Application Note - SolarEdge Inverters, Power Reduction Control

Revision History

- Version 3 (December 2018):
  - Added SetApp menus
  - Modified DSP firmware requirements
- Version 2 (August 2018)
  - Note for Single Phase Inverters with HD-Wave Technology with no PRI connector
  - Updated firmware upgrade instructions
- Version 1 (December 2012): Initial release

Introduction

This document describes how to control and/or limit the inverter's output power.

This application note describes two options for power reduction control in SolarEdge inverters:

- **Hardware Power Reduction:** The inverter can be connected to a RRCR (Radio Ripple Control Receiver) in order to dynamically limit the output power of all the inverters in the installation.
- **Software Configurable Power Limitation:** A fixed power limit as a percentage [%].

NOTE:

Single Phase Inverters with HD-Wave Technology (excluding inverters for Japan and Australia), manufactured from week 28 2018, do not have the PRI connector built-in. A kit of five connectors may be purchased from SolarEdge.

To identify the manufacturing week of the inverter, refer to the 3rd and 4th characters from the left of the serial number. To identify the manufacturing year of the inverter, refer to the 5th and 6th characters.

For example, an inverter with serial number SJ**2318**A-07F004FE5-B3 was manufactured in week 23 of 2018.

Power Reduction Interface Connection

► **To connect a four-relay[1] Radio Ripple Control Receiver (RRCR):**

1 Connect the RRCR[2] directly to the SolarEdge inverter communication board through the Power Reduction Interface (PRI) connector. Figure 1 shows the location of the connector. The connector is an 8-port terminal block.

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[1] For three-relay RRCR connection, please refer to appendix A.

[2] The RRCR must be purchased separately. It is not supplied by SolarEdge.
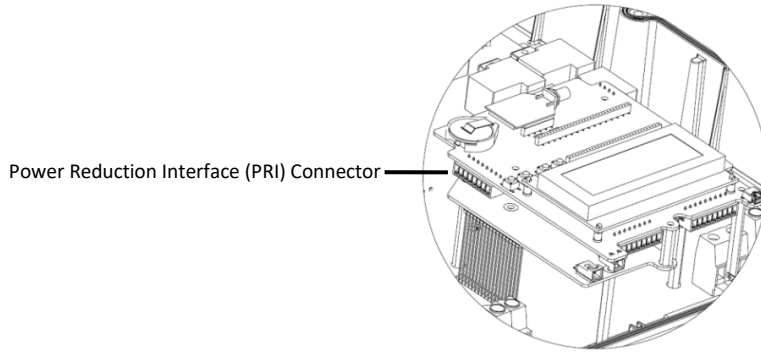
Power Reduction Interface (PRI) Connector

Figure 1: PRI Interface Input

2   The following table describes the connector pin assignment and functionality:

PRI Connector Pin #	Pin Name	Description	Connected to (RRCR)
1	V	5VDC Voltage Supply	Relays common node
2	G	GND	Not connected
3	L4	Relay contact 4 input	K4 – Relay 4 output
4	L3	Relay contact 3 input	K3 – Relay 3 output
5	L2	Relay contact 2 input	K2 – Relay 2 output
6	L1	Relay contact 1 input	K1 – Relay 1 output
7	NC	Not connected	Not connected
8	NC	Not connected	Not connected

Figure 2: Inverter – RRCR Connection

CAUTION:
Excessive voltage can damage the inverter!
Use an insulated power conductor from pin 1 of the PRI connector as the RRCR relay's common node.
Do not use any external voltage.

3   Use a 6-wire cable (not supplied by SolarEdge) with an external diameter ≤ 200mil / 5mm in order to ensure proper fit and sealing of the inverter gland.

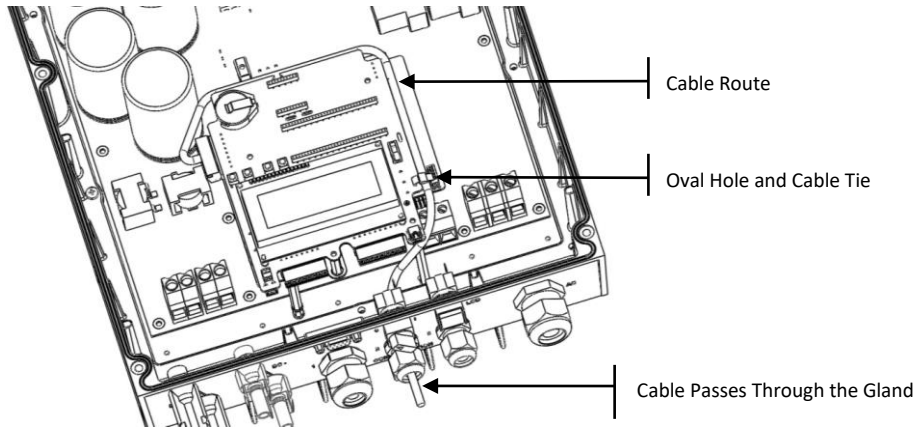4   Route the 6-wire cable as illustrated below and tie it to the oval hole using a cable tie.

Figure 3: Power Reduction Control Cable Route

Using the Power Reduction Control

The inverter is preconfigured to the following RRCR power levels:

L1	L2	L3	L4	Active Power	Cos(φ)
1	0	0	0	0%	1
0	1	0	0	30%	1
0	0	1	0	60%	1
0	0	0	1	100%	1

Active power control and reactive power control are enabled separately.

NOTE:
The inverter saves the last power reduction state in its memory. If the inverter is disconnected from the RRCR, then it retains its last power reduction state until the AC is powered off or until the next morning; whichever is sooner.
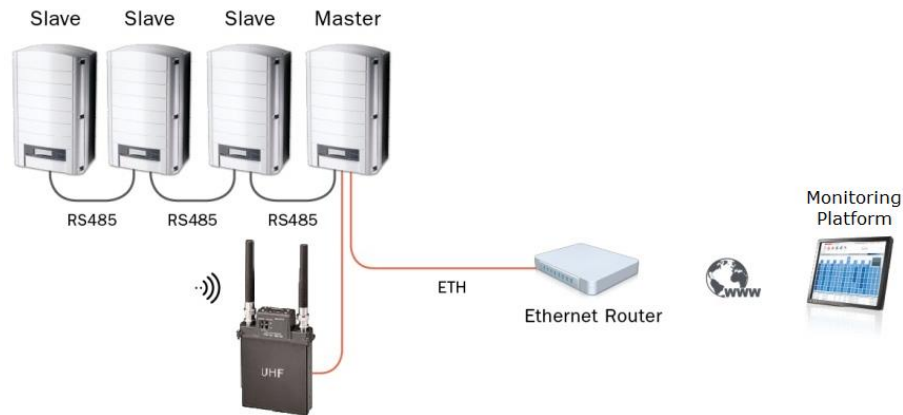

Figure 4: RRCR Connection in a Multi-Inverter Environment

▶ **To enable Power Reduction using SetApp:**

1 Configure the master inverter in the SetApp smartphone application:

- **Communication ➜ RS485-1 ➜ Protocol ➜ SolarEdge Master**

- **Communication ➜ RS485-1 ➜ Slave Detect**
  The Master should report the correct number of slaves. If it does not, verify the connections and terminations.

- **Power Control ➜ Power Reduction Interface (RRCR) ➜ Enabled**
  The inverters will limit their power output according to the RRCR.

  NOTE:
  The reactive power can be configured separately by selecting **Power Control ➜ Reactive Power**.

2 The slave inverters are preconfigured. If a configuration of a slave inverter is required, select:

- **Communication ➜ RS485-1 ➜ Protocol ➜ SolarEdge Slave**
- **Communication ➜ Server ➜ RS485**

► **To enable Power Reduction using the inverter display:**

1 Set a Master Inverter configuration. In the LCD menu, select:

- **Communication ➜ RS485-1 Conf ➜ Device Type ➜** [select *SolarEdge*]
- **Communication ➜ RS485-1 Conf ➜ Protocol ➜** [select *Master*]
- **Communication ➜ RS485-1 Conf ➜ Slave Detect**
  The Master should report the correct number of slaves. If it does not, verify the connections and terminations.

- **Power Control ➜ RRCR Conf. ➜ RRCR Enable**
  The inverters will limit their power output according to the RRCR.

  NOTE:
  The reactive power can be configured separately by selecting the required **Mode** in the **Power Control** menu.

2 The slave inverters are preconfigured. If a configuration of a slave Inverter is required, in the LCD menu, select:

- **Communication ➜ RS485-1 Conf ➜ Device Type ➜** [select *SolarEdge*]
- **Communication ➜ RS485-1 Conf ➜ Protocol ➜** [select *Slave*]
- **Communication ➜ Server ➜ RS485**

► **To enable the power factor control with RRCR using SetApp:**

1 Enable Power Reduction, as described above.

2 Configure all inverters as follows:
Power Control ➜ Reactive Power ➜ Mode ➜ Power Reduction Interface (RRCR, DRED)

► **To enable the power factor control with RRCR using the inverter display:**

1 Enable Power Reduction, as described above.

2 Configure all inverters as follows.
Power Control ➜ Reactive Pwr Conf. ➜ Mode ➜ RRCR

For Further Information

You may refer to the *SolarEdge Inverter Installation Guide* for detailed instructions regarding SolarEdge inverter installation and connectivity.

You may refer to the *SolarEdge Inverters, Power Control Options* application note for a detailed description of how to configure the various active and reactive power modes. Please refer to:

http://www.solaredge.com/files/pdfs/application_note_power_control_configuration.pdf

Fixed Power Limitation

The peak power of the inverter can be limited by software configuration.

No additional hardware is required.

▶ **To configure the inverter using SetApp:**

- Select **Power Control** ➔ **Active Power** ➔ **Power Limit** ➔ Enter the required value, in %.

▶ **To configure the inverter using the inverter display:**

- In the LCD menu select **Power Control** ➔ **Active Pwr Conf.** ➔ **Power Limit** ➔ Set **Power Limit (%)**: [Enter the required value].

Firmware Versions

- Both power limitation methods are supported from CPU firmware release V2.293 and up
- Fixed power limitation also requires the following DSP firmware:

Inverter Type	DSP1	DSP2
1ph inverter	1.210.53 and above	-
3ph inverter	1.13.67 and above	2.52.154 and above

To upgrade inverters with earlier firmware versions, refer to:
https://www.solaredge.com/sites/default/files/upgrading_an_inverter_using_micro_sd_card.pdf

Appendix A – Connect and Configure a Three-relay RRCR

► **To connect a three-relay RRCR:**

Connect the RRCR[3] directly to the SolarEdge inverter communication board through the Power Reduction Interface (PRI) connector. Figure 1 shows the location of the connector. The connector is an 8-port terminal block.

The following table describes the connector pin assignment and functionality:

PRI Connector Pin #	Pin Name	Description	Connected to RRCR
1	V	5VDC Voltage Supply	Relays common node
2	G	GND	Not connected
3	L4	Relay contact 4 input	Not connected
4	L3	Relay contact 3 input	K3 – Relay 3 output
5	L2	Relay contact 2 input	K2 – Relay 2 output
6	L1	Relay contact 1 input	K1 – Relay 1 output
7	NC	Not connected	Not connected
8	NC	Not connected	Not connected

Figure 5: Inverter – Three-Relay RRCR Connection

✎ **IMPORTANT NOTE:**
Excessive voltage can damage the inverter!
Use an insulated power conductor from pin 1 of the PRI connector as the RRCR relay's common node. Do not use any external voltage.

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[3] The RRCR must be purchased separately. It is not supplied by SolarEdge.

Using the Power Reduction Control

The inverter is preconfigured to the following RRCR power levels:

L1	L2	L3	L4	Active Power	Cos(φ)
1	0	0	0	0%	1
0	1	0	0	30%	1
0	0	1	0	60%	1
0	0	0	1	100%	1

To support three–relay RRCR, state "0" (L1 – L4 = 0000) should be enabled in addition to the default setting and its active power should be set to 100%:

L1	L2	L3	L4	Active Power	Cos(φ)
0	0	0	0	100%	1

► **To enable and set the value of State "0" using SetApp:**

1 Select Power Control ➔ **Power Reduction Interface (RRCR)** ➔ Enabled

2 Select **Power Control** ➔ **Power Reduction Interface (RRCR)** ➔ **Set Values** ➔ tap **Edit** to display the Set Values page. In the row "0 0 0 0", switch **Enable** to "Yes", set the value of **Pout%** to 100, and set the value of **CosPhi** to 1. Tap **Done** to complete the configuration.

► **To enable and set the value of State "0" using the inverter display:**

1 Select **Power Control** ➔ **RRCR Conf.** ➔ **Set Values** ➔ select **0000** point and press Enter ➔ select **Enable** ➔ choose **Yes** and press Enter.

2 Select **Power Control** ➔ **RRCR Conf.** ➔ **Set Values** ➔ select **0000** point and press Enter ➔ select **Pwr Reduce** and press Enter ➔ set the value to 100 % by pressing the Down arrow key and pressing Enter.