

# Keysight Technologies

## Practical Tips to Help You Get the Most Out of the E36300 Series Bench Power Supplies

Application Note





## Introduction

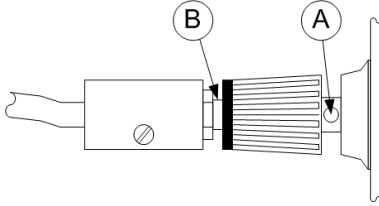
Keysight has been designing and manufacturing all types of power products for over 50 years. The next generation of bench power supplies incorporates your feedback, our engineering knowledge and design practices to bring you one of the most versatile bench power product families. This application note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

In this application note we will cover these topics:

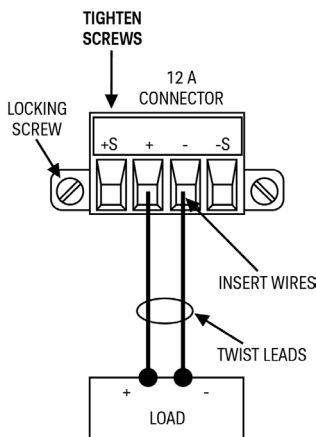
- Connecting to your bench dc power supply
- Achieving accurate voltage with remote sense
- Measuring current in amps
- Tracking dc outputs
- Enabling high voltage capability
- Enabling high current capability
- Powering down safely
- Documenting your test setups and measurements
- Keeping your power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

## Connecting to your dc bench power supply

To start, you may 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 diagrams below.



Front panel binding posts (max size 14 AWG) A = 20A max current, B = 15A max current



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

## Achieving accurate voltage with remote sense

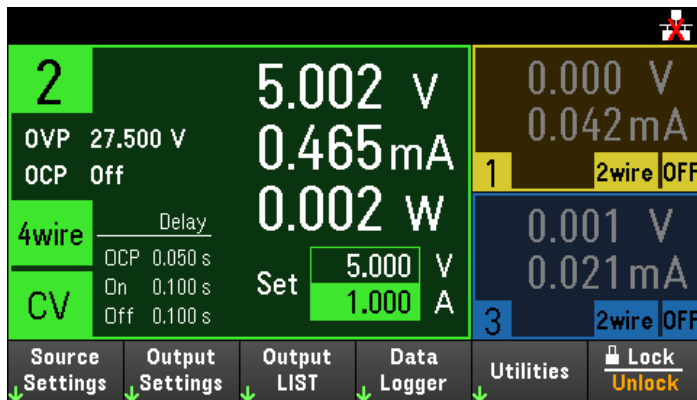
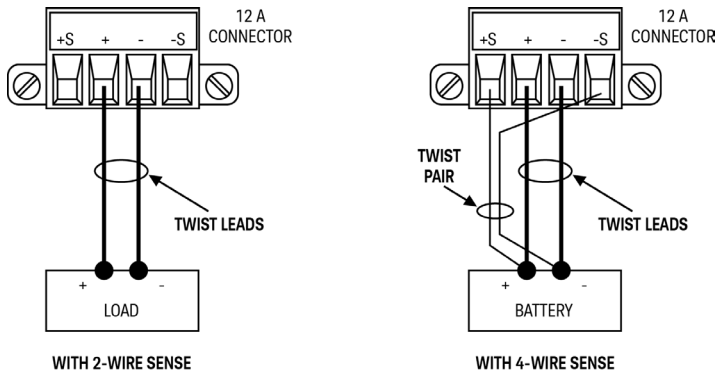
Remote sense capability has been around for a long time and is very useful for delivering accurate voltage at the DUT when using long wiring. In addition, remote sense improves your measurement accuracy.

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 (i.e. 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 caused by wire resistance and amount of current that the load requires. 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.

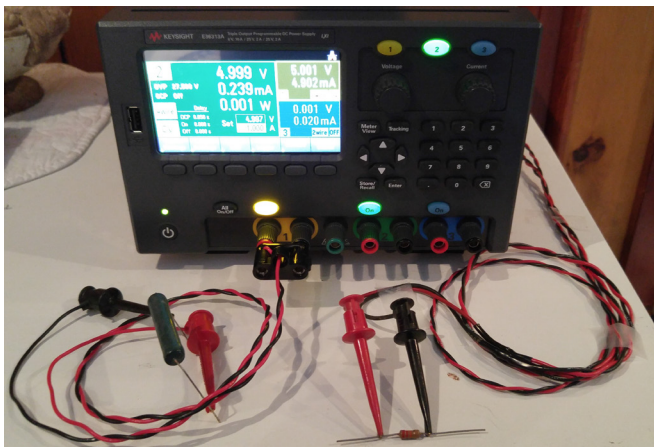
E36300A series bench power supplies include remote sense capability as a standard feature. Remote sense is easily enabled through the built-in internal relays which connect + and - output terminals to the + and - sense terminals without having to remove jumpers. Please note that you must use the rear 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 photo below). Since the sense leads carry very small currents a lighter gauge wire can be used. Try to keep the sense leads less than 0.5 ohm per wire (20 gauge wire works well). Keep the wire pairs as short as possible and less than 50 feet (14.7 meters).



Once the wiring is complete, enable 4-wire operation by pressing Source Settings > Sense 2W/4W. In the screen shot above, on the left side, you will see 4-wire indicated above the CV indicator.

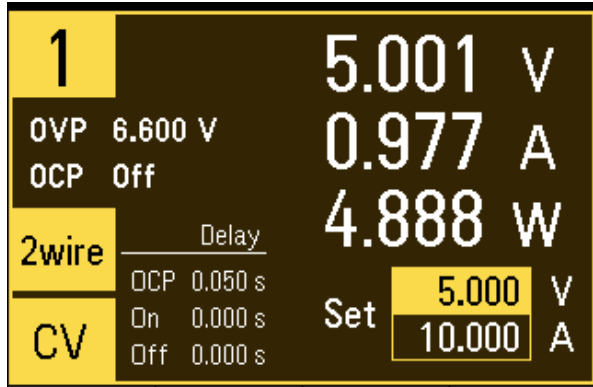


It is good engineering practice to twist your wires to reduce lead inductance and reduce noise pickup. In the test example shown above, Channel 1 is set up for 2-wire operation using a single twisted pair. Channel 2 is set up for 4-wire operation using a twisted pair for the output leads and a separate 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. With today's bench power supplies, everything is designed in and because no external equipment is required, (DMM, current shunt, wiring, etc); the setup has been simplified, eliminating potential errors. Measurement accuracy is specified and, on top of that, you get current measurements in amps on a nice large display. No voltage to current conversion is required!

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



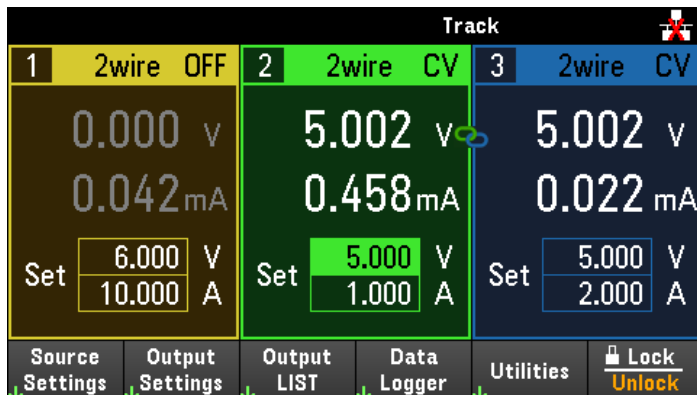
For measurement specifications please see the *E36300 Series Data Sheet*, literature number 5992-2124EN.

## 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 Channel 2 and Channel 3 are independent electrically, but now track their voltage setting. Track mode is available on the E36312A and E36313A.

Enable track mode by pressing: Output Settings > Operation Mode > Mode Tracking



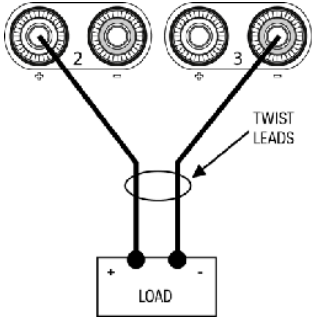
## Enabling high voltage capability in two easy steps

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.

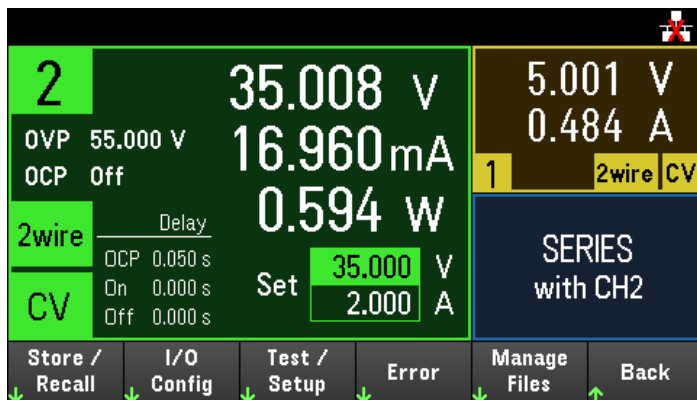
Step 1. Connect your wires as shown in the diagram below

Step 2. Enable series mode.

Output 2 and 3 will now be connected in series to create a single dc output and single measurement Channel up to 50V and 2A. Channel 2 is now the “master” and the output voltage and current settings can easily be controlled by front panel voltage and current knobs or the numeric keypad.



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



Channel 2 now controls the series combination.

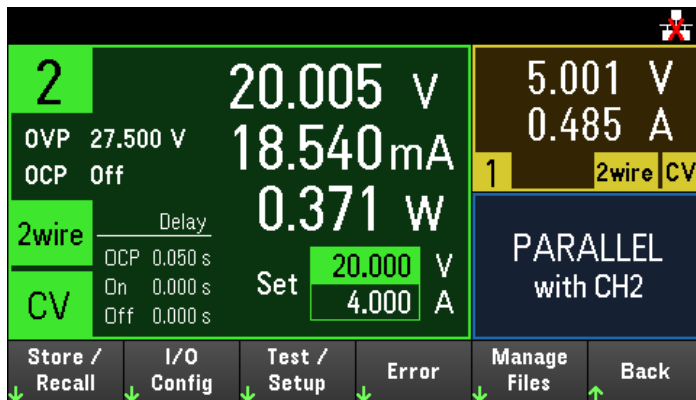
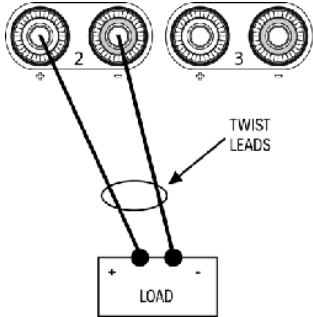
## Enabling high current capability in two easy steps

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

Step 1. Connect your wires as shown in the diagram below

Step 2. Enable parallel mode.

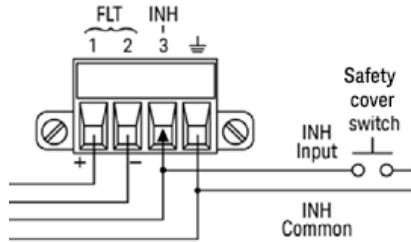
Output 2 and 3 will now be connected in parallel to create a single dc output and single measurement channel up to a 25 V and 4 A. Channel 2 is now the “master” and the output voltage and current settings can easily be controlled by front panel voltage and current knobs or the numeric keypad.



Channel 2 now controls the parallel combination.

## Powering down safely

The remote inhibit signal will disable the dc outputs when the RI input pin is pulled low via a switch, logic chip, or open collector transistor. The remote inhibit feature provides a safe way to shut down a power supply when a test box safety cover is opened.



*Note to layout. Need to omit connector 1 and connector 2 shown above, Just want to use connector 3 and panic switch wiring. Change panic switch text to Safety Cover switch text*

The inhibit input function lets an external signal control the output state of all the dc output channels in the bench power supply. The polarity of pin 3 can also be configured. The input is level triggered and the signal latency is less than 450 microseconds. Maximum time required for all output channels to start to turn off is 45 milliseconds. Pin 4 is the common for Pin 3.

The following non-volatile inhibit input modes can be set using the front panel:

1. LATCHing - causes a logic-true transition to disable all of the dc outputs. The outputs remain latched off after the inhibit signal is received.
2. LIVE - Allows the enabled dc output(s) to follow the state of the inhibit input. When the inhibit input is true the output(s) are disabled. When the inhibit input is false, the output(s) will be re-enabled.
3. OFF - The inhibit input is ignored.

I/O Config - Digital I/O					
Pin 1		Pin 2		Pin 3	
Function	Digital In	Function	Digital In	Function	Inhibit In
Polarity	Positive	Polarity	Positive	Polarity	Positive
In	1	In	1	In	1
Out	0	Out	0	Out	0
Pin	1 2 3	Function	Polarity	Out	Back
			Pos Neg	0 1	

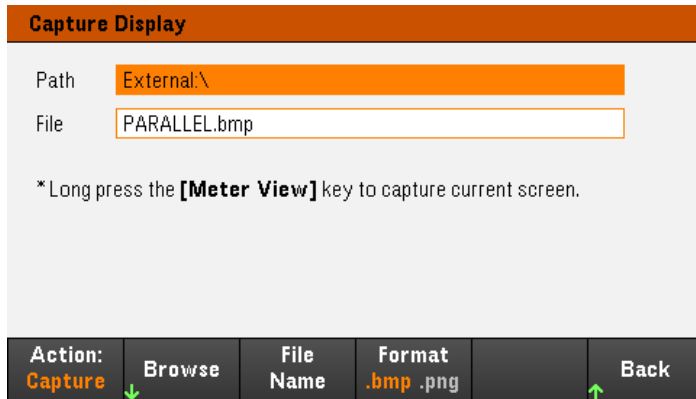
To clear the inhibit protection function, first remove the external inhibit signal. On the front panel select Source Settings > Protection Clear. This will re-enable all dc outputs to their previous states.

More detailed information can be found in the *E36300 Series User's Manual*, literature number E36311-90001



## 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 to a more meaningful filename. Press Manage Files > File Name >). This makes it easy to save them to a USB thumb drive to document your test setup and measurement results.



## 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. Easily lock your front panel lock by pressing and holding the Lock / Unlock soft key for a few seconds.

Lock your bench power supply to your test bench by using the built- in Kensington security slot feature. This nifty little feature will prevent your power supply from disappearing from your bench.

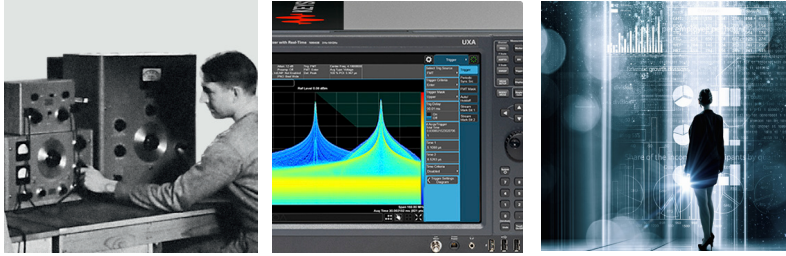
## Conclusion

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.

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