

# ERROR DIAGNOSTIC PROCESS

## TEST PROCEDURE FOR MPPT SOLAR CHARGE CONTROLLERS



### 1. SCOPE

Victron Energy BlueSolar and BlueSmart MPPT solar charge controllers with the exception of the now obsolete: “BlueSolar MPPTs 150/70 and 150/85 VE.Can” solar charge controllers.

### 2. INTRODUCTION

The aim of this test procedure is to ascertain if a product is faulty, and if the product is faulty, to provide test results to the Master Instruments Returns Department so that a warranty decision can be made.

Before an RGA is submitted it first needs to be ascertained if a product is actually faulty, and if the fault is warrantable. Common system issues, like broken fuses, loose cabling, aged or faulty batteries and so forth will need to be ruled out. In addition to this it needs to be ascertained, if the product is indeed faulty and what the cause of the fault could be. This test procedure will provide Master Instruments with a detailed fault report needed for warranty analysis and quality improvement.

The complete test procedure needs to be completed before submitting an RGA unless the outcome of one of the test specifies otherwise. When submitting an RGA, the test results of this test procedure will need to be submitted. There is a separate document called the “Test Result Form”. The results from these test need to be filled out on the Test Result Form.

This test procedure will need to be performed by a knowledgeable electrical or electronic technician or engineer, who has a working knowledge of all applicable electric and battery safety regulations.

### 3. EQUIPMENT NEEDED FOR THIS TEST

- Digital Multimeter True RMS with diode test capability.
- Current clamp for above multimeter.
- Small DC power supply with current limiting capability.
- Large DC power supply (this can also be a battery bank or large Victron battery charger).
- Empty battery or a battery with DC load (this can also be an inverter connected to an AC load like a heater).
- Phone, tablet, mac or pc with VictronConnect installed (Android, Apple, Mac or Windows)
- VE.Direct Bluetooth Smart dongle or VE.Direct to USB interface

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### 4. TEST PROCEDURE

#### A. VISUAL CHECK

Visually inspect the unit and answer these questions:

- ☐ Does the unit have water damage?
- ☐ Is the unit very dirty, is there soot, dust or oil present?
- ☐ Does the unit have mechanical damage to its housing?
- ☐ Does the unit have mechanical damage to its connectors?
- ☐ Does the unit have burned connectors?
- ☐ Does the unit have loose MC4 connectors?
- ☐ Does the unit have burn marks or molten areas to its housing or does it smell burned?

In case of a yes answer to these questions, provide extra details in the bottom of the Test Result Form.

Please be aware that mechanical damage, dirt, dust water are not covered by warranty. Burned battery terminals or burned or molten PV terminals are also not covered under warranty. Damage like this often occurs due to bad cable connections. Do not lodge an RGA for a non-warrantable fault.

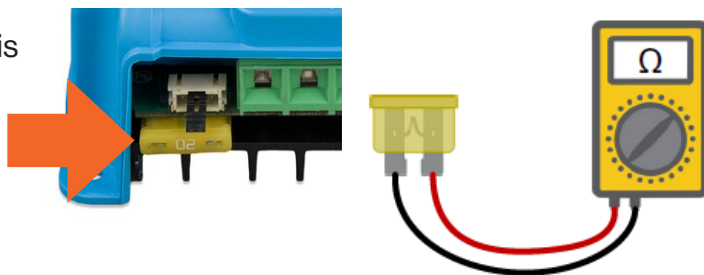
#### B. REPLACABLE FUSE CHECK

- ☐ Does the unit have an external fuse, like in this picture?

If no, go to next test.

If yes, remove the fuse and test its continuity.

- ☐ Is the fuse is broken?
- ☐ If yes, replace the fuse by a new one.

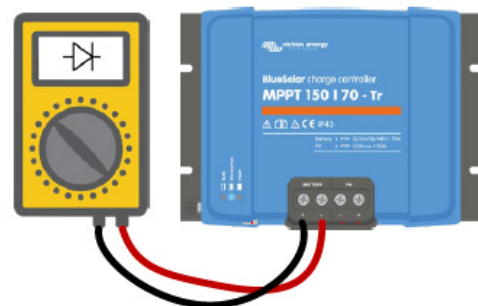


#### C. BATTERY - REVERSE POLARITY TEST

Set the Multimeter to Diode position.

Connect the negative (black) multimeter lead to the battery positive terminal.

Connect the positive (red) multimeter lead to the battery negative terminal.



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- ☐ Write the meter reading and test result on the result form:

Fail: Open circuit (OL) – internal fuse has blown

Fail: Below 0.3 V – internal fuse has blown

Pass: Above 0.3 V

Pass: Overload (OL)

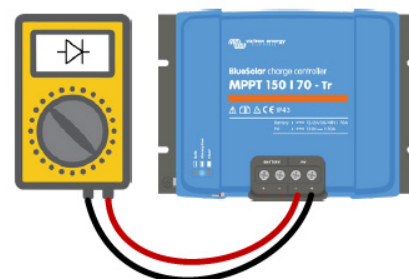
A blown internal fuse is caused by a failure of an internal component in the solar charge controller, which has caused the internal fuse to blow. This fuse is not field replaceable. A typical cause for a blown internal fuse is that the battery has been connected in reverse polarity. Reverse polarity does not fall under warranty. If you suspect that there might have been reverse polarity do not lodge an RGA.

### D. PV - INPUT TEST

Set the Multimeter to Diode position.

Connect the negative (black) multimeter lead to the PV positive terminal.

Connect the positive (red) multimeter lead to the PV negative terminal.



- ☐ Write the meter reading and test result on the result form:

Fail: Open circuit (OL) - The PV FET has failed in open circuit

Fail: Below 0.3 V - The PV FET has failed in short circuit

Pass: Above 0.3 V

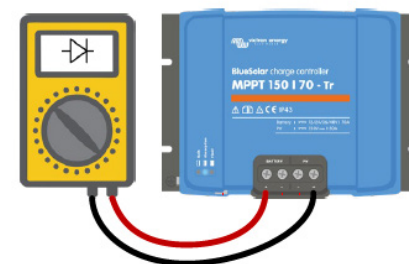
Pass: Overload (OL)

### E. BATTERY TO PV - REVERSE FET TEST

Set the Multimeter to Diode position.

Connect the negative (black) multimeter lead to the PV positive terminal.

Connect the positive (red) multimeter lead to the battery positive terminal.



- ☐ Write the meter reading and test result on the result form:

Fail: Open circuit (OL) - The reverse FET has failed in open circuit

Fail: Below 0.3 V - The reverse FET has failed in open circuit

Fail: Between 0.3 and 0.6V - The reverse FET has failed in short circuit

Pass: Above 0.6 V

Pass: Overload (OL)

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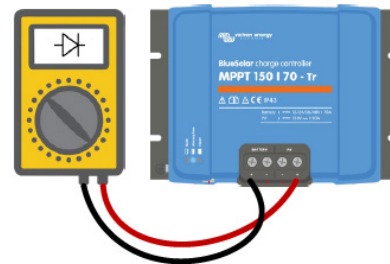


### F. PV TO BATTERY - HIGH SIDE FET TEST

Set the Multimeter to Diode position.

Connect the positive (red) multimeter lead to the PV positive terminal.

Connect the negative (black) multimeter lead to the battery positive terminal.



- ☐ Write the meter reading and test result on the result form:

Fail: Open circuit (OL)

Fail: Below 0.3 V - The high side FET and the reverse FET have failed in short circuit

Fail: Between 0.3 and 0.6V - The high side FET failed in short circuit

Pass: Above 0.6 V

Pass: Overload (OL)

### G. SHORT CIRCUIT TEST PV AND BATTERY

Set the power supply voltage to 12 Vdc

Set the current limit to 0.2 A.

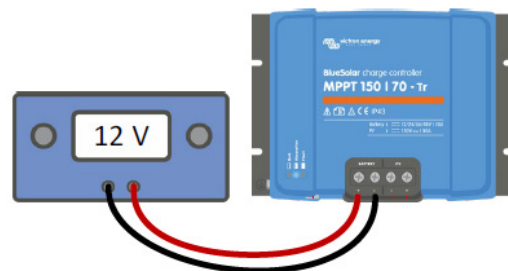
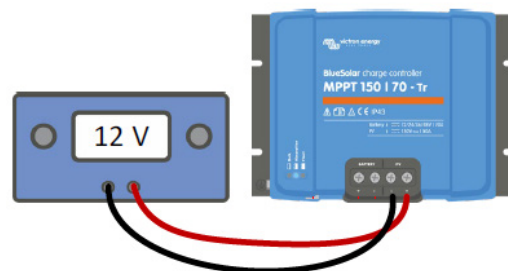
Connect the power supply to the PV Input.

- ☐ Passed if the power supply remains at 12V.

Connect the power supply to the battery Input.

- ☐ Passed if the power supply remains at 12V.

If both of these tests failed, lodge an RGA and don't continue with the other tests.



### H. VICTRONCONNECT TEST

Set the power supply voltage to 12 Vdc.

Connect the power supply to the PV Input (or battery input in case PV input is not working).

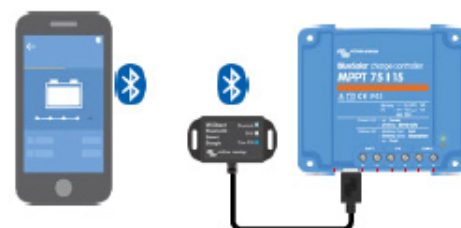
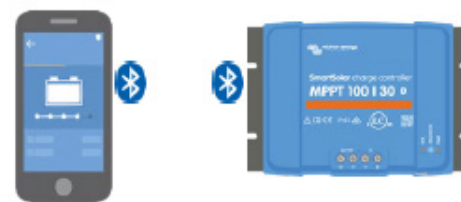
Connect with VictronConnect to the unit. It will ask to update, but don't let it update firmware just yet.

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- ☐ Can a connection with VictronConnect be made? Try both via Bluetooth, the Bluetooth dongle or via the VE.Direct cable. See connection examples on the right. If no connection can be made at all, skip this test and go to test *I. Charge Voltage Test*.
- ☐ If the unit is a SmartSolar unit write down the Bluetooth interface firmware version number. If it asks for an update, let it do the update and write down the updated version number.
- ☐ Write down the solar charger firmware version number. If it asks for an update, let it do the update and write down the updated version number.
- ☐ Was the unit updated in the field after the unit failed? If so, write down the previous firmware version.
- ☐ Check the last 4 errors. See the VictronConnect history tab, look at bottom of graph. If there are errors, write down the last 4 errors.
- ☐ Save the history file and save the settings file.
- ☐ Does the solar charger currently have an unresolvable error? Look at the LEDs or at VictronConnect? If so, write down the error.



If there are any errors, see the [Solar Charger Error document](#) for details. Take the suggested steps to resolve the error. In case the solar charger fault has been resolved, after the error has been resolved, do not submit an RGA.

If the solar charger had already failed test A, B, C, D, E, F and/or G, lodge an RGA and don't continue with the remaining tests.

### I. CHARGE VOLTAGE TEST

Set a power supply at least 10V above the battery voltage as set in the unit. Use VictronConnect to find out what the battery voltage it is set at.

For testing purposes, it might be easier to first set the unit to a lower battery voltage, i.e. set the unit to 12V instead of 48V.

Connect the power supply to the PV terminals.

Connect a multimeter in Vdc mode to the battery terminals.

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Turn the power supply on and measure the battery output voltage:

- ☐ Does this voltage correspond with the expected absorption, float or equalization voltage as set in VictronConnect?

If yes, then this test is passed. Go to next test.



If no, do the following:

- ☐ If the unit is of a type that is equipped with a remote connector, check if the connector and the wire loop are present. Resolve the issue if the connector and/or the loop is missing.
- ☐ Check VictronConnect settings to see if the charger is enabled, if so, enable the charger.



### J. CHARGE CURRENT AND PV VOLTAGE TEST

Leave the power supply connected to the PV terminals.

Increase the current limit of the power supply to the solar charger PV current rating.

Connect an empty battery (or battery with DC load) to the battery terminals.

Connect a current clamp to one of the battery cables (or use VictronConnect).

Check in VictronConnect that the set battery voltage corresponds with the voltage of the connected battery.

Measure the current going into the battery using VictronConnect

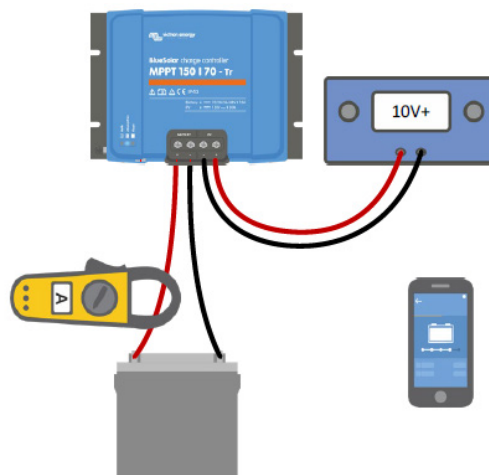
- ☐ Is the unit capable of delivering the expected current?

Please note that the expected current flowing into the battery can be limited due to one of these factors:

- The available power from the power supply is limited.
- The accepted current by the battery or the drawn current by the DC load connected to the battery.
- The maximum charge current setting in VictronConnect.

Measure the voltage on the PV terminal

- ☐ Does the voltage displayed in VictronConnect correspond with the actual PV voltage?





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### K. ACCESSORIES AND SPECIAL FEATURES

Check if any of the accessories or special features have failed. Please note that these accessories or features might not all present in all solar charger models. This test is not compulsory, only perform this test, or part thereof, if you suspect that there could be an issue with a particular accessory.

If any of these have failed add further details in the remarks section on the Test Result Form.

- ☐ Remote on/off connector - Remove the connector with the wire loop and see if unit turns off, replace it again and see if the unit turns on again.
- ☐ Pluggable display and the display port - Connect a pluggable display and see if it works.
- ☐ Load output - Measure the load output voltage. This should be the same as the battery voltage. Check if the load output can provide full current. Check the VictronConnect load output and streetlight settings.
- ☐ Alarm relay - Program with VictronConnect and check functionality. Also check the VictronConnect RX port setting.
- ☐ VE.Direct Port data communication - Connect to a CCGX and see if the unit shows up on the CCGX. If not, check that TX port function in Victron Connect is set to "Normal communication".
- ☐ VE.Direct TX port – Check if ASS0305505500 TX digital output cable is operational and check the VictronConnect TX port function setting.
- ☐ VE.Direct RX Port - Check external BMS functionality by using an ASS030550310 non inverting cable and check the VictronConnect RX port setting.
- ☐ VE.Can port communication - Connect to a CCGX and see if the unit shows up on the CCGX (don't forget the terminators).
- ☐ Bluetooth - Check if Bluetooth is switched on in Victron Connect. Use a VictronConnect with USB-VE.Direct interface. Then check if there is a Bluetooth communication issue. [Follow the trouble shooting section in the VictronConnect manual](#). Please note that the Bluetooth interface in the unit never fails. Do not submit an RGA for Bluetooth issues.

### 5. RGA TEST RESULT FORM

Fill in the Test Result Form and submit this together with the RGA.