AIM & THURLBY THANDAR INSTRUMENTS

PLH & PLH-P Series



PLH Series - 120V & 250V linear regulated laboratory power supplies

true analog controls with digital functionality

PLH-P Series - full remote control for bench & system applications

analog, RS-232, USB, LAN (LXI) or GPIB interfaces

aimtti.com

aimtti.co.uk | aimtti.us

Aim-TTi

PLH Series

higher voltages without lower performance

Higher voltage power supplies from Europe's leading manufacturer

The PLH series is a development of the best-selling New PL series of laboratory bench power supplies which is available in 15V, 30V and 60V variants (covered in a separate brochure and on our web site).

The PLH series retains the ultra compact format, high power density, and smart analog controls of the PL series but offers voltages up to 250V to cover applications beyond the capabilities of standard bench PSUs and into areas such as magnetics.



TTi has been at the forefront of laboratory power supply design for around thirty years during which it has re-defined the state-of-the-art for switch mode products with its innovative Mixed-mode and PowerFlex regulator designs.

Demand for linear regulated PSUs has remained strong and continuing development of linear models has generated the lower cost ELR series, and the advanced QL series in addition to the ever popular PL series.

The PLH and PLH-P series of linear regulated higher voltage dc power supplies joins a large family of PSUs with power levels from 15 watts up to 1200 watts.

See our web site for full details.

Analog controls with digital stability

As technology has changed, many products have moved from analog controls to digital ones. Although digital controls suit many instruments, they do not necessarily suit a bench power supply.

Customer research shows that many users prefer the speed and simplicity of conventional analog controls for setting voltage and current. 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 of its best-selling sister products, the PL series.

The main disadvantage of analog controls is stability and security. The settings of analog potentiometers can drift over time. More importantly, the settings can be changed accidentally with potentially serious consequences.

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.

Lock your settings at the touch of a button !



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 Vmax ≥ (Vmin + 1V). The fine control gives additional adjustment of ±1%.

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



PLH series - ultra compact using minimum bench or rack space

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 ¼ rack 3U sized casing.

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

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

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.

Better Energy Efficiency

Actual size

High accuracy four digit meters have a fixed resolution for consistent readings at-a-glance.

View and adjust setting limits at any time.

S-Lock digitally locks voltage and current settings at the touch of a button.

True analog controls make adjustment quick and simple.

V-Span enables the full 300° rotation of the voltage control to cover any voltage range.

Safety binding post terminals can accept fixed-shroud 4mm plugs** as well as normal plugs, bare wires, and fork connectors.



Low current range gives 0.01mA meter resolution and finer low current setting.

Meter averaging reduces the jitter from rapidly varying load currents.

DC output switch enables voltage and current to be set up before connecting the load.

Voltage sensing can be changed between local and remote at the flick of a switch.

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

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

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)

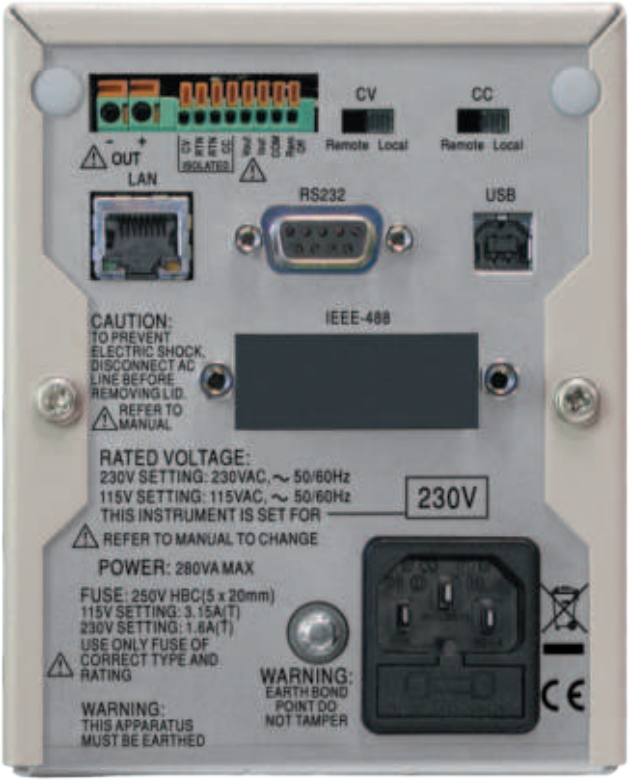
Further versions of the products, are fitted with a GPIB (IEEE-488) interface in addition to USB, RS232 and LAN.

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*	2 x (0 to 30V at 0 to 3A), or 1 x (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

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% + 50µA.
Line Regulation:	Voltage <0·01% + 10mV for 10% line change. Current <0·01% + 50µA. for 10% line change.
Transient Response:	<250µs 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.

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

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.

PLH & PLH-P series - Technical Specifications (continued)

GENERAL SPECIFICATIONS

Input

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

Temperature & Environmental

Operating Range:	+5ºC to +40ºC, 20% to 80% RH
Storage Range:	-40ºC to + 70ºC
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 (¼ rack 3U) x 288mm, PLH-P models - 107mm x 131mm (¼ rack 3U) x 315mm, (sizes exclude feet, knobs and terminals).
Weight:	PLH models - 4·9kg; PLH-P models - 5.0kg

OPTIONS

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.

GPIB Interface (Option G)

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

LOWER VOLTAGE MODELS

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.

Remote Control Interfaces Table PLH series and New PL series

Model	Analog	Isolated Analog	RS-232	USB	LAN (LXI)	GPIB
PLH120						
PLH250						
PLH120-P		•	•	•	•	
PLH250-P		•	•	•	•	
PLH120-P(G)		•	•	•	•	•
PLH250-P(G)		•	•	•	•	•
PL155						
PL303						
PL601						
PL303QMD						
PL155-P	•		•	•	•	
PL303-P	•		•	•	•	
PL601-P	•		•	•	•	
PL303QMD-P			•	•	•	
PL155-P(G)	•		•	•	•	•
PL303-P(G)	•		•	•	•	•
PL601-P(G)	•		•	•	•	•
PL303QMD-P(G)			•	•	•	•

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.

Laboratory power supply series from TTi

TTi offers an extensive range of manual and remote control power supplies for both bench and system applications.

New PL & New PL-P series

Ultra-compact linear regulated power supply series in similar format to PLH series. Single and dual outputs. 75 to 180 watts. RS-232, USB and LAN controlled models with GPIB optional (New PL-P).

EL-R series

Compact linear regulated power supply series with analog controls. Single, dual and triple outputs. 30 to 130 watts.
RS-232 controlled model available (EL302P).

QL & QL-P series

High precision digitally controlled linear regulated power supply series with advanced features. Single and triple outputs. 105 to 220 watts. RS-232, USB, & GPIB controlled models (QL-P).

TS series

Well established linear regulated power supply series. Single and dual outputs. 60 to 120 watts. To be discontinued during 2010.

PL & PL-P series

Long established linear regulated power supply series. Single, dual and triple outputs, 65 to 235 watts. RS-232 and GPIB controlled models (PL-P). Being replaced by the New PL and New PL-P Series as detailed above.

EX-R series

Compact mixed-mode regulated power supply series with analog controls. Single, dual and triple outputs. 175 to 420 watts
RS-232 controlled model available (EX355P).

EX752M

Dual output multi-mode mixed-mode regulated power supply of 300 watts providing up to 150V in single output mode.

TSX & TSX-P series

High performance mixed-mode regulated single output power supply series with analog or digital controls. 360 watts.
RS-232 and GPIB controlled models (TSX-P).

CPX and CPX-P series

Compact 'PowerFlex' regulated dual output series with analog controls. 350 to 840 watts. RS-232, USB, LAN and GPIB controlled models (CPX-P)

QPX series

High power 'PowerFlex' regulated power supplies with digital controls. Single or dual outputs. 1200 watts. Analog, RS-232, USB and LAN interfaces standard. Optional GPIB interface.

Designed and built in Europe by:

Thurlby Thandar Instruments Ltd.
Glebe Road, Huntingdon, Cambridgeshire. PE29 7DR United Kingdom
Tel: +44 1480 412451 Fax: +44 1480 450409
Email: sales@aimtti.com **Web: www.aimtti.com**

Available from:

Brochure Part No. 82100-1420-PDF-Iss1A

AIM & THURLBY THANDAR INSTRUMENTS

Aim-TTi

Product Summary

Laboratory Power Supplies

Bench and system power supplies from 30 watts up to 1200 watts using linear, mixed-mode and PowerFlex regulation technologies.



Waveform Generators

Analog and digital (DDS) function generators, true arbitrary generators, arbitrary/function generators and pulse generators.



Precision Measurement Instruments

Benchtop DMMs, frequency counters, component measurement instruments (LCR), electronic dc loads, current probes.



RF and EMC Test Equipment

Spectrum analyzers, signal generators, frequency counters, power meters, emc measurement instruments.



Company name and product brands

Thurlby Thandar Instruments Ltd. (TTi) is one of Europe's leading manufacturers of test and measurement instruments.

Products have been sold under two brand names: TTi and Aim.

In the future, however, the full product range will be branded Aim-TTi.

This changeover will be gradual and many products will continue to carry the TTi or Aim brands for some time to come.

Web Addresses (URLs)

The preferred URL for obtaining information concerning Aim-TTi products is:

www.aimtti.com (international customers)

Customers in the UK should use the URL:
www.aimtti.co.uk

Customers in the USA should use the URL:
www.aimtti.us

Note that previous URLs such as www.tti-test.com will continue to operate for the time being.

Designed and built in Europe by:

Thurlby Thandar Instruments Ltd.
Glebe Road, Huntingdon, Cambridgeshire PE29 7DR England (United Kingdom)
Tel: +44 (0)1480 412451 Fax: +44 (0)1480 450409
Email: info@aimtti.com **Web: www.aimtti.com**