T. T. I. 6
TRUE TEMPERATURE INDICATOR SIX

The company is always willing to give technical advice and assistance where appropriate.

Equally, because of the programme of continual development and improvement we reserve the right to amend or alter characteristics and design without prior notice.

This publication is for information only.

CONTENTS	PAGE

Information in this publication may be subject to change; the T. T. I. 6 is a microprocessor based, software driven instrument and may therefore be subject to software and hardware changes in line with our policy of continuous product development.

GUARANTEE

This instrument has been manufactured to exacting standards and is guaranteed for twelve months against electrical break-down or mechanical failure caused through defective material or workmanship, provided the failure is not a result of misuse. In the event of failure covered by this guarantee, the instrument must be returned, carriage paid, to the supplier for examination, and will be replaced or repaired at our option.

FRAGILE CERAMIC AND/OR GLASS PARTS ARE
NOT COVERED BY THIS GUARANTEE.

INTERFERENCE WITH, OR FAILURE TO PROPERLY MAINTAIN
THIS INSTRUMENT MAY INVALIDATE THIS GUARANTEE.

RECOMMENDATION

The life of your **ISOTECH** Instrument will be prolonged if regular maintenance and cleaning to remove general dust and debris is carried out.

We recommend this instrument to be re-calibrated annually.

SERIAL NO:

ISSUE DATE:

The company is always willing to give technical advice and assistance where appropriate. Equally, because of the programme or continual development and improvement we reserve the right to amend or alter characteristics and design without prior notice. This publication is for information only.

1. INTRODUCTION

A high precision portable thermometer for metrology and other exacting laboratory applications, the T. T. I. 6 is a proven instrument used worldwide as a laboratory and site standard in pharmaceuticals, medical, food, environmental tesing, R & D, and general industrial applications. It is particularly suitable as the reference standard for temperature calibration baths.

The T. T. I. 6 Digital Thermometer utilizes highly advanced microprocessor circuit design to achieve exceptional measuring accuracy, linearisation conformity and stability in a versatile but easy to use configuration.

Based on a high resolution 20 Bit Analogue to Digital convertor, all measurement computations are performed digitally **without drift.** The 5 digit LED display provides a readout to 0.01°C over the entire -199.99 to +849.99°C range; alternatively °F, Kelvin or Ohms values can be displayed up to 999.99 units.

Single or dual Pt100 3 or 4 wire sensors are accepted, the T. T. I. 6 will automatically recognise and select 3 or 4 wire mode. Display of input A, B or A - B (differential) can be selected; a differential "zero function" allows sensor accuracy differences to be eliminated for accurate differential readings.

An RS232 interface (remote control and measure) is fitted as standard and isolation is incorporated. An analogue (retransmission) output is also fitted as standard; the 1V dc output is programmable between lower and upper set limits.

Calibrated sensors can have their calibration points programmed into the T. T. I. 6 via a personal computer using Isotech Software. The instrument then digitally self calibrates to the probe(s) providing corrected temperature readout to give optimum system accuracy.

The non-volatile memory ensures permanent retention of the values until the user wishes to reprogram using the software, preventing unauthorised personnel from changing the values.

Primary power is provided by an internal, rechargeable sealed lead-acid battery which provides in excess of 12 hours operation from a full charge. A mains adaptor is provided for re-charging and for operation directly from the mains.

A range of precision stainless steel sheath Pt100 probes is available for the T. T. I. 6.

FRONT PANEL INFORMATION AT A GLANCE:

When you switch on
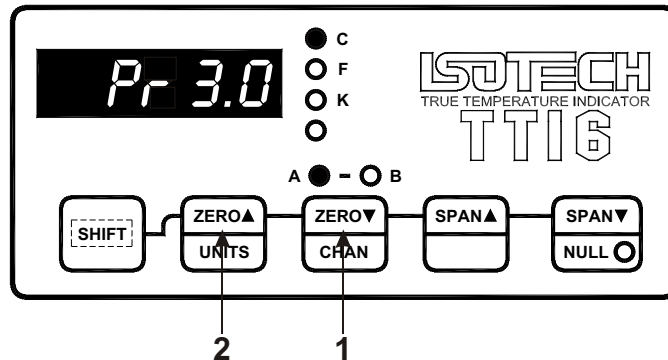
| To obtain a reading from a temperature sensor, select channel A or B (1) and select the required units (2). |

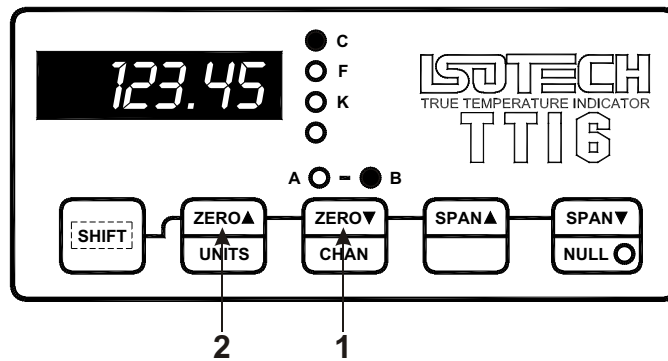| The selected channel and units are indicated by the appropriate indicator LED.
The A and/or B LED indicators, according to the channel selected, cycle between a steady **on** state and a brief **off** state (occulting) when corrections are stored and applied to measurements.
To read differential temperatures from two sensors, select channel A-B (1) and select the required units (2). |

| To set an A-B reading of zero to "null out" probe differences, press NULL (3). |
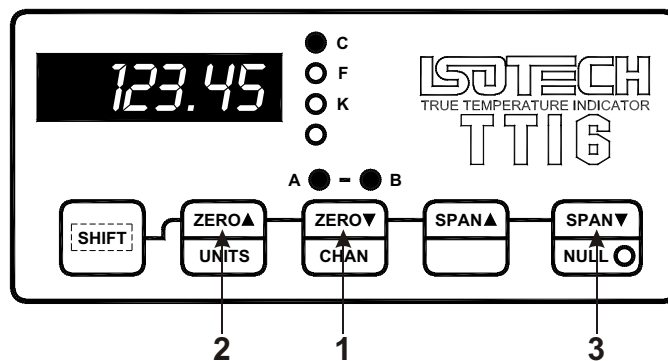
ERROR INDICATIONS
The T. T. I. 6 has several modes of error indication according to internal
or external problems. Refer to section 3.4 for details.

2.   INSTALLATION
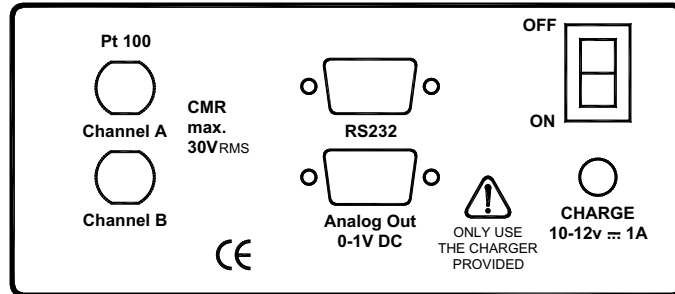
Back Panel

General

The standard version is for bench top use. Retractable legs can be extended to provide a convenient viewing angle.

Supply Connection

Primary power is provided by the internal, rechargeable sealed lead-acid battery which provides up to 12 hours operation from a full charge. The external supply adaptor is provided for recharging and also allows operation directly from a 220/240V 50/60Hz supply (or 110V 50/60Hz to special order). The output lead with its fitted connector is connected to the appropriate rear panel mating connector.

Internal battery power can provide operation for up to 12 hours from full charge. Low battery charge state is indicated by "bAtt" on the display.

Input Connections - Sensors

Platinum Resistance Thermometer(s) (Pt100) must be fitted with an appropriate plug and connected to INPUT A and/or INPUT B as required. A 3 or 4 wire configuration can be used but they are connected differently as shown. The T. T. I. 6 will automatically sense which configuration is employed.

Only use good quality connectors such as Lemo type FGG.1B.306.CLAD42.
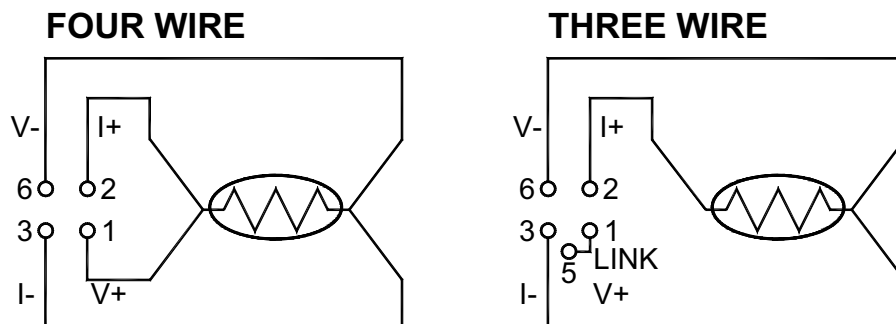
Viewed from Rear of Lemo Plug (solder side).

FOUR WIRE   THREE WIRE

3.   OPERATION

Ensure that the instrument is connected to a suitable supply or has charged batteries and that the required input connections are made.

Switch 'on' using the rear mounted rocker switch.

The display will show the program designation, (Pr 3.0). There is a short delay while internal checks are carried out, then the input A value will be displayed.
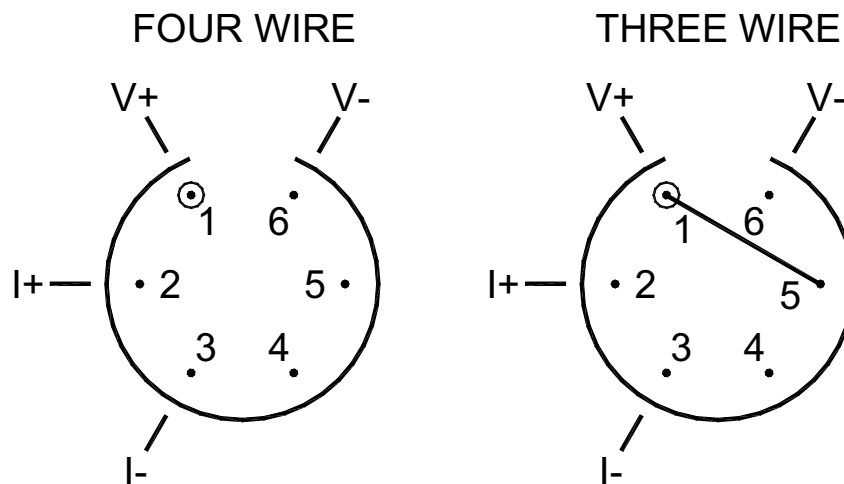
i)   To read sensor temperature correctly

a)   PRT input A is automatically selected at switch-on. **Brief repeated key presses will step through the various functions or holding the key depressed will auto repeat (scroll through); this applies to the other functions as well.**

Note: If for any selected channel, the sensor is either not connected or has a fault connection (including sensor open-circuit), the LED display will show:- 'Err 3'

Press any button to resume normal operation (either select another channel or rectify any fault and continue intended use).

b)   Press CHANNEL to select inputs A, B or A-B (differential).
c)   Press UNITS to display the desired units °C, °F, K or   .

ii)   **To read Differential Temperature**

The difference in temperature between two PRT sensors can be obtained by displaying A-B. Ensure that the necessary sensors are connected to both A and B units as required.

Press CHANNEL to select A-B
Press UNITS to display the desired units

The value now displayed is the difference between the input A and input B (A-B) for the sensor types indicated.

Null Feature

For calorimetry and other applications to optimise the precision of differential measurements, probe tolerances can be nulled by pressing the NULL key when in A-B mode. This gives an A-B reading of zero when pressed regardless of any real difference value.

iii)   **Matching T. T. I. 6 to Calibrated Sensors**

It is possible to automatically **match** the T. T. I. 6 to a Pt100 sensor with up to 10 dedicated calibration values. Such values, published in an associated certificate indicates true   versus °C values corresponding to accurately known reference temperatures. Up to 10 sets of values per sensor can be fed into the instrument via RS232 interface using the associated software supplied with each instrument as standard.

By matching the instrument to a probe on this basis, 'corrected' temperature readings are obtained directly without the need for cross-referncing to temperature/resistance tables or to the calibration certificate. This is particularly helpful when taking differential (A-B) readings.

Refer to sections 7 and 8 for details.

iv)   **Error Indications**

The T. T. I. 6 has several modes of error indication to internal or external problems as follows:

Display	Cause
Err 1	Calibration lost (very unlikely)
Err 2	Software fault
Err 3	Broken probe connection
Err 4	RS232 command error
bAtt	'Low' battery
or	Over-range input
ur	Under-range input

Only Err 1 / Err 2 would require returning the instrument to our factory.

Note: During normal operation, if a selected probe is disconnected from the instrument the display will indicate **Err 3** (broken probe indication). If the same probe is re-connected, **Err 3** will remain on the display until any key is pressed.

T. T. I. 6
HANDBOOK
ISSUE 1 7/99

v)   3/4 Wire recognition

T. T. I. 6 requires a minimum of 80m   lead resistance (eg. 1 metre of 7 stranded 0.2mm^2 wire) ro recognise a 4 wire probe. Otherwise the instrument will default (perhaps incorrectly) to 3 wire mode.

If a simulator is used to apply resistance values to check or calibrate the T. T. I. 6, ensure that at least 80m   of lead resistance exists between the simulator and the PRT input.

If using a shorter leadout from the probe or thicker gauge cable, please ensure that the T. T. I. 6 is in the correct wire recognition mode. This can be checked by pressing the SPAN▲ button ONCE.

Two numbers will be displayed e.g. 3-4. The first digit being the X parameter (e.g. 3) and the second digit being the Y parameter (e.g. 4). These displayed numbers will only be displayed momentarily.

Caution Pressing the SPAN▲ button more than once or holding it down continuously will alter the X-Y setting.

X Parameter

This is a user configurable parameter. If the probe configuration is 4 wire but has a lead resistance of less than 80m   per leg, the instrument may recognise it as a 3 wire probe (showing 3-3); the SPAN▲ may be used to force the instrument into a 4 wire measurement mode by pressing SPAN▲ until X = 4. To verify, allow the T. T. I. 6 to read the currently selected channel and press SPAN▲ once; the displau will now show 4 - 4.

X = 3	3 **OR** 4 wire mode is allowable on either channel A or B i.e. A4, B3 or A3, B4 or A3, B3 or A4, B4 (if both probes are 4 wire). i.e. 3 or 4 wire auto selected.
X = 4	4 wire mode is mandatory on both channels A & B i.e. A4, B4.

Y Parameter

The Y parameter gives the actual measuring mode of the **currently selected channel** (except differential).

Y = 3	3 wire measuring
Y = 4	4 wire measuring

Differential Mode

In A-B mode the SPAN▲ figure is not to be relied upon because the values displayed will be for the last channel which has been read by the instrument and this could be A or B.

In order to verify the status of each channel, select the Channels A and B individually.

4.   INSTRUMENT RE-CALIBRATION

If simulating resistance values to check the accuracy of temperature measurement ensure that the correct resistance versus temperature values are used, IEC 751 Amendment 2 (1995).

Re-calibration of the T. T. I. 6 is unlikely to be required routinely unless specified by user regulations. If this is performed by someone other than the supplier, guarantee of specification compliance may be invalid.

The calibration kit option (two precise resistors) is required to perform re-calibration. No additional instruments are required since the T. T. I. 6 self-calibrates as follows:

CAUTION: Do not proceed unless specified resistors are available. Failure to do so may invalidate the warranty.

a)   With the supply disconnected, remove the instrument case cover by removing the two screws on the rear panel and sliding the cover off the rear of the instrument.

b)   Insert the jumper JP1 (shorting connector)- this places the T. T. I. 6 into self-calibration mode. Connect the supply and switch on*. Calibration is simply a matter of connecting the precision resistors in sequence. The necessary value of the resistor, together with the input to which it has to be applied is indicated on the display. The steps are as follows:
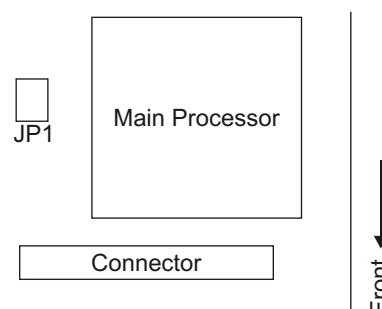
*At this point, the existing calibration has been over-written by default values. The procedure should therefore now be completed.

i)   Connect 100 Ohm calibration resistor to PRT input A.

ii)   Press "SPAN▲ " and display will show a value close to 100 Ohms. If the value shown is wrong by more than 1.00 Ohms, a fault exists and the instrument must be returned for rectification.

iii)   Press "SPAN▲ " again and the instrument will compute the average value of 16 readings of the resistor value.

iv)   When the display reads "A=250", connect the 250 Ohm calibration resistor to input A.

v)   Press "SPAN▲ " and display will show a value close to 250 Ohms. If the value shown is wrong by more than 1.00 Ohms, a fault exists and the instrument must be returned for rectification.

vi)   Press "SPAN▲ " again and the instrument will compute the average value of 16 readings of the resistor value.
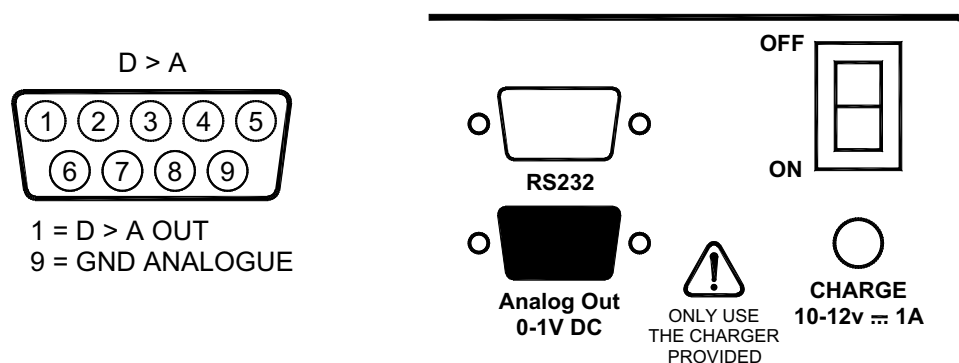
vii)   Repeat steps (i) to (vi) for input B.

The T. T. I. 6 then returns to a normal power-up state, PRT A, degrees C.

Switch off the Instrument

1) Remove the jumper lead JP1. **This is VITAL.** Should the instrument be switched on with JP1 in position, the calibration is lost.

2) Replace the instrument cover.

The instrument is now ready for normal use. The central processor is software driven and no other adjustments or modifications should be attempted. If it is necessary for the supplier to re-calibrate an instrument in consequence of unauthorised person so doing a charge may be made accordingly.

5. ANALOGUE (RE-TRANSMISSION) OUTPUT

D > A

1 = D > A OUT
9 = GND ANALOGUE

OFF

ON

RS232

Analog Out
0-1V DC

ONLY USE
THE CHARGER
PROVIDED

CHARGE
10-12v ⎓ 1A

This output varies linearly between 0 and 1 volt dc. The output will be at 0V whenever the reading of the instrument is at or below the zero parameter as set by front panel button pushes or RS232 commands. The output will be at 1V whenever the reading is at the span parameter as set by the user. Any reading between zero and Span will result in an Analogue output signal proportional to the position of the reading with respect to the defined zero and span values. To set-up the output values :

1) Zero: Press "SHIFT" and "ZERO▲ " to raise the value (in current units) at which a zero output will occur.

   Press "SHIFT" and "ZERO▼ " to reduce the value in a similar way.

2) Span: Press "SHIFT" and "SPAN▲ " to raise the value (in current units) at which a SPAN (1V) output will occur.

   Press "SHIFT" and "SPAN▼ " to reduce the value in a similar way.

The size of the increment is 0.1 Ohm. This is necessary so as to eliminate the requirements of working from degrees of temperature (K, C or F) back to Ohms. If setting up in degrees, some odd looking numbers may occur on the display.

The output falls to 0V in the event of the selected span value being exceeded; this is done to indicate such a condition.

6.   RS232 COMMUNICATIONS

RS232

2 = RX
3 = TX
5 = GND ISOLATED
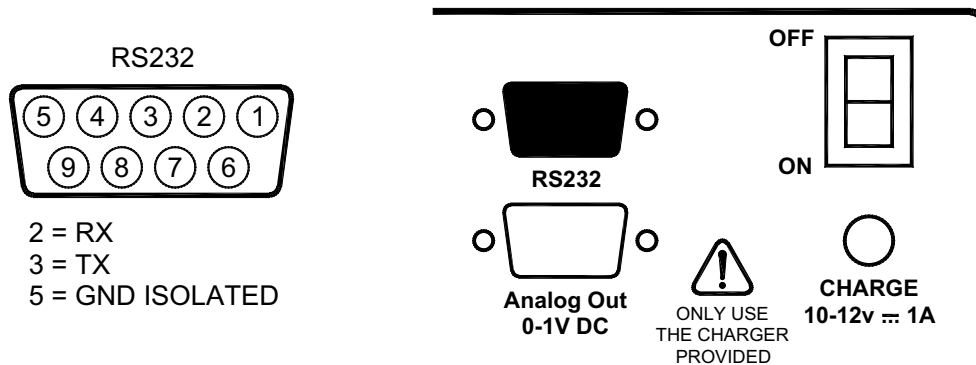
General

Remote control will be seized by sending an RS232 character, and relinquished by sending the LOCAL command. While in remote control the front panel buttons will be locked out (inoperative) and the right hand decimal point will indicate remote operation (local lock-out). RS232 parameters will be a fixed baud rate and word length. 9600 Baud, 8 Data, No parity, 1 stop bit.

RS232 CABLE

If a cable has been supplied then it should be used. If a cable has to be made the connections are as follows:

A,   PC has 25 pin Connector

PC Pin Number	Instrument Connector
25 Pin Female	9 Pin Male

2 ⟷ 2

3 ⟷ 3

7 ⟷ 5

4
5 } Link Together   N/C

6
8 } Link Together   N/C
20

B,   PC has 9 pin Connector

PC Pin Number	Instrument Connector
9 Pin Female	9 Pin Male

2 ⤬ 2

3 ⤬ 3

5 ⟷ 5

7
8 } Link Together   N/C

4
1 } Link Together   N/C
6
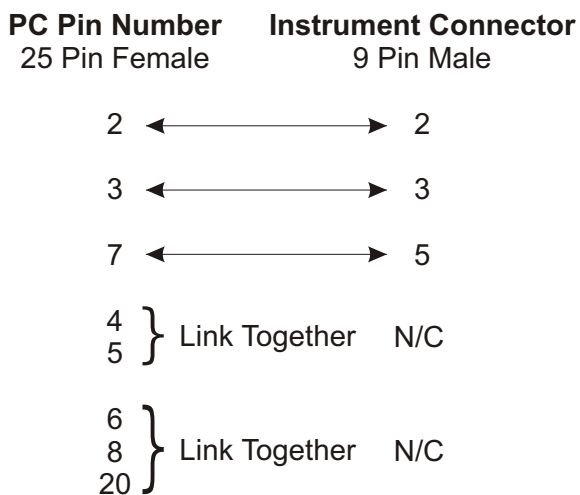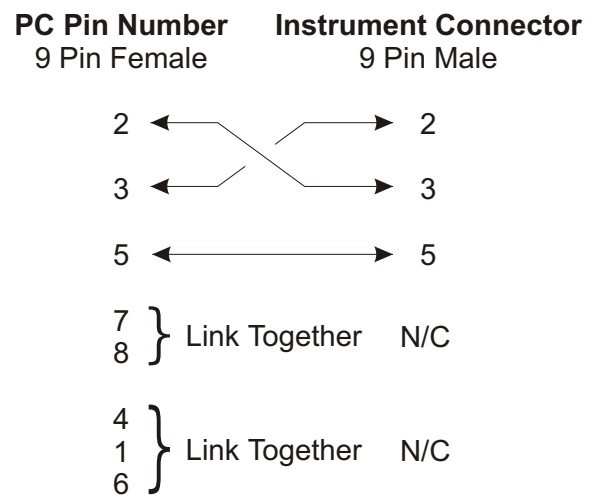
Remote control of calibration has not been included. (Refer to section 4).

Protocol :

Command strings are limited to a single statement; action will occur on receipt of the "end of line" character. All actions will return a status character followed by data if appropriate. The status will be "Ø" for a successful transaction; other values indicate syntax error, broken probe etc.

All commands may be abbreviated to their first two letters eg. UNITS OHMS becomes UN OH. Input delimiters will be spaces or commas.

Command set :

Display parameters:	UNITS	OHMS
	UNITS	C
	UNITS	K
	UNITS	F
	INPUT	A
	INPUT	B
	INPUT	A-B
Analogue parameters:	SPAN	Value in Ohms
	ZERO	Value in Ohms
Measurement:	MEASURE	
Return to Local:	LOCAL	

Output Protocol

Replies will depend on the command implemented, and will be numeric or - with commas and spaces as delimiters. All replies will be terminated by CR and LF. The first number will be an error code.

0	No error
1	Calibration lost. (EEPROM corruption)
2	
3	Broken probe.
4	Syntax error
5	
6	
7	

There will be no further numbers if:

a)   There is an error
b)   The primary command was UNITS, INPUT or LOCAL

Further output will be provided in the case of MEASURE, DUMP (DIAGNOSE)

1.   MEASURE
eg. if output is 0,235.17

first number	- error code
second number	- value in units set by previous commands

For digital probe matching with the instrument additional commands are used as follows:

CORRECTIONS	A	(Turns OFF B corrections)	Turns A on
	B	(Turns OFF A corrections)	Turns B on
	AB	(Turns ON BOTH A & B connections)	
	OFF	(Turns OFF BOTH A & B connections)	

Whatever is set by this command is retained during power-down.

LA	Lists Ch A corrections
LB	Lists Ch B corrections
CA	Enter ChA corrections
CB	Enter Ch B corrections
Query	Says "Not enabled", "A", "B"> "AB"
XX*	Disables connections
ENABLE*	Enables connections
IC	Initialise corrections (i.e. Erase). Useful after installing new software.

*For these commands to be actioned the SPAN▲ key must be pressed as the command is typed

Corrections entered as Follows

Type	TM Sends
CA <CR>	How many points
2 <CR>	Entry =/0 Ohms?
100.000 <CR>	DegC?
0.000 <CR>	0100.000 Ohms 0000.0000 DegC ok?
Y <CR>	Entry =/1 Ohms?
138.510 <CR>	DegC?
100.000 <CR>	0138.5100 Ohms 0100.0000 DegC ok?
Y <CR>	Done

This would repeat for more points.
Pressing N at the ok? prompt will allow re-entry of the point.
Once entered, type LA or LB to see/confirm contents.

Rules of entry.

1) Ohmic values must always increment from point to point
2) All values must be entered to THREE decimal places
   i.e.:- .001 0.001 10.001 are all OK

Note: Use of the "T. T. I. 6 Corrections PC Software" supplied with the instrument facilitates the correction procedure by means of a much simplified, user-friendly approach described below.

7. USE OF PC SOFTWARE
for Digital Probe Matching
Note: Cal NotePad refers to the separate manual for the use of Windows 9x software. Cal NotePad allows the monitoring and recording of date from the T.T.I.6 also the control of Isotech Calibration Baths.
a) Instrument set-up and software loading
PC Requirements: Any PC running in MS-DOS and having a 3½ disk drive, mouse and mouse driver installed, (the software can be used without a mouse; up/down arrows and/or ALT key with the highlighted letter in each function box). A printer allows hard copies to be taken.

i) Connect the RS232 interface lead to the T. T. I. 6 and to the PC according to the pin configuration shown in section 6).
ii) Switch on the instrument and PC.
iii) A the C:\> prompt, select the drive (if this is the correct drive for the PC in use) i.e. C:\> a: "ENTER". At the a:\> prompt type "TTI6" and "ENTER". If using comms port 2, type "TM-C/2". After the introduction screen, the MAIN MENU will appear (refer to the MAIN MENU diagram).

Note 1 These instructions are included in the software as the "text file" and can be viewed or printed out as required.
Note 2 Prior to despatch the T. T. I. 6 and PC software should be "enabled" for normal operation. In the unlikely event of a communications problem between the two items, please perform the following procedure: With all set-up actions completed and the Main Menu on the PC screen, press the SPAN ▲ key on the T. T. I. 6 whilst simultaneously clicking on to the **enable** button on the Main Menu. To check, click the **Query** button and the status box should confirm **enabled.** Normal operation can now be carried out.
Note 3 To prevent corrections being programmed into the T. T. I. 6 click on the **disable** button.
See note 2 to re-enable.

MAIN MENU screen

TTI1 PC Based corrections editor Ver D

Calibration Points
Ohms   Deg C

Buttons: Channel A, Read, Send, Clear, Files, Edit, Disable

Status section: Comms Error, Correct OFF, Enable, Query, Exit

Annotations:

- Click to select view Channel A or B
- Click to read values stored in T.T.I.6 (selected channel)
- Click to input values to T.T.I.6
- Click to clear values in the display window
- Click to obtain file screen (Load/Save/Print Menu)
- Status Indication
- Click to switch on Enable A, B or A and B connections
- See Note 2, Page 14
- Click to find current status of T.T.I.6
- Click to Exit programme
- Display of current values which can be read, loaded or edited
- Click to obtain Edit Corrections Menu to enter or change values
- Disables corrections & clears stored values. See Note 3, Page 15
- Display of current values which can be read, loaded or edited

Load/Save/Print Menu screen

TTI1 PC Based corrections editor Ver D

A:\   Displays drive directories

JOE.COR   Window displays stored file names

Current Selection

Buttons: Load, Save, PRINT, Return to Main menu, Specify

Status   Select File

Annotations:

- Click on with mouse and press letter to change drive
- Click on to display drive list. Select drive by typing drive letter or using arrow keys and enter key
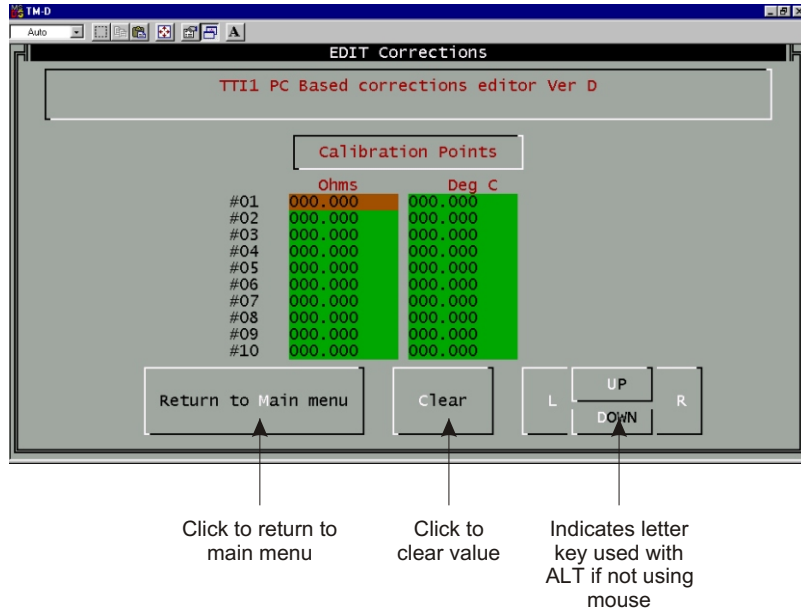- Click to load selected file
- Click to print file/values. Note: Print screen key can be used.
- Click to return to Main Menu
- Click to enter file name
- Status indicator
- Click to save file

Click to return to   Click to   Indicates letter
main menu   clear value   key used with
                                              ALT if not using
                                              mouse

Menu Structure:

Main Menu ─────── Read Instrument
           ─────── Write to Instrument
           ─────── Clear (the PC memory)
           ─────── Disable
           ─────── Query
           ─────── Enable
           ─────── Correct (A, B, A + B)
           ─────── Files
                    ─────── Drive & Directory
                    ─────── Load
                    ─────── Save
                    ─────── Print
                    ─────── Return to main menu
           ─────── Edit
                    ─────── 'Moving around' keys
                    ─────── Clear
                    ─────── Return to main menu
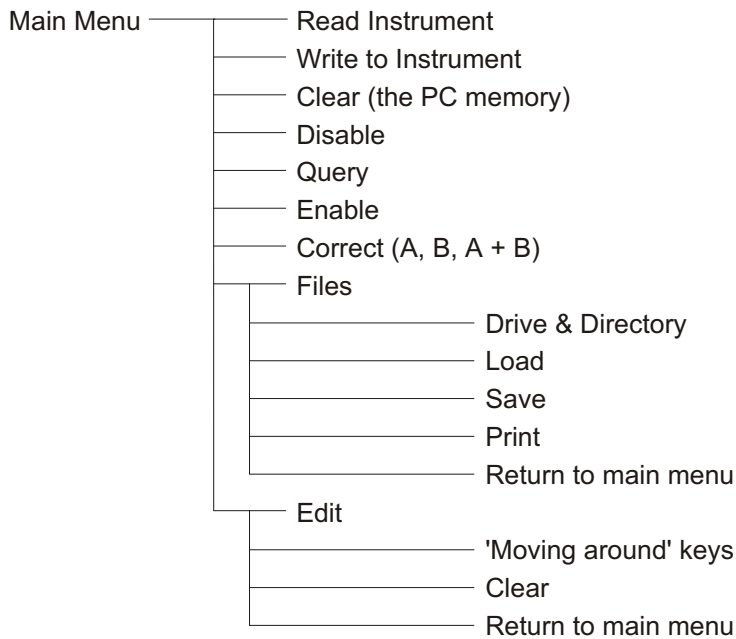
b)   Using the software

From MAIN MENU :-

To input calibration values into the T. T. I. 6 (up to 10 may be used per channel)

--->   Click EDIT to obtain EDIT corrections menu.

--->   Enter values against #01 through #10 but note that

        i)   All 10 need not be entered
        ii)   When returning to the main menu the   values are sorted into ascending order. If the corresponding values are not in ascending order, the status box will show **Error.**
        iii)   All values must be entered with up to three decimal places e.g. 0.001, 10.001 etc. Both °C and   values must be entered.

--->   Click Return to Main Menu

--->   From Main Menu, click FILES to obtain Load/Save/Print Menu
--->   Click SPECIFY
--->   Key file name to 'CURRENT SELECTION' Files name end with .COR eg. EXPI.COR. If .COR is not keyed in, it will be added automatically when ENTER is pressed or OK clicked.
        Note: file name should be cross referenced to probe serial number.

--->   Click SAVE to save file

--->   Click LOAD to load data

--->   Click RETURN TO MAIN MENU and note loaded values are shown under "Calibration Points"

--->   Click CHANNEL A <-> B

--->   Click SEND to transmit correction values to T. T. I. 6

--->   Click CORRECT A, B or A + B to switch on corrections
        Note: Red dot in lower right hand corner of T. T. I. 6 display window lights during "comms" activity.

--->   Observe Channel A/B status LED on T. T. I. 6 occults to indicate corrections stored within defined range. If this does not occult, probe reading does not lie within corrections range and corrections are not used.

        Stored values can be viewed at any time as follows:

--->   from Main Menu, click CHANNEL to select channels A or B

--->   click READ

        Stored values can be changed at any time by repeating input procedure. Stored values can be cleared from the T. T. I. 6 at any time as follows

--->   from Main Menu, click CHANNEL A <-> B

--->   Click DISABLE

--->   Click PRINT in load/save/print menu to print out corrections. To exit programme and return to DOS, click EXIT on Main menu.

Note: Although the T. T. I. 6 stores only one set of corrections for each channel, the number saved in the software is limited only by available diskette space. Data for many probes can thus be stored.

When using corrections the T. T. I. 6 channel annunciation lights (A or B) will occult at 4 second intervals according to the channel selected. In A-B mode channel A and/or B annunciate lights occult at 8 second intervals.

It is important to note that the T. T. I. 6 will only apply corrections within the minimum and maximum temperatures programmed. Outside this range the T. T. I. 6 will revert to its standard resistance versus temperature values for Pt100 sensors and the channel annunciation light will illuminate normally, i.e. the instrument interpolates only and will <u>not</u> extrapolate to extand corrections outside the range entered.

When calibrating probes alone, prior to programming corrections into the T. T. I 6, we recommend calibrating at a point slightly higher and a point slightly lower (e.g. by 5°C) than the maximum and minimum temperatures expected for the probe in use. This ensures corrections are always applied during normal operation. We recommend a minimum of three correction values are programmed. The T. T. I. 6 corrects only in temperature (°C, °F, K). The Ohms value is not affected. Therefore, when measuring in Ohms in corrected mode channel annunciation lights will not occult.

SPECIFICATIONS

All Values are valid for a nominal 240V 50Hz supply and 20°C ambient temperature (±2°C)

General

Range / Sensor Type	Pt100 to IEC 751, Amendment 2 (1995. -199.99 to 849.99°C. Ro = 100 . Two input channels, each 3 or 4 wire connection with automatic recognition (with manual override).
Overall instrument accuracy (4 wire)	±0.02°C ±1 digit for range -200°C to +500°C. ±0.005% reading ±1 digit for range 500°C to 850°C.
Linearised conformity	±0.01°C
Stability (vs ambient temperature)	0.0025°C/°C ambient change.
Warm-up time	Negligible under normal ambient conditions. Allow 5 to 10 minutes for full stability unless stored at low temperatures, then allow 30 minutes minimum.
Pt100 sensor current	0.5mA nominal.
Display resolution	0.01°C, K, °F, .
Measurement units	°C, K, °F, .
Measurement modes	Input A or B or A-B (differential). Null facility in A-B mode.

Custom calibration (via PC software)	Up to 10 calibration values can be allocated to (via PC software) channels A and B. Values are retained in non-volatile memory until replaced by user.
Null function	Corrects differential temperature readout between the two sensors to zero.
Sensor lead resistance	25 each lead maximum.
Supply	Internal rechargeable batteries. Mains 220/240V 50/60Hz, adaptor included. Battery charge life up to 12 hours with full charge dependent on pattern of usage. Charger requirement 10-11V d.c. 1A.
Power consumption	10W nominal. Max 20W when battery is charging.
Series mode rejection	60dB @ 50Hz (50mV rms applied).
Common mode rejection	30V rms applied between input and earth produces no measureable effect.
Ambient temperature range	0 to 50°C non-condensing. Ensure stable temperature range for best accuracy. Allow adequate warm-up time if moved from region of low ambient temperature prior to use.
EMC compliance	Meets EMC regulations. RFI to BS EN 5008-1, 1992 and immunity to BS. EN 50082-1, 1992.
CE compliance	CE marked and compliant to current regulations.
Display	14mm LED, 5 digit, 999.99 range.
Front panel controls	5 x membrane keys for user functions.
Input connections	2 x Pt100 via "LEMO" connectors.

Mechanical

Mechanical/case	Metal bench top. Optional panel mounting kit.
Dimensions	145 x 66 x 240mm deep.
Weight	1.5kg approximately.

Communications

RS232 (Standard)	Remote control and measure. Isolated, 9600 Baud, 8 data, no parity, 1 stop bit.
PC Software (Standard)	A, PC software running in MS DOS allows programming (standard) of custom calibration and preview of set values from a PC. Also provides a print facility and storage of sets of correction values.
	B, Cal NotePad Software for Win 95/98 - allows monitoring and recording of data.
Analogue output (Standard)	Analogue 0 to 1 Volt d.c. between programmable (standard) lower and upper set limits representing channel A, B or A-B. Accuracy 0.5% of reading. Non-isolated.