNet/IP network	e.g. al4x2x	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the [fieldbussetup] > [network] menu.

▷ The menu page displays the current configuration of the EtherNet/IP interface.

9.1.3.2 Reading the connection status

Available information:

Name	Description	Value range	Access
[connectionstatus]	Status of the EtherNet/IP connection	• Disconnected: Not connected • Connected: Connected	ro [1]
[fieldbusfirmware]	Firmware version of the EtherNet/IP stack	e.g. 3.4.0.7 (EtherNet/IP Adapter)	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the [fieldbussetup] menu.

▷ The menu page displays the status of the EtherNet/IP connection.

9.1.4 Process connections

The [io] menu provides access to the parameters of the process connections.

9.1.4.1 Configuring the input filters

▶ Observe the notes on input filters: Digital input filters (→ 🗋 9)

Available parameters:

Name	Description	Value range	Access
[debounce_time]	Debounce time (= value * 0.1 ms)	• 0: 0 ms (default) … • 500: 50 ms	rw [1]
[hold_time]	hold time (= value * 0.1 ms)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
[hold_level]	hold level	• 0: hold LOW • 1: hold HIGH (default)	rw [1]
[invert]	inversion	• 0: do not invert (default) • 1: invert	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

▶ Select menu [io] > [port[n]] > [pin2] (n: 1...8).

▷ The menu page shows the available filter parameters for pin 2 of the port.

▶ Set the parameters.

▶ Select menu [io] > [port[n]] > [pin4] (n: 1...8).

▷ The menu page shows the available filter parameters for pin 4 of the port.

▶ Set the parameters.

▶ Write the changed values to the device.

▷ The digital input filters have been configured.

9.1.4.2 Configuring the counter modules

▶ Observe the notes on counter modules: Counter (→ 🗋 11)

If the operating mode of a counter module is changed, the current counter values will be reset and any active events will be deleted.

Available parameters:

Name	Description	Value range	Access
[mode]	Operating mode of the counter module	• CTU (up counter): up counter (default) • CTD (down counter): Down counter • CTUD (up counter / down counter): up and down counter • CTDIR (direction counter): up or down counter	rw [1]

Name	Description	Value range	Access
[pin2_function]	Pin 2 function of the port (→ Observe note!)	• N/C: no function (default) • Counter Edge Input 2: counting pulse (rising edge) • Count Direction: counting direction • Reset (Main & Batch Counter): reset main counter and batch counter • Disable (Main & Batch Counter): disable main counter and batch counter	rw [1]
[count_direction_selection]	Control instance for selecting the counting direction (→ Observe note!)	• Pin 2 Count Direction: pin 2 of the port (default) • IoT / PLC Count Direction: Fieldbus PLC	rw [1]
[main_threshold]	Main counter threshold (CT)	• 1 … • 4294967295 (default)	rw [1]
[batch_threshold]	Batch counter threshold (CTb)	• 1 … • 65535 (default)	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

For the parameters [pin2_function] and [count_direction_selection] all shown parameter values can be selected. It is not checked whether these make sense. For each counter operating mode (parameter [mode]), the table below indicates the valid value ranges (✓: valid setting; ✕: invalid setting):

[mode]	[pin2_function]					[count_direction_selection]	
	N/C	Counter Edge Input Pin2	Count Direction	Reset (Main & Batch Counter)	Disable (Main & Batch Counter)	Pin 2 Count Direction	IoT / PLC Count Direction
CTU	✓	✕	✕	✓	✓	✕	✕
CTD	✓	✕	✕	✓	✓	✕	✕
CTUD	✕	✓	✕	✕	✕	✕	✕
CTDIR	✕	✕	✓	✕	✕	✓	✕
CTDIR	✓	✕	✕	✓	✓	✕	✓

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select menu [io] > [counter[n]] (n: 1...8).

▷ The menu page displays the configuration options of the counter.

▶ Configure the counter module.

▶ Optional: Configure additional counter modules.

▶ Write the changed values to the device.

▷ The counter modules are configured.

9.1.5 Process data

The dashboard area provides access to the device's process data.

To display the dashboard area:

✓ The parameter value editor for the device is open.

▶ In the vertical bar at the right side of the screen: Click on ⏲.

▷ The dashboard view is displayed.

To hide the dashboard area:

✓ The dashboard area is displayed.

▶ Click on the vertical bar in the middle of the screen: Click on ⏲.

▷ The dashboard view is hidden.

9.1.5.1 Reading digital input data

Available information:

Name	Description	Value range	Access
[digital]	Signal level of the digital input channel (after filtering)	• LOW: off • HIGH: on	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ In the vertical bar at the right side of the screen: Click on ⏲.

▷ The dashboard view is displayed.

▷ The view shows the current signal levels of the digital outputs at pin 2 and pin 4 in substructure [io/port[n]] (n: 1...8).

ℹ The displayed signal levels are the filtered input data.

9.1.5.2 Reading counter values

Available parameters:

Name	Description	Value range	Access
[maincounter_value]	Main counter reading	0…4294967294	ro [1]
[batchcounter_value]	Batch counter value	0…65534	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ In the vertical bar at the right side of the screen: Click on ⏲.

▷ The dashboard view is displayed.

▷ In substructure [io/counter[n]] (n: 1...8), the current counter values of the main and batch counters are displayed.

9.1.5.3 Controlling counter modules

Available parameters:

Name	Description	Value range	Access
[disable]	Disable main counter and batch counter	• 0: counter module is active (default) • 1: counter module is not active	rw [1]
[reset]	Reset main counter, batch counter and CT and CTb thresholds to initial values	• 0: no action (default) • 1: reset	rw [1]

Name	Description	Value range	Access
[direction] [2]	Set the counting direction for the main counter and the batch counter	• 0: up (default) • 1: down	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[2] only effective if operating mode of counter module = `CTDIR`

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ In the vertical bar at the right side of the screen: Click on ⏲.

▷ The dashboard view is displayed.

▷ In substructure [io/counter[n]] (n: 1...8), the available control signals of the counter modules are displayed.

▶ Optional: Disable the counter module.

▶ Optional: Reset the counter module.

▶ Optional: Set the counting direction of the counter module.

▶ Write the changed parameter values to the device.

▷ The selected actions are executed.

9.1.5.4 Reading status and diagnostic information

Available information:

Parameter	Description	Value range	Access
[temperature]	Temperature of the device (value in °C)	-30…80	ro [1]
[voltage_us]	Present voltage value of the device supply US (value in mV)	0…40000	ro [1]
[supervisionstatus_us]	Status of the device supply US	• 0: No error • 1: Error	ro [1]
[current_us]	Present current value of the device supply US (value in mA)	0…40000	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ In the vertical bar at the right side of the screen: Click on ⏲.

▷ The dashboard view is displayed.

▷ The view shows the device's status and diagnostic information in the [processdatamaster] substructure.

9.1.6 Device information

The [deviceinfo] menu provides access to the device's identification information.

9.1.6.1 Reading identification information

Available information:

Name	Description	Value range	Access
[productcode]	Article number	AL4022	ro [1]
[devicefamily]	Device family	Ethernet modules	ro [1]
[vendor]	Manufacturer	ifm electronic gmbh	ro [1]
[swrevision]	Firmware revision	e.g. AL4x2x_fw_eip_1.4.0.137	ro [1]
[hwrevision]	Hardware revision (status)	e.g. AA	ro [1]
[bootloaderrevision]	Bootloader version	e.g. AL4xxx_bl_1.2.0.35	ro [1]
[serialnumber]	Serial number	e.g. 0002043100003	ro [1]
[fieldbustype]	Fieldbus	EtherNet/IP	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the menu option [deviceinfo].

▷ The menu page displays the identification information of the device.

9.1.7 Device ID

Das Menü [devicetag] bietet Zugriff auf die Gerätekennung.

9.1.7.1 Setting the application tag

Available parameters:

Parameter	Description	Value range	Access
[applicationtag]	Application-specific identifier of the device in moneo	e.g. plant 1 machine 3	rw [1]

[1] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select [devicetag] menu.

▶ Enter the application identifier.

▶ Write the changed values to the device.

▷ The device can be identified by the selected application tag.

9.1.8 Device control

Das Menü [firmware] bietet Zugriff auf die Funktionen zur Steuerung des Geräts.

9.1.8.1 Resetting the device

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the [Firmware] menu.

▶ Click on [factoryreset].

▷ The device is reset to factory settings.

▷ All parameters are set to their default values.

9.1.8.2 Restarting the device

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the [Firmware] menu.

▶ Click on [Reboot].

▷ The device will be restarted.

▷ All set parameter values will be retained.

9.1.8.3 Reading the firmware version

Available information:

Parameter	Description	Value range	Access
[version]	Firmware version	e.g. AL4x2x_fw_eip_1.4.0.137	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the [Firmware] menu.

▷ The menu page displays the firmware version of the device.

9.2 IoT-Core Visualizer

The IoT Core Visualizer provides a graphical user interface to access the functions of the ifm IoT Core.

9.2.1 Starting the ifm IoT Core Visualizer

To start the IoT Core Visualizer:

Requirements:

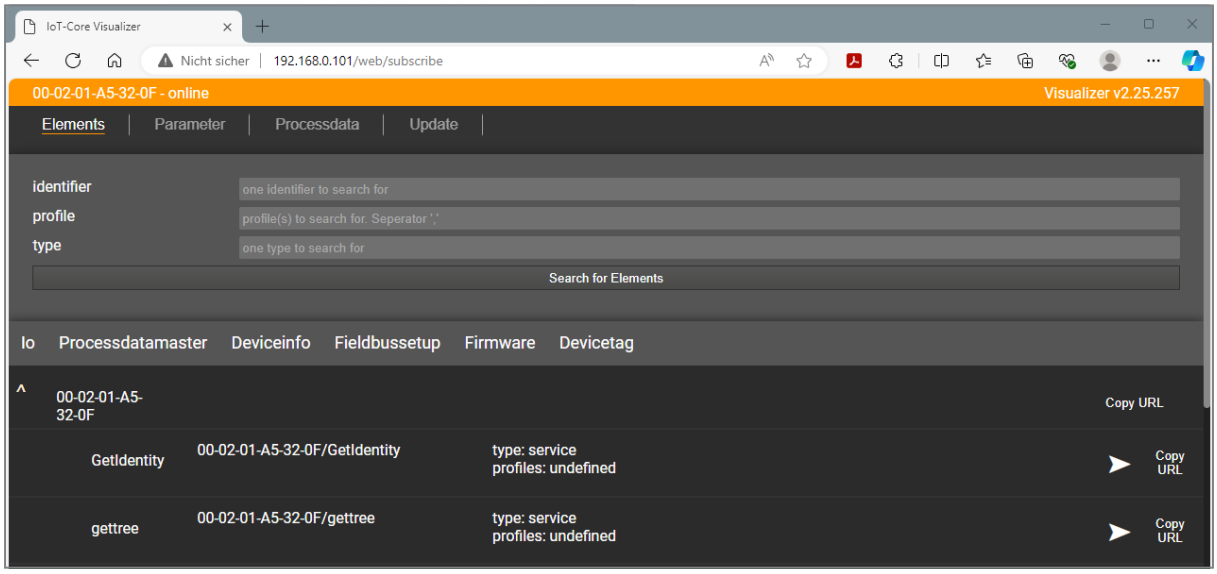
✓ The laptop / PC is connected directly or via a suitable network coupling element (e.g. switch) to a EtherNet/IP port (X21 / X22) of the device.

✓ EtherNet/IP interface has been configured.

▶ Start web browser.

▶ Go to the following URL: http://<ip-address> (e.g. `http://192.168.0.10`)

▷ The web browser displays the start page of the IoT Core Visualizer.



The navigation menu gives the user access to the following functions:

- [Elements]: Searching for elements of the IoT Core (→ 🗋 31)
- [Parameter]: Configuring the device (→ 🗋 32)
- [Processdata]: Accessing the process data (→ 🗋 35)
- [Update]: Update firmware (→ 🗋 38)

9.2.2 Searching for elements of the IoT Core

The [Elements] menu page allows you to search the IoT Core tree for elements with specific properties and output the results.

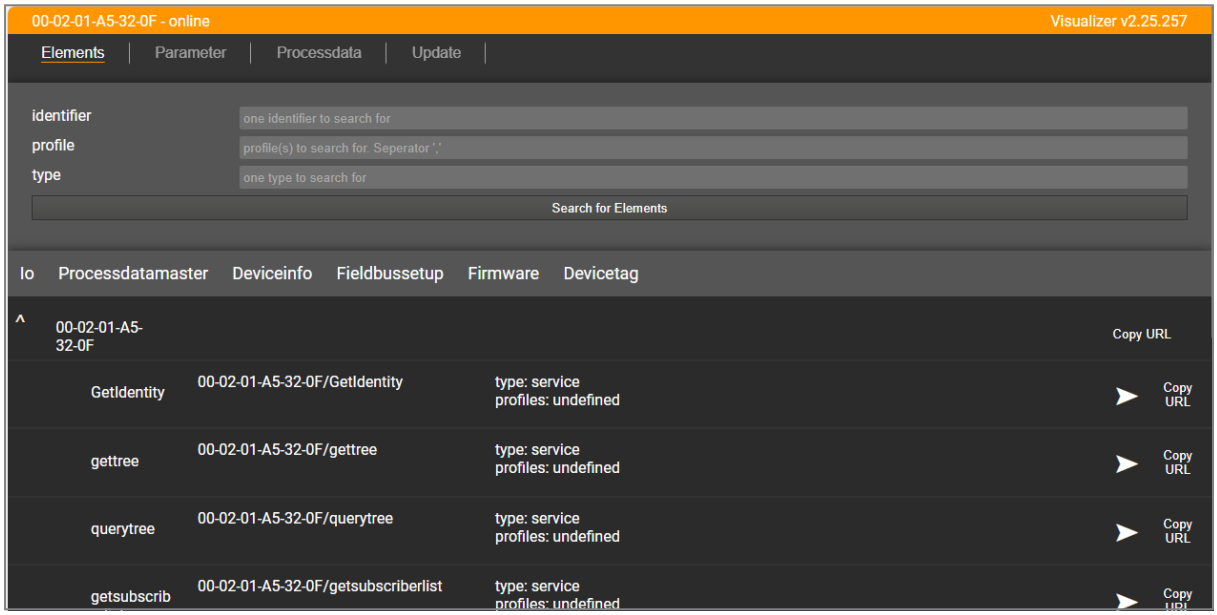
The following properties can be searched for:

- [identifier]: Name of the element
- [profile]: Profile of the element
- [type]: Type of the element

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Elements] menu is active.



▶ Select the search criteria for the required element in the selection lists [identifier], [profile] and [type].

▶ Click on [Search for…].

▷ IoT Core Visualizer searches the device description for elements with selected search criteria.

▷ The result list shows all the elements found.

9.2.3 Configuring the device

The [Parameter] menu page provides access to the configuration options of the device.

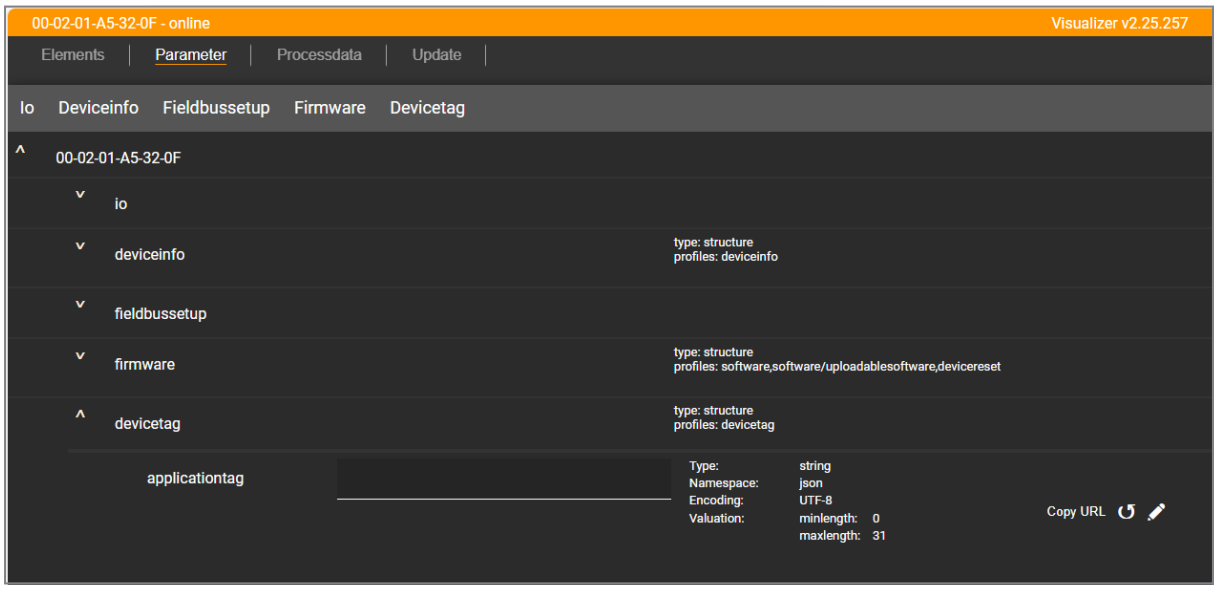
The configuration created with the IoT Core Visualizer will be overwritten when a Configuration Assembly Object is transferred to the device during connection to the EtherNet/IP PLC.

Requirements:

✓ IoT Core Visualizer has been started.

▶ Select the [Parameter] menu.

▷ The menu page shows the available parameters of the device.



9.2.3.1 Reading the configuration of the EtherNet/IP interface

Available parameters:

Name	Description	Values	Access
[network] > [dhcp]	Status of the DHCP client	• Static IP: Static IP address • DHCP: DHCP (Dynamic Host Configuration protocol) • BOOTP: BOOTP (Bootstrap Protocol)	ro [1]
[network] > [ipaddress]	IP address of the Ethernet interface	e.g. 192.200.0.100 • 192.168.1.250 (default)	ro [1]
[network] > [subnetmask]	Subnet mask of the network segment	e.g. 255.255.192.0 • 255.255.255.0 (default)	ro [1]
[network] > [ipdefaultgateway]	IP address of the network gateway	e.g. 192.200.63.1 • 0.0.0.0 (default)	ro [1]
[network] > [macaddress]	MAC address of the Ethernet interface	e.g. 00:02:01:0E:10:7C	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [fieldbussetup] > [network] submenu.

▷ The menu page displays the current configuration of the EtherNet/IP interface.

9.2.3.2 Configuring input filters

▶ Observe the notes on input filters: Digital input filters (→ 🗋 9)

Available parameters:

Name	Description	Value range	Access
[debounce_time]	Debounce time (= value * 0.1 milliseconds)	• 0: 0 ms (default) … • 500: 50 ms	rw [1]
[hold_time]	Hold time (= value * 0.1 milliseconds)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
[hold_level]	Hold level	• low: hold LOW • high: hold HIGH (default)	rw [1]
[invert]	Inversion	• signal not inverted: do not invert (default) • signal inverted: invert	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select submenu [io] > [port[n]] (n: 1...8).

▷ The menu page shows the current settings of the digital input filters on pin 2 and pin 4 of the port.

▶ Set the parameters.

▶ Click on ✎ to save the changes to the device.

▷ The filters of the digital inputs are configured.

9.2.3.3 Configuring counter modules

▶ Observe the notes on counter modules: Counter (→ 🗋 11)

If the operating mode of a counter module is changed, the current counter values will be reset and any active events will be deleted.

For the parameters [pin2_function] and [count_direction_selection] all shown parameter values can be selected. It is not checked whether these make sense. For each counter operating mode (parameter [mode]), the table below indicates the valid value ranges (✓: valid setting; ✕: invalid setting):

[mode]	[pin2_function]					[count_direction_selection]	
	No function	Counting pulse	Counting direction	Reset main counter and batch counter	Disable main counter and batch counter	Pin 2	IoT Core / Fieldbus PLC
CTU	✓	✕	✕	✓	✓	✕	✕
CTD	✓	✕	✕	✓	✓	✕	✕
CTUD	✕	✓	✕	✕	✕	✕	✕
CTDIR	✕	✕	✓	✕	✕	✓	✕
CTDIR	✓	✕	✕	✓	✓	✕	✓

Available parameters:

Name	Description	Value range	Access
[mode]	Operating mode of the counter module	• CTU (up counter): up counter (default) • CTD (down counter): down counter • CTUD (up counter / down counter): up and down counter • CTDIR (direction counter): up and down counter with selectable counting direction	rw [1]
[pin2_function]	Pin 2 function of the port (→ Observe note!)	• N/C: no function (default) • Counter edge input 2: counting pulse (rising edge) • Count direction: counting direction • Reset (main & batch counter): reset main counter and batch counter • Disable (main & batch counter): disable main counter and batch counter	rw [1]
[count_direction_selection]	Control instance for selecting the counting direction (→ Observe note!)	• Pin 2 count direction: pin 2 (default) • IoT / PLC count direction: IoT Core / Fieldbus PLC	rw [1]
[main_threshold]	Main counter threshold (CT)	• 1 … • 4294967295 (default)	rw [1]
[batch_threshold]	Batch counter threshold (CTb)	• 1 … • 65535 (default)	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select submenu [io] > [port[n]] > [counter] (n: 1...8).

▷ The menu page shows the current settings.

▶ Set the parameters.

▶ Click on ✎ to save the changes.

▷ The counter modules are configured.

9.2.3.4 Reading device information

Available information:

Name	Description	Value range	Access
[productcode]	Article number	AL4022	ro [1]
[vendor]	Vendor	ifm electronic	ro [1]
[devicefamily]	Device family	Ethernet modules	ro [1]
[serialnumber]	Serial number (12 digits)	e.g. 000174210161	ro [1]
[hwrevision]	Hardware revision	E.g. AA	ro [1]
[swrevision]	Firmware version	E.g. AL4x2x_fw_eip_1.4.0.137	ro [1]
[bootloaderrevision]	Bootloader version	E.g. AL4xxx_bl_1.2.0.35	ro [1]
[fieldbustype]	Fieldbus	EtherNet/IP	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [deviceinfo] submenu.

▷ The menu page shows device information.

9.2.3.5 Reading the firmware version

Available information:

Name	Description	Value range	Access
[version]	Firmware version	AL4x2x_fw_eip_1.4.0.137	ro [1]
[type]	Type	• firmware: Firmware type	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [firmware] submenu.

▷ The menu page shows the available information.

9.2.3.6 Setting the application tag

Available parameters:

Name	Description	Value range	Access
[applicationtag]	Device designation in monitoring software	E.g. “factory 2 plant 1”	rw [1]

[1] Read and write

32 bytes are available on the device for storing the `applicationtag` parameter. If the memory range is exceeded, the device will abort the write process (diagnostic code 400).

▶ When writing the `applicationtag` parameter, observe the different memory requirements of the individual UTF-8 characters (characters 0-127: 1 byte per character; character >127: more than 1 byte per character).

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [devicetag] submenu.

▷ The menu page shows the current settings.

▶ Enter the application tag.

▶ Click on ✎ to save the changes to the device.

▷ The new application tag is set.

9.2.4 Accessing the process data

The [Processdata] menu page provides access to the process data of the device.

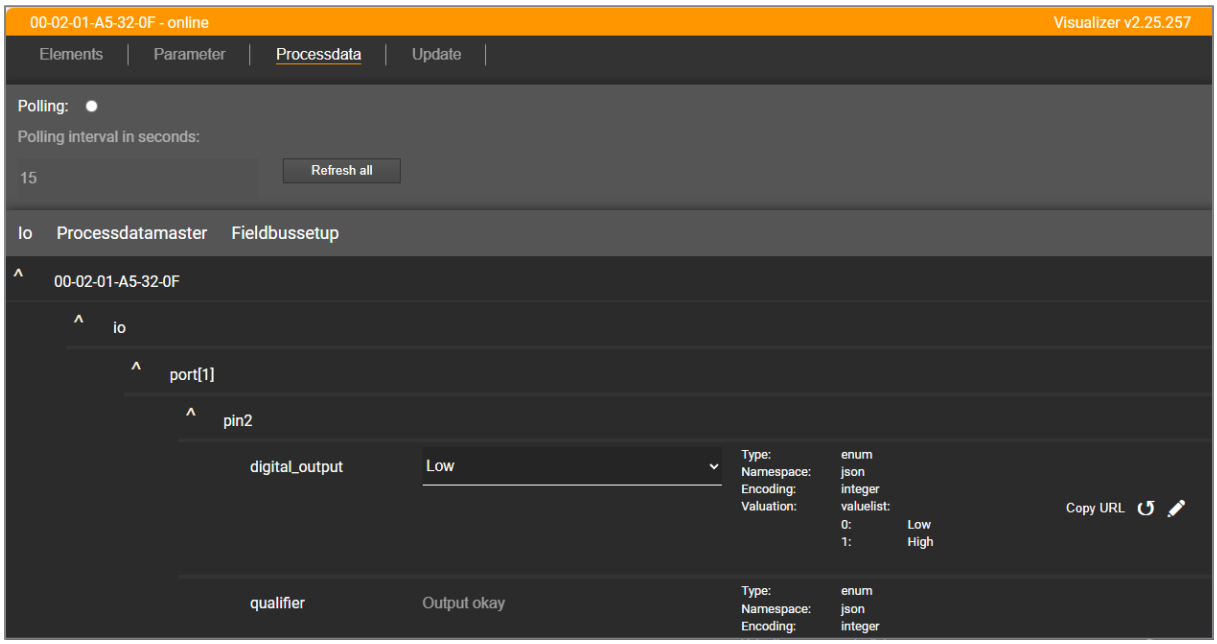
Requirements:

✓ IoT Core Visualizer has been started.

▶ Select the [Processdata] menu.

▷ The menu page shows the substructures of the device description that contains the process data.

▷ The current process values are displayed.



▶ Optional: In the header, activate the [Polling] option and set the polling interval.

▷ The process values will be refreshed with the set interval.

▶ Optional: Click on ↻ next to an element to manually refresh the process value.

9.2.4.1 Reading digital input data

Available information:

Name	Description	Value range	Access
[digital_input]	Process value digital input (after filtering)	• Low: LOW • High: HIGH	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select submenu [io] > [port[n]] (n: 1...8).

▷ The menu page shows the digital input data on pin 2 and pin 4 of the port.

9.2.4.2 Reading counter values

Available information:

Name	Description	Value range	Access
[maincounter_value]	Current main counter value	0…4294967295	ro [1]
[batchcounter_value]	Current batch counter value	0…65535	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select submenu [io] > [port[n]] > [counter] (n: 1...8).

▷ The menu page shows current counter values of the counter module.

9.2.4.3 Controlling counter modules

Available control signals:

Name	Description	Values	Access
[reset]	Reset counter module (reset counter and threshold values to default values)	• inactive: no action (default) • active: reset	rw [1]
[disable]	Disable counter module	• inactive: enable counter (default) • active: disable counter	rw [1]
[direction] [2]	Set counting direction for main counter and batch counter	• up: up (default) • down: down	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[2] only effective if operating mode of counter module = `CTDIR`

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select submenu [io] > [port[n]] > [counter] (n: 1...8).

▷ The menu page shows the available services.

▶ Set the control signals.

▶ Click on ✎ to send the control signals to the device.

▷ The control signals are executed.

9.2.4.4 Reading status and diagnostic information

Available information:

Name	Description	Value range	Access
[temperature]	Device temperature (value in °C)	E.g. 52: 52 °C	ro [1]
[voltage_us]	Present voltage value of device supply US (value in mV)	E.g. 25236: 25236 mV	ro [1]
[current_us]	Present current value of device supply US (value in mA)	E.g. 82: 82 mA	ro [1]
[supervisionstatus_us]	Status of device supply US	• OK: no error • Fault: error	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [processdatamaster] submenu.

▷ The menu page shows status and diagnostic information.

9.2.4.5 Reading the connection status

Available information:

Name	Description	Value range	Access
[connectionstatus]	Status of the connection to the EtherNet/IP network	• disconnected: not connected • Connected: connected	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [fieldbussetup] submenu.

▷ The menu page shows the connection status.

▷ The menu page shows the number of disconnections.

9.2.5 Update firmware

The [Update] menu page allows you to update the firmware of the device:

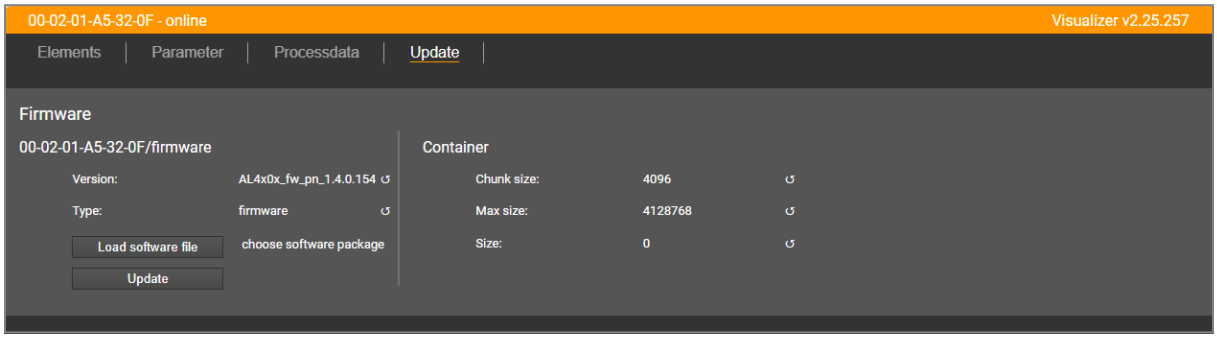
Requirements:

✓ IoT Core Visualizer has been started.

✓ New firmware has been downloaded. documentation.ifm.com

▶ Select the [Update] menu.

▷ Menu page shows information about the current firmware version.



▶ Click on [Load software file] and select the new firmware file (*.bin).

▶ Click on [Update] to start the update process.

▷ The firmware of the device is updated.

▷ The progress of the update process is displayed.

▷ After successful update: The device reboots automatically.

9.3 EtherNet/IP

9.3.1 Register the EDS file

For the mapping of the device in an EtherNet/IP configuration software ifm provides an Electronic Device Description (EDS). The device description file contains identification information, supported parameters, process data and fieldbus objects. The user can download the EDS file from the website documentation.ifm.com.

To add the device to the device catalogue of RSLogix 5000:

Requirements:

✓ Download the EDS file of the device.

▶ Start the EtherNet/IP projection software "RSLogix 5000”.

▶ Select [Tools] > [EDS Hardware Installation Tool].

▷ The wizard starts.

▶ Register the downloaded EDS file using the wizard.

▷ The device is added to the device catalogue of the EtherNet/IP projection software.

▷ RSLogix 5000 can access functions and data of the device.

9.3.2 Integrate the device into the EtherNet/IP project

The device is integrated into the project as an Ethernet module.

Requirements:

✓ The EDS file of the device is installed correctly.

▶ Start RSLogix 5000.

▶ Create a new EtherNet/IP project or open an existing one.

▶ Add the required components (e.g. PLC, IO scanner) to the automation network and configure them.

▶ In [Controller Organizer]: Open the folder [I/O Configuration].

▶ Right-click on the node [Ethernet].

▷ The context menu appears.

▶ In the context menu, select [New module…].

▷ The module selection dialogue appears.

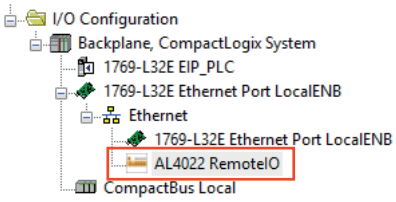
▶ Select the device in the catalogue and click on [Create].

▷ The [New Module]dialogue window appears.

▶ Enter the name and IP address and confirm with [OK].

▷ The device has been integrated in the EtherNet/IP project.

Example:



9.3.3 Set connection types

The connection types determine the type and scope of the available parameters and process data of the device.

Supported connection types:

Connection type	Configuration assembly	Input assembly	Output assembly
Exclusive owner	Instance 198	Instance 102	Instance 150
Input only	Instance 199	Instance 101	Instance 193 (empty)
Listen only	Instance 199	Instance 101	Instance 192 (empty)

Detailed information on the Assembly Objects:

If an “Exclusive owner” connection exists between the IO scanner and the device, the device will switch to the “Implicit protection mode”.

▷ In the “Implicit protection mode”, acyclic access to the CIP object “Identity Object” and its functions (e.g. reset device) is not possible. Any access attempts will be denied with the error message `Device state conflict (0x10)`.

To set the connection type:

Requirements:

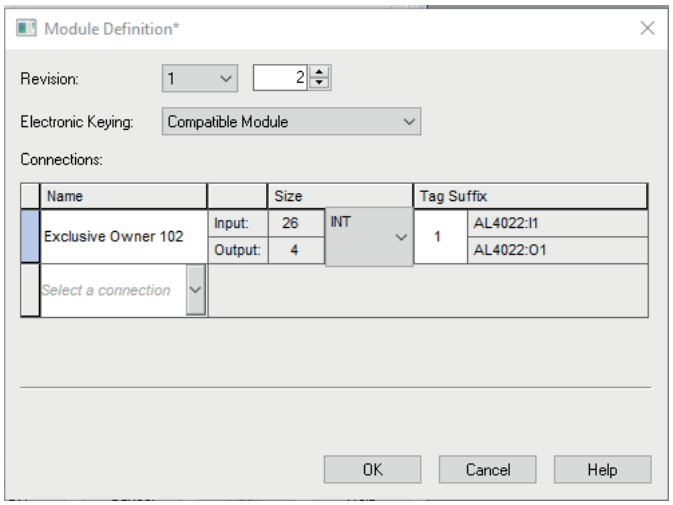
✓ Device is integrated in EtherNet/IP project.

▶ In [Controller Organizer]: Double-click on the device node.

▷ The device configuration dialogue appears.

▶ Click on [Change...].

▷ The [Module Definition] dialogue appears.



▶ Select the required connection type from the list [Connections].

▶ If necessary, set the data type to [INT].

▶ Click on [OK] to acknowledge the input.

▷ Based on the selected connection type, RSLogix 5000 generates the controller tags of the device (`Configuration`, `Input`, `Output`).

9.3.4 Configure input filters

▶ Observe the notes on input filters: Digital input filters (→ 9)

The filters of the digital inputs can be configured via the following objects:

- Configuration Assembly (Instance 198) (→ 🗋 45)
- Configuration Assembly (Instance 199) (→ 🗋 48)

These is a separate configuration area for each input filter.

Available parameters per input filter:

- debounce time
- hold time
- hold level
- signal inversion

Requirements:

✓ Device is integrated in EtherNet/IP project.

✓ Connection type [Exclusive Owner] or [Inputs only] is set.

▶ In [Controller Organizer], select the device folder.

▶ Select [Controller Tags].

▷ [Controller Tags] displays the configuration of the device (`DeviceName.C:Data`).

▶ Set the parameters.

▷ The input filters have been configured.

9.3.5 Configure counters

▶ Observe the notes on counter modules: Counter (→ 🗋 11)

The counter modules can be configured via the following objects:

- Configuration Assembly (Instance 198) (→ 🗋 45)

These is a separate configuration area for each counter module.

Available parameters per counter module:

- Operating mode of the counter module
- threshold CT of the main counter
- threshold CTb of the batch counter
- function of pin 2 of the port
- instance for selecting the counting direction (only with CTDIR operating mode)

Requirements:

✓ Device is integrated in EtherNet/IP project.

✓ Connection type [Exclusive Owner] is set.

▶ In [Controller Organizer], select the device folder.

▶ Select [Controller Tags].

▷ [Controller Tags] contains the configuration data of the device (`DeviceName.C:Data`).

▶ Set the parameters.

▷ The counter modules are configured.

9.3.6 Read process data of the ports

The process data of the digital inputs are transmitted in the following objects:

- Input Assembly (Instance 101) (→ 🗋 50)

- Input Assembly (Instance 102) (→ 🗋 51)

Available data:

- Signal level of the input channels (after filtering)
- Status of the voltage supply

Requirements:

✓ Device is integrated in EtherNet/IP project.

✓ The input filters have been configured.

✓ Connection type [Exclusive Owner], [Inputs only] or [Listen only] is set.

▶ In [Controller Organizer], select the device folder.

▶ Select [Controller Tags].

▷ [Controller Tags] contains the input data of the device (`Devicename.I:Data`).

▶ Link process data to variables.

▷ The process values of the digital inputs are available in the application.

9.3.7 Read counter values and counter events

The process data of the counter modules are transmitted in the following objects:

- Input Assembly (Instance 102) (→ 🗋 51)

Available parameters (per counter module):

- Current main counter value
- Current batch counter value
- Display of batch counter overflow/underflow event

Requirements:

✓ Device is integrated in EtherNet/IP project.

✓ The counter modules are configured.

✓ Connection type [Exclusive Owner] is set.

▶ In [Controller Organizer], select the device folder.

▶ Select [Controller Tags].

▷ [Controller Tags] contains the input data of the device (`DeviceName.I:Data`).

▶ Link process data to variables.

▷ The process values of the counter modules are available in the application.

9.3.8 Control counters

The counter modules of the ports can be controlled separately. The following control signals are available per counter:

- Reset counter module
- Disable counter module
- Set counting direction (only for CTUD counter operating mode)
- Reset overflow/underflow events

The control signals for resetting the counters and overflow/underflow flags are transmitted in the following object:

- Output Assembly (Instance 150) (→ 🗋 54)

To control the counter modules:

Requirements:

✓ Device is integrated in EtherNet/IP project.

✓ The counter modules are configured.

✓ Connection type [Exclusive Owner] is set.

▶ In [Controller Organizer], select the device folder.

▶ Select [Controller Tags].

▷ [Controller Tags] displays the output data of the device (`DeviceName.O:Data`).

▶ Link control signals of the counter modules with variables.

▷ The counters can be controlled via the application.

9.3.9 Acyclic access

The user can access identification and diagnostic information as well as configuration and process data acyclically via the CIP object classes.

The device supports the following CIP objects:

Class Code	Name	Description
0x01	Identity Object	Identity Object (Class Code: 0x01) (→ 🗋 56)
0x02	Message Router Object	Message Router Object (Class Code: 0x02) (→ 🗋 58)
0x04	Assembly Object	Assembly Object (Class Code: 0x04) (→ 🗋 59)
0x06	Connection Manager Object	Connection Manager Object (Class Code: 0x06) (→ 🗋 60)
0x109	LLDP Management Object	LLDP Management Object (Class Code: 0x109) (→ 🗋 65)
0x47	Device Level Ring Object	Device Level Ring Object (Class Code: 0x47) (→ 🗋 61)
0x48	Quality Of Service Object	Quality Of Service Object (Class Code: 0x48) (→ 🗋 62)
0x81	Input Filter Object	Input Filter Object (Class Code: 0x81) (→ 🗋 63)
0x82	Counter Object	Counter Object (Class Code: 0x82) (→ 🗋 64)
0xF5	TCP/IP Object	TCP/IP Object (Class Code: 0xF5) (→ 🗋 66)
0xF6	Ethernet Link Object	Ethernet Link Object (Class Code: 0xF6) (→ 🗋 68)

ifm electronic recommends configuring the counter modules via the Configuration Assembly instead of via Counter Object 0x82.

9.3.9.1 Notes on acyclic access

For acyclic sending and receiving of data, EtherNet/IP applications use the Message (MSG) command.

For detailed information about the Message (MSG) command: → user documentation of the EtherNet/IP projection software

10 Maintenance, repair and disposal

The operation of the device is maintenance-free.

▶ Dispose of the device in an environmentally friendly way in accordance with the applicable national regulations when it is no longer used.

10.1 Cleaning

▶ Disconnect the device from the voltage supply.

▶ Clean the device from dirt using a soft, chemically untreated and dry cloth.

▶ In case of severe soiling, use a damp cloth.

▶ Do not use any caustic cleaning agents for cleaning!

10.2 Update firmware

The system software of the device can be updated using the following options:

- IoT-Core Visualizer: Update firmware (→ 38)

11 Appendix

11.1 EtherNet/IP

11.1.1 Parameters

11.1.1.1 Configuration Assembly (Instance 198)

Byte	Bit							
	7	6	5	4	3	2	1	0
0…5	X01 DI1 pin4: Filter Settings							
6…11	X01 DI2 pin2: Filter Settings							
12…17	X02 DI1 pin4: Filter Settings							
18…23	X02 DI2 pin2: Filter Settings							
24…29	X03 DI1 pin4: Filter Settings							
30…35	X03 DI2 pin2: Filter Settings							
36…41	X04 DI1 pin4: Filter Settings							
42…47	X04 DI2 pin2: Filter Settings							
48…53	X05 DI1 pin4: Filter Settings							
54…59	X05 DI2 pin2: Filter Settings							
60…65	X06 DI1 pin4: Filter Settings							
66…71	X06 DI2 pin2: Filter Settings							
72…77	X07 DI1 pin4: Filter Settings							
78…83	X07 DI2 pin2: Filter Settings							
84…89	X08 DI1 pin4: Filter Settings							
90…95	X08 DI2 pin2: Filter Settings							
96…102	X01: Counter Settings							
103…109	X02: Counter Settings							
110…116	X03: Counter Settings							
117…123	X04: Counter Settings							
124…130	X05: Counter Settings							
131…137	X06: Counter Settings							
138…144	X07: Counter Settings							
145…151	X08: Counter Settings							

Legend:

- Filter Settings — Filter settings of the digital input channel — 6 BYTE / rw — Mapping: Filter Settings (→ 46)
- Counter Settings — Counter settings — 6 BYTE / rw — Mapping: Counter Settings (→ 47)

Mapping: Filter Settings

Byte / Offset	Bit							
	7	6	5	4	3	2	1	0
n	Invert Input							
n+1	Hold Level							
n+2	Debounce Time							
n+4	Hold Time							

Legend:

• Invert Input	Signal inversion	USINT / rw	• 0x00: do not invert (default) • 0x01: invert
• Hold Level	Signal level to be maintained	USINT / rw	• 0x00: LOW • 0x01: HIGH (default)
• Debounce Time	Debounce time (value in *0.1 ms) Debounce Time = 0x0123 • Debounce Time[0] = 0x23 • Debounce Time[1] = 0x01	UINT / rw	• 0x0000: 0 ms (default) … • 0x01F4: 50 ms
• Hold Time	Hold time (value in *0.1 ms) Hold Time = 0x0123 • Hold Time[0] = 0x23 • Hold Time[1] = 0x01	UINT / rw	• 0x0000: 0 ms (default) … • 0xEA60: 6000 ms

Mapping: Counter Settings

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Counter Direction Selection	Pin2 Function			res.	Counter Mode		
n+1	Main Threshold							
n+5	Batch Threshold							

Legend:

- Counter Mode — Operating mode of the counter module — 3 BIT / rw
  - 0x0: CTU – Up counter (default)
  - 0x1: CTD - Down counter
  - 0x2: CTUD – Up and down counter
  - 0x3: CTDIR – Up or down counter
- Pin2 Function — Pin 2 function of the port — 3 BIT / rw
  - 0x0: N/C – No function (default)
  - 0x1: Counter edge input 2 – Counting input
  - 0x2: Count direction – Select counting direction
  - 0x3: Reset Main + Batch Counter – Reset counter
  - 0x4: Disable Main + Batch Counter – Disable counter
- Counter Direction Selection — Instance for selecting the counting direction — 1 BIT / rw
  - 0x0: pin 2 (default)
  - 0x1: PLC
- Main Threshold — Threshold CT of the main counter — UDINT / rw
  - Main Threshold = 0x01234567
  - Main Threshold[0] = 0x67
  - Main Threshold[1] = 0x45
  - Main Threshold[2] = 0x23
  - Main Threshold[3] = 0x01
  - 0x0000 0001: 1

  …
  - 0xFFFF FFFF: 4294967295 (default)
- Batch Threshold — Threshold CTb of the batch counter — UINT / rw

  Batch Threshold = 0x0123
  - Batch Threshold[0] = 0x23
  - Batch Threshold[1] = 0x01
  - 0x0001: 1
  - …
  - 0xFFFF: 65535 (default)

11.1.1.2 Configuration Assembly (Instance 199)

Byte	Bit							
	7	6	5	4	3	2	1	0
0…5	X01 DI1 pin4: Filter Settings							
6…11	X01 DI2 pin2: Filter Settings							
12…17	X02 DI1 pin4: Filter Settings							
18…23	X02 DI2 pin2: Filter Settings							
24…29	X03 DI1 pin4: Filter Settings							
30…35	X03 DI2 pin2: Filter Settings							
36…41	X04 DI1 pin4: Filter Settings							
42…47	X04 DI2 pin2: Filter Settings							
48…53	X05 DI1 pin4: Filter Settings							
54…59	X05 DI2 pin2: Filter Settings							
60…65	X06 DI1 pin4: Filter Settings							
66…71	X06 DI2 pin2: Filter Settings							
72…77	X07 DI1 pin4: Filter Settings							
78…83	X07 DI2 pin2: Filter Settings							
84…89	X08 DI1 pin4: Filter Settings							
90…95	X08 DI2 pin2: Filter Settings							

Legend:

- Filter Settings — Filter settings of the digital input channel — 6 BYTE / rw — Mapping: Filter Settings (→ 49)

Mapping: Filter Settings

Byte / Off-set	Bit							
	7	6	5	4	3	2	1	0
n	Invert Input							
n+1	Hold Level							
n+2	Debounce Time							
n+4	Hold Time							

Legend:

• Invert Input	Signal inversion	USINT / rw	• 0x00: do not invert (default) • 0x01: invert
• Hold Level	Signal level to be maintained	USINT / rw	• 0x00: LOW • 0x01: HIGH (default)
• Debounce Time	Debounce time (value in *0.1 ms) Debounce Time = 0x0123 • Debounce Time[0] = 0x23 • Debounce Time[1] = 0x01	UINT / rw	• 0x0000: 0 ms (default) … • 0x01F4: 50 ms
• Hold Time	Hold time (value in *0.1 ms) Hold Time = 0x0123 • Hold Time[0] = 0x23 • Hold Time[1] = 0x01	UINT / rw	• 0x0000: 0 ms (default) … • 0xEA60: 6000 ms

11.1.2 Cyclic data

11.1.2.1 Input Assembly (Instance 101)

Byte	Contents
0	reserviert
1	Power Status
2…3	Digital Inputs State

Legend:

- Power Status — Status of the voltage supply — USINT / ro — Power Status (Mapping) (→ 50)
- Digital Inputs State — Digital inputs of the X01...X08 ports — UINT / ro — Digital Inputs State (Mapping) (→ 50)

Power Status (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	res.	res.	res.	res.	res.	res.	res.	SENS PWR

Legend:

- SENS PWR — Status of the US voltage supply of the device — 1 BIT / ro
  - 0x0: No error
  - 0x1: Error

Digital Inputs State (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	X04 DI2 Pin 2	X04 DI1 Pin 4	X03 DI2 Pin 2	X03 DI1 Pin 4	X02 DI2 Pin 2	X02 DI1 Pin 4	X01 DI2 Pin 2	X01 DI1 Pin 4
n+1	X08 DI2 Pin 2	X08 DI1 Pin 4	X07 DI2 Pin 2	X07 DI1 Pin 4	X06 DI2 Pin 2	X06 DI1 Pin 4	X05 DI2 Pin 2	X05 DI1 Pin 4

Legend:

- DI1 Pin 4 — Signal level of the digital input channel DI1 on pin 4 of the port (after filtering) — 1 BIT / ro
  - 0x0: LOW
  - 0x1: HIGH
- DI2 Pin 2 — Signal level of the digital input channel DI2 on pin 2 of the port (after filtering) — 1 BIT / ro
  - 0x0: LOW
  - 0x1: HIGH

11.1.2.2 Input Assembly (Instance 102)

Byte	Contents
0	Main & Batch Counter Events
1	Power Status
2…3	Digital Inputs State
4…7	C1 Main Counter Value
8…9	C1 Batch Counter Value
10…13	C2 Main Counter Value
14…15	C2 Batch Counter Value
16…19	C3 Main Counter Value
20…21	C3 Batch Counter Value
22…25	C4 Main Counter Value
26…27	C4 Batch Counter Value
28…31	C5 Main Counter Value
32…33	C5 Batch Counter Value
34…37	C6 Main Counter Value
38…39	C6 Batch Counter Value
40…43	C7 Main Counter Value
44…45	C7 Batch Counter Value
46…49	C8 Main Counter Value
50…51	C8 Batch Counter Value
52	Main Counter Events
53	Batch Counter Events

Legend:

• Main & Batch Counter Events	Overflow/underflow events of the counter modules 1...8	USINT / ro	Main & batch counter events (Mapping) (→ 52)
• Power Status	Status of the voltage supply	USINT / ro	Power Status (Mapping) (→ 52)
• Digital Inputs State	Digital inputs of the X01...X08 ports	UINT / ro	Digital Inputs State (Mapping) (→ 52)
• Cx Main Counter Value	Counter module x: Current counter value of the main counter (x: 1...8)	UDINT / ro	Main counter value (Mapping) (→ 52)
• Cx Batch Counter Value	Counter module x: Current counter value of the batch counter (x: 1...8)	UINT / ro	Batch counter value (Mapping) (→ 53)
• Main Counter Events	Reset overflow/underflow event of the main counter 1...8	USINT / ro	Main Counter Events (mapping) (→ 53)
• Batch Counter Events	Reset overflow/underflow events of the batch counter 1...8	USINT / ro	Batch Counter Events (mapping) (→ 53)

Main & batch counter events (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	C8 OF/UF Event	C7 OF/UF Event	C6 OF/UF Event	C5 OF/UF Event	C4 OF/UF Event	C3 OF/UF Event	C2 OF/UF Event	C1 OF/UF Event

Legend:

- Cx OF/UF Event — Counter module x: Display of an overflow/underflow event (x: 1...8) — 1 BIT / ro
  - 0x0: no event
  - 0x1: overflow/underflow event recognised

Power Status (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	res.	res.	res.	res.	res.	res.	res.	SENS PWR

Legend:

- SENS PWR — Status of the US voltage supply of the device — 1 BIT / ro
  - 0x0: No error
  - 0x1: Error

Digital Inputs State (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	X04 DI2 Pin 2	X04 DI1 Pin 4	X03 DI2 Pin 2	X03 DI1 Pin 4	X02 DI2 Pin 2	X02 DI1 Pin 4	X01 DI2 Pin 2	X01 DI1 Pin 4
n+1	X08 DI2 Pin 2	X08 DI1 Pin 4	X07 DI2 Pin 2	X07 DI1 Pin 4	X06 DI2 Pin 2	X06 DI1 Pin 4	X05 DI2 Pin 2	X05 DI1 Pin 4

Legend:

- DI1 Pin 4 — Signal level of the digital input channel DI1 on pin 4 of the port (after filtering) — 1 BIT / ro
  - 0x0: LOW
  - 0x1: HIGH
- DI2 Pin 2 — Signal level of the digital input channel DI2 on pin 2 of the port (after filtering) — 1 BIT / ro
  - 0x0: LOW
  - 0x1: HIGH

Main counter value (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Main Counter Value[0]							
n+1	Main Counter Value[1]							
n+2	Main Counter Value[2]							
n+3	Main Counter Value[3]							

Legend:

- Main Counter Value — Current counter value of the main counter
  Main Counter Value = 0x01234567:
  - Main Counter Value[0]: 0x67
  - Main Counter Value[2]: 0x45
  - Main Counter Value[1]: 0x23
  - Main Counter Value[0]: 0x01

  UDINT / ro
  - 0x0000 0000: 0

  …
  - 0xFFFF FFFE: 4294967294

Batch counter value (Mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Batch Counter Value[0]							
n+1	Batch Counter Value[1]							

Legend:

• Batch Counter Value	Current counter value of the batch counter Batch Counter Value = 0x0123 • Batch Counter Value[0]: 0x23 • Batch Counter Value[1]: 0x01	UINT / ro	• 0x0000: 0 … • 0xFFFE: 65534

Main Counter Events (mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Main Counter 8 OF/UF Event	Main Counter 7 OF/UF Event	Main Counter 6 OF/UF Event	Main Counter 5 OF/UF Event	Main Counter 4 OF/UF Event	Main Counter 3 OF/UF Event	Main Counter 2 OF/UF Event	Main Counter 1 OF/UF Event

Legend:

• Main Counter x OF/UF Event	Counter x: Display overflow/underflow event on the main counter (x: 1...8)	1 BIT / ro	• 0x0: no event • 0x1: overflow/underflow event

Batch Counter Events (mapping)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Batch Counter 8 OF/UF Event	Batch Counter 7 OF/UF Event	Batch Counter 6 OF/UF Event	Batch Counter 5 OF/UF Event	Batch Counter 4 OF/UF Event	Batch Counter 3 OF/UF Event	Batch Counter 2 OF/UF Event	Batch Counter 1 OF/UF Event

Legend:

• Batch Counter x OF/UF Event	Counter x: Overflow/underflow event displayed on the batch counter (x: 1...8)	1 BIT / ro	• 0x0: no event • 0x1: overflow/underflow event

11.1.2.3 Output Assembly (Instance 150)

Byte	Contents
1	Counter 1 functions
2	Counter 2 functions
3	Counter 3 functions
4	Counter 4 functions
5	Counter 5 functions
6	Counter 6 functions
7	Counter 7 functions
8	Counter 8 functions

Legend:

- Counter x functions — Counter module x: Control signals (x: 1...8) — USINT / rw — Counter x functions (mapping) (→ 54)

Counter x functions (mapping)

Byte	Bit							
	7	6	5	4	3	2	1	0
n	Cx Batch Event Reset	Cx Main Event Reset	res.	res.	Cx Reset Counter Event	Cx Count Direction	Cx Disable Counter	Cx Reset Counter

- Cx Reset Counter — Counter module x: Reset main counter and batch counter to initial value (x: 1...8) — 1 BIT / rw
  - 0x0: no action
  - 0x1: reset main + batch counter and counter events to overflow/underflow
- Cx Disable Counter — Counter module x: Disable main counter & batch counter (x: 1...8) — 1 BIT / rw
  - 0x0: no action
  - 0x1: disable main and batch counter
- Cx Count Direction — Counter module x: Set the counting direction (x: 1...8)
  - only effective if the parameter [Counter Mode] = [CTDIR] — 1 BIT / rw
  - 0x0: up
  - 0x1: down
- Cx Reset Counter Event — Counter module x: Reset all overflow/underflow events (x: 1...8) — 1 BIT / rw
  - 0x0: no action
  - 0x1: reset counter events
- Cx Main Event Reset — Counter module x: reset overflow/underflow events of the main counter (x: 1...8) — 1 BIT / rw
  - 0x0: no action
  - 0x1: Reset main counter events
- Cx Batch Event Reset — Counter module x: reset overflow/underflow events of the batch counter (x: 1...8) — 1 BIT / rw
  - 0x0: no action
  - 0x1. Reset batch counter events

11.1.3 Acyclical data

11.1.3.1 CIP object classes

Supported object classes:

Class Code	Name	Description
0x01	Identity Object	Identity Object (Class Code: 0x01) (→ 56)
0x02	Message Router Object	Message Router Object (Class Code: 0x02) (→ 58)
0x04	Assembly Object	Assembly Object (Class Code: 0x04) (→ 59)
0x06	Connection Manager Object	Connection Manager Object (Class Code: 0x06) (→ 60)
0x47	Device Level Ring Object	Device Level Ring Object (Class Code: 0x47) (→ 61)
0x48	Quality Of Service Object	Quality Of Service Object (Class Code: 0x48) (→ 62)
0x81	Input Filter Object	Input Filter Object (Class Code: 0x81) (→ 63)
0x82	Counter Object	Counter Object (Class Code: 0x82) (→ 64)
0xF5	TCP/IP Object	TCP/IP Object (Class Code: 0xF5) (→ 66)
0xF6	Ethernet Link Object	Ethernet Link Object (Class Code: 0xF6) (→ 68)
0x109	LLDP Management Object	LLDP Management Object (Class Code: 0x109) (→ 65)

11.1.3.2 CIP class and instance services

Supported class and instance services:

Service code	Name	Description
0x01	Get Attribute All	Read all attributes
0x02	Set Attribute All	Write all attributes
0x05	Reset	Reset
0x09	Delete	Delete
0x0E	Get Attribute Single	Read single attribute
0x10	Set Attribute Single	Write single attribute
0x4E	Forward Close	Close connection
0x54	Forward Open	Open new connection

11.1.3.3 Identity Object (Class Code: 0x01)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2.001
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	19

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Vendor ID	UINT	Manufacturer ID	322
2	Get	Device Type	UINT	Device type	12
3	Get	Product Code	UINT	Product code of the device	4022
4	Get	Revision	STRUCT	Revision of the device	2.001
		• Major Revision	USINT	Major revision (1...127)	2
		• Minor Revision	USINT	Minor revision (3 digits)	001
5	Get	Status	WORD	Overall status of the device	
6	Get	Serial Number	UDINT	Serial number of the device	--
7	Get	Product Name	SHORT STRING	Product name of the device	ETH Module SL EIP 16DI IP67
8	Get	State	USINT	State of the device (State machine) • 0: Nonexistent • 1: Device Self Testing • 2: Standby • 3: Operational • 4: Major Recoverable Fault • 5: Major Unrecoverable Fault • 6-254: Reserved • 255: Default for “Get_Attributes_All” service	
19	Get	Protection Mode	UINT	Current protection mode of the device	0

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	Yes	Yes	Read all attributes
0x05	Reset	Yes	Yes	Reset
0x4B	Flash LEDs	No	Yes	Flash device LEDs (identification)
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	Yes	Yes	Write single attribute

If an Identity Object receives a reset request, it carries out the following actions:

- It checks if it supports the requested reset type.
- It responds to the request.
- It tries to execute the requested reset type.

Supported reset types:

- 0: reboot the device (mandatory for all EtherNet/IP devices).
- 1: restore factory settings and reboot the device.

11.1.3.4 Message Router Object (Class Code: 0x02)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	0

Instance attributes

The object class has no instance attributes.

Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.5 Assembly Object (Class Code: 0x04)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2
2	Get	Max. Instance	UINT	Max. number of instances of the object	0x00C7
3	Get	Number of instances	UINT	Number of instances	5
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of the class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	4

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Number of Members	UINT	Number of members in list	--
2	Get	Member	UINT	List of members	--
3	Get / Set	Data	UINT	Current process data image	--
4	Get	Size	UINT	Process data length (number of bytes)	--

The following object instances are available:

- Configuration Assembly (Instance 198) (→ 🗋 45)
- Configuration Assembly (Instance 199) (→ 🗋 48)
- Input Assembly (Instance 101) (→ 🗋 50)
- Input Assembly (Instance 102) (→ 🗋 51)
- Output Assembly (Instance 150) (→ 🗋 54)

Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute
0x18	Get Member	No	Yes	Read member of an instance attribute

11.1.3.6 Connection Manager Object (Class Code: 0x06)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances	3
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	0

Instance attributes

The object class has no instance attributes.

Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute
0x4E	Forward Close	No	Yes	Close connection
0x54	Forward Open	No	Yes	Open new connection

11.1.3.7 Device Level Ring Object (Class Code: 0x47)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of the class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	12

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Network topology	USINT	Current network topology • 0: linear	0
2	Get	Network status	USINT	Current network status • 0: OK	0
10	Get	Active Supervisor	STRUCT	Identification of the supervisor	0
			• UDINT	IP address	
			• ARRAY(6) of USINT	MAC address of the active supervisor	
12	Get	Capability Flags	DWORD	DLR capability of the device • 0x82: Beacon based Ring Node, Flush Table Frame support	0x82

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute

11.1.3.8 Quality Of Service Object (Class Code: 0x48)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	8

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
2	Get / Set	DSCP PTP Event	USINT	DSCP value for PTP event frames	59
3	Get / Set	DSCP PTP General	USINT	DSCP value for PTP general frames	47
4	Get / Set	DSCP PTP Urgent	USINT	DSCP value for implicit messages with “urgent” priority	55
5	Get / Set	DSCP Scheduled	USINT	DSCP value for implicit messages with “scheduled” priority	47
6	Get / Set	DSCP High	USINT	DSCP value for implicit messages with “high” priority	43
7	Get / Set	DSCP Low	USINT	DSCP value for implicit messages with “low” priority	31
8	Get / Set	DSCP Explicit	USINT	DSCP value for explicit messages with “scheduled” priority	27

Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.9 Input Filter Object (Class Code: 0x81)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	16
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	4

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get / Set	Input Inverter	USINT	Signal inversion • 0: no signal inversion • 1: signal inversion	0
2	Get / Set	Hold Level	USINT	Signal level to be maintained • 0: LOW • 1: HIGH	1
3	Get / Set	Debounce Time	UINT	Debounce time • 0: 0 ms … • 500: 50 ms	0
4	Get / Set	Hold Time	UINT	Hold time • 0: 0 ms … • 60000: 6000 ms	0

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.10 Counter Object (Class Code: 0x82)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	8
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	6

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get / Set	Counter Mode	UINT	Operating mode of the counter module • 0x0: CTU – up counter • 0x1: CTD – down counter • 0x2: CTUD – up and down counter • 0x3: CTDIR – up or down counter	0x0
2	Get / Set	Pin 2 function	UINT	Pin 2 function of the port • 0x0: N/C – no function • 0x1: counter transition input 2 – counting input [1] • 0x2: count direction [2] • 0x3: reset Main + Batch Counter – reset counters • 0x4: disable Main + Batch Counter – disable counters	0x0
3	Get / Set	Count Direction Selection	USINT	Instance for selecting the counting direction • 0x0: Pin 2 • 0x1: Fieldbus PLC	0x0
4	Get / Set	Main Threshold	UDINT	Threshold of the main counter • 0x0000 0001: 1 … • 0xFFFF FFFF: 4294967295	0x1
5	Get / Set	Batch Threshold	UINT	Threshold of the batch counter • 0x0001: 1 … • 0xFFFF: 65535	0x1
6	Set	Force Counter	6xUSINT	Write values of the counter modules	

[1] only valid if `Counter Mode = CTUD`

[2] only valid if `Counter Mode = CTDIR`

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.11 LLDP Management Object (Class Code: 0x109)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	5

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get / Set	LLDP Enable	STRUCT	Enable / disable LLDP globally or for individual ports • Length of the LLDP Enable Array (UINT): – 3: 1 + 2 (= value of class attribute 2 of the Ethernet Link Object) • LLDP Enable Array (BYTE): – Bit 0: 1 (= globally enabled, LLDP Tx + Rx enabled) – Bit 1: 1 (= LLDP Tx enabled - Instance 1 Ethernet Link Object – Bit 2: 1 (= LLDP Rx enabled - Instance 2 Ethernet Link Object	0x030007
2	Get / Set	msgTxInterval	UINT	Interval for transmission of LLDP frames (in seconds)	30
3	Get / Set	msgTxHold	USINT	Interval time multiplier, factor for determining the hold time for transmission to adjacent devices • e.g. 4: 4x interval time	4
4	Get	LLDP Datastore	UINT	Supported methods for querying the LLDP database • 0x02: SNMP	0x02
5	Get / Set	Last Change	DWORD	Time since last change in local LLDP database (in seconds)	0

Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.12 TCP/IP Object (Class Code: 0xF5)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attribute	UINT	Max. ID number of the instance attribute	14

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Status	UINT	Status of the TCP/IP interface • 0: interface not configured • 1: interface configured with DHCP, BOOTP or non-volatile memory	
2	Get	Configuration Capability	DWORD	Configuration options for interface • Bit 0: BOOTP Client • Bit 2: DHCP Client • Bit 4: configuration adjustable • Bit 7: ACD-capable	0x95 (BOOTP, DHCP, TCP/IP configurable, ACD capable)
3	Get / Set	Configuration Control	DWORD	Configuration control Bit 0..3: startup configuration • 0: statically assigned IP address • 1: configuration via BOOTP • 2: configuration via DHCP	0
4	Get	Physical Link Object Path	STRUCT of	Logical path to the physical communication interface (Ethernet link object)	
		• Path Size	UINT	Length (number of words, little endian format)	0x02 00
		• Path	Padded EPATH	Class ID: 0xF6 (Ethernet Link Object) • Instance ID: 0x1	0x20 F6 2 4 01
5	Get / Set	Interface configuration	STRUCT of	TCP/IP interface configuration	
		• IP Address	UDINT	IP address	192.168.1.250
		• Network Mask	UDINT	Network mask	255.255.255.0
		• Gateway Address	UDINT	Gateway address	0.0.0.0
		• Name Server	UDINT	Primary name server	0.0.0.0
		• Name Server 2	UDINT	Secondary name server	0.0.0.0
		• Domain Name	STRING	Default domain name	0
6	Get / Set	Host Name	STRING	Host Name • 0: not configured	0
8	Get	TTL Value	UINT	TTL value	1
9	Get / Set	Mcast Config	UINT	Mcast configuration	0
10	Get / Set	SelectAcd	BOOL	ACD activation / deactivation • 0: deactivated • 1: activated	1
11	Get / Set	Last conflict detected	STRUCT of	Last conflict detected	0

Attr. ID	Access	Name	Data type	Description	Default
11	Get / Set	• AcdActivity	USINT	Condition of ACD activity at last conflict detected • 0: Noconflictdetected • 1: ProbeIpv4Address • 2: Ongoing Detection • 3: SemiActiveprobe	
		• Remote MAC	ARRAY(6) of USINT	MAC address of the remote node of the ARP PDU in which the conflict was detected	
		• ArpPdu	ARRAY(28) of USINT	Copy of the data of the ARP PDU in which the conflict was detected	
13	Get / Set	Encapsulation Inactivity Timeout	UINT	Inactivity before the TCP connection is deactivated (in seconds)	120
14	Get	IANA Port Admin	UINT	IANA port administrator configuration • 0x0: tcp: 44818 • 0x1: udp: 44818 • 0x2: udp: 2222	0

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

11.1.3.13 Ethernet Link Object (Class Code: 0xF6)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max. Instance	UINT	Max. number of instances of the object	2
3	Get	Number of instances	UINT	Number of instances	2
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attribute	UINT	Max. ID number of the instance attribute	768

Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Interface Speed	UDINT	Current transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	100
2	Get	Interface Status Flag	DWORD	Interface status flags • Bit 0: link status • Bit 1: half/full duplex • Bit 2…4: negotiation status • Bit 5: manual change requires reset • Bit 6: local hardware error • Bit 7…31: reserved	0x20
3	Get	Physical Address	ARRAY(6) of USINT	MAC address	
4	Get	Interface Counters	STRUCT(11) of UDINT	Interface-specific counter	
5	Get	Media Counters	STRUCT(12) of UDINT	Medium-specific counter	
6	Get / Set	Interface Control	STRUCT of	Interface control	
		• Interface Settings	DWORD	Settings Bit 0: • 0: auto-negotiation on • 1: auto-negotiation off Bit 1: • 0: half duplex • 1: full duplex	0
		• Interface Speed	UINT	Transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	
7	Get	Interface type	USINT	• 0: unknown • 1: internal interface • 2: twisted pair • 3: optical fibre	2
8	Get	Interface State	USINT	Current status of the interface • 0: unknown • 1: active; ready for transmission and reception • 2: not active • 3: test mode	0

Attr. ID	Access	Name	Data type	Description	Default
9	Get / Set	Admin State	USINT	Control of the access to the interface • 1: activate • 2: deactivate	1
10	Get	Interface Label	SHORT_STRING	Interface identifier	• X21 (instance 1) • X22 (instance 2)
11	Get	Interface Capability	STRUCT of	Interface capability	
		• Interface Speed	DWORD	Transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	
		• Interface Duplex Mode	DWORD	Duplex mode • HD: half duplex • FD: full duplex	
768	Get / Set	MDIX	USINT	MDIX configuration • 1: MDIX_AUTO • 2: MDIX_MDI • 3: MDIX_MDIX	1

Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute