Distributed Energy Resources Controller
Compliant with IEEE 1547-2018

IEEE 1547

Distributed Energy Resources (DERs)

With today's focus on sustainable energy sources and reducing carbon emissions, the use of distributed energy resources (DERs) has become more widespread. DERs refer to small-to-medium sized power generation (and energy storage) systems that can be installed in buildings and communities that are connected to area electric power systems (EPSs) (i.e. distribution grid < 60kV). They can generate power for local use, offer a flexible and resilient energy system that meets the growing demand for clean energy, and can be connected to the grid to help meet power demands. Connecting DERs to the grid requires communication between the energy resource and the grid operator to ensure reliability.

Therefore, industry standards such as IEEE1547-2018 have been adopted to help provide a trouble-free interconnection between systems:

IEEE Standard 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems was published in April 2018. This significantly enhanced the performance and functional capability of DERs, connecting specifically to primary and secondary distribution systems.

WAGO's 1547-2018 DER Controller Function Block

IEEE Standard 1547-2018 has 11 clauses and eight annexes that total 136 pages. Clauses 1-4 discuss general terminology with clauses 7-9 focusing on inverters (which is separate from the DER controller certification). WAGO's DER controller function block is verified for Clause 5 and Clause 10 of the standard, with tools to support Clause 6 (frequency control).

Clause 5:

- Requirements for reactive power capabilities and voltage/power control of DERs.
- Describes overall capability and detailed requirements for specific modes of operation for DER performance category A or B.

Clause 10:

- Requirements for interoperability, information exchange, information models and protocols.
- Discusses how to externally exchange and use information about the DER securely and effectively.

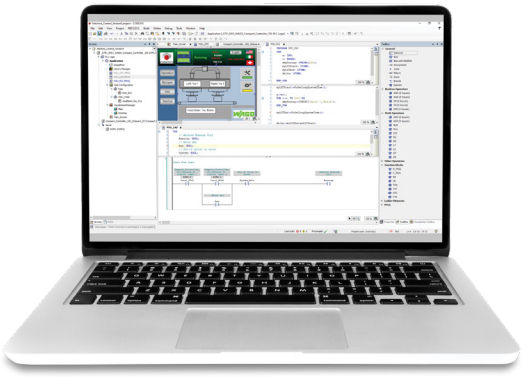
Flexible Hardware & Software

WAGO's IEEE 1547-2018 hardware and software solution has been validated and verified by a Nationally Recognized Test Lab (NRTL) and operates in our portfolio of WAGO controllers. The library function block runs in our controllers that are programmed with CODESYS 3.5 software.

WAGO's family of high-performance, Linux-based, programmable controllers boast a wide range of capabilities for controlling automation tasks in both centralized and decentralized applications.

For decentralized control tasks, WAGO controllers have the capability to:

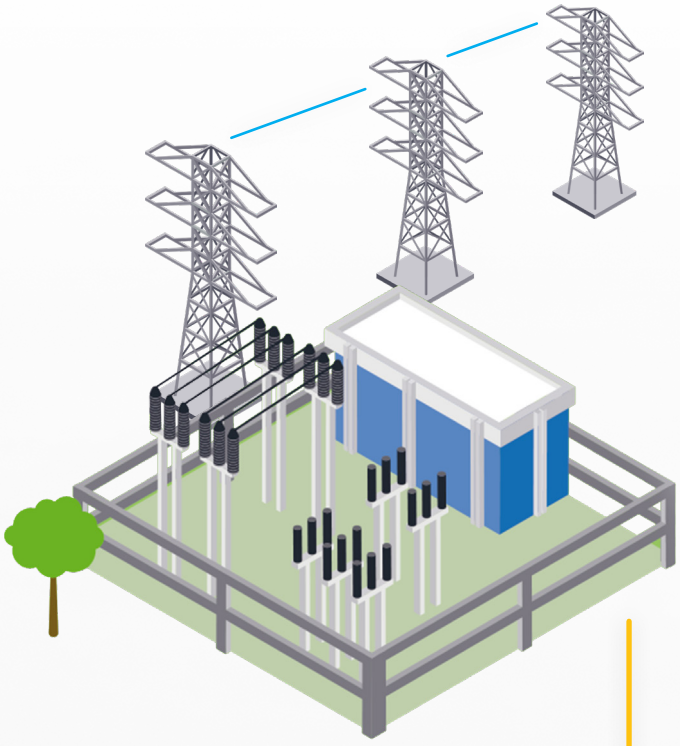
- Connect to the most prevalent fieldbus networks
- Monitor, record, and/or control all field signals via I/O modules.
- Provide the benefits of standard PLC technology such as strength, reliability, and high availability.
- Directly connect to many of the WAGO-I/O-SYSTEM 750 modules
- Provide scalable memory and speed along with a variety of interfaces and communication protocols

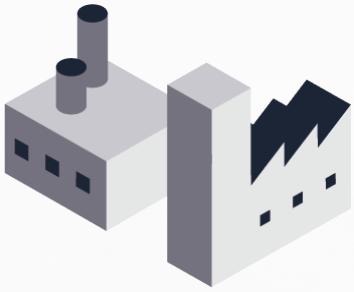


Codesys 3.5 Engineering Tool

Using CODESYS V3.5 development software, engineers are able to use the most appropriate IEC61131-3 programming languages for their applications. This software is used to create control logic and web visualizations that can be used to interface with DERs, distribution grids, and related systems.

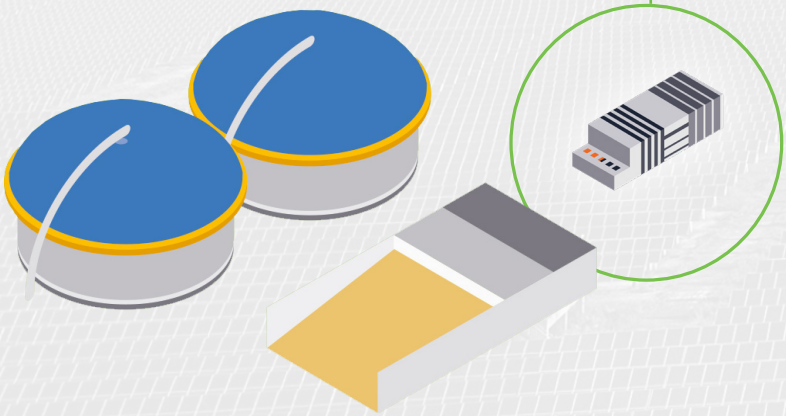
Medium Voltage = High Voltage = Control Communications =

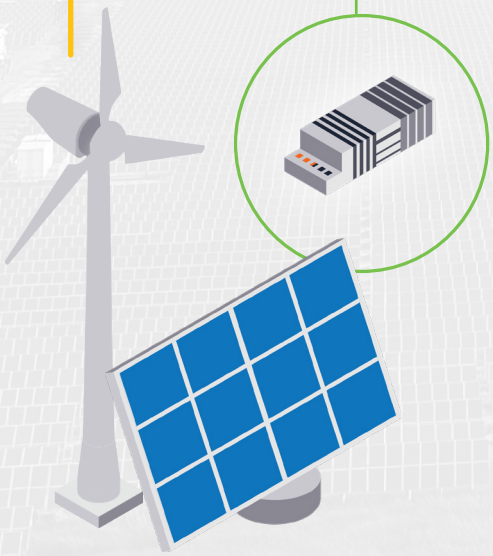


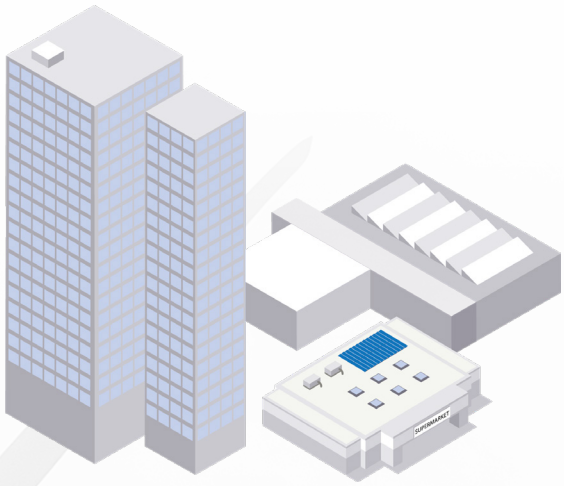


Grid Operators

Distributed Energy Resources



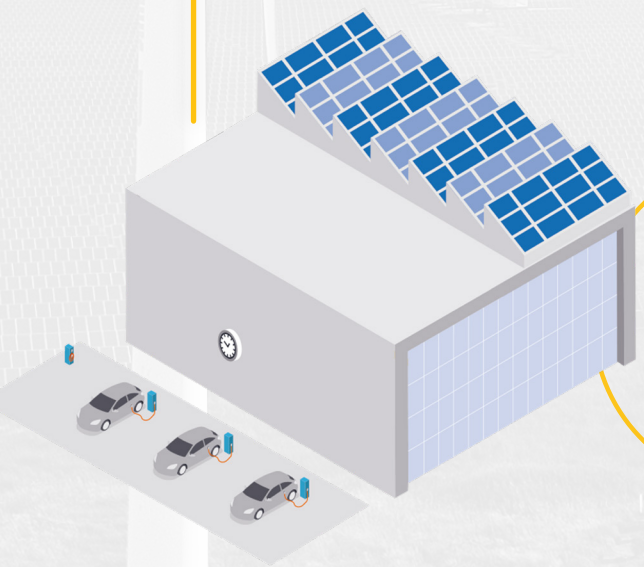


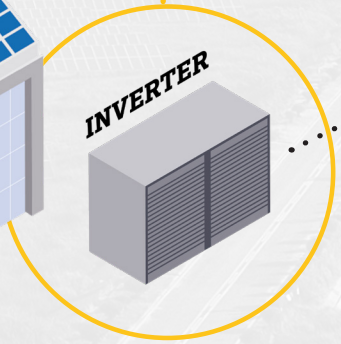


Energy Consumers

Mixed Use

DNP3, IEC61850

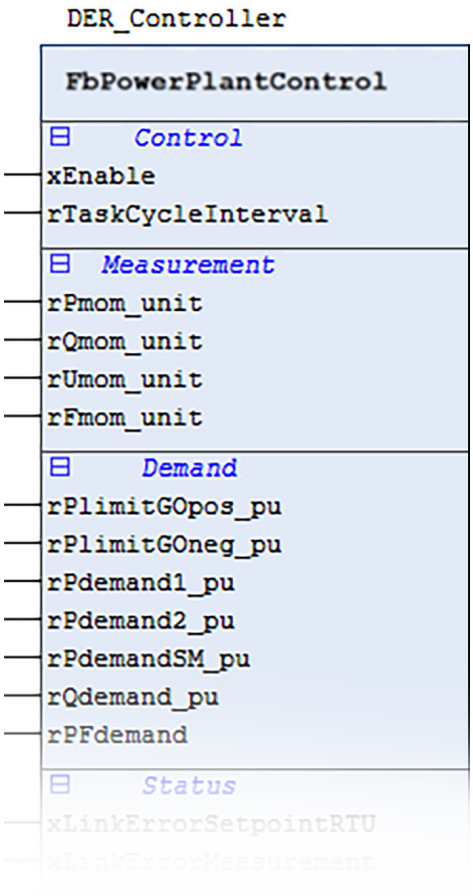




CANopen,
Sunspec Modbus

WAGO 1547-2018
DER Controller Library

The control algorithm for active and reactive power as well as corresponding setpoint specifications can be adjusted during operation using utility communication protocols, including DNP3. The controller compares the specified setpoint values with the actual values measured at the grid connection point. This gives the calculated correction variables that can be communicated via SunSpec Modbus 700 or other protocols to the energy generation plant's smart inverters.



1547-2018 Function Block is grouped into sections

Control: General power plant control parameters

Measurement: Measured values of the grid

Demand: External setpoint specifications of the power plant controller

Plant status: Environmental information

Configuration:
Sets regulation modes per IEEE 1547:

Category A and Category B voltage regulation modes:

Category A
1. Constant Power Factor Mode
2. Constant Reactive Power Mode
3. Voltage Reactive Power (Volt-Var)

Category B additional modes:
1. Active Power-Reactive Power Mode
2. Voltage-Active Power (Volt-Watt)

Setpoint: Calculated new setpoints of the power plant controller for the connected power plants. The power plant controller in this group returns the new setpoints with the help of the input values.

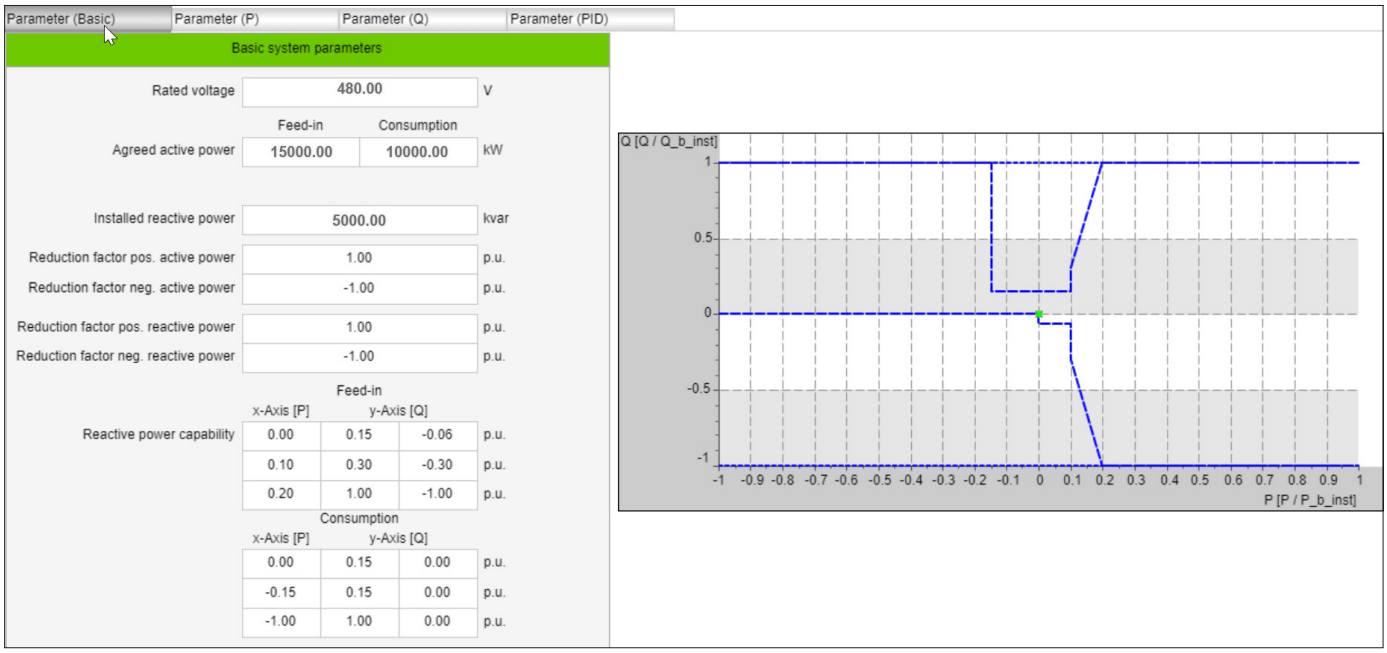
Values: Additional information on individual process values, such as standardized grid measured values and their gradients

DRM: Power plant license information

Status P: Individual values of the active power controller

Status Q: Individual values of the reactive power controller

Status Config: Configuration information



WAGO's library includes visualization templates that can be used in developing your own web-based visualizations. These pre-engineered graphics can be accessed via web browser on devices that have access to the DER 1547 controller network. Used in conjunction with CODESYS 3.5 software, these graphics give operators clear monitoring on the state of the DER function block.

The WAGO 1547-2018 DER Controller is part of the WAGO WagoAppPowerPlant-ControlBase library. The application operates in a wide portfolio of WAGO Controllers programmed with CODESYS 3.5 software.

Users can download the software application from our website Solutions - WAGO Download Center under the Solutions section.

The application will operate in evaluation mode for 30 days, before it requires a license.

Library Part Number
2759-203/211-1000

DER Controller Library

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