Operating and
Service Guide

Keysight AC6800B Series Basic AC Sources



KEYSIGHT
TECHNOLOGIES

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Notices

Copyright Notice

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Warranty

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Safety and Regulatory Information

NOTE This procedure requires the user to send SCPI commands to the instrument. Connect to the instrument via LAN or USB. Use the Keysight IO Libraries to send SCPI commands.

General Information

The equipment is for industrial use.

Equipment operators are subject to all applicable safety regulations. Along with the warning and safety notices in this manual, all relevant safety, accident prevention, and environmental regulations must also be followed. In particular, the operators of the equipment:

- **Must be informed of the relevant safety requirements.**
- **Must have read and understood the operating manual before using the equipment.**
- **Must use the designated and recommended safety equipment.**

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability of the customer's failure to comply with the requirements.

Safety Warnings

WARNING

A WARNING 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 personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

WARNING **Should network communication issues occur, the instrument settings shown in the Browser Web Control page may not represent the actual state of the instrument. This may result in unexpected hazardous voltages on the output and sense connections that could result in personal injury, death, or damage to a device under test. Before touching the output or sense connections or connecting to a device under test, always verify the state of the instrument.**

WARNING ## Product Grounding

The instrument is a Class 1 product and is provided with a grounding-type power cord set. The instrument chassis and cover are connected to the instrument electrical ground to minimize shock hazard. The ground pin of the cord set plug must be firmly connected to the electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective earth (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury or death.

WARNING General Warnings

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

The instrument contains an internal fuse, which is not user accessible.

DO NOT REMOVE COVERS. NO OPERATOR SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

SECURELY TURN OFF THE CIRCUIT BREAKER ON THE SWITCHBOARD BEFORE HANDLING THE POWER CORDS. TO AVOID AN ELECTRIC SHOCK, THE PROTECTIVE CONDUCTOR TERMINAL MUST BE CONNECTED TO AN ELECTRICAL GROUND.

NE PAS RETIRER LES COUVERTURE DE LA BOITE. AUCUN OPÉRATEUR SERVICEABLE PIÈCES À L'INTÉRIEUR. CONFIER L'ENTRETIEN DE PERSONNEL QUALIFIÉ.

CORRECTEMENT COUPER LE DISJONCTEUR ARMOIRE AVANT DE MANIPULER LES CORDONS D'ALIMENTATION. POUR ÉVITER TOUT CHOC ÉLECTRIQUE, LE CONDUCTEUR DE PROTECTION BORNE DOIT ÊTRE RELIÉE À UNE MASSE ÉLECTRIQUE.

WARNING Environmental Warnings

This product is designed for safe indoor use. Use indoors only.

Do not operate the instrument near flammable gases or fumes.

To prevent the possibility of explosion or fire, do not use the product near alcohol, thinner or other combustible materials, or in an atmosphere containing such vapors.

Do not install the product near a heater, in direct sunlight, or in areas subject to drastic temperature changes. The operating temperature range is 0 to 40 °C (32 to 104 °F), and the storage temperature range is -10 to 60 °C (14 to 140 °F).

Do not install the product in high-humidity locations, such as near a boiler, humidifier, or water supply. The operating humidity range is 20% to 80% relative humidity (no condensation), and the storage humidity range is 90% relative humidity or less (no condensation). Condensation may occur even within the operating humidity range. In such cases, do not use the instrument until the condensation dries up completely.

Do not install the product in a corrosive atmosphere or in environments containing sulfuric acid mist, etc. This may cause corrosion of various conductors and bad contacts of connectors inside the instrument leading to malfunction and failure, or in the worst case, a fire.

Do not install the product in a dusty location. Accumulation of dust can lead to electric shock or fire.

WARNING Shock Hazard

Before making any load or sense connections be sure to turn the POWER switch off and remove the power plug from an outlet or turn off the circuit breaker of switchboard.

When the power switch is turned off while the output is on, residual voltage still remains at the output terminals.

Do not touch the output terminal block for at least 20 seconds after the power switch is tuned off.

When installing the switch between the OUTPUT terminal block and the load, be sure to turn the POWER switch off and remove the power plug from an outlet or turn off the circuit breaker of the switchboard.

Be sure to turn the switch off before connecting the load to the terminal at the load end of the switch.

Do not touch the switch terminal or the output terminal when the output is on.

Do not remove the instrument covers. There are no customer-serviceable parts inside. Some circuits are active and have power briefly after the power switch is turned off.

To prevent electric shock, unplug the unit before cleaning.

For protection from electrical shock, the power cord ground must not be defeated. If only a two-contact electrical outlet is available, connect the instrument's chassis ground screw (see above) to a good earth ground.

This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground (earth) the unit.
Connect the protective conductor terminal to earth ground.

In DC mode, L is at positive potential and N is at negative potential when setting the positive value. The opposite is true when setting the negative value.

Do not use the terminal block with the terminal cover removed.

Turn off the switchboard circuit breaker before connecting the cord.

This product includes protective earth terminals. To minimize shock hazard, the instrument must be connected to the AC power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

If a capacitor, battery, or similar device is connected as a load in DC mode, voltage remains at the section connected to the output terminal block even when the output is off until the load energy is discharged. The discharge time of the internal capacitor when no load is connected is approximately 0.1 seconds. To prevent the possibility of electric shock, do not touch the output terminal block.

WARNING Installation Warnings

Have a qualified engineer connect the power cord to the switchboard.

Protective circuits inside the instrument, including input fuses, are connected to match the input terminal polarity. Make sure the colors of the wires connected to the input terminals (L, N, and GND) are correct.

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described under "Safety Symbols."

You cannot use standard rack mounting support rails, as they would block the airflow needed for cooling.

WARNING Heavy Weight

Danger to hands and feet. To avoid personal injury and damage to the instrument, always use a sturdy cart or other suitable device to move the instrument. Do not lift the instrument alone; always use two people to lift the instrument.



Equipment Cautions

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.

CAUTION

General Cautions

Do not place objects on the instrument. Placing objects, especially heavy objects, on top of the product can cause failures.

CAUTION

Installation Cautions

Do not block the air intake at the front of the instrument or the exhaust at the rear.

Large voltage distortion on the AC power line can lead to malfunction. Do not connect the instrument to a generator or a similar device.

Do not use the product in a location where strong magnetic or electric fields are nearby or a location where large amounts of distortion or noise are present on the input power supply waveform. The product may malfunction.

Do not install the product on an inclined surface or location subject to vibrations. The product may fall or tip over, causing damage or injuries or both.

CAUTION

Operational Cautions

You cannot set the voltage limit when the instrument is being controlled by external analog signals. An excessive external voltage may damage the load.

When the output is turned on, several volts of undershoot or overshoot may appear for a time period on the order of ten microseconds.

CAUTION

Moving Cautions

Be sure to include this manual when transporting the instrument.

Turn off the power switch before moving the instrument. Moving the product while the power is turned on can cause electric shock or instrument damage.

Remove all wiring before moving the instrument. Moving the product with the cables connected can cause wires to break or injuries due to the product falling over.

When transporting the product, be sure to use the original packing materials. Damage may result from vibrations or from the product falling during transportation.

Safety Symbols



Direct current



Alternating current



Frame or chassis terminal



Standby supply. Unit is not completely disconnected from AC mains when switch is off.



Caution, risk of electric shock



Caution, refer to accompanying documents



Earth ground terminal



ISM1-A

The CE mark is a registered trademark of the European Community. The text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).



The TUV mark is a registered trademark of the European community.

ICES/NMB-001

This mark indicates product compliance with the Canadian Interference- Causing Equipment Standard.



The RCM mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australian EMC Framework regulations under the terms of the Radio Communications Act of 1992.



South Korean Class A EMC Declaration
This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.



Contains one or more of the 6 hazardous substances above the maximum concentration value (MCV), 40 Year EPUP.

ICES/NMB-001

This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Waste Electrical and Electronic Equipment (WEEE)

This product complies with the WEEE Directive) marketing requirement. The affixed product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as “Monitoring and Control instrumentation” product. Do not dispose in domestic household waste.

To return unwanted products, contact your local Keysight office, or see

about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.



South Korea Class A EMC declaration

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.

Information to the user:

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

This EMC statement applies to the equipment only for use in business environment.

1 Getting Started

Before Installation or Use

Introduction to the Instrument

Instrument Ratings

Installing an Optional Interface Board

Rack Mounting

Connecting the Power Cord

Switchboard and Circuit Breaker Requirements

Quick Start

Interface Connections

Remote Interface Configuration

Output Power Connections

Voltage Ranges and Limits

Error Checking and Soft Limits

Before Installation or Use

Inspect the Unit

When you receive your instrument, inspect it for obvious shipping damage. If there is damage, notify the shipping carrier and nearest Keysight Sales and Support Office immediately. Refer to www.keysight.com/find/assist. Save all packing and shipping materials in case the unit must be returned or moved.

Check for Items Supplied

Verify that you received the following items.

AC6800B Series AC Source

Line cord (AC6801B only)

AC input cover (AC6803B and AC6804B only)

Ferrite core and cable tie (two supplied with AC6803B)

CD - IO Libraries Media Suite

Safety Information booklet

Certificate Of Calibration and envelope

Refer to the box contents list for any additional items that may be included with your shipment. If anything is missing, please contact your nearest Keysight Sales and Support Office.

Review Safety Information

This AC source is a Safety Class 1 instrument, which means it has a protective earth terminal. That terminal must be connected to earth ground through a power source equipped with an earth ground. Refer to the Safety Notices for general safety information. Before installation or operation, check the instrument and review this guide for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places throughout this guide.

Observe Environmental Conditions

WARNING Do not operate the instrument near flammable gases or fumes.

The AC6800B Series instruments are Overvoltage Category II instruments that should only be operated in a controlled, indoor environment subject to the following restrictions:

Operating: 0 to 40 °C (32 to 104 °F), 20% to 80% relative humidity, noncondensing

Storage: –10 to 60 °C (14 to 140 °F), 90% or less relative humidity, noncondensing

Altitude: Up to 2000 m

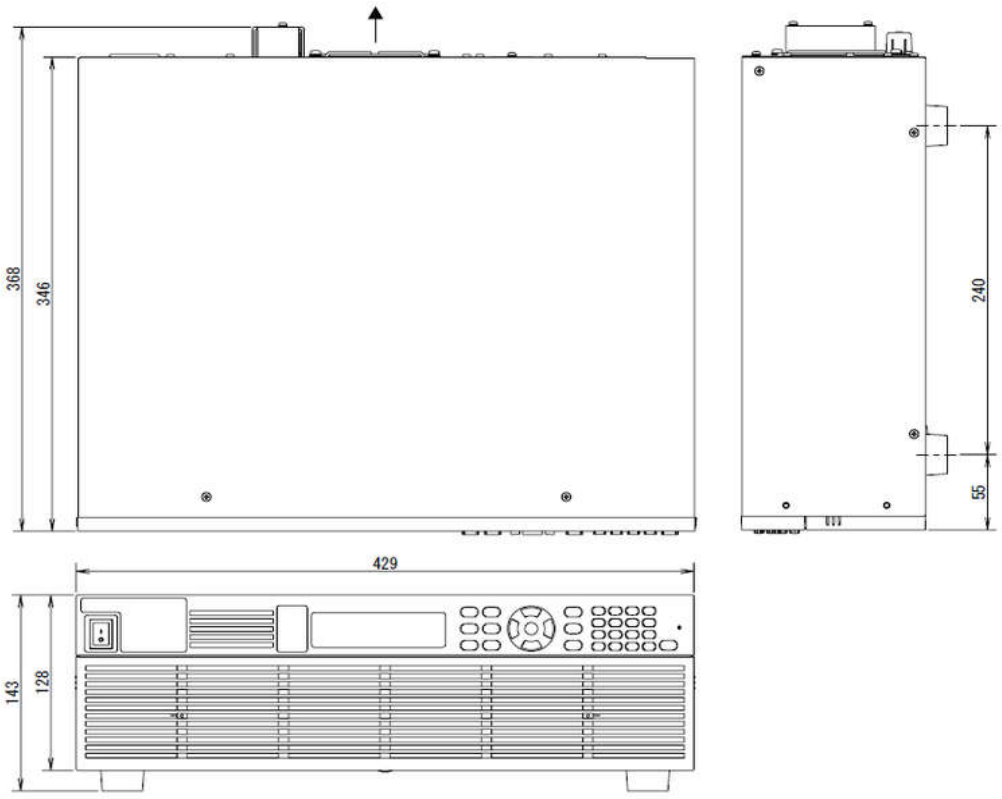
Provide Adequate Air Flow

CAUTION Do not block the air intake at the front of the instrument or the exhaust at the rear.

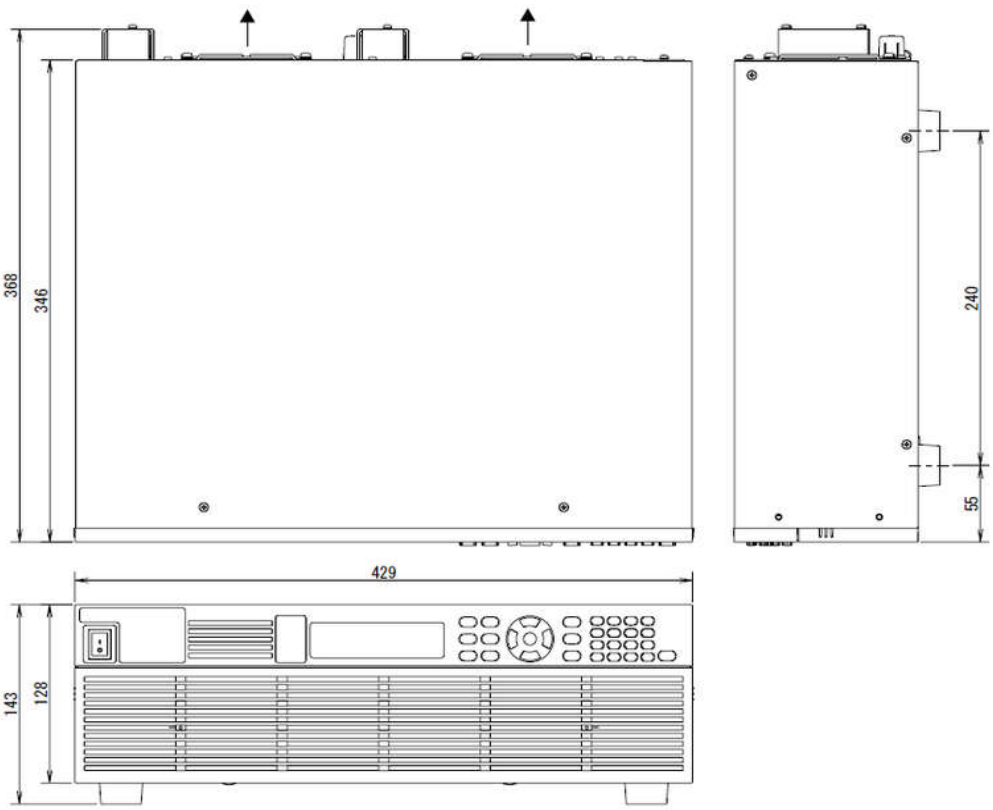
The dimensions of each model are shown below. Fans cool the instrument by drawing air through the front and exhausting it out the back. Allow at least 8 inches (20 cm) of space at the front and back of the unit for air circulation.

All dimensions are in mm.

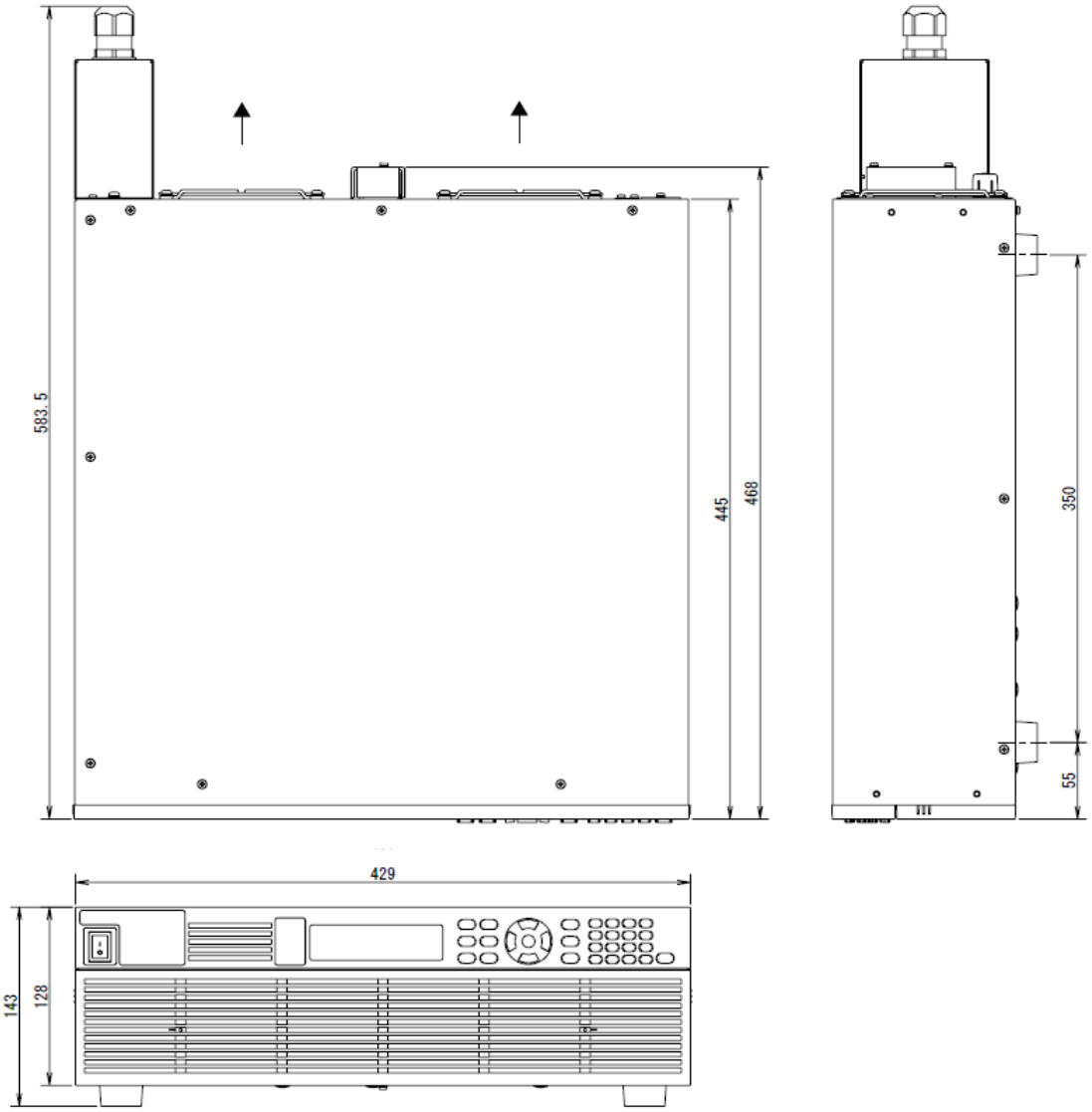
AC6801B



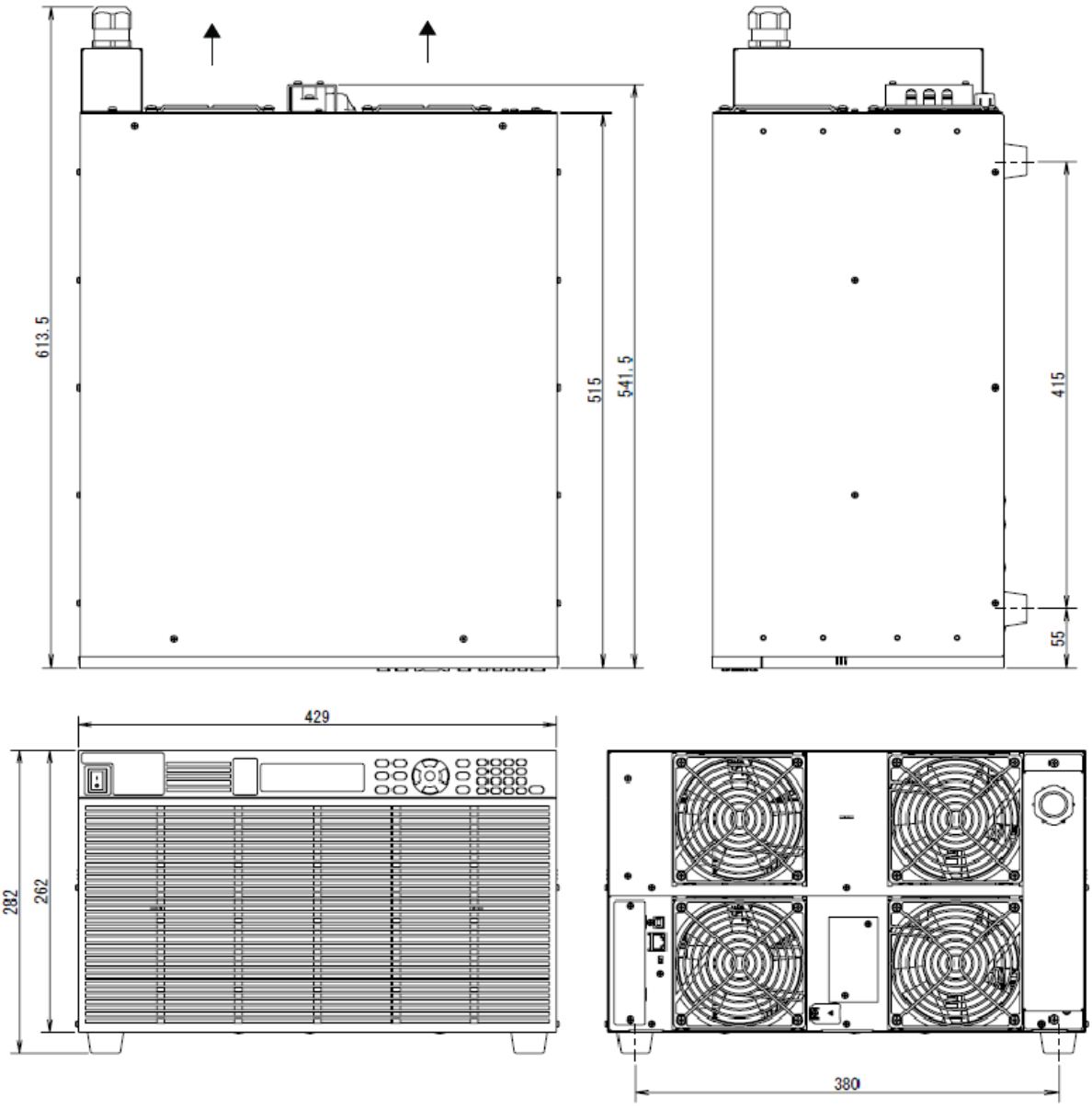
AC6802B



AC6803B



AC6804B



Introduction to the Instrument

Front Panel at a Glance

Front Panel Display at a Glance

Rear Panel at a Glance

Instrument Ratings

Front Panel at a Glance



The following table lists the main parts of the front panel, from left to right:

	The [Power] switch turns the unit on or off. The indicator next to this switch shows the display status. Green indicates normal operation. Yellow indicates that the display is in screen saver mode or that the instrument is in the boot-up process. Press any key to exit screen saver mode.
	The status LEDs light to indicate when a protection event has occurred and when the output is on.
	The display allows you to configure and monitor the instrument.



[Meter] returns the display to metering mode. Pressing it repeatedly cycles the display through all three formats (METER_VI, METER_VIP, and METER_ALL).
[Menu] opens the top level of the command menu. Pressing it a second time returns to the metering mode display.
[Protect] brings the user to the Protect menu. This is equivalent to [Menu] > Protect.
[Back] backs out of a menu without activating any changes.
[Help] describes the displayed menu control.
[Error] displays messages in the error queue.

NOTE The [Error] and [Help] keys provide access to text that is accessed via a vertically scrolling text box. Use the up and down arrow keys to scroll through multiline text, one screen at a time.

To retrieve error messages remotely, send the SYSTem:ERRor? query. The SCPI Status Byte and Standard Event Registers provide an overview of error conditions.



The ▲▶▼◀ arrows move around the command menus and select characters in alphanumeric entry fields. The [Select] key makes a selection in a menu and enters the edit mode for numeric parameters.

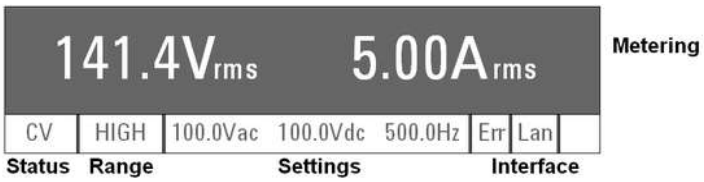


[On/Off] enables or disables the output.
[Voltage] specifies the voltage settings.
[Freq] specifies the frequency settings.



[0] through [9] enter numbers.
[.] enters the decimal point.
[–] toggles between positive and negative numbers.
[!] and [#] increment or decrement voltage or frequency settings and select letters in alphanumeric entry fields.
[E] enters the letter E to allow you to enter an exponent to the right of it.
[-] backspaces to delete characters.
[Enter] enters a value. If you exit a field without pressing [Enter], the value is ignored.

Front Panel Display at a Glance

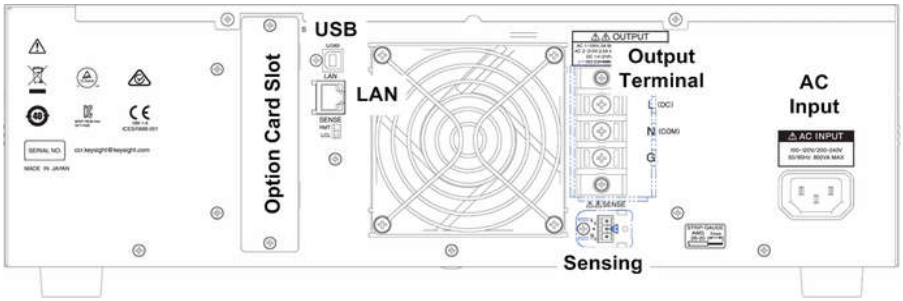


Metering field	Shows the measured output.
Status field	Displays the instrument status: OFF = the output is off. CV = the output is in constant voltage mode. OC = the output is disabled by the overcurrent protection. OT = the overtemperature protection has tripped. OP = the overpower protection has tripped. CLPK = the instrument has gone beyond its peak current limit. CLrms = the instrument has gone beyond its RMS current limit. PL = the instrument has gone beyond its power limit. SF = the output is disabled by a sense fault protection. WDG = watchdog protection - no I/O activity. INH = the remote inhibit is active
Range field	Displays the current voltage range (HIGH, LOW, or AUTO).
Settings field	Displays the output settings.
Interface field	Indicates the following remote interface activity: Err = an error has occurred (press [Error] to display the error message) Lan = the LAN is connected and has been configured IO = there is activity on one of the remote interfaces

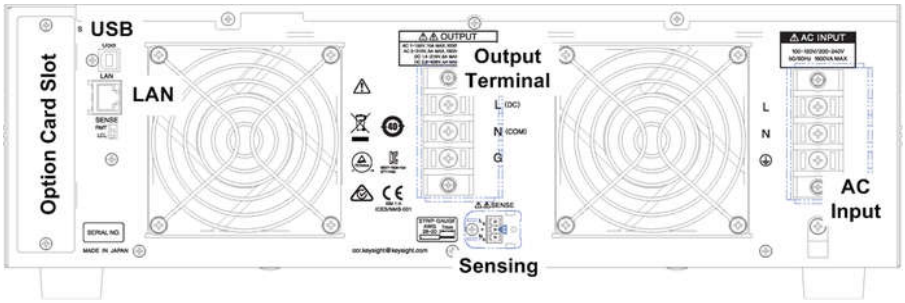
Rear Panel at a Glance

WARNING For protection from electrical shock, the power cord ground must not be defeated. If only a two-contact electrical outlet is available, connect the instrument's chassis ground screw (see above) to a good earth ground.

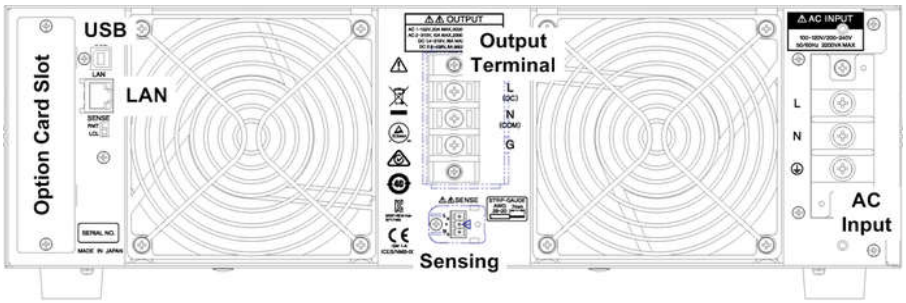
AC6801B



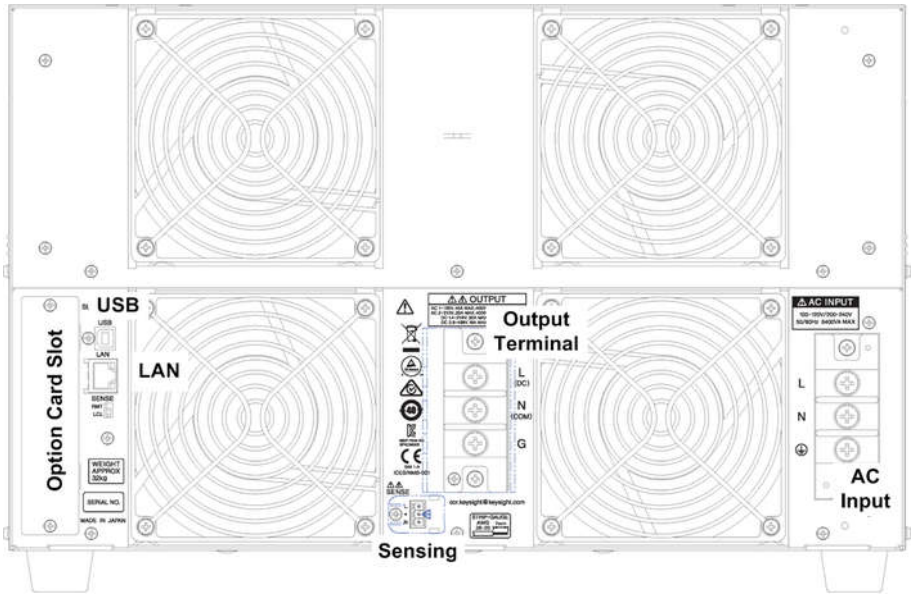
AC6802B



AC6803B



AC6804B



Instrument Ratings

	AC6801B	AC6802B	AC6803B	AC6804B
Output Rating for AC mode (155 V/310 V range)				
Rated voltage range	1 to 155 Vrms/2 to 310 Vrms			
Maximum rms current	5 A/2.5 A	10 A/5 A	20 A/10 A	40 A/20 A
Maximum power	500 VA	1 kVA	2 kVA	4 kVA
Frequency range	40 Hz to 500 Hz			
Output Rating for DC mode (155 V/310 V range)				
Rated voltage range	1.4 to 219 Vrms/2.8 to 438 Vrms			
Maximum DC current	4 A/2 A	8 A/4 A	16 A/8 A	32 A/16 A
Maximum power	400 VA	800 VA	1.6 kVA	3.2 kVA
Input Ratings				
Voltage rating	100 to 120 Vrms/200 to 240 Vrms, 50 Hz or 60 Hz, single-phase			
Voltage range	90 to 132 Vrms/180 to 264 Vrms (auto detected when the power is turned on)			
Frequency range	47 Hz to 63 Hz			
Apparent power	800 VA or less	1600 VA or less	3200 VA or less	6400 VA or less
Power factor	0.9 (typical)			
Maximum input current	8 A/4A @ 100V/200V 6.7A/3.5A @ 120V/230V	16 A/8A @ 100V/200V 13.4 A/7.0 A @ 120/230V	32A/16A @ 100V/200V 26.8 A/14.0 A @ 120/230V	64 A/32A @ 100V/200V 53.6 A/28.0 A @ 120/230V
Environment				
Operating environment	Indoor use, Overvoltage Category II			
Temperature and humidity range	0 to 40 °C (32 to 104 °F), 20% to 80% R.H. non-condensing			
Altitude	Up to 2000 meters			
Acoustic noise	< 70 dbA			
Physical				
Dimensions (with safety covers)	428 × 128 × 350 mm 168.5 x 50.5 x 138”	428 × 128 × 350 mm 168.5 x 50.5 x 138”	428 × 128 × 550 mm 169 x 50.5 x 216.5”	428 × 256 × 600 mm\168.5"×101"×236")
Weight	Approx. 8 kg (17.64 lb)	Approx. 11 kg (24.25 lb)	Approx. 16 kg (35.27 lb)	Approx. 32 kg (70.55 lb)
Input terminal	IEC 320 inlet	M4 terminal block	M6 terminal block	M6 terminal block
Output terminal	M4 terminal block	M4 terminal block	M4 terminal block	M6 terminal block

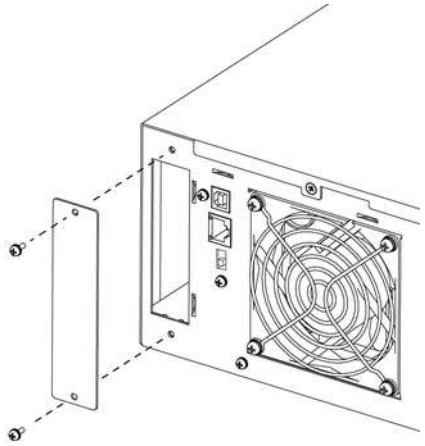
Installing an Optional Interface Board

The rear-panel slot can hold either the GPIB interface board (option AC68GPBU), the analog output interface board (option AC68BALGU), or the fault inhibit interface board (option AC68BFIU).

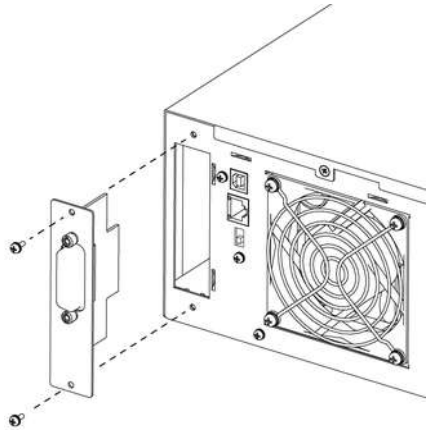
NOTE Consult with your Keysight sales representative or distributor for information regarding the availability of option AC68BALGU or option AC68BFIU.

To install a board:

1. Check that the power switch is turned off.
2. Touch the grounded metal to discharge your static electricity.
3. Unscrew the slot cover screws and remove the cover. Retain the cover for use in case the interface board is ever removed.
4. Verify that the switch at the bottom rear of the slot is in the up position. It should only be down during the firmware update process.



5. Slide the board all the way into the connector at the back of the slot.
6. Use the slot cover screws to secure the board.



Rack Mounting

NOTE This section requires option AC68BRAC3 (for models AC6801B, AC6802B, and AC6803B) or AC68BRAC6 (for model AC6804B).

This section contains instructions for installing the instruments in a 19-inch EIA rack.

Verification of Option Kit

Verify that you received the following items. If anything is missing, please contact your nearest Keysight Sales and Support Office.

Rack Mounting Kit AC68BRAC3 for AC6801B, AC6802B, and AC6803B

Item	Description	Quantity
1	Bracket	2
2	Flat Head Screws M4×0.7×10	4
3	Clip Nuts for Rack Frame 10-32 0.5-in.	4
4	Dress Screws with Nylon Washer, Phantom Gray	4

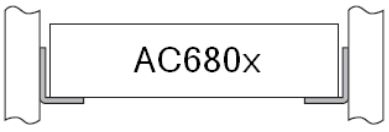
Rack Mounting Kit AC68BRAC6 for AC6804B

Item	Description	Quantity
1	Bracket	2
2	Flat Head Screws M4×0.7×10	8
3	Clip Nuts for Rack Frame 10-32 0.5-in.	8
4	Dress Screws with Nylon Washer, Phantom Gray	8

Installation

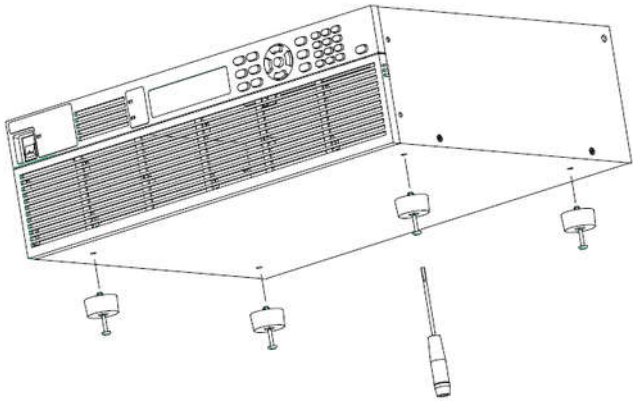
CAUTION Do not block the air intake at the front of the instrument or the exhaust at the rear.

To prevent the instrument from falling, install suitable support angles (not included) to support the instrument as shown.

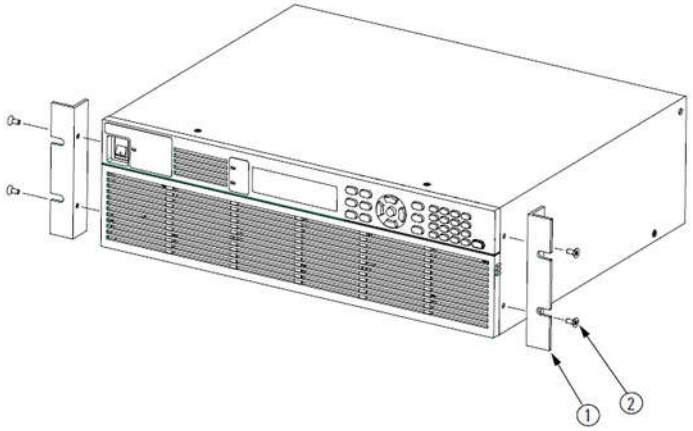


Rack Mounting Models AC6801B, AC6802B, and AC6803B

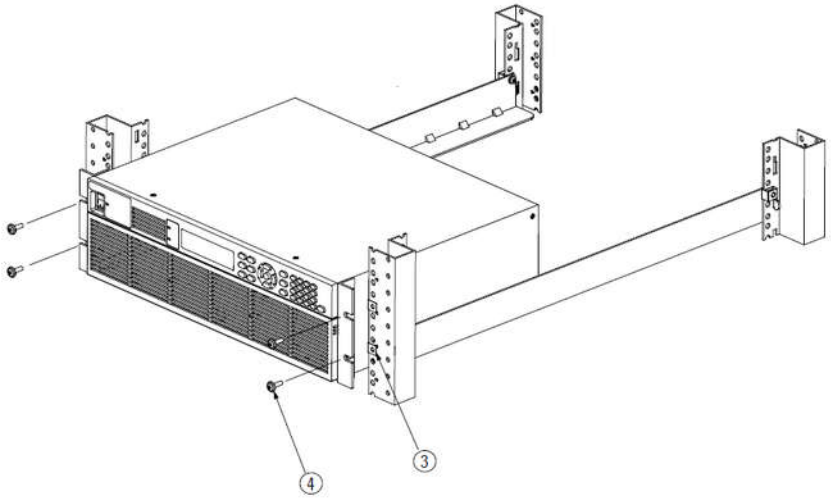
Remove the feet from the bottom panel.



Using the accompanying M4×10 flat head screws, install the brackets.

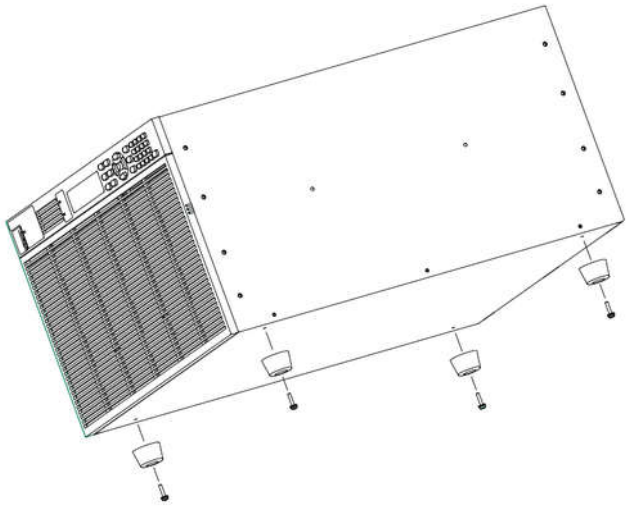


Using the accompanying dress screws and clip nuts (10-32), mount the instrument in the rack.

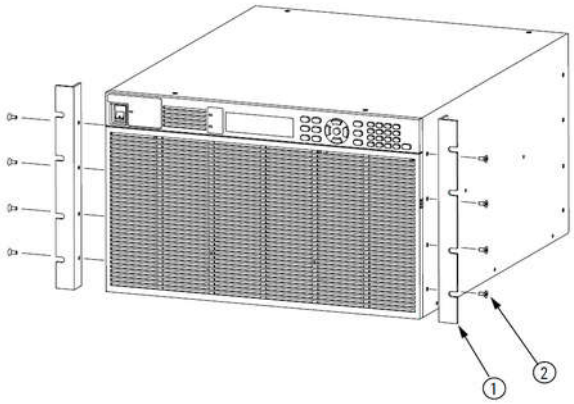


Rack Mounting Model AC6804B

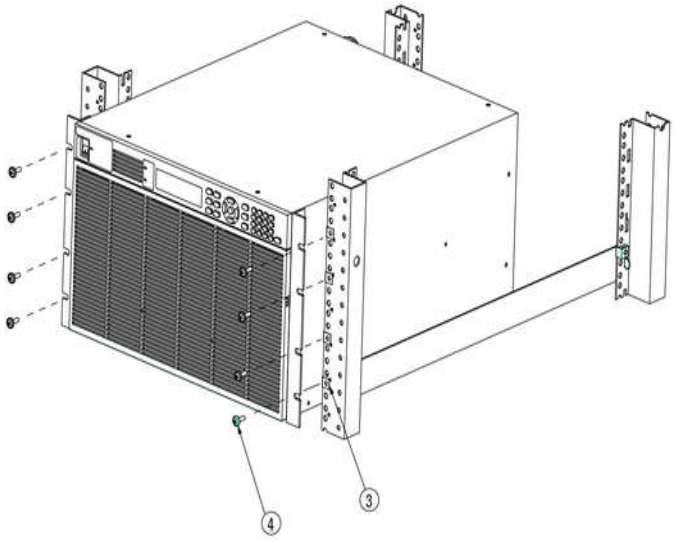
Remove the feet from the bottom panel.



Using the accompanying M4×10 flat head screws, install the brackets.



Using the accompanying dress screws and clip nuts (10-32), mount the instrument in the rack.



Connecting the Power Cord

The power cord used with the product varies depending on the model. This product complies with IEC Overvoltage Category II (energy-consuming equipment supplied from a fixed installation).

NOTE The AC6801B line cord has a molded plug on both ends.
The AC6802B is a single-phase, cord-connected device that requires a plug and cord set.
The AC6802B line cord must have a plug on the utility side; you cannot hard wire the instrument to the utility.

WARNING **Possible Electric Shock**
This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground (earth) the unit.
Connect the protective conductor terminal to earth ground.

AC6801B

Connect the power cord to the AC connector on the back of the instrument. Then connect the other end to a properly grounded power outlet. You will use this plug to disconnect from mains power.

Use the supplied power cord to connect to the AC line. If the supplied power cord cannot be used due to the rated voltage or the plug shape, have a qualified engineer replace it with an appropriate power cord of length 3 m or less. If obtaining a power cord is difficult, contact Keysight.

The power cord with a plug can be used to disconnect the instrument from the AC line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to allow enough space around the power outlet.

To connect the power cord:

1. Check that the AC power supply meets the instrument's nominal input rating, which is any nominal voltage from 100 to 120 VAC or 200 to 240 VAC. The frequency is 50 or 60 Hz.

CAUTION **Large voltage distortion on the AC power line can lead to malfunction. Do not connect the instrument to a generator or a similar device.**

2. Check that the power switch is turned off.
3. Connect the power cord to the AC input receptacle on the rear panel.
4. Insert the power plug into an outlet.

AC6802B, AC6803B, and AC6804B

The AC6802B requires use of a flexible plug and cord set which must be supplied by the user. The line cord must have a plug on the utility side; you cannot hard-wire the instrument to utility mains.

The AC6803B and AC6804B instruments may be connected either by a flexible plug and cord set supplied by the user or may, alternatively, be hard wired to the utility mains. See Switchboard and circuit breaker requirements for guidance on branch circuit and circuit breaker sizing.

NOTE A switchboard circuit breaker disconnect must be provided when connecting AC6803B and AC6804B models, regardless of whether the connection is made with a flexible cord or by hard wiring the device to the AC utility.

WARNING **Possible Electric Shock**
Turn off the switchboard circuit breaker before connecting the cord.
Do not use the terminal block with the terminal cover removed.

WARNING **Possible Fire**
Have a qualified engineer connect the power cord to the switchboard.

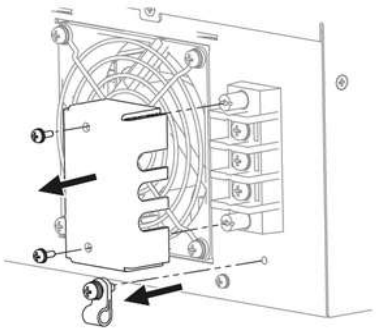
WARNING **Make sure connections are correct**
Protective circuits inside the instrument, including input fuses, are connected to match the input terminal polarity. Make sure the colors of the wires connected to the input terminals (L, N, and GND) are correct.

1. Check that the AC power supply meets the instrument's nominal input rating, which is any nominal voltage from 100 to 120 VAC or 200 to 240 VAC. The frequency is 50 or 60 Hz.

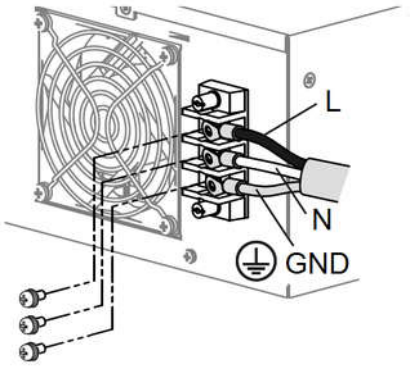
CAUTION Large voltage distortion on the AC power line can lead to malfunction. Do not connect the instrument to a generator or a similar device.

2. Check that the power switch is turned off.

3. On Model AC6802B, remove the terminal cover and cable clamp attached to the AC Input terminal block.

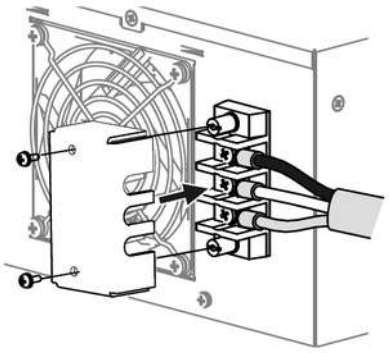


4. Securely connect the power cord to match the L (line), N (neutral), and GND (ground) of the AC Input terminal block. The protective earth terminal (ground) requires an extra length of wire compared to the Line and Neutral wires. Always connect the ground wire first.

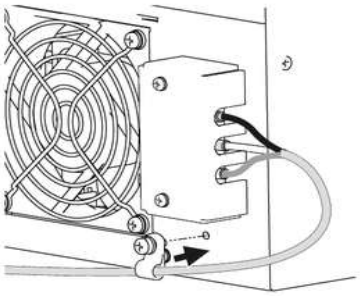


5. Install the terminal cover over the terminal block.

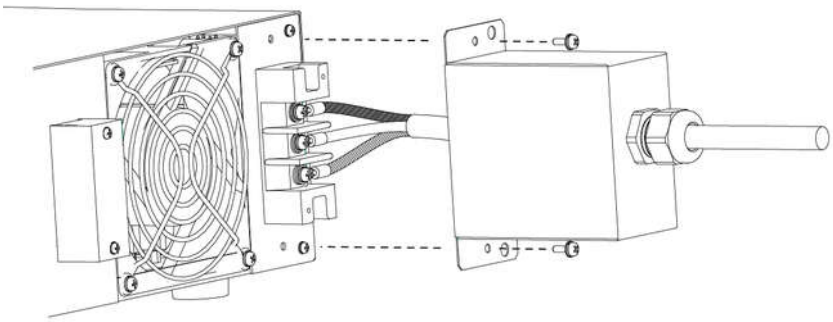
AC6802B



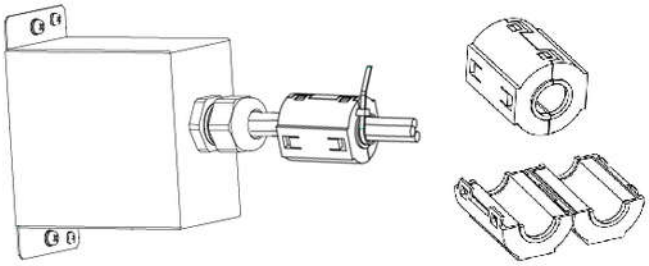
Place the cord inside the cable clamp and attache the clamp as shown:



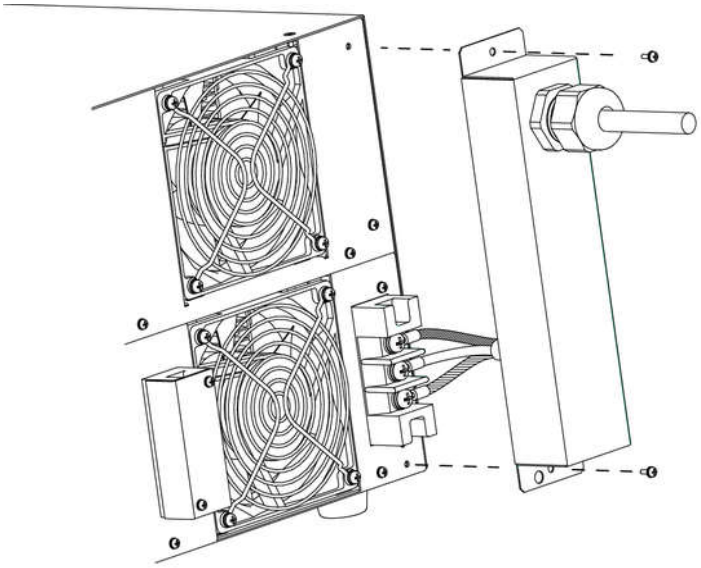
AC6803B



Install one of the two ferrite cores shipped with the unit close to the power cord strain relief as shown:



AC6804B



Attach crimp terminals to the switchboard end of the power cord (the end without terminals). For termination, attach a crimp-style terminal to each wire that meets the terminal screws of the switchboard to be connected, and then securely connect the wires to the terminal screws. Connection must be performed by qualified personnel.

Turn off the switchboard.

Connect the power cord to match the L, N, and GND of the switchboard.

Switchboard and Circuit Breaker Requirements

WARNING Turn off the switchboard circuit breaker to disconnect the instrument from the AC line in an emergency. The breaker must be suitably located and easily reached, and it must be marked as the disconnecting device for the equipment.

This section is provided for guidance only; consult with local experts to ensure strict compliance with all local electrical code and safety requirements. These requirements take precedence over any guidance provided in this section.

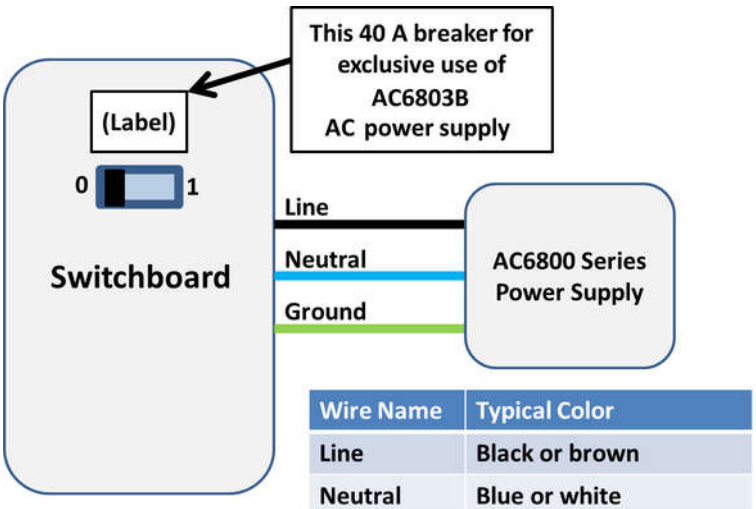
Please note the following switchboard and circuit breaker requirements.

Rated current:
AC6802B: 20 A
AC6803B: 40 A
AC6804B: 80 A

Dedicate the circuit breaker for the AC6802B, AC6803B, and AC6804B.

Keep the switchboard easily accessible at all times.

Apply a label to the switchboard, clearly identifying the disconnecting device and its associated model, as shown below:



Wire Name	Typical Color
Line	Black or brown
Neutral	Blue or white
Ground	Green or green/yellow

The tables below provides information about worst case current consumption for all AC6800B Series models for various nominal AC mains voltages. Entries are obtained by dividing the worst case power consumption (in VA) by the nominal mains voltage and rounding to the next highest integer value. Line currents for other nominal voltages may be calculated similarly.

Maximum Input VA

	AC6801B	AC6802B	AC6803B	AC6804B
Input VA (Max)	800	1600	3200	6400

Approximate Maximum Current

Line Voltage	AC6801B	AC6802B	AC6803B	AC6804B
100	8	16	32	64
120	7	13	27	53
200	4	8	16	32
208	4	8	15	31
230	3	7	14	28
240	3	7	13	27

Breakers

Different regions of the world have different sizing requirements for branch circuit conductors and circuit breakers. In Europe and other regions where IEC standards apply, circuits breakers generally are rated at 100% utilization, meaning that a device connected to a dedicated branch circuit may draw a maximum current up to the circuit breaker rating. In the United States, the NEC generally specifies what is known as the "80% rule" which requires branch circuits to be rated at 1.25 times the maximum nameplate rating of the connected device.

Standard circuit breaker sizes also vary by region. The table below provides guidance for circuit breaker sizing for various nominal mains voltages. The guidance for North American mains voltages (120, 208, and 240 V) includes the 1.25 factor associated with the 80% rule. Guidance for the other voltages (100, 200, and 230 V) assumes 100% utilization. By comparing the table above with the table below, it may be seen that for the AC6801B and AC6802B models, the smallest standard size breaker affords more than enough capability to supply the device. The AC6803B and AC6804B products drawn higher currents and therefore are more likely to require higher breaker current ratings and dedicated circuits.

For convenience, notes below the table give standard breaker sizes per IEC/EN 60898-1 and the NEC for the United States.

Consult with local authorities to ensure full compliance with electrical code and safety requirements before connecting any AC6800B Series instrument.

Breaker Sizes

Line Voltage	AC6801B	AC6802B	AC6803B	AC6804B
100	15	20	35	70
120	15	20	40	70
200	15	15	20	35

Line Voltage	AC6801B	AC6802B	AC6803B	AC6804B
208	15	15	20	40
230	16	16	16	32
240	15	15	20	40

IEC 60898-1 and European Standard EN 60898-1 Standard Sizes

6, 10, 13, 16, 20, 25, 32, 40, 50, 63, 80, and 100 A

NEMA Standard Sizes (also commonly used in Japan)

15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, and 100 A

Quick Start

Turn the Unit On and Off

Use the Menu System

Enter Numeric and Alphanumeric Values

Set the Output Voltage

Set the Output Current Limit

Enable the Output

Use Built-in Help System

Turn the Unit On and Off

To turn the instrument on:

1. Check that the power switch is turned off (**O**) and that nothing is connected to any output terminal block on the instrument.
2. Check that the power cord is of the correct type and correctly connected.
3. Push the (**I**) side of the power switch. If any unusual sound, unusual odor, fire, or smoke is perceived, remove the power plug from the outlet or turn off the switchboard.
4. The display lights up after a few seconds. An automatic power-on self-test ensures that the instrument is operational.

   NOTE It takes about 10 seconds for the instrument to initialize before it is ready for use.

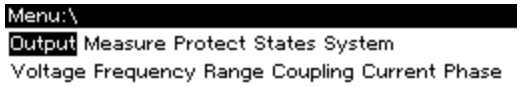
If the instrument does not turn on, verify that the power cord is firmly connected (power-line voltage is automatically sensed at power-on). Also make sure that the instrument is connected to an energized power source. If the LED next to the power switch is off, there is no AC power connected. If the LED is amber, the instrument is in standby mode with AC power connected, and if it is green, the instrument is on.

If a self-test error occurs, a message is displayed on the front panel. For other self-test errors, see Service and Maintenance for instructions.

Push the (**O**) side of the POWER switch to turn the instrument off.

Use the Menu System

Press the [Menu] key to access the top level of the command menu, shown below.



The first line displays the menu path (Menu:\), and the second line indicates the items that are available at the present menu level (Output, Measure, and so on). The third line indicates the items under the highlighted function in the second line.

Use the left and right navigation keys to move across the menu items, and press [Select] to select the highlighted item and move to the next menu level.

The lowest menu level programs the selected item. Use the navigation keys to select an item. Use the numeric entry keys to enter a value, then press [Enter]. Press [Help] at the lowest menu level for detailed help.

Press [Back] to back out of a menu level without saving changes, and press [Menu] to return to the top menu level without saving changes.

Press [Meter] to return to Meter View.

Enter Numeric and Alphanumeric Values

When the focus is on a text box, its label is highlighted within a dashed outline and its present value is displayed in white text on a dark background. Pressing any key on the numeric keypad erases the existing value and allows you to type the rest of the number. Use the [▶] and [◀] keys to move the cursor. Press the [-] key to erase the character to the left of the cursor.

To enter letters or other non-numeric characters, such as when entering a DNS host name in [Menu] > System > IO > LAN > Modify > Name, use the up and down arrows to scroll through the list of characters.

When finished, press either [Enter] or [Select] to enter the data.

In general, pressing [Enter] or [Select] after entering a value into a text box causes the new value to become effective immediately. The exceptions to this rule are when you change the values in [Menu] > Output > Voltage > AC, [Menu] > Output > Voltage > DC, and [Menu] > Output > Frequency. These require you to select the DONE button and press [Enter].

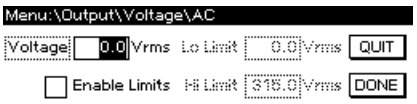
Set the Output Voltage

Method 1

Press [Menu] > Output > Voltage, then choose AC or DC.

Use the left and right navigation keys to navigate to the setting to be changed.

In the following display, the voltage setting is selected. Enter the desired setting using the numeric keypad. Then press [Select]. Use the arrows to navigate to the DONE button and press [Enter].



You can also use the [!] and [#] keys to adjust the value. Values take effect when the output is turned on.

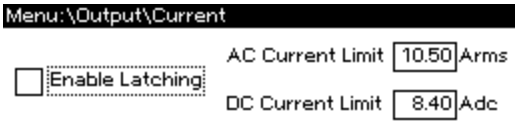
Method 2

Press [Voltage] to select the voltage entry field. Enter the desired setting using the numeric keypad. Then press [Enter].

If you make a mistake, either use the backspace key to delete the number, press [Back] to back out of the menu, or press [Meter] to return to meter mode.

Set the Output Current Limit

To limit the output current, press [Menu] > Output > Current.



Use the [Select] key to enable or disable latching. Specify the AC and DC current limits, and press [Enter] to save your changes or [Back] to discard them.

If Enable Latching is checked, a current limiting event longer than approximately three seconds will disable the output and indicate OC protection fault. If this box is not checked, a current limiting event will decrease the output voltage until the current goes below the limit.

Enable the Output

Press On/Off to enable the output. If a load is connected to the output, the front panel display will indicate that it is drawing current. Otherwise, the current reading will be zero. The status indicator shows the output's status.

For a description of the status indicators, refer to Front Panel Display at a Glance.

Use Built-in Help System

View help

Press [Help] to view help at any time. If you are at a menu screen, you will get help for navigating through the menus, and if you are at a screen that allows you to view or edit settings, you will get help pertaining to those particular settings.

Press any key other than a navigation arrow to exit Help.

View the help information for displayed messages.

Whenever a limit is exceeded or any other invalid configuration is found, the instrument will display a message, including error code information.

Press any key other than a navigation arrow to exit Help.

Interface Connections

GPIB Connection

USB Connection

LAN Connection

This section describes how to connect to the instrument's various communication interfaces. For additional information, refer to Remote Interface Configuration.

To begin, please install the Keysight IO Libraries Suite from the Keysight Automation-Ready CD that is shipped with your instrument.

NOTE For detailed interface connection information, refer to the USB/LAN/GPIB Interfaces Connectivity Guide, located on the Keysight Automation-Ready CD.

GPIB Connection

1. Connect your computer to your instrument's optional GPIB interface card using a GPIB interface cable.
2. Use the Connection Expert utility of the Keysight IO Libraries Suite to connect to the installed GPIB interface card.
3. You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using various programming environments.

USB Connection

1. Connect the instrument's rear-panel USB device port to a USB port on your computer.
2. With the Connection Expert utility of the Keysight IO Libraries Suite running, the computer will automatically recognize the instrument. This may take several seconds. When the instrument is recognized, your computer will display the VISA alias, IDN string, and VISA address. This information is located in the USB folder.
3. You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using various programming environments.

LAN Connection

1. Connect a LAN cable from the instrument's rear-panel LAN port to the site LAN or your computer. The instrument's factory default LAN settings automatically obtain an IP address from the network using a DHCP server (DHCP is on). The DHCP server will register the instrument's host name with the dynamic DNS server. The host name and IP address can then be used to communicate with the instrument. If you are using a private LAN, you can leave all LAN settings as they are. The instrument will automatically choose an IP address using AutoIP if a DHCP server is not present. The instrument assigns itself an IP address from the block 169.254.nnn. The Lan indicator appears in the lower right corner of

the display when the LAN port has been configured.

2. Use the Connection Expert utility of the Keysight IO Libraries Suite to add the instrument and verify a connection. To add the instrument, you can request the Connection Expert to discover the instrument. If the instrument cannot be found, add the instrument using its host name or IP address.
3. You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can program your instrument using various programming environments. You can also use your computer's Web browser to communicate with the instrument. See Using the Web Interface.

Remote Interface Configuration

USB Configuration

GPIB Configuration

LAN Configuration

Modifying the LAN Settings

Using the Web Interface

Using Telnet

Using Sockets

Using HiSLIP

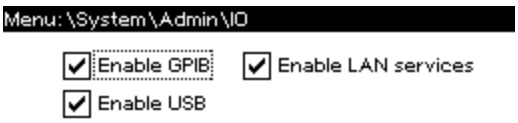
This section describes how to configure each remote interface.

This instrument supports remote interface communication over GPIB (optional), USB, and LAN (default). All three interfaces are "live" at power up, and they may be used simultaneously. To use these interfaces, install the Keysight IO Libraries software from the Keysight Automation-Ready CD and connect the instrument to your PC.

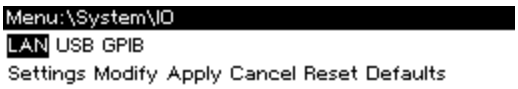
The front-panel IO annunciator indicates remote interface activity. The Lan annunciator appears when the LAN port is connected and configured. This instrument continually monitors the instrument's LAN port and automatically reconfigures it when the instrument is disconnected and then reconnected to a network.

The instrument ships with an Automation-Ready CD that contains Keysight IO Libraries Suite software, which must be installed to enable remote-interface operations. The CD automatically starts and provides information on installing the software. The CD also includes the *Keysight Technologies USB/LAN/GPIB Connectivity Guide*, which contains additional information.

To begin configuring the remote interface from the front panel, log in to the Admin menu by pressing [Menu] > System > Admin > Login. The default password is blank. Then press [Menu] > System > Admin > IO to enable the desired interfaces.



Then press [Menu] > System > IO to configure the individual interfaces.



The Enable LAN services control enables or disables LAN services such as VXI-11, HiSLIP, sockets, and telnet. However, the LAN interface, home page and configuration page remain enabled for the Web interface.

USB Configuration

NOTE The Keysight IO Libraries are required to control the instrument through the USB interface.

Use a standard USB cable to connect the instrument to the computer. There are no configurable USB parameters, but you can retrieve the USB connect string using the front panel.

Front Panel	SCPI Command
[Menu] > System > IO > USB	Not available
The USB connect string appears.	

The instrument complies with USB Specification 2.0, USBTMC Specification 1.0, and USBTMC-USB488 Specification 1.0. The maximum data rate is 12.5 Mbps, the vendor ID is 0x2A8D, and the product ID values are shown in the table below.

Model	Product ID
AC6801B	0x1A02
AC6802B	0x1B02
AC6803B	0x1C02
AC6804B	0x1D02

GPIB Configuration

The GPIB interface requires the optional GPIB interface board and uses a standard IEEE-488 cable to connect to the computer.

Each device on the GPIB (IEEE-488) interface must have a unique whole number address between 0 and 30 (default 5). Your computer's GPIB interface card address must not conflict with any instrument on the interface bus. To change the GPIB address:

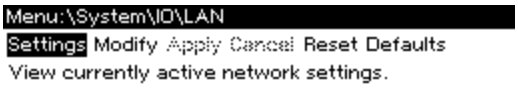
Front Panel	SCPI Command
[Menu] > System > IO > GPIB	Not available
Use the numeric keypad to enter a value from 0 to 30. Then press [Enter].	

This setting is nonvolatile; it will not be changed by power cycling or *RST.

LAN Configuration

The following sections describe the primary front-panel LAN configuration functions. There are no equivalent SCPI commands.

To begin configuring the remote interface from the front panel, press [Menu] > System > IO > LAN.



NOTE After changing LAN settings, you must save the changes by pressing System > IO > LAN > Apply. Saving changes restarts the LAN connection with the new settings. LAN settings are nonvolatile; they will not be changed by power cycling or *RST. To cancel your changes, select System > IO > LAN > Cancel.

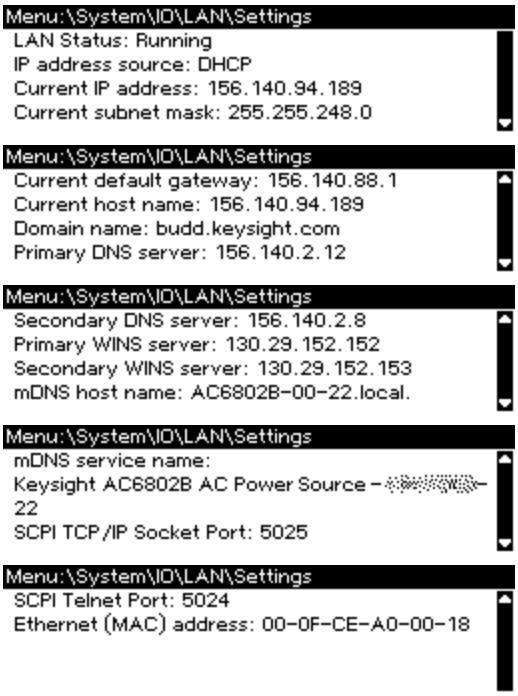
By default, DHCP is on, which may enable communication over LAN. The acronym DHCP stands for Dynamic Host Configuration Protocol, a protocol for assigning dynamic IP addresses to networked devices. With dynamic addressing, a device can have a different IP address every time it connects to the network.

Viewing Active Settings

To view the current LAN settings:

Front Panel	SCPI Command
[Menu > System > IO > LAN > Settings Scroll with the up and down arrows.	Not available

As you scroll through the list of settings, you will see the following:



These may be different from settings requested in the front panel menu due to the configuration of the network, and you cannot edit the settings from this screen.

Resetting the LAN

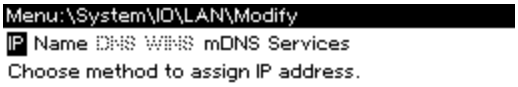
You can perform an LXI reset of the LAN settings. This resets DHCP (ON), DNS server address configuration, mDNS state (ON), and Web password (blank). These settings are optimized for connecting your instrument to a site network. They should also work well for other network configurations.

You can reset the all LAN settings to their factory defaults and restart networking. These default settings are listed under Default Settings.

Front Panel	SCPI Command
[Menu] > System > IO > LAN > Reset or [Menu] > System > IO > LAN > Defaults Select Reset to activate the selected LAN settings and restart networking.	Not available

Modifying the LAN Settings

Press [Menu] > System > IO > LAN > Modify to modify the LAN settings.

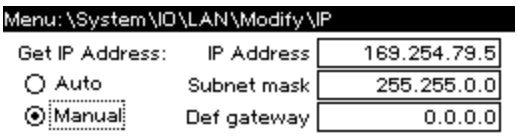


IP Address

Press [Menu] > System > IO > LAN > Modify > IP to configure the instrument addressing.



If Manual is selected, additional parameters appear, as shown below.



Front Panel	SCPI Command
[Menu] > System > IO > LAN > Modify > IP Select Auto or Manual. See below for a full description.	Not available

The configurable parameters include:

Auto	Automatically configures instrument addressing. When selected, the instrument will first try to obtain an IP address from a DHCP server. If a DHCP server is found, the DHCP server will assign an IP address, Subnet Mask, and Default Gateway to the instrument. If a DHCP server is unavailable, the instrument will try to obtain an IP address using AutoIP. AutoIP automatically assigns an IP address, Subnet Mask, and Default Gateway addresses on networks that do not have a DHCP server.
Manual	Manually configures instrument addressing by entering values in the three fields (listed below) that only appear when Manual is selected.
IP Address	Specifies the instrument's Internet Protocol (IP) address, which is required for all IP and TCP/IP communications with the instrument. An IP Address is of the form nnn.nnn.nnn.nnn, where each nnn is a decimal number from 0 to 255 with no leading zeros (for example, 169.254.2.20).
Subnet Mask	Allows the instrument to determine whether a client IP address is on the same local subnet. The same numbering notation applies as for the IP Address. When a client IP address is on a different subnet, all packets must be sent to the Default Gateway.
DEF Gateway	Specifies the IP Address of the default gateway that allows the instrument to communicate with systems not on the local subnet, as determined by the subnet mask setting. The same numbering notation applies as for the IP Address. A value of 0.0.0.0 indicates that no default gateway is defined.

Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a value from 0 to 255) must be expressed with care, as most PC web software interprets byte values with leading zeros as octal (base 8) numbers. For example, "192.168.020.011" is actually equivalent to decimal "192.168.16.9" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use decimal values from 0 to 255, without leading zeros.

Host Name

A host name is the host portion of the domain name, which is translated into an IP address.

Front Panel	SCPI Command
[Menu] > System > IO > LAN > Modify > Name You can enter any value from the numeric keypad. For additional characters, use the up/down navigation keys to enter an alpha character by scrolling through the selection list that appears when you press the keys. Use the left/right navigation keys to traverse the text field. Use the backspace key to delete a value. Press [Enter] when you are finished.	Not available

Host Name - This field registers the supplied name with the selected naming service. The name may contain upper and lower case letters, numbers, and dashes (-). If the field is left blank, no name is registered. The maximum length is 15 characters.

Each instrument is shipped with a default host name with the format: K-modelnumber-serialnumber, where modelnumber is the unit's 7-character model number (e.g. AC6803B), and serialnumber is the last five characters of the 10-character serial number located on the label on the top of the unit, for example 45678.

DNS Server and WINS Server

DNS is an internet service that translates domain names into IP addresses. It is also needed for the instrument to find and display its host name assigned by the network. Normally, DHCP discovers the DNS address information; you only need to change this if DHCP is unused or not functional.

WINS configures the Windows service of the instrument. This is similar to the DNS service that translates domain names into IP addresses.

Front Panel	SCPI Command
[Menu] > System > IO > LAN > Modify > DNS or [Menu] > System > IO > LAN > Modify > WINS Select Primary Address or Secondary Address. See below for a full description.	Not available

Primary Address – This field enters the primary address of the server. Contact your LAN administrator for details. The same numbering notation applies as for the IP Address. A value of 0.0.0.0 indicates that no default server is defined.

Secondary Address – This field enters the secondary address of the server. Contact your LAN administrator for details. The same numbering notation applies as for the IP Address. A value of 0.0.0.0 indicates that no default server is defined.

Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a value from 0 to 255) must be expressed with care, as most PC web software interprets byte values with leading zeros as octal (base 8) numbers. For example, "192.168.020.011" is actually equivalent to decimal "192.168.16.9" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use decimal values from 0 to 255, without leading zeros.

mDNS Service Name

The multicast Domain Name System (mDNS) service name, which can be up to 63 characters long, is registered with the selected naming service.

Front Panel	SCPI Command
[Menu] > System > IO > LAN > Modify > mDNS You can enter any value from the numeric keypad. For additional characters, use the up/down navigation keys to enter an alpha character by scrolling through the selection list that appears when you press the keys. Use the left/right navigation keys to traverse the text field. Use the backspace key to delete a value. Press [Enter] when you are finished.	Not available

mDNS Service Name – This field registers the service name with the selected naming service. The name may contain upper and lower case letters, numbers, and dashes (-). If the field is left blank, no name is registered.

Each instrument ships with a default service name with the format: Keysight-modelnumber-description-serialnumber, where modelnumber is the unit's 7-character model number (e.g. AC6803B), description is the description, and serialnumber is the serial number on the instrument's label.

Services

This enables and disables LAN services.

Front Panel	SCPI Command
[Menu] > System > IO > LAN > Modify > Services. Check (enable) or uncheck (disable) services as desired.	Not available

The configurable services include: VXI-11, Telnet, Web control, Sockets, and mDNS.

You can enable or disable Web control using the Web page 'Browser Web Control' tab.

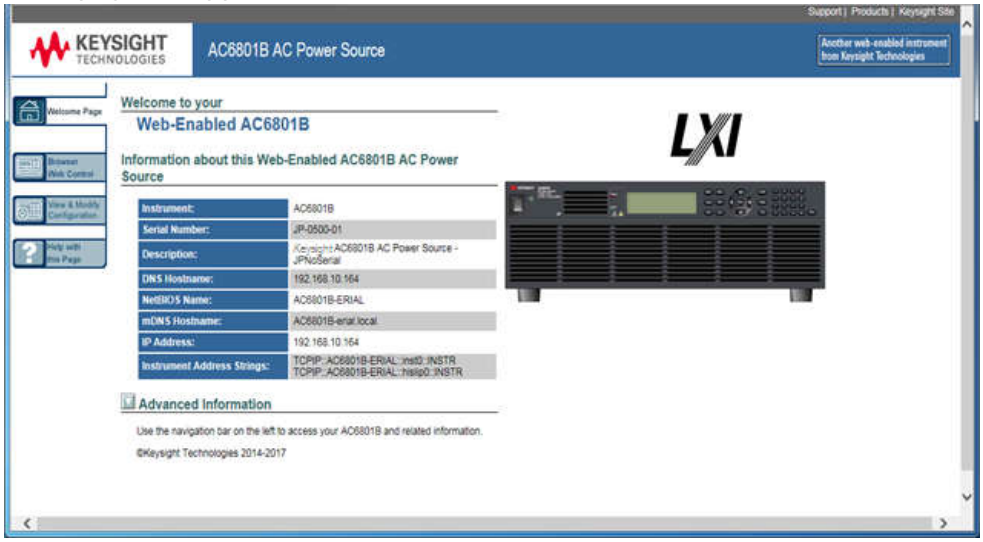
Using the Web Interface

Your instrument has a built-in Web interface that lets you control it directly from the Web browser on your computer. With the Web interface, you can access the front panel control functions including the LAN configuration parameters. Up to six simultaneous connections are allowed. With additional connections, performance will be reduced.

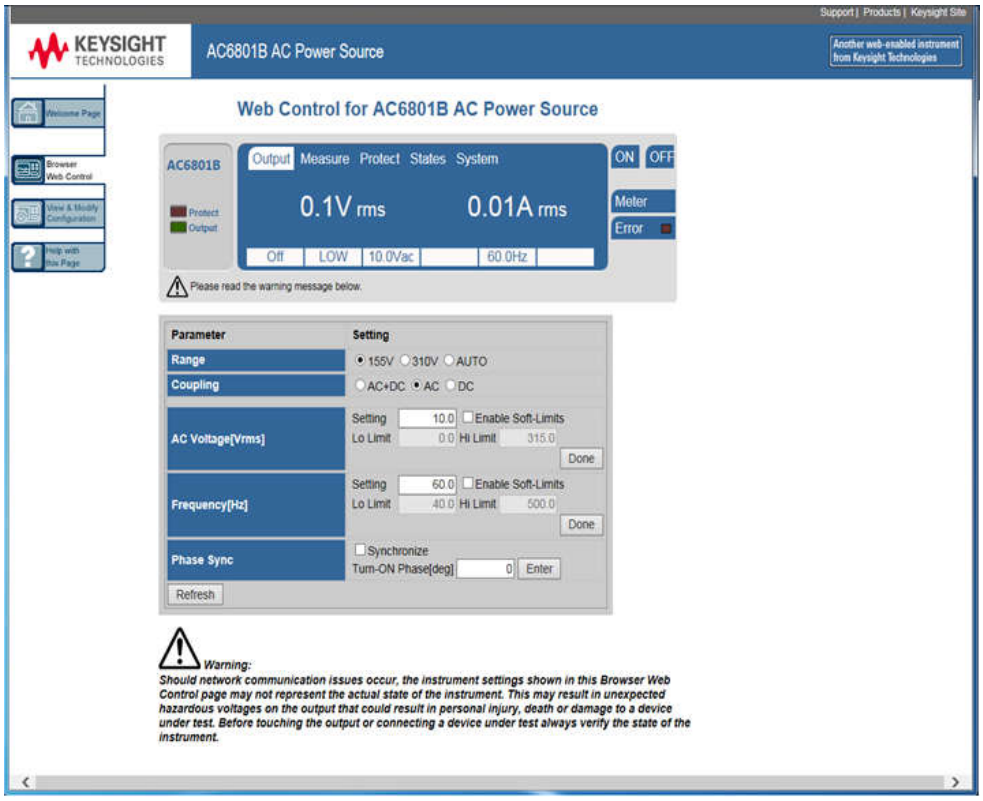
NOTE The built-in Web interface only operates over the LAN. It requires Internet Explorer 7, Firefox, or Chrome. You also need the Java (Sun) Plug-in. This is included in the Java Runtime Environment.

The Web interface is enabled when shipped. To launch the Web interface:

1. Open your computer's Web browser.
2. Enter the instrument's host name or IP address into the browser's Address field. The following welcome page will appear.

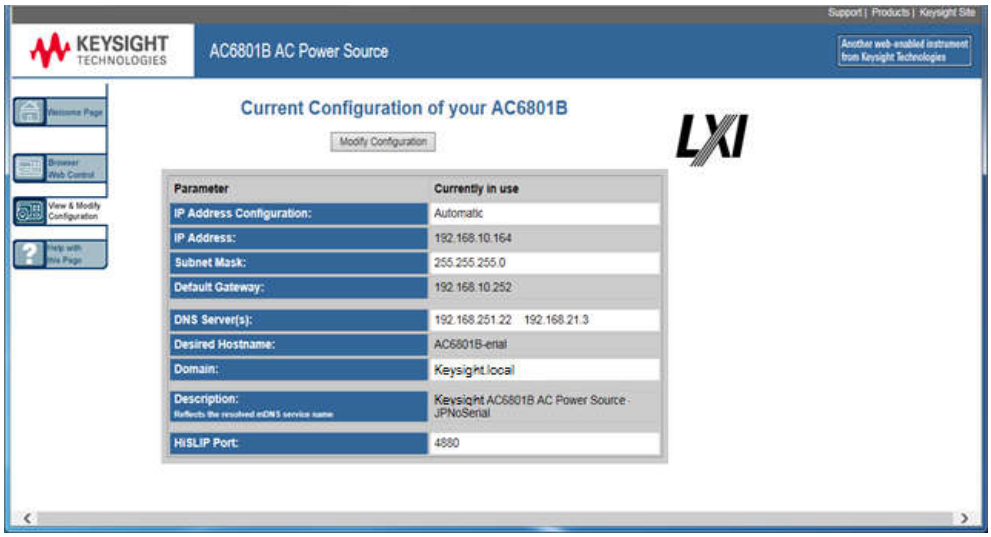


3. Click on the Browser Web Control tab in the navigation bar on the left to begin controlling your instrument.



WARNING Should network communication issues occur, the instrument settings shown in the Browser Web Control page may not represent the actual state of the instrument. This may result in unexpected hazardous voltages on the output and sense connections that could result in personal injury, death, or damage to a device under test. Before touching the output or sense connections or connecting to a device under test, always verify the state of the instrument.

4. Click the View and Modify Configuration tab for information about the instrument and its connectivity.



5. For additional help about any of the pages, click the **Help with this Page** tab.

If desired, you can control access to the Web interface using password protection. As shipped from the factory, no password is set. To set a password, click View & Modify Configuration. Refer to the online help for details.

Using Telnet

In a DOS command window, enter the command telnet host name 5024 where host name is the instrument's host name or IP address, and 5024 is the instrument's telnet port.

You should get a Telnet session box with a title indicating that you are connected to the instrument. Type the SCPI commands at the prompt.

Using Sockets

NOTE The instrument allows any combination of up to six simultaneous data socket, control socket, and telnet connections to be made.

The instrument uses port 5025 for SCPI socket services. A data socket on this port can be used to send and receive ASCII/SCPI commands, queries, and query responses. All commands must be terminated with a newline for the message to be parsed. All query responses will also be terminated with a newline.

The socket programming interface also allows a control socket connection. The control socket can be used by a client to send device clear and to receive service requests. Unlike the data socket, which uses a fixed port number, the port number for a control socket varies and must be obtained by sending the following SCPI query to the data socket: SYSTem:COMMunicate:TCPip:CONTrol?

After the port number is obtained, a control socket connection can be opened. As with the data socket, all commands to the control socket must be terminated with a newline, and all query responses returned on the control socket will be terminated with a newline.

To send a device clear, send the string "DCL" to the control socket. When the power system has finished performing the device clear it echoes the string "DCL" back to the control socket.

Service requests are enabled for control sockets using the Service Request Enable register. Once service requests have been enabled, the client program listens on the control connection. When SRQ goes true the instrument will send the string "SRQ +nn" to the client. The "nn" is the status byte value, which the client can use to determine the source of the service request.

Using HiSLIP

The High-Speed LAN Instrument Protocol (HiSLIP) is a protocol for TCP-based instrument control. It includes conventional test and measurement protocol capabilities with minimal performance impact.

For technical details regarding HiSLIP, see www.ivifoundation.org.

Output Power Connections

Preparation

Connecting the Load Cables

Connecting the Remote Sense Wires

Preparation

Wire Requirements

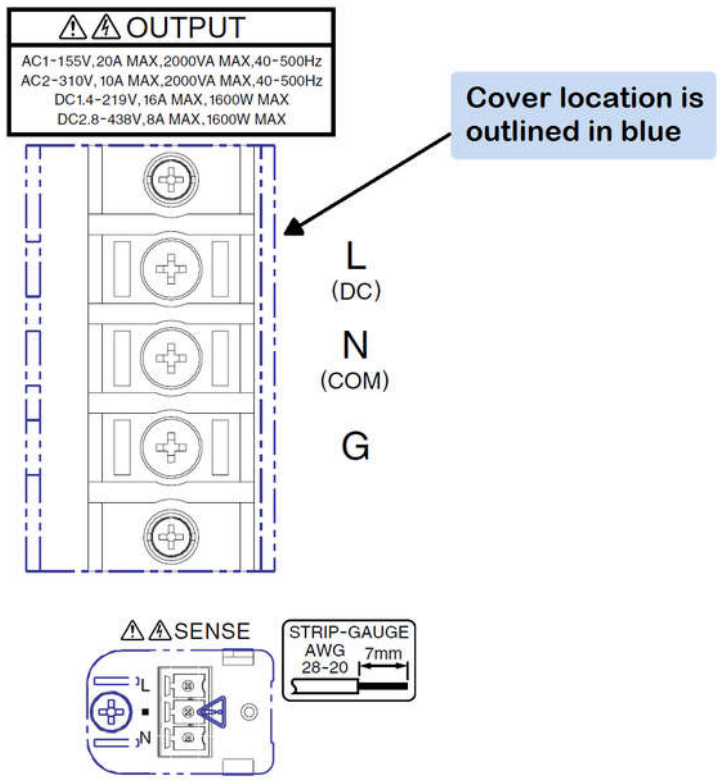
For connecting the load, use noncombustible load wires rated to carry the maximum rated output current.

Nominal Cross-Sectional Area (mm^2)	AWG	Reference cross-sectional area (mm^2)	Allowable Current (A) (Ta=30 °C)
0.9	18	0.82	17
1.25	16	1.31	19
2	14	2.08	27
3.5	12	3.31	37
5.5	10	5.26	49
8	8	8.37	61
14	5	13.3	88

The values vary depending conditions such as the wire covering (insulator) and material (allowable temperature) and whether they are multi-core cables. For cables other than those specified in the table above, please consult with qualified personnel.

Output Terminal Cover

The output terminal is located at or near the center of the rear panel. The terminal cover location is outlined in blue. Note that the sense connector on your unit my not be in the exact location as the one shown in this figure.



Connecting the Load Cables

WARNING **Possible Electric Shock**

Before making any load or sense connections be sure to turn the POWER switch off and remove the power plug from an outlet or turn off the circuit breaker of switchboard.

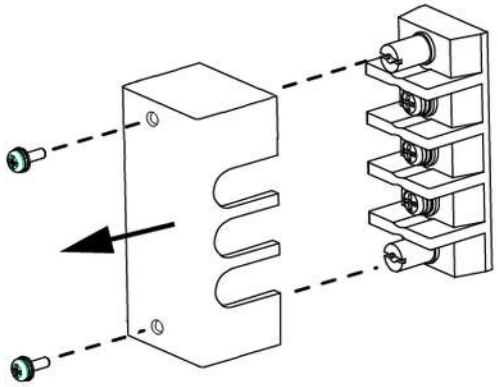
When the power switch is turned off while the output is on, residual voltage still remains at the output terminals.

Do not touch the output terminal block for at least 20 seconds after the power switch is tuned off.

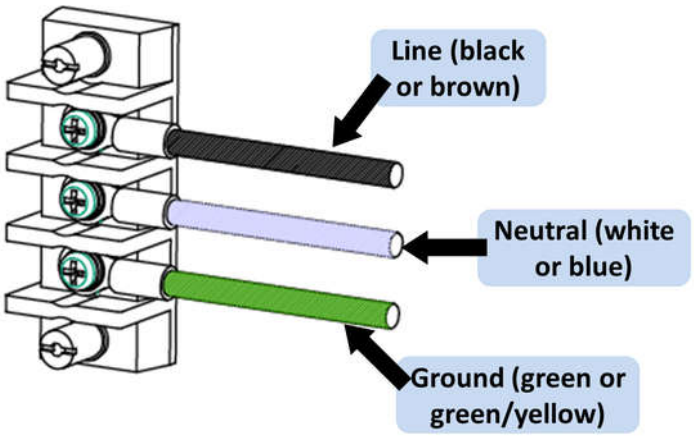
WARNING There is a danger of electric shock. Do not use the terminal block with the terminal cover removed.

WARNING In DC mode, L is at positive potential and N is at negative potential when setting the positive value. The opposite is true when setting the negative value.

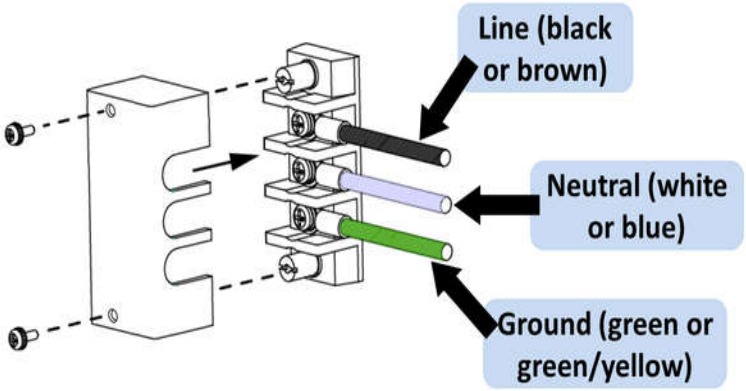
1. Check that the power switch is turned off.
2. Remove the terminal cover attached to the OUTPUT terminal block.



3. Securely connect the load wires to the OUTPUT terminal block. The length of the load cables should be less than 30 meters. If the load has a ground (GND) terminal, be sure to connect it to the G terminal of the instrument's OUTPUT terminal block. Be sure to use a wire that is greater than or equal to the diameter of the wires used to connect the load.

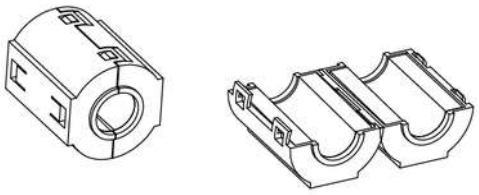


4. Attach the terminal cover that you removed above using the lower holes.

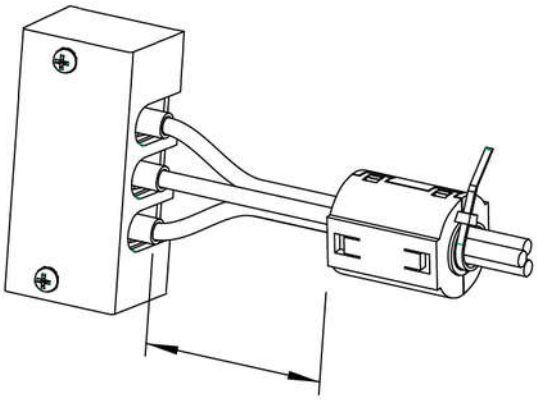


NOTE The L and N terminals of the OUTPUT terminal block are isolated from the AC power line, and the polarity does not constitute a problem in terms of safety. Grounding can be furnished using L or N.

5. Unlock the ferrite core and open it.



6. Close the ferrite core. Avoid catching the wire on the ferrite core. Attach the ferrite core within 10 cm from the OUTPUT terminal block (as indicated by the arrows below). Lock the ferrite core securely in place. To avoid moving the ferrite core, attach the cable tie to fix the position of the ferrite core.



When the load is located at a distance from the instrument

The load may be away from the instrument. You can use remote control to turn the output off, but not to turn off the POWER switch. If the load is at a distance from the instrument, install a switch between the OUTPUT terminal block and the load to prevent electric shock, then turn the switch off.

For the switch circuit, use a two-pole type switch that cuts off L and N wires simultaneously. The current rating of the switch must be greater than or equal to the instrument's maximum current.

WARNING **Possible electric shock**

When installing the switch between the OUTPUT terminal block and the load, be sure to turn the POWER switch off and remove the power plug from an outlet or turn off the circuit breaker of the switchboard.

Be sure to turn the switch off before connecting the load to the terminal at the load end of the switch.

Do not touch the switch terminal or the output terminal when the output is on.

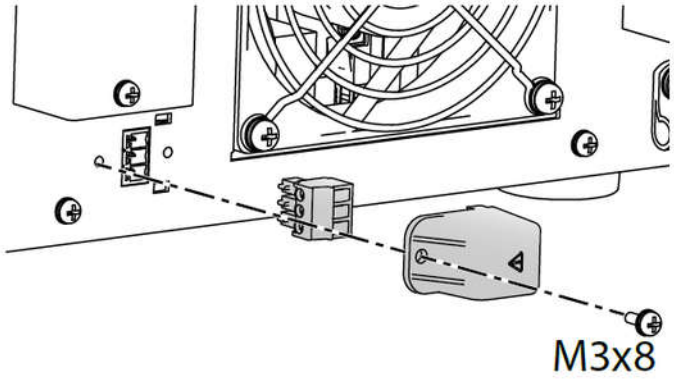
Connecting the Remote Sense Wires

WARNING **Possible Electric Shock**

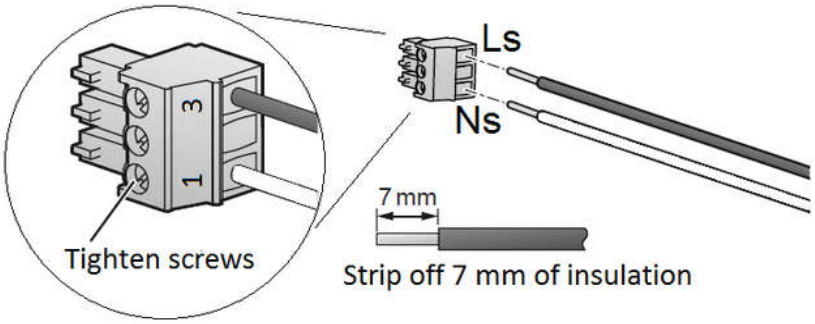
Before making any load or sense connections be sure to turn the POWER switch off and remove the power plug from an outlet or turn off the circuit breaker of switchboard.

Remote sensing compensates for voltage drops in long load cables by monitoring the output voltage directly at the load, The sensing function can compensate up to 1 Vrms for a single load line. Always select a load wire that is thick enough to prevent the voltage drop in the wire from exceeding the compensation voltage.

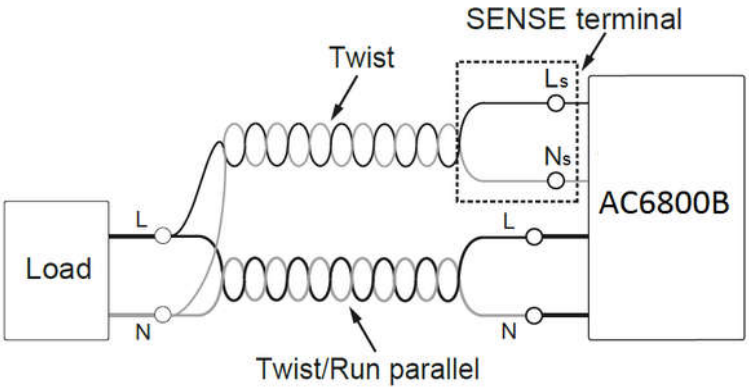
1. Check that the power switch is turned off.
2. Remove the sense connector cover and the sense pug from the rear panel.



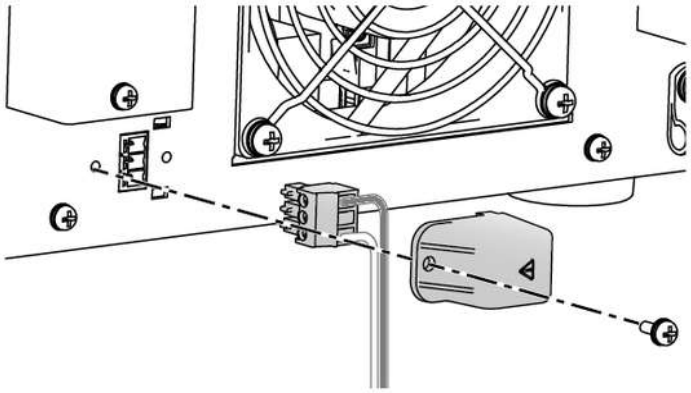
3. Make your connections as shown in the following figure. Connect the Ls (line sense) wire to pin 3. Connect the Ns (neutral sense) wire to pin 1. Sense wires size should be from AWG28 to AWG20. Strip the sense wires back approximately 7 mm.



4. Connect the sense leads as close to the load as possible. Do NOT bundle the sense wire-pair together with the load leads; keep the load wires and sense wires separate. Keep the wire-pair as short as possible and twist or bundle it to reduce lead inductance and noise pickup.

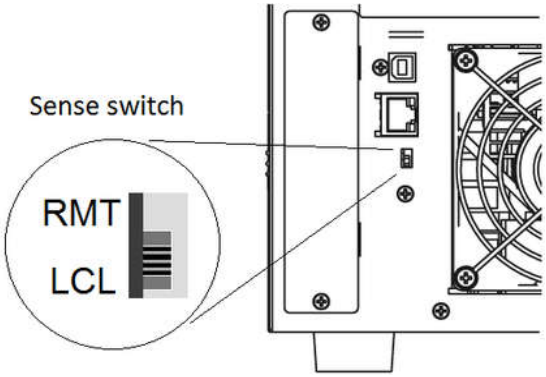


5. Install the sense plug and the sense connector cover.



Remote Sense Operation

Turn the sensing function on and off using the SENSE switch located below the LAN connector on the rear panel. Make sure the output is off when flipping the sense switch.



Flipping the SENSE switch up (RMT) turns the remote sense function on. Flipping it down (LCL) turns remote sensing off. The above figure shows the remote sense function turned off.

The following sense fault will allow the unit to continue to operate, but the output voltage will fluctuate by several volts.

- When the sense wires come loose (open) during operation

The following sense faults will trigger a sense fault protection (SF) on the front panel and disable the output.

- When the sense wiring is reversed at the load
- When the sense wires are shorted together
- When both sense wires are connected to the Line at the load
- When both sense wires are connected to the Neutral at the load
- When the voltage drop exceeds 1 Vrms for a single load wire

NOTE A local lockout (LLO) command sent via the remote interface disables the operation of the sense switch. To enable the operation of the sense switch, Use a communication command to clear the local lockout (LLO) command

Voltage Ranges and Limits

The instrument has two voltage ranges: 155 V (low) and 310 V (high). It can also autorange between the two ranges in AC or DC mode. The instrument will not switch voltage ranges (155 V, 310 V, or AUTO), with the output on. If you attempt to do so, the output shuts off. Also, if you switch the range to 155 V when the voltage is set above 137.5 V the instrument sets the output voltage to 0 V.

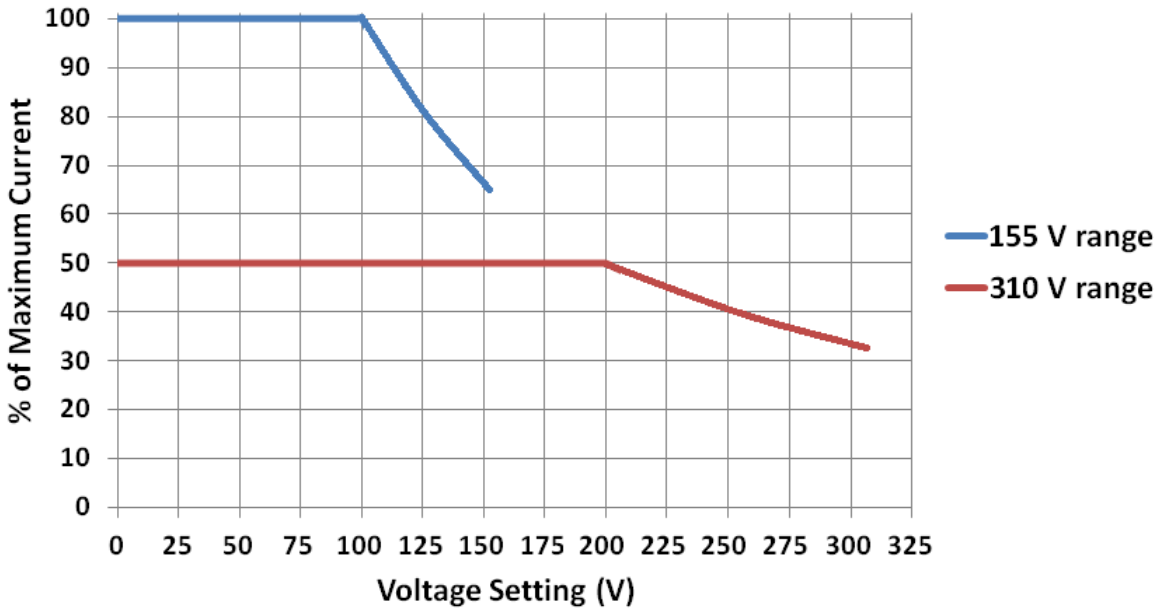
Autoranging automatically switches to the 155 V or 310 V range according to the specified voltage. As it does so, if the output is on, the instrument turns the output off for approximately 0.5 seconds and turns it on again after the range switches.

The tables below indicate the output voltage setting ranges and maximum output current.

Voltage range	Output Voltage Setting	
	AC Mode	DC Mode or AC+DC Mode
155 V	0.0 to 157.5 V	-222.5 to +222.5 V
310 V	0.0 to 315.0 V	-445.0 to +445.0 V

	Voltage range	Maximum Output Current	
		AC Mode	DC Mode or AC+DC Mode
AC6801B	155 V	5 A	4 A
	310 V	2.5 A	2 A
AC6802B	155 V	10 A	8 A
	310 V	5 A	4 A
AC6803B	155 V	20 A	16 A
	310 V	10 A	8 A
AC6804B	155 V	40 A	32 A
	310 V	20 A	16 A

The following chart shows the maximum current output by voltage.



Upper and lower voltage limits

The voltage limit ranges are shown below. Set the limits so that the upper limit is greater than or equal to the lower limit.

Output mode	Voltage Range	Lower Limit	Upper Limit
AC Mode	155 V	0.0 to 157.5 V	0.0 to 315.0 V
	310 V	0.0 to 315.0 V	0.0 to 315.0 V
DC mode	155 V	-445.0 to 222.5 V	-222.5 to 445.5 V
	310 V	-445.0 to +445.0 V	-445.0 to +445.0 V

Error Checking and Soft Limits

The AC6800 Series instruments include error checking measurements and soft limits that prevent unintended operations from being carried.

Basic Principles

Settings are not automatically changed by either front-panel or SCPI commands, unless the changes are obvious and expected.

Improper settings or combination of settings are not allowed for active settings.

User actions which would result in improper active settings generate error messages.

Inactive settings are not checked for errors in response to range changes. If these settings will become active due to output mode changes, such as switching coupling from AC to DC, or due to the enabling of soft limits, error checks are performed before making the settings active.

Error checks should be performed in response to the following events:

Changing Settings invokes Settings Error Checking

Enabling soft limits invokes Settings Error Checking

Changing ranges from high to low invokes Range Error Checking

Changing output coupling invokes Output Coupling Error Checking

Changing to Step mode invokes Settings Error Check

Range Error Checking

The instrument uses the following method to check for range errors.

1. Active settings are limited by MINimum and MAXimum values. The active settings considered are only those relevant to the output coupling. In AC+DC coupling, both DC and AC voltage settings are active, so range checking is applied to the peak absolute value of the combined waveforms.
2. In addition to the immediate DC and AC voltage, in Step mode the triggered voltage setting (VOLT:OFFS:TRIG or VOLT:TRIG, depending on the output coupling) is also checked to ensure that an accepted trigger does not cause an invalid state.
3. Frequency settings are independent of range, output on/off status, and output coupling.
4. Output coupling and output range may only be changed when the output is off. Therefore, the instrument always checks for inconsistent settings when you try to change the output coupling or range before turning the output on.
5. If output coupling settings are changed, the Range Error Checking and Soft Limits Checking are both made for any parameter that becomes active as a result of the output coupling change.
6. Settings that are valid on the low output range are always valid on the high output range, but the Range Error Checking and Soft Limits Checking are both performed whenever the instrument is asked to change ranges in either direction.

Soft Limits Checking

1. The soft limits are checked only if soft limits are enabled at the time the soft limits are set or at the time when the soft limits are enabled.
2. Soft limits can be configured for DC voltage, AC voltage, and Frequency. The soft limit check is independently performed for the AC and DC components in AC+DC coupling.
3. Soft limits also apply to the corresponding trigger values of DC voltage, AC voltage, and Frequency but only in Step mode.

Settings Error Checking

These settings verify that the voltage setting is correct.

In AC and DC output modes, the setting must be between the range's MIN and MAX values.

In AC+DC mode, an additional check verifies that the peak voltage does not exceed 194.5 V (low range) or 389 V (high range).

If soft limits are enabled, the instrument checks that the setting is within the low and high soft limits.

Settings errors are checked when the user changes the mode setting to Step mode.

Output Coupling Error Checking

Changing output coupling from AC+DC requires no error check. Otherwise, changing to DC coupling runs the Volts DC settings error check, and changing to AC or AC+DC runs the Volts AC settings error check.

Coupled Parameter Error Checking

Inactive parameters generally are not checked for being within range or compliant with soft limits even if soft limits are active for the parameter type. This minimizes nuisance error messages when setting values for inactive parameters. Instead, checks are performed when the parameter is made active.

However, parameter entries are always checked for being within the MIN and MAX values even if the parameter is inactive. For example, VOLT:TRIG must be from 0 to 310, even if VOLT:MODE is FIXed.

If coupled parameter settings change, the instrument check on each active parameter setting.

For AC+DC mode, the peak value ($\sqrt{2}\times$AC +|DC|) cannot exceed 389 V.

For AC mode, the voltage setting must be from 0 to the full scale value of the range, and for DC mode, the value must be between the positive and negative full scale value of the range.

Checks are performed in the following order:

1. The Coupled Parameters Error Checking is performed first.
2. Depending on the pending front-panel entry or remote command and the instrument's operating status, the Coupled Parameters Error Checking may lead to the other error checks.
3. In some cases, multiple passes through the Settings Error Check are required. For example, if OUTPut:COUPLing is changing from AC to ACDC and VOLT:OFFSet:MODE is STEP, then both the IMMediate and TRIGgered values for DC volts are checked for being within range and for meeting the peak voltage constraint for the currently selected range. These checks occur before the OUTPut:COUPLing change is accepted.

2
User Information

Welcome

Front Panel Menu Reference

General Front-Panel Organization

Selecting the Output Voltage Programming Source and Output Mode

Specifying Output Coupling

Programming AC Output

Programming DC Voltage

Setting Limit Values

Turning the Output On and Off

Storing and Retrieving Instrument States

Configuring Instrument Preferences

Calibrating from the Front Panel

Configuring Overcurrent Protection

Configuring Watchdog Protection

Configuring and Clearing Measurements

Using External Analog Control

Using Fault Inhibit Control

Viewing Error Messages

Welcome

This manual includes user, service, and programming information for the Keysight AC6800B Series of compact AC sources, which can be readily used on the bench or in a test rack. The simple user interface allows you to easily access and view setup and measurement information directly from the front panel or programmatically.

Choose from models up to 4000 VA, all with 0 to 310 Vrms and 40 to 500 Hz output capability. Both LAN/LXI Core and USB interfaces are standard. You can optionally choose to add GPIB or an analog interface board to add basic transient signals.

Instrument Driver

In addition to using SCPI commands, you can also control the instrument using the IVI driver, available at ivifoundation.org. The newest version can also be downloaded at www.keysight.com/find/AC6800firmware.

Models and Options

The AC6800B Series includes four models and four options, as shown below.

Model	Maximum Power (VA)
AC6801B	500
AC6802B	1,000
AC6803B	2,000
AC6804B	4,000

The AC6800B Series has four options, described below.

Option	Description
AC68BRAC3	Rack mounting kit for AC6801B, AC6802B, and AC6803B
AC68BRAC6	Rack mounting kit for AC6804B
AC68GPBU	GPIB interface board
AC68BALGU	Analog interface board - controls the output with external analog signals in two modes: **EXT-AC:** The AC output voltage varies according to the input DC signal. **EXT-DC:** The input waveform is amplified and output.

Documentation, Firmware, and Technical Support

You can download the latest version of this document from www.keysight.com/find/AC6800B-doc . The latest version is also available for mobile devices at www.keysight.com/find/AC6800B-mobilehelp.

For the latest firmware revision go to the product page at www.keysight.com/find/AC6800B.

If you have questions about your shipment, or if you need information about warranty, service, or technical support, contact Keysight Technologies.

Contacting Keysight Technologies

United States: (800) 829-4444
Europe: 31 20 547 2111
Japan: 0120-421-345

Use www.keysight.com/find/assist to contact Keysight worldwide.

Front Panel Menu Reference

This is an overview of the front-panel menus.

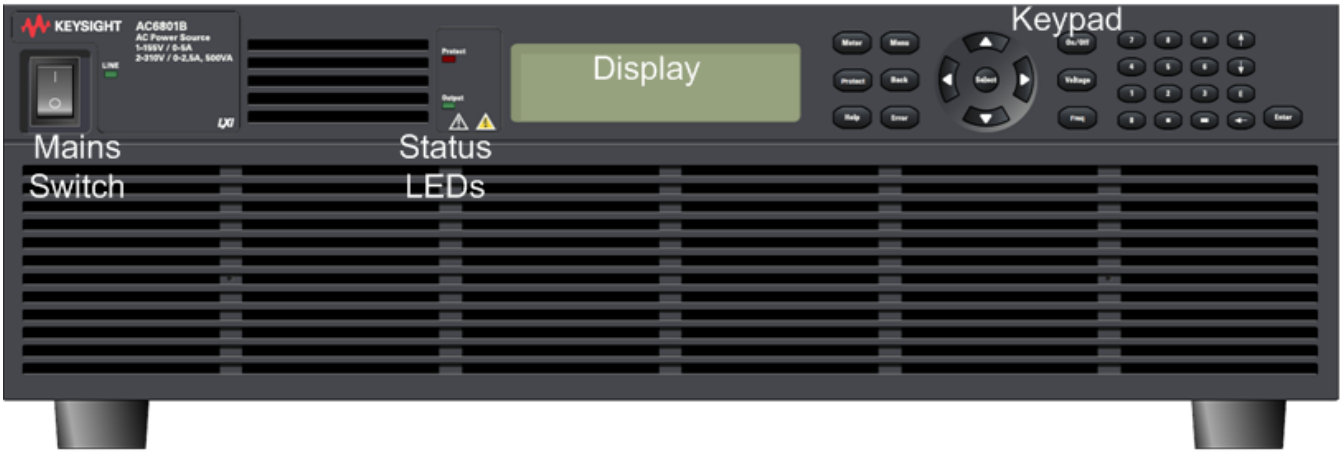
Press [Menu] to access the front-panel menus.

For a menu navigation tutorial, see Use the Menu System.

Level 1	Level 2	Levels 3&4	Description
Output	Voltage		Sets output voltage and limits
		AC	Sets AC voltage and limits
		DC	Sets DC voltage and limits
		Prog	Programs voltage with optional analog board
	Frequency		Sets output frequency and limits
	Range		Selects voltage range
	Coupling		Selects output coupling
	Current		Sets output current limits
	Phase		Sets output-on phase
Measure	IpkHold		Displays or clears peak held current
	Coupling		Selects the measurement coupling
	Average		Selects number of measurements to average
Protect	Current		Configures current limiting
	WDog		Configures IO watchdog
	Clear		Clears protection conditions and displays output status
States	Reset		Resets instrument to the reset (*RST) state
	SaveRecall		Saves and recalls instrument settings
	PowerOn		Selects the power-on instrument state

Level 1	Level 2	Levels 3&4	Description
System	IO		Configures LAN, USB, and optional GPIB
		LAN	Configures LAN IO
		Settings	View the currently active network settings
		Modify	Modify the network configuration (IP, Name, DNS, WINS, mDNS, Services)
		Apply	Applies the configuration changes and restarts unit
		Cancel	Cancels the configuration changes
		Reset	Performs an LXI LCI reset of LAN settings and restarts
		Defaults	Resets LAN settings to factory defaults and restarts
		USB	Displays USB identification string
		GPIB	Display or change the GPIB address
	Preferences		Displays Preferences commands
		Display	Configures screen saver and start-up meter view
		Saver	Configures the screen saver
		View	Configures the start-up meter view
		Lock/Unlock	Locks the front panel keys with a password
	Admin (must log in)		Displays Admin commands
		Login/Logout	Logs in and out of Admin functions
		Cal	Displays calibration commands
		DC	Calibrates DC voltage
		AC	Calibrates AC voltage
		Current	Calibrates current
		Count	View the calibration count
		Date	Saves the calibration date
		Save	Saves the calibration data
		IO	Enables/disables the LAN, USB, and GPIB
		Sanitize	Performs NISPOM secure erase of all user data
		Password	Changes the administration password
	About		Displays model, options, serial number, and firmware

General Front-Panel Organization



Keypad Layout



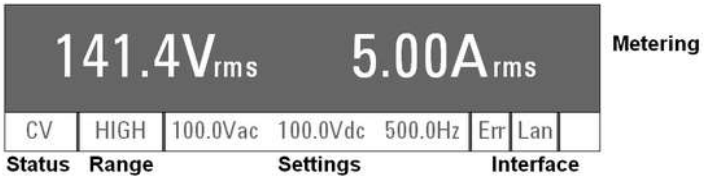
Item		Description
	Mains Switch	Rocker switch for turning the instrument on (1) and off (0). The **LINE** indicator turns green when power is on.
	Display	64 × 256 monochrome dot matrix display
Status LEDs	**PROTECT**	Lights in red when a protection feature has been activated
	OUTPUT	Lights in green when output is ON
System Keys	**[Meter]**	Selects Metering Mode displays and cycles through three display formats (METER_VI, METER_VIP, and METER_ALL).
	[Menu]	Toggles between the top Menu level and the Metering Mode display (METER_VI, METER_VIP, or METER_ALL).
	[Protect]	Opens the Protect menu (equivalent to **[Menu] > Protect**).
	[Back]	Backs out of current menu, eventually returning to the Metering Mode display. Not a backspace for numeric entries.
	[Help]	Displays context-sensitive help messages.
	[Error]	Displays messages in ERROR queue.
Navigation Keys	**[▲] [▼] [◀] [▶]**	Navigate within menus, display fields, or data entry fields.
	[Select]	Selects a menu item to go down in a menu tree. Also confirms a user entered value, such as a GPIB address.

Item		Description
Settings Keys	[On/Off]	Toggles the output ON or OFF.
	[Voltage]	Opens the VAC or VDC (depending on output coupling mode) Settings fields in the Metering Mode display (See Section 6).
	[Freq]	Opens the Frequency Settings field in the Metering Mode display.
Numeric Entry Keys	[0] to [9]	Enters a numeric digit.
	[.]	Enters a decimal point.
	[-]	Toggles the negative sign.
	[E]	Specifies an exponent for a numeric entry. For example, 1.23E2 indicates 123.
	[←]	Deletes the most recently entered digit. When a numeric field is first selected, this key erases the entire entry.
	[↓] [↑]	Increment or decrement a Settings field. No effect on numbers entered under the [Menu] key.
	[Enter]	Finishes a numeric entry.

NOTE You can immediately change values by directly entering numbers into the Settings field.

Display Layout

This section describes the instrument's display. The default Metering Mode is shown below.



Field	Description
Metering	Measurement information (content varies by mode)
Status	Operating status (content varies by mode)
Range	Output range setting: LOW, HIGH, or AUTO
Settings	Settings for VAC, VDC, and Frequency
Interface	ERROR and LAN status. Shows IO in rightmost cell when remote control via LAN is operational.

The possible entries for the Status, Range, and Interface fields are shown below.

Field	Display	Description
Status	Off	Output is disabled
	CV	Constant voltage mode
	CLrms	Current limit mode
	PL	Power limit mode
	OV	Overvoltage protection; output OFF
	OC	Overcurrent protection (rms/avg); output OFF
	OCPK	Overcurrent protection (peak); output OFF
	OP	Overpower protection; output OFF
	OT	Overtemperature protection; output OFF
	LV	Low voltage protection (AC input); output OFF
	WDG	Watchdog timeout error; output OFF
	SF	Sense fault protection; output OFF
Range	LOW	Selected range up to 155 VAC (219 VDC)
	HIGH	Selected range up to 310 VAC (438 VDC)
	AUTO	Autoranging selected (not available in EXT-AC or EXT-DC mode)
Interface	Err	One or more messages in error queue
	LAN (displayed)	LXI LAN "No fault"
	LAN (blinking)	LXI LAN "Identify"
	(LAN section blank)	LXI LAN "Fault"
	IO	Remote activity via the LAN connection

If AUTO is selected prior to entering either of the external programming modes, the range selected by autoranging is retained until changed by the user. The range field is updated to reflect the actual range when the external programming mode is first entered (if AUTO is selected).

Selecting the Output Voltage Programming Source and Output Mode

Select the Output Voltage Programming Source

NOTE The EXT-AC and EXT-DC modes require the optional analog interface board (option AC68BALGU). You cannot use the analog output interface board with the GPIB interface because both boards use the same slot.

Without the analog interface board, only the Internal option is available. This controls the output voltage by the instrument. The Internal option is also selected by *RST.

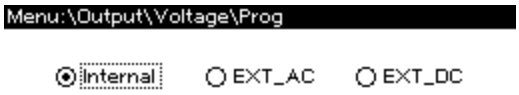
EXT_AC configures the instrument to behave as a variable gain amplifier controlled by an external DC level. The internal frequency control remains in effect.

EXT_DC mode configures the instrument to behave as a fixed gain power amplifier. Internal controls for voltage and frequency are disabled.

CAUTION You cannot set the voltage limit when the instrument is being controlled by external analog signals. An excessive external voltage may damage the load.

Front Panel:

1. Select **[Menu]** > **Output** > **Voltage** > **Prog**.



2. Select **Internal**, **EXT_AC**, or **EXT_DC** and press **[Select]**.

SCPI: VOLTage:PROGramming:SOURce

Select the Output Mode

You can switch the output among the five modes shown below when the output is turned off.

NOTE The EXT-AC and EXT-DC modes require the optional analog interface board. You cannot use the analog output interface board with the GPIB interface because both boards use the same slot.

Output Mode	Description
AC Mode	Produce AC output
DC mode	Produce DC output
AC+DC mode	Superimpose DC voltage on the AC output
EXT-AC mode	Output sine waves using external DC signals
EXT-DC mode	Amplify and output the waveform applied externally

Specifying Output Coupling

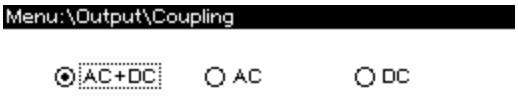
The instruments support three types of output coupling:

Coupling	Description
AC+DC	AC output with positive or negative DC offset
AC	AC output
DC	Positive or negative (bipolar) DC output

In AC+DC mode the combined peak voltage must be between -222.5 and +222.5 V for the low range or -445 and +445 V for the high range.

Turn the output off to change the output coupling. The instrument performs error checking to ensure that pending active settings remain within range.

Front Panel: [Menu] > Output > Coupling



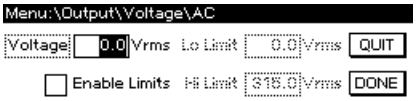
SCPI: OUTPut:COUPling AC|DC|ACDC

Programming AC Output

You can program the voltage, frequency, frequency limits, and starting phase angle of the AC output. Before programming the output, select the appropriate output mode and voltage range.

Output Mode

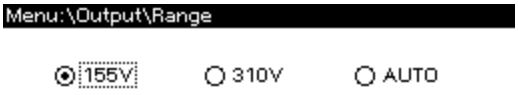
Front Panel: [Menu] > Output > Voltage > AC



SCPI: OUTPut:COUPling AC

Voltage Range

Front Panel: [Menu] > Output > Range



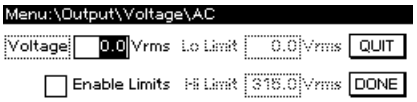
SCPI: [SOURce:]VOLTage:RANGe[:UPPer] 155|310|MINimum|MAXimum

The output must be off to change the range settings. The instrument checks to ensure that currently active settings remain within the new range.

Voltage

Front Panel:

Press [Voltage], enter the desired value with the numeric keypad, and press [Enter]. You may also change the voltage and voltage limits by pressing [Menu] > Output > Voltage > AC. To specify the voltage limits, check the Enable Limits box to enable the Lo Limit and Hi Limit.



NOTE The voltage limits do not limit output; they are safety functions that prevent unintentional settings. For example, setting the voltage **Lo Limit** and **Hi Limit** to 10 and 20 Vrms would prevent you from specifying 175 Vrms when you intended 17.5 Vrms.

Use the [Back] key or QUIT button to exit without saving changes, or use the DONE button to save the changes.

SCPI:

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]

[SOURce:]VOLTage[:LEVel]:LIMit[:STATe]

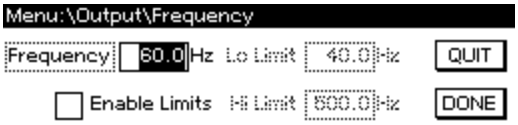
[SOURce:]VOLTage[:LEVel]:LIMit:LOWer

[SOURce:]VOLTage[:LEVel]:LIMit:UPPer

Frequency

You can set the output frequency from 40 to 500 Hz for AC mode and AC+DC mode, regardless of whether the output is on. Set the limits so that the upper limit is greater than or equal to the lower limit.

Select [Menu] > Output > Frequency. Then enter the desired frequency and limit values on the numeric keypad and select DONE. To specify the frequency limits, check the Enable Limits box to enable the Lo Limit and Hi Limit.



NOTE The frequency limits do not limit output; they prevent unintentional settings. For example, setting a frequency **Lo Limit** and **High Limit** of 40 and 45 would prevent you from accidentally entering a frequency of 425 instead of 42.5.

SCPI:

[SOURce:]FREQuency[:CW]

[SOURce:]FREQuency:LIMit[:STATe]

[SOURce:]FREQuency:LIMit:LOWer

[SOURce:]FREQuency:LIMit:UPPer

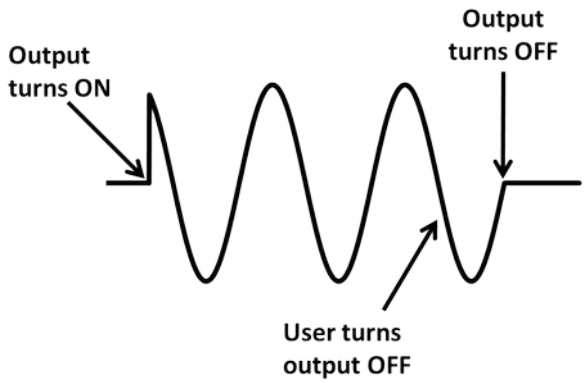
Phase Angle

To select the output-on starting phase for AC output at turn-on, select [Menu] > Output > Phase.



Select the Synchronize checkbox to enable output phase control, otherwise the turn-on phase will be random.

NOTE The output always turns off at the zero-crossing phase to ensure the instrument's output capacitor discharges when there is no load.



SCPI: TRIGger:SYNChronize:PHASe[:ON]

Typical Command Sequence

A typical command sequence is shown below:

OUTPut:COUPling AC	Select AC mode.
VOLTage:RANGe 155	Select the 155 V range.
VOLTage 110	Specify 110 V.
FREQuency 55	Specify 55 Hz.
OUTPut ON	Turn the output on.

When the output is turned on, you cannot change the output mode or voltage range. You must turn the output off first. However, you can change AC voltage and frequency settings when the output is on.

The upper and lower limits may be set if the limit feature is enabled. To save your changes, navigate to Done and press [Select] or [Enter]. You may exit without saving changes by pressing the [Back] key or by navigating to QUIT and pressing [Select] or [Enter]. If soft limits are enabled, an error check confirms that the frequency setting is between the low and high limits.

VOLTage:RANGe 155	Select the 155 V range.
VOLTage:LIMit:UPPer MAX	Sets upper limit to maximum, 315 V
VOLTage:LIMit:LOWer MIN	Sets lower limit to minimum, 0 V
VOLTage 120	Sets voltage to 120 V
FREQuency:LIMit:UPPer MAX	Sets upper limit to maximum, 500 Hz
FREQuency:LIMit:LOWer MIN	Sets lower limit to minimum, 40 Hz
FREQuency 70	Sets frequency to 70 Hz

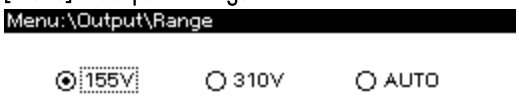
The commands above set the limits to accommodate the widest possible VOLTage and FREQuency settings within the given range. On the 155-V voltage range, the VOLTage setting cannot exceed 157.5 V.

In AC+DC mode, the voltage can be specified only when the AC and DC voltage settings are within the voltage limit range and the peak of the AC+DC waveform is between -445 and 445 V.

Programming DC Voltage

The AC6800B Series can output DC voltage. When the output is turned on, you cannot change the output mode or voltage range. You must turn the output off first. You can set the voltage regardless of whether the output is on or off.

The general procedure for specifying DC output is:

Step	Description	Front Panel	SCPI Command
1	Turn the output off (optional).	[On/Off]	OUTPut OFF
2	Select the DC voltage mode.	[Menu] > Output > Coupling > DC	OUTPut:COUPling DC
3	Select the DC voltage range (155 V, 310 V, or AUTO)[1].	[Menu] > Output > Range 	VOLTage:RANGe
4	Specify the DC voltage limit to be slightly larger than the voltage to be output.	[Menu] > Output > Voltage > DC	VOLTage:OFFSet:LIMit
5	Specify the DC voltage to be output.		VOLTage:OFFSet
6	Turn the output on.	[On/Off]	OUTPut ON

[1]The DC voltage range for the 155 V range is ±222.5 V, and for the 310 V range it is ±445.0 V.

DC Voltage Limit

The instrument allows you to limit the allowable values for the voltage offset. The following example allows the VOLTage:OFFSet to be set to any value within the given range. The factory default lower limit of DC mode is 0.0 V, so remember to change the limit if you need to output a negative DC voltage.

```
VOLTage:RANGe 310                Select the 310 V range.
VOLTage:OFFSet:LIMit:UPPer MAX   Set the upper limit to 445 V.
VOLTage:OFFSet:LIMit:LOWer MIN   Set the lower limit to -445 V.
```

The *RST default for VOLTage:OFFSet:LIMit:LOWer is to 0 for safety reasons.

Setting Limit Values

The limit function limits the instrument's output to prevent damage to the load. You should specify limits before applying output to the load, but you can set limits with the OUTPUT on. Note that the limit value takes precedence over the setting value for voltage and frequency. If the current setting value exceeds the limit range when the voltage or frequency limit value is changed, the setting value (voltage or frequency) is set to a limit value that is closest to the current setting value.

Current limit value and current limit operation

The instrument has programmable AC and DC current limits. If the load attempts to draw more average DC current or RMS AC current than the programmed limit, or if the unit attempts to draw more peak current than the system-defined peak limit, the instrument will take action to prevent excessive current.

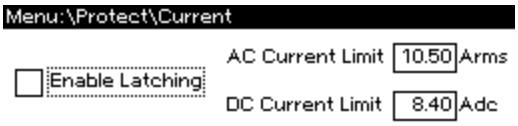
NOTE **The current detection response is not instantaneous.**

If the instrument draws average DC current or RMS AC current that exceeds the limit, it displays OC in the Status field and sets the CL-RMS bit (bit 12) in the STATus:QUEStionable register.

If the instrument detects peak current exceeding the limit, it displays OCPK in the Status field and sets the CL-PEAK bit (bit 10) in the STATus:QUEStionable register.

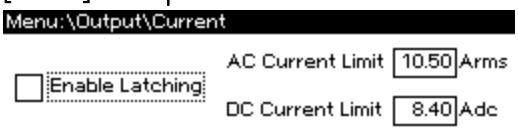
Front Panel:

[Menu] > Protect > Current



or

[Menu] > Output > Current



Both of the above sequences set the same current limits.

SCPI:

CURR:PROT:STAT 0 The voltage output reduces the current without tripping the output. [1]

CURR:PROT:STAT 1 The output turns off after the voltage reduction continues for a given period.

[1]Calculated for the RMS value. Due to the relation between the processing time of measurement and the voltage resolution, it may take a few seconds to exceed the current limit.

Whenever the instrument detects peak current exceeding the limit, it raises an OVERLOAD warning, and sets the CL-PEAK bit (bit 10) on the STATus:QUEStionable register.

The current limit value of the output current can be specified as shown in the following table.

Output mode	Limit			
	AC6801B	AC6802B	AC6803B	AC6804B
AC Mode	0.1 to 5.25 A	0.2 to 10.5 A	0.4 to 21.0 A	0.8 to 42.0 A
DC mode	0.1 to 4.2 A	0.2 to 8.4 A	0.4 to 16.8 A	0.8 to 33.6 A

Turning the Output On and Off

Press [On/Off] to toggle the output on and off.

ON: The specified voltage is output and the Output LED turns green.

OFF: The output voltage turns off (high impedance mode) and the Output LED turns off.

The output is always off at power-on.

If a protection function trips, the output is turned off. However, if the current limit operation is limit control and the overload protection function (current limit) trips, the output is not turned off.

WARNING To prevent the possibility of electric shock, do not touch the output terminal block.

WARNING If a capacitor, battery, or similar device is connected as a load in DC mode, voltage remains at the section connected to the output terminal block even when the output is off until the load energy is discharged. The discharge time of the internal capacitor when no load is connected is approximately 0.1 seconds. To prevent the possibility of electric shock, do not touch the output terminal block.

CAUTION When the output is turned on, several volts of undershoot or overshoot may appear for a time period on the order of ten microseconds.

Principle of Output on/off

The AC6800B Series instruments do not disconnect output from the internal circuits mechanically using switches and relays. Instead, when the output is turned off, the instruments electrically increase output impedance to limit the output without chattering.

The resistance in the high-impedance condition is shown below.

Voltage Range	AC6801B	AC6802B	AC6803B	AC6804B
155 V	approx. 40 kΩ	approx. 20 kΩ	approx. 10 kΩ	approx. 5 kΩ
310 V	approx. 80 kΩ	approx. 40 kΩ	approx. 20 kΩ	approx. 10 kΩ

Storing and Retrieving Instrument States

State Storage

The instrument stores the parameters shown in the table below at five-second intervals. To ensure that settings changes are saved before power-down, wait at least five seconds after changing a setting before turning the instrument off. Otherwise, the last settings may not be stored.

NOTE The instrument's output is always off at power up.

Stored Settings		
Output mode (AC, DC, AC+DC, EXT-AC, or EXT-DC)		
Output voltage range (155 V, 310 V, or AUTO)		
Voltages, AC and DC		
Frequency		
Measured value display (RMS, PEAK, AVG, or W)		
Limit values	AC	Voltage limits (lower and upper)
		Current limit
		Frequency limits (lower and upper)
	DC	Voltage limits (lower and upper)
		Current limit
	Current limit operation	

Save and Recall Instrument States

You can save instrument states into 10 nonvolatile state storage locations. This allows you to switch among several configurations quickly, or to test sudden changes in output voltage or frequency. Select [Menu] > States > SaveRecall to save or recall a state. Specify the state storage location (0 through 9) and select either Recall or Save.



If a state is recalled with the output on and includes an output mode or voltage range change, a short alarm sounds and the state is not recalled when the output mode or voltage range switches. If this happens, turn the output off, recall the memory, and then turn the output back on.

SCPI: *RCL and *SAV

Reset the Instrument to Factory Default Values

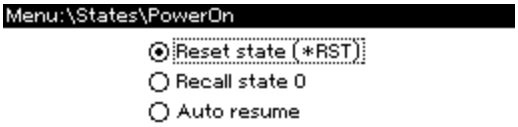
Select [Menu] > States > Reset > Reset to reset the instrument to its factory defaults.



SCPI: *RST

Configure the Instrument's Power-on State

Select [Menu] > States > PowerOn to configure the instrument's power-on state.



Reset state (*RST) is the factory default.

Recall state 0 will recall the state saved in location 0.

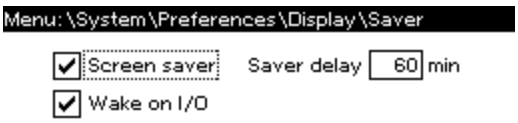
Auto resume causes the unit to power up in its power-down state. State changes occurring in the last three to four seconds before power-down may not be restored. For this option, the output is always off regardless of whether it was on at power-down.

Configuring Instrument Preferences

Press [Menu] > System > Preferences to configure the display and to lock and unlock the instrument.

Configure the Screen Saver

Press [Menu] > System > Preferences > Display > Saver to configure the screen saver.



Screen saver – enables the screen saver function.

Saver delay – specifies the time in minutes between the last time any communication occurs with the instrument or a key is pressed until the screen saver goes into effect.

Wake on I/O – restores the display whenever any I/O interface activity occurs.

SCPI:

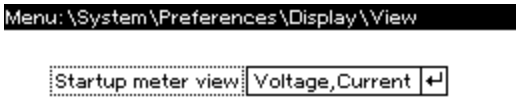
SYSTem:SSAVer[:STATe]

SYSTem:SSAVer:DELay

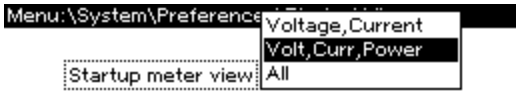
SYSTem:SSAVer:RWAKeup

Specify the Startup Meter View

1. Press **[Menu] > System > Preferences > Display > View** to select the instrument's initial meter view.



2. Press **[Select]** and use the up and down arrows to highlight your selection.



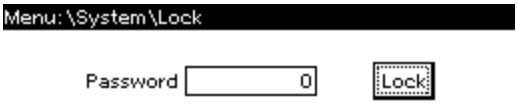
3. Press **[Select]** to confirm your selection and then press **[Meter]** to exit. This setting does not change the current meter view; it only changes upon cycling power. For example, the image below shows the starting meter view with **Volt, Curr, Power** selected.



Lock and Unlock the Front Panel

CAUTION Be certain that you enter the password carefully and remember it. You cannot clear the password by cycling instrument power.

Press [Menu] > System > Preferences > Lock to lock the front panel.



There is no factory default password.

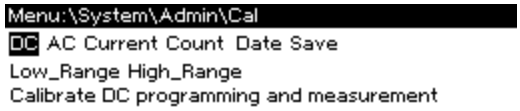
The password must be 4 to 15 characters long and may include any of these characters:

Characters	Description
A-Z	Upper case letters
a-z	Lower case letters
0-9	Numeric digits
+ - ( ) . , <space>	Plus, minus, parentheses, period, comma, space

To unlock the instrument, press any key other than [Meter] and enter the password.

Calibrating from the Front Panel

Log in with the administration password at [Menu] > System > Admin > Login and then use [Menu] > System > Admin > Cal to enter the calibration menu, shown below. Remember to log out with [Menu] > System > Admin > Logout after you have completed your calibration tasks.



Node	Meaning
DC	Calibrate DC voltage programming and measurement (low and high ranges).
AC	Calibrate AC voltage programming and measurement (low and high ranges).
Current	Calibrate current measurement (low and high ranges).
Count	View the calibration count. The calibration count is incremented whenever calibration is saved, the administration password is changed, or the instrument firmware is updated. **NOTE** Be sure to read and record the calibration count when you first receive your instrument from the factory.
Date	Enter the calibration date, which can be up to 15 characters.
Save	Save the updated calibration constants.

For calibration details, see Calibration.

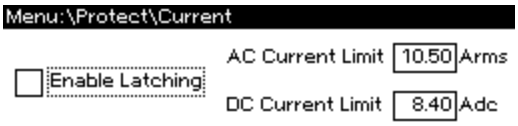
Configuring Overcurrent Protection

Use the [Menu] > Protect menu to configure or clear overcurrent protection. Note that this same menu can be found under [Menu] > Output > Protect.



Configure Overcurrent Protection

To configure overcurrent protection, select [Menu] > Protect > Current.



The current limits are based on the RMS value for both AC and DC current (DC and RMS values are equivalent for DC-only signals). If AC+DC output coupling is selected, the AC Current Limit applies.

If Enable Latching is checked, a current limiting event longer than approximately three seconds will disable the output and indicate OC protection fault. If this box is not checked, a current limiting event will decrease the output voltage until the current goes below the limit.

Current limit settings vary by model, as shown below. The AC limits apply in AC and AC+DC output coupling modes.

Model Number	AC Limit Range (Arms)	DC Limit Range (Arms)
AC6801B	0.1 to 5.3	0.1 to 4.2
AC6802B	0.2 to 10.5	0.2 to 8.4
AC6803B	0.4 to 21.0	0.4 to 16.8
AC6804B	0.8 to 42.0	0.8 to 33.6

SCPI: [SOURce:]CURRent:PROTection:STATe

Clear Overcurrent Protection

To clear an overcurrent protection condition, select [Menu] > Protect > Clear.



The current output status condition is displayed to help you ensure that clearing the protection condition is appropriate and likely to produce expected results.

SCPI: OUTPut:PROTection:CLEar

Configuring Watchdog Protection

The watchdog protection feature places the output in protection mode if a SCPI command or query is not received within the specified delay period, which may be set between 1 and 3600 seconds (factory default 60).

Press [Menu] > Protect > WDog to configure watchdog protection. It is disabled by factory default.



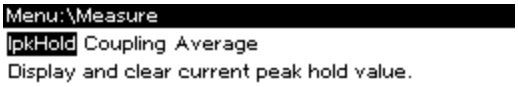
SCPI:

OUTPut:PROTection:WDOG[:STATe]

OUTPut:PROTection:WDOG:DELay

Configuring and Clearing Measurements

The Measure menu [Menu] > Measure allows you to view and clear the current peak hold value, configure the measurement coupling, and specify the number of readings to average.



View and Clear IpkHold

Press [Menu] > Measure > IpkHold to display the current peak hold value. Higher peak values overwrite previously measured lower values until power is cycled or until IpkHold is reset using Clear.

The number displayed next to ApkH is not editable; you may either press Clear or [Back] to exit. Using [Back] does not clear the value.



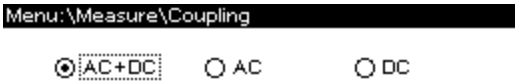
SCPI: SENSe:CURRent[:PEAK]:HOLD:CLEar

Configure Measurement Coupling

Press [Menu] > Measure > Coupling to configure measurement coupling (AC, DC, or AC+DC). The factory default is AC+DC.

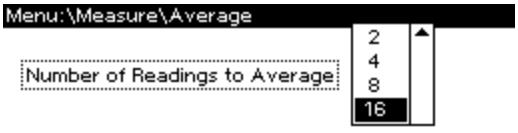
AC+DC The RMS value of the output is presented in the metering displays.
AC The AC component of the output is presented in the metering displays.
DC The average (DC) component of the output is presented in the metering displays.

The Meter All display is not affected by measurement coupling selection.



Specify Number of Readings to Average

Press [Menu] > Measure > Average to specify the number of readings to average for measurements. The drop-down menu allows you to choose 1, 2, 4, 8, or 16. Press [Select] to make your selection.



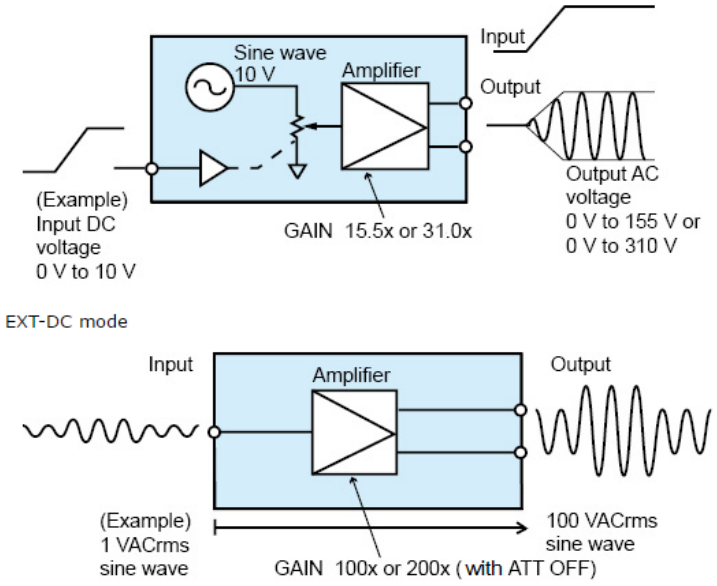
SCPI: SENSe:AVERage

Using External Analog Control

EXT-AC Mode

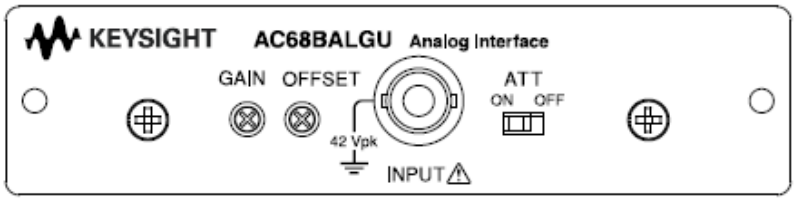
EXT-DC Mode

The analog interface board (option AC68BALGU) supports two external analog programming methods, EXT-AC and EXT-DC. In EXT-AC mode the voltage of the output AC waveform (sine wave) is varied according to the input DC signal. In EXT-DC mode the input waveform is simplify amplified and output.



CAUTION You cannot set the voltage limit when the AC source is being controlled using external analog signals. Accidentally applying an excessive external voltage may damage the load.

Analog controls



Control	Description
INPUT	BNC terminal for applying the external signal. The input is electrically isolated from the output terminals of the AC source.
ATT	Input attenuator switch
GAIN	Variable resistor for fine-adjusting the gain (voltage amplification ratio)
OFFSET	Variable resistor for fine-adjusting the offset.

EXT-AC Mode

In EXT-AC mode, the unit outputs AC voltage ranging from 0 V to 155 V (when the 155 V range is selected) or 0 V to 310 V (when the 310 V range is selected) with respect to a DC input signal ranging from 0 V to ±10 V.

CAUTION The ATT switch must be set ON. Otherwise the load can be damaged due to excessive voltage.

Step 1. Turn the AC source off

Step 2. Turn the ATT switch on. The allowable input DC voltage range is -10 V to +10 V.

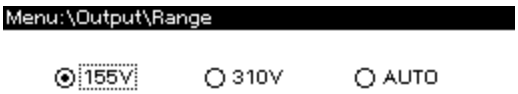
Step 3. Connect an external signal (generator) to the INPUT terminal.

Step 4. Turn the AC source on.

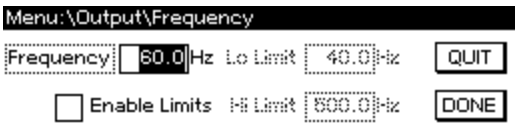
Step 5. Select EXT_AC mode.



Step 6. Select a voltage range (155 V or 310 V). Autoranging is not available in analog mode. If Auto was selected before the instrument entered EXT-AC mode, the presently selected range is retained.



Step 7. Set the frequency (40 Hz to 500 Hz). You can also set the frequency using the Meter display (see step 9).



Step 8. Apply the external signal to the INPUT terminal.

Step 9. Turn the output on. The analog output voltage is displayed on the Meter menu. Note that the frequency settings can be adjusted from the Meter display in the settings area.



Adjusting the Offset

You can fine-adjust the offset by turning the OFFSET adjustment using a Phillips screwdriver. Adjust the offset so that the output voltage is minimum with the input BNC connector shorted.

Adjusting the Gain

You can fine-adjust the gain by turning the GAIN adjustment using a Phillips screwdriver . Adjust the gain so that the output voltage is 155 Vac (in the 155 V range) when 10 VDC is applied to the input BNC connector.

EXT-DC Mode

In EXT-DC mode, the input waveform is simply amplified and output.

NOTE **With the ATT switch set OFF, the AC source outputs a voltage 100 or 200 times the input voltage ranging from -2.19 V to +2.19 V. With the ATT switch set ON, the AC source outputs voltage ranging from -219 V to +219 V (when 155 V range is selected) or -438 V to +438 V (when 310 V range is selected) with respect to a signal input ranging from -10 V to +10 V.**

Step 1. Turn the AC source off

Step 2. Set the ATT switch On or Off.
Off: The input voltage range is -1.90 V to +1.90 V (peak value) The allowable input DC voltage range is -10 V to +10 V.
On: The input voltage range is -10 V to +10 V.

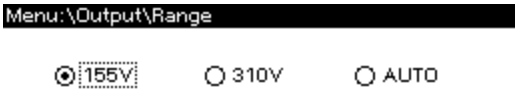
Step 3. Connect an external signal (generator) to the INPUT terminal.

Step 4. Turn the AC source on.

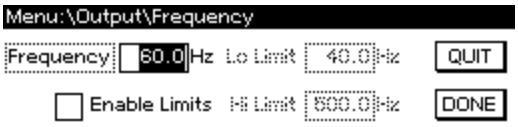
Step 5. Select EXT_DC mode.



Step 6. Select a voltage range (155 V or 310 V). Autoranging is not available in analog mode. If Auto was selected before the instrument entered EXT-AC mode, the presently selected range is retained.



Step 7. If an AC voltage is being applied, set the frequency (40 Hz to 500 Hz). To display the measured value accurately, set the frequency so that it matches the frequency of the external input signal. If the set frequency is out of synchronization, the measured value will be unstable.



Step 8. Apply the external signal to the INPUT terminal.

Step 9. Turn the output on. The analog output voltage is displayed on the Meter menu.



Adjusting the Offset

You can fine-adjust the offset by turning the OFFSET adjustment using a Phillips screwdriver. Adjust the offset so that the output voltage is as close to 0 V (DC) as possible with the ATT switch turned off and the input BNC connector shorted.

Adjusting the Gain

You can fine-adjust the gain by turning the GAIN adjustment using a Phillips screwdriver . Adjust the gain so that the output voltage is 155 Vac (in the 155 V range) when 1.55 Vac is applied to the input BNC connector with the ATT switch turned off.

Using Fault Inhibit Control

Live Mode

Latching Mode

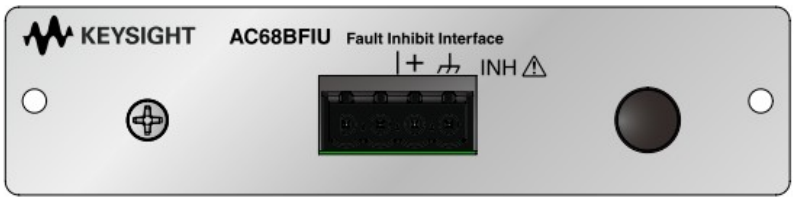
Inhibit Example

This section describes the functionality, the hardware and firmware requirements of the AC68BFIU Fault Inhibit Interface board for the AC68xxB Power Sources.

The Fault Inhibit interface board (option AC68BFIU) lets an external input signal control the output state of instrument. The input signal is level triggered. The signal is referenced to chassis ground. The input polarity and the operating mode are user-configurable.

CAUTION The AC68BFIU Fault Inhibit Interface board can only be installed in the "B" version AC power sources.

Inhibit Connections

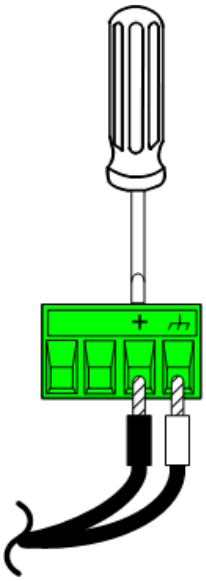


Electrical Characteristics

+ Input characteristic	Description
Maximum voltage rating:	16.5 VDC (Input is 5 V tolerant with internal pull-up)
Maximum low-level input voltage:	0.8 VDC
Minimum high-level input voltage:	2 VDC
Typical high-level current:	6 mA (@ 16.5 VDC)
Typical low-level current:	2 mA (@ 0 V with internal 2.2 k pull-up)
Minimum pulse width:	3 ms
Referenced to:	Chassis ground pin

Wire Connections

Make your connections as shown in the following figure. Connect the signal wire to the + pin. Connect the return wire to the ground pin 1. Wires size should be from AWG28 to AWG20. Strip the wires back approximately 7 mm.



Live Mode

Live mode - allows the enabled output to follow the state of the inhibit signal. When the inhibit signal is true, the output is disabled; when the inhibit signal is false, the output is enabled. The inhibit signal is not latched, and the inhibit event is not treated as a protection event. Therefore, a protection clear is not required when switching between inhibit true and inhibit false.

Step 1. Turn the AC source off

Step 2. Connect an external switch or circuit to the Inhibit terminals.

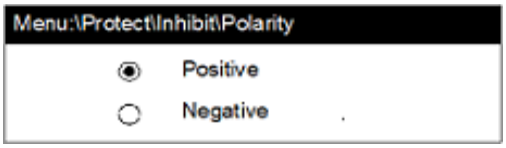
Step 3. Turn the AC source on.

Step 4. Select Live as the inhibit mode.



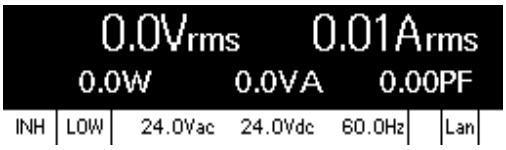
SCPI: OUTPut:INHibit:MODE

Step 5. Select a polarity for the Live inhibit mode.



SCPI: DIGital:PIN:POLarity

Step 6. Turn the output on. When the inhibit signal disables the output, the status indicator displays "INH". The voltage and current meters will display zero.



Latching Mode

Latching mode - disables the output when the inhibit signal is true. This is treated as a protection event, and output remains disabled regardless of subsequent inhibit signal changes. To return the output to normal operation, the Inhibit input must remain false and the latched inhibit signal must be cleared (see "Clearing a latched Inhibit Signal" at the end of this section). The output remains off after the protection is cleared and must be re-enabled to turn it on again.

Step 1. Turn the AC source off

Step 2. Connect an external switch or circuit to the Inhibit terminals.

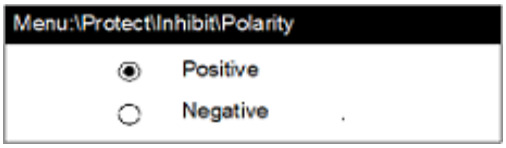
Step 3. Turn the AC source on.

Step 4. Select Latching as the inhibit mode.



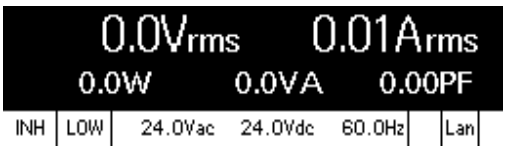
SCPI: OUTPut:INHibit:MODE

Step 5. Select a polarity for the Latching Inhibit mode.



SCPI: DIGital:PIN:POLarity

Step 6. Turn the output on. When the inhibit signal disables the output, the status indicator displays "INH". The voltage and current meters will display zero.

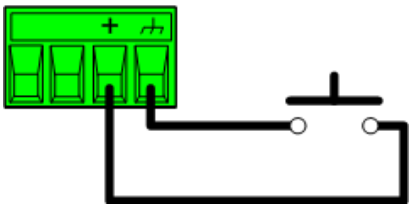


Inhibit Example

As shown in the following figure, you can connect the Inhibit input to a manual switch or external control signal that will short the inhibit pin to ground whenever it is necessary to disable the output. Negative polarity must be programmed for the inhibit pin in this case.

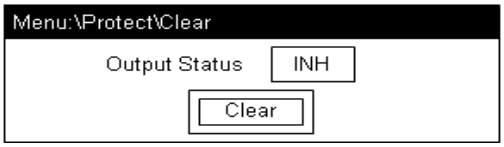
In Live mode, when the switch is closed (Inhibit signal is true) the output is disabled. When the switch is opened (Inhibit signal is false), the output will once again follow the output state setting.

In latching mode, when the switch is closed (inhibit signal is true) the output is disabled. This is treated as a protection event, and output remains disabled regardless of subsequent inhibit signal changes. To return the output to normal operation, the switch must be opened and the latched inhibit signal must be cleared (see "Clearing a latched Inhibit Signal" at the end of this section). The output remains off after the protection is cleared and must be re-enabled to turn it on again.



Clearing a latched Inhibit Signal

To clear a latched inhibit signal, select [Menu] > Protect > Clear. Then select Clear.



SCPI: OUTPut:PROTection:CLEar

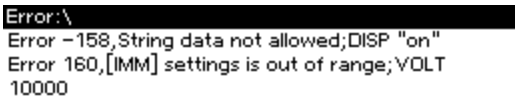
NOTE The output remains off after the protection function is cleared.

Viewing Error Messages

The Err annunciator in the lower right corner indicates messages in the error queue.



Press [Error] to view errors in the error queue. You can also use the SCPI SYSTem:ERRor? query to view error messages.



Errors in the error queue are stored and retrieved on a first-in, first-out basis. Once an error has been read, either by remote command or from the front panel, it is cleared. The only exception is self-test errors, which cannot be cleared until the underlying condition is corrected.

If no errors are in the error queue, "No errors" appears when you press [Error].

See SCPI Error Messages for a list of error messages.

3 SCPI Programming Reference

Introduction to SCPI

Status System Overview

Command Quick Reference

Commands by Subystem

- ABORt Subsystem
- CALibrate Subsystem
- CURRent Subsystem
- DIGital Subsytem
- DISPlay Subsystem
- FETCh/MEASure Subsystem
- FREQuency Subsystem
- HCOPy Subsystem
- IEEE-488 Common Commands
- INITiate Subsystem
- LXI Subsystem
- OUTPut Subsystem
- SENSe Subsystem
- STATus Subsystem
- SYSTem Subsystem
- TRIGger Subsystem
- VOLTage Subsystem

Default Settings

SCPI Error Messages

Introduction to SCPI

Introduction

Keywords

Queries

Command Separators and Terminators

Syntax Conventions

Parameter Types

Device Clear

Typical Command Processing Times

Introduction

This manual describes instrument programming using Standard Commands for Programmable Instruments (SCPI) over LAN, USB, and GPIB (optional). Select the interface type from the front panel, and be sure to understand the SCPI syntax and functions before you send SCPI commands and queries.

The SCPI language is an ASCII-based programming language for test and measurement instruments. SCPI has two types of commands, common and subsystem.

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines common commands that perform functions such as reset, self-test, and status operations. Common commands always begin with an asterisk (*), are three characters long, and may include parameters. The command keyword is separated from the first parameter by a space.

Subsystem Commands

Subsystem commands perform specific instrument functions. They extend one or more levels below the root in a hierarchical structure, or tree. Associated commands are grouped together under a common node, thus forming subsystems. A portion of the OUTPut subsystem is shown below to illustrate the tree system. Note that the brackets around a keyword, such as in [:STATe], indicate an optional keyword.

```
:OUTPut
   [:STATe] ON|1|OFF|0
   :COUPling AC|DC|ACDC
   :PROTection
      :CLEar
```

Keywords

Keywords, also referred to as headers, are instructions recognized by the instrument. Common commands are also keywords.

OUTPut is a root keyword, STATe, COUPling, and PROTection are second-level keywords, and CLEar are third-level keywords. Colons (:) separate the keyword levels.

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better readability, send the long form.

In the above examples, OUTP and OUTPUT are both acceptable. You can use upper- or lower-case letters. Therefore, OUTPUT, outp, and OuTp are all acceptable. Other forms, such as OUT, will generate an error.

Queries

Following a keyword with a question mark (?) turns it into a query (Example: VOLTage?, VOLTage:TRIGgered?). If a query contains parameters, place the question mark after the last keyword, before the parameters. Insert a space between the question mark and the first parameter.

You can query the value of most parameters. For example, to query the output voltage, send:

```
VOLTage?
```

You can also query the minimum or maximum allowable voltage:

```
VOLTage? MIN
VOLTage? MAX
```

Wait for all of the results of a query to be returned before sending another command or query. Otherwise, a *Query Interrupted* error will occur and the unreturned data will be lost.

Command Separators and Terminators

Separators

Colons (:) separate keyword levels. Blank spaces separate command parameters from their corresponding keyword. If a command requires more than one parameter, a comma separates parameters. In the following example, the frequency (100), low frequency limit (90), and high frequency limit (110) are separated by commas. Note the space after the word FREQuency.

```
FREQuency 100,90,110
```

Semicolons (;) separate commands within the same subsystem. This lets you send several subsystem commands within the same message string. For example, the following command:

```
FREQuency 100,90,110;MODE FIXed
```

is the same as sending the following commands:

```
FREQuency 100,90,110
FREQuency:MODE FIXed
```

You can also combine commands of different subsystems within a message string. In this case, you must use a colon to return the command parser to the root level in order to access another subsystem. For example, you could specify the frequency and turn on the output as follows:

```
FREQuency 100,90,110;:OUTPut ON
```

The colon after the semicolon returns the command parser to the root.

Terminators

A command string must terminate with a new line (<NL>) character. The IEEE-488 EOI (End-Or-Identify) message is interpreted as a <NL> character and can be used to terminate a command string in place of an <NL>. A carriage return followed by a new line (<CR><NL>) is also accepted. Command string termination always resets the SCPI command path to the root level.

Syntax Conventions

Triangle brackets (**< >**) indicate that a parameter. For example, in the command syntax DISPlay [:WINDow]:TEXT "<*string*>", the <*string*> parameter is inside triangle brackets. These brackets are not sent with the command string. For example, you could send DISPlay:WINDow:TEXT "Test in progress".

A vertical bar (**|**) separates multiple parameter choices for a given command string. For example, AC|DC|ACDC in the OUTPut:COUPling command indicates that you can specify AC, DC, or ACDC. The bar is not sent with the command string.

Square brackets (**[ ]**) indicate that a keyword or parameter is optional. These brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument ignores the parameter. In the DISPlay[:WINDow]:TEXT example above, the optional [:WINDow] level means that DISPlay:TEXT is the same as DISPlay:WINDow:TEXT.

Parameter Types

The SCPI language defines several data formats to be used in commands and queries.

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. If a command accepts only certain specific values, the instrument will automatically round the input numeric parameters to the accepted values. The following command requires a numeric parameter for the voltage value:

```
[SOURce:]CURRent <value>|MINimum|MAXimum
```

Note that special values for numeric parameters such as MINimum and MAXimum are also accepted. Instead of selecting a specific value for the voltage parameter, you can substitute MIN to set the voltage to its minimum allowable value, or MAX to set it to its maximum allowable value.

You can also optionally include the following engineering unit suffixes with numeric parameters:

Parameter	Default Unit
Voltage	V
Current	A
Wattage	W
Apparent Power	VA
Reactive Power	VAR
Degrees	DEG
Frequency	HZ

You may also put the following prefixes before a unit of measure:

Prefix	Meaning	Number
U	micro	1/1,000,000
M	milli	1/1,000
K	kilo	1,000

As with other SCPI keywords, both units and prefixes are case-insensitive. Thus, you could indicate millivolts as mv, mV, Mv, or MV.

Discrete Parameters

Discrete parameters specify settings that have a limited number of values (like IMMediate, EXTernal, or BUS). Like command keywords, they may have short and long forms. You can mix upper- and lower-case letters. Query responses always return the short form in upper-case letters. The following command requires a discrete parameter:

```
DISPlay:VIEW METER_VI|METER_VP|METER VIP
```

Boolean Parameters

Boolean parameters represent a single binary condition that is either true (1 or ON) or false (0 or OFF). A boolean query always returns 0 or 1. The following command requires a boolean parameter:

```
DISPlay ON|1|OFF|0
```

ASCII String Parameters

String parameters can contain virtually any ASCII characters. A string must begin and end with matching single (') or double (") quotation marks. To include the quote delimiter as part of the string, enter it twice without any characters in between. The following command uses a string parameter:

```
DISPlay:TEXT "Test in progress . . ."
```

Arbitrary Block Program or Response Data

Definite-length block data <Block> allows any type of device-dependent data to be programmed or returned as a series of 8-bit binary data bytes. This is particularly useful for transferring large quantities of data or 8-bit extended ASCII codes.

Device Clear

Device Clear is an IEEE-488 low-level bus message that you can use to return the instrument to a responsive state. Different programming languages and IEEE-488 interface cards provide access to this capability through their own unique commands. The status registers, the error queue, and all configuration states are left unchanged when a Device Clear message is received.

Device Clear performs the following actions:

If a measurement is in progress, it is aborted.

The instrument returns to the trigger idle state.

The instrument's input and output buffers are cleared.

The instrument is prepared to accept a new command string.

NOTE The ABORt command is the recommended method to terminate an instrument operation.

Typical Command Processing Times

The table below documents some typical, average command processing times (milliseconds) for various commands and queries. This can help you determine the impact of some common SCPI commands on total test time.

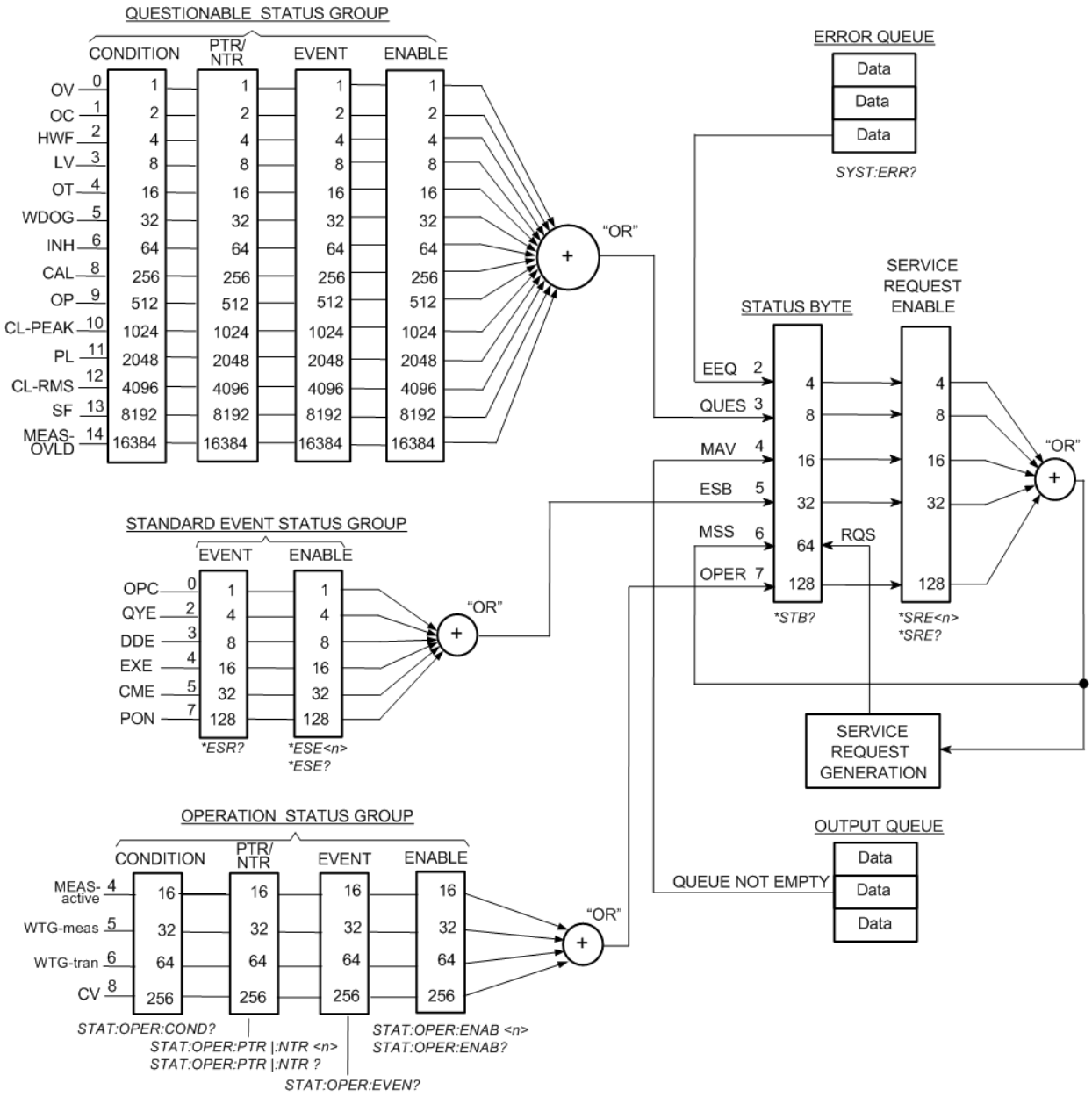
The command processing time is the time until the next command is accepted. It does not include hardware response time.

Command	GPIB [1]	USB	Description
*CLS	5	6	Clear the status data.
*RCL	233	230	Recall the contents of a state storage location.
*RST	233	230	Perform a device reset.
*SAV	13	14	Save the current settings.
FREQuency	15	17	Set the AC output frequency.
MEASure:CURRent:AC?	333	333	Query the AC current.
MEASure:VOLTage:AC?	333	333	Query the AC voltage.
OUTPut OFF	19	23	Turn the output OFF.
OUTPut ON	9	11	Turn the output on.
VOLTage	16	18	Set the AC voltage.

[1]Using Keysight IO Libraries.

Status Overview

This section provides a detailed description of the individual registers and register groups. The status diagram below provides an graphical view of how the status registers and groups are interconnected.



Status Registers

Operation Status Group

Questionable Status Group

Standard Event Status Group

Status Byte Register

Error and Output Queues

Status Registers

The Operation and Questionable status groups use four different types of registers to track qualify, flag, and enable instrument events. The Standard Event group only uses Event and Enable registers.

The instrument uses IEEE 488 and SCPI registers for the status reports. Each SCPI status register has the following subregisters:

CONDition register

EVENt register

ENABle register

The registers also include NTRansition and PTRansition filters.

Item	Description
CONDition register	A Condition register continuously monitors the instrument state and its bits are updated in real time. The bits are not latched, and reading this register does not affect the contents.
EVENt register	An Event register latches transitions that pass through the positive and negative transition registers. When an event bit is set, it remains set until the Event register is read. Reading the Event register clears it. The EVENt register bits are automatically set according to the changes in the CONDition register and is reset when read. The rule varies depending on the positive and negative transition filters (PTRansition and NTRansition).
ENABle register	An Enable register defines which bits in the event register are reported to the Status Byte register. You can write to or read from an enable register.
Transition filter	The transition filters enable or disable the reporting of events when the condition changes from false to true (PTRansition - positive) or from true to false (NTRansition - negative). If both filters are enabled, events will be reported each time the status changes; if both filters are cleared, event reporting is disabled.

Operation Status Group

These registers record signals that occur during normal operation. The group consists of a Condition, PTR/NTR, Event, and Enable register. The outputs of the Operation Status register group are logically OR-ed into the OPERation summary bit (7) of the Status Byte register. See Status Registers for a description of each register.

OPERation status register

The OPERation status register contains information about conditions that are part of the instrument's normal operation.

Bit	Value	Bit Name	Description
0-3	1 to 8	(not used)	(not used)
4	16	MEAS-active	A measurement is in progress.
5	32	WTG-meas	The instrument is waiting for a TRIGger for the measurement (ACQuire) trigger subsystem.
6	64	WTG-tran	The instrument is waiting for a TRIGger for the TRANsition trigger subsystem.
7	128	(not used)	(not used)
8	256	CV	The instrument is in constant voltage (CV) output mode
9-15	512 to 32,768	(not used)	(not used)

Questionable Status Group

These two register groups record signals that indicate abnormal operation. The bits in this register may indicate problems with acquired data. The group consists of a Condition, PTR/NTR, Event, and Enable register. The outputs of the Questionable Status group are logically OR-ed into the QUEStionable summary bit (3) of the Status Byte register. See Status Registers for a description of each register.

Bit	Value	Bit Name	Description
0	1	OV (Overvoltage Protection)	Output is disabled by the overvoltage protection
1	2	OC (Overcurrent protection)	Output is disabled by the overcurrent protection
2	4	HWF	Output is disabled by hardware failure
3	8	LV	Low voltage detected
4	16	OT	Output is disabled by the overtemperature protection
5	32	WDOG	Watchdog protection (caused by no SCPI IO activity over specified time)
6	64	INH	Remote inhibit is active
7	128	(not used)	0 is returned
8	256	CAL	Calibration failure
9	512	OP	Overpower protection
10	1024	CL-PEAK	Current Limit on PEAK (overload state)
11	2048	PL	Power limit (overload state)
12	4096	CL-RMS	Current Limit on RMS (overload state)
13	8192	SF	Sense Fault protection
14	16384	MEAS-OVLD	Measurement overload detected
15	32768	(not used)	0 is returned

Standard Event Status Group

These registers are programmed by Common commands. The group consists of an Event and Enable register. The Standard Event event register latches events relating to communication status. It is a read-only register that is cleared when read. The Standard Event enable register functions similarly to the enable registers of the Operation and Questionable status groups. See Status Registers for a description of each register.

The event status register bits are set when certain events occur during instrument operation.

The register is controlled by the IEEE 488 commands *ESE, *ESE?, and *ESR?.

Bit	Value	Bit Name	Description
0	1	Operation Complete (OPC)	All commands before and including *OPC have completed.
1	2	(not used)	0 is returned
2	4	Query Error (QYE)	The instrument tried to read an empty output buffer, a command was received before a previous query was read, or the input and output buffers are full.
3	8	Device Dependent Error (DDE)	A device-specific error occurred. Error Messages
4	16	Execution Error (EXE)	An execution error occurred. Error Messages. A valid SCPI command may not be executed correctly depending on the instrument's conditions.
5	32	Command Error (CME)	A command syntax error occurred. Error Messages
6	64	Reserved	0 is returned
7	128	Power ON (PON)	Power has been cycled since the last time the event register was read or cleared.

Status Byte Register

This register summarizes the information from all other status groups and stores STB and RQS messages as defined by the IEEE 488 standard. The *STB? query reads the status byte register and transmits the contents of the status byte register and the master status summary (MSS) message. The *STB? query does not change the status byte, MSS, or RQS.

Bit	Value	Bit Name	Description
0	1	Reserved	Reserved for future use; always set to 0.
1	2	Reserved	Reserved for future use; always set to 0.
2	4	Error/Event Queue (EEQ)	One or more errors are in the error queue. Use SYSTem:ERRor? to read and delete errors.
3	8	Questionable Status Summary (QUES)	One or more bits are set in the Questionable Data Register and the corresponding QUEStionable status enable register bit is true. See STATus:QUEStionable:ENABle.
4	16	Message Available (MAV)	Data is available in the instrument's output buffer.
5	32	Event Status Summary (ESB)	One or more bits are set in the Standard Event Status Register. Bits must be enabled, see *ESE.
6	64	Request Service (RQS/MSS)	One or more bits are set in the Status Byte Register and may generate a Request for Service or the Master Summary Status has one or more event bits. Bits must be enabled, see *SRE.
7	128	Operation Status Summary (OPER)	An event in the Operation Status register has been generated. Bits must be enabled, see STATus:OPERation:ENABle.

Master Status Summary and Request for Service Bits

MSS is a real-time (unlatched) summary of all Status Byte register bits that are enabled by the Service Request Enable register. MSS is set when the instrument has one or more reasons for requesting service. *STB? reads the MSS in bit position 6 of the response but does not clear any bits in the Status Byte register.

The RQS bit is a latched version of the MSS bit. Whenever the instrument requests service, it sets the SRQ interrupt line true and latches RQS into bit 6 of the Status Byte register. When the controller does a serial poll, RQS is cleared inside the register and returned in bit position 6 of the response. Other Status Byte register bits are not disturbed.

Error and Output Queues

The Error Queue is a first-in, first-out (FIFO) data register that stores numerical and textual description of an error or event. Error messages are stored until they are read with SYSTem:ERRor? If the queue overflows, the last error/event in the queue is replaced with error -350,"Queue overflow".

The Output Queue is a first-in, first-out (FIFO) data register that stores instrument-to-controller messages until the controller reads them. Whenever the queue holds messages, it sets the MAV bit (4) of the Status Byte register.

Command Quick Reference

ABORt Subsystem

Command/Query	Description
ABORt[:ALL]	Aborts both TRANsient and ACQuire operations.
ABORt:ACQuire	Aborts all ACQuire operations.
ABORt:TRANsient	Aborts all TRANsient actions.

CALibrate Subsystem

Command/Query	Description
CALibrate:COUNt?	Returns the calibration count.
CALibrate:CURRent:OFFSet <*value*>	Starts the DC current limit calibration for the specified voltage range.
CALibrate:DATA <*value*>	Enters the calibration value read from a multimeter.
CALibrate:DATE "<*date*>" CALibrate:DATE?	Sets the calibration date.
CALibrate:LEVel P1|P2|P3|P4|P5	Advances to the next calibration point.
CALibrate:PASSword "<*password*>"	Sets the Admin password, which is used for calibration.
CALibrate:SAVE	Saves the calibration data and date, not the administration password, into nonvolatile memory.
CALibrate:STATe ON|1|OFF|0 [,<password>] CALibrate:STATe?	Enables or disables calibration mode.
CALibrate:VOLTage[:LEVel] <*value*>	Selects the AC voltage range to calibrate.
CALibrate:VOLTage:OFFset <*value*>	Selects the DC voltage range to calibrate.

CURRent Subsytem

Command/Query	Description
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <*value*>|MINimum|MAXimum [SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MINimum|MAXimum]	Sets the immediate AC current limit in amps (rms).
[SOURce:]CURRent:OFFSet[:IMMediate] <*value*>|MINimum|MAXimum [SOURce:]CURRent:OFFSet[:IMMediate]? [MINimum|MAXimum]	Sets the immediate DC current limit in amps.
[SOURce:]CURRent:PROTection:STATe ON|1|OFF|0 [SOURce:]CURRent:PROTection:STATe?	Enables or disables current protection.

DIGital Subsystem

Command/Query	Description
[SOURce:]DIGital:PIN:POLarity POSitive|NEGative [SOURce:]DIGital:PIN:POLarity?	Sets the polarity of the remote inhibit digital pin.

DISPlay Subsystem

Command/Query	Description
DISPlay[:WINDow]:METer:COUPling AC|DC|ACDC DISPlay[:WINDow]:METer:COUPling?	Selects the data to show on the meter display.
DISPlay[:WINDow][:STATe] ON|1|OFF|0 DISPlay[:WINDow][:STATe]?	Turns the front-panel display on or off.
DISPlay[:WINDow]:TEXT "<*string*>" DISPlay[:WINDow]:TEXT?	Displays a text message on the display.
DISPlay[:WINDow]:TEXT:CLEar	Clears the text message from the display.
DISPlay[:WINDow]:VIEW METER_VI|METER_VIP|METER_ALL DISPlay[:WINDow]:VIEW?	Selects the parameters to display on the front panel.

FETCh and MEASure Subsystems

Command/Query	Description
FETCh:ALL? MEASure:ALL?	Returns all measurements, except FREQuency, as a comma-separated list.
FETCh: CURRent[:DC]? MEASure: CURRent[:DC]?	Average DC current (A)
FETCh:CURRent:AC? MEASure:CURRent:AC?	AC current (Arms)
FETCh:CURRent:ACDC? MEASure:CURRent:ACDC?	Current, AC+DC (Arms)
FETCh:CURRent:AMPLitude:MAXimum[:INSTant]? MEASure:CURRent:AMPLitude:MAXimum[:INSTant]?	Peak current (A)
FETCh: CURRent:AMPLitude:MAXimum:HOLD? MEASure: CURRent:AMPLitude:MAXimum:HOLD?	Peak AC current held value (A)
FETCh: CURRent:CREStfactor? MEASure: CURRent:CREStfactor?	Crest factor
FETCh:FREQuency? MEASure:FREQuency?	AC output frequency (Hz)
FETCh:POWer[:DC]? MEASure:POWer[:DC]?	Average DC power (W)
FETCh: POWer:AC[:REAL]? MEASure: POWer:AC[:REAL]?	AC active power (W)
FETCh: POWer:AC:APParent? MEASure: POWer:AC:APParent?	AC apparent power (VA)
FETCh: POWer:AC:PFACtor? MEASure: POWer:AC:PFACtor?	AC power factor
FETCh:POWer:AC:REACtive? MEASure:POWer:AC:REACtive?	AC reactive power (VAR)
FETCh: POWer:ACDC[:REAL]? MEASure: POWer:ACDC[:REAL]?	AC active power (W)
FETCh: POWer:ACDC:APParent? MEASure: POWer:ACDC:APParent?	AC+DC apparent power (VA)
FETCh: POWer:ACDC:PFACtor? MEASure: POWer:ACDC:PFACtor?	AC+DC power factor
FETCh: POWer:ACDC:REACtive? MEASure: POWer:ACDC:REACtive?	AC+DC reactive power (VAR)
FETCh:VOLTage[:DC]? MEASure:VOLTage[:DC]?	Average DC voltage (V)
FETCh: VOLTage:AC? MEASure: VOLTage:AC?	AC output voltage (Vrms)
FETCh: VOLTage:ACDC? MEASure: VOLTage:ACDC?	Voltage, AC+DC (Vrms)

FREQuency Subsystem

Command/Query	Description
[SOURce:]FREQuency[:CW] <*value*>|MINimum|MAXimum[,<*lower_limit*>,<*upper_limit*>] [SOURce:]FREQuency[:CW]? [MINimum|MAXimum] [SOURce:]FREQuency[:IMMediate] <*value*>|MINimum|MAXimum[,<*lower_limit*>,<*upper_limit*>] [SOURce:]FREQuency[:IMMediate]? [MINimum|MAXimum]	Sets the immediate AC frequency and optionally the frequency soft limits.
[SOURce:]FREQuency:LIMit:LOWer <*value*>|MINimum|MAXimum [SOURce:]FREQuency:LIMit:LOWer? [MINimum|MAXimum] [SOURce:]FREQuency:LIMit:UPPer <*value*>|MINimum|MAXimum [SOURce:]FREQuency:LIMit:UPPer? [MINimum|MAXimum]	Sets the lower or upper AC frequency soft limit.
[SOURce:]FREQuency:LIMit[:STATe] ON|1|OFF|0 [SOURce:]FREQuency:LIMit[:STATe]?	Enables or disables frequency soft limits.
[SOURce:]FREQuency:MODE FIXed|STEP [SOURce:]FREQuency:MODE?	Sets the transition mode for frequency settings.
[SOURce:]FREQuency:TRIGgered <*value*>|MINimum|MAXimum [SOURce:]FREQuency:TRIGgered? [MINimum|MAXimum]	Sets the triggered AC output frequency when frequency mode is STEP.

HCOPy Subsystem

Command/Query	Description
HCOPy:SDUMp:DATA?	Returns the display image in BMP format.

IEEE-488 Subsystem

Command/Query	Description
*CLS	Clear status command.
*ESE <*value*> *ESE?	Event status enable command and query.
*ESR?	Event status event query.
*IDN?	Identification Query. Returns the instrument's identification string.
*LRN?	Learn query. Returns the SCPI strings that reproduce the present instrument settings.
*OPC	Sets the OPC (operation complete) bit in the standard event register.
*OPC?	Returns a 1 to the output buffer when all pending operations complete.
*OPT?	Returns a string identifying any installed options.
*PSC 0|1 *PSC?	Enables (1) or disables (0) the clearing of certain enable registers at power on.
*RCL <*0 to 10*>	Recalls a saved instrument state.
*RST	Resets the instrument to default values.
*SAV <0 to 10>	Saves the instrument state to a nonvolatile memory location.
*SRE <*value*> *SRE?	Service request enable command and query.
*STB?	Status byte query. Reads the Status Byte Register, which contains the status summary bits and the Output Queue MAV bit.
*TRG	Trigger command. Applies a software trigger (equivalent to IEEE 488.1 Device Trigger) for both TRANsient and ACQuire trigger groups.
*TST?	Self-test. Returns the errors found during the most recent power-on self-test.

INITiate Subsystem

Command/Query	Description
INITiate[:IMMediate]:ACQuire	Initiates the ACQuire (measurement) operation.
INITiate[:IMMediate]:TRANsient	Initiates the TRANsient operation.
INITiate:CONTinuous:ACQuire ON|1|OFF|0	Initiates a new measurement and enables or disables "continuous" mode.

LXI Subsystem

Command/Query	Description
LXI:IDENtify[:STATe] ON|1|OFF|0 LXI:IDENtify[:STATe]?	Turns the front-panel LXI identify indicator (blinking "Lan" annunciator) on or off.

OUTPut Subsystem

Command/Query	Description
OUTPut[:STATe] ON|1|OFF|0 OUTPut[:STATe]?	Enables or disables the instrument's output.
OUTPut:COUPling AC|DC|ACDC OUTPut:COUPling?	Sets the output coupling mode.
OUTPut:INHibit:MODE LATChing|LIVE|OFF OUTPut:INHibit:MODE?	Sets the operating mode of the remote inhibit digital pin.
OUTPut:PON:STATe RST|RCL0|AUTO OUTPut:PON:STATe?	Sets the power-on output state.
OUTPut:PROTection:CLEar	Resets the latched protection.
OUTPut:PROTection:WDOG[:STATe] ON|1|OFF|0 OUTPut:PROTection:WDOG[:STATe]?	Enables or disables the I/O watchdog timer.
OUTPut:PROTection:WDOG:DELay <*value*>|MINimum|MAXimum OUTPut:PROTection:WDOG:DELay? [MINimum|MAXimum]	Sets the watchdog delay time.

SENSe Subsytem

Command/Query	Description
SENSe:AVERage1|2|4|8|16 SENSe:AVERage?	Sets the averaging count for measurements.
SENSe:CURRent[:PEAK]:HOLD:CLEar	Clears the peak held current measurement.

STATus Subsystem

Command/Query	Description
STATus:OPERation[:EVENt]	Queries the event register for the Operation Status group.
STATus:OPERation:CONDition?	Queries the operation condition register.
STATus:OPERation:ENABle <*value*> STATus:OPERation:ENABle?	Sets the value of the enable register for the Operation Status group.
STATus:OPERation:NTRansition <*value*> STATus:OPERation:NTRansition? STATus:OPERation:PTRansition <*value*> STATus:OPERation:PTRansition?	Sets and queries the value of the NTR (Negative-Transition) and PTR (Positive-Transition) registers.
STATus:PRESet	Initializes the transition and enable filters for both SCPI register groups (OPERation and QUEStionable).
STATus:QUEStionable[:EVENt]?	Queries the event register for the Questionable Status group.
STATus:QUEStionable:CONDition?	Queries the condition register for the Questionable Status group.
STATus:QUEStionable:ENABle <*value*> STATus:QUEStionable:ENABle?	Sets the value of the enable register for the Questionable Status group.
STATus:QUEStionable:NTRansition <*value*> STATus:QUEStionable:NTRansition? STATus:QUEStionable:PTRansition <*value*> STATus:QUEStionable:PTRansition?	Sets and queries the value of the NTR (Negative-Transition) and PTR (Positive-Transition) registers.

SYSTem Subsystem

Command/Query	Description
SYSTem:BEEPer[:IMMediate]	Issues a single beep.
SYSTem:BEEPer:KCLick ON|1|OFF|0 SYSTem:BEEPer:KCLick?	Disables or enables the click tone heard when you press a front-panel key.
SYSTem:BEEPer:STATe ON|1|OFF|0 SYSTem:BEEPer:STATe?	Disables or enables the beep heard when an error is generated.
SYSTem:COMMunicate:RLSTate LOCal|REMote|RWLock SYSTem :COMMunicate:RLSTate?	Configures the remote/local/lockout state of the instrument.
SYSTem:ERRor[:NEXT]?	Reads and clears one error from the error queue.
SYSTem:ERRor:COUNt?	Returns the number of errors in the error queue.
SYSTem:SECurity:IMMediate	Clears all user memory (including stored states) and reboots the instrument in the *RST state.
SYSTem:SSAVer[:STATe] ON|1|OFF|0 SYSTem:SSAVer[:STATe]?	Enables or disables the screen saver.
SYSTem:SSAVer:DELay <*seconds*>|MINimum|MAXimum SYSTem:SSAVer:DELay? [MINimum|MAXimum]	Sets the delay time for screen saver activation.
SYSTem:SSAVer:RWAKeup ON|1|OFF|0 SYSTem:SSAVer:RWAKeup?	Enables or disables remote screen saver wake-up.
SYSTem:VERSion?	Returns the version of SCPI that the instrument uses.

TRIGger Subsystem

Command/Query	Description
TRIGger:ACQuire[:IMMediate]	Sends a software trigger to the ACQuire subsystem.
TRIGger:ACQuire:SOURce IMMediate|BUS TRIGger:ACQuire:SOURce?	Sets the trigger source that starts the measurement after INIT:ACQ.
TRIGger:SYNChronize:SOURce IMMediate|PHASe TRIGger:SYNChronize:SOURce?	Sets the output-on phase control when OUTPut ON is sent.
TRIGger:SYNChronize:PHASe[:ON] <*value*>|MINimum|MAXimum TRIGger:SYNChronize:PHASe? [MINimum|MAXimum]	Sets the phase angle of the output-on phase control in degrees.
TRIGger:TRANsient[:IMMediate]	Triggers the TRANsient subsystem.
TRIGger:TRANsient:SOURce IMMediate|BUS TRIGger:TRANsient:SOURce?	Sets the trigger source for changing the setting value after INIT:TRAN.

VOLTage Subsystem

Command/Query	Description
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <*value*>|MINimum|MAXimum[, <*low_limit*>|MINimum|MAXimum, <*high_limit*>|MINimum|MAXimum] [SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MINimum|MAXimum]	Sets the immediate AC voltage level, and optionally the soft limits.
[SOURce:]VOLTage[:LEVel]:LIMit[:STATe] ON|1|OFF|0 [SOURce:]VOLTage[:LEVel]:LIMit[:STATe]?	Enables or disables soft limits for AC voltage.
[SOURce:]VOLTage[:LEVel]:LIMit:LOWer <*value*>|MINimum|MAXimum [SOURce:]VOLTage[:LEVel]:LIMit:LOWer? [MINimum|MAXimum]	Sets the lower and upper AC voltage limits.
[SOURce:]VOLTage[:LEVel]:LIMit:UPPer <*value*>|MINimum|MAXimum [SOURce:]VOLTage[:LEVel]:LIMit:UPPer? [MINimum|MAXimum]	
[SOURce:]VOLTage[:LEVel]:MODE FIXed|STEP [SOURce:]VOLTage[:LEVel]:MODE?	Sets the trigger transient mode for voltage settings.
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] <*value*>|MINimum|MAXimum [SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [MINimum|MAXimum]	Sets the triggered AC voltage level.
[SOURce:]VOLTage:OFFSet[:IMMediate] <*value*>|MINimum|MAXimum [,<*low_limit*>|MINimum|MAXimum,<*high_limit*>|MINimum|MAXimum] [SOURce:]VOLTage:OFFSet[:IMMediate]? [MINimum|MAXimum]	Sets the immediate DC voltage in VDC, and also optionally sets the soft limits.
[SOURce:]VOLTage:OFFSet:LIMit[:STATe] ON|1|OFF|0 [SOURce:]VOLTage:OFFSet:LIMit[:STATe]?	Enables or disables soft limits for DC voltage.
[SOURce:]VOLTage:OFFSet:LIMit:LOWer <*value*>|MINimum|MAXimum [SOURce:]VOLTage:OFFSet:LIMit:LOWer? [MINimum|MAXimum]	Sets the lower and upper DC voltage soft limits.
[SOURce:]VOLTage:OFFSet:LIMit:UPPer <*value*>|MINimum|MAXimum [SOURce:]VOLTage:OFFSet:LIMit:UPPer? [MINimum|MAXimum]	
[SOURce:]VOLTage:OFFSet:MODE FIXed|STEP [SOURce:]VOLTage:OFFSet:MODE?	Sets the trigger transient mode for DC voltage settings.
[SOURce:]VOLTage:OFFSet:TRIGgered <*value*>|MINimum|MAXimum [SOURce:]VOLTage:OFFSet:TRIGgered? [MINimum|MAXimum]	Sets the triggered DC voltage in VDC.
[SOURce:]VOLTage:PROGramming:SOURce INTernal|EXTAC|EXTDC [SOURce:]VOLTage:PROGramming:SOURce?	Sets the voltage programming source.
[SOURce:]VOLTage:RANGe[:UPPer] 155|310|MINimum|MAXimum [SOURce:]VOLTage:RANGe[:UPPer]? [MINimum|MAXimum]	Sets the voltage range.
[SOURce:]VOLTage:RANGe:AUTO ON|1|OFF|0 [SOURce:]VOLTage:RANGe:AUTO?	Enables or disables voltage autoranging.

ABORt Subsystem

ABORt commands cancel any triggered actions and returns the trigger system back to the Idle state. Send TRIG:SYNC:SOUR IMM instead of ABORt to abort phase synchronization. ABORt commands are also executed with the *RST command.

ABORt[:ALL]

Aborts both TRANsient and ACQuire operations.

Parameter	Typical Return
(none)	(none)
Abort TRANsient and ACQuire operations: ABOR:ALL	

The trigger status at power-on is the same as that after an ABORt.

If an ABORt is sent when a transient or acquisition is in progress, the ACQuire group's acquired data remains invalid.

If an ABORt is sent when the ACQuire group is not initiated and the acquired data that is held is valid, the acquired data is retained.

ABORt:ACQuire

Aborts all ACQuire operations.

Parameter	Typical Return
(none)	(none)
Abort the triggered measurement: ABOR:ACQ	

This command resets the WTG-meas and MEAS-active bits in the Operation Status registers.

If INIT:CONT:ACQ is ON, the ABORt:ACQuire command aborts the measurement but the instrument immediately re-initiates new measurements.

ABORt:TRANsient

Aborts all TRANsient actions.

Parameter	Typical Return
(none)	(none)
Abort any TRANsient actions: ABOR:TRAN	

This command resets the WTG-tran bit in the Operation Status registers.

CALibrate Subsystem

This subsystem calibrates the instrument.

NOTE Follow the procedure in the calibration section before calibrating. Improper calibration can reduce accuracy and reliability.

CALibrate:COUNt?

Returns the calibration count.

Parameter	Typical Return
(none)	+14
Return the calibration count: CAL:COUN?	

The calibration count is incremented whenever any of the following commands is executed:

– CALibrate:SAVE ([Menu] > System > Admin > Cal > Save)

– CALibrate:DATE ([Menu] > System > Admin > Cal > Date)

– CALibrate:PASSword ([Menu] > System > Admin > Password)

– CALibrate:PASSword:RESet

You may execute this query regardless of the CALibrate:STATe value.

CALibrate:CURRent:OFFSet <*value*>

Starts the DC current limit calibration for the specified voltage range.

Parameter	Typical Return
The maximum current of the output range being calibrated, as shown in the table below.	(none)
Calibrate the 10-A current range: CAL:CURR:OFFS 10	

The CALibrate:STATe must be ON to execute this command.

The <*value*> that you specify will select the range to be calibrated, as shown in the table below. For example, a <*value*> of 8 will select the 310 V range on the AC6803B, but the 155 V range on the AC6802B.

	AC6801B	AC6802B	AC6803B	AC6804B
310 V Range	2.0	4.0	8.0	16.0
155 V Range	4.0	8.0	16.0	32.0

Do not use any unit suffix (such as A) in this command.

CALibrate:DATA <*value*>

Enters the calibration value read from a multimeter.

Parameter	Typical Return
Numeric value	(none)
Specify calibration value 0.0237: CAL:DATA 2.37E-2	

The CALibrate:STATe must be ON to execute this command.

Do not use any unit suffix (such as A) in this command.

The CURRent calibration unit is always amps (DC) or amps-rms (AC).

The VOLTage calibration unit is always volts (DC) or volts-rms (AC).

CALibrate:DATE "<*date*>"
CALibrate:DATE?

Sets the calibration date. Use CALibrate:SAVE to store the date into nonvolatile memory.

Parameter	Typical Return
"<*date*>"	"2013 Jul 26"
Enter the calibration date: CAL:DATE "2014 Jul 26"	

The CALibrate:STATe must be ON to execute this command.

This command increments the calibration count by 1.

The date may be up to 15 characters.

Use the format shown above (or the local language equivalent) to avoid confusion. For example, there may be confusion as to whether "14/06/13" is June 14, 2013 or June 13, 2014. The format "2013 Jun 14" avoids that problem.

You may query the value regardless of whether the calibration state is on.

CALibrate:LEVel P1|P2|P3|P4|P5

Advances to the next calibration point. P1 is the first level; P2 is the second, and so on.

WARNING **Some calibration steps may generate very high voltages (such as +155 VAC, +310 VAC, and ±380 VDC). This procedure should only be performed by people with appropriate training, always exercising appropriate caution.**

Parameter	Typical Return
P1|P2|P3|P4|P5	(none)
Select the first calibration point: CAL:LEV P1	

The CALibrate:STATe must be ON to execute this command.

Some calibration sequences may require some settling time after sending CAL:LEV but before reading the data from the DVM and sending CAL:DATA.

AC calibration is performed at 55 Hz for P1 and P2, and higher frequency for P3, P4, and P5.

The calibration steps for each item are shown below:

Calibration Item	P1	P2	P3	P4	P5
CAL:VOLT 155	10% FS	90% FS	90% FS @ 300 Hz	90% FS @ 400 Hz	90% FS @ 500 Hz
CAL:VOLT 310					
CAL:VOLT 219	0% FS	90% FS			
CAL:VOLT 438				n/a	
CAL:CURR <*low_val*>					
CAL:CURR <*high_val*>					

The voltage full-scale (FS) values are 155 VAC (LOW) and 310 VAC (HIGH) for all models.

The current full-scale (FS) values are shown below.

Model	LOW	HIGH
AC6801B	4.0 A	2.0 A
AC6802B	8.0 A	4.0 A
AC6803B	16.0 A	8.0 A
AC6804B	32.0 A	16.0 A

CALibrate:PASSword "<*password*>"

Sets the Admin password, which is used for calibration.

Parameter	Typical Return
an alphanumeric string of 4 to 15 characters	(none)
Set the password to 12345: CAL:PASS "12345"	

The password must be 4 to 15 characters long and may include any of these characters:

Characters	Description
A-Z	Upper case letters
a-z	Lower case letters
0-9	Numeric digits
+ - ( ) . , <space>	Plus, minus, parentheses, period, comma, space

The CALibrate:STATe must be ON to execute this command.

This command increments the calibration count by 1.

The password is case sensitive.

To change the password: unsecure calibration memory with the old code, then set the new code.

If you enter an empty string as the new password and save it with CAL:SAVE once, no password will be required to newly enter the calibration mode the next time.

This setting is non-volatile; it will not be changed by power cycling or *RST.

CALibrate:SAVE

Saves the calibration data and date, not the administration password, into nonvolatile memory. Do this at the end of the calibration to avoid losing changes.

Parameter	Typical Return
(none)	(none)
Store calibration constants into nonvolatile memory: CAL:SAVE	

The CALibrate:STATe must be ON to execute this command.

This command increments the calibration count by 1.

CALibrate:STATe ON|1|OFF|0 [,<password>]
CALibrate:STATe?

Enables or disables calibration mode. Calibration mode must be enabled for the instrument to accept any calibration commands.

Parameter	Typical Return
ON|1|OFF|0 , default OFF	0 (OFF) or 1 (ON)
<*password*> a numeric value up to 15 digits	(none)
Disable calibration: `CAL:STAT OFF`	
Enable calibration: `CAL:STAT ON ,"abc123"`	

The <*password*> is required if it has been set. The factory default is no password, but if one has been set, you must send CALibrate:STATe ON,12345 (replacing 12345 with your instrument's password).

You cannot enable front-panel calibration and SCPI calibration simultaneously.

CALibrate:VOLTage[:LEVel] <*value*>
CALibrate:VOLTage:OFFset <*value*>

Selects the voltage range to calibrate.

Parameter	Typical Return
Either 219 or 438 (for DC OFFset) or 155 or 310 (for AC LEVel).	(none)
Calibrate the voltage of the 310 V range: `CAL:VOLT:LEV 310`	

The CALibrate:STATe must be ON to execute this command.

The CALibrate:VOLTage[:LEVel] command is for AC voltage, and the CALibrate:VOLTage:OFFSet command is for DC voltage.

Do not use unit suffixes, such as V or mV, with this command.

CURRent Subsytem

The CURRent subsystem limits the instrument's output current.

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <*value*>|MINimum|MAXimum
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MINimum|MAXimum]

Sets the immediate AC current limit in amps (rms).

Parameter	Typical Return
AC6801B 0.1 to 5.2 A AC6802B 0.2 to 10.5 A AC6803B 0.4 to 21.0 A AC6804B 0.8 to 42.0 A	+9.00000E-01
Sets the current limit to 900 milliamps: `CURR 900 MA`	

Current units (UA, MA, A) are allowed.

Values exceeding the instrument's maximum value will be set to the instrument's maximum value.

The *RST default is the instrument's MAXimum value.

[SOURce:]CURRent:OFFSet[:IMMediate] <*value*>|MINimum|MAXimum
[SOURce:]CURRent:OFFSet[:IMMediate]? [MINimum|MAXimum]

Sets the immediate DC current limit in amps.

Parameter	Typical Return
AC6801B 0.1 to 4.2 A AC6802B 0.2 to 8.4 A AC6803B 0.4 to 16.8 A AC6804B 0.8 to 33.6 A	+3.00000E+00
Set the DC current limit to 3 A: `CURR:OFFS 3`	

Current units (UA, MA, A) are allowed.

Values exceeding the instrument's maximum value will be set to the instrument's maximum value.

The *RST default is the instrument's MAXimum value.

[SOURce:]CURRent:PROTection:STATe ON|1|OFF|0
[SOURce:]CURRent:PROTection:STATe?

Enables or disables current protection.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Enable limit control operation: CURR:PROT:STATe OFF	

ON (TRIP): Turns OUTPUT off and activates the alarm for overload conditions longer than three seconds.

OFF (LIMIT CONTROL): Decreases output voltage to keep current at or below the limit when an overload occurs.

To clear an overcurrent condition, remove the condition's cause and send OUTPut:PROTection:CLEar.

If overcurrent protection is enabled and the output goes into current limit, the output is disabled and the Questionable Condition status register OCP bit is set.

The *RST command sets this parameter to ON.

DIGital Subsystem

The Digital subsystem has just one command.

NOTE This command only applies when option AC68BFIU (the Fault Inhibit interface board) is installed in the AC source.

[SOURce:]DIGital:PIN:POLarity POSitive|NEGative
[SOURce:]DIGital:PIN:POLarity?

Sets the polarity of the remote inhibit digital pin. POSitive means a logical true signal is a voltage high at the pin. NEGative means a logical true signal is a voltage low at the pin.

Parameter	Typical Return
POSitive|NEGative	POS or NEG
Sets the digital pin to negative polarity: DIG:PIN:POL NEG	

The pin polarities are saved in non-volatile memory.

DISPlay Subsystem

The DISPlay subsystem controls the front-panel display.

DISPlay[:WINDow]:METer:COUPling AC|DC|ACDC
DISPlay[:WINDow]:METer:COUPling?

Selects the data to show on the meter display.

Parameter	Typical Return
AC|DC|ACDC	AC, DC, or ACDC
Set the meter to display DC measurements: DISP:MET:COUP DC	

AC shows pure AC measurement data, DC shows DC measurement data, and ACDC shows all AC and DC measurement data.

The *RST command sets this parameter to ACDC.

DISPlay[:WINDow][:STATe] ON|1|OFF|0
DISPlay[:WINDow][:STATe]?

Turns the front-panel display on or off.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Turn the front-panel display off: DISP:STAT OFF	

Setting this OFF stops the refreshing of the display, turns off the display's backlight, changes the LINE LED to orange, and disables all front-panel key operations.

The *RST command sets this parameter to ON.

DISPlay[:WINDow]:TEXT "<*string*>"
DISPlay[:WINDow]:TEXT?

Displays a text message on the display.

Parameter	Typical Return
Quoted string of up to 127 characters, default "". "Test running. Do not touch."	
Show message on display: DISP:TEXT "Test in progress..."	

While a message is displayed, instrument operation information is not sent to the front-panel display.

To clear the text, send the DISPlay:TEXT:CLEar command or cycle power.

The display text is unaffected by *RCL and *RST`.

DISPlay[:WINDow]:TEXT:CLEar

Clears the text message from the display.

Parameter	Typical Return
(none)	(none)
Clear message on display: DISP:TEXT:CLE	

The display text is unaffected by *RCL and *RST`.

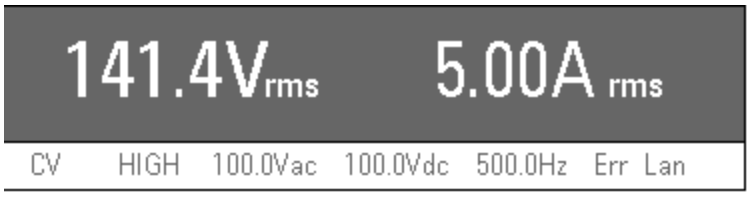
DISPlay[:WINDow]:VIEW METER_VI|METER_VIP|METER_ALL
DISPlay[:WINDow]:VIEW?

Selects the parameters to display on the front panel.

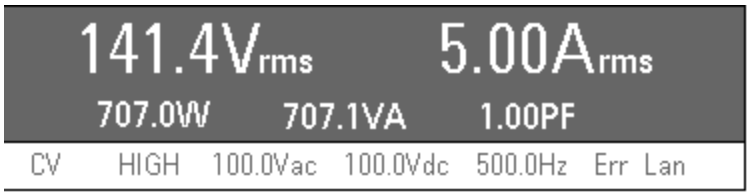
Parameter	Typical Return
METER_VI|METER_VP|METER_VIP, *RST METER_VI	METER_VI, METER_VIP, or METER_ALL
Display voltage and current: DISP:VIEW METER_VI	

Examples of the various displays are shown in the table below.

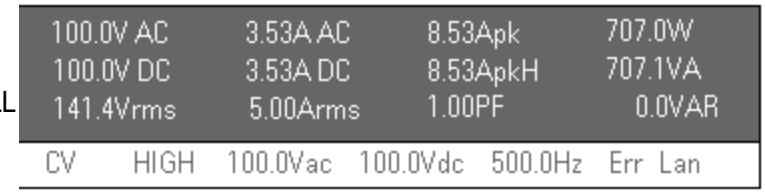
METER_VI



METER_VIP



METER_ALL



FETCh and MEASure Subsystems

The FETCh and MEASure subsystems return measured data. The FETCh and MEASure queries do not take any parameters, and they have the identical syntax (such as FETCh:VOLTage:AC? and MEASure:VOLTage:AC?).

Measurements may be acquired continuously or non-continuously, as specified by INITiate:CONTinuous:ACQuire. The *RST and *RCL commands disable continuous operation.

Non-continuous measurement mode

MEASure Subsystem

A MEASure query or an IMMediate or BUS trigger generates a new measurement that is stored in a buffer and then returned to the user.

Before the instrument can accept an IMMediate or BUS trigger, you must first send INITiate:ACQuire. Otherwise, the instrument will generate SCPI error -211,"Trigger ignored" . The buffer retains the measured data until cleared by another MEASure query, an accepted IMMediate or BUS trigger, a *RST or INITiate:ACQuire command, or a power cycle.

FETCh Subsystem

A FETCh query immediately returns the previously acquired measurement from this buffer. If no measurement is in the buffer, the instrument generates SCPI error -230,"Data corrupt or stale".

General Measurement Operation

Data acquisition occurs at 333 ms intervals, which includes a digitization aperture of 100 to 125 ms. If there are no MEASure queries or triggers, the data is discarded.

When a MEASure query or IMMediate or BUS trigger is received, the instrument waits for the current digitization to finish, discards the data, and waits for the next measurement interval to finish. The instrument then stores the next measurement into the buffer to ensure that the entire measurement was sampled after the MEASure query or IMMediate or BUS trigger. Therefore, a measurement could require from 333 to 666 ms to complete.

The acquired measurement includes both the instantaneous voltage and current. The FETCh query may return any calculated measurement item derived from this data, including FETC:CURR:DC?, FETC:VOLT:AC?, and FETC:POW:ACDC?.

For averaged measurements of 2, 4, 8, or 16 intervals, the instrument stores and averages multiple measurements. Therefore, a measurement could take up to 17 x 333 ms to complete.

Continuous measurement mode

Internal data acquisition occurs at 333 ms update intervals, including the aperture as described above, and each completed measurement overwrites the previous data in the buffer. Averaged

measurements are a moving average of the latest 2, 4, 8, or 16 measurements.

All MEASure and FETCh queries return the measurement presently stored in the buffer, and both BUS and IMMediate triggers are ignored.

FETCh:ALL?
MEASure:ALL?

Returns all measurements, except FREQuency, as a comma-separated list. Every returned item is available, regardless of the measurement coupling or output coupling.

Parameter	Typical Return
(none)	+1.23456E+00
Return the average measured AC output current: FETCh:CURRent:AC?	

The values are returned in the order shown below, using the format 1.23456E+00.

The formulas are similar for voltage and current. All raw measurements (individual A/D conversions and associated array elements), are understood to be DC coupled. This discussion does not consider the effects of windowing (used to ensure stable readings) and adjustments that must be made to correct for window gain (always less than unity when compared to a rectangular window).

General definitions are as follows:

Array Length: N

Array Index Variable: n = 0, 1, 2, ..., N-1

Voltage Array: Volt[N]

Current Array: Current[N]

FETCh/MEASure Query	Notes
CURRent[:DC]?	This command applies to DC, AC+DC, and EXT-DC.
Average DC current (A)	Set the averaging period using SENS:AVER.
$I_{DC} = \frac{1}{N}\left[\sum_{n=0}^{N-1}[Current_n]\right]$	
CURRent:AC?	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
AC current (Arms)	
$I_{AC} = \sqrt{(I_{RMS})^2 - (I_{DC})^2}$	

FETCh/MEASure Query	Notes
CURRent:ACDC? Current, AC+DC (Arms) $I_{RMS} = \sqrt{\frac{1}{N}\left[\sum_{n=0}^{N-1}\left[Current_n\right]^2\right]}$	This command applies to AC+DC.
CURRent:AMPLitude:MAXimum[:INSTant]? Peak current (A) $I_{MAX} = Max(Current_n)\ for\ n \in [0, N-1]$	This command applies to all output modes.
CURRent:AMPLitude:MAXimum:HOLD? Peak AC current held value (A)	This command applies to all output modes. You can clear the peak value with SENS:CURR:PEAK:CLE. This returns the maximum peak current since the power-on or since it was explicitly cleared (SENSe:CURRent:PEAK:CLEar). The peak current (held value) is not cleared by *RST or *RCL.
CURRent:CRESt factor? Crest factor $CF = \frac{I_{MAX}}{I_{RMS}}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC. The crest factor is the AC current divided by the AC peak current. The crest factor for sine waves is $\sqrt{2}$.
FREQuency? AC output frequency (Hz)	This returns the frequency setting for AC, ACDC, and EXT-AC coupling, or +9.91000E+37 for DC and EXT-DC coupling. The instrument does not measure frequency.
POWer[:DC]? Average DC power (W) $Watts_{DC} = V_{DC} \cdot I_{DC}$	This command applies to DC, AC+DC, and EXT-DC. Set the averaging period using SENS:AVER.
POWer:AC[:REAL]? AC active power (W) $Watts_{AC} = Watts_{AC+DC} - Watts_{DC}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
POWer:AC:APParent? AC apparent power (VA) $VA_{AC} = V_{AC} \cdot I_{AC}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
POWer:AC:PFACtor? AC power factor $PF_{AC} = \frac{Watts_{AC}}{VA_{AC}}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC. The power factor indicates the efficiency degradation caused by the phase difference between the AC voltage and AC current.

FETCh/MEASure Query	Notes
POWer:AC:REACtive? AC reactive power (VAR) $VAR_{AC} = \sqrt{(VA_{AC})^2 - (Watts_{AC})^2}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
POWer:ACDC[:REAL]? AC active power (W) $Watts_{AC+DC} = \frac{1}{N}\sum_{n=0}^{N-1} Volt_n \cdot Current_n$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
POWer:ACDC:APParent? AC+DC apparent power (VA) $VA_{AC+DC} = V_{RMS} \cdot I_{RMS}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
POWer:ACDC:PFACtor? AC+DC power factor $PF_{AC+DC} = \frac{Watts_{AC+DC}}{VA_{AC+DC}}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC. The power factor indicates the efficiency degradation caused by the phase difference between the AC voltage and AC current.
POWer:ACDC:REACtive? AC+DC reactive power (VAR) $VAR_{AC+DC} = \sqrt{(VA_{AC+DC})^2 - (Watts_{AC+DC})^2}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
VOLTage[:DC]? Average DC voltage (V) $V_{DC} = \frac{1}{N}\left[\sum_{n=0}^{N-1}[Volt_n]\right]$	This command applies to DC, AC+DC, and EXT-DC. Set the averaging period using SENS:AVER.
VOLTage:AC? AC output voltage (Vrms) $V_{AC} = \sqrt{(V_{RMS})^2 - (V_{DC})^2}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.
VOLTage:ACDC? Voltage, AC+DC (Vrms) $V_{RMS} = \sqrt{\frac{1}{N}\left[\sum_{n=0}^{N-1}[Volt_n]^2\right]}$	This command applies to AC, AC+DC, EXT-DC, and EXT-AC.

FETCh:<*measurement*>
MEASure:<*measurement*>

Returns the <*measurement*> in the form 1.23456E+00. The <*measurement*> may be any of the queries listed in the table above, such as VOLTage:AC? or VOLTage:ACDC?

Examples:

FETC:VOLTage:AC?

MEASure:VOLTage:ACDC?

FREQuency Subsystem

FREQuency commands configure the instrument's output frequency.

[SOURce:]FREQuency[:CW] <*value*>|MINimum|MAXimum[,<*lower_limit*>,<*upper_limit*>]
[SOURce:]FREQuency[:CW]? [MINimum|MAXimum]
[SOURce:]FREQuency[:IMMediate] <*value*>|MINimum|MAXimum[,<*lower_limit*>,<*upper_limit*>]
[SOURce:]FREQuency[:IMMediate]? [MINimum|MAXimum]

Sets the immediate AC frequency and optionally the frequency soft limits.

Parameter	Typical Return
40.0 to 500.0 Hz	+5.00000E+01
Set the output frequency to 50 Hz: FREQ 50	

This command takes one or three arguments. You cannot have a low or high limit without the other.

This command applies to AC, AC+DC, EXT-DC, and EXT-AC.

The *RST default is 60 Hz.

You should set this value between the lower and upper frequency soft limits.

Frequency suffixes (HZ and KHZ) are allowed.

[SOURce:]FREQuency:LIMit:LOWer <*value*>|MINimum|MAXimum
[SOURce:]FREQuency:LIMit:LOWer? [MINimum|MAXimum]

[SOURce:]FREQuency:LIMit:UPPer <*value*>|MINimum|MAXimum
[SOURce:]FREQuency:LIMit:UPPer? [MINimum|MAXimum]

Sets the lower or upper AC frequency soft limit.

Parameter	Typical Return
40.0 to 500.0 Hz Default 500 (UPPer) and 40 (LOWer)	+1.25000E+02
Set the frequency limits to 125 and 300 Hz: FREQ:LIM:LOW 125 FREQ:LIM:UPP 300 FREQ:LIM:STAT ON	

This command applies to AC, AC+DC, EXT-DC, and EXT-AC.

[SOURce:]FREQuency:LIMit[:STATe] ON|1|OFF|0
[SOURce:]FREQuency:LIMit[:STATe]?

Enables or disables frequency soft limits.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Enable the frequency soft limits: FREQ:LIM:STAT ON	

This command applies to AC, AC+DC, EXT-DC, and EXT-AC.

The *RST command sets this parameter to OFF.

[SOURce:]FREQuency:MODE FIXed|STEP
[SOURce:]FREQuency:MODE?

Sets the transition mode for frequency settings.

Parameter	Typical Return
FIXed|STEP	FIX
Set the frequency mode to STEP: FREQ:MODE STEP	

Specifying FIX (default) disables the trigger function; specifying STEP enables it.

The *RST command sets this parameter to FIXed.

[SOURce:]FREQuency:TRIGgered <*value*>|MINimum|MAXimum
[SOURce:]FREQuency:TRIGgered? [MINimum|MAXimum]

Sets the triggered AC output frequency when frequency mode is STEP.

Parameter	Typical Return
40.0 to 500.0 Hz	+9.00000E+01
Set the triggered frequency to 90 Hz: FREQ:TRIG 90	

This command applies to AC, AC+DC, EXT-DC, and EXT-AC.

The *RST default is 60 Hz.

Frequency suffixes (HZ and KHZ) are allowed.

HCOPy Subsystem

HCOPy:SDUMp:DATA?

Returns the display image in BMP format.

Parameter	Typical Return
(none)	<Block>
Return the image in BMP format: HCOP:SDUM:DATA?	

The image is a grey-scale Windows .BMP which has fixed 2,110 bytes. The response format is IEEE488.2 definite-length block data -- #N<length><imagebody>, where N is always 4 and <length> is always 2,110, therefore 2,116 bytes in total.

IEEE-488 Common Commands

IEEE-488 Common commands generally control overall instrument functions, such as reset, status, and synchronization. All common commands consist of a three-letter mnemonic preceded by an asterisk: *RST *IDN? *SRE 8.

*CLS

Clear status command. Clears the event registers in all register groups. Also clears the status byte and error queue. If *CLS immediately follows a program message terminator (<NL>), then the output queue and the MAV bit are also cleared. Refer to Status Overview for more information.

Parameter	Typical Return
(none)	(none)
Clear event registers, status byte, and error queue: *CLS	

*ESE <*value*>
*ESE?

Event status enable command and query. Sets the value in the enable register for the Standard Event Status group. Each set bit of the register enables a corresponding event. All enabled events are logically OR-ed into the ESB bit of the status byte. The query reads the enable register. Refer to Status Overview for more information.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	<*bit value*>
Enable bits 3 and 4 in the enable register: *ESE 24	

The value returned is the binary-weighted sum of all bits set in the register.

Any or all conditions can be reported to the ESB bit through the enable register. To set the enable register mask, write a decimal value to the register using *ESE.

A *CLS does not clear the enable register, but does clear the event register.

This parameter is not affected by *RST or *RCL.

*ESR?

Event status event query. Reads and clears the event register for the Standard Event Status group. The event register is a read-only register that latches all standard events. Refer to Status Overview for more information.

Parameter	Typical Return
(none)	*<bit value>*
Read event status enable register: *ESR?	

The value returned is the binary-weighted sum of all bits set in the register.

Any or all conditions can be reported to the ESB bit through the enable register. To set the enable register mask, write a decimal value to the register using *ESE.

Once a bit is set, it remains set until cleared by this query or *CLS.

*IDN?

Identification Query. Returns the instrument's identification string.

Parameter	Typical Return
(none)	Keysight,AC6801B,JPUB002121,A.01.00.0067
Return the instrument's identification string: *IDN?	

The fields are in the following order: manufacturer name, model number, serial number, firmware revision.

*LRN?

Learn query. Returns the SCPI strings that reproduce the present instrument settings.

Parameter	Typical Return
(none)	:INIT:CONT:ACQ OFF;:ABOR;:OUTP 0;:OUTP:PROT:WDOG:DEL 60;STAT 0;:OUTP:COUP AC;:VOLT:PROG:SOUR INT;:VOLT:RANG 155;:VOLT:PROG:SOUR INT;:VOLT:IMM 0.0,0.0,157.5;MODE FIX;LIM:STAT 0;:FREQ:IMM 60.0,40.0,500.0;MODE FIX;LIM:STAT 0;:CURR 5.25;:CURR:OFFS 4.20;:CURR:PROT:STAT 1;:SENS:AVER 1;VOLT:EQU 0;:DISP:STAT 1;VIEW METER_VI;MET:COUP ACDC;:TRIG:TRAN:SOUR IMM;:TRIG:ACQ:SOUR IMM;:TRIG:SYNC:SOUR IMM;PHAS:ON 0;:OUTP 0
Return the instrument's learn string: *LRN?	

The returned string can be more than 500 characters.

*OPC

Sets the OPC (operation complete) bit in the standard event register. This occurs at the completion of the pending operation. Refer to Status Overview for more information.

Parameter	Typical Return
(none)	(none)
Set the Operation Complete bit: *OPC	

The purpose of this command is to synchronize your application with the instrument.

Used in conjunction with initiated acquisitions, initiated transients, output state changes, and output to settling time to provide a way to poll or interrupt the computer when these pending operations complete.

Other commands may be executed before the operation complete bit is set.

The difference between *OPC and *OPC? is that *OPC? returns "1" to the output buffer when the current operation completes. No further commands can be sent after an *OPC? until it has responded. In this way an explicit polling loop can be avoided. That is, the IO driver will wait for the response.

*OPC?

Returns a 1 to the output buffer when all pending operations complete.

Parameter	Typical Return
(none)	+1
Return a 1 when commands complete: *OPC?	

The purpose of this command is to synchronize your application with the instrument.

Other commands cannot be executed until this command completes.

*OPT?

Returns a string identifying any installed options.

Parameter	Typical Return
(none)	AC68GPBU, AC68BALGU, or 0
Return installed options: *OPT?	

0 (no options installed)

AC68GPBU (GPIB installed), or AC68BALGU (analog interface board installed).

*PSC 0|1
*PSC?

Enables (1) or disables (0) the clearing of certain enable registers at power on. These include:

Questionable Data Register (STATus:QUEStionable:ENABle)

Standard Operation Register (STATus:OPERation:ENABle)

Status Byte Condition Register (*SRE)

Standard Event Enable Register (*ESE)

NOTE **The *PSC command does not affect the clearing of the condition or event registers, just the enable registers. For more information on the SCPI Status System, see Status Subsystem Introduction.**

Parameter	Typical Return
0|1, default 1	0 or 1
Disable power-on clearing of affected registers: *PSC 0	

*RCL <*0 to 10*>

Recalls a saved instrument state.

Parameter	Typical Return
0 to 10	(none)
Recall state from location 1: *RCL 1	

This command restores the instrument to a state that was previously stored with the *SAV command.

All instrument settings are recalled except: (1) trigger systems are set to the Idle state, (2) calibration is disabled, (3) nonvolatile settings are not affected.

This command also aborts TRANsient and ACQuire operations.

Location 0 is recalled at power-on when the Output Power-On state is RCL0.

Stored instrument states are not affected by *RST.

*RST

Resets the instrument to default values. These settings are described in Default Settings.

Parameter	Typical Return
(none)	(none)
Reset the instrument: *RST	

The *RST command forces the ABORt commands. This cancels any measurement or transient actions presently in process. It resets the WTG-meas, MEAS-active, WTG-tran, and TRAN-active bits in the Operation Status registers.

This command also aborts TRANsient and ACQuire operations.

*SAV <0 to 10>

Saves the instrument state to a nonvolatile memory location.

Parameter	Typical Return
0 to 10	(none)
Save state to location 1: *SAV 1	

If a particular state is desired at power-on, it should be stored in location 0. Location 0 is recalled at power-on when the Output Power-On state is RCL0.

The calibration state are NOT saved as part of the *SAV operation.

When shipped, state storage locations 1 through 10 are empty.

*SRE <*value*>
*SRE?

Service request enable command and query. This sets the value of the Service Request Enable register. This determines which bits from the Status Byte Register are summed to set the Master Status Summary (MSS) bit and the Request for Service (RQS) summary bit. A 1 in any Service Request Enable register bit position enables the corresponding Status Byte register bit. All such enabled bits are then logically OR-ed to cause the MSS bit of the Status Byte register to be set. Refer to Status Overview for more information.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	<*bit value*>
Enable bits 3 and 4 in the enable register: *SRE 24	

When a serial poll is conducted in response to SRQ, the RQS bit is cleared, but the MSS bit is not. When *SRE is cleared (by programming it with 0), the instrument cannot generate an SRQ to the controller.

The register contents are not affected by *RST or *RCL.

*STB?

Status byte query. Reads the Status Byte Register, which contains the status summary bits and the Output Queue MAV bit.

Parameter	Typical Return
(none)	*<bit value>*
Read status byte: `*STB?`	

The Status Byte is a read-only register and the bits are not cleared when it is read. Refer to Status Overview for more information.

*TRG

Trigger command. Applies a software trigger (equivalent to IEEE 488.1 Device Trigger) for both TRANsient and ACQuire trigger groups.

Parameter	Typical Return
(none)	(none)

Generate an immediate trigger:
`INIT:ACQ`
`*TRG`	

*TST?

Self-test. Returns the errors found during the most recent power-on self-test.

Parameter	Typical Return
(none)	0 (pass) or +1 (failed)
Perform self-test: `*TST?`	

The instrument's self-test function is performed when the instrument starts up. If a failure is detected, the corresponding SCPI error is generated, and bit 2 of the STATus:QUEStionable register will be set.

When no failure is found the response will be +0. When one or more failures are found the response value will be -330. In this case, SYST:ERR? will return specific failure messages (at first -330,"Self-test error", and then the self-test error codes). See SCPI Error Messages for more information.

The *TST? command does not execute an actual self-test.

INITiate Subsystem

The INITiate commands initialize the trigger system. This moves the trigger system from the "idle" state to the "wait-for-trigger" state, which enables the instrument to receive triggers. An event on the selected trigger source causes the trigger to occur.

INITiate[:IMMediate]:ACQuire

Initiates the ACQuire (measurement) operation.

Parameter	Typical Return
(none)	(none)
Initiate a measurement: `INIT:ACQ`	

If the ACQuire operation is already initiated, this command will produce error -213,"Init ignored".

INITiate[:IMMediate]:TRANsient

Initiates the TRANsient operation.

Parameter	Typical Return
(none)	(none)

Initiate a TRANsient operation:
`VOLT:MODE STEP`
`FREQ:MODE STEP`
`INIT:TRAN`	

If the TRANsient operation is already initiated, this command will produce error -213,"Init ignored".

INITiate:CONTinuous:ACQuire ON|1|OFF|0

Initiates a new measurement and enables or disables "continuous" mode.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Initiate continuous acquisition mode: `INIT:CONT:ACQ ON`	

If continuous mode is on, acquired data is automatically refreshed without the need for an INIT.

You should normally leave continuous mode off (default).

If the TRANsient operation is already initiated, this command will produce error -213,"Init ignored".

The *RST and *RCL commands set this parameter to 0.

LXI Subsystem

The LXI subsystem has just one command.

LXI:IDENtify[:STATe] ON|1|OFF|0
LXI:IDENtify[:STATe]?

Turns the front-panel LXI identify indicator (blinking "Lan" annunciator) on or off. When turned on, the front-panel "LAN" annunciator blinks to identify the instrument that is being addressed.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Blink the front panel LXI annunciator: LXI:IDENT ON	

The *RST command, the *RCL command, a LAN reset, and a LAN restart all turn the LXI indicator off.

OUTPut Subsystem

The OUTPut subsystem configures the output state, power-on state, coupling mode, digital pin, and protection.

OUTPut[:STATe] ON|1|OFF|0
OUTPut[:STATe]?

Enables or disables the instrument's output.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Turn on the output: OUTP ON	

The *RST command sets this parameter to 0.

OUTPut:COUPling AC|DC|ACDC
OUTPut:COUPling?

Sets the output coupling mode.

Parameter	Typical Return
AC|DC|ACDC Default AC	AC, DC, or ACDC
Set the output mode to ACDC: OUTP:COUP ACDC	

AC (default) produces AC output

DC produces DC output

ACDC combines AC and DC output

The *RST command sets this parameter to AC.

OUTPut:INHibit:MODE LATChing|LIVE|OFF
OUTPut:INHibit:MODE?

NOTE This command only applies when option AC68BFIU (the Fault Inhibit interface board) is installed in the AC source.

Sets the operating mode of the remote inhibit digital pin. The inhibit function shuts down the output in response to an external signal on the Inhibit input pin. The Inhibit mode is stored in non-volatile memory. You can specify the polarity of the remote inhibit digital pin using [SOURce:]DIGital:PIN:POLarity POSitive|NEGative.

Parameter	Typical Return
LATChing|LIVE|OFF	LATC,LIVE, or OFF
Sets the inhibit input to Live mode: OUTP:INH:MODE LIVE	

LATChing - a logic-true signal on the Inhibit input causes the output state to latch OFF. The output remains disabled until the Inhibit input is returned to logic-false and the latched INH status bit is cleared by sending the OUTPut:PROTection:CLEar command or a protection clear command from the front panel. Note that the output remains disabled after the protection is cleared and must be re-enabled with the OUTPut ON command to turn it on again.

LIVE - allows the enabled output to follow the state of the Inhibit input.

OFF - the Inhibit input is ignored.

The inhibit mode is stored in non-volatile memory.

OUTPut:PON:STATe RST|RCL0|AUTO
OUTPut:PON:STATe?

Sets the power-on output state.

Parameter	Typical Return
RST|RCL0|AUTO	RST, RCL0, or AUTO
Set the power-on state to the *RST state: OUTP:PON:STAT RST	

RST specifies that the instrument powers on in a state equivalent to *RST.

RCL0 loads the state stored in state storage memory location 0.

AUTO specifies that the instrument powers on in the power-down state. The output state is always off.

This parameter is not affected by *RST or *RCL.

This parameter is saved in nonvolatile memory.

OUTPut:PROTection:CLEar

Resets the latched protection. This clears the latched protection status that disables the output when a protection condition occurs. It also clears the latched Inhibit Input function.

Parameter	Typical Return
(none)	(none)
Clears the latched protection status: OUTP:PROT:CLE	

All conditions that generate the fault must be removed before the latched status can be cleared. The output remains in the OFF state after the fault/inhibit condition is cleared.

OUTPut:PROTection:WDOG[:STATe] ON|1|OFF|0
OUTPut:PROTection:WDOG[:STATe]?

Enables or disables the I/O watchdog timer.

Parameter	Typical Return
0|OFF|1|ON	0 (OFF) or 1 (ON)
Enables the watchdog timer protection: OUTP:PROT:WDOG ON	

When the watchdog timer is enabled, the output will be disabled if there is no I/O activity on any remote interface within the time period specified by OUTput:PROTection:WDOG:DELay. The output is latched off but the programmed output state is not changed.

The watchdog timer function is NOT reset by front-panel activity; the output will still shut down after the time period has elapsed.

The *RST command sets this parameter to 0.

OUTPut:PROTection:WDOG:DELay <*value*>|MINimum|MAXimum
OUTPut:PROTection:WDOG:DELay? [MINimum|MAXimum]

Sets the watchdog delay time.

Parameter	Typical Return
1 to 3600 (seconds)	+6.00000E+02
Sets a watchdog delay for 600 seconds: OUTP:PROT:WDOG:DEL 600	

Values (seconds) must be whole numbers.

The *RST command sets this parameter to 60.

SENSe Subsytem

SENSe:AVERage 1|2|4|8|16
SENSe:AVERage?

Sets the averaging count for measurements.

Parameter	Typical Return
1, 2, 4, 8, or 16	+1
Set the moving average period to 4 counts: SENS:AVER 4	

This parameter does not apply to the peak current measurement.

The *RST command sets this parameter to ON.

SENSe:CURRent[:PEAK]:HOLD:CLEar

Clears the peak held current measurement.

Parameter	Typical Return
(none)	(none)
Clear the peak current measurement: SENS:CURR:HOLD:CLE	

Use FETCh:CURRent:AMPLitude:MAXimum:HOLD? to query the peak held current measurement.

STATus Subsystem

Status register programming lets you determine the operating condition of the instrument at any time. The instrument has three groups of status registers; Operation, Questionable, and Standard Event. The Operation and Questionable status groups each consist of the Condition, Enable, and Event registers as well as NTR and PTR filters.

The Status subsystem is also programmed using Common commands. Common commands control additional status functions such as the Service Request Enable and the Status Byte registers. Refer to Status Overview for more information.

STATus:OPERation[:EVENt]

Queries the event register for the Operation Status group. This is a read-only register, which stores (latches) all events that are passed by the Operation NTR and/or PTR filter. Reading the Operation Status Event register clears it.

Parameter	Typical Return
(none)	<*bit value*>
Read the operation status event register: STAT:OPER?	

The value returned is the binary-weighted sum of all bits set in the register.For example, with bit 3 (value 8) and bit 5 (value 32) set (and corresponding bits enabled), the query returns +40.

*RST does not affect this register unless the reset causes an event that the filters are configured to capture.

STATus:OPERation:CONDition?

Queries the operation condition register. This is a read-only register, which holds the instrument's live (unlatched) operational status. Reading the Operation Status Condition register does not clear it.

Parameter	Typical Return
(none)	<*bit value*>
Read the operation status condition register: STAT:OPER:COND?	

The value returned is the binary-weighted sum of all bits set in the register.For example, with bit 3 (value 8) and bit 5 (value 32) set (and corresponding bits enabled), the query returns +40.

The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared.

A *RST clears this register, other than those bits where the condition still exists after *RST.

STATus:OPERation:ENABle <*value*>
STATus:OPERation:ENABle?

Sets the value of the enable register for the Operation Status group. The enable register is a mask for enabling specific bits from the Operation Event register to set the OPER (operation summary) bit of the Status Byte register. The STATus:PRESet command clears all enable register bits.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	<*bit value*>
Enable bits 3 and 4 in the enable register: STAT:OPER:ENAB 24	

For example, with bit 3 (value 8) and bit 5 (value 32) set (and corresponding bits enabled), the query returns +40.

A *CLS does not clear the enable register, but does clear the event register.

STATus:OPERation:NTRansition <*value*>
STATus:OPERation:NTRansition?

STATus:OPERation:PTRansition <*value*>
STATus:OPERation:PTRansition?

Sets and queries the value of the NTR (Negative-Transition) and PTR (Positive-Transition) registers. These registers serve as a polarity filter between the Operation Condition and Operation Event registers.

When a bit in the NTR register is 1, then a 1-to-0 transition of the corresponding bit in the Operation Condition register causes that bit in the Operation Event register to be set.

When a bit in the PTR register is 1, then a 0-to-1 transition of the corresponding bit in the Operation Condition register causes that bit in the Operation Event register to be set.

The STATus:PRESet command sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	<*bit value*>
Enable bits 3 and 4 in the NTR register: STAT:OPER:NTR 24	

If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Operation Condition register sets the corresponding bit in the Operation Event register.

If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Operation Condition register can set the corresponding bit in the Operation Event register.

The value returned is the binary-weighted sum of all bits set in the register.

STATus:PRESet

Initializes the transition and enable filters for both SCPI register groups (OPERation and QUEStionable).

The STATus:PRESet command only affects the ENABle register and the transition filter register of the status data structure. It does not clear any event registers or the error/event queue. To reset all event registers and the queue within the device status reporting mechanism, use *CLS.

For status data required by SCPI, STAT:PRES sets the transition filter registers so that only positive transitions are detected and sets the ENABle register to all zeros. The settings of the service request enable register, parallel poll enable register, memory registers related to the *SAV command, the instrument address, output queue, and power on status clear flag are not affected by this command.

Operation register	Questionable register	Preset Value
STAT:OPER:ENAB	STAT:QUES:ENAB	0 - all bits disabled
STAT:OPER:NTR	STAT:QUES:NTR	0 - all bits disabled
STAT:OPER:PTR		65535 all bits enabled
	STAT:QUES:PTR	65535 all bits enabled

Parameter	Typical Return
(none)	(none)
Preset the Operation and Questionable registers: STAT:PRES	

STATus:QUEStionable[:EVENt]?

Queries the event register for the Questionable Status group. This is a read-only register, which stores (latches) all events that are passed by the Operation NTR and/or PTR filter. Reading the Questionable Status Event register clears it.

Parameter	Typical Return
(none)	*<bit value>*
Read the questionable status event register: STAT:QUES?	

The value returned is the binary-weighted sum of all bits set in the register.For example, to enable bit 2 (value 4) and bit 4 (value 16), the corresponding decimal value would be 20 (4 + 16).

*RST does not affect this register.

STATus:QUEStionable:CONDition?

Queries the condition register for the Questionable Status group. This is a read-only register, which holds the instrument's live (unlatched) operational status. Reading the Questionable Status Condition register does not clear it.

Parameter	Typical Return
(none)	*<bit value>*
Read questionable status condition register: STAT:QUES:COND?	

The value returned is the binary-weighted sum of all bits set in the register.For example, to enable bit 2 (value 4) and bit 4 (value 16), the corresponding decimal value would be 20 (4 + 16).

The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared.

A *RST clears this register, other than those bits where the condition still exists after *RST.

STATus:QUEStionable:ENABle *<value>*
STATus:QUEStionable:ENABle?

Sets the value of the enable register for the Questionable Status group. The enable register is a mask for enabling specific bits from the Questionable Event register to set the QUES (questionable summary) bit of the Status Byte register. The STATus:PRESet command clears all enable register bits.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	*<bit value>*
Enable bits 2 and 4 in the questionable enable register: STAT:QUES1:ENAB 24	

For example, to enable bit 2 (value 4) and bit 4 (value 16), the corresponding decimal value would be 20 (4 + 16).

A *CLS does not clear the enable register, but does clear the event register.

STATus:QUEStionable:NTRansition <*value*>
STATus:QUEStionable:NTRansition?

STATus:QUEStionable:PTRansition <*value*>
STATus:QUEStionable:PTRansition?

Sets and queries the value of the NTR (Negative-Transition) and PTR (Positive-Transition) registers. These registers serve as a polarity filter between the Questionable Condition and Questionable Event registers.

When a bit in the NTR register is 1, then a 1-to-0 transition of the corresponding bit in the Questionable Condition register causes that bit in the Questionable Event register to be set.

When a bit in the PTR register is 1, then a 0-to-1 transition of the corresponding bit in the Questionable Condition register causes that bit in the Questionable Event register to be set.

The STATus:PRESet command sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical Return
Decimal sum of the bits in the register, default 0. For example, to enable bit 2 (value 4), bit 3 (value 8), and bit 7 (value 128), use decimal sum 140 (4 + 8 + 128). Default 0.	<*bit value*>
Enable bits 3 and 4 in the questionable PTR register: STAT:QUES:PTR 24	

If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable Condition register sets the corresponding bit in the Questionable Event register.

If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable Condition register can set the corresponding bit in the Questionable Event register.

The value returned is the binary-weighted sum of all bits set in the register.

SYSTem Subsystem

The SYSTem subsystem controls instrument functions that are not directly related to output control, measurement, or status functions. Note that IEEE-488 Common commands also control system functions such as state management.

SYSTem:BEEPer[:IMMediate]

Issues a single beep.

Parameter	Typical Return
(none)	(none)
Issue a single beep: SYST:BEEP	

This command overrides the current beeper state . You can issue a beep even if the beeper is turned off by SYSTem:BEEPer:STATe.

Programmed beeps may be useful for program development and troubleshooting.

SYSTem:BEEPer:KCLick ON|1|OFF|0
SYSTem:BEEPer:KCLick?

Disables or enables the click tone heard when you press a front-panel key.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Disable front-panel key click: SYST:BEEP:KCLick OFF	

The front-panel key click and instrument beeper settings do not affect each other.

This parameter is not affected by *RST or *RCL.

SYSTem:BEEPer:STATe ON|1|OFF|0
SYSTem:BEEPer:STATe?

Disables or enables the beep heard when an error is generated.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Disable the beeper state: SYST:BEEP:STAT OFF	

The front-panel key click and instrument beeper settings do not affect each other.

A beep is always emitted (even with beep state OFF) when SYSTem:BEEPer is sent.

This parameter is not affected by *RST or *RCL.

SYSTem:COMMunicate:RLSTate LOCal|REMote|RWLock
SYSTem :COMMunicate:RLSTate?

Configures the remote/local/lockout state of the instrument.

Parameter	Typical Return
LOCal|REMote|RWLock	LOC, REM, or RWL
Sets the remote/local state to remote: SYST:COMM:RLST REM	

The LOCal parameter (the power-on default), disables the remote interface, the REMote parameter enables remote control of the instrument, and RWLock enables remote control of the instrument and locks out front-panel operation. The RWLocal parameter also locks out the operation of the Sense switch on the rear panel.

The remote/local instrument state can also be set by other interface commands over the GPIB and other I/O interfaces. If multiple remote interfaces are active, the interface with the most recently changed remote/local state takes precedence.

This parameter is not affected by *RST or *RCL.

SYSTem:ERRor[:NEXT]?

Reads and clears one error from the error queue.

Parameter	Typical Return
(none)	
Reads and clear first error in error queue: SYST:ERR?	

The Err annunciator turns on when any error is in the error queue. Error retrieval is first-in-first-out, and errors are cleared as you read them. When you have read all errors from the error queue, the Err annunciator turns off.

If more than 16 errors have occurred, the most recent error is replaced with -350,"Error queue overflow". No additional errors are stored until you remove errors from the queue. Reading the error queue when it is empty yields the message +0,"No error".

The error queue is cleared by *CLS and power cycling. It is not cleared by *RST.

Errors have the following format (the error string may contain up to 255 characters).
<*error code*>,<*error string*>
For a list of error codes and error strings, see SCPI Error Messages.

SYSTem:ERRor:COUNt?

Returns the number of errors in the error queue.

Parameter	Typical Return
(none)	+11
Return the number of errors in the error queue: SYST:ERR:COUN?	

The returned value always begins with a + character, even if the number is 0.

The Err annunciator turns on when any error is in the error queue. Error retrieval is first-in-first-out, and errors are cleared as you read them. When you have read all errors from the error queue, the Err annunciator turns off.

If more than 16 errors have occurred, the most recent error is replaced with -350,"Error queue overflow". No additional errors are stored until you remove errors from the queue. Reading the error queue when it is empty yields the message +0,"No error".

The error queue is cleared by *CLS and power cycling. It is not cleared by *RST.

Errors have the following format (the error string may contain up to 255 characters).
<*error code*>,<*error string*>
For a list of error codes and error strings, see SCPI Error Messages.

SYSTem:SECurity:IMMediate

Clears all user memory (including stored states) and reboots the instrument in the *RST state. This command is typically used to prepare the instrument for removal from a secure area. Instrument identification data (instrument firmware, model number, serial number, MAC address) and calibration data is not erased.

The sanitization procedure is not recommended for use in routine applications because of the possibility of unintended loss of data.

Parameter	Typical Return
(none)	(none)
Sanitize the instrument: SYST:SEC:IMM	

SYSTem:SSAVer[:STATe] ON|1|OFF|0
SYSTem:SSAVer[:STATe]?

Enables or disables the screen saver.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Turn the screen saver off: SYST:SSAV OFF	

This parameter is not affected by *RST or *RCL.

This parameter is not affected by power cycling.

SYSTem:SSAVer:DELay <*seconds*>|MINimum|MAXimum
SYSTem:SSAVer:DELay? [MINimum|MAXimum]

Sets the delay time for screen saver activation. The value is the time since the last front-panel access or the last access since remote (with remote wake-up enabled).

Parameter	Typical Return
Integer from 60 to 59940	+6.60000E+02
Set the delay to five minutes: SYST:SSAV DEL 300	

This parameter is not affected by *RST or *RCL.

The unit is in seconds, but the value will be rounded to a the nearest minute. For example, a setting of 100 s will be rounded to 120 s (exactly two minutes).

This parameter is not affected by power cycling.

SYSTem:SSAVer:RWAKeup ON|1|OFF|0
SYSTem:SSAVer:RWAKeup?

Enables or disables remote screen saver wake-up.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Enable remote screen saver wake-up: SYST:SSAV:RWAK ON	

When this feature is on, the screen saver is never activated as long as remote IO is operating and will wake-up by a remote access if the screen saver is active.

This parameter is not affected by *RST or *RCL.

This parameter is not affected by power cycling.

SYSTem:VERSion?

Returns the version of SCPI that the instrument uses.

Parameter	Typical Return
(none)	1999.0
Return the SCPI version: SYST:VERS?	

The query always returns 1999.0

The SCPI version cannot be determined from front panel.

TRIGger Subsystem

The TRIGger subsystem sets the measurement operation and trigger functions for various instrument operations:

TRIGger:ACQuire	Triggers measurement acquisition.
TRIGger:SYNChronize	Synchronizes output phase using OUTPut ON instead of a software trigger.
TRIGger[:TRANsient]	Triggers synchronizes output changes.

TRIGger:ACQuire[:IMMediate]

Sends a software trigger to the ACQuire subsystem.

Parameter	Typical Return
(none)	(none)
Configure and trigger the ACQuire subsystem: TRIG:ACQ:SOUR BUS INIT:ACQ TRIG:ACQ	

TRIGger:ACQuire:SOURce IMMediate|BUS
TRIGger:ACQuire:SOURce?

Sets the trigger source that starts the measurement after INIT:ACQ. Specify IMMediate to start the measurement immediately, or BUS (the default) to wait for a software trigger (*TRG, TRIG:ACQ, or TRIG:ACQ).

Parameter	Typical Return
IMMediate|BUS	IMM or BUS
Set the trigger source to BUS: TRIG:ACQ:SOUR BUS	

This parameter is set to BUS at power-on or after *RCL or *RST.

TRIGger:SYNChronize:SOURce IMMediate|PHASe
TRIGger:SYNChronize:SOURce?

Sets the output-on phase control when OUTPut ON is sent.

Parameter	Typical Return
IMMediate|PHASe	IMM or PHAS
Enable output-on phase control: TRIG:SYNC:SOUR PHASE	

This parameter is set to IMMediate at power-on or after *RCL or *RST.

TRIGger:SYNChronize:PHASe[:ON] <*value*>|MINimum|MAXimum
TRIGger:SYNChronize:PHASe? [MINimum|MAXimum]

Sets the phase angle of the output-on phase control in degrees.

Parameter	Typical Return
An integer from 0 to 359 degrees	+1.80000E+02
Set the OUTPUT on phase angle to 180°: TRIG:SYNC:PHAS 180	

This command supports the parameter suffix DEG (degrees), but not RAD (radians).

The *RST command sets this parameter to 0.

TRIGger:TRANsient[:IMMediate]

Triggers the TRANsient subsystem.

Parameter	Typical Return
(none)	(none)
Configure and trigger the TRANsient subsystem: VOLT:MODE STEP FREQ:MODE STEP TRIG:TRAN:SOUR BUS INIT:TRAN TRIG:TRAN	

TRIGger:TRANsient:SOURce IMMediate|BUS
TRIGger:TRANsient:SOURce?

Sets the trigger source for changing the setting value after INIT:TRAN. Specify IMMediate (the default) to start the measurement immediately, or BUS to wait for a software trigger (*TRG, TRIG, or TRIG:TRAN).

Parameter	Typical Return
IMMediate|BUS	IMM or BUS
Set the trigger source to BUS: TRIG:SOUR BUS	

This parameter is set to IMMediate at power-on or after *RCL or *RST.

VOLTage Subsystem

Voltage commands program the output voltage of the instrument.

WARNING Soft limits apply only if the corresponding limit state is on, and they only apply to voltage settings executed after the limit state is set on. Soft limits do not retroactively apply to the existing voltage setting.

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <*value*>|MINimum|MAXimum[, <*low_limit*>|MINimum|MAXimum, <*high_limit*>|MINimum|MAXimum]
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MINimum|MAXimum]

[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] <*value*>|MINimum|MAXimum
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [MINimum|MAXimum]

Sets the immediate or triggered AC voltage level, and optionally the soft limits for the immediate voltage. The triggered level is the value that is transferred to the output when an output step is triggered. Units are in volts (rms).

Parameter	Typical Return
AC mode 155 V range: 0.0 to 157.5 V	+2.00000E+01
AC mode 310 V range: 0.0 to 315.0 V	
AC+DC mode: The total voltage must be within the voltage limits, and the AC+DC peak must be between -445 and +445 V.	
Sets the output voltage to 20 V: VOLT 20 Sets the triggered voltage to 10 V: VOLT:TRIG 10	

This command takes one or three arguments. You cannot have a low or high limit without the other.

This command applies to AC and AC+DC.

Voltage units (MV, V, KV) are supported.

The *RST command sets this parameter to 0.

When VOLT:LIM:STAT is OFF, only individual range checking for each argument is performed. The <*value*> must be within its own MINimum-MAXimum range considering VOLTage:RANGe and the existing DC component setting if in ACDC coupling mode. The typical MAXimum in OUTP:COUP:AC mode is 157.5 or 315.0 VAC, but in ACDC mode with nonzero DC components the value will be reduced. The lower and upper soft limits must be within their MINimum-MAXimum range as defined by the active VOLT:RANG setting. Both have the same 0 to +157.5 or +315.0 VAC limits regardless of any operational conditions other than VOLT:RANG.

When VOLT:LIM:STAT is ON, the range checking described above is performed, and an additional check ensures that the <*value*> does not go beyond the high and low soft limits.

The allowable range for MINimum and MAXimum varies depending on whether LIM:STAT is ON or OFF. When LIM:STAT is OFF, the MINimum and MAXimum values are simply calculated from the VOLT:RANG and the DC component if it is already set in ACDC mode.

[SOURce:]VOLTage[:LEVel]:LIMit[:STATe] ON|1|OFF|0
[SOURce:]VOLTage[:LEVel]:LIMit[:STATe]?

[SOURce:]VOLTage:OFFSet:LIMit[:STATe] ON|1|OFF|0
[SOURce:]VOLTage:OFFSet:LIMit[:STATe]?

Enables or disables soft limits for voltage. The OFFSet version of the command applies to DC voltage; the [:LEVel] version applies to AC voltage.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)

Limit the AC voltage to between 150 and 250 Vrms:
VOLT:LIM:LOW 150
VOLT:LIM:UPP 250
VOLT:LIM ON

The *RST command sets this parameter to OFF.

Once the soft-limit function is enabled, any new voltage values from the VOLT command are validated against that lower and upper soft limits.

[SOURce:]VOLTage[:LEVel]:LIMit:LOWer <*value*>|MINimum|MAXimum
[SOURce:]VOLTage[:LEVel]:LIMit:LOWer? [MINimum|MAXimum]

[SOURce:]VOLTage[:LEVel]:LIMit:UPPer <*value*>|MINimum|MAXimum
[SOURce:]VOLTage[:LEVel]:LIMit:UPPer? [MINimum|MAXimum]

Sets the lower and upper AC voltage limits.

Parameter	Typical Return
0 to 157.5 V in lower range, 0 to 315.0 V in upper range	+2.50000E+02

Limit the AC voltage to between 150 and 250 Vrms:
VOLT:LIM:LOW 150
VOLT:LIM:UPP 250
VOLT:LIM ON

This command applies to AC and AC+DC.

If the new setting conflicts with the existing immediate voltage setting (because the limit range becomes tighter), this command coerces the voltage setting to fit with the new upper and lower limits.

A SCPI error (-222,"Data out of range") occurs if the entered parameter value is outside the range.

The *RST command sets both limits to 0.

[SOURce:]VOLTage[:LEVel]:MODE FIXed|STEP
[SOURce:]VOLTage[:LEVel]:MODE?

Sets the trigger transient mode for voltage settings.

Parameter	Typical Return
FIXed|STEP	FIX
Set the trigger function control of the AC voltage to STEP: VOLT:MODE STEP	

Specifying FIX (default) disables the trigger function; specifying STEP enables it.

The *RST command sets this parameter to FIXed.

[SOURce:]VOLTage:OFFSet[:IMMediate] <*value*>|MINimum|MAXimum [,<*low_limit*>|MINimum|MAXimum,<*high_limit*>|MINimum|MAXimum]
[SOURce:]VOLTage:OFFSet[:IMMediate]? [MINimum|MAXimum]

[SOURce:]VOLTage:OFFSet:TRIGgered <*value*>|MINimum|MAXimum
[SOURce:]VOLTage:OFFSet:TRIGgered? [MINimum|MAXimum]

Sets the immediate or triggered DC voltage in VDC, and optionally sets the soft limits for the immediate DC voltage.

Parameter	Typical Return
DC mode 155 V range: -222.5 to +222.5 V DC mode 310 V range: -445.0 to +445.0 V AC+DC mode: The total voltage must be within the voltage limits, and the AC+DC peak must be between -445 and +445 V.	+1.50000E+02
Set the immediate DC voltage to 150 V: VOLT:OFFS 150	

This command takes one or three arguments. You cannot have a low or high limit without the other.

This command applies to DC and AC+DC.

Error message +160 is generated if the IMMediate voltage is set outside the MIN/MAX limits, and error message +161 is generated if the TRIGgered voltage is set outside the MIN/MAX limits.

Voltage units (MV, V, KV) are supported.

The *RST command sets this parameter to 0.

[SOURce:]VOLTage:OFFSet:LIMit:LOWer <*value*>|MINimum|MAXimum
[SOURce:]VOLTage:OFFSet:LIMit:LOWer? [MINimum|MAXimum]

[SOURce:]VOLTage:OFFSet:LIMit:UPPer <*value*>|MINimum|MAXimum
[SOURce:]VOLTage:OFFSet:LIMit:UPPer? [MINimum|MAXimum]

Sets the lower and upper DC voltage soft limits.

Parameter	Typical Return
155 V range: -222.5 to 222.5 V 310 V range: -445.0 to 445.0 V	(none)
Set the voltage limits to the be 100 and 350 V: VOLT:OFFS:LIM:LOW 100 VOLT:OFFS:LIM:UPP 350	

This command takes one or three arguments. You cannot have a low or high limit without the other.

This command applies to DC and AC+DC.

Error message +166 is generated if the lower limit is beyond the MIN/MAX limits, and error message +167 is generated if the upper limit is beyond the MIN/MAX limits.

Voltage units (MV, V, KV) are supported.

[SOURce:]VOLTage:OFFSet:MODE FIXed|STEP
[SOURce:]VOLTage:OFFSet:MODE?

Sets the trigger transient mode for DC voltage settings. Specifying FIX (default) disables the trigger function; specifying STEP enables it.

Parameter	Typical Return
FIXed|STEP	FIX
Set the voltage offset mode to FIXed VOLT:OFF:MODE FIXed	

The *RST command sets this parameter to FIXed.

[SOURce:]VOLTage:PROGramming:SOURce INTernal|EXTAC|EXTDC
[SOURce:]VOLTage:PROGramming:SOURce?

Sets the voltage programming source.

Parameter	Typical Return
INTernal|EXTAC|EXTDC	INT, EXTAC, or EXTDC
Set the voltage programming source to external AC: VOLT:PROG:SOUR EXTAC	

The EXTAC and EXTDC modes require the analog interface card.

The *RST command sets this parameter to INTernal.

[SOURce:]VOLTage:RANGe[:UPPer] 155|310|MINimum|MAXimum
[SOURce:]VOLTage:RANGe[:UPPer]? [MINimum|MAXimum]

Sets the voltage range. If the voltage range is switched, the VOLT:TRIG and VOLT:OFFS:TRIG settings are cleared, and ABORt[:ALL] is applied.

Parameter	Typical Return
155|310|MINimum|MAXimum	+2.70000E+02
Set the voltage range to 310 V VOLT:RANG MAX	

You may only set this parameter if output is OFF.

Setting this parameter turns voltage autoranging OFF and aborts both TRANsient and ACQuire operations.

The *RST command sets this parameter to 155.

If you enter a value between 0 and 155, the 155 V range will be chosen. If you enter a value above 155 V, the 310 V range will be chosen.

[SOURce:]VOLTage:RANGe:AUTO ON|1|OFF|0
[SOURce:]VOLTage:RANGe:AUTO?

Enables or disables voltage autoranging. If this parameter changes, the VOLT:TRIG and VOLT:OFFS:TRIG settings are cleared, and all operations are aborted.

Parameter	Typical Return
ON|1|OFF|0	0 (OFF) or 1 (ON)
Turn on voltage autoranging: VOLT:RANG:AUTO 1	

The *RST command sets this parameter to OFF.

Default Settings

Command	*RCL	*RST
OUTPut[:STATe]	(state file value)	OFF
OUTPut:COUPling	(state file value)	AC
OUTPut:PROTection:WDOG[:STATe]	(state file value)	OFF
OUTPut:PROTection:WDOG:DELay	(state file value)	60
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]	(state file value)	MAXimum for instrument
[SOURce:]CURRent:OFFSet[:IMMediate]	(state file value)	MAXimum for instrument
[SOURce:]CURRent:PROTection:STATe	(state file value)	ON
[SOURce:]FREQuency[:CW]	(state file value)	60
[SOURce:]FREQuency:LIMit[:STATe]	(state file value)	OFF
[SOURce:]FREQuency:LIMit:LOWer	(state file value)	40
[SOURce:]FREQuency:LIMit:UPPer	(state file value)	500
[SOURce:]FREQuency:MODE	(state file value)	FIXed
[SOURce:]FREQuency:TRIGgered	(state file value)	(immediate level)
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]	(state file value)	0
[SOURce:]VOLTage[:LEVel]:LIMit[:STATe]	(state file value)	OFF
[SOURce:]VOLTage[:LEVel]:LIMit:LOWer	(state file value)	0
[SOURce:]VOLTage[:LEVel]:LIMit:UPPer	(state file value)	157.5
[SOURce:]VOLTage[:LEVel]:MODE	(state file value)	FIXed
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]	(immediate level)	(immediate level)
[SOURce:]VOLTage:OFFSet[:IMMediate]	(state file value)	0
[SOURce:]VOLTage:OFFSet:LIMit[:STATe]	(state file value)	OFF
[SOURce:]VOLTage:OFFSet:LIMit:LOWer	(state file value)	-222.5
[SOURce:]VOLTage:OFFSet:LIMit:UPPer	(state file value)	222.5
[SOURce:]VOLTage:OFFSet:MODE	(state file value)	FIXed
[SOURce:]VOLTage:OFFSet:TRIGgered	(state file value)	(immediate level)
[SOURce:]VOLTage:PROGramming:SOURce	(state file value)	INTernal
[SOURce:]VOLTage:RANGe[:UPPer]	(state file value)	155.0
[SOURce:]VOLTage:RANGe:AUTO	(state file value)	OFF
INITiate:CONTinuous:ACQuire	OFF	OFF
TRIGger:TRANsient:SOURce	(state file value)	BUS
TRIGger:SYNChronize:SOURce	(state file value)	IMMediate
TRIGger:SYNChronize:PHASe[:ON]	(state file value)	0
TRIGger:ACQuire:SOURce	(state file value)	BUS
DISPlay[:WINDow][:STATe]	(state file value)	1
DISPlay[:WINDow]:METer:COUPling	(state file value)	ACDC
SENSe:AVERage	(state file value)	1

SCPI Error Messages

The error messages below are in the following format, with a numeric error code and a quoted error string separated by a comma:

-222,"Data out of range"

The error/event queue is empty and returns 0,"No error" when the *CLS common command is sent, the last item in the error queue is read, or the instrument cycles power.

Error Code Range	Category	Meaning	Bit in Event Status Register
-100 to -199	Command errors	An IEEE 488 syntax error has been detected by the instrument's parser.	(n/a)
-200 to -299	Execution errors	An error has been detected by the instrument's execution control block.	(n/a)
-300 to -399	Device-specific errors	A device-specific error has been detected, possibly related to a hardware failure.	(n/a)
-400 to -499	Query errors	The instrument's output queue control has detected a problem with the message exchange protocol.	(n/a)
100 to 399	Specific SCPI Errors	An error in the instrument's operation has occurred, such as a settings conflict or an attempt to execute a command when the instrument is in an incorrect mode.	(n/a)
900 and above	Self-test errors	A self-test error has occurred.	2

Error Code	Error Text
-101	Invalid character
-102	Syntax error
-103	Invalid separator
-108	Parameter not allowed
-109	Missing parameter
-110	Command header error
-112	Program mnemonic too long
-113	Undefined header
-114	Header suffix out of range
-115	Unexpected number of parameters
-120	Numeric data error
-128	Numeric data not allowed

Error Code	Error Text
-131	Invalid suffix
-138	Suffix not allowed
-140	Character data error
-141	Invalid character data
-144	Character data too long
-150	String data error
-151	Invalid string data
-158	String data not allowed
-211	Trigger ignored
-213	Init ignored
-214	Trigger deadlock
-220	Parameter error
-221	Settings conflict
-222	Data out of range
-224	Illegal parameter value
-230	Data corrupt or stale
-241	Hardware missing; option not installed
-310	System Error
-311	Memory Error
-313	Calibration memory lost
-314	Save/recall memory lost
-315	Configuration memory lost
-330	Self-test error
-350	Queue overflow
-363	Input buffer overrun
-410	Query INTERRUPTED
-420	Query UNTERMINATED
-430	Query DEADLOCKED
+101	Calibration state is off
+102	Calibration password is incorrect
+104	Bad sequence of calibration commands
+107	Programming cal constants out of range
+108	Measurement cal constants out of range
+117	Calibration error
+130	Remote calibration is inhibited by local operation
+131	Operation conflicts with OUTPUT ON state
+132	Operation conflicts with protection state

Error Code	Error Text
+133	Operation conflicts with OUTPUT COUPLE setting
+134	Operation conflicts with AUTO RANGE
+155	Operation conflicts with EXT-AC or EXT-DC program source
+140	LOW RANGE conflicts with existing VOLT[:IMM] setting
+141	LOW RANGE conflicts with existing VOLT:TRIG setting
+142	LOW RANGE conflicts with existing VOLT:OFFS[:IMM] setting
+143	LOW RANGE conflicts with existing VOLT:OFFS:TRIG setting
+150	Overlaid peak value of AC (IMM) and DC (IMM) components is too large
+151	Overlaid peak value of AC (IMM) and DC (TRIG) components is too large
+152	Overlaid peak value of AC (TRIG) and DC (IMM) components is too large
+153	Overlaid peak value of AC (TRIG) and DC (TRIG) components is too large
+160	IMM setting is out of range
+161	TRIG setting is out of range
+162	Overlaid peak value with existing AC (IMM) component is too large
+163	Overlaid peak value with existing AC (TRIG) component is too large
+164	Overlaid peak value with existing DC (IMM) component is too large
+165	Overlaid peak value with existing DC (TRIG) component is too large
+166	LIM:LOW setting is out of range
+167	LIM:UPP setting is out of range
+168	IMM setting value and soft-limits conflict with LOWER<=VALUE<=UPPER condition
+169	TRIG setting value and soft-limits conflict with LOWER<=VALUE<=UPPER condition
+302	Option not installed
+309	Cannot initiate, voltage and frequency in fixed mode
+901	HW failure (DSP DETECT state)
+902	HW failure (DSP VCC state)
+903	HW failure (DSP INPUT state)
+904	HW failure (DSP Communication Failure)

4
Calibration, Verification, and Service

Calibration Overview

Calibration Procedure

Performance Test Records

Performance Verification

Service and Maintenance

KEYSIGHT TECHNOLOGIES

Calibration Overview

This section contains information regarding the instrument's calibration.Be sure to read through the overview first, and follow the steps in order.

Closed–Case Electronic Calibration

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

Keysight Technologies Calibration Services

Keysight Technologies offers calibration services using automated calibration systems that enable Keysight to provide calibration at competitive prices. See Contacting Keysight for information on contacting Keysight.

Calibration Interval

The instrument should be calibrated on a regular interval determined by the accuracy requirements of your application. A 1-year interval is adequate for most applications. Accuracy specifications are warranted only if adjustment is made at regular calibration intervals. Accuracy specifications are not warranted beyond the 1-year calibration interval.

Time Required for Calibration

The instrument can be automatically calibrated under computer control, including complete calibration procedure and performance verification tests, in approximately 30 minutes once the instrument is warmed–up.

Calibration Procedure

Enter Calibration Mode

DC Voltage Low Range

DC Voltage High Range

AC Voltage Low Range

AC Voltage High Range

Current Low Range

Current High Range

End Calibration

Enter Calibration Mode

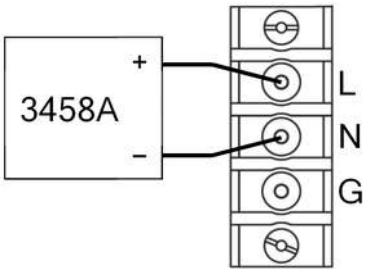
To begin the calibration process, log in using the Admin password. The factory default is no password.

Front Panel	SCPI
Select **System > Admin > Login**. Then enter the password and press **[Select]**.	CAL:STAT ON [, <*password*>]

DC Voltage Low Range

Connect the voltage input of the 3458A DMM to the instrument output as shown below and configure the 3458A for DCV measurements. You can use the following SCPI commands (or their front-panel equivalents) to configure the DMM:

*RST
DCV AUTO, AZERO ON, FIXEDZ OFF
NPLC 100



Step	Description	Front Panel	SCPI
1	Select the low voltage range.	**[Menu] > System > Admin > Cal > DC** Then select the **Low** range.	CAL:VOLT:OFFS 219
2	Select the first voltage calibration point.	Select **Next**. The information field should indicate: **Enter P1 measured data**	CAL:LEV P1 *OPC?
3	Measure the output voltage with the DMM and enter the data.	Enter the measurement from the external DMM in the **Measured Data** field. Press **[Select]** or **[Enter]** when done.	CAL:DATA <*data*>
4	Repeat steps 2 and 3 for calibration point 2 (P2). Note that the SCPI command in step 2 will change to CAL:LEV P2, and the front-panel message will read **Enter P2 measured data**.		
5	Select **Next** or press **Back** to finish this part of the calibration.		

DC Voltage High Range

Use the same DMM configuration as for the DC Voltage Low Range calibration.

Step	Description	Front Panel	SCPI
1	Select the high voltage range.	**[Menu] > System > Admin > Cal > DC** Then select the **High** range.	CAL:VOLT:OFFs 438
2	Select the first voltage calibration point.	Select **Next**. The information field should indicate: **Enter P1 measured data**	CAL:LEV P1 *OPC?
3	Measure the output voltage with the DMM and enter the data.	Enter the measurement from the external DMM in the **Measured Data** field. Press **[Select]** or **[Enter]** when done.	CAL:DATA <*data*>
4	Repeat steps 2 and 3 for calibration point 2 (P2). Note that the SCPI command in step 2 will change to CAL:LEV P2, and the front-panel message will read **Enter P2 measured data**.		
5	Select **Next** or press **Back** to finish this part of the calibration.		

AC Voltage Low Range

Use the same physical configuration that you used for DC Voltage calibration, but configure the 3458A for AC voltage measurements. You can use the following SCPI commands (or their front-panel equivalents) to configure the DMM:

*RST
SETACV ANA, RANGE AUTO, ACBAND 20, 2E6
ACV

Step	Description	Front Panel	SCPI
1	Select the low voltage range.	**[Menu] > System > Admin > Cal > AC.** Then select the **Low** range.	CAL:VOLT 155
2	Select the first voltage calibration point.	Select **Next**. The information field should indicate: **Enter P1 measured data**	CAL:LEV P1 *OPC?
3	Measure the output voltage with the DMM and enter the data.	Enter the measurement from the external DMM in the **Measured Data** field. Press **[Select]** or **[Enter]** when done.	CAL:DATA <*data*>
4	Repeat steps 2 and 3 for the second, third, fourth, and fifth calibration points. Note that the SCPI command should use P2, P3, P4, and P5 in place of P1. Similarly, the front-panel **Enter P1 measured data** message from step 2 will indicate P2, P3, P4, or P5.		
5	Select **Next** or press **Back** to finish this part of the calibration.		

AC Voltage High Range

Use the same DMM configuration as for the AC Voltage Low Range calibration.

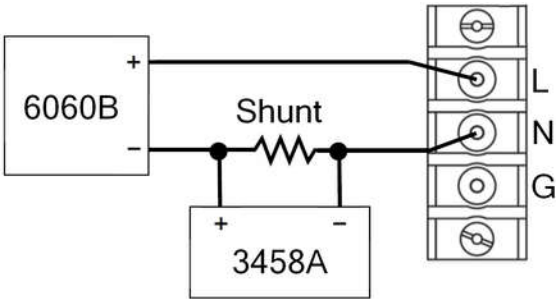
Step	Description	Front Panel	SCPI
1	Select the high voltage range.	**[Menu] > System > Admin > Cal > AC.** Then select the **High** range.	CAL:VOLT 310
2	Select the first voltage calibration point.	Select **Next**. The information field should indicate: **Enter P1 measured data**	CAL:LEV P1 *OPC?
3	Measure the output voltage with the DMM and enter the data.	Enter the measurement from the external DMM in the **Measured Data** field. Press **[Select]** or **[Enter]** when done.	CAL:DATA <*data*>
4	Repeat steps 2 and 3 for the second, third, fourth, and fifth calibration points. Note that the SCPI command should use P2, P3, P4, and P5 in place of P1. Similarly, the front-panel **Enter P1 measured data** message from step 2 will indicate P2, P3, P4, or P5.		
5	Select **Next** or press **Back** to finish this part of the calibration.		

Current Low Range

Connect a precision shunt resistor to the output. The shunt resistor should be able to measure at least 120% of the output's full-scale current. Connect the Keysight 3458A DMM across the shunt resistor. Connect the Keysight 6060B electronic load to the AC source's output. Select the full-scale (FS), Low Range current measurement value from the Current Table for the model being calibrated, 4 A for the AC6801B.

Ensure that the 6060B is in Constant Current (CC) mode. For the 3458, use the following commands to configure the instrument after it powers up in the factory default configuration:

```
DCV AUTO, AZERO ON, FIXEDZ OFF
NPLC 100
```



Step	Description	Front Panel	SCPI
1	Select **Low** range.	**[Menu] > System > Admin > Cal > Current > Low_Range**	CAL:CURR:OFFS 2
2	Disconnect the load and shunt.		
3	Go to next step.	Select **Next**.	CAL:LEV P1 *OPC?
4	Wait five minutes.		
5	Go to next step.	Select **Next**.	
6	Reconnect the load and shunt.		
7		Select **Next**.	
8	Enter a 0 (zero).	(no action required)	CAL:DATA 0
9		Select **Next**.	
10	Set the Keysight 6060B to Constant Current Mode and set the load current to 90% of the value from the table below for the model being calibrated. For example, use 3.6 A for the AC6801B.		
11	Go to next step.	Select **Next**.	CAL:LEV P2 *OPC?
12	Wait five minutes.		
13		Select **Next**.	
14	Calculate the shunt current (I=V/R) and enter the data.	Enter the computed current from the external DMM measurement and Load resistance and press **[Select]** or **[Enter]**. Select **Next** or press **Back** to finish the calibration step.	CAL:DATA <*data*>

Current Table

	AC6801B	AC6802B	AC6803B	AC6804B
Low Range	4.0 A	8.0 A	16.0 A	32.0 A

Current High Range

Use the same setup as used for Current Low Range calibration.

Step	Description	Front Panel	SCPI
1	Select **High** range.	**[Menu] > System > Admin > Cal > Current > High_Range**	CAL:CURR:OFFS 2
2	Disconnect the load and shunt.		
3	Go to next step.	Select **Next**.	CAL:LEV P1 *OPC?
4	Wait five minutes.		
5	Go to next step.	Select **Next**.	
6	Reconnect the load and shunt.		
7		Select **Next**.	
8	Enter a 0 (zero).	(no action required)	CAL:DATA 0
9		Select **Next**.	
10	Set the Keysight 6060B to Constant Current Mode and set the load current to 90% of the value from the table below for the model being calibrated. For example, use 1.8 A for the AC6801B.		
11	Go to next step.	Select **Next**.	CAL:LEV P2 *OPC?
12	Wait five minutes.		
13		Select **Next**.	
14	Calculate the shunt current (I=V/R) and enter the data.	Enter the computed current from the external DMM measurement and Load resistance and press **[Select]** or **[Enter]**. Select **Next** or press **Back** to finish the calibration step.	CAL:DATA <*data*>

Current Table, High Range

	AC6801B	AC6802B	AC6803B	AC6804B
High Range	2.0 A	4.0 A	8.0 A	16.0 A

End Calibration

This section describes the final steps in the calibration process.

CAUTION Storing calibration constants overwrites the existing ones in nonvolatile memory. If you do not save the calibration data, the new calibration constants will only be used until you exit the calibration state or cycle power. For the front panel, leaving the calibration state is defined as exiting the menu levels at or below [Menu] > System > Admin > Cal. For SCPI, leaving the calibration state is accomplished by CAL:STAT OFF.

If you are not sure you want to permanently store the new constants, do not save the data when you exit the calibration mode.

Step	Description	Front Panel	SCPI
1	Enter the calibration date.	**[Menu] > System > Admin > Cal > Date** Enter the calibration date in the **Data** field. Press **[Select]** or **[Enter]** to finish.	CAL:DATE "<*string*>"
2	Save calibration data.	**[Menu] > System > Admin > Cal > Save**	CAL:SAVE
3	Log out.	**[Menu] > System > Admin > Logout**	CAL:STAT OFF

Performance Verification

This chapter provides performance test verification procedures for the AC6800B Series instruments:

Test equipment required

Front-panel instructions

Performance test records

WARNING SHOCK HAZARD

These tests should only be performed by qualified personnel. During the performance of these tests, hazardous voltages may be present at the output of the unit.

Test equipment required

Type	Specifications	Recommended Model
Digital Voltmeter	Resolution: 10 nV @ 1V Readout: 8½ digits Accuracy: 20 ppm	Keysight 3458A
AC Current Monitor	0.01 Ω +/-200 ppm 25 A	Guildline 7350-.01
AC Current Monitor (AC6804B only)	0.01 Ω +/-200 ppm 50 A	Guildline 7340-50A
DC Current Shunt	0.1 Ω 30 A	Guildline 9230A-30
DC Current Shunt (AC6804B only)	0.05 Ω 50 A	Guildline 9230A-50
Frequency Counter	Accuracy @1 KHZ < 0.001%	Keysight 53210A
Load Resistors	16 Ω, 5 A, 400 W minimum (AC6801B) 64 Ω, 2.5 A, 400 W minimum (AC6801B) 8 Ω, 10 A, 800 W minimum (AC6802B) 32 Ω, 5 A, 800 W minimum (AC6802B) 4 Ω, 20 A, 1600 W minimum (AC6803B) 16 Ω, 10 A, 1600 W minimum (AC6803B) 2 Ω, 40 A, 3200 W minimum (AC6804B) 8 Ω, 20 A, 3200 W minimum (AC6804B)	

Current Monitoring Resistor

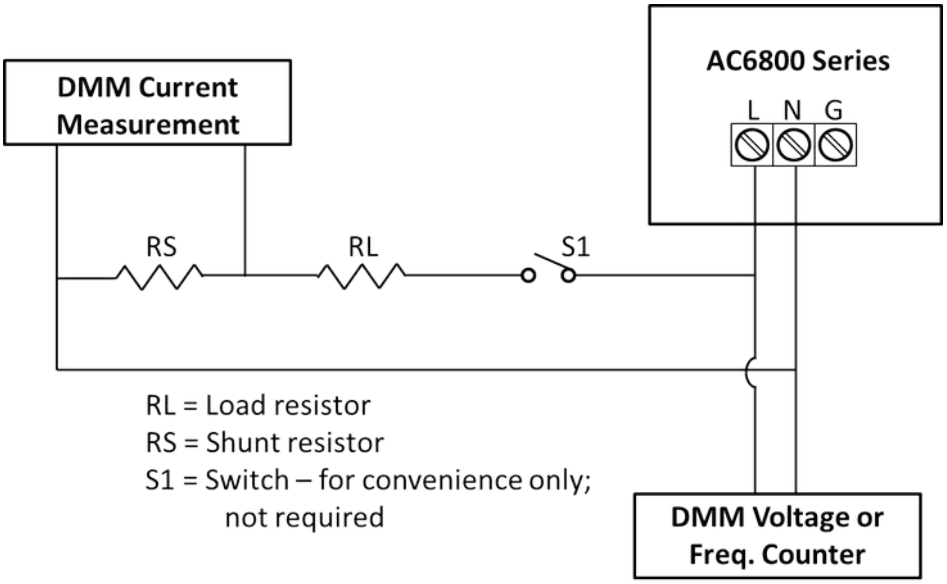
A four-terminal current monitoring resistor (current shunt) listed above is required to eliminate output current measurement error caused by voltage drops in the load leads and connections.

DMM Configuration

For all tests besides the DC Voltage and Current tests, the DMM should be set to measure AC volts and 100 NPLCs. For the DC voltage tests, the DMM should be set to measure DC volts and 100 NPLC.

Constant Voltage Tests

If more than one meter or a meter and an oscilloscope are used, connect each to the sense terminals by separate leads to avoid mutual coupling effects.



Front-panel instructions

NOTE In these procedures, the term "UUT" means "unit under test," or the AC6801B, AC6802B, AC6803B, or AC6804B.

The tables below provide the test procedures for verifying the AC6801B, AC6802B, AC6803B, and the AC6804B, in compliance with the instrument's specifications. Please refer to the calibration procedure if you observe out-of specification performance. The performance test specifications are listed in the Performance Test Records at the end of this chapter. You can record the actual measured values in the columns provided. When performing the load tests select an adequate gauge wire using the procedures given in the User's Guide for connecting the load.

Voltage Programming and Readback Accuracy

This procedure verifies that the voltage programming and readback functions are within specifications.

Step	Action	Normal Result
1	Turn off the UUT and connect the DMM across the output as shown above.	
2	Turn on the UUT. Program output to: RANGE 155 V, VOLT 155, FREQ 60	Voltage at 155 Vrms CV annunciator on Output current near zero
3	Record voltage readings at DMM and on front panel display.	Reading within specified low range limits
4	Turn on the UUT. Program output to: RANGE 310 V, VOLT 310, FREQ 60	Voltage at 310 Vrms CV annunciator on Output current near zero
5	Record voltage readings at DMM and on front panel display.	Reading within specified high range limits
6	Program RANGE155 V, VOLT 155, FREQ 500	Voltage at 155 Vrms CV annunciator on Output current near zero
7	Record voltage readings at DMM and on front panel display.	Reading within specified low range limits
8	Program RANGE 310 V, VOLT 310, FREQ 500	Voltage at 310 Vrms CV annunciator on Output current near zero
9	Record voltage readings at DMM and on front panel display.	Reading within specified high range limits

Voltage Load Regulation

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

Step	Action	Normal Result
1	Turn off the UUT and connect DMM and appropriate load resistors as shown above.	
2	Open S1.	
3	Turn on the UUT. Program output to RANGE 155 V, VOLT 80, FREQ 60	Voltage at 80 Vrms, output current near zero
4	Record voltage reading of DMM.	
5	Disable UUT. Close S1.	
6	Turn on the UUT. Program output to RANGE 155 V, VOLT 80, FREQ 60	Voltage at 80 Vrms, CV annunciator on, output current near: 5 A for AC6801B 10 A for AC6802B 20 A for AC6803B 40 A for AC6804B
7	Record voltage reading of DMM.	
8	Check test results	The difference between the DMM readings in Steps 4 & 7 are within specified load effect limits.
9	Disable the UUT. Open S1.	
10	Turn on the UUT. Program output to RANGE 155 V, VOLT 80, FREQ 500.	Voltage at 80 Vrms, output current near zero
11	Record voltage reading of DMM.	
12	Disable UUT. Close S1.	
13	Turn on the UUT.	Voltage at 80 Vrms, CV annunciator on, output current near: 5 A for AC6801B 10 A for AC6802B 20 A for AC6803B 40 A for AC6804B
14	Record voltage reading of DMM.	
15	Check test results	The difference between the DMM readings in Steps 11 & 14 are within specified load effect limits.
16	Disable UUT. Open S1.	
17	Turn on the UUT. Program output to RANGE 310 V, VOLT 160, FREQ 60	Voltage at 160 Vrms Output current near zero
18	Record voltage reading of DMM.	
19	Close S1. Turn on the UUT.	Voltage at 160 Vrms, CV annunciator on, output current near: 2.5 A for AC6801B 5 A for AC6802B 10 A for AC6803B 20 A for AC6804B

Step	Action	Normal Result
20	Record voltage reading of DMM.	
21	Check test results	The difference between the DMM readings in Steps 18 and 20 are within specified load effect limits.
22	Disable UUT. Open S1.	
23	Turn on the UUT. Program output to RANGE 310 V, VOLT 160, FREQ 500	Voltage at 160 V rms, Output current near zero
24	Record voltage reading of DMM.	
25	Close S1. Turn on the UUT.	Voltage at 160 V rms, CV annunciator on, output current near: 2.5 A for AC6801B 5 A for AC6802B 10 A for AC6803B 20 A for AC6804B
26	Record voltage reading of DMM.	
27	Check test results	The difference between the DMM readings in Steps 24 and 26 are within specified load effect limits.

RMS Current Measurement Accuracy

This test verifies the measurement accuracy of the rms current readback.

Step	Action	Normal Result
1	Turn off the UUT and connect the appropriate load resistor, current shunt and DMM as shown above.	
2	Turn on the UUT. Program the output to RANGE 155 V,VOLT 80, FREQ 60.	Output Voltage at 80 Vrms, CV annunciator on, output current near: 5 A for AC6801B 10 A for AC6802B 20 A for AC6803B 40 A for AC6804B
3	Record DMM reading and calculate rms current	Readings are within specified current limits.
4	Program output to RANGE 155 V,VOLT 80, FREQ 500.	Output Voltage at 80 Vrms, CV annunciator on, output current near: 5 A for AC6801B 10 A for AC6802B 20 A for AC6803B 40 A for AC6804B
5	Record DMM reading and calculate rms current.	Readings are within specified current limits.
6	Turn on the UUT. Program the output to RANGE 310 V,VOLT 160, FREQ 60.	Output Voltage at 160 Vrms, CV annunciator on, output current near: 2.5 A for AC6801B 5 A for AC6802B 10 A for AC6803B 20 A for AC6804B
7	Record DMM reading and calculate rms current	Readings are within specified current limits.
8	Turn on the UUT. Program the output to RANGE 310 V,VOLT 160, FREQ 500.	Output Voltage at 160 Vrms, CV annunciator on, output current near: 2.5 A for AC6801B 5 A for AC6802B 10 A for AC6803B 20 A for AC6804B
9	Record DMM reading and calculate rms current.	Readings are within specified current limits.

Frequency Accuracy

This test verifies the frequency programming and measurement accuracy of the output voltage waveform.

Step	Action	Normal Result
1	Turn off the UUT. Connect the Frequency Counter to the output as shown above.	
2	Turn on the UUT. Program output to RANGE 155 V,VOLT 20, FREQ 500	Output at 80 Vrms, CV annunciator on, Current near 0
3	Record the output frequency reading from counter	Readings are within specified limits

DC Voltage Programming and Readback Accuracy

This test verifies the DC voltage programming and front panel readback functions are within specifications.

Step	Action	Normal Result
1	Turn off the UUT. Connect the DMM directly to the output terminals. The DMM negative lead is connected to the Neutral output terminal.	
2	Turn on UUT. Program output to RANGE 155 V, VOLT 0, OUTP:COUP DC, OFFSET 219	Output at 219 VDC, output current near 0
3	Record DC voltage at DMM and readback from front panel display.	Readings within specified DC voltage programming and readback limits.
4	Program output to RANGE 310 V, VOLT 0, OUTP:COUP DC, OFFSET 438	Output at 438 VDC, output current near 0
5	Record DC voltage at DMM and readback from front panel display.	Readings within specified DC voltage programming and readback limits.

DC Current Measurement Accuracy

This test verifies that the DC voltage programming and front-panel readback functions are within specifications.

Step	Action	Normal Result
1	Turn off the UUT and connect the appropriate load resistor, DC current shunt and DMM as shown in the diagram above.	
2	Turn on UUT. Program output voltage to RANGE 155 V, VOLT 0, OUTP:COUP DC, OFFSET 64.	Output voltage at 64 VDC, CV annunciator on, output current near: 4 A for AC6801B 8 A for AC6802B 16 A for AC6803B 32 A for AC6804B
3	Record DVM reading and calculate current.	Readings within specified DC current readback limits.

Step	Action	Normal Result
4	Program output to RANGE 310, VOLT 0, OUTP:COUP DC, OFFSET 128.	Output voltage at 128 VDC, CV annunciator on, output current near: 2 A for AC6801B 4 A for AC6802B 8 A for AC6803B 16 A for AC6804B
5	Record DVM reading and calculate current.	Readings within specified dc current read-back limits.

Performance Test Records

Performance Test Record - AC6801B

Test Description	Minimum Spec.	Results	Maximum Spec.
AC Voltage Programming and Readback Accuracy			
155 Vrms @ 60Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 1.125 V	_____ V	Vrms + 1.125 V
155 Vrms @ 500Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 2.085 V	_____ V	Vrms + 2.085 V
310 Vrms @ 60Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 2.25 V	_____ V	Vrms + 2.25 V
310 Vrms @ 500Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 4.17 V	_____ V	Vrms + 4.17 V
Voltage Load Regulation			
CV Load Effect Low Range @ 60 Hz	Vout - 0.15 V	_____ V	Vout + 0.15 V
CV Load Effect Low Range @ 500 Hz	Vout - 0.50 V	_____ V	Vout + 0.50 V
CV Load Effect High Range @ 60 Hz	Vout - 0.30 V	_____ V	Vout + 0.30 V
CV Load Effect High Range @ 500 Hz	Vout - 1.00 V	_____ V	Vout + 1.00 V
RMS Current Measurement Accuracy			
Low Range Measurement @ 60 Hz	Iout – 45 mA	_____ A	Iout + 45 mA
Low Range Measurement @ 500 Hz	Iout – 75 mA	_____ A	Iout + 75 mA
High Range Measurement @ 60 Hz	Iout – 22.5 mA	_____ A	Iout + 22.5 mA
High Range Measurement @ 500 Hz	Iout – 37.5 mA	_____ A	Iout + 37.5 mA
Frequency Accuracy			
Program 500 Hz	499.9 Hz	_____ Hz	500.1 Hz
DC Voltage Programming and Readback Accuracy			
+219 VDC Output	218.343 VDC	_____ VDC	219.657
Front Panel Measurement	Vout - 1.445 VDC	_____ VDC	Vout + 1.445 VDC
+438 VDC Output	436.905 VDC	_____ VDC	439.095
Front Panel Measurement	Vout - 2.89 VDC	_____ VDC	Vout + 2.89 VDC
DC Current Readback Accuracy			
Low Range Measurement	Iout – 40 mA	_____ A	Iout + 40 mA
High Range Measurement	Iout – 20 mA	_____ A	Iout + 20 mA

Performance Test Record - AC6802B

Test Description	Minimum Spec.	Results	Maximum Spec.
AC Voltage Programming and Readback Accuracy			
155 Vrms @ 60Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 1.125 V	_____ V	Vrms + 1.125 V
155 Vrms @ 500Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 2.085 V	_____ V	Vrms + 2.085 V
310 Vrms @ 60Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 2.25 V	_____ V	Vrms + 2.25 V
310 Vrms @ 500Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 4.17 V	_____ V	Vrms + 4.17 V
Voltage Load Regulation			
CV Load Effect Low Range @ 60 Hz	Vout - 0.15 V	_____ V	Vout + 0.15 V
CV Load Effect Low Range @ 500 Hz	Vout - 0.50 V	_____ V	Vout + 0.50 V
CV Load Effect High Range @ 60 Hz	Vout - 0.30 V	_____ V	Vout + 0.30 V
CV Load Effect High Range @ 500 Hz	Vout - 1.00 V	_____ V	Vout + 1.00 V
RMS Current Measurement Accuracy			
Low Range Measurement @ 60 Hz	Iout – 90 mA	_____ A	Iout + 90 mA
Low Range Measurement @ 500 Hz	Iout – 150 mA	_____ A	Iout + 150 mA
High Range Measurement @ 60 Hz	Iout – 45 mA	_____ A	Iout + 45 mA
High Range Measurement @ 500 Hz	Iout – 75 mA	_____ A	Iout + 75 mA
Frequency Accuracy			
Program 500 Hz	499.9 Hz	_____ Hz	500.1 Hz
DC Voltage Programming and Readback Accuracy			
+219 VDC Output	218.343 VDC	_____ VDC	219.657
Front Panel Measurement	Vout - 1.445 VDC	_____ VDC	Vout + 1.445 VDC
+438 VDC Output	436.905 VDC	_____ VDC	439.095
Front Panel Measurement	Vout - 2.89 VDC	_____ VDC	Vout + 2.89 VDC
DC Current Readback Accuracy			
Low Range Measurement	Iout – 80 mA	_____ A	Iout + 80 mA
High Range Measurement	Iout – 40 mA	_____ A	Iout + 40 mA

Performance Test Record - AC6803B

Test Description	Minimum Spec.	Results	Maximum Spec.
AC Voltage Programming and Readback Accuracy			
155 Vrms @ 60Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 1.125 V	_____ V	Vrms + 1.125 V
155 Vrms @ 500Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 2.085 V	_____ V	Vrms + 2.085 V
310 Vrms @ 60Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 2.25 V	_____ V	Vrms + 2.25 V
310 Vrms @ 500Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 4.17 V	_____ V	Vrms + 4.17 V
Voltage Load Regulation			
CV Load Effect Low Range @ 60 Hz	Vout - 0.15 V	_____ V	Vout + 0.15 V
CV Load Effect Low Range @ 500 Hz	Vout - 0.50 V	_____ V	Vout + 0.50 V
CV Load Effect High Range @ 60 Hz	Vout - 0.30 V	_____ V	Vout + 0.30 V
CV Load Effect High Range @ 500 Hz	Vout - 1.00 V	_____ V	Vout + 1.00 V
RMS Current Measurement Accuracy			
Low Range Measurement @ 60 Hz	Iout – 180 mA	_____ A	Iout + 180 mA
Low Range Measurement @ 500 Hz	Iout – 300 mA	_____ A	Iout + 300 mA
High Range Measurement @ 60 Hz	Iout – 90 mA	_____ A	Iout + 90 mA
High Range Measurement @ 500 Hz	Iout – 150 mA	_____ A	Iout + 150 mA
Frequency Accuracy			
Program 500 Hz	499.9 Hz	_____ Hz	500.1 Hz
DC Voltage Programming and Readback Accuracy			
+219 VDC Output	218.343 VDC	_____ VDC	219.657
Front Panel Measurement	Vout - 1.445 VDC	_____ VDC	Vout + 1.445 VDC
+438 VDC Output	436.905 VDC	_____ VDC	439.095
Front Panel Measurement	Vout - 2.89 VDC	_____ VDC	Vout + 2.89 VDC
DC Current Readback Accuracy			
Low Range Measurement	Iout – 160 mA	_____ A	Iout + 160 mA
High Range Measurement	Iout – 80 mA	_____ A	Iout + 80 mA

Performance Test Record - AC6804B

Test Description	Minimum Spec.	Results	Maximum Spec.
AC Voltage Programming and Readback Accuracy			
155 Vrms @ 60Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 1.125 V	_____ V	Vrms + 1.125 V
155 Vrms @ 500Hz	154.4575	_____ V	155.5425
Front Panel Measurement	Vrms - 2.085 V	_____ V	Vrms + 2.085 V
310 Vrms @ 60Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 2.25 V	_____ V	Vrms + 2.25 V
310 Vrms @ 500Hz	308.915	_____ V	311.085
Front Panel Measurement	Vrms - 4.17 V	_____ V	Vrms + 4.17 V
Voltage Load Regulation			
CV Load Effect Low Range @ 60 Hz	Vout - 0.15 V	_____ V	Vout + 0.15 V
CV Load Effect Low Range @ 500 Hz	Vout - 0.50 V	_____ V	Vout + 0.50 V
CV Load Effect High Range @ 60 Hz	Vout - 0.30 V	_____ V	Vout + 0.30 V
CV Load Effect High Range @ 500 Hz	Vout - 1.00 V	_____ V	Vout + 1.00 V
RMS Current Measurement Accuracy			
Low Range Measurement @ 60 Hz	Iout – 360 mA	_____ A	Iout + 360 mA
Low Range Measurement @ 500 Hz	Iout – 600 mA	_____ A	Iout + 600 mA
High Range Measurement @ 60 Hz	Iout – 180 mA	_____ A	Iout + 180 mA
High Range Measurement @ 500 Hz	Iout – 300 mA	_____ A	Iout + 300 mA
Frequency Accuracy			
Program 500 Hz	499.9 Hz	_____ Hz	500.1 Hz
DC Voltage Programming and Readback Accuracy			
+219 VDC Output	218.343 VDC	_____ VDC	219.657
Front Panel Measurement	Vout - 1.445 VDC	_____ VDC	Vout + 1.445 VDC
+438 VDC Output	436.905 VDC	_____ VDC	439.095
Front Panel Measurement	Vout - 2.89 VDC	_____ VDC	Vout + 2.89 VDC
DC Current Readback Accuracy			
Low Range Measurement	Iout – 320 mA	_____ A	Iout + 320 mA
High Range Measurement	Iout – 160 mA	_____ A	Iout + 160 mA

Service and Maintenance

Types of Service Available

Self-test

Before Returning the Unit

Repackaging for Shipment

User-replaceable parts

Installing an Optional Interface Board

Updating the Firmware

Log into and out of the System Administration Menu

Change the System Administration Password

Sanitize the Instrument per the NISPOM Standard

Cleaning the Outside of the Instrument

Cleaning and Replacing the Filter

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 may also consider purchasing a service contract that extends coverage after the standard warranty.

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.

Self-test

The instrument performs an automatic self-test at power-on. This test verifies the basic functionality of the instrument's logic and power mesh subsystems without placing any voltages on the output.

The *TST? query returns the result of that test, but it does not run another self-test. If self-test fails, turn the instrument off, remove all connections (front and rear), and turn the instrument back on. The purpose of this is to eliminate signals present on external wiring that can act as antennae.

See SCPI Error Messages for a list of error messages.

Before Returning the Unit

If the unit is inoperative, verify that the AC power is securely connected to the instrument, the mains outlet is live, and the power switch is on. Before returning the unit, cycle power on the unit to run the self-test as described above. Press [Error] to view errors in the error queue. Then report those errors to Keysight Support and be sure that the instrument was calibrated within the last year.

Repackaging for Shipment

To ship the unit to Keysight for service or repair:

Attach a tag to the unit identifying the owner, model number, serial number, and required service.

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.

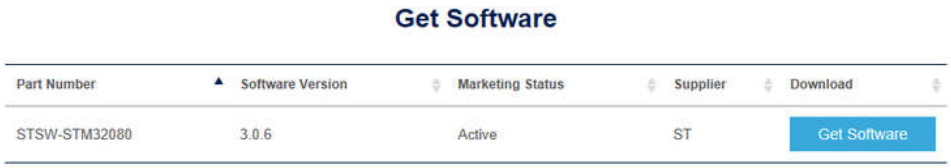
Keysight suggests that you always insure shipments.

User-replaceable parts

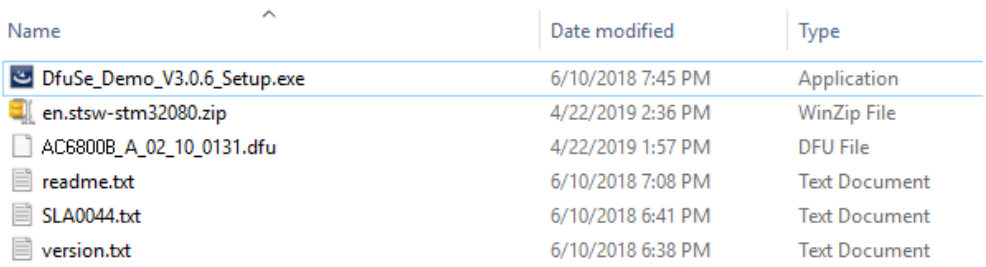
Part Number	Name	Models
5188-9178	Ferrite core	All
AC6802-800003	AC input cover	AC6802B
5003-2136	AC input cover	AC6803B
5003-2137	AC input cover	AC6804B
5066-1893	Dust filter	AC6801B, AC6802B, AC6803B
5066-1894	Dust filter	AC6804B
AC6801-800003	Front grille	AC6801B, AC6802B, AC6803B
AC6804-800003	Front grille	AC6804B
5067-6052	Rubber foot kit (qty 4)	AC6801B, AC6802B, AC6803B
5067-6053	Rubber foot kit (qty 4)	AC6804B
AC6801-800004	Output cover	AC6801B, AC6802B, AC6803B
AC6804-800004	Output cover	AC6804B
AC6800-800001	Sense kit (cover and plug)	All
5067-6057	Option slot cover	All

Updating the Firmware

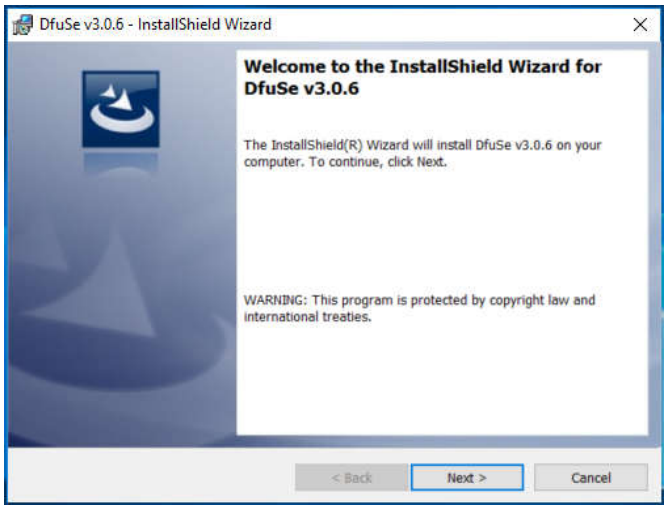
1. Using the Web browser on your PC, go to www.keysight.com/find/ac6801b (replace ac6801b with your ac source model).
2. Under the "Support" tab, select "Drivers, Firmware & Software".
3. Select "AC6800 Basic AC Source Series Firmware" and download the current firmware (DFU file) from this page to a folder on your PC.
4. If you have already installed the STMicroelectronics software to your PC, proceed to step 8. Otherwise, install the STMicroelectronics software to your PC. This software is required to update the firmware. Go to: http://www2.st.com/content/st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-programmers/stsw-stm32080.html . Select “Get Software” on the bottom of the page.



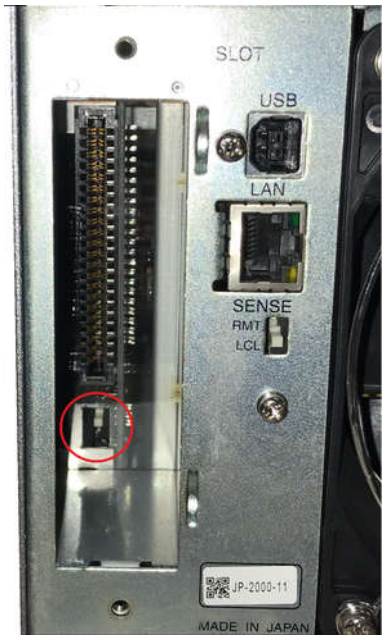
5. Accept the license agreement and provide your name and email. You will now receive an email from STMicroelectronics.c. Select “Download now” in the email. Scroll to the bottom of the page and select “Get Software”. You will now be able to download and then unzip “en.stsw-stm32080.zip to the folder you created in step 3. After unzipping, the following files should be installed:



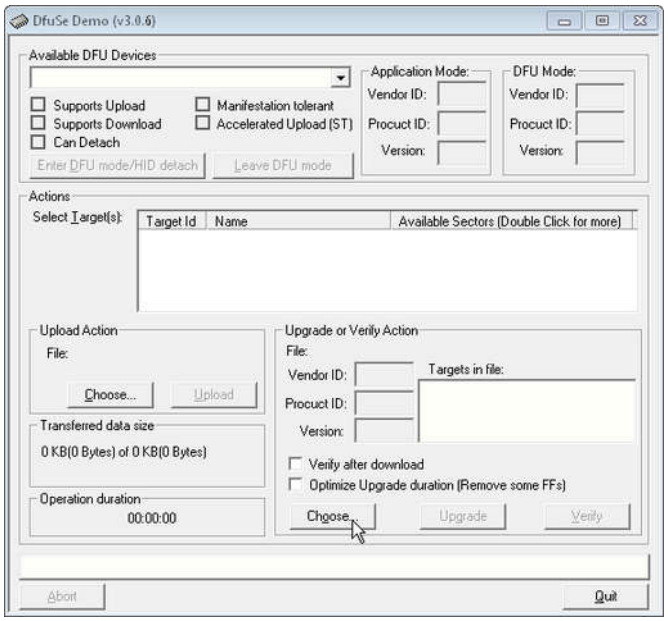
6. Run the “DfuSe_Demo_V3.0.6_Setup.exe” installation package.



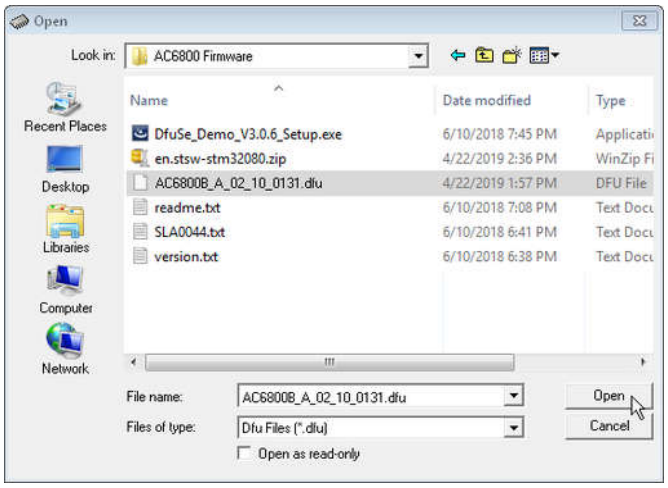
7. After the STMicroelectronics software has installed, you must also install the USB driver.
   If you have a 64-bit operating system, go to C:\Program Files (x86)\STMicroelectronics\Software\DfuSe v3.0.5\Bin\Driver\Win7\x64. Then run dpinst_amd64.exe
   If you have a 32-bit operating system, follow the same path except go to the x86 folder and run dpinst_x86.exe
8. Turn off the ac source and remove the two screws that hold the optional interface board or slot cover in place on the instrument's rear panel. Set the interface board or slot cover aside.
9. Push the switch at the back, bottom of the slot into the down position.



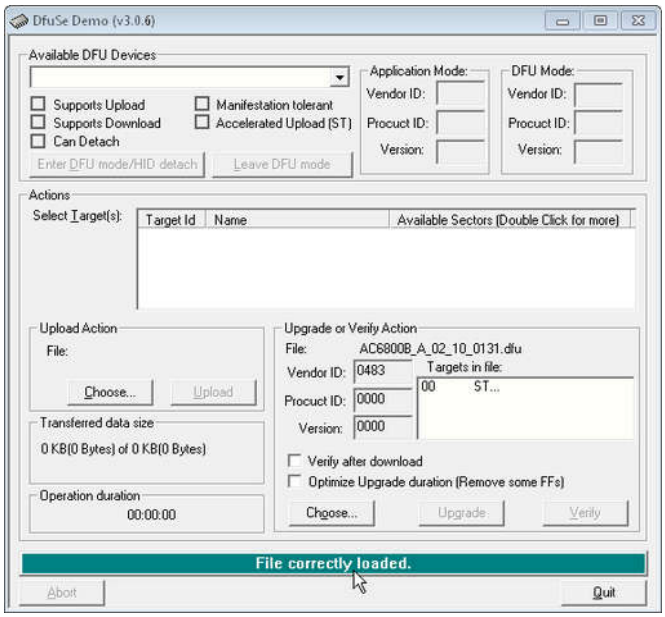
10. On your PC desktop, find and open the DfuSeDemo application. When the screen shown below appears, click **Choose...** in the Upgrade or Verify Action section of the screen.



11. Browse to the folder you created in step 3. Select the DFU file, and click **Open**.

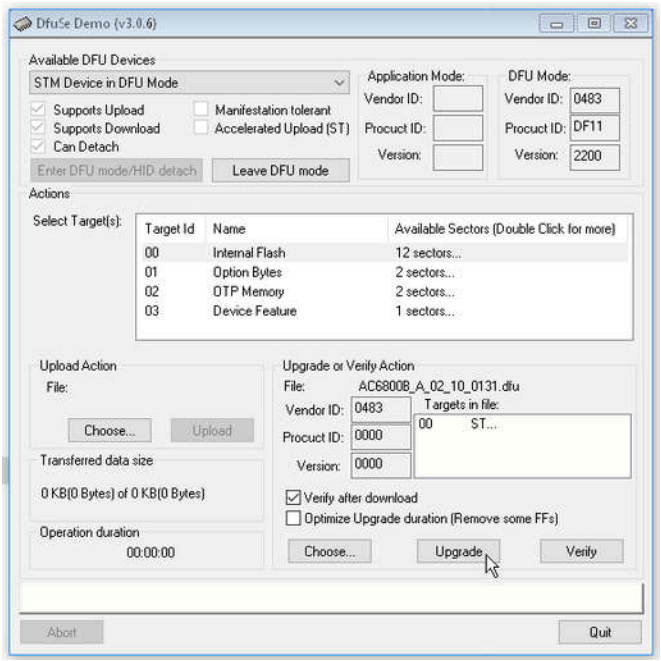


12. Verify that the message at the bottom of the screen indicates that the file loaded correctly.

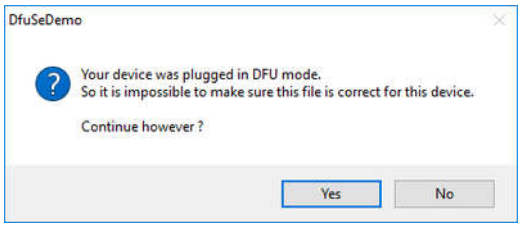


13. Connect a USB cable from the square "USB device" port on the instrument's rear panel to a USB port on your PC. This update must be done via USB, not over LAN or the optional GPIB.

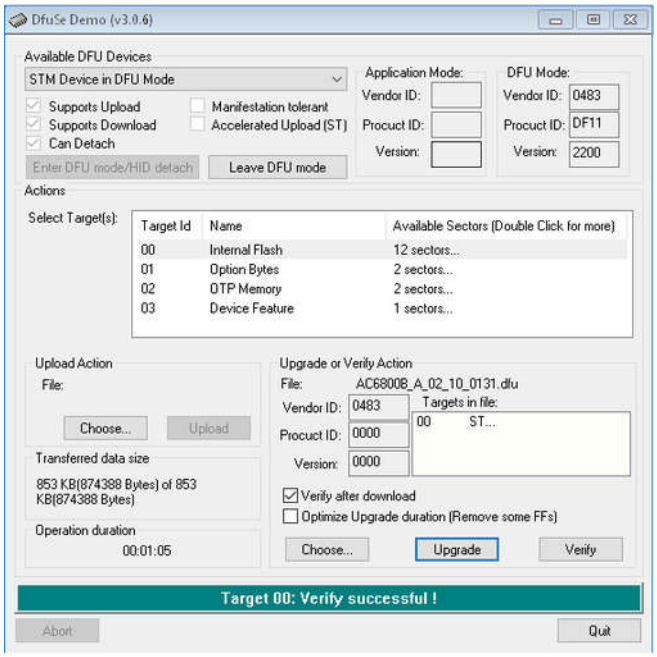
14. Turn on the instrument and wait for the Available DFU Devices field at the top of the screen to indicate that the instrument has been recognized. The selected target should be "00 Internal Flash". Check "Verify after download", and click **Upgrade**.



15. Select Yes in the popup that appears and wait for the upgrade to complete.



16. When the message at the bottom of the screen shows “Verify Successful !” the download is complete.



17. Exit the DfuSe Demonstration software, turn off the instrument, disconnect the USB cable, return the option slot switch to the up position, and replace the optional card or slot cover, screwing it securely in place. The firmware update is complete.

18. When you first turn on the instrument after the firmware installation, the front panel will display an "Err" annunciator . This is normal. Press the front panel **Error** key and you will see "Error -315, Configuration memory is lost". This is normal. Press the **Meter** key to clear the error.

Log into and out of the System Administration Menu

To access any of the functions under the system administration menu, you must log in with a password (the default password is blank). These functions include:

Calibrating the instrument

Configuring instrument I/O

Sanitizing the instrument per the NISPOM standard

Changing the system administration password

To log in, select [Menu] > System > Admin > Login.



The password must be 4 to 15 characters long and may include any of these characters:

Characters	Description
A-Z	Upper case letters
a-z	Lower case letters
0-9	Numeric digits
+ - ( ) . , <space>	Plus, minus, parentheses, period, comma, space

Always remember to log out after completing your administrative tasks if password protection has been enabled. Press [Menu] > System > Admin > Logout > Logout.



Change the System Administration Password

Select [Menu] > System > Admin > Password to change the instrument's system administration password.



The rules for a valid password are described above.

Sanitize the Instrument per the NISPOM Standard

Select [Menu] > System > Admin > Sanitize to sanitize the user data in the instrument per the National Industrial Security Program Operating Manual (NISPOM). Factory data (instrument firmware, model number, serial number, MAC address and calibration data) is not erased. After the data is cleared, the instrument is rebooted. This procedure is typically performed only when you need to remove an instrument from a secure area. The sanitization procedure is not recommended for use in routine applications because of the possibility of unintended loss of data.



Cleaning the Outside of the Instrument

WARNING SHOCK HAZARD To prevent electric shock, unplug the unit before cleaning.

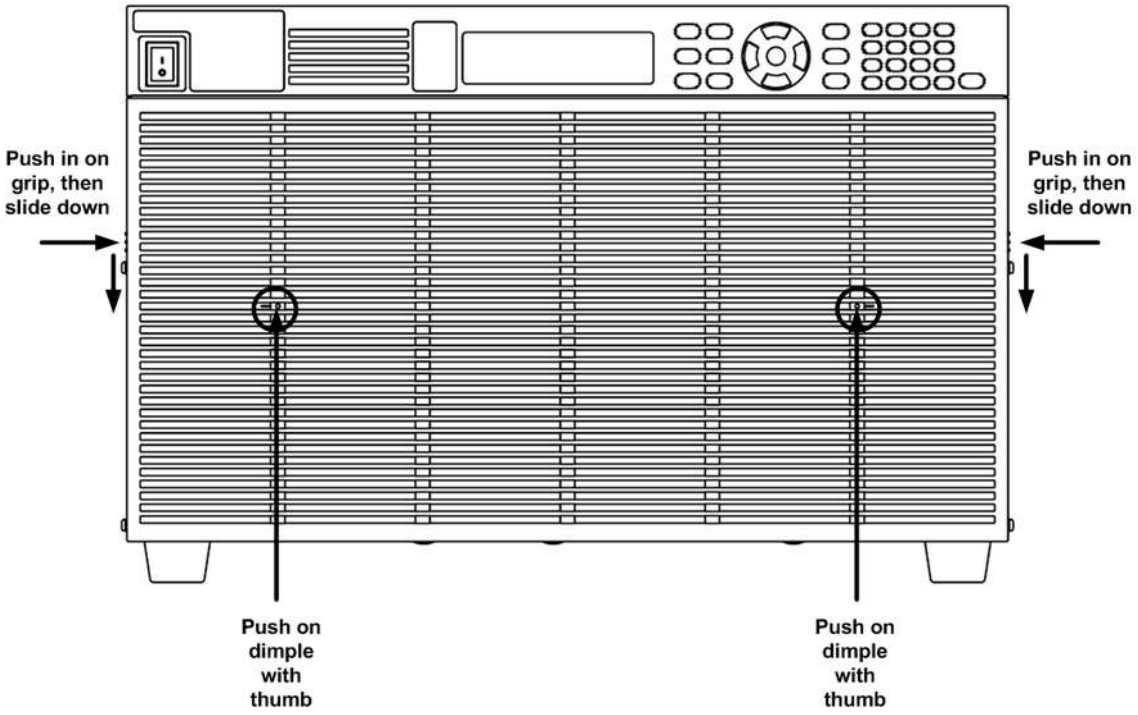
Clean the outside of the instrument with a soft, lint-free cloth, slightly damp with water. Do not use detergent. Do not disassemble the instrument for cleaning and do not clean the rear panel in order to avoid getting moisture near the connections. Ensure that the instrument is completely dry before turning it on.

Cleaning and Replacing the Filter

The following procedure illustrates the AC6804B instrument, but the same procedure applies to all the AC6800B units.

Step 1. With your thumbs, press on the two dimples located on the front panel grill.

Step 2. While pressing on the dimples, use your forefingers to press on the grips and slide the grill down.



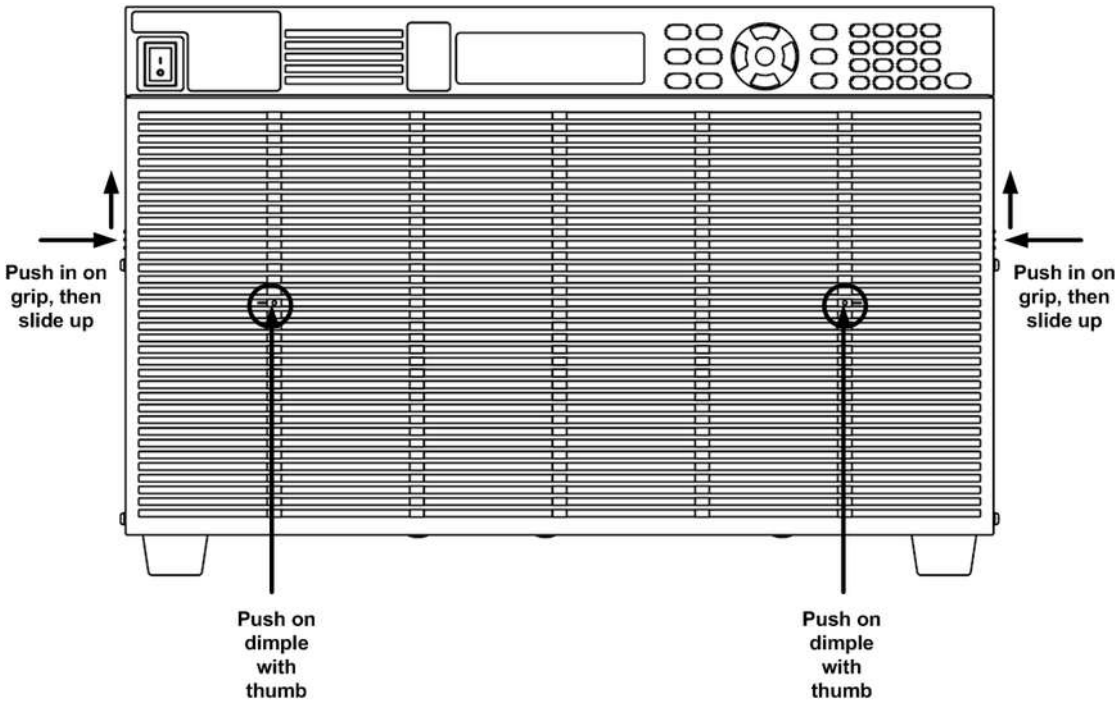
Step 3. Detach the front grill.

Step 4. Remove the filter and clean it by rinsing it in water. Ensure that the filter is completely dry before reinstalling it.

Step 5. Align the plastic fingers on the back of the grille with the slots on the sheet metal.

Step 6. With your thumbs, press the two dimples located on the front panel grill.

Step 7. While pressing on the dimples, use your forefingers to press on the grips and slide the grill up.


Push in on grip, then slide up
Push in on grip, then slide up
Push on dimple with thumb
Push on dimple with thumb

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