Norbar Torque Tools Ltd.

DEDICATED TRANSDUCER SYSTEM

DTS

OPERATOR'S HANDBOOK (PART NO. 34212)

ISSUE 9

CE

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MODEL NUMBERS :-

This operators handbook covers the following DTS display instruments.

DTS OPTIONS	MODEL No
DTS	43158
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DTS + Limit Detector	43160
DTS + Limit Detector for 10 Channel Unit	43163
DTS for Rate Controller	43161
DTS + Limit Detector for Rate Controller	43162

NOTE :- All DTS models are fitted with an RS-232-C interface as standard.

The internal battery pack option cannot be fitted to a DTS with a limit detector option.

All versions of the DTS for rate controller, require a link out plug (supplied) to be fitted to the ancillaries socket for operation without the rate controller.

See appendix for any model numbers not listed.

MITUTOYO is a registered trade mark of Mitutoyo (UK) Ltd.

Due to continuous improvement all specifications are subject to change without prior notice.

OPTIONAL EXTRAS :-

	MODEL NO.
Data Printer (RS-232-C)	60164
Carrying Case	38272
DTS Service Manual	34215
Print Inhibit Controller (Remote, Hand Held)	60167

DTS INTRODUCTION

The Norbar Dedicated Transducer System (DTS) is a precision instrumentation system, which conforms to current EC Directives and safety standards.

The combination of Norbar's instrument and dedicated transducer allow precision measurement of torque and force. Various other types of strain gauge transducers can also be used with the system.

NOTE:- *DTS transducers are **NOT** interchangeable and the transducer supplied with the instrument is the only one that can be used with it. The capacity of the DTS is marked on that transducer.*

The instrument has been designed for robustness, ease of operation, and readability.

Analogue signal processing and memory are used for speed and accuracy, whilst digital signal processing is utilised for clarity and operator convenience.

A specialist signal filter is incorporated for power tool testing in line with ISO standard 5393 - 1994.

A custom liquid crystal display provides a clear, easily read digital readout in engineering units.

Twenty one units of measurement are available, nine torque, eight force, two pressure, angle and length. Verification of units selected is clearly shown on the display.

An analogue trend bar tracks the measured value in steps of 4% of full scale. The bar is always live.

Automatic scale selection

The DTS instrument is bi-directional in operation.

RS-232-C output is standard with an internally selectable control word.

DTS CALIBRATION AND REPAIR :-

To maintain the specified accuracy it is recommended that the DTS be recalibrated at least once per year.

Recalibration, and repair where necessary, should be carried out at Norbar or by a Norbar approved agent, where all the facilities to ensure the instrument is functioning at maximum accuracy are available.

Alternatively, procedures for calibrating the DTS to the specified accuracy can be found in the DTS service manual Part No. 34215.

MAINS PLUG FITTING :-

If a mains plug is not fitted, follow the plug's own instructions. The following may be useful :

BROWN - LIVE BLUE - NEUTRAL GREEN / YELLOW - EARTH

WARNING! IT IS IMPORTANT THAT LIVE, NEUTRAL AND EARTH ARE ALL CONNECTED BETWEEN THE DTS AND MAINS SUPPLY. IF NO EARTH IS AVAILABLE (2 WIRE MAINS SUPPLY) IT IS RECOMMENDED THAT A SEPARATE EARTH IS CONNECTED BETWEEN THE INSTRUMENT CASE (THE BOTTOM RIGHT HAND FIXING SCREW IN THE CORNER OF THE BACK PANEL IS IDEAL) AND A SUITABLE EARTH. ALTERNATIVELY THE INSTRUMENT COULD BE POWERED BY BATTERY.

If the plug has an internal fuse, a 1 amp value is recommended.

CLEANING :-

Do not use abrasives or solvent based cleaners. We recommend a propriety brand of foam based fabric / vinyl cleaner. Use a soft cloth to avoid scratches.

SPECIFICATIONS

INSTRUMENT SPECIFICATION:-

ACCURACY	+/- 0.1% of full scale (Over 10% to 100% of full scale)
RANGE OF OPERATION	0 to 150% of full scale of transducer connected, minimum. 0 to 99,999 counts on display.
READOUT	Custom LCD display giving 5 digits (with 4 digit option). Includes direct readout in engineering units, a stop loading indicator and 25 segment analogue trend bar.
TREND BAR RESOLUTION	4% of full scale transducer capacity.
MEMORY AUTO-RESET TRIGGER	0.7% to 10% of full scale (settable)
MEMORY AUTO RESET HOLD TIMES	1,2,3 or 4 seconds (selectable)
UNITS OF MEASUREMENT	N.m, dN.m, cN.m, lbf.ft, lbf.in, ozf.in, kgf.m, kgf.cm, gf.cm, N, kN, gf, kgf, tonf, tonnef, ozf, lbf, degree, lb/insq, bar, mm. (Selectable).
DISPLAY UPDATE	3 Hz.
FREQUENCY RESPONSE	Filter OFF, Flat response to 1KHz. As BS 6268 - 1982 / ISO 6544 - 1981 Filter ON, -3dB @ 500Hz as ISO 5393 - 1994.
RESOLUTION 5 DIGIT MODE	1 Digit in 10,000 for transducer capacity 1,10,100 etc. 1 Digit in 25,000 for transducer capacity 2500,25000 etc. 1 Digit in 50,000 for transducer capacity 5,50,500 etc.
RESOLUTION 4 DIGIT MODE	1 Digit in 1,000 for transducer capacity 1,10,100 etc. 1 Digit in 2,500 for transducer capacity 2500,25000 etc. 1 Digit in 5,000 for transducer capacity 5,50,500 etc.
DISPLAY SUPPRESSION TRACK	5 DIGIT MODE (Software Version No 1.03 & 1.04) First 4 counts either side of zero for all transducers. 5 DIGIT MODE (Software Version No 1.06 & 1.07) First 4 counts either side of zero for 5's range transducers. First 2 counts either side of zero for 2.5's range transducers. No suppression for 1's range transducers. 4 DIGIT MODE (Software Version No 1.03,1.04,1.06 & 1.07) No suppression.
MEMORY	Suppressed from 0 to approximately 0.5% of full scale, dependent on transducer connected.
POWER REQUIREMENTS	Selectable 110/120 Volts AC +/- 10 % or 220/240 Volts AC +/- 10 % at 50-60 Hz. Also available is an internal battery pack option.
MAINS POWER FUSE	T160 mA anti-surge (2 off).
POWER CONSUMPTION	6.5 W - maximum.

INSTRUMENT SPECIFICATION (Continued.)

ANALOGUE OUTPUT	TORQUE	1.0000 volt full scale for capacity in N.m 1.0000 volt full scale for capacity in dN.m 1.0000 volt full scale for capacity in cN.m 1.3558 volt full scale for capacity in lbf.ft 1.1298 volt full scale for capacity in lbf.in 0.7061 volt full scale for capacity in ozf.in 0.9806 volt full scale for capacity in kgf.m 0.9806 volt full scale for capacity in kgf.cm 0.9806 volt full scale for capacity in gf.cm
	LOAD	1.0000 volt full scale for capacity in N 1.0000 volt full scale for capacity in kN 0.9806 volt full scale for capacity in gf 0.9806 volt full scale for capacity in kgf 0.9964 volt full scale for capacity in tonf 0.9806 volt full scale for capacity in tonnef 1.1120 volt full scale for capacity in ozf (1's range) 0.6950 volt full scale for capacity in ozf (2.5's range) 0.8896 volt full scale for capacity in lbf (1's or 5's range) 1.1120 volt full scale for capacity in lbf (2.5's range)
	ANGLE	1.0000 volt full scale for capacity in degree.
	PRESSURE	1.0000 volt full scale for capacity in lb/insq 0.5801 volt full scale for capacity in bar (1's range) 0.7252 volt full scale for capacity in bar (2.5's range) 0.7252 volt full scale for capacity in bar (5's range)
	LENGTH	1.0000 volt full scale for capacity in mm.
ANALOGUE OUTPUT IMPEDANCE		500 ohms minimum for chart recorders, oscilloscopes etc. Frequency response at least 15 Khz.
DIMENSIONS		108 mm high x 197 mm wide x 282 mm long.
CASE MATERIALS / FINISH		Case engineered in aluminium extrusions and castings. Finished in tough texture paint.
WEIGHT (Basic)		2.80 kg (6.2 lb) as standard. 4.20 kg (9.3 lb) for battery pack option. 3.15 kg (6.9 lb) for limit detector option.
MAINS POWER CABLE		2.5 metres (8 ft 2 ins) long.
OPERATING TEMP RANGE		-10°C to +50°C.
MAXIMUM OPERATING HUMIDITY		85% Relative Humidity @30°C.
ENVIRONMENT		Indoor use within a light industrial environment.
ELECTROMAGNETIC COMPATIBILITY (EMC) DIRECTIVE		In conformance with EN 50081-1 : 1992 & EN 50082-1 : 1992.
LOW VOLTAGE DIRECTIVE		In conformance with EN 61010-1 : 1993. To environmental conditions Pollution Degree 2 & Installation Category (Overvoltage Category) II.
TIME/DATE COMPLIANCE		This equipment does not utilise time or date functions and thus will not be affected by the issues of date compliance in the future.

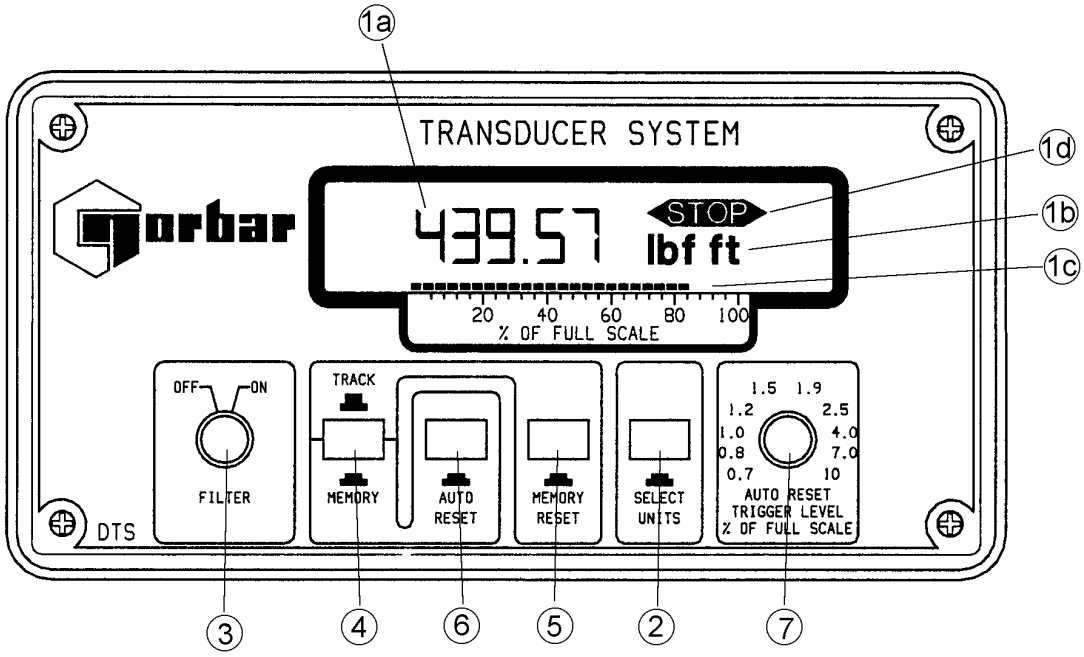
Note : *If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment could be impaired.*

TRANSDUCER SPECIFICATION :-

This specification is typical for Norbar transducers. Due to the wide range of possible transducer options please refer to individual data sheets or calibration data supplied with the transducer.

ACCURACY	Dependant on transducer.
SCALE RANGES	Multiples of : 1, 2.5 or 5. E.g. :- 10, 250, 5000 etc.
STANDARD EXCITATION	20.00 mA constant current.
STANDARD BRIDGE RESISTANCE	350 Ω.
OPERATION	Bi-directional.
CALIBRATION	Torque transducers up to 5000 lbf.ft / 5000 N.m to NAMAS standards at Norbar's own NAMAS laboratory. Other transducers issued with traceable certificate.
TRANSDUCER CABLE	2.0 meters (6 ft 6 ins) long.
CONNECTOR	Military grade bayonet, pattern 105, 6 way.

DTS FUNCTIONS - FRONT PANEL



(1) DISPLAY :-

1a MEASUREMENT VALUE - Shown to 5 digit resolution.

1b UNITS OF MEASUREMENT - 21 possible (9 torque, 8 load, 2 pressure, 1 angle and 1 length.)

1c TREND BAR - Shown along the base of the display as a percentage of transducer full scale. This feature tracks the signal from the transducer in 4% steps and is NOT memorised. Any value over 100% is shown as 100%.

1d STOP - This legend will be displayed to indicate 'stop loading' when a peak has been detected in Memory Auto Reset mode. A bleeper will sound when the legend is on.

(2) SELECT UNITS SWITCH (GREEN) :-

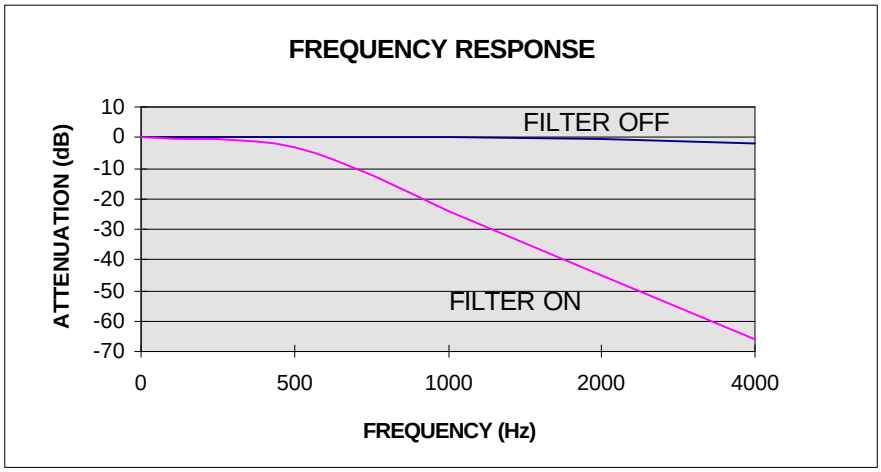
When pressed the units of measurement will step onto the next available unit. Repeated pressing will step through all available units of measurement, then loop round to the start of the list. Changing the units of measurement whilst a signal is stored in the memory will give the correct readout in the reselected units.

NOTE:- *Any of the units of measurement in the specification on page 4 can be made available or discontinued by internal switches. Please refer to internal user settings on page 16.*

(3) FILTER (BLUE) :-

In the 'FILTER OFF' position, the instrument's frequency response is flat to above 1 KHz.

With the 'FILTER ON', the frequency response is -3dB @ 500Hz. This specification corresponds to ISO standard 5393 - 1994 'Rotary tools for threaded fasteners - Performance test method'.



(4) 'TRACK / MEMORY' SWITCH (PARCHMENT & ORANGE) :-

In 'TRACK' the display follows the transducer's output signal. This is generally used for calibration.

Selecting the 'MEMORY' mode causes the display to retain the peak value experienced by the transducer.

The DTS features an analogue memory to ensure fast capture of the peak value, together with digital hold to give infinite storage.

(5) 'MEMORY RESET' SWITCH (PARCHMENT) :-

Press to reset the memory when in the 'MEMORY' mode. On reset, the previously memorised value is output via the RS-232-C connector.

(6) 'MEMORY AND AUTO RESET' SWITCHES (ORANGE) :-

Pressing 'MEMORY' and 'AUTO RESET' switches simultaneously selects memory auto reset mode.

In this mode the DTS holds and displays the first measurement peak. When a peak is detected all following peaks are ignored until the memory resets. The 'STOP' legend will flash and bleep tone sound to give a visual and audible indication to the operator to stop loading. Reset is automatic after a set hold time, this is settable to 1,2,3 or 4 seconds, see internal settings on page 16.

During the cycle the memorised value is output via the RS-232-C connector.

The memory auto reset mode is primarily intended for testing preset (click) torque wrenches and torque screwdrivers.

This mode is used in conjunction with the 'AUTO RESET TRIGGER LEVEL % OF FULL SCALE' knob (7), see following description for it's function.

(7) 'AUTO RESET TRIGGER LEVEL % OF FULL SCALE' (ORANGE) :-

The trigger level setting is used to adjust the sensitivity of the memory auto reset mode that was discussed in (6) on the previous page. It dictates the amount (as a % of transducer full scale) by which the signal must fall below the peak signal for the peak signal to be held and the auto reset to operate.

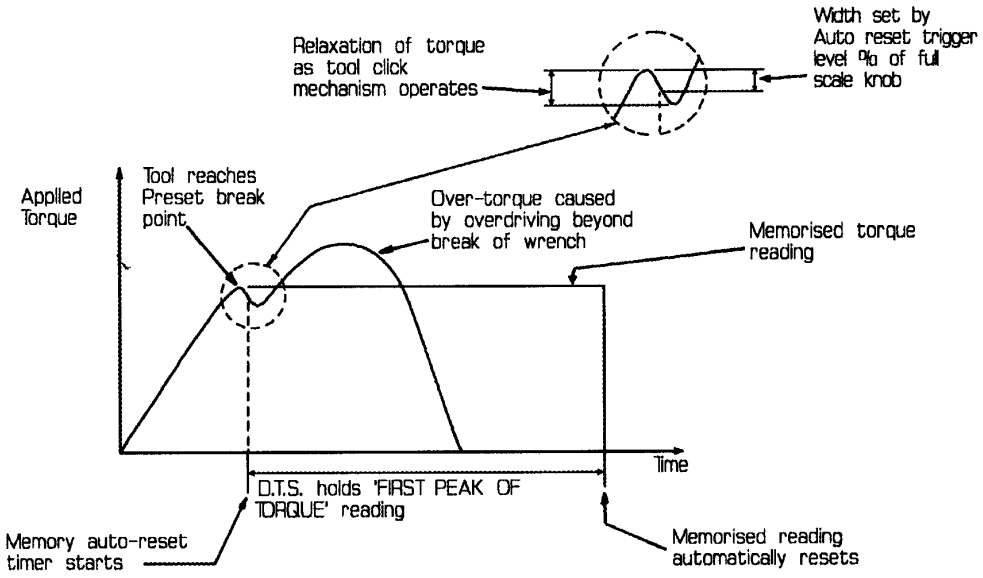
By setting it is possible to ignore small ranging peaks in the transducer's signal in preference to the required larger peak.

When the trigger level is set to a low value (e.g. 0.7%) the auto reset will trigger on a small peak in the transducers signal.

When set to a higher value (e.g. 10%) the auto reset will trigger on a larger peak, ignoring smaller peaks.

The setting is analogue, so allowing for infinite setting resolution within the allowable range.

As an example of the trigger level setting, the operation of a torque wrench is explained in the graph below and guide on the opposite page.



GRAPH showing capture of FIRST PEAK OF TORQUE in memory, when a preset (click) type torque wrench is being tested with the DTS in the 'memory auto reset mode'.

TRIGGER LEVEL SETTING :-

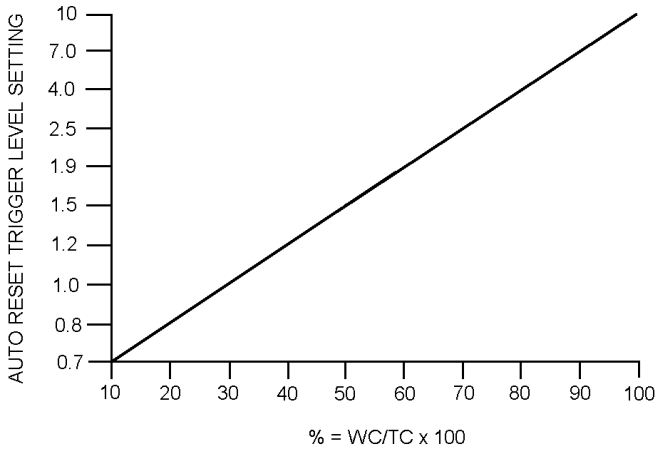
The trigger level only needs to be set when using the auto-reset mode. The following is a guide to it's setting using a torque wrench as an example.

General rule for setting trigger level for testing preset (click type) torque wrenches : -

1. Note the torque **WRENCH MAX CAPACITY**.
2. Note the **TRANSDUCER FULL SCALE** VALUE.
   This is usually stated on the transducer.
3. Calculate the **WRENCH MAX CAPACITY** as a percentage (**%**) of the **TRANSDUCER FULL SCALE**.

$$\% = \frac{\text{WRENCH MAX CAPACITY}}{\text{TRANSDUCER FULL SCALE}} \times 100\%$$

4. Having found the percentage (%) use the following graph to set the trigger level.



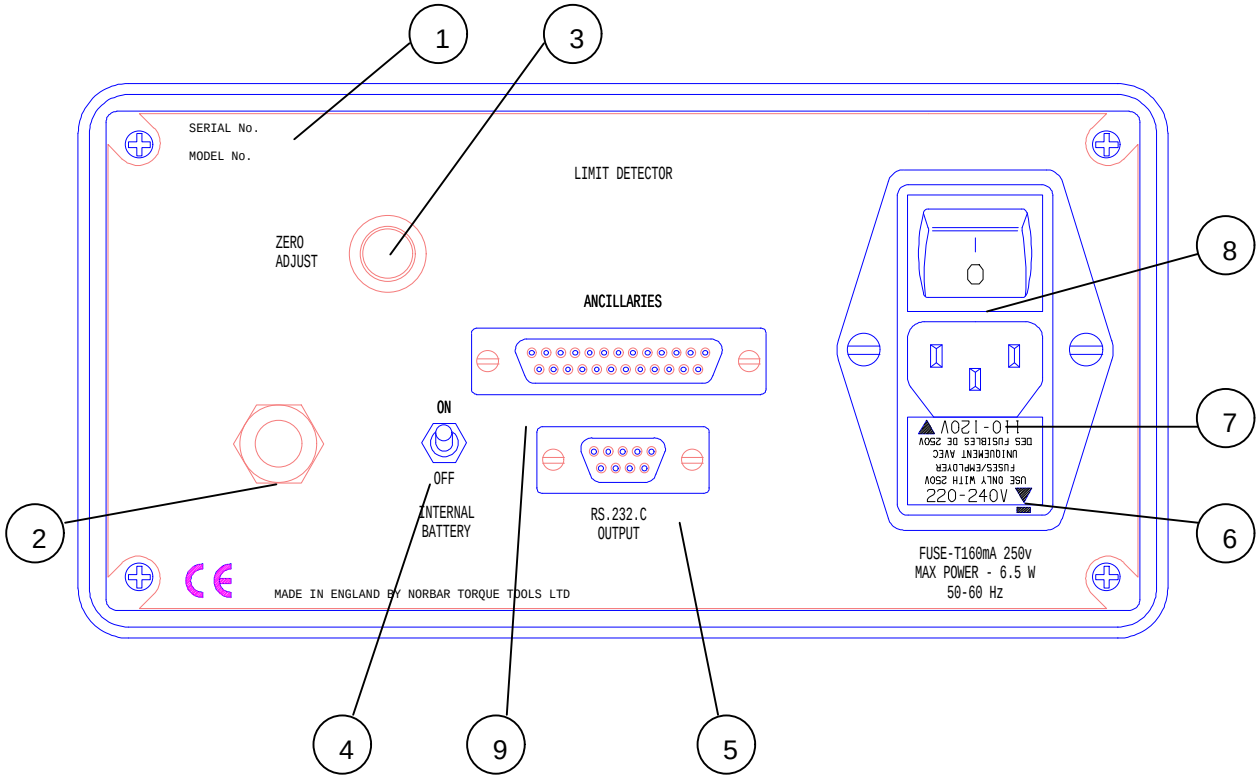
The above is only a guide and because different wrenches have different operating characteristics, it may be necessary to try alternative trigger level settings to obtain consistent results. This will be particularly true for very large and very small torque wrenches, and torque screwdrivers.

If obtaining incorrect readings, check wrench setting and operation.

If the auto reset triggers before expected value, set trigger level higher.

If the auto reset does not trigger at click of wrench, set trigger level lower.

DTS FUNCTIONS - BACK PANEL



(1) INSTRUMENT IDENTIFICATION : -

Each DTS has an individual serial number and a model number, which is the same as the Norbar order part number for the particular model. (NOTE :- *If the serial number or model number is intentionally tampered with any warranty may be void*).

(2) TRANSDUCER CABLE :-

Permanently connected (hard wired).

(3) ZERO ADJUST :-

Adjust 'ZERO ADJUST' knob to give zero on display for no load applied to transducer.

NOTE:- *The DTS must be in the TRACK mode when adjusting for zero.*

(4) 'INTERNAL BATTERY ON / OFF' SWITCH :-

The switch is only fitted to instruments which have an optional internal battery pack fitted. If an AC voltage is not connected to the instrument, or the mains switch (8) is 'OFF', this switch turns the instrument ON / OFF. When an AC voltage is connected, and the mains switch (8) is 'ON', this switch is not functional. A limit detector option cannot be fitted to an instrument with an internal battery pack.

(5) 'RS-232-C OUTPUT' SERIAL INTERFACE :-

The RS-232-C output connector is a 9 way 'D' type socket. See page 12 for specification.

(6) VOLTAGE SELECTION AND FUSE HOLDER DRAWER :-

Drawer orientation indicates 110/120 or 220/240 V AC mains input. Remove, turn through 180° and reinsert drawer to alter voltage selection. To remove the drawer, firstly remove the mains lead, then place a small screwdriver into the slot at the top of the drawer and gently lever open. The drawer contains two fuses, one for 110/120V and one for 220/240V operation. Both are 160 mA anti-surge fuses.

The fuse for the selected voltage is located on the right hand side of the drawer as it is removed.

Always replace fuses with the same value and type of fuses as originally fitted.

(7) POWER INPUT :-

Standard IEC type plug inlet with integral mains filter for use with mains cable supplied.

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(8) MAINS SWITCH :-

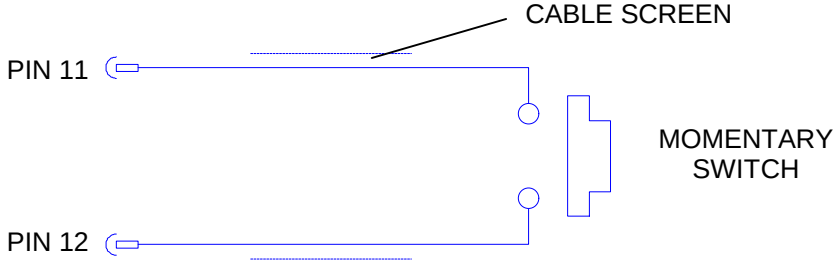
Turns DTS on / off.

(9) ANCILLARIES CONNECTOR:-

The ancillaries connector on the back panel is a 25-way ‘D’ type socket, the pins are designated as:-

PIN No	FUNCTION
1	Transducer amplifier analogue signal output.
2	Analogue signal ground.
3	Analogue memory signal output.
4	Analogue memory signal ground.
11	Remote memory reset.
12	+ 5 volts (from DTS). **WARNING: Not for powering external devices.**
13	Power ground.

NOTE:- *To cause a “remote memory reset” Pins 11 and 12 must be connected as below. Make and release switch to reset memory.*



NOTE:- *When making connections to the ‘ancillaries’ output, a good quality screened cable should be used. The screen should be connected to the metal shell header of the 25 way ‘D’ connector*

RS-232-C SERIAL DATA OUTPUT INTERFACE

The RS-232-C output socket is a 9 way 'D' type socket mounted on the back panel of the instrument.

Output of both measured value and units of measurement (as shown on the display) are in a familiar serial data format for communication with computers, printers etc.

Data is output on the RS-232-C interface when the 'request to send' (pin 7 on output socket) is taken HIGH, automatically when the memory auto-reset mode timer operates, or when the 'MEMORY RESET' button is pressed. Output can be triggered by pressing 'MEMORY RESET' in track and memory modes.

RS-232-C INTERFACE SPECIFICATIONS :-

Control Word
- Parity odd, even or off.
- 7 or 8 data bits.
- 1 or 2 stop bits.

Data rate fixed at 1200 baud.

Option for having a 'blank' or '+' character at start of data stream.

Units of measurement can be selected to be output or inhibited.

Maximum number of characters per line is 17.

Transmitted data voltage levels +9 volts to -9 volts.

Print signal, HIGH to print +3 volts to +20 volts DC.

NOTE :- *All options shown are internally selectable, refer to page 16.*

Options are initially factory set to 8 data bits, 2 stop bits, no parity and no leading '+' character.

RS-232-C OUTPUT PIN CONNECTIONS :-

PIN No	FUNCTION
1	Arm LED for print inhibit option.
2	No connection.
3	Transmitted data (from DTS).
4	Mode switch for print inhibit option.
5	Signal ground 0V.
6	Arm switch for print inhibit option.
7	Request to send (To DTS).
8	+ 5 volts (from DTS). **WARNING: Not for powering external devices.**
9	+ 10 volts (from DTS). **WARNING: Not for powering external devices.**

NOTE: *If Pin 9 is shorted to Pin 7 (via a momentary switch) data will be transmitted on Pin 3 each time the switch is made and released. Up to 5 outputs per second can be requested in this way*

RS-232-C DATA OUTPUT EXAMPLES :-

Code :- DP=Decimal Point. CR=Carriage Return. SP=SPace.

1. Using DTS with 5 N.m torque transducer set to the standard data string, reading 4.9924 Nm.

4	DP	9	9	2	4	SP	N	SP	m	SP	SP	SP	SP	SP	CR

2. Using DTS with 1 Tonne load transducer set to the standard data string, reading 0.6993 Tonne.

0	DP	6	9	9	3	SP	t	o	n	n	e	f	SP	SP	CR

3. Using DTS with 1000 lbf.ft torque transducer, with modified data string giving a '+' at the start and no units of measurement. Reading 724.4 lbf.ft.

+	7	2	4	DP	4	CR

For RS-232-C trouble shooting see page 27.

MITUTOYO DATA PROCESSORS:-

The instrument can be configured to communicate to Mitutoyo DP3DX, DP7, QM1000 and QM5000 families of data processors. This is selected by internal switches, see page 16.

For DP3DX, DP7, QM1000 and QM5000 families, the units of measurement must be inhibited, (set switch 2-3 to ON).

For DP3DX and DP7 families, a '+' character must be added to the start of the data stream, (set switch 5-5 to ON), this is in addition to switch 2-3.

WIRING THE ETS TO A DP3DX and DP7 DATA PROCESSOR :-

ETS RS-232-C OUTPUT		**MITUTOYO DP7 RS-232-C INPUT**
CONNECTOR COVER	CABLE SCREEN	
PIN 3		PIN 3
PIN 5		PIN 7
		LINK PINS 1 AND 5
		LINK PINS 4 AND 8

WIRING THE ETS TO A QM1000 and QM5000 DATA PROCESSOR :-

ETS RS-232-C OUTPUT		**MITUTOYO QM5000 RS-232-C INPUT**
CONNECTOR COVER	CABLE SCREEN	
PIN 3		PIN 3
PIN 5		PIN 7
		LINK PINS 4 AND 5
		LINK PINS 6 AND 8

For more information please consult your Mitutoyo data processor manual.

DTS OPERATING INSTRUCTIONS

1. Securely mount the transducer and connect to DTS via flying lead.

2. There are two possible ways to power the DTS :-

   a) 110/120 V or 220/240 V AC MAINS

   Ensure voltage selector drawer at the rear of the instrument is correctly positioned for your mains supply.
   Connect AC mains lead and switch power 'ON' at rear.
   When being used for the first time fit a mains plug, see page 2.
   If the plug is fused use a rating of 1A.

   b) INTERNAL BATTERY PACK OPTION

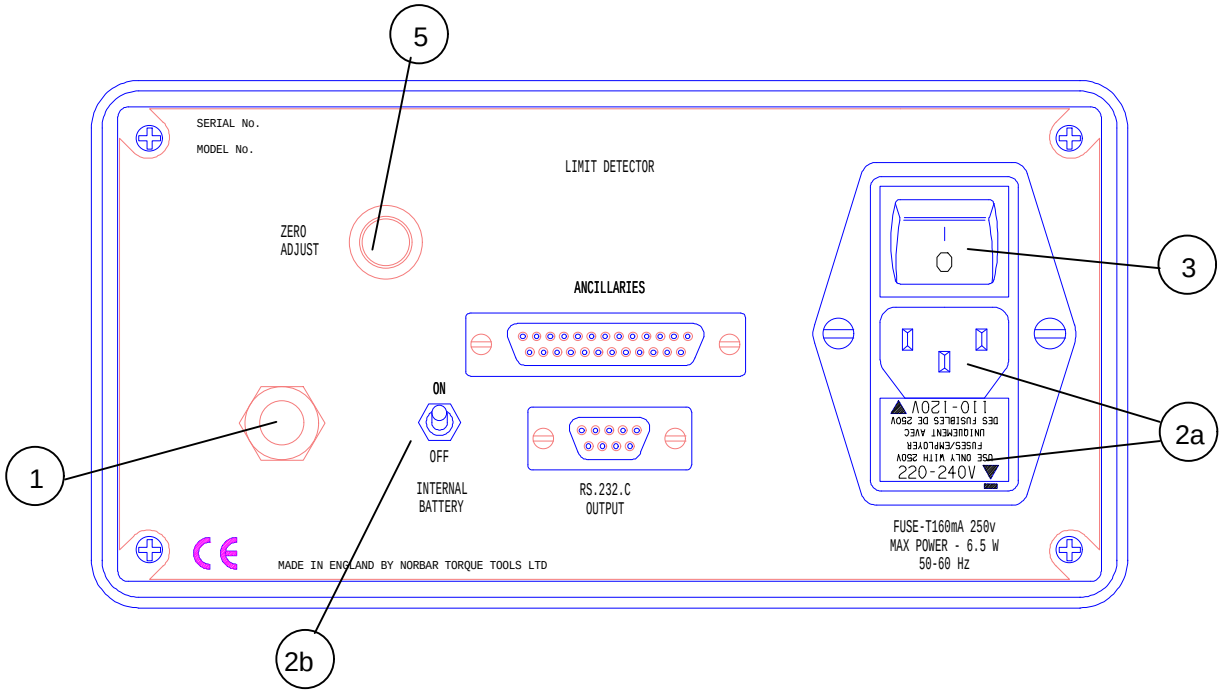
   If fitted, the DTS can be used without an external connection. The DTS rear mains switch is inoperative with this option, so a second ON / OFF switch is fitted to the back panel.

3. Switch instrument 'ON', wait 2 seconds for initialisation.

   Allow 5 minutes for the instrument to warm up and stabilise.

4. Select required units of measurement. Pressing the select units switch once will step onto the next available units of measurement.

NOTE:- *Ensure units are correctly selected for the capacity of the transducer.*



OPERATING INSTRUCTIONS :-

5. If the display does not read zero, the zero control on the back panel will need to be adjusted.

   Firstly, select ‘TRACK’ mode and exercise the transducer in direction of use to overcome hysteresis.

   Then adjust the ‘ZERO ADJUST’ on the back panel until zero is displayed.

6. Select filter 'OFF' or 'ON' dependant on application.

7. a) Select mode of measurement required, i.e. Track, Memory or Memory Auto Reset.

   Track - ‘TRACK / MEMORY’ switch out..

   Memory - 'TRACK / MEMORY' switch in.

   Memory Auto Reset - 'TRACK / MEMORY' and 'AUTO RESET' switches both in.

   b) If Memory Auto Reset is selected, set the 'AUTO RESET TRIGGER LEVEL % OF FULL SCALE’ knob to the required level.

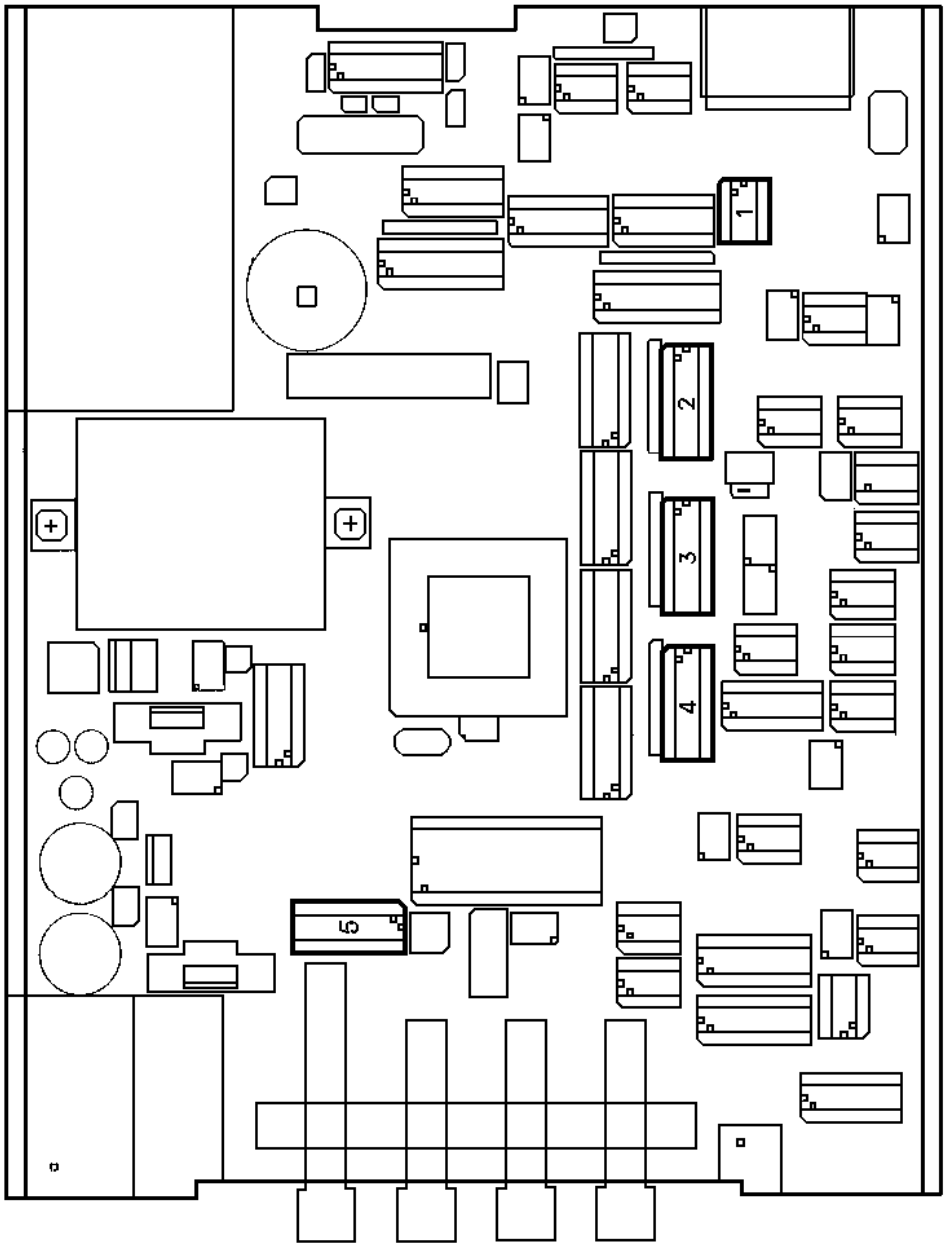
8. The digital display will show the applied measurement with the analogue trend bar being a rapid reference to the transducer's state.

The DTS is now ready for use. Please use the ‘OPERATING GUIDE’ label that is attached to the instrument for everyday operating instructions.

NOTE :- *If direction of measurement application is reversed, load the transducer in the reverse direction then re-zero the display before taking any readings.*

DTS INTERNAL USER SETTINGS

SWITCH LOCATIONS



FRONT OF DTS

INTERNAL USER SETTINGS :-

Only open the instrument to make changes that are essential.

WARNING ! :- SWITCH OFF AND DISCONNECT ALL POWER TO THE UNIT.

1. To access the switches remove the 4 screws that retain the lid (2 at the top of front panel and 2 at the top of rear panel). It will be necessary to loosen the 2 bottom screws of the front panel by about one turn. The lid can be removed, along with limit detector or battery pack if fitted.

Due to human electrostatic discharge (ESD), do not touch components other than those required.

2. Select settings as required, please refer to layout drawing on the opposite page. There is also a switch setting diagram located on the mains inlet socket within the DTS.

SWITCH 1	FUNCTION	OFF	ON
1-1	Not for user selection, DO NOT CHANGE	FACTORY SET	
1-2.	Not for user selection, DO NOT CHANGE		FACTORY SET
1-3.	Not for user selection, DO NOT CHANGE		FACTORY SET
1-4.	Not for user selection, DO NOT CHANGE	FACTORY SET	

SWITCH 2	FUNCTION	OFF	ON
2-1.	RESOLUTION SELECTION (DIGITS)	Standard 5	Reduced 4
2-2.	Not for user selection, DO NOT CHANGE	FACTORY SET	
2-3.	UNITS OF MEASUREMENT OUTPUT WITH RS- 232-C CHARACTER STREAM	Output units	Inhibit units
2-4.	N.m	Disabled	Enabled
2-5.	dN.m	Disabled	Enabled
2-6.	cN.m	Disabled	Enabled
2-7.	lbf.ft	Disabled	Enabled
2-8.	lbf.in	Disabled	Enabled

SWITCH 3	FUNCTION	OFF	ON
3-1.	ozf.in	Disabled	Enabled
3-2.	kgf.m	Disabled	Enabled
3-3.	kgf.cm	Disabled	Enabled
3-4.	gf.cm	Disabled	Enabled
3-5.	N	Disabled	Enabled
3-6.	kN	Disabled	Enabled
3-7.	g	Disabled	Enabled
3-8.	kg	Disabled	Enabled

INTERNAL USER SETTINGS :-

SWITCH 4	FUNCTION	OFF	ON
4-1.	tonf	Disabled	Enabled
4-2.	tonnef	Disabled	Enabled
4-3.	ozf	Disabled	Enabled
4-4.	lbf	Disabled	Enabled
4-5.	degree	Disabled	Enabled
4-6.	lb/insq	Disabled	Enabled
4-7.	bar	Disabled	Enabled
4-8.	mm	Disabled	Enabled

SWITCH 5	FUNCTION	OFF	ON
5-1	RS-232-C CONTROL WORD PARITY	EVEN	ODD
5-2	RS-232-C CONTROL WORD PARITY	NO PARITY	PARITY ON
5-3	RS-232-C CONTROL WORD CHARACTER LENGTH	8	7
5-4	RS-232-C CONTROL WORD STOP BITS	2	1
5-5	RS-232-C LEADING '+' CHARACTER	INHIBIT +	OUTPUT +
5-6	Not for user selection, DO NOT CHANGE	FACTORY SET	
5-7	AUTO RESET TIME (with 5-8), see below	STANDARD SET	
5-8	AUTO RESET TIME (with 5-7), see below	STANDARD SET	

SWITCH 5-7	SWITCH 5-8	TIME
ON	ON	4 SECONDS
OFF	OFF	3 SECONDS
OFF	ON	2 SECONDS
ON	OFF	1 SECOND

3. Replace lid and screws before turning 'ON'.

INTERNAL BATTERY PACK OPTION

MODULE PART NUMBER 44032

The DTS internal battery pack is mounted in the lid of the instrument. Rechargeable nickel cadmium cells are used, these are not user replaceable.

The battery pack will power the instrument for a minimum of 8 hours continuous use. Recharge time is 16 hours.

To use the instrument on battery power, disconnect the mains power and switch 'BATTERY ON / OFF' to 'ON' and select required operating mode, etc. When approximately half an hours battery power life is left in the batteries a 'LO BATT' message will flash on the digital display. When battery output goes below the voltage at which the instrument will not function correctly (out of calibration) the instrument switches OFF automatically. Once batteries are discharged, switch 'BATTERY ON / OFF' switch to 'OFF'.

To recharge batteries connect the DTS to an AC mains supply (110/120 or 220/240 V AC) and switch 'Power On'. The DTS can be used as normal whilst batteries are charging. There is no maximum charge time for the battery pack, so the DTS can be continuously used on mains without causing damage to batteries.

Note :- If the DTS is charged for less than 16 hours or at a mains voltage of less than 110 VAC / 220 VAC then a reduced discharge duration may be expected.

To obtain maximum battery life and performance, it is highly recommended that battery packs are used in a cycle of :-

FULLY DISCHARGE - FULLY CHARGE** (minimum 16 hours**) - FULLY DISCHARGE

TROUBLE SHOOTING :-

If Battery Pack fails to power the ETS after recharging, check the two fuses protecting the batteries that are mounted on the Battery Pack P.C.B. This is achieved by following the procedure below :-

WARNING! SWITCH OFF THE ETS AND REMOVE THE POWER LEAD.
SWITCH THE BATTERY ON / OFF SWITCH TO THE OFF POSITION.

1. Remove the two upper most cross head screws on the instrument's front and back panels (four screws in all).
2. Loosen the two lower cross head screws on the front panel half a turn.
3. Lift off the instrument lid.

WARNING! UNPLUG THE BATTERIES FROM THE BATTERY PACK P.C.B. BEFORE ATTEMPTING TO REMOVE THE FUSES (500 Ma ANTI-SURGE), AND RECONNECT ONCE THE FUSES HAVE BEEN REPLACED.
IF PROBLEMS ARE STILL INCURRED, RETURN TO NORBAR OR A NORBAR APPOINTED AGENT, FOR EVALUATION.

PRINT INHIBIT CONTROLLER OPTION

PART NUMBER 60167

INTRODUCTION :-

The print inhibit controller is a remote, hand held device for controlling the RS-232-C output from the DTS. This option can be retro fitted to DTS model numbers, 43158 - 43162 inclusive.

The function of this device is to either :-

(i) Allow RS-232-C data output as normal, so giving data on each request.

(ii) Completely disable RS-232-C data output.

(iii) Only to allow data RS-232-C output on the next request and inhibit all subsequent requests.

TYPICAL APPLICATIONS :-

This option can control unwanted RS-232-C data in many applications, including :-

Use with Norbar's range of ISO 1000 and 2000 test rigs, when reversing off the torque after the wrench has operated.

Also with calibration and data collection systems.

OPERATION :-

Position of ' PRINT NORMALLY / PRINT WHEN ARMED' switch :-

SWITCH POSITION	STATE OF INDICATOR	ACTION
'PRINT NORMALLY'	UNARMED	The RS-232-C output acts as normal. Every time an output is requested it will be issued.
'PRINT WHEN ARMED'	UNARMED	The RS-232-C output is inhibited, so will not function.
'PRINT WHEN ARMED'	ARMED (Having pressed button on controller)	When the ' ARM ' button is pressed, the arm led will light so indicating that the next request to send data will be acted upon. Upon the next data output taking place, the arm led will turn off and the RS-232-C output will again be inhibited. To obtain further data output either press the 'ARM' button or switch to 'PRINT NORMALLY'.

DTS DUAL LIMIT DETECTOR OPTION

INTRODUCTION :-

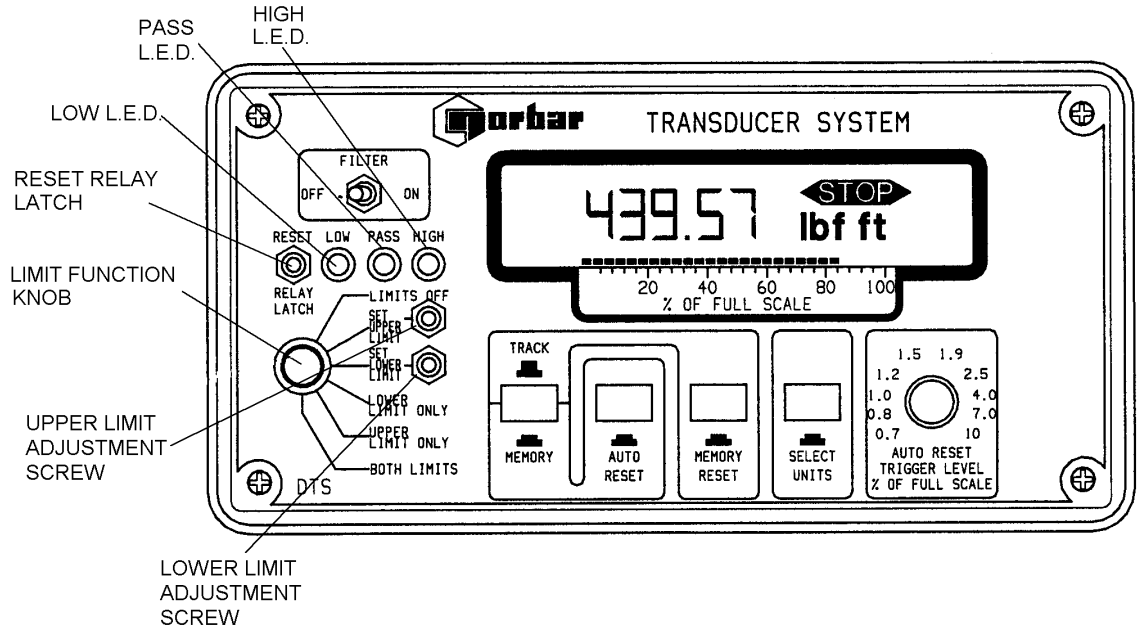
The DTS dual limit detector option provides an easy and foolproof means of inspection checking, giving indication of Pass or Fail of the device under test.

The limit detector option has two operator adjustable limits (set limits), 'Lower limit' and 'Upper limit'. Indication of the 'LOW', 'PASS' or 'HIGH' states is given by three light emitting diodes (LED's) Amber 'Low', Green 'Pass' or Red 'High', and three logic outputs. A typical application for the logic outputs would be the control of external circuitry.

The two operator set limits also control two internal single pole changeover relays. Either or both limits can be used, depending on selection via the front panel function switch. Either or both limits can be internally selected to be active or latching.

Typical applications for the relays are controlling machinery, or external pass / reject indicators, which can be achieved by connecting to the output connector on the back panel

When outputting data via the RS-232.C connector, an 'L' for low, 'P' for pass or 'H' for high (depending on LED state) will be printed preceding the measured value and units of measurement.



SPECIFICATIONS :-

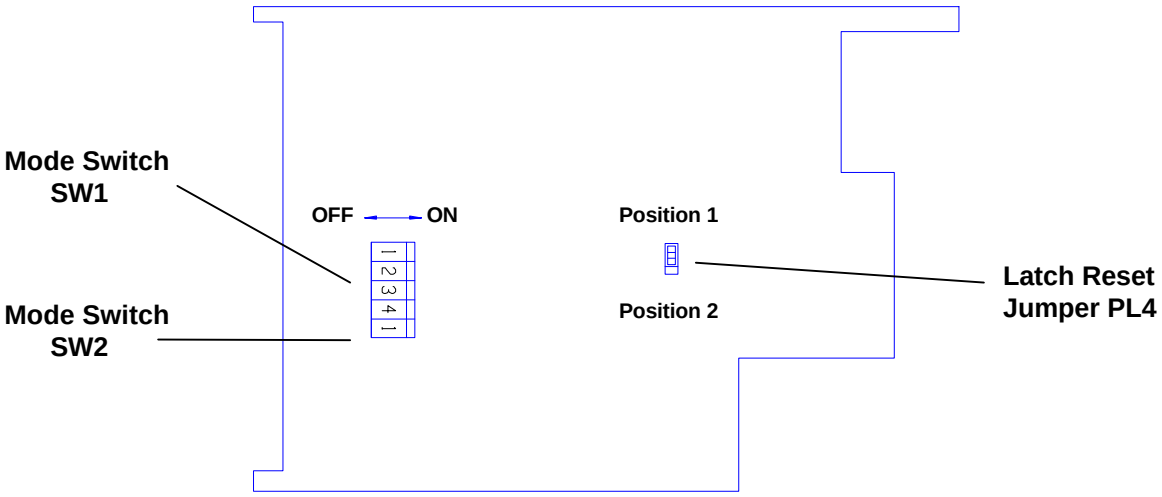
Accuracy of limit set points	+/- 0.2% of transducer full scale
Range of limit set points	2% - 105% of transducer full scale
Hysteresis of limit set points	1% of transducer full scale
Relay maximum switching load	2 amps 260 VAC / 2 amps 28 VDC (Volt Free contacts)
Logic outputs (On Ancillaries Socket)	low 0 VDC / High 5 VDC (CMOS) Maximum Fan out 2 TTL loads

SELECTING THE RELAY, LED AND LOGIC OUTPUT OPERATION MODES :-

The relay, LED and logic output operation modes are set by five switches mounted on the limit detector printed circuit board (shown below), which is situated inside the lid of the DTS.

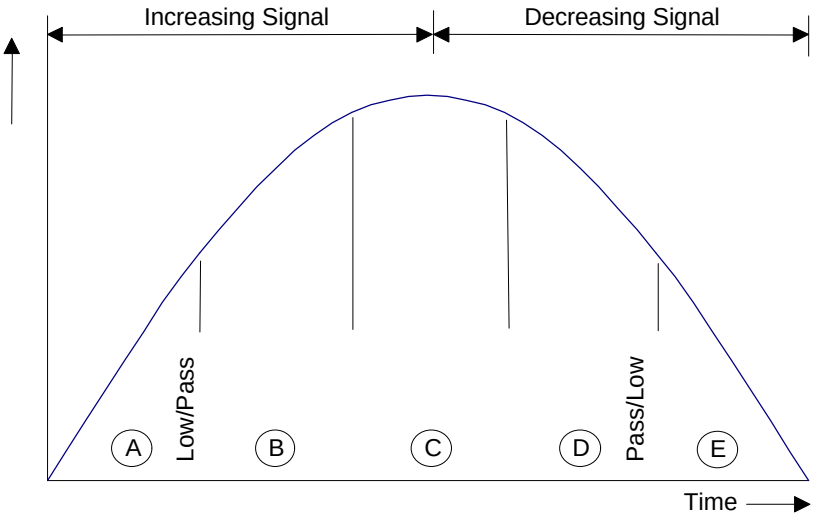
WARNING: **Switch instrument off and disconnect from mains or battery supply before attempting to remove the lid.**

To access the limit detector PCB, remove the four screws retaining the DTS lid (2 at the top of front panel, 2 at the top of back panel). Then loosen the two screws at the bottom of the front panel about one turn and lift the lid away complete with the limit detector board.



SW1/4 and SW2/1 set the direction in which the limit detector is active. The mode selected by SW1/4 and SW2/1 is independent of that selected by SW1/1, SW1/2 and SW1/3

SW1/4	SW2/1	MODE
'OFF'	'OFF'	Relays active for both positive and negative measurements.
'ON'	'OFF'	Relays active for negative measurements only.
'OFF'	'ON'	Relays active for positive measurements only.
ON'	'ON'	Relays will not switch for positive or negative torque/force signals.



SELECTING THE RELAY, LED AND LOGIC OUTPUT OPERATION MODES :-

SW1/1, SW1/2 and SW1/3 select the six active / latch modes for the relays, LED's and logic outputs.

MODE No	SW1/1	SW1/2	SW1/3
1	OFF	OFF	OFF
2	ON	OFF	OFF
3	ON	ON	OFF
4	OFF	ON	OFF
5	OFF	OFF	ON
6	ON	OFF	ON
7	ON	ON	ON
8	OFF	ON	ON

The following three tables show how the eight limit detector modes function for either or both limits, selected via the front panel function knob.

A - E represent the 5 signal regions in the diagram opposite, the LED that is 'ON' is shown as, 'Am' for Amber, 'Gn' for Green and 'Rd' for Red, and the logic output that is at logic level 1, i.e. 5v, is shown as 'L' for Low, 'P' for Pass and 'H' for High. The relay outputs are shown as, 0 for N/O contact open and 1 for N/O contact closed.

LIMIT FUNCTION KNOB SET TO BOTH LIMITS POSITION

MODE No	LED LOGIC & RELAYS	A	B	C	D	E	FUNCTION
1	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 0 1	Gn P 1 0	Am L 0 0	Relays, LED's and logic outputs not latched. Lower relay drops out when signal value is above the upper limit set value.
2	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 1 1	Gn P 1 0	Am L 0 0	Low relay only latched when signal value is above lower limit set value. LED's and logic outputs are not latched.
3 & 4	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 1 1	Gn P 1 0	Gn P 1 0	Low relay and pass logic output latched until reset. Pass LED latched, except when signal value is above the upper limit set value.
5	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 0 1	Rd H 1 1	Rd H 0 1	High relay, LED and logic output latched until reset.
6	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 1 1	Rd H 1 1	Rd H 0 1	High relay, LED and logic output latched until reset. Low relay latched only when signal value is above lower limit set value.
7 & 8	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Rd H 1 1	Rd H 1 1	Rd H 1 1	Both relays latched until reset.

LIMIT FUNCTION KNOB SET TO LOWER LIMIT ONLY POSITION

MODE No	LED LOGIC AND RELAYS	A	B	C	D	E	ACTION
1, 2, 5 & 6	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Gn P 1 0	Gn P 1 0	Am L 0 0	Low relay, pass LED and pass logic output only latched when signal value is above lower limit set value.
3, 4, 7 & 8	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Am L 0 0	Gn P 1 0	Gn P 1 0	Gn P 1 0	Gn P 1 0	Low relay, pass LED and pass logic output latched until reset.

LIMIT FUNCTION KNOB SET TO UPPER LIMIT ONLY POSITION

MODE No	LED LOGIC AND RELAYS	A	B	C	D	E	ACTION
1 & 4	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Gn P 0 0	Gn P 0 0	Rd H 0 1	Gn P 0 0	Gn P 0 0	High relay, high LED and high logic output only latched when signal value is above upper limit set value.
2 & 3	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Gn P 0 0	Gn P 0 0	Rd H 1 1	Gn P 0 0	Gn P 0 0	High and low relays, high LED and high logic output only latched when signal value is above upper limit set value.
5 & 8	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Gn P 0 0	Gn P 0 0	Rd H 0 1	Rd H 0 1	Rd H 0 1	High relay, high LED and high logic output latched until reset.
6 & 7	LED 'ON' LOGIC 'ON' LOW RELAY HIGH RELAY	Gn P 0 0	Gn P 0 0	Rd H 1 1	Rd H 0 1	Rd H 0 1	High relay, high LED and high logic output latched until reset. Low relay latched when signal value is above upper limit set value

When using any of the latch modes, unlatching of the relay(s), LED's and logic outputs can be done as specified in the table below.

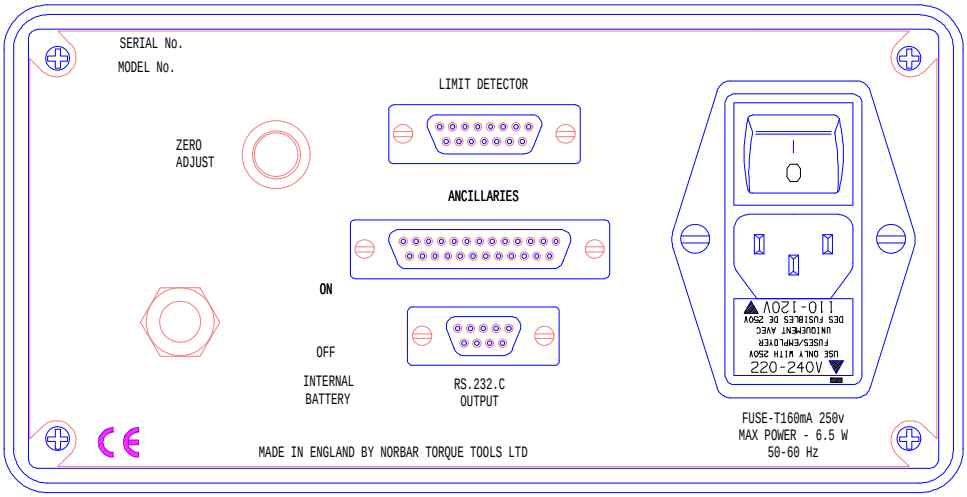
JUMPER (PL4)	**ACTION**
POSITION 1	Pressing of the RESET RELAY LATCH switch on the DTS front panel
POSITION 2	Pressing the MEMORY RESET switch when in MEMORY mode or automatically at the end of the auto reset hold time when in MEMORY AUTO RESET mode.

After selections have been made, refit the lid complete with limit detector board and refit and tighten the four fixing screws. re-tighten the two screws at the bottom of the front panel.

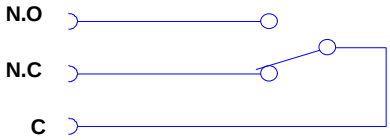
CONNECTING THE LIMIT DETECTOR TO CONTROL EXTERNAL EQUIPMENT:-

WARNING ! ENSURE THE DTS IS SWITCHED OFF AND DISCONNECTED FROM THE MAINS OR BATTERY POWER UNIT. ALSO ENSURE ANY EQUIPMENT TO BE CONNECTED IS NOT LIVE (SWITCHED OFF).

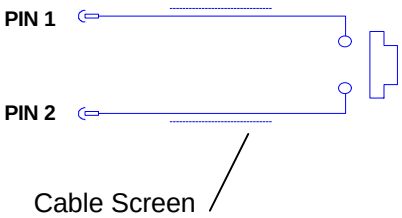
Connect any external connections to the LIMIT DETECTOR OUTPUT connector. All connections are optional.



Internal Relay Contacts



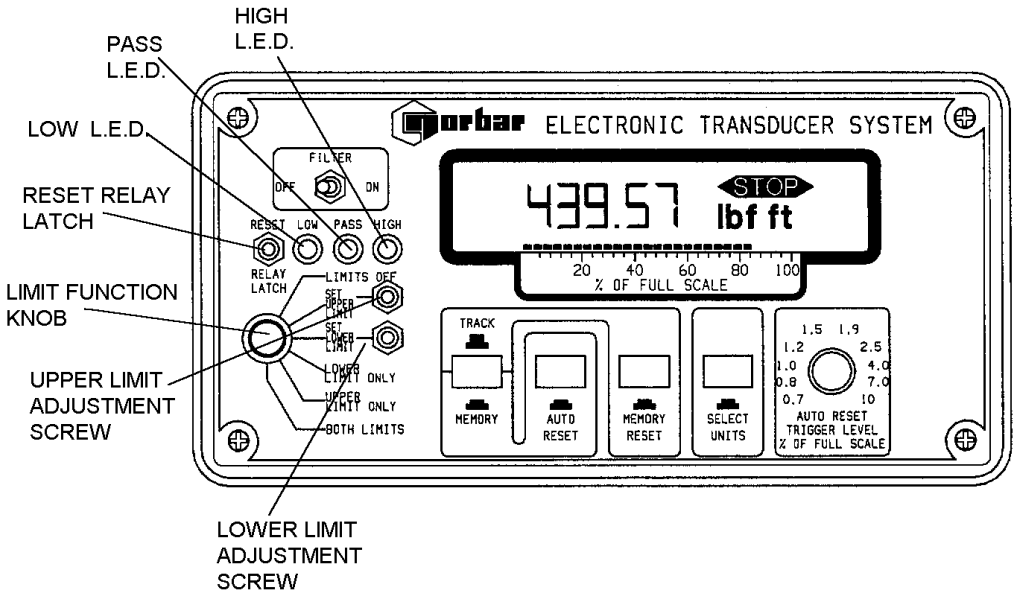
External Remote Latch Reset
(Momentary Switch)



LIMIT DETECTOR OUTPUT	INTERNAL RELAY AND LOGIC OUTPUTS
PIN 1	+5 V To external remote reset latch switch
PIN 2	R/S To external remote reset latch switch
PIN 3	C Common contact of low relay
PIN 4	N.O Normally open contact of low relay
PIN 5	N.C Normally closed contact of low relay
PIN 6	C Common contact of high relay
PIN 7	N.O Normally open contact of high relay
PIN 8	N.C Normally closed contact of high relay
PIN 9	Logic 0 volts
PIN 10	Logic output for low state
PIN 11	Logic output for pass state
PIN 12	Logic output for high state
PIN 13	Low limit trip point output
PIN 14	Power 0 volts
PIN 15	+ve un-regulated voltage output

NOTE :- *It is recommended that a good quality screened cable is used when connecting to the limit detector output. The screen should be connected to a metal shell header for the 15 way 'D' connector*

OPERATING THE LIMIT DETECTOR :-



1. Connect the mains supply or battery input and switch power ‘ON ‘.

2. Select ‘TRACK’ mode for the DTS.

3. To Set Lower Limit Trip Point:-

Switch the limit function knob to 'SET LOWER LIMIT', the trip point set is shown on the DTS display. Use the screwdriver provided with the DTS to set the lower limit adjustment screw if required .

4. To Set Upper Limit Trip Point:-

Switch the limit function knob to 'SET UPPER LIMIT'. Set the trip point as in (2) above, but adjusting the upper limit adjustment screw.

NOTE: *The upper trip point should not be set below or equal to the lower trip point. If this is attempted, the low, pass and high LED indicators will flash. When the trip points have been set correctly, only the pass LED will be permanently on.*

5. Selecting Required Limits :-

Switch the limit function knob to ‘LOWER LIMIT ONLY’, ‘UPPER LIMIT ONLY’ or ‘BOTH LIMITS’ active as required for application.

6 select the required mode of operation for the DTS, i.e. TRACK, MEMORY or MEMORY AUTO RESET.

7. The DTS is now ready to be used with the limit detector option.

DTS TROUBLE SHOOTING

1. **Instrument does not power up.**

   a) Check the Voltage Selector drawer is in the correct orientation for your mains supply.
   b) Check fuse in selector drawer. The fuse is on the right hand side as the drawer is removed
   c) Check fuse in mains plug.

2. **Displayed user error messages.**

   These error messages will be displayed on the DTS front panel display if the following errors occur : -

   a) 'ERROR 27 - OVERANGE' : The transducer may have been taken into an overload state.
   b) 'ERROR 29 - TOO BIG' : Illegal units of measurement selected for transducer connected. Step to next conversion with select units switch.
   c) 'ERROR 30 - TOO SMALL' : Illegal units of measurement selected for transducer connected. Step to next conversion with select units switch.
   d) 'ERROR 33 - FIRMWARE' : Switch power to instrument ‘OFF’, then ‘ON’ again at the rear of the DTS. If message does not clear, return DTS instrument to Norbar for evaluation.

3. **Required units of measurement are not selectable**

   a) Conversion from transducer standard units to required units could not be displayed within available digits on display, thus conversion is not allowed.
   b) Units required have not been enabled. See page 16.

4. **RS-232-C data output not communicating with other equipment**

   a) Check that control word on the DTS and the equipment receiving data match, see page 12.
   b) Check that the baud rate is set to 1200 baud on the equipment receiving data.
   c) Check that the connecting lead is wired correctly at both ends, see page 12.
   d) Check if equipment receiving data requires the units of measurement inhibited or a leading character. This is the case when interfacing to Mitutoyo equipment, see page 13.

5. **Battery pack option**

   If the battery pack option fails to power the instrument after recharging, check the two fuses protecting the batteries, these are mounted on the battery pack board. To complete this task refer to the trouble shooting section of the integral battery pack option on page 19.

6. **Display values changes when transducer cable is moved.**

   This could be caused by broken or loose wires in the transducer lead.

7. **Display will not zero, with no load applied to transducer.**

   Check the relationship of the transducer input square drive to the output square drive, the sides must be parallel. If they are not the transducer has been overstrained and may require recalibration or replacement (applicable to torque transducers).

8. **Recalibration of DTS**

   If there is any doubt concerning the functionality or accuracy of the instrument it should be returned to Norbar, or a Norbar appointed agent, for repair and / or recalibration.

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