MTI Part Number 7000-8028
Revision 5.0 – 27 May 2014

1510A Calibration Kit PN 8000-7152

Operation Manual

This item is PART 1 of 2 of NSN 4940-01-612-5855, PN 8000-7151-AF

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1510A

CALIBRATION KIT PN 8000-7152

Operation Manual

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LIST OF CHANGES

Rev.	Date	Description
C	11/01/12	All sections released
D	04/11/13	All sections reformatted
5.0	05/27/14	ECN 4458

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FOREWORD

The 1510A Calibration Kit is used to precisely calibrate and align the voltage and charge output channels of the 1510A Precision Signal Source. The kit is comprised of a number of various components including a Precision Charge Adapter, several cables and software which must be loaded on a PC style computer. Using this kit to check the calibration and re-calibrate your 1510A Precision Signal Source is the only way to ensure that the charge outputs of the 1510A are accurately calibrated.

This manual provides operation and maintenance instructions for the 1510A Calibration Kit, along with instructions for installing the support software package, and the re-calibration of the Precision Charge Calibration Adapter contained within this kit.

The information and instructions contained within this manual are arranged as follows:

1. Section 1 provides general information about the 1510A Calibration Kit including a description of the various components and a list of specifications for the kit.

2. Section 2 defines the special tools and test equipment required for using the 1510A Calibration Kit and for maintaining and calibrating the kit components.

3. Section 3 provides all the necessary information and instructions to properly prepare the 1510A Calibration Kit for use. This section also includes information and instructions necessary to prepare the kit for shipment or storage.

4. Section 4 contains instructions for safe and proper operation of the 1510A Calibration Kit. Two (2) different procedures are provided:

   Procedure 1 provides instructions for performing an **Acceptance Check** of a 1510A device which checks the accuracy of the outputs of the 1510A.

   Procedure 2 provides instructions for performing a **Calibration (alignment)** of a 1510A device which tests the accuracy of the 1510A, and can update internal calibration coefficients of the unit.

5. Appendix A of this manual contains the Maintenance Manual for the Precision Charge Adapter device. The manual provides detailed instructions for the calibration and alignment of this device.

NOTICE

The PBS-4100 Connection Kit is another accessory developed to provide continued high level performance to products in the PBS-4100 line of engine balancing and vibration monitoring systems manufactured by MTI Instruments Inc. Consequently, references made to either the 1510, the 1510A, PBS-4100, PBS-4100+, or the PBS-4100R and not specifically to the 1510A Calibration Kit should not be considered as typographical or technical errors.

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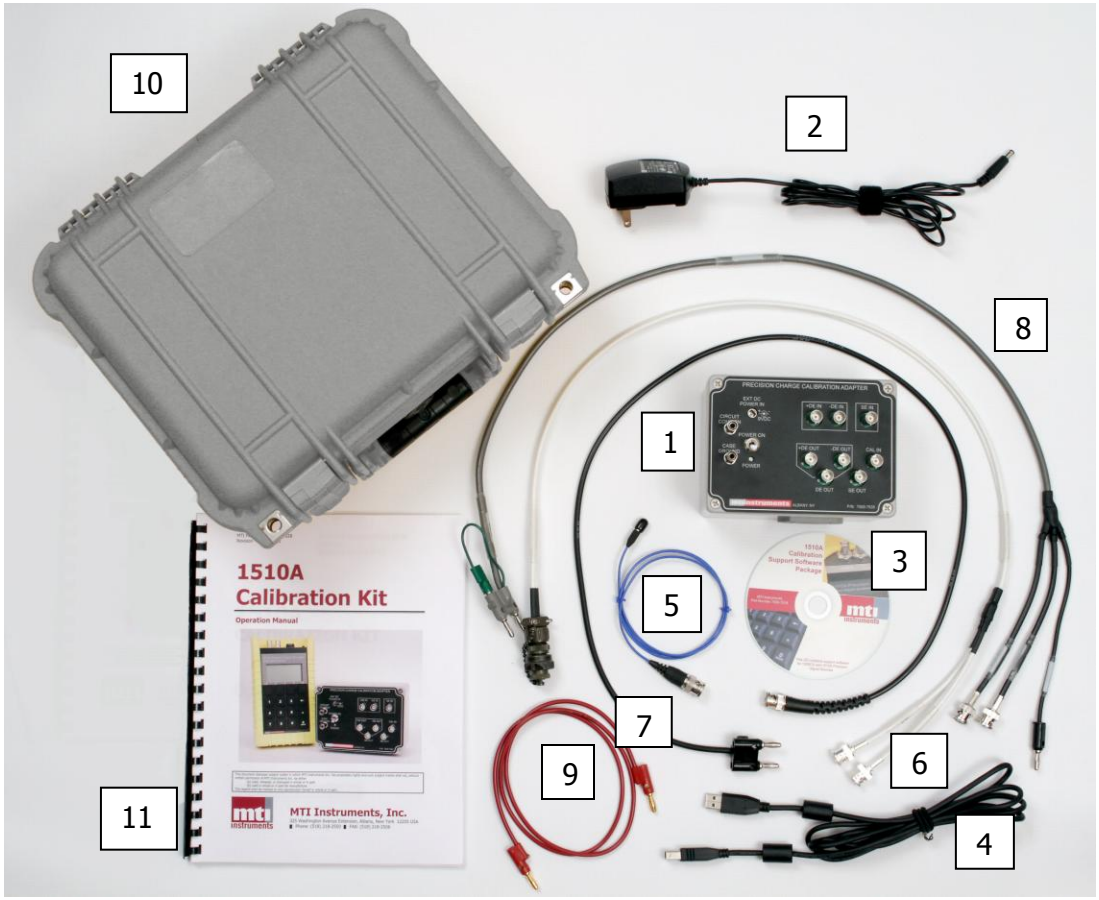
SECTION 1
INTRODUCTION AND GENERAL INFORMATION

1-1 EQUIPMENT DESCRIPTION

1-1.1 Purpose. The 1510A Calibration Kit illustrated below is used to check the calibration and to re-calibrate the charge outputs of the 1510A Precision Signal Source. The kit consists of a Precision Charge Calibration Adapter, a software application that runs on a Windows PC, and a variety of adapter cables. The combination of the equipment, software and a customer supplied high-accuracy digital voltmeter will allow users to perform calibration checks and re-calibration of the voltage and charge output channels of the 1510A Precision Signal Source to factory specifications. The kit has been designed for use in precision test and calibration laboratories.

To ensure the highest level of calibration accuracy, and to minimize procedural errors, the 1510A Calibration Kit includes a software package that provides users with different calibration support routines for the purposes of guiding the calibration check and re-calibration processes.



1510A Calibration Kit, PN 8000-7152

1-1.2 Basic Functional Description. The 1510A Calibration Kit has been designed to support the semi-automated calibration checking and re-calibration of the 1510A Precision Signal Source. The 1510A Calibration Kit will also support the calibration checking and re-calibration of the 1500CS which is an earlier version of the 1510A unit.

The key to the 1510A Calibration Kit is the Calibration Support Software. This software package guides users thru semi-automated processes that command different output values from the device under test, and then require the operator to input voltages measured by a precision voltmeter. Voltmeter readings are then compared to factory acceptable tolerances and a summary report is presented to the operator at the conclusion of the test. Two different procedures are supported by the software package.

> **Calibration Check** - This procedure performs a calibration check of the unit under test. The computer program commands the unit under test to generate precise outputs at various voltage and charge levels. Operators input the measured voltages to the software program, and results are provided to the operator in tabular form. Outputs that are outside of factory allowable limits are highlighted in red to indicate problems.
>
> **Re-Calibration** - A second operation supported by the Support Software Package performs a re-calibration (re-alignment) of the device under test. In this procedure, the computer program commands the unit under test to generate precise outputs at various voltage and charge levels. Operators again input the measured voltages to the software program. After measuring and recording the results of commanded outputs, the re-calibration procedure calculates correction coefficients that can be down-loaded into the device under test. These coefficients are used by the device to correct minor accuracy errors detected during the measurement processes.

The Calibration Support Software also provides guidance and instructions to the users throughout the procedures. Connection diagrams and instructions regarding the use of special connection cables and meters are provided on the computer screen each steep of the process. Operators need only follow the instructions and enter the voltages measured by the meters to progress thru the steps of the procedure. At the conclusion of the process, users are allowed to review and print summary tables that reflect the results of the tests.

Another important component of the 1510A Calibration Kit is the Precision Charge Calibration Adapter. The Precision Charge Calibration Adapter is essential for the checking and recalibration of the charge output signals of the 1510A devices. This electronic device is a precision electronic circuit that accepts Single Ended and Differential Charge Signals and produces precise output voltages proportional to the input charge signal.

1-1.3 Hardware Description. The 1510A Calibration Kit consists of several components to assist in the process of calibration the 1510A Precision Signal source.

Major components of the 1510A Calibration Kit are illustrated in the illustration on page 1-1, and listed in the table below. Further description of the major components is provided in paragraphs 1-1.3.1 through 1-1.3.12.

1510A Calibration Kit Major Components

Figure Index Number	Part Nomenclature
1	Precision Charge Calibration Adapter
2	Power adapter
3	Software Package
4	USB Cable
5	Single Ended Low Noise Calibration Cable
6	Differential Low Noise Calibration Cable
7	Single Ended Output Cable for DVM
8	Differential Output Cable for DVM
9	Grounding Wire
10	Shipping and Storage Case
11	Operator's Manual

User Supplied Items

Item
Precision Digital Volt Meter
PC Computer running Windows Operating system

1-1.3.1 Precision Charge Calibration Adapter, PN 7500-7535. Illustrated and labeled as item #1 in the figure on the first page of this section, the Precision Charge Calibration Adapter is an electronic module that contains precision charge to voltage conversion circuits. The Precision Charge Calibration Adapter is specifically designed to convert charge signals into voltage signals. Many of the components used in the circuit are high precision (0.01% tolerance) components, and some components are matched to better than 0.01 % to ensure high accuracy.

1-1.3.2 Power Adapter. Illustrated and labeled as item #2 in the figure on the first page of this section, the Power Adapter is used to provide 9 volts to the Precision Charge Calibration Adapter.

1-1.3.3 Software Support Package. Illustrated and labeled as item #3 in the figure on the first page of this section, the Software Support Package is a program developed to run on a Windows operating system computer. When used, this package runs a Wizard type program to perform a calibration check or re-alignment of the 1510A under test. The software controls the 1510A, and records measured results. At the conclusion of the test, a summary report is provided to the user. Details of the operation of this software are proved in Section 4.0 of this manual.

1-1.3.4 USB Cable. Illustrated and labeled as item #4 in the figure on the first page of this section, the USB cable is provided to establish communications between the 1510A unit under test and the PC running the calibration support software.

1-1.3.5 Single Ended Low Noise Calibration Cable. Illustrated and labeled as item #5 in the figure on the first page of this section, the Single Ended Low Noise Cable is required to perform calibration checks and re-calibrations of the single ended charge output of the 1510A. This is a special design cable and can not be substituted with other types of cables.

1-1.3.6 Differential Low Noise Calibration Cable. Illustrated and labeled as item #6 in the figure on the first page of this section, the Differential Low Noise Cable is required to perform calibration checks and re-calibrations of the differential charge output of the 1510A. This is a special design cable and can not be substituted with other types of cables.

1-1.3.7 Single Ended Output Cable. Illustrated and labeled as item #7 in the figure on the first page of this section, this cable is used to connect the Charge Calibration Adapter to a high-precision DVM.

1-1.3.8 Differential Output Cable. Illustrated and labeled as item #8 in the figure on the first page of this section, this cable is used to connect the Charge Calibration Adapter to a high-precision DVM. This is a special design cable and can not be substituted with other types of cables.

1-1.3.9 Grounding Cable. Illustrated and labeled as item #9 in the figure on the first page of this section, this cable is only if it is required to ground the Calibration Adapter to the DVM or other instruments.

1-1.3.10 Shipping and Storage Case. Illustrated and labeled as item #10 in the figure on the first page of this section, this case is provided to provide a safe and protected storage place for all of the kit components.

1-1.3.11 Operators Manual. Illustrated and labeled as item #11 in the figure on the first page of this section, this manual is provided to guide user thru the 1510A calibration check and re-calibration procedures.

1-2. CAPABILITIES AND LIMITATIONS

The 1510A Calibration Kit performs the following functions:

- Semi-Automatic check of the accuracy of 1510A Precision Signal Sources
- Semi Re-Calibration (alignment) of 1510A Precision Signal Sources

These functions are accomplished thru the use of a software package designed to control the unit under test and to allow users to record the measured output of the unit under test. It is recommended that the re-calibration (alignment) function not be used to "repair" units that are more than 10% out of calibration. Such a condition is indicative of internal circuit damage and these units need to be returned to the factory for inspection, test, and repair.

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SECTION 2
SPECIAL TOOLS AND TEST EQUIPMENT

2-1 GENERAL

This section covers special tools and test equipment used for maintenance of the 1510A Calibration Kit. If any required item is not available for use during operation and maintenance, equivalent items may be substituted.

2-2 SPECIAL TOOLS

Special tools are not required for general maintenance of the 1510A Calibration Kit. While there are very few user serviceable components, calibration of the Charge Calibration Adapter can be performed and some minor repairs and maintenance of connectors and cables can be accomplished using common hand tools and standard shop practices.

2-3 TEST EQUIPMENT

Test equipment required for calibration checks and calibrations is listed in the table below. Other generally available test equipment such as test leads and coaxial cables will also be required.

User Supplied Equipment for use with the 1510A Calibration Kit		
Description	**Manufacture**	**Model Number**
Digital AC VoltMeter[1]	Fluke	8508A[2]

NOTES:

1 – Voltmeter must have an RMS accuracy of 0.01% (or better) at 1kHz
2 - Or Equivalent

2-4 OTHER ITEMS

Other items such as a Phillips head screw driver, and adjustment screwdriver, and BNC and Banana ended patch cords will be required for calibration activities. These items are generally available in any well-equipped avionics or electronics repair/calibration shop.

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SECTION 3
PREPARATION FOR USE AND SHIPMENT

You may have already unpacked your 1510A Calibration Kit before reading this section of the manual. However, you should read this section carefully so that you are able to properly inspect the system. This information will help you determine if everything you ordered was received and is ready for use.

3-1 UNPACKING AND INSPECTION

Your 1510A Calibration Kit system was carefully packed prior to shipment. However, sometimes shipping problems occur. Please take care in unpacking and inspecting your 1510A Calibration Kit before using it. The following sections describe the recommended precautions.

3-1.1 Unpacking. Upon receipt, you will notice that all items ordered are packaged within a hard shell container. This case is provided to ensure that all components are protected during shipment. You will also find that the case is a convenient way to safely store all components when not in use.

The 1510A Calibration Kit includes:

- Precision Charge Calibration Adapter – MTI Part Number 7500-7535
- Power Adapter – MTI Part Number 4000-0022
- Calibration Kit Software - on CD - MTI Part Number 2075-0023
- Six (6) cables:
  - USB Cable - MTI Part Number 6000-2001
  - 1510A Single Ended Low Noise Cable - MTI Part Number 7500-7531
  - 1510A Differential Low Noise Cable - MTI Part Number 7500-7532
  - Single Ended Calibration Adapter Output Cable - MTI Part Number 7500-7533
  - Differential Calibration Adapter Output Cable - MTI Part Number 7500-7534
  - Grounding Cable – Banana to Banana jumper lead – MTI Part Number 6000-0716
  - Shipping and Storage Case - MTI Part Number 1400-4017
- This manual - MTI Part Number 7000-8028 which includes maintenance instructions for the Precision Charge Calibration Adapter.

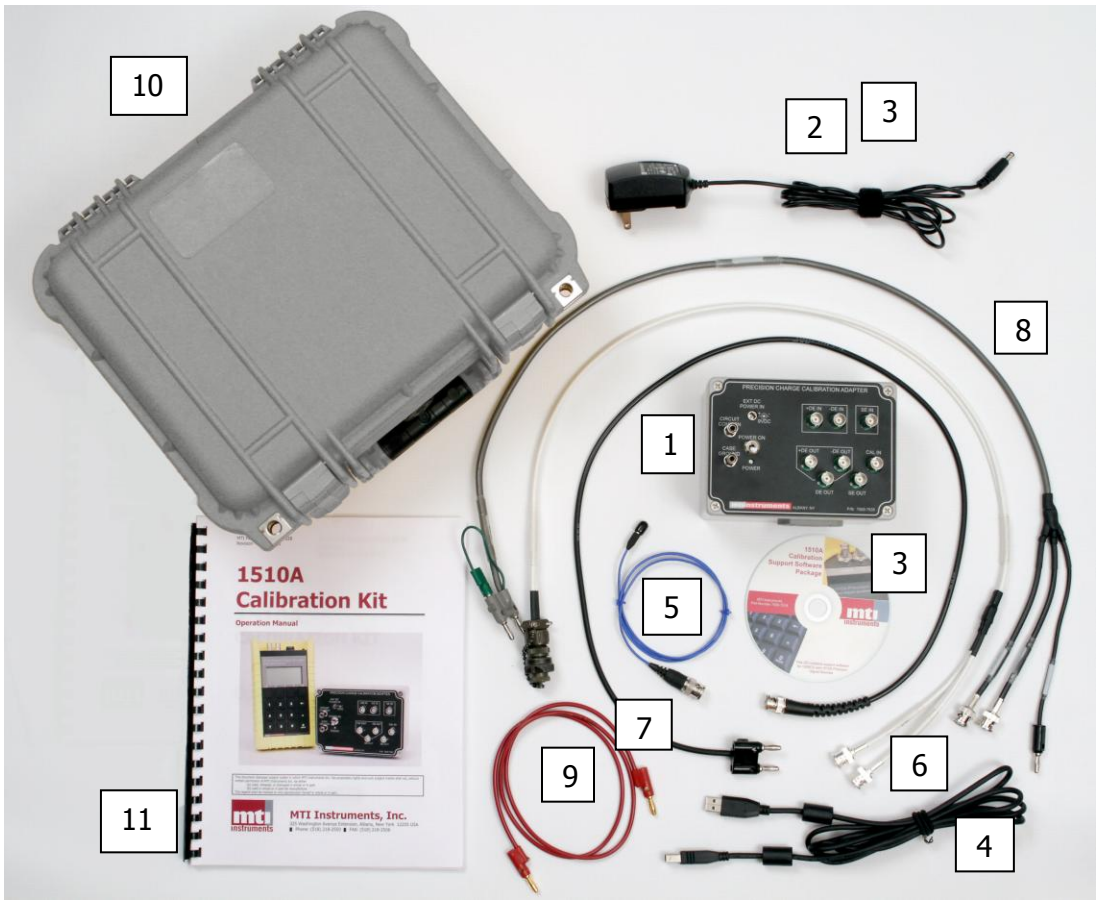
3-1.2 Initial Inspection. When the kit is received, check the shipping container and storage case for evidence of damage. If damage is found, stop unpacking, notify the carrier, and open the carton only in the carrier's presence. If you find no external evidence of damage, carefully unpack the kit and check each item against the packing slip. Refer to your shipping documents and verify that you have received a complete shipment. Place the 1510A Calibration Kit on a bench and inspect for any shipping damage. Contact your MTI sales representative **immediately** if the shipment is incorrect or incomplete.

At the front of this manual, you will find a calibration certificate and a license for use of the Calibration Support Software package. Examine these documents. If you have any questions concerning either document, contact your MTI representative. If you wish to file copies of these items somewhere other than in this manual, please make sure that a copy stays with the manual.

3-2 Components of the 1510A Calibration Kit

Place the1510A Calibration Kit components on a bench, and arrange them so that you can easily inspect the front and rear panels.

Refer to the illustrations on the next pages to familiarize yourself with the Calibration Adapter and the various cables and accessories. Use Table 3-1 to identify each of the items.



1510A Calibration Kit

1510A Calibration Kit Components

Index No.	Item	Function
1	Precision Charge Calibration Adapter	The ***Precision Charge Calibrator Adapter*** is used to support the calibration of the 1500CS and the 1510A precision signal sources. The Adapter contains precision electronic circuits that convert charge signal into voltage signals.
2	AC Power Adapter	This AC power adapter is used to power the Precision Charge Calibrator Adapter.
3	Calibration Support Software	When installed into a Windows PC will provide control and guidance to the calibration and re-calibration of 1510A precision signal sources.
4	USB Cable	This cable is used to connect between the PC running the Calibration Support Software and the 1510A under test.
5	Low Noise SE calibration cable	This cable is used to connect the 1510A ***Single Ended*** charge signal to the Precision Charge Signal Calibration Adapter.
6	Low Noise DE calibration cable	This cable is used to connect the 1510A ***Differential*** charge signal to the Precision Charge Signal Calibration Adapter.
7	SE Output Cable	This cable is used to connect the Precision Charge Calibration Adapter SE output signal to a user provided precision AC voltmeter.
8	DE Output Cable	This cable is used to connect the Precision Charge Calibration Adapter DE output signal to a user provided precision AC voltmeter.
9	Grounding Cable	This cable is provided to ground equipment in the event a ground loop exists among the various components.
10	Storage Case	This case is provided to store and protect the equipment when not in use or while being shipped.
11	Users Manual	A copy of this manual that provides instruction on the use on operation of the 1510A Calibration kit.

PRECISION CHARGE CALIBRATION ADAPTER

Precision Calibration Adapter Front Panel Components

Index No.	Item	Function
1	External DC Power Input	The ***Precision Charge Calibrator Adapter*** can operate from an internal 9 volt battery, or from the external power adapter. When the adapter is to be used, the adapter output plug is inserted into this input connector.
2	Circuit Common Connector	This banana terminal post is used for connecting the internal circuitry common to external voltmeters and signal sources. Refer to the various procedures in Section 4 of this manual for use of this connector.
3	Power Switch	This switch controls the power to the ***Precision Charge Calibration Adapter***.
4	CASE GROUND connector	This banana terminal post is used for connecting the internal circuitry common lines to external voltmeters and signal sources. Refer to the various procedures in Section 4 of this manual for use of this connector.
5	Power Indicator	This Light Emitting Diode indicates when power has been applied to the ***Precision Charge Calibration Adapter*** Circuitry.

Precision Calibration Adapter Front Panel Components (Continued)

Index No.	Item	Function
6	DE IN BNC Connectors	These two BNC connectors (+DE IN and –DE IN) are used for the re-calibration of the ***Precision Charge Calibration Adapter***. Refer to Section 5.0 of this manual for re-calibration procedures.
7	SE IN BNC Connector	This BNC connector is used as an input for the 1510A Single Ended Charge output signal during 1510A signal source calibrations. Refer to Section 4 of this manual for procedures.
8	DE OUT BNC Connectors	These three BNC connectors (+DE OUT, –DE OUT and DE OUT) are used as input connectors for the 1510A Differential Charge output signal during 1510A signal source calibrations. Refer to Section 4.0 of this manual for test procedures.
9	CAL IN BNC Connector	This BNC connector is used for the re-calibration of the ***Precision Charge Calibration Adapter***. Refer to Section 5.0 of this manual for re-calibration procedures.
10	SE OUT BNC Connector	This BNC connector is used as an output form the Precision Charge Calibration Adapter during 1510A Single Ended Charge calibrations. Refer to Section 4 of this manual for procedures.

USB Cable P/N 6000-2001 This three (3) foot long cable is used to connect the 1510A under test to the control computer. This cable will transmit control commands and data between the unit under test and the control PC running the Calibration Support Software. Note that the 1500CS requires the use of an RS-232 cable that ***is not included*** with this kit. For this cable (P/N 7500-7503) please contact MTI Instruments.

Low Noise Single Ended (SE) to Calibration Adapter Cable P/N 7500-7531 This three (3) foot long cable is constructed using special low noise cable to carry charge signals from the 1510A under test to the Precision Charge Calibration Adapter. It includes a micro-dot charge connector on one end, and a BNC connector on the opposite end.

Low Noise Differential (DE) to Calibration Adapter Cable P/N 7500-7532 This three (3) foot long cable is constructed using special low noise cable to carry charge signals from the 1510A under test to the Precision Charge Calibration Adapter. It includes a 3-pin MS style connector on one end and a pair of BNC connector on the opposite end.

Single Ended Calibration Adapter Cable P/N 7500-7533 This three (3) foot long cable is supplied to conduct the precision voltage output of the Precision Charge Calibration Adapter to a user supplied precision AC volt meter. It includes a BNC connector on one end and a BNC connector on the opposite end.

Differential Calibration Adapter Cable P/N 7500-7534 This three (3) foot long cable is supplied to conduct the precision voltage output of the Precision Charge Calibration Adapter to a user supplied precision AC volt meter. It includes a pair of BNC connectors on one end and a BNC connector on the opposite end.

Calibrator Support Software Package - The Calibrator Support Software Package has been designed to help automate the calibration and re-calibration (re-alignment) of 1510A Precision signal sources. In addition to supporting the calibration testing, it also supports several other functions. These include:

Pre-Program Memory Locations – The 1510A has 40 memory locations that can hold pre-programmed signal settings. Each location can be pre-programmed and downloaded using this support package.

Review Memory Location Programs – The 1510A has 40 memory locations that can hold pre-programmed signal settings. Each or all of the 40 memory location settings can be up-loaded for review and editing. Changes can then be downloaded back into the 1510A.

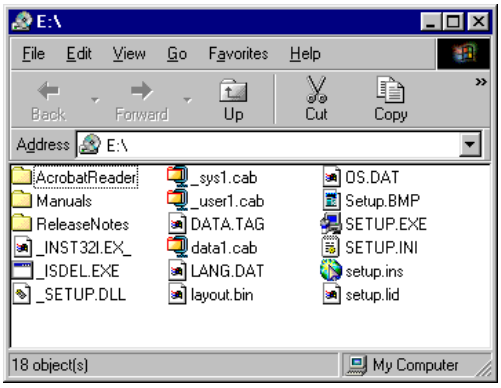
Check Calibrator Configuration – The 1510A has several internal parameters such as software revision level, most recent calibration date, and unit serial numbers stored in its memory. All of these parameters may be viewed using the Calibrator Support Software program.

Remote Control Of signals – The Calibrator Support package also provides an easy to use interface for controlling the signals generated by the 510A calibrator via the USB interface.

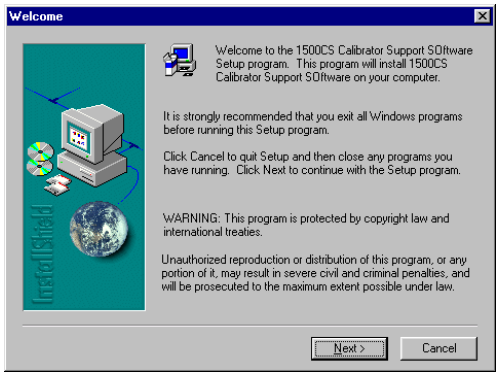
3-3 Installing the 1510A Calibration Support Software Package – The 1510A Calibration kit includes a CD-ROM that contains application software required to perform the semi-automated calibration checks and re-calibration of the 1510A Precision Signal sources. The following sections provide instructions regarding the installation and set-up of the software package. **This software must be installed before connecting the 1510A Precision Signal Source to your computer for the first time**

3-3.1 Installing the Software - To install the software, perform the following steps:

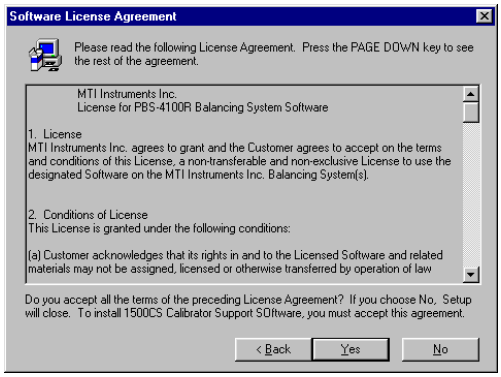
Open a Windows Explorer window to view the contents of the CD.



Double Click on the ***SETUP.EXE*** program to begin the installation process as illustrated:



As the program installation continues, a welcome display will be produced, followed by the License acceptance display. At the conclusion of the installation process, the software loading completion display will appear as illustrated below.



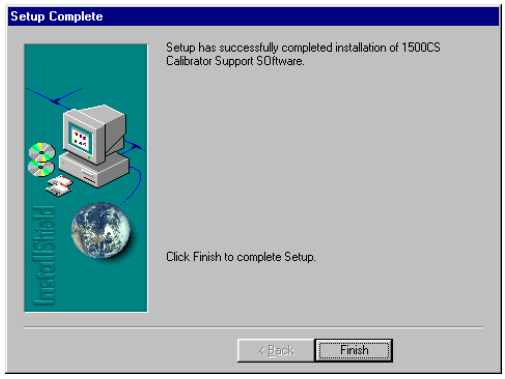
Click on the ***FINISH*** button to complete the process.

At this time, you may also wish to install a copy of the Acrobat Reader which is also included on the CD.

Note that the CD also includes a folder, which contains PDF versions of both this manual and the Precision Charge Calibrator Adapter manual.

If necessary, open the Adobe folder and install the Adobe Reader application.

When all software has been installed, remove the CD from the drive.



3-3.2 Installing the 1510A USB Driver

During the installation of the Support Software, the file **mti1510A.INF** was copied to the **Windows\INF** folder on your computer. This file contains instructions for loading the required USB drivers for the 1510A Precision Signal Source.

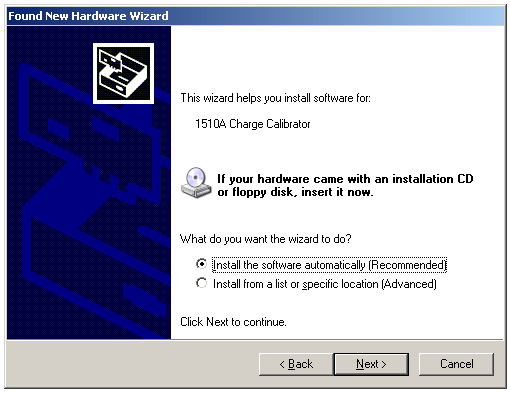
Using the Windows Explore function, verify that this file exists. If it does not, manually copy the file from the USB folder located on the CDROM, copy it and save it in your Windows\INF folder.

After verifying that the INF file exists, connect the USB cable to the 1510A and connect it to an unused USB port on your computer.

Next, power-up the 1510A.

The Windows **Found New Hardware Wizard** screen will pop-up.

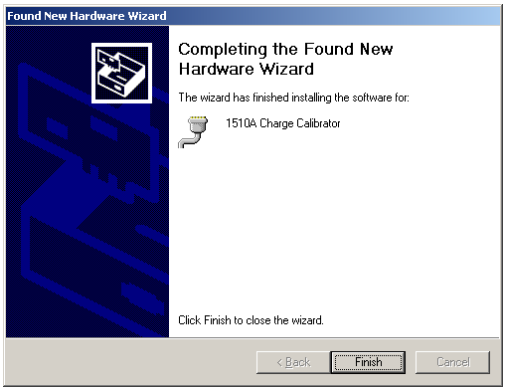
When asked if Windows can connect to update software, select ***No, not this time*** and press **Next**.



Continue with the installation Wizard as the next display appears.

Select ***Install the software automatically (Recommended)*** option, and press **Next**.

If warned that the driver has not passed Windows Logo Testing, press **Continue Anyway**.



When the driver installation process completes, press **Finish**.

Your computer is almost ready to be used with the 1510A.

3-3.3 Identification of the USB Port

The Calibration Support Software program also needs to know to which USB port the 1510A is connected. To perform this part of the installation, follow these steps:

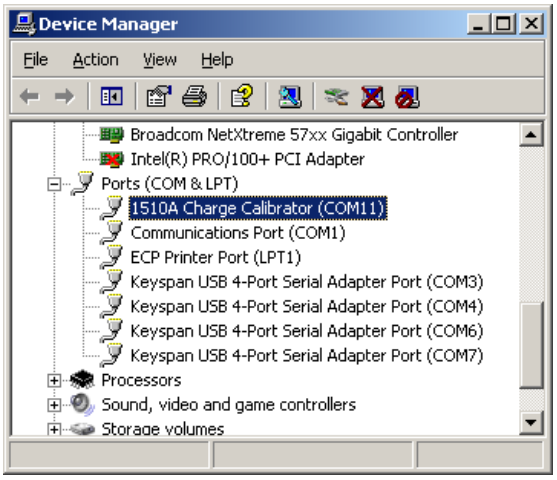
Click **Start**-**Settings**-**Control Panel** and double click the **System** icon. When the System Properties dialog displays, click the ***Hardware*** tab.

Then click the **Device Manger** button.

In ***Device Manage***r, scroll down to the Ports category and open it. Locate the 1510A Charge Calibrator entry and note the assigned COM port.

In the next step, the COM port assignment must be entered into the program INI file.

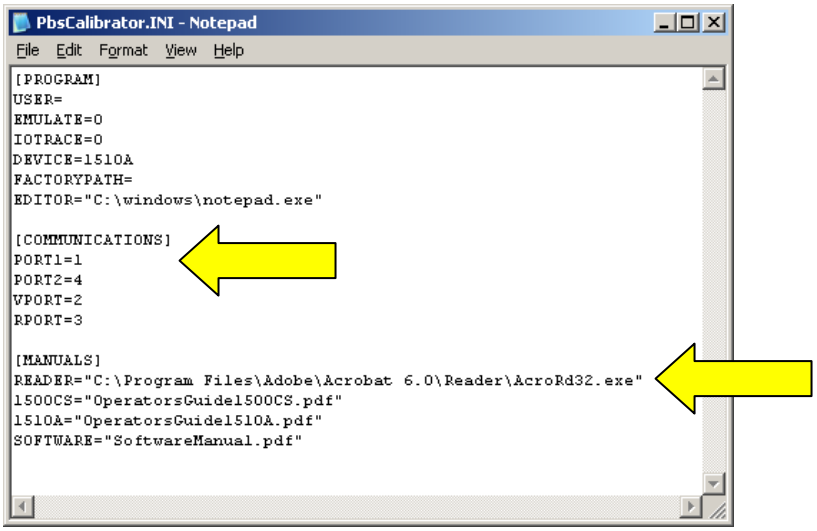
Close the Device Manager application.



3-3.4 Setting up the Support Software Initialization file

After installation of the support software and determining the assigned Communication Port, you will need to check a few final items to ensure efficient operation of all program features.

First, using the Windows Explorer program, open the file:
C:PBS\PbsCalibrator\Program\PbsCalibrator.INI



First, verify that the Serial Port number listed in the INI file is correct for your system. 1=COM1, 2=COM2, etc.

When setting up the software for a 1510A device, set the **PORT2** value to the port number previously determined from Device Manager.

Also, verify that the path to the Adobe reader is correct for your system. If not, replace the correct path within the quotation marks in the INI file and SAVE the changes. If you do not have Adobe reader installed, the 1510A Calibration Support Software Package CD-ROM contains a copy of the Adobe reader installation package.

After making the necessary changes, click on the ***File*** function in the header and select the ***SAVE*** function. Next, close the INI file viewer. All other entries and setting in the file should be left unchanged.

Finally, you may wish to place a shortcut to the program on your computer desktop. The 1510A Calibration Support Software Package program is located in:
C:\PBS\PbsCalibrator\Program\PbsCalibrator.exe

THIS COMPLETES THE SOFTWARE INSTALLATION PROCESS

3-4 Preparation for Storage and Shipment

3-4.1 Storage. The 1510A Calibration Kit should be stored in its hard-shell containers to keep all components together.

Reasonable care should also be exercised to ensure that the selected storage area is otherwise appropriate for electronic instrumentation, and is therefore relatively free of dust, high magnetic fields, and other potentially harmful factors.

3-4.2 Preparation for Shipment. To protect the equipment during shipment, use packaging materials appropriate for electronic instrumentation.

If returning the 1510A Calibration Kit to the factory, place all of the items into the shipping and storage case, and then place the case into a strong carton rated for 0.25kg/mm^2 (350 lbs/in^2) burst strength, minimum or other suitable shipping container. Cartons or other containers should be large enough to accommodate at least 5 cm (2 inches) of shock absorbing material on all sides of each component. Completely fill the areas on all sides of the components with cushioning material. Seal cartons with strong tape or metal bands. Mark the outside of the package "***FRAGILE -- DELICATE INSTRUMENT***".

If corresponding with MTI regarding reshipment, please reference the model number and serial number. If the instrument is being shipped for repair, be sure to enclose all available data regarding the problem that has been observed.

3.5 BATTERY INSTALLATION and REPLACEMENT

This procedure provides instructions for installing or replacing the internal 9 volt battery found inside the Precision Charge Calibration Adapter.

For this procedure, refer to the identification diagram provided along with the following step-by-step instructions.

Step 1 – Ensure that the power switch of the Calibration Adapter is in the ***OFF*** position.

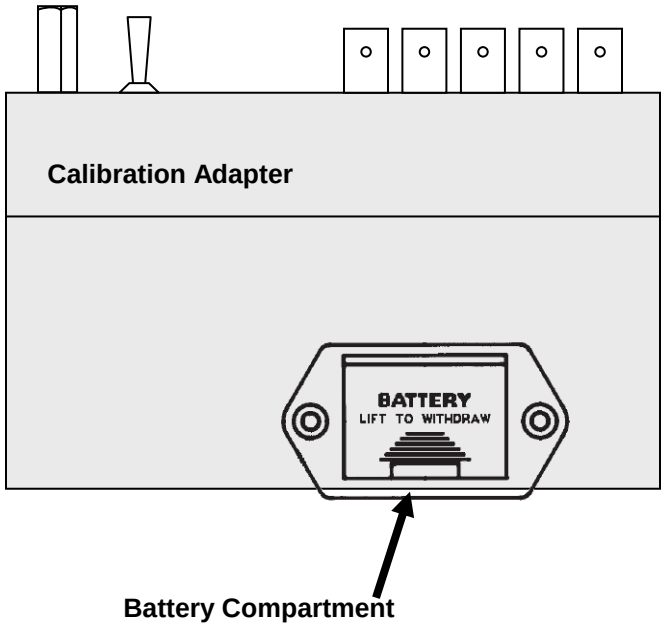
Step 2 – Referring to the diagram shown here, locate the battery compartment door.

Step 3 – Using a small screwdriver or other flat-bladed device, press the battery compartment door up in the direction indicted.

Step 4 – With the compartment now open, pull the drawer out from the case.

Step 5 – Remove the battery and replace it with a fresh 9 volt battery. Carefully note the polarity of the battery when installing it into the compartment.

Step 6 – Slide the compartment door back into the case until a click is detected indicating that the compartment is in the secure and locked position.



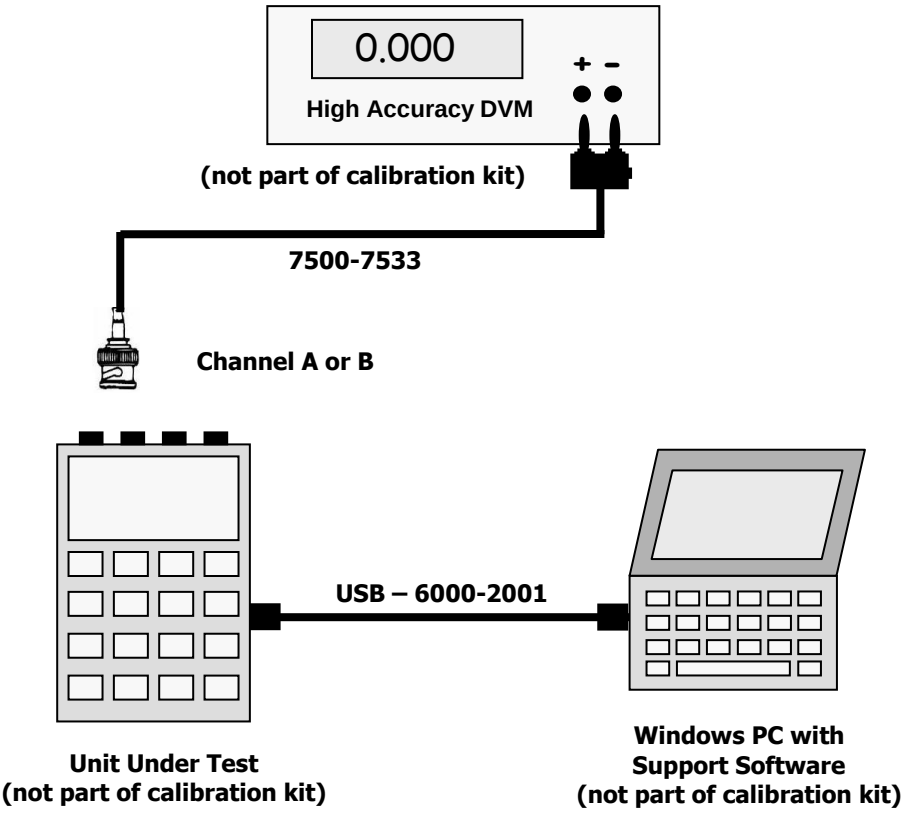
This completes the Battery Replacement Procedure.

SECTION 4
OPERATING INSTRUCTIONS

4-1 OPERATION AND USE OF THE KIT

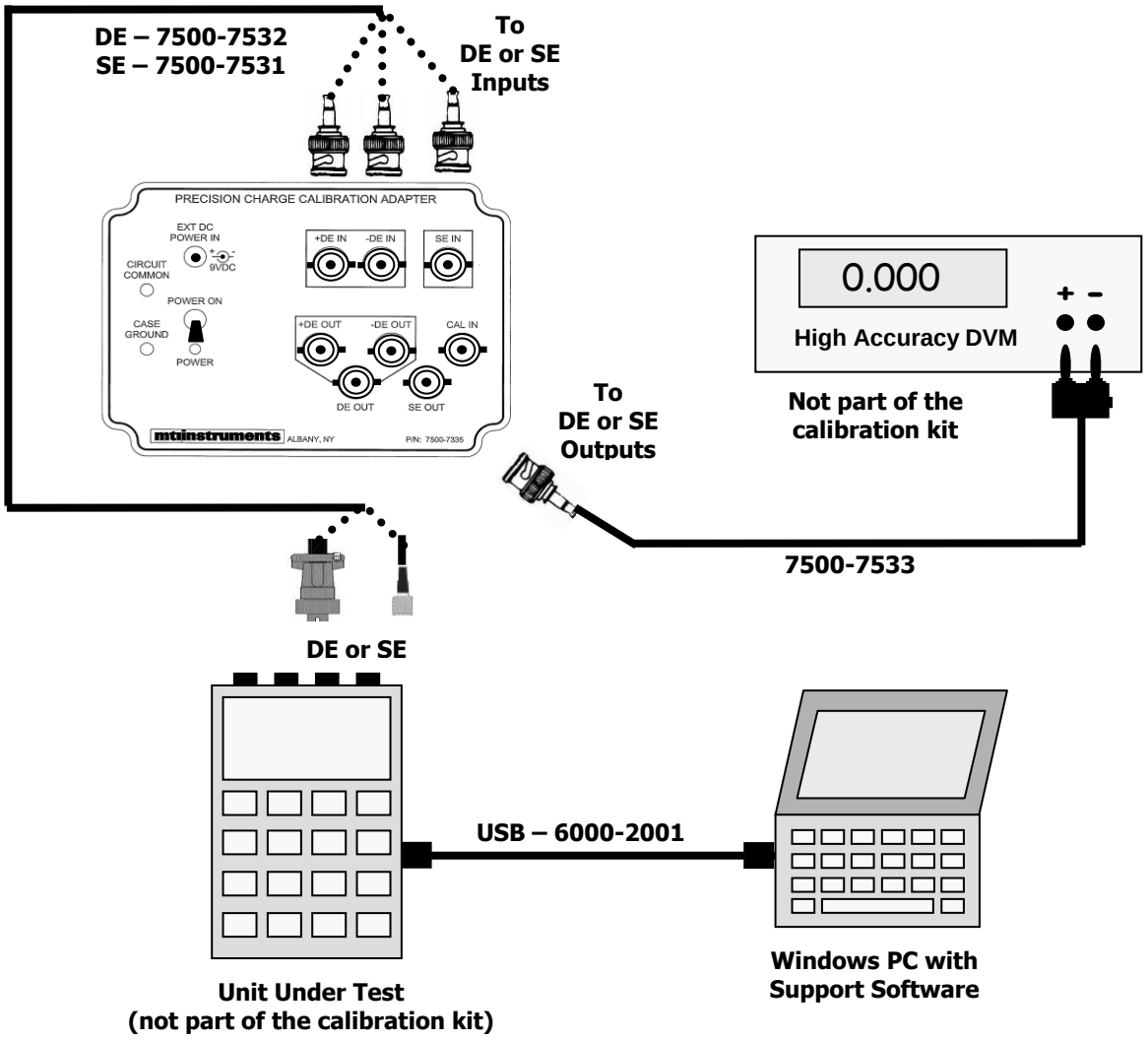
The 1510A Calibration Kit is an easy to use system for the checking the accuracy of and re-calibration (alignment) of 1510A precision signal sources. The kit includes software, accessory cables, and a unique charge calibration adapter which allow users to perform semi-automated checking of the accuracy of the 1510A signal source and when required, re-calibration (alignment) may also be performed. During operation, the calibration support software sends commands to the unit under test, and the resulting output of the 1510A is measured by a user-supplied high-accuracy DVM. The DVM readings are then manually entered into the computer where a complete record of commanded and measured outputs is maintained. At the conclusion of the test, a summary table is displayed indicating measured results either being in-tolerance or out of factory established tolerances.

4-1.1 Calibration Kit Hardware Overview – Because the 1510A Precision Signal Source can produce both voltage and charge signals two different test configurations are required for testing the two different types of outputs. The figure below illustrates the connections and equipment required to conduct the voltage testing portion of the accuracy and calibration tests.



Voltage Checking Diagram

Charge Signal Testing - For the testing and calibration of charge output signals, the calibration kit also includes a special Precision Charge Calibration Adapter device that converts the 1510A charge signals to voltages. The outputs of the Precision Charge Calibration Adapter are then sent to the precision DVM where measurements are recorded by the calibration support software. The figure below illustrates the connections and equipment required to conduct the charge testing portion of the accuracy and calibration tests.



Charge Checking Diagram

Computer Connections - For testing 1510A units, a USB cable is provided with the calibration kit.

Calibrator Connections - Connections between the 1510A and the DVM and the Precision Charge Calibration Adapter, the 1510A calibration Kit includes cables for connecting voltage outputs to the DVM and charge outputs to the Calibration Adapter. Ensure that the correct cables are used at all times for all of the tests.

4-1.2 Calibration Kit Precautions – The 1510A Precision Signal Source is capable of producing very precise voltages and charge signals. Ensuring the continued precision of the instruments demands that checking and re-calibration (alignment) be accomplished in a very precise manner. The following precautions must be observed:

Use precision voltmeters - High precision voltmeters must be employed in the process of measuring the various outputs of the 1510A units. These meters must have at least 6½ digit resolution and have better than 0.01% measurement accuracy at 1,000 Hz. Meters with programmable noise filters and selectable sampling and averaging rates must be set to ensure the highest accuracy at 1,000 Hz and at 15kHz. Section 2.0 of this manual provides recommended models that meet these requirements, although other modes may be substituted.

Refer to the user manual for the voltmeter that you are using. It is recommended that individual voltage ranges be selected, as opposed to operating in "Auto-Range," to ensure the highest measurement accuracy. When measuring low voltages it is also recommended that the voltmeter manual be consulted for operating suggestions for the highest accuracies.

Use high quality cables – All cables used for the testing and calibration (alignment) of the 1510A units should be of the highest quality and as short as practical. Due to the low levels of signals being generated and measured, cables need to be as short a possible. Electrical noise susceptibility can also be an issue when working with charge signals, and these connections demand special low-noise cables that are properly shielded. The cables supplied with the 1510A Calibration kit have been designed to meet these requirements.

Use proper grounding and shielding techniques – The cables and accessories supplied in this kit have been designed for low noise, and follow recommended grounding and shielding practices. When using other laboratory instruments such as voltmeters and signal generators, follow proper ground and shielding techniques to preclude ground loops and electrical noise emissions.

In the unlikely event that a ground loop is created with the instrumentation during the charge signal testing, the Precision Charge Calibration Adapter can be powered from an internal 9 volt battery in place of the AC power adapter supplied with the kit. If a battery is installed, simply removing the power adapter cord from the Calibration Adapter will automatically switch over to the internal battery power. Installation of the battery is described in Section 3.5 of this manual.

4-1.3 Performing the Acceptance Checks and Calibration Procedures – The Calibration Support Software will guide users thru the process of performing "Acceptance" checks or Calibrations (alignment) of the 1510A signal source.

Acceptance Checks – Acceptance Checks are performed to check the accuracy of the signals produced by the 1510A unit under test. These tests are performed in a semi-automated manner where the Calibration Support Software issues commands to the 1510A to produce a pre-programmed signals. A precision voltmeter is used to measure the output signal, and the user then inputs the measured value into the software. The measured output signal is compared against factory allowable limits and declared to be in or out of tolerance. AC voltage, DC voltage and charge outputs of the devices are tested using values throughout their output signal ranges. This is an excellent test to perform to evaluate the accuracy of the unit. If the unit passes the Acceptance check, it can be returned to service. If the unit does not pass, it should be re-calibrated (aligned) using the Calibration Procedure.

Calibration Procedures – Calibration Procedures (alignments) are performed when the results of the Acceptance checks indicate that the outputs do not meet factory specifications. Like the Acceptance Check, the Calibration procedure is performed in a semi-automated manner where the Calibration Support Software issues commands to the 1510A. A precision voltmeter is used to measure the output signals, and the user inputs the measured value into the software. The measured values are then used to calculate correction coefficients for the various output ranges of the 1510A. These correction coefficients can then be down-loaded into the 1510A to correct for any inaccuracies detected in the earlier Acceptance Check.

It is recommended that an Acceptance Check be performed after the Calibration Procedure to ensure acceptable results.

Test Procedures - The next two sections of this manual provide detailed instructions for the checking and re-calibration of the 1510A device.

Section 4-2 provides instructions for performing an **Acceptance Check** of a 1510A device. An acceptance Check tests the accuracy of the outputs of the 1510A and concludes with a summary table which indicates in and out of tolerance conditions of the device.

Section 4-3 provides instructions for performing a **Calibration (alignment)** of a 1510A device. A Calibration tests the accuracy of the outputs of the 1510A, and concludes with the ability to update internal calibration coefficients of the unit.

4-2 1510A Acceptance Check Wizard

4-2.1 Introduction and Overview – The 1510A Acceptance Check provides users with a fast and easy way to assess the accuracy of the 1510A unit. This check is semi-automatically performed by the 1510A Acceptance Check Wizard which is a part of the Support software package. The Acceptance Check Wizard sends a series of commands to the unit under test, and the resulting outputs are measured using a high precision voltmeter. Each measurement point is entered into the computer by the user, which is then recorded by the Wizard. At the conclusion of the test, the Wizard summarizes all test measurements and compares them against factory tolerances.

The Wizard performs four different tests which are:

Channel A output voltage checks
Channel B output voltage checks
Single Ended charge output checks
Differential charge output checks.

The charge output signals from the 1510A can not be measured directly by a precision voltmeter. Therefore, the MTI Instruments Precision Charge Calibration Adapter must be used to convert the charge outputs to voltage signals. The Wizard will prompt the user how to use the Charge Calibration Adapter when it is required.

Required items – Several cables and accessories are required to perform the 1510A Acceptance Check. In addition to the 1510A that will be tested, the following items will be required:

Items provided by the user:

Windows PC with the Calibration Support Software loaded (refer to section 3.3 for installation instructions)

A high accuracy digital voltmeter capable of at least 6½ digit resolution. This meter should be calibrated and capable of measuring both AC and DC voltages.

Items supplied with the calibration kit:

7500-7535 Precision Charge Calibration Adapter
6000-2001 USB Cable
7500-7531 Single Ended Output to Calibration Adapter Cable
7500-7532 Differential Output to Calibration Adapter Cable
7500-7533 Single Ended Calibration Adapter output to DVM cable
7500-7534 Differential Calibration Adapter output to DVM cable

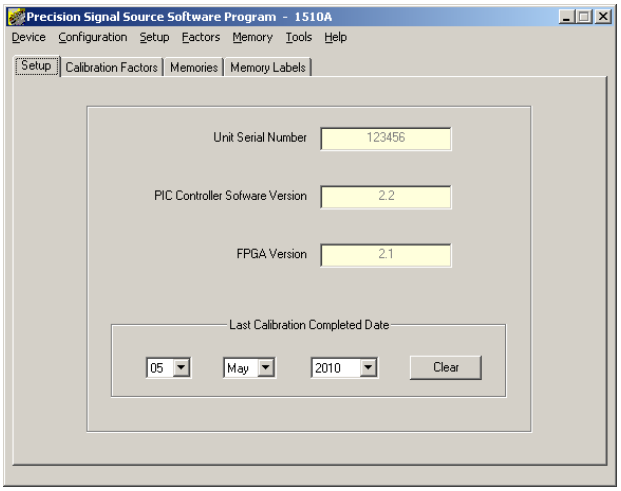
4-2.2 – Starting the Software –

Go the computer which has the software loaded. If the software has not yet been loaded, refer to section 3.3 of this manual.

At the computer, double clicking on the icon will launch the 1510A Support Program.

An introductory display will first be visible for a few seconds:

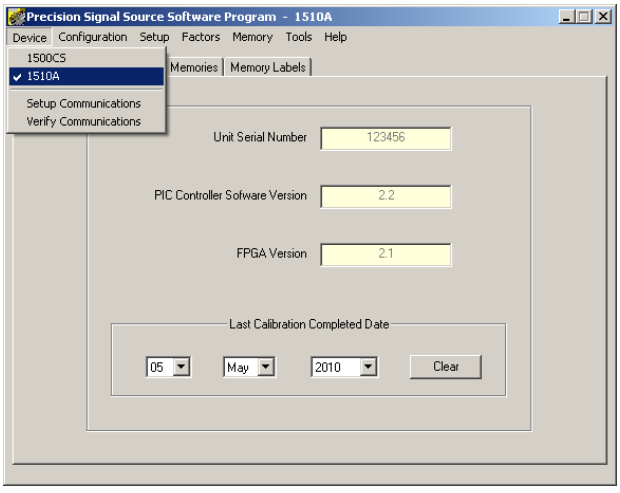
Automatically, the display will transition to the user interface display as illustrated here.



4-2.3 Selecting the Device Type

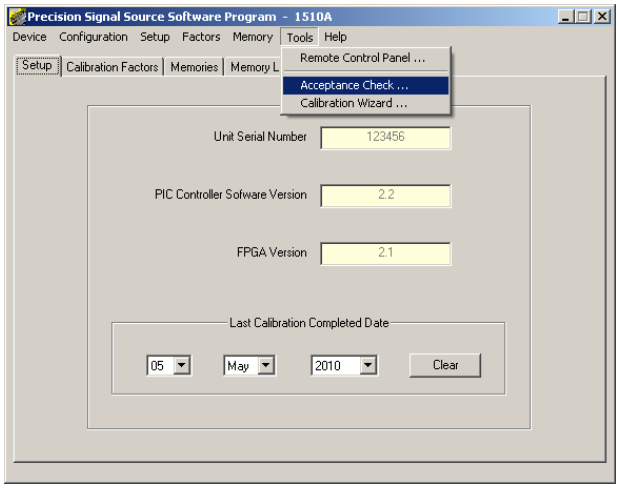
Click on the Device label which will reveal the device selection drop down list as illustrated here.

Select the ***1510A*** as illustrated.



4-2.4 Selecting the Acceptance Test

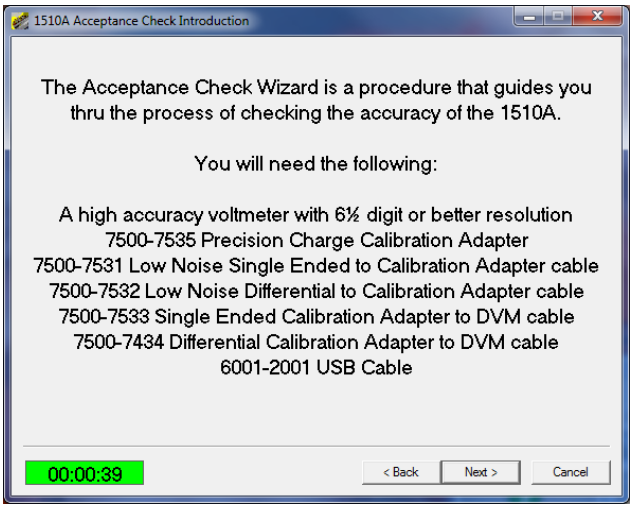
Next, click on the Tools tab which will reveal the following drop down menu of operations and test that can be performed.



As illustrated, select the ***Acceptance Test*** option.

The **Acceptance Check Wizard** is a semi-automated procedure for checking the accuracy the 1510A. The Wizard guides users thru the process of measuring a variety of different outputs from the unit. Results of the measurements are used to gauge the accuracy of the 1510A device.

Users simply need to follow the instructions displayed on each page, and when completed, click the **NEXT** button.

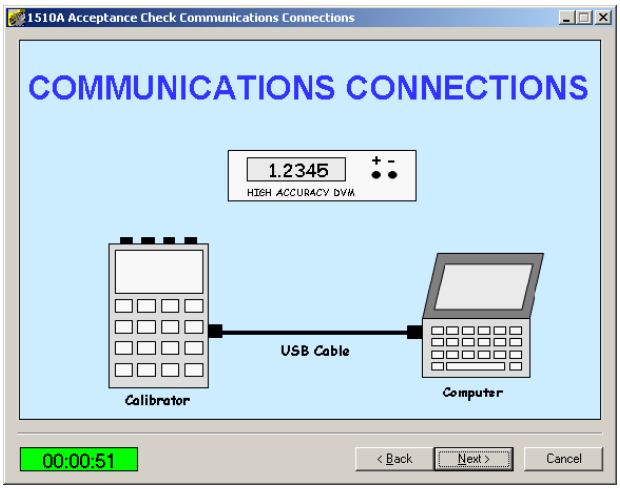


To check a 1510A unit you will need a high accuracy voltmeter and the cables listed.

Connection to the 1510A
Before continuing, ensure that the USB communications cable has been connected between the 1510A and the computer that is running the Acceptance Check Wizard.

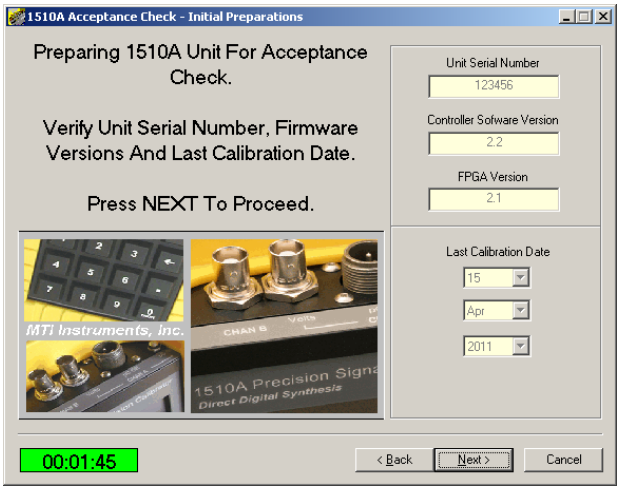
Ensure that the 1510A is on.

After the connection has been made press the ***Next*** button.



4-2.5 Interrogating the device under test
The next step in the Acceptance Check uploads the units' serial number and software version information. Verify these numbers with those found on the label affixed to the back of the unit.

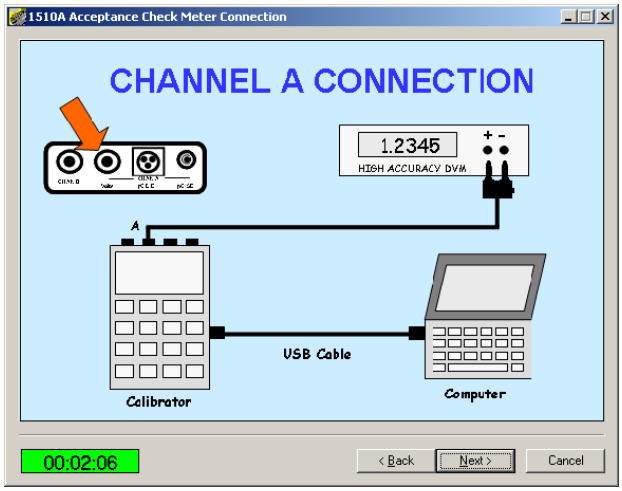
Continue by pressing the ***Next*** button.



4-2.6 Connect to Channel A
Connect the 7500-7533 cable between the 1510A Channel A output connector and to the input of the voltmeter.

Set the voltmeter for AC RMS readings.

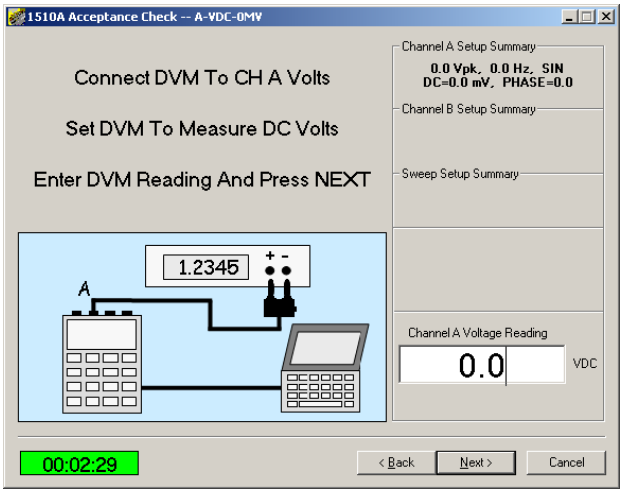
Continue by pressing the ***Next*** button.



Channel A Low DC range #1 check
Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

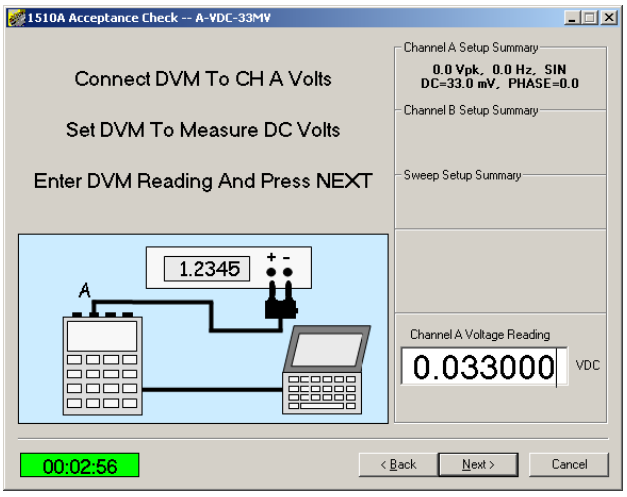
After entering the reading, continue by pressing the ***Next*** button.



Channel A Low DC range #2 AC check
Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

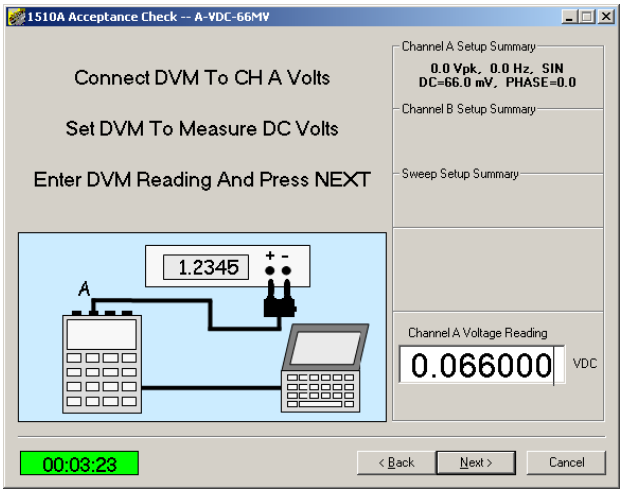
After entering the reading, continue by pressing the ***Next*** button.



Channel A Low DC range #3 check
Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

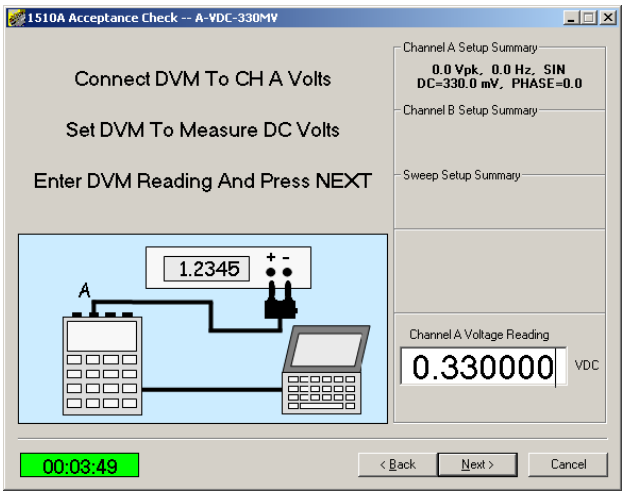
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid DC range #1 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

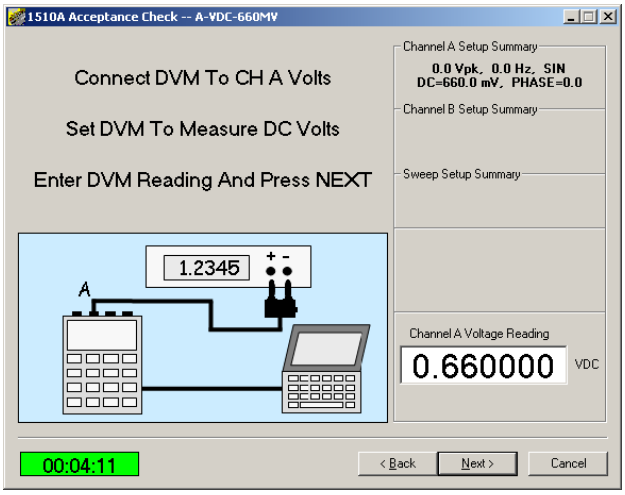
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid DC range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

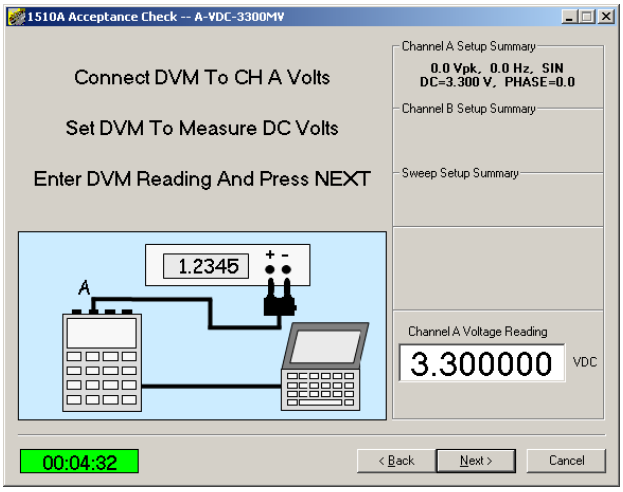
After entering the reading, continue by pressing the ***Next*** button.



Channel A high DC range #1 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

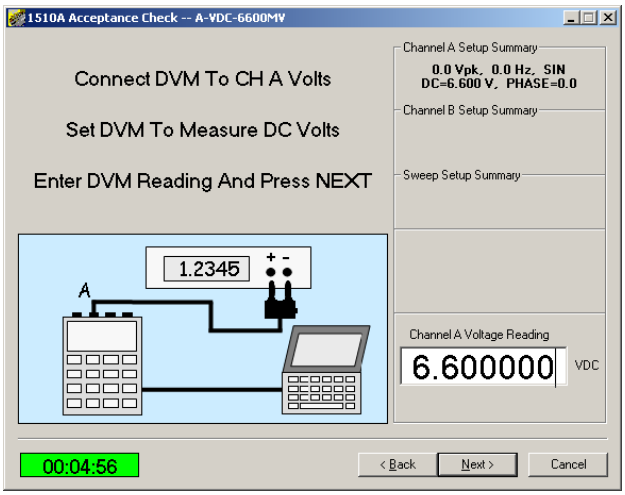
After entering the reading, continue by pressing the ***Next*** button.



Channel A high DC range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

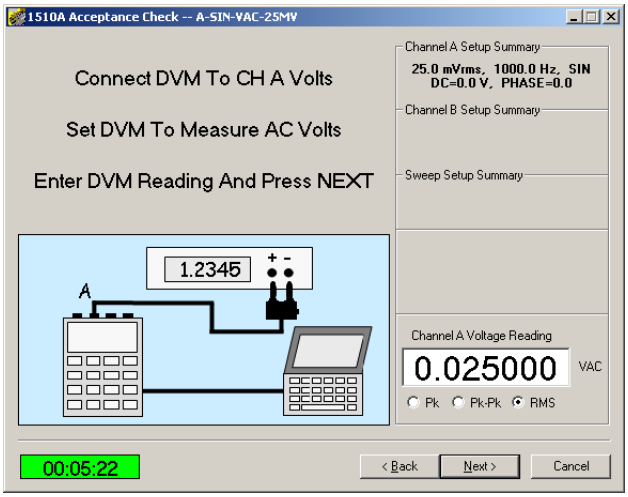


Channel A low AC range #1 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

NOTE – If your voltmeter is not capable of displaying voltage in RMS units, you may click on one of the selector buttons to have the meter reading recorded in PK (peak) or Pk-Pk (peak to peak) units.

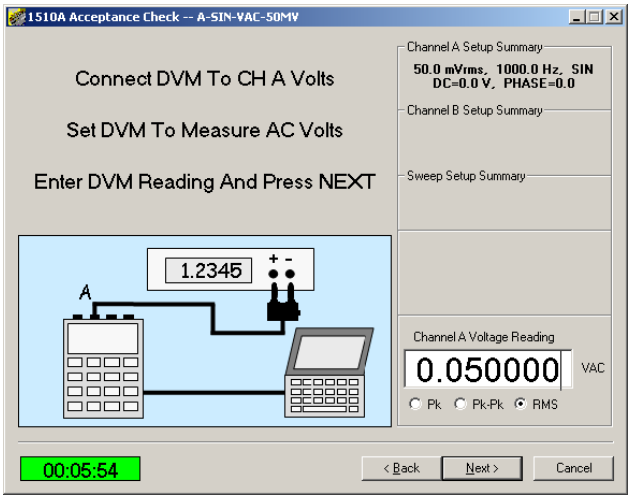
After entering the reading, continue by pressing the ***Next*** button.



Channel A low AC range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

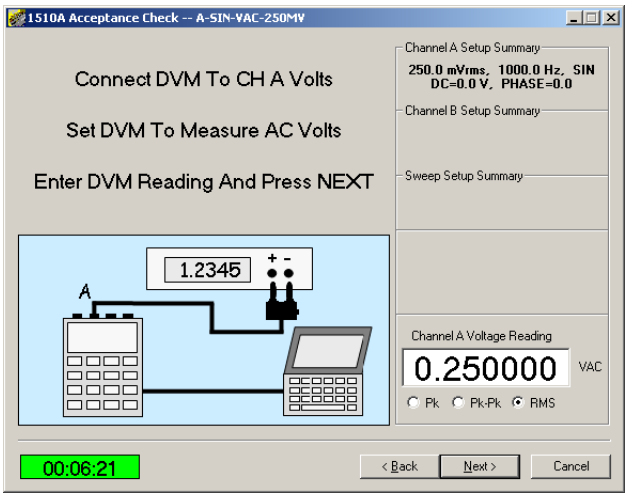
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid AC range #1 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

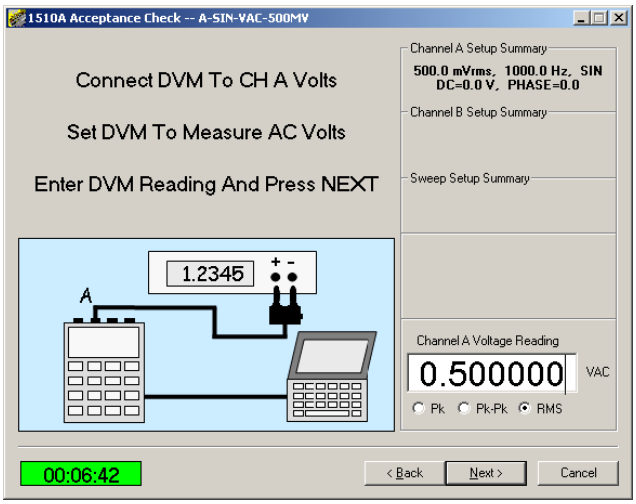
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid AC Range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

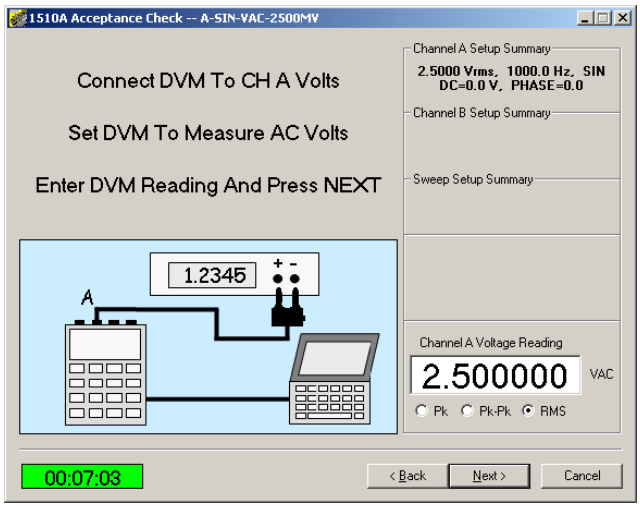
After entering the reading, continue by pressing the ***Next*** button.



Channel A high AC Range #1 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

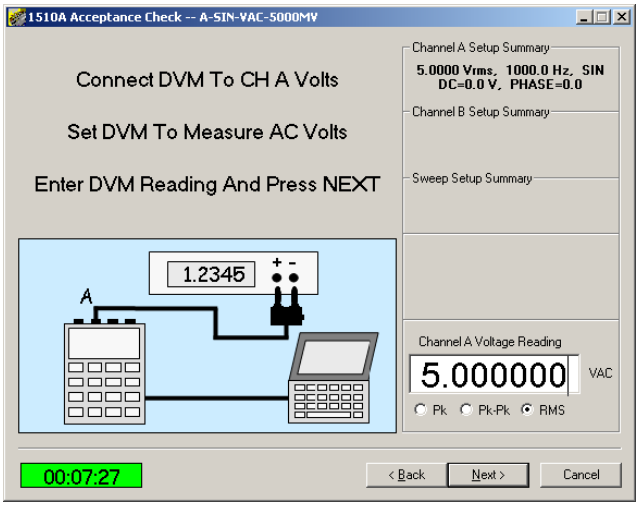


Channel A high AC Range #2 check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

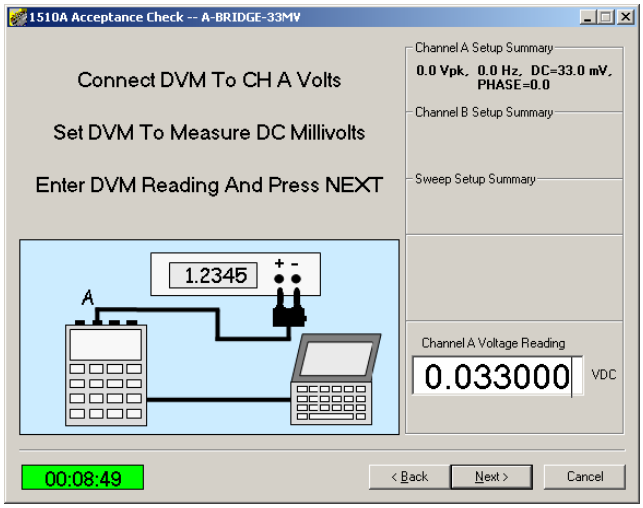


Channel A Bridge Mode low range check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

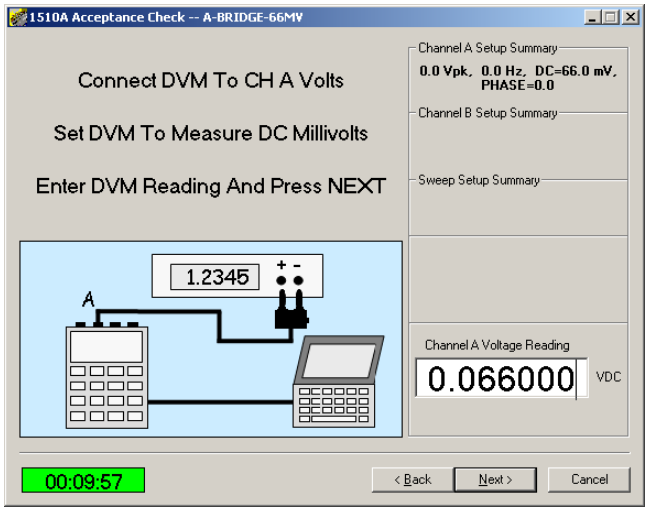


Channel A Bridge Mode high range check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for DC voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

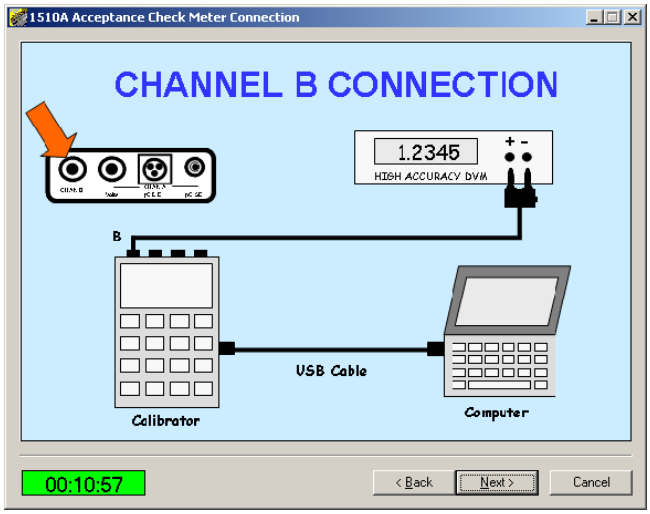


4-2.7 Channel B checks

Next, connect the 7500-7533 cable to the 1510A Channel B output connector and to the input of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After changing the connections, continue by pressing the ***Next*** button.

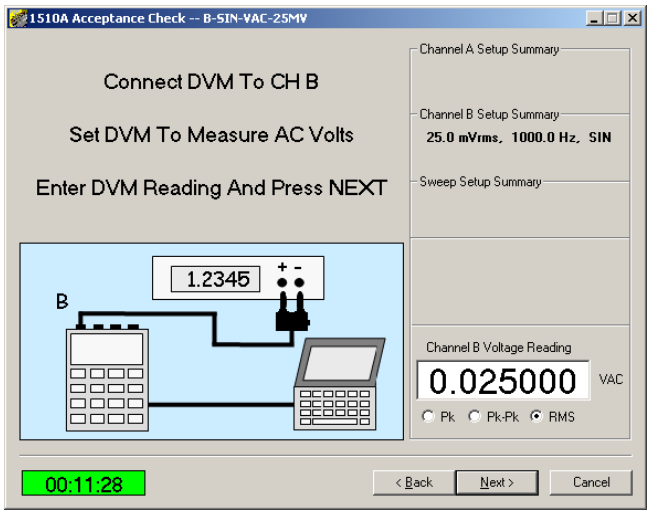


Channel B Low AC range#1 check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

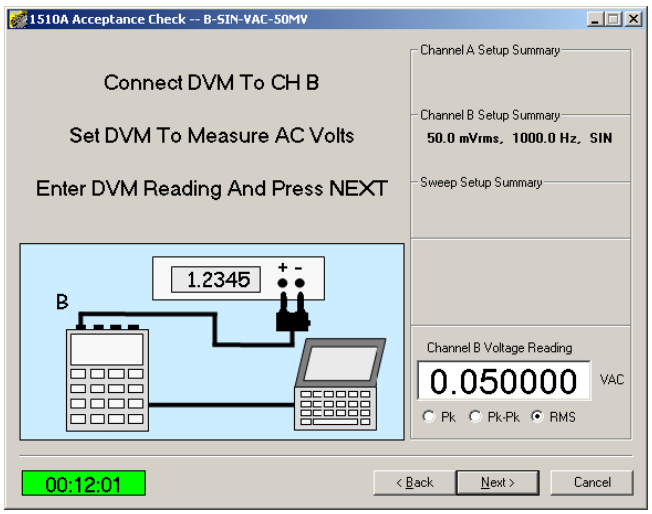


Channel B Low AC range#2 check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

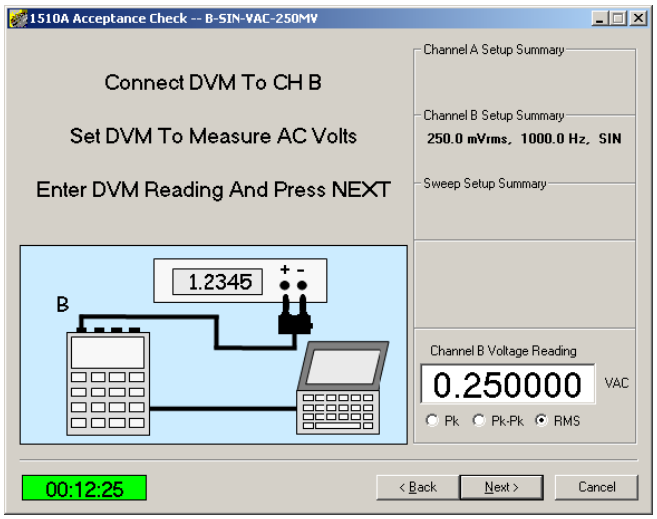
After entering the reading, continue by pressing the ***Next*** button.



Channel B mid AC range#1 AC check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

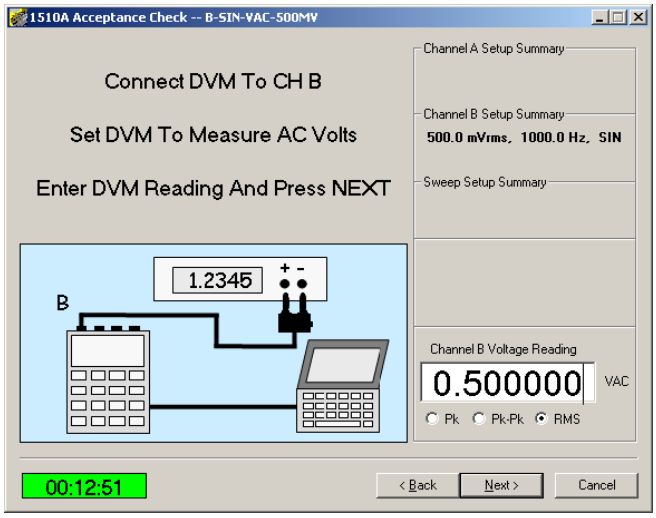
After entering the reading, continue by pressing the ***Next*** button.



Channel B Mid AC range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

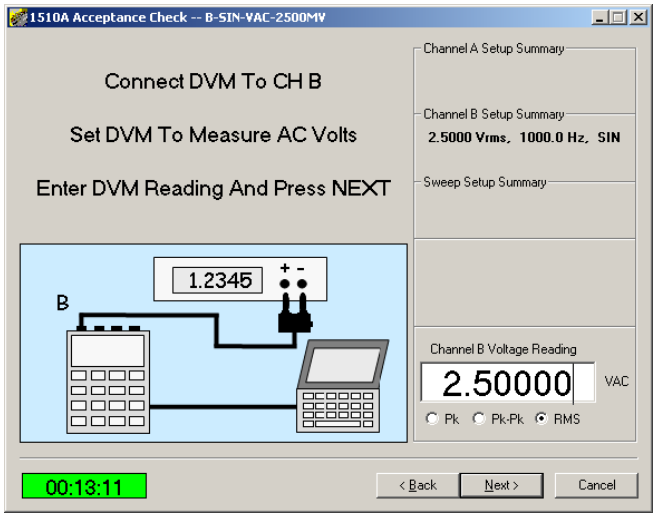
After entering the reading, continue by pressing the ***Next*** button.



Channel B High AC range #1 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

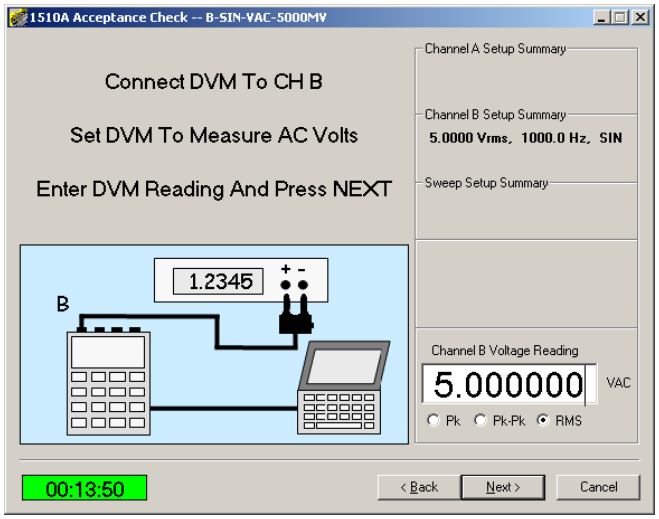
After entering the reading, continue by pressing the ***Next*** button.



Channel B High AC range #2 check
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

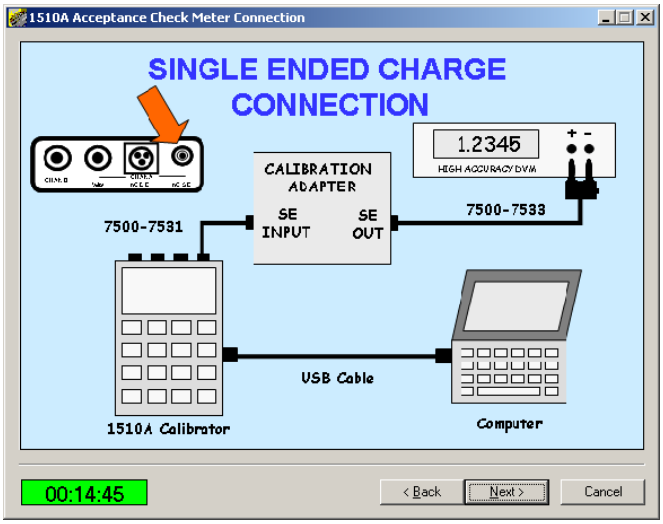
After entering the reading, continue by pressing the ***Next*** button.



4-2.8 Single Ended charge accuracy check –
Next, connect the 1510A to the voltmeter as illustrated using the special charge calibration adapter and associated cables.

Set the voltmeter for AC RMS readings.

When all cables have been connected, turn ***ON*** the Adapter and click on the ***Next*** button.



NOTE

To ensure accuracy, do not allow the cables to move during this series of tests. Even small motion of the cable can induce measurement errors.

NOTE

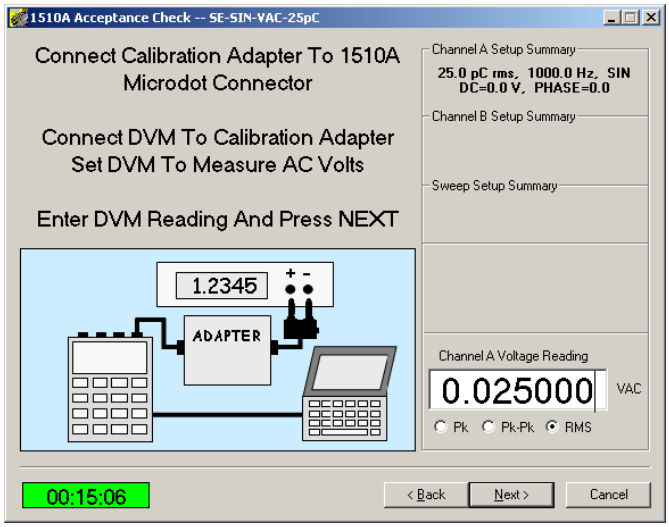
A Banana-to-Banana grounding cord may be required between the Adapter Case Ground and the DVM chassis to minimize noise.

Single Ended Low Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

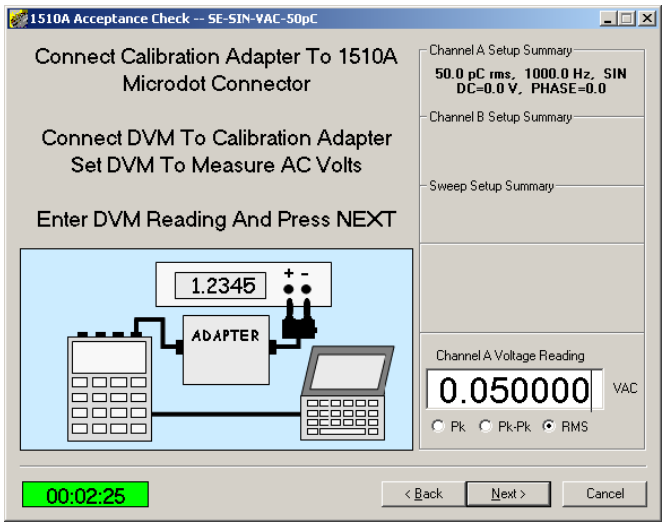


Single Ended Low Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

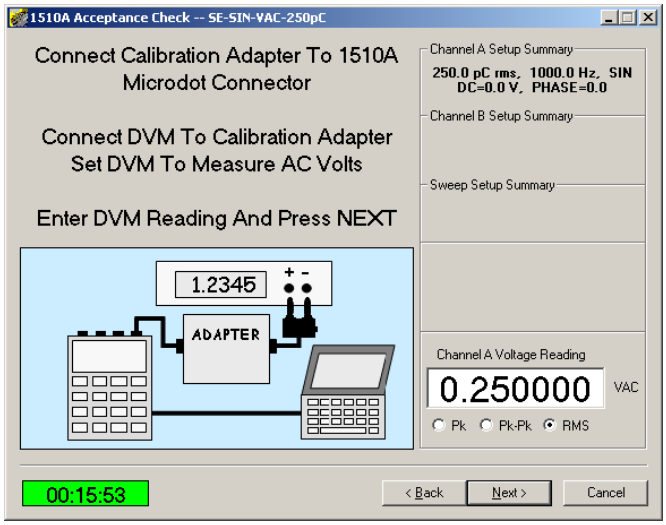


Single Ended Mid Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

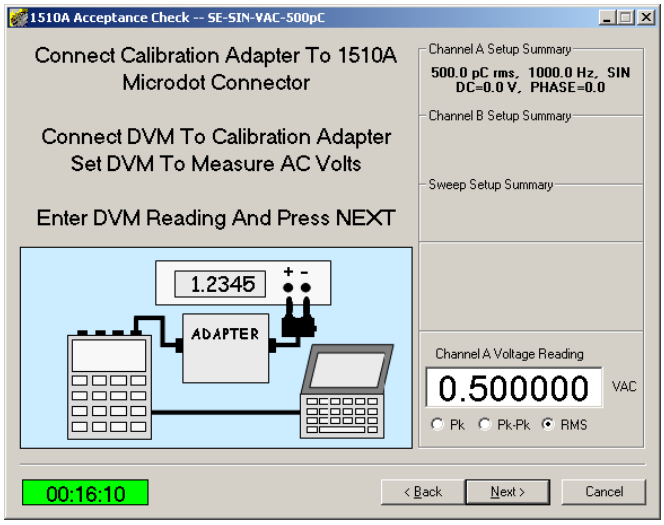


Single Ended Mid Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

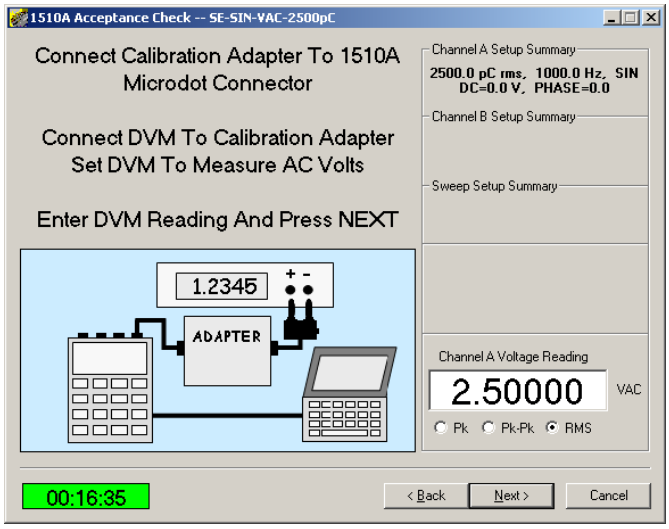


Single Ended High Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

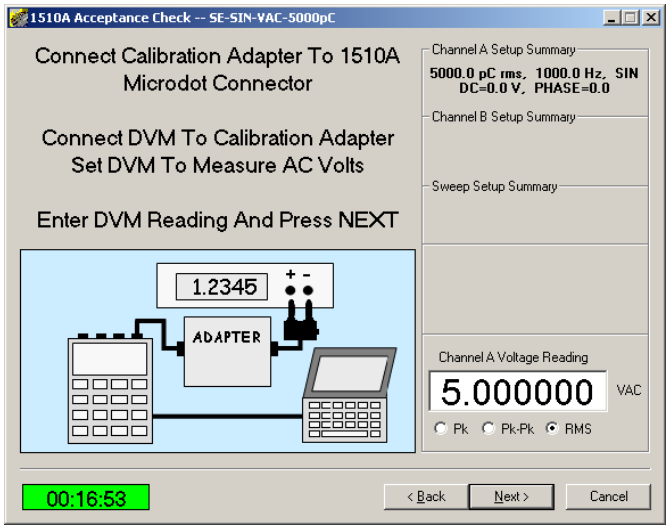


Single Ended High Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

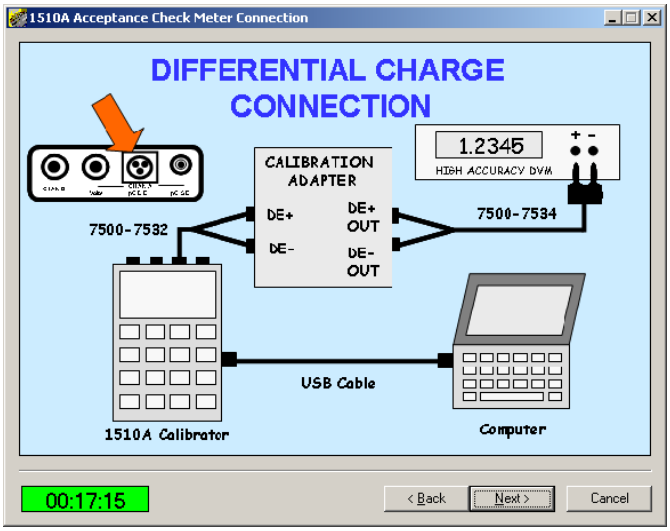


4-2.9 Differential charge Acceptance check

Next, connect the 1510A to the voltmeter as illustrated using the special charge calibration adapter and associated cables.

Set the voltmeter for AC RMS readings.

When all cables have been connected, turn ***ON*** the adapter, and click on the ***Next*** button.



NOTE

To ensure accuracy, do not allow the cables to move during this series of tests. Even small motion of the cable can induce measurement errors.

NOTE

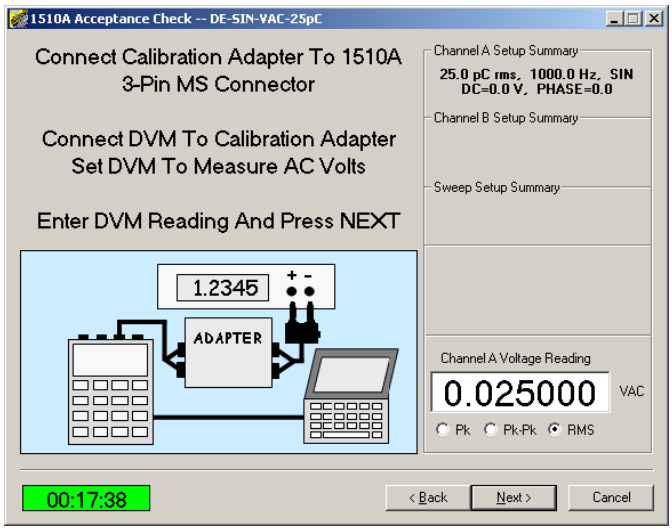
The DE output cable has shield drain banana plugs at each end of the cable. Place one drain plug connector into the Case Ground connector on the Calibration Adapter, and unless there is a serious noise issue with your test set-up, do not connect the grounding banana plug at the DVM.

Differential Low Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

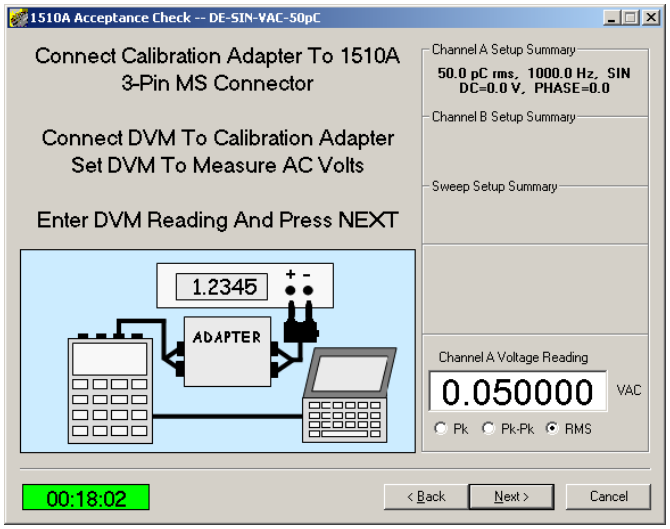


Differential Low Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

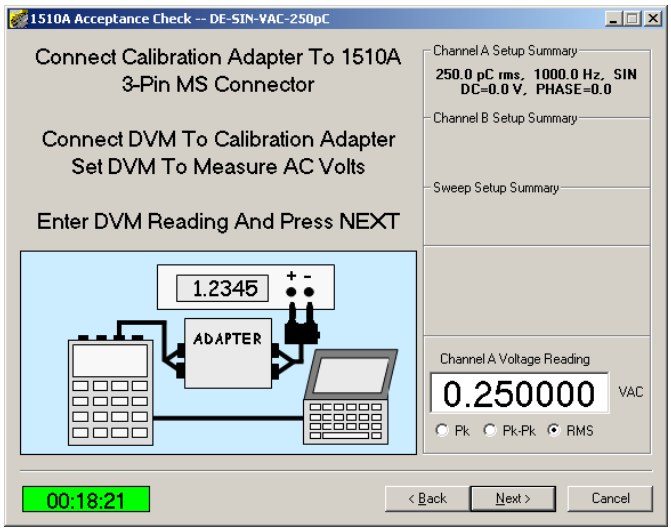


Differential Mid Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

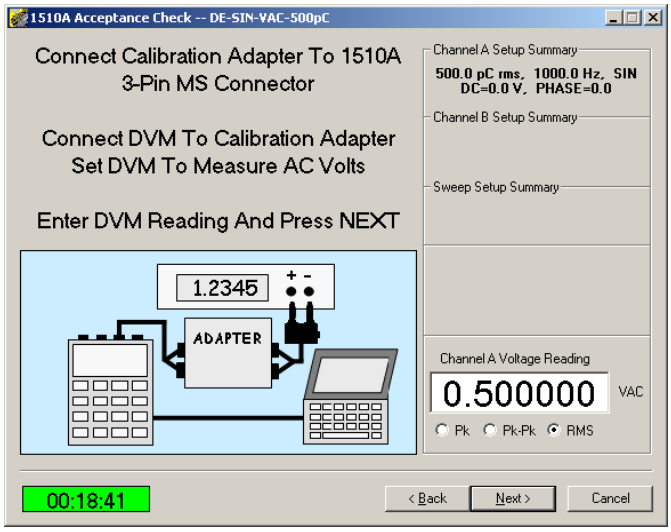


Differential Mid Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

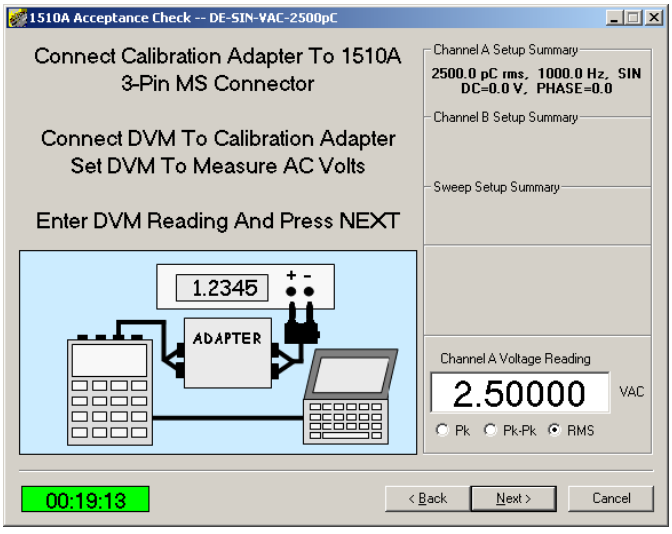


Differential High Range #1 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

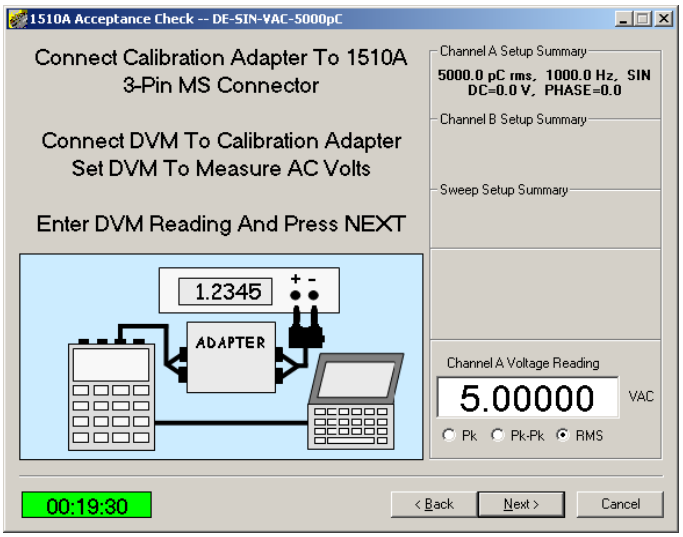
Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.



Differential High Range #2 charge check

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

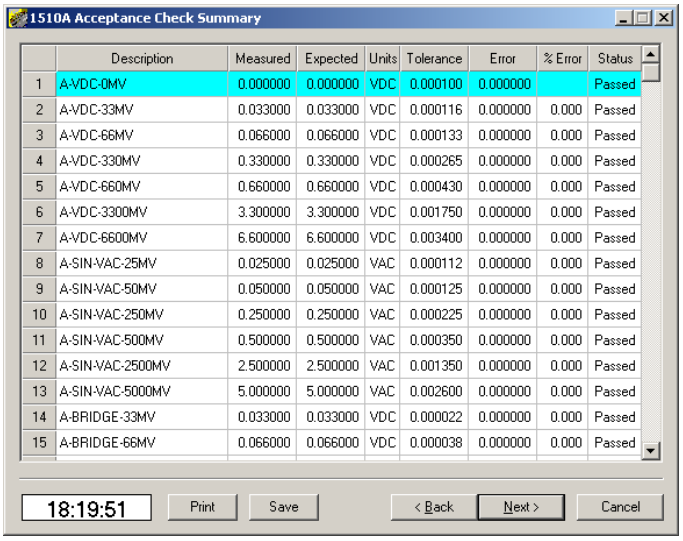


Verify that the meter has been set for AC rms voltage measurement.

After entering the reading, continue by pressing the ***Next*** button.

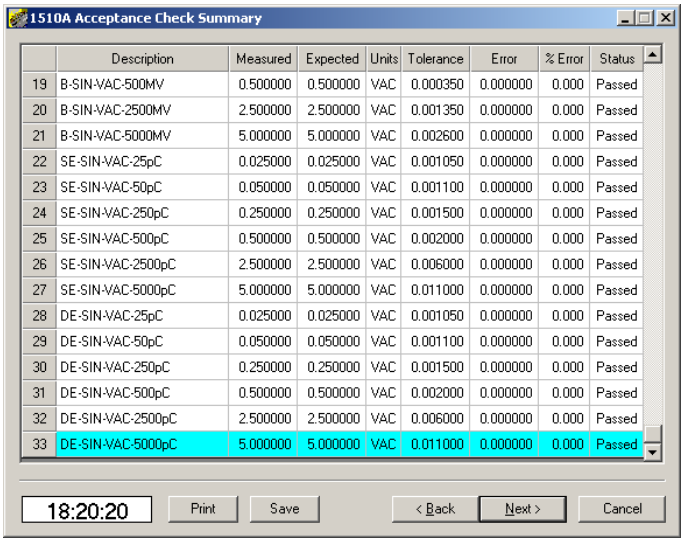
4-2.10 Reviewing the Accuracy Check Results

The accuracy check procedure is nearly complete. Review each of the test results to ensure that they are all within tolerance. Any out of tolerance readings will be highlighted in red.



	Description	Measured	Expected	Units	Tolerance	Error	% Error	Status
1	A-VDC-0MV	0.000000	0.000000	VDC	0.000100	0.000000		Passed
2	A-VDC-33MV	0.033000	0.033000	VDC	0.000116	0.000000	0.000	Passed
3	A-VDC-66MV	0.066000	0.066000	VDC	0.000133	0.000000	0.000	Passed
4	A-VDC-330MV	0.330000	0.330000	VDC	0.000265	0.000000	0.000	Passed
5	A-VDC-660MV	0.660000	0.660000	VDC	0.000430	0.000000	0.000	Passed
6	A-VDC-3300MV	3.300000	3.300000	VDC	0.001750	0.000000	0.000	Passed
7	A-VDC-6600MV	6.600000	6.600000	VDC	0.003400	0.000000	0.000	Passed
8	A-SIN-VAC-25MV	0.025000	0.025000	VAC	0.000112	0.000000	0.000	Passed
9	A-SIN-VAC-50MV	0.050000	0.050000	VAC	0.000125	0.000000	0.000	Passed
10	A-SIN-VAC-250MV	0.250000	0.250000	VAC	0.000225	0.000000	0.000	Passed
11	A-SIN-VAC-500MV	0.500000	0.500000	VAC	0.000350	0.000000	0.000	Passed
12	A-SIN-VAC-2500MV	2.500000	2.500000	VAC	0.001350	0.000000	0.000	Passed
13	A-SIN-VAC-5000MV	5.000000	5.000000	VAC	0.002600	0.000000	0.000	Passed
14	A-BRIDGE-33MV	0.033000	0.033000	VDC	0.000022	0.000000	0.000	Passed
15	A-BRIDGE-66MV	0.066000	0.066000	VDC	0.000038	0.000000	0.000	Passed

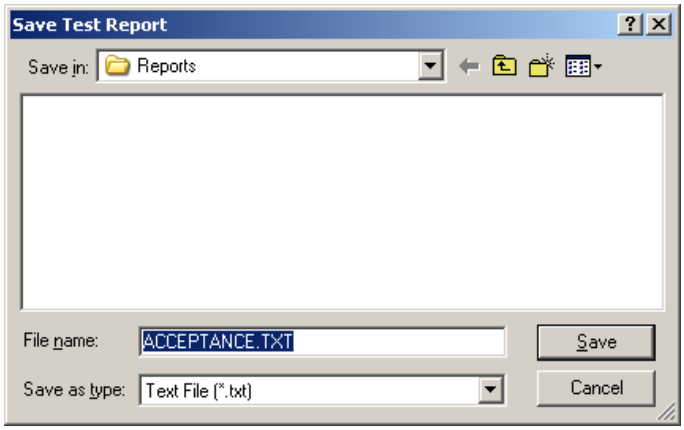
Remember to scroll down to review the results of all the tests performed.



	Description	Measured	Expected	Units	Tolerance	Error	% Error	Status
19	B-SIN-VAC-500MV	0.500000	0.500000	VAC	0.000350	0.000000	0.000	Passed
20	B-SIN-VAC-2500MV	2.500000	2.500000	VAC	0.001350	0.000000	0.000	Passed
21	B-SIN-VAC-5000MV	5.000000	5.000000	VAC	0.002600	0.000000	0.000	Passed
22	SE-SIN-VAC-25pC	0.025000	0.025000	VAC	0.001050	0.000000	0.000	Passed
23	SE-SIN-VAC-50pC	0.050000	0.050000	VAC	0.001100	0.000000	0.000	Passed
24	SE-SIN-VAC-250pC	0.250000	0.250000	VAC	0.001500	0.000000	0.000	Passed
25	SE-SIN-VAC-500pC	0.500000	0.500000	VAC	0.002000	0.000000	0.000	Passed
26	SE-SIN-VAC-2500pC	2.500000	2.500000	VAC	0.006000	0.000000	0.000	Passed
27	SE-SIN-VAC-5000pC	5.000000	5.000000	VAC	0.011000	0.000000	0.000	Passed
28	DE-SIN-VAC-25pC	0.025000	0.025000	VAC	0.001050	0.000000	0.000	Passed
29	DE-SIN-VAC-50pC	0.050000	0.050000	VAC	0.001100	0.000000	0.000	Passed
30	DE-SIN-VAC-250pC	0.250000	0.250000	VAC	0.001500	0.000000	0.000	Passed
31	DE-SIN-VAC-500pC	0.500000	0.500000	VAC	0.002000	0.000000	0.000	Passed
32	DE-SIN-VAC-2500pC	2.500000	2.500000	VAC	0.006000	0.000000	0.000	Passed
33	DE-SIN-VAC-5000pC	5.000000	5.000000	VAC	0.011000	0.000000	0.000	Passed

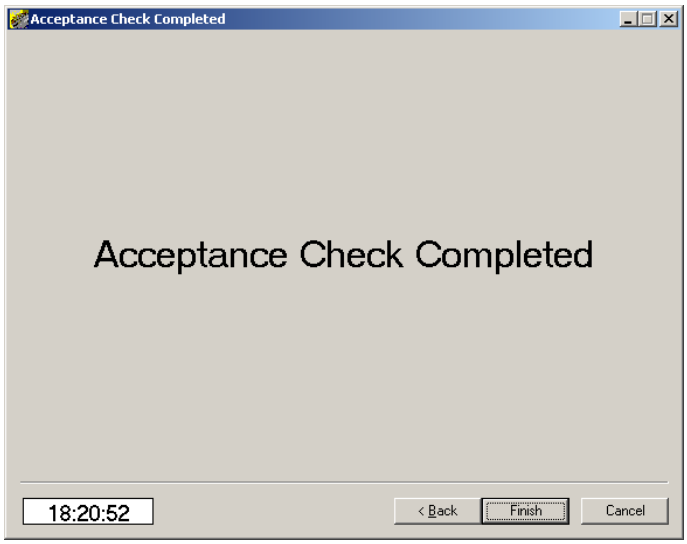
If the results are acceptable, you may choose to SAVE the results. To do this, press the ***SAVE*** button at the bottom of the display. This will produce a Windows dialog box where you can define where the results of the calibration check are to be saved.

If desired you may also print the results by pressing the ***PRINT*** button.



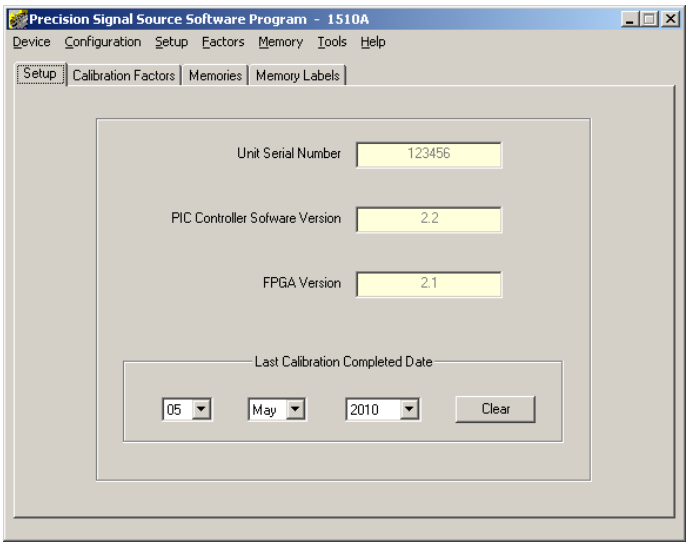
After saving and or printing the summary table pressing the ***NEXT*** button twill conclude the check process.

To exit the routine and return to the main program, click the ***FINISH*** button.

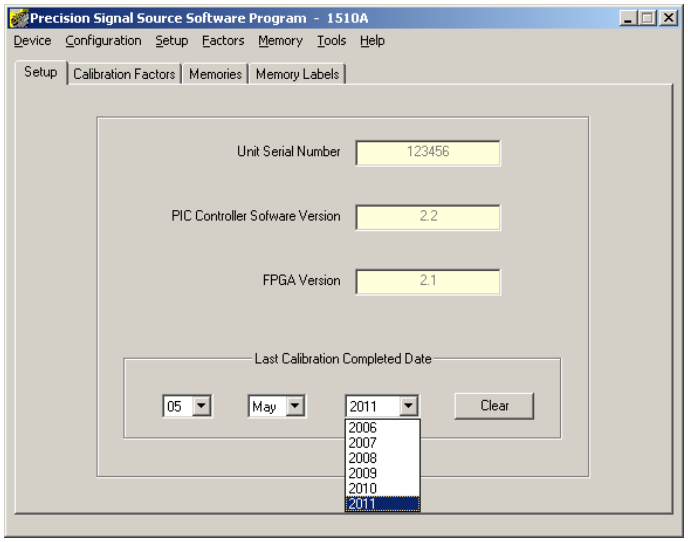


4-2.11 Updating the internal memory

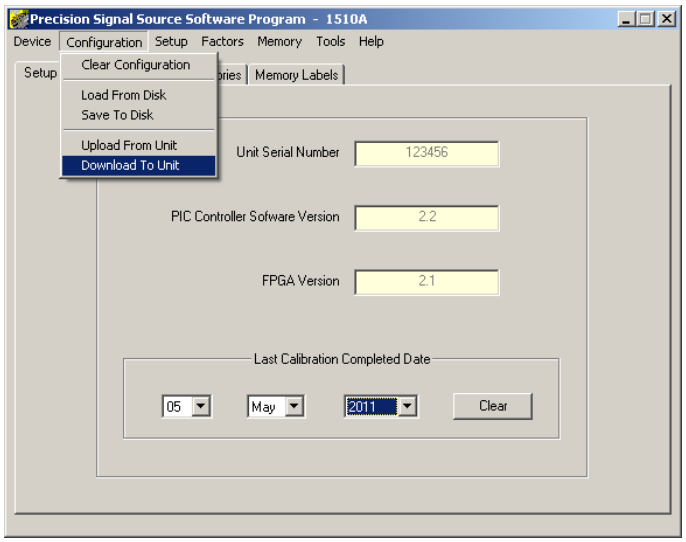
The 1510A has an internal memory where the latest calibration date can be saved. If the unit has passed the Acceptance check, the memory should be updated before the unit is returned to service. To update the memory return to the ***SETUP*** tab on the Support Software main display.



Use the drop-down lists at the bottom of the display to enter the current day, month and year as illustrated.



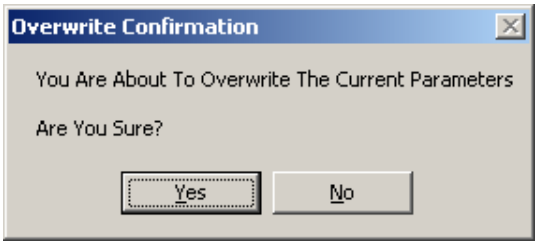
Next, click on the ***Configuration*** function at the top of the display and select the ***Download to Unit*** function as illustrated. This will send the new calibration date to the 1510A unit.

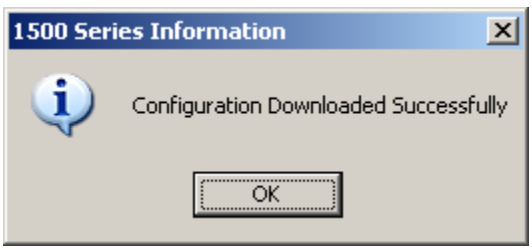


Answer ***YES*** to the "Are you sure" question.

In a few seconds, you will receive the Confirmation of a successful download.

Press ***OK*** to complete the process.





This is the end of the 1510A Acceptance Check Procedure

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4-3 1510A Calibration Wizard

4-3.1 Introduction and Overview – The 1510A Calibration Wizard provides users with a fast and easy way to re-calibrate the 1510A unit to factory levels of precision. This check is semi-automatically performed by the 1510A Calibration Wizard which is a part of the Calibration Support software package. The Calibration Wizard sends a series of commands to the unit under test, and the resulting outputs are measured using a high precision voltmeter. Each measurement point is entered into the computer by the user, which is then recorded by the Wizard. At the conclusion of the test, the Wizard summarizes all test measurements and calculates correction facts that can then be loaded into the 1510A to compensate for any detected errors.

The Wizard performs four different tests which are:

Channel A output voltage checks
Channel B output voltage checks
Single Ended charge output checks
Differential charge output checks.

The charge output signals from the 1510A can not be measured directly by a precision voltmeter. Therefore, the MTI Instruments Precision Charge Calibration Adapter must be used to convert the charge outputs to voltage signals. The Wizard will prompt the user when to use the Charge Calibration Adapter when it is required.

Required items – Several cables and accessories are required to perform the 1510A Calibration Wizard. In addition to the 1510A that will be tested, the following items will be required:

Items provided by the user:

PC computer with the Calibration Support Software loaded (refer to section 3.2.1 for installation instructions)

A high accuracy digital voltmeter capable of at least 6½ digit resolution. This meter should be calibrated and capable of measuring both AC and DC voltages.

Items supplied with the calibration kit:

7500-7535 Precision Charge Calibration Adapter
6000-2001 USB Cable
7500-7531 Single Ended Output to Calibration Adapter Cable
7500-7532 Differential Output to Calibration Adapter Cable
7500-7533 Single Ended Calibration Adapter output to DVM cable
7500-7534 Differential Calibration Adapter output to DVM cable

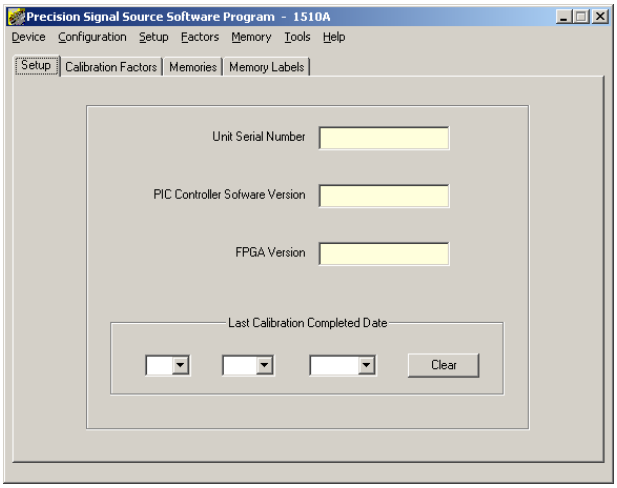
4-3.2 – Starting the Software –

Go the computer which has the software loaded. If the software has not yet been loaded, refer to section 3.2.1 of this manual.

At the computer, double clicking on the icon will launch the 1510A Support Program.

An introductory display will first be visible for a few seconds:

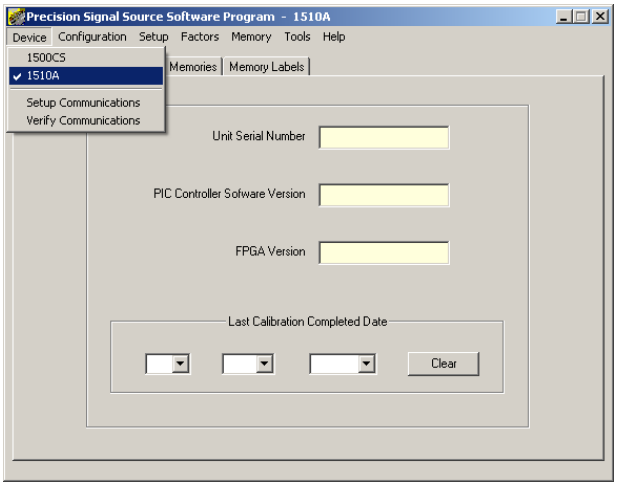
Automatically, the display will transition to the user interface display as illustrated here.



4-3.3 Selecting the Device Type

Click on the Configure tab which will reveal the device selection drop down list as illustrated here.

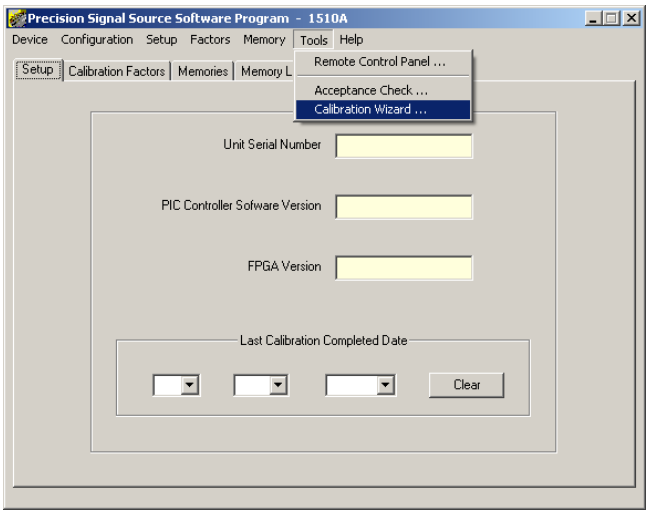
Select the ***1510A*** as illustrated.



4-3.4 Selecting the Calibration Wizard

Next, click on the Tools tab which will reveal the following drop down menu of operations and test that can be performed.

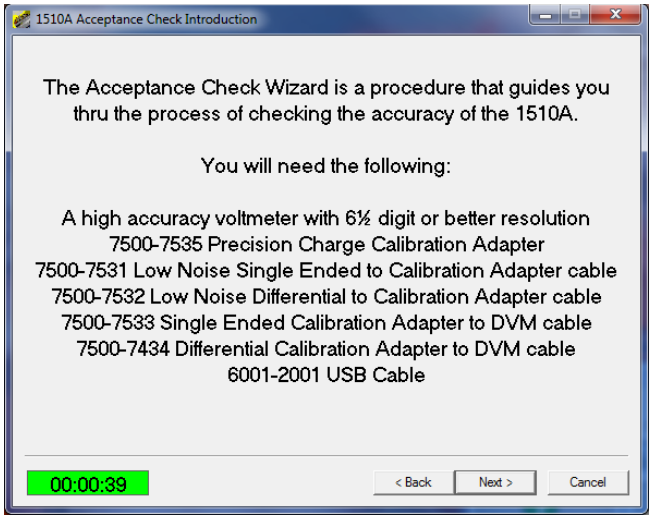
As illustrated, select the ***Calibration Wizard*** option.



The **Calibration Wizard** is a semi-automated procedure for recalibration the 1510A. The Wizard guides users thru the process of measuring different outputs from the unit. Results of the measurements are **used to recalibrate the 1510A device.**

Users simply need to follow the instructions displayed on each page, and when completed, click the **NEXT** button.

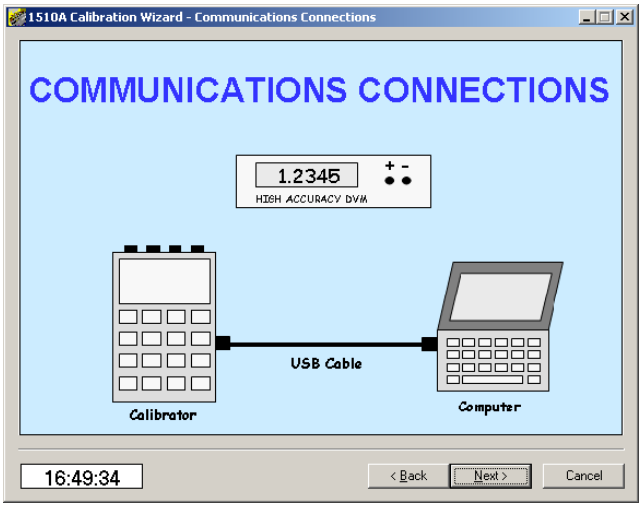
To calibrate a 1510A unit you will need a high accuracy voltmeter and the cables listed.



Connection to the 1510A unit
Before continuing, ensure that the communications cable has been connected between the 1510A and the computer that is running the Calibration Wizard.

After making the connection, turn the 1510A on.

After turning the 1510A on, continue by pressing the ***Next*** button.



4-3.5 Interrogating the unit under test

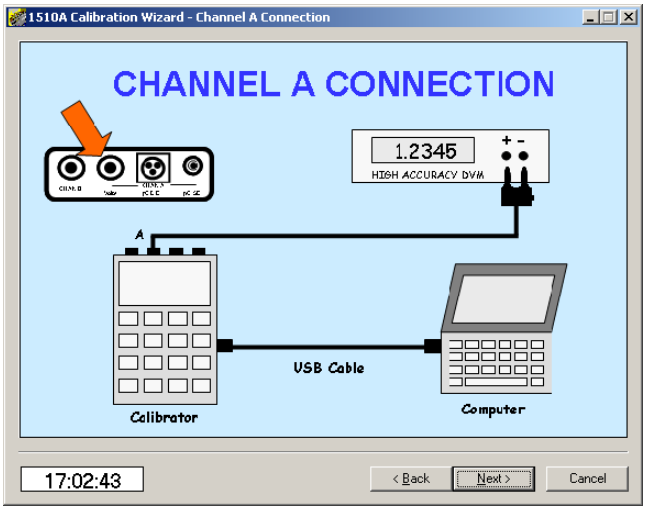
The next step in the Calibration Wizard uploads the units' serial number and software version information. Verify these numbers with those found on the label affixed to the back of the unit.

Continue by pressing the ***Next*** button.

Connect to Channel A –
Connect the 7500-7533 cable between the 1510A Channel A output connector and the input to the voltmeter.

Set the voltmeter for AC RMS readings.

After making the connections, continue by pressing the ***Next*** button.



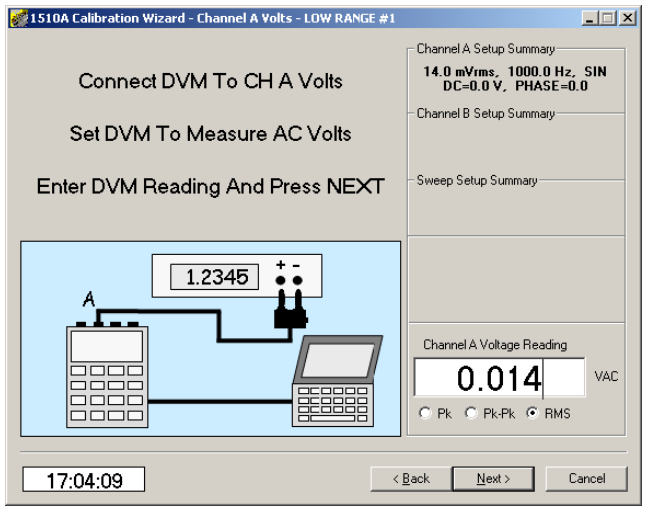
4-3.6 Starting the Channel A Low range AC calibration

Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

NOTE – If your voltmeter is not capable of displaying voltage in RMS units, you may click on one of the selector buttons to have the meter reading recorded in PK (peak) or Pk-Pk (peak to peak) units.

After entering the reading, continue by pressing the ***Next*** button.

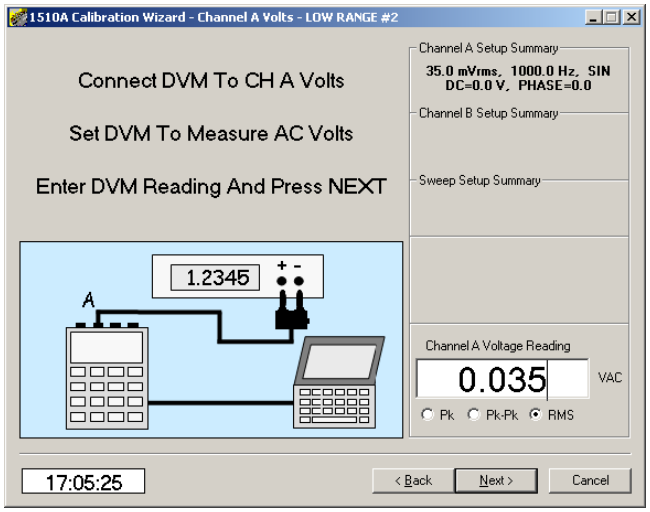


Channel A Low range #2 AC calibration

Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

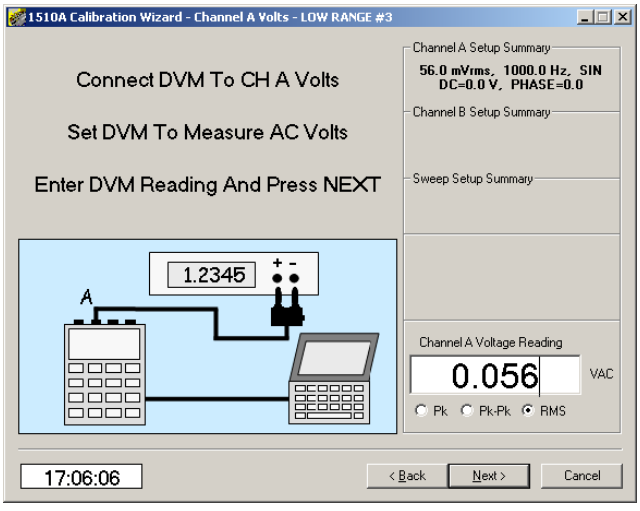


Channel A Low range #3 AC calibration

Click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

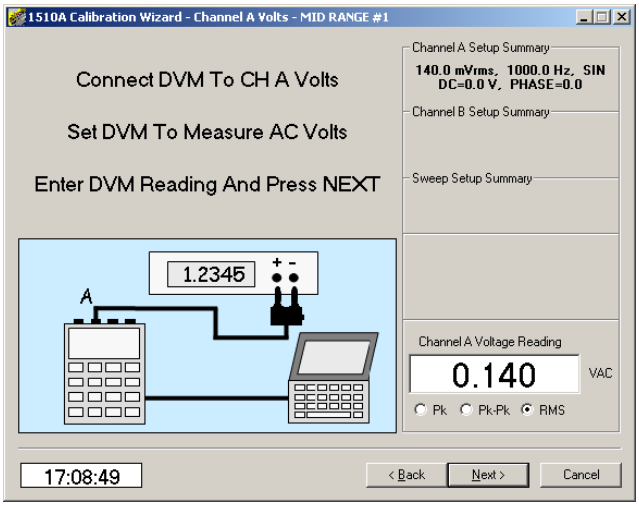
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid range #1 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

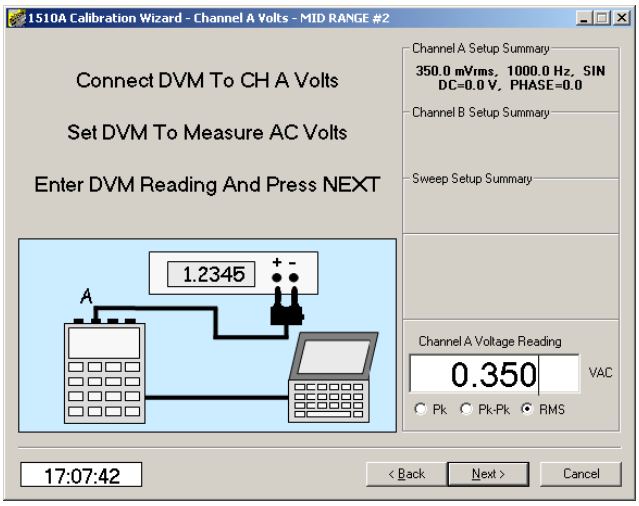
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid range #2 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

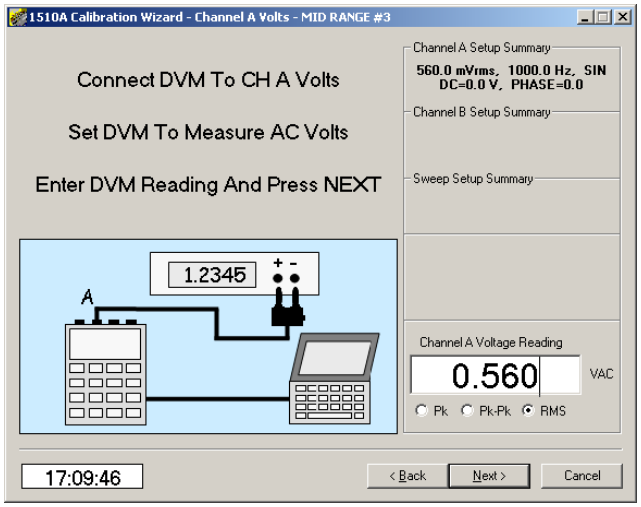
After entering the reading, continue by pressing the ***Next*** button.



Channel A mid range #3 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

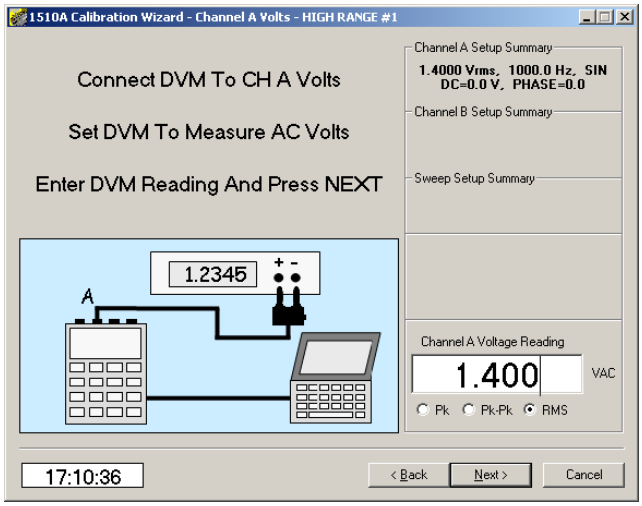
After entering the reading, continue by pressing the ***Next*** button.



Channel A high range #1 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

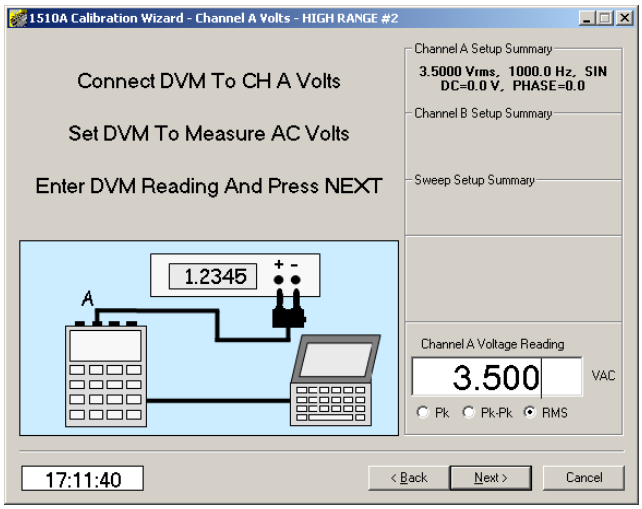
After entering the reading, continue by pressing the ***Next*** button.



Channel A high range #2 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

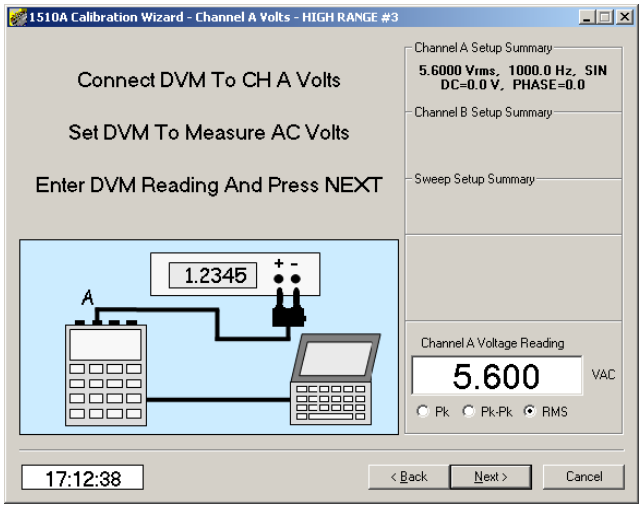
After entering the reading, continue by pressing the ***Next*** button.



Channel A high range #3 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

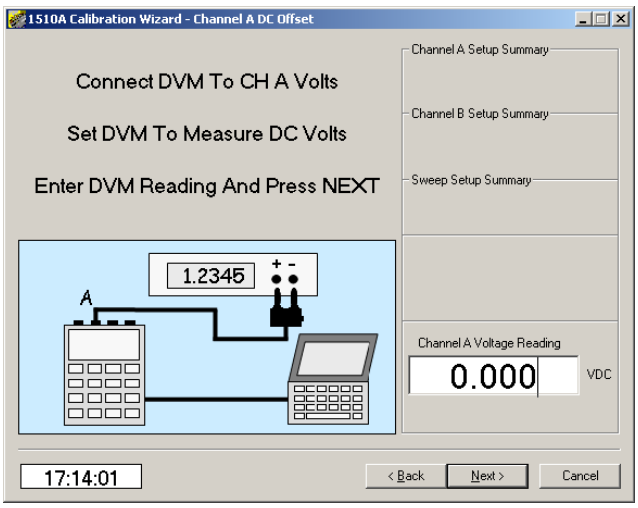


Channel A DC offset calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Set the voltmeter for DC volts readings.

After entering the reading, continue by pressing the ***Next*** button.

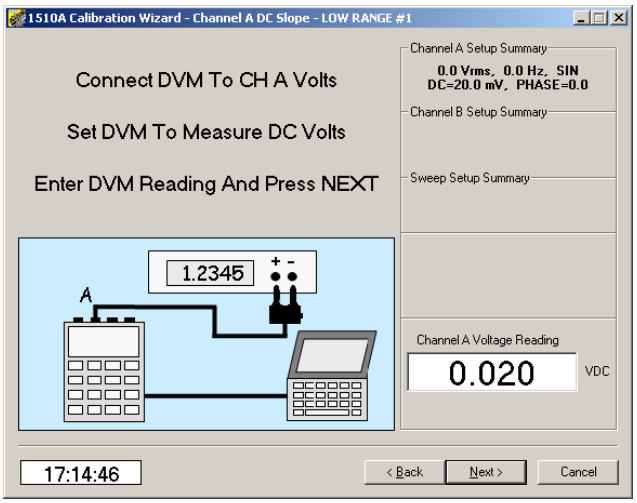


Channel A DC Slope Low Range #1 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.

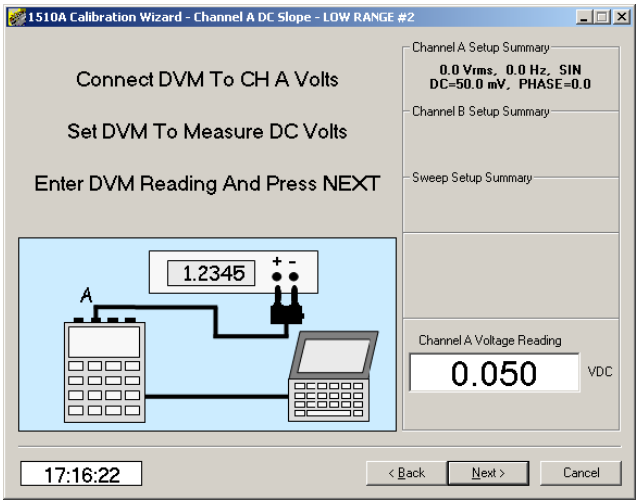


Channel A DC Slope Low Range #2 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.

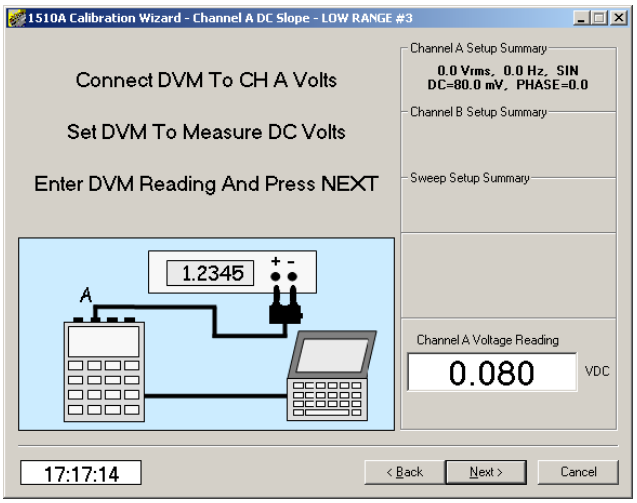


Channel A DC Slope Low Range #3 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.

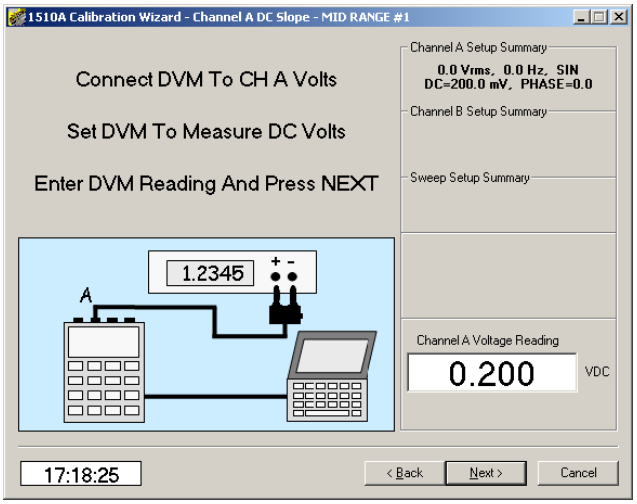


Channel A DC Slope Mid Range #1 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.

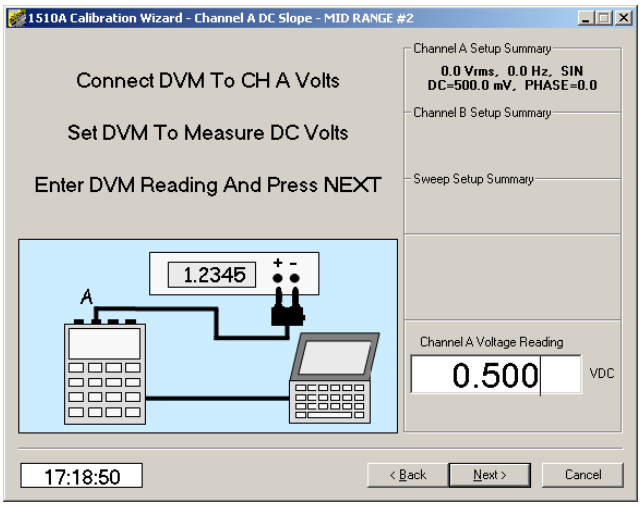


Channel A DC Slope Mid Range #2 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

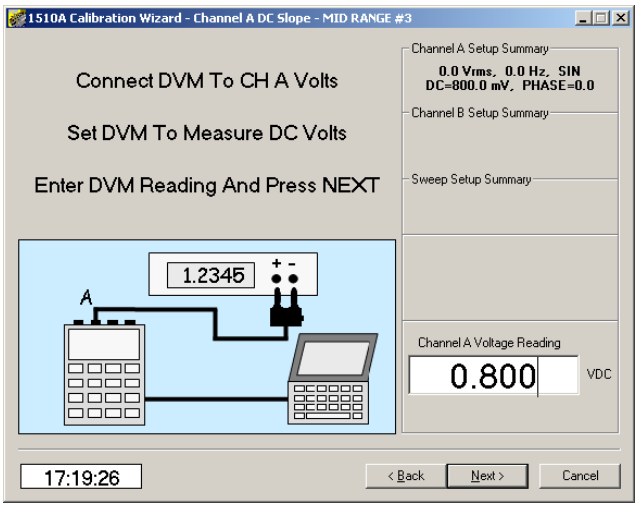
After entering the reading, continue by pressing the ***Next*** button.



Channel A DC Slope Mid Range #3 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

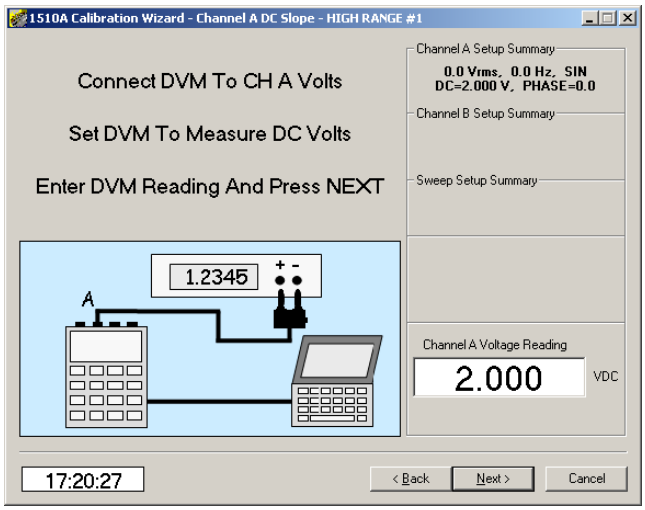
After entering the reading, continue by pressing the ***Next*** button.



Channel A DC Slope High Range #1 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

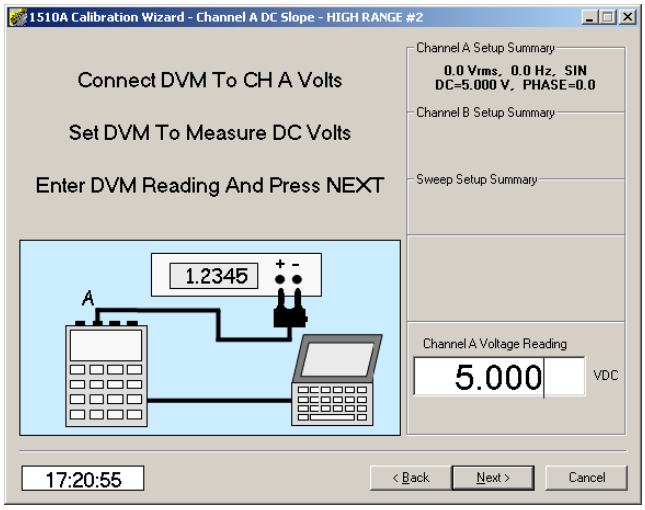
After entering the reading, continue by pressing the ***Next*** button.



Channel A DC Slope High Range #2 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.

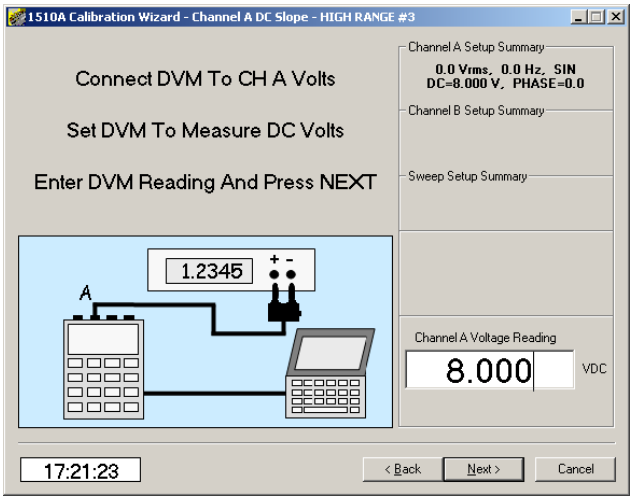


Channel A DC Slope High Range #3 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

After entering the reading, continue by pressing the ***Next*** button.



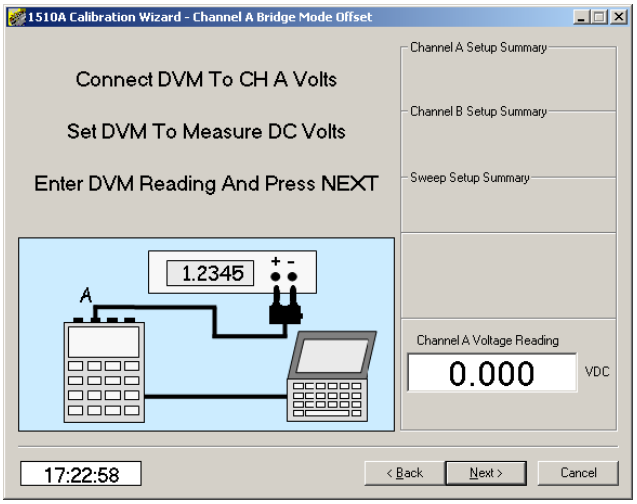
Bridge Mode offset calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

Be sure to wait for the bridge output voltage to stabilize.

After entering the reading, continue by pressing the ***Next*** button.



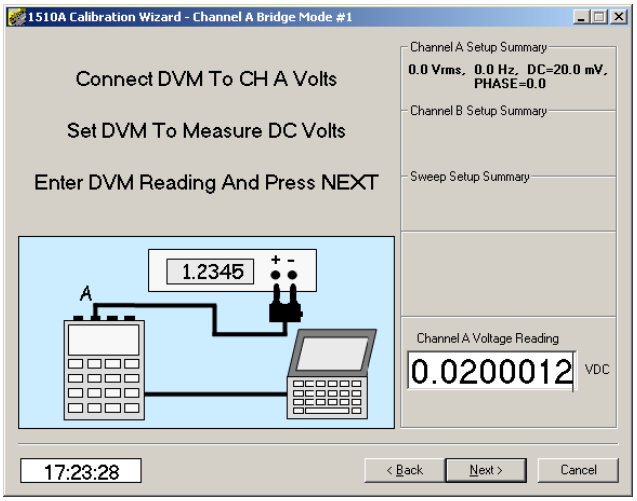
Bridge Mode #1 calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

Be sure to wait for the bridge output voltage to stabilize.

After entering the reading, continue by pressing the ***Next*** button.

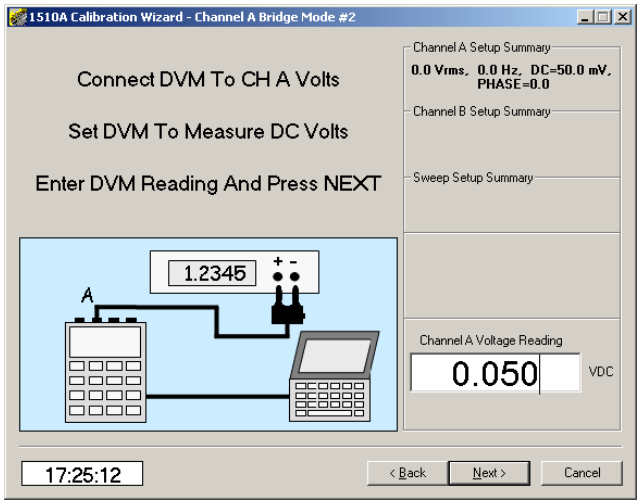


Bridge Mode #2 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

Be sure to wait for the bridge output voltage to stabilize.

After entering the reading, continue by pressing the ***Next*** button.

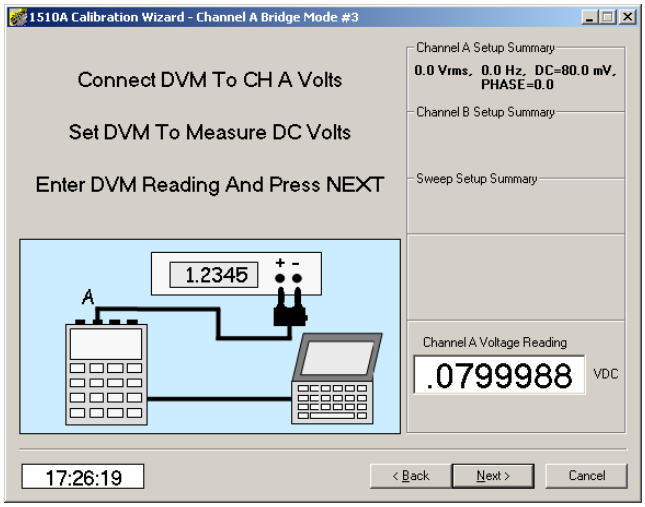


Bridge Mode #3 calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for DC voltage readings.

Be sure to wait for the bridge output voltage to stabilize.

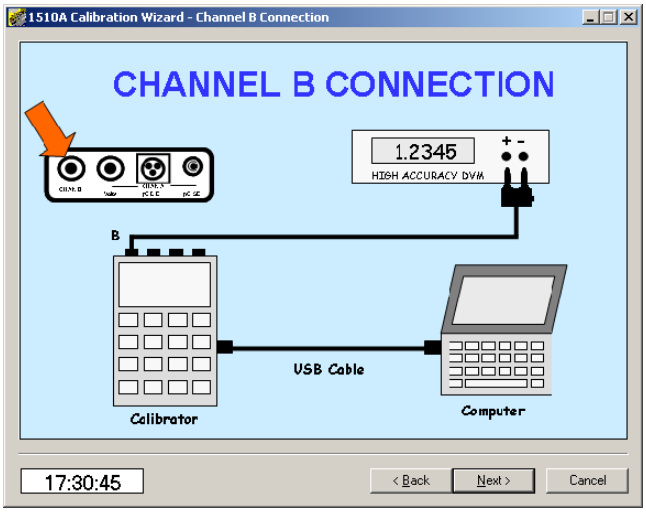
After entering the reading, continue by pressing the ***Next*** button.



4-3.7 Starting the Channel B calibration
Next, connect the 7500-7533cable to the 1510A Channel B output connector and the input to the voltmeter.

Set the voltmeter for AC RMS readings.

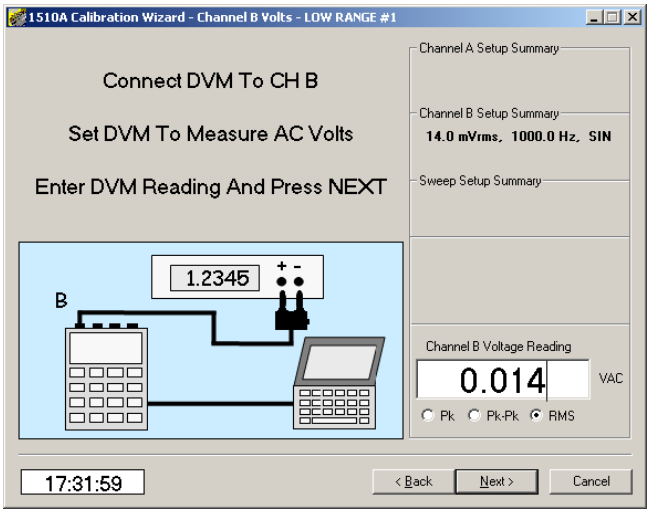
After moving the cable, continue by pressing the ***Next*** button.



Channel B Low range#1 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

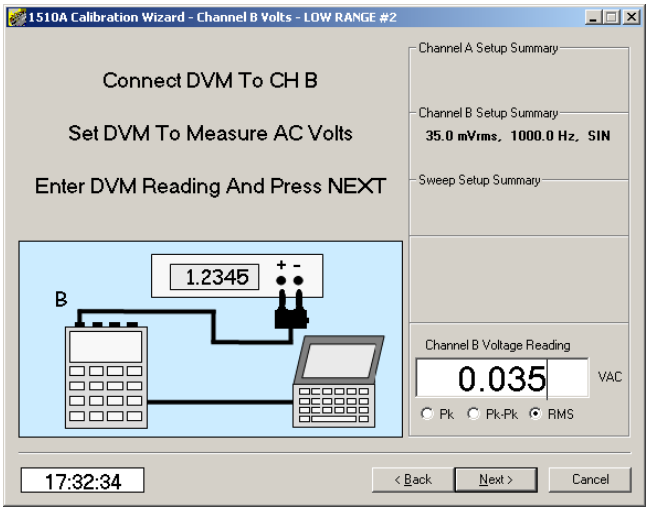
After entering the reading, continue by pressing the ***Next*** button.



Channel B Low range#2 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

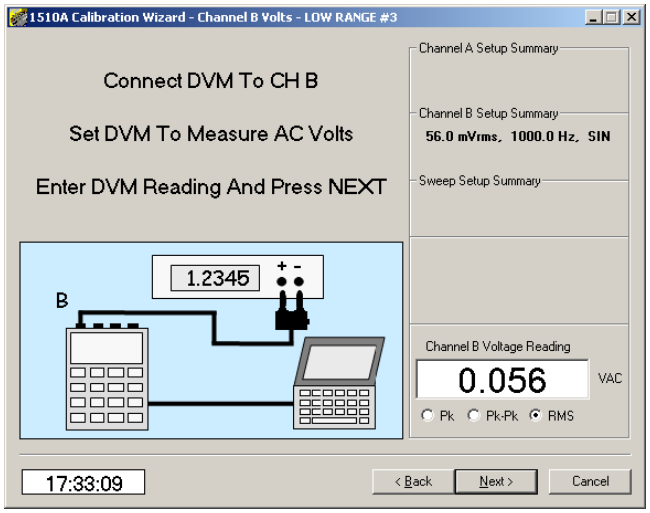
After entering the reading, continue by pressing the ***Next*** button.



Channel B Low range#3 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

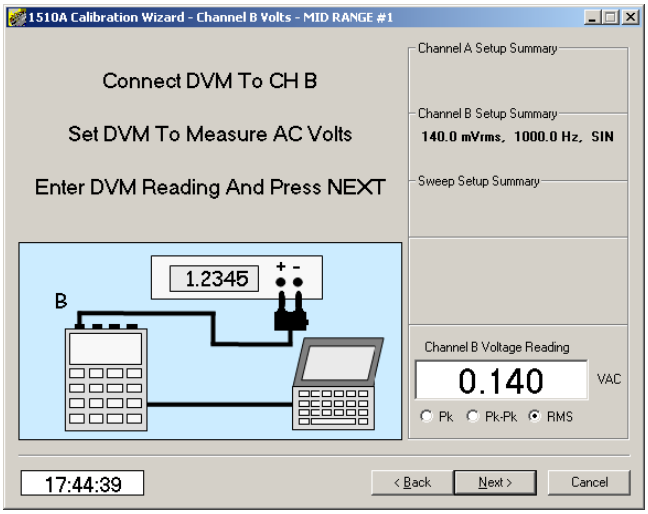
After entering the reading, continue by pressing the ***Next*** button.



Channel B Mid range #1 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

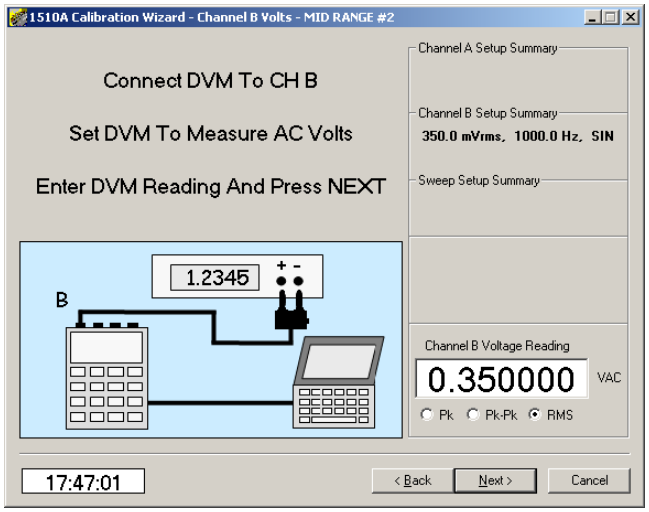
After entering the reading, continue by pressing the ***Next*** button.



Channel B Mid range #2 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

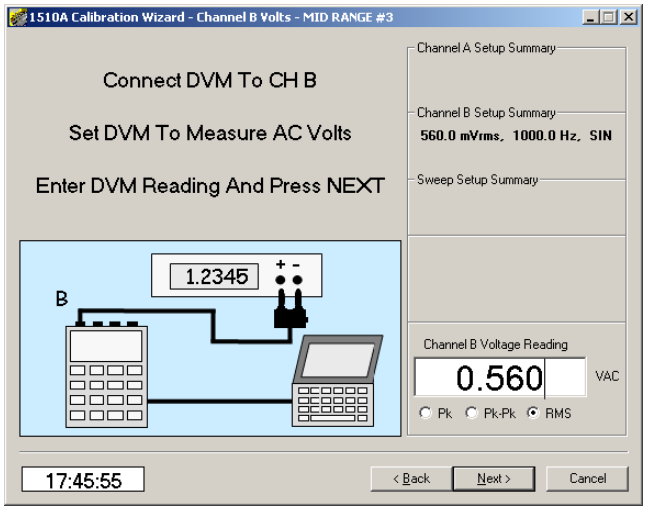
After entering the reading, continue by pressing the ***Next*** button.



Channel B Mid range #3 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

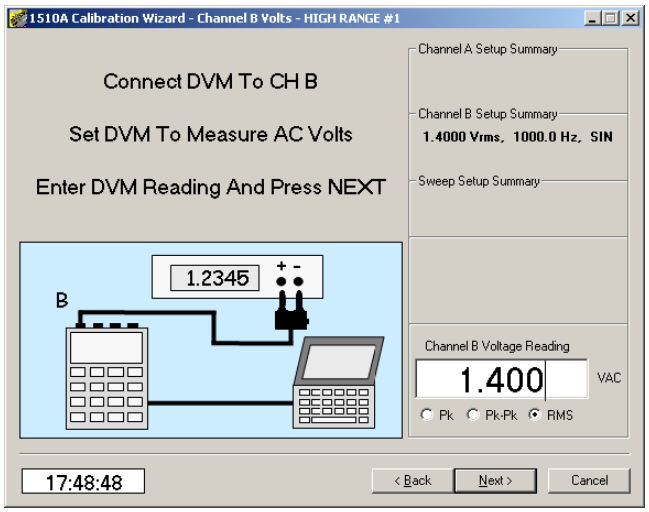
After entering the reading, continue by pressing the ***Next*** button.



Channel B high #1 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

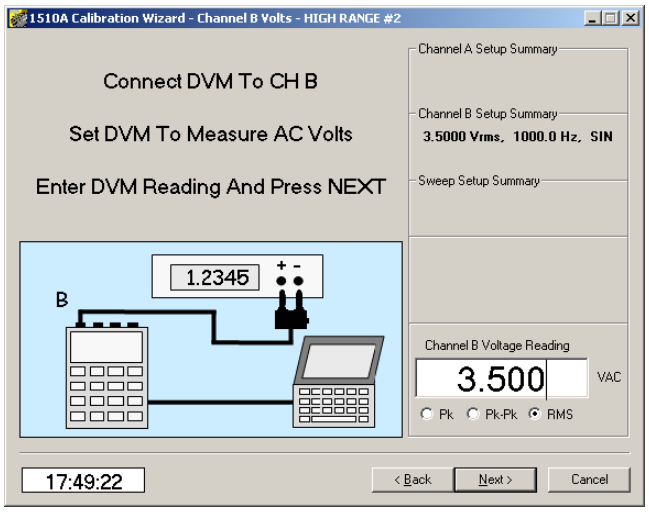
After entering the reading, continue by pressing the ***Next*** button.



Channel B Mid high #2 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

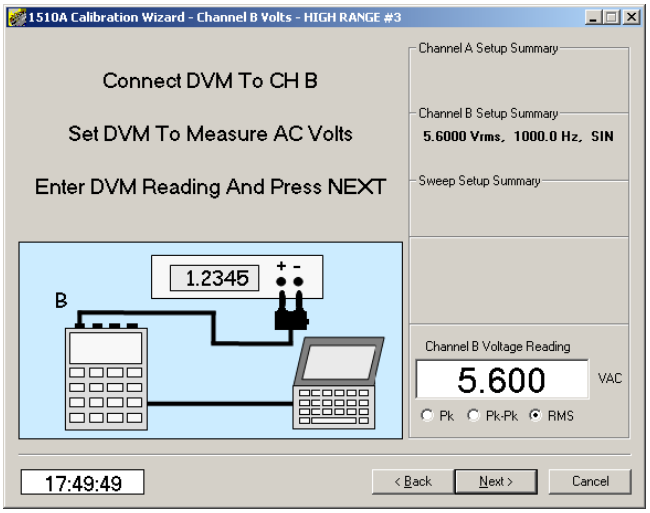
After entering the reading, continue by pressing the ***Next*** button.



Channel B high #3 AC calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

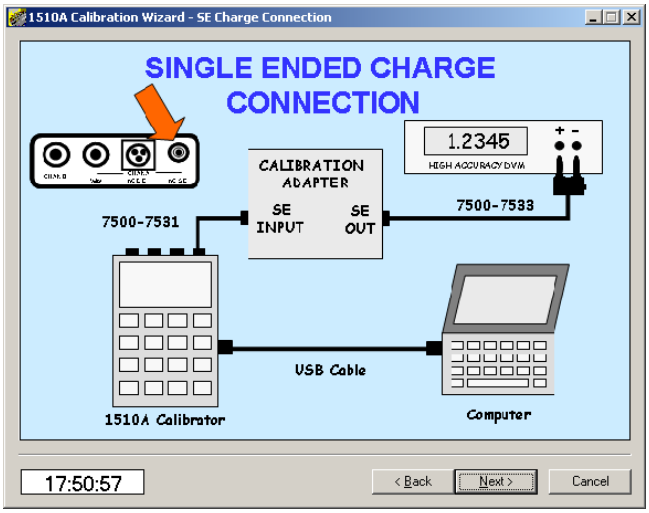


4-3.8 Starting the Single Ended charge calibration –

Next, connect the 1510A to the voltmeter as illustrated using the charge calibration adapter and associated cables.

Set the voltmeter for AC RMS readings.

When all cables have been connected, turn ***ON*** the adapter and click on the ***NEXT*** button.



NOTE

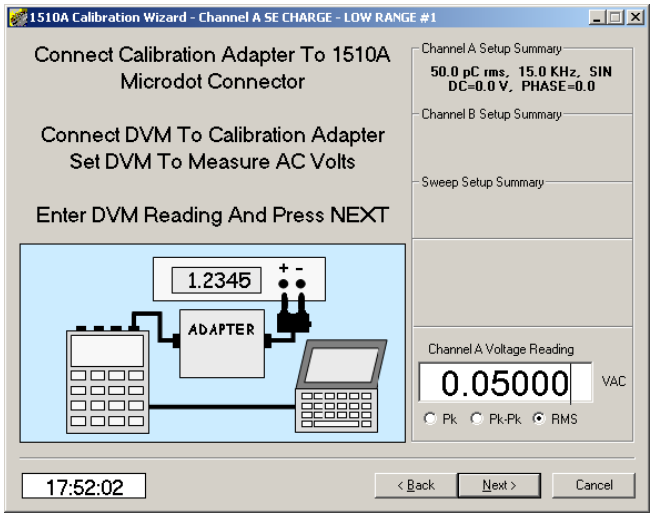
To ensure accuracy, do not allow the cables to move during this series of tests. Even small motion of the cable can induce measurement errors.

Low Range #1 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

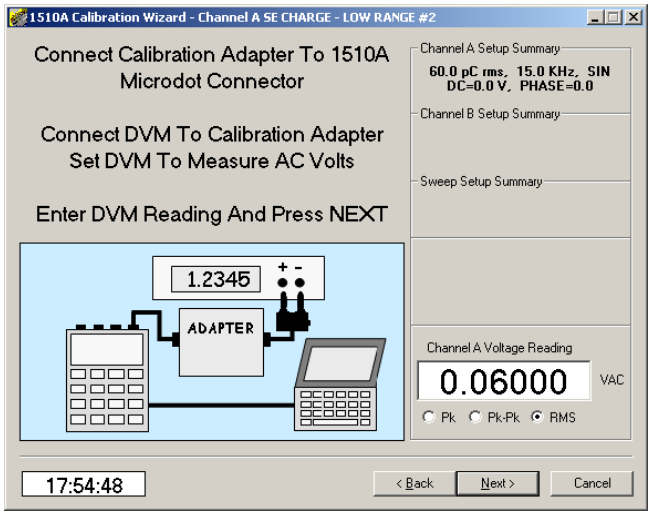


Low Range #2 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

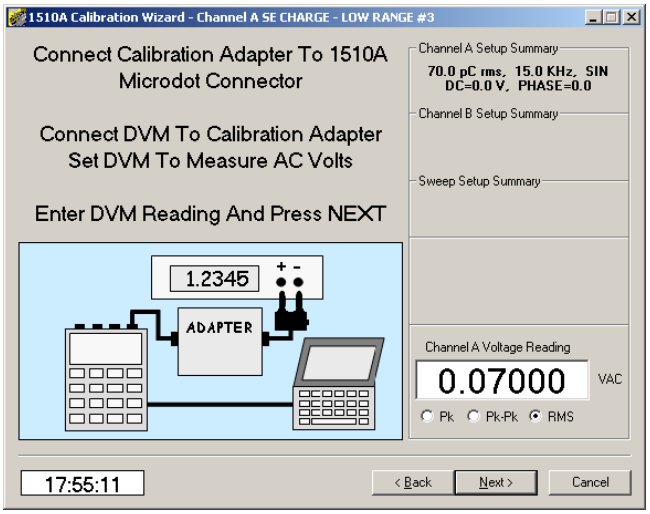


Low Range #3 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

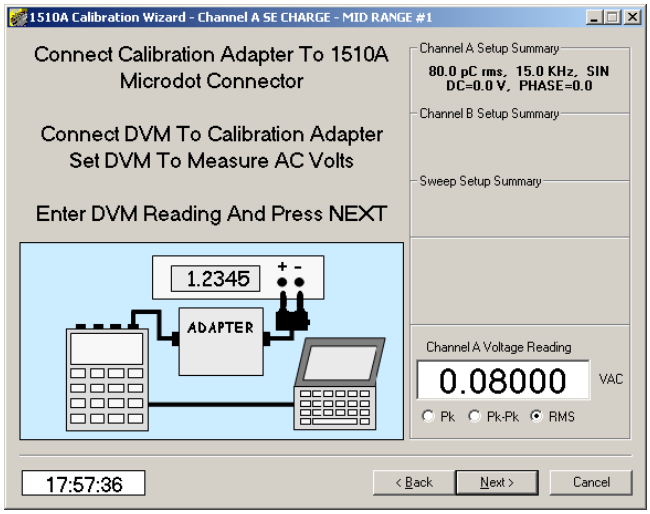


Mid Range #1 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

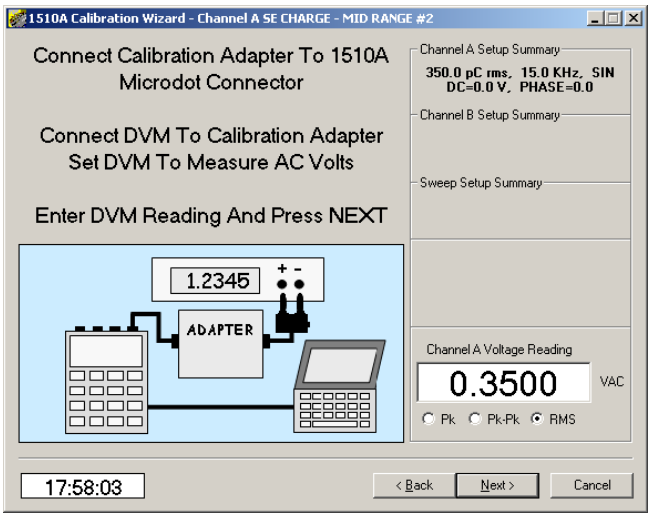


Mid Range #2 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

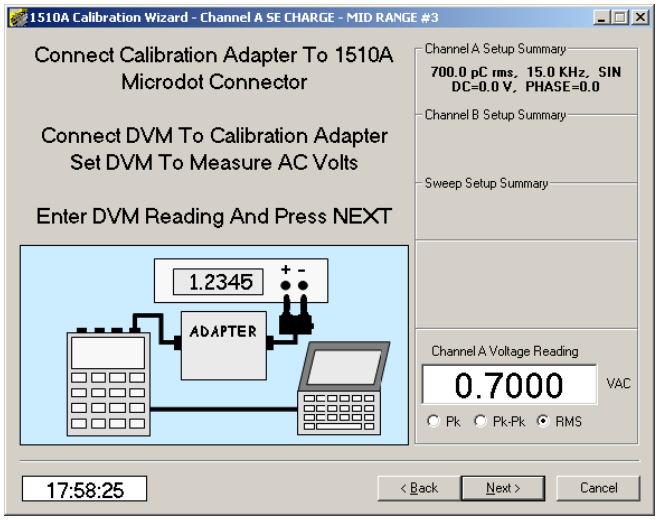


Mid Range #3 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

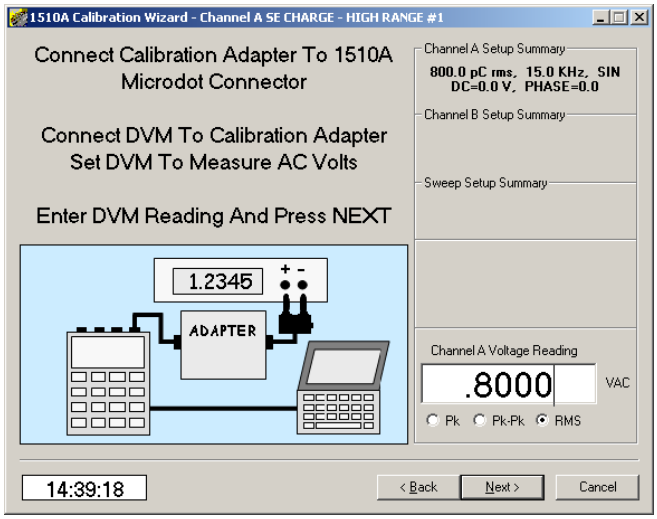


High Range #1 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

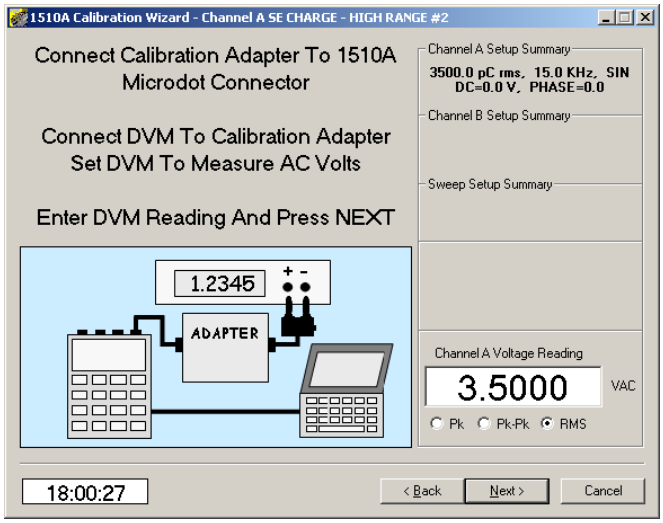


High Range #2 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

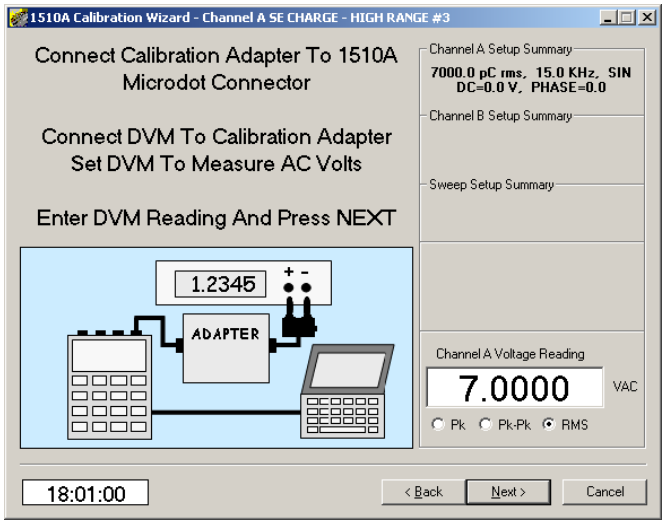


High Range #3 Single Ended charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

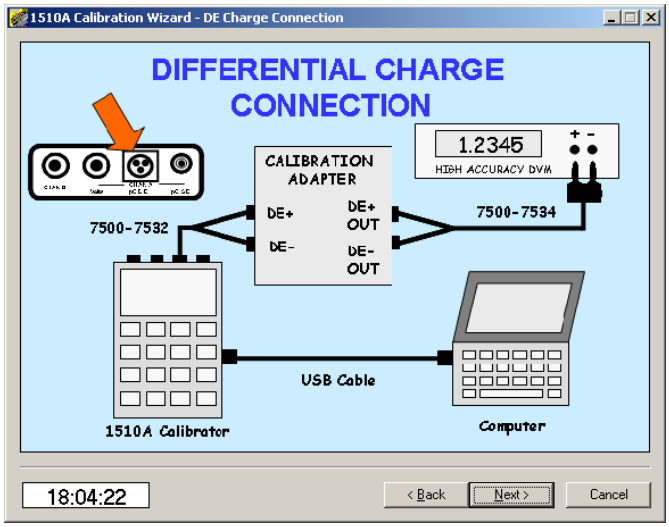


4-3.9 Starting the Differential charge calibration –

Next, connect the 1510A to the voltmeter as illustrated using the special charge calibration adapter and associated cables.

Set the voltmeter for AC RMS readings.

When all cables have been connected, turn ***ON*** the adapter and click on the ***NEXT*** button.



NOTE

To ensure accuracy, do not allow the cables to move during this series of tests. Even small motion of the cable can induce measurement errors.

NOTE

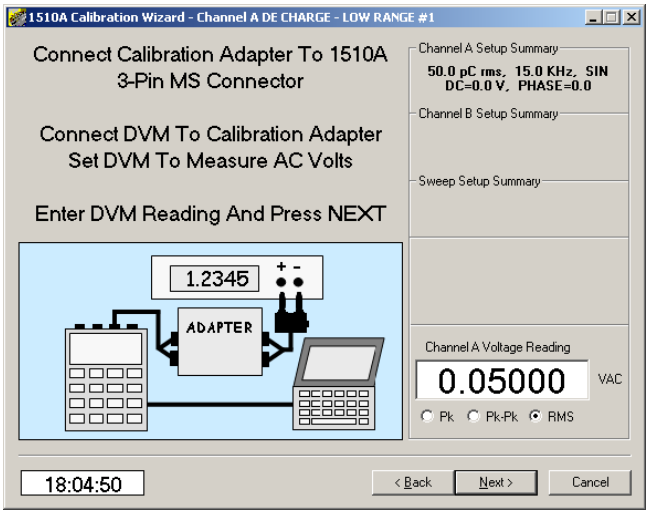
The DE output cable has shield drain banana plugs at each end of the cable. Place one drain plug connector into the Case Ground connector on the Calibration Adapter, and unless there is a serious noise issue with your test set-up, do not connect the grounding banana plug at the DVM.

Low Range #1 Differential charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.

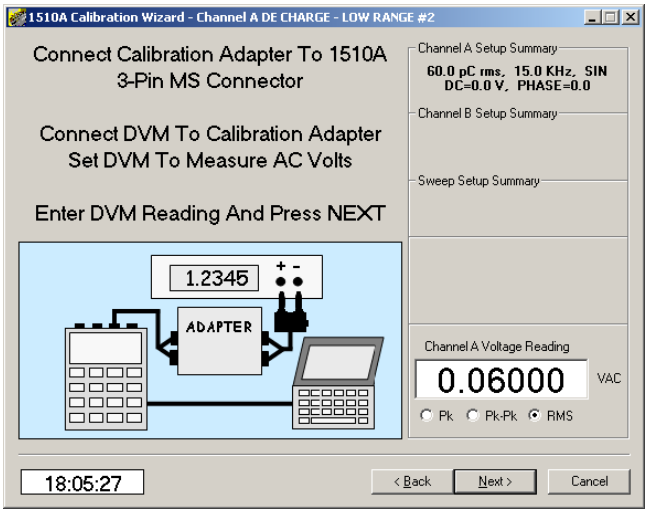


Low Range #2 Differential charge calibration

Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

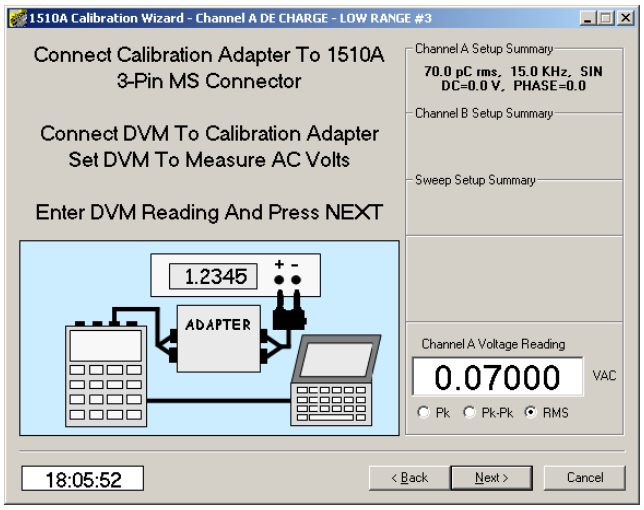
After entering the reading, continue by pressing the ***Next*** button.



Low Range #3 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

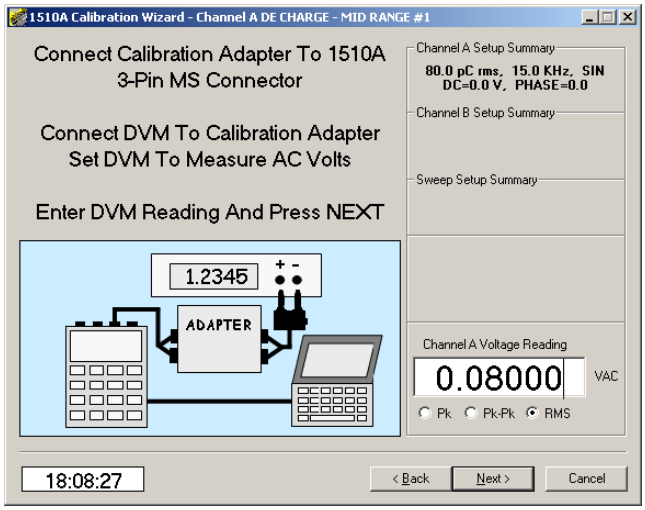
After entering the reading, continue by pressing the ***Next*** button.



Mid Range #1 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

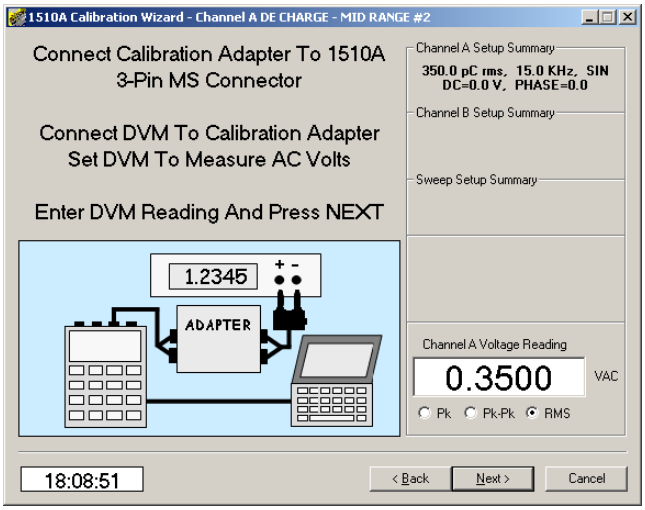
After entering the reading, continue by pressing the ***Next*** button.



Mid Range #2 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

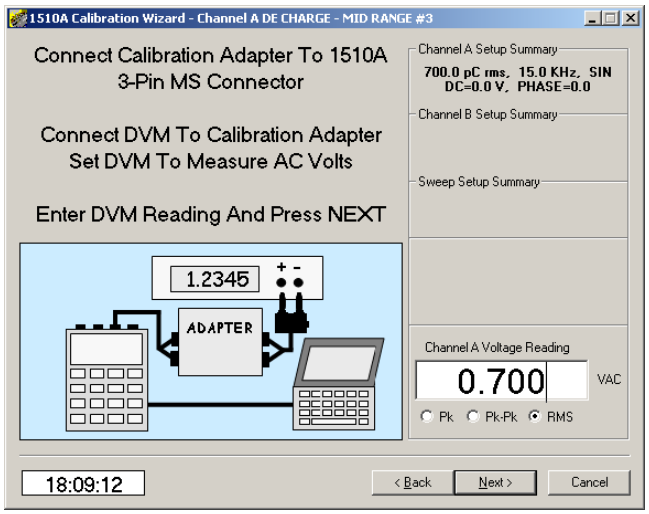
After entering the reading, continue by pressing the ***Next*** button.



Mid Range #3 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

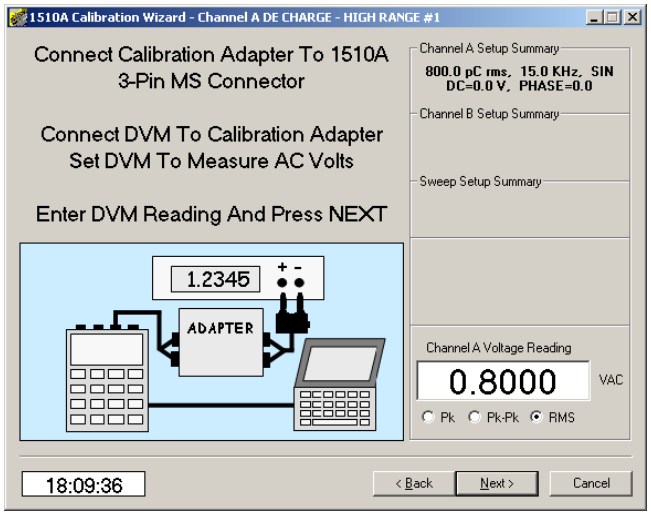
After entering the reading, continue by pressing the ***Next*** button.



High Range #1 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

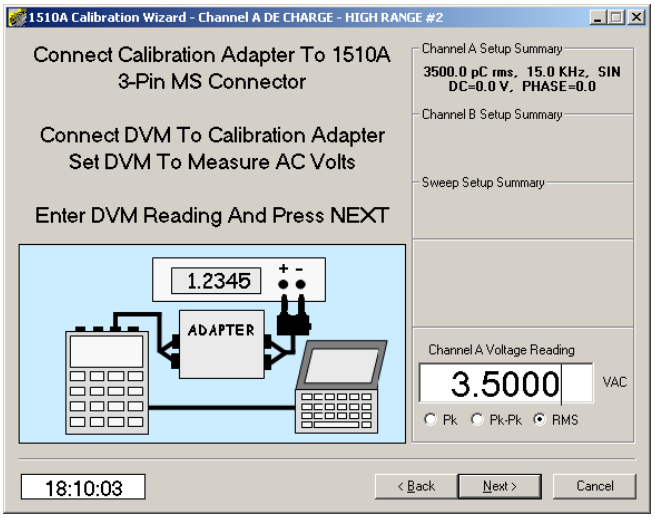
After entering the reading, continue by pressing the ***Next*** button.



High Range #2 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

Verify that the voltmeter is set for AC RMS readings.

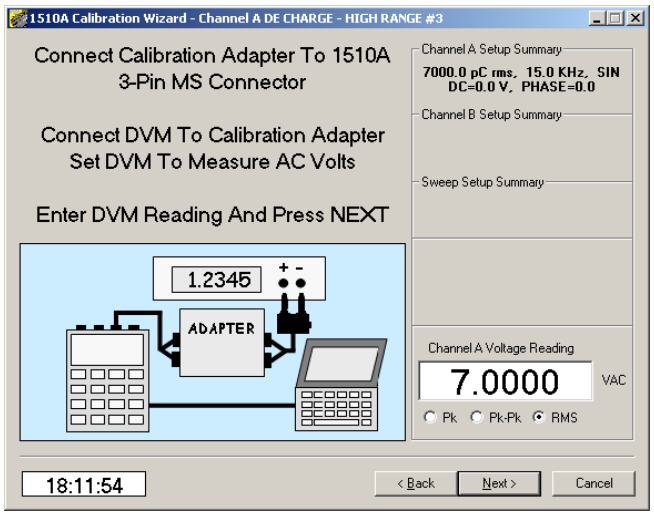
After entering the reading, continue by pressing the ***Next*** button.



High Range #3 Differential charge calibration
Next, click in the Voltage Reading window and enter the reading of the voltmeter.

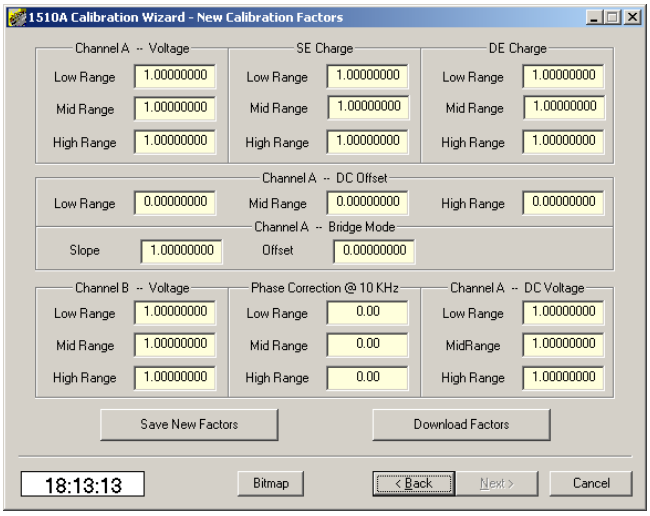
Verify that the voltmeter is set for AC RMS readings.

After entering the reading, continue by pressing the ***Next*** button.



4-3.10 Reviewing and Downloading calibration factors

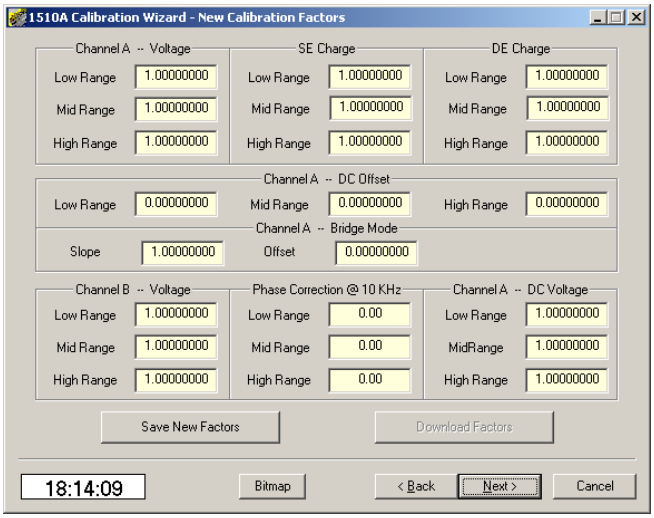
The calibration procedure is nearly complete. Review the calibration constants for each of the different outputs to ensure that the Low range, Mid range and High range numbers are near 1.000 and that the offset factors are near 0.0000. For the 1510A, verify that the Phase is near zero.



Calibration factors should nominally be near 1.0000, with an allowable range from 0.9000 to 1.1000. If any of the values are beyond these limits, the unit may still be able to aligned, but there may be internal component damage that should be investigated. Check with your MTI Instruments representative.

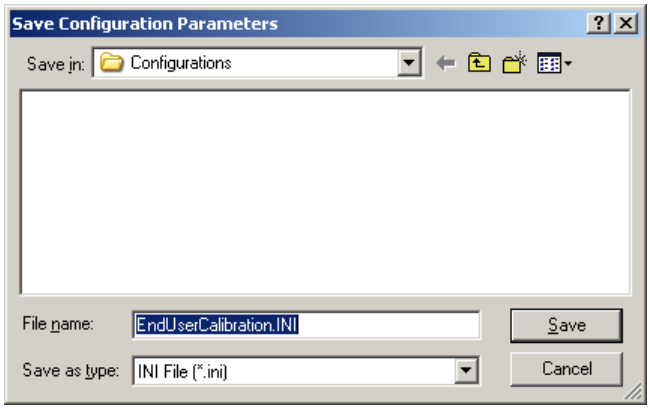
DC Offset factors should be very near the value 0.0000 ranging from a low value of - 0.0300 to a high value of + 0.0300. If any of the offset values are beyond these limits, the unit may still be able to aligned, but there may be internal component damage that should be investigated. Check with your MTI Instruments representative.

If all factors are "reasonable" click the ***DOWNLOAD FACTORS*** button to update the 1510A unit memory. Otherwise, click ***CANCEL***.



If factors were downloaded, verify that the ***Download*** button has grayed-out as illustrated here.

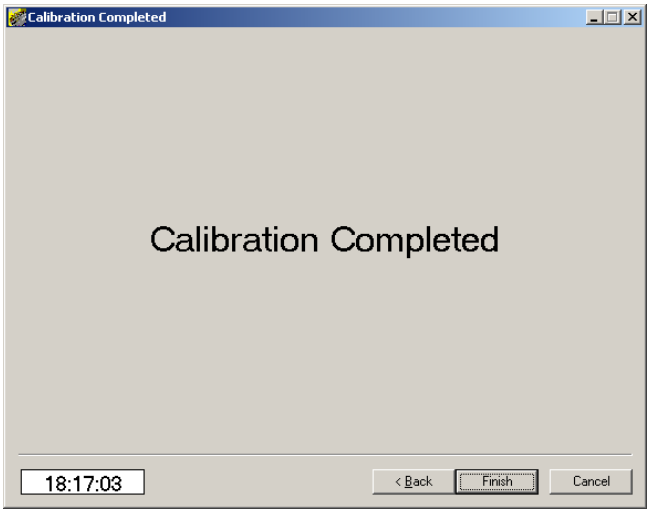
To save the recently computer calibration factors on the PC computer, press the ***SAVE NEW FACTORS*** button and a Windows dialog box will be displayed to allow saving the factors where desired.



After all saving and recording has been accomplished, click the ***NEXT*** button.

Calibration has been completed

Click the ***FINISH*** button.



This is the end of the 1510A Calibration Wizard Procedure