webdyn
flexitron group

WebdynSunPM

Application Note

Power regulation
&
InjectionAndProductionRegulation

Introduction

This application note describes how to implement active power regulation scripts:
ActivePowerRegulation et **InjectionAndProductionRegulation**

These scripts make it possible to control the active power of the inverters of a photovoltaic production site according to one or more active power measurements to comply with a given injection or consumption setpoint.
The **InjectionAndProductionRegulation script** also allows you to limit the production of inverters.

These two scripts also allow the start-up of generator sets to be considered by cutting off the production of the inverters.

The regulation threshold can be modified live by Modbus write request or by FTP or MQTT commands or by POST requests.

The use of these scripts requires the purchase of a license, please contact the Webdyn sales department (https://www.webdyn.com/contact) in order to obtain the appropriate license.

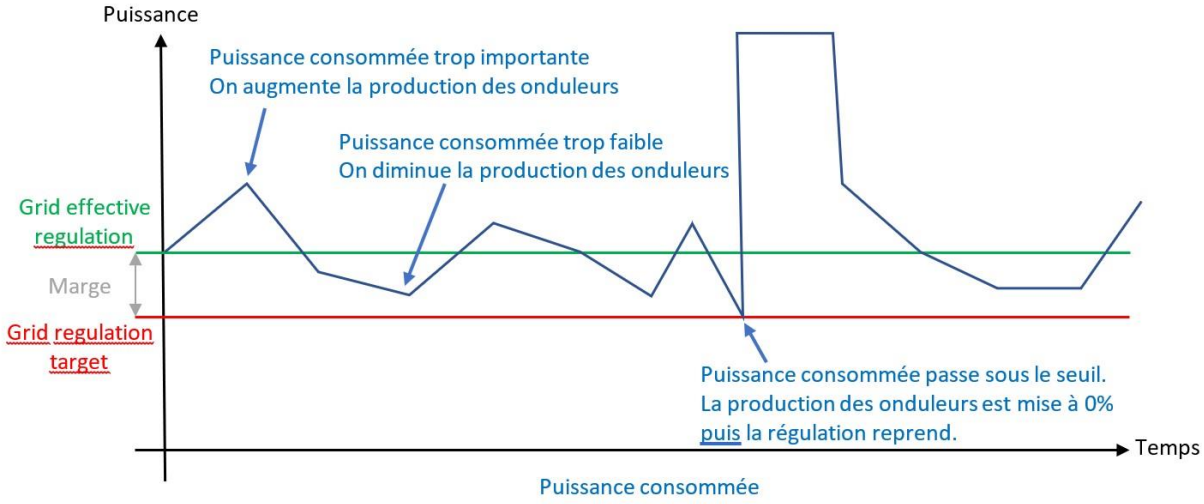
Working principle

The WebdynSunPM script sends active power production limitation commands equally distributed among all the inverters of a power plant in order to comply with a set point called **Grid regulation target** This set point can be defined, as well as a withdrawal set point or an injection set point defined by the **Grid regulation type parameter.**

A dynamic control loop allows the control sent to the inverters to be adapted according to their current production and the local consumption of the production site.

To do this, the script takes into account one or more energy meters reflecting the active power at the injection point and calculates the deviation from the regulation point which corresponds to the **Grid regulation target (kW)** setpoint to which is added a **Grid effective regulation margin (%)** expressed as a percentage of the **total plant solar power (kW) installed capacity**

In the case of a so-called "zero injection" regulation, you will have to choose **Grid regulation type** in consumption and **Grid regulation target** at zero.
The percentage of **the effective grid margin** to be chosen depends on the variations experienced by the network of the production site. A site with industrial machinery that can be stopped or restarted frequently will require a fairly large percentage (30%). Whereas a site without variation will be able to support a small percentage (2%). By default, we recommend a value of 5%.



If the power at the injection point is higher than the target threshold, the photovoltaic production is considered not to be sufficient: the production of the inverters is increased accordingly

If the power at the injection point is below the target threshold, the photovoltaic production is considered too high: the production of the inverters is reduced accordingly.

If the power at the injection point falls below the **Grid regulation target threshold**, then the photovoltaic regulation goes to 0%.

The sign convention used for meters should be as follows: Positive values indicate withdrawal and negative values indicate injection.

The "**Regulation speed**" parameter allows you to limit the sending of commands to the inverters to allow the meter(s) to reflect the previous command and not create a divergent system. This latency is not respected in the event of an emergency (loss of communication with the meter or value below the **Grid regulation target threshold**)
The script complies with regulation constraints requiring correction in the event of a defect of less than 2s.

The "**Phase control**" parameter allows you to fine-tune the control by considering the details of the power of each phase for three-phase systems. To do this, we must use the "***Min of the 3 phases***" value of this parameter. In this case, the WebdynSunPM script will consider the power of the phase closest to the throttle threshold. In the event of an imbalance between the phases, this can lead to production reductions that may seem greater than necessary.
The use of the "***single phase or sum of the 3 phases***" value will reduce production losses but will not prevent injection into a particular phase.
For single-phase installations, the "**Phase control**" parameter of the script must be in "***single phase or sum of the 3 phases***" mode.

In the event of a loss of communication with the counter or if the script stops, the behavior chosen via the "**On error**" parameter is applied.
When the fault disappears, the script starts the regulation again.

When a loss of communication with the meter is detected, an alarm file is instantly sent to the gate.

Special operation

When the script starts, a 60s transient phase takes place, which corresponds to the average start-up time of the UPS. No orders are sent during this period.
Restarting or updating the WebdynSunPM causes the script to stop and then restart. Who applies the policy set by the "**On error**" parameter

Prerequisites

The WebdynSunPM must be updated to firmware version 4.6.5 or higher.

The "ActivePowerRegulation" script is present in the WebdynSunPM script library as of version 5.0.10.
However, it can be retrieved by following the link below and imported via the web interface or server
http://www.webdyn.com/download/ActivePowerRegulation.zip

The "InjectionAndProductionRegulation" script is present in the WebdynSunPM script library as of version 5.0.10.
However, it can be retrieved by following the link below and imported via the web interface or server
https://www.webdyn.com/download/InjectionAndProductionRegulation.zip

A license specific to the WebdynSunPM used is required
Please contact the sales department (https://www.webdyn.com/contact) to obtain it, you will be asked for the identifier of your gateway.

Knowledge of the basic principles of how WebdynSunPM works is highly recommended.
Refer to the WebdynSunPM user manual to acquire the following knowledge:

- Adding equipment
- Contents of the definition file
- Importing a Service or License
- File "<UID>_scl.ini"
- MQTT
- Batch File Json Format
- Modbus slave TCP

The settings described below on the inverter and meter definition files are already made in most of the files integrated in the internal library of the WebdynSunPM.
In such cases, the use of the script does not require any additional specific settings on the definition files.

Meter settings

It is advisable to use meters communicating via an Ethernet link (Modbus TCP) for speed of querying, and better performance of the regulation.

Requests are constantly sent by the WebdynSunPM and can prevent other devices from collecting data on the counter (although it is in TCP). It is preferable that the meter is dedicated to the WebdynSunPM and not be used by another system.

If communication via a serial link is preferred, it is recommended to dedicate this interface to exclusive communication with the meter alone.

In each definition file used by the meters connected to the hub, the following elements must be entered:

• Category (equipment identification)

In the header of the definition files, the category field (first row, 2nd column) must be defined with the name "**meter**." It is this name that identifies all the counters to be considered by the script.
Generally, only one meter providing active power at the injection point is required.
However, under certain conditions, it may be necessary to combine the data from several meters to obtain power at the injection point.
The script automatically adds up the powers of all equipment declared with the "**meter**" category.

***Tips**: If a meter needs to be subtracted, in the case of a production meter and a consumption meter for example, simply modify the gain sign (coef A: column H) of the variables used in the file of the meter to be subtracted.*

• Tags (identification des variables)

In the definition file(s) of the meters connected to the concentrator, the power variables must be identified, checked that they are expressed in kW, the A coefficient (gain) must be adjusted if necessary, and the following tags must be assigned to them:

- If the "**Phase control" script parameter is** set to "***Min of the 3 phases***"

L1 phase active power in kW: tag " **ActivePow1kW** "
L2 phase active power in kW: tag " **ActivePow2kW** "
L3 phase active power in kW: tag " **ActivePow3kW** "

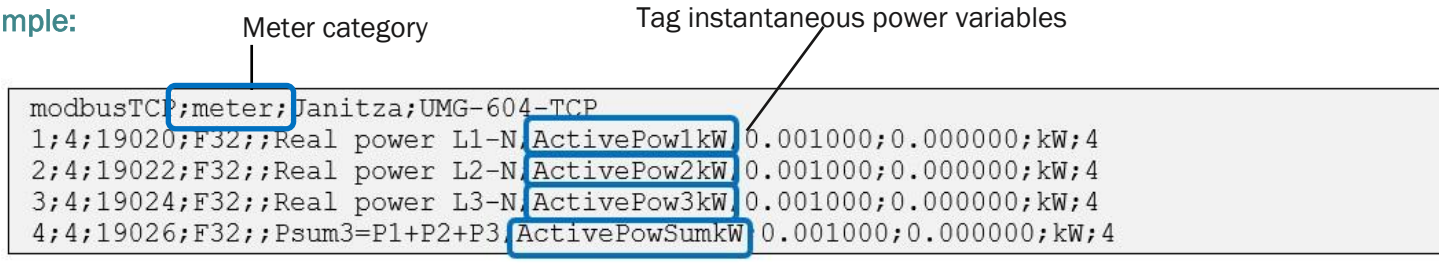
- If the script parameter " **Phase control** " is set to " ***single phase or sum of the 3 phases*** ".

Active power of the 3 phases in kW: tag " **ActivePowSumkW** "

The "Tags" must be filled in column G (fields 7) of the equipment definition file.
If necessary, refer to the equipment manufacturer's manual to identify the necessary variables.

Meter powers must be expressed in **kW**
The sign convention used for counters should be as follows:
Positive values indicate withdrawal and negative values indicate injection.

Example:



Inverters settings

In each definition file used by inverters connected to the gateway, the following is required:

• Category (equipment identification)

In the header of the definition file, the category field (first row, 2nd column) must be defined with the name "**Inverter**". It is this name that identifies all the inverters to be checked.

***Tips**: To exclude inverters from the regulation, you just must define another category in their definition file. This may require duplication and renaming the file if it is also used by a device to be controlled.*

• Tags (identification des variables)

All equipment identified by the "**Inverter**" category must have the following tags:

" **RealPower** " Tag Identifies the variable containing instantaneous active power. This variable is not used directly by the control algorithm but is used to test communication with the inverter. In addition, the information appears in the script logs (see chapter Script Log) and allows us to confirm the application of the power reduction commands.

" **cmdPwrPercent** " tag: Used to identify the variable receiving the power reduction commands

" **WMaxLim_Ena** " tag (optional depending on the inverters): Allows you to identify the power control activation variable.

"**WMaxLimPct_RvrtTms**" tag (optional depending on the inverter) allows you to cancel the original power restoration setpoint in the absence of a new command

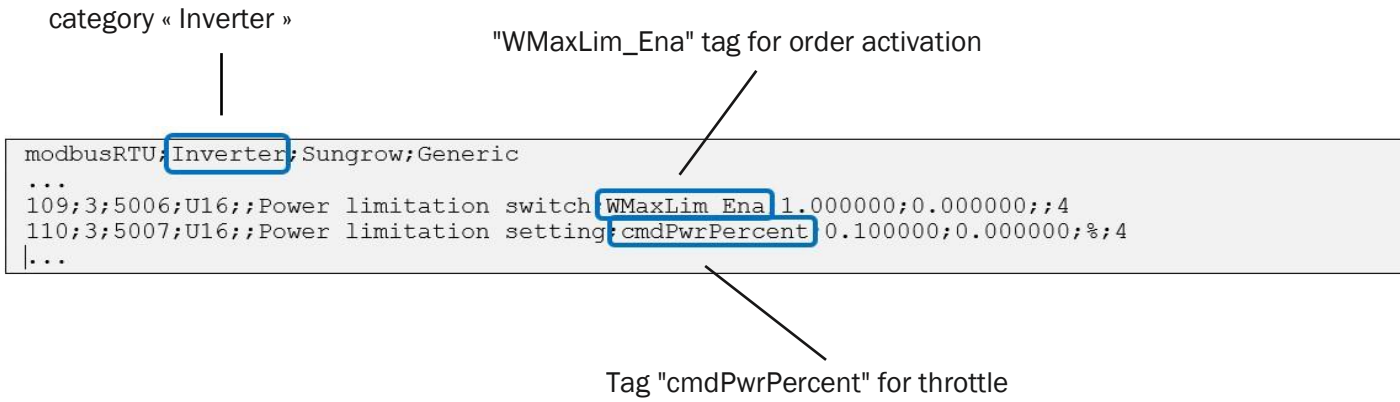
Tag "**WMaxLimPct_RmpTms**" (optional depending on the inverter) allows the setting of the execution times of the power modification instructions.

The **cmdOn** and **CmdOff** tags are only necessary when using the **cmdOnOffINV** parameter (see script parameter)
Tag " **cmdOn** " Identifies the variable that will receive a value of 1 during an inverter pairing command and 0 during a decoupling command.
" **CmdOff** " Tag: Identifies the variable that will receive a value of 0 during an inverter pairing command and 1 during a decoupling command.
It is not necessary for these two tags to be present. If the inverter only has a control register, it will be necessary to associate it with the appropriate tag:
If the logic is "direct": 1 to activate and 0 to deactivate then the "cmdOn" tag will be appropriate.
If the logic is "reverse": 0 to activate and 1 to deactivate then the "cmdOff" tag should be used.

The **NominalPower** Tag is only necessary if the **LoadBalancing=0** parameter is used (see script setting)
The **NominalPower Tag** is used to identify the register that indicates the nominal power of the inverter.

The "Tags" must be filled in column G (fields 7) of the equipment definition file.

Example:


category « Inverter »
"WMaxLim_Ena" tag for order activation
modbusRTU;Inverter;Sungrow;Generic
...
109;3;5006;U16;;Power limitation switch;WMaxLim_Ena;1.000000;0.000000;;4
110;3;5007;U16;;Power limitation setting;cmdPwrPercent;0.100000;0.000000;%;4
...
Tag "cmdPwrPercent" for throttle

Setting up the IOs of the WebdynSunPM

It is possible to configure the IOs of the WebdynSunPM directly from the web interface

• Digital input

The presence of a "**DIN1**" tag on one of the digital inputs configured in state reading (**dry contact**) allows the inverters to be "put to sleep" and thus consider the start of a *generator set* by setting the inverter production to 0% as long as this contact is active.

By default, closing the contact (switching to one) causes the inverters to shut down, but it is possible to reverse the logic of the digital input by configuring the digital input with a gain of -1 and an offset of 1.

The **DIN2** and **DIN3 tags** can be used to allow regulation at 30% of the origin threshold and 60% of the origin threshold respectively when the corresponding contact is closed.

These actions have no effect in the case of a regulation configured to zero (zero injection), on the other hand if an injection of 100kW is allowed, for example, the closure of the contact corresponding to DIN2 will limit the injection to 30kW and the closure of the contact corresponding to DIN3 will limit the injection to 60kW

If several contacts are closed at the same time, the contact with the highest limitation will be given priority.

• Relay output

The configuration of the "**RelayOutput**" tag linked to the relay output of the webdynSunPM allows the script to shut down the control panel independently of commands sent to the inverters, it is necessary when:

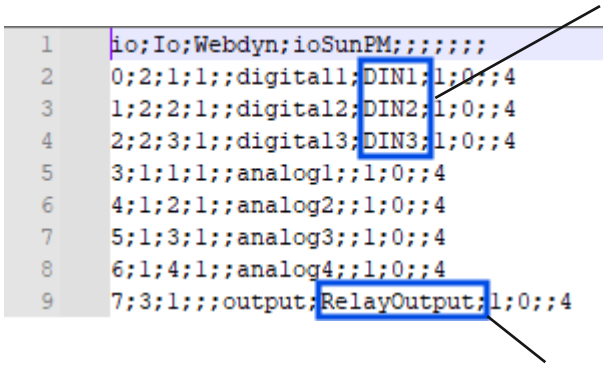
- the script parameter " **onError** " is configured with the value "**Stop with contactor relay**". This device ensures that there is no injection in the event of a failure of the control system.

- the "CmdONOFF" parameter is used. This parameter is recommended when it is desired to prevent residual injection of inverters with a zero control, or when the inverter control control is not fast enough.

The control of a "*Schneider Electric LC1D115004P7*" type power contactor allowing the production shutdown requires the use of an intermediate relay type Finder 55.32.9.024.0000, as the internal relay of the WebdynSunPM does not have sufficient breaking power to ensure direct control.

Example:

Tag for dry contact monitoring



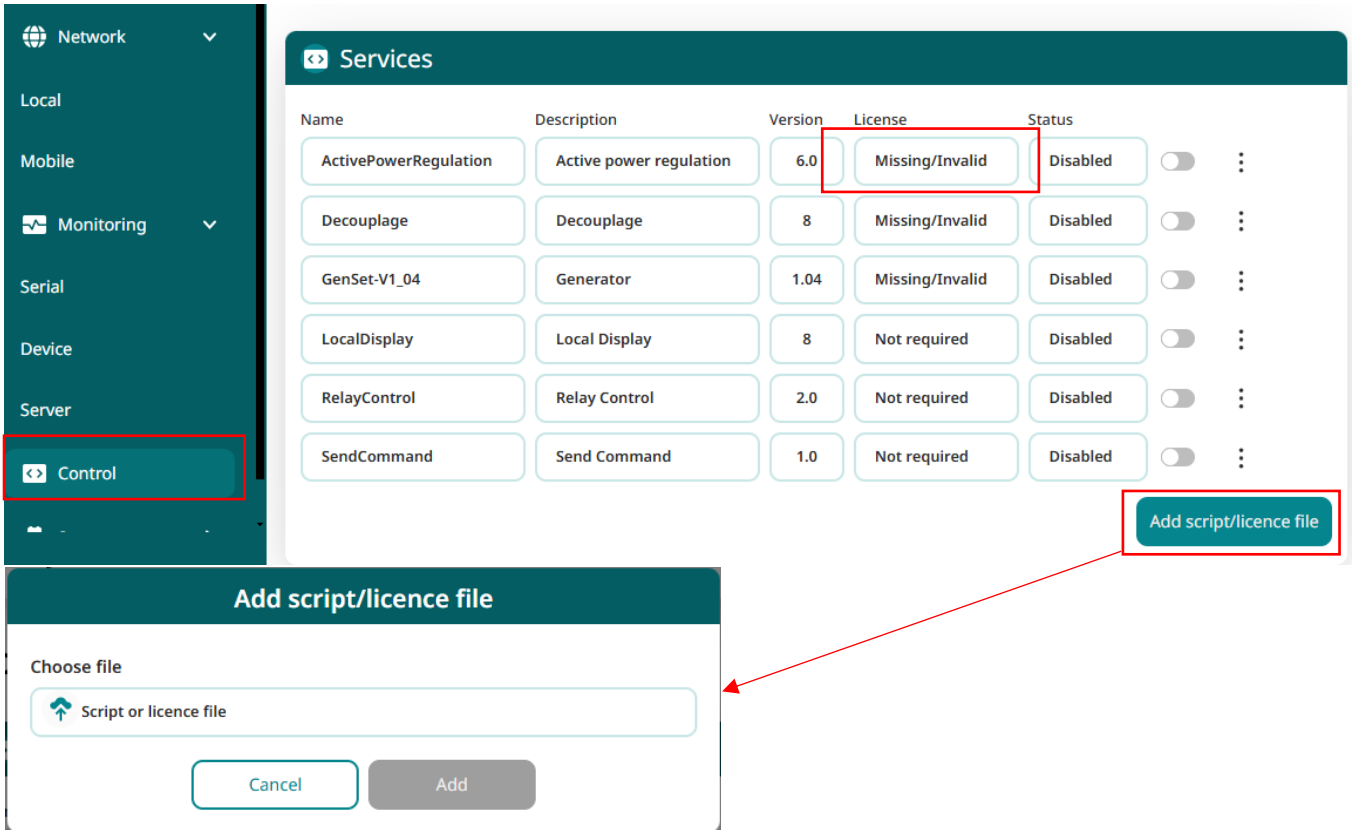
"RelayOutput" tag for relay control

Script

Loading the script and license

The script is present in the WebdynSunPM script library as of version 5.0.10.
However, it can be retrieved via the following link:
http://www.webdyn.com/download/ActivePowerRegulation.zip

From the ***control*** page you can load the script by clicking on the "*Add script/licence file*" button



License Integration Verification:

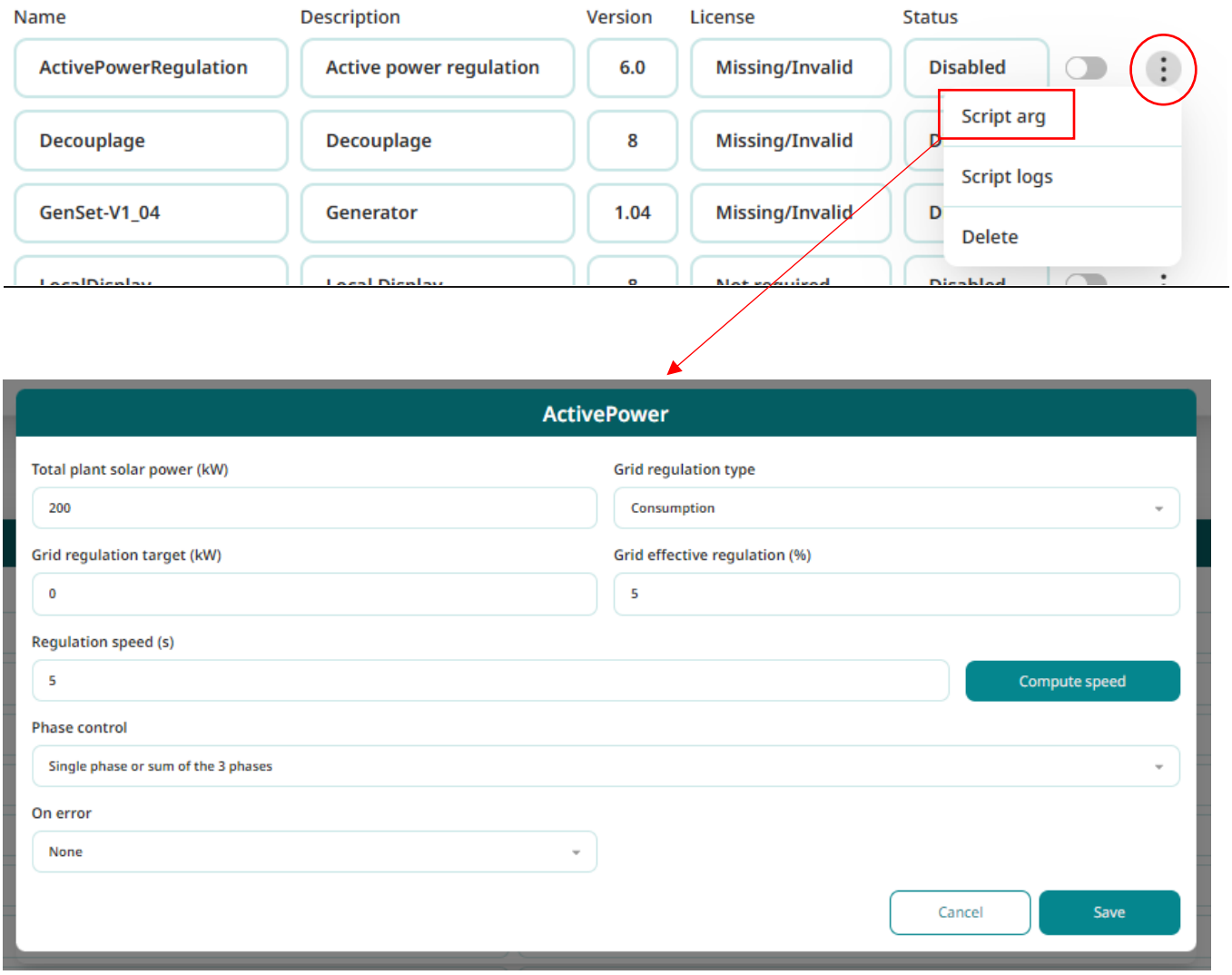
If the license is not loaded into the product, the message "Missing/Invalid" appears in the License column.

Add the license by clicking on the "*Add script/license file*" button

The "License" field must indicate "Active"

Setting up the script and starting from the web interface:

Click on the 3 dots at the end of the line to access the extended menu and then click on ***Script arg***



A control point is calculated from the parameters entered.
It corresponds to the Grid **regulation target (kW) set** point to which is added a **Grid effective regulation margin (%)** expressed as a percentage of the total **plant solar power (kW) installed capacity** (see the operating principle paragraph *above*)

- The "**Grid regulation type" parameter allows** you to choose an injection or consumption setpoint because the value of the Grid **regulation target parameter (kW)** must always be positive.

The "**Regulation speed**" parameter allows you to limit the sending of commands to the inverters to allow the meter(s) to reflect the previous command and not create a divergent system. This latency is not respected in the event of an emergency (loss of communication with the meter or value below the **Grid regulation target threshold**)

-The "**Phase control" parameter allows** you to choose whether the injection monitoring is carried out on the sum of the 3 phases (or on a single phase in the case of a single-phase installation). "***single phase or sum of the 3 phases***" or on each phase independently: "***Min of the 3 phases***"

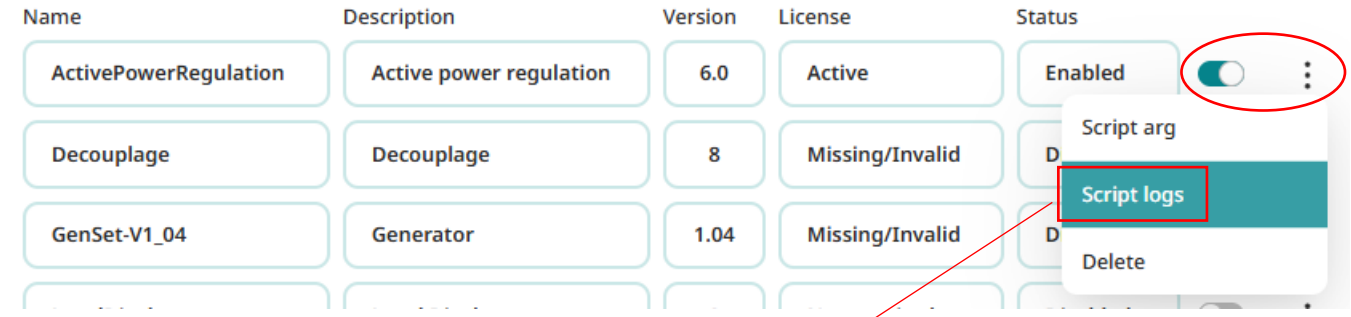
-The "**On error**" parameter allows you to choose the behavior of the script when the WebdynSunPM is stopped (power loss, update) or when communication with the meter is lost.

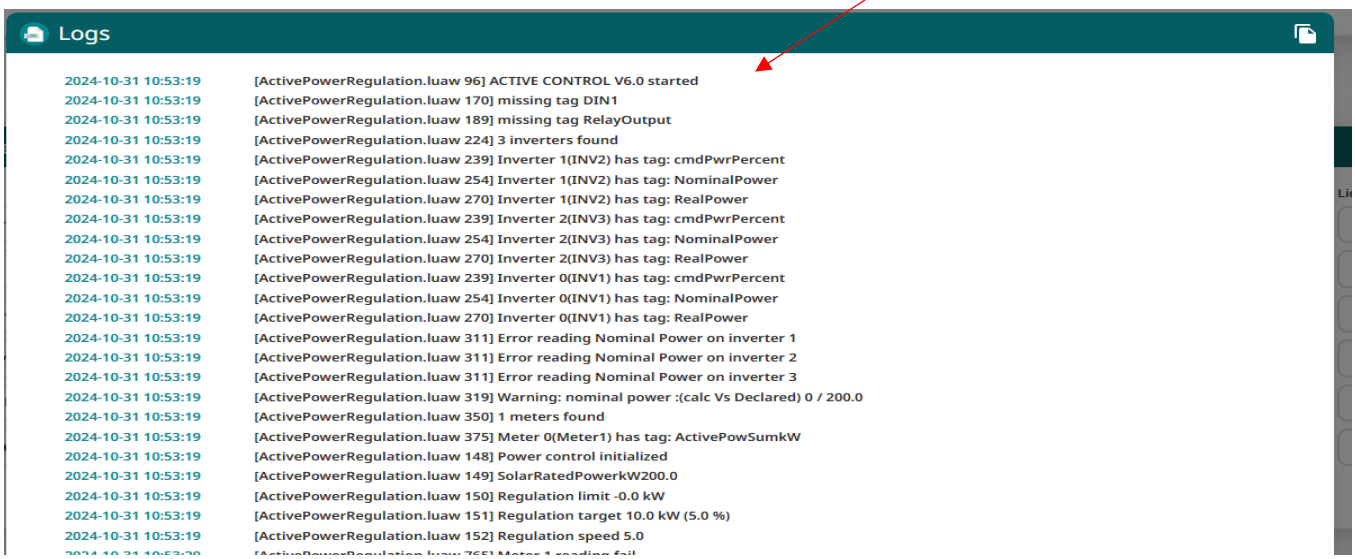
It is possible to perform no action; "**none**" or force a predefined percentage for inverters: "**set inverter to**" followed by a value in the appropriate field.

We recommend the use of the latter with a value of zero; it is the safest configuration to prevent injection when there is no contactor installed on site.

Finally, it is possible to choose the "**stop with contactor relay**" parameter , in this case the configuration of the relay tag is imperative and a "*Schneider Electric LC1D115004P7*" type power contactor allowing the production to be cut off must be installed, it requires the use of an intermediate relay type Finder 55.32.9.024.0000, the internal relay of the WebdynSunPM not having sufficient cutting power to ensure such a functionality.

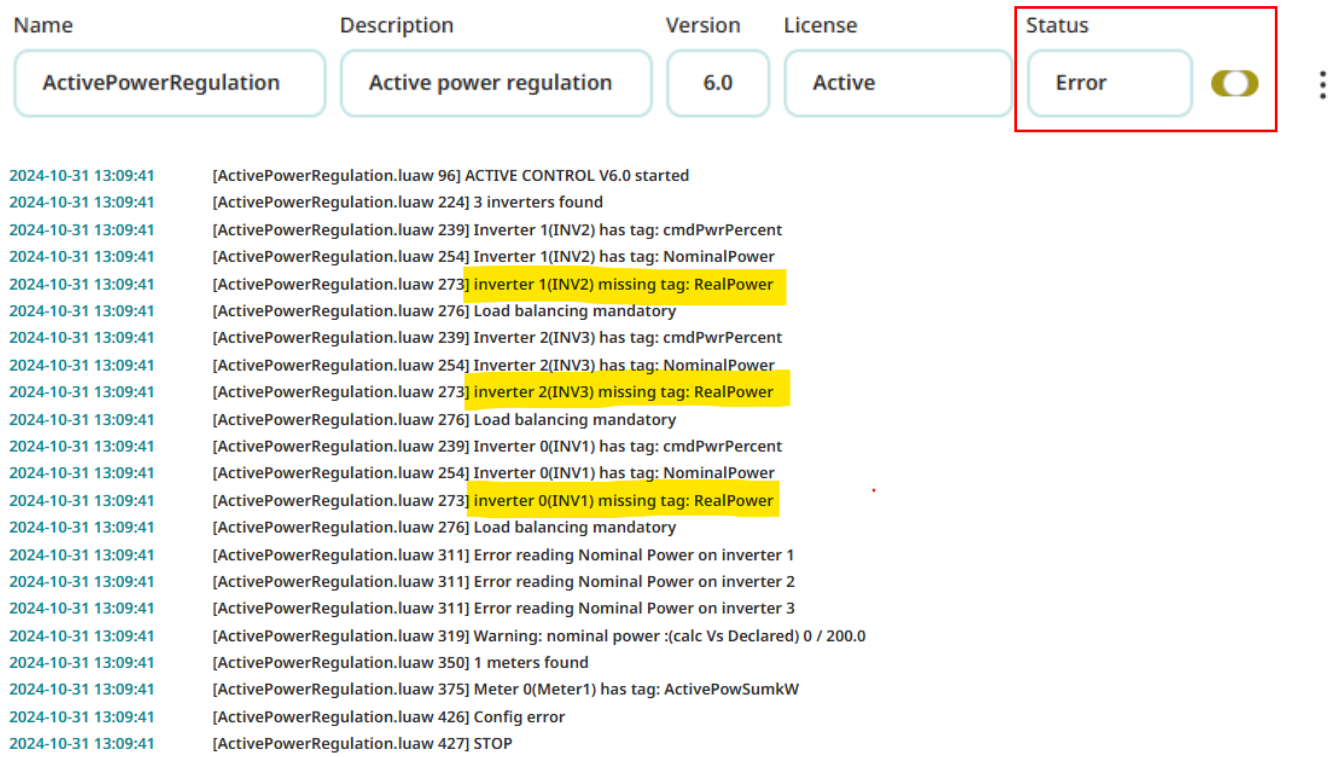
After activating the script using the button at the end of the line, you can access the script log:





When the script starts, the log file summarizes the devices found and the tags present in the files associated with these devices.

If any of the tags are missing, the script will not start and the log file will show the missing tags:



During operation, the loss of communication with the counter causes the policy defined by the "**on error**" parameter to be applied and a connection to the remote server is initiated in order to file an alarm file.

Setting up and starting the script from the remote server

From the remote server, the "<uid>_scl.ini" file allows the configuration and activation of scripts, it is present in the /Config directory

The SCRIPT_Enable[n] **parameter** indicates the operating status and allows the activation (=1) and deactivation (=0) of the script identified by the **SCRIPT_File[n] parameter** which is ActivePowerRegulation.luaw in this case.

The SCRIPT_Args[n] **parameter defaults** to the same configuration items as described in the Web interface, plus the optional parameters described below.

Example file. UID_scl.ini

```
SCRIPT_Args[n] = {"solarRatedPowerKW": 200,"gridRegulationType": "injection","gridRegulationTargetKW":
0,"gridEffectiveRegulationPercent": 5,"regulationSpeedS": 5,"phaseControl": "sum","errorAction":
"none","setToPercent": 100,"DataFreq": 0,"MeterType": 1,"maxGetxCount": 2,"EnableConfirm": 0,"cmdOnOff":
0,"cmdOnOffINV": 0,"AlarmOn": 1,"AlarmDelayed": "false","InvErrorAction": 0,"repeatCmdFreq":
120,"TargetCriticity": 0,"LoadBalancing": 1}
```

Some settings are not available from the script configuration web page.
To change the following settings, it is necessary to access the script configuration file "<uid>_scl.ini" on the server.

DataFreq : This parameter allows you to enable (>0) or disable (=0) the writing of the script variables to the data file sent to the server. The list of available data is described in the definition file of the script that is considered a virtual device. (see next §: operating principle)
When enabled, the parameter value is used to set the given vesting period. By default this parameter is set to 0 (no data emitted).

MeterType : This parameter allows you to change the source of the power measurement that serves as a reference for the regulation.

0 (history): Measurements are taken on a single meter declared with the name "main meter"
1 (default): Measurements are taken via all meters declared with the "Meter" category.
2 (alternative use): The measurements are emitted by a third-party BMS device on a variable of the virtual equipment associated with the script.

MaxGetxCount : This parameter allows you to set the number of failed communications with a device before it is considered to be faulty. It is set to 2 by default; a larger number will cause delays in considering a communication defect. A value that is too low can cause the control panel to shut down unexpectedly if an untimely loss of communication is reported.

EnableConfirm: This parameter enables the sending of a command to acknowledge the previously issued throttle command. This behavior is sometimes expected by some inverters.

CmdOnOffINV : The cmdOnOffINV parameter when enabled (=1) allows the script to drive the internal relay of the inverters.having the necessary tags (CmdOn/CmdOff) in addition to a zeroing of the regulation setpoint. This feature allows for faster shutdown and avoids residual production of the affected inverters.
Warning: A synchronization time with the network is necessary when resuming production (usually 60s) automatically managed by the script.

CmdOnOff : The cmdOnOff parameter allows the script to act on the internal relay of the WebdynSun PM in addition to a zeroing of the regulation setpoint when the power at the injection point falls below the threshold **Grid regulation target** This feature allows a faster shutdown and avoids the residual production of the inverters concerned. Warning: As the inverters are cut off following the activation of the relay, a time of resynchronization with the grid is necessary when the production resumes (usually 60s) automatically managed by the script.

AlarmOn: This setting allows you to enable or disable the transmission of alarm files to the corresponding directory on the server
If activated, the value 1 limits the sending to the alarm relating to the loss of communication with the meter, the value 2 authorizes the sending of all possible alarms: loss of communication with the meter, error in settings, shutdown and activation of the script during power losses and other causes of reboot of the equipment

AlarmDelayed : When the parameter is set to:
"**true**" alarms are issued only when scheduled connections to the server are made
"false". alarms are issued immediately, The appearance of an alarm causes an immediate connection to the server. By default, this variable is false.

InvErrorAction : This parameter is in addition to the OnError parameter, the policy defined by the latter only applies in the event of a loss of communication with the meter (InvErrorAction=0) When InvErrorAction is set to 1, a communication failure on the UPS will have the same consequences as a loss of communication with the meter. This parameter is especially recommended when there is only one inverter on site, otherwise the other inverters will compensate for the lack of communication with the faulty inverter

repeatCmdFreq: This parameter allows you to set the reset control period to zero or 100% when the throttle function is stopped by using the DIN1 IO or by the CmdStop variable. By default, this parameter is set to 60s.

TargetCriticality: This parameter allows you to change the behavior of the script when the baseline value falls below the critical threshold value: **Grid regulation target**

0: criticity low : No specific action, the usual regulatory behavior applies

1: criticity medium : The frequency of updating the command is increased, the new command applies every second, the parameter **regulationSpeed** is no longer in use.

2: criticality high: This is the default behavior, if the meter value is not correct after the first control attempt, the inverters are set to 0% and the regulation resumes normally.

LoadBalancing: This setting changes the behavior of the script to optimize reaction times. When activated (=1 default value) the power variations are permanently evenly distributed over all inverters so that all inverters always have the same percentage of power control.
When disabled (=0), any new order takes into account the current output of each inverter, so the output levels of all inverters are different. This option requires the presence of the NominalPower tag to identify the rated power of each inverter.

Parameters specific to the InjectionAndProductionRegulation script

ProductionLimit: This parameter allows you to set the desired throttling value for the maximum output of the inverters.

DynLimit: This parameter allows you to choose the type of throttling you want

- If the parameter is zero, the throttle is static and a maximum percentage is calculated based on the power of the control unit and the preceding parameter **ProductionLimit.** This percentage sets the maximum limit that can be sent to inverters
- If the parameter is one, the throttling is dynamic and the production limit value may change according to the sum of the productions declared by each inverter.

As with the injection control, in the case of dynamic production throttling, a margin equivalent to that of the injection control is applied. This margin, which corresponds to a percentage of the plant's capacity (**Grid effective regulation**), is removed from the value of the **ProductionLimit parameter.**
For example, on a 300KW power plant, with a Grid effective regulation parameter of 5% and a production limit of 250KW, the production regulation will be around 250 – 15 = 235KW.

Description of the script parameters:

The name of the script parameter in the web interface	Name of the parameter in the file "<uid>_scl.ini"	Description	Type	Default
Total plant solar power	solarRatedPowerKW	Maximum power in kW of the solar power plant	Integer positive	200
Grid regulation type	gridRegulationType	Control Type: • injection: The target value of the regulation (gridRegulationTargetKW) is an injection value (positive): see below. • consumption: The target value of the regulation (gridRegulationTargetKW) is a (positive) consumption value: see below.	List: • injection • consumption	injection
Grid regulation target	gridRegulationTargetKW	Target value in kW for regulation, the operation of this value depends on the type of regulation (gridRegulationType) • injection: The target value of the regulation (gridRegulationTargetKW) represents the maximum value that can be injected. • consumption: The target value of the regulation (gridRegulationTargetKW) is the minimum value that we allow ourselves to consume.	Integer positive	0
Grid effective regulation	gridEffectiveRegulationPercent	As a % of the installed solar power, this value is used to calculate the operating point of the control. This information indicates which margin is calculated in relation to the target (top margin) and what is the effective value of the regulation.	Integer positive	5
Regulation speed	regulationSpeedS	Time of each step in seconds of control management	Integer positive	5

Phase control	phaseControl	The management of the regulation can be done in 2 different ways: • Single phase or sum of the 3 phases (sum): On all phases in three-phase or on a single-phase phase. • Min of the 3 phases (min) : On the lowest phase (only possible for a three-phase installation)	List: • sum • min	sum
On error	errorAction	In case of an error on the equipment or a script stoppage, you can choose 3 scenarios: • none: Current regulation • Set inverters to (setTo)— Throttling as a percentage of a value specified in the "setToPercent" parameter • Stop with contactor relay (stop): Opening the relay (setting the relay with the "RelayOutput" tag)	List: • none • setTo • stop	none
	setToPercent	Percentage of desired power in case of error. (Only if the "errorAction" parameter is in "setTo" mode)	Integer positive	100
DataFreq		Allows you to set the frequency of recording the data of the virtual equipment in the file transmitted to the server (if 0: no data transmitted)	Integer positive	0
Meter Type		MeterType is the reference source for measuring active power.	List: 0 : MainMeter 1 : Meter category 2 : Modbus Slave	1
maxGetxCount		maxGetxCount allows you to set the number of communication failures with a device that triggers a fault.	Integer positive	2

EnableConfirm		Send an acknowledgment order allowing the power regulation command to be taken into account.	Positive integer	0
cmdOnOff		When the 0% set point is issued, the internal relay of the MP is used to ensure non-production.	List: • 0 Function Disabled • 1 function enabled	0
cmdOnOffINV		When the 0% set point is issued, the internal relays of the inverters are used to ensure non-production.	List: • 0 Function Disabled • 1 function enabled	0
AlarmOn		Allows you to configure the alarm policy •	List: 0 :p alarm ace 1: Alarm loss of com counter only 2: All	1
AlarmDelayed		By default (false), alarms are issued instantly. If the setting is set to "true", alarms will not be emitted until the next scheduled connection to the server.	Boolean	false
InvErrorAction		Allows you to apply the same strategy in the event of a com fault with an inverter as in the event of a com fault with the meter. Otherwise, the inverter faults are ignored.	List: 0 : inactive 1: Active	0
repeatCmdFreq		Sets the period of time to repeat the zeroing command in modes where the script is paused. DIN1 enabled or cmdStop to 1.	Positive integer	120
TargetCriticity		Defines the behavior of the script when the **Grid regulation target** threshold is reached	List: 0: No specific action 1: Commands issued every second 2: A corrective order before zeroing.	2
LoadBalancing		Defines the strategy for distributing power variations on inverters.	List: 1: power evenly distributed over all inverters. 0: Differential control takes into account	1

			the current output of each inverter	
ProductionLimit		Defined the desired clamping value for the maximum production of the inverters.	Positive integer	
DynLimit		Allows you to choose the type of clamping of the production.	List: 0: static clamping 1: Dynamic clamping	

Working principle

After startup, the script makes available a series of variables that are described in the "**WPMXXXXXX_Script_ActivePowerRegulation.csv" file** dropped in the server's /DEF directory the first time it is connected after it is activated.

none	Script	Script	ActivePowerRegulation							
1			U8		Alarm	Alarm	1.000000	0.000000		4
2			U8		CmdStop	CmdStop	1.000000	0.000000		4
3			I32		SetTarget	SetTarget	1.000000	0.000000		4
4			U32		TotInvPower	TotInvPower	1.000000	0.000000		4
5			U32		Watchdog	Watchdog	1.000000	0.000000		4
6			U16		inverterCommand	inverterCommand	1.000000	0.000000		4
7			I16		meterValueKW	meterValueKW	1.000000	0.000000		4
8			I16		variation	variation	1.000000	0.000000		4

It describes the variables in the script in the same way that the other files in this directory describe the variables that are accessible on a physical device. In the case of the script, we speak of virtual equipment. These variables can be embedded in data files sent to the server using the **DataFreq parameter**

The **Alarm variable** informs about the operating status of the script and the installation by reporting codes corresponding to the various defects observed
TABLE OF ALARM CODES:

0 No Error
1 Misconfiguration
2 Loss of com with the counter
3 Loss of com with an inverter (only if InvErrorAction=1 parameter)
100 Initialization

The **CmdStop variable** is used to control the operation of the script.

Writing value 1 allows you to stop the regulation by putting the inverters at 0% production
Writing the value of 100 allows the regulation to be stopped by putting the inverters at 100% production

The **SetTarget** variable allows you to modify the control setpoint, it receives power in positive KW for a consumption threshold or negative for an injection threshold.

The **TotInvPower** variable contains the sum of the UPS outputs.

The **Watchdog** variable is used to monitor Modbus communication with a BMS when the BMS provides the control reference value instead of the meter. The GTC must modify the **Watchdog** variable very regularly (<5s) in order to confirm the correct communication. (cf alternative operation)

The **InverterCommand** variable provides the last command sent to the UPS (in %)

The **meterValueKW** variable provides the last reference value read from the meter. Alternatively, it can receive the reference value transmitted by the BMS (see alternative operation).

The variable variable makes available the value of the variation during the last command sent to the inverters.

Remote control of the control panel

The **SetTarget variable** described above allows you to remotely modify the Grid regulation target variable without changing the configuration and therefore without restarting the script.

To do this, you must use the associated function: **SetGridRegulationTarget**

This function can be called by any means made available on the WebdynSunPM

- Command file via FTP server /CMD directory
- Requests via the "command" topic of the MQTT server
- http POST requests

In return, the script responds with the effective regulation value which considers the power of the power plant and the percentage of margin: **Grid effective regulation (%)**

Control by sending orders via an FTP server

By dropping the following command file on the FTP server in the /CMD directory.

The command file must have the following format:

< uid>_cmd.json

Below is the modification of the SetTarget variable to set the threshold at 50KW of injection:

```
{
    "rpcName": "ActivePowerRegulation.SetGridRegulationTarget",
    "parameters": -50,
    "callerId": "1"
}
```

- The use of the command via an FTP server does not allow an immediate application of the order issued. The consideration of the command depends on the frequency of connection to the server. For immediate consideration, you should favor post requests or the MQTT server. A permanent connection is required for these types of use.

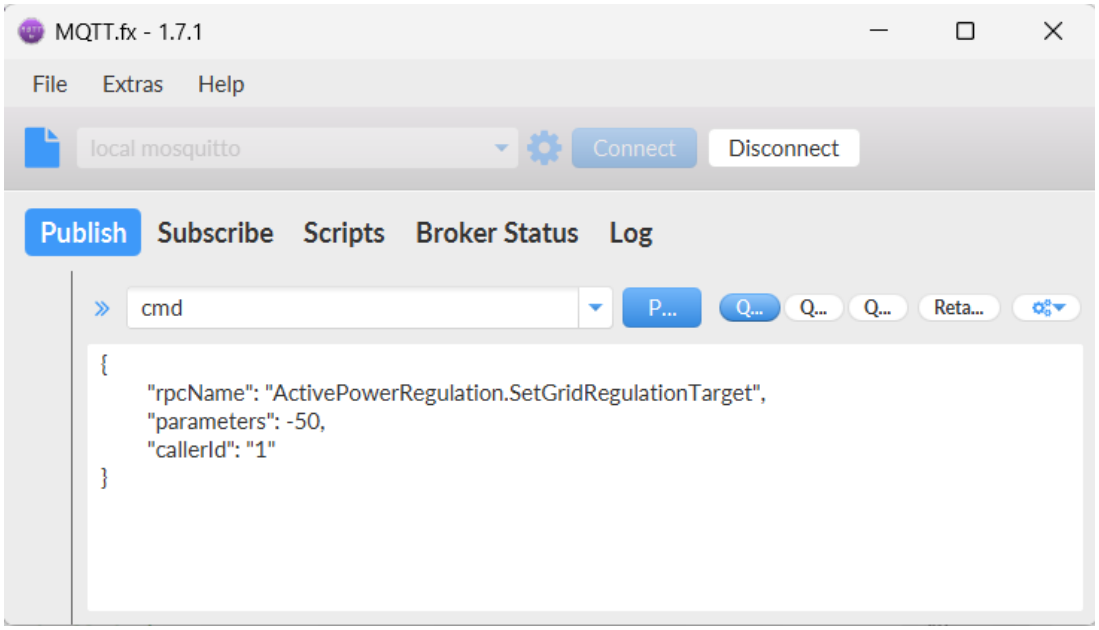
Control by sending a command via an MQTT server

To configure the connection of the WebdynSunPM to an MQTT server, refer to the user. As the MQTT connection does not allow the monitoring of the datalogger configuration, only server 2 can be configured with this type of connection.

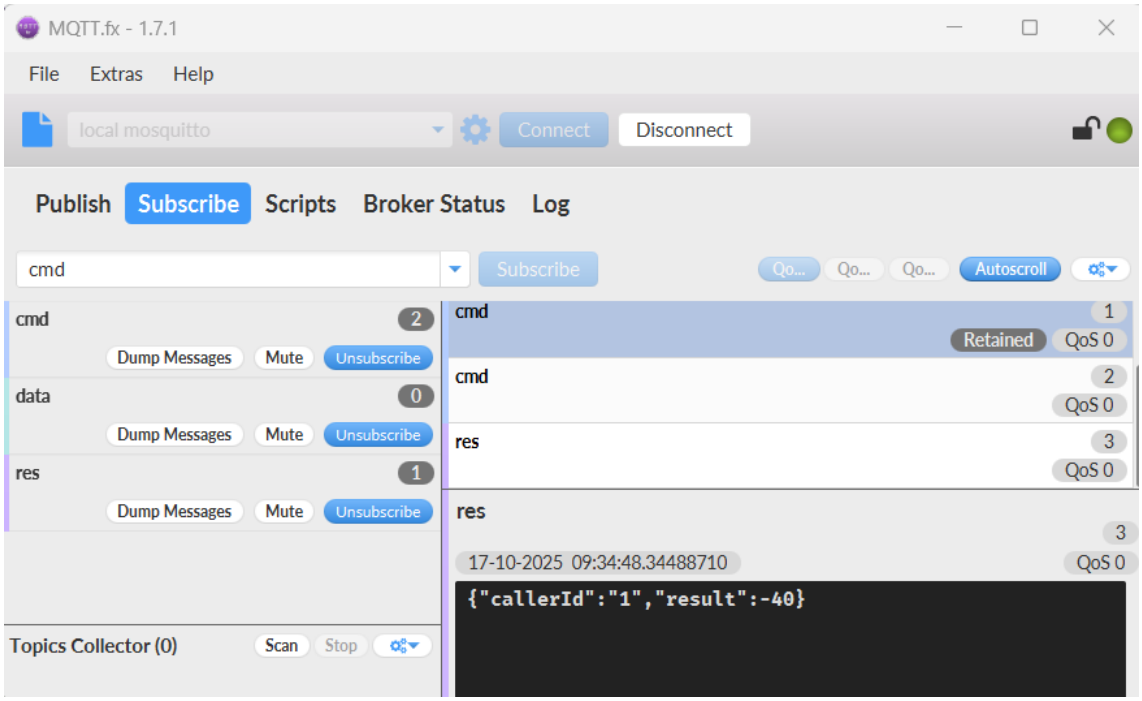
Make sure you have defined a **Commandtopic** and a **ResultTopic** in order to allow the receipt of commands and the sending of the result.

The orders can be transmitted via software that allows you to subscribe to an MQTTfx broker (https://www.softblade.de/download/).

Below is the modification of the SetTarget variable to set the threshold at 50KW of injection:

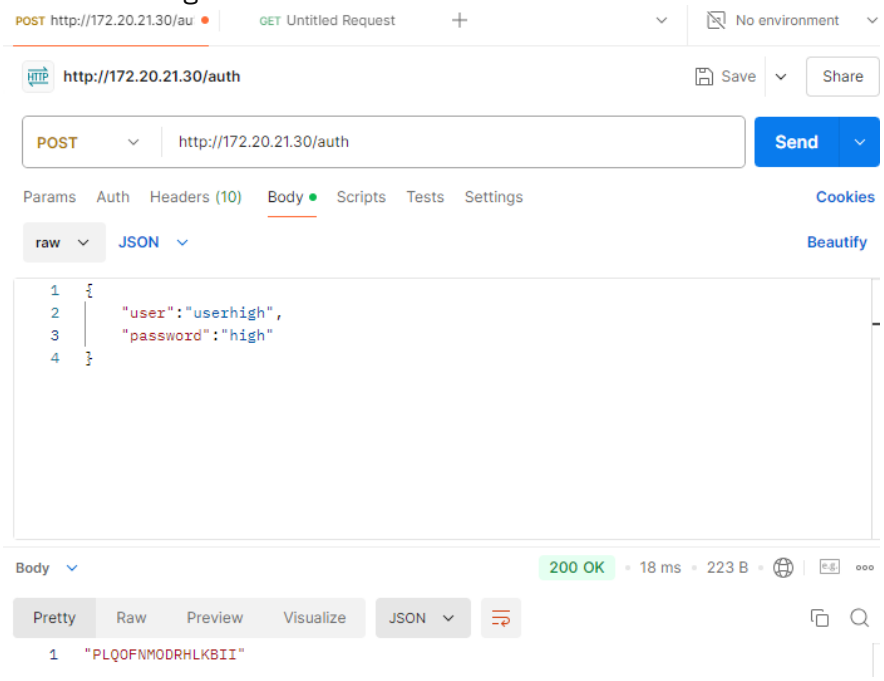


In return, the result of the order indicates that the effective value of the regulation will be 40Kw of injection (5% of a 200KW plant)

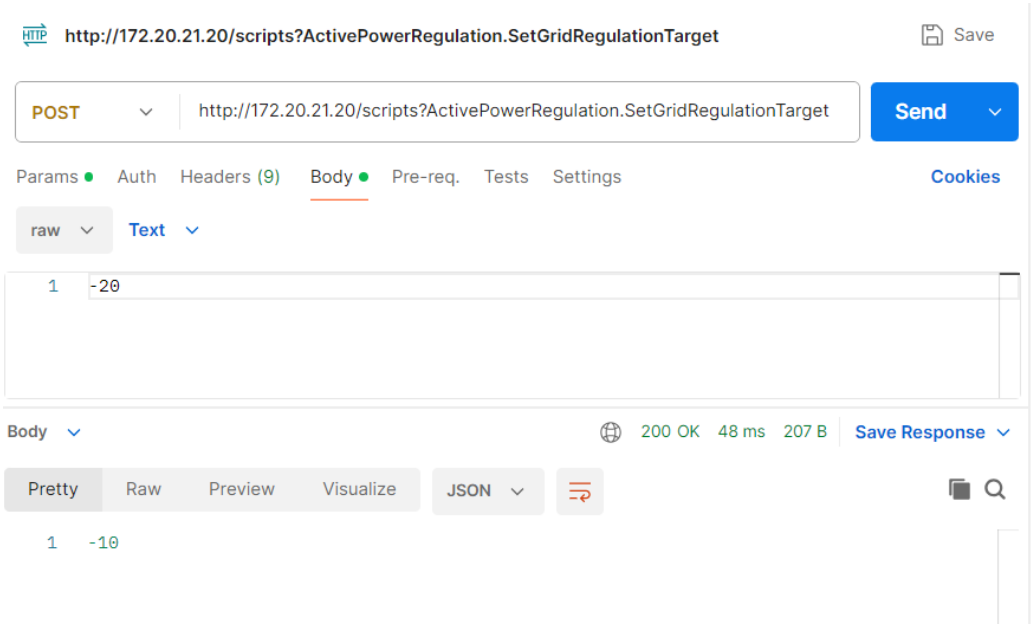


Sending a POST request

Before sending a post command to the WebdynSunPM, it is necessary to log on by sending an authentication request as follows using the Postman API for example (https://web.postman.co/https://web.postman.co/).
Below is the logon command:



After authentication, you can then call the commands described above.
Below is the modification of the SetTarget variable to set the threshold at 20KW of injection:




```
2025-10-16 16:00:40    [ActivePowerRegulation.luaw 543] received new order : -20.0 kW
2025-10-16 16:00:40    [ActivePowerRegulation.luaw 547] New Grid Regulation Target -20.0 kW
2025-10-16 16:00:40    [ActivePowerRegulation.luaw 548] New effective regulation target -10.0 kW
2025-10-16 16:00:40    [ActivePowerRegulation.luaw 1176] meter value is 0.00
2025-10-16 16:00:40    [ActivePowerRegulation.luaw 1176] meter value is 0.00
```

Local control of the plant

Controlling by sending Modbus requests

The variables described above can be viewed or modified by sending Modbus requests.
To do this, you have to "map" the variables in the modbus slave using the description file of the register table internal to the WebdynSunPM. You will then be able to send read and/or write requests on the chosen registers.

Like what:

	A	B	C	D	E	F	G	H	I	J	K
1	ModbusSlave										
2	1		0		ActivePowerRegulation		meterValueKW				4
3	2		1		ActivePowerRegulation		CmdStop				4
4	3		2_4		ActivePowerRegulation		Watchdog				4
5	4		4		ActivePowerRegulation		Alarm				4
6	5		5		ActivePowerRegulation		inverterCommand				4
7	6		6		ActivePowerRegulation		variation				4
8	7		7_4		ActivePowerRegulation		TotInvPower				4
9	8		9		ActivePowerRegulation		SetTarget				4
10											

Variables in the script can be declared in any customer-only registry and available at addresses between 0 and 32000
Refer to the manual for the configuration of the Modbus slave registers.

Thus, a write to the **SetTarget** variable will cause a modification of the regulation policy.

Advanced control by Modbus requests via SCADA (BMS/BMS)

It is possible to control this script from a SCADA local to the site using the variables described in the chapter **Principle of operation** correctly reported in the Modbus slave table

This means that there is no need to connect a new counter if there is already one that communicates with the SCADA or to configure the SCADA to make available the value it collects. As a reminder, it is strongly recommended not to query the reference meter with 2 pieces of equipment.

Indeed, by using the **MeterType** parameter with a value of 2, it allows the SCADA to write the throttling reference value directly to the **meterValueKW variable**

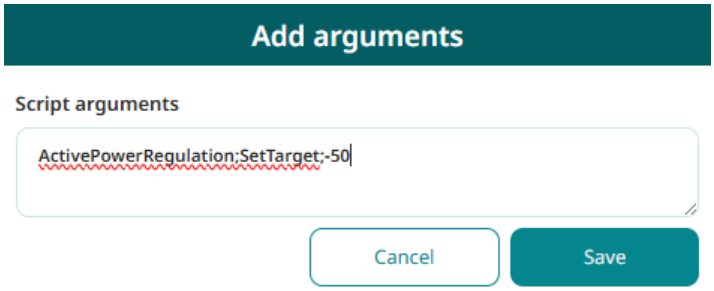
In this case a monitoring of communication with the SCADA is necessary in order to identify the faults of the setpoint transmission, to do this it is necessary that the SCADA periodically refreshes (5s) the value of the **Watchdog variable** with a value different from the previous one.

Other faults are reported in the **Alarm variable**

SendCommand scripted driving

The writable variables described above can be modified from the webdynSunPM web interface using the SendCommand script with the appropriate settings.

Below is the modification of the SetTarget variable to set the threshold at 50KW of injection:



Injection control and decoupling

If a simplified decoupling device (coupling and decoupling by pulse control of the meter) is to be used in parallel with the control script, it is not possible to use the decoupling script in parallel with this control script.

To overcome this problem, we recommend using a typical timed relay: FINDER 80.61 (https://cdn.findernet.com/app/uploads/IB8061_82FR.pdf) in order to allow the conversion of the pulses into a state that can be interpreted by a digital input configured with the **DIN1 tag** (see **Configuring the IO of the WebdynSunPM**) usually used to receive the start-up state of a generator set. The digital input thus configured makes it possible to stop the regulation and position the production of the inverters at zero.

Log exploitation

See chapter 4.1.8.2: "Script logs" in the WebdynSunPM manual
The logs of the script accessible from the web interface of the hub are available on the remote server or a file is deposited each time you connect in the /LOG directory with the following format: WPM000000_LUA_ActivePowerRegulation_241031_150000.log.gz

With the example below:

```
24/10/04-08:52:59;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-08:52:59;tune;state:running;meterValue:40.61596875 kW ;requested variation:21.564427083333 % ;inv command:100 %
24/10/04-08:53:00;meter value is 40.31971484375
24/10/04-08:53:01;meter value is 25.328072265625
24/10/04-08:53:01;meter value is 25.328072265625
24/10/04-08:53:01;no new meter value
24/10/04-08:53:02;meter value is 24.556755859375
24/10/04-08:53:02;meter value is 24.0140078125
24/10/04-08:53:03;meter value is 24.26965234375
24/10/04-08:53:03;meter value is 24.26965234375
24/10/04-08:53:03;no new meter value
24/10/04-08:53:04;meter value is 23.78146484375
24/10/04-08:53:05;meter value is 22.245443359375
24/10/04-08:53:05;meter value is 21.78450390625
24/10/04-08:53:06;meter value is 21.78450390625
24/10/04-08:53:06;no new meter value
24/10/04-08:53:06;meter value is 22.246576171875
24/10/04-08:53:06;variation(21.564427083333->11.359208984375 %)
24/10/04-08:53:06;command(100->100 %)
24/10/04-08:53:06;command sent:100(100%) to inverter 1(43538/60KW)
24/10/04-08:53:06;command sent:100(100%) to inverter 2(40272/60KW)
24/10/04-08:53:06;command sent:100(100%) to inverter 3(39766/60KW)
24/10/04-08:53:06;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-08:53:07;tune;state:running;meterValue:22.246576171875 kW ;requested variation:11.359208984375 % ;inv command:100 %
24/10/04-08:53:07;meter value is 24.85178515625
24/10/04-08:53:08;meter value is 21.26494921875
24/10/04-08:53:08;meter value is 18.313375
24/10/04-08:53:09;meter value is 18.313375
24/10/04-08:53:09;no new meter value
24/10/04-08:53:09;meter value is 19.121578125
24/10/04-08:53:10;meter value is 17.48408984375
24/10/04-08:53:10;meter value is 17.095189453125
24/10/04-08:53:11;meter value is 17.095189453125
24/10/04-08:53:11;no new meter value
24/10/04-08:53:12;meter value is 19.07495703125
24/10/04-08:53:12;meter value is 21.75724609375
24/10/04-08:53:13;meter value is 20.2193359375
24/10/04-08:53:13;variation(11.359208984375->10.232964409722 %)
24/10/04-08:53:13;command(100->100 %)
24/10/04-08:53:13;command sent:100(100%) to inverter 1(43573/60KW)
24/10/04-08:53:13;command sent:100(100%) to inverter 2(40292/60KW)
24/10/04-08:53:13;command sent:100(100%) to inverter 3(39876/60KW)
24/10/04-08:53:13;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-08:53:13;tune;state:running;meterValue:20.2193359375 kW ;requested variation:10.232964409722 % ;inv command:100 %
```

At each regulation loop, the following 2 lines are repeated

```
24/10/04-08:52:59;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-08:52:59;tune;state:running;meterValue:40.61596875 kW ;requested variation:21.564427083333 % ;inv command:100 %
```

The first summarizes the settings:

- *-RegulationPoint* corresponds to the effective regulation point (threshold + percentage of total power)
- *-RegulationLimit* is the threshold set by **Grid regulation target,** in this case it is zero injection
- *-loop* refers to the "**Regulation speed» parameter** of the configuration. We can also observe that these 2 lines are repeated about every 5 seconds.

While the second gives the result of the analysis of the regulation algorithm

- The first 2 fields indicate the status of the regulation

-The first field is "*tune*" in normal operation and "*warn*" if the meter value is below the limit threshold.

-The second field will indicate *state: running* in the first case and *state: limit* in the second.

-*MeterValue* indicates the reference value provided by the meter(s).

-*Requested variation* gives the evolution of the desired power percentage in relation to the effective regulation value.

-Finally, the *inv command* field indicates the percentage of command sent to each inverter.

Between 2 control loops, the meter monitoring continues and the reading values are displayed.
The log "*no new meter value*" indicates that the meter value has not changed, the meter register table has probably not been updated on the meter side.

Below is an example of a log where we can observe a reduction in the power of the inverters as well as an immediate command sending following a meter reading below the limit threshold
The 5s delay is then ignored.

```
24/10/04-09:35:08;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-09:35:08;tune;state:running;meterValue:1.1867084960937 kW ;requested variation:-0.34071750217014 % ;inv command:61.743374892341 %
24/10/04-09:35:09;meter value is 1.1760515136719
24/10/04-09:35:10;meter value is 1.6058214111328
24/10/04-09:35:10;meter value is 1.7040106201172
24/10/04-09:35:11;meter value is 1.7040106201172
24/10/04-09:35:11;no new meter value
24/10/04-09:35:11;meter value is 3.1224379882812
24/10/04-09:35:12;meter value is 2.8238583984375
24/10/04-09:35:12;meter value is 2.7799497070313
24/10/04-09:35:13;meter value is 2.7799497070313
24/10/04-09:35:13;no new meter value
24/10/04-09:35:13;meter value is 1.1767595214844
24/10/04-09:35:14;meter value is 35.79412890625
24/10/04-09:35:15;meter value is 11.716805664063
24/10/04-09:35:15;variation(-0.34071750217014->5.5093364800347 %)
24/10/04-09:35:15;command(61.743374892341->67.252711372376 %)
24/10/04-09:35:15;command sent:67.252711372376(67.252711372376%) to inverter 1(40727/60KW)
24/10/04-09:35:15;command sent:67.252711372376(67.252711372376%) to inverter 2(40724/60KW)
24/10/04-09:35:15;command sent:67.252711372376(67.252711372376%) to inverter 3(40848/60KW)
24/10/04-09:35:15;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-09:35:15;tune;state:running;meterValue:11.716805664063 kW ;requested variation:5.5093364800347 % ;inv command:67.252711372376 %
24/10/04-09:35:15;meter value is 11.763559570313
24/10/04-09:35:16;meter value is 11.763559570313
24/10/04-09:35:16;no new meter value
24/10/04-09:35:17;meter value is 6.1694033203125
24/10/04-09:35:17;meter value is 0.58923120117187
24/10/04-09:35:18;meter value is -6.8441318359375
24/10/04-09:35:18;variation(5.5093364800347->-4.8022954644097 %)
24/10/04-09:35:18;command(67.252711372376->62.450415907966 %)
24/10/04-09:35:18;command sent:62.450415907966(62.450415907966%) to inverter 1(40727/60KW)
24/10/04-09:35:18;command sent:62.450415907966(62.450415907966%) to inverter 2(40724/60KW)
24/10/04-09:35:18;command sent:62.450415907966(62.450415907966%) to inverter 3(40723/60KW)
24/10/04-09:35:18;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-09:35:18;warn;state:limit;meterValue:-6.8441318359375 kW ;requested variation:-4.8022954644097 % ;inv command:62.450415907966 %
24/10/04-09:35:19;meter value is -6.957080078125
24/10/04-09:35:19;tempo
24/10/04-09:35:19;meter value is 22.1135546875
24/10/04-09:35:19;variation(-4.8022954644097->11.285308159722 %)
24/10/04-09:35:19;command(62.450415907966->73.735724067688 %)
24/10/04-09:35:19;command sent:73.735724067688(73.735724067688%) to inverter 1(42212/60KW)
24/10/04-09:35:19;command sent:73.735724067688(73.735724067688%) to inverter 2(40724/60KW)
24/10/04-09:35:19;command sent:73.735724067688(73.735724067688%) to inverter 3(40723/60KW)
24/10/04-09:35:19;RegulationPoint:1.80kW ;RegulationLimit:0.00kW ;loop:5.0 s
24/10/04-09:35:19;tune;state:running;meterValue:22.1135546875 kW ;requested variation:11.285308159722 % ;inv command:73.735724067688 %
```

Alternative script:

It is possible on request to Webdyn's technical support (support@webdyn.com) to adjust the behavior of the script.

For example, an alternative source can be configured as a power reference such as a 4-20mA analog input or a register of the Modbus Slave function.

It is also possible to activate the sending of alarms on loss of communication with the UPSs, by default only the meter causes this to be sent.

It is also possible to send data from the script to the standard data files of the WebdynSunPM so that they can be used by the portal as that of a supervised device.

Recommended equipment

We can currently confirm that the script is working properly with the following equipment:

Inverters:
Sungrow; Huawei; Goodwee (MT, HT); Sofarsolar; Growatt; SMA (core2, STPX),Kaco

Meter :
Janitza (UMG604, UMG96RM); Lettel (MCX4 34V); Schneider (IEM32xx, PM55xx)

For compatibility with other equipment, you can consult us by writing to support@webdyn.com.