

**3320 Series  
Plug-In Electronic  
Load Module  
Operation manual**

# 3320 series module load operation manual

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## Chapter 1 、 Introduction

The 3320 series Electronic Load module is designed to test, evaluation and burn-in of DC power supplies and batteries. The 3320 series Electronic Load module can only be operated on the 3301 Electronic Load mainframe. The power contour of 3320 is shown in Fig 1-1A, it has an input from 0-30A, 0-60V current and voltage operating range respectively. The power contour of 3321 and 3322 are shown in Fig 1-1B and 1-1C respectively. The Prodigit 3320 series plug-in Electronic load can be controlled locally at the front panel, at the 3301 mainframe, or via computer over the GPIB.

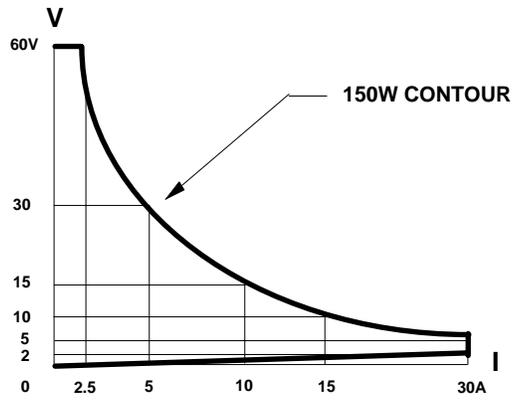


Fig 1-1 3320 OPERATING AREA

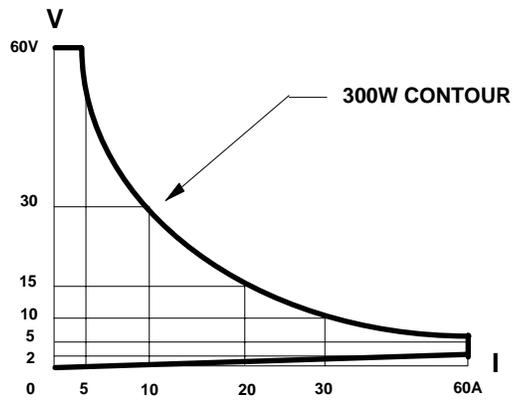


Fig 1-2 3321 OPERATING AREA

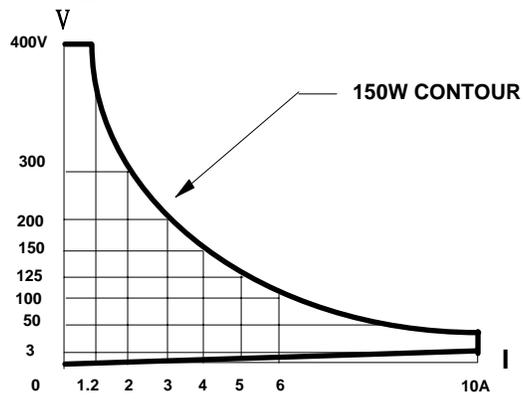


Fig 1-3 3322 OPERATING AREA

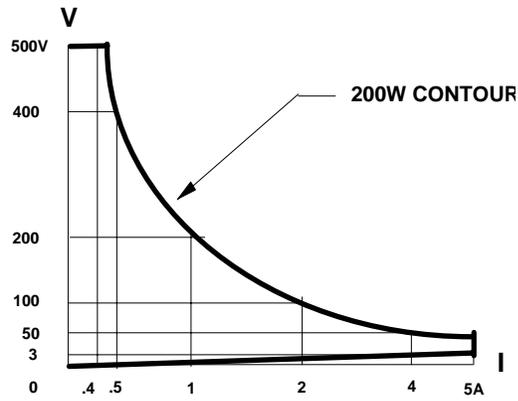


Fig 1-4 3323 OPERATING AREA

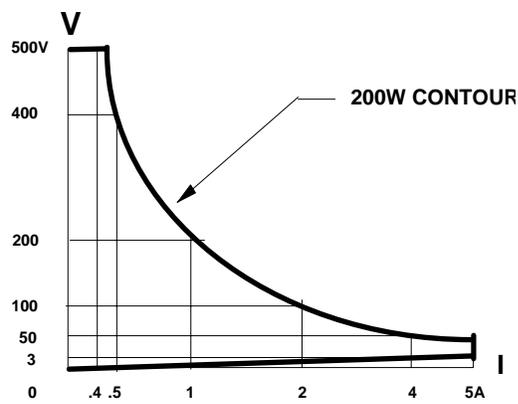


Fig 1-5 3324 OPERATING AREA

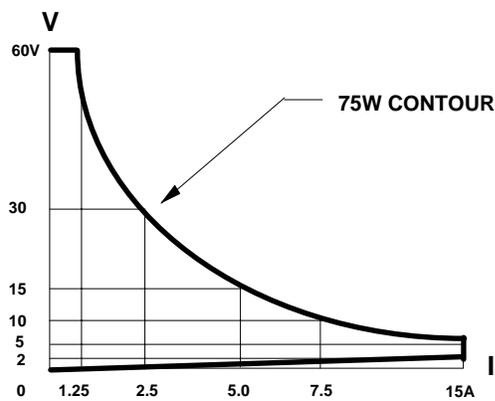


Fig 1-6 3325 OPERATING AREA

#### 4 PRODIGIT

With the operating mode of constant current, the 3320 Electronic load will sink a current in accordance with the programmed value regardless of the input voltage (see Fig 1-2), the load current level and load status can be set with Front panel on each module, six functions key on the mainframe or via GPIB command. (refer 3301 mainframe operation manual), it is called module operation, mainframe operation and GPIB remote operation respectively.

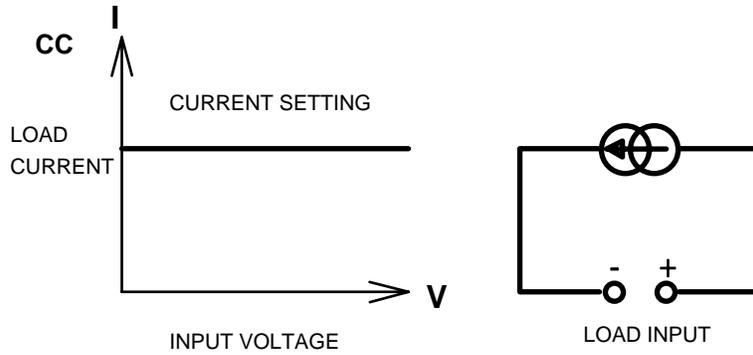


Fig 1-7 Constant Current mode

## 1-1.Features

- 1.Flexible configuration of plug-in Electronic Load module and mainframe.
- 2.GPIB control of Load current and Load status.
- 3.Dual high accuracy & resolution 4 1/2 digit voltage and current meter.
- 4.Easy operation and high testing speed, Five non-volatile user-definable store/recall states are easily controlled by six function keys on the mainframe.
- 5.controllable load current slew rate of load level change, load ON/OFF switch change, and power supply turn on.
- 6.Short circuit current measurement capability, low short resistance and reliable short circuitry is implemented by turn on Power MOSFET and heavy duty relay.
- 7.Automatic voltage sense capability.
- 8.Full protection from overpower, over temperature, over voltage, and reverse polarity.
- 9.Can be paralleled to get more load current and power rating.

## 1-2.Accessories

- |   |      |
|---|------|
| 1.Vsense cable: BNC-CLIP (1M)                         | 1PC  |
| 2.Binding Post Plug (Black)                           | 1PC  |
| Binding Post Plug (Red)                               | 1PC  |
| 3.HOOK terminal                                       | 2PCS |
| 4. 3320 series load module operation manual           | 1PC  |
| 5.High Voltage Vsense Cable: BNC-CLIP 1M (3312, 3314) | 1PC  |

**1-3.Specifications**

MODEL		3320		3321		3322	
MAX. POWER		150W		300W		300W	
MAX. CURRENT		30A		60A		10A	
OPERATING VOLTAGE		60V		60V		250V	
OVER POWER PROTECTION		157.5W		315W		315W	
OVER VOLT. OPERATING		63V		63V		262.5V	
OVER TEMP. PROTECTION		85°C		85°C		85°C	
	RANGE	0 - 3A	0 - 30A	0 - 6A	0 - 60A	0 - 1A	0 - 10A
CC MODE	RESOLUTION	0.75mA	7.5mA	1.5mA	15mA	0.25mA	2.5mA
	ACCURACY	± (0.2% OF SETTING + 0.2% OF RANGE)					
SLEW RATE	FAST	50mA/uS	500mA/uS	0.1A/uS	1A/uS	160mA/uS	16mA/uS
(mA/uS)	MID	30mA/uS	300mA/uS	60mA/uS	600mA/uS	10mA/uS	100mA/uS
	SLOW	10mA/uS	100mA/uS	20mA/uS	200mA/uS	3.3mA/uS	33mA/uS
TSEE NOTE 1	ACCURACY	± 10% OF SETTING					
	NOISE ( rms )	2mA		4mA		1mA	
VOLTAGE	RANGE	±19.999V	±60.00V	±19.999V	±60.00V	±199.99V	±250.0V
READBACK	RESOLUTION	0.001V	0.01V	0.001V	0.01V	0.001V	0.01V
( V METER )	ACCURACY	± (0.05% OF READING + 2 COUNT)					
CURRENT	RANGE	±30.00A		±60.00A		±10.000A	
READBACK	RESOLUTION	0.01A		0.01A		0.001A	
( A METER )	ACCURACY	± (0.2% OF READING + 2 COUNT)					
MAX. SHORT RESISTANCE		0.03Ω		0.04Ω		0.04Ω	
CURRENT MONITOR OUTPUT		3A/V		6A/V		1A/V	
	ACCURACY	± (2% +5mA)		± (2% +10mA)		± (2% +2mA)	
MAX. POWER CONSUMPTION		13W					
WEIGHT		NET : 3.5Kg					

Table 1-1 Specifications

MODEL		3323		3324		3325	
MAX. POWER		150W		200W		75W	
MAX. CURRENT		10A		5A		15A	
OPERATING VOLTAGE		400V		500V		60V	
OVER POWER PROTECTION		157.5W		212.5W		78.75W	
OVER VOLT. PROTECTION		420V		525V		63V	
OVER TEMP. PROTECTION		85°C		85°C		85°C	
CC MODE	RANGE	0 - 1A	0 - 10A	0 - 0.5A	0 - 5A	0 - 1.5A	0 - 15A
	RESOLUTION	0.25mA	2.5mA	0.125mA	12.5mA	0.375mA	3.75mA
	ACCURACY	± (0.2% OF SETTING + 0.2% OF RANGE)					
SLEW RATE (mA/uS)	FAST	16mA/uS	160mA/uS	10mA/uS	0.1A/uS	30mA/uS	0.3A/uS
	MID	10mA/uS	100mA/uS	60mA/uS	600mA/uS	10mA/uS	100mA/uS
	SLOW	3.3mA/uS	33mA/uS	0.83mA/uS	8.33mA/uS	2.5mA/uS	25mA/uS
TSEE NOTE 1	ACCURACY	± 10% OF SETTING					
NOISE ( rms )		1mA		4mA		1mA	
VOLTAGE READBACK ( V METER )	RANGE	±199.99V	±400.0V	±199.99V	±500.0V	±19.999V	±60.0V
	RESOLUTION	0.01V	0.1V	0.01V	0.01V	0.001V	0.01V
	ACCURACY	± (0.05% OF READING + 2 COUNT)					
CURRENT READBACK ( A METER )	RANGE	±10.00A		±5.00A		±15.000A	
	RESOLUTION	0.001A		0.01A		0.001A	
	ACCURACY	± (0.2% OF READING + 2 COUNT)					
MAX. SHORT RESISTANCE		1Ω		1Ω		0.08Ω	
CURRENT MONITOR OUTPUT		1A/V		5A/V		15A/V	
ACCURACY		± (2% + 2mA)		± (2% + 2mA)		± (2% + 5mA)	
MAX. POWER CONSUMPTION		13W					
WEIGHT		NET : 3.5Kg					

Table 1-1 Specifications

**Note:**

3 slew rate selectable on front panel, each slew rate can be by one of four slew rate value internally. More slew rate information see the operation manual.



## Chapter 2 · Installation

This chapter discusses the installation and removal of 3320 series Electronic load module and 3301 mainframe, the 3320 series load module does not need any adjustment after plug in the 3320 series load module to any channel of the 3301 mainframe.

This chapter describes the method of load current slew rate setting with DIP switch and power line frequency setting with DIP switch. This chapter also shows how to adjust the load ON voltage which is set by Trimmer VR7, these DIP switch and Trimmer are located inside the 3320 series load module.

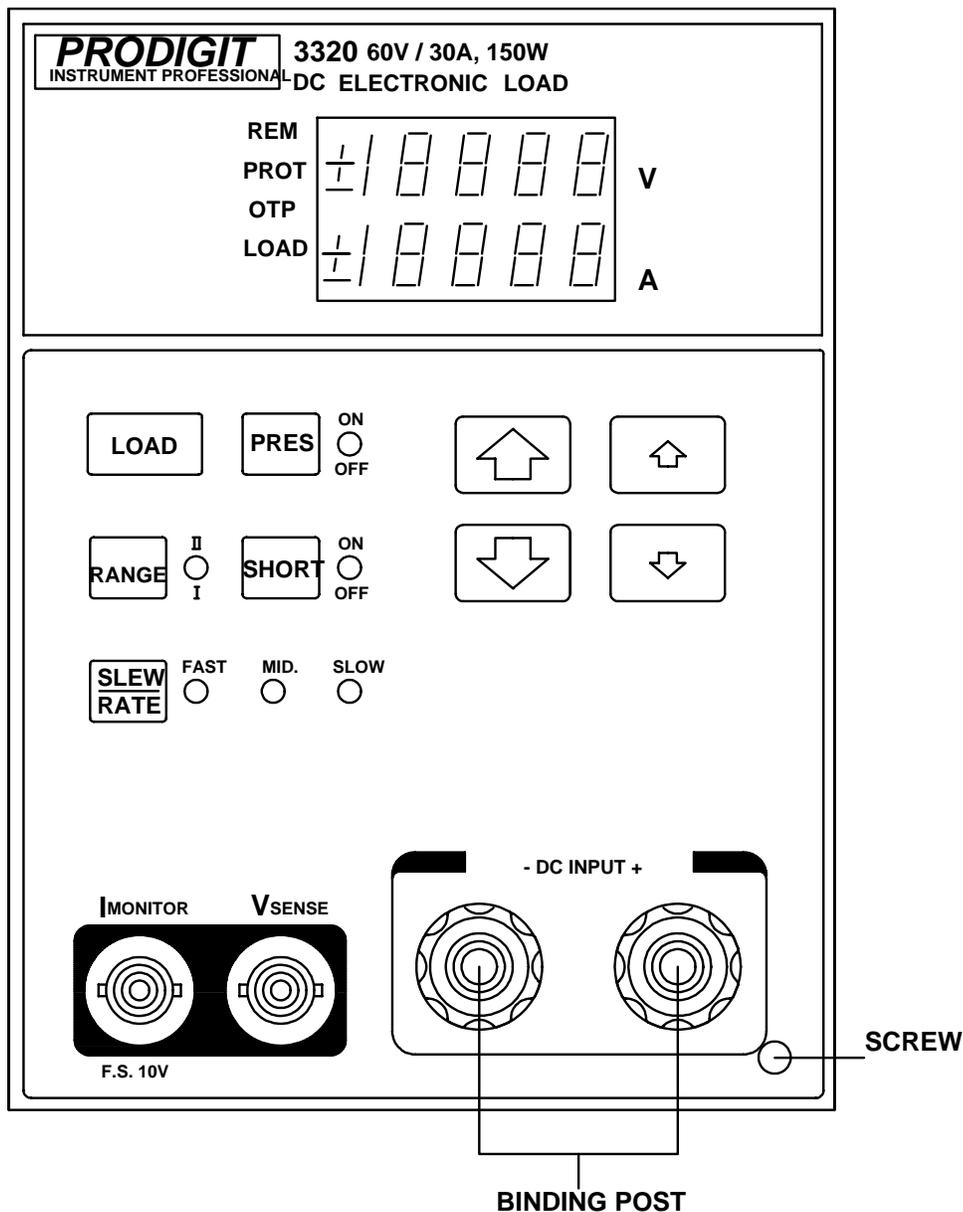


Fig 2-1 Binding post and screw on the front panel of 3320 series plug-in load module

## 2-1. Installation and Removal of 3320 series plug in module

Unless the 3301 mainframe and 3320 series Electronic load module were purchased separately, the 3320 series Electronic load module should be installed in the 3301 mainframe before Shipment from Prodigit.

The 3320 series Electronic load module operates in 3301 mainframe only, and can not be operated in 3300 mainframe. When you want to install or remove the 3320 series load module in or out from the 3301 mainframe for configuration or reconfiguration purpose, please follow the procedures which are listed below.

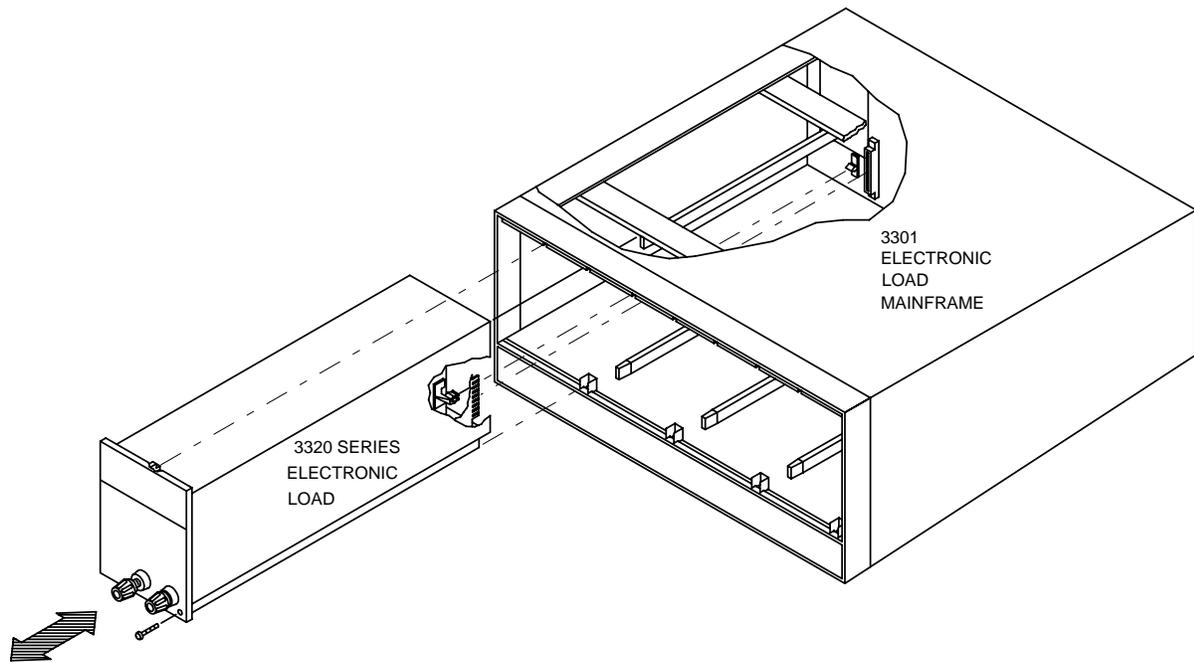


Fig 2-2 Plug-in installation and removal

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#### Installation of 3320 series plug-in load

1. Turn the 3301 mainframe power off before inserting the 3320 series load module, or damage may occur to the plug-in module circuitry.
2. Align the upper and lower grooves of the 3301 mainframe with the upper and lower guides of the selected compartment.
3. Push the 3320 series load module in and press firmly on the binding posts of the front panel to seat the circuit board in the interconnecting jack.
4. Fasten the screw on the lower and right hand side corner of the 3320 series front panel with screw driver, the screw location is shown on Fig 2-1.
5. Turn the 3301 mainframe power on until all of the Electronic modules are completely installed.

#### Removal of 3320 series plug-in load

1. Turn the 3301 mainframe power off first; Otherwise, damage may occur to the plug-in circuitry.
2. Loosen the screw on the front panel of 3320 series with screw driver.
3. Turn the adjustment knob of the black binding post counter clockwise until the adjustment knob is fully move out; then pull on the black adjustment knob of binding post until the interconnecting jack disengages and 3320 series load module will slide out.

## 2-2. Load current slew rate setting.

What is the load current slew rate during load current level change?, at the moment of power supply turn ON?, and LOAD ON/OFF switch between ON and OFF? The 3320 series Electronic load module provides all of the above load current slew rate in controllable condition, there are three different load current slew rate can be selected on the front panel of 3320 series load module, FAST, MID and SLOW indicate by LED indicator respectively, and each slew rate setting can be selected respectively by DIP witch inside the load module to choose one of four different slew rate, below of this section shows how to select and set the appropriate load current slew rate inside the 3320 series load module.

In the application of load level change or switching between Load ON and Load OFF to adjust the Course/Fine Increment/Decrement key or 5 recall function keys on the mainframe. The load current raising or failing slew rate is according the slew rate setting.

This controllable load current slew rate feature can eliminate the overshoot current phenomenon and emulate the acture load current slew rate at turn on the power supply under test. Fig 2-3 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 precess as well as efficiency.

There are two load current range in 3320 series Load module, Range I and Range II, the slew rate Of range I, range II, FAST/MID/SLOW are listed in chapter 1-3 "specifications", and the slew rate of range I, range I, FAST/MID/SLOW, and DIP switch setting of each slow rate are shown in Table 2-1, the Fig 2-4 shows the location of DIP switch SW1.

	SLEW RATE	FAST				MIDDLE				SLOW			
		NO.1,2				NO.3,4				NO.5,6			
		11	10	01	00	11	10	01	00	11	10	01	00
3320	RANGE I	60	55	50	45	40	35	30	25	20	15	10	5
	RANGE II	600	550	500	450	400	350	300	250	200	150	100	50
3321	RANGE I	120	110	100	90	80	70	60	50	40	30	20	10
	RANGE II	1200	1100	1000	900	800	700	600	500	400	300	200	100
3322	RANGE I	20	18	16	15	13	11	10	8.3	6.6	5	3.3	1.6
	RANGE II	200	180	160	150	130	110	100	83	66	50	33	16
3323	RANGE I	20	18	16	15	13	11	10	8.3	6.6	5	3.3	1.6
	RANGE II	200	180	160	150	130	110	100	83	66	50	33	16

TABLE 2-1

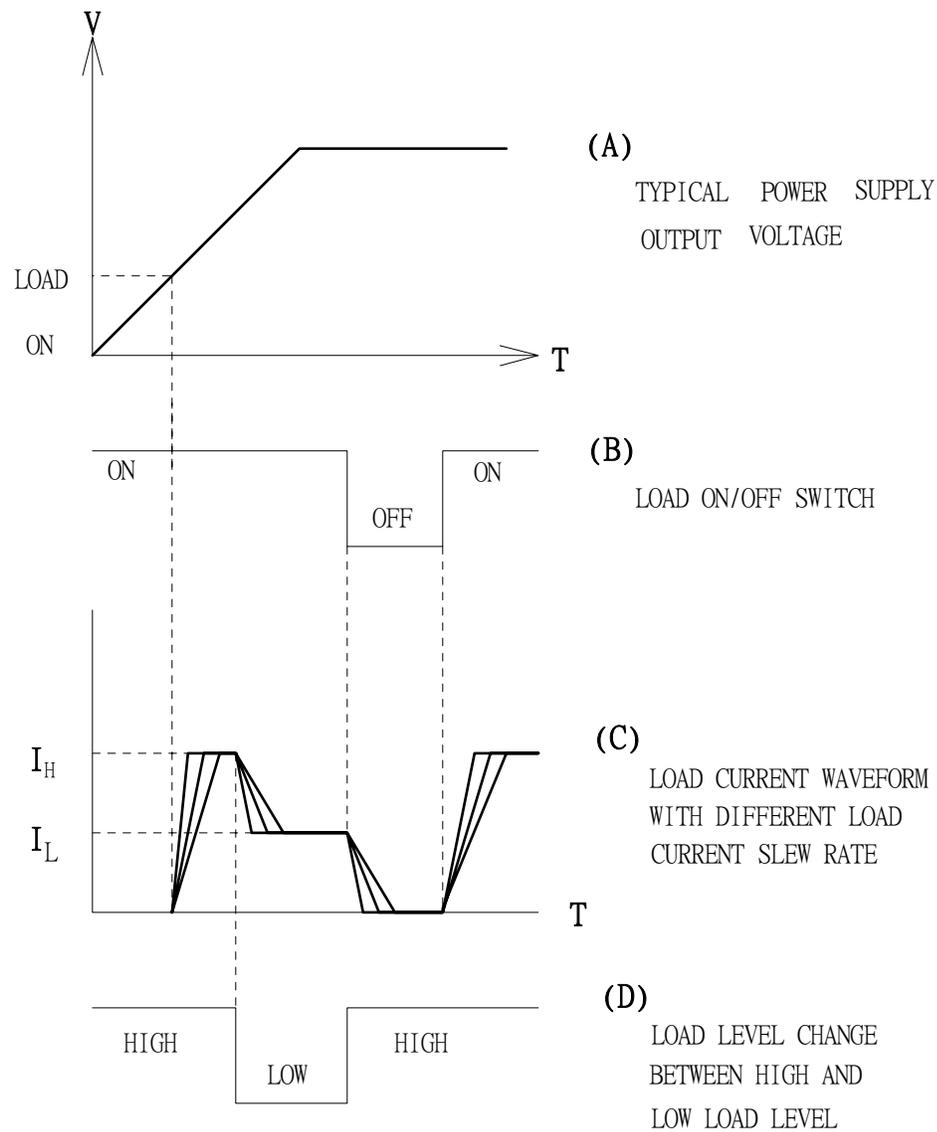


Fig 2-3 the relationship of load current, Load ON/OFF, Load level and output voltage of dc power supply at turn on

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In the application of necessary to change the slew rate please follow the procedures that are listed below.

1. Please follow the removal procedure (chapter 2-1) to remove the Electronic Load module.
2. On the upper and lower of the right hand side of the Electronic Load module, there are three screws respectively, please remove the screws and then remove the right hand side Aluminum plate. (see Fig 2-4)
3. After remove the screws and Aluminum plate, turn the right hand side of the load module to the up position, now you can see there is a 8 switches of DIP switch (SW1) On the PCB, the DIP switch is shown in Fig 2-4.
4. The factory switch setting of SW 1/2, SW 3/4, and SW 5/6 are in 01 switch status. For example, the 3320 load module's slew rates in range I are 50, 30, and 10 mA/us for FAST, MID, and SLOW slew rate respectively, and the slew rates in range II are 500, 300 and 100 mA/us for FAST, MID, and SLOW slew rate respectively.

The method of slew rate switch setting is to put the specific DIP switch to "ON" position means "1", otherwise the specific DIP switch is in "0" position.

\* Example 1 3320 load module:

In the application of 60/600 mA/us in range I/II load current slew rate respectively. Then turn the DIP switch 1 and 2 to "ON" position. This means "11" in Table 2-1, after the DIP switch setting is finished.

When you select the "FAST" slew rate position on the front panel, the slew rate is 60/600 mA/us in range I/II respectively.

\* Example 2 3320 load module:

In the application of 35/350 mA/us slew rate, then turn the DIP switch "3" to "ON" position and DIP switch "4" to "OFF" position. After the DIP switch setting is finished, when you select "MID" slew rate position on the front panel, the slew rate is 35/350 mA/us in range I/II respectively.

5. After all of the slew rate DIP switch setting is finished, please follow the reverse procedure 1 and 2 of this section to install the load module into the 3301 mainframe.

## 2-3.The power line frequency 50/60 Hz setting

For the high accuracy 4 1/2 digit voltage and current meter are using dual slope integrate theory to measure the analogue voltage and current signal, the accuracy of the dual slope integrate meter is the best when the integration cycle is synchronized with the power line frequency. (The input line voltage and line frequency of 3301 mainframe) There are two power line frequency can be selected, 50Hz or 60Hz.

The factory setting of power line frequency depends on the purchasing area of your country, and the power line frequency is indicated on the top cover of the load module. In the case of changing power line frequency, from 50Hz or 60Hz, or from 60Hz to 50Hz, please follow the procedures that are listed below:

- 1.As the same DIP switch is used for slew rate setting and power line frequency setting, so precedes the procedure 1, 2 and 3 of chapter 2-2.
- 2.50Hz power line frequency setting: set switch 7 to "OFF" position and switch 8 to "ON" position. 60Hz power line frequency setting: set switch 7 to "ON" position and switch 8 to "OFF" position.
- 3.After the power line frequency setting is finished, please follow the reverse procedure to reinstall the load module into the 3310 mainframe.

## 2-4. Load ON voltage adjustment

The factory set "Load ON" voltage is 1 volt (typical) for 3320 and 3321, and 3V (typical) for 3322, the 3320 series Electronic load module starts to sink current from power supply until the input voltage of 3320 series Electronic Load module over the "Load ON" voltage.

The controllable load current slew rate is triggered by the load ON comparator signal. The adjustable "Load ON" voltage is ranged from 0V to 3V, (TYP.) for 3320 and 3321, and 0V-5V (TYP.) for 3322 and is set by VR9 on the PCB, the location of VR9 is shown on Fig 2-4, the adjust procedure is listed below:

1. As the load ON voltage setting trimmer is located with the same PCB of slew rate and power line frequency setting DIP switch, so proceeds the procedure 1, 2 and 3 of chapter 2-2.
2. Remove the 3301 mainframe's right hand side Aluminum plate by loosen its screw on the rear panel.
3. Put the 3320 series Electronic load module which load ON voltage to be adjusted into the most right hand side of 3301 mainframe, (the load ON voltage setting trimmer VR9 can be adjusted here during the power of 3301 mainframe is turned ON.)
4. Using screw-driver to set the VR9 to the most clockwise position. ( Maximum load ON voltage ). then connects the power source to the DC Load input of 3320 series module, adjust the DC output voltage to the required Load ON voltage.
5. Set Load ON/OFF key to ON state, the "load" LED annunciator should be ON the front panel, and set the load current to 1 Amp by using Preset key, set the Preset off again after the load current is set.
6. Adjust the load ON voltage setting trimmer VR9 counter clockwise very slowly and stop immediately until the load start to sink current from power source. The load ON voltage setting is finished in this procedure.
7. Using the reverse procedure to reinstall the 3320 series Electronic load module.

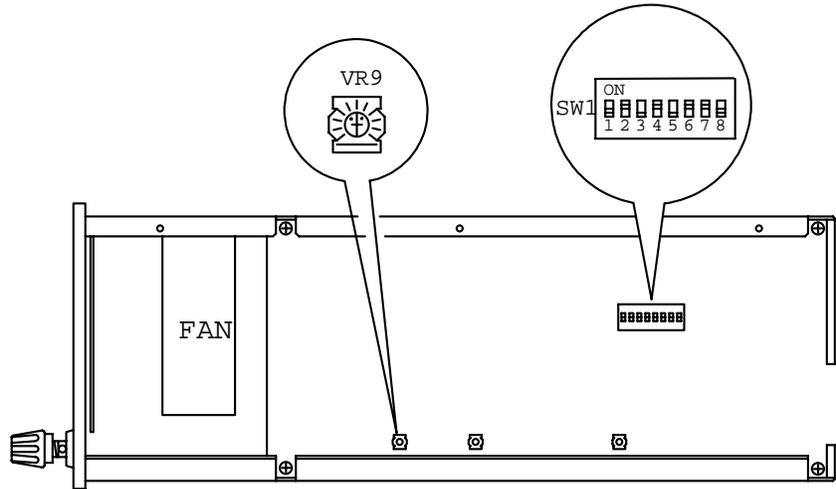
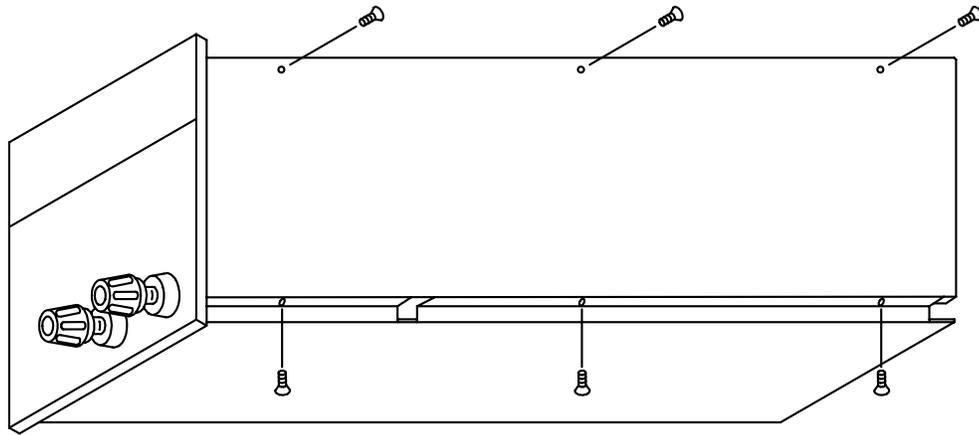


Fig 2-4 Location of Load on LED and Load ON voltage setting trimmer VR9 and LED1

## Chapter 3 · Operation

### 3-1. Front panel description

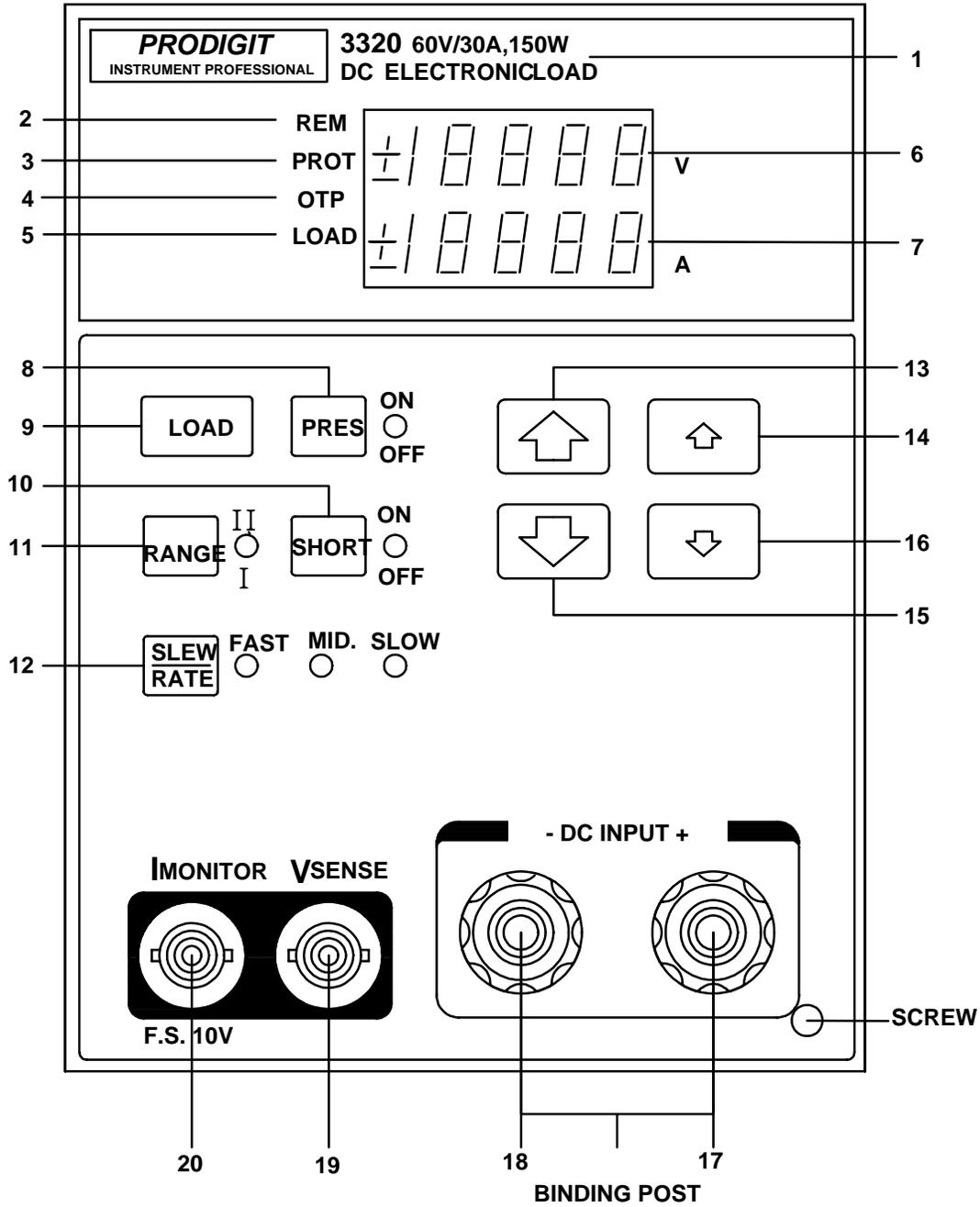


Fig 3-1 Front panel description

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1.3320 60V/30A, 150W  
DC ELECTRONIC LOAD

It indicates the model number and specifications of 3320 series Electronic Load.

2.REM LED annunciator The REM LED annunciator is used to indicate the status of remote operation, all front panel operation can not be operated while REM annunciator is ON, in case of local or manual operation, the REM LED annunciator is OFF.

3.PROT LED annunciator The PROT LED annunciator is used to indicate the abnormal condition is generated, it could be one of Over voltage. Over power or Over Temperature protection. The 3320 series Electronic load will turn itself in "LOAD OFF" status whenever any protection action is occurred. In the normal operation of no protection action the LED annunciator should be OFF.

4.OTP LED annunciator

The Over Temperature LED annunciator indicates the heat sink temperature of 3320 series electronic load is higher than about 85 degree, and cause the over Temperature sensor works, the 3320 series Electronic load is turning OFF immediately.

The PROT LED annunciator will be lit also. After the heat sink temperature of 3320 series Electronic load module lower than about 65 degree, the Over Temperature sensor will turn off, the Electronic load module start to work again.

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

#### 5. LOAD LED annunciator

The Load ON LED annunciator indicates the 3320 series Electronic load is ready to sink current from DC input. LOAD LED annunciator is ON and OFF by toggled the LOAD ON/OFF key.

#### 6.4 1/2 Digit Voltage Meter

The 4 1/2 Digit Voltage Meter displays the voltage of DC input terminal or Vsense BNC input. The 3320 series Electronic load has an auto-sense circuit, it can determine the Vsense cable is connected or not, the Vsense BNC input is detected if it is greater than 1V (3320, 3321) or 3V (3322), if yes then the 4 1/2 DVM measures the Vsense BNC input, otherwise, the 4 1/2 DVM measures the DC input terminals of the load module. There are two measuring range in the 4 1/2 DVM, the range control is selected automatically, please see chapter 1-3 for detail resolution and range for each module.

#### 7.4 1/2 Digit Current Meter

The 4 1/2 Digit Current Meter displays the current of actual load current, actual short circuit current or Preset load current. In Preset OFF condition, the 4 1/2 DCM measures the actual load current when short ON/OFF status is OFF, and measures the short circuit current when the short ON/OFF status is ON.

In Preset ON condition, the 4 1/2 DCM indicates the setting load current either from front panel setting or remote system setting.

#### 8. PRES ON/OFF key and LED annunciator

The LED annunciator is toggled by PRES (Preset) key to indicate the 4 1/2 DCM and Imonitor BNC output are in Preset status or actual load current condition.

#### 9. LOAD ON/OFF key

The LOAD LED annunciator (describe in item 5 of this section) is toggled by LOAD ON/OFF key to indicate the load module is ready to sink current from DC input or not.

Note: The 3320 series Electronic load module will continue sink current from power supply for about 0.5 second at following condition.

##### a. Load ON/OFF key:

Switch load on to load OFF in the load module, the fall slew rate is according the slew rate setting on the second period at the moment of switch from load ON to load OFF.

##### b. DC input voltage:

There is a load on control circuit in 3320 series Electronic load. The comparator is a hysteresis comparator. When the Device Under Test turns OFF, the output voltage of D.U.T will decrease down to 0 volt.

The 3320 series Electronic load will continue sink current for more 0.5 second after the load input voltage below the load OFF threshold voltage, the typical load OFF threshold voltage for model 3320, 3321 load module is 0.1V and for 3322 load module is 0.2V.

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10.SHORT ON/OFF key and LED annunciator

The short circuit of DC input terminal is toggled the short ON/OFF key to ON to status, the LED annunciator is lit also in short ON status.

The low short resistance is implemented by drives the Power MOSFET fully "ON" first and then the heavy duty high current relay "ON" later, this procedure ensures the life cycle of 3320 series electronic load module's heavy duty high current relay can be much higher.

The short circuit current can also be display on the 4 1/2 DCM as well as Imonitor BNC analogue signal output.

11.Range II/I key and LED annunciator

Range II indicated high load current operating range, in this range, the Range II LED annunciator is ON.

Range I indicated low load current operating range, the detail range II/I load current specifications is listed on the Table 1-1.

12.SLEW RATE KEY and SLOW / MID/ FAST annunciators

The load current slew rate SLOW / MIDDLE / FAST is selecting by push the SLEW RATE KEY sequencely, the SLOW / MID / FAST LED annunciator is ON to indicate the selected slew rate. The detail slew rate application and setting is described in chapter 2-2. Please refer chapter 2-2 for more detail information.

13.Load current course increase adjustment key.

14.Load current fine increase adjustment key.

15.Load current course decrease adjustment key.

16.Load current fine decrease adjustment key.

Please see Table 3-1 for detail step resolution of each range and each 3320 series load module.

**Note:**

*The adjustment range of range I is 1/10 of range II, so, in the case of switching the range switch from range II to range I, if the current level setting is higher than the maximum current range of range I, the current level setting value will be limited to the maximum value of range I.*

17.+ DC INPUT Binding Post.

18.- DC INPUT Binding Post.

The positive and negative terminal of load input connector. Please take care the voltage and current rating not to exceed the maximum rating of each 3320 series load module. Please check the polarity of DC input connection also before testing.

19.Vsense BNC

To measure the specific voltage points through the Vsense BNC-CLIP cable, refer section 4-1,4-2 for detail application information.

20.Imonitor

In Preset OFF status, the analogue signal is proportional to the load current flow through the Electronic load module. In Preset ON status, the analogue signal is also proportional to the load current setting value which is set by front panel, mainframe, or system. Please refer chapter 1 Table 1-3 for voltage / current relationship of each 3320 series module.

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## 3-2. Input binding post and wire consideration

The five ways binding posts (+ and -) connect the input wires to the Electronic load the connection methods are made as follow:

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.

2. Hook terminals:

The hook 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. Insert the wire into the binding post:

This is the most easy way to connect the load input and D.U.T. The maximum wire gage AWG14 can be used in this application.

4. Both plug connectors and Hook terminals:

It is recommended to use when input current is greater than 20A or long lead wires.

5. Both plug connectors and Insert the wire into the binding post. 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 required to prevent overheating and to maintain good should be large enough to limit the voltage drop to less than 0.5V per lead.

### 3-3. Load current course/fine increase/decrease adjustment key

The maximum load current level can be adjusted up to 30.71A, 61.42A, and 10.24A for 3320, 3321 and 3322 plug-in Electronic load module respectively. The load current step change or resolution is shown on Table 3-1 for each load module.

3320		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		3 A		30 A	
CURRENT METER	RANGE	±30.00 A			
	RESOLUTION	0.01 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		30 mA	3 mA	300 mA	30 mA

3321		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		6 A		60 A	
CURRENT METER	RANGE	±60.00A			
	RESOLUTION	0.01 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		60 mA	6 mA	600 mA	60 mA

3322		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		1 A		10 A	
CURRENT METER	RANGE	±10.00A			
	RESOLUTION	0.001 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		10 mA	1 mA	100 mA	10 mA

3323		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		1 A		10 A	
CURRENT METER	RANGE	±10.00A			
	RESOLUTION	0.001 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		10 mA	1 mA	100 mA	10 mA

3324		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		0.5 A		5 A	
CURRENT METER	RANGE	±5.000 A			
	RESOLUTION	0.001 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		5 mA	0.5 mA	50 mA	5 mA

3325		RANGE I		RANGE II	
FULL SCALE LOAD CURRENT		1.5 A		15 A	
CURRENT METER	RANGE	±15.000 A			
	RESOLUTION	0.001 A			
COURSE/FINE LOAD CURRENT ADJUSTMENT KEY		↑	↑	↑	↑
KEY'S STEP RESOLUTION		15 mA	1.5 mA	150 mA	15 mA

Table 3-1 the resolution of range I/II vs. course/Fine Load current setting Key

After press the one of four load current adjustment key more than 1 second, the operating mode of the key become increase or decrease the load current resolution every 10ms repeatedly, and the load current will stop the load current change until releasing the press key or the load current setting is reaching the minimum or maximum setting.

### 3-4. Imonitor BNC

The Imonitor BNC is designed to monitor the Electronic load's input current. 0V to 10V full scale signal indicates the zero-to each Electronic load module.

### 3-5. Operating flow chart for each load module operating

The following flow chart shows the typical load current level and status setting procedures of each load module.

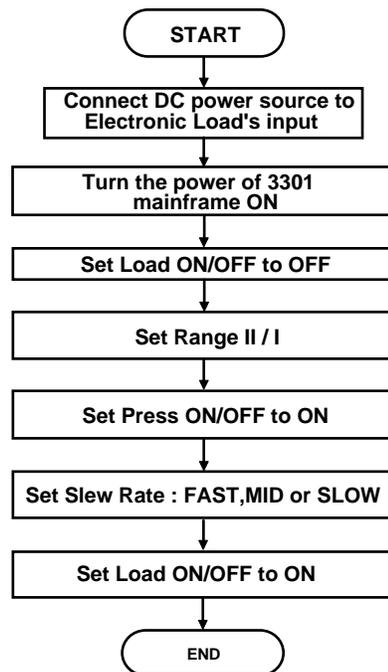


Fig 3-2. flow chart of 3320 series front panel operation.

### 3-6. Operating flow chart for mainframe operation

The following flow chart shows the typical 5 store/recall operation procedures in the load module and mainframe application.

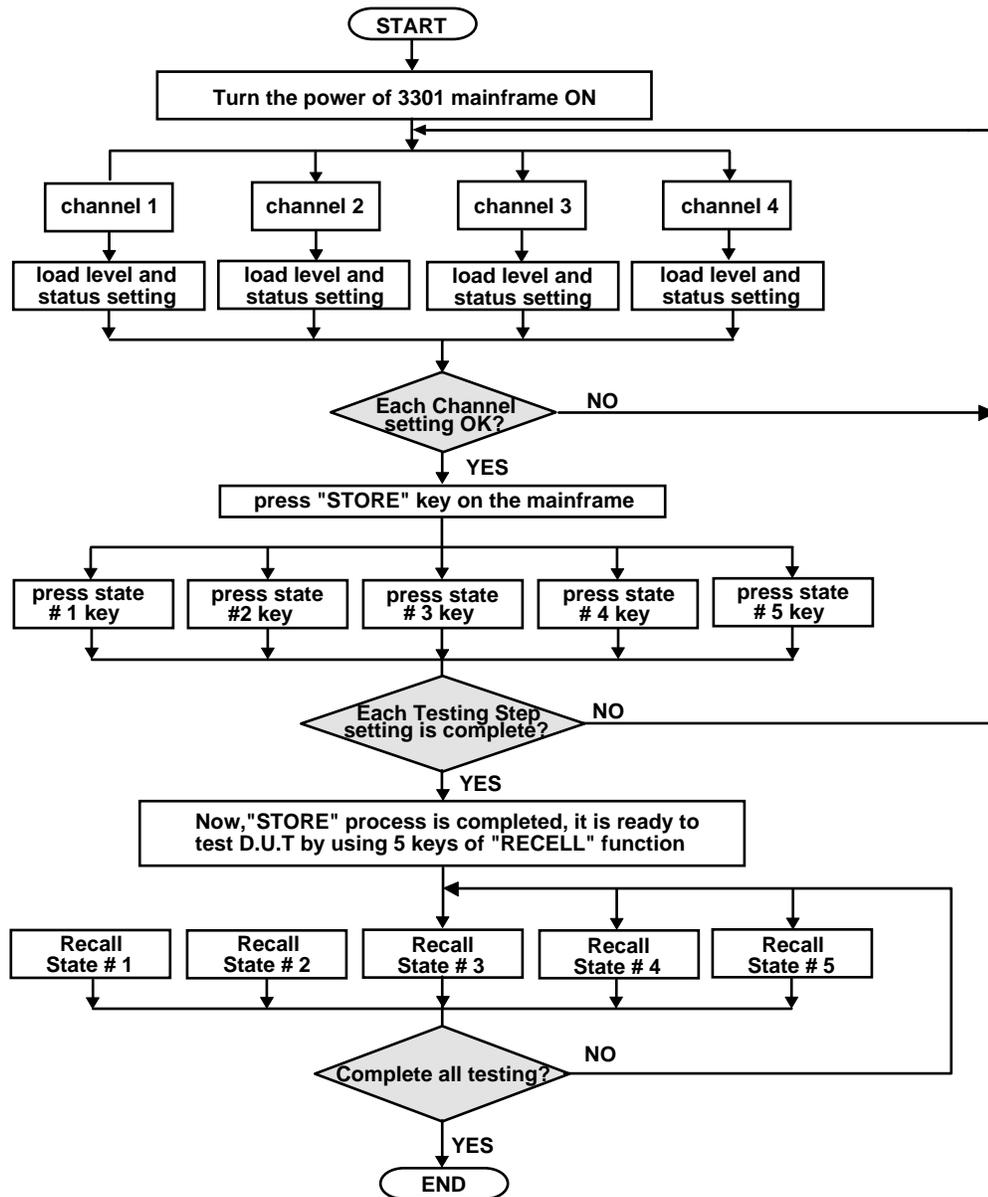


Fig 3-3. Flow chart of mainframe operation

### 3-7. Protection features

The 3320 series Electronic load modules include the following protection features:

1. Overvoltage
2. Overpower
3. Overtemperature
4. Reverse Polarity

The PROT LED annunciator is ON when any of Overvoltage, Overpower and Overtemperature are active. The Overvoltage protection circuit is set at a predetermined voltage (63V for 3320, 3321, 263V for 3322) which can not be changed. If the Overvoltage circuit has tripped, it cause the Electronic load input to be turn OFF internally.



**CAUTION:**

Never apply the AC line voltage or input voltage exceeded than 60V for 3320, 3321 3325, 250V for 3322, 400V for 3323 and 500V for 3324 or it may cause damage of the Electronic load.

The 3320 series Electronic load can monitor the power dissipation of the load module, when the power dissipation is greater than 105% of rate power input, the load module will turn load to OFF state internally. The 3320 series Electronic load can reset the Overvoltage and Overpower protection automatically if the protection condition is removed.

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As soon as the temperature of 3320 module's heat sink greater than about 85 degree, the Overtemperature protection LED (OTP) and PROT LED annuicators are ON, and the 3320 series load module will turn load to OFF state internally and return to the previous load level and condition until the temperature of the about 65 degree.

The 3320 series Electronic load conducts reverse current when polarity of the DC source connection is incorrect. The maximum reverse current is 30A for 3320, 60A for 3321 and 10A for 3322.

When the reverse condition, the reverse current is displayed on the 4 1/2 digit Current Meter on the front panel, and the 4 1/2 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 、 Applications

### 4-1.Local sense connections

Fig 4-1 illustrates a typical set up with the Electronic load connected to the DC power supply.

Local sensing is used in application where lead lengths are relatively short, or where load regulation is not critical. The 4 1/2 digit voltage Meter of 3320 series Electronic load measures the voltage of DC INPUT Terminal automatically, Load leads should be bundled or tie-wrapped together to minimize inductance.

#### 4-2.Remote sense connections



#### CAUTION :

To Avoid High Voltage Hazard on 3322, 3323, and 3324 Electronic Load. The recommended solution for 3322, 3323, and 3324 are as the following:

- 1.Do not use V<sub>sense</sub> in High Voltage Load 3322, 3323, and 3324 if it is not necessary. Because the purpose of V<sub>sense</sub> is to compensate the voltage drop in high load current condition. in necessary to use V<sub>sense</sub> BNC. However, We also recommend to use V<sub>sense</sub> BNC (Remote sense) When calibrate the 3322, 3323, and 3324. Do not supply High Voltage source during connection between the High Voltage source and 3322, 3323, and 3324 Electronic Load.
- 2.Always Turn-OFF the High Voltage source first, during make wire connection, dis-connection, or re-connection, or re-connection between the High Voltage source and 3322, 3323, and 3324 Electronic Load.
- 3.The BNC to clip V<sub>sense</sub> cable (Accessory) for the 3322, 3323, and 3324 is equipped with High Voltage Hazard safety proof to avoid high voltage shock.

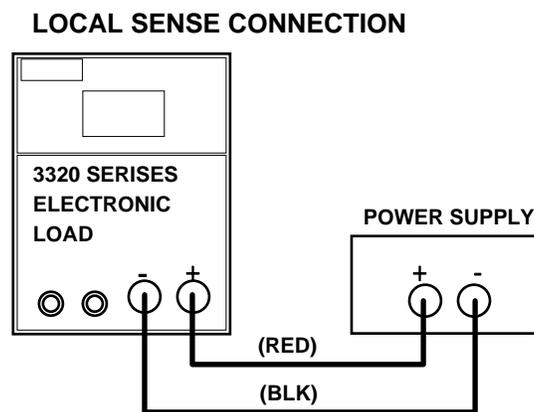


Fig 4-1 Local voltage sense connections

## 4-2.Remote Sense Connections

Fig 4-2 illustrates a typical set up with the Electronic load connected for remote sense operation. The remote Vsense BNC cable of the Electronic load are connedted to the output of the power supply. Remote sensing compensates for the voltage drop in applications that require long lead lengths.

The 4 1/2 digit voltage Meter of 3320 series Electronic load measures the voltage of Vsense BNC input Terminal automatically, so the high accuracy 4 1/2 digit voltage Meter can measure the specific points voltage of the power supply's output voltage.

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

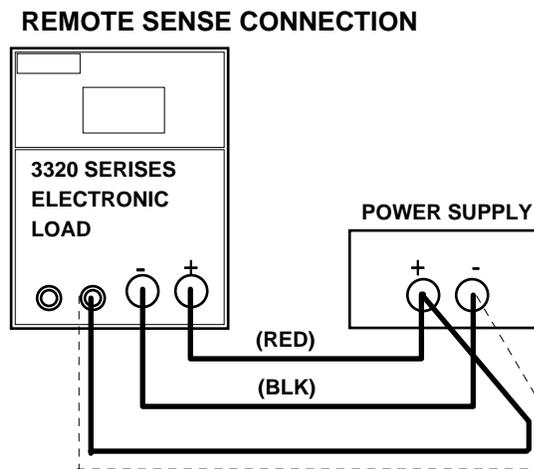


Fig 4-2 Remote voltage sense connections

### 4-3. The connection of a multiple output power supply

The following is a rule for a multiple output power supply connects to the 3320 series Electronic Loads.

**Rule:**

The potential of positive input (Red binding post) must be greater than the potential of negative input (Black binding post) of 3320 series Electronic load. Here is an example of +5V, -5V, +12V and -12V four outputs power supply connected to an 3320 series Electronic load.

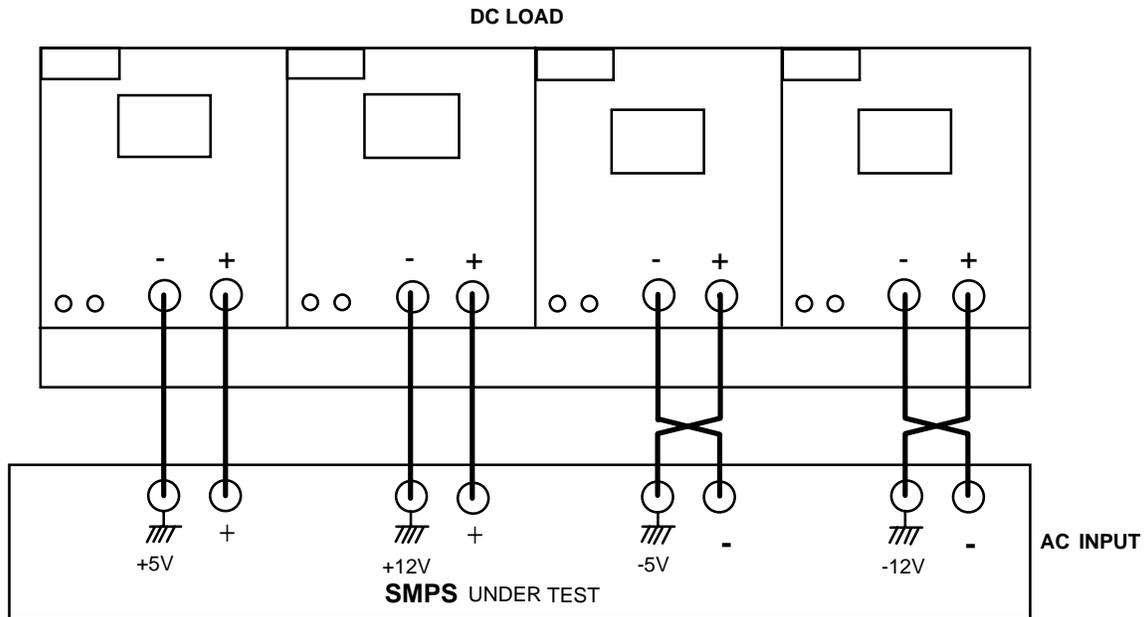


Fig 4-3 Connection between 3320 series plug-in Load and multiple output power supply

## 4-4.Parallel operation

When the power rating is not enough on the Electronic load module, you can combine two or more Electronic load modules as one unit by parallel two or more modules. At this time, the total load current is the sum of the two or more load modules also. This connection can extend the Electronic load module to a Fig 4-4

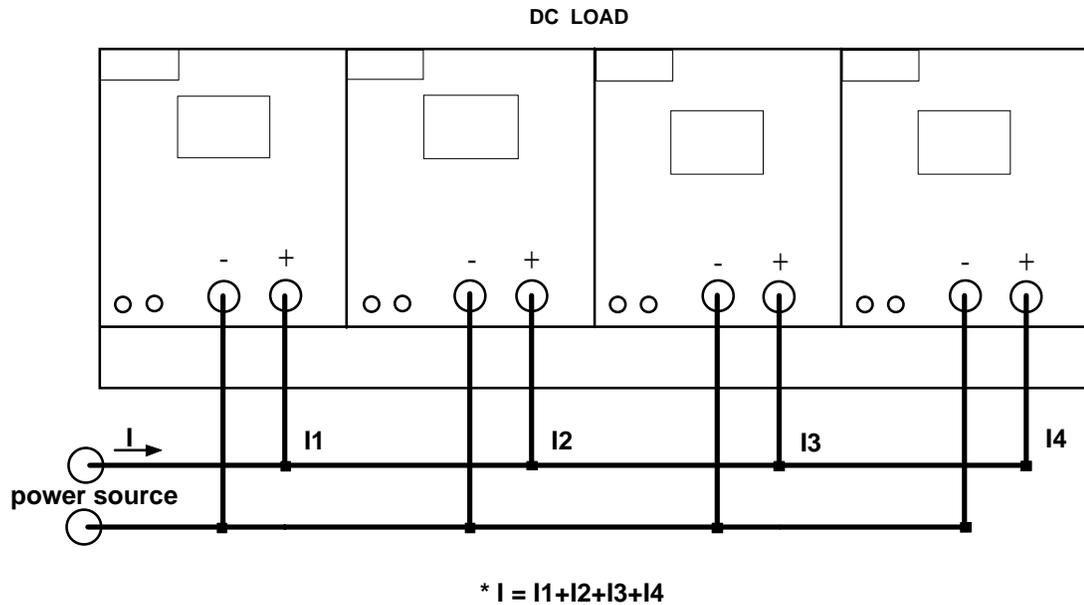


Fig 4-4 3320 series plug-in module parallel operation

## 4-5.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.

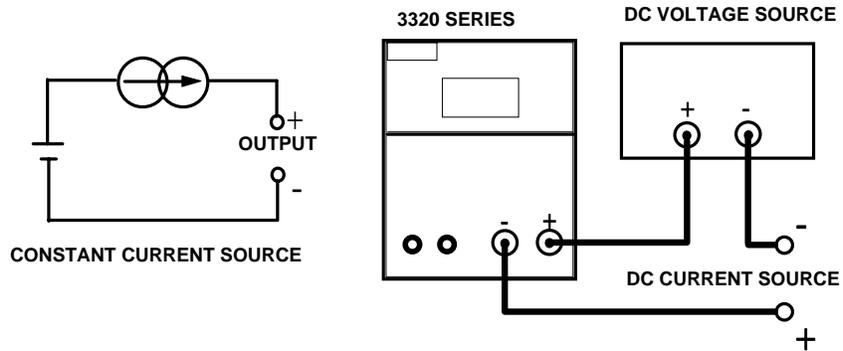


Fig 4-5 Constant current source connection

## 4-6. Zero-Volt loading application

As shown in Fig 4-5, the Electronic load can be connected in series with a DC voltage source which output voltage greater than 2V (3320, 3321) or 3V (3322) 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 2V (3320, . 3321) or 3V (3322) operating voltage required by the Electronic load. This application is suitable for low voltage Battery cell with high discharge current testing.

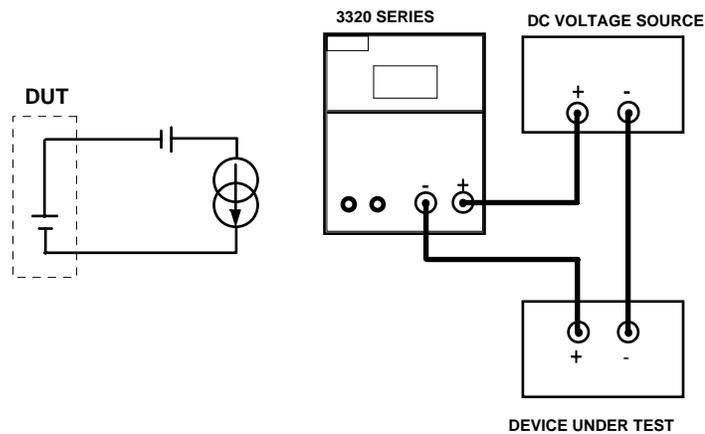


Fig 4-6 Zero-Volt Loading connection