

6100 DC Source User's Manual



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1. DESCRIPTION

1.1 Overview

The 6100 Series DC Sources provide programmable DC power for testing DC – DC converters.

Transients may be programmed to simulate real world input power disturbances.

Waveforms of Voltage, Current, DIN state and time are all measured and displayed. Other measurements include Inrush Current, Power and Trigger In time.

An analog input is included for voltage modulation. An analog output is included for current monitoring. A trigger output is also provided.

Protection is included for over voltage, over current, over current trip delay, short circuit, over power, over temperature and under voltage.

These sources employ switching technology for high operational efficiency and power density. Instrument includes soft start circuitry to limit turn-on surge current. All I/O functions are accomplished using rear panel mounted connectors.

These sources are a “Constant Power” design, meaning that the source delivers current up to 450w at any point within its constant power operating envelope. Constant power operation automatically extends the number of output voltage and current combinations available within the maximum power rating of the source. These sources may be paralleled for higher power.

1.2 Model Number Description

Model Number	Part Number	Voltage	Current	Power
6102	1109091	0 – 20V	0 – 60A	0 – 450W
6104	1109092	0 – 40V	0 – 30A	0 – 450W
6108	1109093	0 – 80V	0 – 15A	0 – 450W
6145	1109094	0 – 450V	0 – 8A	0 – 450W

1.3 Options Part Number

1109143	Output Polarity Switching Relay
1109144	External Shunt Relay
1109145	Output Isolation Relay

1.4 Physical

The source easily installs into one of the six available motherboard slots located in the S400 Power Subsystem Chassis. The Options module attaches to the rear of the source.

	Source	Options Module
Size:	4 ³ / ₄ " (h) x 2.5"(w) x 17"(d)	4 ³ / ₄ " (h) x 2.5"(w) x 4"(d)
Weight:	<6 lb.	<3/4 lb.

2. INSTALLATION

2.1 Hardware Installation

Unpack the source. Save the packing material if a need arises to return the source.

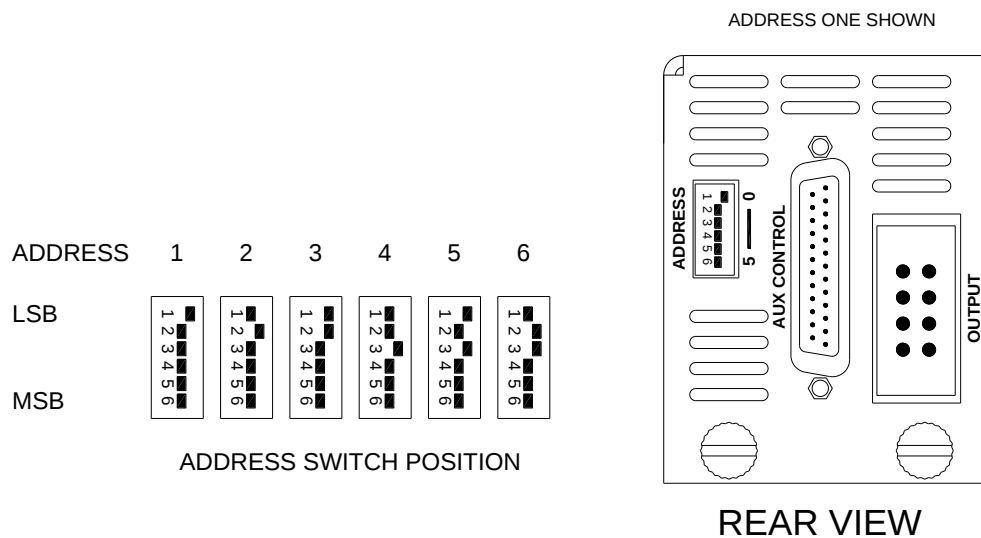
2.2 Communication Port

2.2.1 Baud Rate

A baud rate of 19.2k or 38.4k may be selected. In most cases, 19.2k (factory default) will be used, however, if you may change the baud rate to 38.4k by placing a jumper on W2 of the control PCA.

2.2.2 Address Switch

The 6-bit address switch is used to set a unique communication address for the serial interface. This address switch setting must match the software address. The LSB is labeled 1. The MSB is labeled 6. When a switch bit is moved toward the outside of the source, the bit is set to 0. When a switch bit is moved toward the inside of the source, the bit is set to 1. If all six positions of this switch are off when the source is turned on, it will boot from firmware in EPROM and not from FLASH. This is useful if the firmware in FLASH has been corrupted.

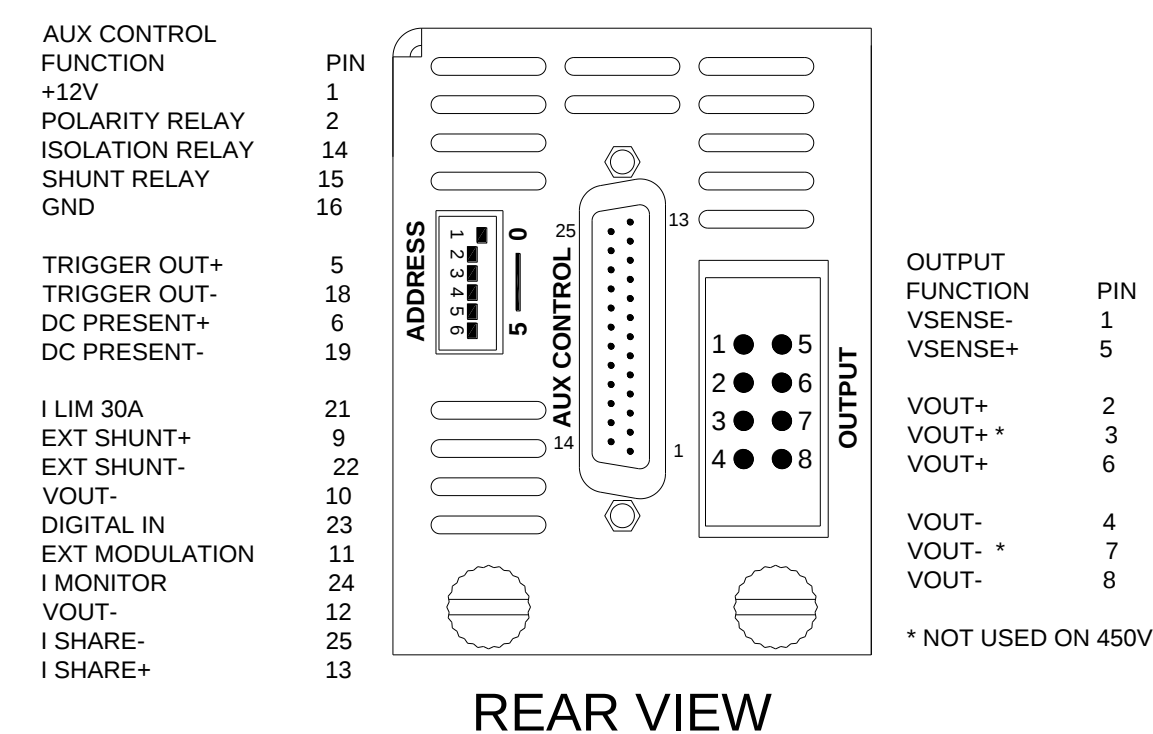


2.3 Interlock

The interlock signal on the S400 chassis must be made to enable operation of the source.

2.4 Connectors

2.4.1 Source Rear View



2.4.2 Output

Connection to the source is made via a cable attached to the power connector labeled "OUTPUT" located on the rear of a DC source.

DC SOURCE "OUTPUT" CONNECTOR

<u>PIN #</u>	<u>DESCRIPTION</u>	<u>PIN #</u>	<u>DESCRIPTION</u>
1	VSENSE-	5	VSENSE+
2	VOUT+	6	VOUT+
3	VOUT+ *	7	VOUT- *
4	VOUT-	8	VOUT-

* NOTE: Pins 3 and 7 are not connected on the 450Vdc Source.

2.4.2.1 External Voltage Sense

VSENSE+ and VSENSE- are the external voltage sense for the source. Voltage sense is selectable internal or external. If internal voltage sense is selected (default) these are not used and the set voltage is regulated internally. If external voltage sense is selected the set voltage is regulated externally to this sense point.

2.4.2.2 Voltage Output

VOUT+ and VOUT- are the main output power from the source. A maximum of 20A per pin is allowed. For the 60A source connect three 12AWG wires (one per pin in parallel) from VOUT+ and three 12AWG wires (one per pin in parallel) from VOUT- to your UUT.

2.4.3 Auxiliary

Auxiliary connections are made through the female 25 pin D-sub connector labeled "AUX CONTROL" on the rear of a DC source.

DC SOURCE AUX CONTROL CONNECTOR

<u>PIN #</u>	<u>DESCRIPTION</u>	<u>PIN #</u>	<u>DESCRIPTION</u>
1	+12V	2	POLARITY RELAY
14	ISOLATION RELAY	15	SHUNT RELAY
16	GND		
5	TRIGGER OUT+	18	TRIGGER OUT-
6	DC PRESENT+	19	DC PRESENT-
21	I LIM 30A		
9	EXT SHUNT+	22	EXT SHUNT-
10	VOUT-	23	DIGITAL IN
11	EXT MODULATION	24	I MONITOR
12	VOUT-		
25	I SHARE-	13	I SHARE+

2.4.3.1 Relay Driver Outputs

POLARITY, ISOLATION and SHUNT RELAY are open collector relay coil drivers referenced to GND. These are used to drive the optional Polarity, Isolation and Shunt Relays. An error is generated if one of these functions is programmed and the firmware detects the option is not present.

2.4.3.2 Trigger Output

TRIGGER OUT consists of an open collector optocoupler, isolated up to 500v from the source common. This is normally open and will close for a minimum of 50 microseconds upon voltage change if programmed to do so. A maximum of 1 milliamp and 20 volts are allowed.

2.4.3.3 DC Present Output

DC PRESENT consists of an open collector optocoupler, isolated up to 500v from the source common. This is normally open and will close while the output is on. A maximum of 1 milliamp and 20 volts are allowed.

2.4.3.4 External Shunt Input

EXT SHUNT is used to measure small currents on an external one ohm shunt. **These signals are not isolated**, they are referenced to the (DC Source output common VOUT-).

2.4.3.5 Digital Input

DIGITAL IN is a +5V CMOS logic level input used for making various timing measurements. A 10k pull up resistor to +5V is provided. **This signal is not isolated**, it is referenced to the (DC Source output common VOUT-).

2.4.3.6 External Voltage Modulation Input

EXT MODULATION will modulate the output voltage from set voltage. +10 Volts in equals FS Voltage out. This input must be enabled by software if used. The peak instantaneous input voltage is limited to +/- 12 VDC. Input impedance is 33Kohms. **This input is not isolated**, it is referenced the (DC Source output common VOUT-).

2.4.3.7 Current Monitor Output

I MONITOR is an analog signal 0 to 10 volts representing 0 to full range output current. **This signal is not isolated**, it is referenced to the (DC Source output common VOUT-).

2.4.3.8 Current Share

I SHARE signals must be tied to other Sources when connected in parallel. **These signals are not isolated**, they are referenced to the (DC Source output common VOUT-).

Vout-Signals (Aux Connector PIN 12) Must be connected to other sources when connected in parallel, as well.

2.4.4 Mating Connector Part Descriptions

2.4.4.1 DC Source (KIT N.H. Part Number 1106718)

N.H. P/N	DESCRIPTION	QTY	COMMERCIAL PART NUMBER	MANUFACTURER.
6202864	PWR-LOK 8P MALE	1	PLB08M0050	POSITRONICS
6202975	PWR-LOK MALE CONTACT	8	MS112N	POSITRONICS
6200644	DSUB 25PIN SOCKET	1	DB25P	ITT CANNON
6201298	DSUB SHELL	1	DB24659	ITT CANNON
6201309	DSUB SCREW LOCK	2	D20419-21	ITT CANNON
	EXTRACTION TOOL		9081	POSITRONICS
	INSERTION TOOL		9099	POSITRONICS

2.4.4.2 Manufacturers Description

POSITRONICS INDUSTRIES, INC.
423 N. CAMPBELL AVE.
P.O. BOX 8247
SPRINGFIELD, MO. 65801
PH# 417-866-2322 FAX# 417-866-4115

CANNON ITT
10550 TALBERT AVE.
P.O. BOX 8040
FOUNTAIN VALLEY, CA. 92708
PH# 714-964-7400

3. OPERATION

3.1 Status Indicator

This yellow indicator may be seen by looking into the rear of the source. This LED blinks at an 8-hertz rate at initial power up and during an error condition. This LED blinks at a one hertz rate during normal operation. If the LED is not blinking, remains off or on, the CPU is not operating.

3.2 COM Indicator

This green indicator may be seen by looking into the rear of the source. This LED will blink when the computer is communicating with any device on the bus. This LED stays on when the computer is communicating with this source. If it remains off, there is no communication on the bus.

3.3 Modes of Operation

3.3.1 Voltage Mode

The source will source current to regulate voltage. A small linear load is built in and will sink a small amount current to discharge output capacitors.

3.3.2 Current Mode

Current Limit - Programmable between zero and full scale current.

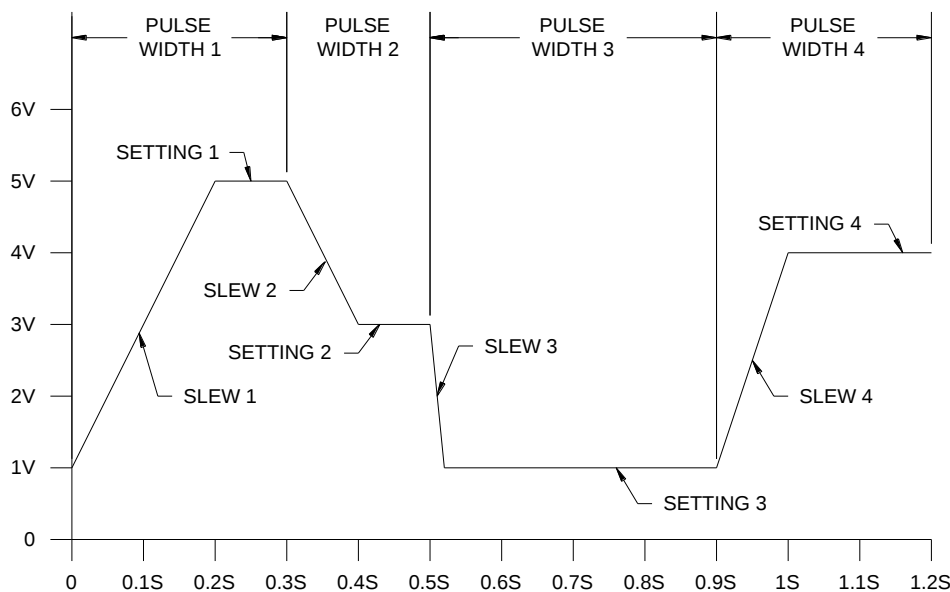
Current Trip - Programmable between zero and 110% of full-scale current. Trip delay is programmable from 1 millisecond to 200 seconds (i.e., current trip condition occurs when current remains at trip level for greater than pre-programmed time). Default is 200 seconds.

3.4 Slew Rate

Programmable slew rate is implemented digitally with a DSP processor, giving high accuracy and flexibility over a wide range without any calibration.

3.4.1 Transient Mode

In transient mode, the source puts out a sequence of up to 100 programmable settings. The time delay between each new setting is independently programmable. This feature, along with the programmable slew rate, allows the user to synthesize a wide range of multi-leveled square, pulse, ramp, or triangle waveforms. The output sequence may be synchronized to other Sources for parallel operation. Transients may run a single burst or continuous.



This voltage waveform is programmed as follows:

Constant voltage is set to 1V.

Step 1, set pulse width to 0.3S, slew rate to 20V/S ($4V / 0.2S$) and voltage to 5V.

Step 2, set pulse width to 0.2S, slew rate to 20V/S ($2V / 0.1S$) and voltage to 3V.

Step 3, set pulse width to 0.4S, slew rate to 200V/S ($2V / 0.01S$) and voltage to 1V.

Step 4, set pulse width to 0.3S, slew rate to 30V/S ($3V / 0.1S$) and voltage to 4V.

3.5 Metering

3.5.1 Voltage

If External Voltage Sense is not selected (default) the voltage measurements are made from inside the source. If External Voltage Sense is selected voltage measurements are made from the external sense point.

Multiple ranges are available for increased accuracy.

3.5.2 Current

The largest two current measurement ranges are made from an internal shunt. If the optional external shunt is installed two additional small current measurement ranges are made from the external shunt.

3.5.3 DSO and Timing Measurements

A sampling Analog to Digital Converter is used for metering which allows the display of waveforms similar to a Digital Storage Oscilloscope. The ADC multiplexes between voltage and current for simultaneous sampling of both.

The following measurements are available for Voltage and Current:

Overshoot, Undershoot, Rise Time, Fall Time, Settling Time, Hold Up Time, AC RMS, AC+DC RMS.

Other measurements include Trigger In Time, DIN State and Time.

3.6 Protection Circuits

3.6.1 Over Current

Current limit is programmable from 0 to maximum for that range. The source will reduce output voltage to limit output current.

Current Trip is programmable from 0 and 110% of maximum for that range. Trip delay is programmable from 1 millisecond to 200 seconds. The source will trip off when the current is greater than the trip level for greater than pre-programmed time. Default is 200 seconds.

3.6.2 Over Voltage

Over voltage is programmable from 0 to 125% of maximum for that range. If the output voltage exceeds this value the source will trip off.

3.6.3 Over Power

The source will reduce output voltage to limit power as needed.

3.6.4 Over Temperature

The unit shuts down when the temperature of the heat sink exceeds a preset limit, for maximum safety and reliability.

The over temperature function protects the source from exceeding its maximum operating temperature and thus damaging itself.

4. OPTIONS

4.1 Output Isolation Relay

An optional Output Isolation Relay is used to completely isolate the instrument from station wiring without removing power to the instrument.

The relay may be programmed to open at 0V or remain closed at all times.

The use of Isolation Relay with the low voltage sources requires limiting output current to 30 amps per channel maximum.

4.2 Output Polarity Switching Relay

An optional Output Polarity Switching Relay is used to change the polarity of the output voltage without rewiring the instrument.

The output voltage must be programmed to 0V before changing the polarity.

The use of Polarity Switching Relay with the low voltage sources requires limiting output current to 30 amps per channel maximum.

4.3 External Shunt Relay

An optional External Shunt Relay is used to enable an external shunt. The addition of this shunt allows for additional 500milliamp and 50milliamp current ranges. The current measurement accuracy is 0.1% of reading, + 0.1% of range. Once a source is calibrated with an external shunt, the shunt cannot be interchangeable with other sources.

The use of External Shunt Relay with the low voltage sources requires limiting output current to 30 amps per channel maximum.

Whenever an external shunt relay is used in conjunction with other relays, it should be connected closest to the source.

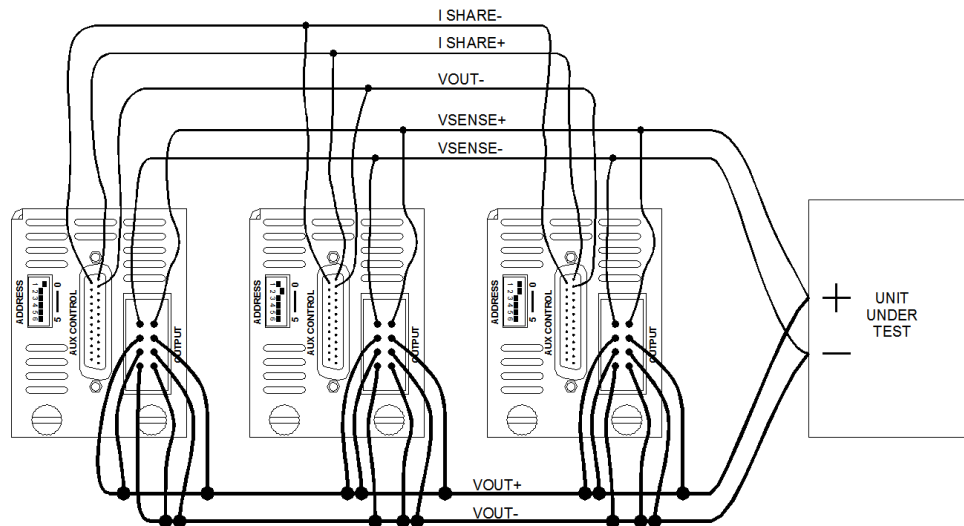
5. PARALLELING

Like source types may be connected in parallel. The paralleled Sources become one Logical Source. The maximum power and maximum current of the Logical Source is the sum of the individual source power and current ratings. The current and power are equally shared between all paralleled Sources.

Current sharing is accomplished via the I SHARE signals. The (Aux Connector I SHARE+ pin 13) of any one source must be connected to the (Aux Connector I SHARE+ pin 13) of all other Sources. The (Aux Connector I SHARE- pin 25) of any one source must be connected to the (Aux Connector I SHARE- pin 25) of all other Sources. The (Aux connector Vout-PIN 12) of any one source must be connected to the (Aux connector Vout-PIN12) of all other sources.

The source outputs must also be connected in parallel. The (Output VOUT+ pins 2, 3 and 6) of any one source must be connected to the (Output VOUT+ pins 2, 3 and 6) of all other Sources. The (Output VOUT- pins 4, 7 and 8) of any one source must be connected to the (Output VOUT- pins 4, 7 and 8) of all other Sources.

All sources external voltage sense wires need be connected if external voltage sense is desired. The (Output VSENSE+ pin 1) of all sources must be connected to the external voltage sense point. The (Output VSENSE- pin 5) of all sources must be connected to the external voltage sense point.



6. SPECIFICATIONS

All the specifications apply above 10% of the full-scale range.

6.1 Configuration

One, isolated DC Source in one module

6.2 Size

Single slot of S430, S440 chassis

6.3 Weight

5 lbs.

6.4 Communication

Implements and conforms to the S6k.2 command packet protocol.

6.5 Output Protection

Over temperature protection is provided by a thermal sensor.

Over current protection is provided in hardware.

Over voltage protection is provided in hardware.

Over power protection is provided in software.

6.6 Isolation

$\pm 1000\text{VDC}$ between input and output or chassis ground.

$\pm 500\text{VDC}$ between output and chassis ground.

6.7 Calibration

Closed cover, all adjustments are done in software and stored in FLASH.

Equipment Required:

Multimeter, Hewlett Packard Model 3458A or equivalent

NHR Calibrator

6.8 Self-test

Power-up self-test is implemented in firmware and will report comprehensive error messages about the status of the input, output, control board and protection mechanism.

6.9 Performance Monitoring

Performance monitoring is performed continuously by the DC Source's controller. In case of measurement ambiguities, over/under range conditions, heat sink temperature limits reached, etc an appropriate error or warning is sent to the controlling device.

6.10 Temperature

Operating from 0°C to 35°C - 450W

Operating at 50°C - 250W

Specifications apply at 23°C $\pm$ 5°C after 10-minute warm-up.

6.11 Input power

Operational from 115/230VAC -20% +10%, 47-63Hz.

6.12 External Modulation

The output can be externally modulated via an external function generator. Modulation output shall vary from set voltage. A 0 to +10 volt waveform corresponds to a 0 to positive full-scale voltage deflection. A 0 to -10 volt waveform corresponds to a set voltage to 0 voltage deflection. This signal is referenced to the source negative output.

6.13 Current Monitor

0 to 10V external output signal is provided which is 0 to 100% current range. This signal is referenced to the source negative output.

6.14 Digital Input

An external logic level DIN is provided. The state may be measured. Timing measurements may be made from Trigger In to Digital In and DC present. This signal is referenced to the source negative output.

6.15 Interlock

The S6K interlock is incorporated.

6.16 PARD

6145 Source: 125mV PK-PK (20MHz bandwidth) max

Other Sources: 30mV PK-PK (20MHz bandwidth) max

6.17 Efficiency

70% minimum at full output power.

6.18 External Sense

2VDC max drop between sense and source output.

6.19 6145 DC Source Programmable Features

Constant Voltage	Range Accuracy Resolution	0 to 450V 0.1% of set + 0.1% of range 0.028% of range
Current Limit, Current Trip	Range Accuracy Resolution	0 to 8A 0.2% of set + 0.2% of range 0.027% of range
Over Voltage	Range Accuracy Resolution	0 to 600V 1% of set + 1% of range 0.032% of range
Slew Rate	Max dv/dt	30000 volts per second
Transient Mode	Settings Total Period Delay Accuracy Resolution Modes	100 10 millisecond to 20 Sec 5 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec Single burst or continuous
Rise and fall time	Range Accuracy Resolution	15 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec
Current Trip delay time	Range Accuracy Resolution	20 millisecond to 200 Sec 1% $\pm$ 1milliSec 20 μ Sec

6.20 6108 DC Source Programmable Features

Constant Voltage	Range Accuracy Resolution	0 to 80V 0.1% of set + 0.1% of range 0.028% of range
Current Limit, Current Trip	Range Accuracy Resolution	0 to 15A 0.2% of set + 0.2% of range 0.033% of range
Over Voltage	Range Accuracy Resolution	0 to 120V 1% of set + 1% of range 0.028% of range
Slew Rate	Max dv/dt	4000 volts per second
Transient Mode	Settings Total Period Delay Accuracy Resolution Modes	100 40 millisecond to 20 Sec 20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec Single burst or continuous
Rise and fall time	Range Accuracy Resolution	20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec
Current Trip delay time	Range Accuracy Resolution	20 millisecond to 200 Sec 1% $\pm$ 1milliSec 20 μ Sec

6.21 6104 DC Source Programmable Features

Constant Voltage	Range Accuracy Resolution	0 to 40V 0.1% of set + 0.1% of range 0.029% of range
Current Limit, Current Trip	Range Accuracy Resolution	0 to 30A 0.2% of set + 0.2% of range 0.028% of range
Over Voltage	Range Accuracy Resolution	0 to 60V 1% of set + 1% of range 0.029% of range
Slew Rate	Max dv/dt	2000 volts per second
Transient Mode	Settings Total Period Delay Accuracy Resolution Modes	100 40 millisecond to 20 Sec 20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec Single burst or continuous
Rise and fall time	Range Accuracy Resolution	20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec
Current Trip delay time	Range Accuracy Resolution	20 millisecond to 200 Sec 1% $\pm$ 1milliSec 20 μ Sec

6.22 6102 DC Source Programmable Features

Constant Voltage	Range Accuracy Resolution	0 to 20V 0.1% of set + 0.1% of range 0.028% of range
Current Limit, Current Trip	Range Accuracy Resolution	0 to 60A 0.2% of set + 0.2% of range 0.028% of range
Over Voltage	Range Accuracy Resolution	0 to 30V 1% of set + 1% of range 0.028% of range
Slew Rate	Max dv/dt	1000 volts per second
Transient Mode	Settings Total Period Delay Accuracy Resolution Modes	100 40 millisecond to 20 Sec 20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec Single burst or continuous
Rise and fall time	Range Accuracy Resolution	20 millisecond to 20 Sec 1% $\pm$ 1milliSec 20 μ Sec
Current Trip delay time	Range Accuracy Resolution	20 millisecond to 200 Sec 1% $\pm$ 1milliSec 20 μ Sec

6.23 6145 DC Source Measurements

Voltage	Range	0 to 500V, 0 to 200V
	Accuracy	0.05% of reading, + 0.05% of range
	Range	0 to 20V
	Accuracy Resolution	0.05% of reading, + 100mV 0.0045% of range
Current Limit	Range	0 to 8A, 0 to 0.8A
	Accuracy	0.1% of reading, + 0.1% of range
	Resolution	0.0039% of range
Inrush Current	Range	0 to 8A, 0 to 0.8A
	Accuracy	1% of reading, + 1% of range
	Resolution	0.0039% of range
DIN, Trigger IN and DC Present Timing	Range	58k years
	Accuracy	0.05% of reading, $\pm 100\mu\text{Seconds}$
	Resolution	100nanoSeconds

6.24 6108 DC Source Measurements

Voltage	Range	0 to 200V, 0 to 20V
	Accuracy	0.05% of reading, + 0.05% of range
	Range	0 to 20V
	Accuracy Resolution	0.05% of reading, + 100mV 0.0045% of range
Current Limit	Range	0 to 15A, 0 to 1.5A
	Accuracy	0.1% of reading, + 0.1% of range
	Resolution	0.0047% of range
Inrush Current	Range	0 to 15A, 0 to 1.5A
	Accuracy	1% of reading, + 1% of range
	Resolution	0.0047% of range
DIN, Trigger IN and DC Present Timing	Range	58k years
	Accuracy	0.05% of reading, $\pm 100\mu\text{Seconds}$
	Resolution	100nanoSeconds

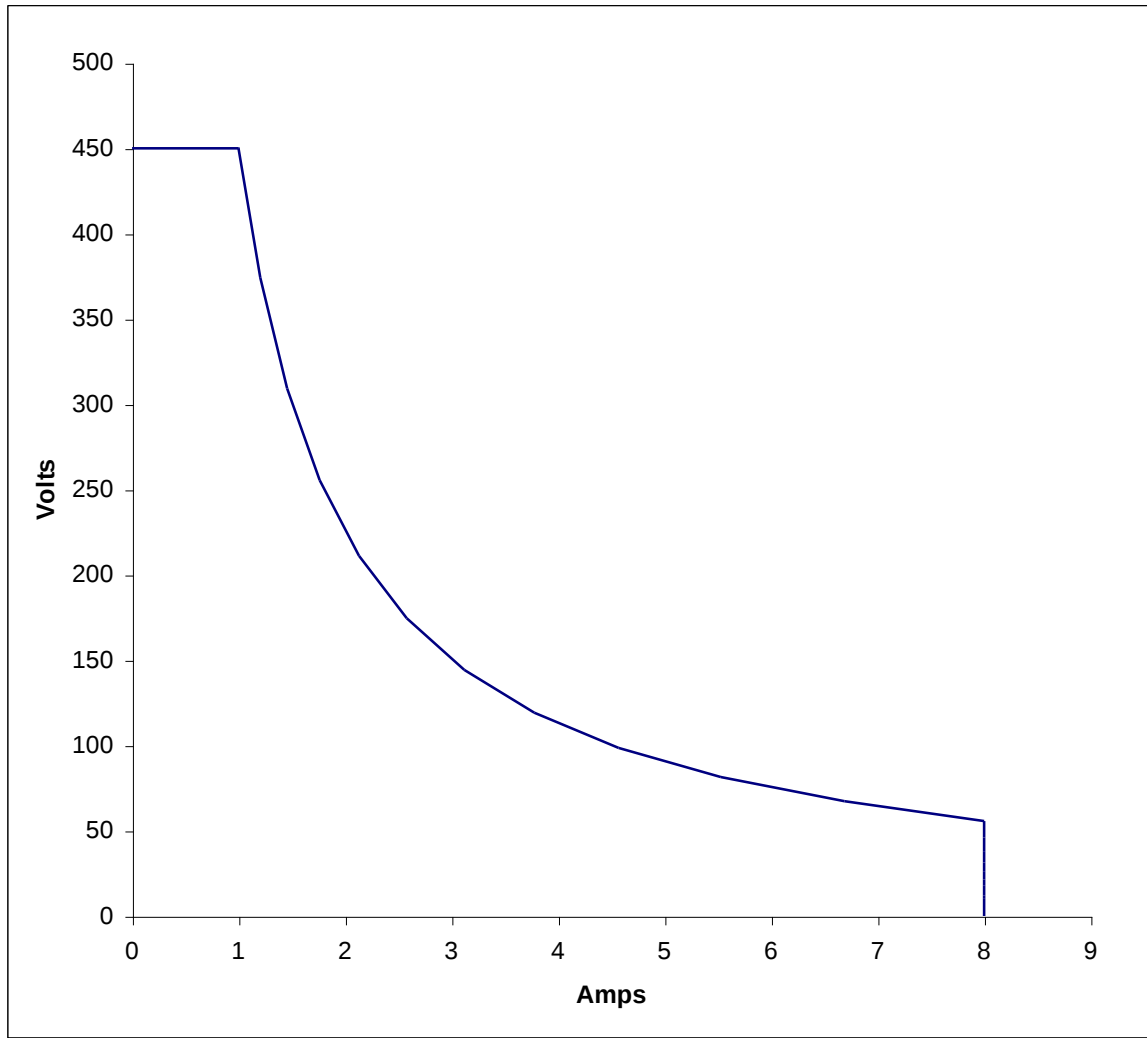
6.25 6104 DC Source Measurements

Voltage	Range	0 to 200V, 0 to 20V, 0 to 10V
	Accuracy Resolution	0.05% of reading, + 0.05% of range 0.0045% of range
Current Limit	Range	0 to 30A, 0 to 3A
	Accuracy Resolution	0.1% of reading, + 0.1% of range 0.0039% of range
Inrush Current	Range	0 to 30A, 0 to 3A
	Accuracy Resolution	1% of reading, + 1% of range 0.0039% of range
DIN, Trigger IN and DC Present Timing	Range	58k years
	Accuracy Resolution	0.05% of reading, $\pm 100\mu\text{Seconds}$ 100nanoSeconds

6.26 6102 DC Source Measurements

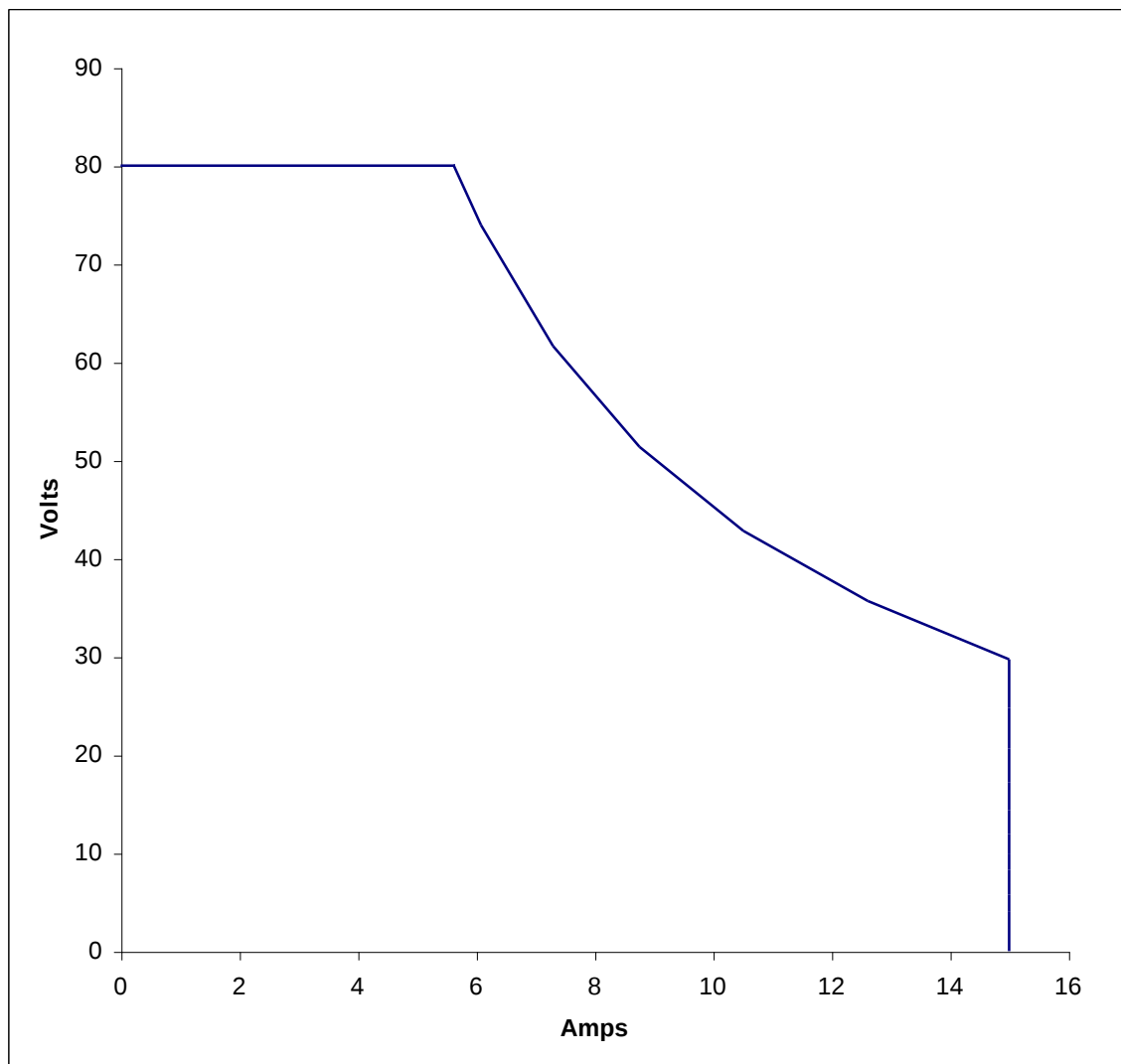
Voltage	Range	0 to 20V, 0 to 10V
	Accuracy Resolution	0.05% of reading, + 0.05% of range 0.0045% of range
Current Limit	Range	0 to 60A, 0 to 6A
	Accuracy Resolution	0.1% of reading, + 0.1% of range 0.0039% of range
Inrush Current	Range	0 to 60A, 0 to 6A
	Accuracy Resolution	1% of reading, + 1% of range 0.0039% of range
DIN, Trigger IN and DC Present Timing	Range	58k years
	Accuracy Resolution	0.05% of reading, $\pm 100\mu\text{Seconds}$ 100nanoSeconds

6.27 6145 DC Source Operating Envelope



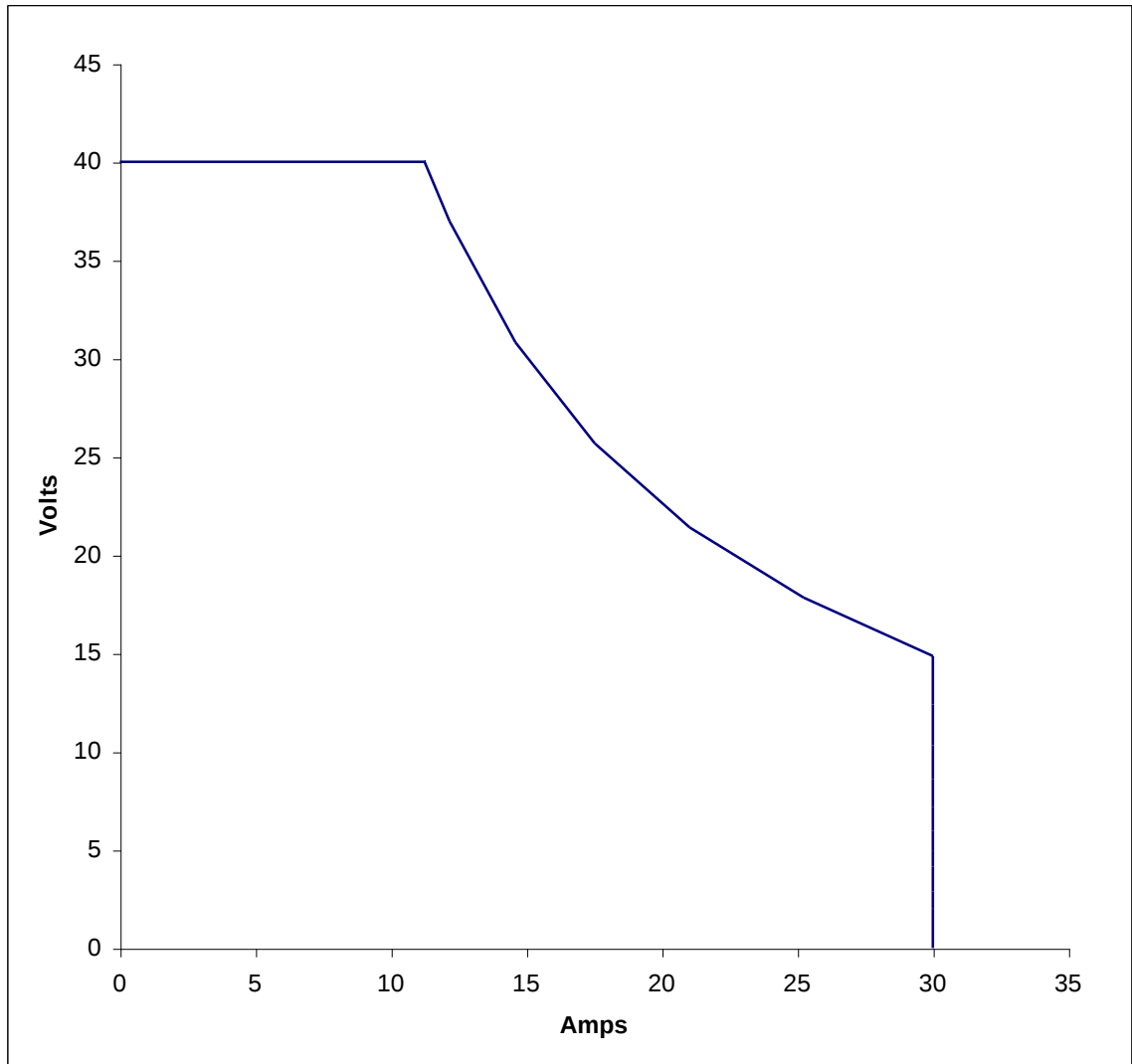
6145 Source Operating Envelope

6.28 6108 DC Source Operating Envelope



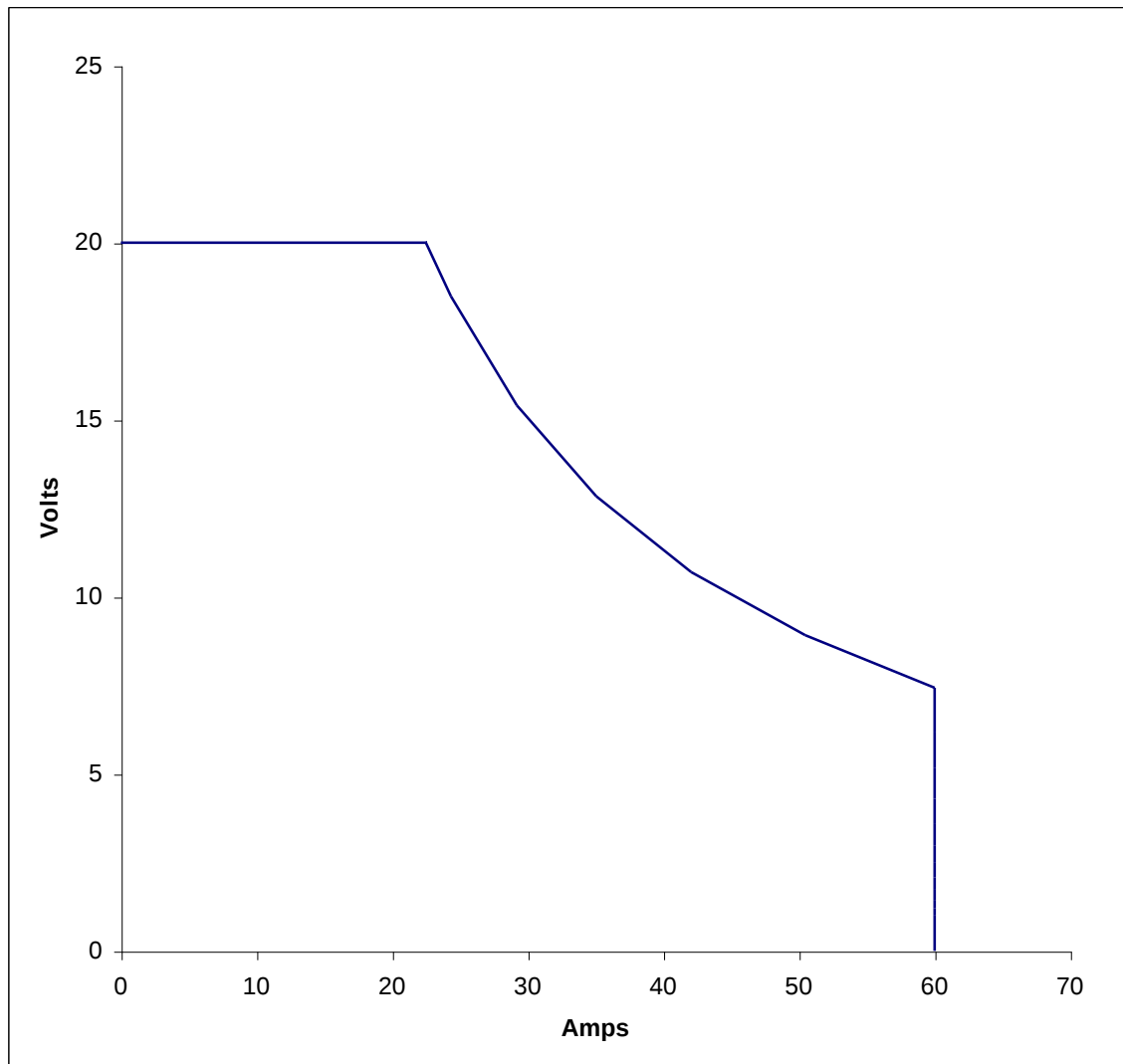
6108 Source Operating Envelope

6.29 6104 Source Operating Envelope



6104 Source Operating Envelope

6.30 6102 Source Operating Envelope



6102 Source Operating Envelope