

# 2220, 2220G, 2230, 2230G

## Multi-Channel USB and USB/GPIB Programmable DC Power Supplies

**3-Year  
Warranty**



- **Dual and triple output models with two 30V/1.5A (45W) channels and a 6V/5A (30W) channel on the triple output supply**
- **All channels are independently controlled and have isolated outputs for maximum flexibility**
- **All channels have remote sensing to ensure that programmed voltage is accurately applied to the load**
- **Two 30V channels can be combined either in series to double output voltage or in parallel to double output current**
- **0.03% basic voltage output accuracy and 0.1% current accuracy ensure quality test data**
- **Low noise, linear regulation with <3mVpp ripple and noise**
- **Voltage and current outputs for all channels are displayed simultaneously for easy observation of each output state**
- **Keypad entry allows fast, precise entry of output values**
- **USB interface standard on all versions for remote control; "G" versions include USB and GPIB interfaces**

The Models 2220, 2220G, 2230, and 2230G Multi-Channel Programmable DC Power Supplies combine two and three channels of output power to cost-effectively characterize and test a wide range of devices, circuit boards, modules, and products that require more than one power source. The Models 2220-30-1 and 2220G-30-1 supplies provide two channels, with each channel capable of outputting up to 30V and up to 1.5A. The Models 2230-30-1 and 2230G-30-1 include two 30V/1.5A channels and add a 6V channel with up to 5A output for powering digital circuits. These multi-channel power supplies offer an excellent combination of performance, versatility, and ease of use to maximize the information from characterization or test as quickly and as easily as possible. They perform as effectively in automated test systems as they do in manual instrument configurations. The USB interface is standard on all models; the "G" versions add a GPIB interface.

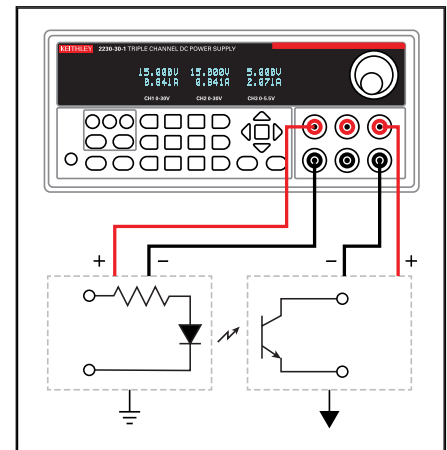
### Independent and Isolated Outputs

Since each channel in these multi-channel power supplies is completely independent and isolated from each other, these power supplies can be used to provide power to two circuits that are optically isolated or transformer-isolated from each other and have different reference points. Their isolated channels eliminate the need for a second power supply to power one of the isolated circuits.

Additionally, each channel can be independently controlled, so channels can be individually turned on and turned off at any time. Thus, these power supplies can be used to power up a circuit with multiple voltage levels (such as a digital circuit) that must be turned on in a specified time sequence. Furthermore, the timer capability allows you to set up unattended tests that turn off the channels after a programmed time interval to protect a device-under-test (DUT) from potential damage due to the continuous application of power beyond a recommended time interval. Both isolated and independent channels provide excellent versatility and flexibility to address a wide range of test applications.

### Accurate Power Delivery to the Load

With basic voltage setting accuracy and voltage readback accuracy of 0.03% for each channel, the exact voltage programmed for any channel is applied at the output terminals. Plus, the rear panel connections for each channel include remote sense terminals that compensate for voltage drops in the power supply leads. This helps to ensure that the correct voltage is delivered accurately to the load terminals of the DUT. Many other multi-channel power supplies do not provide remote sensing, which reduces overall system accuracy.



**Power two isolated circuits with isolated output channels.**

# 2220, 2220G, 2230, 2230G

## Ordering Information

<b>2220-30-1</b>	<b>Programmable Dual Channel DC Power Supply</b>
<b>2220G-30-1</b>	<b>Programmable Dual Channel DC Power Supply with GPIB Interface</b>
<b>2220J-30-1</b>	<b>Programmable Dual Channel DC Power Supply for Japan</b>
<b>2220GJ-30-1</b>	<b>Programmable Dual Channel DC Power Supply with GPIB Interface for Japan</b>
<b>2230-30-1</b>	<b>Programmable Triple Channel DC Power Supply</b>
<b>2230G-30-1</b>	<b>Programmable Triple Channel DC Power Supply with GPIB Interface</b>
<b>2230J-30-1</b>	<b>Programmable Triple Channel DC Power Supply for Japan</b>
<b>2230GJ-30-1</b>	<b>Programmable Triple Channel DC Power Supply with GPIB Interface for Japan</b>

## Accessories Supplied

**CS-1655-15 Rear Panel Mating Connector for Models 2220 and 2230 Multi-Channel DC Power Supplies Documentation and Driver CD**

## ACCESSORIES AVAILABLE

CS-1655-15	Rear Panel Mating Connector for Series 2200 Power Supplies
<i>Model Number JUMPER</i> (example: 2230-30-1 JUMPER)	Shorting Jumper for CS-1655-15 Connector
4299-7	Universal Fixed Rack Mount Kit
RMU2U	Fixed Rack Mount Kit
386-7598-xx	RMU2U Rack Mount Cosmetic Filler Panel
USB-1-1	USB Cable
KPCI-488LPA	IEEE-488.2 Interface Board for the PCI Bus
7007-05	Double Shielded Premium IEEE-488 Interface Cables, 0.5m (1.6 ft)
7007-1	Double Shielded Premium IEEE-488 Interface Cables, 1m (3.2 ft)
7007-2	Double Shielded Premium IEEE-488 Interface Cables, 2m (6.5 ft)
7007-3	Double Shielded Premium IEEE-488 Interface Cables, 3m (10 ft)
7007-4	Double Shielded Premium IEEE-488 Interface Cables, 4m (13 ft)

# Multi-Channel USB and USB/GPIB Programmable DC Power Supplies

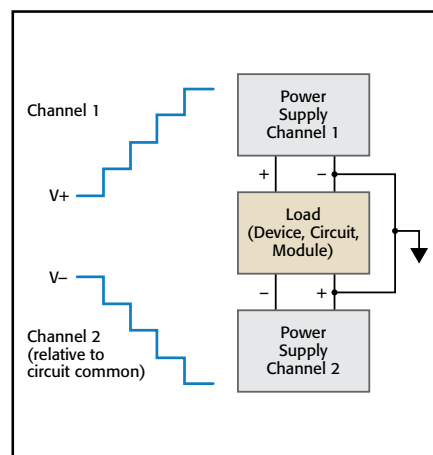
Great accuracy is not limited to voltage; the basic current setting and readback accuracy is 0.1%, providing high quality load current measurements. Also, with less than 3mV p-p noise, the power applied to the DUT's load terminals is both accurate and of high quality.

Excellent accuracy, remote sensing, and a wide power output range make the Series 2200 Multi-Channel DC Power Supplies essential test instruments both on the bench and in test systems. Their ability to generate a wide range of output power and measure a wide range of load currents is supported with:

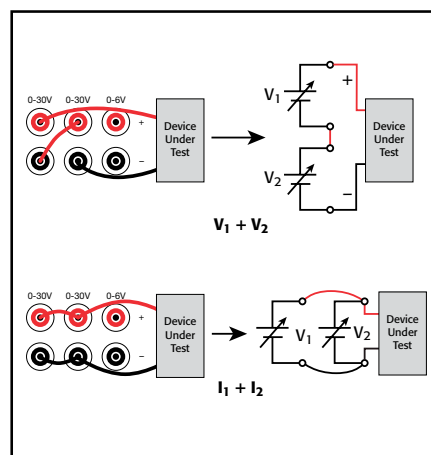
- Maximum output power of 45W on the 30V channels
- Maximum output power of 30W on the 6V channel
- Voltage setting and reading resolution of 1mV
- Current setting and reading resolution of 1mA

## Configure the Channels to Double Output Voltage or Current or Create Bipolar Power Supplies

The two 30V channels can be combined if more than 30V or more than 1.5A is required. The two 30V outputs can be wired in series to enable an output of 60V with a maximum current output of 1.5A or can be wired in parallel to get up to 3A at 30V. In series or parallel configurations, the power supplies offer special display modes that indicate the actual voltage and current for the combined pair. It's also easy to wire the outputs to make a  $\pm 30V$  bipolar supply and to maintain a user-defined ratio between the two outputs when using Tracking mode. These modes of operation extend the performance of the power supplies, while the display shows the actual outputs in these special modes to avoid any confusion or incorrect interpretation of the displayed data.



**Use the two 30V channels to test a bipolar integrated circuit or a bipolar module over its specified voltage operating range.**



**Combine two channels in series to output up to 60V or combine two channels in parallel to output up to 3A. The Model 2220/2230 display will show the combined value.**

## Convenience Features Help Get Results More Quickly

These multi-channel power supplies offer a number of features that return results quickly and easily:

- A rotary knob, with user-selectable step size, makes it easy to check circuit response to changing voltage or current. Alternatively, a direct-entry numeric keypad can be used to simplify setting precise voltage and current values.
- Each channel has its own readout on the display. The voltage and current being delivered to each channel are visible at a glance. A bright vacuum fluorescent display provides excellent readability at a distance, at an angle, or under dim lighting conditions.

# 2220, 2220G, 2230, 2230G

## Multi-Channel USB and USB/GPIB Programmable DC Power Supplies

- To save time when repeating tests, instrument settings can be saved in one of 30 internal memory locations by simply pressing the Save button. To recall that setting, just push the Recall button, and choose the desired setup.

### Protection for Your Device-Under-Test

These multi-channel power supplies include maximum voltage settings that prevent voltage from being accidentally adjusted above user-specified limits. Independent outputs allow a different limit to be specified for each output channel. With the numeric keypad, a current limit can be quickly and precisely specified before a test is started. In addition, a user-definable password allows the front panel to be locked to prevent unwanted adjustment during critical tests.

### Easy Test Automation

Two interface choices are available to enable PC control from a user-preferred programming environment. A USB TMC-compliant device port is included on all versions of these power supplies. The "G" versions add the GPIB interface for the flexibility of either USB or GPIB control. LabView and IVI drivers are provided to facilitate instrument control, data logging, and analysis. With these drivers, the power supplies can be controlled from most commercially-available software packages such as MatLab. Thus, these power supplies can be controlled as a single unit or as part of an automated test system.

### APPLICATIONS

#### Typical applications include:

- Circuit design
- Electrical engineering student labs
- Materials research
- Automated test

### SERVICES AVAILABLE

Model Number*-EW	1 additional year of factory warranty
Model Number-5Y-EW	2 additional years of factory warranty beyond the standard 3-year warranty
C/Model Number-3Y-STD	3 calibrations within 3 years of purchase
C/Model Number-3Y-DATA	3 (ANSI-Z540-1 compliant) calibrations within 3 years of purchase
C/Model Number-5Y-STD	5 calibrations within 5 years of purchase
C/Model Number-5Y-DATA	5 (ANSI-Z540-1 compliant) calibrations within 5 years of purchase

\* Replace "Model Number" with a power supply model number. For example: if the 2230GJ-30-1 is selected, then the part number for the -EW, one year of additional warranty option, is 2230GJ-30-1-EW.

NOTE: the "J" versions truncate the "A" in DATA. Example: C/222GJ-30-1-3Y-DAT

### Specifications

2230-30-1, 2230J-30-1, 2230G-30-1, 2230GJ-30-1				2220-30-1, 2220J-30-1, 2220G-30-1, 2220GJ-30-1	
DC OUTPUT RATING					
Voltage	0 to 30 V	0 to 30 V	0 to 6 V	0 to 30 V	0 to 30 V
Current	0 to 1.5 A	0 to 1.5 A	0 to 5 A	0 to 1.5 A	0 to 1.5 A
MAXIMUM POWER			120 W	90 W	
LOAD REGULATION					
Voltage	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV
Current	< 0.01% + 3 mA	< 0.01% + 3 mA	< 0.01% + 3 mA	< 0.01% + 3 mA	< 0.01% + 3 mA
LINE REGULATION					
Voltage	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV
Current	< 0.1% + 3 mA	< 0.1% + 3 mA	< 0.1% + 3 mA	< 0.1% + 3 mA	< 0.1% + 3 mA
RIPPLE AND NOISE					
Voltage (7MHz)	< 1 mV rms < 3 mV p-p	< 1 mV rms < 3 mV p-p	< 1 mV rms < 3 mV p-p	< 1 mV rms < 3 mV p-p	< 1 mV rms < 3 mV p-p
Current (20MHz)	< 5 mA rms	< 5 mA rms	< 6 mA rms	< 5 mA rms	< 5 mA rms
SETTING RESOLUTION					
Voltage	1 mV	1 mV	1 mV	1 mV	1 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
SETTING ACCURACY					
Voltage	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV
Current	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA
METER RESOLUTION					
Voltage	1 mV	1 mV	1 mV	1 mV	1 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
METER ACCURACY					
Voltage	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV	± 0.03% + 10 mV
Current	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA	± 0.1% + 5 mA

**ISOLATION VOLTAGE, OUTPUT TO CHASSIS:** Any output can be floated up to 240V (DC + peak AC with AC limited to a maximum of 3Vpk-pk and a maximum frequency of 60Hz) relative to earth ground terminal.

**ISOLATION VOLTAGE, OUTPUT TO OUTPUT:** Any output can be floated up to 240V (DC + peak AC with AC limited to a maximum of 3Vpk-pk and a maximum frequency of 60Hz) relative to any other output terminal.

**VOLTAGE TRANSIENT RESPONSE SETTLING TIME, LOAD CHANGE (typical):** <150ms to within 75mV following a change from 0.1A to 1A.

**VOLTAGE TRANSIENT RESPONSE SETTLING TIME, SETTING CHANGE, RISING (typical):** <150ms to within 75mV following a change from 1V to 11V into a 10Ω resistor (Ch. 1, 2); from 0.4V to 4V into a 4Ω resistor (ch. 3.)

**VOLTAGE TRANSIENT RESPONSE SETTLING TIME, SETTING CHANGE, FALLING (typical):** <150ms to within 75mV following a change from 11V to 1V into a 10Ω resistor (Ch. 1, 2); from 0.4V to 4V into a 4Ω resistor (ch. 3.)

**DISPLAY:** Vacuum fluorescent display.

**MEMORY:** 30 setup memories.

#### TRACKING AND COMBINATION MODES:

**Tracking Mode:** Maintains the ratio on the two 30V output channels that is present when the control is activated.

**Combination V1+V2 Series Mode:** Deliver up to 60 V when CH1 and CH2 are wired in series. Meter reads back combined voltage.

**Combination I1+I2 Parallel Mode:** Deliver up to 3 A when CH1 and CH2 are wired in parallel. Meter reads back combined current.

**REAR PANEL CONNECTIONS:** USB Device Port, Type B connector, USBTMC compatible. 2220G and 2230G versions include a GPIB interface, IEEE-488.2 compliant.

### POWER SOURCE

**AC INPUT:** Non-"J" versions: Switchable between 120VAC or 240VAC, nominal (different fuse required for each voltage).

"J" Versions: 100VAC, nominal.

**FREQUENCY:** 50/60Hz

**POWER CONSUMPTION:**

Dual Channel Versions: 350VA.

Triple Channel Versions: 450VA.

### PHYSICAL CHARACTERISTICS

#### PROTECTIVE BOOTS AND HANDLE INSTALLED:

**Height:** 105.3mm (4.15 in.)

**Width:** 241.8mm (9.52 in.)

**Depth:** 384.0mm (15.12 in.)

#### PROTECTIVE BOOTS AND HANDLE REMOVED:

**Height:** 90.7mm (3.57 in.)

**Width:** 217.2mm (8.55 in.)

**Depth:** 361.6mm (14.24 in.)

#### NET WEIGHT:

2220-30-1: 8.2 kg (18 lb.)

2230-30-1: 8.5 kg (19 lb.)

#### SHIPPING WEIGHT:

2220-30-1: 11 kg (24 lb.)

2230-30-1: 11 kg (24 lb.)

# 2220, 2220G, 2230, 2230G

## Multi-Channel USB and USB/GPIB Programmable DC Power Supplies

### ENVIRONMENTAL AND SAFETY

Temperature: **Operating:** 0° to +40°C.

**Storage:** -20° to +70°C.

Relative Humidity (non-condensing):

**Operating:** 5% to 95% relative humidity at up to +40°C.

**Storage:** 5% to 95% relative humidity at up to +40°C. 5% to 60% RH above +40°C up to +70°C, non condensing.

Altitude:

**Operating:** Up to 2000m.

**Storage:** Up to 4000m.

Safety:

European Union: Complies with European Union EMC Directive.

USA: Nationally recognized testing laboratory listing UL61010-1-2004.

Canada: CAN/CSA C22.2 No. 61010-1 2004.

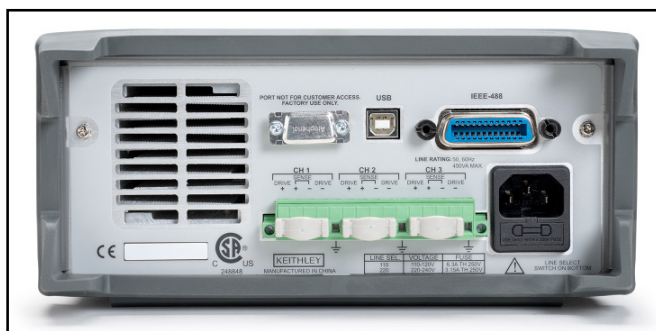
### ELECTROMAGNETIC COMPATIBILITY

European Union: Complies with European Union Low Voltage Directive.

Australia: EMC Framework, demonstrated per Emission Standard AS/NZS 2064 (Industrial, Scientific, and Medical Equipment).



**Model 2220-30-1 rear panel. The Model 2220G-30-1 adds a GPIB connector.**



**Model 2230G-30-1 rear panel. The Model 2230-30-1 does not have the GPIB connector.**

**KEITHLEY**  
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