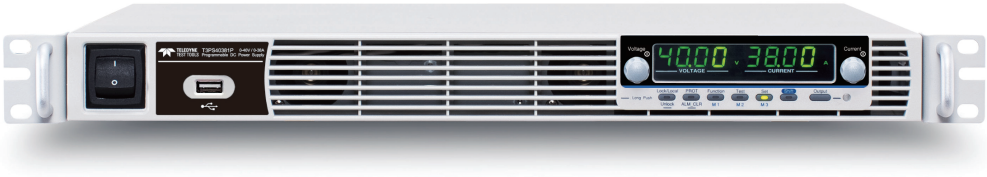
TELEDYNE TEST TOOLS
Everywhereyoulook™

T3PS40381P, T3PS60251P, T3PS062001P

Programmable DC Power Supplies

User Manual



The information in this manual was correct at the time of printing. However, Teledyne LeCroy continues to improve products and reserves the rights to change specification, equipment, and maintenance procedures at any time without notice.

Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow during operation and storage. Read the following before any operation to insure your safety and to keep the instrument in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the T3PS or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline

⚠ CAUTION

- Do not place any heavy object on the T3PS.
- Avoid severe impact or rough handling that leads to damaging the T3PS.
- Do not discharge static electricity to the T3PS.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block the cooling fan opening.
- Do not disassemble the T3PS unless you are qualified.

(Measurement categories) EN61010-1:2010 and EN61010-2-030 specifies the measurement categories and their requirements as follows. The T3PS falls under category II.

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.
- 0 is for measurements performed on circuits not directly connected to Mains.

Power Supply

⚠ WARNING

- AC Input voltage range: 85Vac-265Vac
- Input Power 2000 VA (Max)
- Frequency: 47Hz to 63Hz
- To avoid electrical shock connect the protective grounding conductor of the AC power cord to an earth ground.

	Use proper power cord. **Maintain ground.** The AC inlet ground is connected to the frame of the instrument. Connect line cords only to outlets with safety ground contacts.
⚠ WARNING	Interrupting the protective conductor (safety ground wire) inside or outside the instrument, or disconnecting the safety ground terminal, creates a hazardous situation. Intentional interruption is prohibited.
Cleaning the T3PS	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals containing harsh material such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: 20%- 85% (no condensation) • Altitude: < 2000m • Temperature: 0°C to 50°C (Pollution Degree) EN61010-1:2010 and EN61010-2-030 specifies the pollution degrees and their requirements as follows. The T3PS 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, non-conductive 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 • Temperature: -25°C to 70°C • Relative Humidity: ≤90%(no condensation)
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the power supply in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

This chapter describes the power supply, including its main features and front / rear panel introduction. After going through the overview, please read the theory of operation to become familiar with the operating modes, protection modes and other safety considerations.

T3PS Series Overview

Series lineup

The T3PS series consists of 3 models, covering a number of different current, voltage and power capacities:

Model name	Voltage Rating[1]	Current Rating[2]	Power
T3PS062001P	6V	200A	1200W
T3PS40381P	40V	38A	1520W
T3PS60251P	60V	25A	1500W

[1]Minimum voltage guaranteed to 0.2% of rating voltage.

[2]Minimum current guaranteed to 0.4% of rating current.

Main Features

Performance	• High power density: 1500W in 1U • Universal input voltage 85-265Vac, continuous operation. • Output voltage up to 60V, current up to 200A.
Features	• Active power factor correction. • Parallel master/slave operation with active current sharing. • Remote sensing to compensate for voltage drop in load leads. • 19" rack mounted ATE applications. • OVP, OCP and OHP protection. • Preset memory function. • Adjustable voltage and current slew rates. • Bleeder circuit ON/OFF setting.

	• CV, CC priority start function. (Prevents overshoot with output ON)
Interface	• Built-in RS-232/485, LAN and USB interface. • Analog output programming and monitoring.

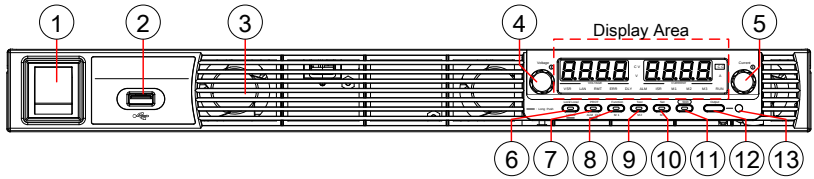
Accessories

Before using the T3PS power supply unit, check the package contents to make sure all the standard accessories are included.

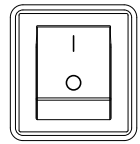
Standard Accessories		Description	Qty.
		Output terminal cover	1
		Analog connector plug kit	1
		Output terminal M8 bolt set (6V-60V model)	1
		Input terminal cover	1
		1U Handle, ROHS	2
		1U BRACKET (LEFT), RoHS	1
		1U BRACKET (RIGHT), RoHS	1
Download	Name	Description	
	T3PS_cdc.inf	T3PS USB driver	
Other	Name	Description	
	Certificate of traceable calibration		

Appearance

Front Panel

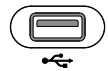


1. Power Switch



Used to turn the power on/off.

2. USB A Port

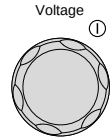


USB A port for data transfer, loading test scripts etc.

3. Air Inlet

Air inlet for cooling the inside of the T3PS series.

4. Voltage Knob

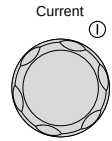


Used to set the voltage value or select a parameter number in the Function settings.

Display Area

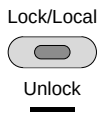
The display area shows setting values, output values and parameter settings. The function LEDs below show the current status and mode of the power supply. See page 16 for details.

5. Current Knob



Used to set the current value or change the value of a Function parameter.

6. Lock/Local Button

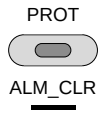


Used to lock all front panel buttons other than the Output Button or it switches to local mode.

Unlock Button

(Long push) Used to unlock the front panel buttons.

7. PROT Button

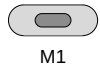


Used to set and display OVP, OCP and UVL.

ALM_CLR Button

(Long push) Used to release protection functions that have been activated.

8. Function Button

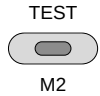


Used to configure the various functions.

M1 Button

(+Shift) Used to recall the M1 setup.
(+Shift and hold) Used to save the current setup to M1.

9. Test Button

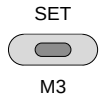


Used to run customized scripts for testing.

M2 Button

(+Shift) Used to recall the M2 setup.
(+Shift and hold) Used to save the current setup to M2.

10. Set Button



Used to set and confirm the output voltage and output current.

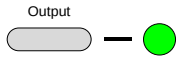
M3 Button

(+Shift) Used to recall the M3 setup.
(+Shift and hold) Used to save the current setup to M3.

11. Shift Button

Used to enable the functions that are written in blue characters below certain buttons.

12. Output Button



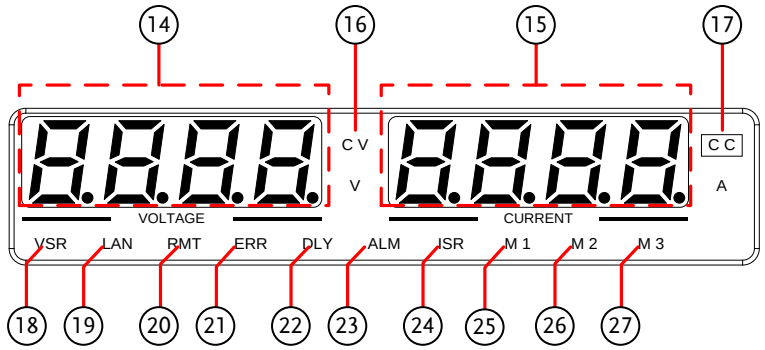
Used to turn the output on or off.

13. Output ON LED

Lights in green when the output is on.

Display and Operation Panel

Display Area



14. Voltage Meter — Displays the voltage or the parameter number of a Function parameter.

15. Current Meter — Displays the current or the value of a Function parameter.

16. CV LED — Lights in green during constant voltage mode.

17. CC LED — Lights in green during constant current mode.

18. VSR LED — Lights up when CV Slew Rate Priority is enabled.

19. LAN LED — Lights up when the LAN interface is connected.

20. RMT LED — Lights in green during remote control.

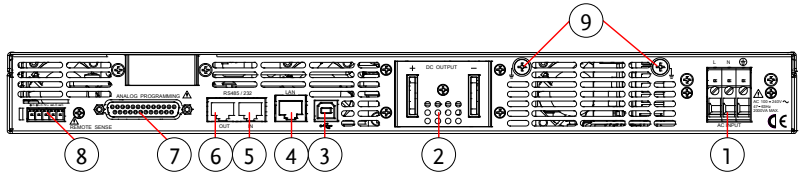
21. ERR LED — Lights in red when an error has occurred.

22. DLY LED — The Output On/Off Delay indicator LED.

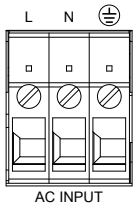
23. ALM LED — Lights in red when a protection function has been activated.

24. ISR LED	Lights up when CC Slew Rate Priority is enabled.
25. M1 LED	Lights in green when the memory value are being recalled or saved.
26. M2 LED	Lights in green when the memory value are being recalled or saved.
27. M3 LED	Lights in green when the memory value are being recalled or saved.
 Note	Only the ERR and ALM LED's are red. All the others are green.

Rear Panel

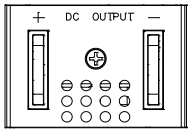


1. AC Input



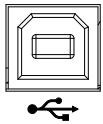
Wire clamp connector.

2. DC Output



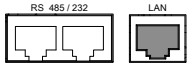
Output terminals for 6V to 60V models.

3. USB



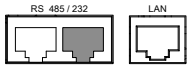
USB port for controlling the T3PS remotely.

4. LAN



Ethernet port for controlling the T3PS remotely.

5. Remote-IN

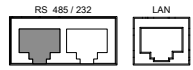


Two different types of cables can be used for RS232 or RS485-based remote control.

RS232 support via user supplied cable with DB9 / RJ45 connectors wired according to the table on page 124.

RS485 support via user supplied cable with DB9 / RJ45 connectors wired according to the table on page 124.

6. Remote-OUT



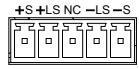
RJ-45 connector that is used to daisy chain power supplies with the Remote-IN port to form a communication bus.

Serial link cable with RJ45 shielded connectors wired according to the table on page 129.

7. Analog Control

External analog control connector.

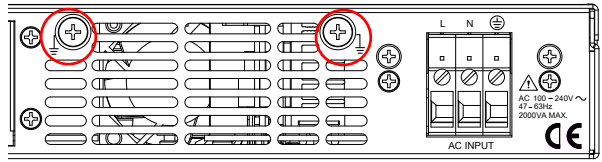
8. Remote Sense



Compensation of load wire drop.

9. Ground Screw

Connectors for grounding the output (two positions, shown in red).



Theory of Operation

The theory of operation chapter describes the basic principles of operation, protection modes and important considerations that must be taken into account before use.

Operating Area Description

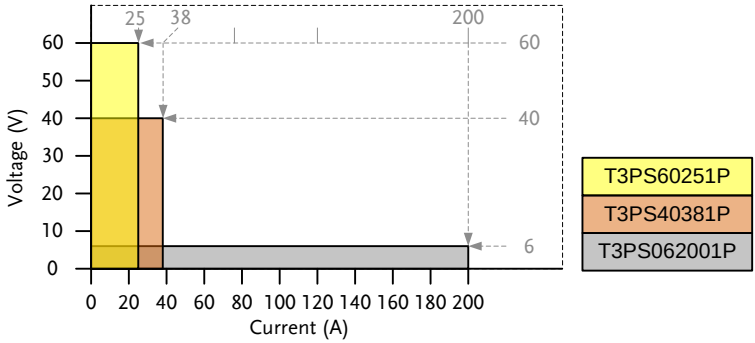
Background

The T3PS power supplies are regulated DC power supplies with a high voltage and current output. These operate in CC or CV mode within a wide operating range limited only by the voltage or current output.

The operating area of each power supply is determined by the rated output power as well as the voltage and current rating.

Below is a comparison of the operating areas of each power supply.

T3PS Series Operating Area



CC and CV Mode

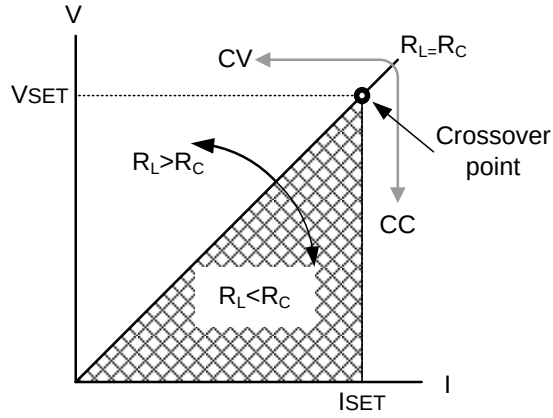
CC and CV mode Description

When the power supply is operating in constant current mode (CC) a constant current will be supplied to the load. When in constant current mode the voltage output can vary, whilst the current remains constant. When the load resistance increases to the point where the set current limit (I_{SET}) can no longer be sustained the power supply switches to CV mode. The point where the power supply switches modes is the crossover point.

When the power supply is operating in CV mode, a constant voltage will be supplied to the load, whilst the current will vary as the load varies. At the point that the load resistance is too low to maintain a constant voltage, the power supply will switch to CC mode and maintain the set current limit.

The conditions that determine whether the power supply operates in CC or CV mode depends on the set current (I_{SET}), the set voltage (V_{SET}), the load resistance (R_L) and the critical resistance (R_C). The critical resistance is determined by V_{SET}/I_{SET}. The power supply will operate in CV mode when the load resistance is greater than the critical resistance. This means that the voltage output will be equal to the V_{SET} voltage but the current will be less than I_{SET}. If the load resistance is reduced to the point that the current output reaches the I_{SET} level, the power supply switches to CC mode.

Conversely the power supply will operate in CC mode when the load resistance is less than the critical resistance. In CC mode the current output is equal to I_{SET} and the voltage output is less than V_{SET}.



Note

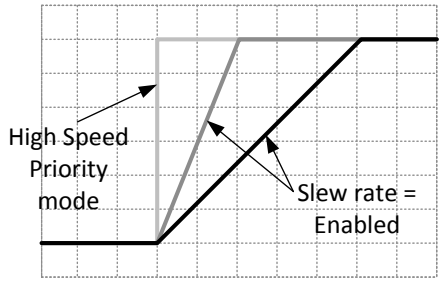
For loads that generate a transient surge voltage, V_{SET} must be set so that the surge voltage does not reach the voltage limit.

For loads in which transient peak current flows, I_{SET} must be set so that the peak value does not reach the current limit.

Slew Rate

Theory

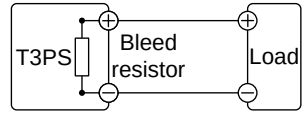
The T3PS has selectable slew rates for CC and CV mode. This gives the T3PS power supply the ability to limit the current/voltage draw of the power supply. Slew rate settings are divided into High Speed Priority and Slew Rate Priority. High speed priority mode will use the fastest slew rate for the instrument. Slew Rate Priority mode allows for user adjustable slew rates for CC or CV mode. The rising and falling slew rate can be set independently.



Bleeder Control

Background

The T3PS DC power supplies employ a bleed resistor in parallel with the output terminals.



Bleed resistors are designed to dissipate the power from the power supply filter capacitors when power is turned off and the load is disconnected. Without a bleed resistor, power may remain charged on the filter capacitors for some time and

be potentially hazardous.

In addition, bleed resistors also allow for smoother voltage regulation of the power supply as the bleed resistor acts as a minimum voltage load.

The bleed resistance can be turned on or off using the configuration settings.

⚠ Note

By default the bleed resistance is on. For battery charging applications, be sure to turn the bleed resistance off as the bleed resistor can discharge the connected battery when the unit is off.

Internal Resistance

Background

On the T3PS, the internal resistance of the power supply can be user-defined in software. (Internal Resistance Setting, see the Normal Function Settings on page 82.) When the internal resistance is set it can be seen as a resistance in series with the positive output terminal. This allows the power supply to simulate power sources that have internal resistances such as lead acid batteries.

By default the internal resistance is 0Ω.

Internal Resistance Range

Unit Model	Internal Resistance Range
T3PS062001P	0.000-0.030Ω
T3PS40381P	0.000-1.053Ω
T3PS60251P	0.000-2.400Ω

Alarms

The T3PS power supplies have a number of protection features. When one of the protection alarms is tripped, the ALM icon on the display will be lit and the type of alarm that has been tripped will be shown on the display. When an alarm has been tripped the output will be automatically turned off. For details on how to clear an alarm or to set the protection modes, please see page 44.

OVP	Over voltage protection (OVP) prevents a high voltage from damaging the load. This alarm can be set by the user.
OCP	Over current protection prevents high current from damaging the load. This alarm can be set by the user.
UVL	Under voltage limit. This function sets a minimum voltage setting level for the output. It can be set by the user.
OHP	Over temperature protection for slave and master board. OHP is a hardware protection function. Only when the unit has cooled can the over temperature protection alarms be cleared.
OH1	Master board over temperature protection.
OH2	Slave board over temperature protection.
ALM SENS	Sense alarm. This alarm will detect if the sense wires have been connected to the wrong polarity.
HW OVP	Hardware over voltage protection. This is a hardware OVP that is fixed at approximately 120% of the rated voltage output.

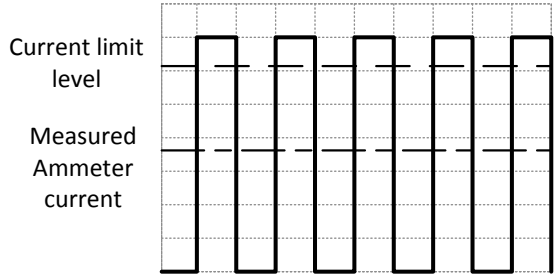
AC	AC Fail. This alarm function is activated when a low AC input is detected.
FAN FAIL	Fan failure. This alarm function is activated when the fan RPMs drop to an abnormally low level.
Shutdown	Force Shutdown is not activated as a result of the T3PS series detecting an error. It is a function that is used to turn the output off through the application of a signal from the rear-panel analog control connector when an abnormal condition occurs.
Alarm output	Alarms are output via the analog control connector. The alarm output is an isolated open-collector photo coupler output.

Considerations

The following situations should be taken into consideration when using the power supply.

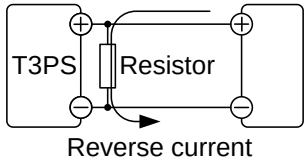
Inrush current	When the power supply switch is first turned on, an inrush current is generated. Ensure there is enough power available for the power supply when first turned on, especially if a number of units are turned on at the same time.
Pulsed or Peaked loads	When the load has current peaks or is pulsed, it is possible for the maximum current to exceed the mean current value. The T3PS power supply ammeter only indicates mean current values, which means for pulsed current loads, the actual current can exceed the indicated value. For pulsed loads, the current limit must be increased, or a power supply with a greater capacity must be chosen. As shown below, a pulsed load may exceed the current limit and the indicated current

on the power supply ammeter.



Reverse Current: Regenerative load

When the power supply is connected to a regenerative load such as a transformer or inverter, reverse current will feed back to the power supply. The T3PS power supply cannot absorb reverse current. For loads that create reverse current, connect a resistor in parallel to the power supply to bypass the reverse current. This description only applies when the bleed resistance is off.



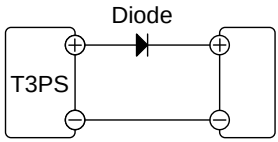
Note

The current output will decrease by the amount of current absorbed by the resistor.

Ensure the resistor used can withstand the power capacity of the power supply/load.

Reverse Current: Accumulative energy.

When the power supply is connected to a load such as a battery, reverse current may flow back to the power supply. To prevent damage to the power supply, use a reverse-current-protection diode in series between the power supply and load.



⚠ CAUTION

Ensure the reverse withstand voltage of the diode is able to withstand 2 times the rated output voltage of the power supply and the forward current capacity can withstand 3 to 10 times the rated output current of the power supply.

Ensure the diode is able to withstand the heat generated in the following scenarios.

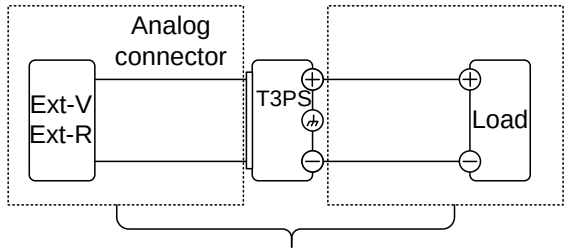
When the diode is used to limit reverse voltage, remote sensing cannot be used.

Grounding

The output terminals of the T3PS power supplies are isolated with respect to the protective grounding terminal. The insulation capacity of the load, the load cables and other connected devices must be taken into consideration when connected to the protective ground or when floating.

Floating

As the output terminals are floating, the load and all load cables must have an insulation capacity that is greater than the isolation voltage of the power supply.

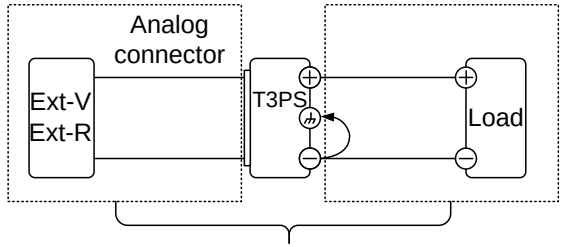


(·····) Insulation capacity ≥ isolation voltage of power supply

WARNING If the insulation capacity of the load and load cables are not greater than the isolation voltage of the power supply, electric shock may occur.

Grounded output terminal

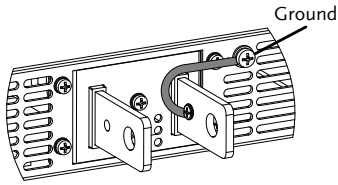
If the positive or negative terminal is connected to the protective ground terminal, the insulation capacity needed for the load and load cables is greatly reduced. The insulation capacity only needs to be greater than the maximum output voltage of the power supply with respect to ground.



(·····) Insulation capacity ≥ voltage of power supply with respect to ground

CAUTION If using external voltage control, do not ground the external voltage terminal as this will create a short circuit.

Example of grounded output terminals:



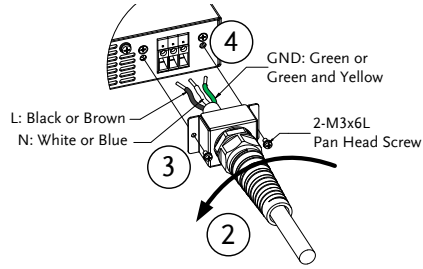
OPERATION

Set Up

Line Voltage Connection

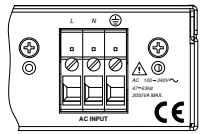
Background	The T3PS power supplies use a universal power input that can be used with 100 and 240 Vac systems. To connect or replace the power cord (user supplied, specification below), use the procedure below:
Warning	The following procedure should only be attempted by competent persons. Ensure the AC power cord is not connected to power. Always allow the power supply to fully discharge before disconnecting the AC power cord.
Recommended Power Cord Specifications	25A 250V, 3x12 AWG, outer diameter: 9-11mm, rated 60 °C min., 3m maximum length and approved by the national safety standards for the country of use.
Note	There are two type power cord protective sheaths in the standard accessories. One is black color and it is used for outer diameter: 8-13.5mm power cord. The other is gray color and it is used for outer diameter: 5.5-11.2mm power cord.
Removal	1. Turn off the power switch and unplug the power from the socket. 2. Unscrew the power cord protective sheath. 3. Remove the 2 screws holding the power cord cover and remove.

4. Remove the AC power cord wires with a flat head screwdriver.

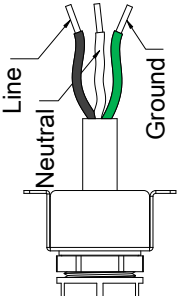


Installation

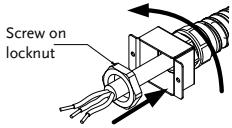
1. Connect the AC power cord wires to the AC input terminals.



- Black/Brown → Line (L)
- White/Blue → Neutral (N)
- Green /Green & Yellow → Ground (⏚)



2. Make sure the sheath is tightened to the lock nut.



3. Re-install the power cord cover.

Power Up

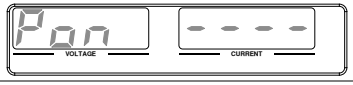
Steps

1. Connect the power cord to the universal power input. Page 32

2. Press the POWER switch on.

3. The power supply will show the Power On settings (Pon) at start up. If no Power On settings are configured, the T3PS will recover the state right before the power was last turned OFF. If used for the first time, the default settings will appear on the display.

   For default configuration settings, see page 140.



Note You may also configure how the T3PS will behave on startup by altering the Power On Configuration settings, see page 89.

Power Down

To turn the T3PS power supply off, press the power switch again (0 position). It may take a few seconds for the power supply to fully turn off.

CAUTION The power supply takes around 8 seconds to fully turn on or shutdown.

Do not turn the power on and off quickly. Please wait for the display to fully turn off.

Wire Gauge Considerations

Background

Before connecting the output terminals to a load, the wire gauge of the cables should be considered.

It is essential that the current capacity of the load cables is adequate. The rating of the cables must equal or exceed the maximum current rated output of the instrument.

Recommended wire gauge

Wire Gauge	Nominal Cross Section	Maximum Current
20	0.5	9
18	0.75	11
18	1	13
16	1.5	18
14	2.5	24
12	4	34
10	6	45
8	10	64
6	16	88
4	25	120
2	32	145
1	50	190
00	70	240
000	95	290
0000	120	340

The maximum temperature rise can only be 60 degrees above the ambient temperature. The ambient temperature must be less than 30 degrees.

To minimize noise pickup or radiation, the load wires and remote sense wires should be twisted-pairs of the shortest possible length. Shielding of the sense leads may be necessary in high noise environments. Where shielding is used, connect the shield to the chassis via the rear panel ground

screw. Even if noise is not a concern, the load and remote sense wires should be twisted-pairs to reduce coupling, which might impact the stability of the power supply. The sense leads should be separated from the power leads.

Output Terminals

Background

Before connecting the output terminals to the load, first consider whether voltage sense will be used, the gauge of the cable wiring and the withstand voltage of the cables and load.

The output terminals is:

Two solid bars equipped with M8 sized bolt and nuts for low voltage models.

WARNING

Dangerous voltages. Ensure that the power to the instrument is disabled before handling the power supply output terminals. Failing to do so may lead to electric shock.

Steps

1. Turn the power switch off.

2. Remove the output terminal cover. Page 37

3. If necessary, connect the chassis ground terminal to either the positive or negative terminal. See the grounding chapter for details. Page 28

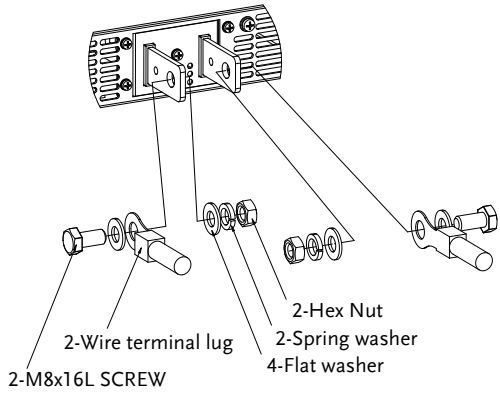
4. Choose a suitable wire gauge and crimping terminal for the load cables. Page 35

5. Connect the positive load cable to the positive output terminal and the negative cable to the negative output terminal.

6. Reattach the output terminal cover. Page 37

Connection Example

Use the included M8-sized bolt set to connect the load cables to the output terminals. Make sure that the connections are tight and that washers and spring washers are used to ensure a good connection.



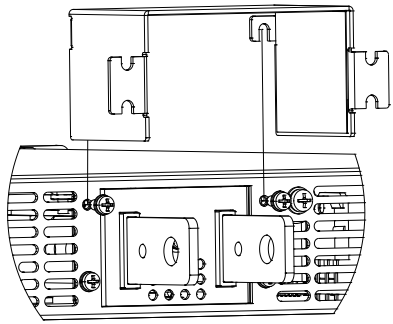
Using the Output Terminal Cover

Steps

1. Partially unscrew the 2 screws beside the terminals.

2. Line-up the notches in the cover with the 2 screws.

3. Tighten the screws to secure the cover over the terminals.



Removal

Reverse the procedure to remove the terminal covers.

How to Use the Instrument

Background

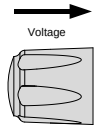
The T3PS power supplies use a novel method of configuring parameter values only using the voltage or current knobs. The knobs are used to quickly edit parameter values at 0.01, 0.1 or 1 unit steps at a time.

When the user manual says to set a value or parameter, use the steps below.

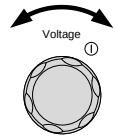
Example

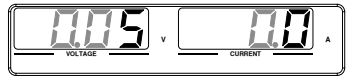
Use the Voltage knob to set a voltage of 10.05 volts.

1. Repeatedly press the Voltage knob until the least significant digit is highlighted. This will allow the voltage to be edited in 0.01 volt steps.



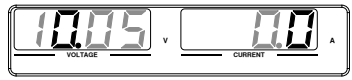
2. Turn the Voltage knob till 0.05 volts is shown on the voltage display.





3. Repeatedly press the Voltage knob until the most significant digit is highlighted. This will allow the voltage to be edited in 1 volt steps.

4. Turn the Voltage knob until 10.05 is shown.



Note

Notice the Set key becomes illuminated when setting the current or voltage.

If the voltage or current knobs are unresponsive, press the Set key first.

Reset to Factory Default Settings

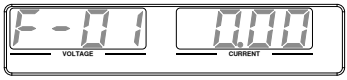
Background

The F-88 configuration setting allows the T3PS to be reset back to the factory default settings. See page 140 for the default factory settings.

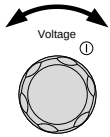
Steps

1. Press the Function key. The Function key will light up.

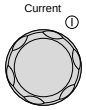
2. The display should show F-01 on the top and the configuration setting for F-01 on the bottom.



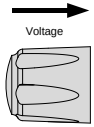
3. Rotate the Voltage knob to change the F setting to F-88 (Factory Set Value).

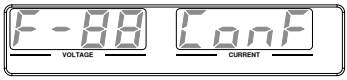


4. Use the Current knob to set the F-88 setting to 1 (Return to factory default settings).



5. Press the Voltage knob to confirm. ConF will be displayed when it is configuring.





6. Press the Function key again to exit. The Function key light will turn off.

View System Version and Build Date

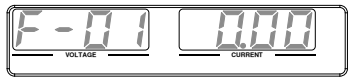
Background

The F-89 configuration setting allows you to view the T3PS version number, build date, keyboard version, analog-control version, kernel build, test command version and test command build date.

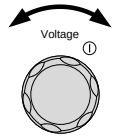
Steps

1. Press the Function key. The Function key will light up.

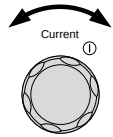
2. The display should show F-01 on the top and the configuration setting for F-01 on the bottom.



3. Rotate the Voltage knob to change the F setting to F-89 (Show Version).

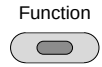


4. Rotate the Current knob to view the version and build date for the various items.



F-89
- 0-XX: Version (1/2)
- 1-XX: Version (2/2)
- 2-XX: Build On-Year. (1/2)
- 3-XX: Build On-Year. (2/2)
- 4-XX: Build On-Month.
- 5-XX: Build On-Day.
- 6-XX: Keyboard CPLD. (1/2)
- 7-XX: Keyboard CPLD. (2/2)
- 8-XX: Analog Board CPLD. (1/2)
- 9-XX: Analog Board CPLD. (2/2)
- A-XX: Analog Board FPGA (1/2)
- B-XX: Analog Board FPGA. (1/2)
- C-XX: Kernel Build On-Year. (1/2)
- D-XX: Kernel Build On-Year. (2/2)
- E -XX: Kernel Build On-Month.
- F-XX: Kernel Build On-Day.
- G-XX: Test Command Version. (1/2)
- H-XX: Test Command Version. (2/2)
- I-XX: Test Command Build On-Year. (1/2)
- J-XX: Test Command Build On-Year. (2/2)
- K-XX: Test Command Build On-Month.
- L-XX: Test Command Build On-Day.
- M-XX: Reserved. (1/2)
- N-XX: Reserved. (2/2)
- O-XX: Option version. (1/2)
- P-XX: Option version. (2/2)

5. Press the Function key again to exit. The Function key light will turn off.



Example

Main Program Version: V01.00, 2013/06-01

0-01: Version
1-00: Version
2-20: Build On-Year.
3-13: Build On-Year.
4-06: Build On-Month.
5-01: Build On-Day.

Example

Keyboard CPLD Version: 0x030C

6-03: Keyboard CPLD Version.
7-0C: Keyboard CPLD Version.

Example

Analog CPLD Version: 0x0421

8-04: Analog CPLD Version.
9-21: Analog CPLD Version.

Example

Analog Board FPGA: 0x0241

A-02: Analog FPGA Version.
B-41: Analog FPGA Version.

Example

Kernel Version: 2013/01/22

C-20: Kernel Build On-Year.
D-13: Kernel Build On-Year.
E-01: Kernel Build On-Month.
F-22: Kernel Build On-Day.

Example	Test Command Version: V01:00, 2013/06/01 G-01: Test Command Version. H-00: Test Command Version. I-20: Test Command Build On-Year. J-13: Test Command Build On-Year. K-06: Test Command Build On-Month. L-01: Test Command Build On-Day.
Example	Reserved: M-XX: Reserved. N-XX: Reserved.
Example	Option version O-XX: Option version. (1/2) P-XX: Option version. (2/2)

Basic Operation

This section describes the basic operations required to operate the power supply.

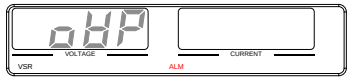
Before operating the power supply, please see the Getting Started chapter, page 10.

Setting OVP/OCP/UVL Levels

The OVP level and OCP level has a selectable range that is based on the output voltage and output current, respectively. The OVP and OCP level is set to the highest level by default. The actual selectable OVP and OCP range depends on the T3PS model.

When one of the protection measures are on, ALM indicator is lit red on the front panel and the type of alarm is also shown on the display. The ALM_CLR button can be used to clear any protection functions that have been tripped. By default, the output will turn off when the OVP or OCP protection levels are tripped.

The UVL will prevent you from setting a voltage that is less than the UVL setting. The UVL setting range is from 0%-105% of the rated output voltage.



Example: OVP alarm

Before setting the protection settings:

- Ensure the load is not connected.
- Ensure the output is turned off.

Note

You can use the Function settings (F-13 and F-14) to apply limits to the voltage and current settings, respectively. You can set limitations so that the values do not exceed the set OVP and the set OCP level, and so that the values are not lower than the set UVL trip point.

By using this feature, you can avoid turning the output off by mistakenly setting the voltage or current to a value that exceeds the set OVP or OCP level or to a value that is lower than the set UVL trip point.

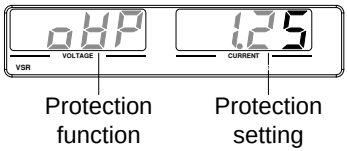
If you have selected to limit the voltage setting (F-14), you will no longer be able to set the output voltage to a value that is above about 95% of the OVP trip point or to a value that is lower than the UVL trip point.

If you have selected to limit the current setting (F-13), you will no longer be able to set the output current to a value that is above about 95% of the OCP trip point.

Steps

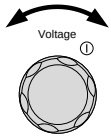
1. Press the PROT key. The PROT key lights up.

2. The OVP protection function will be displayed on the voltage display and the setting will be displayed on the current display.



Choose a Protection Function

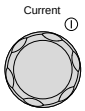
3. Use the Voltage knob to select a protection function.



Range OVP, OCP, UVL

Setting the Protection Level

4. Use the Current knob to set the protection level for the selected function.

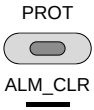


	Setting Range		
Model	OCP	OVP	UVL
T3PS062001P	5-220	0.6-6.6	0-6.3
T3PS40381P	3.8-41.8	4-44	0-42
T3PS60251P	2.5-27.5	5-66	0-63

5. Press PROT again to exit. The PROT key light will turn off.

Clear OVP/OCP/UVL protection

The OVP, OCP or UVL protection can be cleared after it has been tripped by holding the ALM_CLR button for 3 seconds.



Set to C.V. Priority Mode

When setting the power supply to constant voltage mode, a current limit must also be set to determine the crossover point. When the current exceeds the crossover point, the mode switches to C.C. mode. For details about C.V. operation, see page 21. C.C. and C.V. mode have two selectable slew rates: High Speed Priority and Slew Rate Priority. High Speed Priority will use the fastest slew rate for the instrument while Slew Rate Priority will use a user-configured slew rate.

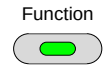
Background

Before setting the power supply to C.V. mode, ensure:

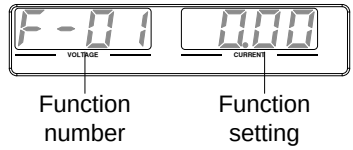
- The output is off.
- The load is connected.

Steps

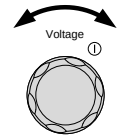
1. Press the Function key. The Function key will light up.



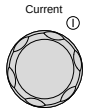
2. The display will show the function (F-01) on the voltage display and the setting for the function in the current display.



3. Rotate the Voltage knob to change the F setting to F-03 (V-I Mode Slew Rate Select).



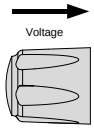
4. Use the Current knob to set the F-03 setting.

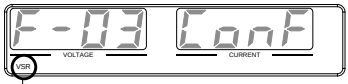


   Set F-03 to 0 (CV High Speed Priority) or 2 (CV Slew Rate Priority).

   F-03 0 = CV High Speed Priority
   2 = CV Slew Rate Priority

5. Press the Voltage knob to save the configuration setting. ConF will be displayed when it is configuring.





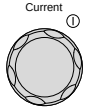
VSR indicator for CV Slew Rate Priority (F-03=2)

6. If CV Slew Rate Priority was chosen as the operating mode, set F-04 (Voltage Slew Rate Up) and the F-05 (Voltage Slew Rate Down) and save.

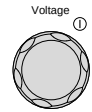
   F-04 / F-05 0.001V-0.06V/msec (T3PS062001P)
   0.001V-0.4V/msec (T3PS40381P)
   0.001V-0.6V/msec (T3PS60251P)

7. Press the Function key again to exit the configuration settings. The function key light will turn off.

8. Use the Current knob to set the current limit (crossover point).



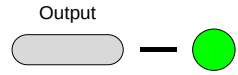
9. Use the Voltage knob to set the voltage.

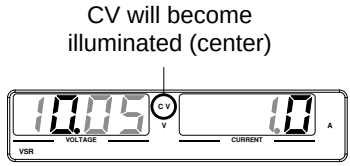


Note

Notice the Set key becomes illuminated when setting the current or voltage. If the Voltage or Current knobs are unresponsive, press the Set key first.

10. Press the Output key. The Output ON LED becomes lit.





Note

Only the voltage level can be altered when the output is on. The current level can only be changed by pressing the Set key.

For more information on the Normal Function Settings, see page 82.

Set to C.C. Priority Mode

When setting the power supply to constant current mode, a voltage limit must also be set to determine the crossover point. When the voltage exceeds the crossover point, the mode switches to C.V. mode. For details about C.C. operation, see page 21. C.C. and C.V. mode have two selectable slew rates: High Speed Priority and Slew Rate Priority. High Speed Priority will use the fastest slew rate for the instrument while Slew Rate Priority will use a user-configured slew rate.

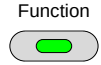
Background

Before setting the power supply to C.C. mode, ensure:

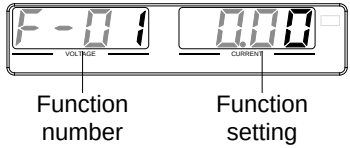
- The output is off.
- The load is connected.

Steps

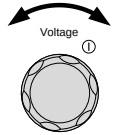
1. Press the Function key. The Function key will light up.



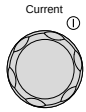
2. The display will show the function (F-01) on the voltage display and the setting for the function in the current display.



3. Rotate the Voltage knob to change the F setting to F-03 (V-I Mode Slew Rate Select).



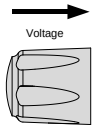
4. Use the Current knob to set the F-03 setting.

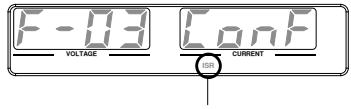


Set F-03 to 1 (CC High Speed Priority) or 3 (CC Slew Rate Priority) and save.

F-03	1 = CC High Speed Priority
	3 = CC Slew Rate Priority

5. Press the Voltage knob to save the configuration setting. ConF will be displayed when it is configuring.



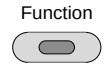


ISR indicator for CC Slew Rate Priority (F-03=3)

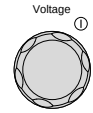
6. If CC Slew Rate Priority was chosen as the operating mode, set F-06 (Current Slew Rate Up) and F-07 (Current Slew Rate Down) and save.

   F-06 / F-07 0.001A-2A / msec (T3PS062001P)
   0.001A-0.38A / msec (T3PS40381P)
   0.001A-0.25A / msec (T3PS60251P)

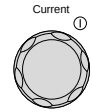
7. Press the Function key again to exit the configuration settings. The Function key light will turn off.



8. Use the Voltage knob to set the voltage limit (crossover point).



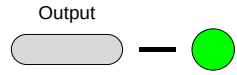
9. Use the Current knob to set the current.

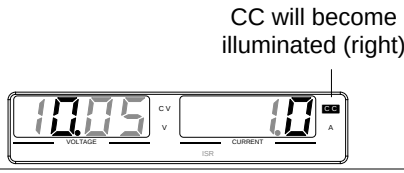


Note

Notice the Set key becomes illuminated when setting the current or voltage. If the Voltage or Current knobs are unresponsive, press the Set key first.

10. Press the Output key. The Output key becomes illuminated.





⚠ Note	Only the current level can be altered when the output is on. The voltage level can only be changed by pressing the Set key.

For more information on the Normal Function Settings, see page 82.

Panel Lock

The panel lock feature prevents settings from being changed accidentally. When activated, the Lock/Local key will become illuminated and all keys and knobs except the Lock/Local key and Output key (if active) will be disabled.

If the instrument is remotely controlled via the USB/LAN interface, the panel lock is automatically enabled.

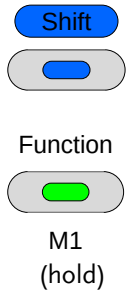
Activate the panel lock	Press the Lock/Local key to active the panel lock. The key will become illuminated.	Lock/Local
Disable the panel lock	Hold the Lock/Local key for 3 seconds to disable the panel lock. The key's light will turn off.	Lock/Local Unlock

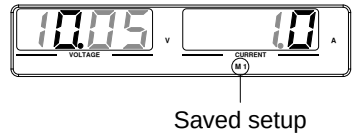
Save Setup

The T3PS has 3 dedicated keys (M1, M2, M3) to save the set current, set voltage, OVP, OCP and ULV settings.

Save Setup

1. Press the SHIFT key. The shift key will light blue.
2. Hold the desired memory key for >3 seconds (M1, M2, M3).
3. When the setup is saved the unit will beep, the setup will be saved and the memory number will be shown on the display.



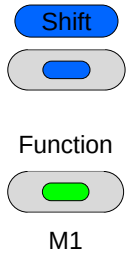


Recall Setup

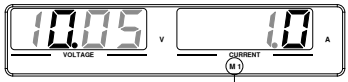
The T3PS has 3 dedicated keys (M1, M2, M3) to recall setups.

Recall Setup

1. Press the SHIFT key. The shift key will light blue.
2. Press the desired memory key to recall the desired setup (M1, M2, M3).



3. When the setup is recalled the setup will be loaded and the memory number will be shown on the display.



Recalled setup

Note The F-15 function setting will determine whether the saved contents of the recalled memory setting are displayed or not.

Voltage Sense

The T3PS power supplies can be operated using local or remote voltage sense. By default the T3PS ships configured for local sense.

Remote Sense Connector

The Remote Sense connector includes a detachable plug to facilitate making the sense connections. The remote sense connector also has a safety cover.

WARNING Ensure the output is off before handling the remote sense connector.

Use sense cables with a voltage rating exceeding the isolation voltage of the power supply.

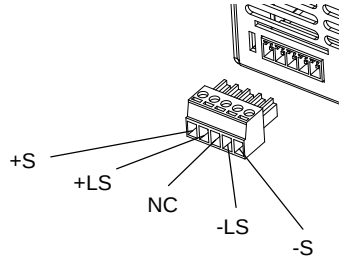
Never connect sensing cables when the output is on. Electric shock or damage to the power supply could result.

Remote Sense Connector Overview

When using the remote sense connector make sure the wires that are used follow the following guidelines:

Wire gauge: AWG 28 to AWG 16

Strip length: 5mm // 0.2 in.



+S: Remote(+) sense
+LS: Local (+) sense
NC: Not connected
-LS: Local (-) sense
-S: Remote (-) sense

Remote Sense Cover

WARNING

Ensure the output is off before handling the remote sense connector.

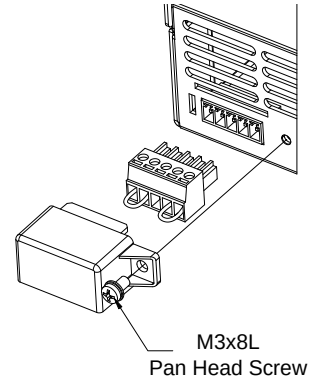
Use sense cables with a voltage rating exceeding the isolation voltage of the power supply.

Never connect sensing cables when the output is on. Electric shock or damage to the power supply could result.

Always operate the T3PS with the remote sense cover.

Connector

1. Place the cover over the remote sense connector.
2. Secure the cover with the provided screw.

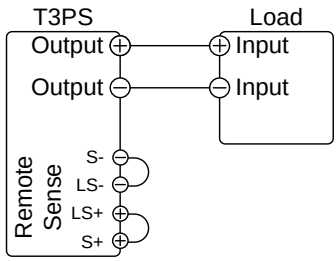


Local Sense

When using local sense, the sensing terminals are connected to the local sense terminals (via the local sense connections) and thus do not compensate for any possible voltage drop that is seen on the load cables. Local sense is only recommended when the voltage drop is of no consequence or for load-current applications. By default, the sense plug is already configured to local sensing.

Local Sense Connection

Page 54



Remote Sense

Remote sense is used to compensate for the voltage drop seen across load cables due to the resistance inherent in the load cables. The remote sense terminals are connected to the load terminals of the DUT to determine the voltage drop across the load cables.

Remote sense can compensate up to 1 volt (T3PS062001P), 2 volts (T3PS40381P), 3 volts (T3PS60251P). Load cables should be chosen with a voltage drop less than the compensation voltage.

Although you can use remote sense to compensate up to 3V for a single line, it is recommended that the voltage drop is minimized to a maximum of 1V to prevent excessive output power consumption from the power supply and poor dynamic response to load changes.

⚠ WARNING

Ensure the output is off before connecting any sense cables.

Use sense cables with a voltage rating exceeding the isolation voltage of the power supply.

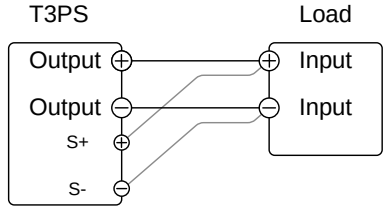
Never connect sensing cables when the output is on. Electric shock or damage to the power supply could result.

Note

Be sure to remove the sense jumpers from the remote sense connector so the unit is not using local sensing.

Single Load

1. Connect the S+ terminal to the positive potential of the load. Connect the S- terminal to the negative potential of the load.



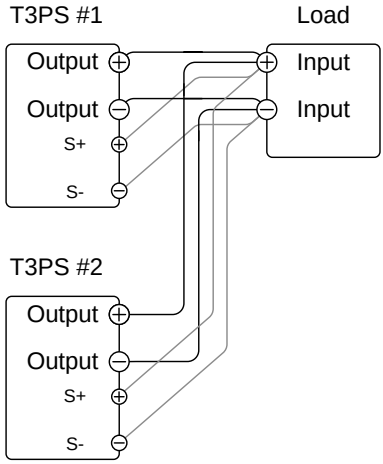
Page 54

2. Operate the instrument as normal. See the Basic Operation chapter for details.

Page 44

Parallel T3PS Units

1. Connect the S+ terminals to the positive potential of the load. Connect the S- terminals to the negative potential of the load.



Page 54

2. Operate the instrument as normal. See the Parallel Operation chapter for details. Page 61

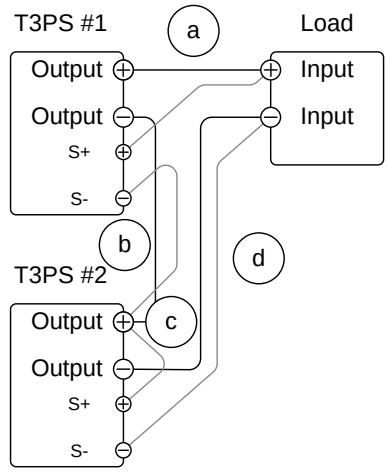
Serial T3PS Units

1. a. Connect the 1st S+ terminal to the positive potential of the load.

   b. Connect the 1st S- terminal to the positive output terminal of the second T3PS unit.

   c. Connect the 2nd S+ terminal to the positive terminal of the second T3PS unit.

   d. Connect the 2nd S- terminal to negative terminal of the load.



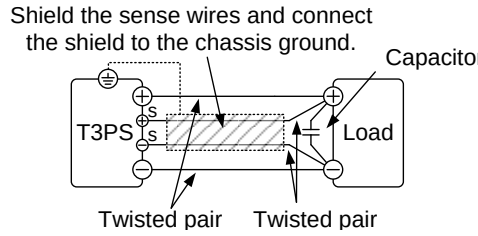
Page 54

2. Operate the instrument as normal. Page 68
   See the Serial Operation chapter for details.

Wire Shielding and Load line impedance

To help to minimize the oscillation due to the inductance and capacitance of the load cables, use an electrolytic capacitor in parallel with the load terminals.

To minimize the effect of load line impedance use twisted wire pairing.



Parallel / Series Operation

This section describes the basic operations required to operate the power supply in series or parallel. Operating the T3PS series in parallel increases the total current output of the power supply units. When used in series, the total output voltage of the power supplies can be increased.

When the units are used in parallel or in series, a number of precautions and limitations apply. Please read the following sections before operating the power supplies in parallel or series.

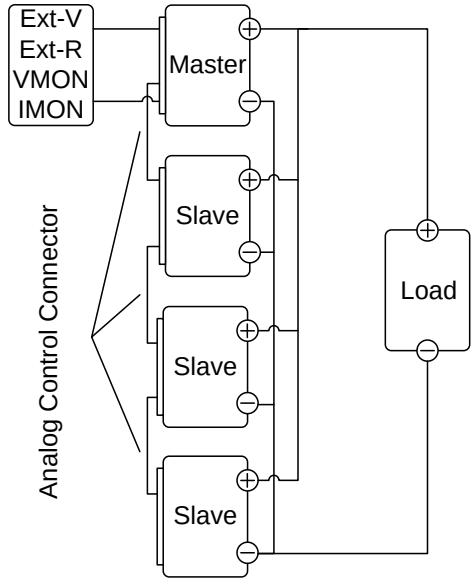
Master-Slave Parallel Overview

Background

When connecting the T3PS power supplies in parallel, up to 4 units can be used in parallel and all units must be of the same model with similar output settings.

To use the power supplies in parallel, units must be used in a "master-slave" configuration. In the master-slave configuration a "master" power supply controls any other connected "slave" power supplies. In order for the master unit to control the slave units, the master unit must use the analog control connector to control the slave units.

When using the Analog Control Connector, the connector must be wired correctly between the master and each of the slave units. For the complete connector pin assignment, see page 98.



Limitations

Display

- Only the master unit will display the voltage and current.

OVP/ OCP/UVL

- Slave units follow the settings of the master when OVP/OCP/UVL is tripped on the master unit.

Remote monitoring

- Voltage monitoring (VMON) and current monitoring (IMON) are only supported on the master unit.
- The IMON current represents the total current of the all the parallelized units.

Remote Sense

- Please see the remote sense chapter for details, page 56.

Parallel Calibration

- The parallel calibration function can be used to offset cables losses.

External Voltage and Resistance Control

- Voltage/Resistance controlled remote control can only be used with the master unit.
- The full scale current (in parallel) is equivalent to the maximum external voltage or resistance.

Internal Resistance

- For 2 units in parallel, the internal resistance is actually half of the setting value.
- For 3 units in parallel, the internal resistance is actually a third of the setting value.
- For 4 units in parallel, the internal resistance is actually a fourth of the setting value.
- See function setting F-08 for internal resistance settings, page 84.

Bleeder Control

- The Master unit is used to control the bleeder settings. The bleeder resistors in all the slave units are always turned off when in parallel mode.

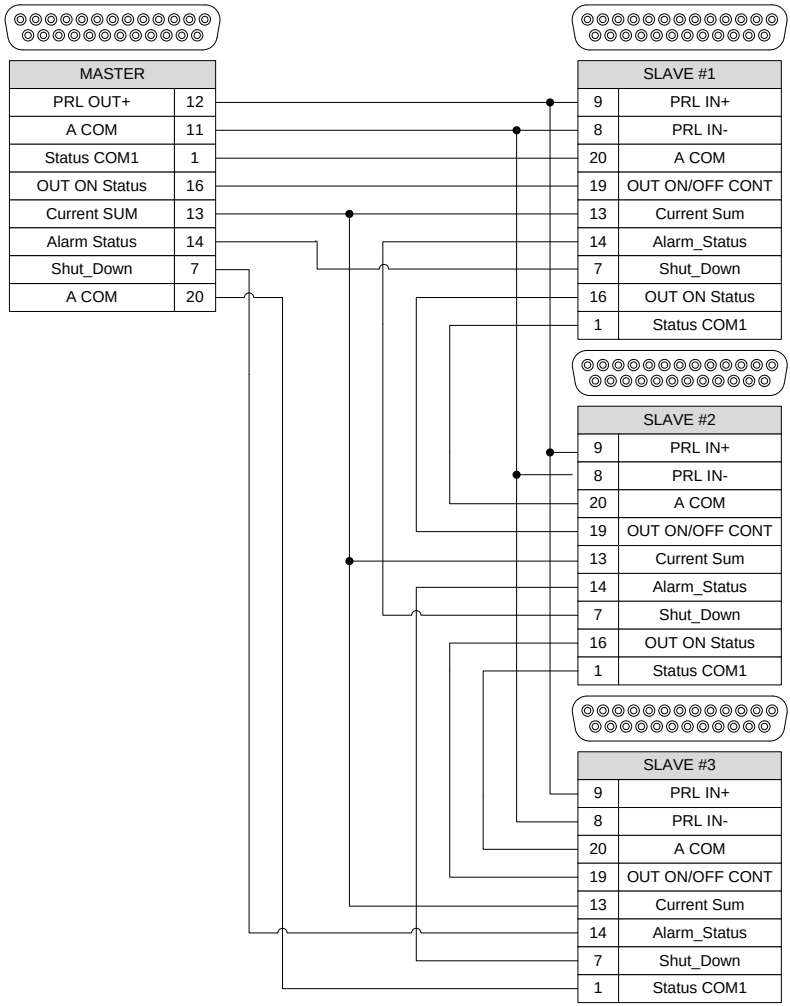
Output Voltage/ Output Current

Model	1 unit	2 units	3 units	4 units
T3PS062001P	6V 200A	6V 400A	6V 600A	6V 800A
T3PS40381P	40V 38A	40V 76A	40V 114A	40V 152A
T3PS60251P	60V 25A	60V 50A	60V 75A	60V 100A

Master-Slave Parallel Connection

Analog Control Connection

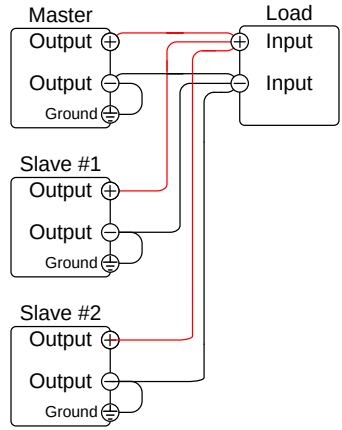
To operate the power supplies in parallel with the analog connectors, connect the analog connectors on the master and slave units as shown in the diagrams below.



Parallel Output Connection

If grounding the positive or negative terminals to the reference ground, be sure to ground the appropriate terminal on each unit (either positive or negative).

Example with negative terminal connected to ground



Steps

1. Ensure the power is off on all power supplies.
2. Choose a master and a slave unit(s).
3. Connect the analog connectors for the master and slave units as shown above.
4. Remove the Output Terminal covers. Page 37
5. Connect the master and slave unit in parallel as shown above.
6. Reattach the terminal covers. Page 37

Note

Ensure the load cables have sufficient current capacity. Page 35

The load wires and remote sense wires should use twisted-paired wiring of the shortest possible length.

Master-Slave Parallel Operation

Master-Slave Configuration

Before using the power supplies in parallel, the master and slave units need to be configured.

Steps

1. Configure the OVP, OCP and ULV settings for the master unit. Page 44

2. For each unit, hold the Function key while turning the power on to enter the power on configuration settings.

3. Configure F-93 (Master/Slave) setting for each master/slave unit. Page 94

Unit	F-93
Independent (default setting)	0
Master unit with 1 slave in parallel	1
Master unit with 2 slaves in parallel	2
Master unit with 3 slaves in parallel	3
Slave (parallel)	4

4. Cycle the power on the units (reset the power).

Note

Configuration settings can be checked on both the master and slave units by pressing the Function key and checking F-93.

Only the Master OVP, OCP and UVL settings are used for protection. Slave protection levels are disregarded.

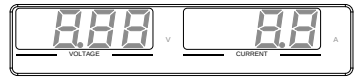
OHP works independently for each unit.

Master-Slave Operation	Only operate the power supplies in parallel if the units are configured correctly.

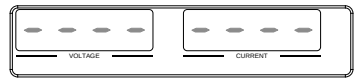
Steps

1. Turn on the master and slave units. The slave unit(s) will show a blank display.

Master unit

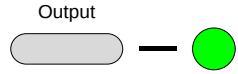


Slave units



2. Operation of all units is controlled via the master unit. Operation of the master unit is the same as for a single unit. See the Basic Operation chapter. Page 44.

3. Press the Output key to begin. The output LED will become lit.



⚠ Caution	Only operate the power supplies in parallel if using units of the same model number.
⚠ Note	The panel controls are disabled on slave units, including the output key. On slave units, only the Function key can be used to view the current settings.

Master-Slave Parallel Calibration

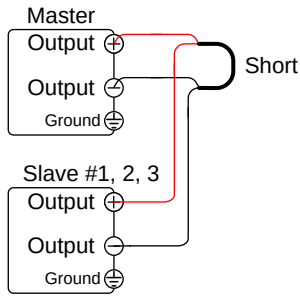
Master-Slave Configuration

The F-16 function setting can be used to calibrate the output of T3PS units connected in parallel.

If you feel the accuracy is not good enough when you measure the accuracy in parallel mode, the parallel calibration can be used to get better measurement accuracy.

Steps

1. Short all the terminals together. This is best accomplished by connecting the master and all the slave units in parallel and then shorting the output terminals.



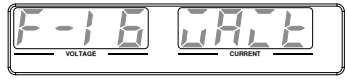
2. Connect the slave units to the master unit using the analog control connectors as described previously. Page 64

3. Configure F-93 (Master/Slave) setting for each master/slave unit, as described previously. Page 66

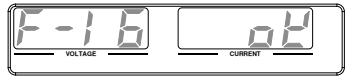
4. Cycle the power on the units (reset the power).

5. On the master unit, set F-16 (Auto Calibration Parallel Control) to 2 to turn on the parallel calibration. Calibration will begin immediately. Page 85

6. Whilst calibration is being performed, *WAIT* will be displayed on the master screen. Calibration will take a few moments.



7. When the calibration has finished, *OK* will be displayed on the master screen.



8. Remove the shorts from the terminals, and proceed with parallel operation.

Note

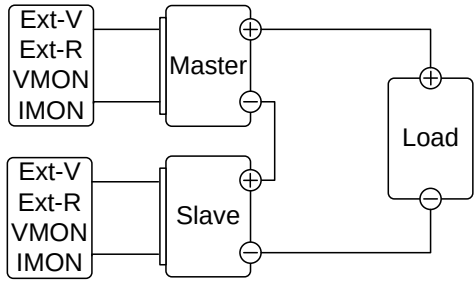
When performing parallel calibration, make sure the terminals are connected with cables or bus bars that are able to withstand the combined current capacity of all the units in parallel.

Master-Slave Series Overview

Background

When connecting T3PS power supplies in series, up to 2 units can be used in series and all units must be of the same model. When operated in series, the power supplies can be used to increase the voltage output or setup the power supplies to output both positive and negative polarities. Unlike with the parallel operation, the series operation does not require any special configuration as each power supply is operated and controlled individually.

When the units are used in series, a number of precautions and limitations apply. Please read this overview before operating the power supplies in series.



Limitations

Display

- Master and slave units display both the current and the voltage. The total voltage is the sum of the units.

OVP/OCP/UVL

- OVP, OCP and UVL level for each unit must be set separately.
- The OVP and OCP protections are tripped independently on the master and slave.

Remote monitoring

- Voltage monitoring (VMON) and current monitoring (IMON) should be performed on both units.
- The VMON voltage represents the voltage of that particular unit.

Remote Sense

- Please see the voltage sense chapter for details, page 54.

External Voltage and Resistance Control

- Voltage/Resistance controlled remote control should be used on both units separately.
- The full scale voltage (in series) is equivalent to the maximum external voltage or resistance.

Slew Rate

- The slave rate should be set for both units.

Internal Resistance

- The internal resistance should be set for both units.

Bleeder Control

- The bleeder resistor setting should be set equally on both units.

CAUTION

When using analog control connector to program or measure with T3PS power supplies connected in series, make sure that each unit is separated and floating from each other.

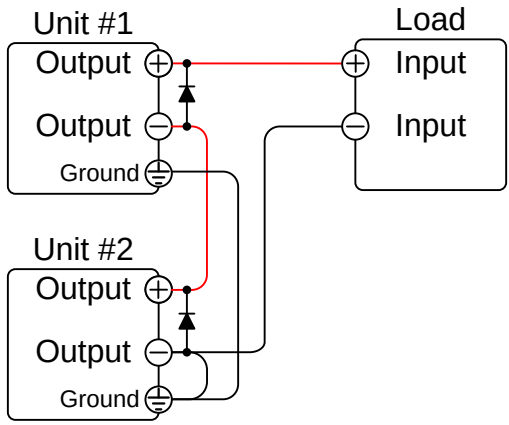
WARNING

When T3PS power supplies are connected in series and the load or one of the output terminals is grounded, no point on the output shall be more than ±600VDC above or below chassis ground.

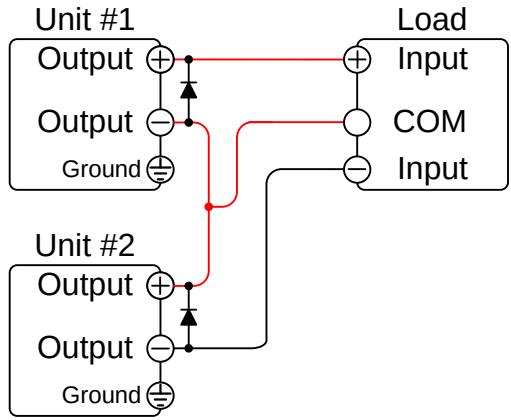
Series Connection

If using the T3PS in series, please be aware that each unit acts independently and thus there are no special communication buses for serial connections.

Series Connection to increase Voltage Output



Series Connection to Output Positive and Negative Polarity



Note: The output reference ground (COMMON) can be grounded at the power supply side instead of the load, depending on the requirements. Local sensing should be used in this configuration.

Caution

When connecting the units in series, diodes should be connected across each output to prevent reverse voltage.

Steps

1. Ensure the power is off on both power supplies.
2. Connect the master and slave unit in series as shown above to either increase the voltage output or to create a positive and negative output. Remember that how the units are grounded depends on the configuration of the series connection.
3. Use diodes across the output terminals to prevent reverse voltage at startup or if one of the units unexpectedly shuts down. Ensure the diodes are rated to withstand the voltage and current output of the power supply.
4. Reattach the terminal cover. Page 37

⚠ Note	Ensure load cables have sufficient current capacity.	Page 35

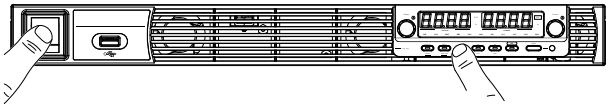
Series Operation

Series Configuration

Before using the power supplies in series, the master and slave units need to be configured.

1. Configure the OVP, OCP and UVL settings for each unit. Page 44

2. For each unit, hold the Function key while turning the power on to enter the power on configuration settings.



3. Make sure each unit is set to Independent (F-93 = 0). When using the power supplies in series, each unit is operated individually, and thus no unit is considered the master or slave. Page 94

Unit	F-93
Independent	0

4. Cycle the power on the units (reset the power).

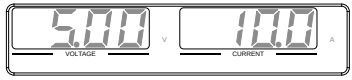
⚠ Note	Configuration settings can be checked for both the master and slave units by pressing the Function key.

Series Operation

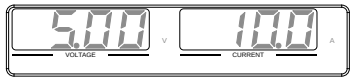
Only operate the power supplies in series if the units are configured correctly.

1. Turn on both units. When connected in series unit will only show the voltage and current of their own unit.

Unit #1

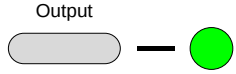


Unit #2



2. Operation of both units is the same as for a single unit. Each unit will only draw as much power as is programmed. Please see the basic operation chapter for details. Page 44

3. Press the Output key on each unit to begin. The output LED will become lit.



CAUTION

Only operate the power supplies in series if using units of the same model number.

Only a maximum of 2 units can be used in series.

CAUTION

Ensure that the insulation capacity of the wiring is sufficient when connected in series. See page 28 for insulation capacity and grounding details.

CONFIGURATION

Configuration Overview

Configuration of the T3PS power supplies is divided into five different configuration settings: Normal Function, USB, LAN, UART, System Configuration Settings, Power ON Configuration, Trigger Input/Output Configuration Settings and Special Function Settings. Power ON Configuration differs from the other settings in that the settings used with Power ON Configuration settings can only be set during power up. The other configuration settings can be changed when the unit is already on. This prevents some important configuration parameters from being changed inadvertently. Power On Configuration settings are numbered F-90 to F-98 and the other configuration settings are numbered F-00 to F-61, F-70 to F-78, F-88 to F-89 and F100 to F122. The Special Function Settings are used for calibration, firmware updated and other special functions; these functions are not supported for end-user use.

Configuration Table

Please use the configuration settings listed below when applying the configuration settings.

Normal Function Settings	Setting	Setting Range
Output ON delay time	F-01	0.00s-99.99s
Output OFF delay time	F-02	0.00s-99.99s
V-I mode slew rate select	F-03	0 = CV high speed priority (CVHS) 1 = CC high speed priority (CCHS) 2 = CV slew rate priority (CVLS) 3 = CC slew rate priority (CVLS)
Rising voltage slew rate	F-04	0.001-0.06V/msec (T3PS062001P) 0.001-0.4V/msec (T3PS40381P) 0.001-0.6V/msec (T3PS60251P)
Falling voltage slew rate	F-05	0.001-0.06V/msec (T3PS062001P) 0.001-0.4V/msec (T3PS40381P) 0.001-0.6V/msec (T3PS60251P)

Rising current slew rate	F-06	0.001-2A/msec (T3PS062001P) 0.001-0.38A/msec (T3PS40381P) 0.001-0.25A/msec (T3PS60251P)
Falling current slew rate	F-07	0.001-2A/msec (T3PS062001P) 0.001-0.38A/msec (T3PS40381P) 0.001-0.25A/msec (T3PS60251P)
Internal resistance setting	F-08	0-0.03Ω (T3PS062001P) 0-1.053Ω (T3PS40381P) 0-2.4Ω (T3PS60251P)
Bleeder circuit control	F-09	0 = OFF, 1 = ON, 2 = AUTO
Buzzer ON/OFF control	F-10	0 = OFF, 1 = ON
OCP Delay Time	F-12	0.1-2.0 sec
Current Setting Limit (I-Limit)	F-13	0 = OFF, 1 = ON
Voltage Setting Limit (V-Limit)	F-14	0 = OFF, 1 = ON
Display memory parameter when recalling (M1, M2, M3)	F-15	0 = OFF, 1 = ON
Auto Calibration Parallel Control	F-16	0 = Disable, 1 = Enable, 2 = Execute Parallel Calibration and set to Enable. Note: Must be a short between each unit before starting.
Measurement Average Setting	F-17	0 = Low, 1 = Middle, 2 = High
Alarm Recovery and Output Status	F-18	0 = Safe Mode, 1 = Force Mode
Lock Mode	F-19	0:Lock Panel, Allow Output OFF 1:Lock Panel, Allow Output ON/OFF
USB Settings		
Show front panel USB status	F-20	0 = None, 1 = Mass Storage
Show rear panel USB status	F-21	0 = None, 1 = Linking to PC
Setup rear USB Speed	F-22	0 = Disable USB, 1 = Full Speed, 2 = Auto Detect Speed
SCPI Emulation	F-26	0 = Teledyne LeCroy, 1 = TDK GEN, 2 = Agilent 5700, 3 = Kikusui PWX, 4 = AMREL SPS

LAN Settings		
Show MAC Address-1	F-30	0x00-0xFF
Show MAC Address-2	F-31	0x00-0xFF
Show MAC Address-3	F-32	0x00-0xFF
Show MAC Address-4	F-33	0x00-0xFF
Show MAC Address-5	F-34	0x00-0xFF
Show MAC Address-6	F-35	0x00-0xFF
LAN Enable	F-36	0 = OFF, 1 = ON
DHCP	F-37	0 = OFF, 1 = ON
IP Address-1	F-39	0-255
IP Address-2	F-40	0-255
IP Address-3	F-41	0-255
IP Address-4	F-42	0-255
Subnet Mask-1	F-43	0-255
Subnet Mask-2	F-44	0-255
Subnet Mask-3	F-45	0-255
Subnet Mask-4	F-46	0-255
Gateway-1	F-47	0-255
Gateway-2	F-48	0-255
Gateway-3	F-49	0-255
Gateway-4	F-50	0-255
DNS address -1	F-51	0-255
DNS address -2	F-52	0-255
DNS address-3	F-53	0-255
DNS address-4	F-54	0-255
Socket Server Enable/Disable	F-57	0 = Disable, 1 = Enable
Show Socket Server Port	F-58	No setting
UART Settings		
UART Mode	F-70	0 = Disable UART, 1 = RS232, 2 = RS485
UART Baud Rate	F-71	0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200
UART Data Bits	F-72	0 = 7 bits, 1 = 8 bits
UART Parity	F-73	0 = None, 1 = Odd, 2 = Even
UART Stop Bit	F-74	0 = 1 bit, 1 = 2 bits
UART TCP	F-75	0 = SCPI, 1 = Emulation mode

UART Address (For multi-unit remote control)	F-76	00-30
UART Multi-Drop control	F-77	0 = Disable, 1 = Master, 2 = Slave, 3 = Display information
UART Multi-Drop status	F-78	Displayed parameter: AA-S AA: 00-30 (Address), S: 0-1(Off-line/On-line status).
System Settings		
Factory Set Value	F-88	0 = None 1 = Return to factory default settings
Show Version	F-89	0, 1 = Version 2, 3, 4, 5 = Build date (YYYYMMDD) 6, 7 = Keyboard CPLD 8, 9 = Analog Board CPLD A, B = Analog Board FPGA C, D, E, F = Kernel Build (YYYYMMDD) G, H = Test Command Version I, J, K, L = Test Command Build (YYYYMMDD) M,N = Reserved O,P = Option module
Power On Configuration Settings*		
CV Control	F-90	0 = Control by Local 1 = Control by External Voltage 2 = Control by External Resistor - Rising  3 = Control by External Resistor - Falling  4 = Control by Isolated Board
CC Control	F-91	0 = Control by Local 1 = Control by External Voltage 2 = Control by External Resistor - Rising  3 = Control by External Resistor - Falling  4 = Control by Isolated Board

Output Status when Power ON	F-92	0 = Safe Mode (Always OFF), 1 = Force Mode (Always ON), 2 = Auto Mode (Status before last time power OFF)
Master/Slave Configuration	F-93	0 = Independent 1 = Master with 1 slave in parallel 2 = Master with 2 slaves in parallel 3 = Master with 3 slaves in parallel 4 = Slave (parallel)
External Output Logic	F-94	0 = High ON, 1 = Low ON
Monitor Voltage Select	F-96	0 = 5V , 1 = 10V
Control Range	F-97	0 = 5V [5kΩ], 1 = 10V [10kΩ]
External Output Control Function	F-98	0 = OFF, 1 = ON
Trigger Input and Output Configuration Settings		
Trigger Input Pulse Width	F100	0-60ms. 0 = trigger controlled by trigger level.
Trigger Input Action	F102	0 = None 1 = Output ON/OFF (refer to F103) 2 = Setting (refer to F104 & F105) 3 = Memory (refer to F106)
Output State When Receiving Trigger	F103	0 = OFF 1 = ON
Apply Voltage Setting on Trigger	F104	0-rated voltage (only applicable when F102 =2)
Apply Current Setting on Trigger	F105	0-rated current (only applicable when F102 =2)
Recall memory number	F106	1-3 (M1-M3)
Trigger Output Pulse Width	F120	0-60ms. 0 = trigger output is set to the active level, not pulse width.
Trigger Output Level	F121	0 = LOW, 1 = HIGH (If F120 = 0)
Trigger Source	F122	0 = None 1 = Switching the output on or off 2 = Changing a setting 3 = Recalling a memory
Special Function Settings*		
Calibration	F-00	0000-9999

⚠ *Note	Power On Configuration settings can only be set during power up. They can, however, be viewed under normal operation.

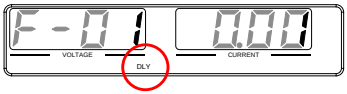
Normal Function Settings

Output ON Delay Time

Delays turning the output on for a designated amount of time. The Delay indicator will light when the Delay time is not 0.

Note: The Output ON Delay Time setting has a maximum deviation (error) of 20ms.

The Output ON Delay Time setting is disabled when the output is set to external control.



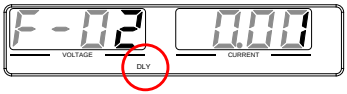
F-01 0.00s-99.99s

Output OFF Delay Time

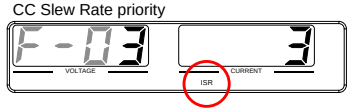
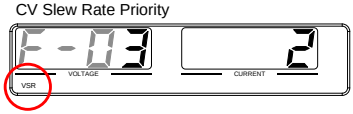
Delays turning the output off for a designated amount of time. The Delay indicator will light when the Delay time is not 0.

Note: The Output OFF Delay Time setting has a maximum deviation (error) of 20ms.

The Output OFF Delay Time setting is disabled when the output is set to external control.



F-02 0.00s-99.99s

V-I Mode	Selects High Speed Priority or Slew Rate Priority for CV or CC mode. The voltage or current slew rate can only be edited if CC/CV Slew Rate Priority is selected. The ISR indicator will be lit for CC Slew Rate Priority and the VSR indicator will be lit for CV Slew Rate Priority. Note: CC and CV Slew Rate Priority mode are disabled when voltage/current output is set to external control. CC Slew Rate priority  CV Slew Rate Priority  F-03 0 = CV high speed priority 1 = CC high speed priority 2 = CV slew rate priority 3 = CC slew rate priority
Rising Voltage Slew Rate	Sets the rising voltage slew rate. Only applicable if V-I Mode is set to CV Slew Rate Priority. F-04 0.001-max. V/msec
Falling Voltage Slew Rate	Sets the falling voltage slew rate. Only applicable if V-I Mode is set to CV Slew Rate Priority. F-05 0.001-max. V/msec
Rising Current Slew Rate	Sets the rising current slew rate. Only applicable if V-I Mode is set to CC Slew Rate Priority. F-06 0.001-max. A/msec
Falling Current Slew Rate	Sets the falling current slew rate. Only applicable if V-I Mode is set to CC Slew Rate Priority. F-07 0.001-max. A/msec

Internal Resistance Settings	Sets the internal resistance of the power supply.	
	F-08	0.000Ω-X.XXXΩ (Where X.XXX = Rating Voltage / Rating Current)
Bleeder Control	Bleeder control turns ON/OFF the bleeder resistor. Bleeder resistors discharge the filter capacitors after power is turned off as a safety measure.	
	F-09	0 = OFF, 1 = ON, 2 = AUTO
Buzzer ON/OFF	Turns the buzzer sound on or off. The buzzer is associated with alarm sounds and keypad entry sounds.	
	F-10	0 = OFF, 1 = ON
OCP Delay Time	Sets the OCP delay time. This parameter will delay the amount of time it takes to trigger the over current protection. This function can be useful to prevent current overshoot from triggering OCP.	
	F-12	0.1-2.0 sec
Current Setting Limit (I-limit)	Turns the current setting limit (I-limit) on or off. Turning this function on will prevent you from accidentally setting the current limit above the set OCP level.	
	F-13	0 = OFF, 1 = ON
Voltage Setting Limit	Turns the voltage setting limit (V-limit) on or off. Turning this function on will prevent you from accidentally setting the voltage limit above the OVP level.	
	F-14	0 = OFF 1 = ON
Display Memory Parameter	Displays which memory setting is recalled (M1, M2 or M3) when recalling a setup.	
	F-15	0 = OFF, 1 = ON

Auto Calibration Parallel Control	This function performs offset calibration for parallel control. There must be a short between each unit before starting the calibration. See page 68 for details.	
	F-16	0 = Disable, 1 = Enable, 2 = Execute Parallel Calibration and set to Enable
Measurement Average Setting	Determines the level of smoothing for the average setting.	
	F-17	0 = Low, 1 = Middle, 2 = High
Alarm Recovery and Output Status	Set the output status when OHP, FAN and AC-Fail alarm be cleared.	
	F-18	0 = Safe Mode, 1 = Force Mode
Lock Mode	When the front panel is locked, the Lock Mode function determines the behavior of the Output key.	
	F-19	0: Lock Panel, Allow Output OFF 1: Lock Panel, Allow Output ON/OFF

Interface Configuration Settings

USB Settings

Show Front Panel USB Status	Displays the front panel USB-A port state. This setting is not configurable.	
	F-20	0 = None, 1 = Mass Storage
Show Rear Panel USB Status	Displays the rear panel USB-B port state. This setting is not configurable.	
	F-21	0 = None, 1 = Linking to PC

Setup Rear USB Speed	Sets the rear panel USB speed or turns the rear USB port off.	
	F-22	0 = Disable USB, 1 = Full Speed, 2 = Auto Detect Speed
SCPI Emulation	Sets the SCPI emulation mode. The emulation modes allow you to emulate the remote commands of legacy equipment that is used in a test environment. Parameter 2, 3 and 4 are only supported as use stand alone.	
	F-26	0 = Teledyne LeCroy, 1 = TDK GEN, 2 = Agilent N5700, 3 = Kikusui PWX, 4 = AMREL SPS

LAN Settings

Show MAC Address-1-6	Displays the MAC address in 6 parts. This setting is not configurable.	
	F-30-F-35	0x00-0xFF
LAN	Turns LAN on or off.	
	F-36	0 = OFF, 1 = ON
DHCP	Turns DHCP on or off.	
	F-37	0 = OFF, 1 = ON
IP Address-1-4	Sets the default IP address. IP address 1-4 splits the IP address into four sections. (F-39 : F-40 : F-41 : F-42) (0-255 : 0-255 : 0-255 : 0-255)	
Subnet Mask 1-4	Sets the subnet mask. The subnet mask is split into four parts. (F-43 : F-44 : F-45: F-46) (0-255 : 0-255 : 0-255 : 0-255)	

Gateway 1-4	Sets the gateway address. The gateway address is split into 4 parts. (F-47 : F-48 : F-49 : F-50) (0-255 : 0-255 : 0-255 : 0-255)	
DNS Address 1-4	Sets the DNS address. The DNS address is split into 4 parts. (F-51 : F-52 : F-53 : F-54) (0-255 : 0-255 : 0-255 : 0-255)	
Socket Server Enable/Disable	Enables web socket connections.	
	F-57	0 = Disable, 1 = Enable
Show Socket Server	Shows the socket server port.	
	F-58	No setting

UART Settings

UART Mode	Sets the UART mode or disables UART.	
	F-70	0 = Disable UART, 1 = RS232, 2 = RS485
UART Baud Rate	Sets the UART baud rate.	
	F-71	0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200
UART Data Bits	Sets the number of data bits.	
	F-72	0 = 7 bits, 1 = 8 bits
UART Parity	Sets the parity.	
	F-73	0 = None, 1 = Odd, 2 = Even
UART Stop Bit	Sets the number of stop bits.	
	F-74	0 = 1 bit, 1 = 2 bits

UART TCP	UART transmission control protocol TCP settings. This is used primarily for multi-unit remote control, see page 126.	
	F-75	0 = SCPI, 1 = Emulation mode
UART Address (For multi-unit remote control)	UART Address: this is used to set the address of a unit when using multi-unit remote control, see page 126 for details.	
	F-76	0-30
UART Multi-Drop control	Sets the master/slave/display-information parameters of a unit when using Multi-Drop remote control, see page 126 for details.	
	F-77	0 = Disable, 1 = Master, 2 = Slave, 3 = Display Information
UART Multi-Drop status	Displays the Multi-Drop status on the master unit for each slave unit belonging to the Multi-Drop bus, see page 126 for details.	
	F-78	Displayed parameter: AA-S AA: 00-30 (Address), S: 0-1 (Off-line/On-line status).

System Settings

Factory Default Configuration	Returns the T3PS to the factory default settings. See page 140 for a list of the default settings.	
	F-88	0 = None, 1 = Factory Default.
Show Version	Displays the T3PS version number, build date, keyboard CPLD, analog board CPLD, analog board FPGA, kernel build date, test command version and test command build date.	
	F-89	0-XX = Version (1/2) 1-XX = Version (2/2) 2-XX = Build year (1/2) 3-XX = Build year (2/2) 4-XX = Build month

5-XX = Build day
6-XX = Keyboard CPLD (1/2)
7-XX = Keyboard CPLD (2/2)
8-XX = Analog board CPLD (1/2)
9-XX = Analog board CPLD (2/2)
A-XX = Analog board FPGA (1/2)
B-XX = Analog board FPGA (2/2)
C-XX = Kernel build year (1/2)
D-XX = Kernel build year (2/2)
E-XX = Kernel build month
F-XX = Kernel build day
G-XX = Test command version (1/2)
H-XX = Test command version (2/2)
I-XX = Test command build year (1/2)
J-XX = Test command build year (2/2)
K-XX = Test command build month
L-XX = Test command build day
M-XX = Reserved (1/2)
N-XX = Reserved (2/2)
O-XX = Option module (1/2)
P-XX = Option module (2/2)

Power On Configuration Settings

CV Control

Sets the constant voltage (CV) control mode between local and external voltage/resistance control. For external voltage control, see page 101 (External Voltage Control of Voltage Output) and page 106 (External Resistance Control of Voltage Output).

F-90
0= Control by local
1 = Control by external voltage
2 = Control by external resistor - rising
3 = Control by external resistor- falling
4 = Control by isolated board

CC Control	Sets the constant current (CC) control mode between local and external voltage/resistance control. For details on external voltage control, see page 104 (External Voltage Control of Current Output) and 108 (External Resistance Control of Current Output).	
	F-91	0 = Control by local 1 = Control by external voltage 2 = Control by external resistor - rising  3 = Control by external resistor- falling  4 = Control by isolated board
Output Status when Power-ON Output	Sets the power supply to turn the output on or off at power up.	
	F-92	0 = Safe Mode (Always OFF), 1 = Force Mode (Always ON), 2 = Auto Mode (Status before last time Power OFF)
Master/Slave Configuration	Sets the power supply as master or slave. See the parallel/series operation for details, page 60.	
	F-93	0 = Independent 1 = Master with 1 slave in parallel 2 = Master with 2 slaves in parallel 3 = Master with 3 slaves in parallel 4 = Slave (parallel)
External Output Logic	Sets the external logic as active high or low for analog control pin 19.	
	F-94	0= High ON, 1 = Low ON
Monitor Voltage Select	Selects the voltage monitor output range.	
	F-96	0 = 5V, 1 = 10V

Control Range	Selects the external control range for external voltage or resistance control.	
	F-97	0 = 5V [5kΩ], 1 = 10V [10kΩ]
External Output Control Function	Set external output control on or off.	
	F-98	0 = OFF, 1 = ON

Trigger Input and Output Configuration Settings

Trigger Input Width	Sets the trigger input width in milliseconds. If the width is set to 0 then the input trigger is controlled by the input active level.	
	F100	0-60ms. 0 = trigger controlled by trigger level.
Trigger Input Action	Determines what actions are performed when a trigger is received.	
	F102	0 = None 1 = Output ON/OFF (refer to F103) 2 = Setting (refer to F104 & F105) 3 = Memory (refer to F106)
Output State When Receiving Trigger	Applies the output state when receiving a trigger.	
	F103	0 = OFF 1 = ON
Apply Voltage Setting on Trigger	Applies the setting voltage when a trigger is received. Only applicable when F102 = 2.	
	F104	0-the rated voltage
Apply Current Setting on Trigger	Applies the setting current when a trigger is received. Only applicable when F102 = 2.	
	F105	0-the rated current

Recall memory number	Recalls the selected memory when a trigger is received.	
	F106	1 = M1 2 = M2 3 = M3
Trigger Output Pulse Width	Trigger output pulse width. A setting of 0 will output the active level.	
	F120	0-60ms. 0 = output active level
Trigger Output Level	Sets the active level of the output trigger if the trigger output pulse width (F120) = 0.	
	F121	0 = LOW 1 = HIGH
Trigger Source	Sets the trigger source.	
	F122	0 = None 1 = Switching the output on/ off 2 = Changing a setting 3 = Recalling a memory

Special Function

Special Function	The special function setting is used to access calibration, firmware updates and other special functions. The special function setting has a password that is used to access the special function menu. The password used determines which function is accessed. Please see your distributor for details.	
	F-00	0000-9999

Setting Normal Function Settings

The Normal Function settings, F-01-F-61, F-70-F-78, F-88-F-89 and F100-F122 can be easily configured with the Function key.

- Ensure the load is not connected.
- Ensure the output is off.
- Function settings F-90-98 can only be viewed.

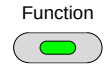
Note

Function setting F-89 (Show Version) can only be viewed, not edited.

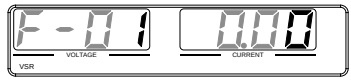
Configuration settings F-90-F-98 cannot be edited in the Normal Function settings. Use the Power On Configuration settings. See page 94 for details.

Steps

1. Press the Function key. The function key will light up.

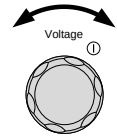


2. The display will show F-01 on the left and the configuration setting for F-01 on the right.

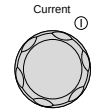


3. Rotate the Voltage knob to change the F setting.

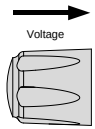
   Range F-00-F-61, F-70-F-78, F-88-F-98, F100-F122

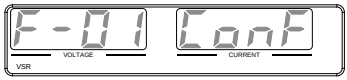


4. Use the Current knob to set the parameter for the chosen F setting.



Press the Voltage knob to save the configuration setting. ConF will be displayed when it is configuring.





Exit

Press the Function key again to exit the configuration settings. The Function key light will turn off.

Setting Power On Configuration Settings

Background

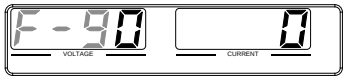
The Power On Configuration settings can only be changed during power up to prevent the configuration settings being inadvertently changed.

- Ensure the load is not connected.
- Ensure the power supply is off.

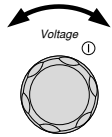
Steps

1. Hold the Function key whilst turning the power on.

2. The display will show F-90 on the left and the configuration setting for F-90 on the right.

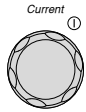


3. Rotate the Voltage knob to change the F setting.

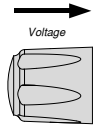


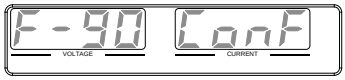
Range F-90-F-98

4. Use the Current knob to set the parameter for the chosen F setting.



Press the Voltage knob to save the configuration setting. ConF will be displayed when it is configuring.





Exit

Cycle the power to save and exit the configuration settings.

ANALOG CONTROL

The Analog Control chapter describes how to control the voltage or current output using an external voltage or resistance, monitor the voltage or current output as well as remotely turning off the output or shutting down the power supply.

Analog Remote Control Overview

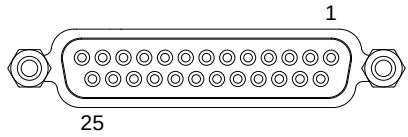
The T3PS power supply series have a number of analog control options. The Analog Control connectors are used to control output voltage and current using external voltage or resistance. The power supply output can also be controlled using external switches.

Analog Control Connector Overview

Overview

The Analog Control Connector is a 25 pin connector that can be used with the ARC (analog remote control) kit for wiring connections. The connector is used for all analog remote control. The pins used determine what remote control mode is used.

Pin Assignment



Pin name	Pin number	Description
Status COM1	1	This is the common line for the status signal pins 2 to 3 and 14 to 16.
CV Status	2	This line is on when the T3PS is in CV mode (photocoupler open collector output)[1].
CC Status	3	This line is on when the T3PS is in CC mode (photocoupler open collector output)[1].
TRIG IN	4	Trigger signal input line (for test script only).
Status COM2	5	This is the common line for status signal pins 4 and 17.
N.C.	6	Not connected.
Shutdown	7	Output shutdown control line. The output is turned off when a low level TTL signal is applied.
PRL IN-	8	Negative input line for master-slave parallel operation.
PRL IN+	9	Positive input line for master-slave parallel operation.

Alarm Clear	10	Alarm clear line. Alarms are cleared when a low level TTL signal is applied.
A COM	11	This is the common line for the external signal pins 7 to 10, 12, 13, 19, 21, 22, 24, and 25. It is connected internally to the negative output.
PRL OUT+	12	Positive output line for master-slave parallel operation.
Current Sum	13	Current signal line for master-slave parallel operation.
Alarm Status	14	On when a protection function (OVP, HW OVP, OCP, OHP, FAN or SEN) has been activated or when an output shutdown signal is being applied (open-collector photocoupler output).[1]
PWR ON Status	15	Outputs a low level signal when power is turned on. (open-collector photocoupler output).[1]
OUT ON Status	16	On when the output is on (open-collector photocoupler output).[1]
TRIG OUT	17	Trigger signal output line (for test script only).
N.C.	18	Not connected.
OUT ON/OFF CONT	19	Output on/off line. On when set to a low level TTL signal, Off when set to a high level TTL signal. (F-94: 1) On when set to a high level TTL signal, Off when set to a low level TTL signal. (F-94: 0)
A COM	20	This is the common line for the external signal pins 7 to 10, 12, 13, 19, 21, 22, 24, and 25. It is connected internally to the negative output.
EXT-V/R CC CONT	21	This line uses an external voltage or resistance to control the output current. External voltage control (F-91: 1); External resistor control (F-91: 2, F-91: 3). 0 to 5V or 0 to 5kΩ; 0 % to 100 % of the rated output current (F-97: 0). 0 to 10V or 0 to 10kΩ; 0 % to 100 % of the rated output current (F-97: 1).

EXT-V/R CV CONT	22	This line uses an external voltage or resistance to control the output voltage. External voltage control (F-90: 1); External resistor control (F-90: 2, F-90: 3). 0 to 5V or 0 to 5kΩ; 0 % to 100 % of the rated output voltage (F-97: 0). 0 to 10V or 0 to 10kΩ; 0 % to 100 % of the rated output voltage (F-97: 1).
A COM	23	This the common line for the external signal pins 7 to 10, 12, 13, 19, 21, 22, 24, and 25. It is connected internally to the negative output.
I MON	24	Output current monitor. 0 % to 100 % of the rated output current is generated as a voltage between 0V and 5V (F-96: 0) or a voltage between 0V and 10V (F-96: 1).
V MON	25	Output voltage monitor. 0 % to 100 % of the rated output voltage is generated as a voltage between 0V and 5V (F-96: 0) or a voltage between 0V and 10V (F-96: 1).

1. Open collector output: 30V max, 8mA max.

   The common line for the status pins is floating (isolated voltage of 60 V or less). It is isolated from the control circuit.

External Voltage Control of Voltage Output

Background

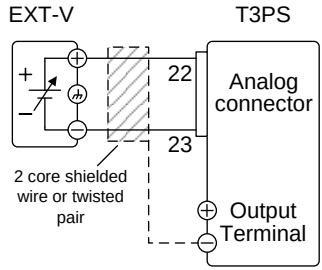
External voltage control of the voltage output is accomplished using the analog control connector on the rear panel. There are two external voltage control ranges, 0-5V and 0-10V, depending on the F-97 configuration. See page 91 for details.

For 0-10V:
Output voltage = full scale voltage x (external voltage/10)

For 0-5V:
Output voltage = full scale voltage x (external voltage/5)

Connection

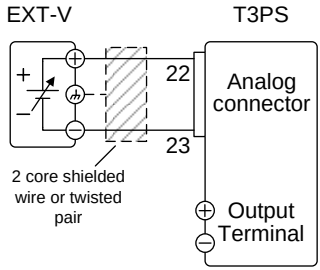
When connecting the external voltage source to the analog connector, use shielded or twisted paired wiring.



- Pin23 → EXT-V (-)
- Pin22 → EXT-V (+)
- Wire shield → negative (-) output terminal

Connection- alt. shielding

If the wire shield needs to be grounded at the voltage source (EXT-V), then the shield cannot also be grounded at the negative (-) terminal output of the T3PS power supply. This would short the output.



- Pin23 → EXT-V(-)
- Pin22 → EXT-V(+)
- Wire shield → EXT-V ground (GND)

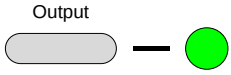
Panel operation

1. Connect the external voltage according to the connection diagrams above.

2. Set the F-90 power on configuration setting to 1 (CV control – Ext voltage). Page 94
   - Be sure to cycle the power after the power on configuration has been set.

3. Press the Function key and confirm the new configuration settings (F-90=1).

4. Press the Output key. The voltage can now be controlled with the External voltage.



Note	The input impedance for external voltage control is 1MΩ. Use a stable voltage supply for the external voltage control.
Note	CV and CC Slew Rate Priority are disabled for V-I mode (F-03) when using external voltage control. See the normal function settings on page 82.
CAUTION	Ensure no more than 10.5V (F-97 = 1) or 5.25 (F-97 = 0) volts are input into the external voltage input. Ensure the voltage polarity is correct when connecting the external voltage.

External Voltage Control of Current Output

Background

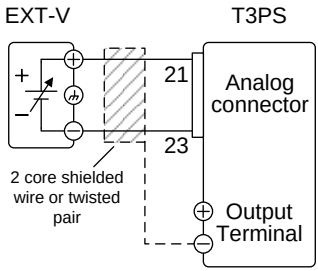
External voltage control of the current output is accomplished using the analog control connector on the rear panel. There are two external voltage control ranges, 0-5V and 0-10V, depending on the F-97 configuration. See page 91 for details.

For 0-10V:
Output current = full scale current x (external voltage/10)

For 0-5V:
Output current = full scale current x (external voltage/5)

Connection

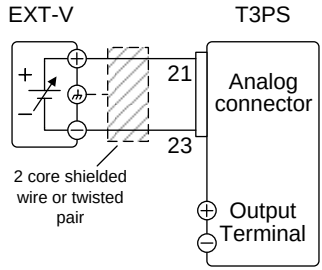
When connecting the external voltage source to the connectors, use shielded or twisted paired wiring.



- Pin23 → EXT-V (-)
- Pin21 → EXT-V (+)
- Wire shield → negative (-) output terminal

Connection- alt. shielding

If the wire shield needs to be grounded at the voltage source (EXT-V), then the shield cannot also be grounded at the negative (-) terminal output of the T3PS power supply. This would short the output.



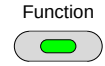
- Pin23 → EXT-V (-)
- Pin21 → EXT-V (+)
- Wire shield → EXT-V ground (GND)

Steps

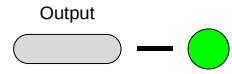
1. Connect the external voltage according to the connection diagrams above.

2. Set the F-91 power on configuration setting to 1 (CC control – Ext voltage). Page 94
   - Be sure to cycle the power after the power on configuration has been set.

3. Press the Function key and confirm the new configuration settings (F-91=1).



4. Press the Output key. The current can now be controlled with the External voltage.



Note	The input impedance for external voltage control is 1MΩ. Use a stable voltage supply for the external voltage control.
Note	CV and CC Slew Rate Priority are disabled for V-I mode (F-03) when using external voltage control. See the normal function settings on page 82.
CAUTION	Ensure the voltage polarity is correct when connecting the external voltage. Ensure no more than 10.5V (F-97 = 1) or 5.25 (F-97 = 0) volts are input into the external voltage input.

External Resistance Control of Voltage Output

Background	External resistance control of the voltage output is accomplished using the analog control connector on the rear panel. There are two external resistance control ranges, 0-5kΩ and 0-10kΩ, depending on the F-97 configuration. See page 91 for details. The output voltage (0 to full scale) can be controlled with the external resistance rising 0kΩ-5kΩ/0kΩ-10kΩ or falling 5kΩ-0kΩ/10kΩ-0kΩ. Rising: For 0kΩ-10kΩ: Output voltage = full scale voltage × (external resistance/10) For 0kΩ-5kΩ: Output voltage = full scale voltage × (external resistance/5)

Falling:
For 10kΩ-0kΩ: Output voltage = full scale voltage × ([10-external resistance]/10)

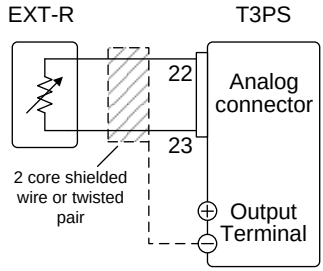
For 5kΩ-0kΩ: Output voltage = full scale voltage × ([5-external resistance]/5)

Note

The falling resistance configuration is recommended for safety reasons. In the event that the cables become accidentaly disconnected (high Ω), the voltage output will drop to zero. Under similar circumstances using the rising resistance configuaration, an unexpectedly high voltage would be output.

If switches are used to switch between fixed resistances, use switches that avoid creating open circuits. Use short-circuit or continous resistance switches.

Connection



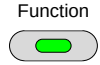
- Pin22 → EXT-R
- Pin23 → EXT-R
- Wire shield → negative (-) output terminal

Steps

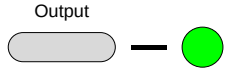
1. Connect the external resistance according to the connection diagrams above.

2. Set the F-90 (CV Control) configuration settings to 2 for Ext-R rising or 3 for Ext-R falling. Page 94
- Be sure to cycle the power after the power on configuration has been set.

3. Press the Function key and confirm the new configuration settings (F-90=2 or 3).



4. Press the Output key. The voltage can now be controlled with the External resistance.



Note

Ensure the resistor(s) and cables used exceed the isolation voltage of the power supply. For example: insulation tubes with a withstand voltage higher than the power supply can be used.

When choosing an external resistor ensure the resistor can withstand a high degree of heat.

Note

CV and CC Slew Rate Priority are disabled for V-I mode (F-03) when using external resistance control. See the normal function settings on page 82.

External Resistance Control of Current Output

Background

External resistance control of the current output is accomplished using the analog connector on the rear panel.

There are two external resistance control ranges, 0-5kΩ and 0-10kΩ, depending on the F-97 configuration. See page 91 for details.

The output current (0 to full scale) can be controlled with the external resistance rising 0kΩ-5kΩ/0kΩ-10kΩ or falling 5kΩ-0kΩ/10kΩ-0kΩ.

Rising:
For 0kΩ-10kΩ: Output current = full scale current × (external resistance/10)

For 0kΩ-5kΩ: Output current = full scale current × (external resistance/5)

Falling:
For 10kΩ-0kΩ: Output current = full scale current × ([10-external resistance]/10)

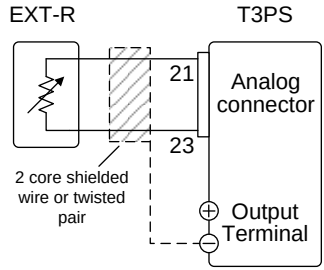
For 5kΩ-0kΩ: Output current = full scale current × ([5-external resistance]/5)

Note

The falling resistance configuration is recommended for safety reasons. In the event that the cables become accidentaly disconnected, the current output will drop to zero (high Ω). Under similar circumstances using the rising configuration, an unexpectedly high current would be output.

If swtiches are used to switch between fixed resistances, use switches that avoid creating open circuits. Use short-circuit or continous resistance switches.

Connection



- Pin21 → EXT-R
- Pin23 → EXT-R
- Wire shield → negative (-) output terminal

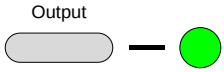
Steps

1. Connect the external resistance according to the connection diagrams above.

2. Set the F-91 (CC Control) configuration settings to 2 for external resistor rising or to 3 for external resistor falling. Page 94
   - Be sure to cycle the power after the power on configuration has been set.

3. Press the Function key and confirm the new configuration settings (F-91 = 2 or 3).

4. Press the Output key. The current can now be controlled with the External resistance.



Note

Ensure the resistor(s) and cables used exceed the isolation voltage of the power supply. For example: insulation tubes with a withstand voltage higher than the power supply can be used.

When choosing an external resistor ensure the resistor can withstand a high degree of heat.

Note

CV and CC Slew Rate Priority are disabled for V-I mode (F-03) when using external resistance control. See the normal function settings on page 82.

External Control of Output

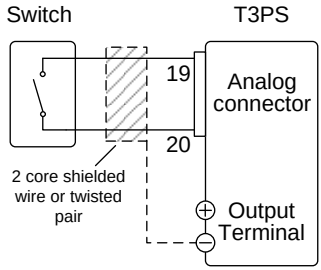
Background

The output can be turned on or off externally using a switch. The analog control connector can be set to turn the output on from a high or low signal. The voltage across pins 19 and 20 are internally pulled up to +5V ±5% @ 500uA with 10kΩ pull-up resistor. A short (closed switch) produces a low signal.

When set to High = On, the output is turned on when the pins 19-20 are open.

When Low = On, the output is turned on when pins 19-20 are shorted.

Connection



- Pin19 → Switch
- Pin20 → Switch
- Wire shield → negative (-) output terminal

Steps

1. Connect the external switch according to the connection diagrams above.

Set F-94 (External output logic) in the power on configuration settings to 0 (High = On) or 1 (Low = On) and set F-98 (External output control function) to 1(On). Page 94

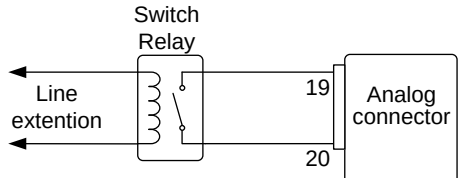
- Be sure to cycle the power after setting the power on configuration settings.

2. Press the Function key and confirm the new configuration settings (F-94 = 0 or 1 and F-98=1).

3. The switch is now ready to set the output on or off.

Note

When using a switch over long distances, please use a switch relay to extend the line from the coil side of the relay.



If a single switch control is to be used for multiple units, please isolate each instrument. This can be achieved by using a relay.

Warning

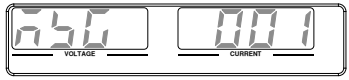
Ensure the cables used and the switch exceed the isolation voltage of the power supply. For example: insulation tubes with a withstand voltage higher than the power supply can be used.

Note

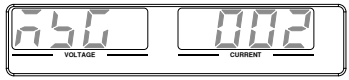
Messages: If F-94 = 0 (High = on) and pin 19 is low (0) “MSG 001” will be displayed on the display.

If F-94 = 1 (Low = on) and pin 19 is high (1) “MSG 002” will be displayed on the display.

Output off (High=on)



Output off (Low=on)



Note

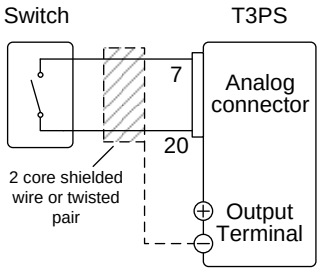
Output ON/OFF Delay Time (F-01, F-02) are disabled when the output is set to external control. See the normal function settings on 82 for details.

External control of Shutdown

Background

The output of the power supplies can be configured to shut down via an external switch. The voltage across pins 7 and 20 are internally pulled to +5V ±5% @ 500uA with 10kΩ pull-up resistor. The output is turned off when a low TTL level signal is applied.

Connection



- Pin7→ Switch
- Pin20 → Switch
- Wire shield → negative (-) output terminal

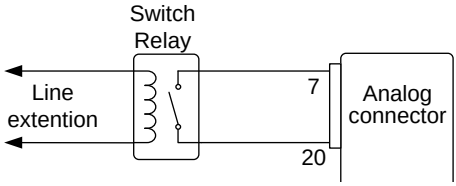
Steps

1. Connect the external switches according to the connection diagrams above.

2. The switch will now shut down the power supply when shorted.

Note

When using a switch over long distances, please use a switch relay to extend the line from the coil side of the relay.



If a single switch control is to be used for multiple units, please isolate each instrument. This can be achieved by using a relay.

Warning

Ensure the cables and switch used exceed the isolation voltage of the power supply. For example: insulation tubes with a withstand voltage higher than the power supply can be used.

Remote Monitoring

The T3PS power supplies have remote monitoring support for current and voltage output. They also support monitoring of operation and alarm status.

External Voltage and Current Monitoring

Background

The analog connector is used to monitor the current (IMON) or voltage (VMON) output.

An output of 0-10V or 0-5V (depending on the configuration) represents the voltage or current output of 0-rated current/voltage output.

- IMON = (current output/full scale) × 10 or 5.
- VMON = (voltage output/full scale) × 10 or 5.

Configuration

The T3PS doesn't need to be configured to use external voltage or current monitoring, however the voltage or current output range does need to be configured. The monitor output voltage can be configured as either 0-10V or 0-5V.

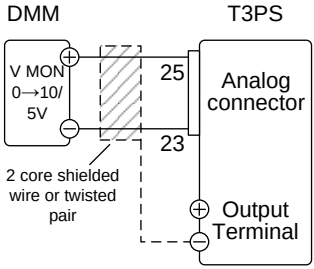
Set F-96 (Monitor Voltage Select) in the power on configuration settings to 0 (5V) or 1 (10V). Page 94

- Be sure to cycle the power after setting the power on configuration settings.

1. Press the Function key and confirm the new configuration settings (F-96 = 0 or 1).

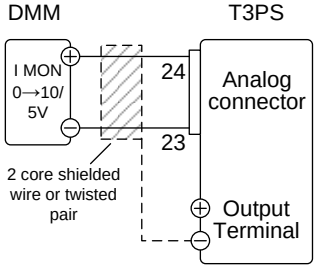
2. An external DMM can now be used to monitor the voltage or current output.

VMON Connection



- Pin25 → Pos (+)
- Pin23 → Neg (-)

IMON Connection



- Pin24 → Pos (+)
- Pin23 → Neg (-)

Note

Maximum current is 5mA. Ensure the sensing circuit has an input impedance greater than 1MΩ.

The monitor outputs are strictly DC and should not be used to monitor analog components such as transient voltage response or ripple etc.

CAUTION

Ensure IMON (pin 24) and VMON (pin 25) are not shorted together. This may cause damage to the unit.

External Operation and Status Monitoring

Background

The analog control connector can also be used to monitor the status operation and alarm status of the instrument.

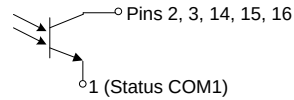
The pins are isolated from the power supply internal circuitry by photo couplers. Status Com1 (Pin 1) and Status Com2 (Pin 5) are photo coupler emitter outputs, whilst pins 2-3, 14-17 are photo coupler collector outputs.

A maximum of 30V and 8mA can be applied to each pin. The Status Com pin is floating with an isolation voltage of 60V.

Pinout

Name and Pin		Description
STATUS COM1	1	Common (photo coupler emitter) for status signals 2, 3, 14, 15 and 16.
CV STATUS	2	Low when CV mode is active.
CC STATUS	3	Low when CC mode is active.
ALM STATUS	14	Low when any of the protection modes are tripped (OVP, OCP, Sense_ALM, OTP_M, AC Fail, OTP_S, Fan_Fail, HW_OVP, and Shutdown). Active low.
PWR ON STATUS	15	Active low.
OUT ON STATUS	16	Low when the output is on.

Schematic

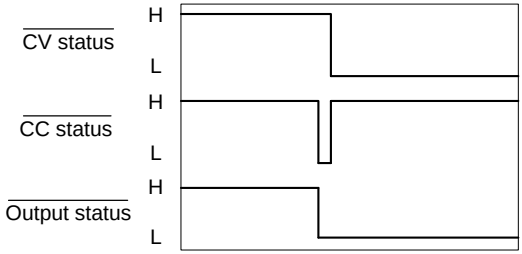


Timing diagrams

Below are 4 example timing diagrams covering a number of scenarios. Note that pins 14-16 are all active low.

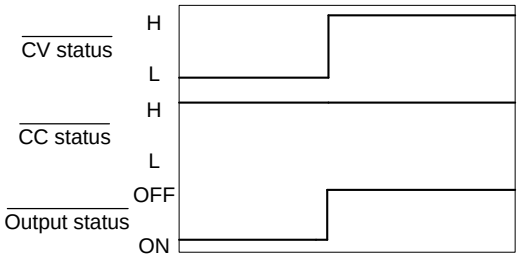
CV MODE: Output turned on

The diagram below shows the timing diagram when the output is turned on when the T3PS is set to CV mode.



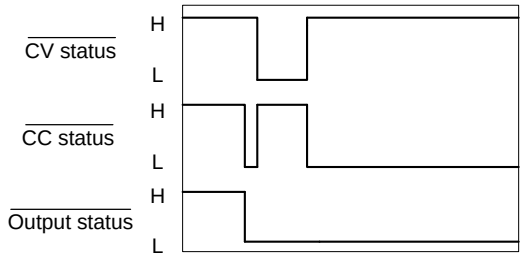
CV MODE: Output turned off

The diagram below shows the output status lines when the output is turned off in CV mode.



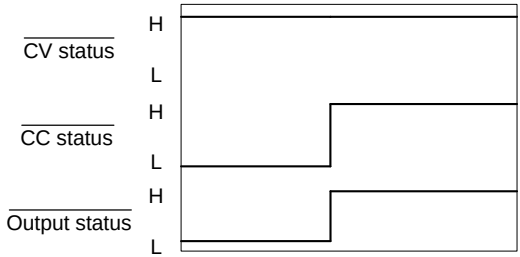
CC MODE: Output turned on

The diagram below shows the timing diagram when the output is turned on when the T3PS is set to CC mode.



CC MODE: Output turned off

The diagram below shows the output status lines when the output is turned off in CC mode.



External Trigger In/Out

Background

Pin 4 is used for the external trigger input and pin 17 is used as the trigger output. Pin 5 is the common for both pins.

The trigger input can be configured to perform an action such as toggling the output on/off, load a memory setting or apply a voltage/current setting when a trigger is received. The trigger input pulse width can also be configured.

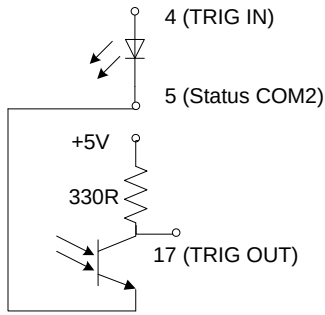
The trigger output can be configured to be active when the output is turned on/off, a setting is changed or when a memory setting has been recalled. The trigger output pulse width or level polarity can also be configured.

See page 91 for details on the trigger input and trigger output configuration settings.

Pinout

Name and Pin		Description
STATUS COM2	5	Common (photo coupler emitter) for trigger pins 4, 17.
TRIG IN	4	External trigger input
TRIG OUT	17	The TRIG OUT signal is held high by an internal 330Ω resistor. The trigger output is pulsed or held high/low for each trigger(depending on the trigger configuration).

Schematic



COMMUNICATION INTERFACE

This chapter describes basic configuration of IEEE488.2 based remote control.

Interface Configuration

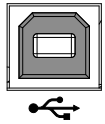
USB Remote Interface

Configuration

USB Configuration	PC side connector	Type A, host
	T3PS side connector	Rear panel Type B, slave
	Speed	1.1/2.0 (full speed/high speed)
	USB Class	CDC (communications device class)

Steps

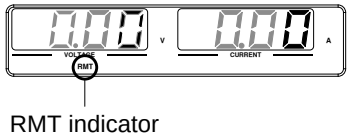
1. Connect the USB cable to the rear panel USB B port.



2. Change the Rear panel-USB (F-22) setting to 2 (Auto Detect Speed) or 1 (USB Full Speed). Page 93

Note: If you are not using the rear panel USB device port, set F-22 to 0 (Disable USB). Page 93

3. The RMT indicator will turn on when a remote connection has been established.



Function Check

Functionality check	Invoke a terminal application such as Realterm. To check the COM port No., see the Device Manager in the PC. For WinXP; Control panel → System → Hardware tab.
	Run this query command via the terminal application after the instrument has been configured for USB remote control (page 122). *idn? This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format. Teledyne, T3PS40381P,TW123456,T0.01.12345678 Manufacturer: Teledyne Model number : T3PS40381P Serial number : TW123456 Firmware version : T0.01.12345678

UART Remote Interface

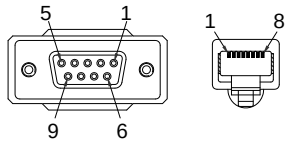
Configure UART

Overview	The T3PS uses the IN & OUT ports for UART communication coupled with RS232 or RS485 adapters.

The pin outs for the adapters are shown below.

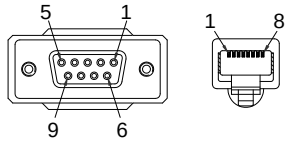
RS232 cable with DB9 connector

DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
2	RX	7	TX	Twisted pair
3	TX	8	RX	
5	SG	1	SG	



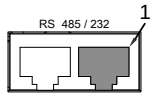
RS485 cable with DB9 connector

DB-9 Connector		Remote IN Port		Remarks
Pin No.	Name	Pin No.	Name	
Housing	Shield	Housing	Shield	
9	TXD -	6	RXD -	Twisted pair
8	TXD +	3	RXD +	
1	SG	1	SG	
5	RXD -	5	TXD -	Twisted pair
4	RXD +	4	TXD +	



Steps

1. Connect the RS232 serial cable or RS485 series cable to the Remote IN port on the real panel.



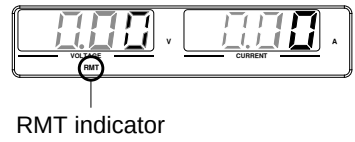
   Connect the other end of the cable to the PC.

2. Press the Function key to enter the Normal configuration settings. Page 93

Set the following UART settings:

F-70 = 1 or 2	Interface: 0= Disable UART, 1= RS232 or 2 = RS485
F-71 = 0-7	Set the baud rate: 0=1200, 1=2400, 2=4800, 3=9600, 4=19200, 5=38400, 6=57600, 7=115200
F-72 = 0 or 1	Data bits: 0=7 or 1=8
F-73 = 0-3	Parity: 0 = none, 1 = odd, 2 = even
F-74 = 0 or 1	Stop bits: 0 = 1, 1 = 2
F-75 = 0 or 1	TCP: 0 = SCPI, 1 = TDK (emulation mode)
F-76 = 00-30	UART address for multi-unit remote connection.
F-77 = 0-3	Multi-Drop control 0 = Disable, 1 = Master, 2 = Slave, 3 = Display Information
F-78 = 00-30	Multi-Drop status display Displayed parameter: AA-S AA: 00-30 (Address), S: 0-1 (Off-line/On-line status).

3. The RMT indicator will turn on when a remote connection has been established.



RMT indicator

UART Function Check

Functionality check	Invoke a terminal application such as Realterm. To check the COM port No, see the Device Manager in the PC. For WinXP; Control panel → System → Hardware tab.
	Run this query command via the terminal application after the instrument has been configured for either RS232 or RS485 remote control (page 123). *idn? This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format: Teledyne, T3PS40381P,TW123456,T0.01.12345678 Manufacturer: Teledyne Model number : T3PS40381P Serial number : TW123456 Firmware version : T0.01.12345678

Multiple Unit Connection

The T3PS power supplies can have up to 31 units daisy-chained together using the 8 pin connectors (IN OUT ports) on the rear panel. The first unit (master) in the chain is remotely connected to a PC using RS232 or RS485 (Legacy Multi-Drop mode), or USB or LAN (Multi-Drop mode). Each subsequent unit (slave) is daisy-chained to the next using a RS485 local bus. The OUT port on the last terminal must be terminated by the end terminal connector.

There are two modes for controlling multiple units. The first mode only allows the user to enter legacy commands (Legacy Multi-Drop mode). All UART parameters have to be configured in this mode. The second mode allows the user to enter the SCPI commands developed for the instrument (Multi-Drop mode). In this mode, only the Multi-Drop parameters have to be specified. For both modes, each unit is assigned a unique address and can then be individually controlled from the host PC.

Legacy Multi-Drop mode

Operation

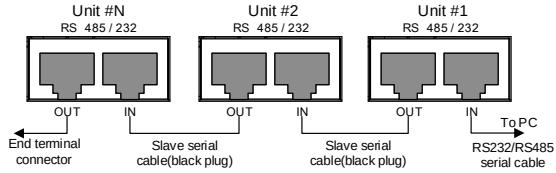
1. Check the F-89 (System version and build date) settings first on all units (see page 88). The two parameters O and P (Option Module) must be the same on all units before any multiple unit connection can be established.

   Example: F-89 O:00, P:01.

2. Connect the first unit's IN port to a PC via RS232 or RS485 serial cable.

3. Connect the OUT port on the first unit to the IN port of the second unit using the slave serial link cable.

4. Connect all the remaining units in the same fashion until all the units have been daisy-chained together.



5. Terminate the OUT port of the last unit with the end terminal connector.

6. Press the Function key to enter the Normal configuration settings for the master unit. Page 93

Set the following settings:

F-70 = 1 or 2	Configure the master unit as you normally would for RS232 or RS485 remote control, see page 123.
F-71 = 0-7	Set the baud rate (set all units the same). See page 123.
F-72 = 1	Set to 8 data bits.
F-73 = 0	Parity to none.
F-74 = 0	1 Stop bit.
F-75 = 1	Set the UART TCP to TDK (emulation mode).
F-76 = 00-30	Set the address of the master unit. It must be a unique address identifier.

7. Press the Function key to enter the Normal configuration settings for the slave(s). Page 93

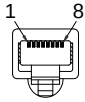
Set the following settings:

F-70 = 2	Set the slave unit to RS485.
F-71 = 0-7	Set the baud rate (make all units, including the master, the same baud). See page 123.
F-72 = 1	Set to 8 data bits.
F-73 = 0	Parity to none.
F-74 = 0	1 Stop bit.
F-75 = 1	Set the UART TCP to TDK (emulation mode).
F-76 = 00-30	Set the address of each slave to a unique address identifier

8. Multiple units can now be operated at the same time. Only legacy commands can be used in this mode. See the programming manual or see the function check below for usage details.

Slave serial link cable with RJ-45 shielded connectors

RS-485 slave serial link pin assignment			
8 Pin Connector (IN)		8 Pin Connector (OUT)	
Pin No.	Name	Pin No.	Name
Housing	Shield	Housing	Shield
1	SG	1	SG
6	TXD -	6	TXD -
3	TXD +	3	TXD +
5	RXD -	5	RXD -
4	RXD +	4	RXD +



Multi-Drop mode

Operation

1. Check the F-89 (System version and build date) settings first on all units (see page 88). The two parameters O and P (Option Module) must be the same on all units before any multiple unit connection can be established.

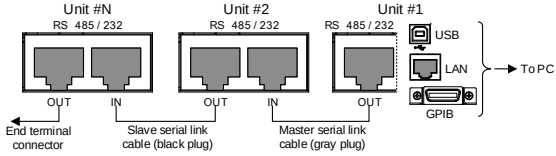
   Example: F-89 O:00, P:01.

2. All units must be powered down before starting the Multi-Drop mode configuration

3. Connect the first unit's LAN, USB or GPIB port to a PC.

4. Connect the OUT port on the first unit to the IN port of the second unit using the master serial link cable.

5. Connect all the remaining units between the OUT port and the IN port with the slave serial link cable until all the desired units have been daisy-chained together.



6. Terminate the OUT port of the last unit with the end terminal connector.

7. Power up all slave units.

8. Set the addresses of all slave units using the F-76 parameter.

F-76 = 00-30	Set the address of the unit. It must be a unique address identifier.

9. Set the Multi-Drop setting parameter (F-77) to Slave for all slave units.

F-77 = 2	Set the Multi-Drop setting to slave.

10. Power up the master unit.

11. Set the address of the master unit using the F-76 parameter.

F-76 = 00-30	Set the address of the unit. It must be a unique address identifier.

12. You can check the slaves' addresses by using the F-77 parameter on the master unit.

F-77 = 3 — Display on each slave units the configured address. This can show if identical addresses have been assigned individually to each slave units.

13. Set the Multi-Drop setting parameter (F-77) to Master.

F-77 = 1 — Set the Multi-Drop setting to master.

14. You can display the status of each slave unit by using the F-78 parameter.

F-78 = 0-30 — Displayed parameter: AA-S

AA: 00-30 (Address),
S: 0-1 (Off-line/On-line status).

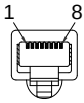
15. Multiple units can now be operated using SCPI commands. See the programming manual or see the function check below for usage details.

Slave serial link cable with RJ-45 shielded connectors

RS-485 slave serial link pin assignment			
8 Pin Connector (IN)		8 Pin Connector (OUT)	
Pin No.	Name	Pin No.	Name
Housing	Shield	Housing	Shield
1	SG	1	SG
6	TXD -	6	TXD -
3	TXD +	3	TXD +
5	RXD -	5	RXD -
4	RXD +	4	RXD +

Master serial link cable with RJ-45 shielded connectors

RS-485 master serial link pin assignment			
8 Pin Connector (IN)		8 Pin Connector (OUT)	
Pin No.	Name	Pin No.	Name
Housing	Shield	Housing	Shield
1	SG	1	SG
6	TXD -	5	RXD -
3	TXD +	4	RXD +
5	RXD -	6	TXD -
4	RXD +	3	TXD +



Multiple units Function Check

Functionality check	Invoke a terminal application such as Realterm. To check the COM port No, see the Device Manager in the PC. For WinXP; Control panel → System → Hardware tab. Below shows examples using the Legacy Multi-Drop mode and the Multi-Drop mode.

Configure Ethernet Connection

The Ethernet interface can be configured for a number of different applications. Ethernet can be configured for basic remote control or monitoring using a web server or it can be configured as a socket server.

The T3PS series supports both DHCP connections so the instrument can be automatically connected to an existing network or alternatively, network settings can be manually configured.

Ethernet configuration Parameters	For details on how to configure the Ethernet settings, please see the configuration chapter on page 86.	
	MAC Address (display only)	LAN Enable/Disable
	DHCP Enable/Disable	IP Address
	Subnet Mask	Gateway
	DNS Address	Sockets Server Enable/Disable

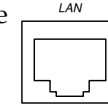
Sockets Server Configuration

Configuration

This configuration example will configure the T3PS socket server.

The following configuration settings will manually assign the T3PS an IP address and enable the socket server. The socket server port number is fixed at 2268.

1. Connect an Ethernet cable from the network to the rear panel Ethernet port.



2. Press the Function key to enter the Normal configuration settings. Page 93

Set the following LAN settings:

F-36 = 1	Enable LAN
F-37 = 0	Disable DHCP
F-39 = 172	IP Address part 1 of 4
F-40 = 16	IP Address part 2 of 4
F-41 = 5	IP Address part 3 of 4
F-42 = 133	IP Address part 4 of 4
F-43 = 255	Subnet Mask part 1 of 4
F-44 = 255	Subnet Mask part 2 of 4
F-45 = 128	Subnet Mask part 3 of 4
F-46 = 0	Subnet Mask part 4 of 4
F-47 = 172	Gateway part 1 of 4
F-48 = 16	Gateway part 2 of 4
F-49 = 21	Gateway part 3 of 4
F-50 = 101	Gateway part 4 of 4
F-57 = 1	Enable Sockets

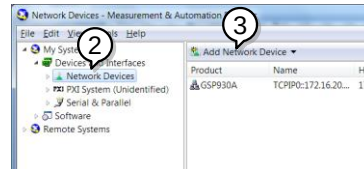
Socket Server Function Check

Background	To test the socket server functionality, National Instruments Measurement and Automation Explorer can be used. This program is available on the NI website, www.ni.com., via a search for the VISA Run-time Engine page, or "downloads" at the following URL, http://www.ni.com/visa/
Requirements	Operating System: Windows XP, 7, 8
Functionality check	1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press: *Start>All Programs>National Instruments>Measurement & Automation*

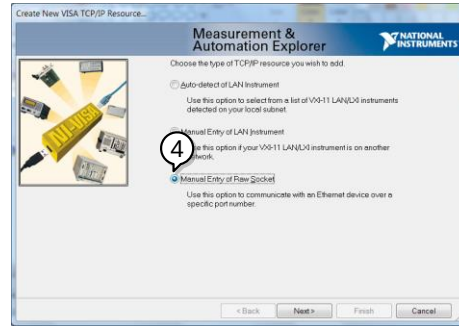
2. From the Configuration panel access;

   My System>Devices and Interfaces>Network Devices

3. Press *Add New Network Device>Visa TCP/IP Resource…*



4. Select *Manual Entry of Raw Socket* from the popup window.

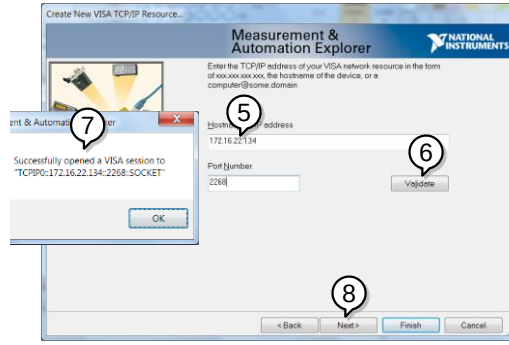


5. Enter the IP address and the port number of the T3PS. The port number is fixed at 2268.

6. Click the Validate button.

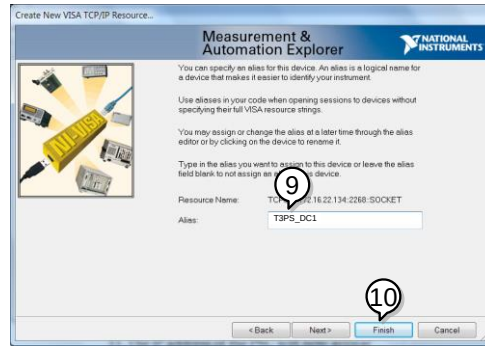
7. A popup will appear if a connection is successfully established.

8. Click Next.



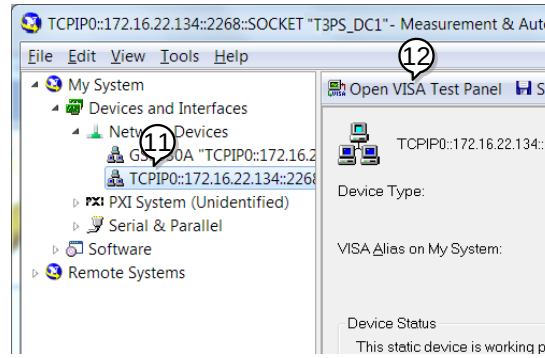
9. Next configure the Alias (name) of the T3PS connection. In this example the Alias is: T3PS_DC1

10. Click finish.



11. The IP address of the T3PS will now appear under Network Devices in the configuration panel. Select this icon now.

12. Click *Open VISA Test Panel.*

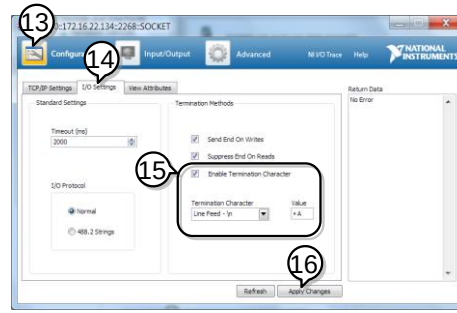


13. Click the *Configuration* icon,

14. Click on *I/O Settings*.

15. Make sure the *Enable Termination Character* check box is checked, and the terminal character is \n (Value: xA).

16. Click *Apply Changes*.



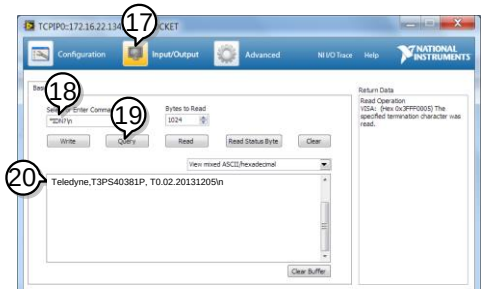
17. Click the *Input/Output* icon.

18. Enter *IDN? in the *Select or Enter Command* dialog box if it is not already.

19. Click the *Query* button.

20. The *IDN? query will return the Manufacturer, model name, serial number and firmware version in the dialog box.

    Teledyne, T3PS40381P,TW123456,T0.02.20131205



FAQ

- The OVP voltage is triggered earlier than expected.
- Can I combine more than 1 cable together for the output wiring?
- The accuracy does not match the specification.

The OVP voltage is triggered earlier than expected.

When setting the OVP voltage, take into account the voltage drop from the load cables. As the OVP level is set from the output terminals and not the load terminals, the voltage at the load terminals may be slightly lower.

Can I combine more than 1 cable together for the output wiring?

Yes. Cables can be used together (in parallel) if the current capacity of a single cable is insufficient. However the withstand voltage should also be taken into account. Ensure the cables are twisted together and are the same length.

The accuracy does not match the specification.

Make sure the device is powered On for at least 30 minutes, within +20°C-+30°C. This is necessary to stabilize the unit to match the specification.

APPENDIX

T3PS Factory Default Settings

The following default settings are the factory configuration settings for the power supply.
For details on how to return to the factory default settings, see page 39.

Initial Settings	Default Setting	
Output	Off	
LOCK	0 (Disabled)	
Voltage	0V	
Current	0A	
OVP	1.1 X Vrate	
OCP	1.1 X Irate	
Normal Function Settings	**Setting**	**Default Setting**
Output ON delay time	F-01	0.00s
Output OFF delay time	F-02	0.00s
V-I mode slew rate select	F-03	0 = CV high speed priority (CVHS)
Internal resistance setting	F-08	0.000Ω
Bleeder circuit control	F-09	1 = ON
Buzzer ON/OFF control	F-10	1 = ON
OCP Delay Time	F-12	0.1 sec
Current Setting Limit	F-13	0 = OFF
Voltage Setting Limit	F-14	0 = OFF
Display Memory parameter when recalling	F-15	0 = OFF
Auto Calibration Parallel Control	F-16	0 = Disable
Measurement Average Setting	F-17	0 = Low

Alarm Recovery and Output Status	F-18	0 = Safe Mode
Lock Mode	F-19	0:Lock Panel, Allow Output OFF
USB setting	Setting	Default Setting
Setup Rear USB Speed	F-22	2 = Auto Detect Speed
SCPI Emulation	F-26	0 = Teledyen LeCroy
LAN setting	Setting	Default Setting
LAN Enable	F-36	1 = ON
DHCP	F-37	1 = ON
Socket Server Enable/Disable	F-57	1 = Enable
Web Server Enable/Disable	F-59	1 = Enable
Web Password Enable/Disable	F-60	1 = Enable
UART setting	Setting	Default Setting
UART Mode	F-70	1 = RS232
UART Baudrate	F-71	7 = 115200
UART Data Bits	F-72	1 = 8 bits
UART Parity	F-73	0 = None
UART Stop Bit	F-74	0 = 1 bit
UART TCP	F-75	0 = SCPI
UART Address	F-76	30
UART Multi-Drop control	F-77	0 = Disable
Power On Configuration setting	Setting	Default Setting
CV Control	F-90	0 = Power On Configuration
CC Control	F-91	0 = Control by local
Output Status when Power ON	F-92	0 = Safe Mode (Always OFF)
Master/Slave Configuration	F-93	0 = Independent
External Output Logic	F-94	0 = High ON
Monitor Voltage Select	F-96	0 = 5V
Control Range	F-97	0 = 5V[5kΩ]
External Output Control Function	F-98	0 = OFF

Trigger Input and Output Configuration Settings	Setting	Default Setting
Trigger Input Pulse Width	F100	0 = trigger controlled by trigger level.
Trigger Input Action	F102	0 = None
Output State When Receiving Trigger	F103	0 = OFF
Apply Voltage Setting on Trigger	F104	0 = 0V
Apply Current Setting on Trigger	F105	0 = 0A
Recall memory number	F106	1 = M1
Trigger Output Pulse Width	F120	0ms
Trigger Output Level	F121	0 = LOW
Trigger Source	F122	0 = None

Error Messages & Messages

The following error messages or messages may appear on the T3PS screen during operation.

Error Messages	Description
OHP	Master & slave board over temperature protection in T3PS
OHP1	Master board over temperature protection in T3PS
OHP2	Slave board over temperature protection in T3PS
ALM SENS	Sense Alarm
HW OVP	Hardware over voltage protection
AC	AC fail
OVP	Over voltage protection
OCP	Over current protection
FAN FAIL	Fan failure
SHUT DOWN	Force shutdown
Err 001	USB mass storage is not present
Err 002	No (such)file in USB mass storage
Err 003	Empty memory location
Err 004	File access error
Err 007	Slave occurs Off-line (Multi-Drop mode)

Normal Messages	Description
MSG 001	External control of output. Output off (F-94=0, High=on)
MSG 002	External control of output. Output off (F-94=1, Low=on)

Communication Interface Messages	Description
USB ON	Rear USB port connected to PC
USB OFF	Rear USB port disconnected from PC
MS ON	Mass storage plugged into front USB port
MS OFF	Mass storage removed from front USB port

LED ASCII Table Character Set

Use the following table to read the LED display messages.

0	1	2	3	4	5	6	7	8	9	A	B	C	D
													
E	F	G	H	I	J	K	L	M	N	O	P	Q	R
													
S	T	U	V	W	X	Y	Z	(	)	+	-	,	
													

T3PS Specifications

The specifications apply when the T3PS is powered on for at least 30 minutes.

Output

Model		T3PS062001P	T3PS40381P	T3PS60251P
Rated Output Voltage[*1]	V	6	40	60
Rated Output Current[*2]	A	200	38	25
Rated Output Power	W	1200	1520	1500

Constant Voltage Mode

Model			T3PS062001P	T3PS40381P	T3PS60251P
Line regulation[*3]		mV	2.6	6	8
Load regulation[*4]		mV	2.6	6	8
Ripple and noise[*5]	p-p[*6]	mV	60	60	60
	r.m.s.[*7]	mV	8	8	8
Temperature coefficient		ppm/ °C	100ppm/°C of rated output voltage, after a 30 minute warm-up.		
Remote sense compensation voltage (single wire)		V	1	2	3
Rise time[*8]	Rated load	ms	80	80	80
	No load	ms	80	80	80
Fall time[*9]	Rated load	ms	10	80	80
	No load	ms	500	1000	1100
Transient response time[*10]		ms	1.5	1	1

Constant Current Mode

Model			T3PS062001P	T3PS40381P	T3PS60251P
Line regulation[*3]		mA	22	5.8	4.5
Load regulation[*11]		mA	45	12.6	10
Ripple and noise[*12]	r.m.s.	mA	400	95	75
Temperature coefficient		ppm/ °C	100ppm/°C of rated output current, after a 30 minute warm-up.		

Protection Function

Model			T3PS062001P	T3PS40381P	T3PS60251P
Over voltage protection (OVP)	Setting range	V	0.6 - 6.6	4 - 44	5 - 66
	Setting accuracy	V	0.06	0.4	0.6
Over current protection (OCP)	Setting range	A	5 - 220	3.8 - 41.8	2.5 - 27.5
	Setting accuracy	A	4	0.76	0.5
Under voltage limit (UVL)	Setting range		0 - 6.3	0 - 42	0 - 63

Model	T3PS All models	
Over temperature protection (OHP)	Operation	Turn the output off.
Incorrect sensing connection protection (SENSE)	Operation	Turn the output off.
Low AC input protection (AC-FAIL)	Operation	Turn the output off.
Shutdown (SD)	Operation	Turn the output off.
Power limit (POWER LIMIT)	Operation	Over power limit.
	Value (fixed)	Approx. 105% of rated output power

Analog Programming and Monitoring

Model	T3PS All models
External voltage control output voltage	Accuracy and linearity: ±0.5% of rated output voltage.
External voltage control output current	Accuracy and linearity: ±1% of rated output current.
External resistor control output voltage	Accuracy and linearity: ±1% of rated output voltage.
External resistor control output current	Accuracy and linearity: ±1.5% of rated output current.
Output voltage monitor	Accuracy: ±1%
Output current monitor	Accuracy: ±1%
Shutdown control	Turns the output off with a LOW (0V to 0.5V) or short-circuit.
Output on/off control	Possible logic selections: Turn the output on using a LOW (0V to 0.5V) or short-circuit, turn the output off using a HIGH (4.5V to 5V) or open-circuit. Turn the output on using a HIGH (4.5V to 5V) or open-circuit, turn the output off using a LOW (0V to 0.5V) or short-circuit.
Alarm clear control	Clear alarms with a LOW (0V to 0.5V) or short-circuit.
CV/CC/ALM/PWR ON/OUT ON indicator	Photo coupler open collector output; Maximum voltage 30V, maximum sink current 8mA.
Trigger out	Maximum low level output = 0.8V; minimum high level output = 2V; Maximum source current = 8mA.
Trigger in	Maximum low level input voltage = 0.8V; minimum high level input voltage = 2.0V, Maximum high level input voltage = 30V, Maximum sink current = 8mA.

Front Panel

Model			T3PS062001P	T3PS40381P	T3PS60251P
Display, 4 digits					
Voltage accuracy	0.1% +	mV	12	80	120
Current accuracy	0.2% +	mA	600	114	75

Model	T3PS All models
Indications	GREEN LED's: CV, CC, V, A, VSR, ISR, DLY, RMT, LAN, M1, M2, M3, RUN, Output ON RED LED's: ALM, ERR
Buttons	Lock/Local(Unlock), PROT(ALM_CLR), Function(M1), Test(M2), Set(M3), Shift, Output
Knobs	Voltage, Current
USB port	Type A USB connector

Programming and Measurement (RS-232/485, USB, LAN)

Model			T3PS062001P	T3PS40381P	T3PS60251P
Output voltage programming accuracy	0.05% +	mV	3	20	30
Output current programming accuracy	0.2% +	mA	200	38	25
Output voltage programming resolution		mV	0.2	1.3	2
Output current programming resolution		mA	6	1.2	0.8
Output voltage measurement accuracy	0.1% +	mV	6	40	60
Output current measurement accuracy	0.2% +	mA	400	76	50
Output voltage measurement resolution		mV	0.2	1.3	2
Output current measurement resolution		mA	6	1.2	0.8

Input Characteristics

Model		T3PS All models
Nominal input rating		100Vac to 240Vac, 50Hz to 60Hz, single phase
Input voltage range		85Vac - 265Vac
Input frequency range		47Hz - 63Hz
Maximum input current	100Vac	21A
	240Vac	9.2A
Inrush current		Less than 50A.
Maximum input power		2000VA

Power factor	100Vac		0.99		
	240Vac		0.98		
Model			T3PS062001P	T3PS40381P	T3PS60251P
Efficiency[*13]	100Vac	%	76.5	84	84
	240Vac	%	79	87	87
Model	T3PS All models				
Hold-up time	20ms or greater				

Interface Capabilities

Model	T3PS All models
USB	Type A: Host, Type B: Slave, Speed: 1.1/2.0, USB Class: CDC(Communications Device Class)
LAN	MAC Address, DNS IP Address, User Password, Gateway IP Address, Instrument IP Address, Subnet Mask
RS-232/RS-485	SCPI - 1993, IEEE 488.2 compliant interface
	Complies with EIA232D / EIA485 Specifications

Environment Conditions

Model	T3PS All models
Operating temperature	0˚C to 50˚C[*14]
Storage temperature	-25˚C to 70˚C
Operating humidity	20% to 85% RH; No condensation
Storage humidity	90% RH or less; No condensation
Altitude	Maximum 2000m

General Specifications

Model	T3PS All models		
Weight	main unit only	kg	Less than 8.7kg
Dimensions	(W×H×D)	mm	423×43.6×447.2
Cooling			Forced air cooling by internal fan.
EMC			Complies with the European EMC directive 2014/30/EU for Class A test and measurement products.
Safety			Complies with the European Low Voltage Directive 2014/35/EU and carries the CE-marking.
Withstand voltage			AC to Chassis: 1500Vac/1min AC to Output terminal: 3000Vac/1min Output terminal to Chassis: 1000Vdc/1min
Insulation resistance			Chassis and output terminal; chassis and AC input; AC input and output terminal: 100MΩ or more (DC 1000V)

Notes:

*1 Minimum voltage is guaranteed to maximum 0.2% of the rated output voltage.

*2 Minimum current is guaranteed to maximum 0.4% of the rated output current.

*3 At 85-132Vac or 170-265Vac, constant load.

*4 From No-load to Full-load, constant input voltage. Measured at the sensing point in Remote Sense.

*5 Measure with JEITA RC-9131B (1:1) probe

*6 Measurement frequency bandwidth is 10Hz to 20MHz.

*7 Measurement frequency bandwidth is 5Hz to 1MHz.

*8 From 10% to 90% of rated output voltage, with rated resistive load.

*9 From 90% to 10% of rated output voltage, with rated resistive load.

*10 Time for output voltage to recover within 0.5% of its rated output for a load change from 0 to 90% of its rated output current. Voltage set point from 10% to 100% of rated output.

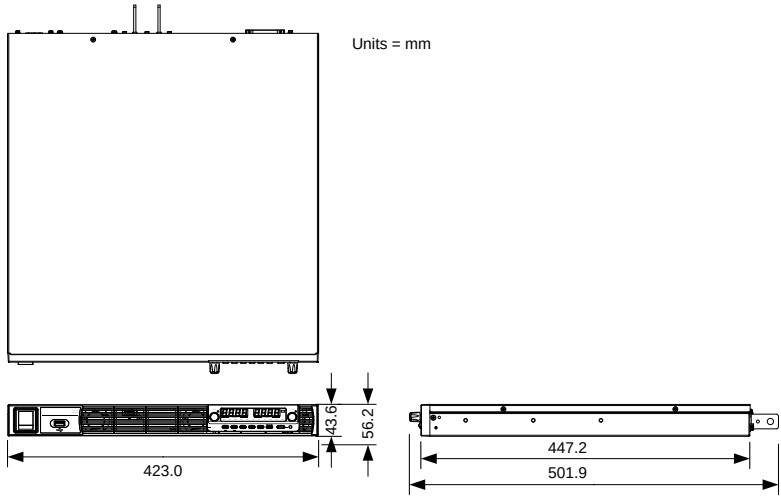
*11 For load voltage change, equal to the unit voltage rating, constant input voltage.

*12 For 6V model the ripple is measured at 2-6V output voltage and full output current. For other models, the ripple is measured at 10-100% output voltage and full output current.

*13 At rated output power.

*14 If install the front panel filter kit, the temperature is guaranteed to 40˚C.

T3PS Dimensions



CERTIFICATIONS

Teledyne LeCroy certifies compliance to the following standards as of the time of publication. Please see the EC Declaration of Conformity document shipped with your product for current certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

The instrument meets intent of EC Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications listed in the Official Journal of the European Communities:

EN 61326-1:2013, EN 61326-2-1:2013 EMC requirements for electrical equipment for measurement, control, and laboratory use.[1]

Electromagnetic Emissions:

EN 55011:2016+A1:2017, Radiated and Conducted Emissions Group 1, Class A [2] [3]

EN 61000-3-2:2014 Harmonic Current Emissions, Class A

EN 61000-3-3:2013 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

EN 61000-4-2:2009 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes [4]

EN 61000-4-3:2006+ A2:2010 RF Radiated Electromagnetic Field,

3 V/m, 80-1000 MHz; 3 V/m, 1400 MHz - 2 GHz; 1 V/m, 2 GHz - 2.7 GHz

EN 61000-4-4:2012 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines [4]

EN 61000-4-5:2014+A1:2017 Power Line Surge, 1 kV AC Mains, L-N, L-PE, N-PE[4]

EN 61000-4-6:2014 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz

EN 61000-4-11:2004+A1:2017 Mains Dips and Interruptions, 0%/1 cycle, 70%/25 cycles, 0%/250 cycles [4 5]

[1] To ensure compliance with all applicable EMC standards, use high-quality shielded interface cables.

[2] Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.

[3] This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

[4] Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

[5] Performance Criteria "C" applied for 70%/25 cycle voltage dips and for 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:*

Teledyne GmbH, European Division

Im Breitspiel 11c

D-69126 Heidelberg

Germany

Tel: + 49 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

The instrument complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

AS/NZS CISPR 11:2015 Radiated and Conducted Emissions, Group 1, Class A.

Australia / New Zealand Contacts:*

RS Components Pty Ltd.
Suite 326 The Parade West
Kent Town, South Australia 5067

RS Components Ltd.
Units 30 & 31 Warehouse World
761 Great South Road
Penrose, Auckland, New Zealand

* Visit teledynelecroy.com/support/contact for the latest contact information.

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The instrument meets intent of EC Directive 2014/35/EU for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use –

Part 1: General requirements

EN 61010-2:030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use –

Part 2-030: Particular requirements for testing and measuring circuits

The design of the instrument has been verified to conform to the following limits put forth by these standards:

- Mains Supply Connector: Overvoltage Category II, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).
- Measuring Circuit Terminals: No rated measurement category. Terminals not intended to be connected directly to the mains supply.

- Unit: Pollution Degree 2, operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

Environmental Compliance

END-OF-LIFE HANDLING

The instrument is marked with this symbol to indicate that it complies with the applicable European Union requirements of Directives 2012/19/EU and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The instrument is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

EC DECLARATION OF CONFORMITY – RoHS

Unless otherwise specified, all the materials and processes are compliant with RoHS Directive 2011/65/EU in its entirety, inclusive of any further amendments or modifications of said Directive.

CHINA RoHS 2

Unless otherwise specified, all the materials and processes are compliant with the latest requirements of China RoHS 2. The hazardous substances contained in the instrument are disclosed in accordance with the standards SJ/T 11364-2014 (Marking for the restricted use of hazardous substances in electronic and electrical products) and GB/T 26572-2011 (Requirements on concentration

limits for certain restricted substances in electrical and electronic products). The instrument is marked with an appropriate Environmental Friendly Use Period (EFUP) symbol. The packaging materials include the appropriate recycling labels. The below substance disclosure tables (in Chinese and English languages) provide the required compliance information.

部件名称	有毒有害物质和元素					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
	(Pb)	(Hg)	(Cd)	(Cr6+)	(PBB)	(PBDE)
PCBAs	X	O	O	O	O	O
机械硬件	O	O	O	O	O	O
金属片	O	O	O	O	O	O
塑料部件	O	O	O	O	O	O
电缆组件	X	O	O	O	O	O
显示器	O	O	O	O	O	O
电源	O	O	O	O	O	O
风扇	O	O	O	O	O	O
电池	O	O	O	O	O	O
电源线	O	O	O	O	O	O
外部电源(如有)	X	O	O	O	O	O
探头(如有)	X	O	O	O	O	O
熔丝(如有)	O	O	O	O	O	O
产品外壳(如有)	O	O	O	O	O	O
适配器/模块(如有)	O	O	O	O	O	O
鼠标(如有)	O	O	O	O	O	O
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11364-2014 标准规定的限量要求之下。						
X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11364-2014 标准规定的限量要求。						

EFUP (对环境友好的使用时间): 30 年。

使用条件：参阅用户手册“环境条件”部分的规定。

探头 EFUP: 10 年。

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr6+)	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	O	O	O	O
Mechanical Hardware	O	O	O	O	O	O
Sheet Metal	O	O	O	O	O	O
Plastic Parts	O	O	O	O	O	O
Cable Assemblies	X	O	O	O	O	O
Display	O	O	O	O	O	O
Power Supply	O	O	O	O	O	O
Fans	O	O	O	O	O	O
Batteries	O	O	O	O	O	O
Power Cord	O	O	O	O	O	O
Ext Power Supply (if present)	X	O	O	O	O	O
Probes (if present)	X	O	O	O	O	O
Fuse (if present)	O	O	O	O	O	O
Product Case (if present)	O	O	O	O	O	O
Adapters/Modules (if present)	O	O	O	O	O	O
Mouse (if present)	O	O	O	O	O	O
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11364-2014.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11364-2014.						

EFUP (Environmental Friendly Use Period): 30 years.

Use Conditions: Refer to the environmental conditions stated in the User Manual.

EFUP for Probes: 10 years.

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ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
Everywhereyoulook™

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 extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has 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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T3 stands for Teledyne Test Tools.