Easy-Touch Pro

Performance Verification Manual

Version 2025.1.0

CIRRIS®

A KOMAX COMPANY

Easy-Touch Pro

Performance Verification Manual

Version 2025.1.0

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Introduction

The Easy-Touch™ Pro Performance Verification Kit allows you to verify the calibration and proper operation of the Easy-Touch Pro tester. Each performance verification kit has a life cycle of two years from the time of purchase. At the end of two years, you can recalibrate or replace the kit. The components for this performance verification kit are tested with instruments traceable to the National Institute of Standards and Technology (NIST).

Easy-Touch Pro Performance verification should be done annually and any time the tester is not operating properly. If a step in the performance verification procedure fails, send the tester back to Cirris for repair. No external adjustments can be made to fix the tester.

For helpful information about setting up a calibration system, see the appendix of this manual.

Hipot Warning!

Possible electric shock! 

Cirris hipot testers are designed to be safe for operators. Injuries from hipot testing are rare; however, not every hipot test situation is safe. Hipot testing is not a danger to healthy individuals. At times an occasional mild electric shock may be experienced. Small shocks only occur during a hipot test when the operator touches an energized connection point. Any shock from the tester may result in a hipot test failure.

Medical Warning!

A child or individual wearing a cardiac pacemaker, an insulin pump, or an electronically controlled medical device should NOT perform Hipot testing.

For more information on improving hipot safety visit:
www.cirris.com/testing/guidelines/hipot_safety.html

Setting Up

Performance Verification Certificate and Data Sheet

You will find the Easy-Touch Pro Performance Verification Certificate and Verification Data Sheet at the end of this manual. You can record verification data on these documents for your records. If you use these documents, make photocopies to maintain master copies for future use.

Install Add-On Scanners

The examples in this manual use an Easy-Touch Pro with no expansion boxes.

Install add-on scanners if you have any. For instructions, see your Easy-Touch Pro User Manual.

Note: *Before performing any of the tests in this manual, remove all adapters from the tester (including from the add-on boxes) except for the adapters needed for verification. Failing to remove unnecessary adapters could result in the wrong signature and cause a failure even when the tester is functioning correctly.*

Plug in the Tester

Plug one end of the power cord into the tester. Plug the other end into a grounded outlet.

Parts List

Make sure you received the following parts:

- ❑ Zero Ohm Adapter

- ❑ Capacitance/Fourwire Adapter

- ❑ Resistor Leak Adapter

Required Tools (not provided by Cirris)

- ❑ Voltmeter

A calibrated multimeter capable of measuring DC voltages within a range of .05 to 1.5 volts (2 volts on testers equipped with optional 2000-volt scanners) with an accuracy of ±1%, such as a Fluke 80 Series meter or equivalent. The meter must have an input impedance of 10 megohms (±10%). Bench multimeters, such as Keysight units, typically do not meet this input impedance requirement.

- ❑ High Voltage Probe

A high voltage probe with a 1000:1 voltage divider, accuracy of ±1% or better and a nominal input impedance of 75 megohms, such as the Fluke 80K-6.

(use alligator clip test lead to connect probe tip to terminal on HV adapter)

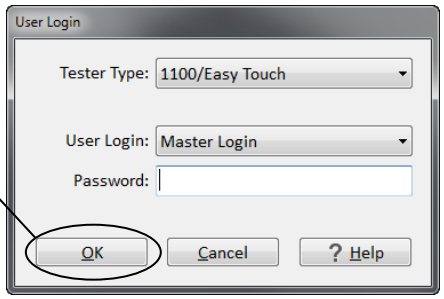
Caution! Your voltmeter may be damaged if a high voltage probe is not used as instructed in this manual. Voltages as high as 2000 VDC may be measured during the verification process and many multimeters have a measurement range that extends to only 1000 VDC. A high voltage probe is required for all voltage measurements.

Creating a Category

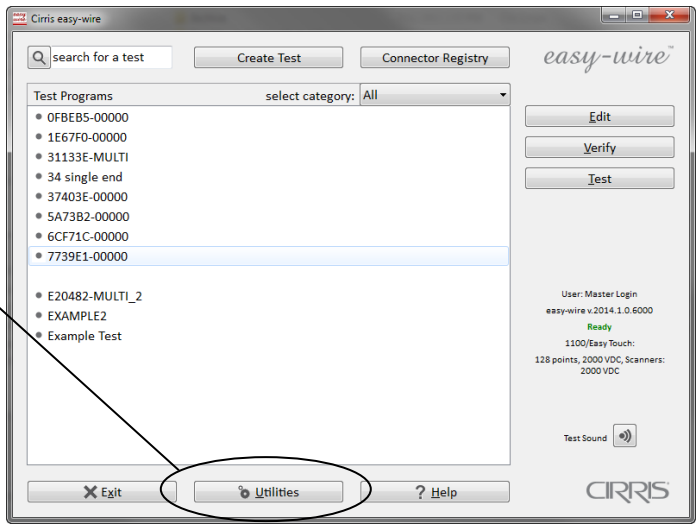
In the Easy-Wire® software, you can organize test programs into groups by assigning them to different categories. You can also create custom test program categories. The steps below illustrate how to create a category for your verification test files.

1. On the back of your Easy-Touch Pro tester, push in the power button for a few seconds to power on the tester.

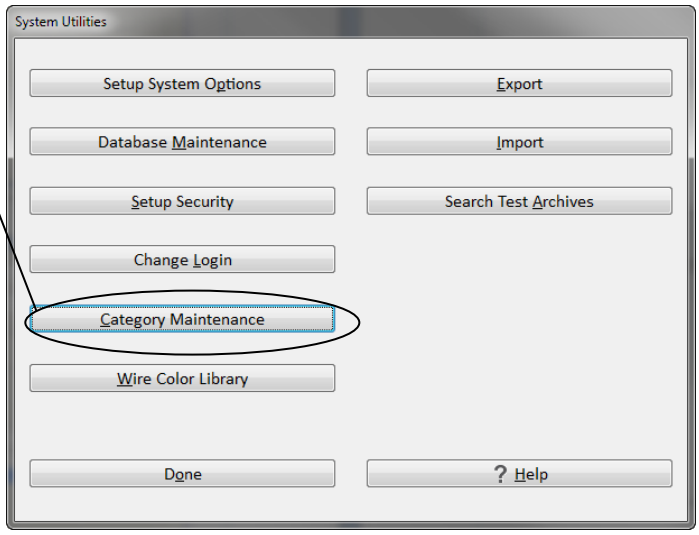
2. When the “User Login” window opens, log in to Easy-Wire.



3. In the Easy-Wire main menu, press **‘Utilities’.**



4. Press **'Category Maintenance'.**



5. In the "Categories" window, do the following:

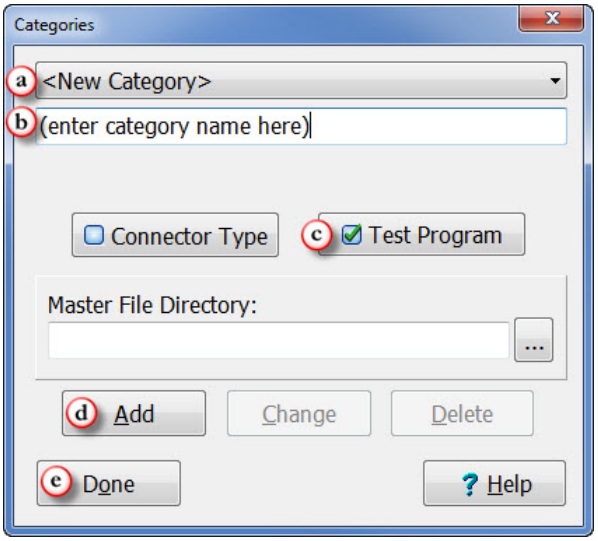
   a. Select <New Category> in the first text box.

   b. Enter a name, such as Verification, for the category in the second text box.

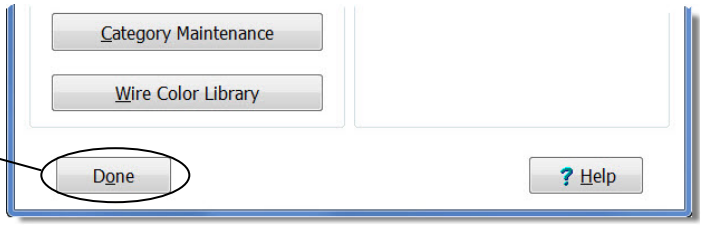
   c. Check the "Test Program" box.

   d. Press **'Add'.**

   e. Press **'Done'.**

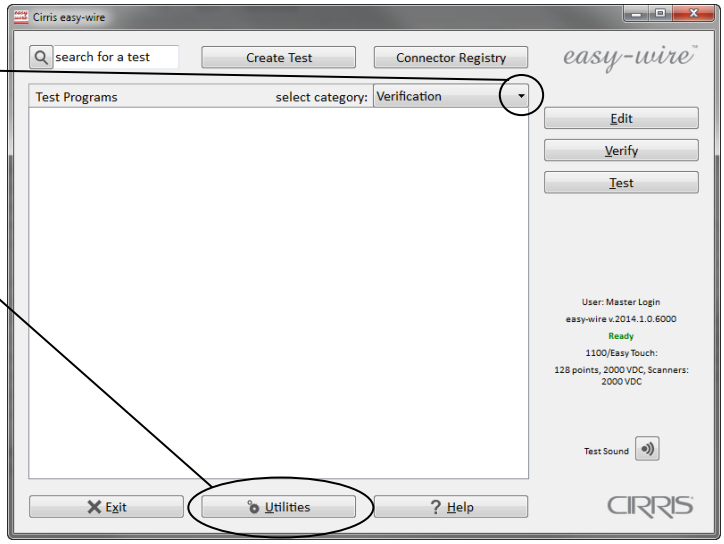


6. Press **'Done'** to return to the main menu**.**

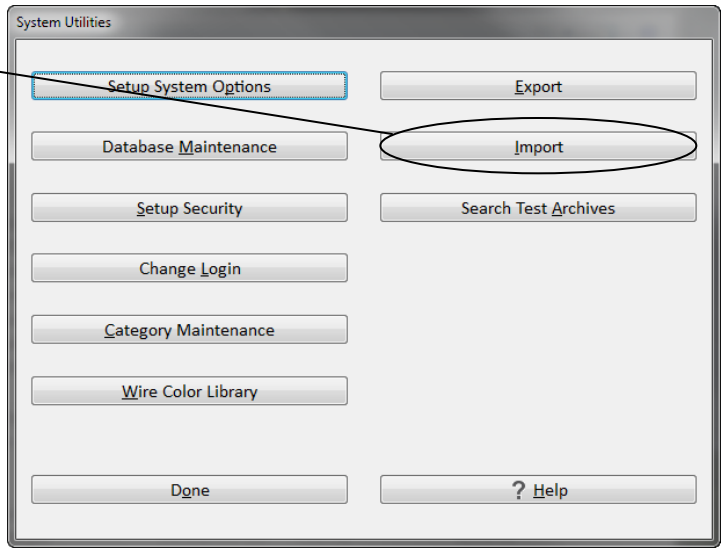


Importing the Test Files

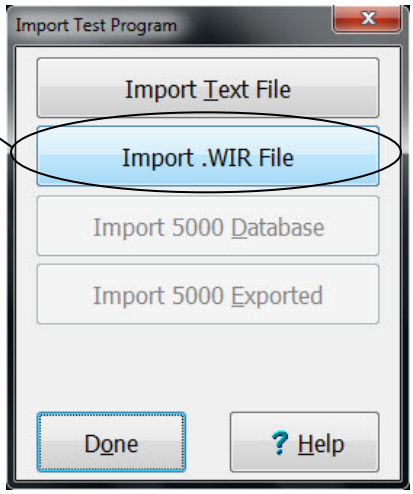
1. In the Easy-Wire main menu, select the category you created in the previous section and press **'Utilities'**.



2. Press **'Import'.**

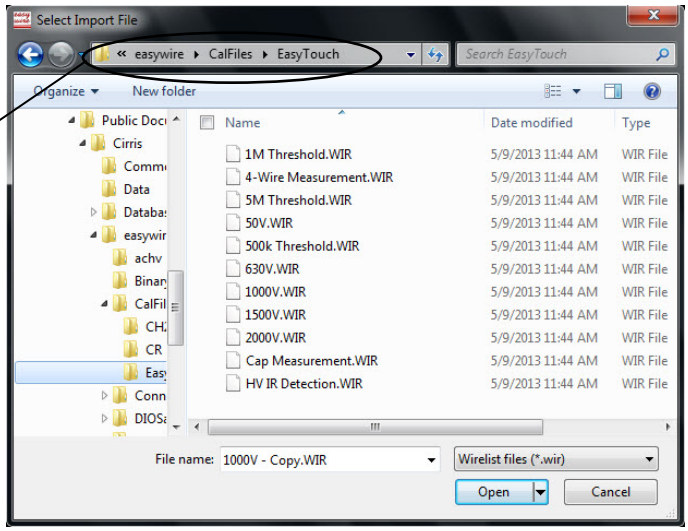


3. Press **'Import .WIR File'.**

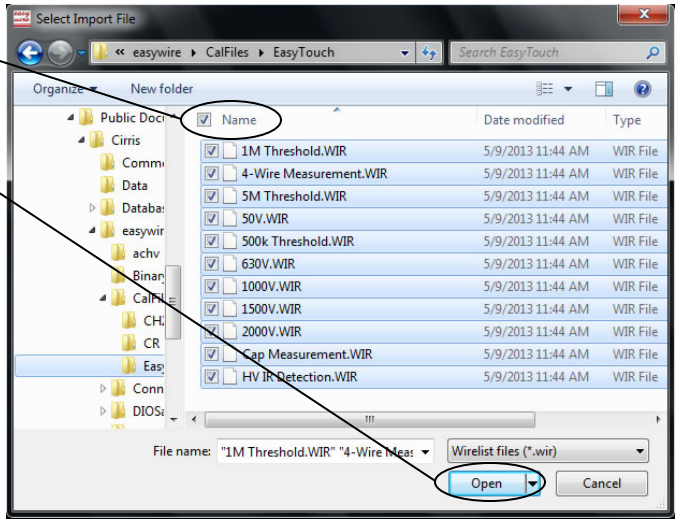


4. Navigate to the file path below:

   `C:\Users\Public\`
   `Public Documents\`
   `Cirris\easywire`
   `\CalFiles\EasyTouch`



5. Press the "Name" check box to select all of the verification files as shown, and press **'Open'.**

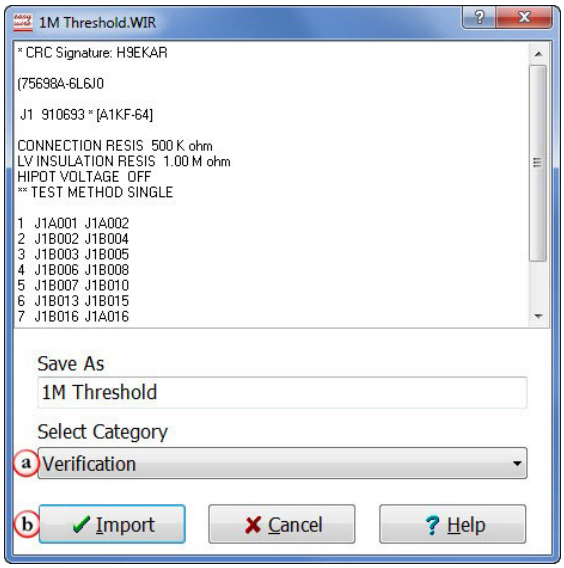


6. In version 2019.1.0 and later, multiple selected files are imported as a group and it won't be possible to select a destination category (one can be assigned later by right-clicking a program name in the Main Menu).

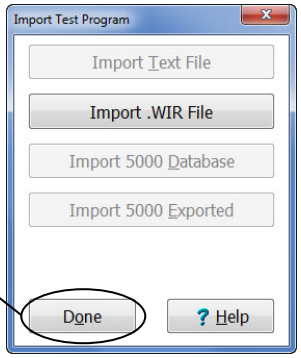
   In earlier versions, or when files are imported individually, the test will be displayed. Do the following:

   a. From the drop down menu, select the verification file category you created.

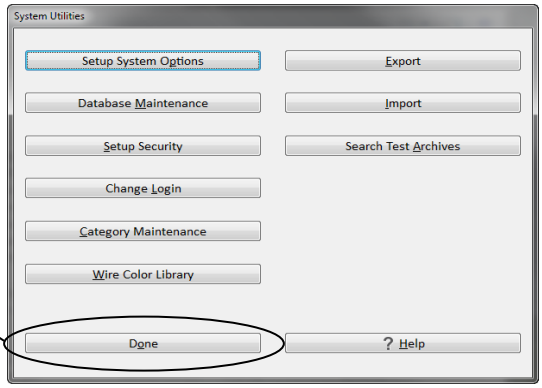
   b. Press **'Import'.**



7. Press **'Done'.**



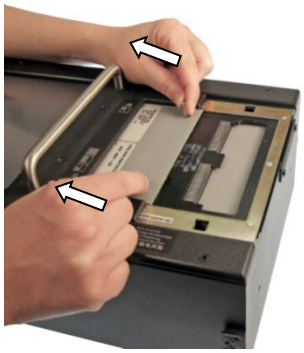
8. Press **'Done'** to return to the main menu.



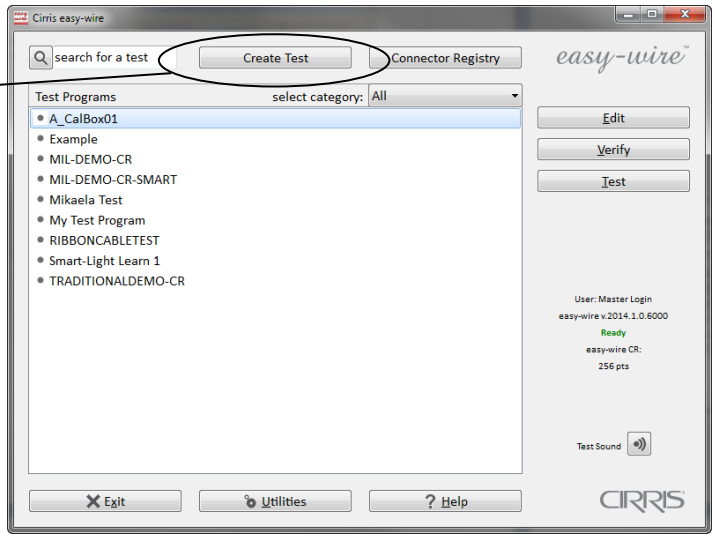
Note: To ensure that you always have the correct test files, re-import the files any time you update Easy-Wire or if you have not run the test in a while. Re-importing test files guarantees version control.

Signal Routing System Test

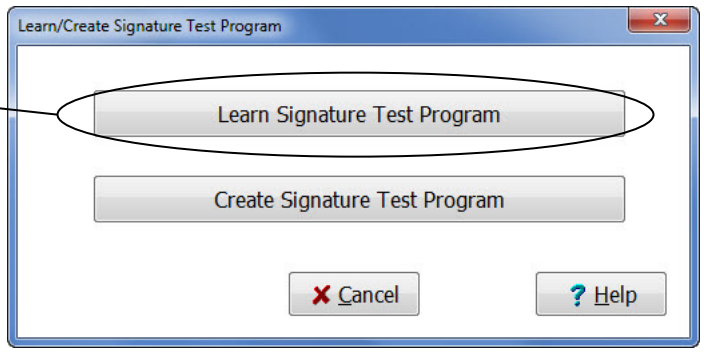
1. Install the Zero Ohm Adapter in the J1-J2 position as shown.



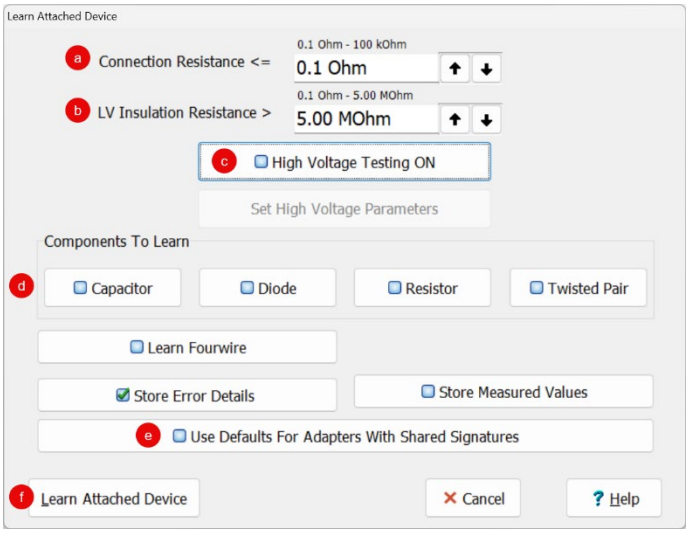
2. In the Easy-Wire main menu, press **‘Create Test’.**



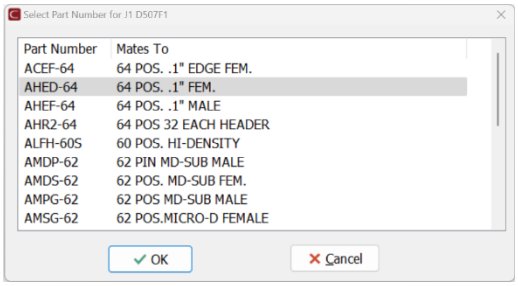
3. Press **‘Learn Signature Test Program’.**



4. In the “Learn Attached Device” window, do the following:
   a. Set the “Connection Resistance” to **0.1 Ohm.**
   b. Set the “LV Insulation Resistance” to **5.00 MOhm.**
   c. **Clear** the “High Voltage Testing ON” checkbox.
   d. **Clear** all component boxes.
   e. If your software contains the **“Use Defaults For Adapters With Shared Signatures”** box, make sure it is NOT checked.
   f. Click **‘Learn Attached Device’.**



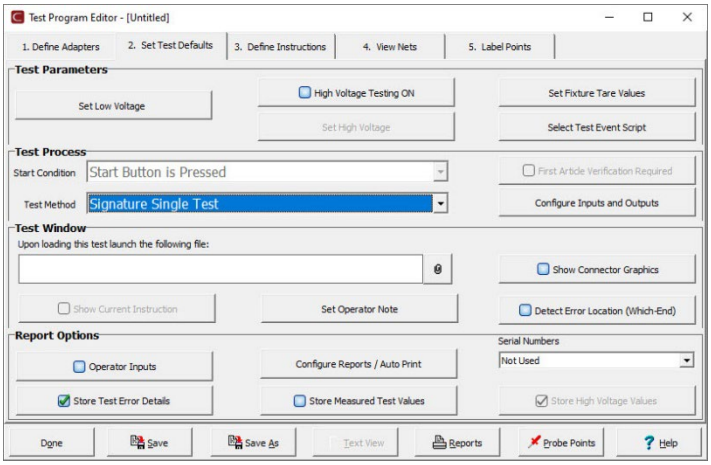
5. In the window that opens, select **AHED-64** as the adapter type and click **OK**.



6. In order to view the signature of the adapter, you must be in a Signature Mode test.

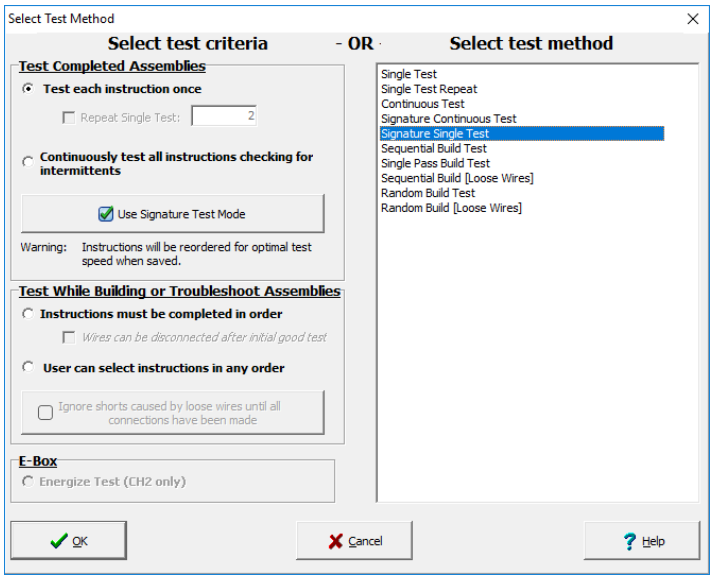
   Go to Tab 2 Set Test Defaults to verify that the Test Method is set to **Signature Single Test** or **Signature Continuous Test.**

   If you are not in a Signature Test method, click on the drop-down box next to Test Method

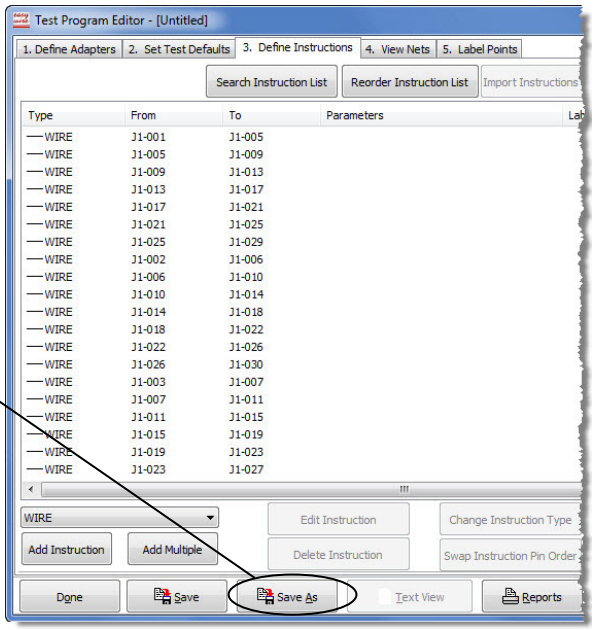


7. A separate window will open and display multiple test options. In the “Select Test Method” column, select a Signature test.

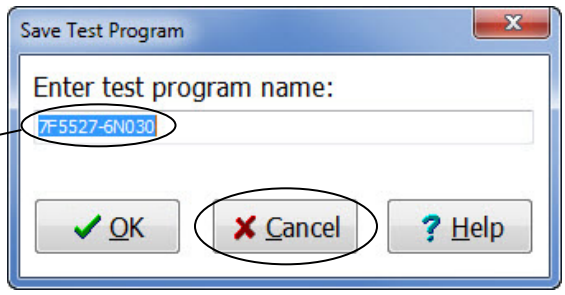
   - **Continuous Test:** Similar to a Single Test but continues repeating until all errors are solved. A Continuous Test allows the operator to move the cable around in an effort to catch intermittent failures such as loose connections. Test will continue to run until the Stop button is pressed.
   - **Signature Single Test:** The tester will perform the specified low voltage tests once. This method is fastest.



8. To view the signature, press **‘Save As’,** but <u>do not save the test!</u>



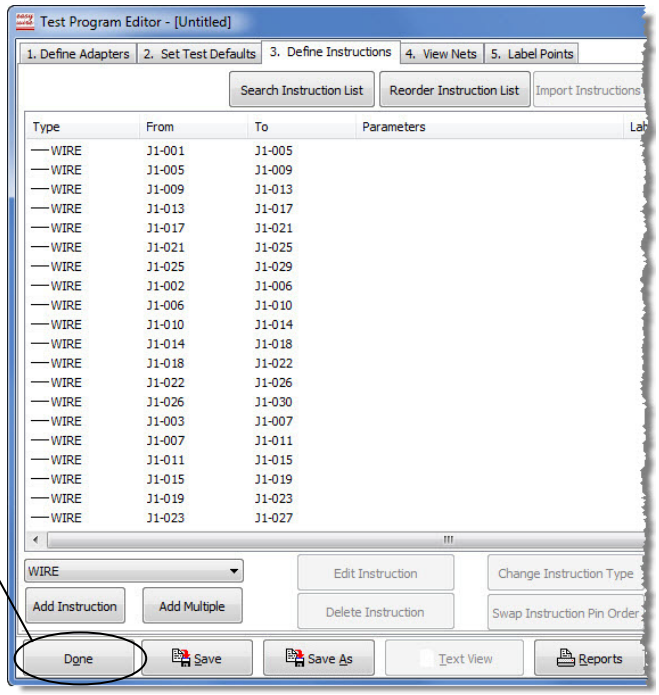
9. If the displayed signature matches the correct signature on the verification data sheet under “Signal Routing System Test”, check **Pass**; otherwise, check **Fail**.



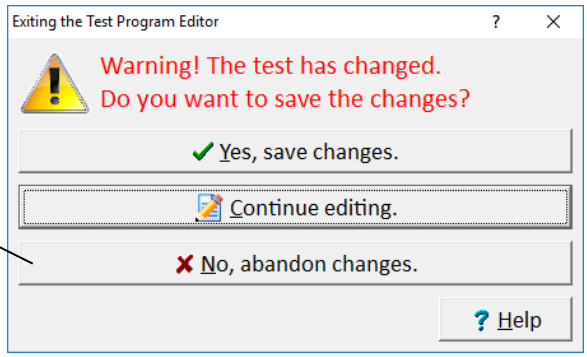
Note: If you do not see the signature displayed and the box reads “untitled”, change the test method to Signature Single Test by canceling, selecting Tab 2, and changing the test method to Signature Single Test. Click Save again to see the signature appear in the box.

10. When you are finished viewing the signature, press **‘Cancel’.**

11. In the Test Program Editor, press **‘Done’.**



12. Select “Abandon changes and return to the main menu” and press **‘OK’.**



13. Install the Zero Ohm Adapter in the J3-J4 position, and repeat steps 2-12. In step 8, you can compare the signature with correct signature in Table 1 below.

14. If you installed add-on scanners, move the Zero Ohm Adapter to each subsequent “J” position and repeat steps 2-12 for each test.

    Table 1 lists the correct signatures for the adapter “J” positions.

Zero Ohm “J” Position Signatures				
“J” Position	**Correct Signature**		**“J” Position**	**Correct Signature**
J1-J2	7F5527-6N030		J17-J18	8CE799-6N030
J3-J4	94C424-6N030		J19-J20	18483C-6N030
J5-J6	5CC1A1-6N030		J21-J22	3476BF-6N030
J7-J8	D3A34A-6N030		J23-J24	B5D5D5-6N030
J9-J10	51A15E-6N030		J25-J26	1E83A5-6N030
J11-J12	C50EFB-6N030		J27-J28	8A2C00-6N030
J13-J14	E93078-6N030		J29-J30	A61283-6N030
J15-J16	719A99-6N030		J31-J32	3BA461-6N030

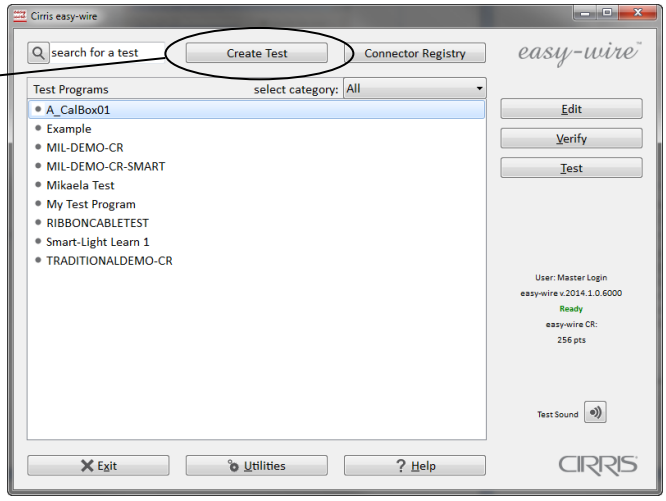
Table 1

15. Remove the Zero Ohm Adapter.

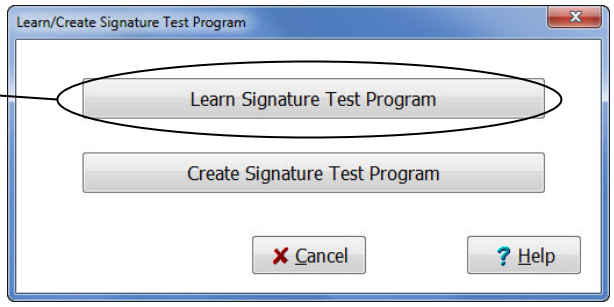
Resistance Measurement System Test

1. Install the Resistor Leak Adapter in the J1-J2 position as shown.

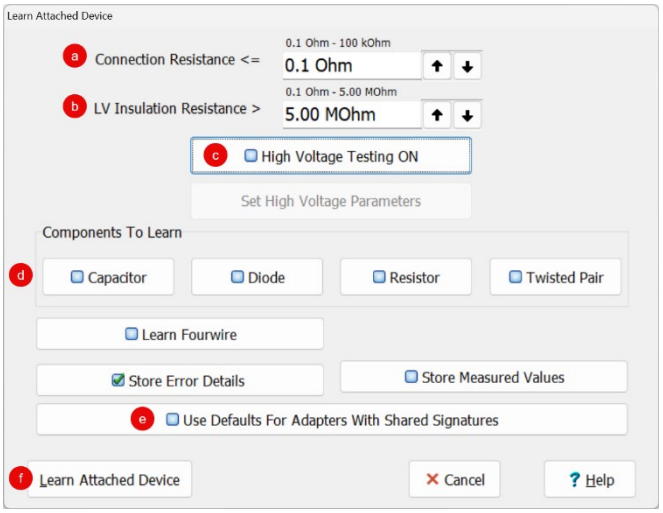
2. In the Easy-Wire main menu, press **‘Create Test’.**



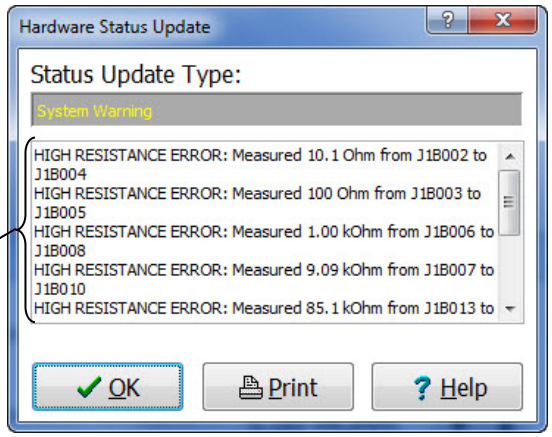
3. Press **‘Learn Signature Test Program’.**



4. In the “Learn Attached Device” window, do the following:
   a. Set the “Connection Resistance” to **0.1 Ohm.**
   b. Set the “LV Insulation Resistance” to **5.00 MOhm.**
   c. **Clear** the “High Voltage Testing ON” checkbox.
   d. **Clear** all component boxes.
   e. If your software contains the **“Use Defaults For Adapters With Shared Signatures”** box, make sure it is NOT checked.
   f. Click **‘Learn Attached Device’.**



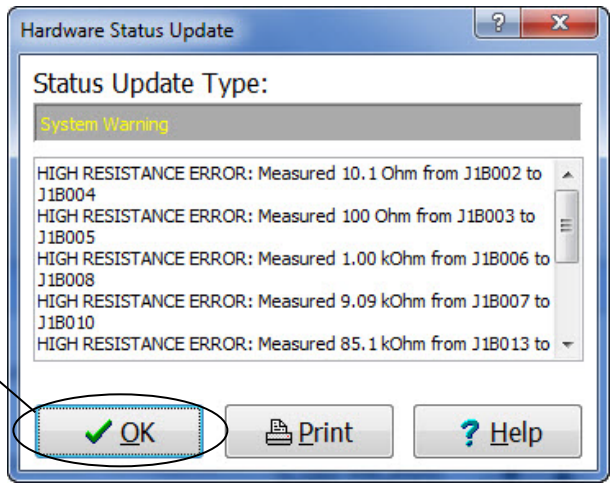
5. Record each Measured value in the “Hardware Status Update” window on the verification data sheet under “Resistence Measurement System Test”. If the value is between the minimum and maximum limits shown in Table 2 below, check **Pass**; otherwise, check **Fail**.



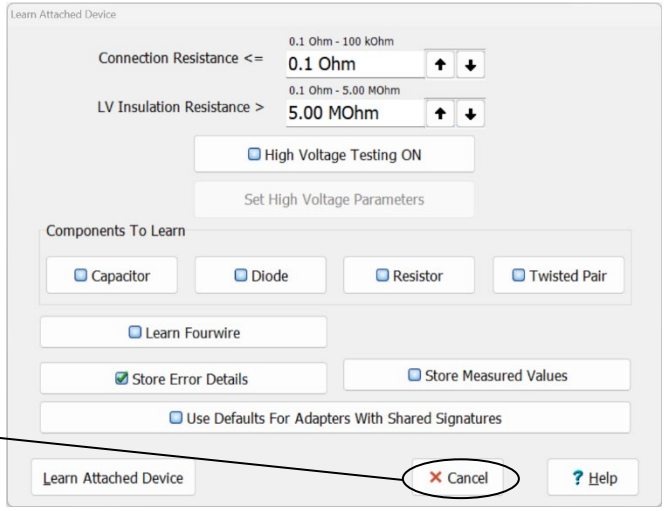
Resistance Measurement			
Resistor Positions	**Correct Resistance**	**Minimum Limit**	**Maximum Limit**
J1B002-J1B004	10.00 Ω	9.80 Ω	10.20 Ω
J1B003-J1B005	100.0 Ω	98.9 Ω	101.1 Ω
J1B006-J1B008	1,000 Ω	989.9 Ω	1,010.1 Ω
J1B007-J1B010	9,090 Ω	8,999 Ω	9,181 Ω
J1B013-J1B015	85.00K Ω	84.15K Ω	85.85K Ω
J1B016-J1A016	404.1K Ω	363.69K Ω	444.51K Ω
J1A020-J1A021	3.806M Ω	3.4254M Ω	4.1866M Ω
J1A022-J1A023	592.0K Ω	532.8K Ω	651.2K Ω

Table 2

6. When you are done recording the measured values, press **‘OK’.**



7. Press **‘Cancel’** to return to the main menu.



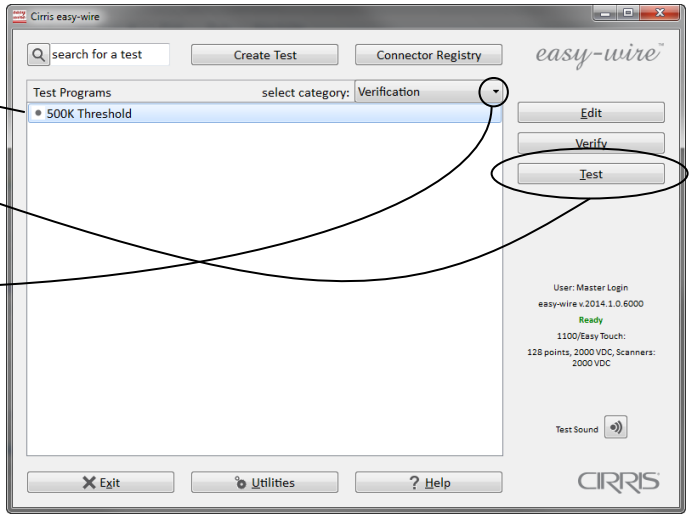
Resistance Threshold System Test

500k Ω

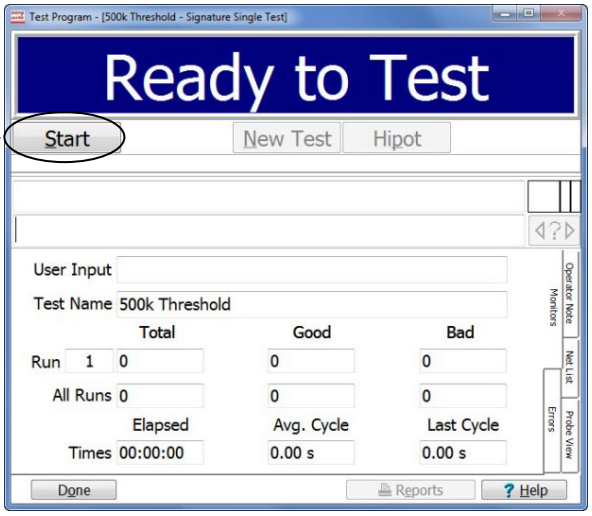
1. Ensure that the Resistor Leak Adapter is in the J1-J2 position as shown.

2. In the Easy-Wire main menu, select “500k Threshold” from the list, and press **‘Test’.**

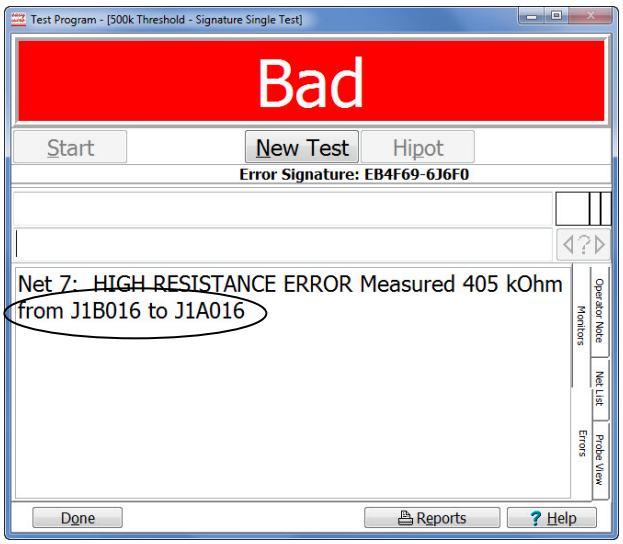
   Note: The proper category must be selected to view the verification files as a group.



3. When the information bar at the top displays “Ready to Test”, press **‘Start’.**

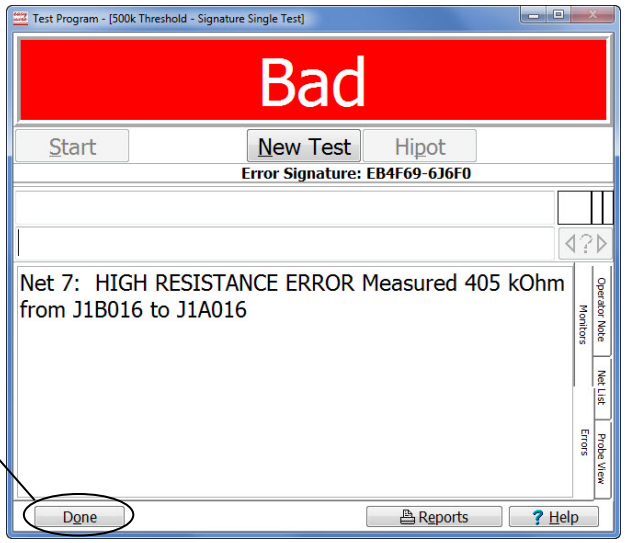


4. The test window should display “HIGH RESISTENCE ERROR”. If the failed points are from J1B016 to J1A016, check **Pass** on the verification sheet under “Resistance Threshold System Test, 500k Ω”; otherwise check **Fail**.



Note: The actual measured value for this part of the test is irrelevant and does not need to be recorded.

5. Press **‘Done’** to return to the main menu.



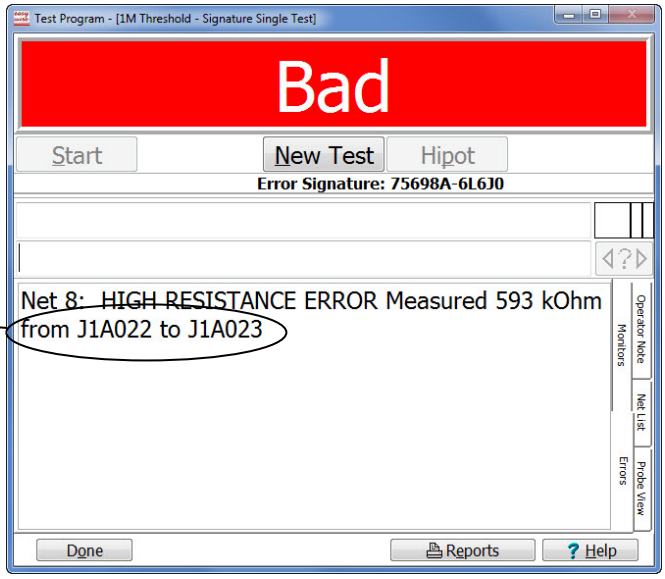
1M Ω

1. Ensure that the Resistor Leak Adapter is in the J1-J2 position as shown.

2. In the Easy-Wire main menu, select "1M Threshold" and press **'Test'.**

3. When the information bar at the top displays "Ready to Test", press **'Start'.**

4. The test window should display "HIGH RESISTENCE ERROR". If the failed points are from J1A022 to J1A023, check **Pass** on the verification sheet under "Resistance Threshold System Test, 1M Ω"; otherwise check **Fail**.



Note: The actual measured value for this part of the test is irrelevant and does not need to be recorded.

5. In the test window, press **'Done'** to return to the main menu.

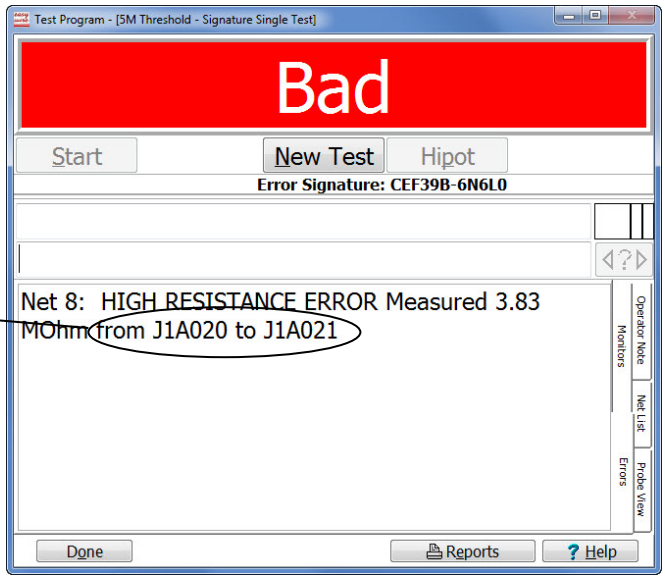
5M Ω

1. Ensure that the Resistor Leak Adapter is in the J1-J2 position as shown.

2. In the Easy-Wire main menu, select “5M Threshold” and press **‘Test’.**

3. When the information bar at the top reads “Ready to Test”, press **‘Start’.**

4. The test window should display “HIGH RESISTENCE ERROR”. If the failed points are from J1A020 to J1A021, check **Pass** on the verification sheet under “Resistance Threshold System Test, 5M Ω”; otherwise check **Fail**.



Note: The actual measured value for this part of the test is irrelevant and does not need to be recorded.

5. In the test window, press **‘Done’** to return to the main menu.

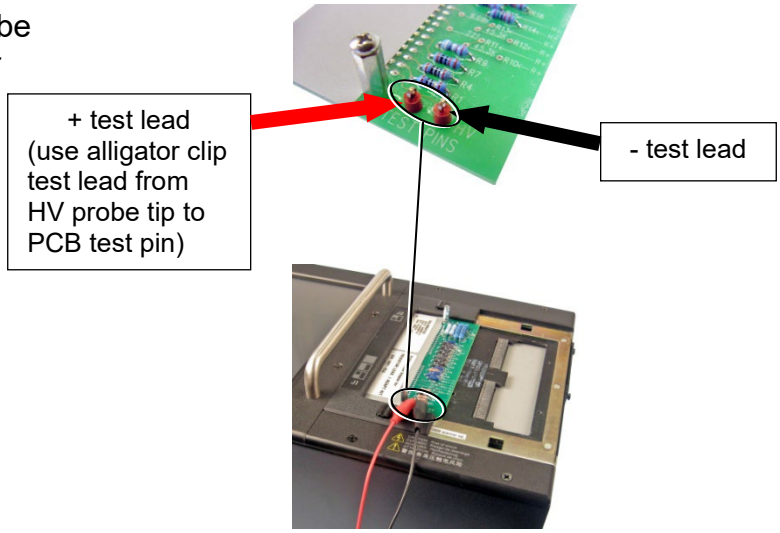
HV System Test

Before you Begin Testing

1. Ensure that the Resistor Leak Adapter is in the J1-J2 position as shown.

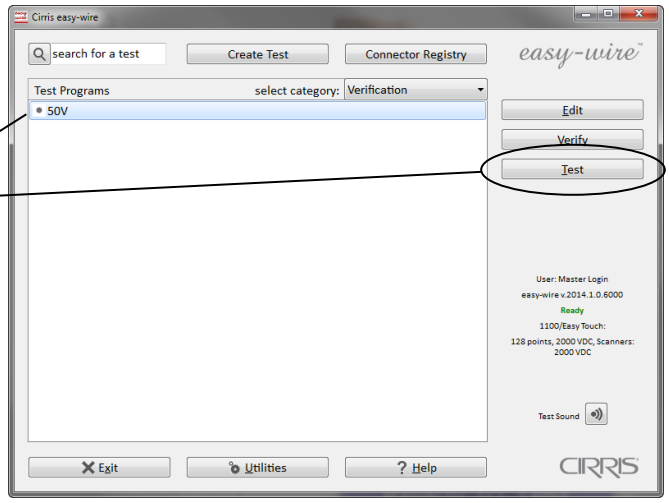
2. Plug the high voltage probe into the Voltmeter.

3. Connect your high voltage probe to the test pins on the Resistor Leak adapter as shown.

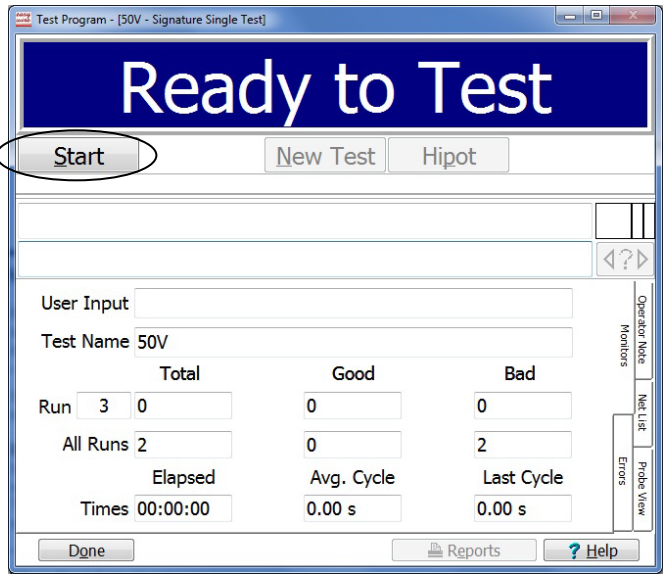


50 Volt

1. In the Easy-Wire main menu, select “50V” and press **‘Test’.**

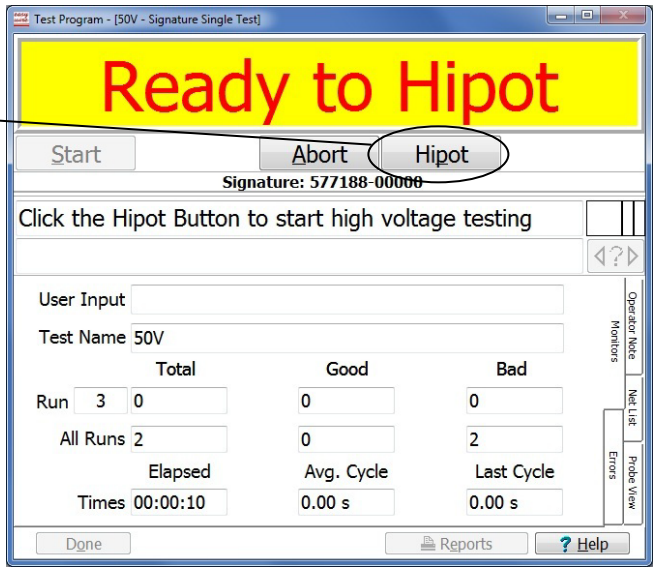


2. When the information bar at the top displays “Ready toTest”, press **‘Start’.**



Be ready to read the meter!
When you do the next step, a voltage will appear on the meter. The value will only display for a few seconds.

3. When the information bar displays "Ready to Hipot", press **'Hipot'** and read the meter.



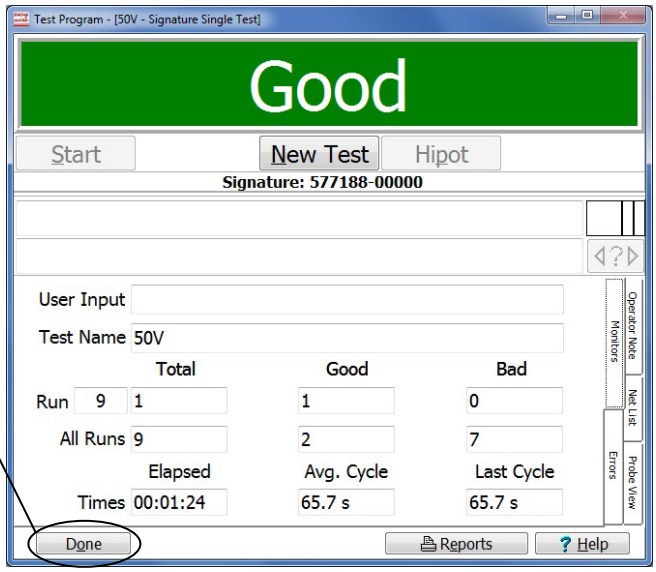
4. Record the voltmeter value on the verification data sheet under "HV System Test, 50 Volt."
   If the voltmeter value is between the minimum and maximum limits shown in Table 3, check **Pass**; otherwise, check **Fail**.

50 Volt Test		
Correct Voltage	**Minimum Limit**	**Maximum Limit**
50 V	45 V	55 V

Table 3

Note: The hipot test takes up to 120 seconds to complete. If the hipot test is still running after this time frame, press **'Abort'** to stop the test.

5. When the information bar displays "Good" or "Bad, press **'Done'** to return to the main menu.



630 Volt

1. In the Easy-Wire main menu, select “630V”and press **‘Test’.**

2. When the information bar displays “Ready to Test”, press **‘Start’.**

Be ready to read the meter!
When you do the next step, a voltage will appear on the meter. The value will only display for a few seconds.

3. When the information bar displays “Ready to Hipot”, press **‘Hipot’** and read the meter.

4. Record the voltmeter value on the verification data sheet under “HV System Test, 630 Volt”. If the voltmeter value is between the minimum and maximum limits shown in Table 4, check **Pass**; otherwise, check **Fail**.

630 Volt Test		
Correct Voltage	**Minimum Limit**	**Maximum Limit**
630 V	599 V	662 V

Table 4

Note: The hipot test takes up to 120 seconds to complete. If the hipot test is still running after this time frame, press **‘Abort’** to stop the test.

5. When the information bar displays “Good” or “Bad”, press **‘Done’** to return to the main menu.

1000 Volt

Caution! Be certain a high voltage probe as specified in the *Setting Up* section of this manual is connected as described above. Your voltmeter may be damaged if you do not take this precaution!

1. In the Easy-Wire main menu, select “1000V” and press **‘Test’.**

2. When the information bar displays “Ready to Test”, press **‘Start’.**

Be ready to read the meter!
When you do the next step, a voltage will appear on the meter. The value will only display for a few seconds.

3. When the information bar displays “Ready to Hipot”, press **‘Hipot’** and read the meter.

4. Record the voltmeter value on the verification sheet under “HV System Test, 1000 Volt.” If the voltmeter value is between the minimum and maximum limits shown in Table 5, check **Pass**; otherwise check **Fail**.

1000 Volt Test		
Correct Voltage	**Minimum Limit**	**Maximum Limit**
1000 V	950 V	1050 V

Table 5

Note: The hipot test takes up to 120 seconds to complete. If the hipot test is still running after this time frame, press **‘Abort’** to stop the test.

5. When the information bar displays “Good” or “Bad”, press **‘Done’** to return to the main menu.

6. Disconnect the clip leads from the Resistance Leak Adapter.

1500 Volt

Caution! Be certain a high voltage probe as specified in the *Setting Up* section of this manual is connected as described above. Your voltmeter may be damaged if you do not take this precaution!

7. In the Easy-Wire main menu, select “1500V” and press **‘Test’.**

8. When the information bar displays “Ready to Test”, press **‘Start’.**

Be ready to read the meter!
When you do the next step, a voltage will appear on the meter. The value will only display for a few seconds.

9. When the information bar displays “Ready to Hipot”, press **‘Hipot’** and read the meter.

10. Record the voltmeter value on the verification sheet under “HV System Test, 1500 Volt.” If the voltmeter value is between the minimum and maximum limits shown in Table 6, check **Pass**; otherwise check **Fail**.

1500 Volt Test		
Correct Voltage	**Minimum Limit**	**Maximum Limit**
1500 V	1425 V	1575 V

Table 6

Note: The hipot test takes up to 120 seconds to complete. If the hipot test is still running after this time frame, press **‘Abort’** to stop the test.

11. When the information bar displays “Good” or “Bad”, press **‘Done’** to return to the main menu.

12. Disconnect the clip leads from the Resistance Leak Adapter.

2000 Volt (only for testers equipped with optional 2000VDC scanners)

Caution! Be certain a high voltage probe as specified in the *Setting Up* section of this manual is connected as described above. Your voltmeter may be damaged if you do not take this precaution!

13. In the Easy-Wire main menu, select “2000V” and press **‘Test’.**

14. When the information bar displays “Ready to Test”, press **‘Start’.**

Be ready to read the meter!
When you do the next step, a voltage will appear on the meter. The value will only display for a few seconds.

15. When the information bar displays “Ready to Hipot”, press **‘Hipot’** and read the meter.

16. Record the voltmeter value on the verification sheet under “HV System Test, 2000 Volt.” If the voltmeter value is between the minimum and maximum limits shown in Table 7, check **Pass**; otherwise check **Fail**.

2000 Volt Test		
Correct Voltage	**Minimum Limit**	**Maximum Limit**
2000 V	1900 V	2100 V

Table 7

Note: These measurements only apply if you have a 2000 V Easy-Touch Pro Unit with 2000 V scanners.

Note: The hipot test takes up to 120 seconds to complete. If the hipot test is still running after this time frame, press **‘Abort’** to stop the test.

17. When the information bar displays “Good” or “Bad”, press **‘Done’** to return to the main menu.

18. Disconnect the clip leads from the Resistance Leak Adapter.

HV Insulation Resistance Detection System Test

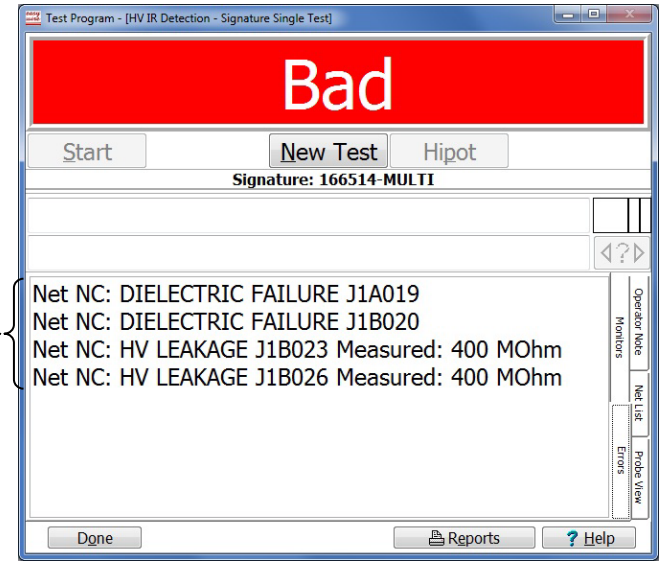
1. Ensure that the Resistor Leak Adapter is in the J1-J2 position as shown.

2. In the Easy-Wire main menu, select “HV IR Detection”and press **‘Test’.**

3. When the information bar displays “Ready to Test”, press **‘Start’.**

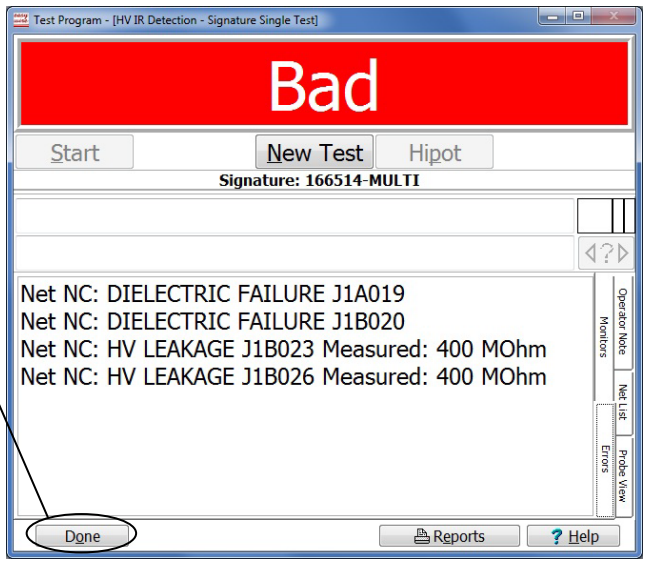
4. When the information bar displays “Ready to Hipot”, press **‘Hipot’.**

5. If the test window only reports the four high voltage errors shown, check **Pass** on the verification sheet under “HV Insulation Resistance Detection System Test” otherwise, check **Fail**.

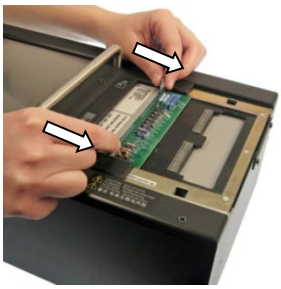


Note: The actual measured value for the error will vary on each tester.

6. In the test window, press **'Done'** to return to the main menu.

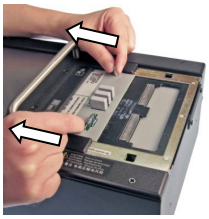


7. Remove the Resistant Leak Adapter from the tester.



Capacitance Measurement System Test

1. Install the Capacitance/4-Wire Adapter in the J1-J2 position as shown.

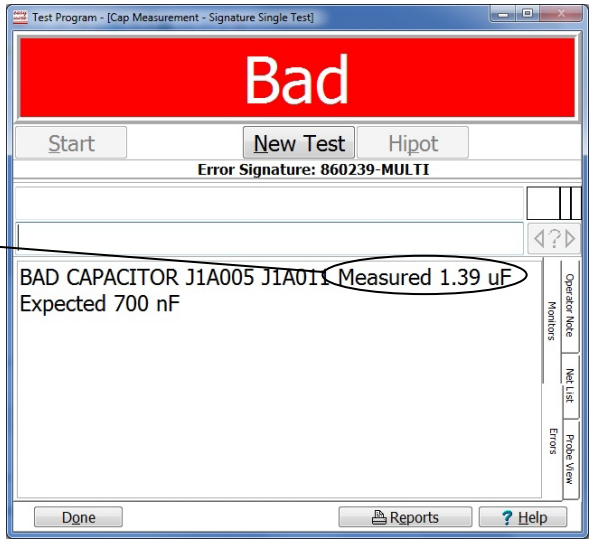


2. In the Easy-Wire main menu, select “Cap Measurement” and press **‘Test’.**

3. When the information bar displays “Ready to Test”, press **‘Start’.**

4. The information bar will display “Bad.” Record the Measured Value on the verification data sheet under “Capacitance Measurement System.”

   Check **Pass** if the measured value is between the minimum and maximum limits shown in Table 8. Otherwise check **Fail**.



Capacitance Measurement		
Correct Capacitance	**Minimum Capacitance**	**Maximum Capacitance**
1.41 µF	1.27 µF	1.55 µF

Table 8

5. In the test window, press **‘Done’** to return to the main menu.

4-Wire Measurement System Test

1. Ensure that the Capacitance/4-Wire Adapter is in the J1-J2 position as shown.

2. In the Easy-Wire main menu, select “4-Wire Measurement”, and press **‘Test’.**

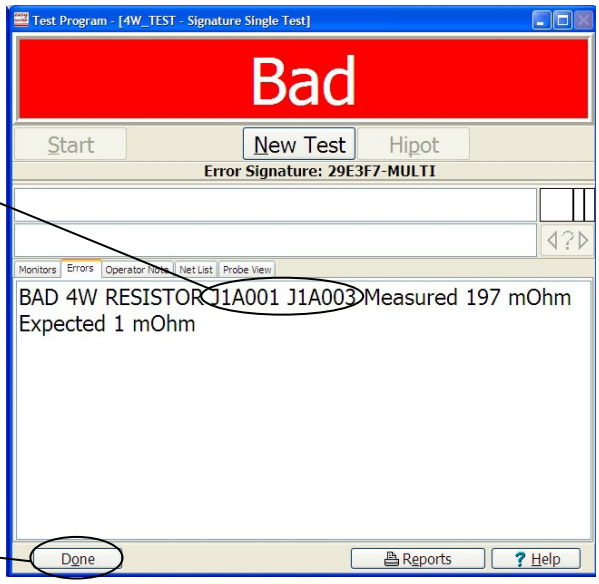
3. When the information bar reads “Ready to Test”, press **‘Start’.**

4. The information bar will read “Bad”.

5. Verify that the “Bad 4W Resistor” reads J1A001 and J1A003.

6. On the verification data sheet under “4-Wire Measurement System”, check **Pass** if the measured value is between 195 and 205 mOhm. Otherwise check **Fail**.

7. Press **‘Done’.**



8. Remove the Capacitance/4-Wire Adapter from the tester.

Appendix

The following references and suggestions may be useful to those new to formal calibration and quality practices.

Standards

The ANSI/NCSL Z540.3 and ISO 17025 standards document requirements for the calibration of measuring and test equipment. The Z540.3 standard can be acquired from the National Conference of Standards Laboratories International (NCSL) at www.ncsli.org. The ISO standard can be acquired from the International Standards Organization (ISO) on their web site www.iso.net. Both standards provide valuable insight into calibration best practices.

Foundational Calibration Principles

Recall System

Use a tickler card file or computerized database recall system to ensure that measurement equipment is calibrated on schedule. This system should include calibration dates, due dates, calibration sources, and any other pertinent information.

Verification Labels

After calibration / verification, the quality standards require that a label indicating the calibration status be affixed to the instrument. This ensures that users will have ready access to the calibration status and helps avoid the inadvertent use of uncalibrated, or out-of-calibration, measurement equipment. The labels should include the instrument serial number, the calibration date, the calibration due date, and the name of the individual that performed the calibration. A good source of inexpensive labels is United Ad Label (www.unitedadlabel.com).

Measurement Uncertainty

Older standards referenced TUR (test uncertainty ratio) or TAR (test accuracy ratio) and suggested a 4:1 ratio between the accuracy of the measurement instrument and the accuracy of the instrument being calibrated. However, current standards emphasize the calculated measurement uncertainty. Many excellent resources that address the subject are available on the Internet.

Performance Verification Certificate

The Performance Verification Certificate is a record of who, when, and with what equipment the instrument was calibrated / verified. A suggested Performance Verification Certificate is provided later in this appendix.

Calibration Data

Supporting verification measurement data can be recorded as described in this manual.

Traceability

Traceability refers to each unbroken link of valid verifications going back to national standards such as those maintained by the NIST in the United States. To maintain traceability, qualified personnel must perform the performance verification under controlled conditions, using correctly calibrated instruments with acceptable accuracy.

Easy-Touch Pro Performance Verification Certificate

Name and Address of Organization:	
Certificate Number:	**Performed by:**
Date:	**Due Date:**
Applicable Quality Standard(s):	**Procedure:** Easy-Touch Pro Performance Verification-Version _____
Temperature:	**Relative Humidity:**
Tester Serial Number:	

Instruments used:	**Serial Number**	**Cal. Date**	**Due Date**
Zero Ohm Adapter			
Resistor Leak Adapter			
Capacitance/Fourwire Adapter			
Voltmeter			

Statement of Traceablility:

Certified by:

Easy-Touch Pro Verification Data Sheet

Date: _____
Tester Serial Number: _____
Tests Performed By: _____

Signal Routing System

J Position for Adapter	Correct Signature	Displayed Signature	Pass	Fail
J1-J2	7F5527-6N030			
J3-J4	94C424-6N030			
J5-J6	5CC1A1-6N030			
J7-J8	D3A34A-6N030			
J9-J10	51A15E-6N030			
J11-J12	C50EFB-6N030			
J13-J14	E93078-6N030			
J15-J16	719A99-6N030			
J17-J18	8CE799-6N030			
J19-J20	18483C-6N030			
J21-J22	3476BF-6N030			
J23-J24	B5D5D5-6N030			
J25-J26	1E83A5-6N030			
J27-J28	8A2C00-6N030			
J29-J30	A61283-6N030			
J31-J32	3BA461-6N030			

Resistance Measurement System

Resistor Positions	Correct Resistance	Minimum Limit	Maximum Limit	Displayed Value	Pass	Fail
J1B002-J1B004	10.00 Ω	9.80 Ω	10.20 Ω			
J1B003-J1B005	100.0 Ω	98.9 Ω	101.1 Ω			
J1B006-J1B008	1,000 Ω	989.9 Ω	1,010.1 Ω			
J1B007-J1B010	9,090 Ω	8,999 Ω	9,181 Ω			
J1B013-J1B015	85.00K Ω	84.15K Ω	85.85K Ω			
J1B016-J1A016	404.1K Ω	363.69K Ω	444.51K Ω			
J1A020-J1A021	3.806M Ω	3.4254M Ω	4.1866M Ω			
J1A022-J1A023	592.0K Ω	532.8K Ω	651.2K Ω			

Resistance Threshold System

- **500 kΩ Test**

High Resistance Error between:	Pass	Fail
J1B016 and J1A016		

- **1 MΩ Test**

High Resistance Error between:	Pass	Fail
J1A022 and J1A023		

- **5 MΩ Test**

High Resistance Error between:	Pass	Fail
J1A020 and J1A021		

HV System Test

- **50 Volt Test**

Correct Voltage	Minimum Voltage	Maximum Voltage	Displayed Value	Pass	Fail
50 V	45 V	55 V			

- **630 Volt Test**

Correct Voltage	Minimum Voltage	Maximum Voltage	Displayed Value	Pass	Fail
630 V	599 V	662 V			

- **1000 Volt Test**

Correct Voltage	Minimum Voltage	Maximum Voltage	Displayed Value	Pass	Fail
1000 V	950 V	1050 V			

- **1500 Volt Test**

Correct Voltage	Minimum Voltage	Maximum Voltage	Displayed Value	Pass	Fail
1500 V	1425 V	1575 V			

- **2000 Volt Test (Optional)**

Correct Voltage	Minimum Voltage	Maximum Voltage	Displayed Value	Pass	Fail
2000 V	1900 V	2100 V			

HV Insulation Resistance Detection System

Dielectric Failure at:	Pass	Fail
J1A019		

Dielectric Failure at:	Pass	Fail
J1B020		

HV Leakage at:	Pass	Fail
J1B023 (measured value: 360-440M Ω)		

HV Leakage at:	Pass	Fail
J1B026 (measured value: 360-440M Ω)		

Capacitance Measurement System

Correct Capacitance	Minimum Capacitance	Maximum Capacitance	Displayed Measured Value	Pass	Fail
1.41 µF	1.27 µF	1.55 µF			

4-Wire Measurement System

Bad 4W Resistor Error between J1A001 and J1A003	Minimum Value	Maximum Value	Pass	Fail
0.2 Ω ± 2% ± 0.001 Ω	0.195 Ω	0.205 Ω		