Service Guide

EDU36311A Triple Output Programmable DC Power Supply

KEYSIGHT TECHNOLOGIES

Notices

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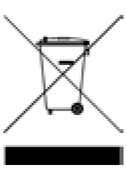

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

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1 Service and Maintenance

This chapter provides the specifications and service information on cleaning, troubleshooting, repair, and replaceable parts of the EDU36311A. This chapter also explains how to assemble and disassemble the EDU36311A.

Specifications and Characteristics

NOTE For the characteristics and specifications of the EDU36311A programmable DC power supply, refer to the datasheet at https://www.keysight.com/us/en/assets/3121-1003/data-sheets/EDU36311A-Triple-Output-Bench-Power-Supply.pdf.

General Information

Types of service available

If your instrument fails during the warranty period, Keysight Technologies will repair or replace it under the terms of your warranty. After your warranty expires, Keysight offers repair services at competitive prices. You also have the option to purchase a service contract that extends the coverage after the standard warranty expires.

Obtaining repair service (worldwide)

To obtain service for your instrument, contact your nearest Keysight Technologies Service Center. They will arrange to have your unit repaired or replaced, and can provide warranty or repair–cost information where applicable. Ask the Keysight Technologies Service Center for shipping instructions, including what components to ship. Keysight recommends that you retain the original shipping carton for return shipments.

Repackaging for shipment

Ensure the following to ship the unit to Keysight for service or repair:

- Attach a tag to the unit identifying the owner and indicating the required service or repair. Include the model number and full serial number.
- Place the unit in its original container with appropriate packaging material.
- Secure the container with strong tape or metal bands.
- If the original shipping container is unavailable, use a container that will ensure at least 10 cm (4 in.) of compressible packaging material around the entire instrument. Use static-free packaging materials.

Keysight suggests that you always insure your shipments.

Cleaning and handling

Cleaning

To prevent electrical shock, disconnect the instrument from AC mains power and disconnect all test leads before cleaning. Clean the outside of the instrument using a soft, lint-free, cloth slightly dampened with water.

- Do not use detergent or solvents.
- Do not attempt to clean internally.

If required, contact a Keysight Technologies Sales and Service office to arrange for proper cleaning to ensure that safety features and performance are maintained.

Electrostatic Discharge (ESD) precautions

Almost all electrical components can be damaged by electrostatic discharge (ESD) during handling. Component damage can occur at electrostatic discharge voltages as low as 50 V.

The following guidelines will help prevent ESD damage during service operations:

- Disassemble instruments only in a static-free work area.
- Use a conductive work area to reduce static charges.
- Use a conductive wrist strap to reduce static charge accumulation.
- Minimize handling.
- Keep replacement parts in original static-free packaging.
- Remove all plastic, foam, vinyl, paper, and other static-generating materials from the immediate work area.

Troubleshooting

Before troubleshooting or repairing the instrument, make sure the failure is in the instrument rather than any external connections. Also make sure that the instrument was accurately calibrated within the last year (see Calibration Adjustment Procedures > Calibration Interval for details).

Perform the following verifications if the unit is inoperative:

- Verify that the ac power cord is connected to the power supply.
- Verify that the front-panel power switch is depressed.
- Verify that the correct power-line fuse is installed. Refer to *EDU36311A User's Guide* for details.
- Verify the power-line voltage setting.

Self-Test Procedures

A power-on self-test occurs automatically when you turn on the power supply. This limited test assures you that the power supply is operational.

Press **Utilities** > **Instr. Setup** > **Self Test** to perform the complete self-test of the power supply. It takes approximate 2 seconds for the self-test to complete.

You can also perform a complete self-test from the remote interface, see Programming Guide for details.

- If the self-test is successful, "Self Test Passed" is displayed on the front panel.
- If the self-test fails, "" is displayed on the front panel. Press **Utilities** > **Help** > **Error** to record the error code and message and contact Keysight support if necessary.
- If the self-test is successful, this indicates a high chance that the power supply is operational.

Replacing the Power-Line Fuse

Refer to *EDU36311A User's Guide* for details.

User Replaceable Parts

You can find the instrument support part list at Keysight's Test & Measurement Parts Catalog http://www.keysight.com/find/parts.

Battery Replacement

WARNING

SHOCK HAZARD

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover. Some circuits are active and have power for a short time even when the power switch is turned off.

The internal battery powers the real-time clock. The primary function of the clock it to provide a time stamp for the internal file system. If the battery fails, the clock and time stamp function will not be available. No other instrument functions are affected.

Under normal use at room temperature, the lithium battery has a life expectancy between seven and ten years. Note that battery life will be reduced if the instrument is stored for a prolonged period at temperatures above 40 degrees Celsius.

The battery type is Panasonic CR 2032.

Replacing the Battery

1. Remove the instrument front panel. See Removing the front panel.
2. The battery is located at the main board.
3. Press out the small spring clip. Use a flat-bladed plastic screwdriver and carefully pry up on the side of the battery.

4. Install the new battery. Make sure that the positive side (+) is facing up. Place the battery under the small spring (see red circle below) and push down on the opposite end of the battery (see red arrow below) to seat the battery.

5. Reassemble the front panel when finished.
6. Reset the date and time.

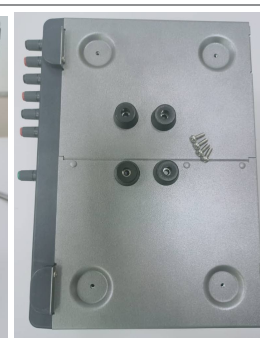
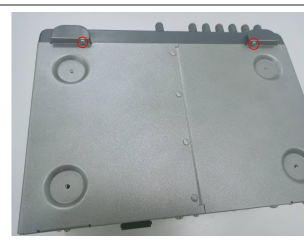
NOTE Properly dispose of the old battery in accordance with local laws and regulations.

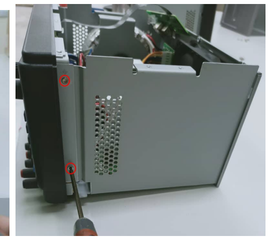
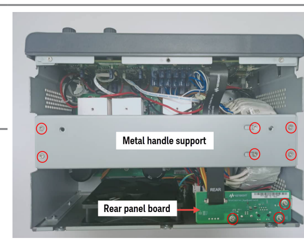
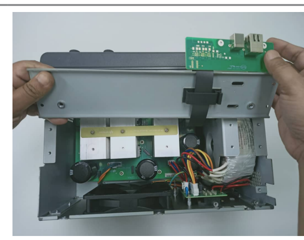
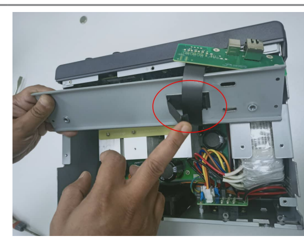
Disassembly

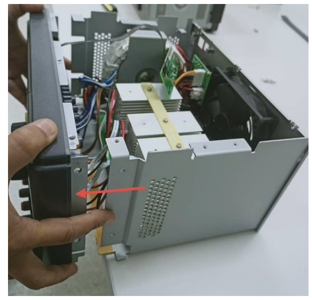
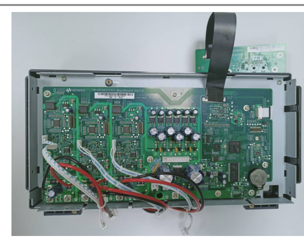
Tools required

Items	Torque value
T25 Torx driver	21 in.lbs
T20 Torx driver	9.0 in.lbs
T10 Torx driver	7 in.lbs

Removing the front panel

Steps	Instructions	Visual
1.	On the top panel, remove two screws (M5x10) with T25 Torx driver from the strap handle. Then, remove the plastic cap and strap handle from the instrument.	 
2.	On the bottom panel, remove the rubber foot. Remove four screws (M4x12) with T20 Torx driver from the rubber foot. Then, remove the rubber foot from the instrument.	 
3.	Remove two screws (M3x6) with T10 Torx driver that holds the front panel and the chassis cover.	
4.	On the rear panel, remove three screws (M3x6) with T10 Torx driver.	
5.	Pull out the chassis cover.	

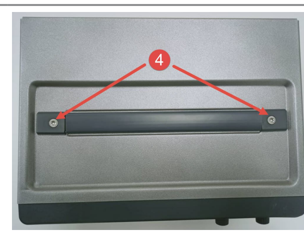
Steps	Instructions	Visual
6.	Remove four screws (M3x6) from both side of the front panel.	 
7.	Remove four screws (M3x6) from the bottom of the rear chassis.	
8.	Remove six screws (M3x6) from the metal handle support.	
9.	Remove three screws (M3x6) from the rear panel board.	
10.	Lift up the metal handle support.	
11.	Open the clip and remove the rear panel board from the metal handle support.	

Steps	Instructions	Visual
12.	**NOTE** Before pulling out the front panel, place the unit at the side of table with the front panel foot position at the outer side of the table edge. See image (A). This is to avoid power switch from being knocked off during the front panel disassembly. See image (B). Pull out the front panel.	  
13.	Disconnect all the cables from the main board.	
14.	The front panel is removed.	
15.	To install back the front panel, perform the above steps in reverse order.	

Removing/Installing the knob

Steps	Instructions	Visual
1.	Pull out the knob to remove the knob from the front panel.	
2.	To install back the knob, push the knob back in the shaft. NOTE: Make sure to follow the shaft orientation before pushing the knob.	 

Installing the strap handle

Steps	Instructions	Visual
1.	Insert the stainless steel belt into the PVC strap.	
2.	Insert the stainless steel gaskets to both side of the stainless steel belt.	
3.	Cover both side with the plastic cap.	
4.	Secure both side of the strap handle with two screws (M5x10) using T25 Torx driver.	

2 Verification and Adjustments

This chapter contains the performance verification procedures which verify that the EDU36311A is operating within its published specifications. This chapter also provides information on adjustments performed after a performance verification fails.

Performance Verification

Performance verification ensures that the instrument performs within the specifications stated in the data sheet (https://www.keysight.com/us/en/assets/3121-1003/data-sheets/EDU36311A-Triple-Output-Bench-Power-Supply.pdf).

Recommended test equipment

The test equipments recommended for the performance verification and adjustment procedures are listed below. If the exact instrument is not available, use the accuracy requirements shown to select substitute calibration standards.

Type	Specification	Recommended model
Digital multimeter	Readout: 8 1/2 digits Basic DC Accuracy: 0.0008%	Keysight 3458A or equivalent
Current monitor	15 A (0.1 Ω), TC = 4 ppm/°C	Guildline 9230A-15R
Electronic load	150 V, 5 A minimum, with transient capability and a slew rate of 833 kA/s or better.	Keysight N3300A mainframe, with N330xA modules
LAN / USB controller	N/A	PC with Keysight Connection Expert loaded
Oscilloscope	Sensitivity: 1 mV; Bandwidth Limit: 20 MHz Probe: 1:1 with RF tip	Keysight DSOX1202A oscilloscope or equivalent
Terminations	1 – 50 Ω BNC termination 2 – 50 Ω, ≥ 1/8 W resistor	N/A
Variable voltage transformer or AC source	Adjustable to highest rated input voltage range. Power: 500 VA	Keysight 6813C or equivalent

Test considerations

– Ensure that the calibration ambient temperature is stable and between 20 °C and 30 °C.

– Ensure ambient relative humidity is less than 80%.

– Allow a 1-hour warm-up period before verification or calibration.

– Keep cables as short as possible, consistent with the impedance requirements.

– Performance verification and calibration procedure must be performed through front panel output.

CAUTION The tests should be performed by qualified personnel. During performance verification tests, hazardous voltages may be present at the outputs of the power supply.

Measurement techniques

Digital Multimeter

To ensure that the values read by the multimeter during both the verification procedure and the calibration procedure are not affected by the instantaneous measurement of the AC peaks of the output current ripple, make several DC measurements and average them.

Current-monitoring resistor

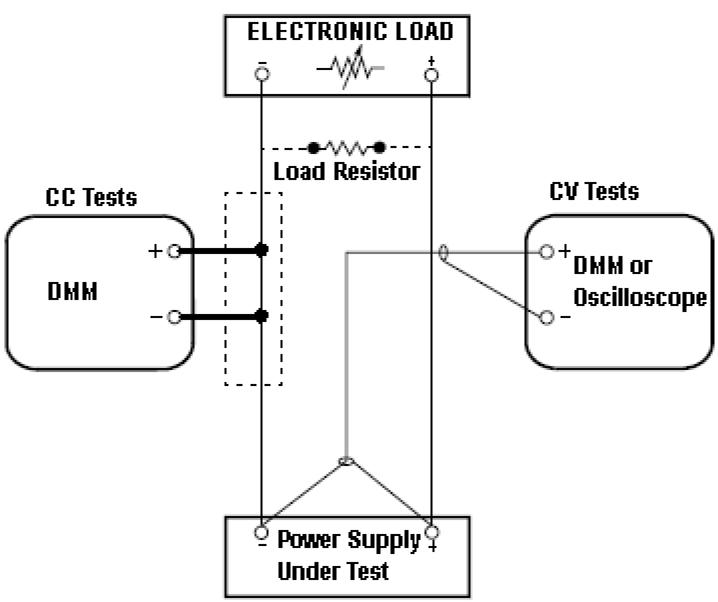
The 4-terminal current shunt is used to eliminate output current measurement error caused by voltage drops in the load leads and connections. It has special current-monitoring terminals inside the load connection terminals. Connect the voltmeter directly to these current-monitoring terminals.

Electronic load

Many of the test procedures require the use of a variable load capable of dissipating the required power. If a variable resistor is used, switches should be used to connect, disconnect, or short the load resistor. For most tests, an electronic load can be used. The electronic load is considerably easier to use than load resistors, but it may not be fast enough to test transient recovery time and may be too noisy for the noise (PARD) tests.

Fixed load resistors may be used in place of a variable load, with minor changes to the test procedures. Also, if computer controlled test setups are used, the relatively slow (compared to computers and system voltmeters) settling times and slew rates of the power system may have to be taken into account. "Wait" statements can be used in the test program if the test system is faster than the power system.

Setup for most tests



This setup is used for most tests and it requires the DMM, electronic load, and power supply being verified. Some wire is also required for connection between instruments. A LAN or USB cable is needed for readback data. The

DMM measures the power supply output, and the electronic load draws current from the power supply. The accuracy of the current monitoring resistor must be 0.01% or better, which should include any self-heating effects.

Constant Voltage (CV) verification

Voltage programming and readback accuracy

These tests verify that the voltage programming and the LAN or USB readback functions are within specifications. Note that the readback values over the remote interface should be identical to those displayed on the front panel, but with maximum resolution.

1. Turn off the power supply using the AC line switch.
2. Connect a DMM between the (+) and (–) terminals of the output.
3. If you are using a computer to control the power supply, connect a LAN or USB cable from the power supply to the PC.
4. Turn on the power supply using the AC line switch.

Voltage programming accuracy

Step	Front Panel	SCPI
5.	Set the instrument settings as described in the test record form under the **Voltage Programming and Readback**. See Test Record Forms for details.	VOLT 6, (@<channel>); CURR 5, (@<channel>) This is an example for 6 V, 5 A output.
6.	Enable the output by pressing **ON** key for the selected output.	OUTP ON, (@<channel>)

7. The output status should be **CV** and the output current should be close to zero.
8. Record the voltage measured by the DMM and verify whether it is within the limits calculated.

Voltage readback accuracy

Step	Front Panel	SCPI
9.		MEAS:VOLT? (@<channel>) This is an example for 6 V, 5 A output.

10. Record the voltage returned by the SCPI command query via Keysight Connection Expert, and verify whether it is within the limits calculated.

CV load and line regulation

These tests verify that the voltage variation due to load or line variation are within specifications.

CV load regulation

This test measures the change in output voltage resulting from a change in output current from full load to no load.

1. Turn off the power supply using the AC line switch.
2. Connect the power supply output with a DMM and an electronic load.
3. If you are using a PC to control the power supply, connect a LAN or USB cable from the power supply to the PC.
4. Turn on the power supply using the AC line switch.
5. Set the power supply settings as described in the test record form under “CV Load Regulation”. See the Test Record Forms under “CV Load Regulation” for details. Enable the output.
6. Operate the electronic load in constant current mode and set its current to the value in the test record form under “CV Load Regulation”. See the Test Record Forms under Test Description of “CV Load Regulation” for details. Check that the front panel CV annunciator of the power supply remains lit. If it turns to **CC** or **UR**, adjust the load so that the output current drops slightly until the CV annunciator lights up. Record the output voltage reading on the DMM as V_{load}.
7. Operate the electronic load in open mode (input off). Record the output voltage reading on the DMM immediately as V_{noload}.
8. Take the difference between the DMM readings in steps 6 and 7 that is the CV load regulation ($V_{load} – V_{noload}$). The difference of the readings during the immediate change should be within the specification limits.

CV line regulation

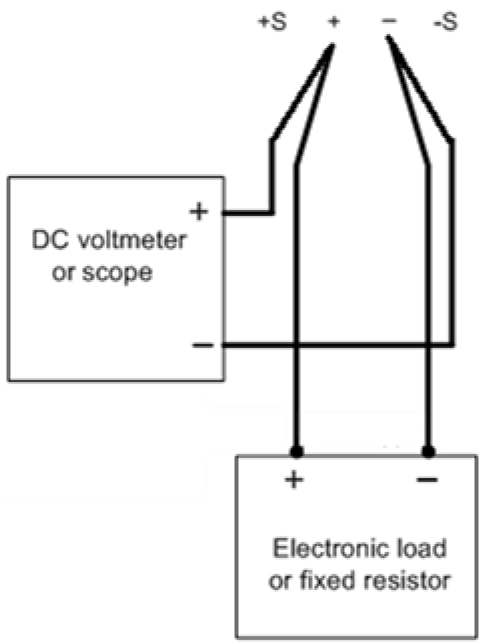
This test measures the change in output voltage that results from a change in AC line voltage from the minimum to maximum value within the line voltage specifications.

1. Turn off the power supply using the AC line switch.
2. Connect the power supply output with a DMM and an electronic load.
3. Connect a variable AC Source or Variac to the AC input, set to an appropriate line voltage for the power supply configuration.
4. If you are using a PC to control the power supply, connect a LAN, or USB cable from the power supply to the PC.
5. Turn on the power supply using the AC line switch.
6. Set the power supply settings as described in the test record form under “CV Line Regulation”. See the Test Record Forms under “CV Line Regulation” for details. Enable the output.
7. Operate the electronic load in constant current mode and set its current to the value in the test record form under “CV Line Regulation”. See the Test Record Forms under Test Description of “CV Line Regulation” for details. Check that the front panel CV annunciator of the power supply remains lit. If it turns to **CC** or **UR**, adjust the load so that the output current drops slightly until the CV annunciator lights up.
8. Adjust the AC power source to low line voltage limit (90 VAC for nominal 100 VAC, 104 VAC for nominal 115 VAC, or 207 VAC for nominal 230 VAC). Record the output reading on the DMM as $V_{lowline}$.
9. Adjust the AC power source to high line voltage (110 VAC for nominal 100 VAC, 127 VAC for nominal 115 VAC, or 253 VAC for nominal 230 VAC). Record the voltage reading on the DMM immediately as $V_{highline}$.
10. Take the difference between the DMM readings in steps 8 and 9 that is the CV line regulation ($V_{lowline} – V_{high-line}$). The difference of the readings during the immediate change should be within the limit calculated from the specification.

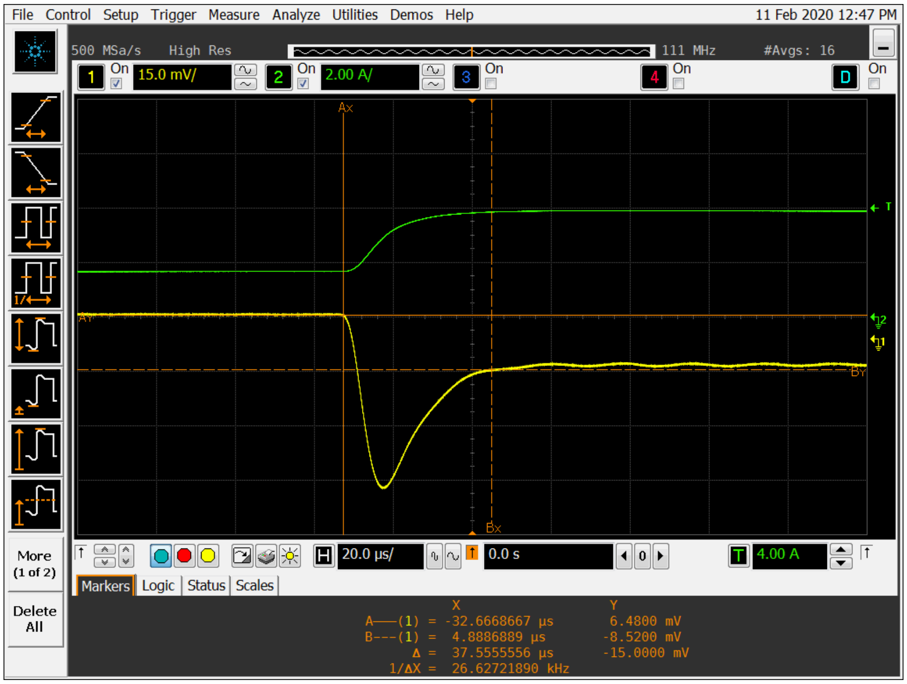
Transient response verification

This test measures the time for the output voltage to recover to within the specified value following a 50% change in the load current.

1. Turn off the power supply using the AC line switch.
2. Connect an oscilloscope and electronic load between the (+) and (–) terminals of the output to be tested as shown below.



3. If you are using a PC to control the power supply, connect a LAN, or USB cable from the power supply to the PC.
4. Turn on the power supply using the AC line switch.
5. Set the instrument settings as described in the test record form under “Transient Response”. See the Test Record Forms under “Transient Response” for details. Enable the output.
6. Operate the electronic load in constant current mode and set its current to the value in the test record form under “Transient Response”. See the Test Record Forms under Test Description of “Transient Response” for details. Set the transient level to ½ the maximum current. Set the transient duty cycle to 50% and transient frequency to 1 kHz. Check that the front panel CV annunciator of the power supply remains lit. If it turns to **CC** or **UR**, adjust the maximum current load so that the output current drops slightly until the CV annunciator lights up.
7. Adjust the oscilloscope to display transients as shown below. Note that the pulse width (t2-t1) of the transient at the voltage settling band, for example 15 mV for Output 1 from the base line is no more than 50 µs.



NOTE The oscilloscope cursors AX and BX represent t1 and t2.
The oscilloscope green trace and yellow trace represent output current and output voltage trace.

8. Transient response specification is met when the voltage recovers within 50 µs.

Constant Current (CC) verification

Current programming and readback accuracy

These tests verify that the current programming and the LAN, or USB readback measurement functions are within specifications. Note that the readback values over the remote interface should be identical to those displayed on the front panel, but with maximum resolution.

1. Turn off the power supply using the AC line switch.
2. Connect the current shunt directly across the output terminals. Connect the DMM directly across the current shunt.
3. If you are using a PC to control the power supply, connect a LAN, or USB cable from the power supply to the PC.
4. Turn on the power supply using the AC line switch.

Current programming accuracy

Step	Front Panel	SCPI
5.	Set the instrument settings as described in the test record form under **Current Programming and Readback**. See Test Record Forms for details.	VOLT 6, (@<channel>); CURR 5, (@<channel>) This is an example for 6 V, 5 A output.
6.	Enable the output by pressing the Output ON key	OUTP ON, (@<channel>)

7. The output status should be **CC** and the output voltage should be close to zero.
8. Divide the voltage drop (DMM reading) across the current shunt by the shunt resistance to convert to amps.
9. Record the current measured by the DMM and verify whether it is within the limits calculated.

Current readback accuracy

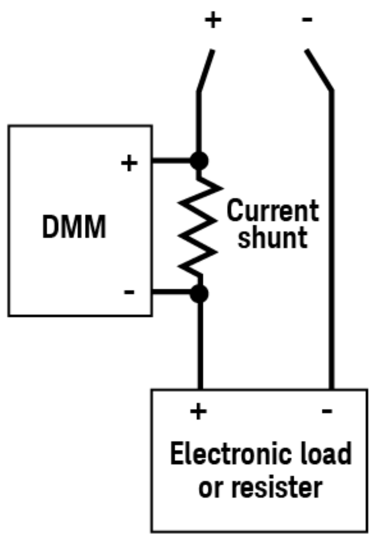
Step	Front Panel	SCPI
10.		MEAS:CURR? (@<channel>) This is an example for 6 V, 5 A output.

11. Record the current returned by the SCPI command query via Keysight Connection Expert, and verify whether it is within the limits calculated.

CC load regulation

This test measures the change in output current resulting from a change in output voltage from full scale to short circuit.

1. Turn off the power supply using the AC line switch.
2. Connect the power supply output with a DMM, an electronic load and a current shunt as shown below.



3. Turn on the power supply using the AC line switch.
4. Program the output voltage and output current as described in the test record form under CC load regulation.
5. Enable the output by sending the command OUTP ON or by pressing the Output ON key.
6. Operate the electronic load in constant voltage mode and set its voltage to the power supply output value as described in the test record form under “CC Load Regulation”. See the Test Record Forms under Test Description of “CC Load Regulation” for details. Check that the front panel CC annunciator of the power supply remains lit. If it turns to **CV** or **UR**, adjust the load so that the output current drops slightly until the CC annunciator lights up. Record the current reading (I_{load}), by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
7. Operate the electronic load in short (input short) mode. Record the current reading, (I_{short}), by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
8. Take the difference between the current readings in steps 6 and 7 is the load regulation current ($I_{load} – I_{short}$). The difference of the readings during the immediate change should be within the specification limits.

CC line regulation

1. Turn off the power supply using the AC line switch.
2. Connect the power supply output with a DMM, an electronic load and a current shunt. See Recommended test equipment for details.
3. Connect the AC power cord of the power supply to the AC power source.
4. Turn on the power supply using the AC line switch.
5. Program the output voltage and output current as described in the test record form under CC line regulation.
6. Operate the electronic load in constant voltage mode and set its voltage to the power supply output value as described the test record form under "CC Line Regulation". See the Test Record Forms under Test Description of "CC Line Regulation" for details. Check that the front panel CC annunciator of the power supply remains lit. If it turns to **CV** or **UR**, adjust the load so that the output current drops slightly until the CC annunciator lights up.
7. Adjust the AC power source to low line voltage limit (90 VAC for nominal 100 VAC, 104 VAC for nominal 115 VAC, or 207 VAC for nominal 230 VAC). Record the output current reading ($I_{lowline}$) by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
8. Adjust the AC power source to high line voltage (110 VAC for nominal 100 VAC, 127 VAC for nominal 115 VAC,or 253 VAC for nominal 230 VAC). Record the current reading ($I_{highline}$) again immediately by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
9. Take the difference between the DMM readings in steps 7 and 8 is the CC line regulation ($I_{lowline} – I_{highline}$). The difference of the readings during the immediate change should be within the specification limits.

Test record form - Keysight EDU36311A

Test record form – Keysight EDU36311A

EDU36311A	Report Number ________		Date ________	
Description	**Outputs**	**Lower limit**	**Result**	**Upper limit**
Constant Voltage Tests				
Voltage Programming				
Zero Voltage Output (V_0)	Output 1	-0.005 V	________	0.005 V
	Output 2	-0.01 V	________	0.01 V
	Output 3	-0.01 V	________	0.01 V
Maximum Voltage Ouput (V_{max})	Output 1	5.989 V	________	6.011 V
	Output 2	29.975 V	________	30.025 V
	Output 3	29.975 V	________	30.025 V
Voltage Readback				
Zero Voltage measured over interface	Output 1	V_0 - 0.005 V	________	V_0 + 0.005 V
	Output 2	V_0 - 0.01 V	________	V_0 + 0.01 V
	Output 3	V_0 - 0.01 V	________	V_0 + 0.01 V
Maximum Voltage measured over interface	Output 1	V_{max} - 0.011 V	________	V_{max} + 0.011 V
	Output 2	V_{max} - 0.025 V	________	V_{max} + 0.025 V
	Output 3	V_{max} - 0.025 V	________	V_{max} + 0.025 V
CV Load Regulation (V_{load} - V_{noload})	Output 1	-2.6 mV	________	2.6 mV
	Output 2	-5 mV	________	5 mV
	Output 3	-5 mV	________	5 mV
CV Line Regulation ($V_{lowline}$ - $V_{highline}$)	Output 1	-2.6 mV	________	2.6 mV
	Output 2	-5 mV	________	5 mV
	Output 3	-5 mV	________	5 mV
Transient Response	Output 1	–	________	50 µs
	Output 2	–	________	50 µs
	Output 3	–	________	50 µs
Constant Current Tests				
Current Programming				
Minimum Current Output (I_0)	Output 1	-0.008 A	________	0.012 A
	Output 2	-0.004 A	________	0.006 A
	Output 3	-0.004 A	________	0.006 A
Maximum Current Ouput (I_{max})	Output 1	4.985 A	________	5.015 A
	Output 2	0.993 A	________	1.007 A
	Output 3	0.993 A	________	1.007 A

EDU36311A		Report Number ___________	Date _____________	
Description	**Outputs**	**Lower limit**	**Result**	**Upper limit**
Current Readback				
Minimum Current measured over interface	Output 1	I_0 - 0.01 A	____________	I_0 + 0.01 A
	Output 2	I_0 - 0.005 A	____________	I_0 + 0.005 A
	Output 3	I_0 - 0.005 A	____________	I_0 + 0.005 A
Maximum Current measured over interface	Output 1	I_0 - 0.015 A	____________	I_0 + 0.015 A
	Output 2	I_0 - 0.007 A	____________	I_0 + 0.007 A
	Output 3	I_0 - 0.007 A	____________	I_0 + 0.007 A
CC Load Regulation (I_{load} - I_{short})	Output 1	-20 mA	____________	20 mA
	Output 2	-12 mA	____________	12 mA
	Output 3	-12 mA	____________	12 mA
CC Line Regulation ($I_{lowline}$ - $I_{highline}$)	Output 1	-20 mA	____________	20 mA
	Output 2	-12 mA	____________	12 mA
	Output 3	-12 mA	____________	12 mA

Test Description	Instrument settings		
	Output 1	**Output 2**	**Output 3**
Voltage Programming & Readback, Zero Voltage (V_0)	0 V, 5 A	0 V, 1 A	0 V, 1 A
Voltage Programming & Readback, Maximum Voltage (V_{max})	6 V, 5 A	30 V, 1 A	30 V, 1 A
CV Load Regulation and Line Regulation	6 V , 5 A	30 V , 1 A	30 V , 1 A
Transient Response	6 V, 2.5 A to 5 A	30 V, 0.5 A to 1 A	30 V, 0.5 A to 1 A
Current Programming & Readback, Minimum Current (I_0)	0.002 A, 6 V	0.001 A, 30 V	0.001 A, 30 V
Current Programming & Readback, Maximum Current (I_{max})	5 A, 6 V	1 A, 30 V	1 A, 30 V
CC Load Regulation and Line Regulation	5 A, 6 V	1 A, 30 V	1 A, 30 V

Calibration Adjustment Procedures

This chapter includes calibration adjustment procedures for Keysight EDU36311A power supply. Instructions are applicable for performing the procedures from either the front panel or a controller over the LAN or USB.

NOTE **Perform the verification tests before calibrating your instrument. If the instrument passes the verification tests, the unit is operating within its calibration limits and does not need to be re-calibrated.**

Closed–case electronic calibration

The instrument uses closed-case electronic calibration; no internal mechanical adjustments are required. The instrument calculates correction factors based on reference signals that you apply and stores the correction factors in non-volatile memory. This data is not changed by cycling power, or *RST.

Calibration interval

The recommended calibration interval for Keysight EDU36311A power supply is one year.

Calibration adjustment process

The following general procedure is recommended to complete a full calibration adjustment.

1. Adhere to the test considerations. See Performance Verification > Test considerations for details.
2. Perform the performance verification tests to characterize the instrument. See Performance Verification for details.
3. Unsecure the instrument for calibration. See Calibration security for details.
4. Perform the calibration procedures. See Calibration procedure for details.
5. Secure the instrument against the calibration. See Calibration security for details.
6. Take note of the security code and calibratizon count in the instrument's maintenance records.
7. Perform the performance verification tests to verify the calibration.

Calibration security

The instrument has a calibration passcode to prevent accidental or unauthorized calibration. When you receive your power supply, it is secured by a default passcode.

The default passcode is EDU36311A. The security code cannot be changed by a power cycle or *RST.

You can enter a passcode of up to 12 characters. The first character must be a letter (A-Z), remaining may contains letters, numbers (0-9), or underscore "_". Blank spaces are not allowed.

You can change the passcode from both front panel and remote interface after unsecure the instrument using the old passcode.

From the front panel:

To unsecure the instrument:
1. Press **Utilities** > **Instr. Setup** > **Calibration**.
2. Use **Keyboard** to enter the security passcode and press **Apply**.
3. Press **State** Login

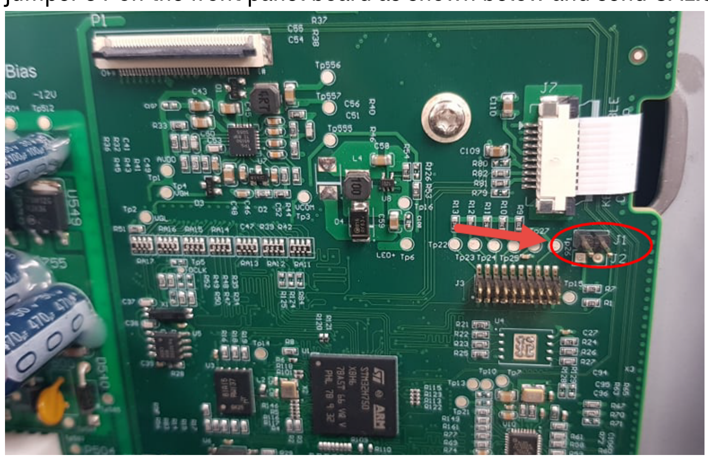
To change passcode:
1. Press **Utilities** > **Instr. Setup** > **Calibration** > **Change Passcode**.
2. Use **Keyboard** to enter the current passcode and your desired passcode.
3. Press **Change**.

From the remote interface:

To unsecure the instrument:
CAL:SEC:STAT 0, EDU36311A

To change a new passcode to K_EDU36311A:
CAL:SEC:CODE K_EDU36311A

NOTE To change a forgotten passcode to a new passcode, you can turn on the instrument after shorting CAL SECURE jumper J1 on the front panel board as shown below and send CAL:SEC:CODE <code> to change the passcode.



Calibration count

The instrument counts the number of times it has saved calibration data. Your instrument was calibrated at the factory; when you receive your instrument, read and record the initial count. You can only read the calibration count by sending the CAL:COUNt? query, and the calibration count is not change by a power cycle or *RST.

If Auto Save is enabled, the count increments whenever a calibration point is calibrated successfully. To avoid double counting, do not manually save the count with Auto Save enabled.

Calibration message

You can use the CALibration:STRing command to store a message of up to 40 characters in calibration memory. For example, you could store the last calibration date, the calibration due date, or contact information for the person responsible for calibration. The calibration message is not affected by a power cycle or *RST.

You can only store the calibration message when the instrument is unsecured, but you can execute the CALibration:STRing? query regardless of whether the instrument is secured. A new calibration message overwrites the previous message, and messages over 40 characters are truncated.

Saving calibration data

You must always save new calibration data before cycling instrument power or leaving the calibration state with the Auto Save feature off. To save calibration data, send CAL:SAVE or save the calibration data from the front panel.

Calibration auto save

The instrument includes a calibration Auto Save feature. This feature automatically saves the calibration data to non-volatile memory and increments the calibration count whenever a calibration point is calibrated successfully.

To enable or disable the CAL auto Save feature, send CAL:ASAVE ON or CAL:ASAVE OFF. To query the CAL auto Save state, send CAL:ASAVE?

Calibration procedure

Enter the calibration state

To begin the calibration procedure, you must enter the calibration state.

Step	Front Panel	SCPI
1	Press **Utilities** > **Instr. Setup** > **Calibration.**	.
	Use **Keyboard** to enter the security passcode (default passcode is EDU36311A) and press **Apply.** Press **State** Login to enter the calibration page.	CAL:SEC:STAT 0, <*code*>
2	To change a forgotten passcode to a new passcode, you can turn on the instrument after shorting CAL SECURE jumper J1 on the front panel board and send scpi command to change the passcode.	CAL:SEC:CODE <code>

Calibrate voltage

Let the unit sit with output ON for one minute, then connect the DMM voltage input to the power supply.

Step	Front Panel	SCPI
1	Press **Perform Calibration** and select the output for calibration. Press **Cal Volt.**	CAL:VOLT:LEV MIN, (@<channel>)
2	Measure the output voltage (low point) with the DMM.	
3	Enter the measured value, and press **Next.**	CAL:VOLT <*reading*>, (@<channel>) CAL:VOLT:LEV MAX, (@<channel>)
4	Measure the output voltage (high point) with the DMM.	
5	Enter the measured value, and press **Next.**	CAL:VOLT <*reading*>, (@<channel>)
6	Read DONE or FAIL on the display.	(wait 30 seconds) SYST:ERR?
7	Press **Cal Save.**	CAL:SAVE

Calibrate current

Let the unit sit with output ON for one minute, then connect a current monitoring resistor across the output terminals to be calibrated and then connect a DMM across the terminals of the monitoring resistor.

Step	Front Panel	SCPI
1	Press **Perform Calibration** and select the output for calibration. Press **Cal Curr.**	CAL:CURR:LEV MIN, (@<channel>)
2	Measure the output current (low point) with the DMM.	
3	Enter the measured value, and press **Next.**	CAL:CURR <*reading*>, (@<channel>) CAL:CURR:LEV MAX, (@<channel>)
4	Measure the output current (high point) with the DMM.	
5	Enter the measured value, and press **Next.**	CAL:CURR <*reading*>, (@<channel>)
6	Read DONE or FAIL on the display.	(wait 30 seconds) SYST:ERR?
7	Press **Cal Save.**	CAL:SAVE

Save the calibration data

To save calibration data, go to the 'CAL Save' menu to save the calibration data or enable the 'Auto Save' feature. With Auto Save, calibration data will be saved whenever a calibration point is calibrated successfully.

After completing the Voltage and Current calibrations, save the calibration data before exiting the calibration state, or simply exit the calibration state if Auto Save is on.

To save the CAL data: CAL:SAVE

To enable the CAL Auto Save: CAL:ASAVE ON

To exit CAL State: CAL:SEC:STAT 1, <code>

This information is subject to change without notice.

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