

# SEL7 Series Programmable DC Electronic Load

## User Manual



SEL711/712 SERIES



SEL713/714 SERIES



SEL715/716 SERIES






SEL717/718 SERIES

### The document applies to DC electronic load of the following models:

- SEL711 programmable DC electronic load (150W, 0-30A, 0-150V)
- SEL712 programmable DC electronic load (300W, 0-30A, 0-150V)
- SEL712B programmable DC electronic load (300W, 0-15A, 0-500V)
- SEL712C programmable DC electronic load (300W, 0-60A, 0-150V)
- SEL712B30 programmable DC electronic load (300W, 0-30A, 0-500V)
- SEL713 programmable DC electronic load (600W, 0-120A, 0-150V)
- SEL713B programmable DC electronic load (600W, 0-30A, 0-500V)
- SEL714 programmable DC electronic load (1200W, 0-240A, 0-150V)
- SEL714B programmable DC electronic load (1200W, 0-60A, 0-500V)
- SEL715 programmable DC electronic load (1800W, 0-240A, 0-150V)
- SEL715B programmable DC electronic load (1800W, 0-120A, 0-500V)
- SEL716 programmable DC electronic load (2400W, 0-240A, 0-150V)
- SEL716B programmable DC electronic load (2400W, 0-120A, 0-500V)
- SEL716E programmable DC electronic load (3000W, 0-480A, 0-150V)
- SEL717 programmable DC electronic load (3600W, 0-240A, 0-150V)
- SEL717B programmable DC electronic load (3600W, 0-120A, 0-500V)
- SEL717C programmable DC electronic load (3600W, 0-500A, 0-150V)
- SEL718 programmable DC electronic load (6000W, 0-240A, 0-150V)
- SEL718B programmable DC electronic load (6000W, 0-120A, 0-500V)
- SEL718D programmable DC electronic load (6000W, 0-240A, 0-500V)
- SEL718E programmable DC electronic load (6000W, 0-120A, 0-600V)
- SEL718F programmable DC electronic load (6000W, 0-480A, 0-150V)

### Options of the SEL7 series DC electronic load:

Option No.	Item	Description
M131	RS232 interface communication cable	

M132	RS485 interface communication cable	
M133	USB interface communication cable	

## Preface

Thank you for choosing Saluki Technology Products.

We devote ourselves to meeting your demands, providing you high-quality measuring instrument and the best after-sales service. We persist with “superior quality and considerate service”, and are committed to offering satisfactory products and service for our clients.

## Document No.

SEL7-03-01

## Version

Rev01 2022.04

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The warranty period of the product is 12 months from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period.

## Product Quality Certificate

The product meets the indicator requirements of the document at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

## Quality/Settings Management

Research, development, manufacturing and testing of the product comply with the requirements of the quality and environmental management system.

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## Chapter 1 Overview

The new SEL7XX series programmable DC electronic load is a new generation product designed by Saluki Technology. Incorporating high-performance chips, the SEL7XX series delivers high speed and high accuracy with a resolution of 0.1 mV and 0.01 mA (basic accuracy is 0.03% and basic current rise speed is 2.5 A/μs).

SEL7XX series have wide application from production lines for cell phone chargers, cell phone batteries, electronic vehicle batteries, switching power supplies, linear power supplies, and LED drivers, to research institute, automotive electronic, aeronautic and astronautic, maritime, solar cell and fuel cell etc.test and measurement applications.

### 1.1 Key Features

- Six high speed operation modes: CC,CR,CV,CW,CC+CV,CR+CV
- Over current, over voltage, over power, overheating and polarity reversal protection
- High-luminance vacuum fluorescent display (VFD) screen with two line, four channel display
- Intelligent fan system will automatically activate based on changing ambient temperatures
- Soft-start time setting, activating the power supply in accordance with the set voltage value
- Battery test and short-circuit test functions
- Capable of rising edge and falling edge dynamic testing
- Supporting external trigger on either input or output
- External current waveform monitor terminal output terminal
- Supports remote voltage compensation and multi-data storage
- Power-on-self-test, software calibration and standard rack mountable
- LED mode for LED power driver test, steady reading, compatible with simulating the capacitance sensitive driver
- Edits arbitrary waveforms in list function
- Available with RS232/RS485/USB serial interfaces

### 1.2 Main Specifications

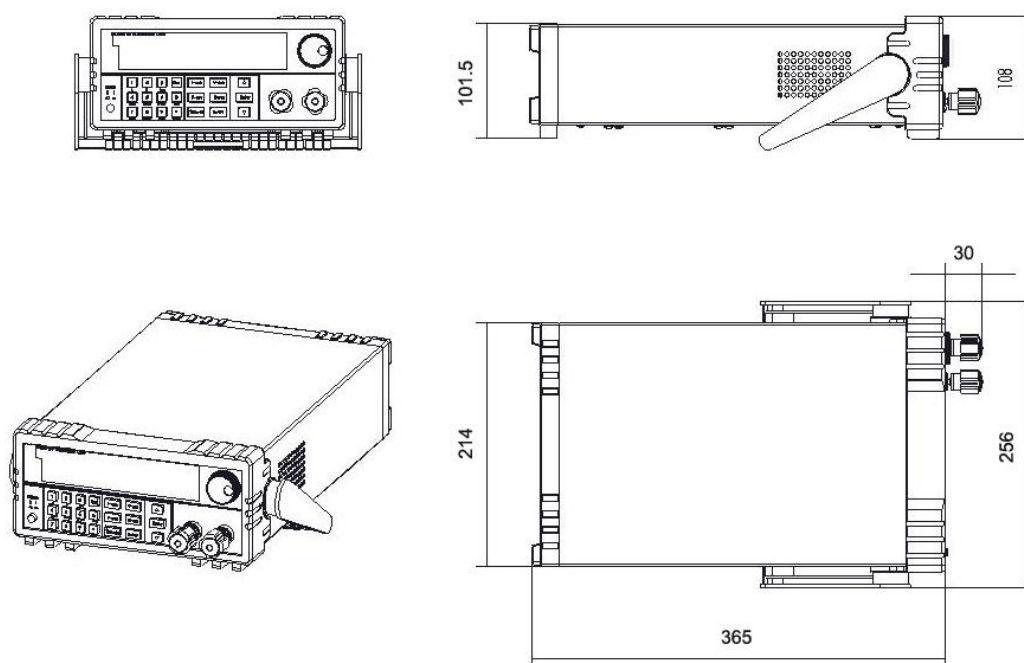
Model	SEL711	SEL712	SEL712B	SEL712C	SEL712B30	SEL713	SEL713B	SEL714	SEL714B
Power	150W	300W	300W	300W	300W	600W	600W	1200W	1200W
Current	0-30A	0-30A	0-15A	0-60A	0-30A	0-120A	0-30A	0-240A	0-60A
Voltage	0-150V	0-150V	0-500V	0-150V	0-500V	0-150V	0-500V	0-150V	0-500V
Model	SEL715	SEL715B	SEL716	SEL716B	SEL716E	SEL717	SEL717B	SEL717C	SEL718
Power	1800W	1800W	2400W	2400W	3000W	3600W	3600W	3600W	6000W
Current	0-240A	0-120A	0-240A	0-120A	0-480A	0-240A	0-120A	0-500A	0-240A
Voltage	0-150V	0-500V	0-150V	0-500V	0-150V	0-150V	0-500V	0-150V	0-150V

Model	SEL718B	SEL718D	SEL718E	SEL718F					
Power	6000W	6000W	6000W	6000W					
Current	0-120A	0-240A	0-120A	0-480A					
Voltage	0-500V	0-500V	0-600V	0-150V					

### 1.3 Electronic Load Dimension

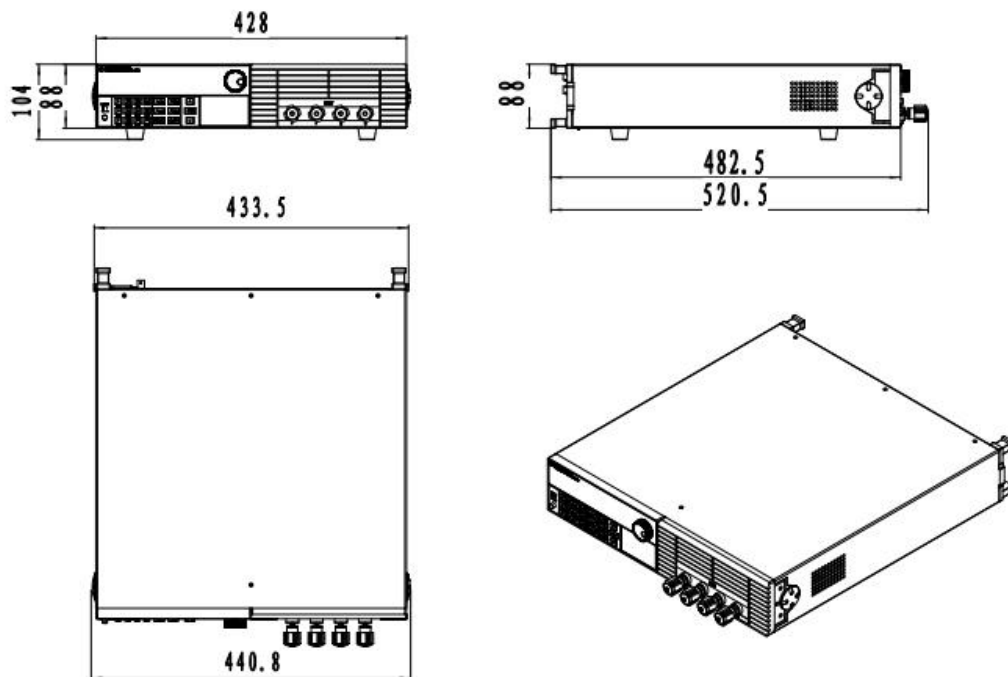
Dimension of the models SEL711 and SEL712 series: 214mm (W) × 108mm (H) × 365mm (D)

These models are provided with a carrying handle. The handle can be removed if desired.

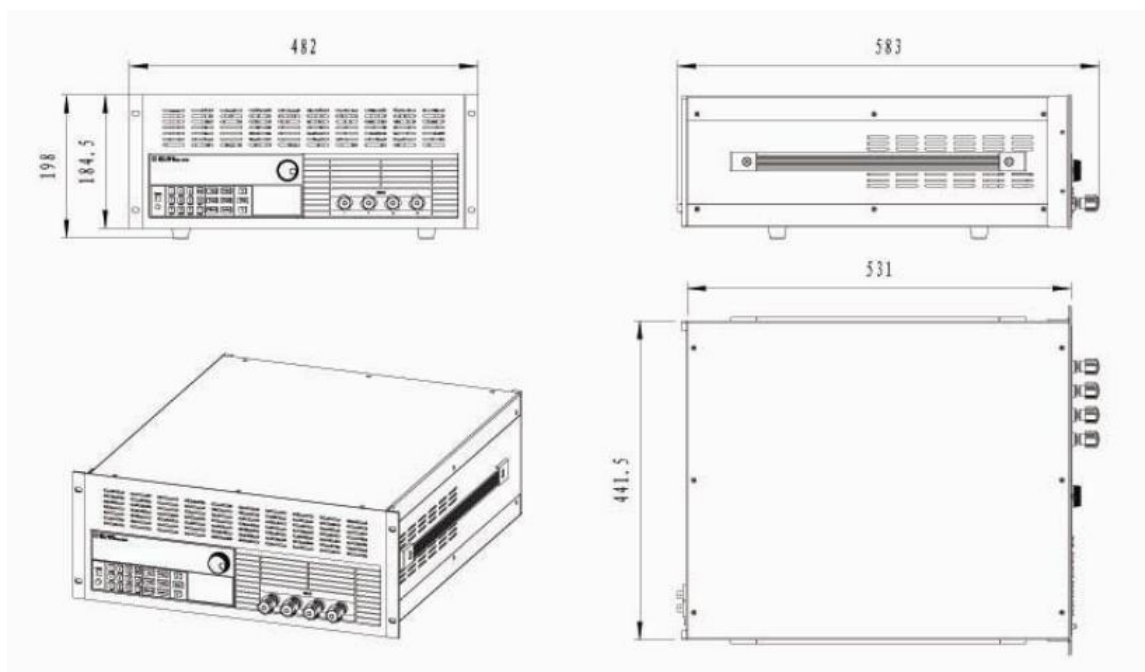


Dimension of the models SEL713 and SEL714 series: 428mm (W) × 104mm (H) × 520.5mm (D)

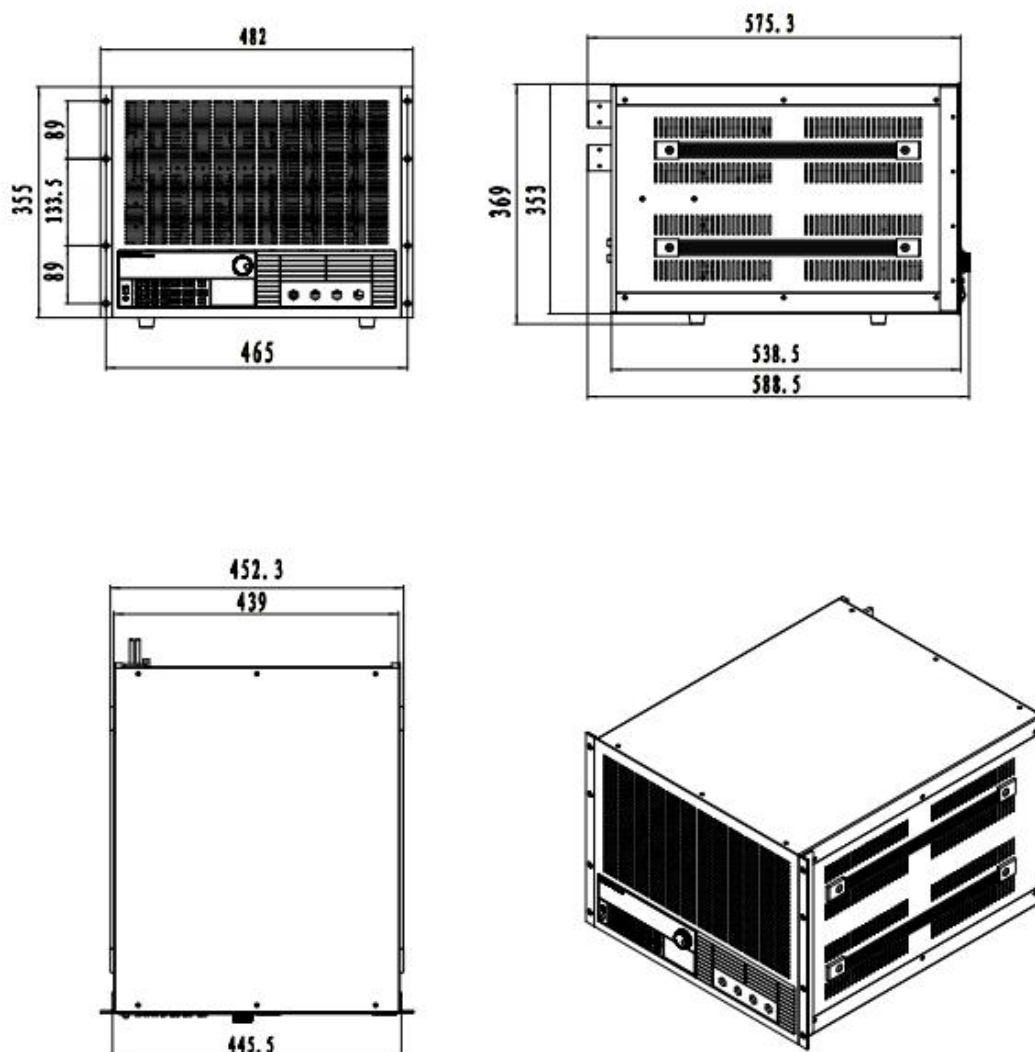




Dimension of the models SEL715 and SEL716 series: 482mm (W) × 198mm (H) × 583mm (D)



Dimension of the models SEL717 and SEL718 series: 482mm (W) × 355mm (H) × 588.5mm (D)



## 1.4 Environmental Conditions

The instrument is intended for the indoor use in a pollution degree 2 environment. Operating environmental limits are as follows.

Parameter	Specification
Humidity	≤70% relative humidity, non-condensing
Altitude	≤2000 m
AC Line Voltage	220AV±10%,47-63 Hz 110AV±10%,47-63 Hz
Operating Temperature	0 to 40 °C
Storage temperature	-20 °C to 70 °C

## Chapter 2 Quick Reference

### 2.1 Power-on-self-test

Verify that you have received the following items with your electronic load.

- ☐ One power cord for your location
- ☐ The user manual
- ☐ One CD (only when you have bought communication accessories)
- ☐ One communication cable (only when you have bought communication accessories)

First, please make sure the electronic load has been correctly connected and powered on. Please refer to the following for the detailed operation steps.

Procedure	Display	Explanation
1. Power on the electronic load	<b>SYSTEM SELF TEST</b> <b>Vxxx</b>	The electronic load start power-on-self-test and the VFD display shows the software serial No.
2. Wait for 1s after turn on electronic load	<b>EPROM ERROR</b>	EEPROM damage or lost data of last power off.
	<b>ERROR CAL.DATA</b>	EEPROM lost calibration data.
3. Wait for another 2S once ERROR occurred	<b>xxxxxxxV    xxxxxxA</b> <b>xxxxxxxW    xxxxxxX</b>	Display the actual input voltage and current value, actual power value and setting value.

### 2.2 In Case of Trouble

If the electronic load fails to run during power-on operation, the following test will help you to solve the problems that might be encountered.

- 1) Make sure if you have connected the power properly and On/Off switch has been pressed.
- 2) Check the power voltage setting.

There are two voltages which can make load work: 110V or 220V. Please make sure you get the right voltage in accordance to the voltage in your area.

- 3) Check the fuse of the load.

If fuse is blowout, please change another fuse with the following specification.

Model	Fuse specification (110VAC)	Fuse specification (220VAC)
SEL711/ SEL712/ SEL712B/ SEL712C/ SEL712B30	T0.5A 250V	T0.3A 250V
SEL713/ SEL713B / SEL714/ SEL714B	T1.25A 250V	T2.5A 250V
SEL715/ SEL715B / SEL716/ SEL716B / SEL716E	T2.5A 250V	T1.25A 250V
SEL717/ SEL717B/ SEL717C/ SEL718/ SEL718B	T2.5A 250V	T1.25A 250V
SEL718D/ SEL718E/ SEL718F	T2.5A 250V	T1.25A 250V

#### 4) Replace the fuse

Open the plastic cover in the rear panel of the electronic load with a flat screwdriver. Then replace the blowout fuse with a new one. So the same place as the other modes.

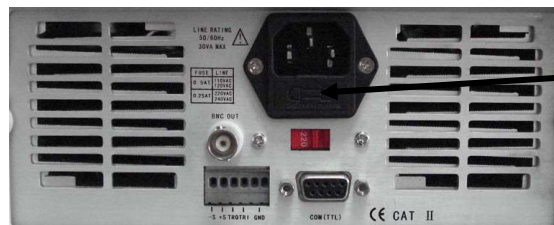


Figure 2.1 Fuse Location

## 2.3 Front Panel Operation

Please refer to the figure 2.2 for the front panel of SEL7 electronic load.



Figure 2.2 Front Panel

- ① The upper half is black VFD display screen
- ② Rotary knob, Turn to adjust the setting values.

- ③ Numeric keys 0-9, ESC key, secondary key functions
- ④ Keypad: set up the current, voltage, power, resistance modes; Scroll through menus and options
- ⑤ Input terminals
- ⑥ Power switch to turn on/off the instrument
- ⑦ Up-Down keys, Enter key

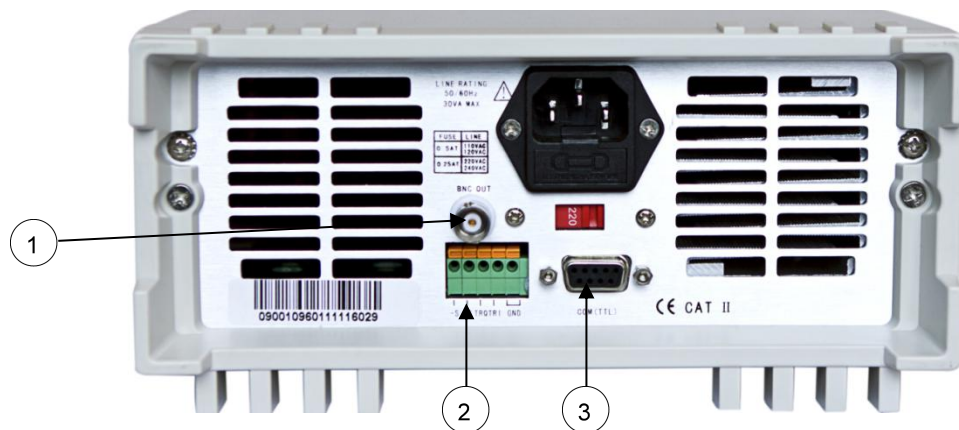
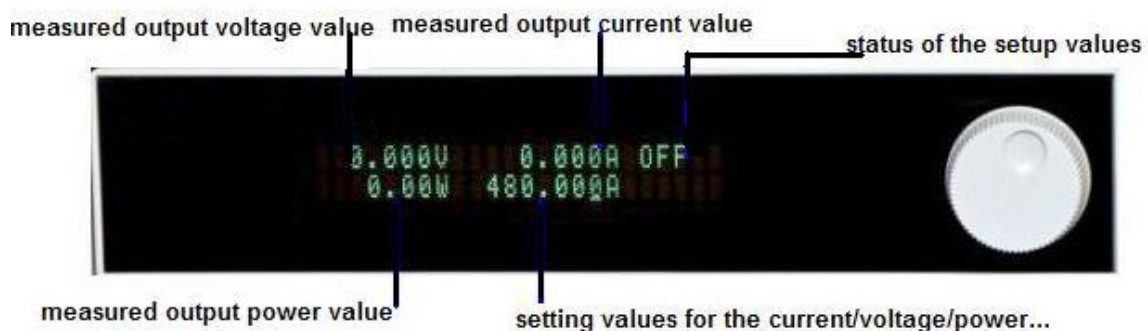


Figure 2.3 Rear Panel of SEL7 Series Load

- ① 0-full range current, in correspond to 0-10V output, Oscillograph can be connected by here to observe dynamic waveforms.
- ② Remote sense terminals (S+, S-) and trigger input/output terminal, GND terminal
- ③ DB Sub 9 pin multifunctional communication interface for RS232, RS485, USB. It is 9-Pin serial port interface connector and utilizes 5 volt TTL logic signals. **Do not connect an M131 cable with standard RS-232 voltages on the cables connectors. Doing so may damage the instrument and is not covered by WARRANTY.**

## 2.4 Standard Display

The standard display of the instrument is as below.



## 2.5 Keypad Directions

<b>1 ~ 9</b>	0-9 numeric keys
<b>Esc</b>	Esc key (can be exited from any working condition)
<b>I-Set</b>	Switch to CC mode Setting up a constant current
<b>V-Set</b>	Switch to CV mode Setting up a constant voltage
<b>P-Set</b>	Switch to CW mode Setting up a constant power
<b>R-Set</b>	Switch to CR mode Setting up a constant resistance
<b>Shift</b>	Multi-purpose Used together with multifunction key to perform diversity functions and applications(for example: <i>shift+Menu</i> can perform menu function)
<b>On/Off</b>	Turn on/off Load
<b>▲</b>	Increasing setup values
<b>▼</b>	decreasing setup values
<b>Enter</b>	Confirm key

## 2.6 Menu Operation

Press the key **Shift+Menu** to access to the menu function and the VFD display screen shows the menu items. Select the menu items by pressing the **▲** and **▼** keys or by rotating the knob, and then press the key **Enter** to enter in the menu item you wanted. Or you can press the key **Esc** to return to the last menu.

MENU		
CONFIG		
	<b>INPUT RECALL</b>	Setting the output to the same state at last time when the load is turned off or to the OFF state when the electronic load supplier is powered on
	<b>ON</b>	Setting the same state as last time you turned off the electronic load
	<b>OFF</b>	Setting the output to OFF state when the electronic load is powered on. The load will work at CC mode
	<b>KEY SOUND SET</b>	Setting the key sound
	<b>ON</b>	The buzzer will sound when any key was pressed.

	<b>OFF</b>	The buzzer will not sound when any key was pressed
	<b>CONNECT MODE</b>	Connect mode
	<b>MAXTIDLEXING</b>	Multi
	<b>SEPARATE</b>	Single
	<b>BAUDRATE SET</b>	Setting the modem Baud rate
	<b>2400</b>	
	<b>9600</b>	
	<b>14400</b>	
	<b>28800</b>	
	<b>57600</b>	
	<b>115200</b>	
	<b>COMM.PARITY</b>	Setting Comm. Parity mode
	<b>NONE</b>	None Parity
	<b>EVEN</b>	Even Parity
	<b>ODD</b>	Odd Parity
	<b>ADDRESS SET</b>	Setting Address
	<b>1 - 200</b>	The address is the input number (1-200).
	<b>KEY LOCK SET</b>	Setting the keyboard unlocking password(when it is 0 or null, there is no password set)
	<b>EXIT</b>	
<b>SYSTEM SET</b>		
	<b>MAX CURRENT SET</b>	Setting the maximum current. If the maximum current is higher than 3A, it is high range. Otherwise, it is low range.
	<b>MAX VOLTAGE SET</b>	Setting the maximum Voltage. If the maximum voltage is higher than 20V, it is high range. Otherwise, it is low range.
	<b>MAX POWER SET</b>	Setup the Maximum Power.
	<b>TERMINAL SEL</b>	Choosing the input terminal
	<b>FRONT</b>	Choose the input terminal at the front panel
	<b>BACK</b>	Choose the input terminal at the back panel
	<b>EXIT</b>	
<b>LIST</b>		
	<b>LOAD LIST</b>	Choose list files, 1-8
	<b>EDIT LIST</b>	Edit list files
	<b>MINIMUM TIME</b>	Edit minimum time(0.02-1310.7mS)
	<b>LIST MODE</b>	LIST output mode
	<b>CONTINUOUS</b>	Continuous mode
	<b>END HOLD</b>	Remains to the last output voltage level after the

		whole steps are executed successfully
	<b>END RESET</b>	Keep load off state after the whole steps are executed successfully
	<b>STEP LENGTH</b>	Step length(1 - 200)
	<b>STEP n</b>	1-whole step length
	<b>CURRENT</b>	Set current
	<b>TIME</b>	Duration
	<b>EXIT</b>	
<b>AUTO TEST</b>		
	<b>LOAD AUTO TEST</b>	Choose automatic test files 1-8
	<b>EDIT AUTO TEST</b>	Edit automatic test files
	<b>STEP LENGTH</b>	Set the whole step length
	<b>STEP n</b>	
	<b>WORK MODE</b>	
	<b>LOAD OFF MODE</b>	Load off mode
	<b>CC MODE</b>	Constant current mode
	<b>CV MODE</b>	Constant voltage mode
	<b>CP MODE</b>	Constant power mode
	<b>CR MODE</b>	Constant resistance mode
	<b>SHORT MODE</b>	Short circuit mode
	<b>TEST MODE</b>	Qualification testing mode
	<b>TEST CURRENT</b>	Test current
	<b>TEST VOLTAGE</b>	Test voltage
	<b>TEST POWER</b>	Test power
	<b>TEST RESI</b>	Test resistance
	<b>DELAY TIME</b>	Test delay time(0.2-25.5S)
	<b>INPUT xxxx</b>	Input the parameters set, for example: CC mode, 1A
	<b>MINIMUM xxxx</b>	Input the minimum lower limit
	<b>MAXIMUM xxxx</b>	Input the maximum upper limit
	<b>SETUP AUTO TEST</b>	
	<b>TRIGGER</b>	Trigger output selection
	<b>WHEN PASS</b>	Trigger once when passing the test
	<b>WHEN FAIL</b>	Trigger once when failing the test
	<b>WHEN TEST END</b>	Trigger output is initiated when test ends
	<b>DISABLE</b>	Disable trigger output
	<b>OUTPUT</b>	Output electrical characteristics selection
	<b>PULSE</b>	Pulse output
	<b>LEVEL</b>	Voltage level output
	<b>EXIT</b>	
<b>EXIT</b>		



## Chapter 3 Panel Operation

### 3.1 Basic Operation Mode

There are six operation modes are for SEL7 series electronic loads:

1. Constant current (CC)
2. Constant voltage (CV)
3. Constant resistance (CR)
4. Constant power (CW)
5. Constant Current Shifting into Constant Voltage Mode (CC+CV)
6. Constant Resistance Shifting into Constant Voltage Mode (CR+CV)

#### 3.1.1 Constant Current Operation Mode (CC)

In this mode, the DC electronic load will synchronize with a current in accordance with the programmed value regardless of the input voltage. Please refer to the Figure 3.1. If maximum current value of the power supply under test is lower than the constant current value set, the electronic load might fail to automatically adjust to these levels. Accordingly, the constant current and the voltage of the measured power supply could be adjusted lower.

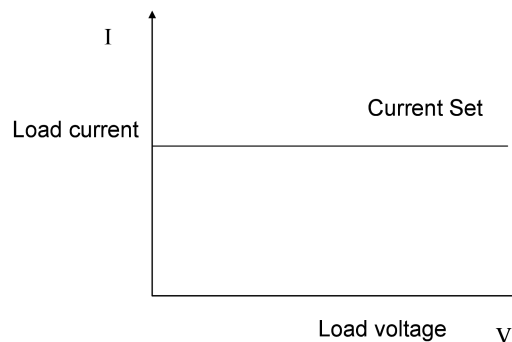


Figure 3.1 Constant Current Mode

##### 3.1.1.1 Setting up a Standard Constant Current Mode

Press the key **I-SET** key, then the VFD display will show **STANDARD CURR=xxxxxxxA**, the present constant current value. Press the numeric keys and decimal point key to enter the constant current value desired, followed by pressing the **Enter** key to confirm the setting. The DC Electronic load will now be in the standard constant current mode.

If the input state is in **OFF** state, then the word **OFF** will appear in upper right corner of the VFD display. Press the **On/Off** key to change the load's input state to an **ON** state. Now **CC** or **Unreg** will appear in the upper right corner of the VFD display. Displaying **CC** means the load has been successfully set with the expected constant current value; if **Unreg** is displayed, the load couldn't adjust itself to the constant current value that was entered. Please check to

determine whether or not the power supply under test has the proper connections and has been turned on; also check to make sure that the desired constant current value is within the range of the power supply under test.

If you want to fine tune the constant current value, rotate the encoder knob to adjust the value. Rotating clockwise will increase the value and rotating it counter-clockwise will decrease the value. Note: if the constant current value you want to set is beyond the maximum constant current value capability of the DC load, the current value will stop increasing even if you continue to rotate the encoder knob clockwise. At this point, the lower right corner of the VFD panel will display the constant current value you set. Within this number sequence, if the cursor underlines one particular digit, that digit requires adjustment. If users want to make adjustments to finetune the accuracy, depress the rotary encoder knob. Every time the rotary encoder is pressed the cursor will move forward to the previous digit.

### 3.1.1.2 Loading and Unloading Constant Current Mode

Loading and unloading CC mode can protect the power supply under test from damage. When the voltage of the power supply under test starts to increase, the load will automatically adjust itself to the open-circuit state, The load then carries the power supply being tested and adjusts itself to the current value of the UUT set when the voltage of the UUT increased to the **ONSET** loading voltage level. When the voltage of the power supply under test begins to decrease to the **OFFSET** unloading value, the load will again automatically adjust itself to the open-circuit state. If the **ONSET** loading voltage value is higher than the **OFFSET** unloading voltage, the load can avoid frequent carrying and unloading at the critical point of unloading voltage; so the power supply under test will be well protected.

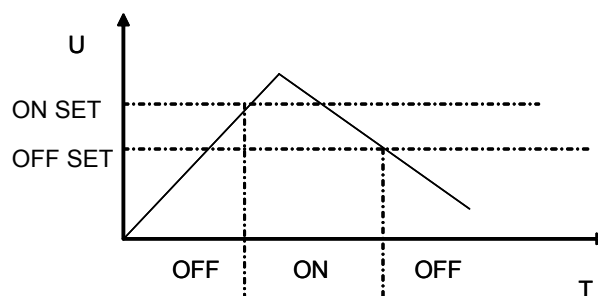


Figure 3.2 Loading and Unloading Mode

When in standard constant current mode, pressing the **Shift+1(V\_Level)** keys in sequence puts the DC Electronic Load into the loading and unloading CC mode. When the VFD display shows **ONSET VOLT=xxxxxxxV** indicating the current loading voltage, use the numeric keys and decimal point key to enter the loading voltage value desired, then press the **Enter** key to confirm the setting. Now the VFD panel will display **OFFSET VOLT=xxxxxxxV** indicating the current unloading voltage level. Press the numeric keys and decimal point key to enter the unloading voltage value desired, followed by pressing the **Enter** key to confirm the setting. Accordingly, the DC Electronic Load will enter into the loading and unloading constant current mode between the two preset limits automatically

If the input state is **OFF**, then the upper right corner of the VFD panel will show the word **OFF**. Press the **- On/Off** key to change the input state back to **ON**. Then the upper right corner of the VFD display will show the word **CC\_UN**

or **Unreg. CC\_UN** means the load was successfully set into the expected constant current value; **Unreg** means the load could not adjust itself to the desired constant current value. Please check that the power supply under test has been correctly connected and power switched on; make sure that the voltage set is normal and the selected constant current value is within the range of the UUT.

While in loading and unloading CC mode, press the **Shift+1(V\_Level)** keys in sequence and the DC Electronic Load will revert back into the standard constant current mode.

### 3.1.1.3 Soft Start Constant Current Mode

The Soft Start CC mode enables the DC Electronic Load to functions as an inductive load, simulating an inductance value which is in direct proportion with the rise time of the soft start. In this mode, the power supply under test can avoid being damaged by a current strike.

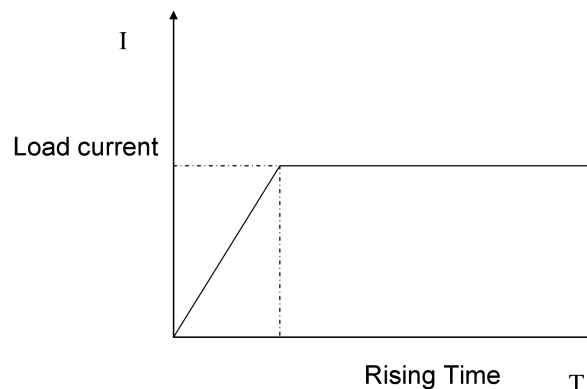


Figure 3.3 Soft Start Current Mode

When in standard CC mode, pressing the **Shift+2(S\_Start)** keys in sequence places the load in the soft start CC mode. When the VFD display shows **Rising TM= xxxxxxxxvmS** indicating the current rise time, use the numeric keys and decimal point key to enter the current rise time desired. Follow by pressing the **Enter** key to confirm the setting and the load will enter into the soft start CC mode.

If the input state is **OFF**, then the upper right corner of the VFD display will show the word **OFF**. Press the **On/Off** key to change the input state to **ON**. Then the upper right corner of the VFD display will show the word **CC\_S** or **Unreg**. Showing **CC\_S** means the load has been successfully set with the desired CC value; **Unreg** on the display means the load couldn't adjust itself to the desired CC value. Check to assure that the power supply under test has been correctly connected and powered on; make certain that the - CC value selected is within the range of the UUT. When the Shift+2(S\_Start) keys are pressed in sequence, the loading and unloading CC mode, of the DC Electronic Load will revert back into the standard CC mode. **Note:** The rise time is automatically regulated and set to a value of 20μS times a round number

### 3.1.1.4 Constant Current Mode Shifting into Constant Voltage Mode

When the CC mode shifts into CV mode, damage to the power supply under test from current strike is avoided.

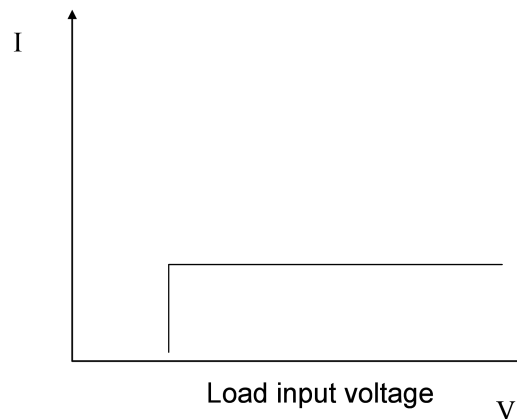


Figure 3.4 Constant Current Shift Mode back into Constant Voltage Mode

When in standard constant current mode, press the **Shift+4(CC+CV)** keys to enter into the constant current shift to constant voltage mode. When the VFD display shows **CC TO CV VOLT=xxxxxxxV** indicating the current constant voltage value, press the numeric keys and decimal point key to enter the constant voltage value desired followed by pressing the **Enter** key to confirm. Now the load will enter into the constant current shift mode into constant voltage mode.

If the input state is in **OFF**, then the upper right corner of the VFD display will show the word **OFF**. Press the **On/Off** key to change the input state into **ON**. The upper right corner of the VFD display will show the combination of **CC+CV** or **Unreg**. When **CC+CV** is displayed, the DC Electronic load has been successfully set into the desired CC value; by displaying **Unreg** means the load could not adjust itself to the selected CC value. Check that the unit under test has been connected correctly and powered on. Also, assure that voltage level is normal.

When in the loading and unloading constant current mode, pressing the **Shift+4(CC+CV)** keys will make the load revert back into the standard constant current mode.

### 3.1.2 Constant Resistance Operation Mode (CR)

In this mode, the DC Electronic Load will synchronize to a current linearly proportional to the input voltage scaled to the resistance programmed. Please refer to the Figure 3.5.

**Note:** when the voltage of the unit under test is set too high and the resistance set is too low, either the unit under test will consume the excess current and be shock damaged, or the DC Electronic Load will fail to automatically adjust to the constant resistance and the load will suffer the shock damage from the excess current.

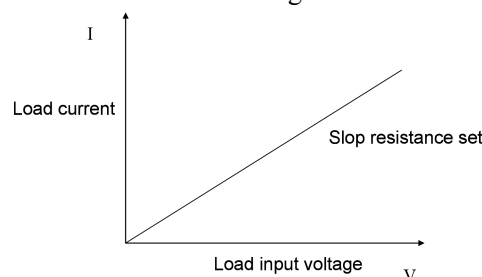


Figure 3.5 Constant Resistance Mode

### 3.1.2.1 Setting up a Standard Constant Resistance Mode

P By pressing the **R-SET** key the VFD display will show **STANDARD RESI=xxxxxxxΩ** indicating the present constant resistance. In order to place the DC Electronic Load into the standard constant resistance mode, press the numeric keys and decimal point key to select the desired values. Finally, after the values are selected press the **Enter** key to confirm the setting.

When the input state is in **OFF**, the upper right corner of the VFD display will show the word **OFF**. Press the **On/Off** key to change the input state to **ON**. Now the upper right corner of the VFD display will show either **CR** or **Unreg**. **-CR** means the load has been successfully set into the expected constant resistance value; **Unreg** means the load was unable adjust itself to the desired constant resistance value. Verify that the unit under test is connected correctly and turned on; be sure the resistance value selected is within the output current of the power supply under test so that it can source the expected amount of resistance to drive the DC Load..

If you need to adjust the constant resistance value, rotate the encoder knob to change the value. Rotating clockwise increases the value while rotating counter-clockwise decreases the value. Now the lower right corner of the VFD display shows the constant resistance value set, but if under the value a cursor is blinking it means the number set, is in need of further adjustment. -When users want to adjust or fine tune the accuracy, simply push in on the rotary encoder knob.. Each click the encoder is rotated moves the cursor left or right on the VFD screen.

### 3.1.2.2 Loading and Unloading Constant Resistance Mode

Figure3.1.1.2 illustrates the CR loading and unloading mode theory of operation.

When in standard constant resistance mode, press the **Shift+I(V\_Level)** keys to enter the CR loading and unloading mode. When the VFD display shows **ONSET VOLT=xxxxxxxV**, it indicates the current load voltage state. Pressing the numeric keys and decimal point key will enter the load's desired voltage setting. Pressing the **Enter** key will confirm the setting. Next the VFD will display **OFFSET VOLT=xxxxxxxV** indicating the need to set an offset voltage. Pressing the numeric keys and decimal point key will set that desired offset voltage, Now press the **Enter** key to confirm the setting. Now the DC Electronic Load will be in the CR load /unload mode.

If the input state shows **OFF**, then the upper right corner of the VFD panel will display **OFF**. Press the **On/Off** key to change the input state to **ON**.. Now the upper right corner of the VFD display will show either **CR\_UN** or **Unreg**. **CR\_UN** means the load has been successfully set into the desired constant resistance value; **Unreg** means the load could not accept the constant resistance value set. Check to see the power supply under test is correctly connected and turned on; make sure the voltage is normal and the output current of the unit under test is within the range that the can drive DC Electronic Load.

From the loading and unloading CC mode, press the **Shift+I(V\_Level)** keys and the DC Electronic Load will the standard constant resistance mode.

### 3.1.2.3 Constant Resistance Shifting into Constant Voltage Mode

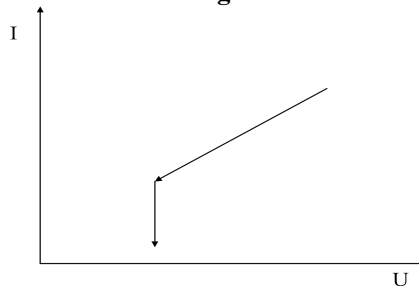


Figure 3.6 Shifting from Constant Resistance to Constant Voltage Mode

By shifting from constant resistance into constant voltage mode, the power supply under test can avoid damage from a current strike..

From the standard constant current mode, press the **Shift+5(CR+CV)** keys to enter the constant current shifting to constant voltage mode. When the VFD display shows **CR TO CV VOLT=xxxxxxxV** it indicates the current constant voltage value that is set. Press the numeric keys and decimal point key to enter the constant voltage value desired, and press the **Enter** key to confirm the setting. In this mode, the load will shift from the constant resistance to the constant voltage set.

If the input state is **OFF**, then the upper right corner of the VFD display will show **OFF**. Press the **On/Off** key to change the input state to **ON**. Then the upper right corner of the VFD display will show either **CR+CV** or **Unreg.** **CR+CV** means the load has been successfully set with the selected constant resistance value; **Unreg.** means the DC Load could not accept the input constant resistance value. Please check that the power supply under test has been correctly connected and turned on; make sure voltage is normal.

Pressing the Shift+5(CR+CV) keys in sequence while in the loading and unloading constant resistance mode, will place the DC Load back into the standard constant resistance mode.

### 3.1.3 Constant Voltage Operation Mode (CV)

In this mode, the DC Electronic Load will attempt to generate sufficient current and synchronize to the source voltage of the unit under test with the programmed value. Please refer to the Diagram at 4.7. Note: When the voltage of the power supply under test is less than the voltage value set, or the input current is beyond the maximum current that the DC load can withstand, the load will be unable to synchronize to the voltage value set.

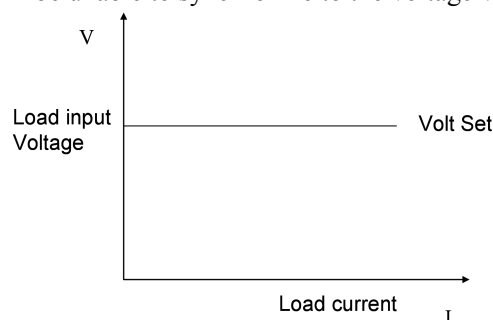


Figure 3.7 Constant Voltage Mode

### 3.1.3.1 Setting up Standard Constant Voltage Mode

Pressing the **V-SET** key - will display **STANDARD VOLT=xxxxxxxV** indicating the current constant voltage value set-up field. Here, enter the constant voltage value desired, followed by pressing **Enter**. Now the DC load will be in standard constant voltage mode.

If the input state is **OFF**, then the upper right corner of the VFD display will show **OFF**. Press the **On/Off** key to change the input state to **ON**. Now the upper right corner of the VFD display will show either **CV** or **Unreg**. **CV** means the DC load has been successfully set with the desired constant voltage value; **Unreg** means the load couldn't accept the selected constant voltage value. Check that the - LED driver has been correctly connected and is powered on; make sure that the voltage of the LED driver is normal and that its output current is not beyond the maximum current that the DC electronic load can accept.

In order to adjust the constant voltage value, rotate the encoder knob at the upper right on the front panel display to adjust the value settings. Rotating clockwise to increase the value while rotating counter-clockwise decreases the value.

Note: if the constant voltage value you want to set is beyond the maximum constant voltage capability of the DC load, the current value will stop at its top end and not increase despite continued rotation of the encoder knob. Once a proper value is selected, the lower right corner of the VFD display shows the constant voltage value that has been set. Should a blinking cursor show up under one of the digits, it will require additional tweaking. If users wish to adjust the accuracy, pushing in the encoder knob will effectuate the change. Each time the encoder knob is pressed, the cursor will move to the next digit position, left or right.

### 3.1.3.2 Loading and Unloading Constant Voltage Mode

For the theory of operation on the loading and unloading of constant voltage mode, please refer to the Diagram -3.1.1.2

From the standard constant voltage mode, press the **Shift+I(V\_Level)** keys to enter into the constant loading and unloading CV mode. When the VFD display shows **ONSET VOLT=xxxxxxxV** indicating the current loading voltage, press the numeric keys and decimal point key to enter the loading voltage value desired, and then press the **Enter** key to confirm. The-VFD now displays, **OFFSET VOLT=xxxxxxxV** indicating the current offset voltage. Press the numeric keys and decimal point key to enter the offset voltage value desired, followed by pressing the **Enter** key to confirm. Now the DC electronic load will enter the loading and unloading constant voltage mode.

If the input state is **OFF**, then the upper right corner of the VFD display will show **OFF**. Press the key **On/Off** to change the input state to **ON**. Then the upper right corner of the VFD display will show either **CV\_UN** or **Unreg**. **CV\_UN** means the load has been successfully set with the desired constant voltage value; **Unreg** means the load couldn't accept the desired constant voltage value. Check the power supply under test has been correctly connected and turned on; also make sure the voltage set is normal and that the maximum output current of the unit under test does

not exceed the range of maximum current that the DC load can absorb.

From the loading and unloading constant voltage mode, press the **Shift+1(V\_Level)** keys, and the load will go back to the standard constant voltage mode.

### 3.1.3.3 Soft Start Constant Voltage Mode

Soft start constant voltage mode enables the DC Electronic Load to function as a condensive load, simulating electric capacity which is in direct proportion to the rise time of the soft start. In this mode, the LED driver under test will avoid damage from a current strike.

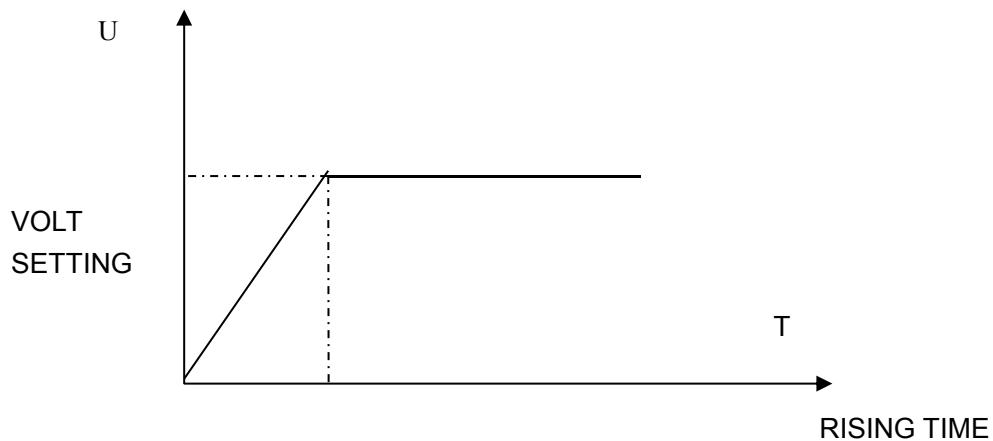


Figure 3.8 SoftStart Constant Voltage Mode

When the **Shift+2(S\_Start)** keys are pressed in standard constant voltage mode, the DC Load will enter the soft start constant voltage mode. The VFD display will show **RISING TM=xxxxxxxxvmS** indicating the current rise time set. Press the numeric keys and decimal point key to enter the rise time desired, and then press the **Enter** key to confirm the setting. Now the DC Load will be in the soft start constant voltage mode.

If the input state is **OFF**, then the upper right corner of the VFD display will say **OFF**. Press the **On/Off** key to change the input state to **ON**. Now the upper right corner of the VFD display will show either **CV\_S** or **Unreg**. **CV\_S** means the load has been successfully set with the desired constant voltage value; **Unreg** means the DC load couldn't accept the selected constant voltage value. Check to see that the LED driver under test has been correctly connected and turned on; also assure that the maximum output current of the LED driver is within the range of the maximum current that the DC load can handle.

From the loading and unloading constant voltage mode, press the **Shift+2(S\_Start)** keys and the DC Load will revert back to the standard constant voltage mode.

**Note:** The rise time that is set will be automatically regulated as value set rounded up to a whole number multiplied by 20μS.

### 3.1.4 Constant Power Operation Mode (CW)

In this mode, the DC Electronic Loads will consume a set constant power. Please refer to the Figure 3.9. As the load's input voltage value increases, the load input current will decrease



in linear increments. Accordingly, the equation of load power(=V \* I)will remain constant in the power setting.

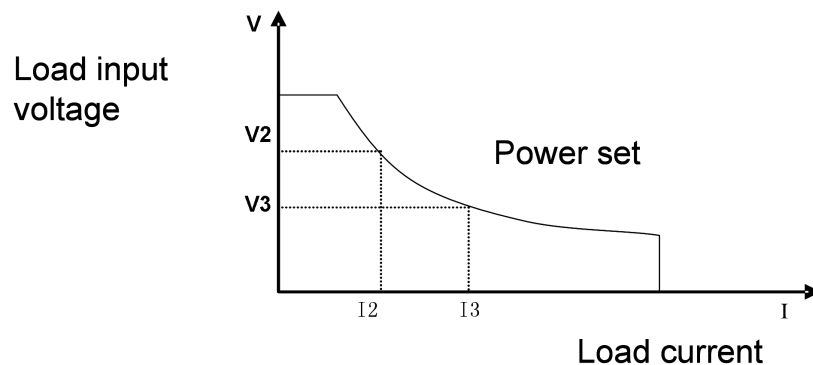


Figure 3.9 Constant Power Mode

#### 3.1.4.1 Setting up a Standard Constant Power Mode

Press the **P-SET** key, and the VFD panel displays **STANDARD POWER=xxxxxxxW** indicating the selection screen for constant power. Press the numeric keys and decimal point key to enter the constant power value desired then press the **Enter** key. The DC load will now be in standard constant power mode.

If the input state is **OFF**, the upper right corner of the VFD panel will display the word **OFF**. Press the **On/Off** key to change the input state to **ON**. Now the upper right corner of the VFD display will show either **CW** or **Unreg. CW**. **CW** means the DC load has been successfully set with the desired constant power value; **Unreg** means the DC load couldn't accept the selected constant power value. Check that the LED driver under test has been correctly connected and powered on; make sure the voltage of the LED driver is normal and that its maximum output current is within the specified range of the DC Load or at an undercurrent threshold.

In order to fine tune the constant power value, rotate the **encoder** knob to adjust the value desired. Rotating clockwise increases the value while rotating counter-clockwise decreases the value desired. Now the lower right corner of the VFD display shows the constant power value set. Should a blinking cursor appear under any digit, more tweaking is needed. . To make additional changes/refinements, use the rotary encoder knob. It also functions as an enter key for changes to DC Load settings. With each key press of the rotary encoder the cursor will move forward to the next digit position..

#### 3.1.4.2 Loading and Unloading Constant Power Mode

For the theory of operation to load and unload constant power mode, please refer to Figure 3.1.1.2

From standard constant power mode, press the **Shift+1(V\_Level)** key to enter the constant power loading and unloading mode. When the VFD panel displays **ONSET VOLT=xxxxxxxV** , it indicates the DC Loads current voltage., To enter a different voltage load, use numeric selector keys and decimal point key to change the load voltage value desired. Then press the **Enter** key to confirm the setting. The VFD panel will next show **OFFSET VOLT=xxxxxxxV** indicating the DC Load's present unload voltage. Press the numeric selector keys and decimal point key to enter the unload voltage value desired, followed by pressing the **Enter** key to confirm. Now the load will

be in the loading and unloading constant power mode.

If the input state is **OFF**, then the upper right corner of the VFD display will show **OFF**. Press the **On/Off** key to change the input state to **ON**. Now the upper right corner of the VFD panel will display either **CW\_UN** or **Unreg**. **CW\_UN** means the DC Load has been successfully set with the desired constant power value; **Unreg** means the DC Load did not accept the desired constant power value. Please check that the LED driver under test has been correctly connected and powered on; make sure that its voltage is normal and that its output current is within the range of current that the DC Load's selected power can with stand.

From the load and unload constant power mode, press the **Shift+1(V\_Level)** keys, and the DC Load will revert back to the standard constant power mode.

## 3.2 Dynamic Testing Operation

Dynamic testing operation enables the DC electronic load to periodically switch between two pre-set load levels. This function can be used to test the transient characteristics of the LED driver being tested.

Dynamic testing operation can be turned on and off by pressing the **Shift** + **Tran** keys on the front panel. Before turning dynamic testing operation on, all of the parameters associated with dynamic testing operation should be set by pressing the **Shift** + **S-Tran** keys including: Value A, A pulse time, Rise time from value A to value B, Value B, B pulse time, Fall time from value B to value A and dynamic testing operation mode. There are three modes of dynamic testing operation: continuous, pulsed and triggered modes.

### 3.2.1 Continuous Mode (CONTINUOUS)

In this mode, when the dynamic test operation is turned on the DC electronic load will periodically switch between values A and B.

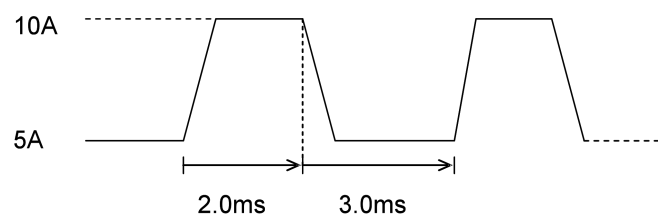


Figure 3.10 Continuous Operation Mode

### 3.2.2 Pulse Mode (PULSE)

In this mode, when the dynamic test operation is turned on, the DC electronic load will switch to value B when receiving one triggered pulse signal, then capture the pulse time(TWD) of value B, after which the DC Electronic Load will return to Value A.

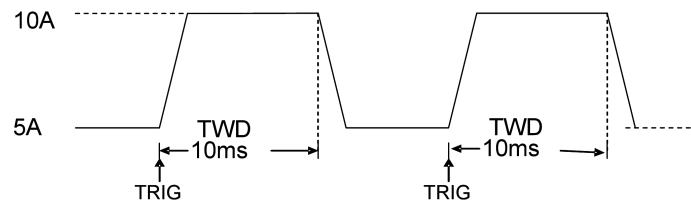


Figure 3.11 Pulse Operation Mode

### 3.2.3 Trigger Mode (TRIGGER)

In this mode, when the dynamic test operation is turned on, the DC electronic load will switch the state between value A and value B after receiving a trigger signal.

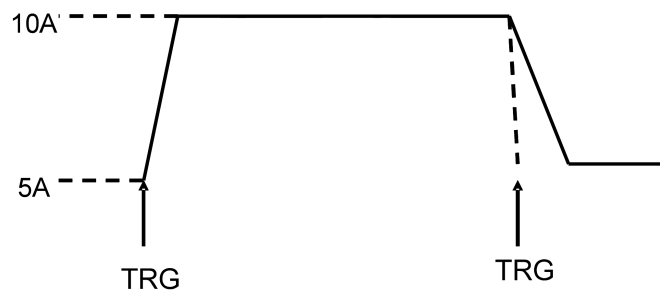


Figure 3.12 Trigger Operation Mode

### 3.2.4 Setting up Dynamic testing operation Parameters

Press the **Shift+6(S\_Tran)** keys, and the DC Electronic Load's VFD display shows **LEVEL A CURR=xxxxxxxA** indicating value A's current setting. Use the numeric keys and decimal point key to select the current value desired, followed by pressing the key **Enter** to confirm the setting.

When the load VFD display shows **WIDTH A TM=xxxxxxxmS**, it indicates the current duration time of current set for value A.. Using the numeric keys and decimal point key, enter the duration time desired, then press the **Enter** key to confirm.

When the DC Load's display shows **RISING TM=xxxxxxxmS**, it indicates the current rise time set from value A to value B. Use the numeric and decimal point keys to enter the rise time desired, and press the **Enter** key to confirm.

Next the DC Load's display shows **LEVEL B CURR=xxxxxxxA** that indicates the current value B setting. Use both the numeric and decimal point keys to enter the current value desired, and press the **Enter** key to confirm.

When **WIDTH B TM=xxxxxxxmS** appears on the display panel it indicates the current duration interval for value B that's set. To enter a different value for current, press the numeric and decimal point keys to enter the duration period desired, followed by pressing the **Enter** key to confirm.

Next the DC Load's VFD panel displays **FALLING TM=xxxxxxxmS** which indicates the current falling off time presently set between value B to value A. To change that value, use both the numeric and decimal point keys to enter the falling off time desired, and press the **Enter** key to confirm.

After all of these parameters have been set, the DC Electronic Load's panel will display the set-up of **TRANMODE**

**CONTINUOUS/ TRANMODE PULSE / TRNMODE TRIGGER** indicating the unit is currently ready for each of the 3 dynamic test operation modes. Select the dynamic operation mode desired by pressing the up ▲ or down ▼ keys followed by pressing the **Enter** key to confirm.

### 3.2.5 Waveform Control

#### 3.2.5.1 Square Wave

When set in the Continuous mode, with the rise time and fall time are both set to zero, the output wave is a square wave. The output frequency will be the inverse of the pulse duration sum of both current A and current B. Since the minimum accuracy of all the time interval is set at 20μS, the DC Electronic Load can read the square wave with a maximum frequency of 25KHz at 50% duty cycle.

#### 3.2.5.2 Triangular Wave

When set in the Continuous mode, with the interval time of current A and current B are both set to zero, the output wave is a triangular wave. The output frequency will be the inverse of the sum of the rise and fall times. Since the minimum accuracy of all the time interval is set at 20μS, the DC Electronic Load can read the triangular wave with a maximum frequency of 25KHz. Since the rising edge and falling edge of the triangular wave are all stepped within a 20μS interval, the ideal angle of the triangular wave will be in inverse proportion to the its output frequency. In extreme situations, the triangular wave might function as a square wave; there are 0-100 different accuracy steps scaled according to the different rising and falling times set.

#### 3.2.5.3 Trapezoidal Wave

When set in the Continuous mode of the dynamic test operation, and all four timing parameters that need to be individually set are all greater than zero, the output wave is a trapezoidal wave. It has the same frequency characteristics as the triangular wave.

### 3.2.6 Trigger Control

In dynamic test operation mode trigger control is initiated when either pulse or trigger mode is set. The three trigger modes are:

- a、 Keypad trigger  
Press the **Shift+Trigger** keys to trigger the DC Electronic load.
- b、 TTL trigger  
Send a high pulse with a constant time greater than 5msec to initiate the trigger-through terminals on rear panel of the DC electronic load.
- c、 PC soft control trigger sends a command to the DC electronic load

### 3.2.7 List Function

#### 3.2.7.1 Editing List

1) Press the **Shift+0** keys to enter the menu operation, and then use the ▲ and ▼ keys to get to **MENU LIST**, followed by keying **Enter** to confirm. Then press the ▲ and ▼ keys to reach **EDIT LIST**, followed by pressing **Enter** to confirm. Then press the ▲ and ▼ keys to select the sequential code that needs to be set, followed by pressing **Enter** to confirm.

2) When the display shows **MINIMUM TM= xxxxxx mS**, it indicates the minimum required time setting. Since this value affects the fine tuning and operable length of all the waveforms, please select the suitable parameters carefully. Then press **Enter** to confirm. The electronic load will offer the following three output modes: **LIST CONTINOUS**, **LIST END HOLD**, and **LIST END RESET**. Press the ▲ and ▼ keys to select the output mode desired, and press **Enter**.

**LIST CONTINOUS** means continuous output mode.

**LIST END HOLD** means the electronic load will retain the last value set in the last step when all the steps in one set of data have been successfully executed.

**LIST END RESET** means the electronic load will reset itself to load off mode when all the steps set in one set of data have been successfully completed.

3) After pressing **Enter** to confirm, the VFD panel displays **STEP LENG= xxx**, indicating the required step length that needs to be set. Press the numeric keys to input the step length desired, followed by pressing **Enter** to confirm. Please note that the step length should be a round number between 1 - 200.

4) When the VFD display shows **STEP 1 CURR=xxxxxA**, it indicates the required current that needs to be set in the first step. Use the numeric keys to input the current desired in the first step, and press **Enter** to confirm. When the display shows **STEP 1 TM=xxxxx mS**, it indicates the current duration of the first step. Press the numeric keys to input the current duration desired in the first step, followed by pressing **Enter** to confirm.

5) After all the setting steps have been entered, the VFD panel will display **EDIT LIST**, which means exiting back to the beginning at list function. If all the setting steps have not been edited, the display will show **STEP n CURR=xxxxxA**. This means that the value of the N step needs to be changed. Make the required changes following the operating instructions in the previous step 4).

6) Since list function shares the same storage space as the automatic testing function; make sure that the sequential code selected in the list function is the same as that in automatic testing function. If the sequential code defined for the automatic testing function prior to now is also the same entered for list function, this sequential code of the automatic testing function of will be deleted and cannot be restored.

#### 3.2.7.2 Executing List Function

Press the **Shift+0** keys to enter menu configuration, and then press the ▲ and ▼ keys to arrive at **MENU LIS**, and

press **Enter**.. Now press the ▲ and ▼ keys to get to **LOAD LIST**, and press the **Enter**.. Then press the ▲ and ▼ keys to set the sequential code of the list function you want to execute, and press **Enter**.

Since the list function shares the same storage space as the automatic testing function, the sequential code set for the automatic testing function will be automatically shielded from the sequential codes chosen for the list function.

### 3.2.8 Automatic Testing Function

The DC electronic load provides an automatic testing function in which 8 data parameters can be set, maximum, and 50 steps that can be changed within each set of data. Each step can be selected from among the following six working modes: load off mode, constant current mode, constant voltage mode, constant power mode, constant resistance mode, short circuit mode. Four comparison choices are available: current comparison, voltage comparison, power comparison and resistance comparison. Moreover, the delay time of each step can also be varied. The delay time of each step range from 0.1 to 25.5S, depending on the quickness and accuracy required. When each automatic test is over, the DC electronic load will indicate a pass or a fail result. The electronic load will sound an alarm when a UUT fails a test. The trigger function of the electronic load can be set at the front-panel for TRIGGE IN for the hardware voltage level in from the back-panel terminal connector and TRIGGER OUT for voltage level out from the terminal connector on the back panel. The trigger mode can be set up as either voltage level trigger or pulse trigger, and has 4 selection options of pass trigger, fail trigger, test complete trigger and disable- trigger.

#### 3.2.8.1 Automatic Test Operation

- 1) Press **Shift+0** keys to enter menu configuration, and then use the ▲ and ▼ keys to reach **MENU AUTO TEST**, and press **Enter** to confirm. Using press the ▲ and ▼ keys, go to **EDIT AUTO TEST**, and press **Enter**.. Now use the ▲ and ▼ keys to select the sequence steps desired and then press **Enter**.
- 2) When **STEP LENG= XX**, appears, set the desired step length. Use the numeric keys to input the step length, and press **Enter**. Note: step lengths should be a round number between 1-50.
- 3) At **STEP 1 xxxxx MODE**, use the ▲ and ▼ keys to select from the following six working modes, then press **Enter**.

Working Mode	Prompting Messages	Explanation
Load Off Mode	LOAD OFF MODE"	Compares the voltages when in load off mode
CC Mode	"CC MODE"	Choose one of four comparison types: current, voltage, power or resistance
CV Mode	"CV MODE"	Choose one of four comparison types: current, voltage, power or resistance
CP Mode	"CP MODE"	Choose one of four comparison types: current, voltage, power or resistance

CR Mode	“CR MODE”	Choose one of four comparison types: current, voltage, power or resistance
Short Circuit Mode	“SHORT MODE”	Compares the current when in short circuit mode

4) At **STEP 1 TEST xxxx**, there are four test types to select from: current, voltage, power and resistance. Use the ▲ and ▼ keys to select one from the four test types, and **Enter**. If in the previous step, if either load off mode or short circuit mode, was selected, then the electronic load will skip step over this step 4).

5) At **DELAY TM=xx.xS**, indicating the delay time input for each step, the valid range is between 0.1-25.5S. . The lower the value set, the shorter the duration of the test. Caution: in certain cases, if the value set is too low, the test result might be compromised because the test was ended before the power supply under test reaches its static state., To assure valid test results, select the delay time within optimal duration for best results. The recommended delay time is 0.5S. Note: The upper range of 25.5S is pre-set as a test suspended mode. Setting the delay time of any certain step at 25.5S, the load will stop and not proceed to the next step until a trigger signal is provided to continue the test. The trigger signal can be made either by the hardware on the back-panel, or by using the **Shift+Trigger** or the **On/Off** keys on the VFD display panel.

6) When **INPUT xxxx=xxxxxx**, is displayed, it indicates the corresponding current, voltage, power and resistance values in the working mode that have been set. Use the numeric keys to enter these values, and press **Enter** to confirm. Again, if in the prior step 3), load off mode or short circuit mode had been selected, the DC electronic load will skip over this step 6).

7) When **MINIMUM xxxx=xxxxxx**, appears, it indicates the lower limit value of a valid test comparison. Use the numeric keys to input the value, and press **Enter** to confirm. When the VFD display shows **MAXIMUM xxxx=xxxxxx**, the upper limit value of a valid test comparison is shown. Use the numeric keys to input the value, and press **Enter** to confirm.

When **EDIT AUTO TEST** is displayed on the screen, all the steps set requiring input values have been completed. The DC electronic load will exit back to the automatic testing function. But if all the steps have not been properly selected and values entered **STEP n xxxxx MODE** will be displayed indicating that some data of the N step needs to be keyed in.

### 3.2.8.2 Setting up Automatic Test Trigger Output Mode

Press **Shift+0** keys to enter the menu configuration mode, and using the ▲ and ▼ keys to get to **MENU AUTO TEST**, and press **Enter**. Scroll the ▲ and ▼ keys to get to **SETUP AUTO TEST**, and press **Enter**. The DC electronic load will be in automatic test trigger output mode.

There are 4 types of trigger output modes shown in the table below. Using the ▲ and ▼ keys, select the mode desired and press **Enter**.

Prompting Messages	Explanation
--------------------	-------------

“TRIGGER WHEN PSS”	Trigger once when pass the test
“TRIGGER WHEN FAIL”	Trigger once when failing the test
“TRIGGER WHEN TEST END”	Trigger once when finishing the test
“TRIGGER DISABLE”	Trigger disabled

Meanwhile, the Load will display the following trigger output electrical feature

Display	Description
“OUTPUT LEVEL”	Upon trigger, the output, voltage level will change from low to high, until a key is pressed or a trigger input signal arrives, and the voltage level then drops to low status.
“OUTPUT PLUSE”	Upon trigger the output voltage level changes from low to high status, and after 5 seconds automatically drops to a lower level

### 3.2.8.3 Executing Automatic Test Function

Using both the **Shift+0** keys go to menu configuration, and then press the **▲** and **▼** keys to get to **MENU AUTO TEST**, and press **Enter**. Scroll with the **▲** and **▼** keys and get to **LOAD AUTO TEST**, and press **Enter**. Use the **▲** and **▼** keys to select the sequential code for the automatic test function you want to execute, then press the **Enter**. The top right corner of the VFD two line display shows

**AUT n**, meaning the **n** automatic test in the list will be initiated. The bottom right of the VFD shows OFF D.

If all settings have been entered correctly, press the **On/Off** key to initiate the automatic test. The automatic test can also be initiated by lowering the voltage level of **TRIG IN** port with a duration of more than 5mS. When in test mode, the lower right corner of the VFD display will show **WAIT** or **STAY**, meaning the DC electronic load is waiting for test initiation or remaining in the suspended mode respectively. Please retrigger it so to testing continues onward.

After each test is completed, the lower right corner of the VFD display will show either **PASS** or **FAIL**. If failure occurs, the buzzer will sound. At this point, initiate the next trigger or press any key to free the load from the pass or fail indication

Once the automated test is finished, press the **▲** and **▼** keys to initiate a manually operated test mode. With each key press of the **▲** or the **▼** keys one time, the DC electronic load will resume the test of the previous step or the next step in the sequence. Users can observe the actual state of every step. When the ON/OFF key is pressed or a trigger is initiated, the DC electronic load will automatically exit from the manually operated test mode and return to the automatic test mode again.



### 3.3 Input Control

#### 3.3.1 Short Circuit Operation (SHORT)

The DC Electronic Load can simulate a short circuit at the input end by turning the load on with full-scale current. The short circuit function can be toggled on/off at the front panel by pressing the **Shift+9(Short)** keys. Short circuit operation does not influence the current value set. When the short circuit operation is in **OFF** state, the Load will return to its original setting state.

The actual current value that the load consumes in short circuit operation depends on the active working mode and current range of the load. In CC, CW and CR modes, the maximum short-circuit current value is 1.2 times the current range. In CV mode, short-circuit operation is identical to setting constant voltage to 0V.

#### 3.3.2 Input On/Off Operation

When the load input state is **ON**, pressing the **On/Off** key will change the input state to **OFF**. Now top right corner of the VFD display shows **OFF**. When the load input state is **OFF**, pressing the **On/Off** key will change the input state to **ON** state. Now the upper right corner of the two line display shows **SHORT** indicating the current working state.

### 3.4 Electronic Load Operation Range

The DC Electronic load operates in the following range of Rated Current, Rated voltage and Rated Power. Please refer to the Figure 3-13 and Figure 3-14.

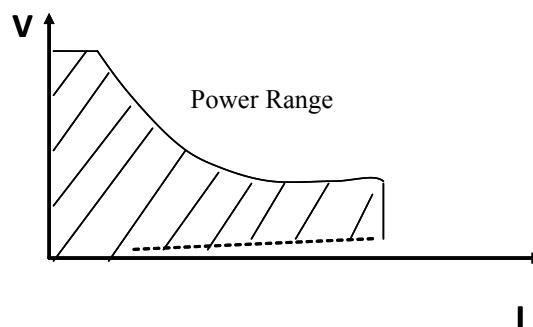


Figure 3-13 Electronic Load Power Range

Electronic load Mode Change

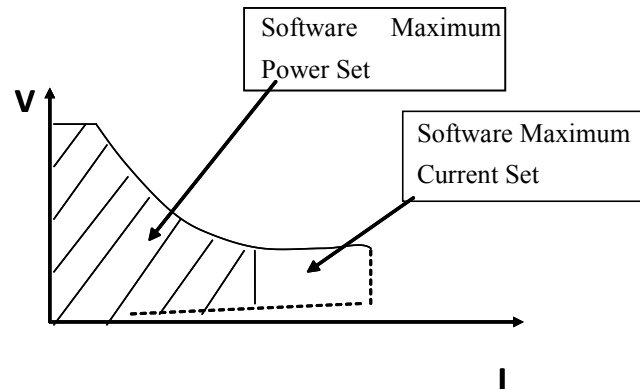


Figure 3-14 Software Maximum Setting Value

## 3.5 Protection Functions

The DC Electronic Load features the following protection functions.

### 3.5.1 Over Voltage Protection (OV)

If input voltage exceeds the maximum voltage range of the load, it will automatically shut down the input. A buzzer will sound and the VFD panel displays the **Over Volt** message

The DC Electronic load's maximum voltage value can be set by pressing both **Shift+0(Menu)** keys. When the VFD display shows **MENU SYSTEM SET**, press the **Enter** key to confirm. Now the VFD display shows **SYSTEM IMAX=xxxxxxx A**. Use the **Up** and **Down** keys to reach **SYSTEM UMAX=xxxxxxx V** setting input. Here the current maximum voltage limit value is displayed as 150V. Entering a different voltage value can be done using both the numeric and decimal point keys. Pressing the **ESC** key exits the **Menu** mode.

**Note:** The maximum acceptable input voltage of the SEL712 DC electronic load is 150V. When any value beyond 150V is input, the load will default back to 150V.

Besides, the maximum voltage value input is closely related to voltage resolution. If the maximum voltage value set is below 20V, the load's voltage resolution will be 0.1mV; if the maximum voltage value set is above 20V, then the load's voltage resolution will be only 1mV.

### 3.5.2 Over Current Protection (OC)

If input current exceeds the maximum current range of the load, it will automatically shut down the input. A beep will sound and the VFD panel displays the **OVER CUR** message

The load's maximum current value can be set by pressing both the **Shift+0(Menu)** keys. When the VFD display shows **MENU SYSTEM SET**, press the **Enter** key to confirm. Now the VFD display shows **SYSTEM IMAX=xxxxxxx A** setting input. Here the current maximum current value is displayed as 30A. Entering a different current value can be done using both the numeric and decimal point keys. Pressing the **ESC** key exits the **Menu** mode. **Note:** The maximum acceptable input current of the SEL712 DC electronic load is 30A. When any value beyond 30A is input, the load will

default back to 30A. Besides, the maximum current value input is closely related to current resolution. If the maximum current value set is below 3A, the load's current resolution will be 0.01mA; if the maximum current value set is above 3A, then the load's current resolution will be only 0.1mA.

### 3.5.3 Over Power Protection (OW)

If input wattage exceeds the maximum wattage range of the load, it will automatically shut down the input. A buzzer will sound and the VFD panel displays the **OVER POW** message

Press any key to get the load back to normal operation. Note: if the current input state is **OFF**, press the **ON/OFF** key to make the load resume normal operation. If the over power problem is not solved, the load will continue to display the **OVER POW** message.

The load's maximum wattage value can be set by pressing both the **Shift+0(Menu)** keys. When the VFD display shows **MENU SYSTEM SET**, press the **Enter** key to confirm. Now the VFD display shows **SYSTEM PMAX=xxxxxxxW** setting input. Here the current maximum wattage value is displayed as 300W. Entering a different current value can be done using both the numeric and decimal point keys. Pressing the **ESC** key exits the **Menu** mode.

**Note:** The maximum acceptable input wattage of the SEL712 DC electronic load is 300W. When any value beyond 300W is input, the load will default back to 300W.

### 3.5.4 Input Polarity Reversed

If the DC electronic load has its input polarity reversed, a buzzer will sound and the VFD display will show **REVERSE** as a message

### 3.5.5 Over Heat Protection (OH)

When the temperature of internal power components exceeds 80°C, over heat protection will be automatically initiated. The load will shut down input, a buzzer will sound and the VFD display will show the **OVERHEAT** message.

## 3.6 Remote Sense Function

When in CV, CR and CP mode, if the DC electronic load consumes high current, the power supply under test will have a voltage drop in the cables/wires connecting it to the load's BP terminals. In order to assure measurement accuracy, there are remote measurement terminals installed on the rear-panel of the DC electronic load. Users can measure the voltage at the output terminals of the power supply under test by using these rear panel terminal connections.

The remote measurement function can be set up by pressing both the **Shift+0(Menu)** keys. Go to **MENU SYSTEM SET**, and press **Enter**. The display will come up at **SYSTEM IMAx=xxxxxxxA**. Use the **Up** and **Down** keys and scroll to **SYSTEM TERMINAL SEL** and press **Enter**. There are only two options for the remote measurement function, **TERMINAL SELECT FRONT** or **TERMINAL SELECT BACK**. Use the **Up** and **Down** keys to make a selection. **TERMINAL SELECT FRONT** means the Binding Post (BP) input terminals on the front panel of the DC

electronic load. Selecting the BP will disable the remote measurement function on the rear panel. **TERMINAL SELECT BACK** means the input terminals on the rear panel of the load. Selecting these back panel terminals will disable the remote measurement function of the BPs on the load's front panel. After making the remote measurement selection, press the key **Esc** to exit **Menu** mode.

Note: Either of the input terminals on the front panel or back panel can be initiated at any time. However, it is impossible to initiate both sets of input terminals simultaneously. If the voltage of the load is near to zero point and does not change in conjunction with the signal, please check that the wire mode matches the parameters of the remote measurement function.

Please refer to the Figure 3.4 for the trigger terminals and measurement terminals.

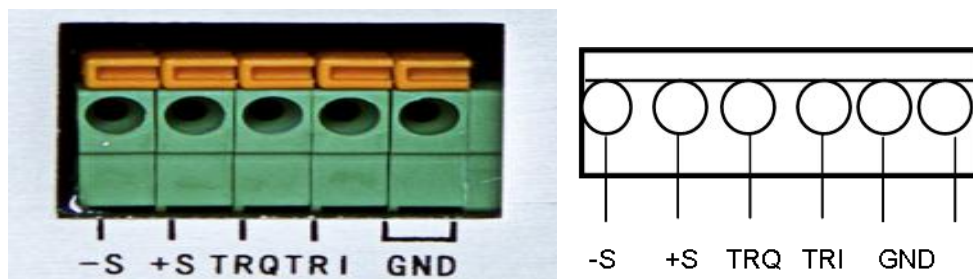


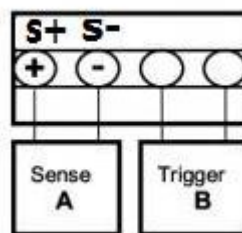
Figure 3.4 Remote Measurement Terminals

-S and +S are remote measurement terminals;

TRQ and TRI are trigger terminals, the last two terminals are ground terminals.

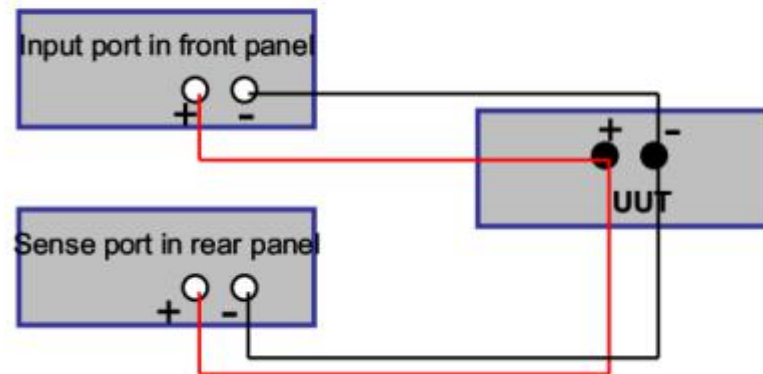
The output of power supply will be turned off when testing out the change in voltage level from high to low from TRQ port which is under the latched mode of the remote control function. As a multifunction extended port, TRI port is designed for future expanded.

The following diagram shows the remote sense terminals on the back panel of the instrument.



The following shows wiring diagram for the remote sensing:

**Wiring diagram for remote sense**



### 3.7 Battery Testing

Experimentation has proven that the DC Electronic Load is the best way to confirm the operability of most batteries. With the correct load test set-up, the battery expectant life curve can be confirmed. The electronic loads can currently be used to test about any type of the battery.

For batteries that are embedded in other equipment or placed in uninterrupted power service systems, it is vital to use a DC electronic load for testing battery life status. Because batteries are among the lowest reliability components in such systems, it should be tested periodically using a DC electronic load for viability and utility.

#### Battery Life Stability Test

In Constant Current mode the Serial electronic load can test battery life stability Set up the load to control voltage level. When the voltage of the battery is too low, the serial electronic load will identify the battery being on the threshold value set or at the margin of an insecure state and will stop testing automatically. When the load is in test mode, you can see the battery's voltage, battery discharge current, electronic, load power and battery capability that remains. If the load is connected through PC software, then you can see the battery discharge curve.. This test can measure the reliability and remaining life of the battery. So it is important to perform the test before the battery is re-charged, or swapped out for a newer battery.

#### Operation:

- 1) In standard constant current mode, adjust the load's current value to the same discharge current value of battery needed.
- 2) Press both **Shift+8(Battery)** keys. When VFD display shows **END TEST VOLT= xxxxxxxxV**, input the shut-off voltage and press **Enter** to start the battery life stability test. When the battery's voltage drops to the turn-off voltage set, the load will automatically shut off.
- 3) Press the **On/Off** keys to start or pause the battery capability test.

- 4) Press both the **Shift+8(Battery)** keys to exit the battery life stability test mode.

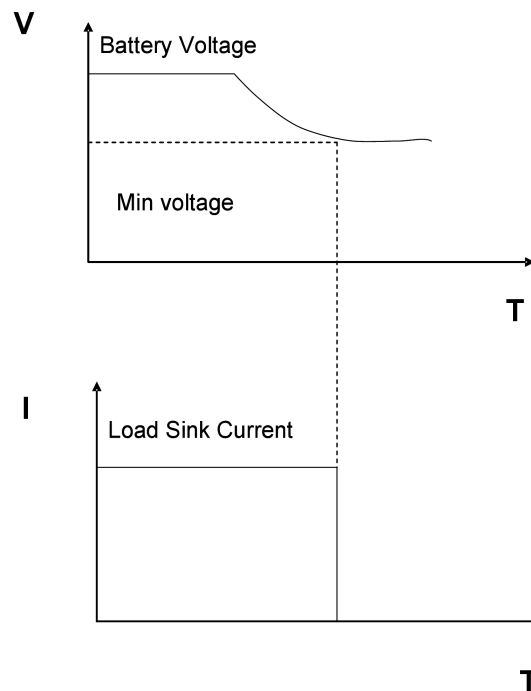


Figure 3-16 Battery capacity calculation

## 3.8 Communication Protocol

### 3.8.1 Introduction

SEL7 series programmable electronic loads work on the Modbus protocol. The data frame contains 4 parts as follows:

Salve Address	Function Code	Data	Error Checking(CRC)
---------------	---------------	------	---------------------

To assure high reliability communications, the frame pitch set must be greater than 3.5 times the transient time of a single bit byte. In other words, when the comm. rate is 9600 baud, the frame pitch time must be set greater than  $11 \times 3.5 / 9600 = 0.004s$ .

SEL7 series programmable DC electronic loads are equipped with two way asynchronous communication, with 1 bit fixed as the start bit, 8 data bits, and 1 stop bit. It supports Non parity check, Odd Parity check and Even parity check. The communications rate is selectable at 2400, 9600, 14400, 28800, 57600, 115200 baud.

#### 1) Setting up additional addresses and communication parameters

The additional address is a single byte with 16 hexadecimal system data; the SEL7 series DC electronic loads will only respond to the request data frame that has the same additional address.

#### 2) Setup the additional address

Press both **Shift+0** keys in sequence, placing you in Main Menu mode. The DC electronic Load display will be at

**MENU CONFIG.** Press the key **Enter** to confirm. Using the **CONFIG Menu**, -up and down ▲ ▼ keys, scroll to **CONFIG ADDRESS SET**, then press Enter to confirm., Now the load will display **ADDRESS ADDR= xxx**. Enter the new address using numeric keys, and press the **Enter** key again to confirm.

**Note:** Only whole numbers from 1 - 200 range will be accepted as valid additional addresses.

### 3) Select the check mode

Press the **Shift+0** keys in sequence, placing you in Main Menu mode. The DC Electronic Load will now display **MENU CONFIG**. Press the **Enter** key to confirm. At **CONFIG menu**, use the up and down ▲ and ▼ keys, and scroll to **CONFIG COMM.PARITY**, and press **Enter**. The load will now display **COMM.PAR xxxxx**. There are three choices, ODD, EVEN and NONE to select from. Enter the numeric value for the parity mode using the keypad and press **ENTER**. Now the load has its parity mode set.

### 3.8.2 Setup Baudrate

Press the **Shift+0** keys in sequence, placing it in Main Menu mode. The DC Electronic Load will now display **MENU CONFIG**. Press the **Enter** key to confirm. At **CONFIG menu**, use the up and down ▲ and ▼ keys, and scroll to **CONFIG BAUDRATE SET**, then press Enter to confirm. The load will now display **BUADRATE xxxxx**. The DC Load offers you six choices of baud rate to set. Use the use up and down ▲ and ▼ keys to set the desired communications rate from 2400,9600,14400,28800,57600 and115200 baud.

### 3.8.3 Data

The SEL7 series loads operate in the Modbus protocol. Accordingly, in some data frames, the date length is fixed, but in other data frames, the length is not fixed. According to this protocol, all the hexadecimal data and the floating point number are fixed in the High Byte and the unfixed data length fields are in the Low Byte. In addition, the output value of a force single coil must be either 0x0000 or 0xFF00. 0x0000 means OFF, and 0xFF00 means ON. All other values are invalid and will not affect the coil.

### 3.8.4 Function Code

Function codes are single byte hex number; there are 4 function modes as follows:

Function Code	Description
0x01	Read Coil Status, read the data by the bit
0x05	Force Single Coil, write the data by the bit
0x03	Read Holding Registers, read the data by the word
0x10	Preset Multiple Registers, write the data by the word

### 3.8.5 Error Checking (CRC)

The SEL7 series loads use the Cyclic Redundancy Check (CRC). The CRC field examines the contents of the entire message. The CRC filed is two bytes, containing a 16-bit binary value. When the CRC is appended to the message, the

low-order byte is appended first, followed by the high-order byte.

The discipline is as follows:

- a) Set one hex CRC register, and give it the initial value as 0xFFFF.
- b) Make bit xor the first byte of the frame data and the lower 8 bit of the CRC register. Save the bit xor result into the CRC register.
- c) Right move the CRC register for 1 byte, and make certain the lowest bit is set as 1. If the lowest bit is 1, then make the bit xor for the CRC register and the fixed data as 0xA001.
- d) Repeat c) 8 times.
- e) Repeat steps b, c and, for the next byte of frame data until the last byte.
- f) The last number of the CRC register is the last parity check result. Place it at the end of the frame data, keeping the lower 8 bits in the latter and higher 8 bits in former.

### 3.8.6 Complete Command Frame Analysis

#### 1. Read Coil Status (0x01)

##### Read Coil Status Example Query

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x01
Starting Address	2	0 - 0xFFFF
N0. of Points	2	1 - 16
CRC Error Check	2	

##### Read Coil Status Example Normal Response

Filed Name	Byte length	Example Value
Slave Address	1	1-200
Function Code	1	0x01
Byte Count	1	1 - 2
Data(Coil Status)	n	
CRC Error Check	2	

##### Read Coil Status Example Abnormal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x81



Abnormal Code	1	01 - 04
CRC Error Check	2	

### For example:

The following example reads the load input state (ISTATE) of Coil at slave device address 0x01.

From table 3.8.7.1, we know that the ISTATE address is 0x0510.

**Query:** 0x01 0x01 0x05 0x10 0x00 0x01 0xFC 0xC3

**The Corresponding Normal Response:** 0x01 0x01 0x01 0x48 0x51 0xBE, among which, 0x48 is the read-back data and its lowest bit is 0; this means the input state ISTATE is OFF.

## 2. Force Single Coil (0x05)

### Force Single Coil Example Query

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x05
Coil Address	2	0 - 0xFFFF
Force Data (Coil Status)	2	0x0000 or 0xFF00
CRC Error Check	2	

### Force Single Coil Example Normal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x01
Coil Address	2	0 - 0xFFFF
Force Data (Coil Status)	2	0x0000 or 0xFF00
CRC Error Check	2	

### Force Single Coil Example Abnormal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x85
Abnormal Code	1	01 - 04
CRC Error Check	2	

A value of 0xFF00 forces the coil to be ON, and 0x0000 forces the coil to be turned OFF. All other values are invalid and will not affect the coil.

#### For example:

The following example sets the load is in remote control at slave device address 0x01.

From table 3.8.7.1, we know that the PC1 remote address is 0x0510.

**Query:** 0x01 0x05 0x05 0x00 0xFF 0x00 0x8C 0xF6

**The Corresponding Response:** 0x01 0x05 0x05 0x00 0xFF 0x00 0x8C 0xF6

### 3. Read Holding Registers (0x03)

#### Read Holding Registers Example Query

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x03
Starting Address	2	0 - 0xFFFF
No. of Points	2	n=1 - 32
CRC Error Check	2	

#### Read Holding Registers Example Normal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x03
Byte Count	1	2*n
Data	2*n	
CRC Error Check	2	

#### Read Holding Registers Example Abnormal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x83
Abnormal Code	1	01 - 04
CRC Error Check	2	

#### For example:

The following example reads the present voltage value at slave device address 0x01.

From table 3.8.7.1, we know that the register address of the present voltage value is 0x0B00,

**Query:** 0x01 0x03 0x0B 0x00 0x00 0x02 0xC6 0x2F

**The Corresponding Normal Response:** 0x01 0x03 0x04 0x41 0x20 0x00 0x2A 0x6E 0x1A, among which, 0x41 0x20 0x00 0x2A is the read-back voltage value, the corresponding floating point number is 10V.

#### 4. Preset Multiple Registers (0x10)

##### Preset Multiple Registers Example Query

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x10
Starting Address	2	0 - 0xFFFF
No. of Registers	2	n=1 - 32
Byte count	1	2*n
Preset Data	2*n	
CRC Error Check	2	

##### Preset Multiple Registers Example Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x10
Starting Address	2	0 - 0xFFFF
No. of Registers	2	N
CRC Error Check	2	

##### Preset Multiple Registers Example Abnormal Response

Field Name	Byte length	Example Value
Slave Address	1	1 - 200
Function Code	1	0x90
Abnormal Code	1	01 - 04
CRC Error Check	2	

#### For example:

The following example sets the load's constant current IFIX is 2.3A at slave device address 0x01.

From table 3.8.7.1, we know that the IFIX register address is 0x0A01, the floating point takes up two-word length.

**Query:** 0x01 0x10 0x0A 0x01 0x00 0x02 0x04 0x40 0x13 0x33 0x33 0xFC 0x23

**The Corresponding Normal Response:** 0x01 0x10 0x0A 0x01 0x00 0x02 0x13 0xD0

### 3.8.7 Coil with the Register Address Allocation

**Table 1: Coil-bit definition:**

Name	Address	Bit	Property	Description
PC1	0x0500	1	W/R	When remote control status bit is 1, front key panel unable
PC2	0x0501	1	W/R	When local prohibition bit is 1, not allow to use key "Shift +7" to snatch away the front panel control.
TRIG	0x0502	1	W/R	Trigger tagged: triggered once by software
REMOTE	0x0503	1	W/R	1: remote input voltage
ISTATE	0x0510	1	R	Input status: 1- input ON, 0- input OFF
TRACK	0x0511	1	R	Tracking status: 1-voltage tracking; 0-current tracking
MEMORY	0x0512	1	R	1:input state memory
VOICEEN	0x0513	1	R	1: key sound ON/OFF
CONNECT	0x0514	1	R	1: multi 0= single
ATEST	0x0515	1	R	1: Automatic test mode
ATESTUN	0x0516	1	R	1: Automatic test pattern waiting to trigger
ATESTPASS	0x0517	1	R	1: success automatic test success ,0: automatic test failed
IOVER	0x0520	1	R	1:over-current tag
UOVER	0x0521	1	R	1: over-voltage tag
POVER	0x0522	1	R	1: over- Power tag
HEAT	0x0523	1	R	1: over-heat tag
REVERSE	0x0524	1	R	1: reverse tag
UNREG	0x0525	1	R	1: register parameter failed tag
ERREP	0x0526	1	R	1: EPPROM error tag
ERRCAL	0x0527	1	R	1: calibration data error tag

**Table 2: Register XRAM area definition**

Name	Address	Bit	Property	Description
CMD	0x0A00	1	W/R	Command Register: lower 8 bits effective, high 8 bits meaningless
IFIX	0x0A01	2	W/R	Constant current register: double-type
UFIX	0x0A03	2	W/R	Constant voltage register, double-type
PFIX	0x0A05	2	W/R	Constant power register, double-type
RFIX	0x0A07	2	W/R	Constant resistance register: double-type
TMCCS	0x0A09	2	W/R	Current soft-start rising time register, double type
TMCVS	0x0A0B	2	W/R	Voltage soft-start rising time register, double type
UCCONSET	0x0A0D	2	W/R	Constant current load voltage register: double-type
UCCOFFSET	0x0A0F	2	W/R	constant current unload voltage register, double-type
UCVONSET	0x0A11	2	W/R	Constant voltage load voltage register :double-type
UCVOFFSET	0x0A13	2	W/R	Constant voltage unloaded voltage register, double-type
UCPONSET	0x0A15	2	W/R	Constant power load voltage register, double- type
UCPOFFSET	0x0A17	2	W/R	Constant power unload voltage register, double-type
UCRONSET	0x0A19	2	W/R	Constant resistance load voltage register , double-type
UCROFFSET	0x0A1B	2	W/R	Constant resistance unload voltage register, double type
UCCCV	0x0A1D	2	W/R	constant current shift constant voltage register: double type
UCRCV	0x0A1F	2	W/R	Constant resistance shift constant voltage register, double type
IA	0x0A21	2	W/R	dynamic mode A phase current register, double-type
IB	0x0A23	2	W/R	dynamic mode B phase current register, double-type
TMAWD	0x0A25	2	W/R	dynamic mode A pulse-width registers, double-type

TMBWD	0x0A27	2	W/R	dynamic mode B pulse-width registers ,double-type
TMTRANRIS	0x0A29	2	W/R	Dynamic mode rising time register, double-type
TMTRANFAL	0x0A2B	2	W/R	Dynamic model falling time register double-type
MODETRAN	0x0A2D	1	W/R	Dynamic mode register,u16-type
UBATTEND	0x0A2E	2	W/R	Battery Test termination voltage register ,double type
BATT	0x0A30	2	W/R	Battery capacity register, double –type
SERLIST	0x0A32	1	W/R	LIST serial number register, u16 type
SERATEST	0x0A33	1	W/R	Automatic Test serial number register , u16 type
IMAX	0x0A34	2	W/R	Current maximum register, double type
UMAX	0x0A36	2	W/R	Voltage maximum register, double type
PMAX	0x0A38	2	W/R	Power maximum register ,double type
ILCAL	0x0A3A	2	W/R	Calibration current low-end target value double type
IHCAL	0x0A3C	2	W/R	Current high-end calibration target value, double type
ULCAL	0x0A3E	2	W/R	Voltage low-end calibration target value, double type
UHCAL	0x0A40	2	W/R	Voltage high-end calibration target value, double type
TAGSCAL	0x0A42	1	W/R	Calibration state tag, u16 type
U	0x0B00	2	R	Voltage Register ,double type
I	0x0B02	2	R	Current Register ,double type
SETMODE	0x0B04	1	R	Operation Mode register,u16e type
INPUTMODE	0x0B05	1	R	Input Status Register, u16 type
MODEL	0x0B06	1	R	Model Register ,u16 type
EDITION	0x0B07	1	R	software version number register,u16 type

### 3.8.8 The Definition Of The Command Register CMD

Definition	CMD Value	Description
CC	1	
CV	2	
CW	3	

CR	4	
CC Soft Start	20	
Dynamic Mode	25	
Short Circuit Mode	26	
List Mode	27	
CC Loading And Unloading Mode	30	
CV Loading And Unloading Mode	31	
CW Loading And Unloading Mode	32	
CR Loading And Unloading Mode	33	
CC Mode Switch To CV Mode	34	
CR Mode Switch To CV Mode	36	
Battery Test Mode	38	
CV Soft Start	39	
Changing System Parameters	41	
Input ON	42	
Input OFF	43	

### 3.8.9 Common Operation Function Description

**Table 1 Remote Control Operation:**

Operation	Register	Value	Description
Force Single Coil	PC1	1	mandatory

**Table 2 cancels remote control operation:**

Operation	Register	Value	Description
Force Single Coil	PC1	0	mandatory

**Table 3 Local Prohibition control operations:**

Operation	Register	Value	Description
Force Single Coil	PC2	1	mandatory

**Table 4 Local allows the operator to:**

Operation	Register	Value	Description
Force Single Coil	PC2	0	mandatory

**Table 5 Input ON operation:**

Operation	Register	Value	Description
Preset Multi-Registers	CMD	42	mandatory

**Table 6 Input OFF operation:**

Operation	Register	Value	Description
Preset Multi-Registers	CMD	43	mandatory

**Table 7 Short-circuit operation:**

Operation	Register	Value	Description
Preset Multi-Registers	CMD	26	mandatory

**Table 8 CC mode operation:**

Operation	Register	Value	Description
Preset Multi-Registers	IFIX	Double	Optional
Preset Multi-Registers	CMD	1	mandatory

**Table 9 CV mode operation:**

Operation	Register	Value	Description
Preset Multi-Registers	UFIX	Double	Optional
Preset Multi-Registers	CMD	2	mandatory

**Table 10 CW mode operation:**

Operation	Register	Value	Description
Preset Multi-Registers	PFIX	Double	Optional
Preset Multi-Registers	CMD	3	mandatory

**Table 11 CR mode operation:**

Operation	Register	Value	Description
Preset Multi-Registers	RFIX	Double	Optional
Preset Multi-Registers	CMD	4	mandatory

**Table 12 CC mode soft-start:**



Operation	Register	Value	Description
Preset Multi-Registers	IFIX	Double	Optional
Preset Multi-Registers	TMCCS	Double	Optional
Preset Multi-Registers	CMD	20	mandatory

**Table 13 CV mode soft-start:**

Operation	Register	Value	Description
Preset Multi-Registers	UFIX	Double	Optional
Preset Multi-Registers	TMCVS	Double	Optional
Preset Multi-Registers	CMD	39	mandatory

**Table 14 CC loading and unloading mode:**

Operation	Register	Value	Description
Preset Multi-Registers	IFIX	Double	Optional
Preset Multi-Registers	UCCONSET	Double	Optional
Preset Multi-Registers	UCCOFFSET	Double	Optional
Preset Multi-Registers	CMD	30	mandatory

**Table 15 CV loading and unloading mode:**

Operation	Register	Value	Description
Preset Multi-Registers	UFIX	Double	Optional
Preset Multi-Registers	UCVONSET	Double	Optional
Preset Multi-Registers	UCVOFFSET	Double	Optional
Preset Multi-Registers	CMD	31	mandatory

**Table 16 CW loading and unloading mode:**

Operation	Register	Value	Description
Preset Multi-Registers	PFIX	Double	Optional
Preset Multi-Registers	UCPONSET	Double	Optional
Preset Multi-Registers	UCPOFFSET	Double	Optional
Preset Multi-Registers	CMD	32	mandatory

**Table 17 CR loading and unloading mode:**

Operation	Register	Value	Description
Preset Multi-Registers	RFIX	Double	Optional
Preset Multi-Registers	UCRONSET	Double	Optional
Preset Multi-Registers	UCROFFSET	Double	Optional
Preset Multi-Registers	CMD	33	mandatory

**Table 18 CC mode switch to CV mode:**

Operation	Register	Value	Description
Preset Multi-Registers	IFIX	Double	Optional
Preset Multi-Registers	UCCCV	Double	Optional
Preset Multi-Registers	CMD	34	mandatory

**Table 19 CR mode switch to CR mode:**

Operation	Register	Value	Description
Preset Multi-Registers	RFIX	Double	Optional
Preset Multi-Registers	UCRCV	Double	Optional
Preset Multi-Registers	CMD	35	Must select

**Table 20 battery test mode:**

Operation	Register	Value	Description
Preset Multi-Registers	IFIX	Double	Optional
Preset Multi-Registers	UBATTEND	Double	Optional
Preset Multi-Registers	CMD	38	mandatory

**Table 21 Dynamic test mode:**

Operation	Register	Value	Description
Preset Multi-Registers	IA	Double	Optional
Preset Multi-Registers	IB	Double	Optional
Preset Multi-Registers	TMAWD	Double	Optional
Preset Multi-Registers	TMBWD	Double	Optional
Preset Multi-Registers	TMTRANRIS	Double	Optional
Preset Multi-Registers	TMTRANFAL	Double	Optional
Preset Multi-Registers	MODETRAN	0 - 2	Optional

Preset Multi-Registers	CMD	25	mandatory
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**Table 22 System parameter setting mode:**

Operation	Register	Value	Description
Preset Multi-Registers	IMAX	Double	Optional
Preset Multi-Registers	UMAX	Double	Optional
Preset Multi-Registers	PMAX	Double	Optional
Force Single Coil	REMOTE	0xFF00/0x0000	Optional
Preset Multi-Registers	CMD	41	mandatory

## 3.9 Remote Operation

The DB9 interface connector on the rear panel of the power supplier can be transferred to RS232 interface through the voltage level shift cable (M-131 or M-133) , the following information will tell you how to use the computer to control the output of the power supplier. Before carrying out the remote operation mode, please use the voltage level shift cable (M-131 or M-133) provided by our company, for M-131 or M-133 can not only transform TTL voltage level into RS232 signal, but also connect the DB9 interface connector with computer's serial interface.

### 3.9.1 M-131 or M-133 Communication Cable

The DB9 interface connector on the rear panel of the DC electronic load provides a TTL voltage level; The communication cable (M-131 or M-133) can be used to connect the DB9 interface connector of the electronic load and an RS-232 interface connector of a PC to enable remote operation/ communication. Please refer to the following photos of the M-131 or M-133 interface cables.



**M-131**



**M-133**

**Note: An industry standard RS-232 interface cable between the SEL7XX and a regular PC will not facilitate communication between the devices. The dongle on the M-133 provides the necessary switching to enable proper communication.**

### 3.9.2 Communication between Power Supply and PC

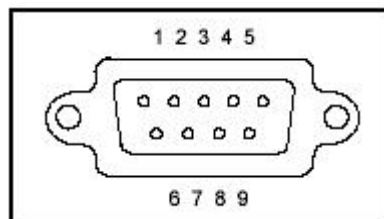
The DB9 interface connector on the rear panel of the electronic load can be transferred to RS232 interface through the voltage level shift cable (M-131 or M-133) . The following instructions can help you understand how to control the output of power supplier by PC.

#### 1. RS232 Setting

Before using the remote operation mode, please insure that the baudrate and communication port address of the DC electronic load are the same as in the PC's software or the communication will fail. You can change the baud rate and communication port address from the front panel of the load or and match it to the PC in the computer set-up for new devices

- (1) Baud rate: 9600(4800, 9600, 19200, 38400, which are selectable from the menu on the front-panel.)
- (2) Data bit: 8
- (3) Stop bit: 1
- (4) Parity: (none, even, odd)

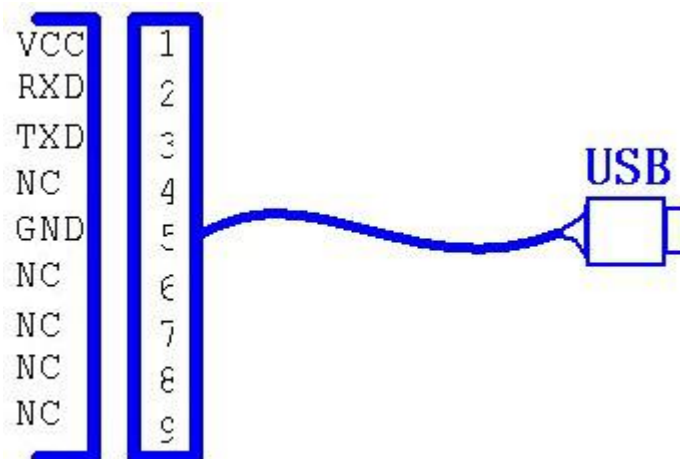
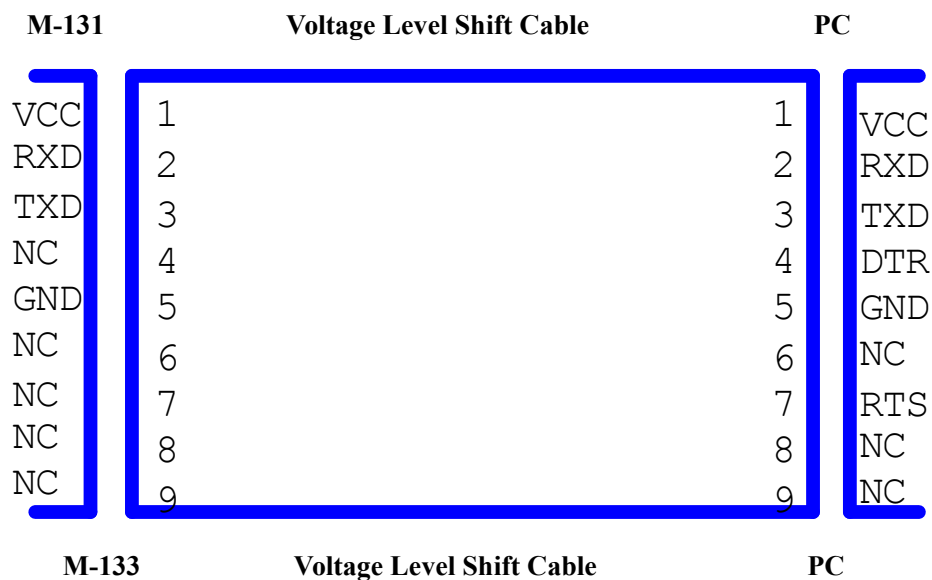
#### 2. DB9 Serial Interface



**DB9 Serial Interface**

- 1 +5V
- 2 TXD
- 3 RXD
- 4 NC
- 5 GND
- 6 NC
- 7 NC
- 8 NC
- 9 NC

The output of DB9 interface on the rear-panel of the power supplier is TTL voltage level, so the pin outs of the voltage level shift cable (M-131 or M-133) must be set-up to match the PC before connecting the DB9 interface with the serial interface on PC.



**Note: An industry standard RS-232 interface cable between the SEL7XX and a regular PC will not facilitate communication between the devices. The dongle on the M-133 provides the necessary switching to enable proper communication.**

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