



## PROGRAMMABLE DC ELECTRONIC LOAD MODEL 6310A SERIES

The Chroma 6310A series Programmable DC Electronic Load is ideal for the test and evaluation of multi-output AC/DC power supplies, DC/DC converters, chargers and power electronic components. It is designed for applications in research and development, production, and incoming inspection. The system is configured by plugging the user selectable load modules into the system mainframe. The user interfaces include an ergonomically designed user friendly keypad on the front panel and the following computer interfaces: RS-232, USB or GPIB.

The 6310A series offers 8 different modules with power ratings from 100 watts to 1,200 watts, current ratings from 0.5mA to 240A, and voltage ratings from 0.5mV to 500V. The loads can be operated in constant current, constant voltage, constant power and constant resistance and may be placed in parallel for increased current and power.

The 6310A series can simulate a wide range of dynamic loading applications. The waveforms

programmable parameters include: slew rate, load level, duration and conducting voltage. In addition, up to 100 sets of system operating status can be stored in EEPROM and recalled instantly for automated testing applications.

Real time measurement of voltage and current are integrated into each 6310A load module using a 16-bit precision measurement circuit. The user can perform on line voltage measurements and adjustments or simulate short circuit test using the user friendly keypad on the front panel. Additionally, the 6310A series offers an optional remote controller for automated production lines.

The 6310A series has a self-diagnosis routines to maintain instrument performance. It also provides OP, OC, OT protection, and alarm indicating OV, reverse polarity to guarantee quality and reliability for even in the most demanding engineering testing and ATE applications.

## Programmable DC Electronic Load

### MODEL 6310A SERIES

#### Key Features:

- Max Power: 200W, 100W×2(Dual), 30W & 250W, 300W, 350W, 600W, 1200W
- Wide range 0~500V operating voltage
- Compatibility between 6310 and 6310A
- Up to eight channels in one mainframe, for testing multiple output SMPS
- Parallel load modules up to 1200W for high current and power applications
- Synchronization with multiple loads
- Flexible CC, CR, CP and CV operation modes
- Dynamic loading with speeds up to 20kHz
- Fast response of 0.32mA/μs ~ 10A/μs slew rate
- Minimum input resistance allows the load to sink high current at low voltages
- Real time power supply load transient response simulation and output measurements
- User programmable 100 sequences. Front panel input status for user-friendly operation
- High/Low limits of testing parameters to test GO/NG
- Digital I/O control
- Over current protection (OCP) testing function
- 16-bit precision voltage and current measurement with dual-range
- Remote sensing capability
- Short circuit test
- Self-test at power-on
- Full Protection: OP, OC, OT protection, and OV, reverse alarm
- USB, GPIB & RS-232 interfaces

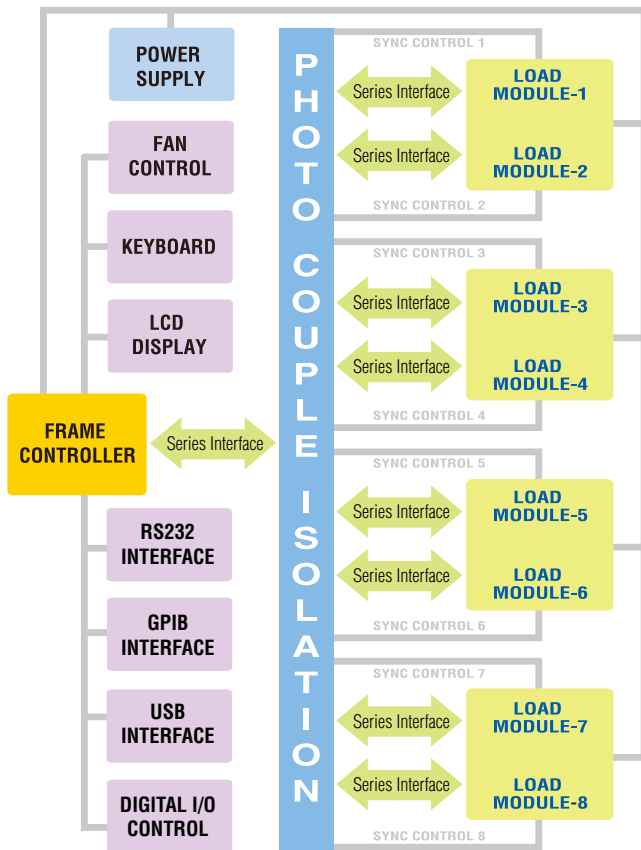


**Chroma**

## VERSATILE SYSTEM CONFIGURATION

Chroma 6310A Programmable Electronic Load integrates microprocessor capabilities into each load module and mainframe to provide simple and accurate parallel operation to optimize the speed and control among multiple load modules. All load modules may be configured to work synchronously, to test multiple outputs simultaneously, thus simulating real life applications.

### 6310A System Block Diagram



## COMPATIBILITY WITH 6310 SERIES

The 6310A series load modules will be compatible with the 6310 series mainframes (6312/6314). In addition, the remote control commands will be compatible between the 6310 and the 6310A series without needing to re-writing any remote control programs.

## MODULE LOAD DESIGN

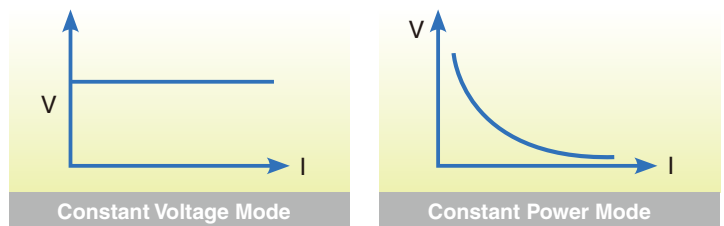
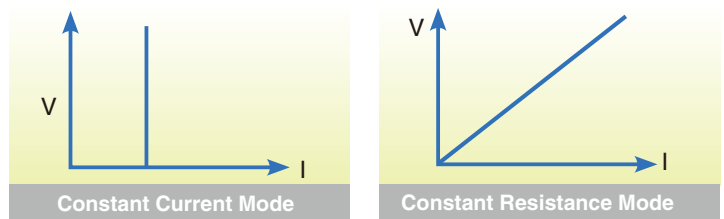
The Chroma 6314A 1200W and 6312A 600W electronic load mainframes accept the user-installable 6310A series load modules for easy system configuration and will mount in a 19" instrument rack. The 6314A holds up to four 63102A load modules, which will result in an 8-channel 100W/channel load with standard front-panel inputs. This makes it ideal for testing

multiple output switching power supplies and multiple DC-DC converters. There are also higher wattage modules that may be mixed and matched for an even more versatile system. Additionally, the GO/NG output port is useful for UUT's pass/fail testing on an automated production line. All modules on the 6314A/6312A mainframe share a common GPIB address to synchronize and speed up the control of the load modules and the read-back of data.



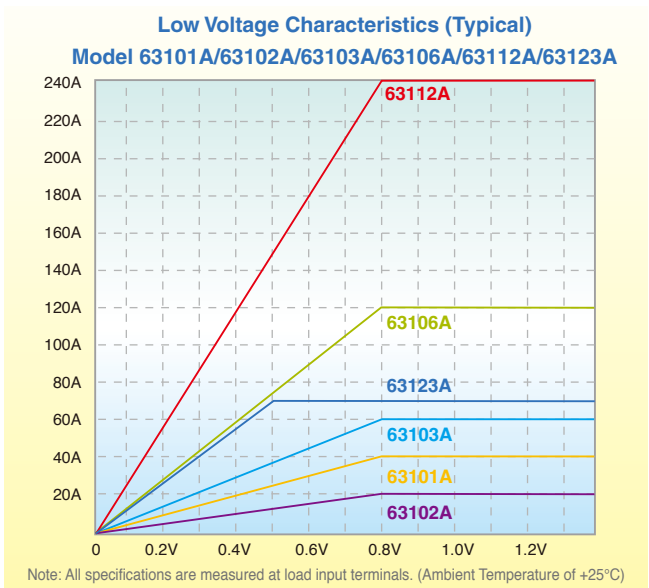
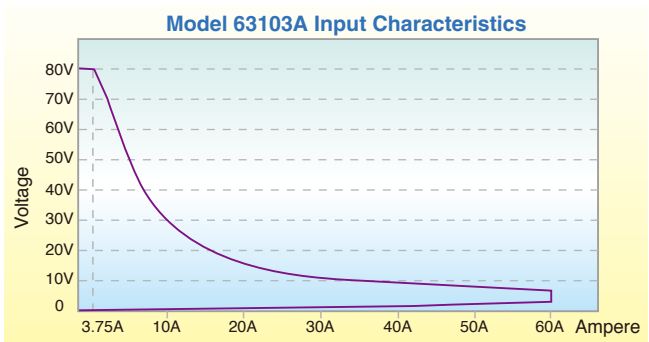
## APPLICATION OF SPECIFIC LOAD SIMULATION

The 6310A load modules operate in constant current, constant voltage, constant power or constant resistance to satisfy a wide range of test requirements. For example, the test of a battery charger can be simulated easily by setting the load to operate in constant voltage.



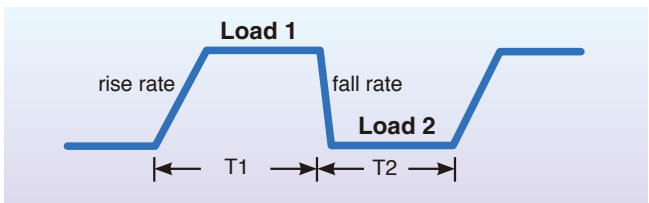
Each load module is designed with state-of-the-art technology and connects all the power MOSFET devices in parallel to insure high accuracy load control with a minimum drift of less than 0.1%+0.1%F.S. of the current setting. Chroma's use of FET technology provides minimum input resistance and enables the load to sink high current even at very low voltages. For example, the model 63103A is capable of sinking 60A at 1V, and well-suited for testing the new 3.3V low voltage power supplies. Low voltage operation, down to zero volts, is possible at reduced current levels. The 6310A load module uses a photo coupler for isolation between the

output and control sections, thus each load is isolated and floating. The user can use multiple load modules independently to test multi-output power supplies, or parallel them for high power testing applications.



### DYNAMIC LOADING AND CONTROL

Modern electronic devices operate at very high speeds and require fast dynamic operation of their power providing components. To satisfy these testing applications, the 6310A loads offer high speed, programmable dynamic load simulation and control capability. The figure below shows the programmable parameters of the 6310A modules:



The programmable slew rate makes the simulation of transient load change demanded by real life applications possible. The 6310A internal waveform generator is capable of producing a maximum slew rate at 10A/μs, and dynamic cycling up to 20kHz. It's dedicated remote load sense and control circuit guarantee minimum waveform distortion during continuous load changes.

### PARALLEL CONTROL

The 6310A provides parallel control, which enables high power testing when a single module cannot meet the requirement of high power applications. Two or more load modules can be paralleled together to achieve the desired loading. The 6310A comes with RS-232 as standard for remote control and automated testing applications. The USB and GPIB interfaces are available as options.

In addition, the 6310A, through its synchronized controls, provides an efficient solution for testing single output AC to DC or DC to DC converters by controlling multiple loads. The 6310A provides the capability to test up to 8 UUTs at a time.

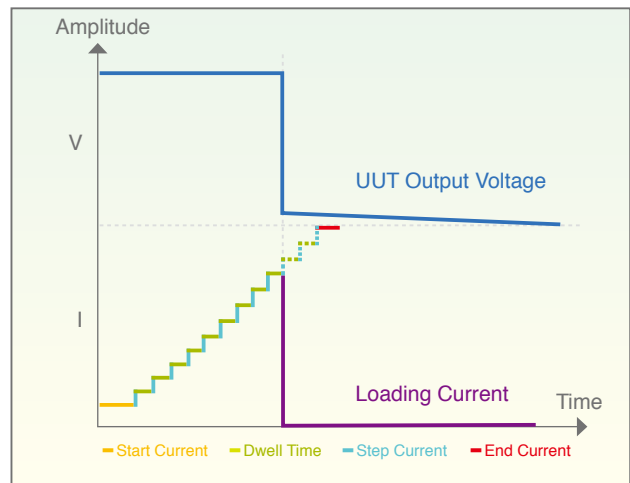
### POWERFUL MEASUREMENTS

Each 6310A load module has an integrated 16-bit precision A/D converter for voltage measurement with an accuracy of 0.025%+0.025% of full scale. The built-in resistive load current sensing circuit is capable of measuring current with an accuracy of 0.05%+0.05% of full scale. Also, short circuit can be simulated. All measurements are done using remote sensing to eliminate any error due to voltage drops along the measurement path. The user can also select from a complete set of voltage and current measurements.

### OCP TEST

Modern switching power supplies are designed with over current protection (OCP) circuitry; therefore, it is important to test the OCP circuitry to make sure it is functioning within its designed specifications. The 6310A series provides an easy and fast solution for this testing.

By simply choosing the channel and setting the OCP parameters (start current, end current, step current and dwell time) from the front panel, the 6310A series provides a fast and easy OCP testing solution. The 6310A series will automatically detect the OCP point, making it an ideal solution for design verification as well as production line testing.

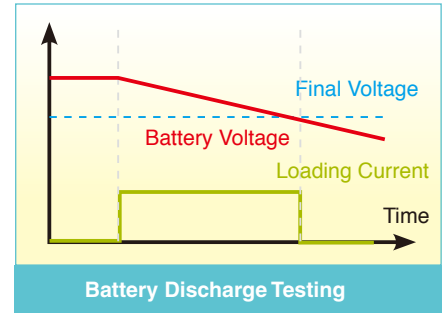


## TIMING FUNCTION

The 6310A series of loads include a unique timing & measurement function, which allows precise time measurements in the range of 1ms to 86,400s. This feature allows the user to set the final voltage & timeout values for battery discharge testing and other similar applications.

For example, the figure on the right shows the 6310A internal timer starting at load ON, and ending when the battery voltage reaches the final voltage.

The Timing function can be used in testing battery and super capacitor discharge, or other similar applications.

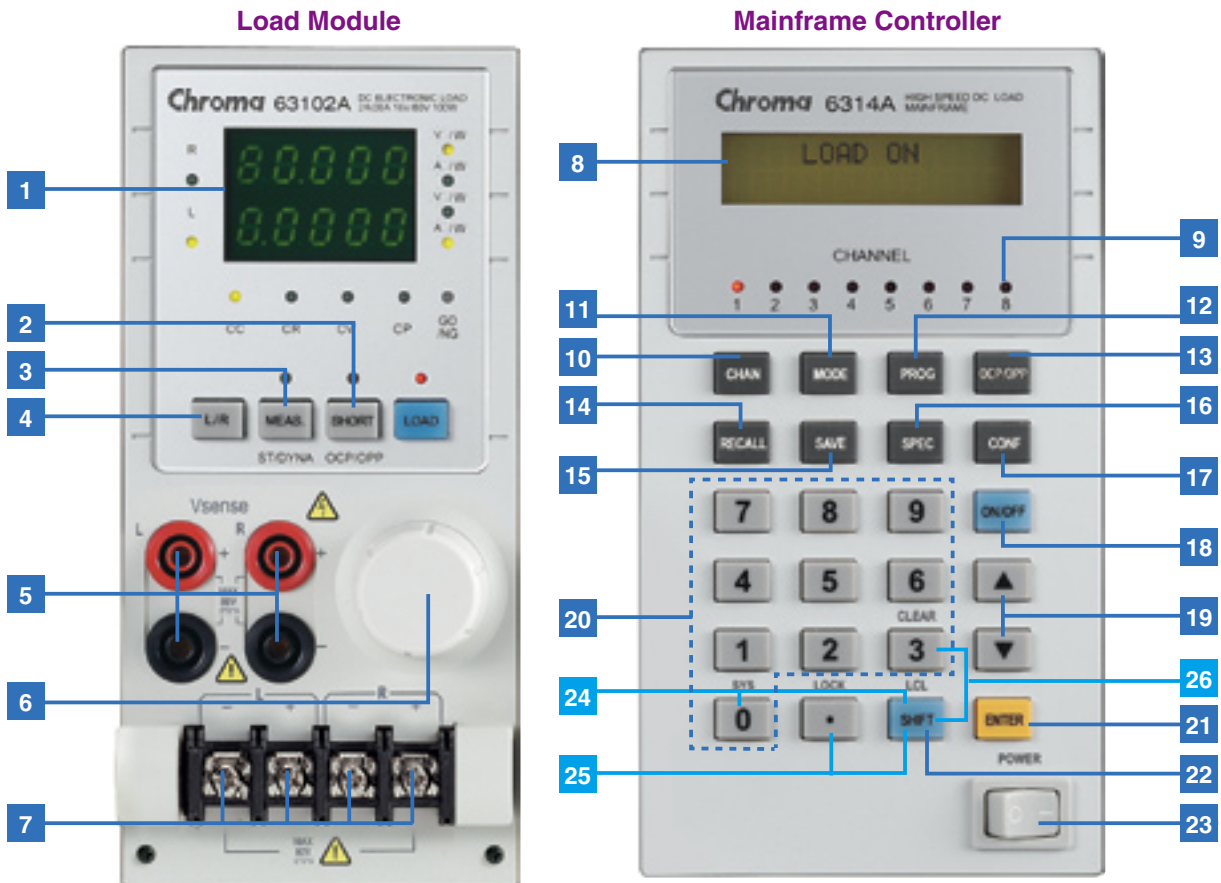


## DIGITAL I/O

The digital I/O interface makes the 6310A DC Load the ideal choice for automated testing requirements. Through the digital I/O, the 6310A can accept digital signals to trigger its functions (Load On/Off, OCP test, etc.) as well as current output status signals.

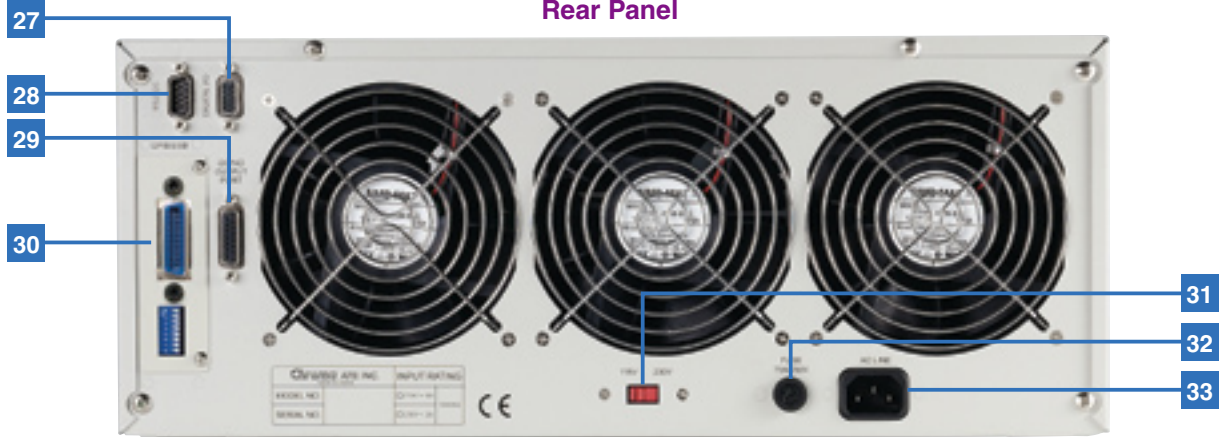
Pin	Definition	Pin	Definition
Pin 1	Reserved	Pin 9	Short Signal (O/P)
Pin 2	DGND	Pin 10	Protection Signal (O/P)
Pin 3	DGND	Pin 11	External Load ON/OFF (I/P)
Pin 4	DGND	Pin 12	Reserved
Pin 5	DGND	Pin 13	Reserved
Pin 6	Load ON/OFF (O/P)	Pin 14	DGND
Pin 7	Total Pass (O/P)	Pin 15	External Trig. For Sequences Run (I/P)
Pin 8	Total Fail (O/P)		

## PANEL DESCRIPTION





## Rear Panel



- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li><b>1 LED indicator</b></li> <li><b>2 SHORT key</b> : To apply a short circuit across the input</li> <li><b>3 STATIC/DYNA key</b> : To select static or dynamic test mode</li> <li><b>4 L/R key</b> : To select left or right channel of input load(63102A, 63107A)<br/><b>A/B key</b> : To select static A or B load (other models)</li> <li><b>5 V terminal</b> : To measure the UUT's output voltage using remote sense</li> <li><b>6 Rotary knob</b> : To adjust load setting continuously</li> <li><b>7 Load terminal</b></li> <li><b>8 LCD display</b></li> <li><b>9 LED indicator</b> : To display the channel at which load is set</li> <li><b>10 CHAN key</b> : To select input load channel</li> <li><b>11 MODE key</b> : To select the operation mode of CC, CR, CV, or CP</li> <li><b>12 PROG key</b> : For program data setting</li> <li><b>13 OCP/OPP key</b> : Over current protection/Over power protection testing</li> <li><b>14 RECALL key</b> : To recall the front panel input status from memory</li> <li><b>15 SAVE key</b> : To save the front panel input status into memory</li> <li><b>16 SPEC key</b> : To set up High/Low limits for GO/NG test</li> <li><b>17 CONF key</b> : To set the configuration</li> </ul> | <ul style="list-style-type: none"> <li><b>18 ON/OFF key</b> : To enable or disable the load input</li> <li><b>19 Up/Down key</b> : To select the next or previous display in edit mode</li> <li><b>20 Numeric key</b> : For data setting</li> <li><b>21 ENTER key</b> : To confirm editing data on the instrument</li> <li><b>22 SHIFT key</b> : As LOCAL Key when in remote mode</li> <li><b>23 Power switch</b></li> <li><b>24 SHIFT + 0 key</b> : System function</li> <li><b>25 SHIFT + . key</b> : Lock function</li> <li><b>26 SHIFT + 3 key</b> : Clear the currently edited data</li> <li><b>27 Digital I/O</b> : Used for system input/output control signals</li> <li><b>28 RS-232 connector</b></li> <li><b>29 GO/NG output port</b></li> <li><b>30 GPIB or USB slot</b></li> <li><b>31 AC input voltage switch</b></li> <li><b>32 AC input fuse</b></li> <li><b>33 AC input connector</b></li> </ul> |
|--|--|

## 6310A SERIES PROGRAMMABLE DC ELECTRONIC LOAD FAMILY



## LED LOAD SIMULATOR

As a constant current source, the LED power driver has an output voltage range with a constant output current. LED power drivers are usually tested in one of the following ways :

1. With LEDs
  2. Using resistors for loading
  3. Using Electronic Loads in Constant Resistance (CR) mode, or Constant Voltage (CV) mode
- However, all these testing methods, each of them has their own disadvantages.

As shown on the V-I curve in Figure 1, the LED has a forward voltage  $V_F$  and a operating resistance ( $R_d$ ). When using a resistor as loading, the V-I curve of the resistor is not able to simulate the V-I curve of the LED as shown in blue on Figure 1. This may cause the LED power driver to not start up due to the difference in V-I characteristic between the resistors and the LEDs. When using Electronic Loads, the CR and CV mode settings are set for when the LED is under stable operation and therefore, is unable to simulate turn on or PWM brightness control characteristics. This may cause the LED power driver to function improperly or trigger it's protection circuits. These testing requirements can be achieved when using a LEDs as a load; however, issues regarding the LED aging as well as different LED power drivers may require different types of LEDs or a number of LEDs. This makes it inconvenient for mass production testing.

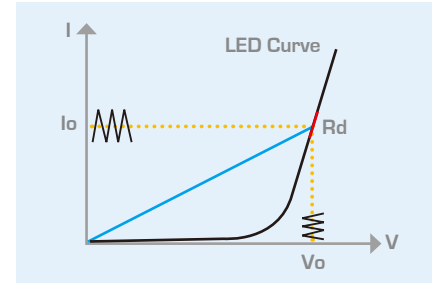


Figure 1 - LED V-I Characteristics

Chroma has created the industries first LED Load Simulator for simulating LED loading with our 63110A load model from our 6310A series Electronic Loads. By setting the LED power driver's output voltage, and current, the Electronic Load can simulate the LED's loading characteristics. The LED's forward voltage and operating resistance can also be set to further adjust the loading current and ripple current to better simulate LED characteristics. The 63110A design also has increased bandwidth to allow for PWM dimming testing.

Figure 2 shows the dimming current waveform of the LED.

Figure 3 shows the dimming current waveform when using 63110A as a load.

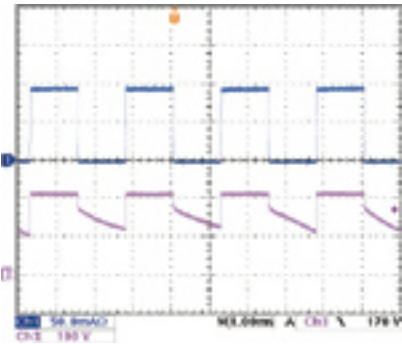


Figure 2 - LED dimming test

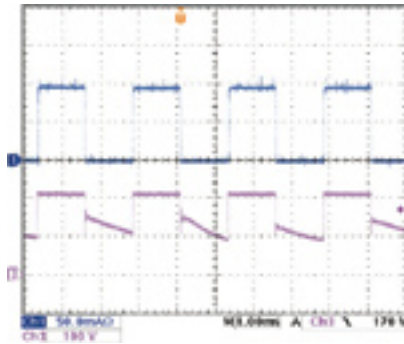


Figure 3 - 63110A dimming test

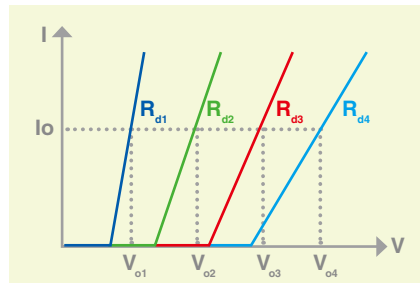


Figure 4 -  
Simulate different number of LEDs

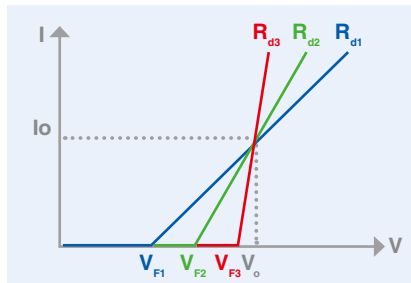


Figure 5 -  
Simulate different characteristic of LEDs

## SPECIFICATIONS

Model	63110A (100Wx2)	
Power	100W	
Current	0-0.6A	0-2A
Voltage*1	0-500V	
Min. Operating Voltage	6V@2A	
LED MODE		
Range	Operation Voltage: 0-100V/0-500V Current : 0-2A / R <sub>d</sub> Coefficient : 0.001-1	
Resolution	V <sub>L</sub> : 4mV / V <sub>H</sub> : 20mV I <sub>o</sub> : 0.1mA / R <sub>d</sub> Coefficient : 0.001	
CONSTANT RESISTANCE MODE		
Range	CRL: 3Ω-1kΩ (100W/100V) CRH: 10Ω-10kΩ (100W/500V)	
Resolution	CRL: 62.5μ mho CRH: 6.25μ mho	
Accuracy	1kΩ : 4m mho + 0.2% 10kΩ : 1m mho + 0.1%	
CONSTANT VOLTAGE MODE		
Range	0-500V	
Resolution	20mV	
Accuracy	0.05% ± 0.1% F.S.	
CONSTANT CURRENT MODE		
Range	0-0.6A	0-2A
Resolution	12μA	40μA
Accuracy	0.1%+0.2% F.S.	0.1%+0.2% F.S.
MEASUREMENT SECTION		
VOLTAGE READ BACK		
Range	0-100V	0-500V
Resolution	2mV	10mV
Accuracy	0.025%+0.025% F.S.	
CURRENT READ BACK		
Range	0-0.6A	0-2A
Resolution	12μA	40μA
Accuracy	0.05%+0.05% F.S.	

**NOTE\*1** : If the operating voltage exceeds 1.1 times of the rated voltage, it would cause permanent damage to the device.

## ORDERING INFORMATION

**6312A** : Mainframe for 2 Load Modules  
**6314A** : Mainframe for 4 Load Modules  
**63101A** : Load Module 40A/80V/200W  
**63102A** : Load Module 20A/80V/100Wx2 channels  
**63103A** : Load Module 60A/80V/300W  
**63105A** : Load Module 10A/500V/300W

**63106A** : Load Module 120A/80V/600W  
**63107A** : Load Module 5A&40A/80V/30W&250W  
**63108A** : Load Module 20A/500V/600W  
**63110A** : Load Module 2A/500V/100Wx2 channels  
**63112A** : Load Module 240A/80V/1200W  
**63123A** : Load Module 70A/80V/350W

**A631000** : GPIB Interface for Model 6314A, 6312A  
**A631003** : USB Interface for Model 6314A, 6312A  
**A631001** : Remote Controller  
**A631005** : 6310A Series Softpanel  
**A800042** : Test Fixture

# SPECIFICATIONS

Model	63101A		63102A (100Wx2)		63103A		63105A	
Power	20W	200W	20W	100W	30W	300W	30W	300W
Current	0-4A	0-40A	0-2A	0-20A	0-6A	0-60A	0-1A	0-10A
Voltage *3	0-80V		0-80V		0-80V		0-500V	
Typical Min. Operation Voltage (DC)*1	0.4V@2A	0.4V@20A	0.4V@1A	0.4V@10A	0.4V@3A	0.4V@30A	1.0V@0.5A	1.0V@5A
	0.8V@4A	0.8V@40A	0.8V@2A	0.8V@20A	0.8V@6A	0.8V@60A	2.0V@1A	2.0V@10A
<b>Constant Current Mode</b>								
Range	0-4A	0-40A	0-2A	0-20A	0-6A	0-60A	0-1A	0-10A
Resolution	1mA	10mA	0.5mA	5mA	1.5mA	15mA	0.25mA	2.5mA
Accuracy	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.
<b>Constant Resistance Mode</b>								
Range	0.0375 Ω -150 Ω (200W/16V) 1.875 Ω -7.5k Ω (200W/80V)		0.075 Ω -300 Ω (100W/16V) 3.75 Ω -15k Ω (100W/80V)		0.025 Ω -100 Ω (300W/16V) 1.25 Ω -5k Ω (300W/80V)		1.25 Ω -5k Ω (300W/125V) 50 Ω -200k Ω (300W/500V)	
Resolution	6.667m mho (200W/16V) 133μ mho (200W/80V)		3.333m mho (100W/16V) 66.667μ mho (100W/80V)		10m mho (300W/16V) 200μ mho (300W/80V)		200μ mho (300W/25V) 5μ mho (300W/500V)	
Accuracy	150 Ω : 0.1 mho+ 0.2% 7.5k Ω : 0.01mho+ 0.1%		300 Ω : 0.1mho + 0.2% 15k Ω : 0.01mho+ 0.1%		100 Ω : 0.1mho+ 0.2% 5k Ω : 0.01mho+ 0.1%		5k Ω : 20m mho+ 0.2% 200k Ω :5m mho+ 0.1%	
<b>Constant Voltage Mode</b>								
Range	0-80V		0-80V		0-80V		0-500V	
Resolution	20mV		20mV		20mV		125mV	
Accuracy	0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.	
<b>Constant Power Mode</b>								
Range	0-20W	0-200W	0-20W	0-100W	0-30W	0-300W	0-30W	0-300W
Resolution	5mW	50mW	5mW	25mW	7.5mW	75mW	7.5mW	75mW
Accuracy	0.5% ± 0.5%F.S.		0.5% ± 0.5%F.S.		0.5% ± 0.5%F.S.		0.5% ± 0.5%F.S.	
<b>Dynamic Mode</b>								
Dynamic Mode	C.C. Mode		C.C. Mode		C.C. Mode		C.C. Mode	
T1 & T2	0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms	
Accuracy	1μs/1ms+100ppm		1μs/1ms+100ppm		1μs/1ms+100ppm		1μs/1ms+100ppm	
Slew Rate	0.64-160mA/μs	6.4-1600mA/μs	0.32-80mA/μs	3.2-800mA/μs	0.001-0.25A/μs	0.01-2.5A/μs	0.16-40mA/μs	1.6-400mA/μs
Resolution	0.64mA/μs	6.4mA/μs	0.32mA/μs	3.2mA/μs	0.001A/μs	0.01A/μs	0.16mA/μs	1.6mA/μs
Min. Rise Time	10μs (Typical)		10μs (Typical)		10μs (Typical)		24μs (Typical)	
Current	0-4A	0-40A	0-2A	0-20A	0-6A	0-60A	0-1A	0-10A
Resolution	1mA	10mA	0.5mA	5mA	1.5mA	15mA	0.25mA	2.5mA
Current Accuracy	0.4%F.S.		0.4%F.S.		0.4%F.S.		0.4%F.S.	
<b>Measurement Section</b>								
<b>Voltage Read Back</b>								
Range	0-16V	0-80V	0-16V	0-80V	0-16V	0-80V	0-125V	0-500V
Resolution	0.25mV	1.25mV	0.25mV	1.25mV	0.25mV	1.25mV	2mV	8mV
Accuracy	0.025% + 0.025%F.S.		0.025% + 0.025%F.S.		0.025% + 0.025%F.S.		0.025% + 0.025%F.S.	
<b>Current Read Back</b>								
Range	0-4A	0-40A	0-2A	0-20A	0-6A	0-60A	0-1A	0-10A
Resolution	0.0625mA	0.625mA	0.03125mA	0.3125mA	0.09375mA	0.9375mA	0.016mA	0.16mA
Accuracy	0.05% + 0.05%F.S.		0.05% + 0.05%F.S.		0.05% + 0.05%F.S.		0.05% + 0.05%F.S.	
<b>Power Read Back*2</b>								
Range	0-20W	0-200W	0-20W	0-100W	0-30W	0-300W	0-30W	0-300W
Accuracy	0.1% + 0.1%F.S.		0.1% + 0.1%F.S.		0.1% + 0.1%F.S.		0.1% + 0.1%F.S.	
<b>Protective Section</b>								
Over Power Protection	≅ 20.8W	≅ 208W	≅ 20.8W	≅ 104W	≅ 31.2W	≅ 312W	≅ 31.2W	≅ 312W
Over Current Protection	≅ 4.08A	≅ 40.8A	≅ 2.04A	≅ 20.4A	≅ 6.12A	≅ 61.2A	≅ 1.02A	≅ 10.2A
Over Temperature Protection	≅ 85°C		≅ 85°C		≅ 85°C		≅ 85°C	
Over Voltage Alarm*3	≅ 81.6V		≅ 81.6V		≅ 81.6V		≅ 510V	
<b>General</b>								
<b>Short Circuit</b>								
Current (CC)	-	≅ 40A	-	≅ 20A	-	≅ 60A	-	≅ 10A
Voltage (CV)	-	0V	-	0V	-	0V	-	0V
Resistance (CR)	-	≅ 0.0375 Ω	-	≅ 0.075 Ω	-	≅ 0.025 Ω	-	≅ 1.25 Ω
Power (CP)	-	≅ 200W	-	≅ 100W	-	≅ 300W	-	≅ 300W
Input Resistance (Load Off)	100k Ω (Typical)		100k Ω (Typical)		100k Ω (Typical)		100k Ω (Typical)	
Temperature Coefficient	100PPM/°C (Typical)		100PPM/°C (Typical)		100PPM/°C (Typical)		100PPM/°C (Typical)	
Power	Supply from 6314A Mainframe		Supply from 6314A Mainframe		Supply from 6314A Mainframe		Supply from 6314A Mainframe	
Dimensions (HxWxD)	172x82x489.5mm / 6.8x3.2x19.3inch		172x82x489.5mm / 6.8x3.2x19.3inch		172x82x489.5mm / 6.8x3.2x19.3inch		172x82x489.5mm / 6.8x3.2x19.3inch	
Weight	4.2 kg / 9.3 lbs		4.2 kg / 9.3 lbs		4.2 kg / 9.3 lbs		4.2 kg / 9.3 lbs	
Operating Range	0-40°C		0-40°C		0-40°C		0-40°C	
EMC & Safety	CE		CE		CE		CE	

Mainframe Model	6312A	6314A
Dimensions(HxWxD)	194x275x550mm / 7.6x10.8x21.7inch	194x439x550mm / 7.6x17.3x21.7inch
Weight	15 kg / 33.1 lbs	21.5 kg / 47.4 lbs

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continued on next page...

Model	63106A		63107A (30W & 250W)			63108A		63112A		63123A		
Power	60W	600W	30W	30W	250W	60W	600W	120W	1200W	350W		
Current	0-12A	0-120A	0-5A	0-4A	0-40A	0-2A	0-20A	0-24A	0-240A	0-7A	0-70A	
Voltage*3	0-80V		0-80V			0-500V		0-80V		0-80V		
Typical Min. Operation Voltage (DC)*1	0.4V@6A 0.8V@12A	0.4V@60A 0.8V@120A	0.4V@2.5A 0.8V@5A	0.4V@2A 0.8V@4A	0.4V@20A 0.8V@40A	1.0V@1A 2.0V@2A	1.0V@10A 2.0V@20A	0.4V@12A 0.8V@24A	0.4V@120A 0.8V@240A	0.25V@3.5A 0.5V @ 7A	0.25V@35A 0.5V @ 70A	
<b>Constant Current Mode</b>												
Range	0-12A	0-120A	0-5A	0-4A	0-40A	0-2A	0-20A	0-24A	0-240A	0-7A	0-70A	
Resolution	3mA	30mA	1.25mA	1mA	10mA	0.5mA	5mA	6mA	60mA	0.5mA	5mA	
Accuracy	0.1%+0.1%F.S.		0.1%+0.2%F.S.		0.1%+0.1%F.S.		0.1%+0.2%F.S.		0.1%+0.1%F.S.		0.1%+0.2%F.S.	
<b>Constant Resistance Mode</b>												
Range	12.5mΩ ~ 50 Ω (600W/16V) 0.625 Ω ~ 2.5k Ω (600W/80V)		0.3 Ω ~ 1.2k Ω (30W/16V) 15 Ω ~ 60k Ω (30W/80V)		0.0375 Ω ~ 150 Ω (250W/16V) 1.875 Ω ~ 7.5k Ω (250W/80V)		0.625 Ω ~ 2.5k Ω (600W/125V) 25 Ω ~ 100k Ω (600W/500V)		6.25mΩ ~ 25 Ω (1200W/16V) 0.3125 Ω ~ 1.25k Ω (1200W/80V)		0.01 Ω ~ 100 Ω (350W/16V)*4 1.25 Ω ~ 7.5k Ω (350W/80V)	
Resolution	20m mho (600W/16V) 400μ mho (600W/80V)		833μ mho (30W/16V) 16.67μ mho (30W/80V)		6.667μ mho (250W/16V) 133μ mho (250W/80V)		400μ mho (600W/125V) 10μ mho (600W/500V)		40m mho (1200W/16V) 800μ mho (1200W/80V)		6.25m mho (350W/16V)*4 50μ mho (350W/80V)	
Accuracy	50 Ω : 0.4mho + 0.5% 2.5k Ω : 0.04mho + 0.2%		1.2k Ω : 0.1mho + 0.2% 60k Ω : 0.01mho + 0.1%		150 Ω : 0.1mho + 0.2% 7.5k Ω : 0.01mho + 0.1%		2.5k Ω : 50m mho+ 0.2% 100k Ω : 5m mho+ 0.1%		25 Ω : 0.8mho+ 0.8% 1.25k Ω : 0.08mho+ 0.2%		100 Ω : 0.1mho+0.2% *4 7.5k Ω : 0.01mho+0.1%	
<b>Constant Voltage Mode</b>												
Range	0-80V		0-80V			0-500V		0-80V		0-80V		
Resolution	20mV		20mV			125mV		20mV		5mV		
Accuracy	0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.			0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.		0.05% ± 0.1%F.S.		
<b>Constant Power Mode</b>												
Range	0-60W	0-600W	0-30W	0-30W	0-250W	0-60W	0-600W	0-120W	0-1200W	0-35W	0-350W	
Resolution	15mW	150mW	7.5mW	7.5mW	62.5mW	15mW	150mW	30mW	300mW	2.5mW	25mW	
Accuracy	0.5% ± 0.5%F.S.		0.5% ± 0.5%F.S.			0.5% ± 0.5%F.S.		0.5% ± 0.5%F.S.		0.5%±0.5%F.S.		
<b>Dynamic Mode</b>												
Dynamic Mode	C.C. Mode		C.C. Mode			C.C. Mode		C.C. Mode		C.C. MODE		
T1 & T2	0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms			0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms ~ 50ms / Res: 5μs 0.1ms ~ 500ms / Res: 25μs 10ms ~ 50s / Res: 2.5ms		0.025ms~50ms/Res: 5μs 0.1ms~500ms / Res: 25μs 10ms~50s / Res: 2.5ms		
Accuracy	1μs/1ms+100ppm		1μs/1ms+100ppm			1μs/1ms+100ppm		1μs/1ms+100ppm		1μs/1ms+100ppm		
Slew Rate	0.002-0.5A/μs	0.02-5A/μs	0.8-200mA/μs	0.64-160mA/μs	6.4-1600mA/μs	0.32-80mA/μs	3.2-800mA/μs	0.004-1A/μs	0.04-10A/μs	0.001-0.25A/μs	0.01-2.5A/μs	
Resolution	0.002A/μs	0.02A/μs	0.8mA/μs	0.64mA/μs	6.4mA/μs	0.32mA/μs	3.2mA/μs	0.004A/μs	0.04A/μs	0.001A/μs	0.01A/μs	
Min. Rise Time	10μs (Typical)		10μs (Typical)			24μs (Typical)		10μs (Typical)		10μs (Typical)		
Current	0-12A	0-120A	0-5A	0-4A	0-40A	0-2A	0-20A	0-24A	0-240A	0-7A	0-70A	
Resolution	3mA	30mA	1.25mA	1mA	10mA	0.5mA	5mA	6mA	60mA	0.5mA	5mA	
Current Accuracy	0.4%F.S.		0.4%F.S.			0.4%F.S.		0.4%F.S.		0.4% F.S.		
<b>Measurement Section</b>												
<b>Voltage Read Back</b>												
Range	0-16V	0-80V	0-16V	0-80V	0-16V	0-80V	0-125V	0-500V	0-16V	0-80V	0-16V	0-80V
Resolution	0.25mV	1.25mV	0.25mV	1.25mV	0.25mV	1.25mV	2mV	8mV	0.25mV	1.25mV	0.25mV	1.25mV
Accuracy	0.025% + 0.025%F.S.		0.025% + 0.025%F.S.			0.025% + 0.025%F.S.		0.025% + 0.025%F.S.		0.025%+0.025% F.S.		
<b>Current Read Back</b>												
Range	0-12A	0-120A	0-5A	0-4A	0-40A	0-2A	0-20A	0-24A	0-240A	0-7A	0-70A	
Resolution	0.1875mA	1.875mA	0.078125mA	0.0625mA	0.625mA	0.03125mA	0.3125mA	0.375mA	3.75mA	0.109375mA	1.09375mA	
Accuracy	0.05% + 0.05%F.S.		0.05% + 0.05%F.S.			0.05% + 0.05%F.S.		0.075% + 0.075%F.S.		0.05%+0.05% F.S.		
<b>Power Read Back*2</b>												
Range	0-60W	0-600W	0-30W	0-30W	0-250W	0-60W	0-600W	0-120W	0-1200W	0-35W	0-350W	
Accuracy	0.1% + 0.1%F.S.		0.1% + 0.1%F.S.			0.1% + 0.1%F.S.		0.1% + 0.1%F.S.		0.1%+0.1% F.S.		
<b>Protective Section</b>												
Over Power Protection	≅ 62.4W	≅ 624W	≅ 31.2W	≅ 31.2W	≅ 260W	≅ 62.4W	≅ 624W	≅ 124.8W	≅ 1248W	≅ 36W	≅ 360W	
Over Current Protection	≅ 12.24A	≅ 122.4A	≅ 5.1A	≅ 4.08A	≅ 40.8A	≅ 2.04A	≅ 20.4A	≅ 24.48A	≅ 244.8A	≅ 6.12A	≅ 61.2A	
Over Temperature Protection	≅ 85°C		≅ 85°C			≅ 85°C		≅ 85°C		≅ 85°C		
Over Voltage Alarm*3	≅ 81.6V		≅ 81.6V			≅ 510V		≅ 81.6V		≅ 81.6V		
<b>General</b>												
<b>Short Circuit</b>												
Current (CC)	-	≅ 120A	-	-	≅ 40A	-	≅ 20A	-	≅ 240A	-	≅ 70A	
Voltage (CV)	-	0V	-	-	0V	-	0V	-	0V	-	0V	
Resistance (CR)	-	≅ 0.0125 Ω	-	-	≅ 0.0375 Ω	-	≅ 0.625 Ω	-	≅ 0.00625 Ω	-	≅ 0.01 Ω	
Power (CP)	-	≅ 600W	-	-	≅ 250W	-	≅ 600W	-	≅ 1200W	-	≅ 350W	
Input Resistance (Load Off)	100k Ω (Typical)		100k Ω (Typical)			100k Ω (Typical)		100k Ω (Typical)		800k Ω (Typical)		
Temperature Coefficient	100PPM/°C (Typical)		100PPM/°C (Typical)			100PPM/°C (Typical)		100PPM/°C (Typical)		100PPM/°C (Typical)		
Power	Supply from 6314A Mainframe		Supply from 6314A Mainframe			Supply from 6314A Mainframe		Supply from 6314A Mainframe		Supply from 6314A Mainframe		
Dimensions (HxWxD)	172x164x489.5mm / 6.8x6.5x19.3inch		172x82x489.5mm / 6.8x3.2x19.3inch			172x164x489.5mm / 6.8x6.5x19.3inch		172x329x495mm / 6.8x12.9x19.5inch		172x82x489.5mm / 6.8x3.2x19.3inch		
Weight	7.3 kg / 16.1 lbs		4.5 kg / 9.9 lbs			7.3 kg / 16.1 lbs		14 kg / 30.8 lbs		4.2kg / 9.3 lbs		
Operating Range	0-40°C		0-40°C			0-40°C		0-40°C		0-40°C		
EMC & Safety	CE		CE			CE		CE		CE		

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NOTE\*1 : Low voltage operation, under 0.8 volt, is possible at correspondingly reduced current level. Operating temperature range is 0°C to 40°C. All specifications apply for 25°C ± 5°C, except as noted

NOTE\*2 : Power F.S. = Vrange F.S. x Irange F.S.

NOTE\*3 : When the operating voltage exceeds the rated voltage for 1.02 times, a warning will occur and if it exceeds 1.1 times of the rated voltage, it would cause permanent damage to the device.

NOTE\*4 : Please refer to user's manual for detail specifications.

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