

VOLTcraft

EL-1000&2000 Series Programmable DC Electronic Load User Manual

Item No.: 3364227 (EL-1400)

Item No.: 3364228 (EL-1200)

Item No.: 3451222 (EL-2200)

Item No.: 3451223 (EL-2400)

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1. General Safety Requirements

Before use, please read the following safety precautions to avoid any possible bodily injury and to prevent this product or any other connected products from damage. In order to avoid any contingent danger, ensure this product is only used within the range specified.

Only the qualified technicians can implement the maintenance.

To avoid Fire or Personal Injury:

- **Use Proper Power Cord.** Use only the power cord supplied with the product and certified to use in your country.
- **Connect the probe correctly.** The grounding end of the probe corresponds to the grounding phase. Please don't connect the grounding end to the positive phase.
- **Check all Terminal Ratings.** To avoid fire or shock hazard, check all ratings and markers of this product. Refer to the user's manual for more information about ratings before connecting to the instrument.
- **Do not operate without covers.** Do not operate the instrument with covers or panels removed.
- **Use Proper Fuse.** Use only the specified type and rating fuse for this instrument.
- **Avoid exposed circuit.** Do not touch exposed junctions and components when the instrument is powered.
- **Do not operate if in any doubt.** If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations.
- **Use your instrument in a well-ventilated area.** Make sure the instrument installed with proper ventilation, refer to the user manual for more details.
- **Do not operate in wet conditions.** To avoid the risk of internal circuit short circuits or electric shock, do not operate the instrument in a humid environment.
- **Do not operate in an explosive atmosphere.** To avoid damage to the instrument or personal injury, do not operate the instrument in flammable or explosive environments.
- **Keep product surfaces clean and dry.** To prevent dust or moisture in the air from affecting the instrument's performance, please keep the product's surface clean and dry.

2. Safety Terms And Symbols

Safety Terms

Terms in this manual. The following terms may appear in this manual:



Warning: Warning indicates the conditions or practices that could result in injury or loss of life.



Caution: Caution indicates the conditions or practices that could result in damage to this product or other property.

Terms on the product. The following terms may appear on this product:

Danger: It indicates an injury or hazard may immediately happen.

Warning: It indicates an injury or hazard may be accessible potentially.

Caution: It indicates a potential damage to the instrument or other property might occur.

Safety Symbols

Symbols on the product. The following symbol may appear on the product:

	Hazardous Voltage		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
	Protective Terminal	Earth	Chassis Ground
	Test Ground		

3. Quick Start

This chapter will introduce the power-on inspection steps for the EL-1000&2000 series load, ensuring that the load can be properly turned on and used in its initialized state. It will also cover the front panel, rear panel, button functions, and display functions of the EL-1000&2000 series load, ensuring that before operating the load, users can quickly understand the load's appearance, structure, and button functionality, which will help you make better use of this series of loads.

3.1 Product Introduction

The EL-1000&2000 series single-channel programmable electronic load offers power ratings of 200W and 400W, with a resolution as high as 1mV and 0.1mA. It is primarily designed for applications such as fast chargers, battery discharge, and power supply testing, and other product performance validation tests. The series provides optimal solution for design R&D and production line testing.

EL-1000&2000 Series Model Selection Table:

Model	Voltage	Current	Power	Communication interface
EL-1200	150V	20A	200W	USB, RS232, RS485
EL-1400	150V	40A	400W	USB, RS232, RS485
EL-2200	600V	20A	200W	USB, RS232, RS485
EL-2400	600V	40A	400W	USB, RS232, RS485

3.2 Panel and User Interface

3.2.1 Front Panel

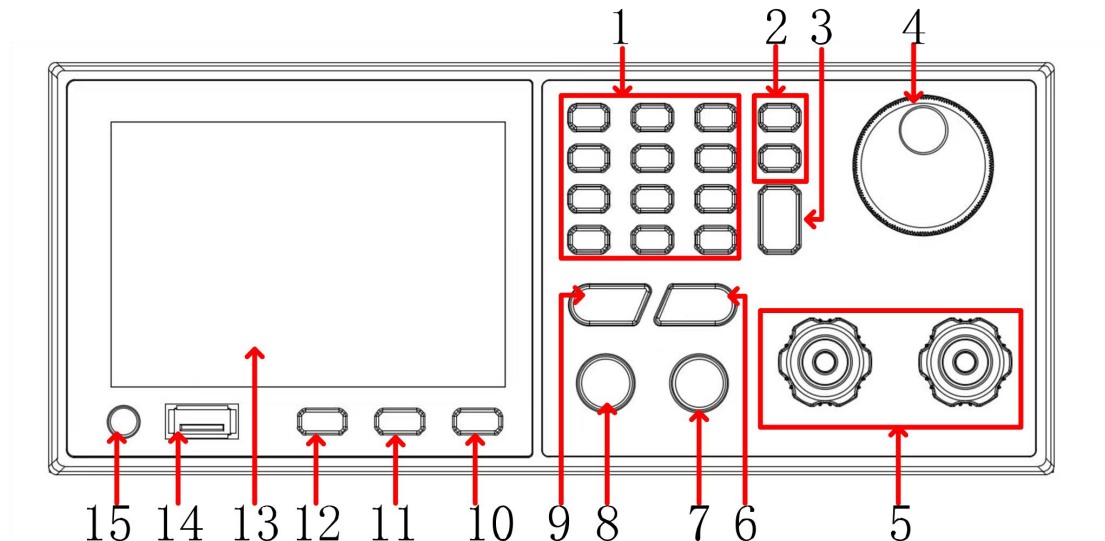


Figure 3- 1 Front Panel

1	0-9 and . Esc	Number and dot key: input number; Esc key: return to the previous page.
2	< >	Use to move the cursor left and right to the desired parameter position.
3	Enter	Confirm parameter setting.
4	Knob	Users can turn the knob to enter programming information or options.
5	DC source Input terminal	The input connection of the DC source.
6	CC	Constant current mode setting button: When the user presses this button, the constant current setting mode is selected, and user can use the numeric buttons or knob to input the set current value.
7	ON/OFF	Control the output status: ON or OFF.

8 LOCK	Lock all buttons and knobs; Way to remove: press and hold the LOCK key to remove the setting.
9 CV	Constant voltage setting button: When the user presses this button, the constant voltage setting mode is selected; and user can use the numeric buttons or knob to input the set voltage value.
10 SHIF	Reuse function keys.
11 MODE	Switch load mode setting selection
12 CONF	Switch to the system menu to select the system settings and parameter settings.
13 Display area	TFT color screen display, output Settings and measurement results.
14 USB Port	Used to connect a USB flash drive for screen image and system upgrade. Press and hold the knob button for about 2–6 seconds to take a screenshot.
15 Power button	Turn on/off instrument.

3.2.2 Rear Panel

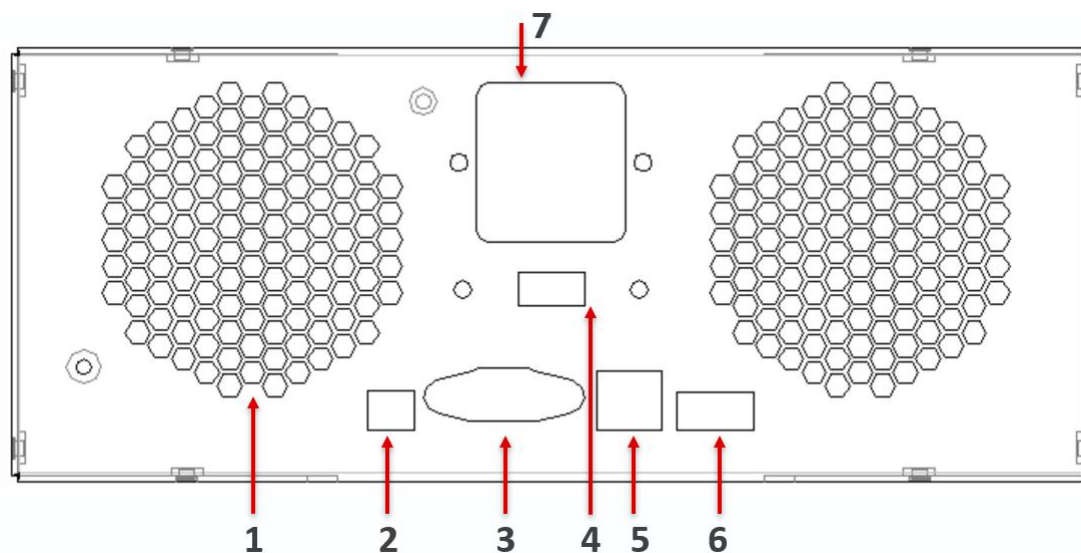


Figure 3-2 Rear Panel

1 Fan	Do not block the outlet of the fan, otherwise the internal heat dissipation of the machine will lead to excessive internal temperature.
2 Remote compensation	When the remote sensing function is enabled, this sampling terminal should be connected to the load side to compensate for the voltage drop across the wires. After enabling the function, please ensure that Vsen+ is connected to the output positive (+), and Vsen- is connected to the output negative (-). Do not reverse the connections or leave them floating.
3 DB9 interface	This port includes RS232 and RS485 function, user can use RS232 for communication control, and RS485 can be used as multi-machines parallel function.
4 AC power Input sticker	Indicate AC power input 230 V/AC.
5 USB(VCP) serial port	This USB(VCP) serial port can be used to connect to a computer.
6 Trig	The Trigger In/Out function allow external trigger signal input and output.
7 AC Power terminal	The power supply line inputs AC power, from this connection terminal to the input terminal.

3.2.3 User Interface



Figure 3-3 User Interface

Status Icon

Icon	Description
	The panel keys are locked
	Enable beeper
	A failure alarm
	USB port detects USB disk data

3.3 General Inspection

When you receive a new EL-1000&2000 series DC electronic load, it is recommended that you follow the steps below to inspect the instrument.

1. Check whether there is any damage caused by transportation.

If it is found that the packaging carton or the foamed plastic protection cushion has suffered serious damage, do not throw it away first till the complete device and its accessories succeed in the electrical and

mechanical property tests.

2. Check the Accessories.

The supplied accessories have been already described in Appendix A: Accessories of this manual. You can check whether there is any loss of accessories with reference to this description. If it is found that there is any accessory lost or damaged, please get in touch with our distributor responsible for this service or our local offices.

3. Check the Complete Instrument.

If it is found that there is damage on the first appearance of the instrument, or the instrument cannot work normally, or fails in the performance test, please get in touch with our distributor responsible for this business or our local offices. If there is damage to the instrument caused by the transportation, please keep the package. With the transportation department or our distributor responsible for this business informed about it, a repairing or replacement of the instrument will be arranged by us.

3.4 Power-on Inspection

- (1) Connect the instrument to an AC power source using the power cord supplied with the accessory.



Warning:

To prevent electric shock, make sure the instrument is properly grounded.

- (2) Press the **power button** on the front panel and the startup screen will be displayed on the screen.

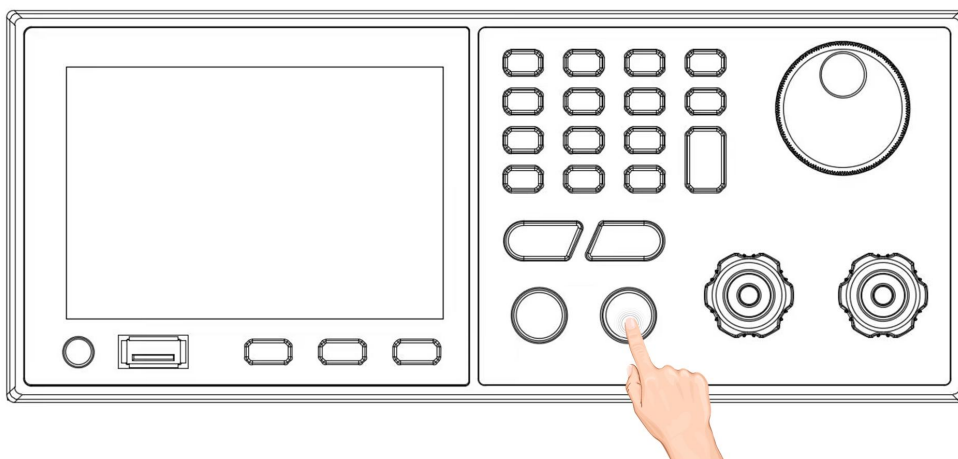
4. Functional features and Panel operation

This chapter will provide a detailed description of the features and functions of the EL-1000&2000 series DC electronic load, as well as the panel menu operations. It will be divided into the following sections:

- Turn on/off channel output
- Local/Remote mode operation switch
- Constant mode function
- Input control function
- Keyboard lock function
- Short circuit simulation function
- System menu function
- Multiple device parallel function
- Fault information
- Introduction to communication interfaces
- Test function - dynamic test (CC Dynamic)

4.1 Turn On/Off the Channel Output

Press the **ON/OFF** key to turn on/off the channel. When the **ON/OFF** key is bright, the output is turned ON; when the **ON/OFF** key light is off, the output is turned off. When the power is turned on, the panel defaults to the main interface to display the current state.



**Press the button, the indicator light shows that the output is open;
Press the key again and the indicator light goes off to indicate that
the output is off.**

4.2 Local/Remote mode Operation switch

The instrument provides both local and remote operation mode, and the two modes can be switched by communication commands. In power initialization mode, the machine is operated locally by default.

- Local operation mode: Use the keys on the panel to perform relevant operations.
- Remote operation mode: The instrument is connected to the PC, and the PC performs relevant operations on the instrument. When the instrument is in remote mode, all the buttons in the panel do not work except for the LOCK key. You can switch to local operation mode by press and hold **LOCK** key. When the operation mode is changed, it will not affect the output parameters of the instrument.

4.3 Constant Mode Operation

The electronic load can operate in the following four constant modes:

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

4.3.1 Constant Current Mode (CC)

When the user selects the **CC** function key, the load enters constant current mode. In constant current operation mode, regardless of changes in the input voltage, the electronic load consumes a constant current. The relationship between voltage and current is shown in the figure below.

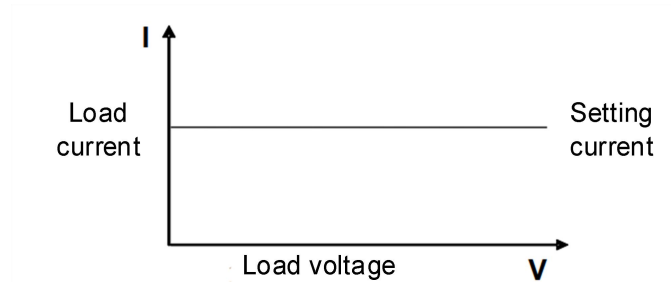


Figure 4.3.1-1 CC mode: The Voltage-Current Relationship Diagram



Figure 4.3.1-2 CC mode operation interface

There are two ways to set the output current (CC mode):

Mode one:

1. Press **MODE** and rotary the knob to select CC mode, press **Enter** to save.
2. Press **Enter** key to edit the current setting, use the numeric **0-9** softkey to set desired current, or turn the **knob** to adjust directly to the set value.
Press **Enter** key to save current setting.
3. Press **ON/OFF** key to output the setting current.

Mode two:

1. Press **CC**, at the same time, the user interface will switch into CC mode.
2. Press **Enter** key to edit the current setting, u use the numeric **0-9** softkey to set desired current, or turn the **knob** to adjust directly to the set value.

Press **Enter** key to save current setting.

3. Press **ON/OFF** key to output the setting current.

In constant current mode, the user can also set the following parameters.

Operation steps:

1. Press CONF to enter PARAM.(PARAMETER SETUP)
2. Set I_LIM (maximum working current)
3. Set V_RANGE, I_RANGE (voltage/current range)
4. Set SR_RISE(the rising slope of current)
5. Set SR_FALL(the falling slope of current)
6. Set OVP, OCP, OPP

4.3.2 Constant Voltage Mode (CV)

When the user selects the **CV** function key, the load enters constant voltage mode. In constant voltage operation mode, the electronic load will draw sufficient current to maintain the input voltage at the set value. The relationship between voltage and current is shown in the figure below.

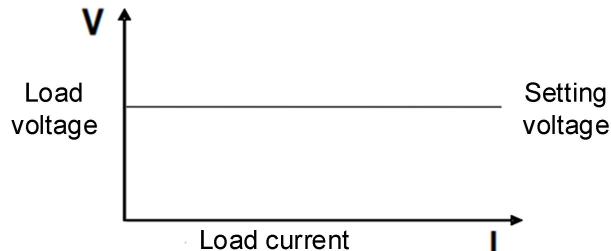


Figure 4.3.2-1 CV mode: The Voltage-Current Relationship Diagram



Figure 4.3.2-2 CV mode operation interface

There are two ways to set the output voltage (CV mode):

Mode one:

1. Press **MODE** and rotary the knob to select CV mode, press **Enter** to save.
2. Press **Enter** key to edit the voltage setting, use the numeric **0-9** softkey to set desired voltage. Press **Enter** key to save voltage setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting voltage.

Mode two:

1. Press **CV**, at the same time, the user interface will switch into CV mode.
2. Press **Enter** key to edit the voltage setting, use the numeric **0-9** softkey to set desired voltage. Press **Enter** key to save voltage setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting voltage.

In constant voltage mode, the user can also set the following parameters.

4.3.3 Constant Resistance Mode (CR)

When the user selects the SHIFT+ **CV** function key, the load enters constant resistance mode (CR). In constant resistance operation mode, the electronic

load will behave as a constant resistor. The current will change linearly with the input voltage. The relationship between voltage and current is shown in the figure below.

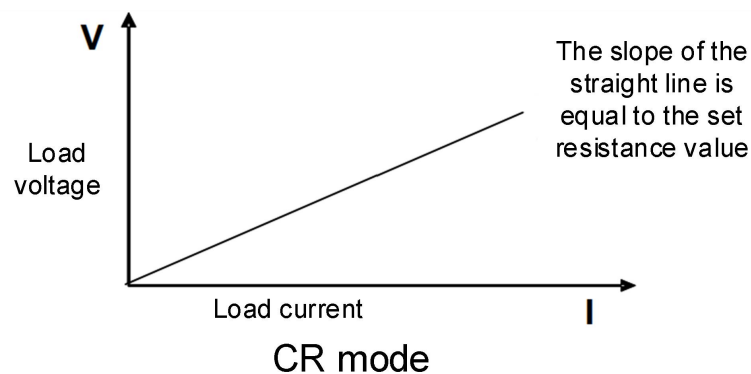


Figure 4.3.3-1 CR mode: The Voltage-Current Relationship Diagram



Figure 4.3.3-2 CR mode operation interface

There are two ways to set the output resistance (CR mode):

Mode one:

1. Press **MODE** and rotary the knob to select CR mode, press **Enter** to save.
2. Press **Enter** key to edit the resistor setting, Use the numeric **0-9** softkey to set desired resistance. Press **Enter** key to save resistance setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting resistance.

Mode two:

1. Press SHIFT+**CV** , at the same time, the user interface will switch into CR mode.
2. Press **Enter** key to edit the resistor setting, Use the numeric **0-9** softkey to set desired resistance. Press **Enter** key to save resistance setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting resistance.

In constant resistance mode, the user can also set the following parameters.

Operation steps

1. Press CONF to enter PARAM.(PARAMETER SETUP)
2. Set I_LIM (maximum working current)
3. Set V_RANGE, I_RANGE (voltage/current range)
4. Set SR_RISE and SR_FALL (the rising/falling slope of resistance)
 - a) Fast b) Normal c) Slow
5. Set OVP, OCP, OPP

4.3.4 Constant Power Mode (CP)

When the user selects the SHIFT+ **CC** function key, the load enters constant power mode. The electronic load will consume a constant power, as shown in the figure below. If the input voltage increases, the input current will decrease. The relationship between voltage and current is shown in the figure below.

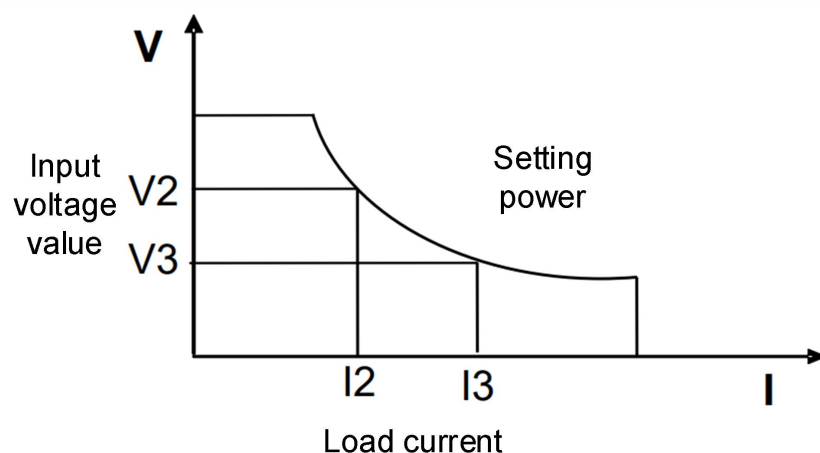


Figure 4.3.4-1 CP mode: The Voltage-Current Relationship Diagram



Figure 4.3.4-2 CP mode operation interface

There are two ways to set the output power (CP mode):

Mode one:

1. Press **MODE** and rotary the knob to select CP mode, press **Enter** to save.
2. Press **Enter** key to edit the power setting, Use the numeric **0-9** softkey to set desired power. Press **Enter** key to save power setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting power.

Mode two:

1. Press **SHIFT+CC**, at the same time, the user interface will switch into CP mode.
2. Press **Enter** key to edit the power setting, Use the numeric **0-9** softkey to set desired power. Press **Enter** key to save power setting, or turn the **knob** to adjust directly to the set value.
3. Press **ON/OFF** key to output the setting power.

In constant power mode, the user can also set the following parameters.

Operation steps

1. Press **CONF** to enter **PARAM.(PARAMETER SETUP)**
2. Set **I_LIM** (maximum working current)
3. Set **V_RANGE, I_RANGE** (voltage/current range)

4. Set SR_RISE and SR_FALL (the rising/falling slope of power)
 - a) Fast b) Normal c) Slow
5. Set OVP, OCP, OPP

4.4 Input Control function

After the electronic load is turned on, it is in an unconnected (no load) state. The input switch of the electronic load can be controlled by pressing the **ON/OFF** button on the front panel of the electronic load.

- When the **ON/OFF** indicator light is on, it means the input is turned on, and the TFT screen displays the current real-time voltage and current information.
- When the **ON/OFF** indicator light is off, the screen will display OFF, indicating that the input is turned off.

4.5 Keyboard Lock Function

The front panel buttons of the electronic load can be locked by pressing the **LOCK** button. The screen will display the LOCK status. In this mode, all buttons are disabled except for unlocking the function by pressing and holding the **LOCK** button.

4.6 Short Circuit Simulation Function

The electronic load can simulate a short circuit at the input terminal to test whether the protection function of the device under test (DUT) operates correctly when a short circuit occurs at its output terminal.

To switch to the short circuit state, press (SHIFT) + 1 (SHORT) on the front panel of the electronic load. The short circuit operation does not affect the current settings, and pressing (SHIFT) + 1 (SHORT) or MODE again will return the electronic load to its original set state. The actual current consumed by the electronic load during a short circuit depends on the current operating mode and current range. In CC, CP, and CR modes, when the current is within the maximum range, the short-circuit current will be equal to the current

input value. If the current exceeds the maximum range, the maximum short-circuit current will be 110% of the current range. In CP mode, a short circuit is equivalent to setting the load's constant voltage value to 0V.



Figure 4.6-1 Short circuit simulation interface

4.7 System Menu Function

Press **CONF** to enter system setting function.

Detail operation steps:

Press **CONF** to enter “Function menu” item setting.

1. Rotary the **knob** to select the item you want to set.
2. Press **Enter** to confirm.
3. Press **Esc** or **CONF** to return the function menu.

Description:

1. To cancel the setting, press the Esc key to return to the function menu page.
 2. If you are on any setting page, pressing the CC key or CV key or ON/OFF will quickly return you to main page.
-

4.7.1 System Setting

The menu of the electronic load is as follows:

Menu	Settings	Description
SYSTEM SETUP	LANGUAGE	ENGLISH
	DATE	Set year/month/day
	TIME	Set hour/minute/second
	PROTOCOL	SCPI or MODBUS communication setting
	BEEPER	Enable or disable button sound
	ALARM	Enable or disable alarm sound
	BRIGHT	Screen brightness adjustment from 10% to 100%, with a 10% adjustment each time.
	BAUD	The baud rate setting range of the communication device is from 115200 to 1200; 8 baud rates are available for selection.
	FACTORY RESET	Restore the settings on the panel to factory defaults.
	PARALLEL	Set the parallel enable or disable.
	M/S	MASTER/SLAVE. Set the local machine as the master device or the slave device.
	ADDRESS	The parallel machine address can be selected from 1 to 9 to set the local machine's parallel address.



Figure 4-7-1 system setup page

4.7.2 Parameter Setting

Select System Settings, then choose Parameter Settings. Press the **Enter** key to enter the Parameter Settings options, as shown in the table below.

The parameter settings of the electronic load are as follows:

Menu	Settings	Description
Parameter setup	OVP	If the input voltage exceeds the set safety threshold (OVP point), the OVP protection will be triggered.
	OCp	If the input current exceeds the set safety threshold (OCp point), the OCp protection will be triggered.
	OPP	If the input power exceeds the set safety threshold (OPP point), the OPP protection will be triggered.
	SR_RISE	RISE SLEW RATE. The setting value for the rise rate of input voltage or current during load operation.
	SR_FALL	FALL SLEW RATE. The setting value for the fall rate of input voltage or current during load operation.
	I_LIM	CURRENT LIMIT. The maximum current value that can be set for normal load operation.
	RComp	REMOTE COMPENSATION. This option allows enabling the remote sensing function at the rear terminals, with the default setting for compensation at the front panel input terminals.
	V_VOFF	NO-LOAD VOLTAGE. After the load is connected and operating normally, the device will shut down when the input voltage reaches the unload voltage setting value.
	V_RANGE	VOLTAGE RANGE. The input voltage range supported by the electronic load is as follows: (eg.EL-1400) ● Low range: 0-15V ● High range: 0-150V
	I_RANGE	CURRENT RANGE. The input current range supported by the electronic load is as follows: ● 0-20A (EL-1200/EL-2200) or 0-40A (EL-1400/EL-2400)
	VON_SET	LOAD VOLTAGE. After the load is connected, normal load operation can occur once the input voltage reaches the set load voltage.



Figure 4-7-2 parameters setup page

4.8 Multiple Device Parallel Function

The EL-1000&2000 series products can be operated in parallel, supporting up to 10 units, with a maximum current of up to 400A.

Model	Parallel mode	
	Maximum number of combinations	Maximum current
EL-1200 EL-2200	10	200A
EL-1400 EL-2400	10	400A

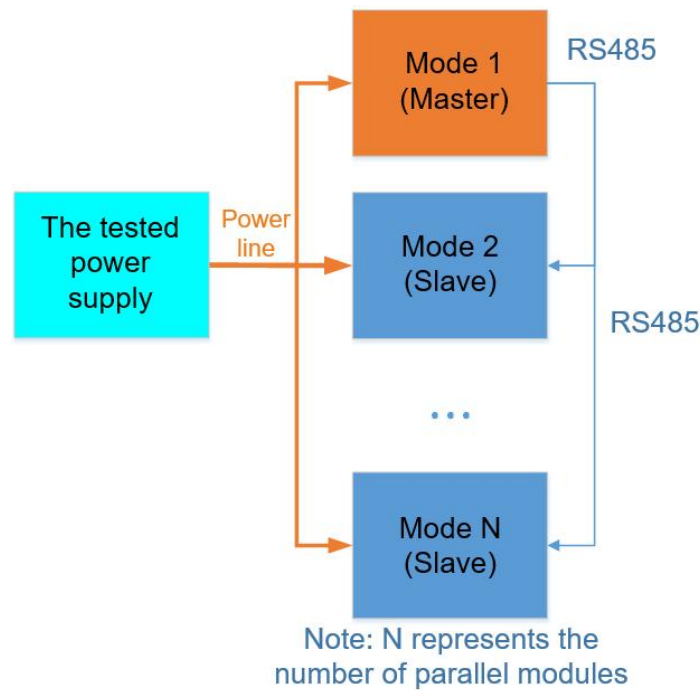
Description:

1. Different models cannot be operated in parallel.
 2. Parallel operation is supported in CC, CP, and CR modes (CV, short, and dynamic modes are not supported).
 3. If the number of parallel units exceeds 10, please consult our customer service or authorized distributor.
-

-
4. Please note that there can only be one master unit in the system, and the addresses of all units should be different.
 5. Communication between multiple units in parallel is done using RS485.
-

4.8.1 Parallel Output line Connection

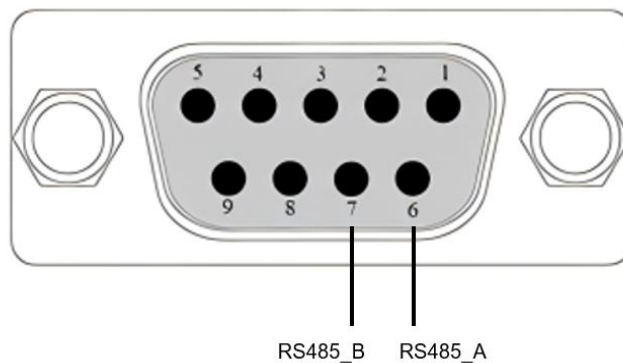
The parallel output wiring method is shown in the figure below.



4.8.2 Parallel Communication line Connection

The EL-1000&2000 series parallel communication uses RS485. Users can communicate through the DB9 interface, with the communication pins as shown in the diagram below: Pin 6 and Pin 7.

Pin	Function
Pin 6	RS485_A
Pin 7	RS485_B



4.8.3 Operating Instructions

- **First setting Master address**

To set a unit as the master, go to the "System Settings" page on the panel, and select "Master" under the "Master/Slave" option.

Then set the address (the default address for the master is 10).

Finally, select Enable Parallel.

- **Then, configure the addresses for the parallel slave**

To set a unit as a slave, go to the "System Settings" page on the panel and select "Slave" under the "Master/Slave" option.

Then, set the address (slave addresses range from 1 to 9, and it is recommended to start from 1).

Finally, select Enable Parallel.

- **Set the current parameters on the master and power it on.**

Finally, configure the relevant operating parameters (such as current, resistance, power, etc.) in the master unit's parameter settings.

Once the settings are complete, press the power button to turn on the system.

4.9 Protection Functions and Fault Information

The EL-1000&2000 series products monitor the internal operation of the machine in real time, including system logic faults, external mains power faults, internal power stage faults such as OVP (Over Voltage Protection), OCP (Over Current Protection), OPP (Over Power Protection), OTP (Over Temperature Protection), as well as parallel operation faults, input reverse

voltage protection, etc.

When any of the above protections are triggered, the electronic load enters the corresponding self-protection mode. For example, in the case of over-temperature protection, the load will trigger an alarm and automatically switch to the OFF state, with the main unit displaying OTP.

Protection mode can be cleared by pressing the power button or the ENTER button on the front panel.

Over Voltage Protection (OVP)

If the over-voltage circuit is triggered, after a 100us delay, the electronic load will immediately turn OFF, and the buzzer will sound. The main unit will display OVP. Protection can be cleared by pressing the power button or the ENTER button.

Over Current Protection (OCP)

There are two types of over-current protection in the electronic load:

- **Hardware overcurrent protection:** The maximum load current of the EL-1000&2000 series will be limited to the corresponding current value by the hardware maximum power (such as EL-1400: 400W). Once the hardware overcurrent protection is triggered, the machine is at the maximum power value and will not trigger the current ON/OFF state.
- **Software Over Current Protection:** When the software overcurrent protection function is turned on, if the load current exceeds the overcurrent protection setting value, after 100ms, the load will automatically turn off, and the panel will display OCP. In order to ensure the reliability of the machine, if the load current abnormally exceeds 2 times the rated maximum current of the machine for 40us or 1.1 times the rated current for 100us, the fast software overcurrent protection is triggered, the load will automatically turn off, and the panel will display OCP. Users can set the software overcurrent protection value of the EL-1000&2000 series product. For related configuration, please refer to CONF key to enter the parameter setting.

Over Power Protection (OPP)

There are two types of over-power protection in the electronic load:

- **Hardware Over Power Protection:** The maximum load power will be

limited to the corresponding power value by the hardware maximum power (such as EL-1400: 400W). Once the hardware over-power protection is triggered, the machine is at the maximum power value and will not trigger the current ON/OFF state.

- **Software Over Power Protection:** When the software over-power protection function is turned on, if the load power exceeds the over-power protection setting value and lasts for 100ms, the load will automatically turn off and the panel will display OPP. In order to ensure the reliability of the machine, if the load power abnormally exceeds 2 times the rated maximum current of the machine for 40us or 1.1 times the rated current for 100us, the fast software over-power protection is triggered, the load will automatically turn off and the panel will display OPP. Users can set the software over-power protection value of the load. For related configuration items, please refer to CONF to enter the parameter setting.

Over Temperature Protection (OTP)

When the internal devices' temperature of the electronic load exceeds about 85°C, the electronic load would trigger the temperature protection mode, and the electronic load automatically turns OFF and the panel displays OTP.

Local Reverse Voltage Protection (LRV)

When the electronic load detects a reverse voltage input on the front panel, it will trigger the Local Reverse Voltage (LRV) protection warning. In this case, please confirm that the front panel input terminals are correctly connected to the device under test. It can be released by pressing the power button or the ENTER button.

Fault Type	ERROR CODE	Fault cause Description
MAINS AC FAULT	0x0002	Abnormal mains undervoltage
INTERNAL FAULT	0x0004	Over temperature protection
	0x0010	Error in internal parameter storage
	0x0020	Model firmware match error
OUTPUT FAULTS	0x0002	Output over voltage protection
	0x0008	Output over current protection

PARALLEL FAULTS	0x0010	Output over power protection
	0x0004	Local Reverse Voltage Protection
	0x0001	Parallel address conflict
	0x0002	Multiple master fault
	0x0008	Communication drop
	0x0010	Mismatch in operable unit fault

4.10 Communication Port Introduction

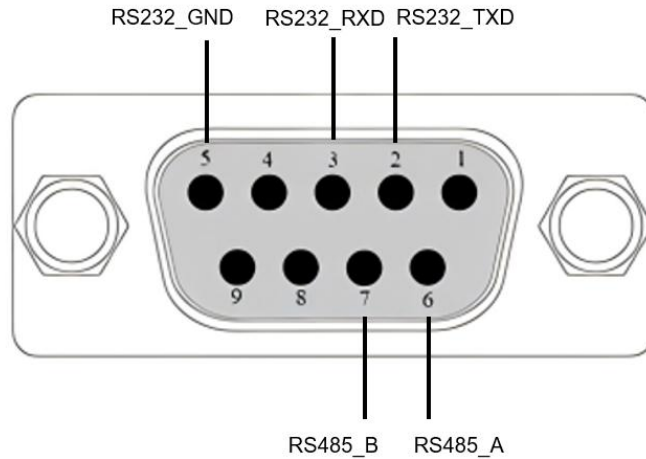
The rear panel of the load in this series is equipped with a USB serial port. After connecting to a PC, ensure that the serial port settings in the PC software interface match those of the load device (9600 baud rate, 8 data bits, no parity, 1 stop bit).

USB port

Use a USB cable with USB A-type on one end and USB B-type on the other end to connect the load to the computer. All electronic load functions can be controlled through USB programming. After connecting the load and PC via USB, the CH340 USB driver needs to be installed (available for download from the our website or by directly contacting our technical support), otherwise, communication will not be successful.

The electronic load supports RS232 and RS485 (for internal parallel use). The following table provides the corresponding pin definitions (output via DB9 terminal connector):

Pin	Function	Supported protocols	Function
Pin 2	RS232	SCPI	TXD
Pin 3			RXD
Pin 5			GND



4.11 Test Function

4.11.1 Dynamic Test Function

In dynamic mode, the EL-1000&2000 series electronic load allows the user to set two load current parameters corresponding to the constant mode. By configuring the operation mode, the load current will switch back and forth between the two set values.

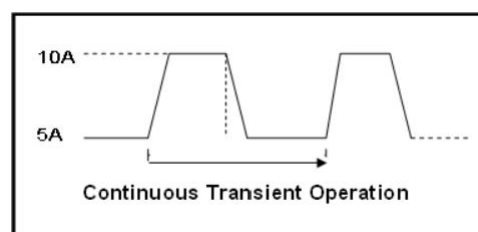


Dynamic Mode Setting Parameters:

Dynamic Test	Description
Operation Mode	Select the continuous operation mode: Continuous / Single
T1 Value	Set the T1 load current parameter
T1 Time	Set the T1 load current duration
T2 Value	Set the T2 load current parameter
T2 Time	Set the T2 load current duration
Rise Slope	Set the rise slope
Fall Slope	Set the fall slope

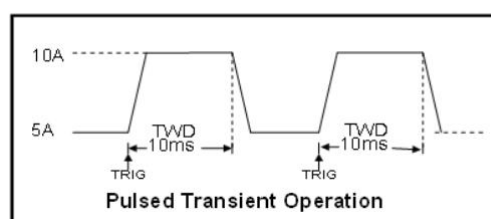
Continuous Mode

In continuous mode, when dynamic test operation is enabled, the load will continuously switch between the T1 value and T2 value.



Single Pulse Mode (Pulse)

In single pulse mode, when dynamic test operation is enabled, the load will switch once between the T1 value and T2 value. Each time the load receives a “SHIF+” trigger command, it will perform a single switching action. The diagram below shows a schematic of the operation interface in this mode.



4.12 Compensation Function

When the electronic load operates with high current, significant voltage drops can occur across the connection cables between the load and the device under test (DUT). To ensure measurement accuracy, the electronic

load provides a pair of remote compensation terminals. Users can use these terminals to sample the precise output voltage of the DUT.

Operating Steps:

1. In the system parameter settings page, locate the remote compensation (RComp) option and select "Rear". Press confirm to enable the remote compensation function. At this point, the remote sampling voltage will be used as the actual detected voltage.
2. Return to the parameter settings page and select the remote compensation (RComp) option as "Front." This will disable the remote compensation function for the rear terminal, and the load will measure the voltage at the main front-panel binding posts as the actual voltage.

Note:

After enabling rear remote compensation, ensure correct polarity connections between the DUT and the terminals. Do not leave connections floating or reverse the polarity! Do not switch the sense mode while the system is running!

5. Troubleshooting

1. The instrument is powered on but no display. Please following the steps:

- Check if the power is connected properly.
- Check if the fuse which is below the AC Power socket is used appropriately and in good condition (the cover can be pried open with a straight screwdriver).
- Restart the instrument after the steps above.
- If the problem still exists, please contact our customer service.

6. Technical Specification

The instrument must be operated continuously for more than 30 minutes at the specified operating temperature to achieve the following specifications:

Model		EL-1400	EL-1200	EL-2400	EL-2200
	Unit	Specification			
Input voltage range	V	0-150	0-150	0-600	0-600
Input current range	A	0-40	0-20	0-40	0-20
Input power range	W	400	200	400	200
Minimum voltage	V	1.1V@40A	0.8V@20A	1.1V@40A	0.8V@20A
Constant voltage mode					
Range	V	0-150	0-150	0-600	0-600
Resolution	mV	1	1	1	1
Accuracy		0.05%+0.05%FS	0.05%+0.05%FS	0.05%+0.05%FS	0.05%+0.05%FS
Constant current mode					
Range	A	0-40	0-20	0-40	0-20
Resolution	mA	1	1	1	1
Accuracy		0.03%+0.03%FS	0.03%+0.03%FS	0.03%+0.03%FS	0.03%+0.03%FS
Constant resistance mode					
Range	Ω	0.05-7.5k	0.05-7.5k	0.05-7.5k	0.05-7.5k
Accuracy *1		0.1%+0.01%R	0.1%+0.01%R	0.1%+0.01%R	0.1%+0.01%R
Constant power mode					
Range	W	400	200	400	200
Resolution	mW	10	10	10	10
Accuracy *1		0.1%+0.1%FS	0.1%+0.1%FS	0.1%+0.1%FS	0.1%+0.1%FS
Dynamic mode					
T1&T2		0.1ms-50s	0.1ms-50s	0.1ms-50s	0.1ms-50s
Rise/Fall slope		0.01A/ms-2000A/ms	0.01A/ms-2000A/ms	0.01A/ms-2000A/ms	0.01A/ms-2000A/ms

Minimum rise time	us	20us		20us		20us		20us	
Voltage readback value									
Range	V	0-15	0-150	0-15	0-150	0-60V	0-600V	0-60V	0-600V
Resolution	mV	1		1		1		1	
Accuracy		0.03%+	0.03%+	0.03%+	0.03%+	0.03%+	0.03%+	0.03%+	0.03%+
		7.5mV	0.025%FS	7.5mV	0.025%FS	7.5mV	0.025%FS	7.5mV	0.025%FS
Current readback value									
Range	A	0-40		0-20		0-40		0-20	
Resolution	mA	0.1		0.1		0.1		0.1	
Accuracy		0.03%+0.03%FS		0.03%+0.03%FS		0.03%+0.03%FS		0.03%+0.03%FS	
Power readback value									
Range	W	0-400		0-200		0-400		0-200	
Resolution	mW	10		10		10		10	
Accuracy		0.1%+0.1%FS		0.1%+0.1%FS		0.1%+0.1%FS		0.1%+0.1%FS	
Protection function									
OPP	W	>OPP value 10ms protection		>OPP value 10ms protection		>OPP value 10ms protection		>OPP value 10ms protection	
OVP	V	>OVP value 0.1ms protection		>OVP value 0.1ms protection		>OVP value 0.1ms protection		>OVP value 0.1ms protection	
OCP	V	>OCP value 0.1ms protection		>OCP value 0.1ms protection		>OCP value 0.1ms protection		>OCP value 0.1ms protection	
Overtemperature protection		85℃							
Short circuit									
Current (CC)	A	>40		>20		>40		>20	
Voltage (CV)	V	0		0		0		0	
Resistance (CR)	mΩ	50		50		50		50	
AC parameter									
Voltage range	V	230 V/AC							
Frequency	Hz	50/60Hz							

range				
Interface				
RS-232	Supported SCPI			
General				
Heat dissipation	Internal intelligent fan forced air cooling			
Safety	Compliant with the European EMC Directive 89/336/EEC, for Class A test and measurement products			
Withstand voltage (Output to Ground)	500V/DC/1mA			
Withstand voltage (Input to Ground)	1.5KV/AC/5mA			
Volume (L*W*H)	375mm*215mm*88mm			
Net weight (kg)	5	4.2	5	4.2

* 1 Accuracy: The voltage and current input values should not be less than 10%FS

If there are any changes to parameters, no separate notice will be given. Please refer to the website update for the latest information.

Interval Period of Adjustment: One year is recommended for the calibration interval period.

7. Appendix

7.1 Appendix A: Accessories

(The accessories subject to final delivery.)

Standard Accessories:

- Power Cord
- USB Cord
- EN Manual
- DE Manual
- Safety hintsheet

7.2 Appendix B: General Care and Cleaning

General Care

Do not store or leave the instrument where the liquid crystal display could be exposed to direct sunlight for long periods of time.

Caution: To avoid any damage to the instrument, do not exposed it to any sprays, liquids, or solvents.

Cleaning

Inspect the instrument as often as operating conditions require. To clean the instrument exterior, perform the following steps:

1. Wipe the dust from the instrument surface with a soft cloth. Take care not to scratch the transparent LCD protection screen when cleaning.
2. Disconnect power before cleaning your instrument. Clean the instrument with a damp soft cloth (not dripping with water). It is recommended to clean with soft detergent or fresh water. To avoid damage to the instrument, do not use any corrosive chemical cleaning agents.

**Warning:**

Before re-applying power, ensure that the instrument is completely dry, avoiding any electric shock or electrical short circuit resulting from moisture.

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