

6100B/6105A

Electrical Power Standards

Getting Started

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Introduction

The Fluke 6100B and 6105A Electrical Power Standards, “the Instruments”, are precise instruments for the calibration of measuring devices used to determine the magnitude and quality of power and electrical energy. With these Instruments, you can synthesize sinusoidal and non-sinusoidal pseudo power with harmonics, interharmonics, fluctuating harmonics, flicker, dips and swells. The 6100B power quality accuracy meets the requirements of commercial power quality devices. The 6105A produces the same flexibility of signals but with the accuracy required to type test and calibrate the most accurate energy meters and energy calibration secondary standards.

The optional Fluke 6101B and 6106A Electrical Power Standards extend functionality to build two, three, or four-phase (three-phase plus neutral) systems. 6101B and 6106A are functionally interchangeable but only the 6106A delivers accuracy to match the 6105A. Both 6100B and 6105A standards can be configured to act as auxiliary units (6101B or the 6106A).

A 6100B or 6105A three-phase system can be connected to test three-phase four-wire WYE, three-phase three wire Delta or three-phase four-wire Delta systems. Three-phase unbalance conditions can be easily simulated.

It is safe to parallel current outputs to obtain higher currents than available from a single 6100B or 6105A. For example, four units with 50 A options can deliver up to 200 A with the same accuracy as a single 50 A output.

Throughout this manual, 6100B is used generically. All operations and performance statements apply to 6105A, 6106A, 6100B and 6101B unless specifically stated. General specifications are provided later in this manual.

This manual contains all of the information necessary for a user to unpack, connect, power on, and operate the 6100B, 6105A, 6101B and 6106A at a basic level.

Contacting Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-993-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-3434-0181
- Singapore: +65-738-5655
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.

To register your product, visit <http://register.fluke.com>.

To view, print, or download the latest manual supplement, visit <http://us.fluke.com/usen/support/manuals>.

General Safety Summary

This Instrument has been designed and type tested in accordance with the following standard publications:

- EN61010-1: 2001
- UL61010A-1
- CAN CSA 22.2 No 1010.1-92

This manual contains information and warnings that must be observed to ensure safe operation and keep the Instrument in a safe condition. Operation or service in conditions or in a manner other than specified could compromise safety. For the correct and safe use of this Instrument, it is essential that both operating and service personnel follow accepted safety procedures in addition to the safety precautions specified.

In this manual, a **Warning** identifies conditions and actions that pose hazard(s) to the user; a **Caution** identifies conditions and actions that may damage the Meter or the test instruments.

Warning

To avoid electrical shock, personal injury, or fire hazard:







- **The Instrument must not be switched ON if it is damaged or suspected to be faulty.**
- **Do not operate the Instrument in damp, wet, condensing, dusty, or explosive gas conditions.**
- **Whenever it is likely that safety protection has been impaired, the Instrument must be made inoperative and be secured against any unintended operation. Inform qualified maintenance or repair personnel.**
- **Safety protection is likely to be impaired if, for example, the Instrument shows visible damage or fails to operate normally.**

- **Be aware that the Instruments can supply lethal voltages to the binding posts of master and auxiliary units.**

Explanation of Safety-Related Symbols and Terms

The symbols in Table 1 are found the Instrument or in this manual.

Table 1. Symbols

Symbol	Explanation
	Hazardous voltage. Risk of electrical shock.
	Risk of danger. Important information. See manual.
	Earth ground.
	Conforms to relevant Canadian Standards Association directives.
	Conforms to relevant European Union directives.
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

Protective Earth (Grounding)

Protection Class 1 - The Instrument must be operated with a protective earth/ground connection via the protective earth/grounding conductor of the ac line supply cable. The protective earth/ground connects before the ac line and neutral connections when the supply plug is inserted into the Instrument's rear panel ac line supply socket. If the final connection to the ac line supply is made elsewhere, ensure that the protective earth/ground connection is made before ac line and neutral.

If there is a possibility the protective earth/ground connection might not be made before the ac line and neutral connections, or the output terminals are connected to a potentially hazardous live circuit, the separate protective earth/ground connection stud on the rear panel of the Instrument must be connected to a suitable protective earth/ground.

 Warning

To avoid electrical shock or personal injury, do not intentionally or unintentionally interrupt the protective ground conductor inside or outside the Instrument. Interrupting the protective ground conductor is likely to make the Instrument dangerous. Intentional interruption is prohibited.

Power Cord and Power Supply Disconnection

The front-panel power switch is a remote on/off switch and does not directly disconnect line power. The power supply disconnect device is the ON / OFF switch on the rear panel of the Instrument. The ON / OFF switch should be readily accessible while the Instrument is in operation. If this operating condition cannot be satisfied, it is essential that either the power cord plug or a separate power disconnecting device be readily reached and accessible to the operator.

⚠⚠ Warning

To avoid electrical shock, personal injury, or fire hazard, ensure that the power cord is not damaged and is adequately rated against power supply network fusing.

If the power plug is to be the accessible disconnecting device, the cord must not be longer than 3 meters.

Signal Connection

⚠⚠ Warning

To avoid an electric shock hazard, injury, or death:

- Make signal connections to the Instrument after the protective earth/ground connection is made and disconnected before the protective earth/ground connection is removed, for example, the ac line supply lead must be connected whenever signal leads are connected.
- Do not connect or disconnect signal leads while they are connected, or suspected of being connected, to any hazardous voltage or current source.
- Safety protection is likely to be impaired if unauthorized signal connector leads are used. Do not use signal connector leads if they are damaged. Voltage and current signal connector leads are provided with each Instrument but they must only be used for the correct purpose. The current signal connector lead must never be connected to the Instrument voltage terminals.

Do Not Operate Without Covers

⚠⚠ Warning

To avoid an electric shock hazard, injury, or death:

- The Instrument must not be operated with covers removed. The covers protect the user from live parts and, unless otherwise stated, should be removed only by suitably qualified personnel for maintenance and repair purposes.
- Removing the covers may expose voltages in excess of 2 kV pk; these voltages may be present for up to one minute after the Instrument has been disconnected from the power source, or longer under fault conditions.

Safe Operating Conditions

The unit must be operated only within the manufacturer's specified operating conditions. Examples of specification that must be considered are:

- For indoor use only
- Ambient temperature
- Ambient humidity
- Power supply voltage and frequency
- Maximum terminal voltages or currents
- Altitude
- Ambient pollution level
- Exposure to shock and vibration

⚠️⚠️ Warning

To avoid an electric shock hazard, injury, or death, do not apply to or subject the Instrument to any condition that is outside specified range. See detailed specifications of the Instrument and its operating conditions in the Users Manual.

⚠️ Caution

To avoid damage to the Instrument, take into account direct sunlight, radiators and other heat sources when assessing the ambient temperature.

Fuse Requirements

The Instruments require a special fuse with rated current of 15 A and rated breaking capacity of 750 A. The fuse must be rated for a voltage of 250 V ac.

To access the fuse and ensure the line power is disconnected, follow the procedure described in the Users Manual. The approved fuse is shown below.

Fluke part number and description:	1998159	T15AH 250 V 32 mm
Fuse manufacturer and part number:	Bussmann	MDA-15

Measurement Category I

Measurement terminals are designed for connection at Measurement (Overvoltage) Category I.

⚠️⚠️ Warning

To avoid electrical shock, personal injury, or fire hazard, do not connect the Instrument's terminals directly to the ac line power supply or any other source of voltage or current that might temporarily exceed the peak ratings of the Instrument.

Maintenance and Repair

Always observe local or national safety regulations and rules for the prevention of accidents and hazard while performing any work. Always disconnect the Instrument from all signal sources and then the ac line power supply before removing any covers. Any adjustment, parts replacement, maintenance or repair should be carried out only by Fluke authorized technical personnel.

⚠️⚠️ Warning

To avoid electrical shock, personal injury, or fire hazard, it is essential that only manufacturer supplied parts be used to replace parts relevant to safety. Safety tests must be performed after the replacement of parts relevant to safety.

Cleaning

Ensure the Instrument signal and then power leads are disconnected prior to cleaning. Use only a damp, lint-free cloth to clean fascia and case parts. See the Users Manual for details of air filter cleaning.

Ventilation and Dust

The Instrument relies on forced-air cooling via ventilation slots in the sides of the Instrument. Adequate ventilation can usually be achieved by positioning the Instrument on a level surface and by leaving a 100 mm (4 in gap) around the Instrument. Care should be taken to avoid restricting the airflow at the sides of the Instrument, as damage may result from overheating. The Instrument is designed to IP4X and is specified for use in a Pollution Category 2 environment, which is normally non-conductive with temporary light condensation.

⚠️ Caution

To avoid damage to the Instrument, do not operate it while condensation is present. Do not use the Instrument in more dusty, damp, or wet conditions.

Features

The Instruments feature the following:

- Traceable power and energy signals
- Configurable from one to four independent phases
- Full independent control of voltage and current on each phase
- 1 kV and 21 A available on each phase (50 A with the 50 A option, 80 A with the 80 A option) on each phase. By default, the N phase is limited to 33 V rms. This can be overridden by the user. Setting up voltage and current waveforms are described in later in this manual.
- Up to 100 harmonics on either or both voltage and current channels at any one time
- Fluctuating harmonics and interharmonics to IEC 61000-4-7 and 61000-4-13, 61000-4-13 and 61000-4-14
- Dips and swells to IEC 61000-4-11
- Flicker to 61000-4-15
- Simultaneous power quality phenomena to IEC61000-4-30 and 61000-4-34
- Built-in IEC 61036 and IEC 62053 series current waveforms for static Watthour meter testing
- User-definable waveforms
- User-selectable reactive power calculation method
- >13 V peak compliance on all current outputs up to 21 A
- Soft start options to handle inrush current taken by instruments that take power from the voltage signal

- Complex Instrument configurations can be saved to internal memory or to a USB memory device for transfer to other 6100B systems
- The optional Energy Comparator provides for calibration of energy meters
- 10 MHz or 20 MHz reference clock output option

General Specifications

Full specifications are located in the Users Manual.

Input Power

Voltage	100 V - 240 V with up to ± 10 % fluctuations
Transient overvoltages	Impulse withstand (overvoltage) category II of IEC 60364-4-443
Frequency	47 Hz - 63 Hz
Max. Consumption	1000 VA max from 100 - 130 V, 1250 VA max from 130 V - 260 V

Dimensions

	6100B, 6101B, 6105A, and 6106A	With 50 A or 80 A Options
Height	233 mm (9.17 inches)	324 mm (12.8 inches)
Height (without feet)	219 mm (8.6 inches)	310 mm (12.2 inches)
Width	432 mm (17 inches)	432 mm (17 inches)
Depth	630 mm (24.8 inches)	630 mm (24.8 inches)
Weight	23 kg (51 lb)	30 kg (66 lb)

Environment

Operating temperature	5 °C - 35 °C
Calibration temperature (tcal) range	16 °C - 30 °C
Storage temperature	0 °C - 50 °C
Transit temperature	-20 °C - 60 °C <100 hours
Warm up time	1 hour
Safe Operating Max. Relative Humidity (non-condensing)	<80 % 5 °C - 31 °C ramping linearly down to 50 % at 35 °C
Storage Max Relative Humidity (non-condensing)	<95 % 0 °C - 50 °C
Operating altitude	0 m - 2,000 m
Non-operating altitude	0 m - 12,000 m
Shock	MIL-PRF-28800F class 3
Vibration	MIL-PRF-28800F class 3
Enclosure	MIL-PRF-28800F class 3

Safety

- Designed to EN61010-1: 2001, CAN/CSA 22.2 No 1010.1-92, UL61010A-1
- Indoor use only, pollution degree 2; installation category II
- CE marked and CSA listed

EMC

EN61326: 2002, class A, FCC rules part 15, sub-part B, class A (Class A equipment is suitable for use in establishments other than domestic, and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes).

Unpacking and Inspection

The Instruments are shipped in a container designed to prevent damage during shipping.

Inspect the Instrument carefully for damage, and immediately report any damage to the shipper. Instructions for inspection and claims are included in the shipping container.

A packing list is included in the packaging. When you unpack the Instrument, check for all the standard equipment listed and check the shipping order for any additional items ordered. Report any shortage to the place of purchase or to the nearest Fluke Service Center.

Reshipping the Instrument

A transit case can be purchased from Fluke. The Fluke part number is 1887580. This container is suitable for most handling conditions but provides less shock protection than the original cardboard packaging. It is recommended that the original container be used when possible.

Placement and Rack Mounting

This Instrument is designed to operate in controlled electromagnetic environments such as calibration and measurement laboratories i.e. where R.F. transmitters such as mobile telephones are not be used in close proximity.

The Instrument is suitable for bench top use, as long as there is sufficient space on either side to allow adequate ventilation.

The Instrument can be rack mounted using Fluke part number 1887571. Details of the rack mounting kit and fitting instructions are provided with the kit. Note that the airflow through the Instrument is from left to right as viewed from the front. If mounted in a rack, the airflow must be in the same direction.

Cooling Considerations

Caution

Damage caused by overheating may occur if the area around the air intake is restricted, the intake air is too warm, or the air filter becomes clogged.

The Instrument must be at least 4 inches from nearby walls or rack enclosures on both sides. The inlet and exhaust perforations on the sides must be clear of obstruction.

The air entering the instrument must be between 5 °C and 35 °C. Make sure that exhaust from another instrument is not directed into the fan inlet.

Clean the air filter every 30 days or more frequently if the Instrument is operated in a dusty environment. Instructions for cleaning the air filter are in the Users Manual.

Line Voltage

The Instrument has automatic mains sensing in the range 100-240 V, so no user line voltage selection is required. The fuse specified covers this voltage range. The Users Manual describes fuse access.

Connecting to Line Power

⚠️⚠️ Warning

To avoid electrical shock, personal injury, or fire hazard, connect the factory-supplied three conductor line power cord to a properly grounded power outlet.

Do not use a two conductor adapter or extension cord; this will break the protective ground connection. If a two conductor power cord must be used, a protective grounding wire must be connected between the ground terminal on the rear panel and ground before connecting the power cord or operating the instrument.

The power outlets supplying the Instrument system should be controlled by an emergency switch so that power can be switched off if a hazard arises.

The line current requirement of the Instrument may exceed the capacity of standard 10 A IEC connectors so the unit is fitted with a 16 A power receptacle at the rear.

A suitable supply lead is provided. Ensure that the room supply outlet is suited to delivering the 1250 VA maximum power requirements and that the Instrument is connected to a properly grounded three prong outlet.

Note

Typical maximum power requirement at 115 V is 1000 VA.

If a supply lead is provided WITHOUT a mains connector, please observe the following color coding when wiring up your own mains connector - line = brown, neutral = blue, earth = green/yellow.

Table 2. Line Cords by Country

Country	Fluke Line Cord Part Number
UK	1998167
Europe	1998171
Australia, New Zealand, China	1998198
USA, Japan	1998209
Other (no plug fitted)	1998211

Connecting Auxiliary Units

The 6100B and 6105A instruments are Masters capable of controlling any combination of up to three Auxiliary units. The 6100B and 6105A Master units can be configured as Master or Auxiliary but the 6101B or 6106A can only operate as Auxiliary units.

Each Auxiliary unit provides an additional phase of voltage and current. Control connections are made by interconnection cable part number 2002080 supplied with each instrument. Figure 1 shows the layout of connections on the rear of a Master instrument. 6101B and 6106A have one Auxiliary Control Input.

The older 6101A can also be added as Auxiliary units to 6100B and 6105A Master units. When upgraded to firmware issue 4.10 or greater the older 6100A Master can control any of 6105A, 6106A, 6100B, and 6101B as Auxiliary units.

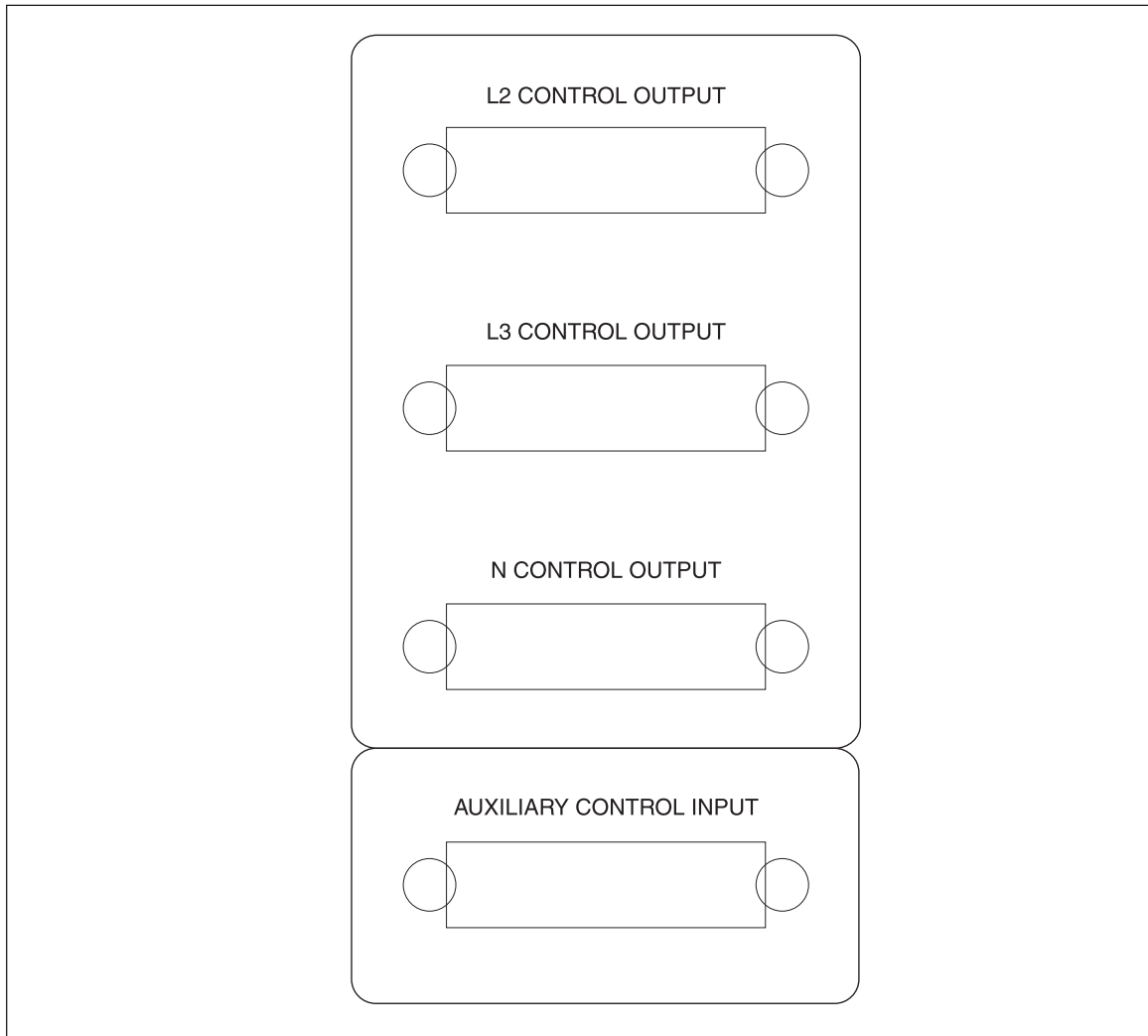


Figure 1. Auxiliary Unit Connectors on the 6100B Rear Panel

gdw01.eps

Allocation of Phases

The 6105A or 6100B is always L1 in a multiphase system. Auxiliary units are allocated phase depending on which auxiliary control output they are connected to. The Auxiliary unit connected to L2 Control Output becomes L2 etc. See the Users Manual for an overview of instrument control and the user interface.

This section is a reference for the functions and locations of the 6100B front and rear panel features, and provides brief descriptions of each feature for quick access.

Complete front-panel operating instructions and remote operating instructions for the 6100B are provided in the Users Manual.

Please read this information before operating the 6100B.

Connection and Power-Up Sequence

Power-Up

When working with poly-phase systems you should connect the control cables between Auxiliary and Master units first. Then switch ON power to the Auxiliary units, then the Master.

Power-Down

Turn off the Master unit first when powering down. Damage will not occur if the sequence is not followed but error messages may show on the User Interface.

Front-Panel Features

Front-panel features (including all controls, displays, indicators, and terminals) are shown in Figure 2. Each front-panel feature is briefly described in Table 3.

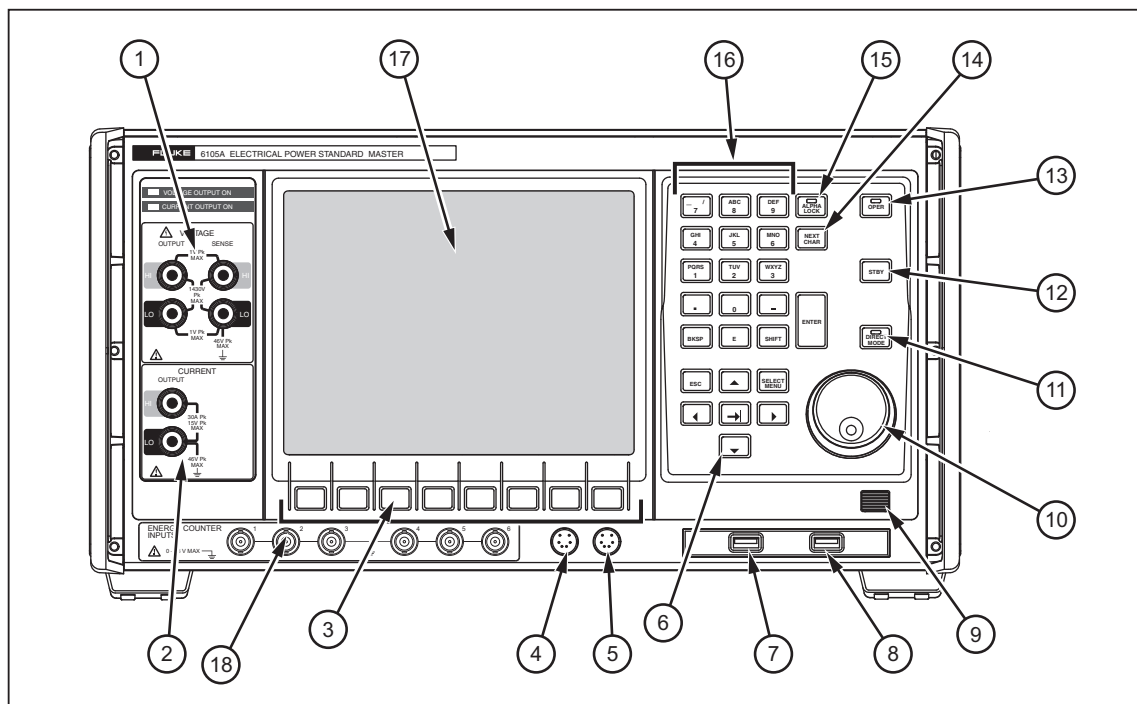


Figure 2. 6100B Front Panel

gdw03.eps

Table 3. Front-Panel Features


















Number	Meaning
①	<p>Voltage Binding Posts - The HI and LO Output Voltage Binding Posts provide connections for voltage outputs.</p> <p>The HI and LO Sense Binding Posts provide External Sensing for best accuracy. Two-wire sensing may be selected via the Global Settings Menu. See the Users Manual for more information.</p>
②	<p>Current Binding Posts - Output Currents</p>
③	<p>Softkeys - Provide direct access to setup functions. If an external keyboard is connected, the keyboard function keys (F1-F8) provide the same navigation technique. See the Users Manual for more information.</p>
④	<p>Keyboard Connector - PS/2 connector for an external keyboard if preferred.</p>
⑤	<p>Mouse Connector - PS/2 connector for a mouse if preferred.</p>
⑥	<p>Navigation Keypad</p> <p> switches between the three main menus: Output, Global Settings and Waveform.</p> <p> (escape) changes the softkey level up through the control hierarchy. It also escapes from pop-up screens.</p> <p> moves focus from control to control within the selected menu area.</p> <p>  and   allow selection of values in data entry and selection fields.</p>
⑦ ⑧	<p>Two USB Ports - For saving and reloading of waveform configurations. Connect mouse or keyboards or update firmware.</p>
⑨	<p>Power On/Off Switch - Turns the power ON and OFF. The switch remains locked inwards when the power is on. Pushing the switch again unlocks it and turns the power off. Note: this controls the power supply electronically and is not an isolation switch. The Main Power On-Off switch is on the rear panel.</p>
⑩	<p>Dual action Spin Wheel - Provides quick data entry within a field. When rotated without pushing, scrolls the value of the currently highlighted numeric character in an input field. When rotated whilst pushed inwards, moves the cursor along the characters in the field.</p>
⑪	<p> - In Direct Mode, the key LED is lit and all waveform changes take immediate effect. When Direct Mode is not active, the 6100B is in Deferred mode. In Deferred mode changes to waveforms are stored but not applied. Stored changes can be applied simultaneously or undone.</p>
⑫	<p> (standby) - Turns the output OFF.</p>
⑬	<p> (operate) - Turns the outputs of enabled channels ON. The LEDs above the terminals indicate which outputs are ON.</p>

Table 3. Front-Panel Features (cont.)

Number	Meaning
<p>(14)</p>	<p> - In text input mode (Alpha Lock LED lit), key text using a combination of  and the Alphanumeric keypad ((15)). This operates much in the manner of a cell phone, allowing one alpha key to source more than one text character by being pushed repeatedly until the required character is displayed. Use  to move onto the next position you wish to key. Push  to finish the text entry.</p>
<p>(15)</p>	<p> - Switches between text and numeric input. In numeric input mode. The Alpha Lock light is out. In text input mode the Alpha Lock light is lit.</p>
<p>(16)</p>	<p>Alphanumeric Keypad - Provides text and numeric input. Use  ((14)) to switch between numeric and text input. In numeric input mode (Alpha Lock light out), key numeric values directly (the E key allows exponents to be entered). In text input mode (Alpha Lock light lit), key text using a combination of the Alphanumeric keypad and the  ((13)). This operates much in the manner of a cell phone, allowing one alpha key to source more than one text character.</p>
<p>(17)</p>	<p>Windows User Interface - The setup of waveforms and other functions of the Electrical Power Standard has been implemented as a Windows program. See the Users Manual for more information.</p>
<p>(18)</p>	<p>Energy Option Connectors (if option is fitted)-Six BNC inputs for receiving pulses from Energy meters.</p>

The Main User Interface Areas

The user interface is divided into five areas. There are three Menu panes, a message window, and at the bottom, the context-sensitive Softkey indicators. See Figure 3.



Figure 3. Graphical User Interface

gdw04.bmp



























The Menu fields are accessed sequentially clockwise by pushing SELECT MENU. A blue border indicates the active Menu. As the focus changes between the menus, the actions of the context-sensitive softkeys change accordingly.




- The Output Menu at the top left of the screen allows selection of the channel that will be operated upon by actions in the Waveform Menu. The channel being set-up is indicated by a white background. The voltage or current and phase angle for all connected phases is shown here. The Output Menu always shows the actual values that are at the voltage and current binding posts (or will be when OPER is pushed). See “Output Control” below.
- The Global Settings Menu at the right of the display sets up common configurations on the Master unit and all connected Auxiliary units.
- The Waveform Menu is the area where the waveform for a channel is constructed. This part of the user interface shows what will be output when the settings are enabled.

- Under the Waveform Menu is the Message Window which provides context-sensitive help and warning and error messages. The background of this area is white for help messages and orange for warnings. Warnings include messages indicating that invalid data has been entered or operating boundaries would be exceeded if a set up request were processed. Messages with red background report serious fault conditions.
- Eight softkeys which may be used to initiate actions appear across the bottom of the screen. Some of these actions may cause a pop-up screen to appear. The context of the softkeys transfers to the pop-up while it is on screen.

Data Entry from the Front Panel



Refer to Figure 3 and Table 3 for the items in this section.


- The keys under the screen (③) operate the softkeys shown on screen. There is a keypad area to the right of the screen. This comprises of the blue Navigation keys (⑥), the alphanumeric keys (⑬,⑭,⑮), the dual action Spin Wheel (⑨) and the output control keys (⑩,⑪,⑫).
-  (⑥) moves focus around the three Menu areas.
-  (⑥) moves focus around the controls within a Menu area.
- Within the Menu panes access to the individual controls is via the softkeys or by moving with . Pushing and holding  while using  reverses the direction of movement.
- The softkeys (③) provide a one-push alternative to using  to access items within the Menu areas.
- Sometimes softkeys have multiple levels of control. When more than one action is appropriate for a particular context, a further level of softkeys will be revealed when the key is pushed. The most complex activities may have several layers of softkeys. Use  to reverse upwards through the hierarchy of softkey levels.
-  (⑥) moves context up through a softkey hierarchy. Pushing  also escapes from pop-up screens.
- Only data fields with yellow background are directly editable. Some are drop-down-list controls and some numeric entry. When a drop-down-list has focus, the background becomes blue.  and  in the navigation group shift through the list items. Pushing  or  completes the selection and moves focus to the next control.
- There are three ways to change the values in the numeric entry controls. The numeric keys (⑮) allow direct entry which is completed by pushing  or .  (backspace) removes the digit to the left of the entry point each time it is pushed.
-  and  move the data entry point along the current value.  and  increment or decrement the digit at the entry point. The Spin Wheel (⑨) can perform the same actions as  and  and  and . Push the Spin Wheel in and rotate to move the data entry point. Release the Spin Wheel and rotate it to increment/decrement the digit at the entry point. It is not necessary to push  or  to complete the change.



- Alpha mode is used when naming files before saving to memory or an external USB device. Shift the Alpha Numeric keys to alpha characters and back to numeric by pushing .  is lit when Alpha mode is selected. Each key push changes the character at the entry point to the next in the three or four available from that key. For example: the first push of the **TUV** key in Alpha mode inserts a **T**. The entry changes to **U** at the second push and **V** at the third. To repeat a character, **TT**, for example, push  to move the entry point and then the **TUV** key a second time.


Direct/Indirect Mode

Changes to 6100B settings will usually be made one at a time. Sometimes it is necessary to make a number of changes all at once. Consider a three phase system where all three voltage phases are set to 120 V. To change each phase voltage individually in sequence would cause the three phase system to become unbalanced. This may be detrimental.

In Direct Mode,  is lit and all changes are applied immediately. The opposite of Direct Mode is Deferred Mode. In Deferred Mode  is not lit. Data field changes are not applied immediately. In changed fields the background is orange rather than yellow to show what the output will be after changes are applied. The changes can be applied in one of two ways:

1. If the output is already On, push .
2. Push softkey **Apply All** (this is only visible when the Output Menu has focus).

Changes are applied virtually simultaneously when  or  is pushed. There is a small delay of a few milliseconds while the changes are applied.

To undo deferred actions without applying them, select the **Undo all** softkey (when Output Menu has focus). Pushing  without applying the changes as described above will also undo deferred actions.

Using an External Keyboard and Mouse

Note


Keyboard/mouse plugged into the PS2 ports on the front panel must be in place before the 6100B is powered up. This restriction does not apply to the USB ports.

In most menu and entry pop-up screens the mouse can be used to point and click on a data field to give it focus. Some mouse operations are not available in some rarely used screens, the calibration/adjustment pop-up screen, for example.

An external keyboard can replicate most of the actions available from the 6100B front panel. Numeric Alpha characters 0-9; a-z; A-Z and the characters “.”, “/”, “_” and “-” are entered as if they came from a 6100B key. All other external keyboard text characters and punctuation are ignored.

External keyboard **Tab**, **Enter**, **Esc**, **Backspace** and cursor keys work as they do from the 6100B front panel.

The external keyboard space key can be used to check and uncheck selection boxes when they have focus.

Some Function keys are assigned to perform operations. **F1** to **F8** act as softkeys one to eight (counting from the left). **F9** acts as  to shift focus around the three Menu panes clockwise.

Sample Reference Signal and F10

The external keyboard **F10** key replicates the “OUTPut:ROSCillator” ON/OFF GPIB command. Pushing **F10** toggles the Sample Reference signal output On and Off.

The Sample Reference signal can be used to synchronize sampling instrumentation in a measurement system. This is described in the Users Manual.

6100B Set Up Exercise

A 6100B or 6105A is required to continue with this training exercise. The task is to set up the current channel to output 2.0 A. After following the Power Up instructions earlier in this manual, the L1 voltage channel (L1 V) output values are shown with a white background. See Figure 4. Note the L3, L3 and N channels are grayed out as Auxiliary units are not connected.

The screenshot shows a software interface titled "Output Menu" with a table of output channels. The L1 channel is selected, indicated by a white background for its settings. The L3 and N channels are grayed out, indicating they are not connected.

Channel	Type	Value 1	Value 2	Enabled	Waveform	Fluct	Inter	Flick	Dip
L1	V	120.000 V,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
L2	V	120.000 V,	-120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
L3	V	120.000 V,	120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
N	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip

Figure 4. The Output Menu (L1 Voltage Selected)

gdw08.bmp



This exercise is divided into seven sections:

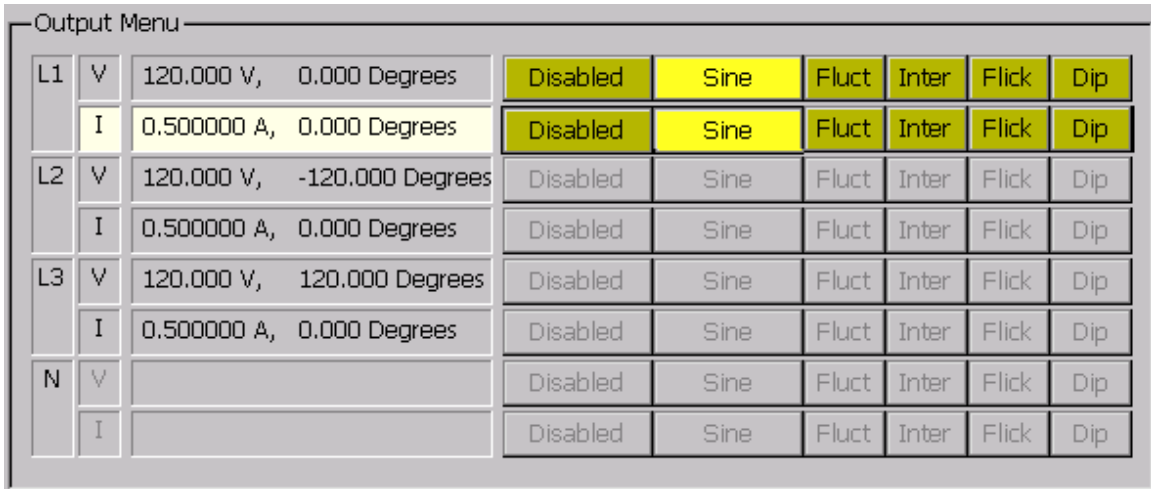
1. Switch to the Current Output
2. Enable the Current Channel
3. The Current Channel is Enabled but not Operating
4. Set up the L1 Current Channel
5. Over Compliance Warning Message
6. Complete the Current Circuit and Turn the Output On
7. Turn the Output Off

An explanation of each of these follows.

Switch to the Current Output

The focus must be on the current channel to set it up. After power up the Menu focus will be on the Waveform Menu (blue border).

1. Push  (or **F9**) once to move the focus to the Output Menu.
2. Use  to change the Output Menu control focus to L1 current (L1 I). Note the white background shifts to the active channel. Leave the focus on L1 current. See Figure 5.



The screenshot shows the 'Output Menu' interface. It features a table with columns for channel type (L1, L2, L3, N), waveform type (V, I), amplitude and phase settings, and a row of softkeys: Disabled, Sine, Fluct, Inter, Flick, and Dip. The L1 I row is highlighted with a white background, indicating it is the active channel.

Channel	Type	Amplitude	Phase	Disabled	Sine	Fluct	Inter	Flick	Dip
L1	V	120.000 V,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
L2	V	120.000 V,	-120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
L3	V	120.000 V,	120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
N	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip

Figure 5. The Output Menu (L1 Current Selected)



gdw10.bmp

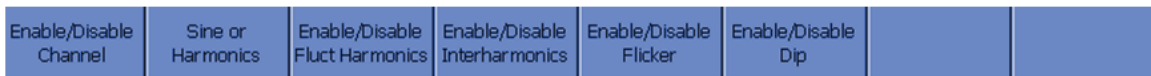
Enable the Current Channel

A channel must be enabled before an output is placed at the 6100B binding posts. Both the L1 voltage and current channels both show “Disabled”. Before an output can appear at the output terminals the relevant channel must be “Enabled”.

When the Output Menu has focus you can enable the L1 current channel using the softkeys. See Figure 6.

Note

If in the future the Menu focus is on the Output Menu but the softkeys are not as expected, push  to move up to the next softkey level. Pushing  then has no effect once the top level is reached.



The screenshot shows a row of seven softkeys: 'Enable/Disable Channel', 'Sine or Harmonics', 'Enable/Disable Fluct Harmonics', 'Enable/Disable Interharmonics', 'Enable/Disable Flicker', 'Enable/Disable Dip', and an empty space.

Enable/Disable Channel	Sine or Harmonics	Enable/Disable Fluct Harmonics	Enable/Disable Interharmonics	Enable/Disable Flicker	Enable/Disable Dip	
------------------------	-------------------	--------------------------------	-------------------------------	------------------------	--------------------	--

Figure 6. The Output Menu Softkeys

gdw06.bmp

1. Push the **Enable/Disable** softkey and the L1 current row in the Output Menu shows as “Enabled”. See Figure 7.

The screenshot shows the 'Output Menu' with a table of settings for various channels. The L1 current channel is highlighted in yellow, indicating it is selected and enabled.

Channel	Type	Value	Phase	Enabled	Waveform	Fluct	Inter	Flick	Dip
L1	V	120.000 V,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Enabled	Sine	Fluct	Inter	Flick	Dip
L2	V	120.000 V,	-120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
L3	V	120.000 V,	120.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
	I	0.500000 A,	0.000 Degrees	Disabled	Sine	Fluct	Inter	Flick	Dip
N	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip

Figure 7. The Output Menu (L1 Current Selected)

gdw09.bmp

The Current Channel is Enabled but not Operating

There is not yet output at the 6100B output terminals. The system must be set to operate mode to achieve this. If the system was set to operate at this point, nothing would appear at the voltage terminals because that channel is not enabled. The system would attempt to output 0.5 A from the current terminals but this would generate a warning message as the output is open-circuit. This will be addressed once the Current channel is set up.

Set Up the L1 Current Channel

To change the settings for an output channel first move the Menu focus to the Waveform menu.

1. Push **SELECT MENU** twice. The Menu focus moves to the Waveform menu. See Figure 8.

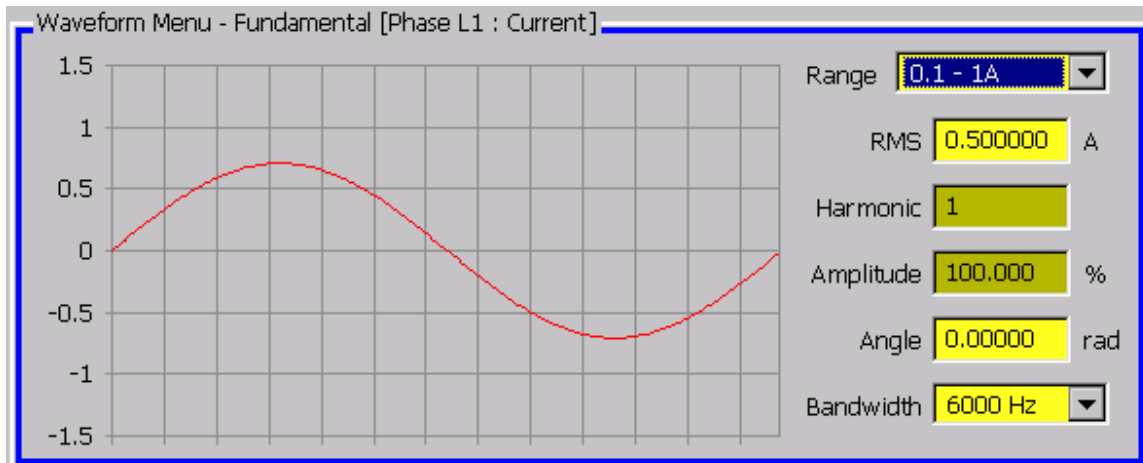


Figure 8. Waveform Menu, Fundamental


gdw11.bmp

2. The Range control has focus (blue background).
3. Use the **▲** and **▼** or the scroll wheel to set the range to 2 A. Push **ENTER** or **→** to complete the entry and move focus to the RMS field.
4. Set the output RMS value to 2.0 A using the controls as described in “Data Entry

from the Front Panel” above. Note that focus shifts to the Bandwidth limit control. Leave that setting as it is. Bandwidth limit is described in the Users Manual.

Over Compliance Warning Message

If the current channel output is turned on while the current terminals are open circuit, the over compliance voltage trips will be activated. The output will turn off and an orange background warning will be displayed. The reason for this is that without a load the current cannot be established because the voltage compliance limit will be exceeded. Simply put, the voltage developed across a load is determined by OHMS law, i.e., $V = I \times Z$. As the terminals are open, the output sees very high impedance which requires very high voltage. The 6100B is 10 V limit is exceeded so the over compliance trips will be activated.

Turn the output On by pushing . Almost immediately the trips operate and an orange background warning message appears. See Figure 9.

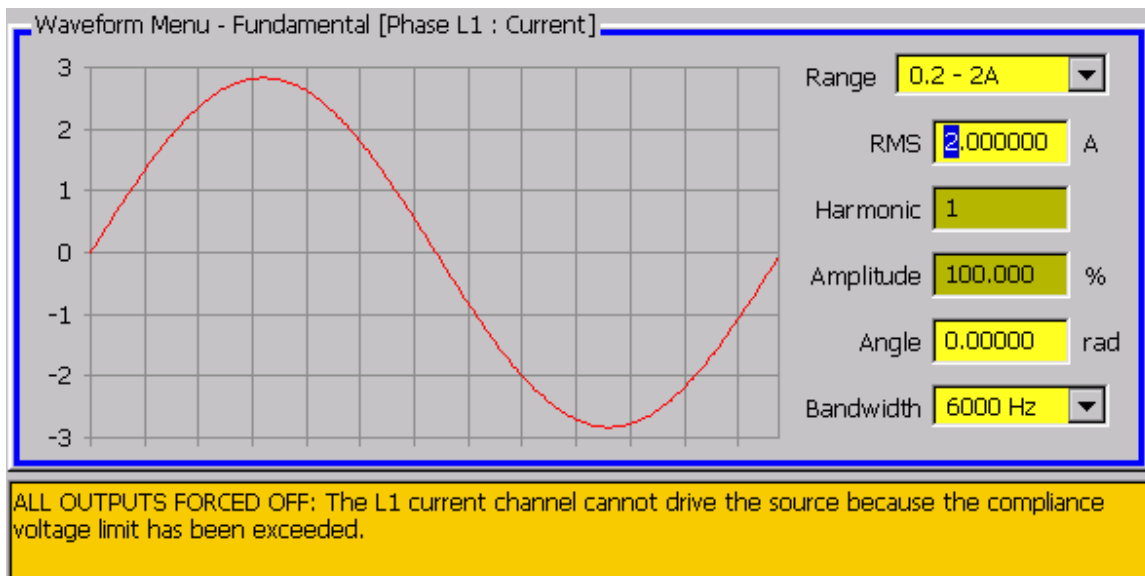


Figure 9. Over Compliance Warning Message

gdw12.bmp

Complete the Current Circuit and Turn the Output On

1. Fit a short circuit across the 6100B output terminals.
2. Push **OPER** again. The output remains on this time and the 6100B is in Operate mode. Notice that the Output Menu Enabled and Sine blocks for L1 current are green. See Figure 10. The green indicator light for current (above the output terminals) is illuminated and **OPER** shows a green light.

Output Menu				Disabled	Sine	Fluct	Inter	Flick	Dip
L1	V	120.0000 V, 0.00000 Radians		Disabled	Sine	Fluct	Inter	Flick	Dip
	I	2.000000 A, 0.00000 Radians		Enabled	Sine	Fluct	Inter	Flick	Dip
L2	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip
L3	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip
N	V			Disabled	Sine	Fluct	Inter	Flick	Dip
	I			Disabled	Sine	Fluct	Inter	Flick	Dip

Figure 10. Waveform Menu, Current Output

gdw13.bmp

Turn the Output Off

To turn the output off, push **STBY**. The On indications disappear.

The training exercise is complete.

Two-wire / Four-wire Voltage Settings

The 6100B voltage output can be configured for either two-wire or four-wire sensing. The default mode is two-wire sense.

⚠️ Warning

To avoid electrical shock, personal injury, know that when the 6100B voltage channel is enabled and operating, full voltage output may be present at the VOLTAGE SENSE terminals even when they are not externally connected.

The 6100B is provided with a four to two-wire lead set for voltage. Irrespective of two-wire / four-wire configuration the four plugs at the 6100B end of the lead should always be plugged in when the lead is in use. The sense wires will always be at the same potential as the output wires.

For measurement accuracy it is important that the two-wire / four-wire setting is correct. In particular, setting four-wire sensing but only connecting two wires will cause voltage errors in the order of 1.2 V. If you are not familiar with four-wire voltage sensing please read the description and warning below. Otherwise refer to the Users Manual to learn more about the 6100B features and how to operate them.

Four-wire Sense

In two-wire sensing, the sense point for the control system feedback loop is at the back of the terminals. Any current flowing in the leads connecting the OUTPUT terminals to the load causes a volt drop in the leads. As a result, the voltage at the load is less than at the terminals and accuracy is compromised. This problem is solved by using four-wire sensing as shown in Figure 11.

The input impedance of the feedback amplifier is very high so very little current flows in the sense leads. The voltage input to the SENSE terminals therefore accurately represents the voltage across Z_{Load} and this is used to correct the voltage at the OUTPUT terminals.

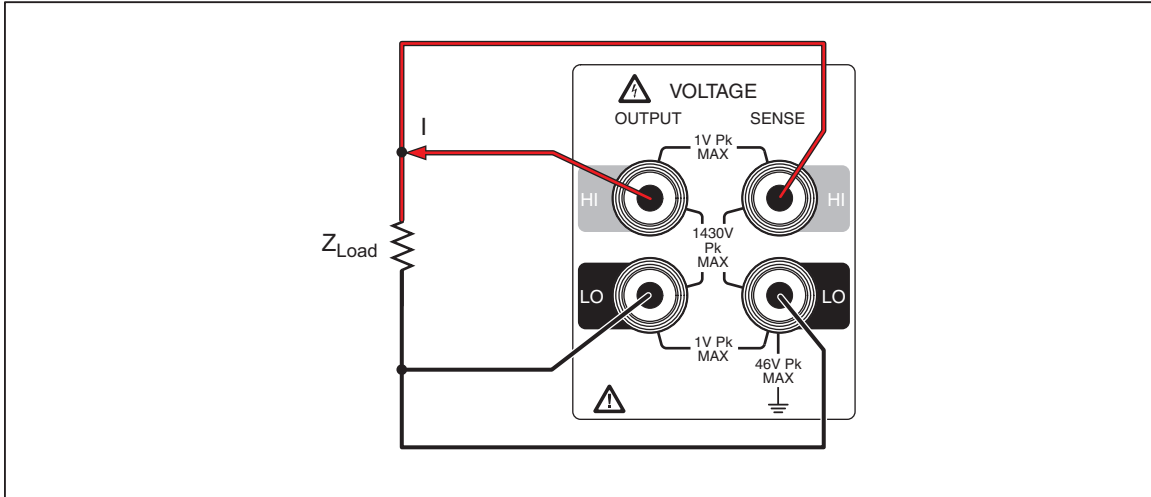


Figure 11. Four-wire Sense Configuration

gdw08.eps

Two-wire / Four-wire Configuration Settings

The 2-wire / 4-wire configuration applies to all connected Master and Auxiliary units. The configuration is made via a pop-up menu called from the Global Settings Menu top-level softkeys. See Figure 12.



Figure 12. Global Settings Menu Top-level Softkeys

gdw14.bmp

Push the **Front Panel Terminals** softkey to open the pop-up screen. See Figure 13.

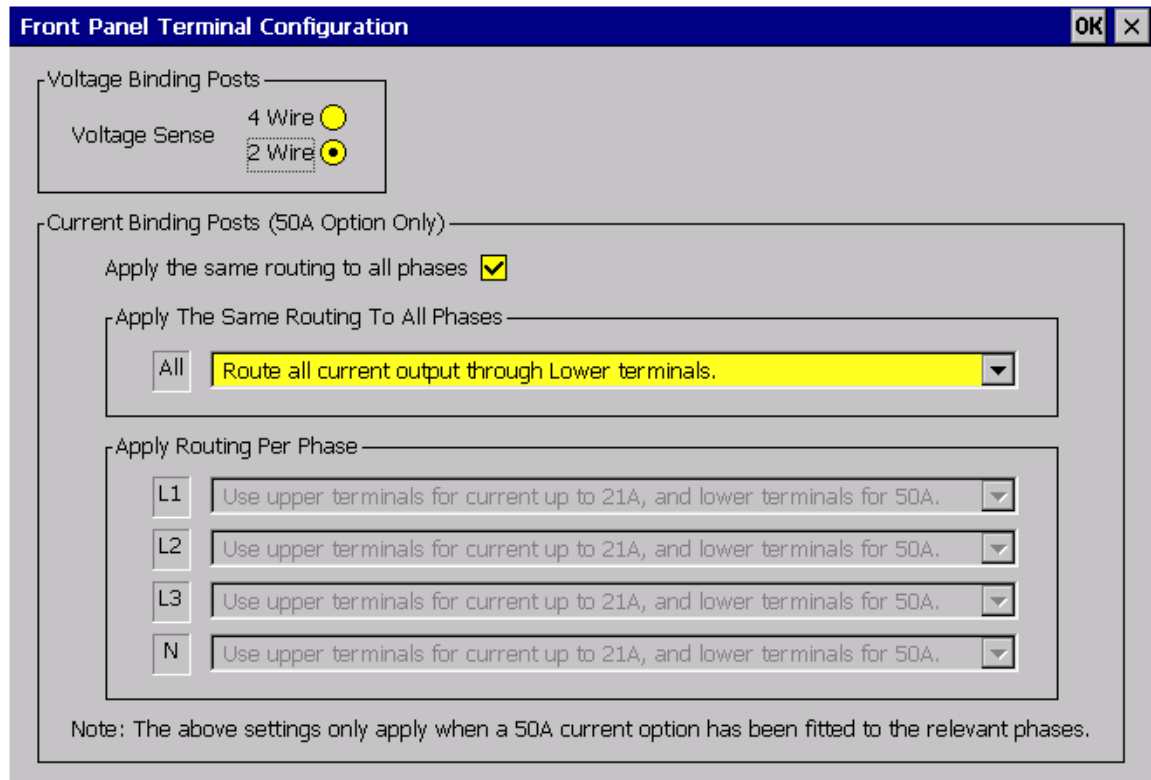




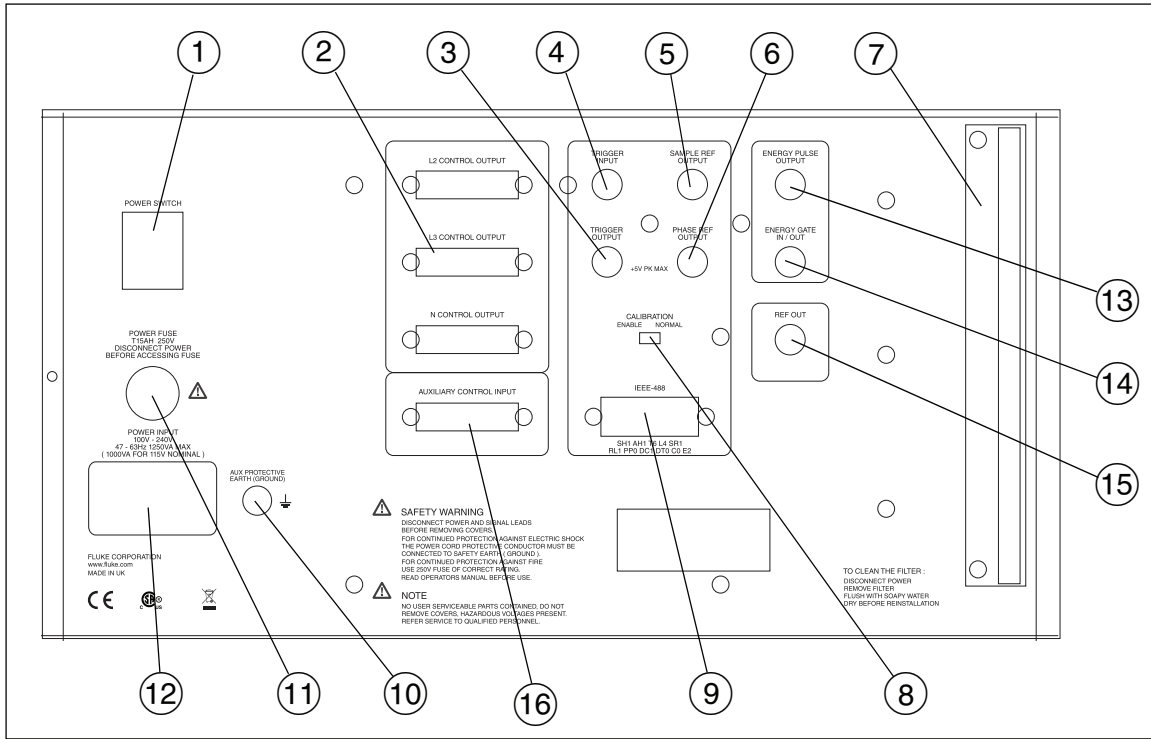
Figure 13. Front-panel Terminal Configuration

gdw15.bmp

Note that the softkeys have changed. Select two or four wire using the softkeys, or with  and  or the Scroll Wheel when the Voltage Binding Posts group has focus. Two wire is the initial default setting but the setting is non-volatile. If four wire is selected, the next time the instrument is powered up it will be in four-wire mode.

Rear-Panel Features

Figure 6 and Table 4 show and explain the rear panel features.



gdw07.eps

Figure 14. Rear-Panel Features

Table 4. Rear-Panel Features

Number	Meaning
1	Main Power On-Off Switch -This is a true mains isolating switch.
2	Auxiliary Unit Control Connectors - Connection to Auxiliary units via Fluke supplied cable.
3	Trigger Out Connector - The Trigger Output Connector has a +5 V CMOS logic drive providing a falling edge time marker intended to synchronize external equipment to the dip/swell function. The point at which the falling edge occurs is controlled by the Trigger Output Delay. After the falling edge the signal will remain low for a minimum of 10 μ s.
4	Trigger Input Connector -iA TTL compatible input which can be selected to initiate a dip/swell on a falling edge. The falling edge can either start the user programmable initial delay timer or arms the user settable output waveform phase angle comparator. These are mutually exclusive. When the timer delay has expired or the comparator has found the required angle of the output waveform the Ramp In section of the dip/swell will commence. The input must remain low for 10 μ s after the falling edge to be recognized properly.

Table 4. Rear-Panel Features (cont.)

Number	Meaning
⑤	Sample Ref Output Connector - The Sample Reference can be used to synchronize sample measurements with the 6100B internal sample clock. When activated the Sample Reference is provided at this connector. The Signal Reference is a falling edge active +5 V to 0 V CMOS logic signal. The Sample Reference output can be enabled from the Global Menu or via the GPIB. When the Sample Ref Output is enabled, the output signal is held high until the next rising zero crossing of the L1 voltage fundamental. The signal will then continue until disabled.
⑥	Phase Reference Output Connector- has a +5 V CMOS logic drive providing a rising edge synchronous to the rising zero crossing of the L1 fundamental voltage. This signal has a 50 % duty.
⑦	Air Filter - See the Users Manual for air filter maintenance procedure.
⑧	Calibration Enable Switch
⑨	IEEE 488 Connector - For connection into a GPIB system.
⑩	Ground Binding Post - Auxiliary protective earth/ground connection stud.
⑪	Fuse - See the Users Manual for fuse replacement procedure.
⑫	Mains Power Receptacle - 16 A mains connector.
⑬	Energy Pulse Out connector (if fitted)- When the Energy option is fitted, the Energy pulse output provides pulses proportional to output power. See the Users Manual for a description of the Energy Option. Blanked if the Energy option is not fitted.
⑭	Energy Gate In/Out connector (if fitted)- A bidirectional input or output gate control used with the Energy option. See the Users Manual for a description of the Energy Option. Blanked if the Energy option is not fitted.
⑮	Reference Signal Output when CLK option is fitted.- TTL compatible 10 MHz or 20 MHz reference output signal derived from the system master clock. Blanked if the CLK option is not fitted.
⑯	Auxiliary Control Input - Two Master units (6100B/6105A) can be connected together to act as Master and Auxiliary. For example, the interconnection cable would be plugged into the L2 Control output of the Master and into the Auxiliary Control Input of the unit delegated to be the Auxiliary.

