33431G Series
LED High power
Electronic Load
Operation manual

S/N:90033431G2 REV:A

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.

SAFETY SYMBOLS

 **Direct current (DC)**

 **Alternating current (AC)**

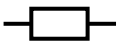
 **Both direct and alternating**

 **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.

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33431G SERIES LED DC LOAD OPERATION MANUAL

TABLE OF CONTENTS

FIGURES

TABLES

Chapter 1 Introduction

1-1. General description

The 33431G Series Electronic Load is designed to test, evaluation and burn-in of DC power supplies and batteries. The 33431G Series electronic load can be operated for manual and GPIB operation. The power contour of 33431G 1800 Watts Electronic Load is shown in Fig 1-1, it has an input from 0-12A, and 0-600V current and voltage operating range respectively. The power contour of 33431G Series. The prodigit 33431G Series high power electronic Load can be controlled locally at the front panel or remotely via computer over the GPIB/RS-232C/USB/LAN. Current (CC) mode, Constant Resistance (CR) mode, and Constant Voltage (CV) mode. and Constant Power (CP) mode. The wide range dynamic load with independent rise and fall current slew rate and analog programming input with arbitrary wave-form input is available in Constant Current mode.

The 33431G series of LED DC high electronic load feature 5 operating modes. These are Constant Current (CC) mode, Constant Resistance (CR) mode, Constant Voltage (CV) mode, Constant Power (CP) and(LED) mode.

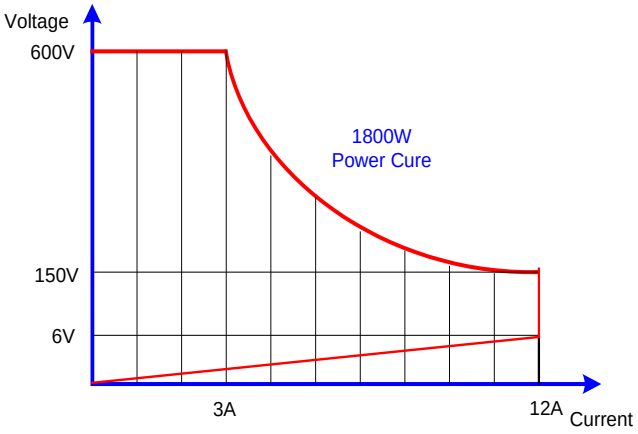


Fig 1-1 33431G 600V/12A/1800W power contour

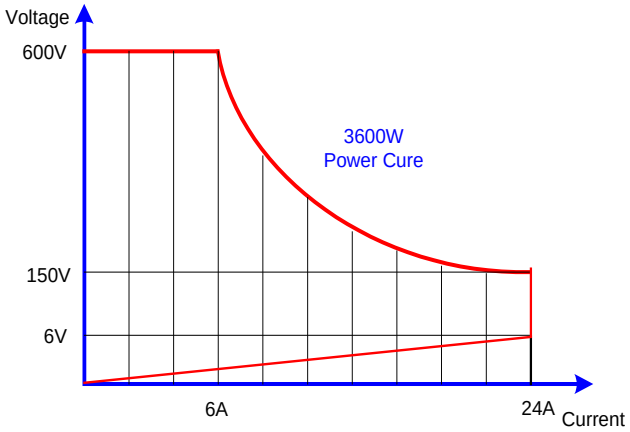


Fig 1-2 33432G 600V/24A/3600W power contour

1.1.1. CC Mode

With the operating mode of Constant Current, the 33431G series electronic load will sink a current in accordance with the programmed value regardless of the input voltage (see Fig.1-3).

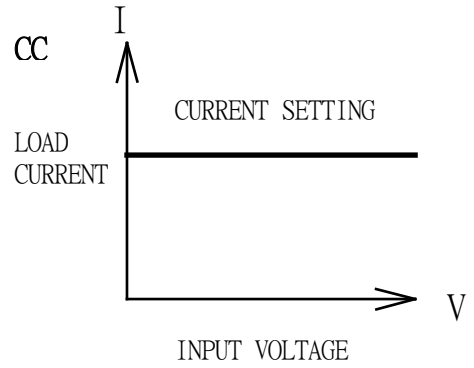


Fig 1-3 Constant Current mode

1.1.2. CR Mode:

At Constant Resistance mode, the 33431G series Electronic Load will sink a current linearly proportional to the load input voltage in accordance with the programmed resistance setting (see Fig 1-4).

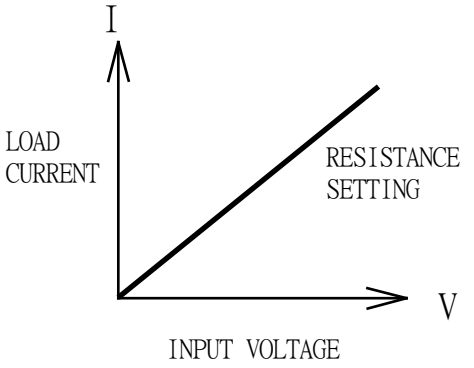


Fig 1-4 Constant Resistance mode

1.1.3. CV Mode:

At Constant Voltage mode, the 33431G series Electronic Load will attempt to sink enough current until the load input voltage reaches the programmed value (see Fig 1-5).

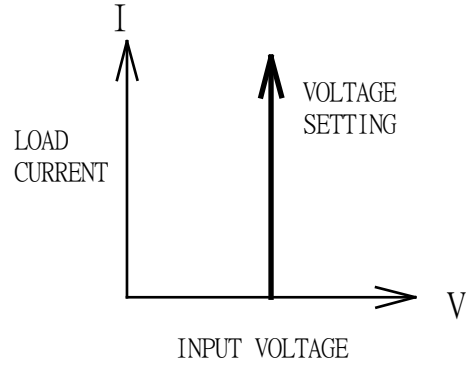


Fig 1-5 Constant Voltage mode

1.1.4. CP Mode:

At Constant Power mode, the 33431G series Electronic Load will attempt to sink load power (load voltage x load current) in accordance with the programmed power. (See Fig 1-6).

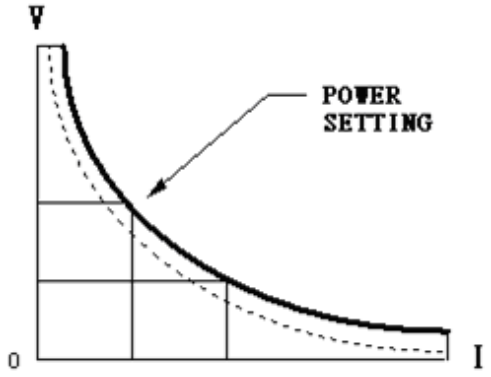


Fig 1-6 Constant Power mode

1.1.5. LED Mode

In the LED mode of operation, Voltage is applied to the 33431G series electronic load until the voltage is greater than Vd load on, Vo = (Io * Rd) + Vd last provided by LED DRIVER corresponding to a constant current Io Io and Vo Vo for their work to this point shown in Figure 1-7.

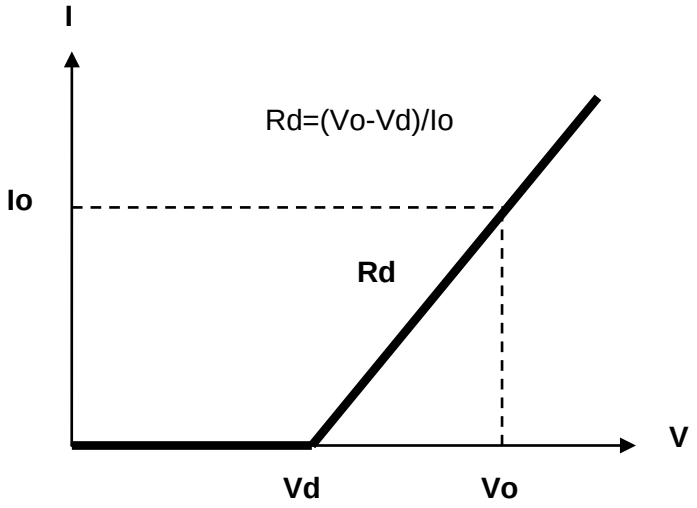


Fig 1-7 LED mode characteristics

1.1.6. Dynamic Waveform Definition

Along with static operation the 33431G series load 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 33431G series load . 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 1-8.

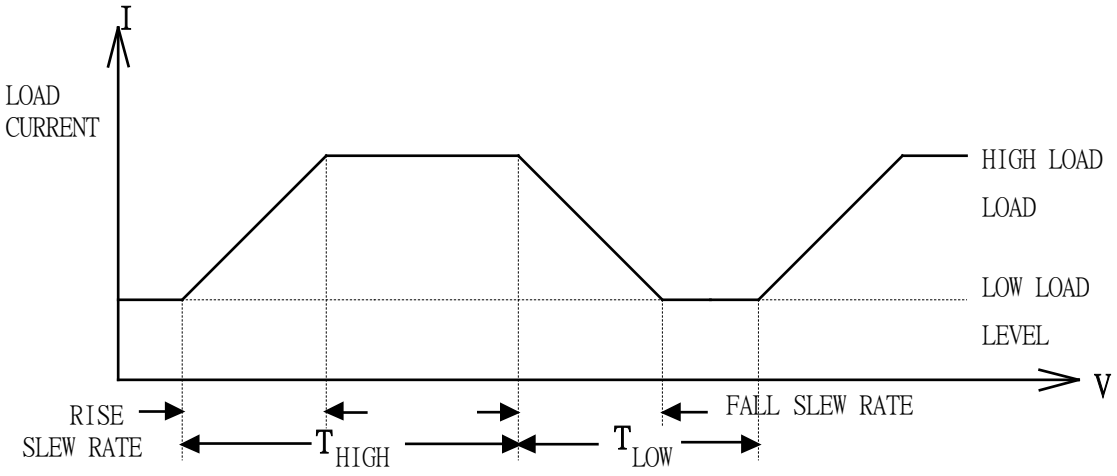


Fig 1-8 Dynamic Wave form

The dynamic waveform can also be set up via the optional computer interface. Dynamic waveform settings made from the front panel of the load can also be saved in the memory of the mainframe.

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)

The analogue programming input also provides a convenient method of implementing a dynamic waveform. Please see the section 3.2.29 titled ‘Analog Programming Input’ for further information.

1.1.7. 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 1-9
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.
Use the following formula to calculate the minimum transition time for a given slew rate

Min transition time=3.6A(12*30%) / slew rate (in amps/second).
6uS (3.6A/0.6) x 0.8(10%~90%) =4.8uS

Use the following formula to calculate the maximum transition time for a given slew rate
Max transition time=12A / slew rate (in amps/second).
20uS (12A/0.6) x 0.8(10~90%) = 16uS

EX. CCH=3A, CCL=0A Slew Rate =0.6A, the expected time is 4uS but the actual transition Time will be limited to 4.8uS
5uS(3/0.6)x 0.8(10%~90%) = 4uS

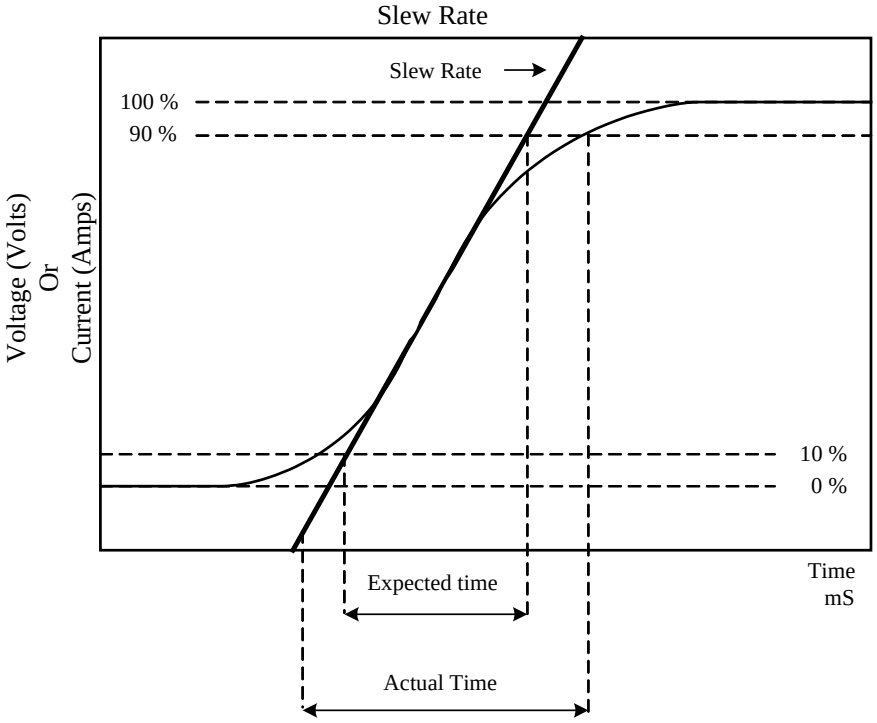


Fig 1-9 Rise Time Transition Limitation

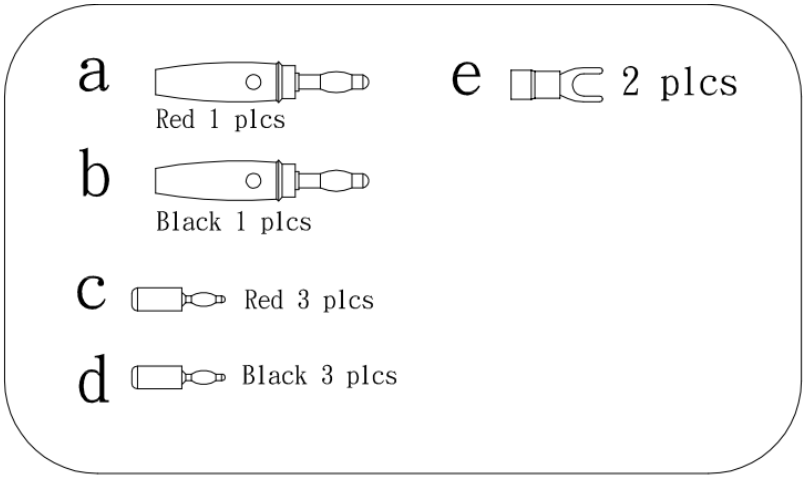
1-2. Features

The main features of the 33431G series of load are highlighted below.

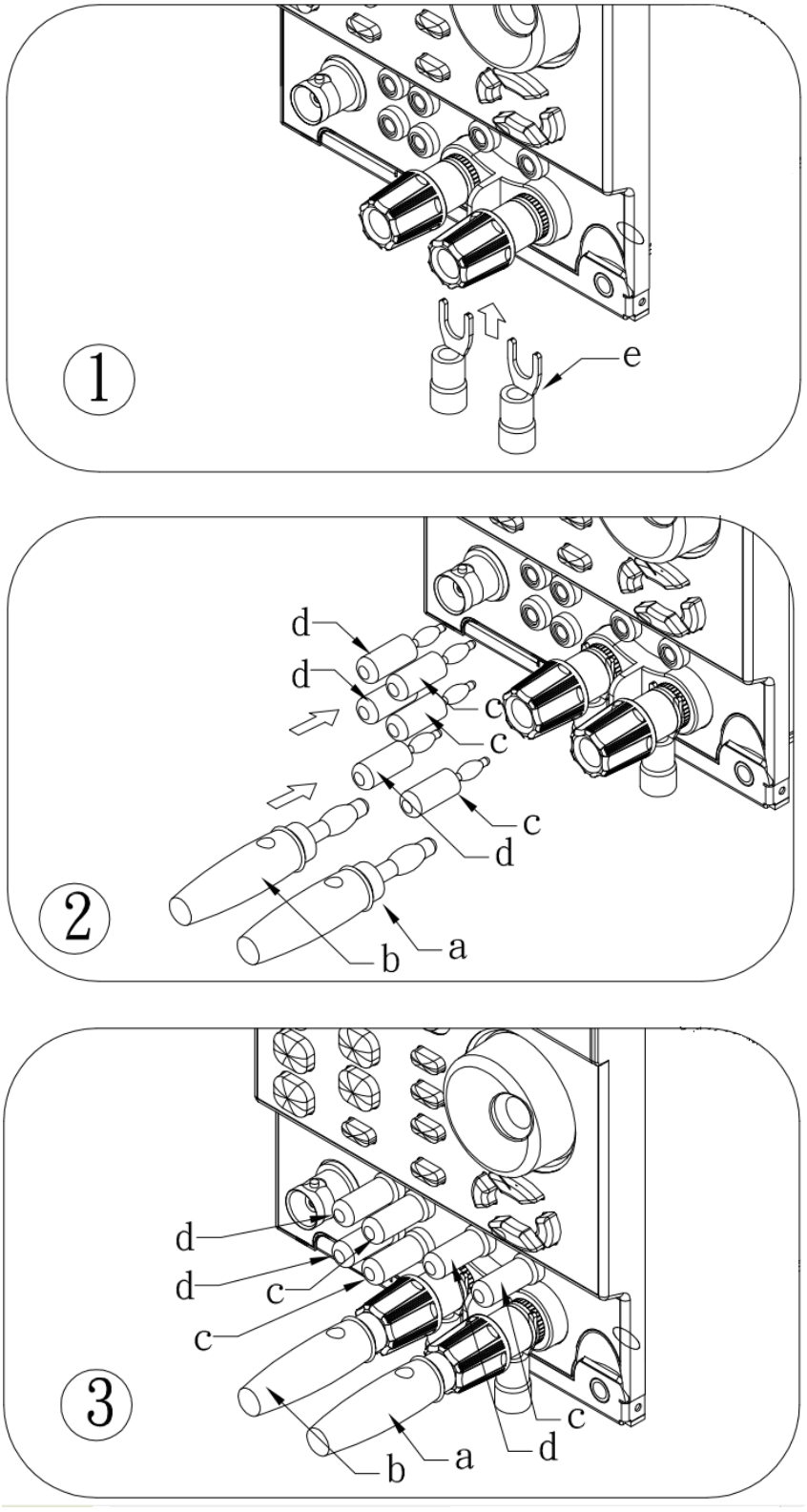
- Bench top and rack mounting flexibility with single, dual and 4 slot mainframes
- CC, CR, CV, CP, LED, Dynamic, and Short Operating Mode.
- Remote control via a choice of computer interfaces.
- High accuracy & resolution with 16 bit voltage and current meter.
- Built in pulse generators for dynamic loading.
- Independently adjustable current rise and fall times.
- Short circuit test with current measurement
- Dedicated over current and overpower protection test functions
- Programmable voltage on/off capability.
- Full protection from overpower, over-temperature, overvoltage, and reverse polarity.
- Analogue programming input for tracking an external signal
- Current Monitor with BNC (non-isolated) socket.
- Digital Calibration
- Advance Fan speed control
- Ability to save load set-ups via the mainframe memory (150 store/recall locations)
- Auto sequence function allowing test routines to be set from the mainframe

1-3. Standard Accessories

a	4mm Banana Plug (Red)	1 PC
b	4mm Banana Plug (Black)	1 PC
c	2mm Banana Plug (Red)	3 PCS
d	2mm Banana Plug (Black)	3 PCS
e	ZE090 SNB8-6 Y type terminal	4 PCS
f	Alligator clips(RED)	1 PC
g	Alligator clips(Black)	1 PC
h	M8 ROUND SCREW	2 PCS
i	WASHER INSIDE DIA-8.5	4 PCS
j	BNC- Alligator clips PTV0.5-9 L=1m	1PC
k	33431G series operation manual	1PC



1.3.1 Accessories Installation Description



1-4. Option

a Short Relay BD 1 PC

1-5. Specifications

Model	**33431G**	**33432G**
Power	1800W	3600W
Current	0~12A	0~24A
Voltage	0~600V	0~600V
Min. Operating Voltage	6V @ 12A	6V @ 24A
Constant Current Mode		
Range *1	0~3A/12A	0~6A/24A
Resolution	0.05mA/0.2mA	0.1mA/0.4mA
Accuracy	± 0.1% OF (Setting + Range)	
Constant Resistance Mode		
Range	CRL: 0.5~1.5K(300V) / CRH:1-3K(600V)	CRL: 0.25-3K(300V) / CRH:0.5-6K(600V)
Resolution	CRL: 3.333uS / CRH:1.666uS	CRL: 6.666uS / CRH: 3.333uS
Accuracy	± 0.2% OF (Setting + Range)	
Constant Voltage Mode		
Range	60V/300V/600V	60V/300V/600V
Resolution	1mV/5mV/10mV	1mV/5mV/10mV
Accuracy	± 0.05% OF (Setting +Range)	
Constant Power Mode		
Range	1800W	3600W
Resolution	30mW	60mW
Accuracy	± 0.5% OF (Setting + Range)	
LED Mode		
Vo Voltage Range	LEDL:60V / LEDM:300V / LEDH:600V	LEDL:60V / LEDM:300V / LEDH:600V
Rd Resistance Range	LEDL : 0.5 ~ 100Ω @ Vo-Vd = 0~6V LEDL : 5 ~ 1KΩ @ Vo-Vd = 6~60V LEDM: 2.5 ~ 500Ω @ Vo-Vd = 0~30V LEDM: 25 ~ 5KΩ @ Vo-Vd = 30~300V LEDH: 5 ~ 1KΩ @ Vo-Vd = 0~60V LEDH: 50 ~ 10KΩ @ Vo-Vd = 60~600V	LEDL : 0.25 ~ 125Ω @ Vo-Vd = 0~6V LEDL : 2.5 ~ 1.25KΩ @ Vo-Vd = 6~60V LEDM: 1.25 ~ 625Ω @ Vo-Vd = 0~30V LEDM :12.5 ~ 6.25KΩ @ Vo-Vd = 30~300V LEDH : 2.5 ~ 1.25KΩ @ Vo-Vd = 0~60V LEDH : 25 ~ 12.5KΩ @ Vo-Vd = 60~600V
Resolution	16Bits	
Accuracy	Vd : ± (0.05% OF SETTING + 0.1% OF RANGE), Rd : ± (0.05% OF SETTING + 0.1% OF RANGE)	
Dynamic Mode -CC		
Timing		
Thigh & Tlow	0.050~9.999 / 99.99 / 999.9 / 9999mS	
Resolution	0.001 / 0.01 / 0.1 / 1mS	
Accuracy	1uS/10uS/100uS/1mS + 50ppm	
Slew rate	2.4mA ~ 150mA/uS 9.6mA ~ 600mA/uS	4.8mA ~ 300mA/uS 19.2mA ~ 1200mA/uS
Resolution	0.6mA / 2.4mA/uS	1.2mA / 4.8mA/uS
Min. Rise Time	20uS(typical)	20uS(typical)
Current		
Range *2	0~3A/12A	0~6A/24A
Resolution	0.05mA/0.2mA	0.1mA/0.4mA
Measurement		
Voltage Read Back		
Range (5 Digital)	60V/300V/600V	60V/300V/600V
Resolution	1mV/5mV/10mV	1mV/5mV/10mV
Accuracy	± 0.025% OF (Reading + Range)	
Current Read Back		
Range (5 Digital)	0~3A/12A	0~6A/24A
Resolution	0.05mA/0.2mA	0.1mA/0.4mA
Accuracy	± 0.1% OF (Reading + Range)	
Power Read Back		
Range (5 Digital)	0~1800W	0~3600W
Resolution	0.01W	
Accuracy	± 0.125% OF (Reading + Range)	
Program mode(Mainframe)		
Sequence No.	F1~9/16 Steps	
T1/T2 (Dwell)	0.1S~9.9S/Repeat 9999	
Load Setting (External Programming)	0~10V for CC mode F.S.	
GO/NG Check	Voltage/Current/Power	

Protections		
Over Power	105% of Rated Power	
Over Current	105% of Rated Current	
Over Voltage	105% of Rated Voltage	
Over Temp.	Yes	
Interface(Mainframe)		
RS-232	Optional	
GPIB	Optional	
USB	Optional	
Ethernet	Optional	
Others		
Load ON Voltage		
Range	0.4~100.0V	0.4~100.0V
Resolution	0.4V	0.4V
Accuracy	1% of Setting + 0.25V	
Load OFF Voltage		
Range	0.4~100.0V	0.4~100.0V
Resolution	Same as Voltage Meter	
Accuracy	Same as Voltage Meter	
General		
Imonitor	1.2A/V	2.4A/V
Accuracy	± 0.5% of (READING+RANGE)	
short Single Output	12V/100mA	12V/100mA
Short Circuit		
Current	12A	24A
Dimming Control		
Level Range	0~12V	
Resolution	0.048V	
Accuracy	1% of (SETTING + RANGE)	
Frequency Range	DC~1KHz	
Resolution	10Hz	
Duty Range	0.01~0.99(1%~99%)	
Resolution	0.01	
Temperature Coefficient	100ppm/℃(typical)	
Power	100Wmax	200Wmax
Operating Temperature *2	0~40℃	
Dimension(HxWxD)	177 x 440 x 445 mm/ 6.97x17.3x17.5 inch	889 x 596 x 600 mm / 35.01x23.43x23.60 inch
Weight	23.6 Kg/52.03 lbs	81.2 kg / 179.02 lbs
Safety & EMC	CE	

Note *1 : The range is automatically or forcing to range II only in CC mode
Note *2 : Operating temperature range is 0~40℃, All specifications apply for 25℃±5℃

Table 1-1 33431G Series Specification

Chapter 2 Installation

2-1. Inspection

The 33431G high power load was carefully inspected before shipment. If instrument damage has occurred during transport, please inform Prodigit's sales and service office or representative.

Your 33431G high power load 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 Prodigit sales office to obtain the correct cord. Refer to “check line voltage “to check the line voltage selection and fuse type.

2-2. Check line voltage

The 33431G Series high power load can operation with 115, 230Vac input as indicated on the label on the rear panel.

Make sure that the factory check mark corresponds to your nominal line voltage. Skip this procedure if the label is corrected marked.

2.2.1 With the 33431G Series load power OFF, disconnect the power cord.

2.2.2 Refer the drawing on the rear panel of 33431G high power load in Fig 2-1, set the switches to the proper voltage as describe in the following:

2.2.3 Refer the drawing on the rear panel of 33432G high power load in Fig 2-2, set the switches to the proper voltage as describe in the following:

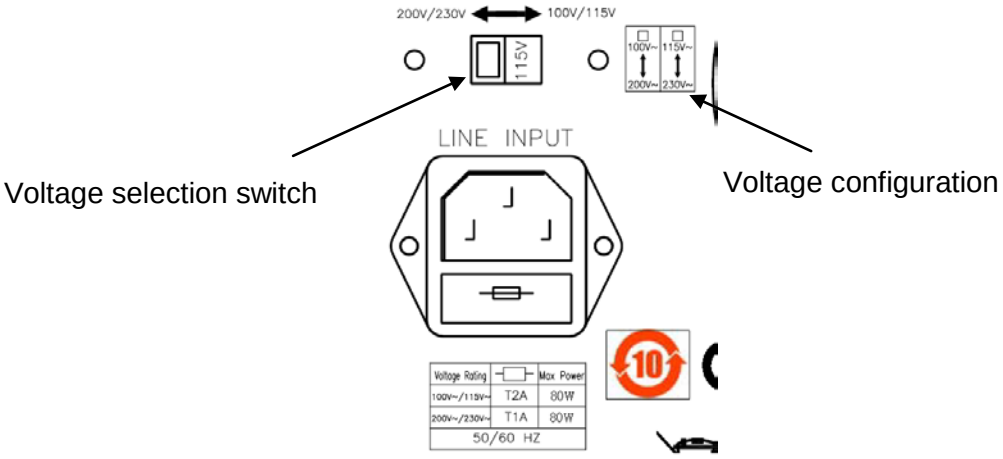


Fig 2-1 33431G LINE INPUT AND VOLTAGE SELECT SWITCH

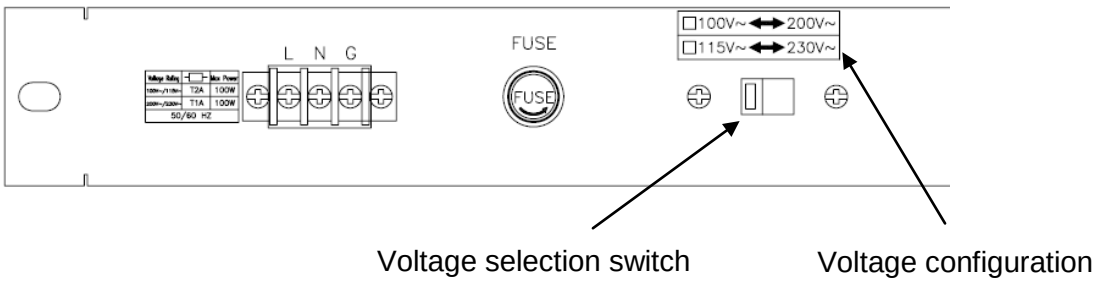


Fig 2-2 33432G LINE INPUT AND VOLTAGE SELECT SWITCH

2-3. Fuse Exchange

This product has the power fuse, and exchanges it according to the following procedure.

Never fail to turn off the power of this product, and disconnect the plug of the AC Power cable.

To avoid the fire or electronic shock, the Fuse that will be used in the product should have the safety standard in the area of the region you use. Any use of improper Fuse or shorting the Fuse holder would be extremely dangerous and would be strictly prohibited.

- Before exchanging the Fuse, if there are abnormal odor or abnormal noise,
  - Please stop using immediately and ask for the repair.

2.3.1 Check the rating of the line fuse and replace it with the correct fuse if necessary.

2.3.2 The AC line fuse is located below the AC line receptacle 33431G see Fig 2-3,33432G see Fig2-4. Use a small screwdriver to extract the fuse holder, to change a new one. Change an appropriate specification fuse which indicated Table 2-1.

2.3.3 Reinstall fuse holder and connect the power cord.

	1Master	1Master + 1Slave
AC110V/ AC115V	Time Delay Fuse 2A/250V (5*20mm)	Time Delay Fuse 4A/250V (5*20mm)
AC200V/ AC230V	Time Delay Fuse 1A/250V (5*20mm)	Time Delay Fuse 2A/250V (5*20mm)

Table 2-1 33431G Series Fuse Specifications

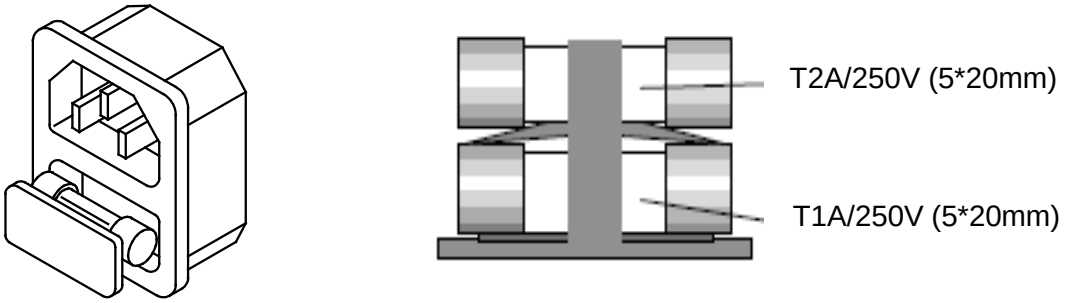


Fig 2-3 33431G FUSE RECEPTACLE

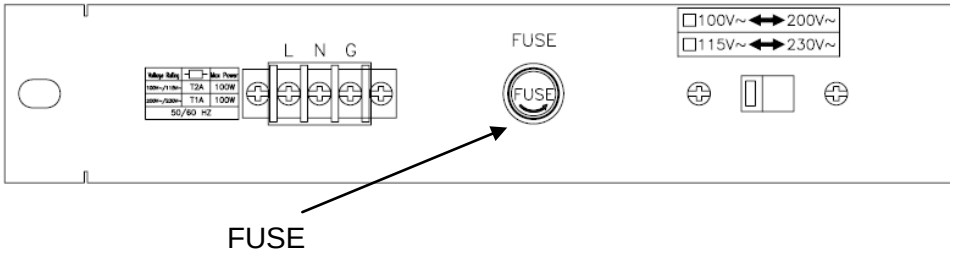


Fig 2-4 33432G FUSE RECEPTACLE

2-4. Grounding requirements

SHOCK HAZARD

1. It is requested to use the 3Pin plug connector only for 33431G mainframe to out of danger when electric leakage. And the complete and proper grounded is necessary.

2. The 33431G Series high power load is equipped with three conductor cable which plugs in an appropriate receptacle to ground the instrument's cover.

2-5. 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.

2-6. Observe the International Electrical Symbol listed below.

Warning ! Risk of electric shock

Caution ! Refer to this manual before using the load.

2-7. Cleaning

To clean this product, use a soft or wet cloth.

Before you clean this product, power this product off and disconnect the power plug.

- Please do Not use any organic solvent capable of changing the nature of the plastic such as benzene or acetone.
- Please pay attention that any liquid should not be penetrated into this product.

2-8. Power Up

Operation check

2.8.1 Turn off (O) the POWER switch
2.8.2 Check that the power cord is corrected.
2.8.3 Check that nothing is connected to the DC INPUT (load input terminal) on the front and rear panels

2-9. Connection to the load Input Terminal on the Rear Panel

Connection procedure of the load input terminal on the rear panel

2.9.1 Turn off POWER switch.
2.9.2 Check that the output of the equipment under test is off.
2.9.3 Connect the load wire to the load input terminal on the rear panel.
2.9.4 Check the polarity of the connection and connect the load wire to the output terminal of the equipment under test.

2-10. Repair

If the instrument is damaged, please attach a tag to the instrument to identify the owner and indicated the require service or repairing. And inform the Prodigit sales and service office or representative.

2-11. GPIB Interface Option

The GPIB connector is on the rear panel which to connect the 33431G mainframe to the controller and other GPIB devices. An GPIB system can be connected in any configuration (star, linear, or both) as long as

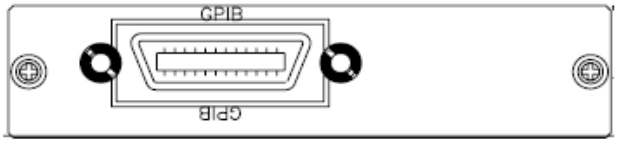


Fig 2-5 33431G Series GPIB Interface card

2-12. RS-232C Interface Option

Fig 2-6 shows the RS-232C connector (Female) on the rear panel connects 33431G mainframe to RS-232C port of computer in one by one configuration .The RS-232C BAUD-RATE can be set in the front panel, it will be lit the GPIB address when press the “SYSTEM” button. Press it again, it will be lit the BAUD-RATE.

Fig 2-6 33431G Series Rs-232 Interface card

2-13. USB Interface Option

Fig 2-7 shows the USB connector in the rear panel of 33431G mainframe. Please refer Appendix B.

Fig 2-7 33431G Series USB Interface card

2-14. LAN Interface Option

Fig 2-8 shows the LAN connector in the rear panel of 33431G mainframe. Please refer Appendix C.

Fig 2-8 33431G Series LAN Interface card

2-15. RS232 + GPIB Interface Option

2.15.1 GPIB + RS-232C connector is on the rear panel of 33431G Series mainframe for application GPIB , or RS-232C.

2.15.2 GPIB and RS-232C interface can only be used at the same time, to Change the interface must be reboot unit.

2.15.3 GPIB connection with three important limitations as Described below:

2.15.3.1 The maximum number of devices including the controller is no more than 15.

2.15.3.2 The maximum length of all cable in no more than 2 meters times the number of devices connected together, up to 20 meters maximum.

2.15.3.3 RS-232C connections on the rear panel, the connecting Device and the computer RS-232C port to pin to pin connection. (Note: Don't 2-wire connection, the detail as 4-2).

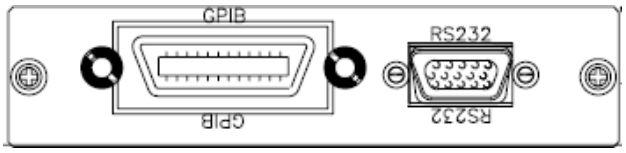


Fig 2-9 33431G Series RS232+GPIB Interface card

2-16. Analog programming Terminal input

The connector on the rear panel connects.

The 0 to 10V Analog signal can program the 0 to full scale input range in the CC mode (0 to 3A range when load current setting is less than 3A, or 0 to 12A range when load current setting is higher than 3A) or in the CP mode (0 to 180W range when load power setting is less than 180W, or 0 to 1800W range when load power setting is higher than 180W). The analog programming signal can act alone or it can be summed with the programmed value via GPIB, RS-232,USB,LAN or the front panel. Fig 2-10 shows the analog programming signal (4 Vac, 500Hz) is summed with the 8A programmed setting in CC mode of 33431G Load.

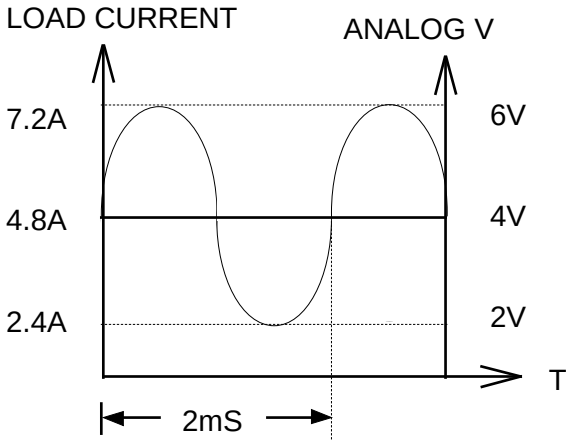


Fig 2-10 Analog programming load current in CC mode operation

2-17. Load current slew rate setting

What is the load current slew rate during load current level change, power supply turn ON/OFF switch between ON, and OFF? The 33431G Electronic load provides all of the above load current slew rate in controllable condition, the rise and fall current slew rate can be set independently from front panel operation or remote programming.

The slew rate determines a rate at which the current changes to a new programmed value. The slew rate can be set at the front panel or via GPIB on the rear panel of 33431G high power load.

The rise and fall slew rate can be independently programmed from 9.6mA/usec to 600mA/usec (33431G Load) in the 12A current range and from 2.4mA/usec to 150mA/usec in the 3A current range. This allows a independent controlled transition from Low load current level to High load current level (Rise current slew rate) or from High load current level to Low load current level(Fall current slew rate) to minimize induced voltage drops on the inductive wiring, or to control induced transients on the est. device (power supply transient response testing).

This controllable load current slew rate feature also can eliminate the overload current phenomenon and emulate the actual load current slew rate at turn ON the power supply under test. Fig 2-11 shows the load current slew rate is according to the power supply's output voltage, load level setting and Load ON/OFF switch. So, you could do all items of power supply testing task by using Constant current mode only, it can significantly improve the testing quality and process as well as efficiency.

There are two load current range in 33431G Load, Range I and Range II, the slew rate of range I, range II, RISE/FALL slew rate are listed in chapter 1-5 specifications.5.

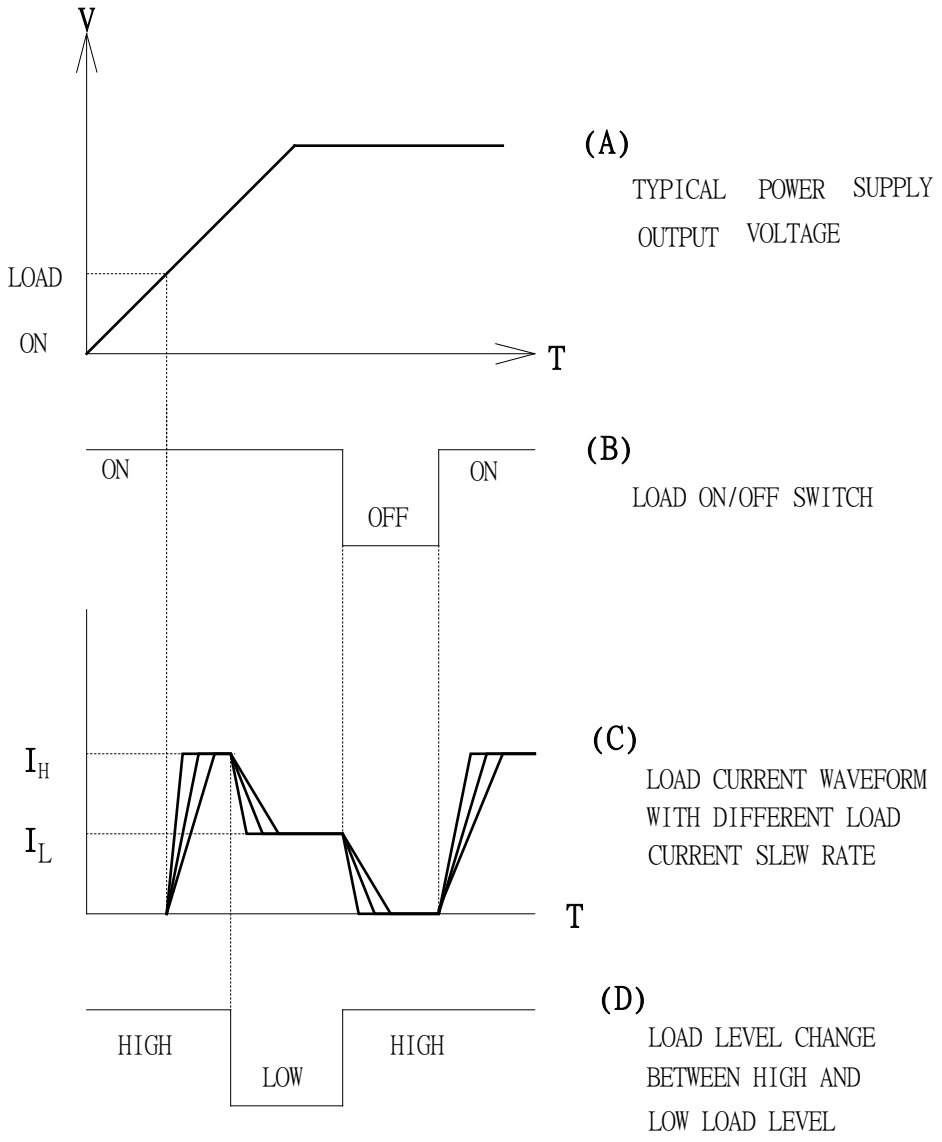


Fig 2-11 The relationship of load current load ON/OFF, load level and output voltage of DC power supply at turn ON

2-18. Emergency stop and Alarm

33431G series electronic load provided emergency stop signal input and alarm signals output interface on the Rear panel, connector to be D-sub25 Pin female port, Emergency stop signal and Alarm signal are isolated.

The emergency stop signal is active low, when emergency stop signal goes to low, the 33431G Series Load will go to load “off” immediately.

The Alarm signal is active low, when any one protection active (OVP, OCP, OPP, OTP), and this time the load will go to load “off” immediately. The Alarm signal will return to high when every protection status release after one second.

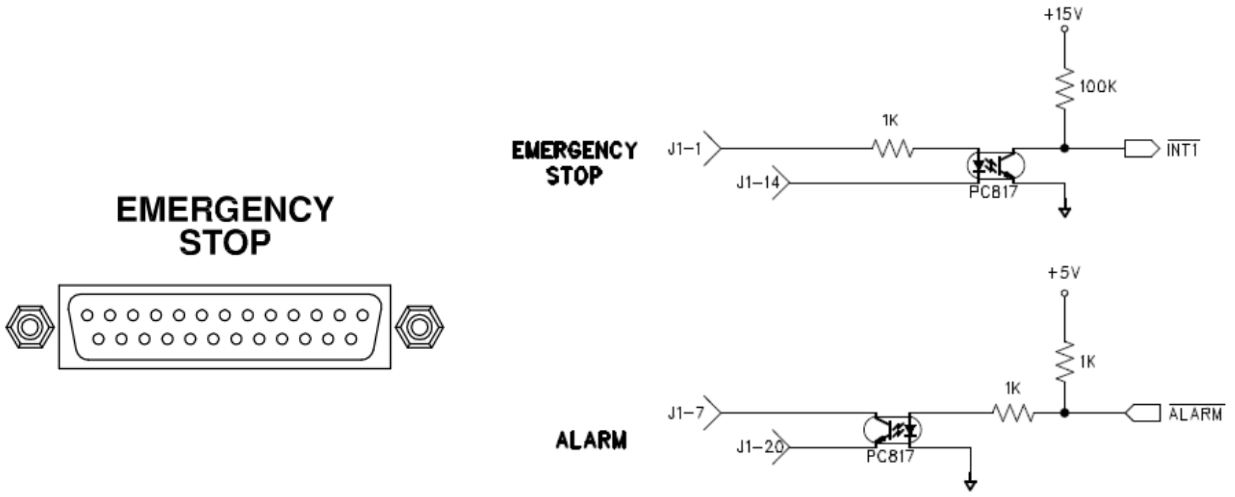


Fig 2-12 Emergency stop controller Connection

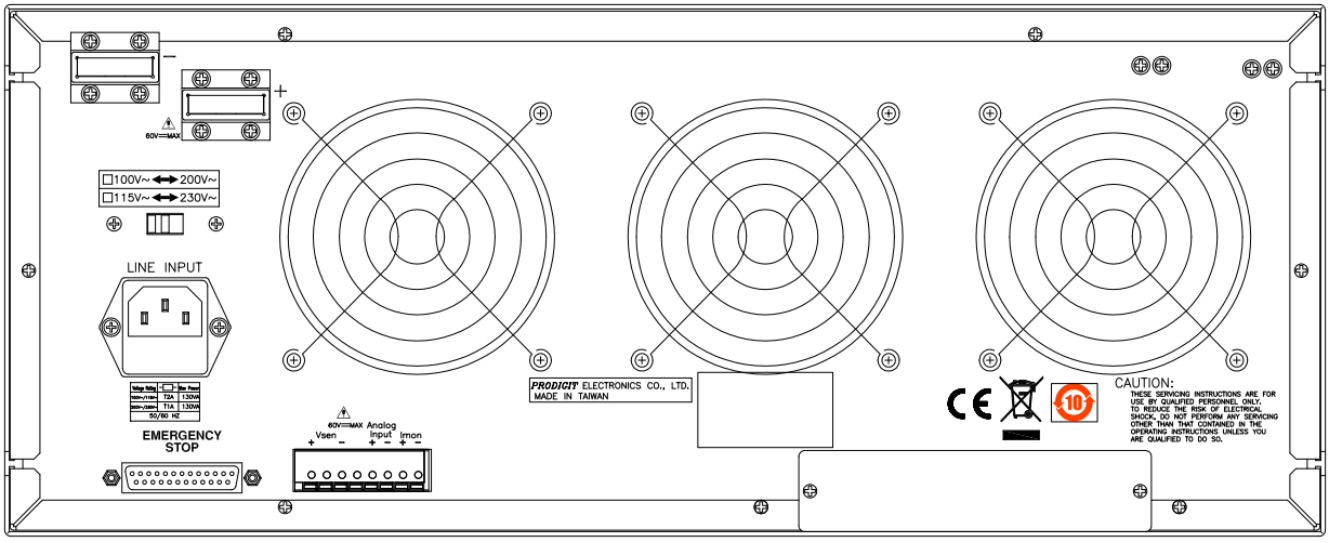


Fig 2-13 33431G series Rear panel

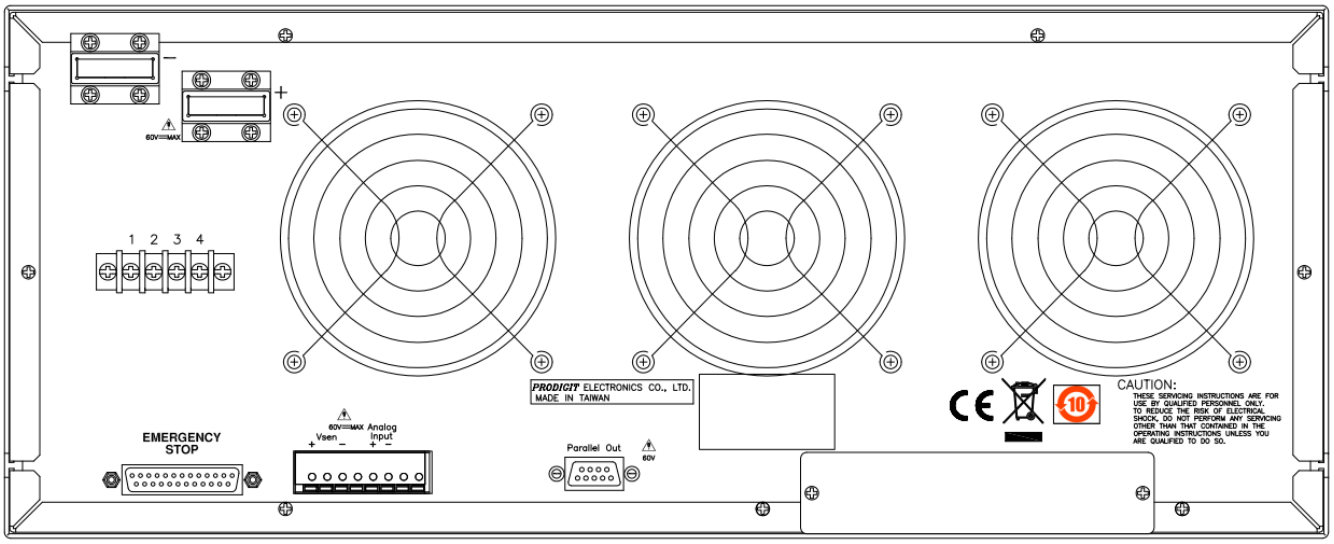


Fig 2-14 33432G series Rear panel

Chapter 3 Operation

This chapter describes the front panel function and operation of each 33431G Series load, the memory Store/Recall, GPIB/RS-232/LAN/USB remote programming are described in the mainframe operation manual. Please refer to the mainframe's operation manual for mainframe store/recall and GPIB/RS-232/LAN/USB programming.

3-1. Front panel 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.

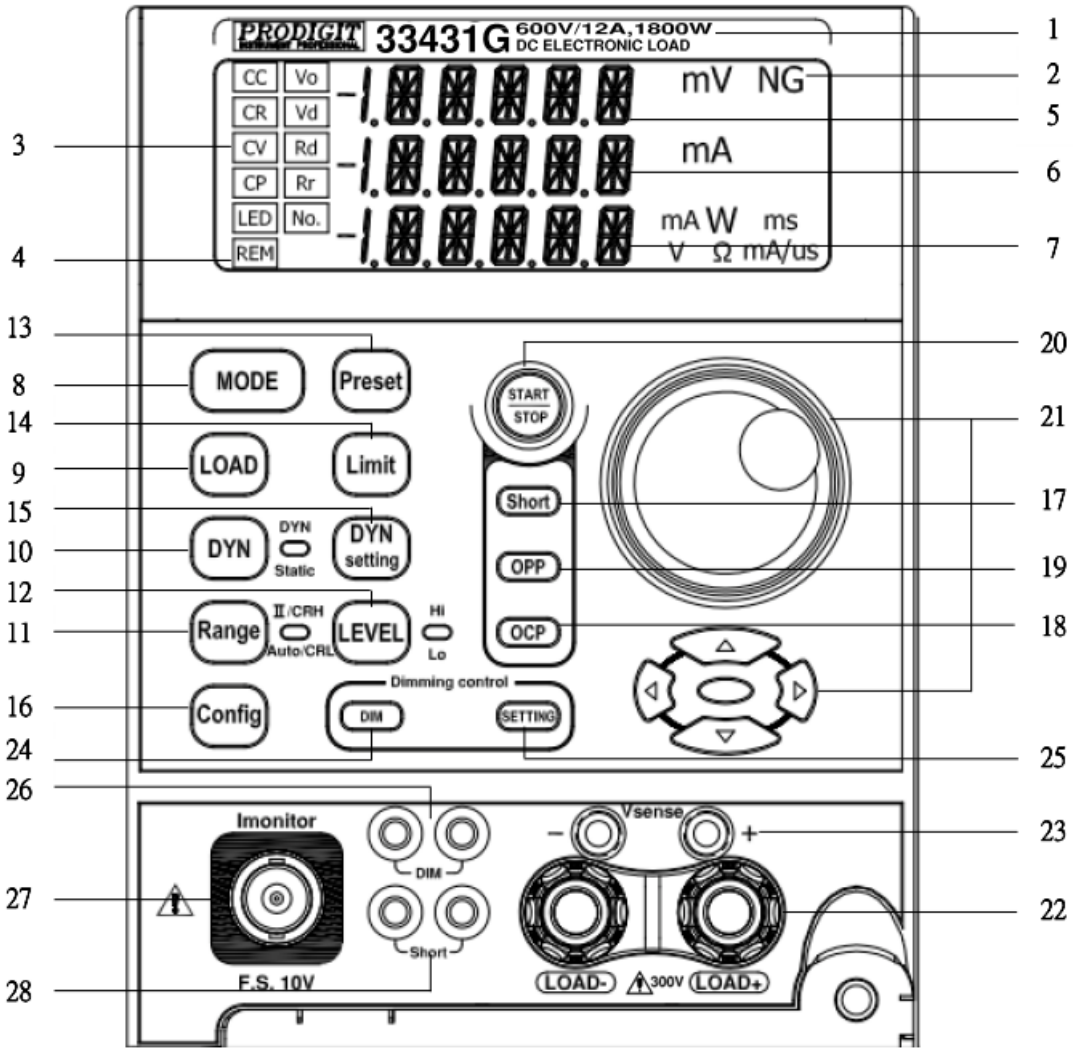


Fig 3-1 33431G High Power Front Panel

3-2. Instructions

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 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 , LED mode, LCD

Indicator, There are four operating modes that can be selected by pressing the "MODE" key on the 33431G series Electronic Load.
The sequence is Constant Current (CC), Constant Resistance (CR), Constant Voltage (CV) , Constant Power (CP) and LED mode (LED). 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, CP and LED modes are described in Section 1-1. Common application examples for the different operating modes are described in Section 5-3 to 5-7 respectively.

Constant current (CC) mode provides a force Range 2 functions, mainly used when using the CC Range 1, but when they need fast Slew Rate can be set in the CC force the Range 2.

In LED mode, Vo setting the Range of third, 33431G series electronic load will be set according to Vo and Vd, automatically adjusts to the most appropriate gear.

Note: The program version 2.16 defaults the boot for the LED Mode and Rd_Io default for Io.

3.2.4. REM LCD Indicator

Remote LCD indicator can be bright by computer control.
When Remote LCD indicator goes off, indicating that manual operation.

3.2.5. 33431G Upper 5 digits LCD display

The 5 digits 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:

<u>Normal mode:</u>
The upper 5 digits 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)

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. 33431G Middle 5 digit LCD display

Normal mode:
There is a 5 digit DAM display. The 5 digit DAM displays the measuring current of the DC load When Load ON programming.

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, SHORT, OPP or OCP buttons are pressed the middle LCD show 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 “LDon” → “LDoff” → “POLAR” → “AVG“→“Rd_Io“→“LED“→“CV_bw“
- **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”
- **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. 33431G 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”.

- If LED mode No is selected the lower display provides setting in number.
- If LED mode Vo is selected the lower display provides setting in volts “V”.
- If LED mode VD is selected the lower display provides setting in volts “V”.
- If LED mode Rd is selected the lower display provides setting in ohms “Ω”.
- If LED mode Io is selected the lower display provides setting in amps "A".

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:

➔ 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」
➔ AVG (Average) can be set value 1~64.
➔ Rd_Io can be set to 「Rd」or「Io」.
➔ LED No. can be set to 「ON」or「OFF」.
➔ CV_bw can be set to 「Hi」or「Lo」.

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.

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

33431G series electronic load MODE has five operating modes.
Select the program for the LED mode (LED)、current (CC)、resistance (CR) and voltage (CV), fixed power (CP), switch on the LCD LED, CC, CR, CV, and CP depending on the selected operating mode

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

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

3.2.9. LOAD key and LED

The input to the 33431G 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 33431G series Load features 2 setting ranges for CC, CR, CV, CP and LED 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.

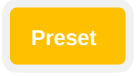
3.2.12.2 In Constant Resistance mode:
The level is initial setting on High, LEVEL High / Low has two level, Low resistance level setting must be higher than Level High.
P.S.：CR Mode Level High / Low level by current perspectives.

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

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.

3.2.13.1. 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.

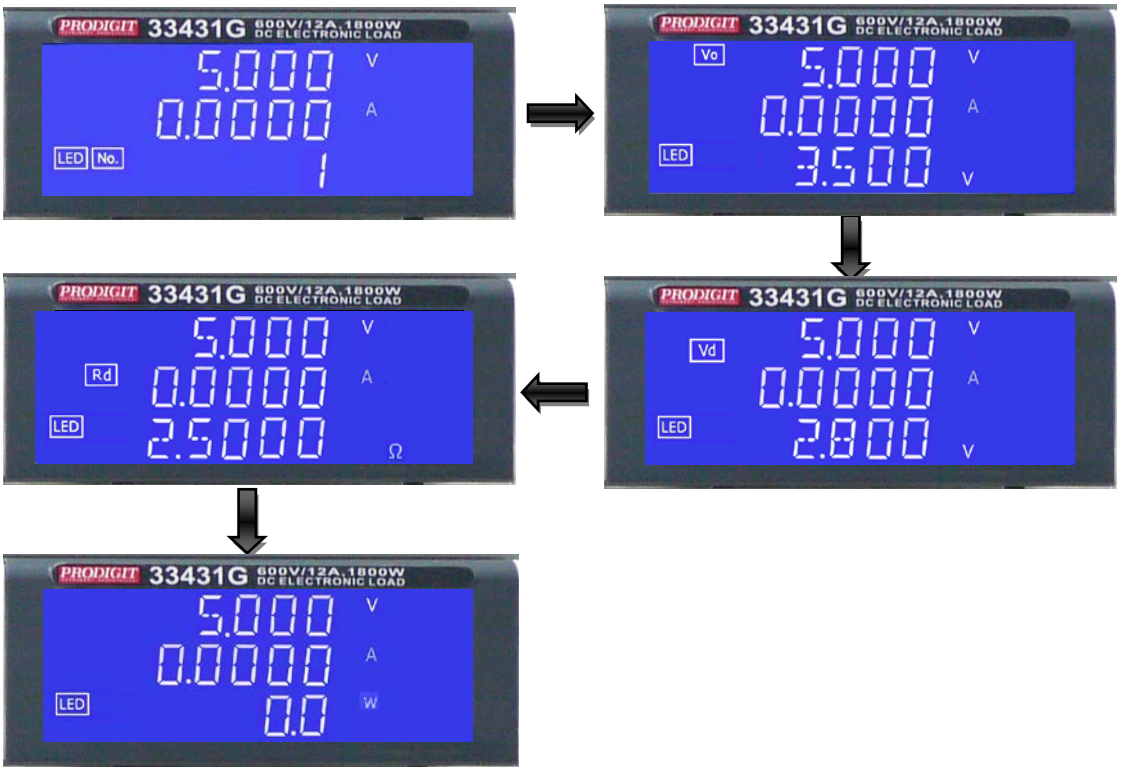
3.2.13.2. Constant Resistance (CR) mode:
The High and Low levels of load resistance can be preset on the lower 5 Digit LCD. The "Ω" LED will be lit indicating the setting value is ohms.

3.2.13.3. 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.

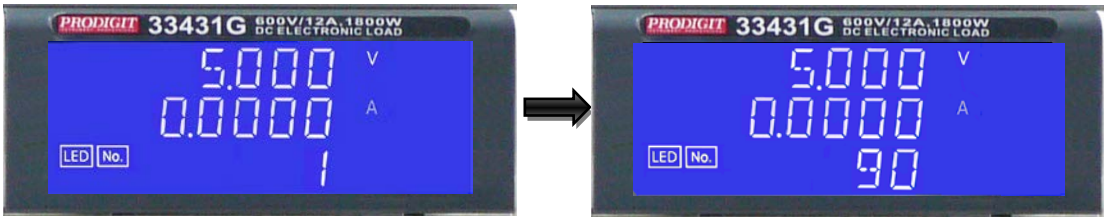
3.2.13.4. LED mode:

Load the LED parameters set value is displayed on the display of below. Press the Preset key ON, sequence set "No." -> "Vo" ->"Vd" -> "Rd" -> Preset OFF.

Note: When the Preset OFF when you cannot change the settings, must Be Set in the Preset ON.



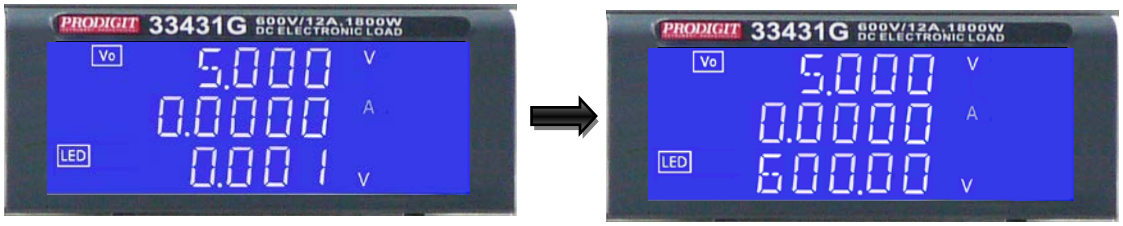
- LED Mode, LED Quantity set the initial value of 1, Simulation can change this setting LED cascading connection features a few pieces, the latter setting the specifications of LED can be set a parameter, cascading connection LED as a light Bar, to set back the settings, 33431G~ 3343G setting range is 1 ~ 90,



Note: Changing the quantity of possible shift caused Rd, Rd automatically switch to The original settings, if you have exceeded the value of the nearest range setting, Change the quantity of confirmed again after the settings are correct.

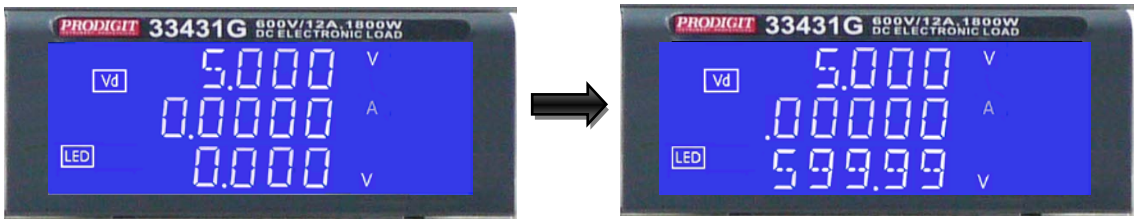
- LED Mode, Vo set the initial value of 3.5V.Vo must be less than the Specifications in addition to set quantity, Vo is a single LED of the Vo voltage.

- LED Mode, setting the Vo, The LCD display shows, lower 5 digit LCD display setting value, the unit is "V", the setting range is 0.000V to the full scale of the LED mode specification. The setting is by rotating the setting knob.

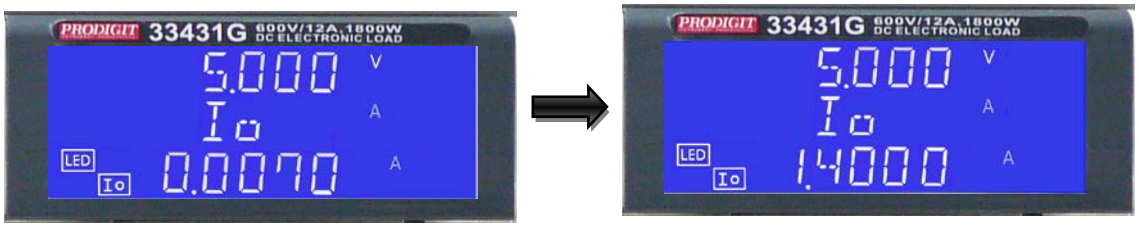


- LED Mode, Vd is 80 percent the initial value of Vo, when change Vo, When the Vo after the change, Vd will also be changed Vo 80 percent ,Vd is a simulation of a single LED of the Vd voltage, Vd initial value of 2.8V

- LED Mode, setting the Vd, The LCD display shows, lower 5 digit LCD display setting value, the unit is "V", the setting range is 0.00V to the 299.99V of the LED mode specification, The setting is by rotating the setting knob.

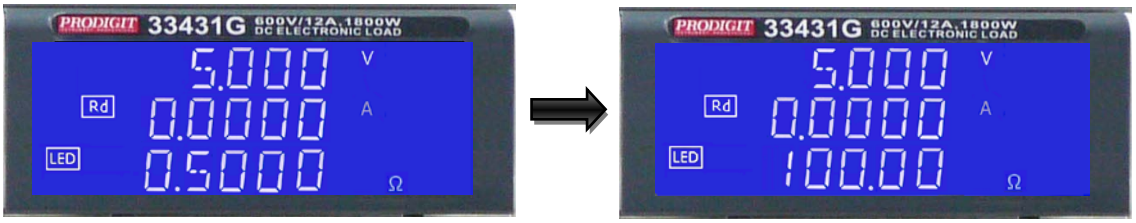


- LED Mode, Io setting, please config to uses the knobs or key setting "Io".
  When Vo is 3.5V and Vd is 2.8V, the setting range is 0.0056A to the 5.6000A of the LED mode specification, The setting is by rotating the setting knob.
  Io= (Vo-Vd)/Rd



- LED Mode, press “Config” and switch Rd_Io.
- Rd setting the initial value of 0.125 ohm, according to n * (Vo-Vd) of the voltage will be three Ranges, See Specifications Table 1-1.

- LED Mode, Rd setting, The LCD display shows, lower 5 digit LCD display, the unit is "Ω", the setting range is 0.5000Ω to the 100.0Ω of the LED mode specification, the setting is by rotating the setting knob.



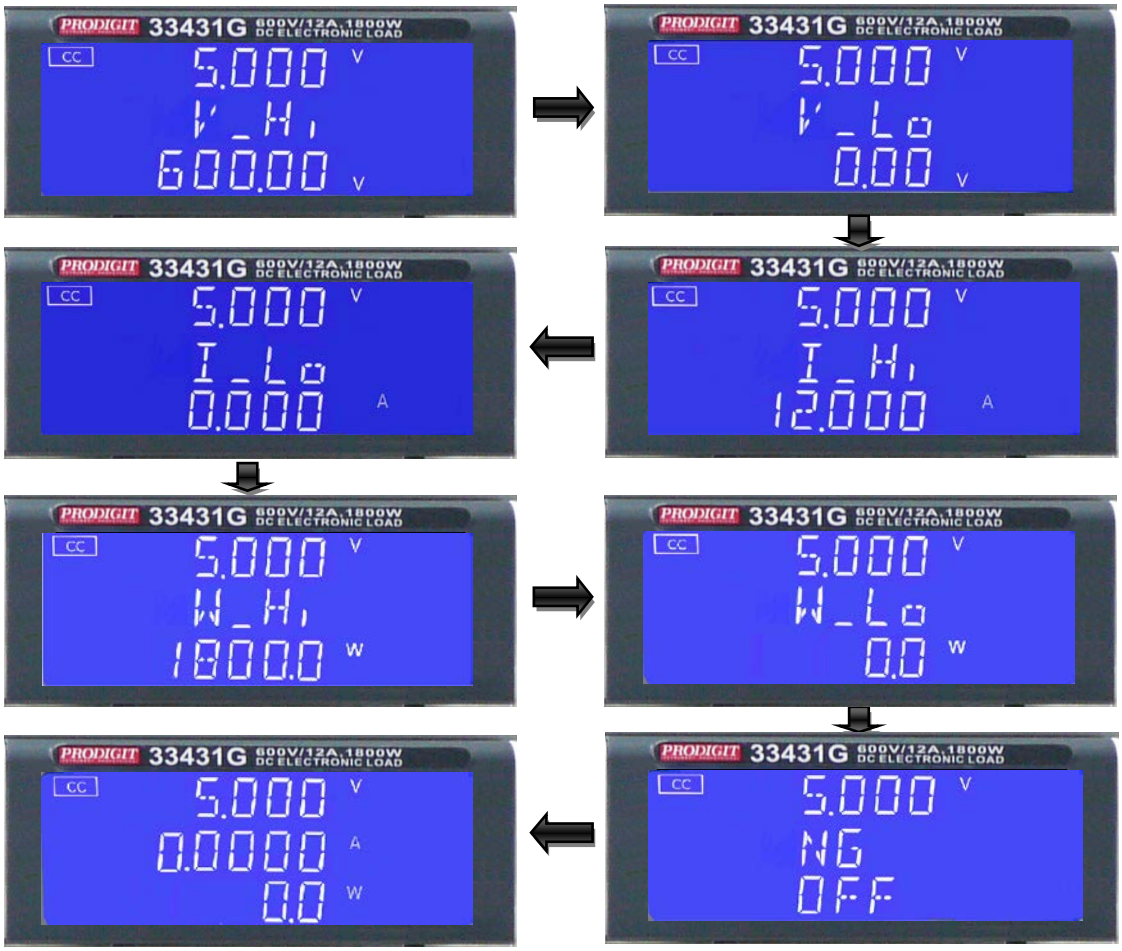
3.2.14. Limit key and LED

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

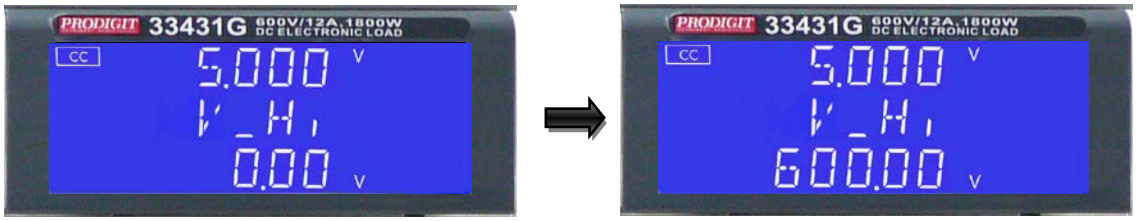
Each press of the LIMIT key enables a different value to be entered. On first press of the LIMIT key the button will illuminate and V-Hi will be displayed on the middle LCD. The setting is made with the rotary knob and can be read from the lower LCD during setting. The setting sequence is shown below:

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

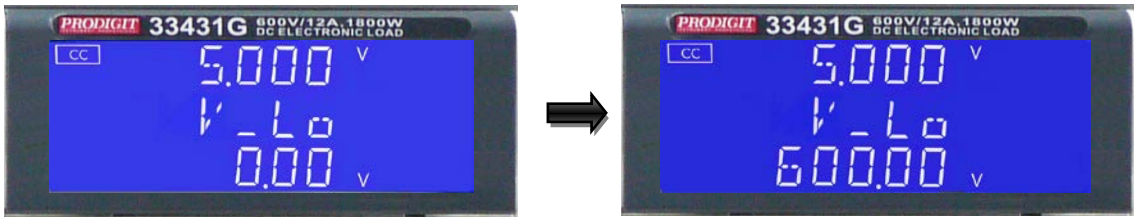
The engineering unit is “V”, “A” or “W” depending on the threshold LIMIT being set.



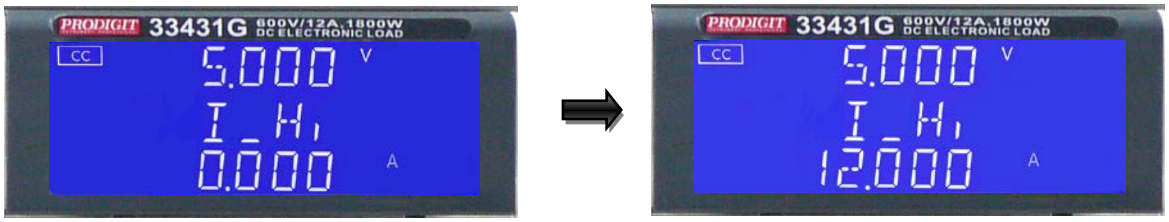
- Setting Upper limit voltage VH , Middle 5 digit LCD display「V-Hi」,lower 5 digit LCD display the unit is "V" ,The V-Hi set range from 0.00 V to 300.00V step 0.01V by rotating the Setting knob.



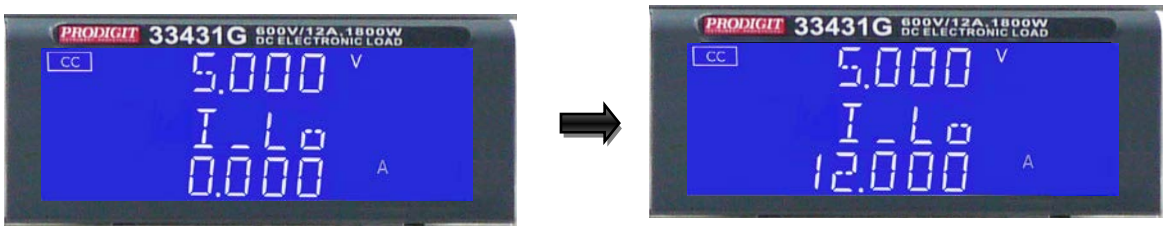
- Setting lower limit voltage VL, Middle 5 digit LCD display「V-Lo」,lower 5 digit LCD display the unit is "V",The V-Lo set range from 0.00 V to 600.00V step 0.01V by rotating the Setting knob.



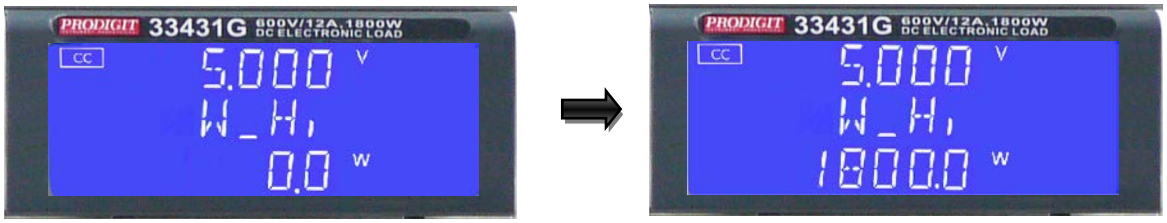
- Setting Upper limit current IH , Middle 5 digit LCD display「I-Hi」,lower 5 digit LCD display the unit is "A", The I-Hi set range from 0.000 A to 12.000A step 0.001A by rotating the Setting knob.



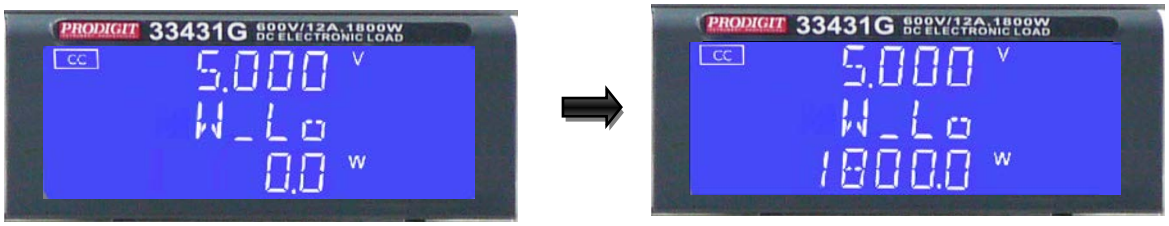
- Setting lower limit current IL , Middle 5 digit LCD display「I-Lo」,lower 5 digit LCD display the unit is "A" ,The I-Lo set range from 0.0000 A to 2.4000A step 0.0001A by rotating the Setting knob.



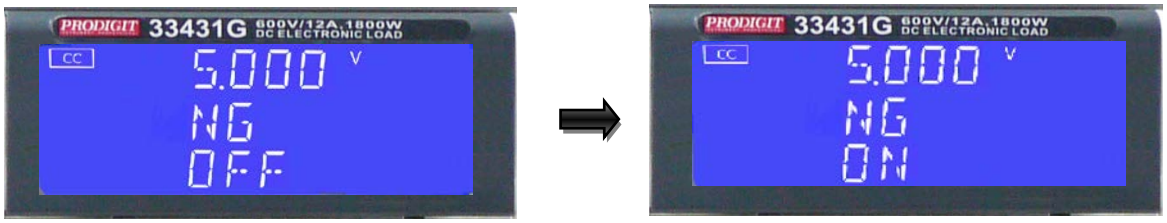
- Setting Upper limit power WH, Middle 5 digit LCD display「W-Hi」lower 5 digit LCD display the unit is "W", The W-Hi set range from 0.00 W to 300.00W step 0.01W by rotating the Setting knob.



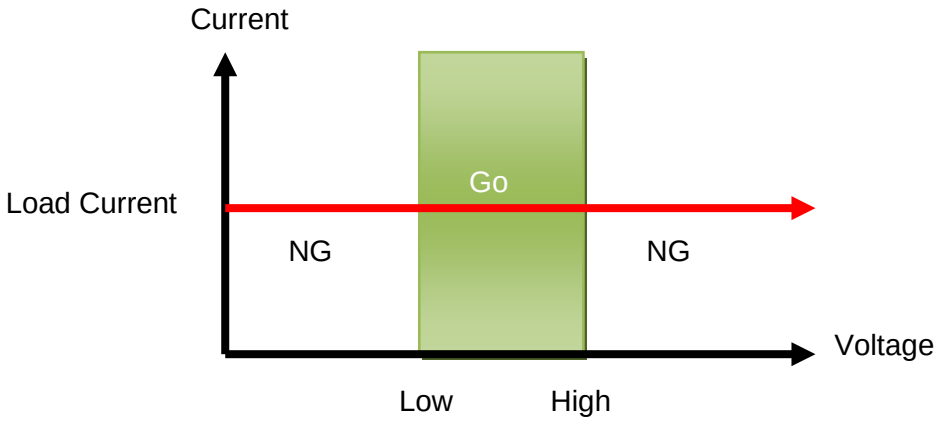
- Setting lower limit power WL, Middle 5 digit LCD display「W-Lo」lower 5 digit LCD display the unit is "W", The W-Lo set range from 0.00 W to 300.00W step 0.01W by rotating the Setting knob.



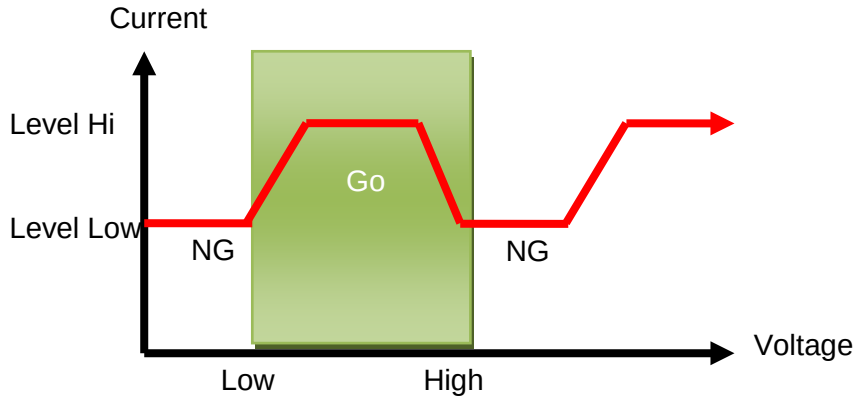
- Setting NG ON/OFF, When exceed VH、VL、IH、IL、WH、WL One of these Whether NG on LCD display.



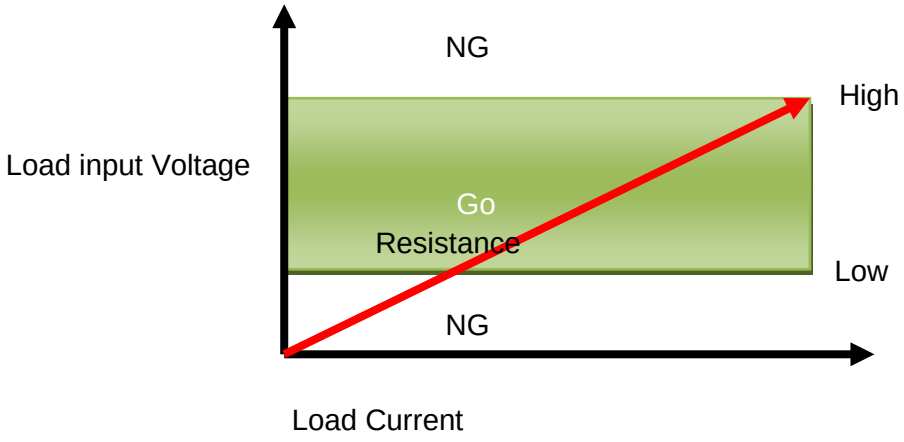
- CC mode, press limits key to set the V-Hi and V-Lo voltage upper and lower limits of the GO / NG.



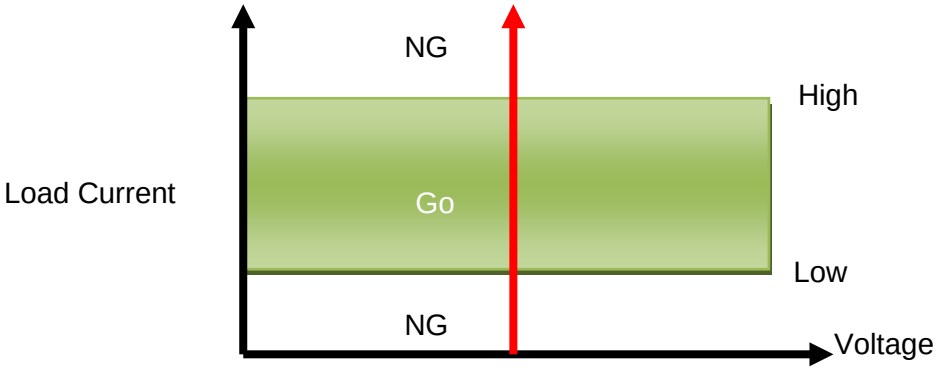
- CC Dynamic Mode, press key to set the Level Hi and Level Low voltage upper and lower limits of the GO / NG.



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

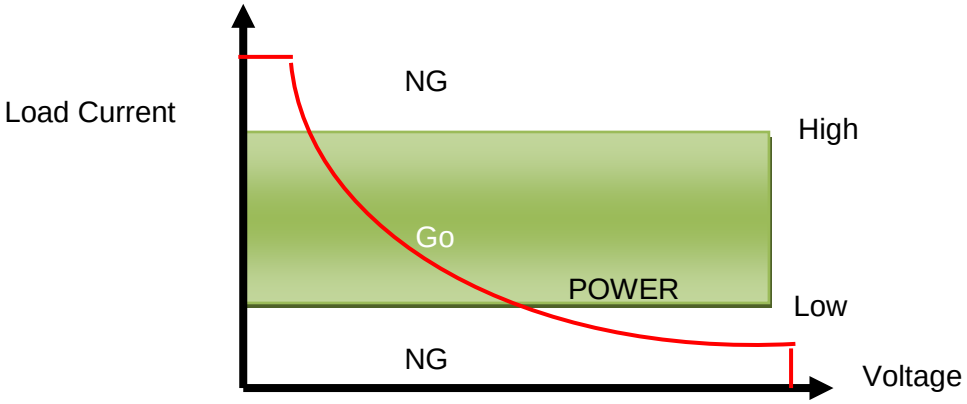


- CV mode, press limits key to set the I-Hi and I-Lo Current upper and lower limits of the GO / NG.



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.



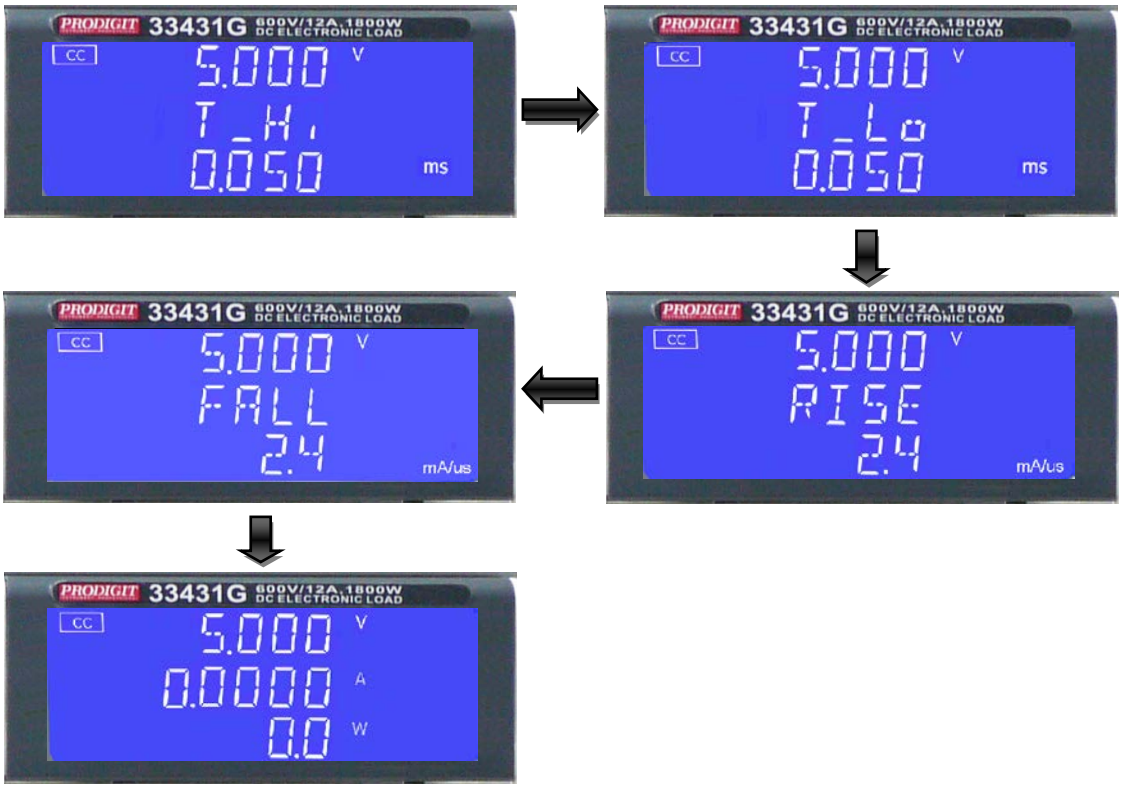
3.2.15. DYN setting and LED

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.

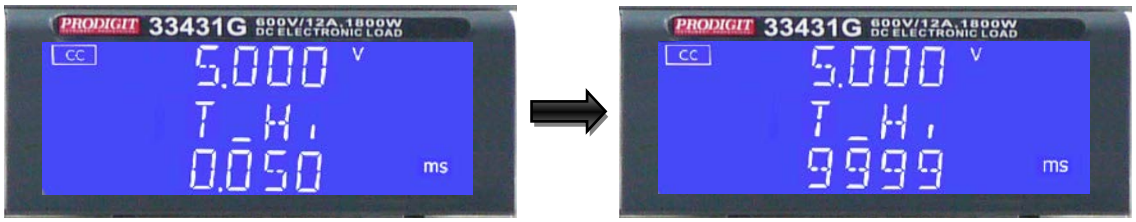
Each press of the DYN key enables a section of the DYNAMIC waveform to be set. On first press of the DYN key the button will illuminate and T-Hi will be displayed On the middle LCD. The value is adjusted with the rotary knob and can be read From the lower LCD during setting. The setting sequence is shown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

T_Hi (time the waveform is high) →
T_Lo (time the waveform is low) →
RISE (rise time) →
FALL (fall time) →
DYN setting function OFF

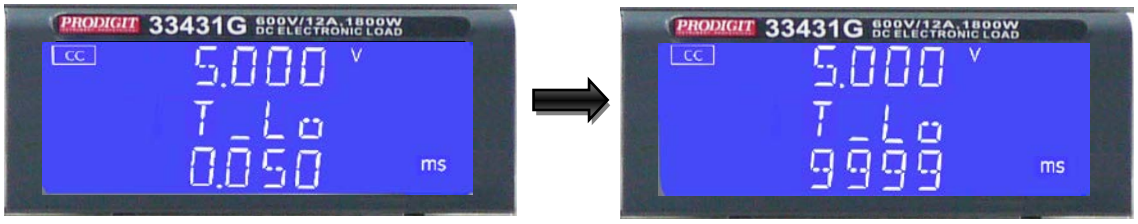
The time that the waveform is high includes the rise time and is set in “ms”
The time that the waveform is low includes the fall time and is set in “ms”
The RISE and FALL time is set in “mA/μs” or “A/μs”. The actual engineering unit is Shown on the right of the lower 5 digit display



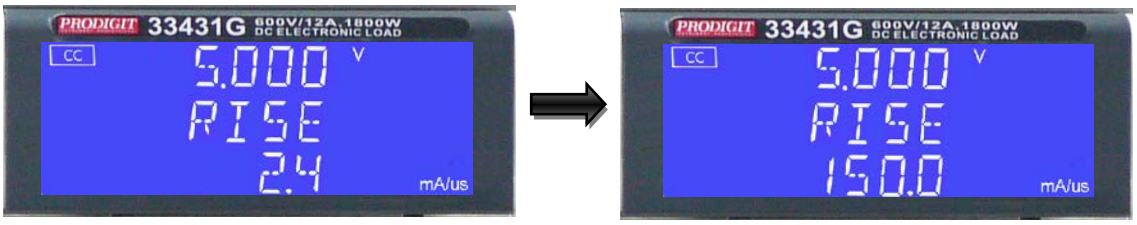
- Press DYN setting key, LED will ON
  Setting level High Period, Middle 5 digit LCD display will show 「T-Hi」
  Lower 5 digit LCD display will show setting value, the unit is “ms” , The T-Hi Set range from 0.050 ms to 9999 ms step 0.001ms by rotating the setting Knob.



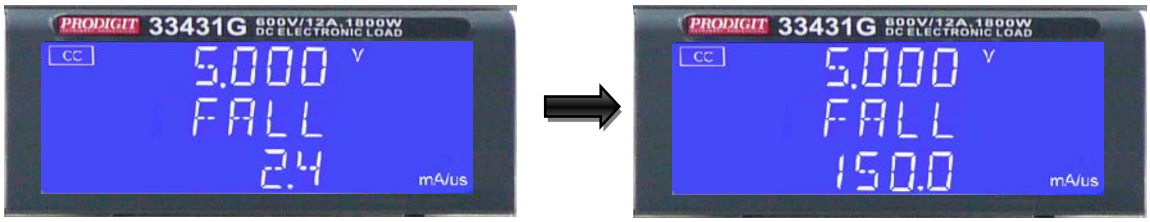
- Setting level Low period, Middle 5 digit LCD display will show 「T-Lo」, Lower 5 digit LCD display will show setting value, the unit is “ms” , The T-Lo set range from 0.050 ms to 9999 ms step 0.001ms by rotating the Setting knob.



- 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 2.4 mA/us to 150.0 mA/us step 0.6mA/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 2.4 mA/us to 150.0 mA/us step 0.6mA/us by rotating the Setting knob.

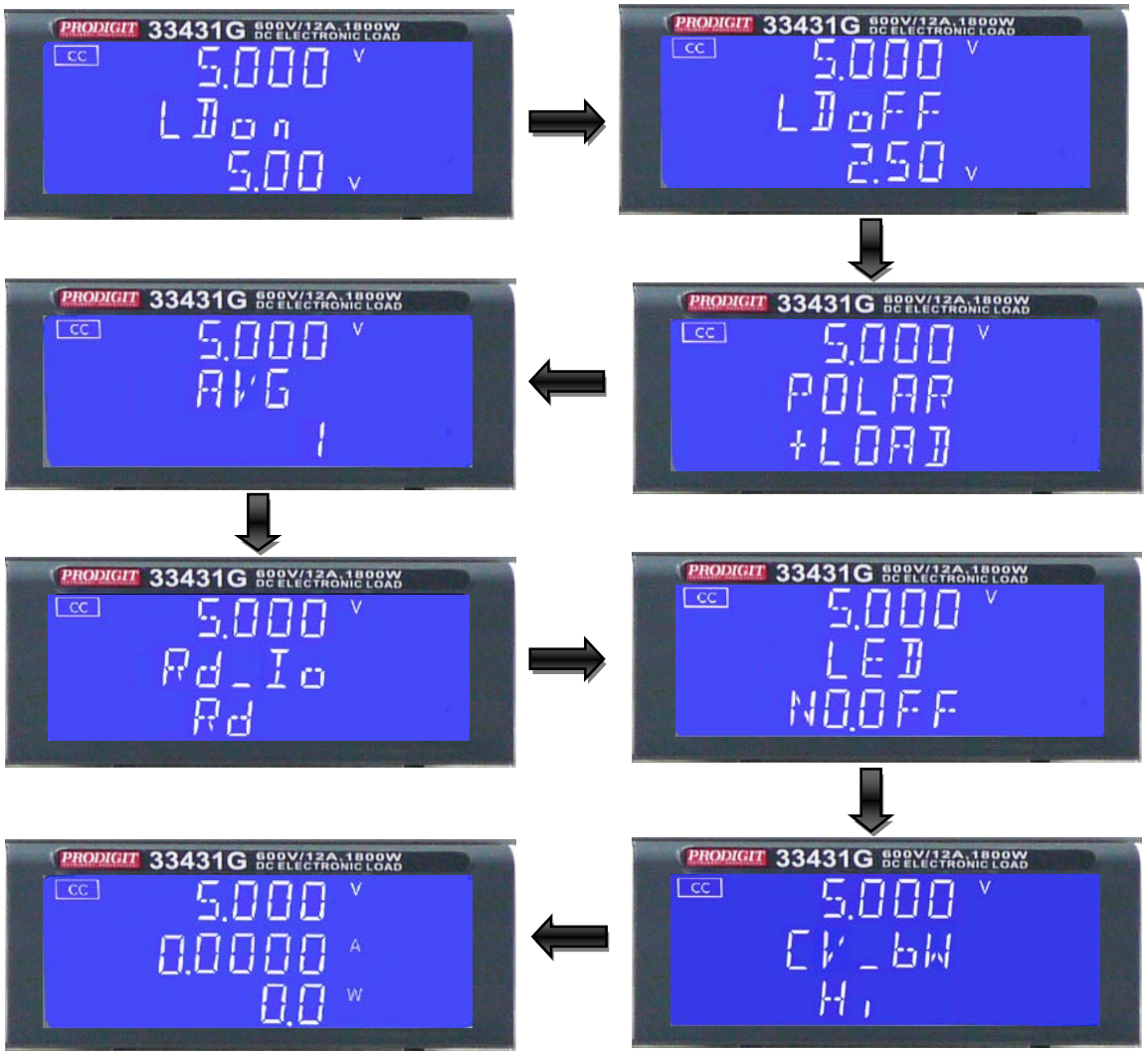


3.2.16. Config key and LED

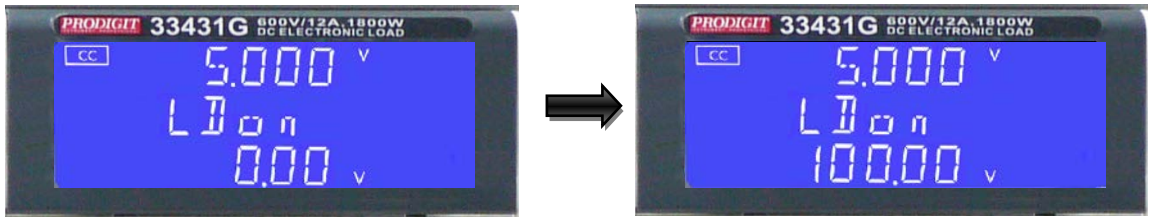
The CONFIG key also enables the LOAD to automatically turn ON/OFF When a voltage level is reached. The polarity symbol can also be switched via the CONFIG menu.

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:

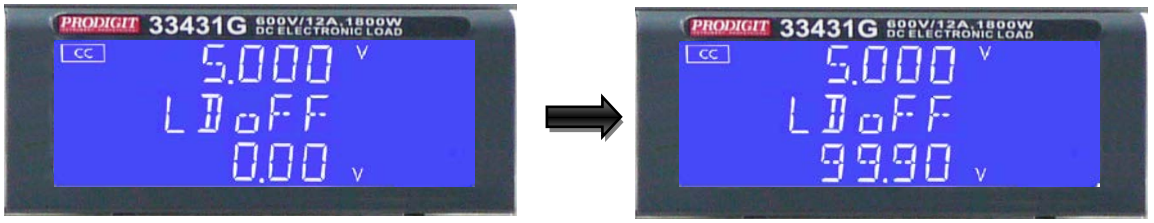
LDon (Voltage at which LOAD turns ON) →
LDoff (Voltage at which LOAD turns OFF) →
POLAR (change polarity symbol) →
AVG (Average 1~64) →
bW (Bandwidth change Hi or Lo) →
Rd.DSP(change Rd or Io) →
LED NO.(ON or OFF) →
exit CONFIG options



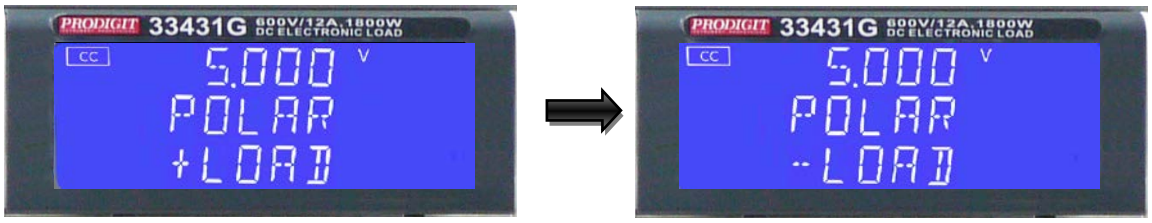
- Set Load ON voltage, the middle of the 5 digit LCD display will show "LDon", Lower 5 digit LCD display will show setting value, the units is V, The Load ON Voltage set range from 0.00V to 100.00V step 0.01V by rotating the setting knob. If the load is greater than the input voltage Load ON voltage setting, the Electronic load current begin to load on.



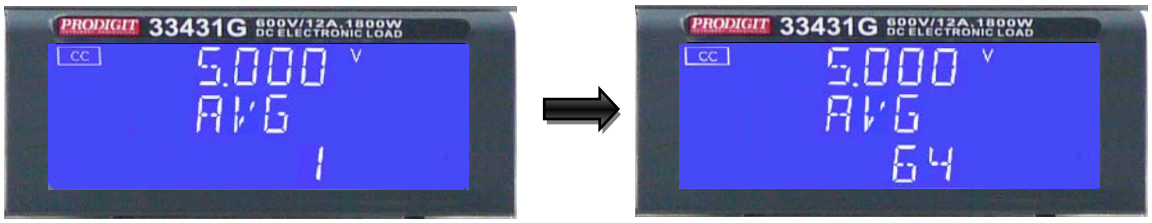
- Setting Load OFF voltage, the middle of the 5 digit LCD display will show "LDoFF", lower the 5 digit LCD display will show settings value, the units is V, The Load OFF Voltage set range from 0.00V to 99.90V step 0.01V by rotating The setting knob.
  if the load input voltage is less than Load OFF setting voltage, the electronic load to load off.



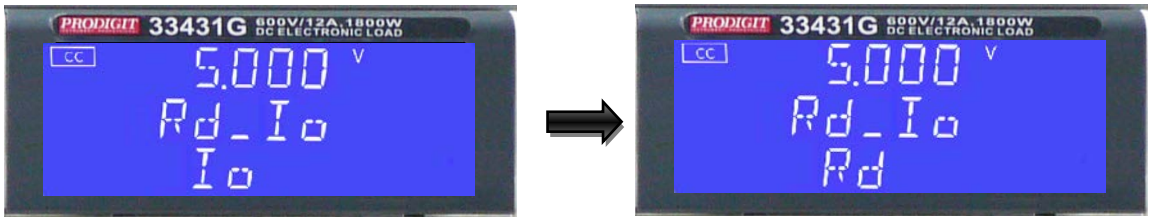
- Set Load polarity, the middle of the 5 digit LCD display will show "POLAR", lower the 5 digit LCD display "will show + LOAD" or "-LOAD", use the knobs and key settings "+ LOAD" or "-LOAD".



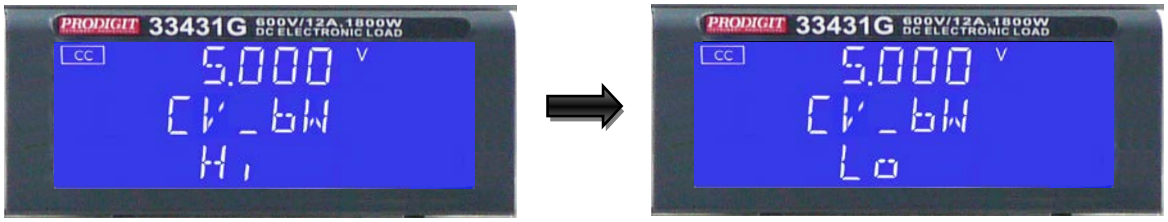
- Setting AVG , the middle of the 5 digit LCD display will show "AVG", lower the 5 digit LCD display will show settings value,the AVG set range from 1 to 64 steps 1 by rotating the setting knob.



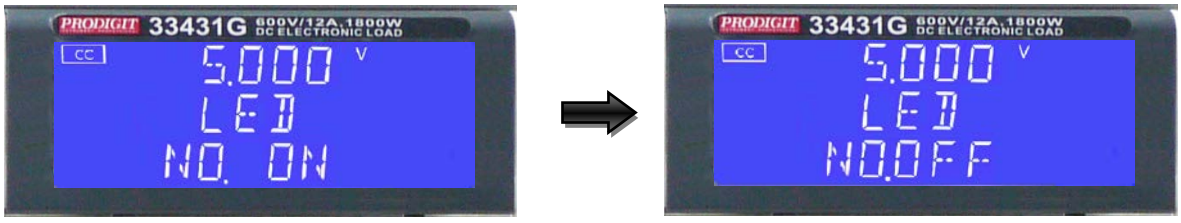
- Set RD.DSP, the middle of the 5 digit LCD display will show " Rd._Io ", lower the 5 digit LCD display will show "Rd" or "-Io". (The default mode is Io.)
  use the knobs or key to setting "Rd" or "Io".
- If setting to Rd the LED mode parameter will be include Rd.
- If setting to Io the LED mode parameter will be include Io.



- Set bW, the middle of the 5 digit LCD display will show "bW", lower the 5 digit LCD display "will show Hi" or "Lo", use the knobs and key settings "Hi" or "Lo".



- Set LED NO, the middle of the 5 digit LCD display will show "LED", lower the 5 digit LCD display "will show NO.ON" or "NO.OFF", use the knobs and key settings "ON" or "OFF", When select No. OFF display will not display LED No Quantity.



3.2.17. Short Key and LED

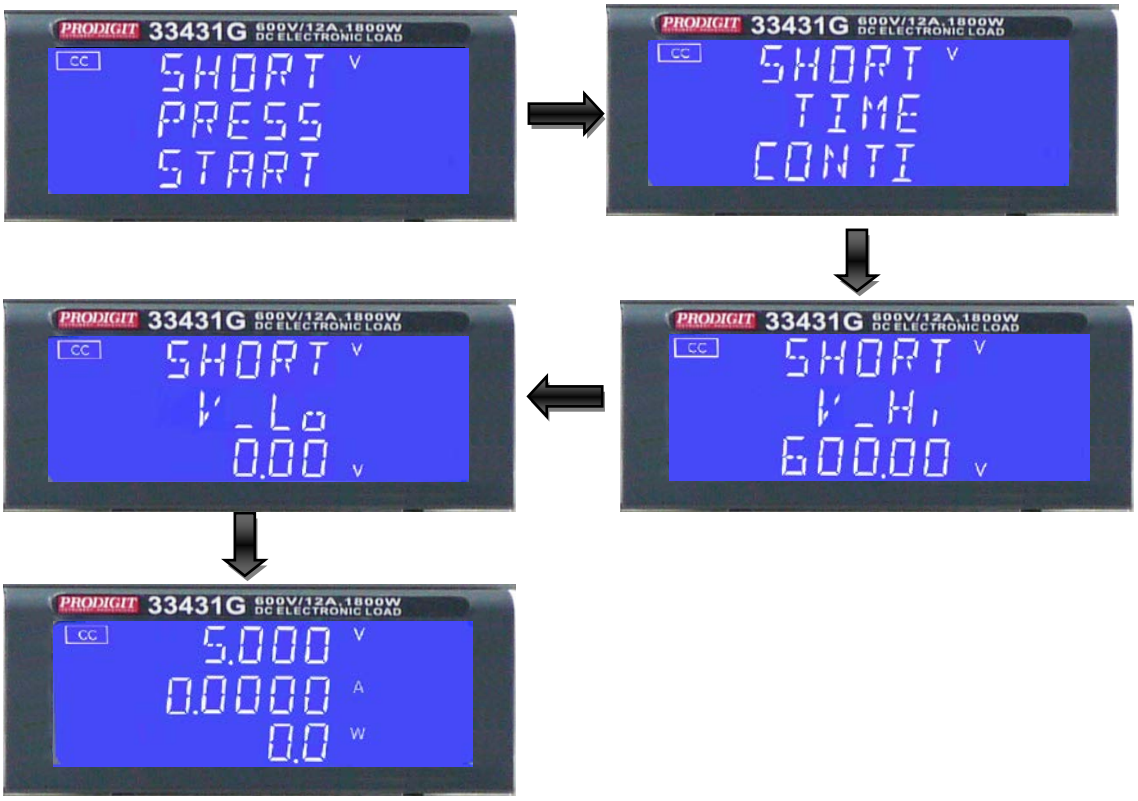
The SHORT key allows the parameters of a SHORT circuit test to be entered. The SHORT test will attempt to sink high current up to the 33431G load maximum current in order to check the power source's protection and behavior. The test time can be adjusted and threshold values for the
High and low voltage 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.

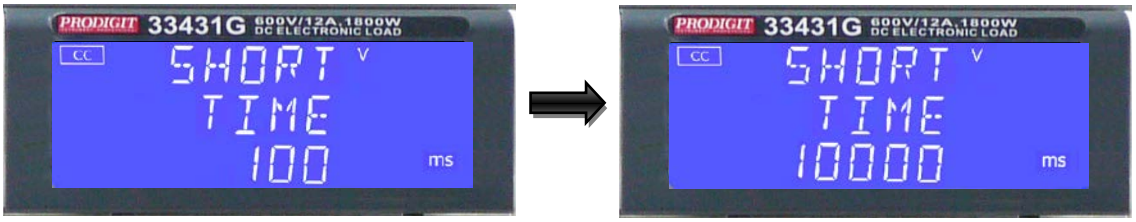
The setting sequence is shown below:

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

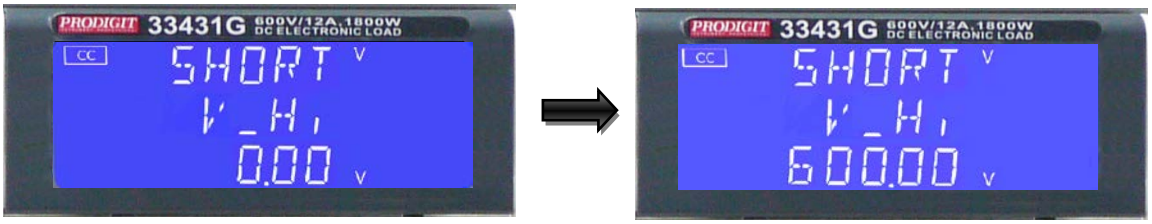


- setting the short test time，The LCD display show 「SHORT」 on upper 5 digits LCD display，shows 「TIME」on middle 5 digits LCD display，lower 5 digit LCD display 「CONTI」, the unit is "ms".

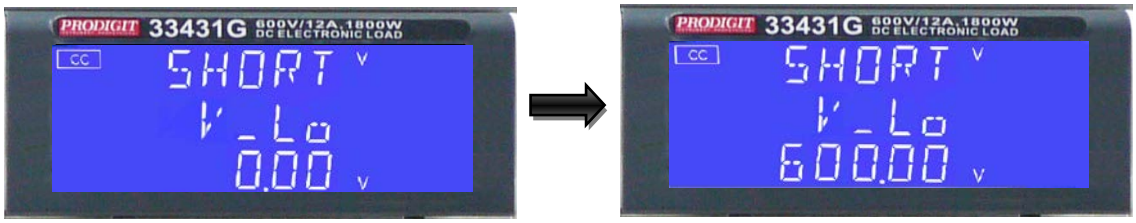
- TIME: setting the short test time, The LCD display show 「SHORT」 on upper 5 digits LCD display, shows 「TIME」on middle 5 digits LCD display the unit is “ms” ,and shows 「CONTI」 on lower 5 digits LCD display, the Setting range is “CONTI” means continue, 100mS to 10000mS step 100mS by clockwise rotate the 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 600.00V step 0.01V 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 0.00V to 600.00V step 0.01V by rotating the setting knob.



Note. The V-Hi and V-Lo parameter is difference with the V-Hi and V-Lo in the LIMIT function.

3.2.18. OCP key and LED

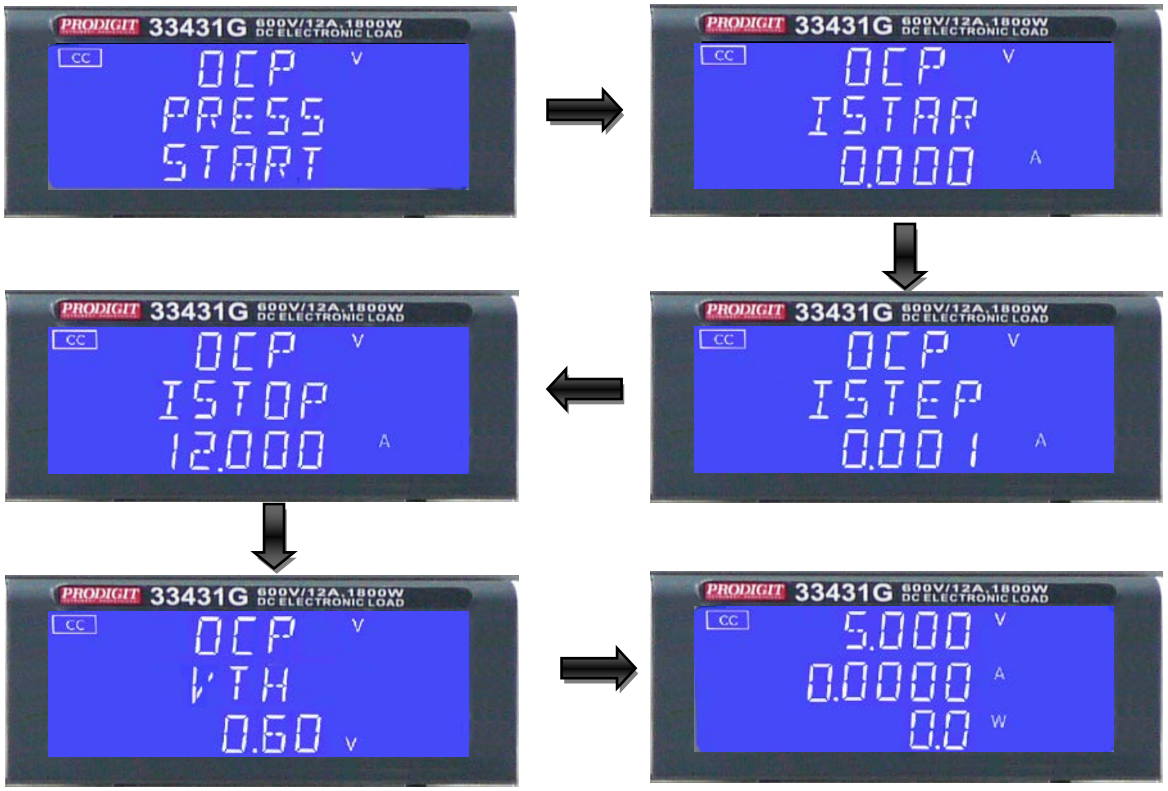
The OCP key allows the parameters of an Over Current Protection test to be entered. The OCP test will ramp up the load current in steps to validate the Device Under test's (DUT) protection and behavior. A voltage threshold level can be set. If the voltage measured during the test is lower than the set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

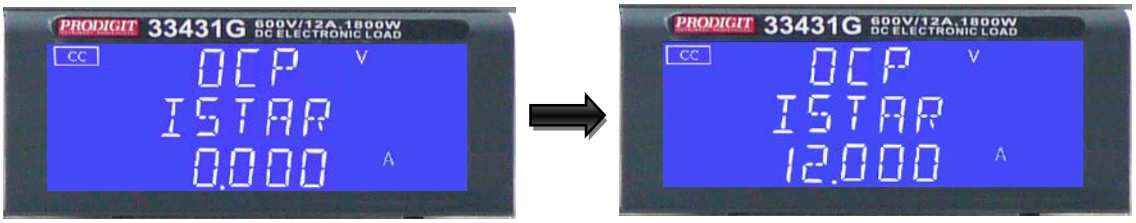
Each press of the OCP button moves the menu on one step. The upper and Middle LCDs show the currently selected test parameter as text. The value is adjusted by the rotary knob and can be read from the lower display during Setting.

The setting sequence is shown below:

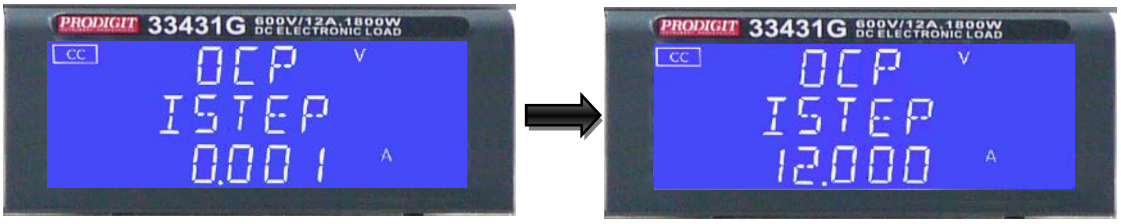
OCP PRESS START (pressing the red start/stop key starts test) →
OCP I STAR (current starting point of the OCP test) →
OCP I STEP (value of incremental current steps from I START) →
OCP I STOP (the OCP test's upper current threshold →
OCP Vth (the voltage threshold setting) →
Exit OCP test set-up



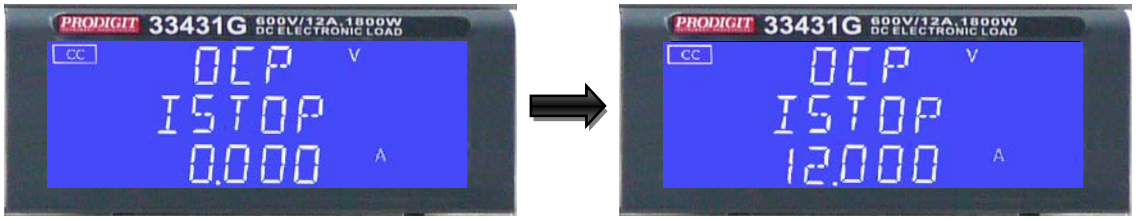
- ISTAR: setting the start current point, The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「ISTAR」,lower 5 digit LCD display setting value, the unit is "A".
  The setting range is 0.000A to the full scale of the CC mode specification. The setting is by rotating the setting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



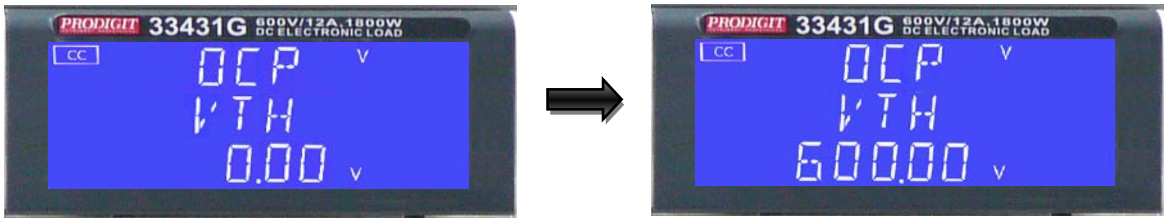
- ISTEP: setting the increment step current point, The LCD display shows 「OCP」on upper 5 digit LCD display, Middle 5 digit LCD display「ISTEP」,lower 5 digit LCD display setting value, the unit is "A".
  The setting range is 0.001A to the full scale of the CC mode specification. The setting is by rotating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

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.

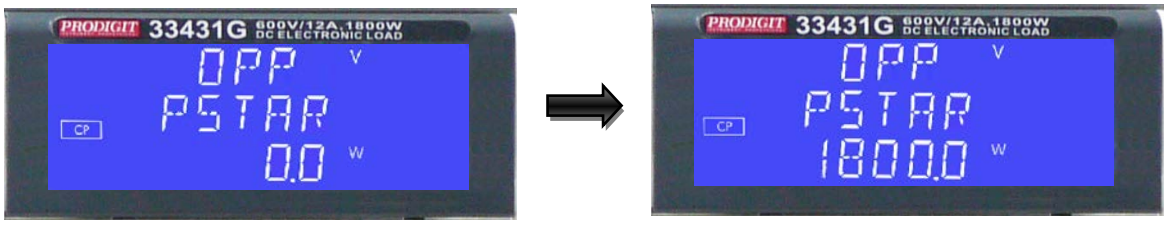
Pressing the OPP key once will cause the button to illuminate. The message "OPP PRESS START" will be shown across the 3 displays.

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.

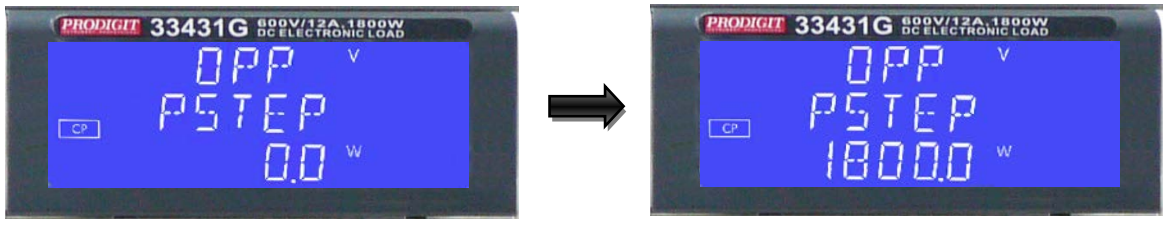
The setting sequence is shown below:

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 0.0W to the full scale of the CP mode specification. The setting is by rotating the setting knob.

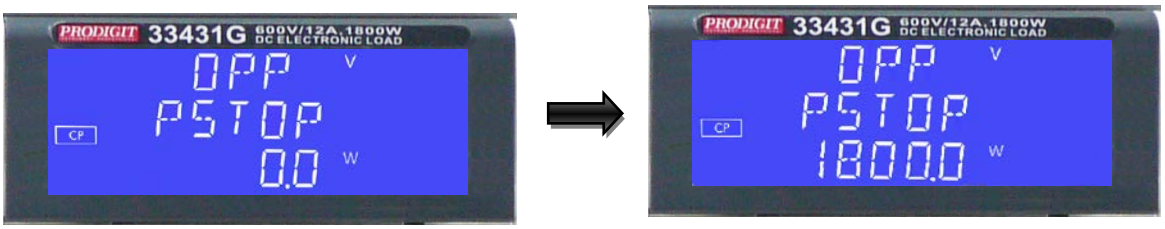


- PSTEP: setting the increment step power, The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「PSTEP」,lower 5 digit LCD display setting value, the unit is "W", the setting range is 0.0W to the full scale of the CP mode specification. The setting is by rotating the setting knob.

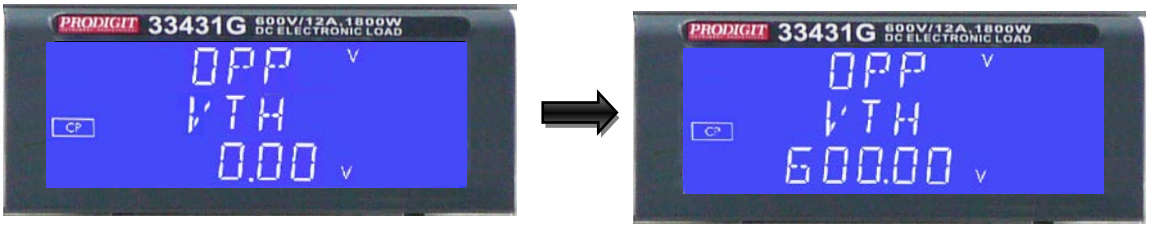


- PSTOP: setting the stop power, The LCD display shows 「OPP」on upper 5 digit LCD display, Middle 5 digit LCD display「PSTOP」,lower 5 digit LCD display setting value, the unit is "W", the setting range is 0.0W to the

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 0.00V to the full scale of the Voltage specification. The setting is by rotating the setting knob.



- START/STOP Test key.
  Press START/STOP key to start or stop the OPP test by OPP test setting parameter when OPP test function is enabled.

  The Load will goes to “ON” automatically when press START/STOP key to start the OPP test and the Load will goes to “OFF” automatically when press START/STOP key to stop the OPP test. The Load will stay to “ON” If load was “ON” before OPP test.

  The OPP test function for test the UUT’s over power protection, The OPP test will start sink current from PSTART to increase PSTEP current until 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".

  Press any key to goes to normal mode of LCD display.

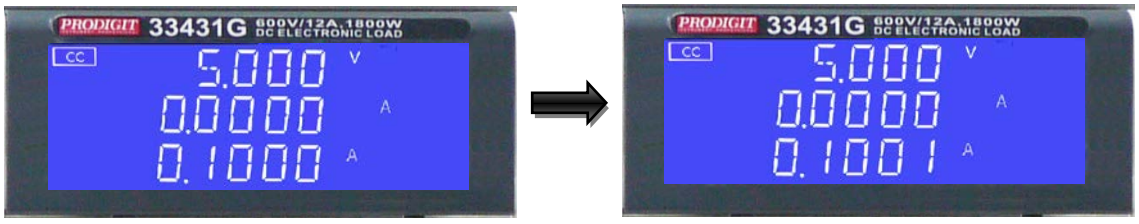
3.2.20. 

key

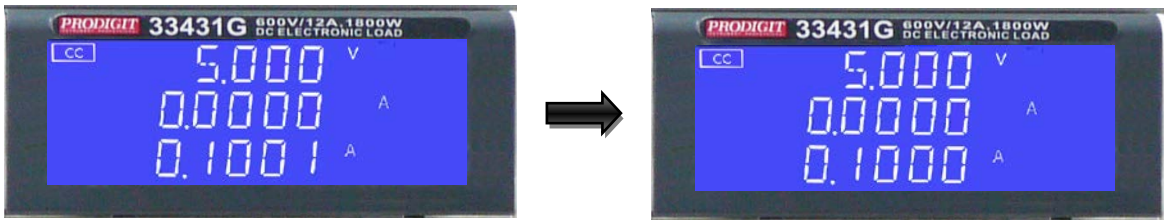
The red START/STOP key is used in conjunction with the SHORT, OCP or OPP test functions. It is used to START a test according to the set parameters or to STOP a test before PASS or FAIL is signaled. Please refer to the preceding sections for more information on the SHORT, OCP & OPP tests.

3.2.21. Knob and Knob key

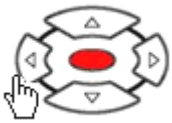
- Right Knob: Setting digit can flash clockwise add setting value.

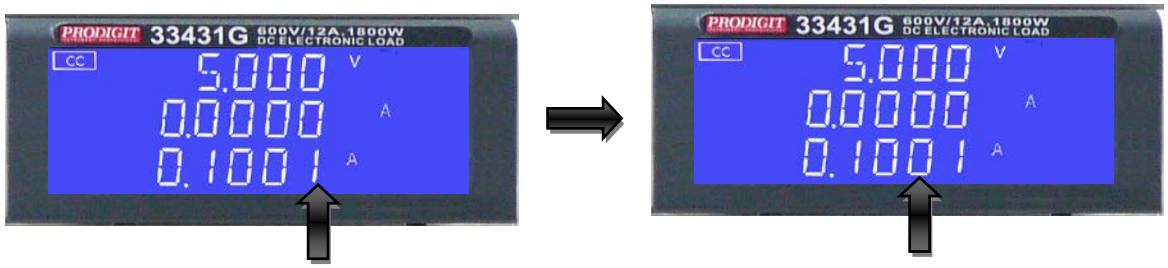


- Left Knob: Setting digit can flash Anti-clockwise to decrease setting value.

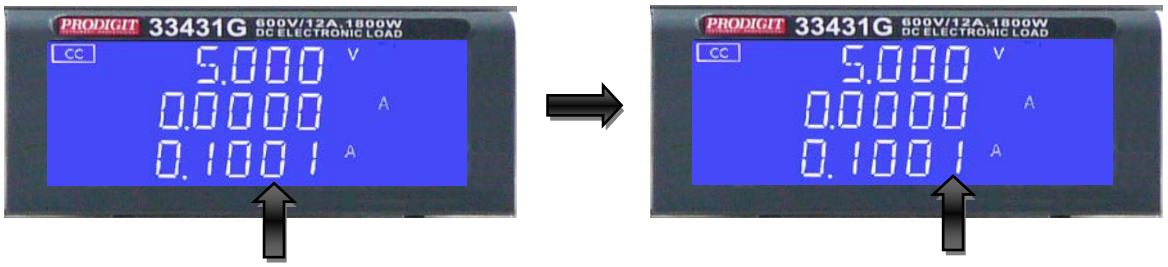


- Knob Left key: Setting digit can flash Left Knob key to push down setting value move left one-digit.

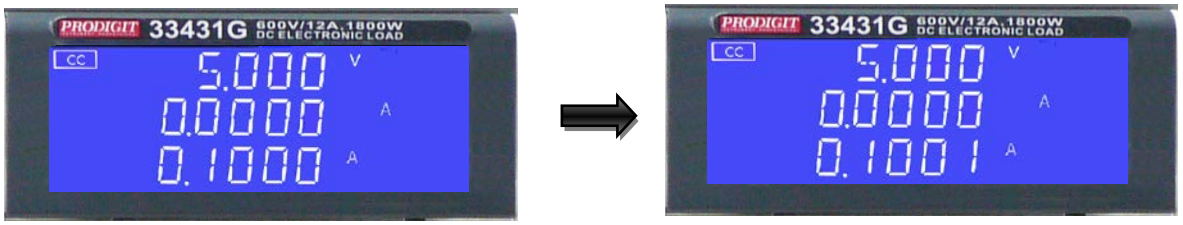




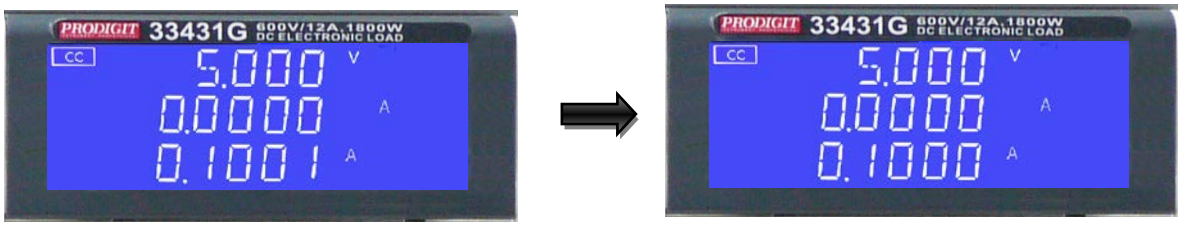
- Knob Right key: Setting digit can flash Knob Right key to push down setting value move Right one-digit.



- Knob up key: Setting digit can flash Knob UP KEY to push down add setting value.



- Knob down key: Setting digit can flash Knob down key to push down to decrease setting value.



NOTE: ON CR MODE Right Knob and Knob UP KEY to push down decrease setting value.
ON CR MODE LEFT Knob DOWN KEY to push down add setting value.

3.2.22. +/- DC INPUT Terminal.

The positive and negative terminal of load input connector, it should connect to the positive and ground output for a positive output power supply, or the ground and negative output for a negative output power supply respectively.

Please take care of the voltage and current rating not to excess the maximum rating of each 33431G series load. Please check the polarity of DC input connection also before testing.

3.2.23. V-sense input terminal

To measure the specific voltage points through the V-sense input terminal, refer Fig 3-2 for detail application information.

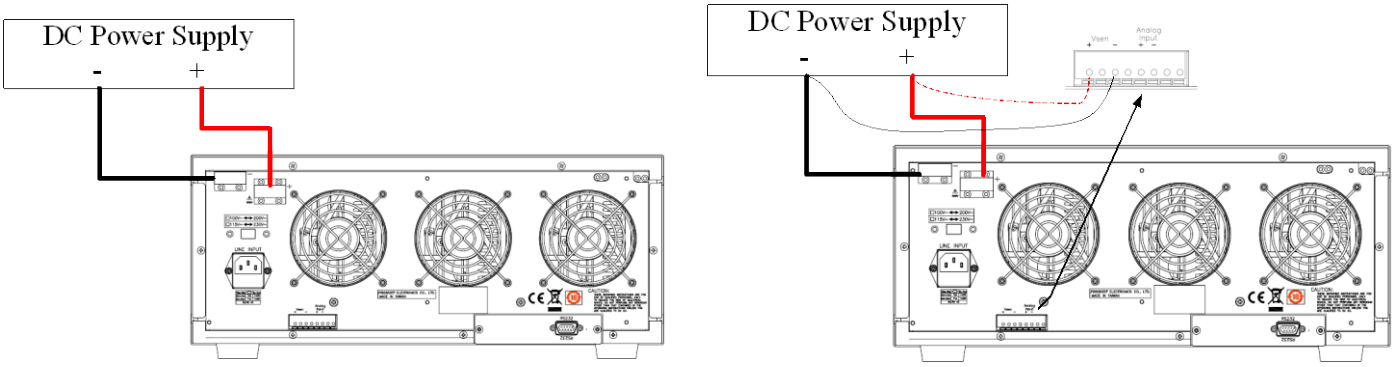


Fig 3-2 typical connection of 33431G series load

3.2.24. DIM and LED

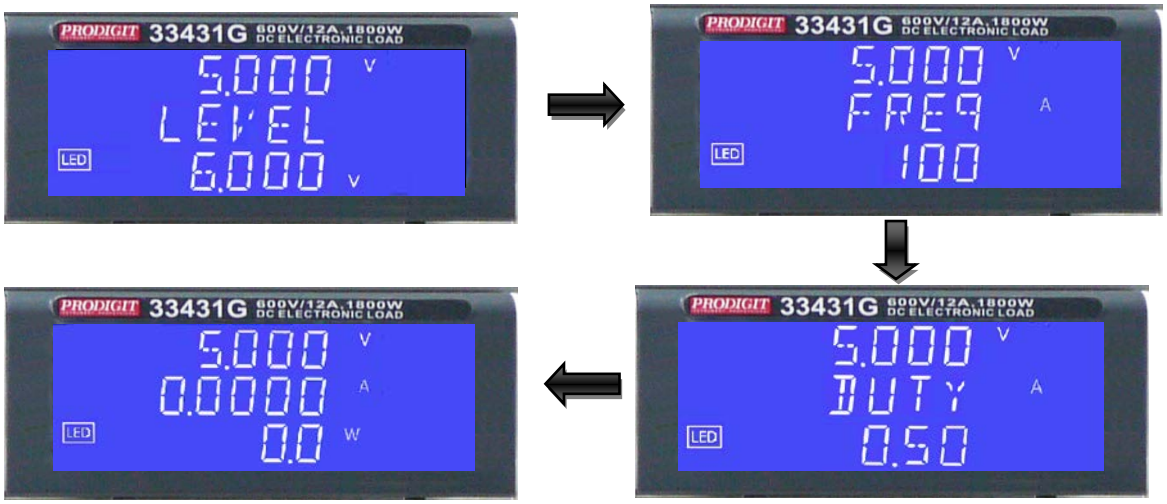
- Dimming setting mode:
  DIM ON: Press the DIM key, LED will be lit and setting control signal by setting parameters output.
  DIM OFF: Press the DIM key again, the LED will be OFF and Control signal output to zero

Note1: When the DIM ON and setting button is OFF, freq parameter is DC, can be Adjusted in the Level value is by rotating the setting knob.

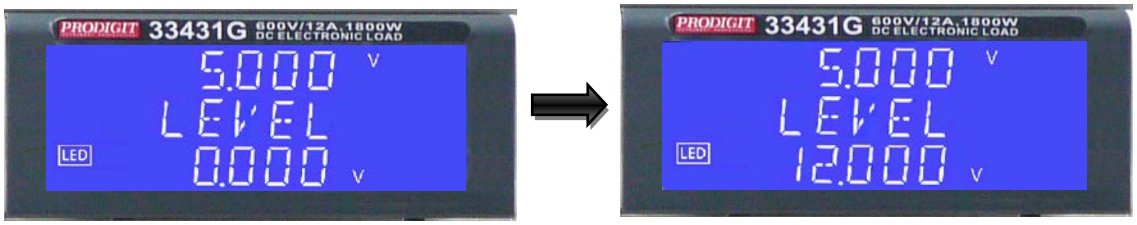
Note2: When the DIM ON and setting button is OFF, freq parameter is 100~1000, Can be adjusted in the Duty value is by rotating the setting knob.

3.2.25. SETTING and LED

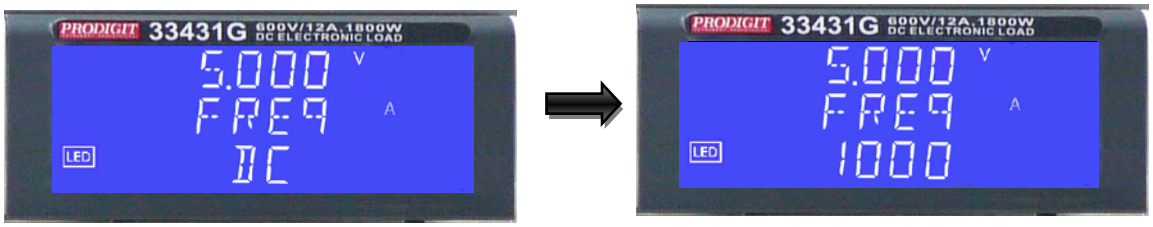
- DIM SETTING function for the 3 parameters, as LEVEL, FREQ and DUTY parameters.
  Press the dim setting key, the next parameter sequence LEVEL, FREQ, DUTY, and Disable press another and will leave and save settings, Setting test parameters as follows:



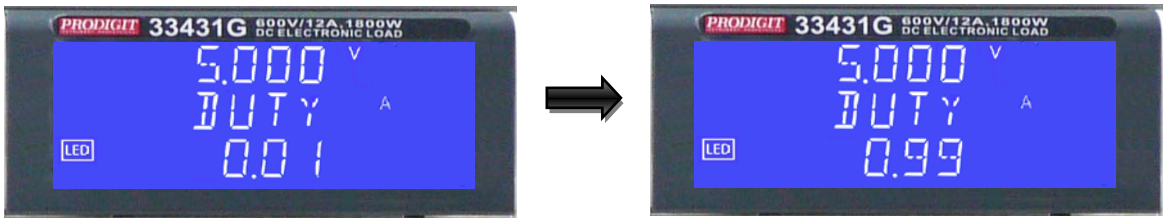
- LEVEL setting, The LCD display shows, lower 5 digit LCD display, the unit is "V", the setting range is 0.000V to the 12.000V of the LED mode specification, Step 0.04V by rotating the setting knob.



- FREQ setting, The LCD display shows, lower 5 digit LCD display, the unit is "Hz", the setting range is DC to the 1000 Hz of the LED mode specification, Step 10 Hz by rotating the setting knob.



- Duty setting, The LCD display shows, lower 5 digit LCD display, the setting range is 0.01 to the 0.99 of the LED mode specification, Step 0.01 by rotating the setting knob.



- 33431G Series Electronic Load DIM Description:

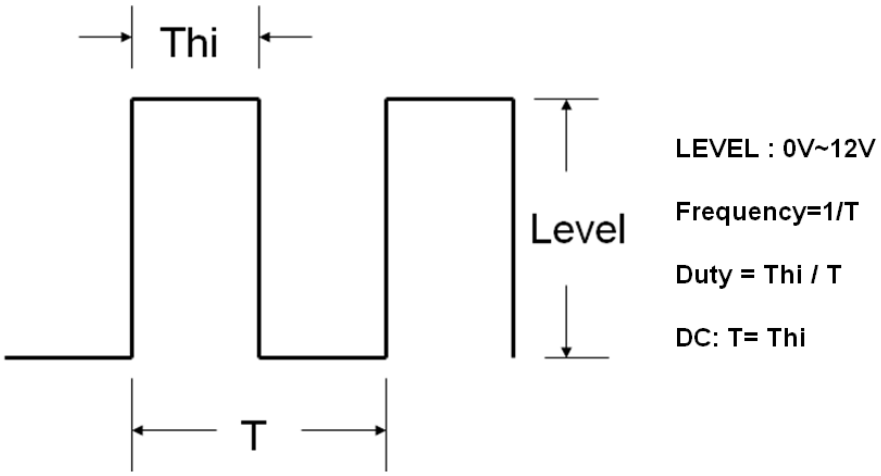
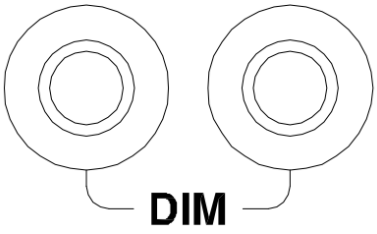
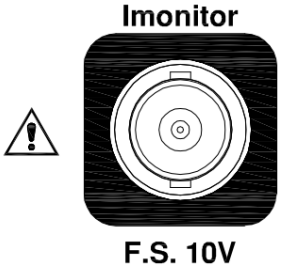


Fig 3-3 33431G Series Electronic Load DIMMING CONTROL(PWM TYPE)

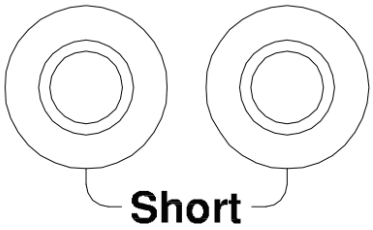
3.2.26. DIM Terminal Description



3.2.27. I-monitor Terminal Description



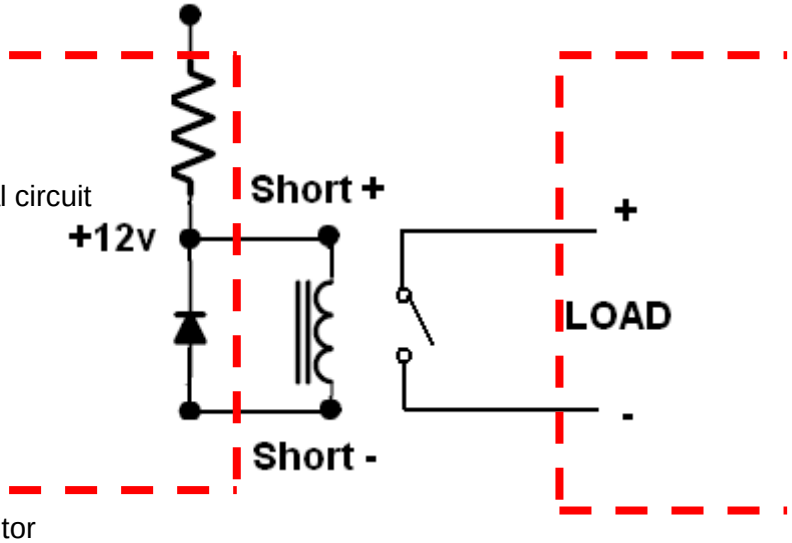
3.2.28. Short Terminal Description



Option
Short Relay BD

- Short Test Description:
  33431G series of internal circuit

33431G series of internal circuit



- I-monitor
  The I-monitor is designed to monitor the Electronic load's input current or short current and non-isolated amplifier output 0V to 10V full scale signal indicates the zero to full scale current for each Electronic load.
  Please refer chapter 1, Table 1-1 for voltage /current relationship of each 33431G series.

  The I-monitor analog signal is proportional to the load current flow through the electronic load.
  I-monitor provides the load current waveform output to an oscilloscope to evaluate The voltage and current waveform of a power supply under test.

  The non-isolated I-monitor provides for power supply testing, it is designed to the ground problem while connect I-monitor and measure power supply output Voltage to oscilloscope simultaneously, because the two or more input terminals in oscilloscope are not isolated.

CAUTION! 33431G series I-monitor not isolated, don‘t use I-monitor with different channel to avoid common ground problem.

Note:
1. The CURRENT MONITER of this unit is NOT isolated. Please be careful When you connect to an oscilloscope. Improper connections would cause Damage.
2. Monitor output volt : 10V , Output impedance : 1K

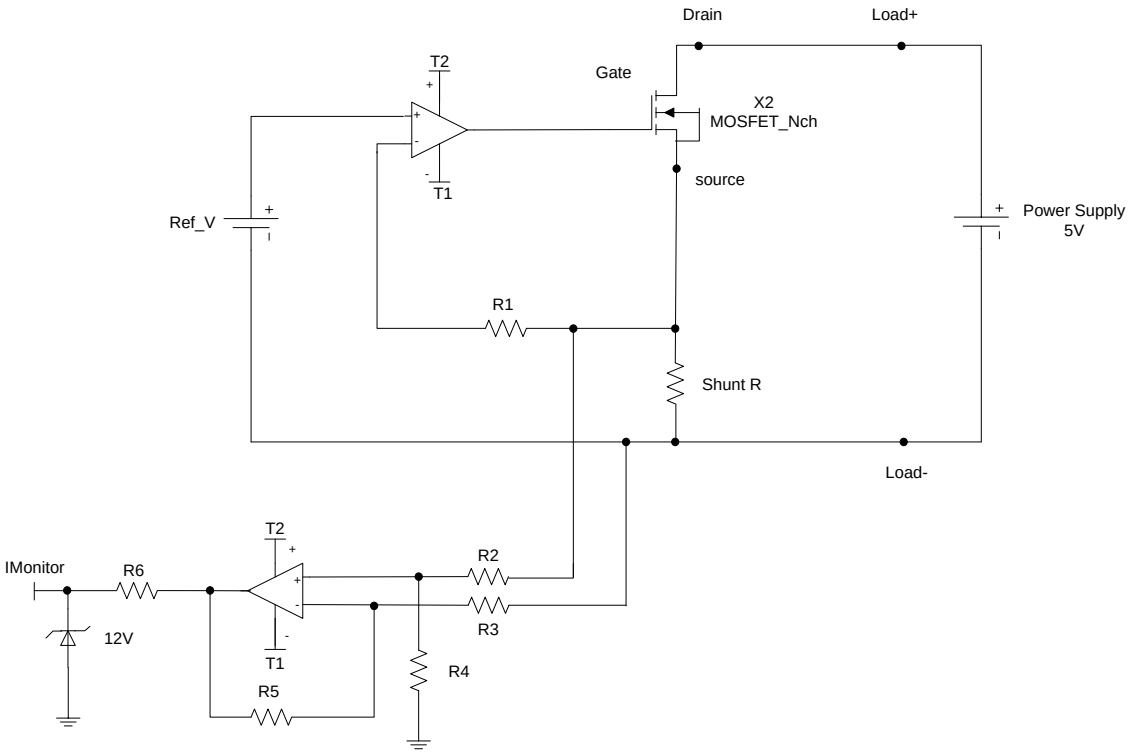


Fig 3-4 An equivalent circuit in terms of the current monitor

Note:

Connection to an oscilloscope

When you connect this product to an oscilloscope, please be careful about the polarities of the probes of the oscilloscope as shown in Fig 3-5.

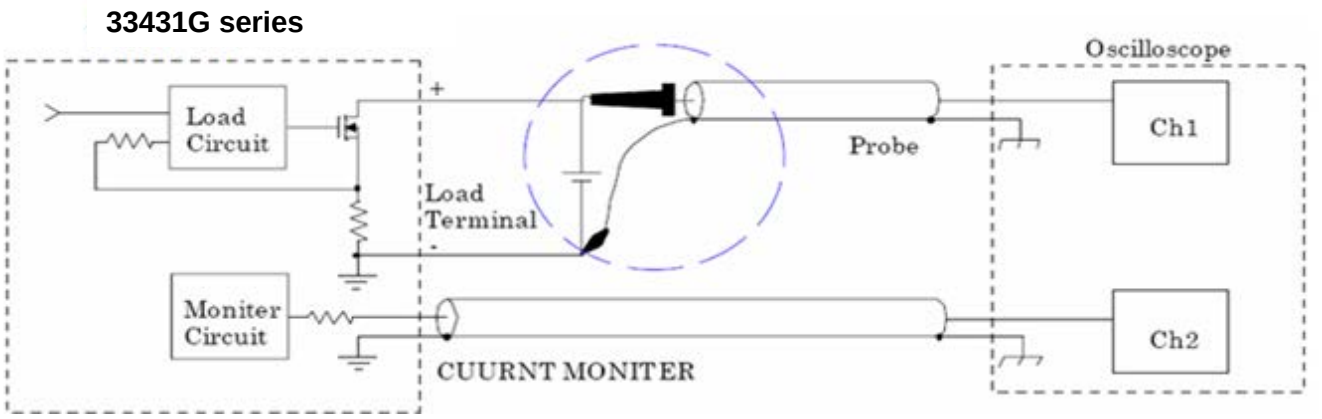
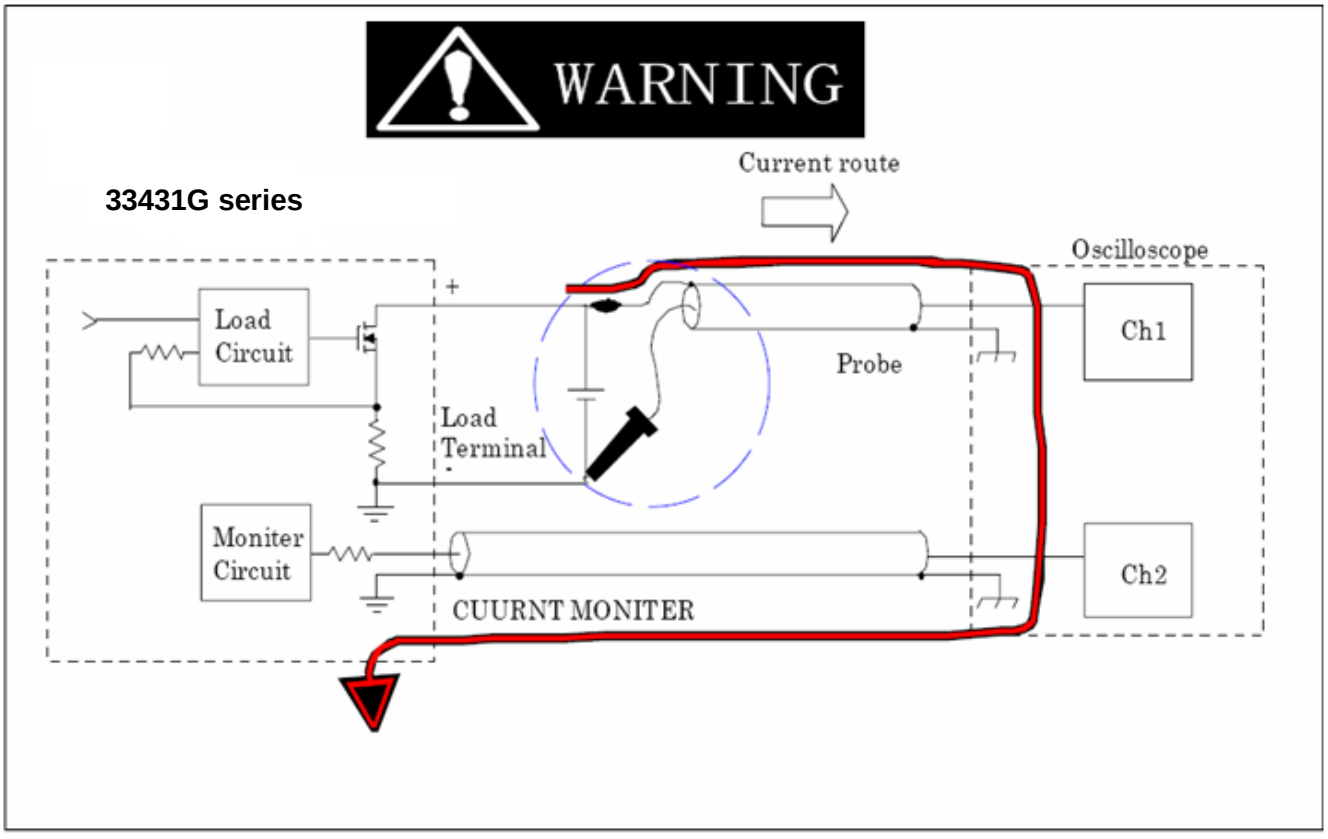


Fig 3-5 (Correct) Connections to an oscilloscope

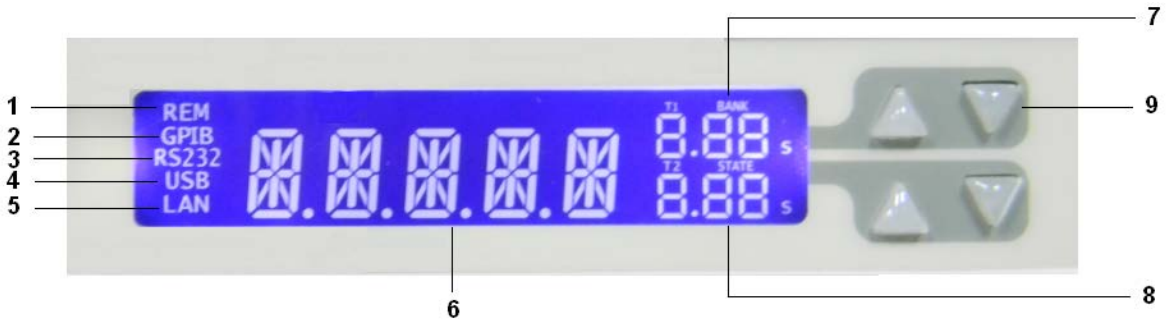


If you should connect in reverse connection as shown in Fig 3-6, large current would flow through the Probe and the internal of the oscilloscope causing a damage.

Fig 3-6 (Wrong) Connections to an oscilloscope

3-3. Front panel description(1)

The LCD will be lit the 33431G status when Power ON :



3.3.1. In REMOTE mode:
The REM will be lit when 33431G is controlled through GPIB/RS232/USE/LAN by PC, and it means 33431G is in REMOTE mode, any icon will not effective but LOCAL.

3.3.2. In GPIB mode:
It is GPIB inside. The LCD will be lit GPIB when Power ON. If 33431G is controlled by GPIB through PC, the GPIB will be lit.

3.3.3. In RS232 mode:
It is RS232 inside. The LCD will be lit RS232 when Power ON. If 33431G is controlled by RS232 through PC, the RS232 will be lit.

3.3.4. USB mode Lit :
It is USB interface inside.

3.3.5. LAN mode Lit :
It is LAN interface inside.

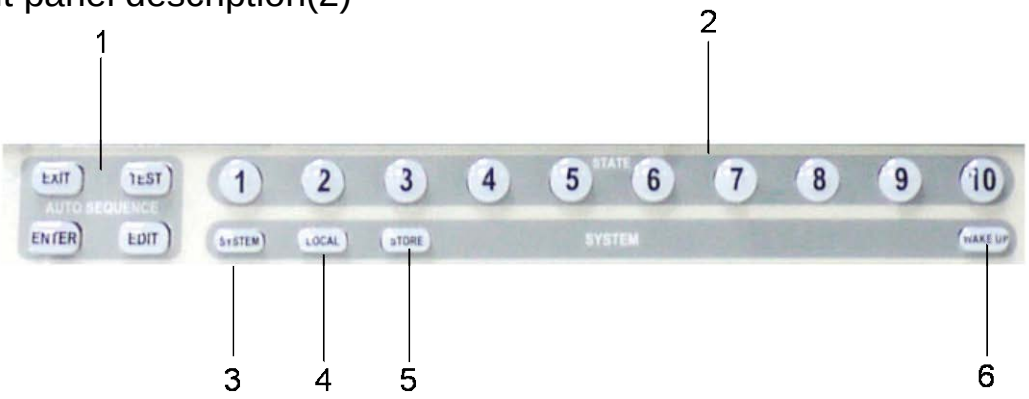
3.3.6. 33431G Display:
Power ON the LCD will display Nor. It means Normal.

3.3.7. T1/BANK Display:
One of T1/BANK Display means T1 (Test Time) value when setting AUTO SEQUENCE. And the second one means the BANK value of RECALL/STORE mode.

3.3.8. T2/STATE Display:
One of T2/STATE Display means T2 (DELAY Time) value when setting AUTO SEQIEMCE. And the second one means the STATE value of RECALL/STORE mode.

3.3.9. Press UP/DOWN to adjust T1/BANK and T2/BANK.

3-4. Front panel description(2)



3.4.1. Press these 4 buttons to set AUTO SEQUENCE
3.4.2. STATE1~10 are used for setting and adjusting the AUTO SEQUENCE and testing the RECALL/STORE mode.
3.4.3. Press SYSTEM to set the argument、GPIB address、RS232 BAUD-RATE and buzzer alarm power ON/OFF.
3.4.4. Press LOCAL to exit REMOTE mode.
3.4.5. Press STORE to save the LOAD and the LOAD of WAKE-UP mode status and AUTO SEQUENCE.
3.4.6. Press WAKE-UP to recall the set status of Load when power ON.

3-5. Front panel description(3)

The function keys on the front panel of 33431G mainframe are designed for high testing throughput purpose. There are 150 operation states or testing steps can be store in the EEPROM memory of 33431G Series electronic load respectively, each state can store or recall the load status and level for Electronic load simultaneously.

	33431G
BANK	15
STATE	10
TOTAL STATE	150

3.5.1. STORE process:
3.5.1.1. Set the load status and load level from load within the mainframe respectively.
3.5.1.2. Select the Memory Bank (01-15) to be stored for 33431G Series load.
3.5.1.3. Press the STORE key on the 33431G mainframe, the STORE LED is flashing (about one time every second) to indicate ready to store. Press Store key again or wait for about 20 sec to exit the store operation.

Press one of the state 1-10 key, the appropriate state key's LED will be lit immediately, the load level and status of load is stored into the EEPROM memory this time, then the STORE LED turns to OFF, it means the STORE procedure is completed.

Note:

After press the STORE key, the STORE LED will flash for 20 seconds, if the STATE 1-10 key is not pressed within this 20 seconds, the STORE LED will be OFF, it indicated the STORE process is not available now, please repeat the STORE procedure for a new STORE operation.
After press the STORE key, then press the STORE key, the STORE LED will be blank, it indicates the STORE process is not available.

After press the STORE key, it is available and useful to operate the front panel key on the 33431G Series Electronic load. However, the STATE LED will be OFF if any key on any load is operated, this indicates the front panel state of load is not the same as STORE state.

3.5.2. STORE function:

3.5.2.1. Please refer chapter section on the 33431G Series electronic load operation manual to more detail operation flow-chart for store and recall operation.

3.5.2.2. It can store up to states of 33431G Series load setting simultaneously, if you store 2 different states in the same state key, the later state will overcome the
previous state, it acts as update the new data.

3.5.3. RECALL operation:

For 33431G Series, using UP and Down key to select the Memory Bank, then press one of the Memory State 1 through 10 key, the appropriate LED will be lit, the store state on the 33431G mainframe is sending to the electronic load simultaneously. Before press the states key, you press any key on the load then the state LED is blank immediately, it indicates the STORE state has been changed on load front panel.

3.5.4. WAKE-UP function

This function is designed for auto setting the load status and load level in turning on the 33431G every time. Press WAKE-UP first, the LCD will be lit and shown “CLEAR” to cancel or “SET” to set. Adjust BANK and STATE keys to reset the WAKE-UP. Press STORE key to be stored or EXIT the WAKE-UP.

3.5.5. AUTO SEQUENCE

There are two modes in AUTO SEQUENCE function, EDIT MODE and TEST MODE, The AUTO SEQ mode can be entered by press EDIT key, after that, the LCD will be lit “FX-XX . “FX” means to select the state F1-F9 . “XX” means the test STEP 01-16 .

3.5.5.1. EDIT MODE

The EDIT MODE flow chart is described below:

1. There are nine Auto Sequence (F1-F9) can be set within 33431G.
2. Each Auto Sequence has up to 16 test steps, where each step is one Memory of 150 sets store memory.

3. Each test step has T1 (Test Time) and T2 (Delay time), the unit is 100ms; the range is 0.1S - 9.9S in 100mS resolution. 33431G mainframe will check each GO/NG at the end of T1 (Test time), the next step will be started after duration T2 (Delay time).

4. Setting REPEAT(REPEAT TEST)，Press UP、DOWN key adjustment setting 0~9999，Press STORE SAVE REPEAT value ，or Press EXIT key Exit EDIT MODE.
   Example: Press UP、DOWN key adjustment setting 2023 the following picture shows.

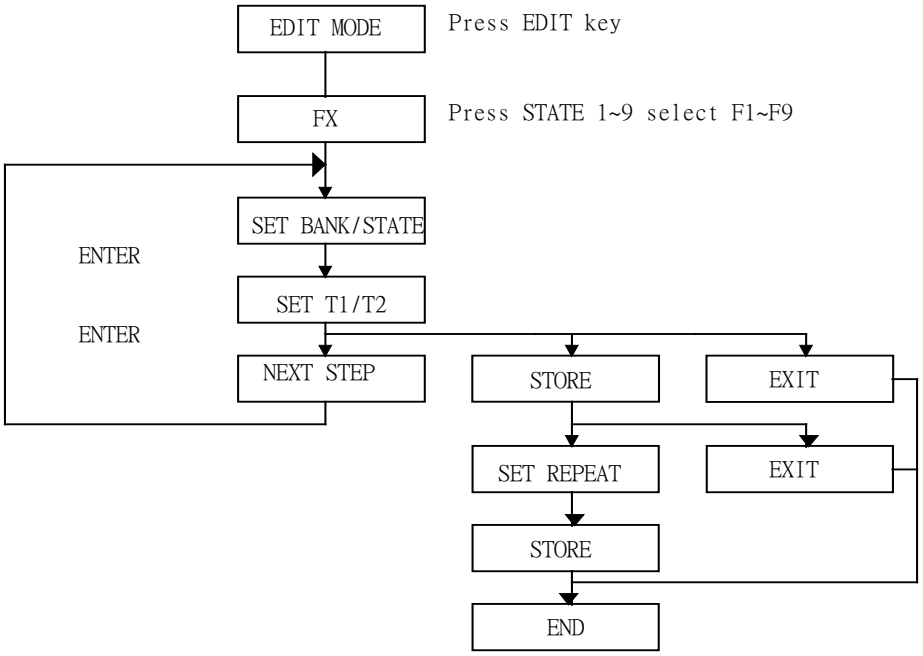
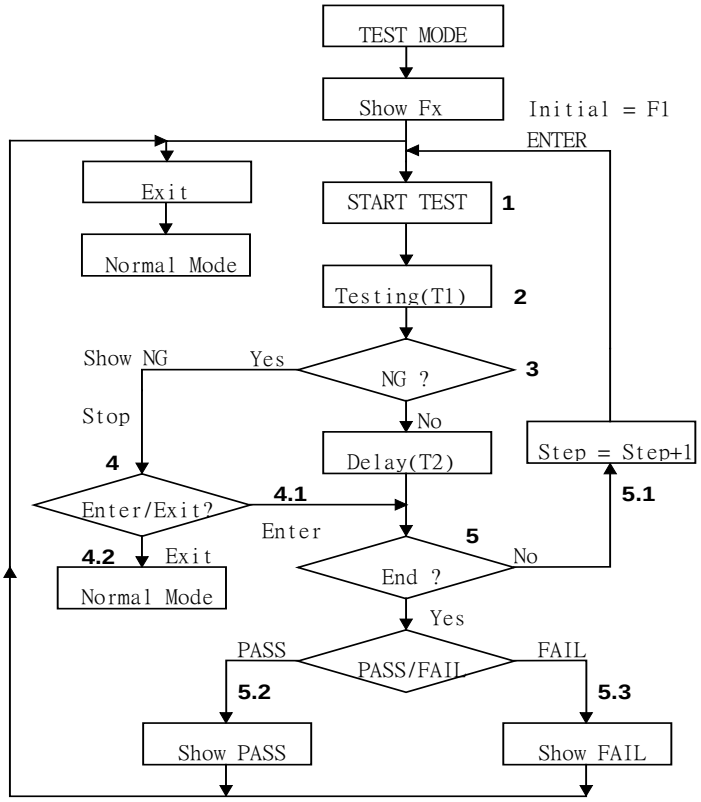


Fig 3-8 STORE (EDIT) MODE OPERATIONO FLOW-CHART

3.5.5.2. TEST MODE

The TEST MODE flow chart is described below:

1. After press TEST, select the state F1-F9 and enter Auto Testing mode.
2. The sequence start from (Step 1 - T1 - T2), then (step 2 - T1 - T2), and so on until last step or stop by press EXIT .The LCD will be lit NG if the result of test is not successful.
3. The LCD display will show PASS if all test in all are passed, and it will show FAIL if there is at least one failure during the test. If the buzzer sets for the ON, When the test result “PASS” the buzzer will call one time, if test result “FAIL” the buzzer will call two times.
4. User can press ENTER to test again, or the 33431G can quit from AUTO-SEQUENCE mode by press EXIT .



1.Press TEST key

2.Press STATE 1~9 Select F1-F9

3.Press ENTER

1.Recall correspond memory which had been stored in F1-F9 memory

2.Check the GO/NG indicator

3.Stop testing if the result was NG.

3.1 Press ENTER to be continued.

3.2 Press EXIT to end the test,and back to normal mode.

4.If test is GO,than step is last?

4.1 If no than Step+1,continue another step

4.2 If "Yes", than if all the test in all module is pass, show GO

4.3 If "Yes", thanif there is at least one failure during the test, show NG

Fig 3-9 TEST MODE OPERATION FLOW-CHART

3-6. Initial setting of 33431G series load

Tables 3-1 to 3-2 were described 33431G series electronic load initialization parameters.

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	600.00 V
CC H+Preset		0.0000 A		V_Lo	0.00 V
CR H+Preset		3000.0 Ω		I_Hi	12.000 A
CR L+Preset		3000.0 Ω		I_Lo	0.000 A
CV H+Preset		600.00 V		W_Hi	1800.0 W
CV L+Preset		600.00 V		W_Lo	0.0 W
CP L+Preset		0.0W			
CP H+Preset		0.0W	CONFIG	LD-ON	5.00 V
DYN	T HI	0.050 mS		LD-OFF	2.50V
	T L0	0.050 mS		POLAR	+LOAD
	RISE	2.4mA/us		AVG	1
	FALL	2.4mA/us		Rd_Io	Io
LED.No+Preset		1		LED NO.	ON
LED+Preset Vo		3.500V		CV_bW	Hi
LED+Preset Io		0.2800A	LED+Preset Vd		2.80 V
SHORT		Disable	SETTING (DIM)	LEVEL	6.000 V
OPP		Disable		FREQ	100 Hz
OCP		Disable		DUTY	0.50

Table 3-1 33431G initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.0000 A	LIMIT	V_Hi	600.00 V
CC H+Preset		0.0000 A		V_Lo	0.00 V
CR H+Preset		6000.0 Ω		I_Hi	2.4000 A
CR L+Preset		6000.0 Ω		I_Lo	0.000 A
CV H+Preset		600.00 V		W_Hi	3600.0 W
CV L+Preset		600.00 V		W_Lo	0.0 W
CP L+Preset		0.0W			
CP H+Preset		0.0W	CONFIG	LD-ON	5.00 V
DYN	T HI	0.050 mS		LD-OFF	2.50V
	T L0	0.050 mS		POLAR	+LOAD
	RISE	4.8mA/us		AVG	1
	FALL	4.8mA/us		Rd_Io	Io
LED.No+Preset		1		LED NO.	ON
LED+Preset Vo		3.500V		CV_bW	Hi
LED+Preset Io		0.5600A	LED+Preset Vd		2.80 V
SHORT		Disable	SETTING (DIM)	LEVEL	6.000 V
OPP		Disable		FREQ	100 Hz
OCP		Disable		DUTY	0.50

Table 3-2 33432G initialize

3-7. Protection features

The 33431G series Electronic load include the following protection features:

3.7.1. Voltage
3.7.2. Over current
3.7.3. Over power
3.7.4. Over temperature
3.7.5. Reverse Polarity

The Over voltage protection circuit is set at a predetermined voltage (315V for 33431G, , 525V for 3342G and 3343G) which cannot be changed. If the Over voltage circuit has tripped, it Electronic load input turns OFF immediately to protect the abnormal condition.

When the Over voltage condition is occurred, the Digital Current Meter's seven segment LED display will indicate " oVP ".

CAUTION: Please do not add on AC line voltage or DC input load exceeds the input voltage specifications of any voltage added to 33431G Series DC Electronic Load input load, otherwise it will cause damage to 33431G series electronic load.

The 33431G series Electronic load can monitor the power dissipation of the load, when the power dissipation is greater than 105% of rate power input, the load will turn load to OFF state internally.

When the Over power condition is occurred, the Digital Current Meter's seven segment LED display will indicate " oPP ".

As soon as the temperature of 33431G series heat sink greater than 90 degree, the Over temperature protection is occurred, the Digital Current Meter's seven segment LED display will indicate " otP " at same time, the 33431G series Electronic Load will turn load to OFF state internally.

Please check the environment condition such as the ambient temperature and distance between the rear panel of Electronic load mainframe and wall is greater than 15cm.

The 33431G series Electronic load can reset the Over voltage, Over correct, Overpower and over temperature protection if the protection condition is removed and press the " LOAD " key to " ON " state.

The 33431G series electronic load conducts reverse current when the polarity of the DC source connection is incorrect. The maximum reverse current is 12A for 3342G, 24A for 33431G and 3343G. If the reverse current excess the maximum reverse current, it may cause damage of the 33431G series Electronic Load.

When the reverse condition ，the reverse current is displayed on the 5 digit Current Meter on the front panel, and the 5 digit DCM indicates negative current reading, whenever the reverse current is displayed on the current meter, turn OFF power to the DC source and make the correct connections.

Chapter 4 Remote control programming operation

4-1. Introduction

The rear panel remote control interface of 33431G mainframe is designed to connect PC or NOTEBOOK PC with remote control interface, the NOTEBOOK PC acts as a remote controller of 33431G Series Electronic Load.

This feature can be used as an automatic load/cross load regulation and centering voltage testing for a switching power supply or an rechargeable battery charge/discharge characteristic testing. The function capability of rear panel remote control interface not only can set the load level and load status, but also can read back the load voltage and load current.

4-2. The summary of RS-232 Interface and command

The following RS-232 commands are same as GPIB commands. The RS-232 protocol in 33431G mainframe is listing below:

Baud-rate	: 9600~115200bps
Parity	: none
Data bit	: 8 bits
Stop bit	: 1 bit
Handshaking	: Hardware(RTS/CTS).

The RS-232C Interface connector of 33431G rear panel, RS-232 is shown in Fig4-1.

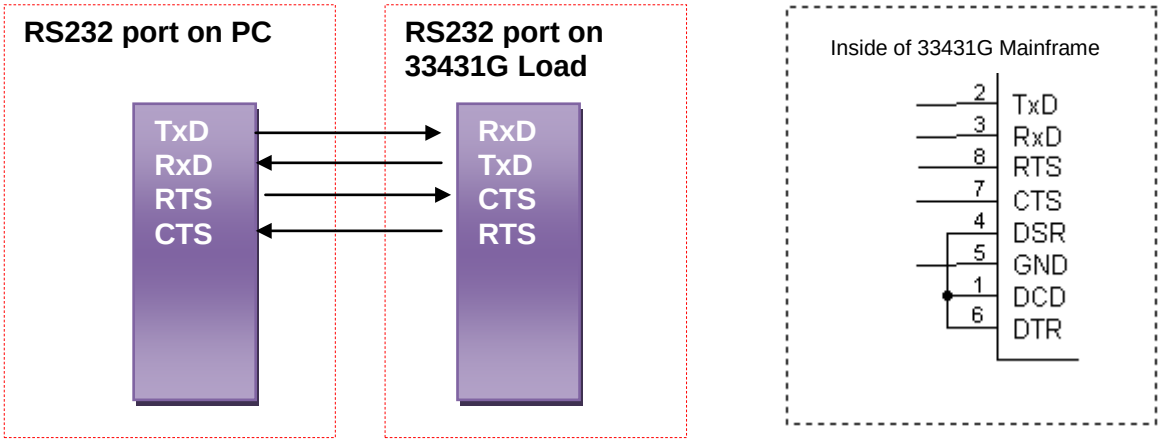
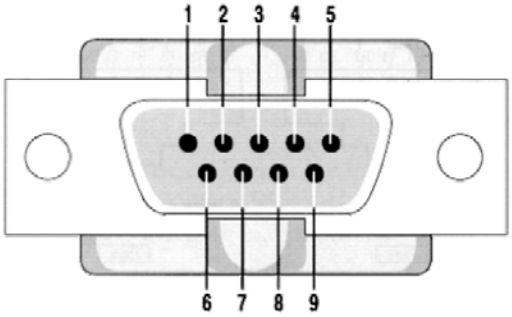


Fig 4-1 RS-232C INTERFACE CONNECTION OF REAR PANEL



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. 33431G REMOTE CONTROL COMMAND LIST1

SIMPLE TYPE FORMAT

SETTING PRESET NUMERIC COMMAND	REMARK
RISE{SP} {NR2} { ; | NL}	mA/us
FALL{SP}{ ; | NL}	mA/us
PERD：{HIGH | LOW} {SP} {NR2} { ; | NL}	
LDONV{SP} {NR2} { ; | NL}	
LDOFFV{SP} {NR2} { ; | NL}	
CC | CURR：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CC | CURR{SP}{NR2}{ ; | NL}	
CP：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CR | RES：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CR | RES{SP}{NR2}{ ; | NL}	
CV | VOLT：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CV | VOLT{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}	

SETTING PRESET NUMERIC COMMAND	REMARK
VO{SP} {NR2} { ; | NL}	
VD{SP} {NR2} { ; | NL}	
RD{SP} {NR2} { ; | NL}	
IO{SP} {NR2} { ; | NL}	
RR{SP} {OFF | NR2} { ; | NL}	
FREQ {NR1} ; { ; | NL}	10-1000=10-1000Hz 0=DC
DIM:LEV {NR2}{ ; | NL}	DIM LEVEL,0-10V
DUTY {NR1}{ ; | NL}	0.01-0.99=1-99% DUTY CYCLE
DIM {OFF|ON}{ ; | NL}	0：OFF 1：ON

Table 4-1 REMOTE CONTROL SETTING COMMAND SUMMARY

QUERY PRESET NUMERIC COMMAND	RETURN
RISE{?} { ; | NL}	###.####
FALL{?} {NR2} { ; | NL}	###.####
PERD：{HIGH | LOW}{?} { ; | NL}	###.####
LDONV {?}{ ; | NL}	###.####
LDOFFV {?}{ ; | NL}	###.####
CC | CURR：{HIGH | LOW} {?} { ; | NL}	###.####
CC | CURR{?} { ; | NL}	###.####
CP：{HIGH | LOW} {?} { ; | NL}	###.####
CR | RES：{HIGH | LOW} {?} { ; | NL}	###.####
CR | RES{?} { ; | NL}	###.####
CV | VOLT：{HIGH | LOW} {?} { ; | NL}	###.####
CV | VOLT{?} { ; | NL}	###.####
TCONFIG {?}{;|NL}	1:NORMAL 2:OCP 3:OPP 4:SHORT
OCP: START {?} {;|NL}	###.####

QUERY PRESET NUMERIC COMMAND	RETURN
OCP: STEP {?}{;|NL}	###.####
OCP: STOP {?}{;|NL}	###.####
VTH {?}{;|NL}	###.####
OPP: START {?} {;|NL}	###.####
OPP: STEP {?}{;|NL}	###.####
OPP: STOP {?}{;|NL}	###.####
STIME {?}{;|NL}	###.####
OCP {?}{ ; | NL}	###.####
OPP {?}{ ; | NL}	###.####
VO {?}{ ; | NL}	###.####
VD {?}{ ; | NL}	###.####
RD {?}{ ; | NL}	###.####
IO {?}{ ; | NL}	###.####
FREQ {?}{ ; | NL}	
DIM: LEV {?}{ ; | NL}	##.##
DUTY {?}{ ; | NL}	##
DIM {?}{ ; | NL}	0：OFF 1：ON
BW {?} { ; | NL}	0:LO 1:HI
AVG {?} { ; | NL}	
LEDNO {?} { ; | NL}	

Table 4-2 REMOTE CONTROL QUERY COMMAND SUMMARY

LIMIT COMMAND	RETURN
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 REMOTE CONTROL LIMIT COMMAND SUMMARY

STAGE COMMAND	REMARK
LOAD {SP}{ON|OFF|} { ; |NL}	
LOAD {?} { ; |NL}	0：OFF 1：ON
MODE {SP} {CC|CR|CV|CP|LED} { ; NL}	
MODE {?} { ; |NL}	0：CC 1：CR 2：CV 3：CP 4 : LED
SHOR {SP} {ON|OFF|} { ; |NL}	
SHOR {?} { ; |NL}	0：OFF 1：ON
PRES {SP} {ON|OFF|} { ; |NL}	
PRES {?} { ; |NL}	0：OFF 1：ON
SENS {SP} {ON|AUTO { ; |NL}	
SENSe {SP} {ON|OFF } { ; |NL}	
SENS {?} { ; |NL}	0：OFF/AUTO 1：ON 334XXF/G No AUTO
LEV {SP} { LOW|HIGH|} { ; |NL}	
LEV {?} { ; |NL}	0：LOW 1：HIGH

STAGE COMMAND	REMARK
DYN {SP} {ON|OFF|} { ; |NL}	
DYN {?} { ; |NL}	0：OFF 1：ON
CLR{ ; |NL}	
ERR {?}{ ; |NL}	
NG {?}{ ; |NL}	0：GO 1：NG
PROT {?}{ ; |NL}	
CCR{SP}{AUTO|R2}{ ; |NL}	
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：

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/LAN command	
LOCAL{ ; | NL}	RS232/USB/LAN command	
NAME {?} { ; | NL}		“XXXXX”
*RST { ; | NL}		

Table 4-5 SYSTEM COMMAND SUMMARY

Measure command

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

Table 4-6 MEASURE COMMAND SUMMARY

REMARK :
1. Current engineering unit : A
2. Voltage engineering unit : V
3. Resistance engineering unit : Ω
4. Period engineering unit : mS
5. Slew-rate engineering unit : mA/uS
6. Power engineering unit : W

AUTO SEQUENCE :

AUTO SEQUENCE COMMAND	NOTE	RETURN
FILE {SP} {n}{ ; | NL}	n=1~9	1~9
STEP {SP} {n} { ; | NL}	n=1~16	1~16
TOTSTEP {SP} {n}{ ; | NL}	Total step n=1~16	1~16
SB {SP} {m,n} { ; | NL}	m=1~10 n=1~15 m:STATE , n:BANK	
T1 {SP} {NR2} { ; | NL}	0.1~9.9(s)	0.1~9.9(sec)
T2 {SP} {NR2} { ; | NL}	0.1~9.9(s)	0.1~9.9(sec)
SAVE { ; | NL}	Save “File n” data	
REPEAT {SP} {n} { ; | NL}	n=0~9999	0~9999
RUN {SP} {F} {n} { ; | NL}	n=1~9	AUTO REPLY “PASS” or “FAIL:XX” (XX=NG STEP)

Table 4-7 Auto sequence command list

33431G REMOTE CONTROL COMMAND LIST2

COMPLEX TYPE FORMAT

SETTING COMMAND SUMMARY	REMARK
[PRESet：] RISE{SP} {NR2} { ; | NL}	mA/us
[PRESet：] FALL{SP}{ ; | NL}	mA/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：] CC | CURR{SP}{NR2}{ ; | NL}	
[PRESet：] CP：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CR | RES：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CR | RES{SP}{NR2}{ ; | NL}	
[PRESet：] CV | VOLT：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CV | VOLT{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}	

SETTING COMMAND SUMMARY	REMARK
[PRESet：] VO{SP} {NR2} { ; | NL}	
[PRESet：] VD{SP} {NR2} { ; | NL}	
[PRESet：] RD{SP} {NR2} { ; | NL}	
[PRESet：] IO{SP} {NR2} { ; | NL}	
[PRESet：]FREQ {NR1} ; { ; | NL}	10-1000=10-1000Hz 0=DC
[PRESet：]DIM:LEV {NR2}	DIM LEVEL,0-10V
[PRESet：]DUTY {NR1}{ ; | NL}	0.01-0.99=1-99% DUTY CYCLE
[PRESet：]BW{SP} {LO | HI} { ; | NL}	
[PRESet：]AVG{SP}{n}{ ; | NL}	n=1/2/4/8/16/32/64
[PRESet：]LEDNO{SP}{n}{ ; | NL}	n=1-99 ,SET LED NUMBER

Table 4-1B REMOTE CONTROL SETTING COMMAND SUMMARY

QUERY COMMAND SUMMARY	RETURN
[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：] CC | CURR{?} { ; | NL}	###.####
[PRESet：] CP：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] CR | RES：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] CR | RES{?} { ; | NL}	
[PRESet：] CV | VOLT：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] CV | VOLT{?} { ; | NL}	
[PRESet：] TCONFIG {?}{;|NL}	1:NORMAL 2:OCP 3:OPP 4:SHORT
[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：] VO {?}{;|NL}	###.####
[PRESet：] VD {?}{;|NL}	###.####
[PRESet：] RD {?}{;|NL}	###.####
[PRESet：] IO {?}{;|NL}	###.####
[PRESet：] RR {?}{;|NL}	OFF or ###.####
[PRESet：] FREQ {?}{;|NL}	

QUERY COMMAND SUMMARY	RETURN
[PRESet：] DIM: LEV {?}{;|NL}	##.##
[PRESet：] DUTY {?}{;|NL}	##
[PRESet：] DIM {?}{;|NL}	0：OFF 1：ON
[PRESet：] BW {?} { ； | NL}	0:LO 1:HI
[PRESet：] AVG {?} { ； | NL}	
[PRESet：] LEDNO {?} { ； | NL}	

Table 4-2B REMOTE CONTROL QUERY COMMAND SUMMARY

LIMIT COMMAND	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 REMOTE CONTROL 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|LED } {；NL}	
[STATe：] MODE {?} {；|NL}	0:CC 1:CR 2:CV 3:CP 4:LED
[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}	

STAGE COMMAND	REMARK
[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:

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/LAN command	
[SYStem：] LOCAL{；| NL}	RS232/USB/LAN command	
[SYStem：] NAME {?} {；| NL}		“XXXXX”
[SYStem：]*RST {；|NL}		

Table 4-5B SYSTEM COMMAND SUMMARY

Measure command:

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

Table 4-6B MEASURE COMMAND SUMMARY

REMARK :
1. Current engineering unit : A
2. Voltage engineering unit : V
3. Resistance engineering unit : Ω
4. Period engineering unit : mS
5. Slew-rate engineering unit : mA/uS
6. Power engineering unit : W

Auto sequence :

AUTO SEQUENCE COMMAND	NOTE	RETURN
FILE {SP} {n}{ ; | NL}	n=1~9	1~9
STEP {SP} {n} { ; | NL}	n=1~16	1~16
TOTSTEP {SP} {n}{ ; | NL}	Total step n=1~16	1~16
SB {SP} {m,n} { ; | NL}	m=1~10 n=1~15 m:STATE , n:BANK	
T1 {SP} {NR2} { ; | NL}	0.1~9.9(s)	0.1~9.9(sec)
T2 {SP} {NR2} { ; | NL}	0.1~9.9(s)	0.1~9.9(sec)
SAVE { ; | NL}	Save “File n” data	
REPEAT {SP} {n} { ; | NL}	n=0~9999	0~9999
RUN {SP} {F} {n} { ; | NL}	n=1~9	AUTO REPLY “PASS” or “FAIL:XX” (XX=NG STEP)

Table 4-7B Auto sequence command list

4-4. The description of abbreviation

SP：Space, the ASCII code is 20 Hexadecimal.

；：Semicolon, Program line terminator, the ASCII code is 0A Hexadecimal.

NL：New line, Program line terminator, the ASCII code is 0A Hexadecimal.

NR2：Digits with decimal point. It can be accepted in the range and format of###.#####.

For Example：

30.12345, 5.0

The description of GPIB programming command syntax.

4-5. Remote Control Command Language description

{ } ： The contents of the { } symbol must be used as a part or data of the GPIB command, it can not 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 GPIB command, the available command terminator characters which can be accepted in 33431G mainframe is listed in Table 4-8.

LF
LF WITH EOI
CR，LF
CR，LF WITH EOI

Table 4-8 GPIB 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.

4-6. Remote control command description

4.6.1 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.
3.33431G will set to the maximum value of the model automatically when the set RISE is over the specification of Load.
4.The unit is mA/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.
2.33431G 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 mA/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. 33431G 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. 33431G will 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. 33431G 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. 33431G 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.

4.6.2 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 GOOD〞.

[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〞.

4.6.3 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｜LED}

Syntax： [STATe：] MODE {SP}{CC｜CR｜CV｜CP｜LED}{；｜NL}
[STATe：] MODE ？{；｜NL}

Purpose：Set and read the mode of LOAD

Description：Load is acting under these four modes as the following TABLE 4-9. When reading the Loading Operation mode, the return value 0｜1｜2｜3｜4 are meant to be CC｜CR｜CV｜CP｜LED

	CC (0)	CR (1)	CV (2)	CP (3)	LED (4)
33431G	V	V	V	V	V

Table 4-9 33431G Series mode

[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 select 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 33431G, 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}{
[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 33431G 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 33431G

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 33431G

Description：1.PROT? means the status of Protection of 33431G. “1” means OPP occurred.”4”means OVP. “8” means OCP. Table 4-10 shows the corresponding number of protection status

2.Use command CLR to clear the register of PROT status to be “0”

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit1	Bit 0
7	6	5	4	3	2	1	0

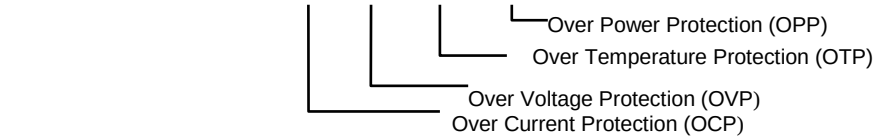


Table 4-10 register of PROT status

[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

4.6.4 SYSTEM Set and Read the Status of 33431G

[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 operatin 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 33431G 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 33431G 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 33431G, BANK will be set the BANK which shows on the display.

	33431G
BANK(n)	15
STATE(m)	10
TOTAL STATE	150

Table 4-11 MEMORY STATE LIST

[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 4-12 :

MODEL
33431G
33432G

Table 4-12 33431G Series MODEL NO. LIST

[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

4.6.5 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 meter, and the unit is Watt (W)

Chapter 5 Applications

This chapter describes the application information of 33431G series Electronic Load.

5-1. Local sense connections

Fig 4-1 illustrates a typical set up with the electronic load connected to the DC power supply. Local sensing is used in application where lead lengths are relatively short, or where load regulation is not critical.

The 5 digit voltage Meter of 33431G series Electronic load measures the voltage of DC INPUT Terminal automatically; load leads should be bundled or tie-wrapped together to minimize inductance.

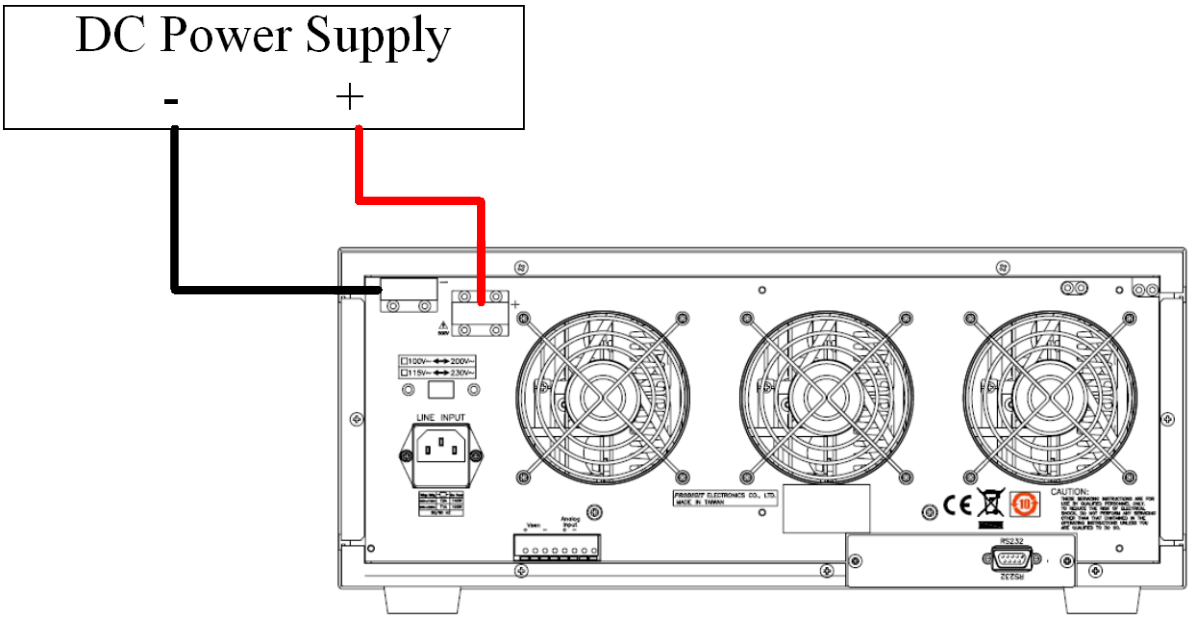


Fig 5-1 Local voltage sense connections

5-2. Remote sense connections

Fig 5-2 illustrates a typical set up with the electronic load connected for remote sense Operation. (Vsense should be set to ON)

The remote V-sense cables of the electronic load are connected to the output of the power supply. Remote sensing compensates for the voltage drop in applications that require long lead lengths.

The 5 digit voltage Meter of 33431G series Electronic load measures the voltage of V-sense input Terminal, so the high accuracy 5 digit voltage Meter can measure the specific points voltage of the power supply's output voltage.
Load leads should be bundled or tie wrapped together to minimize inductance.

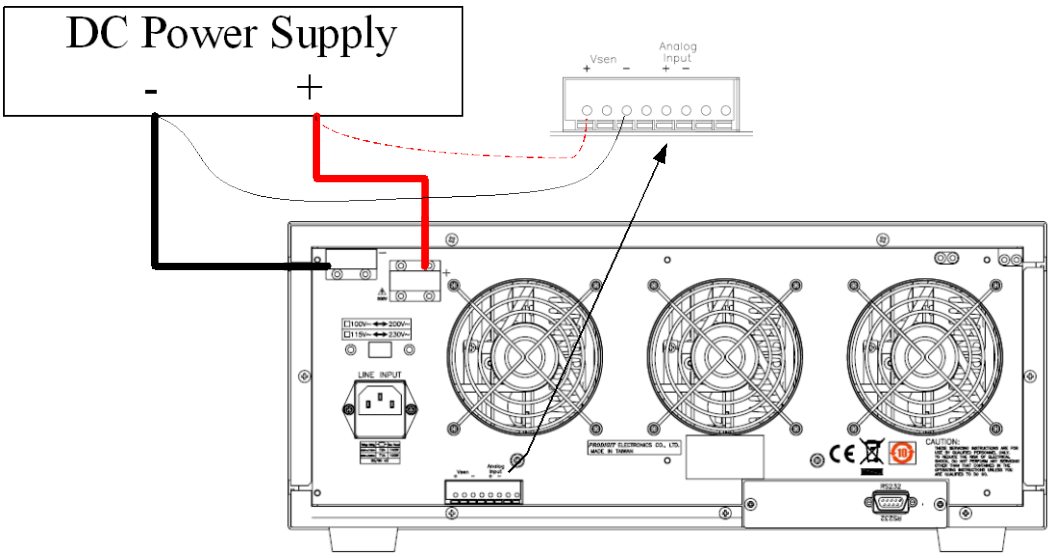


Fig 5-2 Remote voltage sense connections

5-3. Constant Current mode application

The Constant Current mode is very suitable to test the Load Regulation, Cross Regulation, Output Voltage and Dynamic Regulation of the power supply testing, and test the Discharge Characteristic and Life cycle of the Battery testing.

5.3.1 Static mode: (Fig 5-3)

Major application:

5.3.1.1 Source testing

5.3.1.2 Power supply load regulation testing

5.3.1.3 Battery discharge testing

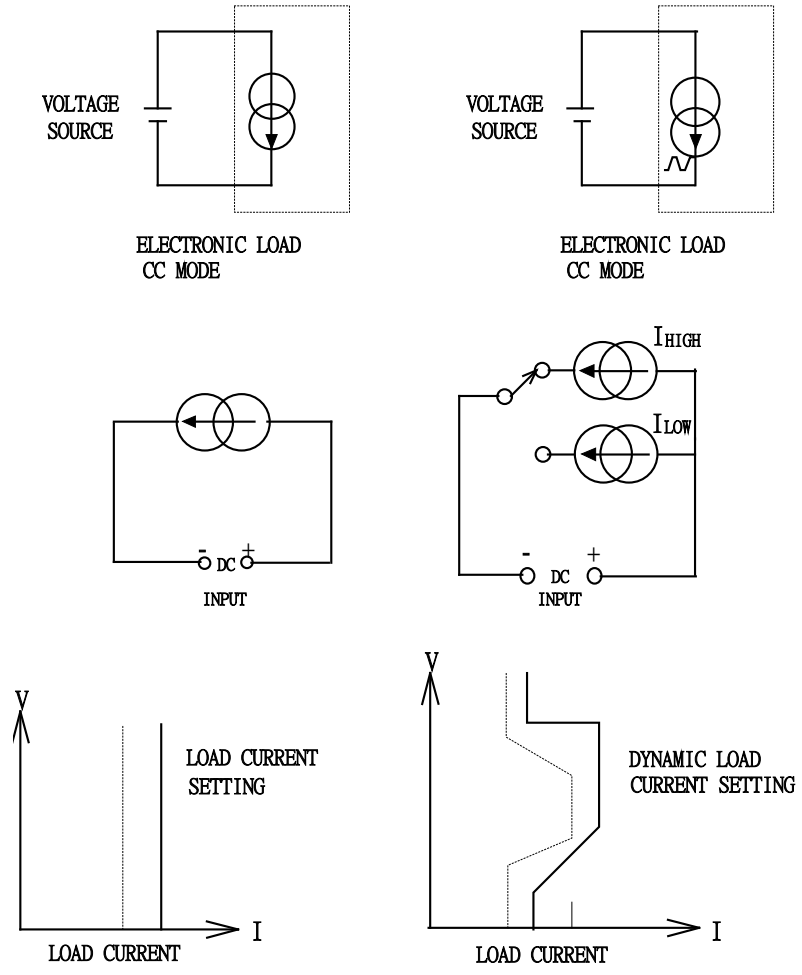


Fig 5-3 constant CURRENT mode application

5.3.2 Dynamic mode:

5.3.2.1 Built-in Pulse generator: (Fig 5-4)

Major application:

5.3.2.1.1 Power supply load transient response testing
5.3.2.1.2 Power recovery time testing
5.3.2.1.3 Pulse load simulation
5.3.2.1.4 Power component testing

Description:

The maximum Rise/Fall current slew rate or minimum Rise/fall time is the time required for the load input to change from 10% to 90% or from 90% to 10% of the programmed High to Low load level.

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

5.3.2.2 Analog programming input: (Fig 5-4) (Please use the CC Mode Range II)

Major application:

5.3.2.2.1 Simulate real load condition
5.3.2.2.2 Battery discharge testing

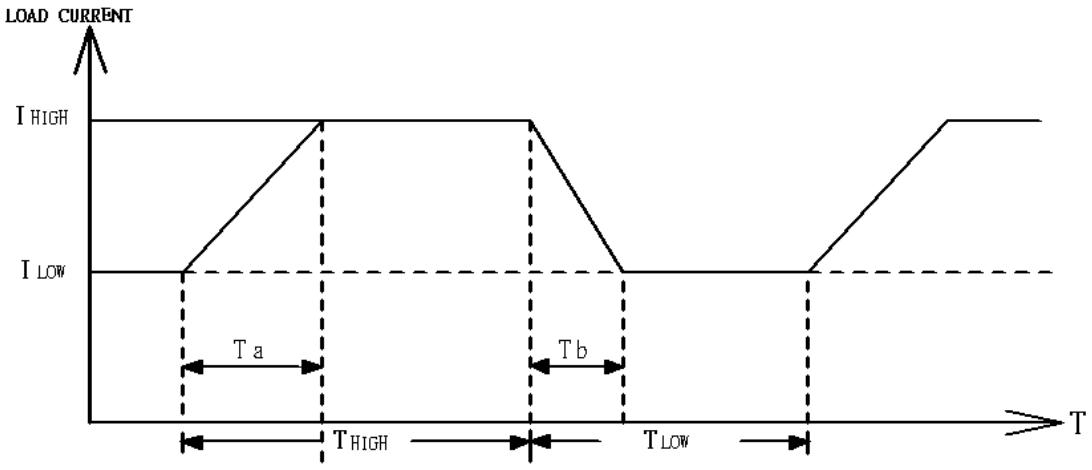


Fig 5-4 Dynamic load current with independent programmed Rise/Fall slew rate

5-4. Constant Voltage mode application

Major application:

5.4.1 Current source testing

The battery charger is a current source to charge current into a re-chargeable battery, the CV mode of electronic load can be used to simulate the terminal voltage of re-chargeable battery, it is designed to test the charge current from battery charger.

The Battery charger of notebook PC and Mobile phone is the most popular products for the current source in the real world, user can use CV mode to set voltage say 6.0V (example), then read charge current from the current meter on the load, next then set CV voltage to 5V (example), then read the charge current again, this method is used to test the load regulation of a current source.

5.4.2 Power supply current limit characteristic testing

The current limit is a necessary function for a power supply; the Fold-back current limit curve is very common for a switching power supply, where the constant current limit curve is very popular for a lab power supply.

It is very difficult or impossible to find out the above current limit curve by CC or CR mode, however, it becomes easy by using CV mode. User can set CV voltage, record the output current, then makes a series voltage and current to result a output current limit curve (Figure 5-5) of a power supply.

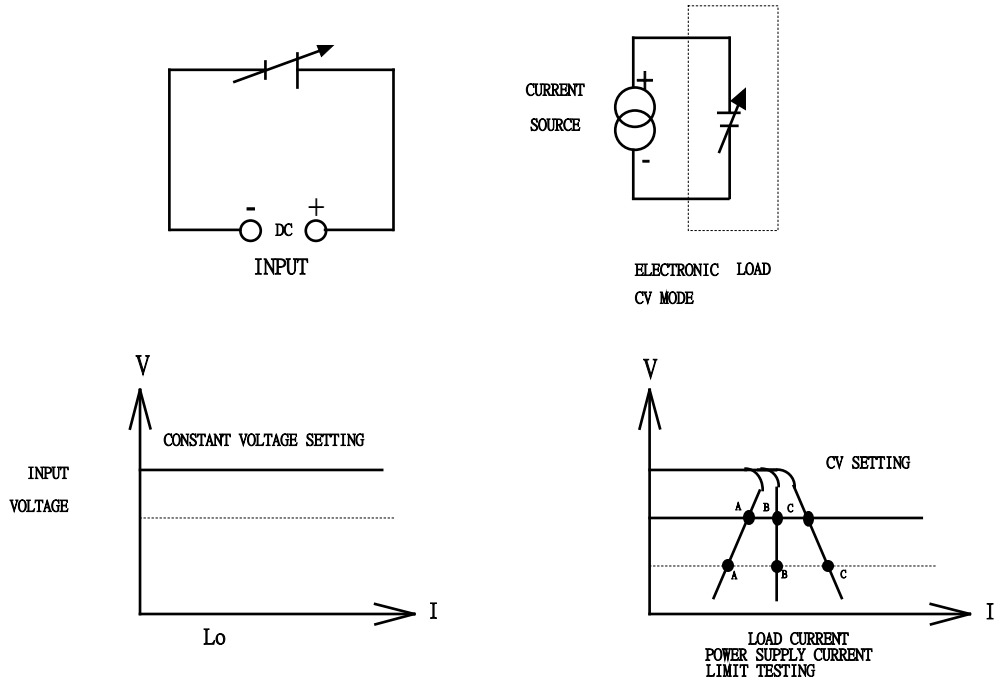


Fig 5-5 Constant Voltage mode application

5-5. Constant Resistance mode application

Major application:

5.5.1 Voltage source or Current source testing

5.5.2 Power supply power-up sequence

The constant current and constant resistance modes are used in conjunction for testing switching power supplies.

Caution must be exercised when using the CC mode in test set up, for example: A 6V/12A output power supply cannot deliver 50A over its start up range 0-6 volts. In many cases the power supply short circuit or over current protection circuit will shut the power supply down. What is occurring is that the power supply is trying to deliver 12A at 6V because the load tester is in the CC mode. The power supply is designed not to do this.

As a result, when testing a power supply, the CR mode should be used to allow the power supply voltage and current to ramp up together. After this has occurred the CC mode should be used to complete testing.

It has eliminated the need for manually switching from the CR to the CC mode with 33431G series Electronic Loads. They can be programmed with proper current and slew rate in the CC mode which allows a power supply to reach its specified output condition in the CC load mode.

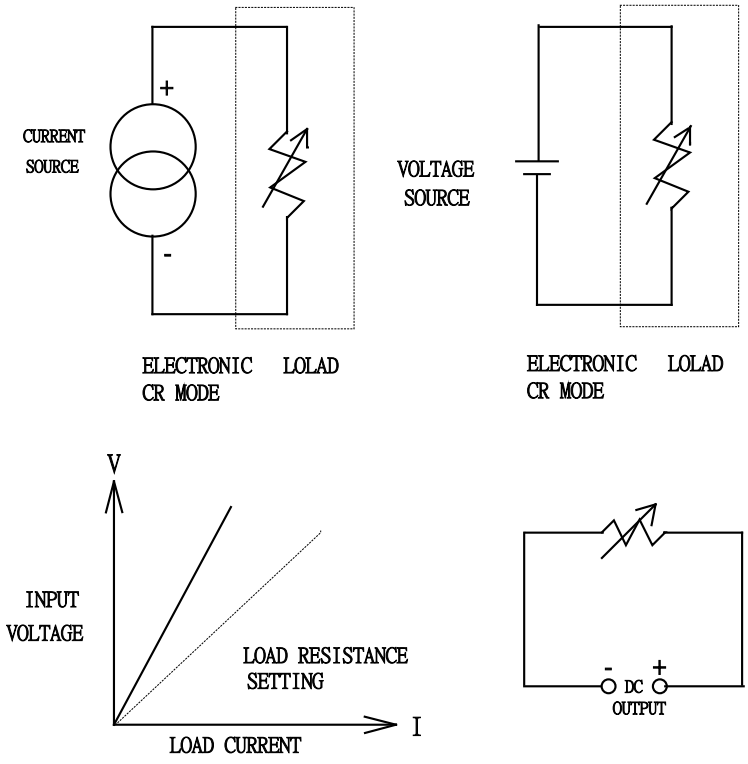


Fig 5-6 Constant Resistance mode Application

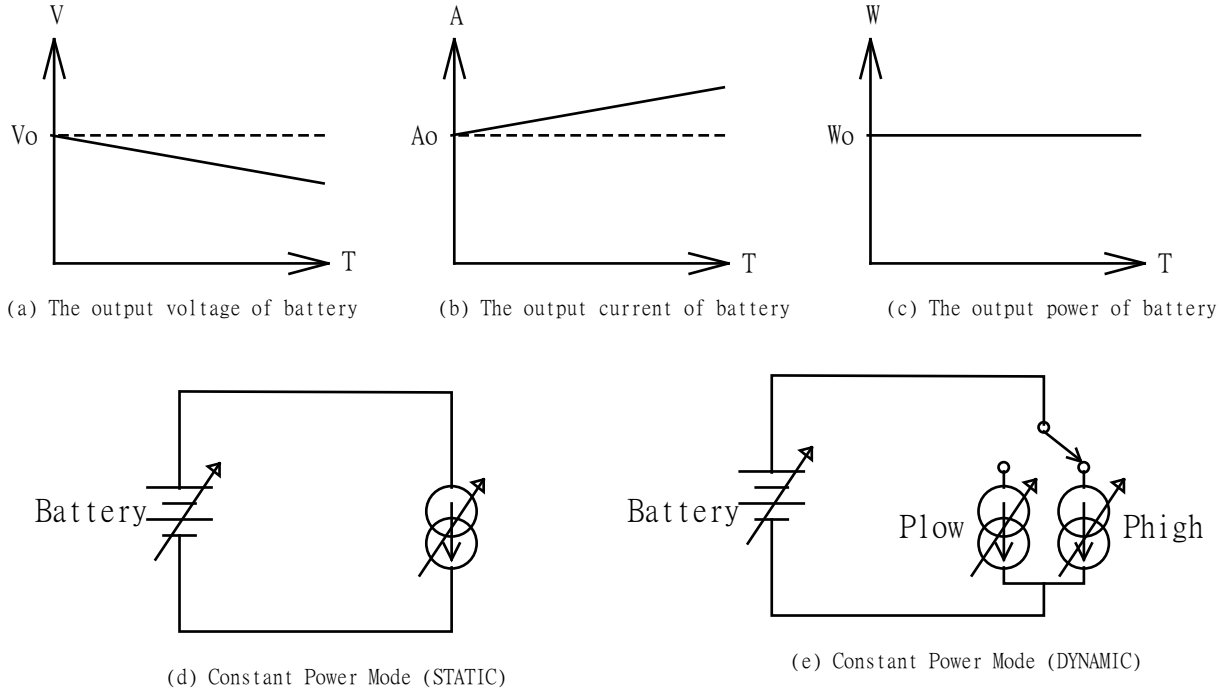
5-6. Constant Power mode application

The Constant Power mode is designed for Battery's energy capacity evaluation and testing.

Primary or secondary battery is the power source for every portable electronics products, such as notebook computer, video camera, etc. The output voltage of battery will start to drop (Fig 5-7a) according to the output current and usage duration time (Fig 5-7b), however, it should provide a stable power output regardless of output voltage (Fig 5-7c), therefore, the energy capacity (output power x time) is one of the most important factor to evaluate a battery.

The CP mode of 33431G series electronic load is designed to test the above characteristics of a battery, it can sink constant power load for a battery, the load current will increase automatically in accordance to the output voltage drop of battery, the load power will be the same to the load power setting of CP mode (Fig 4-7d), the 33431G series CP mode electronic load with time record can be used to evaluate the energy capacity or discharge life time of a battery.

Moreover, the real power could be a dynamic loading condition, the 33431G series CP mode can be operated in Dynamic power load as well, setting the STA/DYN to DYN on the front panel or remote programming, 33431G series can sink dynamic power waveform to test the dynamic characteristics of battery (Fig 5-7e).



(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

5-7. LED mode applications

As the actual connection to the LED Driver of the LED will be by brand, size, cascading , in parallel and then various different load conditions, if each test is required should be get the expensive cost of testing, the use of electronic load to simulate various combinations of LED to test can achieve fast and low cost.

1 LED Characteristic

Figure 4-8 shows LED's equivalent circuit; there is a forward resistance Series a forward Voltage Vd, the exponential V-I characteristic curve ,When Voltage across of LED larger Than forward voltage Vd, then LED current Io is (Vo-Vd)/Rd.

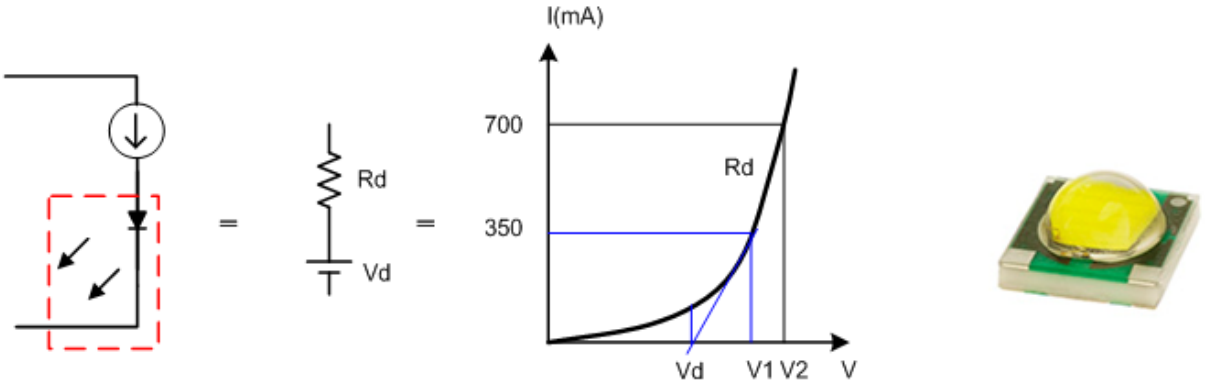


Fig 5-8 LED's equivalent circuit and characteristic curve

1.1 When LED driver is constant current type, the voltage across of LED is Vd+(I*Rd)=Vo, Actually the Vd have a negative temperature coefficient (NTC-2mV/℃~4 mV/℃)With respect to voltage ,e.g. the LED forward voltage Vd decreases as the LED gets Warmer, causing the Vo voltage decreases as temperature goes up.

1.2 Figure 5-9 show LED driver constant current output Io has a current ripple, the Voltage across of LED also got a Io*Rd voltage ripple (Normally is a high frequency Triangle waveform).

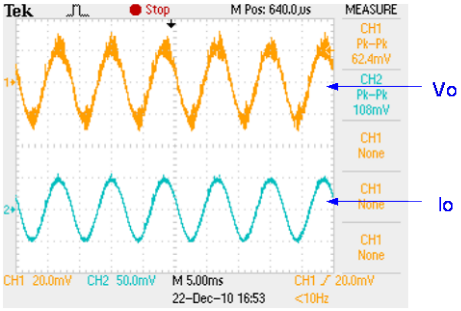


Fig 5-9 LED Driver ripple

1.3 Several LED cascading connection:

Several LED cascading connection can get more output brightness, Vd and Rd also Will increase as series. Fig 5-10 shows 3 LED cascading connection equivalent circuit And characteristic curve

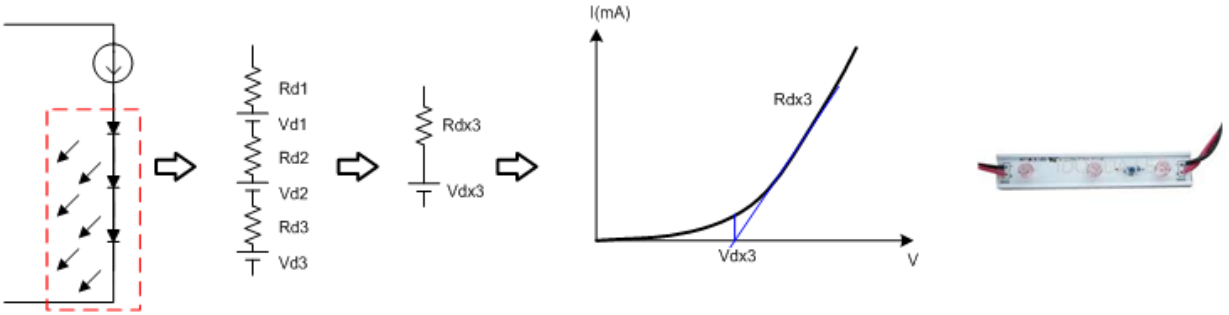


Fig 5-10 3 LED cascading connection equivalent circuit and characteristic curve

1.4 In parallel connection stacks of LED: Several LED stacks in parallel connection is also Can get more output brightness, Vd also will increase as series Rd is according to the Cascade and parallel. Fig 5-11 is 2 stacks LED to parallel, are the LED's equivalent Circuit and exponential V-I characteristic curve.

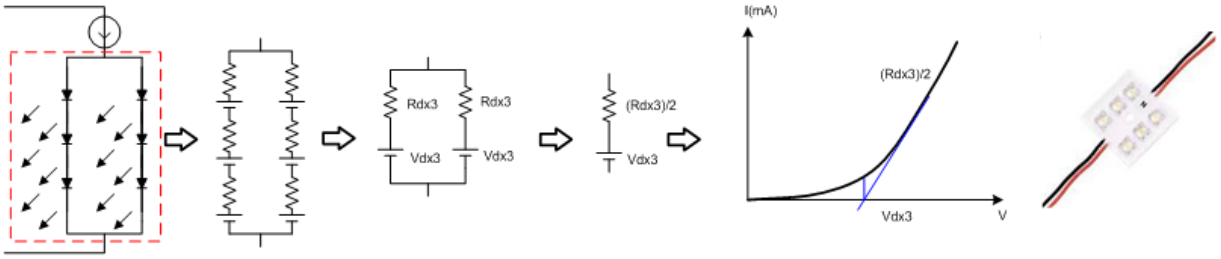


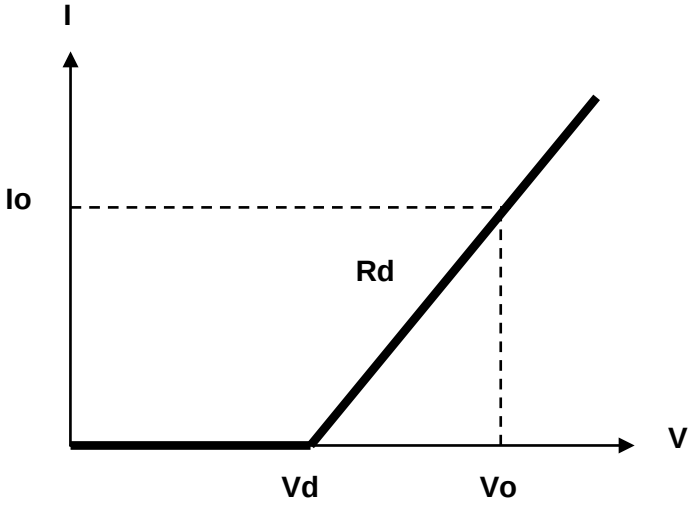
Fig 5-11 Several LED cascading and parallel connection and characteristic curve

2 How to setting Vd,Rd and Vo parameters for LED mode Electronic Load.
If the LED lamp's brand, part no, and specifications is available then follow the LED data To setting the parameters.

Vd voltage LED for different value of different materials, usually about one a LED Vd Voltage, GaAs is 1V, the red GaAsP to 1.2V, GaP to 1.8V, GaN is 2.5V.
If the LED lamp's data information is not available, normally, you can use the LED driver's Specifications to setting the parameters, Vo is the LED driver output voltage Specifications,Vd can predict 70~90 percent of Vo(initial setting to 80%),Rd=(Vo-Vd)/Io , Io Is the LED driver output current specifications

33431G Series LED mode

1. V-I curve as shown
2. Rd=(Vo-Vd)/Io
3. Parameter definition:
4. Vd: LED forward voltage
5. Rd: LED operating impedance
6. Vo: LED Operating Voltage
7. Io: LED operating current



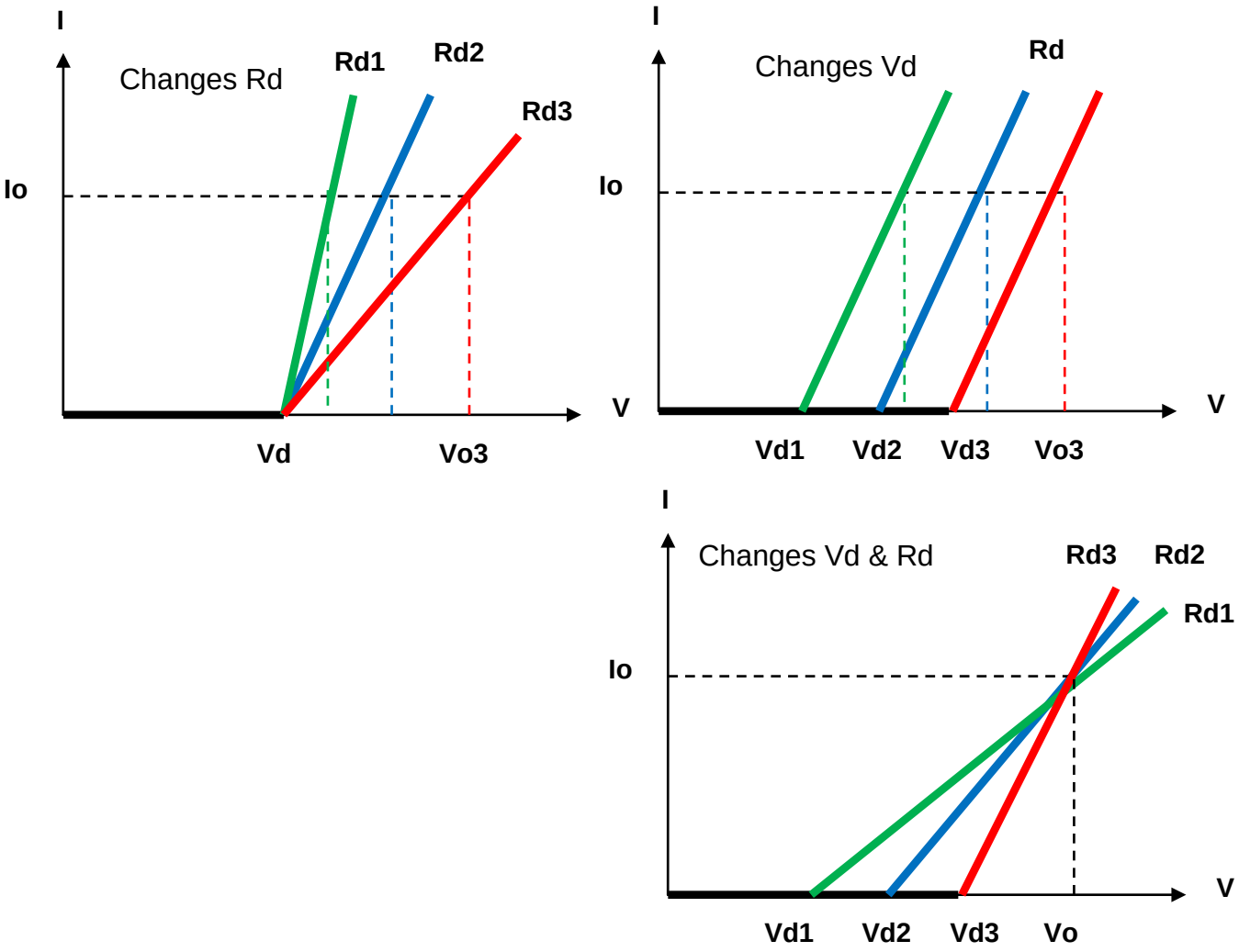


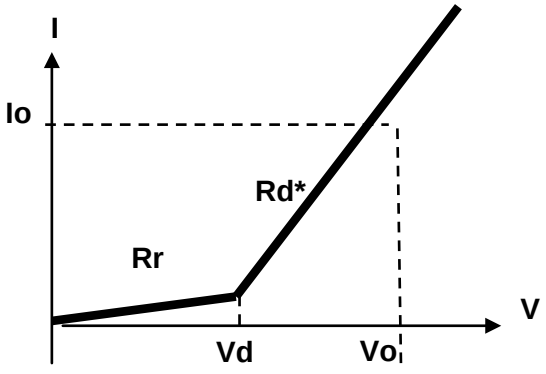
Fig 5-12 LED MODE operation mode of the application

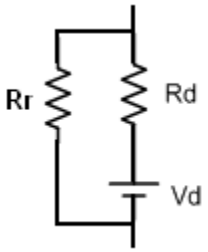
3 Rr Setting methods

When actually LED (Vo <Vd) will still have a currents, The impedance of this work area we Set Rr.

This setting can be more close to the actual LED characteristics, Can also use this setting To adjust the desired ripple size.

$$Rd^* = \frac{Vo-Vd}{Io-\frac{Vo}{Rr}}$$





Equivalent circuit

5-8. Parallel operation

When the power or current rating is not enough on the electronic load, you can combine two or more electronic load as one unit by parallel two or more. At this time, the total load current and power is the sum of the two or more load also. This connection can extend the electronic load to a higher power and current rating.

Note: 1. The electronic load only may carry on the parallel operation under the constant current mode.
2. The electronic load do not use under Series connection.

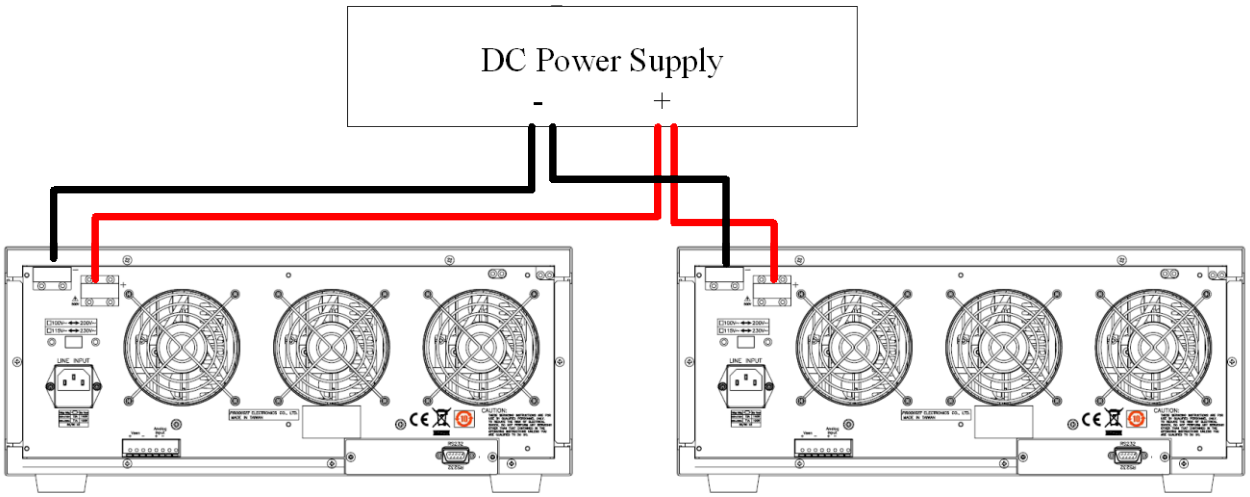


Fig 5-14 33431G series load parallel operation

5-9. Zero-Volt loading application

As shown in Fig 5-15, the Electronic load can be connected in series with a DC voltage source which output voltage greater than 6V 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 6V operating voltage required by the Electronic load. This application is suitable for low voltage Battery cell with high discharge current testing.

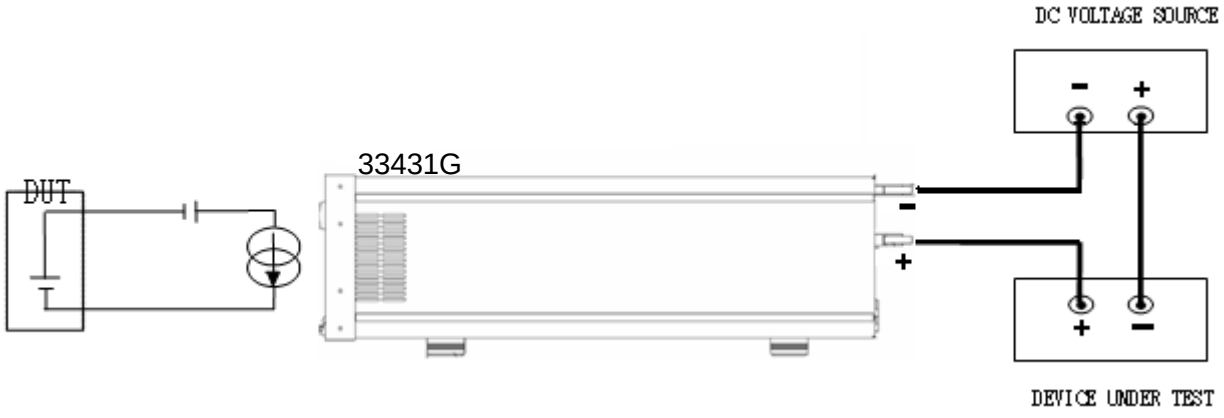


Fig 5-15 33431G series Zero-Volt loading connection

5-10. 33431G series electronic load OCP, OPP, SHORT operation flow Chart

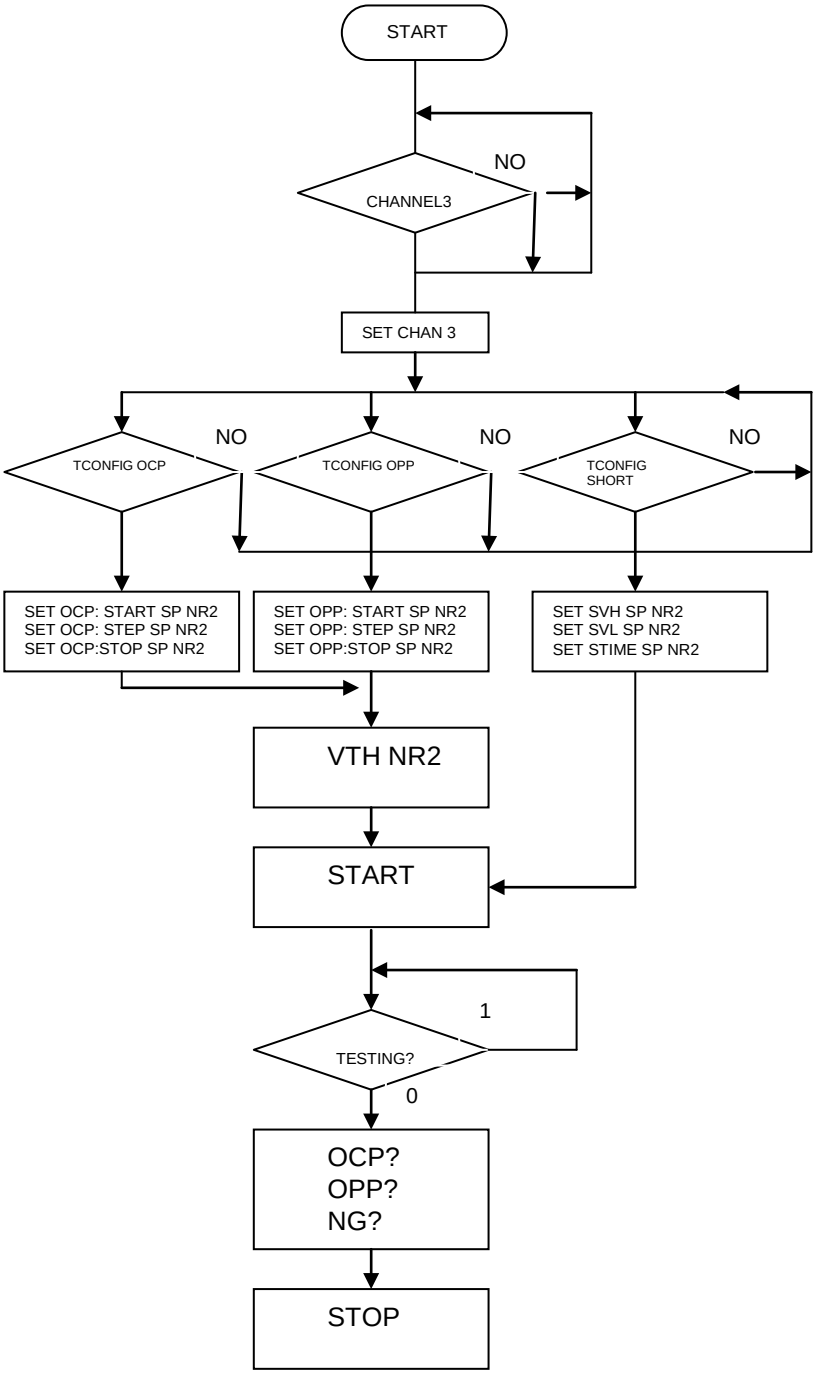


Fig 5-16 33431G series electronic load OCP, OPP, SHORT operation flow chart

5-11. Power Supply OCP testing

5.11.1 OCP Manual control

Example:

5.11.1.1. First, press Limit Key function to setting I_Hi and I_Lo.

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

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

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

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

5.11.1.6. Setting OCP VTH 3.00V, press OCP key to the next step.

5.11.1.7. Press START/STOP test key.

5.11.1.8. 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 "ERROR".

5.11.2 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 2.4A)
VTH 3.0	(Set OCP VTH 3.0V)
IL 0	(Set current low limit 0A)
IH 2	(Set current high limit 2.4A)
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)

5-12. Power Supply OPP testing

5.12.1 OPP Manual control

Example:

5.12.1.1. First, press Limit Key function to setting W_Hi and W_Lo..

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

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

5.12.1.4. Press up key, set step load watt 0.1W, press OPP key to the next step.

5.12.1.5. Press up key, set stop load watt 3.2W, press OPP key to the next step.

5.12.1.6. Setting OPP VTH 3.00V，press OPP key to the next step.

5.12.1.7. Press START/STOP Test key.

5.12.1.8. 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".

5.12.2 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)

5-13. LED Driver SHORT testing

5.13.1 Set output current LED DRIVER General Electronic LOAD cannot be short circuit Test.

5.13.2 33431G Series LED mode Load provides +12 V power supply and Short Relay output Interface to control external +12 V RELAY to short-circuit test.

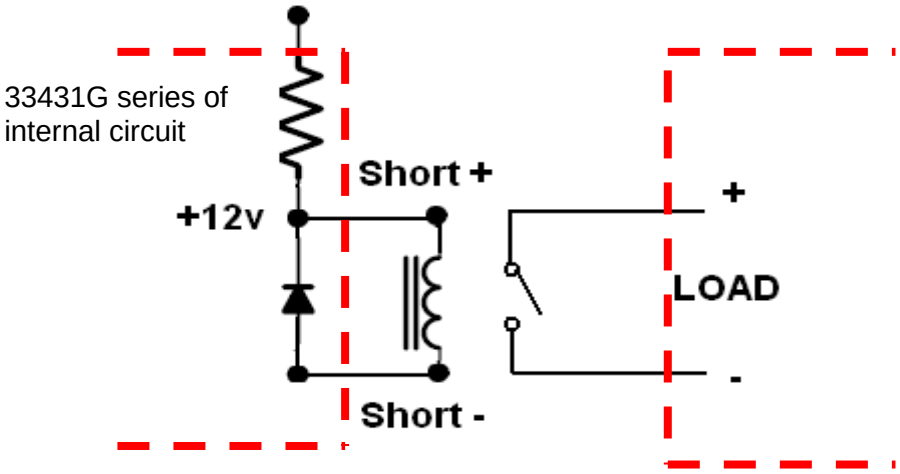


Fig 5-17 short test connection

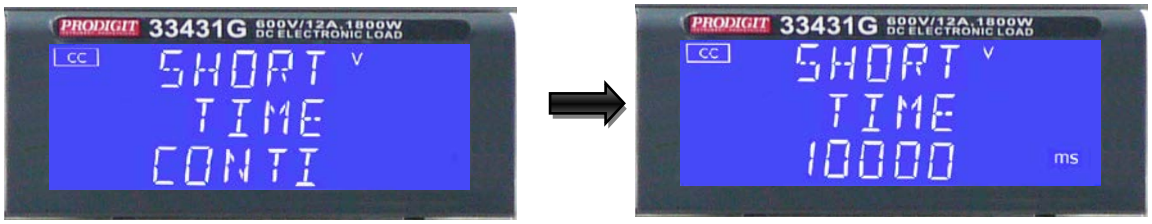
5.13.3 Short-circuit impedance test method:
33431G maximum short circuit current models for the maximum current value.
Example: 33431G maximum short circuit current is 12A

5.13.4 SHORT Manual control

Example:

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

5.14.4.2. Press UP key, setting Short time to 10000ms, press Short key to the next Step.



5.14.4.3. Press down key, setting V-Hi voltage to 1V, press Short key to the next Step.

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

5.14.4.5. Press START/STOP test key.

5.14.4.6. 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"

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

5.13.5 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)

Appendix A GPIB programming Example

C Example Program

```
/* Link this program with appropriate *cib*.obj. */

/* This application program is written in TURBO C 2.0 for the IBM PC-AT compatible. The National
Instruments Cooperation (NIC) Model PC-2A board provides the interface between the PC-AT and a
PRODIGIT MPAL ELECTRONIC LOAD. The appropriate *cib*.obj file is required in each program to
properly link the NIC board to C LANGUAGE. and include the <decl.h.> HEADER FILE to C
LANGUAGE. */

#include <stdio.h>
#include <dos.h>
#include <math.h>
#include "decl.h"        /* NI GPIB CARD HEADER FILE */

main()
{
    char ouster[20],rdbuf[15],spec[10];
    int i,ch,load;
/* Assign unique identifier to the device "dev5" and store in variable load. check for error. ibfind error =
negative value returned. */
    if((load = ibfind("dev5")) < 0)        /*   Device variable name is load   */
      {                                    /*   GPIB address is   5   */
        printf("\r*** INTERFACE ERROR ! ***\a\n");
        printf("\r\nError routine to notify that ibfind failed.\n");
        printf("\r\nCheck software configuration.\n");
        exit(1);
      }
/*   Clear the device   */
    if((ibclr(load)) & ERR);
      {
        printf("INTERFACE ERROR ! \a");
        exit(1);
      }
    clrscr();
/* Clear load error register */
      {
      outstr=chan[0];
      ibwrt(load,outstr,6);
      ibwrt(load,"CLR",3);
      }
```

```
    ibwrt( load,"NAME?",5);                          /*  Get the 33431G load specification  */
    strset(rdbuf,'\0');                  /*  Clear rdbuf string buffer  */
    strset(spec,'\0');                   /*  Clear spec string buffer  */
    ibrd(load,spec,20);
    if (spec[3] == '9')
        printf("\n 33431G specification error !");
/*  Set the channel 1, preset off, current sink 1.0 amps and load on commands to the load. */
    ibwrt( load,"chan 1;pres off;curr:low 0.0;curr:high 1.0;load on ",43);
    ibwrt( load,"meas:curr ?",10);
/*  Get the load actially sink current from the load  */
    ibrd( load,rdbuf,20);
/*  go to local.  */
    ibloc(load);
}
```

BASICA Example Program

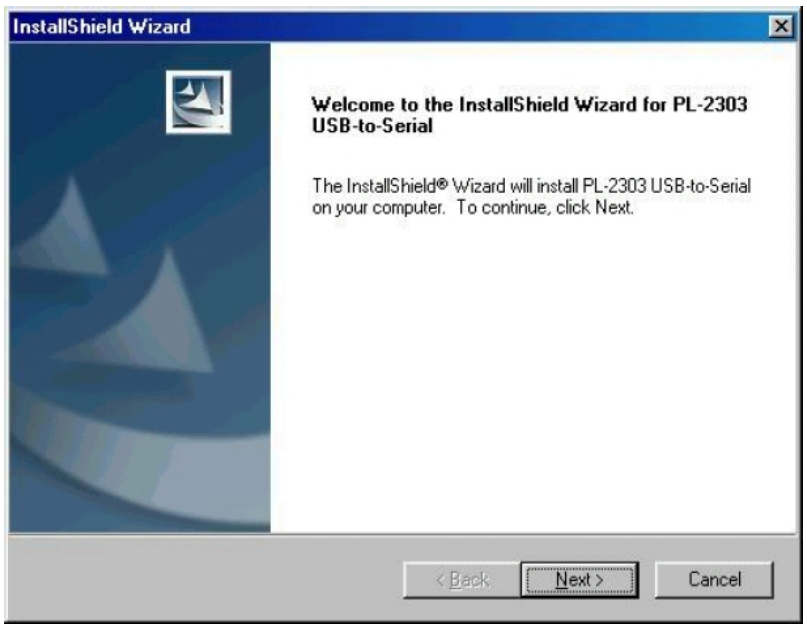
LOAD DECL.BAS using BASICA MERGE command.

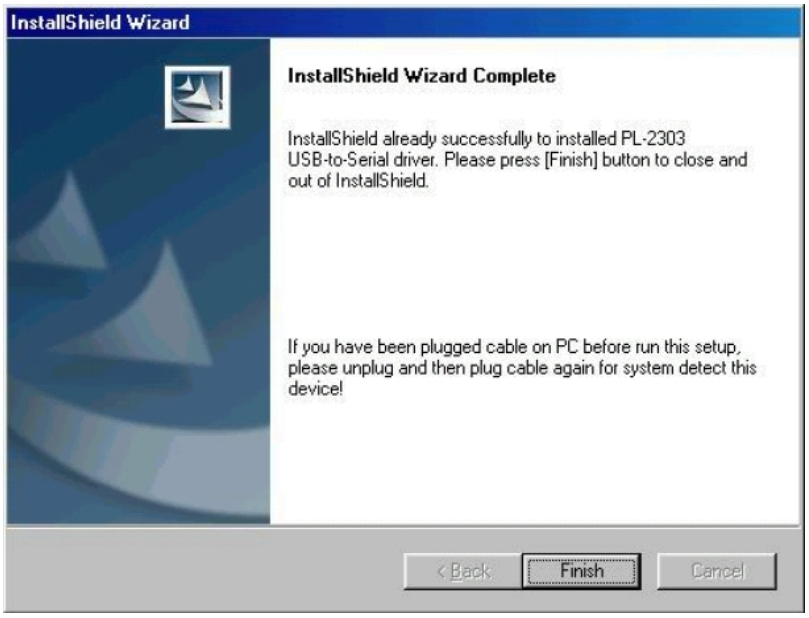
```
100 REM You must merge this code with DECL.BAS
105 REM
110 REM Assign a unique identifier to the device "dev5" and store it in variable load%.
125 REM
130         udname$ = "dev5"
140         CALL ibfind (udname$,load%)
145 REM
150 REM Check for error on ibfind call
155 REM
160         IF load% < 0 THEN GOTO 2000
165 REM
170 REM Clear the device
175 REM
180         CALL ibclr (load%)
185 REM
190 REM Get the 33431G load specification
195 REM
200         wrt$ = "NAME?" : CALL ibwrt(load%,wrt$)
210         rd$ = space$(20) : CALL ibrd(load%,rd$)
215 REM
220 REM Set the preset off, current sink 1.0 amps and load on commands to the load.
225 REM
230         wrt$ = "pres off;curr:low 0.0;curr:high 1.0;load on"
240         CALL ibwrt(load%,wrt$)
245 REM
250 REM Get the load actially sink current from the load
255 REM
260         wrt$ = "meas:curr?" : CALL ibwrt(load%,wrt$)
270         rd$ = space$(20) : CALL ibrd(load%,rd$)
275 REM
280 REM Go to local
285 REM
290 CALL ibloc(load%)

2000 REM Error routine to notify that ibfind failed.
2010 REM Check software configuration.
2020 PRINT "ibfind error !" : STOP
```

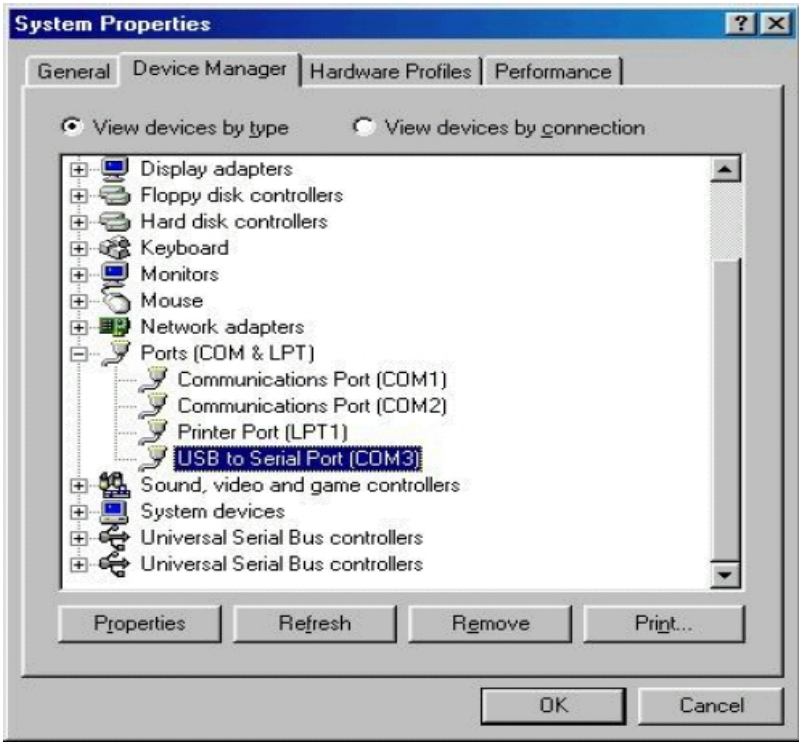
Appendix B 33431G Series USB Instruction

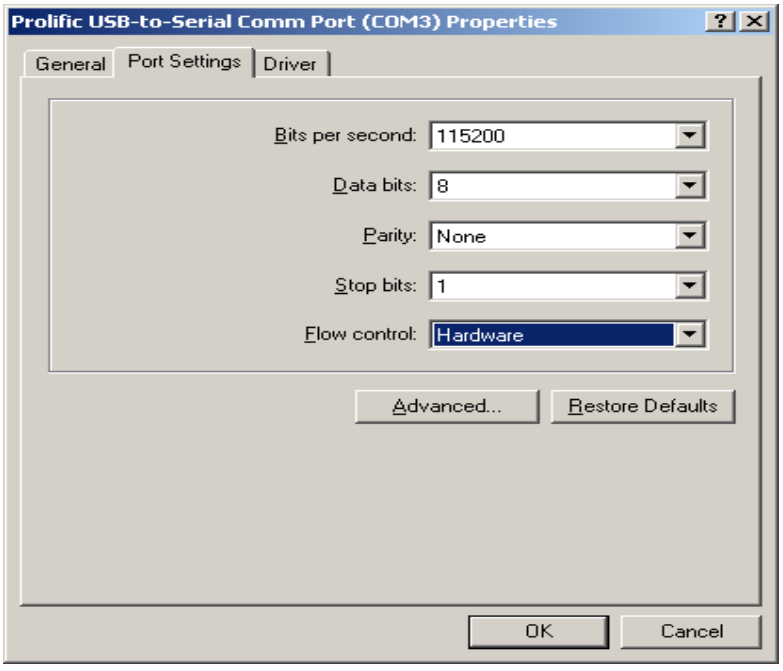
1.Install the USB DRIVER，select USB\SETUP\PL-2303 Driver Installer.exe





2. After the installation , connect the 33431G Series and PC with USB . Then select the item USB to Serial Port (COM3) , set the BAUD-RATE and Flow control to 115200bps and Hardware to control 33431G Series with COM3.





Appendix C 33431G Series LAN Instruction

1. Connecting AC power and the network line to the 33431G Series mainframe, connect the other side of the network line to the HUB.

2. Run the ETM.EXE which bellows the path of the LAN on the CDROM drive, it will show as fig D2-1 if not , please press F5 to search again, or check the first step was succeed or not.

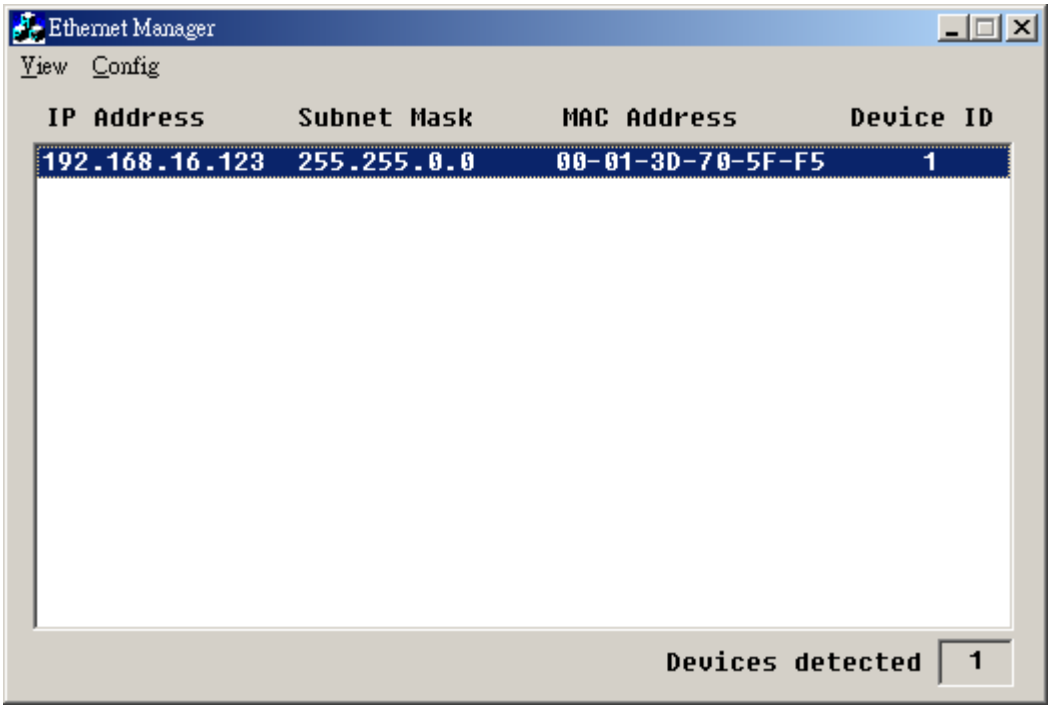
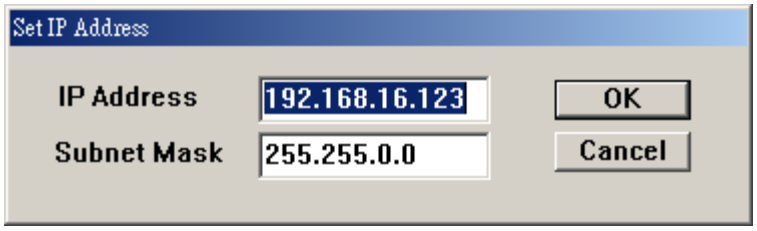


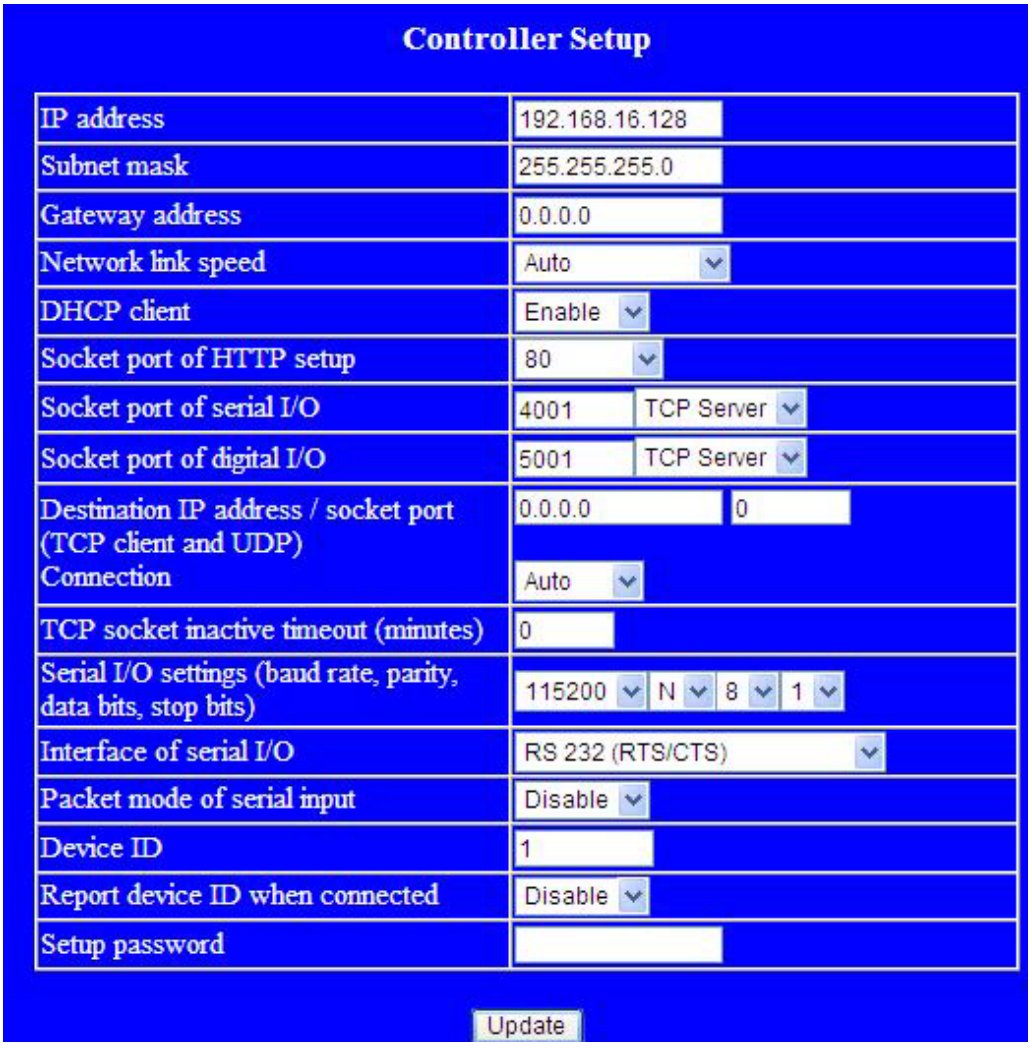
FIG D2-1

3. It will be shown the installation which has been searched on the screen , click it and select the Set IP Address bellows Config：



4. Set an useful IP Address and Subnet Mask.

5. It will be shown the Setup Device as the following figure if all steps was corrected to be run.



6. Insert the numbers as the following :
   - 6.1 IP Address: **as recommended according to your network**
   - 6.2 Subnet Mask: **as recommended according to your network**
   - 6.3 Gateway Address: **as recommended according to your network**
   - 6.4 Network link speed: **Auto**
   - 6.5 DHCP client: **Enable**
   - 6.6 Socket port of HTTP setup: **80**
   - 6.7 Socket port of serial I/O: **4001，TCP Server**
   - 6.8 Socket port of digital I/O: **5001，TCP Server**
   - 6.9 Destination IP address / socket port (TCP client and UDP) Connection: **Auto**
   - 6.10 TCP socket inactive timeout(minutes)：**Set the network disconnection after N minutes, set 0 minutes will work forever.**
   - 6.11 Serial I/O settings (baud rate, parity, data, bits, stop bits): **115200, N, 8, 1**
   - 6.12 Interface of serial I/O: **RS 232 (RTS/CTS)**
   - 6.13 Packet mode of serial input: **Disable**
   - 6.14 Device ID : 5
   - 6.15 Report device ID when connected：**Auto**
   - 6.16 Setup password: Not required

Appendix D 33431G Series Mainframe Auto. Sequ function provide EDIT, ENTER, EXIT, TEST and STORE 5 keys operation.

Edit mode

1. Set mode, Range, current level … Load Setting and Load ON
2. Press STORE key to store the load setting in memory bank
3. Repeat 1~2, for the sequence load setting.
4. Press EDIT key of 33431G Series mainframe.
5. Press 1~9 number key program number.
6. Press BANK up/down key to select memory bank.
7. Press STATE up/down key to select memory state.
8. Press ENTER to next step.
9. Repeat 6~8 to edit Step of sequence
10. Press STORE to confirm the step
11. LCD shows “REP.” to setting repeat count.
12. Press up/down key to set repeat count of sequence loop.
13. Press STORE to confirm the sequence edit.

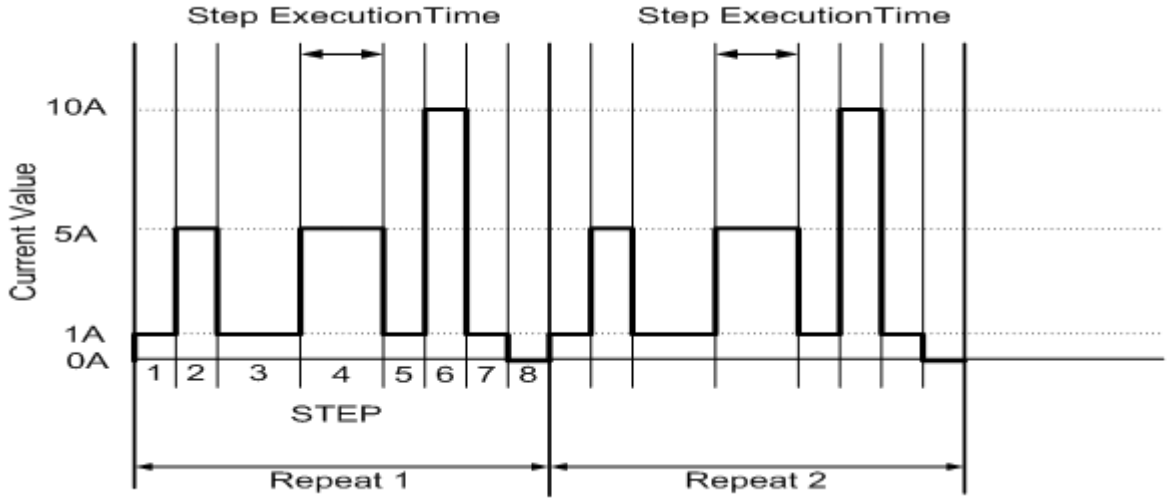
Test mode

1. Press TEST key of 33431G Series mainframe,
2. Press 1~9 number to select sequence number
3. Press ENTER to execution the sequence
4. The LCD shows “PASS” or “FAIL” after testing.

Example Sequence

In this example, we will create a program based on following Figure.

The program repeats steps 1 to 8 two times. After repeating the sequence two times, the load is turned off and the sequence ends.



Sequence Number	Step Number	Current Value	Execution Time(T1+T2)
3	1	1A	200mS
3	2	5A	200mS
3	3	1A	400mS
3	4	5A	400mS
3	5	1A	200mS
3	6	10A	200mS
3	7	1A	200mS
3	8	0A	200mS

Creating the program

1. Setting the Load current level and store to bank 3 state 1~8
2. Set the operation mode
   Press the mode key to CC mode.
3. Set the range
   Press RANGE key to force range 2
4. Press Load ON
5. Set the current value as step 1~8 and store to memory bank 3 state 1~8
6. Press EDIT key of 33431G Series mainframe
7. Press sequence number 3 to edit the sequence
8. Press up/down key to memory bank 3 and state 1
9. Press ENTER key to confirm the sequence memory
10. Press up/down key to setting execution time(T1+ T2)
11. Press ENTER key to confirm the sequence step
12. Repeat 7~10 to setting step 1~8
13. Press STORE key to confirm step 1~8
14. Press up/down key to 1 to repeat one times.
15. Press STORE to confirm the repeat count.

Testing Waveform