GB

Operating instructions

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

AL4022

11425602 / 00 04 / 2022

Contents

1 Preliminary note

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

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.

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 unit 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 Parameter setting

The device can be configured using the following options:

- parameter setting software
  - ifm moneo
  - ifm moneo|configure SA
- ifm IoT Core
  - REST-API
  - IoT-Core Visualizer
- EtherNet/IP projection software

4.3 Inputs

The device has 8 ports. Each port has 2 digital inputs.

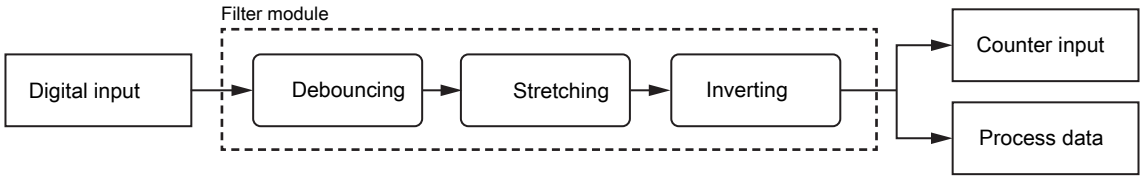
4.3.1 Sensor supply

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

4.4 Digital input filters

The device supports preprocessing of the digital input signals. The filter result is forwarded as a process value. The following filters can be applied to the input signals in the sequence specified.

1. Debouncing
2. Stretching
3. Inverting



Each filter can be configured separately.

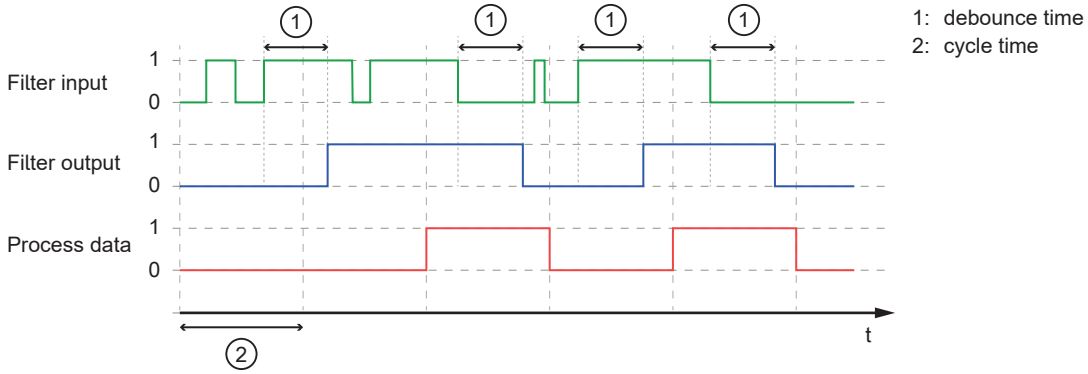
The device detects signals of a length of min. 0.23 ms. Shorter signals are not detected.

Periodic signals are only detected reliably if the signal period is at least twice as long as the cycle time.

4.4.1 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:



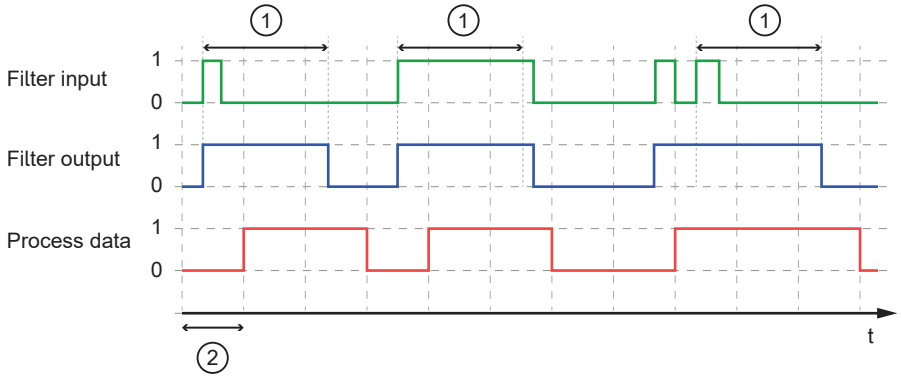
1: debounce time
2: cycle time

4.4.2 Holding

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

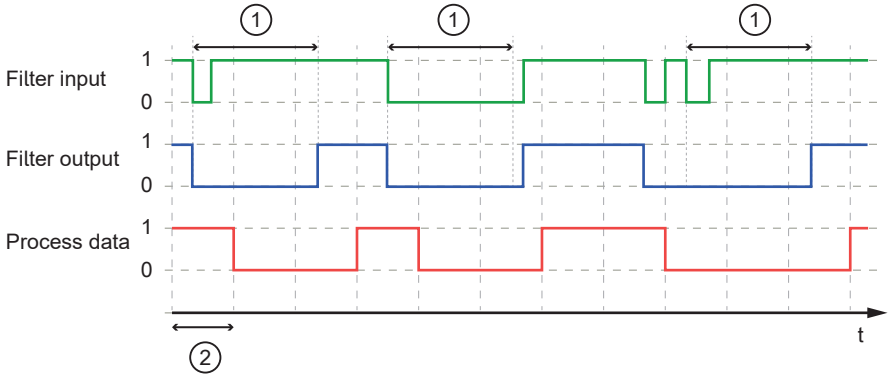
- Hold time: pulse duration to which short pulses are to be prolonged. Pulses that are present for a longer time than the hold time are not prolonged.
- Hold level: signal level to be prolonged (HIGH or LOW)

Time diagram hold filter (status HIGH):



1: hold time
2: cycle time

Time diagram hold filter (status LOW):



1: hold time
2: cycle time

4.4.3 Inverting

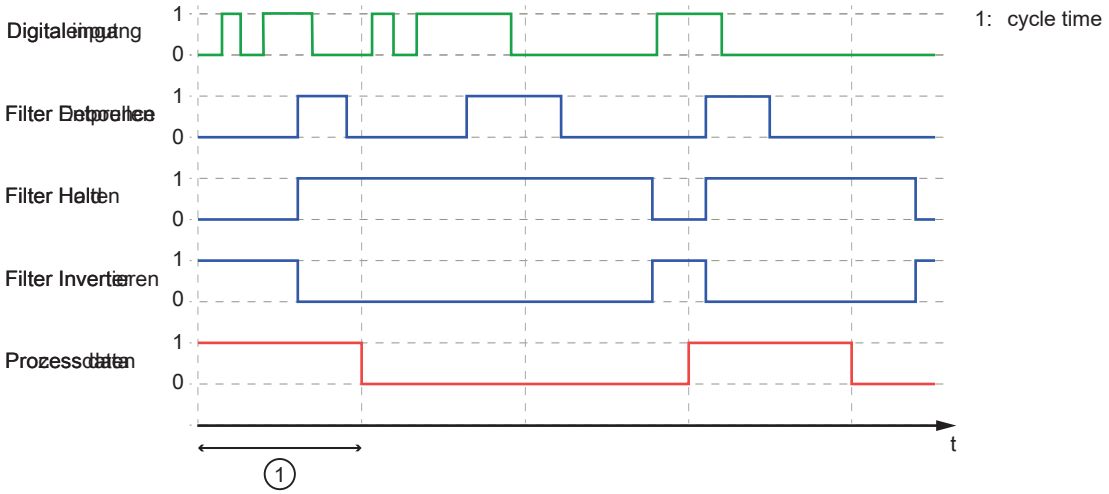
The filter inverts signals.

4.4.4 Filter combination

The filters can be combined.

Example: All 3 filters are activated

Time diagram:

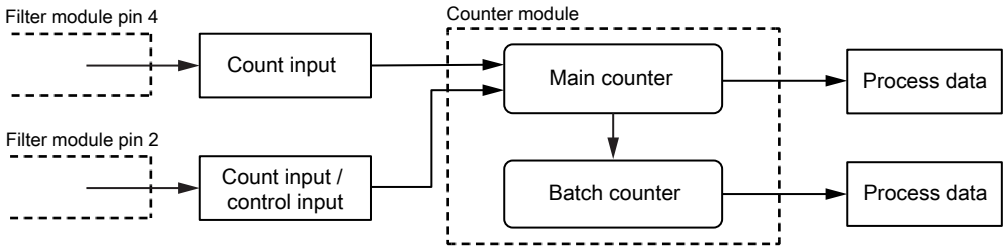


4.5 Counters

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.

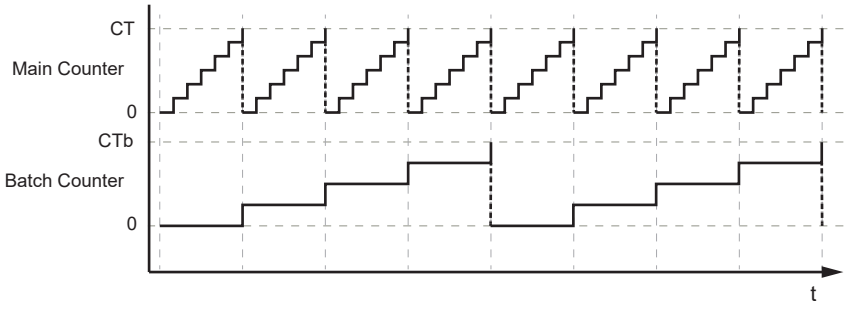
4.5.1 Counter mode CTU

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).

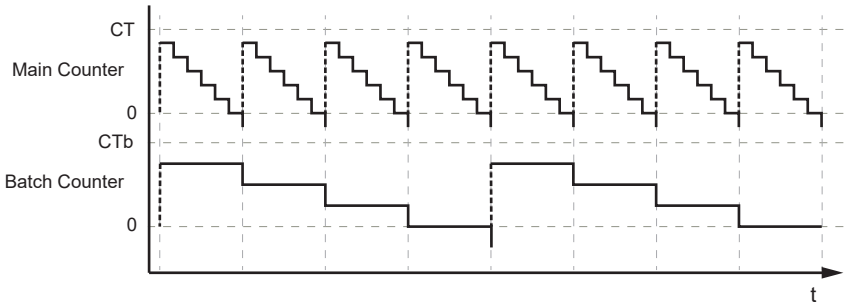


4.5.2 Counter mode CTD

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).



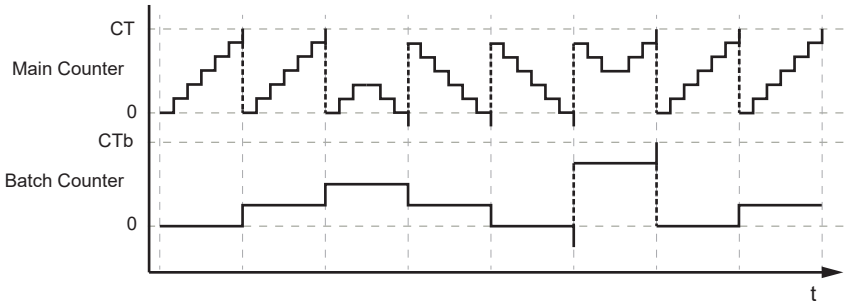
4.5.3 Counter mode CTUD

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).

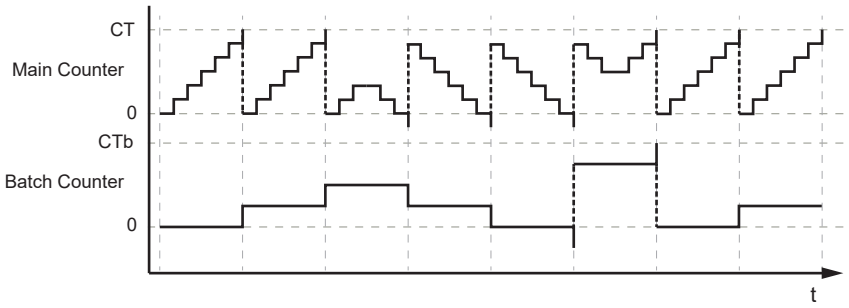


4.5.4 Counter mode CTDIR

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).



4.6 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

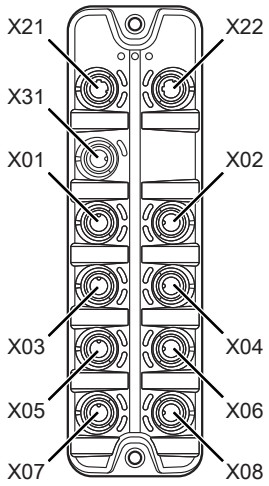
5.1 Install device

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

▶ Fasten the module onto the mounting surface using M5 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 unit 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 using 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: 0.3 ± 0.1 Nm

6.3 Ethernet

The device is connected to the EtherNet/IP network via the 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. Via the IT network, the user can access functions of the ifm IoT Core (configuration tools, REST API, IoT Core Visualizer).

- ▶ 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 (with at least protection rating: IP65 / IP66 / IP67).
- ▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

Wiring:

1: TX +
2: RX +
3: TX -
4: RX -
5: not used

6.4 Process connections

The sensors are connected to the device via the process connections.

The total current supply of the ports X01...X08 is limited to 3.6 A.

The ports feature short-circuit / overload detection.

- ▶ Connect the sensors to ports X01...X08.
- ▶ For connection, use M12 connectors (with at least protection rating: IP65 / IP66 / IP67; max. cable length: 30 m).
- ▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

Wiring:

1: sensor supply L+ (US)
2: digital output 2 (DI2)
3: sensor supply L- (US)
4: digital output 1 (DI1)
5: functional earth (FE)

6.5 Voltage supply

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

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

Port X31 has overvoltage protection (US).

Port X31 has reverse polarity protection (US).

Port X31 has an inrush current limitation.

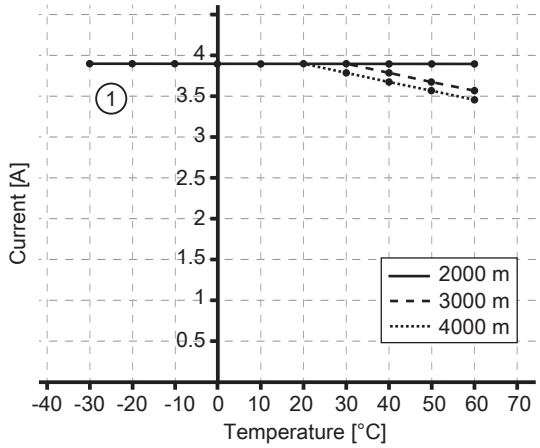
- ▶ Disconnect power!
- ▶ Connect the device via port X31 to 24 V DC (20…30 V SELV/PELV).
- ▶ For connection, use an L-coded M12 connector (with at least protection rating: IP65 / IP66 / IP67).
- ▶ Tighten the cable sockets according to the torque specifications indicated by the cable manufacturer. Maximum permissible tightening torque: 0.8 Nm
- ▶ Observe the derating behaviour of the device (→ Derating behaviour 🗋 17).

Wiring:

1: + 24 V DC (US)
2: not used
3: GND (US)
4: not used

6.5.1 Derating behaviour

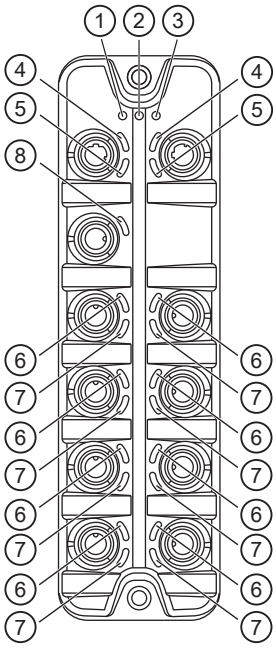
The current IUS available at ports X01...X08 depends on the ambient temperature of the device.



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

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: voltage 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
		Green / red / yellow	Flashes	Self test: device in self-test during start
		Green	Flashes (2 Hz)	Standby: device is not configured

LED	Description	Colour	State	Description
MOD	EtherNet/IP status	Green	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	Green	Off	no Ethernet connection
			On	Ethernet connection established
ACT	Status of the data transmission	Yellow	Off	no data transmission
			Flashes	Data transmission

7.1.3 Voltage supply

LED	Description	Colour	State	Description
US	Voltage supply status	-	Off	No supply voltage is applied or the applied supply voltage is too low
		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

The device can be configured with the following parameter setting software:

- ifm moneo
- ifm moneo|configure SA

▶ Install the desired parameter setting software.

▶ Activate the licences required for operation.

▷ 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 Getting started

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 (→ 🗋 21)

▶ 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: Read the interface configuration

▶ Observe the notes on the configuration of the EtherNet/IP interface: Configure the EtherNet/IP interface (→ 🗋 21)

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.

9.1.4 Fieldbus: Read 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.

9.1.5 Ports: Configure input filters

▶ Observe the notes on input filters: Digital input filters (→ 🗋 8)

Available parameters:

Name	Description	Value range	Access
[pin2]/[debounce_time]	Pin 2: debounce time (= value * 0.1 ms)	• 0: 0 ms (default) … • 500: 50 ms	rw [1]
[pin2]/[hold_time]	Pin 2: hold time (= value * 0.1 ms)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
[pin2]/[hold_level]	Pin 2: hold level	• 0: hold LOW • 1: hold HIGH (default)	rw [1]
[pin2]/[invert]	Pin 2: inversion	• 0: do not invert (default) • 1: invert	rw [1]
[pin4]/[debounce_time]	Pin 4: debounce time (= value * 0.1 ms)	• 0: 0 ms … • 500: 50 ms	rw [1]
[pin4]/[hold_time]	Pin 4: hold time (= value * 0.1 ms)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
[pin4]/[hold_level]	Pin 4: hold level	• 0: hold LOW • 1: hold HIGH (default)	rw [1]
[pin4]/[invert]	Pin 4: inversion	• 0: do not invert (default) • 1: invert	rw [1]

[1] read and write; can only be changed if no connection to the fieldbus controller is active

▶ Select the menu option [io] > [port[n]] (n: 1…8).

▷ The menu page displays the available parameters.

▶ Set the parameters.

▶ Write the changed parameter values to the device.

▷ The digital input filters have been configured.

9.1.6 Ports: Read digital input data

Available information:

Name	Description	Value range	Access
[pin2]/[digital]	Process value digital input - pin 2 (after filtering)	• LOW: off • HIGH: on	ro [1]
[pin4]/[digital]	Process value digital input - pin 4 (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.

▶ Select the menu option [io] > [port[n]] (n: 1…8).

▷ The menu page displays the current process values of the port's digital inputs.

The displayed process values are the filtered input data.

9.1.7 Counters: Configure counter modules

▶ Observe the notes on counter modules: Counters (→ 🗋 10)

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]	
	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	✓	×	×	✓	✓	×	✓

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]
[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; can only be changed if no connection to the fieldbus controller is active

Requirements:

✓ The parameter setting software has been started.

✓ The detailed view of the device is active.

▶ Select the menu option [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.

9.1.8 Counters: Read counter values

Available parameters:

Name	Description	Value range	Access
[maincounter_value]	Main counter value	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.

▶ Select the menu option [io] > [port[n]] (n: 1…8).

▷ The menu page displays the current counter values of the main and batch counter.

9.1.9 Counters: Control 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]
[direction] [2]	Set counting direction for main and batch counter	• 0: up (default) • 1: down	rw [1]

[1] read and write; can only be changed if no connection to the fieldbus controller is active

[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.

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

▷ The menu page displays the available parameters.

▶ Optional: disable counter module.

▶ Optional: reset counter module.

▶ Optional: set counting direction of counter module.

▶ Write the changed parameter values to the device.

▷ Selected actions are executed.

9.1.10 Gateway: Read identification information

Available information:

Name	Description	Value range	Access
[productcode]	Article number	AL4022	ro [1]

Name	Description	Value range	Access
[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.

9.1.11 Gateway: Read 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.

▶ Select the menu option [Processdatamaster].

▷ The menu page displays the diagnostic and status information.

9.1.12 Gateway: Set 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 the menu option [devicetag].

▶ Enter the application identifier.

▶ Write the changed values to the device.

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

9.1.13 Firmware: Read 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.

9.1.14 Firmware: Reset 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 will be reset to the factory settings.

▷ All parameters are set to their default values.

9.1.15 Firmware: Restart 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.

9.2 ifm IoT Core

9.2.1 ifm IoT Core: General information

The device has the ifm IoT Core. The ifm IoT Core represents the functionality of a device. Each device is represented by a number of objects, services and events. The elements of the ifm IoT Core are arranged in a JSON object in a hierarchical tree structure. The ifm IoT Core makes these elements available to the outside world via standard interfaces. This allows the user and other devices to access data (parameters, process data, events) and functions (services) of the ifm IoT Core.

9.2.1.1 Accessing the ifm IoT Core

An element of the ifm IoT Core is accessed via its address (e.g. `root/port1/pin2`). The address is composed of the path leading to the element (`root/port1`) and the identifier of the element (`pin2`).

The user can access the ifm IoT Core via HTTP requests. The following methods are supported:

GET method

Access: reading

Syntax of the request:

```
http://ip/datapoint/service
```

Parameter	Description
ip	IP address of the IoT interface
data_point	Data point which is to be accessed
service	Service

Syntax of the response:

```
{
  "cid":id,
  "data":{"value":"resp_data"},
  "adr":"data_point/service",
  "code":diag_code
}
```

Field	Parameter	Description
cid	id	Correlation ID for the assignment of request and reply
data	resp_data	Value of the data point; depending on the data type of the data point
adr	data_point	Data point accessed
	service	Service that accessed the data point
code	diag_code	Diagnostic code Diagnostic codes

Example: GET request

- Request:

```
http://192.168.0.250/devicetag/applicationtag/getdata
```

- Response:

```
{
  "cid":-1,
  "data":{"value":"factory 2 plant 1"},
  "adr":"devicetag/applicationtag/getdata",
  "code":200
}
```

POST method

Access: reading, writing

Syntax of the request:

```
{
  "code":"code_id",
  "cid":id,
  "adr":"data_point/service",
  "data":{req_data},
}
```

Field	Parameter	Description
code	code_id	Service class • request: Request • transaction: Transaction • event: Event
cid	id	Correlation ID for the assignment in pairs of request and return; identifier freely selectable by the user
adr	data_point	Data point which is to be accessed
	service	Service to access the data point
data [1]	req_data	Data sent to the ifm IoT Core (e.g. new values); syntax depending on the service

[1] optional; only required for services that send data to the ifm IoT Core (e.g. setdata)

Syntax of the response:

```
{
  "cid":id,
  "data":{resp_data},
  "adr":"data_point/service",
  "code":diag_code
}
```

Field	Parameter	Description
cid	id	Correlation ID for the assignment of request and return (→ Request)
data [1]	resp_data	Values returned by the ifm IoT Core; syntax depending on the service
adr	data_point	Data point accessed
	service	Service that accessed the data point
code	diag_code	Diagnostic code

[1] optional; only available for services that receive data from the ifm IoT Core (e.g. getdata)

Example: POST request

- Request:

```
{
  "code":"request",
  "cid":-1,
  "adr":"devicetag/applicationtag/getdata"
}
```

- Response:

```
{
  "cid":-1,
  "data":{"value":"Do not use"},
  "adr":"devicetag/applicationtag/getdata",
  "code":200
}
```

9.2.2 Getting started

To register the device description:

▶ Send the following POST request to the ifm IoT Core:
`{"code":"request", "cid":-1, "adr":"gettree"}`

▷ ifm IoT Core returns the device description as a structured JSON object.

▶ Identify all substructures and the data points contained therein in the tree structure of the JSON object.

▶ Identify the applicable services for the access to substructures and the data points contained therein.

9.2.2.1 Notes on configuration

The configuration created via the IoT Core (API, IoT Core Visualizer) is overwritten when a Configuration Assembly Object is transferred to the device during a connection to the fieldbus PLC.

9.2.3 General functions

The device has the type “device” (→ Types 🗋 46). The following services can be applied to the root element of the device tree:

Service	Description
../gettree	Provide the complete tree or subtree of the device description (JSON)
../getidentity	Read identification information of the device
../getdatamulti	Reading several elements sequentially
../getelementinfo	Reading detailed information of an element
../getsubscriberlist	Print a list of all active notification subscriptions
../querytree	Search device description for specific elements

The following services can be applied to elements of the type `data` depending on its access rights:

Service	Description
../getdata	Reading the value of the element
../setdata	Write the value of the element

9.2.3.1 Example: Outputting the subtree

Task: Output all direct sub-elements of the node firmware.

Solution: Use the service gettree to output the required subtree (root node: firmware, sub-levels to be shown: 1)

- Request:

```
{
  "code":"request",
  "cid":4711,
  "adr":"gettree",
  "data":{"adr":"firmware","level":1}
}
```

- Response:

```
{
  "cid":4711,
  "data":{
    "identifier":"firmware",
    "type":"structure",
    "profiles":["software","software/uploadablesoftware","devicereset"],
    "subs":[
      {"identifier":"version","type":"data","profiles":
["parameter"],"profiles":["parameter"],"format":
{"type":"string","namespace":"json","encoding":"UTF-8"}},
      {"identifier":"type","type":"data","profiles":["parameter"],"format":
{"type":"string","namespace":"json","encoding":"UTF-8"}},
      {"identifier":"factoryreset","type":"service"},
      {"identifier":"install","type":"service"},
      {"identifier":"signal","type":"service"},
      {"identifier":"container","type":"data","profiles":["blob"],"format":
{"type":"binary","namespace":"json","encoding":"base64"}},
      {"identifier":"reboot","type":"service"}
      ]
    },
  "adr":"gettree",
  "code":200
}
```

9.2.3.2 Example: Reading several elements sequentially

Task: The following current values of the device are to be read consecutively: Temperature, serial number

Solution: Read the current parameter values using the service `getdatamulti` (data point temperature: `/processdatamaster/temperature`; data point serial number: `/deviceinfo/serialnumber`)

- Request:

```
{
  "code":"request",
  "cid":4711,
  "adr":"/getdatamulti",
  "data":{"datatosend":[
    "/processdatamaster/temperature",
    "/deviceinfo/serialnumber"]
  }
}
```

- Response:

```
{
  "cid":4711,
  "data":{
    "processdatamaster/temperature":{"code":200,"data":44},
    "deviceinfo/serialnumber":{"code":200,"data":"000174210147"}},
  "adr":/getdatamulti",
  "code":200
}
```

9.2.3.3 Example: Changing a parameter value

Task: The Application Tag parameter of the device is to be written with the value “Do not use”. The new value is only supposed to be valid until the next reboot of the device.

Solution: Write the new value of the `/devicetage/applicationtag` element with the `setdata` service. To keep the new value only until the next restart of the device, pass on the `duration` option with the `uptime` value.

- Request:

```
{
  "code":"request",
  "cid":4711,
  "adr":"/devicetag/applicationtag/setdata",
  "data":{"duration":"uptime","newvalue":"Do not use"}
}
```

- Response:

```
{
  "cid":4711,
  "adr":"/devicetag/applicationtag/setdata",
  "code":200,
}
```

9.2.4 Fieldbus: Read the interface configuration

Substructure: `fieldbussetup`

Available data points:

Name	Description	Values	Access
../network/dhcp	Status of the DHCP client	• 0: static IP address • 1: DHCP • 2: BOOTP	ro [1]

Name	Description	Values	Access
../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/hostname	Name of device in EtherNet/IP project	e.g. al4x2x	ro [1]
../network/macaddress	MAC address of the Ethernet interface	e.g. 00:02:01:0E:10:7C	ro [1]
../fieldbusfirmware	Version of the EtherNet/IP firmware of the device	e.g. 3.4.0.7 (EtherNet/IP Adapter)	ro [1]
../connectionstatus	Status of the connection to the EtherNet/IP network	• 0: not connected • 1: connected	ro [1]

[1] read only

9.2.5 Ports: Configure input filters

▶ Observe the notes on input filters: Digital input filters (→ 🗋 8)

Substructure: `io/port[n]` (n: 1…8)

Available data points:

Name	Description	Values	Access
../pin2/debounce_time	Pin 2: debounce time (= value * 0.1 ms)	• 0: 0 ms (default) … • 500: 50 ms	rw [1]
../pin2/hold_time	Pin 2: hold time (= value * 0.1 ms)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
../pin2/hold_level	Pin 2: hold level	• 0: hold LOW • 1: hold HIGH (default)	rw [1]
../pin2/invert	Pin 2: inversion	• 0: do not invert (default) • 1: invert	rw [1]
../pin4/debounce_time	Pin 4: debounce time (= value * 0.1 ms)	• 0: 0 ms (default) … • 500: 50 ms	rw [1]
../pin4/hold_time	Pin 4: hold time (= value * 0.1 ms)	• 0: 0 ms (default) … • 60000: 6000 ms	rw [1]
../pin4/hold_level	Pin 4: hold level	• 0: hold LOW • 1: hold HIGH (default)	rw [1]
../pin4/invert	Pin 4: inversion	• 0: do not invert (default) • 1: invert	rw [1]

[1] read and write; can only be changed if no connection to the fieldbus controller is active

9.2.6 Ports: Read digital input data

Substructure: `io/port[n]` (n: 1…8)

Available data points:

Name	Description	Values	Access
../pin2/digital	Process value digital input - pin 2 (after filtering)	• 0: LOW • 1: HIGH	ro [1]
../pin4/digital	Process value digital input - pin 4 (after filtering)	• 0: LOW • 1: HIGH	ro [1]

[1] read only

9.2.7 Counters: Configure counter modules

▶ Observe the notes on counter modules: Counters (→ 🗋 10)

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 and batch counter	Disable main and batch counter	Pin 2	Fieldbus PLC
CTU	✓	✕	✕	✓	✓	✕	✕
CTD	✓	✕	✕	✓	✓	✕	✕
CTUD	✕	✓	✕	✕	✕	✕	✕
CTDIR	✕	✕	✓	✕	✕	✓	✕
CTDIR	✓	✕	✕	✓	✓	✕	✓

Substructure: `io/counter[n]` (n: 1…8)

Available data points:

Name	Description	Values	Access
../mode	Operating mode of the counter module	• 0: CTU – up counter (default) • 1: CTD – down counter • 2: CTUD – up and down counter • 3: CTDIR – up and down counter with selectable counting direction	rw [1]
../pin2_function	Pin 2 function of the port (→ Observe note!)	• 0: no function (default) • 1: counting pulse (rising edge) • 2: counting direction • 3: reset main counter and batch counter • 4: disable main counter and batch counter	rw [1]
../count_direction_selection	Control instance for selecting the counting direction (→ Observe note!)	• 0: Pin 2 (default) • 1: 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; can only be changed if no connection to the fieldbus controller is active

9.2.8 Counters: Control counters

Substructure: `io/counter[n]` (n: 1…8)

Available data points:

Name	Description	Values	Access
../reset	Reset counter module (reset counter and threshold values to default values)	• 0: no action (default) • 1: reset	rw [1]
../disable	Disable counter module	• 0: enable counter (default) • 1: disable counter	rw [1]
../direction [2]	Set counting direction for main and batch counter	• 0: up (default) • 1: down	rw [1]

[1] read and write; can only be changed if no connection to the fieldbus controller is active

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

9.2.9 Counters: Read and write counter values

Substructure: `io/counter[n]` (n: 1…8)

Available data points:

Name	Description	Values	Access
../maincounter_value	Current main counter value	0…4294967295	ro [1]
../batchcounter_value	Current batch counter value	0…65535	ro [1]

[1] read only

Applicable services:

Name	Description
../force_counter_value	Write counter values of main and batch counter

9.2.9.1 Example: Write counter values

Task: The counter values of the counter module of port 2 are to be changed (main counter = 100, batch counter = 10).

Solution: Write the new values to the structure `io/counter[2]` with the service `force_counter_value`.

- Request:

```
{
  "code":"request",
  "cid":4711,
  "adr":"io/counter[2]/force_counter_value",
  "data": {"maincounter_value":100,"batchcounter_value":10}
}
```

- Response:

```
{
  "cid":4711,
  "adr":"io/counter[2]/force_counter_value",
  "code":200
}
```

9.2.10 Gateway: Read device information

Substructure: `deviceinfo`

Available data points:

Name	Description	Values	Access
../productcode	Article number	AL4022	ro [1]
../vendor	Manufacturer	ifm electronic	ro [1]
../devicefamily	Device family	Remote IO	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

9.2.11 Gateway: Read status and diagnostic information

Substructure: `processdatamaster`

Available data points:

Name	Description	Values	Access
../temperature	Temperature of the device (value in °C)	e.g. 52	ro [1]
../voltage_us	Present voltage value of the device supply US (value in mV)	e.g. 25236	ro [1]
../current_us	Present current value of the device supply US (value in mA)	e.g. 82	ro [1]
../supervisionstatus_us	Status of the device supply US	• 0: no error • 1: Error	ro [1]

[1] read only

9.2.12 Gateway: Set the application tag

Substructure: `devicetag`

Available data points:

Name	Description	Values	Access
../applicationtag	Name of the device in moneo or LR SMARTOBSERVER	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, note 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).

9.2.13 Gateway: Update firmware

Substructure: `firmware`

Available data points:

Name	Description	Values	Access
../version	Firmware version	AL4x2x_fw_eip_1.4.0.137	ro [1]
../type	Software type	Firmware	ro [1]
../container	Structure for firmware (BLOB)	-	wo [2]
../container/maxsize	Container size (in bytes)	E.g. 4194304	ro [1]
../container/chunksize	Size of a data segment (in bytes)	E.g. 4096	ro [1]
../container/size	Size of firmware file in container (in bytes)	E.g. 634523	ro [1]

[1] read only

[2] write only

Applicable services:

Name	Description
../install	Install firmware
../container/stream_set	Transfer an individual data segment
../container/start_stream_set	Start sequential transmission of several data segments

ifm recommends using the IoT Core Visualizer (→ IoT-Core Visualizer 🗋 37) to update the firmware.

9.2.14 IoT-Core Visualizer

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

9.2.14.1 Start the ifm IoT Core Visualizer

Requirements:

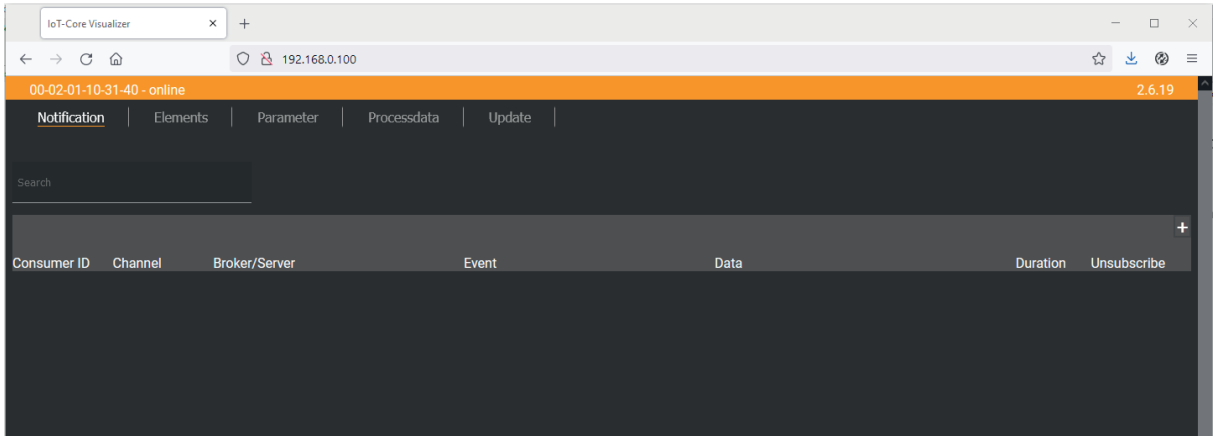
✓ The PC is connected to the Ethernet interface of the device.

✓ Ethernet interface has been configured correctly.

▶ 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 Visualiser.



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

- [Notification]: no function
- [Elements]: Search for elements in the device description (→ 🗋 38)
- [Parameter]: Configure the device (→ 🗋 38)

- [Processdata]: Access process data (→ 🗋 38)
- [Update]: Update firmware (→ 🗋 39)

9.2.14.2 Search for elements in the device description

The [Elements] menu page allows you to search the device description for elements with specific properties (`type`, `profile`, `name`) and to output the results.

Requirements:

✓ The ifm IoT Core Visualizer has been started.

▶ Click on [Elements].

▷ The menu page to search for elements appears.

▷ The input mask appears.

▶ Select the search criteria of the required element in the selection lists `identifier`, `profile` and `type`.

▶ Click on [Search for ...].

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

▷ The result list shows all elements found.

9.2.14.3 Configure the device

The [Parameter] menu page allows you to configure the device.

Requirements:

✓ The ifm IoT Core Visualizer has been started.

▶ Click on [Parameter].

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

▷ Current parameter values are displayed.

▶ Navigate to the desired parameter.

▶ Change the parameter value.

▶ Click on ✎ to save the changes.

▷ The changed parameter value is written to the device.

▷ The changed parameter value is active.

▶ Optional: Repeat the procedure to change further parameter values.

▷ The device has been configured.

9.2.14.4 Access process data

The [Processdata] menu page makes it possible to read and write the process data of the device and the connected sensors.

Requirements:

✓ The ifm IoT Core Visualizer has been started.

▶ Click on [Processdata].

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

▷ The current process values are displayed.

▶ Optional: Activate the [Polling] option and change the update interval.

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

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

To change the value of a process date:

▶ Navigate to the required process date.

▶ Change the process value.

▶ Click on ✎ to save the changes.

▷ The changed process value is written to the device.

▷ The changed process value is active.

9.2.14.5 Update firmware

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

Requirements:

✓ The ifm IoT Core Visualizer has been started.

▶ Click on [Update].

  ▷ The menu page displays information about the current firmware version.

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

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

▷ The firmware of the device is updated.

▷ The area shows the progress of the update process.

▷ After successful update: The device reboots automatically.

9.3 EtherNet/IP

9.3.1 Register the EDS file

To map the device in an EtherNet/IP projection software, ifm provides an EDS file. The device description file contains identification information, supported parameters, process data and fieldbus objects. The user can download the EDS file via documentation.ifm.com.

To add the device to the device catalogue:

▶ Download EDS file of the device.

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

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

▶ Register the downloaded EDS file using the wizard.

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

▷ The EtherNet/IP projection software can access the device functions and data.

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.

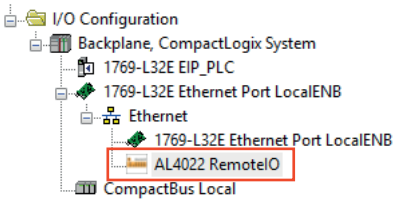
▶ Select the device in the catalogue and click on [Create].

  ▷ 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:

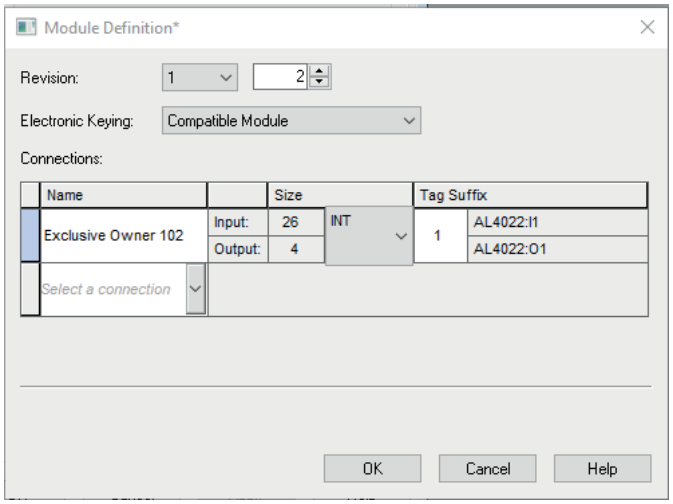
✓ Device is integrated in EtherNet/IP project.

▶ 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 (→ 🗋 8)

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

- Configuration Assembly (Instance 198) (→ 🗋 52)
- Configuration Assembly (Instance 199) (→ 🗋 55)

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: Counters (→ 🗋 10)

The counter modules can be configured via the following objects:

- Configuration Assembly (Instance 198) (→ 🗋 52)

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) (→ 🗋 56)
- Input Assembly (Instance 102) (→ 🗋 57)

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) (→ 🗋 57)

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) (→ 🗋 58)

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) (→ 🗋 60)
0x02	Message Router Object	Message Router Object (Class Code: 0x02) (→ 🗋 62)
0x04	Assembly Object	Assembly Object (Class Code: 0x04) (→ 🗋 63)
0x06	Connection Manager Object	Connection Manager Object (Class Code: 0x06) (→ 🗋 64)
0x109	LLDP Management Object	LLDP Management Object (Class Code: 0x109) (→ 🗋 69)
0x47	Device Level Ring Object	Device Level Ring Object (Class Code: 0x47) (→ 🗋 65)
0x48	Quality Of Service Object	Quality Of Service Object (Class Code: 0x48) (→ 🗋 66)
0x81	Input Filter Object	Input Filter Object (Class Code: 0x81) (→ 🗋 67)
0x82	Counter Object	Counter Object (Class Code: 0x82) (→ 🗋 68)
0xF5	TCP/IP Object	TCP/IP Object (Class Code: 0xF5) (→ 🗋 70)
0xF6	Ethernet Link Object	Ethernet Link Object (Class Code: 0xF6) (→ 🗋 72)

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 unit 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 unit 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 this!

10.2 Update firmware

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

- IoT-Core Visualizer
- IoT-Core REST API

11 Appendix

11.1 ifm IoT Core

11.1.1 Profiles

Profile	Description
blob	Binary Large Object
deviceinfo	Identification information of a device
devicetag	Device-specific identification
devicereset	Restart and reset to factory settings
network	Network
parameter	Parameter
processdata	Process data
service	Service
software	Software
software/uploadablesoft-ware	Upgradeable software

11.1.2 Types

Type	Description
structure	Structural element (e.g. a folder in the file system)
service	Service that can be addressed from the network
event	An event that can be started by the firmware and sends messages.
data	Data point
device	Root element a device represents

11.1.3 Services

11.1.3.1 Service: factoryreset

Name: `factoryreset`

Description: The service sets the parameters of the device to the factory settings.

Request ("data” field): none

Return ("data" field): none

11.1.3.2 Service: force_counter_values

Name: `force_counter_values`

Description: The service writes the values of the main counter and batch counter. The service can only be executed if there is no connection to the fieldbus controller.

Request ("data” field):

Parameter	Mandatory field	Data type	Description
maincounter_value	Optional	INT	Main counter target value

Parameter	Mandatory field	Data type	Description
batchcounter_value	Optional	INT	Batch counter target value

Return (“data” field): none

11.1.3.3 Service: getblobdata

Name: `getblobdata`

Description: The service reads a Binary Large Object (blob).

Request (“data“ field):

Data field	Mandatory field	Data type	Description
pos	mandatory	NUMBER	Byte position
length	mandatory	NUMBER	Size of the object (number of bytes)

Return ("data" field):

Data field	Mandatory field	Data type	Description
data	mandatory	STRING	data to be decoded (BASE64 coded)
crc	optional	HEX STRING	CRC of the data after decoding
md5	optional	HEX STRING	MD5 checksum of the data after decoding

11.1.3.4 Service: getdata

Name: `getdata`

Description: The service reads the value of a data point and outputs it.

Request ("data” field): none

Return data ("data" field):

Parameter	Mandatory field	Data type	Description
value	mandatory	STRING	Value of the data point

11.1.3.5 Service: getdatamulti

Name: `getdatamulti`

Description: The service sequentially reads the values of several data points and provides them. The value and the diagnostic code are provided for each data point.

Request ("data" field):

Data field	Mandatory field	Data type	Description
datatosend	mandatory	ARRAY OF STRINGS	List of data points to be requested; Data points must support the getdata service ("datatosend":["url1", "url2",..., "urlx"])

Return ("data" field):

Data field	Mandatory field	Data type	Description
url	mandatory	STRING	Data point request
code	mandatory	INT	Diagnostic code of the request
data	mandatory	STRING	Value of the data point

11.1.3.6 Service: getelementinfo

Name: `getelementinfo`

Description: The service reads the properties of an element of the IoT tree.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
adr	mandatory	STRING	URL of the element whose proerties are to be changed

Return ("data" field):

Parameter	Mandatory field	Data type	Description
identifier	mandatory	STRING	Identifier of the element
type	mandatory	STRING	Type of the element
format	optional	JSON object	Format of the data or of the service content
uid	optional	STRING	
profiles	optional	JSON-ARRAY	Element profiles
hash	optional	STRING	

11.1.3.7 Service: getidentity

Name: `getidentity`

Description: The service reads device information and outputs it.

Request (field „data“): none

Response (field „data“):

Parameter	Mandatory field	Data type	Description
iot		device	Device description as JSON object
iot.name	mandatory	STRING	Type of the element
iot.uid	optional	STRING	
iot.version	mandatory	STRING	
iot.catalogue	optional	ARRAY OF OBJECTS	
iot.deviceclass	optional	ARRAY OF STRING	Device class
iot.serverlist	optional	ARRAY OF OBJECTS	
device	optional		Article nummer
device.serialnumber	optional		Serial number
device.hwrevision	optional		Hardware version
device.swrevision	optional		Software version
device.custom	optional		

11.1.3.8 Service: gettree

Name: `gettree`

Description: The service reads the device description of the IO-Link master and outputs it as a JSON object. The output can be limited to a subtree of the device description.

Request (“data” field):

Parameter	Mandatory field	Data type	Description
adr	Optional	STRING	Root element of the subtree
level	Optional	STRING	Max. level up to which the subtree is output • no entry: all levels will be displayed • 0: do not display sub-elements (“subs”) • 1: display sub-elements • 2: display sub-elements up to the 2nd level • 3: display sub-elements up to the 3rd level ... • 20: display sub-elements up to the 20th level

Return (“data” field)

Parameter	Mandatory field	Data type	Description
identifier	Mandatory	STRING	Identifier of the root element
type	Mandatory	STRING	Type of the element
format	Optional	JSON object	Format of the data content
uid	Optional	STRING	
profiles	Optional	JSON array	
subs	Mandatory	JSON array	Sub-elements
hash	Optional	STRING	
adr	Mandatory	STRING	Root element of the subtree

11.1.3.9 Service: install

Name: `install`

Description: The service installs the firmware stored in a memory area of the unit.

Request ("data" field): none

Return ("data" field): none

11.1.3.10 Service: querytree

Name: `querytree`

Description: The service searches a device tree for the criteria `profile`, `type` and `name` and outputs a list with the URLs of the elements found. At least one of the search criteria must be specified. The service can only be executed on the root node of the machine.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
profile	optional	STRING	Profile of the searched element
type	optional	STRING	Type of the searched element
name	optional	STRING	Type of the searched element

Return ("data" field):

Parameter	Mandatory field	Data type	Description
urlList	mandatory	ARRAY	Array with URLs of the found elements; URLs are separated by commas

11.1.3.11 Service: reboot

Name: `reboot`

Description: The service reboots the device.

Request ("data" field): none

Return ("data" field): none

11.1.3.12 Service: setblock

Name: `setblock`

Description: The service simultaneously sets the values of several data points of a structure.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
datatoset	mandatory	ARRAY OF OBJECTS	List of data points and their new values; Data points must support the `setdata` service
consitent	optional	BOOL	IO-Link subindex of the parameter

Return ("data" field): none

11.1.3.13 Service: setdata

Name: `setdata`

Description: The service sets the value of the data point.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
newvalue	mandatory	STRING	New value of the data point
duration	optional	STRING	Duration of value storage • lifetime: Value is saved with IoT Core; Value remains valid even after restart of the device • uptime: Value is saved until the next restart of the device

Return ("data" field): none

11.1.3.14 Service: signal

Name: `signal`

Description: The service triggers the flashing of the status LEDs of the unit.

Request ("data" field): none

Return ("data" field): none

11.1.3.15 Service: start_stream_set

Name: `start_stream_set`

Description: The service starts the sequential transmission of several data fragments.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
size	mandatory	STRING	Overal length of the data to be transmitted (number of bytes)

Return ("data" field): none

11.1.3.16 Service: stream_set

Name: `stream_set`

Description: The service transfers a data segment.

Request ("data" field):

Parameter	Mandatory field	Data type	Description
value	mandatory	BIN (BASE64)	Segment of the binary data (BASE64-coded)

Return ("data" field): none

11.2 EtherNet/IP

11.2.1 Parameters

11.2.1.1 Configuration Assembly (Instance 198)

Byte	Bit							
	7	6	5	4	3	2	1	0
0	X01_DI1_Pin4_InvertInput							
1	X01_DI1_Pin4_HoldLevel							
2…3	X01_DI1_Pin4_DebounceTime							
4…5	X01_DI1_Pin4_HoldTime							
6…11	X01_DI2_Pin2: filter settings (structure → bytes 0…5)							
12…17	X02_DI1_Pin 4: filter settings (structure → bytes 0…5)							
18…23	X02_DI2_Pin2: filter settings (structure → bytes 0…5)							
24…29	X03_DI1_Pin4: filter settings (structure → bytes 0…5)							
30…35	X03_DI2_Pin2: filter settings (structure → bytes 0…5)							
36…41	X04_DI1_Pin4: filter settings (structure → bytes 0…5)							
42…47	X04_DI2_Pin2: filter settings (structure → bytes 0…5)							
48…53	X05_DI1_Pin4: filter settings (structure → bytes 0…5)							
54…59	X05_DI2_Pin2: filter settings (structure → bytes 0…5)							
60…65	X06_DI1_Pin4: filter settings (structure → bytes 0…5)							
66…71	X06_DI2_Pin2: filter settings (structure → bytes 0…5)							
72…77	X07_DI1_Pin4: filter settings (structure → bytes 0…5)							
78…83	X07_DI2_Pin2: filter settings (structure → bytes 0…5)							
84…89	X08_DI1_Pin4: filter settings (structure → bytes 0…5)							
90…95	X08_DI2_Pin2: filter settings (structure → bytes 0…5)							
96	X1_CounterSettings (→ Mapping: Counter settings 🗋 54)							
97…100	X1_MainThreshold							
101…102	X1_BatchThreshold							
103	X2_CounterSettings (→ Mapping: Counter settings 🗋 54)							
104…107	X2_MainThreshold							
108…109	X2_BatchThreshold							
110	X3_CounterSettings (→ Mapping: Counter settings 🗋 54)							
111…114	X3_MainThreshold							
115…116	X3_BatchThreshold							
117	X4_CounterSettings (→ Mapping: Counter settings 🗋 54)							
118…121	X4_MainThreshold							
122…123	X4_BatchThreshold							
124	X5_CounterSettings (→ Mapping: Counter settings 🗋 54)							
125…128	X5_MainThreshold							
129…130	X5_BatchThreshold							
131	X6_CounterSettings (→ Mapping: Counter settings 🗋 54)							
132…135	X6_MainThreshold							
136…137	X6_BatchThreshold							

Byte	Bit							
	7	6	5	4	3	2	1	0
138	X7_CounterSettings (→ Mapping: Counter settings 🗋 54)							
139…142	X7_MainThreshold							
143…144	X7_BatchThreshold							
145	X8_CounterSettings (→ Mapping: Counter settings 🗋 54)							
146…149	X8_MainThreshold							
150…151	X8_BatchThreshold							

Legend:

• InvertInput	Signal inversion	1 byte	• 0x00: do not invert (default) • 0x01: invert
• HoldLevel	Signal level to be maintained	1 byte	• 0x00: LOW • 0x01: HIGH (default)
• DebounceTime	Debounce time (value in *0.1 ms) Debounce time = 0x0123 • Debounce time[0] = 0x01 • Debounce time[1] = 0x23	2 bytes	• 0x0000: 0 ms (default) … • 0x01F4: 50 ms
• HoldTime	Hold time (value in *0.1 ms) Hold time = 0x1234 • Hold time[0] = 0x12 • Hold time[1] = 0x34	2 bytes	• 0x0000: 0 ms (default) … • 0xEA60: 6000 ms
• MainThreshold	Threshold CT of the main counter MainThreshold = 0x01234567 • MainThreshold[0] = 0x01 • MainThreshold[1] = 0x23 • MainThreshold[0] = 0x45 • MainThreshold[0] = 0x67	4 bytes	• 0x0000 0001: 1 … • 0xFFFF FFFF: 4294967295 (default)
• BatchThreshold	Threshold CTb of the batch counter BatchThreshold = 0x0123 • BatchThreshold[0] = 0x01 • BatchThreshold[1] = 0x23	2 bytes	• 0x0001: 1 … • 0xFFFF: 65535 (default)

Mapping: Counter settings

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
n	Counter Direction Selection	Pin2 Function			res.	Counter Mode		

Legend:

• Counter Mode	Operating mode of the counter module	3 bits	• 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 bits	• 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 counters • 0x4: Disable Main + Batch Counter – disable counters –
• Counter Direction Selection	Instance for selecting the counting direction	1 bit	• 0x0: Pin 2 (default) • 0x1: PLC

11.2.1.2 Configuration Assembly (Instance 199)

Byte	Bit							
	7	6	5	4	3	2	1	0
0	X01_DI1_Pin4_InvertInput							
1	X01_DI1_Pin4_HoldLevel							
2…3	X01_DI1_Pin4_DebounceTime							
4…5	X01_DI1_Pin4_HoldTime							
6…11	X01_DI2_Pin2: filter settings (structure → bytes 0…5)							
12…17	X02_DI1_Pin 4: filter settings (structure → bytes 0…5)							
18…23	X02_DI2_Pin2: filter settings (structure → bytes 0…5)							
24…29	X03_DI1_Pin4: filter settings (structure → bytes 0…5)							
30…35	X03_DI2_Pin2: filter settings (structure → bytes 0…5)							
36…41	X04_DI1_Pin4: filter settings (structure → bytes 0…5)							
42…47	X04_DI2_Pin2: filter settings (structure → bytes 0…5)							
48…53	X05_DI1_Pin4: filter settings (structure → bytes 0…5)							
54…59	X05_DI2_Pin2: filter settings (structure → bytes 0…5)							
60…65	X06_DI1_Pin4: filter settings (structure → bytes 0…5)							
66…71	X06_DI2_Pin2: filter settings (structure → bytes 0…5)							
72…77	X07_DI1_Pin4: filter settings (structure → bytes 0…5)							
78…83	X07_DI2_Pin2: filter settings (structure → bytes 0…5)							
84…89	X08_DI1_Pin4: filter settings (structure → bytes 0…5)							
90…95	X08_DI2_Pin2: filter settings (structure → bytes 0…5)							

Legend:

• InvertInput	Signal inversion	1 byte	• 0x00: do not invert (default) • 0x01: invert
• HoldLevel	Signal level to be maintained	1 byte	• 0x00: LOW • 0x01: HIGH (default)
• DebounceTime	Debounce time (value in *0.1 ms) Debounce time = 0x0123 • Debounce time[0] = 0x01 • Debounce time[1] = 0x23	2 bytes	• 0x0000: 0 ms (default) … • 0x01F4: 50 ms
• HoldTime	Hold time (value in *0.1 ms) Hold time = 0x1234 • Hold time[0] = 0x12 • Hold time[1] = 0x34	2 bytes	• 0x0000: 0 ms (default) … • 0xEA60: 6000 ms

11.2.2 Cyclic data

11.2.2.1 Input Assembly (Instance 101)

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
0	res.	res.	res.	res.	res.	res.	res.	res.
1	res.	res.	res.	res.	res.	res.	res.	SENS PWR
2	X04: DI2	X04: DI1	X03: DI2	X03: DI1	X02: DI2	X02: DI1	X01: DI2	X01: DI1
3	X08: DI2	X08: DI1	X07: DI2	X07: DI1	X06: DI2	X06: DI1	X05: DI2	X05: DI1

Legend:

• SENS PWR	Status of the device voltage supply	1 bit	• 0x0: no error • 0x1: error
• DI1	Signal level digital input at pin 4 of the port (after filtering)	1 bit	• 0x0: LOW • 0x1: HIGH
• DI2	Signal level digital input at pin 2 of the port (after filtering)	1 bit	• 0x0: LOW • 0x1: HIGH

11.2.2.2 Input Assembly (Instance 102)

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
0	X08: OV/UV	X07: OV/UV	X06: OV/UV	X05: OV/UV	X04: OV/UV	X03: OV/UV	X02: OV/UV	X01: OV/UV
1	res.	res.	res.	res.	res.	res.	res.	SENS PWR
2	X04: DI2	X04: DI1	X03: DI2	X03: DI1	X02: DI2	X02: DI1	X01: DI2	X01: DI1
3	X08: DI2	X08: DI1	X07: DI2	X07: DI1	X06: DI2	X06: DI1	X05: DI2	X05: DI1
4…7	X01: Main Counter Value							
8…9	X01: Batch Counter Value							
10…13	X02: Main Counter Value							
14…15	X02: Batch Counter Value							
16…19	X03: Main Counter Value							
20…21	X03: Batch Counter Value							
22…25	X04: Main Counter Value							
26…27	X04: Batch Counter Value							
28…31	X05: Main Counter Value							
32…33	X05: Batch Counter Value							
34…37	X06: Main Counter Value							
38…39	X06: Batch Counter Value							
40…43	X07: Main Counter Value							
44...45	X07: Batch Counter Value							
46…49	X08: Main Counter Value							
50…51	X08: Batch Counter Value							

Legend:

• OV/UV	Overflow/underflow occurred at batch counter	1 bit	• 0x0: no event • 0x1: overflow/underflow event
• SENS PWR	Status of the device voltage supply	1 bit	• 0x0: no error • 0x1: error
• DI1	Signal level digital input at pin 4 of the port (after filtering)	1 bit	• 0x0: LOW • 0x1: HIGH
• DI2	Signal level digital input at pin 2 of the port (after filtering)	1 bit	• 0x0: LOW • 0x1: HIGH
• Main Counter Value	Current main counter value of the port	4 bytes	• 0x0000 0000: 0 … • 0xFFFF FFFE: 4294967294
• Batch Counter Value	Current batch counter value of the port	2 bytes	• 0x0000: 0 … • 0xFFFE: 65534

11.2.2.3 Output Assembly (Instance 150)

Byte	Bit							
	7	6	5	4	3	2	1	0
0	Reserved				X01: Reset Counter Event	X01: Count Direction	X01: Disable Counter	X01: Reset Counter
1	Reserved				X02: Reset Counter Event	X02: Count Direction	X02: Disable Counter	X02: Reset Counter
2	Reserved				X03: Reset Counter Event	X03: Count Direction	X03: Disable Counter	X03: Reset Counter
3	Reserved				X04: Reset Counter Event	X04: Count Direction	X04: Disable Counter	X04: Reset Counter
4	Reserved				X05: Reset Counter Event	X05: Count Direction	X05: Disable Counter	X05: Reset Counter
5	Reserved				X06: Reset Counter Event	X06: Count Direction	X06: Disable Counter	X06: Reset Counter
6	Reserved				X07: Reset Counter Event	X07: Count Direction	X07: Disable Counter	X07: Reset Counter
7	Reserved				X08: Reset Counter Event	X08: Count Direction	X08: Disable Counter	X08: Reset Counter

Legend:

• Reset Counter	Reset main counter and batch counter to initial value	1 bit	• 0x0: no action • 0x1: reset main + batch counter and counter events to overflow/underflow
• Disable Counter	Disable main counter & batch counter	1 bit	• 0x0: no action • 0x1: disable main and batch counter
• Count Direction	Set counting direction (valid only for counter mode CTDIR)	1 bit	• 0x0: up • 0x1: down
• Reset Counter Event	Reset overflow/underflow counter events	1 bit	• 0x0: no action • 0x1: reset counter events

11.2.3 Acyclical data

11.2.3.1 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
0x18	Get Member	Read member of an instance attribute
0x4B	Flash LEDs	Flash device LEDs (identification)
0x4E	Forward Close	Close connection
0x54	Forward Open	Open new connection

11.2.3.2 CIP object classes

Supported object classes:

Class Code	Name	Description
0x01	Identity Object	Identity Object (Class Code: 0x01) (→ 🗋 60)
0x02	Message Router Object	Message Router Object (Class Code: 0x02) (→ 🗋 62)
0x04	Assembly Object	Assembly Object (Class Code: 0x04) (→ 🗋 63)
0x06	Connection Manager Object	Connection Manager Object (Class Code: 0x06) (→ 🗋 64)
0x47	Device Level Ring Object	Device Level Ring Object (Class Code: 0x47) (→ 🗋 65)
0x48	Quality Of Service Object	Quality Of Service Object (Class Code: 0x48) (→ 🗋 66)
0x81	Input Filter Object	Input Filter Object (Class Code: 0x81) (→ 🗋 67)
0x82	Counter Object	Counter Object (Class Code: 0x82) (→ 🗋 68)
0xF5	TCP/IP Object	TCP/IP Object (Class Code: 0xF5) (→ 🗋 70)
0xF6	Ethernet Link Object	Ethernet Link Object (Class Code: 0xF6) (→ 🗋 72)
0x109	LLDP Management Object	LLDP Management Object (Class Code: 0x109) (→ 🗋 69)

11.2.3.3 Identity Object (Class Code: 0x01)

Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2
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	0x322
2	Get	Device Type	UINT	Device type	0x12
3	Get	Product Code	UINT	Product code of the device	4022
4	Get	Revision	STRUCT	Revision of	1.1
		• Major Revision	USINT	Main revision (1...127)	1
		• Minor Revision	USINT	Side revision (3 digits, if necessary with zeros in the beginning)	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 • 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.

11.2.3.4 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

11.2.3.5 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) (→ 🗋 52)
- Configuration Assembly (Instance 199) (→ 🗋 55)
- Input Assembly (Instance 101) (→ 🗋 56)
- Input Assembly (Instance 102) (→ 🗋 57)
- Output Assembly (Instance 150) (→ 🗋 58)

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

11.2.3.6 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
0x54	Forward Open	No	Yes	Open new connection
0x4E	Forward Close	No	Yes	Close connection

11.2.3.7 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 of UDINT, ARRAY(6) of USINT	IP and/or MAC address of the active supervisor	0
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

11.2.3.8 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

11.2.3.9 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

11.2.3.10 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

11.2.3.11 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	UINT	Enable / disable LLDP • 0: disabled • 1: enabled for all ports	1
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

11.2.3.12 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
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	255.255.2 55.0
		• 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

11.2.3.13 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 Mbits/s • 100: 100 Mbits/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 Mbits/s • 100: 100 Mbits/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 Mbits/s • 100: 100 Mbits/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