



T-BOX XL™

FOR USE WITH T-BOX XL™ FITTED WITH (VERSION 3.0.0.X)
SOFTWARE



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INTRODUCTION

The T-Box XL™ is a hand-held torque measuring instrument with a user-friendly colour touch screen interface. Both hand and powered torque tools can be measured, calibrated or viewed in graph mode. The comprehensive instrument functions in 12 languages, all common torque units, pre-loaded Tool calibration templates and has a large measurement memory for storage of test results. T-Box XL™ features a USB interface to the Torque Data Management System (TDMS) software for data archiving of Test, Calibration and Graphical results on a PC.

Part numbers covered by this manual (43258 T-Box XL™).

| Parts Included | | Part Number | Quantity |
|---|---|----------------|----------|
| T-Box XL™ Instrument. |  | 43258 | 1 |
| T-Box XL™ Stand. |  | 39411.RED3001 | 1 |
| Bolts for stand (M10 x 25). | | 25355.25 | 2 |
| USB flash drive (Operator's Manual / Software). | | 61132 | 1 |
| Quick Reference Guide. | | 34395 | 1 |
| Power supply adapter. | | 39705 | 1 |
| USB lead to PC. | | 39483 | 1 |
| Neck strap screws. | | 25498 | 2 |
| Neck strap clip. | | 38881 | 2 |
| Neck strap spacer. | | 38882 | 2 |
| Neck strap. | | 38883 | 1 |
| Hex Key for neck strap. | | 24933 | 1 |
| Stylus. | | 39484 | 1 |
| Power cord. | | - | 1 |
| Calibration Certificate. | | - | 1 |
| T-Box XL™ carry case. | | 26775 | 1 |
| Accessories Available | | Part Number | |
| T-Box XL™ to 10-way lead, for Norbar Rotary Transducers. | | 60216.200 | |
| T-Box XL™ to 6-way lead, for Norbar Static & Annular Transducers. | | 60217.200 | |
| T-Box XL™ to no connector (for non-Norbar transducers). | | 60223.200 | |
| Extensive range of torque transducers. | | Contact Norbar | |
| Serial Data Lead Kit. | | 60248 | |

NOTE: The suffix after the lead 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).

The maximum length for a single transducer lead is 7 metres.

The maximum combined length of all attached transducer leads is 8 metres.

SOFTWARE COMPATIBILITY

| T-Box XL™ | TDMS |
|---------------------------|-------|
| Software version 1.0.2.27 | 2.2.3 |
| Software version 2.1.0.X | 3.2.X |
| Software version 2.2.0.X | 3.3.X |
| Software version 3.0.0.X | 4.0.X |

FEATURES AND FUNCTIONS

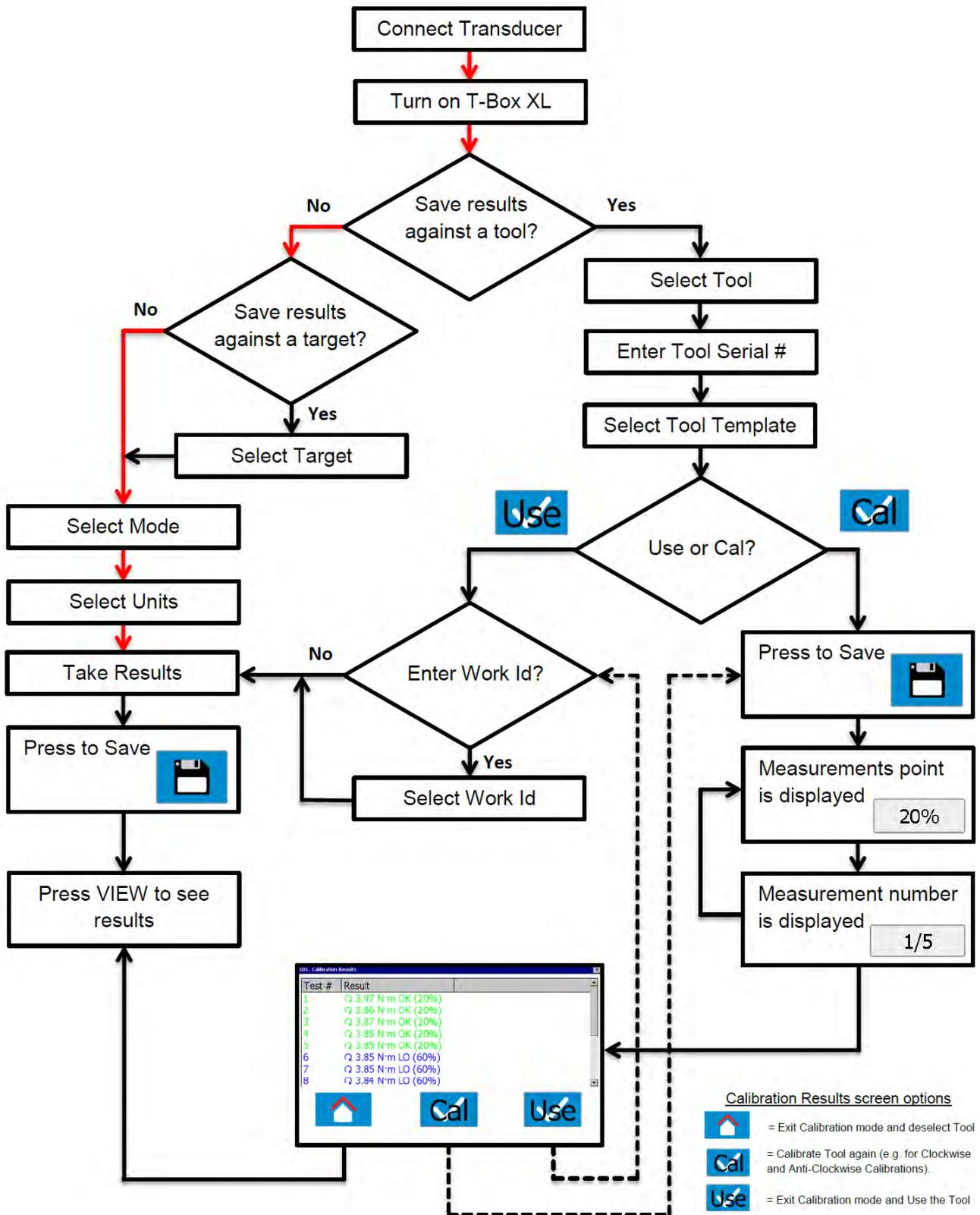
- 7" WVGA Colour touch screen with clear icons for ease of use.
- Hand-held with neck strap or bench mounted.
- 4 transducer inputs with ergonomic front panel selection switch.
- Automatically recognises any 'SMART' Norbar transducer.
Can also work with most mV/V transducers from Norbar or other manufacturers.
- 5-digit resolution for all Norbar transducers.
- Operational from internal rechargeable battery or power supply adaptor.
- Multiple Targets to indicate status of Torque & Angle results. The Targets status is shown as symbols and background colours on the display, as well as outputs on the ancillaries connector and serial port.
- Continuous Data logging of Torque or Torque & Angle results for transfer to TDMS.
- Ability to link targets for applications that require tightening in a sequence.
- Selectable frequency response for each mode of operation.
- Password protection of all selectable features to virtually eliminate operator induced errors.
- Ancillaries connector with analogue output & GO/NO GO control for external equipment.
- Serial Port for data output to a PC or printer.
- 4MB results memory. An example of memory storage.

| Item | Memory Each | Example of Storage |
|------------------------------|-------------|--------------------------------|
| Use (e.g. 20 readings) | 2KB | 100 Uses = 200KB |
| Calibration | 3KB | 100 Calibrations = 300KB |
| Graph (up to 10,000 samples) | Up to 400KB | 3 graphs = 1,200KB |
| Total | | 1,700KB (43% of memory) |

- Templates for all Norbar tools (Torque Wrenches, PneuTorques & EvoTorques) to enable the operator to easily perform calibrations on their tools to the relevant ISO standard using the in-built calibration program.
- Pre-programmed routines for ISO 6789-1:2017 Conformance tests and ISO 6789-2:2017 Calibrations.
- Automatically guides the user through the calibration routine required for the Tool.
- In built uncertainty test routines for tools requiring ISO 6789-2:2017 Certificates of Calibration.
- 2 USB ports for data transfer. Can be used with Bar code scanner, Mouse, Keyboard, Printer, Hub, etc.
- 12 languages.
- 8 modes for torque tool measurement: 'Track', 'Click', 'Dial & Electronic', 'Stall', 'Screwdriver', 'Hydraulic', 'Graph' (for visual analysis of torque profiles) and 'Pulse' (with a unique pulse tool algorithm to accurately determine pulse tool torque output).
- All Peak and 1st Peak modes can be configured for either Manual or Auto Reset.
- 13 Torque units. Plus custom units for measurement of load, pressure, etc.
- Displays torque only, torque & angle, torque & speed, torque & power, torque & turns and torque & rate.
- TDMS (Torque Data Management System) software included for complete data management and archiving to a PC. Includes seamless data synchronisation. See TDMS Operator's Manual part number 34342 for more information.

QUICK START

Follow flowchart to use the T-Box XL™. To just measure torque follow the RED bold path.
 For more comprehensive details refer to BEFORE USE, MEASURE, SETUP and SPECIFICATION sections.



NOTE: If Target, Tool Templates, Tools or Non-Smart Transducers do not exist, add via Setup.

BEFORE USE

Preparation

NOTE: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



WARNING: ALLOW THE T-BOX XL™ TO EQUALISE TO THE AMBIENT TEMPERATURE / HUMIDITY BEFORE SWITCHING ON. WIPE OFF ANY MOISTURE BEFORE USE.

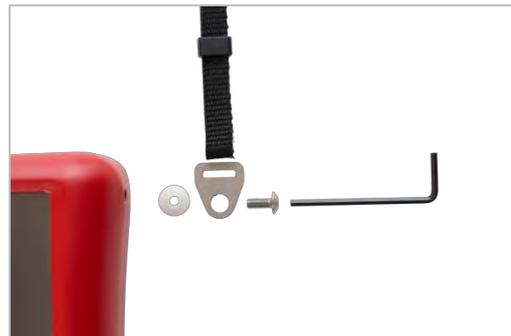


1. For Bench Use:
 - a. Fix stand to bench, use M10 bolts provided. Do not tighten above 10 N·m.
 - b. Mount T-Box XL™ on stand, tighten fixing screw by hand.

TIP: The T-Box XL™ will mount on a standard tri-pod (not supplied).



2. For Portable Use:
 - a. Connect neck strap to right & left of T-Box XL™.
 - b. Fix with hex key provided.



3. Connect up to 4 transducers to transducer connectors TD1, TD2, TD3 & TD4.

4. Select transducer from front (TD1 is fully counter-clockwise).



5. If using with a control or shut-off system; connect to ANCILLARIES connector.
6. If using RS232 to output results; connect to Serial Output.
7. Connect back panel USB to PC (cable included) for use with TDMS software.
TDMS software is included on the USB flash drive. To load the TDMS software onto a PC:
 - a. Insert USB flash drive into PC.
 - b. Open TDMS Operator's Manual (Part No 34342) & follow instructions.

The TDMS software features the following:

- USB connection to Norbar T-Box XL™ instrument for fast data transfer.
 - RS232 connection to other Norbar instruments such as TTT series 3.
 - Database for archiving of data for calibration (and Use) of Torque Tools.
 - Statistical Process Control (SPC) on Test results for USE of Tools.
 - Setup individual (or multiple) T-Box XL's with Tools, Tool Templates, Targets and Non-Smart Transducers via the synchronisation options.
 - Multilingual Calibration Certificate (English / French / German / Spanish / Italian / Russian / Polish / Hungarian / Norwegian / Finnish).
 - Calibration certificate and Declaration of conformance templates to ISO 6789:2017.
 - Uncertainty data management system for ISO6789-2:2017 tools.
 - Calibration certificate templates for PneuTorques etc.
 - Ability to add a Setting (i.e. p.s.i.) and setting values against Torque calibration results on a Calibration Certificate.
 - Air pressure graphs can also be saved, viewed and printed.
 - Compatible with Windows® XP, 7, 8.1 & 10
8. The T-Box XL™ can be powered from mains or battery. It is essential to charge the internal battery for 200 minutes (3 hours & 20 minutes) for full charge. To charge the internal battery, connect the Power supply adapter between the T-Box XL™ (9 V D.C. input) and a live A.C. supply.

TIP: If the power cord has no plug fitted, wire as follows:

BROWN-LIVE

BLUE-NEUTRAL

GREEN / YELLOW-EARTH

If in doubt consult a qualified electrician.

TIP: Insert 9 V D.C. connector into T-Box XL™ before applying A.C. mains to ensure correct charging.

TIP: The T-Box XL™ can be used whilst the battery is charging.

Recharging is independent of the on / off switch. The battery can be charged continuously.

9. Connect USB flash drive to T-Box XL™ front socket to transfer data.

The USB flash drive contains:

T-Box XL™ Operator's Manual (Part # 34396)

TDMS software (Part # 37748)

TDMS Operator's Manual (Part # 34342)

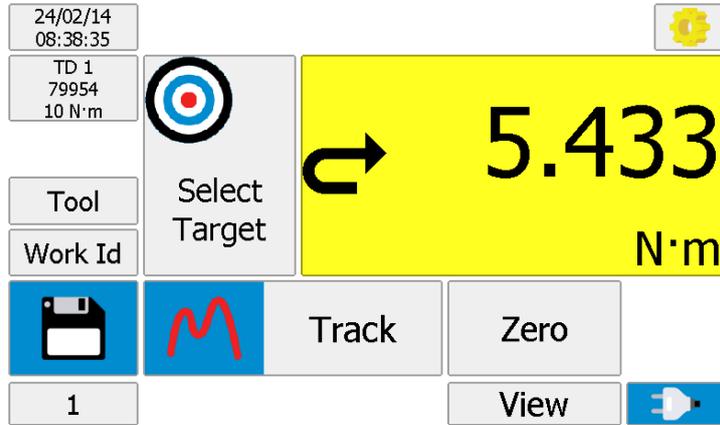
To access the Operator's Manuals & TDMS software, plug USB flash drive into your PC. Copy the Operator's Manual to your PC and open to view.



Setup For Use

Turn T-Box XL™ on. The Norbar logo appears. Wait for the green progress bar at the bottom of the logo screen.

The measure screen will then be shown.



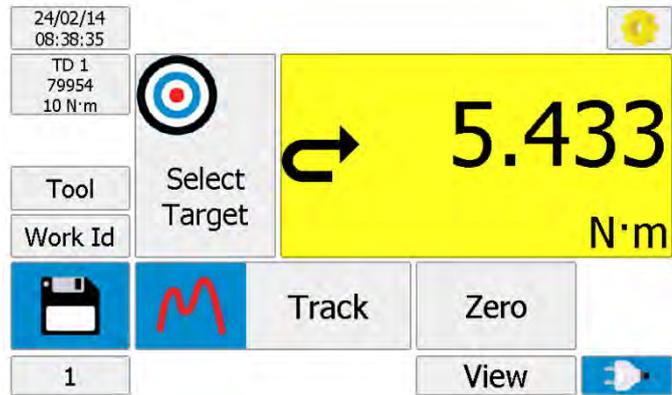
| Screen Area | Action | Further Information |
|-------------|---|---|
| | Date & Time. Press to view Logo screen. | T-Box XL™ Software Version #, Serial # and date last calibrated will also be shown. Press screen to return to Measure. |
| | Battery / Mains condition. | Press to show current power state. Press screen to return to Measure. |
| | Choose options for Transducer, Tool, Work Id, Target & Mode. | See MEASURE. |
| | Measure & save / delete results. | See MEASURE. |
| | SETUP: Targets, Tool Templates, My Tools, Transducers, USB, Language, Modes, Units, etc. | See SETUP. |

NOTE: For more information see SPECIFICATION pages.

MEASURE

Preparation

1. Turn T-Box XL™ on.
The measure screen will be shown:



2. Before taking measurements ensure the T-Box XL™ is prepared correctly.

The following icons are used to navigate:

| Meaning | Scroll | Exit (no change) | Exit |
|---------|---|---|---|
| Icon |     |   |  |

Transducer

Press to show / select transducer details:

For SMART transducer details are shown.



1. Transducer

| | |
|----------------|--------------------|
| Serial # | 79954 |
| Model # | 60242 |
| Units | N·m |
| Capacity | 10 |
| Angle | No |
| Calibration | 24/2/2014 08:37:32 |
| Q mV/V | 2.0000 |
| Not Linearised | |

For non-SMART Transducer shows "TD1 Connect transducer". Press to select transducer. Add new transducer in SETUP.



3. Transducer ?

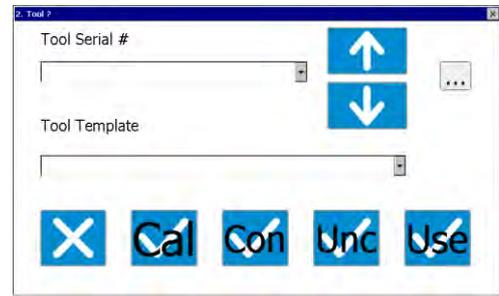
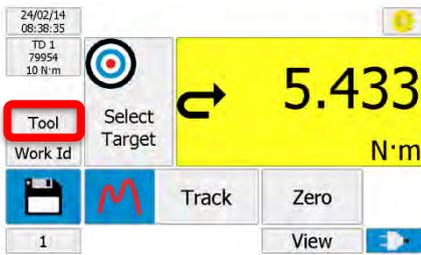
| Serial # | Model # | Capacity |
|----------|---------|----------|
| 65432 | 50030 | 100 N·m |

NOTE: For more information see SPECIFICATION - TRANSDUCER INTERFACE.

Tool

Press 'Tool' to select the tool to be calibrated or used.

A Tool can be a Torque wrench, PneuTorque®, EvoTorque®, Torque screwdriver, etc.



Enter / select "Tool Serial #" (If not required select "No Tool").

TIP: If tools are bar coded, a USB bar code scanner (not supplied) can be used to enter the number.

TIP: To help find a tool serial #, connect a USB keyboard (not supplied).
Enter the first characters to display all tool serial # with that prefix.

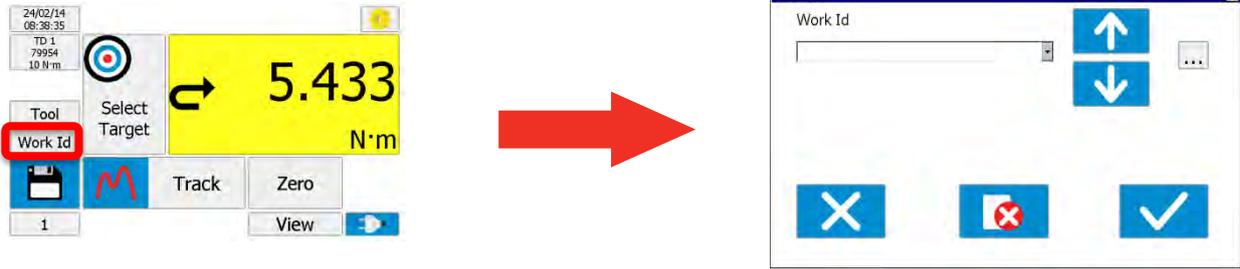
Select "Tool Template", this specifies full details of the tool for calibration purposes.

| Tick Option | Reason | Comment |
|-------------|---|--|
| | Calibrate a tool. | Pre-programmed calibration for Torque wrenches and Torque screwdrivers to ISO 6789-2:2017 or other tool types (e.g. PneuTorques, EvoTorques) |
| | Conformance Test a tool | Pre-programmed conformance test for Torque wrenches and Torque screwdrivers to ISO 6789-1:2017 |
| | Uncertainty Test a tool | Pre-programmed uncertainty tests for Torque wrenches and Torque screwdrivers to ISO 6789-2:2017 |
| | Use a tool. (Take torque results from a task, application or job). | Selecting a tool serial # is important for data management. If tool serial # is not selected, the results will be saved as "No Tool". |

NOTE: To remove the tool PRESS & HOLD the tool area until "Tool" is shown.

Work ID

'Work Id.' (Work identification) is a reference to the task, application, job or operator.



Example of Work ID.

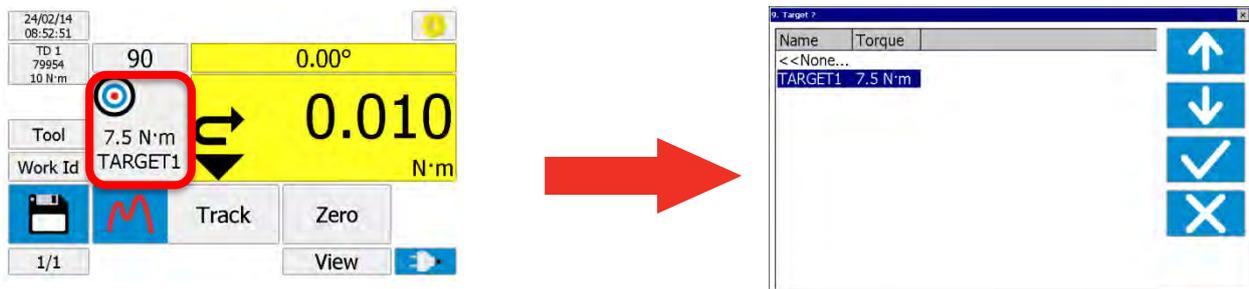
Cal Operator name.

Use Could include a bolted flange, engine cylinder head, vehicle wheel nuts, etc.

NOTE: To remove the Work Id PRESS & HOLD the Work Id area until "Work Id" is shown.

Target

NOTE: Not required for  (or Con or Unc) as target is set in the Tool Template.



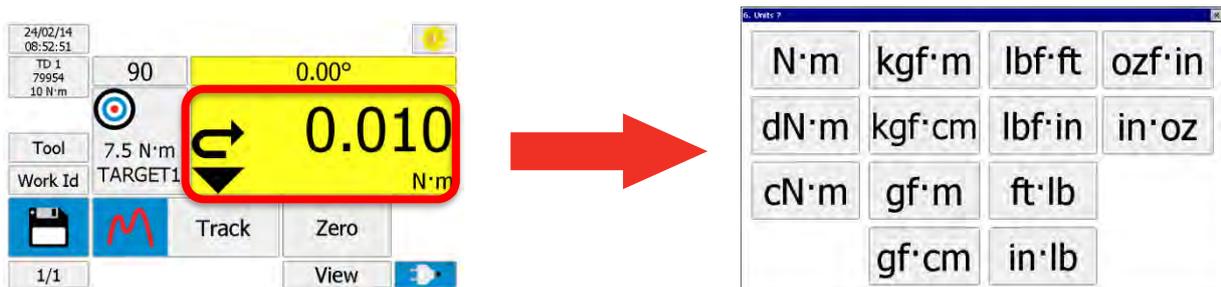
Select target (if required).

If an angle transducer is used, an angle target can also be shown:

NOTE: To remove the target PRESS & HOLD the target area until "Select Target" is shown.

Units

NOTE: The units available for  (and Con and Unc) are set in the Tool Template.



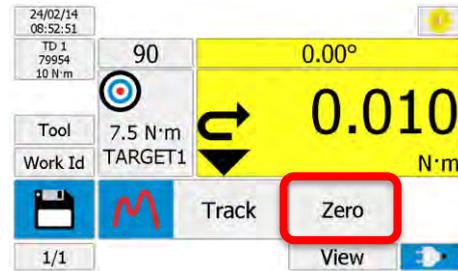
Press to select required units.

Zero Display

Ensure in TRACK mode.

Exercise the transducer in required direction of use.

Press 'Zero' to zero display.

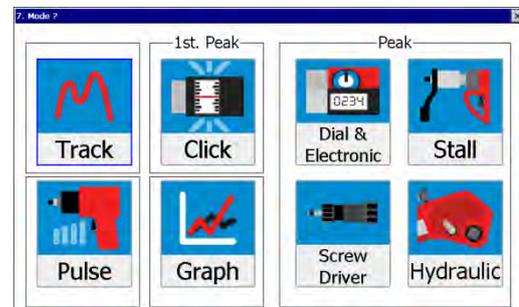


TIP: If the displayed reading does not zero the transducer may be overstrained. Contact a Norbar approved distributor for further advice.

NOTE: It is also possible to zero the display in other modes (e.g. CLICK mode), when the reading is within the 'Active from' threshold (by default this is set to 1.8% of full-scale).

Mode

NOTE: The modes available for  (and Con and Unc) are set in the Tool Template.



Select mode for the Tool being used.

The currently selected mode is shown with a BLUE border.



20%

The measurement point is displayed on the left of the display for an ISO 6789 Tool Template (eg: 20%, 60% & 100%). This is a % of the maximum torque value of the torque tool (or at the nominal / set value for tools of Type II, Classes B, C, E and F). If the measurement points have been set as torque values rather than % values in the tool template, they will be shown as torque values rather than % values in this box.



4 N·m
Calibrate
11035

The Target area shows the first (and subsequent) measurement targets in torque units. Set the tool to the required value.

1/5

The results counter (bottom left) shows the number of measurements at that target. E.g. 1/5 is result 1 of 5.

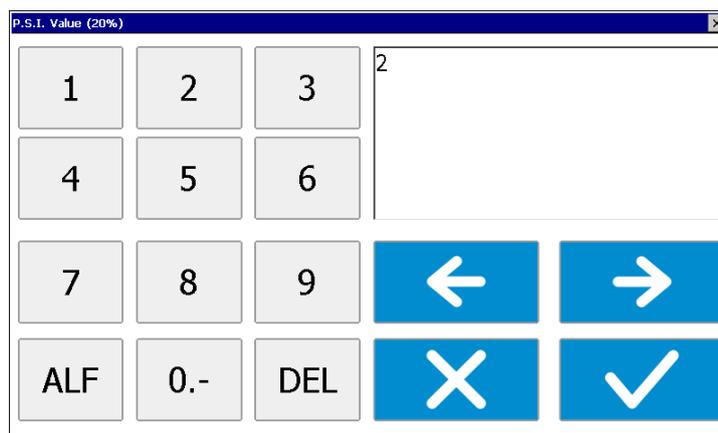
Take Results

Take results (for this example it will be 5 results at 20% of full scale). For full details of the mode operation see SPECIFICATION – MODES. After each result the results counter will increase by 1 (to show 2/5....3/5....4/5....5/5). When 5 results are taken, the % area changes to the next measurement value; in this example it will be 60%. The Target area will confirm the torque value required. Again take the results (5 in this example). The % area changes to the next measurement value, in this example 100%. The Target area will confirm the torque value required. Again take the results (5 in this example). (To exit calibrate mode before complete, PRESS & HOLD the TOOL button until "Tool" is shown).

TIP: COMPLETE will flash up in red if any tests (that are outside of the pass limits) are done on a Tool.

If the Tool template has Setting Values (e.g. for air pressure settings when calibrating pneumatic tools) the following screen will be displayed before each set of torque readings are taken:

Setting Values (optional)

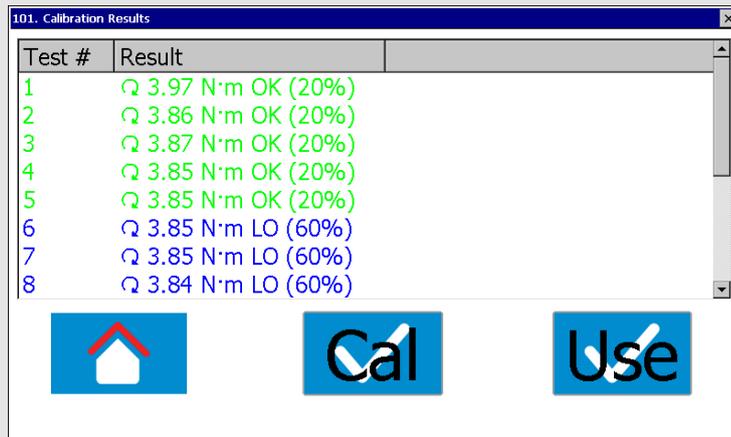


The Setting Value (in this example 2 P.S.I.) can either be accepted or changed to a different value. The Setting Values can then be added to the Certificate after synchronising to TDMS.

TIP: The Setting Values can be changed again in TDMS if required.

At the end of the Calibration, the 'Calibration Results' screen will be displayed:-

Calibration Results



| Test # | Result |
|--------|---------------------|
| 1 | Q 3.97 N·m OK (20%) |
| 2 | Q 3.86 N·m OK (20%) |
| 3 | Q 3.87 N·m OK (20%) |
| 4 | Q 3.85 N·m OK (20%) |
| 5 | Q 3.85 N·m OK (20%) |
| 6 | Q 3.85 N·m LO (60%) |
| 7 | Q 3.85 N·m LO (60%) |
| 8 | Q 3.84 N·m LO (60%) |

Below the table are three buttons: a Home button (house icon), a Cal button (Cal with a checkmark), and a Use button (Use with a checkmark).

The results are colour coded **Green** for readings which are OK (within tolerance), **Blue** for readings which are LO (below tolerance) and **Red** for readings which are HI (above tolerance).



Pressing the Home button exits Calibrate mode, returns to the Measure screen and deselects the Tool.



Pressing the Cal button returns to Calibrate mode with the same Tool selected, to perform another calibration. This is intended for As-Found followed by As-Left calibrations (and/or Clockwise followed by Counter-Clockwise calibrations).



Pressing the Use button exits Calibrate mode and returns to the Measure screen with the current Tool still selected.



Conformance test

20%

The measurement point is displayed on the left of the display for an ISO 6789 Tool Template (eg: 20%, 60% & 100%). This is a % of the maximum torque value of the torque tool (or at the nominal / set value for tools of Type II, Classes B, C, E and F).

If the measurement points have been set as torque values rather than % values in the tool template, they will be shown as torque values rather than % values in this box.



1 N·m
Conformance
11034

The Target area shows the first (and subsequent) measurement targets in torque units.

Set the tool to the required value.

1/5

The results counter (bottom left) shows the number of measurements at that target. E.g. 1/5 is result 1 of 5.

Take Results

Take results (for this example it will be 5 results at 20% of full scale).

For full details of the mode operation see SPECIFICATION – MODES.

After each result the results counter will increase by 1 (to show 2/5....3/5....4/5....5/5).

When 5 results are taken, the % area changes to the next measurement value; in this example it will be 60%. The Target area will confirm the torque value required.

Again take the results (5 in this example).

The % area changes to the next measurement value, in this example 100%.

The Target area will confirm the torque value required.

Again take the results (5 in this example).

(To exit conformance test mode before complete, PRESS & HOLD the TOOL button until "Tool" is shown).

TIP: COMPLETE will flash up in red if any tests (that are outside of the pass limits) are done on a Tool prior to (or post to) the save button being pressed.

At the end of the Conformance test, the 'Conformance Results' screen will be displayed:-

Conformance Results

| Test # | Result |
|--------|----------------------|
| 1 | Q1.016 N·m OK (5%) |
| 2 | Q1.018 N·m OK (5%) |
| 3 | Q1.018 N·m OK (5%) |
| 4 | Q1.018 N·m OK (5%) |
| 5 | Q1.017 N·m OK (5%) |
| 6 | Q11.518 N·m LO (60%) |
| 7 | Q11.521 N·m LO (60%) |
| 8 | Q11.521 N·m LO (60%) |

Home Con Use

The results are colour coded **Green** for readings which are OK (within tolerance), **Blue** for readings which are LO (below tolerance) and **Red** for readings which are HI (above tolerance).



Pressing the Home button exits Conformance test mode, returns to the Measure screen and deselects the Tool.



Pressing the Con button returns to Conformance test mode with the same Tool selected, to perform another conformance test. This is intended for As-Found followed by As-Left conformance tests (and/or Clockwise followed by Counter-Clockwise conformance tests).

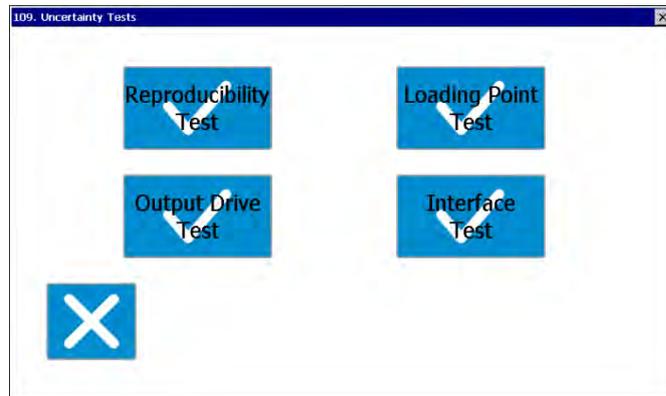


Pressing the Use button exits Conformance test mode and returns to the Measure screen with the current Tool still selected.



Uncertainty test

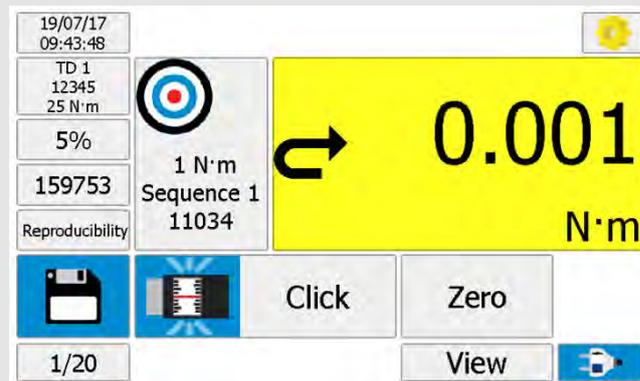
Uncertainty test selection



The uncertainty tests available to the tool will be displayed. Some tool types will have certain uncertainty tests greyed out.



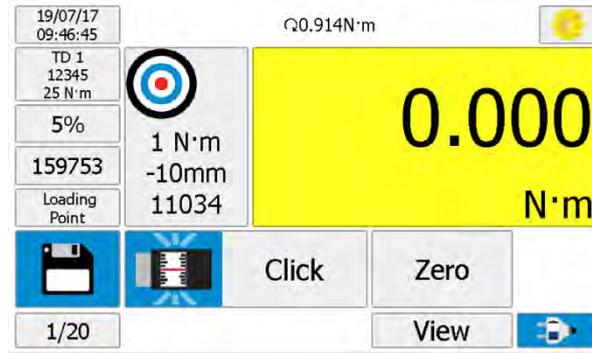
Initiates a Reproducibility uncertainty test to ISO 6789-2:2017.



This takes 4 sequences of 5 readings at the lower limit of the measurement range of the tool.

Initiates a Loading Point uncertainty test to ISO 6789-2:2017.

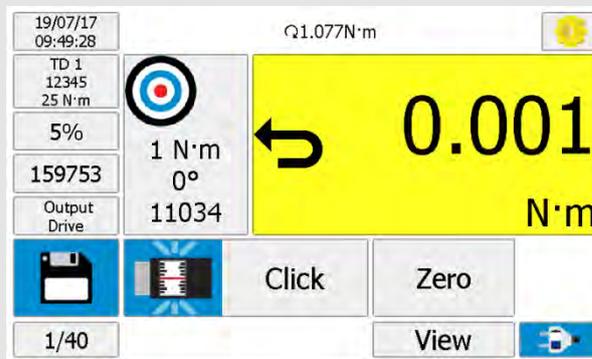
Loading Point Test



This takes 2 sets of 10 readings at 2 loading points, each 10 mm either side of the tools defined loading point.

Initiates an Output Drive uncertainty test to ISO 6789-2:2017.

Output Drive Test

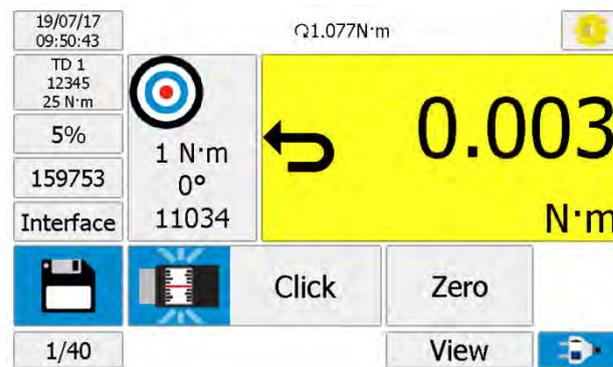


This takes 10 readings at each position of the output drive.
For square drives there are 4 positions at 0°, 90°, 180° and 270°.
For hexagon drives there are 6 positions at 0°, 60°, 120°, 180°, 240° and 300°.

If the output drive is not capable of rotation, this test is unnecessary.

Initiates an Interface uncertainty test to ISO 6789-2:2017.

Interface Test

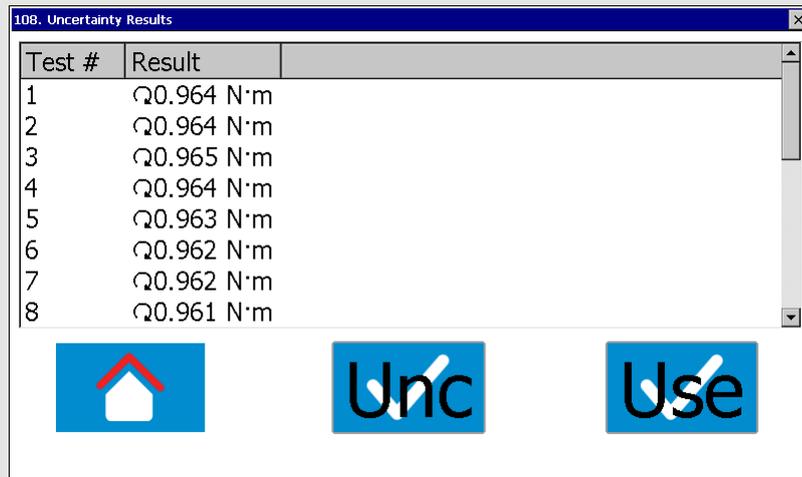


This takes 10 readings at each position of the interface (adaptor).
For square interfaces there are 4 positions at 0°, 90°, 180° and 270°.
For hexagon interfaces there are 6 positions at 0°, 60°, 120°, 180°, 240° and 300°.

If an interface (adaptor) is not used between the output drive of the tool and transducer, this test is unnecessary.

At the end of any of the Uncertainty Tests, the 'Uncertainty Results' screen will be displayed:-

Uncertainty Results



| Test # | Result |
|--------|------------|
| 1 | Q0.964 N·m |
| 2 | Q0.964 N·m |
| 3 | Q0.965 N·m |
| 4 | Q0.964 N·m |
| 5 | Q0.963 N·m |
| 6 | Q0.962 N·m |
| 7 | Q0.962 N·m |
| 8 | Q0.961 N·m |

Below the table are three buttons: a Home button (house icon), an Unc button (Unc with a checkmark), and a Use button (Use with a checkmark).



Pressing the Home button exits Uncertainty test mode, returns to the Measure screen and deselects the Tool.

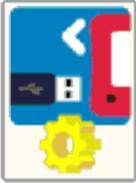


Pressing the Unc button returns to Uncertainty test mode with the same Tool selected, to select another uncertainty test.

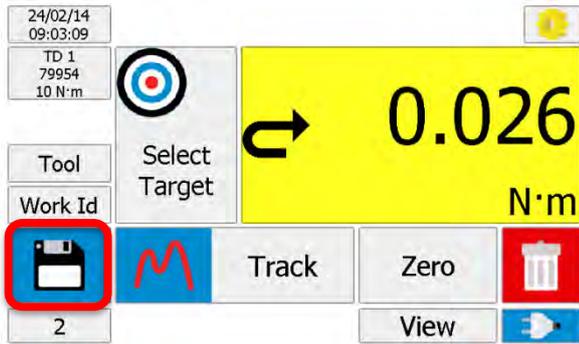


Pressing the Use button exits Uncertainty test mode and returns to the Measure screen with the current Tool still selected.

Data Logging

|  Use | |
|---|---|
| Individual results | <p>For details of the mode operation see SPECIFICATION – MODES.</p> <p><u>To enable Data Logging, configure the Serial Port Setup as follows:</u></p> <p>On screen 74 - Tick “Continuous Output”. On screen 93 - “Minimum angle change for output” = 1 (for example). In this example Torque & Angle values are logged for every 1 degree change in the angle. On screen 93 - Tick “Log All Serial Output”. Select the Tool (if required), select USE. Enter the Work Id (if required).</p> <p><u>To use Data Logging:</u></p> <p>Use TRACK mode for data logging control (other modes will log continuously, with no control).</p> <p>Data is automatically logged at 5 readings per second (factory default). The save button has no effect.</p> <p>For Torque transducer: Data logging starts when the torque passes above 1.8% of transducer capacity. Data logging stops when the torque passes below 1.8% of transducer capacity.</p> <p>For Torque and Angle transducer: If “Minimum Angle change for output = 0” – Data is logged whilst in the measurement screen. If “Minimum Angle change for output = 5” (for example) – In this example Torque & Angle values are logged for every 5 degree change in the angle.</p> <p>NOTE: To view large amounts of data will take many seconds (Only the last 20,000 logged results can be viewed).</p> <p>To avoid this delay, transfer logging data directly from the T-Box XL™ to the USB stick by pressing the following setup button:</p> <div style="text-align: center;"></div> |
| Continuous results (Data Logging) | |

Save Results



When is a measurement saved?

| Reset Type | Save Button Action | Description: | Result Saved? | Result Displayed at Top of Screen? |
|--------------|--------------------|--------------|---------------|------------------------------------|
| Manual reset | Press to save. | SAVE | √ | √ |
| Auto reset | BLUE | Wrench setup | X | √ |
| | GREEN | SAVE | √ | √ |

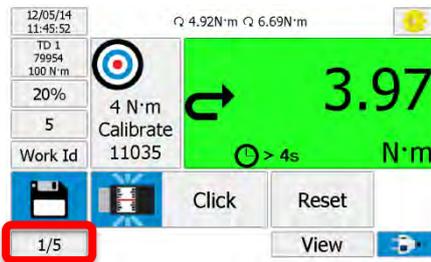
NOTE: The maximum number of save requests in track mode is 1 per second.

The ZERO button becomes RESET in memory modes. Press RESET to reset the memorised reading, without the result being saved.

NOTE: The RESET button reverts to a ZERO button in memory modes when below the Active From threshold (1.8% of full-scale by default).

Every SAVE will add 1 to the Number of Tests counter.

| Use | Number of Tests Counter Example | Explanation |
|--------------------|---------------------------------|---|
| Use without Target | 1 | Number of Tests counter. Press counter to reset. |
| Use with Target | 1/100 | Test 1 of 100 (with “# of Tests” set to 100) in Target Setup. |
| CALIBRATION | 1/5 | The measurement number for the measurement point, e.g. 1/5 for measurement ‘1’ of ‘5’ |



When a result has been saved the ‘BIN’ symbol appears:

Press ‘BIN’ to:

1. Delete the last test result from any saved data.
2. The last measurement will be removed from the top of the screen
3. The Number of Tests counter will decrease by 1.

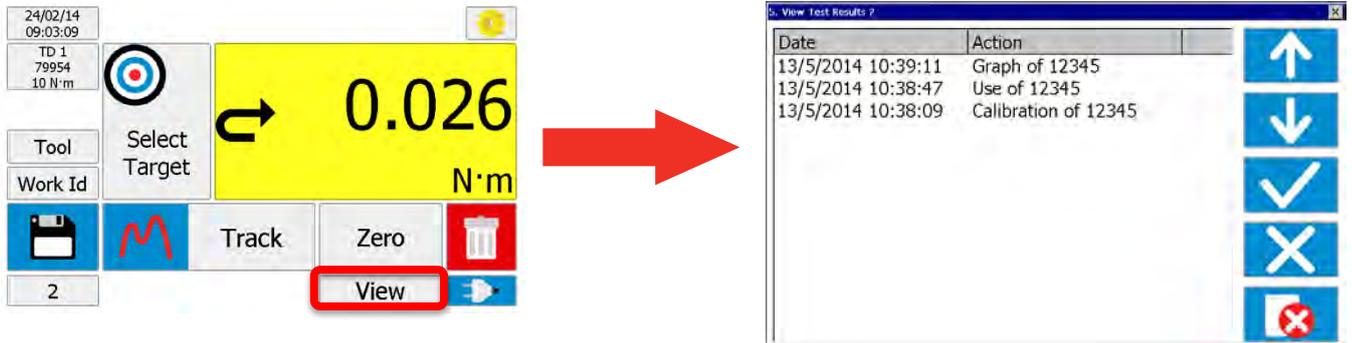


3. The BIN symbol will disappear.

At the end of CALIBRATION or when '# of Tests' complete; T-Box XL™ displays: **COMPLETE**

View / Delete Results

To view results for use, calibrations & graphs:



Select result then press:

TICK to view [Shows: Tool, Mode, Transducer and results (with LO/OK/HI if target was used)].

RED CROSS to delete (via the password if set).

The results are listed in DATE order, with the latest at the top. The action is defined as:

| Type of Results | Tool Selected (Tool Serial # shown, e.g. 12345) | Tool not Selected |
|-----------------|--|------------------------|
| Use | Use of 12345 | Use of No Tool |
| Calibration | Calibration of 12345 | Calibration of No Tool |
| Graph | Graph of 12345 | Graph of No Tool |
| Uncertainty | Uncertainty test for 12345 (Reproducibility) | N/A |
| Conformance | Conformance of 12345 | N/A |

If a Work Id has been specified, it will appear in brackets.

E.g. If the Work Id is "FLANGE 6" the display will show "Use of 12345 (FLANGE 6)".

Mains / Battery

| Mains or Battery | Icon | Power State |
|------------------|------|---|
| Mains. | | Charging. Full charge in 200 minutes. |
| | | Charged. |
| Battery. | | Full. |
| | | Low. |
| | | Flat. |



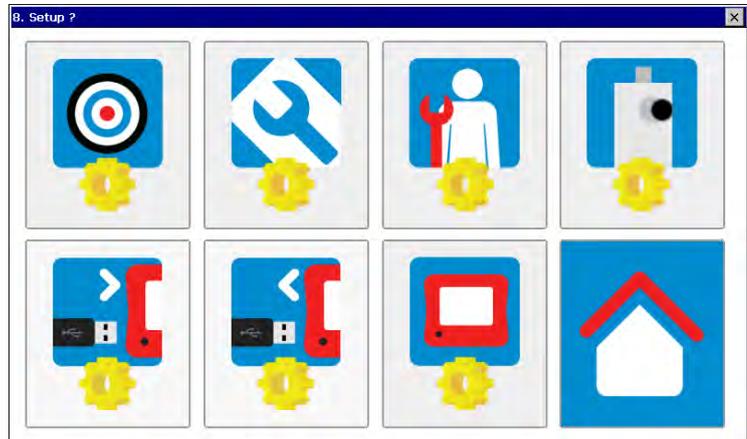
NOTE: The Battery Icon includes the remaining % charge value.

SETUP

T-Box XL™ SETUP covers: Targets, Tool Templates, My Tools, Non-Smart Transducers, USB, Language, Modes, Sleep, Password, Time & Date, Angle Display, Units and Serial Port.

The TDMS software can also setup the Targets, Tool Templates & Transducers.

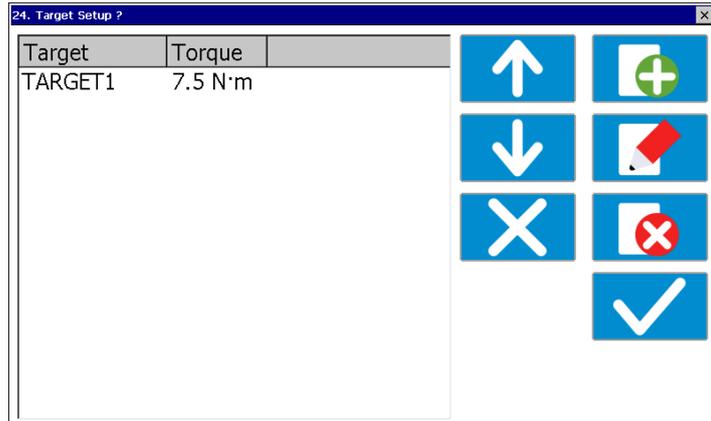
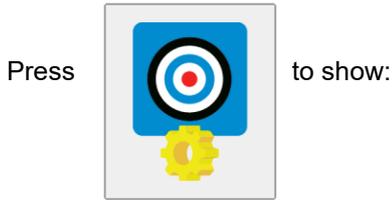
Press:  in measure to show:



Throughout SETUP and Selection, the following functions are used:

| Icon | Meaning |
|--|---------------------------------------|
|    | Scroll |
|  | |
|  | Add |
|  | Edit |
|  | Delete (may be password protected) |
|   | Exit (no change) |
|   | Exit |

Target

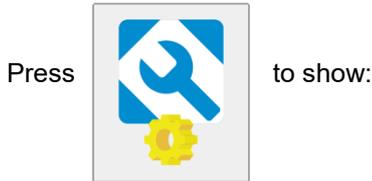


Select Target to Add, Edit or Delete.

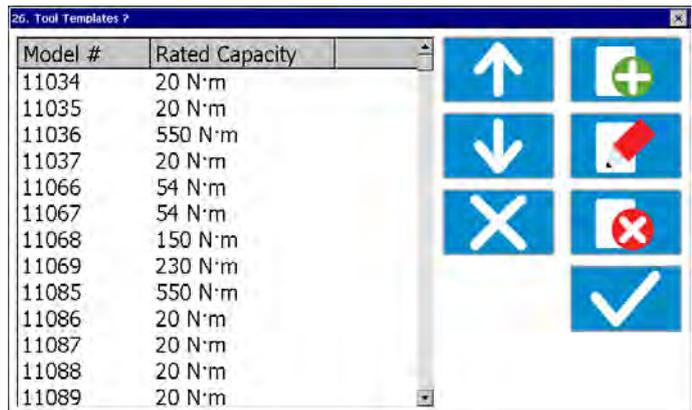
| Target Options | Comment |
|------------------------------|---|
| Name | Target name. |
| Description | Target description. |
| Target | Target torque value. |
| Units | Select units or press  to enter custom units. (Custom Units allow load cells and other non-torque transducers to be used). |
| Upper Limit % | The % of the Target value allowed above the Target value. |
| Lower Limit % | The % of the Target value allowed below the Target value. |
| Direction (↺, ↻, ↻ & ↻) | Direction Torque Target operates. |
| # of tests | The number of tests / measurements saved at this target. |
| Tool Stop | Torque value at which the STOP output on Ancillaries connector changes to logic 1. |
| Internal Snug Torque Trigger | NO-TICK = Snug torque triggered from Ancillaries. TICK = Snug torque triggered when Torque value reaches 'Snug torque' value in T-Box XL™. |
| Snug Torque | Torque value to start measuring angle. |
| Direction (↺, ↻, ↻ & ↻) | Direction Angle Target operates. |
| Angle Limits? | UN-TICK = No angle limits. TICK = Use angle limits. |
| Target Angle | Target angle value in degrees. |
| Upper Limit | The number of degrees allowed above the target. |
| Lower Limit | The number of degrees allowed below the target. |
| Next Target | Ability to link to the next target. Required for sequence tightening to different targets. |
| ISO 6789:2017 timing | UN-TICK = No timing indicators shown. TICK = ISO 6789:2017 timing indicators shown. |

Targets can also be setup in the TDMS software.

Tool Templates



Templates exist for all Norbar tools (Torque Wrenches, PneuTorques & EvoTorques) in multiple torque units.



| Model # | Rated Capacity |
|---------|----------------|
| 11034 | 20 N·m |
| 11035 | 20 N·m |
| 11036 | 550 N·m |
| 11037 | 20 N·m |
| 11066 | 54 N·m |
| 11067 | 54 N·m |
| 11068 | 150 N·m |
| 11069 | 230 N·m |
| 11085 | 550 N·m |
| 11086 | 20 N·m |
| 11087 | 20 N·m |
| 11088 | 20 N·m |
| 11089 | 20 N·m |

Select Tool Template to Add, Edit or Delete.

| Tool Template Options | Comment |
|--|--|
| Model # | Model number of Tool. |
| Description | Description of Tool. |
| Tool Type | ISO 6789 Type I / II & Class A / B / C / D / E / F / G or Other. |
| Rated Capacity | Tool rated capacity. |
| Units | Units of Tool rated capacity. |
| Calibrate Across Range | UN-TICK = Calibrate at single point of measurement. TICK = Calibrated at up to 10 points of measurement (e.g. 20%, 60%, 100%). |
| # of Tests | Number of Tests at each point of measurement. |
| Upper Limit % | The % allowed above the point of measurement (Target). |
| Lower Limit % | The % allowed below the point of measurement (Target). |
| Set Points | The % values used for the different points of measurement (Targets). These can be entered if Tool Type = Other. |
| Dial / Screwdriver / Hydraulic / Click / Stall / Pulse / Graph / All | Select mode(s) available for Tool Template. This will stop the operator selecting the wrong mode. |
| Setting Values? | UN-TICK = No Setting Values required. TICK = Add Setting Values (e.g. pressure settings) to the calibration. |
| Setting Units | Units of Settings Values (e.g. P.S.I. or BAR). |
| Setting Values | Default Setting Value for each point of measurement. These values can be edited during the calibration. |
| Lower limit of measurement range | The lowest torque value the tool is capable of measuring or being set to. |
| Expected measurement error | The expected % measurement error for this model of tool. |
| Interface positions | If an Interface (adaptor) is used between the tool and the transducer, positions should be set to 4 for a square or 6 for a hexagon. |
| Output Drive positions | If the tools output drive is capable of being rotated, positions should be set to 4 for a square or 6 for a hexagon. |

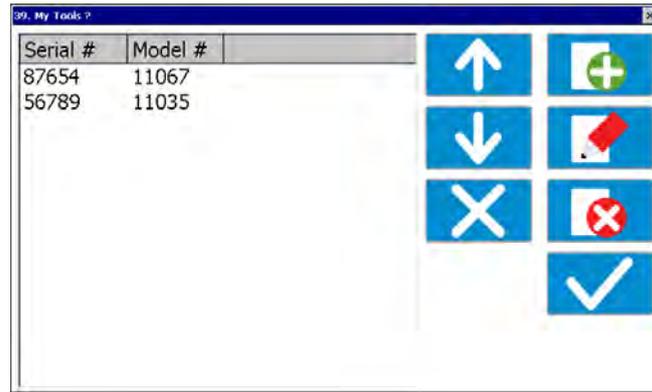
NOTE: For more information on ISO 6789 see “SPECIFICATION - HAND TORQUE TOOL CLASSIFICATION”. Tool Templates can also be setup in the TDMS software.

My Tools

Press



to show:



Select Tool to Add, Edit or Delete.

| My Tools Options | Comment |
|------------------|--|
| Serial # | Serial number of tool. |
| Model # | Select from models with a Tool Template. |

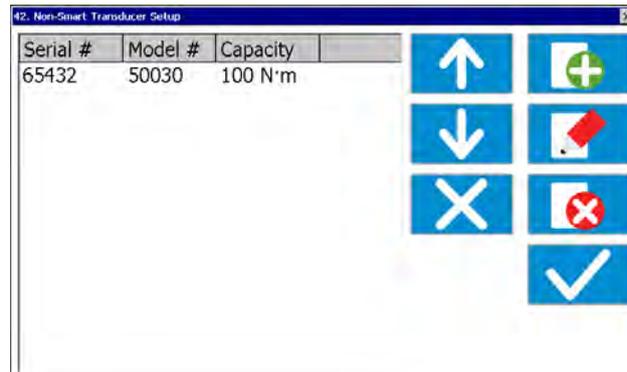
Non-Smart Transducers Setup

NOTE: This feature is not required for Norbar SMART transducers (with suffix: .LOG, .LOGA, .IND & .INDA).

Press



to show:



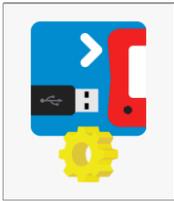
Add / edit / delete as required.

| Transducer Options | Comment |
|----------------------------|---|
| Serial # | Serial number of Transducer. |
| Model # | Model number of Transducer. |
| Capacity | Capacity of Transducer. |
| Units | Select units or press <input type="text"/> for custom units. (Custom Units allow load cells and other non-torque transducers to be used). |
| ⤵ mV/V | Clockwise mV/V from Transducer calibration certificate. |
| ⤴ mV/V | Counter-Clockwise mV/V from Transducer calibration certificate. |
| Supports Angle Measurement | UN-TICK = NO angle measurement. TICK = Angle displayed. |
| Pulses per revolution | Number of pulses per revolution produced by the angle Transducer. |

Non-Smart Transducers can also be setup in the TDMS software.

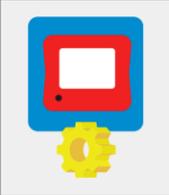
USB In / Out

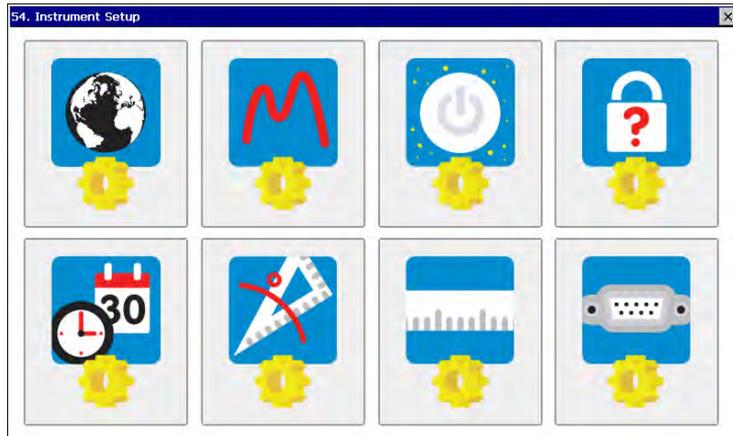
Insert USB flash drive into front of T-Box XL™.

| Action | Press | Message If Not Successful | Message If Successful |
|--|---|---------------------------|--|
| Send data from USB flash drive to T-Box XL™. |  | "No USB drive": | Wait approximately 30 seconds. "All files transferred". |
| Send data from T-Box XL™ to USB flash drive. |  | "No USB drive": | Wait approximately 30 seconds. "All files transferred". |

NOTE: For more information see "SPECIFICATION - USB".

Instrument Setup

Press  to show:



Language

Press  to show:



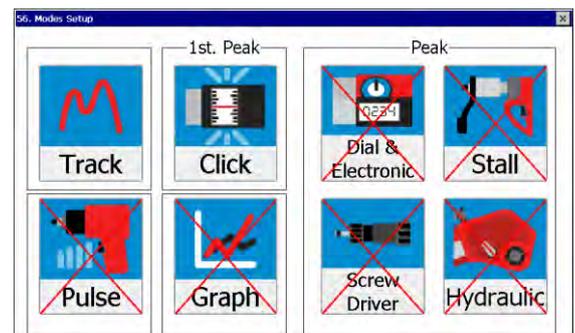
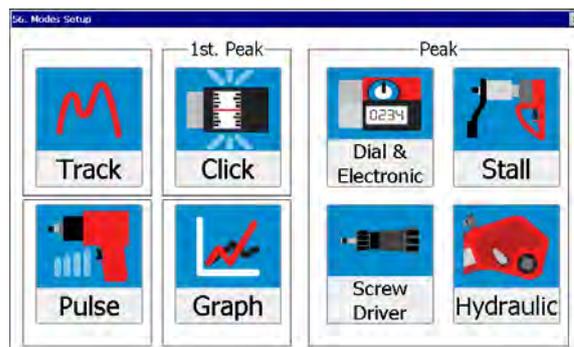
Languages are:

English / French / German / Italian
 Danish / Spanish / Dutch / Finnish
 Swedish / Norwegian / Portuguese /
 Russian

Select language.

Modes Setup

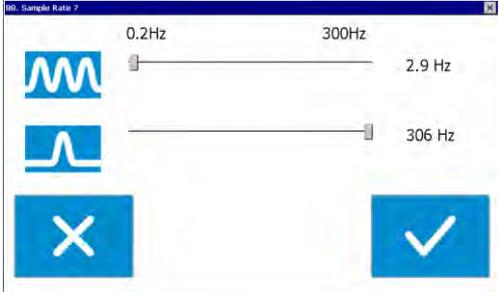
Press  to show:



QUICKLY PRESS icon to enable / disable (RED X) the mode:

Disable all modes that are NOT required.
 (Track mode cannot be disabled).

PRESS AND HOLD icon to setup mode:

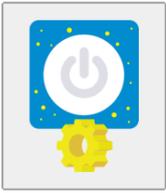
| Mode Options (where applicable) | Comment |
|-------------------------------------|---|
| Filter Frequency | TICK required filter frequency. UN-TICK all and press  to enter "other" frequency. |
| First Peak Sensitivity | Select LOW (10% of reading) / MEDIUM (5% of reading) / HIGH (2.5% of reading). |
| Auto Reset | TICK = Auto Reset (1 st Peak mode – Hold time starts at 1 st peak. Peak modes – Hold time starts when the value goes below 0.5% of full scale at zero). UN-TICK = Manual Reset. |
| Auto Reset Hold time | Hold time in seconds (1 to 10). |
| Active From | Set from 0 to 50% of transducer capacity. Below Active From mode will 'Track'. Above Active From mode will operate. Used to overcome false results caused by some tools / operators at low torques. |
| RS232 Active From | Only applicable to Track mode. Set from 0 to 50% of transducer capacity. Below this setting, RS232 will be disabled in Track mode. |
| Sample Rate | <p>Set sample rate. Only applicable to Graph mode.</p> <p>Set for Multi event:  (0.2Hz to 306Hz)</p> <p>Set for Single event:  (2.5Hz to 306Hz)</p> <p>0.2 Hz is 1 sample every 5 seconds. 306Hz is 306 samples per second.</p>  |
| Standard Setting/ Custom Setting | <p>Only applicable to Pulse mode. Set -40 to +40% for Custom Setting value. If the Standard Setting doesn't suit a particular pulse tool application, the Custom Setting can be used to trim the reading closer to the verified value. e.g. If the verified value is 15% higher than the Standard Setting readings, choose the Custom Setting and set the value to 15%. For guidance on verifying the joint see 'SPECIFICATIONS – MODES – Pulse Tool Joint Verification'</p> |

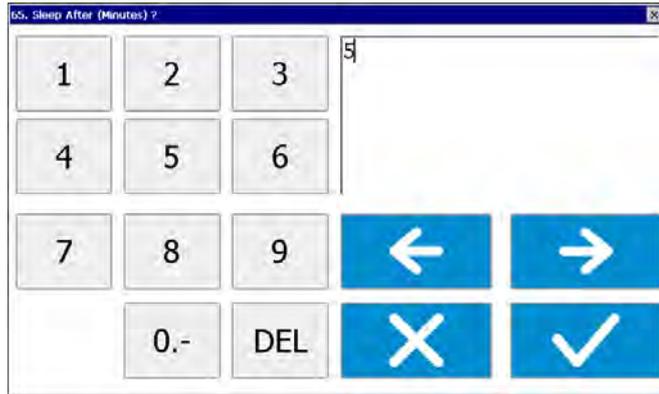
TIP: In **CLICK** mode only a genuine first peak will be output or saved.

TIP: In **CLICK** mode a sensitive torque wrench may give inconsistent results, to compensate:

1. Reduce **FIRST PEAK SENSITIVITY** to **MEDIUM** or **LOW**.
2. Increase **ACTIVE FROM** Threshold.

Sleep After

Press  to show:



Enter time in minutes.

The T-Box XL™ will go to sleep if there has been no activity for the time set in 'Sleep After'.

During sleep, none of the T-Box XL™ functions operate.
If continual operation is essential disable the sleep function.
To disable leave 'Sleep After' value as blank.

The Sleep function is only active on battery power.

The Sleep function will increase battery life when the T-Box XL™ is not in use.

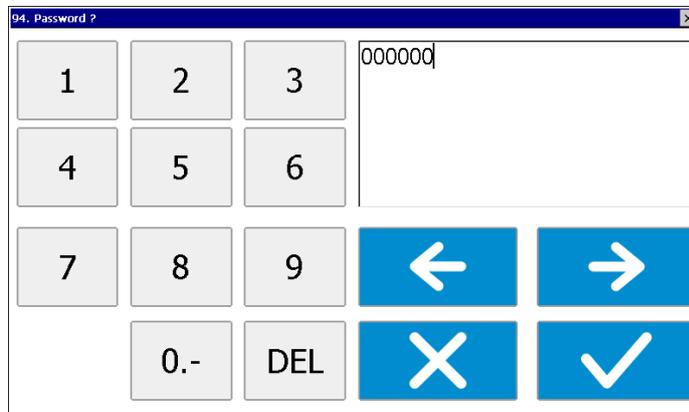
When the T-Box XL™ is sleeping, the front button will light.
The touch screen is inactive.
Press the front button to wake up T-Box XL™.



TIP: Check the zero setting of the transducer on return from sleep after a warm up period.

Password

Press  to show:

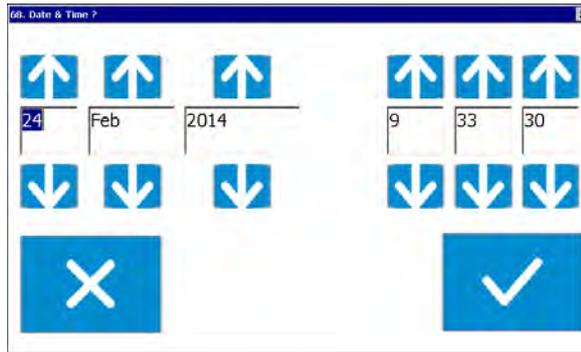


The Password is inactive whilst set to '000000'.

| Options | Password Type | Comment |
|--------------|-------------------|--|
| Press | Password | Default password = 000000 (six zero's) |
| Press & Hold | Advanced Password | No operator functions |

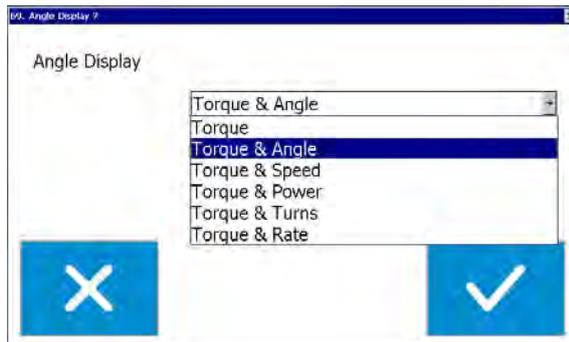
TIP: If password is lost, contact Norbar.

Date & Time



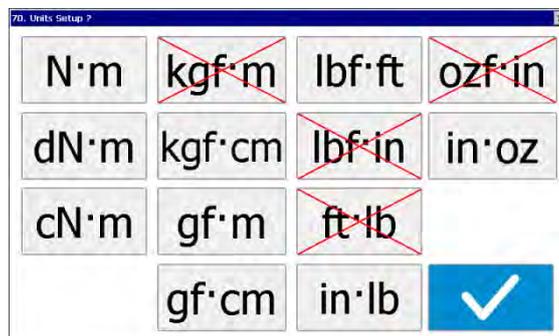
Select Date & Time.

Angle Display



| Angle Display (Options for angle transducer) | Display | |
|--|--|--|
| | Metric Torque Units | Imperial Torque Units |
| Torque | Torque only. | Torque only. |
| Torque & Angle | Torque & angle in ° (degrees). | Torque & angle in ° (degrees). |
| Torque & Speed | Torque & Speed in RPM (Revolutions per minute). | Torque & Speed in RPM (Revolutions per minute). |
| Torque & Power | Torque & Power in W (Watts). | Torque & Power in hp (horse power). |
| Torque & Turns | Torque & Rev (Revolutions). | Torque & Rev (Revolutions). |
| Torque & Rate | Torque & Rate per degree. | Torque & Rate per degree. |

Units



Press to enable / disable (RED X):

Disable all units which are not required.

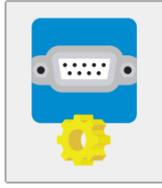
NOTE: These are only applicable if a Tool has NOT been selected.

It is not possible to disable all units.

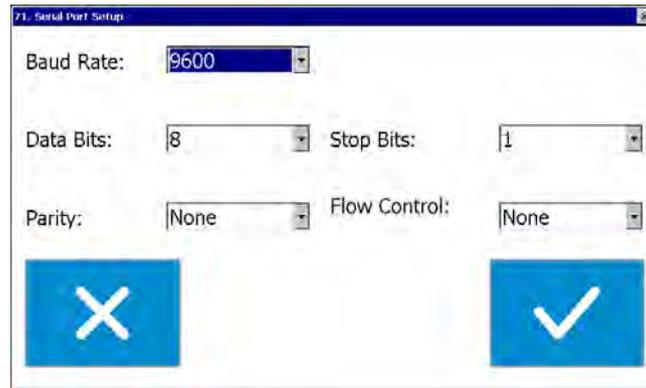
Press TICK when all selections have been made.

Serial Port

Press



to show:



Set serial port to match receiver.

| Serial Port Options | Comment | Default Setting |
|-----------------------------------|---|-----------------|
| Baud Rate | 1200 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 / 230400 | 9600 |
| Data Bits | 7 / 8 | 8 |
| Parity | Mark / Space / Odd / Even / None | None |
| Stop Bits | 1 / 1.5 / 2 | 1 |
| Flow Control | Hardware (CTS) / Software (X-ON/OFF) / None | None |
| First Character | - / +- / None | - |
| Line Delay | Added delay to slow data output. | 0.5 seconds |
| Output Limits | TICK = Torque limits status (LO / OK / HI) sent before data. UN-TICK = No limits status. | TICK |
| Output Units | TICK = Units sent after data. UN-TICK = No units. | TICK |
| Output Date & Time | TICK = Date & Time sent after data. UN-TICK = No Date & Time. | UN-TICK |
| Output Line Feed | TICK = Line Feed sent after data. UN-TICK = No Line Feed. | UN-TICK |
| Continuous Output | TICK = Serial output always sending (Maximum 5 readings per second). Use 'Line Delay' to regulate continuous output (use 0 for maximum output speed). UN-TICK = Serial output sent when requested. | UN-TICK |
| Separator | Comma / Space / Tab | Space |
| Always Output Tool Serial # | TICK = Tool Serial # output before data. UN-TICK = Tool Serial # not output. | UN-TICK |
| Output Tool Serial # when changed | TICK = When changed output Tool Serial # before data. UN-TICK = Tool Serial # not output. | UN-TICK |
| Always output Work ID | TICK = Work ID output before data. UN-TICK = Work ID not output. | UN-TICK |
| Output Work ID when changed | TICK = When changed output Work ID before data UN-TICK = Work ID not output. | UN-TICK |
| Minimum Angle change for output | Data is output for a set change in angle. (Use with angle transducer. Use in TRACK mode. Set "Continuous Output" = TICK. Set "Line Delay" = 0. To turn off set option to 0 (zero)). | 0 |
| Log All Serial Output | Save the Data that is output inside the T-Box XL™. | UN-TICK |

TIP: Using the 'Comma' as the Separator will create results with 'comma separated values' (csv), as often required by Microsoft® Excel.

NOTE: For more details see SPECIFICATION - SERIAL PORT.

SPECIFICATION - GENERAL

| Input voltage | Equivalent torque | Accuracy | Calibration uncertainty* |
|-----------------|------------------------|-------------------|--------------------------|
| @0.5 mV | 5% of full scale | ±0.1% of reading | ±0.23% |
| @1.0 mV | 10% of full scale | ±0.05% of reading | ±0.15% |
| @2.0 mV | 20% of full scale | ±0.05% of reading | ±0.11% |
| @3.0 to 11.0 mV | 30% to 110% full scale | ±0.05% of reading | ±0.090% to ±0.062% |

*Using a coverage factor of k=2, to give a confidence level of approximately 95%.

| | |
|--------------------------|---|
| Resolution: | 5 active digits for all Norbar transducers. |
| Display: | 7" WVGA TFT colour display with touch screen. With update rate of three times per second (3Hz). |
| Torque Unit Conversions: | To 'BS 350:2004 Conversion factors for units'. |
| Zero Suppression: | None |
| Date / Time: | Date format DD/MM/YY. Time format HH:MM:SS (24 Hour clock). |
| Time/Date Compliance: | To year 2099 |
| Units of Measurement: | See MEASURE / Select Units (Custom Units also available). |
| Frequency Response: | 8 th Order Butterworth low pass filter with a -3dB point settable from 100 to 2500 Hz. |
| Angle Display: | Channel A & B quadrature inputs give 4 unique logic states per pulse. Angle display shown to 2 decimal places as examples: |

| Transducer Pulses per Revolution | Transducer Pulses per Degree | Quadrature Logic States per Degree | T-Box XL™ Resolution |
|----------------------------------|------------------------------|------------------------------------|----------------------|
| 360 | 1 | 0.25 | 0.25 |
| 720 | 2 | 0.125 | 0.13 |
| 1440 | 4 | 0.0625 | 0.06 |

NOTE: Maximum Angle 21,000,000 degrees.

| | |
|--|--|
| Operating Temperature Range: | +5°C to +40°C. |
| Storage Temperature Range: | -20°C to +70°C. |
| Maximum Operating Humidity: | 85% Relative Humidity @30°C. |
| Power Supply Adapter: | 100 to 240 V A.C. at 50-60 Hz input. 9V, 3.33A D.C. output (centre positive). |
| Charge Time: | 3 hours and 20 minutes. |
| Discharge Time: | up to 3 hours continuous or 5 hours with sleep mode used 50%. |
| Power Consumption: | 30 W - maximum. |
| Power Cable: | 2 metres (6 ft 6 ins) long minimum. |
| Power Plug Fuse (if fitted): | 2 Amp. |
| Battery Pack: | 2500 mAh, 6.0 volt NiMH (Nickel Metal Hydride). |
| Coin Cell: | Renata 190 mAh (CR2032FH). |
| Weight (T-Box XL™ only): | 1.9 Kg (4.2 lb). |
| Dimensions: | 162 mm high x 205 mm wide x 60 mm deep. |
| 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 61326:2013 |
| Low Voltage Directive: | In conformance with EN 61010-1:2010. To environmental conditions Pollution Degree 2 & Installation Category (Over voltage Category) II. |

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

SPECIFICATION – TRANSDUCER INTERFACE

The 4 transducer connectors are designed for use with most four wire bridge strain gauge type transducers. All 4 transducer inputs can measure Norbar torque & angle transducers.

Smart Transducers

Norbar 'SMART' transducers store the calibration data; they are available in 4 types:

| Suffix | 'SMART' Transducer Description | | |
|------------|--------------------------------|----------------------------------|----------------------|
| | Integral Angle Encoder? | Calibration | mV/V Figure Supplied |
| XXXXX.IND | No | mV/V | Yes |
| XXXXX.INDA | Yes | mV/V | Yes |
| XXXXX.LOG | No | With a T-Box XL™ in torque units | Yes |
| XXXXX.LOGA | Yes | With a T-Box XL™ in torque units | Yes |

For additional accuracy SMART transducers can be factory programmed with a second degree polynomial, so any slight errors can be reduced. These transducers are identified as 'linearised' on the transducer information screen.

Non-Smart Transducers

The T-Box XL™ is designed to measure other transducers with the following specification:

| Parameter | Minimum | Maximum |
|---------------------------------|---|---|
| Bridge Resistance (Ω). | 350 Ω | 1000 Ω |
| Millivolt / volt value (mV/V). | 0.50 mV/V. | 3.15 mV/V. |
| Zero balance. | +/- 3% of transducer capacity (3 mV/V). | +/- 9% of transducer capacity (1 mV/V). |
| Transducer capacity ranges. | 0.010000 | 1,500,000 |
| Displayable overrange. | 120% of transducer capacity. | 120% of transducer capacity. |

For 'NON-SMART' transducers the transducer parameters can be stored in the T-Box XL™ for ease of use.

NOTE: If any of the transducer's parameters are changed, like a re-calibration of the mV/V value, the transducer's stored parameters must be updated prior to use.

NOTE: ETS Transducers supplied with an amplifier module will need to be modified for use with the T Box XL.

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 for transducer selected, digital 0 volts when not selected. |
| 7 | Rotary transducer angle input (Channel A). |
| 8 | Rotary transducer angle input (Channel B). |
| 9 | Serial clock (SMART memory). |
| 10 | Serial data (SMART memory). |

Connector Type

10-way 'Push-Pull' style panel socket.

SPECIFICATION - ANCILLARIES

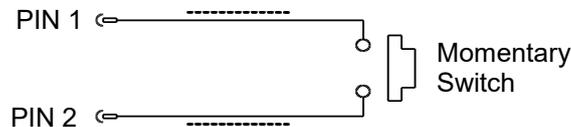
The Ancillaries connector contains inputs and outputs for connection to external equipment.

Pin Connections

| Pin No | Function |
|--------|--|
| 1 | Digital +5 V (maximum current 5 mA). |
| 2 | External PRINT / RESET Input (Active High). |
| 3 | Low Limit Torque Output. |
| 4 | Pass Limit Torque Output. |
| 5 | High Limit Torque Output. |
| 6 | Low Limit Angle Output. |
| 7 | Pass Limit Angle Output. |
| 8 | High Limit Angle Output. |
| 9 | Digital 0 V. |
| 10 | Tool Stop Output. |
| 11 | Analogue Output. |
| 12 | Analogue Output 2.5 V. |
| 13 | Analogue Output 0 V reference (Do not connect to a noisy electrical ground). |
| 14 | External Snug Trigger Input. |
| 15 | Not Used. |

External Print / Reset Input

Pins 1 & 2 are intended for use as an EXTERNAL PRINT / RESET:-



The switch must remain active for at least 200 mS. Screened cable is recommended.

Limit Outputs

Pins 3, 4, 5, 6, 7 & 8 are buffered logic outputs intended for Go/No Go control of external equipment. The limit outputs are referenced to Pin 9 (Digital 0 V). All limit outputs are active HIGH & change at 208 times per second.

The limit outputs change exactly with increasing torque, and at 0.5% of transducer capacity below the limit with decreasing torque. This eliminates the logic lines oscillating.

The Limit output current is, High = -0.8 mA, Low = 16 mA (not for direct control of relays).

NOTE: For more information see 'SPECIFICATION - LIMITS'.

Tool Stop Output

Tool Stop is used to provide a stop signal for an external pneumatic, hydraulic or electric tool. When the measured torque goes above the Tool Stop value (set in the Target Setup) this pin goes HIGH (5 V) with reference to pin 9.

Analogue Output

The analogue output is designed for connection to a control system. It is a true analogue value, so has a very fast frequency response of above 10 kHz. The calibration of the analogue output is factory set and not adjustable, it is not affected by the instrument calibration.

The analogue output is PIN 11.

If the output is measured against PIN 12 (2.5 V) the signal will swing positive for clockwise torque and negative for counter-clockwise torque.

If the output is measured against PIN 13 (0 V) the signal will always be positive, with zero torque around 2.5 V.

TIP: Some transducers (Norbar Annular type) will give a negative output change for a positive torque. This is because they are designed to measure reaction torque.

The output voltage is a function of the mV/V value. The larger the mV/V value the larger the analogue output voltage. At transducer capacity the analogue output voltage (in volts) is numerically equal to the mV/V value divided by 2.

TIP: To find mV/V value press 'TD#' button in measure screen or see transducer's calibration certificate.

Using 2.5V (PIN12) as a reference:

| Torque | Analogue Output (PIN 11) | | |
|--------------------------|--------------------------|------------|------------|
| | @ 1.0mV/V | @ 2.0 mV/V | @ 3.0 mV/V |
| - capacity of transducer | -0.5 V | -1.0 V | -1.5 V |
| Zero | 0.0 V | 0.0 V | 0.0 V |
| + capacity of transducer | +0.5 V | +1.0 V | +1.5 V |

Using 0V (PIN13) as a reference:

| Torque | Analogue Output (PIN 11) | | |
|--------------------------|--------------------------|------------|------------|
| | @ 1.0mV/V | @ 2.0 mV/V | @ 3.0 mV/V |
| - capacity of transducer | 2.0 V | 1.5 V | 1.0 V |
| Zero | 2.5 V | 2.5 V | 2.5 V |
| + capacity of transducer | 3.0 V | 3.5 V | 4.0 V |

TIP: The analogue output will not operate in sleep mode. If using the analogue output continuously then disable the feature (in Instrument Setup) by leaving the 'Sleep After' setting blank.

The accuracy of the analogue output is +/- 2% of voltage reading. For a more accurate output value the voltage can be externally scaled against the displayed torque.

External Snug Trigger Input

The external snug trigger is used to start the angle measurement; for external operation ensure the Target Setup has "Internal Snug Torque Trigger" UN-TICKED. Use logic 5V (HIGH) input with reference to pin 9 (0V).

Connector Type

15-way female 'D' type connector.

SPECIFICATION - SERIAL PORT

The serial port is for sending data to a PC or serial printer.

When is Data Sent?

When the T-Box XL™ is measuring data is sent:

1. When the 'SAVE' key is pressed.
2. When the AUTO RESET timer operates (if the 'SAVE' key has a green background).
3. When the "External Print / Reset Input" is used; see SPECIFICATION – ANCILLARIES.
4. When continuously logging.

What Data is Sent?

The data can include: Date, Time, Tool, Work ID, first character, torque limits, measured value, units of measurement, angle and line feed. The separator appears between each item.

Serial Port Options

See SETUP section.

Pin Connections

The port is configured as DTE (Data Terminal Equipment) and conforms to RS-232-C specifications. The transmitted data voltage levels are between +5 to +9 volts and -5 to -9 volts.

| Pin No | Function |
|--------|------------------------------------|
| 1 | Not Connected. |
| 2 | Received data (to T-Box XL™). |
| 3 | Transmitted data (from T-Box XL™). |
| 4 | Not Connected. |
| 5 | Signal ground 0 V. |
| 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.

T-Box XL™ with the serial port set to the factory defaults. Reading 1068.4 lbf-ft (clockwise).

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

NOTE: The maximum number of characters per line = 24.

Connector Type

9-way male 'D' type connector.

Connecting Lead

A 9-way female to 9-way female null modem connecting lead is required for connection to a PC with a 9-way male connector.

TIP: A null modem connecting lead is available from Norbar (Part Number 39264).

SPECIFICATION - USB

The T-Box XL™ has two Universal Serial Bus (USB) connectors:



| | | |
|---------------|---|--|
| To connect to | USB flash drive, USB mouse, USB keyboard, USB bar code scanner, USB hub, etc. | PC, using the lead supplied. For connection to TDMS software. |
| Maximum power | 1A | 0A |
| Version | 1.1 | 2.0 |
| Hi speed | N/A | 280 Mbps |
| Full speed | 12 Mbps | 12 Mbps |
| Low speed | 1.5 Mbps | 1.5 Mbps |

NOTE: The T-Box XL™ is not designed to send data directly to a USB printer. Pass the data to a PC, then to a USB printer.

When USB flash drive is used, files transferred are:

| Text File On Flash Drive | Purpose |
|--|---|
| xxxxxxAudit (Where xxxxxx is the T-Box XL™ serial number) | Holds the T-Box XL™ history including Test result data. |
| Instrument | Holds T-Box XL™ settings. |
| Targets | Holds Target settings. |
| Templates | Holds Tool Templates. |
| Tools | Holds My Tools. |
| Transducers | Holds Transducers. |

TIP: Instrument, Targets, Templates, Tools & Transducers can be transferred to another T-Box XL™ instrument.

1. Send files to flash drive.
2. Put flash drive into another T-Box XL™.
3. Send files from flash drive.

SPECIFICATION - MODES

Track



Display follows signal.



1st Peak



Used for Click wrenches.

Hold 1st peak for the 'AUTO RESET HOLD TIME', then reset.



If 'Manual Reset' is selected torque will be reset when 'Reset' pressed or external ancillaries reset input active.

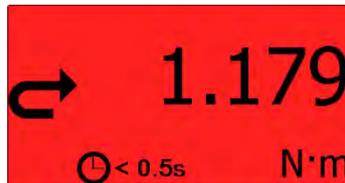
TIP: When calibrating ISO 6789:2017 Type II Torque tools, the standard calls for the time it takes to go from 80% to 100% of the target torque value shall be as follows:-

Type II Class D, E and F tools
Between 0.5s and 1.0s

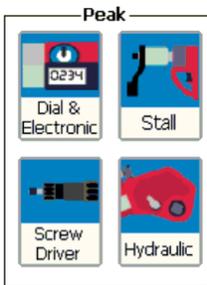
All other Type II tools

| Target torque | <10N·m | 10<100N·m | 100<1000N·m | ≥1000N·m |
|---------------|--------|-----------|-------------|----------|
| Minimum time | 0.5s | 1.0s | 1.5s | 2.0s |

If any readings are taken during a calibration, conformance test or uncertainty test of a Type II tool which don't comply with the above timings, an indicator will be displayed like this:-



Peak



For testing PneuTorques, Hydraulic tools, Screwdrivers, Dial wrenches, etc.

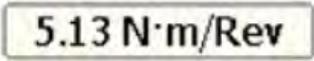
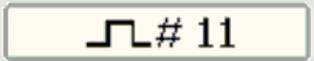
Hold the highest reading until reset.



If 'Auto Reset' is selected the hold time starts when the value goes below 0.5% of full scale at zero.

TIP: Use the 'ACTIVE FROM' setting to ignore small torque readings that are not required.

Extra Features

| Feature | Mode | Example | Comments |
|-------------|--|--|--|
| Torque rate | Click, Dial & Electronic, Stall and Hydraulic. |  Touch screen to select N·m/rev or N·m/°. | The torque applied per revolution (N·m/rev) or per degree (N·m/°), measured from the SNUG TORQUE value to the PEAK (or 1ST PEAK) TORQUE value. Requires: 1. Angle transducer. 2. Torque & Angle selected. 3. Target with Snug Torque set. 4. Target with Angle limits set. |
| Pulse count | Pulse and Screwdriver. |  | The number of pulses applied. Pulses are registered when the torque value passed through the active from threshold. |

Pulse



This mode is for PULSE TOOLS only.



WARNING: DO NOT USE WITH IMPACT TOOLS.



TIP: For best results, keep Filter Frequency = 2500Hz and Active From = 4.8%.

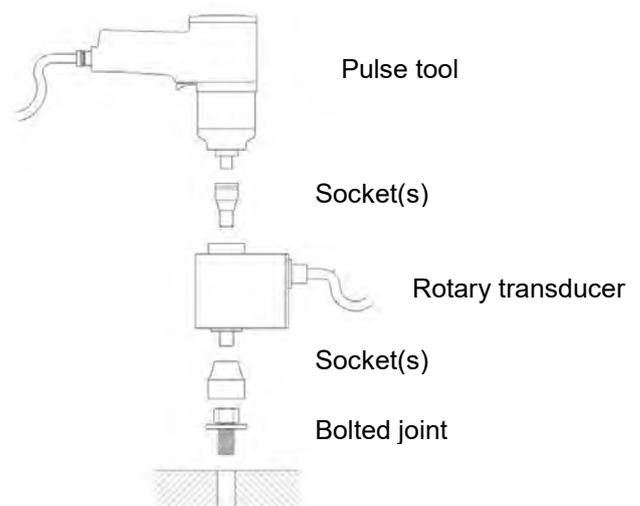
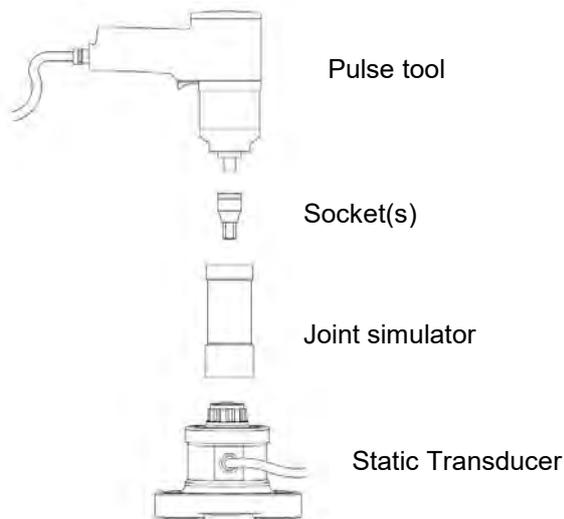
TIP: For best results work above 20% of transducer capacity.

Pulse tools use air to operate a hydraulic mechanism that applies torque in a series of pulses.

- The final torque depends on:
1. The air tool type.
 2. The tool speed / air pressure.
 3. The mass of the hydraulic mechanism.
 4. The number of sockets & drive shafts absorbing energy.
 5. The joint rate (hard or soft joint).

Each pulse is measured and software analysis is used to determine the work done by the pulse and so determine the torque achieved.

| Transducer Mounting Options | |
|---|--|
| Static Transducer Under Joint Simulator | Rotary Transducer In Front Of Bolted Joint |



Ensure rotary transducer brushes do NOT bounce.

Use a low mass rotary transducer to reduce the energy lost in accelerating the transducer with each pulse.

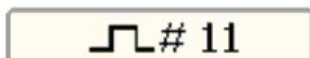
If the torque applied continually (e.g. with a torque wrench) the static transducer & rotary transducer match exactly.

Keep the number of sockets and adaptors to a minimum. The sockets and adaptors are accelerated with each pulse, which absorb energy that would be used to tighten the joint.

Ensure all sockets and adaptors have a tight fit. Any slack will result in lost energy, so less energy will be used to tighten the joint. Slack may also cause the sockets & adaptors to 'rattle'; this can cause extra pulses to be counted.

It is important that different operators use the tool in a consistent way. If a pulse tool is firmly pushed against the joint then slack in the sockets and adaptors may be reduced, this will result in a different amount of torque being applied.

Pulse count is shown:



Pulse Tool Joint Verification

Recommended method to verify the applied torque

1. Mark the bolt head against the mounting surface.
2. Place a torque transducer (static, rotary, electronic wrench, etc) on the bolt head.
3. Undo the bolt whilst measuring the PEAK torque (“UNDO” torque).
4. Re-tighten the bolt to the marked point whilst measuring the PEAK torque (“REDO” torque).

The REDO torque is a measure of the previously applied torque.

TIP: Why measure “UNDO” torque?

For a recently tightened bolt the “UNDO” torque is typically 60 to 70% of the tighten torque; this can be a useful check. The exact value depends on factors including joint type & friction.

Only if the bolt is old (rusty) or has been over stressed (galling has occurred) may the “UNDO” torque be larger than the original “TIGHT” torque.

Issues in attempting to verify the applied torque:

| Issue | Recommendation |
|------------------|---|
| Components | For best results tighten using all new components (bolt, washers, etc) and verify the applied torque directly after. Working with old components (that are used, worn, rusty, painted, etc) may well have an effect on accuracy. |
| Marking | Ensure the bolt is marked against a static surface; markings against a moveable part (e.g. a washer) will not work. Ensure tight bolt is marked with thin precise line between bolt & mounting surface. Place the mark at the position of the operator’s eye when the bolt is re-tightened to reduce line alignment errors. |
| Lever | Using a longer lever to re-tighten the bolt will give the operator more control when getting the marks to match. |
| Joint type | If the torque rate is low (“soft” joint) it is easier to align the marks and get a good “REDO” torque. If the torque rate is high (“hard” joint) a small error in bolt angle has a large effect on torque, so requires more operator care. |
| Friction | If the joint has a low friction coefficient the bolt advances smoothly to get a good “REDO” torque. If the joint has a high friction coefficient the bolt advances less smoothly, so requires more operator care. |
| Repeated testing | Every time the test is repeated errors can occur, these include: Less friction due to the initial ‘rough’ surfaces on the bolt & mounting thread being smoothed. More friction if the metals are over stressed (galling). A temperature rise leading to a change in friction. |

Pulse Mode Custom Setting

If the Pulse Mode readings are not close enough to the verified joint value, select ‘Custom Setting’ in Pulse Mode setup and enter an appropriate % value for the custom setting.

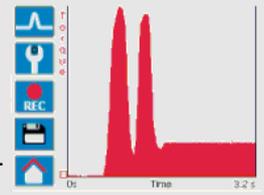
e.g. If the verified joint value is 15% higher than the standard Pulse Mode readings, select Custom Settings and enter a value of 15%.

The Custom Setting value can be set between -40% and +40% from the Standard Setting.

Graph



| Graph Mode | | |
|------------|-----------------|---|
| Step | Action | Option |
| 1 | Select type | Single event:  Automatic start / stop to capture 1 fast event. Graph starts when torque goes above the 'Active From' setting. Graph stops when torque goes below the 'Active From' setting. |
| | | Multi event:  Manual start / stop to capture 1 or more slower events. Graph starts when record (REC) pressed. Graph stops when stop pressed. |
| 2 | Graph data |  = Torque |
| | |  = Torque & Angle |
| 3 | Record |  |
| 4 | Measure | Display shows the graph being plotted in real time. |
| | | The number of samples taken, the current torque value and the highest value (Peak) are also reported on the display. |
| 5 | Stop |  |
| 6 | View | TOUCH screen to view torque against time. For angle transducers, angle against time is viewed. |
| | | For angle transducer: DOUBLE TAP screen to view Torque against angle (torque rate). DOUBLE TAP screen to view Torque against speed. |
| 7 | Save |  |
| 8 | Exit to measure |  |



TIP: The graph mode can record up to 10,000 points. Once 10,000 points are taken, the graph drops the first 1000 points and records another 1000 points.

TIP: If graph results are not detailed enough:
Increase SAMPLE RATE in graph mode SETUP.

TIP: The T-Box XL™ can store up to approximately 10 graphs, depending on the number of samples in each graph. If the T-Box XL™'s internal storage becomes full, the oldest files will be automatically deleted. It is therefore recommended to regularly transfer graphs to a PC using the TDMS program and manually delete the graphs from the T-Box XL™ to free up internal storage space.

SPECIFICATIONS – TARGETS

The T-Box XL™ has targets for both Torque and Angle value. Each Target has an Upper Limit and a Lower Limit.

| Torque Signal | Display Icons | Display Colour | Display Example | Serial Port | Ancillaries |
|-------------------|---|----------------|--|------------------|--------------------|
| At zero | None | YELLOW |  | LO | Logic output Pin 3 |
| Under lower limit |  | YELLOW |  | LO | Logic output Pin 3 |
| Within limits | None. | GREEN |  | OK | Logic output Pin 4 |
| Above upper limit |  | RED |  | HI | Logic output Pin 5 |
| Update rate | 3Hz | | 3Hz | With serial port | 208Hz |

TIP: The Ancillaries are updated quickly to give a fast response to an external control system.

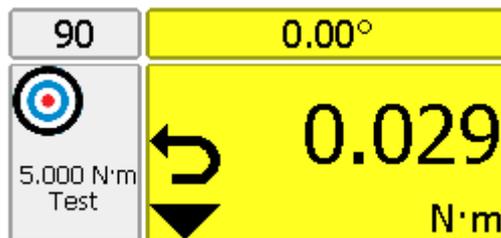
NOTE: This difference in update rate may lead to very small differences between the changeover points.

The limit operation is dependent on the measurement mode:

| Measurement Mode | Limit Operation |
|---|---|
| Track | Limits follow the transducer input and are not held. |
| Click Dial & Electronic Stall Pulse Screw Driver Hydraulic | Limits status is held until: SAVE is pressed or RESET is pressed or after the auto reset timer has operated. |

NOTE: For operation of limits in one direction only, the opposite direction will be shown as LO.

If an angle target is selected, the value is shown above the torque display.



TIP: The T-Box XL™ will automatically change torque units to those set by the limits.

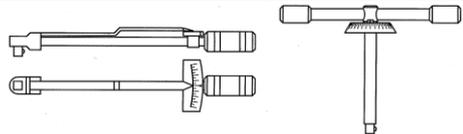
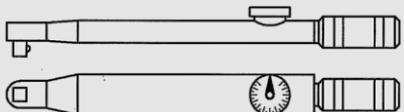
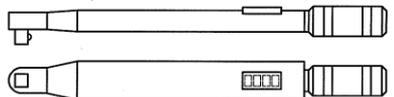
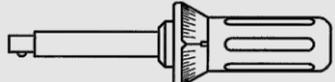
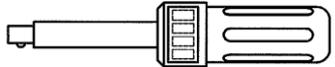
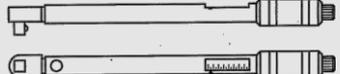
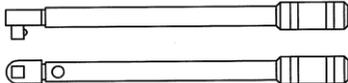
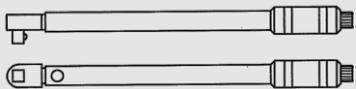
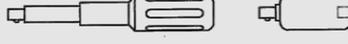
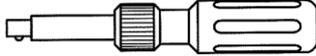
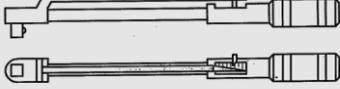
TIP: Limits can be setup in Custom Units for operation with transducers programmed with the same Custom units.

SPECIFICATION - HAND TORQUE TOOL CLASSIFICATION

The T-Box XL™ tool templates conform to ISO 6789:2017 classification for hand torque tools. A summary of the classifications are given below; for full details please refer to the ISO standard.

Tool Type I: Indicating torque tools (The torque exerted is indicated on scale, dial or display).

Tool Type II: Setting torque tools (A signal is given when the pre-set torque value is met).

| Type | Class | Description: | Example: |
|------|-------|---|--|
| I | A | Wrench, torsion or flexion bar. |  |
| | B | Wrench, rigid housing, with scale or dial or display. |  |
| | C | Wrench, rigid housing and electronic measurement. |  |
| | D | Screwdriver, with scale or dial or display. |  |
| | E | Screwdriver, with electronic measurement. |  |
| II | A | Wrench, adjustable, graduated or with display. |  |
| | B | Wrench, fixed adjustment. |  |
| | C | Wrench, adjustable, non-graduated. |  |
| | D | Screwdriver, adjustable, graduated or with display. |  |
| | E | Screwdriver, fixed adjustment |  |
| | F | Screwdriver, adjustable, non-graduated. |  |
| | G | Wrench, flexion bar, adjustable, graduated. |  |

Each TOOL TYPE has several classes to determine the number of set points, number of measurements & permissible deviation.

| Type | Class | Number of Set Points | Number of Measurements (at each point) | Permissible Deviation (+/- %) | |
|------|-------|----------------------|--|-------------------------------|--------------------------|
| | | | | Max Torque Value <= 10N·m | Max Torque Value > 10N·m |
| I | A | 3 | 5 | 6 | 6 |
| | B | 3 | 5 | 6 | 4 |
| | C | 3 | 5 | 6 | 4 |
| | D | 3 | 5 | 6 | 6 |
| | E | 3 | 5 | 6 | 4 |
| II | A | 3 | 5 | 6 | 4 |
| | B | 1 | 10 | 6 | 4 |
| | C | 1 | 10 | 6 | 4 |
| | D | 3 | 5 | 6 | 6 |
| | E | 1 | 10 | 6 | 6 |
| | F | 1 | 10 | 6 | 6 |
| | G | 3 | 5 | 6 | 6 |

The T-Box XL™ automatically calculates the limits to ISO 6789:2017 by the following method:

For ISO 6789-1:2017 Conformances Tests:-

$$\text{Deviation} = \frac{(\text{Displayed reading} - \text{Target value})}{\text{Target value}} \times 100$$

Example -
100 N·m Type II Class B with Permissible Deviation = ± 4%

Lower Limit = 96.0 N·m (96 – 100)/100 = - 4%
Upper Limit = 104.0 N·m (104 – 100)/100 = +4%

For ISO6789-2:2017 Calibrations:-

$$\text{Deviation} = \frac{(\text{Target value} - \text{Displayed reading})}{\text{Displayed reading}} \times 100$$

Example -
100 N·m Type II Class B with Expected measurement error = ± 3%

Note: ISO 6789-2:2017 calibrations don't use the 'Permissible Deviation' values from the above table, but use the 'Expected measurement error' value for the tool.
Also the 'Deviation' calculation is different for ISO 6789-1:2017 Conformance Tests and ISO 6789-2:2017 Calibrations.

Lower Limit = 97.09 N·m (100 – 97.09)/97.09 = +3%
Upper Limit = 103.09 N·m (100 – 103.09)/103.09 = -3%

MAINTENANCE

T-Box XL™ Calibration

Your T-Box XL™ has been supplied with a certificate of calibration. To maintain the specified accuracy it is recommended that the T-Box XL™ is recalibrated at least once per year. Re-calibration 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.

IMPORTANT: DO NOT REMOVE BACK PANEL OR CASE; THERE ARE NO CALIBRATION SETTINGS INSIDE.

Transducer Calibration

To maintain the specified accuracy it is recommended that transducers are recalibrated at least once per year. Re-calibration and repair should be carried out at Norbar or by a Norbar approved agent.

Battery Replacement

There are 2 batteries in this product. A custom battery pack for powering the T-Box XL™ (if the battery life is less than the specification it will require replacing) and a Coin cell to power the clock.

Batteries are to be replaced by Norbar or a Norbar approved agent.

Repair

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.

Do not remove the T-Box XL™ case; there are no parts for operator repair inside.

Cleaning

Do not use abrasives or solvent-based cleaners.

Product Disposal



This symbol on the product indicates that it must not be disposed of in the general waste.

Please dispose of according to your local recycling laws and regulations.

Contact your distributor or see the Norbar web site (www.norbar.com) for further recycling information.

Battery Disposal

This product contains 2 Batteries. Only dispose of batteries at end of product life.

To remove the batteries:

1. Switch off T-Box XL™ and remove DC input power.
2. Remove front transducer selection switch knob (2 mm Allen key needed).
3. Remove front transducer selection switch fixing nut and washer (11 mm hex socket needed).
4. Remove 8 back panel socket head cap screws (2.5 mm Allen key needed).
5. Ease back panel from case by pushing on the front transducer selection switch shaft.
6. Remove battery pack (from back panel) & button cell (from front PCB).

Batteries contain substances that can have a negative effect on the environment and human health. The crossed-out wheeled bin means that batteries must NOT be disposed of in the general waste. All batteries must be disposed of at a local waste battery collection point. The batteries do NOT contain mercury (Hg), cadmium (Cd) or lead (Pb). If the battery substances exceed the legal limits the battery would be marked with Pb, Cd or Hg.

TROUBLESHOOTING

Tips are located within the operator's manual to help with troubleshooting. Common problems are listed below:

| Problem | Likely Solutions |
|--|--|
| No T-Box XL™ display. | Check on/off switch is ON. In sleep – Press blue button on front. Charge battery for at least 1 minute. |
| T-Box XL™ only displays Logo. Battery only powers T-Box XL™ for a short time. | Connection to TDMS. Remove Serial lead (RS232). Charge battery for full charge time. Battery pack may need replacing. |
| Battery will not charge. | Check display has 'Mains' icon when charging. Check Power supply adaptor is ON (green light on adaptor will glow). Check electrical power supply and fuse in plug (if fitted). |
| Display background is RED. | Battery too low. Charge battery. |
| "TD1 Connect Transducer". | Non-smart transducer used. No transducer is detected or transducer cable faulty. |
| "TD1 Setup Transducer". | SMART transducer faulty. Return transducer to Norbar. |
| Date & Time not remembered. | The coin cell battery has failed. Return to Norbar. |
| Cannot zero transducer. | Ensure in TRACK mode. Transducer overstrain. Return defective transducer to Norbar. |
| Measurement modes do not function correctly. | Ensure the 'Active From' setting in Mode Setup is not too low or too high. |
| Password lost. | Contact Norbar. |
| T-Box XL™ locks up. | Turn off /on to reset configuration. |
| Click mode continuously triggers | Check the ZERO of the transducer in TRACK mode. |
| Cannot Transfer data to a USB stick | Do not use a USB U3 drive (Sandisk), the USB stick needs to be a standard one (like the one supplied with the T-Box XL™). |
| Cannot separate 'As Found' and 'As Left' calibrations when viewing results on T-Box XL™. | Enter the Work Id 'As Found' and perform the calibration, then enter the Work Id 'As Left' and perform another calibration. This will separate the results when viewing / deleting. |
| 'Program memory is very low' message appears | Usually caused by the internal storage exceeding its 4MB limit. Turn the T-Box XL™ off and on, transfer all test data to a PC or USB stick, and then delete the test data from the T-Box XL™. |

| Serial Port Problem | Likely Solutions |
|--|--|
| Serial data output is not communicating with other equipment. | <ol style="list-style-type: none"> 1. Check that the baud rate is set to the same as the receiving equipment. 2. Check that all serial port parameters (Data bits, Stop bits, Parity & Flow Control) on the T-Box XL™ and the receiving equipment match. 3. Check the correct null modem serial lead is being used. 4. Check if receiving equipment requires 'First Character' or limits removed or units removed. |
| Serial printer losing data. | The printer is too slow for the fast data output; need to slow down T-Box XL™. In 'Serial Port Setup' change "Line Delay" to a larger time. |
| Serial output is being overwritten. | Line feed required. In 'Serial Port Setup' change 'Output Line Feed' to 'TICK'. |
| Cannot communicate with Norbar 'Torque Wrench Calibration Software' (Part No 37705.XXX). | The software will not accept limit characters LO / OK / HI. In 'Serial Port Setup' change 'Output Limits' to 'UN-TICK'. |
| Serial data too slow. | Speed up by changing the LINE DELAY to 0 SECONDS. |
| Need to view serial output on PC. | Use the HyperTerminal® program found in Microsoft® Windows to view and store the serial output data. For more information see www.norbar.com and select FAQ. |

NOTE: For more complex faults please contact Norbar distributor / manufacturer.

GLOSSARY OF TERMS

| Word or Term | Meaning |
|---------------------------|---|
| # | Number |
| A.C. | Alternating current. |
| Active From | Value from which the memory modes operate. |
| Auto Reset Hold Time | The length of time a reading is displayed until automatically reset. |
| CAL | Calibration. |
| Capacity | Transducer full scale. |
| Custom Calibration | A calibration that is not to ISO 6789. |
| Custom Units | Allow load cells and other non-torque transducers to be used. |
| D.C. | Direct current. |
| ETS | Electronic Transducer System (obsolete product). |
| First Peak Sensitivity | The amount by which the reading must fall below the peak for the display to be held. |
| Frequency Response | Frequency value below which signals are passed. |
| Hz | Hertz, unit of frequency. |
| ISO 6789 | Hand torque tool ISO Standard. Has been updated from ISO 6789:2003 to ISO6789:2017, which is now in 2 parts. |
| ISO 6789-1:2017 | Part 1 of the latest version of the Hand torque tool ISO standard. Specifically refers to design conformance. |
| ISO 6789-2:2017 | Part 2 of the latest version of the Hand torque tool ISO standard. Specifically refers to calibration and measurement uncertainty. |
| KB | Kilobyte – Amount of memory. |
| mA (milliamp) | One thousandth of an amp (0.001A). |
| mAh (milliamp hour) | Rate of charge/discharge of a battery. |
| MB (Megabyte) | Amount of digital memory. |
| mS (millisecond) | One thousandth of a second (0.001 second). |
| mV (millivolt) | One thousandth of a volt (0.001 volt). |
| mV/V (millivolt per volt) | Ratio of millivolt output to voltage input. |
| My Tools | Database of the tools used. |
| NON-SMART | Standard mV/V transducer (NON-INTELLIGENT). |
| PC | Personal Computer. |
| Pulse Count | The number of torque pulses applied in Pulse mode or Screwdriver mode. |
| Sample Rate | Number of measurement samples taken in 1 second. |
| Sleep After | The time after, when not used, the T-Box XL™ goes to sleep; this will save battery power. |
| SMART | Serial Memory Automatic Recognition Transducer (INTELLIGENT). |
| SMART Transducer | A transducer that holds its own calibration data (INTELLIGENT). |
| Snug Torque | Torque value to start measuring angle. |
| Target | Torque or Angle value required. Each Target has an Upper Limit & a Lower Limit. |
| TDMS | Torque Data Management System – Software included for PC use. |
| Tool | A reference to the tool being calibrated or used. E.G: Torque wrenches, PneuTorques, Electric tools, Torque screwdrivers, etc. |
| Tool Templates | A template holding full details of the tool. All Norbar tools are included. |
| Torque Rate | The torque applied per revolution (N-m/rev); measured from the SNUG TORQUE value to the PEAK (or 1ST PEAK) TORQUE value. |
| USB | Universal Serial Bus. |
| V | Volts. |
| Work Id | Work identification - the reference to the task, application or job. E.g.: a bolted flange, engine cylinder head, vehicle wheel nuts, etc. |
| Zero Suppression | Value of torque that has to be achieved for the T-Box XL™ not to display zero. |

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