Data Sheets
Park Control
Open Control of Wind Parks

Today’s wind turbines and wind parks grow increasingly larger as the demand for flexible controlled power in the grid increases. In order to control these wind parks, ensuring that they are balanced and able to comply with the grid codes all over the world, Mita-Teknik offers an open, reliable, flexible and intelligent Wind Park Control Concept that gives our customers the edge when selling their wind turbines for wind parks all over the world.

How it Works

The hierarchical Wind Park Control Concept consists of our field-proven hardware suitable for the harsh environment, and multiple software packages. All units are interconnected by an Ethernet network running the reliable M-Link protocol.

The wind parks is controlled by a Park Controller that dispatches the active and reactive power set points, as ordered by a Transmission System Operator (TSO) either directly to the Wind Turbine unit, or via a Cluster Controller that can be introduced in large wind parks or when there is more than one point of common coupling to the grid.

At the point of common coupling, a Grid Monitor can be installed to accurately measure the grid characteristics and send them back to the Park/Cluster Controller for further control.

As part of the concept, a Weather Monitor may supply the Park Controller with meteorological data. By doing so, you can, for example, produce a wind farm power curve or take special functions like humidity, ice and ambient light detectors into account (upon request). All functions can be setup, monitored and data extracted either directly on the unit or via complete remote control.

Highly Scalable Solution

Whether you are installing only a few or even hundreds of turbines, there is one solution that fits your needs! Our concept supports from 1 to 2500 turbines in 0 to 50 clusters with individual grid and weather measurements and output control in each cluster.

SCADA Integration

Naturally, the concept is fully integrated on all levels in the SCADA system, Gateway, so that you can monitor, supervise and setup the wind park control, no matter if you are on site or on the other side of the world.

Open Flexible System

The concept is designed to be open and flexible, supporting open configurable standards for control and supervision like:

- OPC
- IEC61400-25 (MMS)
- Modbus
Multiple TSO Interfaces
Communication with the TSO, e.g., the utility company, is often different from country to country and from TSO to TSO. To make things easier, Mita-Teknik offers a variety of configurable interfaces for exchanging data with the Transmission System Operator, e.g.:

› Analog inputs/outputs
› Digital inputs/outputs
› Modbus
› OPC
› IEC61400-25 (MMS)
› …..

Built-in Grid Code Support
Often, grid codes vary from country to country, making it difficult to comply with all codes in one solution. The Wind Park Control Concept accommodates this by offering off-the-shelf grid codes support like European and Chinese etc. This makes it easy for you to enter new markets without having to think about compliance with local grid codes. Should a required grid code not be in our database, our grid experts can of course help to analyze and implement it.

Reliable Park Communication
The communication protocol used internally in the park control system is our reliable M-Link protocol. The protocol provides very stable and secure communication via cost-optimized network components.

Backward Compatible
If you have wind parks running on the WP3x00 platform, the new features of the Wind Park Control Concept can of course be utilized. By using the Mita-Teknik ES Ethernet switches and the M-Net communicator software, the previous generation of controllers can be brought up to speed with the newest grid codes requirements etc.

Concept Solution or Tailor-made
With +35 years of experience within the wind industry, Mita-Teknik has compiled a Wind Park Control Concept that will fit most needs concerning e.g.:

› Park/Cluster Controller, Grid Monitor and Weather Monitor
› Fully tested software for controlling the individual wind park components
› Accessories
› Installation and commissioning services
› Integration services
› Training services

However, should you require solutions for special purposes we are always prepared to compile a tailor-made solution that fits your specific needs.
Wind Park Control Concept

System Overview

Transmission System Operator (TSO) interfaces to the park via Modbus TCP, digital in- and outputs, analog in- and outputs.

The Park Controller handles up to 50 turbines or up to 50 Cluster Controllers (which handles up to 50 turbines each). Grid Monitor is available as a combined Park Controller and measurement unit or as a remote substation Grid Monitor.

The Cluster Controller handles up to 50 turbines. The Grid Monitor is available as a combined Cluster Controller and measurement unit or as a remote substation Grid Monitor.

A Weather Monitor can be added either on park or cluster level to supply the system with meteorological data.
WP4x00
With Double Cluster

This configuration example shows a setup with a Park Controller w/o internal grid measurements, a Grid Monitor which supplies the Park Controller with the grid measurements and 2 Cluster Controllers with their own grid measurements which controls up to 50 WP4x00 turbines each.

**Park Controller**
- Required softwares on the Park Controller without grid measurements:
  - Grid Controller Application
- Optional software:
  - TSO Client
  - Alarm Server/Client
  - MMS or Modbus
  - Panel Controller Application

**Grid Monitor**
- Required softwares on the Grid Monitor:
  - Grid Monitor Application
- Optional software:
  - Alarm Server/Client
  - MMS or Modbus
  - Panel Controller Application

**Cluster Controller**
- Required softwares on the Cluster Controller with grid measurements:
  - Cluster Communicator Application
  - Grid Controller Application
  - Grid Monitor Application
- Optional software:
  - Alarm Server/Client
  - MMS or Modbus
  - Panel Controller Application

**Wind Turbine**
- Required software on the turbine controller:
  - Wind Turbine Control Application
  - Data Bridge Application
- Optional:
  - Alarm Server/Client
  - MMS or Modbus

Specifications subject to change

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WP3x00
With Double Cluster

This configuration example shows a setup with a Park Controller w/o internal grid measurements and 2 Cluster Controllers w/their own grid measurements which controls up to 50 WP3x00 turbines each. One Cluster Controller communicates via ArcNet and IC500’s to the WP3100 and the other via Ethernet and ES1000’s to the WP3100.

Required softwares on the Park Controller without grid measurements:
- Grid Controller Application

Optional software:
- TSO Client
- Alarm Server/Client
- MMS or Modbus
- Panel Controller Application

Required softwares on the Cluster Controller with grid measurements:
- Cluster Communicator Application
- Grid Controller Application
- M-Net Communicator Application
- Grid Monitor Application

Optional software:
- Alarm Server/Client
- MMS or Modbus
- Panel Controller Application

Up to 50 wind turbines per Cluster Controller

Up to 20 wind turbines per ES100 - ArcNet

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WP4x00 Single Park
With Grid Monitor

This setup shows a configuration where the Park Controller w/o grid measurements is located in one place and the Grid Monitor is located in another place (e.g. substation or transformer building).
WP4x00 Single Park with Integrated Grid Measurement

This example shows a Park Controller with Grid Monitor functionality integrated. In this example it is not combined with any cluster controllers, so it can handle up to 50 turbines.
Wind Park Control Concept Hardware

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Wind Park Control Panel

The Park Controller is the main controller in the Wind Park Control Concept, controlling up to 1000 turbines in 0-10 clusters. As part of our flexible concept, we offer a Park Controller Panel with the necessary hardware suitable for the harsh environment, irrespective of whether the wind park is onshore/offshore in a hot or in a cold climate or situated in a high altitude.

Installation
The panel is typically installed in the park office, in the substation container or in a turbine where it connects to the park network.

Field-Proven Technology
The panel is designed with our field-proven WP4100, WP4200 and WP100 Controller Platforms that runs special designed software for controlling the individual turbines or clusters. Apart from the controller, a number of inputs and outputs are required to communicate to and from the Transmission System Operator (TSO). Additionally, and depending on the configuration, measuring equipment for grid characteristics can be installed.

Options
The Wind Park Controller Panel comes with spare in- and outputs, which can, for example, be used for intruder alarms. The system is prepared for integration with other power generators than wind turbines, e.g. cluster of solar panels which could be controlled via analog or digital in- and outputs or even a new or existing communication protocol.

Concept Solution or Tailor-made
With +35 years of experience within the wind industry, Mita-Teknik has compiled a Wind Park Controller Panel that will fit most needs. However, should you require solutions for special purposes we are always prepared to compile a tailor-made solution that fits your specific needs.
Cluster Controller Panel

The Cluster Controller is a sub-controller in the Wind Park Control Concept, controlling up to 100 turbines. As part of our flexible Wind Park Control Concept, we offer a Cluster Controller Panel with the necessary hardware suitable for the harsh environment, irrespective of whether the wind park is onshore/offshore in a hot or in a cold climate or on a high altitude.

**Installation**

The panel is typically installed in the cluster office, in the cluster substation container or in a turbine where it connects to the park network to communicate with turbines and the Wind Park Controller.

**Field-Proven Technology**

The panel is designed with our field-proven WP4100, WP4200 and WP100 Controller Platforms that runs the specially designed software for controlling the individual turbines in the cluster. Apart from the controller, a number of inputs and outputs are installed to ensure communication, e.g. with UPS. Depending on the configuration, measuring equipment for grids characteristics can be installed.

**Options**

The Cluster Controller Panel comes with spare in- and outputs, which can, for example, be used for intruder alarms. The system is prepared for integration with other power generators than wind turbines, e.g. cluster of solar panels which could be controlled via analog or digital in-and outputs or even a new or existing communication protocol.

**Concept Solution or Tailor-made**

With +35 years of experience within the wind industry, Mita-Teknik has compiled a Cluster Controller that will fit most needs – however, should you require solutions for special purposes we are always prepared to compile a tailor-made solution that fits your specific needs.
Grid Station Panel

The Grid Monitor is a sub-controller in the Wind Park Control Concept, monitoring the park or cluster output. As part of our flexible Wind Park Control Concept, we offer a Grid Measurement Panel with the necessary hardware suitable for the harsh environment, irrespective of whether the wind park is onshore/offshore in a hot or in a cold climate.

Installation

The panel is typically installed in the park/cluster office, in the substation container or in a turbine where it connects to the wind park network in order to send its data to the Wind Park/Cluster Controller.

Field-Proven Technology

The panel is designed with our field-proven WP4100, WP4200 and WP100 Controller Platforms that runs the specially designed software for monitoring the grid characteristics at the point of common coupling. Apart from the controller, a number of inputs and outputs are installed to ensure communication, e.g. with UPS. The accurate measuring equipment for grid characteristics supports 1-5A and various voltage inputs from substation, making it easy to integrate with all TSOs.

Options

The Grid Measurement Panel comes with spare in- and outputs, which can, for example, be used for intruder alarms.

The system is prepared for integration with other power generators than wind turbines, e.g. cluster of solar panels which could be controlled via analog or digital in- and outputs or even a new or existing communication protocol.

Concept Solution or Tailor-made

With +35 years of experience within the wind industry, Mita-Teknik has compiled a Grid Measurement that will fit most needs – however, should you require solutions for special purposes we are always prepared to compile a tailor-made solution that fits your specific needs.
Weather Station Panel

The Weather Station is a sub-controller in the Wind Park Control Concept that monitors the ambient conditions like e.g. wind, temperature and humidity. As part of our flexible Wind Park Control Concept, we offer a Weather Station Panel with the necessary hardware suitable for the harsh environment, irrespective of whether the wind park is onshore/offshore in a hot or in a cold climate.

Installation

The panel is typically installed on a met mast, holding the sensors in various heights where it connects to the park network in order to send its data to the Wind Park/Cluster Controller for further data processing.

Field-Proven Technology

The panel is designed with our field-proven WP4100, WP4200 and WP100 Controller Platform that runs the specially designed software for weather monitoring. Apart from the controller, a number of inputs and outputs are installed to communicate with the different sensors like wind vanes, anemometers, hygrometer, PT100, ice detection etc.

Accessories

To the Weather Station Panel, we offer a wide range of field-proven sensors like temperature, anemometers, wind vanes, hygrometers, air pressure sensors, ultrasonic sensors and precipitation etc. All sensors are fully tested and compatible with the Weather Station.

Options

The Weather Station Panel comes with spare in- and outputs, which can, for example, be used for intruder alarms, and for other types of sensors and protocols for exchanging data.

Concept Solution or Tailor-Made

With +35 years of experience within the wind industry, Mita-Teknik has compiled a Weather Station that will fit most needs – however, should you require solutions for special purposes we are always prepared to compile a tailor-made solution that fits your specific needs.
Gateway Park Controller Data Panel

The Park Controller Data Panel for Gateway gives a comprehensive view of the data from the Grid Controller Application (GCA), including data related to active and reactive power production etc.

Screen Functions

The data panel consists of several sections. The top section presents information on the four main components controlled by the application:

- **Set points**
  - Set point mode, active and reactive power set points.

- **Output**
  - The values of active and reactive power production, divided into controlled and non-controlled parts.

- **Capability**
  - Active and reactive power capability, max values of active and reactive power and mean park wind speed.

- **Regulation details**
  - Number of controlled, non-controlled and offline clients.

The panel also shows Active Power Overview and Reactive Power Overview as two charts, each of them showing actual values and park set points, power and capability. Under the charts, two graphs show active and reactive power for the last 120 seconds.
Specifications subject to change
Wind Park Graphical Applet

- Wind park operation overview
- Active power control details
- Reactive power control details
- Local set points control
- Set points mode control
- Grid Measurements
- Produced by wind park energy data
- Statistical information

Graphical Applet Functions
The Graphical Applet gives a comprehensive graphical view of the data from the Grid Controller Application (GCA).

Installation
GLG Java applet is a part of CCA application image and can be installed on any WP4100, WP4200 or WP100 Controller Platforms. Graphical applet can be opened in any browser on the PC where Java is installed or from Gateway SCADA. Also it is possible to run Wind Park Graphical Applet on Mita-Teknik WP4051 MK II, WP4052 or WP4053 Touch Displays.

Screen Functions
The graphical applet shows all main information for wind park controller. It contains following data:

- Power Production
  Active and Reactive power production are presented on the applet in Bar and chart view.

- Set Points
  Active and Reactive power set points are presented on the applet in Bar and chart view. Also it is possible to change the set points’ modes and set the local set point value from the graphical applet.

- Capability
  Active and Reactive power capabilities are presented on the applet in Bar and chart view.

- Grid Measurements
  Wind park grid measurements from point of common coupling (PCC) are represented in meters view on the applet. There are Grid voltage, current, frequency and cos(phi) measurements.

- Energy Summation
  Active power energy production data is present on the applet. There are production values in MWh for Today, This Month and Total.

- Statistic Data
  Wind Turbines statistic data is present on the applet. It is shown number of grid connected, stopped, in fault, idling, P controlled, Q controlled, offline and total wind turbines in the wind park.

Specifications subject to change
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Wind Park
Graphical Applet
Layout
Grid Controller Application (GCA)

The main function of Grid Controller Application (GCA) is handling the control of wind turbines or clusters in the wind park. One Grid Controller application is able to control up to 100 wind turbines (only for WP4200 Controller Platform) and up to 50 wind turbines for other controllers’ types. It is possible to connect up to 10 cluster controllers to one wind park controller. Also GCA supports up to 5 grid measurement stations and up to 3 weather stations.

Installation
The GCA can be installed on a WP4100, WP4200 or WP100 Controller Platform on the Wind Park and/or Cluster controller.

Active Power Control
The purpose of the wind park Active Power Control is to limit the total generated active power according to the Transmission System Operator (TSO) demand or locally set limit. The TSO can order the wind park to operate either with unlimited or limited active power production via the P10518 TSO Client Application. The GCA is responsible for keeping the active power limitation at the point of common coupling (PCC).

Reactive Power Control
The Reactive Power Control for wind parks is very important for successfully integration of wind power into the electrical grid. Grid codes require wind parks to be able to adjust their power factor or reactive power to TSO requirements to meet system operating conditions. GCA receives a set point from TSO and uses the reactive power capabilities of the wind turbines, which are equipped with inverters to regulate reactive power at the point of common coupling.

Rate Control
If Rate Control function is enabled, the Wind Park Controller will monitor the change rate of wind park active power output. If the change rate of power output is more than limit value, the Wind Park Controller will generate a power limiting set points to each wind turbine to keep the change rate of collective active power output below configured limits.

Start/Stop Management
Start/Stop algorithm is useful when it is not possible to reduce park active power by wind turbines’ pitch system. The algorithm examines the need of starting or stopping of wind turbines by comparing the value of not regulated active power to the value of active power set point. Then Grid Controller application is able to stop or start wind turbines in accordance with one of selected strategy and defined for each wind turbine priority.

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Universal Interface to Wind Turbines
Start/Stop algorithm is useful when it is not possible to reduce park active power by wind turbines’ pitch system. The algorithm examines the need of starting or stopping of wind turbines by comparing the value of not regulated active power to the value of active power set point. Then Grid Controller application is able to stop or start wind turbines in accordance with one of selected strategy and defined for each wind turbine priority.

Grid Controller Application supports several communication protocols to wind turbines and is able to control wind turbines with different protocols simultaneously. Following protocols are already supported:

› M-Link
› M-Net
› Modbus TCP

New protocols support requires development of additional communicator application, which should handle the communication between third party wind turbines’ controllers and Grid Controller application.
The GCA receives set point commands from the TSO Client and distributes it to the Cluster Controllers and/or the wind turbines over M-Link communication.

The GCA installed on cluster controller receives set point commands etc. via M-Link communication from GCA installed on wind park controller and distributes it over M-Link communication to the wind turbines.

The GCA receives set point commands etc. from TSO Client and distributes it via the M-Net Communicator application over M-Net protocol.

Specifications subject to change

MT_Wind Park Control Concept Software_DataSheet_R5_0
Grid Monitor Application (GMA)

The main function of Grid Monitor Application (GMA) is measuring the grid characteristics at the point of common coupling and deliver information to the Grid Controller Application. GMA also implements advanced grid protection functionality.

Installation
The GMA is installed on a WP4100, WP4200 Controller or WP100 Controller - 30 Platform on Wind Park, Cluster and/or Grid Station Controller.

Accurate Grid Measurements
The GMA is able to measure the grid characteristics very accurately via the WP-Line 151 module or WP100 Controller - 30. From these inputs GMA calculates all necessary grid parameters like current, voltage, active power, reactive power, grid frequency, etc.

Power Summation
The GMA summerizes produced/consumed active and reactive power per day, month, year and totally. The user has access to daily, monthly and yearly production data for the last 30 days, 12 months and 30 years correspondingly.

Advanced Grid Protection
The Grid Monitor Application implements simple and advanced grid protection functions, which include configurable thresholds for over and under frequency, over and under voltage, overproduction, high frequency change rate, current asymmetry, phase shift and many others. The user is able to configure LVRT and LF RT.
The GMA utilises measurements from the WP100 Controller - 30 Platform or WP-Line 151 module to provide the GCA on a Wind Park or a Cluster Controller with accurate grid measurements via M-Link communication.

The GMA utilises measurements from the WP100 Controller - 30 Platform or WP-Line 151 module to provide the GCA on a Wind Park or a Cluster Controller with accurate grid measurements via shared variable interface on the same controller.
Transmission System Operator Client Application (TSO)

The TSO Client handles the communication between the grid operator and Wind Park Controller. Based on the commands from grid operator and grid security parameters, calculated inside the application, the TSO Client generates active and reactive power set points for Grid Controller or Data Bridge Applications.

Installation
The TSO Client application is installed on a WP4100, WP4200 or WP100 Controller Platform on Wind Park or Wind Turbine controller. On a stand-alone wind turbine, the TSO Client makes it possible to have the same interface to the grid operator as in larger systems.

Wide Range of Interfaces
TSO Clients provides a wide range of possible interfaces so that active power, reactive power, power factor and voltage at the point of common coupling can be controlled from outside and necessary data can be signaled back.

Active Power Reserve (Delta) Control
The Active Power Reserve Control function allows the grid operator to run the wind park with a constant reserved active power based on the capability value. Reserved active power can be used to support eventual power grid contingencies by allowing the wind park to increase the active power output in case it is required.

High and Low Frequency Response
The TSO Client Application is able to reduce the park active power automatically if high frequency is detected according to the defined gradient. It is also possible to use low frequency response if the wind park is running with enabled active power reserve function. The system will use reserved active power to increase the active power output during low grid frequency.

Voltage Control
In this mode TSO Client Application uses the reactive power capability of the wind park to control the voltage in the point of common coupling. Dependently on deviation between voltage and set point values, the TSO Client Application generates an inductive or capacitive reactive power set point to keep the voltage within the specified range.

Cos(ϕ) (P) Control
When mentioned above mode is selected, reactive power set point is calculated as a cos(ϕ) value which proportionally depends on the currently active power production.

Grid Code Compliance
The TSO Client Application is designed so a wide range of grid codes and grid operator interfaces can be accommodated.
In a Wind Park Controller the TSO Client handles the communication to the grid company via one of the many possible interfaces and supplies this data to the GCA.

In a stand-alone wind turbine the TSO Client handles the communication to the grid operator via one of the many possible interfaces and provides the set points to the wind turbine application via the DBA.
Data Bridge Application (DBA)

The Data Bridge Application (DBA) is the link between a wind turbine application and the Wind Park or Cluster Controller. The application can also be used for the direct communication between the grid operator and wind turbine.

Installation
The Data Bridge Application is installed on a WP4100, WP4200 or WP100 Controller Platform on Wind Turbine controller.

Added Value
The DBA supports the Wind Park/Cluster Controller with additional information normally not available in turbine applications, like active power capability based on theoretical power curve reactive power capability calculated from P-Q table.

Easy Setup
The DBA is fully designed to match the default settings of the Mita-Teknik power management object for wind turbine control applications. Installation and configuration is fast and easy.

Stand-alone Solution
The application is also used to establish the direct communication between a grid operator and a wind turbine with the help of the TSO Client Application.
The DBA handles the M-Link communication to a Wind Park- or Cluster Controller on behalf of the Wind Turbine Application.

To Wind Park/Cluster over M-Link
- P- and Q set points
- Start/stop commands
- Production data
- Weather data

The DBA handles the interface to a TSO Client on behalf of the Wind Turbine Application in case of a stand-alone turbine.

- TSO Client
  - P10518
  - I/O interface to grid company
  - Active power reserve (delta) control
  - Frequency response
  - Power factor control
  - \( \cos(\phi) \) (P) control
  - Voltage control

- DBA
  - P10501
  - Linking WT to M-Link or TSO client

- WTA
  - Pxxxxx
  - Wind Turbine Control Application

Specifications subject to change
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M-Net Communicator Application (MCA)

The MCA converts Wind Park controller to the M-Net communication router from locally or remotely installed Gateway SCADA systems to the wind park network with Ethernet or serial M-Net topology. The application also provides the communication between the Grid Controller Application and the WP3x00 Controllers.

**Installation**

The MCA is installed on a WP4100, WP4200 or WP100 Controller Platform on Wind Park or Cluster Controller together with Grid Controller Application.

**M-Net over Redundant Ethernet Rings**

The MCA can communicate with WP3x00 Controllers via redundant Ethernet rings. In that case, each WP3x00 Controller must be connected to the COM-port of Mita-Teknik ES1000 Ethernet switch.

**M-Net over Serial Rings**

Network configurations where WP3x00 Controllers are connected as one or more serial rings are also supported. Each such ring can be connected to the ES1000 COM-port or directly to the COM-port of Wind Park controller.

**Gateway Connections**

The M-Net Communicator Application manages up to 10 simultaneous Gateways SCADA system connections to the Wind Park. Different users can simultaneously monitor the same wind turbine and open up to 4 remote display sessions.

**Wind Park Control**

Thanks to MCA, wind turbines with WP3x00 Controllers are fully integrated to the new Mita-Teknik Wind Park Control Concept. Application prioritizes the data related to Park Control. This ensures control of the wind park in realtime, even if communication is overloaded.

**Multiple Fast Communications**

By using Ethernet and multiplexing technology, the MCA also makes it possible to access the individual controllers much faster than the original network and with up to 10 Gateway connections per unit/turbine. This is a big step up for existing parks that need multiple users to connect or stream real-time data via OPC, Modbus or other standard protocols.
The MCA handles the communication to wind turbines and controllers via M-Net. This gives the GCA a possibility to control WP3x00 controlled turbines.
Weather Monitor Application (WMA)

The Weather Monitor Application (WMA) monitors the ambient conditions in the wind park such as wind speed, wind directions, temperature and humidity etc.

Installation

The WMA is installed on WP4100, WP4200 or WP100 Controller Platform on Weather Station Controller, which interacts with the wind park controller via M-Link communication.
Panel Controller Application (PCA)

The Panel Controller Application (PCA) controls and supervises panel-specific functionalities like control of UPS, heating, fans, humidity and surge protection etc.

Installation

The PCA is suitable for installation on all WP4100, WP4200 or WP100 Controller Platforms and for many types of units like Wind Turbines, Wind Park Controllers, Cluster Controllers, Weather and Grid Stations.

Added Value

With the usage of a ready-made tested concept solution for controlling the panels, you can, by using parameters, ensure that the panel is controlled correctly and similarly in all your units.