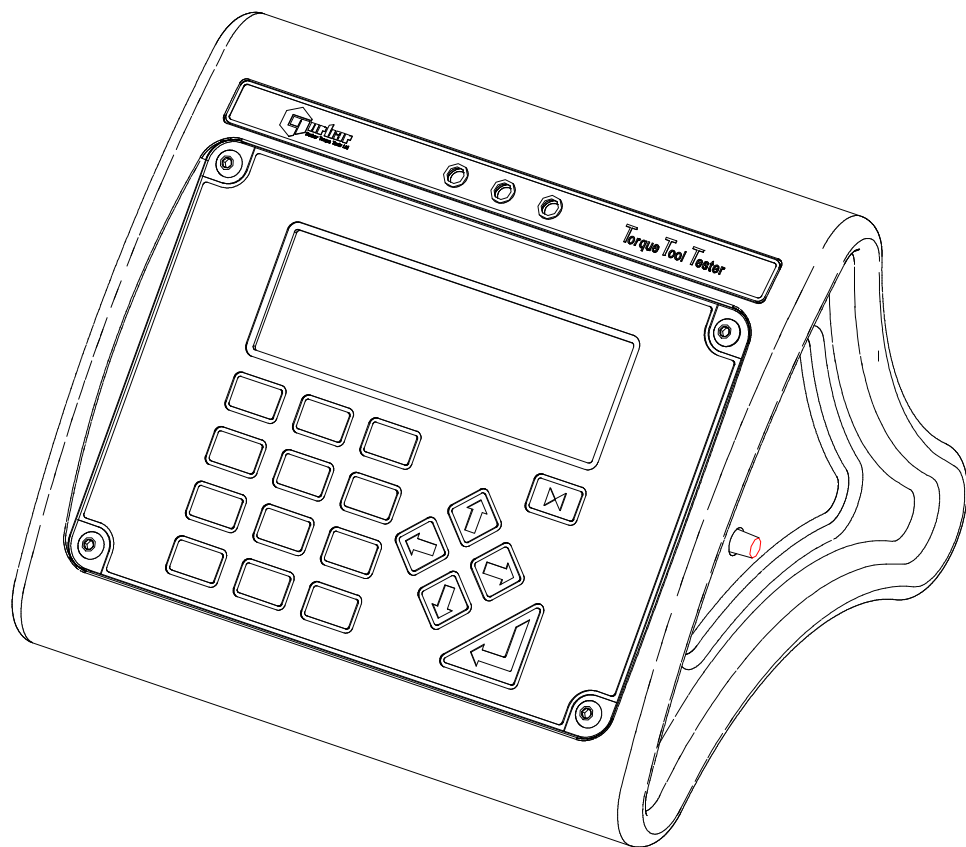




# Torque Tool Tester (TTT)

**OPERATOR'S HANDBOOK (PART No. 34275) Issue 1**  
(ENGLISH)  
FOR USE WITH TTT'S FITTED WITH VERSION 37712.102 SOFTWARE



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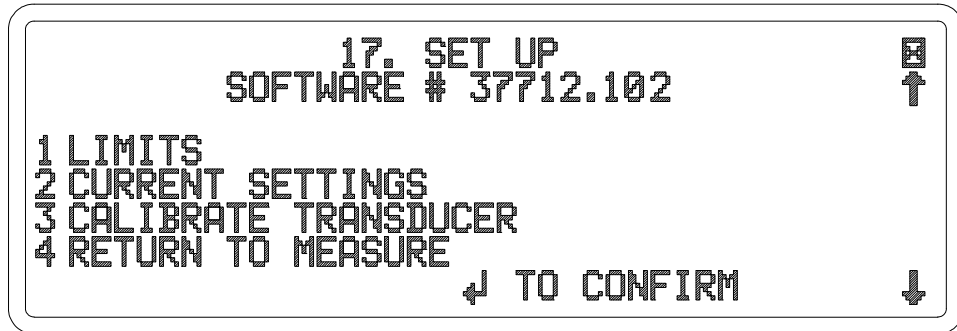
**PARTS INCLUDED:-** \_\_\_\_\_

<b>PART NUMBER</b>	<b>DESCRIPTION</b>	<b>QTY</b>
43201	Torque Tool Tester Instrument	1
38877	a.c. power adapter	1
	Power cord	1
34275	Operators Handbook	1
	Calibration Certificate	1
34279	Quick reference card(s)	

## INTRODUCTION

Torque Tool Tester (TTT) is a bench top measuring instrument which has two external Transducer inputs. These are compatible with most strain gauge type transducers with a millivolt / volt (mV/V) output. When used with the 'SMART' range of transducers from Norbar, simply connecting the transducer will automatically set up the TTT for use.

The TTT is a menu driven system with full control via the front panel keys. The main set up menu is shown below followed by an explanation of each selection option.



### 1 LIMITS

The user can set up to 8 target values that each have two settable LIMITS. When operating, the limit status is indicated on the display i.e. LO, OK or HI and the illumination of the corresponding yellow, green or red L.E.D. The limits are active after the torque value has passed through 0.5% of the transducer capacity and then operate as the mode selected, for example;

Measurement mode	Limit operation
Track	Limits follow signal and are not held.
Dial & Electronic Impulse tool Clutch tool Stall tool	Limits status is held until RESET/PRINT is pressed.
Click & Cam	Limit status is held until after the auto reset timer has operated.

The limit status shown on the display i.e. 'LO', 'OK' or 'HI' along with the reading will be output on the serial port when requested.

Entry to the limits set up is password protected (default password = 000000). Set up of the limits enables the user to define the target (1 to 8), torque units in which limits are to operate, target value, upper and lower set points, and direction of operation for each target number.

### 2 CURRENT SETTINGS

CURRENT SETTINGS are system parameters which include; language, password, date / time setting and format, serial port settings, mode frequency response. They also include first peak sensitivity, auto reset hold time, trigger from threshold, conversion units, modes of operation and power down time when in battery operation. All of these settings are password protected (default password = 000000).

All of the settings for limits and current settings can be printed if 'print defaults' is selected from the current settings menu. This is not password protected.

**INTRODUCTION CONTINUED :-** \_\_\_\_\_**3 CALIBRATE TRANSDUCER**

Selecting this option from the set up menu allows the user to calibrate any connected SMART transducer. The calibration screen is shown in torque units with the direction of torque also being shown. The TTT automatically works out the mV/V value to reprogram into any SMART transducer and also displays the date and time that the transducer was last calibrated.

**4 RETURN TO MEASURE**

This option allows the user to view the measurement screen, but also gives the user access to the ability to store details of up to 20 NON-SMART transducers. These stored transducers can be edited or deleted from the store and the whole store can be printed. The last transducer used will always be retained for quick selection. When using SMART transducers, there is no need to enter the transducer's details into the TTT as these are stored in the connected transducer.

**BATTERY RECHARGING :-** \_\_\_\_\_

To recharge the batteries simply connect the ac power adapter between the TTT and a live a.c supply. Recharging is independent of the on/off switch and TTT can still be used when recharging. Indication of external power is shown by the illumination of the display back light.

Battery life can be greatly increased from a minimum of 16 hours by making use of the auto power down function, which will send the instrument into standby mode if no key has been pressed or measurement reading taken for the specified time. The battery is constantly monitored and indication is given on the display if it should become low or flat. When low battery has been shown on the display there is approximately 20 minutes of use left.

**HYPER TERMINAL INTERFACE :-** \_\_\_\_\_

Entry of information into the TTT can be greatly speeded up by attaching the serial port of the TTT to the serial port of a P.C. and using the standard Hyper Terminal program found in Microsoft® Windows. This gives the P.C. total control of the TTT via the P.C. keyboard with serial output data being able to be viewed and stored. The necessary cables, connectors and instructions are available from Norbar, part no 60229.

**TTT CALIBRATION AND REPAIR :-** \_\_\_\_\_

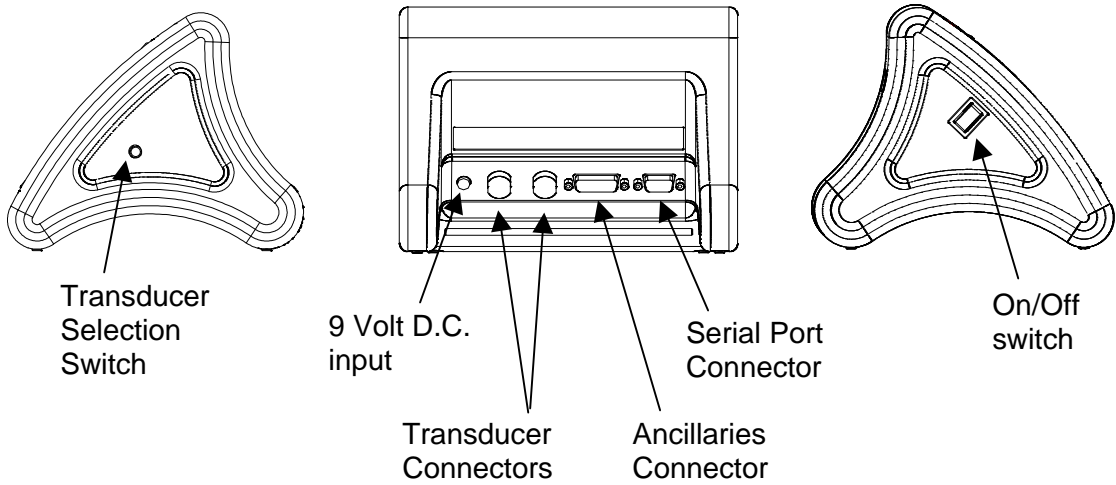
Your TTT has been supplied with a current certificate of calibration. To maintain the specified accuracy it is recommended that the TTT and any external transducers are recalibrated at least once per year.



Re-calibration and repair 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 TTT to the specified accuracy can be obtained from Norbar.

## OPERATING INSTRUCTIONS


### REAR VIEW



1. Connect to serial data connector and/or ancillaries connector (if required).
2. Ensure transducer selection switch is in the correct position for the transducer in use.  
See  and  symbols next to transducer connectors.
3. Switch On/Off switch to On (I in down position) for battery operation. For a.c. power operation, plug a.c. power adapter into 9 volt D.C. input then plug power cord into a.c. power adapter. Switch on. If the power cord has no plug fitted, wire as follows:-

BROWN-LIVE      BLUE-NEUTRAL      GREEN / YELLOW-EARTH

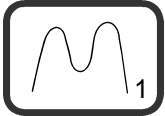
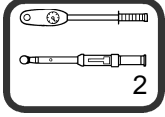
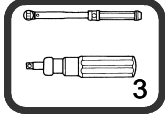
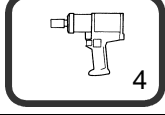
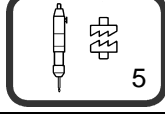
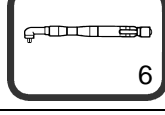
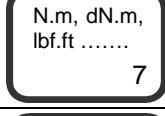
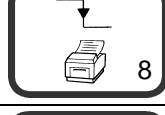



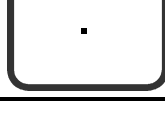
**NOTE:-** *It is essential that the TTT is charged for 14 hours on ac power to ensure a full battery charge. TTT can be operated from the a.c. power adapter when the batteries are being charged.*

4. The TRACK screen should now be displayed, From here you can go into any measurement mode. To exit any measurement screen and go into SET UP, press 

### 17. SET UP

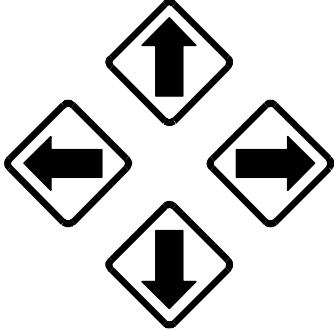
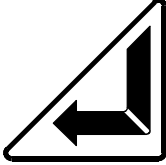
1. LIMITS See flow diagram on page 9.
2. CURRENT SETTINGS See flow diagram on page 11.
3. CALIBRATE TRANSDUCER See flow diagram on page 12.
4. RETURN TO MEASURE See flow diagram on page 9 & 10.

**BUTTON FUNCTIONS :-** \_\_\_\_\_


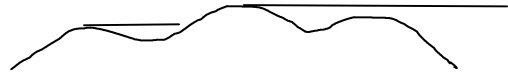
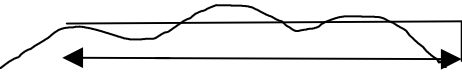
Button	Function	Numeric entry	Alpha entry
	Track	1	A,B & C
	Dial & Electronic	2	D,E & F
	Click & Cam	3	G,H & I
	Impulse Tool	4	J,K & L
	Clutch Tool	5	M,N & O
	Stall Tool	6	P,Q & R
	Selection of torque units the user wishes to operate in.	7	S,T & U
	RESET/PRINT for measurement modes.	8	V & W
	PRINT/NO PRINT selection. PRINT enables serial output, NO PRINT disables serial output.	9	X,Y & Z
	Calibrate & confirm key with selection of CALIBRATE TRANSDUCER	#	% ( ) * , / : = 
	Zero the transducer output when in TRACK mode. RESET/PRINT for measurement modes	0	
	Entry of a full stop or decimal point.	.	

**NOTE:-** For entry of alpha characters, Press and hold until required character is displayed, then release. The buttons 0 – 9 are shortcuts for menu selection.

**BUTTON FUNCTIONS CONTINUED:-**

Button	Function
	<ul style="list-style-type: none"> <li>a) To navigate through menu options and choices.</li> <li>b) Left arrow becomes delete when entering alphanumeric data.</li> <li>c) Right arrow becomes space when entering alphanumeric data.</li> <li>d) Use down arrow to move on to next option in a set up menu.</li> <li>e) Use left and right arrows for quick selection of torque units in measurement screen.</li> </ul>
	Exit from measure modes and set up menus
	<ul style="list-style-type: none"> <li>a) Confirmation that all entry's are correct in a set up menu.</li> <li>b) RESET/PRINT for measurement modes</li> </ul>

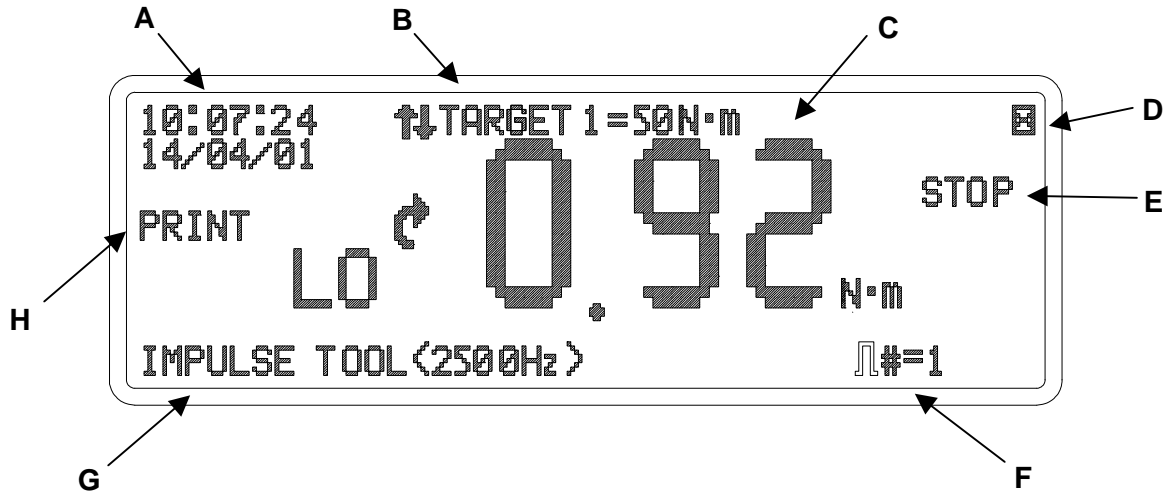
**MODES OF MEASUREMENT :-**

MODE	Filter setting	How it works.	Visual representation
Track	500 Hz	Follows signal.	
Dial & Electronic	500 Hz	Hold highest signal until reset by user.	
Impulse Tool	2500 Hz		
Clutch Tool	2500 Hz		
Stall Tool	500 Hz		
Click & Cam	500 Hz	Hold 1 <sup>st</sup> signal peak for set time, then resets.	

**NOTE:-** The frequency response for each mode can be set independently. To change the frequency response, select 'CURRENT SETTINGS' and then 'MODE FREQUENCY'. Choose the measurement mode that you want to set and then select a frequency. When selecting 'OTHER FREQUENCY' the user can enter a frequency response that does not appear on the selection list.



**MEASUREMENT SCREEN LAYOUT & OPERATION :-**



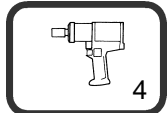
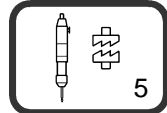
**A.** Time/Date display.

**B.** Press  $\downarrow \uparrow$  to select target value and associated limits to be used.


**C.** Measurement display showing limit indication (if enabled), direction of measurement, torque reading and units of measurement.


**D.** Press  to exit.

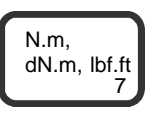
**E.** Indicates when to stop loading in  measuring mode.

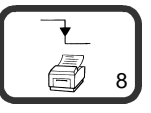
**F.** Pulse count when in  or  measurement modes.

**G.** Current 'mode of measurement' in use along with frequency response set for that mode.

Press  to toggle between 'PRINT' and 'NO PRINT' on the display (**H** above).

Press  to zero TORQUE reading in the 'TRACK' mode. This button will also 'RESET' (memory reset) when in any other measurement mode.

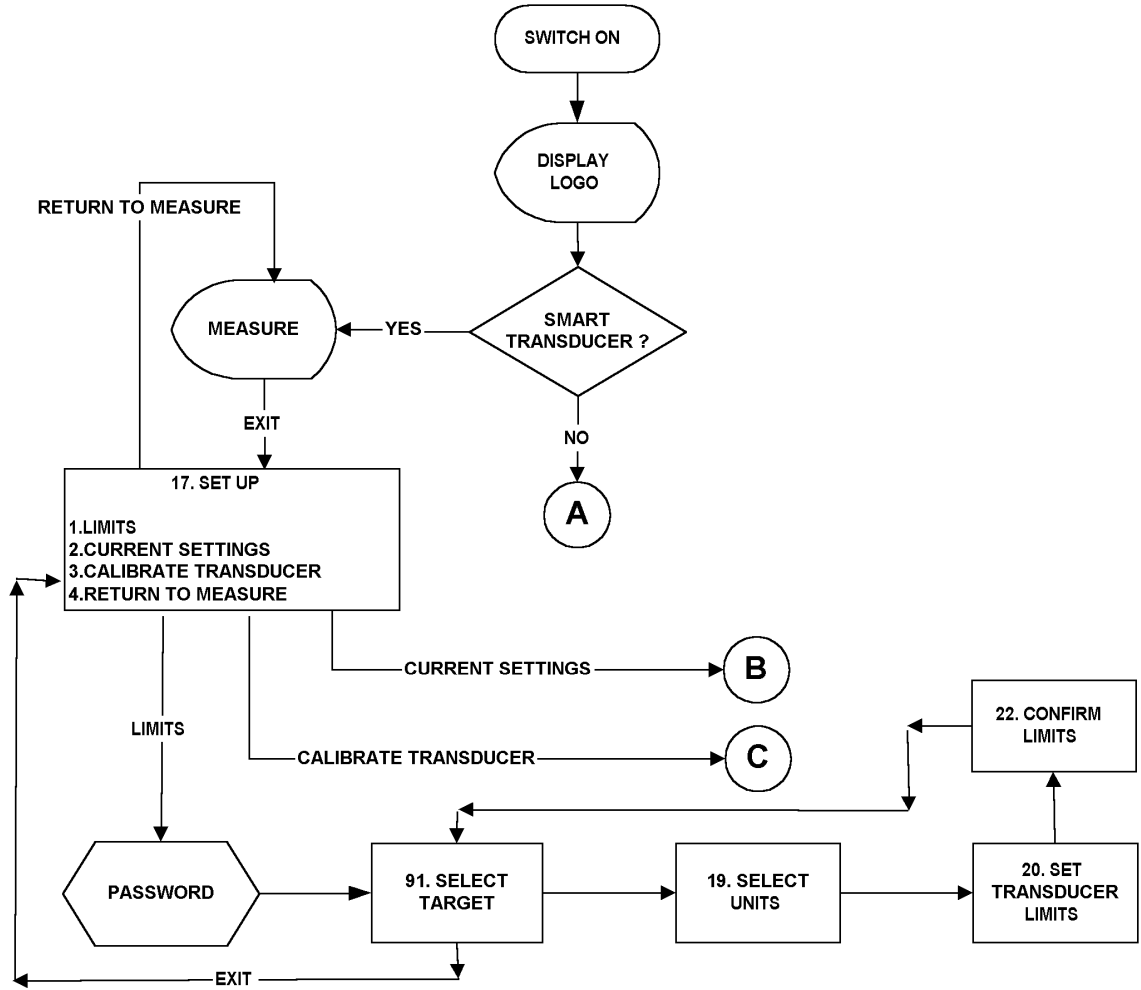
Press  to step to the next enabled 'UNIT' of measurement.

Press  to 'PRINT' the measurement value shown on the display when in 'TRACK' mode. This button will also 'RESET' (memory reset) when in any other measurement mode.

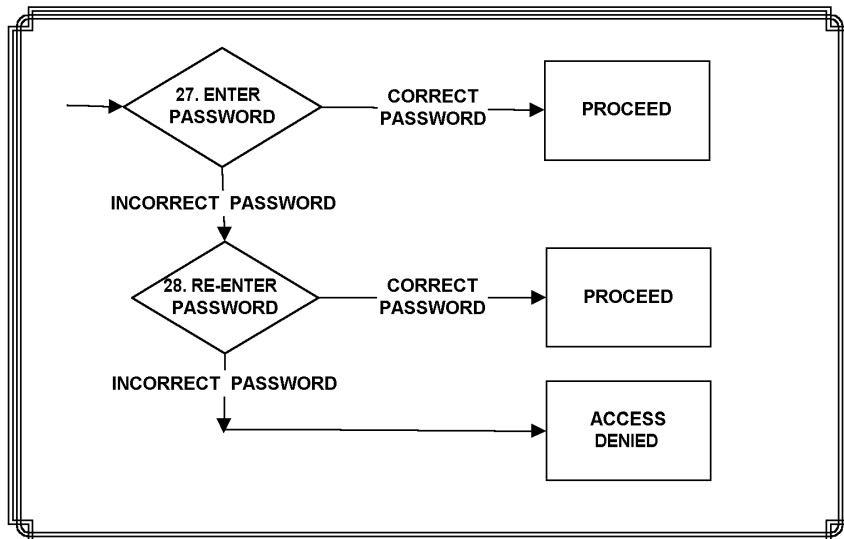
**OPERATION FLOW DIAGRAMS :-**

All set up menus are numbered on the TTT for ease of identification.

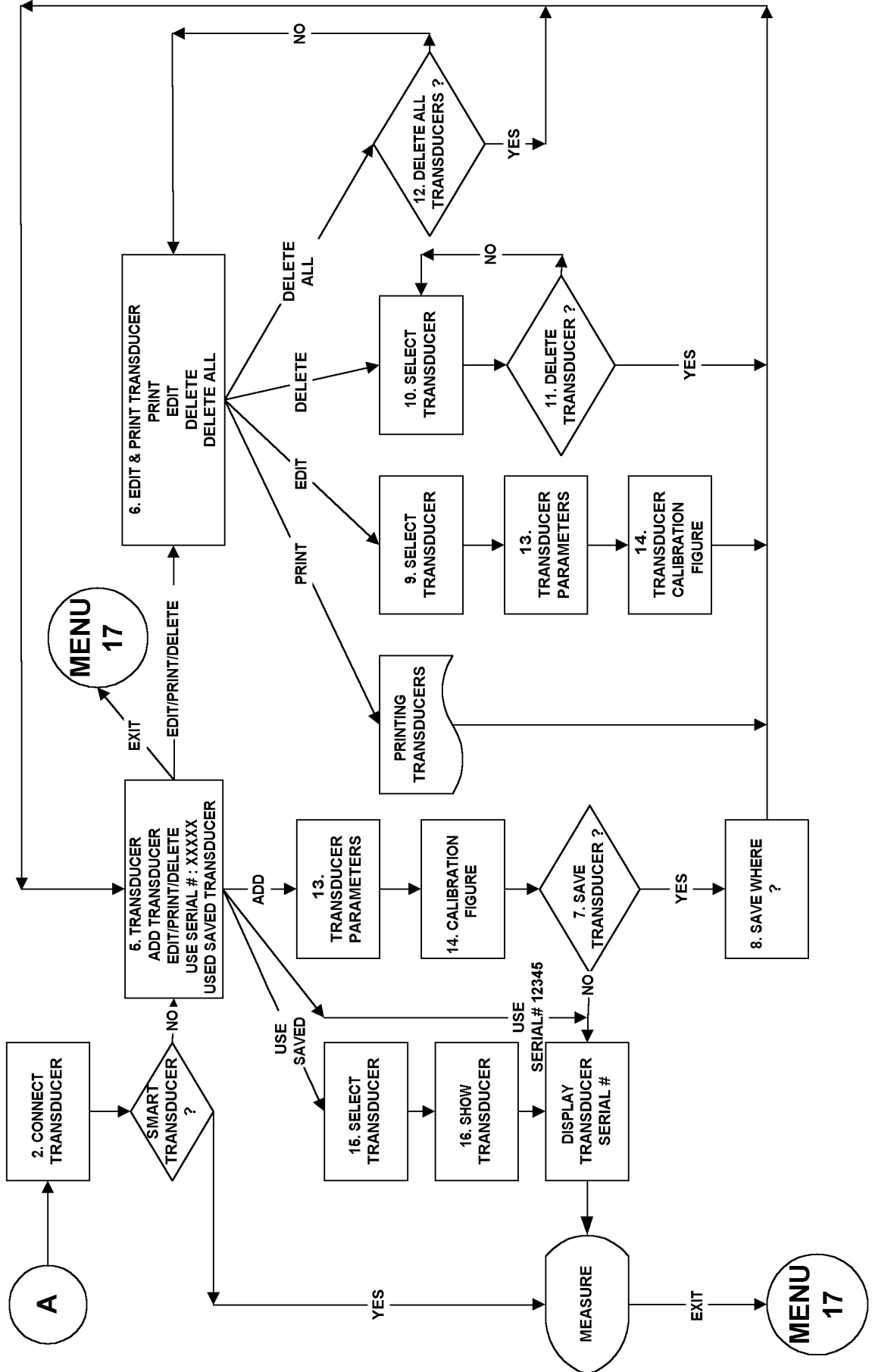
**Menu structure + limits flow diagram**



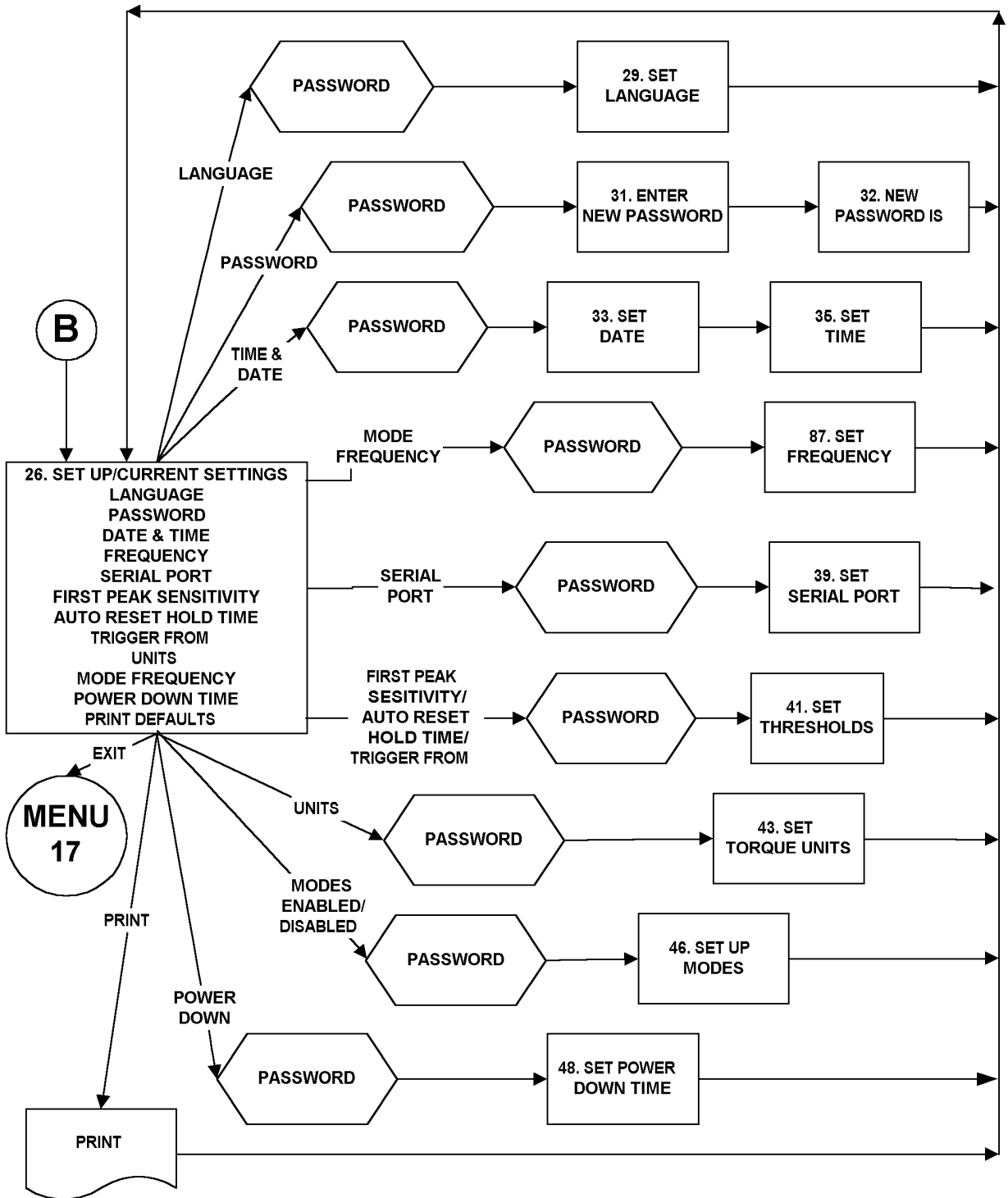
**Password flow diagram**



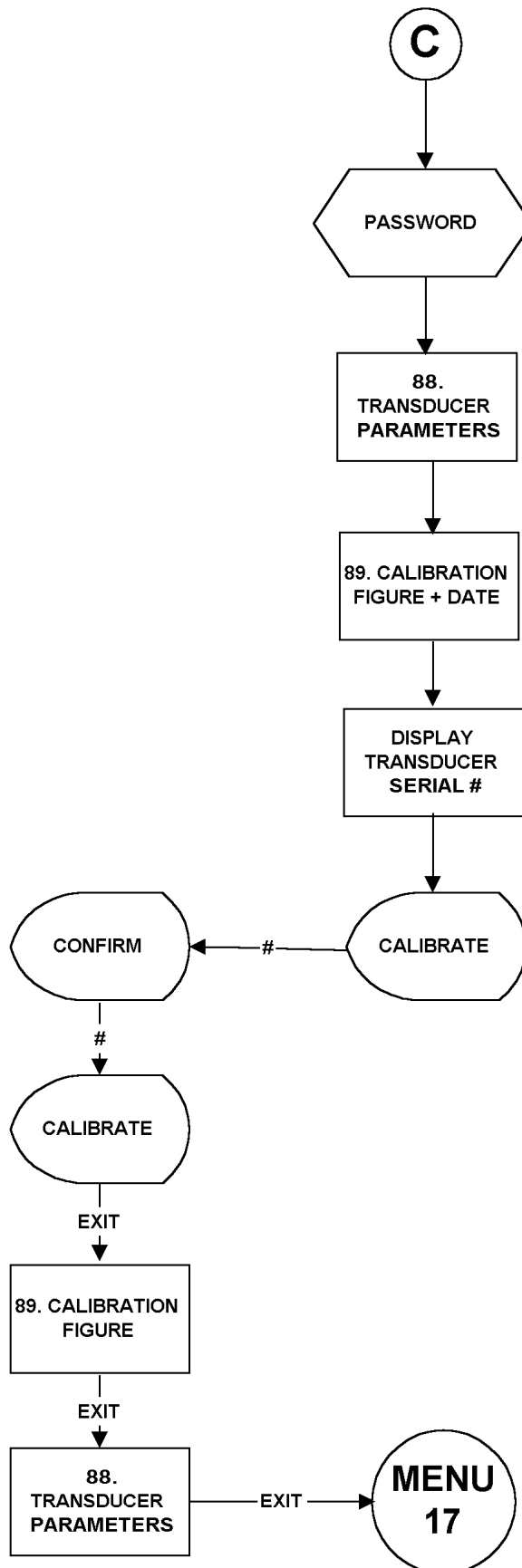
Measure flow diagram



### Current settings flow diagram



### Calibrate transducer flow diagram



## TRANSDUCER INTERFACE

### INTRODUCTION :- \_\_\_\_\_

TTT will accept input from most strain gauge type transducers and is capable of storing the settings for up to 20 NON-SMART transducers. TTT can display units of measurement and direction of torque. When used with Norbar 'SMART' range of transducers simply connecting the transducer will automatically set up the TTT with the transducer's details. Ensure the 'Transducer Selection Switch' on the right hand side of the TTT is in the correct position for the transducer you wish to use.

Norbar transducers with the following suffix are all suitable for use with the TTT.

XXXXX.IND	Transducer calibrated in mV/V.
XXXXX.INDA	Transducer calibrated in mV/V with integral angle encoder.
XXXXX.LOG	SMART transducer calibrated with a TTT in units of calibration. A mV/V figure is also supplied.
XXXXX.LOGA	SMART transducer with integral angle encoder calibrated with a TTT in units of calibration. A mV/V figure is also supplied.

*NOTE:- Transducers supplied for use with the Pro-Log are compatible with the TTT. The TTT will not display angle when interfaced to an .INDA or .LOGA transducer.*

*ETS Transducers supplied with an amplifier module will need to be modified for use with the TTT.*

### TRANSDUCER LEADS AVAILABLE:- \_\_\_\_\_

PART NUMBER	DESCRIPTION
60216.200	TTT to 10 way Transducer connector
60217.200	TTT to 6 way Transducer connector
60223.200	TTT to no connector
60230.210	TTT to miniature Transducer connector

*NOTE:- The suffix after the part number indicates the length of the lead in cm, thus XXXXX.200 = 2 metres. If Transducer leads are required of a non-standard length, the new suffix must be added to the part number when ordering (to the nearest metre).*

**INTERFACE SPECIFICATIONS :-**

PARAMETER	MINIMUM	MAXIMUM
Bridge Resistance ( $\Omega$ )	350 $\Omega$	1000 $\Omega$
Millivolt / volt value (mV/V)	0.95 mV/V	3.15 mV/V
Zero balance	+/- 3% of full scale	+/- 3% of full scale.
Torque Resolution	3.5 Active digits	4.5 Active digits.
Torque full scale transducer ranges	0.010000	1,500,000
Torque units	Dependent on transducer capacity and millivolt / volt value	Nm, dNm, cNm, lbf.ft, lbf.in, ozf.in, ft.lb, in.lb, in.oz, kgf.m, kgf.cm, gf.m, gf.cm
Displayable overrange	120%	120%

**INTERFACE PIN CONNECTIONS :-**

PIN No	FUNCTION
1	+ve transducer excitation
2	-ve transducer excitation
3	+ve transducer signal
4	-ve transducer signal
5	Digital 0 volts
6	Digital +5 volts.
7	No connection
8	No connection
9	Serial clock ( e <sup>2</sup> prom )
10	Serial data ( e <sup>2</sup> prom )

**CONNECTOR TYPE :-**

Lemo 10 way panel socket, size 2B. The mating part to this connector is a Lemo 10 way, size 2B free plug, manufacturers part number FGG.2B.310.CLAD722.

## SERIAL DATA INTERFACE

### INTRODUCTION :-

The serial data interface is configured as DTE (Data Terminal Equipment) and conforms to RS-232-C specifications.

When the TTT is measuring, data can be output on the serial interface automatically when the click & cam mode timer operates, when the 'RESET / PRINT' or 'ZERO' button is pressed, or by pressing the 'RESET / PRINT' or 'ZERO' button when in track mode. The information can include the measured value, units of measurement and time/date (as shown on the display). Output can also be requested externally via pin 2 (ancillaries connector), see ancillaries interface section.

### INTERFACE SPECIFICATIONS :-

	OPTIONS	FACTORY DEFAULTS
Parity =	ODD, EVEN or OFF.	OFF.
Baud rate =	1200, 2400, 4800, 9600 or 19200.	9600.
Data bits =	7 or 8.	8.
Stop bits =	1 or 2.	2.
First character =	+/- or NONE.	NONE.
Output units =	YES or NO.	YES.
Output date & time =	YES or NO	NO.
Output line feed =	YES or NO	NO.
Handshake =	NONE, CTS or X-ON/OFF	NONE.
Line delay =	X.XX SECONDS	0.50 SECONDS.
	SET TO FACTORY DEFAULTS	

Maximum number of characters per line = 24.

Maximum number of requests per second in track mode = 1 every 2 seconds.

Transmitted data voltage levels are between +5 to +9 volts and -5 to -9 volts.

### INTERFACE PIN CONNECTIONS :-

PIN No	FUNCTION
1	Not Connected
2	Received data (to TTT)
3	Transmitted data (from TTT)
4	Not Connected
5	Signal ground 0V.
6	Not Connected
7	Not Connected
8	CTS (clear to send)
9	Not Connected

### DATA OUTPUT EXAMPLE :-

Code : DP=Decimal Point. CR=Carriage Return. SP=Space.

TTT with the serial port set to the factory defaults. Reading 1068.4 lbf.ft (clockwise).

1	0	6	8	DP	4	SP	l	b	f	DP	f	t	CR
---	---	---	---	----	---	----	---	---	---	----	---	---	----

### CONNECTOR TYPE :-

9 way female 'D' type connector.



## ANCILLARIES INTERFACE

### INTRODUCTION :-

The buffered logic outputs are intended for Go/No Go control of external equipment. The limit state outputs are indicated by L.E.D's, displayed on screen and printed before the measurement value. For more information on limits see 'LIMITS' menu which can be accessed via the 'SET UP' menu. Pins 1 & 2 are intended for use as an external RESET / PRINT to the TTT, see below:-



### INTERFACE SPECIFICATIONS :-

Digital +5 volts current, 5 mA maximum

External reset / print input – Low to high transition (must remain high for at least 200 mS),  
Limit output current, High = -0.88 mA, Low = 0.88 mA

### INTERFACE PIN CONNECTIONS :-

PIN No	FUNCTION
1	Digital +5 volts (maximum current 5 mA)
2	External memory reset / print (Active High)
3	Low limit output (LO)
4	Pass limit output (OK)
5	High limit output (HI)
6	Not Used
7	Not Used
8	Not Used
9	Digital 0 volts
10	Not Connected
11	Not Connected
12	Not Connected
13	Not Connected
14	Not Connected
15	Not Connected

*NOTE:- All limit outputs are active HIGH.*

### CONNECTOR TYPE :-

15 way female 'D' type connector.

## SPECIFICATIONS

Display	240 x 64 pixel dot matrix display. With update rate of twice per second (2Hz).
Resolution	1 in 19999 maximum (dependent on Transducer specification & units selected).
Weight	1 Kg
Dimensions	150mm high x 200 mm wide x 180 mm deep.
Accuracy	@ 0.5 mV input +/-0.3% of reading @ 1.0 mV input +/-0.18% of reading @ 2.0 mV to 18.9 mV input +/-0.14% of reading Expressed as an expanded uncertainty using a coverage factor of K=2, to give a confidence level of approximately 95%.
Zero suppression	TRACK None. ALL OTHER MODES Suppressed from 0 to approximately 0.5% of transducer calibration range.
Password	000000 (default), must be 6 characters.
Time/date	Hours, minutes & seconds. Standard or American date format.
Time/date compliance	To year 2062.
Units of measurement	See TRANSDUCER INTERFACE section (page 14).
First peak sensitivity	2.5%(High), 5%(Medium), or 10%(Low) of reading.
Auto reset hold time	1, 2, 3 or 4 seconds
Frequency response	8 <sup>th</sup> Order butterworth low pass filter with a -3dB point settable from 100 to 6000 Hz
Trigger from setting	0 to 99% of transducer capacity.
Operating temperature range	+5°C to +40°C.
Storage temperature range	-20°C to +70°C.
Maximum operating humidity	85% Relative Humidity @30°C.
a.c. power adapter	90 to 264 Volts a.c. at 50-60 Hz input. 9V, 300 mA D.C. output (centre positive).
Power down time	1 to 99 minutes (enter 0 to disable)
Power consumption	2.4 W - maximum.
Power cable	2 metres (6 ft 6 ins) long minimum.
Power plug fuse (if fitted)	1 Amp
Battery pack	1500 mAh,6.0 volt (5 cell) NiMH ( Recharge time 14 hours).
Back up battery	Renata 190 mAh (CR2032FH).
Case materials / finish	Rigid polyurethane with fine texture acrylic paint finish.
Environment	Indoor use within a light industrial environment.
Electromagnetic Compatibility (EMC) Directive	In conformance with EN 61326 : 1997
Low voltage directive	In conformance with EN 61010-1 : 1993. To environmental conditions Pollution Degree 2 & Installation Category (Over voltage Category) II.
Cleaning	Do not use abrasives or solvent based cleaners.

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

## TROUBLE SHOOTING

### 1. Zero does not function in track mode.

Transducer zero must be within +/- 3% of full scale, return defective transducer to Norbar.

### 2. Measurement modes do not function correctly.

Ensure that the 'TRIGGER FROM' setting is not set too high.

### 3. Battery only powers TTT for a short time.

Battery pack (Part number 38876) may need replacing.

*NOTE:- Precautions must be taken during this procedure to prevent static shock damage to the circuit boards.*

- a) Switch off and remove ac power adapter.
- b) Remove the 4 screws from the corners of the TTT front panel using 2.5 mm hexagonal key provided.
- c) Pull front panel forward from the top edge, unplug battery connector (red & black leads) from CONN4.
- d) Remove battery pack from case.

Refitting is the reversal of removal.

### 4. Serial data output is not communicating with other equipment.

- a) Check that control word on the TTT and the equipment receiving data match. See page 15.
- b) Check that the baud rate is set to the same as the equipment receiving data.
- c) Check that the connecting lead is wired correctly at both ends, see page 15.
- d) Check if equipment receiving data requires the units of measurement inhibited or a leading character. This is applicable when interfacing to Mitutoyo equipment.

*NOTE:- Use the 'TEST OUTPUT' to help in fault finding. This can be found by entering SET UP – CURRENT SETTINGS – SERIAL PORT, then select CONFIRM.*

### 5. Serial data output is being overwritten.

Your printer may need a line feed. Enable the line feed function via the following menus SET UP – CURRENT SETTINGS – SERIAL PORT.

### 6. Serial data is being output too fast.

Your printer may be too slow. To slow down the TTT output change the delay between lines function via the menus SET UP – CURRENT SETTINGS – SERIAL PORT.

### 7. Display shows 'SMART TD NOT INITIALISED'.

- a) You have an unmodified ETS transducer plugged in.
- b) The transducer lead may have a broken connection.
- c) Your 'SMART' transducer may have lost its memory, return to Norbar.

### 8. Menu 82. 'CLOCK & SETTINGS NOT INITIALISED' is displayed on power on.

The back up battery has failed. Replace or return to Norbar.

*NOTE:- Precautions must be taken during this procedure to prevent static shock damage to the circuit boards.*

### 9. Password lost.

Contact Norbar quoting the coded number in brackets on the password menu.

**HINTS & TIPS**

<b>Messages</b>	Warning and Error messages are shown to help the user with audible warnings given when necessary.
<b>Entering information into set up screens</b>	When in a set up screen, after entering one option press the down arrow to enter the next. When all entry's have been made, press '↵'.
<b>More menu items</b>	When ↑ or ↓ is shown on screen, this means more menu items are available.
<b>Auto reset hold time</b>	For quicker operation of auto reset modes, change AUTO RESET HOLD TIME to 1 SECOND in the CURRENT SETTINGS menu.
<b>Inconsistent readings</b>	If readings are inconsistent in Click & Cam mode, try changing FIRST PEAK SENSITIVITY in the CURRENT SETTINGS menu. This will compensate for sensitive torque wrenches.
<b>Disabling units of measurement</b>	If only a few units of measurement are required, the rest can be disabled in the CURRENT SETTINGS menu. The quickest way of setting up is to enter UNITS ENABLE/DISABLE, disable all then enable the required units.
<b>Disabling modes of measurement</b>	If only a few modes of measurement are required, the rest can be disabled in the CURRENT SETTINGS menu. The quickest way of setting up is to enter MODES ENABLE/DISABLE, disable all then enable the required modes.
<b>Changing transducer parameters</b>	If any of the transducer's parameters are changed i.e. re-calibration of mV/V value, the transducer's stored parameters must be edited prior to re-calibration.
<b>Marking NON-SMART transducers</b>	Mark NON-SMART transducers with their stored 'T' number for ease of identification.
<b>Disabling power down.</b>	Set the POWER DOWN TIME to 0 in CURRENT SETTINGS.
<b>Maximising battery life.</b>	Set the POWER DOWN TIME to 1 minute in CURRENT SETTINGS.
<b>Exceptions to entering power down.</b>	The TTT does not enter the standby mode when showing a set up menu.
<b>Printing all of the default settings</b>	The user must enter SET UP then CURRENT SETTINGS then select PRINT DEFAULTS. This gives the user a print out of all of the default settings for the items in the CURRENT SETTINGS menu and the LIMITS menu.
<b>Downloading data</b>	Downloading of data can be speeded up by changing the LINE DELAY to 0 SECONDS. The user can get to this menu option via SET UP, CURRENT SETTINGS, then SERIAL PORT.

**GLOSSARY OF TERMS**

<b>WORD or TERM</b>	<b>MEANING</b>
a.c.	Alternating current.
Alphanumeric	The same key can enter letters and numbers.
Current Settings	The settings that are being used.
D.C.	Direct current.
ETS	Electronic Transducer System.
First peak sensitivity	The amount by which the reading must fall from a peak for the display to be held.
Frequency Response	Frequency value below which signals are passed.
Hold Time	The length of time a reading is displayed for until it is auto reset.
Hz	Hertz, unit of frequency.
L.E.D.	Light Emitting Diode.
Lemo	Reference for manufacturers of connector.
mA	One thousandth of an amp (milli amp).
mAh	Rate of charge/discharge of a battery (milli ampere hour).
Millisecond (mS)	One thousandth of a second (0.001 second).
Millivolt (mV)	One thousandth of a volt (0.001 volt).
Millivolt per volt (mV/V)	Ratio of millivolt output to voltage input.
Navigate	Go from one selection to another.
NiMH	Nickel metal Hydride.
NON-SMART	Standard mV/V transducer (NON-INTELLIGENT).
P.C.	Personal Computer.
Power Down Time	The length of time that the TTT has not been used before the instrument goes into standby mode.
Print / No print	Print can be switched no print to stop readings being printed, referred to as built in print inhibit controller.
Pulse Count	Display of how many torque pulses have been applied to the TTT for the measured value.
Saved	SET UP information is saved.
SMART	Serial Memory Automatic Recognition Transducer.
SMART Transducer	A transducer that holds its own calibration data, (INTELLIGENT).
Trigger From	Value at which the instrument stops tracking and memorises the reading.
TTT	Torque Tool Tester.
Zero suppression	Value of torque that has to be achieved for the TTT not to display zero.