

## Measurement and Calibration – Glossary of Terms

The following information may help in selecting the appropriate measuring device for your needs.

### Accuracy

The precision of the instrument which can be reported in three ways.

1. By quoting the guaranteed tolerance as a percentage of the reading or indicated value, (eg. “0.5% of Reading”).
2. By quoting the guaranteed tolerance as a percentage of the full scale value of the instrument, (eg. 0.1% FS or 0.1% FSD).
3. By quoting a ‘class’ of device in accordance with BS7882:1997 “Method for calibration and classification of torque measuring devices”. (See page 90).

### Modes of Operation

**First Peak of Torque** - when a “click type” torque wrench signals that the set torque has been achieved, the applied torque will momentarily drop before climbing again. Generally the fastener stops rotating at point 1, and from a standstill, the breakaway torque to achieve further rotation of the fastener will be higher than point 3b. Only if the operator is very insensitive to the break point will the final tightening effort be incorrect.

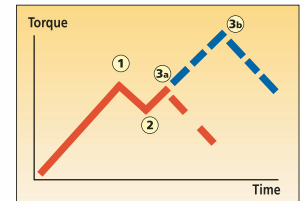
“First Peak of Torque” mode will detect the break point of the torque wrench, not the highest torque applied.

**Peak Torque** - this mode of operation will record the highest torque applied. In the case of a “click type” torque wrench this may be higher than the actual break point if the wrench continues to be loaded beyond the break.

Consequently, Peak Torque is more useful for calibrating devices without a break signal such as dial or electronic wrenches.

**Track** - this mode has no memory at all. When the load is removed the display will return to zero.

Track is used for calibrating the device itself or for monitoring a fluctuating torque.



- 1 = Torque wrench activates
- 2 = ‘Click’ heard
- 3a = Wrench released quickly
- 3b = Wrench released slowly

### Resolution

The smallest measurement interval that can be determined on the indicating device.

This applies to analogue and digital devices.

### Number of Digits

Digital displays are described as having a certain number of ‘digits’ or ‘active digits’.

Half digits can be used to increase the resolution of a device without the expense of going to an additional full active digit.

Eg 1. 1000 N.m displayed on a 4 digit system would read 1000 (resolution = 1 N.m).

Eg 2. 1000 N.m displayed on a 4½ digit system would read 1000.0 (resolution = 0.1 N.m).

Active digits change as the torque changes. Non active digits only assist in showing the magnitude of the torque. For example, 10,000 N.m requires 5 digits to display its magnitude.

Eg 3. With 4 active digits (and 1 passive digit), 10,000 N.m would change in steps of 10 N.m.

Eg 4. With 4½ or 5 active digits, 10,000 N.m would change in steps of 1 N.m.

### Signal Processing

Electronic Circuitry falls broadly into two types, analogue and digital, with most electronic measurement systems comprising a mixture of the two. There are also whole analogue electronic systems, but these are rare in torque measurement. Most systems start with an analogue signal. The point at which the signal is converted defines the type.

Analogue systems – one in which the signal is processed before being converted to digital.

Digital systems – the original analogue signal is converted to digital before processing.

## Static Torque Meter

The Static Torque Meter is a compact instrument designed to provide a quick and easy check for all types of torque wrench.

- Classification to BS7882:1997, typically Class 2 for the primary classification range (+/-1% of reading).
- Easy to read 200 mm (8 in) dial.
- Dial can be tilted to face the operator to maintain readability, whatever the wrench length.
- Colour coded, metric and imperial scales, reduce the possibility of conversion errors.
- Maximum reading pointer simplifies the checking of dial and bending beam type torque wrenches.
- Double ended drive spindle allows calibration of right handed and left handed torque tools.
- Suitable for wall and bench mounting.
- Suitable for checking some stall type nut runners.  
Not suitable for use with impulse or impact tools.

**Note:** Due to limitations in resolution in all analogue torque testers, accurate wrench calibration below 20% of full scale is not advised.



**Base Measurements:**

Width 150 mm  
Height 112 mm  
Length 335 mm

**Fixing Screw Centres:**

112 mm

**Weight:** 9 Kg

### Static Torque Meters

Model	Part No.	Range						Square Drive Adaptors
			Scale Sub-Divs		Scale Sub-Divs		Scale Sub-Divs	in
60	21020	2.5-60 N.m	0.5 N.m	2.5-46 lbf.ft	0.5 lbf.ft	25-625 Kgf.cm	5 Kgf.cm	⅜, ½
60/INS	21020.INS	2.5-60 N.m	0.5 N.m	30-550 lbf.in	5 lbf.in	25-625 Kgf.cm	5 Kgf.cm	⅜, ½
125	21021	5-125 N.m	1 N.m	5-92 lbf.ft	1 lbf.ft	50-1250 Kgf.cm	10 Kgf.cm	⅜, ½, ¾
250	21022	10-250 N.m	2 N.m	10-184 lbf.ft	2 lbf.ft	1-25 Kgf.m	0.2 Kgf.m	⅜, ½, ¾
500	21023	25-500 N.m	5 N.m	20-370 lbf.ft	5 lbf.ft	2.5-50 Kgf.m	0.5 Kgf.m	½, ¾, 1
1000	21024	50-1000 N.m	10 N.m	40-750 lbf.ft	5 lbf.ft	5-100 Kgf.m	1 Kgf.m	½, ¾, 1
2000	21025	100-2000 N.m	20 N.m	80-1500 lbf.ft	10 lbf.ft	10-200 Kgf.m	2 Kgf.m	½, ¾, 1
4000	21026	200-4000 N.m	40 N.m	160-3000 lbf.ft	20 lbf.ft	20-400 Kgf.m	4 Kgf.m	¾, 1, 1½

## TruCheck

### Simple, Cost Effective Torque Wrench Testing

The importance of keeping your torque tools in peak calibration condition is well established and the method that many businesses use to achieve this is to use a third party calibration service. However, how much more convenient would it be to perform calibration checks in-house? Wrenches could be checked more frequently, immediately if a problem is suspected, and wrenches would not need to leave site unnecessarily.

The main reasons that more companies do not perform calibration checks on their own wrenches are the cost of testers and fears over the complexity of the testing equipment. Norbar's new 'TruCheck' torque wrench testers aim to sweep aside these concerns. Both testers are very cost effective being significantly cheaper than most similar products on the market and the basic version of the TruCheck particularly is very simple to use.

The product comes in two versions: there is a basic version, simply called 'TruCheck' and a version with greater functionality called 'TruCheck Plus'.



### TruCheck

One of the concerns in putting a torque tester into an environment where people are not calibration specialists is that incorrect selections will be made with the potential of incorrect tool setting and consequently joint failure. Norbar's solution is to remove all choices from the operator. The TruCheck is for click type torque wrenches and comes with a single measurement unit (N.m or lbf.ft). There is only one button on the device and that is to zero the display. Operation is simplicity itself and it is virtually impossible to go wrong! TruCheck has an accuracy of +/-1% of reading over its operating range of 10 to 350 N.m or 25 to 250 lbf.ft and comes with a traceable calibration certificate.

TruCheck instruments are supplied as standard with a traceable calibration certificate for the clockwise direction. As an option, a traceable calibration certificate for the counter clockwise direction can be supplied. Also, as an option, UKAS calibration certificates from Norbar's laboratory can be supplied.



### TruCheck Plus

Accepting that some customers require more flexibility than the basic TruCheck, the 'Plus' adds a comprehensive range of features. With three modes of operation the TruCheck Plus is suitable for click wrenches, dial and electronic wrenches and in 'track' mode will continuously monitor the torque signal.

There are three torque units - N.m, lbf.ft and lbf.in.

TruCheck Plus also has a user selectable 'limit' feature. The operator sets the target torque and tolerance and the instrument will calculate whether the reading is within tolerance and indicate the result by illuminating one of three coloured LEDs: orange = low, green = OK, red = high.

Finally, TruCheck Plus has an RS-232 output and comes complete with an RS-232 cable. The reading, measurement unit and limit status (Low, OK or High) are output via RS-232.



### TruCheck

Model	Part No.	Range
TruCheck	43221	10 - 350 N.m
TruCheck	43226	10 - 250 lbf.ft
TruCheck Plus	43222	10 - 350 N.m

### Calibration Options

Part No.	Description
TCUKAS.CW	TruCheck UKAS Clockwise Calibration
TCUKAS.CW+CCW	TruCheck UKAS Clockwise and Counter Clockwise Calibration

## Professional Torque Tester (Pro-Test) – Series 2

The accuracy, ease of use and price competitiveness of the original Pro-Test instrument has made it the choice of many industrial, military and automotive customers worldwide. The 'Series 2' adds some unique features designed to make life easier and reduce the opportunities for error when calibrating torque wrenches.

### New Features

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and high indication both on the screen, and by coloured LEDs. Limit status is also output via RS-232-C. Target torque and tolerance can be set by the operator.
- ISO 6789 calibration mode automatically calculates the torque wrench calibration points and tolerance. All the user has to do is set the maximum calibration point for the wrench – the instrument does the rest for you!
- Memory function displays the 5 previous readings taken by the operator. For operators creating manual calibration certificates, there is no need to stop and write after each reading, hence speeding the process.
- Carry case is now a standard feature.
- RS-232 cable included as standard.



Pro-Test display and transducer in carry case.



Flexible mounting options of Pro-Test on Bracket, Part No. 62198



## Professional Torque Tester (Pro-Test) – Series 2

- Guaranteed classification to BS7882:1997, Class 1 or better over the primary calibration range (20% to 100% of full scale), Class 2 or better over the secondary calibration range (lowest calibrated value to 20% of full scale). Class 1 equates to  $\pm 0.5\%$  of reading.
- Three transducers are available in the range, up to 1500 N.m (1100 lbf.ft).
- Three essential operating modes allow the Pro-Test to be used with all torque wrench types: 'Track' displays the live value, 'Peak Memory' records the highest value and 'First Peak Memory' records the first peak of torque (for click type torque wrenches). Both memory modes can be used with manual or automatic reset.
- Large back lit display is easily visible from a distance and in poor light.
- All common units of torque measurement are included.
- User can select the language they wish to work in (most European languages are included).
- Transducer can be mounted for torque wrench operation in the horizontal or vertical plane.
- RS-232-C is included for the output of reading to a printer, PC, data capture unit, SPC software etc.
- Optional mounting plate, Part No. 62198 gives greater flexibility of mounting options.
- All user settable parameters are menu selectable from the front panel.
- As standard, all transducers are calibrated in a clockwise direction. For additional anti clockwise direction order Part No. PROTEST.CCW.



Measure Screen



Limit type selection

### Pro-Test

Model	Part No.	Operating Range	Calibrated Range	System Resolution	Input Hex A/F	Square Drive Adaptor
		N.m	N.m	N.m	mm	in
Pro-Test 60	43218	0 - 60	1.2 - 60	0.001	10	¼ + ⅜ + ½
Pro-Test 400	43219	0 - 400	8 - 400	0.01	22	⅜ + ½ + ¾
Pro-Test 1500	43220	0 - 1500	30 - 1500	0.1	36	¾

### Pro-Test Ancillaries

Part No.	Description
60253	12V DC Power Supply*
62198	Mounting Plate
PROTEST.CCW	Pro-Test Counter Clockwise Calibration

\* Option only necessary when powering from a 12V DC vehicle battery.

## Torque Screwdriver Tester (TST) – Series 2

The TST combines simplicity with up to date technology to provide a high quality instrument for the testing and calibration of low capacity torque tools.

Featuring an internal transducer complete with Rundown Fixture, the TST is available in 3 torque ranges, 0.04 to 2 N.m, 0.5 to 10 N.m and 1.25 to 25 N.m. Class 1 system accuracy over its Primary range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).

What makes the TST genuinely versatile is the interface for an external transducer. This interface, accessed by a 2 way switch in the TST, allows the connection of any transducer from Norbar's "SMART" range and most mV/V calibrated transducers from Norbar or other manufacturers.

Norbar is UKAS accredited for the calibration of electrical torque indicator displays and the TST is supplied with a calibration certificate. This ensures that each element of the system is fully traceable and interchangeable. The TST is also supplied with a UKAS torque calibration certificate for the complete system i.e. display and internal transducer.



Back Panel



TST in standard carry case.

## Torque Screwdriver Tester (TST) – Series 2

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and fail indication. Up to 12 target values can be set.
- Digital limit state output for control of external tools.
- Operation from fast charge internal battery pack (maximum time of 3 hours 20 minutes for full charge) or a.c. supply (90 to 264 Volts).
- RS-232-C serial data interface for connection to a printer or PC. Continuous RS 232 output when used in track mode (up to 11 readings per sec).
- Pulse count feature in Impulse mode and Clutch Tool mode.
- "SMART" intelligence for transducer recognition.
- Memory for calibration details of 20 non-"SMART" mV/V calibrated transducers.
- Analogue output allows the instrument to be used as part of a process control system for performance analysis.
- User selectable frequency response for each mode of operation.
- All user selectable features have password protection. The instrument can be issued to users with only the required modes of operation and units of measure enabled. This feature can virtually eliminate operator induced errors.
- Supplied in carry case.
- All common measurement units for torque are included plus users can configure their own units to interface with non torque transducers.



### TST

Model	Part No.	Range	
		N.m	lbf.in
TST 2	43212	0.04-2	0.4-20
TST 10	43213	0.5-10	5-100
TST 25	43214	1.25-25	12.5-250

### TST Ancillaries

Part No.	Description
60216.200	TST to 10 Way lead, for Norbar Rotary Transducers
60217.200	TST to 6 Way lead, for Norbar Static & Annular Transducers
TST.CCW	TST Counter Clockwise Calibration
50539*	Joint Simulator 2 N.m
50540*	Joint Simulator 10 N.m
50541*	Joint Simulator 25 N.m

\*The TST comes with a Rundown Fixture as standard. These Part No.s are for replacement or additional fixtures only.



Limit Setting Screen

### Accuracy when used with external transducer port:

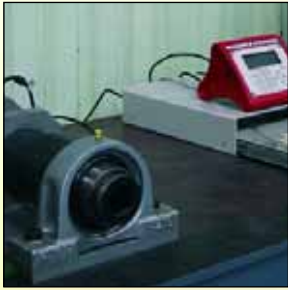
Input Voltage	Equivalent torque	Accuracy	Calibration uncertainty*
@0.5 mV	5% of full scale	±0.1% of reading	±0.13%
@1.0 mV	10% of full scale	±0.05% of reading	±0.08%
@2.0 to 18.9 mV	20% to 110% full scale	±0.05% of reading	±0.06%

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



Measure Screen

Resolution: 5 digits for all Norbar transducers.  
 Weight: 2.2 kg (4.8 lb).  
 Dimensions: 160 mm deep x 288 mm wide x 72 mm high.



## Torque Tool Tester (TTT) – Series 3

The TTT shares all of the extensive features of the TST except that it has no internal transducer. Instead, the TTT offers not one but three external transducer interfaces allowing any three transducers to be simultaneously connected. Selection between the transducers is made by a rotary switch at the back of the instrument case.

Any transducer from Norbar’s “SMART” range and most mV/V calibrated transducers from Norbar or other manufacturers can be connected to the TTT. The “SMART” feature means that once a transducer has been connected, the instrument will automatically recognise calibration details such as mV/V output, serial number and capacity.

Norbar is UKAS accredited for the calibration of electrical torque indicator displays and the TTT is supplied with a calibration certificate. This ensures that each element of the system is fully traceable and interchangeable.



Back panel



TST in standard carry case.  
STB 1000 Transducer also shown.

### Torque Tool Tester (TTT) – Series 3

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and fail indication. Up to 12 target values can be set.
- Digital limit state output for control of external tools.
- Operation from fast charge internal battery pack (maximum time of 3 hours 20 minutes for full charge) or a.c. supply (90 to 264 Volts).
- RS-232-C serial data interface for connection to a printer or PC. Continuous RS 232 output when used in track mode (up to 11 readings per sec).
- Pulse count feature in Impulse mode and Clutch Tool mode.
- “SMART” intelligence for transducer recognition.
- Memory for calibration details of 20 non-“SMART” mV/V calibrated transducers.
- Analogue output allows the instrument to be used as part of a process control system for performance analysis.
- User selectable frequency response for each mode of operation.
- All user selectable features have password protection. The instrument can be issued to users with only the required modes of operation and units of measure enabled. This feature can virtually eliminate operator induced errors.
- Supplied in carry case.
- All common measurement units for torque are included plus users can configure their own units to interface with non torque transducers.



### TTT

Part No.	Description
43228	Torque Tool Tester

### TTT Ancillaries

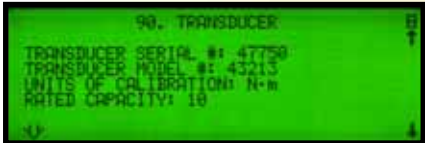
Part No.	Description
60216.200	TTT to 10 Way lead, for Norbar Rotary Transducers
60217.200	TTT to 6 Way lead, for Norbar Static & Annular Transducers
TTT.CCW	TTT Counter Clockwise Calibration

### Accuracy:

Input Voltage	Equivalent torque	Accuracy	Calibration uncertainty*
@0.5 mV	5% of full scale	±0.1% of reading	±0.13%
@1.0 mV	10% of full scale	±0.05% of reading	±0.08%
@2.0 to 18.9 mV	20% to 110% full scale	±0.05% of reading	±0.06%

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

Resolution: 5 digits for all Norbar transducers.  
 Weight: 1 Kg (2.2 lb).  
 Dimensions: 150 mm high x 200 mm wide x 180 mm deep.



Details of connected transducer displayed by pressing # key.



Language setting



## Flange Mounted Transducers - FMT

Flange Mounted Transducers incorporate mounting points for securely fixing the transducer to the working surface. The transducer lead is also included and is fitted with a high quality Lemo® connector, suitable for attachment to TST and TTT instruments.

- Classified to BS7882:1997, typically better than Class 1 for the primary classification range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).
- "SMART" – TST and TTT instruments will automatically recognise calibration details.
- Rundown Fixture is included on transducers up to 150 N.m (100 lbf.ft) allowing joint simulation for power tool testing.
- Supplied with UKAS calibration certificate.
- Transducers are supplied with precision made square drive adaptors.



### S.I Calibrated Transducers

Capacity	Part No.	Range	Square Drives Supplied - in
2 N.m	50671.xxx	0.04-2 N.m	$\frac{1}{4}$
10 N.m	50672.xxx	0.5-10 N.m	$\frac{1}{4}$
25 N.m	50673.xxx	1.25-25 N.m	$\frac{1}{4} + \frac{3}{8}$
150 N.m	50674.xxx	7.5-150 N.m	$\frac{3}{8} + \frac{1}{2}$
400 N.m	50675.xxx	20-400 N.m	$\frac{1}{2} + \frac{3}{4}$
1500 N.m	50676.xxx	30-1500 N.m	$\frac{1}{2} + \frac{3}{4} + 1$

### Imperial Calibrated Transducers

Capacity	Part No.	Range	Square Drives Supplied - in
20 lbf.in	50677.xxx	0.4-20 lbf.in	$\frac{1}{4}$
100 lbf.in	50678.xxx	5-100 lbf.in	$\frac{1}{4}$
250 lbf.in	50679.xxx	12.5-250 lbf.in	$\frac{1}{4} + \frac{3}{8}$
100 lbf.ft	50680.xxx	5-100 lbf.ft	$\frac{3}{8} + \frac{1}{2}$
250 lbf.ft	50681.xxx	12.5-250 lbf.ft	$\frac{1}{2} + \frac{3}{4}$
1000 lbf.ft	50682.xxx	20-1000 lbf.ft	$\frac{1}{2} + \frac{3}{4} + 1$

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50671.LOG). For connection to a non Norbar instrument or when a m/VV certificate is required, select .IND.

### Rundown Nose Assemblies for Flange Mounted Transducers

Part No.	Range	A/F Size of Hex Screws
50539	0.04 – 2 N.m 0.4 – 20 lbf.in	$\frac{1}{4}$ "
50540	0.5 – 10 N.m 5 – 100 lbf.in	$\frac{1}{4}$ "
50541	1.25 – 25 N.m 12.5 – 250 lbf.in	$\frac{1}{4}$ "
50692	7.5 – 150 N.m 5 – 100 lbf.ft	14 mm

The above Rundown Assemblies are supplied with the Flange Mounted Transducer as standard, but can also be ordered separately.



2 N.m Transducer

150 N.m Transducer

Large Mounting Bracket, Part No. 62220 suitable for 150 N.m to 1500 N.m Transducers

Small Mounting Bracket, Part No. 62221 suitable for 2 N.m to 400 N.m Transducers

### “SMART” Torque Block – STB

- Classified to BS7882:1997, typically better than Class I for the primary classification range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).
- “SMART” – TST and TTT instruments will automatically recognise calibration details.
- Supplied with UKAS calibration certificate.

There are two models, STB1000 and STB3000. Transducer Lead is incorporated and is terminated in a Lemo® connector suitable for the TST and TTT.

### S.I. Calibrated Transducers

Capacity	Part No.	Range	Square Drives - in
STB1000	50683.xxx	20-1000 N.m	$\frac{1}{2} + \frac{3}{4}$
STB3000	50684.xxx	150-3000 N.m	$\frac{3}{4} + 1$

Select part no. suffix .LOG if the transducer is to be connected to TST and TTT (example: .LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

### Rundown Nose Assemblies for STB1000

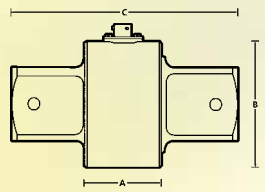
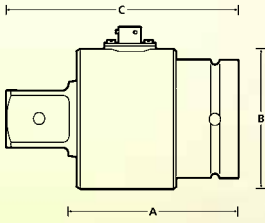
Part No.	Range	A/F Size of Hex Screws - mm
50693	10 – 140 N.m 10 – 100 lbf.ft	12
50694	100 – 700 N.m 70 – 500 lbf.ft	19



## Static Torque Transducer

The accuracy and quality of the Norbar Static Torque Transducers has made them the first choice of many calibration laboratories throughout the world.

- Up to 5000 N.m (5000 lbf.ft) classified to BS7882:1997, typically better than Class 1 for the primary classification range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).
- Robust, heat treated, alloy steel torsion shaft design.
- Designed to ignore non torsional forces.
- Operates in clockwise and anti-clockwise directions.
- Calibration up to 5000 N.m (lbf.ft) with UKAS Certificate, above 5000 N.m (lbf.ft) with a traceable calibration certificate.
- Calibrated in clockwise direction as standard. Anti-clockwise calibration provided on request.
- 'SMART' transducers have built in memory circuit which contains essential information about the transducer. This information can be read by Norbar's TST and TTT instruments meaning that when the transducer is connected, it is immediately recognised and ready for use. When ordering for a TST or TTT, use part no. suffix '.LOG' (eg. 50659.LOG) if you require a torque units calibration certificate.
- 'SMART' transducers can also be used with many instruments not of Norbar manufacture. However, these will operate as normal ratio calibrated (mV/V) transducers – the 'SMART' data will not be read. For non Norbar instruments or for when a mV/V certificate is required, use part code suffix '.IND'.



### S.I Calibrated Transducers

Capacity	Part No.	Sq. Drive	Dimensions (mm)			Bench Stand
		in	A	B Ø	C	
1 N.m	50587.IND*	¼ m/f	79	36.5	86	50211
2.5 N.m	50588.xxx	¼ m/f	79	36.5	86	50211
5 N.m	50589.xxx	¼ m/f	79	36.5	86	50211
10 N.m	50590.xxx	¼ m/f	79	36.5	86	50211
25 N.m	50591.xxx	⅜ m/f	79	36.5	89.5	50212
50 N.m	50592.xxx	⅜ m/f	79	36.5	89.5	50212
100 N.m	50593.xxx	½ m/f	79	36.5	92.8	50213
250 N.m	50594.xxx	½ m/f	79	36.5	92.8	-
250 N.m	50701.xxx	¾ m/f	118	54	141	50220
500 N.m	50596.xxx	¾ m/f	118	54	141	50220
1000 N.m	50597.xxx	1 m/f	118	54	146	50221
2500 N.m	50703.xxx	1½ m/f	117	95	160	50127
5000 N.m	50599.xxx	1½ m/f	117	95	160	50127
7000 N.m	50669.xxx	1½ m/f	117	95	160	50127
10000 N.m	50600.xxx	2½ m/f	125.5	124	189	-
25000 N.m	50603.xxx	2½ m/m	68.5	110	200	-
25000 N.m	50602.IND*	2½ m/f	125.5	127	189	-
50000 N.m	50604.xxx	2½ m/f	125.5	127	189	-
100000 N.m	50607.xxx	3½ m/m	98	165	271	-

\*Not suitable for TST and TTT.

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50588.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

Static Torque Transducer



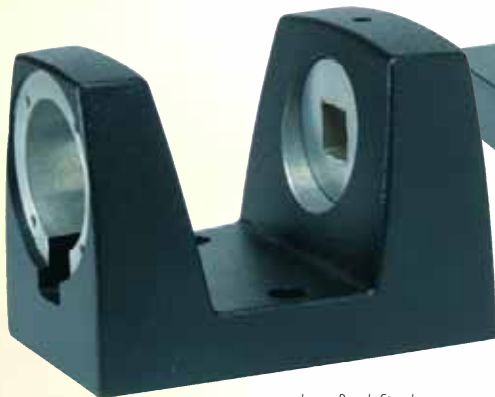
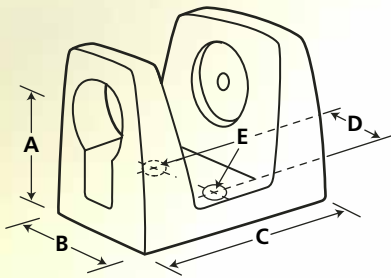
Imperial Calibrated Transducers

Capacity	Part No.	Sq. Drive	Dimensions (mm)			Bench Stand
		in	A	B Ø	C	
100 ozf.in	50609.IND*	¼ m/f	79	36.5	86	50211
1000 ozf.in	50616.xxx	¼ m/f	79	36.5	86	50211
10 lbf.in	50610.IND*	¼ m/f	79	36.5	86	50211
25 lbf.in	50612.xxx	¼ m/f	79	36.5	86	50211
50 lbf.in	50614.xxx	¼ m/f	79	36.5	86	50211
100 lbf.in	50617.xxx	¼ m/f	79	36.5	86	50211
250 lbf.in	50619.xxx	⅜ m/f	79	36.5	89.5	50212
500 lbf.in	50621.xxx	⅜ m/f	79	36.5	89.5	50212
1000 lbf.in	50623.xxx	½ m/f	79	36.5	92.8	50213
1 lbf.ft	50611.xxx	¼ m/f	79	36.5	86	50211
2.5 lbf.ft	50613.xxx	¼ m/f	79	36.5	86	50211
5 lbf.ft	50615.xxx	¼ m/f	79	36.5	86	50211
25 lbf.ft	50620.xxx	⅜ m/f	79	36.5	89.5	50212
50 lbf.ft	50622.xxx	⅜ m/f	79	36.5	89.5	50212
100 lbf.ft	50624.xxx	½ m/f	79	36.5	92.8	50213
250 lbf.ft	50625.xxx	½ m/f	79	36.5	92.8	-
250 lbf.ft	50702.xxx	⅜ m/f	118	54	141	50220
500 lbf.ft	50627.xxx	⅜ m/f	118	54	141	50220
1000 lbf.ft	50628.xxx	1 m/f	118	54	146	50221
2500 lbf.ft	50704.xxx	1½ m/f	117	95	160	50127
5000 lbf.ft	50630.xxx	1½ m/f	117	95	160	50127
10000 lbf.ft	50632.xxx	2½ m/f	125.5	124	189	-
25000 lbf.ft	50635.xxx	2½ m/m	68.5	110	200	-
25000 lbf.ft	50634.xxx	2½ m/f	125.5	127	189	-
50000 lbf.ft	50636.xxx	3½ m/m	98	165	271	-
100000 lbf.ft	50637.xxx	3½ m/m	98	165	271	-

\* Not suitable for TST and TTT  
 Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50616.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

## Bench Stands

- Ensures the correct mounting of Norbar's Static Torque Transducers up to 5000 N.m (5000 lbf.ft).
- All bench stands (except Extra Large) are machined to accept Norbar Rundown Nose Assemblies (Joint simulators) for power tool testing and calibration.
- For transducers in the range 1 N.m to 10 N.m (100 ozf.in to 100 lbf.in), Torque Limiting Bench stands are available. These are designed to prevent transducer over-load.
- All 'Small Frame Size' Bench Stands can be mounted horizontally or vertically.



Large Bench Stand



Extra Large Bench Stand

## Transducer Bench Stands

Part No.	Model Description	Sq. Drive	Dimensions (mm)				
		in	A	B	C	D	EØ
60210	Torque Limiting (set to 1.6 N.m)	¼	50	65	96	56	8.5
60211	Torque Limiting (set to 8.1 N.m)	¼	50	65	96	56	8.5
60212	Torque Limiting (set to 16 N.m)	¼	50	65	96	56	8.5
50211	Small Frame Size (10 N.m)	¼	50	65	96	56	8.5
50212	Small Frame Size (50 N.m)	⅜	50	65	96	56	8.5
50213	Small Frame Size (100 N.m)	½	50	65	96	56	8.5
50220	Large Frame Size (500 N.m)	¾	70	87	150	79	13.5
50221	Large Frame Size (1000 N.m)	1	70	87	150	79	13.5
50127	Extra Large Size (5000 N.m)	1½	105	280	152	240	16.5

### Joint Simulation Rundown Assemblies

The Norbar Rundown Assemblies are designed to simulate the working conditions of screwed or bolted joints. Used in conjunction with a Norbar transducer, bench stand and display instrument, the output of torque controlled power tools can be measured against a range of simulated joint rates, from hard through to soft.

- Suitable for a wide variety of power tools including pneumatic/electric screwdriver and angle wrenches with either clutch or stall torque control.
- Models available for torques from 0.2 N.m to 500 N.m (2 lbf.in to 500 lbf.ft).
- Spring washers and full instructions are provided to simulate a wide range of joint types as detailed in: BS6268:1982 , BS6544:1981, ISO5393:1981.



### Joint Simulators for Static Transducers

Part No.	Socket	Range	Bench Stand Required	A/F Size of Hex Screws - mm
	in			
50313	¼	0.2 - 2 N.m 2 - 20 N.m	50211	5
50251	¼	2 - 10 N.m 20 - 100 lbf.in	50211	5
50252	⅜	5 - 50 N.m 5 - 50 lbf.ft	50212	8
50253	½	10 - 100 N.m 10 - 100 lbf.ft	50213	10
50254	¾	100 - 500 N.m 100 - 500 lbf.ft	50220	19



### Rundown Fixture RD 5000

The RD5000 is designed for testing the output of powered torque controlled tools up to 5000 lbf.ft (6800 N.m). A suitable 1½” square drive Norbar Static Transducer, Lead and Display Instrument are also required for a complete system. For testing tools up to 1500 N.m, please order the alternative washer stack, part number 50548.2.

### RD 5000 and Ancillaries

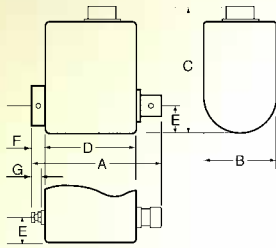
Part No.	Description
50548	135 - 6780 N.m (100 - 5000 lbf.ft) Rundown Fixture
50548.1	Nut and Bolt Kit UNC
50548.2	Washer Stack 1500 N.m



## Rotary Torque Transducer

These transducers are designed to measure the torque output from rotating shafts, particularly torque controlled power tools including impulse wrenches.

- Classified to BS7882:1997, typically better than Class 1 for the primary classification range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).
- "SMART" – TST and TTT instruments will automatically recognise calibration details.
- Supplied with UKAS calibration certificate.
- Designed to give excellent performance with impulse tools.
- Optional angle measurement – contact Norbar for details.



### Rotary Torque Transducers – S.I. Calibration

Capacity	Part No.	Sq. Drive	Maximum RPM*		Dimensions (mm)						
		in	Continuous	Intermittent	A	B	C	D	E	F	G
5 N.m	50708.xxx	1/4" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
20 N.m	50709.xxx	1/4" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
20 N.m	50710.xxx	1/4" m/f	5000	11000	71.5	30	71.5	56	13	6	-
75 N.m	50711.xxx	3/8" m/f	5000	11000	77	30	74	56	15	8	-
200 N.m	50712.xxx	1/2" m/f	2500	7600	87	42	82.5	58	21	12	-
250 N.m	50713.xxx	3/4" m/f	2000	5000	106	52	93.5	60	26	21	-
500 N.m	50714.xxx	3/4" m/f	2000	5000	106	52	93.5	60	26	21	-
1500 N.m	50715.xxx	1" m/f	1000	4400	125	63	104	64.5	31.5	29	-

### Rotary Torque Transducers – Imperial Calibration

Capacity	Part No.	Sq. Drive	Maximum RPM*		Dimensions (mm)						
		in	Continuous	Intermittent	A	B	C	D	E	F	G
50 lbf.in	50717.xxx	1/4" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
15 lbf.ft	50718.xxx	1/4" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
15 lbf.ft	50719.xxx	1/4" m/f	5000	11000	71.5	30	71.5	56	13	6	-
50 lbf.ft	50720.xxx	3/8" m/f	5000	11000	77	30	74	56	15	8	-
150 lbf.ft	50721.xxx	1/2" m/f	2500	7600	87	42	82.5	58	21	12	-
200 lbf.ft	50722.xxx	3/4" m/f	2000	5000	106	52	93.5	60	26	21	-
300 lbf.ft	50723.xxx	3/4" m/f	2000	5000	106	52	93.5	60	26	21	-
1000 lbf.ft	50724.xxx	1" m/f	1000	4400	125	63	104	64.5	31.5	29	-

\* Continuous is defined as 100% usage at the given speed in either direction and intermittent as usage 10% of the total time at the given speed.

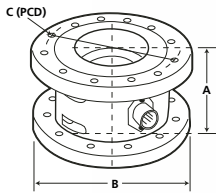
## Annular Torque Transducer 72mm Series, Standard Series and Small Diameter Series

These Annular transducers are designed to fit directly to Norbar gearboxes (Pneutorque and Handtorque) and will accurately measure the torque output via a display instrument.

Up to 5000 N.m (5000 lbf.ft) classified to BS7882:1997, typically better than Class 1 for the primary classification range ( $\pm 0.5\%$  of reading from 20% to 100% of full scale).



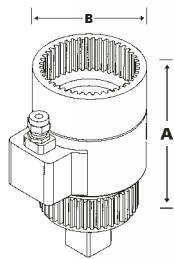
### Transducers for Remote 72mm Series and HT-72 Multipliers



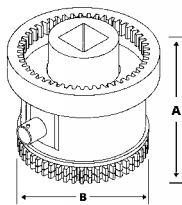
Standard Series

Capacity	Part No.	Dimensions (mm)		
		A	B	C
1000 N.m	50666.xxx	73	117	64.30
1500 N.m	50667.xxx	73	117	64.30
2000 N.m	50668.xxx	73	117	64.30

### Annular Torque Transducers – S.I. Calibration



PT72, PT4500 & HT45 type



Small Diameter Series

Capacity	Part No.	Sq. Drive	To Fit Tool	Dimensions (mm)		
		in	(HT/PT)	A	B Ø	C
1000 N.m	50638.xxx	3/4	1, 1A & 2	61	108	99.06
1500 N.m	50639.xxx	1	1, 1A & 2 (All HD Type*)	61	108	99.06
2500 N.m	50640.xxx	1	5	79.5	119	99.06
2500 N.m	50642.xxx	1 1/2	6	79.5	119	99.06
3000 N.m	50662.xxx	1	HT30 & PT2700	82	108	-
3500 N.m	50641.xxx	1	5	79.5	119	99.06
3500 N.m	50700.xxx	1 1/2	6	79.5	119	99.06
4500 N.m	50664.xxx	1	HT45 & PT4500	128.5	85	-
5000 N.m	50643.xxx	1 1/2	7	83	144	125.00
6000 N.m	50663.xxx	1 1/2	HT60 & PT5500	88	120	-
10000 N.m	50644.xxx	1 1/2	9	90	184	152.40
20000 N.m	50645.xxx	2 1/2	11	97	212	195.00
50000 N.m	50646.xxx	2 1/2	13	126	315	290.00
100000 N.m	50647.xxx	3 1/2	14	126	315	290.00

### Annular Torque Transducers – Imperial Calibration

Capacity	Part No.	Sq. Drive	To Fit Tool	Dimensions (mm)		
		in	(HT/PT)	A	B Ø	C
1000 lbf.ft	50648.xxx	3/4	1, 1A & 2	61	108	99.06
1500 lbf.ft	50649.xxx	1	1, 1A & 2 (All HD Type*)	61	108	99.06
2500 lbf.ft	50650.xxx	1	5	79.5	119	99.06
2500 lbf.ft	50651.xxx	1 1/2	6	79.5	119	99.06
5000 lbf.ft	50652.xxx	1 1/2	7	83	144	125.00
7000 lbf.ft	50653.xxx	1 1/2	9	90	184	152.40
15000 lbf.ft	50654.xxx	2 1/2	11	97	212	195.00
50000 lbf.ft	50655.xxx	2 1/2	13	126	315	290.00
50000 lbf.ft	50656.xxx	3 1/2	14	126	315	290.00
75000 lbf.ft	50657.xxx	3 1/2	14	126	315	290.00

\*Gearbox must be fitted with Heavy Duty (HD) final carrier.

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50638.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.



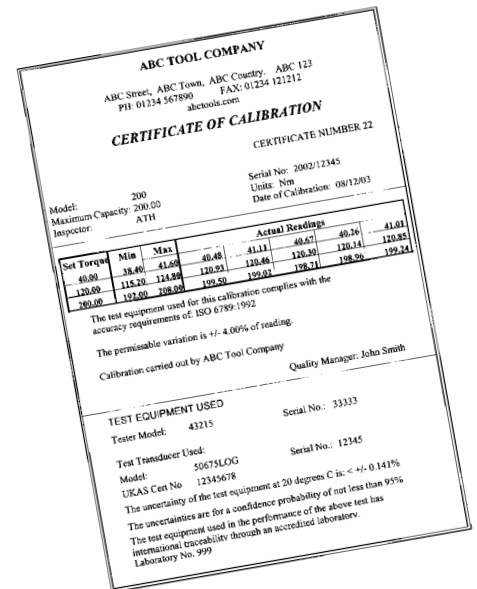
## Calibration Certificate Software

This easy to use software allows data from a Norbar torque measuring instrument to be downloaded onto a PC and formatted as a torque calibration certificate. This software can be downloaded free of charge from Norbar's website, [www.norbar.com](http://www.norbar.com).

- Certificate can be customised with the laboratory's own name and contact details.
- The certificate format complies with the requirements of ISO 6789.
- The software steps the operator through the calibration process making it very simple to use.
- A certification number is automatically generated. Certificates are filed and can be easily retrieved.

Note: Because the best way to enter data onto the certificate is via the RS232 output of the measurement instrument, it is strongly recommended that a Serial Data Lead Kit, Part number 60248, is purchased, see details below.

Certificate Software Part No.: 37705



## Serial Data Lead Kit

This kit enables Norbar Pro-Test, TST and TTT instruments to connect to most PCs and RS232 printers.

Kit contains 1 of each of the following:

- 9 way 'D' socket to 9 way 'D' socket, null modem.
- 25 way 'D' plug to 9 way 'D' socket.
- 25 pin gender changer, socket to socket.
- 9 pin gender changer, plug to plug.

A Guide Book, Part No. 34256, is available on the Norbar Web Site, [www.norbar.com](http://www.norbar.com) (select Frequently Asked Questions, FAQs). It provides comprehensive information on RS-232 data transmission both in general and specifically how it is applied to Norbar instruments.

Lead Kit Part No.: 60248.

## Transducer Leads

Part No.	Description	For use with
60152.225	ETS to 6 way transducer	Post 1994 ETS and 5 way Switch Box Model 60163
51067.225	ETS to 6 way transducer	Pre 1994 ETS and 5 Way Switch Box Model 60055
60217.200	Pro-Log, TST & TTT to 6 way transducer	All 'Smart' Static and Annular transducers
60216.200	Pro-Log, TST & TTT to 10 way transducer	All Rotary transducers with .IND or .LOG Part No. suffix
60223.200	Pro-Log, TST & TTT to no connector	Non Norbar transducers
60225.200	6 way transducer to no connector	Norbar 6 way connector to a non Norbar instrument
60224.200	10 way to no connector	Norbar Rotary transducer to a non Norbar instrument

The Part No. suffix indicates the length of the cable, ie. 225 is 225cm (2.25m). Other cable lengths available on request. Please use suffix to indicate required length (preferably in whole meter increments).

## Harsh Environment Range (HE)

Norbar has developed a range of measurement and calibration equipment that has been tested to conform with EN 60529: 1992.

Rated to IP65/IP67 the products are aimed specifically for use in harsh environments.

Particularly suited for use in the Offshore and Power Generation industries, the combination of high quality components, sound design and many years field experience allow calibration and control in previously restrictive areas.

The IP65/IP67 rating gives the product protection against dust ingress, pressurised water jet and complete water immersion to a 1 metre depth for a 30 minute period.

The HE range provides a fully traceable system to National calibration standards through Norbar's own UKAS accredited laboratory.

### Key features

- IP65/67 rated.
- Stainless steel transducer design with 'SMART' intelligence.
- Bi-Direction calibration for both instrument and transducer.
- Class 1 accuracy over the 'Primary' classification range (+/-0.5% of reading from 20 to 100% of full scale).
- Battery power for use in harsh environments (mains supply for charging).
- Continuous RS-232 output.
- Analogue output.
- Limit indication for up to 8 user defined target values.
- HE transducers are available in both static and annular transducer designs.
- Supplied in a water tight carry case.

### HE Transducers

Part No.	Description
50736.xxx	500 N.m Static Transducer 3/4" M/F sq. dr.
50737.xxx	500 lbf.ft Static Transducer 3/4" M/F sq. dr.
50738.xxx	1000 N.m Static Transducer 3/4" M/F sq. dr.
50739.xxx	1000 lbf.ft Static Transducer 3/4" M/F sq. dr.
50705.xxx	5000 N.m Static Transducer 1 1/2" M/F sq. dr.
50729.xxx	5000 N.m Static Transducer 1 1/2" M/M sq. dr.
50706.xxx	5000 lbf.ft Static Transducer 1 1/2" M/F sq. dr.
50730.xxx	5000 lbf.ft Static Transducer 1 1/2" M/M sq. dr.
50726.xxx	25000 N.m Static Transducer 3 1/2" M/M sq. dr.
50727.xxx	40000 N.m Static Transducer 3 1/2" M/M sq. dr.
50744.xxx	100000 N.m Static Transducer 3 1/2" M/M sq. dr.
50743.xxx	100000 lbf.ft Static Transducer 3 1/2" M/M sq. dr.
50745.xxx	3500 N.m Annular Transducer
50725.xxx	10000 N.m Annular Transducer

Other Transducers available on request.



5000 N.m Static Transducer



Back panel. Two connector covers removed for illustration.



### HE Instrument and Ancillaries

Part No.	Description
43217	TTL-HE instrument
60245.200	HE transducer Lead
60250.200	HE Inst to Standard Smart Static TD Lead
60263.200	HE Inst to Standard Smart Rotary TD Lead
60266.200	HE Transducer to TTTT/TST Lead
60256.200	Serial Data Lead for TTL-HE to no connector
60257.200	Ancillaries output lead for TTL-HE to no connector

## Torque Wrench Loader TWL1500

The design of the TWL1500 includes features that will provide an accurate and cost effective method for the calibration or testing of torque wrenches.

Designed to suit the majority of torque wrenches available with a torque value between 1 to 1500 N.m, the TWL1500 has been manufactured using quality materials that will provide many years of continuous, trouble-free operation.

The most significant feature of the TWL1500 is its compatibility with our wide range of Flange Mounted, Pro-Test and Smart Torque Block transducers. All fixtures, fastener kits and instructions are supplied allowing for complete flexibility and functionality.



With Pro-Test



TWL1500 shown with Flange Mounted Transducers, TTT and Model 1000 torque wrench

### TWL1500 Torque Wrench Loader - Part No. 60246

Transducer Mounting Position	Transducer Options	Transducer Part No.	Calibrated Range	Torque Wrench	
				min	max
<b>With FMT Range (see main photograph)</b>					
Position 1	FMT10	50672.LOG	0.5-10 N.m	145mm	1310mm
-	FMT25	50673.LOG	1.25-25 N.m	145mm	1310mm
Position 2	FMT150	50674.LOG	7.5-150 N.m	240mm	1405mm
-	FMT400	50675.LOG	20-400 N.m	240mm	1405mm
Position 3	FMT1500	50676.LOG	30-1500 N.m	336mm	1500mm
<b>With Pro-Test</b>					
Position 1	Pro-Test 400	43219	8-400 N.m	240mm	1405mm
-	Pro-Test 1500	43220	30-1500 N.m	240mm	1405mm
Position 2	Pro-Test 1500	43220	30-1500 N.m	336mm	1500mm
<b>With STB1000</b>					
Position 1	STB1000	50683.LOG	20-1000 N.m	240mm	1405mm
Position 2	STB1000	50683.LOG	20-1000 N.m	336mm	1500mm

Note 1: Min and Max torque wrench lengths are from the square drive to the centre of the handle.

Note 2: Position 1 is closest to the loading carriage and position 3 is furthest away.



With STB1000

#### Dimensions

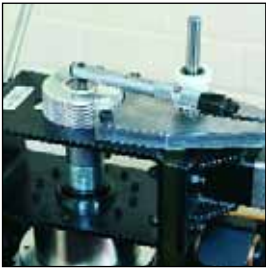
Max Width: 753 mm  
(inc. handle & instrument tray)

Max Height: 342 mm  
(excluding instrument)

Max Length: 1721 mm



ISO 1000



ISO 1000 fitted with Small Reaction Plate, Part No. 20588.

## Torque Wrench Loader ISO 1000 and 2000

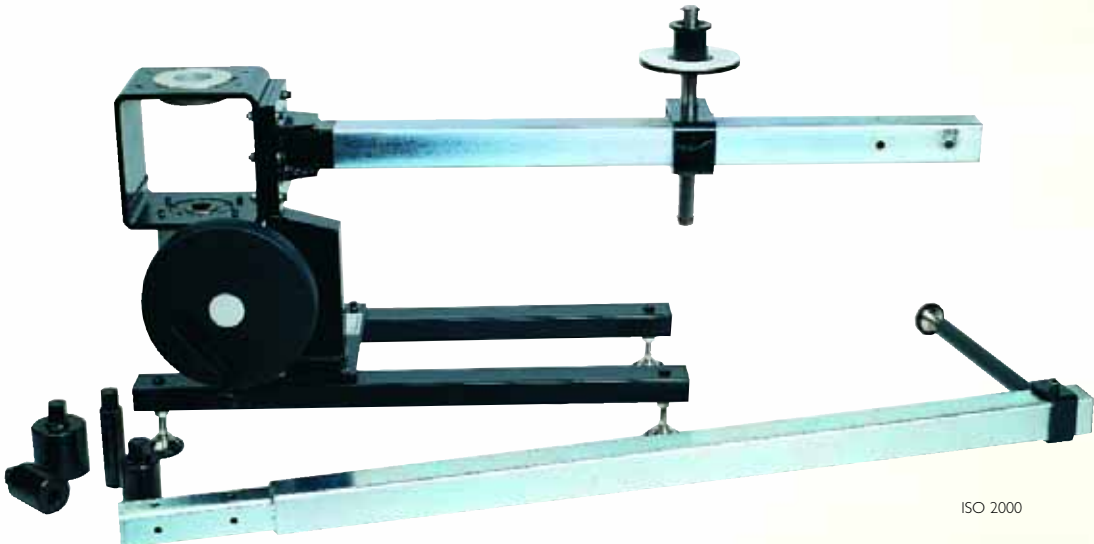
These loaders allow torque wrenches to be calibrated or tested in accordance with ISO 6789:2003, BS EN 26789:2003 and American military standard GGG-W-686. Their function is to take full advantage of the accuracy of Norbar's torque measuring system by reducing operator induced variations in the calibration process.

- The high ratio, 1200:1 (ISO 2000, 1250:1) gearbox allows high torques to be applied, whilst ensuring that the operator does not exceed the rate of increase of torque specified in the standards.
- The design allows for easy interchange of transducers using the Norbar Static Transducer system.
- The ISO 1000 90° facility allows performance of torque wrenches to be checked in two planes. Many wrenches give different torque values according to their orientation in use.
- Floating reaction point minimises side loads on wrench.
- ISO 2000 reaction extension bar allows wrenches up to 2250mm to be tested. This can be removed to save space. Wrenches up to 1045mm can be tested when the extension bar is not fitted
- Optional Small Reaction Plate (part no. 20588) allows torque wrenches down to 100 mm in length (centre of square to centre of handle) to be tested.
- Motorised version with speed control is available for the ISO 1000. This can be purchased as a kit to motorise an existing ISO or as a complete ISO 1000 Motorised Torque Wrench Loader.

### ISO 1000 and 2000 Torque Wrench Loaders

Part No.	Description	Range		Torque Wrench Length (mm)		Adaptors
		N.m	lbf.ft	min	max	
60118	ISO 1000 with 90° rotation	1-1350	1-1000	200	1200	¼, ½, ¾, 1
60193	ISO 1000 Motorised Torque Wrench Tester	1-1350	1-1000	200	1200	¼, ½, ¾, 1
60194	Kit to motorise an ISO 1000	-	-	-	-	-
20502	ISO 2000	1-2500	1-2000	200	2250	¼, ½, ¾, 1, 1½
20588	Small Reaction Plate	-	-	100	180	-

Note: Min and Max torque wrench lengths are from the centre of the square drive to the centre of the handle.



ISO 2000

## Calibration Beams and Weights Principals of Operation

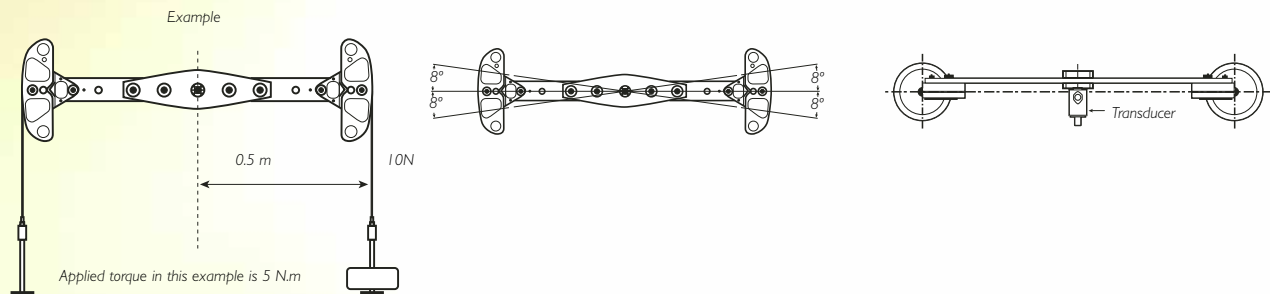
Norbar's Test Beams are designed for the static calibration of Torque Transducers. They are ideally suited to Norbar's transducers, but can be employed on other manufacturer's equipment.

Torque is generated by the application of a known force at a known radius from the centre of rotation of the torque transducer.

The Beams are designed with square drives machined to the top limit of ISO 2725. This minimises any play between the beam and the transducer. However, a combination of square drive tolerances, misalignment of fittings and elastic rotation of the transducer shaft inevitably cause the beam to rotate from the horizontal under load.

Norbar's Radius Ended Beams are designed with a +/-8 degree usable arc within which the calibration accuracy is unaffected.

Additionally the beams are designed to apply load on a vertical plane which cuts through the square drive inside the transducer. This minimises bending moments on the transducer and, for safe operation, ensures that the beam will not fall out of the transducer.



### Gravitational Effects

It is very important that the gravitational value for the Laboratory is established. The effect of not doing this could be a variation in the force produced by the weight of perhaps 0.5% of reading.

It is therefore strongly recommended that you establish the local value of gravity (g) for your Laboratory and use weights that have been calibrated at that gravitational constant.

Norbar will supply weights calibrated to gravitational constants specified by the customer. However, if the customer does not specify a value for 'g' they will have been calibrated at an estimated gravitational constant for the customers' location.

### Buoyancy Effects

The Norbar system uses calibrated weights to generate a downwards force.

This means that Archimedes principle applies, ie. air pressure under the weights causes an upwards force. This reduces the effective force generated by the weights and therefore the mass must be increased to allow for this.

Under standard conditions (ie. Air density 1.2 kg/m<sup>3</sup> and 20 degrees centigrade and working in conventional mass terms) the increase required is by a factor of 0.015%.

Weights purchased from Norbar will already have this factor taken into account.

Weights that are calibrated to standard procedures do not have this factor taken into account because the air buoyancy affects both sides of the mass balance and can be ignored. It is important that weights used for torque transducer calibration are adjusted for air buoyancy.

It should also be noted that the double ended beam design employed by Norbar means that each half of the beam is balanced with regard to buoyancy of the beam. This is a significant advantage over single-arm counterbalanced systems.

### Calibration Disc

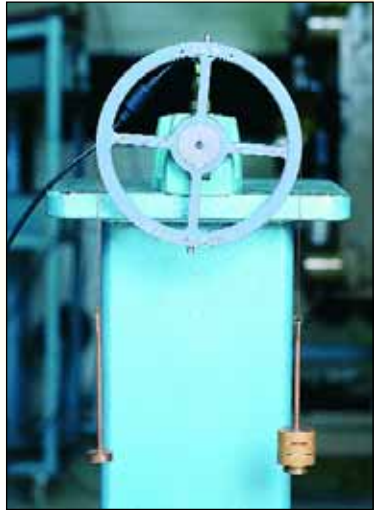
Designed to remove potential sources of measurement error; these Discs can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The < 0.04% uncertainty of applied torque achievable with this disc allows calibration to the high classes of accuracy specified by BS7882:1997.
- Machined to  $\pm 0.03\%$  from aircraft alloys.
- Clockwise and counter-clockwise operation.
- Capable of SI or Imperial calibrations.
- Compatible with male and female 1/4" square transducer drives.
- No bearings to cause energy loss during loading.
- Brass weights with an accuracy better than  $\pm 0.01\%$  are available in five sets to achieve a variety of calibration ranges.
- Special weight sets can be specified up to a maximum torque of 2.5N.m.

**NOTE:** A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.



Calibration Disc shown with more than one weight set.



### Calibration Discs – S.I and Imperial

Range		Disc Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F in
Minimum	Maximum						
0.05 N.m	0.50 N.m	21400	100 mm	21452	10 x 0.5 N	4 mm	¼
0.10 N.m	1.00 N.m	21400	100 mm	21450	10 x 1.0 N	4 mm	¼
0.25 N.m	2.5 N.m	21400	100 mm	21479	10 x 2.5 N	4 mm	¼
5 ozf.in	50 ozf.in	21400	100 mm	21455	10 x 1.27 ozf	4 mm	¼
10 ozf.in	100 ozf.in	21400	100 mm	21453	10 x 2.54 ozf	4 mm	¼
16 ozf.in (1 lbf.in)	160 ozf.in (10 lbf.in)	21400	100 mm	21451	10 x 4.064 ozf	4 mm	¼

## Radius Ended Beam

Designed to remove potential sources of measurement error, these beams can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The < 0.02% uncertainty of applied torque achievable with these beams allows calibration to the highest class of accuracy specified by BS7882:1997.
- Machined to  $\pm 0.01\%$  (100 microns per meter) from aircraft alloys.
- Clockwise and counter-clockwise operation.
- All have interchangeable square drive to increase flexibility of use.
- Torque radius maintained throughout  $\pm 8$  degrees of rotation from horizontal.
- No bearings to cause energy loss during loading.
- Balanced to maximise energy transfer to transducer during loading.
- Loading point offset to reduce bending moments on the transducer.
- High torque radius accuracy allows use of cast iron weights rather than stainless steel. Weight accuracy is required to be equal to or better than  $\pm 0.01\%$ .



**NOTE:** A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.

### Radius Ended Beams - S.I. Calibration

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
0.5 N.m	5.0 N.m	21420	250 mm	21476	10 x 2 N	9.5 mm	¼, ⅜
1 N.m	10 N.m	21420	250 mm	21454	10 x 4 N	9.5 mm	¼, ⅜
5 N.m	50 N.m	21420	250 mm	21458	10 x 20 N	9.5 mm	¼, ⅜
5 N.m	50 N.m	21421	500 mm	21477	10 x 10 N	9.5 mm	⅜, ½
10 N.m	100 N.m	21421	500 mm	21458	10 x 20 N	9.5 mm	¼, ⅜
5 N.m	250 N.m	21427	500 mm	21459	1 x 10 N 10 x 50 N	9.5 mm	¼, ⅜
5 N.m	500 N.m	21427	500 mm	21460	1 x 10 N 10 x 100 N	9.5 mm	¼, ⅜
10 N.m	500 N.m	21428	1000 mm	21459	1 x 10 N 10 x 50 N	9.5 mm	¼, ⅜, 1
10 N.m	1000 N.m	21428	1000 mm	21460	1 x 10 N 10 x 100 N	9.5 mm	¼, ⅜, 1
10 N.m	1500 N.m	21428	1000 mm	21483	14 x 100 N 1 x 50 N 2 x 20 N 1 x 10 N	9.5 mm	¼, ⅜, 1

### Radius Ended Beams - Imperial Calibration

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
10 lbf.in	100 lbf.in	21423	10"	21465	10 x 1 lbf	9.5 mm	¼, ⅜
50 lbf.in	500 lbf.in	21423	10"	21466	10 x 5 lbf	9.5 mm	¼, ⅜
10 lbf.ft	100 lbf.ft	21424	12"	21467	10 x 10 lbf	9.5 mm	⅜, ½
50 lbf.ft	500 lbf.ft	21425	24"	21468	10 x 25 lbf	9.5 mm	¼, ⅜
100 lbf.ft	1000 lbf.ft	21426	48"	21468	10 x 25 lbf	9.5 mm	⅜, 1

### 5000 lbf.ft Calibration Beam

Designed to remove potential sources of measurement error, these beams can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The < 0.04% uncertainty of applied torque achievable with this beam allows calibration to the high classes of accuracy specified by BS7882:1997.
- Beam length machined to +/-0.01% (100 microns per meter).
- Clockwise and counter-clockwise operation.
- Beams balanced to maximise energy transfer to transducer during loading.
- High beam accuracy allows use of cast iron weights rather than stainless steel. Weight accuracy is required to be equal to or better than 0.01%.
- High quality bearings to reduce energy losses.
- Gearbox provided to level beam and remove cosine errors.
- SI and Imperial Calibration possible with one beam (using different weights).

**NOTE:** A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.

### 5000 lbf.ft Calibration Beam

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
500 N.m	5000 N.m	21842	1275 mm	21469	20 x 50 lbf	12 mm	1½
500 lbf.ft	5000 lbf.ft	21842	60 in	21469	20 x 50 lbf	12 mm	1½





Instrument calibration bench

## Calibration Certificates

As a UKAS accredited calibration Laboratory No. 0256, Norbar is required to calibrate torque measuring devices that are within the Laboratory's scope, in accordance with BS 7882:1997. We will be working to the revised standard (BS 7882:2008) in early 2008, see the 'UKAS Schedule of Accreditation' on the 'Calibration Services' page of our website, [www.norbar.com](http://www.norbar.com).

The sections below summarise the main features of this document, but purchase and careful study of the standard is advised for those who wish more detailed information.

- The "device" is defined as all parts of a system, e.g. Display, Transducer Cable, and Transducer: Transducer cables will therefore be serial numbered if they are separate items.
- It is preferable to calibrate all parts of a system together. If a transducer is sent for calibration without its normal display unit, an equivalent calibrated display held in the laboratory will be used. The normal display must also be in a calibrated state or the certification for the transducer is invalidated.
- Norbar is currently the only laboratory accredited by UKAS for the calibration of Electrical Torque Measuring Indicators.
- A preliminary overload test is performed (to 110% of nominal maximum capacity) to establish the amount of zero shift under load. If this exceeds the tabulated values the device is considered too unstable for further calibration.
- The device is calibrated with at least five approximately equal steps from 20% to 100% of maximum torque. Lower values are allowed as long as they meet certain criteria for resolution.
- Two series of readings are taken, and the device is then disturbed, generally by being disconnected from the calibration fixture and rotated through 90°. A third series of readings is then taken.
- Should readings be required in both directions, the three series of readings are repeated in the opposite direction.
- The calibration data is then analysed to establish the following parameters.

### Repeatability

The variation between the indicated readings from series 1 and 2, expressed as a percentage of the average indicated reading.

### Reproducibility

The variation between series 1, 2 and 3, expressed as for Repeatability.

### Error of Interpolation

Where the results are expressed in volts or units other than torque units, a 2nd order polynomial (best fit line) is established and the variation of reading from the calculated value is expressed as a percentage of the calculated value.

### Error of Indication

Where the results are expressed in units of torque, the errors of indications are the variation between each reading and the average reading of all three series at that torque.

### Error of Zero Torque

The zero readings taken from after each loading series are given a mean value, which is expressed as a percentage of the mean maximum indicated reading.

- The five parameters are each compared with a table to establish the device's classification. Class 0.1 is the highest performance, and class 5 is the lowest defined by the standard. The overall class reported will be that of the lowest performing parameter: For example reproducibility may be a class 1 when all other parameters meet class 0.5. The device will be classified as 1.
- Additionally the uncertainty of measurement of the applied torque must be five times better than the overall class reported. Norbar's uncertainty of measurement (typically 0.02%) therefore allows classification of the highest class devices.

Different classes may be quoted for ranges below 20% of maximum capacity.

## CERTIFICATE OF CALIBRATION

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### Expression of Uncertainties (as left)

The estimated expanded uncertainty of the torque measuring device under the conditions of calibration, generated by the application of masses, calibrated to produce forces, at the known radius of an unsupported length, is:

Applied Torque (N.m)	Expanded Uncertainty (N.m)	k
at 100.00 N.m	$\pm 0.07\%$	k=2.0
at 200.00 N.m	$\pm 0.06\%$	k=2.0
at 400.00 N.m	$\pm 0.04\%$	k=2.0
at 600.00 N.m	$\pm 0.04\%$	k=2.0
at 800.00 N.m	$\pm 0.04\%$	k=2.0
at 1000.00 N.m	$\pm 0.04\%$	k=2.0

## CERTIFICATE OF CALIBRATION

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### Calibration Method

The above torque measuring device has been statically calibrated by the application of known torques, which were generated by the application of masses, calibrated to produce forces, at the known radius of an unsupported length, by the calibrated user.

The torque measuring system was switched on and allowed to warm up for at least 15 minutes before commencing the calibration. The electrical output from the torque measuring device was measured and displayed in N.m, by the instrument (Serial Number: 47697) which is supported by a UKAS certificate of calibration.

The torque measuring device was mounted in a suitable fixture which permitted the length board drive to be engaged and the indicator for zero torque before and after each application of torque were recorded.

Prior to calibration the torque measuring device was overloaded three times to 110% of its rated capacity; the readings of the indicator for zero torque before and after each application of torque were recorded.

The torque measuring device was preloaded once to its rated capacity and then three series of increasing torques, in a clockwise direction when viewed from the drive end, were applied to the torque measuring device and the indicated outputs recorded. Between the second and third series, the torque measuring device was disconnected from the calibrating beam and rotated through 90 degrees, then preloaded once to maximum torque before applying the first series. The average of zero torque before and after each application of the series of torques were recorded. The indicator output was zero at the beginning of each series.

The calculations as described in clauses 5.1, 5.2, 5.3, 5.5 and 5.7 of BS 7882 were then made for the results.

The calculations as described in clauses 5.1, 5.2, 5.3, 5.5 and 5.7 of BS 7882 were then made for the results.

The calibration was performed at an ambient temperature within the range 20°C Celsius  $\pm$  2°C Celsius and did not fluctuate by more than  $\pm 1^\circ$  Celsius during a measurement series.

The uncertainty of the applied torque is  $\pm 0.02\%$ , k=2. The estimated uncertainty of the device under the conditions of calibration is inclusive of this value.

The measured values obtained in the loading series and the calculated parameters are given overleaf. The lower calibration is inclusive of this value.

An output of 1.9842mV/V is produced by the torque measuring device at its rated capacity. The voltage output is inclusive of any voltage loading effects caused by the device and the connection cable. Connection cables Part No. 60017/200 may be interchanged with other makes of the same part number. The use of connection cables of other lengths or types than the one specified may affect the validity of the calibration.

Clause 7.2 of BS 7882 requires that "The torque measuring device shall be recalibrated at least every 12 months and whenever it suffers any damage or has been subjected to any repair".

When used with the display instrument detailed on page one or an equivalent unit, a classification of between 0.1, with an uncertainty of less than 0.7% will meet the requirement of clause 5.1 of BS EN ISO 6189:2003.

Where the display instrument is required to be replaced by an equivalent unit, the requirements of clause 4.1 of BS 7882 shall be fully met to ensure that the calibration is not invalidated.

## CERTIFICATE OF CALIBRATION

ISSUED BY NORBAR TORQUE TOOLS CALIBRATION LABORATORY No. 0256  
DATE OF ISSUE: 05 November 2003 CERTIFICATE NUMBER: 100352

UKAS ACCREDITED CALIBRATION LABORATORY No. 0256  
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APPROVED SIGNATORY  
B. C. PRATT  
M. HERBERT  
*M. Herbert*



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**CUSTOMER:** NORBAR TORQUE TOOLS LTD, CALIBRATION LABORATORY,  
BEAUMONT ROAD, BANBURY, OXON, OX16 1XJ.

**DESCRIPTION OF DEVICE:** STATIC TRANSDUCER  
**MANUFACTURER:** Norbar Torque Tools Ltd.  
**DEVICE MODEL NUMBER:** 50597.LOG  
**MAXIMUM CAPACITY:** 1000.0 N.m  
**VOLTAGE OUTPUT:** 1.9842 mV/V at maximum capacity  
**DEVICE SERIAL NUMBER:** 47639  
**DATE OF CALIBRATION:** 31 OCT 2003  
**BASIS OF CALIBRATION:** BS 7882:1997  
**DISPLAY INSTRUMENT:** Norbar Torque Tool Tester Serial No. 47697 supplied by Norbar for the calibration only.  
**CABLE:** Connection cable Serial No. 37993 supplied by Norbar for the calibration only.

**Classification**  
The torque measuring device satisfies the requirements of BS 7882:1997 for the following classification ranges:

**Clockwise Torques (as left)**

Class	From	To
Class 0.1	from 1000.0 N.m	to 200.0 N.m
Class 0.2	from 1000.0 N.m	to 100.0 N.m

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## CERTIFICATE OF CALIBRATION

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### Calibration Results

**CLOCKWISE READINGS FOR THE DEVICE (as left: 31 OCT 2003)**

Applied Torque N.m	Orientation 0° Indicated Reading N.m		Orientation 90° Indicated Reading N.m		Mean Indicated Output N.m
	Series 1	Series 2	Series 1	Series 2	
0.0	0.0	0.0	0.0	0.0	0.0
100.0	100.0	100.0	100.0	100.0	100.0
200.0	199.9	199.9	199.9	199.9	199.9
400.0	399.9	399.9	399.9	399.9	399.9
600.0	599.9	599.9	599.9	599.9	599.9
800.0	799.9	799.9	799.9	799.9	799.9
1000.0	999.9	999.9	999.9	999.9	999.9
0.0	0.0	0.0	0.0	0.0	0.0

### CALCULATED PARAMETERS FOR THE DEVICE (as left)

Applied Torque N.m	Relative Repeatability %		Relative Error of Zero %		Relative Error of Indication %
	Series 1	Series 2	Series 1	Series 2	
100.0	0.000	0.000	0.000	0.000	0.000
200.0	0.000	0.000	0.000	0.000	-0.033
400.0	0.000	0.000	0.000	0.000	-0.017
600.0	0.000	0.000	0.000	0.000	-0.017
800.0	0.000	0.000	0.000	0.000	-0.021
1000.0	0.010	0.010	0.000	0.000	-0.013

### MAXIMUM PERMISSIBLE ERROR FOR THE DEVICE

Class	Relative Repeatability %		Relative Error of Indication %	
	Series 1	Series 2	Series 1	Series 2
0.10	0.05	0.10	$\pm 0.02$	$\pm 0.05$
0.20	0.10	0.20	$\pm 0.04$	$\pm 0.10$



Calibration office