

ELECTRONIC TRANSDUCER SYSTEM ETS

OPERATOR'S HANDBOOK (PART NO. 34210)
ISSUE 9



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MODEL NUMBERS :-

This operators handbook covers the following ETS display instruments.

<u>ETS TYPE</u>	<u>MODEL No</u>
ETS	40320
ETS + Limit Detector	40322
ETS + Internal Battery Pack	40321
ETS + LD for 10 channel selection unit	40326
ETS + LD for flask tool	40327
ETS for Rate Controller	40323
ETS + Limit Detector for Rate Controller	40324
ETS + Internal Battery Pack for Rate Controller	40325

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

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

All versions of the ETS 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.

OPTIONAL EXTRAS :-

<u>OPTION</u>	<u>MODEL NO.</u>
External Battery Power Unit	60166
Data Printer (RS-232-C)	60164
5 Way Switch Unit	60163
Carrying Case	38272
ETS Service Manual	34213
Print Inhibit Controller (Remote, Hand Held)	60167

NOTE:- A comprehensive range of transducers are available from Norbar. Bench stands to suit static torque transducers can also be purchased.

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ETS INTRODUCTION

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

The combination of Norbar's instrument and standard transducers (with their own amplifiers) allow precision measurement of torque and force. Various other types of strain gauge transducers can also be used with the system.

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 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 by the transducer's amplifier.

The ETS instrument is bi-directional in operation.

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

ETS CALIBRATION AND REPAIR :- _____

To maintain the specified accuracy it is recommended that the ETS 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 ETS to the specified accuracy can be found in the ETS service manual Part No. 34213.

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 ETS 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.
RANGE OF OPERATION	0 to 150% of full scale of transducer connected, minimum. 0 to 99,999 counts on display.
READOUT	Custom 7 digit LCD display which includes direct readout of 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 RATE	3 per second (3 Hz).
MEMORY 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 250,2500 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 250,2500 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.

INSTRUMENT SPECIFICATION (Continued.):- _____

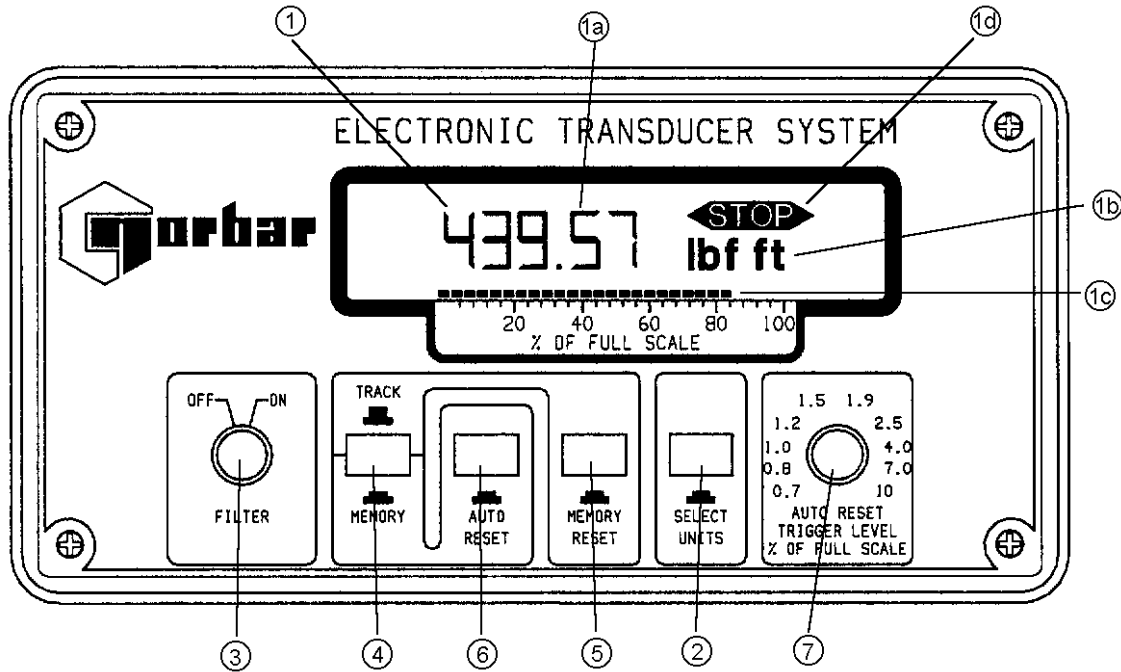
POWER REQUIREMENTS	Selectable 110/120 Volts AC +/- 10 % or 220/240 Volts AC +/- 10 % at 50-60 Hz. Also available are an internal battery pack or external Battery Power Unit.
MAINS POWER FUSE	T160 mA anti-surge (2 off)
POWER CONSUMPTION	6.5 W - maximum.
ANALOGUE OUTPUT	TORQUE
	1.0000 volt full scale for 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 range). 1.1120 volt full scale for capacity in lbf (2.5's range). 0.8896 volt full scale for capacity in lbf (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.
	NOTE: <i>Capacity is as marked on transducer connected to ETS.</i>
ANALOGUE OUTPUT IMPEDANCE	500 ohms minimum for chart recorders, oscilloscopes etc. Frequency response at least 15KHz.

INSTRUMENT SPECIFICATION (Continued.):- _____

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	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
TRANSDUCER CABLE	2.0 meters (6 ft 6 ins) long (standard)
OPERATING TEMP RANGE	-10°C to +50°C
MAXIMUM OPERATING HUMIDITY	85% Relative Humidity @30°
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.*

ETS 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. It also acts as a warning for potential overload.
- 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) :- _____

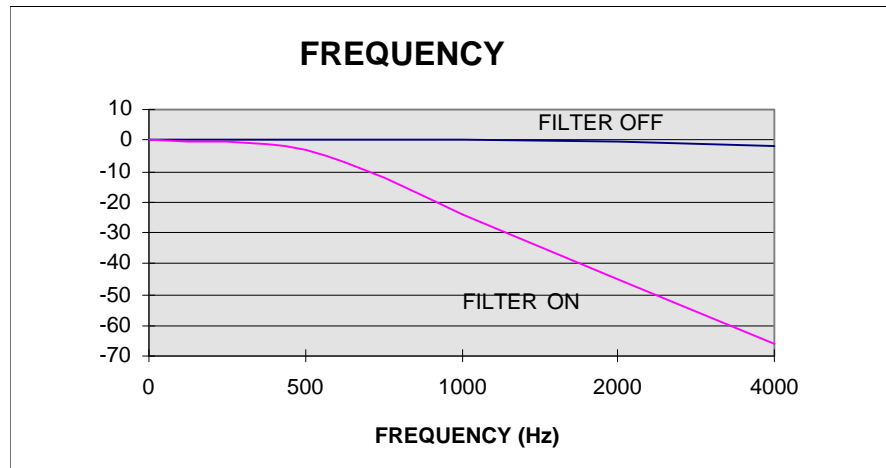
When pressed the units of measurement will step onto the next available unit. Repeated pressing will step through all available units of measurement, then loop round to the start of the list. Changing the units of measurement whilst a signal is stored in the memory will give the correct readout in the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

NOTE:- *Any of the units of measurement in the specification on page 5 can be enabled or disabled 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 tracks 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 ETS 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.

NOTE: *The memory can be reset with the use of an external remote switch. See page 11.*

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

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

In this mode the ETS holds and displays the first peak of torque. 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.

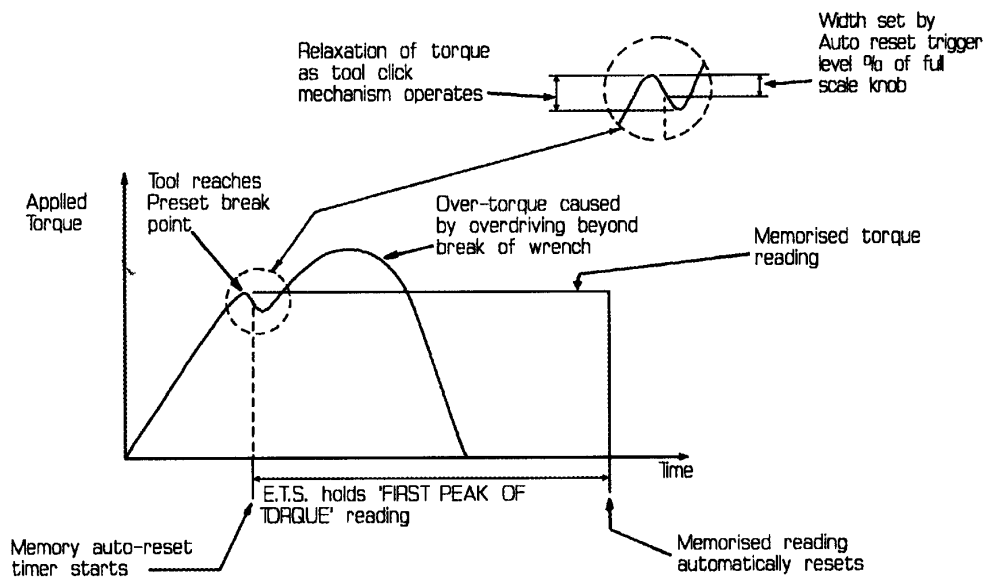
By setting it is possible to ignore small ranging peaks in the transducer's signal in preference to the required larger peak.

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 transducer's 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 ETS 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** .

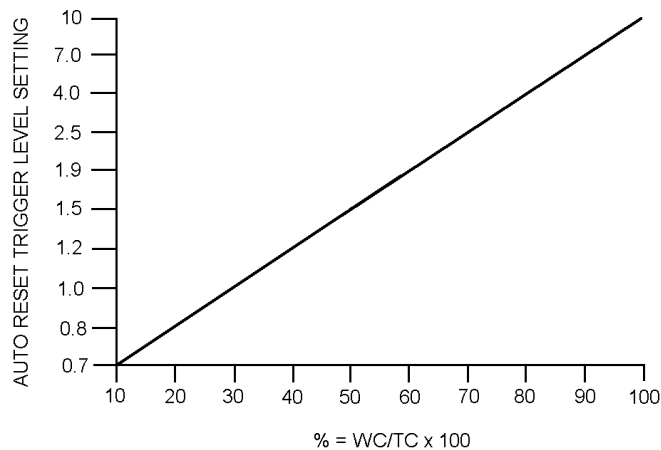
2. Note the **TRANSDUCER FULL SCALE VALUE**.

This is usually stated on the transducer housing.

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.



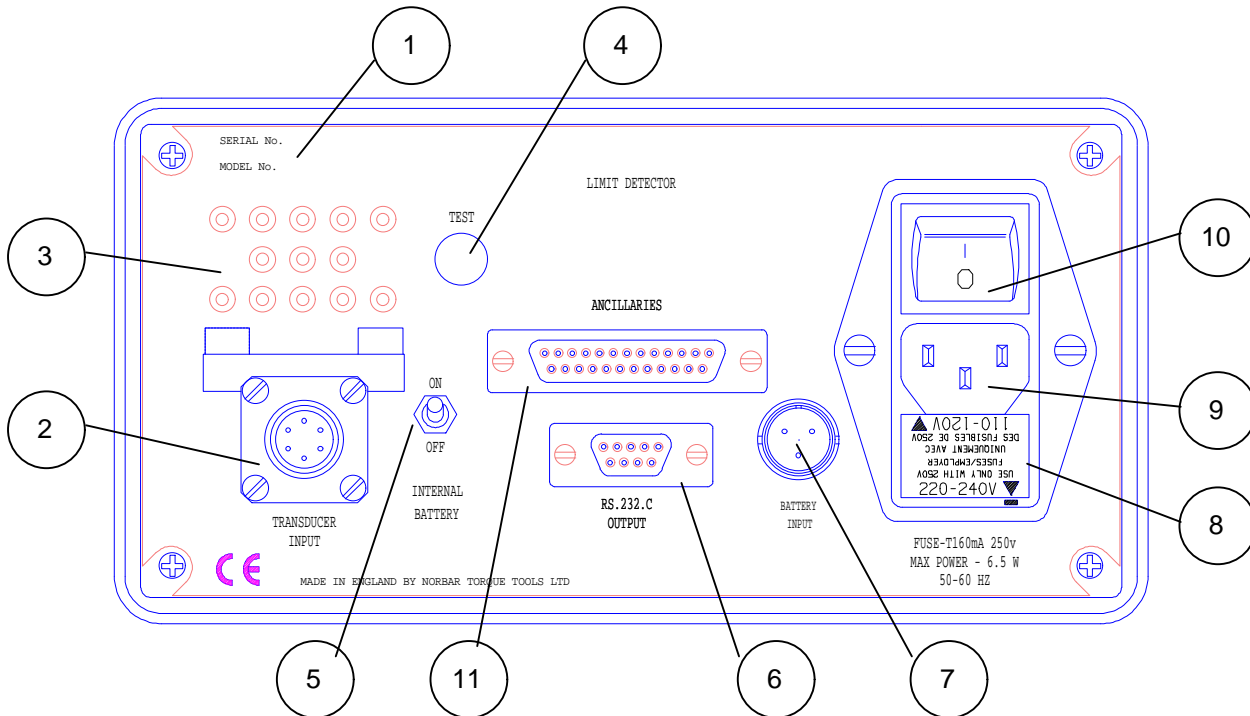
The above is only a guide and because different wrenches have different operating characteristics, it may be necessary to try alternative trigger level settings to obtain consistent results. This will be particularly true for very large and very small torque wrenches, and torque screwdrivers.

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.

ETS FUNCTIONS - BACK PANEL



(1) INSTRUMENT IDENTIFICATION :- _____

Each ETS has an individual serial number and a model number, which is the same as the Norbar order part number for the particular model. If the serial number or model number is intentionally tampered with any warranty may be void.

(2) TRANSDUCER INPUT SOCKET :- _____

Connection to transducer, via transducer lead supplied (or to 5 way switch box option, if fitted).

(3) TRANSDUCER AMPLIFIER MODULE SOCKET :- _____

Socket to accept interchangeable transducer amplifier module.

This module matches the transducer being used, sharing the same serial number. A transducer can only be used with it's corresponding amplifier module. Exposed on the module is a 'ZERO' fine adjustment, other adjustments being non user adjustable and covered by the label. See page 26 and the transducer operators handbook for further details of the transducer and amplifier modules.

(4) 'TEST' BUTTON :- _____

This functionally tests the ETS and transducer by causing the instrument to display (to 1% accuracy) the transducer's maximum capacity. Use in 'FILTER OFF' only. This is NOT a calibration test.

(5) 'INTERNAL BATTERY ON / OFF' SWITCH :- _____

The switch is only fitted to instruments that have an optional internal battery pack. If an AC voltage is not connected to the instrument, or the mains switch (10) is 'OFF', this switch turns the instrument ON / OFF. When an AC voltage is connected, and the mains switch (10) is 'ON', this switch is not functional.

(6) 'RS-232-C OUTPUT' SERIAL INTERFACE :- _____

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

(7) BATTERY INPUT :- _____

For connection to optional (external) Battery Power Unit. (Model 60166). Connector not fitted if internal battery pack option fitted.

(8) 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 160mA 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.

(9) POWER INPUT :- _____

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

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(10) MAINS SWITCH :- _____

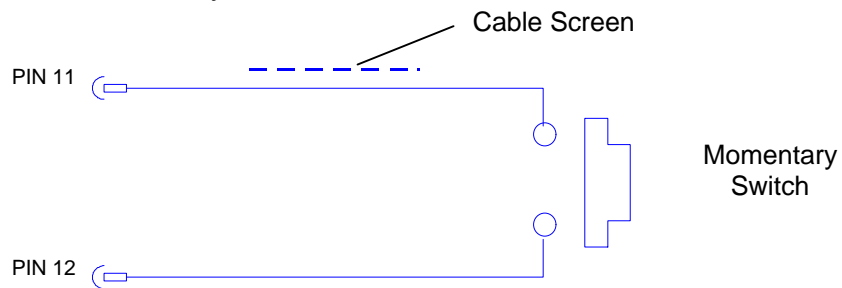
Turns ETS on / off.

(11) 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 ETS). WARNING: Not for powering external devices.
13	Power ground.

NOTE:- To cause "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 '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.

Maximum of 5 data stream outputs per second.

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 ETS).
4	Mode switch for print inhibit option.
5	Signal ground 0V.
6	Arm switch for print inhibit option.
7	Request to send (To ETS).
8	+ 5 volts (from ETS). WARNING: Not for powering external devices.
9	+ 10 volts (from ETS). 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 ETS 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 ETS 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 ETS 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 28.

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 or 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 or 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

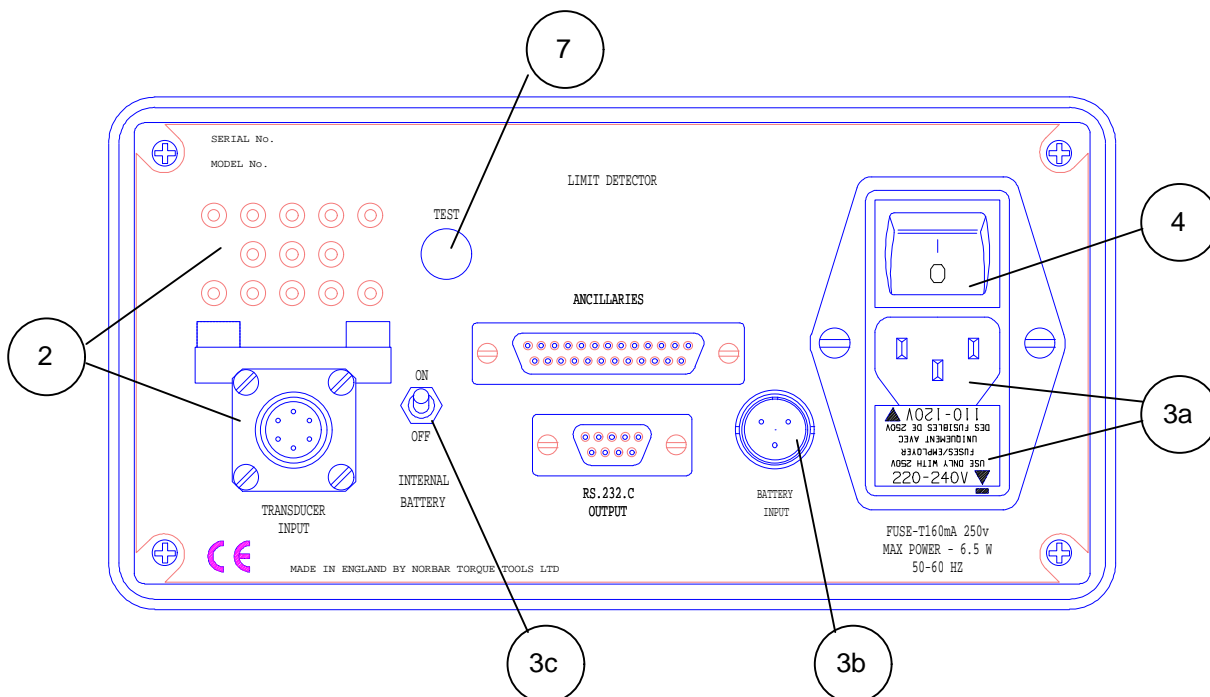
For more information please consult your Mitutoyo data processor manual.

ETS OPERATING INSTRUCTIONS

1. Securely mount the transducer.
2. Connect the transducer cable between the transducer and ETS. Plug the matching amplifier into the rear of the instrument ensuring it is the correct way up.
3. There are three possible ways to power the ETS :
 - 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) EXTERNAL BATTERY POWER UNIT (BPU) MODEL No. 60166
 Connect ETS and BPU with lead provided and switch the BPU into the 'BATTERY' mode.
 The ETS rear mains switch is inoperative when powered from the BPU, so the ETS must be switched on and off from the BPU.
 - c) INTERNAL BATTERY PACK OPTION
 If fitted, the ETS can be used without an external connection. The ETS rear mains switch is not functional with this option, so a battery ON / OFF switch is fitted to the back panel.
4. Switch instrument 'ON', wait 2 seconds for initialisation.
 Allow 5 minutes for the instrument to warm up and stabilise.
5. Select required units of measurement, pressing the select units switch once will move onto the next available units.



OPERATING INSTRUCTION :-

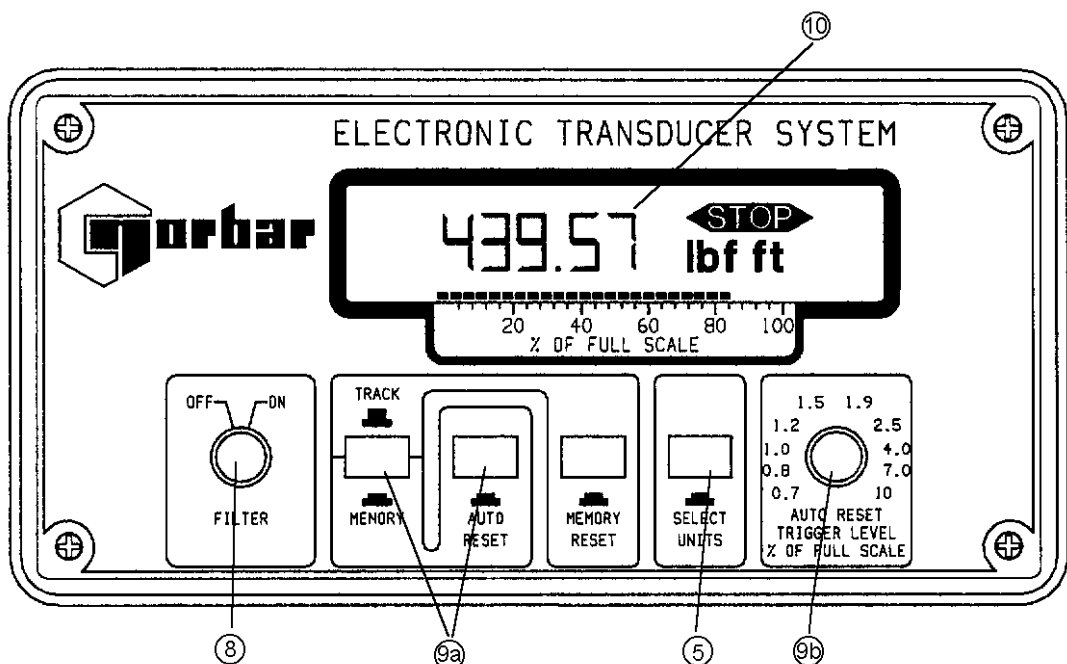
6. If the display does not read zero, the zero control will need to be adjusted.
Firstly, select 'TRACK' mode and exercise transducer to full scale in direction of use to overcome hysteresis.
Then adjust the fine zero control on the amplifier with the adjustment trim tool provided.
7. Press the 'TEST' button on the back panel and hold in. The display should indicate of full scale of the transducer to within 1%, if not see page 27. This is NOT a calibration test.

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

8. Select filter 'OFF' or 'ON' dependant on application.
9. 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.
10. The digital display will show the applied measurement with the analogue trend bar being a rapid reference to the transducer's state.

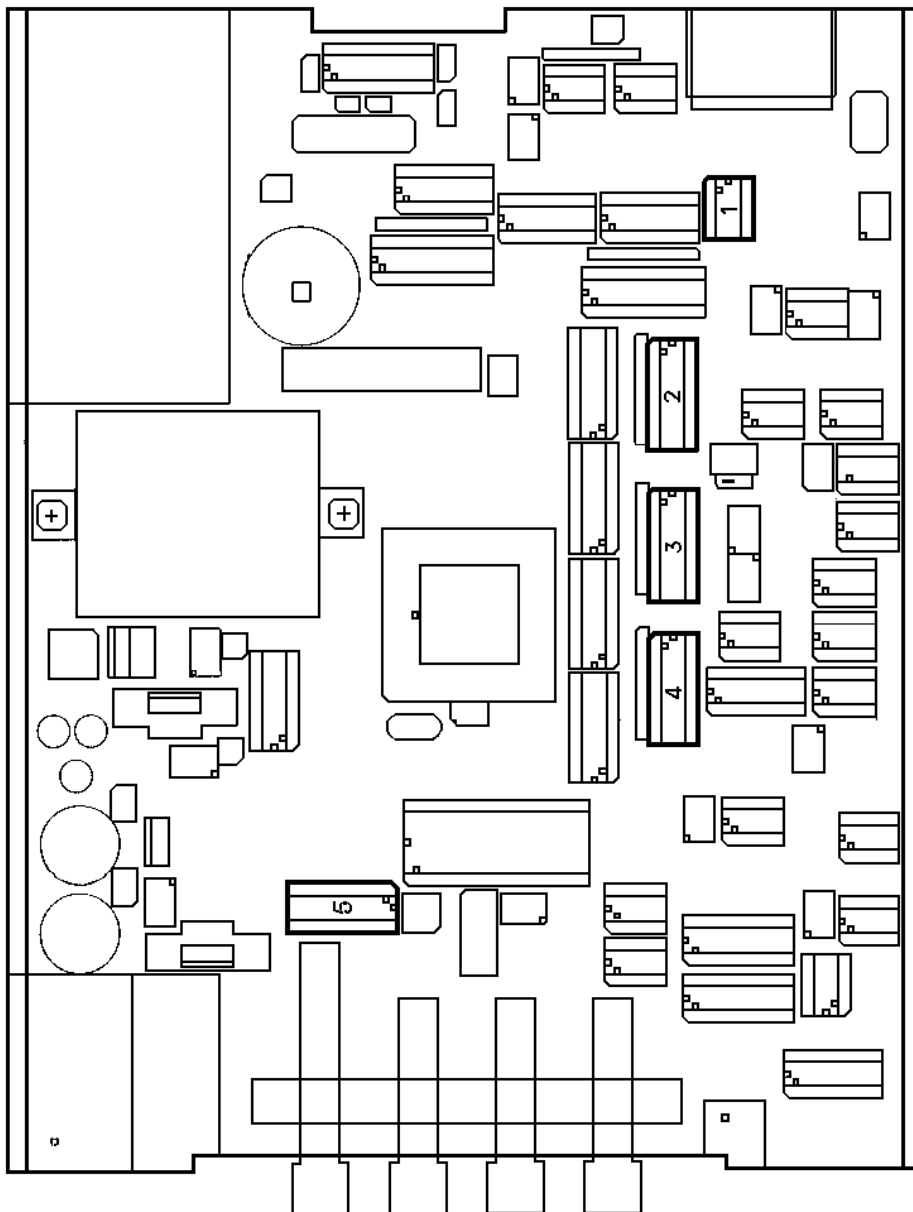
The ETS is now ready for use. Please use the 'OPERATING GUIDE' label that is attached to the instrument for everyday operating instructions.

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



ETS INTERNAL USER SETTINGS

SWITCH LOCATIONS



FRONT OF ETS

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 board 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 ETS.

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 (No 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.	gf	Disabled	Enabled
3-8.	kgf	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 ETS 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 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 ETS to an AC mains supply (110/120 or 220/240 V AC), and switch 'Power On'. The ETS can be used as normal whilst batteries are charging. There is no maximum charge time for the battery pack, so the ETS can be continuously used on mains without causing damage to batteries.

Note : If the ETS 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 ETS. This option can be retro fitted to ETS model numbers, 40320 - 40325 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

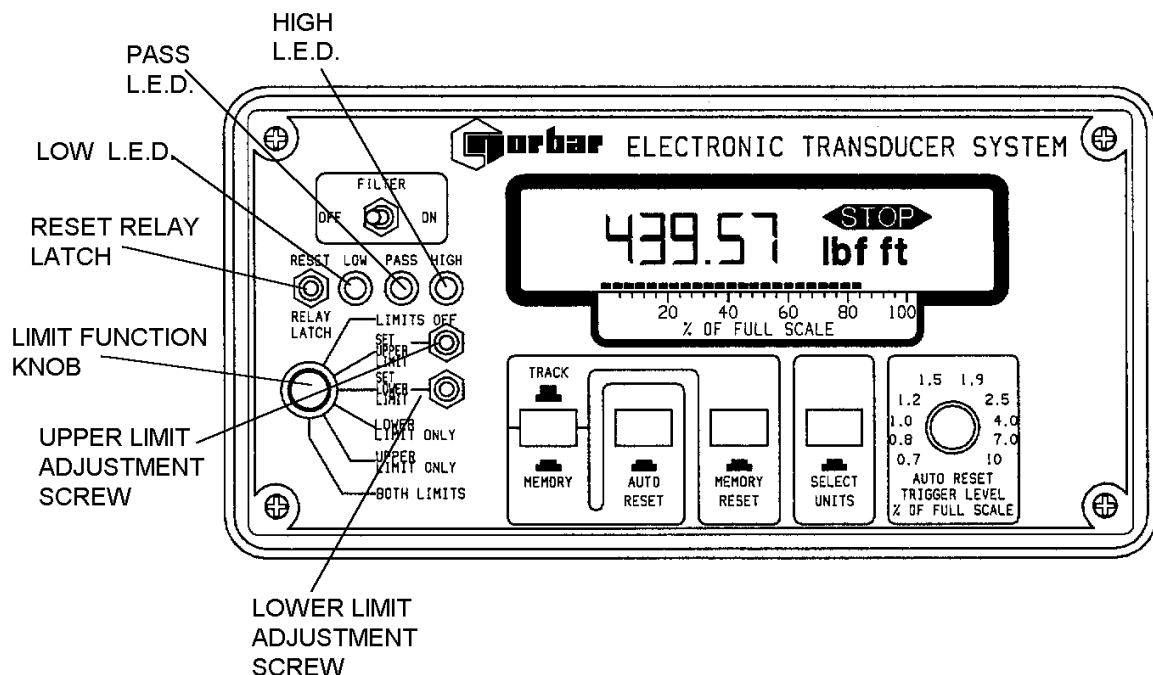
The ETS dual limit detector option provides an easy and foolproof means of inspection checking, giving indication of Pass or Fail of the device under test.

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 :-

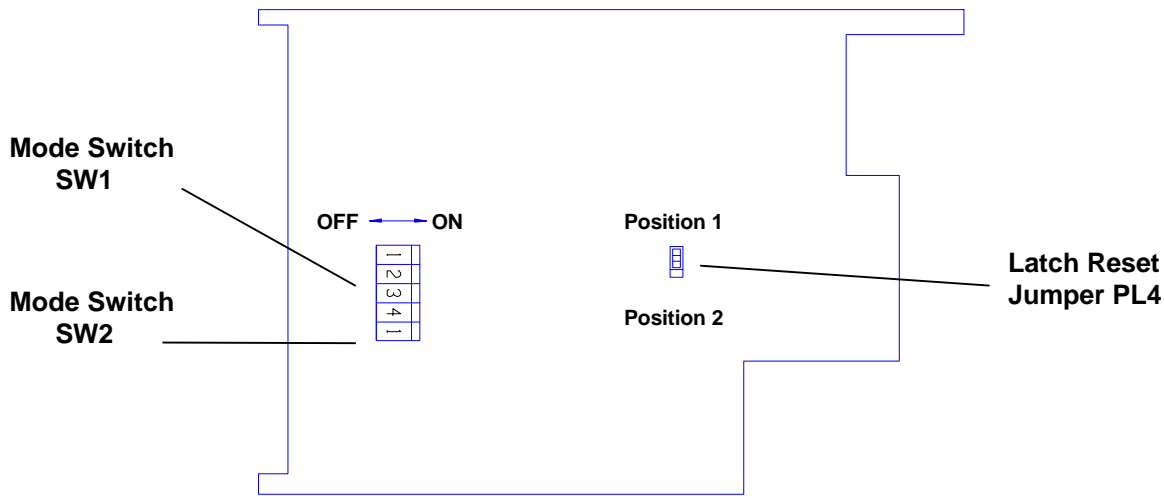
Accuracy of limit set points	+/- 0.2% of transducer full scale
Range of limit set points	2% - 105% of transducer full scale
Hysteresis of limit set points	1% of transducer full scale
Relay maximum switching load	2 amps 260 VAC / 2 amps 28 VDC (Volt Free contacts)
Logic outputs (On Ancillaries Socket)	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 ETS.

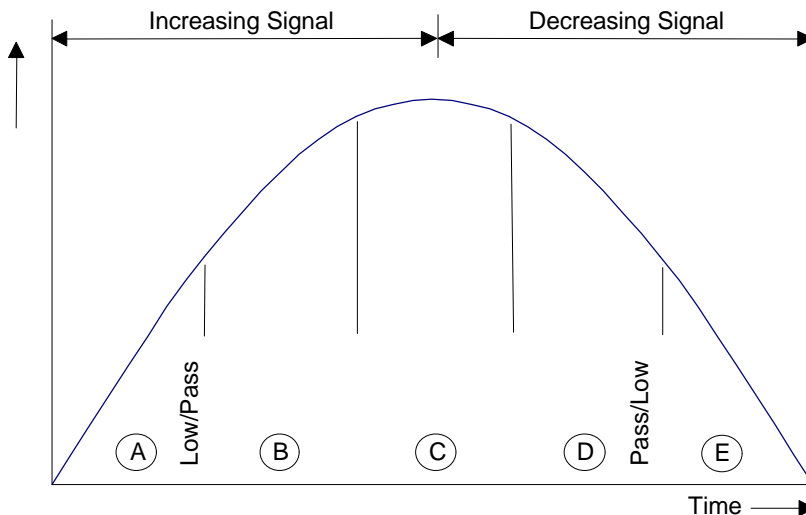
WARNING: Switch instrument off and disconnect from mains or battery supply before attempting to remove the lid.

To access the limit detector PCB, remove the four screws retaining the ETS 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 AND 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 0	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 0	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 0	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 0	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.

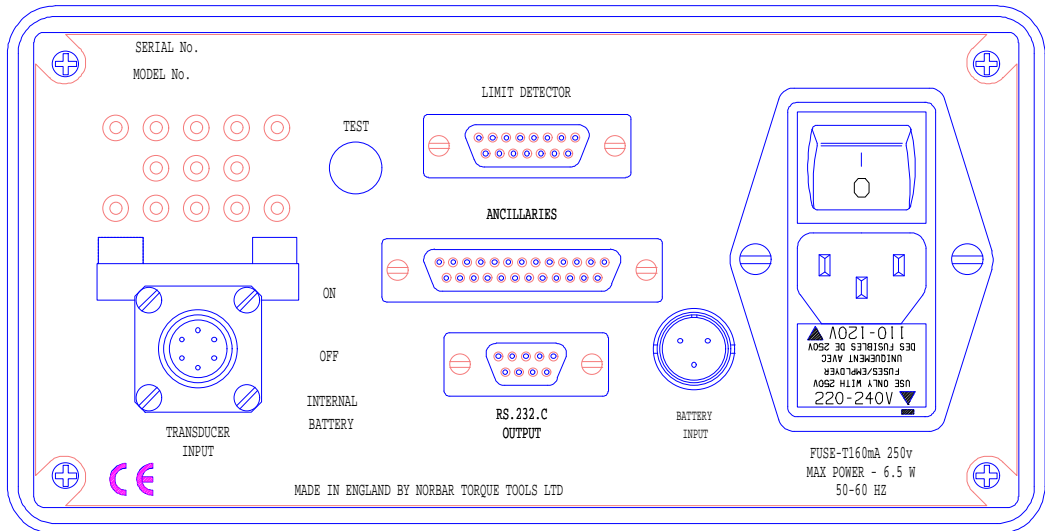
JUMPER (PL4)	ACTION
POSITION 1	Pressing of the RESET RELAY LATCH switch on the ETS front panel
POSITION 2	Pressing the MEMORY RESET switch when in MEMORY mode, or automatically at the end of the auto reset hold time when in MEMORY AUTO RESET mode.

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.

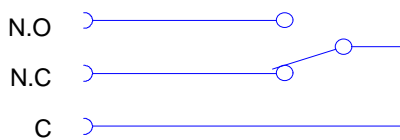
CONNECTING THE LIMIT DETECTOR TO CONTROL EXTERNAL EQUIPMENT:- _____

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

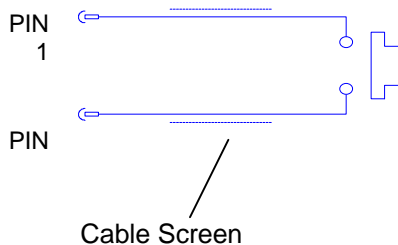
Connect any external connections to the LIMIT DETECTOR OUTPUT connector. All connections are optional.



Internal Relay Contacts



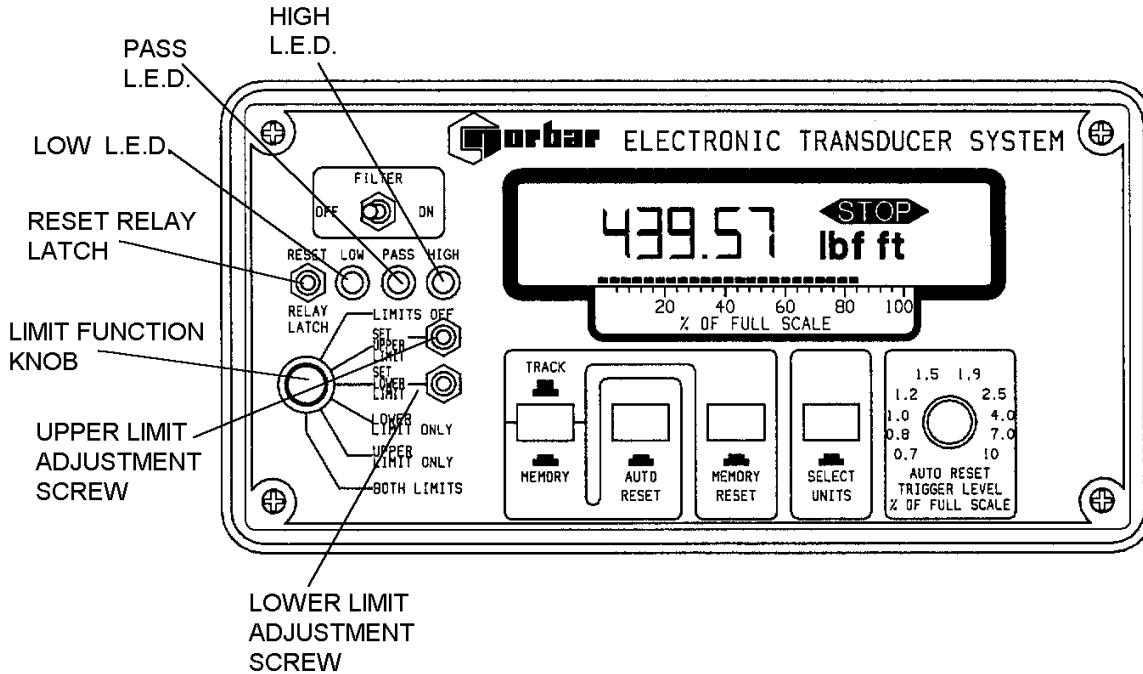
External Remote Latch Reset (Momentary Switch)



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 ETS.
3. **To Set Lower Limit Trip Point:-**

Switch the limit function knob to 'SET LOWER LIMIT', the trip point set is shown on the ETS display. Use the screwdriver provided with the ETS 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 ETS, i.e. TRACK, MEMORY or MEMORY AUTO RESET.
7. The ETS is now ready to be used with the limit detector option.

TRANSDUCER AND AMPLIFIER DESCRIPTION

TRANSDUCER :- _____

All ETS torque transducer shafts are robustly constructed from precision machined and heat-treated specialised stainless steel onto which strain gauges are bonded in the form of a Wheatstone Bridge. These strain gauges vary their electrical resistance in direct proportion to the strain produced in the steel shaft by the applied torque. This small change in resistance causes a change in voltage across the strain gauges, which is amplified by the ETS amplifier module.

The gauges are bonded to the shaft in a configuration that ignores bending moments and other forces, and only responds to the true torque applied. The gauge configuration also helps in maintaining temperature stability.

The ETS powers the strain gauges with a highly stable constant current supply for accuracy.

AMPLIFIER :- _____

The amplifier module is individual to each transducer. The amplifier converts the very small signals from the transducer to a suitable signal for display on the instrument. It also selects the correct range and decimal point within the ETS instrument for the transducer (but not the units of measurement). The amplifier also has the zero, span and tests setting controls for the transducer.

Span and test adjustments are factory set on calibration. Together with the coarse zero, the amplifier identification label covers them. These must only be re-adjusted on transducer recalibration.

A fine zero adjustment is made available to the operator so enabling zero of the transducer output at no load (Use adjustment trim tool supplied with the ETS).

TRANSDUCER AND AMPLIFIER SPECIFICATIONS :- _____

This specification is typical for Norbar transducers. For a full specification always refer to individual data sheets or calibration data supplied with transducer and amplifier.

AMPLIFIER SUPPLY FROM ETS	± 10 V DC.
STANDARD EXCITATION FROM ETS	20.00 mA constant current.
RESOLUTION	Infinite.
OPERATION	Bi-directional.
CALIBRATION	To NAMAS standards at Norbar's own NAMAS laboratory.
SCALE RANGES	Multiples of : 1, 2.5 or 5, E.g. : 10, 250, 5000 etc.
BRIDGE RESISTANCE	350 Ohms.

ETS 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 the voltage selector drawer.
- c) Check fuse in mains plug.

2. Displayed user error messages.

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

- a) "ERROR 22 - MULT SEL" : Check the correct amplifier is securely connected and is the right way up.
- b) "ERROR 27 - OVERANGE" : Check a transducer is connected and that it has not been taken into an overload state.
- c) "ERROR 29 - TOO BIG" : Units of measurement selected not available for transducer connected.
- d) "ERROR 30 - TOO SMALL" : Units of measurement selected not available for transducer connected.
- e) "ERROR 33 - FIRMWARE" : Switch power to instrument 'OFF', then 'ON' again at the rear of the ETS. If message does not clear, return ETS 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 ETS and the equipment receiving data match. See page 16.
- 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 particularly applicable when interfacing to Mitutoyo equipment, see page 13.

5. Battery pack option

- a) If the battery pack option fails to power the instrument after recharging, check the two fuse 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. Recalibration of instrument

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

7. Display values changes when transducer cable is moved.

- a) This could be due to dirty connectors. Spray electronic contact cleaner into the female end of the transducer cable, shake out excess. Spray into the plug connector on the transducer and scrub with a brush, shake out the excess.
- b) This could be caused by broken or loose wires in the transducer lead.

8. Display will not zero with no load applied to the transducer

- a) Verify that the serial numbers of the transducer and amplifier match.
- b) Put ETS into 'TRACK' mode and adjust the fine zero (marked ZERO on amplifier) clockwise, while watching the display. When the numbers stop increasing, turn the zero adjustment two full turns anti-clockwise. Peel back the upper left hand corner of the amplifier label. Underneath the label is a coarse zero adjustment, adjust this as close to zero on the display as possible. Smooth down label and once again use fine zero adjustment to trim the display to all zeros. Check transducer against a known torque or load as calibration accuracy may have altered. Transducer and amplifier should ideally be returned to Norbar, or a Norbar appointed agent, for recalibration.

9. Transducer will not zero or is not functional.

- a) Verify that the serial numbers of the transducer and amplifier match.
- b) 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. If the sides are parallel the amplifier may be faulty and both the transducer and amplifier should be returned to Norbar for evaluation.

10. Recalibration of transducer / amplifier

- a) If there is any doubt concerning the functionality or accuracy of the transducer and amplifier combination, it should be returned to Norbar, or a Norbar appointed agent, for repair and recalibration.

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