3350F Series
High power
Electronic Load
Operation manual

S/N:9003350F04 REV: J

SAFETY SYMBOLS



Direct current (DC)



Alternating current (AC)



Both direct and alternating



Three-phase alternating

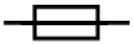


Protective earth

On (Supply)



Off (Supply)



Fuse



Caution ! Refer to this manual before using the meter.



Caution, risk of electric shock

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

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

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

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

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.

EC DECLARATION OF CONFORMITY

We **Prodigit Electronics Co., Ltd.** declares under our own responsibility that the product

DC Electronic Load

(Model No.: 3350F, 3351F, 3352F, 3353F, 3354F, 3356F)

Satisfies all the technical relations application to the product within the scope of council:

Directive: 2014/30/EU; 2014/35/EU; 2015/863/EU; 2012/19/EU

The above product is in conformity with the following standards or other normative documents

Harmonized Standard：

EN 61010-1: 2010+A1:2019

EN IEC 61010-2-030:2021+A11:2021

EN 61326-1:2013

EN 61326-2-1:2013

Reference Basic Standards：

Emission:

EN 55011: 2016+A1: 2020 Class A

EN 55032: 2015+A1:2020

EN 61000-3-2: 2014

EN 61000-3-3: 2013

Immunity:

EN 61000-4-2: 2009

EN 61000-4-3: 2006+A2:2010

EN 61000-4-4: 2012

EN 61000-4-5: 2014+A1:2017

EN 61000-4-6: 2014

EN 61000-4-8: 2010

EN 61000-4-11: 2020

Company Name : Prodigit Electronics Co., Ltd.

Company Address : 8F, No.88, Baojhong Rd., Sindian District, New Taipei City,Taiwan.

Person is responsible for marking this declaration:

PRODIGIT INSTRUMENT PROFESSIONAL

Manufacturer/Importer

Signature: Dean Wang

Date: **2022/10/20** Name: Dean Wang
R&D Assistant Manager

UK Declaration of Conformity

We Prodigit Electronics Co., Ltd. declares under our own responsibility that the product

DC Electronic Load

(Model No.: 3350F, 3351F, 3352F, 3353F, 3354F, 3356F)

Satisfies all the technical relations application to the product within the scope of council:

Directive: Electromagnetic Compatibility Regulations 2016**;** Electrical Equipment (Safety) Regulations 2016**;** the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The above product is in conformity with the following standards or other normative documents

Harmonized Standard：

BS EN 61010-1:2010+A1:2019 ;BS EN IEC 61010-2-030:2021+A11:2021

BS EN 61326-1: 2013 ; BS EN 61326-2-1: 2013

Reference Basic Standards：

Emission:		**Immunity:**
BS EN 55011: 2016+A1: 2020	Class A	BS EN 61000-4-2: 2009
BS EN 55032: 2015+A1:2020		BS EN 61000-4-3: 2006+A2:2010
BS EN 61000-3-2: 2014		BS EN 61000-4-4: 2012
BS EN 61000-3-3: 2013		BS EN 61000-4-5: 2014+A1:2017
		BS EN 61000-4-6: 2014
		BS EN 61000-4-8: 2010
		BS EN 61000-4-11: 2020

Company Name : Prodigit Electronics Co., Ltd

Company Address : 8F,No.88, Baojhong Rd., Sindian District, New Taipei City,Taiwan

Person is responsible for marking this declaration:

Manufacturer/Importer

Signature: Dean Wang

Date: **2022/10/20** Name: Dean Wang
R&D Assistant Manager

3350F Series High Power Electronic load operation manual
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Chapter 1 Introduction

1-1. General description

The 3350F Series Electronic Load is designed to test, evaluation and burn-in of DC power supplies and batteries.



The 3350F Series electronic load can be operated for manual and GPIB operation. The power contour of 3350F 1200 Watts Electronic Load is shown in Fig 1-1~1-6, it has an input from 0-120A, and 0 -60V current and voltage operating range respectively. The power contour of 3350F series. The prodigit 3350F 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.

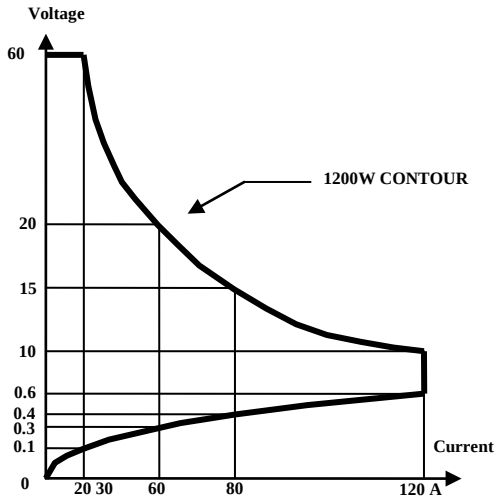


Fig 1-1 3350F Power Contour

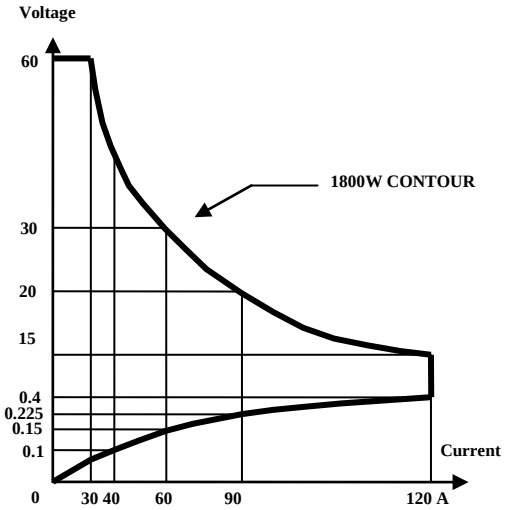


Fig 1-2 3351F Power Contour

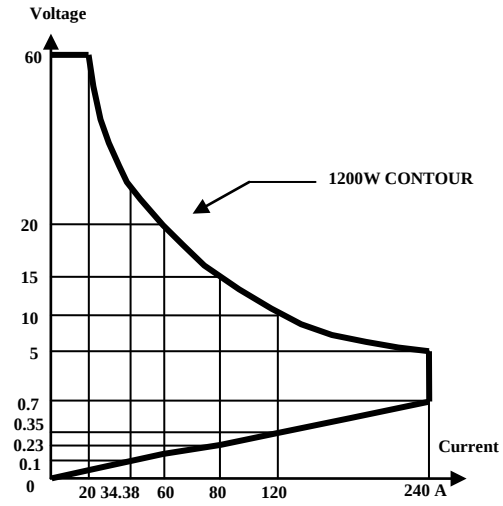


Fig 1-3 3352F Power Contour

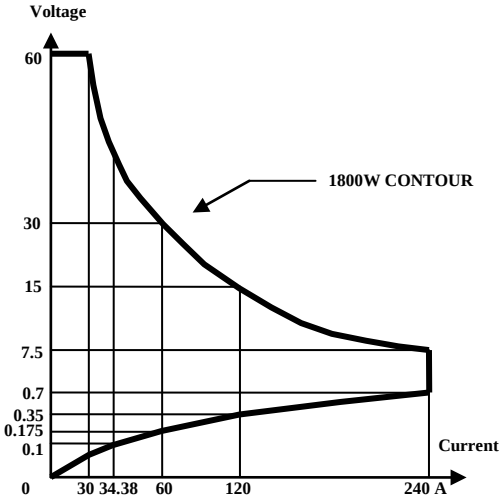


Fig 1-4 3353F Power Contour

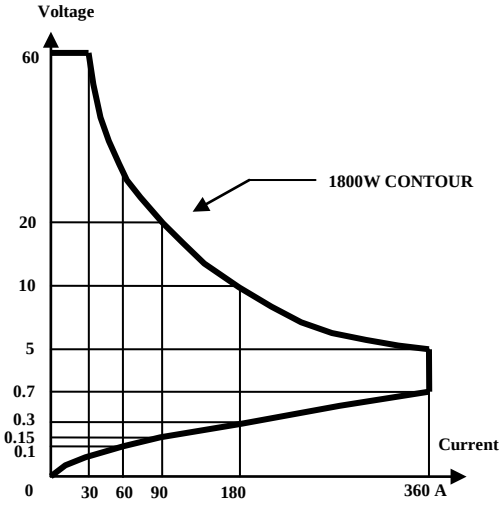


Fig 1-5 3354F Power Contour

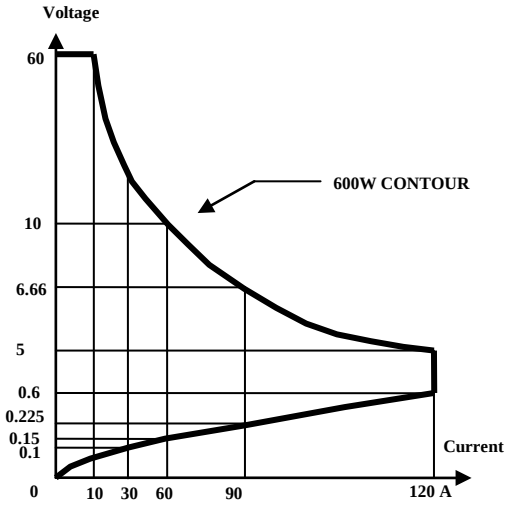


Fig 1-6 3356F Power Contour

CC Mode:

With the operating mode of constant current, the 3350F Series Electronic load will sink a current in accordance with the programmed value regardless of the input voltage (see Fig.1-7).

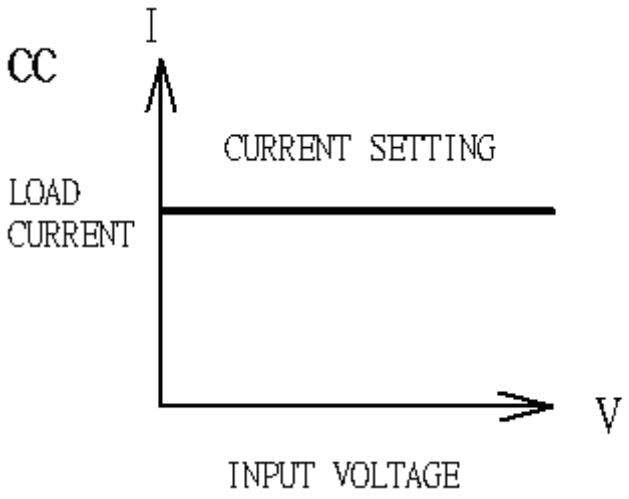


Fig 1-7 Constant Current mode

CR Mode:

At constant resistance mode, The 3350F Series Electronic Load will sink a current linearly proportional to the load input voltage in accordance with the programmed resistance setting (see Fig 1-8).

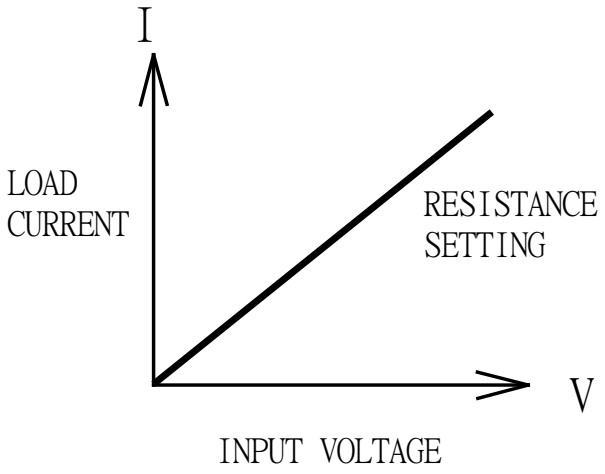


Fig 1-8 Constant Resistance mode

CV Mode:

At constant voltage mode, the 3350F Series Electronic Load will attempt to sink enough current until the load input voltage is equaled to the programmed value (see Fig 1-9).

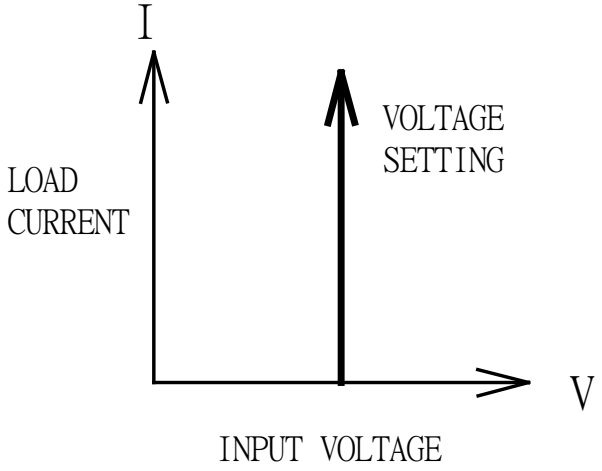


Fig 1-9 Constant Voltage mode

CP Mode:

At Constant Power mode, the 3350F Series Electronic Load will attempt to sink load power (load voltage x load current) in accordance with the programmed power. (See Fig 1-10).

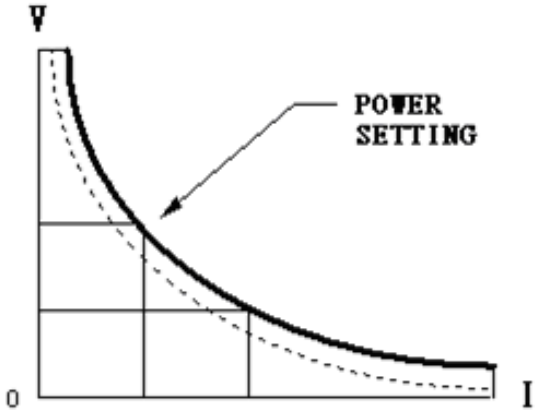


Fig 1-10 Constant Power mode

Dynamic wave form definition:

There are six parameters to generate dynamic wave form or pulse wave form, the 3350F Series Electronic Load will sink current from power source proportional to the dynamic wave form, the dynamic wave form definition is shown in Fig 1-11. The period of dynamic wave form is Thigh + Tlow, dynamic frequency = 1 / (Thigh + Tlow), the Duty cycle = Thigh / (Thigh + Tlow)

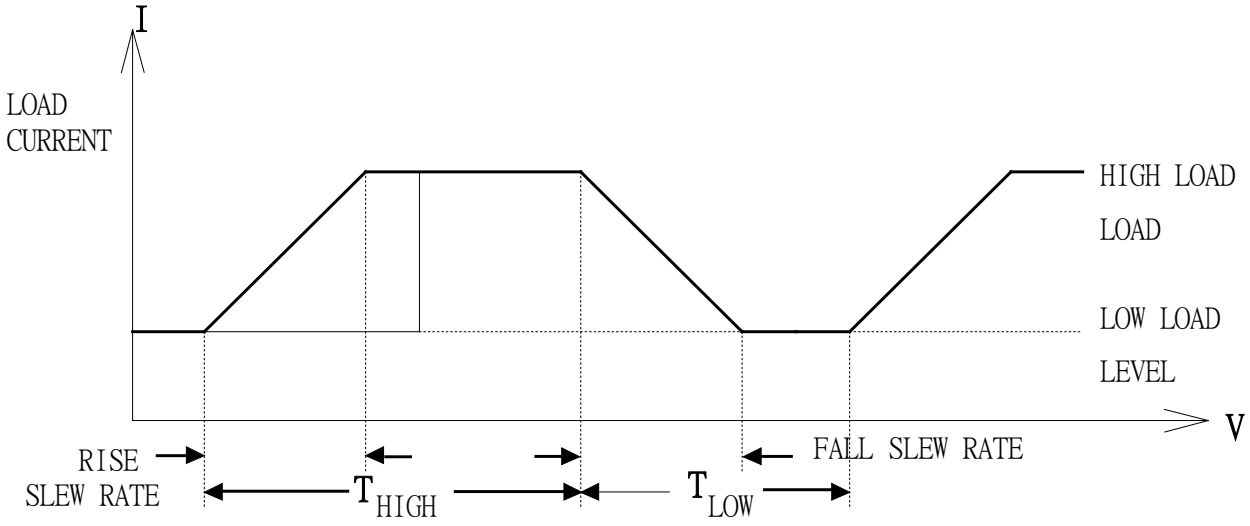


Fig 1-11 Dynamic Wave form

The load current level and load status are can be set with Front panel on each module, GPIB command. It is called manual operation and GPIB operation respectively, the load input voltage and load current can be read back to computer through GPIB.
The GPIB operation is described in Chapter 4 GPIB operation.

Slew Rate:

Slew rate is defined as the change in current or voltage over time. A programmable slew rate allows a controlled transition from one load setting to another 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 1-12

Therefore, both minimum transition time and slew rate must be considered when determining the actual transition time.

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 = 36/slew rate (in amps/second)(7.2us(36/5)*0.8(10%~90%)=5.76uS)

Use the following formula to calculate the maximum transition time for a given slew rate

Max transition time = 120/slew rate (in amps/second) (24us(120/5)*0.8(10%~90%)=19.2uS)

EX. CCH=24A, CCL=0A Slew Rate = 5A, The expected time is 3.84uS but the actual transition time will be limited to 5.76uS((36/5)x0.8)

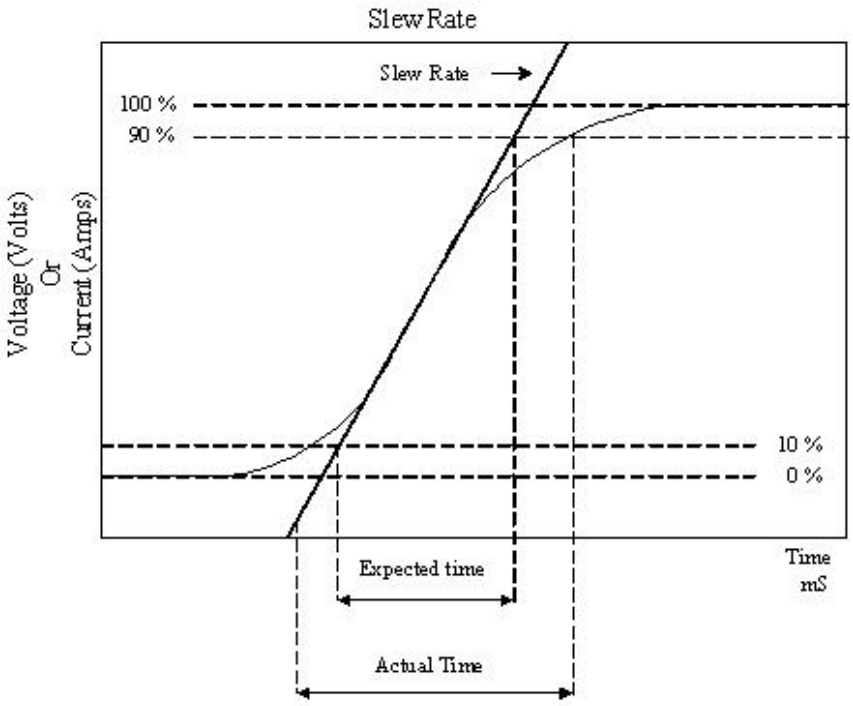


Fig 1-12 Rise Time Transition Limitation

1-2. Features

1.2.1. Flexible configuration of high power Electronic Load.
1.2.2. Fully GPIB control of Load condition setting and meter read back.
1.2.3. Dual high accuracy & resolution 5 digit voltage and current meter.
1.2.4. Built-in pulse generator includes wide Thigh/Tlow dynamic load range, independent Rise/Fall load current slew rate control, and High/Low Load level.
1.2.5. Controllable load current slew rate of load level change, load ON/OFF switch change, and power supply turn ON.
1.2.6. Short circuit test and current measure capability.
1.2.7. Automatic voltage sense capability.
1.2.8. Full protection from over power, over temperature, over voltage, and reverse polarity.
1.2.9. Analog programming input capability at rear panel.

1-3. Accessories

1.3.1. 3350F series operation manual	1 PC
1.3.2. M8 ROUND SCREW	2 PCs
1.3.3. Vsense ─ Alligator Clip(red、black) Cable	1 PC
1.3.4. I-monitor ─ BNC Cable	1 PC
1.3.5. Power Cord	1 PC

1-4. Option

1.4.1. IEEE-488 cable (1 Meter)
1.4.2. IEEE-488 cable (2 Meter)
1.4.3. RS232 interface
1.4.4. GPIB interface
1.4.5. USB interface + USB DRIVER CD
1.4.6. LAN interface + LAN DRIVER CD

1-5. Specifications

AC INPUT	LINE	115V ± 10%	230V ± 10%
	FREQUENCY	50/60 Hz	
	FUSE	T2A/250V(5×20 mm)	T1A/250V(5×20 mm)
	MAX. POWER CONSUMPTION	100 VA	
DIMENSIONS (W * H * D)		483 mm × 177 mm × 445Dmm/EA	
WEIGHT		NET：23.6 Kg	

Table 1-1A 3350F Series Specifications

Model	3350F	3351F	3352F	3353F	3354F	3356F
Power	1200W	1800W	1200W	1800W	1800W	600W
Current	0~120A	0~120A	0~240A	0~240A	0~360A	0~120A
Voltage	0~60V	0~60V	0~60V	0~60V	0~60V	0~60V
Min. Operating Voltage	0.6V @ 120A	0.4V @ 120A	0.7V @ 240A	0.7V @ 240A	0.7V @ 360A	0.6V @ 120A
Constant Current Mode						
Range *1	0~12A/120A	0~12A/120A	0~24A/240A	0~24A/240A	0~36A/360A	0~12A/120A
Resolution	0.2mA/2mA	0.2mA/2mA	0.4mA/4mA	0.4mA/4mA	0.6mA/6mA	0.2mA/2mA
Accuracy	± 0.1% OF (Setting + Range)					
Constant Resistance Mode						
Range	0.0083~0.5~30KΩ	0.0083~0.5~30KΩ	0.0041~0.25~15KΩ	0.0041~0.25~15KΩ	0.0027~0.167~10KΩ	0.0083~0.5~30KΩ
Resolution	0.0083mΩ /0.033mS	0.0083mΩ /0.033mS	0.0041mΩ /0.066mS	0.0041mΩ /0.066mS	0.0027mΩ /0.1mS	0.0083mΩ /0.033mS
Accuracy	± 0.2% OF (Setting + Range)					
Constant Voltage Mode						
Range	6V/60V					
Resolution	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV
Accuracy	± 0.05% OF (Setting +Range)					
Constant Power Mode						
Range	120W/1200W	180W/1800W	120W/1200W	180W/1800W	180W/1800W	60W/600W
Resolution	2mW/20mW	3mW/30mW	2mW/20mW	3mW/30mW	3mW/30mW	1mW/10mW
Accuracy	± 0.5% OF (Setting + 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	8mA~500mA/uS 80mA~5000mA/uS	8mA~500mA/uS 80mA~5000mA/uS	0.016A~1A/uS 0.16A~10A/uS	0.016A~1A/uS 0.16A~10A/uS	0.024A~1.5A/uS 0.24A~15A/uS	8mA~500mA/uS 80mA~5000mA/uS
Resolution	2/20mA/uS	2/20mA/uS	0.004/0.04A/uS	0.004/0.04A/uS	0.006/0.06A/uS	2m/20mA/uS
Accuracy	(5% of setting) ± 10 uS					
Min. Rise Time	24uS(typical)					
Current						
Range *2	12A/120A	12A/120A	24A/240A	24A/240A	36A/360A	12A/120A
Resolution	0.2mA/2mA	0.2mA/2mA	0.4mA/4mA	0.4mA/4mA	0.6mA/6mA	0.2mA/2mA
Accuracy	± 0.1% OF (Setting + Range)					
Measurement						
Voltage Read Back						
Range (5 Digital)	0~6V/60V	0~6V/60V	0~6V/60V	0~6V/60V	0~6V/60V	0~6V/60V
Resolution	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV	0.1mV/1mV
Accuracy	± 0.025% OF (Reading + Range)					
Current Read Back						
Range (5 Digital)	0~12A/120A	0~12A/120A	0~24A/240A	0~24A/240A	0~36A/360A	0~12A/120A
Resolution	0.2mA/2mA	0.2mA/2mA	0.4mA/4mA	0.4mA/4mA	0.6mA/6mA	0.2mA/2mA
Accuracy	± 0.1% OF (Reading + Range)					
Power Read Back						
Range (5 Digital)	0~1200W	0~1800W	0~1200W	0~1800W	0~1800W	0~600W
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	0.1~25.0V					
Resolution	0.1V					
Accuracy	1% of Setting + 0.25V					
Load OFF Voltage						
Range	0~25V					
Resolution	Same as Voltage Meter					
Accuracy	Same as Voltage Meter					
General						
Short Circuit						
Current	120A	120A	240A	240A	360A	120A
Temperature Coefficient	100ppm/℃(typical)					
Power	100Wmax	100Wmax	100Wmax	100Wmax	100Wmax	100Wmax
Operating Temperature *2	0~40℃					
Dimension(HxWxD)	177 x 440 x 445 mm/6.97x17.3x17.5 inch					
Weight	19.4 kg / 42.77 lbs	23.6 Kg/52.03 lbs	19.4 kg / 42.77 lbs	23.6 Kg/52.03 lbs	23.6 Kg/52.03 lbs	15.2 Kg/33.51 lbs
Safety & EMC	CE					

Table 1-1B 3350F Series Specifications

Chapter 2 Installation

2-1. Inspection

The 3350F Series 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 3350F Series 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 3350F 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 3350F Series load power OFF, disconnect the power cord.

2.2.2. Refer the drawing on the rear panel of 3350F Series high power load in Fig 2-1, set The switches to the proper voltage as describe in the following:

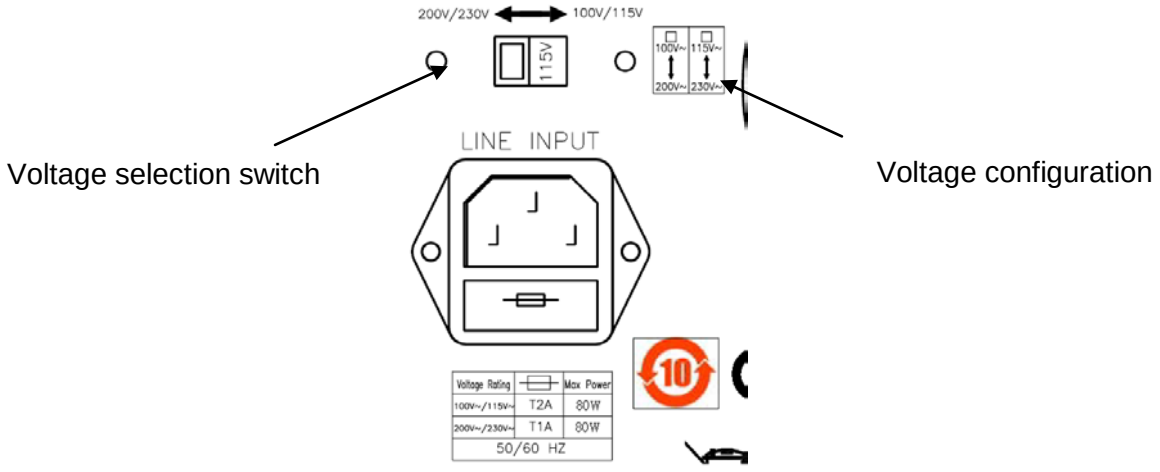


Fig 2-1 SET OF SWITCH

2-3. Fuse Exchange

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

CAUTION

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

WARNING

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. 100V/115V use T2A/250V (5*20mm), 200V/230V use T1A/250V (5*20mm)

2.3.2. The AC line fuse is located below the AC line receptacle see Fig 2-2. Use a small Screwdriver to extract the fuse holder, to change a new one. Change an appropriate Specifications fuse which indicated in Table 1-1A.

2.3.3. Reinstall fuse holder and connect the power cord.

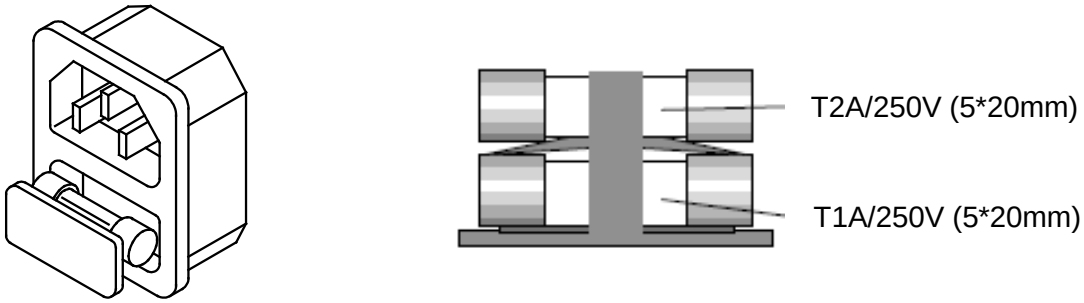


Fig 2-2 FUSE RECEPTACLE

2-4. Grounding requirements



SHOCK HAZARD

1. It is requested to use the 3Pin plug connector only for 3350F mainframe to out of danger when electric leakage. And the complete and proper grounded is necessary.

2. The 3350F Series high power load is equipped with three conductor cable which plugs in an appropriate receptacle to ground the instrument's cover.

2-5. Adjust the feet

The 3350F Series high power load is equipped with feet and tilt stands installed and is ready for used as a bench instrument.
The feet provide a good viewing angle for bench-top use.

2-6. Rack mount

The 3350F Series high power load is designed to permit mounted in a standard 19 inches rack for system application.

2-7. Environmental requirements

- For indoor use only
- installation Category I
- Pollution Degree 2
- Altitude up to 2000 meters
- Relative Humidity 80% RH Max

2-8. Observe the International Electrical Symbol listed below

⚠ Warning ! Risk of electric shock.

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

2-9. 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.

2-10. Power Up

Operation check

2.10.1. Turn off (O) the POWER switch
2.10.2. Check that the power cord is corrected.
2.10.3. Check that nothing is connected to the DC INPUT (load input terminal) on the Front and rear panels.

2-11. Connection to the load Input Terminal on the Rear Panel

Connection procedure of the load input terminal on the rear panel

2.11.1. Turn off POWER switch.
2.11.2. Check that the output of the equipment under test is off.
2.11.3. Connect the load wire to the load input terminal on the rear panel.
2.11.4. Check the polarity of the connection and connect the load wire to the output Terminal of the equipment under test.

2-12. Repair

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

2-13. GPIB connection Option

The GPIB connector is on the rear panel which to connect the 3350F 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 2-3 3350F series GPIB Rear panel

2-14. RS-232C Connection Option

The RS-232C connector (Female) on the rear panel connects 3350F 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 2-4 3350F Series RS-232 Rear panel

2-15. USB Connection Option

Fig 2-5 shows the USB connector in the rear panel of 3350F mainframe. Please refer Appendix B.



Fig 2-5 3350F USB Connection

2-16. LAN Connection Option

Fig 2-6 shows the LAN connector in the rear panel of 3350F mainframe. Please refer Appendix C.



Fig 2-6 3350F LAN Connection

2-17. GPIB & RS232 connection

2.17.1. GPIB + RS-232C connector is on the rear panel of 3350F mainframe for Application GPIB or RS-232 C.

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

2.17.3. GPIB connection with three important limitations as Described below:

2.17.3.1. The maximum number of devices including the controller is no More than 15.

2.17.3.2. The maximum length of all cable is no more than 2 meters times The Number of devices connected together, up to 20 meters Maximum.

2.17.3.3. RS-232C Female Block connections on the back panel, the Connecting Device and the computer RS-232C port to one-way Connection.
(Note: Not 2-wire connection, the detail as 4-2).

2.17.4. Fig 2-7 shows the RS-232C connector (Female) on the rear panel Connects 3350F Mainframe to RS-232C port of computer in one by one Configuration .The RS-232 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 2-7 3350F GPIB & RS232 Connection

2-18. Analog programming Terminal input

The terminal 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 12A range when load current setting is less than 12A, or 0 to 120A range when load current setting is higher than 12A) or in the CP mode (0 to 1200W). 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 2-8 shows the analog programming signal (4 Vac, 500Hz) is summed with the 48A programmed setting in CC mode of 3350F Load module.

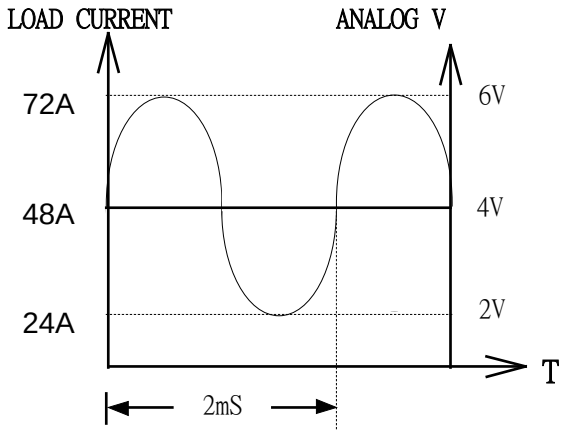


Fig 2-8 Analog programming load current in CC mode operation

2-19. 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 3350F Series 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 3350F Series high power load.

The rise and fall slew rate can be independently programmed from 80mA/usec to 5000mA/usec (3350F Load) in the 120A current range and from 8mA/usec to 500mA/usec in the 12A 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 2-9 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 3350F 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.

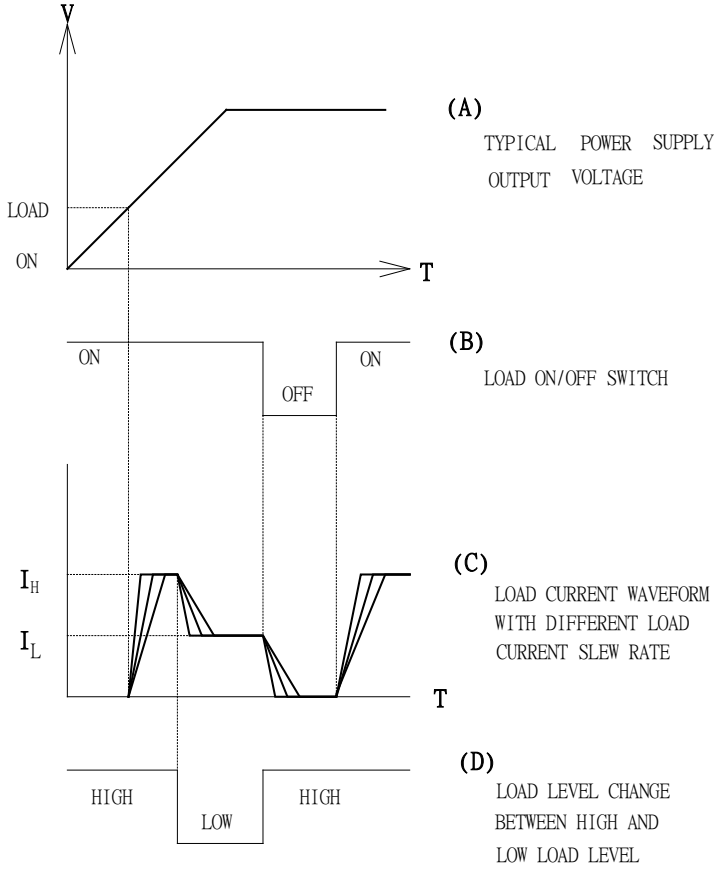


Fig 2-9 The relationship of load current load ON/OFF, load level and output voltage of DC power Supply at turn ON

2-20. Emergency stop and Alarm

3350F 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 3350F 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.

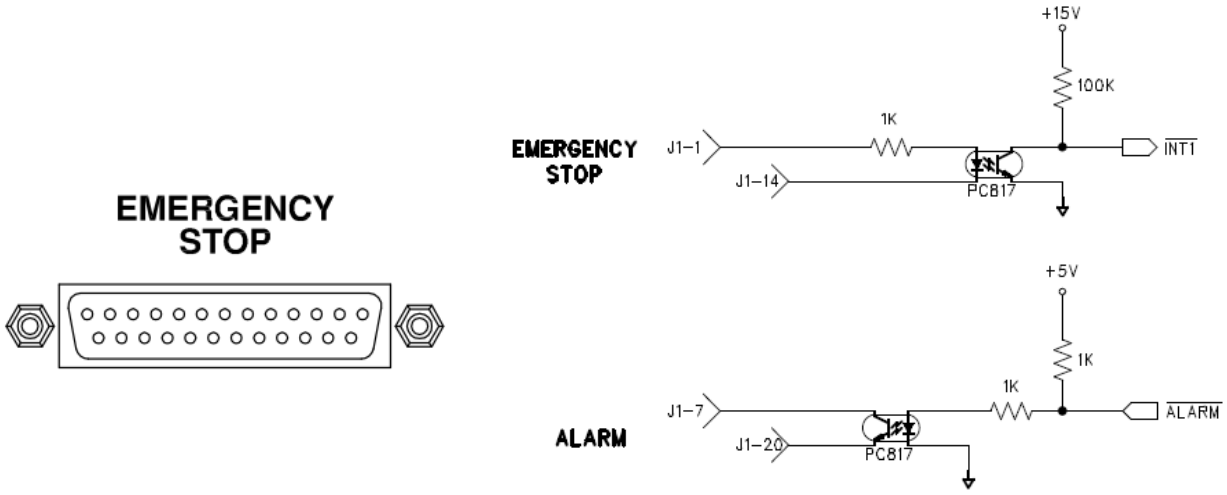


Fig 2-10 Emergency stop controller Connection

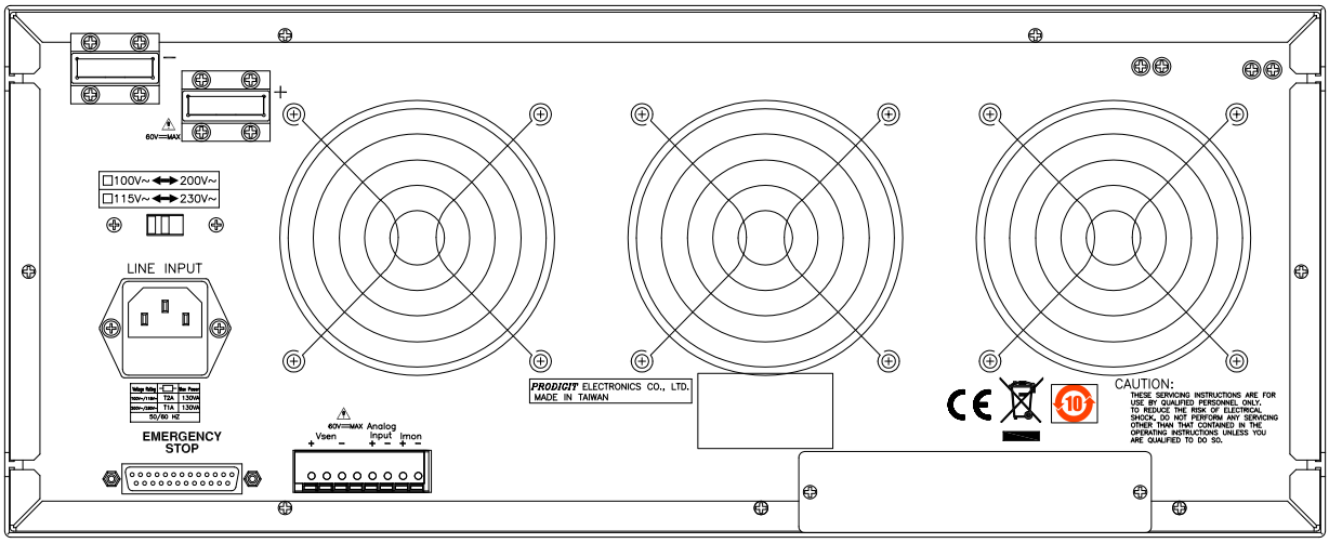
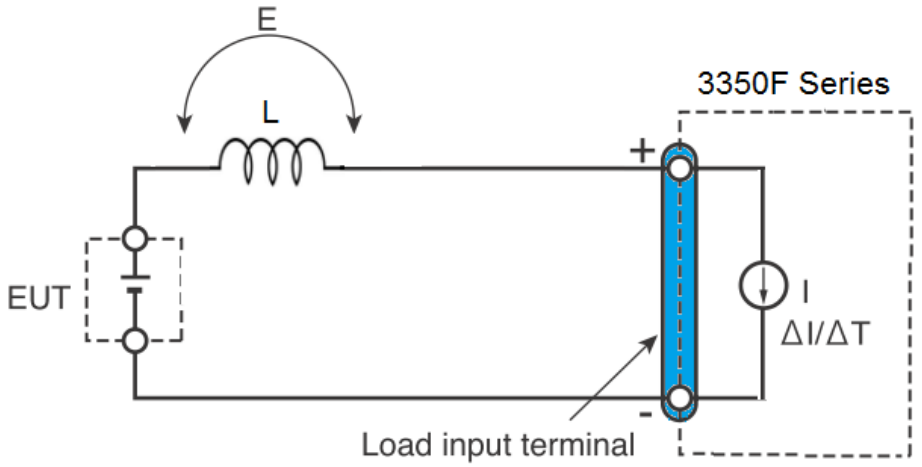


Fig 2-11 3350F series Rear panel

2-21. Load wire inductance

The load wiring has an inductance (L). When the current (I) varies in short time period, It Generates a large voltage at both ends of the wiring cable. This voltage applies to all of the Load input terminals of the 3350F series when the impedance of the EUT is relatively small. The voltage generated by the load wire inductance (L) and the current variation (I) is Expressed using the following equation.



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

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

In general, the wire inductance can be measured approximately 1 μH per 1 meter. If the 10 meters of Load wires is connected between the EUT and the electronic load (3350F Series) with the current Variation of 2 A/μs, the voltage generated by the wire inductance Will be 20 V.

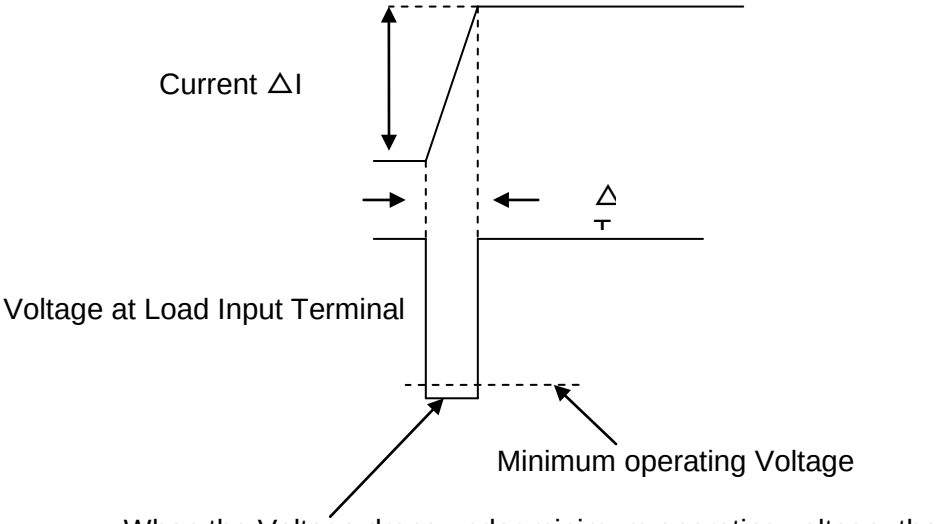
The negative polarity of the load input terminal is the reference potential of the external Control signal, Therefore, the device connected to the external control terminal may get Malfunctioned.

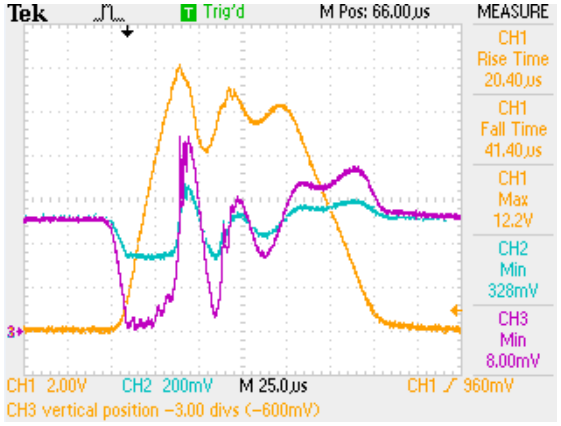
When operating under the constant voltage (CV) mode or constant resistance (CR) mode or Constant power (CP), the load current is varied by the voltage at the load input terminal, so The operation can be affected easily by the generated voltage.

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

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

In such event, the electronic load (3350F) may generate unstable oscillation.
In such condition, the input voltage may exceed the maximum input voltage and Cause Damage to the 3350F Series.





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

Fig 2-12 Waveform example: Generate unstable oscillation

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

To prevent problems, connect the 3350F series and the equipment under test using the Shortest Twisted Wire possible to keep the voltage caused by inductance between the Minimum operating Voltage and the maximum input voltage range or set a low slew rate.

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

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

In the case of DC operation also, the phase delay of the current may cause instability in The 3350F Series Control inducing oscillation. In this case also, connect the 3350F Series And the equipment under test using the shortest twisted wire possible.

If only DC operation is required, a capacitor and a resistor may be connected to the load Input Terminal as shown in Fig. 2-13 to alleviate oscillation. In this case, use the capacitor Within its Allowable ripple current.

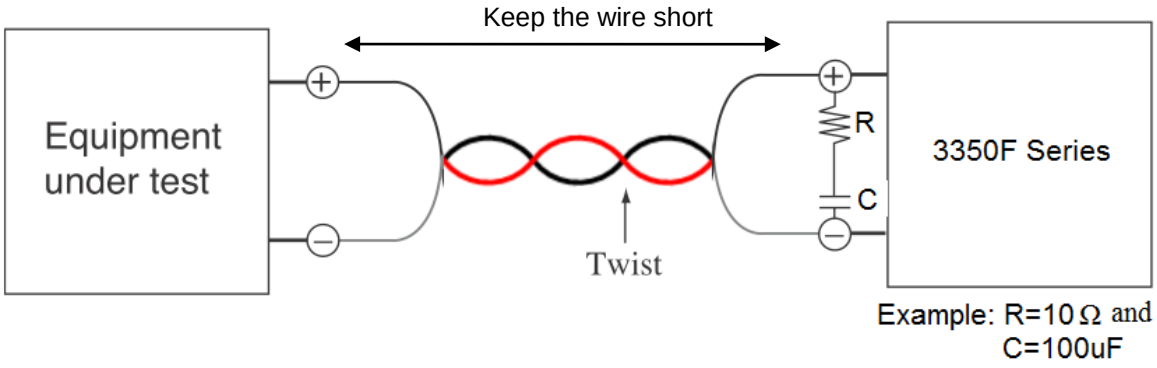


Fig 2-13 Length of wiring

Chapter 3 Operation

This chapter describes the front panel function and operation of each 3350F 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 (1)

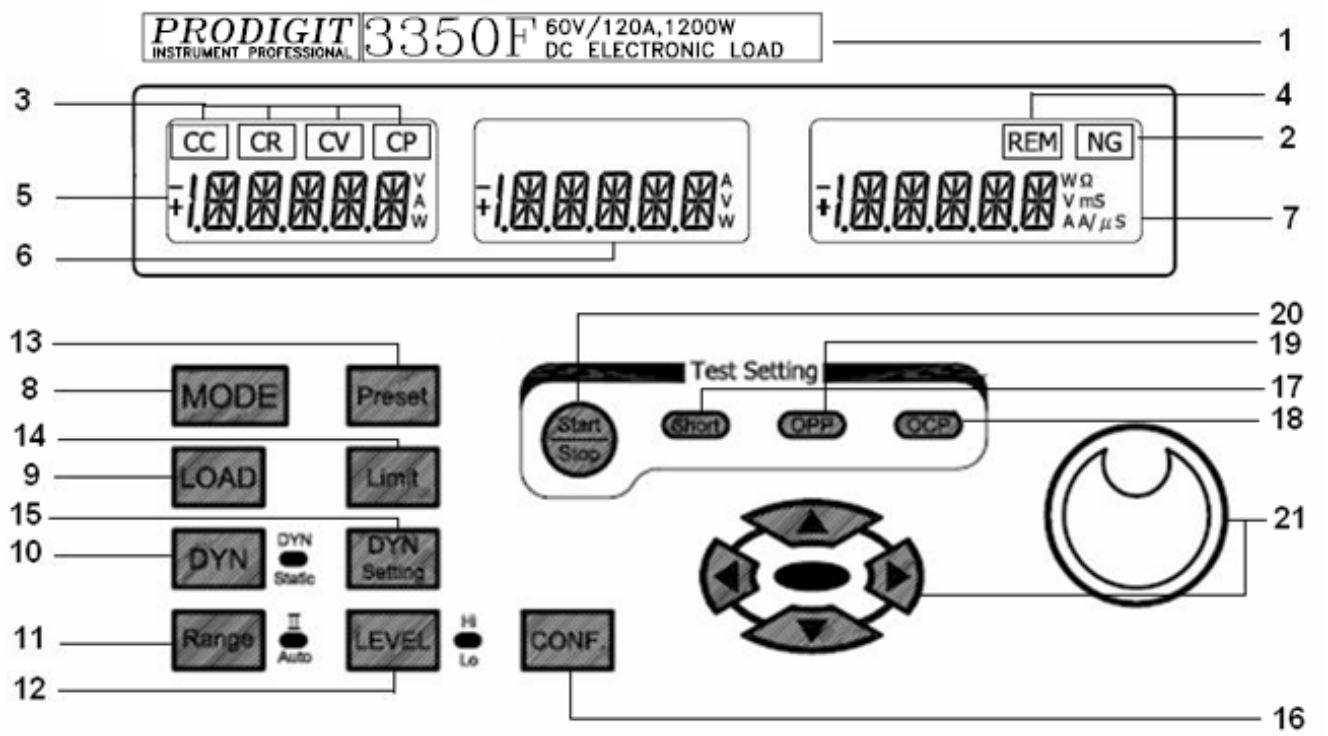


Fig 3-1 3350F-Series High Power Front Panel

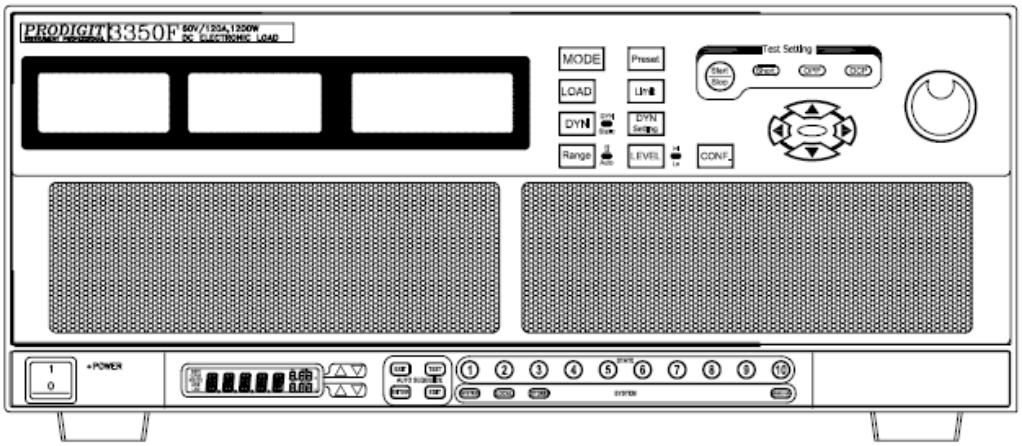


Fig 3-2 3350F Series High Power electronic load

3-2. Operating instructions

3.2.1. 3354F 60V/360A，1200W DC ELECTRONIC LOAD

It indicates the model number and specifications of 3350F electronic load.

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 Indicator

There are four operating modes that can be selected by pressing the "MODE" key On the 3350F series Electronic Load.

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

The operating theorem of CC, CR, CV and CP mode is described in Chapter 1-1, and the application information is described in Chapter 5-3, 5-4, 5-5 and 5-6 respectively.

3.2.4. Remote LCD Indicator

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

3.2.5. Left 5 digit LCD display

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

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

Please note that if V-sense is set to 'AUTO' and the sense leads are connected to The DUT the losses need to be approx. 700mV (3350F) before the display compensates for the voltage loss.

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

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: left display will show "Short".
OPP test selected:left display will show "OPP".
OCP test selected: left display will show "OCP".

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

3.2.6. Middle 5 digit LCD display

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

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

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

- **CONFIG**: Sequence is "SENSE" → "LDon" → "LDoff" → "POLAR".
- **LIMIT**: Sequence is "V_Hi" → "V_Lo" → "I_Hi" → "I_Lo" → "W_Hi" → "W_Lo" → "NG".
- **DYN setting**: Sequence is "T-Hi" → "T-Lo" → "RISE" → "FALL"
- **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. Right 5 digit LCD display

The right 5 digit displays 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 right 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 right display provides setting in amps "A".
- If CR mode is selected the right display provides setting in ohms “Ω”
- If CV mode is selected the right display provides setting in volts “V”.
- If CP mode is selected the right display provides setting in watts “W”.

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

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

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

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

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

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

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

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

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

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

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

When the test is started the right 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 right 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) right display provides setting in amps “A”
➔ ISTEP (current steps) right display provides setting in amps “A”
➔ ISTOP (current stop point) right display provides setting in amps “A”
➔ VTH (voltage threshold) right display provides setting in volts “V”

When the test is started the right 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 right 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 Indicator

There are four operating modes. These can be selected in turn by pressing the "MODE" key on the 3350F series Electronic Load module. The sequence is:

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

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

3.2.9. LOAD Key and LED

The input to the 3350F 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.

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 3350F series Load Module features 2 setting ranges for CC, CR, CV & CP Operation. This allows improved resolution for setting low values. When left in the Default AUTO mode the changeover between ranges is automatic depending on The setting value entered.

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

Note: Coercion Range II only in CC Mode.

3.2.12. LEVEL Key and LED

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

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

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

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

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

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

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

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

P.S Automatically Push Function

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

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

3.2.13. Preset Key and LED

If the PRESET key is pressed the button will become lit indicating that the PRESET Mode has been accessed. The right 5 digit displays 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 right 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 right 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 right 5 Digit LCD. The “V" LED will be lit indicating the setting value is volts.

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

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

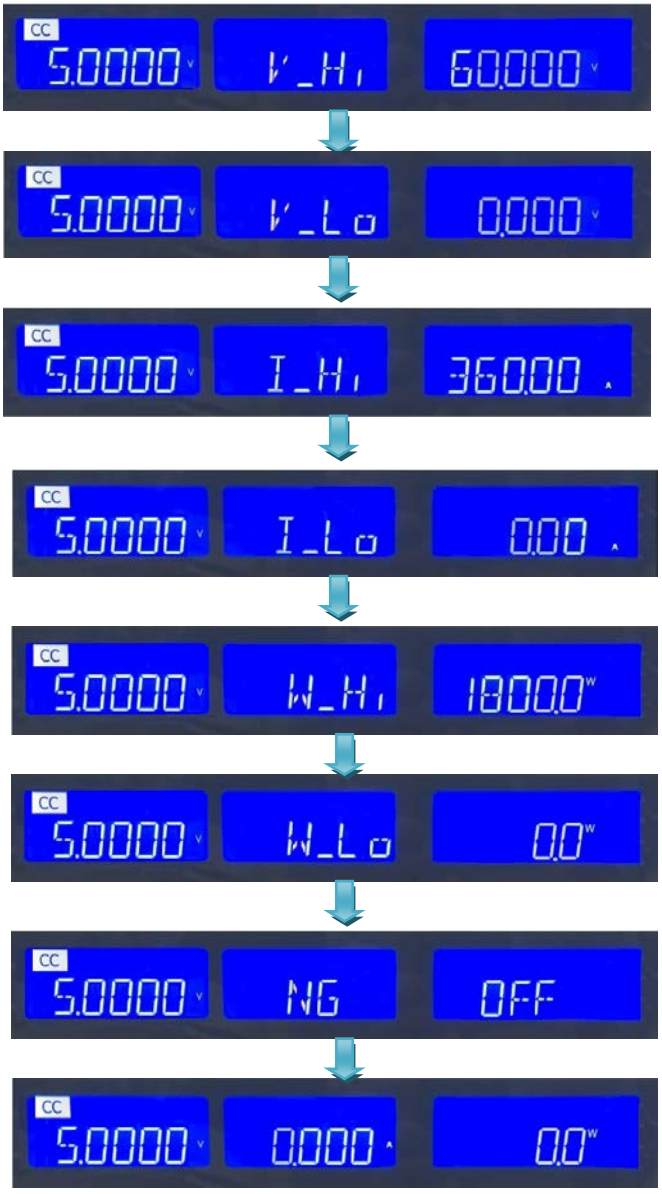
3.2.14. Limit Key and LED

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

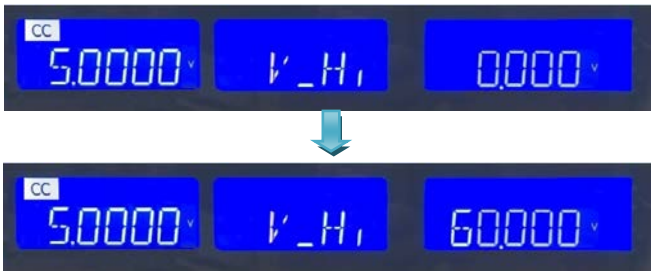
Each press of the LIMIT key enables a different value to be entered. On first press Of the LIMIT key the button will illuminate and V-Hi will be displayed on the middle LCD. The setting is made with the rotary knob and can be read from the lower LCD During setting. The setting sequence is shown below:

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」,right 5 digit LCD Display the unit is "V", The V-Hi set range from 0.000 V to 60.000V step 0.001V by Rotating the Setting knob.



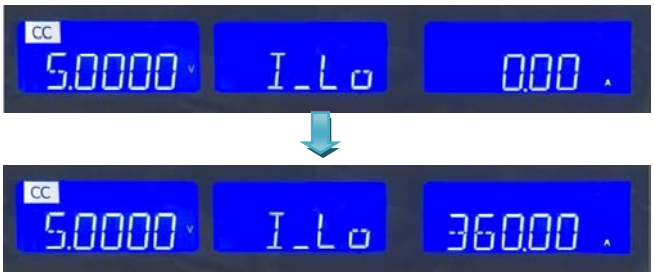
- Setting lower limit voltage VL, Middle 5 digit LCD display「V-Lo」,right 5 digit LCD Display the unit is "V",The V-Lo set range from 0.000 V to 60.000V step 0.001V by Rotating the Setting knob.



- Setting Upper limit current IH , Middle 5 digit LCD display「I-Hi」,right 5 digit LCD Display the unit is "A", The I-Hi set range from 0.00 A to 360.00A step 0.01A by Rotating the Setting knob.



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



- Setting Upper limit power WH, Middle 5 digit LCD display「W-Hi」right 5 digit LCD Display the unit is "W", The W-Hi set range from 0.0 W to 1800.0W step 0.1W by Rotating the Setting knob.



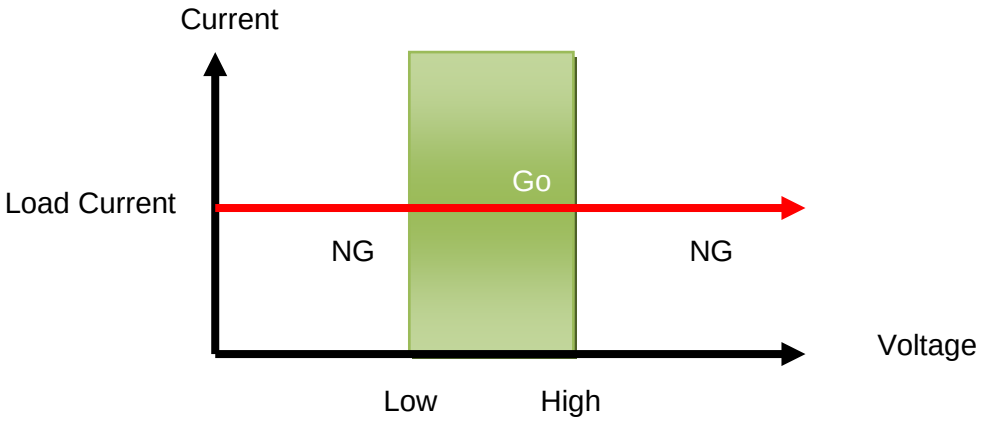
- Setting lower limit power WL, Middle 5 digit LCD display「W-Lo」lower 5 digit LCD Display the unit is "W", The W-Lo set range from 0.0 W to 1800.0W step 0.1W by Rotating the Setting knob.



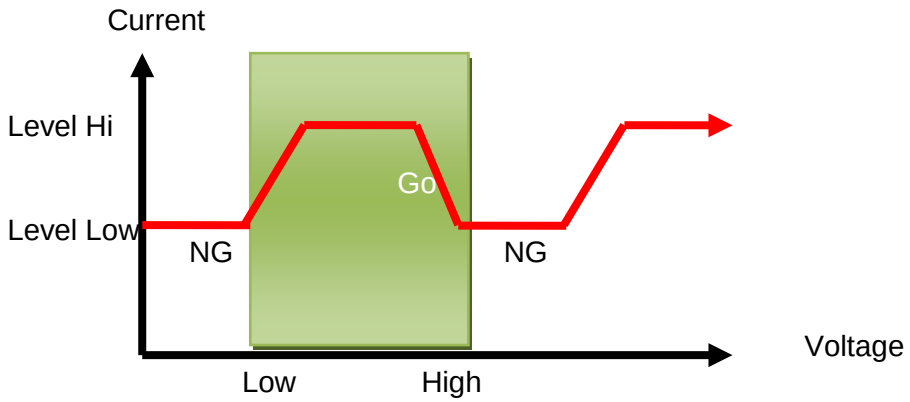
- Setting NG ON/OFF, When exceed VH、VL、IH、IL、WH、WL One of these Whether NG on LCD display.



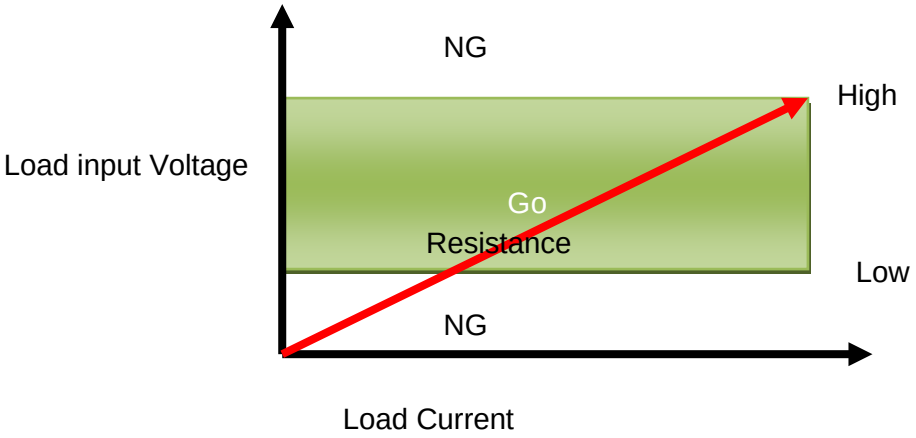
- CC mode, press limits key to set the V-Hi and V-Lo voltage upper and lower Limits of the GO / NG.



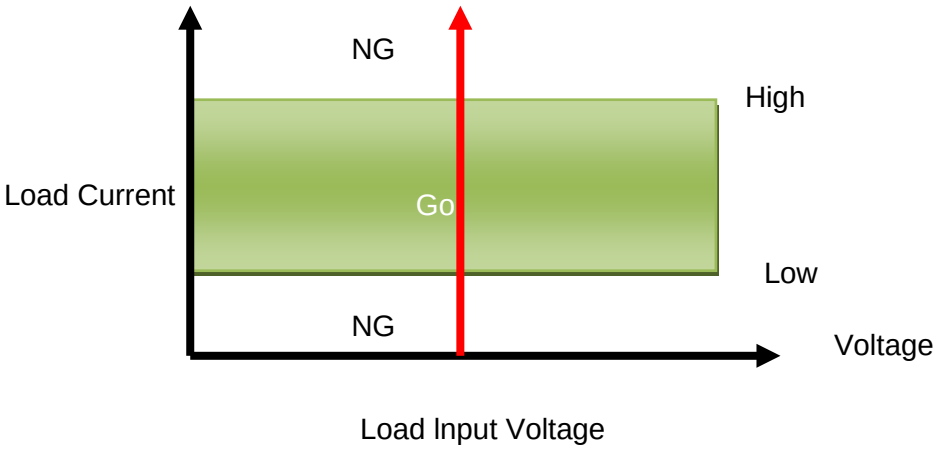
- CC Dynamic Mode, press key to set the Level Hi and Level Low voltage upper and lower limits of the GO / NG.



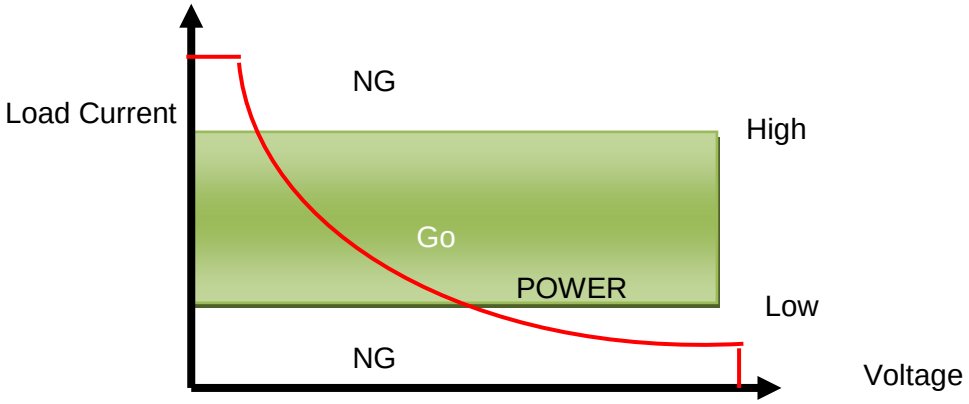
- CR mode, press limits key to set the V-Hi and V-Lo voltage upper and lower limits of the GO / NG.



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



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



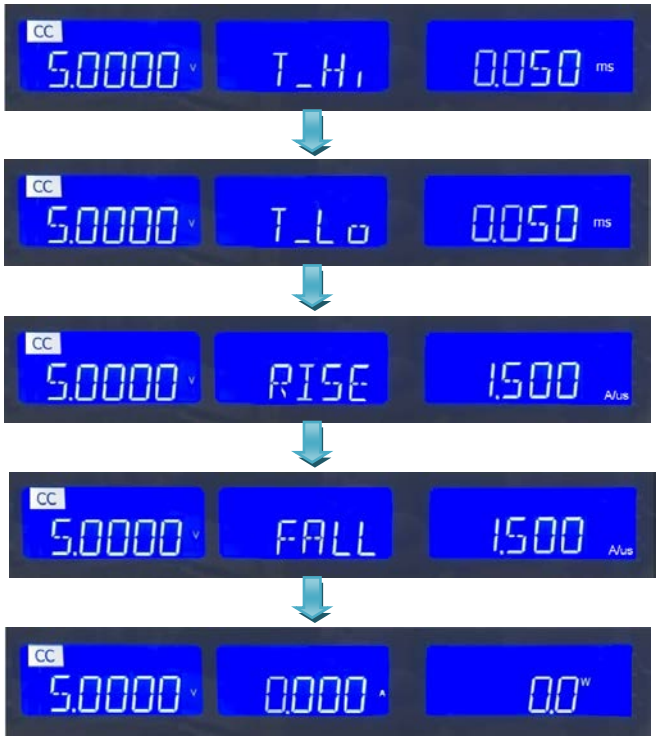
3.2.15. DYN setting Key and LED

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.

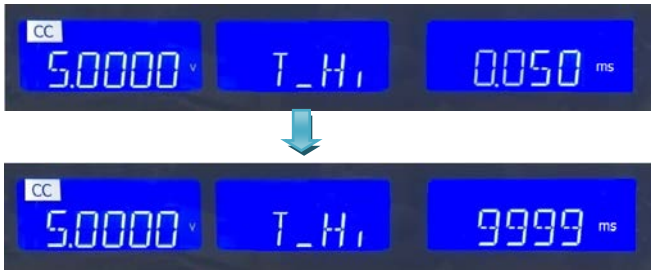
Each press of the DYN key enables a section of the DYNAMIC waveform to be set. On first press of the DYN key the button will illuminate and T-Hi will be displayed On the middle LCD. The value is adjusted with the rotary knob and can be read From the right LCD during setting. The setting sequence is shown 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 right 5 digit display



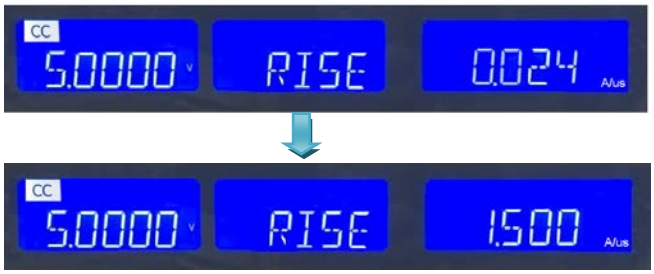
- Press DYN setting key, LED will ON Setting level High Period, Middle 5 digit LCD Display will show 「T-Hi」right 5 digit LCD display will show setting value, the unit Is “ms” , The T-Hi Set range from 0.050 ms to 9999 ms step 0.001ms by rotating the Setting Knob.



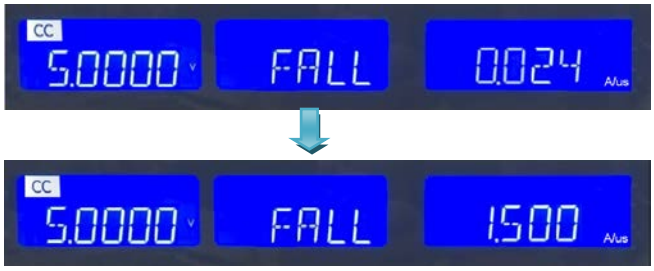
- Setting level Low period, Middle 5 digit LCD display will show「T-Lo」, right 5 digit LCD display will show setting value, the unit is “ms”, The T-Lo set range from 0.050 ms to 9999 ms step 0.001ms by rotating the Setting knob.



- Setting rise time, Middle 5 digit LCD display will show 「RISE」, right 5 digit LCD Display will show setting value, the unit is “A/μs”, The RISE time set range from 0.024 A/us to 1.53 A/us step 0.006 A/us by rotating the Setting knob.



- Setting fall time, Middle 5 digit LCD display will show 「FALL」, right 5 digit LCD Display will show setting value, the unit is “A/μs”, The FALL time set range from 0.024 A/us to 1.53 A/us step 0.006 A/us by rotating the Setting knob.



3.2.16. Config Key and LED

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

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

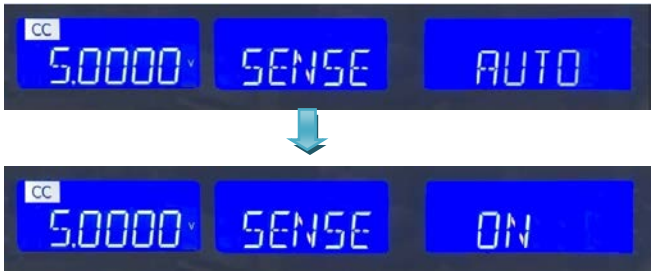
SENSE (AUTO or ON) →
LDon (Voltage at which LOAD turns ON) →
LDoff (Voltage at which LOAD turns OFF) →
POLAR (change polarity symbol) →
exit CONFIG options



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

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

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



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



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



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



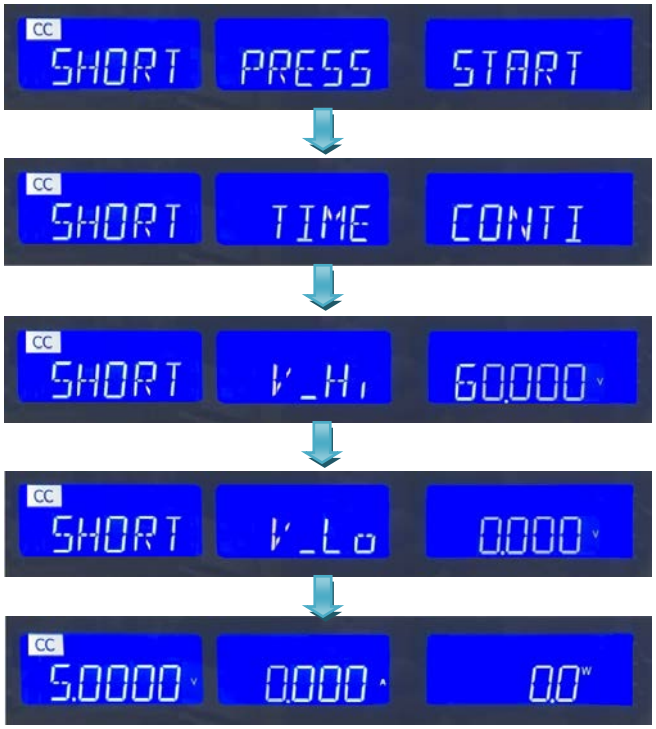
3.2.17. Short Key and LED

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 3350F 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 left 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 right 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

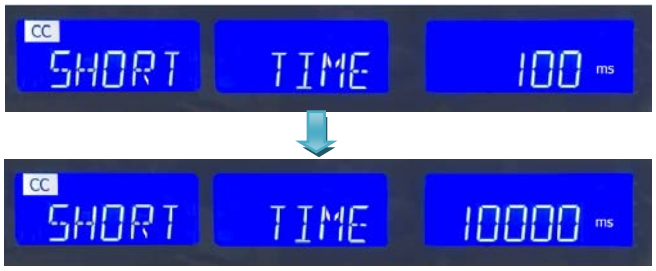
Press any key to goes to normal mode of LCD display.



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



- TIME: setting the short test time, The LCD display show 「SHORT」 on left 5 digits LCD display, shows 「TIME」on middle 5 digits LCD display the unit is “ms” ,and shows 「CONTI」 on right 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 left 5 digit LCD display, Middle 5 digit LCD display「V-Hi」,right 5 Digit LCD display setting value, the unit is "V", The V-Hi setting range from 0.000V to 60.000V step 0.001V by rotating the setting knob.



- V-Lo : Short test voltage check lower limitation setting, The LCD display shows 「SHORT」on left 5 digit LCD display, Middle 5 digit LCD display「V-Lo」,right 5 Digit LCD display setting value, the unit is "V", the V-Hi setting range from 0.000V to 60.000V step 0.001V by rotating the setting knob.



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

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

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

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

3.2.18. **OCP** Key and LED

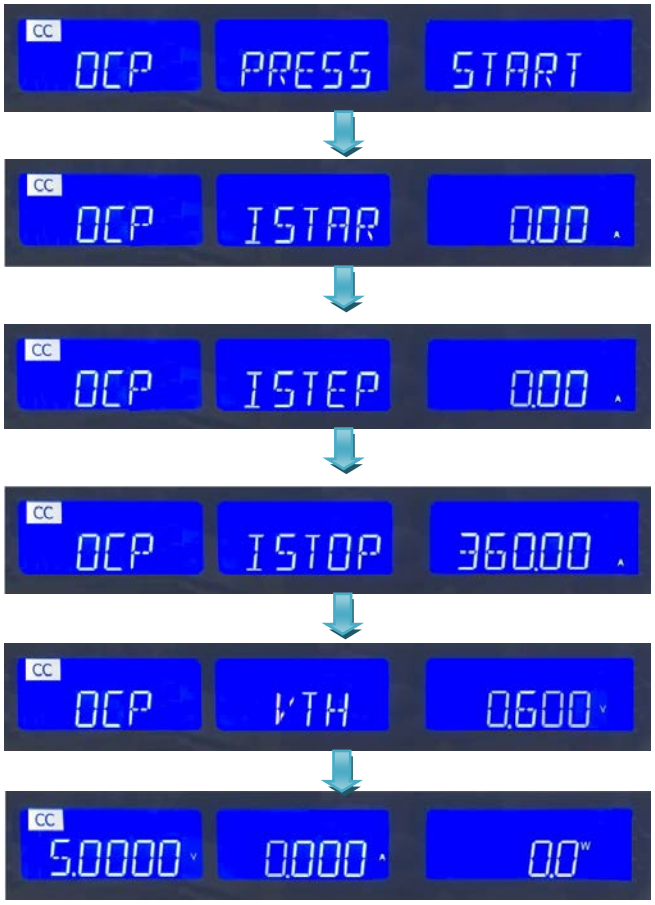
The OCP key allows the parameters of an Over Current Protection test to be entered. The OCP test will ramp up the load current in steps to validate the Device Under test's (DUT) protection and behavior. A voltage threshold level can be set. If the voltage measured during the test is lower than the set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



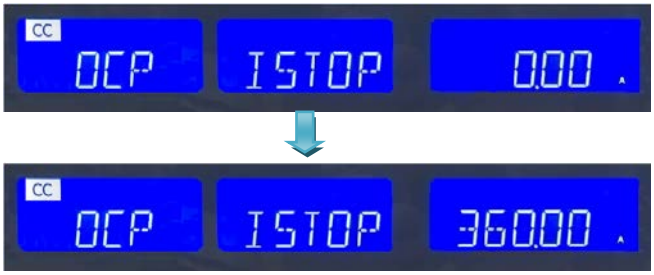
- ISTAR: setting the start current point, The LCD display shows 「OCP」on left 5 digit LCD display, Middle 5 digit LCD display「ISTAR」,right 5 digit LCD display Setting value, the unit is "A".
  The setting range is 0.00A to the full scale of the CC mode specification. The setting Is by rotating the setting knob.



- ISTEP: setting the increment step current point, The LCD display shows 「OCP」on left 5 digit LCD display, Middle 5 digit LCD display「ISTEP」,right 5 digit LCD Display setting value, the unit is "A".
  The setting range is 0.01A 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 left 5 digit LCD display, Middle 5 digit LCD display「ISTOP」,right 5 digit LCD display Setting value, the unit is "A", the setting range is 0.00A 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 left 5 digit LCD display, Middle 5 digit LCD display「Vth」,right 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:

The voltage level of the DUT falls below the set voltage threshold (OCP Vth) during the test
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

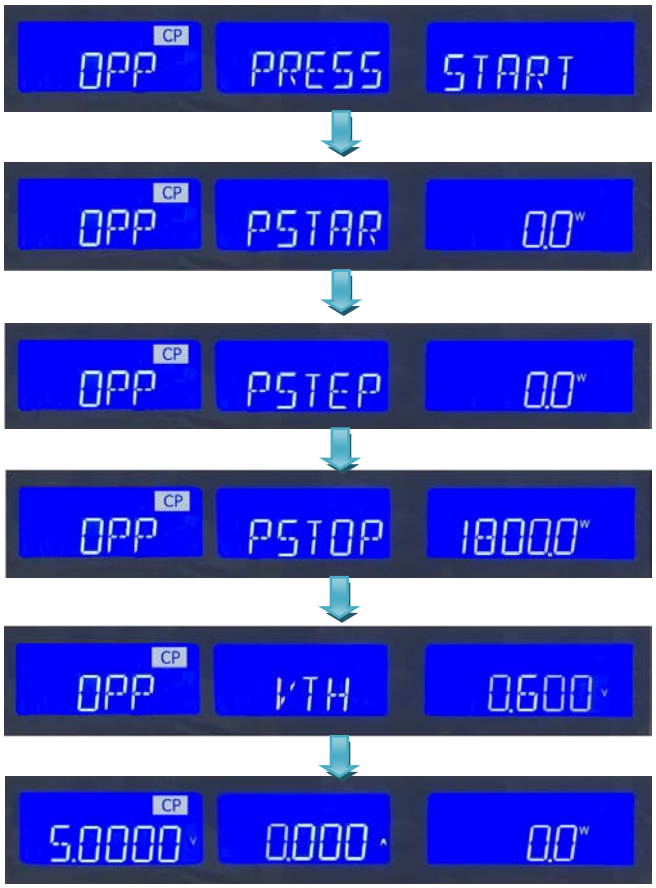
The OPP key allows the parameters of an Over Power Protection test to be Entered. The OPP test will ramp up the load power in steps to validate the Device Under Test's (DUT) protection and behavior. A voltage threshold level can be set. If the voltage measured during the test is lower than the set Threshold 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 PSTOP 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 left 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 left 5 digit LCD display, Middle 5 digit LCD display「PSTAR」,right 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.



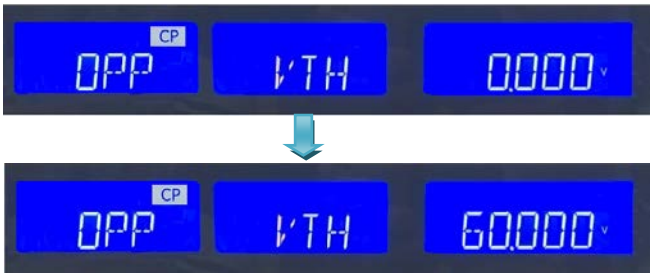
- PSTEP: setting the increment step power, The LCD display shows 「OPP」on left 5 digit LCD display, Middle 5 digit LCD display「PSTEP」,right 5 digit LCD display Setting value, the unit is "W", the setting range is 0.0W to the full scale of the CP Mode specification. The setting is by rotating the setting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



- PSTOP: setting the stop power, The LCD display shows 「OPP」on left 5 digit LCD display, Middle 5 digit LCD display「PSTOP」,right 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 left 5 digit LCD Display, Middle 5 digit LCD display「Vth」,right 5 digit LCD display setting value, the Unit is "V", the setting range is 0.000V to the full scale of the Voltage specification. The setting is by rotating the setting knob.



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

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

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

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

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

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

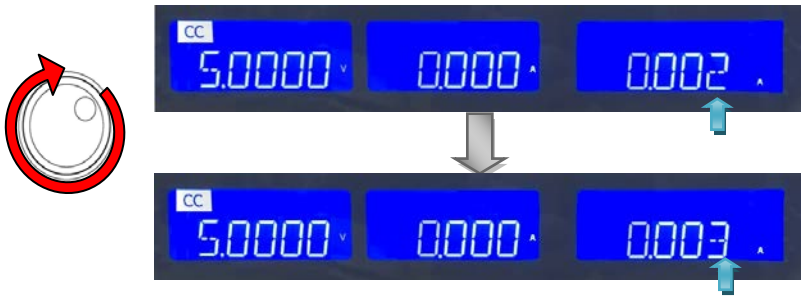
3.2.20. 

Key

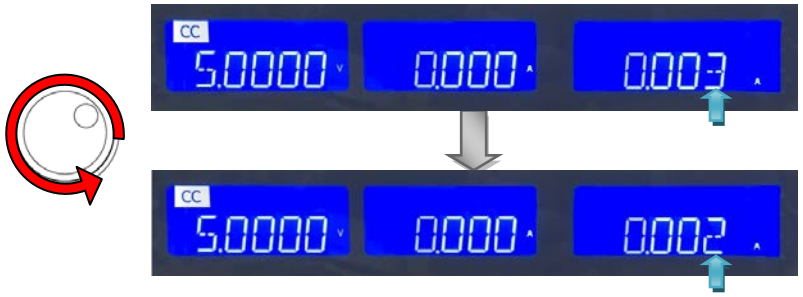
The red START/STOP key is used in conjunction with the SHORT, OCP or OPP test functions. It is used to START a test according to the set parameters or to STOP a test before PASS or FAIL is signaled. Please refer to the preceding sections for more information on the SHORT, OCP & OPP tests.

3.2.21. Knob and Knob key

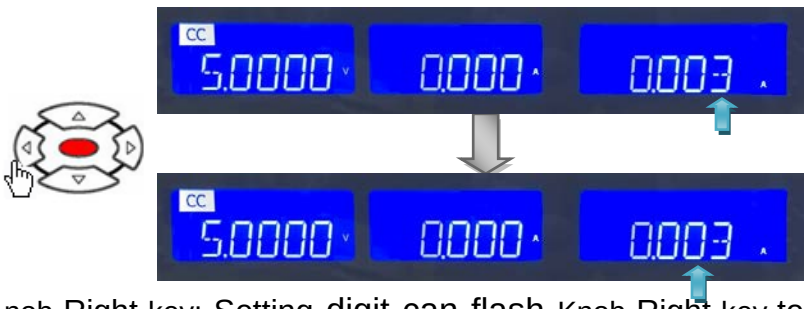
- Right Knob: Setting digit can flash clockwise add setting value.



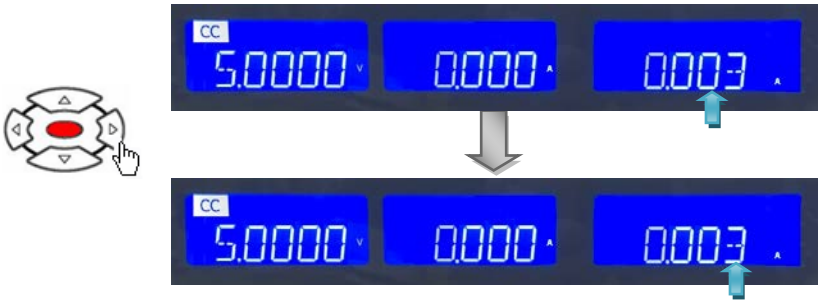
- Left Knob: Setting digit can flash Anti-clockwise to decrease setting value.



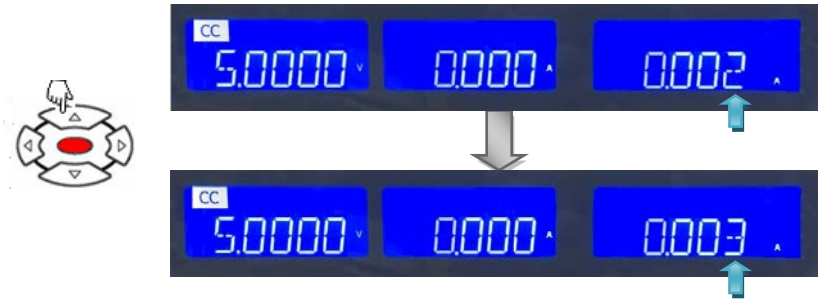
- Knob Left key: Setting digit can flash Left Knob key to push down setting value move left one-digit.



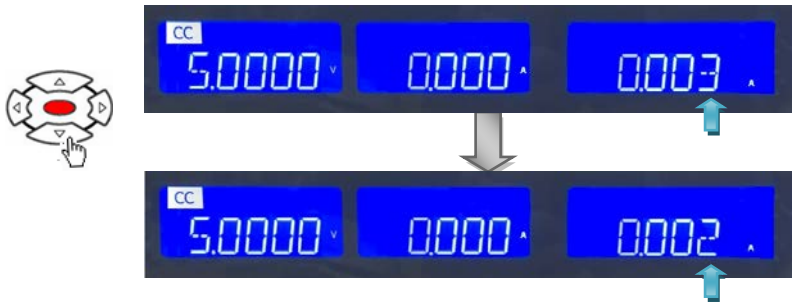
- nob Right key: Setting digit can flash Knob Right key to push down setting value move Right one-digit.



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

Please ensure that the voltage and current rating of the DUT do not exceed the Maximum rating of the 3350F Electronic load being used. Please also check the output polarity of the DUT prior to connection and testing.

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

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

3.2.23. V-sense input terminal

The V-sense terminals can be used to compensate for a voltage drop in the load Lines between the power supply and the 3350F series Electronic Load. This is a useful feature useful when the load current is relatively high.

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

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

Please note that if V-sense is set to AUTO and the sense leads are connected to The DUT the losses need to be approx. 700mV (3350F) before the display compensates for the voltage loss.

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

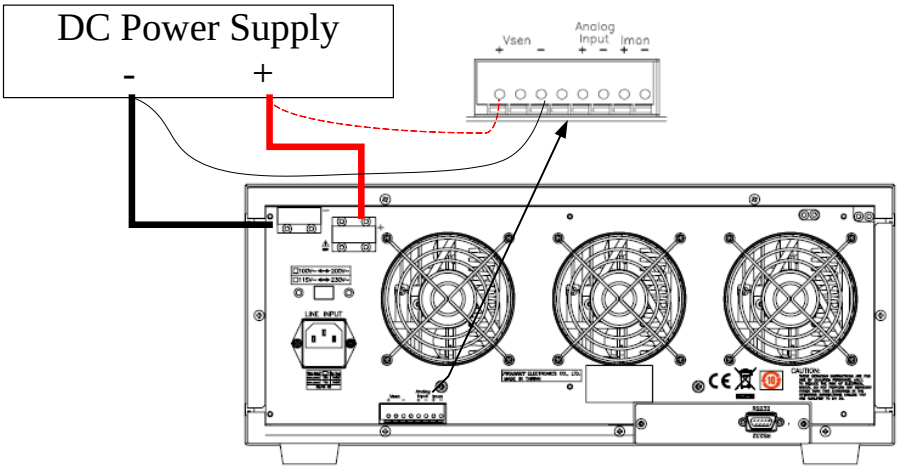


Fig 3-3 Remote sense connection on front panel

3.2.24. I-monitor

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

For example: 3350F: Imax = 120A therefore I-monitor 10V = 120A so 1V = 12A

Please refer to the specification Table 1-1 for the maximum current that each 3350F series is capable of.



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

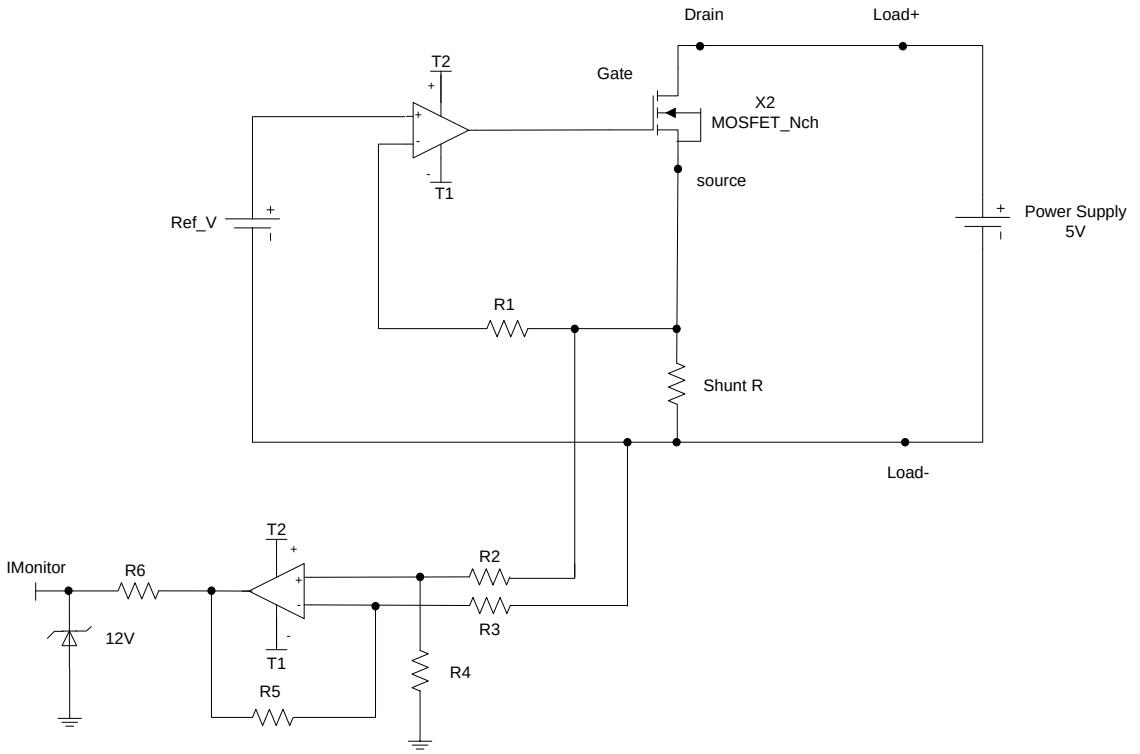
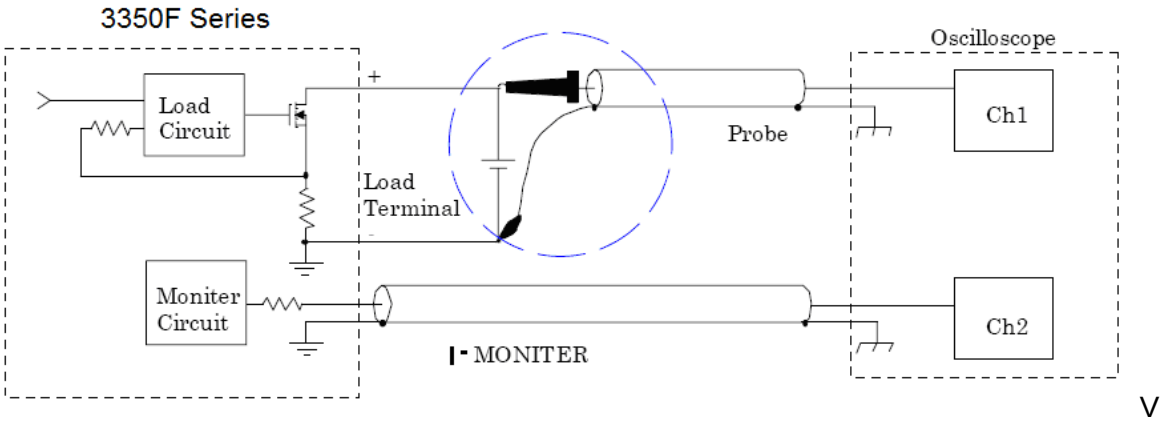


Fig 3-4 an equivalent circuit in terms of the current monitor

Connecting the I-monitor to an oscilloscope

When you connect this product to an oscilloscope, please ensure the correct polarities of the Connecting probes as shown in Fig. 3-5.



V

Fig 3-5 (Correct) Connections to an oscilloscope



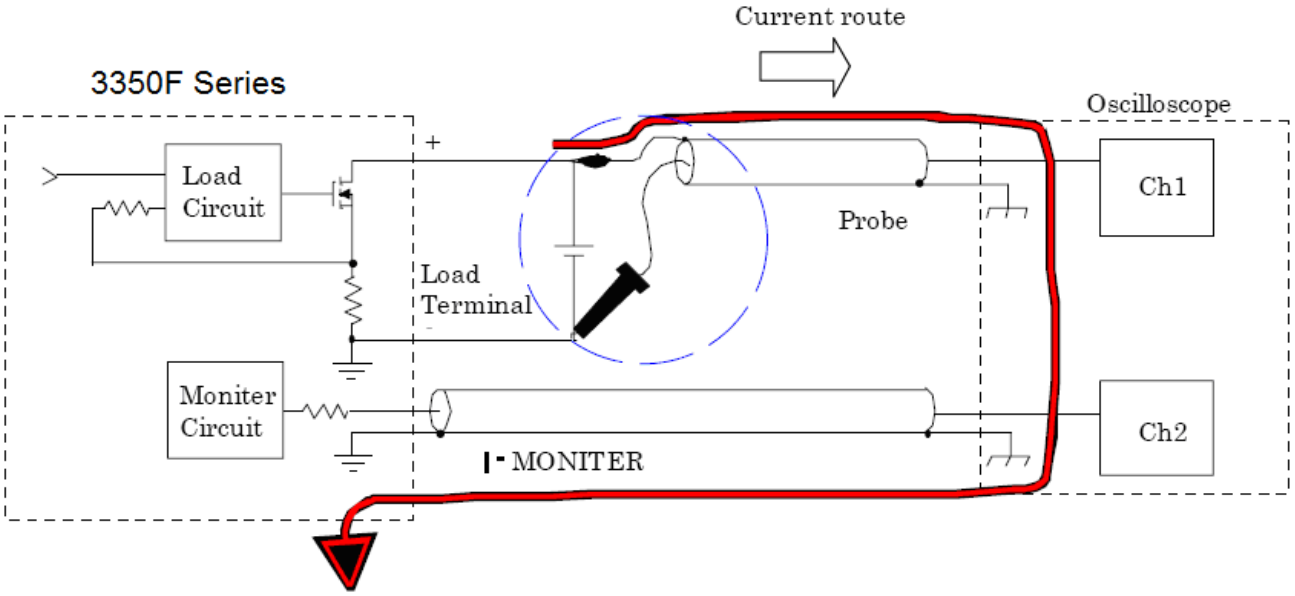
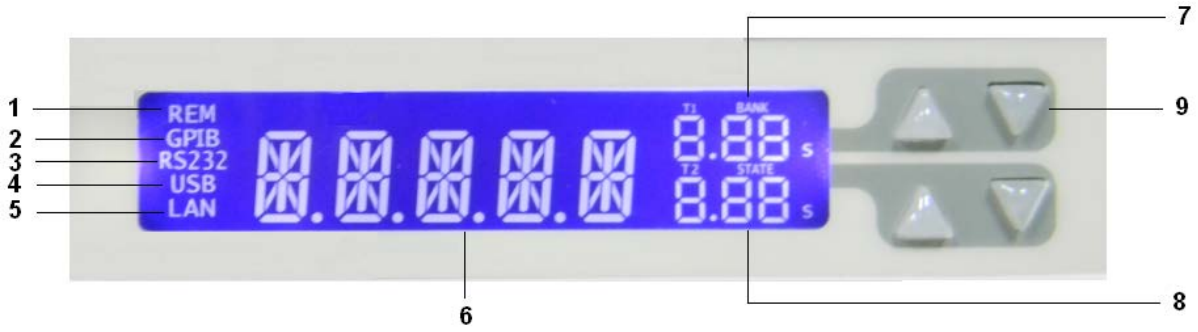


Fig 3-6 (Wrong) Connections to an oscilloscope

If the probes connection is reversed as shown in Fig 3-6, a large current would flow through the Probe and the internal circuitry of the oscilloscope is likely to be damaged.

3-3. Front panel description (2)

The mainframe's LCD will illuminate fully at mains power ON.



3.3.1. REMOTE mode

The REM will be lit when 3350F is being controlled via the GPIB/RS232/USB or LAN -Interface. To bring back the unit to front panel control the local button on the Right hand side of the mainframe can be pressed.

3.3.2. GPIB Card

The LCD will permanently show GPIB if this computer interface has been fitted.



3.3.3. RS232 Card

The LCD will permanently show RS232 if this computer interface has been fitted.



3.3.4. USB Card:

The LCD will permanently show USB if this computer interface has been fitted.



3.3.5. LAN Card

The LCD will permanently show LAN if this computer interface has been fitted.



3.3.6. 3350F Main Display



3.3.7. BANK/T1 Display

The upper digits on the right hand side of the screen relate to the memory BANK in Normal mode. There are 15 BANKS which can be selected in turn by pressing the Upper pair of arrow keys. Each BANK has 10 memory separate memory STATES (Locations) which are selected with the lower pair of arrow keys.

When in auto-sequence mode T1 is displayed. T1 is the test time. The test time Can be adjusted using the upper arrow keys between 0.1sec and 9.9sec in 100ms Steps. Please note that during the T1 test time the mainframe LCD will not flag NG. The T2 setting is used for checking the NG function according to the voltage, Current or power limits set via the LIMIT menu.

3.3.8. STATE/T2 Display

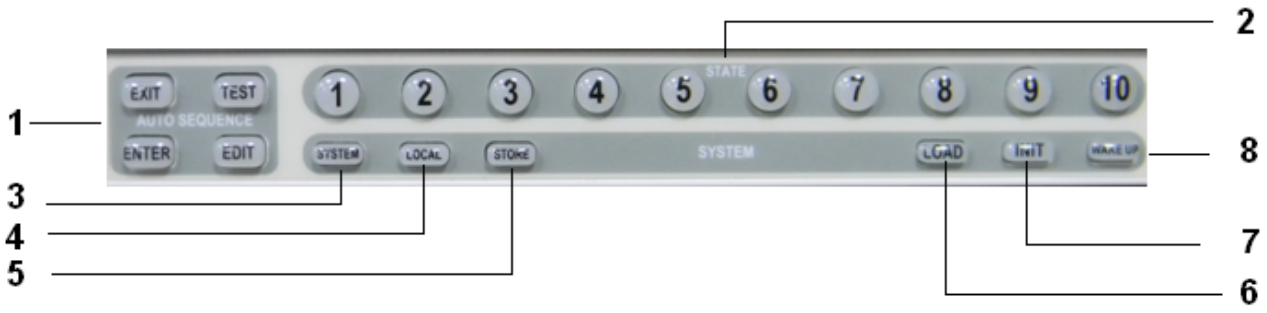
The lower digits relate to the memory STATE (location) in normal mode. There are 10 memory STATES (locations) which can be selected in turn by pressing the Lower arrow keys. These memory STATES are supplemented by 15 memory BANKS giving the user 150 memory locations in total.

When in auto-sequence mode the T2 function is displayed. T2 is the time that NG/GO is checked according to the LIMITS that have been set for that test step.
So if the NG flag has been enabled and the load measures values outside the preset LIMIT values then the test will stop during T2. The mainframe's LCD will flash NG And the test will stop at that step in the auto-sequence. The user can then press ENTER to carry on to the next step or EXIT to leave the auto-sequence.

3.3.9. Arrow buttons

The ARROW key is used to increase or decrease the set values.

3-4. Front panel description (3)

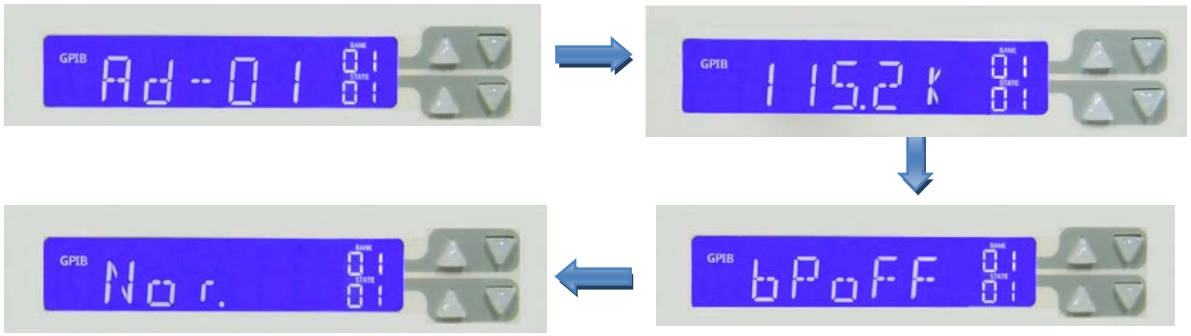


This section briefly describes the buttons on the right hand side of the mainframe. Their Functional use is further described in section 3.4.

3.4.1. The 4 buttons marked exit, test, enter and edit are used to set an auto-sequence.

3.4.2. The numbered buttons 1~10 are the memory states (locations) for storing or Recalling a load set up. They are also used to select a previously saved Auto-sequence when in test mode

3.4.3. Pressing the system button once allows the GPIB address to be changed by using The arrow keys. Pressing the system button again allows the RS232 baud rate to Be adjusted. With the third press of the system button the buzzer can be switched On/off. Another press puts the LCD back to Normal state as shown below.



3.4.4. The local button is used to exit the remote mode and bring the unit back to front Panel control.
3.4.5. The store button is used to save the load configuration.
3.4.6. The load button is used to setting LOAD Synchronous Load ON.
3.4.7. The init button is used to restart LOAD.
3.4.8. The wake up button is used to recall the load configuration at mains power on.

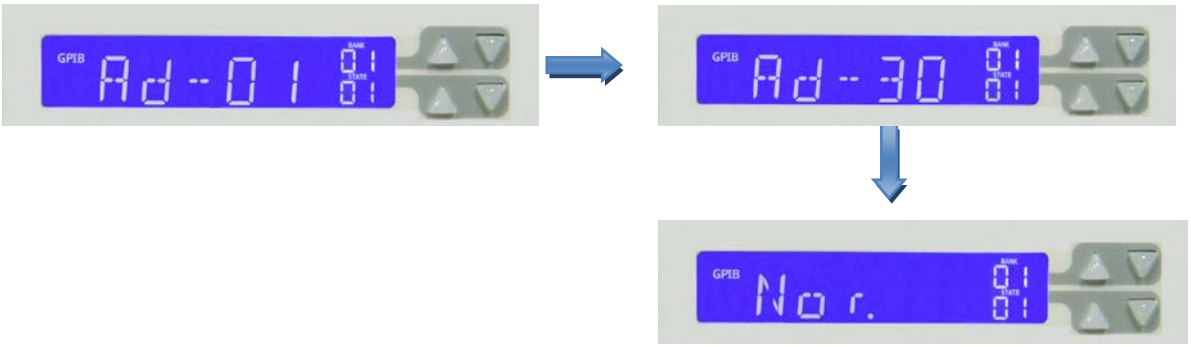
3-5. Operating Instructions

3.5.1. Setting System Parameters

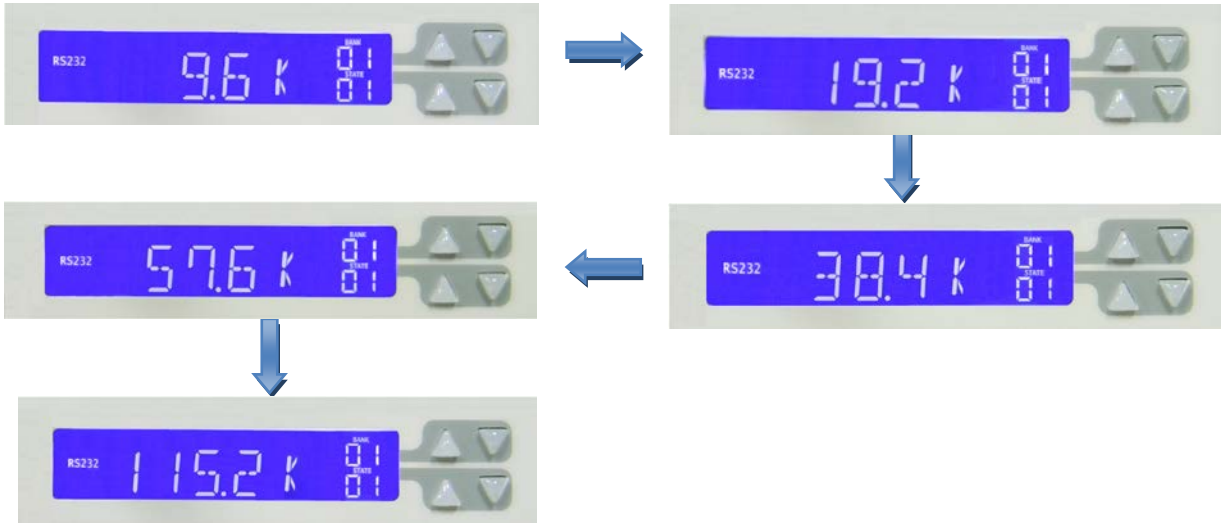
The system button allows the setting of:

a. GPIB address
b. RS232 BAUD RATE
c. Buzzer ON/OFF

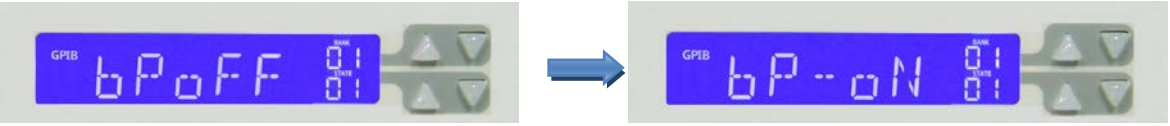
3.5.1.1. To set the GPIB address you must press the system key once. The LCD will Display the current address. The arrow keys are used to change the address. Once the required address is reached press enter or store button to save the New address. The exit key can be pressed to return to the normal screen.



3.5.1.2. To set the RS232 baud rate you must press the system key twice. The LCD will Display the current baud rate. The upper arrow keys are used to change the baud rate. Once the required value is reached press enter or store button to save the new setting. The exit key can be pressed to return to the normal screen.



3.5.1.3. To set the buzzer on/off you need to press the system key 3 times. The arrow Key is used to change the buzzer state. The buzzer can be used to signal that an automatic sequence has ended or failed. To save the setting press enter or Store.



3.5.2. STORE/RECALL Operation

The function keys on the front panel of 3350F series electronic load, 3350F STORE/RECALL Ten electronic load STATE Setting items and 15 BANK a total of 150 electronic load state set, each state can store a variety of electronic load status And settings.

	335XF
BANK(n)	15
STATE(m)	10
TOTAL STATES ((Memory locations)	150

3.5.2.1. How to STORE a load set up:

1. Adjust Electronic Load to desired status and settings.
2. With the UP and DOWN keys on the mainframe select the bank (1 to 15) in which you will store the set up
3. Press the store key on the mainframe. The store key starts flashing. (If you no longer wish to store a setting you can press the exit button or Wait about 20 seconds for the unit to automatically exit the store Operation).
4. While the store light is flashing press a one of the number keys (1 to10) Where the set-up is to be saved. The store light will go out and the Numbered key pressed will stay illuminated. This indicates the set-up has Been saved to that location.

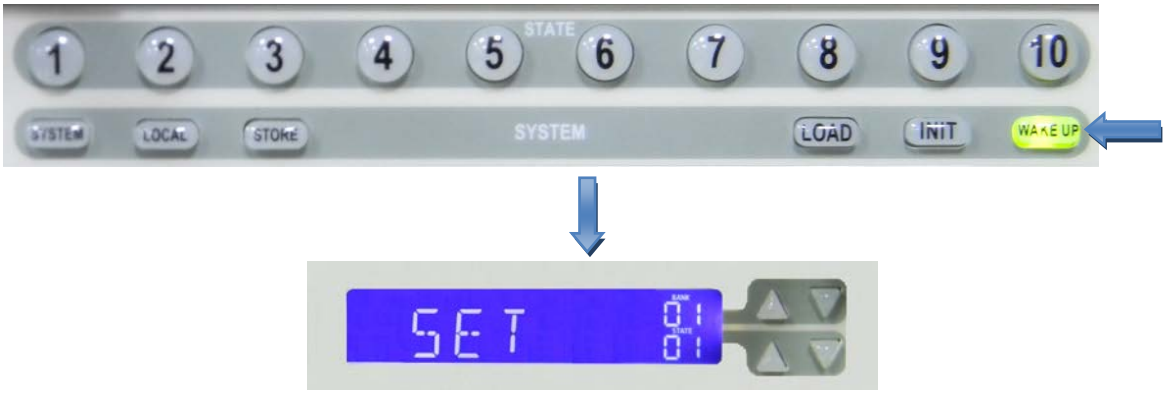
3.5.2.2. How to RECALL a saved set up.

First select the memory bank by using the up and down arrow buttons. Pressing one of the numbered state buttons will recall the previously Saved load configuration. The electronic load will immediately switch to The previously saved set-up changing the load values, operation mode And limits accordingly.

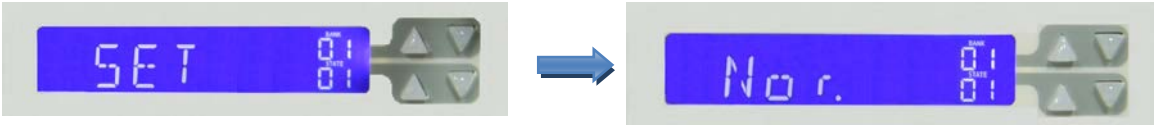
3.5.3. WAKE-UP Function

The wake up function is designed to automatically recall a setting at mains power on.

Step 1 Press WAKE UP once or twice so that message SET is displayed on the 3350F LCD.



Step 2 Select the memory location (bank and state) that is to be used. Once the Correct location has been selected press the STORE key. This example below Shows bank 01 state 01. After pressing store key the LCD will revert to the Normal message.





Step 3 Use the mains switch on the front panel to power down the unit.

Step 4 at mains power on the unit will automatically recall the previously saved Set-up from the nominated memory location.

Step 5 to clear the settings, press the wake up key once or twice so that the LCD Shows clear. Now press them STORE key to cancel the previously set Wake Up Function.

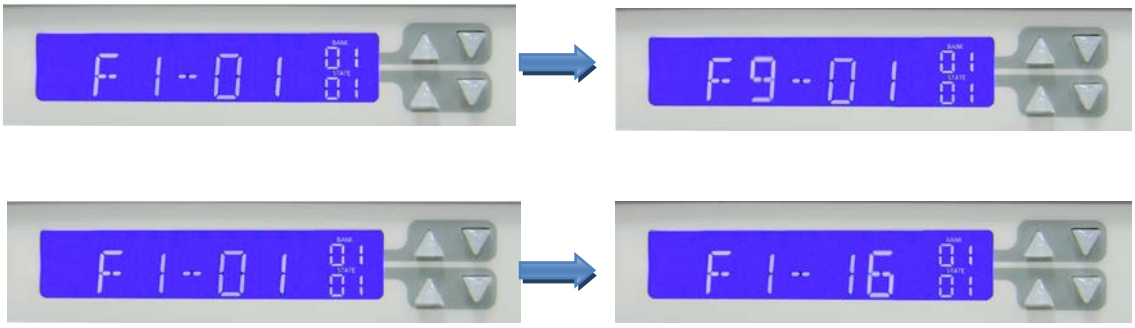


3.5.4. AUTO-SEQUENCE

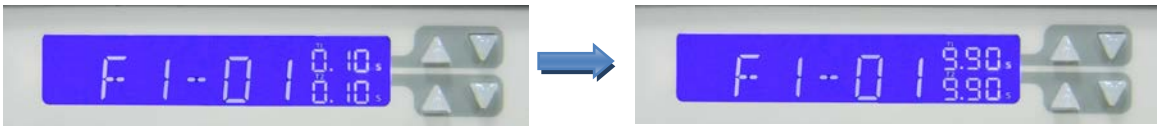
An auto-sequence allows the user to step through previously saved set-ups stored in The mainframe's memory. Up to 9 auto-sequences can be saved. Each auto-Sequence can consist of up to 16 steps. There are two modes in the auto-sequence Function. These are edit mode and test mode.

3.5.4.1 Edit Mode

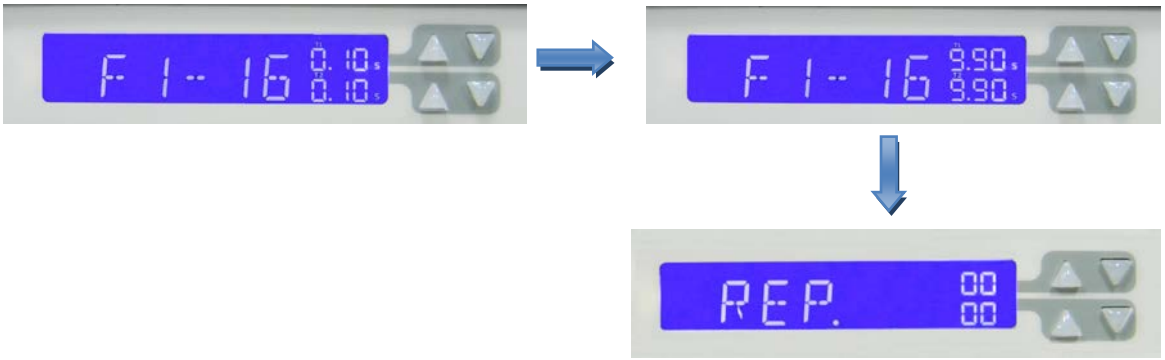
1. Press EDIT key, then EDIT button will become lit and the LCD will display "FX-XX". This is defined as follows:
   The "FX" part indicates the auto-sequence number (F1 to F9 are possible). The Numbered STATE keys are Used to select the auto-sequence numberThe "XX" Part is the test step (1 to 16 is possible).



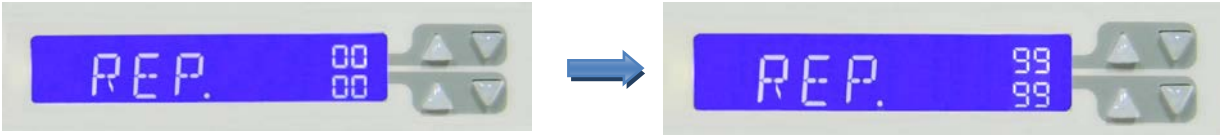
2. Once the auto-sequence number has been selected the Memory location of the First test step can be selected. The Arrow keys next to the 3350F LCD are used to Select the Memory BANK and Memory STATE.
   Once the desired location has been selected press ENTER next the total test time For that step (T1+T2) can be entered.
   T1 is the test time without checking the NG/LIMIT settings.
   T2 is the test time where if NG is ON the LIMIT settings will be checked. The Upper arrow keys are used to set T1 and the lower arrow keys are used to set T2.
   The time setting can be adjusted in the range of 0.1s to 9.9s in 100ms Increments.
   Please see sections 3.2.7 and 3.2.8 for a definition of T1 and T2.



3. Press ENTER to set the next setting step. Repeat the same Process for each Setting steps. Up to 16 steps can be entered.
   Once the T1 and T2 settings have been entered for the final
   Step press the STORE button. The LCD will now show REP.



4. The REP function allows the auto-sequence to be repeated a number of times. Both sets of arrow keys are used to set the number of repeats between 0 and 9999 times. Once the Number of repeats has been set press the STORE button to Save the auto-sequence.



Example: The following screen shot shows the
Number of repetitions has been set to 2023



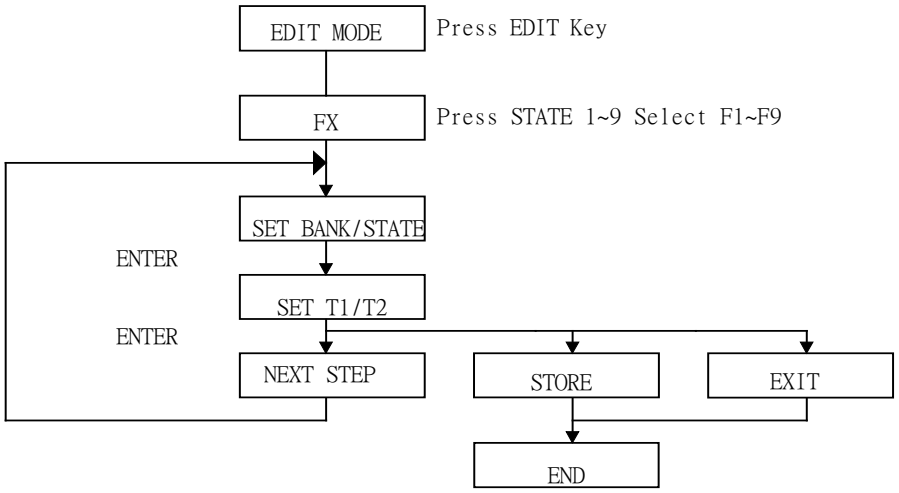
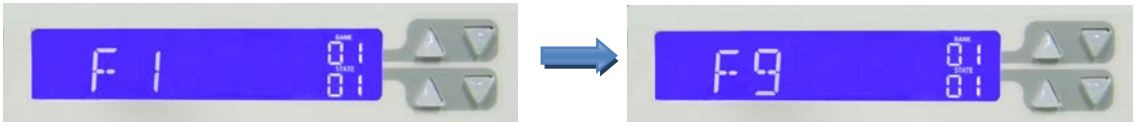


Fig 3-7 EDIT MODE OPERATION FLOW CHART

3.5.4.2 Test Mode

1. Pressing the TEST button will cause the TEST switch to Illuminate and the LCD to show the last selected Auto-sequence number (F1 to F9).
   The numbered STATE buttons (1-9) are used to change the Auto-Sequence number (F1 ~ F9). Once the desired Auto-sequence has been Selected press ENTER to start the test.



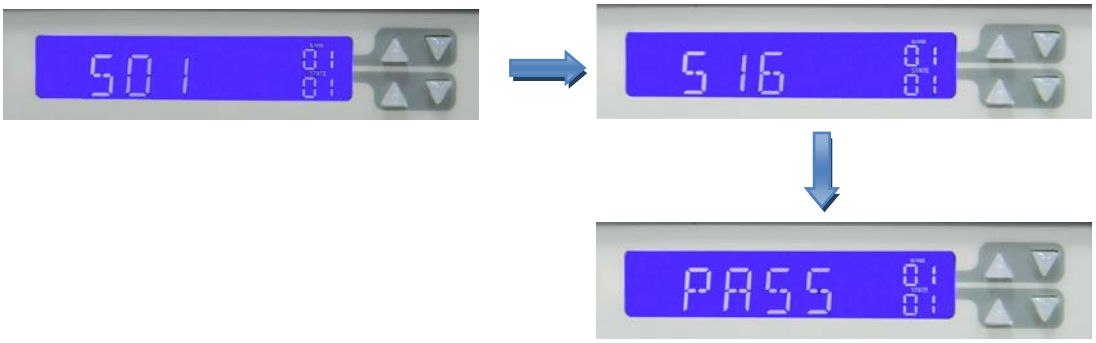
2. The LCD will display "SXX", where "XX" is the actual STEP being Presently tested. If during a given test step the values measured are Outside the preset limits (and the NG Function has been enabled) then The LCD will flash "NG" And the test is suspended.

   The user can press the ENTER button to continue the Remaining test Steps. Alternatively the EXIT button can be used to leave the test mode.

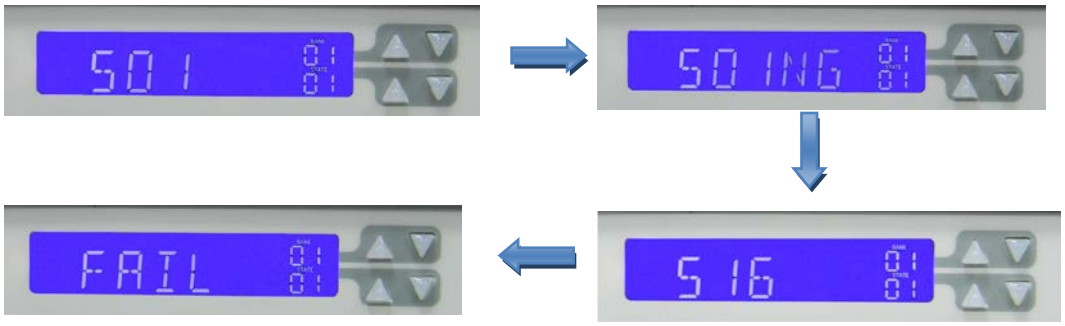
3. If all the test steps are OK, the LCD displays "PASS". If the Unit under test Fails any of the test steps the mainframe's LCD will show "FAIL".
   If the buzzer is set to ON, the PASS result is also accompanied by a Single buzzer call out. If the test shows FAIL the buzzer will sound twice.

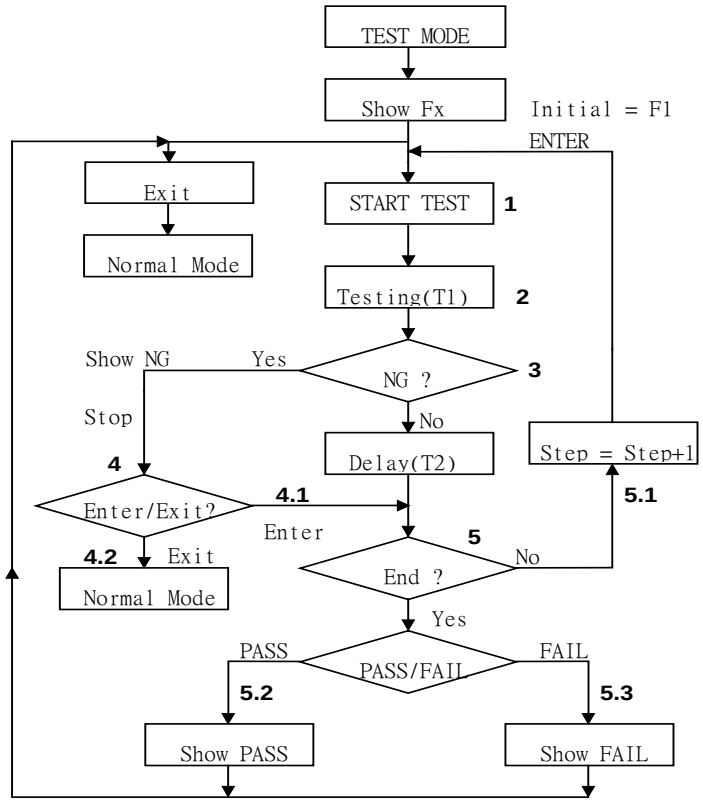
4. When the test is completed, the user can press the ENTER Key again to Start the test again. Alternatively the EXIT Button can be used to leave The test mode.

Example 1: Once the editing of the 16 step test is completed, press the TEST key. The unit Will then automatically run through the test steps S01 to S16 in order. If all tests Steps have been completed then the LCD will show PASS.



Example 2: Once the edit mode has been used to set the 16 step auto-sequence the user can Press the TEST key. If the test fails at one of the test steps the LCD will flash “NG” And the test will stop. The user can then press ENTER key to continue the test or Press the EXIT button to leave the test mode.





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 3-8 TEST MODE OPERATION FLOW-CHART

3-6. Initial setting of 3350F series load module

When you receive the 3350F series electronic load, the load value initial setting after power ON is listed in table 3-1 ~ table 3-6 respectively, this is the factory or initial setting.

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		30000 Ω		I_Hi	120.00 A
CR L+Preset		30000 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	1200.0 W
CV L+Preset		60.000 V		W_Lo	0.0 W
CP L+Preset		0.00W	CONFIG	SENSE	Auto
CP H+Preset		0.00W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	8.0mA/uS	SHORT		Disable
	FALL	8.0mA/uS	OPP		Disable
			OCP		Disable

Table 3-1 3350F initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		30000 Ω		I_Hi	120.00 A
CR L+Preset		30000 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	1800.0 W
CV L+Preset		60.000 V		W_Lo	0.0 W
CP L+Preset		0.00W	CONFIG	SENSE	Auto
CP H+Preset		0.00W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	8.0mA/uS	SHORT		Disable
	FALL	8.0mA/uS	OPP		Disable
			OCP		Disable

Table 3-2 3351F initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		15000 Ω		I_Hi	240.00 A
CR L+Preset		15000 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	1200.0 W
CV L+Preset		60.000 V		W_Lo	0.0 W
CP L+Preset		0.00W	CONFIG	SENSE	Auto
CP H+Preset		0.00W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	0.016A/uS	SHORT		Disable
	FALL	0.016A/uS	OPP		Disable
			OCP		Disable

Table 3-3 3352F initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		15000 Ω		I_Hi	240.00 A
CR L+Preset		15000 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	1800.0 W
CV L+Preset		60.000 V		W_Lo	0.0 W
CP L+Preset		0.00W	CONFIG	SENSE	Auto
CP H+Preset		0.00W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	0.016A/uS	SHORT		Disable
	FALL	0.016A/uS	OPP		Disable
			OCP		Disable

Table 3-4 3353F initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		10020 Ω		I_Hi	360.00 A
CR L+Preset		10020 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	1800.0 W
CV L+Preset		60.000 V		W_Lo	0.0 W
CP L+Preset		0.00W	CONFIG	SENSE	Auto
CP H+Preset		0.00W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	0.024A/uS	SHORT		Disable
	FALL	0.024A/uS	OPP		Disable
			OCP		Disable

Table 3-5 3354F initialize

Item		Initial value	Item		Initial value
CC L+Preset		0.000 A	LIMIT	V_Hi	60.000 V
CC H+Preset		0.000 A		V_Lo	0.000 V
CR H+Preset		30000 Ω		I_Hi	120.00 A
CR L+Preset		30000 Ω		I_Lo	0.00 A
CV H+Preset		60.000 V		W_Hi	600.00 W
CV L+Preset		60.000 V		W_Lo	0.00 W
CP L+Preset		0.000W	CONFIG	SENSE	Auto
CP H+Preset		0.000W		LD-ON	1.0 V
DYN	T HI	0.050 mS		LD-OFF	0.500 V
	T L0	0.050 mS		POLAR+LOAD	
	RISE	8.0mA/uS	SHORT		Disable
	FALL	8.0mA/uS	OPP		Disable
			OCP		Disable

Table 3-6 3356F initialize

3-7. Input binding post and wire consideration

The five ways connect the input wires to the Electronic load the connection methods are Made as follow:

3.7.1. Plug connectors: This is the most popular way to connect the input of Electronic load to the device under test. It is recommended the load current is Less than 20A in this connection for the current rating of the plug is rated to 20A. the maximum wire gage AWG14 can be used in this application.

3.7.2. Spade terminals: The spade terminal provides a good contact to the binding Post, it is recommended to use anytime. The maximum wire gage 10 can be used in this application.

3.7.3. Insert the wire into the input terminal: This is the most convenient way to Connect the load input and D.U.T. The maximum wire gage AWG14 can be Used in this application.

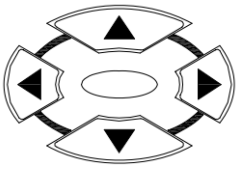
3.7.4. Both plug connectors and spade terminals:
It is recommended to use when input current is greater than 20A or long lead Wires.

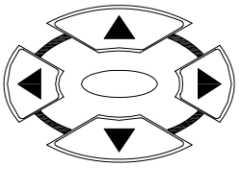
3.7.5. Both plug connectors and Insert the wire into the input terminal.
It is recommended to use when input current is greater than 20A or long lead Wires.

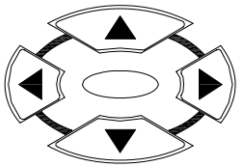
A major consideration in making input connection is the wire size. The Minimum wire size is required to prevent overheating and to maintain good Regulation. It is recommended that the wires should be large enough to limit The voltage drop to less than 0.5V per lead.

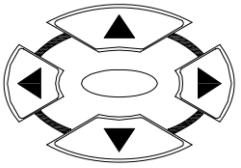
3-8. Load current course/fine increase/decrease adjustment knob

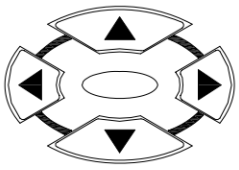
Change amount that CC/CR/CV/CP MODE (CR contrary) load current adjusts form 3-6 shows Analyzes one degree of relations with knobing. Push the knob when operate (the figure will glimmer), can enter one and analogize , rotate increment right or rotate decrement left, will Continue increasing or reducing and reach the minimum value or the maximum to establish Constantly to adjust in load current, or the knob no longer continues rotating in the way.

3350F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		12A			120 A		
CURRENT METER	RANGE	0~12A/120A					
	RESOLUTION	0.2mA/2mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100mA	10mA	1mA	1A	100mA	10mA
CR Mode		3.3mS	0.33mS	0.033mS	0.83mΩ	0.083mΩ	0.0083mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		1W	0.1W	0.01W	10W	1W	0.1W

3351F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		12A			120 A		
CURRENT METER	RANGE	0~12A/120A					
	RESOLUTION	0.2mA/2mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100mA	10mA	1mA	1A	100mA	10mA
CR Mode		3.3mS	0.33mS	0.033mS	0.83mΩ	0.083mΩ	0.0083mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		1.002W	0.102W	0.009W	10.02W	1.002W	0.102W

3352F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		24A			240 A		
CURRENT METER	RANGE	0~24A/240A					
	RESOLUTION	0.4m A/4mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100mA	10mA	0.8mA	1A	100mA	10mA
CR Mode		6.6mS	0.66mS	0.066mS	0.41mΩ	0.041mΩ	0.0041mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		1W	0.1W	0.01W	10W	1W	0.1W

3353F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		24A			240 A		
CURRENT METER	RANGE	0~24A/240A					
	RESOLUTION	0.4m A/4mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100mA	10mA	0.8mA	1A	100mA	10mA
CR Mode		6.6mS	0.66mS	0.066mS	0.41mΩ	0.041mΩ	0.0041mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		1.002W	0.102W	0.009W	10.02W	1.002W	0.102W

3354F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		36A			360 A		
CURRENT METER	RANGE	0~36A/360A					
	RESOLUTION	0.6mA/6mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100.2mA	10.2mA	0.6mA	1000.2mA	100.2mA	10.2mA
CR Mode		10mS	1mS	0.1mS	0.27mΩ	0.027mΩ	0.0027mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		1.002W	0.102W	0.009W	10.02W	1.002W	0.102W

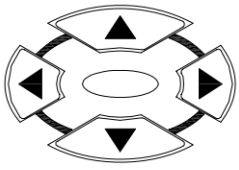
3356F		RANGE I			RANGE II		
FULL SCALE LOAD CURRENT		12A			120 A		
CURRENT METER	RANGE	0~12A/120A					
	RESOLUTION	0.2mA/2mA					
COURSE/FINE LOAD CURRENT ADJUSTMENT knob							
CC Mode		100mA	10mA	1mA	1000mA	100mA	10mA
CR Mode		3.3mS	0.33mS	0.033mS	0.83mΩ	0.083mΩ	0.0083mΩ
CV Mode		0.01V	0.001V	0.0001V	0.1V	0.01V	0.001V
CP Mode		0.1W	0.01W	0.001W	1.00W	0.1W	0.01W

Table 3-7 the resolution of range I/II vs. Course/Fine load setting Key

3-9. Protection features

The 3350F Series Electronic load modules include the following protection features:

3.9.1. Over voltage
3.9.2. Over current
3.9.3. Over power
3.9.4. Over temperature
3.9.5. Reverse Polarity

The Over voltage protection circuit is set at a predetermined voltage (63V for 3350F) which can not 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 LCD display will indicate “OVP ".

CAUTION: Never apply the AC line voltage or input voltage excised than 60V, or it may cause damage of the electronic load module.

The 3350F 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 module will turn load to OFF state internally.

When the Over power condition is occurred, the Digital Current Meter's LCD display will indicate “OPP ".

As soon as the temperature of 3350F Series heat sink greater than 85 degree, the Over temperature protection is occurred, the Digital Current Meter's LCD display will indicate “OTP “at same time, the 3350F 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 3350F 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 3350F Series electronic load conducts reverse current when the polarity of the DC source connection is incorrect. The maximum reverse current is 120A for 3350F. If the reverse current excesses the maximum reverse current, it may cause damage of the 3350F 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 3350F mainframe is designed to connect PC or NOTEBOOK PC with remote control interface, the NOTEBOOK PC acts as a remote controller of 3350F 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 3350F 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 3350F rear panel, RS-232 is shown in Fig4-1.

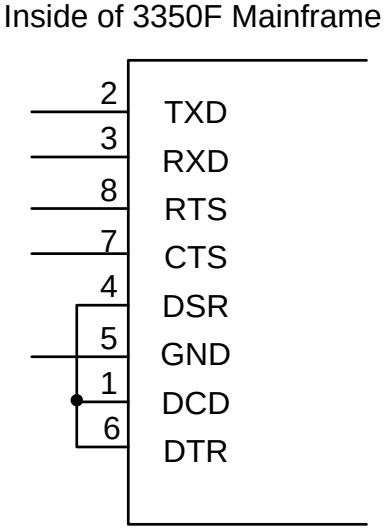


Fig 4-1 RS-232C INTERFACE CONNECTION OF REAR PANEL

4-3.3350F REMOTE CONTROL COMMAND LIST1

SIMPLE TYPE FORMAT

SETTING PRESET NUMERIC COMMAND	REMARK
RISE{SP} {NR2} { ; | NL}	(m)A/us
FALL{SP}{ ; | NL}	(m)A/us
PERD：{HIGH | LOW} {SP} {NR2} { ; | NL}	
LDONV{SP} {NR2} { ; | NL}	
LDOFFV{SP} {NR2} { ; | NL}	
CC | CURR：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CP：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CR | RES：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
CV | VOLT：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
TCONFIG {SP} {NORMAL|OCP | OPP| SHORT }{;|NL}	
OCP:START {SP} {NR2}{;|NL}	
OCP:STEP {SP} {NR2}{;|NL}	
OCP:STOP {SP} {NR2}{;|NL}	
VTH {SP} {NR2}{;|NL}	
OPP:START {SP} {NR2}{;|NL}	
OPP:STEP {SP} {NR2}{;|NL}	
OPP:STOP {SP} {NR2}{;|NL}	
STIME {SP} {NR2}{;|NL}	

Table 4-1 REMOTE CONTROL SETTING COMMAND SUMMARY

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

Table 4-2 REMOTE CONTROL QUERY COMMAND SUMMARY

LIMIT COMMAND	REMARK
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|1|0} { ; |NL}	
LOAD {?} { ; |NL}	0：OFF 1：ON
MODE {SP} {CC|CR|CV|CP} { ; NL}	
MODE {?} { ; |NL}	0：CC 1：CR 2：CV 3：CP
SHOR {SP} {ON|OFF|1|0} { ; |NL}	
SHOR {?} { ; |NL}	0：OFF 1：ON
PRES {SP} {ON|OFF|1|0} { ; |NL}	
PRES {?} { ; |NL}	0：OFF 1：ON
SENS {SP} {ON|OFF|AUTO|1|0} { ; |NL}	
SENS {?} { ; |NL}	0：OFF/AUTO 1：ON
LEV {SP} { LOW|HIGH|0|1} { ; |NL}	
LEV {?} { ; |NL}	0：LOW　1：HIGH
DYN {SP} {ON|OFF|1|0} { ; |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：Available for all module.

COMMAND	NOTE	RETURN
CHAN {SP} {1|2} { ;|NL}		
CHAN {?}{ ;|NL}		{1|2}
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”

Table 4-5 SYSTEM COMMAND SUMMARY

Measure command

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

Table 4-6 MEASURE COMMAND SUMMARY

REMARK :

1. Current engineering unit: A
2. Voltage engineering unit: V
3. Period engineering unit: mS
4. Slew-rate engineering unit: (m)A/uS
5. Power engineering unit: W

AUTO SEQUENCE: Available for all modules.

AUTO SEQUENCE SET 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}	0.0~9.9(s)	0.0~9.9(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

3350F REMOTE CONTROL COMMAND LIST2

COMPLEX TYPE FORMAT

SETTING COMMAND SUMMARY	REMARK
[PRESet：] RISE{SP} {NR2} { ; | NL}	(m)A/us
[PRESet：] FALL{SP}{ ; | NL}	(m)A/us
[PRESet：] PERI | PERD：HIGH | LOW {SP} {NR2} { ; | NL}	
[PRESet：] LDONv{SP} {NR2} { ; | NL}	
[PRESet：] LDOFfv{SP} {NR2} { ; | NL}	
[PRESet：] CC | CURR：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CP：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CR | RES：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：] CV | VOLT：{HIGH | LOW} {SP} {NR2}{ ; | NL}	
[PRESet：]TCONFIG {SP} {NORMAL|OCP| OPP|SHORT}{;|NL}	
[PRESet：] OCP:START {SP} {NR2}{;|NL}	
[PRESet：] OCP:STEP {SP} {NR2}{;|NL}	
[PRESet：] OCP:STOP {SP} {NR2}{;|NL}	
[PRESet：] VTH {SP} {NR2}{;|NL}	
[PRESet：] OPP:START {SP} {NR2}{;|NL}	
[PRESet：] OPP:STEP {SP} {NR2}{;|NL}	
[PRESet：] OPP:STOP {SP} {NR2}{;|NL}	
[PRESet：] STIME {SP} {NR2}{;|NL}	

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：] CP：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] CR| RES：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] CV| VOLT：{HIGH | LOW} {?} { ; | NL}	###.####
[PRESet：] TCONFIG {?}{;|NL}	1:NORMAL 3:OPP 2:OCP 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}	###.####

Table 4-2B REMOTE CONTROL QUERY COMMAND SUMMARY

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

Table 4-3B 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} {；NL}	
[STATe：] MODE {?} {；|NL}	**0|1|2|3：CC|CR|CV|CP**
[STATe：] SHORt {SP} {ON|OFF} {；|NL}	
[STATe：] SHORt {?} {；|NL}	0：OFF 1：ON
[STATe：] PRESet {SP} {ON|OFF} {；|NL}	
[STATe：] PRESet {?} {；|NL}	0：OFF 1：ON
[STATe：] SENSe {SP} {ON|OFF|AUTO } {；|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}（Note1）	
[STATe：] NGENABLE{SP}{ON|OFF}{；|NL}	
[STATe：]POLAR{SP}{POS|NEG}{；|NL}	
[STATe：]START{；|NL}	
[STATe：]STOP{；|NL}	
[STATe：]TESTING {?}{；|NL}	0：TEST END，1：TESTING

Table 4-4B STAGE COMMAND SUMMARY

SYSTEM COMMAND: available for all module

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”

Table 4-5B SYSTEM COMMAND SUMMARY

Measure command: available for all module

COMMAND	RETURN
MEASure：CURRent{?}{ ; | NL}	###.####
MEASure：VOLTage{?}{ ; | NL}	###.####
MEASure：POWer{?}{ ; | NL}	###.####

Table 4-6B MEASURE COMMAND SUMMARY

REMARK ：
1. Current engineering unit: A
2. Voltage engineering unit: V
3. Period engineering unit: mS
4. Slew-rate engineering unit: (m)A/uS
5. Power engineering unit: W

Auto sequence: avilable for all module

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}	0.0~9.9(s)	0.0~9.9(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 4-8B 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 OA Hexadecimal.
NL：New line, Program line terminator, the ASCII code is OA Hexadecimal.
NR2：Digits with decimal point. It can be accepted in the range and format of###.#####.
For Example：
30.12345, 5.0

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 3350F mainframe is listed in Table 4-9.

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. The least significant number is the 3th behind the decimal point.
4. 3350F will set to the maximum value of the model automatically when the set RISE is over the specification of Load.
5. The unit is (m)A/uS.

FALL

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

Purpose： Set and read the FALL SLEW-RATE

Description：

1. The definition of FALL SLEW-RATE is load level change or dynamic load can be programmed of RISE and FALL are completely independent.
2. 3350F 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 (m)A/uS .

PERI or PERD

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

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

Description：

1. A period of loading waveform of DYNAMIC is combined by TLOW and THIGH.
2. The value of TLOW and THIGH have to be included the number of the decimal Point, otherwise the command will not be available.
3. The least significant number is the 5th behind the decimal point.
4. 3350F 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. 3350F 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. 3350F 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. 3350F 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}

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

Purpose：Set and read the mode of LOAD

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

	CC (0)	CR (1)	CV (2)	CP (3)
3350F	V	V	V	V

Table 4-9 module for each series

[STATe：] SHORt {SP}{ON｜OFF}

Syntax： [STATe：] SHORt {SP}{ON｜OFF}{；｜NL}
[STATe：] SHORt ？ {；｜NL}

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

Description：This command is for setting the Load to make a short-circuit test. While setting for the ON, the V+, V- pin of Load like short-circuit status.

[STATe：] PRESet {SP}{ON｜OFF}

Syntax： [STATe：] PRESet {SP}{ON｜OFF}{；｜NL}
[STATe：] PRESet ？ {；｜NL}

Purpose：Set the upper or lower digit multi-function meter to display the programming load level.

Description：This command is for select the left 5 digit LCD display to show current setting or DWM.

Pres ON：To 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 3350F, the optional are ON and AUTO. So, if setting for AUTO, it means the voltage is got and read from VSENSE. But if no voltage is inputted from VSENSE, the voltage will be inputted from INPUT Connector.

[STATe：] LEVel {SP}{HIGH｜LOW} or LEV {SP}{HIGH｜LOW}

Syntax： [STATe：] LEVel {SP}{HIGH｜LOW }{；｜NL}
[STATe：] LEVel ？ {；｜NL}
[STATe：] LEV{SP}{HIGH｜LOW}{；｜NL}
[STATe：] LEV？ {；｜NL}

Purpose：Set and read the LOW and HIGH of Load

Description：LEV LOW is a low level value of current on CC mode. It is a low level value of resistance on CR mode. It is a low level value of voltage on CV mode. It is a low level value of power on CP mode.

[STATe：] DYNamic{SP}{ON｜OFF}

Syntax： [STATe：] DYNamic{SP}{ON｜OFF}{；｜NL}
[STATe：] DYNamic ？ {；｜NL}

Purpose：Set and read whether the status is Dynamic or Static of Load

Description：1. DYN ON , set for a DYNAMIC Load
2. DYN OFF, set for a STATIC Load

[STATe：] CLR

Syntax：[STATe：] CLR{；｜NL}

Purpose： Clear the error flag of 3350F 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 3350F

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 3350F

Description：1.PROT? means the status of Protection of 3350F. “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”

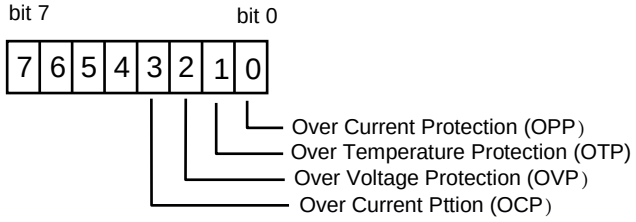


Table 4-10 register of PROT status

[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 3350F

[SYStem：] RECall{ SP }m{ ,n }

Syntax：[SYStem：] RECall{ SP }m{ ,n }{；|NL}

Purpose： Recall the status of Loading which had been saved in the Memory

Description： This command is for recalling the status of Load which had been saved in the Memory .

m(STATE)=1~10，n(BANK)=1~15。

If the operating module is other series, omit “n” and it will be operated in the BANK Which has been shown on the display.

For Example

RECALL 2，15 → Recall the status of Loading which had been saved in the 2nd and 15th BANK of the memory

REC 3 → Recall the status of Loading which had been saved in the 3rd of Memory. If 3350F 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 3350F 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 3350F, BANK will be set the BANK which shows on the display.

	3350F
BANK(n)	15
STATE(m)	10
TOTAL STATE	150

[SYStem：] NAME？

Syntax：[SYStem：] NAME？{；｜NL}

Use ： Read the model number of Load

State ： This command is for reading the model number of Load. it will be lit the model number as table 4-11 :

MODEL
3350F
3351F
3352F
3353F
3354F
3356F

Table 4-11 MODEL NUMBER

[SYStem：] REMOTE

Syntax： [SYStem：] REMOTE {；｜NL}

Purpose：Command to enter the REMOTE status (only for RS232)

Description：This command is for controlling the RS232

[SYStem：] LOCAL

Syntax：[SYStem：] LOCAL {；｜NL}

Purpose：Command to exit the REMOTE status (only for RS232)

Description：This command is for finishing the RS232

4.6.5. 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 3350F Series Electronic Load.

5-1. Local sense connections

Fig 5-1 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 3350F Electronic load measures the voltage of DC INPUT Terminal automatically; load leads should be bundled or tie-wrapped together to minimize inductance.

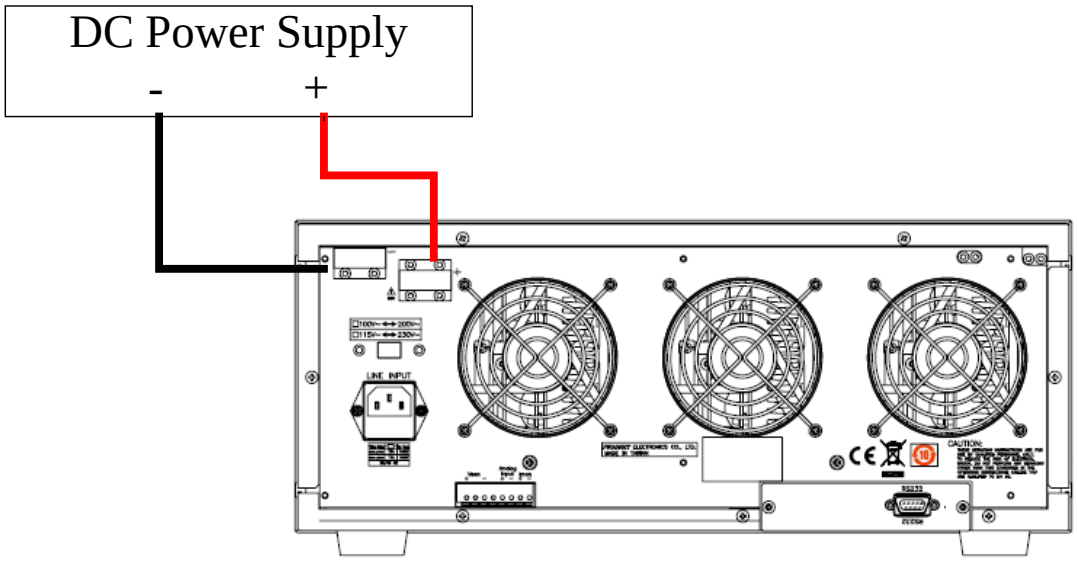


Fig 5-1 Local voltage sense connections

5-2. Remote sense connections

Fig 5-2 illustrates a typical set up with the electronic load connected for remote sense operation. The remote Vsense 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 3350F electronic load measures the voltage of Vsense input Terminal automatically, so the high accuracy 5 digit voltage Meter can measure the specific point’s voltage of the power supply's output voltage.

Load leads should be bundled or tie wrapped together to minimize inductance.

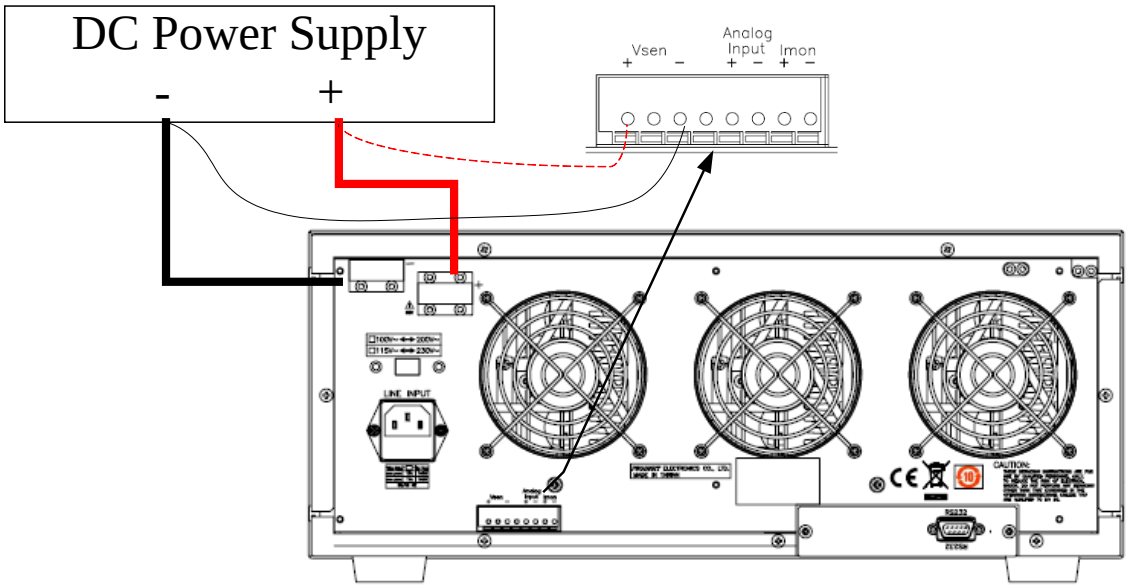


Fig 5-2 Remote voltage sense connections

5-3. Constant Current mode application

The Constant Current (CC) mode is ideal for testing the Load Regulation, Cross Regulation, Output Voltage and Dynamic Regulation of the power supply under test. The CC mode can Also be used to test the Discharge Characteristics and the Life Cycle of cells and battery packs. In CC operation the 3350F can operate as a static load with switchable high and low current Levels. It is also possible to operate the load dynamically enabling the user to adjust sink Current with time.

5.3.1. Static mode: (Fig 5-3)

Major application:

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

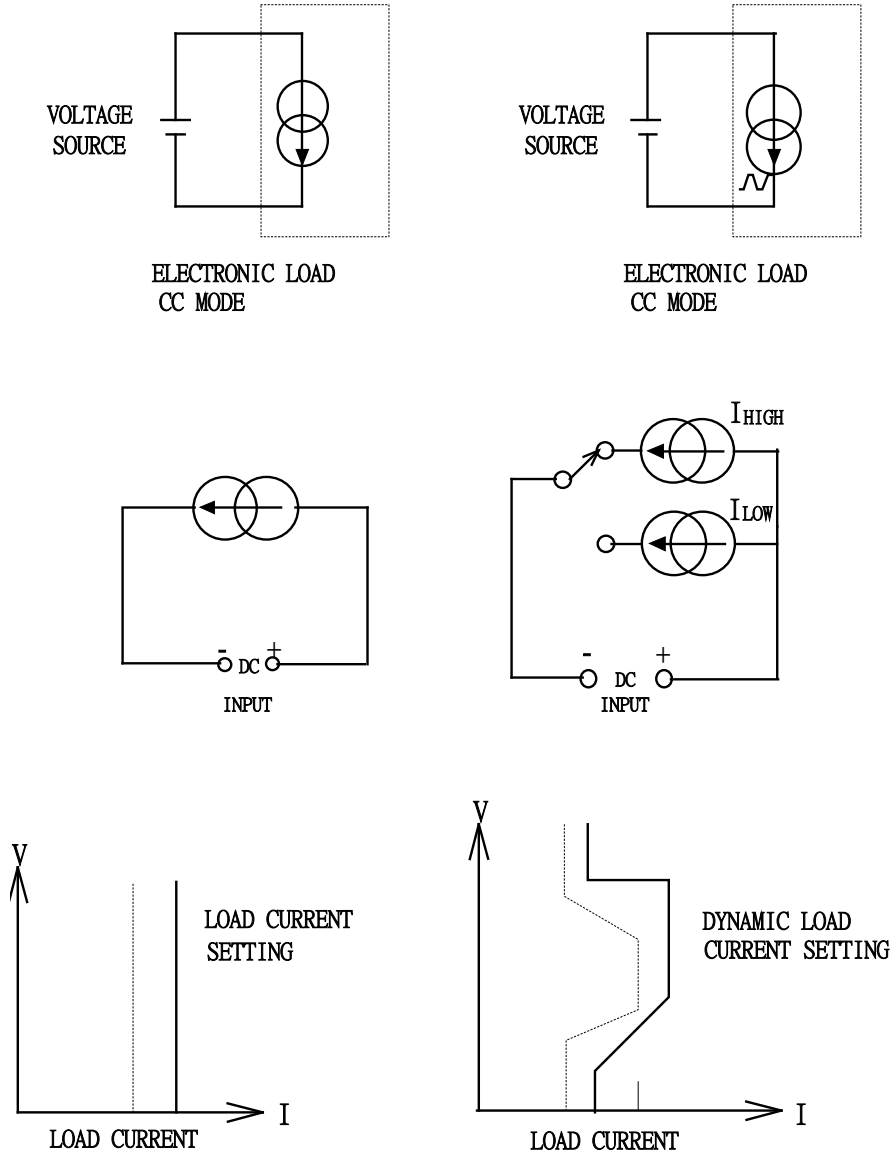


Fig 5-3 constant mode application

5.3.2. Dynamic mode:

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

Major application areas for dynamic operation in CC mode include:

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

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

- Please see Fig 1-12 for more information on slew rates.

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

5.3.3. Analogue programming input

The analogue programming input can also be used in CC mode. The analogue Programming input allows a complex dynamic waveform to be set up on an external Oscillator. The 3350F series load module will track and load according to the external Signal as long as it is within its dynamic capability. The input signal can be the range of 0-10V (dc+ac). The 10V is proportional to the full current capability of the load module. More information on the analogue programming input can be seen in section 3.2.

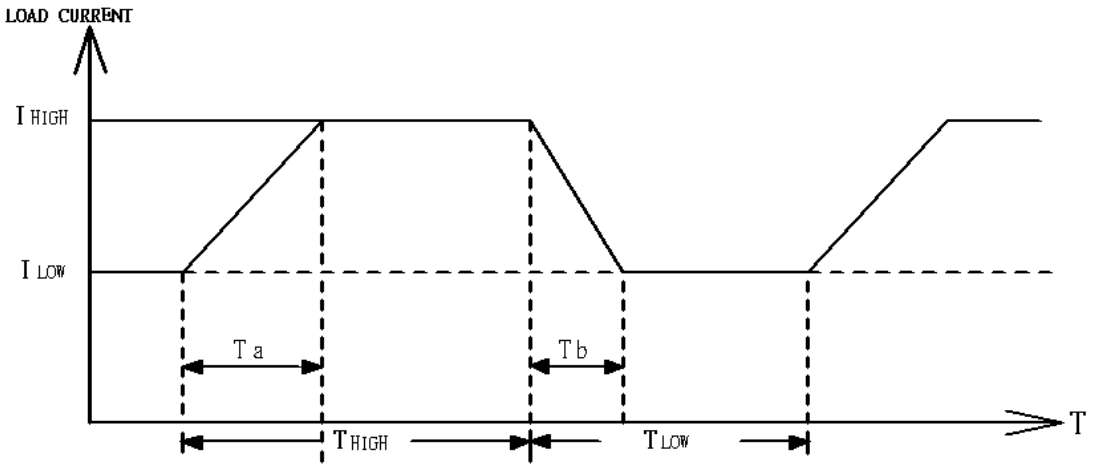
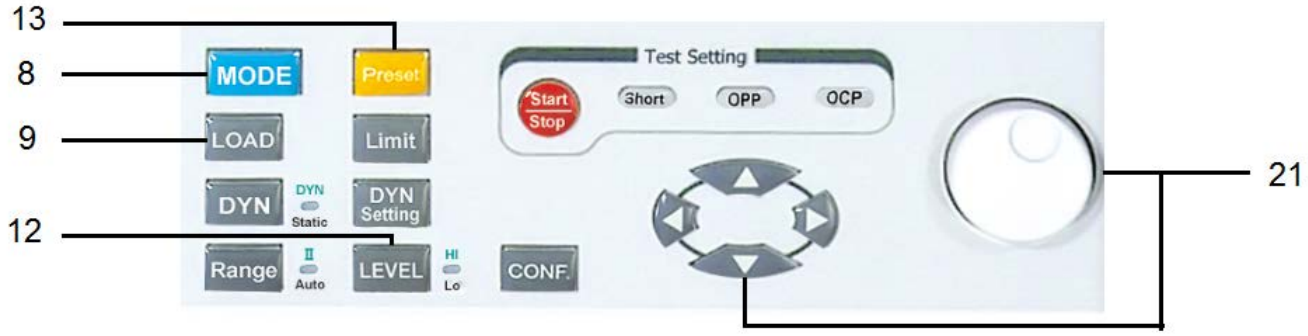


Fig 5-4 Dynamic load current with independent programmed Rise/Fall slew rate

5.3.4. CC Mode Operating Instructions



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

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

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



5.3.4.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the Right display during Setting 3.000 A.



5.3.4.2.2. Pressing the LEVEL key (12) LED once will off, Select LEVEL Lo, Adjusted by the Rotary knob and arrow key (21) can be read from The right display during setting 1.500A.



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



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



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



5-4. Constant Voltage mode application

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

5.4.1 Current source testing.

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

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

5.4.2 Power supply current limit characterization

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

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

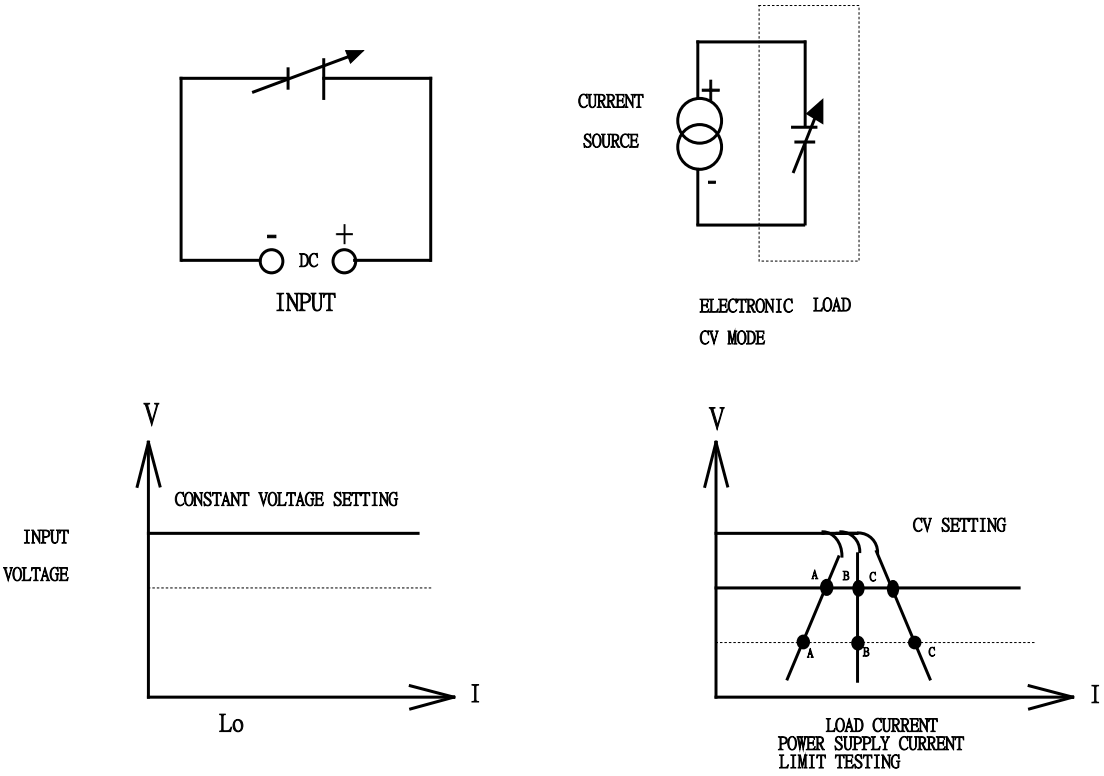
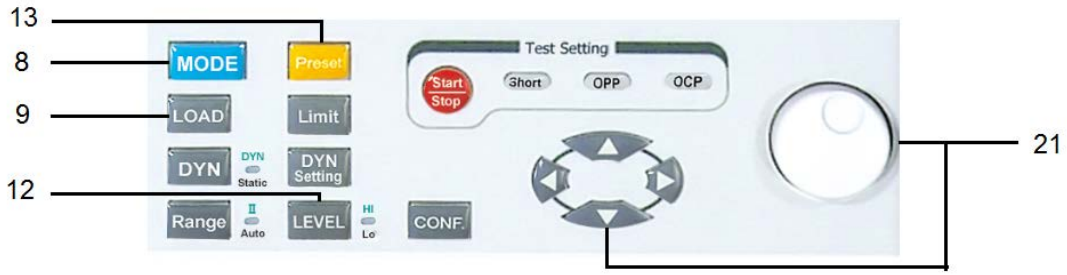


Fig 5-5 Constant Voltage mode application

5.4.3 CV Mode Operating Instructions



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

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



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

5.4.3.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Lo, Adjusted by the rotary knob and arrow key (21) can be read from the right Display during Setting 3.000V.



5.4.3.2.2. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the right Display during Setting 4.000V.



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



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



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



5-5. Constant Resistance mode application

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

5.5.1 Power supply power up sequence

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

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

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

However please note that with the 3350F series of Electronic Loads allow an adjustable current ramp can be set. This feature is found within the dynamic settings as RISE slew rate. Even in static mode the 3350F load will regulate its current demand at ‘Load ON’ in line with the adjusted RISE slew rate. The FALL slew rate also in the dynamic settings allows the current ramp down to be controlled at ‘Load OFF’.

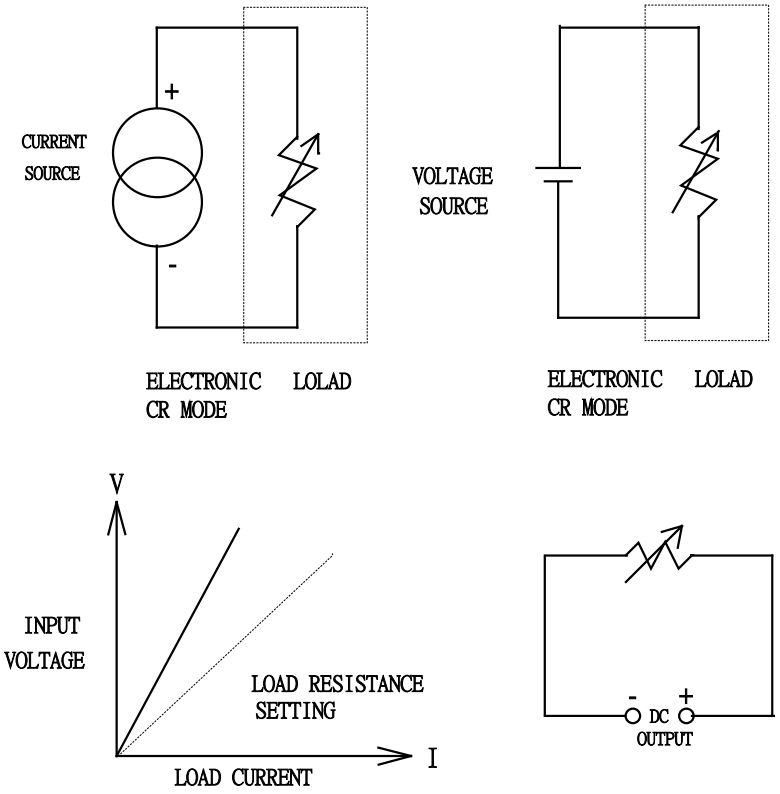
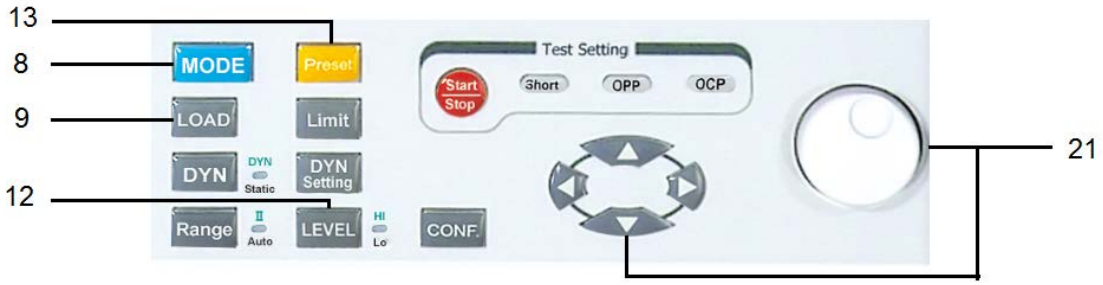


Fig 5-6 Constant Resistance mode Application

5.5.2 CR Mode Operating Instructions



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

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



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

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



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



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



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



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



5-6. Constant Power mode application

5.6.1. Battery Evaluation

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

It can be measured that the output voltage of a battery will drop over time (Fig 4-7a). The rate of voltage decay depends on a number of factors including duty cycle, chemistry type, battery age and ambient temperature.

So to keep the device powered for the longest possible time the battery must be able to provide a stable power output regardless of output voltage (Fig 4-7c). In order to maintain a constant power the output current will need to increase over time to compensate for the reducing voltage (Fig 4-7b).

Operating the 3350F series electronic load in CP mode is ideal for testing the characteristics of a battery. This is because as the battery voltage drops the load current will automatically increase in order to keep the CP setting. By logging sink values against time the test engineer can also measure the battery’s energy capacity at various discharge rates.

The 3350F also features an adjustable Load OFF setting. This allows a voltage level to be set so that the electronic load automatically stops sinking power upon reaching this preset voltage. This can be used to ensure the battery is not subjected to a damaging deep discharge.

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

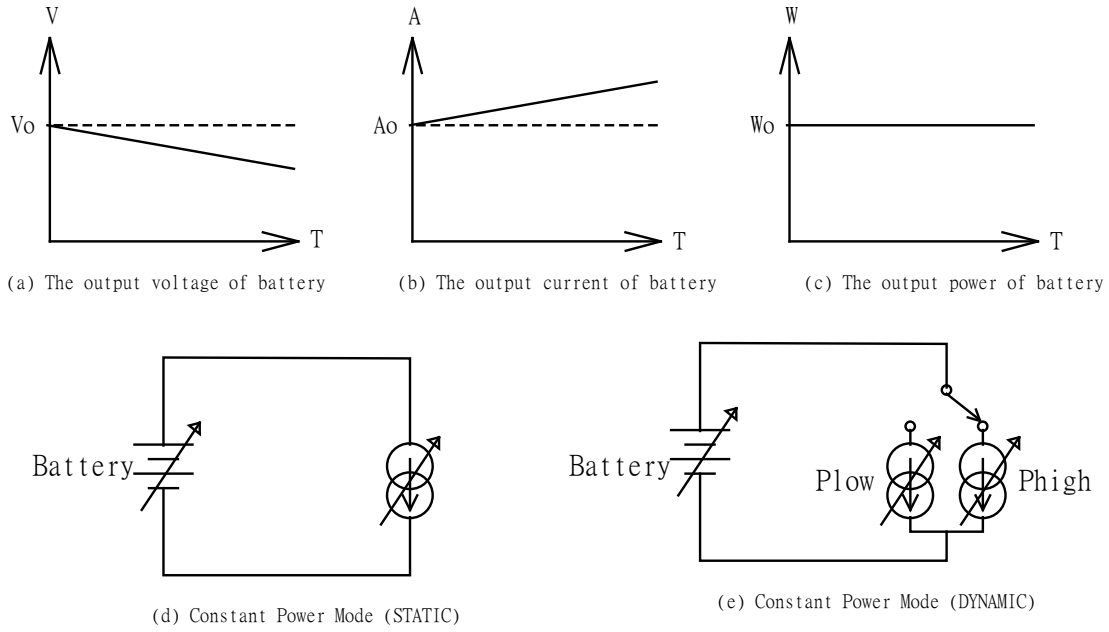
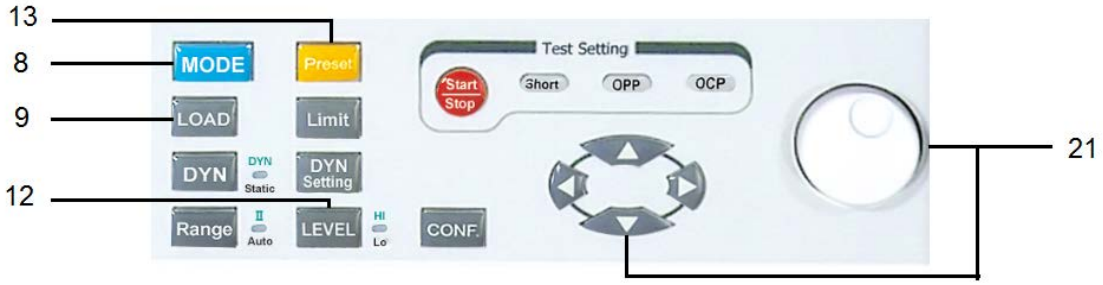


Fig 5-7 CONSTANT POWER MODE APPLICATION

5.6.2. CP Mode Operating Instructions



Example: PSU 5 V / 3 A, CC mode, Level HI 10.00W, Level 5.00W

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



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

5.6.2.2.1. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the right Display during Setting 10.00W.



5.6.2.2.2. Pressing the LEVEL key (12) LED once will illuminate, Select LEVEL Hi, Adjusted by the rotary knob and arrow key (21) can be read from the lower Display during Setting 5.00W.



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



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



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



5-7. Constant current source operation

The Electronic load can also be used as a high current constant current source if the following connection is made. This function can be used as a battery charger or other application. It can also combine two or more modules as one unit by parallel connection for higher current operation.

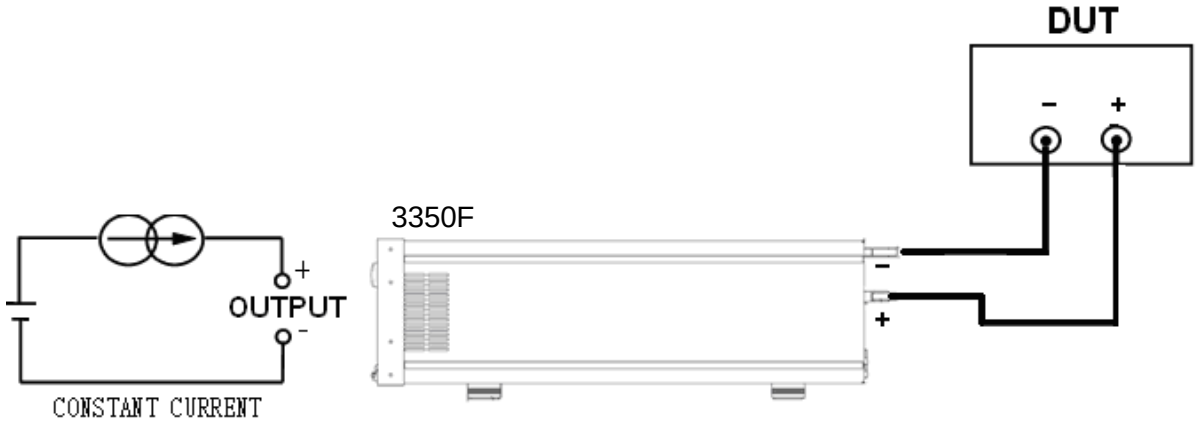
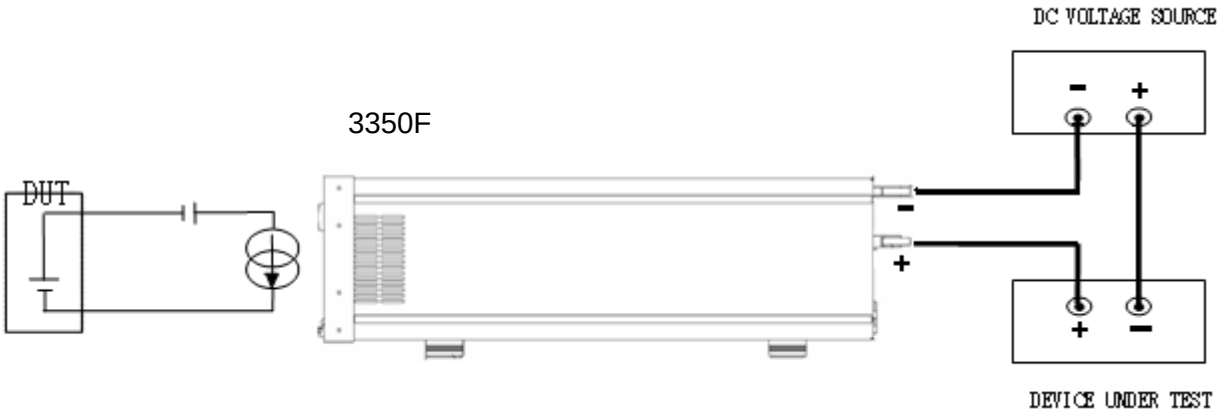


Fig 5-8 Constant current source connection

5-8. Zero-Volt loading application

As shown in Fig 5-8, the electronic load can be connected in series with a DC voltage source which output voltage greater than 5V. 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 5V operating voltage required by the Electronic load. This application is suitable for low voltage Battery cell with high discharge current testing.



5-9. Parallel operation

The following is a rule for a multiple output power supply connects to the 3350F series Electronic Loads.

Rule: The potential of positive input (Red binding post) must be higher than the potential of negative input (Black binding post) of 3350F series Electronic load.

Here is an example of outputs power supply connected to a 3350F series electronic load

Note: 1. the electronic load only may carry on the parallel operation under the fixed electric Current pattern.
2. The electronic load do not use under series connection.

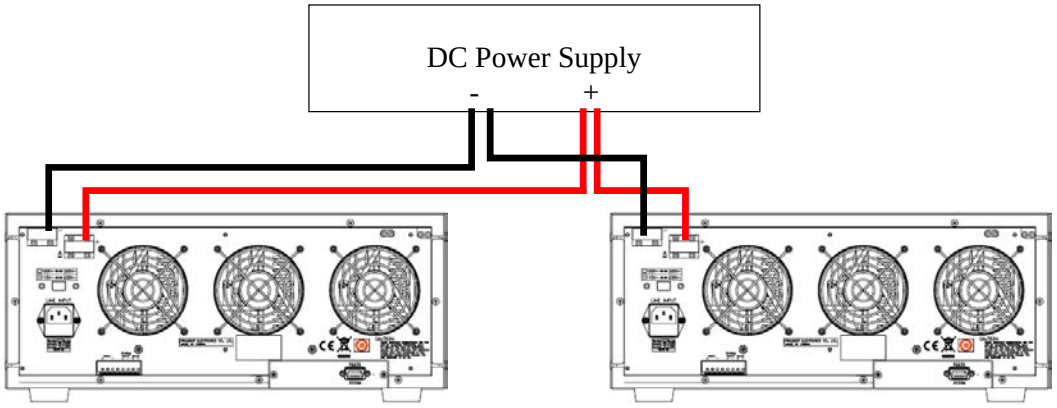


Fig 5-10 Parallel operation connection

5-10. Power Supply OCP testing

5.10.1 OCP Manual control

Example:

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



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



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



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



5.10.1.5. Setting step load current 0.01A, press OCP key to the next step.



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



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



5.10.1.8. Press START/STOP test key.



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



5.10.2 Remote control OCP

EX：

REMOTE	（Set Remote）
TCONFIG OCP	（Set OCP test）
OCP:START 3	（Set start load current 3A）
OCP:STEP 1	（Set step load current 1A）
OCP:STOP 5	（Set stop load current 5A）
VTH 0.6	（Set OCP VTH 0.6V）
IL 0	（Set current low limit 0A）
IH 5	（Set current high limit 5A）
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）

5-11. Power Supply OPP testing

5.11.1. OPP Manual control

Example:

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



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



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



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



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



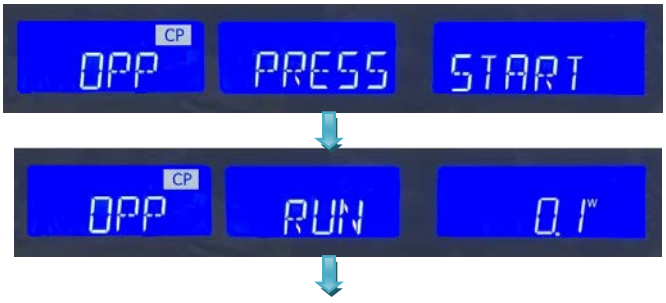
5.11.1.6. Press up key, set stop load watt 3.2W, press OPP key to the next step.



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



5.11.1.8. Press START/STOP Test key.





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



5.11.2. 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 0.6	（Set OPP VTH 0.6V）
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）

5-12. Power Supply SHORT testing

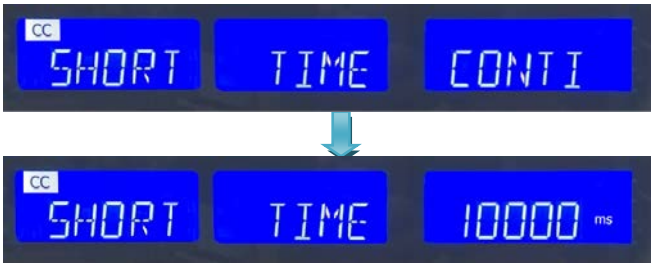
5.12.1. SHORT Manual control

Example:

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



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



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



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



5.12.1.5. Press START/STOP test key.



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



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



5.12.2. 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 3350F 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 3350F 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

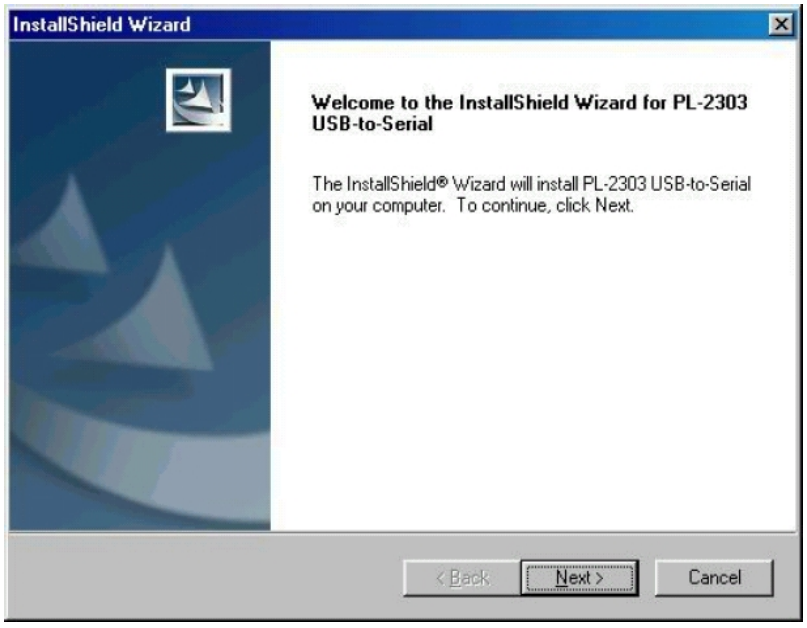
LOAD DECL.BAS using BASICA MERGE command.

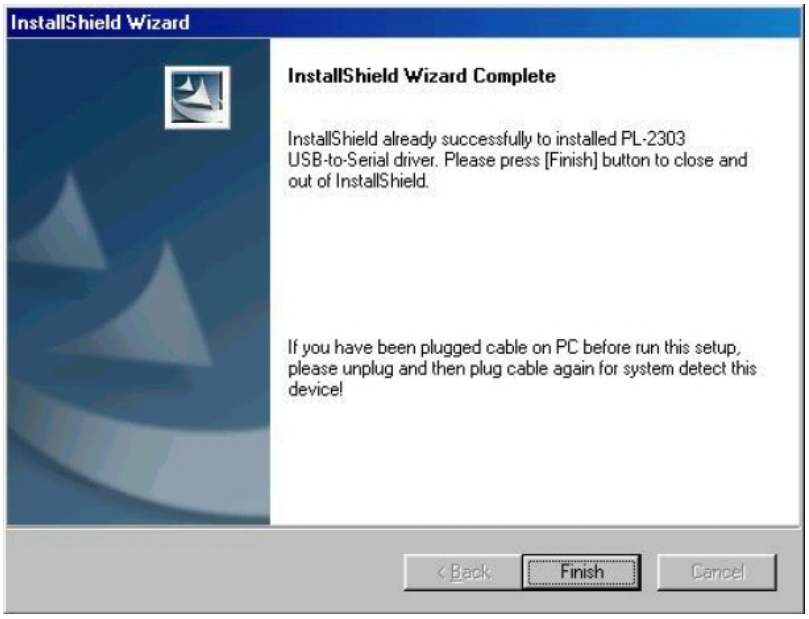
```
100 REM You must merge this code with DECL.BAS
105 REM
110 REM Assign a unique identifier to the device "dev5" and store it in variable load%.
125 REM
130     udname$ = "dev5"
140     CALL ibfind (udname$,load%)
145 REM
150 REM Check for error on ibfind call
155 REM
160     IF load% < 0 THEN GOTO 2000
165 REM
170 REM Clear the device
175 REM
180     CALL ibclr (load%)
185 REM
190 REM Get the 3350F series module load specification
195 REM
200     wrt$ = "NAME?" : CALL ibwrt(load%,wrt$)
210     rd$ = space$(20) : CALL ibrd(load%,rd$)
215 REM
220 REM Set the channel 1, preset off, current sink 1.0 amps and load on commands to the load.
225 REM
230     wrt$ = "chan 1;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
```

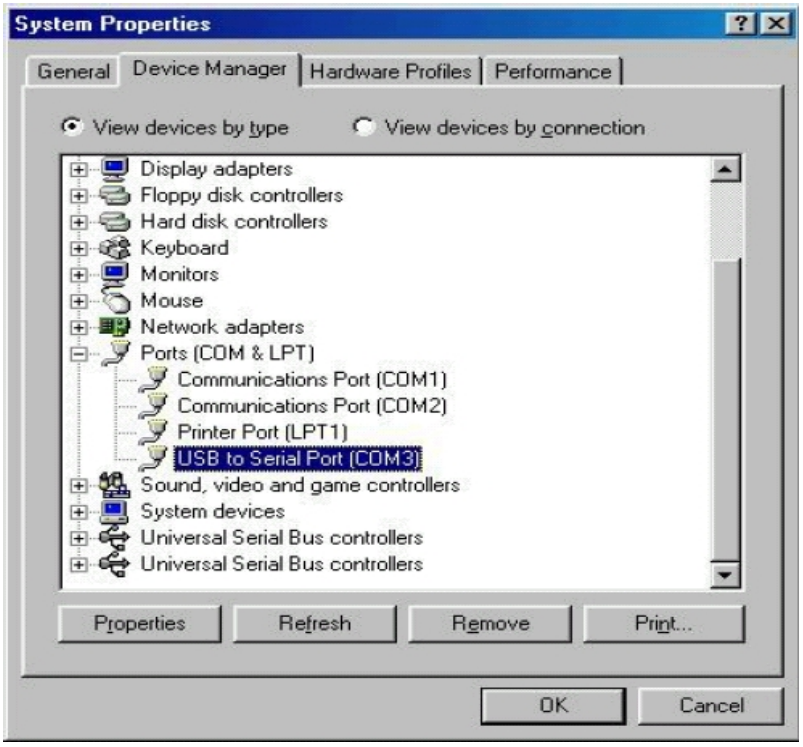
Appendix B 3350F USB Instruction

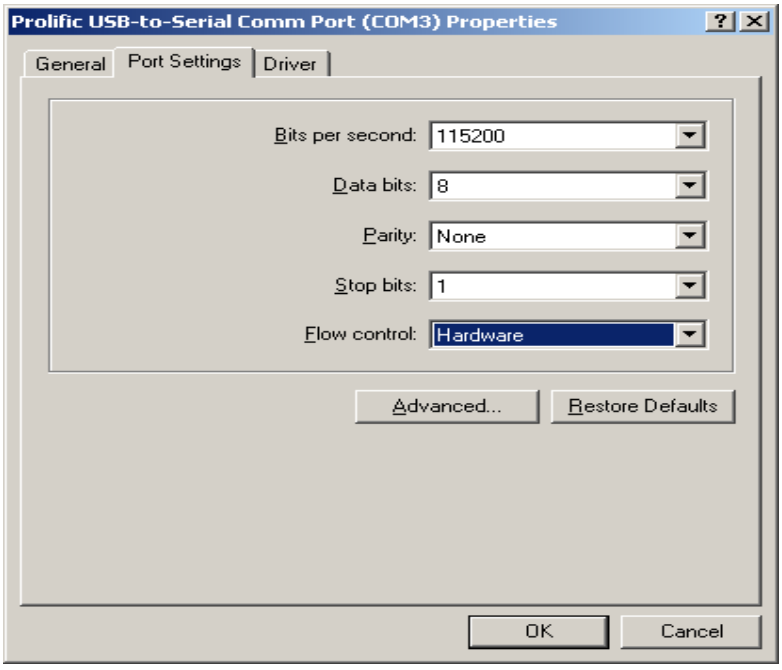
1.Install the USB DRIVER，select USB\SETUP\PL-2303 Driver Installer.exe





2. After the installation, connect the 3350F 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 3350F with COM3.





Appendix C 3350F LAN Instruction

1. Connecting AC power and the network line to the 3350F 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.

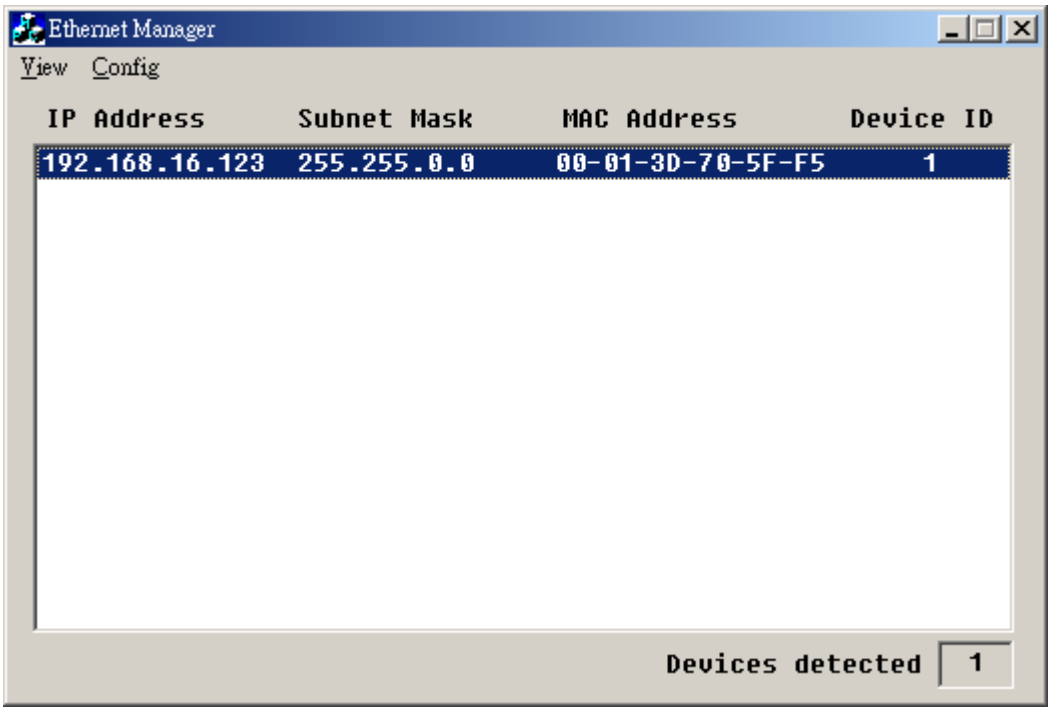
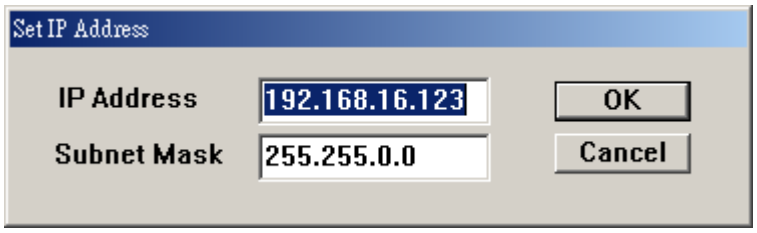


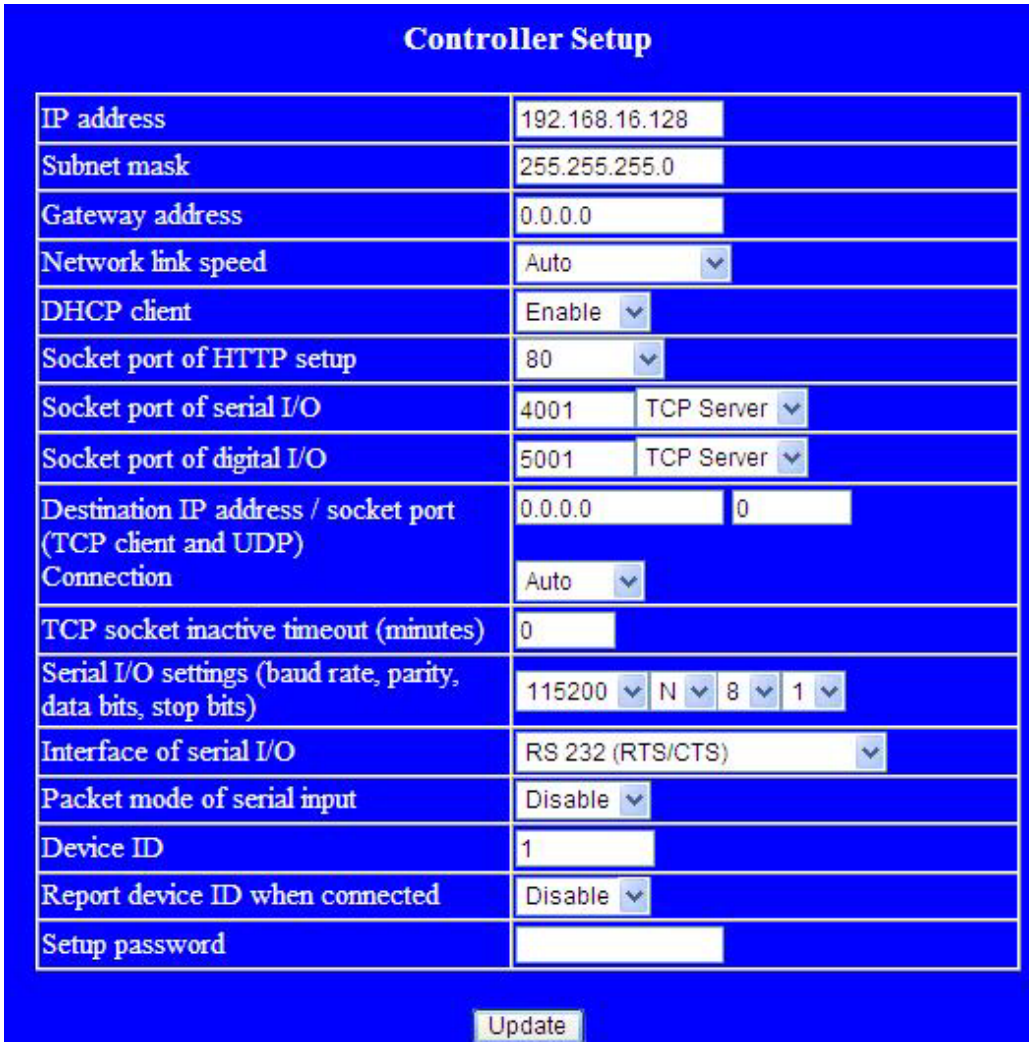
FIG D2-1

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 3350F 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 3350F 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 3350F 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 executes steps 1 to 8 on sequence.



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 3350F 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 time (initial).
15. Press STORE key to confirm the repeat count.

Testing Waveform

