INSTRUCTION MANUAL

EN

TSX-P Series II

Bench/System silent DC Power Supply with mixed-mode regulation

Table of Contents

Specification	3
Safety	6
Installation	7
Connections	8
Manual Operation	10
Maintenance and Repair	13
Remote Operation	14
Remote Commands	24

Note: The latest revision of this manual, device drivers and software tools can be downloaded from: http://www.aimtti.com/support.

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Specification

OUTPUT SPECIFICATIONS

Output Voltage Range:	0V to 35.3V (35V/10A); 0V to 18.15V (18V/20A).
Output Current Range:	0.01A to 10.2A (35V/10A); 0.01A to 20.2A (18V/20A).
Output Voltage Setting:	Direct keyboard entry or quasi-analog rotary control; setting resolution 10mV.
Output Current Setting:	Direct keyboard entry or quasi-analog rotary control; setting resolution 10mA.
Output Mode:	Constant voltage or constant current with automatic crossover.
Output Switch:	Electronic. Preset voltage and current displayed when off.
Output Terminals:	Front panel: Universal 4mm safety binding posts on 19mm (0·75”) spacing Rear panel: Terminal block screw terminals.
Sensing:	Remote via rear panel terminal block screw terminals or direct via shorting strip (supplied).
Output Protection:	Forward protection by Over-Voltage-Protection (OVP) trip. Output will withstand an applied forward voltage of up to 50V (35V/10A) or 35V (18V/20A). Reverse protection by diode clamp for reverse currents up to 3A.
OVP Setting:	Direct keyboard entry.
OVP Range:	1V to 40V (35V/10A); 1V to 25V (18V/20A).
OVP Delay:	<200µs
Load Regulation:	For any load change, measured at the O/P terminals, using remote sense: Constant voltage: <0.01% ± 5mV Constant current: < 0.01% ±0.5mA
Line Regulation:	Change in output for a 10% line change: Constant voltage: <0.01% ± 5mV Constant current: < 0.01% ± 250uA
Ripple & Noise: (20MHz bandwidth)	Typically <1mV rms; <3mVrms max in CV mode. Typically <3mA rms; <5mArms max in CI mode.
HF Common Mode Noise:	Typically <3mV rms, <15mV peak.
Transient Response:	100µs to within 50mV of setting for a 5% to 95% load change.
Temperature Coefficient:	Typically <100 ppm/°C.
Protection Functions:	Overvoltage trip; regulator overtemperature; sense miswiring.
Status Indication:	LED indicators for Output ON, constant voltage mode, constant current mode, current meter damping, remote operation, and LAN status; trip & error messages on display.

METER SPECIFICATIONS

Meter Types:	Dual 4 digit meters with 12·5mm (0.5") LEDs. Reading rate 4Hz.
Meter Resolution:	10mV, 10mA
Meter Accuracy:	Voltage 0.2% of reading ± 1 digit, current 0.5% of reading ± 1 digit.

KEYBOARD FUNCTIONS

Delta Mode:	Increase or decrease voltage or current in user-selectable steps.
Store/Recall:	Store and recall voltage, current and OVP levels from non-volatile memory (25 memories).
Address Setting:	Set GPIB address.
Damping ON/OFF:	Sets current meter damping ON or OFF

Note: All voltage and current levels set via the keyboard are displayed on a separate 0·3” 4-digit display. This entry preview system ensures that the user can observe the value entered before it is effected thus avoiding possible error. The display is also used for setting additional functions. When the output switch is on and no other function is selected, the display shows output power in Watts.

DIGITAL INTERFACES

Operational Functions:	Set voltage, set current, set OVP; set output on/off; read output voltage; read output current; read output power.
RS232:	9600 baud; 9 pin D-connector (female).
GPIB (optional)	Conforming to IEEE488.1 and IEEE488.2.
USB Interface	Standard USB 2.0 hardware connection. Implemented as Virtual COM Port
LAN Interface	LAN Ethernet 100/10base-T hardware connection. 1.4 LXI Core 2011

OUTPUT SPECIFICATIONS - REMOTE OPERATION

Output Voltage Setting:	10mV resolution.
Output Current Setting:	10mA resolution.
Setting Accuracy:	Voltage: ±(0·1% + 10mV); Current: ± (0.2% + 20mA)
Output Switch:	Electronic by interface command.
Readback Resolution:	Voltage: 10mV. Current: 10mA .
Readback Accuracy:	Voltage: ± (0.2% of reading + 1 digit). Current: ± (0.5% of reading + 1 digit).

INTERFACE RESPONSE TIME

Remote Command Processing Time:	Typically <50ms between receiving the command terminator for a step voltage change at the instrument and the output voltage beginning to change.
Power Supply:	An internal time constant, T, (typically 22ms) governs the settling time of a step voltage increase. Settling time to within 1% of the step change = 4.6T, to 0.1% = 6.9T, to 0.01% = 9.2T; for example, after a 10V step the output will be within 1 digit (10mV = 0.1%) of its new value in typically 150ms. For load current of 1 Amp or more, settling times for downward steps will be very similar; however, response times will be longer at low loads.

GENERAL

AC Input Voltage:	110V – 240V AC ± 10%, 50/60Hz. Installation Category II.
Power Consumption:	600VA max.
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.
Size:	200 x 140 x 385mm (WxHxD); half rack width x 3U height; (optional rack mounting kit available)
Weight:	5kg.
Safety & EMC:	Complies with EN61010-1 & EN61326-1. For details, request the EU Declaration of Conformity for this instrument via http://www.aimtti.com/support (serial no. needed).

Safety

This power supply is a Safety Class I instrument according to IEC classification and has been designed to meet the requirements of EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use). It is an Installation Category II instrument intended for operation from a normal single phase supply.

This instrument has been tested in accordance with EN61010-1 and has been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

This instrument has been designed for indoor use in a Pollution Degree 2 environment in the temperature range 5°C to 40°C, 20% - 80% RH (non-condensing). It may occasionally be subjected to temperatures between +5°C and –10°C without degradation of its safety. Do not operate while condensation is present.

Use of this instrument in a manner not specified by these instructions may impair the safety protection provided. Do not operate the instrument outside its rated supply voltages or environmental range.

WARNING! THIS INSTRUMENT MUST BE EARTHED

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited. The protective action must not be negated by the use of an extension cord without a protective conductor.

When the instrument is connected to its supply, terminals may be live and opening the covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts. The apparatus shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair. Capacitors inside the power supply may still be charged even if the power supply has been disconnected from all voltage sources but will be safely discharged about 10 minutes after switching off power.

Any adjustment, maintenance and repair of the opened instrument under voltage shall be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

If the instrument is clearly defective, has been subject to mechanical damage, excessive moisture or chemical corrosion the safety protection may be impaired and the apparatus should be withdrawn from use and returned for checking and repair.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders is prohibited.

Do not wet the instrument when cleaning it.

The following symbols are used on the instrument and in this manual:-

⏚	Earth (ground) terminal.
O	mains supply OFF.
I	mains supply ON.
∿	alternating current (ac)
⎓	direct current (dc)

Installation

Mains Operating Voltage

This instrument has a universal input range and will operate from a nominal 110V - 240V mains supply without adjustment. Check that the local supply meets the AC Input requirement given in the Specification.

Mains Lead

Connect the instrument to the AC supply using the mains lead provided. Should a mains plug be required for a different mains outlet socket, a suitably rated and approved mains lead set should be used which is fitted with the required wall plug and an IEC60320 C13 connector for the instrument end. To determine the minimum current rating of the lead-set for the intended AC supply, refer to the power rating information on the equipment or in the Specification.

WARNING! THIS INSTRUMENT MUST BE EARTHED.

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited.

Ventilation

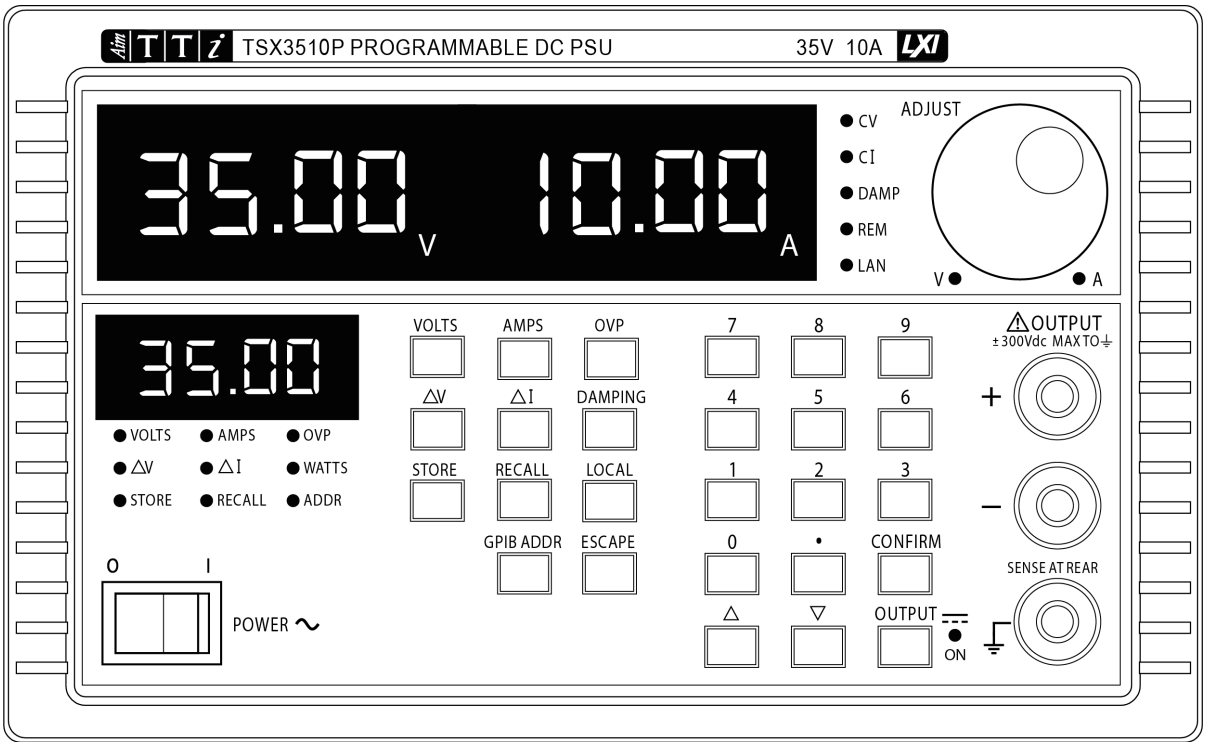
These instruments are very efficient but nevertheless can generate significant heat at full power. The supplies rely on convection cooling only and it is therefore important that ventilation is never restricted if performance and safety are to be maintained. If the supplies are mounted in a restricted space, eg. a 19 inch rack, then adequate ventilation must be ensured by using, for example, a fan tray.

Mounting

This instrument is suitable both for bench use and rack mounting. It is delivered with feet for bench mounting.

A rack kit for mounting one or two of these Half-width 3U high units in a 19” rack is available from the Manufacturers or their overseas agents.

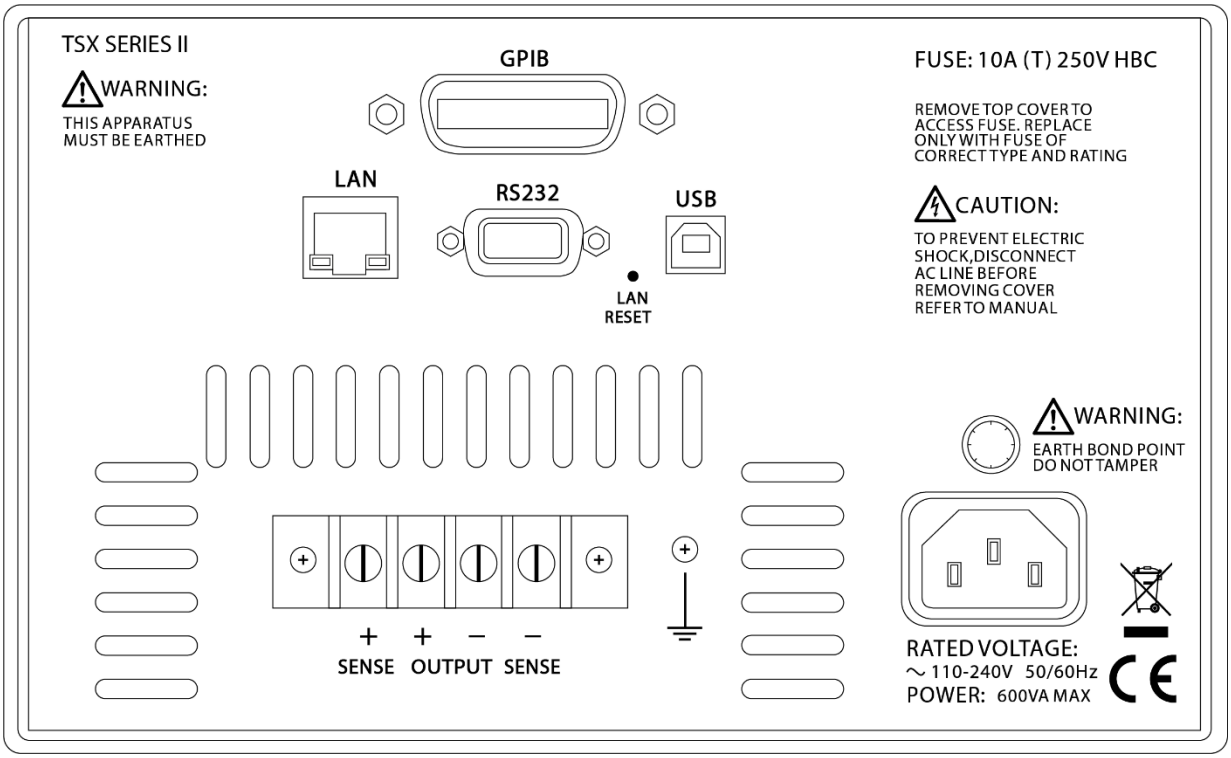
Front Panel Connections



The load should be connected to the positive (red) and negative (black) terminals marked OUTPUT. The OUTPUT terminals are rated at 30A.

The terminal marked ⏚ is connected to the chassis and safety earth ground.

Rear Panel Connections



The output terminals are duplicated on the rear panel terminal block, together with the sense terminals, and are marked +, −, +SENSE and −SENSE

RS232

9–pin female D–connector with pin connections as shown below. Can be connected to a standard PC port using a fully wired 1:1 male-female cable without any cross-over connections.

Pin	Name	Description
1	RI	Passively asserted (+V through 10kΩ)
2	TXD	Transmitted data from instrument
3	RXD	Received data to instrument
4	CTS	
5	GND	Signal ground
6	RTS	Passively asserted (+V through 10kΩ)
7	DSR	No internal connection
8	DTR	
9	CD	No internal connection

Signal ground is connected to instrument ground.

USB

The USB port is connected to instrument ground. It conforms to USB 2.0 (Full Speed) and accepts a standard USB cable. The Windows plug-and-play functions should automatically recognise that the instrument has been connected. If the correct driver is not found, follow the Windows on-screen prompts and select the driver files downloaded from the AIM-TTi support website (www.aimtti.com/support).

LAN

The LAN interface is designed to meet 1.4 LXI (LAN eXtensions for Instrumentation) Core 2011. Remote control using the LAN interface is possible using a TCP/IP Socket protocol. The instrument also contains a basic Web server which provides information on the unit and allows it to be configured. Since it is possible to misconfigure the LAN interface, making it impossible to communicate with the instrument over LAN, a LAN Configuration Initialise (LCI) mechanism is provided via a recessed switch on the rear panel (marked LAN RESET) to reset the unit to the factory default.

Further details are given in the Remote Operation chapter. For more information on LXI standards refer to www.lxistandard.org .

GPIB (Optional)

The GPIB signal grounds are connected to the instrument ground. The implemented subsets are:

SH1 AH1 T6 TE0 L4 LE0 SR1 RL2 PP1 DC1 DT0 C0 E2

The GPIB address is set from the front panel.

Manual Operation

Front Panel

The POWER switch is used to apply line voltage to the instrument. When switched to on (**I**) the instrument will be powered and the start-up procedure will be executed; this will take approximately 5 second to complete. If all is well the settings from the last power-down will be installed and the instrument will be ready for use.

The output terminals are located on the right of the front panel. The red terminal is positive and the black terminal is negative. Connection to the output terminals can be made with any of the following: 4mm plugs, spade terminals or wire ends. To minimise voltage drop, the connecting leads to the load should be of an adequate wire gauge and be kept short. The output terminals are duplicated on the rear panel, together with the sense terminals.

The keyboard is located to the left of the output terminals. This consists of 26 keys and a LED indicating the instrument output status. The use of the keyboard to control all instrument functions is discussed in the following sections.

To the left of the keyboard is the status display which consists of a 4-digit, 7-segment display and 9 LEDs. Normally the status display will show the output power (in Watts) when the output is on or will be blank when the output is off; however, other information will appear when selections are made from the keyboard. The relevant annunciator LED will indicate what the contents of the display represent at any time.

Above the keyboard are the main displays and LED indicators which show the conditions of the output. The displays show the set voltage and set current when the output is off and the voltage at the output terminals and output current when the output is on.

To the right of the LED indicators is a continuously rotating control which may be used to make fine adjustments to voltage or current as described later.

General Principles of Manual Operation

The following sections explain in detail the use of the keyboard to control all instrument functions. If an error is encountered during keyboard operation the status display will show `Ennn` where nnn is a decimal number. A full list of possible errors is given in the STATUS REPORTING section.

Set Voltage

The set voltage is normally shown in the top left hand display marked V. The exception to this is when the output is on and in constant current (CI) mode. In this case the actual output voltage will be less than the set value and will be shown instead.

To set the voltage press the VOLTS key. The status display will show the set voltage value and the VOLTS LED will light. A new value may now be entered from the numeric keypad. The value will be in Volts and the POINT key may be used to enter decimal digits. Once the required value is entered press the CONFIRM key and the set voltage will be updated immediately. To exit without making any changes press the ESCAPE key. If a mistake is made during entry press the VOLTS key and start again. The maximum and minimum values accepted will depend on the particular model, see the specification section for details.

Set Current

When the output is off the set current is shown in the top right hand display marked A. When the output is on and in constant voltage (CV) mode the output current is shown. When in constant current (CI) mode the output current is equal to the set current and this is shown.

To set the current press the AMPS key. The status display will show the set current value and the AMPS LED will light. A new value may now be entered from the numeric keypad. The value will be in Amps and the POINT key may be used to enter decimal digits. Once the required value is entered press the CONFIRM key and the set current will be updated immediately. To exit without making any changes press the ESCAPE key. If a mistake is made during entry press the AMPS key and start again.

The maximum and minimum values accepted will depend on the particular model, see the specification section for details.

Set OVP

The Over-Voltage Protection (OVP) value is not shown in the main display; however, it is active and if at any time the actual value of the output voltage exceeds the set value the OVP circuit will immediately shut down the output, thus avoiding any damage to the circuit under test. The OVP circuit will protect against adjustments by the user or via the digital interfaces, external voltages impressed across the output terminals, or a failure in the circuitry of the instrument itself. If the OVP circuit trips for any reason the main displays will both show **triP** and the output will be shut down, i.e. switched off. The system will then attempt to recover from the trip and if successful the **triP** message will be removed and normal operation will resume.

To set the OVP press the OVP key. The status display will show the set OVP value and the OVP LED will light. A new value may now be entered from the numeric keypad. The value will be in VOLTS and the POINT key may be used to enter decimal digits. Once the required value is entered press the CONFIRM key and the set OVP will be updated immediately. To exit without making any changes press the ESCAPE key. If a mistake is made during entry press the OVP key and start again.

The maximum and minimum values accepted will depend on the particular model, see the specification section for details.

Delta Volts

Delta Volts mode is entered by pressing the DeltaV key. The status display will show the set Delta Volts value and the DeltaV LED will light. A new value may now be entered from the numeric keypad. The value will be in Volts and the POINT key may be used to enter decimal digits. Once the required value is entered press the CONFIRM key and the set Delta Volts value will be updated immediately. To exit without making any changes press the ESCAPE key. If a mistake is made during entry press the DeltaV key and start again.

While in DeltaV mode, i.e. while the DeltaV LED is on, the UP and DOWN keys are active and will increment or decrement the set volts value by the set DeltaV value shown in the status display. The VOLTS LED next to the knob will also be on indicating that the knob is active for adjusting volts. Turning the knob will increment or decrement the set volts value in 10mV steps irrespective of the set DeltaV value.

The maximum value for DeltaV is 1·00V. The minimum value is 0·00V.

Delta Amps

Delta Amps mode is entered by pressing the Deltal key. The status display will show the set Delta Amps value and the Deltal LED will light. A new value may now be entered from the numeric keypad. The value will be in Amps and the POINT key may be used to enter decimal digits. Once the required value is entered press the CONFIRM key and the set Delta Amps value will be updated immediately. To exit without making any changes press the ESCAPE key. If a mistake is made during entry press the Deltal key and start again.

Whilst in Delta Amps mode, i.e. while the Deltal LED is on, the UP and DOWN keys are active and will increment or decrement the set current value by the set Delta Amps value shown in the status display. The AMPS LED next to the knob will also be on indicating that the knob is active for adjusting current. Turning the knob will increment or decrement the set current value in 10mA steps irrespective of the set Delta Amps value.

The maximum value for Delta Amps is 1·00A. The minimum value is 0·00A.

Current Meter Damping

The output current meter damping is toggled on and off by pressing the DAMPING key. When damping is on the DAMP LED will also be on.

Output On/Off

The output is alternatively turned on and off by pressing the OUTPUT key. The status is shown by the ON LED next to the key.

Store Settings

The instrument contains 25 stores each capable of holding the entire set-up. The stored data is non-volatile and is retained while power is off.

To save the instrument set-up to a store press the STORE key. The status display will show the number of the last store which was accessed. This store may be used or a new store number may be entered from the numeric key pad. When the required value is displayed press the CONFIRM key to store the data in that store. Pressing the ESCAPE key will exit without making any changes.

Recall Settings

The instrument contains 25 stores each capable of holding the entire set-up. The stored data is non-volatile and is retained while power is off.

To recall the instrument set up from a store press the RECALL key. The status display will show the number of the last store which was accessed. This store may be used or a new store number may be entered from the numeric key pad. When the required value is displayed press the CONFIRM key to recall the data from that store. Pressing the ESCAPE key will exit without making any changes.

Thermal Trip

If the instrument overheats a thermal trip will occur and the main displays will show the `triP` message. The output will then be shut down, i.e. the output will be switched off. This condition will persist until the instrument cools to below the trip temperature value, when the output will be usable again.

Connection to the Load

Output Terminals

Connection to the front panel output terminals can be made with 4mm plugs, spade terminals or wire ends. To minimise voltage drop, the connecting leads to the load should be of an adequate wire gauge and be kept short. Load wires should also be twisted together to reduce inductance.

The output is fully floating and either terminal can be connected to ground or raised by up to 300V peak above true ground; however, such voltages are hazardous and great care should be taken.

The current limit can be set to limit the continuous output current to levels down to 10mA. However, in common with all precision bench power supplies, a capacitor is connected across the output to maintain stability and good transient response. This capacitor charges to the output voltage, and short circuiting of the output will produce a short current pulse as the capacitor discharges which is independent of the current limit setting.

Sense Terminals

To overcome errors introduced by connecting lead resistance at higher currents (10milliOhms of lead resistance will drop 0·2V at 20Amps) the remote sensing facility should be used. Remove the two shorting links made between the rear output and sense terminals and connect the sense terminals directly to the load; the power connections may be made from either the front or rear terminals. To ensure good coupling between the output and sense, the sense wires should be twisted with their corresponding output leads before the output leads are twisted together.

The voltage drop in each output lead must not exceed 1V.

The shorting links should be re-made between the rear sense and output terminals when remote sensing is not being used. However, the sense connection is also made internally through a low value resistor and only a small error between the set and actual voltage will result if the links are left disconnected.

Sense Miswiring Trip

The output will be tripped off if the sense wires are wired to the wrong output or if an attempt is made to draw power from the sense wires; the **`triP`** message will be shown in both displays.

The system will then attempt to recover from the trip and, if successful (because the wiring has been corrected), the **triP** message will be removed and normal operation will resume.

Output Protection

In addition to OVP for forward overvoltage protection, the output is protected from reverse voltages by a diode; the continuous reverse current must not exceed 3 Amps, although transients can be much higher.

Maintenance and Repair

The Manufacturers or their agents overseas will provide repair for any unit developing a fault. Where owners wish to undertake their own maintenance work, this should only be done by skilled personnel in conjunction with the service guide which is available directly from the Manufacturers or their agents overseas.

Fuse

The correct fuse type for all models and AC supply ranges is:

10 Amp 250V HBC time-lag, 5 x 20 mm

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse-holders is prohibited.

To replace the fuse, first disconnect the instrument from the AC supply. Remove the 6 cover securing screws and lift off the cover. Replace the fuse with one of the correct type and refit the cover.

Note that the main function of the fuse is to make the instrument safe and limit damage in the event of failure of one of the switching devices. If a fuse fails it is therefore very likely that the replacement will also blow, because the supply has developed a fault; in such circumstances the instrument will need to be returned to the manufacturer for service.

Cleaning

If the PSU requires cleaning use a cloth that is only lightly dampened with water or a mild detergent. Polish the display window with a soft dry cloth.

WARNING! TO AVOID ELECTRIC SHOCK, OR DAMAGE TO THE PSU, NEVER ALLOW WATER TO GET INSIDE THE CASE. TO AVOID DAMAGE TO THE CASE OR DISPLAY WINDOW NEVER CLEAN WITH SOLVENTS.

Remote Operation

The instrument can be remotely controlled via its RS232, USB, LAN or GPIB (optional) interfaces.

The RS232 interface communicates directly with a standard COM port.

The USB interface enumerates as a Communications Class device and interacts with application software through a standard virtual COM port device driver on the PC.

The LAN interface is designed to meet 1.4 LXI (LAN eXtensions for Instrumentation) Core 2011. Remote control using the LAN interface is possible using the TCP/IP Sockets protocol. The instrument also contains a basic Web server which provides information on the unit and allows it to be configured from a web browser. Simple command line control from the browser is also possible.

The GPIB interface provides full facilities as described in IEEE Std. 488 parts 1 and 2.

Address Selection

The instrument address capability is strictly required only by the GPIB interface. However, use can be made of the ADDRESS? command over any of the interfaces to easily identify which instrument is being controlled by a particular COM port (for RS232 or USB) or TCP socket (for LAN). Note that the LAN interface also has a separate 'Identify' function, accessible from the instrument's web pages, that flashes the instrument's display until the function is cancelled.

To set an address, press GPIB ADDRess, and enter the required number from the numeric key pad. When the required value is displayed press the CONFIRM key to make it active. Pressing the ESCAPE key will exit without making any changes. The range of addresses accepted is 1 to31.
A change of address will become active immediately it is entered from the keyboard and the device will no longer respond to the previous address.

The address can also be set from the instrument's web pages.

Remote/Local Operation

At power-on the instrument will be in the local state with the REMote indicator off. In this state al front panel operations are possible. When the instrument receives a command the remote state will be entered and REMote indicator will be turned on. In this state the front panel is locked out and remote commands only will be processed.

The instrument may be returned to the local state by pressing the LOCAL key; however, the effect of this action will only remain until the instrument receives another command from the interface, when the remote state will once again be entered. Returning to Local by this action, or by the use of the LOCAL command, will keep the V/I settings at their last remotely set values, and will leave the outputs in their present state.

RS232 Interface

RS232 Interface Connector

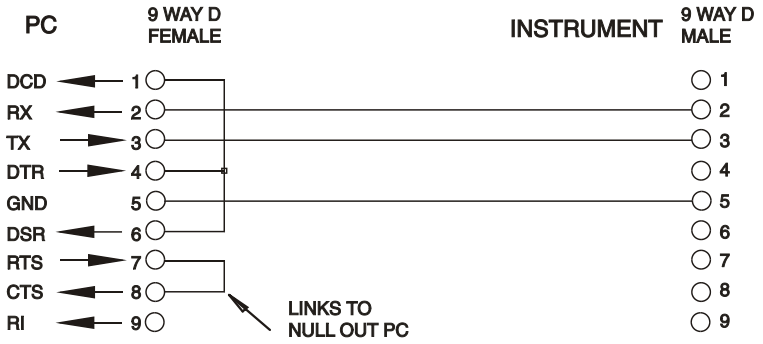
The 9-way D-type serial interface connector is located on the instrument rear panel. The pin connections are as shown below:

Pin	Name	Description
1	RI	Passively asserted (+V through 10kΩ)
2	TXD	Transmitted data from instrument
3	RXD	Received data to instrument
4	CTS	

5	GND	Signal ground
6	RTS	Passively asserted (+V through 10kΩ)
7	DSR	No internal connection
8	DTR	
9	CD	No internal connection

RS232 Connections

The RS232 interface should be connected to a standard PC port using a fully wired 1:1 male-female cable without any cross-over connections. Alternatively, only pins 2, 3 and 5 need be connected to the PC, but with links made in the connector at the PC end between pins 1, 4 and 6 and between pins 7 and 8, see diagram.



Baud Rate for this instrument is fixed at 9600; the other parameters are fixed as follows:

Start Bits: 1	Parity: None
Data Bits: 8	Stop Bits: 1

RS232 Character Set

Because of the need for XON/XOFF handshake it is possible to send ASCII coded data only; binary blocks are not allowed. Bit 7 of ASCII codes is ignored, i.e. assumed to be low. No distinction is made between upper and lower case characters in command mnemonics and they may be freely mixed. The ASCII codes below 20H (space) are not used. In this manual 20H, etc. means 20 in hexadecimal. The unit will send XOFF when there are 50 free bytes remaining and XON when this increases to 100 bytes.

USB Interface

Using the USB interface for remote control requires a Communications Device Class driver on the PC to provide a virtual COM port instance. In Windows a suitable driver is provided by Microsoft, but it is not installed by default. The data (.INF) file to control the installation is available for download from the AIM-TTi support website (www.aimtti.com/support); however the same driver is also used by many other instruments from this manufacturer and may already be known to the PC.

To install the driver for the first time, first switch the unit on, and then connect the USB port to the PC. The Windows plug and play functions should automatically recognise the attachment of new hardware to the USB interface and (possibly after searching the internet for some time) prompt for the location of a suitable driver. Follow the Windows prompts and select the driver files downloaded from the AIM-TTi support website (www.aimtti.com/support). The file is named USB_ARM_VCP_xxx.INF, where xxx is a version number. (A readme.pdf file is also included in the downloaded driver package if further assistance is needed).

In some cases Windows will not complete this procedure (especially recent versions which search the internet first, looking for the unique Vendor ID and Product ID), in which case the instrument will show in Device Manager as “not working properly”. If this happens, select this device, right click and choose “update driver software...” and then “browse this computer for driver software...”. Then locate the .INF file within the driver package downloaded from the AIM-TTi support website (www.aimtti.com/support), as described above.

Once Windows has installed the device driver it will assign a COM port number to this particular unit. This number will depend on previous COM port assignments on this PC, and it may be necessary to use Device Manager to discover it. Each instrument has a unique USB identifier which is remembered by the system, so it will receive the same COM port number whenever it is attached to the same PC (regardless of the physical interface socket used), even though the COM port will disappear while the instrument is disconnected or switched off. Other instruments will receive different COM port numbers.

Note that a different PC will not necessarily assign the same COM port number to a particular instrument (it depends on the history of installations), however Device Manager can be used to change the assignments given.

This virtual COM port can be driven by Windows applications (including a terminal emulator) in exactly the same way as any standard COM port, except that the Baud rate and other settings are unnecessary and are ignored. Some old applications might not function with COM port numbers 3 or 4, or above 9. In this case, use Device Manager to change the allocation given. Once it is installed, the driver will be maintained by Windows Update in the usual way.

LAN Interface

The LAN interface is designed to comply with 1.4 LXI Core 2011 and contains the interfaces and protocols described below. Since it is possible to misconfigure the LAN interface, making it impossible to communicate with the instrument over LAN, a LAN Configuration Initialise (LCI) mechanism is provided via a recessed switch on the rear panel to reset the unit to the factory default. The default setting is for the instrument to attempt to obtain settings via DHCP if available or, if DHCP times out (30 seconds), via Auto-IP. In the very unlikely event that an Auto-IP address cannot be found a static IP address of 192.168.0.100 is assigned. Resetting the LAN removes any password protection.

For more information on LXI standards refer to www.lxistandard.org .

LAN Connection

To use the LAN interface, the IP address of the unit must be known. The AIM-TTi support website (www.aimtti.com/support) includes a guide to the LXI Discovery Tool, providing links to the latest version of the tool and associated downloads. The tool is a Windows PC application which can be used to display the IP addresses or host names of all connected devices that comply with the VXI-11 protocol or support multicast Domain Name System (mDNS) records. Connecting via a router is recommended as this is significantly quicker to assign an IP address; connecting directly to the PC will begin to assign an IP address only after a 30 second DHCP timeout. Double clicking on any entry in the list of devices discovered will open the PC's web browser and display the Home page of that device.

There are also tools for LAN discovery included as part of the National Instruments Measurement and Automation Explorer package and the Agilent Vee application.

The unit will, when first powered up, attempt to obtain settings via DHCP if available or, if DHCP times out (30 seconds), via Auto-IP. In the very unlikely event that an Auto-IP address cannot be found a static IP address of 192.168.0.100 is assigned. During this time the LAN will be lit and it will stay lit if a LAN connection is successfully made. However, if a connection is still not made by the end of the above process, or if the LAN connector is physically removed at any time, the LAN lamp will go off; see LAN Error section for details.

Web Server; Configuration Password Protection

The unit contains a basic web server. This provides information on the instrument and allows it to be configured. The Configure page can be password protected to deter unauthorised changes to the remote operation configuration; the default configuration is 'no password'.

The Configure page itself explains how to set the password. The password can be up to 15 characters long; note that the **User Name should be left blank**. The password will, however, be reset to the default (no password) if the rear panel LAN RESET switch is used to reset all the LAN parameters to their factory default.

The web pages also have an 'Identify' function which allows the user to send an identifying command to the instrument which causes its displays to flash until the command is cancelled.

ICMP Ping Server

The unit contains an ICMP server allowing the instrument to be 'pinged' via either its host name or IP address.

VXI-11 Discovery Protocol

The instrument has very limited support of VXI-11 which is sufficient for the discovery protocol and no more.

The instrument implements a Sun RPC Port-mapper on TCP port 111 and UDP port 111 as defined in RPC1183. The calls supported are: NULL, GET PORT and DUMP.

On TCP port 1024 a very simple VXI-11 protocol is implemented sufficient only for instrument discovery. This implements the following calls: CREATE LINK, DEVICE_WRITE, DEVICE_READ and DESTROY_LINK.

Once a link has been created anything written to the device is ignored and any read from the device returns the identification string as would be expected from a "*IDN?" of the form

'Manufacturer,Model,Serial No.,X.xx – Y.yy'

for example

THURLBY THANDAR,TSX1820P,389730,1.00 – 1.00

where 'X.xx' is the revision of the main firmware and 'Y.yy' is the revision of the interface firmware. The complete firmware is user field updateable via the USB port.

mDNS and DNS-SD Support

Multicast DNS provides DNS services even on networks without a central DNS server (or DHCP server). This simplifies the setting up of a simple LAN using meaningful hostnames instead of a raw IP address. With service discovery it becomes straightforward for the device to be discovered and the services it provides.

The services provided by the instrument are http (_http._tcp) and lxi (_lxi._tcp).

VISA Resource Name

Because of the limited support for VXI-11(Discovery Protocol only), the instrument must be referred to by its raw socket information when used in software packages which communicate via a VISA resource name. For example, an instrument at IP address 192.168.1.100 would normally have a VISA resource name of "TCPIP0::192.168.1.100::inst0::INSTR" but for this instrument the name must be modified to read "TCPIP0::192.168.1.100::9221::SOCKET" where 9221 is the TCP port used by this instrument for control and monitoring, see below.

XML Identification Document URL

As required by the LXI Standard, the instrument provides an XML identification document that can be queried via a GET at "http://<hostname>:80/lxi/identification" that conforms to the LXI XSD Schema (available at http://www.lxistandard.org/InstrumentIdentification/1.0) and the W3C XML Schema Standards (http://www.w3.org/XML/Schema). This document describes the instrument.

TCP Sockets

The instrument uses 1 socket on TCP port 9221 for instrument control and monitoring. Text commands are sent to this port as defined in 'Remote Commands' and any replies are returned via the same port. Any command string must contain one or more complete commands. Multiple commands may be separated with either semicolons ";" or line feeds. No final terminator is required, since the TCP frame implies a terminator, but one may be sent if desired.

LAN Error

If a LAN connection is made but an error is detected (e.g. the IP address is the same as another device on the network) then the instrument's LAN lamp will be off until the error is corrected. If a LAN error occurs; check and correct the configuration of the instrument; a LAN Configuration Initialise (LCI) mechanism is provided via a recessed switch on the rear panel (marked LAN RESET) to reset the unit to the factory default. The default setting is for the instrument to attempt to obtain settings via DHCP if available or, if DHCP times out (30 seconds), via Auto-IP. In the very unlikely event that an Auto-IP address cannot be found a static IP address of 192.168.0.100 is assigned.

If no physical LAN connection is found at any time the LAN lamp will be off.

GPIB Interface

The 24-way GPIB connector is located on the instrument rear panel.

The pin connections are as specified in IEEE Std. 488.1-1987 and the instruments in the range comply with IEEE Std. 488.1-1987 and IEEE Std. 488.2-1987 and contain the following IEEE 488.1 subsets.

GPIB Subsets

This instrument contains the following IEEE 488.1 subsets:

Source Handshake	SH1
Acceptor Handshake	AH1
Talker	T6
Listener	L4
Service Request	SR1
Remote Local	RL1
Parallel Poll	PP1
Device Clear	DC1
Device Trigger	DT0*
Controller	C0
Electrical Interface	E2

* Although no Device Trigger capability is included, the GET message will not cause a command error unless its position in the input stream dictates that it should; e.g. buried inside a <PROGRAM MESSAGE UNIT>.

GPIB IEEE Std. 488.2 Error Handling

The IEEE 488.2 UNTERMINATED error (addressed to talk with nothing to say) is handled as follows. If the instrument is addressed to talk and the response formatter is inactive and the input queue is empty then the UNTERMINATED error is generated. This will cause the Query Error bit to be set in the Standard Event Status Register, a value of 3 to be placed in the Query Error Register and the parser to be reset. See the Status Reporting section for further information.

The IEEE 488.2 INTERRUPTED error is handled as follows. If the response formatter is waiting to send a response message and a <PROGRAM MESSAGE TERMINATOR> has been read by the parser or the input queue contains more than one END message then the instrument has been INTERRUPTED and an error is generated. This will cause the Query Error bit to be set in the

Standard Event Status Register, a value of 1 to be placed in the Query Error Register and the response formatter to be reset thus clearing the output queue. The parser will then start parsing the next <PROGRAM MESSAGE UNIT> from the input queue. See the Status Reporting section for further information.

The IEEE 488.2 DEADLOCK error is handled as follows. If the response formatter is waiting to send a response message and the input queue becomes full then the instrument enters the DEADLOCK state and an error is generated. This will cause the Query Error bit to be set in the Standard Event Status Register, a value of 2 to be placed in the Query Error Register and the response formatter to be reset thus clearing the output queue. The parser will then start parsing the next <PROGRAM MESSAGE UNIT> from the input queue. See the Status Reporting section for further information.

GPIB Parallel Poll

The power supplies offer complete parallel poll capabilities. The Parallel Poll Enable Register is set to specify which bits in the Status Byte Register are to be used to form the ist local message The Parallel Poll Enable Register is set by the ∗PRE <nrf> command and read by the ∗PRE? command. The value in the Parallel Poll Enable Register is ANDed with the Status Byte Register; if the result is zero then the value of ist is 0 otherwise the value of ist is 1.

The instrument must also be configured so that the value of ist can be returned to the controller during a parallel poll operation. The instrument is configured by the controller sending a Parallel Poll Configure command (PPC) followed by a Parallel Poll Enable command (PPE). The bits in the PPE command are shown below:

bit 7 =	X	don't care
bit 6 =	1	Parallel poll enable
bit 5 =	1	
bit 4 =	0	
bit 3 =	Sense - sense of the response bit; 0 = low, 1 = high	
bit 2 =	?	bit position of the response
bit 1 =	?	
bit 0 =	?	

Example. To return the RQS bit (bit 6 of the Status Byte Register) as a 1 when true and a 0 when 002

∗PRE 64<pmt>, then PPC followed by 69H (PPE)

The parallel poll response from the generator will then be 00H if RQS is 0 and 01H if RQS is 1.

During parallel poll response the DIO interface lines are resistively terminated (passive termination). This allows multiple devices to share the same response bit position in either wired-AND or wired-OR configuration, see IEEE 488.1 for more information.

Status Reporting

The standard status and error reporting model described in IEEE Std. 488.2 was designed for the GPIB interface and contains some features intended for use with the Service Request and Parallel Poll hardware capabilities of that interface, and to accommodate its semi-duplex operation. Although those facilities are of little use with other interfaces, this instrument makes the full set of capabilities available to all of the interfaces. All the remote interfaces share the same set of status and error registers

These are described in the following paragraphs and shown on the Status Model at the end of this section.

Standard Event Status and Standard Event Status Enable Registers

These two registers are implemented as required by the IEEE std. 488.2.

Any bits set in the Standard Event Status Register which correspond to bits set in the Standard Event Status Enable Register will cause the ESB bit to be set in the Status Byte Register.

The Standard Event Status Register is read and cleared by the ∗ESR? command. The Standard Event Status Enable register is set by the ∗ESE <nrf> command and read by the ∗ESE? command.

Bit 7 - Power On. Set when power is first applied to the instrument.

Bit 6 - Not used.

Bit 5 - Command Error. Set when a syntax type error is detected in a command from the bus. The parser is reset and parsing continues at the next byte in the input stream.

Bit 4 - Execution Error. Set when an error is encountered while attempting to execute a completely parsed command. The appropriate error number will be reported in the Execution Error Register, as listed below:

001	Checksum error in EEPROM data for fixed PSU parameters, at power-on. Fatal error; requires return to manufacturer.
002	Checksum error in EEPROM data for PSU last settings data, at power-on. Default settings will be loaded instead, as per *RST command.
003	Checksum error in EEPROM data for PSU calibration data, at power-on. Default calibration settings loaded instead, but PSU must be recalibrated.
100	Maximum set voltage value exceeded.
101	Maximum set amps value exceeded.
102	Minimum set voltage exceeded.
103	Minimum set amps value exceeded.
104	Maximum delta voltage value exceeded.
105	Maximum delta amps value exceeded.
107	Minimum set OVP value exceeded.
108	Maximum set OVP value exceeded.
109	Minimum delta amps value exceeded.
110	Minimum delta voltage value exceeded.
114	Illegal bus address requested.
115	Illegal store number.
116	Recall empty store requested.
117	Stored data is corrupt.
118	Output stage has tripped (OVP or Temperature).
119	Value out of range.

Bit 3 - Operation Time-out Error. Set when an attempt is made to set an output to a specific voltage value, with verify specified, and the output Volts do not settle within 5 seconds. This can happen if, for example, a large value of capacitance exists across the output and the current limit is set to a very low value.

Bit 2 - Query Error. Set when a query error occurs. The appropriate error number will be reported in the Query Error Register as listed below.

1	Interrupted error
2	Deadlock error
3	Unterminated error

Bit 1 - Not used.

Bit 0 - Operation Complete. Set in response to the ∗OPC command.

Limit Event Status Register and Limit Event Status Enable Register

These two registers are implemented as an addition to the IEEE std.488.2. Their purpose is to allow the controller to be informed of entry to and/or exit from current limit by any output.

Any bits set in the Limit Event Status Register which correspond to bits set in the Limit Event Status Enable Register will cause the LIM bit to be set in the Status Byte Register.

The Limit Event Status Register is read and cleared by the LSR<N>? command. The Limit Event Status Enable register is set by the LSE<N> <nrf> command and read by the LSE<N>? command.

Bit 7 ... Bit 3 are not used.

Bit 2 - Set when an output trip has occurred.

Bit 1 - Set when output enters voltage limit.

Bit 0 - Set when output enters current limit.

Status Byte Register and Service Request Enable Register

These two registers are implemented as required by the IEEE std. 488.2.

Any bits set in the Status Byte Register which correspond to bits set in the Service Request Enable Register will cause the RQS/MSS bit to be set in the Status Byte Register, thus generating a Service Request on the bus.

The Status Byte Register is read either by the ∗STB? command, which will return MSS in bit 6, or by a Serial Poll which will return RQS in bit 6. The Service Request Enable register is set by the ∗SRE <nrf> command and read by the ∗SRE? command.

Bit 7 - Not used

Bit 6 - RQS/MSS. This bit, as defined by IEEE Std. 488.2, contains both the Requesting Service message and the Master Status Summary message. RQS is returned in response to a Serial Poll and MSS is returned in response to the ∗STB? command.

Bit 5 - ESB. The Event Status Bit. This bit is set if any bits set in the Standard Event Status Register correspond to bits set in the Standard Event Status Enable Register.

Bit 4 - MAV. The Message Available Bit. This will be set when the instrument has a response message formatted and ready to send to the controller. The bit will be cleared after the Response Message Terminator has been sent.

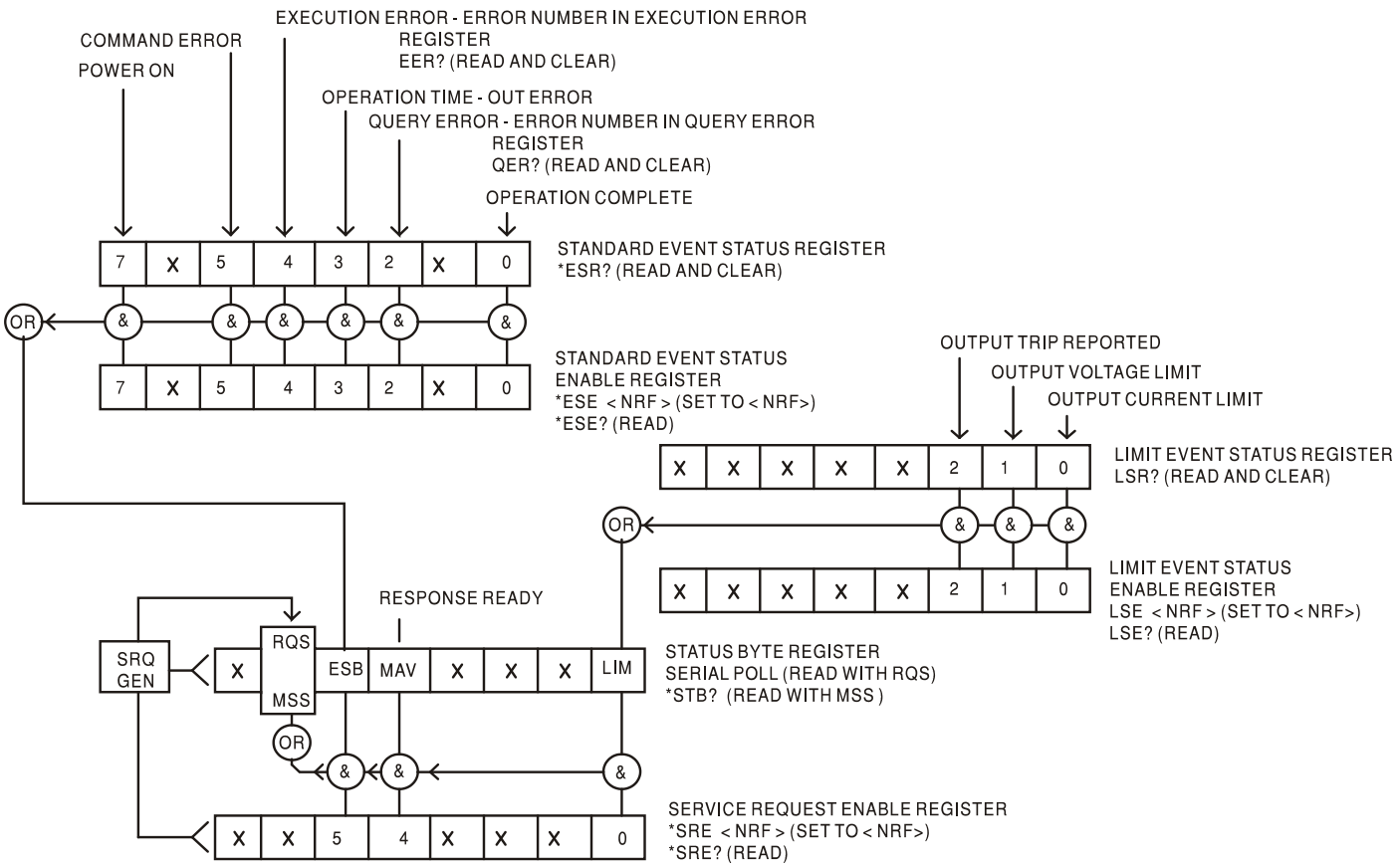
Bit 3 - Not used.

Bit 2 - Not used.

Bit 1 - Not used.

Bit 0 - LIM. The Limit status bit. This bit is set if any bits set in the Limit Event Status Register correspond to bits set in the Limit Event Status Enable Register.

Status Model



Power-on and Remote Operation Default Settings

Most instrument settings are stored in non-volatile ram and will remain unchanged while power is off. The following instrument status values are set at power on:

	Status Byte Register	= 0
*	Service Request Enable Register	= 0
	Standard Event Status Register	= 128 (pon bit set)
*	Standard Event Status Enable Register	= 0
	Limit Event Status Register	= 0 (Then set to show new limit status)
*	Limit Event Status Enable Register	= 0
	Execution Error Register	= 0
	Query Error Register	= 0
*	Parallel Poll Enable Register	= 0

* Registers marked thus are specific to the GPIB section of the instrument and are of limited use via other interfaces.

The standby state will be set and the instrument will be in local with the keyboard active.

Due to the non-volatile storage the power on settings are essentially modified by any command, local or remote, which changes any value not listed above. If a defined state is require at start up by the controller the *RST command should be issued which will load the settings as listed in the description of that command.

If for any reason an error is detected at power up in the non-volatile ram a warning will be issued and all settings will be returned to their default states as for a *RST command.

The *RST (reset) interface command resets the instrument to the Remote Operation Default settings:

The instrument will be in local state with the front panel controls active.
The output is set to minimum voltage, minimum current, maximum OVP, meter damping off and output OFF. No other action taken.

Remote interface settings are unchanged by *RST.

RS232/USB Remote Command Format

RS232 input to the instrument is buffered in a 256 byte input queue which is filled, under interrupt, in a manner transparent to all other instrument operations. The instrument will send XOFF when approximately 200 characters are in the queue. XON will be sent when approximately 100 free spaces become available in the queue after XOFF was sent. This queue contains raw (un-parsed) data which is taken, by the parser, as required. Commands (and queries) are executed in order and the parser will not start a new command until any previous command or query is complete. RS232 responses to commands or queries are sent immediately; there is no output queue.

USB input conforms to USB 2.0 Full Speed.

LAN input to the instrument is buffered in a 1500 byte input queue which is filled, under interrupt, in a manner transparent to all other instrument operations. LAN interface conforms with 1.4 LXI (LAN eXtensions for Instrumentation) Core 2011.

Commands must be sent as specified in the commands list and must be terminated with the command terminator code 0AH (Line Feed, LF). Commands may be sent in groups with individual commands separated from each other by the code 3BH (;). The group must be terminated with command terminator 0AH (Line Feed, LF).

Responses from the instrument to the controller are sent as specified in the commands list. Each response is terminated by a <RESPONSE MESSAGE TERMINATOR> which is 0DH (Carriage Return, CR) followed by 0AH (Line Feed, LF).

<WHITE SPACE> is defined as character codes 00H to 20H inclusive.

<WHITE SPACE> is ignored except in command identifiers. e.g. '*C LS' is not equivalent to '*CLS'.

The high bit of all characters is ignored.

The commands are case insensitive.

GPIB Remote Command Formats

GPIB input to the instrument is buffered in a 256 byte input queue which is filled, under interrupt, in a manner transparent to all other instrument operations. The queue contains raw (un-parsed) data which is taken, by the parser, as required. Commands (and queries) are executed in order and the parser will not start a new command until any previous command or query is complete. There is no output queue which means that the response formatter will wait, indefinitely if necessary, until the instrument is addressed to talk and the complete response message has been sent, before the parser is allowed to start the next command in the input queue.

Commands are sent as <PROGRAM MESSAGES> by the controller, each message consisting of zero or more <PROGRAM MESSAGE UNIT> elements separated by <PROGRAM MESSAGE UNIT SEPARATOR>

>.elements.

A <PROGRAM MESSAGE UNIT> is any of the commands in the remote commands list.

A <PROGRAM MESSAGE UNIT SEPARATOR> is the semi-colon character ';' (3BH).

<PROGRAM MESSAGES> are separated by <PROGRAM MESSAGE TERMINATOR> elements which may be any of the following:

NL	The new line character (0AH)
NL^END	The new line character with the END message
^END	The END message with the last character of the message

Responses from the instrument to the controller are sent as <RESPONSE MESSAGES>. A <RESPONSE MESSAGE> consists of one <RESPONSE MESSAGE UNIT> followed by a <RESPONSE MESSAGE TERMINATOR
A <RESPONSE MESSAGE TERMINATOR> is the new line character with the END message NL^END.

Each query produces a specific <RESPONSE MESSAGE> which is listed along with the command in the remote commands list.

<WHITE SPACE> is ignored except in command identifiers. e.g. '*C LS' is not equivalent to '*CLS'. <WHITE SPACE> is defined as character codes 00H to 20H inclusive with the exception of the NL character (0AH).

The high bit of all characters is ignored.

The commands are case insensitive.

Command List

This section lists all commands and queries implemented in this instrument.

Note that there are no dependent parameters, coupled parameters, overlapping commands, expression program data elements or compound command program headers; each command is completely executed before the next command is started. All commands are sequential and the operation complete message is generated immediately after execution in all cases.

The following nomenclature is used:

<RMT>	<RESPONSE MESSAGE TERMINATOR>
<NRF>	A number in any format. e.g. 12, 12·00, 1·2 e1 and 120 e-1 are all accepted as the number 12. Any number, when received, is converted to the required precision consistent with the use then rounded to obtain the value of the command.
<NR1>	A number with no fractional part, i.e. an integer.
<NR2>	A number in fixed point format e.g. 11·52, 0·78 etc.
<N>	The number of the output (1, 2, etc) or associated status register to which the command relates. On single output supplies <N> is always 1.
<CPD>	<CHARACTER PROGRAM DATA>
<CRD>	<CHARACTER RESPONSE DATA>

The commands which begin with a ***** are implemented as specified by IEEE Std 488.2 as Common commands. All will function when used on the other interfaces but some may be of little use.

Instrument Specific Commands

For commands specified as 'WITH VERIFY' the operation is completed when the parameter being adjusted reaches the required value to within ±5% or ±10 counts, whichever is the greater. If the value fails to settle within these limits within 5 seconds then the Verify Timeout bit (bit 3) is set in the Standard Event Status Register and the operation is completed at the end of the timeout period.

The Operation Complete bit (bit 0) in the Standard Event Status Register is only ever set by the *OPC command. The *OPC (or the *OPC?) command can be used for device synchronisation due to the sequential nature of remote operations.

V<N> <NRF>	Set output <N> to <NRF> Volts
V<N>V <NRF>	Set output <N> to <NRF> Volts with verify
OVP<N> <NRF>	Set output <N> over voltage protection trip point to <NRF> Volts
I<N> <NRF>	Set output <N> current limit to <NRF> Amps
V<N>?	Returns the set voltage of output <N> The response is V <N> <NR2><RMT> where <NR2> is in Volts

I<N>?	Returns the set current limit of output <N> The response is I <N> <NR2><RMT> where <NR2> is in Amps
OVP<N>?	Returns the voltage trip setting for output <N> The response is VP<N> <NR2><RMT> where <NR2> is in Volts
V<N>O?	Returns the output readback voltage for output <N> The response is <NR2>V<RMT> where <NR2> is in Volts
I<N>O?	Returns the output readback current for output <N> The response is <NR2>A<RMT> where <NR2> is in Amps
DELTAV<N> <NRF>	Set the output <N> voltage step size to <NRF> Volts
DELTAI<N> <NRF>	Set the output <N> current step size to <NRF> Amps
DELTAV<N>?	Returns the output <N> voltage step size The response is DELTAV<N> <NR2><RMT> where <NR2> is in Volts.
DELTAI<N>?	Returns the output <N> current step size The response is DELTAI<N> <NR2><RMT> where <NR2> is in Amps.
INCV<N>	Increment the output <N> voltage by the step size set for output <N>
INCV<N>V	Increment the output <N> voltage by the step size set for output <N> and verify.
DECV<N>	Decrement the output <N> voltage by the step size set for output <N>
DECV<N>V	Decrement the output <N> voltage by the step size set for output <N> and verify
INCI<N>	Increment the output <N> current limit by the step size set for output <N>
DECI<N>	decrement the output <N> current limit by the step size set for output <N>
OP<N> <NRF>	set output <N> on/off where <NRF> has the following meaning: 0=OFF, 1=ON
OP<N>?	Returns output <N> on/off status. The response is <NR1><RMT> where 1 = ON, 0 = OFF.
LSR<N>?	Query and clear Limit Event Status Register <N>. The response is <NR1><RMT>. See Status Reporting section for details.
LSE<N> <NRF>	Set the value of LSE<N>, Limit Event Status Enable Register <N>, to <NRF>
LSE<N>?	Return the value of LSE<N>, Limit Event Status Enable Register <N> - response is <NR1><RMT>
*SAV<N> <NRF>	Save the current set-up of output <N> to the set-up store specified by <NRF> where <NRF> can be 1-25
*RCL<N> <NRF>	Recall a set up for output <N> from the set-up store specified by <NRF> where <NRF> can be 1-25
POWER <N>?	Returns the power being output from the instrument, in watts. The response is <NR2><RMT> where <NR2> is in Watts.
DAMPING<N> <NRF>	Sets the current meter damping to OFF or ON. If the value of <NRF>, is 0 the meter damping will be set to OFF, if 1 the meter damping will be set to ON.
BUZZER <NRF>	Sets the buzzer status to ON or OFF. If the value of <NRF>after rounding, is 0 the buzzer status will be set to OFF, if 1 the buzzer status will be set to ON
BUZZ	Sounds the buzzer and sets the buzzer status to ON.

Note: All instrument specific 'legacy' commands for the earlier generation TSX-P models will also be accepted as valid commands.

System and Status Commands

*CLS	Clear Status. Clears the Status structure. This indirectly clears the Status Byte

	Register.
EER?	Query and clear Execution Error Register. The response format is nr1<RMT>.
*ESE <NRF>	Set the Standard Event Status Enable Register to the value of <NRF>
*ESE?	Returns the value in the Standard Event Status Enable Register in <NR1> numeric format. The syntax of the response is <NR1><RMT>
*ESR?	Returns the value in the Standard Event Status Register in <NR1> numeric format. The register is then cleared. The response is <NR1><RMT>. See Status Reporting section for details.
*IST?	Returns **ist** local message as defined by IEEE Std. 488.2. The syntax of the response is 0<RMT>, if the local message is false, or 1<RMT>, if the local message is true.
*OPC	Sets the Operation Complete bit (bit 0) in the Standard Event Status Register. This will happen immediately the command is executed because of the sequential nature of all operations.
*OPC?	Query Operation Complete status. The response is always 1<RMT> and will be available immediately the command is executed because all commands are sequential.
*PRE <NRF>	Set the Parallel Poll Enable Register to the value <NRF>.
*PRE?	Returns the value in the Parallel Poll Enable Register in <NR1> numeric format. The syntax of the response is <NR1><RMT>
QER?	Query and clear Query Error Register. The response format is nr1<RMT>
*RST	Resets the instrument to the remote control default settings : The instrument will be in local state with the front panel controls active. The output is set to minimum voltage, minimum current, maximum OVP, meter damping off and output OFF. Remote interface settings are unchanged by *RST.
*SRE <NRF>	Set the Service Request Enable Register to <NRF>.
*SRE?	Returns the value of the Service Request Enable Register in <NR1> numeric format. The syntax of the response is<NR1><RMT>
*STB?	Returns the value of the Status Byte Register in <NR1> numeric format. The syntax of the response is<NR1><RMT>
*WAI	Wait for Operation Complete true. As all commands are completely executed before the next is started this command takes no additional action.

Interface Management Commands

LOCAL	Go to local. This does not release any active interface lock so that the lock remains with the selected interface when the next remote command is received.
ADDRESS?	Returns the bus address <NR1><RMT>. This number can be used to identify the unit
IPADDR?	Returns the present IP address of the LAN interface, provided it is connected. If it is not connected, the response will be the static IP if configured to always use that static IP, otherwise it will be 0.0.0.0 if waiting for DHCP or Auto-IP. The response is nnn.nnn.nnn.nnn<RMT>, where each nnn is 0 to 255.
NETMASK?	Returns the present netmask of the LAN interface, provided it is connected. The response is nnn.nnn.nnn.nnn<RMT>, where each nnn is 0 to 255.
NETCONFIG?	Returns the first means by which an IP address will be sought. The response is <CRD><RMT> where <CRD> is DHCP, AUTO or STATIC.

The following commands specify the parameters to be used by the LAN interface. **Note:** a power cycle is required after these commands are sent before the new settings are used (or returned in response to the queries listed above). The instrument does not attempt to check the validity of the IP address or netmask in any way other than checking that each part fits in 8 bits. The rear panel LAN RESET switch will override these commands and restore the defaults as described earlier.

NETCONFIG <CPD>	Specifies the means by which an IP address will be sought. <CPD> must be one of DHCP, AUTO or STATIC.
IPADDR <quad>	Sets the potential static IP address of the LAN interface (as on the webpage). The parameter must be strictly a dotted quad for the IP address, with each address part an <NR1> in the range 0 to 255, (e.g. 192.168.1.101).
NETMASK <quad>	Sets the netmask to accompany the static IP address of the LAN interface. The parameter must be strictly a dotted quad for the netmask, with each part an <NR1> in the range 0 to 255, (e.g. 255.255.255.0).

Miscellaneous Commands

*IDN?	Returns the instrument identification. The exact response is determined by the instrument configuration and is of the form <NAME>,<model>, <serial>, <version><RMT> where <NAME> is the manufacturer's name, <model> defines the type of instrument, <serial> is the instrument serial number and<version> is the revision level of the software installed.
*TST?	The PSU has no self-test capability and the response is always 0 <RMT>.
*TRG	The PSU has no trigger capability. The command is ignored in this instrument.

Error Messages

Each error message has a number; only this number is reported via the remote control interfaces. Error message numbers are not displayed but are placed in the Execution Error Register where they can be read via the remote interfaces, see Status Reporting section.

EXCELLENCE THROUGH EXPERIENCE

Aim-TTi is the trading name of Thurlby Thandar Instruments Ltd. (TTi), one of Europe's leading manufacturers of test and measurement instruments.

The company has wide experience in the design and manufacture of advanced test instruments and power supplies built up over more than thirty years.

The company is based in the United Kingdom, and all products are built at the main facility in Huntingdon, close to the famous university city of Cambridge

TRACEABLE QUALITY SYSTEMS

TTi is an ISO9001 registered company operating fully traceable quality systems for all processes from design through to final calibration

ISO9001:2015
Certificate number FM 20695

WHERE TO BUY AIM-TTI PRODUCTS

Aim-TTi products are widely available from a network of distributors and agents in more than sixty countries across the world.

To find your local distributor, please visit our website which provides full contact details

Designed and built in Europe by:

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48511-1810 Issue 2