BENCHTOP INSTRUMENT

Multi-channel Programmable DC Power Supply Operation Manual V1.0

CE

Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When mobbing the product to another location, be sure to bring the manual as well.

Calibration notification

We notify that the instruments included in this manual are in compliance with the features and specifications as stated in this manual. Before shipment, the instrument has been calibrated in factory. The calibration procedures and standards are compliant to the national regulations and standards for electronic calibration.

Warranty

We guarantee that the instrument has been passed strict quality check. We warrant our instrument's mainframe and accessories in materials within the warranty period of one year. We guarantee the free replacement or repair of products which are approved defective. To get repair service, please contact with your nearest sales and service office. We do not provide any other warranty items except the one being provided by this summary and the warranty statement. The warranty items include but not being subjected to the hinted guarantee items related to tradable characteristics and any particular purpose. We will not take any responsibility in cases regarding to indirect, particular and ensuing damage, such as modifications to the circuit and functions by the users, repairing or component replacement by the users, or damage during transportation.

For product improvement, the specifications are subject to change without prior notice.

SAFEFY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating the instrument and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for the instrument.

Safety Symbols

The following safety symbols may appear in this manual or on the instrument:

	**WARNING**	Identifies conditions or practices that could result in injury or loss of life.
	**CAUTION**	Identifies conditions or practices that could result in damage to the instrument or to other properties.
	**DANGER**	High voltage
	**ATTENTION**	Refer to the manual
		Protective conductor terminal
		Earth (ground) terminal

Safety Guidelines

CAUTION	● Before plugging into local AC mains, check and make sure that the output voltage is compatible to the load. (It is suggested to disconnect a load before plugging into local AC mains. ● Do not use this instrument near water. ● Do not operate or touch this instrument with wet hands. ● Do not open the casing of the instrument when it is connected to AC mains. ● The max.output voltage of the instrument may be over 60VDC, avoid touch the metal contact part of the output terminals. ● Do not use the instrument in an atmosphere which contains sulfuric acid mist or other substances which cause corrosion to metal. ● Do not use the instrument in a dusty place or a highly humid place as such will cause instrument reliability degradation and instrument failures. ● Install the instrument in a place where is free from vibration. ● Install the instrument in a place where the ambient temperature is in range of -10~70℃. Note that the instrument operation may become unstable if it is operated in an ambient temperature exceeding the range of 0~40℃
Power supply **WARNING**	AC Input voltage: 110V/115V/120V/220V/230V/240V ±10%, 50/60Hz Connect the protective grounding conductor of the AC power cord to an earth ground to avoid electrical shock.
Fuse **WARNING**	● Fuse type: 110V/115V/120V: T6.3A /250V, or 220V/230V: T3.15A/250V. ● Make sure the correct type of fuse is installed before power up. ● Replace the AC fuse with the same type and rating as the original fuse. ● Disconnect the power cord before fuse replacement. ● Make sure the cause of fuse blowout is fixed before fuse replacement.

1. OVERVIEW

This chapter describes the instrument in a nutshell, including its main features and front /rear panel introduction. After going through the overview, follow the SETUP chapter to properly power up and set operation environment.

1.1 Operation and Storage Environment

Operation Environment

Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (note below)

Relative Humidity: < 80%

Altitude: < 2000m

Temperature: 0℃ to 40℃

(Pollution Degree) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. The instrument falls under degree 2.

Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".

Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

Pollution degree 3: Conductive pollution occurs, or dry, nonconductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage Environment

Location: Indoor

Relative Humidity: < 70%

Temperature: .10℃ to 70℃

1.2 Introduction

The TP series of regulated programmable DC power supply are light weight, adjustable, multifunctional work stations. They have three independent outputs: two with adjustable voltage level and one with fixed level selectable from 2.5V, 3.3V and 5V. The power supply can be used for logic circuits where various output voltage or current are needed, and for tracking mode definition systems where positive and negative voltages with good accuracy are required.

Independent /Tracking Series /Tracking Parallel

The three output modes of the power supply - independent, tracking series, and tracking parallel - can be selected by pressing the TRACKING key on the front panel. In the independent mode, the output voltage and current of each channel are controlled separately. The isolation degree, from output terminal to chassis or from output terminal to output terminal, is 300V. In the tracking modes, both the CH1 and CH2 outputs are automatically connected in series or parallel; no need to connect output leads. In the series mode, the output voltage is doubled; in the parallel mode, the output current is doubled.

Constant Voltage/Constant Current

Except for CH3, each output channel is completely transistorized and well-regulated, and works in constant voltage (CV) or constant current (CC) mode. Even at the maximum output current, a fully rated, continuously adjustable output voltage is provided. For a big load, the power supply can be used as a CV source; while for a small load, a CC source.

When in the CV mode (independent or tracking mode), output current (overload or short circuit) can be controlled via the front panel. When in the CC mode (independent mode only), the maximum (ceiling) output voltage can be controlled via the front panel. The power supply will automatically cross over from CV to CC operation when the output current reaches the target value. The power supply will automatically cross over from CC to CV when the output voltage reaches the target value. For more details about CV/CC mode operation, see page 5.

Automatic Tracking Mode

The front panel display (CH1, CH2) shows the output voltage or current. When operating in the tracking mode, the power supply will automatically connect to the auto- tracking mode.

Dynamic Load

When used in audio production lines, the power supply will provide a continuous or dynamic load connector. When the connectors are connected to the position "ON", a stable DC current power will be provided for audio power amplifiers.

1.3 Series Lineup/Main Features

Serial Lineup

Model	Output	Voltmeter	Ammeter	USB Interface
1mV, 1mA model	0~30VX2, 0~3AX2 Fixed 2.5V/3.3V/5A, 3A	5 digits LED	4 digits LED	√
	0~30VX2, 0~5AX2 Fixed 2.5V/3.3V/5A, 3A	5 digits LED	4 digits LED	√
100mV, 10mA model	0~30VX2, 0~3AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	√
	0~30VX2, 0~5AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	√
	0~30VX2, 0~3AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	_____
	0~30VX2, 0~5AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	_____
	0~30VX2, 0~3AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	_____
	0~30VX2, 0~5AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	_____
100mV, 10mA model With timmer control	0~30VX2, 0~3AX2 Fixed 2.5V/3.3V/5A, 3A	3 digits LED	3 digits LED	_____
	0~30VX2, 0~5AX2	3 digits LED	3 digits LED	_____

Main Features

Performance	➢ Low ripple & noise, intelligent cooling fan ➢ Compact design, light weight
Operation	➢ Constant voltage/constant current operation ➢ Tracking serial/tracking parallel operation

	➢ Output ON/OFF control ➢ Panel lock function ➢ Programmable time control, time range 1sec.~59min.59sec. (only for 3300T seies) ➢ 4 programming presets for voltage and current save/recall ➢ Coarse and fine control for voltage and current ➢ Software calibration (only for models with USB interface) ➢ Beeper output ➢ Voltage and current limit preset
Protection	➢ Over voltage, over current, over load, over temperature protections ➢ Reverse polarity protection
Interface	➢ USB interface for remote PC control (only for models with USB interface)

1.4 Front Panel Overview

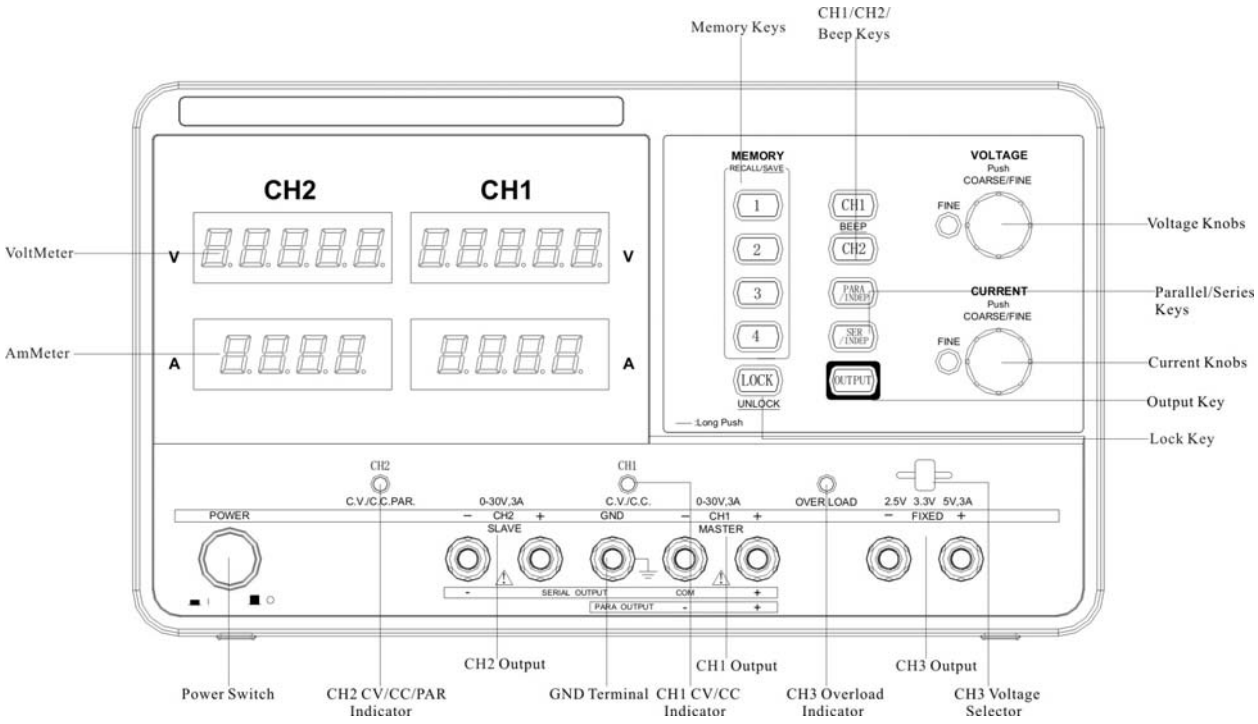


Fig.1.4-1 Front panel of 1mV, 1mA models

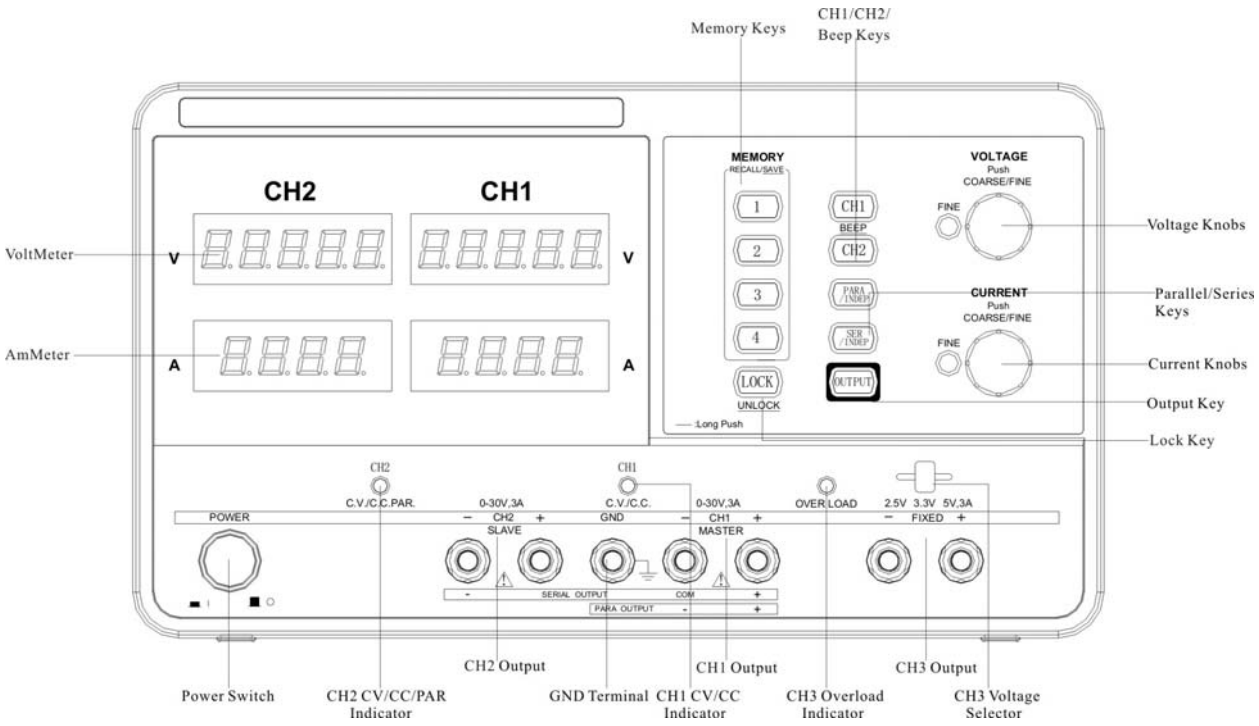


Fig.1.4-2 Front panel of 100mV, 10mA models

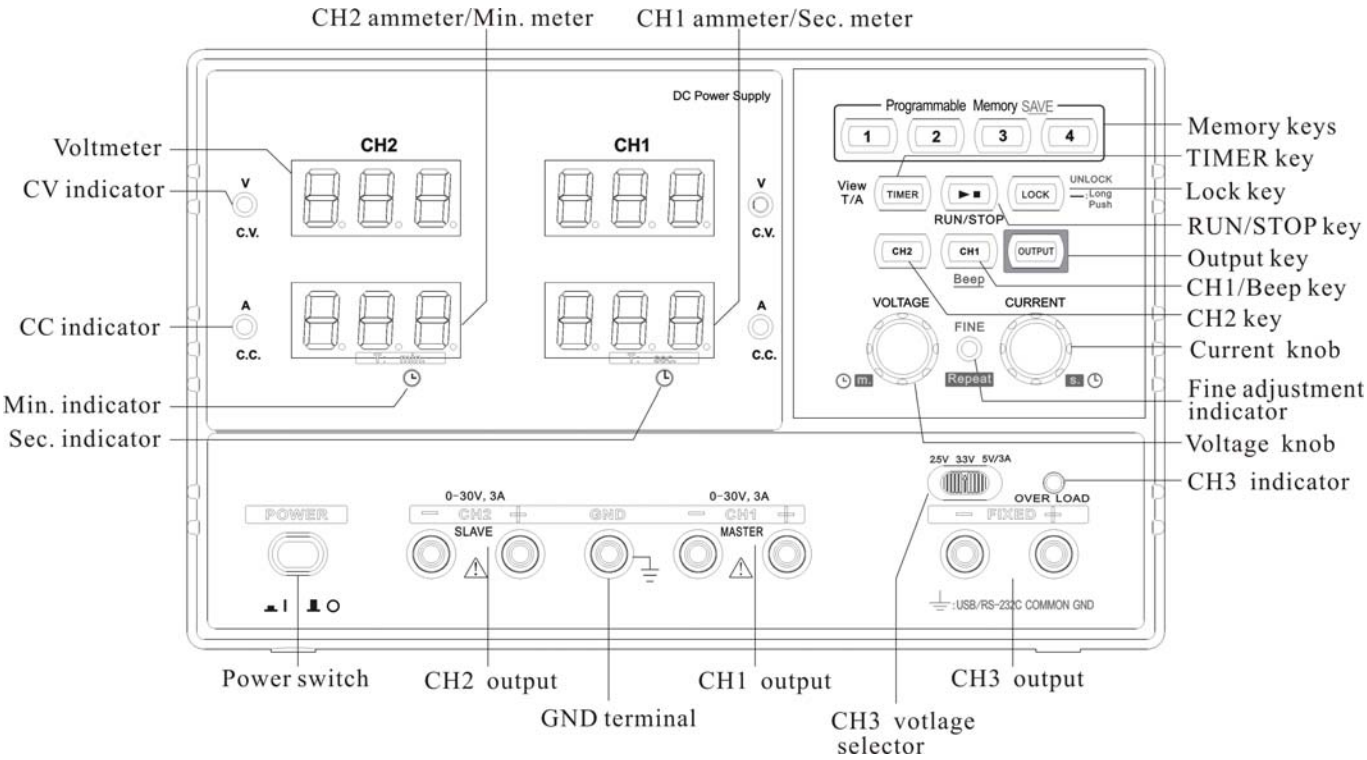
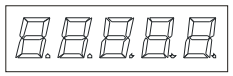
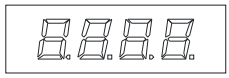
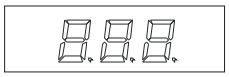
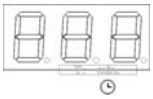
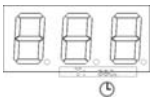
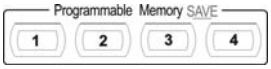
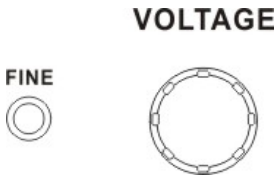
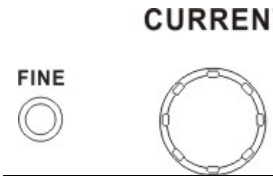
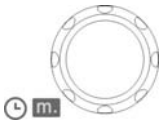
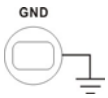


Fig.1.4-3 Front panel of 100mV, 10mA with timmer control models

Display		
Voltmeter	Displays CH1 or CH2 output voltage	
`	 V	 V
	For model 1mV, 1mA models (5 digits)	For model 100mV, 10mA models (3 digits)
Ammeter	Display CH1 or CH2 output current	
	 A	 A
	For model 1mV, 1mA models (5 digits)	For model model 100mV, 10mA models (3 digits)
Min.meter		
	For display of time in minute when the instrument is in programmable mode. (only for 100mV, 10mA models with timmer control)	
Sec.meter		
	For display of time in second when the instrument is in programmable mode. (only for 100mV, 10mA models with timmer control)	

Control Panel		
Memory keys		 Saves or recalls panel settings. Max.4 sets for programming preset. Refer to page 18 for details.
CH1/CH2 beep keys		 Selects the output channel for level adjustment. Refer to page 11 for level setting details Pressing and holding CH2 key enables beep sound. Refer to page 10 for details.
Parallel/Serial keys		Activates Tracking Parallel operation or Tracking Serial operation. Refer to page 13 for details.
Lock key		Locks or unlocks the front panel settings. Refer to page 11 for details.
Output key		Turns the output on or off.

Voltage knobs		Adjusts the output voltage level for CH1 or CH2. Pressing the knob switches for coarse and fine level setting. When in fine adjustment, the FINE indicator lights on.
Current knobs		Adjusts the output current level for CH1 or CH2. Pressing the knob switches coarse and fine level setting. When in fine adjustment, the FINE indicator lights on.
TIMER key		Sets the programmable parameter T (time) and switch display between time and current. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control)
RUN/STOP key		Starts or stops the programmable auto running mode. It also turns the programmable output on or off. Refer to page 17 for details. (only for 3300T series)
Min.knob		Adjust the programambe parameter T (time) by minute when in TIMER mode. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control)
Sec.knob		Adjust the programambe parameter T (time) by second when in TIMER mode. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control)
Terminals		
Power switch		Turns on ▂ or off ▆ the main power. Refer to page 9 for power up sequence.
GND terminal		Accepts a grounding wire.
CH1 output		Outputs CH1 voltage and current.
CH1 CV/CC indicator		Indicates CH1 constant voltage or constant current operation mode.
CH2 output		Outputs CH2 voltage and current.
CH2 CV/CC/ PAR indicator		Indicates CH2 constant voltage, constant current or tracking parallel operation mode.

CH3 output		Outputs CH3 voltage and current.
CH3 overload indicator		Indicates when CH3 output current is overloaded.
CH3 voltage selector		Selects CH3 output voltage from 2.5V, 3.3V, 5V.
FINE indicator		Indicates when there is fine adjustment operation for voltage or current.
Repeat indicator		Indicates when the power supply in repeating programmable points in programmable mode. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control)
Min.indicator		Indicates when the power supply is executing programmable points in programmable mode. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control
Sec.indicator		Indicates when the power supply is executing programmable points in programmable mode. Refer to page 17 for details. (only for 100mV, 10mA models with timmer control)

1.5 Rear Panel Overview

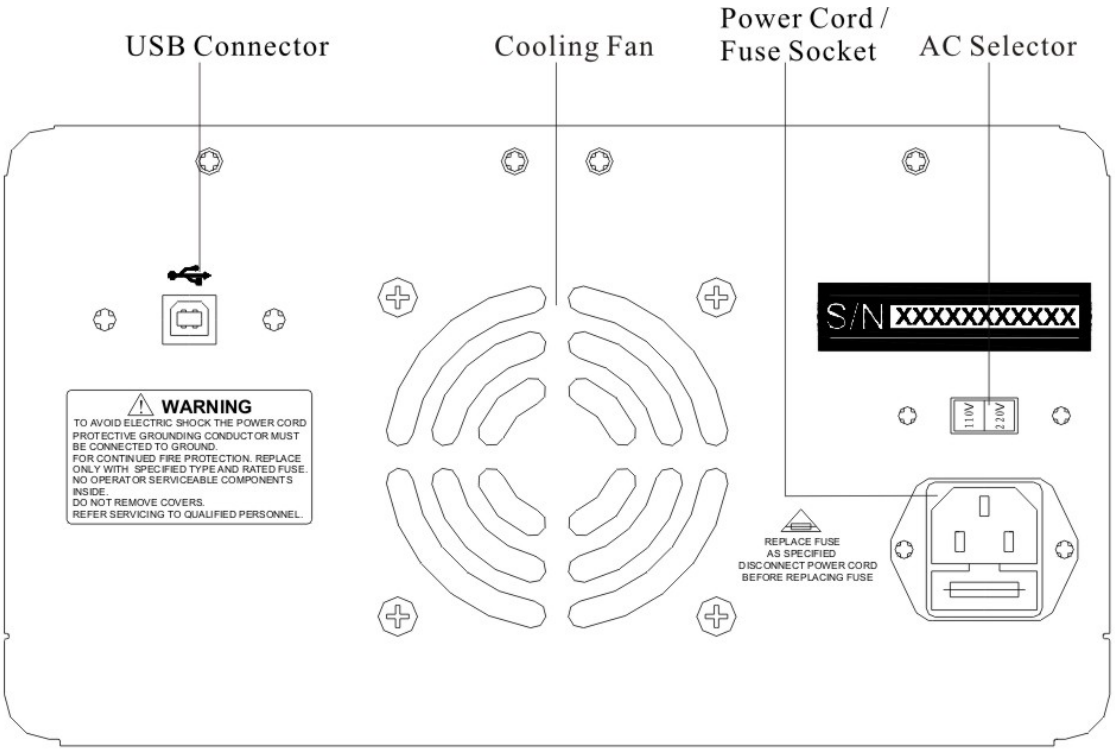


Fig.1.5-1 Rear panel of 1mV, 1mA models

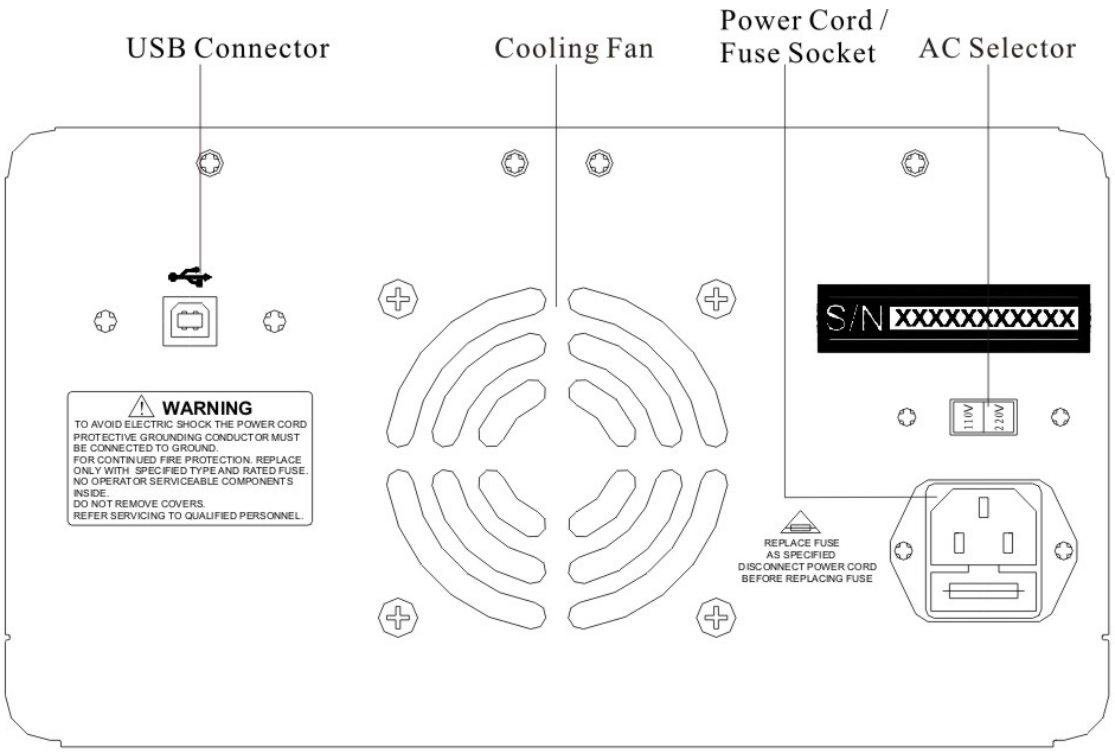


Fig.1.5-3 Rear panel of 100mV, 10mA models

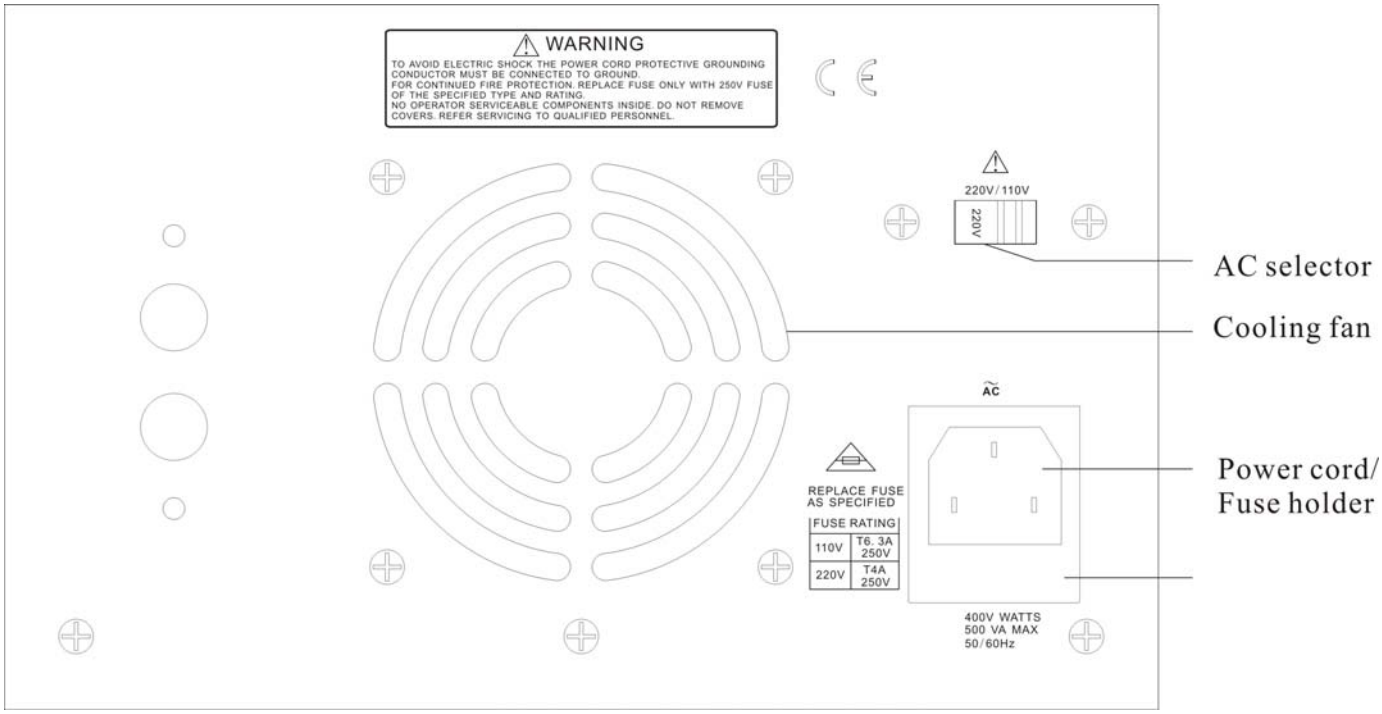
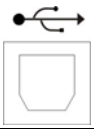
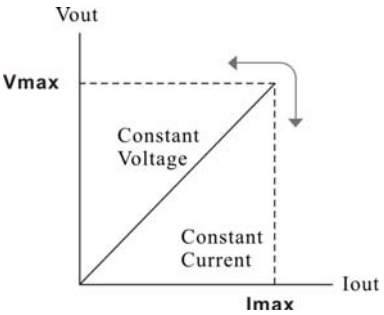


Fig.1.5-3 Rear panel of 100mV, 10mA models with timmer control

USB connector		Accepts a USB slave connector for command-based remote control (page 19). For models with USB interface
Power cord/fuse socket		The power cord socket accepts the AC mains. Refer to page 9 for power up details. The fuse holder contains the AC main fuse. Refer to page 23 for details of fuse replacement.
AC line voltage selector		Selects AC line voltage from 110V/115V/120V/220V/230V/240V

1.6 CV/CC Crossover Characteristics

Background	The instrument automatically switches between constant voltage mode (CV) and constant current mode (CC), according to load condition.
CV mode	When the current level is smaller than the output setting, the instrument operates in Constant Voltage mode. The indicator on the front panel turns green (C.V.) The Voltage level is kept at the setting and the Current level fluctuates according to the load condition until it reaches the output current setting.
CC mode	When the current level reaches the output setting, the instrument starts operating in Constant Current mode. The indicator on the front panel turns red (C.C.) The Current level is kept at the setting but the Voltage level becomes lower than the setting, in order to suppress the output power level from overload. When the current level becomes lower than the setting, the instrument goes back to the Constant Voltage mode.
Diagram	

2. SETUP

This chapter describes how to properly power up and configure the power supply series before operation.

2.1 Power Up

Select AC line voltage

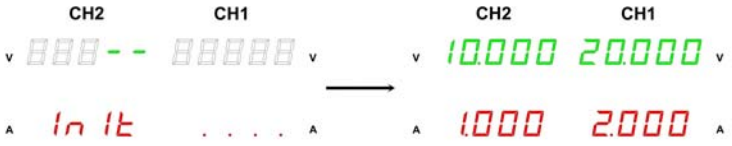
Before powering up the power supply, select the AC input voltage from the rear panel.

Connect AC power cord

Connect the AC power cord to the rear panel socket.

Power on

Press the power switch to turn on the power. The display shows the initialization screen with the model name, followed by the last recalled settings.



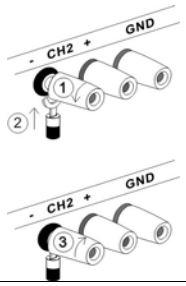
Power off

Press the power switch again to turn off the power.

2.2 Load Cable Connection

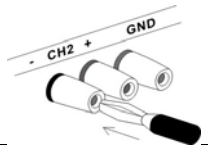
Standard accessory

1. Turn the terminal counterclockwise and loosen the screw.
2. Insert the cable terminal.
3. Turn the terminal clockwise and tighten the screw.



Banana plug

Insert the plug into the socket.



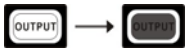
Wire type

When using load cables other than the attached, make sure they have enough current capacity for minimizing cable loss and load line impedance. Voltage drop across a wire should not excess 0.5V. The following list is the wire current rating at 450A/c ㎡.

Wire size (AWG)	Max. current (A)
20	2.5
18	4
16	6
14	10
12	16

2.3 Output ON/OFF

Panel operation

Pressing the Output key turns on all CH 1/2/3 outputs. 

The key LED also turns on. Pressing the Output key again turns off the output and the key LED.

Automatic output off

Any of the following actions during output on automatically turns it off. They might involve sudden and harmful change in the output level.

- Change the operation mode between independent / tracking series / tracking parallel
- Recalling other setups from the memory
- Storing the setup into the memory

2.4 Beep ON/OFF

Panel operation

By default, the beeper sound is enabled. To turn off the beep, press the beep key for 2 seconds. 

A beep sound comes out and the beeper setting will be turned off. To enable the beeper, press the beep key again for 2 seconds.

List of beeper

The following operations go with a beep sound when the beeper setting is on.

Power on
INDEP – SER – PAR mode switching
Setup save/recall
Voltage/current knob, fine/coarse knob
TIMER key
RUN/STOP key
Output on/off
Panel lock/unlock
CH1/CH2 output level knob
Voltage/current level reaching minimum (zero) level

2.5 Front Panel Lock

Panel operation

Press the LOCK key to lock the front panel key operation. The key LED turns on. To unlock, press the LOCK key for 2 seconds. The key LED also turns off. 

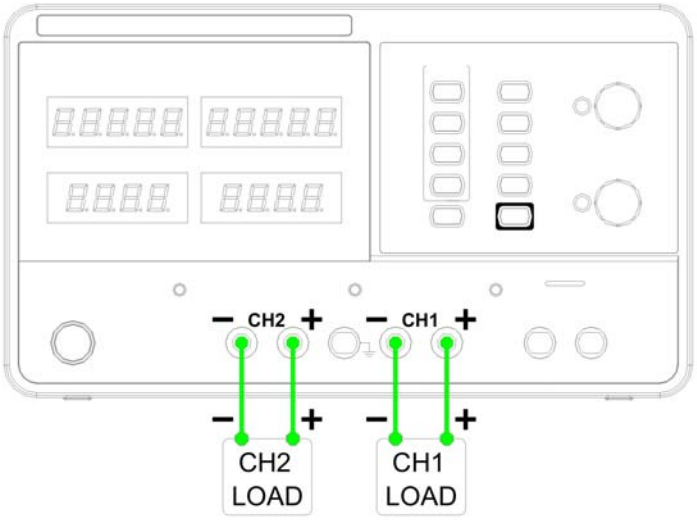
Note

The OUTPUT key is not affected by the lock operation. 

3. OPERATION

3.1 CH1/CH2 Independent Mode

Background/Connection CH1 and CH2 outputs work independent of each other and are separately controlled.



Output rating

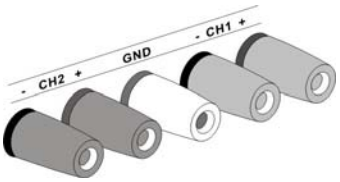
0~30V/0~3A for each channel (I≤3A)

0~30V/0~5A for each channel (I>3A)

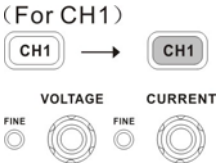
Panel operation

1. Make sure the PARA INDEP and SERIES INDEP keys are turned off (the key LEDs are off)

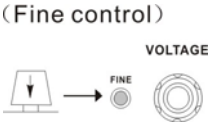
2. Connect the load to the front panel terminals, CH1 +/-, CH2 +/-.



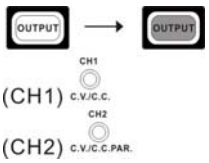
3. Set the CH1 output voltage and current. Press the CH1 switch (LED turns on) and use the Voltage and Current knob. By default, the Voltage and Current knob work in the coarse mode. To activate the fine mode, press the knob and turn on the FINE LED.



Coarse: 0.1V or 0.1A @ rotation click.
Fine: the smallest digit @ rotation click.

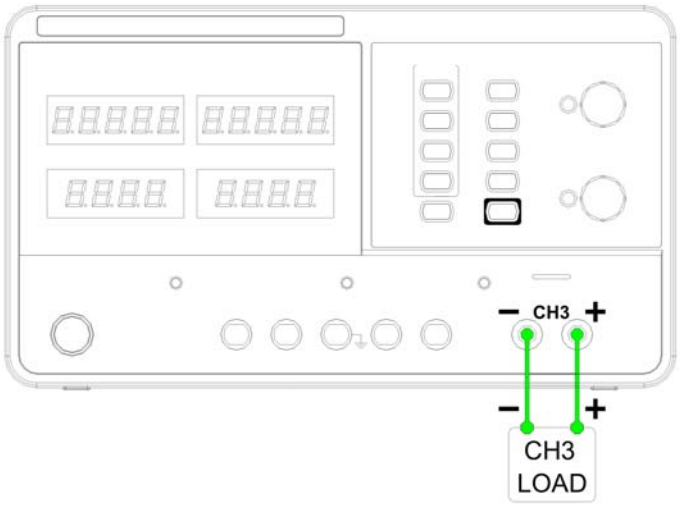


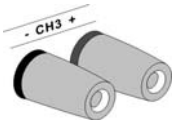
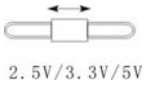
4. Repeat the above settings for CH2 channel.
5. To turn on the output, press the output key. The key LED turns on and the CH1 /CH2 indicator shows the output mode, CV or CC.



3.2 CH3 Independent Mode

Background/Connection The CH3 rating is 2.5V/3.3V/5V, maximum 3A. It works independently from CH1 and CH2, regardless of their modes.



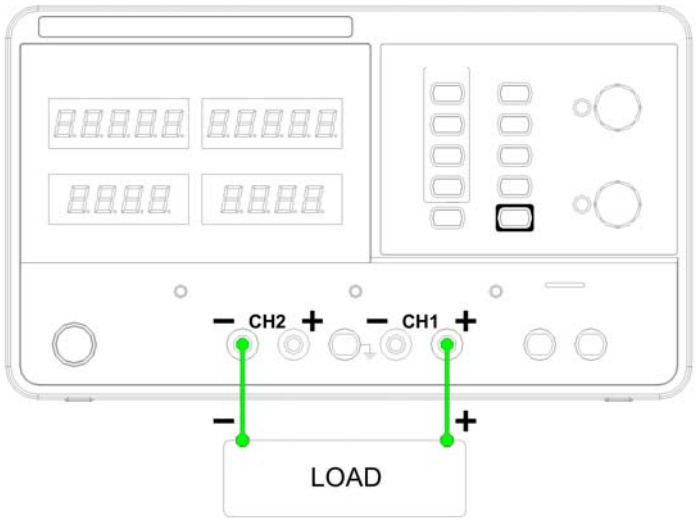
Output rating	Fixed 2.5V/3.3V/5V, 3A
No tracking Serial/Parallel mode	CH3 does not have tracking serial/parallel mode. Also, CH3 output is not affected by CH1 and 2 modes.
Panel operation	1. Connect the load to the front panel CH3 +/- terminal.  2. Select the output voltage from 2.5V, 3.3V and 5V, using the CH3 voltage selector switch.  3. To turn on the output, press the output key. The key LED turns on.
CC to CV	When the output Current level exceeds 3A, the overload indicator turns red and CH3 operation mode switches from Constant Voltage to Constant Current.  Note: “overload” in this case does not mean an abnormal operation.

3.3 CH1/CH2 Tracking Serial Mode (Not available for TP-3300T Series)

Background	Tracking series operation doubles the Voltage capacity of the power supply series by internally connecting CH1 (Master) and CH2 (Slave) in serial and combining the output to a single channel. CH1 (Master) controls the combined Voltage output level. The following describes two types of configurations depending on the common ground usage.

Tracking serial without common terminal

Connection

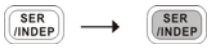


Output rating

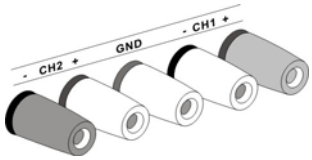
0~60V/0~3A (I≤3A)
0~60V/0~5A (I>3A)

Panel operation

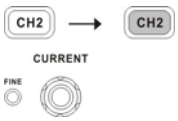
1. Press the SER/INDEP key to activate the tracking serial mode. The key LED turns on.



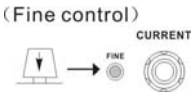
2. Connect the load to the front panel terminals, CH1+ & CH2-. (Single supply).



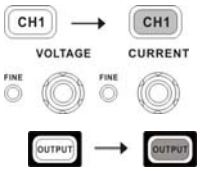
3. Press the CH2 switch (LED turns on) and use the Current knob to set the CH2 output current to the maximum level. By default, the Voltage and Current knob work in the coarse mode. To activate the fine mode, press the knob and turn on the FINE LED.



Coarse: 0.1V or 0.1A @ rotation click.
Fine: the smallest digit @ rotation click.



4. Press the CH1 switch (LED turns on) and use the Voltage and Current knob to set the output voltage and current level.



5. To turn on the output, press the output key. The key LED turns on.

6. Refer to the CH1 (Master) meter and indicator for the output setting level and CV/CC status.

Voltage level

Double the reading on the CH1 Voltage meter. In the above case, the actual output is 20.0 x

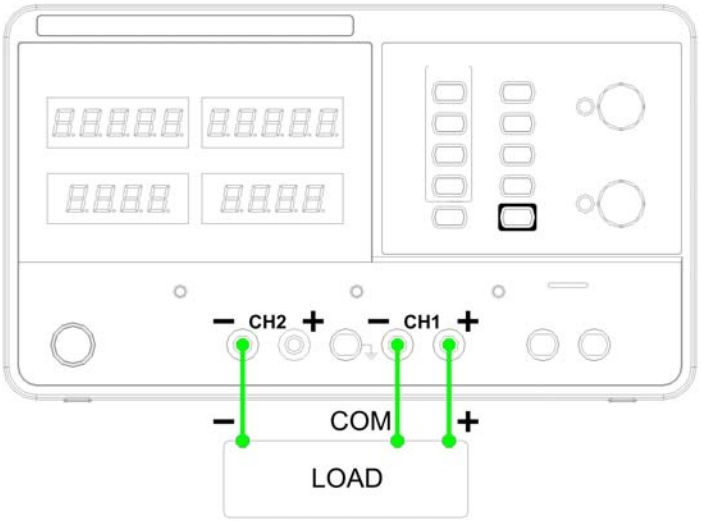
2= 40.0V.

Current level

CH1 meter reading shows the output Current. In the above case, 2.000A. (CH2 Current control must be in the Maximum position=3.0A).

Tracking serial with common terminal

Connection



Output rating

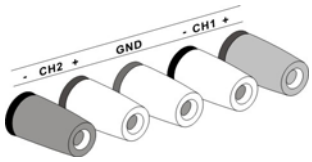
0~60V/0~3A for CH1~COM (I≤3A)

0~60V/0~5A for CH2~COM (I>3A)

Panel operation

1. Press the SER/INDEP key to activate the tracking series mode. The key LED turns on.

2. Connect the load to the front panel terminals, CH1+/- & CH2-. Use the CH1 (-) terminal as the common line connection.

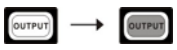


3. Press the CH1 switch (LED turns on) and use the Voltage knob to set the master & slave output voltage (the same level for both channels). By default, the Voltage and Current knob work in the coarse mode. To activate the fine mode, press the knob and turn on the FINE LED.

Coarse: 0.1V or 0.1A @ rotation click.
Fine: the smallest digit @ rotation click.

4. Use the current knob to set the master output current.

5. To turn on the output, press the output key. The key LED turns on.

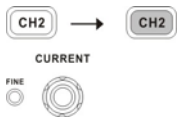


6. For the master (CH1) output level and CV/CC status, refer to the CH1 meter and indicator.

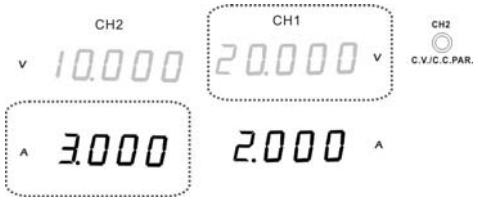
Master (CH1) voltage level: CH1 meter reading shows the output voltage. In the above case, 20.0V.

Master (CH1) current level: CH1 meter reading shows the output current. In the above case, 2.000A.

7. Press the CH2 switch (LED turns on) and use the Current knob to set the slave output current.



8. For the slave (CH2) output level and CV/CC status, refer to the CH1/2 meter and CH2 indicator.



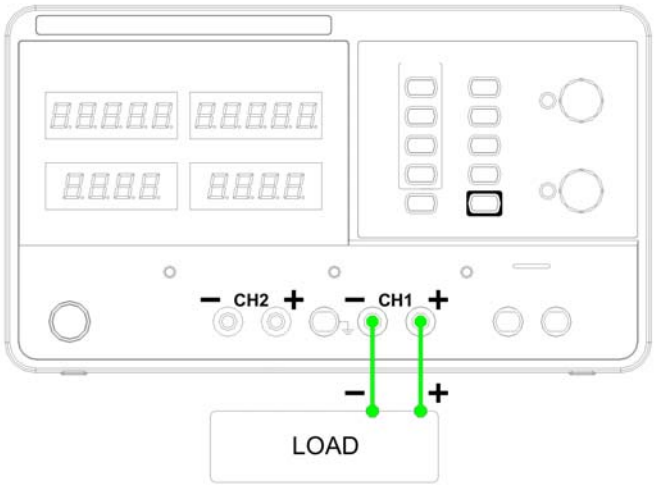
Master (CH1) voltage level: CH1 meter reading shows the output voltage. In the above case, 20.0V.

Master (CH1) current level: CH1 meter reading shows the output current. In the above case, 2.000A.

3.4 CH1/CH2 Tracking Parallel Mode (Not available with models with timmer controls)

Background/connection

Tracking parallel operation doubles the current capacity of the power supply series by internally connecting CH1 and CH2 in parallel and combining the output to a single channel. CH1 controls the combined output.



Output rating

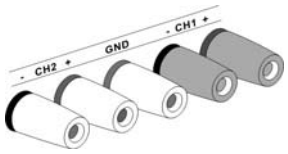
0~30V/0~6A (I≤3A)

0~30V/0~10A (I>3A)

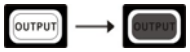
Panel operation

1. Press the PAR/INDEP key to activate the tracking parallel mode. The key LED turns on.

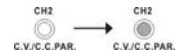
2. Connect the load to the CH1 +/- terminals.



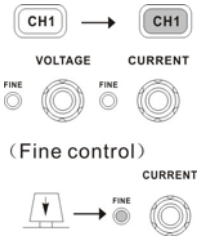
3. To turn on the output, press the output key. The key LED turns on.



4. The CH2 indicator turns red, indicating tracking parallel (PAR) mode.



5. Press the CH1 switch (LED turns on) and use the Voltage and Current knob to set the output voltage and current. The CH2 output control is disabled. By default, the Voltage and Current knob work in the coarse mode. To activate the fine mode, press the knob and turn on the FINE LED.



6. For the output level and CV/CC status, refer to the CH1 meter and indicator.

Voltage level: The CH1 meter reading shows the output voltage. In the above case, 20.0V.

Current level: Double the amount of CH1 current meter reading. In the above case, 2.0A x 2 = 4.0A.

3.5 Auto Running Mode (Only for models with timmer control)

Background

Different from manual operation mode, the TP3300T series can be set to run the preset programming sets one by one with preset running time (T).

The maximum preset running time is 59 minutes 59 seconds.

Keys related to the auto running mode are: memory keys, TIMER key, RUN/STOP key, OUTPUT key and Repeat key.

Set programming sets (CH, V, I, T)

One programming set contains parameters of channel position (CH), voltage (V), current (I), running time (T). The TP3300T series have maximum four programming sets, which can be stored into the power supplies memory groups 1, 2, 3, 4.

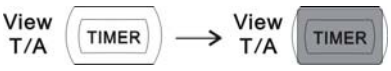
1. Select channel: in manual mode, press CH1 or CH2 key to choose channel 1 or channel 2.

2. Set voltage vaule: in manual mode, set the voltage value by rotating the voltage knob.

3. Set current value: in manual mode, set the current value by rotating the current knob.

4. Set time value: by pressing the TIMER key, it goes into running time setting mode. The TIMER key LED, the min. meter and sec. meter light on. In this mode, voltage knob is used to set time value by minute, while the current knob is used to set time value by

second. Rotate the two knobs to set targeted time values. The CH2 ammeter will be used as min.meter to display the time value by minute, while the CH2 ammeter will be used as sec.meter to display the time value by second.



Store programming sets (CH, V, I, T)

After the CH, V, I and T paramters are set, follow the instructions in page 7 to save the parameters into memory groups of the power supply.

Run/stop programming sets

1. Press RUN/STOP key to run or stop the programming sets which are stored in memory groups 1, 2, 3, 4 in a countdown way. By default, the power supply starts the auto running from memory 1. If user recall a memory group as the start set, the power supply will start the auto running from the selected memory.
2. Make repeat running: in auto running programming mode, the auto running can be set to a repeatable running. Push the voltage of current knob, the REPEAT indicator lights on. At this time, the repeatable auto running is started. The power supply will repeat the auto running (1 2 3 4 1 2 3 4…..) until it is stopped by press RUN/STOP key. In the non-repeatable auto running mode, press the LOCK key to light on the key LED. The power supply runs the programming sets from the start set to the lst set, and will not goes back to the start point. But there is still output from the power supply. Press the LOCK key again to light off the key LED. There will be no output when the power supply finishes running the last programming set.
3. DEMO: In programming mode, if press RUN/STOP key to light off the key LED, the output is turned off. There is no power ouput, but the display is till going on. In this case, the power supply is in DEMO mode. Press RUN/STOP key again to light on the key LED, the output will be restarted.

Example

1. Unrepeatable auto running (CH1 voltage at 24V, current at 2A, running time 2 minutes and 30 secons.)

   In manual mode, press CH1 key to select channel 1. Tune the VOLTAGE knob to set voltage at 24V, and tune CURRETN knob to set current at 2A. Press TIMER key, tune the VOLTGAE knob to set running time at 2 minutes, and tune the CURRENT knob to set running time at 30 seconds. Long push the memoey key 4 to store the current panel setting to memory group 4. Press OUPUT key to turn on the output, and press RUN/STOP key to start auton running. The power supply reads the memory and output for 2 minutes and 30 seconds. The auto running and output stop when running time runs out.
2. Repeatable auto running (Square pulse voltage ouput: amplitude 5V, current 1A, pulse width 3 seconds)

   Apply the same setting method of the above to set CH1 voltage at 5V, curent at 1A, running time at 3 seconds. Store the panel settings to memory 1 and 3. Set CH1 voltage at 0V, current at 1A, running time at 3seconds. Store the panel settings to memory 2 and 4. Press OUTPUT key to turn on the output, and press RUN/STOP key to start auto running. Press VOLTAGE or CURRENT knob to light on the REPEAT led. The power supply atuomtatically runs the programming sets from 1 to 4 to output a pulse voltage of 5V, 1A with pulse width 3 seconds, and then return to 1 to repeat.

4. SAVE/RECALL SETUP

4.1 Save Setup

Background

The front panel settings can be stored into one of the four internal memories.

Programming contents

The following list shows the programming setting contents:

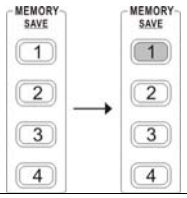
- Independent / tracking serial / tracking parallel mode
- CH1/CH2 knob selection
- Fine/coarse knob editing mode
- Beeper on/off
- Output voltage/current level
- Programmable time by minute and seceond (only for models with timmer control)

The following settings are always saved as “off”:

- Output on/off
- Front panel lock on/off

Panel operation

Press one of the 1~4 Memory keys for 2 seconds, for example number 1. The panel settings will be saved in memory No.1 by long push to this key and the key LED turns on. When the panel settings are modified, the LED turns off.



Note

When the setting is stored, the output automatically turns off.

4.2 Recall Setup

Background

The front panel settings can be recalled from one of the four internal memories.

Programming contents

The following list shows the programming setting contents:

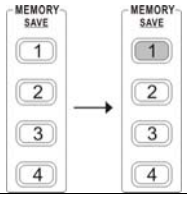
- Independent / tracking serial / tracking parallel mode
- CH1/CH2 knob selection
- Fine/coarse knob editing mode
- Beep on/off
- Output voltage/current level

The following settings are always saved as “off”:

- Output on/off
- Front panel lock on/OFF

Panel operation

Press one of the 1~4 Memory keys, for example number 1. The panel settings saved in memory No.1 will be recalled by pressing this key. The key LED turns on. When the panel settings are modified, the LED turns off.

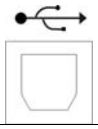


Note

When a setting is recalled, the output automatically turns off.

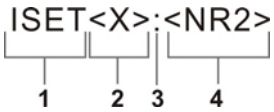
5. REMOTE CONTROL (Only for models with USB interface)

5.1 Remote Control Setup

Background	The front panel settings can be recalled from one of the four internal memories.
Interface	 USB slave port, rear panel
COM setting	Set up the COM port inside the PC according to the following list: Baud rate: 9600 Parity bit: None Data bit: 8 Stop bit: 1 Data flow control: None
Functionality check	Run this query command via the terminal application such as MTTTY (Multi-threaded TTY). *idn? This should return the identification information: Manufacturer, model name, serial number.

5.2 Command Syntax

Command format



1: command header
2: output channel
3: separator
4: parameter

Output channel

Type	Description	Example
<Boolean>	Boolean logi	0 (off), 1 (on)
<NR1>	Integers	0, 1, 2, 3
<NR2>	Decimal numbers	0.1, 3.14, 8.5

Output channel: 1 (CH1) or 2 (CH2)

Note: Commands must be capital letters

5.3 Error Messages

The following error messages might appear when the instrument cannot accept the command.

Message contents	Descriptions
a Program mnemonic too long	The command length must be 12 characters or less.
b Invalid character	Invalid characters, such as symbols, are entered. Example: VOUT#
c Too many digits	The command exceeded the maximum number of decimals: 3 digits.
d Missing parameter	The parameter is missing from the command. Example: VSET: (should have a number)

e	Data out of range	The entered value exceeds the specification. Example: VSET:33 (should be . 32V)
f	Command not allowed	The entered command is not allowed in the circumstance. Example: trying to set CH2 output while in the tracking mode.
g	Undefined header	The entered command does not exist, or the syntax is wrong.

5.4 Command List

Detailed descriptions of each command starts from the next page.

The “HELP” command shows all the following commands and their meanings, except for the HELP command itself.

Command	Meanings
ISET<X>:<NR2>	Sets the output current
ISET<X>	Retunes the output current setting
VSET<X>:<NR2>	Sets the output voltage
VSET	Returns the output voltage setting
IOUT<X>	Returns the actual output current
VOUT<X>	Returns the actual output voltage
TRACK<NR1>	Selects the operation mode
BEEP<BOOLEAN>	Turn on of off the output
LOCK<BOOLEAN>	Turn on or off the front panel lock
OUT<BOOLEAN>	Turn on or off the output
SATATUS	Returns the MODEL status
IDN	Returns the MODEL identification
RCL<NR1>	Recalls a panel setting
SAVE<NR1>	Saves the panel setting
HELP	Shows the command list

5.5 Command Details

Command	ISET<X>:<NR2>
Description	Sets the output current.
Panel operation	Refer to page 11
Response time	Min.70ms
Example	ISET1:2.234 Sets the CH1 output current to 2.234A,

Command	ISET<X>
Description	Returns the output current setting
Response time	Min.70ms
Example	ISET1 Returns CH1 output current setting.

Command	VSET<X>:<NR2>
Description	Sets the output voltage.
Panel operation	Refer to page 11
Response time	Min.70ms
Example	VSET1:20.345 Sets the CH1 voltage to 20.345V.

Command	VSET<X>
Description	Returns the output voltage setting.
Response time	Min.80ms
Example	VSET1 Returns the CH1 voltage setting.

Command	IOUT<X>
Description	Returns the actual output current.
Response time	Min.80ms
Example	IOUT1 Returns the CH1 output current.

Command	VOUT<X>
Description	Returns the actual output voltage.
Response time	Min.70ms
Example	VOUT1 Returns the CH1 output voltage.

Command	TRACK<NR1>
Description	Selects the operation mode: INDEP, tracking SER, tracking PAR
Panel operation	Refer to page 11
NR1	0: Independent 1: Tracking serial 2: Tracking parallel
Response time	Min.70ms
Example	TRACK0 Selects the independent mode.

Command	BEEP<Boolean>
Description	Turns on or off the beeper.
Panel operation	Refer to page 10
Response time	Min.70ms
Example	BEEP1 Turns on the beeper/

Command	OUT<Boolean>
Description	Turns on or off the output.
Panel operation	Refer to page 5
Response time	Min.70ms
Example	OUT1 Turns on the output.

Command	LOCK<Boolean>
Description	Turns on or off the front panel lock
Panel operation	Refer to page 11
Response time	Min.70ms
Example	LOCK1 Locks the front panel.

Command	STATUS
Description	Returns the MODEL status.
Response time	Min.400ms
Contents	8 bits in the following format. (Refer to table on the right.)

Bit	Item	Description
0	CH1	0=CC mode, 1=CV mode
1	CH2	0=CC mode, 1=CV mode
2, 3	Tracking	00=Independent, 01=Tracking serial，11=Tracking parallel
4	Beep	0=Off, 1=On
5	Lock	0=Lock, 1=Unlock
6	Output	0=Off, 1=On
7	N/A	N/A

Command	RCL<NR1>
Description	Recalls a panel setting.
Panel operation	Refer to page 18
NR1	1~4: Memory number 1 to 4
Reponses time	Min.70ms
Example	RCL1 Recalls the panel setting stored in memory NO. 1.

Command	IDN
Description	Returns the MODEL identification
Reponses time	Min.300ms
Contents	Manufacturer, model name, serial number

Command	SAV<NR1>
Description	Saves the panel setting.
Panel operation	Refer to page 18
NR1	1~4: Memory number 1 to 4
Reponses time	Min.70ms
Example	SAV1 Stores the panel setting into memory NO. 1.

Command	HELP
Description	Shows the command list.
Reponses time	Min.1000ms
Contents	Refer to the following tale.

Contents for Command HELP	
ISET<x>:<NR2>	Sets the value of current.
VSET<x>:<NR2>	Sets the value of voltage. X: 1=CH1, 2=CH2.
ISET<x>	Return the value of current.
VSET<x>	Return the value of voltage.
IOUT<x>	Returns actual output current.
VOUT<x>	Returns actual output voltage.
TRACK<NR1>	Sets the output of the power supply working on independent or tracking mode. NR1: 0=INDE, 1=SER, 2=PARA.
BEEP<Boolean>	Sets the BEEP state on or off.
LOCK<Boolean>	Sets the entry-key lock state on or off.
OUT<Boolean>	Sets the output state on or off
STATUS	Returns the power supply state.
bit0:(CH1)0=CC,1=CV	
bit1:(CH2)0=CC,1=CV	
bit23:(TRACK)10=DEP, 11=SER,01=PAR	
bit4:(BEEP)0=OFF,1=ON	
bit5:(LOCK)0=LOCK,1=UNLOCK	
bit6:(OUT)0=OFF,1=ON	
IDN	Returns instrument identification.
RCL<NR0>	Recall the setting data from the memory which previous saved.
SAV<NR0>	Saves the setting data to memory.

NR0: 1=Memory1, 2=Memory2, 3=Memory3, 4=Memory4;

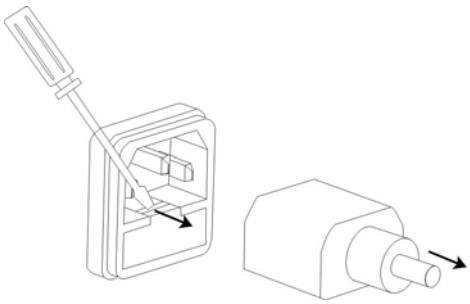
6. MAITENANCE

6.1 Inspection

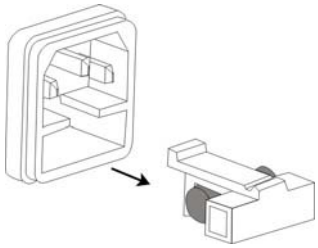
- Inspect the instrument at regular intervals so that it maintains its initial performance for a long time.
- Check the input power cord for damage of the vinyl cover and overheating of the plug and cord stopper. Check the terminal screws and binding posts for loosening.
- Remove dust from the inside of the casing and ventilation holes of the cover by using a compressed air of the exhaust air of a vacuum cleaner.

6.2 Fuse Replacement

Steps 1. Take off the power cord and remove the fuse socket using a minus driver.



2. Replace the fuse in the holder.



Fuse rating 110V//115V/120V: T6.3A/250V
220V/230V/240V: T3.15A/250V

6.3 Cleaning

- Before cleaning, disconnect the AC mains.
- To clean the power supply, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.
- Do not use chemicals containing benzene, benzene, toluene, xylene, acetone, or similar solvents.
- Do not use abrasive cleaners on any portion of the instrument.

7. FAQ

Q1: I pressed the panel lock key but the output still turns on/off.

A1: The output key is not affected by the panel lock key operation, for ensuring safety.

Q2: The CH3 overload indicator turned on - is this an error?

A2: No, it simply means that the CH3 output current reached the maximum 3.0A and the operation mode turned from CV (constant voltage) to CC (constant current). You can continue using the power supply, although reducing the output load is recommended.

Q3: The specifications do not match the real accuracies.

A3: Make sure that the instrument is powered on for at least 30 minutes, within ambient temperature of +20℃~+30℃

Q4: The internal memory is not recording the panel setting correctly - the output should be on.

A4: The output is always stored or recalled as "off" to ensure safety.

SPECIFICATIONS for 1mV, 1mA models

Output ratings

CH1/CH2 independent: 0~30V, 0~3A (I≤3A) / 0~30V, 0~5A (I>3A)

CH1/CH2 serial: 0~60V, 0~3A (I≤3A) / 0~60V, 0~5A (I>3A)

CH1/CH2 parallel: 0~30V, 0~6A (I≤3A) / 0~30V, 0~10A (I>3A)

CH3: 2.5V/3.3V/5V, 3A

Constant voltage operation

Line regulation: ≤0.01%+3mV

Load regulation: ≤0.01%+3mV (I≤3A) / ≤0.02%+5mV (I>3A)

Recovery time: ≤100us (50% load change, minimum load 0.5A)

Ripple & Noise: ≤1mV rms (I≤3A) / ≤2mV rms (I>3A)

Temp.co-efficient: ≤300PPm/℃

Constant current operation

Line regulation: ≤0.2%+3mA

Load regulation: ≤0.2%+3mA (I≤3A) / ≤0.2%+5mA (I>3A)

Ripple & Noise: ≤3mA rms (I≤3A) / ≤6mA rms (I>3A)

Tracking parallel operation

Line regulation: ≤0.01%+3mV

Load regulation: ≤0.01%+5mV (I≤3A) / ≤0.02%+10mV (I>3A)

Tracking error: ≤0.05%+10mV

Tracking serial operation

Line regulation: ≤0.01%+5mV

Load regulation: ≤300mV

Positive and Negative Supply: Slave tracking error: ≤0.5%+10mV of the master (No load. With load, add load regulation≤300mV)

CH3 output

Line regulation: ≤25mV

Load regulation: ≤25mV

Ripple & Noise: ≤2mV rms

Output voltage: 2.5V, 3.3V, 5V (selectable), ±8%

Output current: 3A

Display

Ammeter: 3.200A full scale, 4 digits 0.4" LED display

Voltmeter: 32.000V full scale, 5 digits 0.4" LED display

Voltmeter resolution: 1mV

Ammeter resolution: 1mA

Programming accuracy: ±(0.03% of reading + 10mV), ±(0.3% of reading + 10mA (I≤3A)

±(0.03% of reading + 10mV), ±(0.3% of rdg + 10mA (I>3A)

Readback accuracy: ±(0.03% of reading + 10mV), ±(0.3% of reading + 10mA) (I≤3A)

±(0.03% of reading + 10mV), ±(0.3% of rdg + 10mA) (I>3A)

Protection: Over voltage, over current, over load, over temperature, current limit, short circuit and reverser polarity protections.

Insulation: Between base and output terminal≥20MΩ/500VDC

Between base and power cord≥30MΩ/500VDC

Operation environment: Indoor use

Altitude:≤2000m

Ambient temperature: 0~40℃

Relative humidity: ≤80%

Installation category: II

Pollution degree: 2

Storage environment: Ambient temperature: -10~70℃

Relative humidity: ≤70%

Power source: AC 110V/220V±10%,50/60Hz

Accessorories: User manual ×1, power cord×1, USB interface software CD

Dimensions: 310(D)*250(W)*150(H)mm

Weight: 7.5kg (I≤3A)

10kg (I>3A)

SPECIFICATIONS for 100mV, 10mA models

Output ratings

CH1/CH2 independent: 0~30V, 0~3A (I≤3A) / 0~30V, 0~5A (I>3A)

CH1/CH2 serial: 0~60V, 0~3A (I≤3A) / 0~60V, 0~5A (I>3A)

CH1/CH2 parallel: 0~30V, 0~6A (I≤3A) / 0~30V, 0~10A (I>3A)

CH3: 2.5V/3.3V/5V, 3A

Constant voltage operation

Line regulation: ≤0.01%+3mV

Load regulation: ≤0.01%+3mV (I≤3A) / ≤0.02%+5mV (I>3A)
Recovery time: ≤100us (50% load change, minimum load 0.5A)
Ripple & Noise: ≤1mV rms (I≤3A) / ≤2mV rms (I>3A)
Temp.co-efficient: ≤300PPm/℃

Constant current operation
Line regulation: ≤0.2%+3mA
Load regulation: ≤0.2%+3mA (I≤3A) / ≤0.2%+5mA (I>3A)
Ripple & Noise: ≤3mA rms (I≤3A) /
≤6mA rms (I>3A)

Tracking parallel operation
Line regulation: ≤0.01%+3mV
Load regulation: ≤0.01%+5mV (I≤3A) / ≤0.02%+10mV (I>3A)
Tracking error: ≤0.05%+50mV of Master (no load)
≤0.05%+100mV of Master (no load)

Tracking serial operation
Line regulation: ≤0.01%+5mV
Load regulation: ≤300mV
Positive and Negative Supply: Slave tracking error: ≤0.5%+10mV of the master (No load. With load, add load regulation≤300mV)

CH3 output
Line regulation: ≤25mV
Load regulation: ≤25mV
Ripple & Noise: ≤2mV rms
Output voltage: 2.5V, 3.3V, 5V (selectable), ±8%
Output current: 3A

Display
Ammeter: 3.20A full scale, 3 digits 0.5" LED display
Voltmeter: 32.0V full scale, 3 digits 0.5" LED display
Voltmeter resolution: 10mV (0~9.99V) , 100mV (10~30V)
100mV
Ammeter resolution: 10mA
Programming accuracy: ±(0.2% of reading + 3digits) (0~9.99V), ±(0.5% of reading + 2digits) (10~30V), ±(0.5% of reading + 2digits) (I≤3A)
±(0.2% of reading + 3digits) (0~9.99V), ±(0.5% of reading + 2digits) (10~30V), ±(0.5% of reading + 5digits) (I>3A)
±(0.5% of reading + 2digits), ±(0.5% of reading + 2digits) (I≤3A)
±(0.5% of reading + 2digits , ±(0.5% of reading + 5digits) (I>3A)

Readback accuracy: ±(0.2% of reading + 3digits) (0~9.99V), ±(0.5% of reading + 2digits) (10~30V), ±(0.5% of reading + 2digits) (I≤3A)
±(0.2% of reading + 3digits) (0~9.99V), ±(0.5% of reading + 2digits) (10~30V), ±(0.5% of

reading + 5digits) (I>3A)
±(0.5% of reading + 2digits), ±(0.5% of reading + 2digits) (I≤3A)
±(0.5% of reading + 2digits , ±(0.5% of reading + 5digits) (I>3A)

Protection: Over voltage, over current, over load, over temperature, current limit, short circuit and reverser polarity protections.

Insulation: Between base and output terminal≥20MΩ/500VDC
Between base and power cord≥30MΩ/500VDC

Operation environment: Indoor use
Altitude:≤2000m
Ambient temperature: 0~40℃
Relative humidity: ≤80%
Installation category: II
Pollution degree: 2

Storage environment: Ambient temperature: -10~70℃
Relative humidity: ≤70%

Power source: AC 110V/220V±10%,50/60Hz

Accessorories: User manual ×1, power cord×1, USB interface software CD (only for models with USB interface)

Dimensions: 310(D)*250(W)*150(H)mm

Weight: 7.5kg ((I≤3A))
10kg (I>3A)

SPECIFICATIONS for 100mV, 10mA models with timmer control

Output ratings

CH1/CH2 independent: 0~30V, 0~3A (I≤3A) / 0~30V, 0~5A (I>3A)

CH3: 2.5V/3.3V/5V, 3A

Constant voltage operation

Line regulation: ≤0.01%+3mV

Load regulation: ≤0.01%+3mV (I≤3A) / ≤0.02%+5mV (I>3A)

Recovery time: ≤100us (50% load change, minimum load 0.5A)

Ripple & Noise: ≤1mV rms (I≤3A) / ≤2mV rms (I>3A)

Temp.co-efficient: ≤300PPm/℃

Constant current operation

Line regulation: ≤0.2%+3mA

Load regulation: ≤0.2%+3mA (I≤3A)
≤0.2%+5mA (I>3A)

Ripple & Noise: ≤3mA rms (I≤3A)
≤6mA rms (I>3A)

CH3 output

Line regulation: ≤25mV

Load regulation: ≤25mV

Ripple & Noise: ≤2mV rms

Output voltage: 2.5V, 3.3V, 5V (selectable), ±8%
Output current: 3A

Display
Ammeter: 3.20A full scale, 3 digits 0.5" LED display
Voltmeter: 32.0V full scale, 3 digits 0.5" LED display
Voltmeter resolution: 100mV
Ammeter resolution: 10mA
Programming accuracy: ±(0.5% of reading + 2digits), ±(0.5% of reading + 2digits) (I≤3A)
±(0.5% of reading + 2digits , ±(0.5% of reading + 5digits) (I>3A)

Readback accuracy: ±(0.5% of reading + 2digits), ±(0.5% of reading + 2digits) (I≤3A)
±(0.5% of reading + 2digits , ±(0.5% of reading + 5digits) (I>3A)

Protection: Over voltage, over current, over load, over temperature, current limit, short circuit and reverser polarity protections.
Insulation: Between base and output terminal≥20MΩ/500VDC
Between base and power cord≥30MΩ/500VDC
Operation environment: Indoor use
Altitude:≤2000m
Ambient temperature: 0~40℃
Relative humidity: ≤80%
Installation category: II
Pollution degree: 2
Storage environment: Ambient temperature: -10~70℃
Relative humidity: ≤70%
Power source: AC 110V/220V±10%,50/60Hz
Accessorories: User manual ×1, power cord×1
Dimensions: 310(D)*250(W)*150(H)mm
Weight: 7.5kg (I≤3A)
10kg (I>3A)