# T3EL15030xP

## Programmable DC Electronic Load

# User Manual

# Contents

# General Safety Summary

Read the following precautions carefully to avoid any personal injuries, or damage to the instrument or products connected to it. Use the instrument only as specified.

**Use only the power cord supplied for the instrument.**

**Ground the instrument.** The instrument is grounded through the ground conductor of the power cord. To avoid electric shock, always connect to grounded outlets. Make sure the instrument is grounded correctly before connecting its input or output terminals.

**Observe all terminal ratings and signs on the instrument to avoid fire or electric shock.** Before connecting to the instrument, read the manual to understand the input/output ratings.

**Do not operate with suspected failures.** If you suspect that the instrument is damaged, contact the Teledyne LeCroy service department immediately.

**Do not operate in wet/damp conditions.**

**Do not operate in an explosive atmosphere. Keep**

**the surface of the instrument clean and dry.**

**Avoid touching exposed circuits or wires.** Do not touch exposed contacts or components when the power is on.

**Do not operate without covers.** Do not operate the instrument with covers or panels removed.

**Use only the fuse specified for the instrument.**

**Use proper overvoltage protection.**

**Observe ventilation requirements.** Ensure good ventilation. Check the vent and fan regularly to prevent overheating.

## Safety Terms and Symbols

The following terms may appear on the instrument:

**DANGER:** Direct injury or hazard may occur.

**WARNING:** Potential injury or hazard may occur.

**CAUTION:** Potential damage to instrument/property may occur.

The following symbols may appear on the instrument:

| **CAUTION** Risk of injury or damage. Refer to manual. | **WARNING** Risk of electric shock or burn | Earth Ground Terminal | Protective Conductor Terminal | Frame or Chassis Terminal | ON/ Standby Power |
|---|---|---|---|---|---|

## Operating Environment

**Temperature:** 0 °C to 40 °C

**Relative Humidity:** 5 to 80% RH at ≤ 30 °C

**Altitude:** ≤ 2000 m at ≤ 30 °C

**Use indoors only.**

**Pollution degree 2.** Use in an operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

## AC Power

**Input Voltage & Frequency:** 110-220 V ±10% at 50/60 Hz

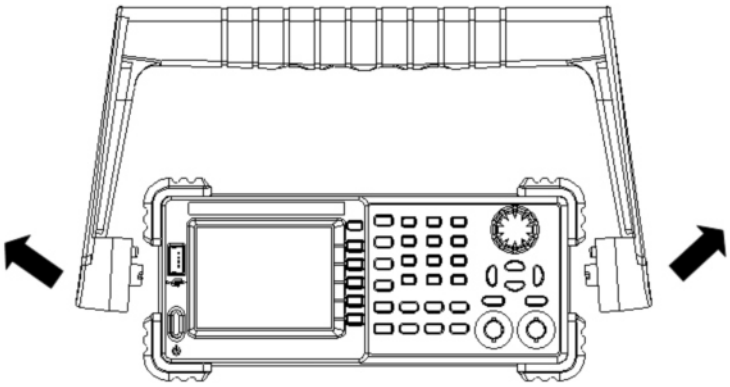
**Power Consumption:** 50 W maximum

**Mains Supply Connector:** CAT II per IEC/EN 61010-1:2010, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).

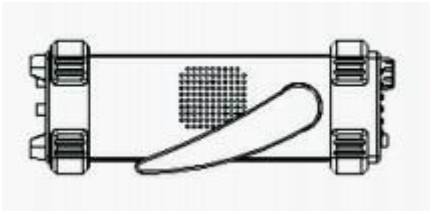
**Fuse Type:** T315 mA, 250 V

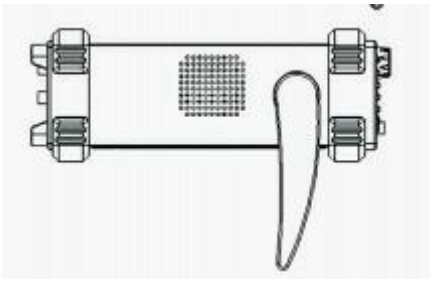
# Handle Adjustment

Users can adjust the handle to the required position by pulling the mounting points outward and adjusting the handle position.

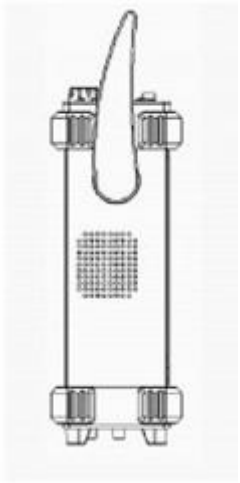


**Handle Adjustment**





**Horizontal Position**



**Carrying Position**

# Brief Introduction

The T3EL15030xP series Programmable DC Electronic Load has a 3.5 inch TFT-LCD display, and comes with a simple, user-friendly interface and superb performance specifications. The T3EL150302P comes with an input range of 150 V/30 A @ 200 W. The T3EL150303P comes with an input range of 150 V/30 A @ 300 W. The T3EL15030xP series has a measurement resolution of 1mV/mA. Adjustable current slew rate range is 0.001 A/μs-2.5 A/μs, and it comes with built-in RS232/USB/LAN communication interfaces. Standard SCPI communication protocol is used to establish an intelligent testing platform for applications in various industries, such as the power industry, battery industry, LED lighting, automotive electronics, and aerospace.

- T3EL150302P (Single channel): DC 150 V/30 A, total power up to 200 W
- T3EL150303P (Single channel): DC 150 V/30 A, total power up to 300 W
- 4 Static modes / Dynamic mode: CC/CV/CR/CP
- CC Dynamic modes, continuous, pulsed, toggled
- CC Dynamic mode: 25 KHz, CP Dynamic mode: 12.5 KHz, CV Dynamic mode: 0.5 Hz
- Adjustable current slew rate range 0.001 A/us-2.5 A/us
- Min read-back resolution: 0.1 mV, 0.1 mA
- Measuring speed of voltage and current: up to 500 KHz
- Over current protection test, Over power protection test, Battery test, short circuit and CR-LED test functions
- 4-wire SENSE compensation mode function
- External voltage and current control function
- Voltage, Current monitoring via 0-10V
- 3.5 inch TFT-LCD display, capable of displaying multiple parameters and states simultaneously
- With memory function in case of power-down
- OCP, OVP, OPP, OTP and LRV protection
- Graphical display of the waveform
- Von and Vlatch functions
- Smart fan control
- Remote control and measurements via PC

# Chapter 1: Start Guide

In this chapter, we introduce the front panel and display interface of the T3EL15030xP, and also tips for how to check and operate the digital load for the first time.

This chapter includes:

- The front panel
- The rear panel
- Connecting power
- User interface
- Output Inspection
- Fuse Replacement

# The Front Panel

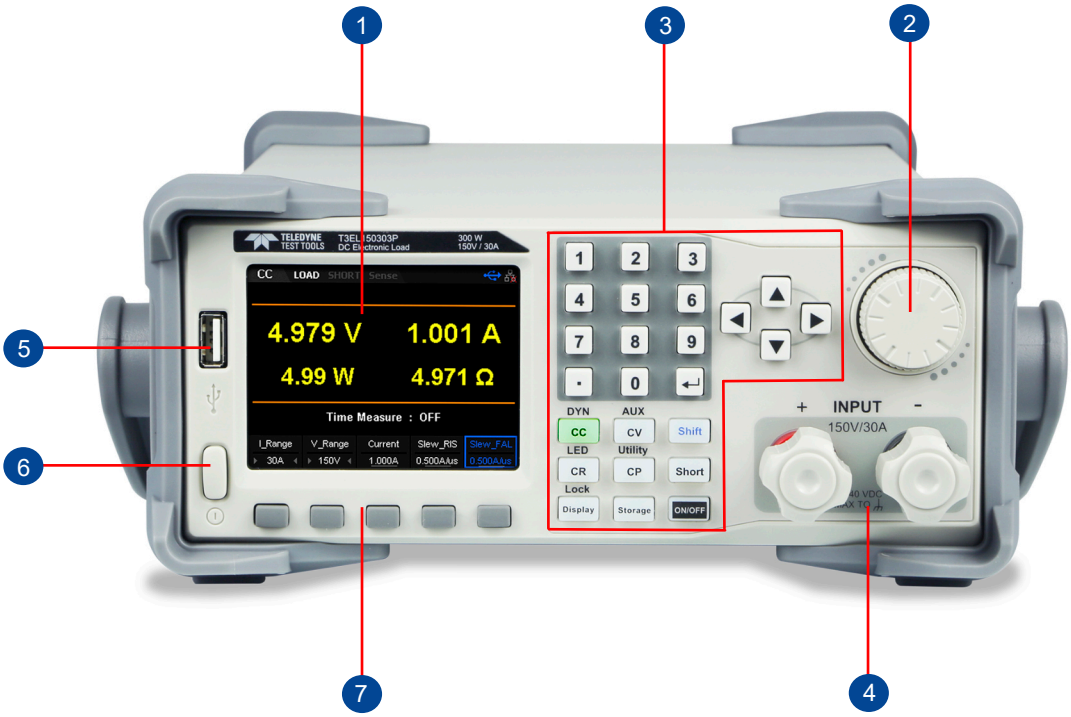



Figure1: The front panel of the T3EL150302P

| | | | |
|---|---|---|---|
| 1 | **LCD** | 5 | **USB interface** |
| 2 | **Knob** | 6 | **Power key** |
| 3 | **Function button and power key** | 7 | **Function key** |
| 4 | **Input Terminal** | | |

### 1. LCD

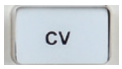
The 3.5 inch TFT-LCD display is used to display system parameter settings, system output state, waveforms, menu options, prompt messages, etc.

### 2. Knob

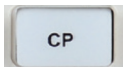
When setting parameters, rotate the knob to increase or decrease the value of the digit at the cursor. When browsing the setting object, sense, voltage and current protection, store or read files and switch modes etc, rotate the knob to quickly move the cursor or switch options.

## 3. Function buttons


Press the button to enter the constant current mode. Enter DYN mode by pressing the shift button at the same time.



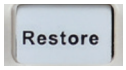

Press the button to enter the constant voltage mode. Enter AUX mode by pressing the shift button at the same time.



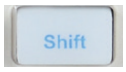

Press the button to enter the constant power mode. Enter Utility mode by pressing the shift button at the same time.


Press the button to enter the constant resistor mode. Enter LED mode by pressing the shift button at the same time.

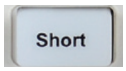

Press the button to enter Display mode. Enable key lock function by pressing the shift button at the same time.




Press the button to use the Restore function.




Press the button to allow a button's secondary function to be selected.




Press the button to enter the Short function.

Use the right, left, up, down buttons to move the cursor in that direction or select the appropriate field.

0-9 Select the appropriate numerical digit.

Decimal point.

Push to Enter a value.

This key selects a function in the interface.

## 4. Input Terminal

Physical input connections for the external circuit under test.

## 5. USB interface

Interface port used to insert USB device. Supports FAT32 file system formats.

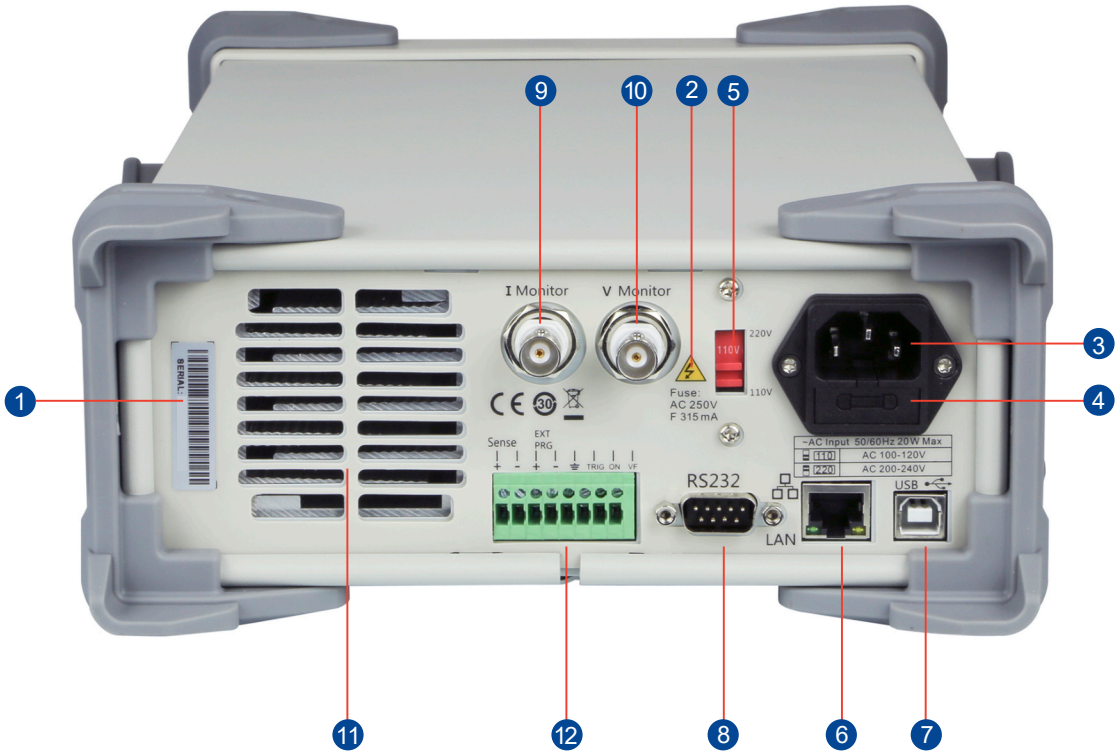
## 6. Power key

Turns the instrument On or Off.

## 7. Function key

Used to select different interface functions.

# The Rear Panel




### 1. Serial Number

Serial number of the device.

### 2. AC input Fuse Rating

The specified input fuse rating.

### 3. AC power socket

The AC input power socket. The voltage and frequency rating for the instrument is in the table below the AC power socket.

### 4. Fuse

The location of the AC input fuse. (Please refer to point 2 for the AC input fuse rating).

### 5. AC line power selection switch

AC Input Voltages: 110/220 V.

### 6. LAN interface

Use to connect to the local network by RJ45 interface.

### 7. USB device

Connects the instrument (as “slave” device) to external USB device (such as, USB storage device or external computer).

## 8. RS232 interface

Connect to the computer via 9-pin RS232 cable.

## 9. Analog current monitor output

User can observe the DUT output current level by connecting to an oscilloscope to monitor the current level.

## 10. Analog voltage monitor output

User can observe the DUT output voltage level by connecting to an oscilloscope to monitor the current level.

## 11. FAN

## 12. Sense terminal, External control terminal, PWM output terminal

Terminals used in conjunction with various external functions.

# Connect Power

The T3EL15030xP electronic load supports a variety of AC line power input values. For each line voltage, the rear panel voltage selector settings are to be set according to the table below:

| AC Power Input | Voltage Selector |
|---|---|
| 110 Vac ± 10%<br>50/60Hz |  110V |
| 220 Vac ± 10%<br>50/60Hz |  220V |

**Please connect the power carefully by following the steps below:**

**1. Check the input power**

Ensure that the AC line power to be connected to the instrument meets the requirements in Table 1.

**2. Check the voltage selector at the rear panel**

Make certain that the voltage selector setting located at the rear panel of the instrument matches the actual input voltage.

**3. Check the fuse**

When the instrument leaves the factory, the specified fuse is installed. Please check to verify the fuse matches the actual input voltage according to the "Input Power Requirements" on the rear panel of the instrument.

**4. Connect the power**

Connect the instrument to the AC power source using the power cord provided in the accessories. Then press the button  to turn on the electronic load.

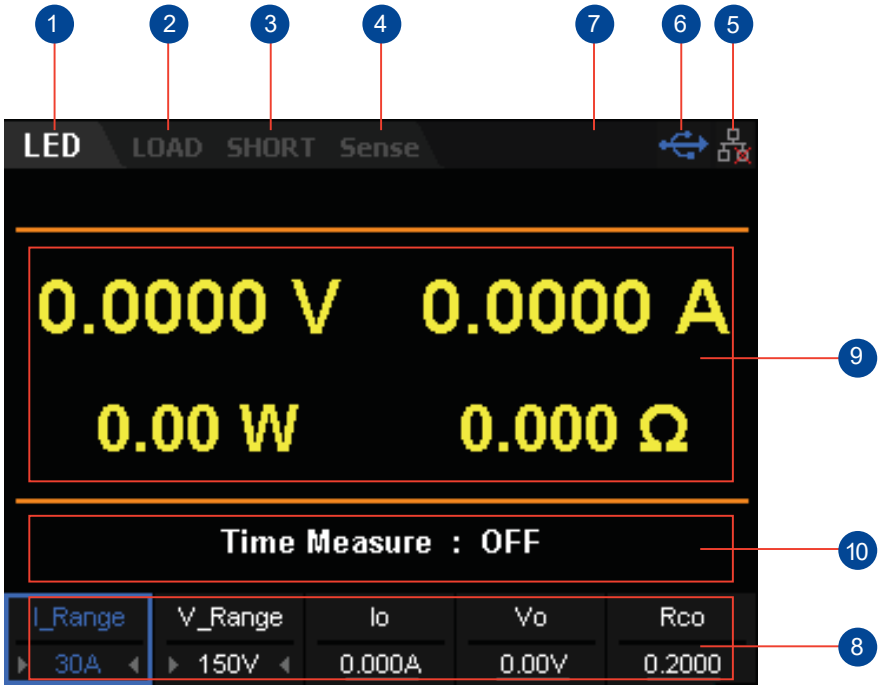
**WARNING**

Before switching on the input power supply voltage, please disconnect the power supply before setting the voltage selector to the appropriate position.

**WARNING**

To avoid electric shock, please ensure that the instrument is correctly grounded.

# User Interface




1. Displays the load's mode
2. Displays the load's state
3. Displays a Short state
4. Remote sense mode
5. LAN connection icon
6. USB connection icon
7. Keyboard lock
8. Setting value
9. Measured output values
10. Voltage slew rate

## To Power on the instrument

After the instrument is connected to the power source, press the Power key at the left bottom of the front panel to power on the instrument. When the instrument is turned on, it will undergo a self-test. If the instrument passes the self-test, the welcome interface is displayed; otherwise, self-test failure information will be displayed. If this does occur please contact Teledyne LeCroy.

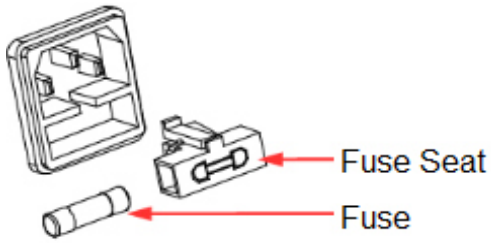
## Fuse Replacement

The specifications of the fuse are relative to the actual input line voltage, shown in the table below. You can also refer to the rear panel “Input power requirement”.

| Input voltage | Fuse specification |
|---|---|
| 110 VAC | T315 mA / 250V |
| 220 VAC | T315 mA / 250V |

To replace the fuse, please follow the steps below:

1. Turn off the instrument and remove the power cord.
2. Insert a small straight screwdriver into the slot at the power socket and gently pry out the fuse seat.




3. Adjust the power voltage selector manually to select the correct voltage scale.
4. Take out the fuse and replace it with the specified fuse (to check the relationship between the input voltage and the fuse specification, refer to the “Input power requirement” on the rear panel).
5. Re-insert the fuse holder into the power socket (please pay attention to the alignment).

**WARNING**

To avoid personal injuries, unplug the power supply before replacing the fuse. To avoid electric shock or fire, select the proper power supply specification and the correctly rated fuse.

# Chapter 2: Function and Features

This chapter includes:

- Local/Remote Operation Mode
- Static Operation Mode
- Transient Test Function
- OCPT Test Function
- OPPT Test Function
- Auto Test Function
- LED Test Function
- Waveform Display Function
- Store and Recall
- Rear Panel Terminal functions
- Short monitor function
- Protective function

## Local/Remote Operation Mode

The T3EL15030xP Programmable Electronic load provides two operation modes: Local and Remote.

## Local Operation Mode

After you power on the instrument, it will be in Local operation mode by default. In Local operation mode, all the keys on the front panel are available for use.

## Remote Operation Mode

In the Remote operation mode, you can send programming commands from a controller (computer) via any one of the interfaces (GPIB, USB, RS232, or LAN). In Remote operation mode, all the keys (except the Shift key plus the Display key) will be disabled. This is known as “local lock out”. When locked, the instrument front panel is disabled and the load can only be controlled via programming commands. To return to the local operation mode, press the Shift key plus the Display key on the front panel.

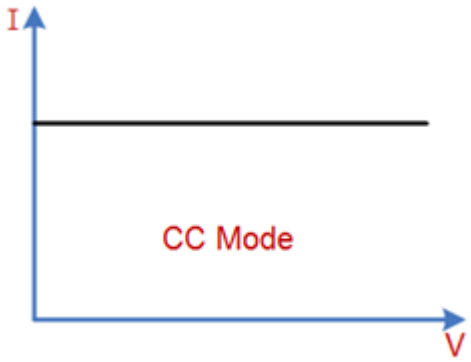
# Static Operation Mode

The static operation modes include the following 4 modes:

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

## Constant Current (CC) Mode

In CC mode, the electronic load will sink a current in accordance with the programmed value regardless of the input voltage, as shown in Figure 2-1.




Constant Current Mode
Figure 2-1 Voltage-Current Relationship in CC Mode

Operating Steps

1. Turn off the instrument, then as shown in Figure 2-2, connect the DUT and the channel input terminals on the front panel of the load.

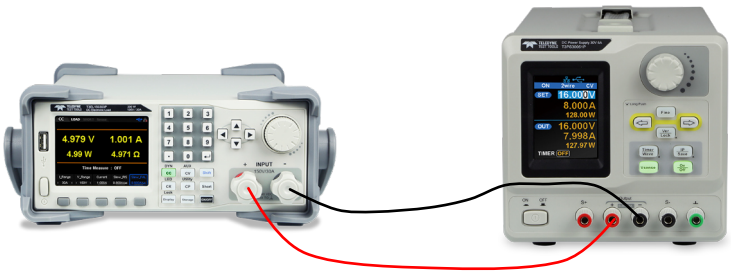


Figure 2-2

**CAUTION**

While making a connection, the positive polarity of the load should be connected to the (+) terminal of the channel output, and the negative polarity of the load to the (-) terminal of the channel output. Incorrect polarity may cause damage to the instrument or the DUT.

2. Press CC to enter the main interface of CC mode, as shown in Figure 2-3.

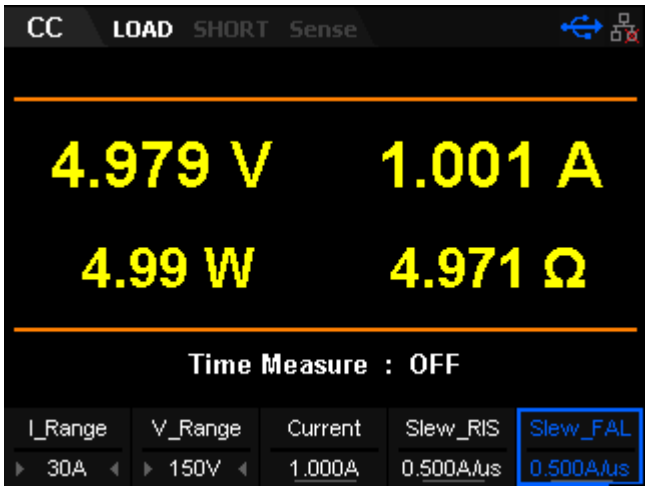



Figure 2-3 CC Mode Main Interface

3. Set CC mode current range (5 A or 30 A) and voltage mode (36 V or 150 V)

   **Note:** The lower ranges provide better resolution and accuracy at low current settings.

4. Set the current input value. This is the amount of current that the load will attempt to draw when the output is enabled.
5. Set the rising slew rate and the falling slew rate in CC mode. The default unit for the slew rate is A/us.
6. Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface.

   **Note:** The load will begin to sink current only if the input voltage is greater than the conduction voltage of the system (default value is 0 V).

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

8. Press the Display key to enter the waveform display interface, as shown in Figure 2-4. By default, the current waveform is displayed. When the input voltage changes, the load will sink a constant current.

   Press the Display key again to exit the waveform display interface and return to the main interface of CC mode.

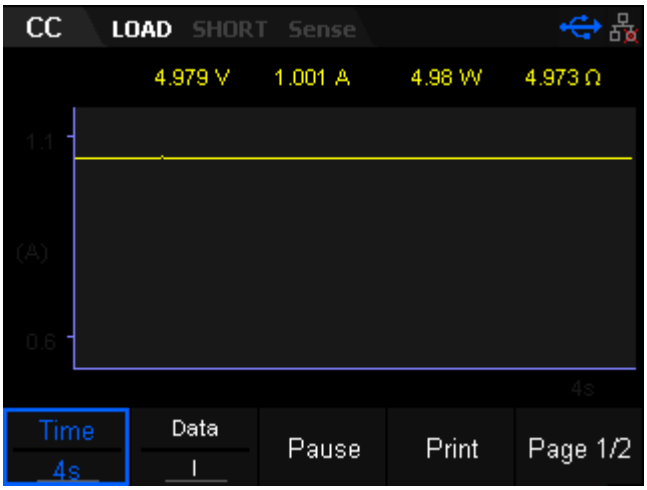
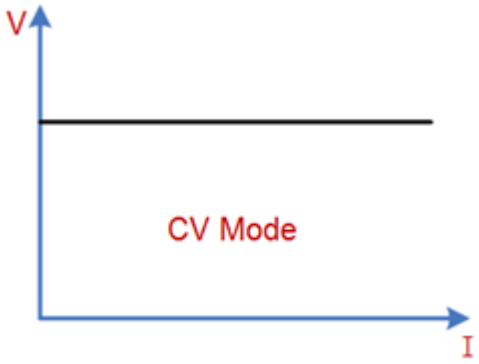



Figure 2-4 Waveform display interface of CC Mode

## Constant Voltage (CV) Mode

In CV mode, the electronic load will sink enough current to maintain the input voltage at the setpoint, as shown in Figure 2-5.




Constant voltage mode

Figure 2-5 Voltage-Current Relationship Schema under CV Mode

Operating Steps

1. Turn off the instrument, as shown in Figure 2-2, connect the DUT and the channel input terminals on the front panel of the load.

**CAUTION**

While making a connection, the positive polarity of the load should be connected to the (+) terminal of the channel output, and the negative polarity of the load to the (-) terminal of the channel output. Incorrect polarity may cause damage to the instrument or the DUT.

2. Press CV to enter the main interface of CV mode, as shown in Figure 2-6.

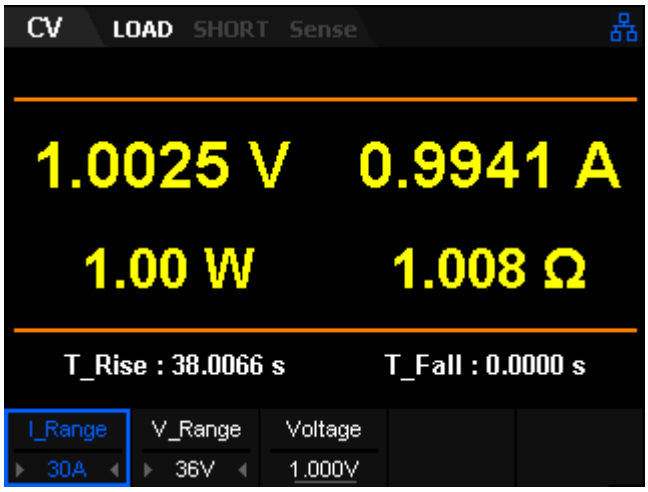



Figure 2-6 CV Mode Main Interface

3. Set CV mode current range (5 A or 30 A) and voltage range (36 V

or 150 V)

**Note:** The low range provides better resolution and accuracy at low voltage settings.

4. Set voltage
5. Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface.

**Note:** The load will sink current only if the input voltage is larger than the conduction voltage of the system (default value is 0 V).

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

6. Press the Display key to enter the waveform display interface, as shown in Figure 2-7. By default, the voltage waveform is displayed. When the input current changes, the load will apply a constant voltage. Press the Display key again to exit the waveform display interface and return to the main interface of CV mode.

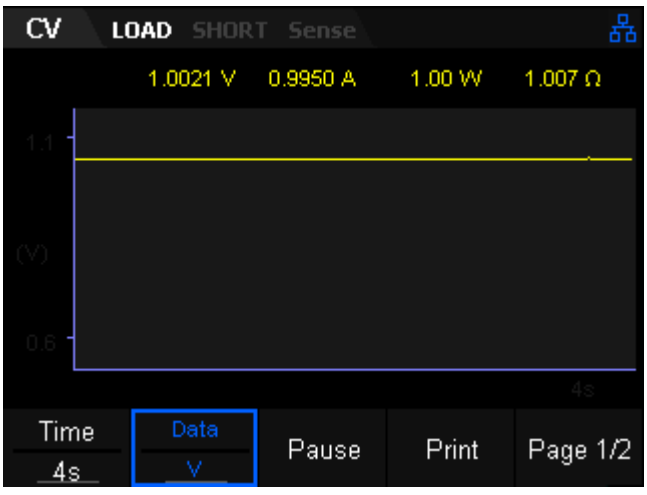
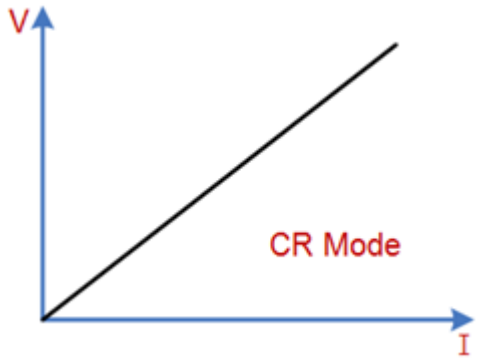



Figure 2-7 Waveform display interface of CV Mode

## Constant Resistance (CR) Mode

In CR mode, the electronic load is regard as a constant resistance and will give linear change of current with respect to input voltage changes, as shown in Figure 2-8.




Constant resistance mode

Figure 2-8 Voltage-Current Relationship Schema under CR Mode

Operating Steps

1. Turn off the instrument, as shown in Figure 2-2, connect the DUT and the channel input terminals on the front panel of the load.

**CAUTION**

While making a connection, the positive polarity of the load should be connected to the (+) terminal of the channel output, and the negative polarity of the load to the (-) terminal of the channel output. Incorrect polarity may cause damage to the instrument or the DUT.

2. Press CR to enter the main interface of CR mode, as shown in Figure 2-9.

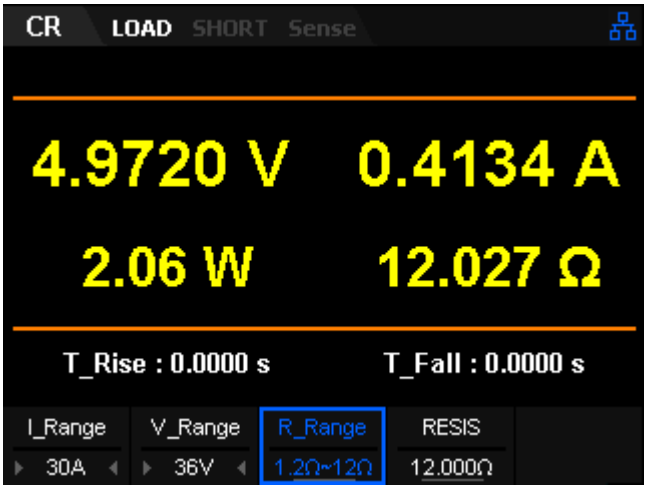



Figure 2-9 Main Interface of CR Mode

3. Set CR mode current range (5 A or 30 A), voltage range (36 V or 150 V) and resistance range (Low/Middle/High/Upper).

   **Note:** The low range provides better resolution and accuracy at low resistance settings.

4. Set the target resistance value
5. Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface.

**Note:** The load will begin to sink current only if the input voltage is greater than the conduction voltage of the system (default value is 0 V)

**Warning**

To avoid electrical shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

6. Press the Display key to enter the waveform display interface, as shown in Figure 2-10. By default, the resistance waveform is displayed. When the input voltage changes, the load current will linearly change. Press the Display key again to exit the waveform display interface and return to the main interface of CR mode.

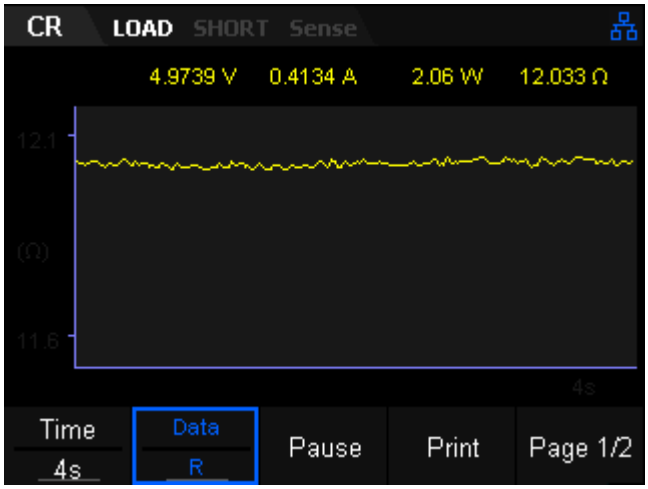
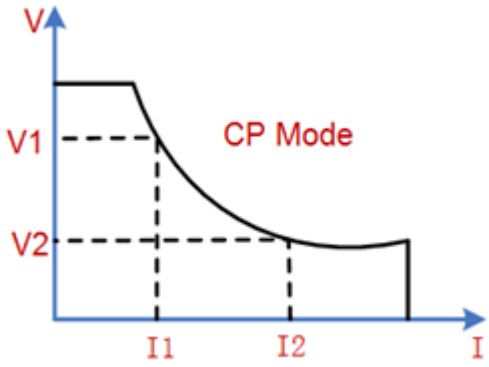



Figure 2-10 Waveform display interface of CR Mode

## Constant Power (CP) Mode

In CP mode, the electronic load will sink a constant power. If the input voltage rises, the input current draw will be decreased to maintain a constant power sink following the equation (P= V*I), as shown in Figure 2-11.




Constant power mode

Figure 2-11 Voltage-Current Relationship Schema under CP Mode

Operating Steps

1. Turn off the instrument, as shown in Figure 2-2, connect the DUT and the channel input terminals on the front panel of the load.

**CAUTION**

While making a connection, the positive polarity of the load should be connected to the (+) terminal of the channel output, and the

polarity of the load to the (-) terminal of the channel output. Incorrect polarity may cause damage to the instrument or the DUT.

2. Press CP to enter the main interface of CP mode, as shown in Figure 2-12.

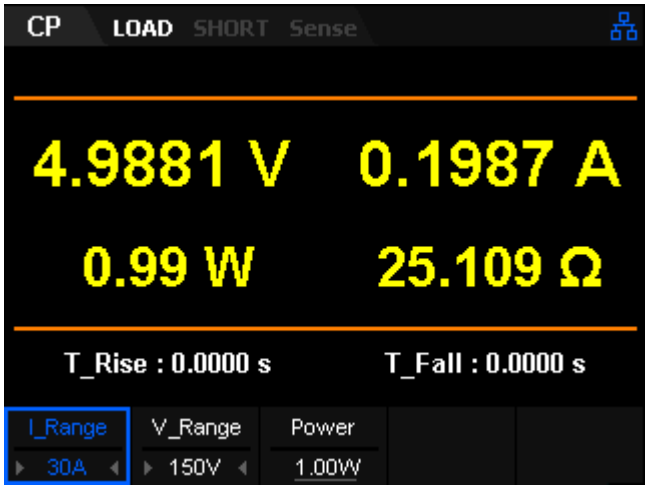



Figure 2-12 CP Mode Main Interface

3. Set CP mode current range (5 A or 30 A) and voltage range (36 V or 150 V).
4. Set power value.
5. Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface.

**Note:** The load begins to sink power only if the input voltage is greater than the conduction voltage of the system (default value is 0 V)

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

6. Press the Display key to enter the waveform display interface, as shown in Figure 2-13. By default, the power waveform is displayed. When the input voltage changes, the load will sink a constant power. Press the Display key again to exit the waveform display interface and return to the main interface of CP mode.

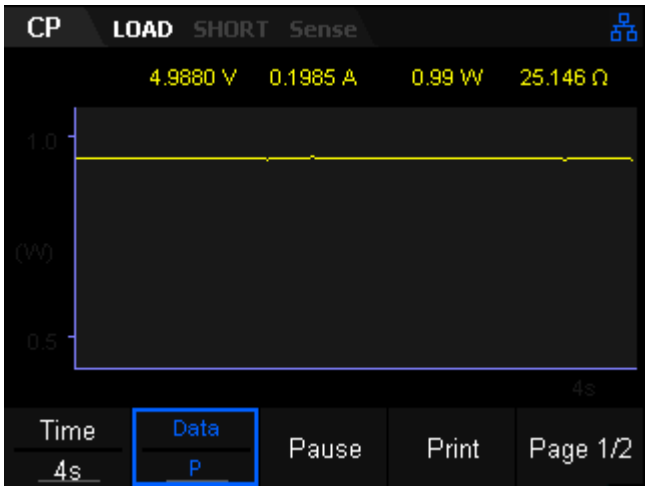



Figure 2-13 Waveform display interface of CP Mode

## Dynamic test function

In dynamic test operation, the electronic load can be switched between two parameters based on the set values. This can be useful when testing the dynamic performance of a power supply or source. Press Shift + CC key on the front panel to enter the dynamic test interface.

Before testing, it is important to configure the load set points: A value, B value, pulse width time, frequency, duty ratio,etc. The rise and fall slew rates are also important settings for dynamic testing.

Dynamic test supports three modes:

- Continuous
- Pulse
- Toggle

## Continuous mode

In continuous operation, when you enable the dynamic test operation, the load will continuously switch between Level A and Level B, as shown in Figure 2-14.

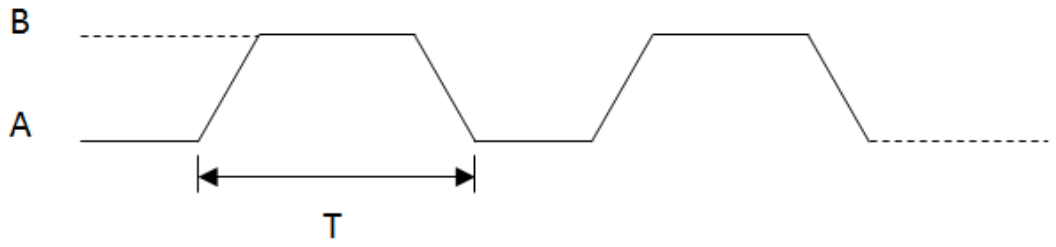



Figure 2-14 Transient CC Continuous Mode (Cont)

Taking CC mode as example (other modes function in a similar fashion), procedure:

1. **Connect device**
   Power on instruments Connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CC key on the front panel to enter transient test operation. Continuous mode (CC) requires setting the proper slew rates for all Level steps, as shown in 2-15, 2-16, 2-17.

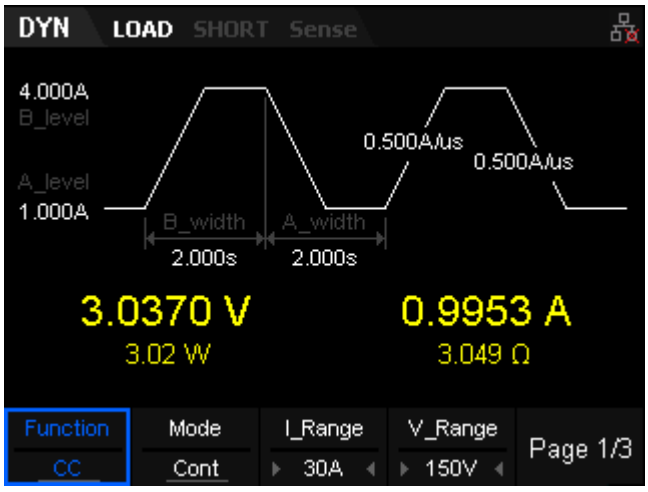



Figure 2-15 CC Cont mode page 1

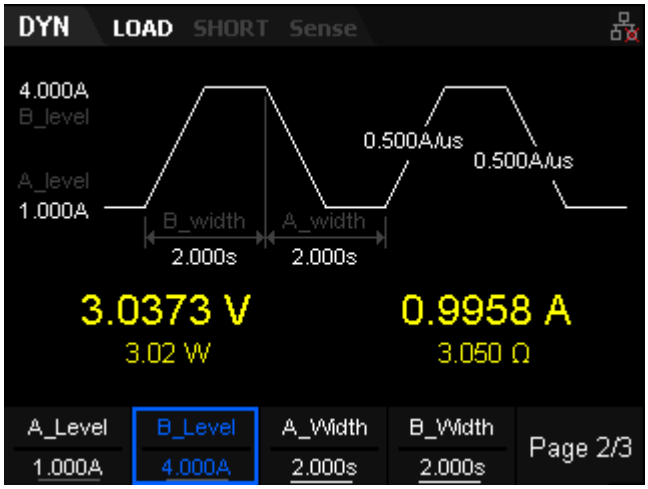



Figure 2-16 CC Cont mode page 2

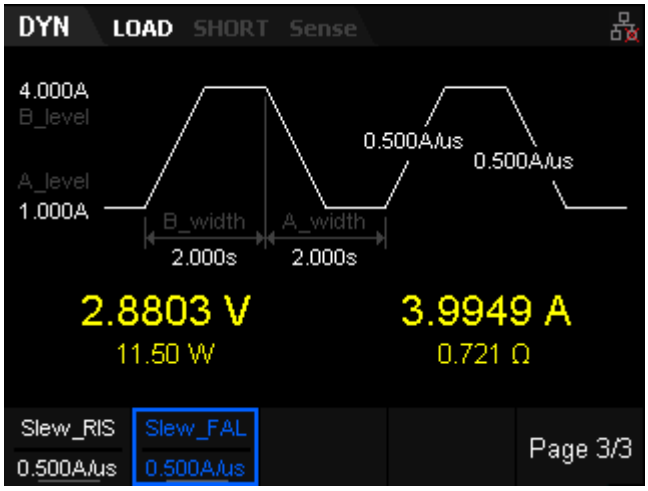



Figure 2-17 CC Cont mode page 3

The parameters for the continuous operation mode include Function, Mode, range, A _Level, B_Level, rising slew rate, falling slew rate, A_width, B_width and trigger selection. The interface menu can be divided into three pages.

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set A_level**
The sink current toggles between a high value and a low value in continuous mode. The A_Level indicates a low value. The default unit for A_Level is Ampere (A).

**Set B_level**

The sink current toggles between a high value and a low value in continuous mode. The B_Level indicates a high value. The default unit for B_Level is Ampere (A).

**Set width**

A_width/B_width: The time during which the sink current stays at Level A. Default units are s or ms and the available range is 0.020 ms - 999 s.

**Slew_RIS and Slew_FAL**

Slew_RIS and Slew_FAL: The set rate of change to a new level from the current value. Units are A/us and the available range is 0.001 - 2.5 A/us.

**3. Enable trigger**

Press Shift + CP key to enter the Utility interface. After pressing the “Config” key, the trigger source can be set in page 2 of the selection menu which includes Manual/Ext/Bus. Manual displays a trigger softkey on page 3 of the Dynamic test. Pressing this key will trigger the step. Ext sets the trigger type to external, which looks for a valid trigger on the rear panel Ext Trig input. Bus is a trigger sent over the remote control bus. See “Set trigger” in Section 3 for more details. Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface. The sink current will toggle continuously between the set A level and B levels.

**Tip:**

The sink current may maintain a constant value in the main interface when the width is set to a very small value because the load is switching too quickly between A_level and B_level set points. Use the waveform display function to see the waveform more clearly.

**4. View waveform display**

Press Display to enter waveform display interface, shown in figure 2-18. The waveform will display the current curve when ”I” is selected in CC Cont mode. Press Display again to exit the waveform display interface and return to the main interface of CC Cont mode.

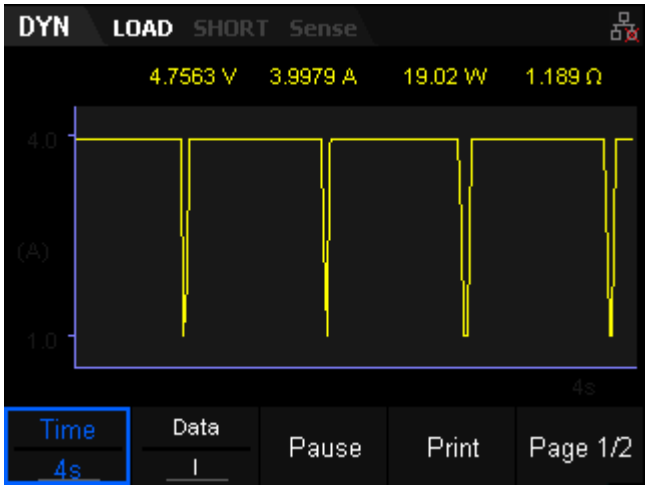



**Figure 2-18 Waveform display interface of Cont mode**

## Pulse mode

Dynamic test operations using pulse mode configures the load to source the low value (Level A) until a valid trigger is received. At this time, the load settings will change to the B values. The settings will switch back to the A values after maintaining B for the set pulse width time, as shown in Figure 2-19.

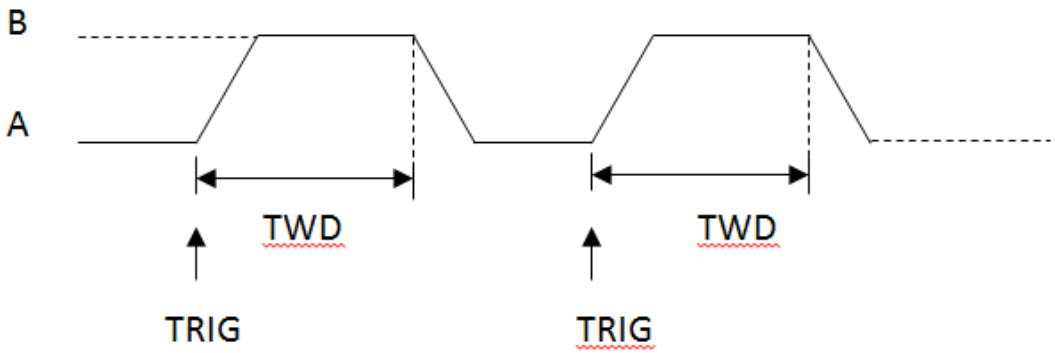



Figure 2-19 Transient CC Pulse Mode(Cont)

Take CC mode as an example (other modes are similar)

Operating Steps

1. **Connect device**
   Power on the instrument, connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CC key on the front panel to enter transient test operation. CC continuous mode is not only the default mode but also

the only mode that requires a set slew rate. Switch to pulse mode by pressing the “Mode” key, as shown in 2-20, 2-21, 2-22.

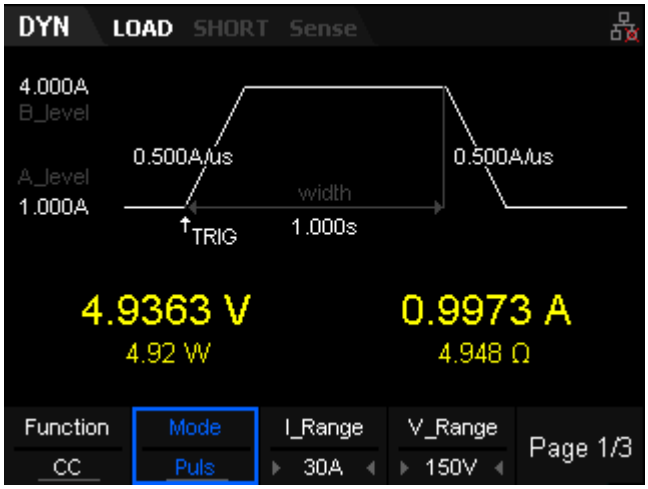



Figure 2-20 CC pulse mode page 1

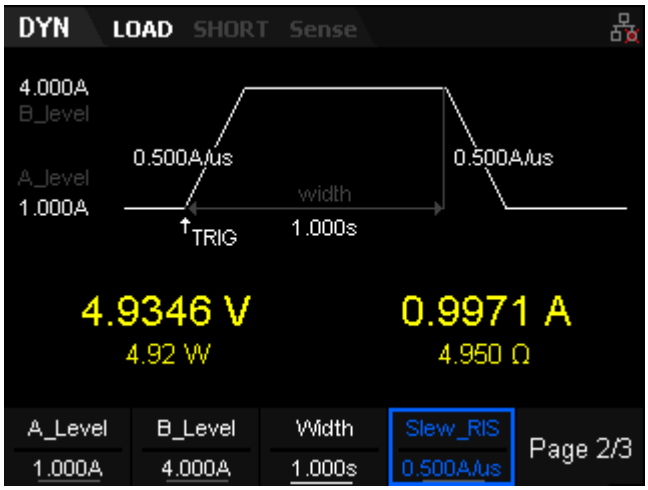



Figure 2-21 CC pulse mode page 2

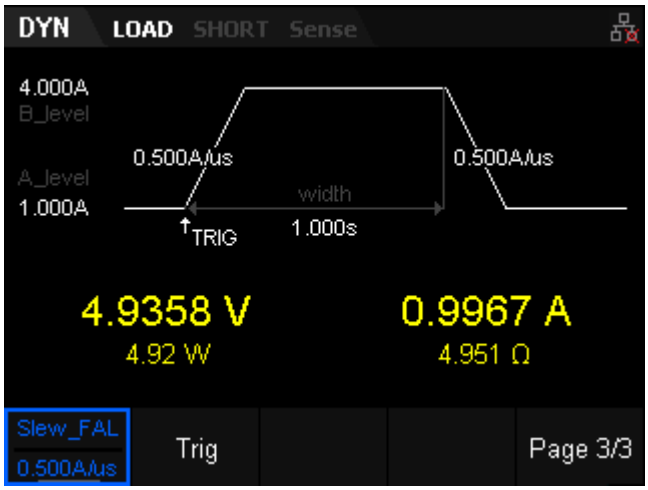



Figure 2-22 CC pulse mode page 3

The parameters for the pulse operation mode include Function, Mode, range, A_ Level, B_ Level, rising slew rate, falling slew rate, width and trigger selection. The interface menu can be divided into three pages.

**Set range**
Current range:5 A or 30 A
Voltage range: 36 V or 150 V

**Set A_level**
The sink current toggles between a high value and a low value in Pulse mode. The A_Level is designated as the low value. The default unit for A_Level is Ampere (A).

**Set B_level**
The sink current toggles between a high value and a low value in Pulse mode. The B_Level is designated as the high value. The default unit for B_Level is Ampere (A).

**Set width**
Width: The time duration for the step to sink current Level B. Units are s or ms and setting range is 0.020 ms - 999 s.

**Slew_RIS and Slew_FALL**
Slew_RIS and Slew_FALL: The rate of change to a new level from the current sink value of the load. Slew units are A/us and setting range is 0.001 - 2.5 A/us.

**3. Enable trigger**

Press Shift + CP key to enter the Utility interface. After pressing the “Config” key, the trigger source can be set on page 2 of the menu. There are three trigger options available: Manual/Ext/Bus. Manual displays a trigger softkey on page 3 of the Dynamic test. Pressing this key will trigger the step. Ext sets the trigger type to external, which looks for a valid trigger on the rear panel Ext Trig input. Bus is a trigger sent over the remote control bus. See “Set trigger” in Section 3 for more details.

Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface. The sink current will continuously toggle between the A level and the B level.

**Tip:** The sink current may maintain a constant value in the main interface when the width is set to a very small value because the load is switching quickly between A_level and B_level. Users can use the waveform display function to see the waveform more clearly.

## Toggle mode

Under Toggle mode (Tog), when you enable the dynamic test operation, the load will switch from the A value to the B value after receipt of a trigger signal. It will switch from B to A upon receipt of the next trigger signal, as shown in Figure 2-23.

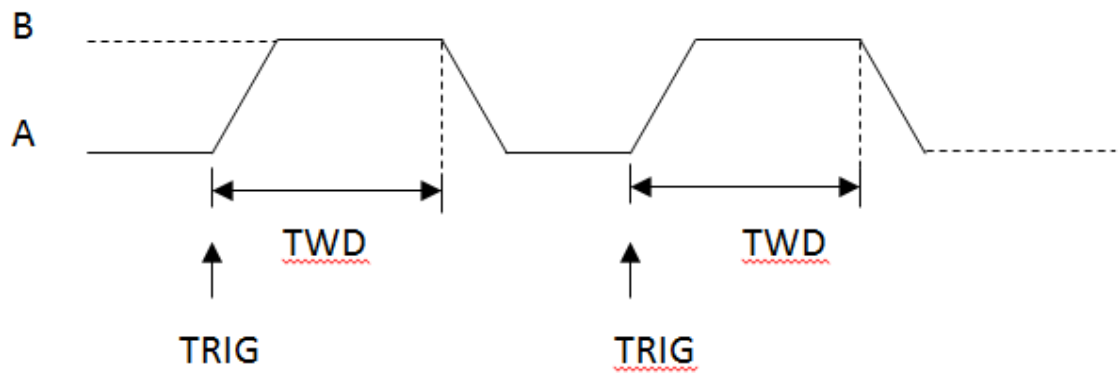



Figure 2-23 Transient CC Toggle Mode(Tog)

Take CC mode as an example (other modes are similar)

Operating Steps

1. **Connect device**

   Power on the instrument, connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.

2. **Set running parameters**

   Press the Shift + CC key on the front panel to enter tansient test

operation. CC continuous mode is not only the default mode but also the only one mode that requires setting the slew rate. Switch to Tog mode by press the “Mode” key, as shown in 2-24, 2-25, 2-26.

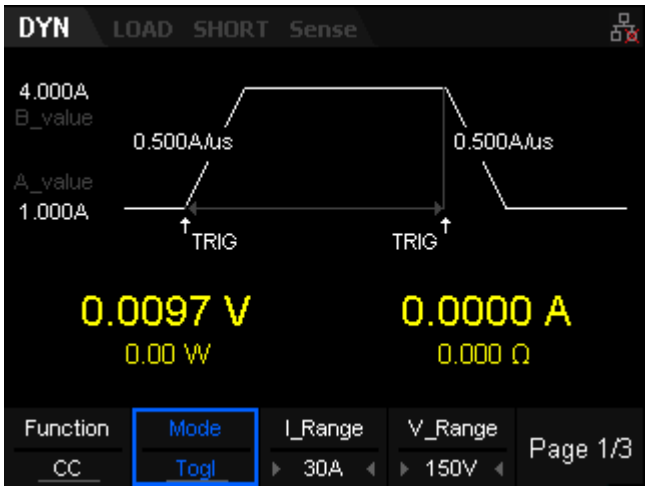



Figure 2-24 CC Tog mode page 1

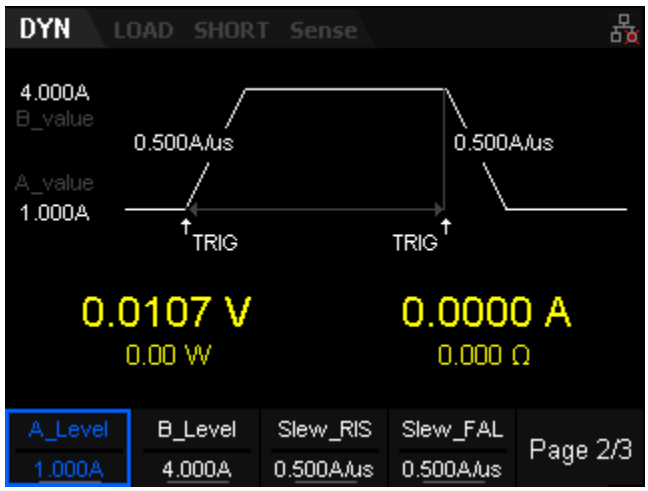



Figure 2-25 CC Tog mode page 2

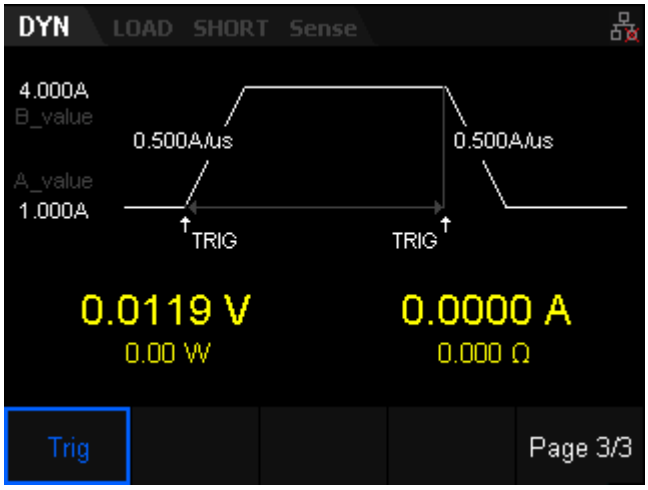



Figure 2-26 CC Tog mode page 3

The parameters for the pulse operation mode include Function, Mode, range, A_ Level, B_ Level, rising slew rate, falling slew rate and trigger selection. The interface menu can be divided into three pages.

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set A_level**
The sink current toggles between a high value and a low value in Pul mode. A_Level indicates the low value. The default unit for A_Level is Ampere (A).

**Set B_level**
The sink current toggles between a high value and a low value in Pul mode. B_Level indicates the high value. The default unit for B_Level is Ampere (A).

**Slew_RIS and Slew_FALL**
Slew_RIS and Slew_FALL: The rate of change to a new level from the current sink value of the load. Its unit is A/us and the setting range is 0.001 - 2.5 A/us.

3. **Enable trigger**
Press Shift + CP key to enter Utility interface .After pressing “Config” key the trigger source can be set in page 2 of the menu. There are three trigger types:Manual/Ext/Bus. Manual displays a trigger softkey on page 3 of the Dynamic test. Pressing this key will trigger the step. Ext sets the trigger type to external, which looks for a valid trigger on the rear panel Ext Trig input. Bus is a trigger sent over the remote control bus.

See “Set trigger” in Section 3 for more details.

Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface.

## OCPT Test Function

Overcurrent Protection Testing (OCPT) uses preset limits on current to halt a test. At the beginning of a test, the load measures the input voltage. If this value meets or exceeds the Von setpoint (OCP_V), the load starts to sink the current after a period of delay time. The load then increments the sink current value using the user-defined step size (I_Step) and time interval (Delay). At each step, the load measures the input voltage and compares it to the protection voltage value (OCP_V). If the measured value is higher, it indicates that OCPT did not occur. If the load has not reached the maximum current set point (I_MAX), the sink current will increment again. The load proceeds to run and increases with regular steps until it reaches the set protection voltage value (OCP_V) or the end current (I_End). If the sink current of the load reaches the stop value at any time during the test, the load will halt the test automatically. The OCPT test fails, and the test ends. If lower, it indicates that OCPT does occur. Judge whether the current under test is within the set current range (I_MIN to I_MAX). If yes, the load passes the test. If no, the load fails the test.

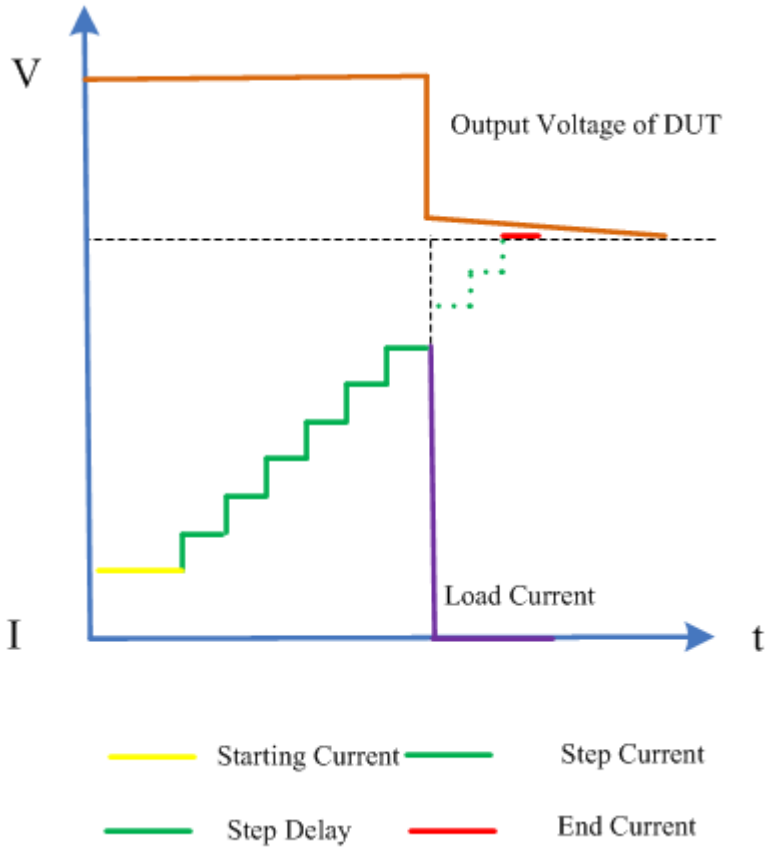



Figure 2-27 OCPT Test Function

Operating Steps

1. **Connect device**
   Power on the instrument and connect the DUT and the channel input

**2. Set running parameters**

Press the Shift + CV key on the front panel , select “OCPT” then enter OCPT test operation, as shown in 2-28, 2-29, 2-30.

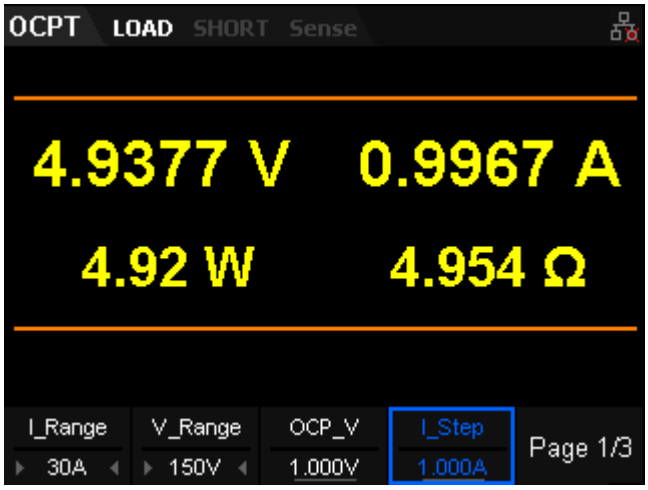



Figure 2-28 OCPT Test Function Page 1

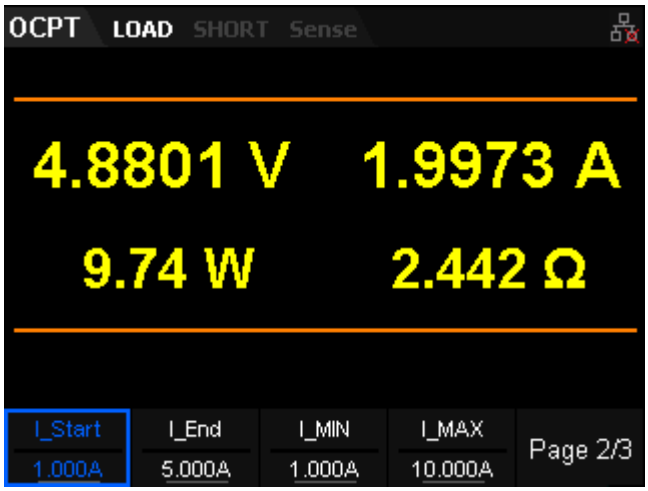



Figure 2-29 OCPT Test Function Page 2

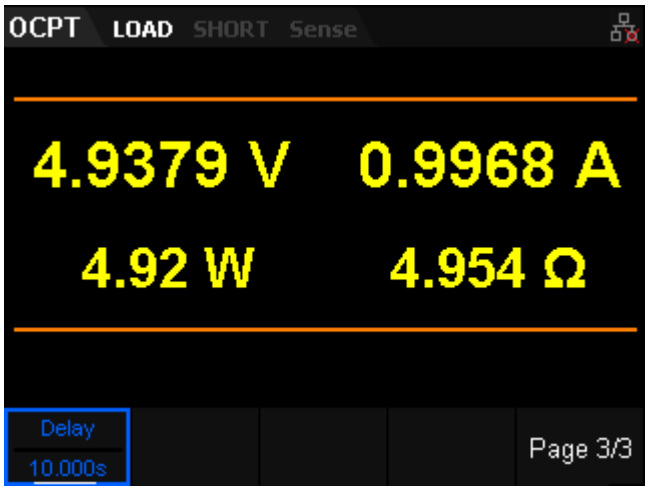



Figure 2-30 OCPT Test Function Page 3

The parameters for the OCPT test mode include range, OCP_V, I_Step, I_Start, I_End, I_MIN, I_MAX, Delay. The interface menu can be divided into three pages.

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set OCP_V**
The protection voltage of the OCPT test function. The default unit for the value is V.

**Set I_Step**
The step current in OCPT test function. The default unit for I_Step is Ampere (A).

**Set I_Start**
The sink current when the load starts the OCPT test sequence. The default unit for I_Start is Ampere (A).

**Set I_End**
The sink current when the load stops the OCPT test sequence. The default unit for I_End is Ampere (A).

**Set I_MIN**
The minimum value of the protection current in OCPT test function. The default unit for I_End is Ampere (A).

**Set I_MAX**
The maximum value of the protection current in OCPT test sequence. The default unit for I_End is Ampere (A).

**Set Delay**
The time interval during which the current moves from step-to-step in the OCPT test sequence. The default unit for Delay is s.

3. **Turn on the input channel**
   Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface. If the OCPT test passes, the interface of the load will pop-up a message box with the words “Test complete”. Then the load will disable

its output. If an OCPT test fails, the interface of the load will pop-up a message box such as “Below limit, Test fail”, “Over limit, Test fail”, etc. Then the input channel of the load will automatically turn off.

4. **View waveform**

   Press the Display key to enter the waveform display interface, as shown in figure 2-31. The sink current should have a stepped increase in the waveform when viewing current (I) data. . Press the Display key again to exit the waveform display interface and return to the main interface of OCPT test mode.

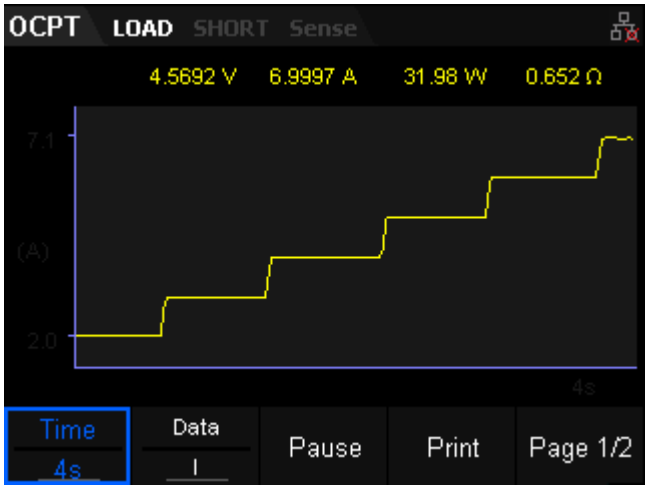



Figure 2-31 Waveform display interface of OCPT

## OPPT Test Function

When the Over Power Protection Test (OPPT) test starts, if the input voltage is less than the Von value, the load will start when the delay time specified by the delay setting has expired. The power increases with incrementing steps set by P_Step. At each step, the load input voltage is compared to the overpower protection voltage (OPP_V). If higher, it indicates that OPPT will not occur. The load proceeds to run and increases the sink power with regular steps until it reaches the protection voltage setting (OPP_V) or the last power setting (P_End). If the sink power of the load has reached the stop value (P_End) , the load output will shut off automatically, the OPPT test fails, and the test ends. If lower, it indicates that OPPT will occur. If the measured power under test is within the set maximum (P_MAX) and minimum power range (P_MIN), the load passes the test. If not, the load fails the test.

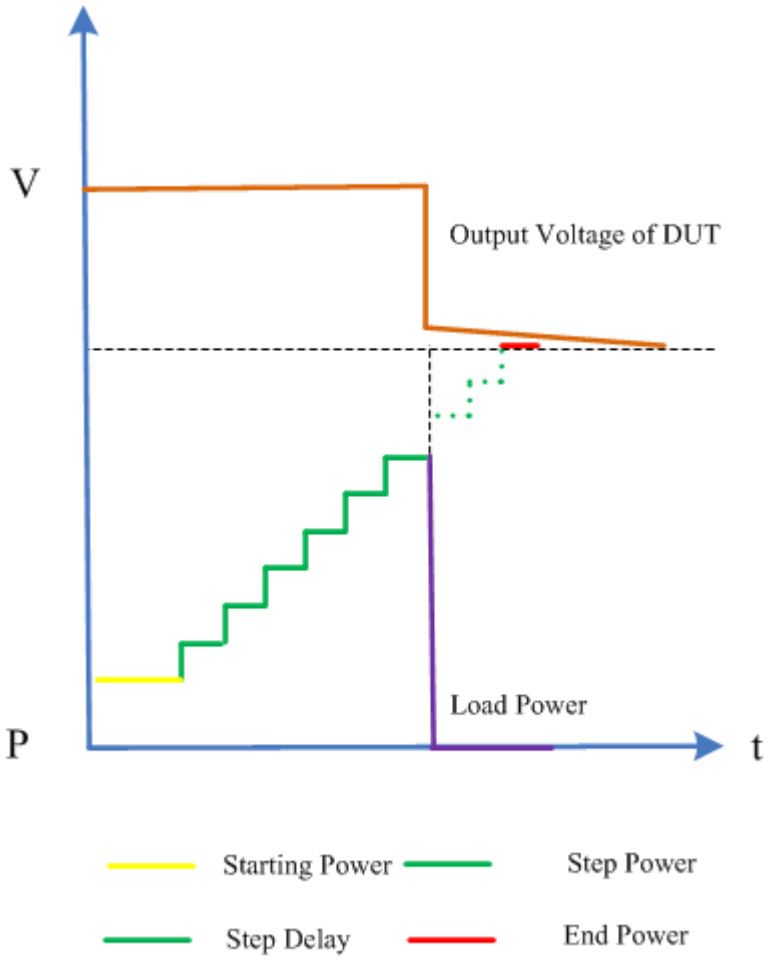



Figure 2-32 OPPT Test Function

Operating Steps

1. **Connect device**
   Power on the instrument, connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CV key on the front panel , select “OPPT” then enter OPPT test operation, as shown in 2-33, 2-34, 2-35.

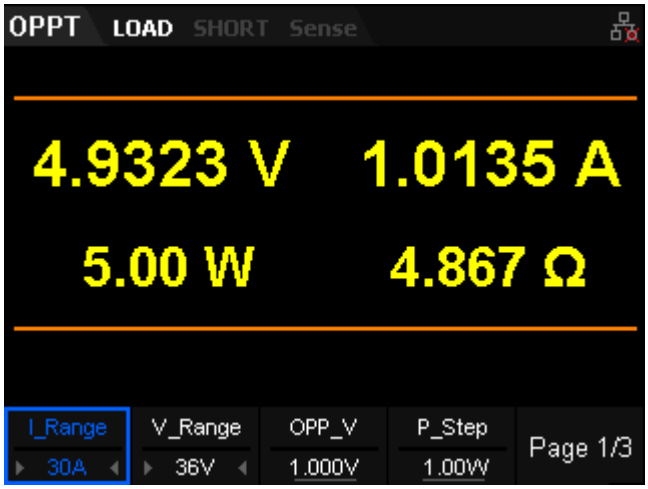



Figure 2-33 OPPT Test Function Page 1

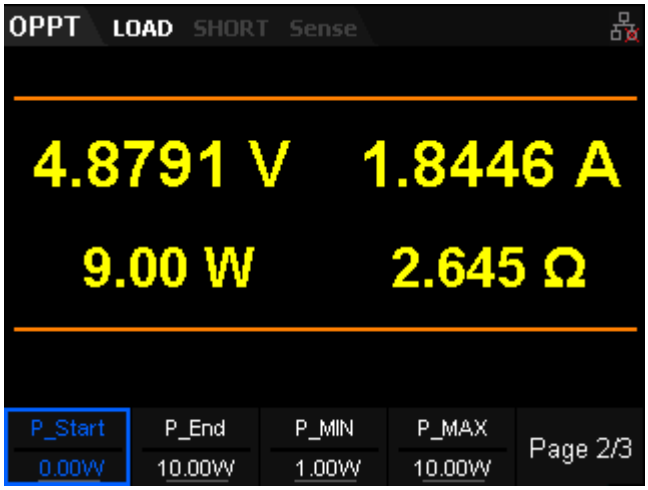



Figure 2-34 OPPT Test Function Page 2

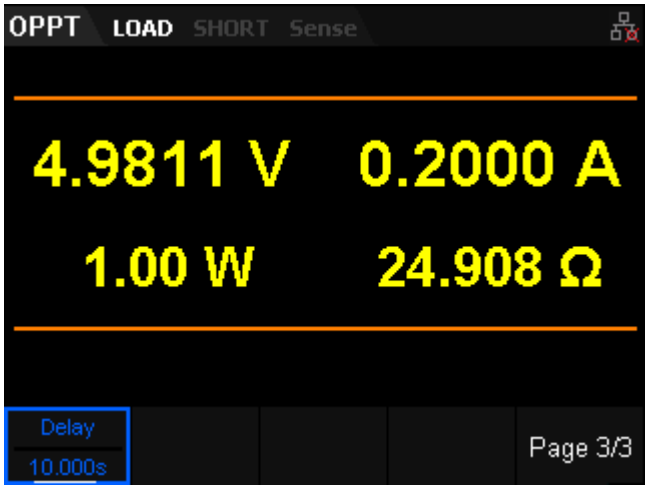



Figure 2-35 OPPT Test Function Page 3

The parameters for the OPPT test mode include range, OPP_V,P_Step, P_Start, P_End, P_MIN, P_MAX, Delay.

The interface menu can be divided into three pages.

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set OPP_V**
The protection voltage of the OPPT test function. The default unit for the value is Volts (V).

**Set P_Step**
The step power for the OPPT test function. The default unit for I_Step is Watts (W).

**Set P_Start**
The sink power when the load starts the OPPT test sequence. The default unit for P_Start is Watts (W).

**Set P_End**
The sink power when the load stops the OPPT test sequence. The default unit for P_End is Watts (W).

**Set P_MIN**
The minimum value of the protection power in the OPPT test function. The default unit for P_End is Watts (W).

**Set P_MAX**
The maximum value of the protection power in the OPPT test function. The default unit for I_End is Watts (W).

**Set Delay**
The time interval during which the power moves from step-to-step in OPPT test function. The default unit for Delay is seconds (s).

3. **Turn on the input channel**
   Press On/Off to turn on the channel input. At this time, the actual input voltage, current, resistance and power will be displayed on the main interface. If the OPPT test results are a pass, the interface of the load

will pop-up a message box stating “Test complete”, the load will then disable the output. If the OPPT test fails, the interface of the load will pop-up a message box stating “Below limit, Test fail”, “Over limit, Test fail”, etc. then the input channel of the load will be switched off automatically.

4. **View waveform**

   Press Display key to enter waveform display interface, as shown in figure 2-36. The sink power will have a stepped increase in the waveform after setting the Data selection to be power (“P”). Press the Display key again to exit the waveform display interface and return to the main interface of OPPT test mode.

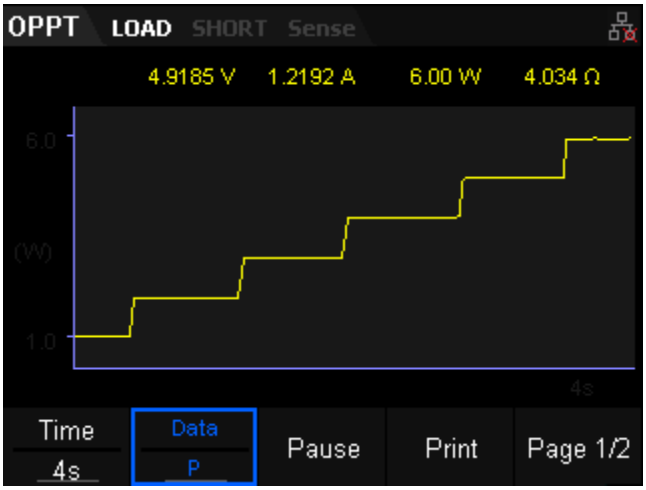



Figure 2-36 Waveform display interface of OPPT

## Battery Test Function

The Battery test function can be used in CC,CP, or CR mode. The primary termination conditions for the Battery test function include: cut-off voltage, cut-off capacity, and/or discharge time. When any one of the three conditions is met, the load immediately stops discharging. When only one or two condition(s) is/are selected as the termination condition(s) for the battery test, please set the unused termination conditions to the "OFF" state. The C-Add function can record accumulated capacity if required.

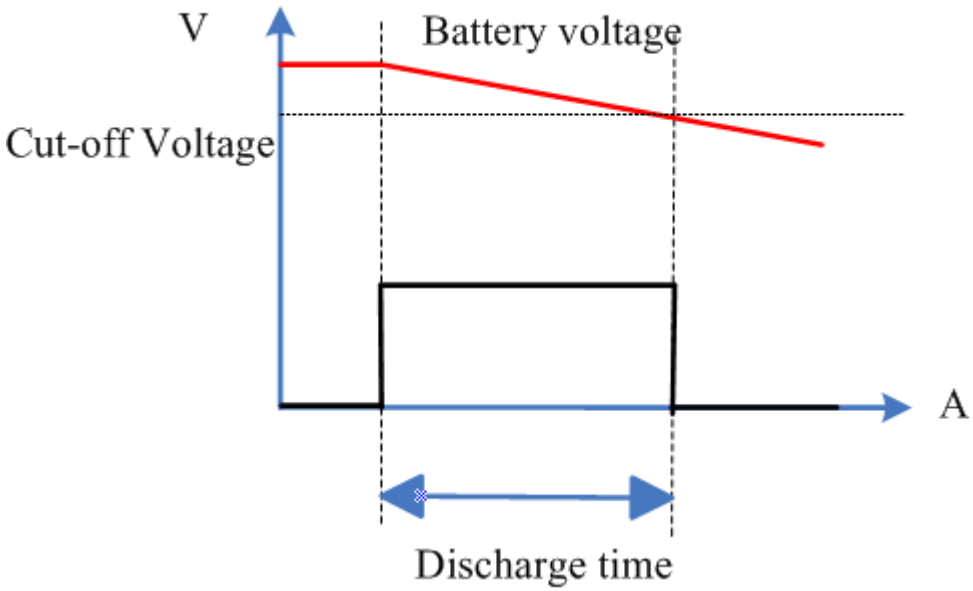



Figure 2-37 OPPT Test Function

The Battery test function reflects the reliability of the battery and the remaining battery life.

Take CC mode as example (other modes are similar)

Operating Steps

1. **Connect device**
   Power on the instrument and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CV key on the front panel , select “Battery” then enter the Battery test operation mode, as shown in 2-38, 2-39.

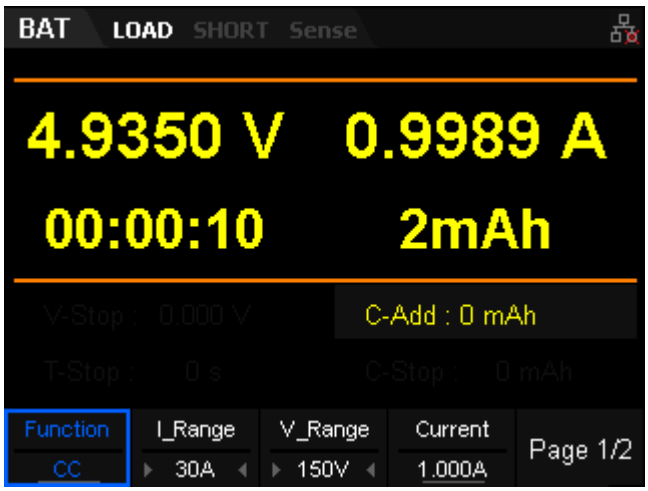



Figure 2-38 Battery Test Function

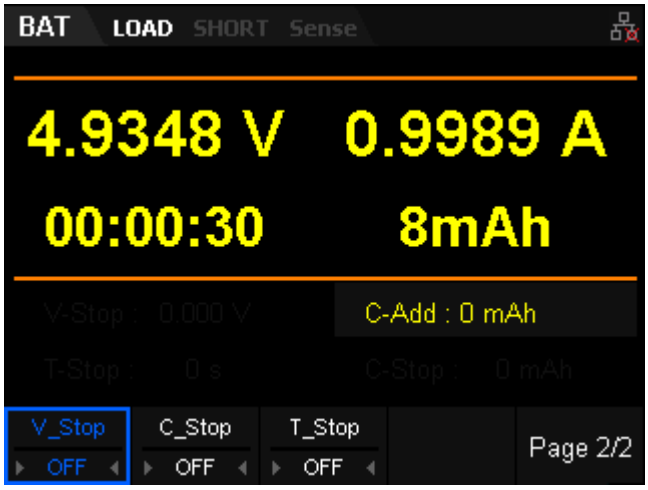



Figure 2-39 Battery Test Function Page 2

The parameters for the Battery test mode include Function, Range, Current, V_Stop, C_Stop, T_Stop . The interface menu can be divided into two pages.

**Set Function**
Choose CC, CR, or CP mode

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set current**
The discharge current of the Battery test function. The default unit for the value is Ampere (A).

**Set V_Stop**
The cut-off voltage in the Battery test function . When the battery voltage reaches the cut-off voltage, the load stops discharging automatically. The default unit for V_Stop is Volts (V).

**Set C_Stop**
The cut-off discharge capacity in the Battery test function . When the accumulated capacity is greater than the cut-off capacity, the load

stops discharging automatically. The default unit for C_Stop is milliamp-hour (mAh).

**Set T_Stop**

The discharge time in the Battery test function. When the accumulated time is greater than the cut-off time, the load stops discharging automatically. The default unit for T_Stop is seconds (s).

3. **Turn on the input channel**

   Press On/Off to turn on the channel input. At this time, the actual discharge voltage, current, time and capacity will be displayed on the main interface. If any of the termination conditions are met, the load will pop-up a message box stating “Battery test compelete”, which will disappear by pressing any key.

   **Note:** Once the channel input is turned on, the load will not start to sink current until the input voltage is greater than the break-over voltage.

4. **View waveform**

   Press the Display key to enter the waveform display interface, as shown in figure 2-40. By observing the CC waveform with the Data parameter set to current (I), you can see the load discharge with a constant current. Press the Display key again to exit the waveform display interface and return to the main interface of OPPT test mode.

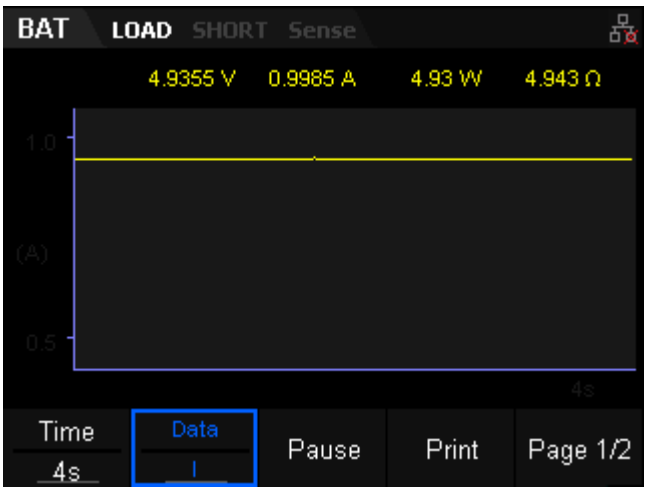



**Figure 2-40 Waveform display interface of BAT**

# List Test Function

List test mode enables you to automatically test devices by creating and executing a sequence of test steps using a single function. For example, you could create a list test that contains 10 different steps using the CC function, or a two step list using CV. You define each step limit, measurement ranges, dwell time, slew rate and trigger mode then save this specific sequence as a list. The external trigger mode can be used to sequence the test with other operations and instrumentation. All listed data is stored in non-volatile memory with ".list" as the file extension. This secures the data and makes it easy to store and edit directly from the SDL front panel.

As shown in Figure 2-41, the load simulates the complex sequences of input changes based on the list parameters that you create. The list function supports CC, CV, CR, and CP modes.

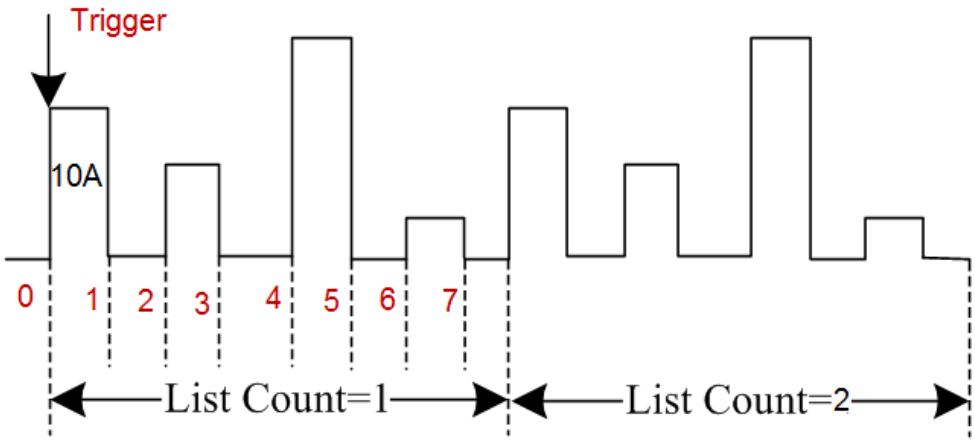



Figure 2-41 List Test Function

Users can edit list files through the front panel or use a previously created list. Here, we will use the CC mode as an example (other modes are similar)

Operating steps

1. **Connect device**

   Power on the instrument and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.

**2. Set running parameters**

Press the Shift + CV key on the front panel , select “List” then enter List test mode, as shown in 2-42, 2-43.

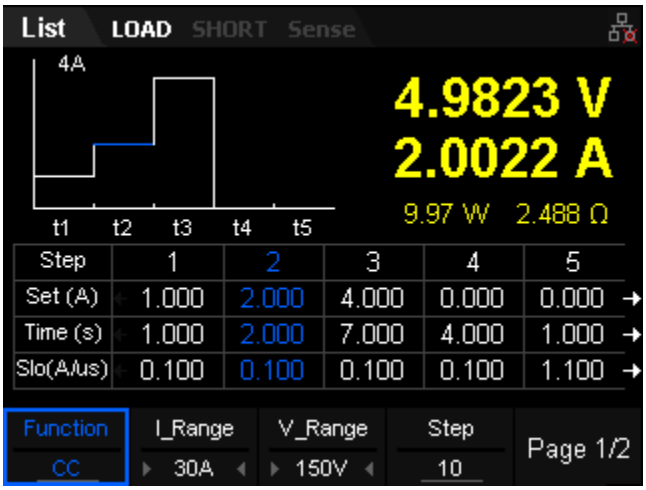



Figure 2-42 List Test Function Page 1

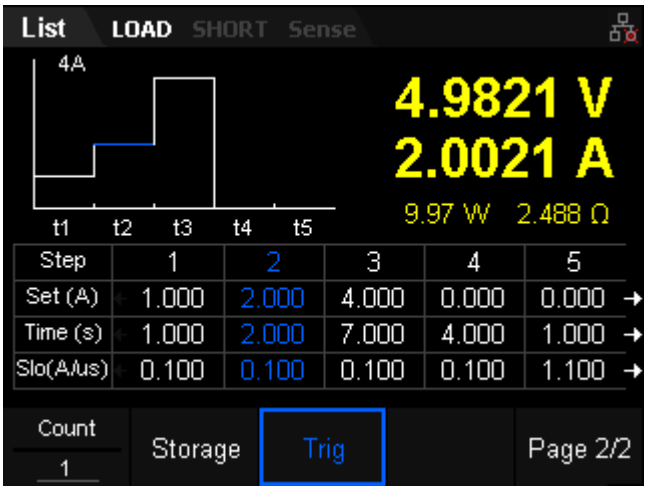
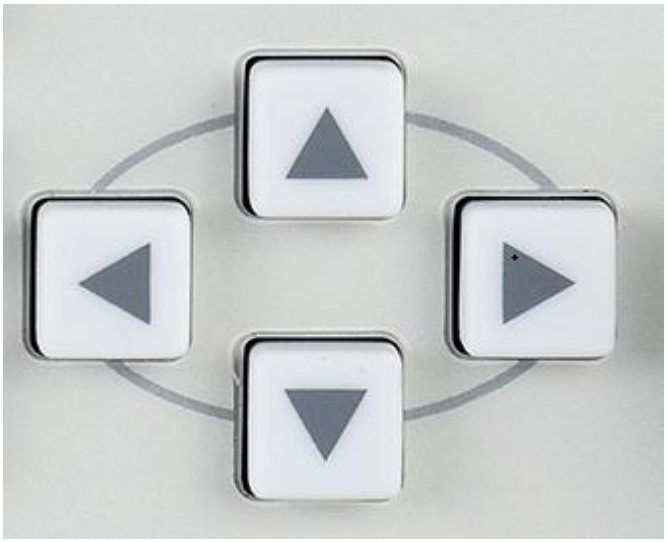



Figure 2-43 List Test Function Page 2

The parameters for the List test mode include Function, Range, Step, Count, Storage, and Trig . The interface menu can be divided into two pages.

To edit the values of the list, use the front panel arrows and keypad to navigate the list step table and adjust each step value:



**Set Function**
Choose CC, CV, CR, or CP mode

**Set range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set Step**
Here, you set the number of steps that are required for the list.

**Set Count**

The Count is the number of times the list will be executed before the end of the test. The Count has a range from 0-255. When Count is 0, the SDL will display “infinite” and will run each step in the list until it is disabled or stopped manually.

**Set parameter of list**
The parameter list of List mode includes step, sink value of each step, running time of each step, slew rate, readback current, readback voltage, readback resistor, readback power. The arrow in the right of parameter list indicates that the current interface can not display parameters of all steps. At this time, the user can edit all parameters of each step by using the direction keys/arrows to move the focus to different areas of the list.

3. **Turn on the input channel**
   Press On/Off to turn on the channel input. At this time, the actual discharge voltage, current, time and capacity will be displayed on the main interface. The parameter status can be displayed in real time in

the parameter preview area.

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

4. **View waveform**

   Press Display key to enter the waveform display interface, as shown in figure 2-44. Here, you can observe the measured performance of the input signal. Change the Data label (I, V, P, or R) to view a different parameter. Press the Display key again to exit the waveform display interface and return to the main interface of List test mode.

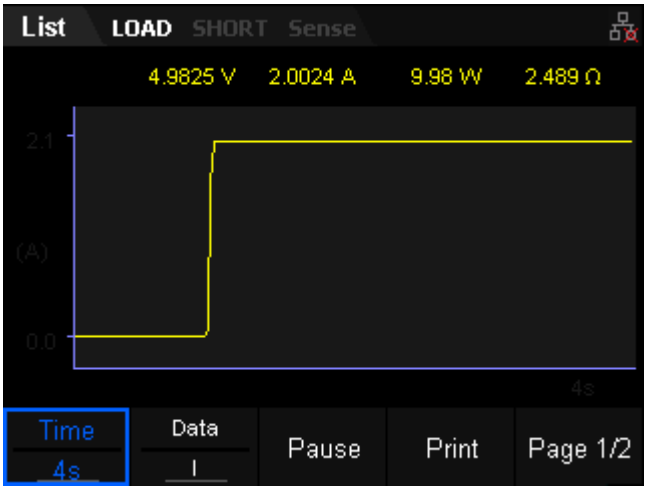



Figure 2-44 Waveform display interface of List mode

5. **Storage**

   In the List function interface, you can press “Save” to save the parameters for List mode to the internal or external memory, and you can read and recall it if necessary by pressing “Recall”. Up to eight List files can be stored internally.

## Auto Test Function

The Auto test function of the Teledyne Test Tools T3EL15030xP electronic load is very powerful. It allows for multiple steps, similar to List mode. The biggest difference is that it can also change the test function type (CC, CV, CP, CR,

LED, etc..) at every step. Up to ten test files can be saved with each test file having a maximum of fifty steps. The file extension defined for an Auto test file is “.prog”.

Operating Steps

1. **Connect device**
   Power on the instrument and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CV key on the front panel , select “Program” then enter Program test mode, as shown in 2-45.

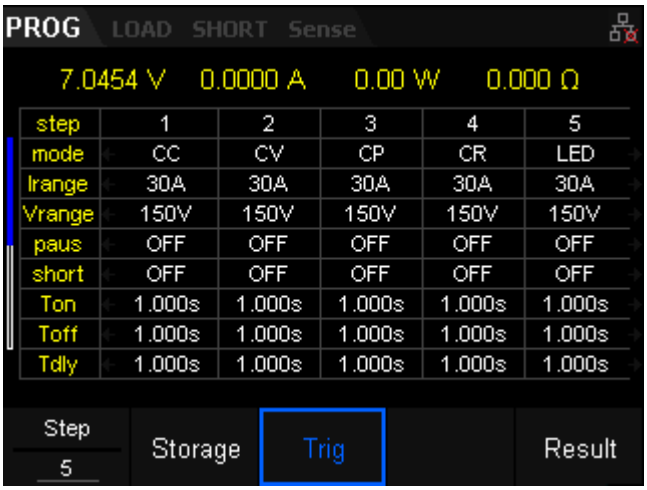



Figure 2-45 Program Test Function

The parameters for the program test mode include Step, Storage, Trig, Result.

**Set Step**

Set the number of steps you wish to run in this specific program.

**Set parameter list**

The parameter list of program mode includes: mode, current range (Irange), voltage range (Vrange), pause (paus), Short, time on (Ton), time off (Toff), delay (Tdly), min, max, Set, resistance range (Rrange), Vo, Io, Rco. The arrow in the right of parameter list indicates that the current interface can not display parameters of all steps. At this time, user can edit all parameters of each steps by using direction key after move the focus to the list.

(1) Set operating mode

There are five modes that can be selected: CC, CV, CP, CR, or LED.

(2) Set the current and voltage ranges: Current
range: 5 A or 30 A
Voltage range: 36 V or 150 V

(3) Set pause Status
Users can pause auto test if needed. Simply highlight/select the cell labelled pause using the keypad arrows on the front panel and rotate the SDL control knob to enable change the entry value. Then the load will pause at this step when running this auto test step. Auto test can recover after receiving the next trigger.

(4) Set short Status
Users can enter a short circuit step if needed. Similar to pause, use the keypad arrows to select the Short cell and rotate the knob to enable it. Then the load will short the circuit at this step when running an auto test.

(5) Set Loading Time(Ton)
This is the time duration of each step and its range is 0.01-100 seconds (s).

(6) Set unLoading Time(Toff)
The time interval in adjacent step and its setting range is 0.01-100S

(7) Set Delay Time(Tdly)
The time is between begin test to sample the current or voltage value of the load. Its setting range is 0.01-Ton s.

(8) Set minimum
The minimum sink value. Units depend on the current mode in use.

- In CC mode, its default unit is V
- In CV mode, its default unit is A
- In CP mode, its default unit is W
- In CR mode, its default unit is Ω

(9) Set maximum
The maximum sink value Units depend on the current mode in use.

- In CC mode, its default unit is V
- In CV mode, its default unit is A
- In CP mode, its default unit is W
- In CR mode, its default unit is Ω

(10) Set input value

- Set running current value in CC mode. The default unit is A
- Set running voltage value in CV mode. The default unit is V
- Set running power value in CP mode. The default unit is W
- Set running resistance value in CR mode. The default unit is Ω

(11) Set Rrange

Resistance range includes Low, Middle, High and Upper.

(12) Set LED operating voltage (Vo)

Set the operating voltage value in LED mode. The default unit is V

(13) Set LED operating current (Io)

Set the operating current value in LED mode. The default unit is A

(14) Set LED Coeff (Rco)

Users can change the operating voltage and resistance by changing “Rco” which has a set range from 0-1.

3. **Turn on the input channel**

Press On/Off to turn on the channel input. At this time, the actual discharge voltage, current, time and capacity will be displayed on the main interface. The parameter status can be displayed in real time in parameter preview area.

**NOTE:** The test operation depends on the trigger setting. If you have selected manual trigger, you can press Trigger to being the programmed test at this time.

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

4. **View waveform**

Press Display key to enter the waveform display interface, as shown in figure 2-44. Here, you can observe the change of the current/voltage/ resistance/power over time. Press the Display key again to exit the waveform display interface and return to the main interface of the Program test mode.

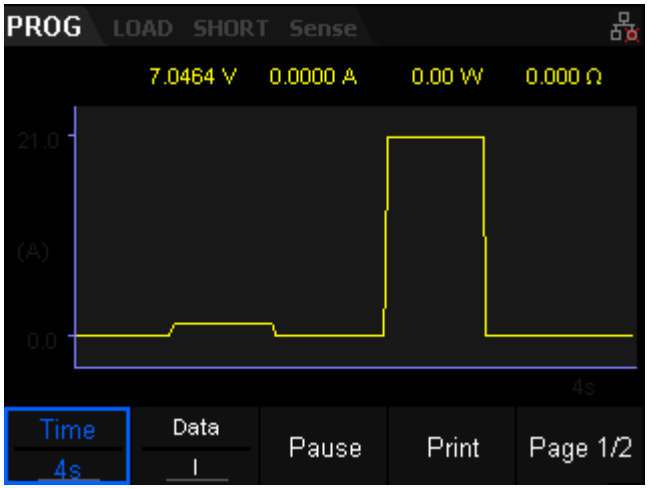



Figure 2-44 Waveform display interface of Program mode

5. **Result**

   The auto test complete interface, as shown in Figure 2-45.

   - Result list: Steps, Results and Remarks.
   - Readback parameters: including readback current, etc.
   - Running step: Indicates the number of running steps.
   - Clear: Remove all data in the result list.

6. **Storage**

   In the Program function interface, you can press “Save” to save the parameters for Program mode to the internal or external memory, and you can read and recall it if necessary by pressing “Recall”. The T3EL15030xP can save ten Program files.

## LED Test Function

This function adds a break-over voltage setting to the conventional CR mode. In short, the load acts like a diode. When the input voltage of the load is greater than the diode break-over voltage, the load can simulate the working principle of a diode and measure the drive current simulating a real LED test.

Calculation method of Vd and Rd value:

- Vo: Working voltage of the load of an LED constant current source.
- Io: Working current of an LED constant source.
- Vd: Break-over voltage of the diode

- Rd: Resistance of operating point

A typical V - I characteristic curve of LED lights, as shown in Figure 2-45:

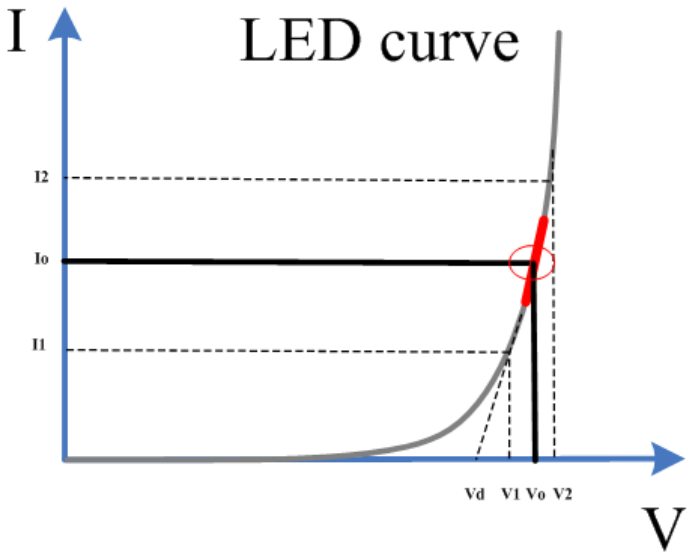



Figure 2-45 V - I characteristic curve of LEDs

According to the V-I curve, we can get Rd and Vd:

$$\mathrm{Rd} = \frac{V_2 - V_1}{I_2 - I_1}$$

$$V_d = V_o - (I_o * Rd)$$

Choose V2, I2, V1, and I1 near the static working point (as shown in the red circle of the curve). Users also can calculate the value of Vd and Rd according to methods below:

$$Vd = V * 0.8 \; Rd = 0.2 \; V/I$$

Operating Steps

1. **Connect device**
   Power on the instrument and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.
2. **Set running parameters**
   Press the Shift + CR key on the front panel to enter LED test mode, as shown in 2-46.

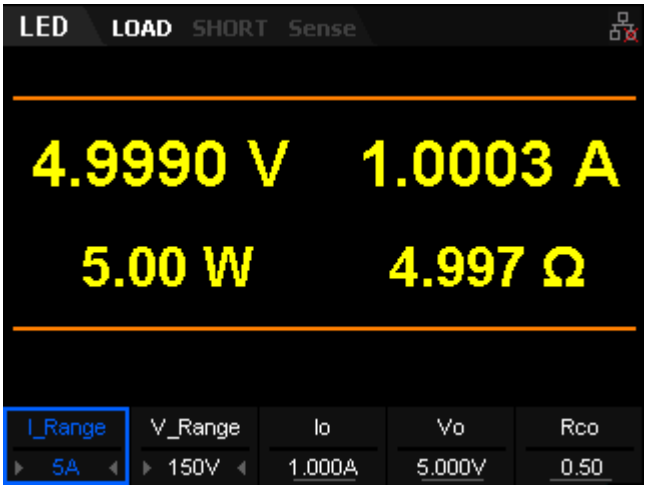



Figure 2-46 LED Test Function

The parameters for the LED test mode include Range, Io, Vo, Rco.

**Set Range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set Vo**
The working voltage at the operating point.

**Set Io**
The working current at the operating point.

**Set Rco**
Set Rd by the following formula:

$$Rd=(Vo/Io)*(1-Rco)$$

3. **Turn on the input channel**
   Press On/Off to turn on the channel input. At this time, the actual sink voltage, current, power, resistance will be displayed on the main interface. The sink current will be increasing with increase input voltage of the load.

   **Note:**
   Once the channel input is turned on, the load will not start to sink the current until the input voltage is greater than the break-over voltage.

**Warning**

To avoid electric shock, ensure that the DUT is connected to the input terminals of the load properly before you turn on the channel input.

---

4. **View waveform**

   Press Display key to enter waveform display interface, as shown in figure 2-47. Here, you can view data with respect to time. Select a data type to choose the graphed values. Press the Display key again to exit the waveform display interface and return to the main interface of LED test mode.

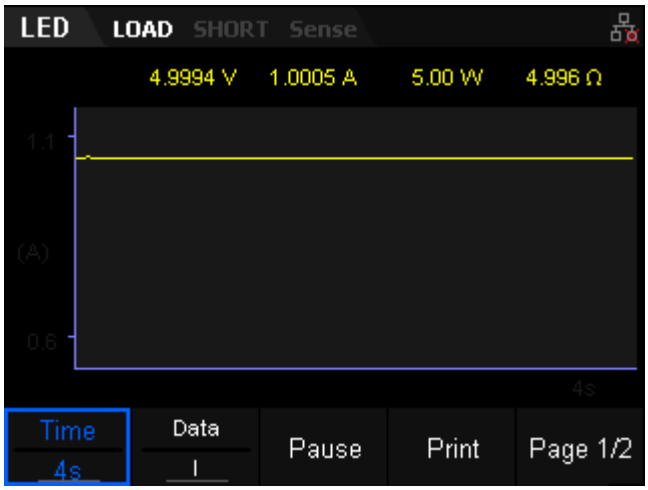



Figure 2-47 Waveform display interface of LED test mode

## Waveform Display Function

The electronic load provides the waveform display function and supports the following operations: pausing, recording, and capturing the waveform. Therefore, you can dynamically observe the trend of the input. The waveform display function is applicable to CC/CV/CR/CP/LED/Con/Pul/Tog/OCPT/ OPPT/List/ Battery/Program/ExtI/ExtV modes.

For example, in CC mode press Display key to enter waveform display interface, as shown in figure 2-48.

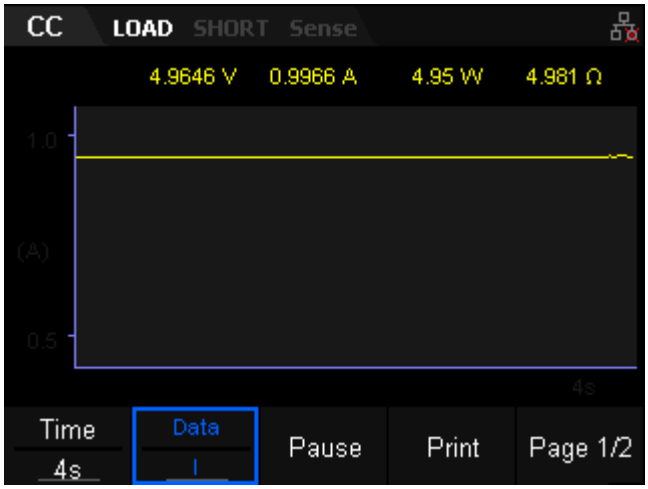



Figure 2-48 The waveform display in CC mode

Operating Steps

1. **Set Time**
   The time set range is 4 s - 80 h in all modes.

   **Tip**
   When the time that you set is greater than 120s, it will be automatically displayed in minutes. When greater than 120 min, it will be automatically displayed in hours.

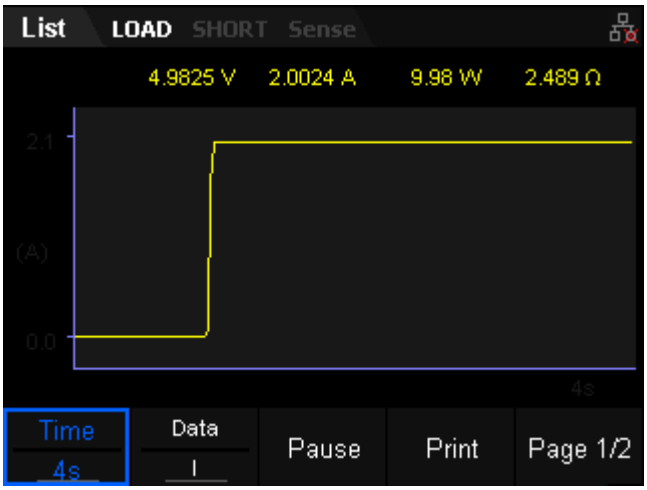
2. **Set Data**
   Menu items under "Data" include I, U, R, and P.

3. **Pause and Start**
   When the “Pause” key is pressed, the load will suspend the data collection and graphing of the waveform. When the “Start” key is pressed, the load will continue to graph waveform. These operations govern graphing only. The active state of the load is still being governed independently by the current settings, list, or program running.

4. **Print**
   After you insert the USB storage device, press “Print” to capture the screen or images and save them in ".BMP" format to the USB storage device.

5. **Record**
   After you insert the USB storage device, press the “Record” key to save

the data file in ".CSV" format to the USB storage device. This will prompt you to name the file. The load will begin to graph the data as well as write it to the USB memory stick. When you are recording data, the corresponding flag will display in the top of the interface :




The flag will disappear after pressing the “Record” key again.

6. **Playback**

Press “PlayBack” to play back the recorded data files.

(1) After stopping a recording, press ”Playback” to enter the playback interface.

(2) Press the File softkey to open the file dialog window.

(3) Use the keypad arrows to navigate and select the data file in “.CSV” format that you wish to replay.

(4) Press the “Read” key , the instrument will read the selected data file and display in the waveform display interface.

**Tip**

The recording function and palyback function can not be enabled at the same time.

## Restore

The load can save various types of files to internal or external memories. You can recall and read them when necessary. The load supports an internal non-volatile memory (Local(C:) and an external memory (USB(D:). Disk D is only available when a USB storage device is detected over the USB HOST interface on the front panel.

**Note:**

The load only supports FAT32 USB flash drives.

1. Local(C:)
   User can save the currently set state files to the local storage area and recall them when necessary. Eight list files and ten program files can be saved to the local drive.

2. USB(D:)
   Disk D is only available when a USB storage device is detected over the USB HOST interface on the front panel. You can save the currently set state files and data files of various function modes to the USB storage device and you can also copy the files from Disk C to Disk D. The number of files that can be saved is determined by the storage space of the disk.

Press Restore key on the front panel of the load to enter the storage and recall interface, as shown in Figure 2-49.

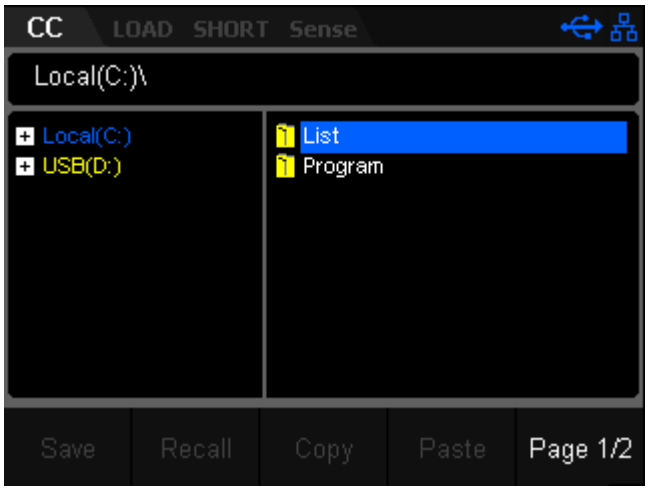



Figure 2-49 Storage and Recall Interface under CC mode

**Save**

Operating Steps

1. Press Restore to enter storage interface, then enter the file catalogue list in List/Program.
2. User can select an arbitrary file in the files catalogue in List/ Program, then click “Save” to enter file name edit interface which is default display “Default”, as shown in figure 2-50.


Figure 2-50 filename edit interface

3. The filename edit box can be input uppercase and lowercase English letters、0-9 natural numbers and special characters “-” or “_” or ”.”, etc.

   **Input character:**
   The character can only be edit in the place where the cursor is located in the filename edit box. Press Enter or “Next Char” key to edit the next character.

   **Character selection area:**
   The white color area is the character selection area in the interface. Press up and down key to select character in vertical direction and press left and right key to select character in the horizontal direction. Then press Enter key or rotary knob to confirm.

4. Selection function of the interface:
   1. Delete Char: Delete the character where the cursor is and the length of filename will reduce one character length. If the character is the final one, it will display “A” after deleted.
   2. Previous Char: Cursor moves left
   3. Next Char: Cursor moves right
   4. OK
   5. Cancel

   Press “OK” key after input the filename in the filename edit interface.

**Read**

Operating Steps

1. Press Restore to enter the storage interface, then enter the file catalogue list in List/Program.
2. You can select an arbitrary file in the file catalogue in List/Program, then click “Read” to enter List/Program mode.

**Copy and Paste**

This function only operates in copying files from the internal storage (C:\ to an external USB memory device D:\).

Operating steps

1. Press Restore to enter the storage interface, then enter the files catalogue list in List/Program.
2. Users can select an arbitrary file in the files catalogue in List/ Program, then click “Copy” to copy the current file that is selected.
3. Switch to the Disk D file catalogue and press “Paste” in the target path to paste the file to Disk D. Only one file can be copied and pasted at a time.

**Delete**

Users can delete files in Disk C and Disk D.

Operating steps

1. Press Restore to enter the storage interface, then enter the files catalogue list in Disk C and Disk D.
2. User can select an arbitrary file in the files catalogue in List/Program or Disk C and Disk D, then click “Delete” to delete the current file that be selected. Only one file can be deleted at a time.

**Rename**

Users can rename filename of the files in Disk C and Disk D.

Operating steps

1. Press Restore to enter storage interface, then enter the files catalogue list in Disk C and Disk D.
2. Users can select an arbitrary file in the files catalogue in List/Program or Disk C and Disk D, then click “Rename” to rename the current file that be selected. Press “OK” when finished editing.

# Function of Terminals on the Rear Panel

## Sense mode

When the DUT outputs large currents, the voltage drop due to the lead and contact resistance of the load leads cannot be ignored. To ensure an accurate measurement for the output voltage of the DUT, the load provides Sense (remote sense) working mode. In this mode, the Sense terminals (as shown in figure 2-51) are directly connected to the output terminals of the DUT. Remote sensing compensates for the voltage drop caused by the load leads, ensuring that the output voltage of the DUT is consistent with the input voltage of the load.

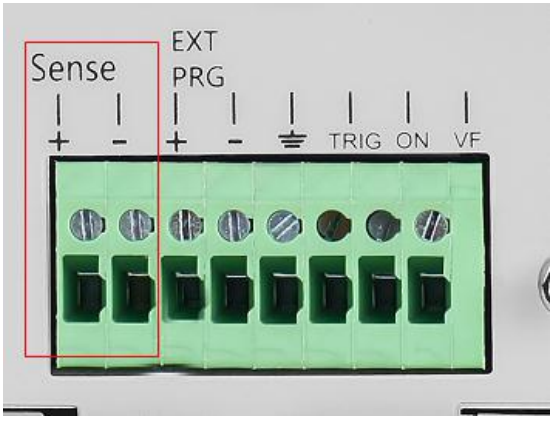



Figure 2-51 Sense terminal on the real panel

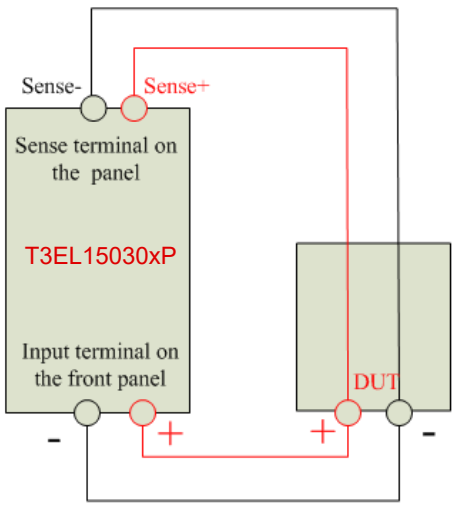



Figure 2-52 Sense connections

Operating steps

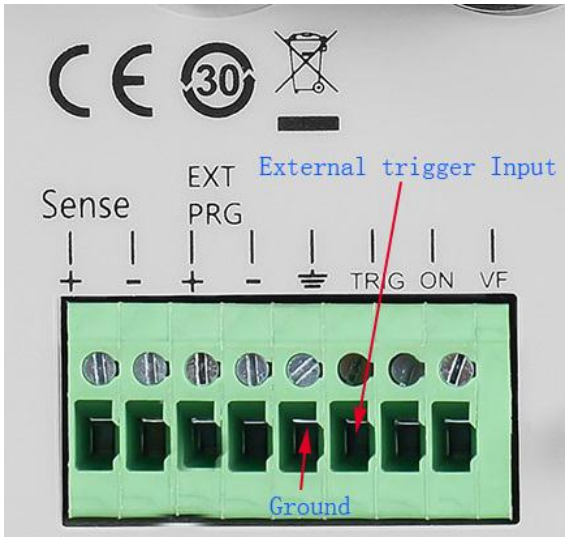
1. As shown in the above figure, connect the load to the DUT. Ensure that the polarity of the connections is correct.
2. Press Shift and CP key to enter the system utility function interface. Press “Config” and “Sense” to enable (disable) the Sense function.

**Note:** The Sense terminals must be connected to the output terminals of the DUT. If not, then the load cannot accurately measure the voltage of the terminals in any function.

**Tip:** In case where the DUT outputs large currents, the load leads should be as short as possible. Twisting the sense leads can also assist in minimizing measurement noise.

## External Trigger Function

The SDL features an external trigger which allows sequencing and control to be performed using another instrument or trigger source. To start, set the trigger source to “External” by pressing Shift > Utiity > Config > Page 2/2 and set Trig to Ext. The trigger signal input and ground connection are shown on the rear panel. The trigger input signal should be 0-5V TTL level



Operating Steps

1. Press Shift and CP key to enter the system utility function menu. Select “Config” and set trigger mode of the trigger source be “Ext”, then press Enter to confirm.
2. When using the external trigger mode, the falling edge of the trigger signal output from the negative and positive trigger terminal can enable trigger function. The trigger can be used in List, Program, and dynamic test mode.

## Voltage Fault Indicating Function

When the load is in overvoltage protection or reverse connection protection, the VF terminal which indicates a voltage fault will output a high level.

## Current and Voltage monitor

The output terminal of current and voltage monitor sources a 0-10 V analog signal that represents the input from zero to full range. Users can use an external voltmeter or oscilloscope to observe the trend of the input current or voltage.

# Short Circuit monitor

The load can deliver a short circuit at the input terminals. The protection functions are still active even when using the short circuit function. Press Shift and Short key to switch the short circuit status. The short circuit status does not influence existing setting values. When exiting short-circuit mode, the load will return back to the original setting status.

# Protection Functions

## Overvoltage Protection (OVP)

The load will be immediately disable the input, the buzzer will sound, and the LCD screen will pop-up an overvoltage message if overvoltage protection is triggered. The VF pin on the rear board will output a TTL high level signal if overvoltage occurs. This signal can be used to monitor the output status of

the DUT. Press Shift and Display key to clear overvoltage protection status.

## Overcurrent Protection (OCP)

The load supports two kinds of overcurrent protections: Hardware overcurrent protection and software overcurrent protection.

- Hardware overcurrent protection: The maximum load current of the electronic load is limited to the max current of the existing current range by hardware. When the hardware triggers overcurrent protection, the load will automatically disable the input and the LCD screen will pop-up an overcurrent message. The prompt box of overcurrent protection will disappear if the input drops below the set current range (I_Range).
- Software overcurrent protection: For a more precise protection limit, you can set the load software overcurrent protection value using the following steps:
  Press Shift and CP key to enter system utility interface. Then press "Limit" and "I_Protect" to set relevant parameters, such as current value and delay time. If the load sink current is greater than the protection current value, the load input will automatically be disabled and an overcurrent message will pop-up.

To exit OCP protection, press any key on the front panel of the load. .

## Overpower Protection (OPP)

The load supports two kinds of overpower protections: Hardware overpower protection and Software overpower protection.

- Hardware overpower protection: The maximum load power of the electronic load is limited within about two hundred watt. When the hardware triggers overpower protection, the load input will be disabled automatically and the LCD screen will pop-up an overpower message. The prompt box of overpower protection will disappear if the hardware overpower protection situation is relieved.
- Software overpower protection: The user can set load software overpower protection value following steps: Press Shift and CP key to enter system utility interface. Then press "Limit" and "I_Protect" to set relevant parameters, such as power value and delay time. If the sink

power of the load is greater than the protection power value, the the load input will be disabled and a pop-up overpower message will appear..

To exit OPP protection, press any key on the front panel of the load.

## Over-temperature Protection (OTP)

The load will enter OTP if the temperature of internal power devices exceeds 85℃. If an OTP fault occurs, the load input will be disabled and an OTP warning message will pop-up. When the temperature of the load decreases and is below the protection point, press any key on the front panel of the load to clear the error and exit OTP status.

## Input Reverse Polarity Protection (RPP)

When the load makes a reverse connection with the DUT, the load input will be automatically disabled immediately. At this time, the buzzer sound and the LCD screen will pop-up an RPP message.

**Tip**

If the reverse current is greater than the rated maximum current, the load may be destroyed.

**Warning**

To avoid damaging the load, when the load RRP occurs, the user should close the load and reconnect the positive and negative poles.

# Chapter 3: System Utility Function

## System

Press Shift and the CP key to enter the System utility function interface. Then press ”System” to enter the System info interface, as shown in figure 3-1 and 3-2.


Figure 3-1 System info page 1

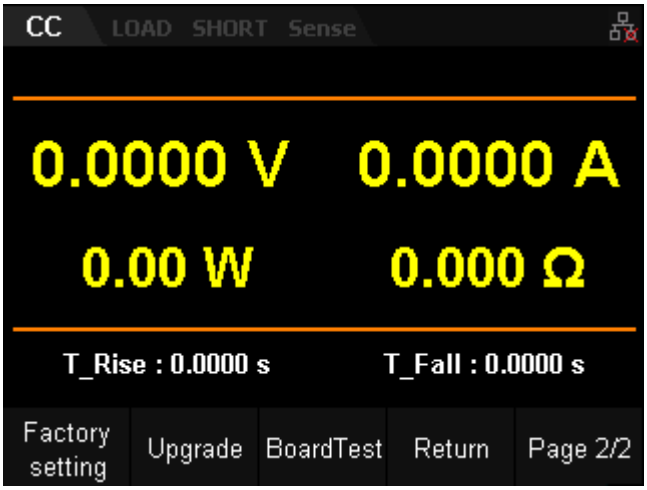



Figure 3-2 System info page 2

Table 3-1 Tab Descriptions

| No. | Name | Description |
|---|---|---|
| 1 | System info | System info tab.<br>View startup times, software version, hardware version, serial number and product ID. |
| 2 | Interface | Communication interface setting tab.<br>Configures parameters for remote communication interfaces (USB/RS232/GPIB/LAN). |
| 3 | Sound | Sound tab.<br>Enabled/disable sounds. |
| 4 | Language | Language tab.<br>English/Chinese |
| 5 | Factory | Factory tab.<br>Reset the system to the default settings. |
| 6 | Upgrade | Upgrade tab.<br>Select software version and upgrade the load. |
| 7 | BoardTest | BoardTest<br>Includes LCD test, LED test, LCD test, Keyboard test, Buzzer function test and Chip test. |

## 3.1 System info

Press Shift and CP key to enter system utility function interface. Then press the “System” key to enter system info interface, as shown in figure 3-3.

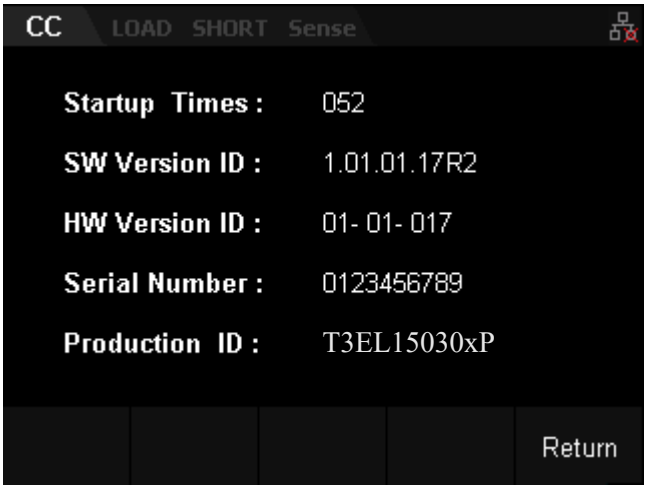



Figure 3-3 System info interface

In the “System info” interface, users can View startup times，software version, hardware version, serial number and product ID of the load.

## 3.2 Interface

Press Shift and the CP key to enter the system utility function interface. Then press the “Interface” key to enter the interface tab of the load which default selection tab is USB, as shown in figure 3-4.


Figure 3-4 USB interface

The instrument supports USB/RS232/GPIB/LAN communication interfaces. Users can use this remote interface to control the instrument using a computer. Please set the relevant parameters when selecting the communication interface.

**Note:** The USB and LAN interface of the load are “hot swappable” and can be connected and disconnected while the instrument is powered on. USB/RS-232/GPIB/LAN cannot be used at the same time. Only one interface can be used for remote control.

**View USB ID**

Use a USB cable to connect the load to a computer via the USB DEVICE interface. Then, the load can be controlled remotely.

Press Interface to enter the communication interface tab, and then press the USB key to select the "USB" tab, as shown in Figure 3-4.

**Set the parameters of the RS232 interface**

Use the 9-pin RS232 cable (female-to-female, cross-over) to connect the RS232 interface to the PC, and set the interface parameters (such as baud rate, parity, etc.) that match the PC. Then, user can remotely control the instrument. The RS232 interface is shown in the following figure. For the descriptions of the pins, refer to Table 3-2.

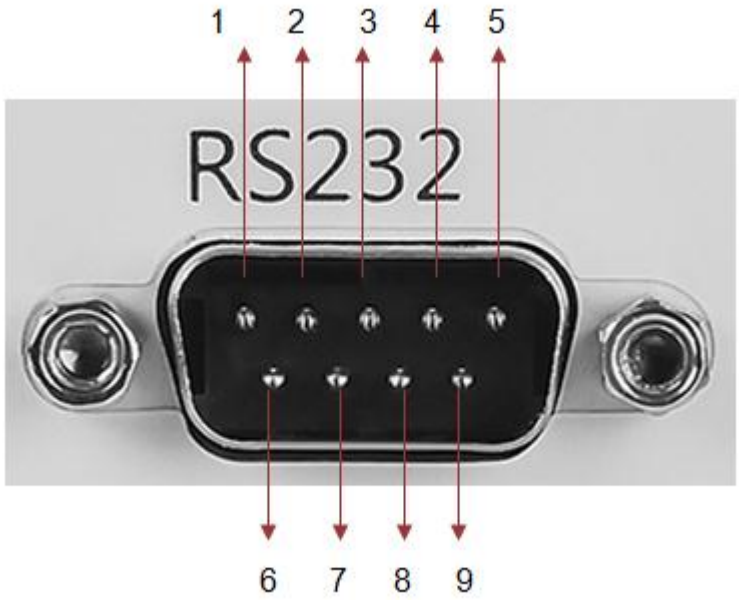
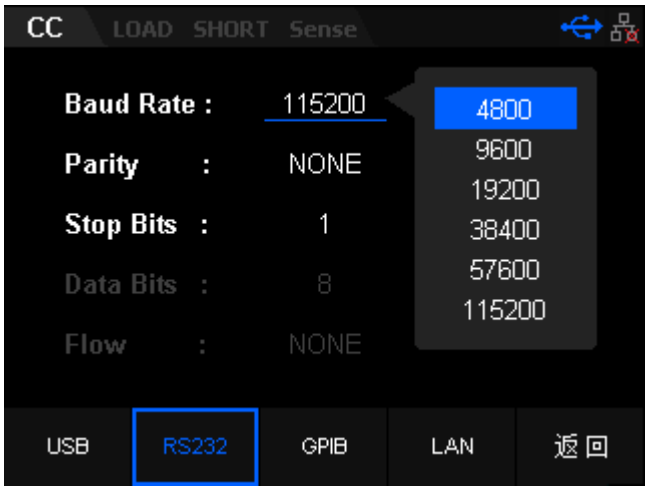



Figure 3-5 RS232 Interface

Table 3-2 Pin description of RS232.

| Pin | Name | Description |
|---|---|---|
| **1** | NC | No Conjunction |
| **2** | TXD（Transmit Data） | Data transmission |
| **3** | RXD (Receive Data) | Data receiving |
| **4** | NC | No Conjunction |
| **5** | SGND | Signal grounding |
| **6** | NC | No Conjunction |
| **7** | CTS (Clear To Send) | Clear to send |
| **8** | RTS (Request To Send) | Request to send |
| **9** | NC | No Conjunction |

Press Interface key to enter “Interface” tab and press “RS232” to enter the RS232 interface, as shown in figure 3-6.




Figue 3-6 RS232 Interface

In “RS232” interface, user can set and view relevant interface parameters about RS232.

i. **Baud Rate**
The available baud rates include 4800 9600, 19200, 38400 , 57600 , and 115200 bps.

ii. **Parity**
The available parity modes include None, Even, and Odd.

iii. **Stop Bits**
The available stop bits include 1 or 2.

iv. **Data Bits**
The default data bits is 8.

v. **Flow**
The default flow is None.

**Set GPIB Adress**
Before using the GPIB interface, use the USB-GPIB interface converter to extend the GPIB interface, and then use the GPIB cable to connect the load to the PC. Figure 3-7 shows the GPIB interface.

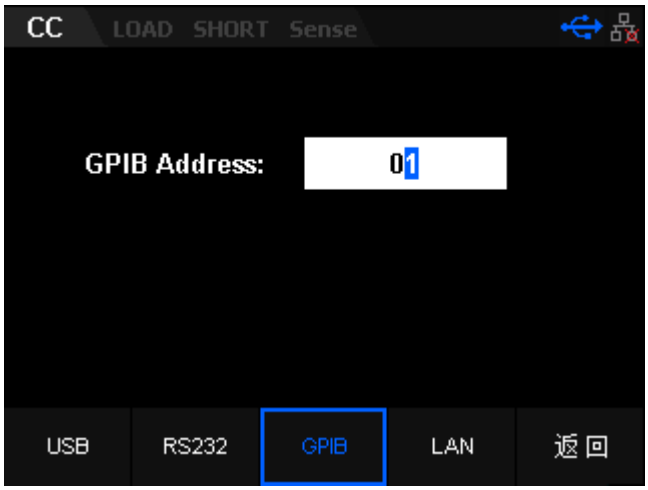



Figure 3-7 GPIB Interface

The GPIB Load address range is from 0-30. The default address of GPIB is 1 which is stored in the non-volatile memory and is not influenced by restoration of factory settings.

**Set the parameters of the LAN interface**

Before using the LAN interface, connect the load to a computer or the local area network (LAN) where the computer is visible and ensure sufficient connectivity.
Press Interface to enter the communication interface tab, and then press the “LAN” key to select the "LAN" tab to enter the network parameter setting interface, as shown in Figure 3-8.

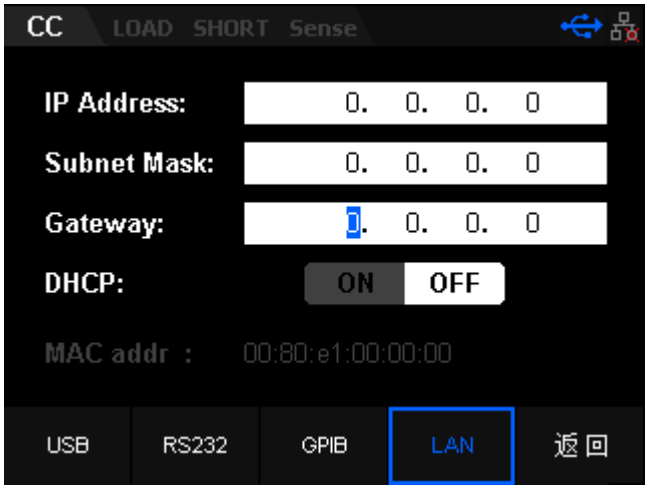



Figure 3-8 LAN Interface

In this interface, you can view the network connection status and configure the network parameters such as IP address, subnet mask, default gateway and DHCP status. The setting is stored in the non-volatile memory and is not influenced by restoring factory settings.

**Connection Status**

IP configuration include two modes:

- DHCP(Dynamic host configuration protocol)
- Manual IP(Manual configuration)

In different IP configuration modes, the configurations for IP address and other network parameters are different.

1) DHCP

Under DHCP mode, the DHCP server on the current network assigns network parameters (such as the IP address) to the instrument. When DHCP is ON, relevant parameters can not be edited; When DHCP is OFF, the IP address must be set manually.

2) Manual IP

In this mode, the user needs to set sufficient IP net parameters.

Physical address is also called media access control address (MAC address). It is also called the hardware address, which can be used to define the location of the network device. The physical address for one device is unique and is not allowed to be modified. It can be used to identify the instrument when you assign the IP address to the instrument. A physical address is a 48-bit (6-byte) addressing scheme, usually represented in Hex. For example, 00-80-e1-00-00-00.

## 3.3 Sound

Press Shift and CP key to enter system utility function interface. Then press ”Sound” to enter the Sound menu, as shown in figure 3-9.

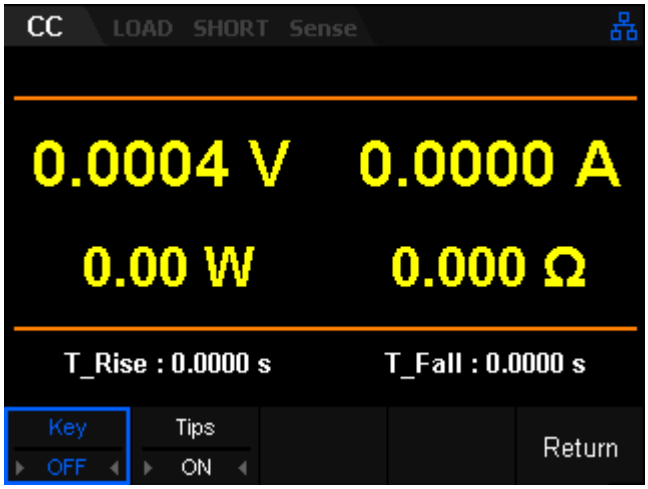



Figure 3-9 Sound tab

In the “Sound” menu, you can enable or disable the key sound and tips sound. The load buzzer will sound when you press the key on the front panel or rotate the knob after the key sound is enabled. It will not sound if sound is disabled. If the Tips sound is set to ON, the buzzer will sound when pop-up tips or warning messages. Turn off the Tips sound, and the buzzer will not sound except during any load protection tips.

## 3.4 Language

The load supports English and Chinese language man-machine interaction and tips.

## 3.5 Factory Setting

Press Shift and the CP key to enter the system utility function interface. Switch to page 2 then press ”Factory” to restore factory settings, as shown in figure 3-10.

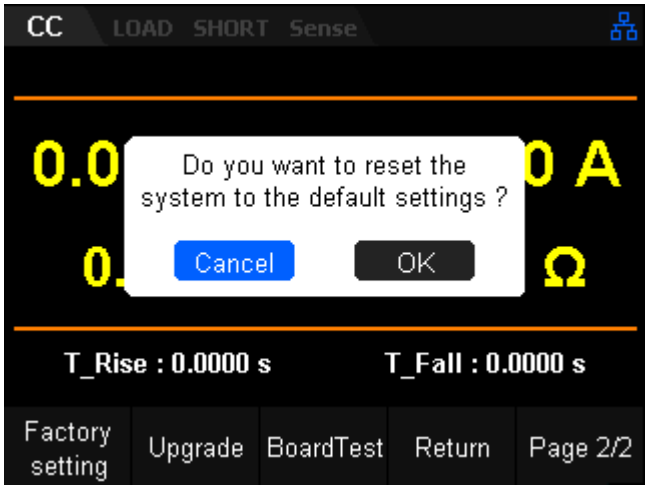



Figure 3-10 Restore factory setting interface

When user selects OK, the parameters in every function will restore to defaults.

## 3.6 Firmware Upgrade

The T3EL15030xP can be upgraded with new firmware using an external FAT32 formatted USB memory device.
To update the firmware, press Shift and CP key to enter system utility function interface. Then switch to page 2 and press the “Upgrade” key on the front panel. Finally, select the proper firmware upgrade version in the interface of the USB file list.

**NOTE:** Firmware updates can be found on the product page located on the website (www.teledynelecroy.com)

## 3.7 BoardTest

Users can check the current status of the load by using the BoardTest function. This feature tests the keypad LEDs, LCD, Keyboard, Buzzer and Chip test function.

- LED Test: Test the LED lights for the keypad backlight are operational
- LCD Test: Test the LCD screen display operation
- Keyboard Test: Test the function of all front panel keys except the power switch.
- Buzzer: Test the buzzer sound.
- Chip Test: Including the self-test result of the load, EEPROM and ADC

# Config

## Turn ON/OFF the Sense Function

When the DUT outputs large currents, the Sense terminal can be used to accurately test the voltage across the output terminals to compensate for the voltage drop on the load. Set Vrmt to ON to enable the remote sense test function.

## Turn ON/OFF SOF Function

SOF stands for Stop On Fail. When enabled, the auto test function will stop running immediately when any step fails during an auto test. If SOF is disabled, the auto test will continue to run until the test is completed, even if a failure is detected.

## Break-Over Voltage

When testing power products with slow voltage rise rates, if the electronic load input is opened before power, the power may latch protection. In this way, the user may set VON value. The electronic load only latches when the power voltage is higher than this value.

## Turn ON/OFF Von-Latch Function

The Von Latch function locks the input voltage to the Von-Latch value if the Von-Latch value is measured. The load will start testing when the the power output voltage rises and is higher than the break-over voltage. When the power voltage drops and is lower than the break-over voltage, the load will continue to latch at the Von-Latch value, as shown in figure 3-11.

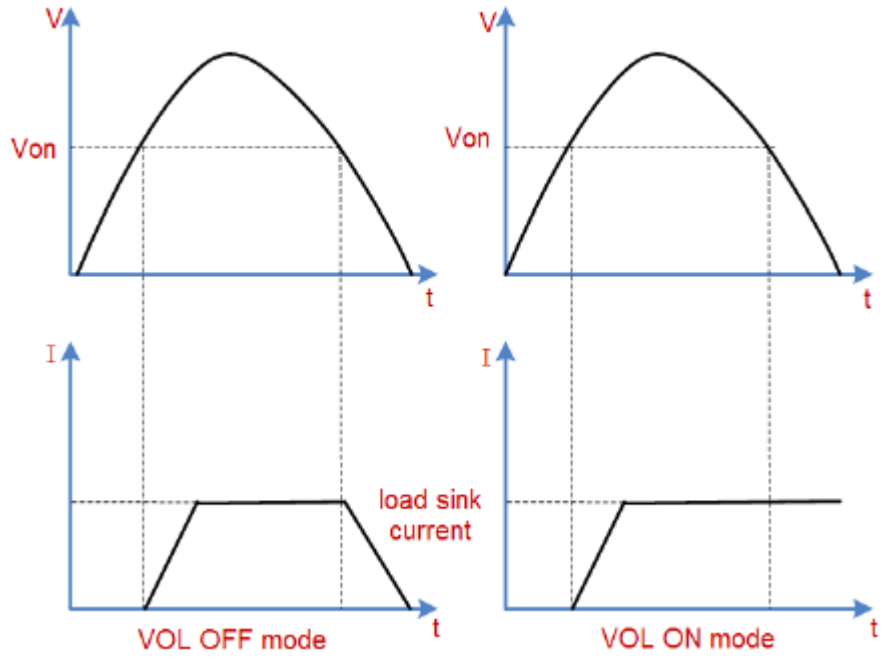



Figure 3-11 V - I characteristic curve of Von Latch

## Set Trigger

Trigger operation is mainly applied to the Dynamic, List and Program test functions. The load supports three modes: Manual, Ext and Bus.

- Manual
  When the trigger source is set to Manual mode, press the trig tab in dynamic, List or Program mode will generate a trigger signal.
- Bus
  When the trigger source is set to Bus mode, the load will execute a trigger operation when it receives the remote command (such as *TRG) from USB, LAN, RS232 and GPIB interface.

The Ext monitor terminals on the rear panel of the load can receive external trigger signals. When the trigger source is set to be Ext mode and receives a pulse (0-5V TTL) which has a falling edge, the load will trigger.

## Set Average

In “Config” tab, when user select “Aver” can set the average point number of the read-back current and voltage in the load. The range is 6-14. The greater of the average point number, the slower of the read-back current and voltage in the load.

## Set EXTC (External Interface)

The “EXTC” tab includes: (Int, ExtI, ExtV), ExtSwitch, I_M_ON, V_M_ON four tabs. It mainly supplies the way user controls the external terminals on the rear panel, current and voltage monitor, external control ON/OFF.

### Int

The load will return the mode before enter “EXTC” tab after select the “Int” tab.

### ExtI

After selecting “ExtI” tab, the load will display the ExtI interface. It includes: Type, RangeI, RangeV options. The sink current of the load can be controlled by the “EXT” terminals on the rear panel of the load. The input voltage is not suggested to be greater than 10V, otherwise it may destroy the load. Users can simulate input current of the load which ranges from zero to full current range.

Operating Steps

1. **Connect device**
   Power on the instrument and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.

**Warning**

The input voltage range of the “EXT” terminals is 0-10 V. To avoid damage to the instrument, please pay attention to the polarity of the device terminals .

2. **Set running parameters**
   Press the Shift + CP key on the front panel to enter system utility function interface. Select “Config” option and Switch to page 2, then choose “EXTC”. User can enter ExtI interface after press “INT” and choose “ExtI” tab, as shown in 3-12.

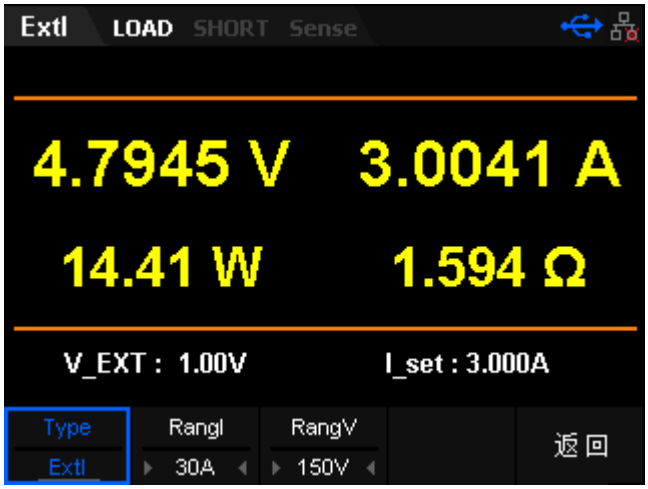
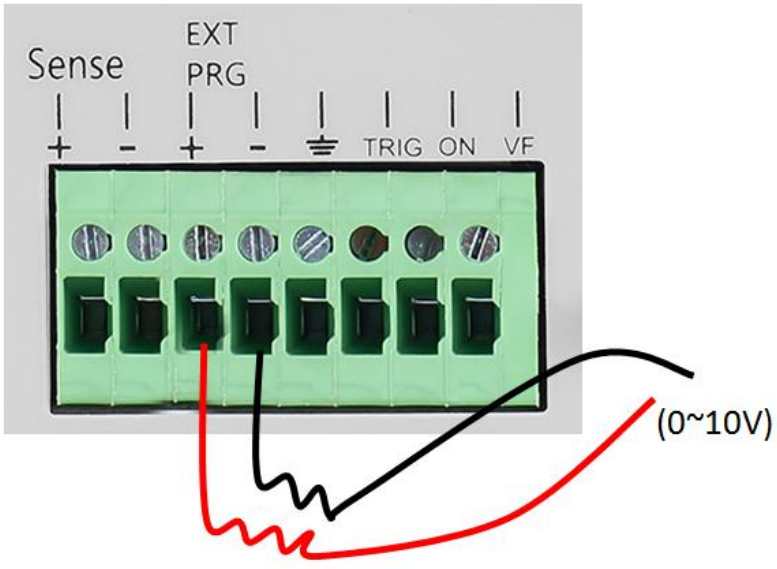



Figure 3-12 The main interface of the ExtI mode

The parameters for the ExtI mode include RangI and RangV.

**Set Range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set External Input Voltage**
The sink current in ExtI mode can be controled by the external input voltage which range is 0-10 V. The default unit of current is A




3. **Turn on the input channel**
   Press On/Off to turn on the channel input. At this time, the actual sink voltage, current, power, resistance will be displayed on the main interface.

**Note:** Once the channel input is turned on, the load will not start to sink the current until the input voltage is greater than the break-over voltage.

4. **View waveform**
   Press Display key to enter waveform display interface, as shown in figure 3-13. By means of observe waveform of ExtI mode after set the Data selection be “I”, user can see the trend of the sink current. Press the Display key again to exit the waveform display interface and return to the main interface of ExtI mode.

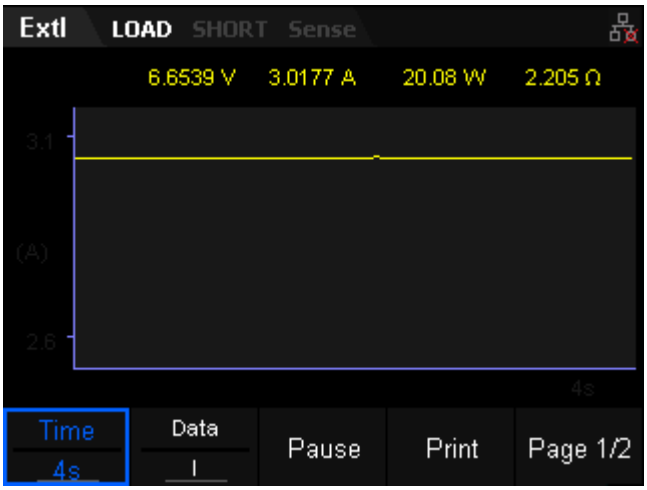



Figure 3-13 Waveform display interface of ExtI mode

## ExtV

After selecting “ExtV” tab, the load will enter ExtV interface. It includes Type, RangeI, RangeV three options. The sink voltage of the load can be controlled by the “EXT” terminals on in the rear panel of the load. User can simulate input voltage of the load which range is from zero to full range.

Operating Steps

1. **Connect device**
   Power on instruments and connect the DUT and the channel input terminals of the electronic load, as shown in Figure 2-2.

**Warning**

The input voltage range of the “EXT” terminals is 0-10 V. To avoid damage to the instrument , please pay attention to the polarity of the device terminals.

2. **Set running parameters**
   Press the Shift + CP key on the front panel to enter the system utility function interface. Select “Config” option and Switch to page 2, then choose “EXTC”. User can enter ExtI interface after press “INT” and choose “ExtV” tab, as shown in 3-14.

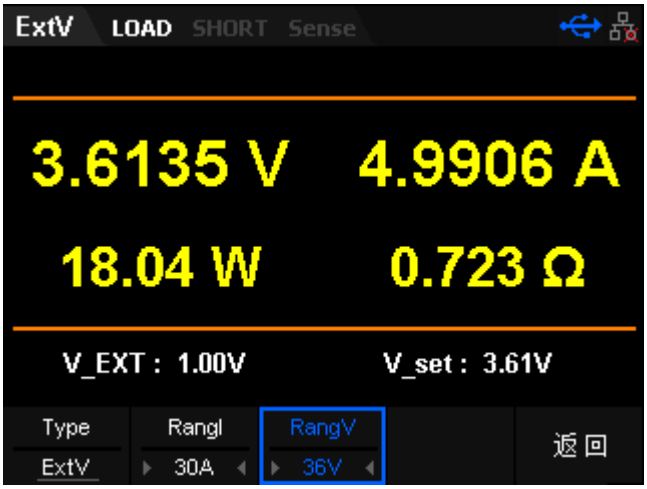
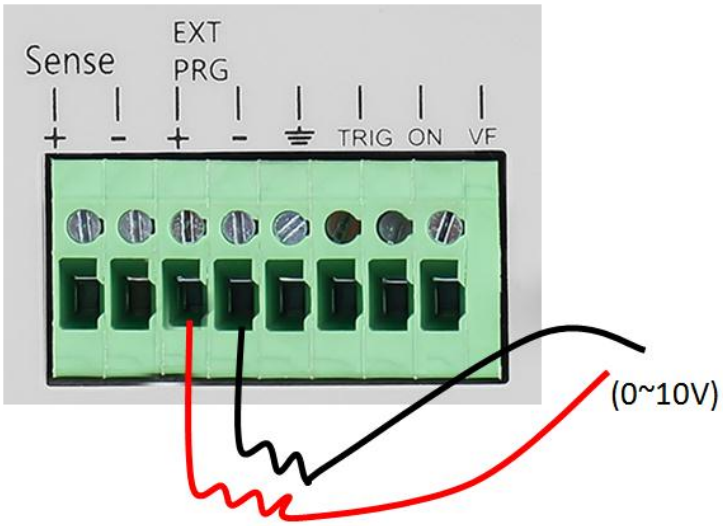



Figure 3-14 The main interface of the ExtV mode

The parameters for the ExtV mode include RangI and RangV.

**Set Range**
Current range: 5 A or 30 A
Voltage range: 36 V or 150 V

**Set External Input Voltage**
The sink voltage in ExtV mode can be controled by the external input voltage which range is 0-10 V. The default unit of voltage is V




3. **Turn on the input channel**

   Press On/Off to turn on the channel input. At this time, the actual sink voltage, current, power, resistance will be displayed on the main interface.

   **Note:** Once the channel input is turned on, the load will not start to sink the current until the input voltage is greater than the break-over voltage.

4. **View waveform**

   Press Display key to enter waveform display interface, as shown in figure 3-15. By means of observe waveform of ExtV mode after set the Data selection be “V”, user can see the trend of the sink voltage. Press the Display key again to exit the waveform display interface and return to the main interface of ExtV mode.

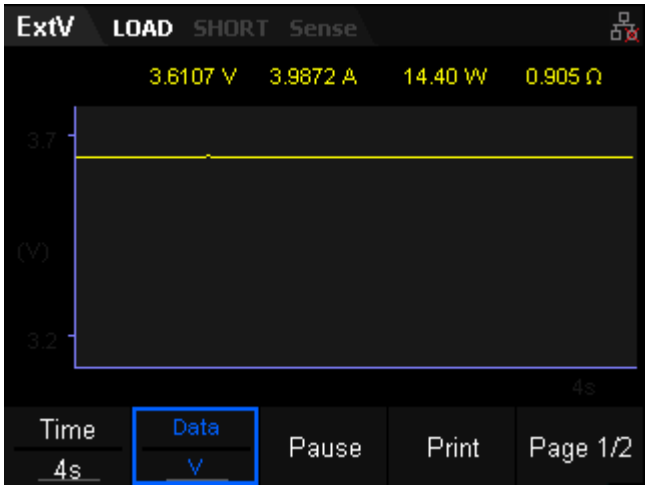



Figure 3-15 Waveform display interface of ExtV mode

### ExtSwitch

The load input switches can be controlled by the external TTL electrical level. During external input control, the [On/Off] key will become invalid and the load input switches can only be controlled by the external TTL electrical level. The load input will be switched on in case of low level external input and meet a falling edge; and the load input will be switched off in case of high level external input.

### IMON

The 0-10 V analog quantity output signal of current monitoring output terminal represents input current to which the terminal belongs from 0 to full range. The input current is proportional to the voltage on the terminal. An external voltmeter or oscilloscope can be connected to display input current change.

### VMON

The 0-10 V analog quantity output signal of voltage monitoring output terminal represents input voltage to which the terminal belongs from 0 to full range. The sink voltage is proportional to the voltage on the terminal. An external voltmeter or oscilloscope can be connected to display input current change.

## SLMT

T3EL15030xP electronic load can measure the rise and fall time of the voltage in CC, CV, CR and CP mode. This function can simply simulate the rise and fall rate of the power voltage.

Operating Steps

1. Press Shift and CP key to enter system utility function interface. Then enter “Config” tab and select “SLMT” tab to enter SLMT function.
2. Turn on the “TMon” tab, The voltage rise time “T_Rise” and falling time “T_Fall” will be displayed on LCD screen, as shown in figure 3-16.


Figure 3-16 SLTM tab

3. Input the low voltage and high voltage, then turn on the TMon
4. Connect the load to the DC power under test. Set the power output higher than the V_High. At this time, the power is OFF.
5. Set a sink current of the load in CC mode, then turn on the load input.
6. Turn on the power under test, the T_Rise is displayed quickly on the LCD screen which is the voltage rise time.
7. Turn off the power under test, the T_Fall on the LCD screen is the falling time.
8. Close all instruments and finish the test.

# Limits

## I_Protect

T3EL15030xP electronic load can have overcurrent protection set by the electronic load control software. Turn on the load input, if the sink current of the load is higher than the protection current, the load will turn off it's input automatically and pop-up an overcurrent protection message after a delay period.

Operating Steps

1. Press Shift and CP key to enter system utility function interface. Then enter "Config" tab and select "I_Protect" tab to enter I_Protect function.
2. Turn on the "TMon" tab to enable the I_Protect. Then set the protection current and delay time, as shown in Figure 3-17.


Figure 3-17 I_Protect tab

3. Connect the load to the DC power under test when the power is OFF.
4. Set a sink current in CC mode of the load.
5. Turn on the power output and the load input. Delay a period of time, the overcurrent protection of the load will occur.
6. Close all instruments and finish the test.

## P_Protect

T3EL15030xP electronic load can simulate overpower protection by the software of the load. Turn on the load input, if the sink power of the load is higher than the protection power, the load will turn off input automatically and pop-up over power protection message after a delay period.

Operating Steps

1. Press Shift and CP key to enter system utility function interface. Then enter “Config” tab and select “P_Protect” tab to enter P_Protect function.
2. Turn on the “TMon” tab to enable the P_Protect. Then set the protection power value and delay time, as shown in Figure 3-18.


Figure 3-18 P_Protect tab

3. Connect the load to the DC power under test when the power is OFF.
4. Set a sink current in CC mode of the load.
5. Turn on the power output and the load input. Delay a period of time, the overpower protection of the load will occur.
6. Close all instruments and finish the test.

# Troubleshooting

The following are some common failures and their solutions. If the problem persists after following the listed steps, please contact **Teledyne LeCroy**.

**1. The instrument cannot power up.**

(1) Check whether the power source is correctly connected.

(2) Check whether the power switch at the front panel is on.

(3) Remove the power cord and check whether the voltage selector is at the proper setting, whether the specification of the fuse is correct and whether the fuse is intact. If the fuse needs to be changed, refer to "**To Replace the Fuse**".

(4) If the problem remains, please contact **Teledyne LeCroy**.

**2. The USB device cannot be identified.**

(1) Check whether the USB device is correctly working.

(2) Check whether the USB Host interface of the electronic load is correctly working.

(3) Make certain to use a Flash U-disk. This electronic load cannot support hard drive disk devices.

(4) Make certain to use FAT32 system format.

(5) Restart the electronic load then insert the USB device.

(6) If the problem remains, please contact **Teledyne LeCroy**.

**3. The electronic load is working incorrectly.**

(1) Check whether the input connection wiring is correct.

(2) Check whether the power is turned on.

(3) Check whether the value of the conduction voltage.

(4) Check whether the load settings for power, voltage and current meet the requirements.

(5) If the problem remains, please contact **Teledyne LeCroy**.

# ABOUT TELEDYNE TEST TOOLS

## Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand expands on the Teledyne LeCroy product portfolio by adding a comprehensive range of test equipment solutions for its customers. The new range of product solutions deliver engineers with a broad range of quality test solutions that enables speed to market product validation and design. More and more designers, engineers and lecturers are relying on Teledyne Test Tools to meet their testing, education and electronics validation needs with confidence and within budget.

## Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy have sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

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