



### Better performance ....

**Linear regulation:** low output noise and fast transient recovery

**High power density:** up to 94 watts from an ultra-compact case size

**Higher precision:**

- exceptional line and load regulation;
- easy-switch remote sense

**Better metering:**

- high accuracy four digit fixed-resolution meters;
- low current range; current meter averaging

.... with real ease of use

**True analog controls:** quick and intuitive adjustment of voltage and current

**With digital convenience:** unique S-Lock and V-Span functions (see opposite)

**See exactly what's happening:**

- dc output switch - check your settings before applying them;
- 'view settings' button - check and adjust limits at any time

**Safe and secure to use:**

- lockable voltage and current settings (using S-Lock);
- connect via safety binding-post terminals

### Models

PLH120/PLH120-P	0 to 120V / 0.01mA to 750mA	(90W max.)
PLH250/PLH250-P	0 to 250V / 0.01mA to 375mA	(94W max.)

### Remote Control Interfaces Table

Model	Isolated Analog	RS-232	USB	LAN (LXI)	GPIO
PLH120					
PLH250					
PLH120-P	•	•	•	•	
PLH250-P	•	•	•	•	
PLH120-P(G)		•	•	•	•
PLH250-P(G) DI 1 CR		•	•	•	•

## Features

### Analog controls with digital stability

Digital controls may offer greater precision, but often at the expense of ease-of-use. With this in mind, the PLH series has retained the true analog controls. The main disadvantage of analog controls is stability and security. The settings of analog potentiometers can drift over time and the settings can be changed accidentally.



The PLH series incorporates S-Lock. One press of the Lock button transfers control of voltage and current from the analog controls to internal digital circuitry. This offers not just complete security, but exceptional stability as well with each setting controlled by an instrumentation quality DAC.

### Linear regulation for best performance

Linear regulation still offers the lowest output noise and the best transient response (recovery time from a sudden current step).

Despite the high output voltages, the PLH series maintains output noise figures of below 2mV, and transient recovery times of better than 250µs.

In addition, the lack of a high frequency switching circuit reduces radiated noise and common mode signals enabling the PLH series to be used in sensitive environments.

### Choose a voltage range that suits your task



When working with any particular piece of equipment, engineers often require a voltage source variable over only a narrow range. Set the voltage too high and damage might occur, set it too low and the circuit may reset.

That's where the V-Span function of the PLH series comes in. It allows the user to redefine the end-stop values of the voltage control to define a specific voltage range.

For example:

An engineer is working on a circuit that will eventually operate from a peak rectified 110V rms 5% supply.

They use V-Span to set a Vmax of 164 volts (to prevent over-voltage damage) and a Vmin of 147 volts (to ensure that the circuit doesn't reset).

They now have a power supply which provides high resolution analog control over the exact voltage range they need.

Vmin and Vmax can be set anywhere between zero and maximum output voltage subject only to  $V_{max} > (V_{min} + 1V)$ .

The fine control gives additional adjustment of  $\pm 1\%$ .

Once set, the voltage span function can be turned on or off at the press of a button\*.

### Ultra-compact design with higher power efficiency and near-silent cooling

The PLH series achieves an exceptional power density for a linear regulated power supply by offering up to 94 watts from a rack 3U sized casing.

This gives it an unusually small bench footprint taking up less space on a crowded bench.

Despite its small size and linear regulation, the PLH series generates relatively little heat through the use of an advanced phase controlled pre-regulator.

This gives it significantly higher energy efficiency than conventional linear regulated designs, particularly when supplying voltages below maximum.

The internal heat-sinks use fan-assisted convection cooling in order to remove the heat with minimal fan noise.

For rack-mount application, up to four units can be mounted into a single slot.

# PLH-P Series

## Interfacing to every application

### Bench and System use

The PLH-P series includes all of the manual control features of the PLH series, but adds comprehensive remote control facilities.

The ultra-compact rack-modular sizing makes it ideally suited to rack mounted system applications, while its user-friendly manual controls are retained for bench top applications.

### Rear Power Terminals

Power output terminals are duplicated on the rear panel for rack mount applications or other situations where rear connection is more appropriate.

### Digital Remote Control

To meet the varying needs of today's engineers, a comprehensive array of interfaces is provided. RS-232, USB and LAN (Ethernet) with LXI support are provided as standard. An additional GPIB interface is also optionally available. Each of the digital bus interfaces provides full control of voltage, current, and output on/off, plus read-back of voltage, current and status. The interfaces are at ground potential and are opto-isolated from the output terminals.

### RS-232

An RS-232/RS-423 interface is provided for use with legacy systems. This type of serial interface remains in common useage and is perfectly satisfactory for the control of power supplies because data speed is not an issue.

### USB

USB provides a simple and convenient means of connection to a PC and is particularly appropriate for small system use. A USB driver is provided which supports Windows 2000, XP, Vista and Windows 7 (including 64 bit versions).

### LAN-Ethernet with LXI

The LAN interface uses a standard 10/100 base-T Ethernet hardware connection with ICMP and TCP/IP Protocol for connection to a Local Area Network or direct connection to a single PC. This interface supports LXI and is the most appropriate for larger system use because of its scalable nature.

### LXI Compliance

The LAN interface is compliant with LXI-C. LXI (LAN eXtensions for Instrumentation) is the next-generation, LAN-based modular architecture standard for automated test systems managed by the LXI Consortium, and is expected to become the successor to GPIB in many systems. For more information on LXI and how it replaces GPIB, or operates along side it, go to: [www.tti-test.com/go/lxi](http://www.tti-test.com/go/lxi)

### IVI Driver

An IVI driver for Windows is included. This provides support for common high-level applications such as LabView\*, LabWindows\*, and HP/Agilent VEE\*.

### GPIB (option G)

Further versions of the products, are fitted with a GPIB (IEEE-488) interface in addition to USB, RS232 and LAN.

### Isolated Analog Remote Control

PLH-P units include isolated analog voltage control of both voltage and current. Analog control outputs (non-isolated) are also incorporated to enable easy parallel connection of multiple units in a master-slave configuration.

Terminals for remote on/off control are also provided.



### PLH-P Additional Facilities

From the front, PLH-P models are identical to standard PLH models and retain all of their manual control features.

The rear panel carries RS-232, USB and LAN (Ethernet) connectors, together with isolated analog in and non-isolated out for voltage and current, plus remote on/off control. Power output terminals are also duplicated on the rear panel.

All models can be additionally fitted with a GPIB interface (option G - factory fit only).

### Rack Mounting

Up to four single output units can be fitted into one rack width.

Alternatively, where PLH units are being used along side New PL units, a combination of singles and duals can be used i.e. one dual plus up to two singles. The TTI RM450 rack mount is 4U high and incorporates limited ventilation space above and below the power supplies.

Blanking plates are provided for unused positions.

\* Safety interlocks for manual control

A key requirement in a power supply is to prevent the wrong voltage or current being accidentally applied to the circuit-under-test. Consequently all operations that could result in an unexpected change in voltage or current settings have intelligent interlocks to prevent this.

\*\* Safety terminals

The use of fixed-shroud 4mm plugs is becoming mandatory within an increasing number of laboratories for safety reasons. Standard binding post terminals can not accept these fixed-shroud plugs, but the new safety binding post terminals from TTI can.

# PLH & PLH-P series - Technical Specifications

## MODEL RANGE:

PLH120	0 to 120V at	0 to 750mA
PLH250	0 to 250V at	0 to 360mA
PLH120-P	0 to 120V at	0 to 750mA
PLH250-P	0 to 250V at	0 to 360mA

PLH-P series units have identical manual control features and include remote control and read-back using isolated analog, RS232, USB and LAN (LXI) interfaces with GPIB optional.

PL155/PL155-P*	0 to 15V at 0 to 5A
PL303/PL303-P*	0 to 30V at 0 to 3A
PL601/PL601-P*	0 to 60V at 0 to 1.5A
PL303QMD/PL303QMD-P*	2x (0 to 30V at 0 to 3A), or 1x (0 to 30V at 0 to 6A)

\* These models, which have a similar format and feature set to the PLH series, are covered in a separate brochure - New PL Series or see our web site: [www.tti-test.com/go/npl](http://www.tti-test.com/go/npl)

## OUTPUT SPECIFICATIONS

### Voltage/Current Levels

PLH120/PLH120-P	0 to 120V / 0.01mA to 750mA (90W max.)
PLH250/PLH250-P	0 to 250V / 0.01mA to 375mA (94W max.)

Note: Actual maxima for voltage and current are typically 1% greater than the figures given above except for the voltage control on the PLH250/PLH250-P which is limited to 250.0V.

### Output Setting & Control

Voltage Setting:	By coarse and fine controls.
Current Setting:	By single logarithmic control.
Low Current Range:	Reduces max. current to 75mA and increases resolution to 0.01mA.
Output Mode:	Constant voltage or constant current with automatic cross-over. CC indicator lit in constant current mode.
Output Switch:	Electronic, non isolating. Preset voltage and current limit displayed when Output is off. Output rise time no load <20ms.
View Settings:	With the output On, the meters show actual voltage and current. The preset levels can be viewed and adjusted at any time by pressing the View Settings button.

### V-Span

(Voltage Span Control)

The voltage adjustment range can be controlled by digital setting of the end-stop values of the coarse voltage control to any desired values. The range for Vmax is 1V to 120V or 250V depending on model. The range for Vmin is 0 to (Vmax - 1V).

### S-Lock

(Settings Lock)

Voltage and current settings can be locked by a single button press. Lock accuracy is equal to the meter accuracy (see Meter Specification).

### Output Performance

Ripple & Noise:	Normal mode voltage: <2mV rms and 10mV p-p Normal mode current: <10uA rms ; <1uA rms on 75mA range Common mode current: <20uA rms
Load Regulation:	Voltage - <0.01% + 10mV. Current - typically 0.01% + 50 A.
Line Regulation:	Voltage <0.01% + 10mV for 10% line change. Current <0.01% + 50 A. for 10% line change.
Transient Response:	<250 s to within 50mV of setting for a 90% load change.
Temp. Coefficient:	Voltage: typically <(50ppm + 2mV)/°C Current: typically <(100ppm + 0.1mA)/°C; <(100ppm + 0.01mA)/°C on 75mA range.

### Output Protection

Output Protection:	Output will withstand forward voltages of up to rated output voltage. Reverse protection by diode clamp for currents to 3A.
OVP and OCP Trips:	Voltage or current measured to be in excess of 105% of the rated maximum will cause the output to trip off.
Over-temperature:	Output trips off for over-temperature.
Safety Interlocks:	Operations that could cause an unexpected change in voltage or current settings are interlocked with the output switch.

### Output Connections

Output Terminals: Universal 4mm safety binding posts on 19mm (0.75") spacing.  
*Terminals can accept fixed shroud 4mm plugs, standard 4mm plugs, fork terminals and bare wires.*

### Remote Sense

Sense Selection:	Voltage sensing is selected as Local or Remote by front panel switch.
Sense Terminals:	Sprung loaded screw-less terminals.

## REAR TERMINALS (PLH-P models only)

Power output connections are duplicated on the rear panel using a screw-less connector block.

## METER SPECIFICATIONS

Display Type: Dual 4-digit meters, 10mm (0.39") LED.

### Voltage Meter

Resolution:	100mV
Accuracy:	± (0.1% of reading + 100mV)

### Current Meter

Resolution:	0.1mA (0.01mA on 75mA range)
Accuracy:	± (0.3% + 0.3mA); ±(0.3% + 0.03mA) on 75mA range
Meter Damping:	Normally 20ms, switchable to 2 sec for averaging rapidly varying loads.

Accuracy specifications apply for the temperature range 18°C to 28°C after 1 hour warm-up. Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.

## DIGITAL BUS INTERFACES (PLH-P models only)

The standard PL-P product offers full remote control and read-back using RS-232, USB or LAN (LXI-C). All interfaces are at ground potential and opto-isolated from the output terminals.

Note: Remote/Local Sense, and Operational Mode (PL303QMD-P) are manually selectable only.

### RS-232

Standard 9-pin D connector. Baud rate 9,600.

### USB

Standard USB 2.0 connection (backwards compatible with USB 1.x). Operates as a virtual

### COM port.

### Ethernet (LAN)

Standard 10/100 base-T hardware connection. ICMP and TCP/IP Protocol for connection to Local Area Network or direct connection to a single PC.

### LXI Compliance

LAN interface is compliant with LXI-C. (LXI is the abbreviation for Lan eXtensions for Instrumentation). For more information visit: [www.tti-test.com/go/lxi](http://www.tti-test.com/go/lxi)

### GPIB INTERFACE (Option G, factory fit only)

Option G adds a GPIB (IEEE-488) interface.

This is in addition to the RS-232, USB and LAN interfaces of the standard PL-P product. The interface conforms with IEEE-488.1 and IEEE-488.2.

## DIGITAL PROGRAMMING PERFORMANCE (PLH-P models only)

### Voltage Setting

Setting Resolution:	10mV
Setting Accuracy:	±(0.05% +50mV)

### Current Setting

Setting Resolution:	0.1mA (0.01mA on 75mA range)
Setting Accuracy:	± (0.3% +0.1mA); (0.3% +0.01mA) on 75mA range

### Programming Speed

Command Delay:	Typically <25ms (this must be added to any of the figures below)
Voltage Up Time:	Typically <45ms* to 1%
Voltage Down Time:	Typically <200ms* to 1% (full load); typically <500ms* to 1% (no load)

\* The up and down times vary with model, current range and voltage step size. More information is contained in the operating manual - downloadable from our web site.

### Voltage Readback

Resolution:	10mV
Accuracy:	±± (0.1% +50mV)

### Current Readback

Resolution:	0.1mA (0.01mA on 75mA range)
Accuracy:	±± (0.3% +0.1mA); (0.3% +0.01mA) on 75mA range

### VARIABLE OVP and OCP PROTECTION (PLH-P models only)

Measure-and-compare over-voltage and over-current protection are implemented in firmware and can be set via the remote interfaces only. Output trips Off for OVP and OCP conditions.

Setting resolution: 100mV and 0.1mA.

Response time: typically 500ms

## ANALOG REMOTE CONTROL (PLH-P models only)

Isolated analog voltage control of voltage and current. Non-isolated analog control outputs are also provided to enable easy parallel connection of multiple units in a master-slave configuration.

### Control Inputs (Isolated)

Reference Point: Control input voltages are referenced to their own return points.  
Set Voltage Input: 0V to 10V sets 0 to 100% of rated output (e.g. 0 to 120V for PLH120-P).

Alternative scaling of 0V to 5V (selectable using internal link).

Set Current Input: 0V to 10V sets 0 to 100% of rated output (0 to 750mA for PLH120-P).

Alternative scaling of 0V to 5V (selectable using internal link).

Set Voltage Accuracy: ± (0.3% +100mV); Input Impedance = 10kΩ

Set Current Accuracy: ± (0.5% +0.5mA); Input Impedance = 10kΩ

Control Outputs (Non-isolated)

Reference Point: Control output voltages are referenced to the positive output terminal.

Voltage Output: 0 to 100% of rated output voltage generates 0V to 5V.

Current Output: 0 to 100% of rated output current generates 0V to 5V.

Voltage Out Accuracy: ± (0.3% +100mV); Output Impedance = 125Ω

Current Out Accuracy: ± (0.5% +0.5mA); Output Impedance = 125Ω

Note that Analog control of current can not be used with the low current range selected.

### REMOTE ANALOG ON/OFF CONTROL (PLH-P models only)

Non-isolated terminal which sets the output to Off when pulled low by gate signal or relay closure. Signal is reference to the positive output terminal.

DRIVER SOFTWARE SUPPLIED (PLH-P models only)

### IVI Driver

An IVI driver for Windows is supplied. This provides support for common applications such as LabView\*, LabWindows\*, HPVEE\* etc.

### USB Driver

An installation file is supplied which calls a standard Windows\* USB driver.

\* LabView and LabWindows are trademarks of National Instruments.

HPVEE (now Agilent VEE) is a trademark of Agilent Technologies.

\* USB interface is supported for Windows 2000, XP, and Vista.

Windows is a trademark of Microsoft.

## GENERAL SPECIFICATIONS

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### Input

AC Input: 230V AC or 115V AC 10%, 50/60Hz. Installation Category II  
Input Power: 280VA max.

### Temperature & Environmental

Operating Range: +5°C to +40°C, 20% to 80% RH  
Storage Range: -40°C to +70°C  
Environmental: Indoor use at altitudes up to 2000m, Pollution Degree 2.  
Cooling: Intelligent variable-speed low noise fan assists convection.

### Safety & EMC

Safety: Complies with EN61010-1  
EMC: Complies with EN61326

### Physical

Size: PLH models - 107mm x 131mm ( rack 3U) x 288mm, PLH-P models - 107mm x 131mm ( rack 3U) x 315mm,  
(sizes exclude feet, knobs and terminals).  
Weight: PLH models - 4.9kg; PLH-P models - 5.0kg

## OPTIONS

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### Rack Mount (RM450)

19 inch 4U rack mount suitable for up to four PLH series power supplies. Alternatively they can be mixed with the lower voltage New PL series in a single rack with up to four single power supplies, two dual power supplies, or any mixture. Blanking plates are provided for unused positions. The 4U height provides limited ventilation space above and below the power supplies.

### GPIO Interface (Option G)

Option G adds a GPIO (IEEE-488) interface. This is a factory-fit option only.

## LOWER VOLTAGE MODELS

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### New PL and New PL-P Series

The New PL and PL-P series have a similar format and power level to the PLH series and are available in 15V, 30V and 60V variants as well as 30V dual output. Detailed specifications differ from the PLH and PLH-P series. Please visit our website for full information or request a copy of the New PL Series brochure.

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