

Application Note – Inverter AC Relay Control by Secondary Protection Device

Version history

- 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.

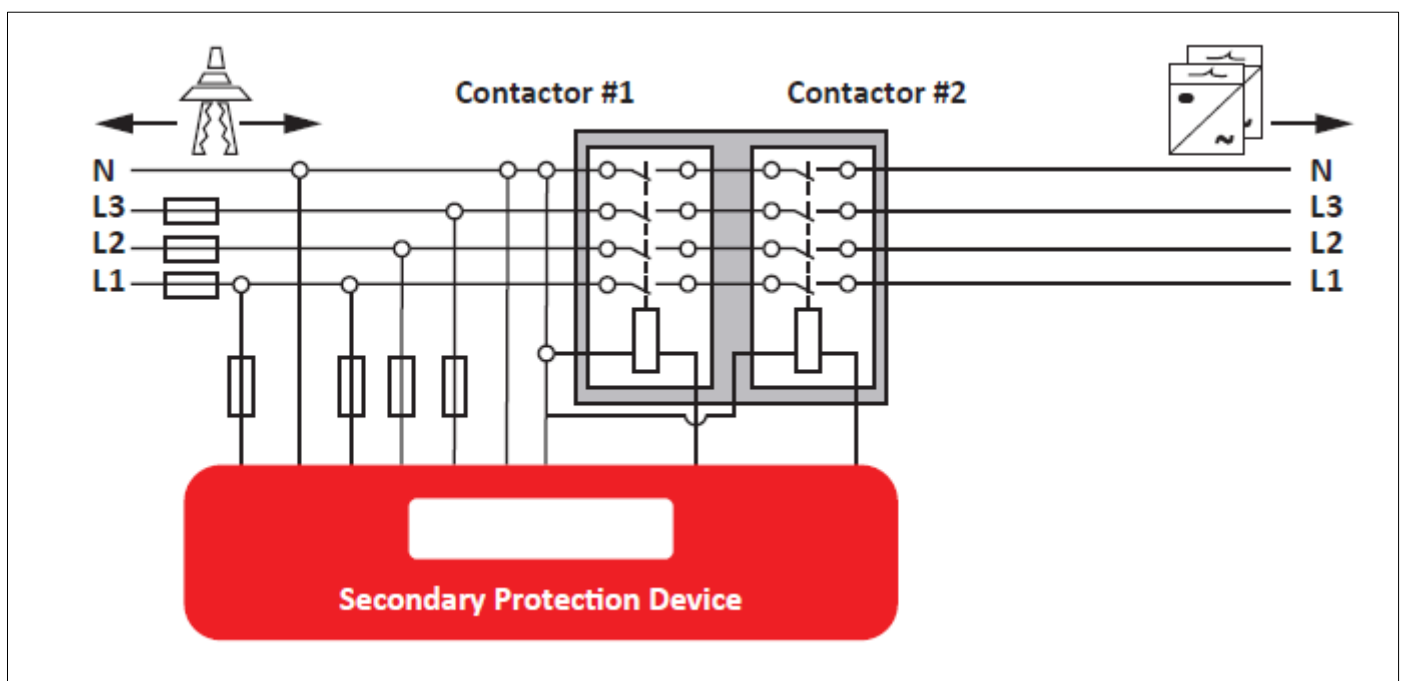


Figure 1: Secondary Protection Device

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 ≤100ms version 3.22xx and above should be used.

For further related information about power control of SolarEdge inverters, please 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 Control and Communication Gateway (CCG) the device should be connected to the CCG's PRI connector as shown in

Figure 5. Only one of the four PRI signals (L1) is used to control the internal inverter relays.



NOTE

Up to 15 inverters can be connected to a single secondary protection device. The total length for all inverters' cable wiring cannot exceed 15 meters. For sites with more than 15 inverters, multiple devices should be used.

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.

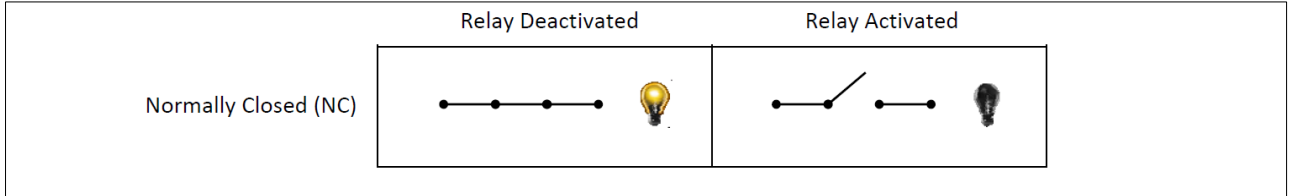


Figure 2: NC Relay Modes



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.

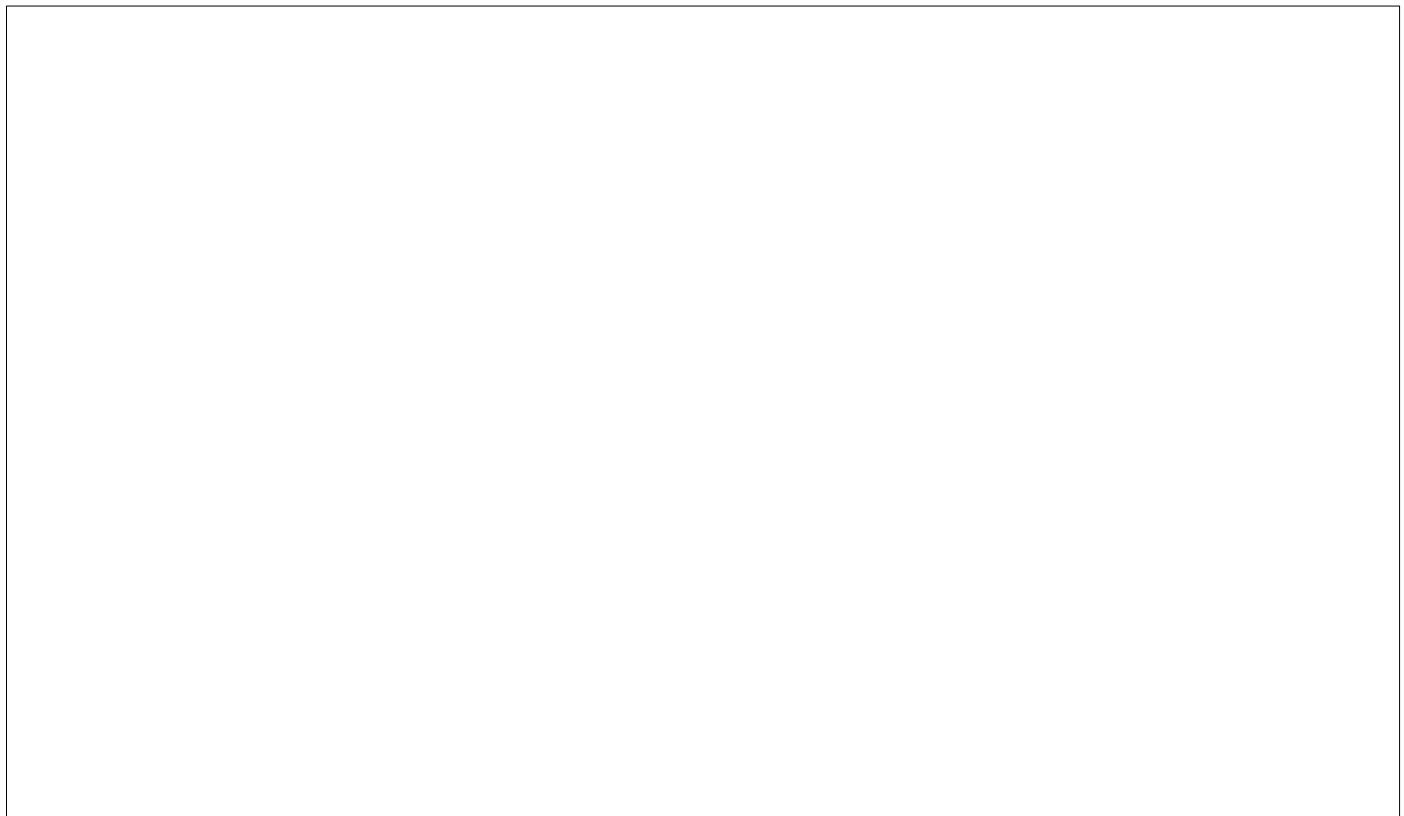
Multiple Inverter System without RRCR

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 master 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.



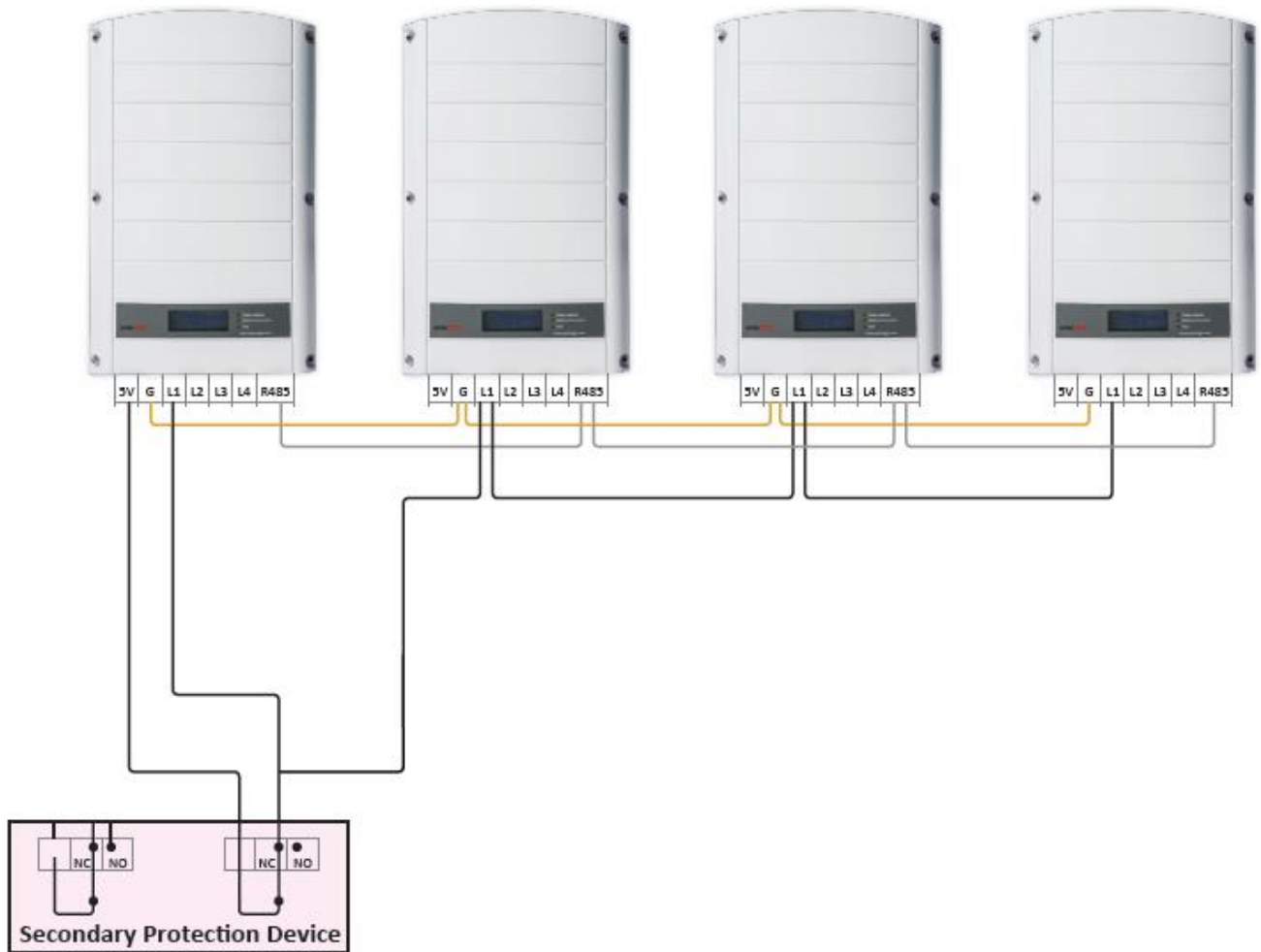


Figure 3: Multiple inverter system, no RRCR

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 L1 of the first inverter to which the RRCR is connected.
- 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 master inverter.

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

System behavior:

- Master 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.
- Slave inverters:
 - When L1=1 the inverter relays are closed. Any RRCR signals will be received from the master inverter via RS485.
 - When L1=0 the inverter relays automatically open. They remain open until L1=1.

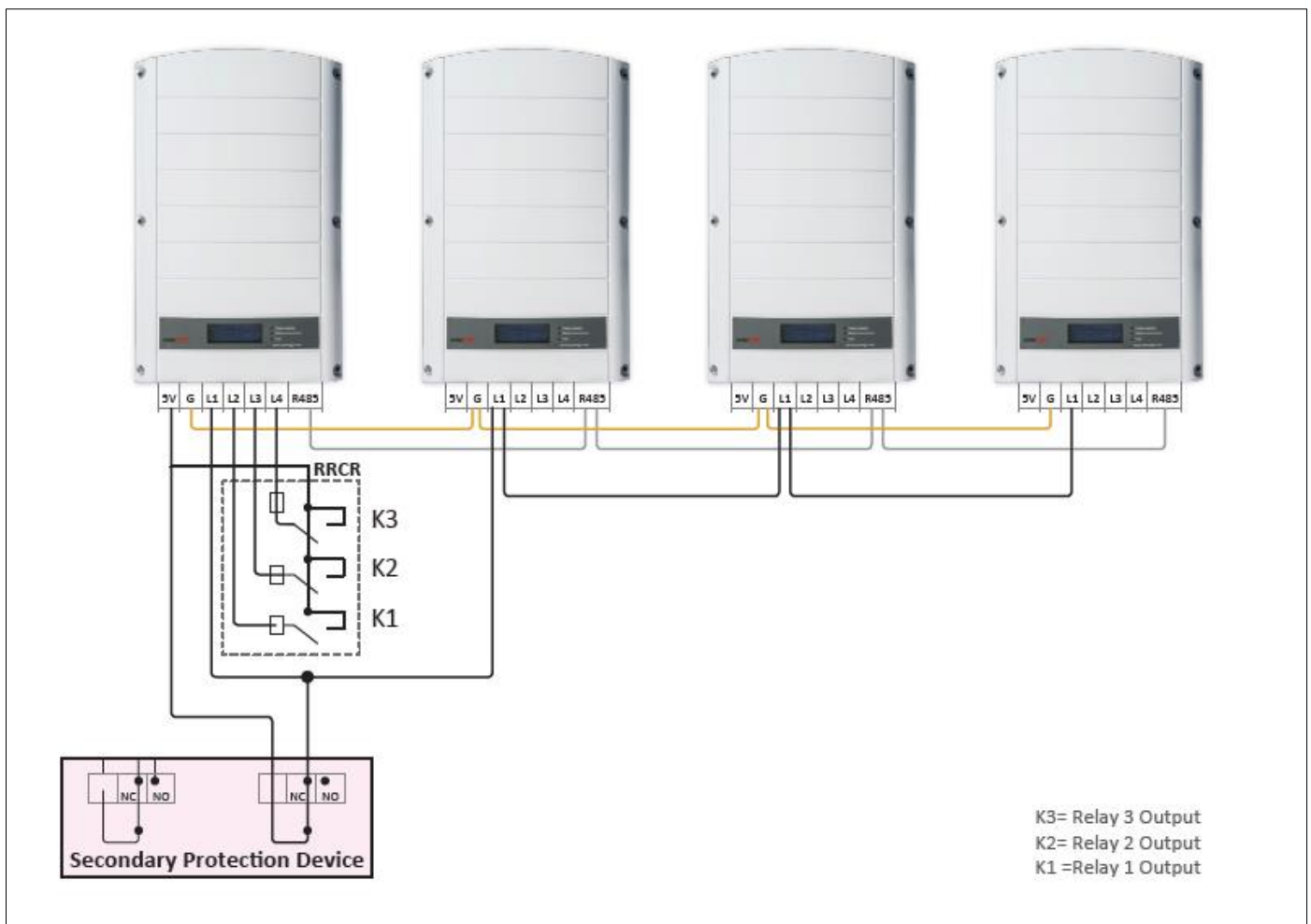


Figure 4: Multiple inverter system, with RCCR

Multiple Inverter System with RRCR and CCG

Connection procedure:

- 1 Connect one wire from the secondary protection device to the 5V PRI pin of the CCG.
- 2 Connect one wire from the secondary protection device to the L1 pin of the inverter connected to the CCG.
- 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 CCG and not directly to an inverter. The secondary protection device is connected to both the CCG and to the inverter to which the CCG is connected.

System behavior:

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

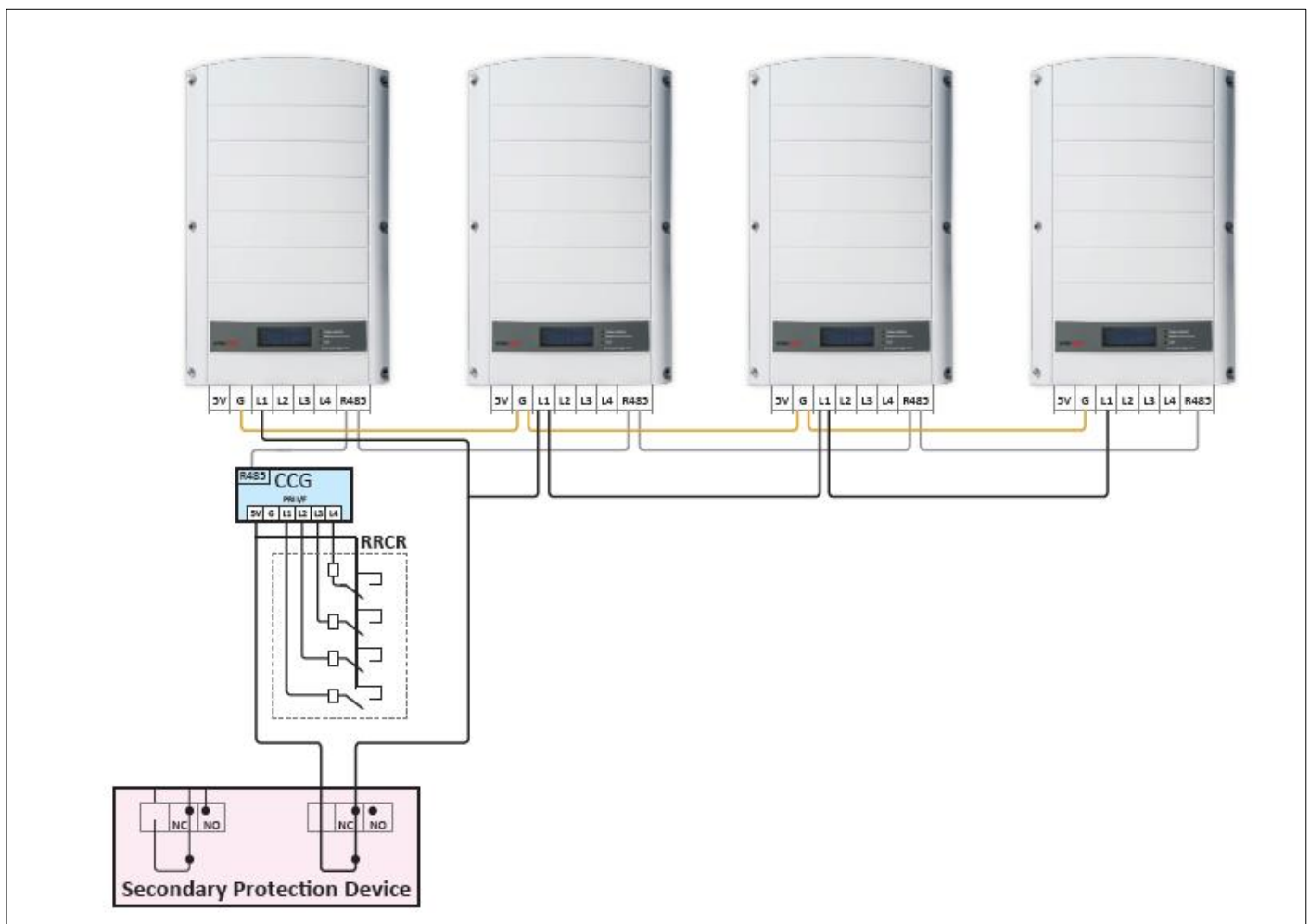


Figure 5: Multiple inverter system, with RRCR and CCG

Configuring AC Relay Control

Configuration Requirements

- To use the AC Relay Control feature, 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 CCG 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

System with RRCR

- Select **Communication** → **Server <LAN>**
- Select **Server <LAN>** → **LAN**
- 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 >
```

- Select **Device Type** → **< AC RELAY CTL+RRCR >**.

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

System without RRCR

- Select **Communication** → **Server <LAN>**
- Select **Server <LAN>** → **LAN**
- Select **GPIO Conf.**
- Select **Device Type** → **AC RELAY CTL**

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

Disabling AC Relay Control

- Select **Communication** → **Server <LAN>**
- Select **Server <LAN>** → **LAN**
- Select **GPIO Conf.**
- 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:

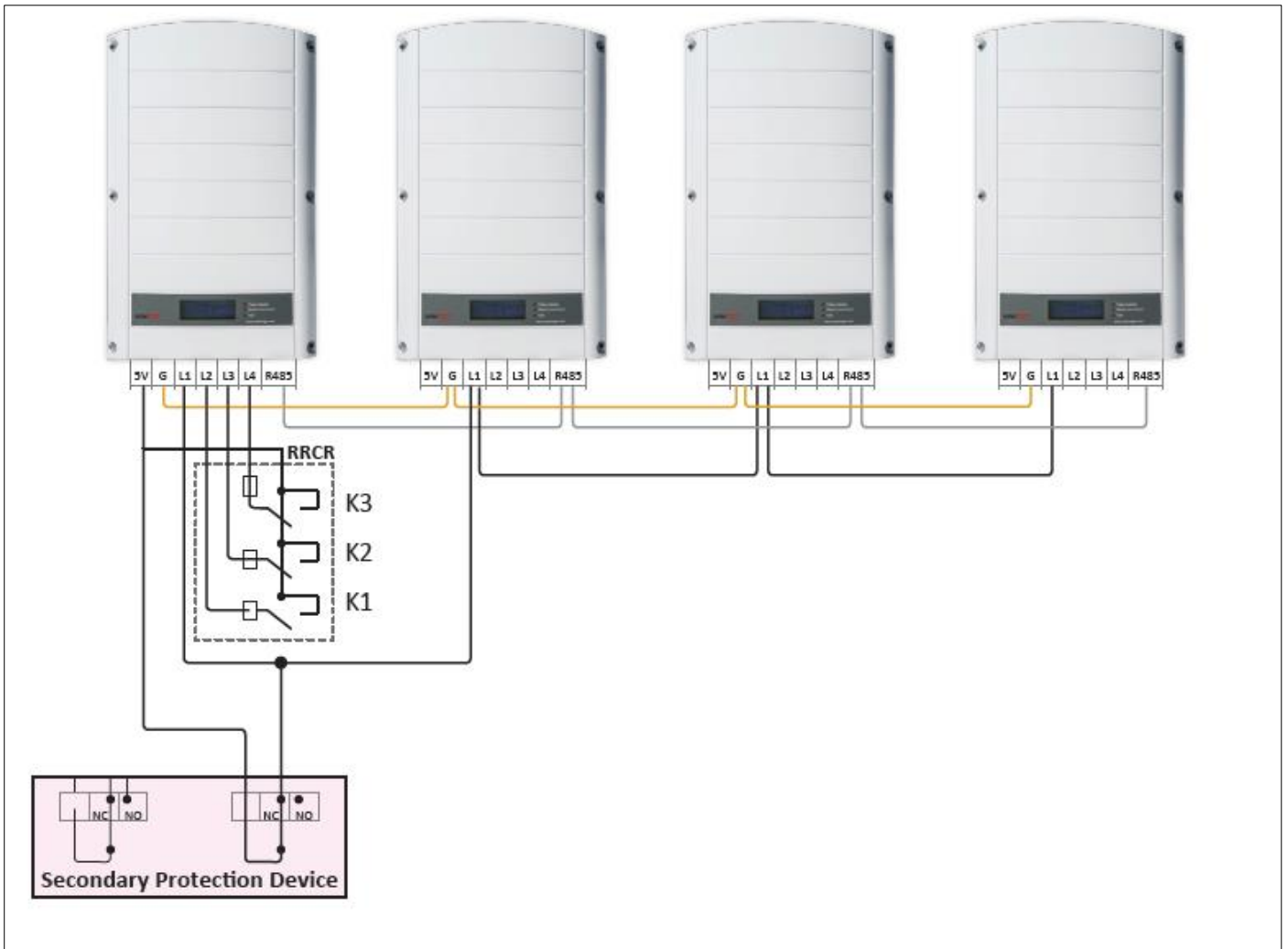


Figure 6: Three Relay RRCR and AC Relay Control

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