



TerraSAS Calibration Suitcase

User Guide

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Date and Revision

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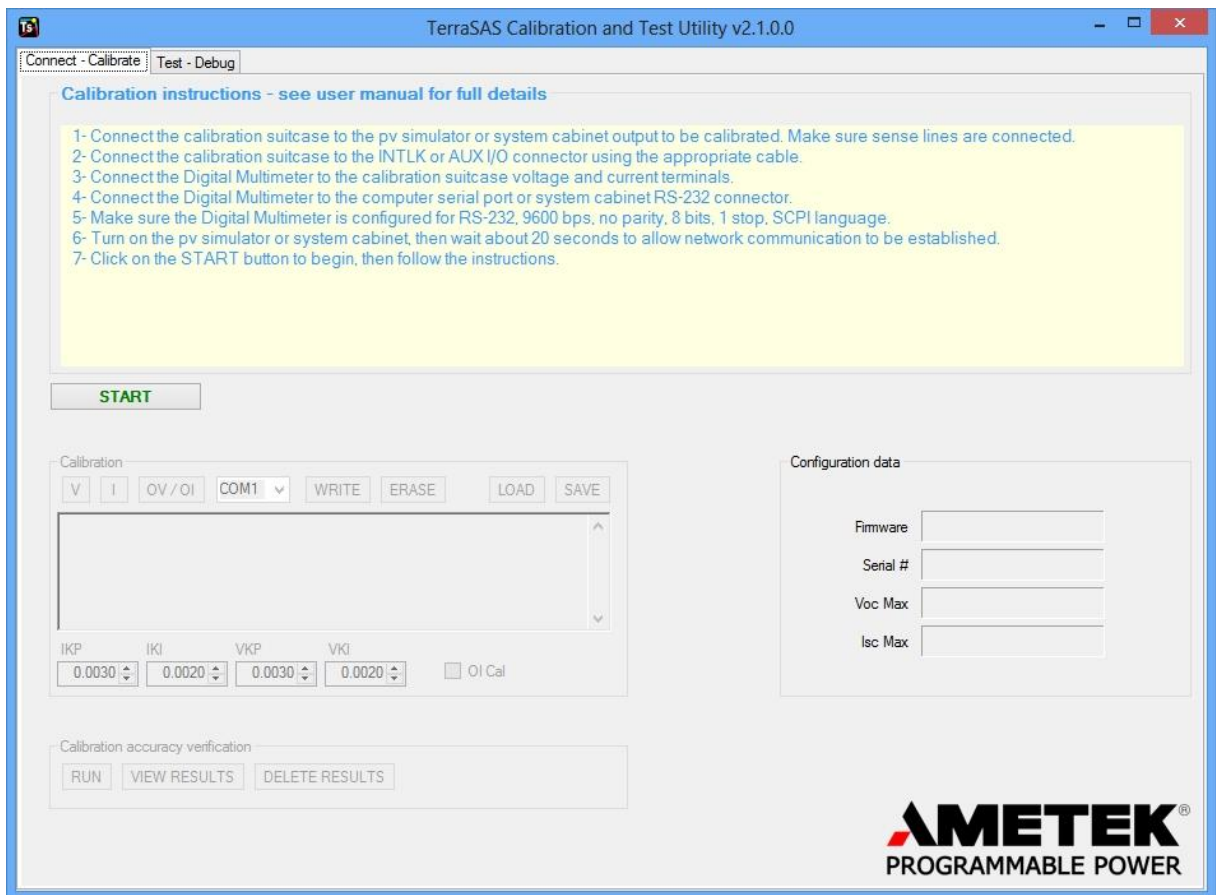
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1 Overview

TerraSAS Calibration is a calibration and test utility that supports all Elgar PV simulators.

The user interface is shown in **Figure 1** below.

Figure 1: TerraSAS Calibration User Interface



2 Software installation

TerraSAS Calibration can be installed on computers running Microsoft Windows XP Service Pack 3, Microsoft Windows 7 Service Pack 1 (32-bit or 64-bit) or Microsoft Windows 8 (32-bit or 64-bit).

All required components, including the Microsoft .NET Framework 4.0, are included in the installation disk. The framework installation is automatically skipped if detected on the user computer. On machines running Windows 8 it is always skipped since the .NET Framework 4.5 is embedded and compatible with .NET 4.0.

The installation disk (p/n 5609174-06) contains the following files and folders:

M609174-01.pdf - This user guide in Adobe Acrobat (.pdf) format

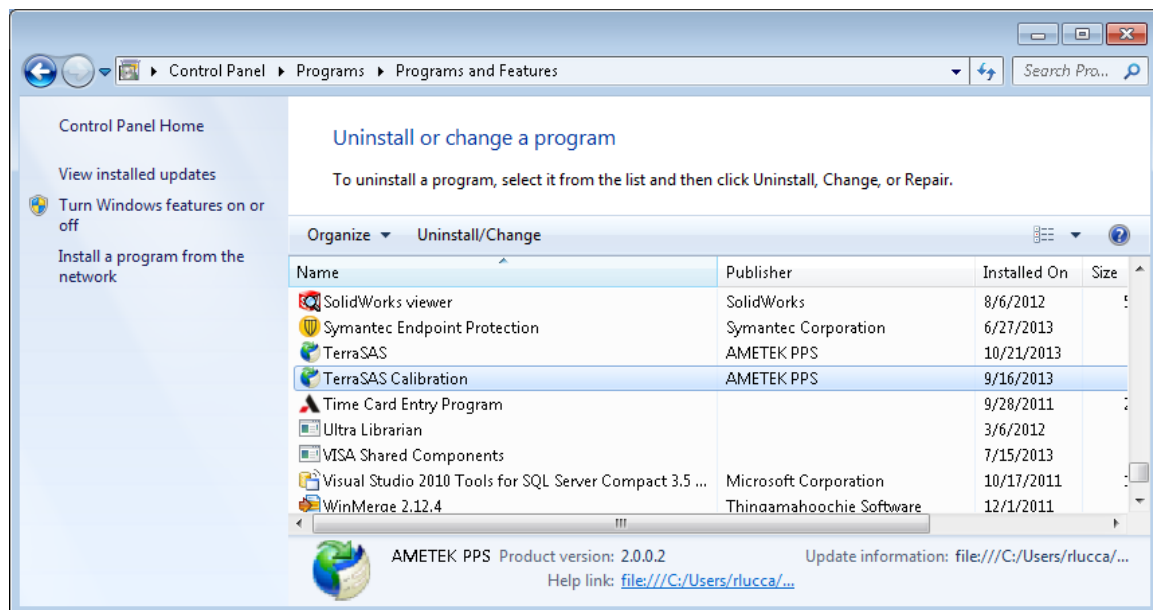
TerraSAS Calibration Install. Open this folder and double click on **Setup.exe** to install.

TerraSAS Calibration, including any future updates, can be delivered via e-mail as a download link or as a physical disk. The download file size (in .zip compressed format) is approximately 60 Mbytes.

While a disk is always included with a calibration suitcase, updates are typically delivered via e-mail. Please send your e-mail address to PPSsupport.ppd@ametek.com to receive software updates as soon as they become available.

To install an update, the previous version needs to be removed first. This can be done from the Windows Control Panel, right click on TerraSAS Calibration to uninstall. See **Figure 2**.

Figure 2: Control Panel



3 Operation

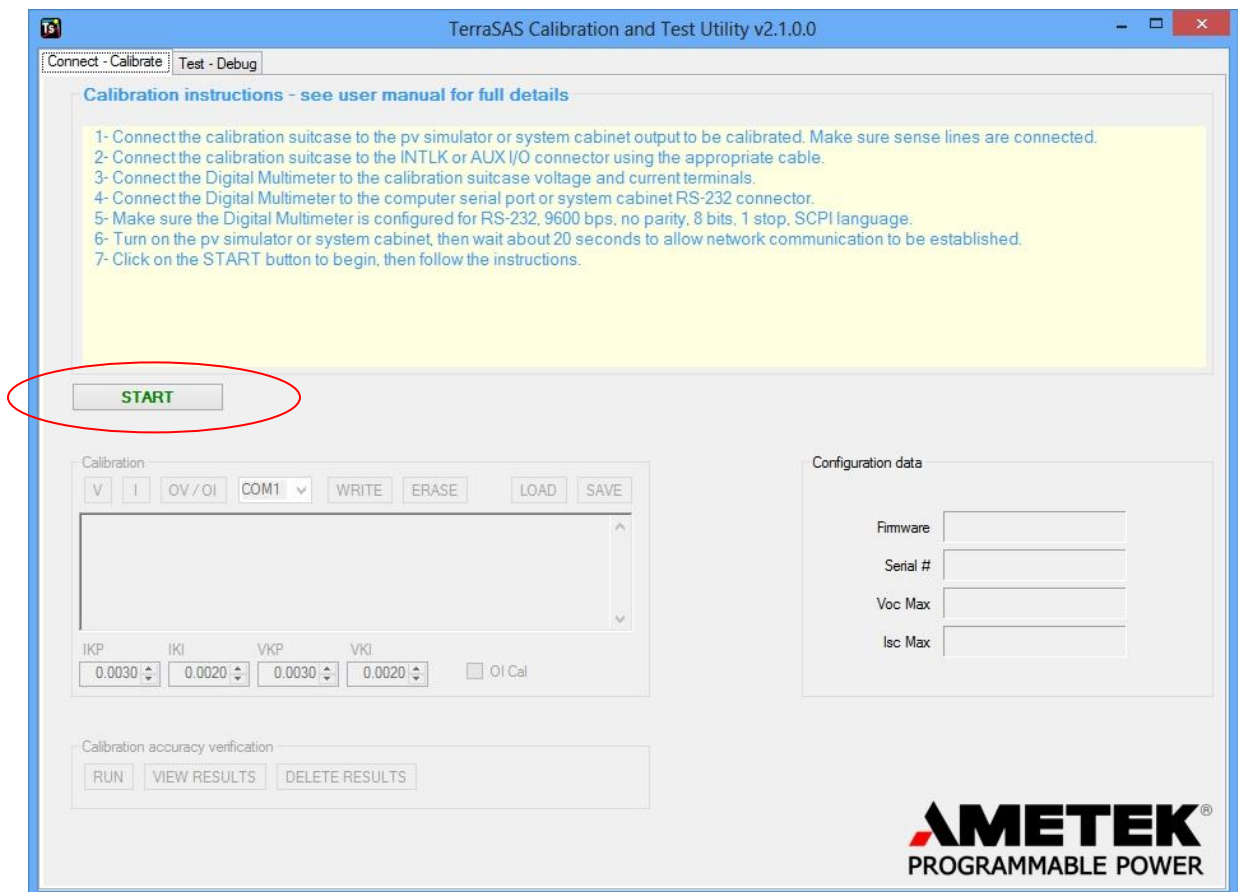
3.1 Connecting to a PV simulator

The software will automatically detect all connected PV simulator(s). It is recommended that the user connects all necessary equipment to the simulator for calibration before starting. See section 4 for reference.

NOTE:

Do not run TerraSAS Software and TerraSAS Calibration Software at the same time.

Figure 3: Connect-Calibrate Tab



On the **Connect-Calibrate** tab, click on the **START** button to connect to the PV Simulator(s). See Figure 3.

NOTE:

When connecting a desktop or laptop computer to a standalone PV simulator using a direct connection, simply set the computer's Ethernet adapter to static IP addressing, IP address 10.0.0.2 and IP mask 255.255.0.0. The LAN LED on the simulator will not fast-blink but communication will be immediately established.

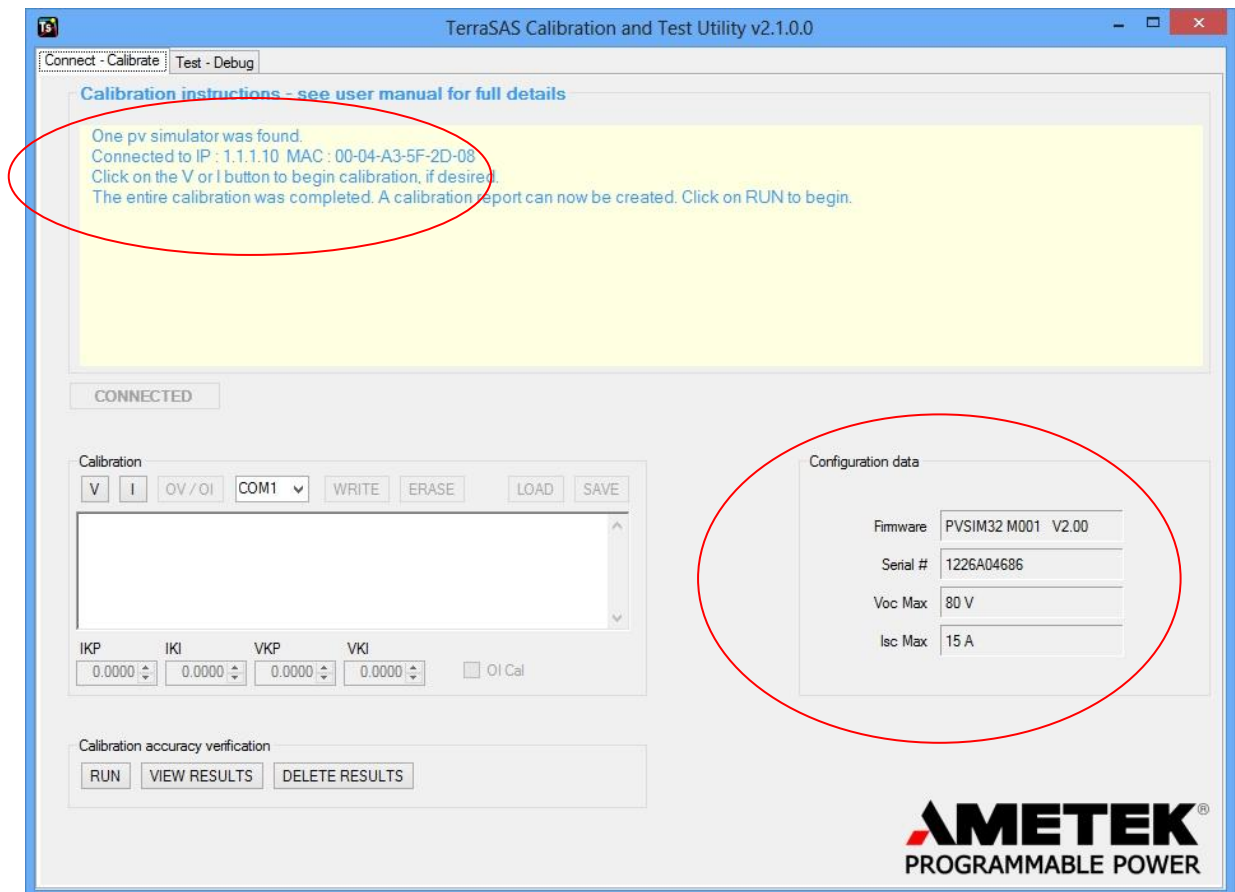
For systems already configured with a computer, it is recommended to install the calibration software on the same computer where the Ethernet setup is already done. If for any reason the Ethernet setup needs to be performed, please refer to the software user manual P/N M609155-01.

If the communication channel is healthy, the **START** button will immediately show **CONNECTED**.

The software will display the number of PV simulators found as shown in the following paragraphs.

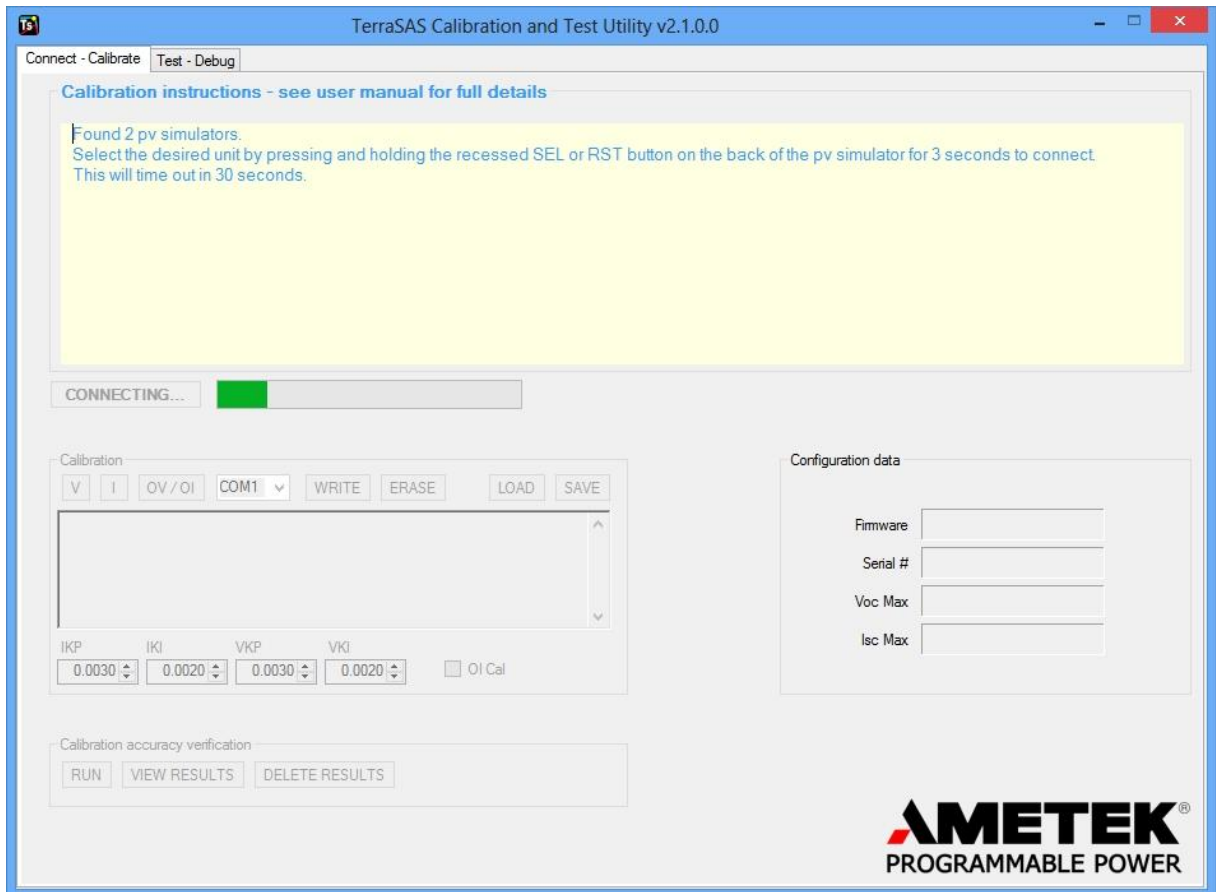
The software will automatically show the PV Simulator's factory configuration data and IP address if there is a single PV simulator connected.

Figure 4: Single PV Simulator



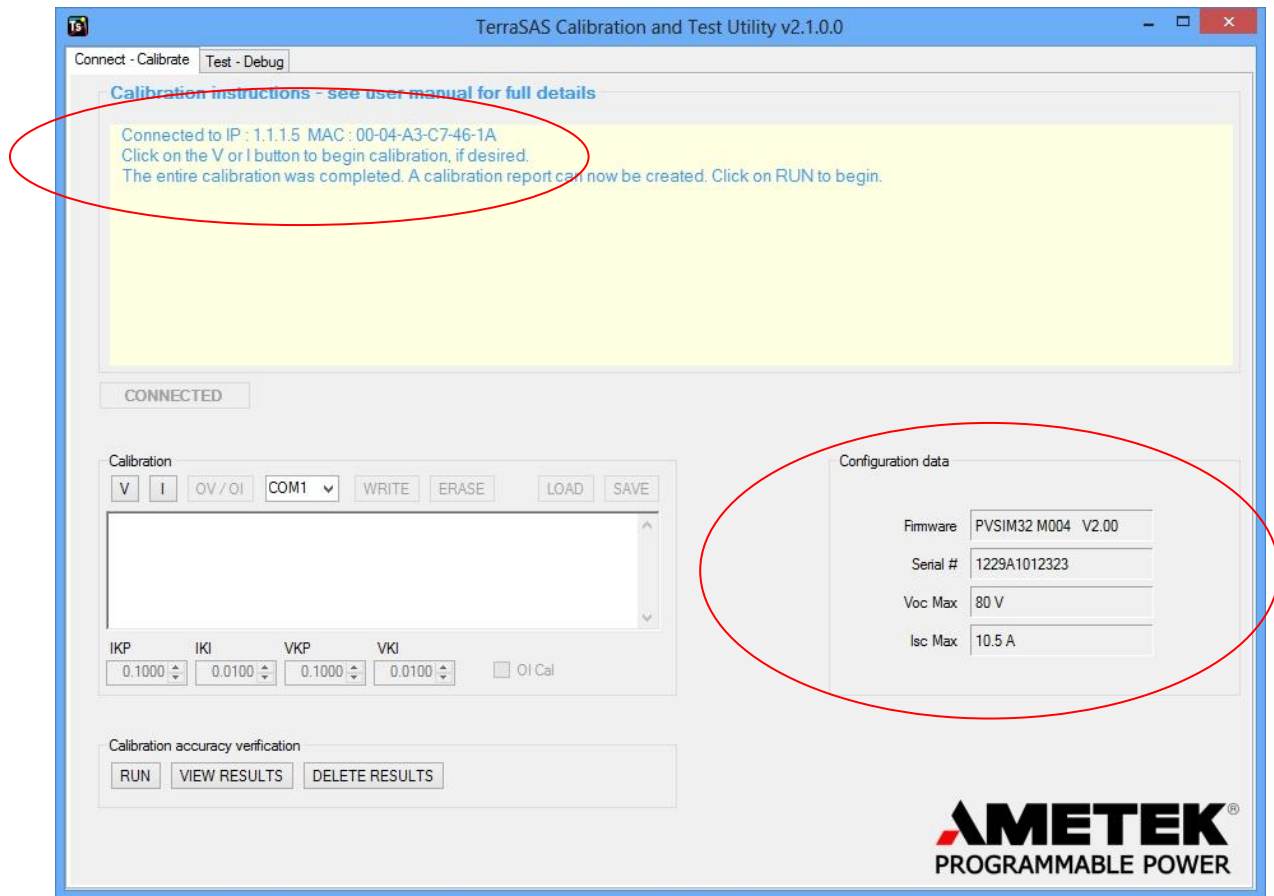
If more than one PV simulator is connected, the software will allow the user to select the desired unit to be calibrated by pressing and holding the recessed SEL or RST button on the back of the PV simulator (see **Figure 8** for reference). The software will wait for input and will time out in 30 seconds if no user input is detected. See **Figure 5** for reference.

Figure 5: Multiple PV Simulators



Once the user presses and holds the **SEL** or **RST** button (see **Figure 8** for reference), the **CONNECTING...** button will immediately show **CONNECTED** and the Configuration data fields will be populated with factory configuration information and the PV Simulator's MAC address will be displayed as shown in **Figure 6**.

Figure 6: PV Simulator Connected

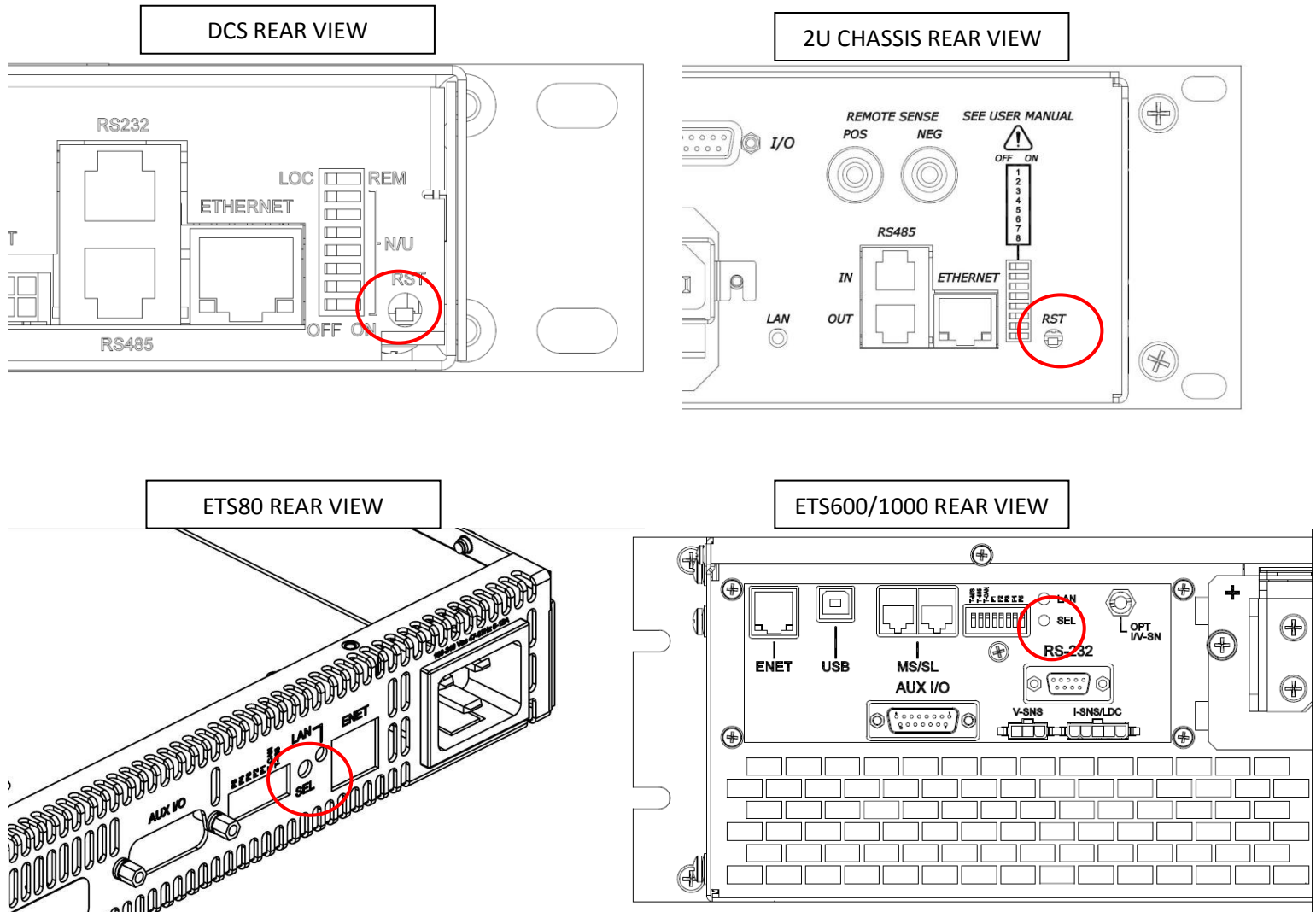


If the message in **Figure 7** appears on the status window, check the Ethernet wiring between the computer and the PV simulator.

Figure 7: Communication Error Message



Figure 8: Sample rear views of PV Simulator



4 Calibration

WARNING

This procedure should be performed by qualified electronic technicians only. Appropriate safety procedures must be followed to avoid high voltage hazards.

4.1 Meter configuration

The digital meter needs to be configured for RS-232 operation, 9600 bps, 8 bit, 1 stop, no parity, no handshake. The software has been tested with HP 34401A and Keithley 2000 models. Connect the serial port of the DMM to the RS-232 port on the rear side of the system rack, using an appropriate cable (straight M-F cable for Keithley 2000, crossover F-F cable for HP 34401A). Select autoranging operation, DC voltage. If using a laptop or non-rack mounted computer, use the computer serial port. If not present, use a USB-to-RS232 adapter.

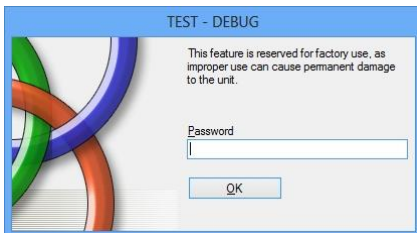
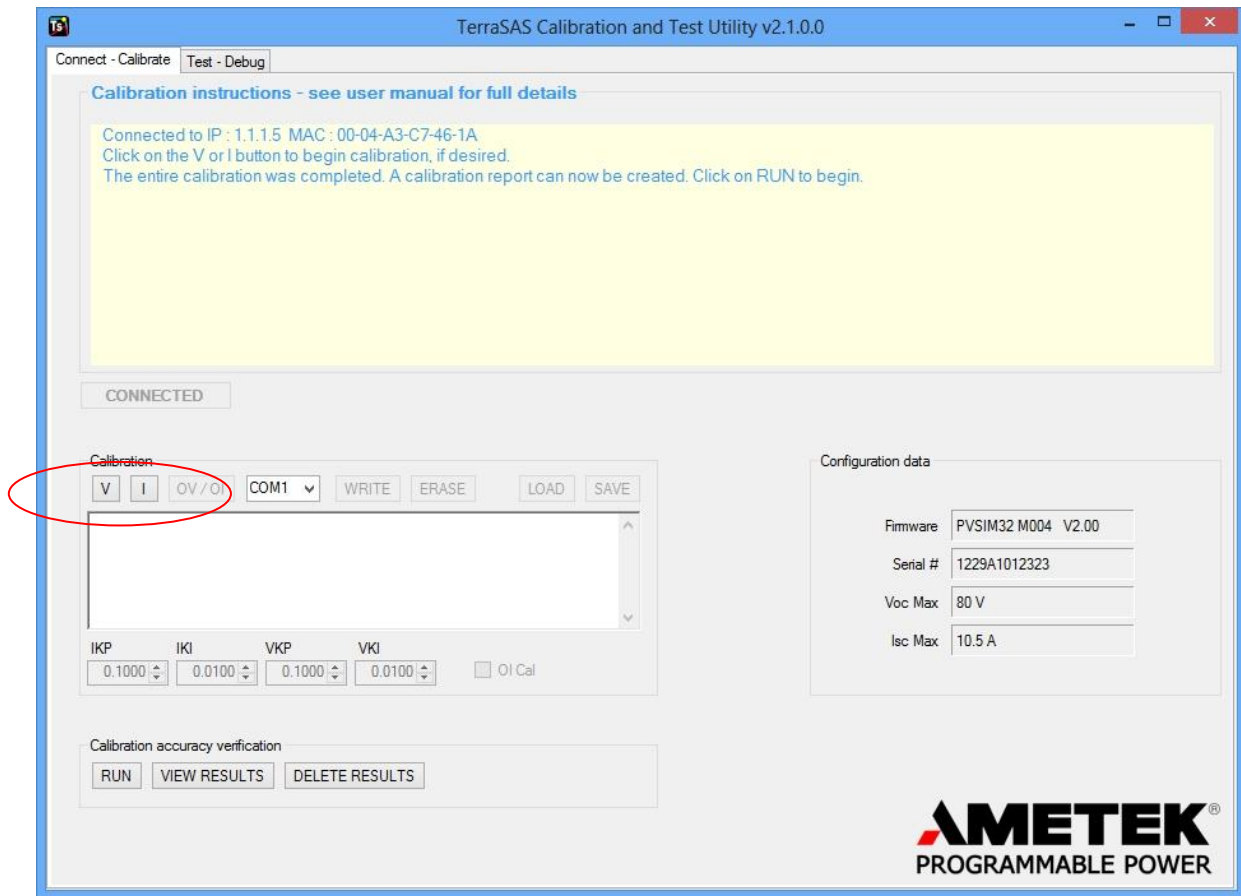
4.2 Voltage and Current Calibration

Connect the TerraSAS Calibration Suitcase to the system. See Appendix A for reference.

Once communication is established and connection has been made to the PV simulator, the **V** and **I** buttons on the window become active. See **Figure 9** for reference.

The **Test- Debug** tab is intended for factory use and will require a password to access. See **Figure 9** for reference.

Figure 9: V and I Calibration



Click on the **V** button to start the calibration process.

NOTE:

Make sure that the correct COM port is selected to continue with calibration. To check the computer's COM ports, right click on My Computer → Properties → Device Manager → Ports (COM & LPT)

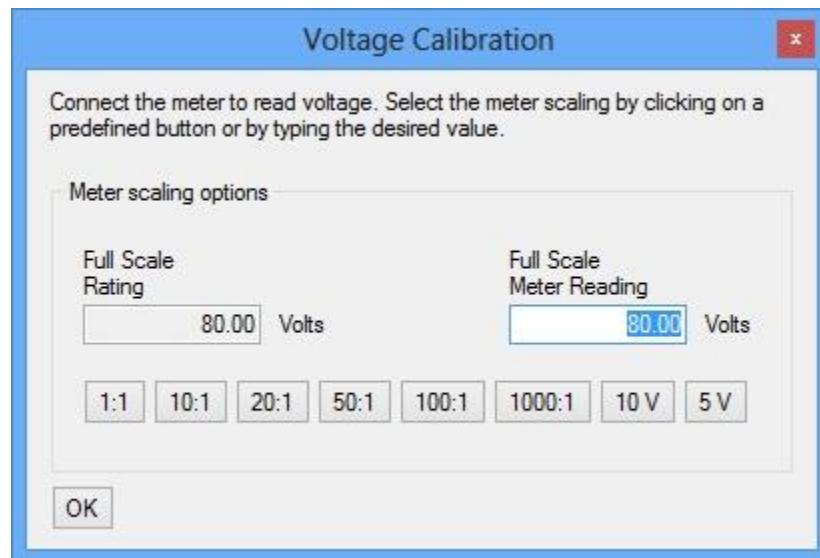
WARNING: Output voltage will be enabled once calibration has been initiated. Use extreme caution when working with the PV Simulator.

The **Voltage Calibration scaling dialog** will be displayed. Make sure the meter is set to measure where the connection to the Voltage Meter on the TerraSAS CAL Suitcase is. Set the meter to use front or rear jacks, whichever is the applicable connection.

Leave the default 1:1 scaling when directly connected to a suitcase. When calibrating high power systems, a voltage divider may be required. For instance, a 2000 V TerraSAS High Power system might use a 10:1 divider, since most meters can only measure up to 1000V. In this case click on the 10:1 button, which will show 200V as the full scale meter reading. If using a 2:1 divider, simply type 1000 in the full scale meter reading field.

Click **OK** to continue. See **Figure 10**.

Figure 10: Voltage Calibration scaling



Voltage Calibration

Connect the meter to read voltage. Select the meter scaling by clicking on a predefined button or by typing the desired value.

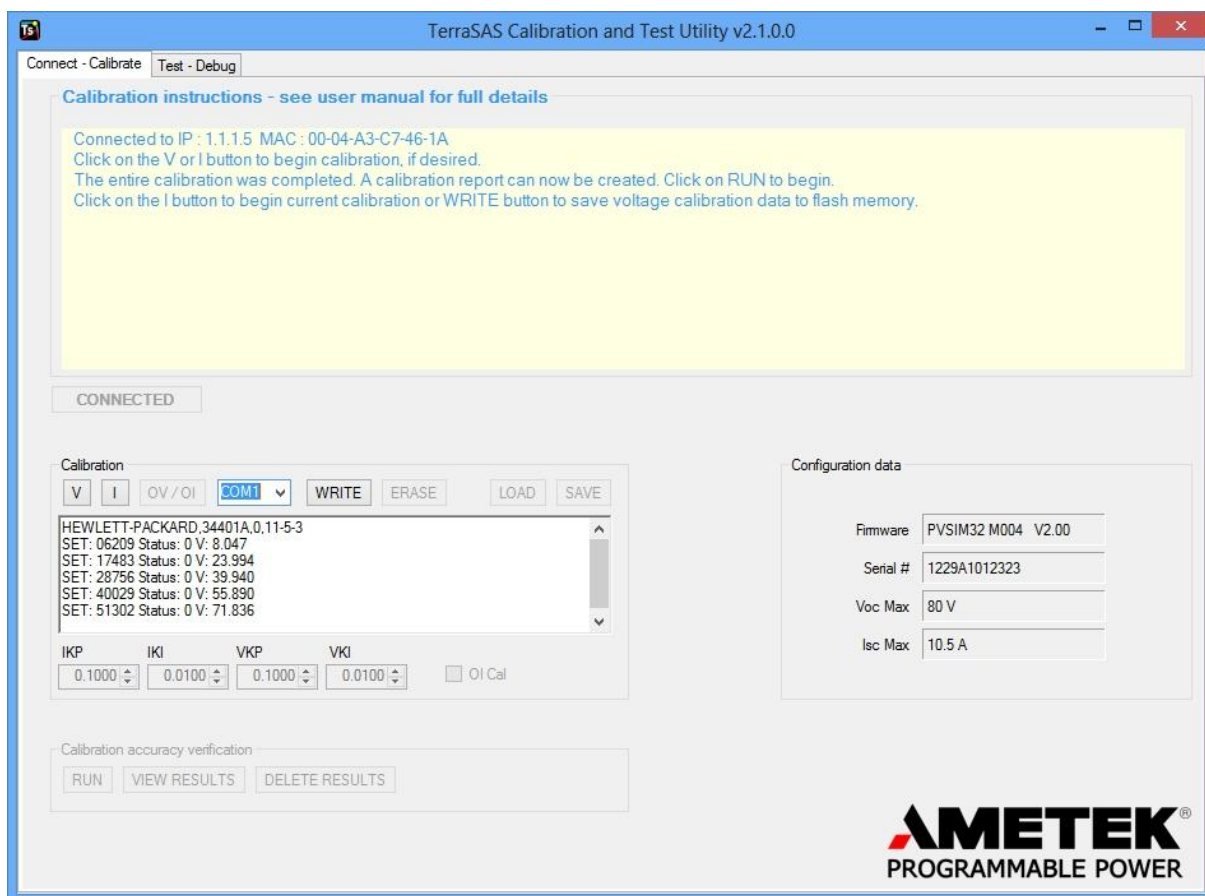
Meter scaling options

Full Scale Rating	Full Scale Meter Reading
<input type="text" value="80.00"/> Volts	<input type="text" value="80.00"/> Volts
<input type="button" value="1:1"/> <input type="button" value="10:1"/> <input type="button" value="20:1"/> <input type="button" value="50:1"/> <input type="button" value="100:1"/> <input type="button" value="1000:1"/> <input type="button" value="10 V"/> <input type="button" value="5 V"/>	

Once the voltage calibration is completed, voltage calibration coefficients can be stored in flash memory if desired, by clicking the **WRITE** button. See **Figure 11**. This allows to power down a large system, exit the software if desired and then perform the current calibration when the system is ready and powered back up.

When a delay is not needed, simply click on the **I** button to initiate the current calibration immediately.

Figure 11: Voltage calibration completed



When clicking the **I** button, the **Current calibration scaling dialog** will be displayed. When using a calibration suitcase, enter the shunt resistance in milliohms as printed on the Maximum Current Rating Label attached to the suitcase.

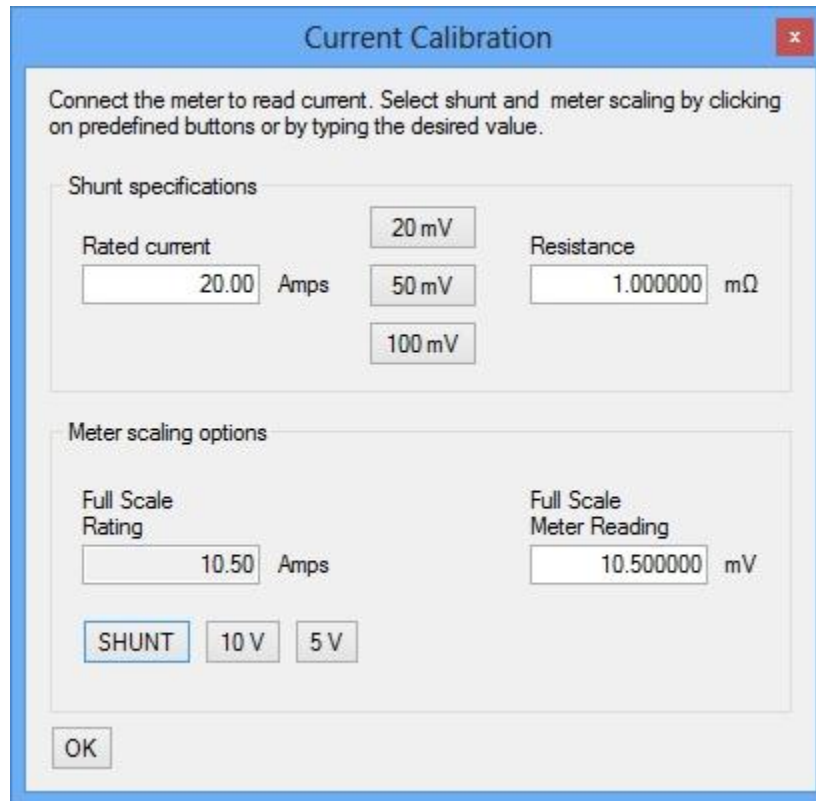
If using a shunt with no calibration sticker, enter the shunt rated current then click on the 20mV, 50mV or 100mV button to compute the nominal shunt resistance (a calibrated shunt is of course recommended for best accuracy, however a non-calibrated shunt can be used if the calibration accuracy is not important).

Then click on the **SHUNT** button to compute the full scale meter reading in millivolts.

It is also possible to enter the full scale meter reading in millivolts directly in the Full Scale Meter Reading field that corresponds to the rated current of the unit being calibrated.

See **Figure 12**.

Figure 12: Current Calibration Scaling



The image shows a software dialog box titled "Current Calibration" with a red close button in the top right corner. The dialog contains two main sections: "Shunt specifications" and "Meter scaling options".

Shunt specifications: This section includes a text input for "Rated current" with the value "20.00" and the unit "Amps". To its right are three buttons labeled "20 mV", "50 mV", and "100 mV". Further right is a text input for "Resistance" with the value "1.000000" and the unit "mΩ".

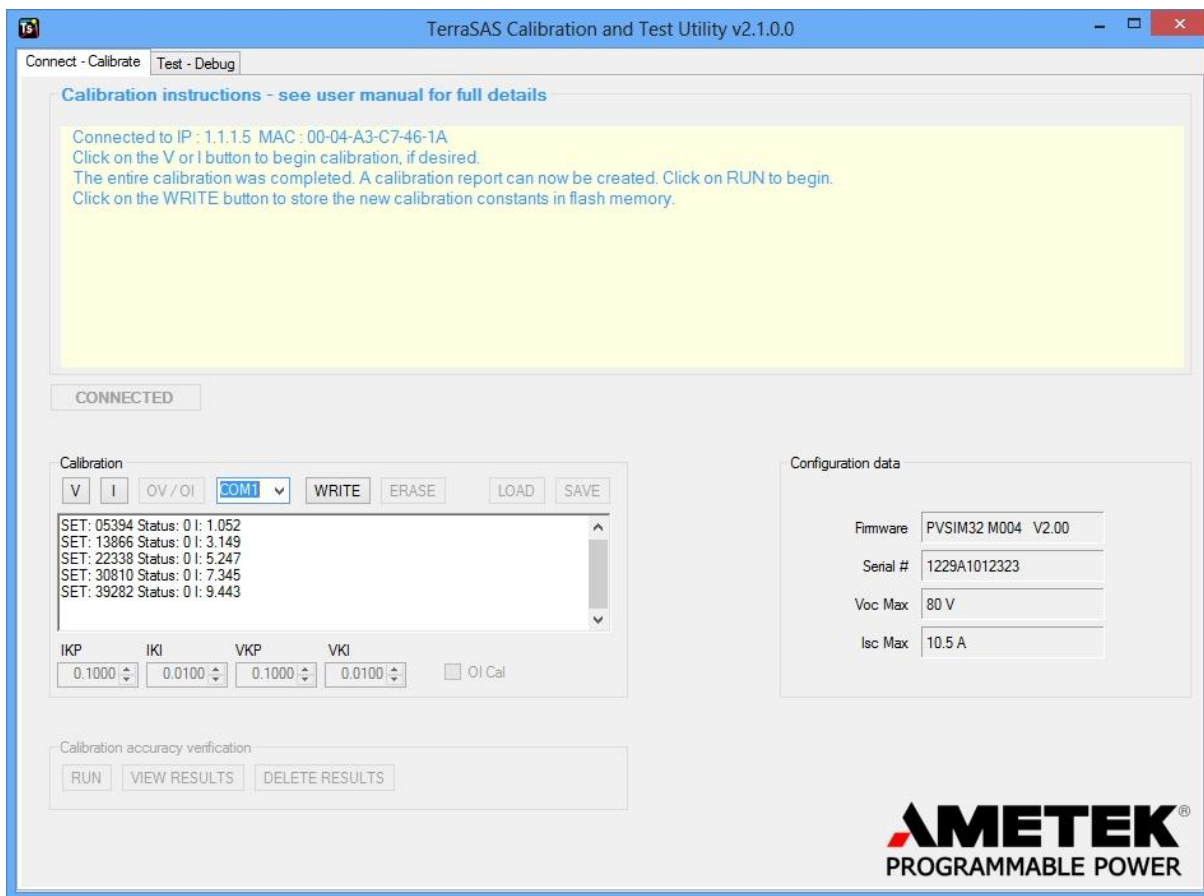
Meter scaling options: This section includes a text input for "Full Scale Rating" with the value "10.50" and the unit "Amps". To its right is a text input for "Full Scale Meter Reading" with the value "10.500000" and the unit "mV". Below these inputs are three buttons labeled "SHUNT", "10 V", and "5 V".

At the bottom left of the dialog is an "OK" button.

Make sure the meter is set to measure where the connection to the Current Meter on the TerraSAS CAL Suitcase is. Set the meter to use front or rear jacks whichever is the applicable connection. Click on **OK** to continue.

Once current calibration is completed, the user is prompted to click on the **WRITE** button to store the new calibration constants in the flash memory. See **Figure 13**.

Figure 13: Current calibration completed



When clicking on the **WRITE** button, the **Write calibration** window is displayed. The window shows the PV Simulator's maximum OVP and serial number. See **Figure 14** for reference. Note that the data displayed is for information only and cannot be changed by the user.

Figure 14: Write calibration



Click on the **OK** button to continue. Once the write to flash is finished the calibration is complete.

NOTE:

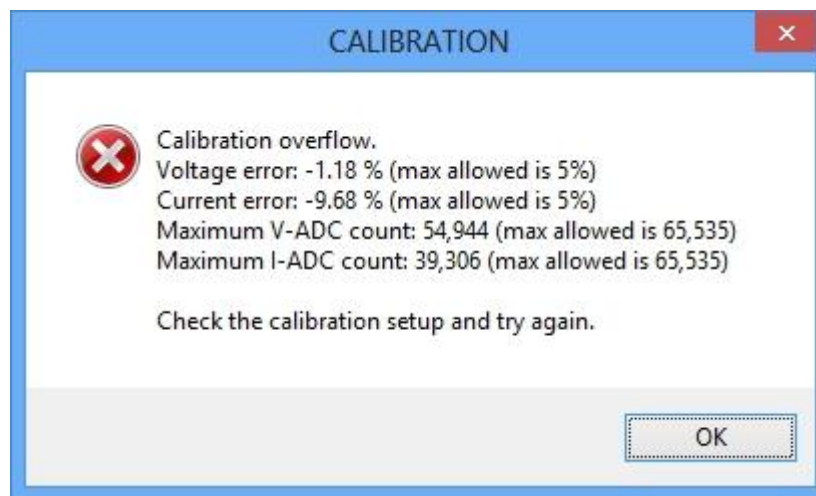
If more than one PV simulator is connected, the user will need to restart the software in order to calibrate the next PV simulator. Make sure to move the Control cable and output cable to the next PV simulator before starting.

CAUTION:

Make sure power is **OFF** before moving the output connection to the next PV simulator to be calibrated.

TROUBLE SHOOTING GUIDE:

Figure 15: Calibration Overflow



The Calibration Overflow Window (Figure 15) might appear due to the following reasons:

- The user entered a wrong current shunt value when prompted in Figure 12.
- The user chose the wrong current shunt on the calibration suitcase to calibrate the system.
- The meter is connected to the wrong current shunt on the calibration suitcase.
- The calibration suitcase is defective or damaged.
- The voltage or current measuring device inside the simulator is defective or damaged.

4.3 Verifying the calibration accuracy

When the calibration process has been successfully completed, the calibration accuracy can be verified. It is also possible to use this feature to measure how much variation occurred since the last calibration was performed. To do this, simply run the calibration verification **before** performing a new calibration.

To start the calibration verification, click on the **DELETE RESULTS** button to clear any previous data, then click on the **RUN** button, see **Figure 16**.

Figure 16: Calibration verification

The screenshot shows a software interface for calibration. The top section, titled "Calibration", contains several buttons: "V", "I", "OV/OI", a dropdown menu set to "COM1", "WRITE", "ERASE", "LOAD", and "SAVE". Below these buttons is a text area displaying the following text: "SET: 22338 Status: 0 I: 5.245", "SET: 30810 Status: 0 I: 7.342", "SET: 39282 Status: 0 I: 9.440", "Write successful.", and "Read successful.". Below the text area are four input fields for "IKP", "IKI", "VKP", and "VKI", each with a value of "0.1000" and a small up/down arrow. To the right of these fields is a checkbox labeled "OI Cal". The bottom section, titled "Calibration accuracy verification", contains three buttons: "RUN", "VIEW RESULTS", and "DELETE RESULTS". The "RUN" and "DELETE RESULTS" buttons are circled in red.

When the **RUN** button is clicked, the data entry form in **Figure 17** is displayed. Data entered in this form is automatically saved on disk when the form is closed.

Grayed out fields are automatically generated and cannot be modified by the user.

Make sure the shunt resistance entered here is accurate, since the accuracy of the verification depends on it.

When all the data has been entered and carefully checked, click on the **START VOLTAGE VERIFICATION** button and, when finished, click on the **START CURRENT VERIFICATION** button.

The exact sequence does not matter (current can be done first, if desired). When the voltage verification is started, the meter scaling window shown in **Figure 10** is displayed.

Figure 17: Calibration verification data entry

The screenshot shows a software window titled "CALIBRATION VERIFICATION" with a blue header bar. The window contains several sections for data entry:

- Calibration provider information:** Fields for Name (AMETEK Programmable Power Solutions), Address Line 1 (9250 Brown Deer Rd), Address Line 2 (San Diego, California 92121), Phone Number (+1 (858) 450-0085), and E-mail Address (PPSupport.ppd@ametek.com).
- Test instruments information:** Fields for Meter Make (Agilent), Meter Model (34401A), Meter Serial Number (MY47050966), Calibration Due Date (December 31, 2014), Shunt Make (Guildline), Shunt Model (9250A), Shunt Serial Number (12345), Calibration Due Date (June 15, 2014), and Shunt Resistance - mΩ (1.0001418).
- Calibration session information:** Fields for Test Operator Name (John Doe), Ambient Temperature (20.0 °C), Ambient Humidity (65.0 %), and Date (Wednesday, November 6, 2013).
- Unit information:** Fields for Model (ETS80X10.5C-PVF), Serial Number (1229A1012323), Max Voltage - V (80), Max Current - A (10.5), and Max Power - kW (0.84).

At the bottom, there are two buttons: "START VOLTAGE VERIFICATION" and "START CURRENT VERIFICATION". A note states: "Verification results are automatically saved on disk when exiting the program."


When active, the **VIEW RESULTS** button (see Figure 16) can be clicked to show the results of the data collected up to that point. This is possible at the end of the measurement sequence, which cannot be interrupted.

If the measurement sequence is performed more than once, new data replaces the previous one.

The data can be edited in this window before using it.

See **Figure 18**.

Figure 18: Calibration verification results



CALIBRATION RESULTS

CALIBRATION CERTIFICATE

CALIBRATION SERVICE PROVIDER

AMETEK Programmable Power Solutions

9250 Brown Deer Rd

San Diego, California 92121

+1 (858) 450-0085

PPSsupport.ppd@ametek.com

TEST INSTRUMENTS DESCRIPTION

MAKE	MODEL	SERIAL NUMBER	CALIBRATION DUE DATE
Agilent	34401A	MY47050966	December 31, 2014
Guildline	9250A	12345	June 15, 2014

CALIBRATED UNIT

MODEL	SERIAL NUMBER	VOLTS	AMPS	KW
ETS80X10.5C-PVF	1229A1012323	80	10.5	0.84

VOLTAGE SETTING CALIBRATION VERIFICATION (SPEC: $\pm 0.2\%$ OF FULL SCALE)

SET VALUE (V)	ACTUAL VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL
0.000000	0.019123	0.023904	11.951809	PASS
20.000000	19.993235	-0.008456	4.228125	PASS
40.000000	39.992811	-0.008986	4.493125	PASS
60.000000	59.998312	-0.002110	1.055000	PASS
80.000000	80.000473	0.000591	0.295625	PASS

VOLTAGE READBACK CALIBRATION VERIFICATION (SPEC: $\pm 0.2\%$ OF FULL SCALE)

ACTUAL VALUE (V)	READBACK VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL
0.019123	0.018030	-0.001366	0.682862	PASS
19.993235	19.995022	0.002234	1.116763	PASS
39.992811	39.994938	0.002659	1.329310	PASS
59.998312	59.994854	-0.004323	2.161267	PASS
80.000473	79.994774	-0.007124	3.561960	PASS

COPY TO CLIPBOARD

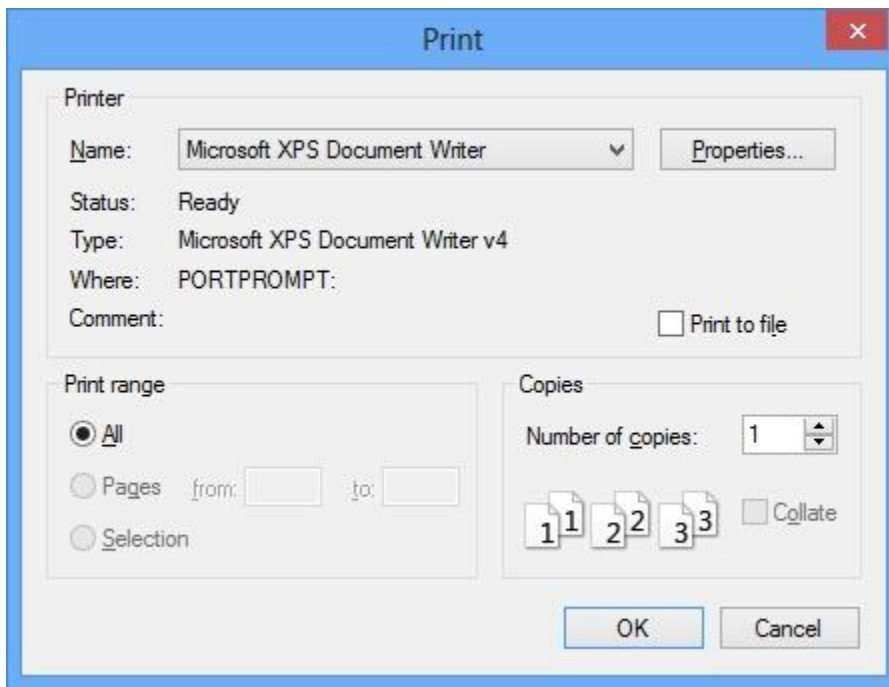
PRINT

4.4 Printing a calibration certificate

Calibration verification data, with any applied changes, can be copied to the Windows Clipboard and pasted into Microsoft Word or other application and then stored or printed.

It can also be directly printed on any available printer (local or network connected). Click on the **PRINT** button and then select the desired printer, see **Figure 19**.

Figure 19: Printer selection



An example print is shown on the next page. See **Figure 20**.

Figure 20: Calibration certificate example

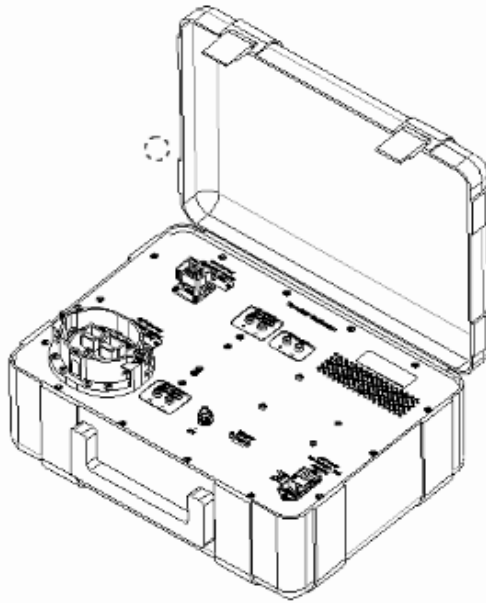
CALIBRATION CERTIFICATE						
CALIBRATION SERVICE PROVIDER						
AMETEK Programmable Power Solutions 9250 Brown Deer Rd San Diego, California 92121 +1 (858) 450-0085 PPSsupport.ppd@ametek.com						
TEST INSTRUMENTS DESCRIPTION						
MAKE Agilent Guildline	MODEL 34401A 9250A	SERIAL NUMBER MY47050966 12345	CALIBRATION DUE DATE December 31, 2014 June 15, 2014			
CALIBRATED UNIT						
MODEL ETS80X10.5C-PVF	SERIAL NUMBER 1229A1012323	VOLTS 80	AMPS 10.5	KW 0.84		
VOLTAGE SETTING CALIBRATION VERIFICATION (SPEC: ± 0.2 % OF FULL SCALE)						
SET VALUE (V)	ACTUAL VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL		
0.000000	0.019123	0.023904	11.951809	PASS		
20.000000	19.993235	-0.008456	4.228125	PASS		
40.000000	39.992811	-0.008986	4.493125	PASS		
60.000000	59.998312	-0.002110	1.055000	PASS		
80.000000	80.000473	0.000591	0.295625	PASS		
VOLTAGE READBACK CALIBRATION VERIFICATION (SPEC: ± 0.2 % OF FULL SCALE)						
ACTUAL VALUE (V)	READBACK VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL		
0.019123	0.018030	-0.001366	0.682862	PASS		
19.993235	19.995022	0.002234	1.116763	PASS		
39.992811	39.994938	0.002659	1.329310	PASS		
59.998312	59.994854	-0.004323	2.161267	PASS		
80.000473	79.994774	-0.007124	3.561960	PASS		
CURRENT SETTING CALIBRATION VERIFICATION (SPEC: ± 0.5 % OF FULL SCALE)						
SET VALUE (V)	ACTUAL VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL		
0.000000	-0.000280	-0.002666	0.533258	PASS		
2.625000	2.626684	0.016034	3.206736	PASS		
5.250000	5.251662	0.015832	3.166313	PASS		
7.875000	7.876295	0.012335	2.466936	PASS		
10.500000	10.501394	0.013275	2.655052	PASS		
CURRENT READBACK CALIBRATION VERIFICATION (SPEC: ± 0.5 % OF FULL SCALE)						
ACTUAL VALUE (V)	READBACK VALUE (V)	ERROR (% OF FS)	ERROR (% OF SPEC)	PASS/FAIL		
-0.000280	-0.002092	-0.017256	3.451108	PASS		
2.626684	2.624690	-0.018983	3.796651	PASS		
5.251662	5.249739	-0.018316	3.663132	PASS		
7.876295	7.874788	-0.014356	2.871112	PASS		
10.501394	10.499837	-0.014828	2.965677	PASS		
SHUNT RESISTANCE: 1.0001418 mΩ						
AMBIENT TEMPERATURE: 20.0 °C AMBIENT HUMIDITY: 65.0 %						
CALIBRATION DATE: Wednesday, November 6, 2013						
CALIBRATION DUE DATE: Thursday, November 6, 2014						
TEST OPERATOR: John Doe						

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APPENDIX A: CALIBRATION SUITCASE USER GUIDE

CONFIGURATION 5609175-01 (20A and 75A Calibration Suitcase)

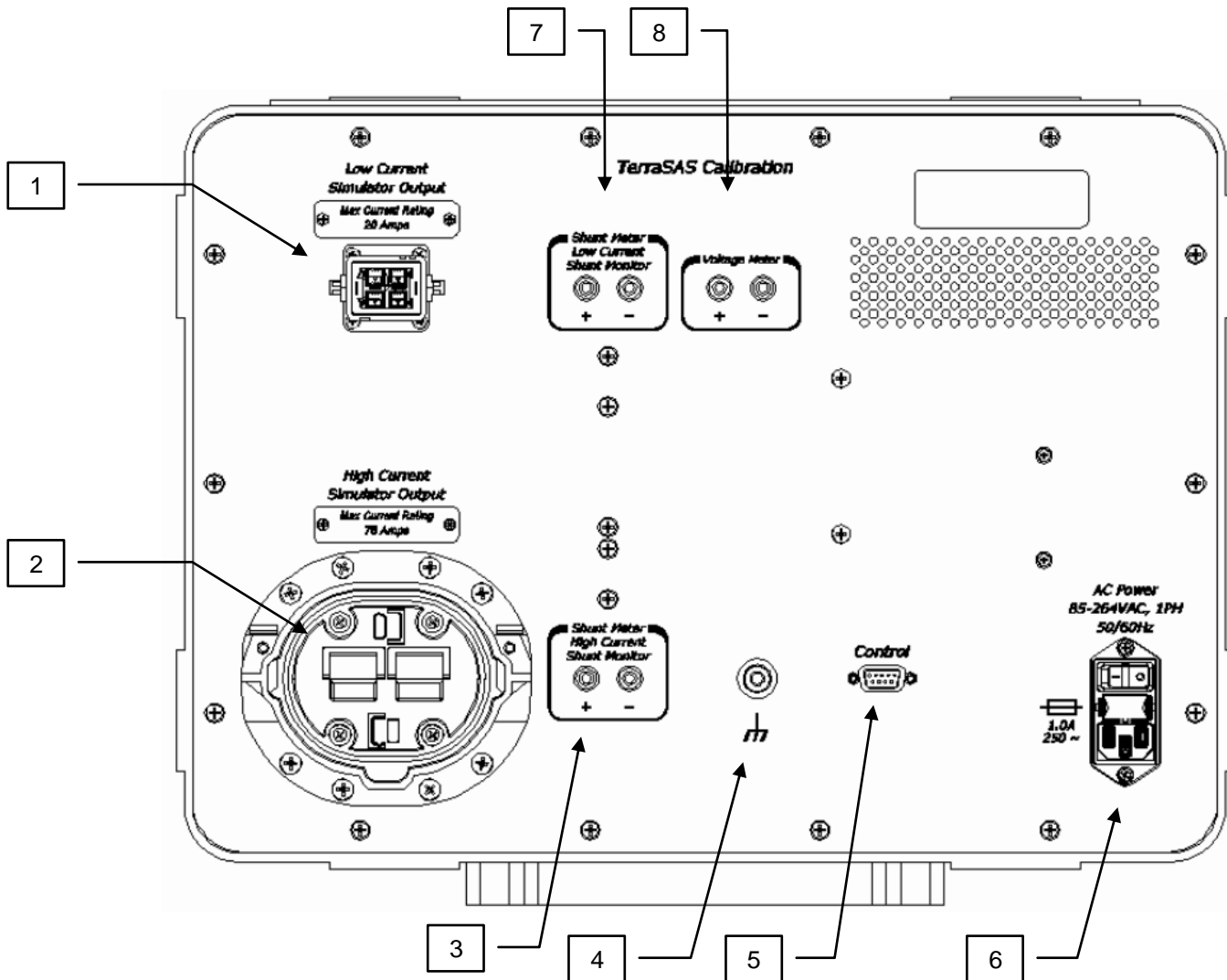
Consult factory for all other available configuration of the calibration suitcase.



A separate suitcase 5609539-01 is supplied and contains the following cable assemblies:

Part Number	Description	Quantity
890-009-09	CABLE,9P,D-SUB,F-F,NULL,10FT	1
890-009-10	CABLE,9P,D-SUB,M-F,SHLD,10FT	1
890-320-13	CORD,PWR,18AWG,IEC320-C13,SVT	1
5609525-01	CABLE,CALIBRATION, 20A -TSAS	1
5609526-01	CABLE,CALIBRATION, 75A -TSAS	1
5609528-01	CABLE,CAL,DB9 JUMPER - TSAS	1
5609529-01	CABLE,CAL,DB9-DB9, RK INT-TSAS	1
5609530-01	CABLE,CAL,DB9-DB15,ETS INTFC	1
5609543-01	CABLE,CAL, GND, 4AWG-TSAS	1

CALIBRATION SUITCASE 5609175-01 CONNECTOR INTERFACE



1. Low Current Simulator Output Interface
2. High Current Simulator Output Interface
3. Shunt Meter High Current Shunt Monitor
4. Chassis Ground Interface
5. Control Interface
6. AC Power 85-264VAC, 1PH, 50/60HZ, with indicator light, switch, and 1A Fuse (250V, 5X20MM, SLO-BLO)
7. Shunt Meter Low Current Monitor
8. Voltage Meter

To use the 5609175-01 calibration suitcase, follow the steps below:

1. Connect 5609525-01 or 5609526-01 to the PV simulator's output terminals whichever is applicable to the system being calibrated. Make sure sense terminals are connected to the output terminals to avoid calibration errors. Connections will be made through either the *Low Current Simulator Output Connector* or the *High Current Simulator Output*.

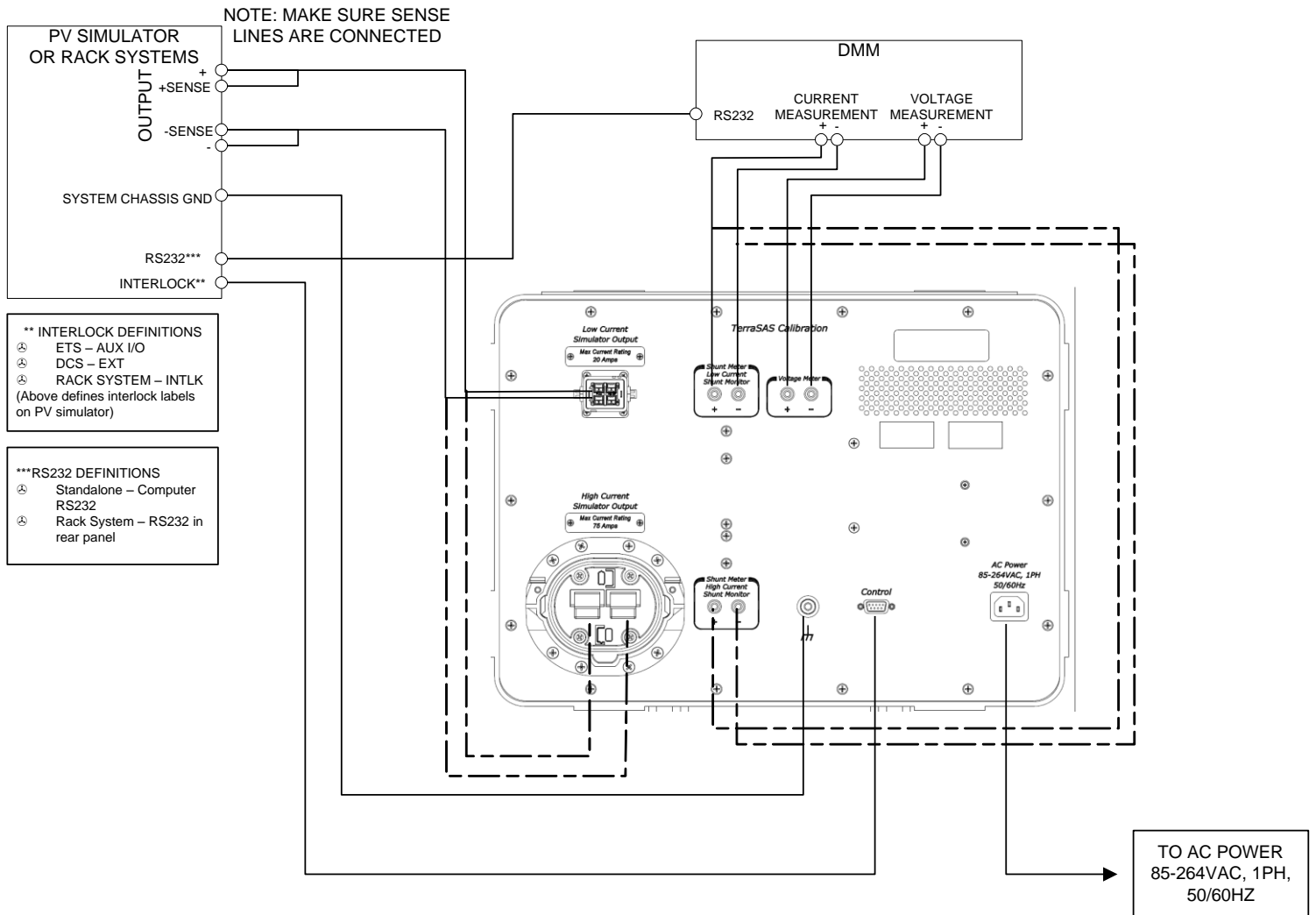
Warning: Do not exceed maximum current rating as identified on connector labels.

2. Connect the suitcase chassis Ground to the simulator chassis Ground using 5609543-01
3. Connect the *Control* cable 5609529-01 or 5609530-01 to the PV simulator's AUX I/O/INTLK/EXT connector whichever is applicable to the system being calibrated. When calibrating a DCS, use 5609528-01 to switch the TerraSAS Calibration Suitcase into current mode. When prompted for current calibration, connect 5609528-01 to the *Control* connector.
4. Connect 890-009-09 or 890-009-10 to the DMM RS232 and PV simulator's RS232 ports whichever is applicable to the DMM. The PV Simulator's RS232 is located in the rear panel for the rack system or connect directly to the computer's RS232 port for a standalone unit.
5. Provide AC power to the TerraSAS Calibration Suitcase through connection labeled *AC Power 85-264VAC, 1PH 50/60Hz* using cable 890-320-13.
6. Connect Shunt Meter Low or High Current to the DMM. Use high voltage test leads. Consult DMM user manual on how to connect to the DMM to measure current.
7. Connect Voltage Meter to the DMM. Use high voltage test leads. Consult DMM user manual on how to connect to the DMM to measure voltage.

NOTE: The DMM has to be set to measure correctly between the Current Meter and Voltage Meter of the TerraSAS CAL Suitcase. Press front or rear button of the DMM (see reference DMM front panels on page VIII) to select the correct connection to the TerraSAS CAL Suitcase.

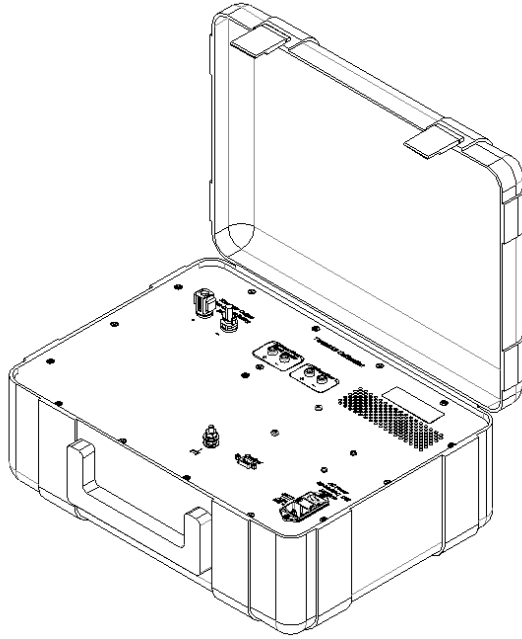
8. Follow calibration instructions in section 4 of this manual.

See Diagram below for connection details:



CONFIGURATION 5609175-02 (30A)

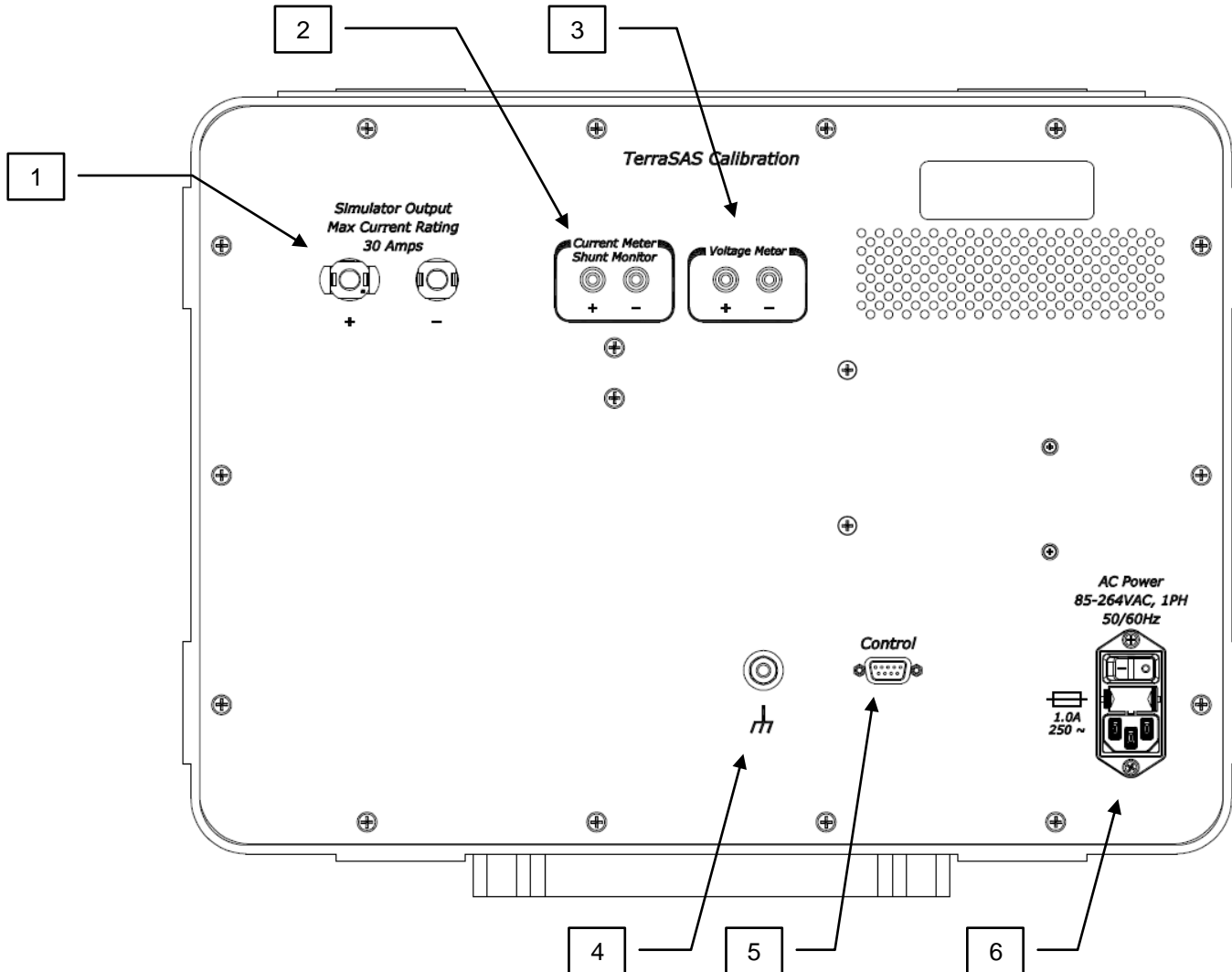
Consult factory for all other available configuration of the calibration suitcase.



A cable set 5609561-01 is supplied and contains the following cable assemblies:

Part Number	Description	Quantity
5609569-01	CABLE,CAL,30A,1000V,POS	1
5609570-01	CABLE,CAL,30A,1000V,NEG	1
5609528-01	CABLE,CAL,DB9,JUMPER	1
5609529-01	CABLE,CAL,DB9-DB9,RK INT	1
5609530-01	CABLE,CAL, DB9-DB15,ETS INTFC	1
5609543-02	CABLE ASSY,CAL GND,10AWG	1
890-009-09	CABLE,9P,D-SUB,F-F,NULL,10FT	1
890-009-10	CABLE,9P,D-SUB,M-F,SHLD,10FT	1
890-320-13	CORD,PWR,18AWG,IEC320-C13,SVT	1

CALIBRATION SUITCASE 5609175-02 CONNECTOR INTERFACE



1. Simulator Output Interface
2. Current Meter Shunt Monitor
3. Voltage Monitor (Shunt)
4. Chassis Ground Interface
5. Control Interface
6. AC Power 85-264VAC, 1PH, 50/60HZ, with indicator light, switch, and 1A Fuse (250V, 5X20MM, SLO-BLO)

To use the 5609175-02 calibration suitcase, follow the steps below:

1. Connect 5609569-01 and 5609570-01 to the PV simulator's output terminals. Make sure sense terminals are connected to the output terminals to avoid calibration errors.

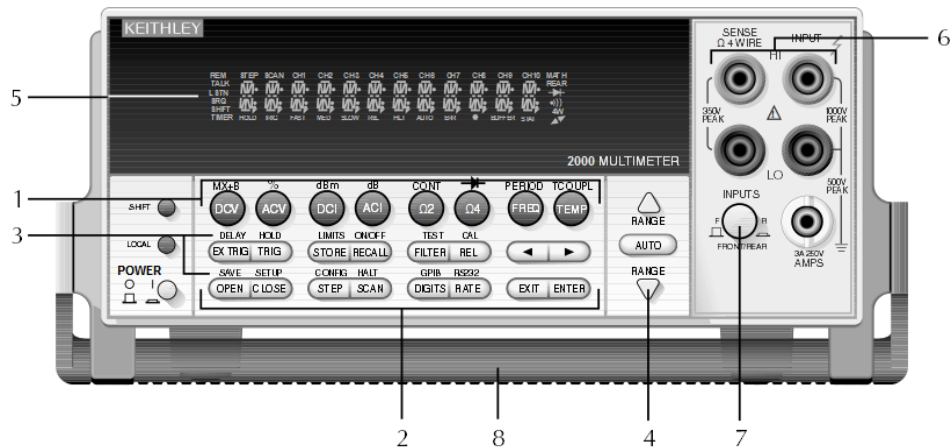
Warning: Do not exceed maximum current rating as identified on connector label.

2. Connect the suitcase chassis Ground to the simulator chassis Ground using 5609543-02
3. Connect the *Control* cable 5609529-01 or 5609530-01 to the PV simulator's AUX I/O/INTLK/EXT connector whichever is applicable to the system being calibrated. When calibrating a DCS, use 5609528-01 to switch the TerraSAS Calibration Suitcase into current mode. When prompted for current calibration, connect 5609528-01 to the *Control* connector.
4. Connect 890-009-09 or 890-009-10 to the DMM RS232 and PV simulator's RS232 ports whichever is applicable to the DMM. The PV Simulator's RS232 is located in the rear panel for the rack system or connect directly to the computer's RS232 port for a standalone unit.
5. Provide AC power to the TerraSAS Calibration Suitcase through connection labeled *AC Power 85-264VAC, 1PH 50/60Hz* using cable 890-320-13.
6. Connect Current Shunt Meter to the DMM. Use high voltage test leads. Consult DMM user manual on how to connect to the DMM to measure current.
7. Connect Voltage Meter to the DMM. Use high voltage test leads. Consult DMM user manual on how to connect to the DMM to measure voltage.

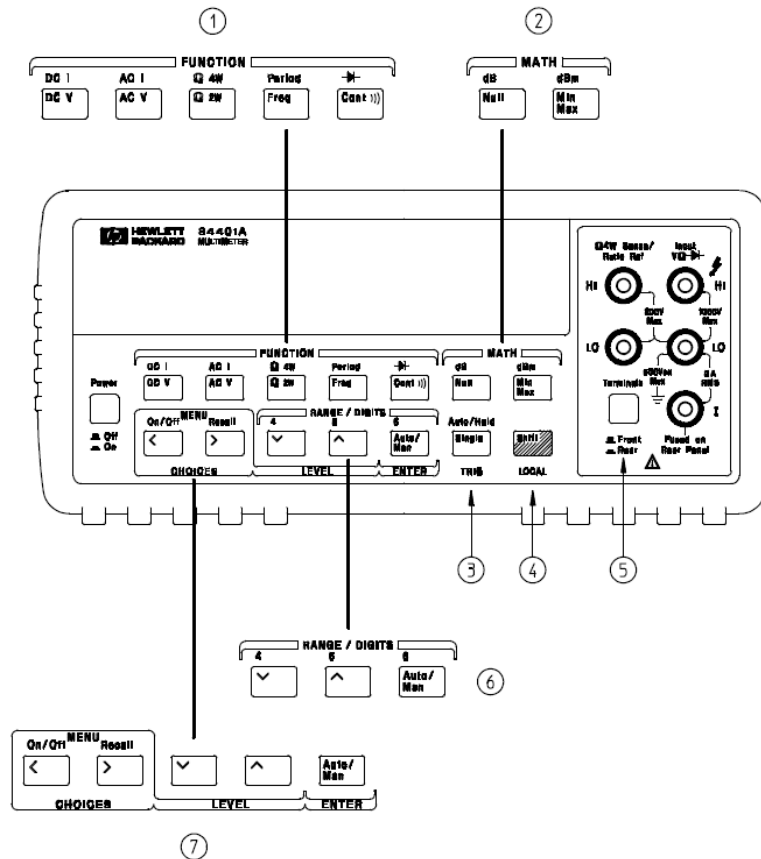
NOTE: The DMM has to be set to measure correctly between the Current Meter and Voltage Meter of the TerraSAS CAL Suitcase. Press front or rear button of the DMM (see reference DMM front panels on page VIII) to select the correct connection to the TerraSAS CAL Suitcase.

8. Follow calibration instructions in section 4 of this manual.

REFERENCE DMM FRONT PANEL FOR RECOMMENDED MODELS



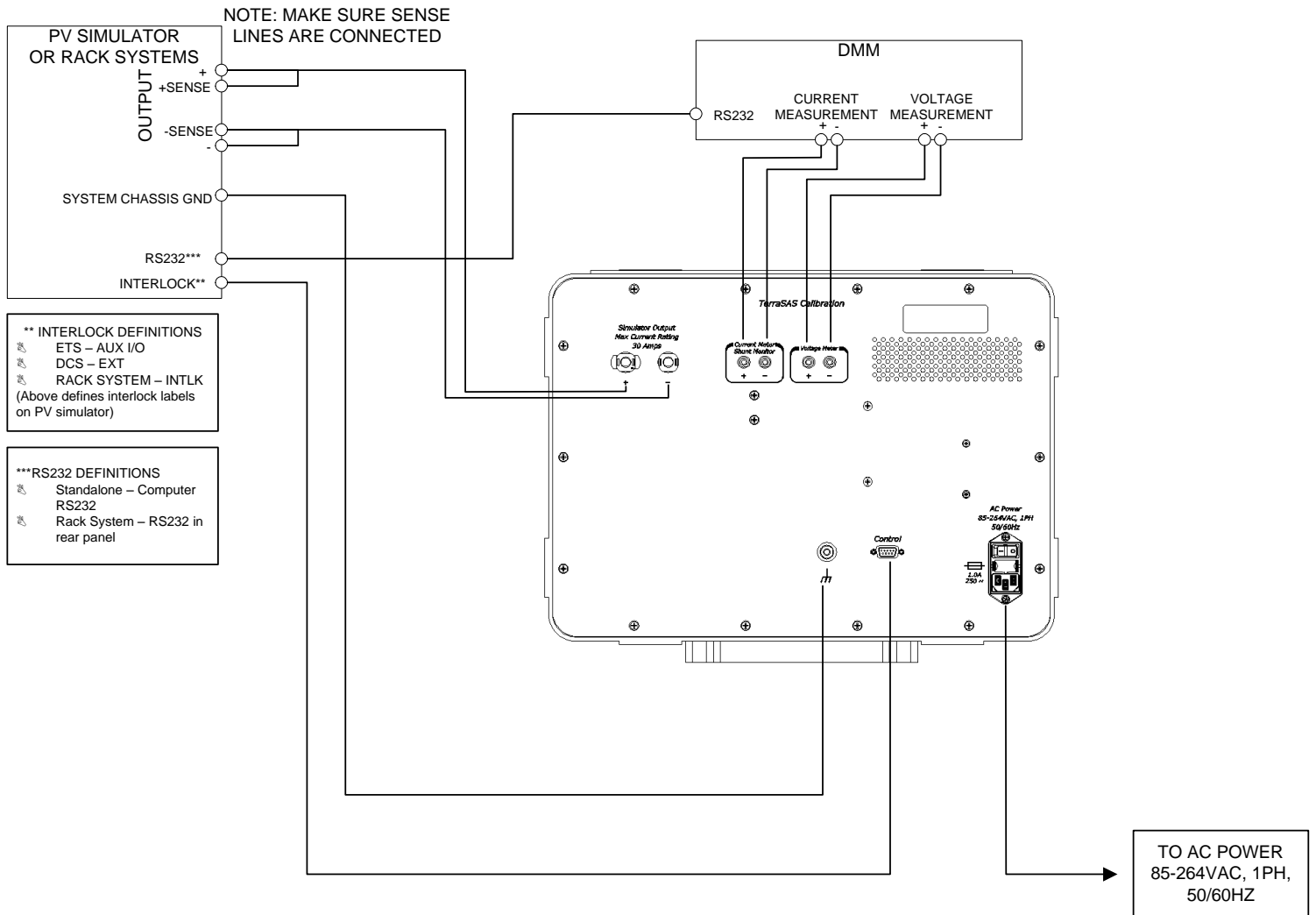
Keithley 2000 model Front/Rear button – ITEM 7*



HP 34401A model Front/Rear button – ITEM 5*

*Above images are for reference only. User should consult DMM User Manual for updated images of device front panels.

See Diagram below for 5609175-02 connection details:



CALIBRATION SUITCASE SUGGESTED MAINTENANCE

Factory recommends calibrating suitcase's internal shunts yearly. Connector assembly 5609528-01 is provided and can be connected to the *Control* connector to activate the relay inside the suitcase and access the shunts.

Warning: Do not open the suitcase panel and detach shunts to calibrate. This may damage the shunts and may result in inaccurate calibration.