3110 Series
Plug-In Electronic
Load Operation manual

S/N:900311002 REV:A

PRODIGIT
INSTRUMENT PROFESSIONAL

Material Contents Declaration

(材料含量宣称)

(Part Name) 零件名称	Hazardous Substance (有毒有害物质或元素)					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬 (Cr6+)	多溴联苯(PBB)	多溴二苯醚 (PBDE)
PCBA (印刷电路装配件)	X	○	X	○	○	○
Electrical part not on PCBA's 未在PCBA上的电子零件	X	○	X	○	○	○
Metal parts **金属零件**	○	○	○	X	○	○
Plastic parts 塑料零件	○	○	○	○	X	X
Wiring 电线	X	○	○	○	○	○
Package **封装**	X	○	○	○	○	○

对销售之日的所售产品,本表显示, PRODIGIT 供应链的电子信息产品可能包含这些物质。注意:在所售产品中可能会也可能不会含有所有所列的部件。This table shows where these substances may be found in the supply chain of Prodigit electronic information products, as of the date of sale of the enclosed product. Note that some of the component types listed above may or may not be a part of the enclosed product. ○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。○：Indicates that the concentration of the hazardous substance in all homogeneous materials in the parts is below the relevant threshold of the SJ/T 113632006 standard. ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。×： Indicates that the concentration of the hazardous substance of at least one of all homogeneous materials in the parts is above the relevant threshold of the SJ/T 11363-2006 standard.

Note(注释):

1.Prodigit has not fully transitioned to lead-free solder assembly at this moment；However, most of the components used are RoHS compliant.
(此刻，Prodigit 并非完全过渡到无铅焊料组装；但是大部份的元器件一至于RoHS的规定。)

2. The product is labeled with an environment-friendly usage period in years.

The marked period is assumed under the operating environment specified in the product specifications.
(产品标注了环境友好的使用期限制(年)。所标注的环境使用期限假定是在此产品定义的使用环境之下。)

Example of a marking for a 10 year period:

(例如此标制环境使用期限为10年)

SAFETY SUMMARY

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

GENERAL

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

ENVIRONMENTAL CONDITIONS

This instrument is intended for indoor use in an installation category I, pollution degree 2 environments. It is designed to operate at a maximum relative humidity of 80% and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

GROUND THE INSTRUMENT

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a three conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

FUSES

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

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

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT EXCEED INPUT RATINGS.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be connected to a properly grounded receptacle to minimize electric shock hazard. Operation at line voltages or frequencies in excess of those stated on the data plate may cause leakage currents in excess of 5.0 mA peak.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a PRODIGIT ELECTRONICS Sales and Service Office for service and repair to ensure that safety features
are maintained.

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

DECLARATION OF CONFORMITY

Company Name: PRODIGIT ELECTRONICS CO., LTD
Address: 8F, No.88, Baojhong Rd., Sindian District, New Taipei City, Taiwan.

Declares under sole responsibility that the product as originally delivered
Product Names: DC Electronic Loads
Model Numbers: 3110, 3111, 3114, 3117, 3119
(And other customized products based upon the above)
Product Options:
Safety and EMC Information:
This declaration covers all options and customized products based on the above products.
Complies with the essential requirements of the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU and carries the CE Marking accordingly.
Safety standard:
Safety standards following:
IEC 61010-1:2010 / EN 61010-1:2010
EMC standard:

EN 61326-1:2012
EN 55011:2009+A1:2010
EN 61000-3-2:2006+A1:2009+A2:2009
EN 61000-3-3:2008
EN 61000-4-2:2009
EN 61000-4-3:2006+A1:2008+A2:2010
EN 61000-4-4:2004+A1:2010
EN 61000-4-5:2006
EN 61000-4-6:2009
EN 61000-4-8:2010
EN 61000-4-11:2004

9, 18, 2019
Date

Larsson Tsou / R&D Assistant Manager

The holder of the verification is authorized to use this verification in connection with the EC declaration of conformity according to the Directives. The CE marking may only be used if all releveant and effective EC Directives are complied with. Together with the manufacturer's own documented production control, The manufacturer (or his European authorized representative) can in his EC Declaration of Conformity Verify compliance with the directives.

SAFETY SYMBOLS

 **Direct current (DC)**

 **Alternating current (AC)**

 **Both direct and alternating**

 **Three-phase alternating current**

 **Protective earth (ground)**

 On (Supply)

 **Off (Supply)**

 **Fuse**

 **Caution ! Refer to this manual before using the meter.**

 **Caution, risk of electric shock**

CAT IV – Is for measurements performed at the source of the low-voltage installation.

CAT III – Is for measurements performed in the building installation.

CAT II – Is for measurements performed on circuits directly connected to the low-voltage installation.

CAT I – Is for measurements performed on circuits not directly connected to Mains.

3110 series module load operation manual
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Chapter 1 Introduction

1-1 General description

More and more electronic products, such as mobile phones, laptops, tablet chargers, mobile power supplies, wireless chargers, electric hand tool chargers, etc., are currently using a single input voltage. In response to this trend, Electronics introduced the single-machine 3110 series of five electronic loads, including 80V and 500V, 350W and 700W four loads, and a 250W / 80V / 50A low wattage load to meet the needs of various tests on the market. .

3110 series electronic load continues the functions of various electronic load modes, including constant current, constant resistance, constant voltage, and constant power, dynamic and short-circuits mode, high-precision 5bit voltage, current, and power meter display simultaneously, full range RS232 and USB interfaces are standard.

For fast-charging mobile phones and mobile power supplies, the 3110 Series electronic load can be used with the 9922 or 9922-R Fast Charge Controller to test and validate USB-C and QC 2.0, QC 3.0 and other specifications. In addition, it also includes various complete performance tests for battery CC, CP, timed discharge, etc., and Surge function for simulating electronic product startup overcurrent and hot plugging instantaneous current.

Each load module is capable of sinking a wide range of voltage and current values. The load modules are limited by the maximum power they can sink. For example the 3110 can sink up to 50A and 80Vdc at a maximum of 250W. So if the maximum voltage of 80Vdc is present at the load's input terminals a maximum load current of 3.125A is possible. Conversely if the 3110 is required to sink 50A the voltage must be limited to 5V.

The power contour of each load module in the 3110 series is shown in Fig 1-1, to 1-5.

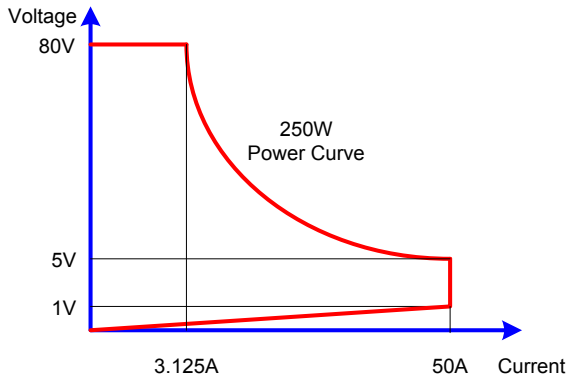


Fig 1-1 3110 80V/50A/250W power contour

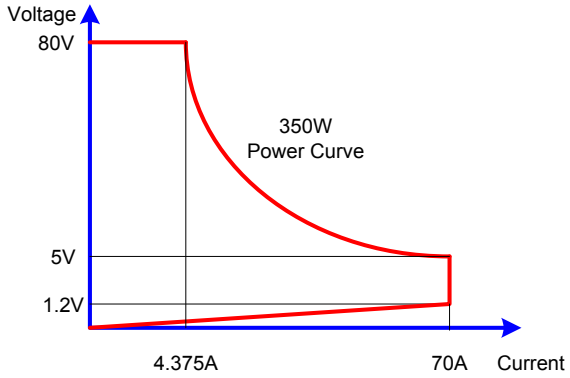


Fig 1-2 3111 80V/70A/350W power contour

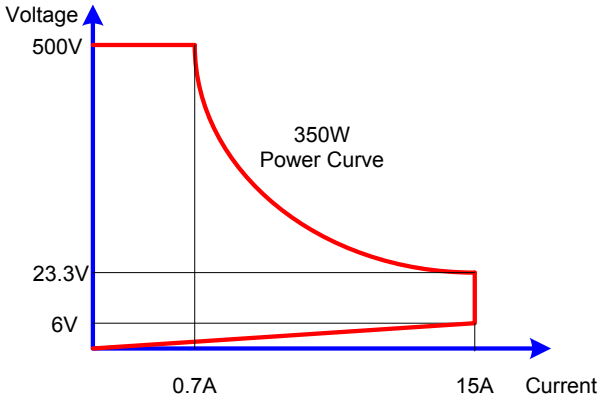


Fig 1-3 3114 500V/15A/350W power contour

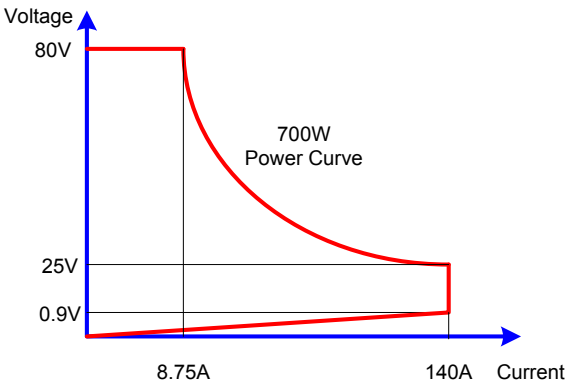


Fig 1-4 3117 80V/140A/700W power contour

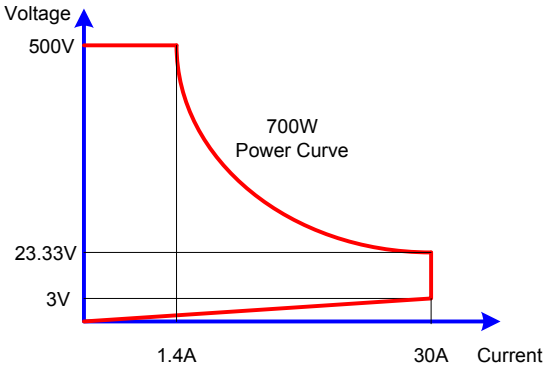


Fig 1-5 3119 500V/30A/700W power contour

The 3110 series of electronic load modules feature 4 operating modes. These are Constant Current (CC) mode, Constant Resistance (CR) mode, Constant Voltage (CV) mode, and Constant Power (CP) mode.

1.1.1. CC Mode

With the operating mode of Constant Current, the 3110 series electronic load will sink a current in accordance with the programmed value regardless of the input voltage (see Fig.1-6).

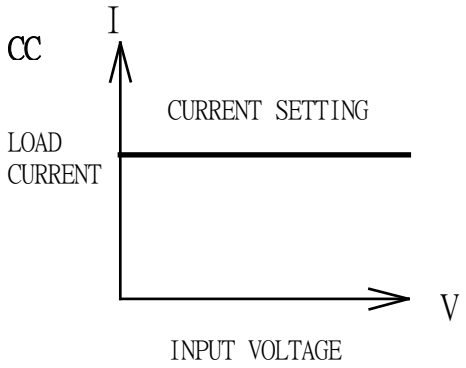


Fig 1-6 Constant Current mode

1.1.2. CR Mode:

At Constant Resistance mode, the 3110 series Electronic Load will sink a current linearly proportional to the load input voltage in accordance with the programmed resistance setting (see Fig 1-7).

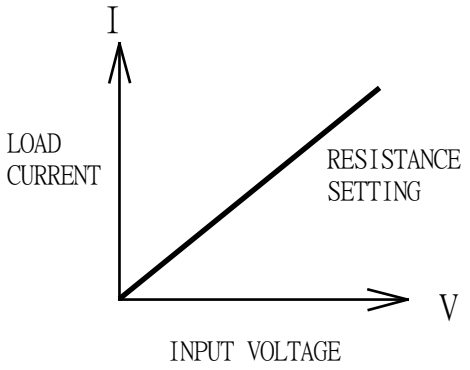


Fig 1-7 Constant Resistance mode

1.1.3. CV Mode:

At Constant Voltage mode, the 3110 series Electronic Load will attempt to sink enough current until the load input voltage reaches the programmed value (see Fig 1-8).

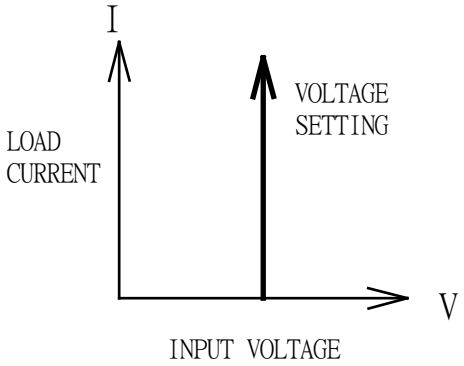


Fig 1-8 Constant Voltage mode

1.1.4. CP Mode:

At Constant Power mode, the 3110 series Electronic Load will attempt to sink load power (load voltage * load current) in accordance with the programmed power. (See Fig 1-9).

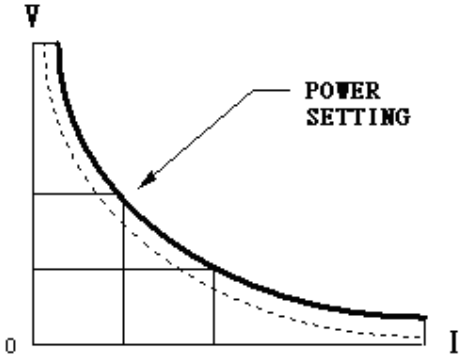


Fig 1-9 Constant Power mode

1.1.5. Dynamic Waveform Definition

Along with static operation the 3110 load modules are built with a Dynamic mode for operation in Constant Current (CC), Constant Resistance (CR) or Constant Power (CP). This allows the test engineer to simulate real world pulsing loads or implement a load profile that varies with time.

A dynamic waveform can be programmed from the front panel of the 3110 load module. The user would first set a High and low value of load current using the Level button. The Dynamic Setting then allows for the rise and fall time between these 2 current values to be adjusted. The time period that the waveform is high (Thigh) along with the time period that the waveform is low (Tlow) can also be set.

The dynamic waveform is illustrated below in Fig 1-10.

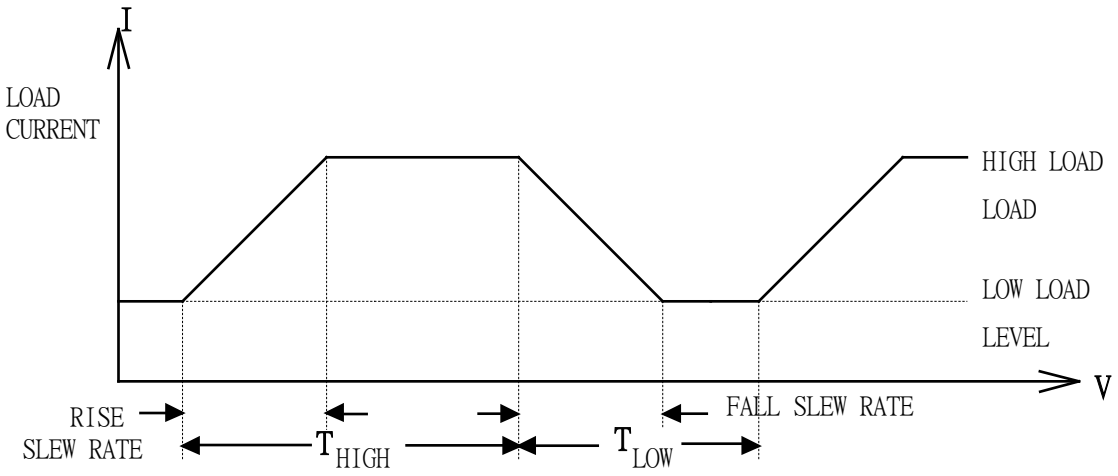


Fig 1-10 Dynamic Wave form

The dynamic waveform can also be set up via the optional computer interface. Dynamic waveform settings made from the front panel of the load module can also be saved in the memory of the mainframe. For the store/recall procedure and the computer command set please refer to the relevant operating manual for the 3300G/3302G/3305G mainframes.

Further dynamic waveform definitions are:

- The period of dynamic waveform is Thigh + Tlow
- The dynamic frequency = 1 /(Thigh + Tlow)
- The duty cycle = Thigh / (Thigh + Tlow)

1.1.6. Slew Rate

Slew rate is defined as the change in current or voltage over time. A programmable slew rate allows for a controlled transition from one load setting to another. It can be used to minimize induced voltage drops on inductive power wiring, or to control induced transients on a test device (such as would occur during power supply transient response testing).

In cases where the transition from one setting to another is large, the actual transition time can be calculated by dividing the voltage or current transition by the slew rate. The actual transition time is defined as the time required for the input to change from 10% to 90% or from 90% to 10% of the programmed excursion.

In cases where the transition from one setting to another is small, the small signal bandwidth (of the load) limits the minimum transition time for all programmable slew rates. Because of this limitation, the actual transition time is longer than the expected time based on the slew rate, as shown in Figure 1-11

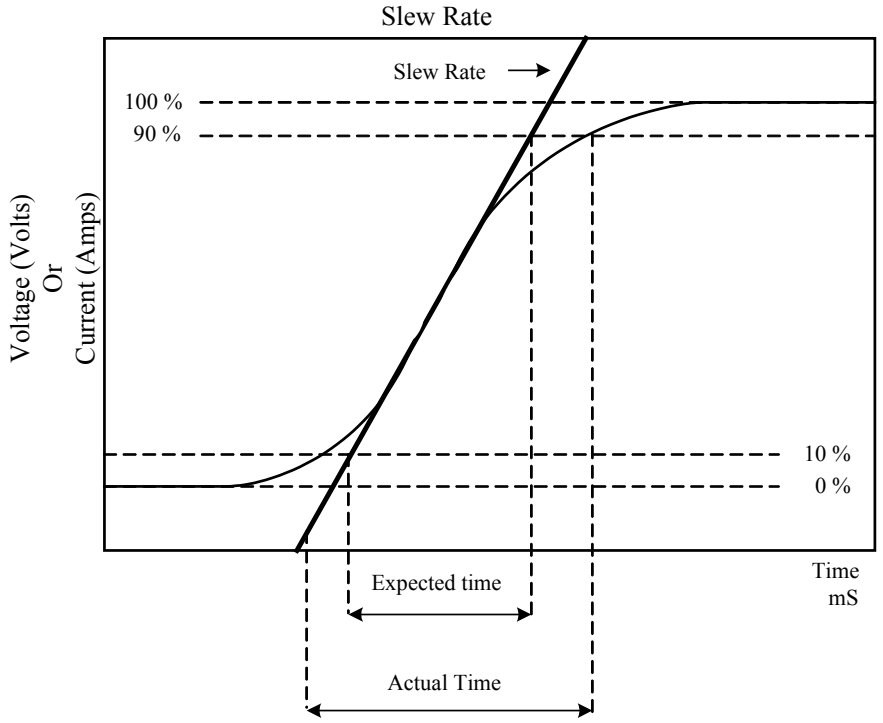


Fig 1-11 Rise Time Transition Limitation

Therefore, both minimum transition time and slew rate must be considered when determining the actual transition time.
Following detail description is exclude in operation manual.
The minimum transition time for a given slew rate as about a 30% or greater load change,
The slew rate increases from the minimum transition time to the Maximum transition time at a 100% load change. The actual transition time will be either the minimum transition time,
Or the total slew time (transition divided by slew rate), whichever is longer.
EX: 3110 80V/50A/250W (CCH - CCL >50.4Ax 30%)

Use the following formula to calculate the minimum transition time for a given slew rate
Min transition time=18A/slew rate (in amps/second).
7.56uS (15.12A/2) x 0.8(10%~90%) =6.048uS

Use the following formula to calculate the maximum transition time for a given slew rate
Max transition time=60/slew rate (in amps/second).
25.2uS (50.4A/2) x 0.8(10~90%) = 20.16uS

EX. CCH=10.08A, CCL=0A Slew Rate =2A/uS, the expected time is 128uS but the actual Transition Time will be limited to 144uS
5.04uS (10.08A/2) x 0.8(10%~90%) = 4.032uS

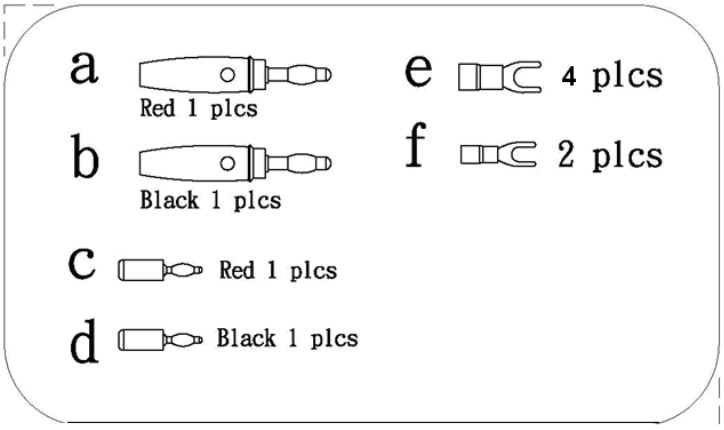
1-2 Features

The main features of the 3110 series of load modules are highlighted below.

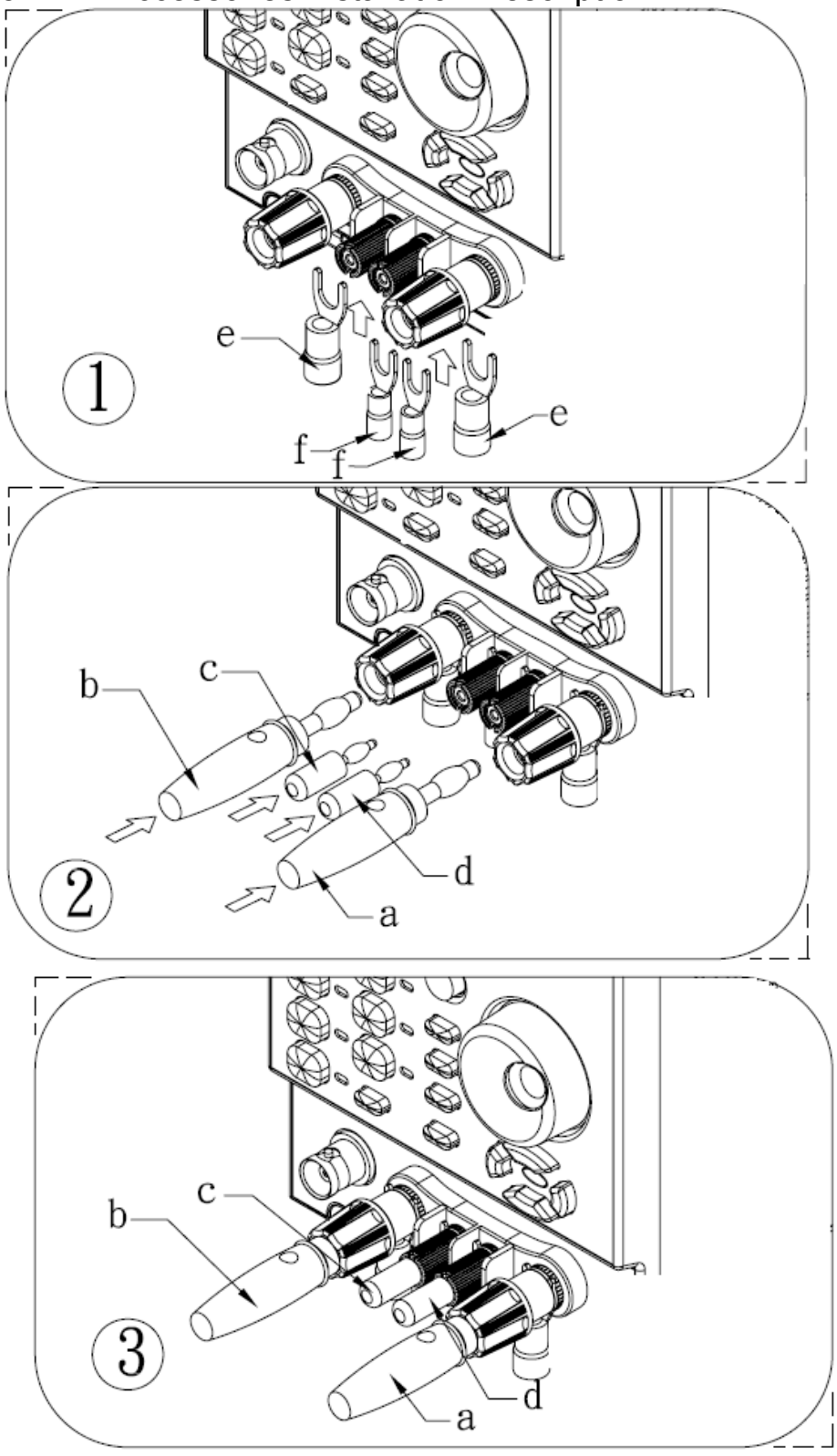
- 5 digital V / A / W Meter.
- High-speed measurement and communication transmission.
- V.A.W. values can be displayed simultaneously.
- Large LCD Display、setting values can be adjusted by rotary knob or push button.
- Short, OCP, OPP, Battery and Surge test function.
- Battery test function with stop condition: Vbatt, Discharge capacity and discharge time.
- Surge test with boot-on inrush simulation and hot-swap simulation.
- Flexible CC. CR, CV, CP, Dynamic and Short operation modes.
- SHORT time setting and SHORT_VH, SHORT_VL setting function.
- Protections against V, I, W, and °C.
- Voltage meter display the polarity positive（”＋”）or negative（”－”）is selectable.
- Interface : RS232、USB

1-3 Standard Accessories

a	4mm Banana Plug (Red)	1 PC
b	4mm Banana Plug (Black)	1 PC
c	2mm Banana Plug (Red)	1 PC
d	2mm Banana Plug (Black)	1 PC
e	Hook Terminal Y type Large size terminal	4 PCS
f	Hook Terminal Y type small size terminal	2 PCS
g	BNC Cable	1 PC
h	3110 series operation manual	1 PC



1.3.1 Accessories Installation Description



1-4 Specifications

Specifications

MODEL		3110	3111	3114	3117	3119
Max Power		250 W	350 W	350 W	700 W	700 W
Max Current		50 A	70 A	15 A	140 A	30 A
Operation Voltage		80 V	80 V	500 V	80 V	500 V
Min. Operating Voltage		1.0V @ 50A	1.2V @ 70A	6V @ 15A	0.9V @ 140A	3.0V @ 30A
PROTECTIONS						
Over Power Protection (OPP)		≒ 262.5 W	≒ 367.5 W	≒ 367.5 W	≒ 735 W	≒ 735 W
Over Current Protection (OCP)		≒ 52.5 A	≒ 73.5 A	≒ 15.75 A	≒ 147 A	≒ 31.5 A
Over Voltage Protection (OVP)		≒ 84 V	≒ 84 V	≒ 525 V	≒ 84 V	≒ 525 V
Over Temp. Protection (OTP)		YES	YES	YES	YES	YES
CC MODE						
Range		0~5.04~50.4 A	0~7.02~70.2 A	0~1.5~15 A	0~14.04~140.4 A	0~3~30 A
Resolution		0.084 mA / 0.84 mA	0.117 mA / 1.17 mA	0.025 mA / 0.25 mA	0.234 mA / 2.34 mA	0.05 mA / 0.5 mA
Accuracy		±0.1% OF (SETTING + RANGE)				
CR MODE						
Range		0.016~1.6~96000Ω	0.0114~1.14~68400Ω	0.4~40~2400000Ω	0.0057~0.57~34200 Ω	0.2~20~1200000Ω
Resolution		26.666μΩ / 0.010416mS	19μΩ / 0.014619mS	666.667μΩ / 0.416μS	9.5μΩ / 29.239μS	333.334μΩ / 0.833μS
Accuracy		±0.1% OF (SETTING + RANGE)				
CV MODE						
Range		0~8.1~81 V	0~8.1~81 V	0~60~500 V	0~8.1~81 V	0~60~500 V
Resolution		0.135mV / 1.35mV	0.135mV / 1.35mV	1 mV / 10mV	0.135mV / 1.35mV	1 mV / 10mV
Accuracy		±0.05% OF (SETTING + RANGE)				
CP MODE						
Range		0~25.02~250.2 W (Imax.= r1:5A , r2:50A)	0~35.04~350.4W (Imax.= r1:7A , r2:70A)	0~35.04~350.4 W (Imax.= r1:1.5A,r2:15A)	0~70.02~700.2 W (Imax.=r1:14A,r2:140A)	0~70.02~700.2 W (Imax.=r1:3A,r2:30A)
Resolution		0.417 mW / 4.17 mW	0.584mW / 5.84 mW	0.584 mW / 5.584 mW	1.167 mW/ 11.67 mW	1.167 mW / 11.67 mW
Accuracy		±0.5% OF (SETTING + RANGE)				
Dynamic Operation						
THIGH/TLOW		50 μS to 9.999 Sec				
SLEW-RATE		3.2~200mA/μs | 0.032~2A/μS	4.64~290mA/μs | 0.0464~2.90A/μS	1~62.5 mA/μs | 10~625 mA/μS	0.0096~0.6A/μs | 0.096~6A/μS	2~125mA/μs | 20~1250mA/μS
ACCURACY		±5% ±10μS				
Measurement						
5 1/2 DVM	Range	0~8.1~81 V	0~8.1~81 V	0~60~500 V	0~8.1~81 V	0~60~500 V
	Resolution	0.135mV / 1.35mV	0.135mV / 1.35mV	1 mV / 10mV	0.135mV / 1.35mV	1 mV / 10mV
	Accuracy	±0.02% OF (READING + RANGE)				
5 1/2 DAM	Range	0~5.04~50.4 A	0~7.02~70.2 A	0~1.5~15 A	0~14.04~140.4 A	0~3~30 A
	Resolution	0.084 mA / 0.84 mA	0.117 mA / 1.17 mA	0.025 mA / 0.25 mA	0.234 mA / 2.34 mA	0.05 mA / 0.5 mA
	Accuracy	±0.05% OF (READING + RANGE)				
Surge Test						
Surge & Normal current		0~50A	0~70A	0~15A	0~140A	0~30A
Surge time		10~1000ms				
Surge step		1~5				
Battery Discharge Test						
UVP		0~81V	0~81V	0~500V	0~81V	0~500V
Time		1~99999Sec				
Capacity		0.1~19999.9AH / 0.1~19999.9WH				
Others						
Load ON Voltage		0.1~25V		0.4~100V	0.1~25V	0.4~100V
Accuracy		1% of (Setting + Range)				
Load OFF Voltage		0~25V		0~100V	0~25V	0~100V
Accuracy		0.05% of (Setting +Range)				
Imonitor (non-Isolated)		5.04 A/V	7.02 A/V	1.5 A/V	14.04 A/V	3 A/V
Typical Short Resistance		0.018 Ω	0.0169 Ω	0.367Ω	0.0053Ω	0.087Ω
Max. short Current		50A	70A	15A	140A	30A
Interface		USB / RS232				
Power Comsumption		40VA			60VA	
Dimension(HxWxD)		205 x 123 x 477mm			205 x 231 x 480mm	
Weight		5.3Kg			10.3Kg	

Input AC Power： 100~240Vac +/-10%，50/60Hz　　Cooling：Advanced Fan Cooled

Order Information

DC Electronic Load

- **3110** 80V，50A，250W
- **3111** 80V，70A，350W
- **3114** 500V，15A，350W

Interface：RS232 & USB

option：
9935 Recall/Store controller

5.3kg
W=123mm
H=205mm
D=477mm

10.3kg
W=231mm
H=205mm
D=480mm

3117 80V，140A，700W

10.3kg
W=231mm
H=205mm
D=480mm

3119 500V，30A，700W

Table 1-1 3110 Series Specification

Chapter 2 Installation

The 3110 Series was carefully inspected, tested and calibrated before shipment. If damage to the instrument has occurred during transport, please inform Prodigit's sales and service office or representative. Your 3110 series was shipped with a power cord for the type of outlet used at your location. If the appropriated cord was not included, please contact your nearest sales office to obtain the correct cord. Refer to "check line voltage" to check the line voltage selection and fuse type.

2-1 Check line voltage

The 3110 Series can be operated from a 100/115 or 200/230Vac input as indicated on the label on the rear panel. The input is switchable so please make sure that the switch is set correctly for your nominal mains input before turning on the mains power. The procedure below details how to change the switch position:

2.1.1 With the 3110 series power OFF, disconnect the power cord.

2.1.2 Refer the drawing on the rear panel in Fig 2-1, set the switches to the Proper voltage as described in the following:

a. Set Switch to 100V/115V for 115Vac line voltage

b. Set Switch to 200V/230V for 230Vac

Note: 100Vac and 200Vac is used for Japan only (Option)

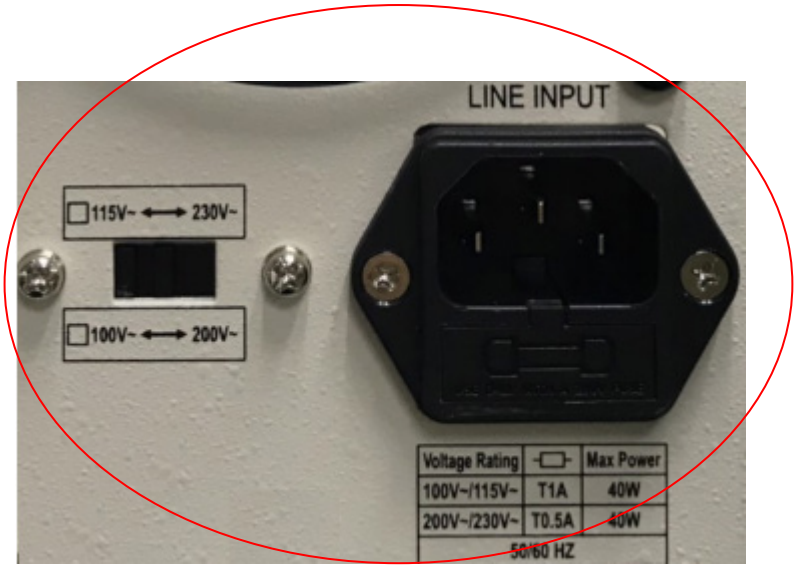


Fig 2-1 SET OF SWITCH

2-2 Input Fuse

This product is fitted with a mains input fuse. If it needs to be replaced please adhere to the Following procedure.

CAUTION

BEFORE replacing the fuse you must switch off the unit and mains power outlet and disconnect the plug of the AC Power cable from the input socket of the 3110 series.

WARNING

If prior to exchanging the fuse, there is any abnormal noise or odour do not use the unit. Please inform your local sales office to organise repair of the 3110 series.

To avoid the risk of fire or electronic shock the fuse must only be replaced with same type and rating as the original. Any replacement fuse used should meet your national safety standards. Any use of improper fuse or shorting the Fuse holder would be extremely dangerous and would be strictly prohibited.

2.2.1 Check the rating of the mains input fuse. Replace only with the correct Type and rating.
For 100V/115Vac Input use T1A/250V (5*20mm),
For 200V/230Vac Input useT0.5A/250V (5*20mm)

2.2.2 The AC line fuse is located below the AC line socket (see Fig 2-2). Use A small screwdriver to remove the fuse holder. Replace the failed fuse With the appropriate type and rating according to your mains voltage. (See Table 1-2)

2.2.3 Refit the fuse holder and connect the power cord.

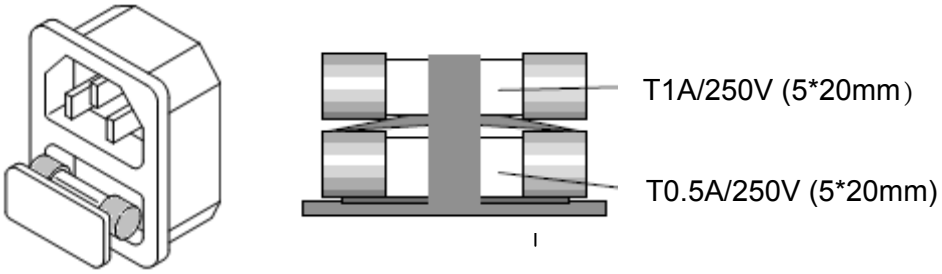


Fig 2-2 FUSE RECEPTACLE

2-3 Environmental requirements

- Indoor use.
- Measurement Category I.
- Pollution Degree 2.
- Relative Humidity 80% Max.
- Ambient Temperature 0 to +40°C
- Altitude up to 2000m.
- The equipment is not for measurements performed for CAT II, III and IV.
- Transient Overvoltage on the mains supply can be 2500V.

2-4 Observe the International Electrical Symbol listed below.

⚠ Warning！Risk of electric shock

⚠ Caution！Carefully read and understand the guidance in the operating manual Before performing any action.

2-5 Cleaning

Use a soft or slightly damp cloth to clean this product.

BEFORE you clean the unit, switch the mains power off and disconnect the input lead.

- Please do NOT use any organic solvent capable of changing the nature of the plastic such as benzene or acetone.
- Please ensure that no liquid is allowed to penetrate this product.

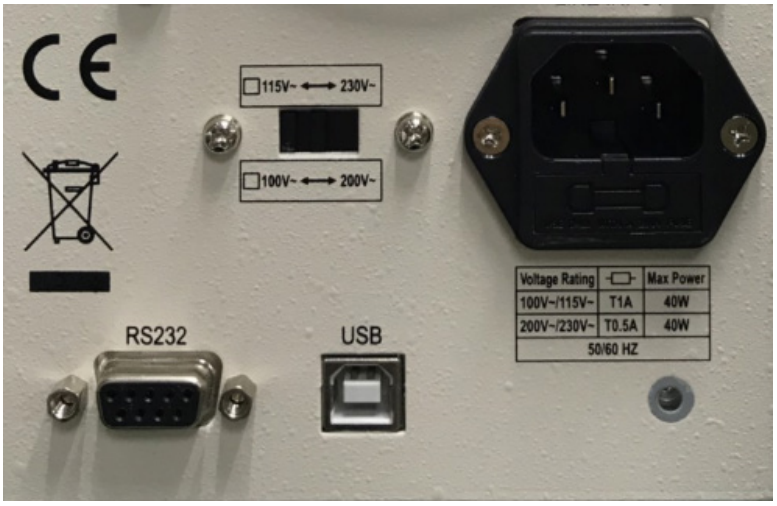
2-6 Power Up

The following procedure should be followed before applying mains power:

2.6.1 Check that the POWER switch is in the off (O) position
2.6.2 Check the rear panel voltage selector of the 3110 series is Correctly set.
2.6.3 Check that nothing is connected to the DC INPUT (load input terminals) on the Front panel of the 3110 load .
2.6.4 Connect correct AC mains lead to the 3110 series.
2.6.5 Turn on (I) the POWER switch.

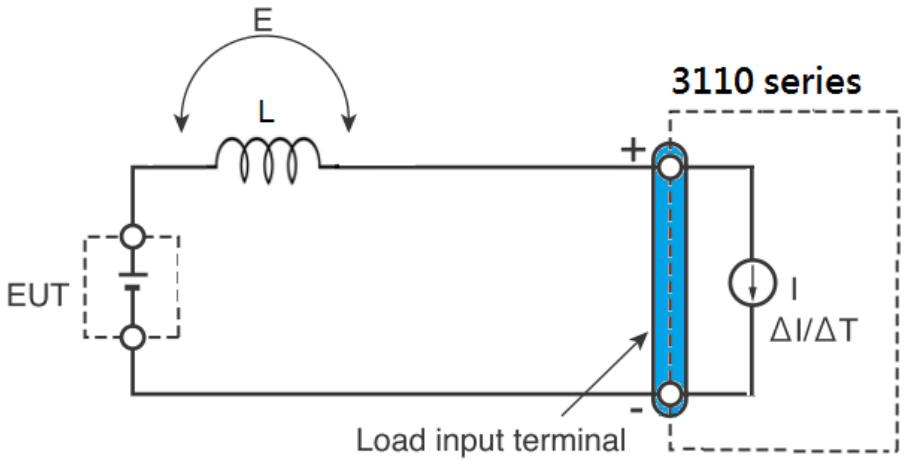
2-7 RS232 & USB Interface

Fig 2-3 shows the RS232 & USB interface (Female) on the rear panel. This connects the 3110 Series to RS232 port of computer.



2-8 Load wire inductance

The load wiring has an inductance (L). When the current (I) varies in short time period, It Generates a large voltage at both ends of the wiring cable. This voltage applies to all of the Load input terminals of the 3110 series when the impedance of the EUT is relatively small. The voltage generated by the load wire inductance (L) and the current variation (I) is Expressed using the following equation.



$E = L \times (\Delta I / \Delta T)$

E: Voltage generated by the wire inductance
L: Load wire inductance
ΔI: Amount of Current variation
ΔT: Variation period of current

In general, the wire inductance can be measured approximately 1 μH per 1 meter. If the 10 meters of Load wires is connected between the EUT and the electronic load (3110 Series) with the current Variation of 2 A/μs, the voltage generated by the wire inductance Will be 20 V.

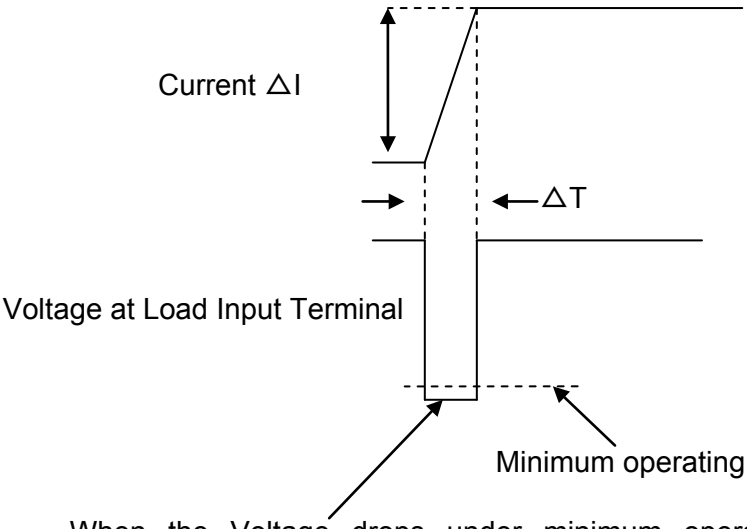
The negative polarity of the load input terminal is the reference potential of the external Control signal, Therefore, the device connected to the external control terminal may get Malfunctioned.

When operating under the constant voltage (CV) mode or constant resistance (CR) mode or Constant power (CP), the load current is varied by the voltage at the load input terminal, so The operation can be affected easily by the generated voltage.

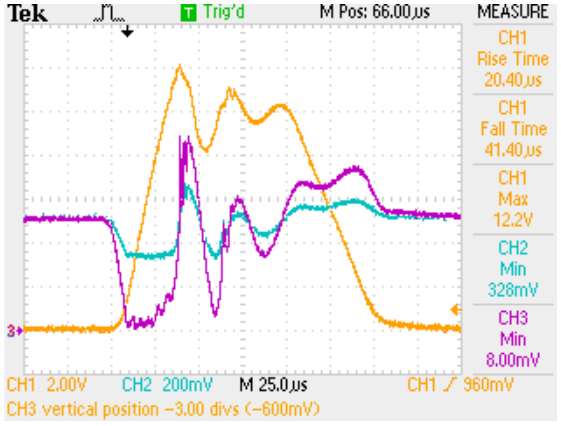
The wiring to the EUT should be twisted and the shortest as possible.
If the load wire is long or has a large loop, the wire inductance is increased. Consequently, The Current variation that results when switching occurs will cause a large voltage drop.

When the value of instantaneous voltage drops under the minimum operating voltage Depends on the generated voltage at the load input terminal, the response of recovery will be extensively delayed.

In such event, the electronic load (3110 series) may generate unstable oscillation.
In such condition, the input voltage may exceed the maximum input voltage and Cause Damage to the 3110 Series.



When the Voltage drops under minimum operating voltage, the electronic load may generate unstable oscillation



CH1=Imonitor
CH2=Power Supply output Voltage (x10)
CH3= LOAD Input Voltage (x10)

Fig 2-3 Waveform example: Generate unstable oscillation

You must be careful especially when the slew rate setting is high or switching is performed Using large currents through parallel operation.

To prevent problems, connect the 3110 series and the equipment under test using the Shortest Twisted Wire possible to keep the voltage caused by inductance between the Minimum operating Voltage and the maximum input voltage range or set a low slew rate.

If the high-speed response operation is not required, decrease the slew rate setting.

In such settings, the value of DI /DT will be decreased, accordingly the generated voltage Will be Reduced even the inductance of load wiring can not be reduced.

In the case of DC operation also, the phase delay of the current may cause instability in The 3110 Series Control inducing oscillation. In this case also, connect the 3110 Series And the equipment under test using the shortest twisted wire possible.

If only DC operation is required, a capacitor and a resistor may be connected to the load Input Terminal as shown in Fig. 2-4 to alleviate oscillation. In this case, use the capacitor Within its Allowable ripple current.

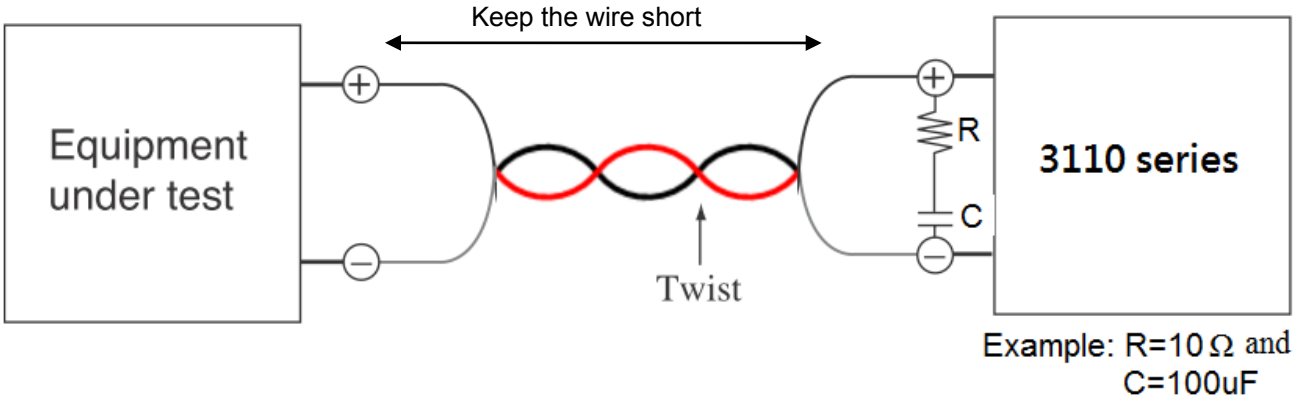


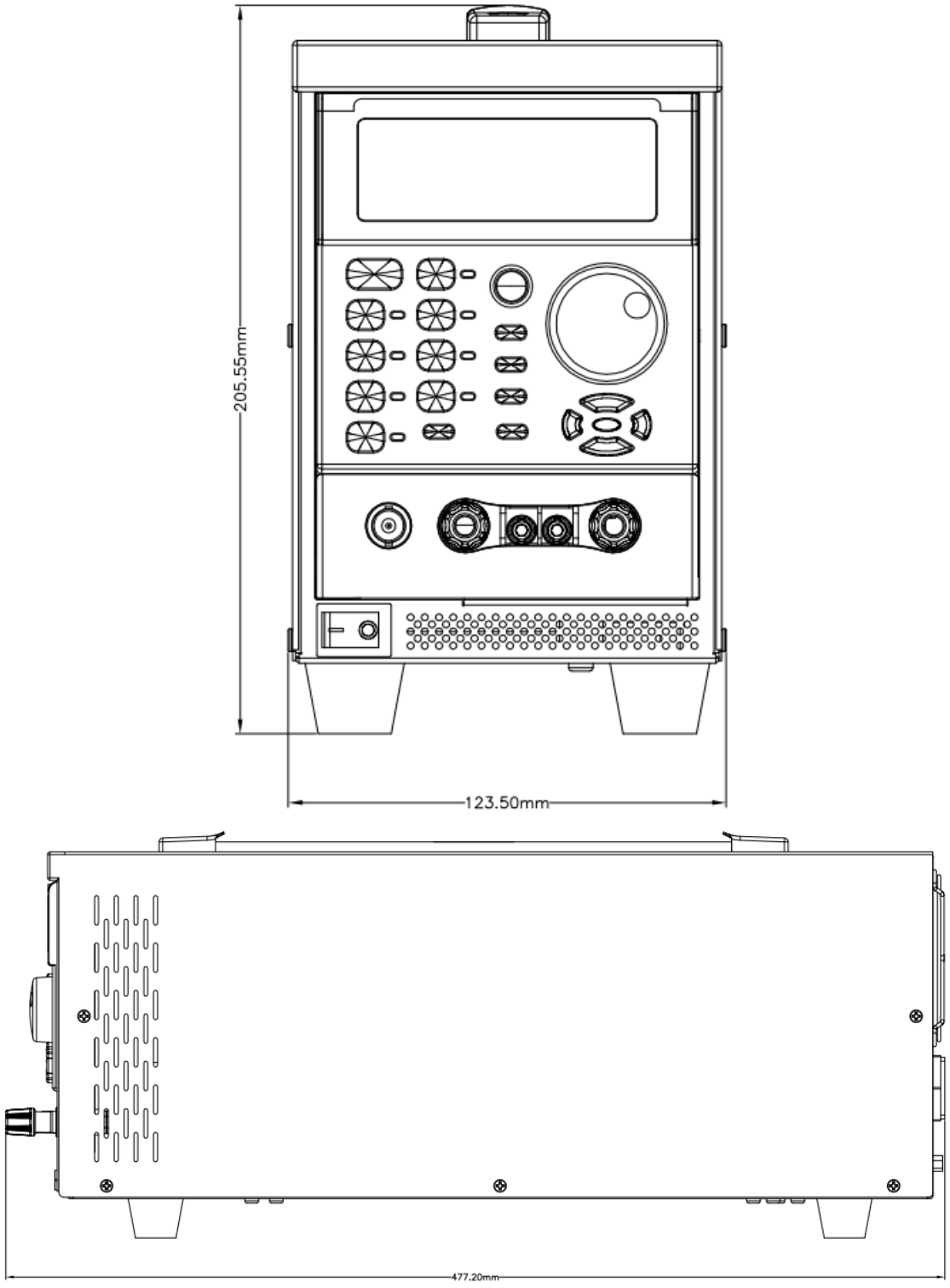
Fig 2-4 Length of wiring

Chapter 3 Operation

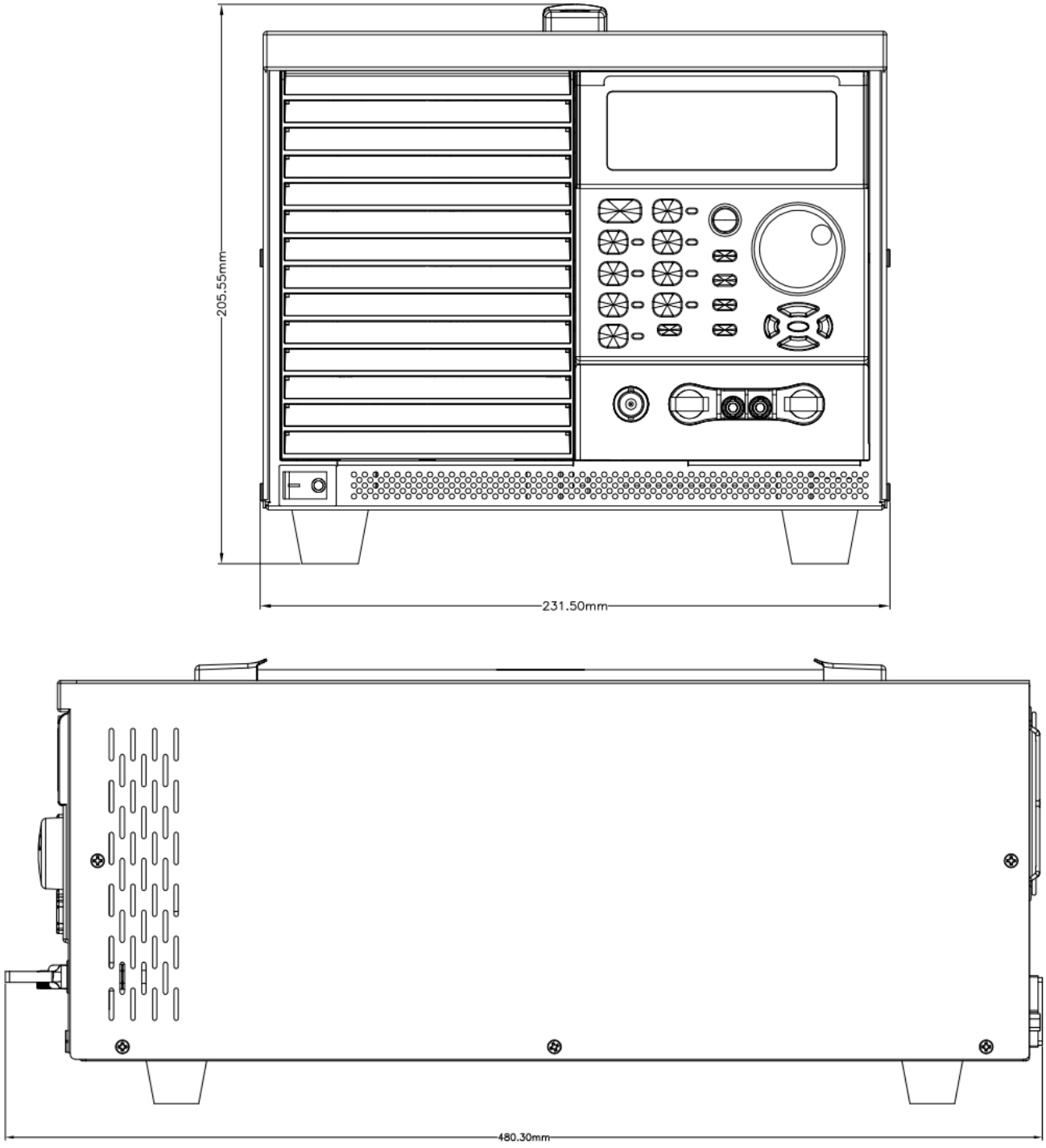
This chapter describes the front panel operation of each 3110 series load. Please note that RS-232C/USB remote programming terms are detailed in the separate 3110 series operation manual.

3-1. Dimension

3110, 3111, 3114 Dimension



3117, 3119 Dimension



3-2. Front panel LCD description

The following sketch shows the layout of the front panel of the unit. Please refer to the relevant Section as indicated by the number assigned to a front panel function.

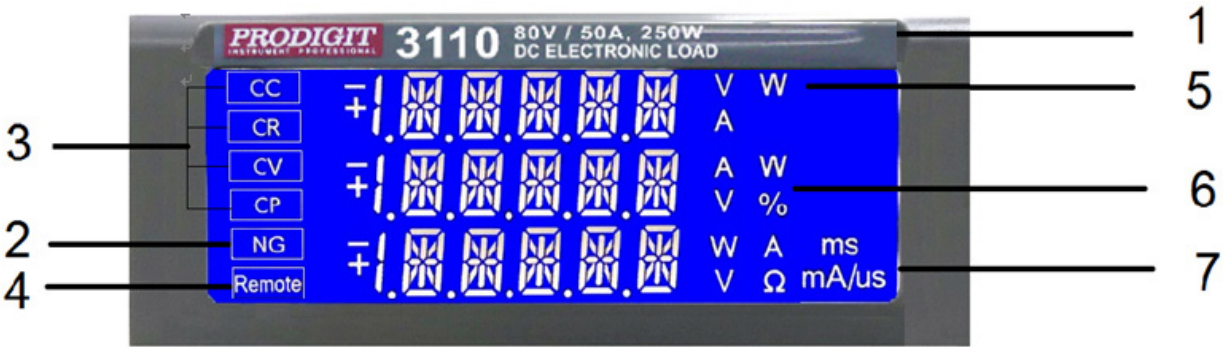


Fig 3-1 Front panel of 3110 Series LCD

3.2.1. Model number and sink ranges

The model number along with maximum voltage, current and power values are Detailed in this position at the top of the load module's front panel.

3.2.2. NG Indicator

The user can adjust upper and lower limits for voltage, current and power within the CONFIG menu and turn the NG Indicator ON. If a Voltmeter, Ammeter or Wattmeter measurement is outside these set limits then the NG indicator will illuminate.

3.2.3. MODE and CC , CR , CV , CP mode, LCD Indicator

There are four operating modes that can be selected by pressing the "MODE" key on the 3110 series Electronic Load module.

The sequence is Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV), Constant Power (CP). Each time the "MODE" key is pressed the operating mode is changed. The actual operating mode selected is indicated on the left hand side of the LCD.

The operating theorem of CC, CR, CV and CP modes are described in Section 1-1. Common application examples for the different operating modes are described in Section 5-3 to 5-6 respectively.

3.2.4. Remote LCD Indicator

If the REMOTE LCD Indicator is illuminated this means that the unit is operating remotely via one of the optional interfaces. While REMOTE is lit it is not possible to make settings manually at the front panel. The LOCAL button on the mainframe can be used to revert back to front panel control. When the unit is operating from the front panel the REMOTE LCD will not be illuminated.

3.2.5. Upper 5 digit LCD display

The 5 digit LCD display is a multi-function display. The function of the display changes depending whether the user is in NORMAL mode or in a SHORT, OPP or OCP test modes:

Normal mode:

The upper 5 digit display displays the voltage present at the load's input terminals. The value displayed will include the automatic voltage compensation if the sense Terminals are also connected to the device under test (DUT)

Please note that if V-sense is set to 'AUTO' and the sense leads are connected to The DUT the losses need to be approx.

If V-sense is set to 'ON' and the sense terminals are connected to the DUT the Load will check and compensate for all voltage drops.

Test Mode:

If the SHORT, OPP or OCP buttons are pressed the upper display will show a text Message that correlates with the selected test function.

SHORT test selected: upper display will show "Short".
OPP test selected: upper display will show "OPP".
OCP test selected: upper display will show "OCP".

During the test the upper display will show the load Input voltage.

3.2.6. Middle 5 digit LCD display

The middle 5 digit displays also changes function depending if the user is in Normal mode or has entered a setting menu

Normal mode:

In normal mode the middle LCD display functions as a 5 digit ammeter. The 5 digit DAM shows the load current flowing into the DC load when the Load is ON.

Setting Mode:

If CONFIG, LIMIT, DYN, SURGE, BATT, SHORT, OPP or OCP buttons are pressed The middle LCD shows a text message according to the setting function it is in. Each subsequent press of the button moves the display to the next available function. The sequence of each setting menu is detailed below

- **CONFIG**: Sequence is “SENSE” → “LDon” → “LDoff” → “POLAR”
- **LIMIT**: Sequence is ”V_Hi” → “V_Lo” → “I_Hi” → “I_Lo” → “W_Hi” → “W_Lo” → “NG”.
- **DYN setting**: Sequence is “T-Hi” → ”T-Lo” → ”RISE” → “FALL”
- **SURGE:** Sequence is ““SUR._I” → ”NOR._I” → ”S.TIME” → “S.STEP**.**
- **BATT** Sequence is MODE” → ”CC” → ”VOLT.V” MODE” →”CC” → ”VOLT.V” →”TIME.S”→”CAP.AH→”CAP.WH.
- **SHORT**: Sequence is “PRESS” → “TIME” → ”V_Hi” → “V_Lo”
- **OPP**: Sequence is “PSTAR” → “PSTEP” → “PSTOP” → “Vth”.
- **OCP**: Sequence is “ISTAR” → “ISTEP” → “ISTOP” → ”Vth”.

3.2.7. Lower 5 digit LCD display

The lower 5 digit display also changes function depending if the unit is in normal Mode or one of the setting menus has been activated.

Normal mode:

In normal mode the lower 5 digit display shows the power consumption in Watts (W).

Setting Mode:

The lower display together with the rotary adjustment knob is used to set values. The value changes according to the setting function that is active. The middle LCD Provides a text message to tell the user which part of the setting menu is active.

3.2.7.1. **PRESET** mode. The value of the setting entered on the lower display Changes depending on the operating MODE that has been selected.

- If CC mode is selected the lower display provides setting in amps "A".
- If CR mode is selected the lower display provides setting in ohms “Ω”
- If CV mode is selected the lower display provides setting in volts “V”.
- If CP mode is selected the lower display provides setting in watts “W”.

3.2.7.2. **LIMIT.** Each press of the LIMIT button changes the middle LCD text. The Sequence and the corresponding setting value shown on the bottom Display are as follows:

➔ V_Hi (upper limit voltage) displays the set value in volts “V”
➔ V_Lo (lower limit voltage) displays the set value in volts “V”
➔ I_Hi (upper limit current) displays the set value in amps “A”
➔ I_Lo (lower limit current) displays the set value in amps “A”
➔ W_Hi (upper limit power) displays the set value in watts “A”
➔ W_Lo (lower limit power) displays the set value in watts “A”
➔ NG displays whether the NG flag is set to「ON」or「OFF」

3.2.7.3. DYN setting. Each press of the DYN setting button changes the text on The middle LCD. The sequence and the corresponding setting value Shown on the bottom display are as follows:

➔ T-Hi (time high) displays the set value in milliseconds “ms”
➔ T-Lo (time low) displays the set value in milliseconds “ms”
➔ Rise (current rise time/slew rate) displays the set value in “A/us” or “A/ms”
➔ Fall (current fall time/slew rate) displays the set value in “A/us” or “A/ms”

3.2.7.4. CONFIG. Each press of the CONFIG button changes the middle LCD Text.
The sequence and the corresponding setting value shown on the bottom Display are as follows:

➔ SENSE can be set to「AUTO」or 「ON」
➔ LDon (load ON voltage) displays the set value in volts “V”
➔ LDoff (load OFF voltage) displays the set value in volts “V”
➔ POLAR (load polarity) can be set to「＋LOAD」or「－LOAD」

3.2.7.5. SHORT test. This allows the parameters of the short test to be set up.
Each press of the SHORT button moves the setting function. The Sequence of the short test along with the setting value is as follows:

➔ Short Press Start (pressing the red START/STOP button starts the test)
➔ TIME shows the duration of the SHORT test. “CONTI”, on the bottom
➔ Display indicates continuous. Time can be adjusted in “ms”.
➔ V-Hi (voltage high threshold) displays the set value in volts “V”
➔ V-Lo (voltage low threshold) displays the set value in volts “V”

When the test is started the lower display will show RUN. When the test Has finished the lower display will show END.

3.2.7.6. OPP test. This allows the parameters of the over power protection test to Be Set up. Each press of the OPP button moves the setting function.
The Sequence of the OPP test along with the setting value is as follows:

➔ OPP Press Start (pressing the red START/STOP button starts the test)
➔ PSTAR (power start point) lower display provides setting in watts “W”
➔ PSTEP (power steps) lower display provides setting in watts “W”
➔ PSTOP (power stop point) lower display provides setting in watts “W”
➔ VTH (voltage threshold) lower display provides setting in volts “V”

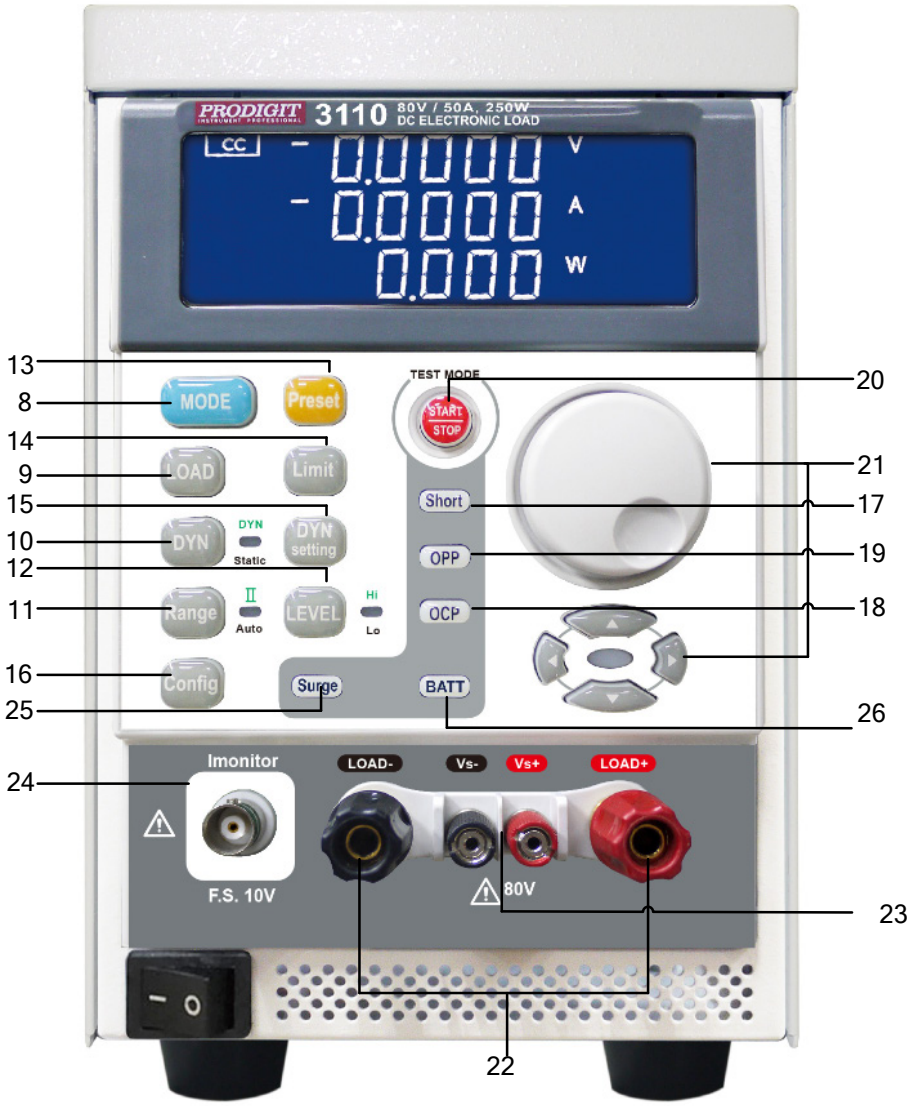
When the test is started the lower display will show the power value Being taken by the load. If the Device Under Test is able to supply the Load according to the values set then the middle display will show PASS And the lower display will show the maximum power taken during the OPP test. If, during the test, OTP is displayed the over temperature Protection has been engaged. Similarly if OPP is shown on the display The over power protection has been activated.

3.2.7.7. OCP test. This allows the parameters of the over current protection test To be set up. Each press of the OCP button moves the setting function. The sequence of the OCP test along with the setting value is as follows:

➔ OCP Press Start (pressing the red START/STOP button starts the test)
➔ ISTAR (current start point) lower display provides setting in amps “A”
➔ ISTEP (current steps) lower display provides setting in amps “A”
➔ ISTOP (current stop point) lower display provides setting in amps “A”
➔ VTH (voltage threshold) lower display provides setting in volts “V”

When the test is started the lower display will show the current value being Taken by the load. If the Device Under Test is able to supply the load According to the values set then the middle display will show PASS and the Lower display will show the maximum current taken during the OCP test. If, During the test, OTP is displayed the over temperature protection has been Engaged. Similarly if OPP is shown on the display the over power Protection has been activated.

3110 Series Panel instructions



3.2.8. MODE and CC, CR, CV, CP Indicator

There are four operating modes. These can be selected in turn by pressing the "MODE" key on the 3110 series Electronic Load module. The sequence is:

- ➔ (CC) Constant Current
- ➔ (CR) Constant Resistance
- ➔ (CV) Constant Voltage
- ➔ (CP) Constant Power

The appropriate LCD will illuminate according to the operating mode is selected.

3.2.9. LOAD key and LED

The input to the 3110 series Electronic Load can be switched ON/OFF by using The “LOAD” button. Indication of the ON/OFF state is provided by illumination of The Button.

LOAD button lit	= LOAD ON	(load sinks according to the preset values)
LOAD button unlit	= LOAD OFF	(the load does not sink current)

Turning the LOAD OFF does not affect the preset values. When the LOAD ON state Is enabled the unit will revert to sinking according to the preset values.

3.2.9.1. When the Load ON/OFF key is operated the current taken by load will follow The RISE or FALL with time according to the preset rate. The current RISE And FALL times can be adjusted in the DYN Setting button of the front panel.

3.2.9.2. In addition to the LOAD ON/OFF function the user can also adjust the Voltage level at which the unit will automatically start or stop sinking energy. The adjustable LDon and LDoff voltage levels are found within the CONFIG Menu. Please note that the LDoff level cannot be set higher than the LDon Level.

Please refer to table 1-4 for adjustment ranges.

3.2.10. DYN /STA key and LED

The DYN button allows the user to switch between DYNAMIC operation and STATIC operation. Dynamic operation is only possible in constant current (CC) or Constant power (CP) mode only. The LED next to the DYN button will become lit When DYNAMIC operation is selected. If you are in constant resistance (CR) or Constant voltage (CV) mode pressing the DYN button will have no effect.

3.2.11. Range Key and LED

The 3110 series Load Module features 2 setting ranges for CC, CR, CV & CP Operation. This allows improved resolution for setting low values. When left in the Default AUTO mode the changeover between ranges is automatic depending on The setting value entered.

If desired the RANGE button can be pressed to force the unit to operate only in RANGE II. This is signaled by the accompanying LED becoming lit. Please note That it is only possible to force RANGE II in CC mode.

3.2.12. LEVEL key and LED

The LEVEL button is used to program a High or Low load value. The setting value Changes between current, resistance, voltage or power depending whether CC, CR, CV or CP mode has been selected. If the LED is lit then the High level value Setting Has been enabled. If the LED is not lit then the low load level can be set Using the rotary switch in combination with the arrow keys.

In STATIC mode the user can switch between High and low load levels during Operation.

In DYNAMIC operation (CC & CP modes only) the preset high and low levels are Used to define the dynamic waveform.

Please note that the low level setting cannot exceed the high level. The converse Is also true in that the High level cannot be set below the low level.

3.2.12.1. In Constant Current mode:
The level is initial setting on High, LEVEL High / Low has two level, Low Current level setting must be lower than Level High.

3.2.12.2. In Constant Resistance mode:
The level is initial setting on High, LEVEL High / Low has two level, Low Resistance level setting must be lower than Level High.
P.S.：CR Mode Level High / Low level by current perspectives.

3.2.12.3. In Constant Voltage mode:
IF Low level load voltage value greater than High level load voltage value or opposite status，the load voltage value is equal.
P.S.：CV Mode Level High / Low has "automatic push function".

3.2.12.4. In Constant Power mode:
The level is initial setting on High, LEVEL High / Low has two level, Low Power level setting must be lower than Level High.

P.S Automatically Push Function
Level setting, Level High must be higher or equal than Level Low; When Level High equal to than LEVEL Low, it can not be adjusted anymore.

When Level High equals to lower low, the Automatic push function can push Down the level Low value.
Therefore, the Level High can continue adjusting.

3.2.13. Preset Key and LED

If the PRESET key is pressed the button will become lit indicating that the PRESET mode has been accessed. The lowest 5 digit display will change from showing the power consumption in watts to displaying the value to be preset. The value that can be programmed changes according to the operating mode that has been selected.

3.213.1. Constant Current (CC) mode:
The High and Low levels of load current can be preset at lower 5 digit LCD. The "A" LED will be lit indicating the setting value is amps.

3.213.2. Constant Resistance (CR) mode:

The High and Low levels of load resistance can be preset on the lower 5 Digit LCD. The "Ω" LED will be lit indicating the setting value is ohms.

3.213.3. Constant Voltage (CV) mode:
The High and Low levels of load voltage can be preset on the lower 5 Digit LCD. The “V" LED will be lit indicating the setting value is volts.

3.213.4. Constant Power (CP) mode:
The High and Low levels of load power can be preset on the lower 5 digit LCD. The "W" LED will be lit indicating the setting value is watts.

3.213.5. Dynamic mode (CC, CR or CP modes only):
Each press of the DYN button cycles through the dynamic load settings. The DYN settings are used in conjunction with the High and Low levels Of load current to define the dynamic waveform. Each press of the DYN Button switches from T_Hi (time high), to T_Lo (time low), to Rise time And then to fall time. The middle LCD shows the section of the dynamic Waveform which is programmed with the rotary knob and read from the Lower display. The “ms” LED shows that the settings are programmed in Milliseconds.

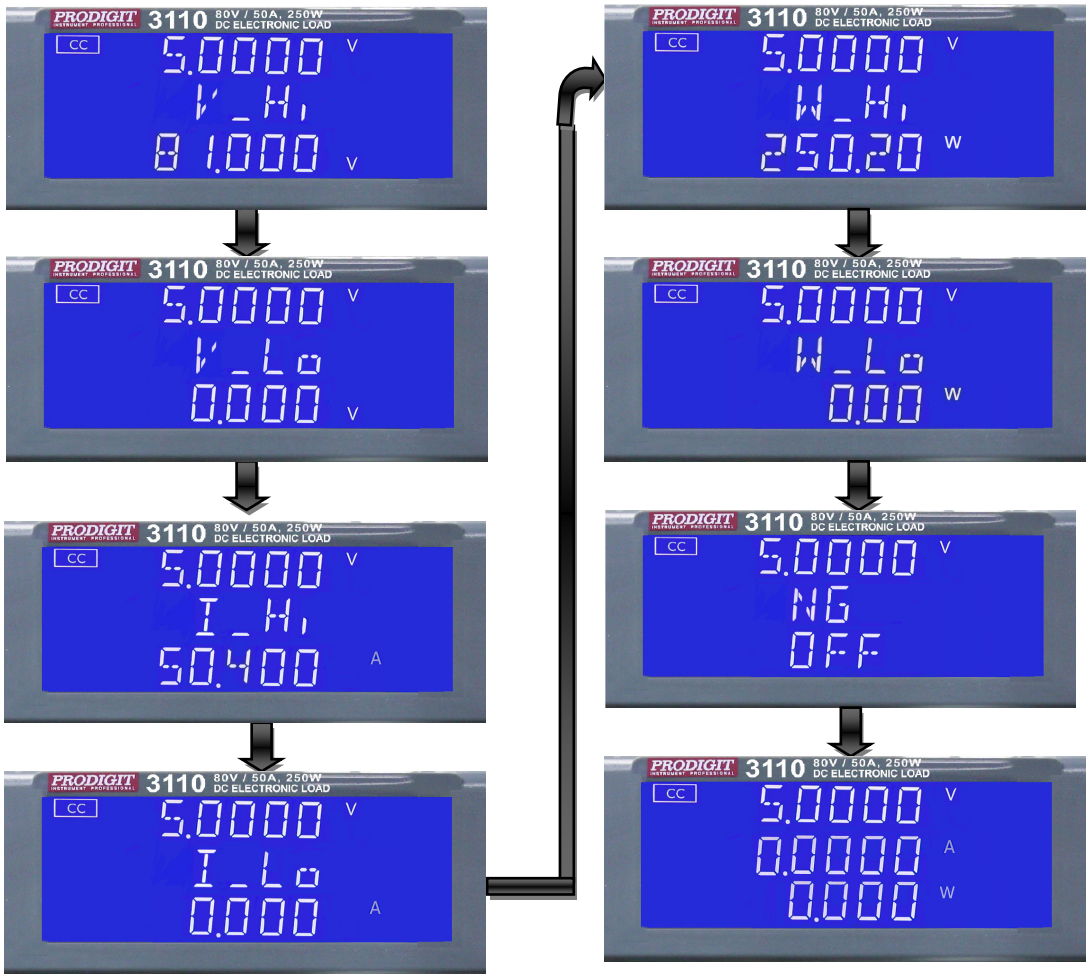
3.2.14. 

key

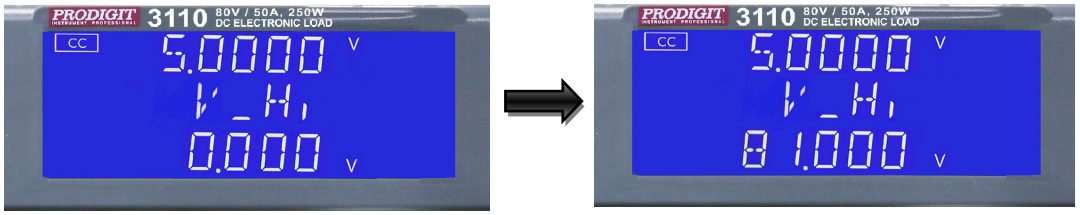
The LIMIT button allows the user to set upper and lower thresholds for voltage, Current or power. These threshold settings are used in conjunction with the NG function to flag when the load is operating outside the desired limits
Each press of the LIMIT key enables a different value to be entered. On first press of the LIMIT key the button will illuminate and +CV will be displayed on the middle LCD. The setting is made with the rotary knob and can be read from the lower LCD during setting. The setting sequence is shown below:

V_Hi (DVM upper limit) →
V_Lo (DVM lower limit) →
I_Hi (DAM upper limit) →
I_Lo (DAM lower limit) →
W_Hi (DWM upper limit) →
W_Lo (DWM lower limit) →
NG OFF/ON (No Good Flag) →
LIMIT setting function OFF

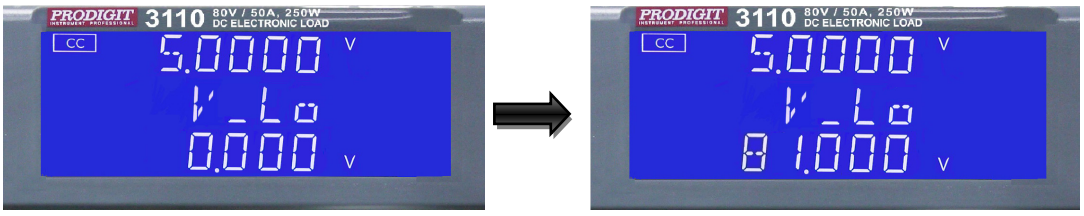
The engineering unit is “V”, “A” or “W” depending on the threshold LIMIT being set.



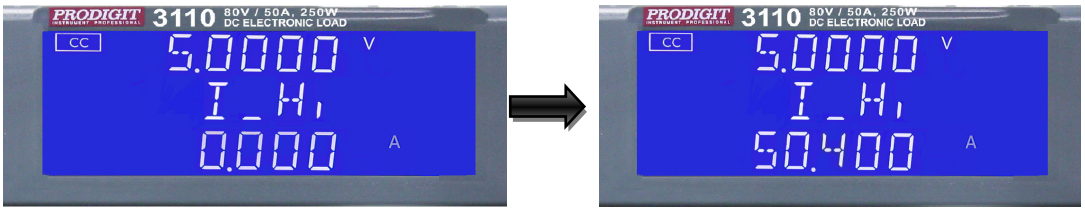
- Setting Upper limit voltage VH , Middle 5 digit LCD display「V-Hi」,lower 5 Digit LCD display the unit is "V", the V-Hi set range from 0.000 V to 81.000V step 0.001V by rotating the Setting knob.



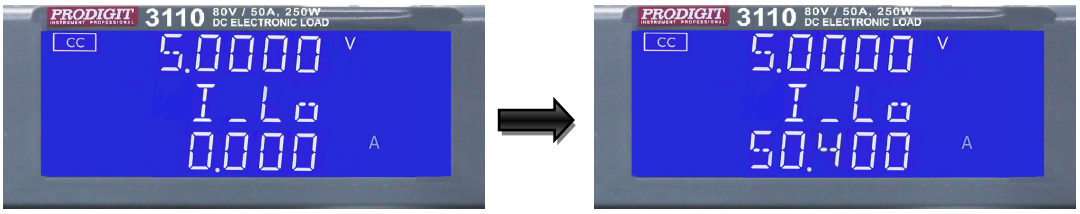
- Setting lower limit voltage VL, Middle 5 digit LCD display「V-Lo」,lower 5 Digit LCD display the unit is "V", the V-Lo set range from 0.000 V to 81.000V step 0.001V by rotating the Setting knob.



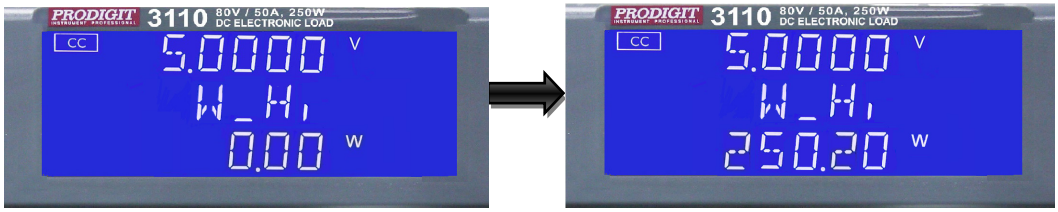
- Setting Upper limit current IH , Middle 5 digit LCD display「I-Hi」,lower 5 Digit LCD display the unit is "A", the I-Hi set range from 0.000 A to 50.400A Step 0.001A by rotating the Setting knob.



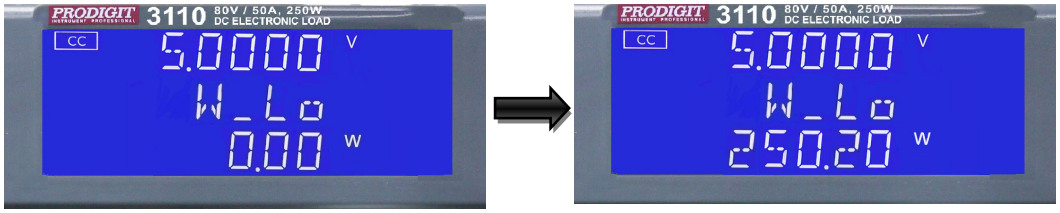
- Setting lower limit current IL , Middle 5 digit LCD display「I-Lo」,lower 5 Digit LCD display the unit is "A", the I-Lo set range from 0.000 A to 60.000A step 0.001A by rotating the Setting knob.



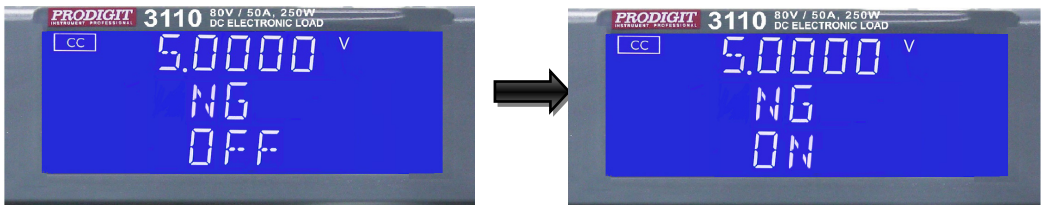
- Setting Upper limit power WH, Middle 5 digit LCD display「W-Hi」lower 5 Digit LCD display the unit is "W", the W-Hi set range from 0.00 W to 250.20W step 0.01W by rotating the Setting knob.



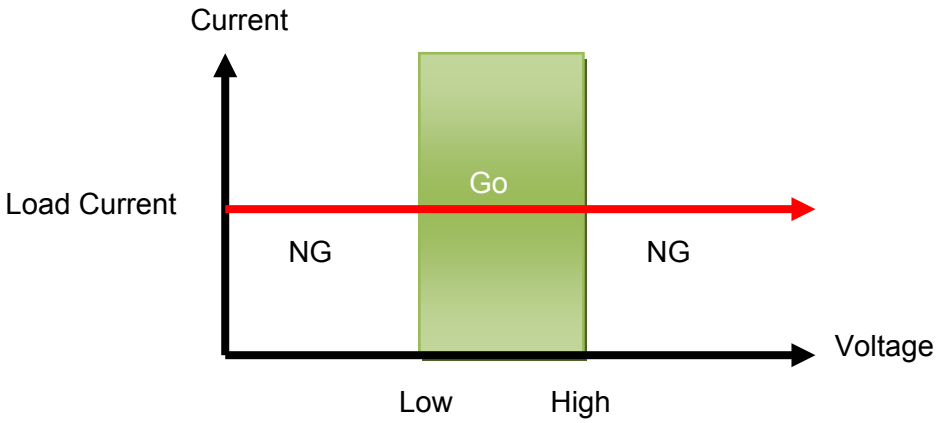
- Setting lower limit power WL, Middle 5 digit LCD display「W-Lo」lower 5 Digit LCD display the unit is "W", the W-Lo set range from 0.00 W to 300.00W step 0.01W by rotating the Setting knob.



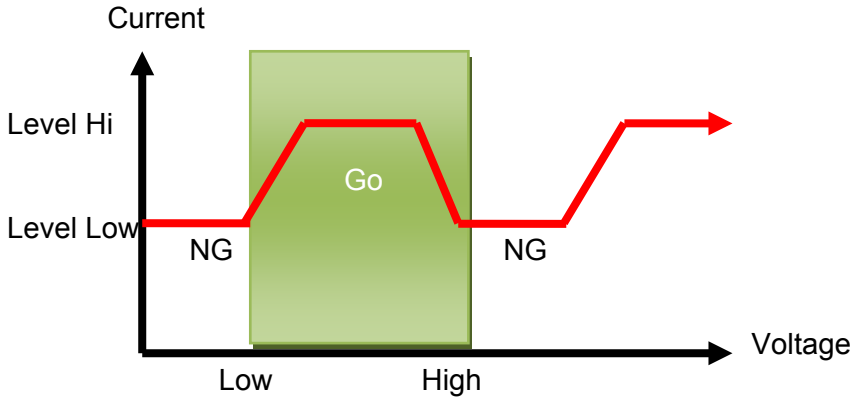
- Setting NG ON/OFF, When exceed VH、VL、IH、IL、WH、WL One of These Whether NG on LCD display.



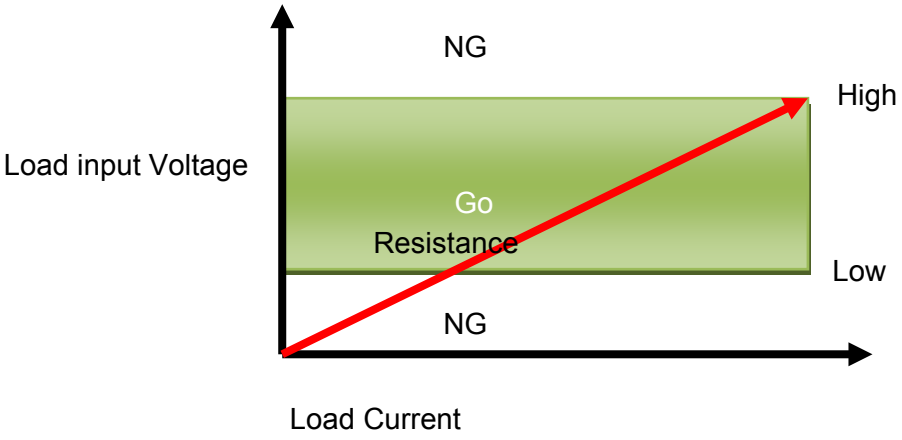
- CC mode, press limits key to set the V-Hi and V-Lo voltage upper and lower Limits of the GO / NG.



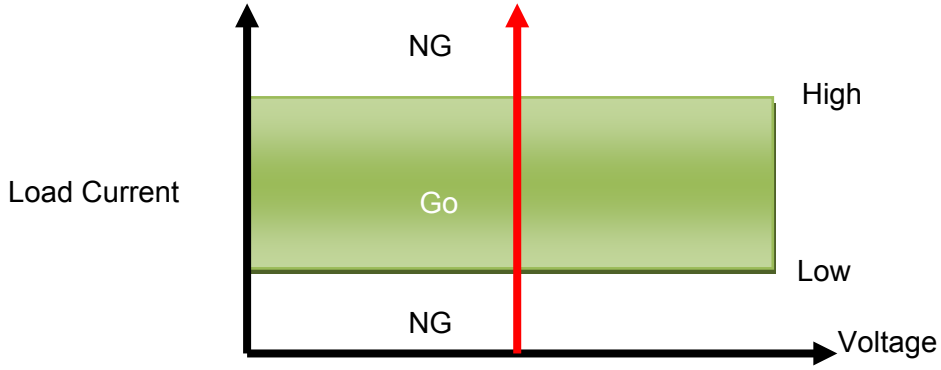
- CC Dynamic Mode, press key to set the Level Hi and Level Low voltage Upper and lower limits of the GO / NG.



- CR mode, press limits key to set the V-Hi and V-Lo voltage upper and lower Limits of the GO / NG.

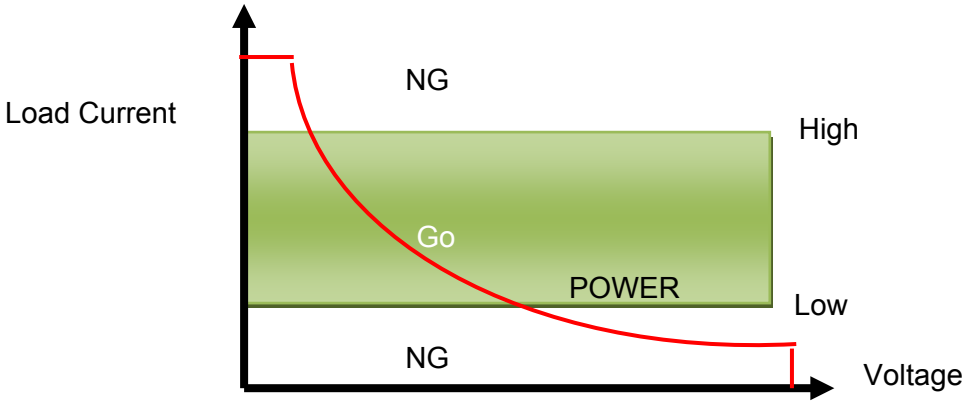


- CV mode, press limits key to set the I-Hi and I-Lo Current upper and lower Limits of the GO / NG.



Load Input Voltage

- CP mode, press limits key to set the W-Hi and W-Lo power upper and lower limits of the GO / NG.



3.2.15. 

Key

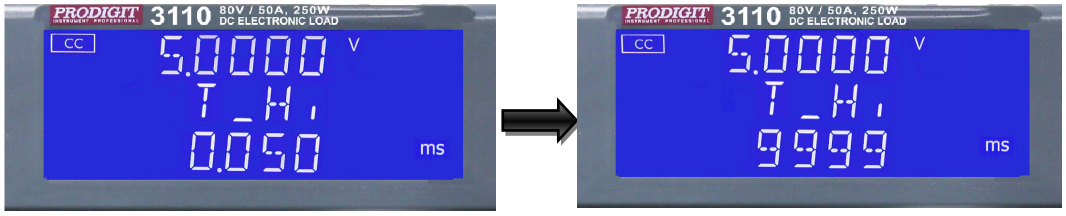
The DYN button allows the user to define the timings of the dynamic load Waveform. Firstly the high and low levels of load current will need to be set via the LEVEL switch. The RISE and FALL times between the low load current and the High load current along with the TIME the waveform is HIGH and the TIME LOW Can be set via the DYN menu.

Each press of the DYN key enables a section of the DYNAMIC waveform to be set. On first press of the DYN key the button will illuminate and T-Hi will be displayed On the middle LCD. The value is adjusted with the rotary knob and can be read From the lower LCD during setting. The setting sequence is shown below:

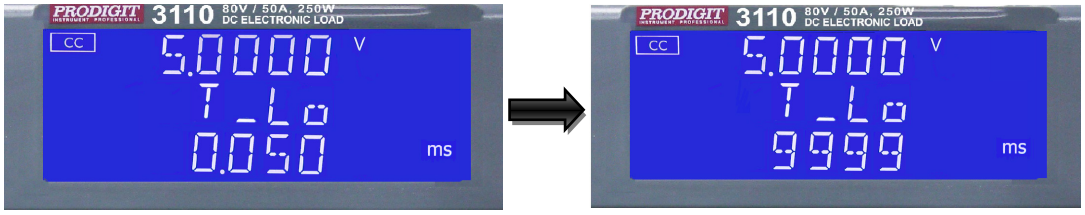
T_Hi (time the waveform is high) →
T_Lo (time the waveform is low) →
RISE (rise time) →
FALL (fall time) →

The time that the waveform is high includes the rise time and is set in “ms”
The time that the waveform is low includes the fall time and is set in “ms”
The RISE and FALL time is set in “mA/µs” or “A/µs”. The actual engineering unit is Shown on the right of the lower 5 digit display.

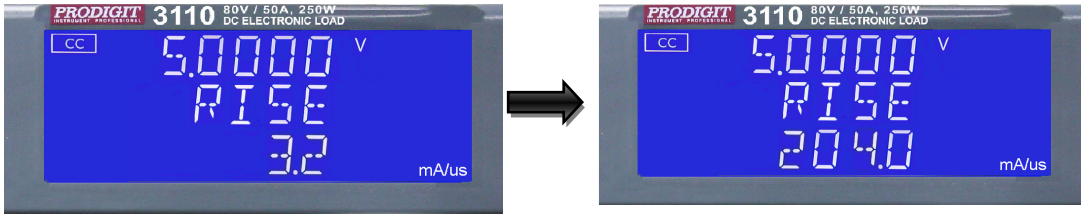
- Press DYN setting key, LED will ON
  Setting level High Period, Middle 5 digit LCD display will show 「T-Hi」 Lower 5 digit LCD display will show setting value, the unit is “ms” , The T-Hi Set range from 0.050 ms to 9999 ms step 0.001ms by rotating the setting Knob.



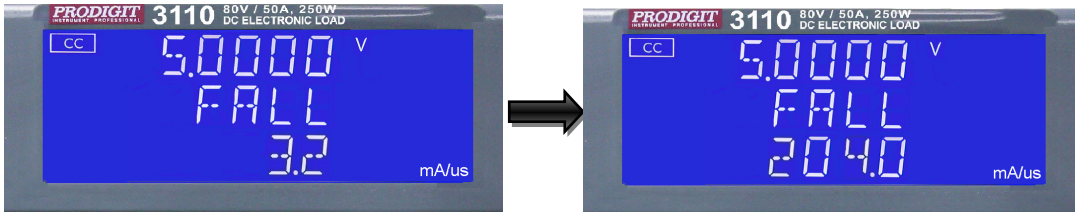
- Setting level Low period, Middle 5 digit LCD display will show 「T-Lo」, Lower 5 digit LCD display will show setting value, the unit is “ms”, The T-Lo Set range from 0.050 ms to 9999 ms step 0.001ms by rotating the Setting Knob.



- Setting rise time, Middle 5 digit LCD display will show 「RISE」, Lower 5 Digit LCD display will show setting value, the unit is “mA/μs”, The RISE Time set range from 3.2 mA/us to 204.0 mA/us step 1mA/us by rotating the Setting knob.



- Setting fall time, Middle 5 digit LCD display will show 「FALL」, Lower 5 Digit LCD display will show setting value, the unit is “mA/μs”, The FALL Time set range from 3.2 mA/us to 204.0 mA/us step 1mA/us by rotating the Setting knob.

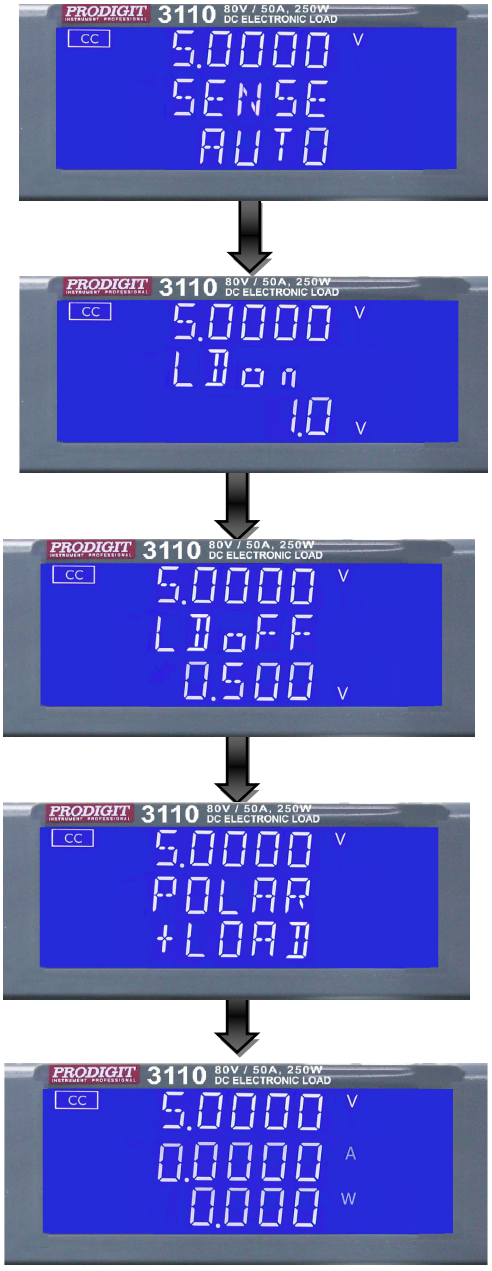


3.2.16. Config key

The CONFIG key allows the sense function to engage automatically or switched ON. The CONFIG key also enables the LOAD to automatically turn ON/OFF When a voltage level is reached. The polarity symbol can also be switched via the CONFIG menu.

Each press of the CONFIG key moves the menu on one step. On first press of the CONFIG key the button will illuminate and SENSE will be displayed on the middle LCD. The value is adjusted with the rotary knob and can be read from the lower LCD during setting. The setting sequence is shown below:

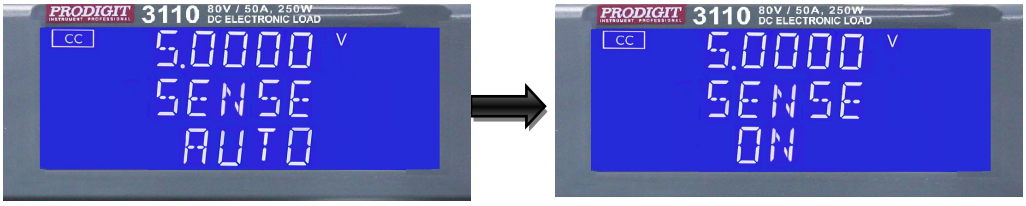
SENSE (AUTO or ON) →
LDon (Voltage at which LOAD turns ON) →
LDoff (Voltage at which LOAD turns OFF) →
POLAR (change polarity symbol) →
Exit CONFIG options



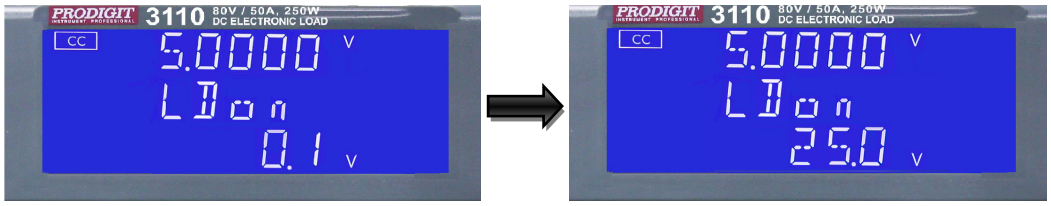
Note 1: The adjustable LDon (LOAD ON) voltage is valid for CC, CR & CP operating Modes. The adjusted LDon voltage will not operate in CV mode.

Note 2: The LDon (LOAD ON) voltage setting cannot be lower than the LDoff (LOAD OFF) voltage. If 0V is required for both LOAD ON and LOAD OFF make the LOAD OFF adjustment first.

- Setting Vsense and load input switching methods, the middle of the 5 digit LCD Display will show "SENSE", Lower 5 digit LCD display will show "AUTO" or "ON".



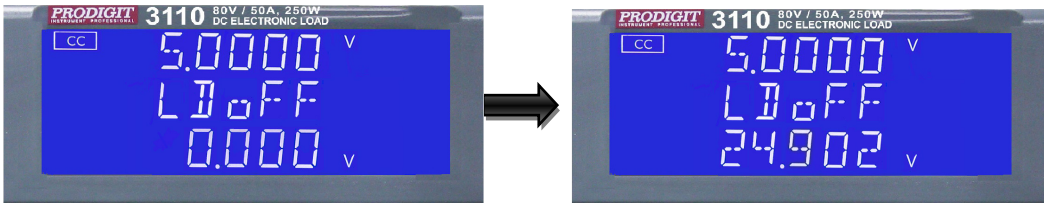
- Set Load ON voltage, the middle of the 5 digit LCD display will show "LDon", Lower 5 digit LCD display will show setting value, the units is V, The Load ON Voltage set range from 0.0V to 25.0V step 0.1V by rotating the setting knob. If the load is greater than the input voltage Load ON voltage setting, the Electronic load current begin to load on.



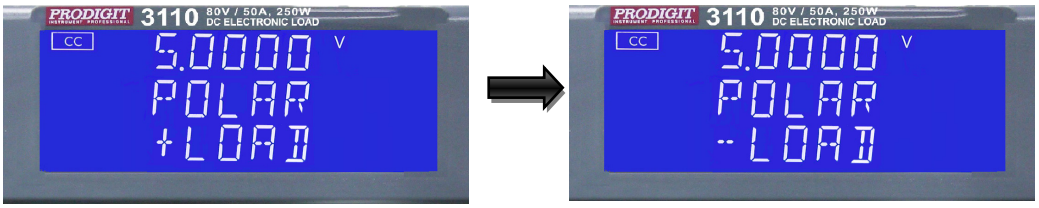
NOTE1: CC/CR/CP MODE is controlled by Load ON voltage, CV MODE is not Controlled by Load ON voltage.

NOTE2: If Load ON voltage Setting 0V, load OFF voltage has to setting to 0V.

- Setting Load OFF voltage, the middle of the 5 digit LCD display will show "LDoFF", lower the 5 digit LCD display will show settings value, the units is V, The Load OFF Voltage set range from 0.0V to 24.9V step 0.1V by rotating the Setting knob.
  If the load input voltage is less than Load OFF setting voltage, the electronic Load to load off.



- Set Load polarity, the middle of the 5 digit LCD display will show "POLAR", Lower the 5 digit LCD display "will show + LOAD" or "-LOAD", use the knobs And key settings "+ LOAD" or "-LOAD".

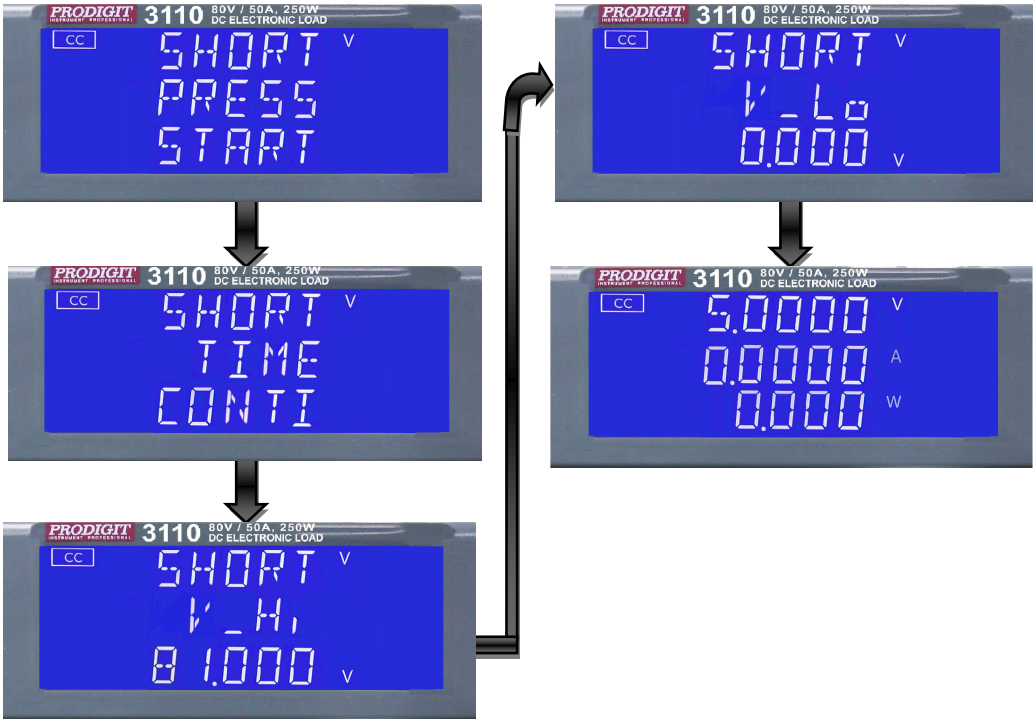


3.2.17. **Short** key

The SHORT key allows the parameters of a SHORT circuit test to be entered. The SHORT test will attempt to sink high current up to the 3110 load module's maximum current in order to check the power source's protection and behavior. The test time can be adjusted and threshold values for the
High and low voltage limits set.

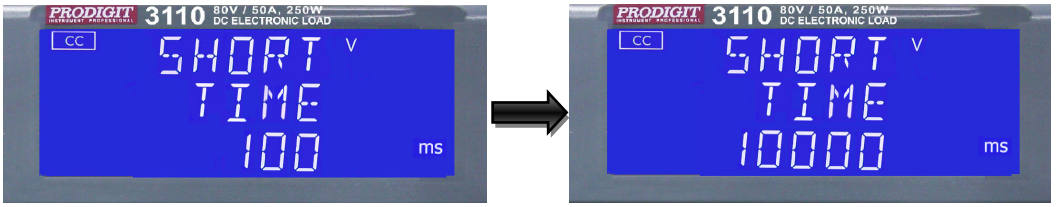
Pressing the SHORT key once will cause the button to illuminate. The Message "SHORT PRESS START" will be shown across the 3 displays.
Each press of the SHORT key moves the menu on one step. The upper and Middle LCDs show the currently selected test parameter as text. The value is adjusted by the rotary knob and can be read from the lower display during Setting.
The setting sequence is shown below:

SHORT PRESS START (pressing the red start/stop key starts test) →
SHORT TIME (CONTI = Continuous or 100ms to 10,000ms possible) →
SHORT V_Hi (High voltage threshold setting) →
SHORT V_Lo (Low voltage threshold setting →
Exit SHORT test set-up

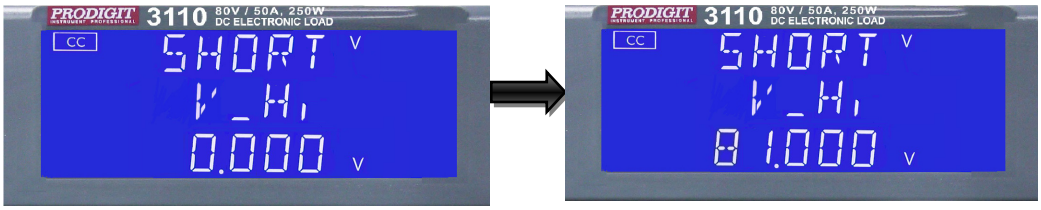


- setting the short test time，The LCD display show 「SHORT」 on upper 5 digits LCD display，shows 「TIME」on middle 5 digits LCD display，lower 5 digit LCD display 「CONTI」, the unit is "ms".

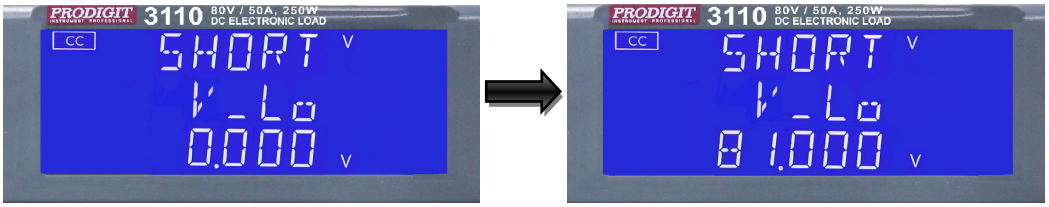
- TIME: setting the short test time, The LCD display show 「SHORT」 on upper 5 digits LCD display, shows 「TIME」on middle 5 digits LCD display the unit is “ms” ,and shows 「CONTI」 on lower 5 digits LCD display, the Setting range is “CONTI” means continue, 100mS to 10000mS step 100mS By clockwise rotate the setting knob.
  The short test will be no time limitation when setting to CONTI until press “START/STOP” key to stop the short test.



- V-Hi : Short test voltage check upper limitation setting, The LCD display shows 「SHORT」on upper 5 digit LCD display, Middle 5 digit LCD display 「V-Hi」,lower 5 digit LCD display setting value, the unit is "V", The V-Hi setting range from 0.000V to 81.000V step 0.001V by rotating the setting knob.



- V-Lo : Short test voltage check lower limitation setting, The LCD display shows 「SHORT」on upper 5 digit LCD display, Middle 5 digit LCD display 「V-Lo」,lower 5 digit LCD display setting value, the unit is "V", the V-Hi setting range from 0.000V to 81.000V step 0.001V by rotating the setting knob.



Once the test parameters have been entered the test is started by pressing The red START/STOP button while the SHORT PRESS START text is Displayed. During the test the bottom LCD will show run and the actual short Current will be displayed on the middle LCD.

Note 1: The message PASS END will be displayed if the measured voltage levels Stays within the V_Hi and V_Lo threshold levels during the test

Note 2: The message FAIL END will be displayed if the measured voltage levels falls outside the V_Hi and V_Lo threshold levels during the test. The NG flag will also illuminate.

Note 3: If continuous short time is selected the test is ended by pressing the red START/STOP button.

3.2.18. OCP key

The OCP key allows the parameters of an Over Current Protection test to be entered. The OCP test will ramp up the load current in steps to validate the Device Under test's (DUT) protection and behavior. A voltage threshold level can be set. If the voltage measured during the test is lower than the set Threshold voltage then the test will fail and the display will signal OCP ERROR. Similarly a current Threshold (I STOP) can be set. If the measured

Current reaches the I STOP Threshold the test will be discontinued and the OCP ERROR message will be displayed.

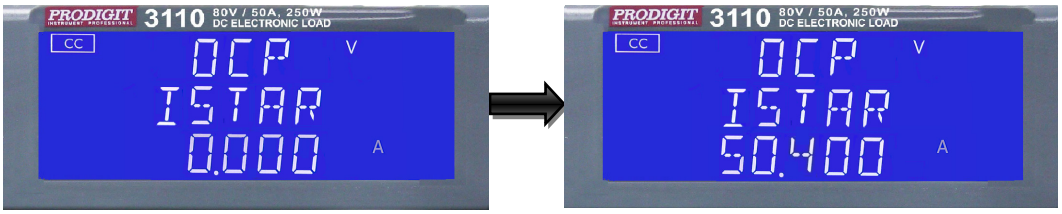
Pressing the OCP key once will cause the button to illuminate. The message "OCP PRESS START" will be shown across the 3 displays.

Each press of the OCP button moves the menu on one step. The upper and Middle LCDs show the currently selected test parameter as text. The value is adjusted by the rotary knob and can be read from the lower display during Setting.

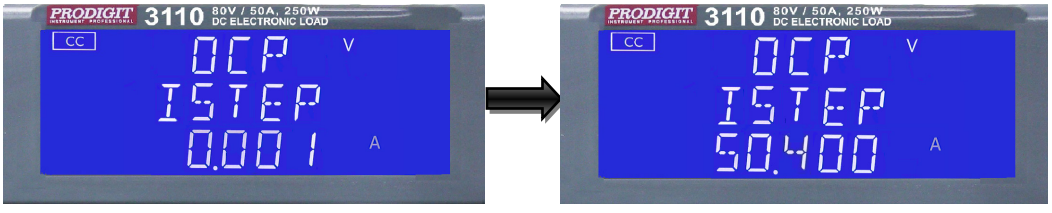
The setting sequence is shown below:

OCP PRESS START (pressing the red start/stop key starts test) →
OCP I STAR (current starting point of the OCP test) →
OCP I STEP (value of incremental current steps from I START) →
OCP I STOP (the OCP test's upper current threshold →
OCP Vth (the voltage threshold setting) →
Exit OCP test set-up

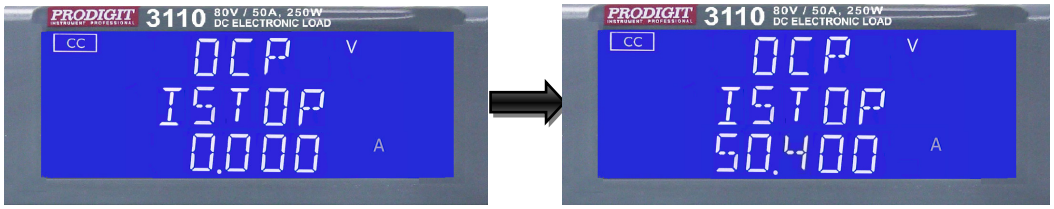
- ISTAR: setting the start current point, The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「ISTAR」,lower 5 digit LCD display setting value, the unit is "A".
  The setting range is 0.000A to the full scale of the CC mode specification.
  The setting is by rotating the setting knob.



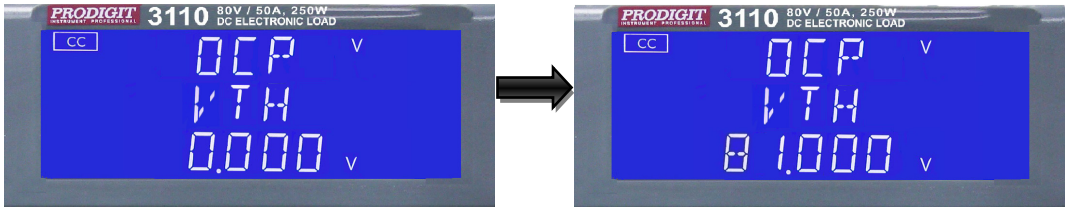
- ISTEP: setting the increment step current point, The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「ISTEP」,lower 5 digit LCD display setting value, the unit is "A".
  The setting range is 0.001A to the full scale of the CC mode specification.
  The setting is by rotating the setting knob.



- ISTOP: setting the stop current point, The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「ISTOP」,lower 5 digit LCD display setting value, the unit is "A", the setting range is 0.000A to the full scale of the CC mode specification. The setting is by rotating the setting knob.



- Vth: Setting threshold voltage; The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「Vth」,lower 5 digit LCD display setting value, the unit is "V", the setting range is 0.00V to the full scale of the Voltage specification. The setting is by rotating the setting knob.



Once the test parameters have been entered the test is started by pressing the red START/STOP button while the OCP PRESS START text is displayed. During the Test the middle LCD will show run and the actual current being Taken will be Displayed on the lower LCD

Note 1: The message OCP ERROR will be displayed if the DUT fails the test. The reasons for failure are due to one of the following conditions:

(a) the voltage level of the DUT falls below the set voltage threshold (OCP Vth) during the test
(b) The current taken from the DUT reaches the OCP I STOP setting.

Note 2: The message PASS will be displayed if the DUTs voltage stays above The set threshold. Also to PASS the OCP test the current taken from the DUT cannot equal the I STOP setting.

Note 3: If the DUT passes the OCP test the maximum current taken during the Test is displayed on the lower LCD.

Upon PASS or OCP ERROR the test will automatically stop. The red START/STOP button can be used during the test to immediately cease operation.

3.2.19. OPP key

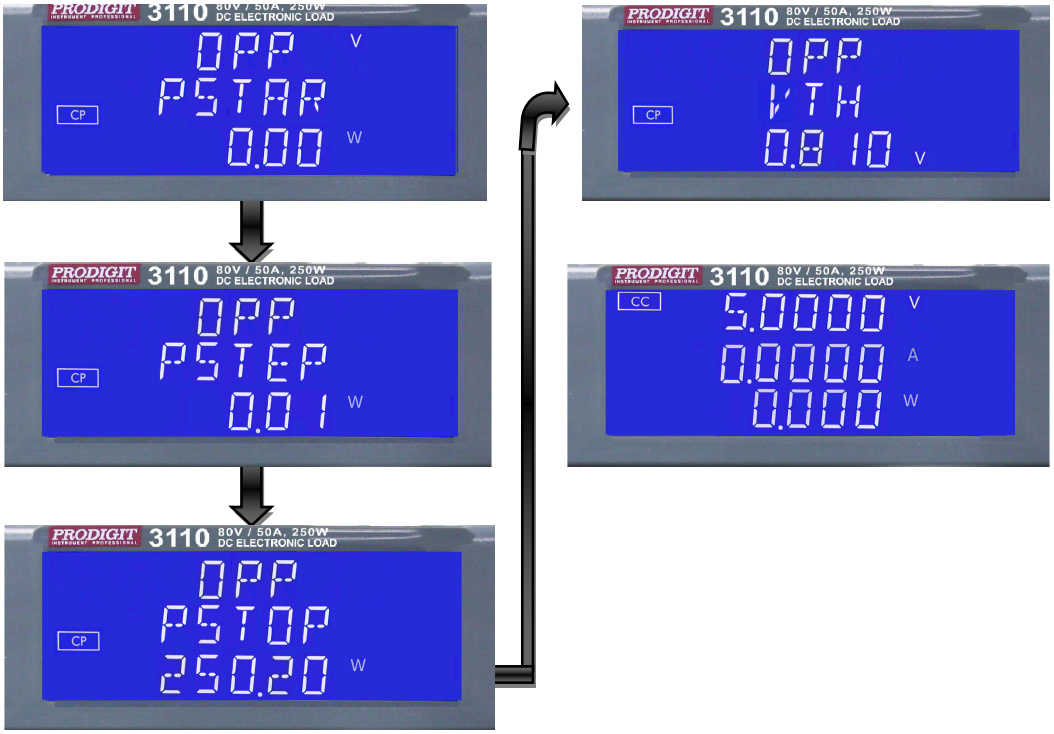
The OPP key allows the parameters of an Over Power Protection test to be entered. The OPP test will ramp up the load power in steps to validate the Device under Test's (DUT) protection and behavior. A voltage threshold level can be set. If the voltage measured during the test is lower than the set Threshold voltage then the test will fail and the display will signal OPP ERROR. Similarly a power threshold (P STOP) can be set. If the measured power reaches the P STOP threshold the test will be discontinued and the OPP ERROR message will be displayed.

Pressing the OPP key once will cause the button to illuminate. The message "OPP PRESS START" will be shown across the 3 displays.

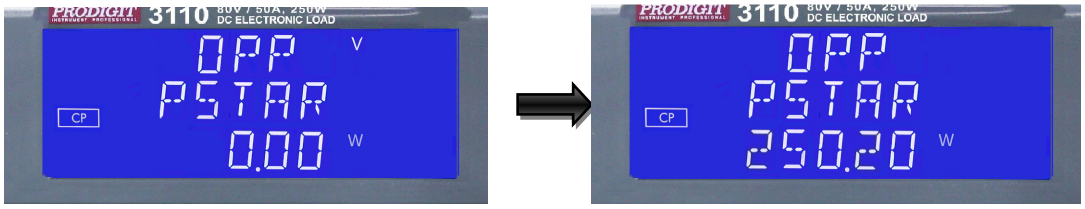
Each press of the OPP button moves the menu on one step. The upper and Middle LCDs show the currently selected test parameter as text. The value is adjusted by the rotary knob and can be read from the lower display during Setting.

The setting sequence is shown below:

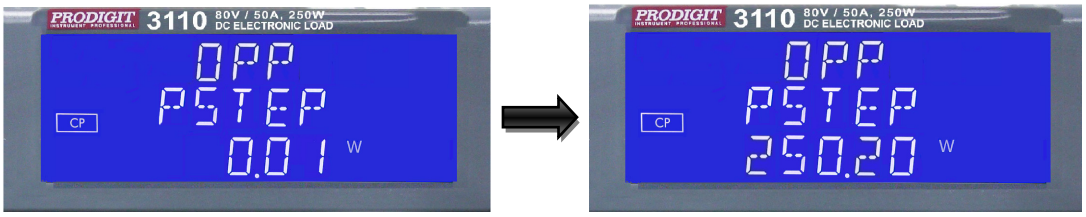
OPP PRESS START (pressing the red start/stop key starts test) →
OPP P STAR (power starting point of the OPP test) →
OPP P STEP (value of incremental current steps from P START) →
OPP P STOP (the OPP test's upper threshold power limit) →
OPP Vth (the voltage threshold setting) →
Exit OPP test set-up



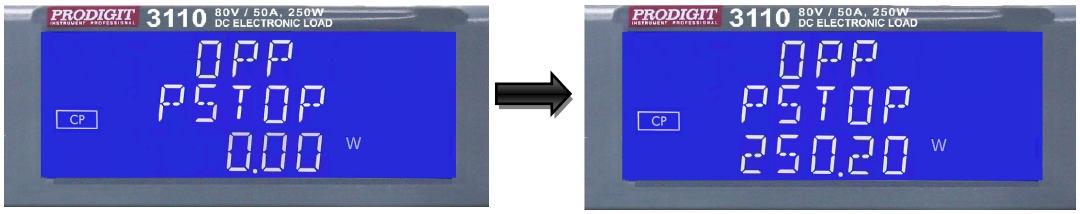
- PSTAR: setting the start power, The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「PSTAR」,lower 5 digit LCD display setting value, the unit is "W", the setting range is 0.00W to the full scale of the CP mode specification. The setting is by rotating the setting knob.



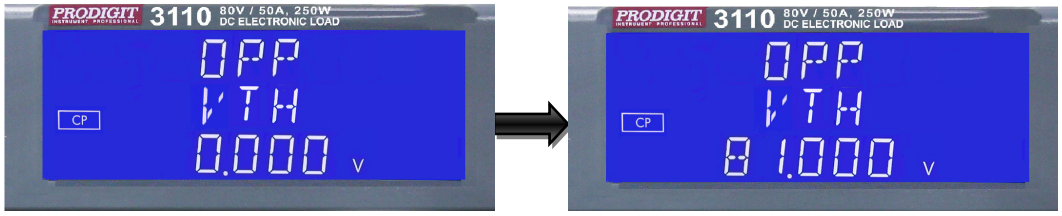
- PSTEP: setting the increment step power, The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「PSTEP」,lower 5 digit LCD display setting value, the unit is "W", the setting range is 0.00W to the full scale of the CP mode specification. The setting is by rotating the setting knob.



- PSTOP: setting the stop power, The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「PSTOP」,lower 5 digit LCD display setting value, the unit is "W", the setting range is 0.00W to the full scale of the CP mode specification. The setting is by rotating the setting knob.



- Vth : Setting threshold voltage; The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「Vth」,lower 5 digit LCD display setting value, the unit is "V", the setting range is 0.000V to the full scale of the Voltage specification. The setting is by rotating the setting knob.



Once the test parameters have been entered the test is started by pressing the red START/STOP button while the OPP PRESS START text is displayed. During the test the middle LCD will show run and the actual power being taken will be displayed on the lower LCD.

Note 1: The message OPP ERROR will be displayed if the DUT fails the test. The reasons for failure are due to one of the following conditions:

(a) The voltage level of the DUT falls below the set voltage threshold (OPP Vth) during the test
(b) The current taken from the DUT reaches the OPP P STOP setting.

Note 2: The message PASS will be displayed if the DUTs voltage stays above the set threshold. Also to PASS the OPP test the current taken from the DUT cannot equal the I STOP setting.

Note 3: If the DUT passes the OPP test the maximum power taken during the test is displayed on the lower LCD.

Upon PASS or OPP ERROR the test will automatically stop. The red START/STOP button can be used during the test to immediately cease operation.

3.2.20. 

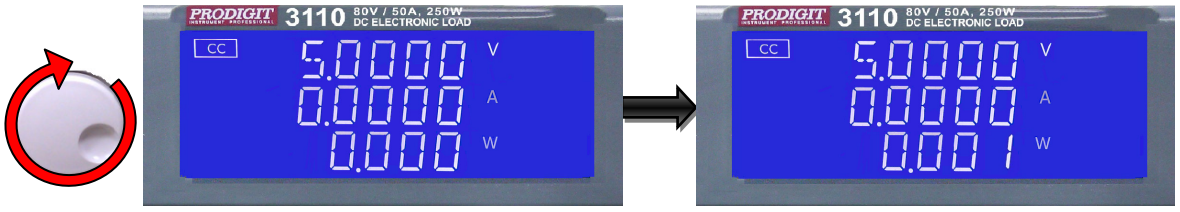
key

The red START/STOP key is used in conjunction with the FUSE, BMS, SHORT, OCP or OPP test functions. It is used to START a test according to the set parameters or to STOP a test before PASS or FAIL is signaled. Please refer to the preceding sections for more information on the FUSE, BMS, SHORT, OCP & OPP tests.

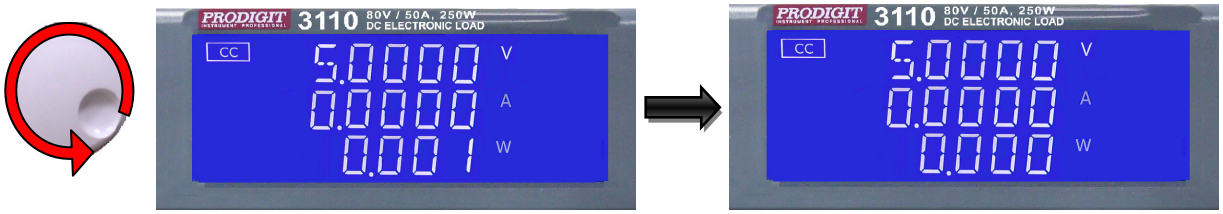
3.2.21. ROTARY Knob and ARROW Keys

The ROTARY knob and ARROW keys are used to increase or decrease the set values.

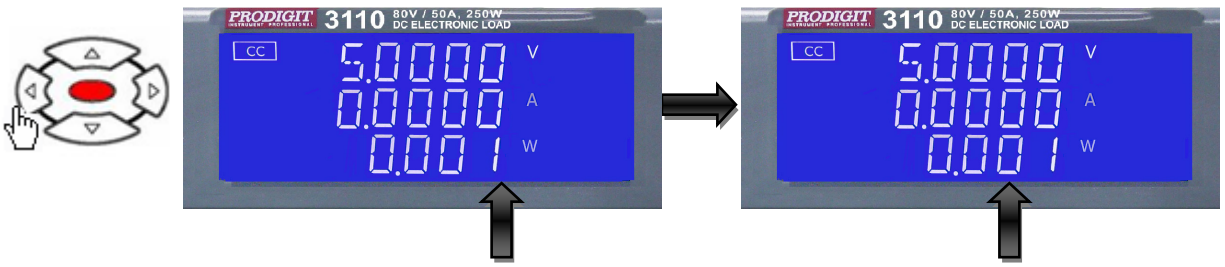
- CLOCKWISE operation of the ROTARY Knob increases the setting value.



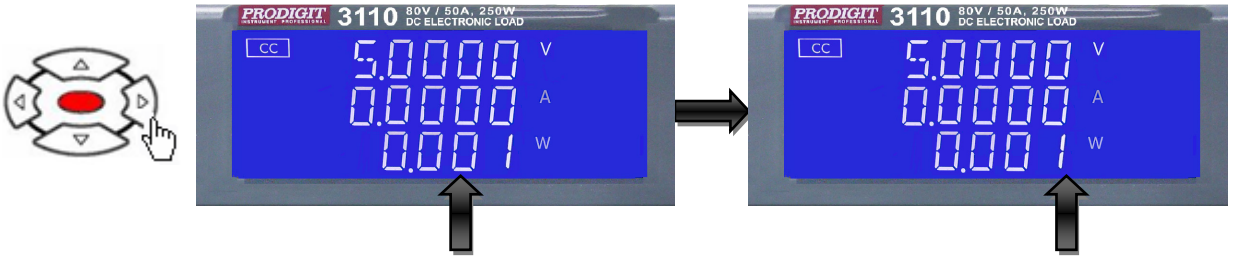
- ANTI-CLOCKWISE operation of the ROTARY Knob decreases the setting value.



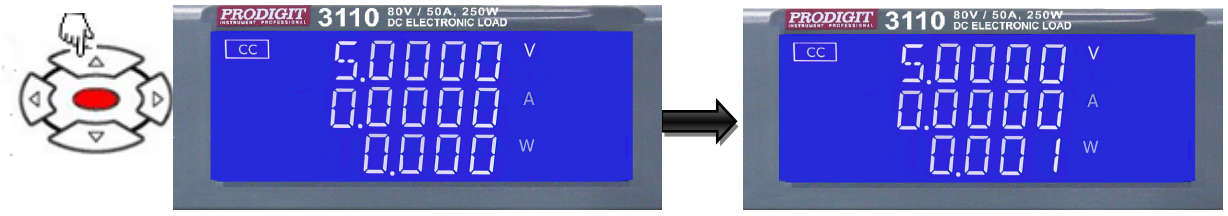
- LEFT ARROW key: Moves the setting selection one digit to the left.



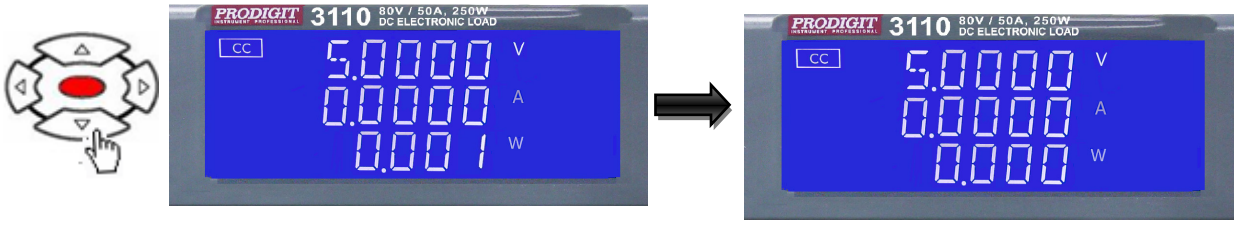
- RIGHT ARROW key moves the setting selection one digit to the right.



- UP ARROW key increases the setting value.



- DOWN ARROW key reduces the setting value.



Note 1: In CR MODE the UP ARROW key and CLOCKWISE operation of The ROTARY Knob reduces the resistance.

Note 2: In CR MODE the DOWN ARROW key & ANTI-CLOCKWISE Operation of the ROTARY Knob increases the resistance.

3.2.22. DC INPUT Terminal.

The positive (LOAD +) and negative (LOAD -) power input terminals are clearly marked. DO NOT confuse them with the smaller SENSE terminals.

Please ensure that the voltage and current rating of the DUT do not exceed the maximum rating of the 3110 load module being used. Please also check the output polarity of the DUT prior to connection and testing.

The negative load terminal should be connected to ground if testing a positive output power supply. This is normally achieved when the negative output of the power supply is grounded.

Similarly if a power supply with a negative output is to be tested then the positive load terminal should be grounded. This is normally achieved when the positive output of the power supply under test is grounded.

3.2.23. V-sense input terminal

The V-sense terminals can be used to compensate for a voltage drop in the load lines between the power supply and the 3110 series Electronic Load. This is a useful feature useful when the load current is relatively high.

If remote sense is required the V-sense terminals are connected to the appropriate positive and negative terminals of the power supply as shown in Fig 3-2.

In the CONFIG menu the V-sense function can be set to AUTO or ON.

Please note that if V-sense is set to AUTO and the sense leads are connected to the DUT the losses need to be approx. 1V (3110, 3111,3117) or 6V (3114 & 3119) before the display compensates for the voltage loss.

If V-sense is set to 'ON' and the sense terminals are connected to the DUT the load will check and compensate for all voltage drops.

The maximum voltage sense compensation is the same as the rating of the 3110 series electronic load module. For example the 3110 is capable of sinking current at up to 80Vdc. Therefore the maximum V-sense is also 80Vdc.

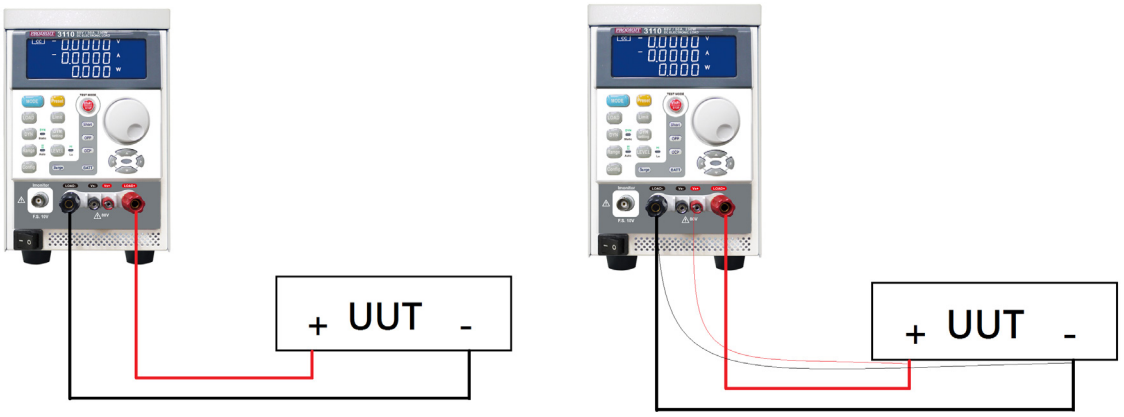


Fig 3-2 typical connection of 3110 series load module

3.2.24. I-monitor

The I-monitor is provided as a BNC socket. It is designed to enable the user to Monitor the Electronic Load's input current or short current. The I-monitor's signal Is 0V to 10V. This signal is proportional to the full scale current that the particular Electronic Load module is capable of.

For example. 3110: Imax = 50A therefore I-monitor 10V = 50A so 1V = 5A

Please refer to the specification Table 1-1 for the maximum current that each 3110 series module is capable of.

CAUTION

The current monitor of this unit is NOT isolated. Please be careful when you connect an oscilloscope. Improper connections are likely to cause damage. Please follow the connection rule on the following page.

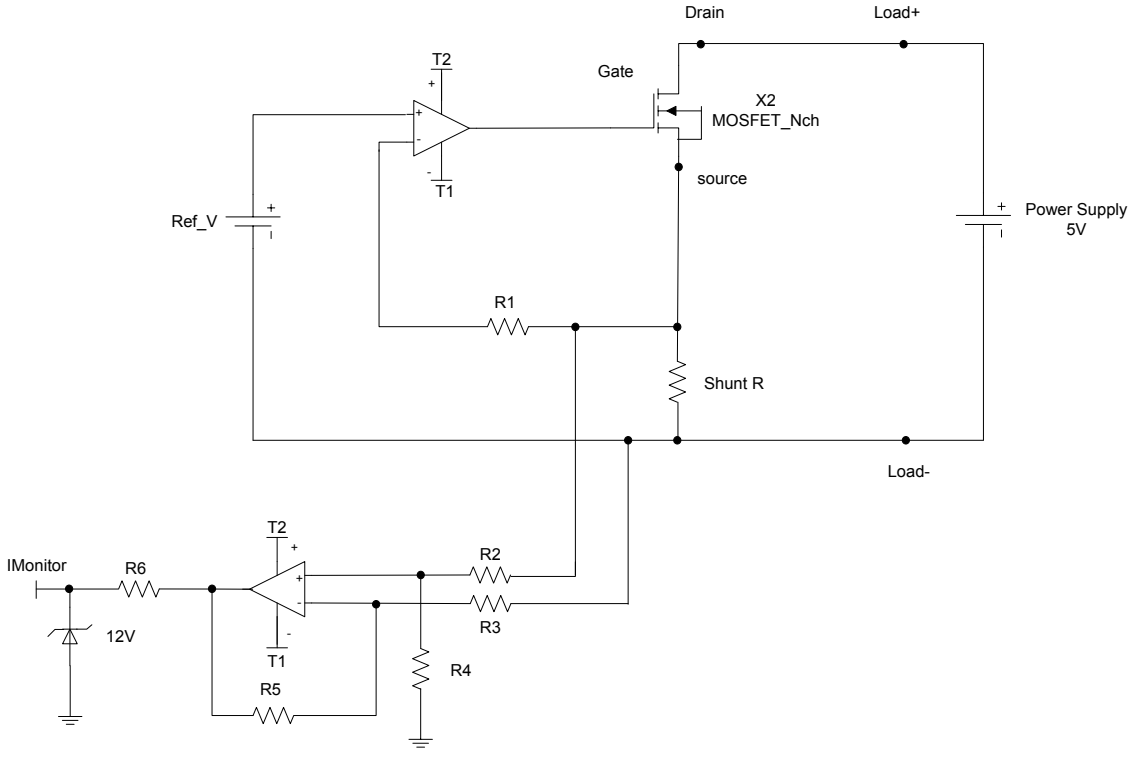


Fig 3-3 An equivalent circuit in terms of the current monitor

Connecting the I-monitor to an oscilloscope

When you connect this product to an oscilloscope, please ensure the correct polarities of the connecting probes as shown in Fig. 3-4.

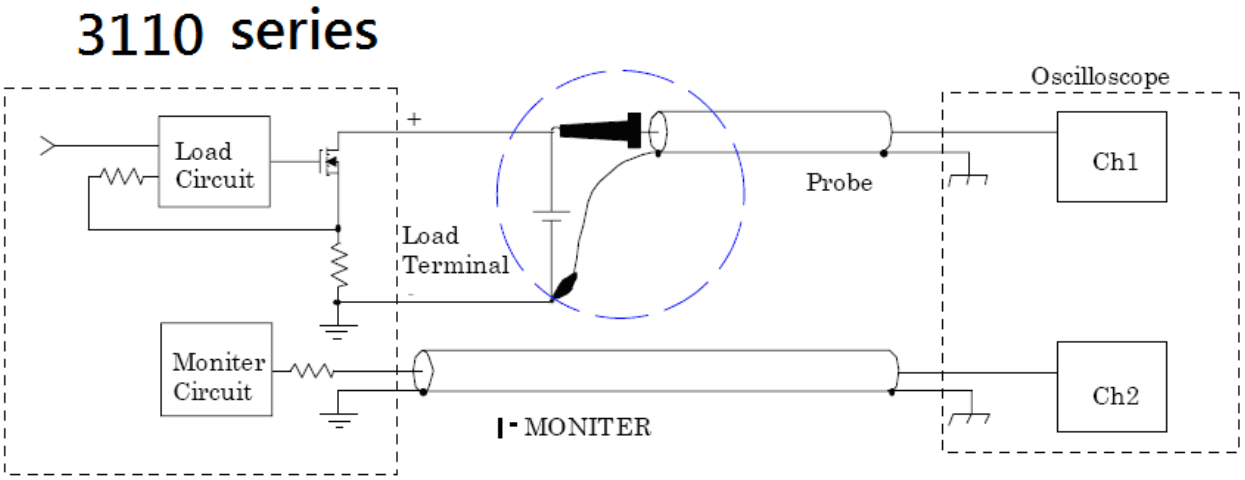


Fig 3-4 (Correct) Connections to an oscilloscope

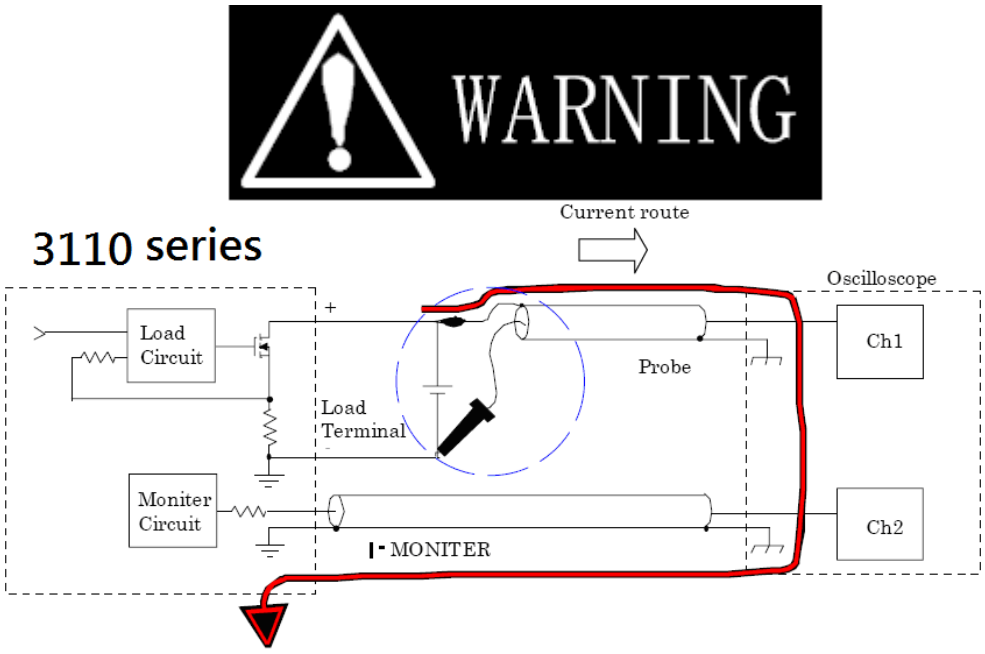


Fig 3-5 (Wrong) Connections to an oscilloscope

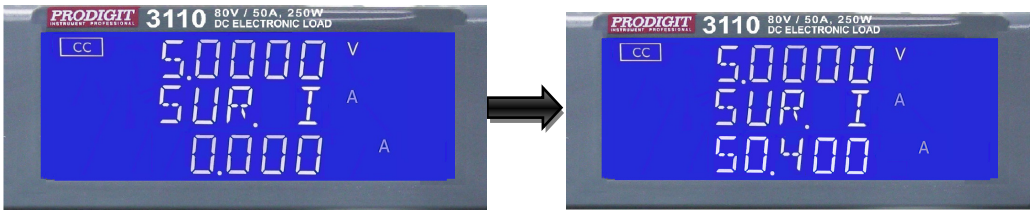
If the probes connection is reversed as shown in Fig 3-5, a large current would flow through the probe and the internal circuitry of the oscilloscope is likely to be damaged.

3.2.25. SURGE KEY

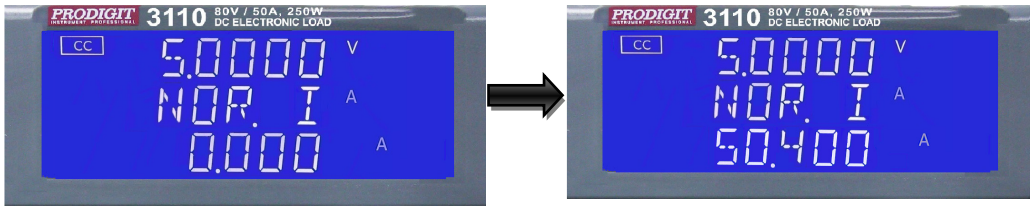
Press the SURGE button to enter the SURGE setting mode. The LED indicator is ON and its setting sequence is as follows:

➔ SUR._I →
➔ NOR._I →
➔ S.TIME →
➔ S.STEP →

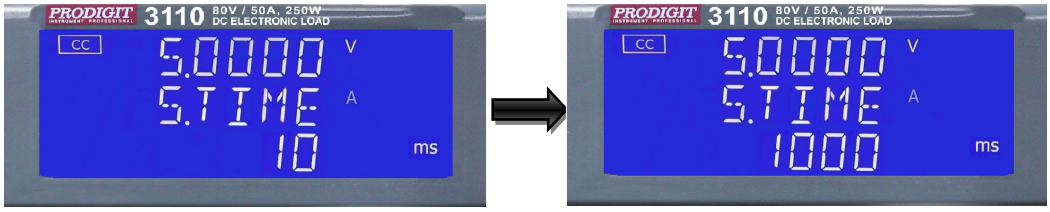
- Setting Surge current, Middle 5 digit LCD display will show 「SUR_I」, Lower 5 Digit LCD display will show setting value, the unit is "A", the surge current set range from 0.000 A to 50.400A step 0.005A by rotating the setting knob.



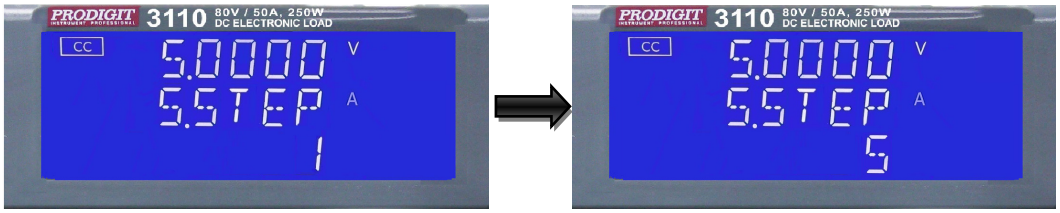
- Setting normal current, Middle 5 digit LCD display will show 「NOR_I」, Lower 5 Digit LCD display will show setting value, the unit is "A", The Normal current set range from 0.000 A to 50.400A step 0.005A by rotating the setting knob.



- Setting S.TIME, Middle 5 digit LCD display will show 「S.TIME」, Lower 5 Digit LCD display will show setting value, the unit is "ms", the surge current time set range from 10 to 1000ms step 10ms by rotating the setting knob.



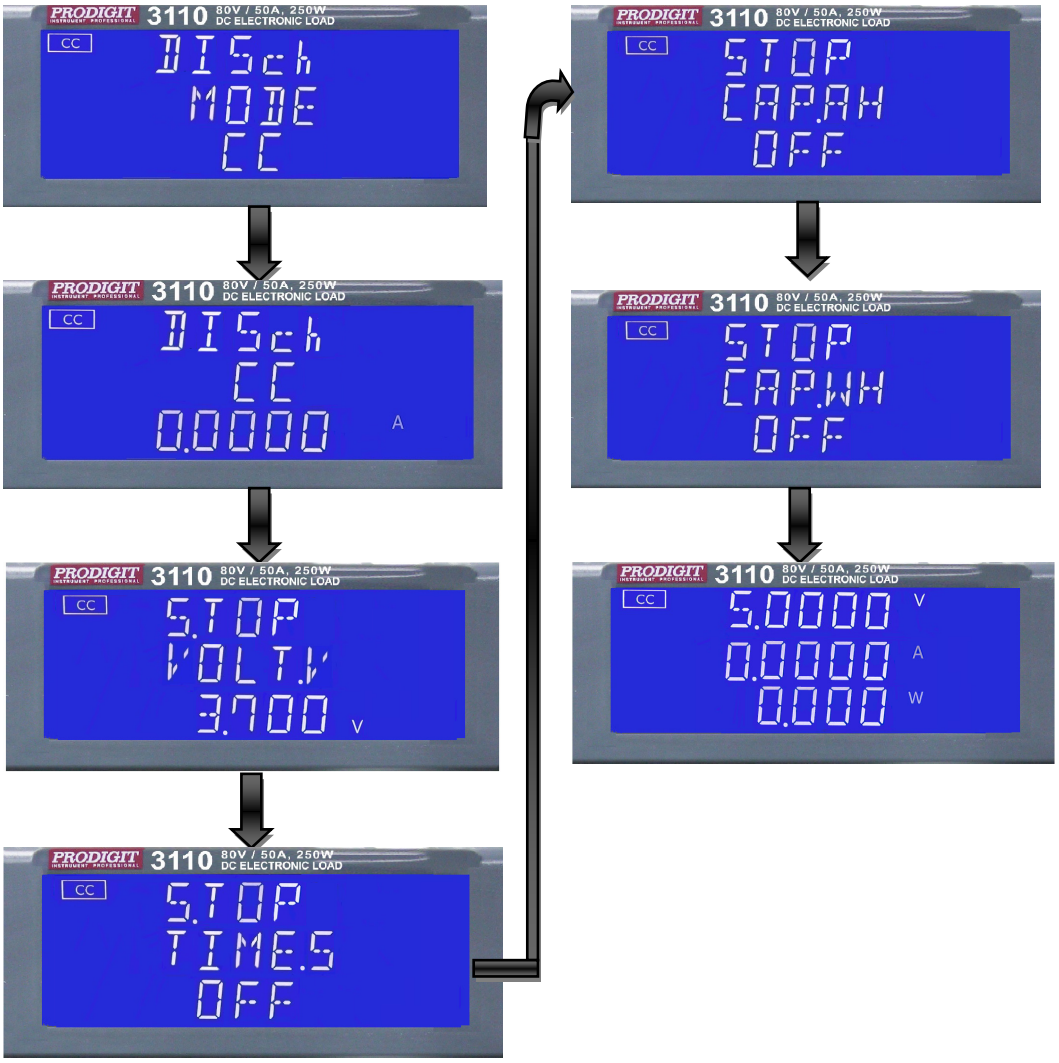
- Setting S.STEP, Middle 5 digit LCD display will show 「S.STEP」, Lower 5 Digit LCD display will show setting value, the S.STEP set range from 1 to 5, Press the START key to start the test.



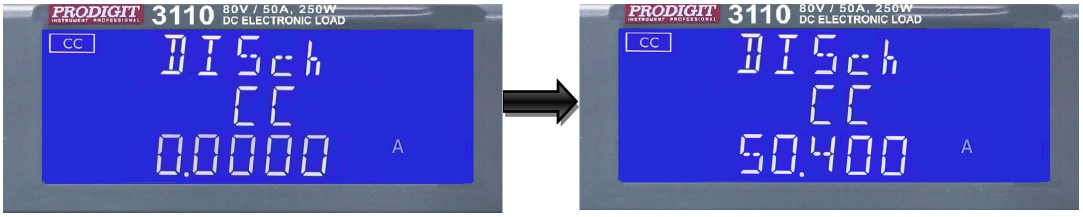
3.2.26. BATT KEY

Press the BATT key to enter the BATT setting mode, the LED indicator is ON, and The setting sequence is as follows:

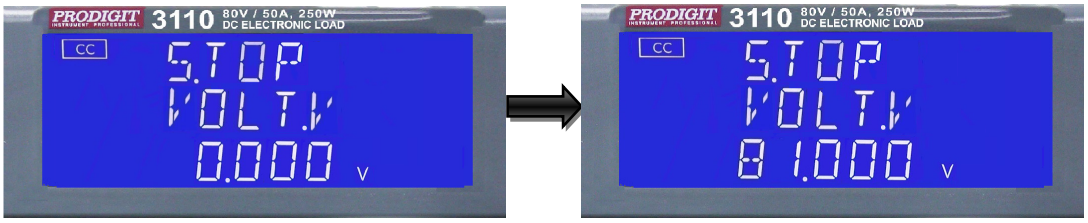
➔ DISCH MODE CC
➔ DISCH CC
➔ STOP VOLT.V
➔ STOP TIME.S
➔ STOP CAP.AH
➔ STOP CAP.WH



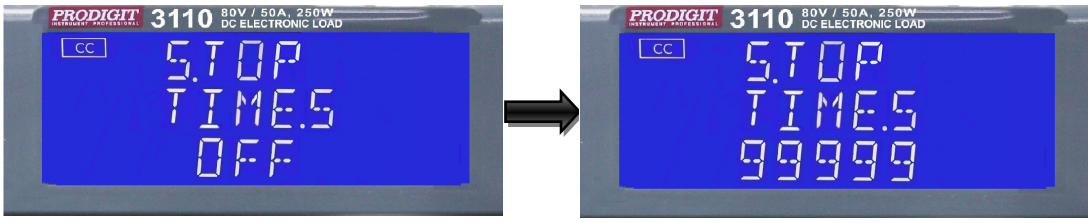
- Set DISCH CC, LCD displays “DISCH”, the middle 5 digit monitor display “CC”, the setting range is from 0.000A to 50.400A, and the setting interval of each setting knob and key is 0.0001A.



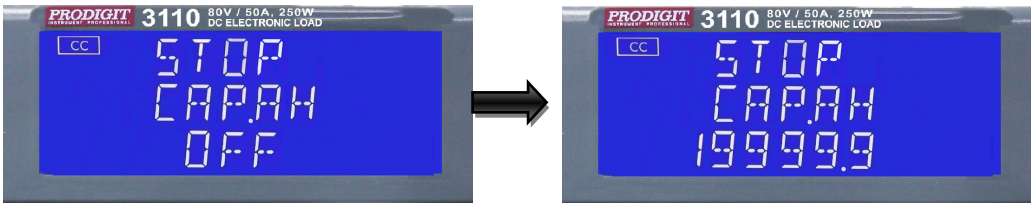
- Set STOP VOLT.V, the middle 5 digit monitor display “VOLT.V”, the lower 5 digit display shows the set value, the unit is V, STOP VOLT.V The setting Range is from 0.000V to 81.000V, each setting knob and key adjustment The interval is 0.001V.



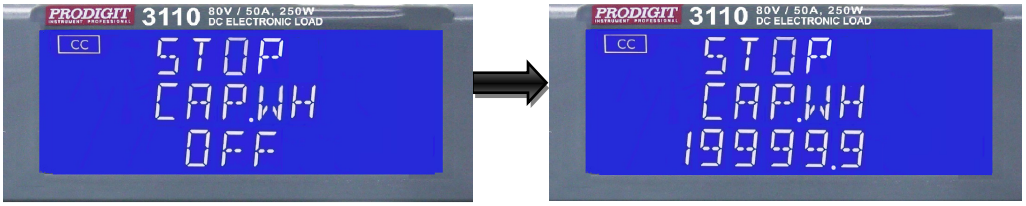
- Set STOP TIME.S, the middle 5 digit monitor display will display “TIME.S”, The lower 5 digit display will display the set value, and the STOP TIME.S Setting range will be from OFF to 99999. The setting interval of each setting Knob and key is 1.



- Set STOP CAP.AH, the middle 5 digit monitor display “CAP.AH”, the lower 5 digit monitor display the set value, the STOP CAP.AH setting range is from OFF to 19999.9, and the setting interval of each setting knob and key is 0.1.



- Set STOP CAP.WH, the middle 5 digit monitor display “CAP.WH”, the lower 5-digit monitor display the set value, the STOP CAP.WH setting range is from OFF to 19999.9, and the setting interval of each setting knob and key is 0.1.



3-3. Initial setting of 3110 series load module

The following tables detail the initial settings of the 3110 series of Load Modules when Shipped from the factory.

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	81.000 V
CC H+Preset		0.0000 A		V_Lo	0.000 V
CR H+Preset		96000 Ω		I_Hi	50.400 A
CR L+Preset		96000 Ω		I_Lo	0.000 A
CV H+Preset		81.000 V		W_Hi	250.20 W
CV L+Preset		81.000 V		W_Lo	0.00 W
CP L+Preset		0.000 W	CONFIG	SENSE	Auto
CP H+Preset		0.000 W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	200.0 mA/uS	SHORT		Disable
	FALL	200.0 mA/uS	OPP		Disable
			OCP		Disable

Table 3-1 3110 initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	81.000 V
CC H+Preset		0.0000 A		V_Lo	0.000 V
CR H+Preset		68400 Ω		I_Hi	70.200 A
CR L+Preset		68400 Ω		I_Lo	0.00 A
CV H+Preset		81.000 V		W_Hi	350.40 W
CV L+Preset		81.000 V		W_Lo	0.00 W
CP L+Preset		0.000 W	CONFIG	SENSE	Auto
CP H+Preset		0.000 W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	290.0 mA/uS	SHORT		Disable
	FALL	290.0 mA/uS	OPP		Disable
			OCP		Disable

Table 3-2 3111 initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.00000 A	LIMIT	V_Hi	500.00 V
CC H+Preset		0.00000 A		V_Lo	0.00 V
CR H+Preset		2400000 Ω		I_Hi	15.0000 A
CR L+Preset		2400000 Ω		I_Lo	0.0000 A
CV H+Preset		500.00 V		W_Hi	350.40 W
CV L+Preset		500.00 V		W_Lo	0.00 W
CP L+Preset		0.000 W	CONFIG	SENSE	Auto
CP H+Preset		0.000 W		LD-ON	2.0 V
DYN	T HI	0.050 mS		LD-OFF	0.50 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	62.5 mA/uS	SHORT		Disable
	FALL	62.5 mA/uS	OPP		Disable
			OCP		Disable

Table 3-3 3114 initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	81.000 V
CC H+Preset		0.0000 A		V_Lo	0.000 V
CR H+Preset		34200 Ω		I_Hi	140.400 A
CR L+Preset		34200 Ω		I_Lo	0.000 A
CV H+Preset		81.000 V		W_Hi	700.20 W
CV L+Preset		81.000 V		W_Lo	0.00 W
CP L+Preset		0.000 W	CONFIG	SENSE	Auto
CP H+Preset		0.000 W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	600.0 mA/uS	SHORT		Disable
	FALL	600.0 mA/uS	OPP		Disable
			OCP		Disable

Table 3-4 3117 initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	500.00 V
CC H+Preset		0.0000 A		V_Lo	0.000 V
CR H+Preset		1200000 Ω		I_Hi	30.000 A
CR L+Preset		1200000 Ω		I_Lo	0.000 A
CV H+Preset		500.00 V		W_Hi	700.20 W
CV L+Preset		500.00 V		W_Lo	0.00 W
CP L+Preset		0.000 W	CONFIG	SENSE	Auto
CP H+Preset		0.000 W		LD-ON	2.0 V
DYN	T HI	0.050 mS		LD-OFF	0.50 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	1250.0 mA/uS	SHORT		Disable
	FALL	1250.0 mA/uS	OPP		Disable
			OCP		Disable

Table 3-5 3119 initialize

3-4. Input terminal and wire consideration

The Load input terminals are rated at 70A. Please note that the banana plug and spade/hook connectors provided in the accessory pack have a current rating of 20A. Please be sure to use the correct connection method if sinking high currents. There are five ways to connect the Device under Test (DUT) to the Electronic Load as detailed below.

3.4.1 Plug connectors: This is the most popular way to connect the input of electronic load to the device under test. It is recommended that the load current is less than 20A to keep within the current rating of the plug. A maximum wire gauge of AWG14 can be used in this application.

3.4.2 Spade/Hook terminals: The spade terminals provide a good contact to the binding posts. The spade terminals provided in the accessory pack are rated at 20A. The maximum wire gauge of AWG10 can be used for this connection method.

3.4.3 Insert the wire into the input terminal: Unscrewing the binding post will reveal a hole. The wire from the output of the DUT can be pushed into this hole and the binding post tightened to clamp the wire. The Maximum wire gauge is AWG14.

3.4.4 Both plug connectors and spade terminals:
It is recommended to use this method when input current is greater than 20A or if long load wires are used between the DUT and the load module.

3.4.5 Both plug connectors and Insert the wire into the input terminal.
It is recommended to use this method when the input current is greater than 20A or long wires are needed to connect the DUT to the load module.

A major consideration in making the input connection is the wire size. The minimum wire size is required to prevent overheating and to maintain good regulation. It is recommended that the wires should be large enough to limit the voltage drop to less than 0.5V per lead.

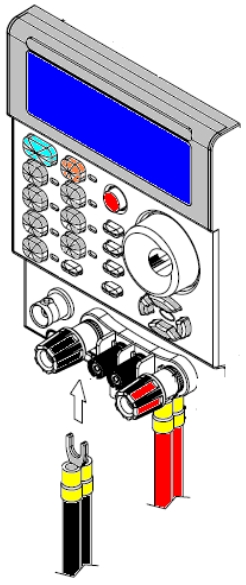


Fig 3-6 Hook Terminal Y type large size terminal connections

3.4.6 Wire/Cable Guide

The following table provides a guide to the current carrying capability (ampacity) of Both Metric and AWG sizes. Metric sizes are expressed as a cross sectional areas (CSA). If in any doubt of a cables ampacity it is recommended that you ask your Cable supplier.

Wire Size AWG	Ampacity (A)	CSA (mm^2)	Notes: Ratings for AWG-sized wires derived from MIL-W-5088B. Ratings for metric-sized wires derived from IEC Publication
			Ampacity of aluminium wire is approximately 84% of
22	5.0	-----	that listed for copper wire.
20	8.33	-----	
---	10	0.75	When two or more wires are bundled together,
18	15.4	-----	ampacity for each wire must be reduced to the
---	13.5	1	following percentages:
16		------	
---	16	1.5	2 conductors 94%
14	31.2	-------	3 conductors 89%
---	25	2.5	4 conductors 83%
12	40	-------	5 conductors 76%
---	32	4	
10	55	------	
---	40	6	4. Maximum temperatures:
8	75	------	Ambient = 50° C
---	63	10	Conductor = 105° C
6	100	------	
4	135	------	

Table 3-6 Stranded Copper Wire Ampere Capacity

3-5. . Protection features

The protection features of the 3110 series Electronic load modules are as follows:

3.5.1. **Overvoltage protection:** The Electronic Load input will turn OFF if the overvoltage circuit is tripped. The message OVP will be displayed on the LCD. When the OVP fault has been removed the load can be set to sink power again. While the unit will attempt to protect itself given an OVP state it is strongly advised to guard against any potential OVP fault state by using external protection and the correctly rated electronic load.

The Overvoltage protection circuit is set at a predetermined voltage and cannot be adjusted. The OVP level is 105% of the 3110 nominal voltage rating.

CAUTION: Never apply an AC voltage to the input of the 3110 series Load. Do not apply a DC voltage that is higher than 3110 Load Module's rating. If this advice is ignored it is likely that damage will be caused to the electronic load module. This damage will not be covered by the warranty.

3.5.2. Over current protection (OCP): The OCP protection will engage if the current being taken by the load reaches 105% of the load module's maximum current. The message OCP will be displayed on the front panel and the unit will switch to its

LOAD OFF state. Once the source of the over current has been removed the load can be switched on again.

3.5.3. Over power protection (OPP): The 3110 series Electronic Load monitors the power dissipation level. The input to the load is automatically switched to LOAD OFF if the power dissipation is greater than 105% of the rated power input. If an over power condition occurs the display will show OPP

3.5.4. Over temperature protection (OTP): The load module's internal temperature at the heat sink is monitored. If the temperature reaches approximately 90°C the OTP message will be displayed and the unit will automatically switch to the LOAD OFF state. If an OTP error occurs please check the ambient temperature is between 0 to 40°C. Also ensure that the front and rear air vents of the mainframe are not obstructed. The air flow is taken from the front of the mainframe and exhausted from the rear. Therefore a suitable gap needs to be left at the rear of the mainframe. A minimum of 15cm is recommended. After a suitable cooling period the load can be switched.

3.5.5. Reverse Polarity: The 3110 series load module will tolerate a reverse current up to the maximum current rating of the load module. The '-'symbol will be shown on the voltage and current displays.

Please note that damage will occur if the reverse current is higher than the load module's maximum rating. If a reverse current is noticed turn off and disconnect the dc power source and turn the load off. The connections between the DC Source and the Load Module can now be correctly made.

If a reverse polarity situation occurs the load will sink power even if the LOAD button is OFF. No current will be displayed on the 3110 series load module. Current up to the load's maximum current rating will be tolerated in reverse polarity. However there is no OVP OCP and OPP protection. It is strongly recommended that the load lines be fused if it is likely that the load could be subject to reverse polarity. These fuses should be fast acting and rated at the maximum current of the load module +5%.

Chapter 4 Communication Interface programming operation

4-1. Introduction

If your unit is fitted with a computer interface option then a RS232, USB socket will be present on the rear panel according to what was ordered. The interface allows the load settings to be configured remotely and measurements read back.

There are two sets of programming terms for the 3110 series. One is referred to as the SIMPLE format and the other is COMPLEX format.

4-2. RS232 Set-up

The RS232 interface of the 3110 set up as follows.

Baud-rate	:115200bps
Parity	:None
Data bit	:8 bits
Stop bit	:1 bit
Handshaking	: Hardware (RTS/CTS).

The RS232 Interface connector of 3110 series rear panel, RS232 is shown in Fig4-1.

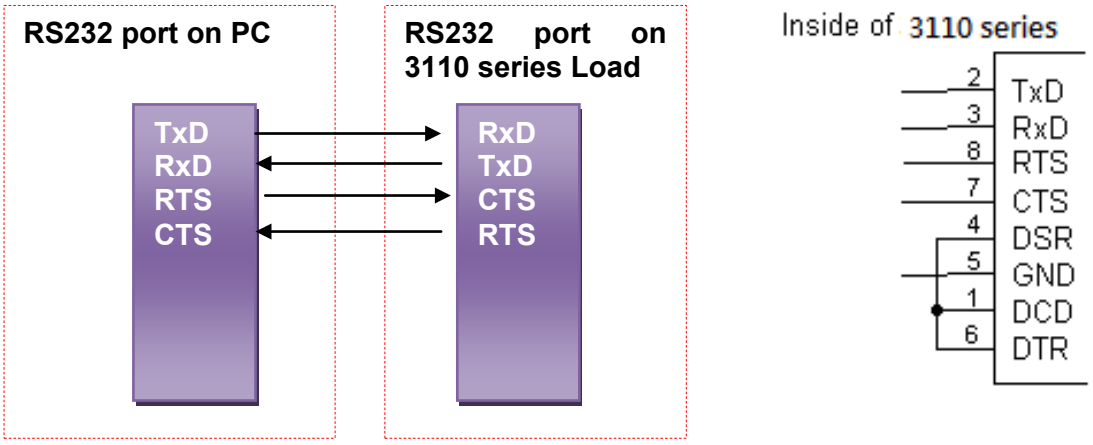
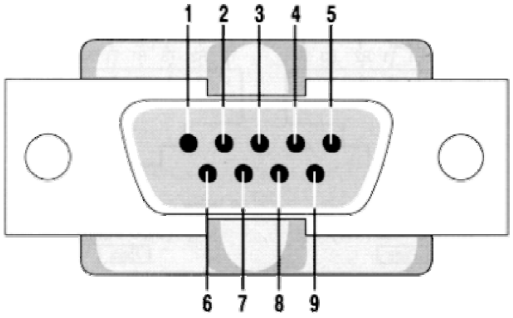


FIG 4-1 RS232 INTERFACE CONNECTION OF REAR PANEL



PIN	Abbreviation	Description
Pin1	CD	Carrier Detect
Pin2	RXD	Receive
Pin3	TXD	Transmit
Pin4	DTR	Data Terminal Ready
Pin5	GND	Ground
Pin6	DSR	Data Set Ready
Pin7	RTS	Request To Send
Pin8	CTS	Clear To Send
Pin9	RI	Ring Indicator

PC RS232 Port

4-3. 3110 series Communication Interface programming command list 1

SIMPLE TYPE FORMAT

SETTING PRESET NUMERIC COMMAND	note
RISE{SP} {NR2} {; | NL}	A/us
FALL{SP} {; | NL}	A/us
PERD:{HIGH | LOW} {SP} {NR2}{;|NL}	
LDONV{SP} {NR2}{;|NL}	
LDOFFV{SP} {NR2}{;|NL}	
CC | CURR:{HIGH | LOW} {SP} {NR2}{;|NL}	
CP:{HIGH | LOW} {SP} {NR2}{;|NL}	
CR | RES:{HIGH | LOW} {SP} {NR2}{;|NL}	
CV | VOLT:{HIGH | LOW} {SP} {NR2}{;|NL}	
TCONFIG {SP} {NORMAL|OCP | OPP | SHORT }{;|NL}	
OCP:START {SP} {NR2}{;|NL}	
OCP:STEP {SP} {NR2}{;|NL}	
OCP:STOP {SP} {NR2}{;|NL}	
VTH {SP} {NR2}{;|NL}	
OPP:START {SP} {NR2}{;|NL}	
OPP:STEP {SP} {NR2}{;|NL}	
OPP:STOP {SP} {NR2}{;|NL}	
STIME {SP} {NR2}{;|NL}	
BATT:UVP{SP}{NR2}{;|NL}	unit:V
BATT:TIME{SP}{n}{;|NL}	n= 1~99999sec
BATT:TEST {SP} {ON|OFF}{;|NL}	ON: Start test, OFF: Stop test
TESTING {?}{;|NL}	0:TEST END,1:TESTING
BATT:AH{SP}{NR2){;|NL}	
BATT:WH{SP}{NR2){;|NL}	
SURGE: SURI{SP} {NR2}{; |NL}	
SURGE: NORI{SP} {NR2}{; |NL}	
SURGE: TIME{SP} {NR2}{; |NL}	SURGE TIME:10~1000ms
SURGE: STEP{n} {;|NL}	n=1~5
SURGE {ON|OFF}{;|NL}	:ON:RUN SURGE,OFF:STOP

Table 4-1 Communication Interface programming Setting command summary

詢問預置數值命令	備註
RISE{?} {;|NL}	###.####
FALL{?}{;|NL}	###.####
PERI| PERD : {HIGH|LOW}{?} {;|NL}	###.####
LDONv {?}{;|NL}	###.####
LDOFfv {?}{;|NL}	###.####
CC| CURR : {HIGH|LOW} {?} {;|NL}	###.####
CP: {HIGH|LOW} {?} {;|NL}	###.####
CR| RES:{HIGH|LOW} {?} {;|NL}	###.####
CV| VOLT : {HIGH|LOW} {?} {;|NL}	###.####
TCONFIG {?}{;|NL}	1:NORMAL
	2:OCP
	3:OPP
	4:SHORT
OCP: START {?} {;|NL}	###.####
OCP: STEP {?}{;|NL}	###.####
OCP: STOP {?}{;|NL}	###.####
VTH {?}{;|NL}	###.####
OPP: START {?} {;|NL}	###.####
OPP: STEP {?}{;|NL}	###.####
OPP: STOP {?}{;|NL}	###.####
STIME {?}{;|NL}	###.####
OCP {?}{;|NL}	###.####
OPP {?}{;|NL}	###.####
BATT: AH? {;|NL}	
BATT: WH? {;|NL}	
BATT:RTIME? {;|NL}	
BATT:TIME? {;|NL}	
BATT:RAH? {;|NL}	
BATT:RWH? {;|NL}	
BATT:RVOLT? {;|NL}	
SURGE: SURI {?}{; |NL}	
SURGE: NORI {?}{; |NL}	
SURGE: TIME {?}{; |NL}	
SURGE: STEP {?} {;|NL}	

Table 4-2 Communication Interface programming query command summary

LIMIT COMMAND	note
IH|IL{SP}{NR2}{;|NL}	
IH|IL {?}{;|NL}	
WH|WL{SP}{NR2}{;|NL}	
WH|WL {?}{;|NL}	###.####
VH|VL{SP}{NR2}{;|NL}	
VH|VL {?}{;|NL}	###.####
SVH|SVL{SP}{NR2}{;|NL}	
SVH|SVL {?}{;|NL}	###.####

Table 4-3 Communication Interface programming limit command summary

STAGE COMMAND	note
LOAD {SP}{ON | OFF} {; | NL}	
LOAD {?} {;|NL}	0:OFF 1:ON
MODE {SP} {CC|CR|CV|CP} {;NL}	
MODE {SP} {CC|CR|CV|} {; NL}	
MODE {?} {;|NL}	0:CC 1:CR 2:CV 3:CP
SHORt {SP} {ON|OFF} {;|NL}	
SHORt {?} {;|NL}	0 : OFF 1 : ON
PRESet {SP} {ON|OFF} {;|NL}	
PRESet {?} {;|NL}	0 : OFF 1 : ON
SENSe {SP} {ON|AUTO } {;|NL}	
SENSe {SP} {ON|OFF } {;|NL}	
SENSe {?} {;|NL}	0 : OFF/AUTO 1 : ON
LEVEl {SP} { LOW|HIGH} {;|NL}	
LEVEl {?} {;|NL}	0 : LOW 1 : HIGH
LEV{SP} {LOW |HIGH} {;|NL}	
LEV {?} {;|NL}	0 : LOW 1 : HIGH
DYN {SP} {ON|OFF} {;|NL}	
DYN {?} {;|NL}	0: OFF 1 : ON
CLRerr{;|NL}	

ERRor {?}{;|NL}	
NG {?}{;|NL}	0 : GO 1 : NG
PROTect {?}{;|NL}	
CCR{SP}{AUTO | R2}{;|NL}（NOTE 1）	
NGENABLE{SP}{ON|OFF}{;|NL}	
POLAR{SP}{POS|NEG}{;|NL}	
START{;|NL}	
STOP{;|NL}	
TESTING {?}{;|NL}	0:TEST END,1:TESTING

Table 4-4 STAGE COMMAND SUMMARY

System command：	NOTE	RETURN
RECALL {SP} {m [,n] }{;|NL}	m=1~10 n=1~15 m:STATE , n:BANK	
STORE {SP} {m [,n] }{;|NL}	m=1~10 n=1~15 m:STATE , n:BANK	
REMOTE {;|NL}	RS232/USB command	
LOCAL{;| NL}	RS232/USB command	
NAME {?} {;| NL}		“XXXX”
*RST {;|NL}		

Table 4-5 SYSTEM COMMAND SUMMARY

Measure command	RETURN
MEAS: CURR {?}{;|NL}	###.####
MEAS: VOLT {?}{ ;|NL}	###.####
MEAS: POW {?}{;| NL}	###.####
MEAS: VC {?}{;|NL}	###.####,###.####

Table 4-6 MEASURE COMMAND SUMMARY

4-4. Communication Interface programming command list 2

COMPLEX TYPE FORMAT

SETTING COMMAND SUMMARY	REMARK
[PRESet :] RISE{SP} {NR2} {;|NL}	A/us
[PRESet :] FALL{SP}{;|NL}	A/us
[PRESet :] PERI|PERD : HIGH|LOW {SP} {NR2} {;|NL}	
[PRESet :] LDONv{SP} {NR2} {;|NL}	
[PRESet :] LDOFfv{SP} {NR2} {;|NL}	
[PRESet :] CC|CURR : {HIGH|LOW} {SP} {NR2}{;|NL}	
[PRESet :] CP : {HIGH|LOW} {SP} {NR2}{;|NL}	
[PRESet :] CR|RES : {HIGH|LOW} {SP} {NR2}{;|NL}	
[PRESet :] CV|VOLT : {HIGH|LOW} {SP} {NR2}{;|NL}	
[PRESet :]TCONFIG {SP} {NORMAL|OCP | OPP|SHORT}{;|NL}	
[PRESet :] OCP:START {SP} {NR2}{;|NL}	
[PRESet :] OCP:STEP {SP} {NR2}{;|NL}	
[PRESet :] OCP:STOP {SP} {NR2}{;|NL}	
[PRESet :] VTH {SP} {NR2}{;|NL}	
[PRESet :] OPP:START {SP} {NR2}{;|NL}	
[PRESet :] OPP:STEP {SP} {NR2}{;|NL}	
[PRESet :] OPP:STOP {SP} {NR2}{;|NL}	
[PRESet :] STIME {SP} {NR2}{;|NL}	
[PRESet :]BATT:UVP{SP}{NR2}{;|NL}	
[PRESet :]BATT:TIME{SP}{n}{;|NL}	
[PRESet :]BATT:TEST {SP} {ON|OFF}{;|NL}	
[PRESet :] BATT:AH{SP}{NR2}{;|NL}	
[PRESet :] BATT:WH{SP}{NR2}{;|NL}	
[PRESet :]TESTING {?}{;|NL}	
[PRESet :]SURGE: SURI {SP}{NR2}{; |NL}	
[PRESet :]SURGE: NORI {SP}NR2}{; |NL}	
[PRESet :]SURGE: TIME {SP}{NR2}{; |NL}	
[PRESet :]SURGE: STEP {n} {;|NL}	
[PRESet :]SURGE {ON|OFF}{;|NL}	

Table 4-1B Communication Interface programming Setting command summary

QUERY COMMAND SUMMARY	
[PRESet :] RISE{?} {;|NL}	
[PRESet :] FALL{?}{;|NL}	
[PRESet :] PERI| PERD : {HIGH|LOW}{?} {;|NL}	
[PRESet :] LDONv {?}{;|NL}	
[PRESet :] LDOFfv {?}{;|NL}	
[PRESet :] CC| CURR : {HIGH|LOW} {?} {;|NL}	
[PRESet :] CP: {HIGH|LOW} {?} {;|NL}	
[PRESet :] CR| RES:{HIGH|LOW} {?} {;|NL}	
[PRESet :] CV| VOLT : {HIGH|LOW} {?} {;|NL}	
[PRESet :] TCONFIG {?}{;|NL}	
[PRESet :] OCP: START {?} {;|NL}	
[PRESet :] OCP: STEP {?}{;|NL}	
[PRESet :] OCP: STOP {?}{;|NL}	
[PRESet :] VTH {?}{;|NL}	
[PRESet :] OPP: START {?} {;|NL}	
[PRESet :] OPP: STEP {?}{;|NL}	
[PRESet :] OPP: STOP {?}{;|NL}	
[PRESet :] STIME {?}{;|NL}	
[PRESet :] BATT: AH? {;|NL}	
[PRESet :] BATT: WH? {;|NL}	
[PRESet :] BATT:RTIME? {;|NL}	
[PRESet :]BATT:RTIME? {;|NL}	
[PRESet :] BATT:RAH? {;|NL}	
[PRESet :] BATT:RWH? {;|NL}	
[PRESet :] BATT:RVOLT? {;|NL}	
[PRESet :]SURGE: SURI {?}{; |NL}	
[PRESet :]SURGE: NORI {?}{; |NL}	
[PRESet :]SURGE: TIME {?}{; |NL}	
[PRESet :]SURGE: STEP {SP}{?} {;|NL}	

Table 4-2B Communication Interface programming query command summary

LIMIT	RETURN
LIMit : CURRent : {HIGH | LOW}{SP}{NR2}{; | NL}	
LIMit : CURRent : {HIGH | LOW }{?}{; | NL}	###.####
IH | IL{SP}{NR2}{; | NL}	
IH | IL {?}{; | NL}	
LIMit : POWer:{HIGH | LOW}{SP}{NR2}{; | NL}	
LIMit : POWer:{HIGH | LOW }{?}{; | NL}	###.####
WH | WL{SP}{NR2}{; | NL}	
WH | WL {?}{; | NL}	###.####
LIMit : VOLTage : {HIGH | LOW}{SP}{NR2}{; | NL}	
LIMit : VOLTage : {HIGH | LOW }{?}{; | NL}	###.####
VH | VL{SP}{NR2}{; | NL}	
VH | VL {?}{; | NL}	###.####
SVH | SVL{SP}{NR2}{; | NL}	
SVH | SVL {?}{; | NL}	###.####

Table 4-3B Communication Interface programming limit command summary

STAGE COMMAND	REMARK
[STATe :] LOAD {SP}{ON | OFF} {; | NL}	
[STATe :] LOAD {?} {; | NL}	0 : OFF 1 : ON
[STATe :] MODE {SP} {CC | CR | CV | CP } {; | NL}	
[STATe :] MODE {?} {; | NL}	0:CC 1:CR 2:CV 3:CP
[STATe :] SHORt {SP} {ON | OFF} {; | NL}	
[STATe :] SHORt {?} { ; | NL}	0 : OFF 1 : ON
[STATe :] PRESet {SP} {ON | OFF} {; | NL}	
[STATe :] PRESet {?} {; | NL}	0 : OFF 1 : ON
[STATe :] SENSe {SP} {ON | AUTO } { ; | NL}	
[STATe :] SENSe {SP} {ON | OFF } { ; | NL}	
[STATe :] SENSe {?} {; | NL}	0 : OFF/AUTO 1 : ON
[STATe :] LEVEl {SP} { LOW | HIGH} {; | NL}	
[STATe :] LEVEl {?} {; | NL}	0 : LOW 1 : HIGH
[STATe :] LEV{SP} {LOW | HIGH} {; | NL}	
[STATe :] LEV {?} {; | NL}	0 : LOW 1 : HIGH
[STATe :] DYNamic {SP} {ON | OFF} { ; | NL}	
[STATe :] DYNamic {?} { ; | NL}	0 : OFF 1 : ON

[STATe :] CLR{;|NL}	
[STATe :] ERRor {?}{ ; |NL}	
[STATe :] NO {SP} GOOD {?}{ ; |NL}	0 : GO 1 : NG
[STATe :] NG {?}{ ; |NL}	0 : GO 1 : NG
[STATe :] PROTect {?}{ ; |NL}	
[STATe :] CCR{SP}{AUTO|R2}{ ; |NL}（ NOTE 1）	
[STATe :] NGENABLE{SP}{ON|OFF}{ ; |NL}	
[STATe :]POLAR{SP}{POS|NEG}{ ; |NL}	
[STATe :]START{ ; |NL}	
[STATe :]STOP{ ; |NL}	
[STATe :] TESTING {?}{ ; |NL}	0 : TEST END， 1 : TESTING

Table 4-4B STAGE COMMAND SUMMARY

SYSTEM COMMAND:	NOTE	RETURN
[SYStem :] RECall {SP} {m [,n] }{ ; |NL}	m=1~10 n=1~15	
[SYStem :] STORe {SP} {m [,n] }{ ; |NL}	m=1~10 n=1~15	
[SYStem :] REMOTE { ; |NL}	RS232/USB command	
[SYStem :] LOCAL{ ; |NL}	RS232/USB command	
[SYStem :] NAME {?} { ; |NL}		“XXXX”
[SYStem :]*RST { ; |NL}		

Table 4-5B SYSTEM COMMAND SUMMARY

Measure command:	RETURN
MEASure : CURRent{?}{ ; |NL}	###.####
MEASure : VOLTage{?}{ ; |NL}	###.####
MEASure : POW{?}{ ; |NL}	###.####
MEAS :VC{?}{ ; |NL}	###.####,###.####

Table 4-6B MEASURE COMMAND SUMMARY

Note:

1. The current unit is Ampere (A).
2. The resistance is in ohms (Ω).
3. The voltage is in volts (V).
4. The period unit is milliseconds (mS).
5. SLEW-RATE is in milliamps per microsecond (A/uS).
6. The power unit is watts (W).

4-5. The description of abbreviation

SP：Space, the ASCII code is 20 Hexadecimal.
；：Semicolon, Program line terminator, the ASCII code is OA Hexadecimal.
NL：New line, Program line terminator, the ASCII code is OA Hexadecimal.
NR2：Digits with decimal point. It can be accepted in the range and format of ###.#####.
For Example：
30.12345, 5.0

4-6. Communication Interface programming command syntax description

{ } : The contents of the { } symbol must be used as a part or data of the command, it cannot be omitted.

[ ] : The contents of the [ ] symbol indicts the command can be used or not. It depends on the testing application.

| : This symbol means option. For example〝LOW|HIGH〞means it can only use LOW or HIGH as the command, it can choose only one as the setting command.

Terminator：You have to send the program line terminator character after send the command, the available command terminator characters which can be accepted in 3110 Series mainframe is listed in Table 4-8.

LF
LF WITH EOI
CR，LF
CR,LF WITH EOI

Table 4-7 COMMAND TERMINATOR

Semicolon〝；〞：The semicolon〝；〞is a back-up command, the semicolon allows you to combine command statement on one line to create command message.

4-7. Communication Interface programming command description

4.7.1. PRESET Set and Read the Default of Load

RISE

Syntax : [PRESet :] RISE {SP}{NR2}{;|NL}
[PRESet :] RISE ? {;|NL}

Purpose: Set and read the RISE SLEW-RATE

Description:

1. The definition of RISE SLEW-RATE is load level change or dynamic load can be programmed of RISE and FALL are completely independent.
2. The value of RISE has to be included the number of the decimal point; otherwise the command will not be available.
3. The least significant number is the 3th behind the decimal point.
4. 3110 series will set to the maximum value of the model automatically when the set RISE is over the specification of Load.
5. The unit is A/uS.

FALL

Syntax : [PRESet :] FALL {SP}{;|NL}
[PRESet :] FALL?{;|NL}

Purpose: Set and read the FALL SLEW-RATE

Description:

1. The definition of FALL SLEW-RATE is load level change or dynamic load can be programmed of RISE and FALL are completely independent.
2. 3110 series will set to the maximum value of the model automatically when the FALL which has been set is over the specification of Load.
3. The unit is A/uS .

PERI or PERD

Syntax : [PRESet :] PERI|PERD : HIGH|LOW{SP}{ NR2}{;|NL}
[PRESet :] PERI|PERD : HIGH|LOW?{;|NL}

Purpose: Set and read the TLOW and Thigh of DYNAMIC when loading

Description:

1. A period of loading waveform of DYNAMIC is combined by TLOW and THIGH.
2. The value of TLOW and THIGH have to be included the number of the decimal Point, otherwise the command will not be available.
3. The least significant number is the 5th behind the decimal point.
4. 3110 series will set the value of TLOW or THIGH automatically when the value Which has been set is over the maximum of the Load.
5. The unit is mS.

LDONv

Syntax : [PRESet :] LDONv {SP}{NR2}{;|NL}
[PRESet :] LDONv?{;|NL}

Purpose: Set and Read the voltage of LOAD ON

Description: This command is for setting the Load voltage value of LOAD ON.

LDOFfv

Syntax : [PRESet :] LDOFfv{SP}{ NR2}{;|NL}
[PRESet :] LDOFfv ?{;|NL}

Purpose : Set and read the voltage of LOAD OFF

Description : This command is for setting the Load voltage value of LOAD OFF.

CURR : HIGH|LOW

Syntax : [PRESet :] CC|CURR : HIGH|LOW{SP}{ NR2}{;|NL}
[PRESet :] CC|CURR : HIGH|LOW ?{;|NL}

Purpose: Set and read the current of HIGH|LOW

Description: This command is for setting the required Load current. And this command must be followed the next notices :

1. The required value of current must be included the number of the decimal Point, otherwise the command will not be available.
2. The least significant number is the 5th behind the decimal point.
3. 3110 serieswill set the maximum value of current of the Load automatically When the value which has been set is over the maximum of the Load.
4. The value of LOW has to be smaller than HIGH.
5. The unit is A.

CP: {HIGH|LOW}

Syntax : [PRESet :] CP: { HIGH|LOW}{SP}{ NR2}{;|NL}
[PRESet :] CP : { HIGH|LOW} ? {;|NL}

Purpose : Set and read the value of Watt

Description : This command is for setting the required value of Watt, and the unit is W

CR|RES: {HIGH|LOW}

Syntax : [PRESet :] CR|RES : { HIGH|LOW}{SP}{ NR2}{ ; |NL}
[PRESet :] CR|RES : { HIGH|LOW}? { ; |NL}

Purpose : Set and read the value of Resistance

Description : This command is used for setting the required value of Load Resistance. And this command must be followed the next notices:

1. The required value of resistance must be included the number of the decimal Point, otherwise the command will not be available.
2. The least significant number is the 3rd behind the decimal point.
3. 3110 will set to the maximum value of the model automatically when the value Of Resistance which has been set is over the specification of Load.
4. The Resistance value which has been set of LOW has to be smaller than HIGH.
5. The unit is Ω.

CV : {HIGH|LOW}

Syntax : [PRESet :] CV : { HIGH|LOW}{SP}{ NR2}{;|NL}
[PRESet :] CV : { HIGH|LOW}? {;|NL}

Purpose: Set and Read the value of Load Voltage

Description: This command is used for setting the required Load Voltage. And this command must be followed the next notices:

1. The required value of resistance must be included the number of the decimal point, otherwise the command will not be available.
2. The least significant number is the 5th behind the decimal point.
3. 3110 series will set to the maximum value of the model automatically when the value of Voltage which has been set is over the specification of Load.
4. The Voltage value which has been set of LOW has to be smaller than HIGH.
5. The unit is Voltage (V)

OCP: START

Syntax : [PRESet:] OCP:START {SP}{NR2}{;|NL}
[PRESet:] OCP:START ? {;|NL}

Purpose : Set and read the initial value of OCP test

Description : This command is used for setting the required initial value (I-START) of OCP test.

OCP: STEP

Syntax : [PRESet:] OCP:STEP {SP}{NR2}{;|NL}
[PRESet:] OCP:STEP ? { ; |NL}

Purpose : Set and read the increasing value of OCP test

Description: This command is used for setting the increasing value(I-STEP) of OCP test

OCP: STOP

Syntax: [PRESet:] OCP:STOP {SP}{NR2}{;|NL}
[PRESet:] OCP:STOP ? { ; |NL}

Purpose: Set and read the maximum value of OCP test

Description: This command is used for setting the maximum value (I-STOP) of OCP Test.

VTH

Syntax: [PRESet :] VTH {SP}{NR2}{;|NL}
[PRESet :] VTH ? {;|NL}

Purpose:Set and read the value of the Threshold Voltage

Description : This command is used for setting the Threshold Voltage. That is the OCP/OPP of this Load model when the output voltage of appliance is lower or equaled to the VTH

OPP: START

Syntax: [PRESet :] OPP:START {SP}{NR2}{;|NL}
[PRESet :] OPP:START ? {; |NL}

Purpose : Set and read the initial value of OPP test

Description : This command is used for setting the initial value (P-START) of OPP Test

OPP: STEP

Syntax: [PRESet :] OPP:STEP {SP}{NR2}{;|NL}
[PRESet :] OPP:STEP ? {;|NL}

Purpose : Set and read the increasing value of OPP test

Description : This command is used for setting the increasing value (P-STEP) of OPP Test

OPP: STOP

Syntax: [PRESet :] OPP:STOP {SP}{NR2}{;|NL}
[PRESet :] OPP: STOP ? {;|NL}

Purpose: Set and read the maximum value of OPP test

Description: This command is used for setting the maximum value (P-STOP) of OPP test

TCONFIG

Syntax: [PRESet :] TONFIG {NORMAL|OCP|OVP|OPP|SHORT}{;|NL}
[PRESet :] TONFIG ? {;|NL}

Purpose : Set and read the function of Dynamic test

Description : There are four options of this command. Those are NORMAL mode,OCP test ,OPP test and SHORT test.

STIME

Syntax : [PRESet :] STIME {SP}{NR2}{;|NL}
[PRESet :] STIME ? {;|NL}

Purpose : Set and read time of the short-circuit test

Description : This command is used for setting time of the short-circuit test. If time set to 0, it means that have no the time limit and continue to be short –circuited. The unit is milli-second (ms)

OCP

Syntax: OCP?

Purpose: Set read OCP testing current.

Description: This command is used for setting OCP test read OCP current.

OPP

Syntax : OPP?

Purpose : Set read OPP testing watt.

Description : This command is used for setting OPP test read OPP watt.

BATT: UVP

Syntax:

[PRESet :] BATT : UVP {SP} {NR2}{ ; |NL}

Purpose: Set UVP function.

Description: Set UVP (Under Voltage Protection), UNIT: V.

BATT: TIME

Syntax:

[PRESet :] BATT: TIME {SP} {n}{ ; |NL}

[PRESet :] BATT: TIME?{ ; |NL}

Purpose: Set and read BATT TIME.

Description: Set and read BATT TIME, n=1~99999 sec.

BATT: TEST

Syntax:

[PRESet :] BATT: TEST {SP} {ON|OFF} {; |NL}

Purpose: Set BATT TEST

Description: Set BATT TEST ON: Start test, OFF: Stop test.

BATT: AH

Syntax:

[PRESet :] BATT: AH {SP} {NR2} {; |NL}

[PRESet :] BATT: AH?{; |NL}

Purpose: Set and read BATT AH

Description: Set and read BATT AH.

BATT: WH
Syntax:
[PRESet :] BATT: WH {SP} {NR2} {; |NL}
[PRESet :] BATT: WH? {; |NL}
Purpose: Set and read BATT WH
Description: Set and read BATT WH.

BATT: RTIME
Syntax:
[PRESet :] BATT: RTIME? {; |NL}
Purpose: read BATT RTIME
Description: read BATT RESULT TME.

BATT: RAH
Syntax:
[PRESet :] BATT: RAH? {; |NL}
Purpose: read BATT RAH
Description: read BATT RESULT AH.

BATT: RWH
Syntax:
[PRESet :] BATT: RWH? {; |NL}
Purpose: read BATT RWH
Description: read BATT RESULT WH.

BATT: RVOLT
Syntax:
[PRESet :] BATT: RVOLT? {; |NL}
Purpose: read BATT RVOLT
Description: read BATT RESULT VOLT

SURGE: SURI
Syntax
[PRESet :] SURGE: SURI {SP}{NR2}{; | NL}
[PRESet :] SURGE: SURI?{; | NL}
Purpose: Set and read the load current value of the surge current test.
Description: This command is set and read the load current value of the surge current Test.

SURGE: NORI
Syntax
PRESet :] SURGE: NORI {SP}{NR2}{; | NL}
[PRESet :] SURGE: NORI?{; | NL}
Purpose: Set and read the load current value of the Normal current test.
Description: This command is Set and read the load current value of the Normal Current test.

SURGE: TIME
Syntax
[PRESet:] SURGE: TIME {SP}{NR2}{; | NL}
[PRESet:] SURGE: TIME ?{; | NL}
Purpose: Set and read the surge current test time.
Description: This command is to set and read the surge current test time, SURGE TIME: 10~1000ms.

SURGE: STEP
Syntax
[PRESet:] SURGE: STEP {SP}{n}{; | NL}
[PRESet:] SURGE: STEP ?{; | NL}
Purpose: Set and read the surge current test decrement current setting.
Description:This command is to Set and read the surge current test decrement current setting, n=1~5.

SURGE: ON | OFF
Syntax
[PRESet:] SURGE: ON| OFF {; | NL}
Purpose: Set and read the surge current ON or OFF.
Description: This command is to set and read the surge current ON or OFF, ON: RUN SURGE, OFF: STOP.

4.6.1. LIMIT Set and read the top and bottom of the load judgment NG limit

[LIMit :]CURRent : { HIGH｜LOW} or IH｜IL
Syntax : [LIMit] : CURRent : { HIGH｜LOW}{SP}{ NR2 }{ ; ｜NL}
[LIMit] : CURRent : { HIGH｜LOW} ?{ ; ｜NL}
[IH｜IL]{SP}{ NR2 }{ ; ｜NL}
[IH｜IL} ?{ ; ｜NL}
Purpose: To set the upper/lower limit value of threshold current.
Description: This command is to set the lower limit value of threshold current. When load sink current is lower than this lower limit value or higher than the upper limit value, NG indicating light will come on to indicate "NO GOOD".

[LIMit :]POWer : {HIGH｜LOW} or WH｜WL
Syntax: [LIMit] : POWer : { HIGH｜LOW}{SP}{ NR2 }{;｜NL}
[LIMit] : POWer : { HIGH｜LOW} ?{;｜NL}
[WH｜WL]{SP}{ NR2 }{;｜NL}
[WH｜WL]?{ ; ｜NL}
Purpose: To set the upper/lower limit value of threshold power (W).
Description: This command is to set the upper/lower limit value of threshold power (WATT). When power (WATT) is lower than this lower limit value or higher than the upper limit value, NG indicating light will come on to indicate"NO GOOD".

[LIMit :] VOLtage : {HIGH｜LOW} or VH｜VL
Syntax : [LIMit] VOLtage : { HIGH｜LOW}{SP}{ NR2 }{;｜NL}
[LIMit] VOLtage : { HIGH｜LOW} ?{;｜NL}
[VH｜VL]{SP}{ NR2 }{;｜NL}
[VH｜VL}?{; ｜NL}

Purpose: To set the upper/lower limit value of threshold voltage.
Description: This command is to set the upper/lower limit value of threshold voltage. When input voltage is lower than the lower limit value or higher than the upper limit value, NG indicating light will come on to indicate ”NO GOO”.

[LIMit :] SVH｜SVL
Syntax : [LIMit:] {SVH｜SVL}{SP}{ NR2 }{;｜NL}
[LIMit:] { SVH｜SVL} ?{;｜NL}
Purpose : To set the upper/lower limit value of short current.
Description: This command is to set the upper/lower limit value of short current. When short current is lower than the lower limit value or higher than the upper limit value, NG indicating light will come on to indicate “NO GOOD”.

4.6.2. STAGE Set and read the status of Load

[STATe:] LOAD {SP}{ON｜OFF}
Syntax: [STATe:] LOAD{SP}{ON｜OFF}{;｜NL}
[STATe:] LOAD ?{; ｜NL}
Purpose: Set and read the status of Sink Current or not
Description: This command is used for setting the status of Sink Current. When setting it to ON, the Load is going to sink current from appliance. When setting it to OFF, the Load would not act.

[STATe :] MODE {SP}{CC｜CR｜CV｜CP}
Syntax: [STATe :] MODE {SP}{CC｜CR｜CV｜CP}{;｜NL}
[STATe :] MODE ?{ ;｜NL}
Purpose : Set and read the mode of LOAD
Description : Load is acting under these four modes as the following TABLE 4-8. When reading the Loading Operation mode, the return value 0｜1｜2｜3 are meant to be CC｜CR｜CV｜CP

	CC (0)	CR (1)	CV (2)	CP (3)
3110 series	V	V	V	V

Table 4-8 module for each series

[STATe :] SHORt {SP}{ON｜OFF}
Syntax : [STATe :] SHORt {SP}{ON｜OFF}{;｜NL}
[STATe :] SHORt ? {;｜NL}
Purpose: Set and read the short-circuit test of Load
Description: This command is for setting the Load to make a short-circuit test. While setting for the ON, the V+, V- pin of Load like short-circuit status.

[STATe :] PRESet {SP}{ON|OFF}
Syntax: [STATe :] PRESet {SP}{ON|OFF}{;|NL}
[STATe :] PRESet ? {;|NL}
Purpose: Set the upper or lower digit multi-function meter to display the programming load level.
Description: This command is for select the left 5 digit LCD display to show current setting or DWM.
Pres ON : To selects the LCD display to shows current setting
Pres OFF: To select the LCD Display is “DWM”

[STATe :] SENSe{SP}{ON|OFF|AUTO}
Syntax: [STATe:] SENSe{SP}{ON|OFF|AUTO }{;|NL}
[STATe:] SENSe ? {;|NL}
Purpose: Set and read the Load voltage to read whether is carried by the VSENSE or not.
Description: This command is for setting the Load voltage to read whether is carried by VSENSE or INPUT Connector. When setting for ON, the voltage is got from VSENSE, and setting for OFF, the voltage is got from INPUT Connector. In 3110, the optional are ON and AUTO. So, if setting for AUTO, it means the voltage is got and read from VSENSE. But if no voltage is inputted from VSENSE, the voltage will be inputted from INPUT Connector.

[STATe :] LEVel {SP}{HIGH|LOW} or LEV {SP}{HIGH|LOW}
Syntax: [STATe :] LEVel {SP}{HIGH|LOW }{;|NL}
[STATe :] LEVel ? {;|NL}
[STATe :] LEV{SP}{HIGH|LOW}{;|NL}
[STATe :] LEV? {;|NL}
Purpose: Set and read the LOW and HIGH of Load
Description: LEV LOW is a low level value of current on CC mode. It is a low level value of resistance on CR mode. It is a low level value of voltage on CV mode. It is a low level value of power on CP mode.

[STATe :] DYNamic{SP}{ON|OFF}
Syntax: [STATe:] DYNamic{SP}{ON|OFF}{;|NL}
[STATe:] DYNamic ? {;|NL}
Purpose: Set and read whether the status is Dynamic or Static of Load
Description: 1. DYN ON, set for a DYNAMIC Load
2. DYN OFF set for a STATIC Load

[STATe :] CLR
Syntax : [STATe:] CLR{;|NL}
Purpose : Clear the error flag of 3110 series which during the period of working
Description : This command is for clearing the contents in the register of PROT and ERR. After implementation, the contents of these two registers will be “0”.

[STATe :] NG?
Syntax: [STATe:] NG?{;|NL}
Purpose:Query if there have NG flag in this 3110 series
Description : Set command NG?to show the NG status. Set for “0” the LCD of NG (NO GOOD) will be put out .Set for ”1” the LCD will be lit. -

[STATe :] PROTect ?
Syntax: [STATe:] PROTect?{;|NL}
Purpose: Query if there have protection flag which had been set in this 3110 series
Description: 1.PROT? means the status of Protection of 3110 series. “1” means OPP occurred.”4”means OVP. “8” means OCP. Table 4-9 shows the corresponding number of protection status
2.Use command CLR to clear the register of PROT status to be “0”

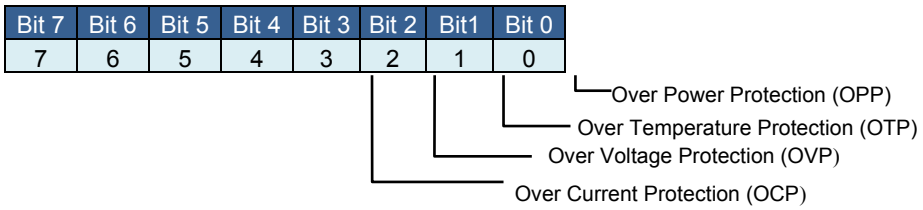


Table 4-9 register of PROT status

[STATe :] CCR {AUTO|R2}
Syntax: [STATe :] CCR {AUTO|R2}{;|NL}
Purpose : Set the CC MODE RANGE to be forced to switch to RANGE II
Description : It will switch the RANGE position automatically when setting for AUTO Set R2 when implementing RANGE II

[STATe :] NGEABLE {ON|OFF}
Syntax : [STATe:] NGEABLE {ON|OFF} {;|NL}
Purpose :To set the GO/NG check function enable or disable.
Description : To set the function of NG judgment opens when POWER ON. When setting for POWER OFF, the function of NG judgment will not be implemented.

[STATe :] POLAR {POS|NEG}
Syntax: [STATe :] POLAR {POS|NEG} {;|NL}
Purpose: Set for the display of the voltage meter shows the pole is contrary or not
Description: Set the display of the voltage meter shows the pole. If it shows POS, that means the pole is not contrary. If the pole is contrary, it will show NEG

[STATe:] START
Syntax: [STATe :]START {;|NL}
Purpose: Set for Load to implement the test.
Description: Set for Load to implement the test, and according to TEST CONFIG (TCONFIG), the Load will start to test the items and parameters which are required

[STATe :] STOP
Syntax: [STATe :]STOP {;|NL}
Purpose: Set for Load to stop the test

4.6.3. SYSTEM Set and Read the Status of 3110

[SYStem :] RECall{ SP }m{ ,n }
Syntax : [SYStem :] RECall{ SP }m{ ,n }{;|NL}
Purpose : Recall the status of Loading which had been saved in the Memory
Description: This command is for recalling the status of Load which had been saved In the Memory .
m(STATE)=1~10,n(BANK)=1~15.
If the operating module is other series, omit “n” and it will be operated in the BANK Which has been shown on the display.
For Example
RECALL 2,15 → Recall the status of Loading which had been saved in the 2nd and 15th BANK of the memory
REC 3 → Recall the status of loading which had been saved in the 3rd of Memory. If 3110 is operated, it will be operated in the BANK which has been shown on the display.

[SYStem:] STORe{SP}m{,n}
Syntax : [SYStem :] STORe{SP}m{,n}{;|NL}
Purpose：Save the status of Loading to the Memory
Description:This command is for saving the status of Loading to the Memory.
m(STATE)=1~10，n(BANK)=1~15 .
If 3110 is operated, omit “n” and it will be operated in the BANK which has been shown on the display
For Example
STORE 2,15 → Save the status of Loading which had been saved in the 2nd and 15th BANK of memory.
STOR 3 → Save the status of Loading to the 3rd memory. If it is operated with 3110, BANK will be set the BANK which shows on the display.

	3110
BANK(n)	15
STATE(m)	10
TOTAL STATE	150

[SYStem :] NAME？
Syntax : [SYStem :] NAME?{;|NL}
Purpose : Read the model number of Load
Description: This command is for reading the model number of Load. it will be lit the model number as table 4-10 :

MODEL
3110
3111
3114
3117
3119

Table 4-10 MODEL NUMBER

[SYStem :] REMOTE
Syntax : [SYStem :] REMOTE { ; |NL}
Purpose : Command to enter the REMOTE status (only for RS232)
Description:This command is for controlling the RS232

[SYStem :] LOCAL
Syntax : [SYStem :] LOCAL { ; |NL}
Purpose : Command to exit the REMOTE status (only for RS232)
Description : This command is for finishing the RS232

4.6.4. MEASURE Measure the actual current and voltage value of Load

MEASure : CURRent?
Syntax : MEASure : CURRent?{; |NL}
Purpose : Read the current which is loading of Load
Description : Read the five numbers of current meter, and the unit is Ampere(A)

MEASure : VOLTage?
Syntax : MEASure : VOLTage?{; |NL}
Purpose : Read the voltage which is loading of Load
Description : Read the five numbers of current meter, and the unit is Voltage(V)

MEASure : POWer?
Syntax: MEASure : POW?{; |NL}
Purpose: Read the power which is loading of Load
Description: Read the five numbers of current meters, and the unit is Watt (W)

Chapter 5 Applications

This chapter details the basic operating modes along with some common applications in which the 3110 series Electronic Load are used.

5-1. Local sense connections

Local sensing is used in applications where the lead lengths are relatively short, or where load regulation is not critical. When connected in local sense mode the 5 digit voltage meter of the 3110 series Electronic load measures the voltage at its DC input terminals. The connecting leads between the DUT and the Electronic Load should be bundled or tie wrapped together to minimize inductance.

Fig 5-1 illustrates a typical set up with the electronic load connected to the DC power supply.

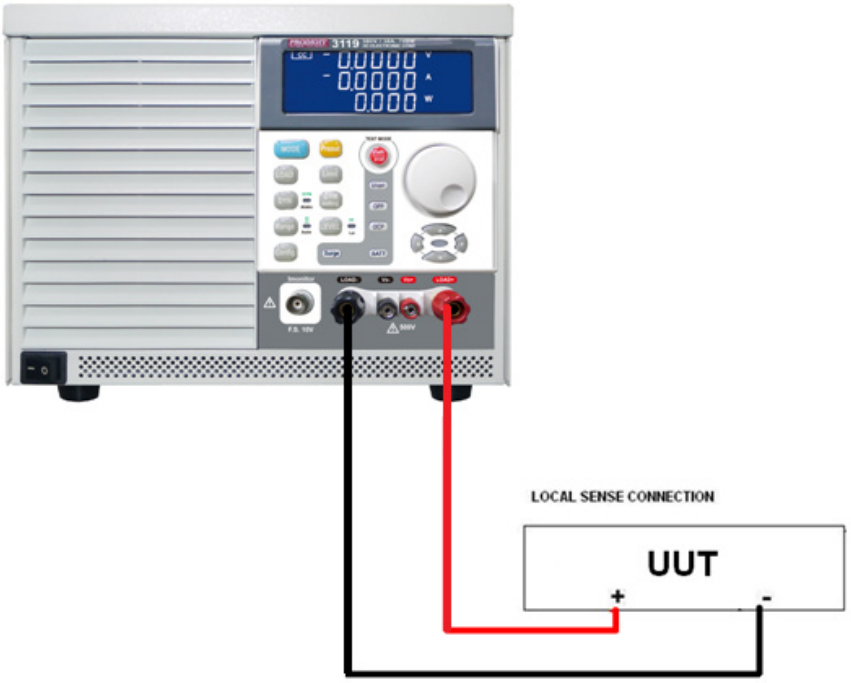


Fig 5-1 Local voltage sense connections

5-2. Remote sense connections

Remote sensing compensates for the voltage drop in applications that require long lead lengths. It is useful under low voltage high current conditions. The remote voltage sense terminals (Vs+) and (Vs-) of the load are connected to (+) and (-) output of the DC Source. Be sure to observe the correct polarity or damage may occur. The power and sense cables should be bundled or tie wrapped together to minimize inductance.

Fig 5-2 illustrates a typical set up with the electronic load connected for remote sense operation.

Please note that if V-sense is set to AUTO and the sense leads are connected to the DUT the losses need to be approx. 1.2V (3110, 3111,3117) or 6V (3114,3119) before the display compensates for the voltage loss. If V-sense is set to 'ON' and the sense terminals are connected to the DUT the load will check and compensate for all voltage drops. The maximum voltage sense compensation is the same as the rating of the 3110. For example Vmax of 3110 is 80Vdc so maximum Vsense is also 80Vdc.

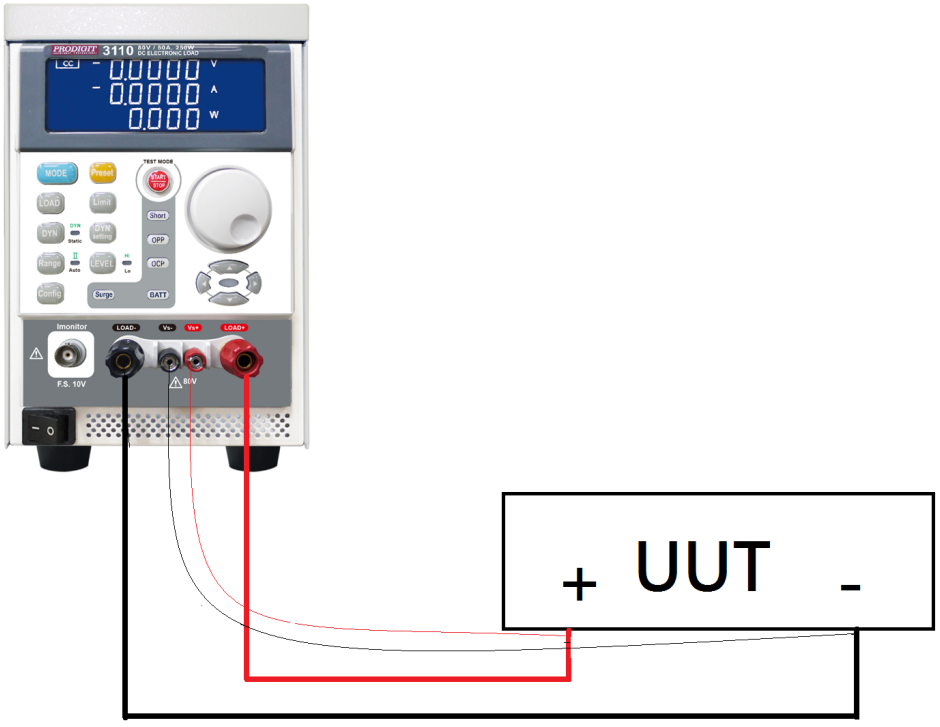


Fig 5-2 Remote voltage sense connections

5-3. Constant Current mode application

The Constant Current (CC) mode is ideal for testing the Load Regulation, Cross Regulation, Output Voltage and Dynamic Regulation of the power supply under test. The CC mode can also be used to test the Discharge Characteristics and the Life Cycle of cells and battery packs. In CC operation the 3110 can operate as a static load with switchable high and low current levels. It is also possible to operate the load dynamically enabling the user to adjust sink current with time.

5.3.1 Static mode: (Fig 5-3)
Major application areas include:

- Voltage source testing
- Power supply load regulation testing
- Battery discharge testing

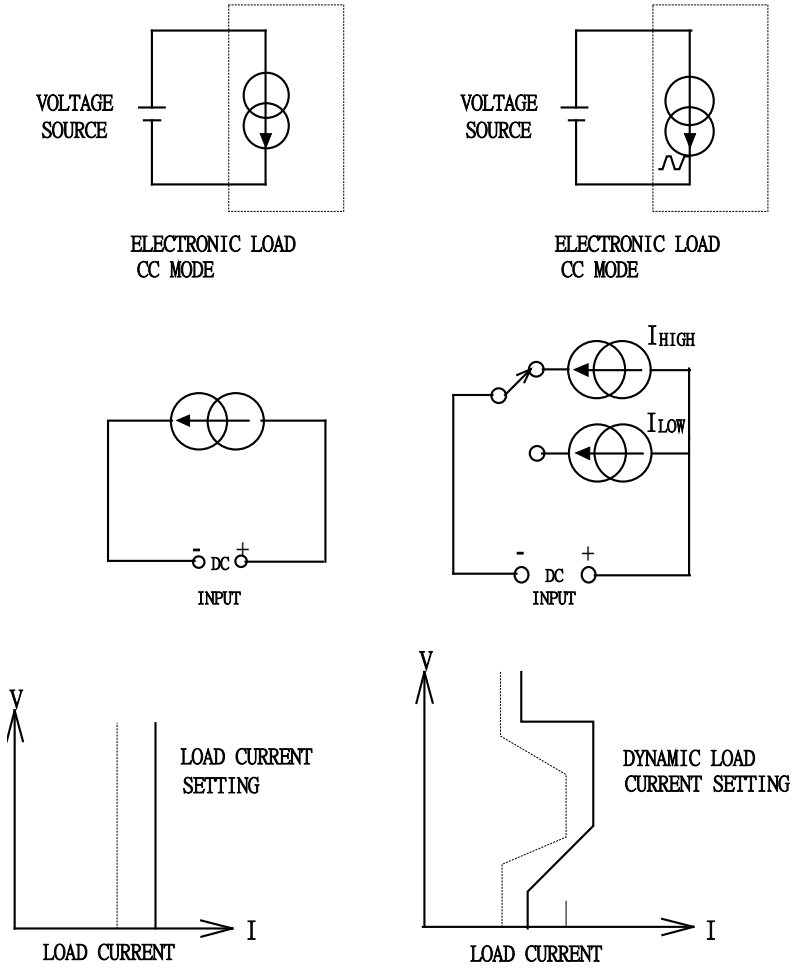


Fig 5-3 constant CURRENT mode application

5.3.2 Dynamic mode:

The built-in pulse generators allow the user to recreate real world loads that vary With time

Major application areas for dynamic operation in CC mode include:

- Power supply load transient response testing
- Power recovery time testing
- Battery Pulse load simulation
- Power component testing
- Two levels of current can be set and the rate of change between the 2 current levels can be adjusted in relation to time. The current rise (slew) rate and the current fall (slew) rate can be adjusted independently from each other and are further defined below

- Rise slew rate = | Ilow - Ihigh | / Ta (A/us)
- Fall slew rate = (Ihigh - Ilow) / Tb (A/us)
- Rise time (Ta) = (Ilow - Ihigh) / Rise slew rate
- Fall time (Tb) = (Ihigh - Ilow) / Fall slew rate

- Please see Fig 1-11 for more information on slew rates.

- The time the waveform is high (Thigh) and the time the waveform is low (Tlow) can Also be adjusted. The diagram below shows the 6 adjustable parameters that Define the dynamic waveform.

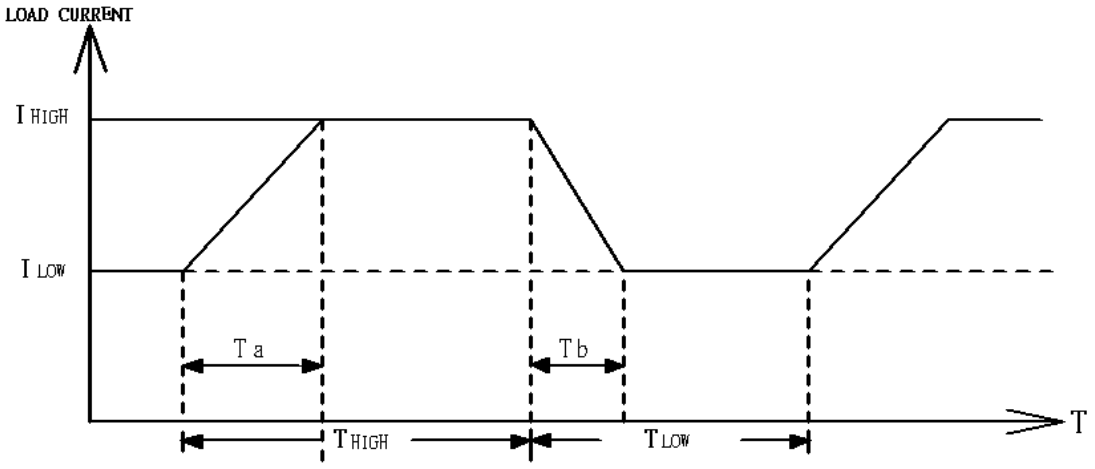


Fig 5-4 Dynamic load current with independent programmed Rise/Fall slew rate

5.3.3 CC Mode Operating Instructions

Example: PSU 5 V / 3 A, CC mode, Level HI 3.000A, Level 1.500A

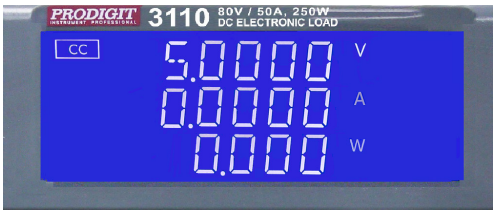
5.3.4.1 . These can be selected in turn by pressing the "MODE" key (8), LCD will illuminate According to the operating mode is selected CC.

5.3.4.2 . Pressing the "Preset" Key (13) once will cause the Button to illuminate.

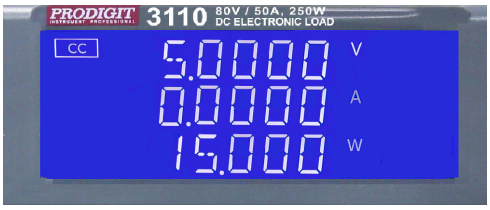
5.3.4.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, adjusted By The rotary knob and arrow key (21) can be read from the lower display during Setting 3.0000 A.

5.3.4.2.2. Pressing the LEVEL key (12) LED once will off, Select LEVEL Lo, adjusted by the Rotary knob and arrow key (21) can be read from the lower display during setting 1.5000A.

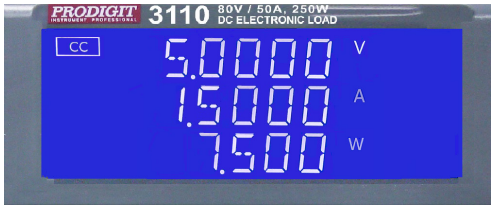
5.3.4.3 . Pressing the "Preset" Key (13) LED once will cause the button to off, Leave setting mode.



5.3.4.4..Pressing the “LOAD “ Key(9) LOAD button lit(Load on), Pressing the "LEVEL" key(12), LED Once will illuminate, Select is “LEVEL Hi”



5.3.4.5..Pressing the "LEVEL" key(12), LED Once will off, Select is “LEVEL Lo”



5-4. Constant Resistance mode application

Operating in Constant Resistance mode is useful for testing both voltage and current Sources. The CR mode is particularly suited for the ‘soft start’ of power supplies.
This is explained in more detail below.

5.4.1 Power supply power up sequence

In constant current mode the demand at initial ‘Load ON’ of the preset current value is almost instantaneous. This might cause the Device under Test (DUT) problems meeting the relatively high current demand at initial switch on. .

For example: 5V/50A output power supply may not be able to deliver 50A over its entire start-up range of 0-5 volts. In many cases the power supply’s short circuit or over current protection circuit cause the power supply to shut down. This is because the power supply is trying to deliver the 50A at a voltage level that is too low.

The answer to this problem is not to use CC mode but to use CR mode instead. This is because in CR mode the current and voltage ramp up together providing a ‘soft start’ when compared to standard CC mode.

However please note that with the 3110 series of Electronic Loads allow an adjustable current ramp can be set. This feature is found within the dynamic settings as RISE slew rate. Even in static mode the 3110 load will regulate its current demand at ‘Load ON’ in line with the adjusted RISE slew rate. The FALL slew rate also in the dynamic settings allows the current ramp down to be controlled at ‘Load OFF’.

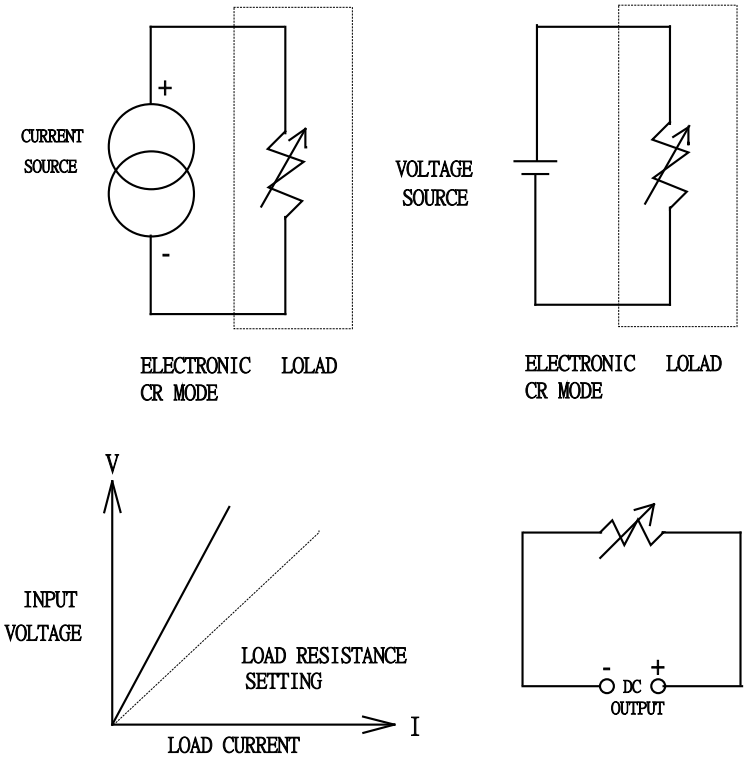
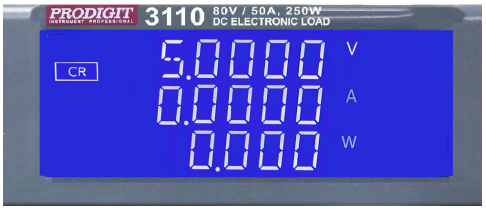


Fig 5-5 Constant Resistance mode Application

5.4.2 CR Mode Operating Instructions

Example: PSU 5 V / 3 A, CR mode, Level HI 2.0 Ohm, Level Lo 4.0 Ohm

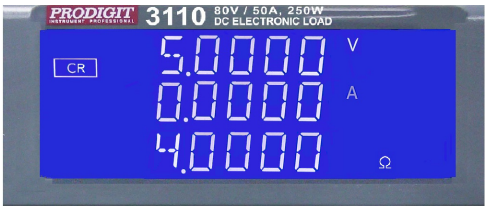
5.4.2.1. These can be selected in turn by pressing the "MODE" key (8), LCD will illuminate According to the operating mode is selected CR



5.4.2.2. Pressing the "Preset" Key (13) once will cause the button to illuminate.

5.4.2.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 2.0000Ω.

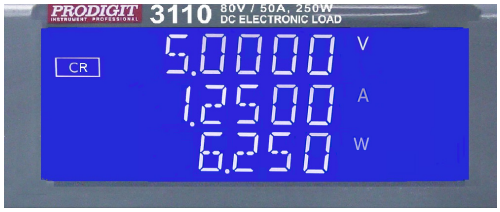
5.4.2.2.2. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Lo, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 4.0000Ω.



5.4.2.3. Pressing the "Preset" Key (13) LED once will cause the button to off, Leave setting Mode.

5.4.2.4. Pressing the “LOAD “Key (9) LOAD button lit (Load on), Pressing the "LEVEL" Key (12), LED Once will illuminate, Select is “LEVEL Hi”.

5.4.2.5. Pressing the "LEVEL" key (12), LED Once will off, Select is “LEVEL Lo”.



5-5. Constant Voltage mode application

In Constant Voltage (CV) operation the load will attempt to sink as much current as required in order to reach the set voltage value. CV operation is useful in checking the load regulation of dc current sources. The CV mode is also ideal for characterizing the current limit of dc power supplies. These application areas are explained a little more below.

5.5.1 Current source testing.

A common application for a dc current source is as a battery charger. Most battery chargers are designed to automatically adjust their charging current according to the battery voltage. In CV mode the electronic load will sink the current that is needed to reach the desired voltage. The CV mode is therefore ideal for checking the charge current at a particular voltage level.

If the battery charger is tested at a number of different voltage levels in CV mode a current curve can be recorded. Thus the battery charger's load regulation can be checked during development, production and batch testing.

5.5.2 Power supply current limit characterization

The current limit is a necessary function for power supplies. The fold back current limit curve is very common for fixed output switching power supplies. The constant current limit curve is more popular for adjustable laboratory power supplies.

It is very difficult or impossible to find the current limit curve by CC or CR mode. However it becomes simple by using CV mode. The user sets the CV voltage and Records the output current. Plotting the current measurements against the voltage Settings result in the output current limit curve of a power supply (Figure 5-6).

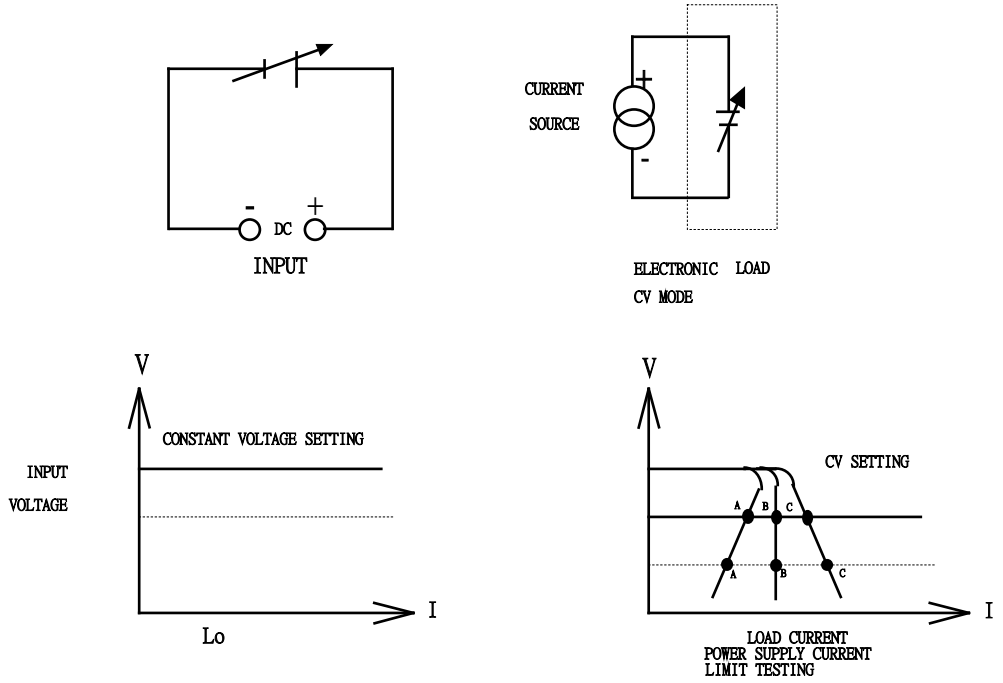


Fig 5-6 Constant Voltage mode application

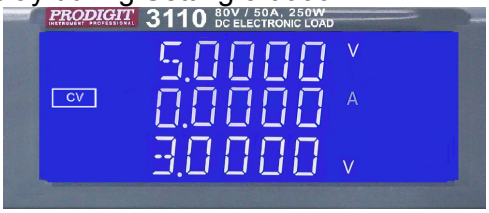
5.5.3 CV Mode Operating Instructions

Example: PSU 5 V / 1A, CV mode, Level HI 4.000V, Level 3.000V

5.5.3.1. These can be selected in turn by pressing the "MODE" key (8), LCD will illuminate According to the operating mode is selected CV.

5.5.3.2. Pressing the "Preset" Key (13) once will cause the button to illuminate.

5.5.3.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Lo, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 3.0000V.



5.5.3.2.2. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 4.0000V.

5.5.3.3. Pressing the "Preset" Key (13) LED once will cause the button to off, Leave setting Mode.

5.5.3.4. Pressing the “LOAD “Key (9) LOAD button lit (Load on), Pressing the "LEVEL" Key (12), LED Once will illuminate, Select is “LEVEL Hi”.

5.5.3.5. Pressing the "LEVEL" key (12), LED Once will off, Select is “LEVEL Lo”.

5-6. Constant Power mode application

5.6.1. Battery Evaluation

Primary or secondary batteries are the power source for a wide range of portable electronics products, such as notebook computers, video cameras and mobile phones. To ensure long usage times and customer satisfaction the battery pack should be able to provide a constant power for the longest time possible.

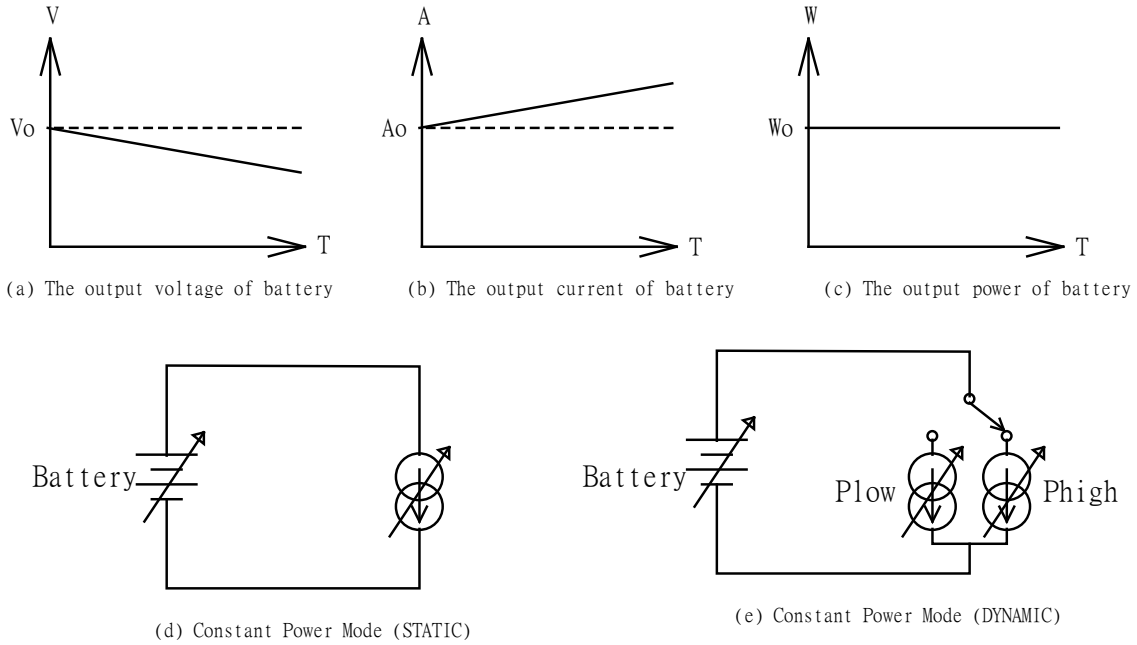
It can be measured that the output voltage of a battery will drop over time (Fig 5-7a). The rate of voltage decay depends on a number of factors including duty cycle, chemistry type, battery age and ambient temperature.

So to keep the device powered for the longest possible time the battery must be able to provide a stable power output regardless of output voltage (Fig 5-7c). In order to maintain a constant power the output current will need to increase over time to compensate for the reducing voltage (Fig 5-7b).

Operating the 3110 series electronic load in CP mode is ideal for testing the characteristics of a battery. This is because as the battery voltage drops the load current will automatically increase in order to keep the CP setting. By logging sink values against time the test engineer can also measure the battery’s energy capacity at various discharge rates.

The 3110 also features an adjustable Load OFF setting. This allows a voltage level to be set so that the electronic load automatically stops sinking power upon reaching this preset voltage. This can be used to ensure the battery is not subjected to a damaging deep discharge.

Along with static operation the load can also be operated dynamically in CP mode. The dynamic functions allow the ramp, fall and plateau times to be adjusted between 2 levels of power. This capability means that ‘real world’ loads can be more accurately simulated. For example the dynamic mode could be used to test the performance of a battery that is required to provide power pulses to transmit data from a radio frequency terminal.



(a) The output voltage of battery (b) The output current of battery (c) The output power of battery

(d) Constant Power Mode (STATIC) (e) Constant Power Mode (DYNAMIC)

Fig 5-7 CONSTANT POWER MODE APPLICATION

5.6.2. CP Mode Operating Instructions

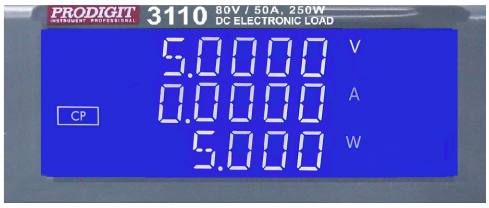
Example: PSU 5 V / 3 A, CC mode, Level HI 10.00W, Level 5.000W

5.6.2.1. These can be selected in turn by pressing the "MODE" key (8), LCD will illuminate According to the operating mode is selected CP.

5.6.2.2. Pressing the "Preset" Key (13) once will cause the button to illuminate.

5.6.2.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 10.000W.

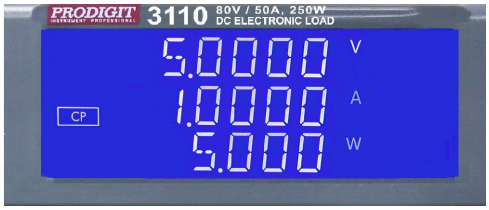
5.6.2.2.2. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 5.000W.



5.6.2.3. Pressing the "Preset" Key (13) LED once will cause the button to off, Leave setting Mode.

5.6.2.4. Pressing the “LOAD “Key (9) LOAD button lit (Load on), Pressing the "LEVEL" Key (12), LED Once will illuminate, Select is “LEVEL Hi”.

5.6.2.5. Pressing the "LEVEL" key (12), LED Once will off, Select is “LEVEL Lo”.



5-7. Zero-Volt loading application

As shown in Fig 5-8, the Electronic load can be connected in series with a DC voltage source which output voltage greater than 1V (3110, 3111, 3117), 6V (3114, 3119) or so that the device under test that are connected to the Electronic load can be operated down to a Zero- Volt condition, the DC voltage source provides the minimum 1V (3110, 3111, 3117), 6V (3114, 3119) operating voltage required by the Electronic load. This application is suitable for low voltage Battery cell with high discharge current testing.

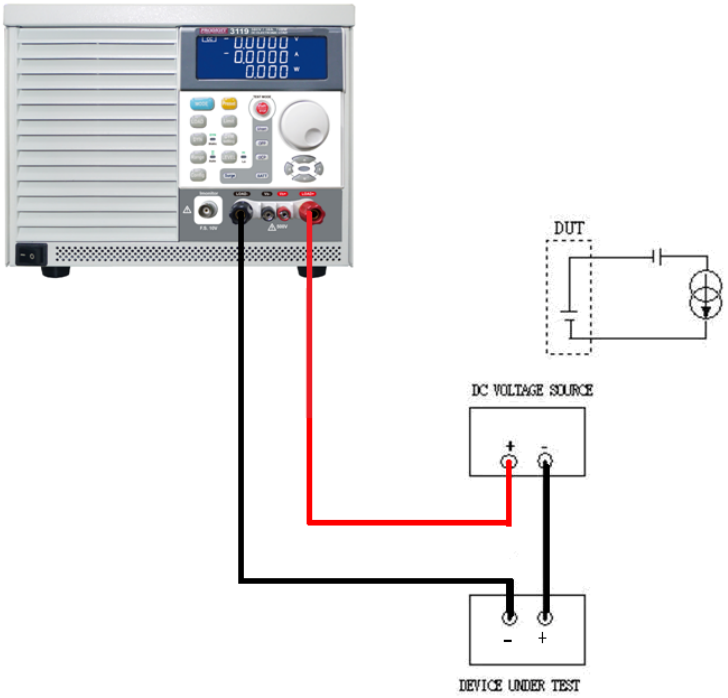


Fig 5-8 Zero-Volt loading connection

5-8. 3110 series electronic load OCP, OPP, SHORT operation flow Chart

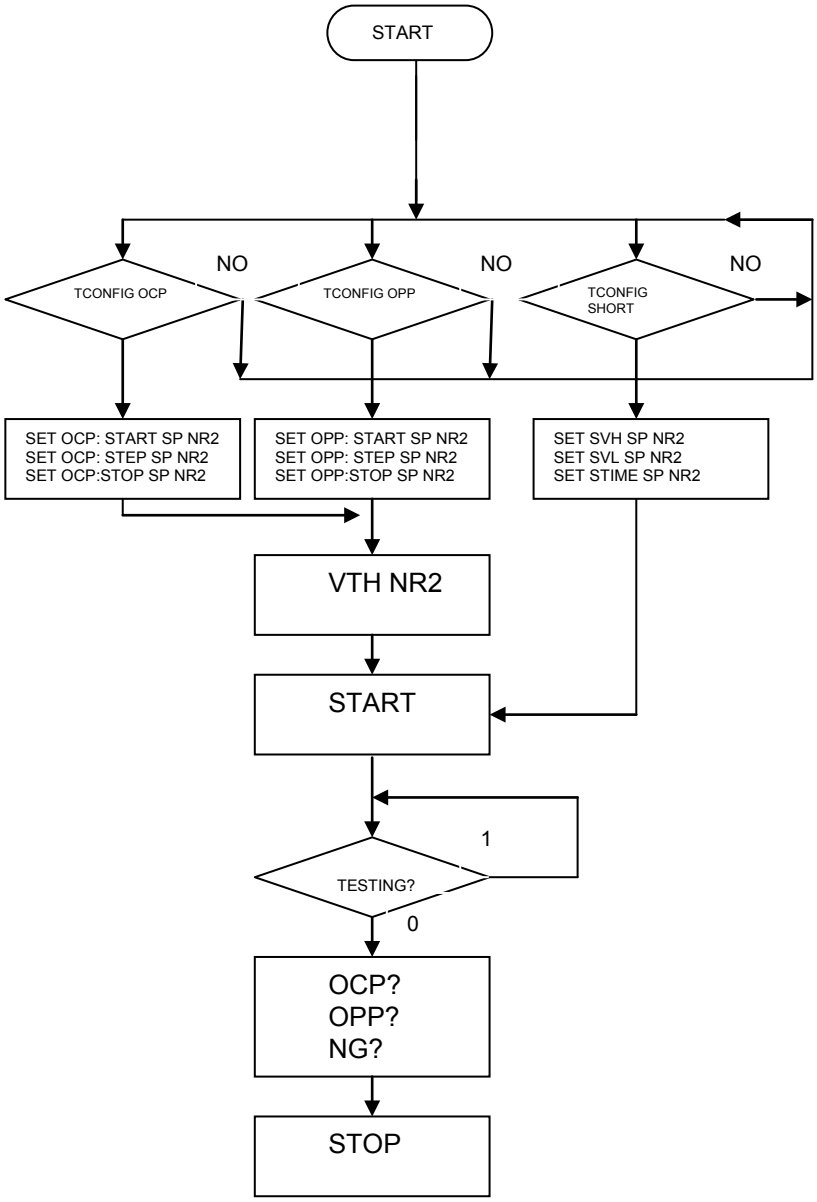


Fig 5-9 3110 series electronic load OCP, OPP, SHORT operation flow chart

5-9. Power Supply OCP testing

5.9.1 OCP Manual control

Example:

5.9.1.1.First, press Limit Key function to setting I_Hi 6A.

5.9.1.2.Press Limit Key function to setting I_Lo 0A.

5.9.1.3.Setting OCP test, press OCP key to the next step.

5.9.1.4.Setting start load current 0A, press OCP key to the next step.

5.9.1.5.Setting step load current 0.001A, press OCP key to the next step.

5.9.1.6.Setting stop load current 0.65A, press OCP key to the next step.

5.9.1.7.Setting OCP VTH 0.600V, press OCP key to the next step.

5.9.1.8.Press START/STOP test key.

5.9.1.9. The UUT's output voltage drop-out lower than the threshold voltage (V-th Setting), and the OCP trip point is between I_Hi and I_Lo limitation, then Middle 5 digits LCD display will shows "PASS", otherwise shows "FAIL".

5.9.2 Remote control OCP

EX:

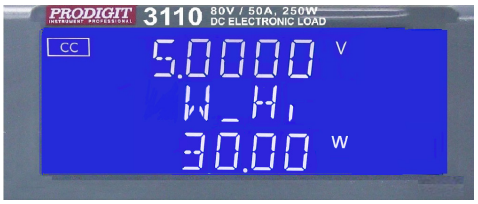
REMOTE	(Set Remote)
TCONFIG OCP	(Set OCP test)
OCP:START 0.1	(Set start load current 0.1A)
OCP:STEP 0.01	(Set step load current 0.01A)
OCP:STOP 2	(Set stop load current 2A)
VTH 3.0	(Set OCP VTH 3.0V)
IL 0	(Set current low limit 0A)
IH 2	(Set current high limit 2A)
NGENABLE ON	(Set NG Enable ON)
START	(Start OCP testing)
TESTING?	(Ask Testing? 1:Testing,0:Testing End)
NG?	(Ask PASS/FAIL?,0:PASS,1:FAIL)
OCP?	(Ask OCP current value)
STOP	(Stop OCP testing)

5-10. Power Supply OPP testing

5.10.1 OPP Manual control

Example:

5.10.1.1. First, press Limit Key function to setting W_Hi 30.00W..



5.10.1.2. Press Limit Key function to setting W_Lo 0W..

5.10.1.3. Setting OPP test, press OPP key to the next step.

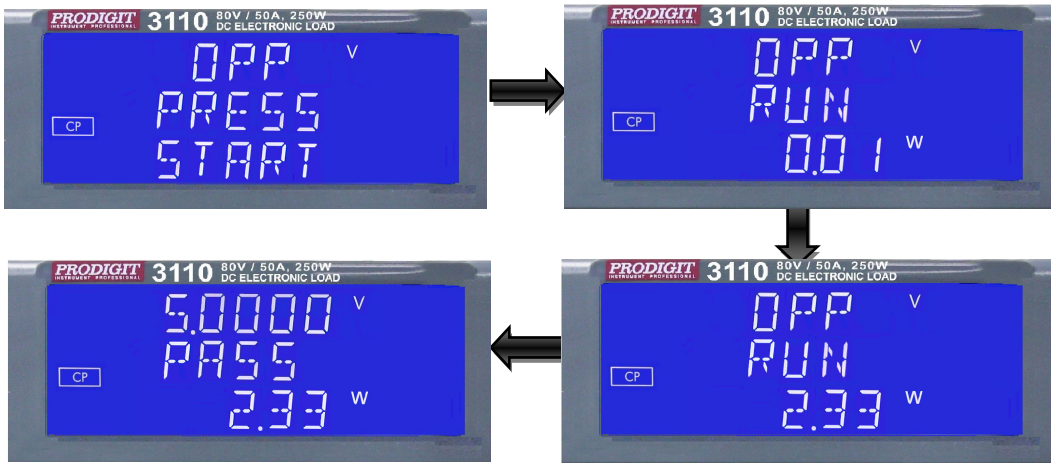
5.10.1.4. Setting start load watt 0W, press OPP key to the next step.

5.10.1.5. Press up key, set step load watt 0.01W, press OPP key to the next step.

5.10.1.6. Press up key, set stop load watt 3.25W, press OPP key to the next step.

5.10.1.7. Setting OPP VTH 0.600V，press OPP key to the next step.

5.10.1.8. Press START/STOP Test key.



5.10.1.9. the UUT's output voltage drop-out lower than the threshold voltage (V-th setting), and the OPP trip point is between W_Hi and W_Lo limitation, then lower 5 digits LCD display will shows "PASS", otherwise shows "FAIL".

5.10.2 Remote control OPP

EX:

REMOTE	(Set Remote)
TCONFIG OPP	(Set OCP test)
OPP:START 3	(Set start load watt 3W)
OPP:STEP 1	(Set step load watt 1W)
OPP:STOP 5	(Set stop load watt 5W)
VTH 3.0	(Set OPP VTH 3.0V)
WL 0	(Set watt low limit 0W)
WH 5	(Set watt high limit 5W)
NGENABLE ON	(Set NG Enable ON)
START	(Start OPP testing)
TESTING?	(Ask Testing? 1:Testing,0:Testing End)
NG?	(Ask PASS/FAIL?,0:PASS,1:FAIL)
OPP?	(Ask OPP watt value)
STOP	(Stop OPP testing)

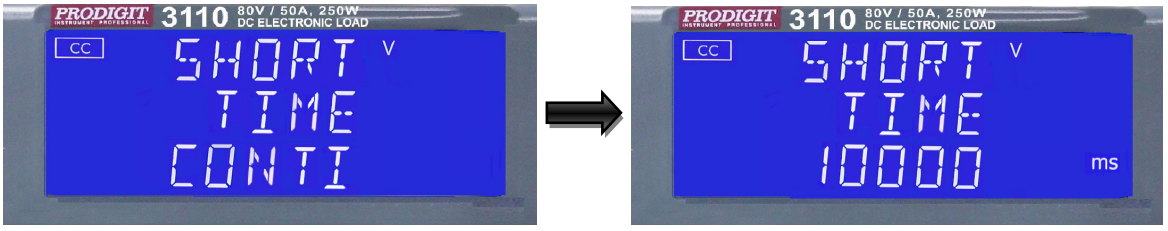
5-11. SHORT testing

SHORT Manual control

Example:

5.11.1.1. Setting SHORT test, press Short key to the next step.

5.11.1.2. Press UP key, setting Short time to 10000ms, press Short key to The next Step.



5.11.1.3. Press down key, setting V-Hi voltage to 1.000V, press Short key to the Next Step.

5.11.1.4. Press down key, setting V-Lo voltage to 0V, press Short key to the Next Step.

5.11.1.5. Press START/STOP test key.

5.11.1.6. Short test finish, the UUT's drop voltage is between V_Hi and V_Lo limitation, then middle 5 digits LCD display will shows "PASS"

5.11.1.7. The UUT's not drop voltage is between V_Hi and V_Lo limitation, LCD Display will shows FAIL.

Remote control SHORT

EX:

REMOTE	(Set Remote)
TCONFIG SHORT	(Set SHORT test)
STIME 1	(Set short time 1ms)
START	(Start SHORT testing)
TESTING?	(Ask Testing? 1:Testing,0:Testing End)
STOP	(Stop SHORT testing)