ABB solar inverters

Grid Support Function
Rule 14h Settings Review Document for PVS-60-TL-US

General liability warnings concerning inverter use

Please refer to the Product Manual for complete installation instructions and product use.

ABB accepts no liability for failure to comply with the instructions for correct installation and will not be held responsible for systems upstream or downstream the equipment it has supplied. It is absolutely forbidden to modify the equipment. Any modification, manipulation, or alteration not expressly agreed with the manufacturer, concerning either hardware or software, shall result in the immediate cancellation of the warranty.

The Customer is fully liable for any modifications made to the system.

Given the countless array of system configurations and installation environments possible, it is essential to check the following: sufficient space suitable for housing the equipment; airborne noise produced depending on the environment; potential flammability hazards.

ABB will NOT be held liable for defects or malfunctions arising from: improper use of the equipment; deterioration resulting from transportation or particular environmental conditions; performing maintenance incorrectly or not at all; tampering or unsafe repairs; use or installation by unqualified personnel.

ABB will NOT be held responsible for the disposal of: displays, cables, batteries, accumulators etc. The Customer shall therefore arrange for the disposal of substances potentially harmful for the environment in accordance with the legislation in force within the country of installation.

Field of use, general conditions

ABB shall not be liable for any damages whatsoever that may result from incorrect or careless operations.

You may not use the equipment for a use that does not conform to that provided for in the field of use. The equipment MUST NOT be used by inexperienced staff, or even experienced staff if carrying out operations on the equipment that fail to comply with the indications in this manual and enclosed documentation.

Intended or allowed use

This equipment is a multi-string inverter designed for transforming a continuous electrical current (DC) supplied by a photovoltaic generator (PV) in an alternating electrical current (AC) suitable for feeding into the public distribution network

Effective: October 18, 2019 Rev. 0.0 (See revision control at end of document)

Configuration through Web Server

REQUIRED TOOL: Device capable to connect to internet for example laptop or smart phone, LAN/WiFi name and password, IP configuration of the inverter, admin account password and admin-plus token (service password).

Before to proceed with the Web Server configuration you need to receive the token to enable the admin-plus account, contact the ABB service with the Serial Number and week/year of production of each inverter to be configured.

Serial Number and week/year of production can be retrieved from the inverter label or from web server.

PROCEDURE:

Connect the networking device to the same WiFi or LAN of the Inverter then open a browser and insert the inverter IP address on the browser address bar then login to the inverter with the admin account.

Select *Settings* and then *line*, the available settings through web server are shown on figure 1.

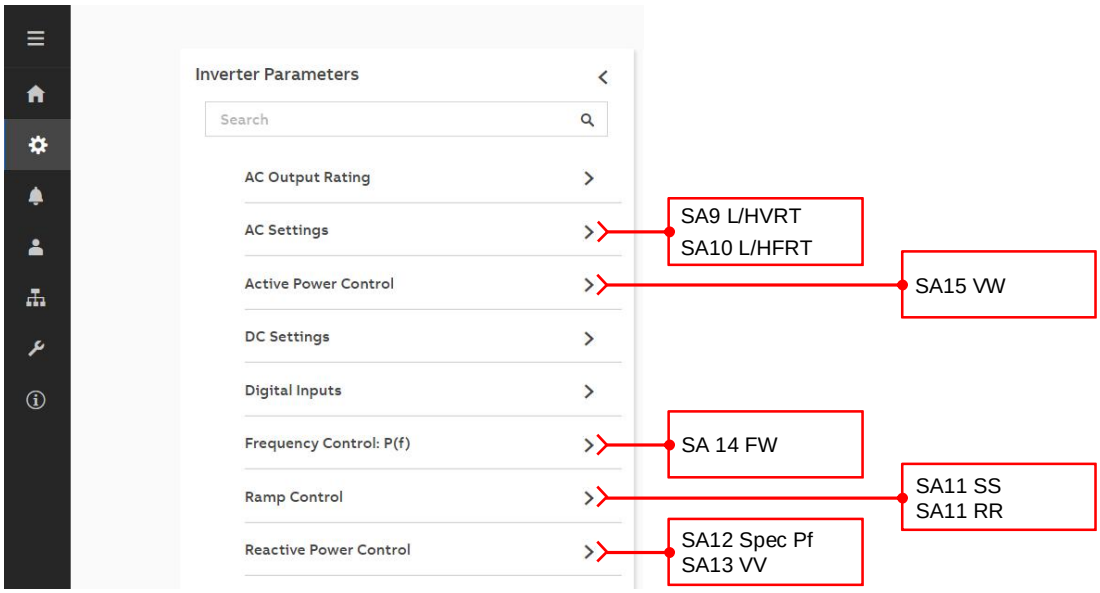


Fig. 1: Web Server – Settings Menu

SA8 (Anti Islanding Protection)

No configuration possible.

SA9 (L/HVRT)

Enter on the sub menu AC Settings à *Grid Protections – VRT/FRT*

For each Variable OV2, OV1, UV1, UV2, UV3, the following applies:

Vgrid Voltage – En / Dis: to disable and enable the specific protection

Vgrid Voltage - Value: set the voltage threshold of the specific variable

Vgrid Trip Time: set the trip time threshold of the specific variable

When the “Momentary Cess. General En / Dis” parameter is set to “Enabled”, the activation and trigger points of the Momentary Cessation function associated to voltage transients can be adjusted within this section as follows:

L/HVRT Momentary Cess. En / Dis: to disable and enable the momentary cessation function associated to LVRT and HVRT transients.

HVRT Momentary Cess. Threshold: set the voltage threshold that triggers the momentary cessation during grid overvoltage transients

LVRT Momentary Cess. Threshold: set the voltage threshold that triggers the momentary cessation during grid undervoltage transients

NOTE: In case voltage protection limits or trip times are modified, please obey the following rules:

OV2 ≥ OV1; Trip time_OV1 ≥ Trip time_OV2

UV1 ≥ UV2 ≥ UV3; Trip time_UV1 ≥ Trip time_UV2 ≥ Trip time_UV3

SA10 (L/HFRT)

Enter on the sub menu AC Settings à *Grid Protections – VRT/FRT*

For each Variable OF2, OF1, UF1, UF2 the following applies:

Grid Frequency – En / Dis: to disable and enable the specific protection

Grid Frequency: set the frequency threshold of the specific protection

Grid Frequency Trip Time: set the trip time threshold of the specific protection

When the "Momentary Cess. General En / Dis" parameter is set to "Enabled", the activation and trigger points of the Momentary Cessation function associated to frequency transients can be adjusted within this section as follows:

L/HFRT Momentary Cess. En / Dis: to disable and enable the momentary cessation function associated to LFRT and HFRT transients.

HFRT Momentary Cessation: set the frequency threshold that triggers the momentary cessation during grid overfrequency transients

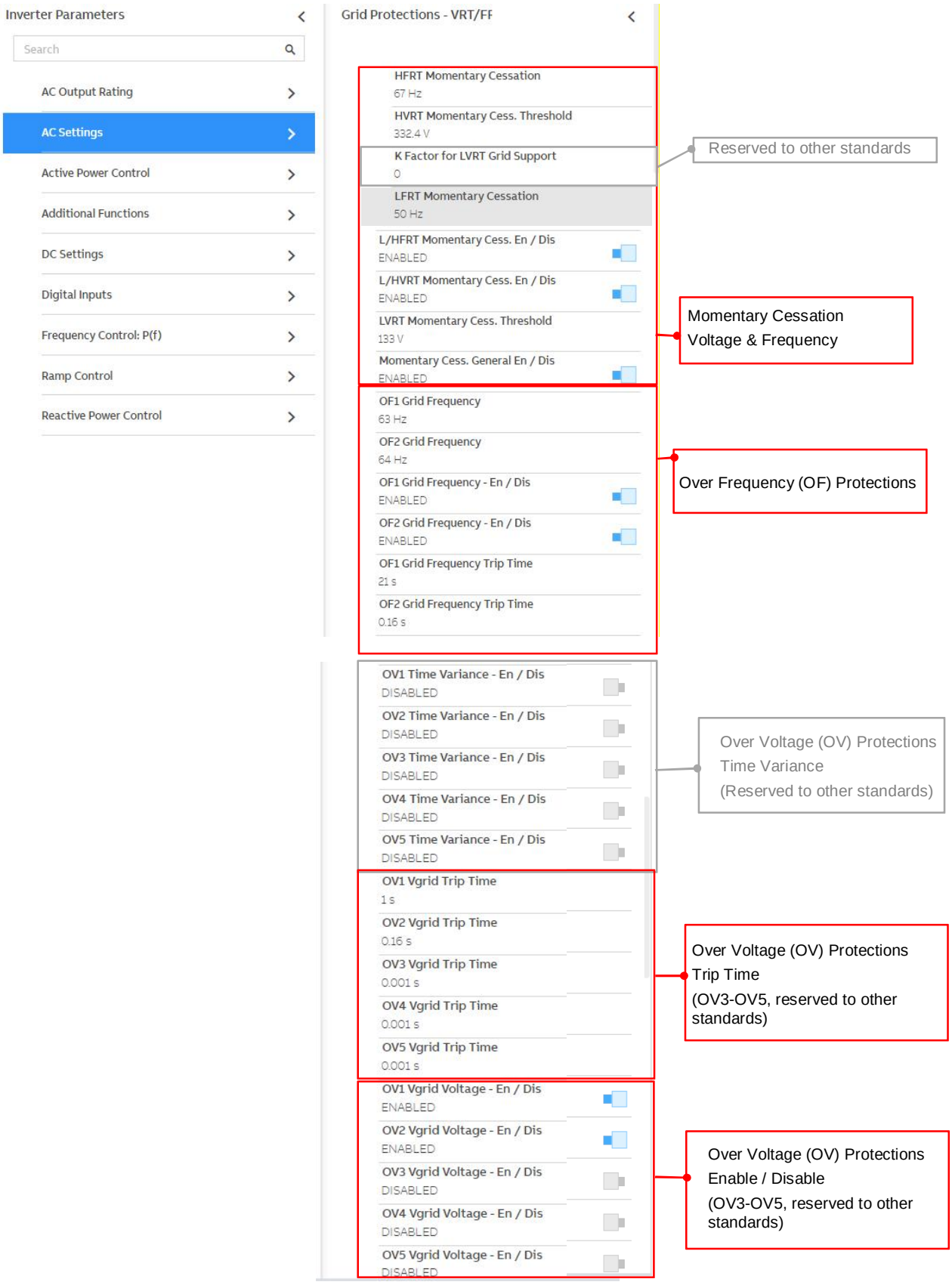
LFRT Momentary Cessation: set the frequency threshold that triggers the momentary cessation during grid underfrequency transients

NOTE: In case frequency protection limits or trip times are modified, please obey the following rules:

OF2 ≥ OF1; Trip time_OF1 ≥ Trip time_OF2

UF1 ≥ UF2; Trip time_UF1 ≥ Trip time_UF2

Refer to the **SA9 Low and High Voltage Ride Through and SA10 Low and High Frequency Ride Through** chapters for details about the description of the parameters.


Inverter Parameters
Search
AC Output Rating
AC Settings
Active Power Control
Additional Functions
DC Settings
Digital Inputs
Frequency Control: P(f)
Ramp Control
Reactive Power Control
Grid Protections - VRT/FF
HFRT Momentary Cessation
67 Hz
HVRT Momentary Cess. Threshold
332.4 V
K Factor for LVRT Grid Support
0
LFRT Momentary Cessation
50 Hz
L/HFRT Momentary Cess. En / Dis
ENABLED
L/HVRT Momentary Cess. En / Dis
ENABLED
LVRT Momentary Cess. Threshold
133 V
Momentary Cess. General En / Dis
ENABLED
OF1 Grid Frequency
63 Hz
OF2 Grid Frequency
64 Hz
OF1 Grid Frequency - En / Dis
ENABLED
OF2 Grid Frequency - En / Dis
ENABLED
OF1 Grid Frequency Trip Time
21 s
OF2 Grid Frequency Trip Time
0.16 s
OV1 Time Variance - En / Dis
DISABLED
OV2 Time Variance - En / Dis
DISABLED
OV3 Time Variance - En / Dis
DISABLED
OV4 Time Variance - En / Dis
DISABLED
OV5 Time Variance - En / Dis
DISABLED
OV1 Vgrid Trip Time
1 s
OV2 Vgrid Trip Time
0.16 s
OV3 Vgrid Trip Time
0.001 s
OV4 Vgrid Trip Time
0.001 s
OV5 Vgrid Trip Time
0.001 s
OV1 Vgrid Voltage - En / Dis
ENABLED
OV2 Vgrid Voltage - En / Dis
ENABLED
OV3 Vgrid Voltage - En / Dis
DISABLED
OV4 Vgrid Voltage - En / Dis
DISABLED
OV5 Vgrid Voltage - En / Dis
DISABLED
Reserved to other standards
Momentary Cessation
Voltage & Frequency
Over Frequency (OF) Protections
Over Voltage (OV) Protections
Time Variance
(Reserved to other standards)
Over Voltage (OV) Protections
Trip Time
(OV3-OV5, reserved to other standards)
Over Voltage (OV) Protections
Enable / Disable
(OV3-OV5, reserved to other standards)

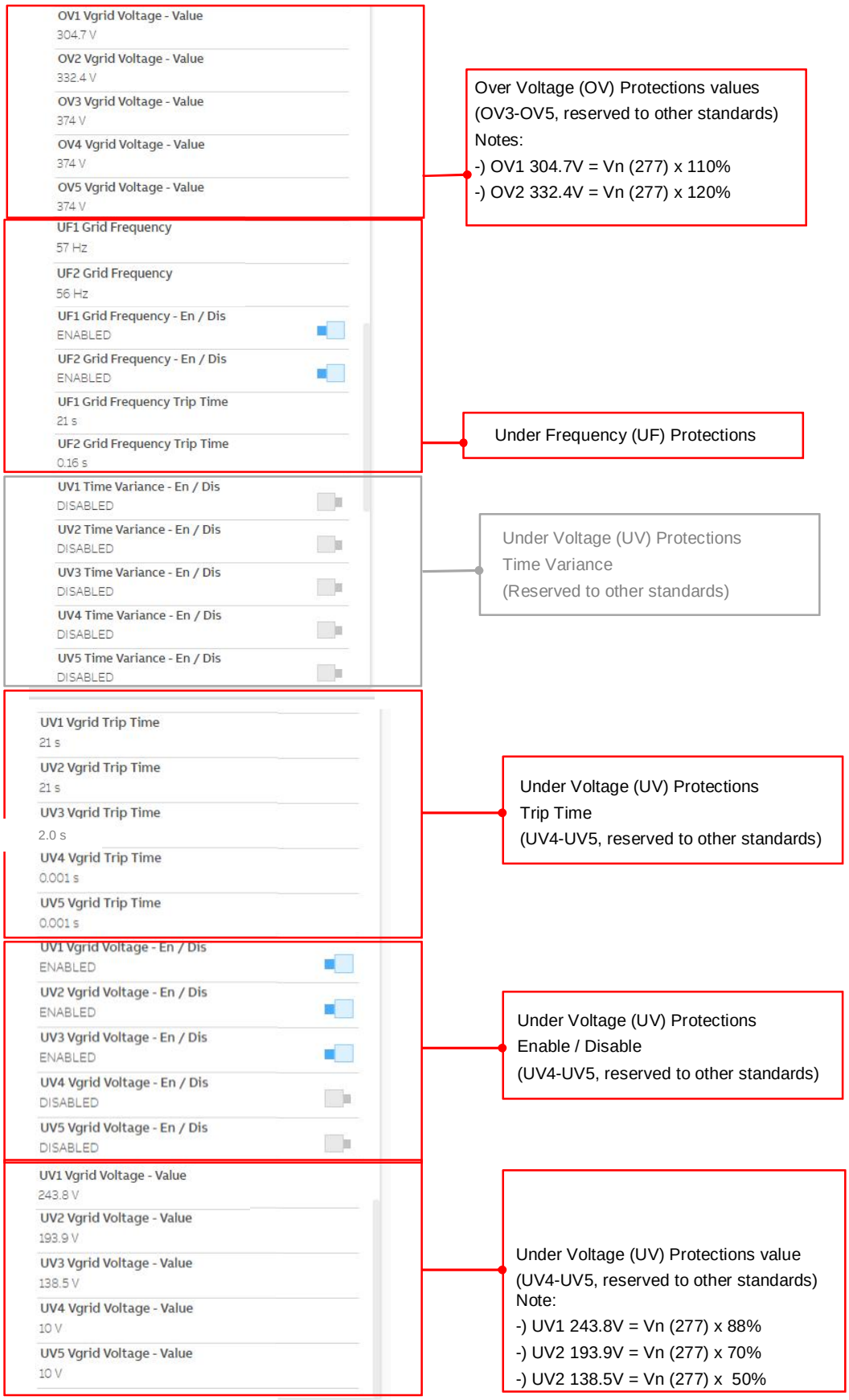
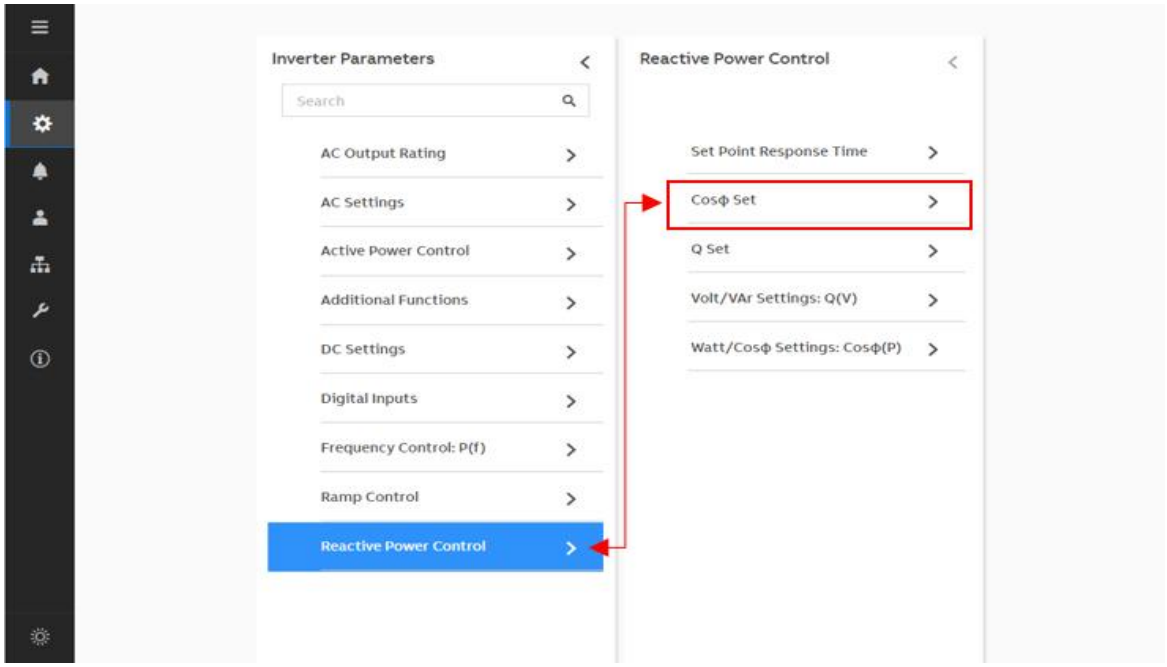


Figure 2: L/HVRT Configuration through Web Server

SA12 (Specified Power Factor)

(1) Select the **Reactive Power Control à CosΦ Set** menu from the Inverter Parameters section of the Settings Menu to configure the power factor (PF) according to Utility request.



(2) **CosΦ Set** sub-menu will allow you to Enable/Disable the control of the reactive power output of the unit based on a fixed cosΦ and define the value of the cosΦ within the capability limits of the inverter [+ 0.8 to - 0.8] for PVS-60-TL-US.

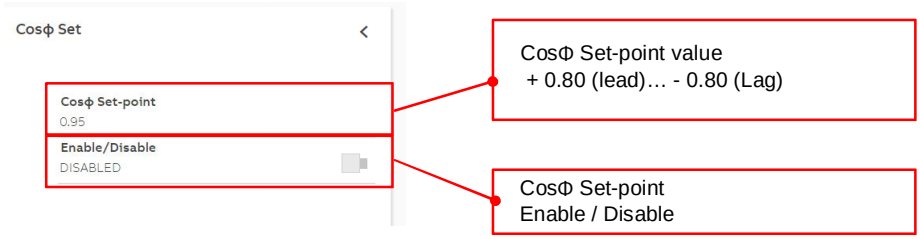


Figure 3: SA12 Specified Power Factor Configuration through Web Server

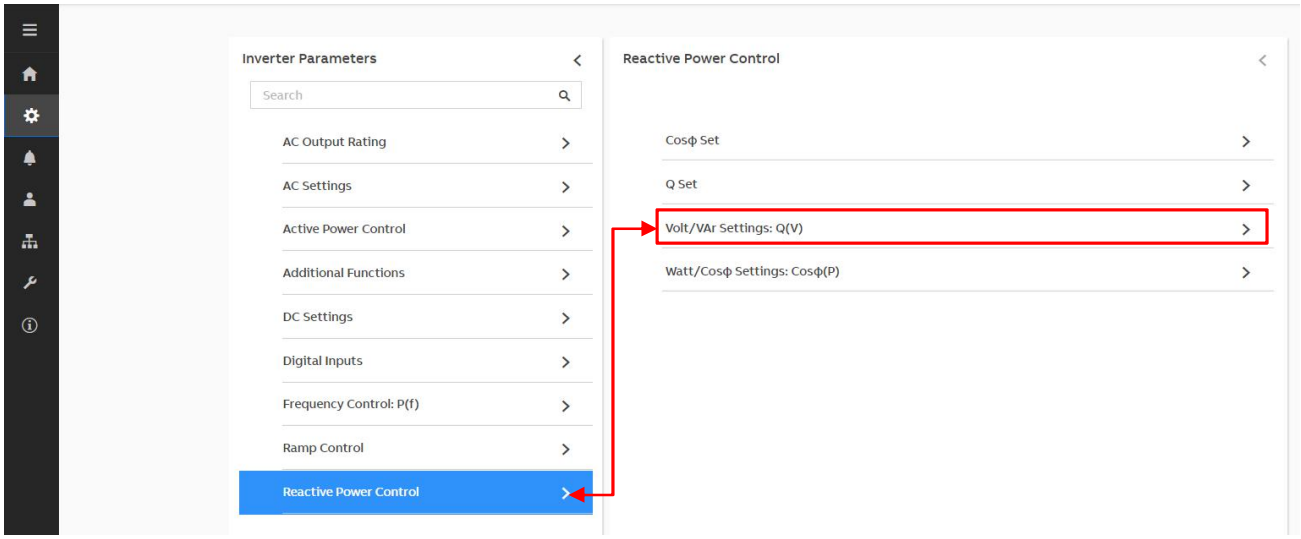
For details about the above parameters or inverter capability, refer to the description on chapter **SA12 Specified Power Factor Mode**

NOTE: Enabling the Power Factor control mode it will automatically disable any other reactive power mode.

NOTE: the sign of the power factor is assigned according to the reactive power sign and NOT according to EEI, as described on Annex 1.

SA13 VV

(1) Select the **Reactive Power Control à Volt/Var Settings: Q(V)** menu from the Inverter Parameters section of the Settings Menu to configure the Volt-Var mode according to Utility request.



(2) **Volt/Var Settings: Q(V)** sub-menu will allow you to Enable/Disable the control of reactive power based on the AC terminal voltage by a user(utility)-defined piecewise linear control curve.

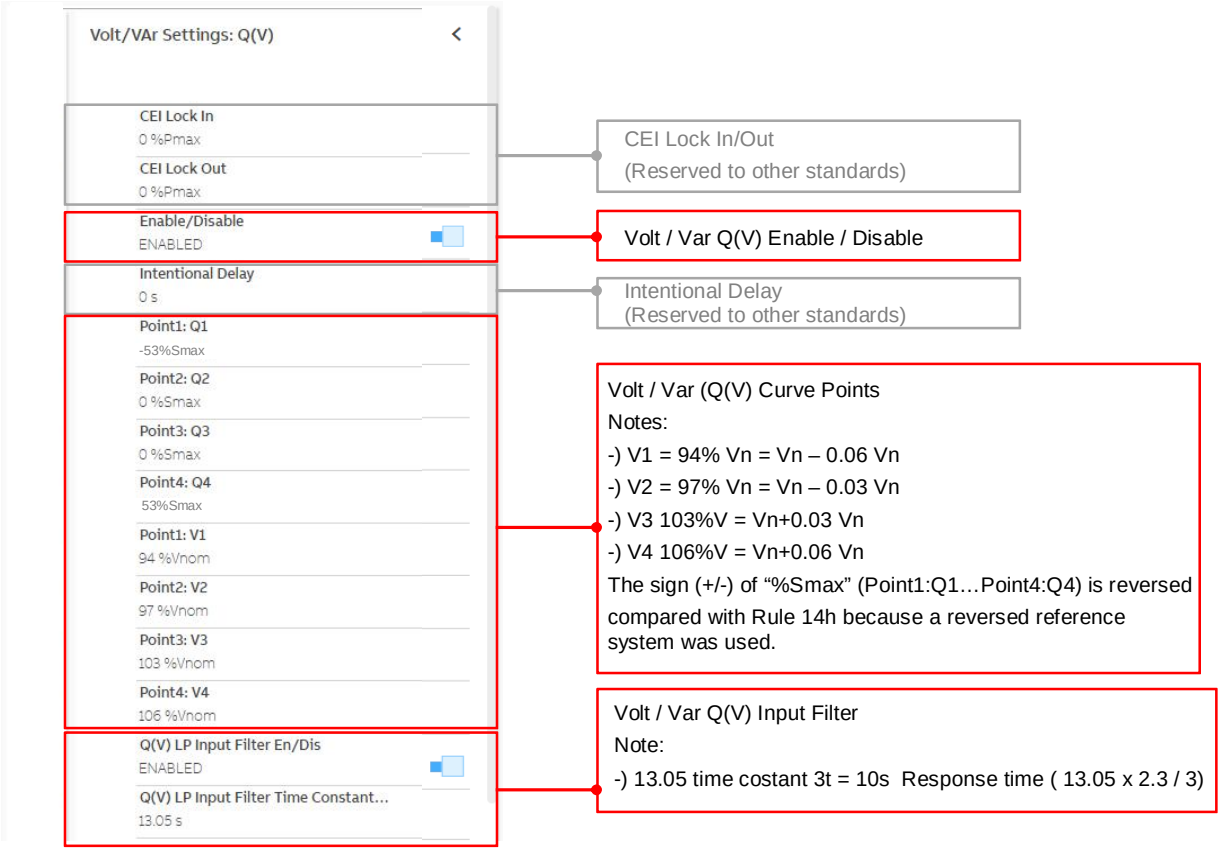


Figure 4: SA13 VV Configuration through Web Server

For details about the above parameters or inverter capability, refer to the description on chapter **SA13 VV Volt VAr Mode**

NOTE: the sign of the reactive power is assigned with REVERSE values with respect to the EEI reference system specified in Annex 1.

SA11 SS and **SA11 RR**

Select the Ramp Control menu to configure the soft start and normal ramp up according to Utility request.

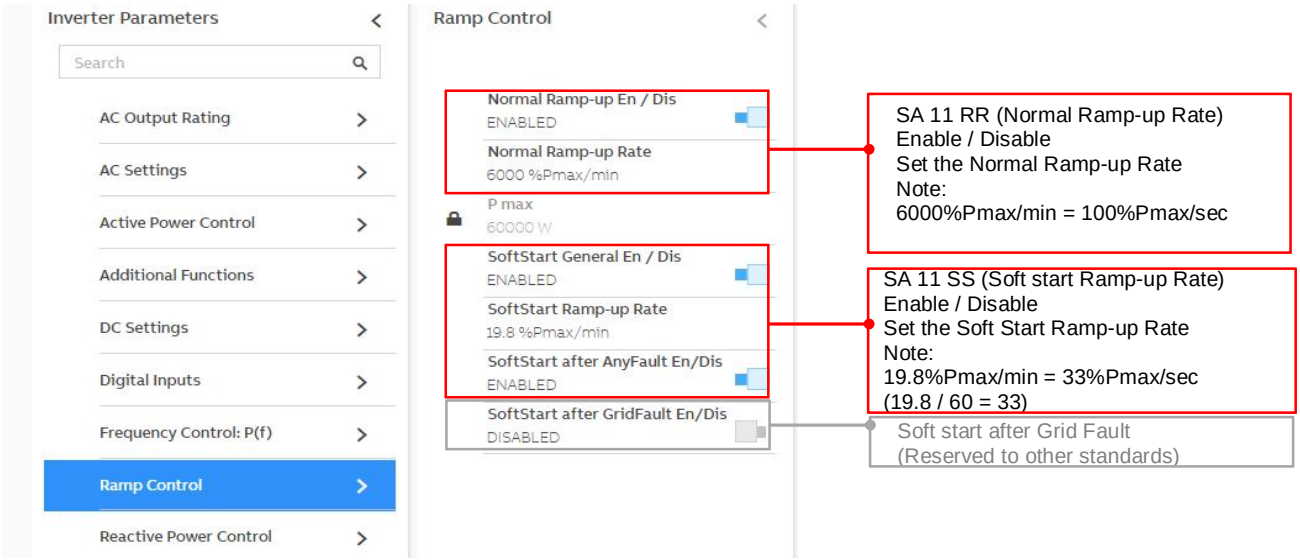


Figure 5: SA11 Normal Ramp Rate and Soft-Start Configuration through Web Server

NOTE: Rule 21 and Rule 14H requires setting the values as %Pn/s. To set properly the value it is necessary to multiply by 60 the SA11 SS and SA11 RR ramp rate values expressed as %Pn/s. For example, a SA11 RR request of 50%Pmax/s should be set on inverter as 3000%Pmax/min.

SA14 FW

Select the Frequency Control: P(f) menu to configure the Frequency - Watt according to Utility request.

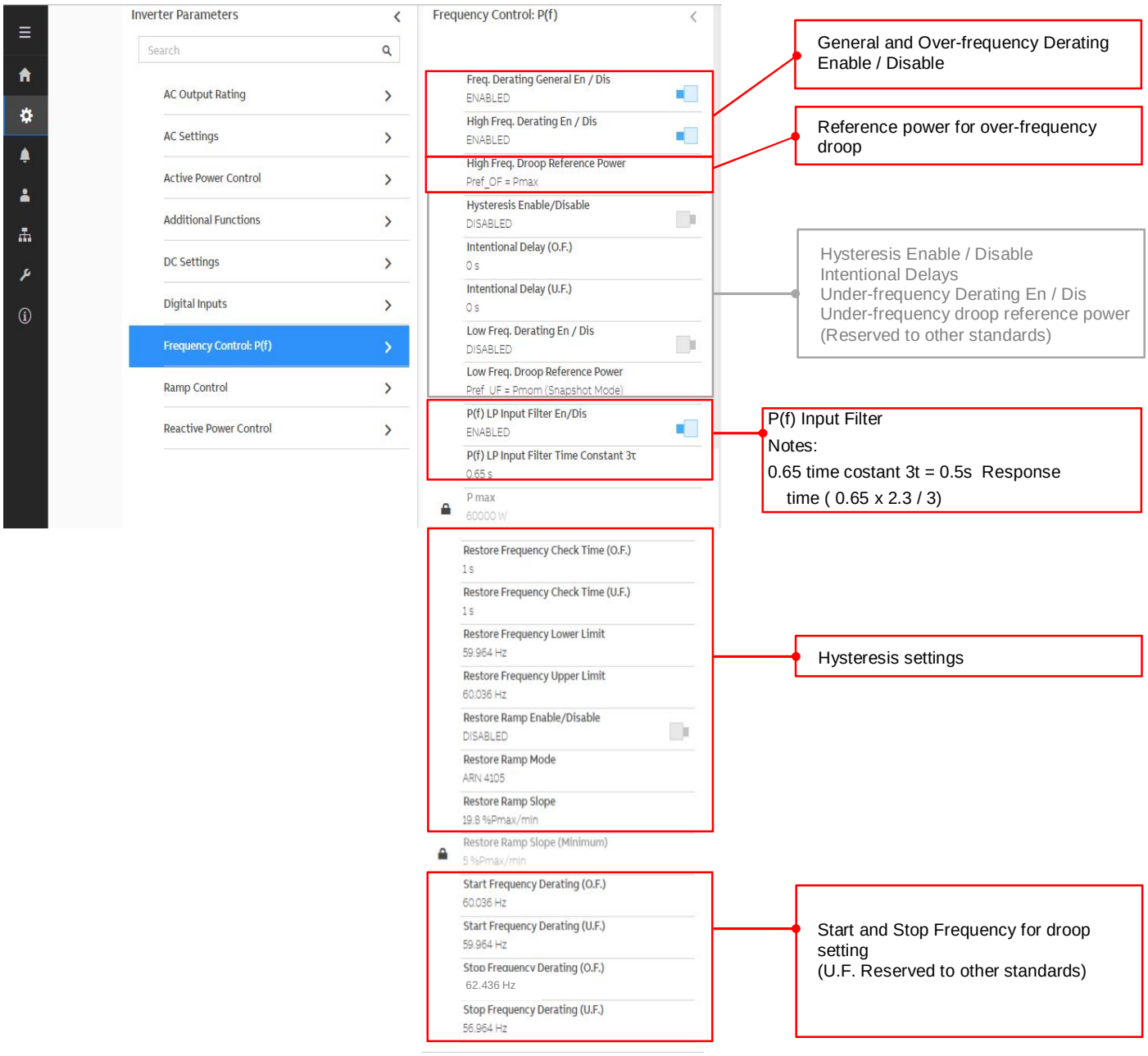


Figure 6: SA14 FW Configuration through Web Server

Start and Stop frequency defines also the slope of the Frequency – Watt curve. The slope is defined as:

$Slope = P_{max} / (f_{start} - f_{stop})$ = 60 kW / 2.4 = 41.67 % [Pn / Hz]

To deactivate the Frequency - Watt, it is sufficient to disable one between the frequency and the high frequency control flag.

To enable the Frequency - Watt, both general and high frequency control flags must be enabled.

SA15 VW

Select the *Active Power Control* à *Volt/Watt Settings: P(V)* menu to configure the Volt-Watt function according to Utility request.

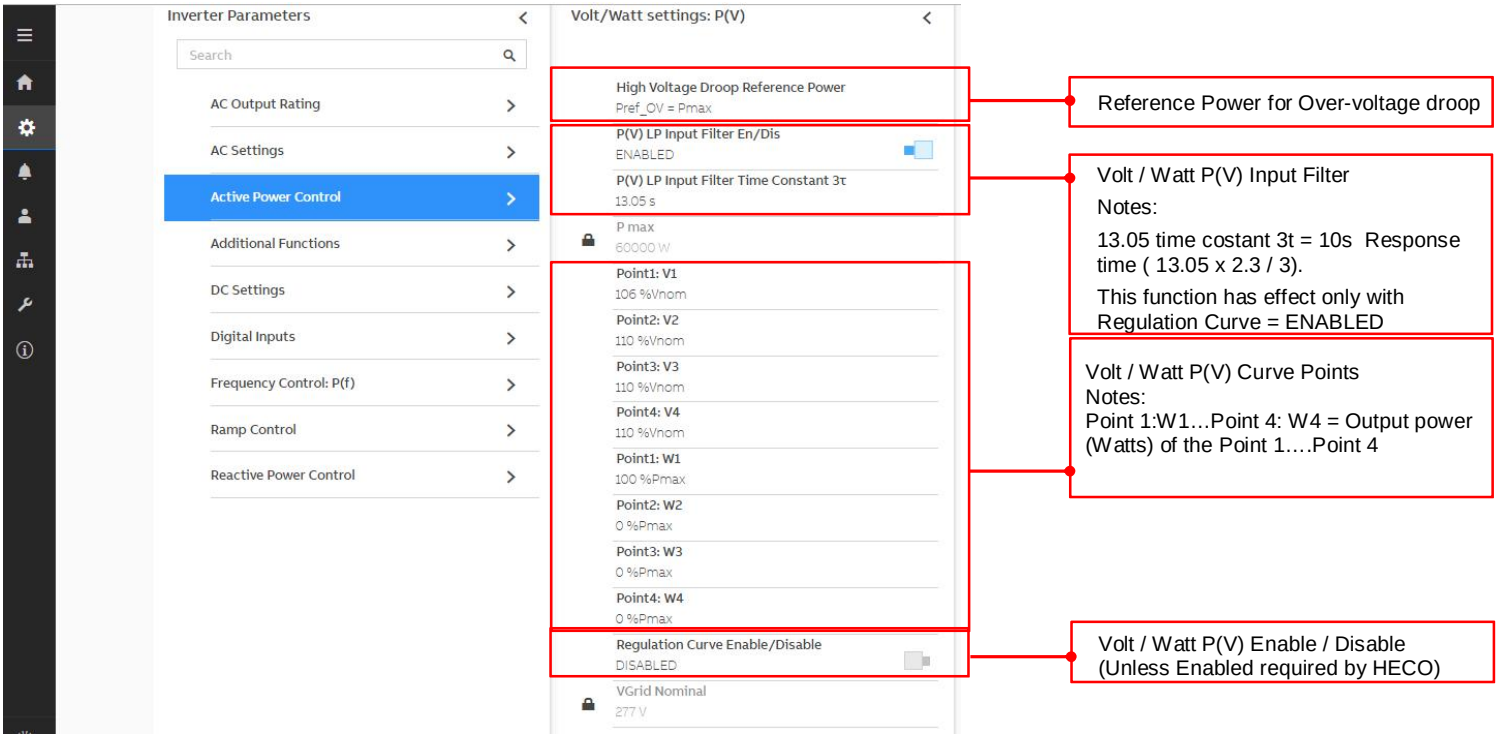


Figure 7: SA15 VW Configuration through Web Server

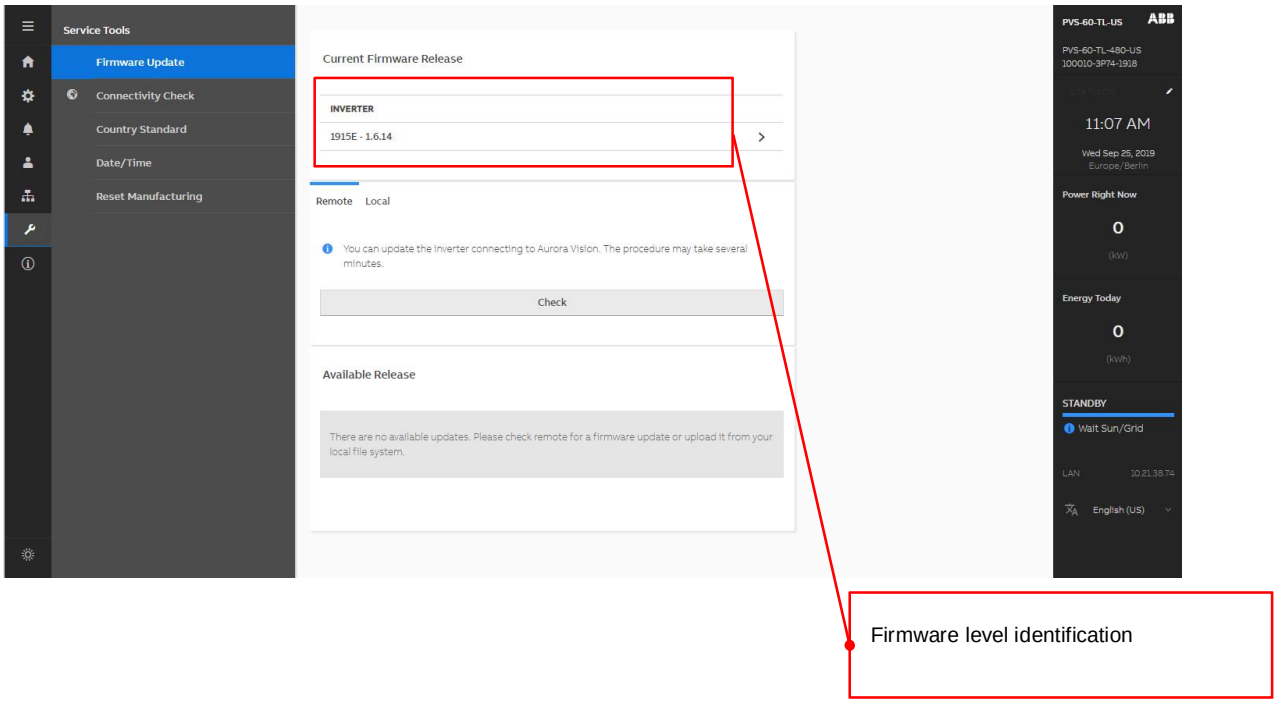


Figure 8: Firmware level identification through Web Server .

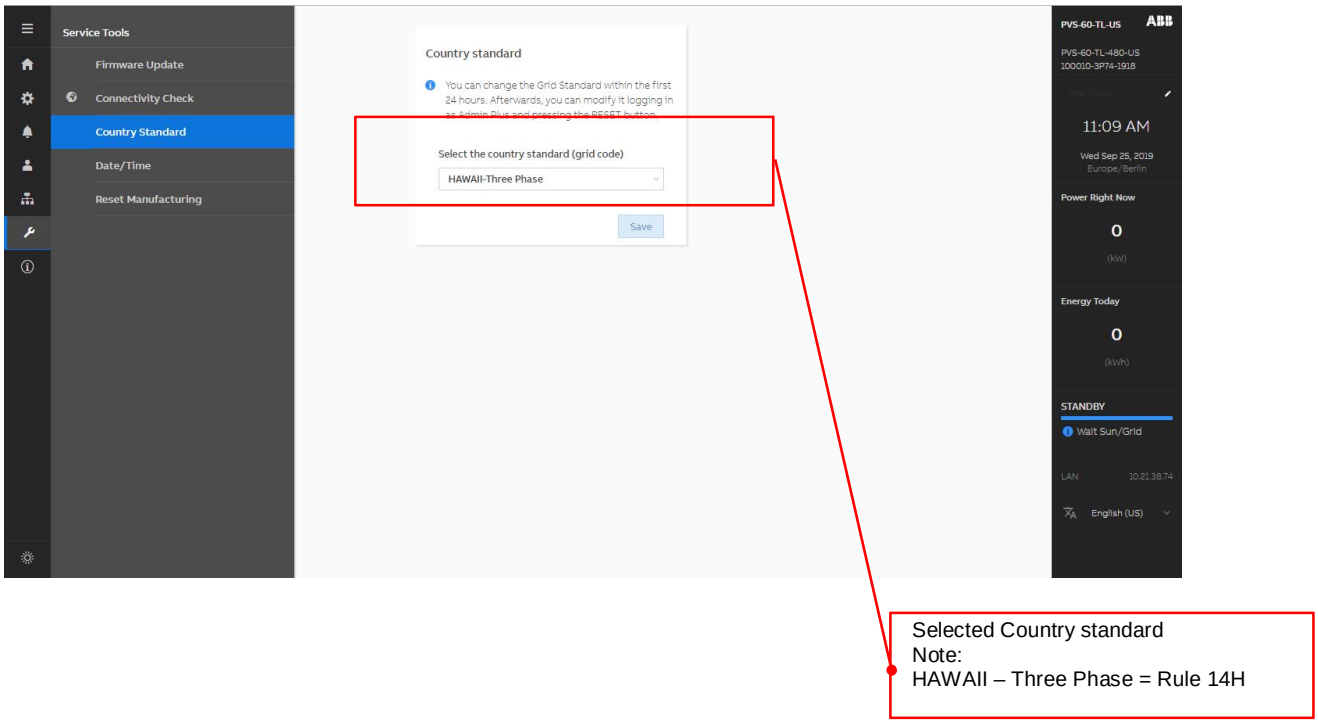


Figure 9: Selected Country standard identification through Web Server .

Annex 1: Firmware Compatibility Matrix to Rule 21/14H

This Annex correlate the inverter firmware with the default settings included on this guideline.

If your inverter is not updated to the firmware release within this table then the inverter could have a different default settings with respect to the documents.

In case it is suggested to use the Parameter Adjustment chapter to update the inverter to Rule21 or Rule 14H Utility settings.

Inverter model	SA8	SA9 L/HVRT	SA10 L/HFRT	SA11 SS	SA11 RR	SA12 Spec P f	SA 13 VV	SA 14 FW	SA15 VW
PVS-60-TL-US	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**

Table A2: Rule 21 Firmware Compatibility Matrix (minimum firmware level)

Inverter model	SA8	SA9 L/HVRT	SA10 L/HFRT	SA11 SS	SA11 RR	SA12 Spec P f	SA13 VV	SA 14 FW	SA15 VW
PVS-60-TL-US	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**

Table A3: Rule 14H Firmware Compatibility Matrix (minimum firmware level)

Tables A2 and A3 define, for each grid support function, the minimum FW release that satisfy the Rule 21/14H default settings described on this application guideline.

Inverter with older firmware could not be aligned, in case the chapter *Parameter Adjustment* describes the procedure to update the inverter settings.

Table A4 defines the starting firmware release of inverters that includes all the Rule 21 function and that can be configured to satisfy the requirements of Rule 21/14H.

Inverter model	SA8	SA9 L/HVRT	SA10 L/HFRT	SA11 SS	SA11 RR	SA12 Spec P f	SA 13 VV	SA 14 FW	SA15 VW
PVS-60-TL-US	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**	**1915E 1.6.14**

Table A4: Inverter FW compatible with Rule 21/14H (minimum firmware level)

Firmware XXYYK is encoded as follows:

XX: represents the latest two digit for year of release, for example 18 means 2018

YY: represents the week of release within the year, for example 1803 means 3rd week of 2018

K: represents the day of release within the week, for example 1803G means 7th day (Sunday) of the 3rd day of 2018 and corresponds to 21 January 2018. A firmware is greater than another one if it is released on a later date.

Document revisions

Revision	Date	Change Log
Rev 0.0	October 18th / 2019	Specific revision for HECO (PVS-60-TL-US; FW > 1915E - 1.6.14)

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