



THURLBY THANDAR INSTRUMENTS

Laboratory DC Power Supplies



Bench and bus programmable power supplies

single, dual and triple output models

powers from 15 watts to over 800 watts

currents up to 20A, voltages up to 150V

Laboratory power supplies

Standard bench-top models

A major manufacturer of PSUs

TTi is one of the world's major producers of laboratory power supply units (PSUs) with nearly 25 years of experience.

Hundreds of thousands of TTi power supplies are in everyday use around the world.

Power Technologies

TTi laboratory power supplies use both linear and switch-mode technologies in order to optimise performance and value for money.

Linear Regulation

Pure linear regulation still provides the lowest output noise and best transient response. The disadvantage is greater physical size and weight for a given power, together with higher heat output.

Pure linear regulation is used on the EL, PL, QL and TS series, as well as on the TSP3222.

Mixed-mode regulation

For higher power levels, TTi have developed a technology that uses switch-mode pre-regulation and linear final regulation. This technique combines exceptional efficiency with noise levels that are close to that of pure linears.

Mixed-mode regulation is used in the EX and TSX series.

PowerFlex regulation

The TTi PowerFlex system uses a modified form of mixed-mode regulation to provide higher levels of current when the voltage is set to lower values. Although producing slightly higher noise levels than the standard mixed-mode regulation, performance is still excellent.

PowerFlex regulation is used on the CPX series.

Measurement and control

With the exception of the 'powerpack' and 'basic' models (TS1410 and EB2025T), all TTi laboratory power supplies offer high accuracy digital meters together with high resolution controls and dc output switches.

Standard models

The EL and EX series incorporate three digit meters for both voltage and current. This provides a level of accuracy and resolution sufficient for many purposes.

Separate coarse and fine voltage controls allow rapid and precise adjustment whilst a semi-logarithmic current control provides increased setting resolution at lower currents.

Precision models

The EX-R, PL, TS, TSX and CPX series offer a higher level of precision by incorporating four digit meters and remote sense terminals.

Four digit meters provide higher resolution and accuracy. Remote sense enables the PSU to regulate the voltage directly at the load thus eliminating the effect of connection lead resistance.

High precision digital control models

The QL series offer an unprecedented level of precision by incorporating 16-bit digital control and five digit metering with a resolution of 1mV. This is matched with 0.1mA current resolution and remote sense terminals.

Voltage and current can be set directly from a numeric keyboard or can be set in quasi-analogue mode using a spin-wheel.

The very high accuracy and stability of the QL series makes it suitable for use as a calibration source as well as a power supply.

EL series: compact linear bench PSUs



Specifications for Main Outputs: Line & load regulation <0.01%. Output noise <1mV rms. Meter accuracies 0.3% \pm 1digit - voltage, 0.6% \pm 1digit - current.

- ▶ Single, dual or triple outputs - 30W to 125W
- ▶ Linear regulation with low noise and good regulation
- ▶ 3 digit voltage & current meters on each output
- ▶ Constant voltage or constant current operation
- ▶ Switchable 3.3V/5V output on triple output model
- ▶ Compact design uses less bench space
- ▶ DC output switches, automatic mode indication
- ▶ Bus programmable version available ▶▶

PL series: precision bench PSUs



Specifications for Main Outputs: Line & load regulation <0.01%. Output noise <1mV rms. Meter accuracies 0.1% \pm 1digit - voltage, 0.3% \pm 1digit - current.

- ▶ Single, dual or triple outputs - 35W to 240W
- ▶ Linear regulation, precision metering and control including remote sense terminals
- ▶ 4 digit voltage & current meters on each output
- ▶ Meter resolution 10mV and 1mA
- ▶ Constant voltage or constant current operation
- ▶ Duals & triples have four modes of operation: isolated, series, series-tracking, true parallel
- ▶ Higher current 'logic voltage' output on triples
- ▶ DC output switches, automatic mode indication
- ▶ Bus programmable versions available ▶▶

QL series: digitally controlled PSUs



Specifications for Main Outputs: Line & load regulation <0.01%. Output noise <0.35mV rms. Setting accuracies 0.03% ± 5mV - voltage, 0.3% ± 0.5mA - current.

- ▶ Single or triple outputs - 105W to 215W
- ▶ Setting by direct numeric entry or spin wheel
- ▶ Very high precision with 1mV and 0.1mA resolution
- ▶ Multiple ranges for increased current flexibility
- ▶ Excellent noise, regulation and dynamics
- ▶ Multiple non-volatile setting memories
- ▶ OVP and OCP trips with alarm output
- ▶ Selectable remote sense terminals
- ▶ Switchable 2.7V/3.3V/5V output on triple
- ▶ Bus programmable versions available ▶▶

TS series: precision bench PSUs



Specifications for Main Outputs: Line & load regulation <0.01%. Output noise <1mV rms. Meter accuracies 0.1% ±1digit - voltage, 0.3% ±1digit - current.

- ▶ Single, dual or triple outputs - 60W to 145W
- ▶ Linear regulation, precision metering and control including remote sense terminals
- ▶ 3.5 digit voltage & current meters on each output
- ▶ Meter resolution 10mV and 1mA
- ▶ Constant voltage or constant current operation
- ▶ Higher current 'logic voltage' output on triples
- ▶ DC output switches, automatic mode indication

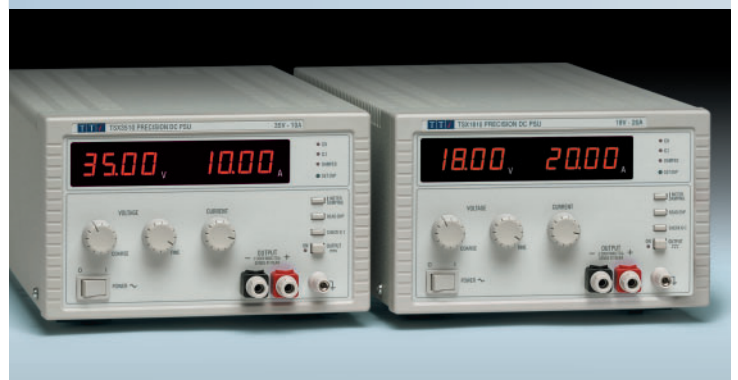
EX series: compact high power bench PSUs



Specifications for Main Outputs: Line & load regulation <0.01%. Output noise <2mV rms. Meter accuracies 0.3% ±1digit - voltage, 0.6% ±1digit - current.

- ▶ Single, dual or triple outputs - 175W to 420W
- ▶ Mixed-mode regulation, silent fan-free cooling
- ▶ 3 digit voltage & current meters on each output (4 digit meters on EX-R versions)
- ▶ Constant voltage or constant current operation
- ▶ Remote sense terminals on EX-R versions
- ▶ Switchable 3.3V/5V output on triple output model
- ▶ Compact design uses less bench space
- ▶ DC output switches, automatic mode indication
- ▶ Bus programmable version available ▶▶

TSX series: high power bench PSUs



Specifications: Line & load regulation <0.01%. Output noise <1mV rms. Meter accuracies 0.2% ±1digit - voltage, 0.5% ±1digit - current.

- ▶ High power single output - 350W plus
- ▶ Mixed-mode regulation, silent fan-free cooling
- ▶ Precision metering & control, remote sense
- ▶ 4 digit voltage & current meters on each output
- ▶ Meter resolution 10mV and 10mA
- ▶ Constant voltage or constant current operation
- ▶ DC output switches; variable OVP protection
- ▶ Bus programmable versions available ▶▶

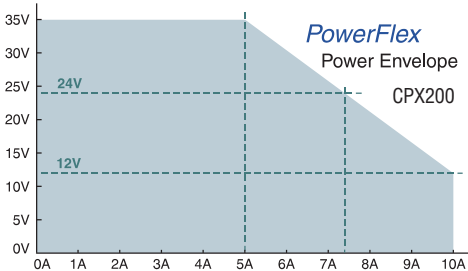
Bus programmable models

CPX series: PowerFlex dual output PSUs



Line regulation <0.01%.
Load regulation <0.01%.
Output noise <3mV rms.
Meter accuracies:
0.2% ±1digit - voltage,
0.5% ±1digit - current.

- ▶ Dual outputs, 350W to 840W maximum
- ▶ PowerFlex design - see Power Envelope graph
- ▶ 4 digit voltage and current meters on each output
- ▶ Meter resolution 10mV and 10mA
- ▶ Switchable remote or local sensing
- ▶ Individual dc output switches
- ▶ Comprehensive protection, variable OVP trips
- ▶ Compact half-rack 3U case size



The CPX200 can provide up to 350 watts (175W per channel). As the set voltage is reduced below 35V, the maximum output current increases up to a maximum of 10A.

Bus programmability

As well as the large range of standard bench power supplies, TTI also offers bus programmable units incorporating varying combination of GPIB (IEEE-488), RS-232 and USB interfaces.

LabView or LabWindows drivers are available for most power supplies as are rack mounts.

These models are equally suited to use on the bench, and in some cases have additional features which will be particularly useful to bench users.

For example, the TSX1810P provides many extra features such as setting memories, watts display and increment stepping which are not incorporated into the standard TSX1810.

Digitally controlled PSUs can also provide faster set-up and better setting stability than analogue controlled units.

EL-P & EX-P: with RS-232



- ▶ Low-cost single output PSUs with RS-232
- ▶ 30V/2A linear or 35V/5A mixed-mode regulation
- ▶ Setting resolution of 10mV and 10mA
- ▶ Front panel control using rotary encoders
- ▶ Other features as per EL and EX series ◀◀

Basic & powerpack models

EB2025T: Triple output 'basic' bench PSU



- ▶ Three isolated outputs
- ▶ Two 0.3 - 20V outputs
- ▶ Fixed 5V/1A output
- ▶ Variable current limit
- ▶ Single analogue meter
- ▶ Full output protection

Specifications (main outputs): Max. output current >250mA. (adjustable 1mA to >250mA).
Line regulation <0.1%. Load regulation 0.2%. Output noise <2mV rms.

TS1410: high current 'powerpack' PSU



- ▶ 12 to 14 volts range
- ▶ More than 10A continuous
- ▶ Analogue current meter
- ▶ Remote sense terminals
- ▶ Low ripple and noise
- ▶ Over-voltage crowbar

Specifications: Line and load regulation <0.1%. Output noise <1mV rms.

PL-P series: with RS-232 and GPIB



- ▶ Single, dual or triple outputs - 32V/3A
- ▶ Setting resolution of 10mV and 1mA
- ▶ 4-6V/7A logic output on triple output model
- ▶ RS-232 & GPIB (IEEE-488.2) interfaces
- ▶ Other specifications as per bench PL series ◀◀

for more bus programmable models see over ▶▶

Bus programmable PSUs (continued)

QL-P series: with GPIB, RS-232 and USB



- ▶ Single or triple outputs - 105W to 215W
- ▶ RS-232, GPIB (IEEE-488.2) and USB interfaces
- ▶ Front and rear output terminals
- ▶ Other features as per standard QL series ◀◀

TSX-P series: with GPIB and RS-232



- ▶ High power single output - 18V/20A or 35V/10A
- ▶ RS-232 and GPIB (IEEE-488.2) interfaces
- ▶ Regulation and metering as per standard TSX ◀◀
- ▶ Digital setting via keypad or spinwheel
- ▶ Compact half-rack 3U case size

TSP3222: with GPIB



Linear Regulation
Line regulation <0.001%.
Load regulation <0.005%.
Output noise <1mV rms.
Meter accuracies:
0.1% ±1digit - voltage,
0.3% ±1digit - current.

- ▶ Dual isolated outputs (0-32V, 0-2A each)
- ▶ GPIB interface as standard (IEEE-488.2)
- ▶ Total control from front panel or GPIB
- ▶ Full voltage and current readback
- ▶ Relay switched series and parallel modes
- ▶ Variable OVP trip, full thermal protection
- ▶ Compact half-rack 3U case size

Rack mounting

Rack-mount kits are available for both bus programmable and standard bench power supplies.

TSX and CPX models use a 3U rack capable of taking one or two units. PL and QL models use a 4U rack. Up to three QL singles can be mounted side by side or one single plus one triple.

Silent Cooling

Most TTI power supplies use convection cooling thus removing the need for a fan and providing silent operation.

Certain models which offer particularly high power density (e.g. EX4210R) use fan-blown cooling to limit temperature rise in the power section.

Additionally, the QL series of high precision linear power supplies uses fan cooling to minimise power related temperature variation within the precision analogue circuitry.

Detailed information

A detailed brochure giving complete technical specifications is available for each power supply series.

Specifications and downloadable brochures are also available from our web site.

Further models

New models may have been added since this brochure was printed. Similarly a few older models may have been discontinued.

- ▶ For the latest information please contact our sales office or visit our website - www.tti-test.com

Front cover photograph (left to right):

EL302T: 125 watt compact triple output PSU
QL355P: 105 watt high precision PSU with bus interface
CPX200: 350 watt PowerFlex dual output PSU

Explanatory Notes to Power Supply Selector table ▶▶

* Quad-mode switching (PL Series)

The main outputs on most TTI power supplies are isolated and have automatic crossover between CV and CI modes. This allows wiring in series or parallel in order to achieve higher voltages or higher currents.

The PL series also features "quad-mode" switching on duals and triples which allows push-button selection of four modes of operation: isolated, series, series-tracking, or parallel.

** Multi-mode switching (EX752M)

The EX752M incorporates switching that enables it to operate as a dual power supply with two independent and isolated outputs, or as a single power supply of double the power.

As a dual, each output provides 0 to 75V at 0 to 2A (mode A). As a single the output can be selected as either 0 to 75V at 0 to 4A (mode B) or 0 to 150V at 0 to 2A (mode C). In single modes, the unused half of the unit becomes completely inoperative and its displays are blanked.

† PowerFlex (CPX Series)

The PowerFlex system enables a power supply to provide higher currents at lower voltages. Each output of the CPX200, for example, can provide 5 amps at 35 volts. As the voltage is reduced, the maximum current available increases up to a maximum of 10 amps at 12 volts or below.

Multi-range (QL Series)

The QL series uses all linear regulation and incorporates range switching to provide higher currents at lower voltages. The maximum voltage and current shown in the table are not available simultaneously.

Power Supply Selector

BENCH MODELS												
Model No	Type	Regulation	O/Ps	Main Output(s)	Logic Output	Power	Fan	OVP	Controls	Meters	Size mm	Weight
EB2025T	Basic	Linear	Triple	0.3 - 20V@ 0.25A	5V @ 1A	15W	No	No	Analogue	Analogue	220x82x230	1.8kg
TS1410	PowerPack	Linear	Single	12V - 14V @ 10A		140W	No	No	Analogue	Analogue	190x160x273	7.8kg
EL301	Compact	Linear	Single	0V - 30V @ 1A		30W	No	No	Analogue	LED	140x160x195	3.4kg
EL183	Compact	Linear	Single	0V - 18V @ 3.3A		60W	No	No	Analogue	LED	140x160x195	4.4kg
EL302	Compact	Linear	Single	0V - 30V @ 2A		60W	No	No	Analogue	LED	140x160x195	4.4kg
EL561	Compact	Linear	Single	0V - 56V @ 1.1A		60W	No	No	Analogue	LED	140x160x195	4.4kg
EL302D	Compact	Linear	Dual	0V - 30V @ 2A		120W	No	No	Analogue	LED	260x160x195	7.5kg
EL302T	Compact	Linear	Triple	0V - 30V @ 2A	3.3V/5V @ 1A	125W	No	No	Analogue	LED	260x160x195	7.5kg
EX1810R	Precision	Mixed Mode	Single	0V - 18V @ 10A		180W	No	No	Analogue	LED	140x160x195	3.0kg
EX355	Compact	Mixed Mode	Single	0V - 35V @ 5A		175W	No	No	Analogue	LED	140x160x195	3.0kg
EX4210R	Precision	Mixed Mode	Single	0V - 42V @ 10A		420W	Yes	No	Analogue	LED	140x160x195	3.5kg
EX354D	Compact	Mixed Mode	Dual	0V - 35V @ 4A		280W	No	No	Analogue	LED	260x160x195	4.3kg
EX354T	Compact	Mixed Mode	Triple	0V - 35V @ 4A	3.3V/5V @ 5A	305W	No	No	Analogue	LED	260x160x195	4.3kg
EX752M	Compact	Mixed Mode	Dual **	0V - 75V @ 2A		300W	No	No	Analogue	LED	260x160x195	4.4kg
PL310	Precision	Linear	Single	0V - 32V @ 1.1A		35W	No	No	Analogue	LED	155x170x265	4.0kg
PL154	Precision	Linear	Single	0V - 15V @ 4A		60W	No	No	Analogue	LED	155x170x265	5.0kg
PL320	Precision	Linear	Single	0V - 32V @ 2.1A		65W	No	No	Analogue	LED	155x170x265	5.0kg
PL330	Precision	Linear	Single	0V - 32V @ 3.1A		95W	No	No	Analogue	LED	155x170x300	6.0kg
PL310QMD	Precision	Linear	Dual *	0V - 32V @ 1.1A		70W	No	No	Analogue	LED	350x170x265	8.0kg
PL320QMD	Precision	Linear	Dual *	0V - 32V @ 2.1A		130W	No	No	Analogue	LED	350x170x265	9.5kg
PL330QMD	Precision	Linear	Dual *	0V - 32V @ 3.1A		190W	No	No	Analogue	LED	350x170x300	12.0kg
PL310QMT	Precision	Linear	Triple *	0V - 32V @ 1.1A	5V @1.5A	77W	No	No	Analogue	LED	350x170x265	11.5kg
PL320QMT	Precision	Linear	Triple *	0V - 32V @ 2.1A	4V - 6V @ 4A	155W	No	No	Analogue	LED	425x170x265	13.5kg
PL330QMT	Precision	Linear	Triple *	0V - 32V @ 3.1A	4V - 6V @ 7A	230W	No	No	Analogue	LED	425x170x300	15.5kg
TS1541S	Precision	Linear	Single	0V - 15V @ 4A		60W	No	No	Analogue	LCD	160x160x238	4.9kg
TS3021S	Precision	Linear	Single	0V - 30V @ 2A		60W	No	No	Analogue	LCD	160x160x238	4.9kg
TS1542S	Precision	Linear	Dual	0V - 15V @ 4A		120W	No	No	Analogue	LCD	308x160x238	9.6kg
TS3022S	Precision	Linear	Dual	0V - 30V @ 2A		120W	No	No	Analogue	LCD	308x160x238	9.6kg
TS3023S	Precision	Linear	Triple	0V - 30V @ 2A	4V - 6V @ 4A	145W	No	No	Analogue	LCD	386x160x238	11.0kg
QL355	High Precision	Linear	Single	0V - 35V @ 5A #		105W	Yes	Yes	Digital	LED	141x171x300	5.0kg
QL564	High Precision	Linear	Single	0V - 56V @ 4A #		112W	Yes	Yes	Digital	LED	141x171x300	5.0kg
QL355T	High Precision	Linear	Triple	0V - 35V @ 5A #	2.7V-5V @ 1A	215W	Yes	Yes	Digital	LED	282x171x300	10.0kg
TSX1820	Precision	Mixed Mode	Single	0V - 18V @ 20A		360W	No	Yes	Analogue	LED	210x130x350	5.0kg
TSX3510	Precision	Mixed Mode	Single	0V - 35V @ 10A		350W	No	Yes	Analogue	LED	210x130x350	5.0kg
CPX200	Precision	PowerFlex	Dual	0V - 35V @ 10A †		350W	No	Yes	Analogue	LED	210x130x350	6.0kg
CPX400	Precision	PowerFlex	Dual	0V -42V @ 20A †		840W	Yes	Yes	Analogue	LED	210x130x350	7.5kg
BUS PROGRAMMABLE MODELS												
Model No	Interfaces	Regulation	O/Ps	Main Output(s)	Logic Output	Power	Fan	OVP	Controls	Meters	Size mm	Weight
EL302-P	RS-232	Linear	Single	0V - 30V @ 2A		60W	No	No	Digital	LED	140x160x195	4.4kg
EX355-P	RS-232	Mixed Mode	Single	0V - 35V @ 5A		175W	No	No	Digital	LED	140x160x195	3.0kg
PL330-P	RS-232 & GPIB	Linear	Single	0V - 32V @ 3.1A		95W	No	No	Analogue	LED	207x170x300	6.5kg
PL330D-P	RS-232 & GPIB	Linear	Dual	0V - 32V @ 3.1A		190W	No	No	Analogue	LED	350x170x300	12.5kg
PL330T-P	RS-232 & GPIB	Linear	Triple	0V - 32V @ 3.1A	4V - 6V @ 7A	230W	No	No	Analogue	LED	425x170x300	16.0kg
QL355-P	USB/RS232/GPIB	Linear	Single	0V - 35V @ 5A #		105W	Yes	Yes	Digital	LED	141x171x300	5.0kg
QL564-P	USB/RS232/GPIB	Linear	Single	0V - 56V @ 4A #		112W	Yes	Yes	Digital	LED	141x171x300	5.0kg
QL355T-P	USB/RS232/GPIB	Linear	Triple	0V - 35V @ 5A #	2.7V-5V @ 1A	215W	Yes	Yes	Digital	LED	282x171x300	10.0kg
TSP3222	GPIB	Linear	Dual	0V - 30V @ 2A		120W	Yes	Yes	Digital	LCD	210x130x380	11.0kg
TSX1820-P	RS-232 & GPIB	Mixed Mode	Single	0V - 18V @ 20A		360W	No	Yes	Digital	LED	210x130x350	5.5kg
TSX3510-P	RS-232 & GPIB	Mixed Mode	Single	0V - 35V @ 10A		350W	No	Yes	Digital	LED	210x130x350	5.5kg

For an explanatory key to the above table please see the previous page ◀ ◀

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.

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