



Operating instructions
Remote I/O module 16 DI
EtherCAT
IP65 / IP66 / IP67
AL4132

GB

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1 Preliminary note

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

1.1 Legal and copyright information

© All rights reserved by ifm electronic gmbh. No part of these instructions may be reproduced and used without the consent of ifm electronic gmbh.

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

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 Symbols used

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

1.3 Warnings

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



WARNING

Warning of serious personal injury

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



CAUTION

Warning of minor to moderate personal injury

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

ATTENTION

Warning of damage to property

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

1.4 Safety symbol on the device



Safety symbol on the device:

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

1.5 Change history

Issue	Subject	Date
00	New creation of the document	11 / 2023
01	• Changed: Supported supply voltages, General wiring information (→ □ 15) • Changed: Screenshots IoT Core Visualizer	11 / 2024

2 Safety instructions

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

2.1 Cyber security

ATTENTION

Operating the machine in an unprotected network environment

- ▷ Unauthorised read or write access to data is possible.
 - ▷ Unauthorised manipulation of the device function is possible.
 - ▶ Check and restrict access options to the device.
-

3 Intended use

The device may only be used for the following purposes:

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

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

4 Function

4.1 Visual indication

The device displays the following indications:

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

4.2 Parameter setting

The device can be configured using the following options:

- ifm IoT Core
 - IoT-Core Visualizer
- EtherCAT
 - Projection software

4.3 Inputs

Ports X1...X8 each have 2 digital inputs (type 2 according to EN 61131-3).

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

4.3.1 Sensor supply

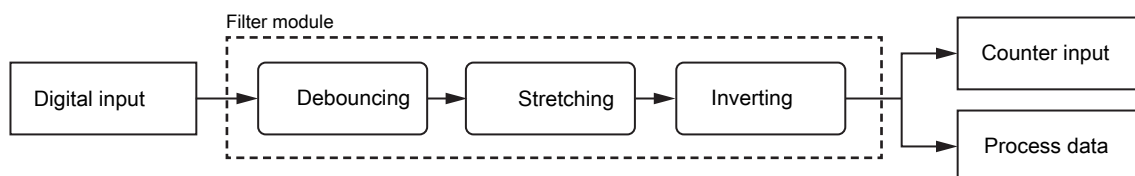
The device has a total of 8 sensor supplies (1 sensor supply per port).

4.4 Digital input filters

The device pre-processes the digital input signals at ports X1...X8. The filter result is forwarded as a process value and as an input signal for a counter module.

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

1. Debounce
2. Hold
3. Invert



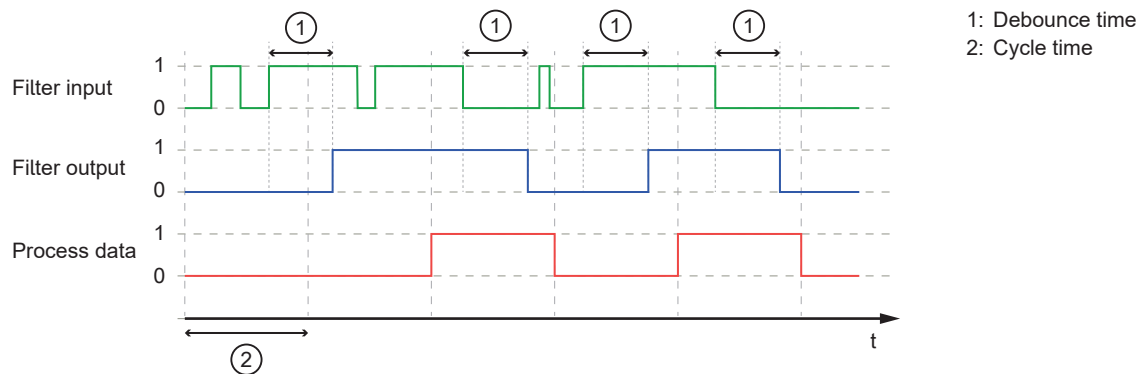
Each filter can be configured separately.

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

4.4.1 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:

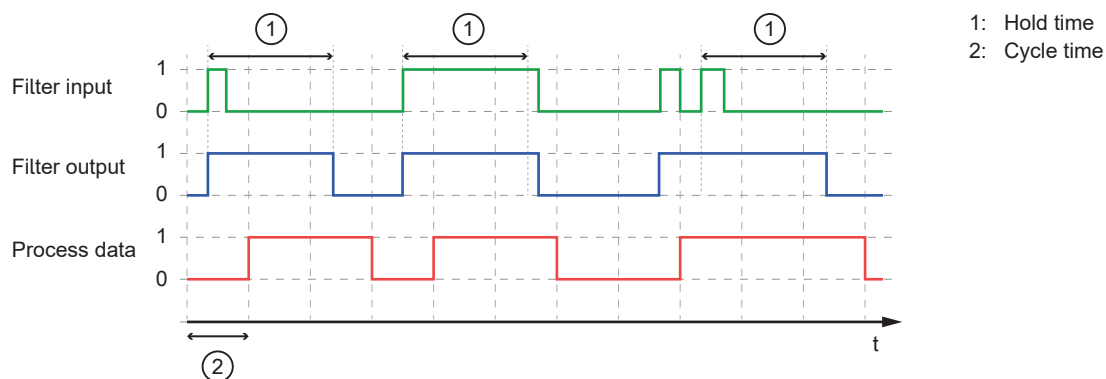


4.4.2 Stretching

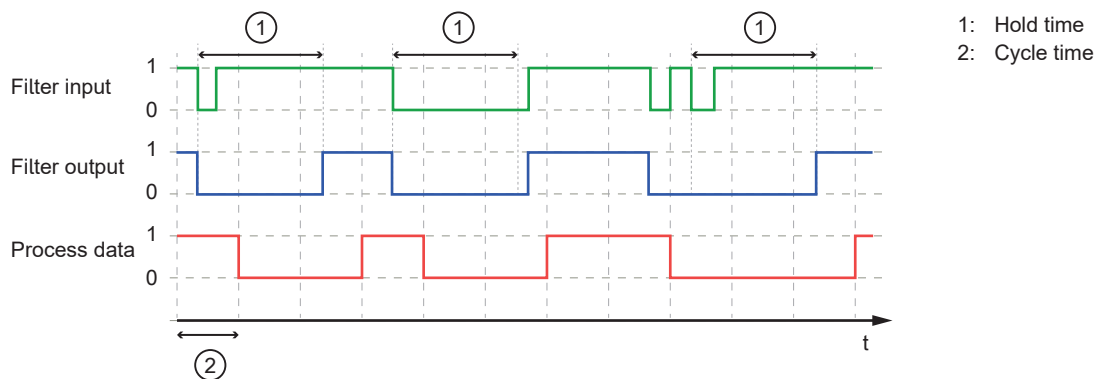
The filter stretches short input pulses. Level changes that occur during a stretching period are ignored. The filter is configured via the following parameters:

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

Time diagram stretch filter (status HIGH):



Time diagram stretch filter (status LOW):



4.4.3 Inverting

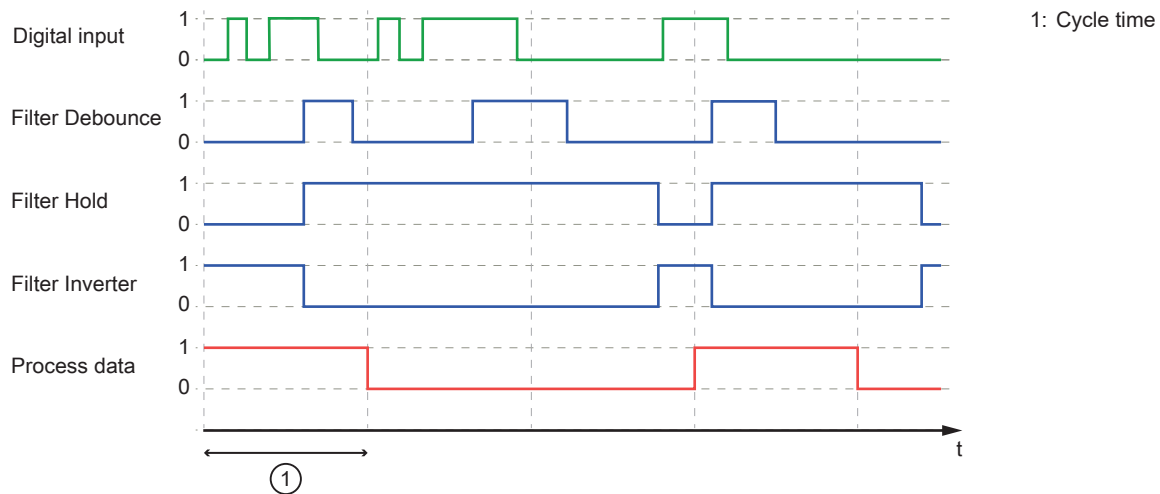
The filter inverts signals.

4.4.4 Filter combination

The filters can be combined.

Example: All 3 filters are activated

Time diagram:

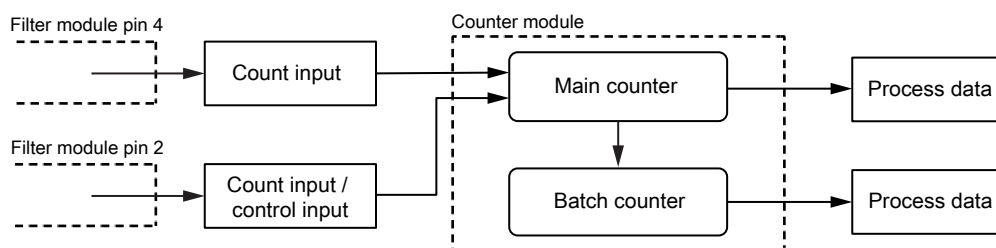


4.5 Counter

The device features one counter module per port.

A counter module consists of 2 separate counters:

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



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

Maximum count frequency: 4500 Hz

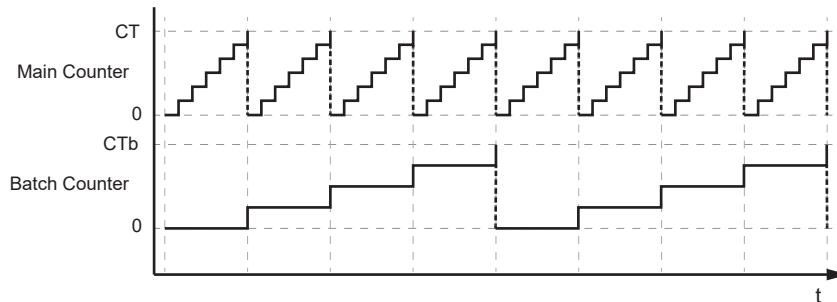
4.5.1 Counter mode CTU

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 ($b = 0$).

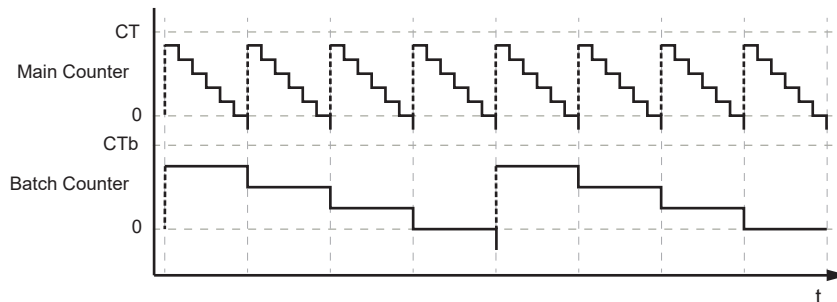


4.5.2 Counter mode CTD

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 ($b = CTb-1$).



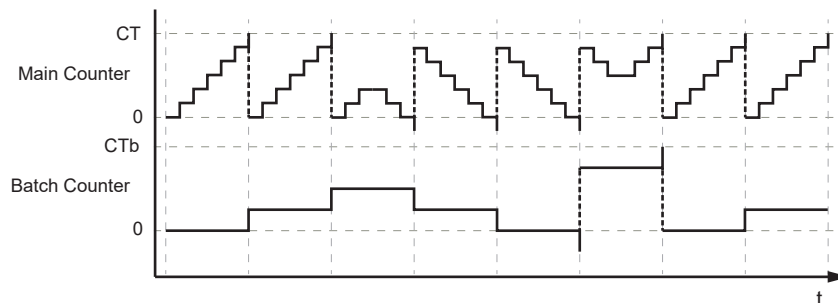
4.5.3 Counter mode CTUD

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 ($b = CTb-1$).

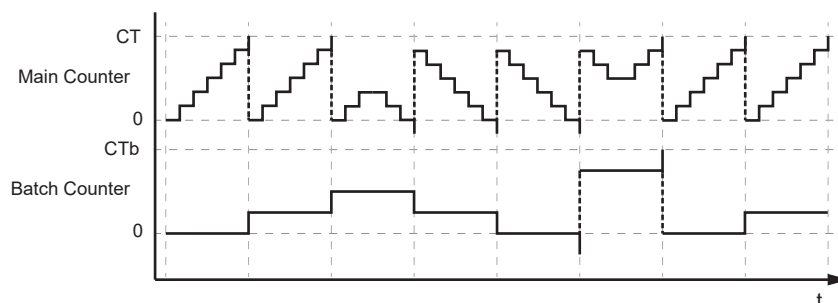


4.5.4 Counter mode CTDIR

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 ($b = CTb-1$).



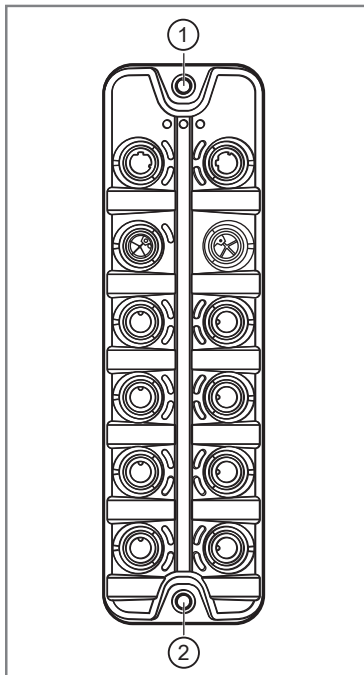
4.6 EtherCAT

- Device profile: Module device profile (EtherCAT slave)
- Supported protocols:

- CoE (CANopen over EtherCAT)
 - AoE (ADS over EtherCAT)
 - EoE (Ethernet over EtherCAT)
 - File Access over EtherCAT (FoE)
- Device description: ESI file

5 Installation

5.1 Overview



- 1: Upper mounting lug
- 2: Lower mounting lugs lug

5.2 Install device

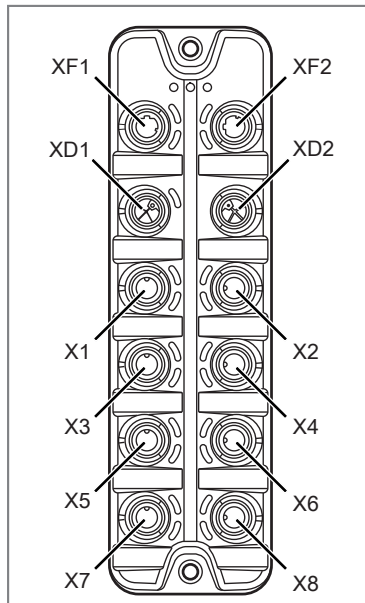


- ▶ Disconnect the power of the machine before installation.
- ▶ Use a flat mounting surface for installation.
- ▶ Please observe the maximum tightening torque.

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

6 Electrical connection

6.1 Overview



- XF1: Ethernet 1 (EtherCAT)
- XF2: Ethernet 2 (EtherCAT)
- XD1: Power IN
- XD2: Power OUT
- X1: Process connection 1 (sensor)
- X2: Process connection 2 (sensor)
- X3: Process connection 3 (sensor)
- X4: Process connection 4 (sensor)
- X5: Process connection 5 (sensor)
- X6: Process connection 6 (sensor)
- X7: Process connection 7 (sensor)
- X8: Process connection 8 (sensor)

6.2 General wiring information

The device must be connected by a qualified electrician.

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

The device is only suitable for operation on PELV voltages.

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

- Please observe the required precautions against electrostatic discharge!

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

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

6.2.1 Connection technology

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

- Use connectors with gold-plated contacts.
- During installation, place the connectors vertically so that the coupling nut will not damage the thread.
- Observe the coding of the connectors during installation.
- Cover unused connections with protective covers. Tightening torque: 1.3 ± 0.1 Nm

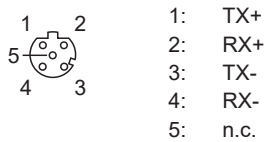
For UL applications:

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

6.3 Ethernet

The device is connected to the EtherCAT network via Ethernet ports XF1 / XF2 (e. g. EtherCAT control, additional EtherCAT device). In addition, the device can be connected to an IT network via the Ethernet ports. The user can access functions of the ifm IoT Core via the IT network (parameter setting software, IoT Core Visualizer).

Wiring:



- ▶ Connect the device to the EtherCAT network via a free Ethernet port.
- ▶ Optional: Connect the device to the IT network via a free Ethernet port.
- ▶ For connection, use an M12 connector (minimum protection rating: IP65 / IP66 / IP67).
- ▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

6.4 Process connections

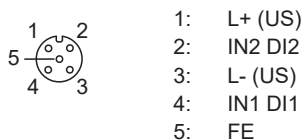
The sensors are connected to the device via the X1...X8 ports.

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

The ports feature short-circuit / overload detection.

- ▶ Connect the sensors to the X1...X8 ports.
- ▶ For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67; max. cable length: 30 m).
- ▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

Wiring:



6.5 Voltage supply

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

The US supply voltage supplies the device and the sensors connected to the X1...X8 ports.

Optionally, an additional UA supply voltage can be fed to the device via the Power IN port. UA is looped through to the Power OUT port. UA is used exclusively to supply additional devices via the Power OUT port (daisy chain).

The XD1 port is equipped with overvoltage protection (US).

The XD1 port is equipped with reverse polarity protection (US).

The XD1 port is equipped with cross polarity protection (US, UA).

**CAUTION**

Exceeding the maximum input current of 16 A

▷ Risk of fire

▶ Dimension the I_U and I_A of the US and UA supply voltages accordingly, taking into account the derating behaviour of the device: [Derating behaviour](#) (→ [17](#))

Wiring:



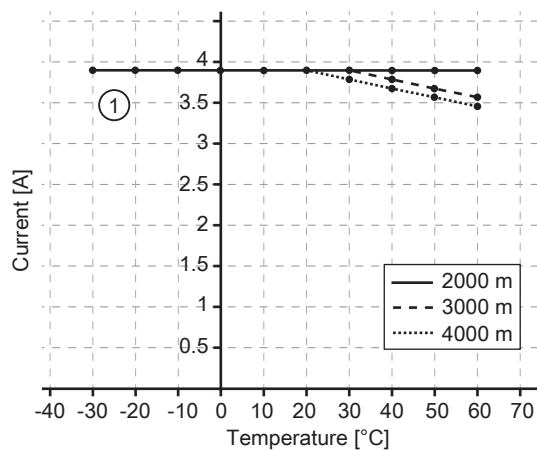
- 1: L+ (US)
- 2: L- (UA)
- 3: L- (US)
- 4: L+ (UA)
- 5: FE

- ▶ Disconnect power.
- ▶ Connect the device via the XD1 port to the US supply voltage with 24 V DC (20...30 V PELV).
- ▶ Optional: Connect the device via the XD1 port to the UA supply voltage with 24 V DC (20...30 V 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 vendor.
Maximum permissible tightening torque: 0.8 Nm

6.5.1 Derating behaviour

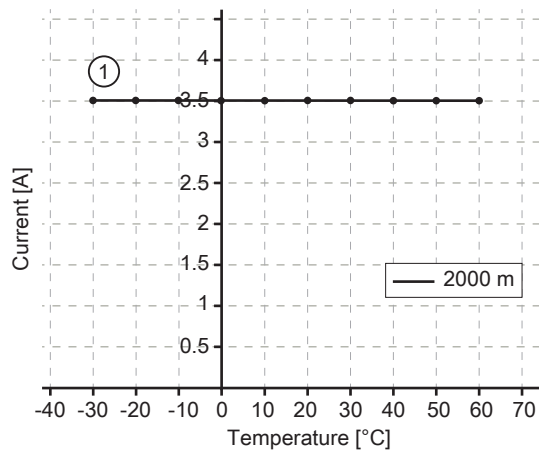
The current I_{US} available at ports X1...X8 and the currents $I_{US-daisy-chain}$ and $I_{UA-daisy-chain}$ available at port XD2 depend on the ambient temperature of the device.

6.5.1.1 Derating without daisy chain



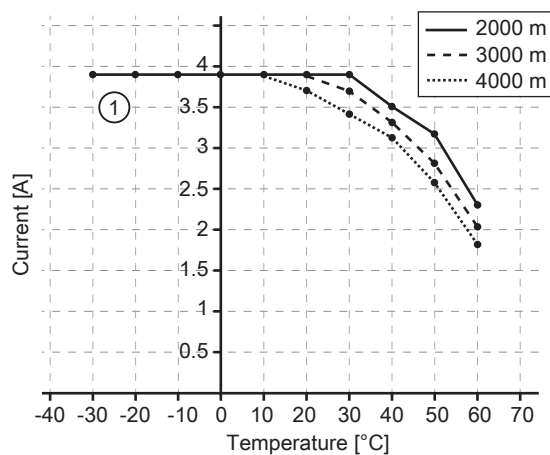
1: I_{US} at ports X1...X8

For UL applications:

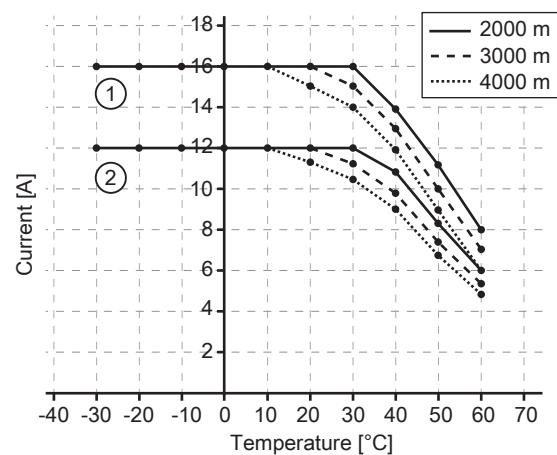


1: I_{US} at ports X1...X8

6.5.1.2 Derating with daisy chain



1: I_{US} at ports X1...X8



1: $I_{UA-daisy-chain}$ at port XD2

2: $I_{US-daisy-chain}$ at port XD2

Example: derating (2000 m)

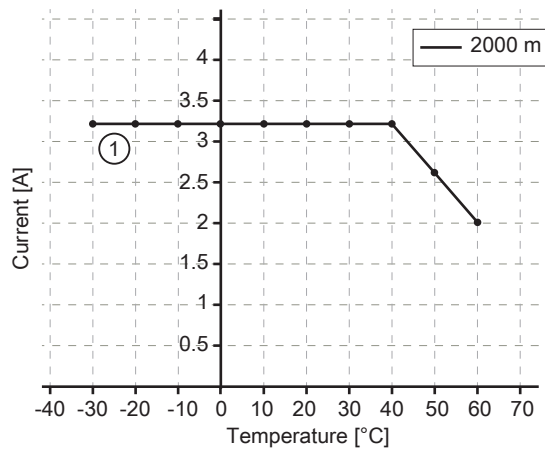
Temperature	$I_{UA-daisy-chain}$ (XD2)	I_{USmax} (XD1)	I_{US} (X1...X8)	$I_{US-daisy-chain}$ (XD2)
30 °C	16 A	15.9 A	3.9 A	12 A
30 °C			0 A	15.9 A
30 °C			1.8 A	14.1 A
60 °C	8 A	8 A	2 A	6 A
60 °C			0 A	8 A
60 °C			1 A	7 A

Explanation: The current I_{USmax} at port XD1 is the sum of the currents I_{US} taken from ports X1...X8 and the current $I_{US-daisy-chain}$ taken from port XD2 for the supply of further devices.

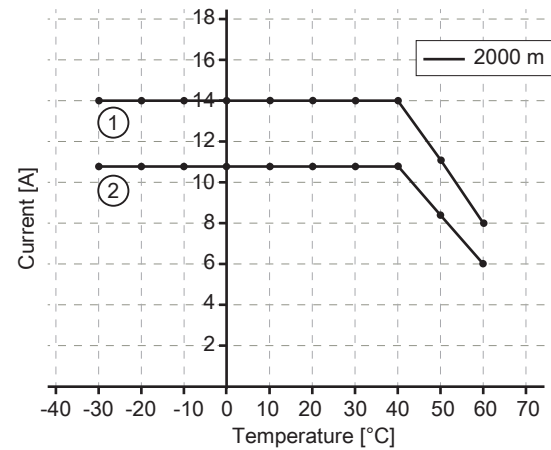
Formula: $I_{USmax} (XD1) = I_{US} (X1...X8) + I_{US-daisy-chain} (XD2)$

The less current is consumed at ports X1...X8, the more current will be available to supply further devices via daisy chain through port XD2.

For UL applications:



1: I_{US} at ports X1...X8



1: $I_{UA-daisy-chain}$ at port XD2

2: $I_{US-daisy-chain}$ at port XD2

Example:

Temperature	$I_{UA-daisy-chain}$ (XD2)	I_{USmax} (XD1)	I_{US} (X1...X8)	$I_{US-daisy-chain}$ (XD2)
50°C	11.2 A	11.0 A	2.6 A	8.4 A

6.6 Voltage output

An additional device can be supplied via the power OUT port (daisy chain). The supply voltages US and UA are looped through from port XD1 to port XD2.

Max. current of US: 15.9 A (for UL applications: 10.8 A)

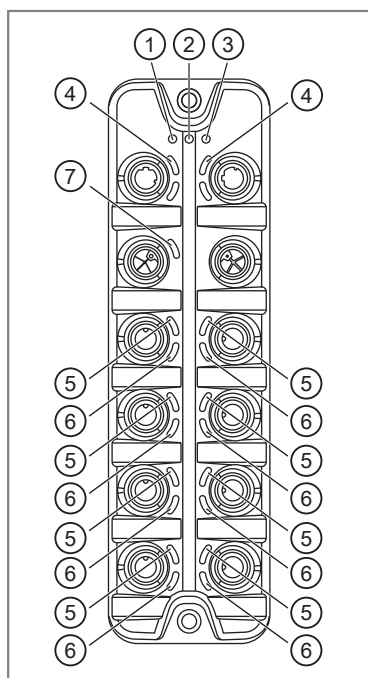
Max. current of UA: 16 A (for UL applications: 14 A)

Wiring:

- Optional: Connect an additional device to port XD2.
- For connection, use an L-coded M12 connector (with at least protection rating: IP65 / IP66 / IP67).
- Tighten the cable plug using 1.3 ± 0.1 Nm.
- Observe the derating behaviour of the device ([→ Derating behaviour](#) [17](#))!

7 Operating and display elements

7.1 LEDs



- 1: Status: RDY
- 2: Status: ERR
- 3: Status: RUN
- 4: EtherCAT: L/A
- 5: Process connection: DI1
- 6: Process connection: DI2
- 7: 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)
RUN	EtherCAT status	-	Off	Device in "INIT" state
		Green	Flashes (2.5 Hz)	Device in "PRE-OPERATIONAL" state
			Flashes (200 ms on, 1000 ms off)	Device in "SAFE-OPERATIONAL" state
			On	Device in "OPERATIONAL" state
ERR	Error indication	-	Off	No error
		Red	Flashes (2.5 Hz)	Invalid configuration
			Flashes (200 ms on, 1000 ms off)	Local error
			Flashes (200 ms on, 200 ms off, 200 ms on, 1000 ms off)	Application watchdog error

7.1.2 Ethernet

LED	Description	Colour	State	Description
L/A	Status of the connection	Green	Off	No Ethernet connection
			Flashes	Data transmission
			On	Ethernet connection established

7.1.3 Voltage supply

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

7.1.4 Process connections

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

8 Set-up

- ▶ Install the unit correctly.
- ▶ Establish a correct electrical connection with the device.
- ▷ Once connected to the supply voltage, the unit will start.
- ▷ The LEDs show status and error conditions.
- ▷ The unit is ready for operation.
- ▷ The device can be configured.

9 Settings

9.1 IoT-Core Visualizer

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

9.1.1 Starting the ifm IoT Core Visualizer



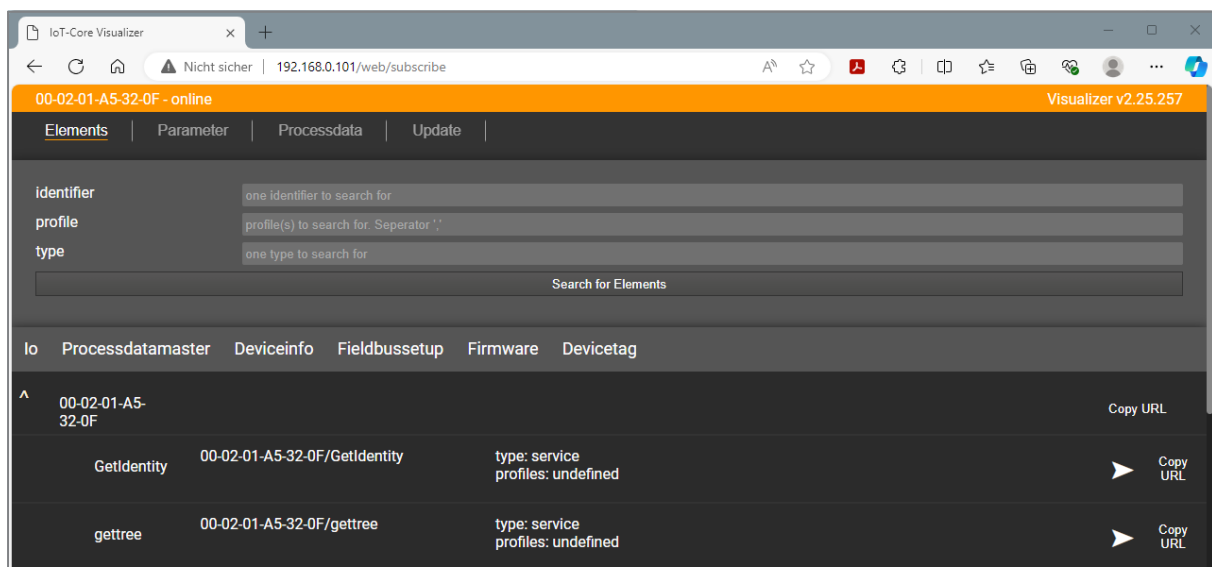
Access to the functions of ifm IoT Core is only possible if the Ethernet over EtherCAT (EoE) protocol is activated and configured on the EtherCAT master and the EtherCAT slave.

► Observe the notes: [Using Ethernet over EtherCAT \(EoE\)](#) (→ [32](#))

To start the IoT Core Visualizer:

Requirements:

- ✓ The laptop / PC is connected directly or via a suitable network coupling element (e.g. switch) to a EtherCAT port (XF1 / XF2) of the device.
- ✓ Ethernet over EtherCAT (EoE) has been activated and configured.
- Start web browser.
- Go to the following URL: `http://<ip-address>` (e.g. `http://192.168.0.10`)
- The web browser displays the start page of the IoT Core Visualizer.



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

- [Elements]: [Searching for elements of the IoT Core](#) (→ [24](#))
- [Parameter]: [Configuring the device](#) (→ [25](#))
- [Processdata]: [Accessing the process data](#) (→ [28](#))
- [Update]: [Update firmware](#) (→ [30](#))

9.1.2 Searching for elements of the IoT Core

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

The following properties can be searched for:

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

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Elements] menu is active.

The screenshot shows the 'Elements' search page in the IoT Core Visualizer. The top bar indicates the device '00-02-01-A5-32-0F - online' and the version 'Visualizer v2.25.257'. The 'Elements' menu is selected. Below the menu, there are three search filters: 'identifier' (one identifier to search for), 'profile' (profile(s) to search for. Separator ','), and 'type' (one type to search for). A 'Search for Elements' button is present. Below the search filters, there is a table of results for the device '00-02-01-A5-32-0F'.

Io	Processdatamaster	Deviceinfo	Fieldbussetup	Firmware	Devicetag
^	00-02-01-A5-32-0F				Copy URL
GetIdentity	00-02-01-A5-32-0F/GetIdentity			type: service profiles: undefined	Copy URL
gettree	00-02-01-A5-32-0F/gettree			type: service profiles: undefined	Copy URL
querytree	00-02-01-A5-32-0F/querytree			type: service profiles: undefined	Copy URL
getsubscrib	00-02-01-A5-32-0F/getsubscriberlist			type: service profiles: undefined	Copy URL

- ▶ Select the search criteria for the required element in the selection lists [identifier], [profile] and [type].
- ▶ Click on [Search for...].
- ▷ IoT Core Visualizer searches the device description for elements with selected search criteria.
- ▷ The result list shows all the elements found.

9.1.3 Configuring the device

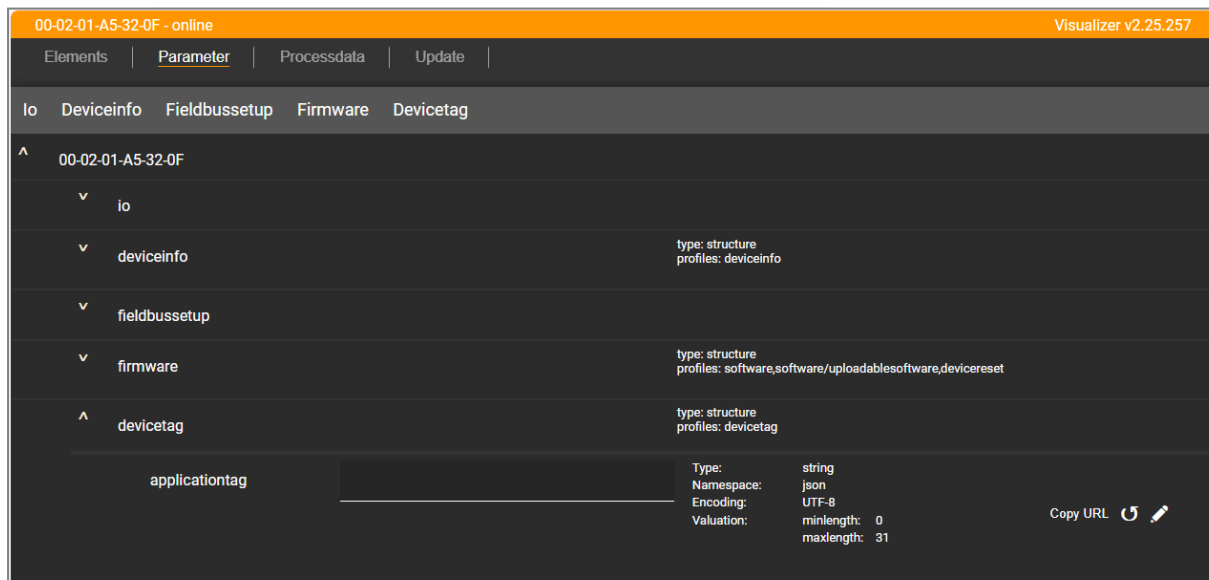
The [Parameter] menu page provides access to the configuration options of the device.



The parameters can only be changed if the device is in one of the following ECAT operating modes: PRE-OPERATIONAL, SAFE-OPERATIONAL

Requirements:

- ✓ IoT Core Visualizer has been started.
- Select the [Parameter] menu.
- ▷ The menu page shows the available parameters of the device.



9.1.3.1 Configuring input filters



- Observe the notes on input filters: [Digital input filters \(→ 8\)](#)

Available parameters:

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

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

Requirements:

- ✓ The device is in the EtherCAT operating mode PRE-OPERATIONAL or SAFE-OPERATIONAL.
- ✓ IoT Core Visualizer has been started.
- ✓ The [Parameter] menu is active.
- Select submenu [io] > [port[n]] (n: 1...8).

- ▷ The menu page shows the current settings of the digital input filters on pin 2 and pin 4 of the port.
- ▶ Set the parameters.
- ▶ Click on  to save the changes to the device.
- ▷ The filters of the digital inputs are configured.

9.1.3.2 Configuring counter modules



- ▶ Observe the notes on counter modules: [Counter](#) (→ [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 counter and batch counter	Disable main counter and batch counter	Pin 2	IoT Core / Fieldbus PLC
CTU	✓	✗	✗	✓	✓	✗	✗
CTD	✓	✗	✗	✓	✓	✗	✗
CTUD	✗	✓	✗	✗	✗	✗	✗
CTDIR	✗	✗	✓	✗	✗	✓	✗
CTDIR	✓	✗	✗	✓	✓	✗	✓

Available parameters:

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

Name	Description	Value range	Access
[batch_threshold]	Batch counter threshold (CTb)	1 ... 65535 (default)	rw ¹

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

Requirements:

- ✓ The device is in the EtherCAT operating mode PRE-OPERATIONAL or SAFE-OPERATIONAL.
- ✓ IoT Core Visualizer has been started.
- ✓ The [Parameter] menu is active.
- ▶ Select submenu [io] > [port[n]] > [counter] (n: 1...8).
 - ▷ The menu page shows the current settings.
- ▶ Set the parameters.
- ▶ Click on  to save the changes.
- ▷ The counter modules are configured.

9.1.3.3 Reading device information

Available information:

Name	Description	Value range	Access
[productcode]	Article number	AL4132	ro ¹
[vendor]	Vendor	ifm electronic	ro ¹
[devicefamily]	Device family	Ethernet modules	ro ¹
[serialnumber]	Serial number (12 digits)	e.g. 000174210161	ro ¹
[hwrevision]	Hardware revision	E.g. AA	ro ¹
[swrevision]	Firmware version	E.g. AL4x3x_fw_ec_1.4.0.147	ro ¹
[bootloaderrevision]	Bootloader version	E.g. AL4xxx_bl_1.5.0.40	ro ¹
[fieldbustype]	Fieldbus	EtherCAT	ro ¹

¹ Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Parameter] menu is active.
- ▶ Select the [deviceinfo] submenu.
- ▷ The menu page shows device information.

9.1.3.4 Reading the firmware version

Available information:

Name	Description	Value range	Access
[version]	Firmware version	AL4x3x_fw_ec_1.4.0.147?	ro ¹
[type]	Type	firmware: Firmware type	ro ¹

¹ Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Parameter] menu is active.
- ▶ Select the [firmware] submenu.

▷ The menu page shows the available information.

9.1.3.5 Setting the application tag

Available parameters:

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

¹ Read and write



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

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

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Parameter] menu is active.
- ▶ Select the [devicetag] submenu.
 - ▷ The menu page shows the current settings.
- ▶ Enter the application tag.
- ▶ Click on  to save the changes to the device.
- ▷ The new application tag is set.

9.1.4 Accessing the process data

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

Requirements:

- ✓ IoT Core Visualizer has been started.
- ▶ Select the [Processdata] menu.
- ▷ The menu page shows the substructures of the device description that contains the process data.
- ▷ The current process values are displayed.

- Optional: In the header, activate the [Polling] option and set the polling interval.
 - ▷ The process values will be refreshed with the set interval.
- Optional: Click on  next to an element to manually refresh the process value.

9.1.4.1 Reading digital input data

Available information:

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

¹ Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Processdata] menu is active.
- Select submenu [io] > [port[n]] (n: 1...8).
- ▷ The menu page shows the digital input data on pin 2 and pin 4 of the port.

9.1.4.2 Reading counter values

Available information:

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

¹ Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The [Processdata] menu is active.
- Select submenu [io] > [port[n]] > [counter] (n: 1...8).
- ▷ The menu page shows current counter values of the counter module.

9.1.4.3 Controlling counter modules

Available control signals:

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

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

² only effective if operating mode of counter module = CTDIR

Requirements:

- ✓ The device is in the EtherCAT operating mode PRE-OPERATIONAL or SAFE-OPERATIONAL.
- ✓ IoT Core Visualizer has been started.
- ✓ The [Processdata] menu is active.

- Select submenu [io] > [port[n]] > [counter] (n: 1...8).
 - ▷ The menu page shows the available services.
- Set the control signals.
- Click on  to send the control signals to the device.
 - ▷ The control signals are executed.

9.1.4.4 Reading status and diagnostic information

Available information:

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

¹ Read only

Requirements:

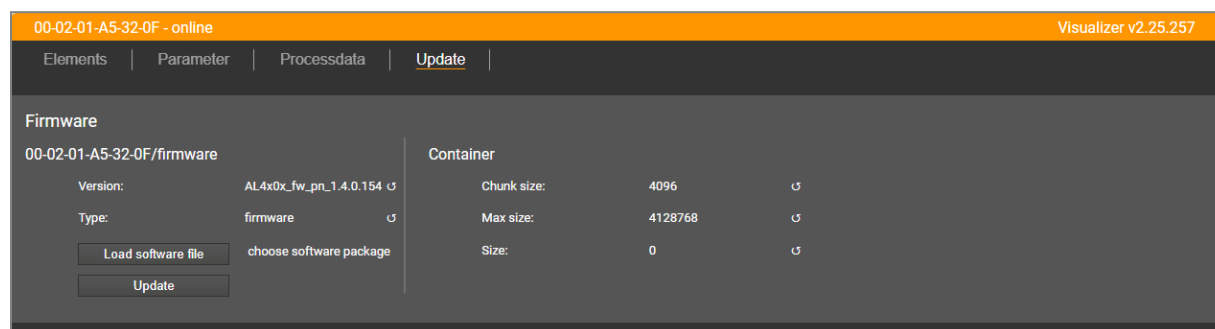
- ✓ IoT Core Visualizer has been started.
- ✓ The [Processdata] menu is active.
- Select the [processdatamaster] submenu.
 - ▷ The menu page shows status and diagnostic information.

9.1.5 Update firmware

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

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ New firmware has been downloaded. documentation.ifm.com
- Select the [Update] menu.
 - ▷ Menu page shows information about the current firmware version.



- Click on [Load software file] and select the new firmware file (*.bin).
- Click on [Update] to start the update process.
 - ▷ The firmware of the device is updated.
 - ▷ The progress of the update process is displayed.
 - ▷ After successful update: The device reboots automatically.

9.2 EtherCAT

9.2.1 Installing the ESI file

For mapping of the device in an EtherCAT projection software, ifm electronic provides a device description file in ESI format (ESI - Electronic Slave Information). In the ESI file, all parameters, process data and their valid status and diagnostic information are defined.

The ESI file is available on ifm's website: www.ifm.com

Example:

To install the ESI file in the TwinCAT 3.1 EtherCAT projection software:

- ▶ Download the ESI file.
- ▶ Copy the file to the following subdirectory of the TwinCAT installation directory: `.. \3.1\Config\Io\EtherCAT`
- ▶ Start TwinCAT.
 - ▷ The device description is loaded into the device catalogue.
 - ▷ TwinCAT can access data provided by the device.

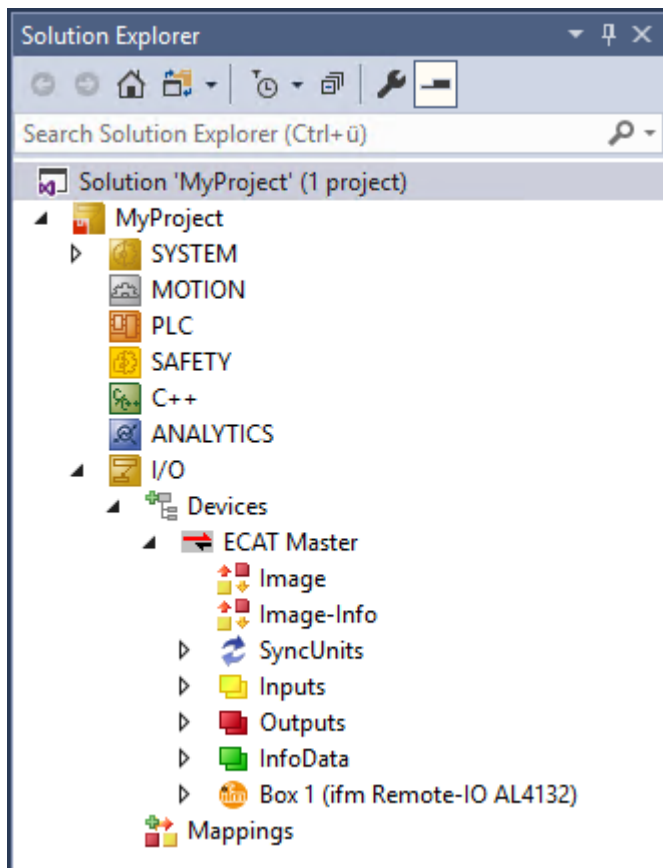
9.2.2 Integrating the device into a project

The device is integrated into the automation project as an EtherCAT slave.

To integrate the device into a TwinCAT project:

Requirements:

- ✓ The ESI file of the device is installed in TwinCAT.
- ✓ The project contains an EtherCAT master to which the device is connected.
- ▶ In the [Solution Explorer]: Mark the EtherCAT master under the [I/O] node.
- ▶ Right-click the node of the EtherCAT master.
 - ▷ The context menu appears.
- ▶ Click on [Add new item...].
 - ▷ A dialogue window appears.
- ▶ Under [ifm electronic] > [ifm Remote-IO], select the device.
- ▶ Click on [OK].
 - ▷ The device has been added to the project.



- Save the project.
- ▷ The device has been integrated into the TwinCAT project.

9.2.2.1 Using Ethernet over EtherCAT (EoE)

The device supports the Ethernet over EtherCAT (EoE) protocol.

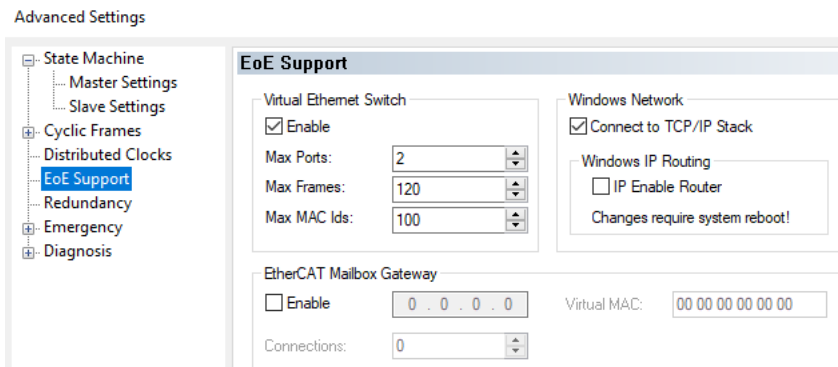
To use EoE, the following conditions must be met:

- The EtherCAT master supports the EoE protocol.
- EoE is activated and configured on the EtherCAT master and the EtherCAT slave.

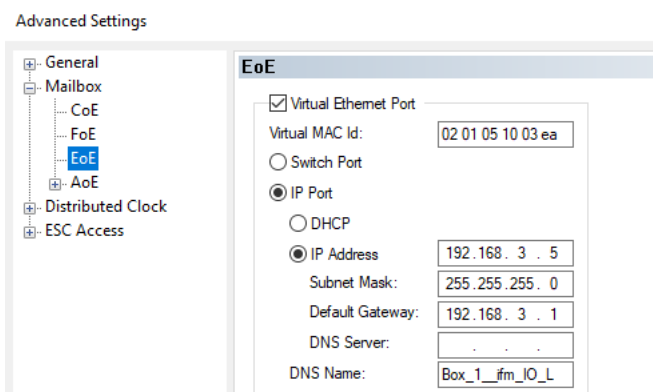
The configuration differs depending on the network topology used. The following example shows the configuration steps for a direct connection between a PC with TwinCAT and the device. The EtherCAT master is assigned to the Ethernet interface of the PC.

Requirements:

- ✓ The device is integrated into the project.
- ✓ IP parameters of the Ethernet interface of the TwinCAT PC are set (e.g. IP address: 192.168.3.1, subnet mask: 255.255.255.0)
- In the [Solution Explorer]: Select the node of the EtherCAT master.
 - ▷ The detail window shows device settings.
- Select the [EtherCAT] tab.
 - ▷ The detail window shows EtherCAT settings.
- Click on [Advanced Settings...].
 - ▷ A dialogue window appears.
- Select the [EoE Support] menu item.
- Set the parameters as follows:



- ▶ Click on [OK].
- ▷ The EoE protocol is activated and configured on the EtherCAT master.
- ▶ In the [Solution Explorer]: Select the node of the device.
 - ▷ The detail window shows device settings.
- ▶ Select the [EtherCAT] tab.
 - ▷ The detail window shows EtherCAT settings.
- ▶ Click on [Advanced Settings...].
 - ▷ A dialogue window appears.
- ▶ Select the [Mailbox] > [EOE] menu item.



- ▶ Activate the [Virtual Ethernet Port] parameters.
- ▶ Activate the [IP Port] parameters.
- ▶ Enter IP settings of the device in the Ethernet network.
- ▶ Click on [OK].
- ▷ The EoE protocol is activated and configured on the EtherCAT slave.
- ▷ The device can be reached from the TwinCAT PC via the set IP address.

9.2.3 Setting the startup parameters

The user can set startup parameters for the device. The set parameters are transferred to the device when changing from the PREOP state to the SAFEOP state.

The user can define additional startup parameters.

To set startup parameters:

Requirements:

- ✓ The TwinCAT project has been created.
- ✓ The device is integrated into the project.
- ▶ In the [Solution Explorer]: Double-click on the device node.
 - ▷ A detailed view of the device appears.
- ▶ Select the [Startup] tab.
 - ▷ The detail window shows the available startup parameters.
- ▶ Configure the startup parameters.
- ▶ Optional: Add and set additional startup parameters.
- ▶ Save the project.
- ▷ The startup parameters are set.

9.2.4 Configuring process data

The device provides the following cyclic process data:

- Digital input channels:

Process data	Type	Description
Digital Input Channel	TxPDO	Digital input channels 1...16

- Per counter module:

Process data	Type	Description
Main Counter Value	TxPDO	Current value of the main counter
Batch Counter Value	TxPDO	Current value of the batch counter
Reset Main and Batch Counter	RxPDO	Reset main and batch counter
Disable Main and Batch Counter	RxPDO	Enable / Disable main and batch counter
Counter Direction	RxPDO	Set counting direction (only valid in CTDIR operating mode)

The process data is configured via the fieldbus slots. The user can assign a module to each slot. Each module defines which data is transmitted.

Available slots:

Slot	Description	Reference
Slot 1	Digital input data	Slot 1 (→ 45)
Slot 2	Counter module port 1	Slot 2 (→ 45)
Slot 3	Counter module port 2	Slot 3 (→ 45)
Slot 4	Counter module port 3	Slot 4 (→ 45)
Slot 5	Counter module port 4	Slot 5 (→ 45)
Slot 6	Counter module port 5	Slot 6 (→ 45)
Slot 7	Counter module port 6	Slot 7 (→ 46)
Slot 8	Counter module port 7	Slot 8 (→ 46)
Slot 9	Counter module port 8	Slot 9 (→ 46)

To configure the process data:

Requirements:

- ✓ The TwinCAT project has been created.
- ✓ The device is integrated into the project.
- ▶ In the [Solution Explorer]: Double-click on the device node.
 - ▷ A detailed view of the device appears.
- ▶ Select the [Slots] tab.
 - ▷ The detail window shows slots and the modules available in each case.
- ▶ Assign the desired module to each slot.
- ▷ Cyclic input and output data has been configured.
- ▶ Save the project.
- ▷ The process data is configured.
- ▷ In the [Solution Explorer], symbol nodes are created for the configured process data.

9.2.5 Setting the arrangement of the digital input channels

The device has 16 digital input channels. The input channels are assigned to pins 2 and 4 of each port:

Port	X8		X7		X6		X5		X4		X3		X2		X1	
Pin	2	4	2	4	2	4	2	4	2	4	2	4	2	4	2	4
DI Ch	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

The arrangement of the digital input channels in the process data can be set.

Available options:

- Pin-based: [Mapping: DI channel mapping - pin-based \(→ 55\)](#)
- Port-based: [Mapping: DI channel mapping - port-based \(→ 55\)](#)

The parameters are set via the object area [Configuration area \(0x8000 - 0x8FFF\) \(→ 58\)](#).

Available parameters:

Index	Parameter	Description
0x8000	DI Channel Mapping	Arrangement of the digital input channels in the process data

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.6 Configuring the digital input filters



- ▶ Observe the notes on input filters: [Digital input filters \(→ 8\)](#)

The digital input channels each have a digital input filter. The process value can be pre-processed using the input filter. The filter of each digital input channel can be configured separately.

The parameters are set via the object area [Configuration area \(0x8000 - 0x8FFF\) \(→ 58\)](#).

Available parameters:

Per digital input channel:

Index	Parameter	Description
0x8001... 0x8008	Invert DI - pin 4	Signal inversion - pin 4
	Hold level - pin 4	Hold level - pin 4
	Debounce time - pin 4	Debounce time - Pin 4
	Hold time - pin 4	Hold time - pin 4
	Invert DI - pin 2	Signal inversion - pin 2
	Hold level - pin 2	Hold level - pin 2
	Debounce time - pin 2	Debounce time - pin 2
	Hold time - pin 2	Hold time - pin 2

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.7 Configuring the counter modules



► Observe the notes on counter modules: [Counter \(→ 10\)](#)



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

The properties of the enabled counter modules can be configured.

Each counter module can be configured separately.

The following table shows the valid combinations of the parameters [Pin 2 function] and [Count direction selection] (✓) for each counter operating mode: valid setting; ✗: invalid setting):

Counter mode	Pin 2 function					Count direction selection	
	N/C	Counter Edge Input Pin2	Count Direction	Reset	Disable	Pin 2 Count Direction	IoT / PLC Count Direction
CTU	✓	✗	✗	✓	✓	✗	✗
CTD	✓	✗	✗	✓	✓	✗	✗
CTUD	✗	✓	✗	✗	✗	✗	✗
CTDIR	✗	✗	✓	✗	✗	✓	✗
CTDIR	✓	✗	✗	✓	✓	✗	✓



For the parameters [Pin 2 function] and [Count direction selection] all parameter values can be selected. The validity of the set value combinations is not checked.

► Make sure that only valid value combinations are set.



Counting pulses are also processed by the main counter and the batch counter while the device is in the INIT EtherCAT state.

► When creating the application, ensure that the counter readings have the desired initial values.



In the CTDIR operating mode with set counting instance IoT / PLC Count Direction, the counting direction can only be set via the output process data (RxPDO) in the OPERATIONAL state. Counting pulses are already processed by the main counter while the device is in the SAFE-OPERATIONAL EtherCAT state.

► When creating the application, ensure that the counting pulses are processed by the main counter in the desired counting direction.

The parameters are set via the object area [Configuration area \(0x8000 - 0x8FFF\) \(→ 58\)](#).

Available parameters:

Per counter module:

Index	Parameter	Description
0x8010... 0x8088	Counter mode	Operating mode of the counter module
	Pin 2 function	Pin 2 function of the port
	Count direction selection	Instance for selecting the counting direction
	Main counter threshold	Threshold CT of the main counter
	Batch counter threshold	Threshold CTb of the batch counter
	Enable main counter event	Enable event messages for main counter
	Enable batch counter event	Enable event messages for batch counter
	Force main counter value	Set counter value of the main counter
	Force batch counter value	Set counter value of the batch counter

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.8 Reading counter events

The device can indicate overflow and underflow events for all enabled counter modules.

The events are accessed via the object area [Information area \(0x9000 - 0x9FFF\) \(→ 60\)](#).



The overflow and underflow indication for the main counter and the batch counter must be activated separately [Configuring the counter modules \(→ 36\)](#).

Available information:

Index	Event	Description
0x9010... 0x9080	Main counter event overflow	Overflow of the main counter
	Main counter event underflow	Underflow of the main counter
	Batch counter event overflow	Overflow of the batch counter
	Batch counter event underflow	Underflow of the batch counter

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

After an overflow or underflow, the corresponding event display will remain active. The event display must be reset manually.

Available options:

- Set the output [Reset Main and Batch Counter] of the counter module [Controlling counter modules \(→ 40\)](#)
- Set the control signals of the [Reset Counter Event] object of the port [Resetting counter events \(→ 37\)](#)
- Change the settings of the counter module [Configuring the counter modules \(→ 36\)](#)

9.2.9 Resetting counter events

The device provides control signals to reset the overflow and underflow events of the counter modules. Separate control signals are available for each counter module.

The control signals are accessed via the object area [Output area \(0x7000 - 0x7FFF\) \(→ 57\)](#).

Available control signals:

Index	Signal	Description
0x7018... 0x7088	Reset Main Counter Event Overflow	Reset main counter overflow event
	Reset Main Counter Event Underflow	Reset main counter underflow event
	Reset Batch Counter Event Overflow	Reset batch counter overflow event
	Reset Batch Counter Event Underflow	Reset batch counter underflow event
	Reset counter events	Reset all counter events

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.10 Controlling the device

The device is controlled via the object area [Manufacturer-specific area \(0x2000 - 0x5FFF\) \(→ 53\)](#).

Available commands:

Index	Command	Description
0x2F00	Factory Reset	Resets the device to factory settings
0x2F01	Reboot	Reboots the device
0x2F02	Device Localization	RDY status LEDs flash

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.11 Reading digital inputs

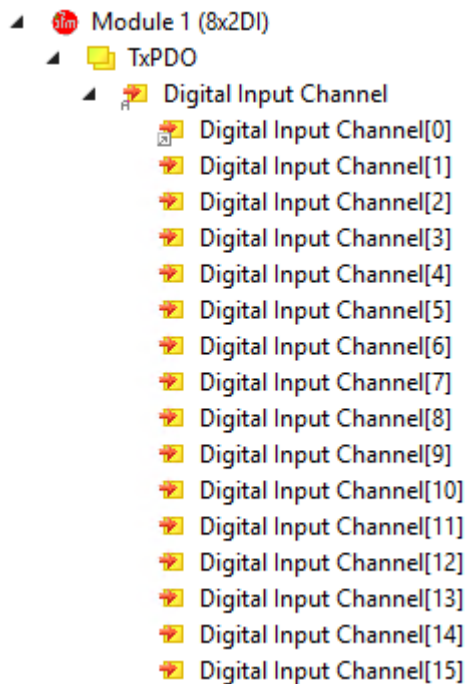
The digital inputs are transmitted in the cyclic process data of the 2x8 DI module.

Available data:

Index	Parameter	Description
0x6000	• Digital Input Channel[0]	Digital input channel 1 (port 1, pin 4)
	• Digital Input Channel[1]	Digital input channel 2 (port 1, pin 2)
	• Digital Input Channel[2]	Digital input channel 3 (port 2, pin 4)
	• Digital Input Channel[3]	Digital input channel 4 (port 2, pin 2)
	• Digital Input Channel[4]	Digital input channel 5 (port 3, pin 4)
	• Digital Input Channel[5]	Digital input channel 6 (port 3, pin 2)
	• Digital Input Channel[6]	Digital input channel 7 (port 4, pin 4)
	• Digital Input Channel[7]	Digital input channel 8 (port 4, pin 2)
	• Digital Input Channel[8]	Digital input channel 9 (port 5, pin 4)
	• Digital Input Channel[9]	Digital input channel 10 (port 5, pin 2)
	• Digital Input Channel[10]	Digital input channel 11 (port 6, pin 4)
	• Digital Input Channel[11]	Digital input channel 12 (port 6, pin 2)
	• Digital Input Channel[12]	Digital input channel 13 (port 7, pin 4)
	• Digital Input Channel[13]	Digital input channel 14 (port 7, pin 2)
	• Digital Input Channel[14]	Digital input channel 15 (port 8, pin 4)
	• Digital Input Channel[15]	Digital input channel 16 (port 8, pin 2)

The current data values can only be accessed via the process data objects (TxPDO).

When configuring the process data, symbol nodes are automatically created for all digital input channels:



Requirements:

- ✓ The device is integrated into the project.
- ✓ The process data is configured.
- In the [Solution Explorer]: Under [SYSTEM] > [Tasks] declare all required variables of the appropriate type.
- Link the symbol nodes of the digital input channels with the declared variables.
- ▷ The user can access the digital input data in the application via the variables.

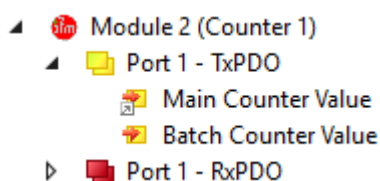
9.2.12 Reading counter values

The current counter values are transmitted in the cyclic process data of the Counter 1...Counter 8 modules.

Index	Parameter	Description
0x6010... 0x6080	• Main Counter Value	Current value of the main counter
	• Batch Counter Value	Current value of the batch counter

The current data values can only be accessed via the process data objects (TxPDO).

When configuring the process data, symbol nodes are automatically created for the counter values of all enabled counter modules:



Requirements:

- ✓ The device is integrated into the project.
- ✓ The process data is configured.

- In the [Solution Explorer]: Under [SYSTEM] > [Tasks] declare all required variables of the appropriate type.
- Link the symbol nodes of the current counter values with the declared variables.
- The user can access the current counter values in the application via the variables.

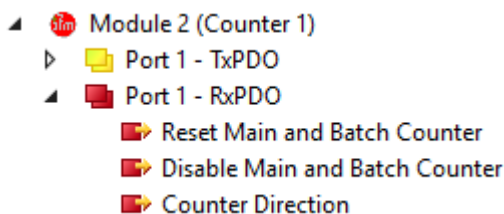
9.2.13 Controlling counter modules

The control signals for the activated counter modules are transmitted in the cyclic process data of the Counter 1...Counter 8 modules.

Available data:

Index	Parameter	Description
0x6010... 0x6080	• Reset Main and Batch Counter	Reset main and batch counter
	• Disable Main and Batch Counter	Disable / Enable main counter and batch counter
	• Counter Direction	Set counting direction

When configuring the process data, symbol nodes are automatically created for the control signals of all enabled counter modules:



Requirements:

- ✓ The device is integrated into the project.
- ✓ The process data is configured.
- In the [Solution Explorer]: Under [SYSTEM] > [Tasks] declare all required variables of the appropriate type.
- Link the symbol nodes of the control signals with the declared variables.
- The user can access the control signals in the application via the variables.

9.2.14 Reading diagnostic and status information

Diagnostic and status information is provided in the object areas [Communication area \(0x1000 - 0x1FFF\)](#) (→ [47](#)) and [Device area \(0xF000 - 0xFFFF\)](#) (→ [61](#)).

Available information:

Index	Information	Description
0x10F3	Diagnosis History	Error messages
0xF110	Power Status Error	Error in the device supply (undervoltage, overvoltage, overcurrent, short circuit, excess temperature)

Access options:

- CANopen over EtherCAT (EoE): [Using CANopen over EtherCAT \(CoE\)](#) (→ [41](#))
- ADS over EtherCAT (AoE): [Using ADS over EtherCAT \(AoE\)](#) (→ [41](#))

9.2.15 Acyclic access

The device supports the following mailbox protocols for acyclic read and write access to the objects in the object directory:

- [Using CANopen over EtherCAT \(CoE\) \(→ 41\)](#)
- [Using ADS over EtherCAT \(AoE\) \(→ 41\)](#)

9.2.15.1 Using CANopen over EtherCAT (CoE)

The device supports the mailbox protocol “CANopen over EtherCAT” (CoE). CoE allows acyclic read or write access to objects on the device.



Only 1 acyclic read/write access can be executed at a time.



Acyclic access options via CoE: → user documentation of the projection software

Example: reading the manufacturer ID via CoE

Task: read the manufacturer ID of the device in TwinCAT via CoE

Solution: In TwinCAT via the [CoE – Online] view in [Identity Object] (index: 0x1018), read the value for [Vendor ID] (subindex: 0x01)

Requirements:

- ✓ The connection to the device is established (online).
- ▶ In the [Solution Explorer]: Double-click on the device node.
 - ▷ A detailed view of the device appears.
- ▶ Select the [CoE – Online] tab.
 - ▷ The object directory of the device appears.
- ▶ Select object 0x1018:01 from the table.
 - ▷ The [Value] column displays the value of the object: 0x00000622 (= ifm electronic)

9.2.15.2 Using ADS over EtherCAT (AoE)

The device supports the “ADS over EtherCAT” (AoE) protocol. AoE allows uninterrupted acyclic read and write access to objects on the device.



Multiple acyclic AoE requests can be executed at the same time.



Acyclic access options via AoE: → user documentation of the projection software

Specific parameters for device access:

Parameter	Description	Value range
Port	Port number	0x0000FFFF
Index Group	AoE index group	0x00003F02
Index Offset	Index and subindex of the object Index Offset: • bits 16...31: index • bit 8: complete access (always 0x0) • bits 0...7: subindex	Index and subindex depend on device, see Object directory (→ 47)

Example: read the manufacturer ID via AoE

Task: read the manufacturer ID of the device in TwinCAT via AoE

Solution: In TwinCAT via the [AoE – Online] view in [Identity Object] (index: 0x1018), read the value for [Vendor ID] (subindex: 0x0001)

Requirements:

- ✓ The connection to the device is established (online).
- ▶ In the [Solution Explorer]: Double-click on the device node.
 - ▷ A detailed view of the device appears.
- ▶ Select the [AoE – Online] tab.
 - ▷ The input mask for acyclic communication via AoE is displayed.
- ▶ Enter the following parameter values:
 - [Port]: 0x0000FFFF
 - [Index Group]: 0x00003F02
 - [Index Offset]: 0x10180001
- ▶ Click on [Read].
 - ▷ The Read-Data field displays the read value: 0x00000622 (= ifm electronic)

9.2.16 Updating the firmware

The firmware of the device can be updated using the protocol File over EtherCAT (FoE).

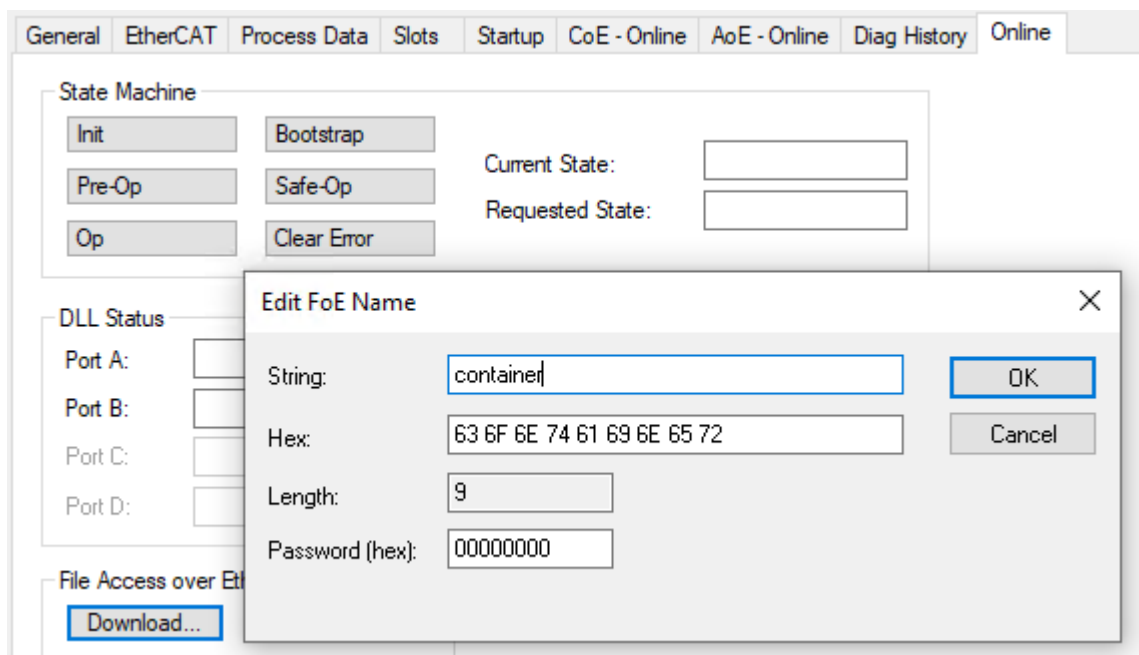


The firmware update can only be executed in the following EtherCAT operating modes: BOOTSTRAP (recommended), PRE-OPERATIONAL, SAFE-OPERATIONAL.

Example: TwinCAT

Requirements:

- ✓ The connection to the device is established (online).
- ✓ The device is in one of the following EtherCAT operating modes: BOOTSTRAP, PRE-OPERATIONAL or SAFE-OPERATIONAL.
- ✓ The new firmware has been downloaded and unpacked.
- ▶ Rename the new firmware file to `container.bin`.
- ▶ In the [Solution Explorer]: Double-click on the device node.
 - ▷ A detailed view of the device appears.
- ▶ Select the [Online] tab.
- ▶ In the [File Access over EtherCAT] area: Click on [Download].
 - ▷ A dialogue window appears.
- ▶ Select the new firmware file and click [OK] to confirm your selection.
 - ▷ A dialogue window appears.



- Click on [OK].
 - ▷ The new firmware is transferred to the device.
 - ▷ After transmission of the firmware, the device restarts automatically.
- ▷ The firmware of the device is updated.

10 Maintenance, repair and disposal

The operation of the device is maintenance-free.

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

10.1 Cleaning

- ▶ Disconnect the device from the voltage supply.
- ▶ Clean the device from dirt using a soft, chemically untreated and dry cloth.
- ▶ In case of severe soiling, use a damp cloth.



- ▶ Do not use any caustic cleaning agents for cleaning!

10.2 Update firmware

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

- IoT-Core Visualizer: [Update firmware \(→ 30\)](#)
- TwinCAT projection software: [Updating the firmware \(→ 42\)](#)

11 Appendix

11.1 EtherCAT

11.1.1 EtherCAT modules

11.1.1.1 Slot 1

Slot	Description	Available modules	Length [bytes]
1	Digital input data	• Deactivated: slot deactivated	0
		• 8x2DI: digital input data activated (default)	2 / 0

11.1.1.2 Slot 2

Slot	Description	Available modules	Length [bytes]
2	Counter module 1	• Deactivated: counter module port 1 deactivated (default)	0
		• Counter 1: counter module port 1 activated	6 / 3

11.1.1.3 Slot 3

Slot	Description	Available modules	Length [bytes]
3	Counter module 2	• Deactivated: counter module port 2 deactivated (default)	0
		• Counter 2: counter module port 2 activated	6 / 3

11.1.1.4 Slot 4

Slot	Description	Available modules	Length [bytes]
4	Counter module 3	• Deactivated: counter module port 3 deactivated (default)	0
		• Counter 3: counter module port 3 activated	6 / 3

11.1.1.5 Slot 5

Slot	Description	Available modules	Length [bytes]
5	Counter module 4	• Deactivated: counter module port 4 deactivated (default)	0
		• Counter 4: counter module port 4 activated	6 / 3

11.1.1.6 Slot 6

Slot	Description	Available modules	Length [bytes]
6	counter module 5	• Deactivated: counter module port 5 deactivated (default)	0
		• Counter 5: counter module port 5 activated	6 / 3

11.1.1.7 Slot 7

Slot	Description	Available modules	Length [bytes]
7	Counter module 6	• Deactivated: counter module port 6 deactivated (default)	0
		• Counter 6: counter module port 6 activated	6 / 3

11.1.1.8 Slot 8

Slot	Description	Available modules	Length [bytes]
8	Counter module 7	• Deactivated: counter module port 7 deactivated (default)	0
		• Counter 7: counter module port 7 activated	6 / 3

11.1.1.9 Slot 9

Slot	Description	Available modules	Length [bytes]
9	Counter module 8	• Deactivated: counter module port 8 deactivated (default)	0
		• Counter 8: counter module port 8 activated	6 / 3

11.1.2 Object directory

11.1.2.1 Communication area (0x1000 - 0x1FFF)

Index	Subindex	Name	Possible values	Data type / access
0x1000	--	Device Type	• 0x184C1389: Modular Device Profile (MDP)	UINT32 / ro
0x1008	--	Manufacturer Device Name	"AL4132"	STRING / ro
0x1009	--	Manufacturer Hardware Version	E.g. "AA"	STRING / ro
0x100A	--	Manufacturer Software Version	E.g. "1.4.0"	STRING / ro
0x1018	--	Identity Object		
	• 0x01	Vendor ID	0x00000622: ifm electronic	UINT32 / ro
	• 0x02	Product Code	0x00004132	UINT32 / ro
	• 0x03	Revision Number	E.g. 0x00000001	UINT32 / ro
	• 0x04	Serial number	Device-dependent	UINT32 / ro
0x10F3		Diagnosis History		
	• 0x01	Maximum Messages	• 0x00: 0 messages ... • 0x32: 50 messages	UINT8 / ro
	• 0x02	Newest Message	• 0x01: message 1 ... • 0x32: message 50	UINT8 / ro
	• 0x03	Newest Acknowledged Message	Override Mode: • 0x00: Reading: When the message queue will be overwritten, the slave shall set subindex 0x03 to 0 • 0x01...0x05: Writing: The slave shall return SDO-Abort with codes 0x06090030 (value range of parameter exceeded) or 0x0609003 • 0x06...0x46: Writing: Subindex 0x03 = Written value without checking • 0x47...0xFF: Writing: SDO-Abort with codes 0x06090030 or 0x06090031 (value of parameter written too high) Acknowledge Mode: • 0x00: – Read: No messages have been acknowledged so far – Writing: All acknowledged messages will be deleted • 0x01...0x05: Writing: The slave shall return SDO-Abort with codes 0x06090030 (value range of parameter exceeded) or 0x06090032 • 0x06...0x37: – Read: Subindex of latest acknowledged diagnosis message – Writing: Messages are acknowledged • 0x38...0xFF: Writing: SDO-Abort with codes 0x06090030 or 0x06090031 (value of parameter written too high)	UINT8 / rw
	• 0x04	New Message Available	Override mode: • 0x0: Newest message was read • 0x1: Newest message was not read Acknowledge mode: • 0x0: No acknowledged message • 0x1: Diagnosis messages are available which can be acknowledged (subindex 0x02 <> subindex 0x03)	BOOL / ro

Index	Subindex	Name	Possible values	Data type / access
0x10F3	• 0x05	Flags	Mapping: Flags (→ □ 51)	UINT16 / rw
	• 0x06	Diagnosis Message 01	Mapping: Diagnosis Message (→ □ 52)	OCTET STRING / ro
	...	...	...	...
	• 0x32	Diagnosis Message 50	Mapping: Diagnosis Message (→ □ 52)	OCTET STRING / ro
0x10F8	--	Timestamp (value in ns)		UINT64 / ro
0x1601		RxPDO Mapping of Outputs Module 2		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7010:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7010:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7010:03	UINT32 / rw
0x1602		RxPDO Mapping of Outputs Module 3		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7020:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7020:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7020:03	UINT32 / rw
0x1603		RxPDO Mapping of Outputs Module 4		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7030:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7030:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7030:03	UINT32 / rw
0x1604		RxPDO Mapping of Outputs Module 5		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7040:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7040:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7040:03	UINT32 / rw
0x1605		RxPDO Mapping of Outputs Module 6		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7050:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7050:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7050:03	UINT32 / rw
0x1606		RxPDO Mapping of Outputs Module 7		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7060:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7060:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7060:03	UINT32 / rw
0x1607		RxPDO Mapping of Outputs Module 8		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7070:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7070:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7070:03	UINT32 / rw
0x1608		RxPDO Mapping of Outputs Module 9		
	• 0x01	1 Byte Out (0)	• PDO Content: 0x7080:01	UINT32 / rw
	• 0x02	1 Byte Out (1)	• PDO Content: 0x7080:02	UINT32 / rw
	• 0x03	1 Byte Out (2)	• PDO Content: 0x7080:03	UINT32 / rw
0x1A00		TxPDO Mapping of Inputs Module 1		
	• 0x01	2 Bytes Out (0)	• PDO Content: 0x6000:01	UINT32 / rw
0x1A01		TxPDO Mapping of Inputs Module 2		
	• 0x01	4 Bytes In (0)	• PDO Content: 0x6010:01	UINT32 / rw
	• 0x02	2 Bytes In (1)	• PDO Content: 0x6010:02	UINT32 / rw

Index	Subindex	Name	Possible values	Data type / access
0x1A02		TxPDO Mapping of Inputs Module 3		
	0x01	4 Bytes In (0)	• PDO Content: 0x6020:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6020:02	UINT32 / rw
0x1A03		TxPDO Mapping of Inputs Module 4		
	0x01	4 Bytes In (0)	• PDO Content: 0x6030:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6030:02	UINT32 / rw
0x1A04		TxPDO Mapping of Inputs Module 5		
	0x01	4 Bytes In (0)	• PDO Content: 0x6040:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6040:02	UINT32 / rw
0x1A05		TxPDO Mapping of Inputs Module 6		
	0x01	4 Bytes In (0)	• PDO Content: 0x6050:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6050:02	UINT32 / rw
0x1A06		TxPDO Mapping of Inputs Module 7		
	0x01	4 Bytes In (0)	• PDO Content: 0x6060:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6060:02	UINT32 / rw
0x1A07		TxPDO Mapping of Inputs Module 8		
	0x01	4 Bytes In (0)	• PDO Content: 0x6070:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6070:02	UINT32 / rw
0x1A08		TxPDO Mapping of Inputs Module 9		
	0x01	4 Bytes In (0)	• PDO Content: 0x6080:01	UINT32 / rw
	0x02	2 Bytes In (1)	• PDO Content: 0x6080:02	UINT32 / rw
0x1C00		Sync Manager Type		
	0x01	Subindex 001	• 0x01: SM Type Channel 1 – Mailbox Write	UINT8 / ro
	0x02	Subindex 002	• 0x02: SM Type Channel 2 – Mailbox Read	UINT8 / ro
	0x03	Subindex 003	• 0x03: SM Type Channel 3 – Process Data Write (outputs)	UINT8 / ro
	0x04	Subindex 004	• 0x04: SM Type Channel 4 – Process Data Read (inputs)	UINT8 / ro
0x1C12		Sync Manager 2 PDO Assignment		
	0x01	Subindex 001	• 0x1601: RxPDO - counter port 1	UINT16 / rw
	0x02	Subindex 002	• 0x1602: RxPDO - counter port 2	UINT16 / rw
	0x03	Subindex 003	• 0x1603: RxPDO - counter port 3	UINT16 / rw
	0x04	Subindex 004	• 0x1604: RxPDO - counter port 4	UINT16 / rw
	0x05	Subindex 005	• 0x1605: RxPDO - counter port 5	UINT16 / rw
	0x06	Subindex 006	• 0x1606: RxPDO - counter port 6	UINT16 / rw
	0x07	Subindex 007	• 0x1607: RxPDO - counter port 7	UINT16 / rw
	0x08	Subindex 008	• 0x1608: RxPDO - counter port 8	UINT16 / rw
0x1C13		Sync Manager 3 PDO Assignment		
	0x01	Subindex 001	• 0x1A00: TxPDO - 8x2DI modules	UINT16 / rw
	0x02	Subindex 002	• 0x1A01: TxPDO - counter port 1	UINT16 / rw
	0x03	Subindex 003	• 0x1A02: TxPDO - counter port 2	UINT16 / rw
	0x04	Subindex 004	• 0x1A03: TxPDO - counter port 3	UINT16 / rw
	0x05	Subindex 005	• 0x1A04: TxPDO - counter port 4	UINT16 / rw
	0x06	Subindex 006	• 0x1A05: TxPDO - counter port 5	UINT16 / rw

Index	Subindex	Name	Possible values	Data type / access
0x1C13	• 0x07	Subindex 007	• 0x1A06: TxPDO - counter port 6	UINT16 / rw
	• 0x08	Subindex 008	• 0x1A07: TxPDO - counter port 7	UINT16 / rw
	• 0x09	Subindex 009	• 0x1A08: TxPDO - counter port 8	UINT16 / rw

Mapping: Flags

Word (Offset)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n	reserved										OI	MS	DE	DW	DI	EE

Legend:

- EE Enable Emergency sending (acc. to ETG.1000-6) 1 BIT
 - 0x0: Do not transmit diagnostic messages as emergency messages
 - 0x1: Transmit new diagnostic message as emergency message
- DI Disable information messages 1 BIT
 - 0x0: Information messages are stored in the message queue (default)
 - 0x1: Information messages are not stored in the message queue
- DW Disable warning messages 1 BIT
 - 0x0: Warning messages are stored in the message queue (default)
 - 0x1: Warning messages are not stored in the message queue
- DE Disable error messages 1 bit
 - 0x0: Error messages are stored in the message queue (default)
 - 0x1: Error messages are not stored in the message queue
- MS Mode selection 1 bit
 - 0x0: Override Mode
 - 0x1: Acknowledge Mode
- OI Overwrite/discard information
 - Override Mode:
 - 0x0: no event
 - 0x1: Unacknowledged messages were overwritten (buffer overrun); Subindex 0x03 = 0
 - Acknowledge Mode:
 - 0x0: no event
 - 0x1: Buffer is full of unacknowledged messages and new messages are discarded

Mapping: Diagnosis Message

Parameter	Description	Value range	Data type / access
Diag Code	Diagnostic code	Bits 0...15: • 0x0000...0xDFFF: not used • 0xE000...0xE7FF: bit 16...31 vendor specific • 0xE800: bit 16...31: emergency error code from DS301 or DS4xxx • 0xE801...0xEDFF: reserved • 0xEE00...0xEFFF: bit 16...31: profile specific • 0xF000...0xFF00: not used • 0xFF01: New Remote-IO Counter Event	UINT32 / ro
Flags	Event qualifier type	• 0x0000: Notification • 0x0001: Warning • 0x0002: Error	UINT16 / ro
Text ID	Text ID as reference to diagnosis text as defined in ESI file	• 0x0000: not Text ID • 0x0001...0xFFFF: Text ID reference to ESI file	UINT16 / ro
Time Stamp	Time Stamp (value in ms)	0x0000000000000000...0xFFFFFFFFFFFFFFFF	UINT64 / to
Flags Parameter 1	Data type Parameter 1	• 0x0005: UINT8	UINT16 / ro
Flags Parameter 2	Data type parameter 2	• 0x0006: UINT16 • 0x0000: not used	UINT16 / ro
Parameter 2	Event Code	• 0xFF01: new counter event – Byte 0: port number – Byte 1...2: 0x1000: main counter overflow 0x0100: main counter underflow 0x0010: batch counter overflow 0x0001: batch counter underflow – Byte 3...4: not used	UINT16 / ro

11.1.2.2 Manufacturer-specific area (0x2000 - 0x5FFF)

Index	Subindex	Name	Possible values	Data type / access
0x2001	--	Component Name	"ETH Module PFL ECAT 16DI IP67"	STRING / ro
0x2002	--	Vendor Name	"ifm electronic"	STRING / ro
0x2003	--	Vendor URL	"www.ifm.com"	STRING / ro
0x2004	--	Order Number	"AL4132"	STRING / ro
0x2005	--	Manufacturing Date	e.g. "31.10.2023, 15:33:22"	STRING / ro
0x2006	--	Fieldbus Firmware	e.g. "5.3.0.12 (EtherCAT Slave)"	STRING / ro
0x2F00	--	Factory Reset	• 0x00...0xFE: no action • 0xFF: Reset device to factory settings	UINT8 / wo
0x2F01	--	Reboot	• 0x00...0xFE: no action • 0xFF: reboot device	UINT8 / wo
0x2F02	--	Device Localization	• 0x00: RDY status LED flashes (5 s) • 0x01...0xFF: no action	UINT8 / wo

11.1.2.3 Input area (0x6000 - 0x6FFF)

Index	Subindex	Name	Possible values	Data type / access
0x6000		Inputs Module 1		
	• 0x01	Digital Input Channel 0...15	• Mapping: DI channel mapping - port-based (→ □ 55) • Mapping: DI channel mapping - pin-based (→ □ 55)	BITARR16 / ro
0x6010		Inputs Module 2		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6020		Inputs Module 3		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6030		Inputs Module 4		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6040		Inputs Module 5		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6050		Inputs Module 6		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6060		Inputs Module 7		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6070		Inputs Module 8		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro
0x6080		Inputs Module 9		
	• 0x1	Main Counter Value	• Mapping: Main Counter Value (→ □ 56)	UINT32 / ro
	• 0x2	Batch Counter Value	• Mapping: Batch Counter Value (→ □ 56)	UINT16 / ro

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
n	DI Ch14	DI Ch12	DI Ch10	DI Ch8	DI Ch6	DI Ch4	DI Ch2	DI Ch0
n+1	DI Ch15	DI Ch13	DI Ch11	DI Ch9	DI Ch7	DI Ch5	DI Ch3	DI Ch1

• DI Chx	Signal level digital input channel x	1 BIT	• 0x0: LOW • 0x1: HIGH
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Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
n	DI Ch7	DI Ch6	DI Ch5	DI Ch4	DI Ch3	DI Ch2	DI Ch1	DI Ch0
n+1	DI Ch1	DI Ch14	DI Ch13	DI Ch12	DI Ch11	DI Ch10	DI Ch9	DI Ch8

• DI Chx	Signal level digital input channel x	1 BIT	• 0x0: LOW • 0x1: HIGH
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Mapping: Main Counter Value

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

Legend:

- Main Counter Value Current main counter value 4 BYTES • 0x00000000: 0
Main counter value = 0x12345678 ...
• Main Counter Value[0] = 0x12 • 0xFFFFFFFF: 4294967294
• Main Counter Value[1] = 0x34
• Main Counter Value[2] = 0x56
• Main Counter Value[3] = 0x78

Mapping: Batch Counter Value

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

Legend:

- Batch Counter Value Current batch counter value 2 BYTES • 0x0000: 0
Batch Counter Value = 0x1234 ...
• Batch Counter Value[0] = 0x12 • 0xFFFF: 65534
• Batch Counter Value[1] = 0x34

11.1.2.4 Output area (0x7000 - 0x7FFF)

Index	Subindex	Name	Possible values	Data type / access
0x7010		Output Module 2		
	• 0x01	Reset Main and Batch Counter	• 0x00: no action • 0x01: reset main counter and batch counter	UINT8 / ro
	• 0x02	Disable Main and Batch Counter	• 0x00: enable main and batch counter • 0x01: disable main and batch counter	UINT8 / ro
	• 0x03	Counter Direction	• 0x00: up • 0x01: down	UINT8 / ro
0x7018		Reset Counter Event Port 1		
	• 0x01	Reset Main Counter Event Overflow	• 0x00, 0x02...0xFF: no action • 0x01: Reset	UINT8 / wo
	• 0x02	Reset Main Counter Event Underflow	• 0x00, 0x02...0xFF: no action • 0x01: Reset	UINT8 / wo
	• 0x03	Reset Batch Counter Event Overflow	• 0x00, 0x02...0xFF: no action • 0x01: Reset	UINT8 / wo
	• 0x04	Reset Batch Counter Event Underflow	• 0x00, 0x02...0xFF: no action • 0x01: Reset	UINT8 / wo
	• 0x05	Reset counter events	• 0x00, 0x02...0xFF: no action • 0x01: Reset	UINT8 / wo
0x7020		Output Module 2 (structure: → Index 0x7010)		
0x7028		Reset Counter Event Port 2 (structure: → Index 0x7018)		
0x7030		Output Module 3 (structure: → Index 0x7010)		
0x7038		Reset Counter Event Port 3 (structure: → Index 0x7018)		
0x7040		Output Module 4 (structure: → Index 0x7010)		
0x7048		Reset Counter Event Port 4 (structure: → Index 0x7018)		
0x7050		Output Module 5 (structure: → Index 0x7010)		
0x7058		Reset Counter Event Port 5 (structure: → Index 0x7018)		
0x7060		Output Module 6 (structure: → Index 0x7010)		
0x7068		Reset Counter Event Port 6 (structure: → Index 0x7018)		
0x7070		Output Module 7 (structure: → Index 0x7010)		
0x7078		Reset Counter Event Port 7 (structure: → Index 0x7018)		
0x7080		Output Module 8 (structure: → Index 0x7010)		
0x7088		Reset Counter Event Port 8 (structure: → Index 0x7018)		

11.1.2.5 Configuration area (0x8000 - 0x8FFF)

Index	Subindex	Name	Possible values	Data type / access
0x8000		DI Channel Mapping	• 0x0: pin-based (default) • 0x1: port-based	UINT8 / rw
0x8001		Settings – DI Module Port 1		
	• 0x01	Invert DI – Pin 4	• 0x00: do not invert (default) • 0x01: invert	UINT8 / rw
	• 0x02	Hold Level – Pin 4	• 0x00: hold LOW level • 0x01: hold HIGH level (default)	UINT8 / rw
	• 0x03	Debounce Time – Pin 4 (= value * 0.1 ms)	• 0x0000: 0 ms (default) ... • 0x01F4: 50 ms	UINT16 / rw
	• 0x04	Hold Time – Pin 4 (= value * 0.1 ms)	• 0x0000: 0 ms (default) ... • 0xEA60: 6000 ms	UINT16 / rw
	• 0x05	Invert DI – Pin 2	• 0x00: do not invert (default) • 0x01: invert	UINT8 / rw
	• 0x06	Hold Level – Pin 2	• 0x00: hold LOW level • 0x01: hold HIGH level (default)	UINT8 / rw
	• 0x07	Debounce Time – Pin 2 (= value * 0.1 ms)	• 0x0000: 0 ms (default) ... • 0x01F4: 50 ms	UINT16 / rw
	• 0x08	Hold Time – Pin 2 (= value * 0.1 ms)	• 0x0000: 0 ms (default) ... • 0xEA60: 6000 ms	UINT16 / rw
0x8002		Settings – DI Module Port 2 (structure: → Index 0x8001)		
0x8003		Settings – DI Module Port 3 (structure: → Index 0x8001)		
0x8004		Settings – DI Module Port 4 (structure: → Index 0x8001)		
0x8005		Settings – DI Module Port 5 (structure: → Index 0x8001)		
0x8006		Settings – DI Module Port 6 (structure: → Index 0x8001)		
0x8007		Settings – DI Module Port 7 (structure: → Index 0x8001)		
0x8008		Settings – DI Module Port 8 (structure: → Index 0x8001)		
0x8010		Settings – Counter Module Port 1		
	• 0x01	Counter mode	• 0x00: CTU - up counter (default) • 0x01: CTD - down counter • 0x02: CTUD - up and down counter • 0x03: CTDIR - up and down counter with selectable counting direction	UINT8 / rw
	• 0x02	Pin 2 function	For CTU and CTD: • 0x00: N/C - no function (default) • 0x03: Reset - reset counter module • 0x04: Disable - disable counter module For CTUD: • 0x01: Counter Edge Input Pin2 - counting input For CTDIR: • 0x02: count direction	UINT8 / rw
	• 0x03	Count direction selection (CTDIR only)	• 0x00: pin 2 count direction (default) • 0x01: IoT / PLC count direction	UINT8 / rw
	• 0x04	Main counter threshold	• 0x00000001: 1 ... • 0xFFFFFFFF: 4294967295 (default)	UINT32 / rw

Index	Subindex	Name	Possible values	Data type / access
0x8010	• 0x05	Batch counter threshold	• 0x0001: 1 ... • 0xFFFF: 65535 (default)	UINT16 / rw
	• 0x06	Enable main counter event	• 0x0: disable • 0x1: enable (default)	BOOL / rw
	• 0x07	Enable batch counter event	• 0x0: disable • 0x1: enable (default)	BOOL / rw
0x8018		Configuration – TxPDO Counter 1		
	• 0x01	Force main counter value	• 0x00000000: 0 (default) ... • 0xFFFFFFFF: 4294967294	UINT32 / rw
	• 0x02	Force batch counter value	• 0x0000: 0 (default) ... • 0xFFFE: 65534	UINT16 / rw
0x8020		Settings – Counter Module Port 2 (structure: → Index 0x8010)		
0x8028		Configuration – TxPDO Counter 2 (structure: → Index 0x8018)		
0x8030		Settings – Counter Module Port 3 (structure: → Index 0x8010)		
0x8038		Configuration – TxPDO Counter 3 (structure: → Index 0x8018)		
0x8040		Settings – Counter Module Port 4 (structure: → Index 0x8010)		
0x8048		Configuration – TxPDO Counter 4 (structure: → Index 0x8018)		
0x8050		Settings – Counter Module Port 5 (structure: → Index 0x8010)		
0x8058		Configuration – TxPDO Counter 5 (structure: → Index 0x8018)		
0x8060		Settings – Counter Module Port 6 (structure: → Index 0x8010)		
0x8068		Configuration – TxPDO Counter 6 (structure: → Index 0x8018)		
0x8070		Settings – Counter Module Port 7 (structure: → Index 0x8010)		
0x8078		Configuration – TxPDO Counter 7 (structure: → Index 0x8018)		
0x8080		Settings – Counter Module Port 8 (structure: → Index 0x8010)		
0x8088		Configuration – TxPDO Counter 8 (structure: → Index 0x8018)		

11.1.2.6 Information area (0x9000 - 0x9FFF)

Index	Subindex	Name	Possible values	Data type / access
0x9010		Events - Counter Module Status Port 1		
	• 0x01	Main counter event overflow	• 0x0: no event • 0x1: event occurred	BOOL / ro
	• 0x02	Main counter event underflow	• 0x0: no event • 0x1: event occurred	BOOL / ro
	• 0x03	Batch counter event overflow	• 0x0: no event • 0x1: event occurred	BOOL / ro
	• 0x04	Batch counter event underflow	• 0x0: no event • 0x1: event occurred	BOOL / ro
0x9020		Events - Counter Module Status Port 2 (structure: → Index 0x9010)		
0x9030		Events - Counter Module Status Port 3 (structure: → Index 0x9010)		
0x9040		Events - Counter Module Status Port 4 (structure: → Index 0x9010)		
0x9050		Events - Counter Module Status Port 5 (structure: → Index 0x9010)		
0x9060		Events - Counter Module Status Port 6 (structure: → Index 0x9010)		
0x9070		Events - Counter Module Status Port 7 (structure: → Index 0x9010)		
0x9080		Events - Counter Module Status Port 8 (structure: → Index 0x9010)		

11.1.2.7 Device area (0xF000 - 0xFFFF)

Index	Subindex	Name	Possible values	Data type / access
0xF000		Module Device Profile		
	• 0x01	Module Index Distance	• 0x000A: 10	UINT16 / ro
	• 0x02	Maximum Number of Modules	• 0x0009: 9 elements	UINT16 / ro
0xF030		Configured Module Identity List		
	• 0x01	Subindex 001	• 0x0000 1111: deactivated • 0x0000 1000: Digital inputs - 2 bytes (default)	UINT32 / rw
	• 0x02	Subindex 002	• 0x0000 1111: deactivated (default) • 0x0000 1100: counter module 1 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x03	Subindex 003	• 0x0000 1111: deactivated (default) • 0x0000 1200: counter module 2 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x04	Subindex 004	• 0x0000 1111: deactivated (default) • 0x0000 1300: counter module 3 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x05	Subindex 005	• 0x0000 1111: deactivated (default) • 0x0000 1400: counter module 4 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x06	Subindex 006	• 0x0000 1111: deactivated (default) • 0x0000 1500: counter module 5 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x07	Subindex 007	• 0x0000 1111: deactivated (default) • 0x0000 1600: counter module 6 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x08	Subindex 008	• 0x0000 1111: deactivated (default) • 0x0000 1700: counter module 7 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
	• 0x09	Subindex 009	• 0x0000 1111: deactivated (default) • 0x0000 1800: counter module 8 - 6 bytes inputs / 3 bytes outputs	UINT32 / rw
0xF050		Detected Module Identity List		
	• 0x01	Subindex 001	• 0x0000 1111: deactivated • 0x0000 1000: Digital inputs: 2 bytes	UINT32 / ro
	• 0x02	Subindex 002	• 0x0000 1111: deactivated • 0x0000 1100: counter module 1 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x03	Subindex 003	• 0x0000 1111: deactivated • 0x0000 1200: counter module 2 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x04	Subindex 004	• 0x0000 1111: deactivated • 0x0000 1300: counter module 3 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x05	Subindex 005	• 0x0000 1111: deactivated • 0x0000 1400: counter module 4 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x06	Subindex 006	• 0x0000 1111: deactivated • 0x0000 1500: counter module 5 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x07	Subindex 007	• 0x0000 1111: deactivated • 0x0000 1600: counter module 6 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro

Index	Subindex	Name	Possible values	Data type / access
0xF050	• 0x08	Subindex 008	• 0x0000 1111: deactivated • 0x0000 1700: counter module 7 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
	• 0x09	Subindex 009	• 0x0000 1111: deactivated • 0x0000 1800: counter module 8 - 6 bytes inputs / 3 bytes outputs	UINT32 / ro
0xF110		Device Diagnosis		
	• 0x01	Power Status Error	• 0x0: no error • 0x1: error detected (undervoltage < 17.5 V, overvoltage > 33.0 V, overcurrent > 3.6 A, short circuit pin 1 + pin 3, temperature > 150 °C)	BOOL / ro