

THURLBY THANDAR INSTRUMENTS

PL & PL-P Series



*Laboratory Power Supplies*

Standard and Bus Programmable versions

Single, dual and triple output models

Power from 66 watts to 240 watts

# PL series laboratory dc power supplies

## Precision with convenience

The PL series from TTI is accepted as the industry standard for laboratory bench PSUs in many countries.

High resolution controls enable precise setting of voltage and current levels whilst high accuracy digital meters provide clear, unambiguous readings.

## Accuracy and convenience

PL series units incorporate digital meters with a 3.75 digit scale length (4095 counts) to provide greater accuracy and resolution than other PSUs.

Large and bright LEDs give a clear and unambiguous reading. An update rate of 4 per second provides near instantaneous response.

Separate meters are used for voltage and current, eliminating the need for meter function switches with their attendant problems of misinterpretation.

A damping switch for the current meter simplifies measurements on rapidly varying loads.

## Remote sense

Remote sense terminals enable the precision to be maintained at high currents by eliminating the effects of connection lead resistance.

Without remote sense lead resistance of just a few tens of milliohms can seriously degrade regulation and produce misleading results. (Two cables of  $0.05\Omega$  each will drop a total of  $0.3V$  at  $3$  Amps.)

## Resolution and control

The PL series sets the standard for simple and comprehensive control. Voltages are set with coarse and fine controls for speed with precision. Currents are set with a semi-logarithmic control for increased resolution at low current levels.

The DC output switch enables voltage and current levels to be set before the load is connected.

With the output switch "off" the current limit set point is displayed. With the output switch "on" the actual output current flowing is displayed.



- Simultaneous digital metering of voltage and current.
- True constant voltage or constant current operation.
- Twin 3.75 digit meters with large LED displays.
- 0.1% accuracy; 0.01 Volts and 0.001 Amps resolution.
- Excellent stability, resolution and setting accuracy.
- DC output switches, automatic mode indication.
- Precise control and monitoring of current limit settings.
- Remote sense facility for high-current precision.
- Current meter damping switch for fluctuating currents.
- Parallel and tracking modes on QMD & QMT models.
- High current "logic supply" output on QMT models.

This invaluable feature allows delicate circuits to be protected by accurately setting the current limit level (down to a few milliamps if necessary) before connecting the circuit under test.

## Safety and protection

PL series PSUs are designed and built to meet the stringent requirements of IEC348 and IEC1010.

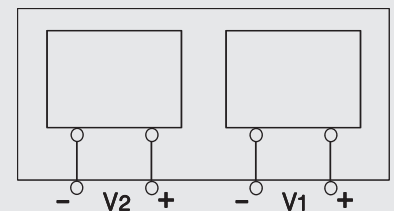
All outputs are fully protected against short circuit, reverse voltage and reverse currents.

## Quad-Mode Dual versions

The 32V-2A and 32V-3A supplies are each available as a dual unit incorporating push button selection of four different modes of operation.

### Isolated

Completely independent operation of each supply.

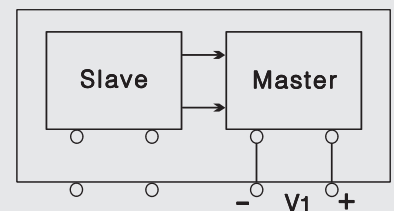


### Series

Internal linking of the two supplies providing up to 64 Volts.

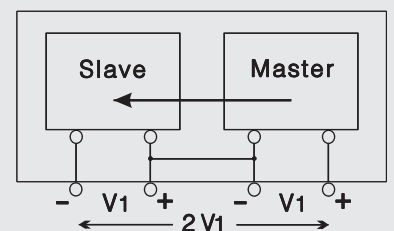
### True Parallel

Converts the Master unit into a 4 Amp or 6 Amp supply respectively.



### Series Tracking

The Master unit voltage control sets up equal voltages on both supplies.



# PL-P series programmable PSUs

## Quad Mode Triple versions

Each of the quad-mode dual models is alternatively available as a triple supply incorporating one further independent output.

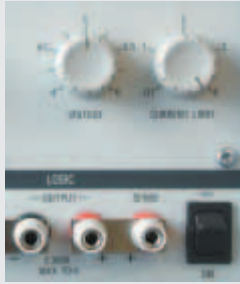
This is a higher current low voltage output intended for powering logic circuits.

The current rating and sophistication of the logic output varies according to the model as follows:

### PL320QMT

Variable output voltage (4V to 6V) and variable current limit (0.1A to 4A).

Calibrated voltage control. Remote sense terminals, DC output switch, over-voltage trip.



### PL330QMT

Variable output voltage (4V to 6V) and variable current limit (0.1A to 7A).

Digital meter for current measurement and voltage setting.

Remote sense terminals, DC output switch, over-voltage trip.



## A wide range of models

The PL series includes single, dual and triple output models from 66 Watts up to 240 Watts.

The PL series is part of a wide range of bench PSUs from TTI which covers voltages up to 150V and currents up to 20A.

MODEL	OUTPUT(S)	Notes
PL320	0 - 32V at 0 - 2A	
PL154	0 - 15.5V at 0 - 4A	
PL330	0 - 32V at 0 - 3A	
PL320QMD	2 x (0 - 32V at 0 - 2A)	QM*
PL330QMD	2 x (0 - 32V at 0 - 3A)	QM*
PL320QMT	2 x (0 - 32V at 0 - 2A) plus 4 - 6V at 0.1 - 4A	QM*
PL330QMT	2 x (0 - 32V at 0 - 3A) plus 4 - 6V at 0.1 - 7A	QM*
PL330P	0 - 32V at 0 - 3A	GPB RS-232
PL330DP	2 x (0 - 32V at 0 - 3A)	GPB RS-232
PL330TP	2 x (0 - 32V at 0 - 3A) plus 4 - 6V at 0.1 - 7A	GPB RS-232

QM\* - Quad-mode switching - see text.

### Lower Power Models:

1A versions; PL310, PL310QMD, PL310QMT are also manufactured but will be discontinued during 2003.

## PL-P models

The Thurlby Thandar PL-P series offers a high performance bus programmable power supply system at low cost.

Based around the 32V-3A versions of the standard PL series, the PL-P models include single, dual and triple output units suitable for bench or rack mounting.

When not connected to the bus, these PSUs can be operated exactly as a standard PL series PSU.

## Fully isolated outputs

Each output is fully floating and is opto-isolated from the bus interfaces.

Outputs can be linked in series or parallel to produce higher voltages or higher currents as required.

## GPB and RS-232 interfaces

Each PL-P series PSU is fitted with both a GPB (IEEE-488) and RS-232 interfaces.

Both interfaces provide full bus control of voltage and current settings along with full readback of actual current and voltage levels. The GPB interface conforms fully with IEEE-488.2 as well as IEEE-488.1.

On dual and triple output models a single bus address controls all outputs.

The RS-232 interface can operate in normal RS-232 mode or in ARC mode.

ARC stands for "Addressable RS-232 Chain" and is a low-cost system for linking TTI instruments together (up to 32) so that they can be controlled and monitored using a single RS-232 port.

## High resolution setting

Voltage and current levels can be set via the bus to a resolution of 10mV and 1mA for each main output.

The 7 Amp logic output of the PL330TP can also be set to a resolution of 10mV but the current control resolution is limited.

Each main output can be read back via the bus to a resolution of 10mV and 1mA.

## Simple and consistent control

PL-P series supplies use simple and consistent command structures which make programming particularly easy regardless of which interface is used.

A National Instruments LabWindows\* device driver is available.



- Full bus control and readback of voltage and current.
- GPB interface conforms to IEEE-488.2.
- RS-232 interface with ARC for low-cost PC based control.
- Can be operated as a conventional bench PSU.
- Single, dual and triple output models available.
- Fully controllable high current logic output (PL330TP).
- Rack mounting kit (4U) available for all models.

\* LabWindows is a trademark of National Instruments Corporation.

# Technical Specifications

## MAIN OUTPUT(S)

Output Range:	0 - 32 Volts nominal; 0 - 15.5V (PL154); 0 - 2.1A nominal (PL320); 0 - 3.1A nominal (PL330); 0 - 4A nominal (PL154).
Voltage Setting:	By coarse and fine controls; resolution better than 5mV.
Current Setting:	By single logarithmic control.
Output Mode:	The power supply operates in constant current or constant voltage modes with automatic cross-over and indication.
Configuration Selection:	Isolated, True parallel, Series or Series Tracking via front panel switches. (QMD and QMT only)
Output Switch:	Isolates the output and permits voltage and current limits to be set up before connecting the load.
Output Impedance:	Constant Voltage: Typically <math>5m\Omega</math> at 1kHz. Constant Current: Typically 50k $\Omega$ with voltage limit at maximum
Output Protection:	Up to maximum output voltage +20 Volts forward; diode clamped for reverse voltages and up to 3A reverse current.
Load Regulation:	<math><0.01\%</math> of maximum output for 90% load change
Line Regulation:	<math><0.01\%</math> of maximum output for 10% line voltage change
Remote Sense:	Eliminates up to 0.5V drop per lead.
Ripple and Noise:	Typically <math><1mV</math> rms
Transient Response:	<math><20\mu\text{sec}</math> to within 50mV of setting for 90% load change
Temp. Coefficient:	Typically <math><100\text{ppm}/^{\circ}\text{C}</math>
Meter Type:	Dual 3.75 digit (4095 count) with 12.5mm (0.5") LEDs, (scale length increased to 8190 on PL330QMD/QMT).
Meter Resolution:	Voltage: 10mV. Current: 1mA.
Meter Accuracy:	Voltage: $\pm(0.1\%$ of reading + 1 digit) Current: $\pm(0.3\%$ of reading + 1 digit)
Current Meter Damping:	Nominally 20ms switchable to 2 sec for averaging of rapidly varying loads

## LOGIC OUTPUT - PL320QMT

Voltage Range:	4 to 6 Volts fully variable.
Setting Accuracy:	Calibrated knob gives typical accuracy of $\pm 0.1V$
Output Current:	0.1 to 4 Amps variable limit.
Output Switch:	Isolates the output.
OVP:	Over-voltage Protection operates above 7 Volts.
Output Protection:	Clamped by the OVP circuit for forward voltages over 7 Volts and up to 1 Amp forward current. Diode clamped for reverse voltages and up to 3 Amps reverse current.
Load Regulation:	<math><0.01\%</math> of maximum output for 90% load change
Line Regulation:	<math><0.01\%</math> of maximum output for 10% line voltage change
Remote Sense:	Eliminates up to 0.5V drop per lead.
Ripple and Noise:	Typically <math><1mV</math> rms
Transient Response:	<math><20\mu\text{sec}</math> to within 50mV of setting for 90% load change
Temp. Coefficient:	Typically <math><100\text{ppm}/^{\circ}\text{C}</math>

## LOGIC OUTPUT - PL330QMT & PL330TP

Voltage Range:	4 to 6 Volts fully variable.
Output Current:	0.1 to 7 Amps variable limit.
Output Switch:	Isolates the output.
OVP:	Over-voltage Protection operates above 7 Volts.
Output Protection:	Clamped by the OVP circuit for forward voltages over 7 Volts and up to 1 Amp forward current. Diode clamped for reverse voltages and up to 3 Amps reverse current.
Load Regulation:	<math><0.01\%</math> of maximum output for 90% load change
Line Regulation:	<math><0.01\%</math> of maximum output for 10% line voltage change
Remote Sense:	Eliminates up to 0.5V drop per lead.
Ripple and Noise:	Typically <math><1mV</math> rms
Transient Response:	<math><20\mu\text{sec}</math> to within 50mV of setting for 90% load change
Temp. Coefficient:	Typically <math><100\text{ppm}/^{\circ}\text{C}</math>
Meter Type:	3.75 digit (4095 count) with 12.5mm (0.5") LEDs.
Meter Resolution:	Voltage: 10mA. Current: 10mA
Meter Accuracy:	Voltage: $\pm(0.2\%$ of reading + 1 digit ) Current: $\pm(0.5\%$ of reading + 1 digit )

## LOWER POWER MODELS (1A output current)

32V/1A versions of the PL series - PL310, PL310QMD and PL310QMT are also manufactured but will be discontinued during 2003. Specifications for these models are similar to those for the 2A or 3A models but with a maximum current of 1.1A. The logic output of the PL310QMT is fixed 5V and 1.5A max. current. It has no output switch, remote sense or metering.

Designed and built in Europe by:



## PL-P MODELS - ADDITIONAL SPECIFICATIONS

Remote programmable versions in the range feature full control, read back and status reporting via the GPIB and RS232 interfaces. The GPIB interface conforms to the IEEE 488.1 and 488.2 standards and the RS232 interface is fully compatible with the TTI Addressable RS232 Chain (ARC) standard.

Rear panel DIP switches are used to specify baud rate, bus address and active interface (GPIB or RS232). Remote/Local operation is by a front panel switch.

### LOCAL OPERATION

For a programmable instrument operated in local state, all capabilities and specifications remain unchanged from those of a standard instrument.

### REMOTE OPERATION

With the instrument switched to the remote state, all voltage and current adjustment controls become inoperative and commands received over the active bus interface will be parsed and executed.

## MAIN OUTPUT(S) - REMOTE OPERATION

Voltage Setting:	12 bit resolution (10mV steps)
Current Setting:	12 bit resolution (1mA steps)
Setting Accuracy:	Voltage: $\pm(0.1\% + 10mV)$ . Current: $\pm(0.2\% + 2mA)$
Output Switching:	Electronic by interface command
Readback Resolution:	Voltage: 10mV. Current: 1mA.
Readback Accuracy:	Voltage: $\pm(0.1\%$ of reading + 1 digit) Current: $\pm(0.3\%$ of reading + 1 digit)
Meter Damping:	Nominally 20ms switchable to 2 sec by remote commands

## LOGIC OUTPUT (PL330TP) - REMOTE OPERATION

Voltage Range:	4 to 6 Volts in 10mV steps
Output Current:	1 to 7 Amps in approximate 1A steps
Setting Accuracy:	Voltage: $\pm(0.2\% + 10mV)$
Output Switch:	Electronic by interface command
Readback Resolution:	Current: 10mA
Readback Accuracy:	Current: $\pm(0.5\%$ of reading + 1 digit )

## REMOTE CONTROL INTERFACES - PL-P MODELS

Both interfaces feature full control, readback and status reporting.

RS232: Variable Baud rate (9600 maximum), 9 pin D-connector (female). Fully compatible with ARC (Addressable RS232 Chain) system.

GPIB: Conforming with IEEE-488.1 and IEEE-488.2

Address Selection: By rear panel DIP switch.

Remote/Local: Remote or Local operation selected by front panel switch.

Remote Command Response Time:

Interface: <math><15\text{ms}</math> (single command, input buffer empty).

Output Voltage - Up: Time constant typically 2ms, e.g. 10ms to settle within 1% of a step change, 15ms to settle within 0.1%.

Output Voltage - Down: Time constant determined by the discharge of the power supply output capacitor (47 $\mu\text{F}$ ). Typically <math><10\text{ms}</math> to settle within 1% for a 10V step change at 50mA load current; typically <math><200\text{ms}</math> to settle within 1% at zero load.

Output Current: Typically 50ms to settle within 10mA for a 1A change.

## GENERAL

Output Terminals:	4mm "binding post" terminals suitable for plugs or wires; optionally 4mm safety sockets, suitable for shrouded plugs.
AC Input:	230V or 115V $\pm 10\%$ , 50/60Hz. Installation Category II.
Environmental:	Indoor use at altitudes to 2000m, Pollution Degree 2.
Operating Range:	5 $^{\circ}\text{C}$ to 40 $^{\circ}\text{C}$ , 20% to 80% RH.
Storage Range:	-20 $^{\circ}\text{C}$ to 60 $^{\circ}\text{C}$ .
Cooling:	Silent fan-less convection cooling.
Safety:	Complies with EN61010-1.
EMC:	Complies with EN61326.
Weights (kg):	5.0-PL320/PL154; 6.0-PL330; 6.5-PL330P; 9.5-PL320QMD; 12.0-PL330QMD; 12.5-PL330DP; 13.5-PL320QMT; 15.5-PL330QMT; 16.0-PL330TP.
Height	170mm (All Models)
Width	155mm (PL154, PL320, PL330); 207mm (PL330P); 350mm (PL320QMD, PL330QMD, PL330DP); 425mm (PL320QMT, PL330QMT, PL330TP).
Depth	265mm (PL154, PL320, PL320QMD, PL320QMT); 300mm (PL330, PL330QMD, PL330QMT, PL330P, PL330DP, PL330TP).



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