SOP Title: **solarZero Battery Default Field Service Checks**
Version: **SOP1156-PV-BT-v1.1**
Effective Date: **05/04/2019**

DOCUMENT CONTROL

Version no.	Date	Significant Changes	Author	Reviewer
1.0	04/04/19	DRAFT	Timm Brehm	AF, TH
1.1	05/04/19	First issue	Timm Brehm	AF,TH

Table of Contents

1. PURPOSE

To ensure that systems are completely operational after a field service there are a number of default checks that must be completed within the scope of replacing the USB comms cable in the solarZero cabinet and resolving internet connectivity issues. This document contains a brief description of each check and a check list that must be completed.

2. SCOPE

This document addresses 2 major issues found with solarZero batteries and applies to solarZero Power Pillar systems that are shown offline in our monitoring platform and systems where the PCS communication status is shown to be inactive. It further covers some default checks to ensure that the system is fully operational. The following procedures apply to new solarZero battery installations only.

3. TOOLS REQUIRED

The following tools and materials are required for each site visit:

- Laptop with a free USB2.0 and Ethernet port, running on Microsoft Windows 7, 8 or 10. Windows 10 is recommended.
- Panasonic Diagnostic Tool, which can be downloaded here.
- Ethernet patch lead, >2m
- Smartphone and 'GoodWe PV master' app, available in Apple Appstore and Google Play Store. For Android: Version 4.1 or higher and for iOS: Version 9.0 or higher are required.
- RJ45 crimp tool, electrical tools, multi meter
- Replacement micro SD card for EMU (supplied)
- Replacement USB/FTDI cables for EMU (supplied)
- Warranty label (supplied)

Only for OFFLINE sites, the following additional items are required

- Spare mikroTik HAP mini and MAP lite router (supplied)
- Confirmed working reference EMU – TBC (supplied)

4. DEFAULT CHECKS

4.1 USB CABLE REPLACEMENT AND COMMS TESTS

The Diagnosis Tool provided by Panasonic must be run after replacing the comms cable. This will give you instant confirmation of the correct installation and operation of each data cable and does aid in fault finding.

The tool also includes a function to test the quality of the internet connection at the EMU.

4.1.1 BACKGROUND

After further investigation of the communication issues between inverter, EMU and battery it has been confirmed that the chip in the USB comms cables previously used is extremely sensitive to voltage variations. A new USB cable with overvoltage protection has been sourced which will be used for all future replacements.

4.1.2 DETAILS

There are currently 2 versions of replacement cables in the field. One is contained in a black box and does not require new SD card. The latest version of cables has an integrated FTDI chip and is shipped with a new SD card.

4.1.3 USB REPLACEMENT WITH BLACK BOX USB CABLES

To complete the replacement, you will require the following tools and materials:

- Replacement cable(s)
- RJ45 crimp connectors
- A side cutter
- A short Philips screwdriver
- An RJ45 crimping tool
- Socket driver set to remove EMU screw
- Laptop running Win 7, 8 or 10 with admin rights.
- Ethernet patch lead

The new replacement cables come with a black plastic enclosure that houses the RS485 chips.

Figure 1: New USB replacement cable

All connectors aside from the PCS RJ45 connections are already configured.

Remove the existing USB cables connected to port 1 and port 2 at the EMU and unplug the RJ45 connector from the RS232 socket at the battery pack (rear). At the inverter side, cut the PCS comms cable connected to inverter's RS485 port (see fig. 2).

Proceed to removing the 4 screws that secure the inverter communication port. Slightly open the glands and slide down the cover to expose the RJ45 sockets. Remove the leftover piece of the previously cut USB to RJ45 cable.

Fig 2: Cut the existing USB cable

Fig 3: Remove the cover

Feed the uncrimped, light blue cable that is labelled PCS through the gland of the now freed up RS485 connection port as shown below.

Fig 4: PCS and Battery RS485 connection

Fig 5: Feed the new PCS cable through the gland

Now use your RJ45 crimp tool to attach a new RJ45 connector to the PCS cable. The two RJ45 connectors of the new USB cable box should be identical. Only 1 of the 4 wire pairs is required. Please crimp the cable as per schematic below.

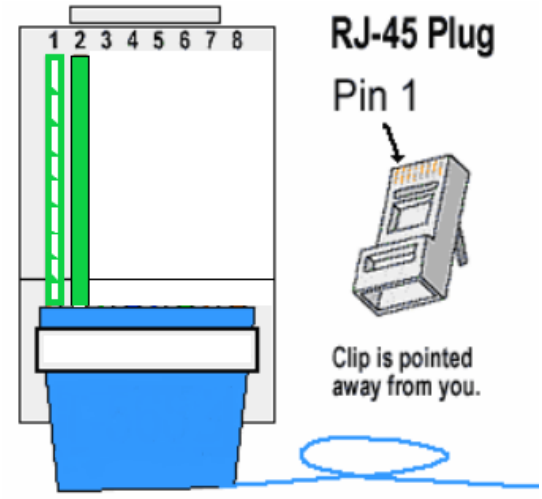


Fig 6: Green-white to pin 1, green to pin 2

Plug the newly crimped PCS comms cable into the inverter RJ45 port and close the cover. Equally, plug the 2 USB ends into the EMU as illustrated below.

Fig 7: PCS and Battery RS485 connection

The black box can be attached to the bottom right screw of the EMU as shown in figure 8. A suitably sized socket driver will be required for that. Alternatively, the black box can be attached on the right side of the cabinet, adjacent to the AC switch box using cable ties.

Fig 8: Black box placed beneath EMU

Fig 9: Black box placed adjacent to switch box

4.1.4 USB REPLACEMENT WITH FTDI CABLES

To complete the replacement, you will require the following tools:

- Cable cutter
- Phillips head screwdriver (a short one is best)
- An RJ45 crimping tool
- 2 x FTDI Replacement cables
- 2 x RJ45 crimp connectors
- 1 x micro SD Card
- 1 x Warranty Seal

The FTDI cables supplied have six colour-coded wires as illustrated in below image (Fig. 10). Only the orange and yellow wire-pair is required. Remove all other wires as shown in Figure 11.

Fig 10: FTDI cable

Fig 11: Orange/yellow wire pair

Note: The pin layout of the BMS cable is different from the PCS cable. For the BMS cable, pin 1 of the RJ45 connector is yellow, pin 2 is orange. Vice versa, the PCS cable uses orange for pin 1 and yellow for pin 2.

Fig 12: RJ45 plug connector pins

pin	BMS	PCS
1	yellow	orange
2	orange	yellow
3		
4		
5		
6		
7		
8		

Fig 13: Pin allocation for BMS and PCS cable

Remove the existing USB cables connected to port 1 and port 2 at the EMU and unplug the BMS cable from the RS232 socket at the battery pack (rear). Do not confuse the BMS USB cable with the battery can bus cable, which is labelled BMS on the inverter. On the inverter side, cut the PCS comms cable connected to inverter's RS485 port (see fig. 14).

Proceed to removing the 4 screws that secure the inverter communication port. Slightly open the glands and slide down the cover to expose the RJ45 sockets. Remove the leftover piece of the previously cut USB to RJ45 cable.

Fig 14: Cut the existing USB cable

Fig 15: Remove the cover

Feed the new, uncrimped FTDI cable for the PCS through the gland of the now free RS485 connection port. Now crimp the RJ45 connector and connect the it to the RJ45 socket shown on the right.

Once completed, put the cover back in place and tighten the compression glands.

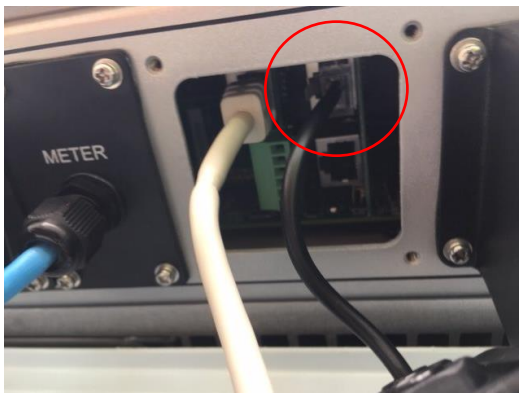


Fig 16: RJ45 socket for RS485 connection

4.1.5 REPLACING THE MICRO SD CARD IN THE EMU

The new cables require a new driver in the EMU software which means that the SD card in the EMU needs to be changed when the cables are changed.

Ensure that the Internet is available at the EMU by either plugging the Ethernet from the EMU into a laptop and testing internet speed or by using the diagnostic tool provided by Panasonic. If there is a good internet connection the EMU will also show as online in the Energy Management System (EMS) portal.

Power off the EMU before removing the SD card by switching off the EMU Power supply shown in figure 17.

Fig 17: EMU power supply MCB

Fig 18: EMU power supply LED

Once the EMU is powered down, the blue light shown in figure 9 will fade.

At the bottom of the EMU remove the Warranty seal. The SD card slot is below the seal in the place market in figure 10.

At the bottom of the EMU remove the Warranty seal. The SD card slot is below the seal at the center and rear of the EMU. The exact location is illustrated in Fig. 19.

Remove the seal on the bottom of the EMU and push the SD card so that it pops out (just like on laptops or desktop computers) and then insert the new SD card. A small flat head screw drive works well to release the mirco SD card. However, be careful to not damage the card.

Fig 19: SD card slot location

Replacing the SD Card is very delicate. You may take the below into consideration:

a) When you remove the SD card, take the old card and mark it or put it into a container marked "Old SD Card" as it is easy to get distracted and forget which card is the new one.

b) It is a lot easier to remove the SD card if you can remove the EMU from the cabinet. If the battery isn't installed yet access is easier as there is space below the EMU. Please make sure you push the SD card into the intended slot. The opening of the case is wider, and the card may result being pushed into the case of the EMU beside the SD slot.

Once the new SD card is installed, put the new Warranty Seal sticker in place and power on the EMU. It will take a couple of minutes to start all services. After approximately 10 minutes the EMU should show as online in the EMS portal.

NOTE: The industrial grade SLC micro SD cards are very expensive and must be returned to us! Please put the old SD card in the supplied return envelope.

4.1.6 TESTING INTERNET CONNECTION AND USB COMMS

Panasonic has released a tool to test all comms connections of the cabinet. The tool can be downloaded from here. Please download and unzip the content and follow the instructions below.

a) Download the Diagnosis tool and save it in a location where you can find it later (e.g. desktop). You can skip this step if you have downloaded the tool before. The latest version is 1.2.

b) Unzip the folder first, then open the unzipped folder and double click the diagnosis.bat file highlighted below.

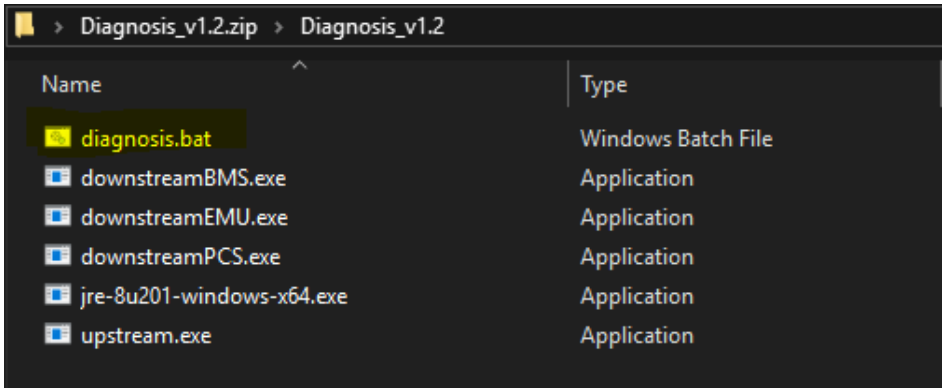


Fig 20: Unzip the folder and run diagnosis.bat

Note: Windows may display an error message that the software is not safe. Please click on "more info" and chose 'Run Anyway' to execute the bat file.

c) A command window will open. The first test will check the internet connectivity. Plug the Ethernet cable currently connected to the EMU into your laptop to run this test. In the command line, type "1" and press enter as shown below.

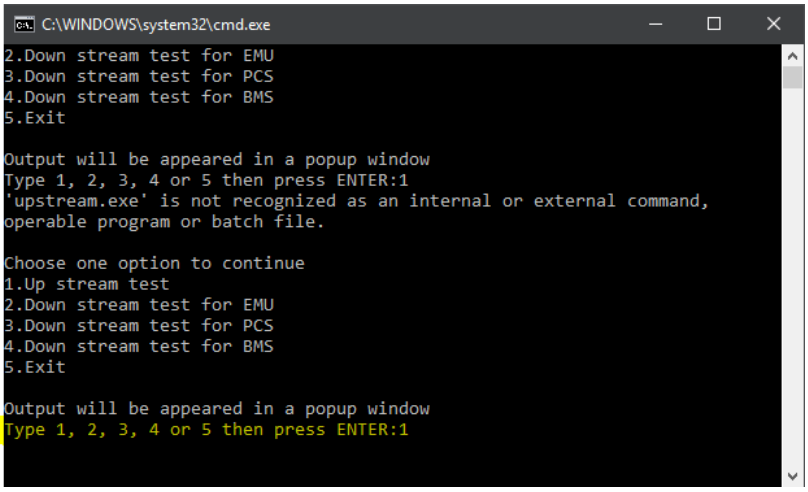


Fig 21: Run test 1 to check the internet connection

A pop-up window will notify of the test result.

d) The following test will check the functionality of the EMU and the USB comms cables. For test 2, 3 and 4 your laptop should be connected to the EMU, using a standard Ethernet patch lead.
(Note: The Panasonic manual is calling for a cross over cable here – this is NOT required.)

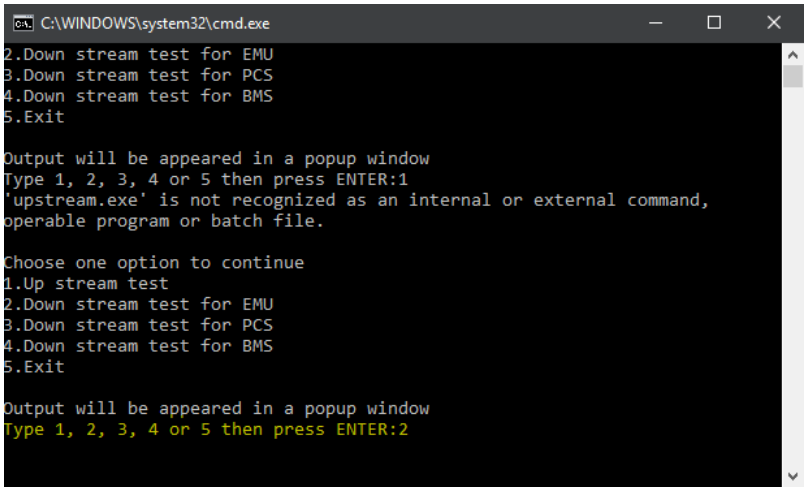


Fig 22: proceed to test 2, 3 and 4.

If any of the above tests (2,3,4) return a negative result, please contact the solarcity technical care team for detailed trouble shooting steps.

In any case, you are required to contact the technical care line on 021457100 once you have completed the replacement and all checks.

The more in-depth manual “Diagnosis Tool User Manual v1.0” for the tool can be found in our installer portal

4.2 EZMETER AND CT ORIENTATION TEST

This below instruction details the steps required for every installation to confirm that the CT has been installed in the correct orientation. It further confirms that the EZ-meter is operational, connected to the inverter and communicating.

4.2.1 BACKGROUND

Correct orientation of the EZ meter current transformer (CT) is critical to the successful operation of the solarZero Power Pillar battery system.

Note that the correct orientation of the EZ meter CT is opposite to that of previous solarcity systems using Carbontrack equipment.

4.2.2 DETAILS

a) Install the CT to capture the total house consumption with the arrow pointing towards the grid as per below

Fig. 23 Open CT showing arrow direction inside CT

Fig. 14 Sticker on the back of CT showing correct orientation

b) Turn off all solar and battery energy sources so that the only energy supply to the house is from the grid.

c) Ensure that the house is using electricity from the grid (make sure there are some loads running in the house).

d) If the CT orientation is correct and the meter is detecting electricity being imported from the grid the 'R_P' LED on the front of EZ meter will be lit solid red. The 'Com' LED should also be blinking red.

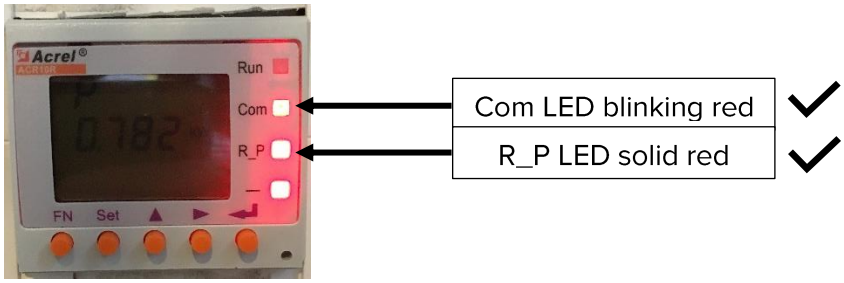


Fig 25 EZ Meter with R_P LED indicating electricity import

e) If the 'R_P' LED remains unlit, confirm steps 2 and 3 above then reverse the CT orientation and recheck.

4.3 BACKUP SUPPLY TEST

This test is to confirm that the inverter supplies power to the circuits connected to the backup supply when grid power is not available. It also confirms that the backed-up circuits are supplied by the grid during on-grid operation.

Turn on a load connected to each RCBO and press the test button on each RCBO to verify that all RCBOs are operational.

There have been reports of transposed contactor wiring. For issues with the contactor, please refer to the attached solarZero switchboard Schematic and the solarZero switchboard equipment layout.

The GoodWe inverter used in the solarZero Power Pillar system should come preconfigured with the backup power supply enabled by default.

If this is not the case, the installer can manually enable the backup supply using the PV Master application for smart phone/tablet using the instructions in this technote.

4.3.1 REQUIREMENTS

Download the 'PV Master' application from the App store for iOS devices or the Google Play store for Android devices.

Android: Version 4.1 or higher

iOS: Version 9.0 or higher for iphone/ipad

Note: Before starting this procedure, check the battery LED at the inverter. If the battery LED is double flashing, it may be required to open the battery pack and reverse the communications wiring on the green terminal block first. Refer to section 4.3.4 for details.

4.3.2 CONNECTING TO THE INVERTER WI-FI

Connect your device to the inverter's Wi-Fi network. The network name will be "Solar-WiFi" followed by the last 8 characters of the inverter's serial number.

Password: 12345678

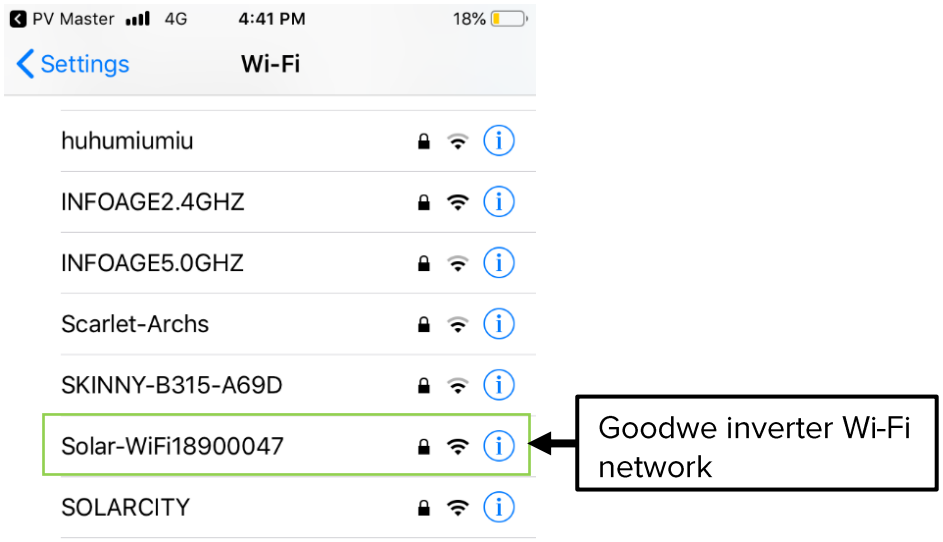


Fig. 26 Select the inverter WIFI access point

4.3.3 ENABLING BACKUP SUPPLY

Once you are connected to the inverter Wi-Fi, open the 'Set' menu on the PV Master app and click on the 'Advanced Setting' menu.

Password: goodwe2010

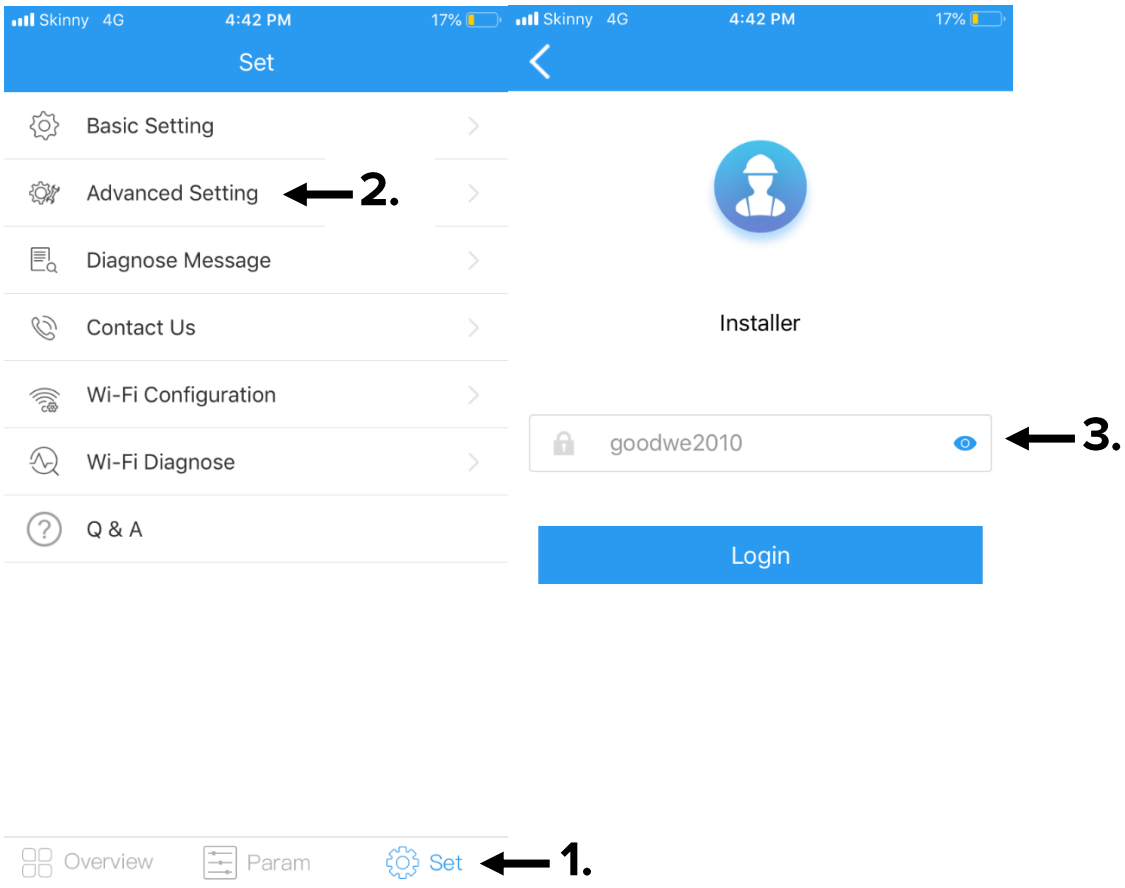


Fig. 37 Advanced settings and password

Turn on the Back-Up Supply toggle.

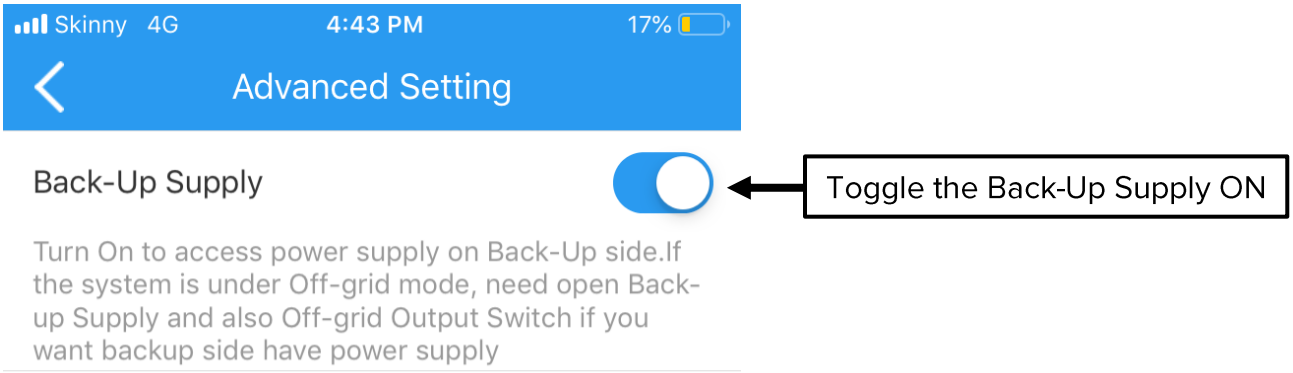


Fig. 28 Back-Up supply toggle

The Back-Up supply on the inverter should now have voltage at the output terminals and the backup loads can be supplied in a power outage.

4.3.4 CHECKING THE BATTERY COMMUNICATIONS CABLE

In some cases, the internal communication wiring of the battery may be reversed which prevents the back-up supply from being activated. If the wiring is reversed, the inverter cannot read the Battery State of Charge (SoC) and the inverter will report a low SoC as shown in below.

BATTERY		ON = BATTERY IS CHARGING
		BLINK 1 = BATTERY IS DISCHARGING
		BLINK 2 = BATTERY IS LOW / SOC IS LOW
		OFF = BATTERY IS DISCONNECTED / NOT ACTIVE

Fig. 49 LED flash code for battery

Tools required

- Phillips head screwdriver
- Small flat head screwdriver

Process

a) Remove the top of the battery. The screws are different lengths so be sure to remember which side you removed the screws from.

Fig. 30 Removing the battery pack cover

b) Locate the green plug and unplug the RJ45 plug that connects to the external plug of the battery. These are circled in Figure 30.

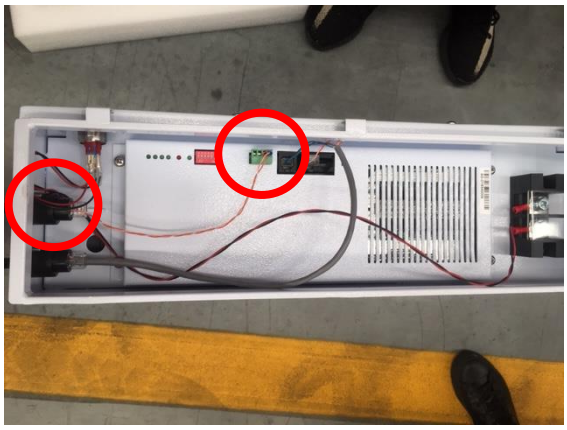


Fig. 31 Terminal block and RJ45 socket

c) Check that the cable that goes to the right side of the RJ45 plug goes into the left of the two inputs on the green plug as shown in figure 4.
Note that in this picture, the RJ45 plug is shown with the retention clip on top.

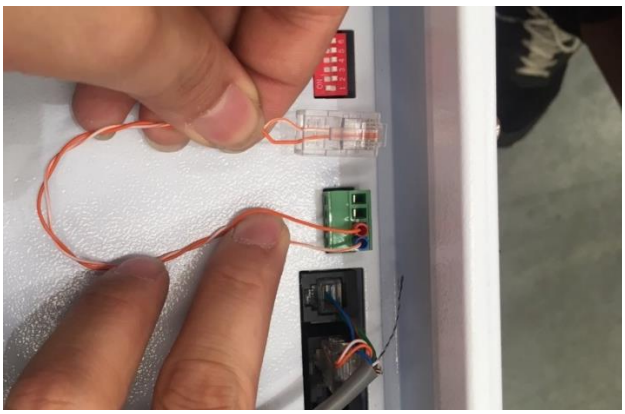


Fig. 32 Correct orientation of wires

d) If the wires are not connected as per above the wires are probably transposed and need to be reversed. Use a small flat head scredriver to carefully open the terminal screws and reverse thew polarisation.

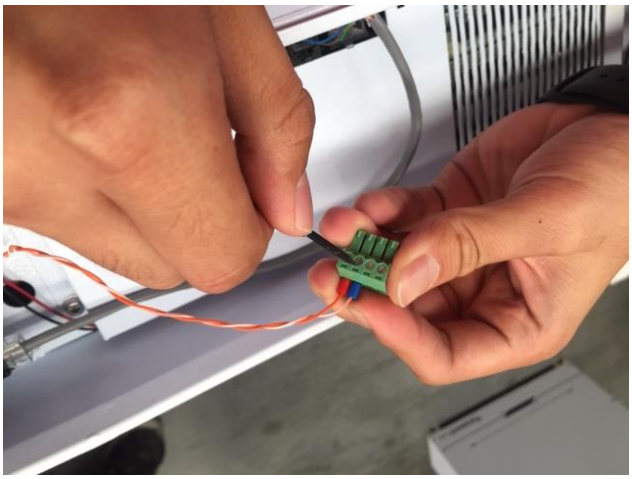
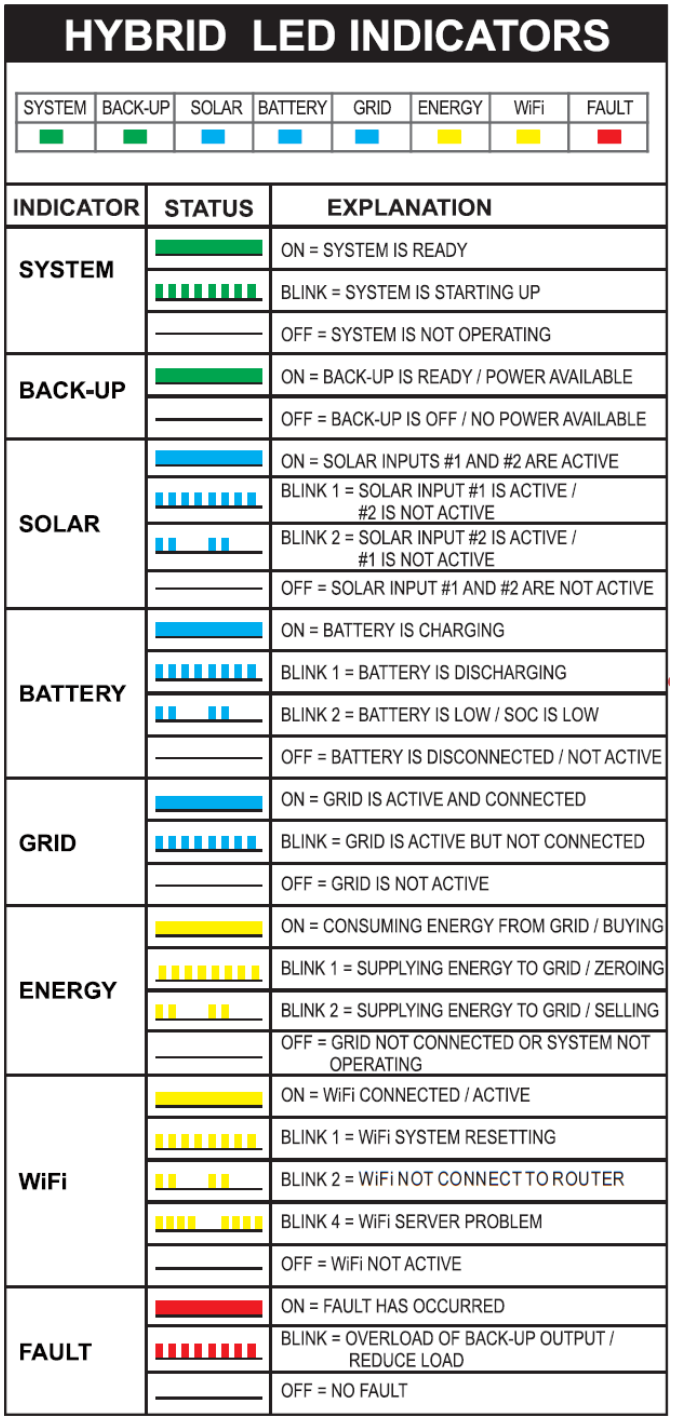


Fig. 33 Reverse the wires

4.4 **INVERTER INDICATOR LIGHTS**

The inverter's LED lights are a good indication of the inverter being fully operational. Please use the **attached overview of LED indicator lights** to understand the flash codes and check that functions are working as expected.



HYBRID LED INDICATORS

SYSTEM	BACK-UP	SOLAR	BATTERY	GRID	ENERGY	WiFi	FAULT

INDICATOR	STATUS	EXPLANATION
SYSTEM		ON = SYSTEM IS READY
		BLINK = SYSTEM IS STARTING UP
		OFF = SYSTEM IS NOT OPERATING
BACK-UP		ON = BACK-UP IS READY / POWER AVAILABLE
		OFF = BACK-UP IS OFF / NO POWER AVAILABLE
SOLAR		ON = SOLAR INPUTS #1 AND #2 ARE ACTIVE
		BLINK 1 = SOLAR INPUT #1 IS ACTIVE / #2 IS NOT ACTIVE
		BLINK 2 = SOLAR INPUT #2 IS ACTIVE / #1 IS NOT ACTIVE
		OFF = SOLAR INPUT #1 AND #2 ARE NOT ACTIVE
BATTERY		ON = BATTERY IS CHARGING
		BLINK 1 = BATTERY IS DISCHARGING
		BLINK 2 = BATTERY IS LOW / SOC IS LOW
		OFF = BATTERY IS DISCONNECTED / NOT ACTIVE
GRID		ON = GRID IS ACTIVE AND CONNECTED
		BLINK = GRID IS ACTIVE BUT NOT CONNECTED
		OFF = GRID IS NOT ACTIVE
ENERGY		ON = CONSUMING ENERGY FROM GRID / BUYING
		BLINK 1 = SUPPLYING ENERGY TO GRID / ZEROING
		BLINK 2 = SUPPLYING ENERGY TO GRID / SELLING
		OFF = GRID NOT CONNECTED OR SYSTEM NOT OPERATING
WiFi		ON = WiFi CONNECTED / ACTIVE
		BLINK 1 = WiFi SYSTEM RESETTING
		BLINK 2 = WiFi NOT CONNECT TO ROUTER
		BLINK 4 = WiFi SERVER PROBLEM
		OFF = WiFi NOT ACTIVE
FAULT		ON = FAULT HAS OCCURRED
		BLINK = OVERLOAD OF BACK-UP OUTPUT / REDUCE LOAD
		OFF = NO FAULT

Fig. 33 Reverse the wires

5. CHECKLIST

Please tick each box where applicable. Once all checks are completed or if you encounter any issues, please call the engineering support line on **021 457 100**. You required to provide a copy/ photo of the completed checklist.

Site Number: SC - _____ - _____ EMU ID: _____

Site Address: _____ ☐ New Installation ☐ Upgrade Installation

COMMS

- ☐ Diagnostic tool – upstream comms test completed (internet) – Test 1
- ☐ Diagnostic tool – downstream comms test completed (EMU) – Test 2
- ☐ Diagnostic tool – downstream comms test completed (PCS USB) – Test 3
- ☐ Diagnostic tool – downstream comms test completed (BMS USB) – Test 4
- ☐ Hot Water relay is connected to USB port 3 (left, rear of EMU) where applicable

EZ METER

- ☐ Confirm that the EZmeter comms light is flashing
- ☐ Confirm that the EZmeter R-P light is solid when importing (load > generation)

BACK-UP SUPPLY

- ☐ Backup circuits supplied by inverter in off-grid operation
- ☐ Backup circuits supplied by grid in on-grid operation
- ☐ RCBO's operational and in on position (where applicable)
- ☐ RCBO's that are not used are marked as spare and turned off

SYSTEM START-UP

- ☐ Battery D.C. isolator in on position
- ☐ PV Array D.C. isolator 1 in on position (if applicable)
- ☐ PV Array D.C. isolator 2 in on position (if applicable)
- ☐ Battery BMS button pressed (BMS on, light on)
- ☐ EMU PSU MCB in switched on
- ☐ Inverter A.C. Isolator/MCB (Grid) switched on
- ☐ Inverter A.C. Isolator/MCB (Backup) switched

INVERTER LED LIGHTS

- ☐ Inverter "System" LED solid green
- ☐ Inverter "Back-Up" LED solid green
- ☐ Inverter "Solar" LED is operational (if PV is connected)
- ☐ Inverter "Battery" LED is operational
- ☐ Inverter "Grid" LED is solid blue
- ☐ Inverter "Energy" LED is operational
- ☐ Inverter "Fault" LED is off

6. SYSTEM START UP

Ensure that all DC switches and all AC switches are in on position. The system should be operational when leaving site!

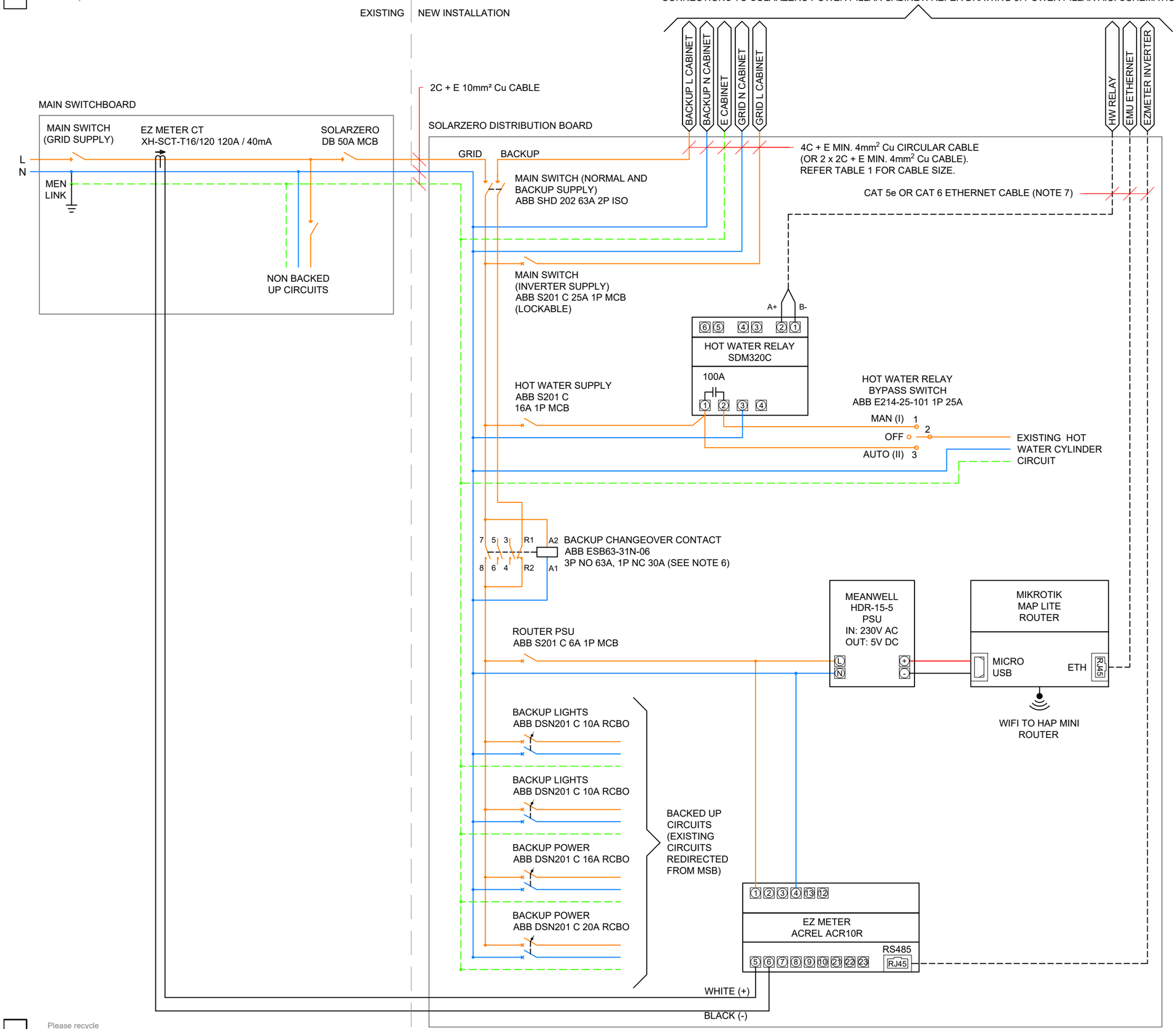
7. ATTACHMENTS

7.1 solarZero SWITCHBOARD WIRING SCHEMATIC

7.2 solarZero SWITCHBOARD EQUIPMENT LAYOUT

EXISTING | NEW INSTALLATION

CONNECTIONS TO SOLARZERO POWER PILLAR CABINET. REFER DRAWING 3: POWER PILLAR A.C. SCHEMATIC



Notes:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE MANUFACTURERS SPECIFICATIONS, INSTALLATION MANUAL AND SOLARCITY'S SOP.

2. EARTH CABLE TO BE SIZED ACCORDING TO AS/NZS 5033 AND AS/NZS 3000 TABLE 5.1. MINIMUM SIZE 4mm^2.

3. AC CABLE SIZING ASSUMES SINGLE CIRCUIT PARTIALLY ENCLOSED IN INSULATION, WHERE INSTALLATION CONDITIONS VARY REFER TO AS/NZS 3000:2007, AS/NZS 3008. CABLE TO BE SIZED IN ACCORDANCE WITH NZ ELECTRICAL REGULATIONS, AND TO MAINTAIN VOLTAGE DROP BELOW 2% FROM POINT OF SUPPLY TO INVERTER AS PER AS/NZS4777.1:2016.

4. REFER TO LOCAL ENERGY SUPPLIER'S INSTRUCTIONS FOR CONNECTION AND METERING REQUIREMENTS.

5. IN ADDITION TO LOCAL REQUIREMENTS, INSTALLATION MUST CONFORM WITH THE FOLLOWING STANDARDS.
   - -AS/NZS 5033
   - -AS/NZS 4777
   - -AS/NZS 3000
   - -AS/NZS 3008

6. BACKUP CHANGEOVER CONTACTOR COIL LIVE REFERENCE (A2) FROM GRID SUPPLY SO THAT NORMAL GRID SUPPLIES BACKUP CIRCUITS UNTIL GRID OUTAGE.

7. CAT5e or CAT 6 CABLE SHOULD BE SLEEVED WITH SUITABLY RATED HEATSHRINK WHERE EXPOSED TO SINGLE INSULATED LV CABLES INSIDE 230V SWITCHBOARDS.

TABLE 1: AC CABLE SIZING (NOTE 3)	
CABLE SIZE (mm^2)	MAX AC CABLE LENGTH (m)
4 mm^2	15
6 mm^2	24

REV	CHANGE	DATE	DWN	CHKD
01	REVISED	22/03/19	TH	TB
00	FIRST ISSUE	30/10/18	KT	TB

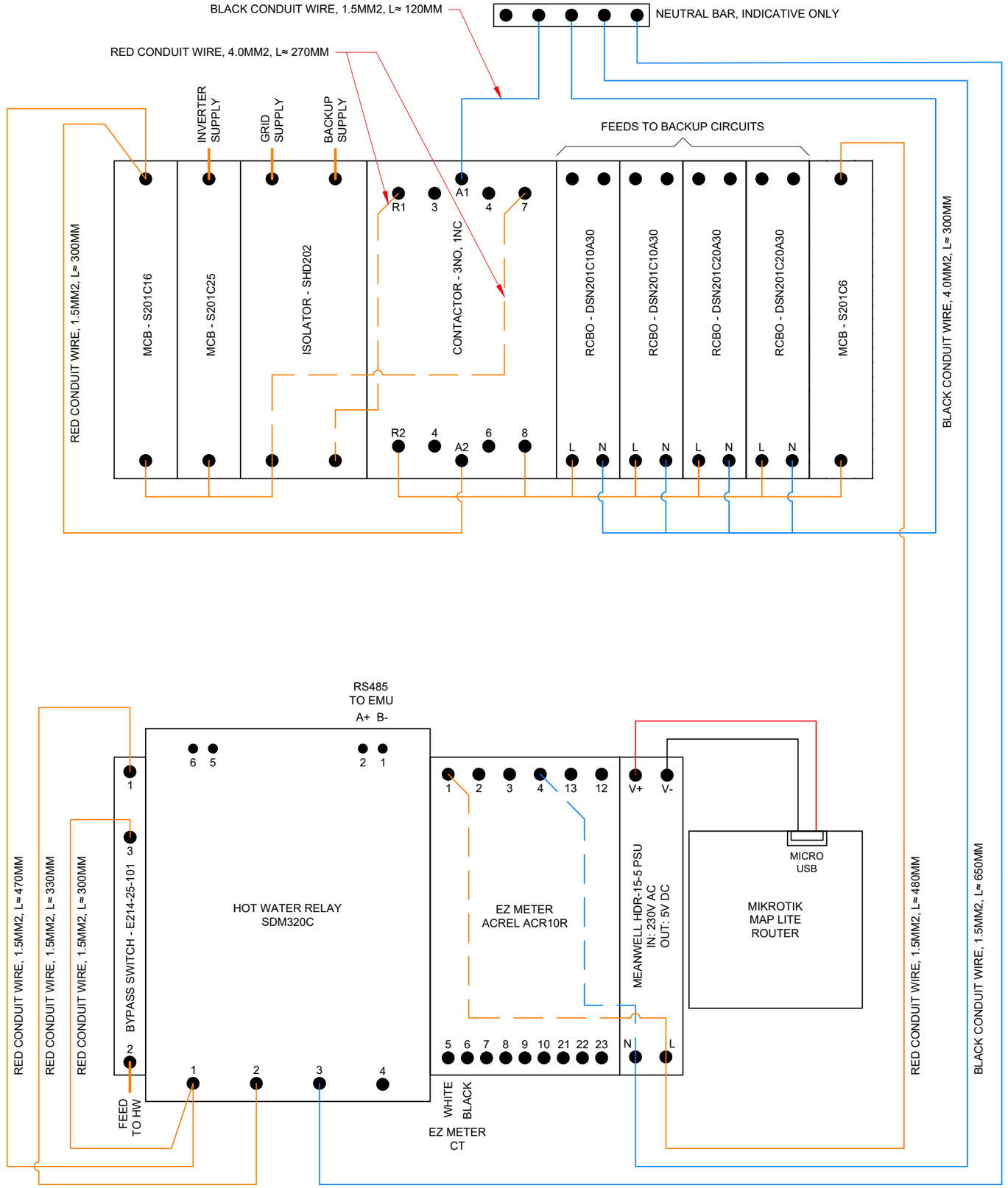
CONSTRUCTION ISSUE

JOB NUMBER: G400
DRAWING NUMBER: 2 OF 5
REV: 01
DESCRIPTION: SOLARZERO DB WIRING SCHEMATIC
PROJECT: SOLARZERO POWER PILLAR

DRAWN: TH | CHECKED: TB | DATE: 22/03/19 | SCALE: NTS | A3

SOLARCITY

solarcity New Zealand Limited
8 Railway Street, Newmarket
Auckland, New Zealand
0800 11 66 55
www.solarcity.co.nz
info@solarcity.co.nz



NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE MANUFACTURERS SPECIFICATIONS.
2. ALL WIRES TO BE SIZED ACCORDING TO AS/NZS 3000. UNLESS NOTED, MINIMUM SIZE IS 4mm^2 Cu.
3. RELAY BYPASS ISOLATOR TO BE RATED EQUAL TO OR GREATER THAN EXISTING CIRCUIT PROTECTION. AUTO POSITION SHALL BYPASS THE H/W RELAY.
4. IN ADDITION TO SOLARCITY SPECIFIC REQUIREMENTS, THE ASSEMBLY SHALL COMPLY WITH THE FOLLOWING STANDARDS.
   -AS/NZS 3439
   -AS/NZS 3000
   -AS/NZS 3008

REV	CHANGE	DATE	DWN	CHKD
03	ADDED EZMETER & OTHER REVISIONS	22/03/18	TH	TB
02	CORRECTIONS & ADDITIONS	16/11/18	TB	--
01	CORRECTIONS	6/11/18	TB	--
00	FIRST ISSUE	1/11/18	TB	--

CONSTRUCTION ISSUE

JOB NUMBER: G400
DRAWING NUMBER: 5 OF 5
REV: 03

DESCRIPTION: SOLARZERO DB EQUIPMENT LAYOUT

PROJECT: SOLARZERO POWER PILLAR

DRAWN: TH | CHECKED: TB | DATE: 22/03/19 | SCALE: NTS | A3

SOLARCITY

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