

SP PRO KACO Managed AC Coupling Installation Notes



SP PRO KACO Managed AC Coupling

Introduction

The SP PRO KACO Managed AC Coupling provides a method of linking the KACO xx02 series grid tie inverters to the SP PRO via the AC Load supply so that regardless of whether the grid or a generator is connected, the SP PRO can manage and control the KACO grid tie inverters.

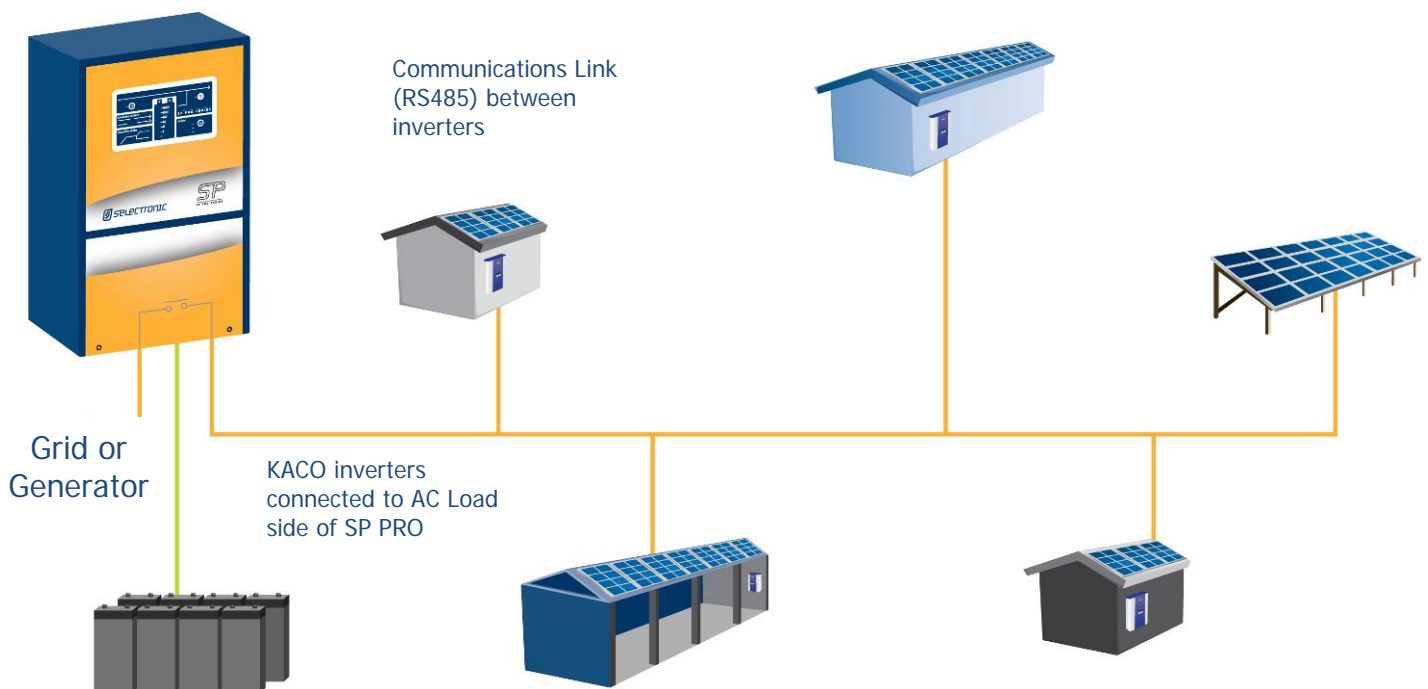
The SP PRO manages a maximum of five KACO grid tie inverters by commanding each grid tie inverter to output the right amount of power that is needed to simultaneously supply the load, export any excess and maintain the battery bank at any particular point in time. This is done via a communications link which also serves to retrieve all the operational data for display and logging by the SP PRO.

This document details the additional steps needed to install the managed system. The SP PRO and KACO inverters can be installed as per their individual installation instructions with the additional allowance of a communications cable linking all of the inverters.

Note: This document needs to be read in conjunction with the SP PRO Instruction Manual and the KACO xx02 Series Instruction Manual.

Overview

The diagram below shows a managed AC coupled system with five KACO inverters.



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System Requirements

To successfully install a SP PRO KACO managed system, there are particular system requirements that need to be met.

- Combined maximum AC output of all the connected KACO inverters must not exceed twice the continuous SP PRO output power rating.
- Battery bank must be sized to suit the SP PRO model and the combined maximum AC Output power of the KACO inverters.
- SP PRO and KACO inverters must have appropriate firmware version installed.

SP PRO MODEL AND TOTAL KACO AC OUTPUT

The total AC output of the KACO inverters must not be greater than twice the nominal capacity of the SP PRO, with the exception of the SPLC1201 which has a maximum of 28kW.

SP PRO Model	Combined maximum KACO AC Output power
SPMC240	6 kW
SPMC241	9 kW
SPMC481	10 kW
SPMC482	15 kW
SPMC1201	15 kW
SPLC1201	28 kW

Table 1: Maximum KACO AC output per SP PRO model

The KACO AC Output must not exceed the maximums listed.

Note: The AC Output of the KACO inverter should be reduced in line with the connected solar panels i.e. a 6002 inverter has an AC output of 5kW, yet if only 4kW of panels are installed then the lower power should be used.

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SP PRO MODEL AND MINIMUM BATTERY CAPACITY

The minimum battery capacity that must be connected to the SP PRO inverter varies depending on SP PRO model, an overriding minimum battery capacity and the Combined maximum KACO AC Output. The following table defines the minimum battery capacity for each SP PRO model.

Combined max. KACO AC Output	SP PRO Model					
	SPMC240	SPMC241	SPMC481	SPMC482	SPMC1201	SPLC1201
1 kW	180 Ah	180 Ah	180 Ah	180 Ah	100 Ah	250 Ah
2 kW	180 Ah	180 Ah	180 Ah	180 Ah	100 Ah	250 Ah
3 kW	240 Ah	240 Ah	180 Ah	180 Ah	100 Ah	250 Ah
4 kW	320 Ah	320 Ah	180 Ah	180 Ah	100 Ah	250 Ah
5 kW	400 Ah	400 Ah	200 Ah	200 Ah	100 Ah	250 Ah
6 kW	480 Ah	480 Ah	240 Ah	240 Ah	100 Ah	250 Ah
7 kW	-	560 Ah	280 Ah	280 Ah	112 Ah	250 Ah
8 kW	-	640 Ah	320 Ah	320 Ah	128 Ah	250 Ah
9 kW	-	720 Ah	360 Ah	360 Ah	144 Ah	250 Ah
10 kW	-	-	400 Ah	400 Ah	160 Ah	250 Ah
11 kW	-	-	-	440 Ah	176 Ah	250 Ah
12 kW	-	-	-	480 Ah	192 Ah	250 Ah
13 kW	-	-	-	520 Ah	208 Ah	250 Ah
14 kW	-	-	-	560 Ah	224 Ah	250 Ah
15 kW	-	-	-	600 Ah	240 Ah	250 Ah
16 kW	-	-	-	-	-	256 Ah
17 kW	-	-	-	-	-	272 Ah
18 kW	-	-	-	-	-	288 Ah
19 kW	-	-	-	-	-	304 Ah
20 kW	-	-	-	-	-	320 Ah
21 kW	-	-	-	-	-	336 Ah
22 kW	-	-	-	-	-	352 Ah
23 kW	-	-	-	-	-	368 Ah
24 kW	-	-	-	-	-	384 Ah
25 kW	-	-	-	-	-	400 Ah
26 kW	-	-	-	-	-	416 Ah
27 kW	-	-	-	-	-	432 Ah
28 kW	-	-	-	-	-	448 Ah

Table 2: Minimum battery capacity per SP PRO model and Total KACO AC power

Note 1: Shaded cells = minimum battery capacity

Note 2: - = n/a, maximum power exceeded for that SP PRO model.

Note 3: Battery capacity is C10 rating.

Note 4: Round battery capacity up as appropriate to available battery sizes.

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Ensure that the system meets these minimum battery capacity requirements. Any battery combinations larger than the minimum are suitable.

SP PRO AND KACO FIRMWARE REQUIREMENTS

The **SP PRO MUST** have firmware version 5.13 or later. Do **NOT** change any configuration settings until latest SP PRO is updated to latest firmware. SP PRO KACO Managed AC Coupling is not available in previous versions.

Site Information		Configuration Settings		QuickView		Data View	
Now	Today	DC History	AC History	Technical Data	Exp		
Inverter							
SP PRO Model	SPMC481-AU			Power Module 1 Serial Number	79901		
SP PRO Ratings	48V DC, 4kW, 240V AC			Power Module 1 Revision	3		
SP PRO Serial Number	82773			Power Module 1 Mod Status			
SP PRO Revision	7			Power Module 2 Serial Number	79973		
SP PRO Mod Status				Power Module 2 Revision	3		
Software Version	5.13			Power Module 2 Mod Status			
Control PCA Serial Number	80542						

SP LINK – Data View – Technical Data – “Software Version”

Note: See included USB memory stick or Selectronic web site – <http://www.selectronic.com.au> for latest SP PRO firmware and Tech Note 34 SP PRO Firmware Update Procedure.

KACO inverters must be manufactured during 2011 or later to contain the compatible firmware. KACO inverters prior to 2011 do not have compatible firmware installed.



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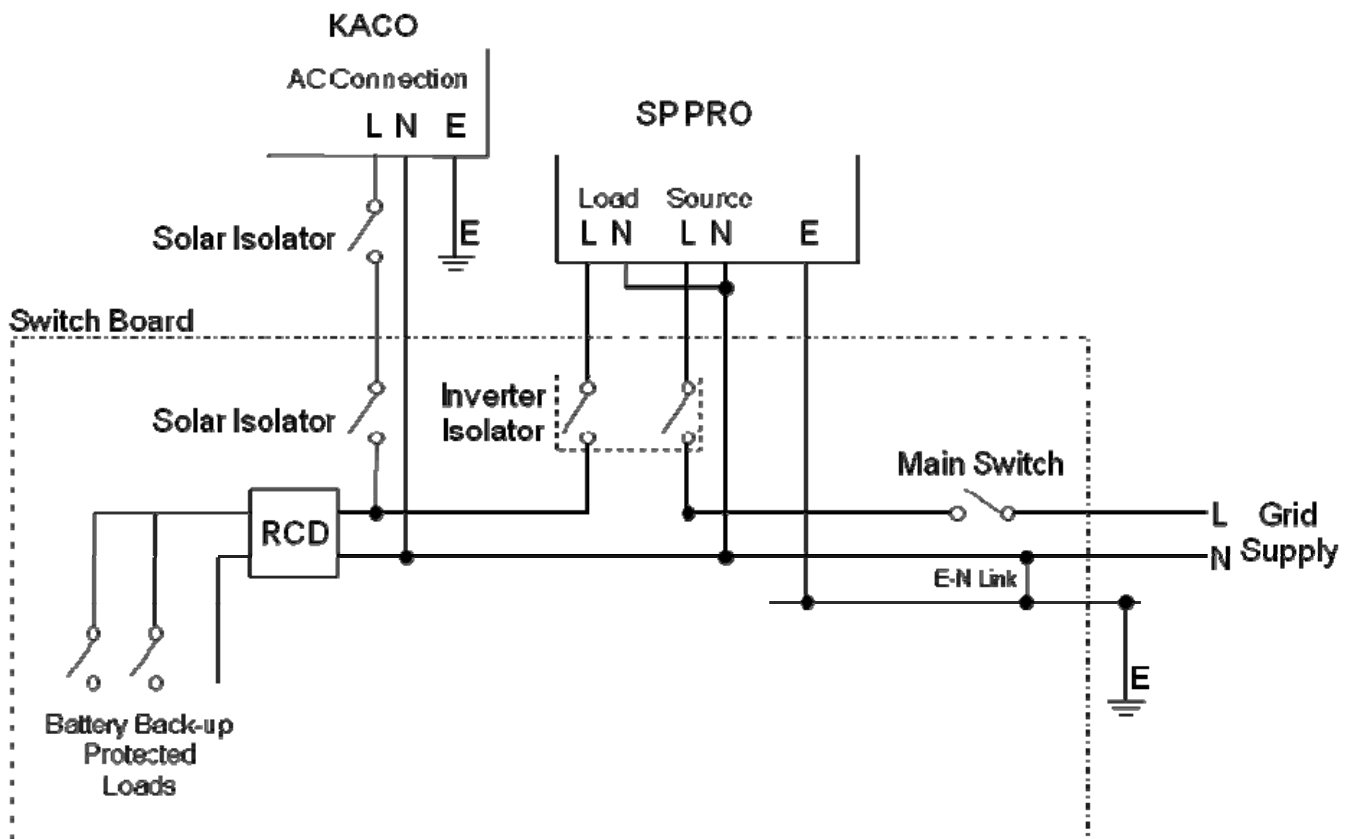
Installation

The SP PRO and KACO inverters should be installed as per their respective installation instructions. Particular instructions directly related to Managed AC Coupling are listed below.

It is good practice to number each KACO inverter from 1 up to 5 so that each inverter can be easily referenced within SP LINK. This number is also used for the Communications Link addressing. See Configuration section.

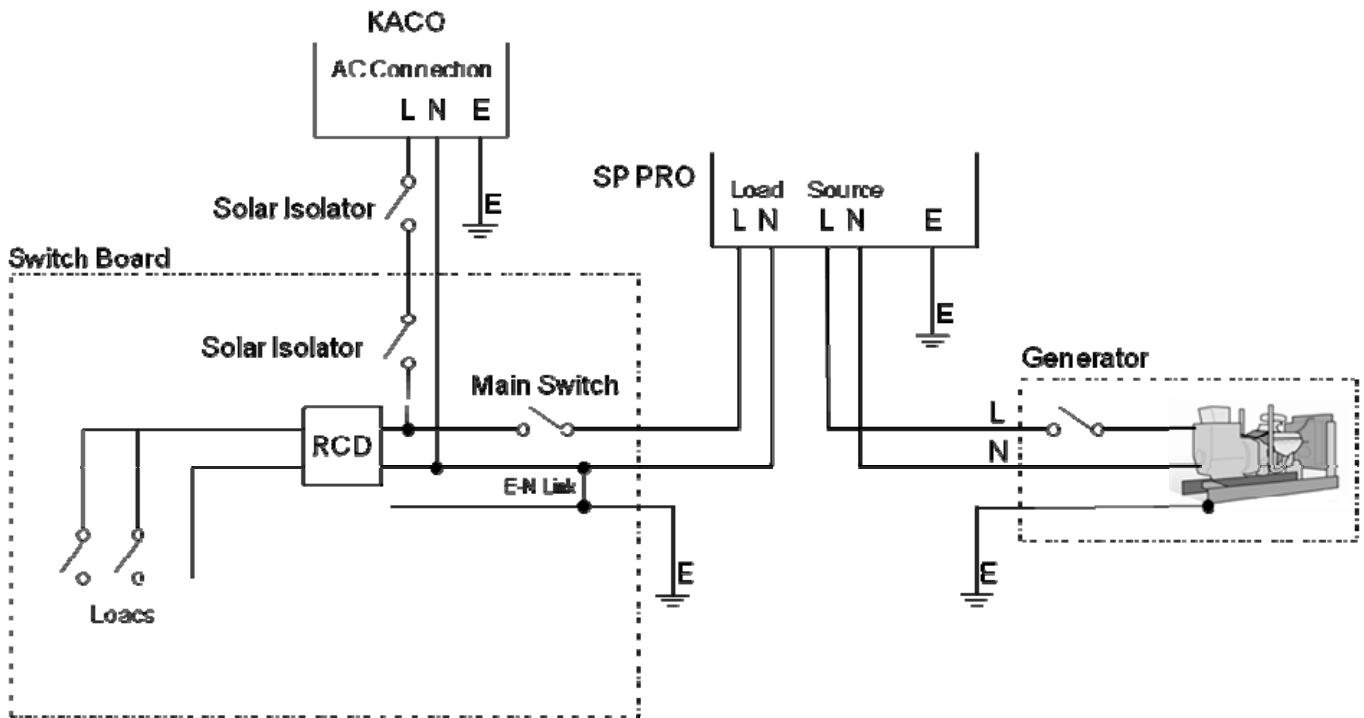
KACO AC WIRING

The KACO AC output wiring must be connected to the AC Load terminals of the SP PRO in accordance with local wiring rules for correct operation.



KACO AC Wiring guide for Grid connected installation

SP PRO KACO Managed AC Coupling Installation Notes



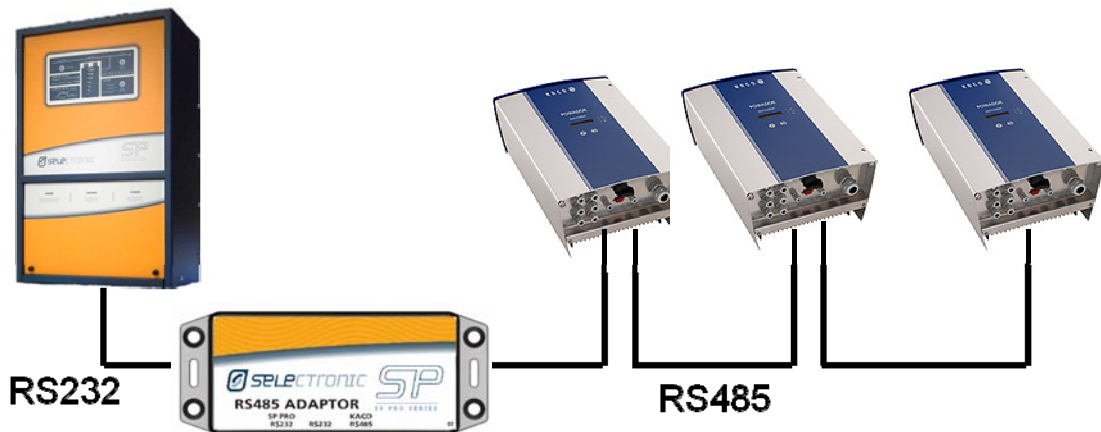
KACO AC Wiring guide for Off Grid connected installation

Note: The system will NOT function correctly if the KACO inverters are installed on the AC Source side of the SP PRO.

COMMUNICATIONS LINK (RS485)

The communications link always starts at the SP PRO, then connects to all the KACO inverters in a daisy chain arrangement and finishes at the last KACO inverter. There is no need to connect the KACO inverters in any particular order.

Install 'CAT5' or similar cabling between the SP PRO RS485 Adaptor and each KACO inverter in a daisy chain fashion.



Example showing three KACO inverters.

The RS485 adaptor must be located beside (or within if space allows) the SP PRO inverter.

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SP PRO TO RS485 ADAPTOR

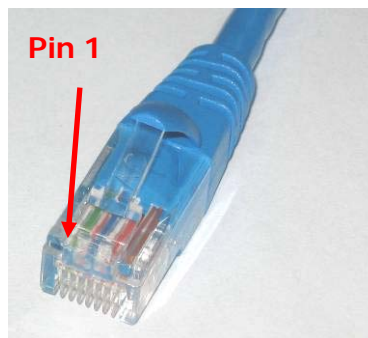
The installation kit will contain a RS485 adaptor (pictured below) and two straight through 'CAT5' network cables plus a bag of wire crimps.



Using one of the supplied 'CAT5' network cables, connect the SP PRO **Serial Port 2** to the **SP PRO RS232** port on RS485 adaptor.

RS485 ADAPTOR TO KACO INVERTERS

Using the second supplied 'CAT5' network cable, cut off one of the RJ45 connectors, expose and crimp the wires using supplied wire crimps or alternatively use a longer cable as required (not supplied) as outlined in the table below.



RS485 RJ45 Adaptor Pin 1 designation

RS485 RJ45 Adaptor pin #	Signal	Wire Colour	KACO RS485 Connector
1	GND	Green/White	GND
2	GND	Green	
3	RS485 - B	Orange/White	B
4	GND	Blue	-
5	GND	Blue/White	-
6	RS485 - A	Orange	A
7	GND	Brown/White	-
8	GND	Brown	-

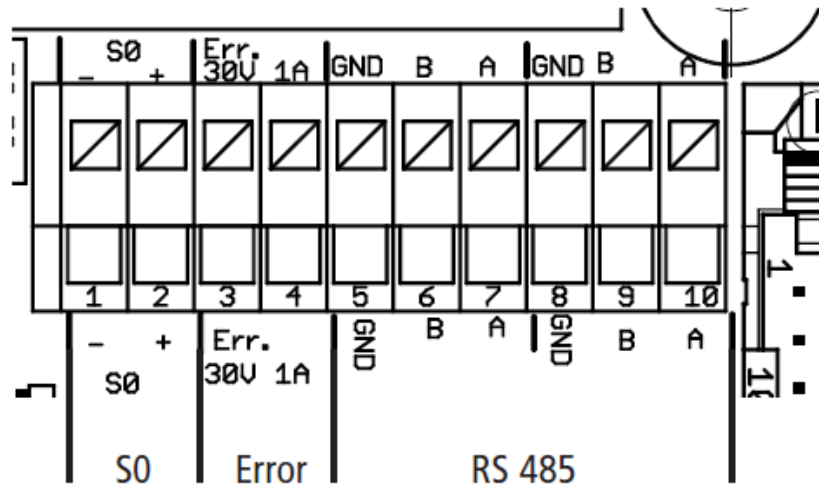
RS485 adaptor to KACO connections and wire colours

Note: Only the Green/White pair and the Orange/White pair of wires are used.

SP PRO KACO Managed AC Coupling Installation Notes



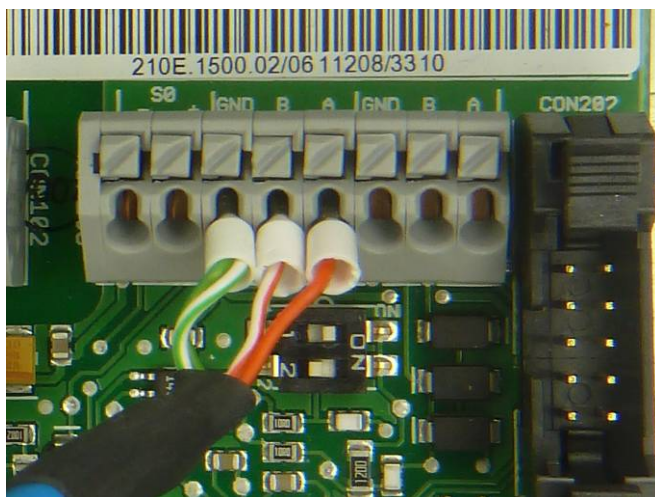
Connect the RS485 adaptor **KACO RS485** port to the **RS485** port on the KACO inverter.



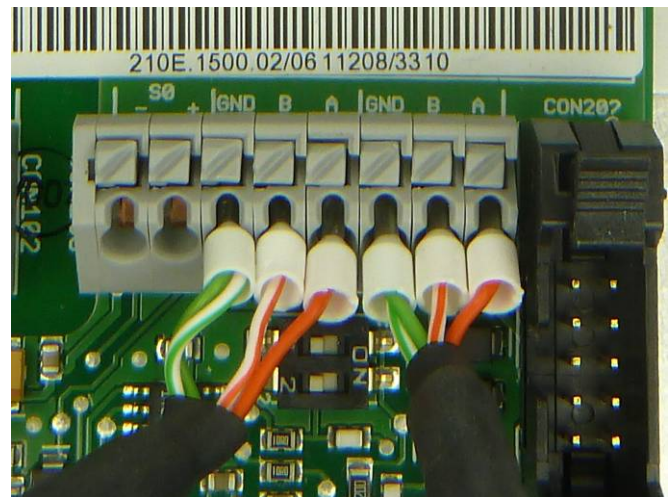
KACO RS485 Connections (inside unit) – spring loaded terminals

On the KACO inverter there are two parallel sets of connections allowing “looping through” of the wiring to additional inverters. Either connection point is suitable.

When looped to another KACO, the termination switch position 1 should be set to “OFF” (away from ON). For the last KACO inverter on the Communications Link (RS485) (or when only one KACO inverter is used), the termination switch position 1 must be set to “ON”



Last KACO on Communications Link (RS485), or when only 1 KACO is used:
SW 1 ON (Terminator ON)



KACO loop-through:
SW 1 OFF (Terminator OFF)

Note: Switch position 2 is always set to OFF

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Configuration – Additional Settings

The settings detailed here are only the additional settings required to enable KACO Managed AC Coupling. The remainder of systems settings are not covered in this document.

The SP PRO **must** have the KACO settings configured in the SP PRO **before** any of the KACO inverters are energised. The AC coupled failsafe system in the SP PRO is only enabled when the correct KACO configuration has been programmed into the SP PRO.

The KACO inverters must be set to RS485 and appropriately addressed to ensure correct communications.

SP PRO CONFIGURATION – ADDITIONAL MANAGED KACO CONFIGURATION SETTINGS

The configuration settings listed below are the additional settings required to enable the KACO Managed AC Coupling.

SP LINK – CONFIGURATION SETTINGS – SYSTEM

WARNING: SP PRO Firmware **MUST** be updated to latest version **BEFORE** any configuration settings are changed.

The additional system settings required are detailed and shown below.

- **Port 2 DTR/DCD** must be set to **Enabled**.
- **Enable KACO Link** must be set to **RS485 on Port 2**.
- **Number of KACO inverters connected** must be set to the number of KACO inverters installed in the system.

Source	System	Inputs / Outputs	Shunts	Expansion Card
Communication		Enable KACO Link		
Port 1 Baud Rate	57600	KACO Com Port		
Port 1 DTR/DCD	Enabled	RS485 on Port 2		
Port 2 Baud Rate	57600	Number of KACO inverters connected [1-5]		
Port 2 DTR/DCD	Enabled	1		

SP LINK - Configuration Settings – System tab

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Note: Port 2 Communication settings will not be available once KACO Com port has been enabled. This is normal operation.

In the example used above, only one KACO inverter is connected to the SP PRO.

KACO PORT CONFIGURATION

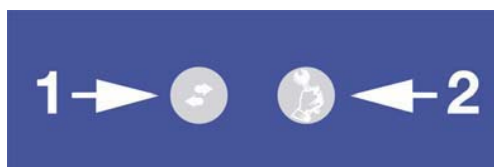
The settings listed below are all that is required.

The serial port on the KACO inverter must be set to RS485 and each inverter set to an inverter address from 1 through to 5 as appropriate.

1. Isolate the DC solar from the KACO inverter(s) (via the appropriate DC circuit breaker).
2. Disconnect the RS485 adaptor from the SP PRO. The KACO parameter settings cannot be accessed when the communications link is active between the SP PRO and the KACO(s).
3. Ensuring that the SP PRO AC Load supply is present at the KACO inverter, switch on the AC supply to the KACO inverter.
4. Wake up the KACO inverter by pressing and holding the **Night Switch** for 10 seconds.



5. Once the display is active on the KACO, enter parameter settings mode. To enter settings mode, hold down both keys **1** and **2** for approximately one second.



Use key **1** to scroll through the various menu items. The menu is continuous. When the end is reached, the display automatically returns to the first item.

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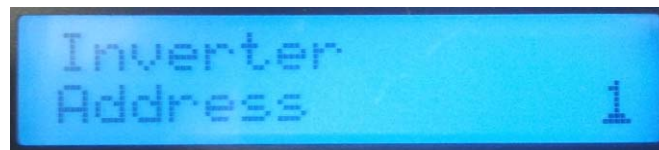
Use the **2** key to change the parameter that is shown. The values here are also continuous, i.e. after you reach the maximum value, they return to the minimum value.

6. Scroll to **Interface** setting and ensure that it is set to **RS485**.



7. Scroll to **Inverter Address** setting.
 - a. If only one KACO is installed then the address must be set to 1.
 - b. If more than one KACO is installed then the addresses must be allocated sequentially starting from 1 (i.e. first KACO = 1, second KACO = 2, third KACO = 3 etc). It is best practice if the address number matches the labelled KACO number.

Note: It is forbidden to skip any address numbers in the sequence when using multiple KACO inverters.



8. Save parameters, simultaneously press both keys **1** and **2**.
9. If there are multiple KACO inverters installed, repeat for all others.
10. Reconnect the RS485 adaptor to the SP PRO.

Note: See Level 2 menu - page 9 of the KACO Operating Instructions.

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System Commissioning – Additional Tests

In addition to the normal system testing that would be performed, the following additional tests must be performed as detailed below.

The commissioning sequence should verify the SP PRO and its operation without any of the KACO inverters in operation, then once the steps below are performed, the KACO inverters can be brought into service.

COMMUNICATIONS LINK(RS485) VERIFICATION

The correct operation of the KACO Managed AC Coupling relies on the Communications Link. It is vital that the communications link (RS485) connection has been setup correctly before operating the AC coupled system.

1. Check that all the RS485 connections have been connected correctly.
2. Wake the KACO(s) up by pressing and holding the **Night Switch** for 10 seconds (if they are not already awake). In the case of multiple KACOs this must be done for each inverter.
3. In the Data View => Technical Data tab there should be live data for all the connected KACO inverters. At a minimum there should be a reading for the AC volts.
 - a. If the KACO data is all zeros then check the RS485 wiring and connections. Take careful note that A connects to A, B to B between all KACO inverters and the RS485 Adaptor.

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	KACO #1	KACO #2	KACO #3
Control 1 Status	AC Energy Today 6.7 kWh	AC Energy Today 6.7 kWh	AC Energy Today 6.9 kWh
Control 2 Status	AC Power 0.25 kW	AC Power 0.24 kW	AC Power 0.24 kW
Control 3 Status	AC Volts 249.6 V	AC Volts 249.4 V	AC Volts 250.0 V
Status	AC Current 1.0 A	AC Current 0.9 A	AC Current 0.9 A
Status	DC Power 0.26 kW	DC Power 0.25 kW	DC Power 0.25 kW
Status	DC Volts 310.2 V	DC Volts 281.9 V	DC Volts 295.5 V
Status	DC Current 0.8 A	DC Current 0.9 A	DC Current 0.8 A
	Temperature 36 °C	Temperature 37 °C	Temperature 38 °C
	AC Power Peak Today 1.29 kW	AC Power Peak Today 1.26 kW	AC Power Peak Today 1.30 kW

SP LINK – Data View – Technical Data

The above screen shows the data from three connected KACO inverters with KACO #1 corresponding to the KACO inverter with inverter address 1 etc.

Once the Communications link has been verified for each KACO inverter, the DC feeds to each KACO inverter can be switch on.

Full system testing and verification can now be performed.

Operation

The SP PRO will operate normally, exporting and charging as set and required. The KACO inverters will behave slightly differently than in straight grid tie operation.

The KACO display will often show – External Limiting – with a percentage listed afterwards. Also, the KACO inverters display will be locked and no other screens will be able to be selected.

This is normal operation.

Additional Information

Selectronic web site – <http://www.selectronic.com.au> or contact the Selectronic Sales Team.