Model DMM7510
Quick Start Guide

KEITHLEY
A Tektronix Company

Safety precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a ⏚ screw is present, connect it to protective earth (safety ground) using the wire recommended in the user documentation.

The ⚠ symbol on an instrument means caution, risk of hazard. The user must refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The ⚠ symbol on an instrument means warning, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.

The ⚠ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The ⏚ symbol indicates a connection terminal to the equipment frame.

If this Hg symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains hazards that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

The **CAUTION** heading with the ⚠ symbol in the user documentation explains hazards that could result in moderate or minor injury or damage the instrument. Always read the associated information very carefully before performing the indicated procedure. Damage to the instrument may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F); and pollution degree 1 or 2.

To clean an instrument, use a cloth dampened with deionized water or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of June 2017.

Safety

Power and environmental specifications

For indoor use only.

Power supply	100 V to 240 V_{RMS} 50 Hz to 60 Hz (automatically sensed at power up)
Maximum VA	60 VA
Operating altitude	Maximum 2000 m (6562 ft) above sea level
Operating temperature	0 °C to 50 °C, less than 80% relative humidity at 35 °C
Storage temperature	− 30 °C to +70 °C
Pollution degree	1 or 2

Introduction

The Model DMM7510 is a 7½ digit graphical sampling multimeter that expands standard digital multimeter (DMM) functions with high-speed digitizing and a large color graphical touchscreen display.

In addition to industry-leading DC accuracies, functions such as capacitance, 10 A current, and 18-bit current and voltage digitizing are included. The large 5-inch color touchscreen display ties all of these features into a package that brings you an unprecedented combination of data visualization and interaction for greater insight into your measurements.

The DMM7510 provides superior measurement accuracy and the speed necessary for a broad range of applications, from system applications and production testing to benchtop applications. The DMM7510 meets application requirements for production engineers, research and development engineers, test engineers, and scientists.

This guide provides quick steps to set up and use the DMM7510. Complete documentation is available for download on the Keithley web page at tek.com/keithley.

The DMM7510 documentation includes:

- **Quick Start Guide:** This document. Provides unpacking instructions, describes basic connections, and reviews basic operation information.
- **User's Manual:** Provides information so that you can understand and start working with the instrument.
- **Application Manual:** Provides examples that you can use as a starting point to create your own applications.
- **Reference Manual:** Includes advanced operation topics, maintenance information, troubleshooting procedures, and in-depth descriptions of programming commands.
- **Accessories information:** Documentation for accessories that are available for the DMM7510.

Contact information

If you have any questions after you review the information in this documentation, please contact your local Keithley Instruments office, sales partner, or distributor. You can also call the Tektronix corporate headquarters (toll-free inside the U.S. and Canada only) at 1-800-833-9200. For worldwide contact numbers, visit tek.com/contact-us.

Unpack and inspect the instrument

To unpack and inspect the instrument:

1. Inspect the box for damage.
2. Open the top of the box.
3. Remove the bag that contains the documentation and standard accessories.
4. Remove the packaging insert.
5. Remove the DMM7510 from the box.
6. Inspect the instrument for any obvious signs of physical damage. Report any damage to the shipping agent immediately.

CAUTION

Do not lift the DMM7510 by the front bezel. Lifting the instrument by the front bezel can cause instrument damage.

You should have received the DMM7510 with the following accessories:

1. USB cable, Type A to Type B, 1 m (3.28 ft)
2. Power-line cord
3. Standard Test Lead Kit
4. Crossover cable for TSP-Link or ethernet connections
5. Safety Precautions, 0713411*XX* (not shown)

Refer to the packing list for additional items that may have shipped with your instrument.

Items may vary from those pictured here

Connect the instrument

Important test system safety information

This product is sold as a stand-alone instrument that may become part of a system that could contain hazardous voltages and energy sources. It is the responsibility of the test system designer, integrator, installer, maintenance personnel, and service personnel to make sure the system is safe during use and is operating properly.

You must also realize that in many test systems, a single fault such as a software error may output hazardous signal levels, even when the system indicates that there is no hazard present.

It is important that you consider the following factors in your system design and use:

- The international safety standard IEC 61010-1 defines voltages as hazardous if they exceed 30 V_{RMS} and 42.4 V_{PEAK} or 60 V dc for equipment rated for dry locations. Keithley Instruments products are only rated for dry locations.
- Read and comply with the specifications of all instruments in the system. The overall allowed signal levels may be constrained by the lowest rated instrument in the system. For example, if you are using a 500 V power supply with a 300 V dc rated switch, the maximum allowed voltage in the system is 300 V dc.
- Make sure any test fixture connected to the system protects the operator from contact with hazardous voltages, hot surfaces, and sharp objects. Use shields, barriers, insulation, and safety interlocks to accomplish this.
- Cover the device under test (DUT) to protect the operator from flying debris in the event of a system or DUT failure.
- Double-insulate all electrical connections that an operator can touch. Double insulation ensures the operator is still protected even if one insulation layer fails. Refer to IEC 61010-1 for specific requirements.

- Make sure all connections are behind a locked cabinet door or other barrier. This protects the system operator from accidentally removing a connection by hand and exposing hazardous voltages. Use high-reliability, fail-safe interlock switches to disconnect power sources when a test fixture cover is opened.
- Where possible, use automatic handlers so operators are not required to access the DUT or other potentially hazardous areas.
- Provide training to all users of the system so they understand all potential hazards and know how to protect themselves from injury.
- During power up in many systems, the outputs may be in an unknown state until they are properly initialized. Make sure the design can tolerate this situation without causing operator injury or hardware damage.

NOTE

To keep users safe, always read and follow all safety warnings provided with each of the instruments in your system.

Install the instrument

You can use the DMM7510 on a bench or in a rack. If you are installing the DMM7510 in a rack, please see the instructions that came with your rack-mount kit.

To prevent damaging heat build-up and ensure specified performance, make sure there is adequate ventilation and air flow around the instrument to ensure proper cooling. Do not cover the ventilation holes on the top, sides, or bottom of the instrument.

Make sure the instrument is positioned so that it is easy to reach any disconnecting devices, such as the power cord.

The DMM7510 operates from a line voltage of 100 V to 240 V at a frequency of 50 Hz or 60 Hz. The line voltage is sensed automatically. Before connecting line power, make sure the operating voltage in your area is compatible.

The DMM7510 must be turned on and allowed to warm up for at least 90 minutes to achieve rated accuracies.

⚠ WARNING

The power cord supplied with the DMM7510 contains a separate protective earth (safety ground) wire for use with grounded outlets. When proper connections are made, the instrument chassis is connected to power-line ground through the ground wire in the power cord. In the event of a failure, not using a properly grounded protective earth and grounded outlet may result in personal injury or death due to electric shock.

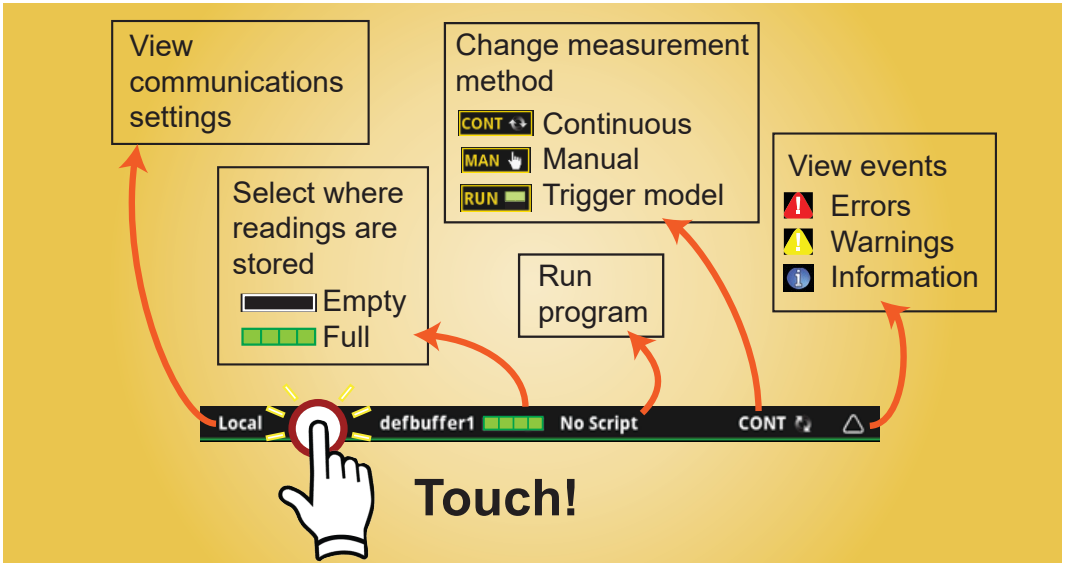
Do not replace detachable mains supply cords with inadequately rated cords. Failure to use properly rated cords may result in personal injury or death due to electric shock.

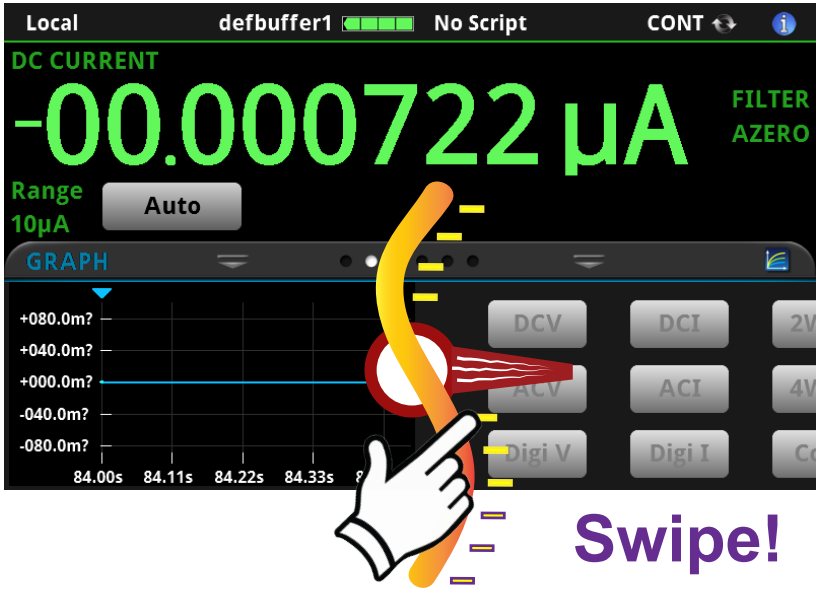
To connect line power and turn on the instrument:

1. Make sure the front-panel power switch is in the off (0) position.
2. Connect the socket of the supplied power cord to the power module on the rear panel.
3. Connect the plug of the power cord to a grounded ac outlet.
4. Press the front-panel power switch to on (|) position.

Explore the DMM7510

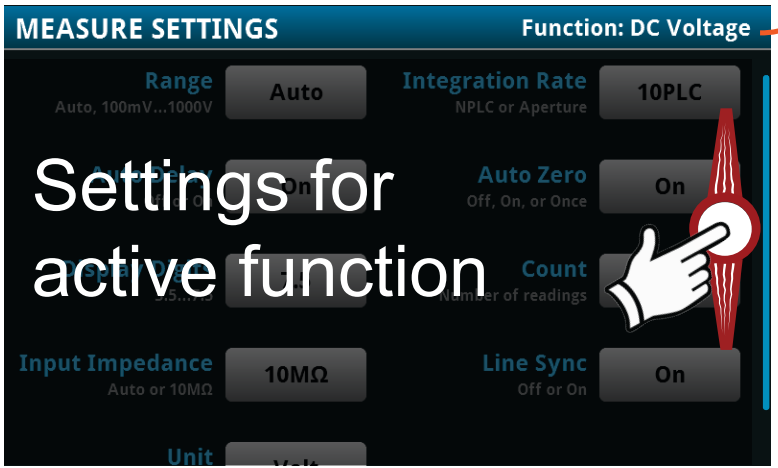
Explore


View communications settings
Change measurement method
CONT Continuous
MAN Manual
RUN Trigger model
View events
Errors
Warnings
Information
Select where readings are stored
Empty
Full
Run program
Local
defbuffer1
No Script
CONT
Touch!


Local
defbuffer1
No Script
CONT
DC CURRENT
-00.000722 µA
FILTER
AZERO
Range
10µA
Auto
GRAPH
+080.0m?
+040.0m?
+000.0m?
-040.0m?
-080.0m?
84.00s
84.11s
84.22s
84.33s
DCV
DCI
ACV
ACI
Digi V
Digi I
Swipe!

Explore

Measure settings



Active measure function

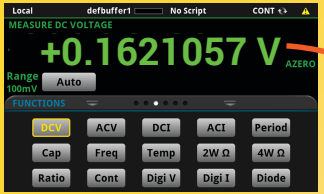
Press to change

Swipe screen

or

for more content

A buffer stores readings.



Where do measurements go?

defbuffer1

In the active buffer you selected

View the buffer data

MENU > Reading Table

Use a default buffer or create your own

MENU > Reading Buffers > Reading Buffer: defbuffer1, defbuffer2, Create New

User-created buffers

Default buffers

defbuffer1

Buffer Index	Time	Reading
1	05/04 14:47:59.517784	-000.02946 mV
2	05/04 14:47:59.535157	-000.07213 mV
3	05/04 14:47:59.552514	-000.07303 mV
4	05/04 14:47:59.569873	-000.11106 mV
5	05/04 14:47:59.606851	-000.03472 mV

defbuffer2

Buffer Index	Time	Reading
1	05/04 14:46:08.268112	-000.08936 mV
2	05/04 14:46:08.285502	-000.05738 mV
3	05/04 14:46:08.302862	-000.11121 mV
4	05/04 14:46:08.320218	-000.07939 mV
5	05/04 14:46:08.356350	-000.07976 mV

myBuff1

Buffer Index	Time	Reading
1	05/04 14:47:59.517784	-000.02946 mV
2	05/04 14:47:59.535157	-000.07213 mV
3	05/04 14:47:59.552514	-000.07303 mV
4	05/04 14:47:59.569873	-000.11106 mV
5	05/04 14:47:59.606851	-000.03472 mV

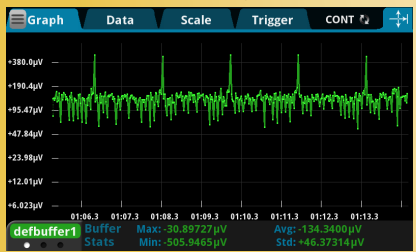
test2

Buffer Index	Time	Reading
1	05/04 14:46:08.268112	-000.08936 mV
2	05/04 14:46:08.285502	-000.05738 mV
3	05/04 14:46:08.302862	-000.11121 mV
4	05/04 14:46:08.320218	-000.07939 mV
5	05/04 14:46:08.356350	-000.07976 mV

Save to USB

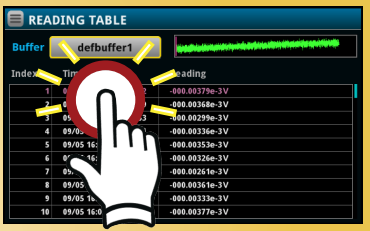
Stored as a .csv file

Plot data on a graph

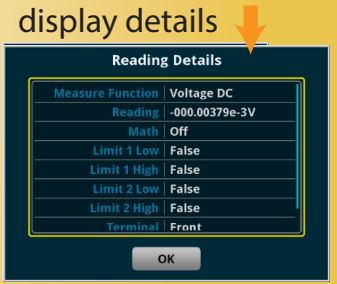


What can you do with buffer data?

View data



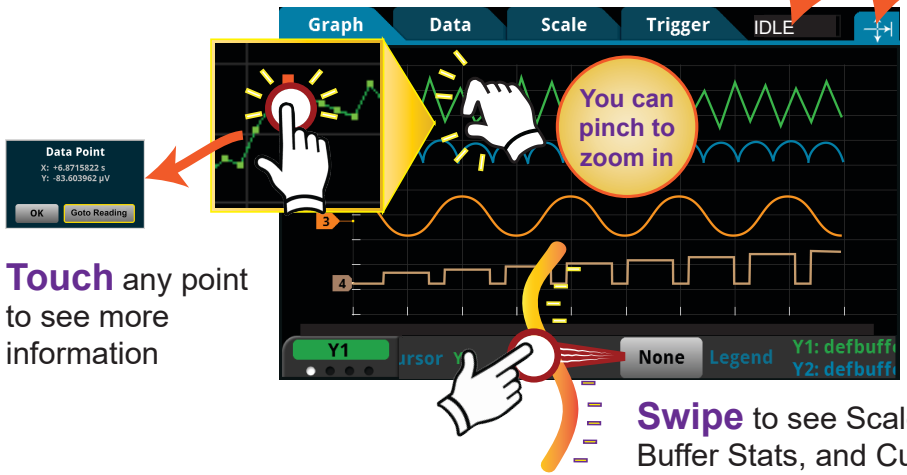
Touch to display details



Graphing

Touch to initiate trigger model

SmartScale®
Touch to scale automatically



Touch any point to see more information

Swipe to see Scale, Buffer Stats, and Cursor

Explore

Scale

Scaling options

Show All Readings

Show Group of Readings

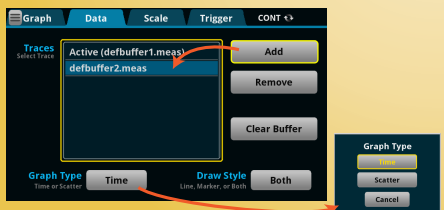
Show New Readings

SmartScale

Picks scale for you based on available data

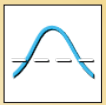
Data

Select which data to graph



Trigger

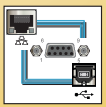
Similar to oscilloscope triggering



Analog Edge

Analog Pulse

Analog Window



External Digital Inputs

Getting help

Connections for testing

WARNING

To prevent electric shock, test connections must be configured such that the user cannot come in contact with test leads or any device under test (DUT) that is in contact with the conductors. It is good practice to disconnect DUTs from the instrument before powering the instrument. Safe installation requires proper shields, barriers, and grounding to prevent contact with test leads.

CAUTION

Do not apply more than 1000 V_{PEAK} to the INPUT terminals or more than 350 V_{PEAK} to the SENSE terminals. Failure to heed this caution may result in instrument damage.

Do not apply more than 500 V_{PEAK} between INPUT LO and the AMPS input. Failure to observe this caution may result in instrument damage.

The figure below shows the physical connections for the front panel. Note that you must use either the front terminals or rear terminals — you cannot mix connections. The front-panel and rear-panel connections are safety banana jacks.

The example in this guide shows you how to make connections to the front panel and short the connections.

For this example, you can make the connections with the standard test-lead kit that is supplied with the DMM7510.

To make connections:

1. Make sure the front-panel power switch is in the off (O) position.
2. Connect the red lead to the **INPUT HI** connection.
3. Connect the black lead to the **INPUT LO** connection.

Verify measurement operation

The following steps provide a quick way to verify that the instrument is operating correctly.

To verify measurement operation:

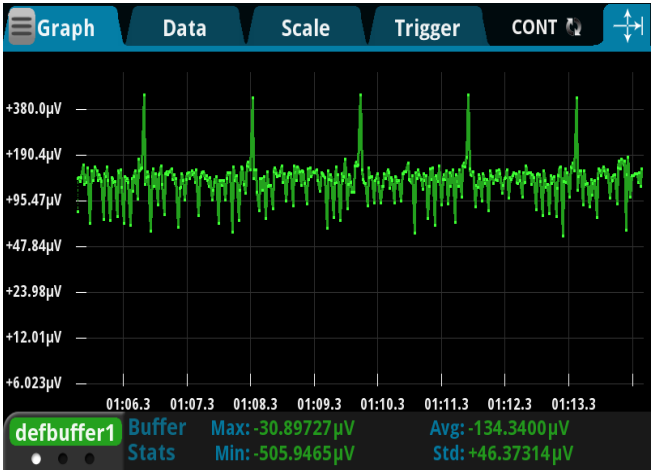
1. Turn the instrument on.
2. On the front panel, press the **HOME** key.
3. On the Functions swipe screen, select **DCV**.
4. Short the connections.

The voltage measurements appear in the MEASURE DC VOLTAGE area of the home screen and should read approximately 0 V.

To view the measurements on the graph screen:

1. Press the **MENU** key.
2. Under Views, select **Graph**.

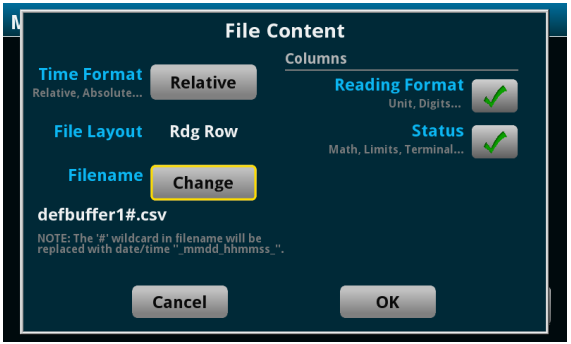
You can adjust the graph settings using the options in the Data and Scale tabs.



FAQs

How do I save data to a USB flash drive?

1. Insert a USB flash drive into the USB port.
2. Press the **MENU** key.
3. Under Measure, select **Reading Buffers**. The MANAGE READING BUFFERS window is displayed.
4. Select the reading buffer that you want to save.
5. Select **Save To USB**. The File Content dialog box is displayed.



6. To change the file name, select **Change**. A keyboard is displayed.
7. Enter the name of the file in which to save the readings.
8. Select **OK** to save the file. When the MANAGE READING BUFFERS window is displayed again, the file is saved.

The data is saved to a `.csv` file.

My data looks odd or is wrong. What should I do?

Verify the connections from the instrument to the test fixture. Also check the connections from the DUT to the test fixture socket.

How do I change the command set?

In addition to the front panel options, you can use a remote interface to set up the instrument. You can choose one of the following command sets:

- **SCPI:** An instrument-specific language built on the SCPI standard.
- **TSP:** A programming language that can be used to send individual commands or combine commands into scripts.

You cannot combine the command sets.

As delivered from Keithley Instruments, the DMM7510 is set to work with the SCPI command set.

To set the command set using the front panel:

1. Press the **MENU** key.
2. Under System, select **Settings**.
3. Select **Command Set**.
4. Select the command set.
5. You are prompted to reboot the instrument.

Why did my settings change?

Many of the settings in the DMM7510 are saved with the function that was active when you set them. For example, assume you have measure function set to current and set a value for the number of digits to display. When you change the measure function to voltage, the displayed digits value changes to the value that was last set, in this case the voltage measure function. When you return to the current measure function, the displays digits value returns to the value you set previously.

Next steps

For more information, see the Keithley Instruments website, tek.com/keithley for the following documents:

- **Model DMM7510 User's Manual:** Provides information so that you can understand and start working with the instrument.
- **Application Manual:** Provides examples that you can use as a starting point to create your own applications.
- **Model DMM7510 Reference Manual:** Includes advanced operation topics, maintenance information, troubleshooting procedures, and in-depth descriptions of programming commands.
- **Accessories information:** Documentation for accessories that are available for the DMM7510.
- Application notes
- Updated drivers
- Information about related products

Your local Field Applications Engineer can help you with product selection, configuration, and usage. Check tek.com/keithley for contact information.

FAQs and next steps

Contact information: 1-800-833-9200
For additional contacts, see **https://www.tek.com/contact-us**

Find more valuable resources at TEK.COM.

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