Series 2281S Precision DC Power Supply and Battery Simulator 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 AC/120 V AC/220 V AC/240 V AC, 50 Hz or 60 Hz
Operating altitude	Maximum 2000 m (6562 ft) above sea level
Operating temperature	0 °C to 40 °C, full accuracy to 80 % relative humidity at up to 35 °C, noncondensing
Storage temperature	-25 °C to 70 °C, 5 % to 95 % relative humidity at up to 40 °C and 5 % to 60 % relative humidity above 40 °C up to 70 °C
Pollution degree	2

*See full specifications for other pulse regions

CAUTION

Carefully consider and configure the appropriate output-off state, source levels, and compliance levels before connecting the instrument to a device that can deliver energy. Failure to consider the output-off state, source levels, and compliance levels may result in damage to the instrument or to the device under test.

Introduction

The Keithley Instruments Model 2281S Precision DC Power Supply and Battery Simulator is a is a highly-sensitive, accurate, programmable power supply that sources stable low-noise voltage and monitors load currents over a wide dynamic range, from amperes to nanoamperes. It can also test batteries and generate battery models to simulate batteries.

The high-resolution 4.3-inch color display shows numerous parameters that describe the state of the instrument to enable you to get the most information from your measurements.

You can generate and edit battery models on the display. In addition, the capacity and voltage changes are shown on the display during the battery simulation.

Complete documentation for the Series 2281S instrument is available for download at tek.com/product-support.

Model Number	Description
2281S-20-6	Precision DC Power Supply and Battery Simulator, 20 V, 6 A

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 documentation and accessories.
4. Carefully lift the instrument out of the box.
5. Remove the packaging insert.
6. Inspect the instrument for any obvious signs of physical damage. Report any damage to the shipping agent immediately.

CAUTION

Do not lift the Series 2281S using the front bezel. Lifting the instrument by the front bezel can cause instrument damage.

You should have received the Series 2281S with the following accessories:

1. Power line cord
2. Series 2281S Quick Start Guide (this document)
3. LAN crossover cable for ethernet
4. Keithley Instruments Safety Precautions
5. Rear-panel mating connector with cover

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

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 ensure the system is safe during use and 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 VDC 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 VDC rated switch, the maximum allowed voltage in the system is 300 VDC.
- 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.
- In many systems, during power up, 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 Series 2281S on a bench or in a rack. Please see the instructions that came with your rack-mount kit if you are installing the Series 2281S in a rack.

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 and the power switch.

Power up the instrument

The Series 2281S operates at 100 V, 120 V, 220 V, or 240 V with a frequency of 50 Hz or 60 Hz. Make sure that the AC line voltage indicator in the center of the rear-panel power module matches the AC line voltage in your facility.

CAUTION

On some sensitive or easily damaged devices under test (DUTs), the instrument power-up and power down sequences can apply transient signals to the DUT that may affect or damage it. When testing this type of DUT, do not make final connections to it until the instrument has completed its power-up sequence and is in a known operating state.

WARNING

The power cord supplied with the Series 2281 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 addition, a redundant protective earth connection is provided through a screw on the rear panel. This terminal should be connected to a known protective earth. 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:

1. Make sure the front-panel power switch is in the off position.
2. Connect the socket of the supplied power cord to the power connection on the rear panel.

3. Connect the plug of the power cord to a grounded AC outlet.

CAUTION

Operating the instrument on an incorrect line voltage may cause damage to the instrument, possibly voiding the warranty.

Turn on the instrument

Turn on the instrument by pressing the front-panel POWER switch to the on position. The instrument powers up.

Connections for testing

Use the wire ratings listed in the following table when making connections to the instrument.

Usage	Specifications
Front-panel binding posts	AWG 20 to AWG 12
Rear-panel output terminals	AWG 20 to AWG 12

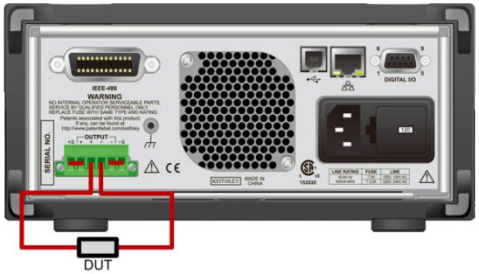
CAUTION

The wire must be heavy enough not to overheat while carrying the short-circuit output current of the unit. Please meet the wiring requirements described above.

Two-wire connection

Two-wire connections are used for basic operation when maximum accuracy is not required. Keep the wire as short as possible to reduce lead inductance and noise pickup. The following illustration shows two-wire (local sensing) DUT connections to the front panel.

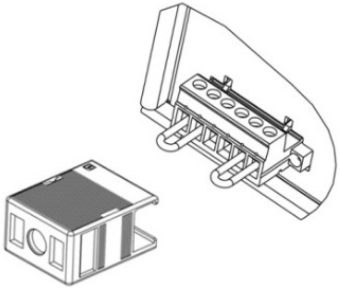
The following illustration shows two-wire (local sensing) DUT connections to the rear panel.



NOTE

When making two-wire connections with the Series 2281S, you must short both Output Hi and Sense Hi and Output Lo and Sense Lo with the shorting jumpers. If you do not do this, the display will show incorrect voltage output readings.

After making the connections, slide the cover over the rear-panel mating connector and wires.



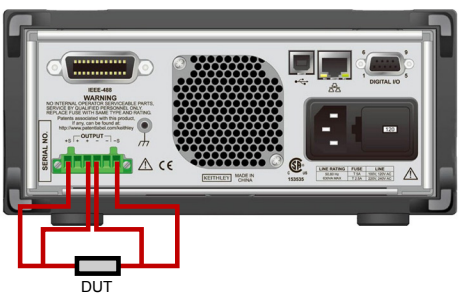
WARNING

Failure to install the cable housing may result in personal injury or death due to electric shock.

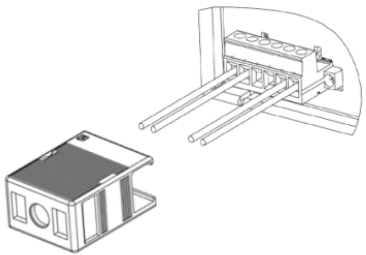
Four-wire remote sense connection

Using four-wire remote sensing connections ensures that the programmed voltage is applied to the load and compensates for the voltage drop in the leads between the power supply and the load.

As shipped, the sense terminals are connected to the output terminals by shorting jumpers. Before connecting the wire, make sure the shorting jumpers have been removed. When you connect the power supply for remote sensing, the remote sense circuit detects the voltage at the sensing points (load) and not the output terminals. The following illustration shows the four-wire (remote sensing) DUT connection to the rear panel.



After making the connections, slide the cover over the rear-panel mating connector and wires.



WARNING

Failure to install the cable housing may result in personal injury or death due to electric shock.

Overview of the front-panel options

The front panel of the Series 2281S allows you to set up most instrument functions and features and perform sourcing and measuring operations. The front panel includes:

- A high-resolution color display that allows you to access instrument settings and measurement readings
- Keys that select menu options and start measurement operations
- A navigation control that can be used to select screen options
- An OUTPUT switch turns the source output on or off
- Front-panel binding posts for output connections

ENTER and EXIT keys

The ENTER key selects a highlighted option. In most cases, it opens the menu or dialog box that allows you to change settings for that option.

The EXIT key returns to the previous menu or closes a dialog box. For example, if you are on the menu screen, pressing **EXIT** returns you to the Home screen.

TRIGGER key

The action of the TRIGGER key depends on the trigger method that is selected and the state of the trigger model:

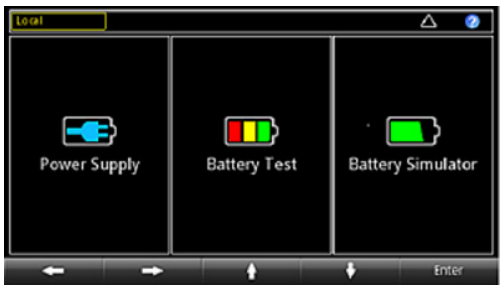
- If manual triggering is selected, pressing **TRIGGER** causes the instrument to make a measurement.
- If the trigger model is in idle, pressing **TRIGGER** initiates the trigger model.

Front-panel user interface overview

The front-panel user interface gives you quick access to source settings, measure settings, system configuration, instrument status, reading buffer information, and other instrument functionality.

Startup screen

When you turn on the 2281S, you will see the following startup screen.



As you can see from the figure, the 2281S has three functions:

- **High-precision power supply:** Supplies 20 V, 6 ADC power
- **Battery test:** Conducts battery charging and discharging tests to calculate the capacity and resistance of the battery and creates a battery model
- **Battery simulator:** Simulates a battery to determine what effect the battery has on the Device Under Test (DUT) in different states

You can choose a function by turning the navigation control or pressing the soft keys and pressing **ENTER** to access the respective home screens of the function.

Home screen overview

The Home screen is the first screen that opens on power up. You can always return to the Home screen by pressing the **HOME** key.

Home screen for the power supply function

The above figure shows the home screen for the power supply function. You can enter this screen by choosing the power supply function on the startup screen.

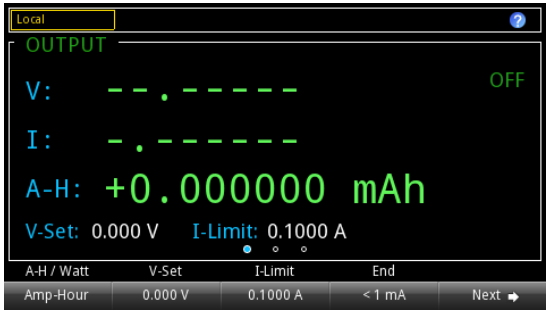
The top row on the Home screen displays the status and event indicators. You can select these options to open dialog boxes that provide additional information about the status or event.

The OUTPUT view area of the Home screen displays the value of the present outputs and status indicators. The outputs show dashed lines until the output is turned on.

The settings area of the Home screen is in the lower left corner of the OUTPUT view area. It shows the presently set measure range, voltage, and current limit.

The soft-key area is on the bottom of the Home screen. It shows the present setting values. You can change these values by pressing the buttons below the screen. Select **Next** to view additional soft-key area options.

Home screen for the battery test function



The above figure shows the home screen for the battery test function.

You can enter this screen by choosing the battery test function on the startup screen.

The top row on the Home screen displays the status and event indicators. You can select these options to open dialog boxes that provide additional information about the status or event.

The OUTPUT view area of the Home screen displays the values of the battery under test.

The soft-key area is on the bottom of the Home screen. It shows the present setting values. You can change these values by pressing the buttons below the screen. Select **Next** to view additional soft-key area options.

Home screen for the battery simulator function

The above figure is the Home screen for the battery simulator function. You can enter this screen by choosing the battery simulation function in the startup screen.

The top row on the home screen displays the status and event indicators. You can select these options to open dialog boxes that provide additional information about the status or event.

The OUTPUT view area of the Home screen displays the values and status of the battery simulator.

The soft-key area is located on the bottom of the Home screen. It shows the present setting values. You can change these values by selecting the buttons below the screen. Select **Next** to view additional soft-key area options.

Menu screen overview

When you press the **MENU** key on the front panel, the menu screen is displayed.

NOTE

The options on main menu screen are different for each function chosen on the startup screen (power supply, battery test, and battery simulator).

The menu items are organized under headings at the top of the menu screen. Select an icon to access additional settings.

These menus allow you to choose options to set up your instrument for your applications. Select a setup item by either scrolling the navigation control or using the arrow keys to highlight an icon. Then press **ENTER**.

An example of the options that are available for the power supply function when you select **Settings** under Measure is shown below.

Voltage output and current measurement

The following example demonstrates how to configure voltage output and make a precision voltage and current measurement using the default instrument configuration.

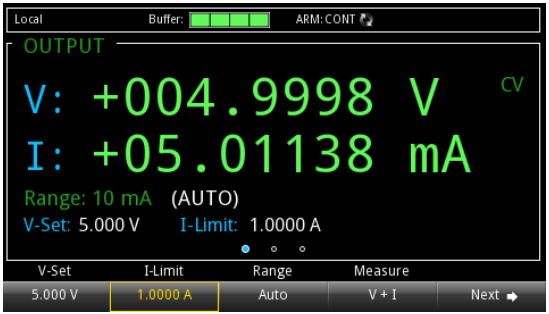
Connect the DUT (for this example, a 1 kΩ resistor) to the output binding post on the front panel. For details, refer to the two-wire connection drawing in the Connect section.

To set the voltage and current limit on the front panel:

1. Press the **Home** key. The Home screen is displayed.
2. Press the **V-Set** soft key. The editing window is displayed at the bottom.
3. Set the voltage to 5 V. Enter `5` using the numerical keys on the right of the front panel. You can also change the value using either the arrow keys or navigation control.
4. Press **ENTER**
5. Press the **I-Limit** soft key. The editing window is displayed at the bottom.
6. Set the current limit to `1 A` and press **ENTER**.
7. Press the **OUTPUT** switch to turn the output on.

CAUTION

When the output is turned on, changing the value with the navigation control can source voltage and current instantly. Make sure the output does not damage your device under test (DUT).



Select a measure function

The Series 2281 allows you to perform the following measurement functions.

Measure functions	What the instrument measures
Concurrent (V + I)	Measure voltage and current at the same time
Voltage (V)	Only measure voltage
Current (I)	Only measure current

To set the measure function from the power supply main menu screen:

1. Press the **MENU** key.
2. Under Measure, select **Settings**.
3. Select the button next to **Function** and press the **ENTER** key. The selection window is displayed.
4. Select a measure function.

To set the measure function from the power supply Home screen:

1. Press the **Measure** soft key. The selection window is displayed.
2. Select a measure function.

Specify a measurement range

You can set ranges for the measurement values in the power supply function. You can set specific ranges or allow the instrument to choose the ranges automatically.

The measurement range determines the full-scale input for the measurement. The measurement range also affects the accuracy of the measurements and the maximum signal that can be measured.

The Series 2281 has multiple current measurement ranges and one voltage range. The ranges are listed in the following table.

Model number	Current measurement range	Voltage measurement range
2281S-20-6	10 A 1 A 100 mA 10 mA	20 V

To set the ranges from the power supply Home screen:

1. Press the **HOME** key and select the **Range** soft key. The Range dialog box is displayed.
2. Use the up and down arrow soft keys to select the range. The Home page is updated with the new range setting. Press **ENTER** or **EXIT** to close the Range dialog box.

To set the ranges from the Menu screen (power supply function only):

1. Press the **MENU** key.
2. Highlight the **Settings** icon under Measure using either the navigation control or the soft keys. Press **ENTER**.
3. On the MEASURE SETTINGS page, select the button next to **Range**. The Range dialog box is displayed.
4. Select the range. You are returned to the MEASURE SETTINGS screen.

Application examples

Battery test

The following example demonstrates how to conduct a battery test and generate a battery model with 2281S-20-6.

This example uses the Model 2281S to charge a rechargeable lithium battery from empty to full and measure battery capacity (amp-hour), battery resistance, and charging curve (voltage current), and generate a battery model based on the test results.

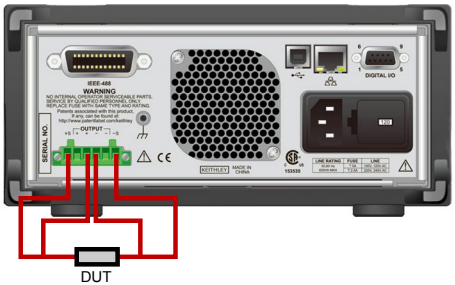
To achieve a full-charge cycle, you need to use the 2281S to discharge the battery to an empty state first, then charge the battery from empty to full state and measure voltage, current, resistance, and amp-hour.

After the charging process is done, the Model 2281S generates a battery model automatically based on the results.

Equipment required:

- One 2281S Battery Simulator
- Rechargeable batteries
- Wires

The battery under test and the Model 2281S-20-6 can be connected by two-wire sense connections. However, four-wire sense connections, as shown in the following figure, are recommended because they cancel out the wire resistance.



To measure the battery capacity and generate a battery model in the battery test function:

After connecting the battery to the instrument, test the battery and generate a battery model using the front panel, with the following process.

To test a battery and generate a battery model:

1. Select the battery test function on the startup screen.
2. Press the **MENU** key.
3. Under Source, select **(Dis)charge** to configure the settings for discharging the battery to the empty state first.

WARNING

The instrument always absorbs current at its maximum capacity, approximately 1 A. This sink current is not programmable. If the maximum output current of the battery under test is less than 1 A, you should connect a resistor between the instrument and the battery to prevent the battery from switching into protection mode or being damaged.

4. Set the target voltage next to **V-Set**. For example, for a Li-Ion battery that works in the range of 3.8 V to 4.2 V, you need to set the target voltage slightly lower than 3.8 V to make sure the battery will be discharged fully.
5. Set the end current next to **End condition** to `10 mA`. When the discharging current is lower than this value, the 2281S stops discharging and turn off the output.
6. Press the **OUTPUT** key on the front panel to discharge the battery.Wait until the discharging is complete and the 2281S output is turned off.

7. Under Measure, select **A-H/C**. Starting from this step, the 2281S charges the battery, measures its capacity, and generates a battery model.
8. Set the target voltage next to **V-Full**. If the battery works in the range of 3.8 V to 4.2 V, set this value slightly higher than 4.2 V.
9. Set the maximum charging limit next to **Source I-Limit**. This value is set based on the battery specification. If the current is larger than the maximum current of the battery, damage may occur.
10. Set the end current to 10 mA next to **End condition**. When the charging current is lower than this value, the 2281S stops charging and turns off the output.
11. Return to the battery test home screen by pressing **HOME** on the front panel.
12. Select **Measure AH** in soft key area 2.
13. Set the state to **On**. Charging starts with the measurement result (voltage/current/Amp-Hour) displayed on the screen.
14. After the charging is finished, select Generate in the soft key Measure AH area to generate a battery model.
15. Set the Voc range for the battery model.
16. Assign a name to the battery model.
17. Select **Yes** to save the battery model. The Model 2281S-20-6 can save up to nine battery models.

NOTE

You can view the charging process by selecting **Graph** or **Data Sheet** in soft key area 3 when the charging is in progress.

Battery simulation test

The following example demonstrates simulating a battery with Model 2281S-20-6.

This example shows how to use a 2281S to replace a real battery so you can power your device and test the device in different battery states more efficiently.

Equipment required:

- One 2281S battery simulator
- A cell phone supplied by a battery
- Wires

The device under test and the 2281S-20-6 can be connected using a two-wire sense connection, as shown in the following figure. However, the four-wire sense connection is recommended because it will cancel out the wire resistance.

To simulate a battery with 2281S-20-6 using the front panel:

1. Select the battery simulator function on the startup screen.
2. Select **Model** in soft key area 1.
3. Choose **10.mdl**, since it is the model of a cellphone Li-Ion battery normally seen in the market with a voltage range of 3.7 V to 4.2 V.
4. Press the **MENU** key.
5. Under Battery, select **Settings**.
6. Set Method to **Dynamic**. The Voc, SOC, and ESR of the simulated battery will change according to the discharging states, just like a real battery.
7. Return to the battery simulator home screen by pressing **HOME** on the front panel.
8. Select **I-Limit** in soft key area 2 and set the current limit. The maximum current from the 2281S to the DUT cannot be set higher than 6.1 A.

NOTE

To test a product at a specific battery state, you can either select an SOC value or an open-circuit voltage value. The values of the other parameters and internal resistance adjust based on the battery model. Alternatively, you can discharge the battery starting at 100% SOC.

You can adjust the capacity of the model by going to soft key area 2, selecting the Capacity soft key, and setting the value. If you do not set this value, the battery model defines the capacity of the battery.

9. On the front panel, press the **OUTPUT** key to start the battery simulation.

Next steps

For more information, refer to the *Series 2281S-20-6 Precision DC Power Supply and Battery Simulator Reference Manual*, which provides detailed information about all of the features of the instrument.

Also see the Keithley Instruments website, tek.com/keithley for support and additional information about the instrument.

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