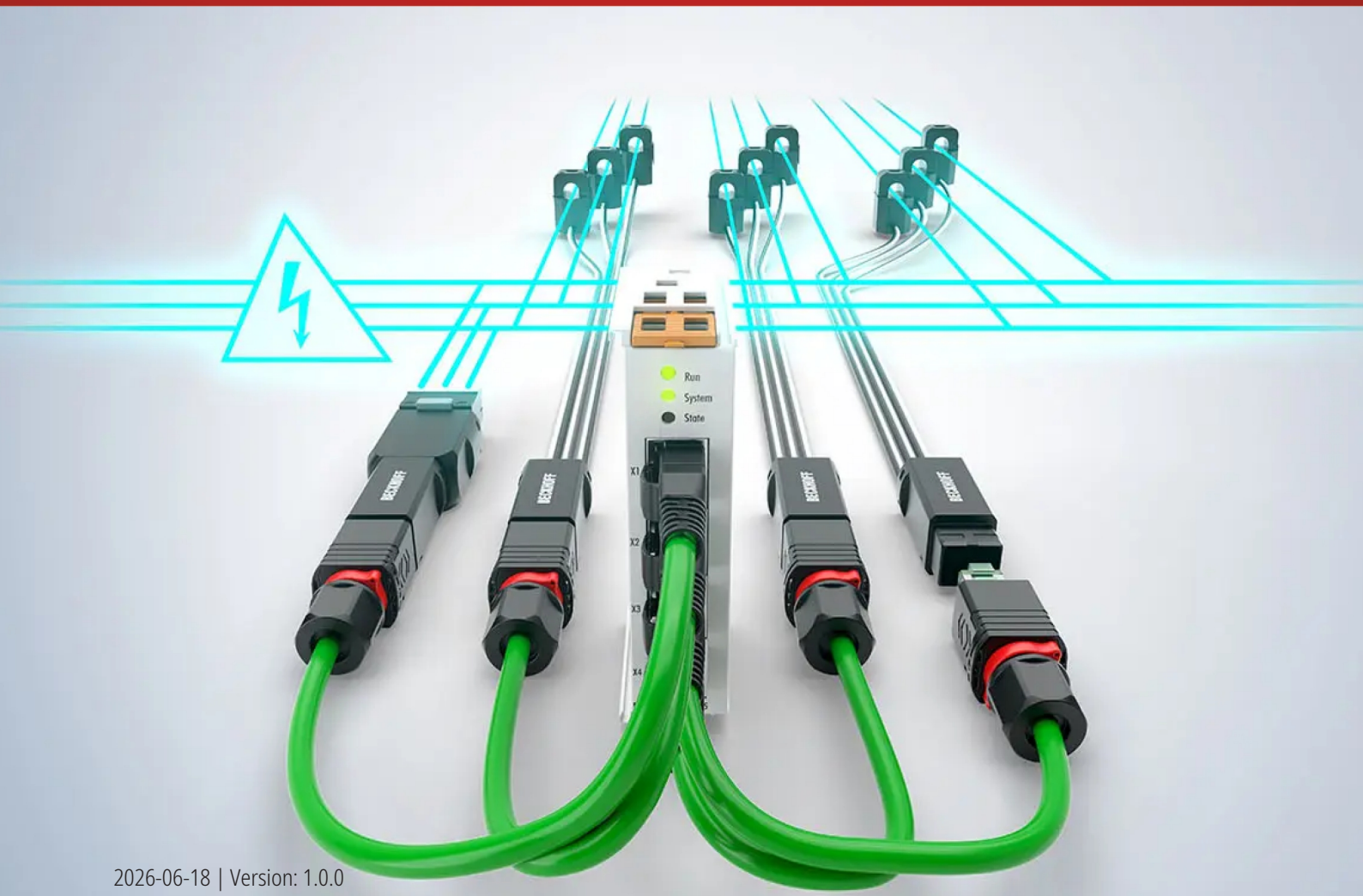
BECKHOFF New Automation Technology

Documentation | EN

EL3475

EtherCAT Terminal - Distributed power measurement, 4-port, RJ45, multi-function, 333 mV, 24 bit



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1 Foreword

1.1 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.
The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

Trademarks

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Guide through documentation

NOTICE

Further components of documentation

This documentation describes device-specific content. It is part of the modular documentation concept for Beckhoff I/O components. For the use and safe operation of the device / devices described in this documentation, additional cross-product descriptions are required, which can be found in the following table.

Title	Description
EtherCAT System Documentation (PDF)	• System overview • EtherCAT basics • Cable redundancy • Hot Connect • EtherCAT devices configuration
I/O Analog Manual (PDF)	Notes on I/O components with analog in and outputs
Infrastructure for EtherCAT/Ethernet (PDF)	Technical recommendations and notes for design, implementation and testing
Software Declarations I/O (PDF)	Open source software declarations for Beckhoff I/O components

The documentations can be viewed at and downloaded from the Beckhoff website (www.beckhoff.com) via:

- the “Documentation and Download” area of the respective product page,
- the Download finder,
- the Beckhoff Information System.

If you have any suggestions or proposals for our documentation, please send us an e-mail stating the documentation title and version number to: documentation@beckhoff.com

1.4 Documentation issue status

Version	Comment
1.0.0	• Chapter *Technical data* updated • Chapter *SCL6xxx – Low power transformer* updated • Chapter *Assignment of the RJ45 interface* updated • First release
0.5	• Chapter *TF8330 – TwinCAT 3 Power Collector* updated
0.4	• Chapter *Objects for regular operation* updated • Chapter *Evaluation via IoT Communicator App* (TF6735) updated
0.3	• Chapter *Technical data* updated • Chapter *Command List* added • Chapter *U/I Mapping* added • Chapter *Cabling* updated • Chapter *Evaluation via IoT Communicator App* (TF6735) added • Chapter *Restoring the delivery state* updated
0.2	• Chapter *Product overview* extended • Chapter *Technical data* updated • Chapter *Cabling* updated • Chapter *Commissioning* updated • Notes on compatible low power split-core transformers (SCL6xxx) added.
0.1	First draft

2 Product description

2.1 EL3475 – Introduction

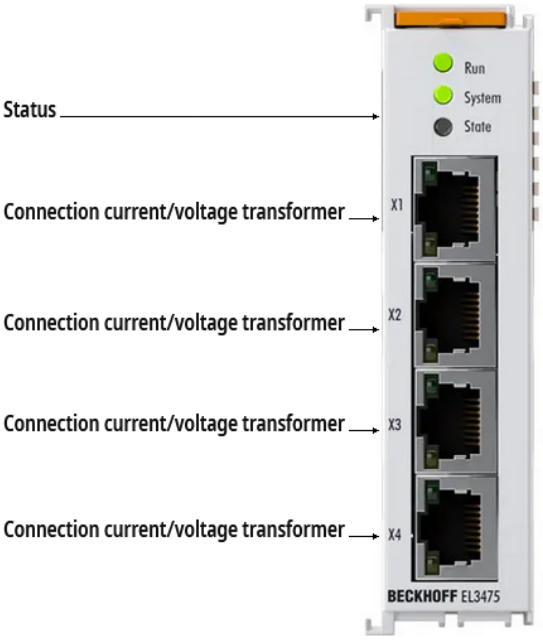


Fig. 1: EL3475 – EtherCAT Terminal, 4-port, RJ45, multi-function, 333 mV, 24-bit

EL3475 – EtherCAT Terminal for distributed power measurement

The EL3475 is a 12-channel analog input module that, with a 24-bit resolution and an input voltage of 333 mV, enables simple and detailed measurements in supply networks. With four RJ45 connections that can each connect three current and/or voltage transformers, the EL3475 is multi-functional and offers the ideal solution for keeping installation simple in demanding applications.

In combination with the SCL6xxx pluggable low power split-core transformers, the EL3475 enables configuration-free commissioning, as the current transformer ratios are set automatically between the transformer and terminal during start-up thanks to the electronic nameplate.

With a single voltage transformer in the system, several EL3475 EtherCAT Terminals can work together as a distributed power measurement system. and perform any number of power measurements without any loss in performance.

2.2 Technical data

Technical data	EL3475
Number of inputs	12
Wiring	2-wire
Oversampling factor	-
Distributed clocks	optional (required for distributed power measurement)
Update interval	RMS values 20 ms at 50 Hz and 100 ms for other values such as harmonics
Measured values	current (with SVL or via DPM: voltage, active power, reactive power, apparent power, active energy, reactive energy, apparent energy, cos φ, frequency, THD, power quality factor, harmonics (up to the 50th harmonic))
Measuring voltage	via SVL
Measuring current	via SCL
Nominal voltage measurement range	333 mV RMS
Technical voltage measuring range	+/- 600 mV for 125 % overrange
Maximum permissible time for voltages above +/- 460 mV	t_{max} < 10 s**
Max. permitted overvoltage	+/- 1 V, above this voltage damage to the device cannot be ruled out
Measuring error	current: 0.3 % (relative to full scale value) calculated values: 0.6 %
Update time	mains-synchronous
Monitoring functions	undercurrents/overcurrents (adjustable)
Electrical isolation	2500 V (channel/bus)
Current consumption via E-bus	typ. 150 mA
Current consumption from the power contacts	-
Special features	distributed power measurement (DPM), electronic nameplates can be read out
Width in the process image	configurable default: 418 bytes input, 32 bytes output
Permissible ambient temperature range during operation	-25 °C ... +60 °C
Permissible ambient temperature range during storage	-40 °C ... +85 °C
Permissible relative air humidity	95 %, no condensation
Weight	approx. 75 g
Dimensions (W x H x D)	approx. 24 mm x 100 mm x 52 mm
Installation	on 35 mm DIN rail, conforms to EN 60715
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	variable
Approvals / markings*	CE, UKCA, EAC

*) Real applicable approvals/markings see type plate on the side (product marking).

NOTICE

****) Consequences of prolonged operation above the nominal range of the measuring voltage**

Prolonged operation above the nominal range can lead to functional impairment and/or shortening of the service life.

2.3 Safety instructions

⚠ WARNING

Risk of injury due to electric shock/arcing/burning

The following instructions (Part I) must be observed:

- The operator must ensure that this product is only installed and operated in perfect working order and by sufficiently qualified and authorized personnel.
- Intended use: industrial, stationary indoor use:
  The analog input devices extend the field of application of the Beckhoff Bus Terminal system with functions for measuring sensor signals via voltage, current or resistance. The intended field of application is data acquisition and control tasks in industrial automation. Use of the device beyond its intended use is not permitted.
- The decision to use and release for operation must be made by an electrotechnical specialist in accordance with the applicable safety rules (occupational health and safety) for the application. National regulations may have to be observed.
- Ensure proper wiring by following all local and national regulations.
- The cables and plugs used must be in the required measuring category or be approved for the applied voltages. Note: when laying such cables, it may be necessary to comply with installation specifications, such as those specified in EN 60204.
- Live measuring cables must be equipped with a maximum fuse protection of 1 A close to the source to prevent high energy input into the cable section or the measuring device in the event of a fault.
- The installation must be thoroughly checked for incorrect wiring before commissioning; appropriate cable labeling/marking is recommended.
- To protect against direct contact, the terminal must be installed in a control cabinet that complies with protection class IP54 or higher in accordance with EN 60529. The control cabinet must be connected to the system protective earth (PE).
- Voltages > 60 V DC / 48 V AC should not be supplied when the control cabinet is open. Supplying these voltages is only permitted in individual cases, when safety precautions have been taken by appropriately qualified personnel.
- If the application contains unearthed potential differences and an earth fault can pose a hazard, an insulation monitor must be provided and evaluated.
- Check the device before, during and after installation and periodically during breaks in operation for visible damage, such as damaged/cracked sockets/cables/plugs and loose parts. If damage is present, commissioning or further operation is prohibited.
- Ensure that the device and the wiring are de-energized on the field and bus side during installation/assembly/testing/disassembly. The 5 safety rules of electrical engineering must be observed:
  - De-energize
  - Secure against reconnection
  - Ensure that no voltage is present
  - Ground and short-circuit
  - Cover or isolate adjacent live parts
- Avoid foreign bodies entering the housing.
- Do not modify or attempt to repair the device.
- Do not open the device or interfere with the interior of the device.

⚠ WARNING

Risk of injury due to electric shock/arcing/burning

The following instructions (Part II) must be observed:

- Do not use the terminals in a damp or explosive environment. Check the installation regularly for contamination.
- The terminal may only be used in areas with a maximum pollution degree of 2 (non-conductive pollution) in accordance with IEC 60664-1.
- Do not use the device in damp locations or in areas where moisture or condensation is likely to occur.
- The ambient conditions regarding temperature, humidity, heat dissipation, EMC and vibrations, as specified in the operating instructions under technical data, must be observed.
- After final decommissioning or in the event of damage, the terminal must be clearly marked and, if necessary, disposed of in such a way as to prevent hazards from careless use.

⚠ CAUTION

Risk of injury from sharp edges and falling parts

Care must be taken when handling the product

- The product may have sharp edges/corners.
- Depending on the weight of the product, it could cause injury or damage if it falls.

NOTICE

Notes on operation General

The following instructions must be observed

- The installation of an external transient protection of max. 6 kV is recommended to keep short-term overvoltages away from the measuring instrument. Its functionality must be monitored.
- The terminal mounted on the DIN rail must be covered on the right by either a subsequent terminal or the EL9011 bus end cap.
- SELV/PELV circuits (Safety Extra Low Voltage) in accordance with IEC 61010-2-201 must be used to supply this device (see note on power supply).

2.4 Additional notes

Accuracy - Technical data

Please note that the DPM algorithm generally performs compression over several waves. This can lead to limitations in accuracy, especially for signals with a period duration over more than one mains wave (e.g. wave packet control).

Measurement deviations due to ESD contact discharges

ESD contact discharges in accordance with EN 61000-6-4 on the terminal housing can lead to measurement deviations of up to ±1 % of the FSV in all channels. The use of the EL9550 surge filter terminal or the EKM1101 EtherCAT Coupler is recommended for fast transient disturbances in accordance with EN 61000-4-4 (burst) that affect the entire structure.

Surge voltages or fast transients (burst) directly on the inputs will be visible in the measurement signal. If this is not desired, activate a digital filter in the terminal.

Maximum permissible cable length

The maximum permissible cable length between the EL3475 and connected measuring transformers is 30 meters.

2.5 Slot groups

2.5.1 Basics of the "Modules/Slots" procedure

The modules/slots procedure enables simplified configuration and parameterization of multifunctional EtherCAT devices. The configuration is carried out in TwinCAT via the "Slots" tab.

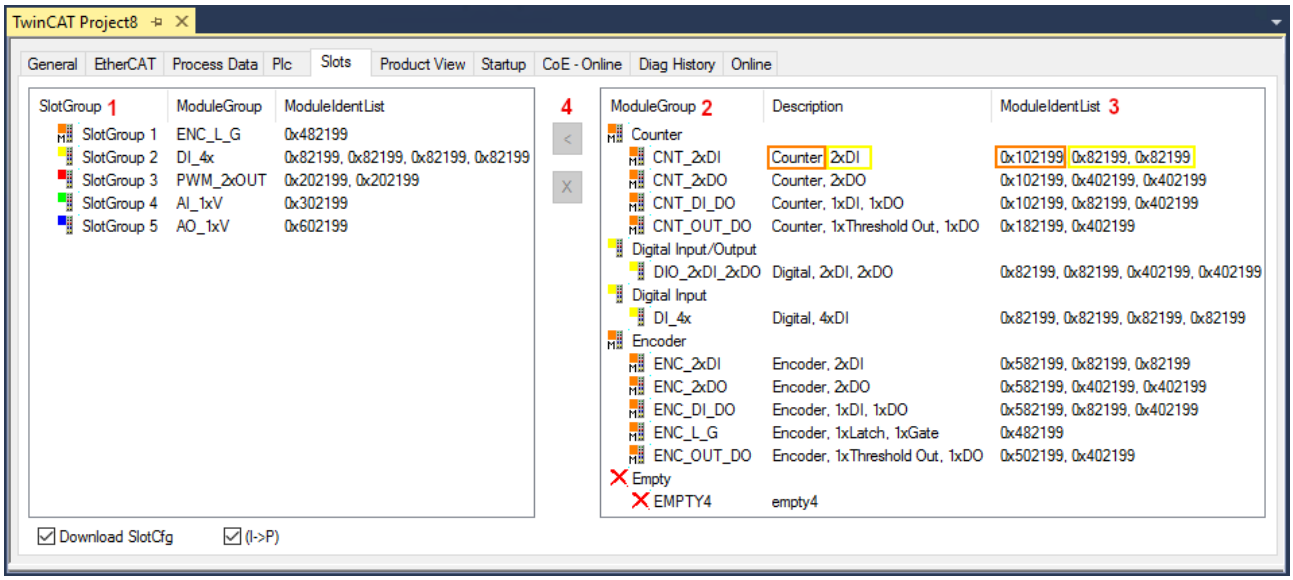


Fig. 2: Configuration in the "Slots" tab using an EL8601-8411 as example

1. The operating mode is defined for each "**SlotGroup**" by assigning a maximum of one "ModuleGroup". When the "SlotGroup" is selected in the left-hand field, the "ModuleGroups" available for this "SlotGroup" with the associated "Modules" are displayed in the right-hand field.
2. **"ModuleGroups"** describe the possible combinations of the individual "Modules". In this way, the configuration of invalid combinations can be excluded. The operation mode of the group is explained in short form in the "Description" section.
3. Each **"Module"** has a defined **"ModuleIdent"** number that is fixed to an operation mode and the corresponding process data and CoE objects.
   In the "ModuleIdentList", all "ModuleIdents" of a "ModuleGroup" are displayed according to the frequency of their use (see Fig. above CNT_2xDI).
4. Each SlotGroup must be assigned exactly one "ModuleGroup" using the **"<" (assign)** and **"X" (remove)** buttons.
   ⇨ The process data and the CoE objects are automatically adjusted according to the selected "ModuleGroup", in the respective SlotGroup.
   ⇨ In the TwinCAT "Product View" tab, the pin assignment is displayed according to the configuration (see chapter Connections in the "Product View" tab) [▶ 15].

Notes on configuration with the modules/slots procedure

- The TwinCAT system must be in "ConfigMode"  to perform the configuration.
- If a "SlotGroup" is to be operated without function, the "ModuleGroup" "Empty" must be selected. A "SlotGroup" without an assigned "ModuleGroup" is not allowed.
- If the configuration is changed, the settings in the Setting objects of the changed "ModuleGroups" are reset to the factory settings.
- To reset the product to the delivery state (factory settings), the "PreOP" state is required before the "Restore default parameters" object is used.

2.5.1.1 Connections in the "Product View" tab

The "Product View" tab shows the connections of the product according to the current configuration. This makes it easier to assign the individual signal types to the connection points, especially for multi-interface products. To make it easier to assign the connections, the designation also contains the corresponding SlotGroup in addition to the function.

For some products, the LED status is also displayed in real-time in the "Product View" tab. The LED status display is currently only supported for products that have the "LED status" CoE object.

Requirement for displaying the "Product View" tab:

- Development environment TwinCAT 3.1 Build 4024.59

After making changes in the "Slots" area, refresh the view as follows:

- The project must be saved for offline configuration.
- With an online configuration, a "Reload Devices"  is sufficient to refresh the view.

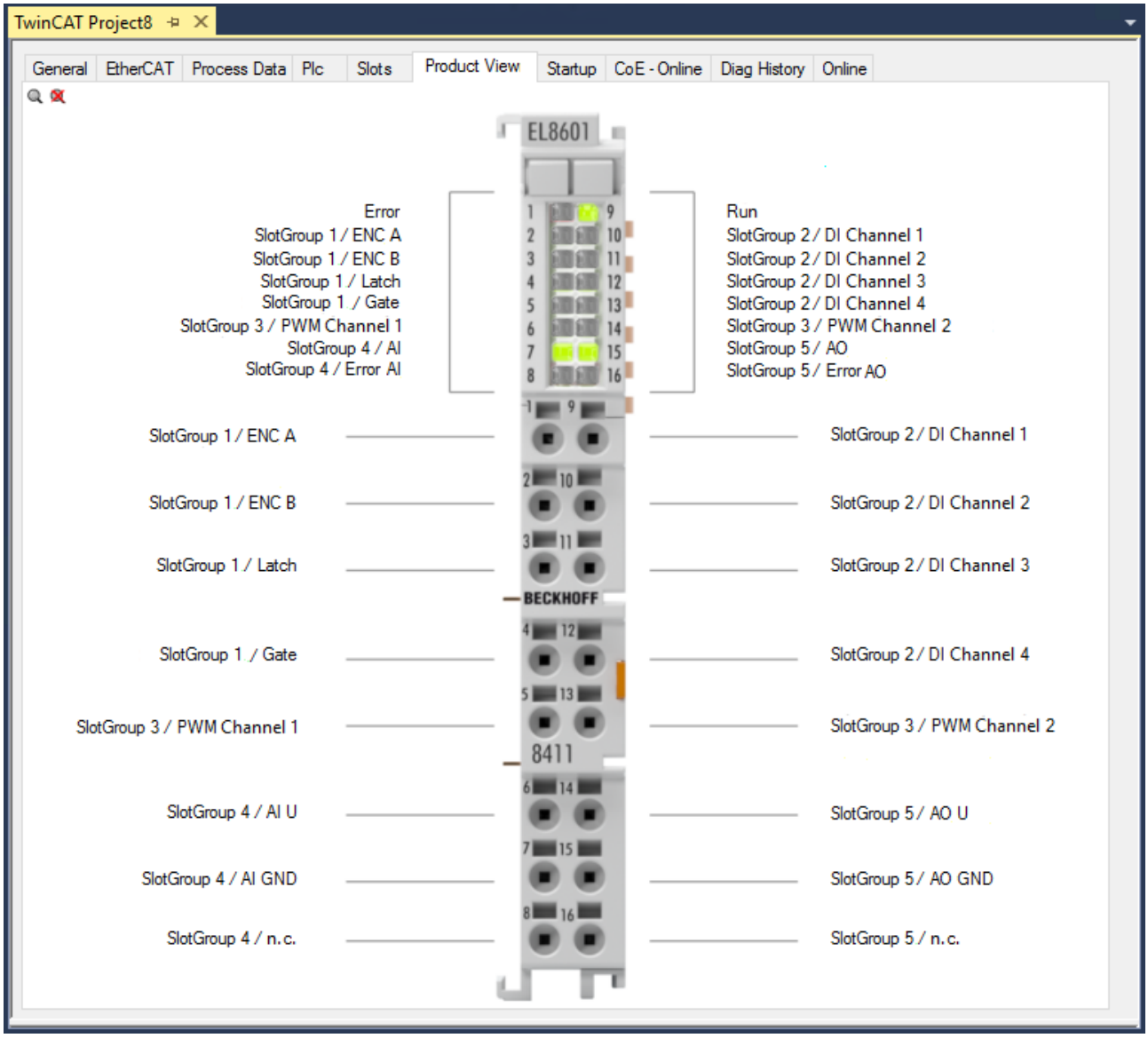


Fig. 3: View in the "Product View" tab using the EL8601-8411 as an example

A detailed description of the connections can be found in the chapter "Connections".

2.5.2 Slot groups of the EL3475

The EL3475 uses slot groups to improve ease of use and configurability. These slot groups can accommodate two different types of module groups and can be configured with TwinCAT in the *Slots* tab as either voltage or current power ports. The corresponding CoE entries and process data elements are adjusted accordingly. On delivery, the EL3475 is configured for voltage at port 0 and for current at the other ports.

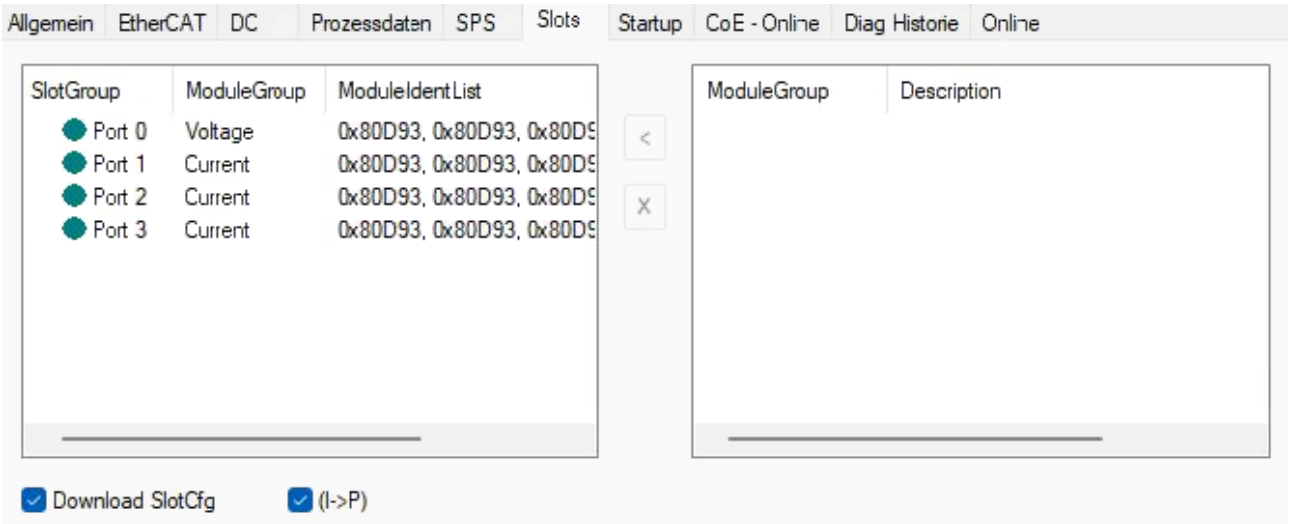


Fig. 4: EL3475 – SlotGroups

The configuration of the slots follows the physical configuration of the four connections of the terminal, depending on the connected sensor (SVL or SCL). In the past, the use of such sensors required the manual configuration of sensor parameters, e.g. the transformer ratio. Thanks to TED (Transducer Electronic Data Sheet), the EL3475 supports the transmission of configuration data from the sensor to the terminal. This process can be triggered via commands (see table). Depending on the command, the parameters are automatically applied to the internal data flow (e.g. 0x800C, 0x801C, 0x802C for port 1).

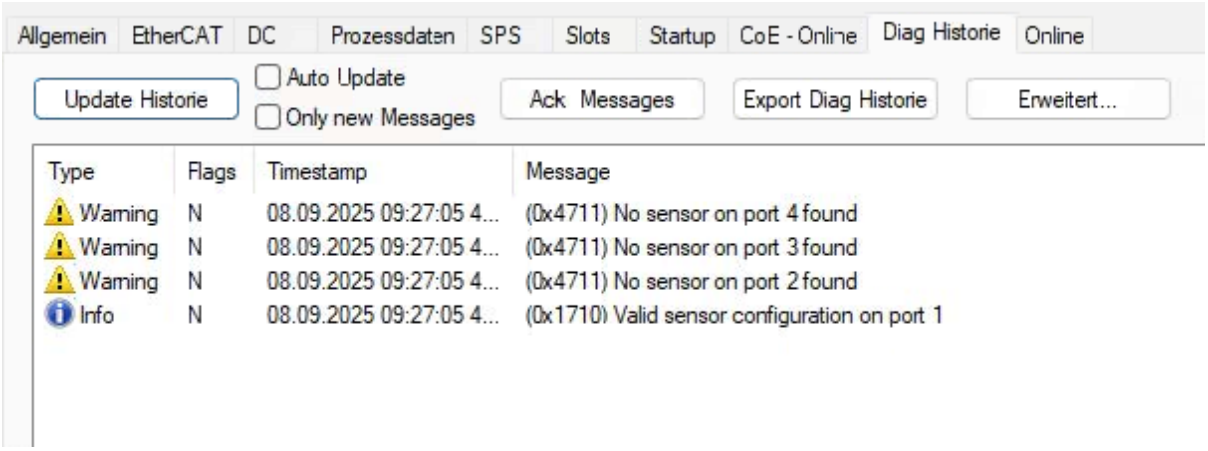


Fig. 5: EL3475 – DiagHistory

During start-up, the terminal checks the physical sensor configuration and compares the values with the internally stored information. The results are displayed via diagnostic messages.

Distributed power measurement

The EL3475 uses distributed power measurement (DPM) to calculate power. It is therefore irrelevant for the function which port of an EL3475 in an EtherCAT segment supplies the voltage data for the respective current measurement port. By default, the terminal uses the first port as the source for all subsequent ports.

Via the objects

- 0x8060:11 (port 0)

- 0x8110:11 (port 1)
- 0x81C0:11 (port 2)
- 0x8270:11 (port 3)

the DPM voltage sources can either be set to another port of the terminal or to an external source. In this case, the DPM voltage data on PDO 0x1701 is used for the power calculation. The corresponding **PDO PMD DPM Out** (e.g. 0x1A26 for port 0) must be activated on the DPM main device side.

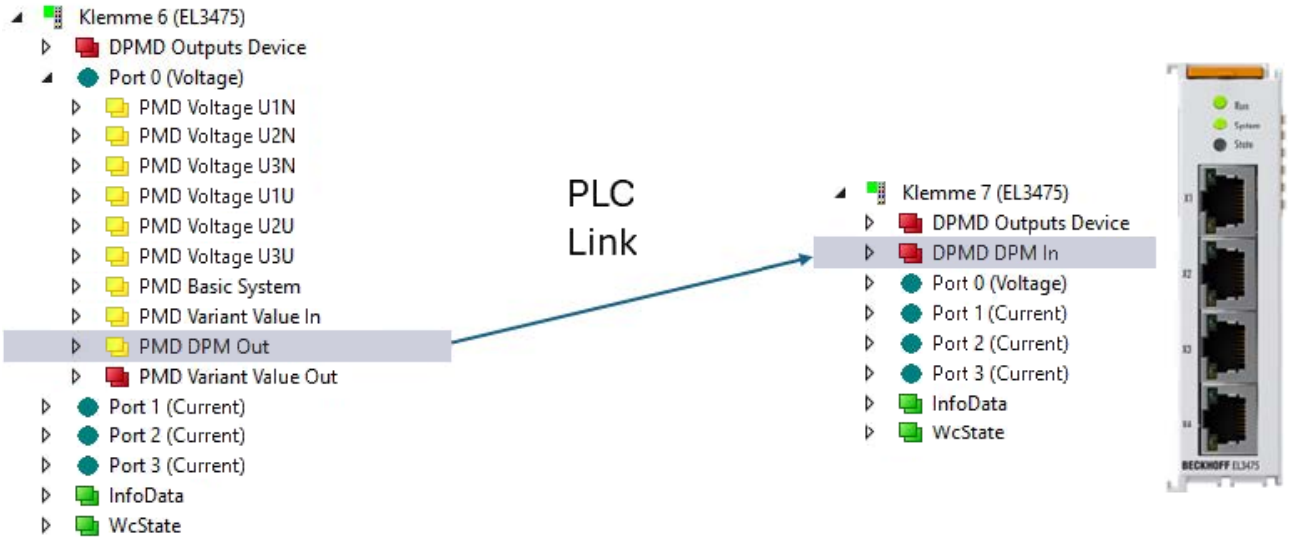


Fig. 6: EL3475 – PLC-Link

2.6 SCL6xxx – Low power transformer

Beckhoff offers the separable, 3-phase SCL6xxx measuring system with RJ45 connection which enables flexible retrofitting with minimal installation work and without the need to disconnect the primary conductors.

Four sizes are available for use in poorly accessible spaces or where space is limited. Thanks to the 333 mV output signals, all instrument transformers can easily be connected via patch cable without short-circuiting terminals. Electronic nameplates eliminate the need for manual configuration of current transformer ratios.

The EL3475 can automatically detect what a mechanically assembled system looks like, making commissioning much easier.

An overview of compatible low power transformers can be found on the Beckhoff website at www.beckhoff.com/SCL6xxx.

⚠ WARNING

Only use transformers that guarantee safe isolation from hazardous voltages!

If no SCL/SVL transformers from Beckhoff are used, other transformers connected to the EL3475 must ensure safe isolation from hazardous voltages appropriate for the application. This could, for example, be designed as reinforced insulation in accordance with IEC 61010-2-201.

2.7 Accessories

We recommend the following accessories for wiring the SCLxxxx and SVLxxxx low power transformers with the EL3475-xxxx EtherCAT Terminals for distributed power measurement:

Name	Description	Figure
ZK2003-91D1-3xxx	Sensor cable, shielded, PVC, 4 x 2 AWG26, fixed installation, gray	
C9900-K938	Ethernet/EtherCAT connector, for field assembly, IP65/67	

3 Installation

3.1 Instructions for ESD protection

NOTICE

Destruction of the devices by electrostatic discharge possible!

The devices contain components at risk from electrostatic discharge caused by improper handling.

- When handling the components, ensure that there is no electrostatic discharge; also avoid touching the spring contacts directly (see illustration).
- Contact with highly insulating materials (synthetic fibers, plastic films, etc.) should be avoided when handling components at the same time.
- When handling the components, ensure that the environment (workplace, packaging and persons) is properly earthed.
- Each bus station must be terminated on the right-hand side with the EL9011 or EL9012 end cap to ensure the degree of protection and ESD protection.

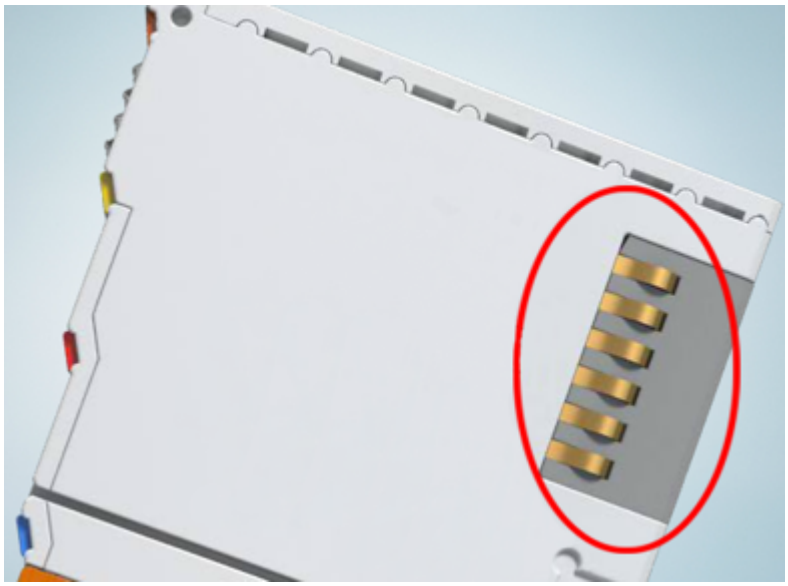


Fig. 7: Spring contacts of the Beckhoff I/O components

3.2 Mounting and demounting - top front unlocking

The terminal modules are fastened to the assembly surface with the aid of a 35 mm mounting rail (e. g. mounting rail TH 35-15).

Fixing of mounting rails

The locking mechanism of the terminals and couplers extends to the profile of the mounting rail. At the installation, the locking mechanism of the components must not come into conflict with the fixing bolts of the mounting rail. To mount the recommended mounting rails under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

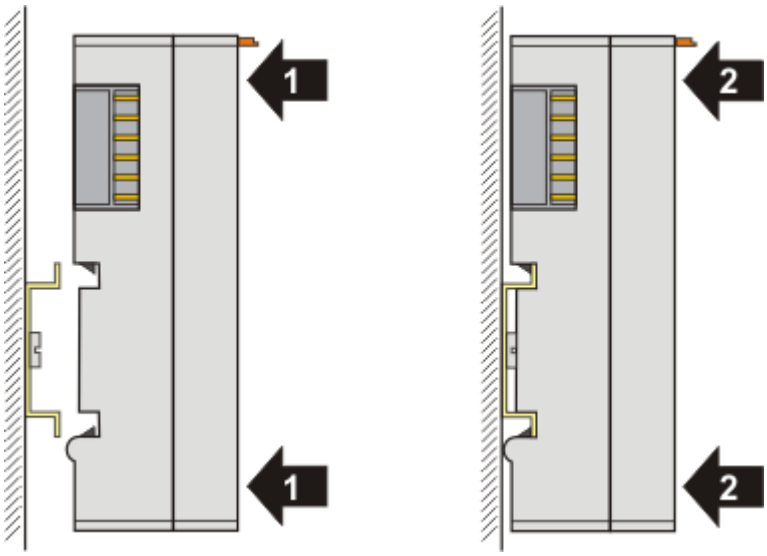
⚠ WARNING

Risk of electric shock and damage of device!

Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

Mounting

- Fit the mounting rail to the planned assembly location.

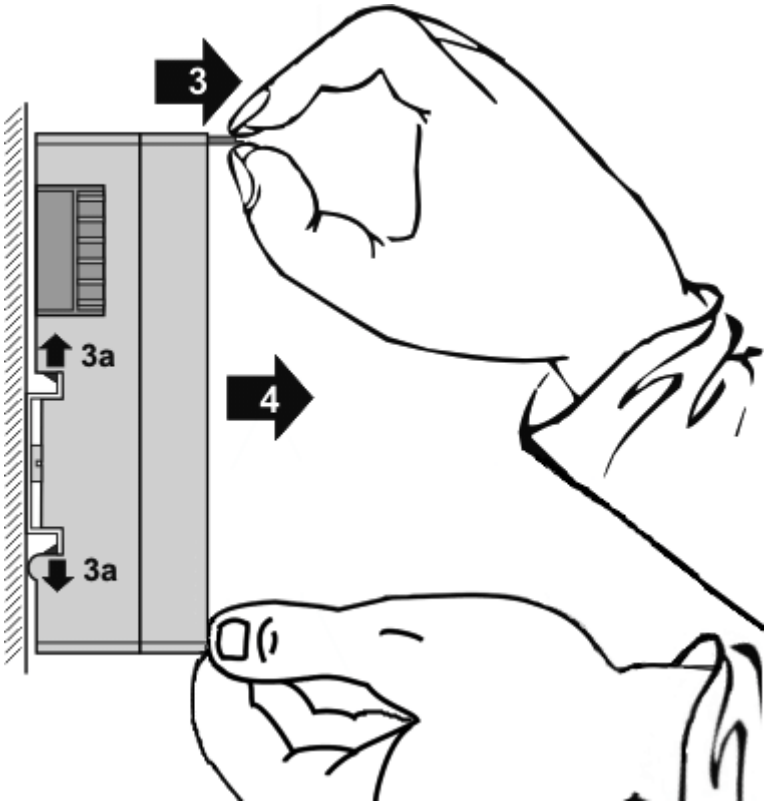


and press (1) the terminal module against the mounting rail until it latches in place on the mounting rail (2).

- Attach the cables.

Demounting

- Remove all the cables.
- Lever the unlatching hook back with thumb and forefinger (3). An internal mechanism pulls the two latching lugs (3a) from the top hat rail back into the terminal module.



- Pull (4) the terminal module away from the mounting surface.
  Avoid canting of the module; you should stabilize the module with the other hand, if required.

3.3 Disposal

Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

3.4 Installation positions

NOTICE

Constraints regarding installation position and operating temperature range

- Please refer to the technical data of the device to ascertain whether any restrictions regarding the installation position and/or the operating temperature range have been specified.
- When installing devices with increased heat dissipation, ensure that there is sufficient space above and below the devices during operation to guarantee adequate ventilation!

The installation positions and their names for mounting devices on mounting rails are specified below. The illustration of the devices in the following figures is an example.
The following applies to all installation positions: The reference direction "down" (see arrow) is the acceleration of gravity.

Horizontal installation (standard installation)

The mounting rail is mounted horizontally on a vertical mounting plate.
The connection level of the devices points to the front.

The devices are ventilated from below, which enables optimum cooling of the electronics through convection. This is therefore also the recommended installation position.

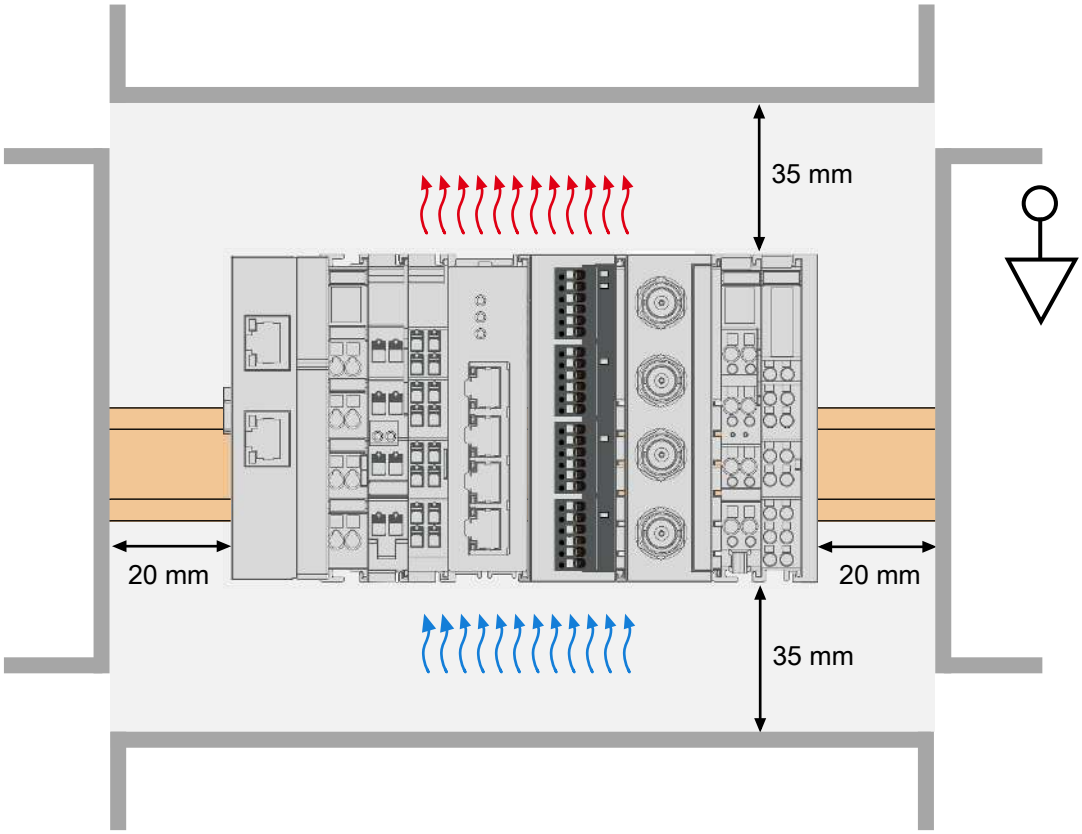


Fig. 8: Recommended minimum distances for standard installation position

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure "Recommended minimum distances for standard installation position" is strongly recommended in all installation positions.

Vertical installation

The mounting rail is mounted vertically on a vertical mounting plate.
The connection level of the devices points to the front.
The devices can be arranged as follows:

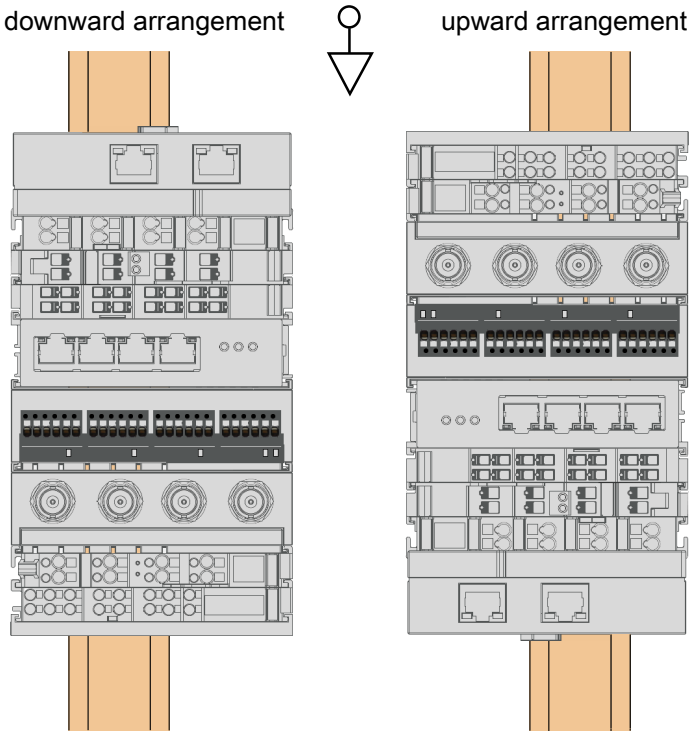


Fig. 9: Installation position Vertical, downward arrangement (left) / upward arrangement (right)

Flat installation

In the flat installation position, the mounting rail is laid on a horizontal mounting plate.
The connection level of the devices points upwards.

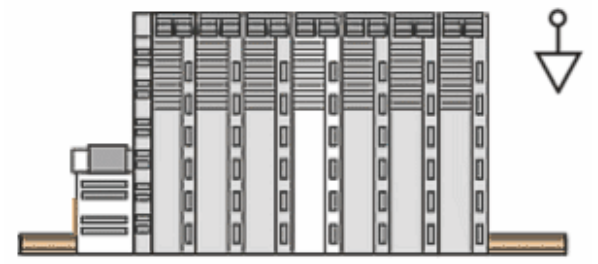


Fig. 10: Flat installation position

NOTICE

Danger of sliding off the mounting rail

Particularly in the "vertical" installation position, but also in other installation positions under corresponding mechanical load, the terminal segment may move on the mounting rail. These can lead to undesirable malfunctions.

- If this risk exists, secure the terminal segment with appropriate locking devices, e.g. by clamping it to the mounting rail.

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure "Recommended minimum distances for standard installation position" is strongly recommended in all installation positions.

Installation positions with ZB8610 fan cartridge

If the cooling should or must be increased for the intended application, the ZB8610 fan cartridge can be mounted on the underside of the device. In the horizontal installation position, the devices are ventilated from bottom to top by the fan cartridge. The optimum cooling is further enhanced by convection ventilation (see following figure).

The fan cartridge can be used in any installation position.

Further information on operation with and without a fan can be found in the technical data for the device (e.g. derating, information on installation positions, etc.).

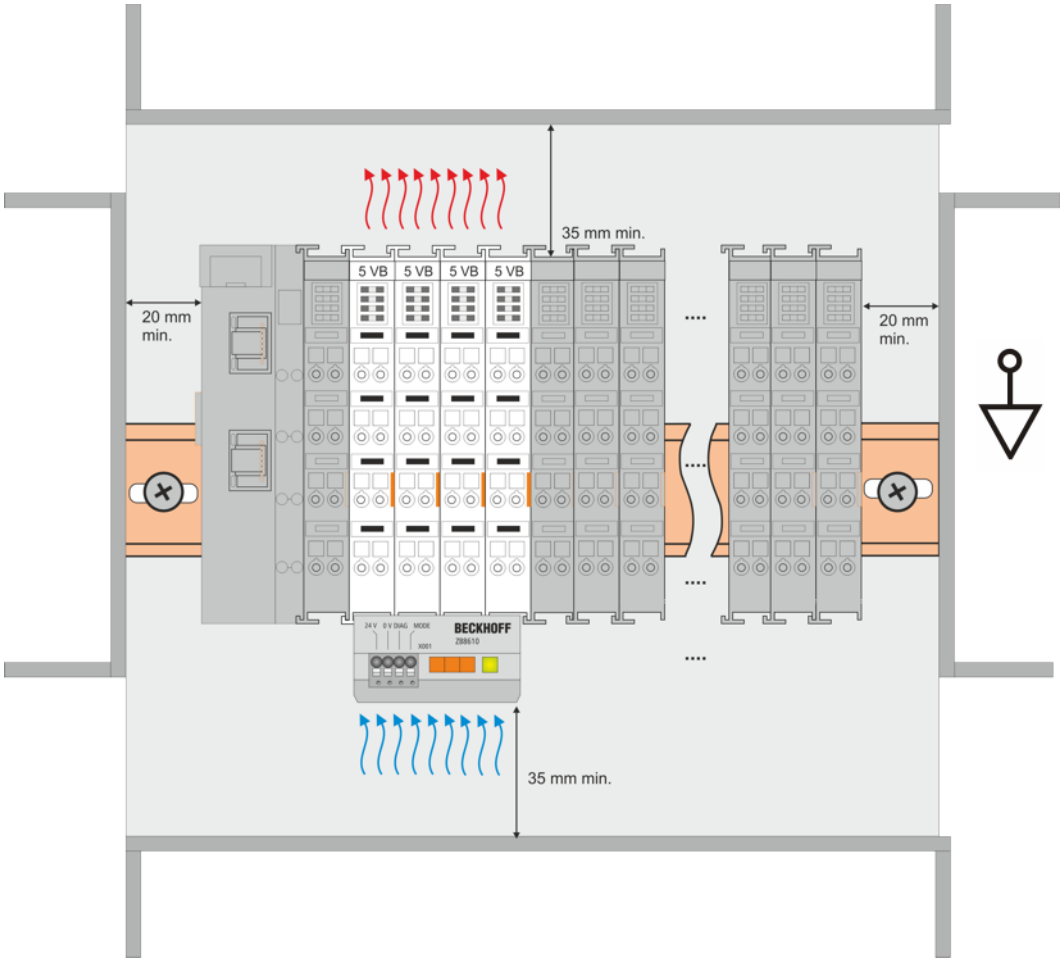


Fig. 11: Recommended minimum distances for operation with fan, using horizontal installation position as an example

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances as shown in the figure "Recommended minimum distances for operation with fan" is strongly recommended.

3.5 Positioning of passive Terminals

Hint for positioning of passive terminals in the bus terminal block

EtherCAT Terminals, which do not take an active part in data transfer within the bus terminal block are so called passive terminals. The passive terminals have no current consumption out of the E-Bus.
To ensure an optimal data transfer, you must not directly string together more than two passive terminals!

Examples for positioning of passive terminals (highlighted)

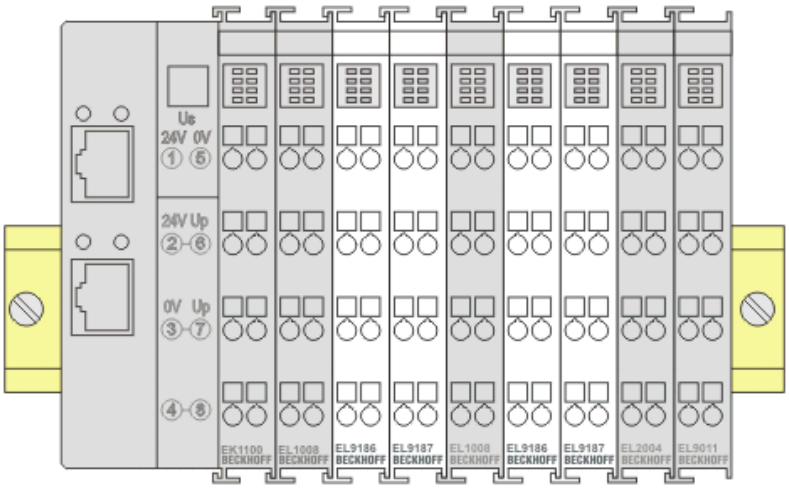


Fig. 12: Correct positioning

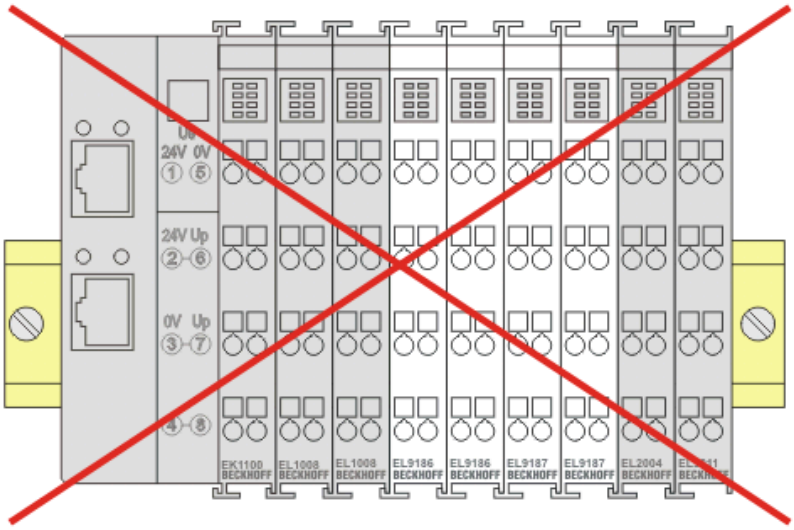


Fig. 13: Incorrect positioning

4 Connection

⚠ DANGER

Dangerous electrical voltage leads to electric shock and arc flashover!

Non-compliance will result in death, personal injury or considerable material damage!
Ensure a safe working environment during assembly, maintenance and installation work

- Before beginning any assembly, maintenance, or installation work, disconnect the system from the power supply!
- Interrupt the power supply of the primary conductor and secure against being switched on again inadvertently.
- Make sure that the details on the nameplate and in the “Technical data” correspond to the operating parameters of the system.

⚠ WARNING

Power supply from SELV / PELV power supply unit!

SELV / PELV circuits (safety extra-low voltage / protective extra-low voltage) according to IEC 61010-2-201 must be used to supply this device.

Notes:

- SELV / PELV circuits may give rise to further requirements from standards such as IEC 60204-1 et al, for example with regard to cable spacing and insulation.
- A SELV supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor, a PELV supply also requires a safe connection to the protective conductor.

4.1 Cabling

1. Connect the connection housing of the transformers to the measuring unit for distributed power measurement (e.g. EL3475, EL3475-xxxx) via:
   - the pre-assembled sensor cable ZK2003-91D1-3xxx, shielded, PVC, 4 x 2 AWG26, for fixed installation, gray,
   - the EtherCAT connector C9900-K938, an 8-pin EtherCAT cable and an application-specific connector.

Note on connecting the measuring unit

We recommend connection via the pre-assembled sensor cable,

- as this connection enables quick and easy assembly and disassembly and
- the contact is completely protected against contact (dust-tight) and moisture via this connection in accordance with protection rating IP65/67.

⇨ Alternative connection options for laboratory operation are possible (see Alternative connection options for laboratory operation [▶ 27]).

2. To do this, insert the RJ45 plug of the connection cable into the RJ45 socket of the transformer housing so that the arrows printed on it match and push the plug into the socket until it audibly clicks into place.

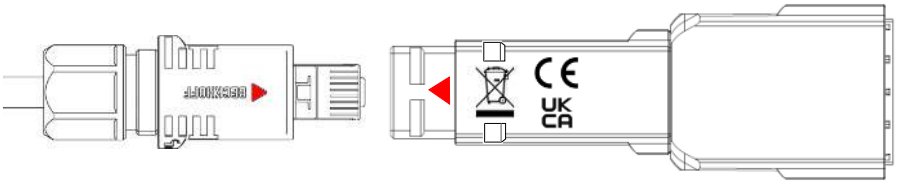


Fig. 14: Connect the secondary side of the transformer to the measuring unit

3. Also lock the connection with the red locking ring on the connector housing.

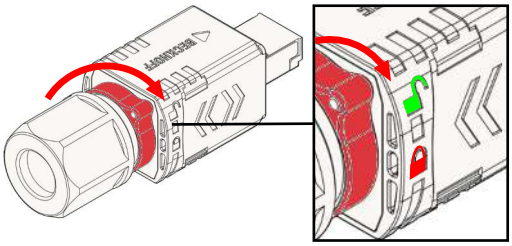


Fig. 15: Locking the connection to the measuring unit

Alternative connection option for laboratory operation

- an 8-pin standard EtherCAT cable with RJ45 plugs (e.g. ZK1093-9191-0xxx).
  The connection housing of the transformers is designed so that most standard RJ45 plugs snap into the housing.
  - Make sure that the RJ45 plug is securely engaged in the connection housing of the transformer!
  - A small screwdriver is required for disassembly (e.g. ZB8701).

    You can use the position of the latching lug to determine whether the plug snaps into the connection housing:

    - Latching lug outside the flexible cover:
      - Plug snaps into the connection housing

    - Latching lug inside the flexible cover:
      - Plug **does not** engage in the connection housing.

NOTICE

Alternative connection option for laboratory operation only

The solution described above is suitable for laboratory use and is not recommended for industrial environments.

- Please note that tool-free disassembly is no longer possible after engaging!

4.2 Assignment of the RJ45 interface

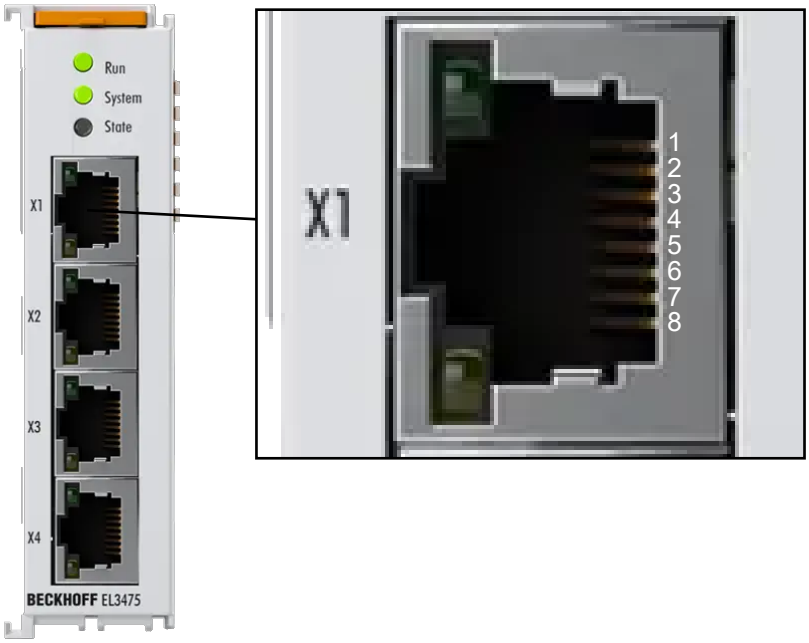


Fig. 16: RJ45 interface

Assignment of the X1 … X4 RJ45 interfaces

PIN	Signal	Description
1	Channel 1	analog signal (333 mV) for channel 1
2		
3	Supply / TEDS*	sensor power supply (5 V) and integration of the electronic nameplate **
4	Channel 2	analog signal (333 mV) for channel 2
5		
6	Supply / TEDS*	sensor power supply (5 V) and integration of the electronic nameplate **
7	Channel 3	analog signal (333 mV) for channel 3
8		
*) **T**ransducer **E**lectronic **D**ata **S**heet **) When reading out the TEDS, the sensor power supply is switched off briefly.		

5 Commissioning

NOTICE

Further information

For information on commissioning with TwinCAT and EtherCAT basics, please refer to the EtherCAT system documentation.

5.1 TF8330 – TwinCAT 3 Power Collector

The easiest way to commission the EL3475 energy measurement terminal is to use the TwinCAT 3 Power Collector TF8330.

The TwinCAT 3 Power Collector provides software modules for programming applications for power measurement. These modules offer a standardized interface for all terminals in the EL34xx series. Parameters such as transformer ratio and frequency range can be configured automatically. Interfaces for advanced transmission protocols such as MQTT, HTTP REST, and OPC UA have already been implemented. Telecontrol protocols such as IEC 61850 and IEC 60870 are also available.

A sample implementation of the Power Collector together with an EL3475, an SVL voltage transformer and three SCL current transformers can be found at the following link:

https://infosys.beckhoff.com/content/1033/el3475/Resources/21627068043.zip (TF8330-EL3475-Sample)

If you do not use the TwinCAT 3 Power Collector and want to configure the EL3475 manually, please refer to the chapter Manual configuration of the EL3475 [▶ 30].

5.2 Manual configuration of the EL3475

5.2.1 Modules and slots of the EL3475

The EL3475 has configurable PDOs.

Individual PDOs can be changed and elements added.

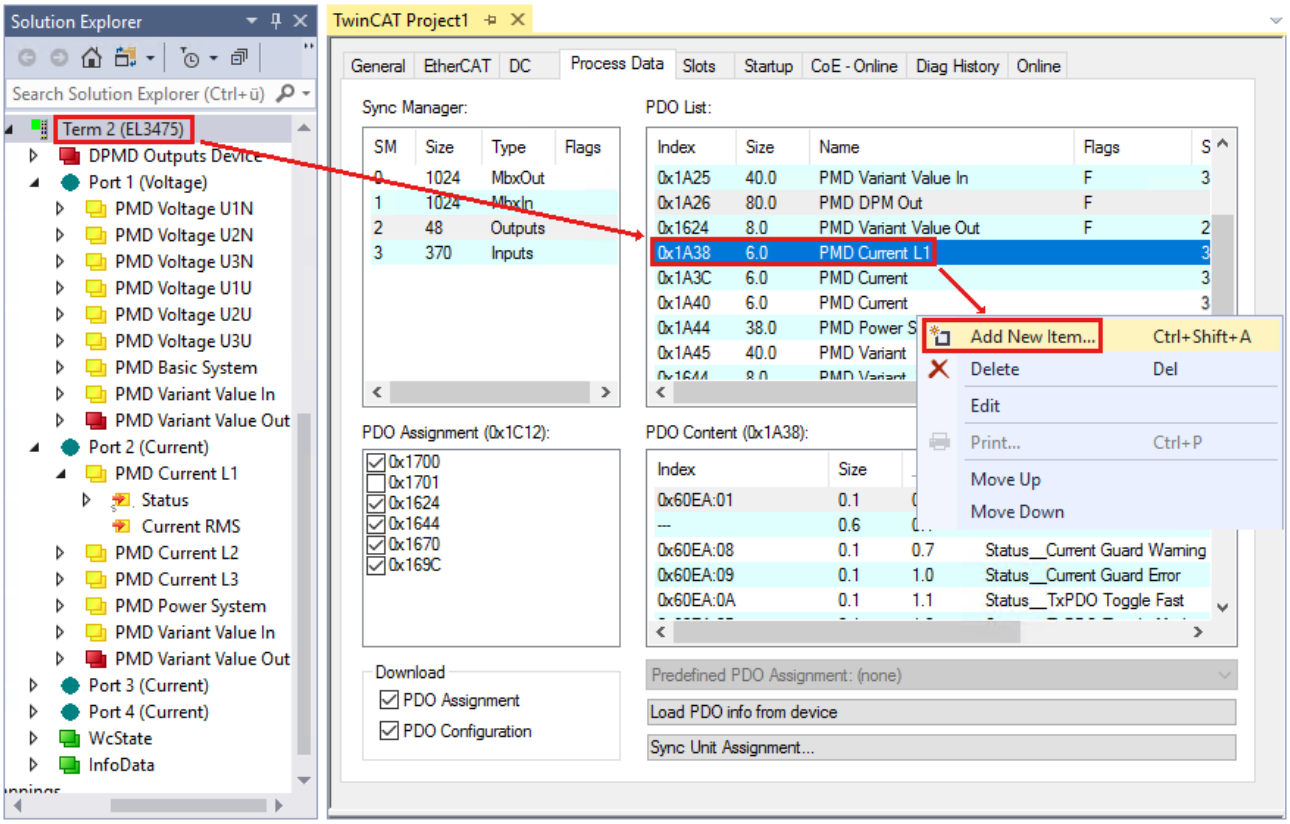


Fig. 17: EL3475 – Configuring the PDO

With a right-click on the PDO contents and "Add new element", you can add the fundamental wave RMS values, for example, via the dialog that then opens.

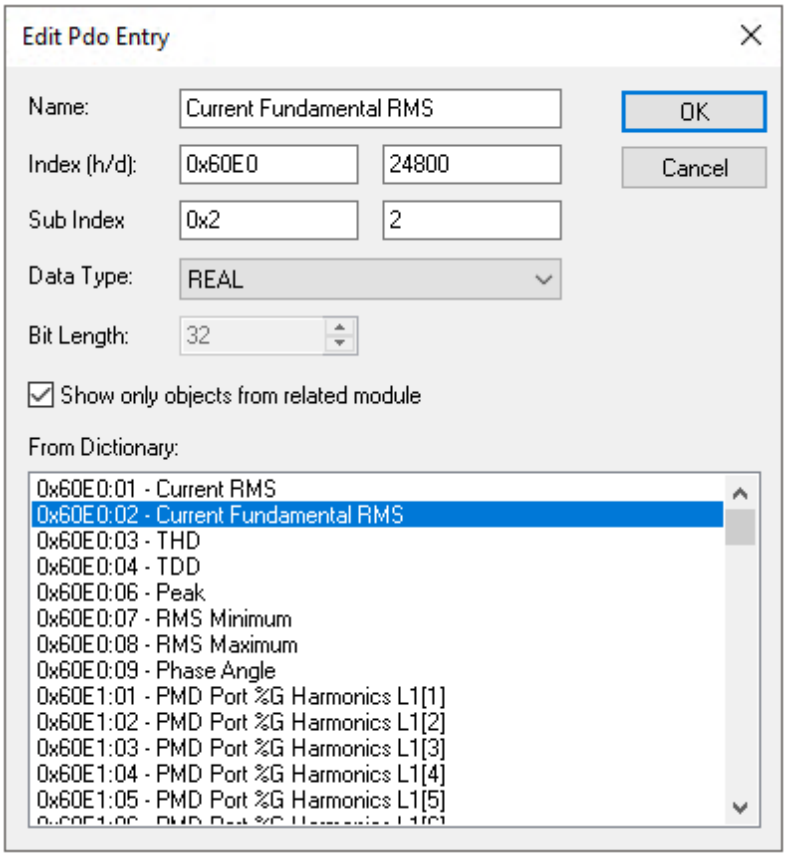


Fig. 18: EL3475 – Editing the PDO entry

Now the PDO has more entries than in the screenshot above:

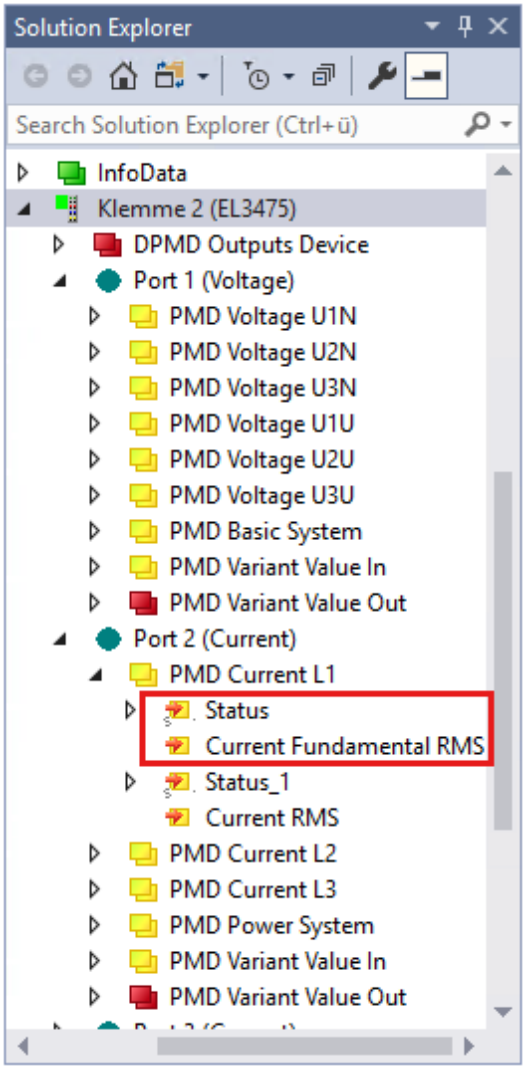


Fig. 19: EL3475 – PDO with more entries

5.2.2 Object description and parameterization

EtherCAT XML Device Description

The display matches that of the CoE objects from the EtherCAT ESI Device Description (XML).We recommend downloading the latest XML file from the download area of the Beckhoff website and installing it according to installation instructions.

Parameterization via the CoE list (CAN over EtherCAT)

The EtherCAT device is parameterized via the CoE-Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE notes when using/manipulating the CoE parameters:

- Keep a startup list if components have to be replaced
- Differentiation between online/offline dictionary, existence of current XML description
- use "CoE reload [▶ 52]" for resetting changes

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization during commissioning:
  - Restore object index 0x1011
  - Configuration data index 0xF800
- Objects intended for regular operation, e.g. through ADS access.
  - PM command object index 0xFB00
- Profile-specific objects:
  - Configuration data (vendor-specific) index 0x80nF
  - Input data index 0x60n0
  - Output data index 0x70n0
  - Information and diagnostic data index 0xF000, 0xF008, 0xF100, 0xF801 and 0xF80F
- Standard objects

The following section first describes the objects required for normal operation, followed by a complete overview of missing objects.

5.2.2.1 Restore object

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default
1011:0	Restore default parameters [▶ 52]	Restore default parameters	UINT8	RO	0x01 (1_{dec})
1011:01	SubIndex 001	If this object is set to **"0x64616F6C"** in the set value dialog, all backup objects are reset to their delivery state.	UINT32	RW	0x00000000 (0_{dec})

5.2.2.2 Objects for regular operation

Index FB00 PM Command

The command object is used for triggering an action in the terminal. The command is started by writing subindex 1 (request). Write access is disabled until the current command is completed.

Index (hex)	Name	Meaning	Data type	Flags	Default
FB00:0	PM Command	Largest subindex of this object	UINT8	RO	0x03
FB00:01	Request		OCTET-STRING [2]	RW	0x0000 (0_{dec})
FB00:02	Status		UINT8	RO	0x00 (0_{dec})
FB00:03	Response		OCTET-STRING [2]	RO	0x00000000 (0_{dec})

Command list

Command	Description	Restrictions	Response
0x0004	Energy reset of all ports		No response
0x0104	Energy reset of port 1		No response
0x0204	Energy reset of port 2		No response
0x0304	Energy reset of port 3		No response
0x0404	Energy reset of port 4		No response
0x3010 + 3 x Port [0…3] + Channel [0...2]	Resets the peak hold registers of the analog dataflow		No response
0x6000	Search for sensors and apply datasheets for all channels (using one command)	In PreOP only	STATE S1* S2* S3* S4*
0x6001 + Port [0...3]	Search for sensor and apply datasheet for a single sensor	In PreOP only	STATE S1* S2* S3* S4*
0x6010	Search for sensors and compare datasheets with current configuration for all channels (using one command)	In PreOP only	STATE S1* S2* S3* S4*
0x6011 + Port [0...3]	Search sensor and compare datasheet with current configuration for a single sensor	In PreOP only	STATE S1* S2* S3* S4
0x6020	Start blinking on all sensors	In PreOP only	No response
0x6021 + Port [0...3]	Start blinking on a single sensor	In PreOP only	No response
0x6030	Stop blinking on all sensors	-	No response
0x6031 + Port [0...3]	Stop blinking on a single sensor	-	No response
0x6040	Clear all sensor configuration	In PreOP only	No response
0x6041 + Port [0...3]	Clear sensor configuration of a single port	In PreOP only	No response

*) Sx (Sensor result):

01: Sensor match
02: Sensor no match
03: Sensor match but wrong slot group selected
04: Sensor applied
05: Sensor cleared

5.2.2.3 AI module (Analog Input)

Analog input module (slots 1...3 per port). Configures the analog inputs including calibration and signal processing.

AI (#x00080d93)

Index 8000 AI Port %G Settings LC

Options for switching on and off different internal terminal calibrations.

Index (hex)	Name	Meaning	Data type	Flags	Default
000:0	AI Port %G Settings LC	Largest subindex of this object	USINT	RO	0x0D (13_{dec})
8000:0A	Enable user calibration		BOOL	RW	0x00 (0_{dec})
8000:0B	Enable vendor calibration		BOOL	RW	0x01 (1_{dec})
8000:0C	Enable Sensor Calibration		BOOL	RW	0x00 (0_{dec})
8000:0D	Enable certificate calibration		BOOL	RW	0x00 (0_{dec})

Index 800C AI Port %G User Calibration Data LC

The following values are calibration data of the measuring electronics and the connected sensor.

Index (hex)	Name	Meaning	Data type	Flags	Default
800C:0	AI Port %G User Calibration Data LC	Largest subindex of this object	USINT	RO	0x17 (23_{dec})
800C:01	Calibration Date		ARRAY [0...3] OF BYTE	RW	
800C:03	S0	User offset of the terminal	REAL	RW	
800C:04	S1	User gain of the terminal	REAL	RW	
800C:05	S2		REAL	RW	
800C:06	S3		REAL	RW	
800C:07	T1		REAL	RW	
800C:08	T1S1		REAL	RW	
800C:0E	D0	User delay of the terminal	DINT	RW	
800C:0F	S0 Sensor	Offset of the sensor	REAL	RW	
800C:10	S1 Sensor	Gain of the sensor (also includes the conversion ratio)	REAL	RW	
800C:11	S2 Sensor		REAL	RW	
800C:12	S3 Sensor		REAL	RW	
800C:13	T1 Sensor		REAL	RW	
800C:14	T1S1 Sensor		REAL	RW	
800C:16	D0 Sensor	Delay of the sensor	DINT	RW	
800C:17	Sensor Calibration Date		ARRAY [0...3] OF BYTE	RW	

Index 800D AI Port %G Advanced Settings LC

Index (hex)	Name	Meaning	Data type	Flags	Default
800D:0	AI Port %G Advanced Settings LC	Largest subindex of this object	USINT	RO	0x22 (34_{dec})
800D:21	Integrator/ Differentiator 1 Type		DT080AEN 16	RW	0x0000 (0_{dec})
800D:22	Integrator/ Differentiator 1 Samples Delta		UINT	RW	0x0000 (0_{dec})

Index 800F AI Port %G Vendor Calibration Data LC

Vendor calibration data

Index (hex)	Name	Meaning	Data type	Flags	Default
800F:0	AI Port %G Vendor Calibration Data LC	Largest subindex of this object	USINT	RO	0x17 (23_{dec})
800F:01	Calibration Date		ARRAY [0...3] OF BYTE	RW	
800F:03	S0	Vendor offset of the terminal	REAL	RW	
800F:04	S1	Vendor gain of the terminal	REAL	RW	
800F:05	S2		REAL	RW	
800F:06	S3		REAL	RW	
800F:07	T1		REAL	RW	
800F:08	T1S1		REAL	RW	
800F:0E	D0		DINT	RW	
800F:0F	S0 Certificate		REAL	RW	
800F:17	Certificate Calibration Date		ARRAY [0...3] OF BYTE	RW	

Index 9000 AI Port %G Internal Data LC

Index (hex)	Name	Meaning	Data type	Flags	Default
9000:0	AI Port %G Internal Data LC	Largest subindex of this object	USINT	RO	0x23 (35_{dec})
9000:01	Saturation time		UDINT	RO	
9000:02	ADC raw value	ADC raw value	DINT	RO	
9000:05	Value After Vendor Calibration		REAL	RO	
9000:06	Value After User Calibration		REAL	RO	
9000:0C	Actual positive peak hold		REAL	RO	
9000:0D	Actual negative peak hold		REAL	RO	
9000:11	Value After Integrator/ Differentiator 1		REAL	RO	
9000:1B	Sampling rate	Sampling rate	REAL	RO	
9000:1C	Value After Calibration		REAL	RO	
9000:20	Positive peak hold timestamp		ULINT	RO	
9000:21	Negative peak hold timestamp		ULINT	RO	
9000:22	Value After Sensor Calibration		REAL	RO	
9000:23	Value After Certificate Calibration		REAL	RO	

Index 9002 AI Port %G Info Data LC

Index (hex)	Name	Meaning	Data type	Flags	Default
9002:0	AI Port %G Info Data LC	Largest subindex of this object	USINT	RO	0x14 (20_{dec})
9002:11	Vendor calibration counter	Number of calibration cycles of the vendor	UDINT	RO	
9002:12	User Calibration Counter	Number of calibration cycles of the user	UDINT	RO	
9002:13	Certificate Calibration Counter	Number of calibration cycles of the calibration certificate	UDINT	RO	
9002:14	Sensor Calibration Counter	Number of calibration cycles of the sensor	UDINT	RO	

5.2.2.4 Profile-specific objects (0x6000-0xFFFF)

The profile-specific objects have the same meaning for all EtherCAT slaves that support the profile 5001.

5.2.2.4.1 Information and diagnostic data

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	Largest subindex of this object	UINT8	RO	0x02
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RW	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RW	0x002C (44_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default
F008:0	Code word	reserved	UINT32	RW	0x00000000 (0_{dec})

Code Word

The vendor reserves the authority for the basic calibration of the terminals. The code word is therefore at present reserved.

Index F009 Password protection

Index (hex)	Name	Meaning	Data type	Flags	Default
F009:0	Password protection	Largest subindex of this object	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module Profile List

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module Profile List	Largest subindex of this object	UINT8	RO	0x2C (44_{dec})
F010:01	SubIndex 001		UINT32	RO	0x0000012C (300_{dec})
F010:02	SubIndex 002		UINT32	RO	0x0000012C (300_{dec})
F010:03	SubIndex 003		UINT32	RO	0x0000012C (300_{dec})
F010:04	SubIndex 004		UINT32	RO	0x00000157 (343_{dec})
F010:05	SubIndex 005		UINT32	RO	0x00000157 (343_{dec})
F010:06	SubIndex 006		UINT32	RO	0x00000157 (343_{dec})
F010:07	SubIndex 007		UINT32	RO	0x00000157 (343_{dec})
F010:08	SubIndex 008		UINT32	RO	0x00000157 (343_{dec})
F010:09	SubIndex 009		UINT32	RO	0x00000157 (343_{dec})
F010:0A	SubIndex 010		UINT32	RO	0x00000157 (343_{dec})
F010:0B	SubIndex 011		UINT32	RO	0x00000186 (390_{dec})
F010:0C	SubIndex 012		UINT32	RO	0x0000012C (300_{dec})
F010:0D	SubIndex 013		UINT32	RO	0x0000012C (300_{dec})
F010:0E	SubIndex 014		UINT32	RO	0x0000012C (300_{dec})
F010:0F	SubIndex 015		UINT32	RO	0x00000157 (343_{dec})
F010:10	SubIndex 016		UINT32	RO	0x00000157 (343_{dec})
F010:11	SubIndex 017		UINT32	RO	0x00000157 (343_{dec})
F010:12	SubIndex 018		UINT32	RO	0x00000157 (343_{dec})
F010:13	SubIndex 019		UINT32	RO	0x00000000 (0_{dec})
F010:14	SubIndex 020		UINT32	RO	0x00000000 (0_{dec})
F010:15	SubIndex 021		UINT32	RO	0x00000000 (0_{dec})
F010:16	SubIndex 022		UINT32	RO	0x00000186 (390_{dec})
F010:17	SubIndex 023		UINT32	RO	0x0000012C (300_{dec})
F010:18	SubIndex 024		UINT32	RO	0x0000012C (300_{dec})
F010:19	SubIndex 025		UINT32	RO	0x0000012C (300_{dec})
F010:1A	SubIndex 026		UINT32	RO	0x00000157 (343_{dec})
F010:1B	SubIndex 027		UINT32	RO	0x00000157 (343_{dec})
F010:1C	SubIndex 028		UINT32	RO	0x00000157 (343_{dec})
F010:1D	SubIndex 029		UINT32	RO	0x00000157 (343_{dec})
F010:1E	SubIndex 030		UINT32	RO	0x00000000 (0_{dec})
F010:1F	SubIndex 031		UINT32	RO	0x00000000 (0_{dec})
F010:20	SubIndex 032		UINT32	RO	0x00000000 (0_{dec})
F010:21	SubIndex 033		UINT32	RO	0x00000186 (390_{dec})
F010:22	SubIndex 034		UINT32	RO	0x0000012C (300_{dec})
F010:23	SubIndex 035		UINT32	RO	0x0000012C (300_{dec})
F010:24	SubIndex 036		UINT32	RO	0x0000012C (300_{dec})
F010:25	SubIndex 037		UINT32	RO	0x00000157 (343_{dec})
F010:26	SubIndex 038		UINT32	RO	0x00000157 (343_{dec})
F010:27	SubIndex 039		UINT32	RO	0x00000157 (343_{dec})
F010:28	SubIndex 3A		UINT32	RO	0x00000157 (343_{dec})
F010:29	SubIndex 3B		UINT32	RO	0x00000000 (0_{dec})
F010:2A	SubIndex 042		UINT32	RO	0x00000000 (0_{dec})
F010:2B	SubIndex 043		UINT32	RO	0x00000000 (0_{dec})
F010:2C	SubIndex 044		UINT32	RO	0x00000186 (390_{dec})

Index F030 Configured Module ID List

Index (hex)	Name	Meaning	Data type	Flags	Default
F030:0	Configured Module ID List	Largest subindex of this object	UINT8	RW	0x2C (44_{dec})
F030:01	SubIndex 001		UINT32	RW	0x00080D93 (527763_{dec})
F030:02	SubIndex 002		UINT32	RW	0x00080D93 (527763_{dec})
F030:03	SubIndex 003		UINT32	RW	0x00080D93 (527763_{dec})
F030:04	SubIndex 004		UINT32	RW	0x00090157 (590167_{dec})
F030:05	SubIndex 005		UINT32	RW	0x00090157 (590167_{dec})
F030:06	SubIndex 006		UINT32	RW	0x00090157 (590167_{dec})
F030:07	SubIndex 007		UINT32	RW	0x00110157 (1114455_{dec})
F030:08	SubIndex 008		UINT32	RW	0x00110157 (1114455_{dec})
F030:09	SubIndex 009		UINT32	RW	0x00110157 (1114455_{dec})
F030:0A	SubIndex 010		UINT32	RW	0x00190157 (1638743_{dec})
F030:0B	SubIndex 011		UINT32	RW	0x00010186 (65926_{dec})
F030:0C	SubIndex 012		UINT32	RW	0x00080D93 (527763_{dec})
F030:0D	SubIndex 013		UINT32	RW	0x00080D93 (527763_{dec})
F030:0E	SubIndex 014		UINT32	RW	0x00080D93 (527763_{dec})
F030:0F	SubIndex 015		UINT32	RW	0x00210157 (2163031_{dec})
F030:10	SubIndex 016		UINT32	RW	0x00210157 (2163031_{dec})
F030:11	SubIndex 017		UINT32	RW	0x00210157 (2163031_{dec})
F030:12	SubIndex 018		UINT32	RW	0x00290157 (2687319_{dec})
F030:13	SubIndex 019		UINT32	RW	0x00000000 (0_{dec})
F030:14	SubIndex 020		UINT32	RW	0x00000000 (0_{dec})
F030:15	SubIndex 021		UINT32	RW	0x00000000 (0_{dec})
F030:16	SubIndex 022		UINT32	RW	0x00010186 (65926_{dec})
F030:17	SubIndex 023		UINT32	RW	0x00080D93 (527763_{dec})
F030:18	SubIndex 024		UINT32	RW	0x00080D93 (527763_{dec})
F030:19	SubIndex 025		UINT32	RW	0x00080D93 (527763_{dec})
F030:1A	SubIndex 026		UINT32	RW	0x00210157 (2163031_{dec})
F030:1B	SubIndex 027		UINT32	RW	0x00210157 (2163031_{dec})
F030:1C	SubIndex 028		UINT32	RW	0x00210157 (2163031_{dec})
F030:1D	SubIndex 029		UINT32	RW	0x00290157 (2687319_{dec})
F030:1E	SubIndex 030		UINT32	RW	0x00000000 (0_{dec})
F030:1F	SubIndex 031		UINT32	RW	0x00000000 (0_{dec})
F030:20	SubIndex 032		UINT32	RW	0x00000000 (0_{dec})
F030:21	SubIndex 033		UINT32	RW	0x00010186 (65926_{dec})
F030:22	SubIndex 034		UINT32	RW	0x00080D93 (527763_{dec})
F030:23	SubIndex 035		UINT32	RW	0x00080D93 (527763_{dec})
F030:24	SubIndex 036		UINT32	RW	0x00080D93 (527763_{dec})
F030:25	SubIndex 037		UINT32	RW	0x00210157 (2163031_{dec})
F030:26	SubIndex 038		UINT32	RW	0x00210157 (2163031_{dec})
F030:27	SubIndex 039		UINT32	RW	0x00210157 (2163031_{dec})
F030:28	SubIndex 3A		UINT32	RW	0x00290157 (2687319_{dec})
F030:29	SubIndex 3B		UINT32	RW	0x00000000 (0_{dec})
F030:2A	SubIndex 042		UINT32	RW	0x00000000 (0_{dec})
F030:2B	SubIndex 043		UINT32	RW	0x00000000 (0_{dec})
F030:2C	SubIndex 044		UINT32	RW	0x00010186 (65926_{dec})

Index F050 Detected Module Ident List

Index (hex)	Name	Meaning	Data type	Flags	Default
F050:0	Detected Module Ident List	Largest subindex of this object	UINT8	RO	0x2C (44_{dec})
F050:01	SubIndex 001		UINT32	RO	0x00080D93 (527763_{dec})
F050:02	SubIndex 002		UINT32	RO	0x00080D93 (527763_{dec})
F050:03	SubIndex 003		UINT32	RO	0x00080D93 (527763_{dec})
F050:04	SubIndex 004		UINT32	RO	0x00090157 (590167_{dec})
F050:05	SubIndex 005		UINT32	RO	0x00090157 (590167_{dec})
F050:06	SubIndex 006		UINT32	RO	0x00090157 (590167_{dec})
F050:07	SubIndex 007		UINT32	RO	0x00110157 (1114455_{dec})
F050:08	SubIndex 008		UINT32	RO	0x00110157 (1114455_{dec})
F050:09	SubIndex 009		UINT32	RO	0x00110157 (1114455_{dec})
F050:0A	SubIndex 010		UINT32	RO	0x00190157 (1638743_{dec})
F050:0B	SubIndex 011		UINT32	RO	0x00010186 (65926_{dec})
F050:0C	SubIndex 012		UINT32	RO	0x00080D93 (527763_{dec})
F050:0D	SubIndex 013		UINT32	RO	0x00080D93 (527763_{dec})
F050:0E	SubIndex 014		UINT32	RO	0x00080D93 (527763_{dec})
F050:0F	SubIndex 015		UINT32	RO	0x00210157 (2163031_{dec})
F050:10	SubIndex 016		UINT32	RO	0x00210157 (2163031_{dec})
F050:11	SubIndex 017		UINT32	RO	0x00210157 (2163031_{dec})
F050:12	SubIndex 018		UINT32	RO	0x00290157 (2687319_{dec})
F050:13	SubIndex 019		UINT32	RO	0x00000000 (0_{dec})
F050:14	SubIndex 020		UINT32	RO	0x00000000 (0_{dec})
F050:15	SubIndex 021		UINT32	RO	0x00000000 (0_{dec})
F050:16	SubIndex 022		UINT32	RO	0x00010186 (65926_{dec})
F050:17	SubIndex 023		UINT32	RO	0x00080D93 (527763_{dec})
F050:18	SubIndex 024		UINT32	RO	0x00080D93 (527763_{dec})
F050:19	SubIndex 025		UINT32	RO	0x00080D93 (527763_{dec})
F050:1A	SubIndex 026		UINT32	RO	0x00210157 (2163031_{dec})
F050:1B	SubIndex 027		UINT32	RO	0x00210157 (2163031_{dec})
F050:1C	SubIndex 028		UINT32	RO	0x00210157 (2163031_{dec})
F050:1D	SubIndex 029		UINT32	RO	0x00290157 (2687319_{dec})
F050:1E	SubIndex 030		UINT32	RO	0x00000000 (0_{dec})
F050:1F	SubIndex 031		UINT32	RO	0x00000000 (0_{dec})
F050:20	SubIndex 032		UINT32	RO	0x00000000 (0_{dec})
F050:21	SubIndex 033		UINT32	RO	0x00010186 (65926_{dec})
F050:22	SubIndex 034		UINT32	RO	0x00080D93 (527763_{dec})
F050:23	SubIndex 035		UINT32	RO	0x00080D93 (527763_{dec})
F050:24	SubIndex 036		UINT32	RO	0x00080D93 (527763_{dec})
F050:25	SubIndex 037		UINT32	RO	0x00210157 (2163031_{dec})
F050:26	SubIndex 038		UINT32	RO	0x00210157 (2163031_{dec})
F050:27	SubIndex 039		UINT32	RO	0x00210157 (2163031_{dec})
F050:28	SubIndex 3A		UINT32	RO	0x00290157 (2687319_{dec})
F050:29	SubIndex 3B		UINT32	RO	0x00000000 (0_{dec})
F050:2A	SubIndex 042		UINT32	RO	0x00000000 (0_{dec})
F050:2B	SubIndex 043		UINT32	RO	0x00000000 (0_{dec})
F050:2C	SubIndex 044		UINT32	RO	0x00010186 (65926_{dec})

Index F081 Download Revision

Index (hex)	Name	Meaning	Data type	Flags	Default
F081:0	Download revision	Largest subindex of this object	UINT8	RO	0x01 (1_{dec})
F081:01	Revision Number		UINT32	RW	0x00000000 (0_{dec})

Index F700 PMD Outputs Device

Index (hex)	Name	Meaning	Data type	Flags	Default
F700:0	PMD Outputs Device	Largest subindex of this object	UINT8	RO	0x11 (17_{dec})
F700:02	Intervall Reset		BOOLEAN	RO	0x00 (0_{dec})
F700.11	Time		UINT64	RO	

Index F708 PMD DPM In

Index (hex)	Name	Meaning	Data type	Flags	Default
F708:0	PMD DPM In	Largest subindex of this object	UINT8	RO	0x14 (20_{dec})
F708:01	SubIndex 001		UINT32	RO	0x00000000 (0_{dec})
F708:02	SubIndex 002		UINT32	RO	0x00000000 (0_{dec})
F708:03	SubIndex 003		UINT32	RO	0x00000000 (0_{dec})
F708:04	SubIndex 004		UINT32	RO	0x00000000 (0_{dec})
F708:05	SubIndex 005		UINT32	RO	0x00000000 (0_{dec})
F708:06	SubIndex 006		UINT32	RO	0x00000000 (0_{dec})
F708:07	SubIndex 007		UINT32	RO	0x00000000 (0_{dec})
F708:08	SubIndex 008		UINT32	RO	0x00000000 (0_{dec})
F708:09	SubIndex 009		UINT32	RO	0x00000000 (0_{dec})
F708:0A	SubIndex 010		UINT32	RO	0x00000000 (0_{dec})
F708:0B	SubIndex 011		UINT32	RO	0x00000000 (0_{dec})
F708:0C	SubIndex 012		UINT32	RO	0x00000000 (0_{dec})
F708:0D	SubIndex 013		UINT32	RO	0x00000000 (0_{dec})
F708:0E	SubIndex 014		UINT32	RO	0x00000000 (0_{dec})
F708:0F	SubIndex 015		UINT32	RO	0x00000000 (0_{dec})
F708:10	SubIndex 016		UINT32	RO	0x00000000 (0_{dec})
F708:11	SubIndex 017		UINT32	RO	0x00000000 (0_{dec})
F708:12	SubIndex 018		UINT32	RO	0x00000000 (0_{dec})
F708:13	SubIndex 019		UINT32	RO	0x00000000 (0_{dec})
F708:14	SubIndex 020		UINT32	RO	0x00000000 (0_{dec})

Index F803 PMD Settings Device

Index (hex)	Name	Meaning	Data type	Flags	Default
F803:0	PMD Settings Device	Largest subindex of this object	UINT8	RO	0x12 (18_{dec})
F803:12	Time Offset		INT64	RW	

Index F81F PMD Vendor Data

Index (hex)	Name	Meaning	Data type	Flags	Default
F81F:0	PMD Vendor Data	Largest subindex of this object	UINT8	RO	0x12 (18_{dec})
F81F:12	Terminal Type		INT32	RW	0x00000000 (0_{dec})

Index FA00 PMD Diagnosis

Index (hex)	Name	Meaning	Data type	Flags	Default
FA00:0	PMD Diagnosis	Largest subindex of this object	UINT8	RO	0x13 (19_{dec})
FA00:11	Minimum CPU Die Temperature	Minimum CPU die temperature	REAL32	RO	0x00000000 (0_{dec})
FA00.12	Maximum CPU Die Temperature	Maximum CPU die temperature	REAL32	RO	0x00000000 (0_{dec})
FA00.13	E-BUS Voltage	E-bus voltage	REAL32	RO	0x00000000 (0_{dec})

Index FB00 PMD Command

Index (hex)	Name	Meaning	Data type	Flags	Default
FB00:0	PMD Command	Largest subindex of this object	UINT8	RO	0x03 (3_{dec})
FB00:01	Request		OCTET-STRING[2]	RW	0x00000000 (0_{dec})
FB00.02	Status		UINT8	RO	0x00000000 (0_{dec})
FB00.03	Response		OCTET-STRING[2]	RO	0x00000000 (0_{dec})

5.2.2.5 Standard objects

Standard objects (0x1000-0x1FFF)

The standard objects have the same meaning for all EtherCAT slaves.

Index 1000 Device type

Index (hex)	Name	Meaning	Data type	Flags	Default
1000:0	Device type	Device type of the EtherCAT slave: the low word contains the used CoE profile (5001). The high word contains the module profile according to the modular device profile.	UINT32	RO	0x01541389

Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EL3403

Index 1009 Hardware version

Index (hex)	Name	Meaning	Data type	Flags	Default
1009:0	Hardware version	Hardware version of the EtherCAT slave	STRING	RO	01

Index 100A Software version

Index (hex)	Name	Meaning	Data type	Flags	Default
100A:0	Software version	Firmware version of the EtherCAT slave	STRING	RO	00

Index 100B Bootloader version

Index (hex)	Name	Meaning	Data type	Flags	Default
100B:0	Bootloader version	Bootloader version	STRING	RO	n.a.

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default
1018:0	Identity	Largest subindex of this object	UINT8	RO	4
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	2
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	0x0D933052 (227749970_{dec})
1018:03	Revision	Revision number of the EtherCAT slave: • The low word (bit 0…15) identifies the special terminal number. • The high word (bit 16…31) refers to the device description.	UINT32	RO	
1018:04	Serial number	Serial number of the EtherCAT slave: • The low byte (bit 0…7) of the low word contains the year of production. • The high byte (bit 8…15) of the low word contains the week of production. • The high word (bit 16…31) is 0.	UINT32	RO	

Index 10E2 Manufacturer-specific Identification Code

Index (hex)	Name	Meaning	Data type	Flags	Default
10E2:0	Manufacturer specific identification code	Largest subindex of this object	UINT8	RO	0x01 (1_{dec})
10E2:01	SubIndex 001	Vendor-specific identification code	UINT32	RW	

Index 10F0 Backup parameter handling

Index (hex)	Name	Meaning	Data type	Flags	Default
10F0:0	Backup parameter handling	Largest subindex of this object	UINT8	RO	0x01 (1_{dec})
10F0:01	Checksum		UINT32	RW	0x00000000 (0_{dec})

Index 10F3 Diagnosis history

Index (hex)	Name	Meaning	Data type	Flags	Default
10F3:0	Diagnosis history	Largest subindex of this object	UINT8	RO	0x15 (21_{dec})
10F3:01	Maximum messages	Maximum number of messages	UINT8	RO	0x00 (0_{dec})
10F3:02	Newest message	Newest message	UINT8	RO	0x00 (0_{dec}
10F3:03	Newest acknowledged message	Newest acknowledged message	UINT8	RW	0x00 (0_{dec}
10F3:04	New Messages available	New message available	BOOLEAN	RO	0x00 (0_{dec}
10F3:05	Flags		UINT16	RW	0x0000 (0_{dec}
10F3:06	Diagnosis message 001	Diagnostic message 001	OCTET-STRING[20]	RO	{0}
10F3:07	Diagnosis message 002	…	OCTET-STRING[20]	RO	{0}
10F3:08	Diagnosis message 003	…	OCTET-STRING[20]	RO	{0}
10F3:09	Diagnosis message 004	…	OCTET-STRING[20]	RO	{0}
10F3:0A	Diagnosis message 005	…	OCTET-STRING[20]	RO	{0}
10F3:0B	Diagnosis message 006	…	OCTET-STRING[20]	RO	{0}
10F3:0C	Diagnosis message 007	…	OCTET-STRING[20]	RO	{0}
10F3:0D	Diagnosis message 008	…	OCTET-STRING[20]	RO	{0}
10F3:0E	Diagnosis message 009	…	OCTET-STRING[20]	RO	{0}
10F3:0F	Diagnosis message 010	…	OCTET-STRING[20]	RO	{0}
10F3:10	Diagnosis message 011	…	OCTET-STRING[20]	RO	{0}
10F3:11	Diagnosis message 012	…	OCTET-STRING[20]	RO	{0}
10F3:12	Diagnosis message 013	…	OCTET-STRING[20]	RO	{0}
10F3:13	Diagnosis message 014		OCTET-STRING[20]	RO	{0}
10F3:14	Diagnosis message 015	…	OCTET-STRING[20]	RO	{0}
10F3:15	Diagnosis message 016	Diagnostic message 016	OCTET-STRING[20]	RO	{0}

Index 10F8 Timestamp Object

Index (hex)	Name	Meaning	Data type	Flags	Default
10F8:0	Timestamp Object	Largest subindex of this object	UINT64	RO	

Index 10F9 Time Distribution Object

Index (hex)	Name	Meaning	Data type	Flags	Default
10F9:0	Time Distribution Object	Largest subindex of this object	UINT8	RO	0x01 (1_{dec})
10F9:01	Distributed Time Value		UINT64	RW	

Index 1700 DPMD RxPDO-Map Outputs Device

Index (hex)	Name	Meaning	Data type	Flags	Default
1700:0	DPMD RxPDO-Map Outputs Device	PDO Mapping RxPDO 257	UINT8	RO	0x00 (0_{dec})
1700:01	SubIndex 001	1st PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1700:02	SubIndex 002	2nd PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1700:03	SubIndex 003	3rd PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1700:04	SubIndex 004	4th PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0

Index 1701 DPMD RxPDO-Map DPM In

Index (hex)	Name	Meaning	Data type	Flags	Default
1701:0	DPMD RxPDO-Map DPM In	PDO Mapping RxPDO 258	UINT8	RO	0x00 (0_{dec})
1701:01	SubIndex 001	1st PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1701:02	SubIndex 002	2nd PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1701:03	SubIndex 003	3rd PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1701:04	SubIndex 004	4th PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0
1701:05	SubIndex 005	…	UINT32	RO	0x0000:00, 0
1701:06	SubIndex 006	…	UINT32	RO	0x0000:00, 0
1701:07	SubIndex 007	…	UINT32	RO	0x0000:00, 0
1701:08	SubIndex 008	…	UINT32	RO	0x0000:00, 0
1701:09	SubIndex 009	…	UINT32	RO	0x0000:00, 0
1701:0A	SubIndex 010	…	UINT32	RO	0x0000:00, 0
1701:0B	SubIndex 011	…	UINT32	RO	0x0000:00, 0
1701:0C	SubIndex 012	…	UINT32	RO	0x0000:00, 0
1701:0D	SubIndex 013	…	UINT32	RO	0x0000:00, 0
1701:0E	SubIndex 014	…	UINT32	RO	0x0000:00, 0
1701:0F	SubIndex 015	…	UINT32	RO	0x0000:00, 0
1701:10	SubIndex 016		UINT32	RO	0x0000:00, 0
1701:11	SubIndex 017	…	UINT32	RO	0x0000:00, 0
1701:12	SubIndex 018	…	UINT32	RO	0x0000:00, 0
1701:13	SubIndex 019	…	UINT32	RO	0x0000:00, 0
1701:14	SubIndex 020	20th PDO Mapping entry (0 bits align)	UINT32	RO	0x0000:00, 0

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default
1C00:0	Sync manager type	Length of this object	UINT8	RO	0x04 (4_{dec})
1C00:01	SubIndex 001	Sync Manager Type Channel 1: Mailbox Write	UINT8	RW	0x01 (1_{dec})
1C00:02	SubIndex 002	Sync Manager Type Channel 2: Mailbox Read	UINT8	RW	0x02 (2_{dec})
1C00:03	SubIndex 003		UINT8	RW	0x03 (3_{dec})
1C00:04	SubIndex 004		UINT8	RW	0x04 (4_{dec})

Index 1C12 RxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C12:0	RxPDO assign	PDO assign of the outputs	UINT8	RO	0x05 (5_{dec})
1C12:01	Subindex 001	1st assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1700 (5888_{dec})
1C12:02	Subindex 002	2nd assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1624 (5668_{dec})
1C12:03	Subindex 003	3rd assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1644 (5700_{dec})
1C12:04	Subindex 004	4th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1670 (5744_{dec})
1C12:05	Subindex 005	5th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x169C (5788_{dec})
1C12:06	Subindex 006	6th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0_{dec})
1C12:07	Subindex 007	7th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0_{dec})
1C12:08	Subindex 008	8th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0_{dec})
1C12:09	Subindex 009	9th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0_{dec})
1C12:010	Subindex 010	10th assigned RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO assign of the inputs	UINT8	RO	0x14 (23_{dec})
1C13:01	Subindex 001	1st assigned TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A0C (6668_{dec})
1C13:02	Subindex 002	2nd assigned TxPDO (see above)	UINT16	RW	0x1A10 (6672_{dec})
1C13:03	Subindex 003	3rd assigned TxPDO (see above)	UINT16	RW	0x1A14 (6676_{dec})
1C13:04	Subindex 004	4th assigned TxPDO (see above)	UINT16	RW	0x1A18 (6680_{dec})
1C13:05	Subindex 005	5th assigned TxPDO (see above)	UINT16	RW	0x1A1C (6684_{dec})
1C13:06	Subindex 006	6th assigned TxPDO (see above)	UINT16	RW	0x1A20 (6688_{dec})
1C13:07	Subindex 007	7th assigned TxPDO (see above)	UINT16	RW	0x1A24 (6692_{dec})
1C13:08	Subindex 008	8th assigned TxPDO (see above)	UINT16	RW	0x1A25 (6693_{dec})
1C13:09	Subindex 009	9th assigned TxPDO (see above)	UINT16	RW	0x1A38 (6712_{dec})
1C13:0A	Subindex 010	10th assigned TxPDO (see above)	UINT16	RW	0x1A3C (6716_{dec})
1C13:0B	Subindex 011	11th assigned TxPDO (see above)	UINT16	RW	0x1A40 (6720_{dec})
1C13:0C	Subindex 012	12th assigned TxPDO (see above)	UINT16	RW	0x1A44 (6724_{dec})
1C13:0D	Subindex 013	13th assigned TxPDO (see above)	UINT16	RW	0x1A45 (6725_{dec})
1C13:0E	Subindex 014	14th assigned TxPDO (see above)	UINT16	RW	0x1A64 (6756_{dec})
1C13:0F	Subindex 015	15th assigned TxPDO (see above)	UINT16	RW	0x1A68 (6760_{dec})
1C13:10	Subindex 016	16th assigned TxPDO (see above)	UINT16	RW	0x1A6C (6764_{dec})
1C13:11	Subindex 017	17th assigned TxPDO (see above)	UINT16	RW	0x1A70 (6768_{dec})
1C13:12	Subindex 018	18th assigned TxPDO (see above)	UINT16	RW	0x1A71 (6769_{dec})
1C13:13	Subindex 019	19th assigned TxPDO (see above)	UINT16	RW	0x1A90 (6800_{dec})
1C13:14	Subindex 020	20th assigned TxPDO (see above)	UINT16	RW	0x1A94 (6804_{dec})
1C13:15	Subindex 021	21st assigned TxPDO (see above)	UINT16	RW	0x1A98 (6808_{dec})
1C13:16	Subindex 022	22nd assigned TxPDO (see above)	UINT16	RW	0x1A9C (6812_{dec})
1C13:17	Subindex 023	23rd assigned TxPDO (see above)	UINT16	RW	0x1A9D (6813_{dec})
1C13:18	Subindex 024	24th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:19	Subindex 025	25th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1A	Subindex 026	26th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1B	Subindex 027	27th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1C	Subindex 028	28th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1D	Subindex 029	29th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1E	Subindex 030	30th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:1F	Subindex 031	31st assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:20	Subindex 032	32nd assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:21	Subindex 033	33rd assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:22	Subindex 034	34th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:23	Subindex 035	35th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:24	Subindex 036	36th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:25	Subindex 037	37th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:26	Subindex 038	38th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:27	Subindex 039	39th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})
1C13:28	Subindex 040	40th assigned TxPDO (see above)	UINT16	RW	0x0000 (0_{dec})

Index 1C32 SM output parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C32:0	SM output parameter	Synchronization parameters for the outputs	UINT8 BOOLEAN	RO	0x14 (20_{dec})
1C32:01	Sync mode	Current synchronization mode: 0: Free Run 1: Synchronous with SM 2 event 2: DC mode – Synchronous with SYNC0 event 3: DC mode – Synchronous with SYNC1 event	UINT16	RW	0x0001 (1_{dec})
1C32:02	Cycle time	Cycle time (in ns): Free Run: cycle time of the local timer Synchronous with SM 2 event: cycle time of the master DC mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x000AAE60 (700000_{dec})
1C32:03	Shift time	Time between SYNC0 event and output of the outputs (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C32:04	Sync modes supported	Supported synchronization modes: Bit 0 = 1: Free Run is supported Bit 1 = 1: Synchronous with SM 2 event is supported Bit 2-3 = 01: DC mode is supported Bit 4-5 = 10: Output Shift with SYNC1 event (DC mode only) Bit 14 = 1: dynamic times (measurement by writing to 0x1C32:08)	UINT16	RW	0x8007 (32775_{dec})
1C32:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RW	0x000AAE60 (700000_{dec})
1C32:06	Calc and copy time	Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C32:08	Command	0: Measurement of the local cycle time is stopped 1: Measurement of the local cycle time is started 0x1C32:033, 0x1C32:05, 0x1C32:06, 0x1C32:09, 0x1C33:03 [▶ 48], 0x1C33:06 [▶ 47], 0x1C33:09 [▶ 48] are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C32:09	Delay time	Time between SYNC1 event and output of the outputs (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C32:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC Mode only)	UINT166	RW	0x0000 (0_{dec})
1C32:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RW	0x0000 (0_{dec})
1C32:0D	Shift too short counter	Number of intervals between SYNC0 and SYNC1 events that are too short (DC Mode only)	UINT16	RW	0x0000 (0_{dec})
1C32:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC Mode only)	BOOLEAN	RW	0x00 (0_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x14 (20_{dec})
1C33:01	Sync mode	Current synchronization mode: 0: Free Run 1: Synchronous with SM 3 event (no outputs available) 2: DC – Synchronous with SYNC0 event 3: DC – Synchronous with SYNC1 event 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0022 (34_{dec})
1C33:02	Cycle time	as 0x1C32:02 [▶ 47]	UINT32	RW	0x000AAE60 (700000_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: Bit 0: Free Run is supported Bit 1: Synchronization with SM 2 event is supported (outputs available) Bit 1: Synchronization with SM 3 event is supported (no outputs available) Bit 2-3 = 01: DC mode is supported Bit 4-5 = 01: Input shift through local event (outputs available) Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available) Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 [▶ 47] or 0x1C33:08 [▶ 48])	UINT16	RW	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	as 0x1C32:05 [▶ 47]	UINT32	RW	0x000AAE60 (700000_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and the inputs being available for the master (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C33:08	Command	as 0x1C32:08 [▶ 47]	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, DC mode only)	UINT32	RW	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	as 0x1C32:0B [▶ 47]	UINT16	RW	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	as 0x1C32:0C [▶ 47]	UINT16	RW	0x0000 (0_{dec})
1C33:0D	Shift too short counter	as 0x1C32:0D [▶ 47]	UINT16	RW	0x0000 (0_{dec})
1C33:20	Sync error	as 0x1C32:20 [▶ 47]	BOOLEAN	RWW	0x00 (0_{dec})

6 Application examples

6.1 Power measurement at a machine

⚠ WARNING

Risk of injury from electric shock!

Bring the bus terminal system into a safe, de-energized state before starting mounting, disassembly or wiring of the bus terminals!

Connection of low power split-core transformers with current and voltage interfaces

Both low power transformers with current and voltage interfaces can be connected to the RJ45 connections X1 - X4.

- When using small signal transformers from the SCL and SVL series, the transformer ratios are set automatically via the electronic nameplate.
- When using transformers without an electronic nameplate, manual configuration via the “modules/slots” procedure is required.

- The voltage is measured via a low power voltage transformer (e.g. from the Beckhoff SVL series) in the following example via the RJ45 connection X1.
- The current is measured by means of a low power transformer, 3-channel current interface (e.g. from the Beckhoff SCL series) in the following example, the RJ45 connection X2.

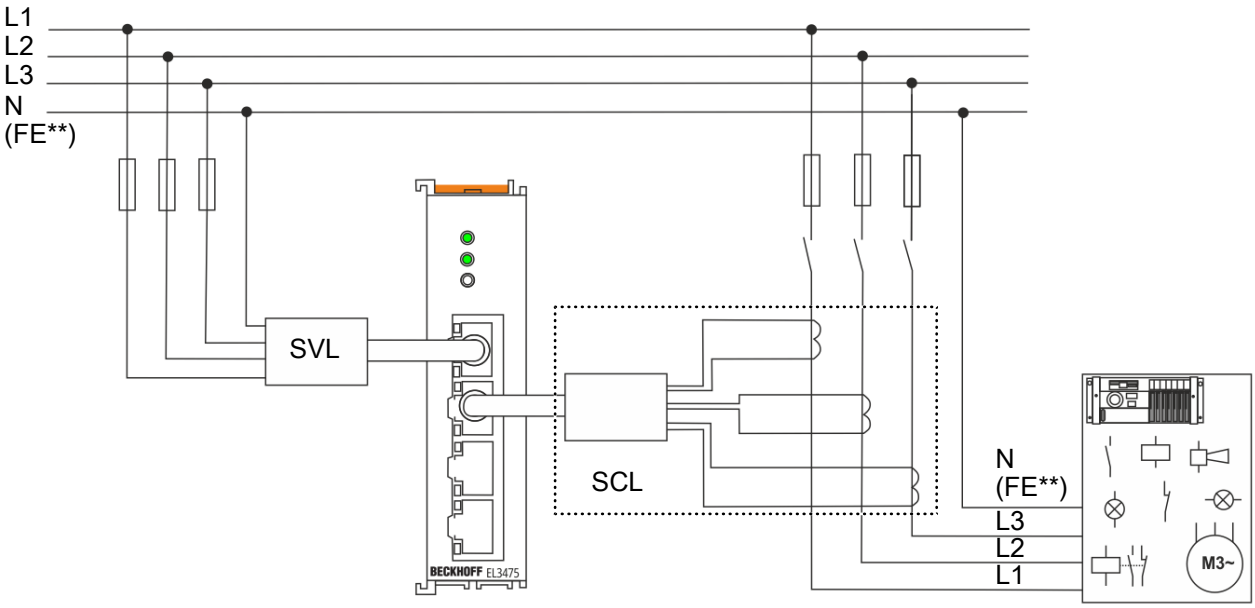


Fig. 20: Power measurement on a machine with EL3475 and low power transformers SCL and SVL

Terminal fuse protection

- The voltage measurement inputs are high-resistance; a minimum measuring current flows. The protection for the SVL connections must therefore be applied in accordance with the conductor cross-section used.
- For current measurement inputs, the fuse protection must be adapted by the device to be measured. The secondary currents of the transformers are no longer fused (see fig.)

****) FE as star point for 3-phase systems without neutral conductor**

Depending on the current transformer used, in 3-phase systems without a neutral conductor FE must be connected as a star point as shown in the figure above.
Please observe the current transformer manufacturer's instructions!

Negative power values

If negative power values are measured on a circuit, please check whether the associated current transformer circuit is connected correctly.

6.2 U/I Mapping

The problem often arises that the voltages U_1, U_2, and U_3 and the currents I_a, I_b and I_c are connected to a power meter and it must then be determined which voltage corresponds to which current. Formally, the goal is to find a bijective mapping between currents I_a, I_b and I_c to voltages U_1, U_2, and U_3. Since this problem cannot generally be solved (except by tracing the cables), the following assumptions have to be made:

- Right-hand rotation field
- Power flow is either feeding in or consuming

From the assumptions, it follows that the angle between current and voltage is only a maximum of 90 degrees. Therefore, the phases of the resulting currents of the voltages U_1, U_2, and U_3 lie in the following ranges:

$$-90° \leq \varphi_{I1} \leq 90°$$
$$-210° \leq \varphi_{I2} \leq -30°$$
$$30° \leq \varphi_{I3} \leq 210°$$

This results in areas that are exclusive to some phases and others that are shared by two subsequent phases:

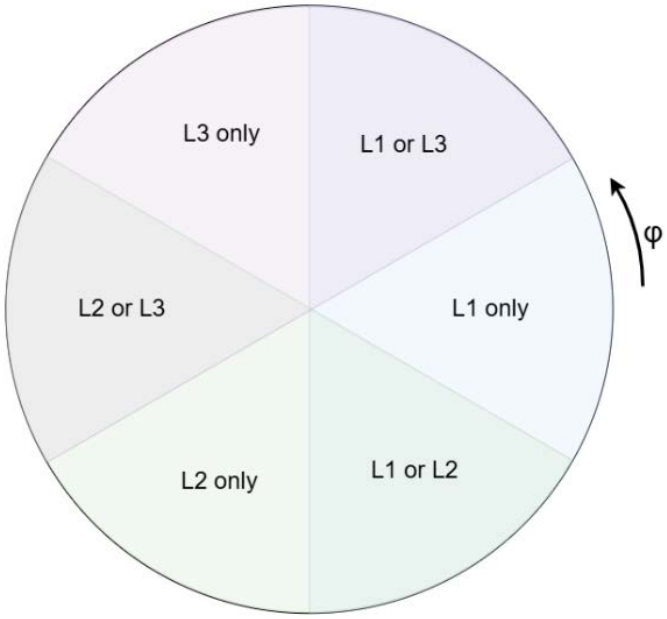


Fig. 21: EL3475 - U/I mapping, Phases

The respective relationship between current and voltage can then be derived from these areas using a process of elimination.

Example

Let us assume three currents I_a, I_b and I_c having the following phases:

$\varphi_a = 0°$
$\varphi_b = -90°$
$\varphi_c = 150°$

The mapping a = L1 is unique.

Since I_{L1} is already determined, I_b is mapped to L2.

Finally, c = 3 can be determined.

7 Appendix

7.1 Restoring the delivery state

Some EtherCAT devices (“Slaves”, “SubDevices”) save parameters or data locally in a persistent (non-volatile) manner. To reset them, the CoE object *Restore default parameters*, subindex 001 can be used via an EtherCAT master (e.g. TwinCAT) (see Fig. *Selecting the “Restore default parameters” PDO*)

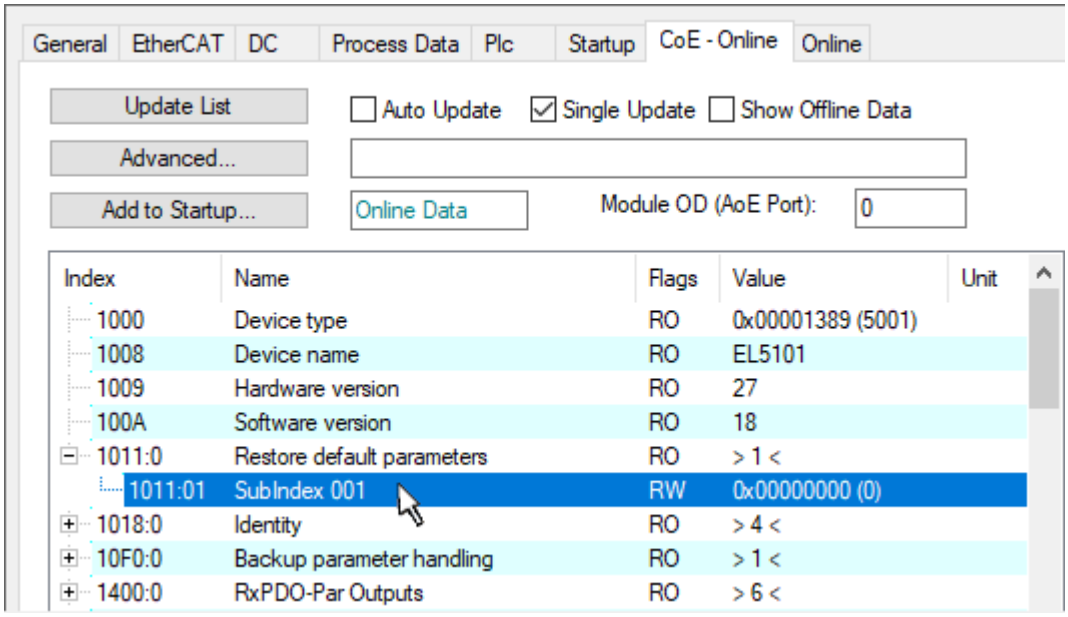


Fig. 22: Selecting the *Restore default parameters* PDO

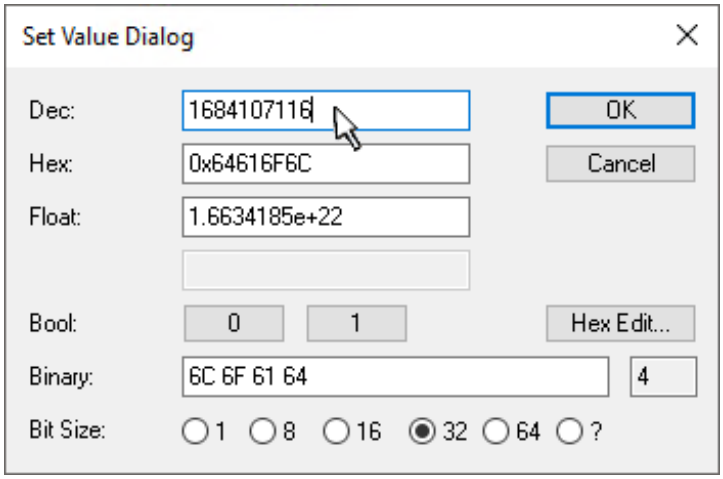


Fig. 23: Entering a restore value in the Set Value dialog

Double-click on *SubIndex 001* to open the Set Value dialog.

The aim is to reset function-controlling “parameters” (settings, values) that are persistently stored in the device and can be changed by the user to the default state.

Volatile (not power-fail-safe) “parameters” are reset

- by a RePower On/Off
- by an EtherCAT status change through INIT

unless otherwise described in the device documentation. Depending on the device and FW version, one or two reset functions are available; please refer to the respective device documentation for availability.

NOTICE

Changing existing checksums

Any existing checksums for the parameter ranges will (of course) change as a result of the reset.

Reset level 1: Function reset “load”

It is assumed that the function reset is used more often, possibly several times, e.g. during commissioning.

Enter the reset value **1684107116** in the *Dec* field or alternatively the value **0x64616F6C** in the *Hex* field (ASCII: “load”) and confirm with OK (Fig. *Entering the restore value in the Set Value dialog*).

- All changeable CoE entries are reset to the default values.
  Exception: objects protected by a write protection password
- Depending on the size of the object directory, this process can take from a few ms to > 1 second.
- The values can only be successfully restored if the reset is directly applied to the online CoE, i.e. to the slave. No values can be changed in the offline CoE.
- TwinCAT must be in the RUN or CONFIG/Freerun state, i.e. EtherCAT data exchange is taking place. Ensure error-free EtherCAT transmission.
- The reset does not result in a separate confirmation. A changeable object can be modified beforehand for checking purposes.
- This reset procedure can also be included as the first entry in the startup list of the slave, e.g. in the PREOP->SAFEOP state transition or, as in Fig. *CoE reset as a startup entry*, in SAFEOP->OP.
- In this way, backup objects are reset to the delivery state.

NOTICE

Depending on the device, individual values are not reset

Depending on the device, some values are intentionally not reset on “load” if the values are necessary for commissioning or essential device functions, for example, and determining them (after a deletion) would require considerable effort.

Alternative restore value

With some older terminals (FW created around 2007 or earlier), the backup objects can be changed with an alternative restore value: Decimal value: 1819238756, Hexadecimal value: 0x6C6F6164.

An incorrect entry for the restore value has no effect!

Reset level 2: Data reset “wipe”

It is assumed that a data reset is rarely used, e.g. when a product is decommissioned.

Enter the reset value **2003398757** in the *Dec* field or alternatively the value **0x77697065** in the *Hex* field (ASCII: “wipe”) and confirm with OK (Fig. *Entering the restore value in the Set Value dialog*).

- The aim of this function is a complete reset (data deletion) to the factory settings so that no user-specific settings can be read afterwards
- It affects the following parameter areas (if available on the device)
  - CoE (parameters)
  - SoE (parameters)
  - FoE (files on the device)
  - Register values (if stored persistently)
  - User memory such as NOVRAM (if available)
  - Additional data areas, if available
- Values/data are deleted even if they are protected, for example with a user-defined write-protection password.
- The following are not reset:
  - FW version and EtherCAT revision status; any updates remain installed on the device
  - Electrical health data such as Device Statistics (CoE: 0x1020), all types of operating hours counters, possibly histograms or peak values relating to ambient temperature or load conditions, …
  - Vendor calibration data protected by the vendor password

7.2 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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