




KEITHLEY 2601B-PULSE System SourceMeter Instrument User Guide

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Model 2601B-PULSE System SourceMeter® Instrument Quick Start Guide



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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 performs 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 is 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 them 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  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 to 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 the 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 ratings

For indoor use only.

Power supply	100 V ac to 240 V ac, 50 Hz to 60 Hz (autosensing)
Maximum VA	240
Operating altitude	Maximum 2000 m (6562 ft) above sea level
Operating temperature	0 °C to 35 °C at up to 70% relative humidity; at 35 °C to 50 °C, derate 3% relative humidity per °C
Storage temperature	–25 °C to 65 °C
Pollution degree	1 or 2
DC source input electrical ratings	Voltage: 40 V dc Maximum Current: 3 A maximum at 6 V dc, 1 A maximum at 40 V dc
Pulser feature output, region 4	Region maximums: 10 A at 20 V Maximum pulse width: 1.8 ms Maximum duty cycle: 1%
Measurement input electrical ratings	Measurement category O Voltage: 40 V dc maximum HI to LO Current: 3 A at 6 V dc; 1 A maximum at 40 V dc Impedance: Variable

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 Model 2601B-PULSE System SourceMeter 10 μ s Pulser/SMU Instrument with PulseMeter™ technology is® an industry-leading high current, high-speed pulser with measure capabilities and the full functionality of a traditional source-measure unit (SMU). This instrument offers a 10 A current pulse output at 10 V with a pulse width of 10 μ s.

Complete documentation for the 2601B-PULSE instrument is available for download on the Keithley web page at tek.com/keithley.

The 2601B-PULSE documentation includes:

- Quick Start Guide: This document. It provides unpacking instructions, describes basic connections, and reviews basic operation information.
- Reference Manual: Provides comprehensive information about the features, operation, optimization, maintenance, troubleshooting, and programming commands of the instrument.
- Information on accessories.

Software for the 2601B-PULSE is also available for download from the Keithley web page at tek.com/keithley. You can search for the specific software you need. Available software includes:

- Keithley KickStart Instrument Control Software: This Lets you start making measurements in minutes without complex instrument programming. Free 30-day trial.
- Test Script Builder: This software provides an environment to develop a test program and the ability to load the test program onto the instrument.
- IVI-COM Driver: A IVI instrument driver you can use to create your own test applications in C/C++, VB.NET, or C#. It can also be called from other languages that support calling a DLL or ActiveX(COM) object.
- LabVIEW™ Software drivers: Drivers to communicate with National Instruments LabView software.
- Keithley I/O layer: Manages communications between Keithley instrument drivers and software applications and the instrument.

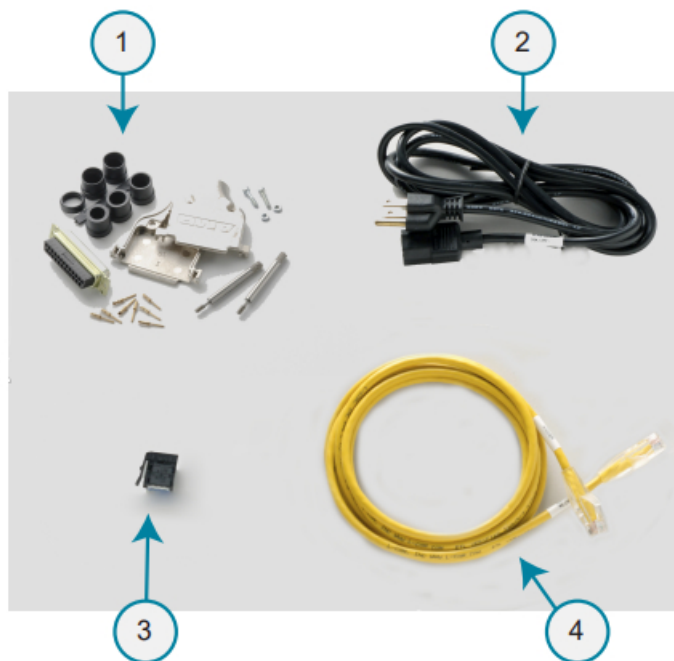
Introduction

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. Inspect the instrument for any obvious signs of physical damage. Report any damage to the shipping agent immediately.

You receive the 2601B-PULSE with these accessories and documents:

1. Interlock DB-25 male connector kit hardware
2. Power line cord
3. Safety interlock mating connector
4. Two RJ-45 LAN crossover cables.
5. 2601B-P-INT Rear Panel Interlock and Cable Connector Box (not shown)
6. Safety supplement (not shown)
7. Safety precautions (not shown)
8. Software and documentation downloads document (not shown)
9. Model 2601B-PULSE System SourceMeter Instrument Quick Start Guide (this document; not shown)



Items shipped may vary from items 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 VRMS and 42.4 VPEAK 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.
- Cover the device under test (DUT) to protect the operator from flying debris in the event of a system or DUT failure.
- 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.
- 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 another 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 that operators are not required to access the DUT or other potentially hazardous areas.
- Provide training to all users of the system so that 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.

Unpack

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 2601B-PULSE on a bench or in a rack. See the instructions that came with your rack-mount kit if you are installing the 2601B-PULSE in a rack.

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

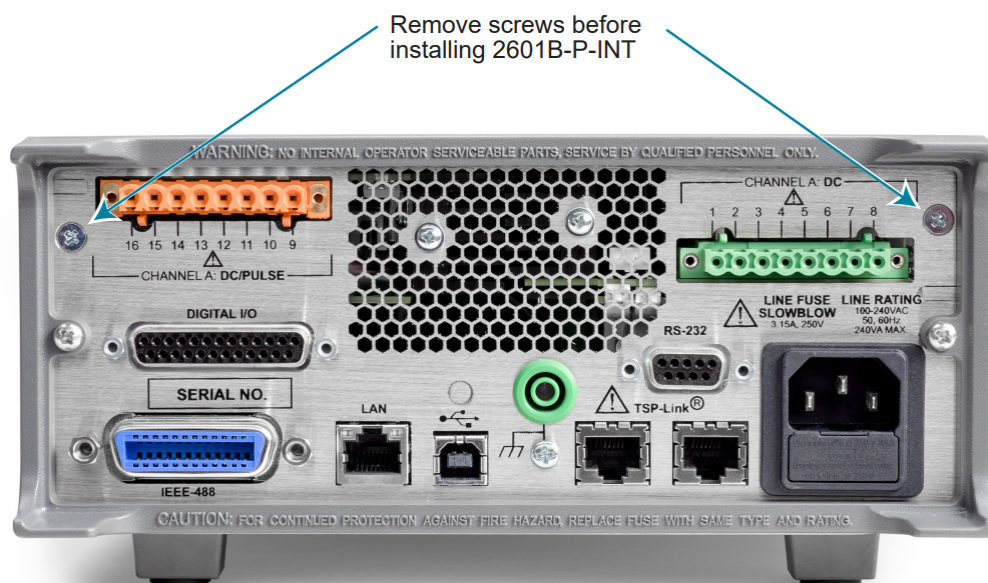
Position the instrument so that it is easy to reach any disconnecting devices, such as the power cord and the power switch.

Install the 2601B-P-INT

The 2601B-PULSE is shipped with the 2601B-P-INT Rear-Panel Interlock and Cable Connector Box. The 2601B-P-INT provides connections for an optional hardware safety interlock and simplifies test connections to the 2601B-PULSE.

To install the 2601B-P-INT:

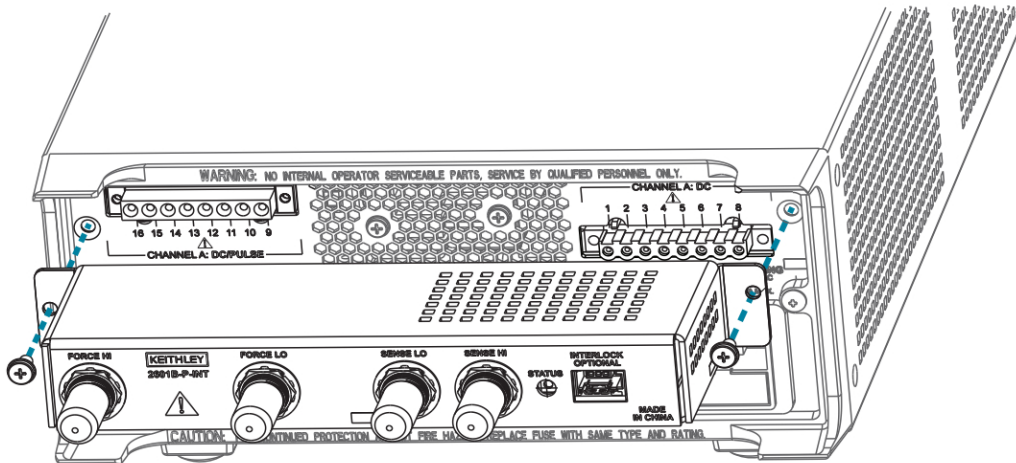
1. Remove power connections from the 2601B-PULSE.
2. On the rear panel of the 2601B-PULSE, remove the screws to the left of the CHANNEL A: DC/PULSE terminal strip and to the right of the CHANNEL A: DC terminal strip. Screw locations are shown in the following figure.



3. On the 2601B-P-INT terminal strip panel, use needlenose pliers to position the INTERLOCK jumper. Place it in the ENABLE slot if you are using an interlock or in the DISABLE slot if you are not using the interlock.



4. Align the terminal strip panel of the 2601B-P-INT to the terminal strips on the rear panel of the 2601B-PULSE.
5. Press the 2601B-P-INT connections firmly onto the terminal strips on the rear panel of the 2601B-PULSE.
6. Use the two 6-32 × ½ in. screws provided with the 2601B-P-INT to secure it to the rear panel of the 2601B-PULSE.



Wiring the interlock

You can use the 2601B-P-INT and the 2601B-PULSE digital I/O port or external wiring to make interlock connections to an external device. When properly connected, the output of the instrument will turn OFF when a remote switch is closed.

Refer to the Model 2601B-PULSE Reference Manual (document number 2601B-PULSE-901-01) for detail on making interlock connections.

Connect line power

The 2601B-PULSE operates from a line voltage of 100 V to 240 V at 50 Hz or 60 Hz. Line voltage is automatically sensed (there are no switches to set). Make sure the operating voltage in your area is compatible.



WARNING

The power cord supplied with the 2601B-PULSE contains a separate protective earth (safety ground) wire for use with grounded outlets. When proper connections are made, the instrument chassis is connected to the 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.

CAUTION

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

To connect line power:

1. Make sure the front-panel power switch is in the off (O) position.
2. Connect the socket of the supplied power cord to the power module on the rear panel.
Connect power line cord



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

Turn on the instrument

Turn on the instrument by pressing the front-panel POWER switch to the on (I) position.

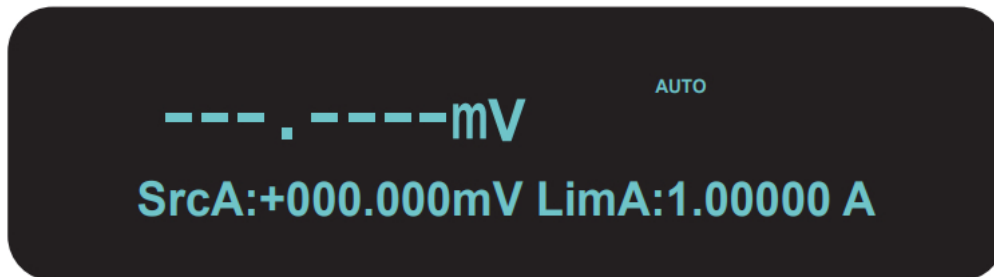


Power switch ON position

Power-up sequence

When the instrument is turned on, you should see:

- A series of dots.
- All segments of the display light.
- A brief display showing the instrument model, 2601B-PULSE.
- Line frequency detection and other startup checks. The entire power-up process takes approximately 30 seconds to complete. When initialization is complete, you see the default display screen shown below.

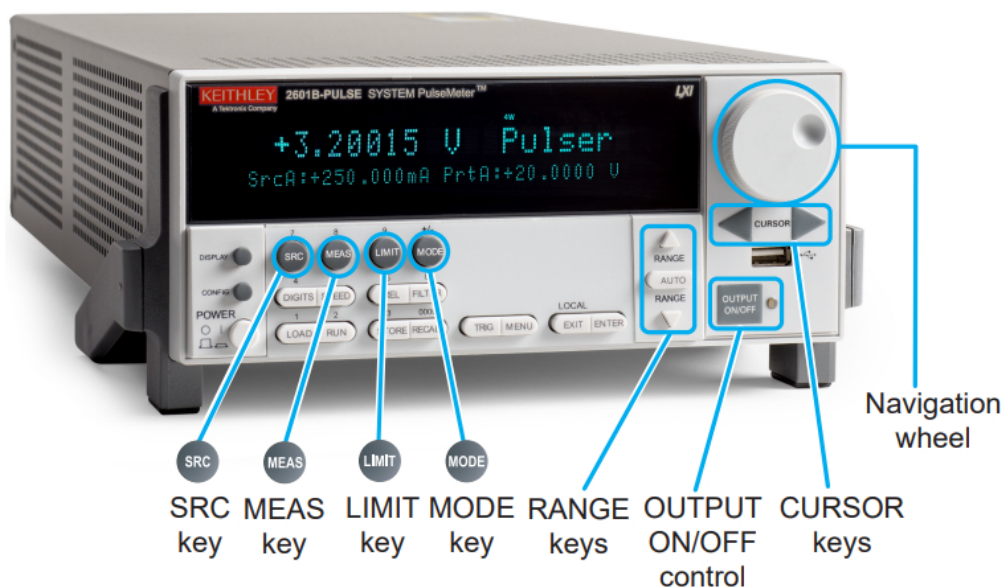


Connect


Test the instrument

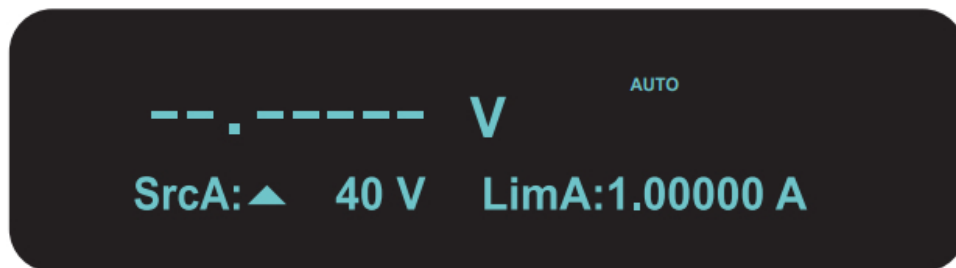
The following test verifies basic operation of the 2601B-PULSE. In this test, you will use the front-panel controls shown below to source voltage and measure the voltage output.

You do not need to connect a device under test (DUT) for this test.

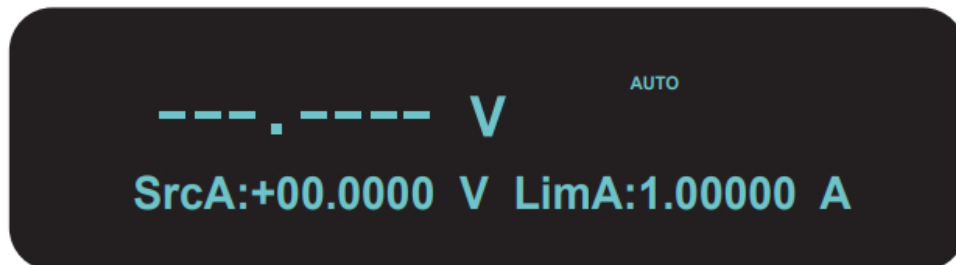





Step 1: Set source function, range, and level

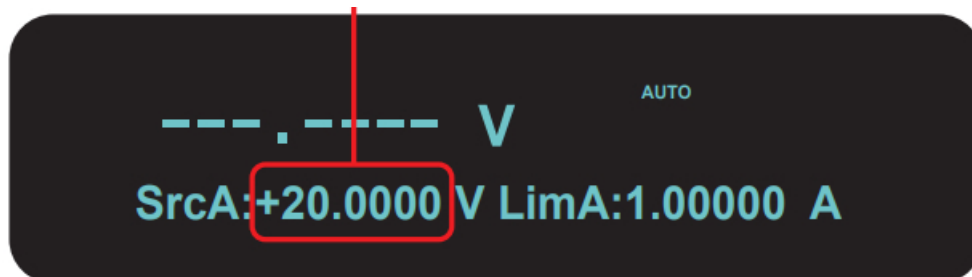
1. Press the **SRC** key. You will see a blinking character in the SrcA value field. Confirm that mV is displayed; if not, press the **SRC** key again.
2. While that character is still blinking, press the up or down RANGE key  s until 40 V is displayed.





The main display screen is refreshed.

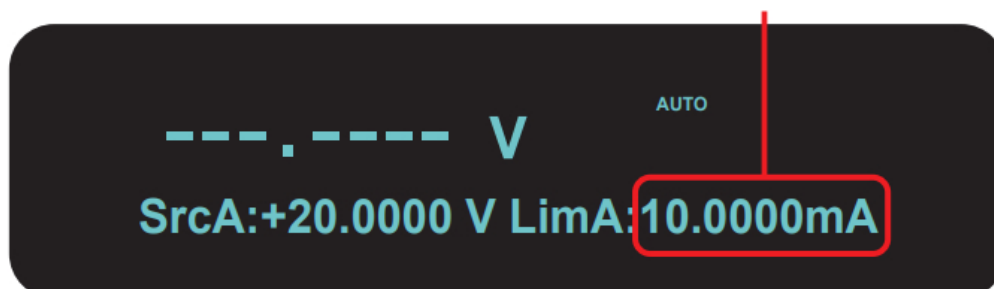


- Press the CURSOR  keys to move the cursor to the 10s digit.
- Press the **navigation wheel**  to enter EDIT mode. The EDIT indicator appears in the upper left corner of the display.
- Turn the navigation wheel to set the source value to 20.0000 V, and then press the **navigation wheel**  to enter the selection and exit EDIT mode. **Source value set to 20.0000 V**




Step 2: Set the source limit

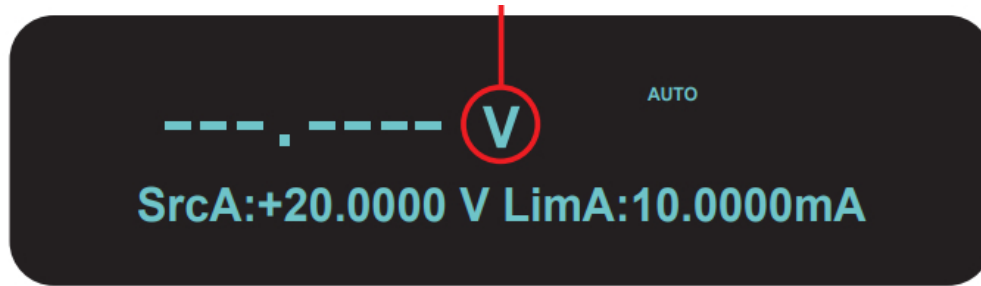
- Press the **LIMIT**  key. You will see a blinking character in the LimA value field.
- Press the down **RANGE**  key to select the 10 mA limit range. Verify that the source limit value in the LimA field is 10.0000 mA. **Source limit set to 10.0000mA**




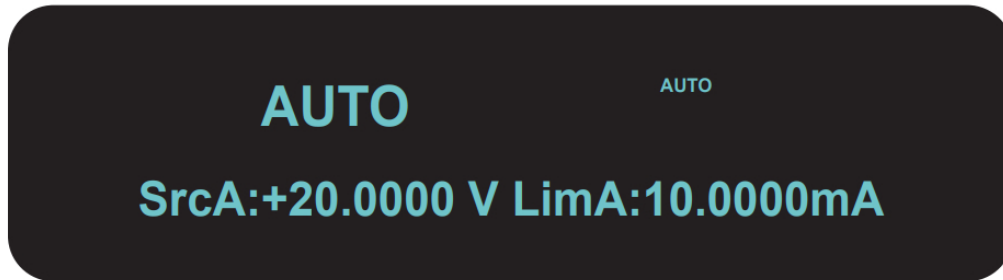
Step 3: Set measurement function and range

- Press the **MEAS**  key until the V (voltage) measurement function is selected. In the following figure, the

measurement function has been set to V. **Measurement function set to voltage (V)**



2. Press the **AUTO**  key as many times as needed to select the AUTO range function. When AUTO is selected, the 2601B- PULSE automatically selects the best range for the measured value. You will briefly see the display shown below, and then the main display screen reappears.



Test


Step 4: Turn the output on

Turn the output on by pressing the OUTPUT ON/OFF control . The ON/OFF indicator LED lights and measurements begin.

Step 5: Observe measurements

Observe the measured voltage on the main area of the front-panel display. The readings should be very close to the 20 V source value.

Step 6: Turn the output off

When you finish making measurements, turn the output off by pressing the OUTPUT ON/OFF  control. The output indicator LED turns off.

NOTE

These steps confirm the basic functionality of your instrument. Turn the instrument power OFF now. To use the pulser feature, you must have remote communications set up. Refer to the Model 2601B-PULSE Reference Manual (document number 2601B-PULSE-901-01) for information on remote communications setup.

FAQs

Where can I find updated drivers or firmware?

For the latest drivers and additional support information, see the Keithley Instruments support website.

To find drivers that are available for your instrument:

1. Go to tek.com/product-support.
2. Enter 2601B-PULSE and select GO.

3. Select Software.

What should I do if I see an error message when I turn the instrument on?

If an error message is displayed, press the EXIT (LOCAL) key. The 2601B-PULSE will return to the default display screen. For detailed information about error messages, see “Errors and status messages” in the Model 2601B-PULSE Reference Manual.

Next steps

For more information, refer to the Keithley Instruments website, [tek.com/keithley](https://www.tek.com/keithley), for support and additional information about the instrument, including the Model 2601B-PULSE Reference Manual, which provides detailed information about all features of the instrument, including descriptions of TSP commands.

FAQs and next steps

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



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Documents / Resources

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References

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Manuals+.