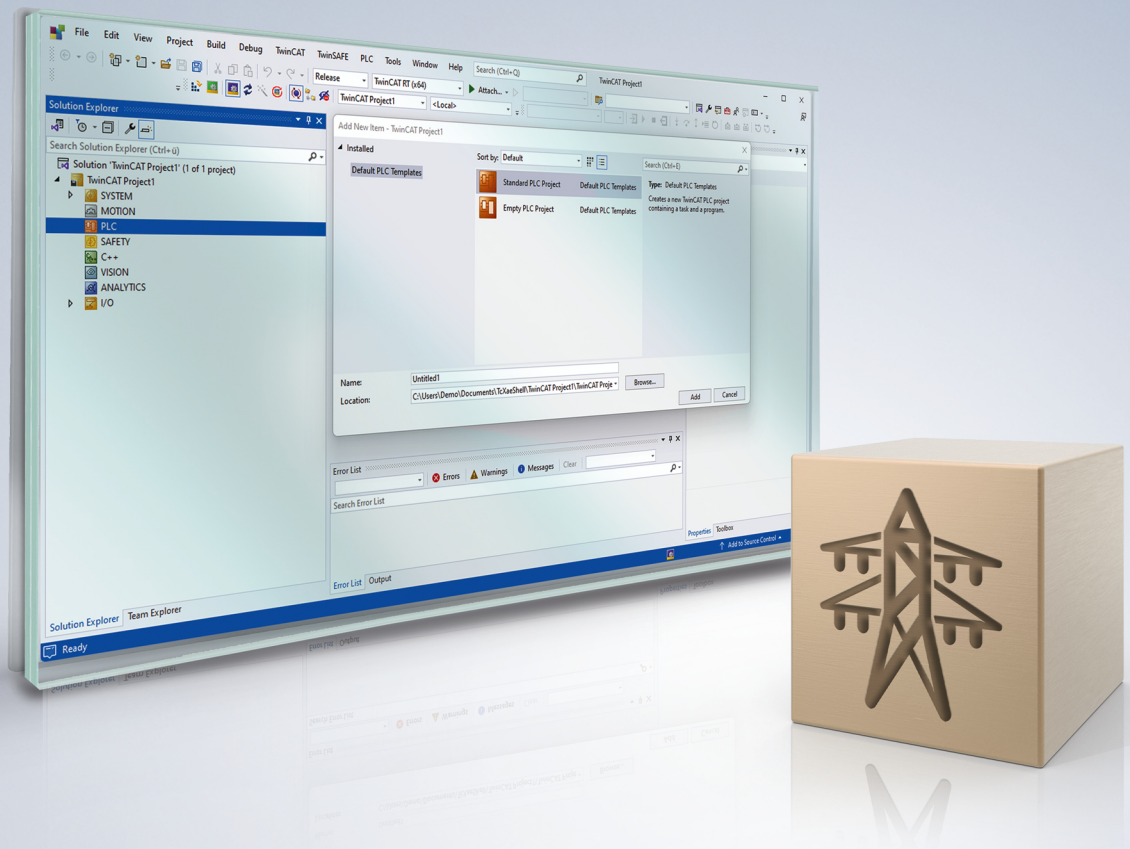
BECKHOFF New Automation Technology

Manual | EN

TF8350

TwinCAT 3 | Power Technologies



2026-04-23 | Version: 0.1.3

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1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
The documentation and the following notes and explanations must be complied with when installing and commissioning the components.
The trained specialists must always use the current valid documentation.

The trained specialists must ensure that the application and use of the products described is in line with all safety requirements, including all relevant laws, regulations, guidelines, and standards.

Disclaimer

The documentation has been compiled 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 notice.
Claims to modify products that have already been supplied may not be made on the basis of the data, diagrams, and descriptions in this documentation.

Trademarks

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1.2 For your safety

Safety regulations

Read the following explanations for your safety.
Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

Exclusion of liability

All the components are supplied in particular hardware and software configurations which are 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 technology 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 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our https://www.beckhoff.com/secguide.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

1.4 Documentation issue status

Version	Changes
0.1.3	Release with adaptations for TF8350 in version 0.1.3
0.1.0	First release with TF8350 in version 0.1.0

2 Overview

The *TwinCAT 3 Power Functions* provide software in the form of TwinCAT modules for use in electrical power systems. These are divided into three *TwinCAT Functions* with corresponding licenses:

- **TF8330 | TwinCAT 3 Power Collector**
  Functions for power measurement using EtherCAT Terminals of the EL34xx series.
- **TF8350 | TwinCAT 3 Power Technologies**
  Functions for power measurement using EtherCAT Terminals of the EL37x3 and ELM3xxx series.
- **TF8360 | TwinCAT 3 Power Control**
  Functions for the control of power generating plants.

3 Functions

The *TF8350 | TwinCAT 3 Power Technologies* offers modular software blocks for power measurement. These modules provide a standardized interface for all EL37x3 series power measurement terminals. Essential evaluations, such as effectives, frequency and harmonics, are calculated directly from the recorded instantaneous values.

3.1 Measure

The TwinCAT modules of the `Measure` group in *TwinCAT Power Technologies* interact with EtherCAT power measurement terminals of the *EL37xx* series and the EtherCAT measurement terminals of the *ELM3xxx* series. They record and evaluate the measurement data.

The focus is on measuring the three phase voltages against neutral conductor and the three phase currents in a star connection.

The EtherCAT Terminals provide instantaneous values of voltages and currents for this purpose. These are read in by the modules as process data via PDOs (**Process Data Objects**) and then evaluated.

The modules calculate the following parameters, among others, from the instantaneous values:

- Frequency and phase angle
- Effective values of voltages and currents
- Effective values of active, reactive and apparent power
- Fundamental oscillation components of voltage, current and power
- Harmonics and harmonic distortion
- …

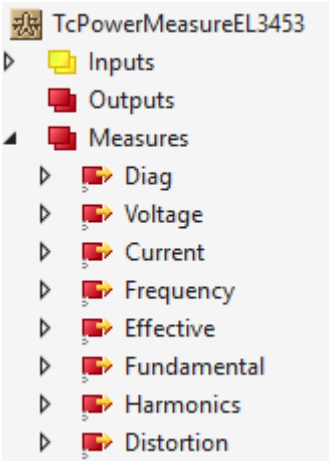
The following is an overview of supported terminals and the corresponding modules:

Terminal	Module
EL3773	TcPowerMeasureEL3773 [▶ 19]
EL3783	TcPowerMeasureEL3783 [▶ 30]
…	

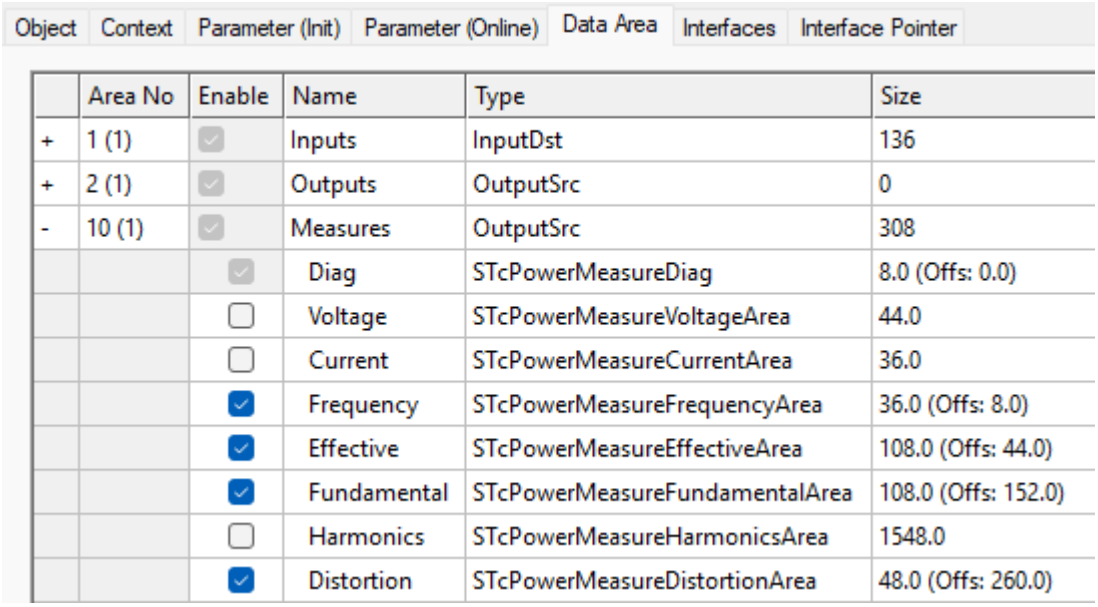
Further modules of the group for EtherCAT Terminals of the EL34xx series can be found in the documentation for TF8330 | TwinCAT 3 Power Collector.

3.1.1 Measurement data

Each module of the `Measure` group provides the recorded measurement data as output process data via a defined Data Area.

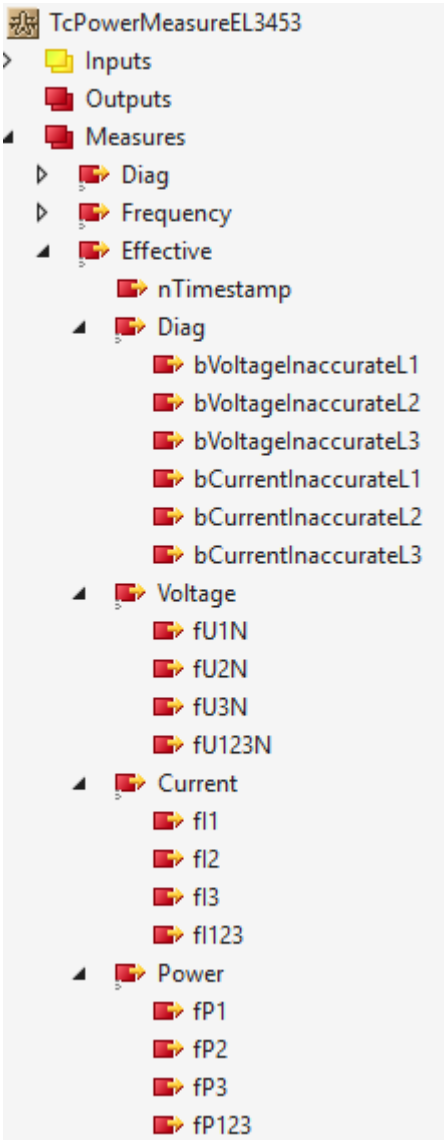


The measurement data is divided into logically separate structures, which can be individually enabled or disabled as required under *Data Area* in the *Enable* column. When starting up, the module automatically recognizes the activated structures and only reads the relevant measured values from the EtherCAT Terminal or carries out the necessary calculations.



	Area No	Enable	Name	Type	Size
+	1 (1)	☑	Inputs	InputDst	136
+	2 (1)	☑	Outputs	OutputSrc	0
-	10 (1)	☑	Measures	OutputSrc	308
		☑	Diag	STcPowerMeasureDiag	8.0 (Offs: 0.0)
		☐	Voltage	STcPowerMeasureVoltageArea	44.0
		☐	Current	STcPowerMeasureCurrentArea	36.0
		☑	Frequency	STcPowerMeasureFrequencyArea	36.0 (Offs: 8.0)
		☑	Effective	STcPowerMeasureEffectiveArea	108.0 (Offs: 44.0)
		☑	Fundamental	STcPowerMeasureFundamentalArea	108.0 (Offs: 152.0)
		☐	Harmonics	STcPowerMeasureHarmonicsArea	1548.0
		☑	Distortion	STcPowerMeasureDistortionArea	48.0 (Offs: 260.0)

Each of these structures begins with a timestamp (`nTimestamp`), which indicates the time of the last update in distributed clocks time (DC time). This is followed by the diagnostic structure (*Diag*), which contains status information such as when measuring ranges are exceeded or not reached. This is followed by the actual measurement data, which can be divided into further substructures, for example to distinguish between phase-neutral (`LN`) and phase-phase voltages (`LL`).



By default, the measured values are provided as effective values per phase and as a mean value across all three phases. The power is output as a sum across all three phases. All values are given in SI units (e.g. volts, amperes, watts) and are represented as single-precision floating-point numbers in accordance with IEEE 754.

The following is an overview of the data types for corresponding structures:

Name	Data Type	Description
Diag	STcPowerMeasureDiag [▶ 42]	General state of the measurement.
Voltage	STcPowerMeasureVoltageArea [▶ 42]	Effective values of the voltages for all three phases, expressed as phase-to-neutral and phase-to-phase values.
Current	STcPowerMeasureCurrentArea [▶ 43]	Effective values of the currents for all three phases, as well as fault and neutral currents.
Frequency	STcPowerMeasureFrequencyArea [▶ 44]	Determined frequency and frequency changes (RoCoF) and their filtered values.
Effective	STcPowerMeasureEffectiveArea [▶ 44]	Effective values of voltages, currents and determined active, reactive and apparent power.
Fundamental	STcPowerMeasureFundamentalArea [▶ 46]	Determined voltage, current and power components of the fundamental.
Harmonics	STcPowerMeasureHarmonicsArea [▶ 47]	Determined harmonics of the three voltage and current phases.
Distortion	STcPowerMeasureDistortionArea [▶ 48]	Determined harmonic distortion (THD and TDD) of the three voltage and current phases.

3.1.2 Naming

In the measurement data, electrical variables are labeled with a uniform naming convention. These are based on the usual parameters in three-phase systems.

Phases

- **L1, L2, L3**: Individually considered conductors (phases).

Voltages

- **U1N, U2N, U3N**: Phase voltages (phase conductor to neutral conductor).
- **U123N**: Phase voltage of the three-phase system (mean value).
- **U12, U23, U31**: Conductor voltages (between two outer conductors).
- **U123**: Conductor voltage of the three-phase system (mean value).

Currents

- **I1, I2, I3**: Currents of the individual phase conductors.
- **I123**: Conductor current of the three-phase system (mean value).

Power

- **P1, P2, P3**: Active power per phase.
- **P123**: Total active power of the three-phase system (sum of the phase powers).

Similarly, Q1/Q123 for reactive power and S1/S123 for apparent power.

3.1.3 Diagnostic data

There is a structure and diagnostic information for each structure of measurement data. It specifies the following typical states.

Inaccurate

The `Inaccurate` state indicates an inaccurate measurement, for example if the measured values are below the specified measuring accuracy. This accuracy is defined as a parameter and is referred to as `Threshold`.

Overvoltage/Overcurrent

The states `Overvoltage` and `Overcurrent` indicate that the measured voltage or current exceeds the permissible measuring range of the EtherCAT Terminal.

3.1.4 Frequency

The frequency is continuously determined from the voltage curves of the grid. This is based on the change in the phase angle of a reference signal (typically voltage L1) over time. The calculation is performed using a **p**hase **l**ocked **l**oop (PLL). The PLL synchronizes itself to the fundamental of the measured voltage. The current frequency is calculated from the phase change. Short-term fluctuations are smoothed out by filtering.

The frequency is a central variable for synchronization, grid monitoring and other frequency-dependent evaluations.

The measured values are provided via the STcPowerMeasureFrequency [▶ 44] structure.

3.1.5 Effectives

The effective values in the measurement data are determined as a true root mean square (True RMS). This method also takes into account non-sinusoidal signal components, such as those caused by harmonics or non-linear loads.

The calculation is performed continuously on the basis of the measured instantaneous values. The voltage and current signals are recorded at a fixed sampling rate. The effective value is calculated from the instantaneous values using a sliding time window. The number of grid half-waves taken into account can be set via the parameter `EffectiveWindowCycles`. This time window is shifted continuously so that an updated value is available in each cycle.

The time window is based on the period value of the grid frequency. The modules use a phase-locked loop (PLL) to determine this frequency. The PLL synchronizes to the measured voltage as a reference signal. The current grid frequency and thus the period value is determined from the phase angle. This serves as the integration period for the effective value calculation. The dynamic adaptation of the time window to the current grid frequency ensures that the calculation is always carried out over whole multiples of periods. This means that the effective value determination remains robust even with frequency fluctuations.

This method is used for the effective values of voltages and currents in the structures `Voltage`, `Current` and for the power values (active, reactive and apparent power) in the structure `Power`. In contrast, the fundamental components of voltage, current and power in the structure `Fundamentals` are determined exclusively from the sinusoidal signal components of the fundamental frequency.

The measured values are provided via the STcPowerMeasureEffective [▶ 44] structure.

3.1.6 Fundamentals

The fundamental components are extracted from the measured voltage and current curves and describe the sinusoidal component at the grid frequency. The component at the fundamental frequency is determined via a sliding time window. A discrete Fourier transformation is used to determine the fundamental oscillation. The time window is based on the current grid frequency, which is determined using a PLL method (see also Frequency [▶ 14] and Effectives [▶ 14]).

The measured values are provided via the STcPowerMeasureFundamental [▶ 46] structure.

3.1.7 Harmonics

The harmonics are calculated using Fourier transformation over a time window synchronized to the grid frequency. The signals are recorded over several grid periods. The number of grid half-waves taken into account can be set via the parameter `HarmonicsWindowCycles`.

In order to calculate harmonics using Fourier analysis, the sampling rate must meet the Shannon-Nyquist criterion. A multiplier of 2.5 to 10 is usually applied to the fundamental frequency in order to take into account conversion inaccuracies, measurement errors and transients. A higher sampling rate also improves the resolution and reduces alias effects and leakages in the spectral analysis. The *EL3783* record the measured

values at 20 kHz. Based on this sampling rate, it was decided to provide harmonics up to the 63rd order in order to ensure a uniform interface for all modules. The 63rd harmonic corresponds to 63 times the fundamental frequency: at 50 Hz this corresponds to 3150 Hz, at 60 Hz to 3780 Hz.

The harmonic analysis is used to evaluate grid perturbations, ensure compliance with standards and identify non-linear loads.

The measured values are provided via the STcPowerMeasureHarmonics [▶ 47] structure.

The TF3650 | TwinCAT 3 Power Monitoring, whose license is included in *TF8350*, is available for the calculation of higher-order harmonics.

3.1.8 Distortions

Distortion describes the deviation of a signal from the ideal sinusoidal fundamental. The distortion is determined from the ratio of the effective values to the fundamental values.

The distortion parameters enable a quantitative assessment of the signal quality and the safe operation of electrical systems.

The measured values are provided via the STcPowerMeasureDistortion [▶ 48] structure.

3.1.9 Phasors

The phasors represent voltages and currents as complex values with magnitude and phase angle. Amplitude and phase are determined from the filtered fundamental oscillation signals. The phases are determined in comparison to a synchronous, time-synchronized reference and displayed as complex pointer variables. The phasors are updated at a defined rate, which is defined via the parameter `PhasorReportingRate`.

The phasors enable a compact description of multi-phase systems and form the basis for power flow analyses, grid protection and synchronization tasks.

The measured values are provided via the STcPowerMeasurePhasor [▶ 49] structure.

3.1.10 Transformation

Transformations are used to convert multiphase systems into alternative coordinate systems. The calculation is based on the measured voltages and currents. The three-phase variables are converted into a two-axis system using the Clarke transformation. The values are then transferred to a rotating coordinate system using the Park transformation. This is used to determine the instantaneous active power and reactive power.

These methods are used in particular in the control of electrical machines and in the analysis of dynamic grid processes.

The measured values are provided via the STcPowerMeasurePhasor [▶ 50] structure.

3.1.11 Symmetrical

The symmetrical components are the decomposition of a three-phase system into positive, negative and zero systems. The calculation is based on the fundamental oscillation, which is broken down into the symmetrical and asymmetrical components of the system.

The analysis of symmetrical components enables the targeted detection of imbalances, error states and grid faults and is particularly important in protection technology.

The measured values are provided via the STcPowerMeasureSymmetrical [▶ 50] structure.

4 Installation

4.1 System Requirements

Engineering (XAE)

Technical data	Requirements
Operating system	Windows 10, Windows 11
Target platform	x64
TwinCAT version	Build 4026.21
Required TwinCAT license	

Runtime (XAR)

Technical data	Requirements
Operating system	Windows 10, Windows 11, TwinCAT/BSD, Beckhoff RT Linux®
Target platform	x64, Arm®
TwinCAT version	Build 4026.21
Required TwinCAT license	TF8350

4.2 Installation

TwinCAT Package Manager: Installation (TwinCAT 3.1 Build 4026)

Detailed instructions on installing products can be found in the chapter Managing TwinCAT software in the TwinCAT 3.1 Build 4026 installation instructions.

Install the following workload to be able to use the product:

TwinCAT Package Manager UI:

- TF8350 | TwinCAT 3 Power Technologies

TwinCAT Package Manager CLI:

- `TcPkg install TF8350.PowerTechnologies.XAE`

4.3 Licensing

The TwinCAT 3 function can be activated as a full version or as a 7-day test version. Both license types can be activated via the TwinCAT 3 development environment (XAE).

Licensing the full version of a TwinCAT 3 Function

A description of the procedure to license a full version can be found in the Beckhoff Information System in the documentation "TwinCAT 3 Licensing".

Licensing the 7-day test version of a TwinCAT 3 Function

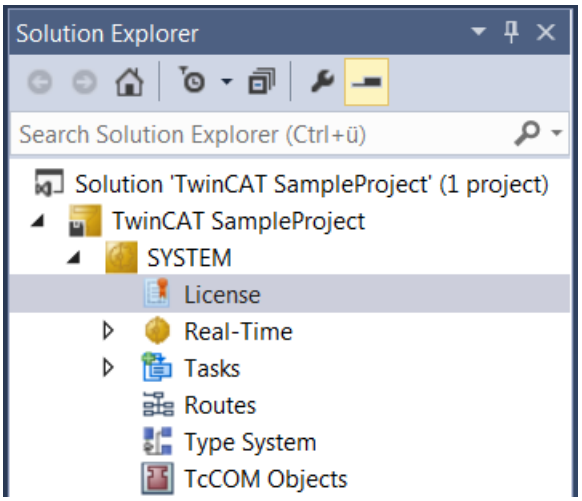
A 7-day test version cannot be enabled for a TwinCAT 3 license dongle.

1. Start the TwinCAT 3 development environment (XAE).
2. Open an existing TwinCAT 3 project or create a new project.

3. If you want to activate the license for a remote device, set the desired target system. To do this, select the target system from the **Choose Target System** drop-down list in the toolbar.

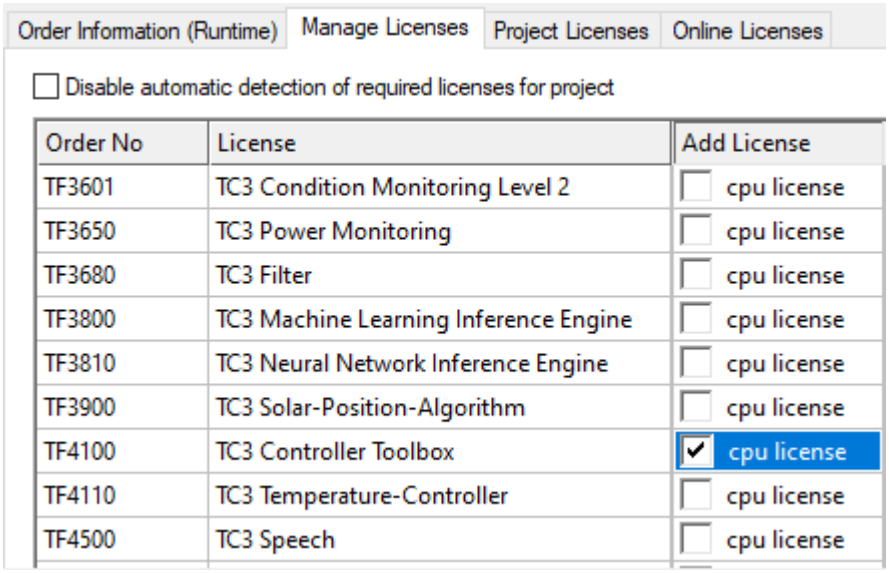
   ⇨ The licensing settings always refer to the selected target system. When the project is activated on the target system, the corresponding TwinCAT 3 licenses are automatically copied to this system.

4. In the **Solution Explorer**, double-click **License** in the **SYSTEM** subtree.



   ⇨ The TwinCAT 3 license manager opens.

5. Open the **Manage Licenses** tab. In the **Add License** column, check the check box for the license you want to add to your project (e.g. "TF4100 TC3 Controller Toolbox").

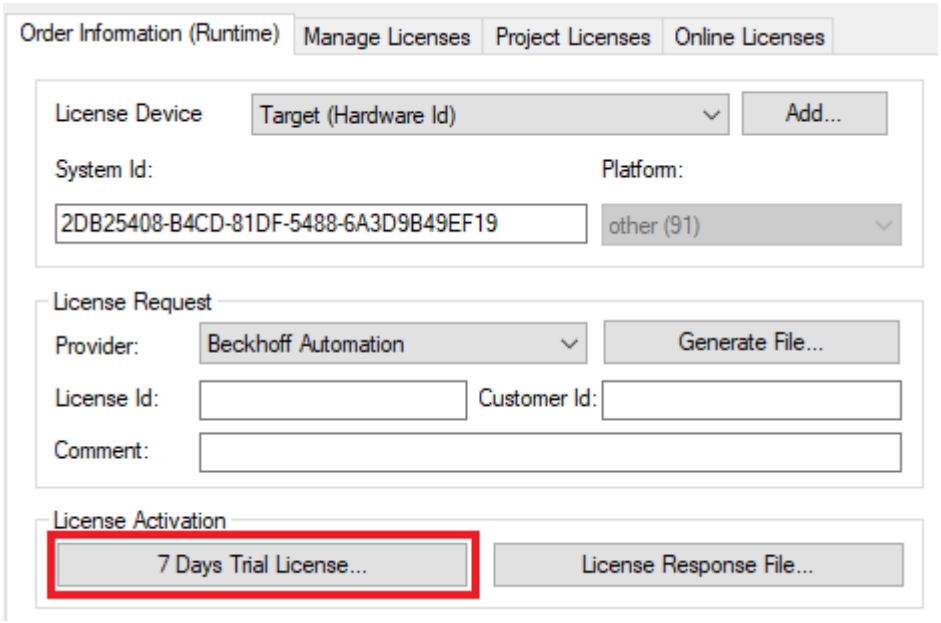


Order No	License	Add License
TF3601	TC3 Condition Monitoring Level 2	cpu license
TF3650	TC3 Power Monitoring	cpu license
TF3680	TC3 Filter	cpu license
TF3800	TC3 Machine Learning Inference Engine	cpu license
TF3810	TC3 Neural Network Inference Engine	cpu license
TF3900	TC3 Solar-Position-Algorithm	cpu license
TF4100	TC3 Controller Toolbox	cpu license
TF4110	TC3 Temperature-Controller	cpu license
TF4500	TC3 Speech	cpu license

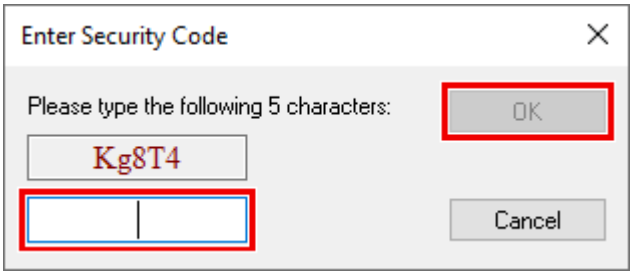
6. Open the **Order Information (Runtime)** tab.

   ⇨ In the tabular overview of licenses, the previously selected license is displayed with the status “missing”**.**

7. Click **7-Day Trial License...** to activate the 7-day trial license.



⇨ A dialog box opens, prompting you to enter the security code displayed in the dialog.



8. Enter the code exactly as it is displayed and confirm the entry.
9. Confirm the subsequent dialog, which indicates the successful activation.
   ⇨ In the tabular overview of licenses, the license status now indicates the expiry date of the license.
10. Restart the TwinCAT system.

⇨ The 7-day trial version is enabled.

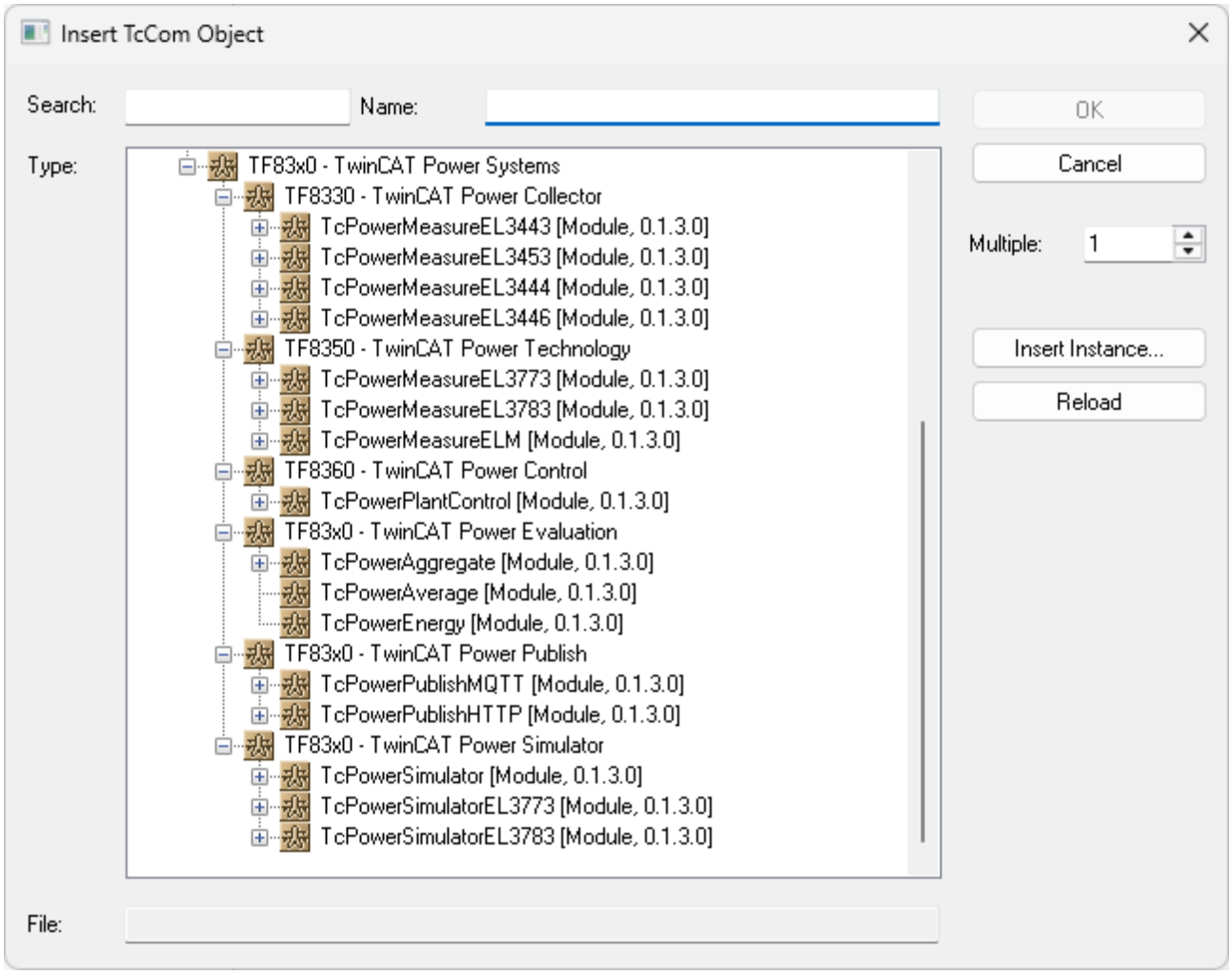
5 Modules

5.1 TcPowerMeasureEL3773

5.1.1 Function

The `TcPowerMeasureEL3773` is integrated into the system as a TcCOM object and executed cyclically via a task (see Context [▶ 19]). The raw data from the EL3773 is recorded and processed according to the configuration (see parameters [▶ 20]). The processed measured values are then provided as a measure (see Measure [▶ 10]) in the corresponding Data Area (see DataAreas [▶ 20]).

5.1.2 Module



License

A valid *TF8350 | TwinCAT Power Technologies* license is required for permanent operation of the module. Alternatively, a 7-day trial license can be used for testing or evaluation (see Licensing [▶ 16]).

5.1.3 Context

The task in which the module is executed is defined in the `Context` section.

A task with a cycle time of 1 ms is required.

5.1.4 Parameters

The parameters of the module are used to configure the EtherCAT Terminal as well as to set the internal evaluation and determine the measured variables.

Name	Data Type	De-fault	Unit	Description
VoltageRatio	REAL	1.0		Scaling factor for voltage measurement, for adapting the raw values to the actual voltage (e.g. for voltage transformers).
VoltageInaccurateThreshold	REAL	0.3	%	Threshold value for the voltage measurement, below which the measured values are considered inaccurate or invalid.
VoltageInaccurateMode	ETcPowerInaccurateMode	SetZero		Defines the behavior for inaccurate voltage values (e.g. set to zero).
CurrentRatio	REAL	1.0		Scaling factor for the current measurement to adapt the raw values to the actual current (e.g. for current transformers).
CurrentInaccurateThreshold	REAL	0.3	%	Threshold value for the current measurement, below which the measured values are considered inaccurate or invalid.
CurrentInaccurateMode	ETcPowerInaccurateMode	SetZero		Defines the behavior for inaccurate current values (e.g. set to zero).
FrequencyNominal	REAL	50.0		Nominal frequency of the system (e.g. 50 Hz or 60 Hz) as a reference for frequency-dependent calculations.
FrequencyFilterTime1	REAL	0.1		Time constant of the first filter for smoothing the frequency measurement.
FrequencyFilterTime2	REAL	0.5		Time constant of the second filter for smoothing the frequency measurement.
EffectiveWindowCycles	UDINT	2		Number of grid half-waves used to calculate effective values.
HarmonicsWindowCycles	UDINT	20	%	Number of grid half-waves used for the analysis of harmonics.

5.1.5 DataAreas

The input and output process data of the module are configured in the Data Area section.

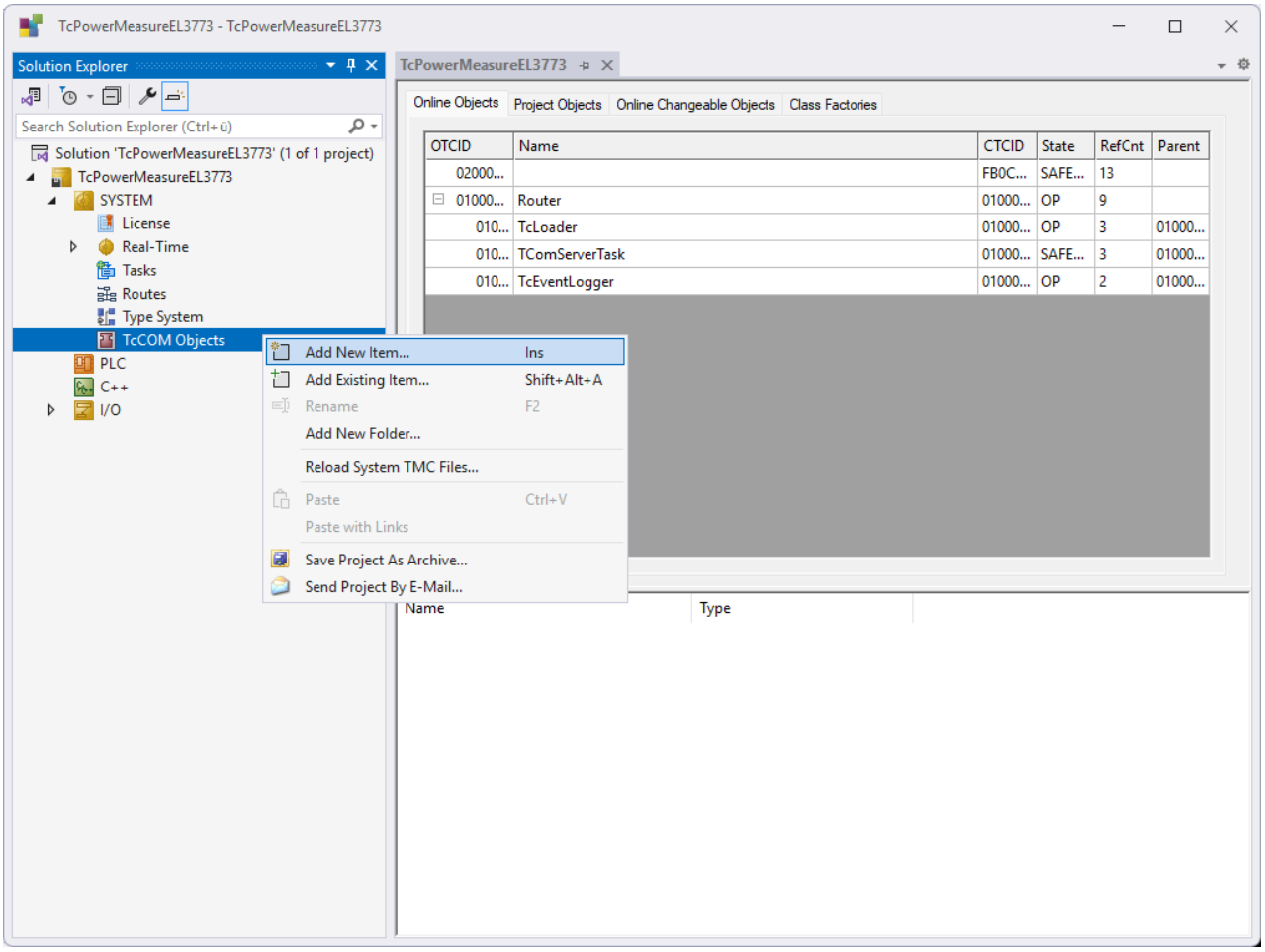
- The area `Inputs` receives the raw data of the voltages and currents for direct exchange with the EtherCAT Terminal.
- The area `Inbox` provides the scaled and structured instantaneous values of voltages and currents, based on the raw data of the EtherCAT Terminal.
- The area `Measure` contains the calculated and structured measured values, such as effective values, fundamental oscillations and harmonics (see Measure [▶ 10]).

No	Name	Type	Optional	Description
1	Inputs	Input		Process data of the EtherCAT Terminal
3	Inbox	Output	X	Scaled instantaneous values
10	Measures	Output		Calculated measured values

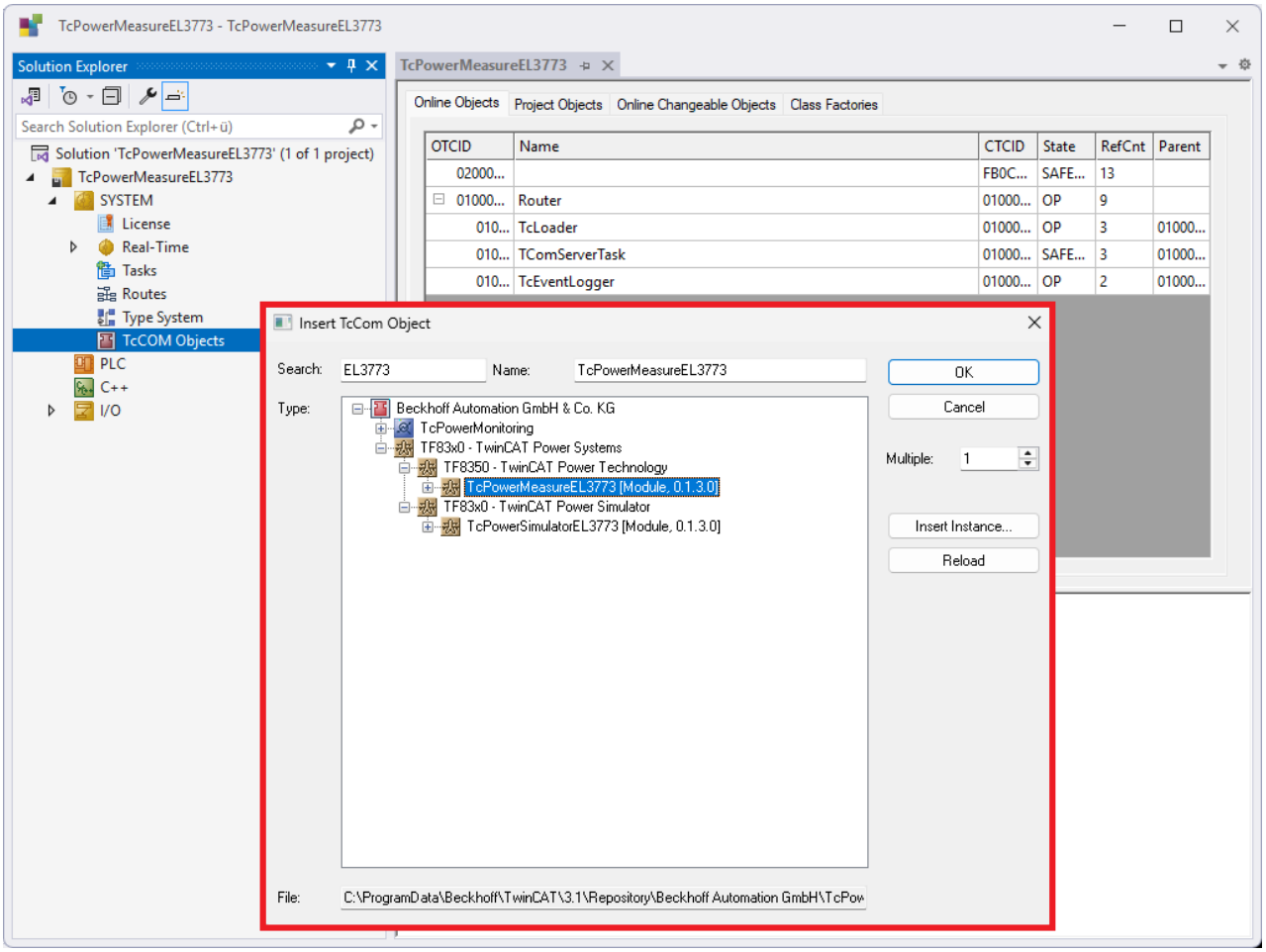
5.1.6 Application

The following shows how the `TcPowerMeasureEL3773` module (version 0.1.3) is used in *TwinCAT XAE* (version 3.1.4026.22) with an *EL3783*.

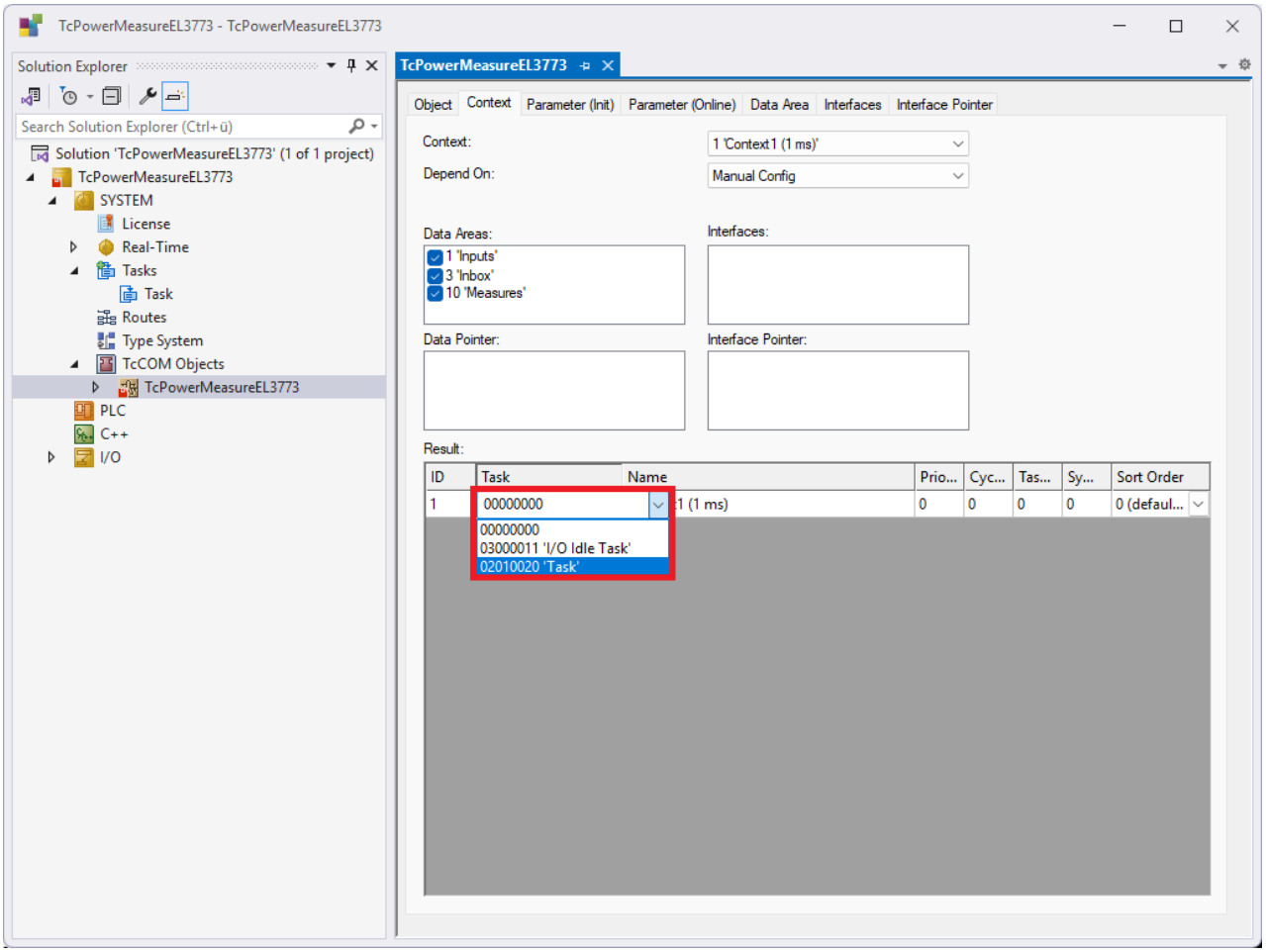
1. Right-click on **TcCOM Objects** in the Solution Explorer and select **Add New Item...**.
   ⇨ You have added a new module.



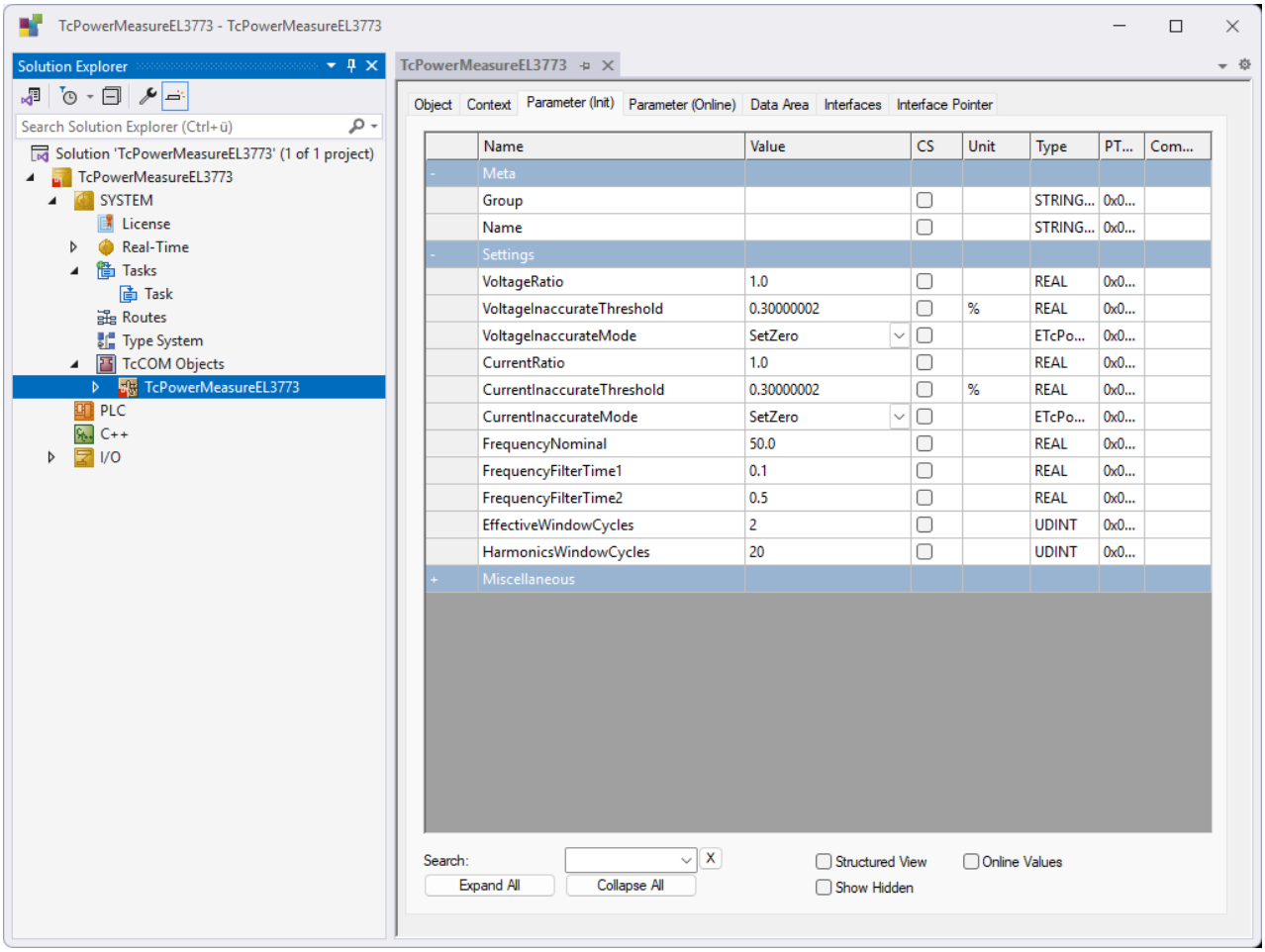
2. Use the search input field (Search) of *EL3773* to choose the **TcPowerMeasureEL3773** module.
3. Assign a name and click the **OK** button.



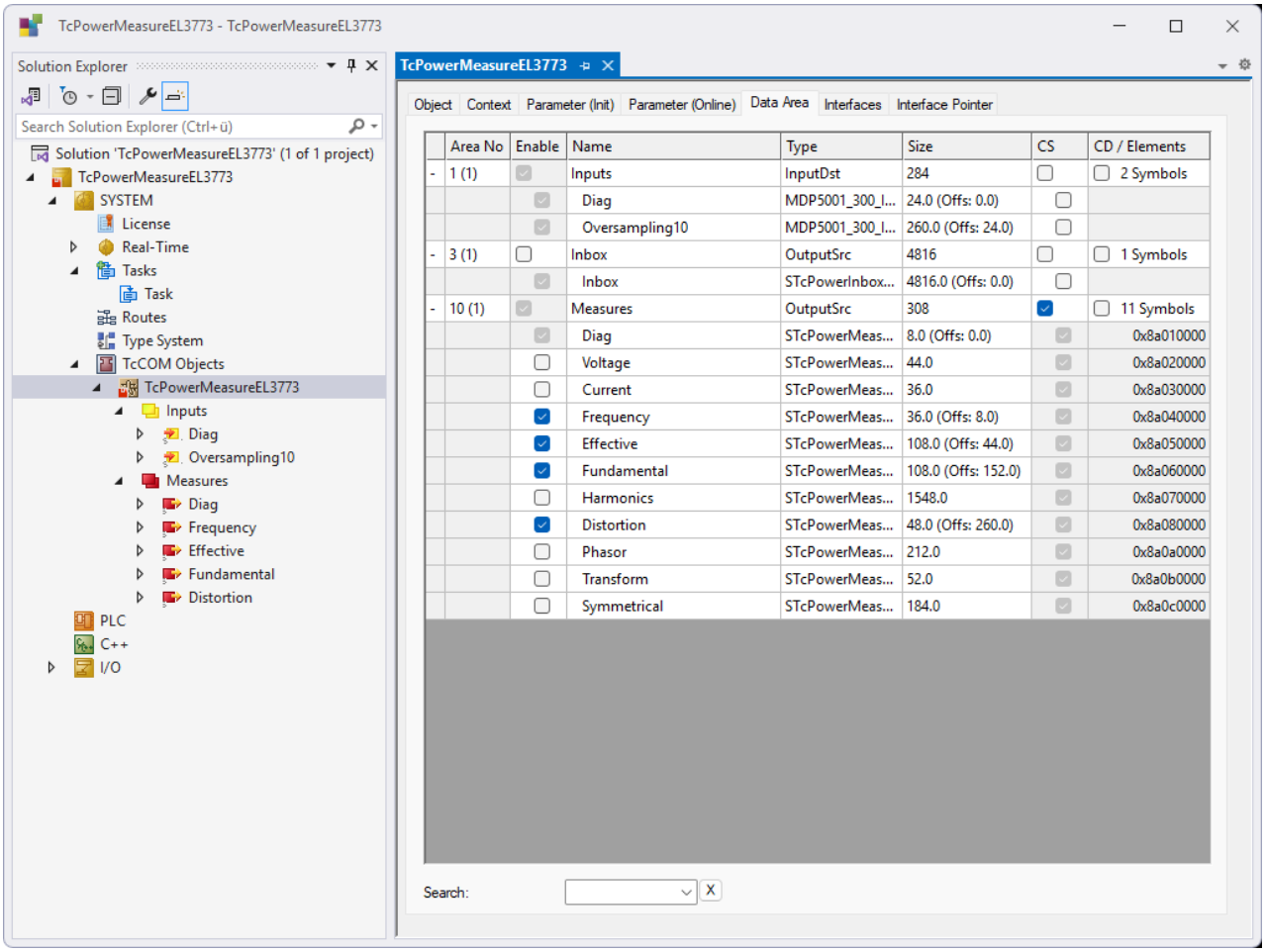
4. Assign a task with a cycle time of 1 ms to the module in the **Context > Result** tab.



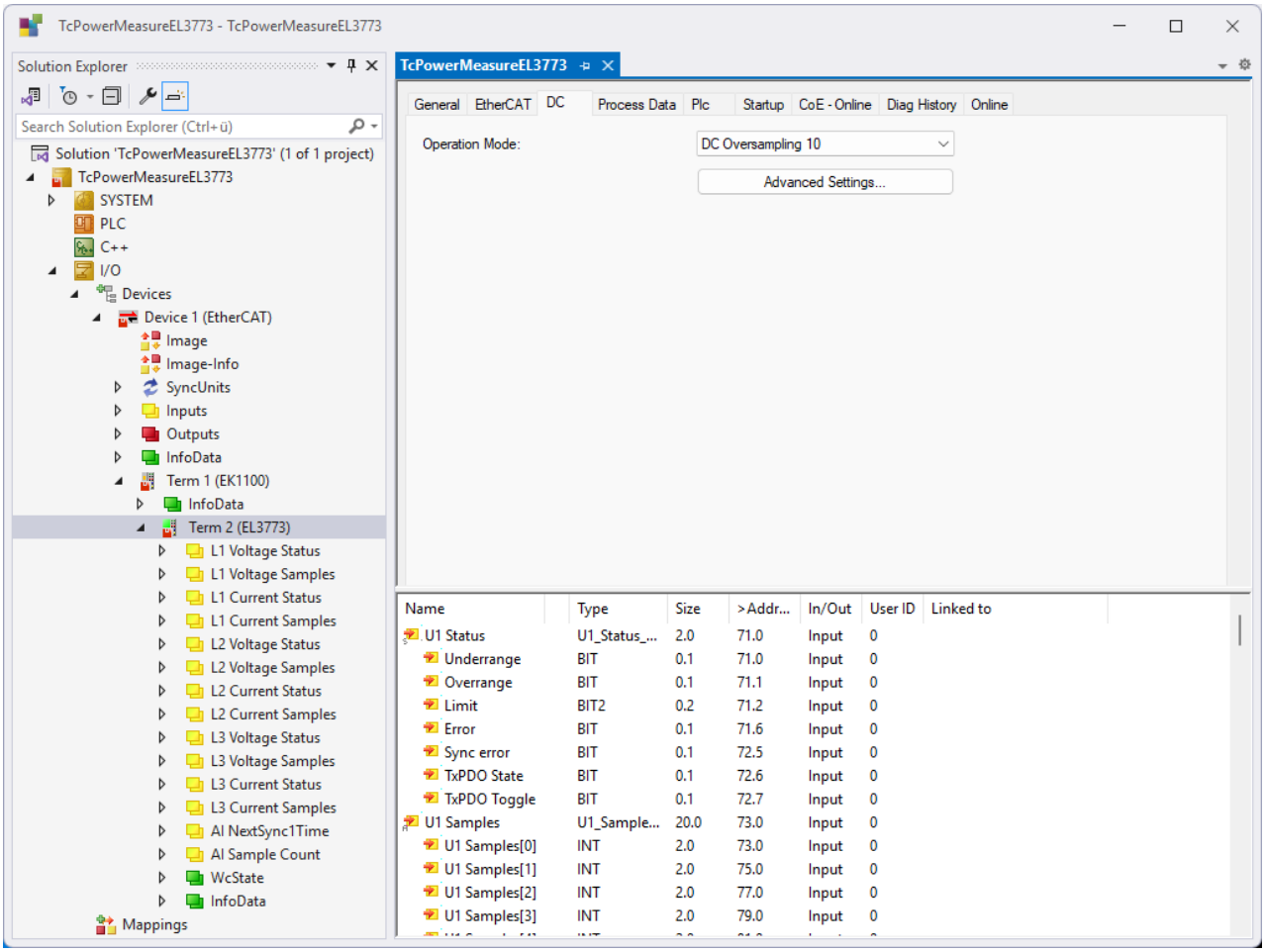
5. Make the required settings for the module, terminal and data processing in the **Parameters (Init)** tab.



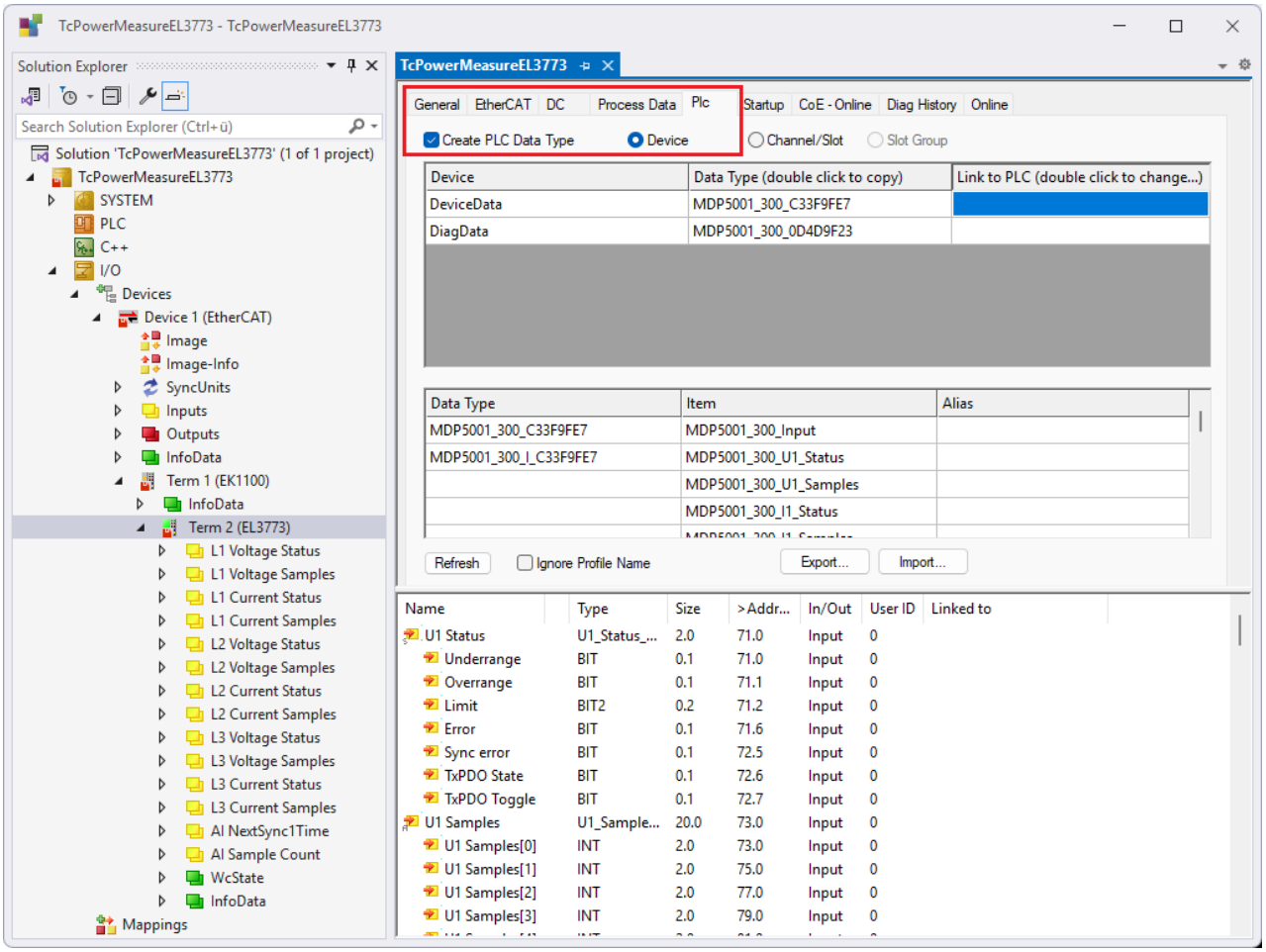
6. Activate the desired measurement data in the **Data Area > Measures** tab using the **Enable** checkbox (see Measure [▶ 10]).



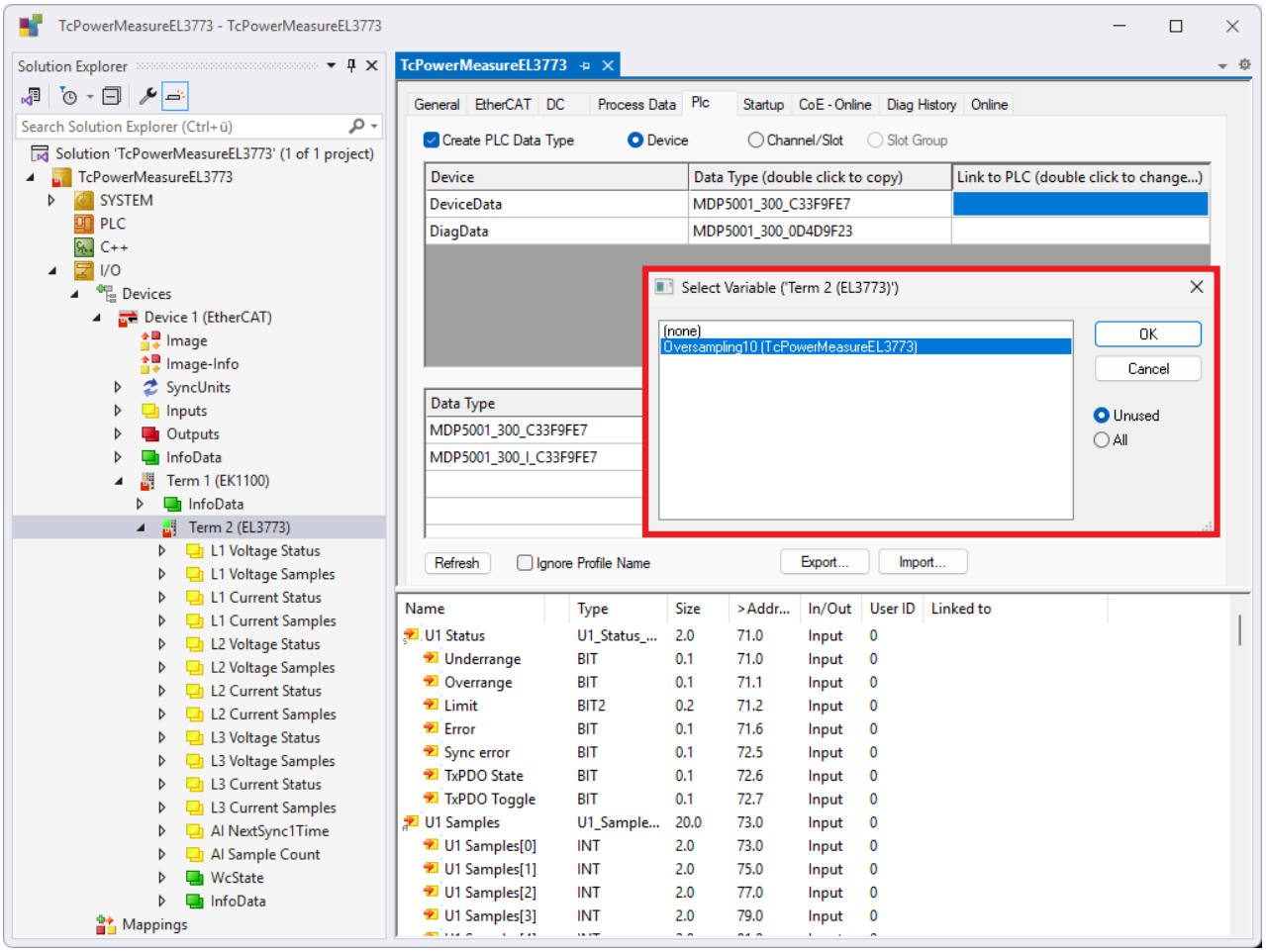
7. Select the *EL3773* in the project tree of the Solution Explorer under **I/O > Devices**.
8. In the **DC** tab, select "DC Oversampling 10" as the **Operation Mode**.



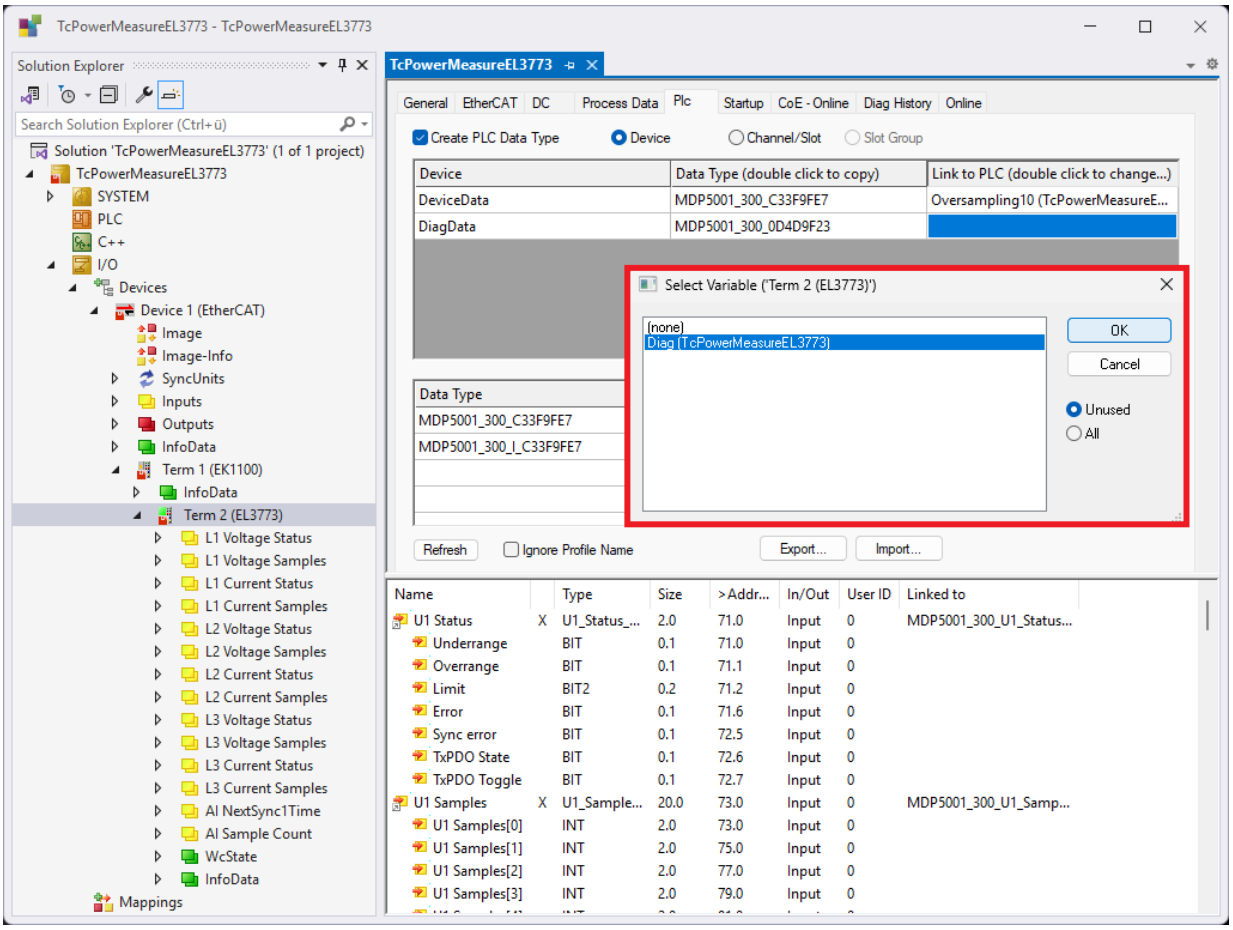
9. In the **PLC** *Create PLC Data Type* tab, activate .
10. Select the option *Device*.
11. Double-click on **Link To PLC...** to create the link.



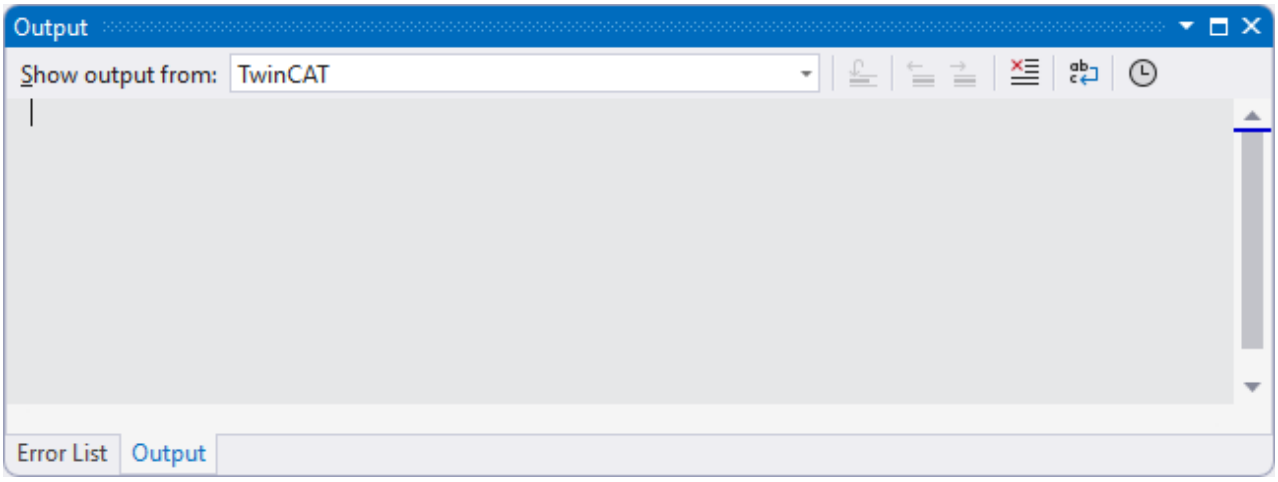
12. Link process data via **DeviceData** to the *Oversampling10* area of the TcPowerMeasureEL3773 module.


TcPowerMeasureEL3773 - TcPowerMeasureEL3773
Solution Explorer
Search Solution Explorer (Ctrl+ü)
Solution 'TcPowerMeasureEL3773' (1 of 1 project)
TcPowerMeasureEL3773
SYSTEM
PLC
C++
I/O
Devices
Device 1 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Outputs
InfoData
Term 1 (EK1100)
InfoData
Term 2 (EL3773)
L1 Voltage Status
L1 Voltage Samples
L1 Current Status
L1 Current Samples
L2 Voltage Status
L2 Voltage Samples
L2 Current Status
L2 Current Samples
L3 Voltage Status
L3 Voltage Samples
L3 Current Status
L3 Current Samples
AI NextSync1Time
AI Sample Count
WcState
InfoData
Mappings
TcPowerMeasureEL3773
General
EtherCAT
DC
Process Data
Plc
Startup
CoE - Online
Diag History
Online
Create PLC Data Type
Device
Channel/Slot
Slot Group
Device
Data Type (double click to copy)
Link to PLC (double click to change...)
DeviceData
MDP5001_300_C33F9FE7
DiagData
MDP5001_300_0D4D9F23
Select Variable ('Term 2 (EL3773)')
(none)
Oversampling10 (TcPowerMeasureEL3773)
OK
Cancel
Unused
All
Data Type
MDP5001_300_C33F9FE7
MDP5001_300_I_C33F9FE7
Refresh
Ignore Profile Name
Export...
Import...
Name
Type
Size
>Addr...
In/Out
User ID
Linked to
U1 Status
U1_Status_...
2.0
71.0
Input
0
Underrange
BIT
0.1
71.0
Input
0
Overrange
BIT
0.1
71.1
Input
0
Limit
BIT2
0.2
71.2
Input
0
Error
BIT
0.1
71.6
Input
0
Sync error
BIT
0.1
72.5
Input
0
TxPDO State
BIT
0.1
72.6
Input
0
TxPDO Toggle
BIT
0.1
72.7
Input
0
U1 Samples
U1_Sample...
20.0
73.0
Input
0
U1 Samples[0]
INT
2.0
73.0
Input
0
U1 Samples[1]
INT
2.0
75.0
Input
0
U1 Samples[2]
INT
2.0
77.0
Input
0
U1 Samples[3]
INT
2.0
79.0
Input
0

13. Link diagnostic data to the area *Diag* of the TcPowerMeasureEL3773 module using **DiagData**.



⇨ By selecting **Activate Configuration** and starting TwinCAT on the target system, the configuration is put into effect. The validity of the measurement data can be checked using the *bValid* under the Data Area *Measure* in the **Diag** structure. Otherwise, the messages from TwinCAT should be checked in the output window.

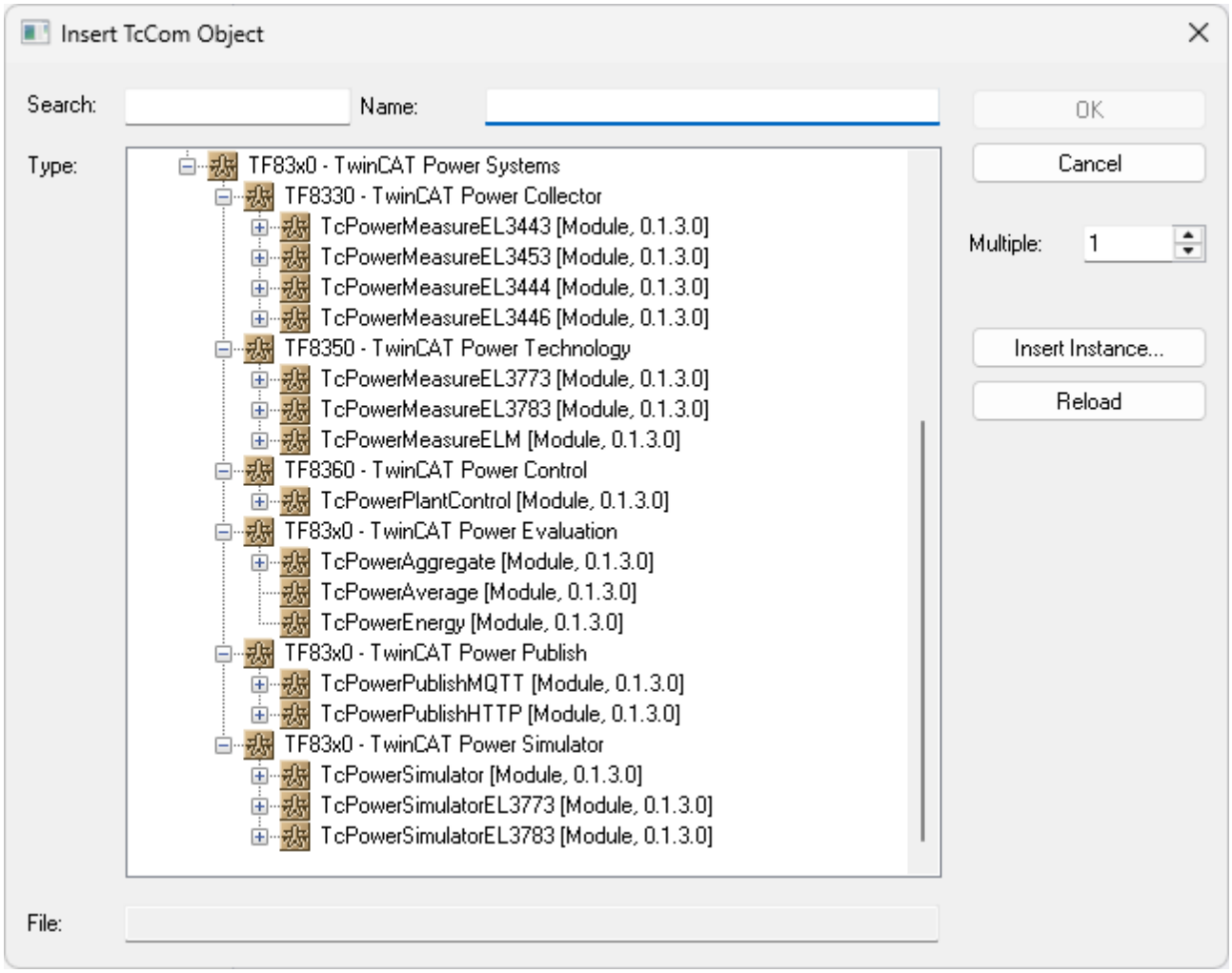


5.2 TcPowerMeasureEL3783

5.2.1 Function

The `TcPowerMeasureEL3783` is integrated into the system as a TcCOM object and executed cyclically via a task (see Context [▶ 30]). The raw data from the EL3783 is recorded and processed according to the configuration (see parameters [▶ 30]). The processed measured values are then provided as a measure (see Measure [▶ 10]) in the corresponding Data Area (see DataAreas [▶ 31]).

5.2.2 Module



License

A valid *TF8350 | TwinCAT Power Technologies* license is required for permanent operation of the module. Alternatively, a 7-day trial license can be used for testing or evaluation (see Licensing [▶ 16]).

5.2.3 Context

The task in which the module is executed is defined in the `Context` section.

A task with a cycle time of 1 ms is required.

5.2.4 Parameters

The parameters of the module are used to configure the EtherCAT Terminal as well as to set the internal evaluation and determine the measured variables.

Name	Data Type	De-fault	Unit	Description
VoltageRatio	REAL	1.0		Scaling factor for voltage measurement, for adapting the raw values to the actual voltage (e.g. for voltage transformers).
VoltageRange	VoltageRange	690V		Measuring range of the voltage measurement, for setting the maximum measured voltage of the EtherCAT Terminal (690 V for EL3783, 100 V for EL3783-0100).
VoltageInaccurateThreshold	REAL	0.3	%	Threshold value for the voltage measurement, below which the measured values are considered inaccurate or invalid.
VoltageInaccurateMode	ETcPowerInaccurateMode	SetZero		Defines the behavior for inaccurate voltage values (e.g. set to zero).
CurrentRatio	REAL	1.0		Scaling factor for the current measurement to adapt the raw values to the actual current (e.g. for current transformers).
CurrentRange	CurrentRange	Auto		Measuring range of the current measurement for setting the maximum measured current of the EtherCAT Terminal (Auto for automatic current measuring range switching).
CurrentInaccurateThreshold	REAL	0.3	%	Threshold value for the current measurement, below which the measured values are considered inaccurate or invalid.
CurrentInaccurateMode	ETcPowerInaccurateMode	SetZero		Defines the behavior for inaccurate current values (e.g. set to zero).
FrequencyNominal	REAL	50.0		Nominal frequency of the system (e.g. 50 Hz or 60 Hz) as a reference for frequency-dependent calculations.
FrequencyFilterTime1	REAL	0.1		Time constant of the first filter for smoothing the frequency measurement.
FrequencyFilterTime2	REAL	0.5		Time constant of the second filter for smoothing the frequency measurement.
EffectiveWindowCycles	UDINT	2		Number of grid half-waves used to calculate effective values.
HarmonicsWindowCycles	UDINT	20	%	Number of grid half-waves used for the analysis of harmonics.
PhasorReportingRate	REAL	100.0	Hz	Update rate of the calculated phasors (pointer variables for voltage and current).

5.2.5 DataAreas

The input and output process data of the module are configured in the Data Area section.

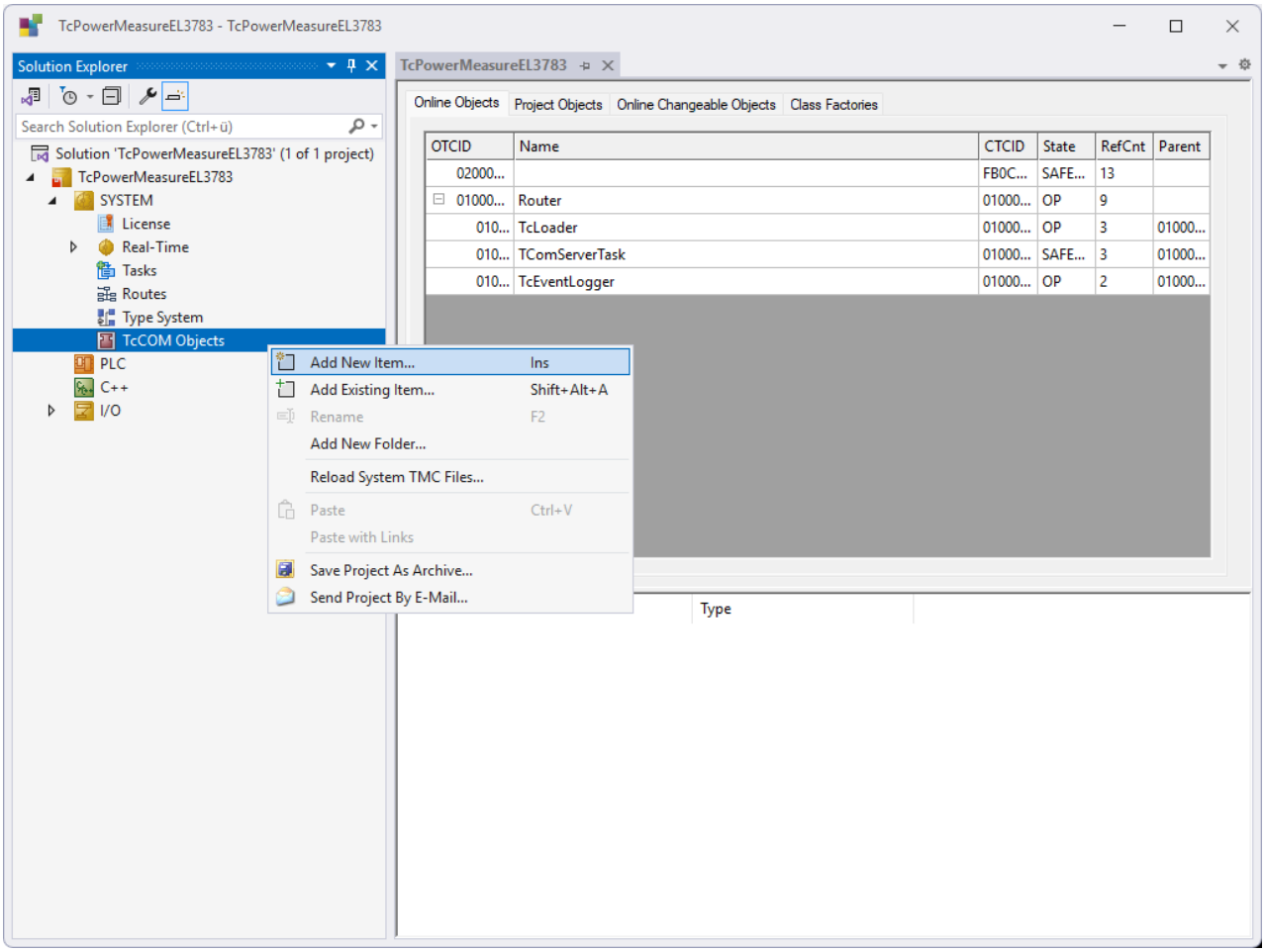
- The area `Inputs` receives the raw data of the voltages and currents for direct exchange with the EtherCAT Terminal.
- The area `Inbox` provides the scaled and structured instantaneous values of voltages and currents, based on the raw data of the EtherCAT Terminal.
- The area `Measure` contains the calculated and structured measured values, such as effective values, fundamental oscillations and harmonics (see Measure [▶ 10]).

No	Name	Type	Optional	Description
1	Inputs	Input		Process data of the EtherCAT Terminal
3	Inbox	Output	X	Scaled instantaneous values
10	Measures	Output		Calculated measured values

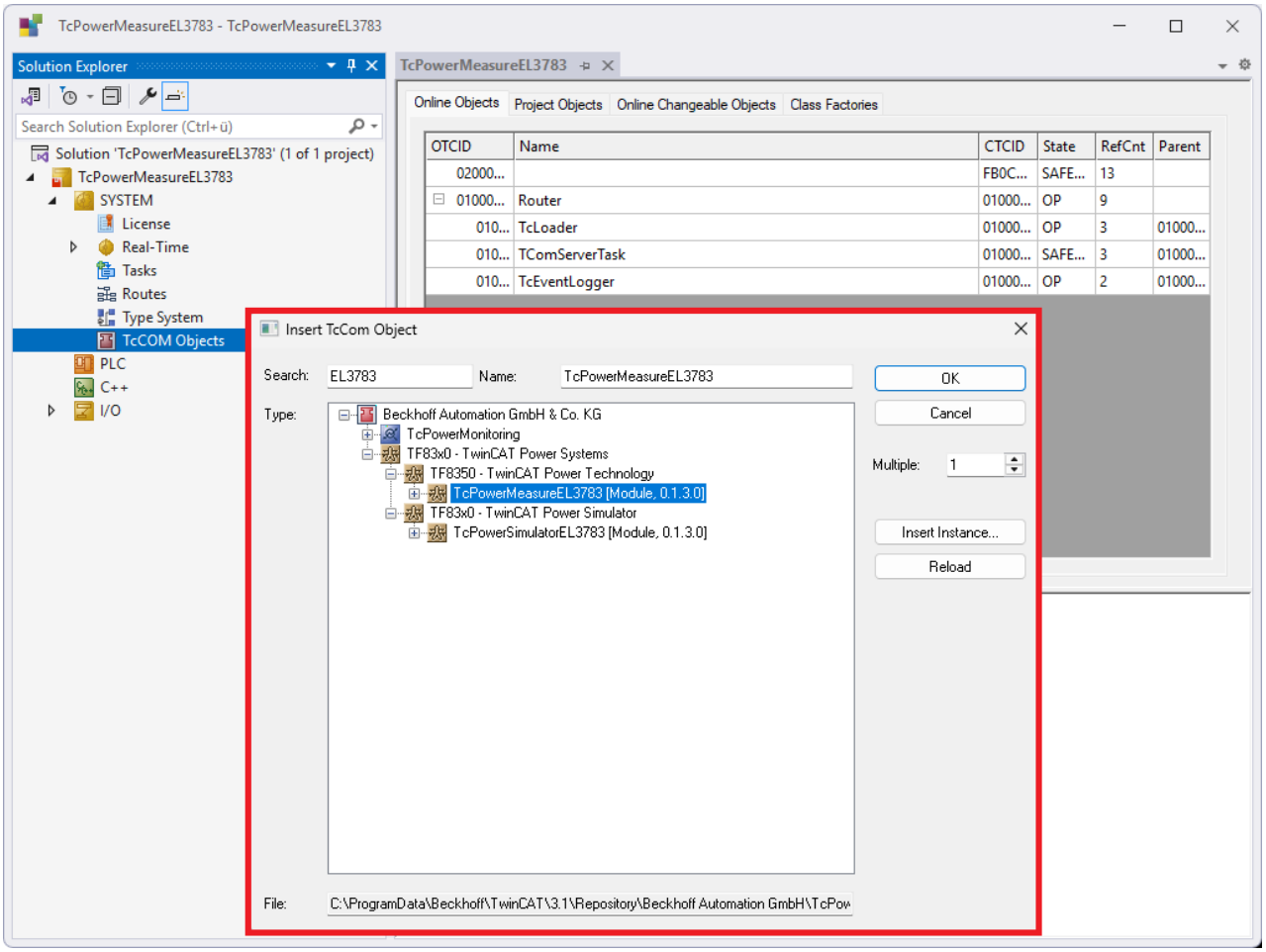
5.2.6 Application

The following shows how the `TcPowerMeasureEL3783` module (version 0.1.3) is used in *TwinCAT XAE* (version 3.1.4026.22) with an *EL3783*.

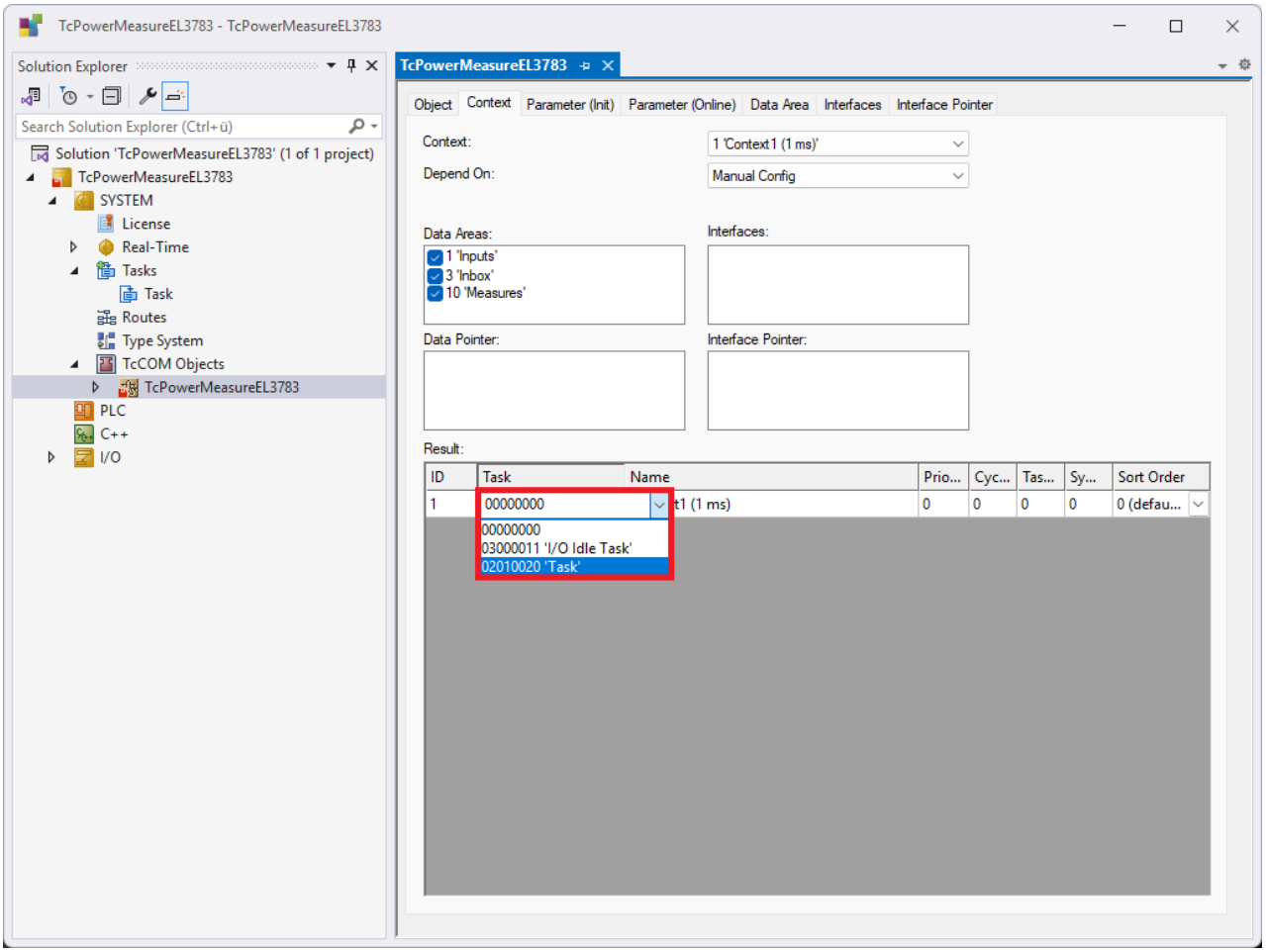
1. Right-click on **TcCOM Objects** in the Solution Explorer and select **Add New Item...**.
   ⇨ You have added a new module.



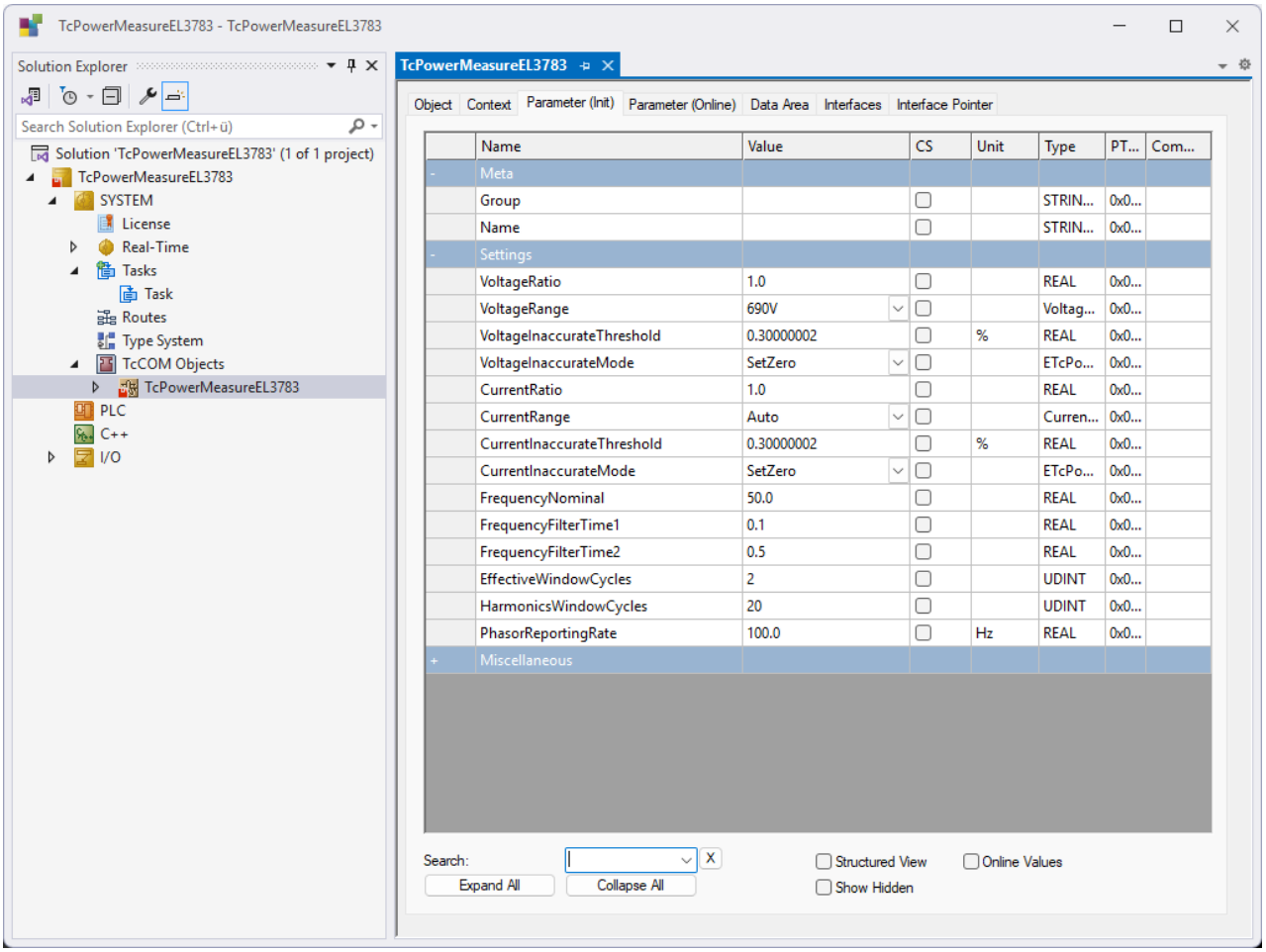
2. Use the search input field (Search) of *EL3783* to choose the **TcPowerMeasureEL3783** module.
3. Assign a name and click the **OK** button.



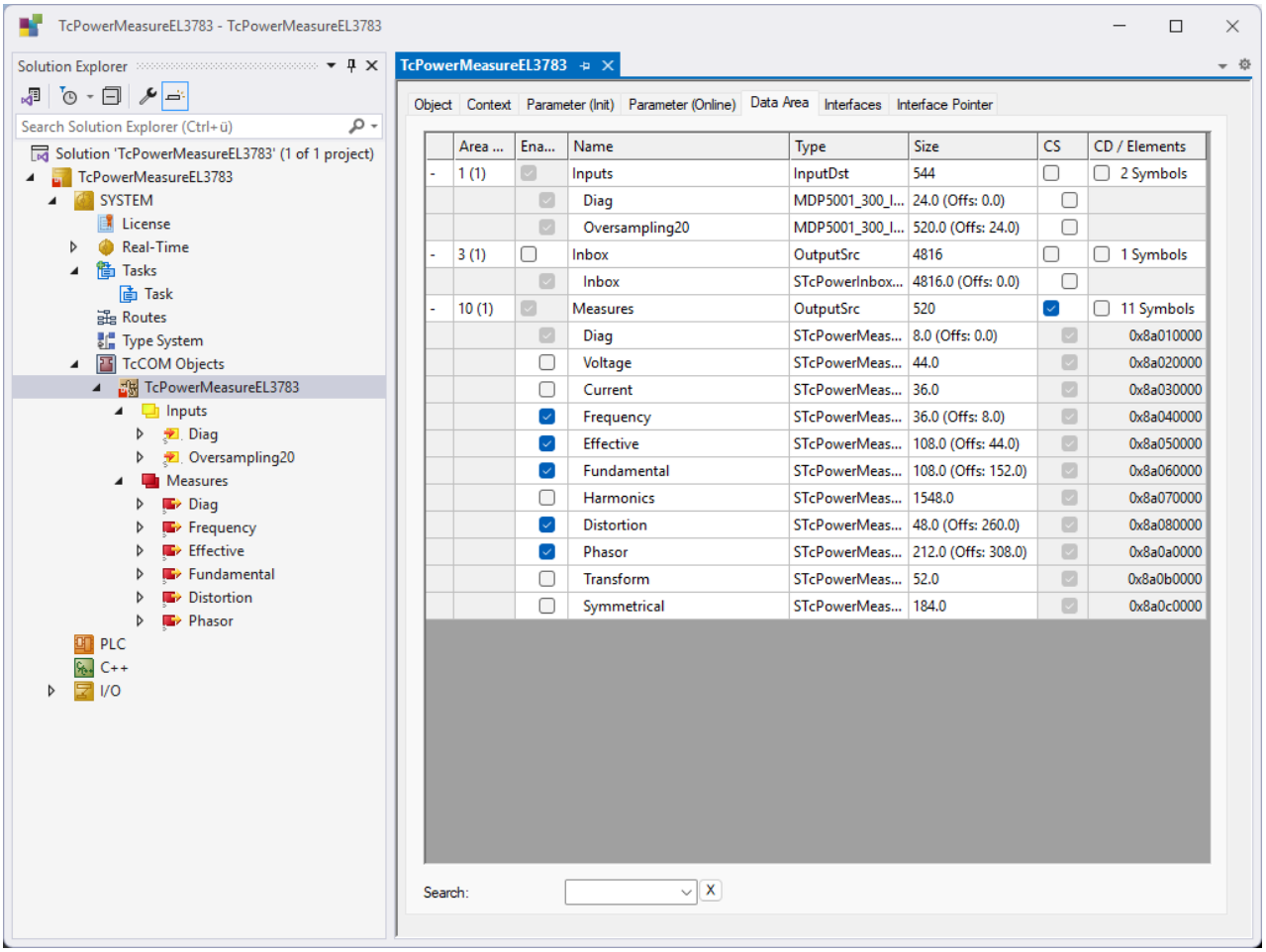
4. Assign a task with a cycle time of 1 ms to the module in the **Context > Result** tab.



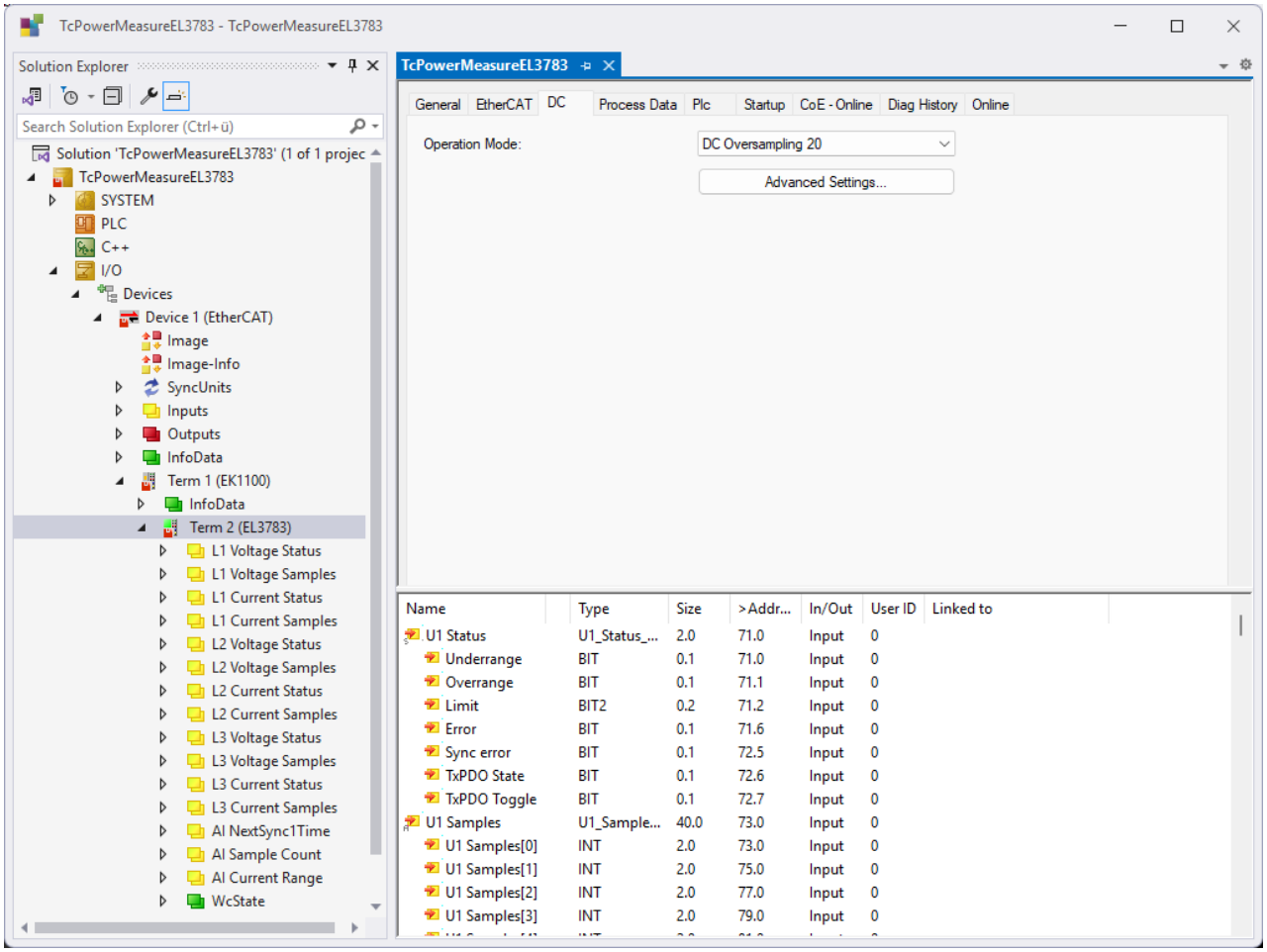
5. Make the required settings for the module, terminal and data processing in the **Parameters (Init)** tab.



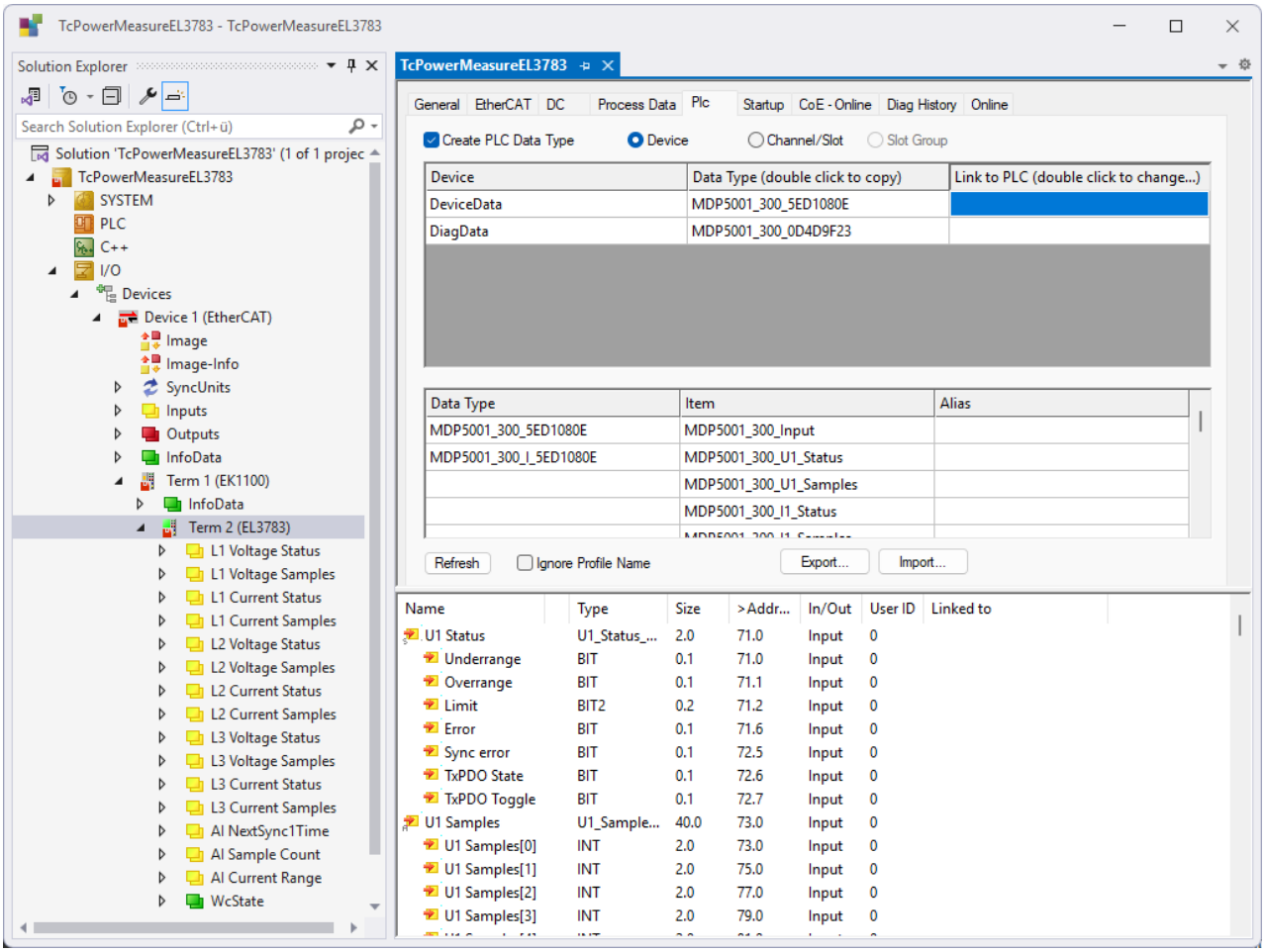
6. Activate the desired measurement data in the **Data Area > Measures** tab using the **Enable** checkbox (see Measure [▶ 10]).



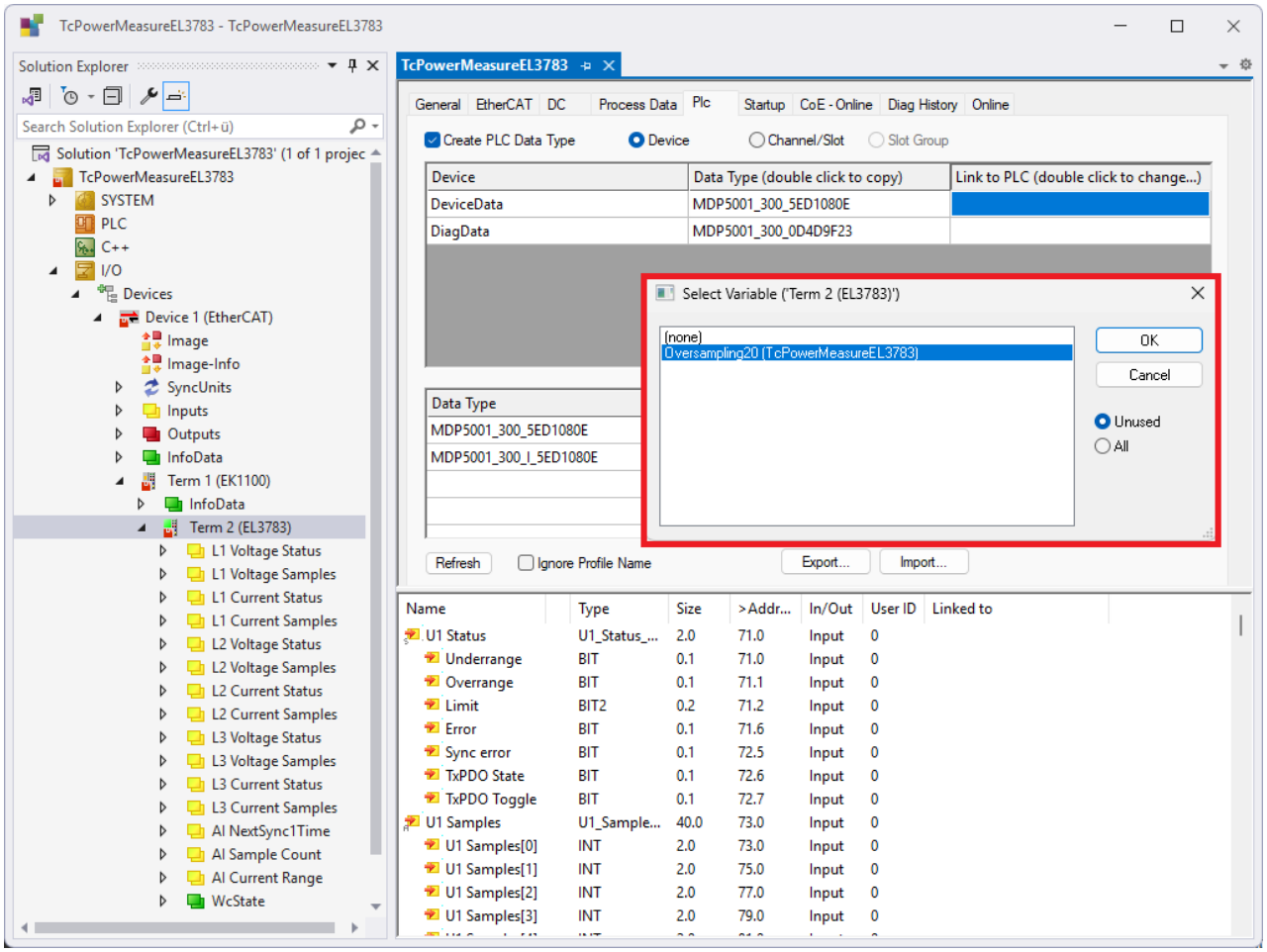
7. Select the *EL3783* in the project tree of the Solution Explorer under **I/O > Devices**.
8. In the **DC** tab, select "DC Oversampling 20" as the **Operation Mode**.



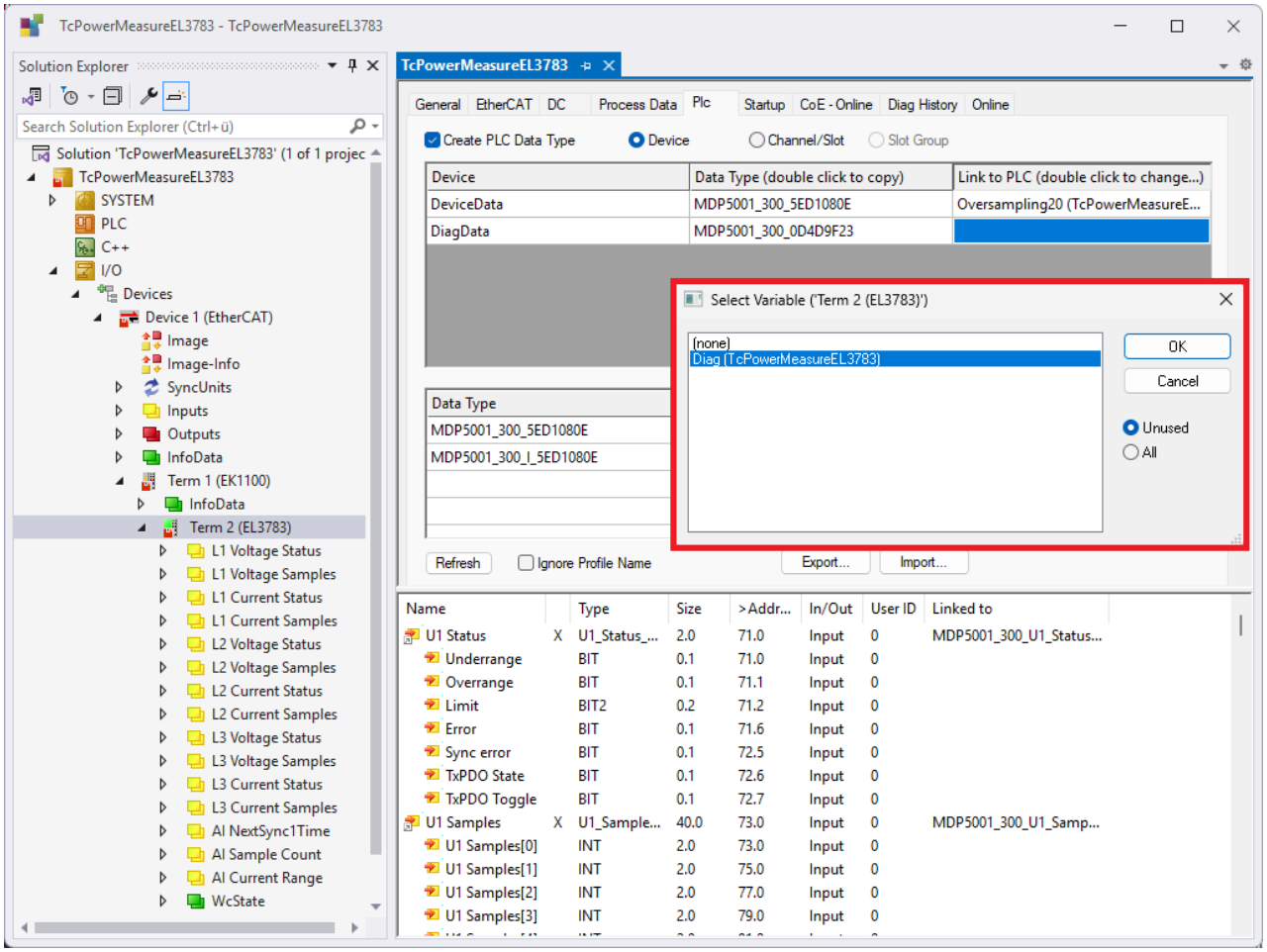
9. In the **PLC** *Create PLC Data Type* tab, activate .
10. Select the option *Device*.
11. Double-click on **Link To PLC...** to create the link.



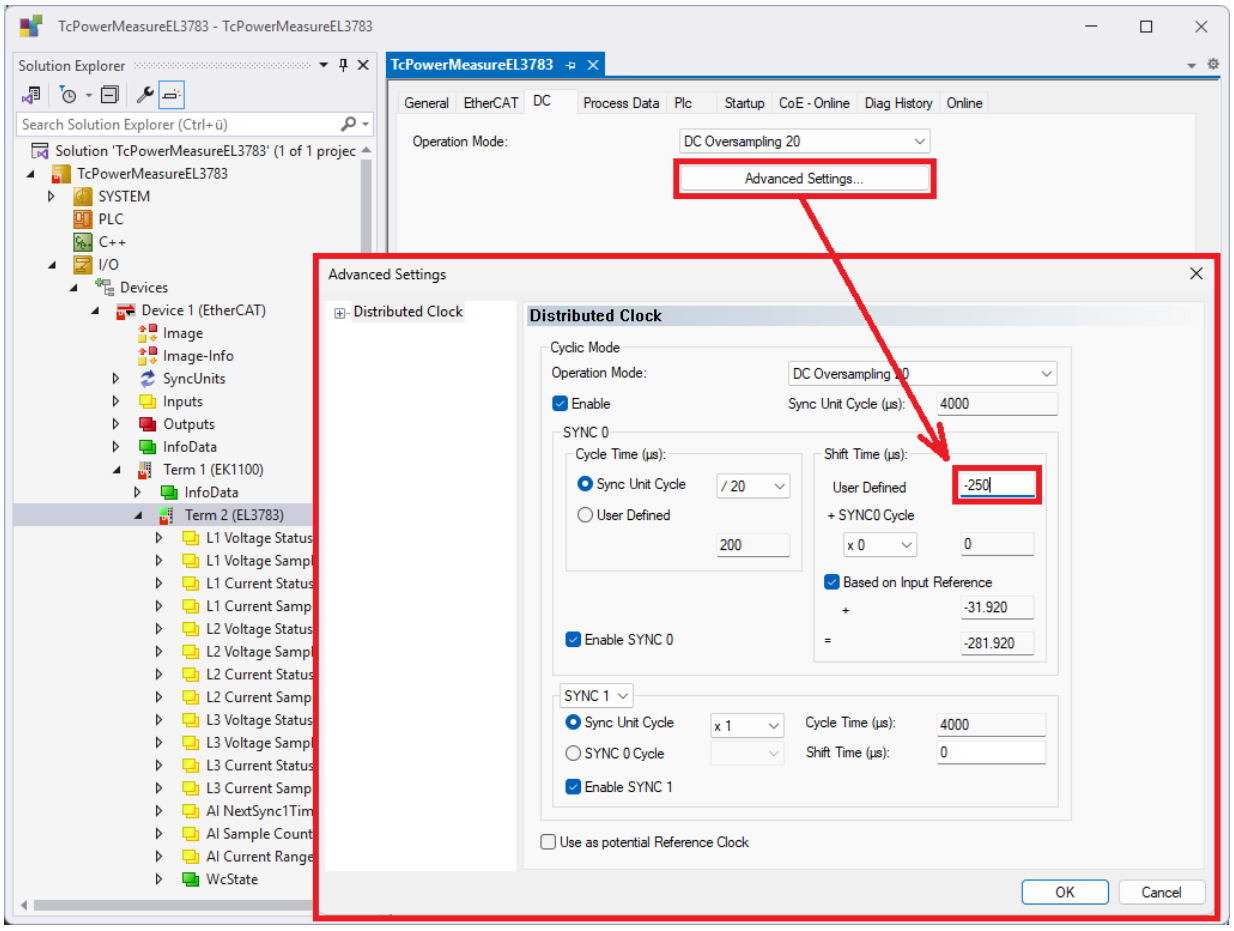
12. Link process data via **DeviceData** to the *Oversampling20* area of the TcPowerMeasureEL3783 module.



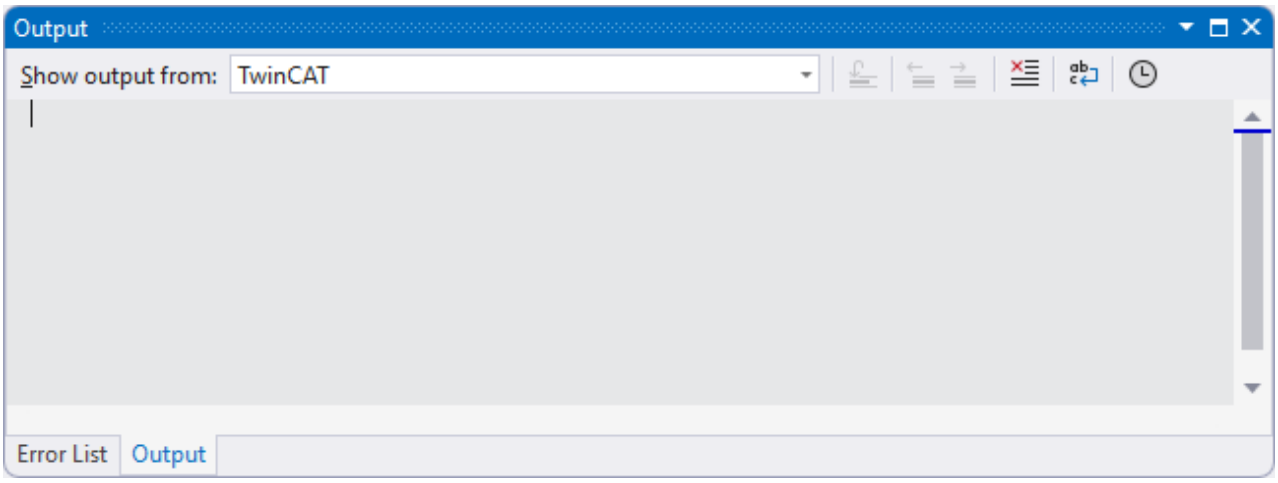
13. Link diagnostic data to the area *Diag* of the TcPowerMeasureEL3783 module using **DiagData**.


TcPowerMeasureEL3783 - TcPowerMeasureEL3783
Solution Explorer
Search Solution Explorer (Ctrl+ü)
Solution 'TcPowerMeasureEL3783' (1 of 1 projec
TcPowerMeasureEL3783
SYSTEM
PLC
C++
I/O
Devices
Device 1 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Outputs
InfoData
Term 1 (EK1100)
InfoData
Term 2 (EL3783)
L1 Voltage Status
L1 Voltage Samples
L1 Current Status
L1 Current Samples
L2 Voltage Status
L2 Voltage Samples
L2 Current Status
L2 Current Samples
L3 Voltage Status
L3 Voltage Samples
L3 Current Status
L3 Current Samples
AI NextSync1Time
AI Sample Count
AI Current Range
WcState
TcPowerMeasureEL3783
General
EtherCAT
DC
Process Data
Plc
Startup
CoE - Online
Diag History
Online
Create PLC Data Type
Device
Channel/Slot
Slot Group
Device
Data Type (double click to copy)
Link to PLC (double click to change...)
DeviceData
MDP5001_300_5ED1080E
Oversampling20 (TcPowerMeasureE...
DiagData
MDP5001_300_0D4D9F23
Select Variable ('Term 2 (EL3783)')
(none)
Diag (TcPowerMeasureEL3783)
OK
Cancel
Unused
All
Data Type
MDP5001_300_5ED1080E
MDP5001_300_I_5ED1080E
Refresh
Ignore Profile Name
Export...
Import...
Name
Type
Size
>Addr...
In/Out
User ID
Linked to
U1 Status
U1_Status_...
2.0
71.0
Input
0
MDP5001_300_U1_Status...
Underrange
BIT
0.1
71.0
Input
0
Overrange
BIT
0.1
71.1
Input
0
Limit
BIT2
0.2
71.2
Input
0
Error
BIT
0.1
71.6
Input
0
Sync error
BIT
0.1
72.5
Input
0
TxPDO State
BIT
0.1
72.6
Input
0
TxPDO Toggle
BIT
0.1
72.7
Input
0
U1 Samples
U1_Sample...
40.0
73.0
Input
0
MDP5001_300_U1_Samp...
U1 Samples[0]
INT
2.0
73.0
Input
0
U1 Samples[1]
INT
2.0
75.0
Input
0
U1 Samples[2]
INT
2.0
77.0
Input
0
U1 Samples[3]
INT
2.0
79.0
Input
0

14. Depending on the utilization of the real-time and the EtherCAT system, adjust the **User Defined Shift Time** under **Distributed Clocks**.



⇨ By selecting **Activate Configuration** and starting TwinCAT on the target system, the configuration is put into effect. The validity of the measurement data can be checked using the *bValid* under the Data Area *Measure* in the **Diag** structure. Otherwise, the messages from TwinCAT should be checked in the output window.



6 Appendix

6.1 Data types

6.1.1 STcPowerMeasureDiag

The `STcPowerMeasureDiag` structure displays general information on the state of the measurement data.

Name	Data Type	Unit	Description
`bValid`	`BOOL`		Measurements are available and valid.

6.1.2 STcPowerMeasureVoltage

The structures `STcPowerMeasureVoltageDiag`, `STcPowerMeasureVoltageValuesLN` and `STcPowerMeasureVoltageValuesLL` represent measurement data of the voltage and are summarized in the `STcPowerMeasureVoltageArea` structure.

STcPowerMeasureVoltageDiag

State of voltage measurement. See also Diagnostic data [▶ 13].

Name	Data Type	Description
`bInaccurateL1`	`BIT`	Inaccurate voltage phase L1.
`bInaccurateL2`	`BIT`	Inaccurate voltage phase L2.
`bInaccurateL3`	`BIT`	Inaccurate voltage phase L3.
`bOvervoltageL1`	`BIT`	Overvoltage phase L1.
`bOvervoltageL2`	`BIT`	Overvoltage phase L2.
`bOvervoltageL3`	`BIT`	Overvoltage phase L3.
`bReverseDirection`	`BIT`	Reversed phase sequence/rotating field direction (FALSE for L1-L2-L3).

STcPowerMeasureVoltageValuesLN

Voltages between phase and neutral conductor.

Name	Data Type	Unit	Description
`fU1N`	`REAL`	`V`	Effective value of voltage L1-N.
`fU2N`	`REAL`	`V`	Effective value of voltage L2-N.
`fU3N`	`REAL`	`V`	Effective value of voltage L3-N.
`fU123N`	`REAL`	`V`	Mean value of the effective values of the voltages L1-N, L2-N and L3-N.

STcPowerMeasureVoltageValuesLL

Voltages between the phases.

Name	Data Type	Unit	Description
`fU12`	`REAL`	`V`	Effective value of voltage L1-L2
`fU23`	`REAL`	`V`	Effective value of voltage L2-L3.
`fU31`	`REAL`	`V`	Effective value of voltage L3-L1.
`fU123`	`REAL`	`V`	Mean value of the effective values of the voltages L1-L2, L2-L3 and L3-L1.

STcPowerMeasureVoltageArea

Summary of the voltage measurement.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasureVoltageDiag	State of the measurement.
ValuesLN	STcPowerMeasureVoltageValuesLN	Phase to neutral conductor voltages.
ValuesLL	STcPowerMeasureVoltageValuesLL	Phase to phase voltages.

6.1.3 STcPowerMeasureCurrent

The structures STcPowerMeasureCurrentDiag, STcPowerMeasureCurrentValues and STcPowerMeasureCurrentValuesEN represent measurement data of the currents and are summarized in the STcPowerMeasureCurrentArea structure.

STcPowerMeasureCurrentDiag

State of the current measurement. See also Diagnostic data [▶ 13].

Name	Data Type	Description
bInaccurateL1	BIT	Inaccurate current phase L1.
bInaccurateL2	BIT	Inaccurate current phase L2.
bInaccurateL3	BIT	Inaccurate current phase L3.
bOvercurrentL1	BIT	Overcurrent phase L1.
bOvercurrentL2	BIT	Overcurrent phase L2.
bOvercurrentL3	BIT	Overcurrent phase L3.

STcPowerMeasureCurrentValues

Currents of the three phases.

Name	Data Type	Unit	Description
fI1	REAL	A	Effective value of current L1.
fI2	REAL	A	Effective value of current L2.
fI3	REAL	A	Effective value of current L3.
fI123	REAL	A	Mean value of the effective values of the currents L1, L2 and L3.

STcPowerMeasureCurrentValuesEN

Currents of the three phases, as well as fault current and neutral conductor.

Name	Data Type	Unit	Description
fI1	REAL	A	Effective value of current L1.
fI2	REAL	A	Effective value of current L2.
fI3	REAL	A	Effective value of current L3.
fI123	REAL	A	Mean value of the effective values of the currents L1, L2 and L3.
fIE	REAL	A	Determined error current.
fIN	REAL	A	Effective value of the current in the neutral conductor

STcPowerMeasureCurrentArea

Summary of the current measurement.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasureCurrentDiag	State of the measurement.
Values	STcPowerMeasureCurrentValuesEN	Currents

6.1.4 STcPowerMeasureFrequency

The structures STcPowerMeasureFrequencyDiag, STcPowerMeasureFrequencyValues and STcPowerMeasureFrequencyRoCoF represent the determined frequency and frequency change (*RoCoF*) and are summarized in the structure STcPowerMeasureFrequencyArea.

STcPowerMeasureFrequencyDiag

State of the frequency determination. See also Diagnostic data [▶ 13].

Name	Data Type	Description
bInaccurateL1	BIT	Inaccurate frequency phase L1.
bInaccurateL2	BIT	Inaccurate frequency phase L2.
bInaccurateL3	BIT	Inaccurate frequency phase L3.

STcPowerMeasureFrequencyValues

Determined frequency and filtered frequency values.

Name	Data Type	Unit	Description
fF	REAL	Hz	Determined frequency.
fF1	REAL	Hz	First stage filtered frequency.
fF2	REAL	Hz	Second stage filtered frequency.

STcPowerMeasureFrequencyRoCoF

Determined frequency change and filtered frequency change.

Name	Data Type	Unit	Description
fR	REAL	Hz/s	Determined frequency change.
fR1	REAL	Hz/s	First stage filtered frequency change.
fR2	REAL	Hz/s	Second stage filtered frequency change.

STcPowerMeasureFrequencyArea

Summary of the frequency determination.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasureFrequencyDiag	State of determination.
Values	STcPowerMeasureFrequencyValues	Determined frequency.
RoCoF	STcPowerMeasureFrequencyRoCoF	Determined frequency change.

6.1.5 STcPowerMeasureEffective

The structure STcPowerMeasureEffectiveArea contains information on diagnostics in the structure STcPowerMeasurePowerDiag, the effective values of the voltages in the structure STcPowerMeasureVoltageValuesLN, the effective values of the currents in the structure STcPowerMeasureCurrentValues and the instantaneous values of the power (active, reactive and apparent power) in the structure STcPowerMeasurePowerEffective.

STcPowerMeasurePowerDiag

State of the measurement data (see diagnostic data [▶ 13]).

Name	Data Type	Description
bVoltageInaccurateL1	BIT	Inaccurate voltage phase L1.
bVoltageInaccurateL2	BIT	Inaccurate voltage phase L2.
bVoltageInaccurateL3	BIT	Inaccurate voltage phase L3.
bCurrentInaccurateL1	BIT	Inaccurate current phase L1.
bCurrentInaccurateL2	BIT	Inaccurate current phase L2.
bCurrentInaccurateL3	BIT	Inaccurate current phase L3.

STcPowerMeasureVoltageValuesLN

Effective values of the voltages.

Name	Data Type	Unit	Description
fU1N	REAL	V	Effective value of voltage L1-N.
fU2N	REAL	V	Effective value of voltage L2-N.
fU3N	REAL	V	Effective value of voltage L3-N.
fU123N	REAL	V	Mean value of the effective values of the voltages L1-N, L2-N and L3-N.

STcPowerMeasureCurrentValues

Effective values of the currents.

Name	Data Type	Unit	Description
fI1	REAL	A	Effective value of current L1.
fI2	REAL	A	Effective value of current L2.
fI3	REAL	A	Effective value of current L3.
fI123	REAL	A	Mean value of the effective values of the currents L1, L2 and L3.

STcPowerMeasurePowerEffective

Instantaneous power values (active, reactive and apparent power)

Name	Data Type	Unit	Description
fP1	REAL	W	Active power phase L1.
fP2	REAL	W	Active power phase L2.
fP3	REAL	W	Active power phase L3.
fP123	REAL	W	Sum of the active power of phases L1, L2 and L3.
fQ1	REAL	Var	Reactive power phase L1.
fQ2	REAL	Var	Reactive power phase L2.
fQ3	REAL	Var	Reactive power phase L3.
fQ123	REAL	Var	Sum of the reactive power of phases L1, L2 and L3.
fS1	REAL	VA	Apparent power of phase L1.
fS2	REAL	VA	Apparent power of phase L2.
fS3	REAL	VA	Apparent power of phase L3.
fS123	REAL	VA	Sum of the apparent power of phases L1, L2 and L3.
fPF1	REAL	-	Power factor phase L1.
fPF2	REAL	-	Power factor phase L2.
fPF3	REAL	-	Power factor phase L3.
fPF123	REAL	-	Total power factors

STcPowerMeasureEffectiveArea

Summary of effective values.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Voltage	STcPowerMeasureVoltageValuesLN	Effective values of the voltages.
Current	STcPowerMeasureCurrentValues	Effective values of the currents.
Power	STcPowerMeasurePowerEffective	Instantaneous power values.

6.1.6 STcPowerMeasureFundamental

The structures `STcPowerMeasurePowerDiag` and `STcPowerMeasurePowerFundamental` contain the determined voltage, current and power components of the fundamental and are summarized in the `STcPowerMeasureFundamentalArea` structure.

STcPowerMeasurePowerFundamentals

Determined power components of the fundamental.

Name	Data Type	Unit	Description
fP1	REAL	W	Fundamental component of the active power L1.
fP2	REAL	W	Fundamental component of the active power L2.
fP3	REAL	W	Fundamental component of the active power L3.
fP123	REAL	W	Sum of the fundamental components of the active power L1, L2 and L3.
fQ1	REAL	var	Fundamental component of the reactive power L1.
fQ2	REAL	var	Fundamental component of the reactive power L2.
fQ3	REAL	var	Fundamental component of the reactive power L3.
fQ123	REAL	var	Sum of the fundamental components of the reactive power L1, L2 and L3.
fS1	REAL	var	Fundamental oscillation component of the apparent power L1.
fS2	REAL	var	Fundamental oscillation component of the apparent power L2.
fS3	REAL	var	Fundamental oscillation component of the apparent power L3.
fS123	REAL	var	Sum of the fundamental frequency components of the apparent power L1, L2 and L3.
fCosPhi1	REAL	-	Displacement factor phase L1.
fCosPhi2	REAL	-	Displacement factor phase L2.
fCosPhi3	REAL	-	Displacement factor phase L3.
fCosPhi123	REAL	-	Total displacement factor

STcPowerMeasureFundamentalsArea

Summary of the fundamental determination.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Voltage	STcPowerMeasureVoltageValuesLN [▶ 42]	Voltage components of the fundamental.
Current	STcPowerMeasureCurrentValues [▶ 43]	Current components of the fundamental.
Power	STcPowerMeasurePowerFundamentals	Power components of the fundamental

6.1.7 STcPowerMeasureHarmonics

The structures STcPowerMeasureHarmonicsDiag and STcPowerMeasureHarmonicsValues represent the determined harmonics and are summarized in the structure STcPowerMeasureHarmonicsArea.

STcPowerMeasureHarmonicsValues

Determined harmonics up to and including the 64th harmonic.

Name	Data Type	Unit	Description
aHarm1	ARRAY [0..63] OF REAL	%	[0] DC component [1..62] Ratio of the nth harmonic to the fundamental L1.
aHarm2	ARRAY [0..63] OF REAL	%	[0] DC component [1..62] Ratio of the nth harmonic to the fundamental L2.
aHarm3	ARRAY [0..63] OF REAL	%	[0] DC component [1..62] Ratio of the nth harmonic to the fundamental L3.

STcPowerMeasureHarmonicsArea

Summary of the harmonics determination.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Voltage	STcPowerMeasureHarmonicsValues	Harmonics of the voltage.
Current	STcPowerMeasureHarmonicsValues	Harmonics of the current.

6.1.8 STcPowerMeasureDistortion

The structures STcPowerMeasureDistortionDiag, STcPowerMeasureDistortionValues and STcPowerMeasureDistortionValuesTDD represent the determined harmonic distortion and are summarized in the structure STcPowerMeasureDistortionArea.

STcPowerMeasureDistortionValues

Determined harmonic distortion in relation to the fundamental.

Name	Data Type	Unit	Description
fTHD1	REAL	%	Distortion on phase L1.
fTHD2	REAL	%	Distortion on phase L2.
fTHD3	REAL	%	Distortion on phase L3.

STcPowerMeasureDistortionValuesTDD

Determined distortion in relation to the maximum fundamental.

Name	Data Type	Unit	Description
fTDD1	REAL	%	Distortion on phase L1.
fTDD2	REAL	%	Distortion on phase L2.
fTDD3	REAL	%	Distortion on phase L3.

STcPowerMeasureDistortionArea

Summary of the distortion determination.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
VoltageTHD	STcPowerMeasureDistortionValues	Distortion of the voltage in relation to the fundamental.
CurrentTHD	STcPowerMeasureDistortionValues	Distortion of the current in relation to the fundamental.
CurrentTDD	STcPowerMeasureDistortionValues TDD	Distortion of the current in relation to the maximum fundamental.

6.1.9 STcPowerMeasurePhasor

The structures STcPowerMeasurePowerDiag and STcPowerMeasurePhasorValues contain the calculated phasors and are summarized in the STcPowerMeasurePhasorArea structure.

STcPowerMeasurePhasorComplexValues

The size of a phasor in different display forms.

Name	Data Type	Unit	Description
fRe	REAL	V/A	Real component of the phasor.
fIm	REAL	V/A	Imaginary part of the phasor.
fAmp	REAL	V/A	Amplitude of the phasor.
fPhi	REAL	°	Phase angle of the phasor.

STcPowerMeasurePhasorValues

Determined phasors for the individual phases and the symmetrical components.

Name	Data Type	Description
L1	STcPowerMeasurePhasorComplexValues	Phasors of phase L1.
L2	STcPowerMeasurePhasorComplexValues	Phasors of phase L2.
L3	STcPowerMeasurePhasorComplexValues	Phasors of phase L3.
PosSeq	STcPowerMeasurePhasorComplexValues	Phasors from the positive-sequence system.
NegSeq	STcPowerMeasurePhasorComplexValues	Phasors from the negative-sequence system.
ZeoSeq	STcPowerMeasurePhasorComplexValues	Phasors from the zero system.

STcPowerMeasurePhasorFrequency

The frequency and frequency change determined from the phasors.

Name	Data Type	Unit	Description
fF	REAL	Hz	Determined frequency.
fR	REAL	Hz/s	Determined frequency change.

STcPowerMeasurePhasorArea

Summary of the phasors.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Voltage	STcPowerMeasurePhasorValues	Phasors of the voltage.
Current	STcPowerMeasurePhasorValues	Phasors of the current.
Frequency	STcPowerMeasurePhasorFrequency	Determined frequency.

6.1.10 STcPowerMeasureTransform

The structures `STcPowerMeasureTransformClark`, `STcPowerMeasureTransformPark` and `STcPowerMeasureTransformPower` represent the transformed variables and are summarized in the structure `STcPowerMeasureTransformArea`.

STcPowerMeasureTransformClark

Voltage and current in the α-β coordinate system.

Name	Data Type	Unit	Description
fUa	REAL	V	Real axis of the voltage.
fUb	REAL	V	Orthogonal axis of the voltage.
fIa	REAL	A	Real axis of the current.
fIb	REAL	A	Orthogonal axis of the current.

STcPowerMeasureTransformPark

Voltage and current in the d-q coordinate system.

Name	Data Type	Unit	Description
fUd	REAL	V	Direct axis of the voltage.
fUq	REAL	V	Quadrature axis of the voltage.
fId	REAL	A	Direct axis of the current.
fIq	REAL	A	Quadrature axis of the current.

STcPowerMeasureTransformPower

Power values calculated from the d-q components of voltage and current.

Name	Data Type	Unit	Description
fP	REAL	V	Active power.
fQ	REAL	V	Reactive power.

STcPowerMeasureTransformArea

Summary of the transformed variables.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Clark	STcPowerMeasureTransformClark	Variables in the α-β coordinate system.
Park	STcPowerMeasureTransformPark	Variables in the d-q coordinate system.
Power	STcPowerMeasureTransformPower	Power in the d-q coordinate system.

6.1.11 STcPowerMeasureSymmetrical

The structures `STcPowerMeasurePowerDiag` and `STcPowerMeasurePhasorValues` contain the calculated phasors and are summarized in the `STcPowerMeasurePhasorArea` structure.

STcPowerMeasureSymmetricalComplexValues

This structure describes a pointer as a complex variable in polar representation.

Name	Data Type	Unit	Description
fEff	REAL	V/A	Amplitude of the pointer.
fPhi	REAL	°	Angle of the pointer.

STcPowerMeasureSymmetricalVoltage

This structure contains the determined voltages of the individual phases and their symmetrical components.

Name	Data Type	Description
U1N	STcPowerMeasureSymetricalComplexValues	Phase voltage L1 against neutral conductor.
U2N	STcPowerMeasureSymetricalComplexValues	Phase voltage L2 against neutral conductor.
U3N	STcPowerMeasureSymetricalComplexValues	Phase voltage L3 against neutral conductor
U12	STcPowerMeasureSymetricalComplexValues	Conductor voltage between L1 and L2
U23	STcPowerMeasureSymetricalComplexValues	Conductor voltage between L2 and L3
U31	STcPowerMeasureSymetricalComplexValues	Conductor voltage between L3 and L1
PosSeq	STcPowerMeasureSymetricalComplexValues	Voltage in the positive-sequence system.
NegSeq	STcPowerMeasureSymetricalComplexValues	Voltage in the negative-sequence system.
ZeoZeq	STcPowerMeasureSymetricalComplexValues	Voltage in the zero system.

STcPowerMeasureSymmetricalCurrent

This structure contains the currents of the individual phases and their symmetrical components.

Name	Data Type	Description
I1	STcPowerMeasureSymetricalComplexValues	Current phase L1.
I2	STcPowerMeasureSymetricalComplexValues	Current phase L2.
I3	STcPowerMeasureSymetricalComplexValues	Current phase L3.
PosSeq	STcPowerMeasureSymetricalComplexValues	Current in the positive-sequence system.
NegSeq	STcPowerMeasureSymetricalComplexValues	Current in the negative-sequence system.
ZeoZeq	STcPowerMeasureSymetricalComplexValues	Current in the zero system.

STcPowerMeasureSymmetricalPowerValues

The power of the symmetrical components.

Name	Data Type	Unit	Description
fP	REAL	W	Active power.
fQ	REAL	Var	Reactive power.
fS	REAL	VA	Apparent power.

STcPowerMeasureSymmetricalPower

Determined power for the individual phases and the symmetrical components.

Name	Data Type	Description
L1	STcPowerMeasureSymmetricalPowerValues	Power phase L1.
L2	STcPowerMeasureSymmetricalPowerValues	Power phase L2.
L3	STcPowerMeasureSymmetricalPowerValues	Power phase L3.
PosSeq	STcPowerMeasureSymmetricalPowerValues	Power of the positive-sequence system.

STcPowerMeasureSymmetricalArea

Summary of the symmetrical components.

Name	Data Type	Description
nTimestamp	DCTIME	Time of update.
Diag	STcPowerMeasurePowerDiag	State of determination.
Voltage	STcPowerMeasureSymmetricalVoltage	Voltage pointer.
Current	STcPowerMeasureSymmetricalCurrent	Pointer of the current.
Power	STcPowerMeasureSymmetricalPower	Power values.

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