Keysight Models 6811C, 6812C, and 6813C AC Power Solutions

Quick Start Guide

KEYSIGHT TECHNOLOGIES

Notices

Copyright Notice

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Safety Information

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.

La mention ATTENTION signale un danger. Si la manoeuvre ou la procédure correspondante n'est pas exécutée correctement, il peut y avoir un risque d'endommagement de l'appareil ou de perte de données importantes. En présence de la mention ATTENTION, il convient de ne pas poursuivre tant que les conditions indiquées n'ont pas été parfaitement comprises et remplies.

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.

La mention AVERTISSEMENT signale un danger pour la sécurité de l'opérateur. Si la manoeuvre ou la procédure correspondante n'est pas exécutée correctement, il peut y avoir un risque grave, voire mortel pour les personnes. En présence d'une mention AVERTISSEMENT, il convient de s'interrompre tant que les conditions indiquées n'ont pas été parfaitement comprises et satisfaites.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

	Standby supply, unit is not completely disconnected from ac mains when switch is off		Alternating current (AC)
	Frame or chassis (ground) terminal		On (mains supply)
	Protective earth (ground) terminal		Caution, risk of electric shock
L	Line conductor on permanently installed equipment		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
N	Neutral conductor on permanently installed equipment		

Safety Considerations

Read the information below before using this instrument.

This product 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 a ground receptacle. Before installation or operation, check the ac source and review this guide for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places in the guide.

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

GENERAL

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Any LEDs used in this product are Class 1 LEDs as per IEC 60825-1.

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

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. KEYSIGHT TECHNOLOGIES SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

WARNING

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage, the correct fuse is installed, and all safety precautions are taken. Note the instrument's external markings described under “Safety Information” on page 3.

AVANT LA MISE SOUS TENSION

Vérifiez que le produit est réglé pour correspondre à la tension secteur disponible, que le fusible adéquat est installé et que toutes les précautions de sécurité sont respectées. Consultez les marquages externes de l’instrument décrits sous “Safety Information” à la page 3.

WARNING

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical ground. 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.

MISE À LA TERRE DE L’INSTRUMENT

Pour réduire au minimum le risque de choc électrique, le châssis et le couvercle de l’instrument doivent être connectés à la terre. L’instrument doit être connecté au réseau électrique alternatif par le biais d’un câble d’alimentation relié à la terre, le fil de terre solidement connecté à une terre électrique (masse de sécurité) au niveau de la prise de courant. Toute interruption du conducteur protecteur (de mise à la terre) ou déconnexion de la borne de terre de protection entraînera un risque de choc électrique pouvant entraîner des blessures corporelles.

Un circuit de terre continu est essentiel en vue du fonctionnement sécuritaire de l’appareil. Ne jamais mettre l’appareil en marche lorsque le conducteur de mise ... la terre est débranché,.

WARNING

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes.

NE PAS FAIRE FONCTIONNER DANS UNE ATMOSPHÈRE EXPLOSIVE

Ne faites pas fonctionner l'instrument en présence de fumées ou de gaz inflammables.

WARNING

DO NOT REMOVE THE INSTRUMENT COVER

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified service personnel.

NE PAS RETIRER LE COUVERCLE DE L'INSTRUMENT

Le personnel d'exploitation ne doit pas retirer les couvercles de l'instrument. Le remplacement des composants et les réglages internes doivent être uniquement effectués par du personnel de service qualifié.

WARNING

IN CASE OF DAMAGE

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

EN CAS DE DOMMAGES

Les instruments endommagés ou défectueux doivent être désactivés et protégés contre toute utilisation involontaire jusqu'à ce qu'ils aient été réparés par une personne qualifiée.

WARNING

LETHAL VOLTAGES

AC Sources can supply 425 V peak at their output. DEATH on contact may result if the output terminals or circuits connected to the output are touched when power is applied. Hazardous voltages can remain active inside the unit even after it has been turned off. If the internal LED's are on, hazardous voltages are present.

TENSIONS MORTELLES

Source AC peuvent fournir 425 V maximum à leur sortie. Tout contact peut entraîner la MORT si les circuits ou bornes de sorties connectés à la sortie sont touchés lorsqu'ils sont sous tension. Des tensions dangereuses peuvent rester actives à l'intérieur de l'unité, même après l'avoir mise hors tension. Si les DEL internes sont allumées, des tensions dangereuses sont présentes.

CAUTION

ENVIRONMENTAL CONDITIONS

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 85% and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

CONDITIONS ENVIRONNEMENTALES

Cet instrument est destiné à une utilisation en intérieur dans un environnement d'installation de catégorie II, degré de pollution 2. Il est conçu pour fonctionner dans une humidité relative maximale de 85 % et à jusqu'à 2000 mètres d'altitude. Consultez les tableaux de spécifications pour connaître les exigences en matière de tension secteur et de plage de températures de fonctionnement ambiante.

CAUTION

FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.

FUSIBLES

Seuls des fusibles délivrant la tension nominale et le courant nominal requis et ayant le type spécifié (à action normale, à action retardée et autres) doivent être utilisés. N'utilisez pas de fusibles réparés ou de porte-fusibles court-circuités. Vous pourriez provoquer un choc ou un risque d'incendie.

Environmental ConditionsRegulatory Information

CAUTION

The Models 6811C, 6812C, and 6813C is designed for indoor use and in an area with low condensation. The table below shows the general environmental requirements for this instrument.

Environmental condition	Requirement
Temperature	Operating condition – 0 °C to 40 °C Storage condition – –40 °C to 70 °C
Humidity	Operating condition – Up to 85% RH at 40°C (non-condensing) Storage condition – Up to 95% RH at 40°C (non-condensing)
Altitude	Up to 2000 m
Pollution degree	2

Refer to the specification tables in the *User's and Service Guide* for the AC mains voltage requirements and ambient operating temperature range. Do not operate the instrument in the presence of flammable gases or fumes.

Ce Models 6811C, 6812C, and 6813C est conçu pour être utilisé dans des locaux fermés où la condensation est faible. Le tableau ci-dessous indique les conditions d'environnement générales requises pour cet instrument.

Condition d'environnement	Exigences
Température	Conditions de fonctionnement – Entre 0°C et 40 °C Conditions de stockage – –40 °C à 70 °C
Humidité	Conditions de fonctionnement – Jusqu'à 85% d'humidité relative à 40 °C (sans condensation) Conditions de stockage – Jusqu'à 95% d'humidité relative à 40 °C (sans condensation)
Altitude	Jusqu'à 2 000 m
Degré de pollution	2

Consultez les tableaux de spécifications dans le *Guide d'utilisateur et d'entretien* pour connaitre les exigences en matière de tension secteur AC et de plage de températures de fonctionnement ambiante. Ne faites pas fonctionner l'instrument en présence de fumées ou de gaz inflammables.

CAUTION

The Models 6811C, 6812C, and 6813C AC Power Solutions complies with the following safety and Electromagnetic Compatibility (EMC) compliances:

Safety compliance

- IEC 61010-1:2010/ EN 61010-1:2010
- Canada: CAN/CSA-C22.2 No. 61010-1-12
- USA: UL 61010 Issue:2012/05/11 Ed:3

EMC compliance

- IEC 61326-1:2012 / EN 61326-1:2013
- Canada: ICES/NMB-001
- Australia/New Zealand: AS/NZS CISPR 11:2011
- South Korea RRA Notice 2016-24

Le Models 6811C, 6812C, and 6813C AC Power Solutions est conforme aux normes de sécurité et aux normes EMC suivantes :

Conformité de sécurité

- CEI 61010-1:2010/ EN 61010-1:2010
- Canada : CAN/CSA-C22.2 No. 61010-1-12
- Etats-Unis : UL 61010 Publication :2012/05/11 Ed :3

Conformité CEM

- CEI 61326-1:2012/ EN 61326-1:2013
- Canada : ICES/NMB-001
- Australie/Nouvelle Zélande : AS/NZS CISPR11:2011
- Corée du Sud RRA Notification 2016-24

Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.

Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit http://about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/6800
  (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
  (worldwide contact information for repair and service)

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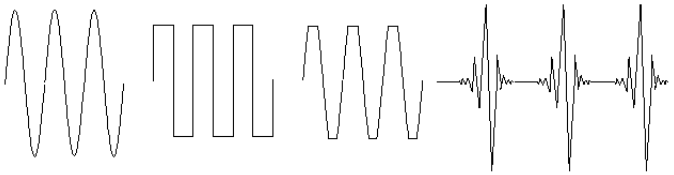
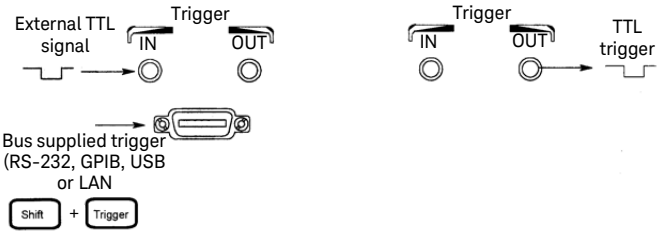
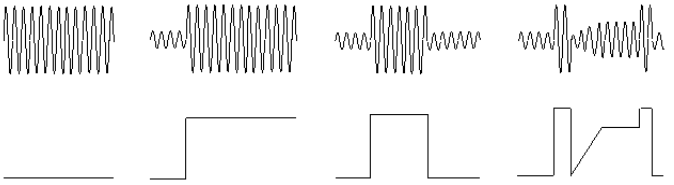
Features of the AC Source

The Keysight Models 6811C, 6812C, and 6813C AC Power Solutions will be referred to as “ac source” or “ac sources” throughout this guide.

Feature	Description
Generate waveform shapes	 **Sine wave Square wave Clipped sine wave User-definable waveforms**
Program the output	– Phase – AC root mean square (rms) voltage – Distortion – Frequency – Voltage and frequency slew rates – rms current limit – DC voltage – Peak current limit – AC coupling – Impedance
Make measurements	– AC rms, AC + DC rms voltage – AC rms, AC + DC rms current; plus repetitive and non-repetitive peak current – Real, reactive, and apparent power – Harmonic analysis of voltage and current waveforms giving amplitude, phase, and total harmonic distortion results of up to the 50th harmonic. – Triggered acquisition of digitized voltage and current with extensive post-acquisition calculations – DC voltage – DC current

Feature	Description
Synchronize transient events or measurements with external signals	
Operate in four transient modes	
Operate under local or remote control	– From the front panel keys – Through the built-in GPIB, RS-232, LAN, and USB interfaces
Implement protection features	– Overvoltage – Overcurrent – Overpower – Overtemperature – User-defined external events (via a fault (FLT) shutdown signal)

The Front Panel - At a Glance

14-character display shows menu commands and measured values.

- Annunciators indicate operating modes and status conditions.

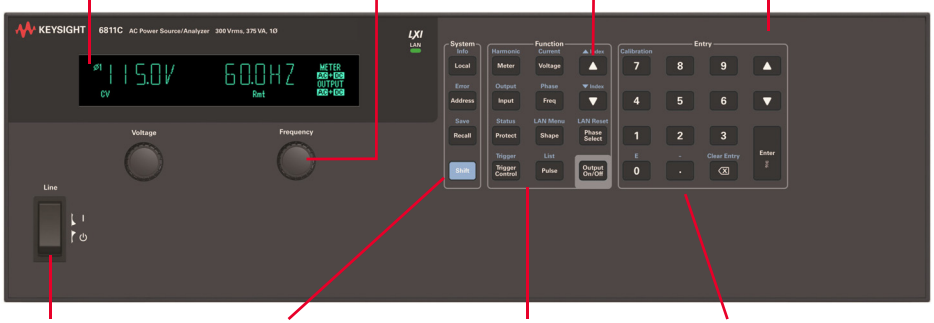
Rotary controls set voltage and frequency when ac source is in local mode.

- Turn rapidly for coarse control
- Turn slowly for fine control.

Press ▲ Index or ▼ Index to scroll through menu commands.

Press Shift then ▲ Index or ▼ Index to scroll through lists and harmonic arrays.

Press ▲ or ▼ to scroll through command parameters.



Turns the ac source on or off

System keys

Function keys

Entry keys

NOTE

- If ✳ is displayed, press **[Enter]** to display the information for the command or save the command settings.
- If △ and ▽ are displayed, use ▲ or ▼ of the function keys or entry keys to scroll up or down to display the information.

System key press	Function key press	Function command on the front panel display	Entry key press	Description
	-	-	-	Change the ac source's selected interface from remote operation to local (front panel) operation. Pressing the key will have no effect if the interface state is already Local, Local-with-Lockout, or Remote-with-Lockout.

System key press	Function key press	Function command on the front panel display	Entry key press	Description
	Use ▲ or ▼ to navigate between the **Info** function commands	MODEL: <info>	-	Display the instrument model name.
		OPTION: <info>	-	Display the instrument option.
		SERIAL NO.: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display the instrument serial number.
		FW REV: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display instrument firmware revision.
		MAC: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display instrument MAC address.
		USB VID: <info>	-	Display instrument USB Vendor ID.
		USB PID: <info>	-	Display instrument USB Product ID.

System key press	Function key press	Function command on the front panel display	Entry key press	Description
	Use ▲ or ▼ to navigate between the **Address** function commands	ADDRESS <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the GPIB address.
		BAUDRATE 1200 | 2400 | 4800 | 9600	Use ▲ or ▼ to navigate between 1200 | 2400 | 4800 | 9600. Press **[Enter]** to save.	Select the baud rate.
		PARITY NONE | EVEN | ODD	Use ▲ or ▼ to navigate between NONE | EVEN | ODD. Press **[Enter]** to save.	Select message parity.
	-	-	-	Display system error codes stored in the SCPI error queue. If no errors exist, a 0 is displayed. The **Err** annunciator is lit when there are errors.
	-	-	-	Return the ac source into a previously saved state. Up to 16 states can be recalled (0-15).
	-	-	-	Save an existing ac source state in nonvolatile memory. Up to 16 states can be saved (0-15).

Function keys

NOTE

- If ✳ is displayed, press **[Enter]** to display the information for the command or save the command settings.
- If ▲ and ▼ are displayed, use ▲ or ▼ of the function keys or entry keys to scroll up or down to display the information.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Meter** function commands.	<reading> V <reading> Hz	-	Display rms voltage and frequency.
	<reading> V <reading> A	-	Display rms voltage and rms current.
	<reading> A <reading> Hz	-	Display rms current and frequency.
	<reading> V <reading> W	-	Display rms voltage and power.
	<reading> CREST F	-	Display current crest factor.
	<reading> A PK REP	-	Display peak current, repetitive.
	<reading> A PK NR	-	Display peak current, non-repetitive.
	<reading> VA	-	Display apparent power.
	<reading> VAR	-	Display reactive power.
	<reading> PFACTOR	-	Display power factor.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Harmonic** function commands. Press  then ▲ or ▼ to increment or decrement the index of the **Harmonic** function commands.	<reading> A I:MAG: <index>	-	Display current harmonic magnitude.
	<reading>° I:PHASE: <index>	-	Display current harmonic phase.
	<reading> V V:MAG: <index>	-	Display voltage harmonic magnitude.
	<reading>° V:PHASE: <index>	-	Display voltage harmonic phase.
	<reading> CURR:THD	-	Display current total % harmonic distortion.
	<reading> VOLT:THD	-	Display voltage total % harmonic distortion.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Voltage** function commands.	VOLT <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate AC output voltage.
	VOLT:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered output voltage.
	VOLT:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the voltage mode.
	OFFSET <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate DC offset voltage.
	OFFSET:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered DC offset voltage.
	OFFSET:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the DC offset voltage mode.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Voltage** function commands.	SLEW <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set voltage slew in V/sec.
	SLEW:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered voltage slew in V/sec.
	SLEW:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the voltage slew mode.
	OFF:SLW <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set DC offset slew in V/sec.
	OFF:SLW:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered DC offset slew in V/sec.
	OFF:SLW:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the voltage slew mode.
	ALC INT | EXT	Use ▲ or ▼ to navigate between INT | EXT. Press **[Enter]** to save.	Select the voltage sense source.
	ALC:DET RTIME | RMS	Use ▲ or ▼ to navigate between RTIME | RMS. Press **[Enter]** to save.	Select the voltage sense detector.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Current** function commands.	CURR:LEV <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate rms current limit.
	CURR:PEAK <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate peak current limit.
	CURR:PEAK:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered peak current limit.
	CURR:PEAK:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the peak current limit mode.
 Use ▲ or ▼ to navigate between the **Input** function commands.	INP:COUP AC | DC | ACDC	Use ▲ or ▼ to navigate between AC | DC | ACDC. Press **[Enter]** to save.	Select meter coupling.
	CURR:RANGE HIGH | LOW	Use ▲ or ▼ to navigate between HIGH | LOW. Press **[Enter]** to save.	Select current measurement range.
	WINDOW KBESSEL | RECT	Use ▲ or ▼ to navigate between KBESSEL | RECT. Press **[Enter]** to save.	Select harmonic measurement window meter.
 Use ▲ or ▼ to navigate between the **Output** function commands.	OUTP:COUP AC | DC	Use ▲ or ▼ to navigate between AC | DC. Press **[Enter]** to save.	Select output coupling.
	✳ RST	Press **[Enter]** to execute.	Execute the *RST command
	TTLT:SOUR BOT | EOT | LIST	Use ▲ or ▼ to navigate between BOT | EOT | LIST. Press **[Enter]** to save.	Select trigger out source coupling.
	TTLT:STATE ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set trigger out state.
	IMP:STATE ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set output impedance programming.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Output** function commands.	IMP:REAL <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set real part of output impedance.
	IMP:REAC <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set reactive part of output impedance.
	PON:STATE RST | RCL0	Use ▲ or ▼ to navigate between RST | RCL0. Press **[Enter]** to save.	Select power-on state command.
	RI LATCHING | OFF | LIVE	Use ▲ or ▼ to navigate between LATCHING | OFF | LIVE. Press **[Enter]** to save.	Set remote inhibit mode.
	DFI ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set discrete fault indicator state.
	DFI:SOUR QUES | OPER | ESB | RQS | OFF	Use ▲ or ▼ to navigate between QUES | OPER | ESB | RQS | OFF. Press **[Enter]** to save.	Select the DFI source.
 Use ▲ or ▼ to navigate between the **Freq** function commands.	FREQ <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate output frequency.
	FREQ:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered output frequency.
	FREQ:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the frequency mode.
	SLEW <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set frequency slew in Hz/sec.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Freq** function commands.	SLEW:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered frequency slew Hz/ sec.
	SLEW:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the frequency slew mode.
 Use ▲ or ▼ to navigate between the **Phase** function commands.	PHASE <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set immediate output phase.
	PHASE:T <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set triggered output phase.
	PHASE:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Select the phase mode.
 Use ▲ or ▼ to navigate between the **Protect** function commands.	PROT:CLEAR	Press **[Enter]** to execute.	Clear latched protection signal.
	CURR:PROT ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set overcurrent protection function.
	VOLT:PROT ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set overvoltage protection function.
	VOLT:PROT <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set overvoltage protection level.
	DELAY <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set a time delay for activating a protection fault.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Status** function commands.	✳ CLS	Press **[Enter]** to execute.	Execute the *CLS command.
	STATUS:PRESET	Press **[Enter]** to execute.	Execute STATus:PRESet command.
	✳ ESR? <value>	Press **[Enter]** to display the information for command.	Return event status register value.
	✳ STB <value>	-	Return status byte register value.
	OPER:EVEN? <value>	Press **[Enter]** to display the information for command.	Return STAT:OPER:EVENT? value.
	OPER:COND <value>	-	Return STAT:OPER:COND? value.
	QUES:EVEN? <value>	Press **[Enter]** to display the information for command.	Return STAT:QUES:EVENT? value.
	QUES:COND <value>	-	Return STAT:QUES:COND? value.
 Use ▲ or ▼ to navigate between the **Shape** function commands.	SHAPE SINE | SQUARE | CSIN | <user>	Use ▲ or ▼ to navigate between SINE | SQUARE | CSIN | <user>. Press **[Enter]** to save.	Set immediate waveform shape.
	SHAPE:T SINE | SQUARE | CSIN | <user>	Use ▲ or ▼ to navigate between SINE | SQUARE | CSIN | <user>. Press **[Enter]** to save.	Set triggered waveform shape.
	SHAPE:M FIXED | LIST | PULSE | STEP	Use ▲ or ▼ to navigate between FIXED | LIST | PULSE | STEP. Press **[Enter]** to save.	Set waveform shape mode.
	CLIP <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set clipping level.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **LAN Menu** function commands.	LAN STATUS: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display LAN connectivity status.
	DHCP: ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set DHCP for LAN.
	AUTO DNS: ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set auto DNS for LAN.
	MDNS: ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set MDNS for LAN.
	IP: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display IP address.
	SUBNET: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display subnet address.
	GATEWAY: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display gateway address.
	DNS 1: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display DNS1 address.
	DNS 2: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display DNS2 address.
	HOSTNAME: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display ac source hostname.
	DOMAIN NAME: < ✳ ><info>	Press **[Enter]** to display the information for command with < ✳ > symbol.	Display ac source domain name.
	IP CONF: < ✳ ><value>	Press **[Enter]** then use keypad to key in an exact value.	Configure IP address only when DHCP is OFF.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **LAN Menu** function commands.	SUBNET CONF: < ✱ ><value>	Press **[Enter]** then use keypad to key in an exact value.	Configure Subnet address only when DHCP is OFF.
	GATEWAY CONF: < ✱ ><value>	Press **[Enter]** then use keypad to key in an exact value.	Configure Gateway address only when DHCP is OFF.
	DNS 1 CONF: < ✱ ><value>	Press **[Enter]** then use keypad to key in an exact value.	Configure DNS 1 address only when AUTO DNS is OFF.
	DNS 2 CONF: < ✱ ><value>	Press **[Enter]** then use keypad to key in an exact value.	Configure DNS 2 address only when AUTO DNS is OFF.
	UPDATE? YES | NO	Use ▲ or ▼ to navigate between YES | NO. Press **[Enter]** to save.	Update the configuration.
	-	-	Phase select function is not available. Key press has no effect on ac source.
	CONFIRM? YES | NO	Use ▲ or ▼ to navigate between YES | NO. Press **[Enter]** to save.	Reset the LAN configuration to factory default conditions.
 Use ▲ or ▼ to navigate between the **Trigger Control** function commands.	INIT:IMMED	Press **[Enter]** to execute.	Initiate trigger immediately.
	INIT:CONT ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Initiate trigger continuously.
	TRIG:SOUR BUS | IMM | TTLT | EXT	Use ▲ or ▼ to navigate between BUS | IMM | TTLT | EXT. Press **[Enter]** to save.	Select transient trigger source.
	DELAY <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set trigger delay in seconds.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **Trigger Control** function commands.	ABORT	Press **[Enter]** to execute.	Abort all trigger sequences.
	SYNC:SOUR PHASE | IMM	Use ▲ or ▼ to navigate between PHASE | IMM. Press **[Enter]** to save.	Select synchronous trigger source.
	SYNC:PHASE <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set synchronous phase reference.
	-	-	Generate an immediate trigger.
 Use ▲ or ▼ to navigate between the **Pulse** function commands.	WIDTH <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the pulse width.
	COUNT <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the number of output pulses.
	DCYCLE <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the pulse duty cycle.
	PER <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the pulse period count.
	HOLD WIDTH | DCYCLE	Use ▲ or ▼ to navigate between WIDTH | DCYCLE. Press **[Enter]** to save.	Set parameter that is held constant.

Function key press	Function command on the front panel display	Entry key press	Description
 Use ▲ or ▼ to navigate between the **List** function commands. Press  then ▲ or ▼ to increment or decrement the index of the **List** function commands.	COUNT <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the number of times a list repeats.
	DWEL: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output dwell times.
	FREQ: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output frequencies.
	FSLW: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output frequency slew rates.
	IPK: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output peak current limits.
	OFFS: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of DC output voltages.
	OSLW: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of DC offset voltage slew rate.
	PHASE: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output voltage phase angles.
	SHAP: <index> SINE | SQUARE | CSIN | <table>	Use ▲ or ▼ to navigate between SINE | SQUARE | CSIN | <table>. Press **[Enter]** to save.	Set the list of output waveform shapes.

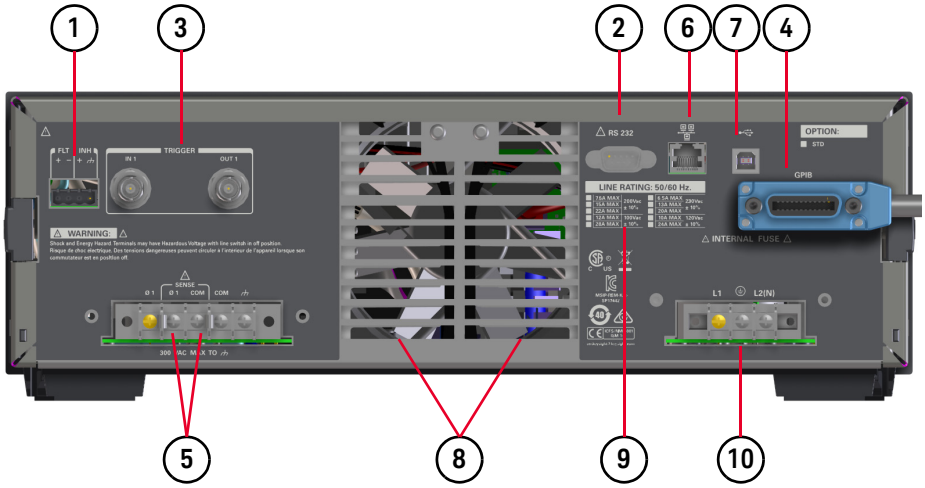
Function key press	Function command on the front panel display	Entry key press	Description
	STEP ONCE | AUTO	Use ▲ or ▼ to navigate between ONCE | AUTO. Press **[Enter]** to save.	Set response of the list to triggers.
Use ▲ or ▼ to navigate between the **List** function commands. Press  then ▲ or ▼ to increment or decrement the index of the **List** function commands.	TTLT: <index> ON | OFF	Use ▲ or ▼ to navigate between ON | OFF. Press **[Enter]** to save.	Set trigger out pulse list.
	VOLT: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of AC output voltages.
	VSLW: <index> <value>	Use keypad to key in an exact value, alternatively use ▲ to increment or ▼ to decrement. Press **[Enter]** to save.	Set the list of output voltage slew rates.
	-	-	Toggle the output on and off. When off, the ac source output is disabled and the **Dis** annunciator is on

Entry keys

Entry key press	Description
	Access the calibration menu. Refer to “Appendix B” in the *User's Guide* for more information.
	Enter an exponent.
	Enter a decimal point.
	Enter a minus.
	Delete the last digit entered.
	Abort a keypad entry and clear the value. When editing a list, pressing **[Clear Entry]** truncates or clears the list at the presently displayed list point.

The Rear Panel - At a Glance

Rear Panel Connections (see “Chapter 3” in the *User's Guide* for details)



1. INH (Remote Inhibit) TTL input signal for externally disabling the power source.
   FLT (Discrete Fault Indicator) TTL output signal when there is a device fault.
2. RS-232 connector for remote controller.
3. TRIGGER BNC connectors for external trigger inputs and source trigger outputs.
4. GPIB connector and GPIB cable for remote controller.
5. SENSE connections for remote voltage sensing at the load.
6. LAN connection. Connects to the 10/100 Base-T interface.
7. USB connection.
8. Airflow vents must not be blocked.
9. LINE RATING label specifies power source required by the power source.
10. AC Line Input connections from the power source.

How to Use the Front Panel

Turn on the ac source.

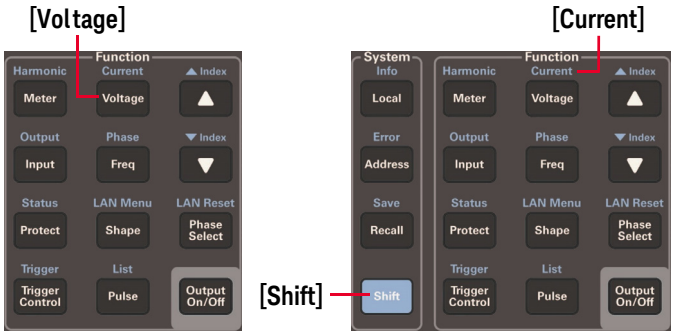
From the System key group

Press **[Local]** to activate the front panel keypad. If the Local Lockout command is in effect, cycle power to return the unit to local mode.

From the Function key group

Press **[Voltage]** to select the voltage function. To select a different function, press the appropriate key.

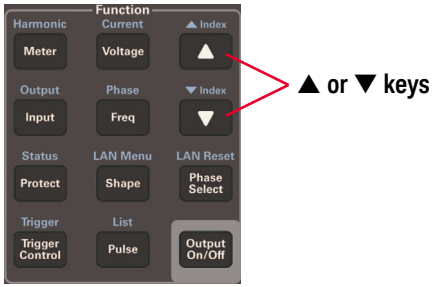
To select a function appearing above a key such as **[Current]** as indicated in the blue text, first press the blue **[Shift]** key, then press the key below the function.



NOTE

Pressing **[Output On/Off]**, or **[Shift]** **[Trigger]** *immediately implements the function*. The display annunciators will indicate that an immediate action has occurred. All other **Function** keys have command menus underneath them that are accessed via the ▲ and ▼ keys after the **Function** key is pressed. Refer to "The Front Panel - At a Glance" on page 16.

Use these keys to move through the list of commands of the selected function. The commands are displayed as you press ▲ or ▼.

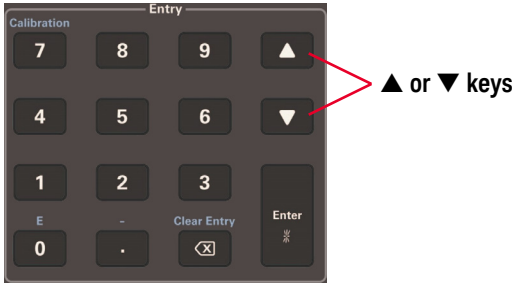


The following shows the commands in the Voltage function menu. Some commands may not appear on all models. Menus are circular, you can return to the starting position by continuously pressing ▲ or ▼.

Key press	Display and voltage function commands	
1 Press Current Voltage. **2** Press ▲ or ▼ of the **Function** key group to navigate between voltage function commands.	VOLT <value>	Sets immediate rms output voltage.
	VOLT:T <value>	Sets triggered rms output voltage.
	VOLT:M FIXED	Selects the voltage mode.
	OFFSET <value>	Sets immediate DC offset voltage.
	OFFSET:T <value>	Sets triggered DC offset voltage.
	OFFSET:M FIXED	Selects the DC offset voltage mode.
	SLEW <value>	Sets immediate voltage slew rate in volts/second.
	SLEW:T <value>	Sets triggered voltage slew rate in volts/second.
	SLEW:M FIXED	Selects the voltage slew mode.
	ALC INT	Selects the voltage sense source.
	ALC:DET RMS	Selects the voltage sense detector.

From the Entry key group

Use these keys to increment/decrement or select the command parameters to be executed. If the parameter is a number, use these keys to make minor changes to the value. **[Enter]** enters the selection and returns to the Meter function.



Key press	Display (voltage function command parameters)	
1 Press Current Voltage.	VOLT:M FIXED	Sets fixed mode.
2 Press ▲ or ▼ of the **Function** key group until the display shows the VOLT:M FIXED command.	VOLT:M STEP	Sets step mode.
3 Press ▲ or ▼ of the **Entry** key group to navigate between voltage function command parameters FIXED, STEP, PULSE, or LIST.	VOLT:M PULSE	Sets pulse mode.
	VOLT:M LIST	Sets list mode.

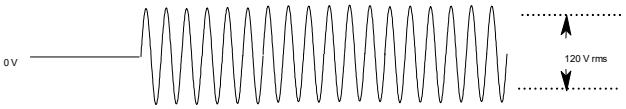
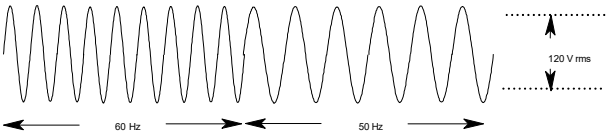
Use the numeric Entry keys to directly enter a value for the command parameter. For example, to enter a value for the voltage parameter:

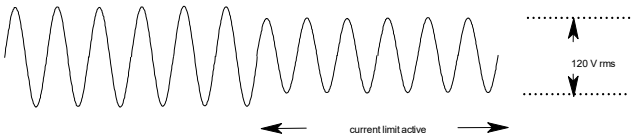
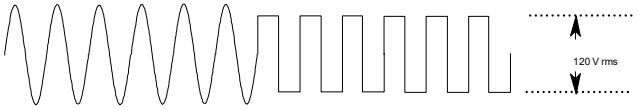
Key press	Display (voltage function command parameters)	
1 Press Current Voltage.	VOLT 0	0 volts
2 Press 60 on the keypad of the Entry key group.	VOLT 60	60 volts
3 Press **[Enter]**.	60 V 60 Hz	Enters the value and returns to the Meter function

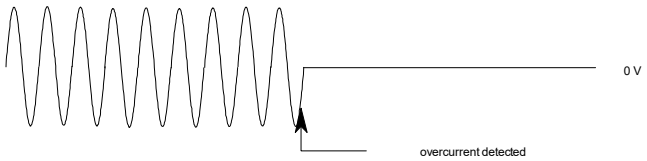
Basic Operations

Turn on the ac source. Use either the front panel keys or the corresponding SCPI commands.

The text to the right describes the result. If appropriate, the resultant output waveshape is shown underneath the description.

Action, key press, or display	Result
Enable the output **1** Press Output On/Off.	The programmed voltage appears at the output and the **Dis** display on the annunciator turns off.
Set the voltage **1** Press Current Voltage. **2** Press 120 on the keypad of the **Entry** key group. **3** **VOLT 120** is displayed. **4** Press **[Enter]**.	The output voltage is set to 120 V rms. 
Set the frequency **1** Press Phase Freq. **2** Press 50 on the keypad of the **Entry** key group. **3** **FREQ 50** is displayed. **4** Press **[Enter]**.	The output frequency is set to 50 Hz. 

Action, key press, or display	Result
Set the rms current limit **1** Press Shift then Current Voltage. **2** Press 10 on the keypad of the **Entry** key group. **3** Press **[Enter]**. **4** **CURR:LEV 10** is displayed.	The rms current limit is set to 10 A. If more current than the programmed limit is drawn, the output voltage amplitude is reduced to keep the rms current within the specified limit. Press **[Shift] [Current]** and ▼ to access CURR:PEAK, which lets you set the peak current limit on the ac source. The peak current limit circuit on the ac source acts instantly and clips the output voltage to maintain the programmed peak limit.  **NOTE:** The rms current limit circuit is slower than the peak current limit circuit and, depending on the setting of the peak current limit and the load on the output, your ac source may generate momentary peak currents that can well exceed the rms current limit.
Select a waveshape **1** Press LAN Menu Shape. **2** Press ▲ or ▼ of the **Function** key group until the display shows **SHAPE SQUARE**. **3** Press **[Enter]**.	The output generates a square wave. The peak-to-peak amplitude of the square wave is less than that of a sine wave when it is programmed to the same rms voltage amplitude. 

Action, key press, or display	Result
Program a protection function **1** Press Shift then LAN Menu Shape. **2** Enter the respective current using the keypad of the **Entry** key group. **3** Press **[Enter]**. **4** Press ▲ or ▼ of the **Function** key group until the display shows **CURR:PROT**. **5** Press ▲ or ▼ of the **Entry** key group until the display shows **CURR:PROT ON**. **6** Press **[Enter]**.	Clears all previously set protection functions and then set the current protection, which disables the output when an overcurrent condition is detected. The OCP annunciator will light when this command is programmed. 
Access ac source information **1** Press Shift then Info Local. **2** Press ▲ or ▼ of the **Function** key group to access the ac source basic information.	Displays ac source basic information such as model, option, serial number, firmware revision, media access control (MAC) address, USB vendor identification (VID), and USB product identification (PID).
View LAN information **1** Press Shift then LAN Menu Shape. **2** Press ▲ or ▼ of the **Function** key group to access the LAN information.	Displays LAN information such as LAN status, DHCP, auto DNS, MDNS, IP, subnet, gateway, DNS l, DNS 2, hostname, and domain name.
Reset LAN **1** Press Shift then LAN Reset Phase Select. **2** Press ▲ or ▼ of the **Entry** key group until the display shows **CONFIRM? YES**. **3** Press **[Enter]**.	Resets the LAN configuration to factory default conditions.

Configuring the LAN

The steps below illustrate how to configure IP, subnet, and gateway after you turn off the DHCP.

1 Press 

then 

.

2 Press ▲ or ▼ of the **Function** key group until the display shows **DHCP**.

3 Press ▲ or ▼ of the **Entry** key group until the display shows **DHCP: OFF**.

4 Press **[Enter]**.

5 Press ▲ or ▼ of the **Function** key group until the display shows **IP CONF**, **SUBNET CONF**, or **GATEWAY CONF**.

6 Press **[Enter]** to configure **IP CONF**, **SUBNET CONF**, or **GATEWAY CONF**.

7 Enter the respective configuration using the keypad of the **Entry** key group.

8 Press ▲ or ▼ of the **Function** key group until the display shows **UPDATE? NO**.

9 Press ▲ or ▼ of the **Entry** key group until the display shows **UPDATE? YES**.

10 Press **[Enter]**.

The steps below illustrate how to configure DNS 1 and DNS 2 after you turn off auto DNS.

1 Press 

then 

.

2 Press ▲ or ▼ of the **Function** key group until the display shows **AUTO DNS**.

3 Press ▲ or ▼ of the **Entry** key group until the display shows **AUTO DNS: OFF**.

4 Press **[Enter]**.

5 Press ▲ or ▼ of the **Function** key group until the display shows **DNS 1 CONF** or **DNS 2 CONF**.

6 Press **[Enter]** to configure **DNS 1 CONF** or **DNS 2 CONF**.

7 Enter the respective configuration using the keypad of the **Entry** key group.

8 Press ▲ or ▼ of the **Function** key group until the display shows **UPDATE? NO**.

9 Press ▲ or ▼ of the **Entry** key group until the display shows **UPDATE? YES**.

10 Press **[Enter]**.

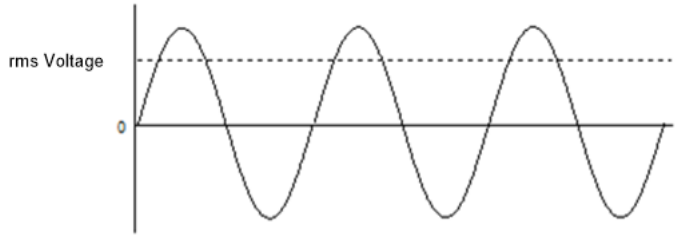
Measuring the Output

All measurements are based on acquiring and subsequently processing output waveform information. When the ac source is on, it takes measurements and updates the front panel meter continuously. The **[Meter]** key accesses the measurement functions from the front panel.

The SCPI MEASure command acquires new waveform information each time it is executed. The SCPI FETCh command does not acquire new waveform information but extracts the desired information from previously acquired waveform data. SCPI commands let you measure phases individually or simultaneously measure all phases using the FETCh command.

Measurement functions

The following example illustrates the measurements that can be returned by the front panel of the ac source when sourcing power to a typical non-resistive load such as a power supply. The ac source output voltage is shown in the following figure.

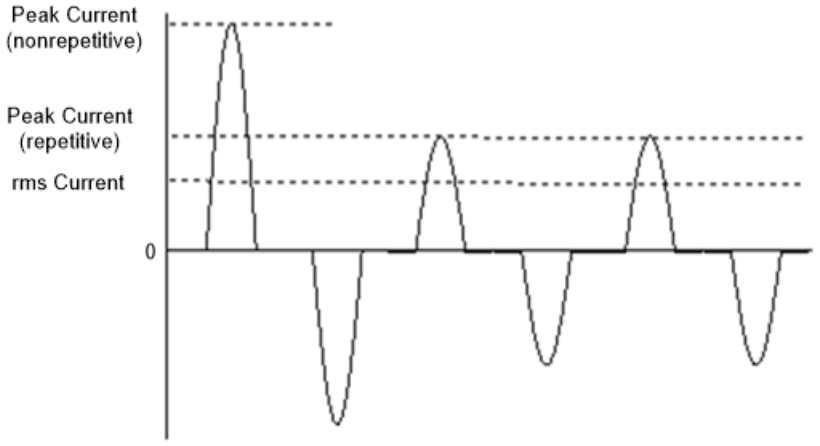


NOTE The **[Input]** key selects the meter coupling and hence, what the meter will measure. The choices are: AC only, DC only, or AC + DC.

Key press	Display (voltage function command parameters)		
1 Press Harmonic Meter. 2 Press ▲ or ▼ of the **Function** key group to access the ac source measurement features.	120 V	60 HZ	rms voltage and frequency
	120 V	1.925 A	rms voltage and current
	1.93 A	60 HZ	rms current and frequency
	120 V	150.5 W	rms voltage and power
	2.82	CREST F	current crest factor
	5.379 A	PK REP	peak current, repetitive
	36.83 A	PK NR	peak current, non repetitive
	230.6	VA	apparent power
	175.2	VAR	reactive power
	0.65	PFACTOR	power factor

Harmonic measurements

Use the harmonic menu to make harmonic measurements of the output current. The following example illustrates the current magnitude measurements returned at harmonics 0 to 5. The ac source current waveforms are shown in the following figure.



NOTE Harmonic 1 is the fundamental. Harmonic 0 is the DC component.

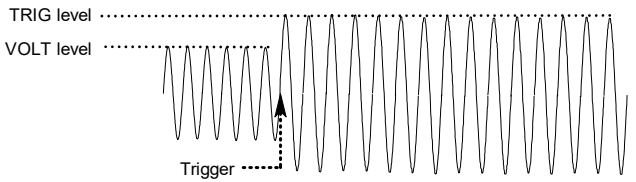
Key press	Display		Harmonic measurement functions
1 Press Shift then Harmonic Meter.	0.01 A	I:MAG:0	current amplitude at harmonic 0
	1.43 A	I:MAG:1	current amplitude at harmonic 1
2 Press Shift then ▲ or ▼ of the **Function** key group to access the ac source measurement features.	0.01 A	I:MAG:2	current amplitude at harmonic 2
	0.91 A	I:MAG:3	current amplitude at harmonic 3
	0.01 A	I:MAG:4	current amplitude at harmonic 4
	0.74 A	I:MAG:5	current amplitude at harmonic 5

Programming Output Transients

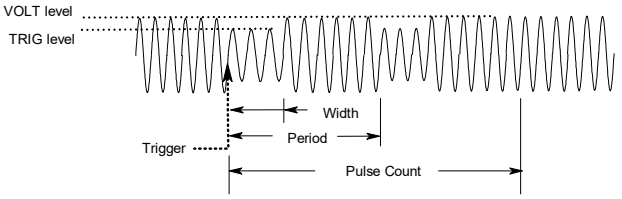
The ac source has been programmed with the transient system in Fixed mode in the earlier examples. The following examples briefly describe the transient system's Step, Pulse, and List modes, which require the application of a trigger to implement the transient mode.

NOTE For the following examples, press **[Shift] [Output]**, scroll to *RST and press **[Enter]** to reset the unit prior to each example. Also press **[Enter]** to enter or activate each selection.

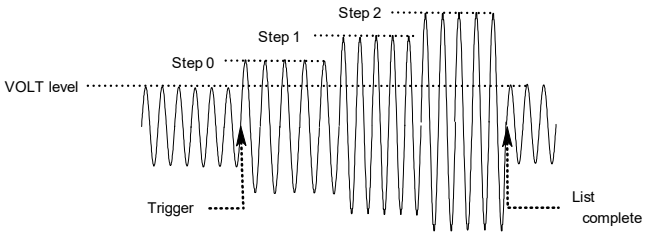
Program an output step

Key press and display	Result
Current Voltage VOLT:M STEP VOLT 120 VOLT:T 150 Trigger Trigger Control INIT:IMMED Shift + Trigger Control	Step transients transition to a new output level upon receipt of a trigger. When these commands are sent, the voltage amplitude is stepped from its previous setting to 150 V rms upon receipt of a trigger. 

Program an output pulse

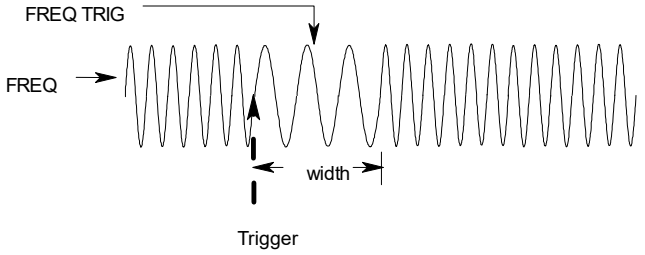
Key press and display	Result
Current Voltage VOLT:M PULSE VOLT 120 VOLT:T 90 List Pulse WIDTH .01 PER .03 COUNT 2 Trigger Trigger Control INIT:IMMED Shift Trigger Trigger Control	Pulse transients transition to a new output level upon receipt of a trigger and return to the original level after a specified time, repeating this action by the number of times specified by the count. When these commands are sent, two output pulses step the voltage amplitude from its previous setting to 90 V rms upon receipt of a trigger. At the end of the specified period (multiplied by the count), the voltage returns to its original level. 

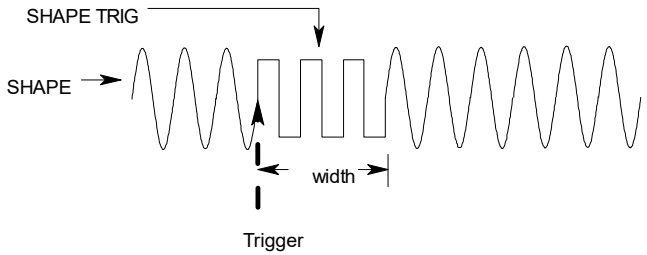
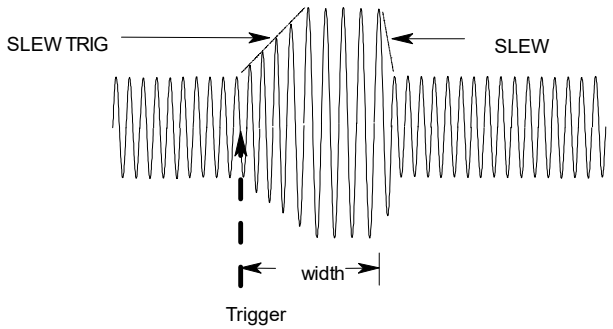
Program an output list

Key press and display	Result
Current Voltage VOLT:M LIST VOLT 120 Shift + List Pulse DWELL [0] .5 DWELL [1] .5 DWELL [2] .5 VOLT [0] 130 VOLT [1] 140 VOLT [2] 150 STEP AUTO Trigger Trigger Control INIT:IMMED Shift + Trigger Trigger Control	List transients generate complex output sequences. When these commands are sent, the voltage amplitude is sequentially stepped to three levels upon receipt of a trigger, and then returns to the original voltage level. The output remains at each list step for .5 seconds. The values inside the brackets ([ ]) are the list index references. Use **Clear Entry** to clear a list. 

More transient examples

The previous examples showed how the transient system can be used to control the output voltage amplitude. The transient system can also control output frequency, phase, waveform shape, voltage and frequency slew rates, offset voltage, and peak current limit. The following examples illustrate how the transient system's Pulse mode can generate frequency, shape, phase, and voltage slew pulses.

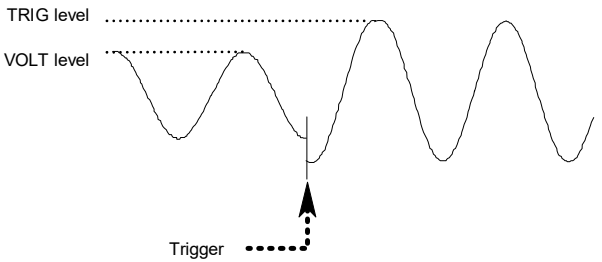
Key press and display	Result
 FREQ:M PULSE FREQ 60 FREQ:T 50  WIDTH .1  INIT:IMMED 	Generate output frequency. 

Key press and display	Result
LAN Menu Shape SHAPE:M PULSE SHAPE SINE SHAPE:T SQUARE List Pulse WIDTH .05 Trigger Trigger Control INIT:IMMED Shift + Trigger Trigger Control	Generate waveform shape. 
Current Voltage VOLT:M PULSE VOLT 120 VOLT:T 150 SLEW:M PULSE SLEW 10000 SLEW:T 1000 List Pulse WIDTH .1 Trigger Trigger Control INIT:IMMED Shift + Trigger Trigger Control	Generate voltage and frequency slew rates. 

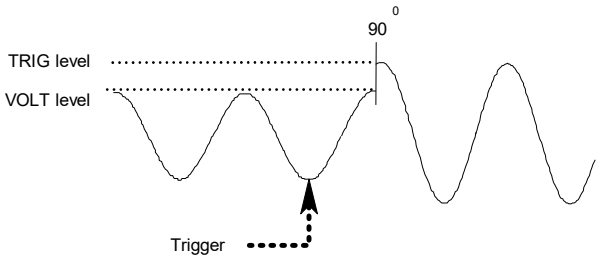
Programming Trigger Synchronization and Delays

The previous transient examples were programmed to respond to immediate triggers. However, delayed and phase synchronized triggers can also be programmed as shown in the following examples.

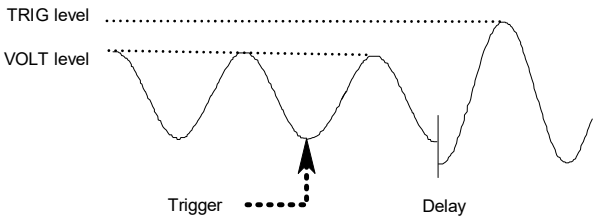
No delay; no phase synchronization

Key press and display	Result
Current Voltage VOLT:M STEP VOLT 120 VOLT:T 150 Trigger Trigger Control DELAY 0 SYNC:SOUR IMM INIT:IMMED Shift Trigger Control	When these commands are sent, the voltage amplitude changes immediately upon the receipt of a trigger. 

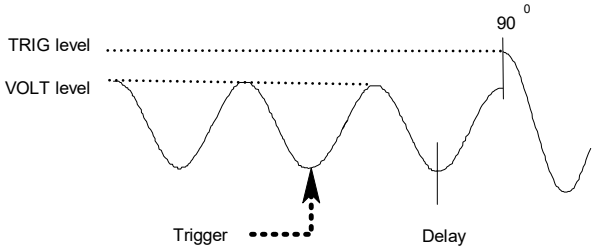
No delay; 90 degrees phase synchronization

Key press and display	Result
Current Voltage VOLT:M STEP VOLT 120 VOLT:T 150 Trigger Trigger Control DELAY 0 SYNC:SOUR PHAS SYNC:PHAS 90 INIT:IMMED Shift + Trigger Control	When these commands are sent, the voltage amplitude changes at the next 90 degree phase angle that occurs following the receipt of a trigger. 

Trigger delay; no phase synchronization

Key press and display	Result
 VOLT:M STEP VOLT 120 VOLT:T 150  DELAY .0167 SYNC:SOUR IMM INIT:IMMED 	When these commands are sent, the voltage amplitude changes .0167 seconds after the receipt of a trigger. 

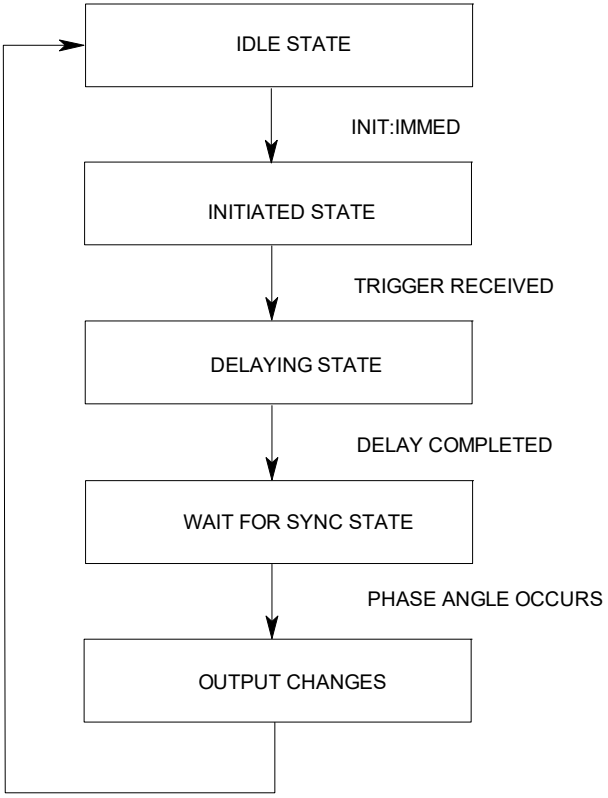
Trigger delay; 90 degrees phase synchronization

Key press and display	Result
Current Voltage VOLT:M STEP VOLT 120 VOLT:T 150 Trigger Trigger Control DELAY .0167 SYNC:SOUR PHAS SYNC:PHAS 90 INIT:IMMED Shift Trigger Trigger Control	When these commands are sent, the voltage amplitude changes at the next 90 degree phase angle that occurs after the .0167 second delay has expired, following the receipt of a trigger. 

More about the trigger system

In the previous examples, a front panel trigger is used to generate the output transients. The trigger is shown occurring at 270 degrees but actual triggers may occur at any phase. Delay and phase synchronization however, will occur as programmed.

Note that trigger system used in the ac source provides great flexibility in generating triggers. The following figure is a simplified model of the trigger system. A complete discussion of the capabilities of the trigger system is found in the ac source *Programming Guide*.



Documentation map	
Quick Start Guide (this document)	Condensed overview of ac source operation. Read this to quickly get started.
User's and Service Guide (PDF file on Keysight website)	Includes description, installation, checkout, operation, specifications, and calibration.
Programming Guide (PDF file on Keysight website)	Includes introduction to SCPI, command reference dictionary, and application examples.

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