

# Practical Tips For Getting the Most Out of Keysight's E36300 Series Bench Power Supplies

## Introduction

Keysight has more than 50 years of experience designing and manufacturing all types of power products. The next generation of bench power supplies incorporates your feedback, our engineering knowledge, and design practices to bring you one of the most versatile bench power product families. This application note provides practical tips to help you get the most out of Keysight's E36300A Series bench power supplies. It also introduces you to several convenient features that are now available in E36311A, E36312A, and E36313A bench power supplies. Please note that some of features are not available on the E36311A model.

We will cover the following topics:

- Connecting to your bench DC power supply
- Achieving accurate voltage with remote sense
- Measuring current in amps
- Tracking DC outputs
- Enabling high voltage capability
- Enabling high current capability
- Documenting test setups and measurements
- Keeping power supplies secure

## Connecting to your DC bench power supply

To start, connect to the outputs of a E36300 Series DC bench power supply in two ways – through convenient front panel binding posts (optional recessed binding posts are available), and through rear panel screw type output connectors. See Figures 1 and 2.



The next generation of bench power supplies offers new features that will help you increase measurement accuracy, and keep power supplies consistent and secure.

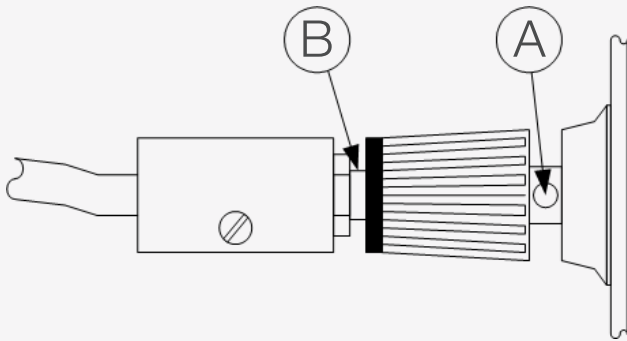


Figure 1. Front panel binding posts (max size 14 American Wire Gauge (AWG)). A = 20A max current, B = 15A max current

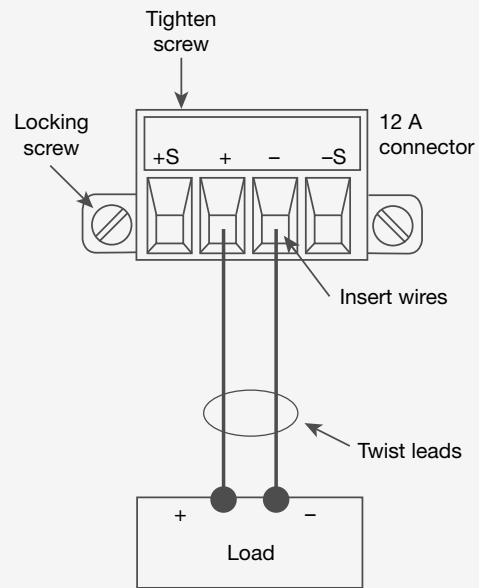


Figure 2. Rear panel (Channel 1 example) 12A max current (accepts wire sizes from 12 to 30 AWG)

## Achieving accurate voltage with remote sense

Remote sense capability is very useful for delivering accurate voltage at the device under test (DUT) when using long wiring. In addition, remote sense improves your measurement accuracy.

For example, you may need to use your bench DC source to power a development board located in a thermal chamber using a long wire (20 to 30 feet or more). If you do not use remote sense and proper cabling, you will not get your programmed voltage at the DUT. For example, you may set the voltage to 5 volts and only get 4.5 V at the DUT). This is due to the voltage drop ( $V_{drop}$ ) in the output wiring; wire resistance and the amount of current that the load requires is the reason for the  $V_{drop}$ . Remote sense automatically compensates for the  $V_{drop}$  in the power leads which is useful in constant voltage (CV) operation with varying load impedance or significant lead resistance.

The E36300A series bench power supplies include remote sense capability as a standard feature. You can easily enable remote sense through the built-in internal relays which connect + and - output terminals to the + and - sense terminals without having to remove jumpers. Please note that you must use the rear output connectors when using 4-wire remote sense operation.

## Wiring tips for remote sense applications

We recommend that you use a single twisted pair for the output leads and a separate twisted pair for the sense leads (see Figure 3). Since the sense leads carry very small currents, you may use a lighter gauge wire. Try to keep the sense leads less than 0.5 ohm per wire (a 20 gauge wire works well). Keep the wire pairs as short as possible and less than 50 feet (14.7 meters).

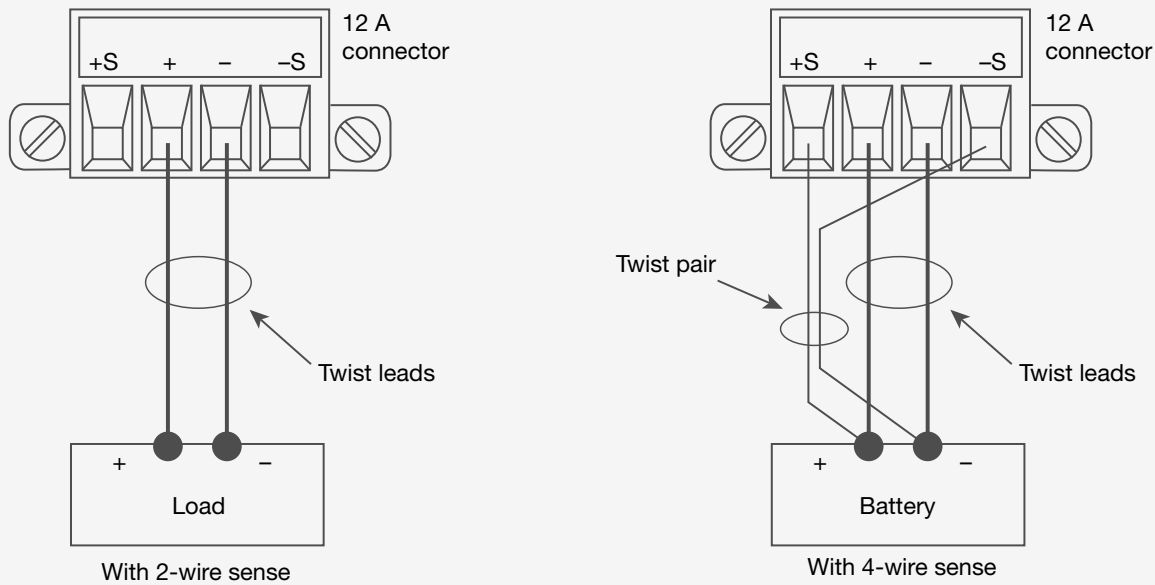


Figure 3. Use a single twisted pair for output leads and a separate twisted pair for sense leads

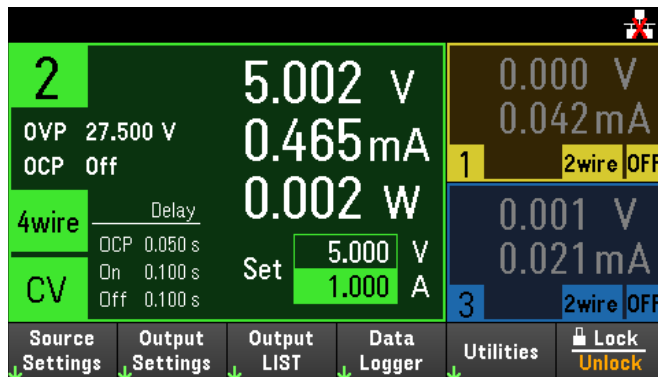


Figure 4. Enable 4-wire operation using Source Settings > Sense 2W/4W

Once the wiring is complete, enable 4-wire operation by pressing Source Settings > Sense 2W/4W. The 4-wire operation appears above the CV indicator in the screenshot above.

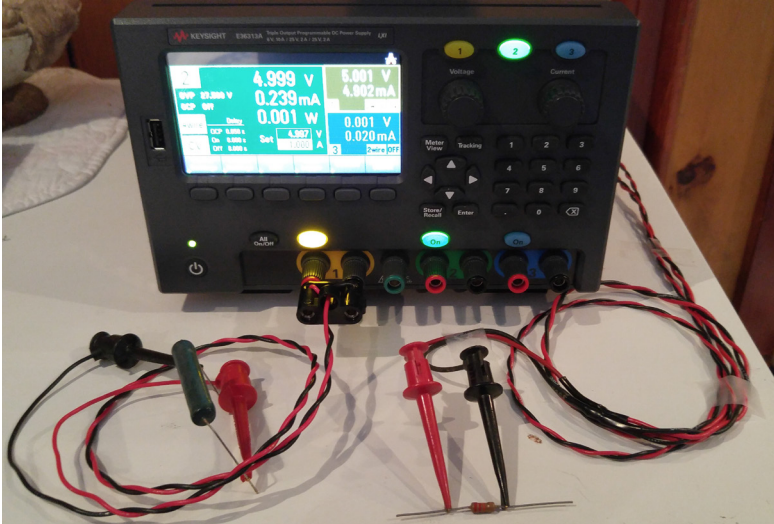


Figure 5. Twist wires to reduce lead inductance and noise pick-up

It is a best practice to twist your wires to reduce lead inductance and noise pickup. In the test example in Figure 5, Channel 1 is set up for 2-wire operation using a single twisted pair. Channel 2 is set up for 4-wire operation using a twisted pair for the output leads and a separate twisted pair for the remote sense leads.

## Measuring current in amps

Making current measurements using a bench power supply is now very easy to do. Today's bench power supplies require no external equipment such as digital multimedia (DMM), current shunt, wiring, etc., so the setup is much simpler, thereby eliminating potential errors. Measurement accuracy is specified and the current measurements appear in amps on a large display. The setup requires no voltage to current conversion.

Low measurement range is the default setting on Keysight's E36312A and E36313A models. To change the measurement range press Utilities > Test Setup > Lower Range (On/Off).

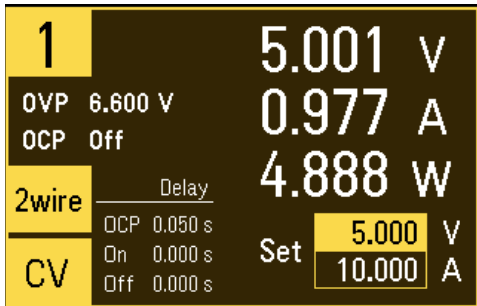


Figure 6. Current measurement using a bench power supply

For measurement specifications please see the E36300 Series Data Sheet, literature number [5992-2124EN](#).

## Tracking power supply outputs

The E36300A series provides 0 to  $\pm 25$  V tracking outputs. In track mode, voltages from Channel 2 and Channel 3 track each other by varying the symmetrical voltages required by operational amps and other circuits that need positive and negative voltages.

For example, you can configure your bench power supply for + 5 V and +5 V tracking DC outputs by enabling track mode. Use the front panel voltage knob or numeric keypad to adjust the output voltage of both Channel 2 and Channel 3. Please note that while Channel 2 and Channel 3 are independent electrically, they now track their voltage setting. Track mode is available on the E36312A and E36313A.

To enable track mode, press Output Settings > Operation Mode > Mode Tracking; see Figure 7 below.

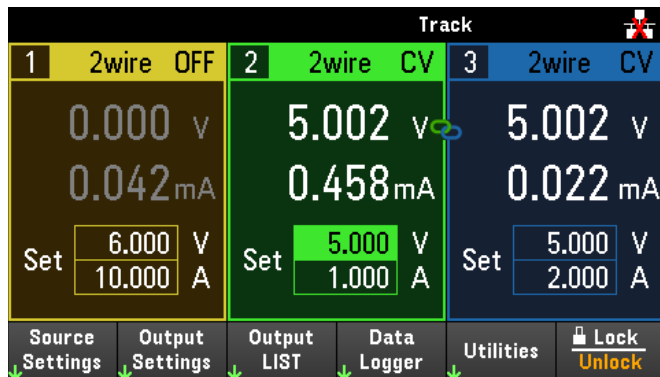


Figure 7. Tracking DC outputs voltage

## Enabling high voltage capability in two easy steps

You may enable higher voltage by using the built-in auto-series mode with the E36312A or E36313A in two easy steps, without external connectors or jumpers.

Step 1. Connect wires as they appear in Figure 8

Step 2. Enable series mode

Outputs 2 and 3 will now connect in a series to create a single DC output and single measurement channel up to 50V and 2A. Channel 2 is the “master”. You can easily control the output voltage and current setting using the front panel voltage and current knobs or the numeric keypad.

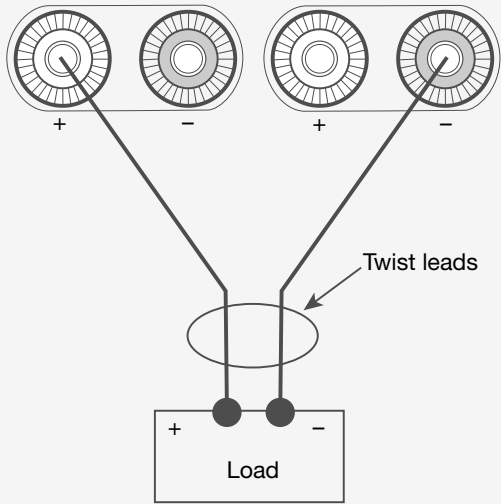


Figure 8. Wire connections enable higher voltage

Enable auto-series operation by pressing Output Settings > Operation Mode > Mode Series. The large display indicates a series connection as shown in Figure 9.

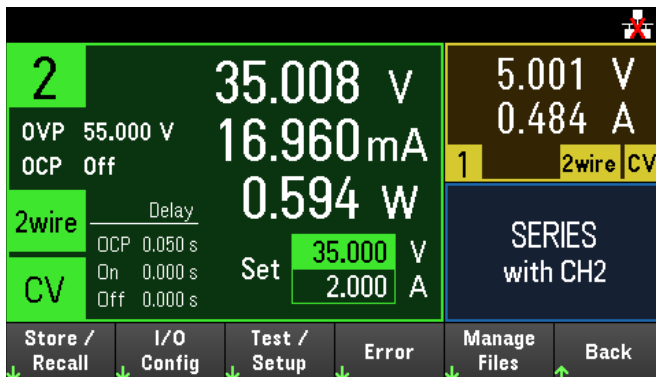


Figure 9. Channel 2 controls the series combination

## Enabling high current capability in two easy steps

You may enable higher current capability using the built-in auto-parallel mode with the E36312A or E36313A in two easy steps, with no external connectors or jumpers.

Step 1. Connect your wires as they appear in Figure 10

Step 2. Enable parallel mode

This configuration allows outputs 2 and 3 to connect in parallel to create a single DC output and single measurement channel up to a 25 V and 4 A. Now Channel 2 becomes the “master” that enables control of the output voltage and current settings through front panel voltage and current knobs, or the numeric keypad.

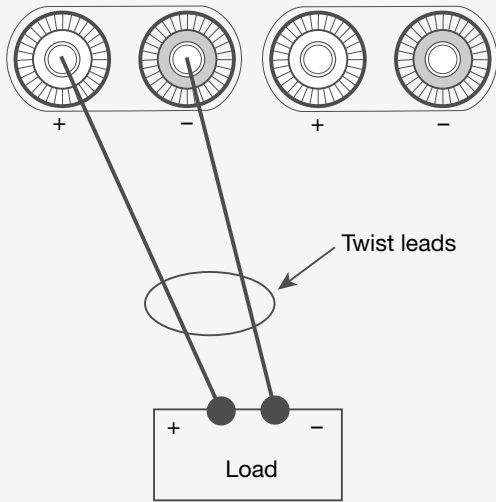


Figure 10. Set-up that enables higher current capability

Enable auto-series operation by pressing Output Settings > Operation Mode > Mode Series. The large display indicates a series connection as shown in Figure 9



Figure 11. Channel 2 is the “master” that controls the parallel combination

## Documenting your test setup and measurements

With the E36300A series bench power supplies, you can easily capture screenshots, save them using the default screenshot filename (screenshot.bmp - date/time stamped), or rename them to a more meaningful filename. Press Manage Files > File Name >) to save files easily to a USB thumb drive to document your test setup and measurement results.

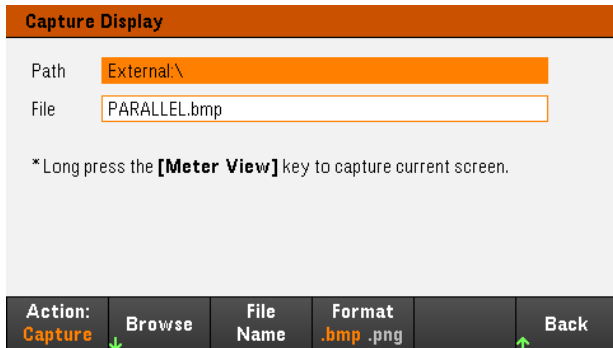


Figure 12. Capture screenshots and save using default screenshot filename

## Keeping your power supply secure

You can keep your power supply secure against unauthorized or accidental setting changes by locking the front panel keypad, knobs, and buttons. Press and hold the Lock / Unlock soft key for a few seconds to easily lock the front panel. In addition, lock the bench power supply to your test bench by using the built-in Kensington security slot feature.

## Conclusion

The E36300A series bench power supply with low output ripple/noise and accurate voltage/current measurements, you can test with confidence. Power multiple voltage buses with clean, reliable power, view voltage and current on all outputs simultaneously.

We hope this application note has offered you a few practical tips and techniques to help you get the most out of a E36300A series DC bench power supply.

Learn more about the [E36300 Series DC bench power supply](#).

Learn more at: [www.keysight.com](http://www.keysight.com)

For more information on Keysight Technologies' products, applications, or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

