SolarEdge Instruction - California Electric Rule 21

Version History

- Version 1.6, March 2019: Rule 21 phase 3 adaptation
- Version 1.5, Aug 2018: Simplified inverter configuration instructions to meet requirements

Introduction

Electric Rule 21 describes the interconnection, operating and metering requirements for generation facilities to be connected to the public utilities' distribution systems, over which the California Public Utilities Commission (CPUC) has jurisdiction. To operate SolarEdge systems in accordance with these requirements, effective on systems permitted on or after September 8 2017, the following instructions must be followed.

Upgrade and Configuration

Upgrade the inverter firmware to the latest available version at the time of commissioning. For SetApp Enabled inverters, the firmware will be automatically upgraded upon activation of the inverter. If the inverter does not upgrade automatically, navigate to **Maintenance → Firmware Upgrade** to initiate the upgrade manually (See Chapter 5 of the Installation Guide). Make sure you have the latest SetApp version on your smart phone.

For inverters with a display, download the latest firmware version or contact SolarEdge Support to obtain the latest version. Follow the upgrade instructions in Software Upgrade using SD/MicroSD card – Application Note.

Minimum Firmware and CPU Versions

DSP1 and DSP2 versions **must be equal to, or greater than** the ones listed below.

Inverter	DSP1	DSP2
Single Phase Inverters with HD-Wave Technology	1.0000.0749	2.0000.608*/2.0000.0350 (for 10kW at 208V and 240V & 11.4kW at 240V)
Previous Generation Single Phase Inverters (including StorEdge)	1.0.210.1427	2.0052.0410
Three Phase Inverters and Three Phase inverters with Synergy Technology	1.0013.1453	2.0019.1207*

* The minimum DSP2 versions to meet certification are 2.0.140 for Single Phase Inverters with HD-Wave Technology, and 2.19.759 for Three Phase Inverters and Three Phase inverters with Synergy Technology. If your DSP2 is above these versions, your inverter is compliant with Rule 21.

The minimum CPU Versions **must be equal to, or greater than** the ones listed below.

Inverter	CPU
SetApp Enabled Inverters	4.4.70
Inverters with a display	3.2467

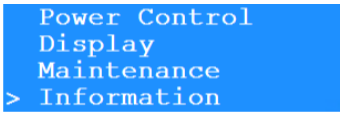
Verifying the current DSP1, DSP2 and CPU versions

SetApp Enabled inverters

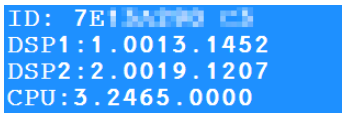
1. Navigate to **Information**.
2. Take a screenshot and supply to the utility as proof of valid commissioning. See example below of a Synergy inverter.

Inverters with a display

1. Navigate to **Information → Versions**.



2. Take a picture of the screen and supply to the utility as proof of valid commissioning. See example below.

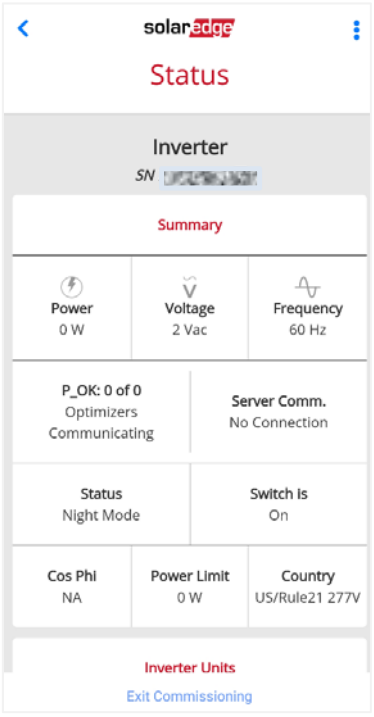


Set Country Code

Once the firmware and CPU versions meet the minimum specification outlined above, select the appropriate Rule 21 country setting in accordance with the installation guide (SetApp Enabled: Chapter 5; Inverter with a display: Chapter 6).

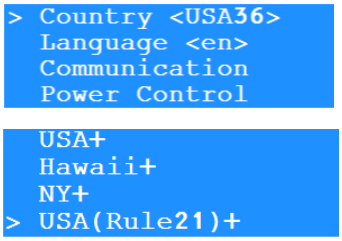
SetApp Enabled inverters

3. Navigate to **Country and Language** and select the required **Country** from the drop-down list.
4. To verify, navigate to **Status** and take a screenshot to supply to the utility as proof of valid commissioning. See example below.

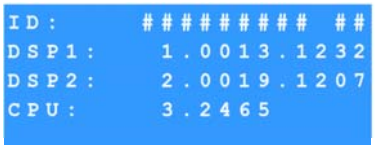


Inverters with a display

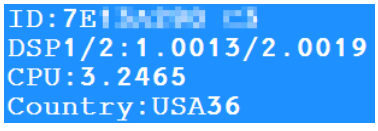
1. Navigate to **Country Code → USA (Rule 21)+ → Rule 21 XXX** (XXX being the appropriate grid voltage).



2. Outside the menu tree, verify the country by navigating to the screen containing the inverter ID, DSP1/2 versions, CPU version, and the Country setting (as shown below).



3. Take a picture of the screen and supply to the utility as proof of valid commissioning. See example below.



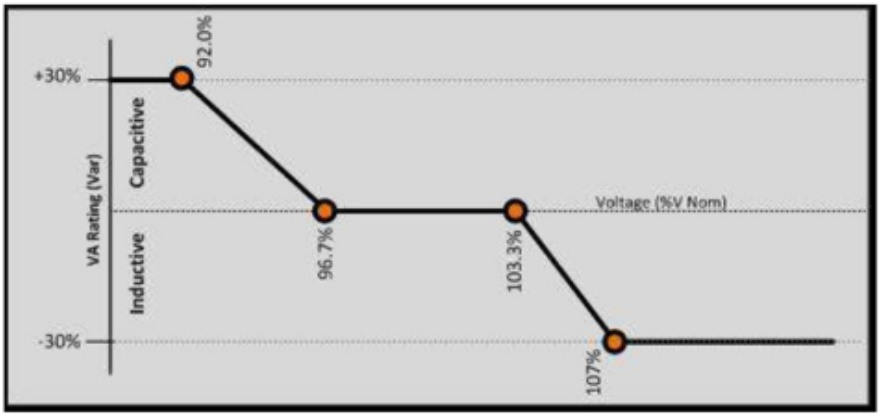
Appropriate Country setting will be shown as listed:

- Rule 21 Auto: **USA31**
- Rule 21 208V: **USA32**
- Rule 21 208V No N: **USA33**
- Rule 21 240V: **USA34**
- Rule 21 240V No N: **USA35**
- Rule 21 277V: **USA36**

Volt-VAR Configuration

To meet the Rule 21 Volt-VAR requirements, the inverter Volt-VAR mode will need to be enabled and the graph settings set according to the values as shown below:

Volt-VAR Graph



Required Volt-VAR Set Points and Values

Voltage Setpoint	Voltage Value	Reactive Setpoint	Reactive Value	Operation
V1	92.0%	Q1	30%	Reactive Power Injection
V2	96.7%	Q2	0	Unity Power Factor
V3	103.3%	Q3	0	Unity Power Factor
V4	107.0%	Q4	30%	Reactive Power Absorption

	X (V/Vnom[%])	Y (Q/Qnom[%])
P0	50	-30
P1	92	-30
P2	96.7	0
P3	103.3	0
P4	107	30
P5	120	30

Table 1

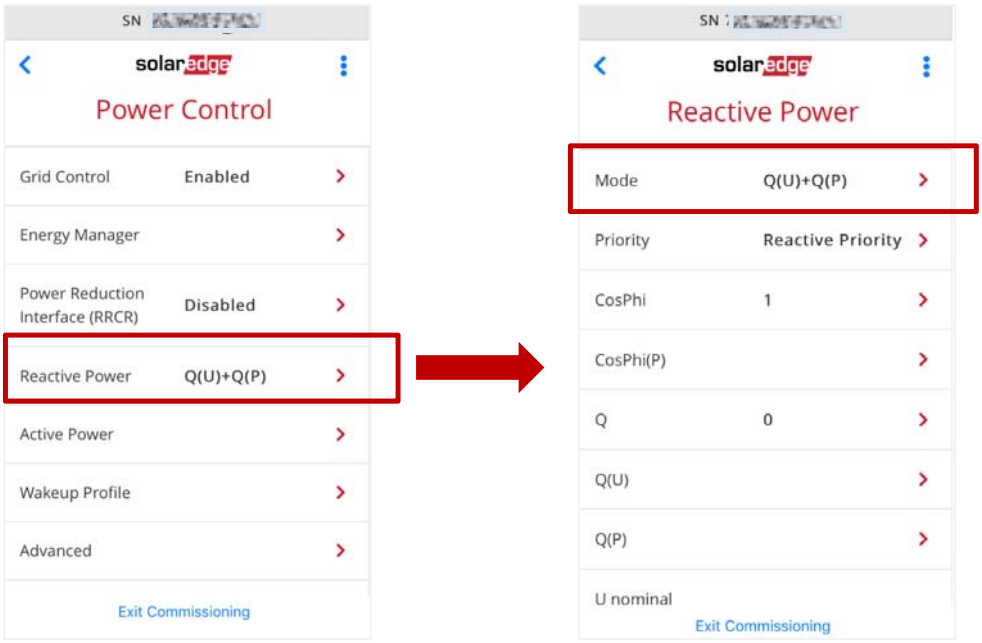
NOTE

The inverter will **inject (value of -30%)** or **absorb (value of 30%)** reactive power.

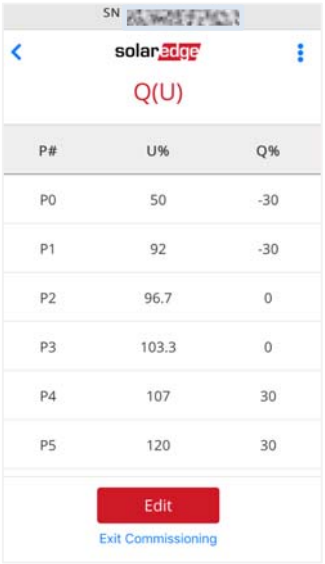
Follow these instructions to set the Volt-VAR graph settings appropriately

SetApp Enabled inverters

1. Navigate to **Power Control → Reactive Power → Mode**



2. Enable Volt-VAR mode by changing the **Mode** to **Q(U)+Q(P)**, if not enabled already
3. Navigate to **Q(U)** and ensure set the points are as shown in Table 1 above. If the set points do not match, click **Edit** and manually input the values to match Table 1.
4. Take a screenshot and supply to the utility as proof of valid commissioning. See example below.

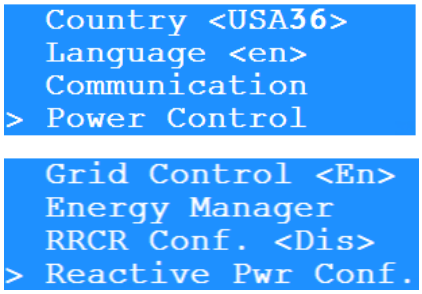


NOTE

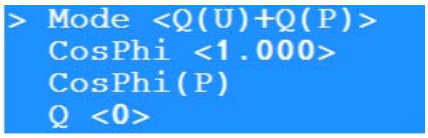
the inverter will **inject (value of -30%)** or **absorb (value of 30%)** reactive power.

Inverters with a display

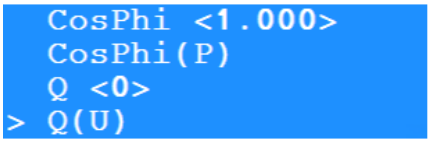
1. Navigate to Power Control → Reactive PWR Conf → Mode



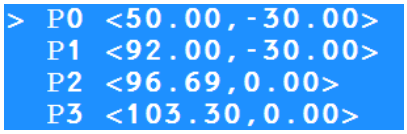
2. Enable Volt-VAR mode by changing the **Mode** to **Q(U)+Q(P)**

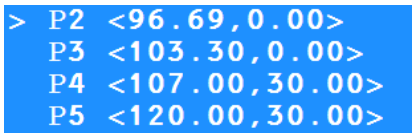


3. Navigate to **Q(U)** and set the points as shown in the Table 2 below.



4. Take a picture of the screen and supply to the utility as proof of valid commissioning. See example below.



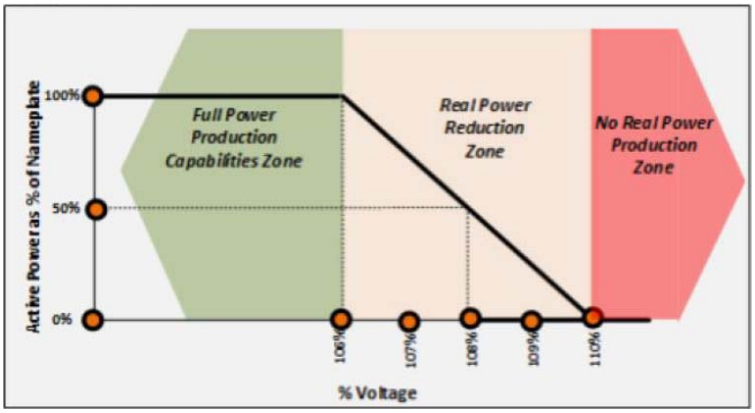


A Power Factor (PF) of 0.8 leading to 0.8 lagging is the maximum inverter setting supported, or 100%. A value of **50 equals 30% Qnom**, 0.9 PF. The P0 and P5 voltage settings are based off of the IEEE 1547 limits. The inverter will **inject (value of -30)** or **absorb (value of 30)** reactive power until the inverter trips off on low or high voltage conditions.

Volt-Watt Configuration

To meet the Rule 21 Volt-Watt requirements, the inverter Volt-Watt graph settings will need to be set according to the values as shown below:

Volt-Watt Graph



Required Volt-Watt Set Points and Values

Voltage Set point	Voltage Value	Active Set point	Active Value
V1	106%	P1	100%
V2	110%	P2	0%

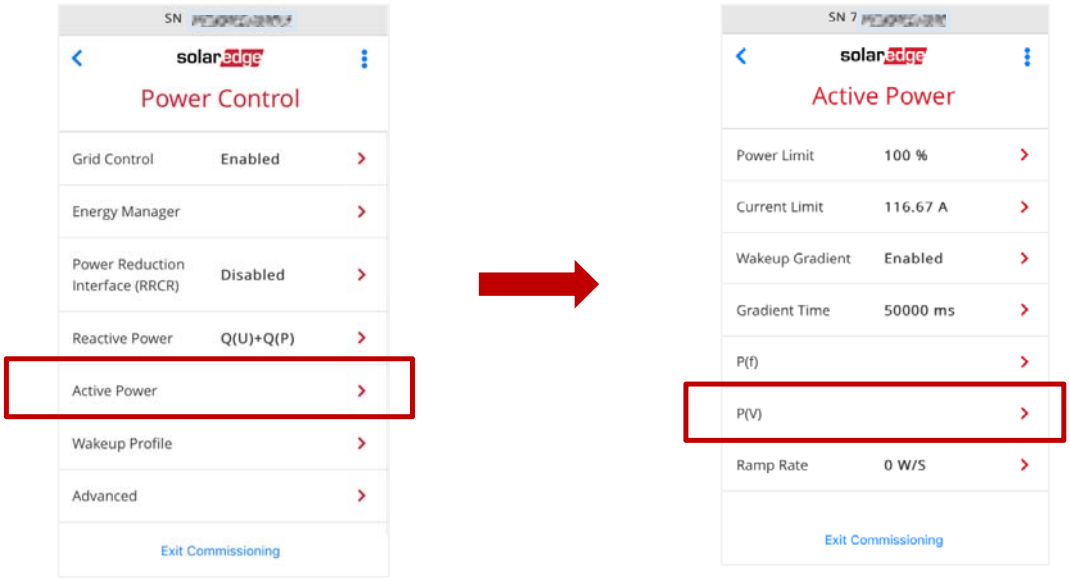
	X (V/Vnom [%])	Y (Q/Qnom [%])
P0	0	100
P1	49	100
P2	100	100
P3	106	100
P4	110	0
P5	130	0

Table 2

Follow these instructions to set the Volt-Watt graph settings appropriately:

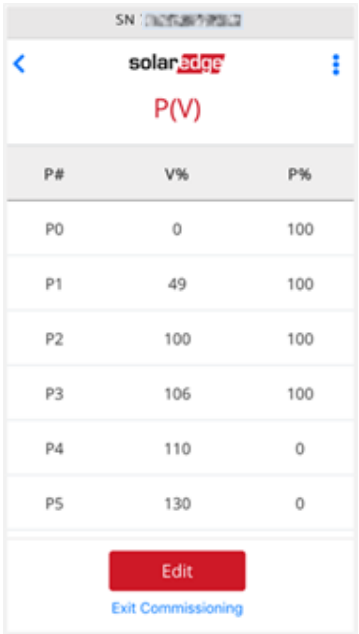
SetApp Enabled inverters

1. Navigate to **Power Control → Active Power → P (V)**



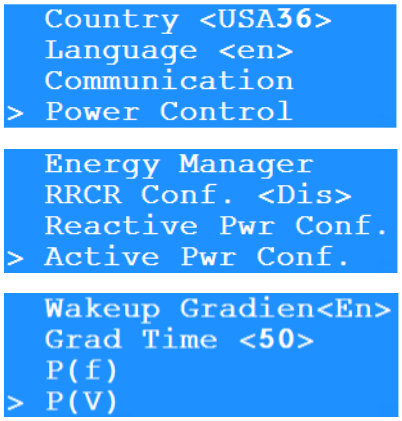
2. Navigate to **P(V)** and ensure the set points are as shown in Table 2. If the set points do not match, click on Edit and manually enter the values to match Table 2.

3. Take a screenshot and supply to the utility as proof of valid commissioning. See example below.

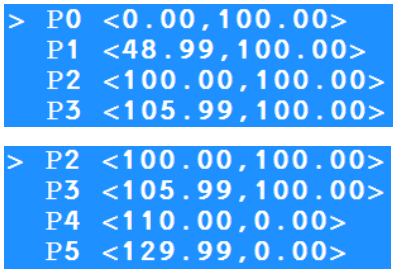


Inverters with a display:

1. Navigate to **Power Control → Active PWR Conf → P(V)**



2. Navigate to **P(V)** and set the points as shown in Table 2 above.
3. Take a picture of the screen and supply to the utility as proof of valid commissioning. See example below.



NOTE

when setting a point value, the screen may show the decimal number lowered by 0.01 for that value. For example, a value set at 106 may appear on the screen as 105.99.

Frequency-Watt Configuration

To meet the Rule 21 Frequency-Watt requirements, the inverter Frequency-Watt mode will need to be enabled and graph settings set according to the values as shown below. Additionally, the open loop response time will need to be 5 seconds.

Required Frequency-Watt Set Points and Values

Power Setpoint	Start Frequency Value (Hz)	Slope P (%age)	
P0	59.964	50%	Low
P1	60.036	-50%	High

Table 3

Dead-Band Over/Under Frequency	Hz
DBandOF	60.036
DBandUF	59.964

Table 4

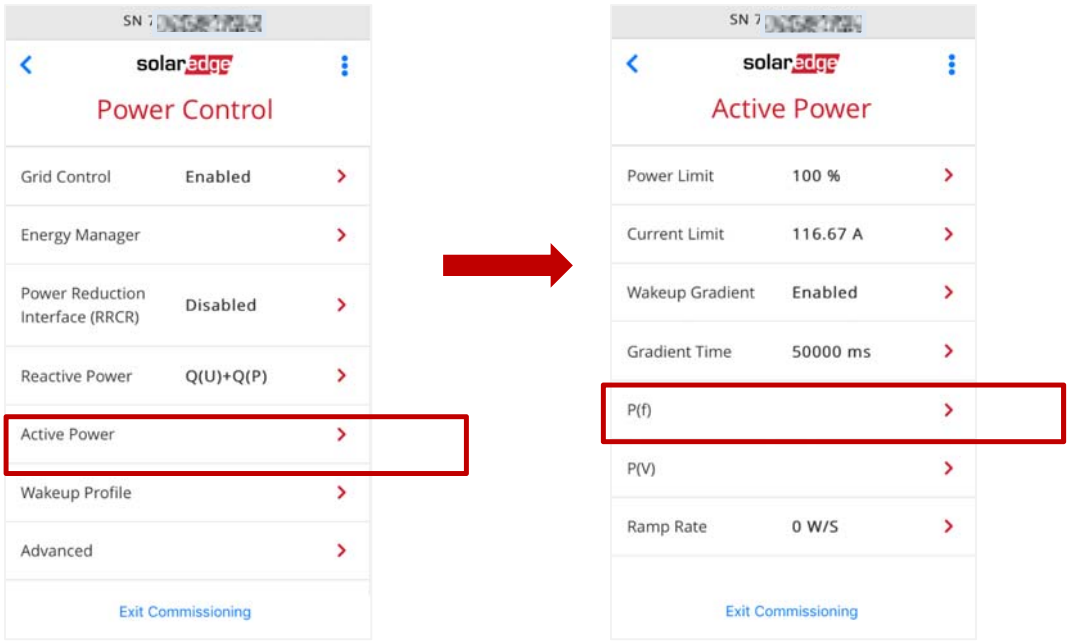
Slope Over/Under Frequency	1/Hz
Slope Over Flow	0.5
Slope Under Flow	0.5

Table 5

Follow these instructions to set the Frequency-Watt graph settings appropriately:

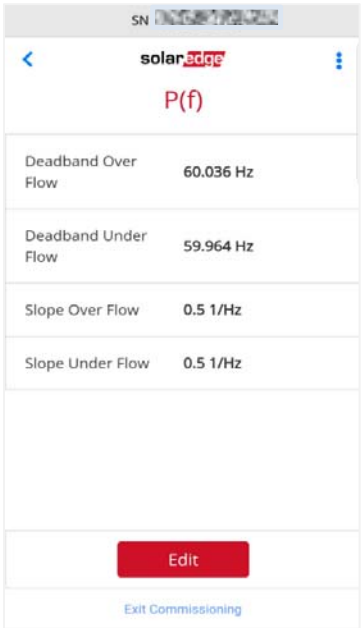
SetApp Enabled inverters:

1. Navigate to **Power Control → Active Power → P(f)**



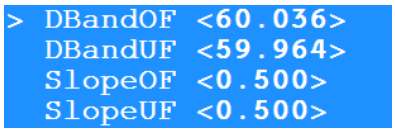
2. Navigate to **P(f)** and ensure the set points are as shown in Table 4 and Table 5. If the set points do not match, click on **Edit** and manually enter values to match both tables.

3. Take a screenshot and supply to the utility as proof of valid commissioning. See example below.



Inverters with a display:

1. Navigate to **Power Control → Active PWR Conf → P(f)**
2. Navigate to **P(f)** and set the points as shown in Table 4 and Table 5.
3. Take a picture and supply to the utility as proof of valid commissioning. See example below.

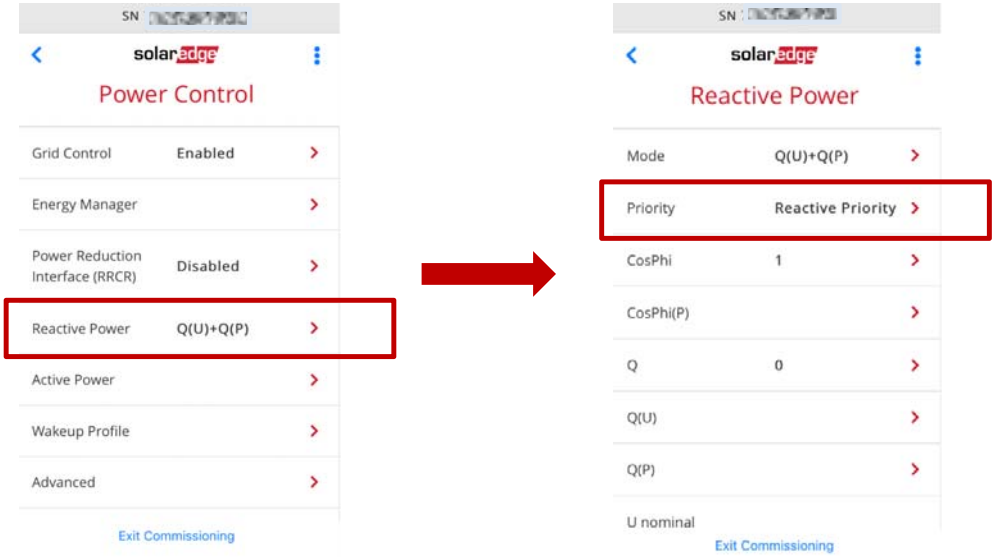


Reactive Power Priority Configuration

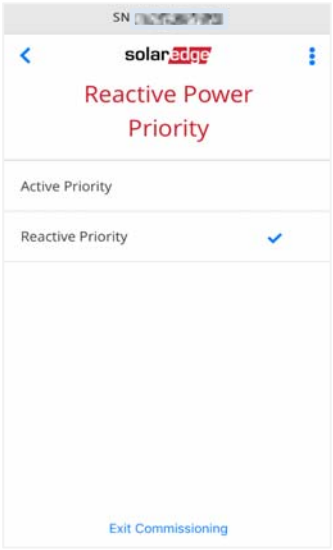
Reactive Power Priority is enabled by default when setting the appropriate USA Rule 21 country code.

SetApp Enabled inverters:

1. For verification, navigate to **Power Control → Reactive Power → Priority**

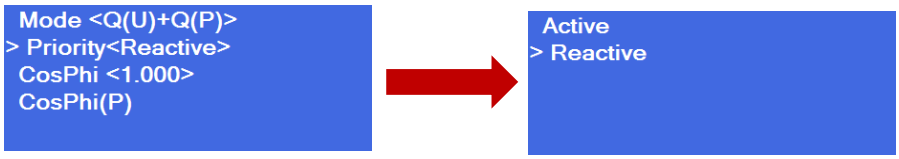


2. Ensure **Reactive Power** is checked and take a screenshot and supply to the utility as proof of valid commissioning. See example below.

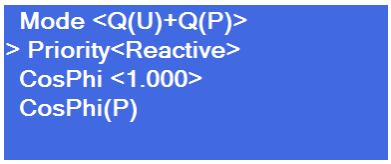


Inverters with a display:

1. For verification, navigate to Power Control → Reactive Pwr Conf. → Priority and select Reactive



2. Take a picture and supply to the utility as proof of valid commissioning. See example below.



Appendix A – Applicable Inverter Models

The following SolarEdge inverters have been evaluated to UL-1741-SA and CPUC Rule 21 and appear on the CEC list [S|1] of eligible smart inverters.

Single Phase Inverters	SE3000A-US, SE3800A-US, SE5000A-US, SE6000A-US, SE7600A-US, SE1000A-US, SE11400A-US
Single Phase Inverters with HD-wave technology	SE3000H-US, SE3800H-US, SE5000H-US, SE6000H-US, SE7600H-US, SE1000H-US, SE11400H-US
Three Phase Inverters	SE9KUS, SE14.4KUS, SE20KUS, SE30KUS, SE33.3KUS
Three Phase inverters with Synergy Technology	SE43.2KUS, SE66.6KUS, SE100KUS