solaredge 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 <u>SetApp Enabled inverters</u>, the firmware will be automatically upgraded upon activation of the inverter. If the inverter does not upgrade automatically, navigate to **Maintenance** \rightarrow **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 <u>inverters with a display</u>, <u>download the latest firmware version</u> or contact SolarEdge Support to obtain the latest version. Follow the upgrade instructions in <u>Software Upgrade using SD/MicroSD card – Application Note</u>.

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

solar<mark>edge</mark>

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.

SN 731 BERCHED					
<	5	olar <mark>edge</mark>	:		
\$	Info	ormation			
CPU	version	4.4.67			
DSP	l Version	1.0.746			
DSP2	2 Version	2.0.608			
Seria	il Number	73180765-80			
Erro	r Log	2 Controllers	>		
	Exit	Commissioning			

Inverters with a display

1. Navigate to Information \rightarrow Versions.

	Power Control Display Maintenance
>	Information
>	Versions
	Error Log
	Warning Log
	Harden TD-
	Hardware 1Ds

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

ID: 7E15ADHO CS	
DSP1:1.0013.1452	
DSP2:2.0019.1207	
CPU:3.2465.0000	



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.

<	:	solar	edge	:			
	Status						
Inverter SN							
		Sum	mary				
Power 0 W	,	Voltage Frequency 2 Vac 60 Hz					
P_O Opt Comm	P_OK: 0 of 0 Optimizers Communicating						
S Nigł	tatus it Mode			Switch is On			
Cos Pr NA	hi	Power 0	Country US/Rule21 277V				
Inverter Units Exit Commissioning							

Inverters with a display

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

>	Country <usa36></usa
	Language <en></en>
	Communication
	Power Control
	USA+
	Hawaii+
	NY+
>	USA(Rule21)+

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).

ID:	#	#	#	#	#	#	#	#	#		#	#
DSP1:		1				1	3		1	2	3	2
DSP2:		2				1	9		1	2		
CPU:		3		2	4	6	5					

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

ID:7E15A190 C5 DSP1/2:1.0013/2.0019 CPU:3.2465 Country:USA36

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



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

SetApp Enabled inverters

1. Navigate to Power Control \rightarrow Reactive Power \rightarrow 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.

<	solaredge	
	Q(U)	
P#	U%	Q%
PO	50	-30
P1	92	-30
P2	96.7	0
P3	103.3	0
P4	107	30
P5	120	30
	Edit	Ĺ
	Exit Commissioning	



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



Inverters with a display

1. Navigate to Power Control \rightarrow Reactive PWR Conf \rightarrow Mode



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

>	Mode $\langle Q(U) + Q(P) \rangle$
	CosPhi <1.000>
	CosPhi(P)
	Q < 0 >

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.

>	P0 P1 P2 P3	<50.00,-30.00> <92.00,-30.00> <96.69,0.00> <103.30,0.00>
>	P2 P3 P4 P5	<96.69,0.00> <103.30,0.00> <107.00,30.00> <120.00,30.00>

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:



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%

	Х	Y
	(V/Vnom	(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 \rightarrow Active Power \rightarrow 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.

SN (nortalin) india				
<	solar <u>edge</u> P(V)	ł		
P#	V%	P%		
PO	0	100		
P1	49	100		
P2	100	100		
P3	106	100		
P4	110	0		
P5	130	0		
	Edit Exit Commissioning			

Inverters with a display:

1. Navigate to **Power Control** \rightarrow **Active PWR Conf** \rightarrow **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.

>	P0 P1 P2 P3	<0.00,100.00> <48.99,100.00> <100.00,100.00> <105.99,100.00>
>	P2 P3 P4 P5	<100.00,100.00> <105.99,100.00> <110.00,0.00> <129.99,0.00>

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

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



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



Slope	
Over/Under	1/Hz
Frequency	
Slope Over Flow	0.5
Slope Under Flow	0.5
Ta	ble 5

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

SetApp Enabled inverters:

1. Navigate to Power Control \rightarrow Active Power \rightarrow P(f)

SN 7	065807847	
so	lanedge	1
Powe	er Control	
ontrol	Enabled	>
ergy Manager		>
er Reduction face (RRCR)	Disabled	>
active Power	Q(U)+Q(P)	>
ve Power		>
eup Profile		>
anced		>
Exit C	ommissioning	

- 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.

SN 🛛	0.0000000000	
< sol	ar <mark>edge</mark>	:
	P(f)	
Deadband Over Flow	60.036 Hz	
Deadband Under Flow	59.964 Hz	
Slope Over Flow	0.5 1/Hz	
Slope Under Flow	0.5 1/Hz	
	Edit	
Exit Co	mmissioning	

Inverters with a display:

- 1. Navigate to Power Control \rightarrow Active PWR Conf \rightarrow 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.

>	DBandOF	<60.036>
	DBandUF	<59.964>
	SlopeOF	<0.500>
	SlopeUF	<0.500>

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**

SN	0.058679500			SN 1 DICHTERPORT
< s	olaredge	1	<	solan <mark>edge</mark>
Pow	er Control			Reactive Power
Grid Control	Enabled	>	Mode	Q(U)+Q(P)
Energy Manager		>	Priority	Reactive Priority
Power Reduction Interface (RRCR)	Disabled	>	CosPhi	1
leactive Power	Q(U)+Q(P)	>	CosPhi(P	ŋ ::
ctive Power		>	Q	0
Wakeup Profile		>	Q(U)	
Advanced		>	Q(P)	
Exit (Commissioning		U nomin	al Exit Commissioning

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

SN DICTURE		
<	solaradg	7 :
	Reactive Po	ower
	Priority	/
Active P	riority	
Reactive	Priority	~
	Exit Commissio	ning



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