

Application Note – Inverter AC Relay Control by a Secondary Protection Device

Version History

- **Version 1.6, February 2023**
 - Updated Figure 4 and Figure 6.
 - Editorial changes
- **Version 1.5, September 2020**
 - Added configuration of AC relay control using SetApp.
 - Editorial changes
- **Version 1.4, March 2019** - modified figures 4 and 6 (replaced Secondary Protection Device to Grid Monitoring Device and deleted K1, K2 and K3)
- **Version 1.3, September 2018** – added missing Ground connection from inverter to Commercial Gateway in figure 5 and changed CCG to Commercial Gateway.
- **Version 1.2, June 2018** – added missing figure
- **Version 1.1, January 2018** – updated response time when using version 3.22xx
- **Version 1, July 2016** – initial version

Introduction

In some cases, PV installations are required to have secondary grid protection that is independent of the inverter's internal grid protection (an example of secondary grid protection is defined in VDE-AR- N-4105). This secondary grid protection can be provided by a device which controls two contactors connected in line with the grid and the inverter. It continuously monitors grid parameters such as voltage and frequency and automatically disconnects the system from the grid if a parameter is outside the permitted range by opening the contactors. Once the parameters are within the permitted range for the required time it reconnects the system to the grid by closing the contactors.

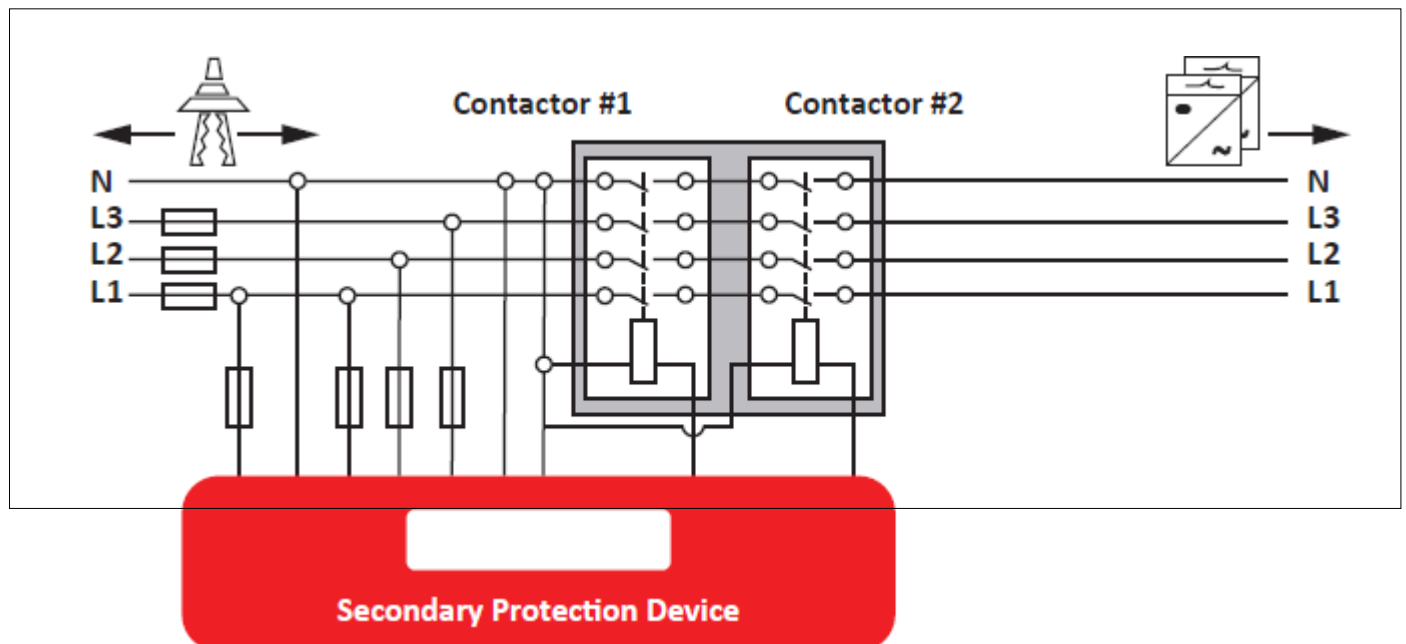


Figure 1: Secondary Protection Device

Alternately, the inverter's internal relays can be used instead of the external contactors. This option can save the cost of the external contactors, which normally ranges between €100 and €1,000, depending on the installation size.

This application note describes how to connect such a device to the SolarEdge inverter and how to configure the relay control. To use the AC Relay Control feature, the inverter communication board firmware (CPU) version must be 3.18xx and above; AC relay response time is ~1sec. For a response time of $\leq 100\text{ms}$ version 3.22xx and above should be used.

For further related information about power control of SolarEdge inverters, refer to:

- [Application Note Power Reduction Control](#)
- [Application Note Power Control Options](#)

Connecting a Secondary Protection Device to the SolarEdge Inverter

To control the inverter relays the secondary protection device is connected to the inverter's Power Reduction Interface (PRI) connector located on the inverter communication board. In an installation with a Commercial Gateway the device should be connected to the Commercial Gateway's PRI connector as shown in Figure 5: Multiple inverter system, with RRCR and Commercial Gateway .

Only one of the four PRI signals (L1) is used to control the internal inverter relays.



NOTES

- You can connect up to 15 inverters to one secondary protection device. For sites with more than 15 inverters, use multiple devices.
- The total length for all inverter wiring cannot exceed 200m. Total length of cable includes:
 - Inverter-to- inverter cables.
 - Inverter-to-secondary-protection-device cables.
 - Secondary-protection-device-to-inverter cables.
 - Cables between "G" terminals.
- Use a CAT6 cable to connect inverters to the secondary protection device and to each other.

The secondary protection device should operate in a Normally Closed (NC) mode. In a normally closed circuit, power flows until the relay is activated which disconnects the circuit and interrupts the power; the circuit is connected and the power returns when the relay is deactivated.



CAUTION!

Relays typically have low IP protection and need to be placed inside an enclosure.

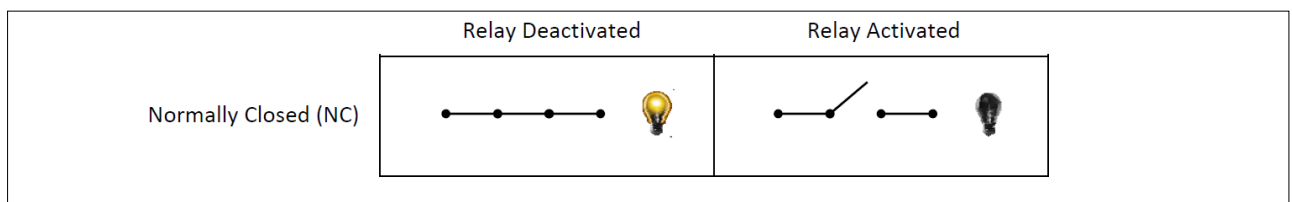


Figure 2: NC Relay Modes



NOTE

If RRCR power control is required, the default RRCR setting used by utilities for power reduction (L4/L3/L2/L1: 0001→0%, 0010→ 30%, 0100→60% and 1000 → 100%) must not be overridden.

Multiple Inverter System without RRCR

Connection procedure:

1. Connect two wires from the secondary protection device to the 5V and L1 PRI pins of any inverter (it does not have to be the communication leader inverter).
2. Connect wires from the L1 pin of one inverter to the L1 pin of the next inverter and so on.
3. Connect wires from the G pin of one inverter to the G pin of the next inverter and so on.

System behavior:

- When L1=1, the inverter relays are closed
- When L1=0, the inverter relays automatically open. They remain open until L1=1.

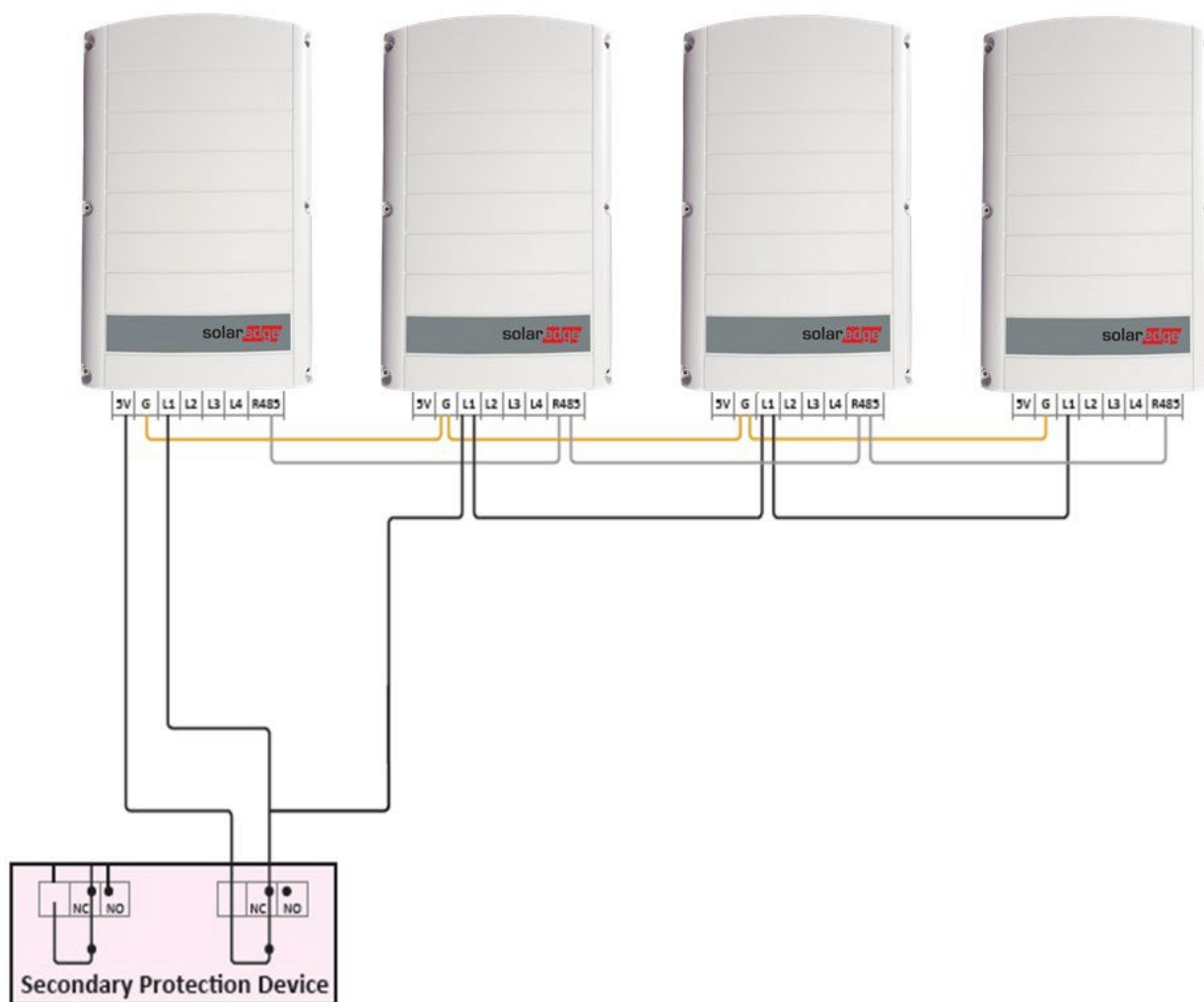


Figure 3: Multiple Inverter System, no RRCR

Multiple Inverter System with RRCR

Connection procedure:

1. Connect a wire from the secondary protection device to the 5V of the inverter to which the RRCR is connected.
2. Connect a wire from the secondary protection device to the RRCR.
3. Connect wires from the L1 pin of this inverter to the L1 pin of the next inverter and so on.



NOTE

The RRCR needs to be connected to the communication leader inverter.

4. Connect wires from the G pin of one inverter to the G pin of the next inverter and so on.

System behavior:

- Leader inverter:
 - When $L1 = L2 = L3 = L4 = 0$ the inverter relays automatically open.
 - During any other signal combination, the inverter will behave according to the RRCR settings.
- Follower inverters:
 - When $L1=1$ the inverter relays are closed. Any RRCR signals will be received from the leader inverter via RS485.
 - When $L1=0$ the inverter relays automatically open. They remain open until $L1=1$.

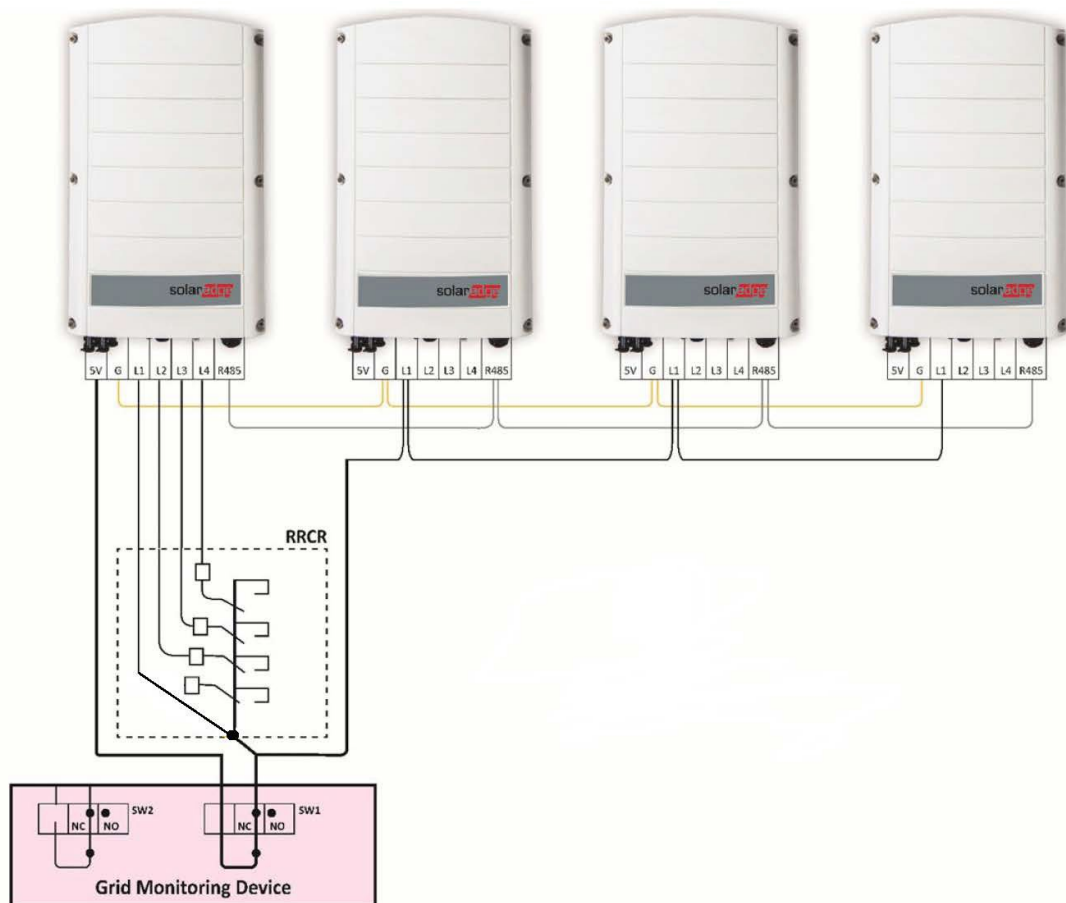


Figure 4: Multiple Inverter System, with RRCR

Multiple Inverter System with RRCR and Commercial Gateway

Connection procedure:

1. Connect one wire from the secondary protection device to the 5V PRI pin of the Commercial Gateway.
2. Connect one wire from the secondary protection device to the L1 pin of the inverter connected to the Commercial Gateway.
3. Connect wires from the L1 pin of this inverter to the L1 pin of the next inverter and so on.
4. Connect wires from the G pin of one inverter to the G pin of the next inverter and so on.



NOTE

The RRCR is connected to the Commercial Gateway and not directly to an inverter. The secondary protection device is connected to both the Commercial Gateway and to the inverter to which the Commercial Gateway is connected.

System behavior:

- If L1=1, the inverter relays remain closed. Any RRCR power commands will be received from the Commercial Gateway via RS485. If L1=0, the inverter relays will automatically open. They will remain open until L1=1.

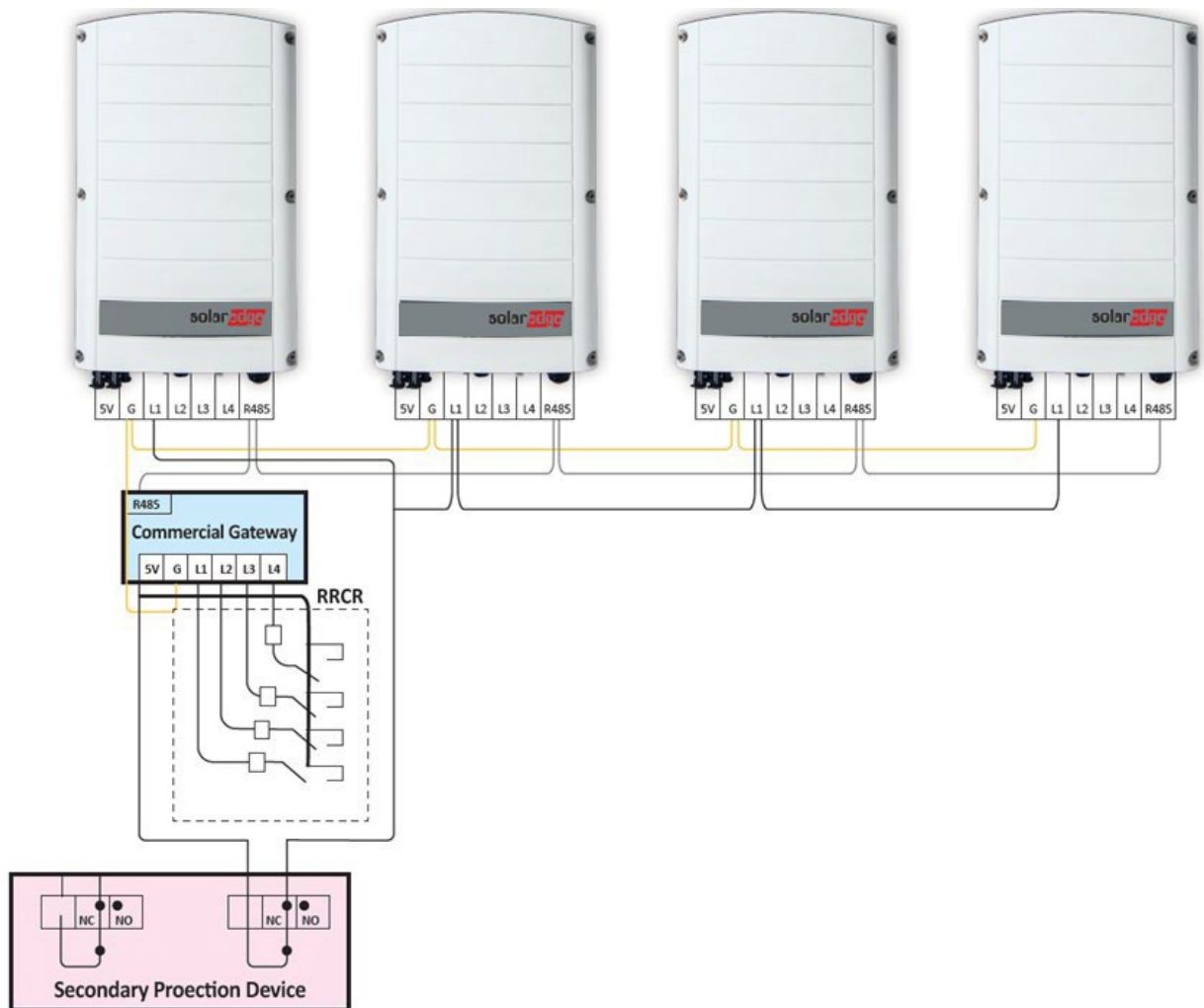


Figure 5: Multiple Inverter System, with RRCR and Commercial Gateway

Configuring AC Relay Control

Configuration Requirements

- To use the AC Relay Control feature in inverters using SetApp, the inverter communication board firmware (CPU) version must be 4.2xx and above.
- To use the AC Relay Control feature in inverters with LCD and buttons, the inverter communication board firmware (CPU) version must be 3.18xx and above. For an upgrade file and instructions, contact SolarEdge support.
- When AC Relay Control is enabled, all inverters in the system need to be configured to AC Relay Control mode.
- If a Commercial Gateway is installed, it should **not** be configured to AC Relay Control mode.



NOTE

AC Relay Control is disabled by default and should be enabled from the inverter menus.

Enabling AC Relay Control in Inverters with SetApp Configuration

1. Open the SetApp application.
2. Select **Commissioning** > **Site Communication** > **GPIO** > **Device Type** > **Power Reduction Interface (RRCR)**.
3. Select **GPIO** > **Power Reduction Interface (RRCR) Mode** > [Select the applicable mode].

Enabling AC Relay Control in Inverters with LCD and Buttons

System with RRCR

1. Select Communication ➔ Server <LAN>
2. Select Server <LAN> ➔ LAN
3. Select GPIO Conf.

```
> S e r v e r < L A N >
L A N C o n f
G P I O C o n f < R R C R >
```

4. Select Device Type ➔ < AC RELAY CTL+RRCR>.

```
> D e v i c e T y p e < A C + R >
```

System without RRCR

1. Select Communication ➔ Server <LAN>
2. Select Server <LAN> ➔ LAN
3. Select GPIO Conf.
4. Select Device Type ➔ AC RELAY CTL

```
> D e v i c e T y p e < A C >
```

Disabling AC Relay Control

1. Select Communication ➔ Server <LAN>
2. Select Server <LAN> ➔ LAN
3. Select GPIO Conf.
4. Select Device Type ➔ RRCR

Appendix - Three Relay RRCR and AC Relay Control

If the installation has a three relay RRCR, to use the AC Relay Control feature the system should be connected as follows:

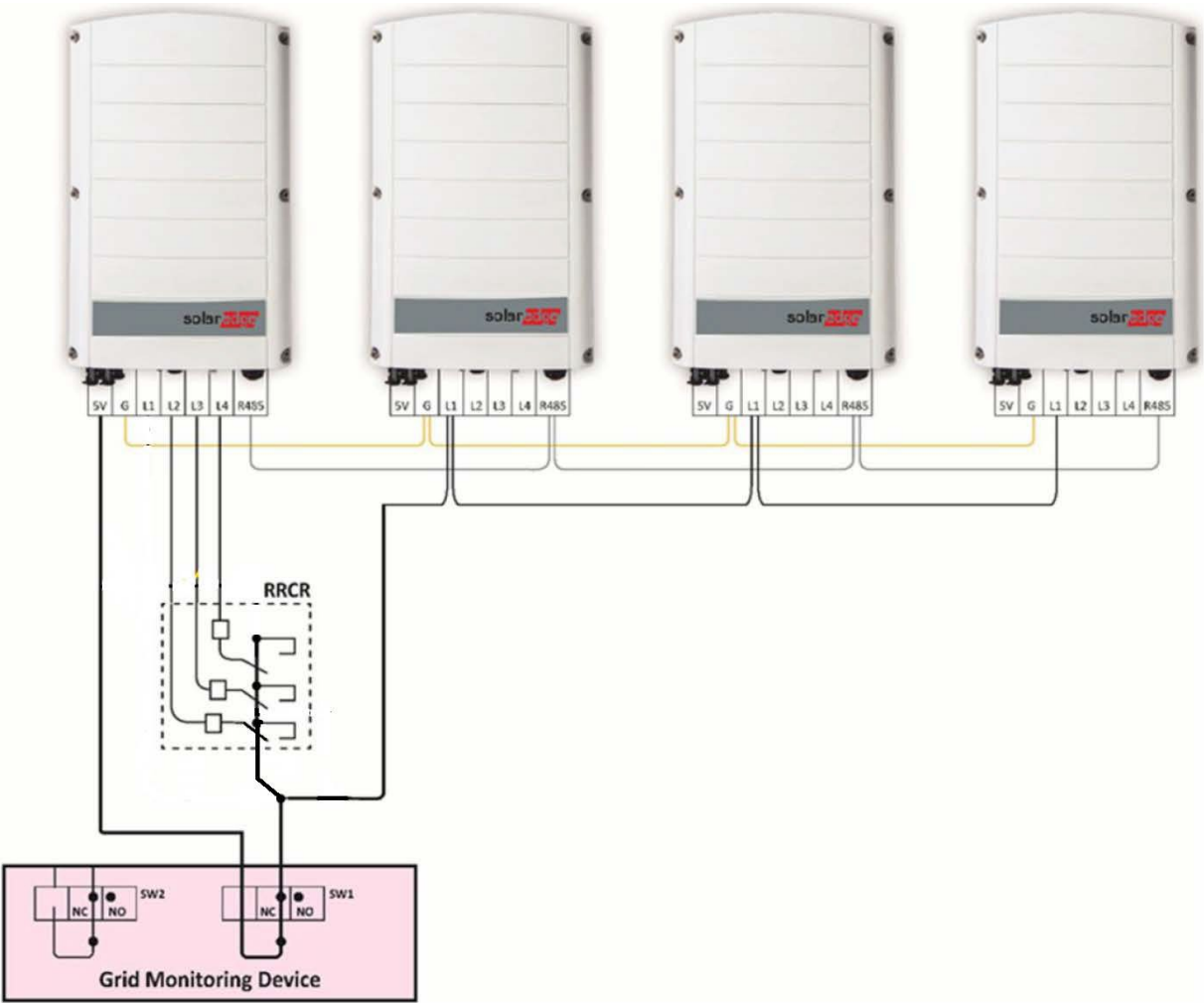


Figure 6: Three Relay RRCR and AC Relay Control

The RRCR settings should be configured as follows:

Active Power	L1	L2	L3	L4
0%	1	1	0	0
30%	1	0	1	0
60%	1	0	0	1
100%	1	0	0	0
Relays Open	0	0	0	0