Solar-Log™

Manual - Feed-In Management Control (from firmware 6.0.0) - V1.12

Solar-Log™

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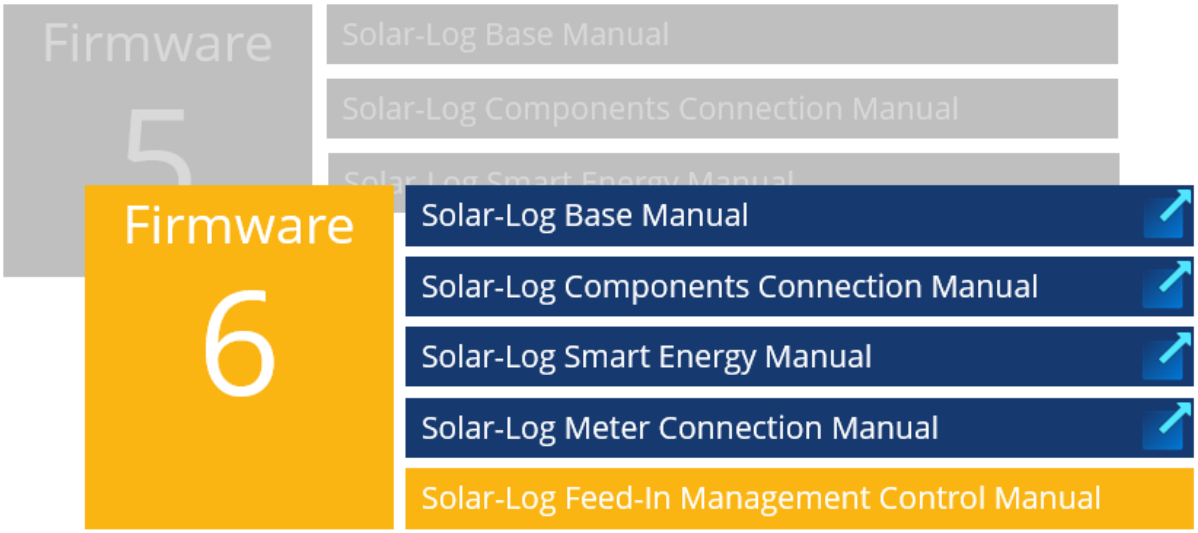
The Solar-Log™ Manual Orientation



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Introduction

This manual refers to firmware 6.0.0 (and higher) of the Solar-Log Base devices and describes the configuration of the functions for active and reactive power control as part of the feed-in management for photovoltaic systems (e.g. according to VDE-AR-4110). The functions for active and reactive power control are summarized in this manual under the term „PM control“.

The implemented functions for active and reactive power control are partly subject to licensing. Pay attention to the possibly necessary licenses already during the planning of the plant control. Further information on the subject of licenses can be found on our website www.solar-log.com.
The manual describes the license-free functions in part 1 and the functions requiring a license in part 2.
If more than one Solar-Log is used for plant control in a master-slave network, an additional network control license is required.

01

Feed-In Management (license free part)

1 Feed-In Management Functions

The following feed-in management functions are available in the license-free (cost-free) version:

Active power:

The active power can be permanently limited to a fixed percentage or to a fixed feed-in value. The current consumption can be taken into account for the limitation.

The input source of the limitation are:

- From Configuration - the maximum feed-in value is set fixed in the configuration.
- PM+ input - the feed-in value is transmitted via a ripple control receiver.

Different functions are available for the implementation of the consumption consideration. Which of these functions is to be used depends mainly on the possibility of placing the necessary meters.

Reactive power:

The reactive power can be set to a fixed value. The displacement factor and the value of the reactive power are available here.

Note

For both functions, individual interfaces can be activated and deactivated. Through this possibility, only parts of the plant can be controlled if required.

2 General parameters

2.1 Plant parameters

The menu item of the plant parameter is called via the following path:
Configuration | Feed-in management | Plant parameters

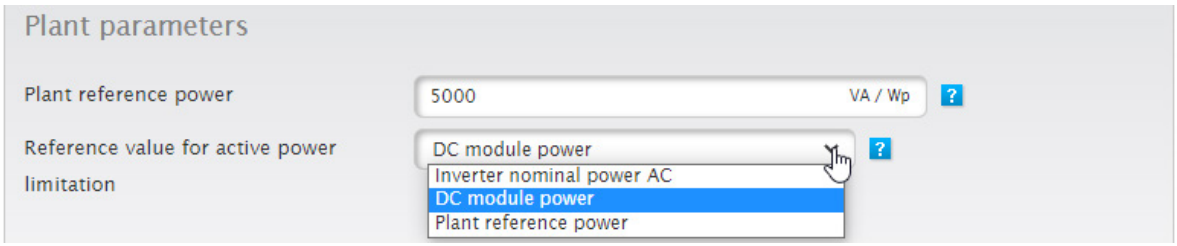


Fig.: Example - plant parameters

In order to be able to serve the different requirements of the energy suppliers, the reference value for the active power control is adjustable. The options AC nominal power, DC module power and reference power of the plant are available. The DC module power and AC nominal power are calculated from the inverter values, the reference power of the plant can be entered via the corresponding field.

2.1.1 Measurement grid connection point

Path:
Configuration | Feed-in management | Plant parameters | Measurement Grid Connection Point.

Fig.: Measurement of grid connection point (set to inactive in the example)

The data points for the feedback values are recorded with the data of this measuring point. Unless otherwise requested, the counter is set here at the grid connection point.

2.1.2 Measuring point for active power control

Path:
Configuration | Feed-In Management | Plant parameters | Measurement point for active power control

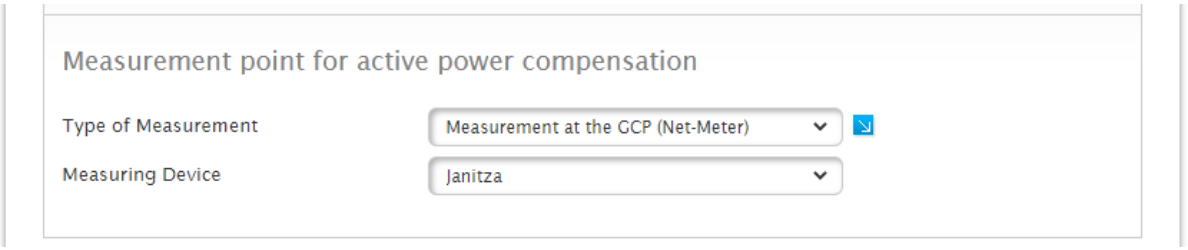


Fig.: Measuring point for active power control with example of the type and source

The measurement point for active power control is specified here. In our example, the measurement is performed at the feed-in point by a Janitza meter.
For more information on the „Limitation of active power“ function, see page 12.

3 Active power

In the following section, the following points of active power are explained:

- Power reduction
- Limitation
- Compensation mode

The active power area is called up via the following path:
Configuration | Feed-in management | Active power.

Note

The „Reduction to percentage of consumption“ mode available in firmware version 5.x is no longer available in firmware version 6.x and is replaced by the „Regulation to measuring point“ function.

3.1 Power reduction

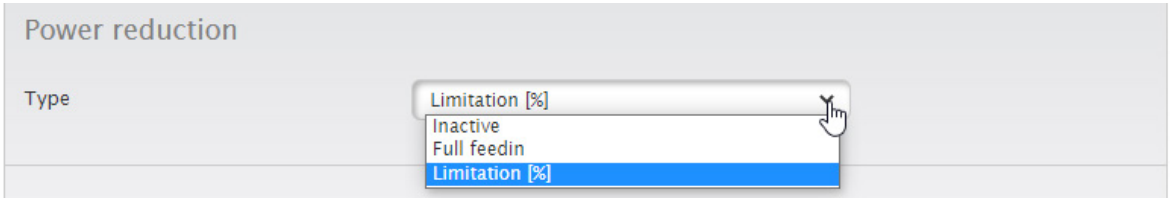


Fig.: Power reduction selection field

This selection field is used to define the type of active power control.

- Inactive:
  No control of the inverters takes place here.
- Full feed-in:
  The inverters are always controlled at 100%.
- Limitation:
  With this selection, the inverters are limited to a fixed value.
  The type of limitation is entered under „Limitation“.

Interface assignments to control

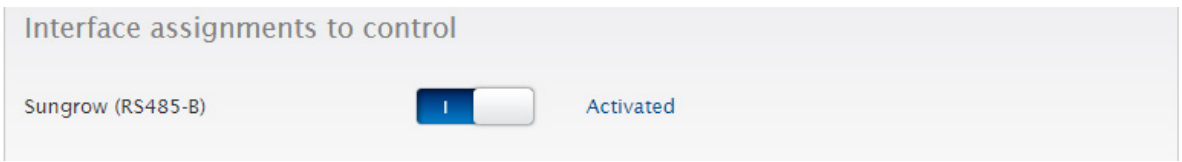


Fig.: Interface assignment with activated example

The interface to be controlled can be activated and deactivated via the slide control.
The interfaces are displayed depending on the assignment of the Solar-Log. This parameter can be used to limit the feed-in management control of the plant to individual interfaces.

3.2 Limitation

„From configuration“ or „PM+ input“ can be selected as the input source.
With input source „Configuration“ the value of the limitation is entered in % or as absolute value in Watt.
Example below. This entry limits the PV system to 70% of the plant power. By moving the slider from Watt [W] to Percent [%], the respective limiting value can be set.

Fig.: Limitation [%] - From configuration

With input source: „PM+ Input“, the individual switching stages of the ripple control receiver are assigned to the digital inputs of the Solar-Log MOD I/O. The example shows a typical setting for a 4 step control with the values 100, 60, 30, 0 in percent. Additional levels can be added via the plus symbol.

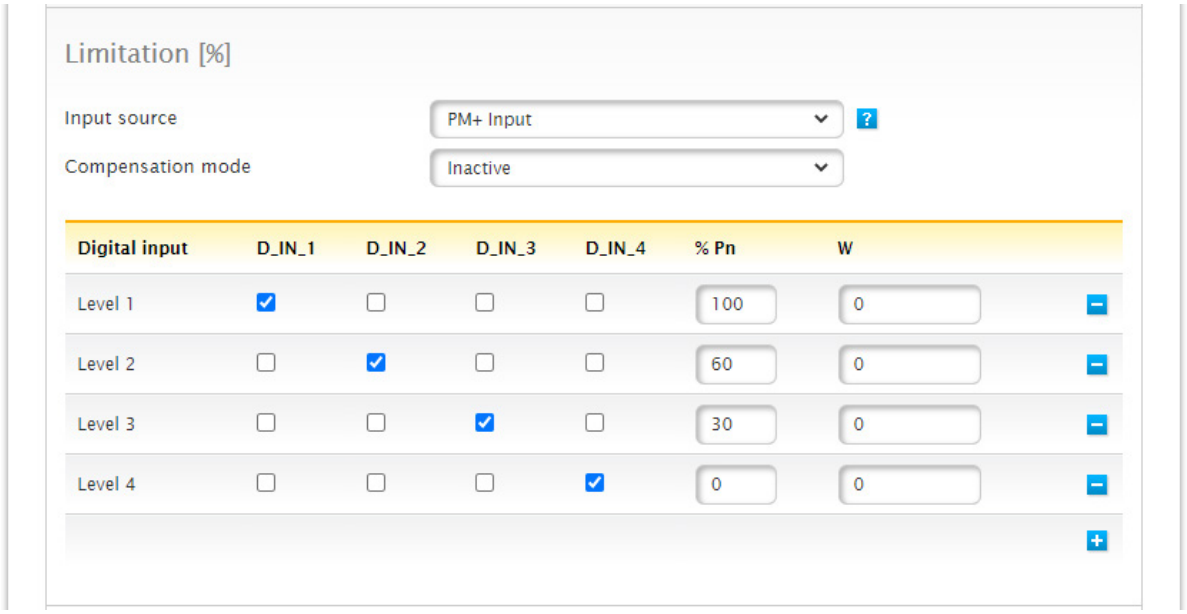


Fig.: Limitation [%] - PM+ Input with example settings

3.3 Compensation mode

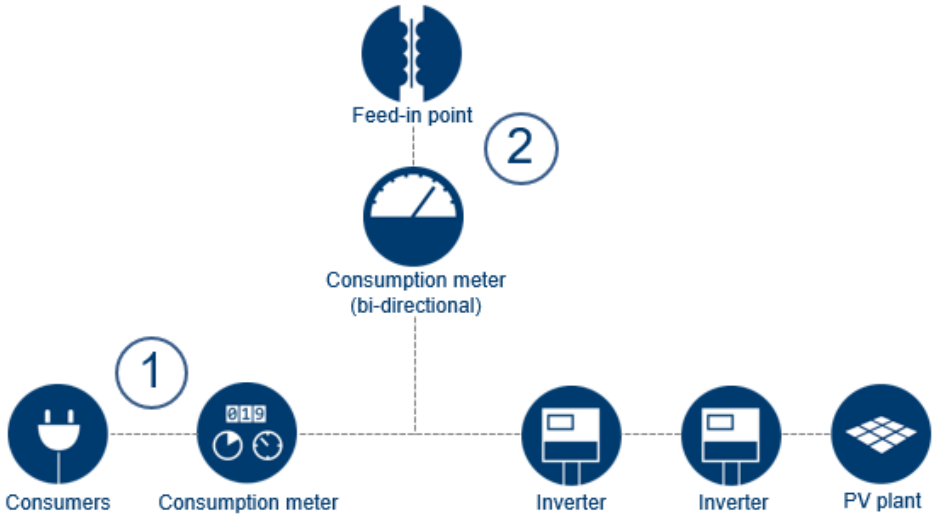


Fig.: Example - meter installation locations

The type of active power reduction, is specified by the installation location of the consumption meter.

- In the case of an explicit consumption meter, the compensation mode „Billing consumption“ is used. is used.
- In case of a meter at the supply point, the compensation mode „Regulation to measuring point“ is used.

Explanation of the example image

Meter location 1: Consumption meter

The meter is integrated as a pure consumption meter in the consumer branch of the installation. All consumption of the system runs through this meter and is thus recorded. The Solar-Log™ uses the production and consumption values to determine the surplus and then decides on the basis of the set configuration whether the system must be limited.

Meter location 2: Consumption meter (2-direction meter - measurement at GCP (grid connection point))

The current direction and quantity is controlled via this meter. Depending on these values, the inverters are controlled directly. In order to prevent unwanted feed-in even with extremely fluctuating consumption, the control works with an adjustable limit (buffer). The preset limit is usually suitable for all plants and should only be changed with caution.

Note on restrictions for the active power function „Control to measuring point“.

For the active power function „Control to measuring point“, the inverter must support the necessary, fast active power changes. With older inverters, this often leads to problems, which means that the limitation cannot be implemented correctly.

An indication that the inverters can process these active power commands quickly is if the model or inverter family supports VDE 4110, 4120, or 4105.

In systems with very high consumption fluctuations, it may not be possible to maintain the x% control. To counteract this condition we have added a configurable safety buffer. This buffer can be adapted to the consumption fluctuations of the plant if necessary (a buffer of 3% is preset here by default).

- ► This function is supported by all utility meters as well as the Solar-Log PRO380, Solar-Log PRO380-CT and the Schneider Electric iEM 3000 Series meters.

- ► The „x% control“ function is currently not supported in an interconnected control system.

To protect the x% feed-in, we recommend the use of a fuse in the form of a meter with relay triggering.
This fuse protection is also urgently required in the event of a Solar-Log failure, a component communication failure, or the failure of the measuring device.

- ► If you have any questions, please contact our support.

The following are two examples of limitation settings

Example 1 - Meter location 1: Consumption meter

Configuration of a 70% limitation with consideration of self-consumption with an explicit consumption meter. Here, the type „Limitation [%]“ must be selected in the active power area and the input source (in the example: „From configuration“), the compensation mode „Billing consumption“ and the „Limitation by“ must be entered at 70 %. By switching, using the slide control, the value can also be entered in watts.

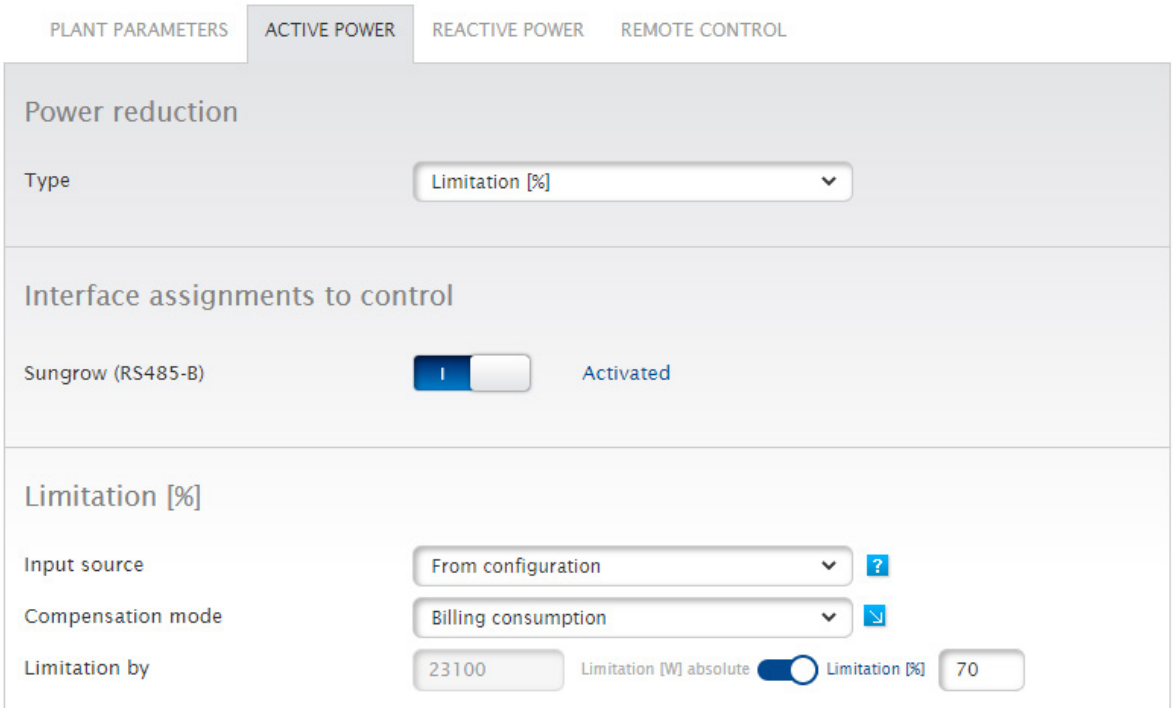


Fig.: Example with 70% limitation and billing consumption

Note

See also example picture - „Meter installation locations“ and explanations on page 13.

Example 2 - Meter location 2: Consumption meter (bi-directional) - measurement at the grid connection point

Configuration of a 70% limitation with a 2-direction meter at the feed-in point (grid connection point). Here, settings must be made both in the active power area and in the system parameters area.
In the active power area, the type „Limitation [%]“ must be selected and the input source (in the example: „From configuration“), the compensation mode „Control to measurement point“ and „Limitation by“ must be set to 70%.

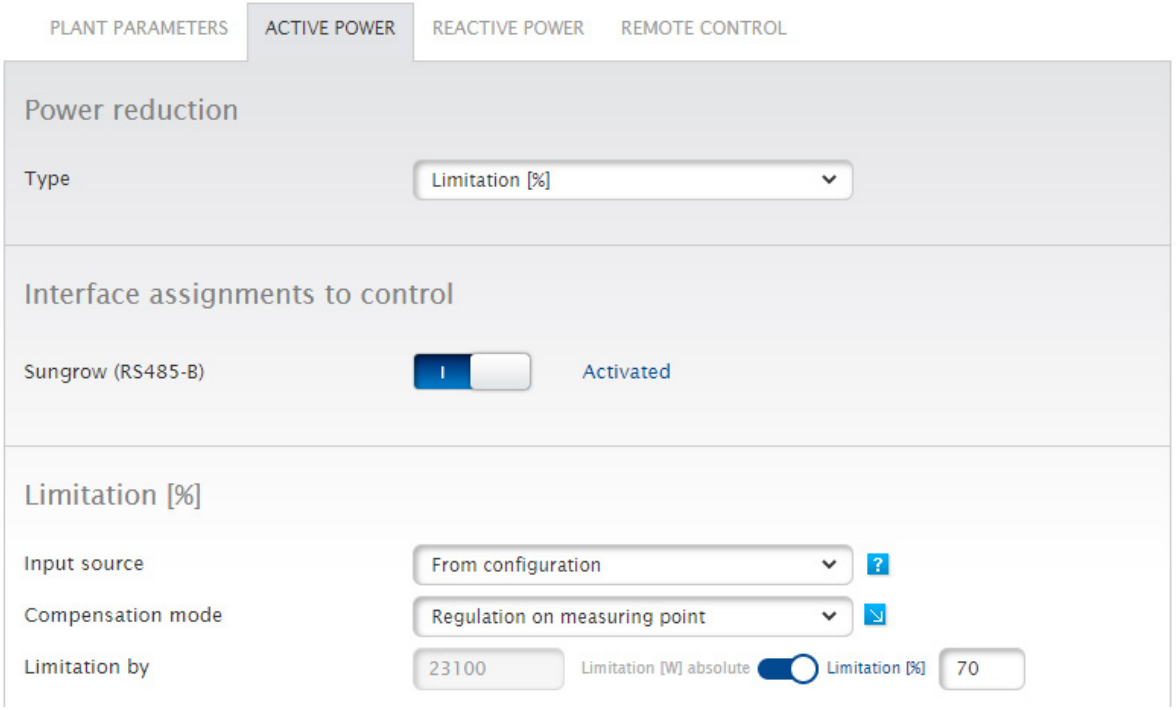


Fig.: Example with 70% limitation and control to measuring point

In the Plant parameters section, the following parameters are important under the „Measuring point for active power control“ item for 70% limitation with 2-direction meter:

- Type of measurement:
  Select measurement at GCP (Grid Connection Point) (2-direction meter).
- Source for measurement:
  Here the source of the measurement must be determined. In the example, this is the „Janitza“ meter.

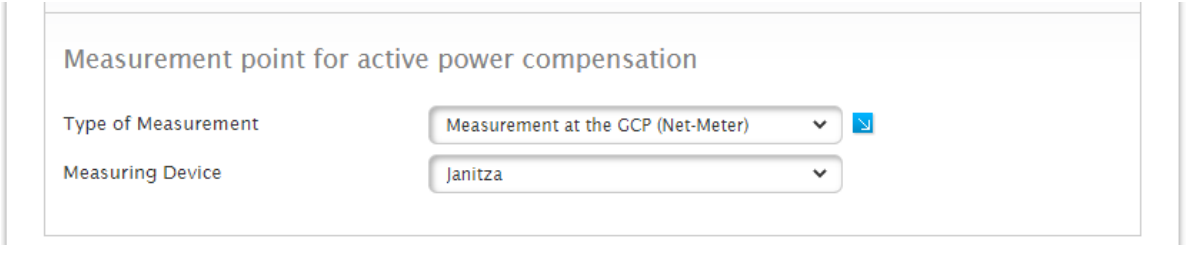


Fig.: Example of measuring point for active power control (2-direction meter)

Note

See also example picture - „Meter installation locations“ and explanations on page 13.

4 Reactive power

The menu item of the reactive power can be found under Configuration | Feed-in management | Reactive power control.

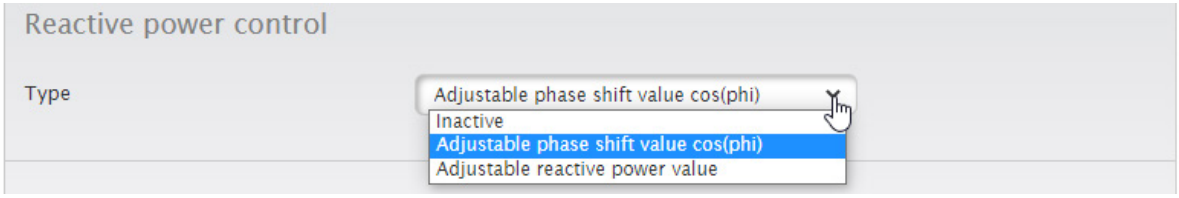


Fig.: Reactive power control

At this point the type of reactive power control is defined. The value can be set as a displacement factor in the form of a cos(phi) or as reactive power in Q.

4.1 Interface assignments to control

Path:
Configuration | Feed-in management | Active power | Interface assignments to control

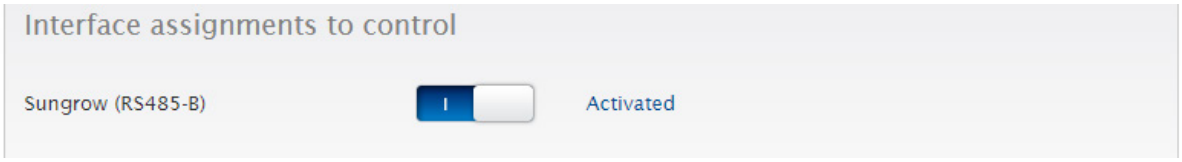


Fig.: Interface assignments to be controlled with example inverter

The interface to be controlled can be activated and deactivated via this slider.
The interfaces are displayed depending on the assignment of the Solar-Log™. Via this parameter it is possible to control only plant parts.

4.2 Adjustable reactive power value

Path:
Configuration | Feed-in management | Active power | Adjustable reactive power value

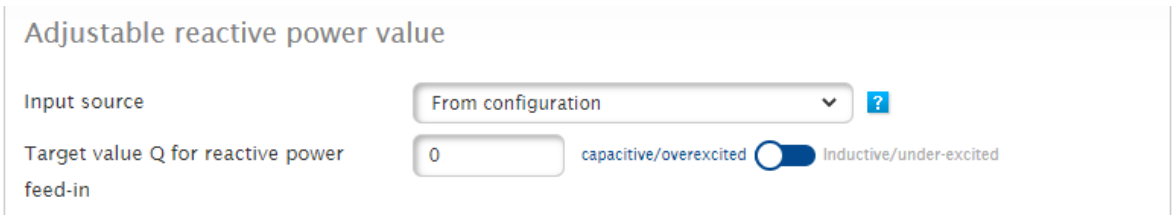


Fig.: Adjustable reactive power with input source

Depending on the type selected above, the displacement factor or the value of the reactive power can be set here.

4.3 Limits

Path:
Configuration | Feed-in management | Active power | Limits

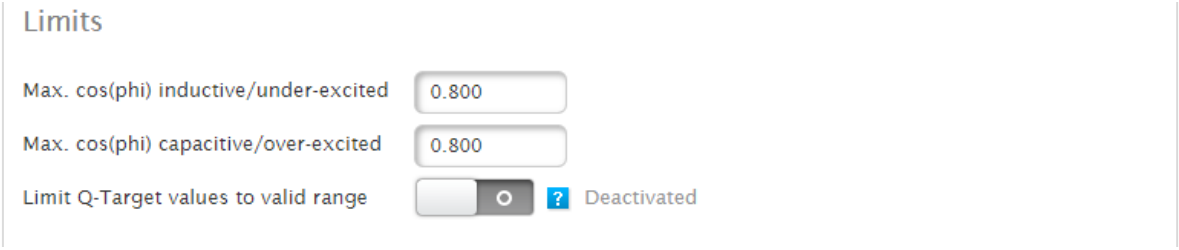


Fig.: Limits with example data

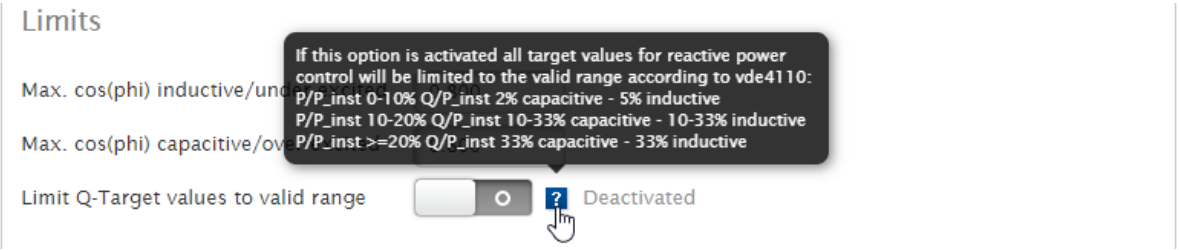


Fig.: Limits with example data and displayed help text

The maximum values of the cos(phi) inductive and capacitive can be specified via the item Limits. If the area „Limit Q-Target values to valid range“ is activated, all targets for reactive power control of the inverters are limited to the valid range according to vde4110. (See help text)

5 Diagnostics

A detailed description of the possible diagnostic functions can be found in the license required part (Pro version) of this manual in the chapter 10.

02

Feed-In Management
Pro Version
(license required part)

1 Feed-In Management Functions

In the course of the VDE 4110 certification of the Solar-Log™, we have fundamentally renewed the feed-in management section. Here, the Solar-Log Base with firmware 6.x was expanded to a complete park controller.

In the area of active power, the existing functions were expanded and new regulations for the compensation of self-consumption were added.

The reactive power area includes all relevant reactive power controls. The controllers operate voltage or power controlled and are flexibly configurable.

Fallback functions have been added so that the status of the system is always defined even in the event of a fault or failure of a component. These fallback functions are used to intercept possible failures of the utility meter or the remote control system.

An adjustable interpolation between the target values defines the way new target values are transferred to the inverters.

All controls can be switched on and off via a remote control system using Modbus, and various parameters are available for modifying settings.

2 General parameters

The configuration area contains the items Plant parameters and Measurement points. In this area, the basic parameters for the smooth operation of the PV system are set.

2.1 Plant parameters

Path:
Configuration | Feed-in management | Plant parameters

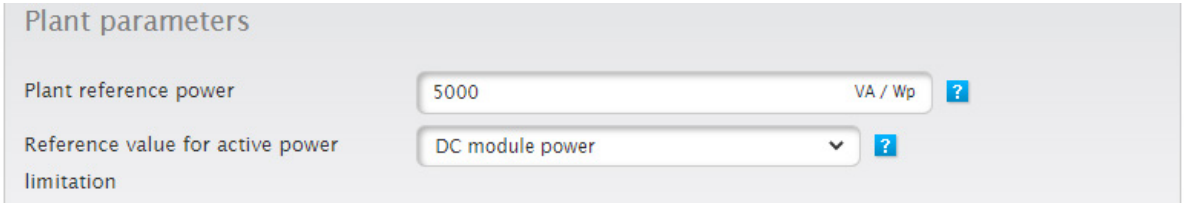


Fig.: Example - reference power of the plant

In order to be able to serve the different requirements of the energy suppliers, the reference value for the active power control is adjustable.

The following options are available:

- Inverter nominal power AC
- DC module power
- Plant reference power

The DC and AC power is calculated from the inverter values, the reference power can be entered via the corresponding field.

2.1.1 Measurement Grid Connection Point

Path:
Configuration | Feed-in Management | Plant parameters | Measurement Grid Connection Point

Fig.: Measurement Grid Connection Point - Example - Source for Measuring Device Inactive

The data points for the feedback values are recorded with the data of this measuring point. Unless otherwise requested, the meter at the grid connection point is stored here.

2.1.2 Measurement PV Plant

Path:
Configuration | Feed-in Management | Plant parameters | Measurement PV Plant

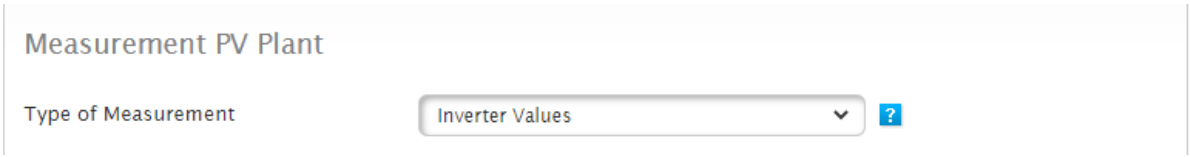


Fig.: Measurement PV Plant - Example - Type of Measurement „Inverter Values“

For certain requirements, an overall measurement of the PV plant is necessary.

2.1.3 Measurement Point Voltage (Curve Operation Q(U)/CosPhi(U))

Path:
Configuration | Feed-in Management | Plant parameters | Measuring Point Voltage (Curve Operation Q(U)/CosPhi(U))

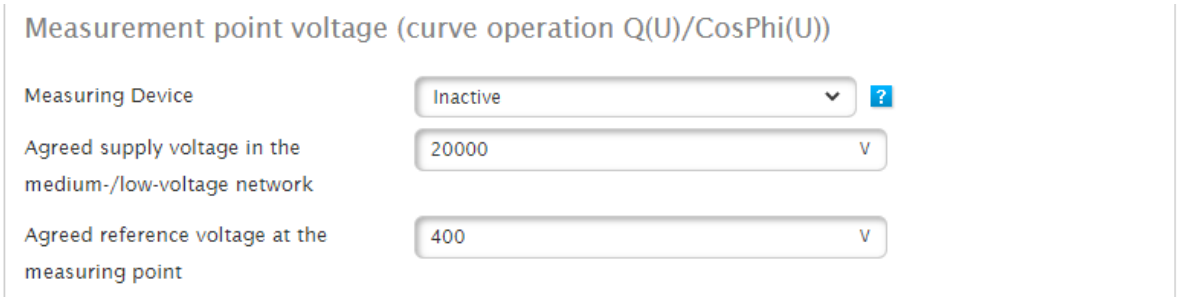


Fig.: Measurement Point Voltage with example values

The measurement point for the voltage-controlled characteristic curves is stored here. The supply and reference voltage of the meter must be recorded according to the specifications of the grid operator.
The measured values of the utility meter can be checked in the Diagnosis | Feed-in management | Utility meter area.

2.1.4 Measurement Point Active Power (Curve Operation Q(P)/CosPhi(P))

Path:
Configuration | Feed-in Management | Plant parameters | Measurement Point Active Power (Curve Operation Q(P)/CosPhi(P))

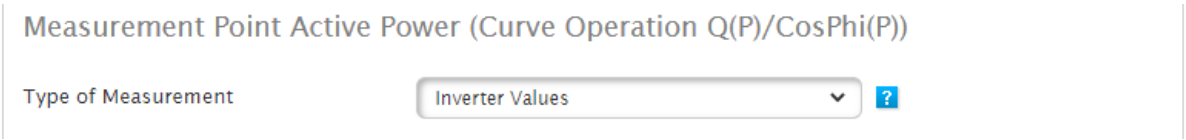


Fig.: Measurement Point Active Power - For example - Type of Measurement „Inverter Values“.

The measurement point for the current-guided characteristic curves is stored here. As a rule, the inverter values are used.

2.1.5 Measurement Point for Reactive Power Compensation

Path:
Configuration | Feed-in Management | Plant parameters | Measurement Point for Reactive Power Compensation

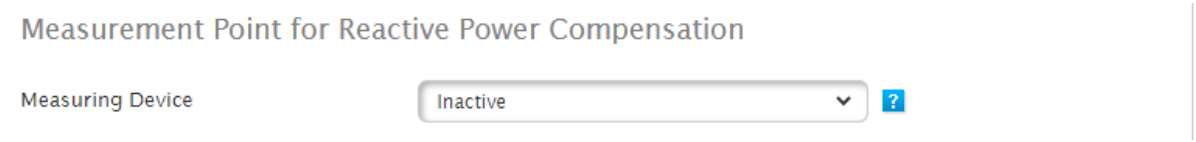


Fig.: Measurement Point for Reactive Power Compensation - For example „Inactive“

The measurement point for reactive power compensation is stored in this field. For certain plant constellations (mixed plants), different measurement points are prescribed for the voltage and the compensation measurement.

2.1.6 Measurement point for active power compensation

Path:
Configuration | Feed-in Management | Plant parameters | Measurement point for active power compensation

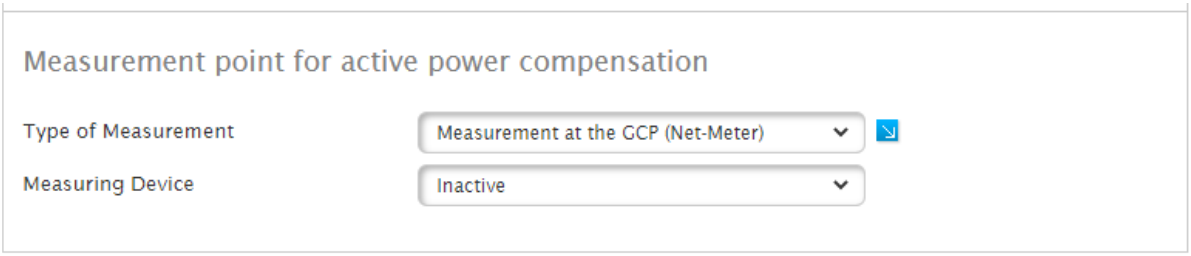


Fig.: Measurement point for active power compensation - For example - „Measurement at the GCP (Grid Connection Point)“

This parameter defines the measurement of the active power for an x% control.

- The „Type of measurement“ parameter defines the measurement point.
- „Source of measurement“ defines the meter.

3 Active Power

In this area, the configuration of the Solar-Log™, all settings related to the active power are made.

3.1 Power reduction

Path:
Configuration | Feed-in Management | Active power | Power reduction

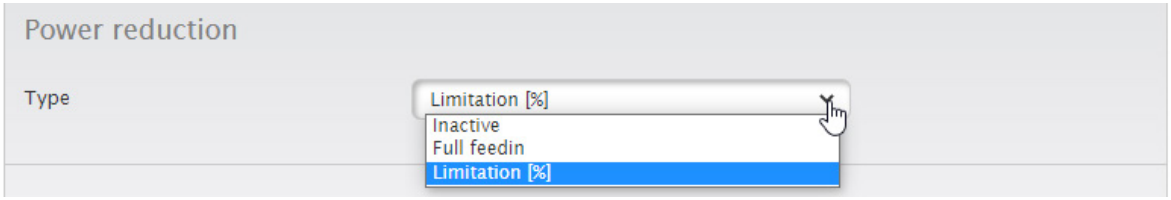


Fig.: Power reduction selection field

This selection field is used to define the type of active power control.

- Inactive:
  No control of the inverters takes place here.
- Full feed-in:
  The inverters are always controlled at 100%.

Limitation:
With this selection, the inverters are limited to a fixed value.
The type of limitation is entered under „Limitation“.

The reference value for the limitation is set under „Configuration | Feed-in management | Plant parameters | Plant reference power“.

Note

The correct entry of the reference power is very important and must be coordinated with the energy supplier.

The type of limitation is entered under „Limitation [%]“.

3.1.1 Interface assignments to control

Path:
Configuration | Feed-in Management | Active power| Interface assignments to control

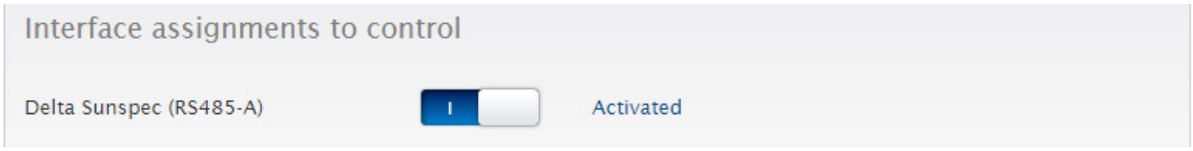


Fig.: Interface assignments to control - For example, „with Delta Sunspec“.

The interface to be controlled can be activated and deactivated via this controller.
The interfaces are displayed depending on the assignment of the Solar-Log. Via this parameter it is possible to control only certain plant parts.

3.2 Limitation

„From configuration“ or „PM+ input“ can be selected as the input source.
With input source „Configuration“ the value of the limitation is entered in % or as absolute value in Watt.
Example below. This entry limits the PV system to 70% of the plant power. By moving the slider from Watt [W] to Percent [%], the respective limiting value can be set.

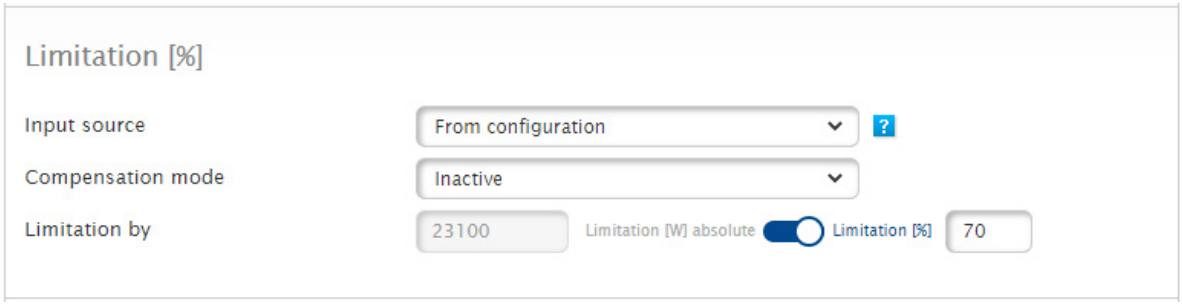


Fig.: Limitation [%] - From configuration

With input source: „PM+ Input“, the individual switching stages of the ripple control receiver are assigned to the digital inputs of the Solar-Log MOD I/O. The example shows a typical setting for a 4 step control with the values 100, 60, 30, 0 in percent. Additional levels can be added via the plus symbol.

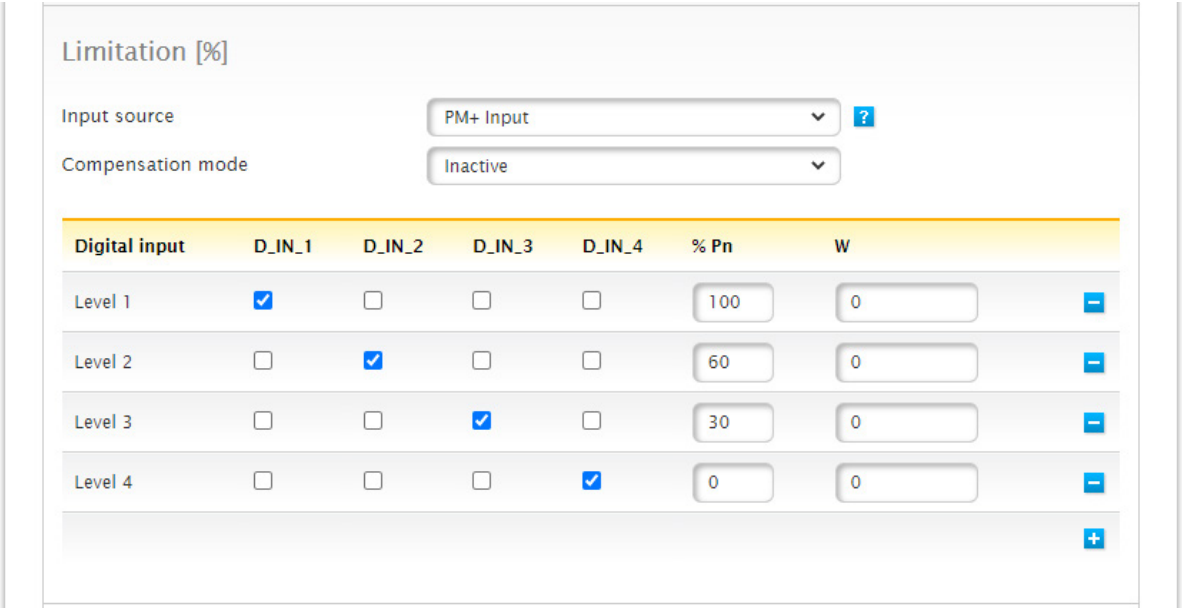


Fig.: Limitation [%] - PM+ Input with example settings

3.2.1 Fallback settings

Path:
Configuration | Feed-in Management | Active power| Fallback settings

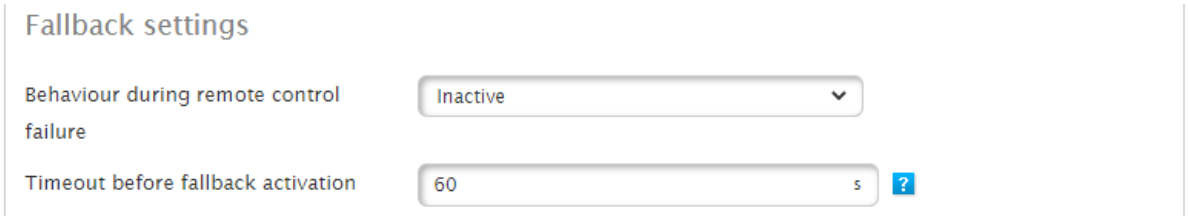


Fig.: Example - Fallback settings to inactive

The fallback settings define the plant status in the event of a failure of the connection between the remote control technology and the Solar-Log.
The monitoring of the communication (watchdog) is carried out either by the remote control technology or directly by the Solar-Log. Please choose one of the options. The simultaneous use of both watchdog functionalities can lead to problems.

Option 1 - Remote control technology describes defined watchdog registers.

Here, the remote control technology actively writes a register with changing values at defined intervals. The writing of this register is monitored by the Solar-Log. To activate this function, an interval in seconds is set in Modbus V2 register 10213. Within this interval, the value in register 10211 must change. If this value does not change, the Solar-Log detects a communication failure of the remote control technology.
(Modbus_PM_V2 register 10213 WatchDog_Time and 10211 WatchDog_Tag. For more information, please refer to the document: SolarLog_Datasheet_Modbus_TCP_PM_V2).

WatchDog_Tag	-	32 bit unsigned	10211	2	4/16	3.3.0	Watchdog register to indicate valid power limit settings
WatchDog_Time*	sec	32 bit unsigned	10213	2	4/16	3.3.0	Watchdog timeout 0=deactivated

Fig.: Extract Modbus_PM_V2 register with number 10211 and 10213

Option 2 - Solar-Log actively monitors the Modbus_PM_V2 registers.

This function is activated in the Configuration | Feed-in management | Remote control area.
Validation of the Modbus_PM_V2 interface by write accesses - activate.
Time until error - input in seconds.

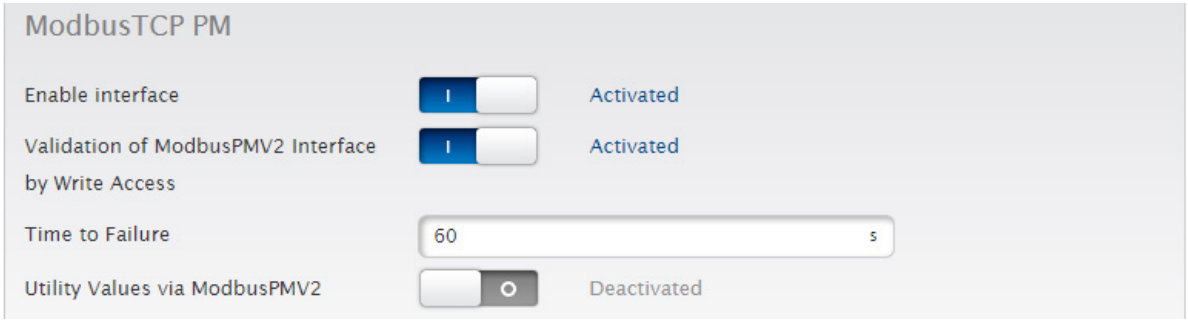


Fig.: Modbus TCP PM with example settings

After the watchdog monitoring is active, the Solar-Log switches to the set function.
The following functions are available:

- Inactive
- Last valid value
- Fallback value from configuration
- Full feed-in
- Limitation in %, Watt, or % consumption

If the fallback function requires parameters, these can be entered directly.

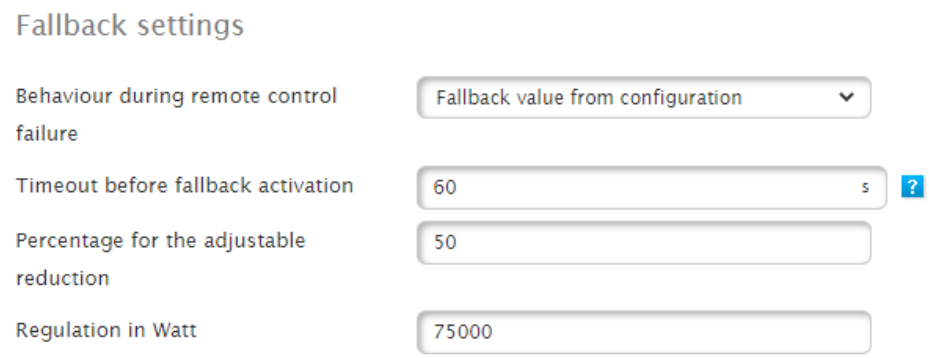


Fig.: Fallback settings with example values

The currently valid function cannot be set as fallback.

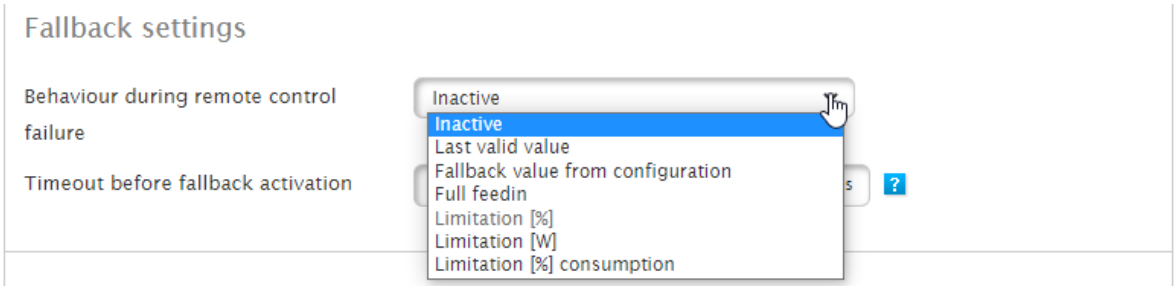


Fig.: Fallback settings with selection menu

3.2.2 Utility fallback settings

Path:
Configuration | Feed-in Management | Active power | Utility fallback settings

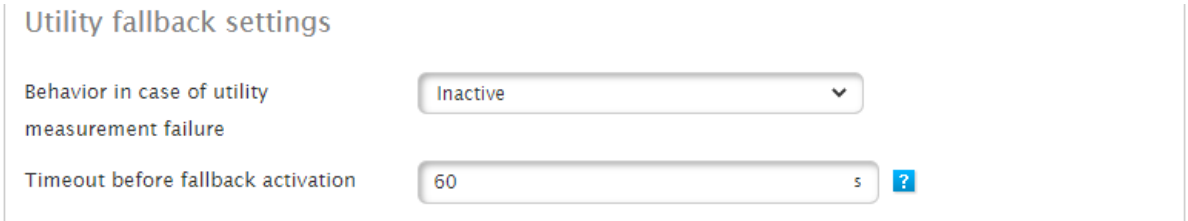


Fig.: Utility fallback settings in the example set to inactive

The utility fallback settings define the plant status in the event of a failure of the measured values from the Utility Meter between the remote control technology and the Solar-Log. The required scenarios and the time in seconds until switchover to fallback can also be set for this case.

The following scenarios can be selected as fallback:

- Inactive
- Deactivate control
- Last valid value
- Full feed-in
- Limitation in %, Watt, or % consumption

3.2.3 Interpolation between target values

Path:
Configuration | Feed-in Management | Active power| Interpolation between target values

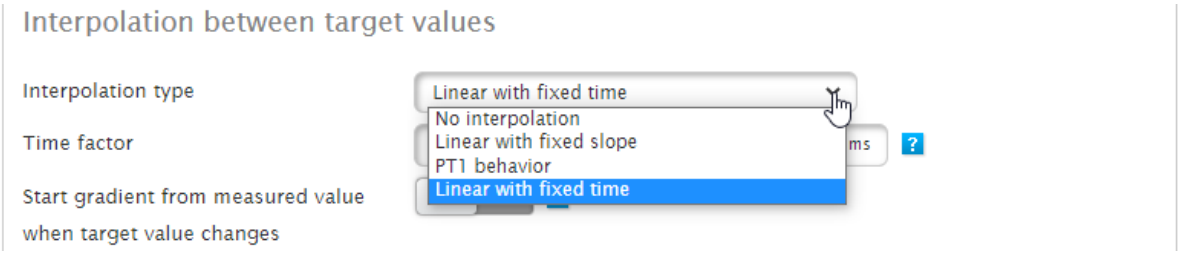


Fig.: Interpolation between target values with selection menu

The item: Interpolation between target values regulates the control of the inverters by the Solar-Log in the event of a change in active power.
The following parameters are available:

- No interpolation
  The changed setpoint of the active power is sent directly to the inverter. The change of the setpoint is defined by the setting in the inverter.
- Linear with fixed slope
  With this setting, the setpoint is approached via a linear ramp. The slope of the ramp is set via the Maximum change parameter. The parameter is recorded in percent per second. Different ramps can be defined for rising and falling values.
- PT1 behavior
  The new setpoint is controlled via a PT1 curve. The curve is defined by the time constant Tau. The input value corresponds to 1 Tau in milliseconds. The time constant for the PT1 curve is usually defined by the power supplier.
- Linear with fixed time
  The control of the new setpoint happens, independent of the size of the jump, in a defined time span. The time is entered in milliseconds.

3.2.4 Grid Safety

Path:
Configuration | Feed-in Management | Active power| Grid Safety

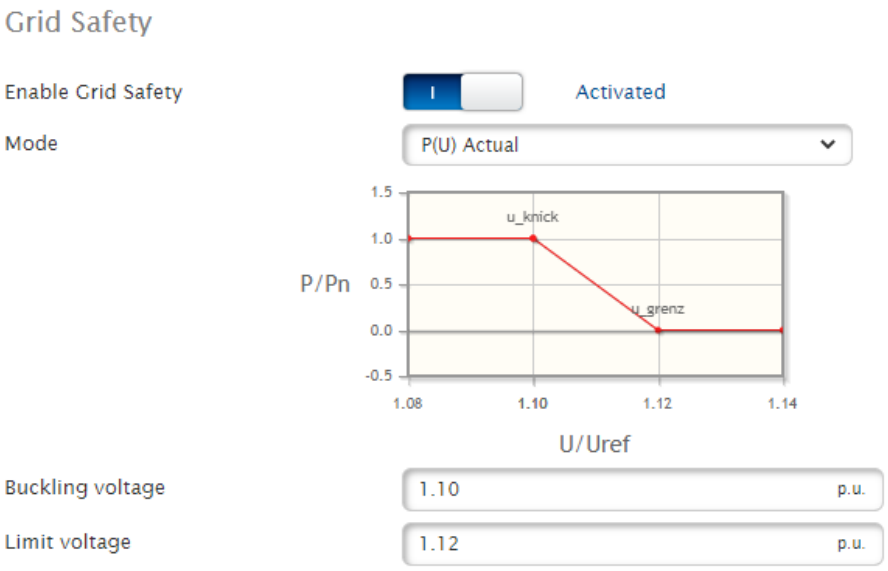


Fig.: Network security with example values

This switch is used to activate P(U) control (voltage-controlled active power derating). The modes P(U) Nominal and P(U) Actual are available. The curve to be adhered to is defined via the kink and limit voltage parameters.

4 Reactive power

To be able to make settings on the reactive power, call up the menu via the following path:
Configuration | Feed-in management | Reactive power

4.1 Explanations of the settings and functionality

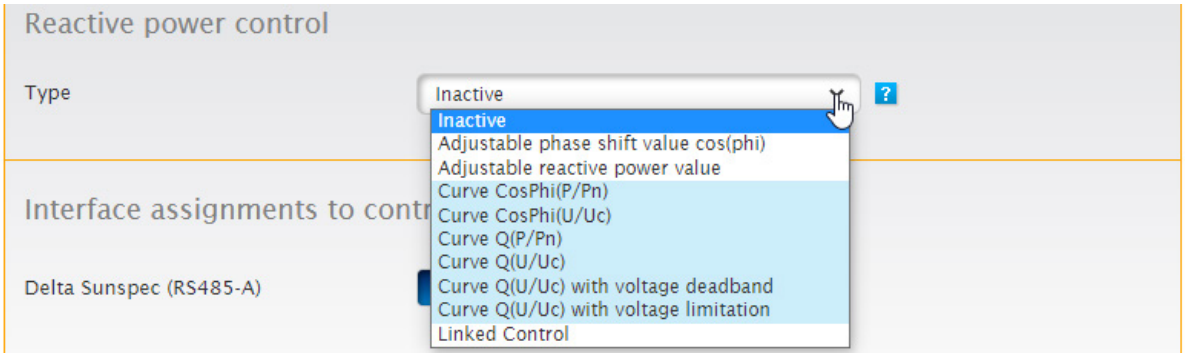


Fig.: Reactive power control with „Type“ selection menu

The type of reactive power control is set via the „Type“ item. The following functions are available:

Inactive

There is no reactive power control.

Adjustable phase shift value cos(Phi)

The phase shift factor for the plant is transmitted directly to the inverters. This value can be transferred to the Solar-Log via different sources.
The following sources are available for recording / transferring the setpoints to the Solar-Log:

- From configuration
  The phase shift factor cos(Phi) is stored as a fixed target value.
- PM+ Input
  The phase shift factor cos(Phi) is transferred to the Solar-Log via a ripple control receiver. The assignment of digital input to value is entered via a matrix. A Solar-Log MOD I/O module is required for this function.
- Modbus PM V1
  The phase shift factor cos(Phi) is transferred via the Modbus PM V1 interface. Version 1 of the interface is only available for compatibility reasons and must no longer be used for current installations.
- Modbus PM V2
  The phase shift factor cos(Phi) is transferred via the Modbus PM V2 interface. Please refer to the Modbus TCP PM V2 document on our homepage for the register description.
- Analog input
  This parameter is required when using a PM package. After activation, the device (Adam Box) that transfers the value via an analog input must be specified. For more information, please refer to the documentation of the PM package.

Adjustable reactive power

The target value Q for the reactive feed-in is transmitted directly to the inverters. This value can be transferred to the Solar-Log via different sources.
The following sources are available for recording / transferring the setpoints to the Solar-Log:

- From configuration
  The value Q for the reactive power is stored as a fixed target value. It can be specified capacitively or inductively.
- Modbus PM V2
  The value Q for the reactive power is transferred via the Modbus PM V2 interface. Please refer to the Modbus TCP PM V2 document on our homepage for the register description.
- Analog input
  This parameter is required when using a PM package. After activation, the device (Adam Box) that transfers the value via an analog input must be specified. For more information, please refer to the documentation of the PM package.

Curve cos(Phi)(P/Pn)

This curve is power controlled and enables reactive power control depending on the current inverter production. The control is done by setting the shift factor cos(Phi).
The necessary production measurement can be done via a meter or by adding the inverter values. This setting is made in the plant parameters. (See chapter „Measurement Point Active Power (Curve Operation Q(P)/CosPhi(P))“)
The curve is set by parameters, which are usually specified by the network operator.

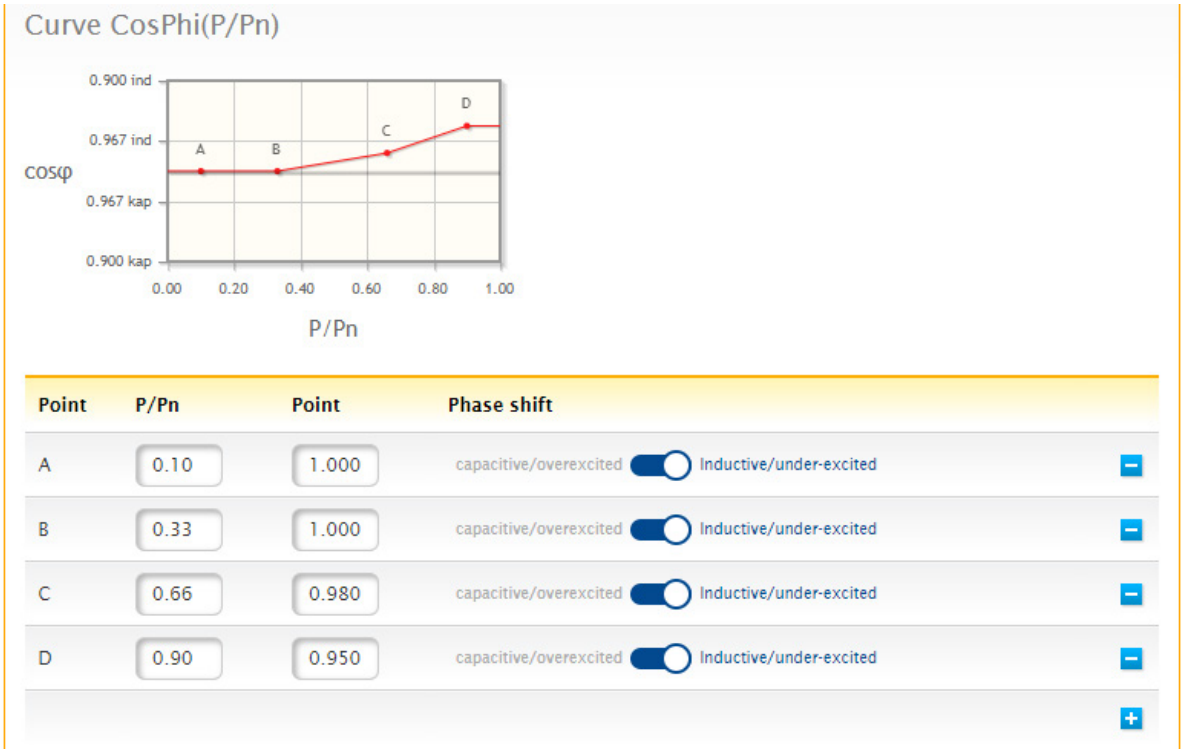


Fig.: Curve cos(Phi)(P/Pn) with example values

Curve cos(Phi)(U/Uc)

This curve is voltage controlled and enables reactive power control depending on the current voltage in the network. The control is done by presetting the shift factor cos(Phi).
The necessary measurement takes place via a meter (utility meter) on the medium or low voltage side. The measured voltage is applied to the set curve by the Solar-Log and then converted. The meter is assigned in the system parameters. (See chapter „Measurement Point Voltage (Curve Operation Q(U)/CosPhi(U))“)
The curve is set by parameters, which are usually specified by the network operator.

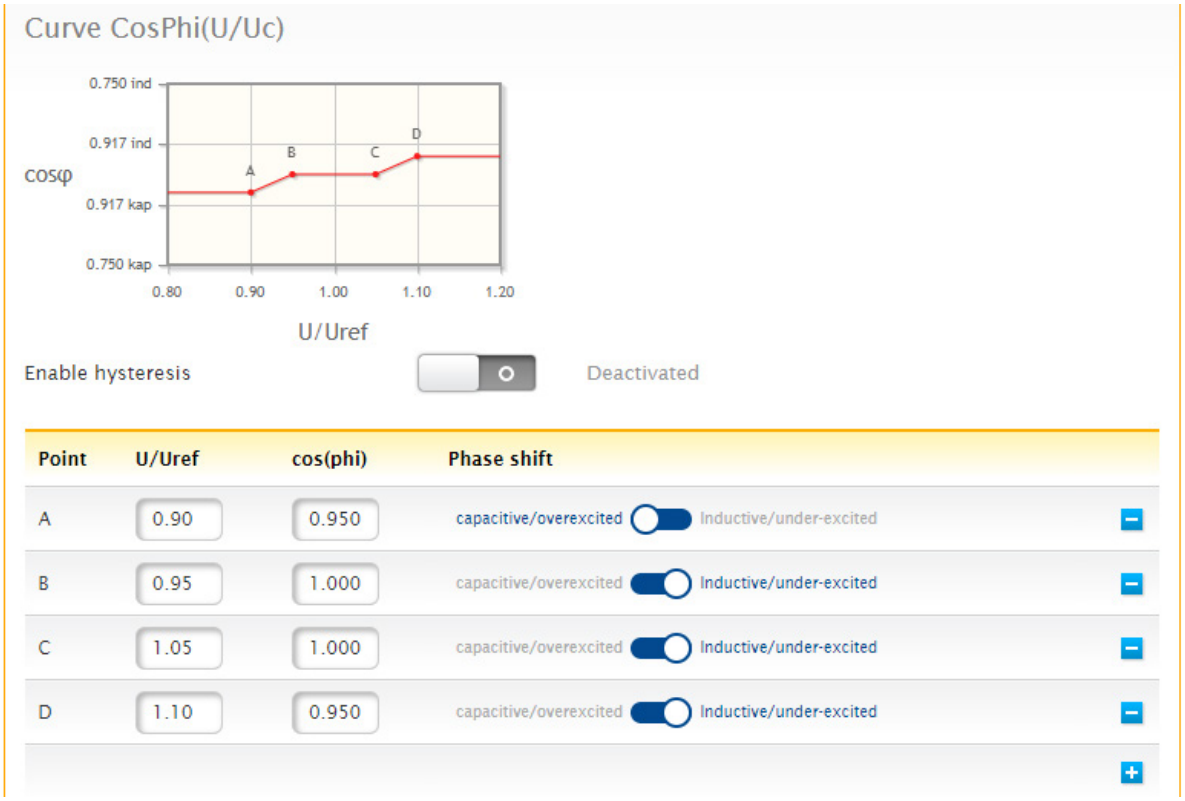


Fig.: Curve cos(Phi)(U/Uc) with example values

Curve Q(P/Pn)

This curve is power controlled and allows reactive power control depending on the current inverter production. The control is done via the reactive power Q.
The necessary production measurement can be done via a meter or by adding the inverter values. This setting is made in the plant parameters. (See chapter „Measurement Point Active Power (Curve Operation Q(P)/CosPhi(P))“)
The curve is set by parameters, which are usually specified by the network operator.

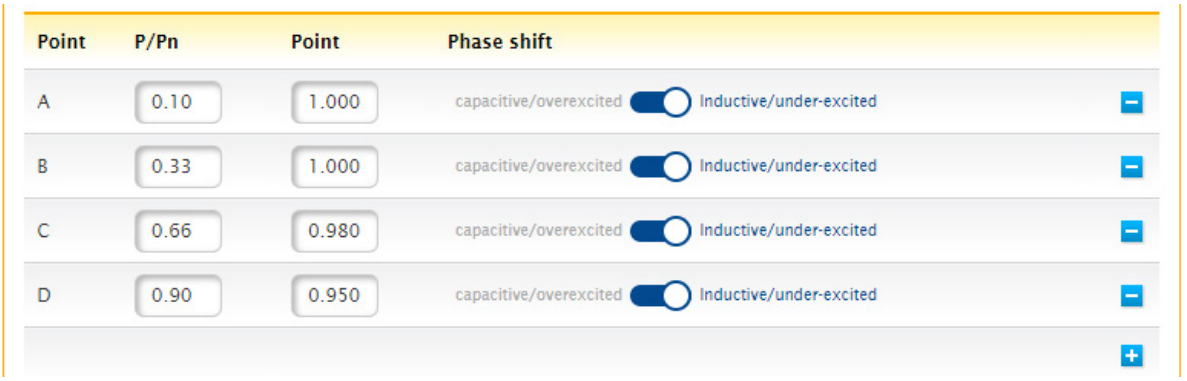


Fig.: Curve Q(P/Pn) with example values

Curve Q(U/Uc)

This curve is voltage controlled and enables reactive power control depending on the current voltage in the network. The control takes place via the specification of the reactive power Q.
The necessary measurement takes place via a meter (utility meter) on the medium or low voltage side. The measured voltage is applied to the set curve by the Solar-Log and then converted. The meter is assigned in the system parameters.
(See chapter „Measurement Point Active Power (Curve Operation Q(P)/CosPhi(P))“)
The curve is set by parameters, which are usually specified by the network operator.

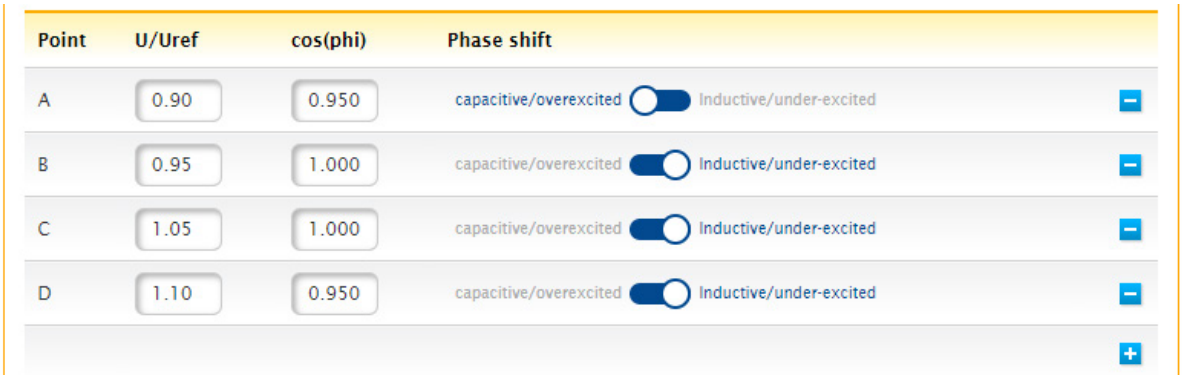


Fig.: Curve Q(U/Uc) with example values

Curve Q(U/Uc) with voltage dead band

This curve is voltage controlled and enables reactive power control depending on the current voltage in the network. The control takes place via the specification of the reactive power Q.
The necessary measurement takes place via a meter (utility meter) on the medium or low voltage side. The measured voltage is applied to the set curve by the Solar-Log and then converted. The meter is assigned in the system parameters.
(See chapter „Measurement Point Voltage (Curve Operation Q(U)/CosPhi(U))“)
The curve is set via parameters which are usually specified by the network operator.
The dead band is specified as a percentage of the reference voltage Uc and is shown hatched in the graph. In the range of the dead band, the reactive power is not changed.
The configuration of the control offers the possibility to shift the dead band. The shifting can be done via Modbus PM V2. Register 10242 is used for this purpose. Please refer to the Modbus TCP PM V2 document on our homepage for the register description.

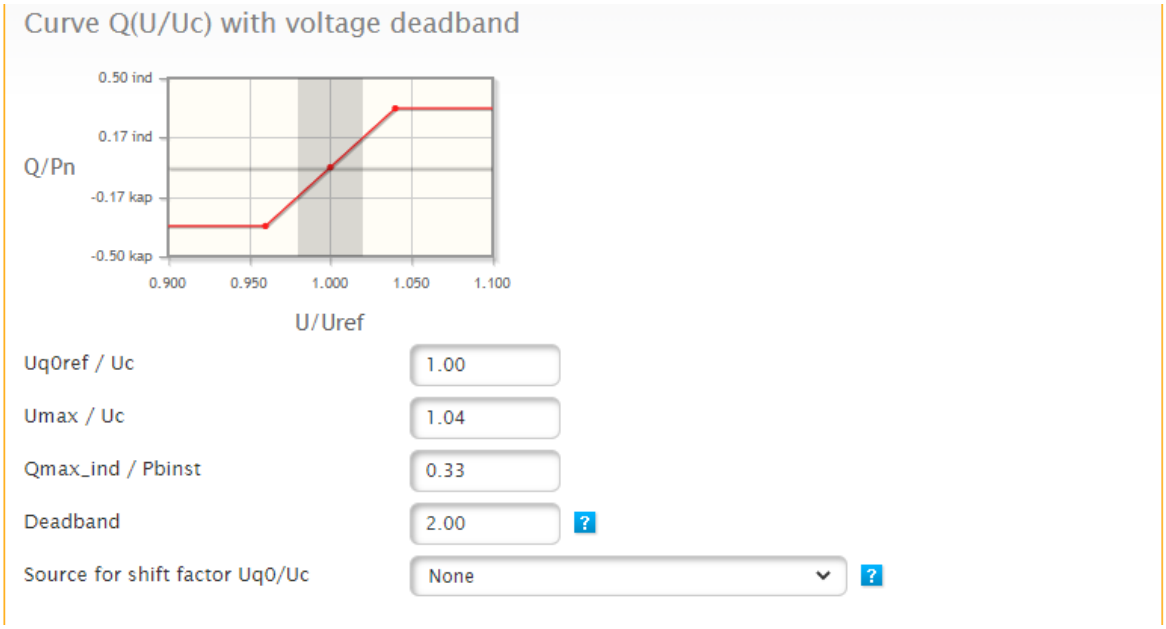


Fig.: Curve Q(U/Uc) with voltage dead band

Curve Q(U/Uc) with voltage limitation

This curve is voltage controlled and enables reactive power control depending on the current voltage in the network. The control takes place via the specification of the reactive power Q.
The necessary measurement takes place via a meter (utility meter) on the medium or low voltage side. The measured voltage is applied to the set curve by the Solar-Log and then converted. The meter is assigned in the system parameters. (See chapter „Measurement Point Voltage (Curve Operation Q(U)/CosPhi(U))“)
The curve is set via parameters, which are usually specified by the network operator.
The voltage limitation is set via parameters. The reactive power is not changed in the voltage limitation range.
The configuration of the control offers the possibility to shift the voltage limitation. The shifting can be done via Modbus PM V2. For the register description please refer to the document Modbus TCP PM V2 on our homepage.

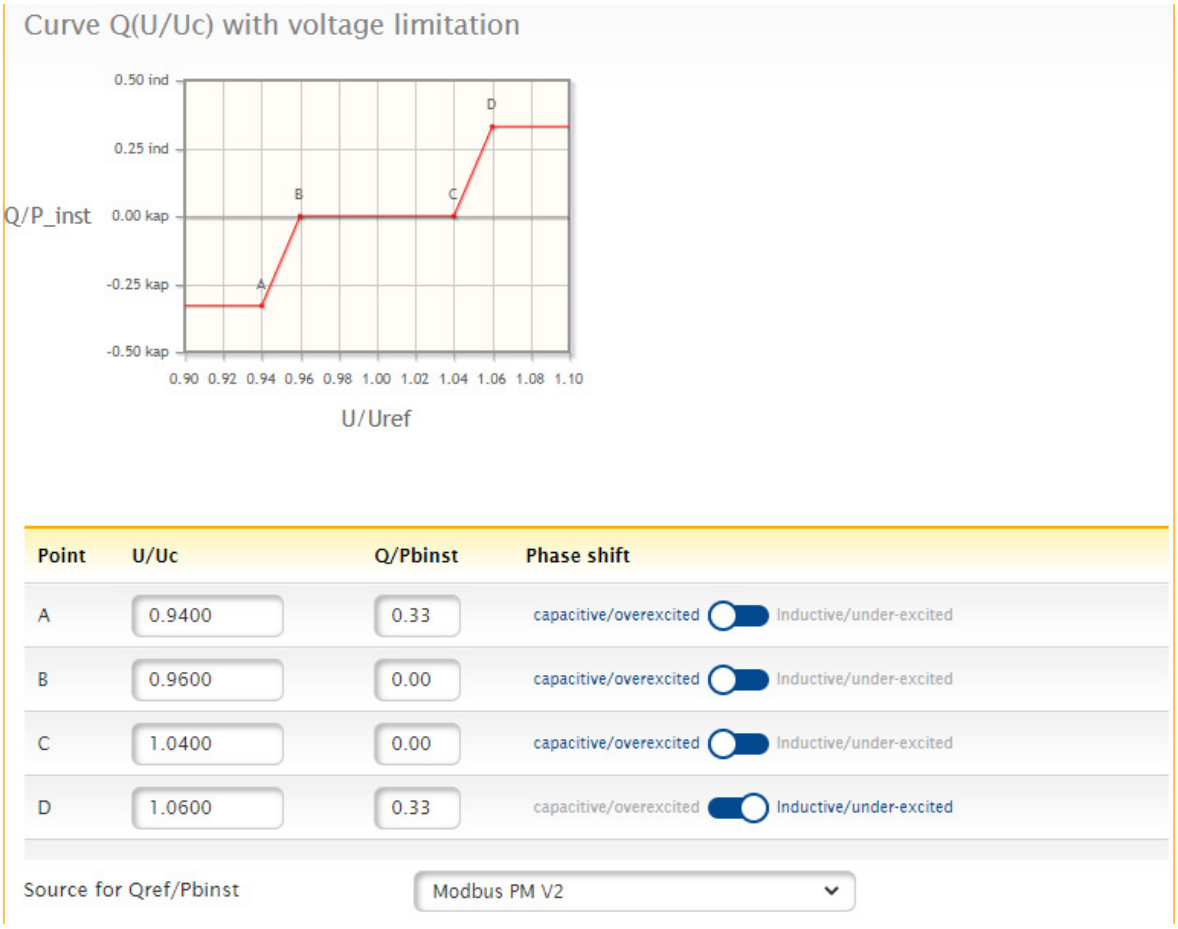


Fig.: Curve Q(U/Uc) with voltage limitation

4.2 Fallback settings

The fallback settings define the plant status in the event of a failure of the connection between the remote control technology and the Solar-Log.
The monitoring of the communication (watchdog) is carried out either by the remote control technology or directly by the Solar-Log. Please choose one of the options. The simultaneous use of both watchdog functionalities can lead to problems.

Option 1 - Remote control technology describes defined watchdog registers.

Here, the remote control technology actively writes a register with changing values at defined intervals. The writing of this register is monitored by the Solar-Log. To activate this function, an interval in seconds is set in Modbus V2 register 10213. Within this interval, the value in register 10211 must change. If this value does not change, the Solar-Log detects a communication failure of the remote control technology.
(Modbus_PM_V2 register 10213 WatchDog_Time and 10211 WatchDog_Tag. For more information, please refer to the document: the document Modbus TCP PM V2).

WatchDog_Tag	-	32 bit unsigned	10211	2	4/16	3.3.0	Watchdog register to indicate valid power limit settings
WatchDog_Time*	sec	32 bit unsigned	10213	2	4/16	3.3.0	Watchdog timeout 0=deactivated

Fig.: Extract Modbus_PM_V2 register with number 10211 and 10213

Option 2 - Solar-Log actively monitors the Modbus_PM_V2 registers.

This function is activated in the Configuration | Feed-in management | Remote control area.
Validation of the Modbus_PM_V2 interface by write accesses - activate.
Time until error - input in seconds.

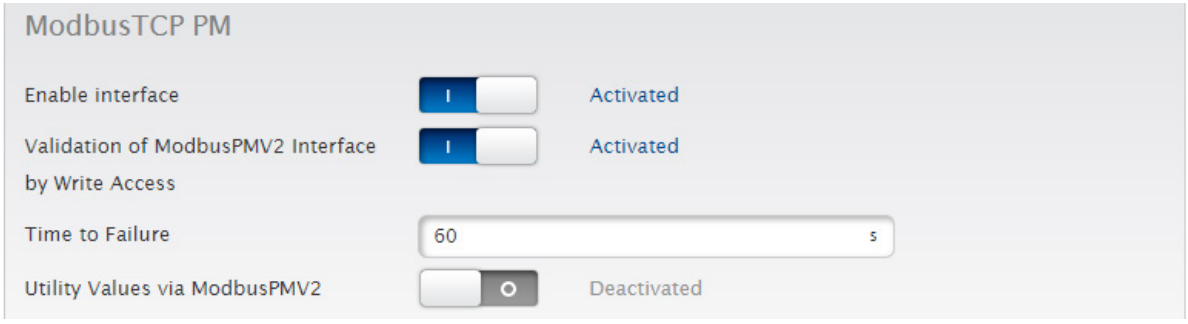


Fig.: Modbus TCP PM with example settings

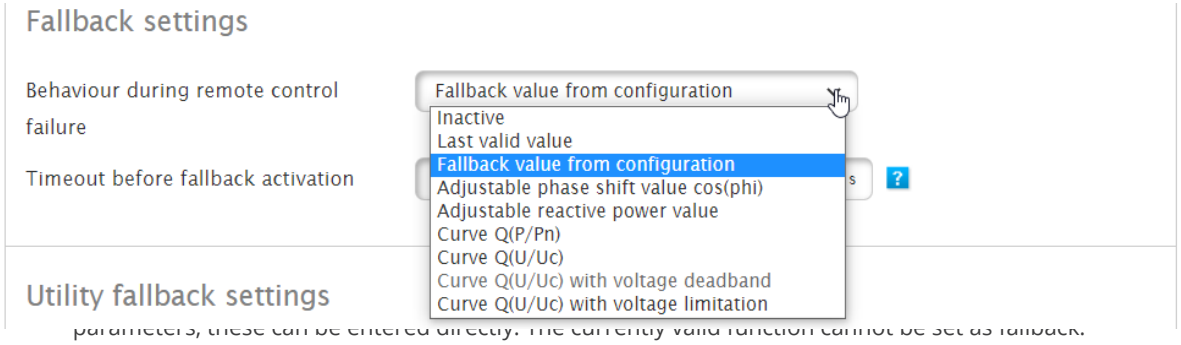


Fig.: Fallback settings with selection menu

4.3 Utility fallback settings

The Utility fallback settings define the system status in the event of a failure of the measured values from the Utility Meter and Solar-Log. Here, too, the required scenarios and the time in seconds until the switchover to the fallback case can be set.

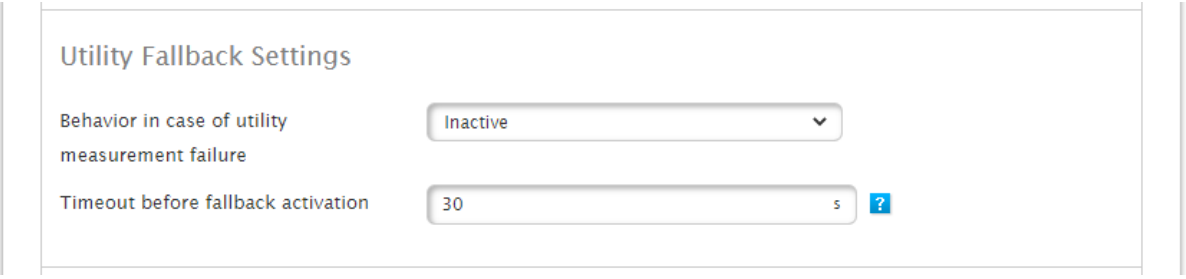


Fig.: Utility fallback settings in the example set to inactive

Only scenarios are available that do not require measurement at the transfer station.
The following scenarios can be selected as fallback:

- Inactive
- Last valid value
- Adjustable shift factor cos(Phi)
- Adjustable reactive power

4.4 Interpolation between target values

The item „Interpolation between target values“ regulates the control of the inverters by the Solar-Log in the event of a reactive power change.

The following parameters are available:

- No interpolation
  The changed setpoint of the active power is sent directly to the inverter. The change of the setpoint is defined by the setting in the inverter.
- Linear with fixed slope
  With this setting, the setpoint is approached via a linear ramp. The slope of the ramp is set via the Maximum change parameter. The parameter is recorded in percent per second. Different ramps can be defined for rising and falling values.
- PT1 behavior
  The new setpoint is controlled via a PT1 curve. The curve is defined by the time constant Tau. The input value corresponds to 1 Tau in milliseconds. The time constant for the PT1 curve is usually defined by the power supplier.

4.5 Limits

This parameter defines upper and lower limits for the shift factor cos(Phi). Automated controls cannot exceed these limits.

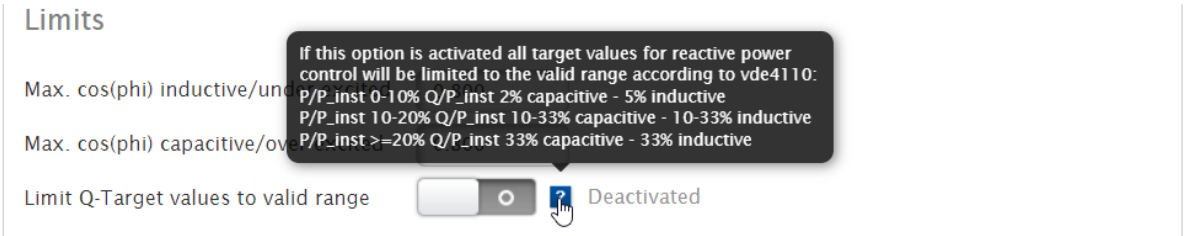


Fig.: Limits with displayed help text

The „Limitation of Q target to standard range“ parameter can be used to limit the control ranges for the reactive power to the values permitted by the VDE.

- P/P_inst 0%-10% Q/P_inst 2% capacitive - 5% inductive
- P/P_inst 10%-20% Q/P_inst 10%-33% capacitive - 10%-33% inductive
- P/P_inst >=20% Q/P_inst 33% capacitive - 33% inductive

4.6 Measurement at the feeding point

This parameter activates the power factor correction.

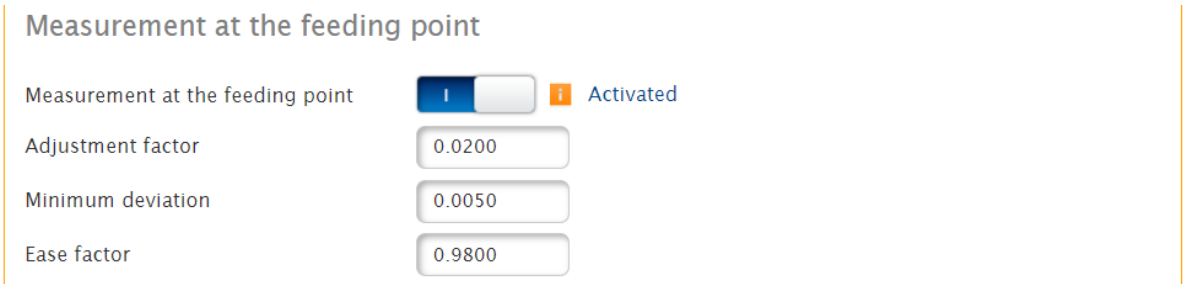


Fig.: Measurement at the feeding point with example values

This parameter activates the reactive power correction.
Depending on the type of plant, especially in the case of mixed plants, the grid operator defines the place of performance of the reactive power supply.
As a rule, a distinction is made here between the transfer station and the generation plant. If reactive power is supplied at the transfer station (power factor correction), the utility meter can also be used for voltage measurement.
If compensation is required at the DCA (generation plant), another meter must be placed after the inverters if necessary.
The meter for power factor correction must be defined in the plant parameters.
The path to the plant parameter:
Configuration | Feed-In Management | Plant parameters | Measurement Point for Reactive Power Compensation

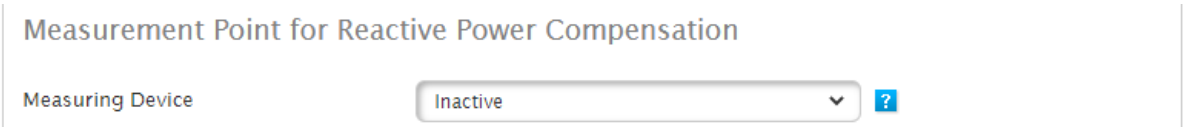


Fig.: Measuring point for reactive power correction with example source

5 Licenses

5.1 PM Pro license

The full feed-in management functions of the Solar-Log Base are only available with firmware 6.x and the PM Pro license. The license is available for each Base model.

- Solar-Log™ PM PRO license up to 500 kWp - Item No. 257201
- Solar-Log™ PM PRO license up to 1 MWp - Item No. 257202
- Solar-Log™ PM PRO license up to 2 MWp - Item No. 257203
- Solar-Log™ PM PRO license > 2 MWp - Item No. 257204

5.2 Interconnected control license

For plants >2 MWp and plants with distributed locations, the use of several Solar-Log is necessary. A group control license is required for this case of application. The prerequisite for the interconnection control license is the PM Pro license of corresponding size in kWp on the interconnection control device.
This license allows PM commands received by the group master to be passed on to the group slaves. The group control always only affects the PM control of the plant, the group slave devices remain independent and record inverter and other values separately. Via the portal it is possible to configure a „virtual“ plant from the different Solar-Logs of a group control.
The interconnected control license regulates the combination of a maximum of 10 devices (1x master, 9x slave) and only needs to be installed on the master.
Solar-Log™ group control license - Item No. 257205

Very important!

Please note:
Master - Slave systems that have been configured with a 5.x firmware will not be migrated automatically when updating to 6.x firmware.

» For this reason, we urgently ask you to discuss a firmware update for a master - slave system in advance with our support.

6 Linking

For solar parks with a size of more than 2 MWp and/or for solar parks with large distances between plant components (inverters) and the feed-in point (utility meter), the Solar-Log offers network controller (formerly Master - Slave).
In the case of network controller, a Solar-Log is defined as the master. This Solar-Log communicates with the remote control technology and the Utility Meter. Control and regulation commands for active and reactive power are passed on to the connected slave devices via the Solar-Log.
The complete feed-in management configuration is performed on the master and automatically distributed to the slave Solar-Log by the system.
Outside of the feed-in management control, the Solar-Log devices continue to operate completely autonomously.
A interconnected control license (item no. 257205 Solar-Log™ interconnected control license) is required for interconnected control. The license must be installed once on the master Solar-Log and can then control 9 slave devices.

6.1 Linking

Operating mode - activation on the Solar-Log Master
After activating the interconnection control license, the operating mode on the master can be set to „ Network controller“.

Fig.: Activated network controller

After setting the operating mode, the „Search“ button can be used to search for Solar-Log Slave devices.
During the search process, the Solar-Log slaves must have the same firmware version as the master, and the slave devices must also be in the same IP range as the master. (Class C network)
All slave devices must be switched on and completely booted during the search.
After the „Search“ process, the master Solar-Log displays a list of available devices.
The plus sign at the end of the line adds the Solar-Log to the paired devices.
When all slave devices are entered in the „paired devices“ list, the page can be closed with „Save“.

After successful linking from the point of view of the Solar-Log Master

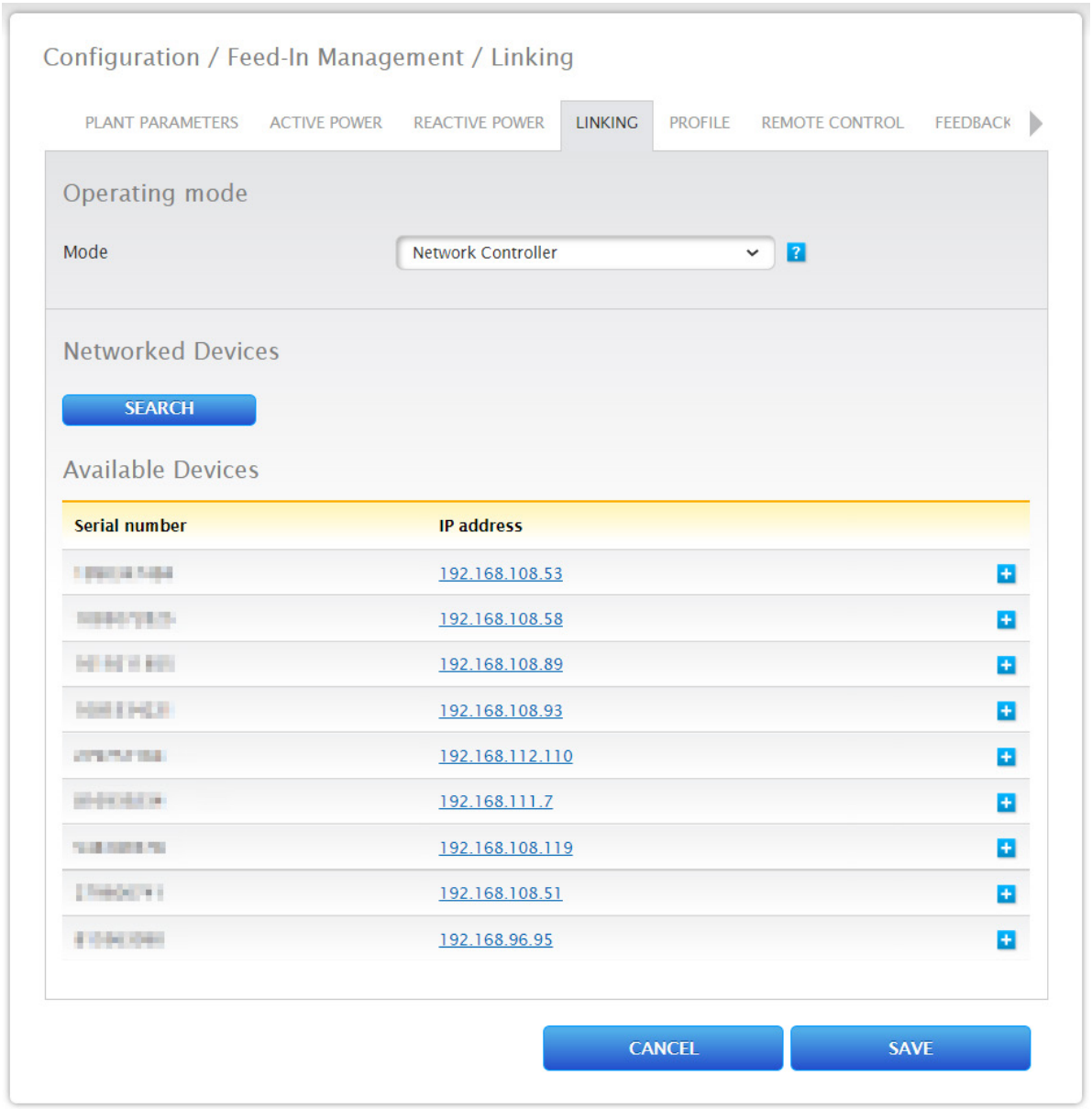


Fig.: Devices available after the successful sample search.

After successful linking from the point of view of the Solar-Log Slave

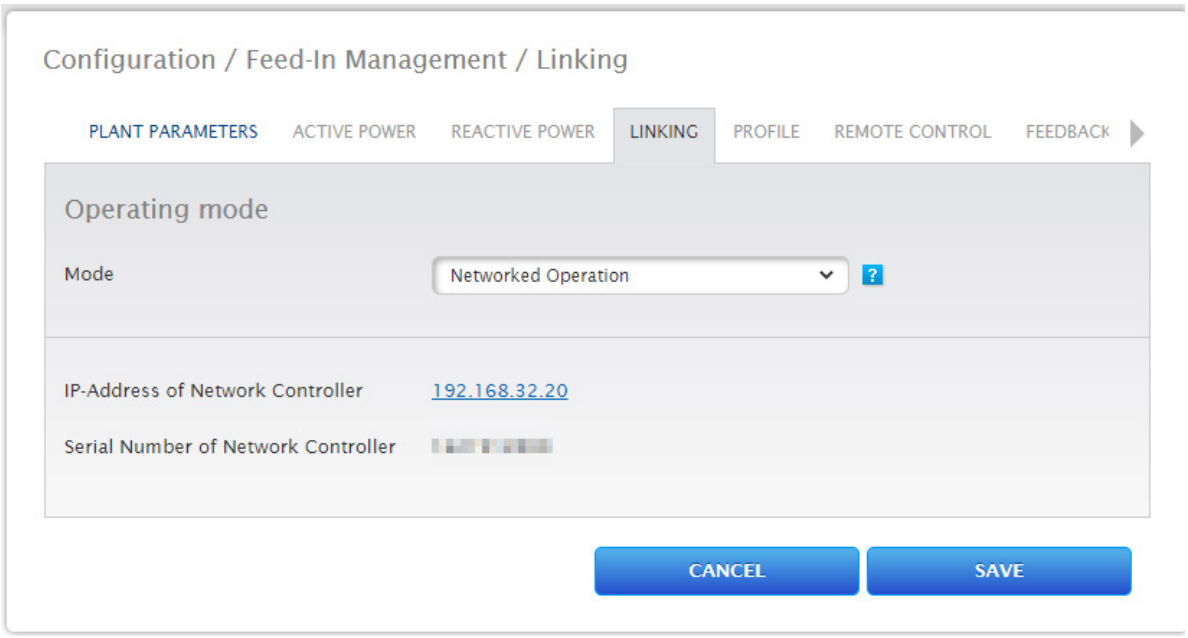


Fig.: Mode - „Networked Operation“ with example device

After the linking has been completed, the configuration of the Solar-Log Slave devices is automatically adjusted. The type of active and reactive power is set to „ Linked Control“.

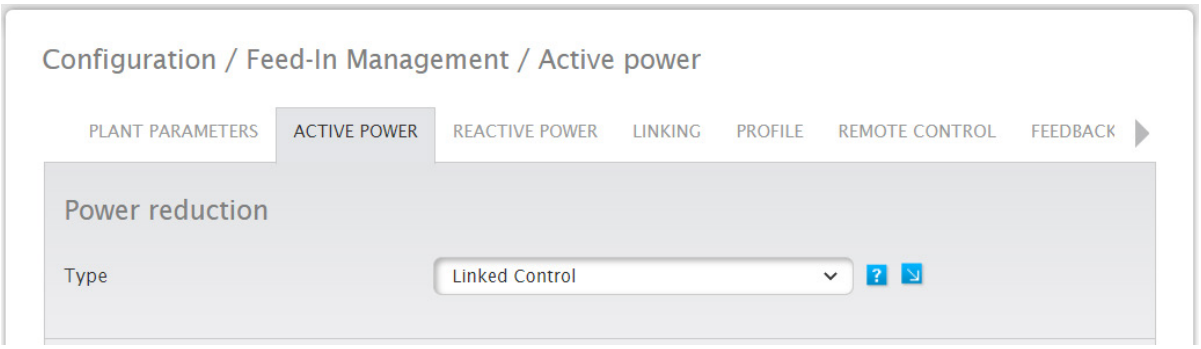


Fig.: Example active power type „ Linked Control“.

7 Profile

7.1 PM profile management

Path:
Configuration | Feed-In Management | Profile

In some cases, grid operators still require values to be transferred via analog or digital interfaces. To meet these different requirements, we offer Solar-Log™ feed-in management packages. The packages contain hardware and software to connect the PV plant to the respective energy supplier. A detailed list of currently available PM packages is available on our homepage. (List only available in German)
Detailed instructions for the installation and configuration of the feed-in management packages are included in the packages.

8 Remote control

The remote control of the interface is reached via the following path:
Configuration | Feed-In Management | Remote control

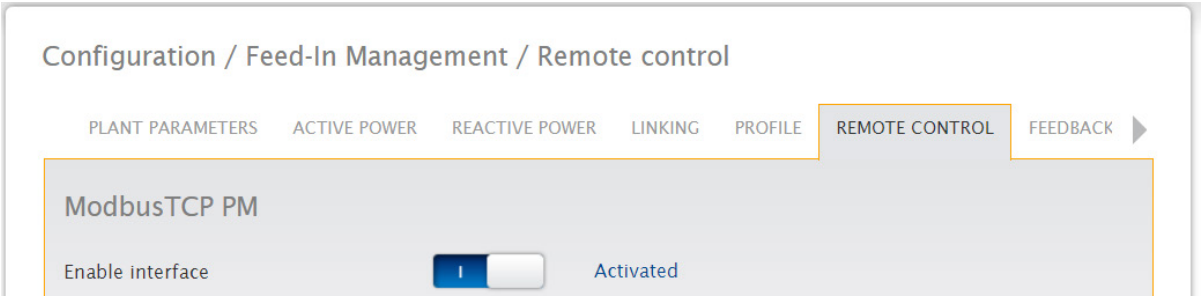


Fig.: Modbus TCP PM with activated interface

The Modbus TCP PM interface is activated via the „Enable interface“ button. Activation is mandatory so that the Solar-Log can communicate with the remote control technology.

With the validation of the Modbus PM V2 interface by write accesses, a watchdog for monitoring the communication to the remote control is activated. Detailed information can be found under: Watchdog communication to remote control in this document.

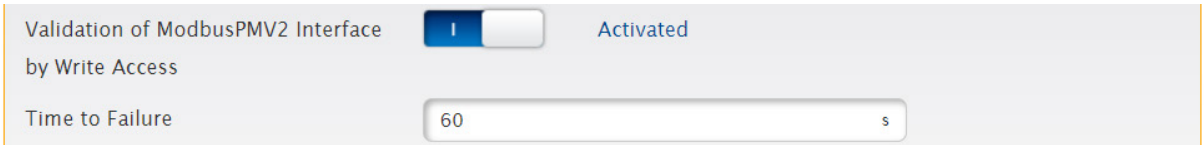


Fig.: With activated „Validation of the ModbusPMV2 interface by Write Access“.

Utility Values via Modbus PMV2

Fig.: Utility Values via ModbusPMV2 in the example set to deactivated

The system offers the possibility to receive measurement data from external sources (remote control or meter). For this purpose, the source must write the measured values to our PM V2 registers from 10216. For the controls, the data source must meet certain requirements for availability and time. For detailed information about the values to be supplied, please refer to our document: Modbus TCP PM V2 on our homepage.

Very Important!

The use of the function „Utility values via Modbus“ must be discussed with our VDE team in advance of the installation.

Permitted remote control modes

This item can be used to set permissible active and reactive power modes for the PV system. Only if the modes on this page are active can they be activated accordingly via the corresponding Modbus register. This ensures that only the mode stored by the grid operator in the E9 sheet can be activated.

9 Feedback

The Feedback section can be opened via the following path:
Configuration | Feed-In Management | Feedback

The feedback section was introduced to meet the diverse requirements of grid operators and utilities for data from the PV plant.
A register set of feedbacks is available via the Modbus TCP PM V2 interface.
If this set of values is not sufficient, it is possible to output a variety of the data available in the Solar-Log via configurable registers.
If the feedback of the Modbus TCP PM V2 interface is not sufficient for your PV plant and your grid operator requires further data, please contact our VDE team.

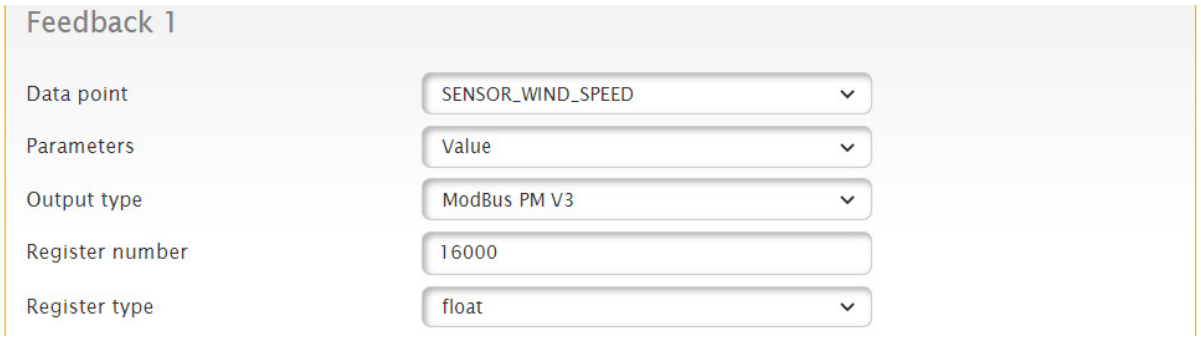


Fig.: Feedback (Feedback 1) with sample values

10 Diagnostics

The „Diagnostics - Feed-in management“ area has been completely revised in firmware 6.x. With firmware 6.x, the set configuration and control can be conveniently checked.

A complete overview of the plant parameters is available and also the states of the set controllers are summarized on one page. Furthermore, live views of the Modbus registers are available. This function is very helpful for configuration and test of the telecontrol.

10.1 Overview

The diagnostics overview is called up via Diagnostics | Feed-In management | Overview.

On this page, the configured plant data is summarized and clearly displayed. The page provides a quick overview and helps with troubleshooting.

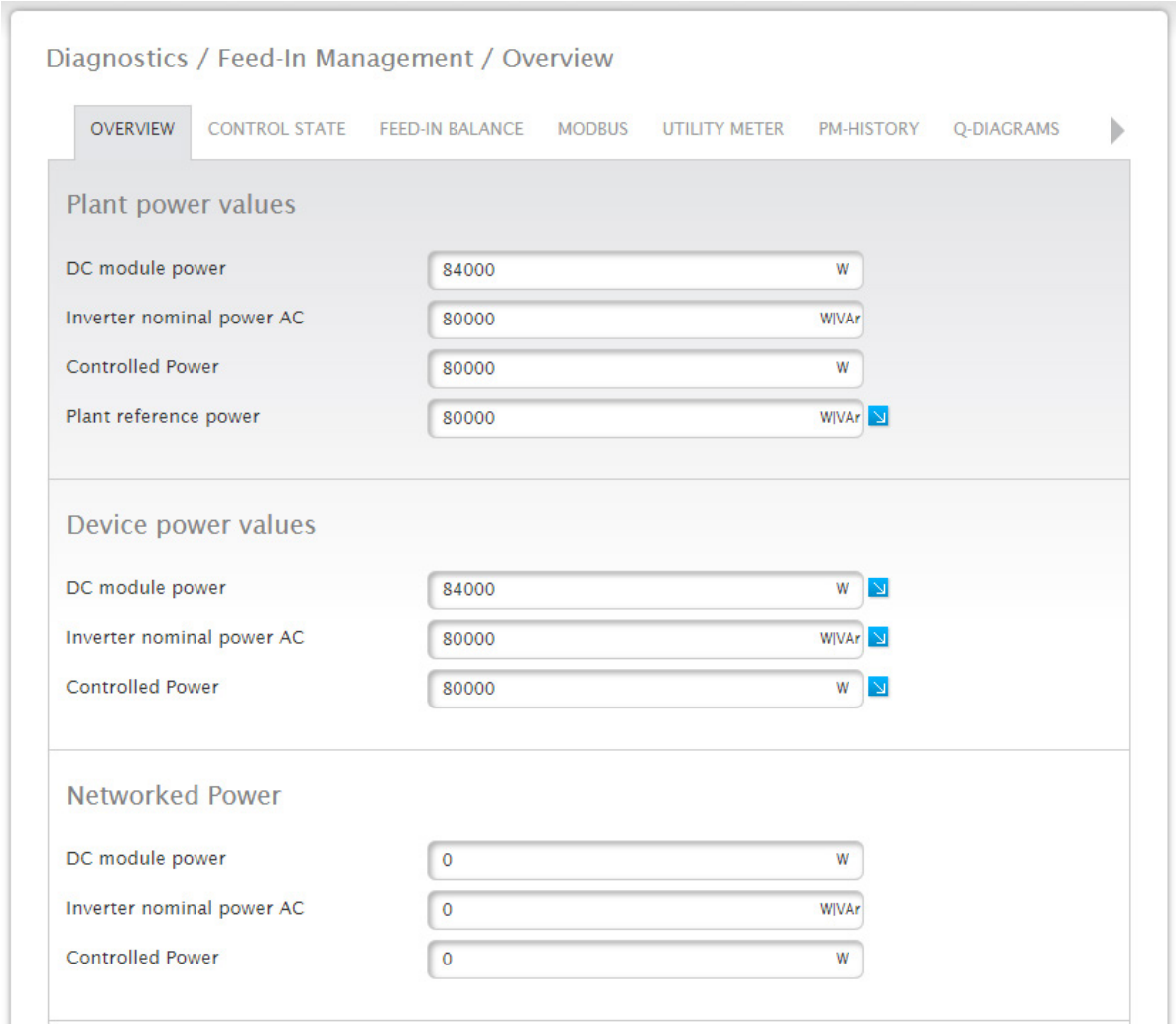


Fig.: Diagnostics - overview with example values

10.1.1 Plant power values

The data of the complete PV system are summarized in the plant power values area. Here the summed values of all slaves and the master are available. The following values are displayed:

- DC module power - sum of the generator power of the connected and detected inverters.
- AC nominal inverter power - sum of AC power of the connected inverters.
- Controlled power of the complete system.

10.1.2 Device power values

In the area of device power values the data of the network master are summarized. Here the values of the current master are available. The following values are displayed:

- DC module power - sum of the generator power of the connected and detected inverters of the master.
- AC nominal inverter power - sum of AC power of the inverters connected to the master.
- Controlled power of the master.

10.1.3 Networked Power

The data of the network slaves are summarized in the networked power area. Here the values of the slaves are available. These are in the following:

- DC module power - sum of the generator power of the connected and detected inverters of the slaves.
- AC nominal inverter power - sum of AC power of the inverters connected to the slaves.
- Controlled power of the slaves.

10.1.4 Power reduction

In this area, the active power parameters are displayed in summary form. All parameters relevant for active power control are listed.
The blue arrows at the end of the field take you directly to the configuration area of the respective parameter.

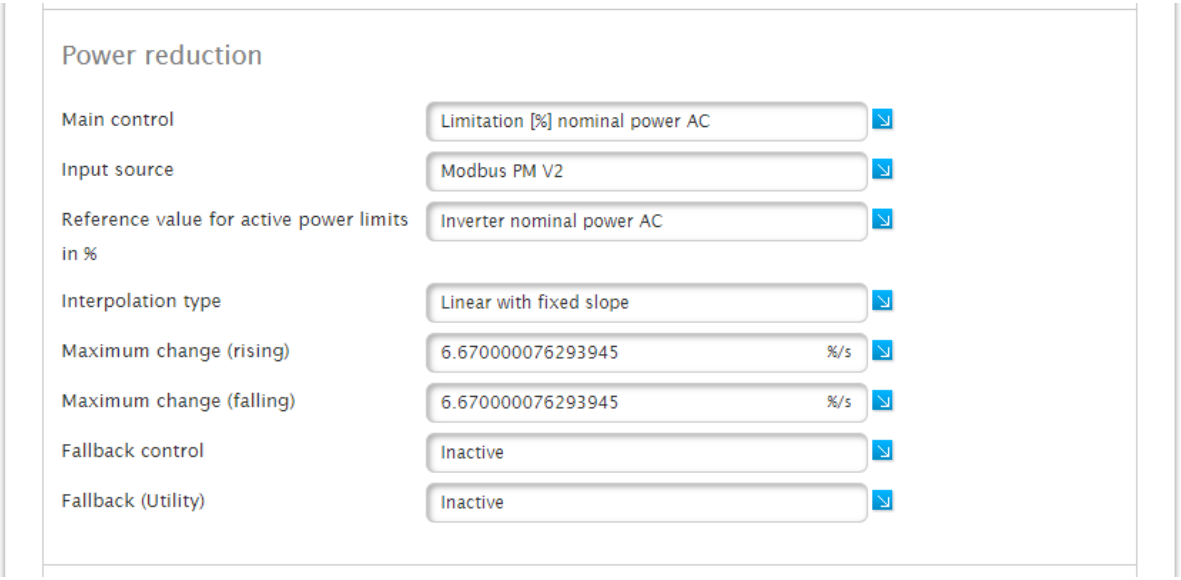


Fig.: Diagnostics - Power reduction with example values

10.1.5 Reactive power control

In this area, the reactive power parameters are displayed in summary form. All parameters relevant for reactive power control are listed.
The blue arrows at the end of the field take you directly to the configuration area of the respective parameter.

10.2 Control state

Can be called up via Diagnostics | Feed-in management | Control state.

10.2.1 Operating point

The „Operating point“ graphic provides an overview of the status of the PV plant. Various measuring points are visualized in the graphic and updated every second.

- Green area: defines the valid control range.
- Red X: calculated set point.
- Red +: current measuring point (consumption).
- Blue line: level of reactive power setpoint.
- Orange line: active power.

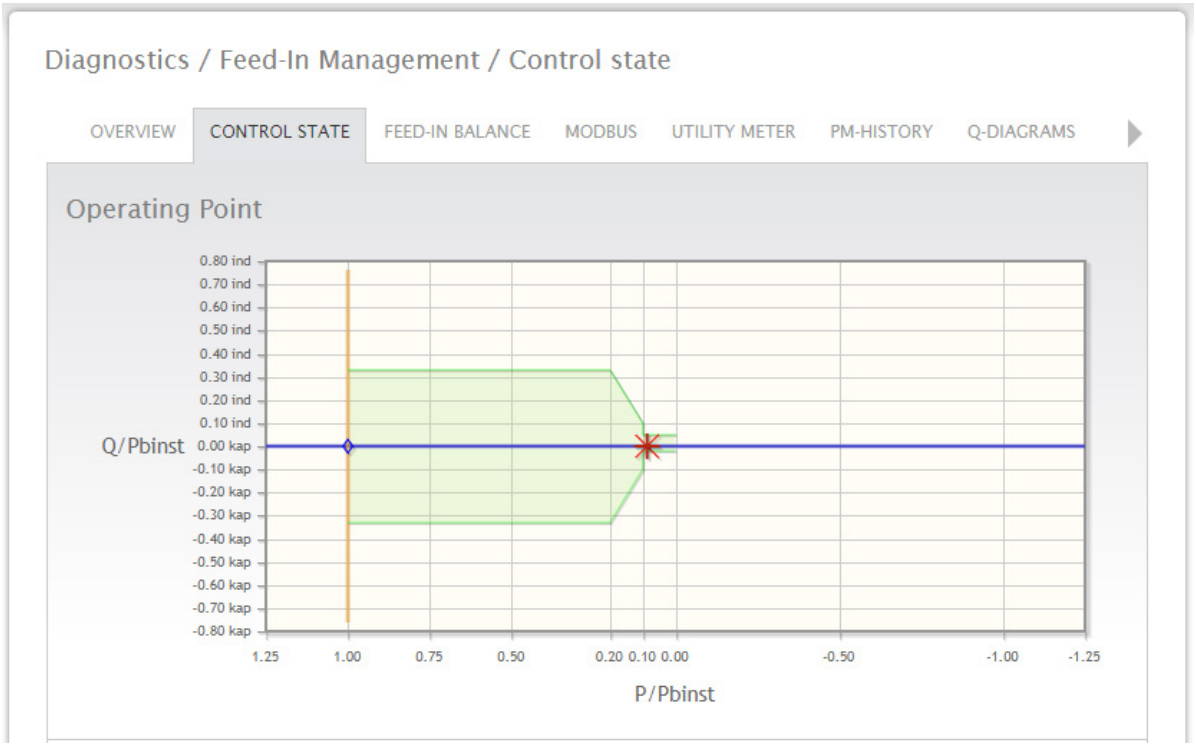


Fig.: Diagnostics - operating point (control state) - with example values

10.2.2 Power reduction

The current settings and values for reactive power control are displayed in the corresponding fields.

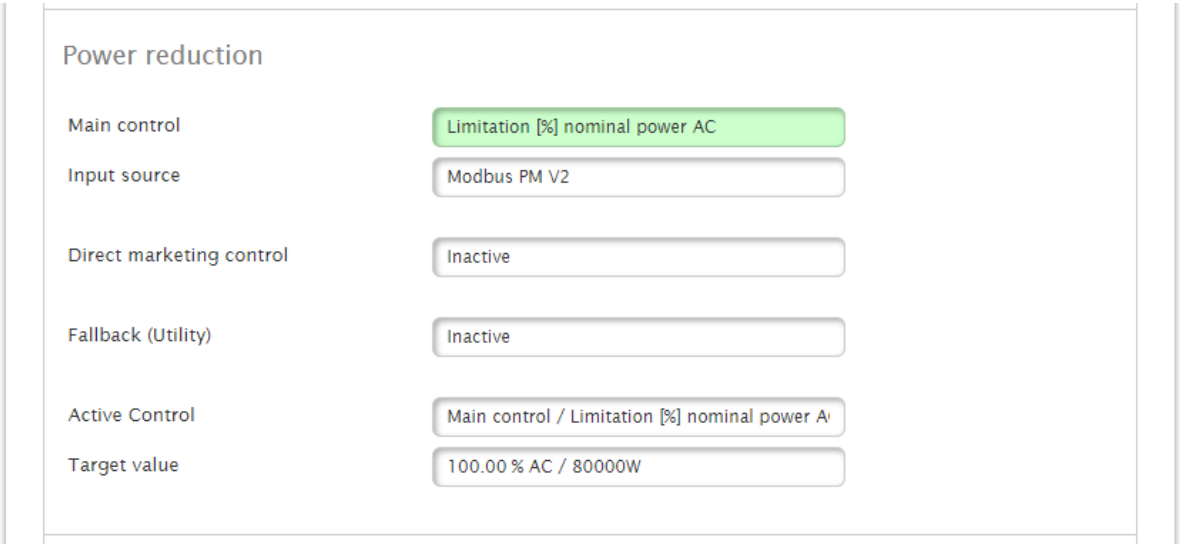


Fig.: Diagnostics - Power reduction (control state) - with example values

10.2.3 Reactive power control

The current settings and values for reactive power control are displayed in the corresponding fields.

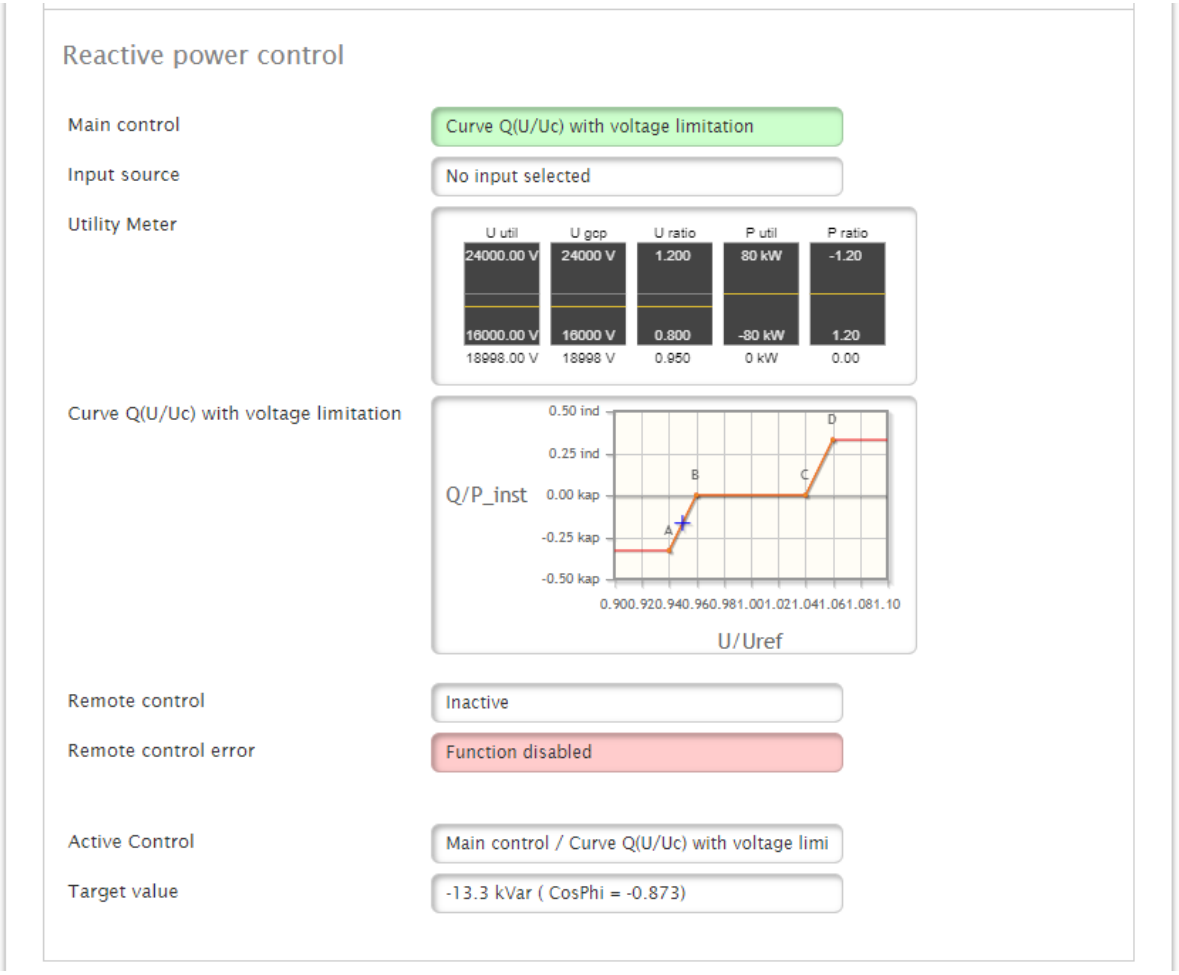


Fig.: Diagnostics - reactive power control (control state) - with example values

10.3 Modbus

The Modbus menu item is called up via the path Diagnostics | Feed-in management | Modbus.

On this page the contents of the Modbus registers can be controlled. The values are live values and are permanently updated. The sorting of the registers depends on the existing Modbus interfaces. (Direct marketing, Modbus V1, Modbus V2)
The blue bars can be used to switch to the corresponding interface.
The tables are perfect for controlling the communication via the Modbus interface. Control commands from the energy suppliers via e.g. a telecontrol system can be checked here immediately.

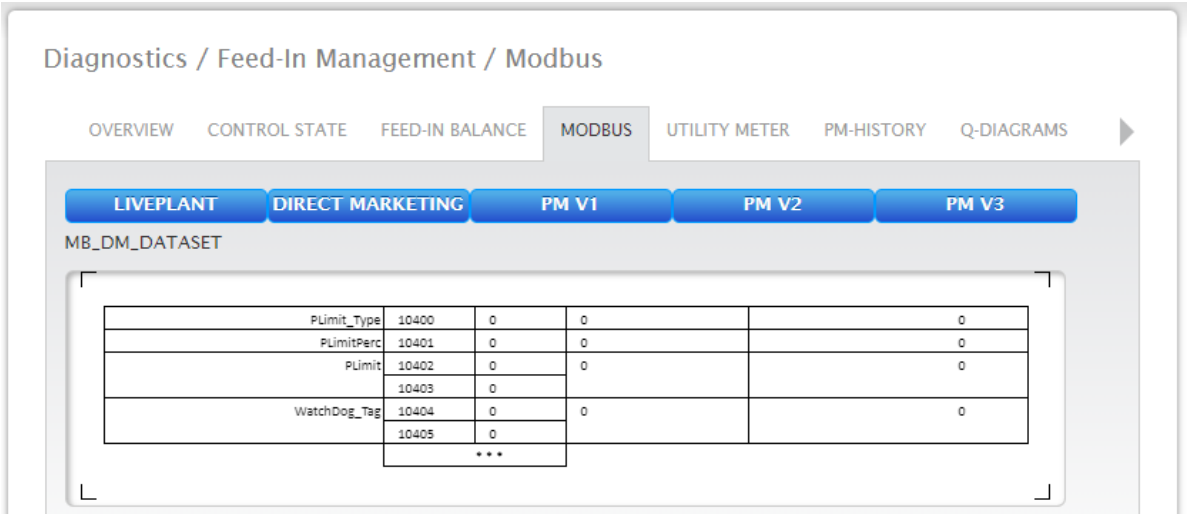


Fig.: Diagnostics - Modbus - Direct marketing - „Dataset“ example

In the Modbus overview the register values are plausibilized, wrong or invalid values are highlighted.

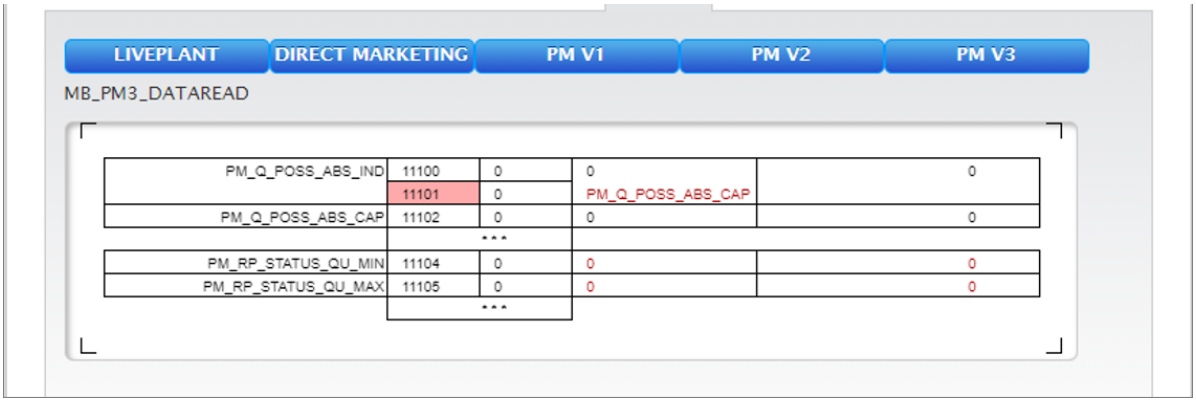


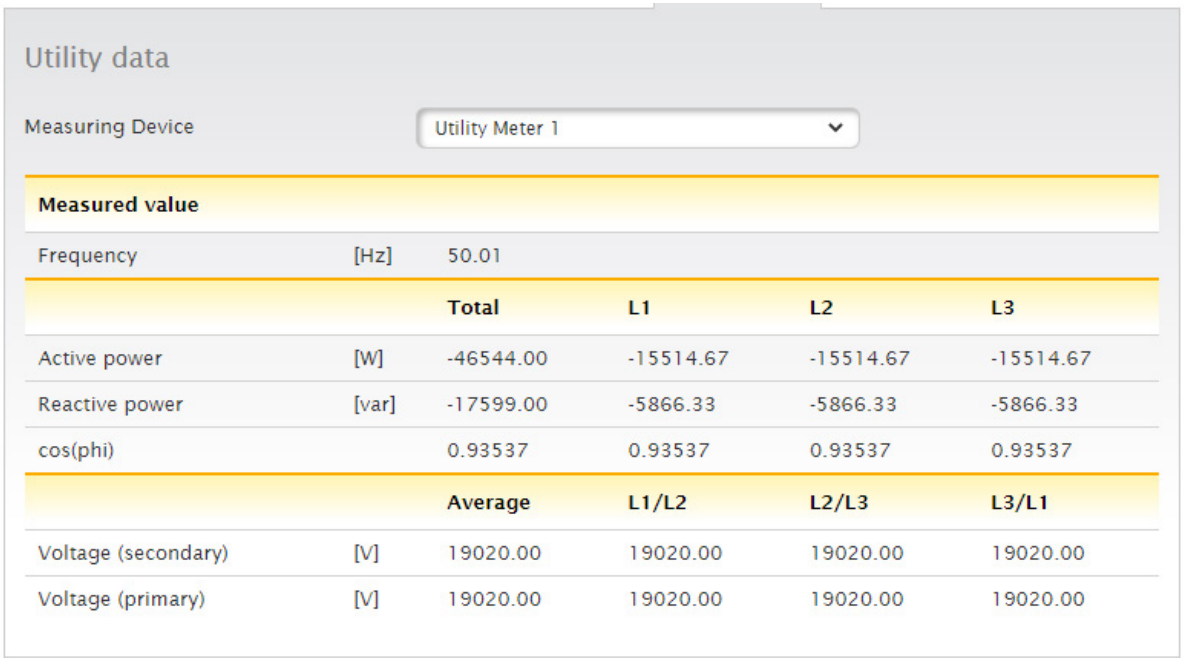
Fig.: Diagnostics - Modbus - Direct marketing - Example „Dataread“ with highlighted value

10.4 Utility Meter

To be found via Diagnostics | Feed-in management | Utility Meter.

10.4.1 Utility data

In the Utility data area, the current measured values of the utility meter are displayed. The values are permanently updated so that changes to the reactive or active power can be read immediately. Problems such as incorrectly connected CT's and incorrectly set meter arrow systems can be easily checked.
Please note: By default, the Solar-Log operates in the consumer arrow counter system. In this case, the active power display in the feed-in case must be displayed with a minus as a sign.



Measured value					
Frequency	[Hz]	50.01			
		Total	**L1**	**L2**	**L3**
Active power	[W]	-46544.00	-15514.67	-15514.67	-15514.67
Reactive power	[var]	-17599.00	-5866.33	-5866.33	-5866.33
cos(phi)		0.93537	0.93537	0.93537	0.93537
		Average	**L1/L2**	**L2/L3**	**L3/L1**
Voltage (secondary)	[V]	19020.00	19020.00	19020.00	19020.00
Voltage (primary)	[V]	19020.00	19020.00	19020.00	19020.00

Fig.: Diagnostics - Utility data with sample values

In the lower part of the page there are flow charts with the following values:

- Voltage
- Active power
- Compensation
- Phase shift
- Reactive power

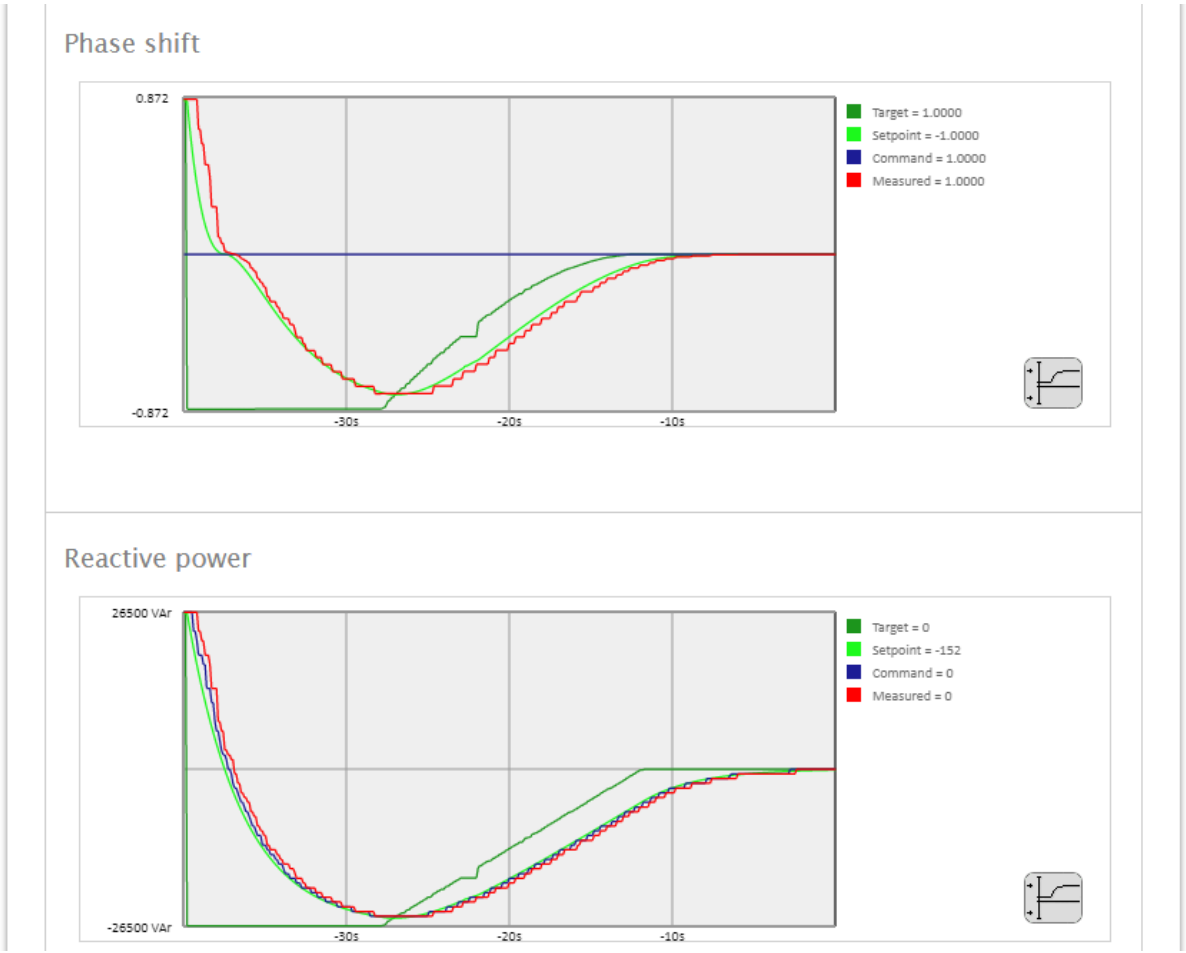
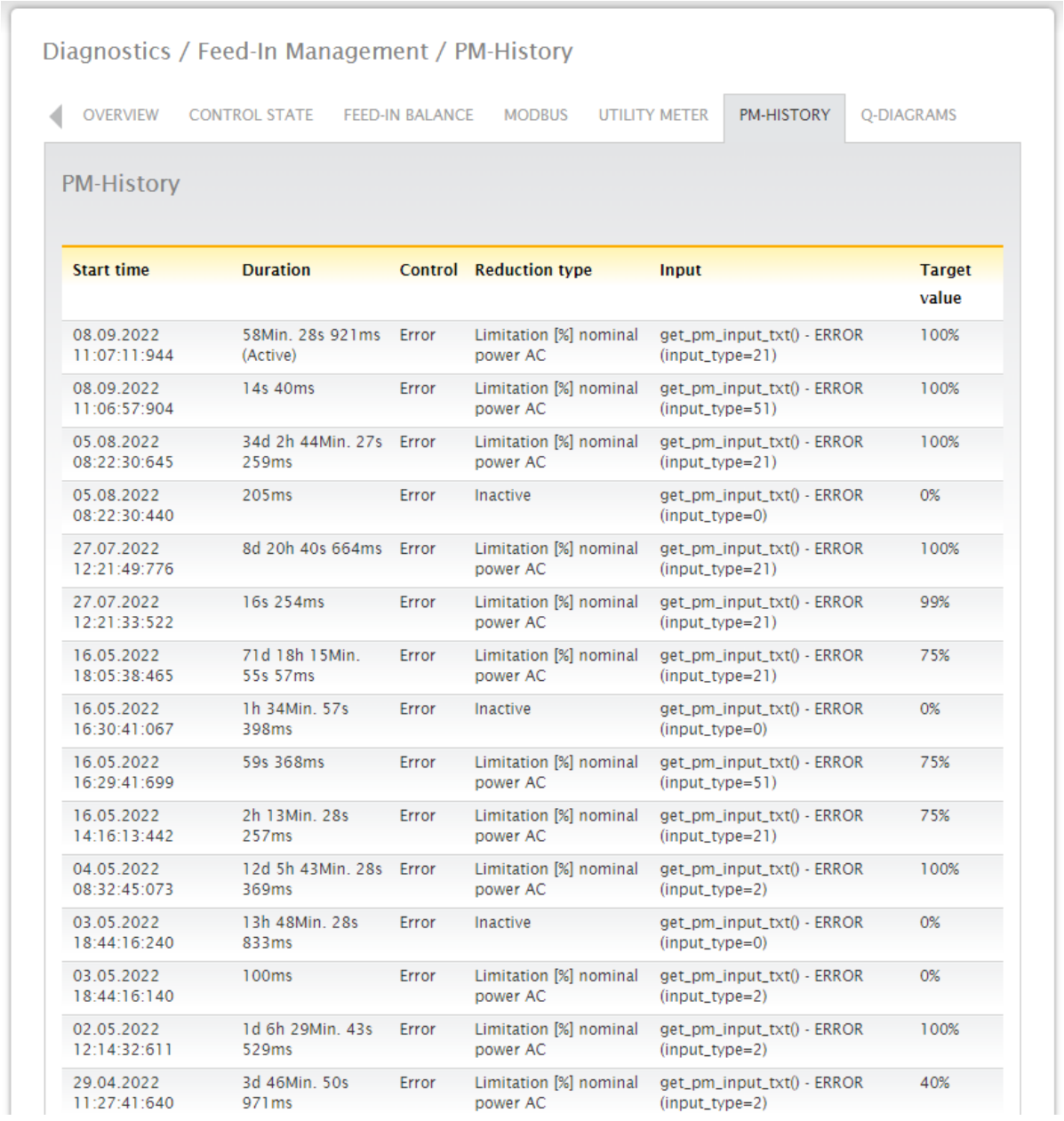


Fig.: Flow charts (excerpts) - phase shift and reactive power with example values

10.5 PM History

To be found via Diagnosis | Feed-in management | PM-History.

Any active power reductions are documented in the PM-History. A distinction is made between main control and fallback control. Furthermore, the type of reduction and source are recorded. (PM control, direct marketer control, etc.) The target value of the control is also recorded.



Start time	Duration	Control	Reduction type	Input	Target value
08.09.2022 11:07:11:944	58Min. 28s 921ms (Active)	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	100%
08.09.2022 11:06:57:904	14s 40ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=51)	100%
05.08.2022 08:22:30:645	34d 2h 44Min. 27s 259ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	100%
05.08.2022 08:22:30:440	205ms	Error	Inactive	get_pm_input_txt() - ERROR (input_type=0)	0%
27.07.2022 12:21:49:776	8d 20h 40s 664ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	100%
27.07.2022 12:21:33:522	16s 254ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	99%
16.05.2022 18:05:38:465	71d 18h 15Min. 55s 57ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	75%
16.05.2022 16:30:41:067	1h 34Min. 57s 398ms	Error	Inactive	get_pm_input_txt() - ERROR (input_type=0)	0%
16.05.2022 16:29:41:699	59s 368ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=51)	75%
16.05.2022 14:16:13:442	2h 13Min. 28s 257ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=21)	75%
04.05.2022 08:32:45:073	12d 5h 43Min. 28s 369ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=2)	100%
03.05.2022 18:44:16:240	13h 48Min. 28s 833ms	Error	Inactive	get_pm_input_txt() - ERROR (input_type=0)	0%
03.05.2022 18:44:16:140	100ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=2)	0%
02.05.2022 12:14:32:611	1d 6h 29Min. 43s 529ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=2)	100%
29.04.2022 11:27:41:640	3d 46Min. 50s 971ms	Error	Limitation [%] nominal power AC	get_pm_input_txt() - ERROR (input_type=2)	40%

Fig.: Diagnostics - PM History (excerpt) - with example values

10.6 Q-Diagrams

To be found via Diagnostics | Feed-in management | Q-Diagrams.

In the graphic, the determined measuring points from the control are documented.
These measuring points are placed on the characteristic curve in the lower graphic. Any deviations from the characteristic curve can thus be detected immediately. The individual days are stored in the Solar-Log.

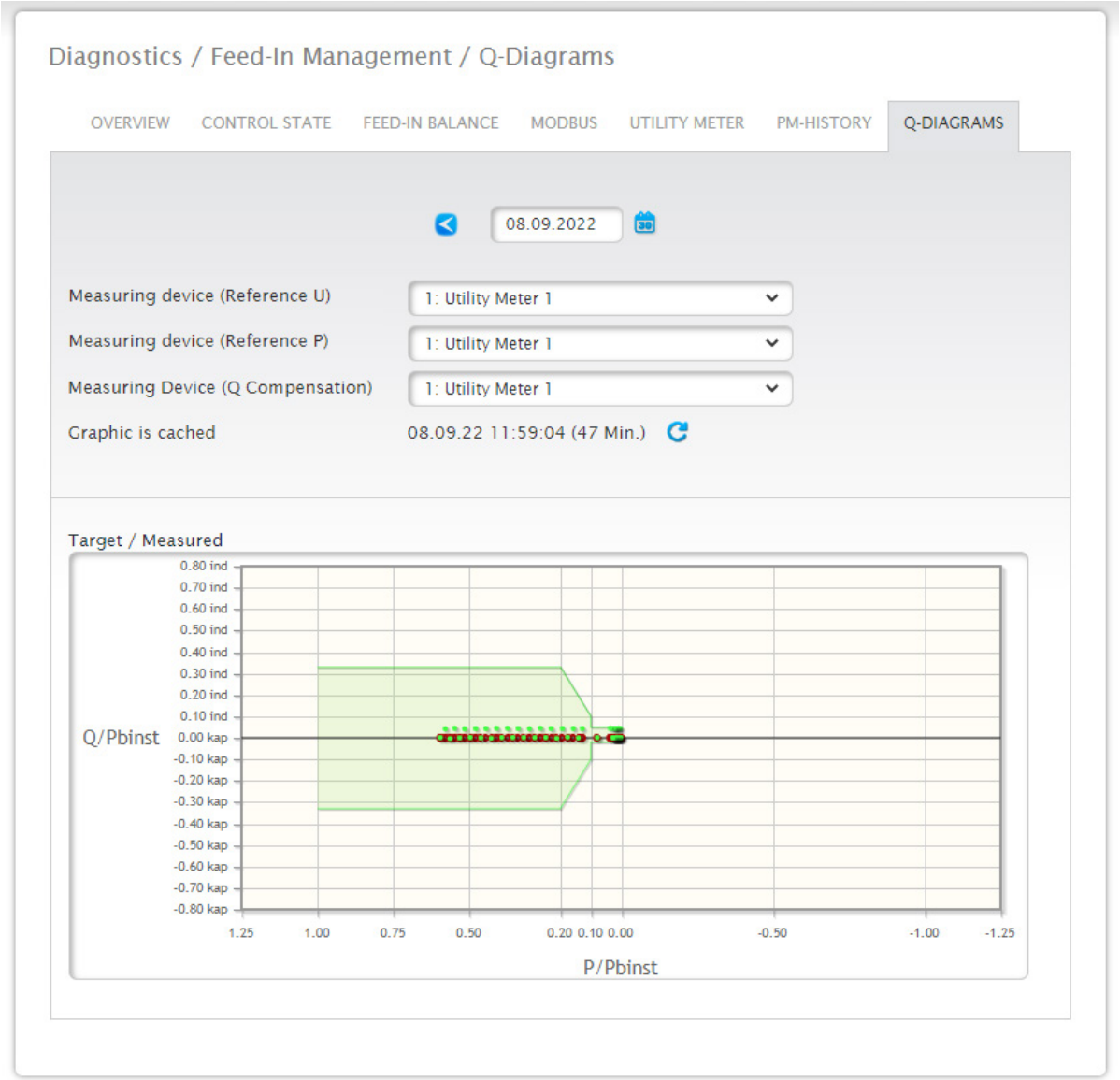


Fig.: Diagnostics - Q-Diagrams - with example values

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