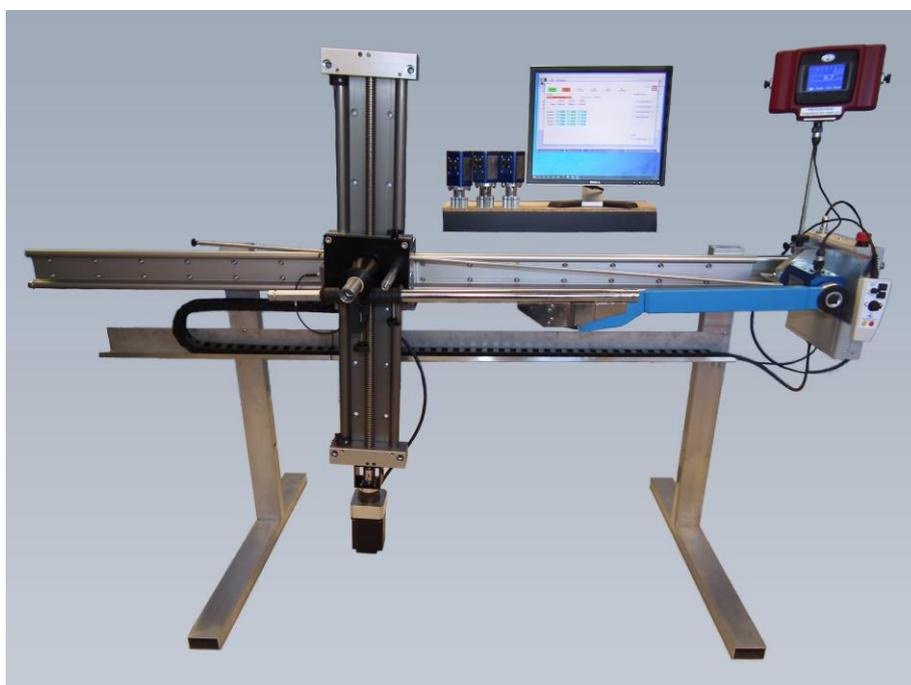


# UNIVERSAL TORQUE WRENCH CALIBRATION MACHINE 1500Nm AND 3000Nm



## User Manual

USER MANUAL

**USER MANUAL**

# Advanced Witness Systems Ltd

## Universal Torque Wrench Calibration Machine 1500Nm and 3000Nm

VERSION 1.5



# **AWS**

**Advanced Witness Systems Ltd.**

*Torque Measurement & Calibration*

Advanced Witness Systems Ltd © 2023

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## Introduction

The Universal Torque Wrench Calibration Machine (UTWCM) from Advanced Witness Systems Ltd is a fully integrated system used to calibrate torque wrenches to BS EN 6789:2017. It is available in two ranges, semi-automatic or automatic:

- 10Nm to 1500Nm Semi-Automatic / Automatic
- 10Nm to 3000Nm Semi-Automatic / Automatic

The UTWCM uses a stepper motor and drive system to precisely exert a force on the handle of a torque wrench, and an automated control system to ensure repeatable loading with minimal operator input.

The UTWCM can be used in automatic mode with the AWS 1010 Professional Torque Display and either AWS Intelligent Inline Torque Transducers (IITT) or Intelligent Instrumented Transducer Cables (IITC) with other manufacturer's transducers.

Automatic mode reduces calibration time on click and cam type wrenches, reducing required operator input.

The UTWCM can be connected via a display unit's RS232 output to a PC running ADMS Ltd Kepler 4 software for Calibration and Conformity for fast readings input. The display unit can be either the AWS 1010 Display unit or one of the customer's own choice. (Please note an RS232 to USB adaptor may be required)

Conforms to UKCA and CE regulations.



Please note references to Torque Transducer Display Instrument refer to the AWS PTD-1010 Professional Torque Display (Please see 1010 PTD manual for more information). For other manufacturer's display instruments please see the appropriate manual.

## Features

- Single push button operation requiring minimal operator effort and training.
- Variety of transducer cassettes to suit operator's requirements.
- Star shaped spline adaptors to allow the transducer to be rotated in increments of 30 degrees for wrenches with fixed drives and operator convenience
- Emergency stop button situated within operator reach to stop the machine moving in the event of an emergency.
- Overload sensors to stop the machine if 110% of the transducer maximum load is detected.

## Safety

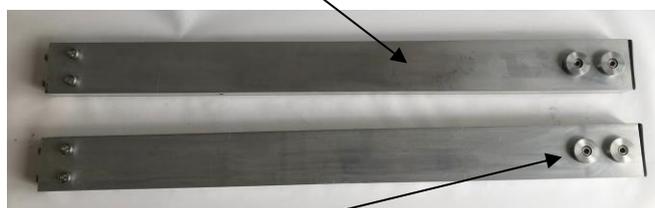
- 2 people are required to lift the UTWCM.
- Do not place liquids on or near the machine control box.
- Do not disconnect cables while the machine is powered on.
- This machine can exert high forces during operation. Keep hands clear of moving parts when it is operating.
- This machine must be supervised at all times during operation.

## Parts List

- 4x Operation Prompt Cards
- 1x Universal Torque Wrench Calibration Machine main body (36kg)
- 1x UTWCM Cross Track (28kg)



- 1x UTWCM Stand (Requires Assembly).
- 2x Upright Box Sections



- 4x Boss Inserts
- 2x Horizontal Feet Box Sections



- 2x Stand insert blocks
- 1x Stand crossbar



- 4 x M8 levelling feet
- Various Bolts (See picture)



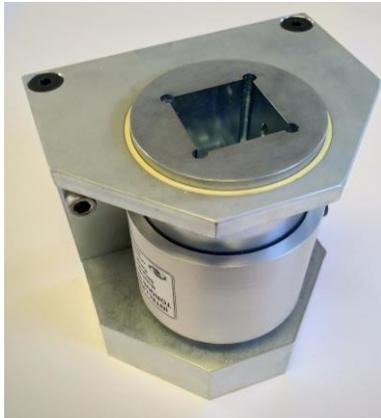
- 1x Single 1500Nm AWS IITT Transducer Fixed Cassette (**Optional**). This cassette is used for AWS Intelligent Inline Torque Transducers and appropriate splines.



- 1x Single 1500Nm AWS NITT Transducer Fixed Cassette (**Optional**). This cassette is used for AWS Intelligent Inline Torque Transducers and appropriate splines.



- 1x Single 3000Nm Transducer Sliding Cassette (**Optional**). This cassette is for a single 3000Nm AWS Transducer.



- 1x IEC power cable
- Reaction rod extensions. (3x for 1500Nm version, 5x for 3000Nm version)  
These are used to increase the length of the reaction rod for longer torque wrenches.



- AWS Intelligent Inline Torque Transducer (IITT) splines (**Optional**). These splines are used in the Single AWS IITT Transducer Fixed Cassette to fit AWS IITT transducers.



- AWS N-Type Inline Torque Transducer (NITT) splines (**Optional**). These splines are used in the Single AWS NITT Transducer Fixed Cassette to fit AWS NITT transducers.



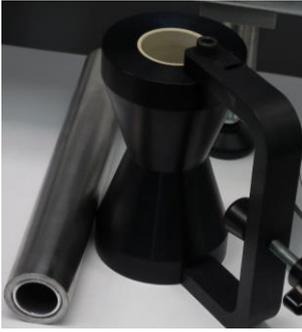
- 1x UTWCM Handheld controller.



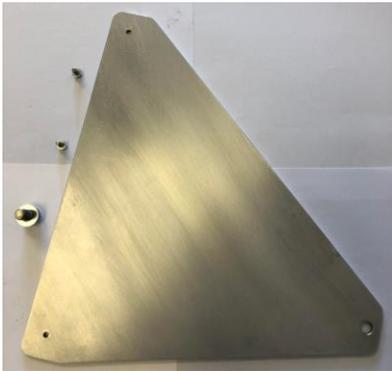
- 2x Travel limit sensors with 3D printed housings. These are the end stops for the cross carriage. They can be slid along the track to change the maximum limits of the carriage movement.



- 1x 36mm outer shaft tube and 1x Cotton Reel



- 2x Triangle plate brackets



- 1x Transducer storage shelf



## Assembly

### Required tools

- Philips Screwdrivers
- Metric Allen Key set
- 8mm metric spanner
- 10mm metric spanner
- 13mm metric spanner

### Assembly Instructions

Assemble the UTWCM according to the following Instructions:

**Please note this assembly requires three people with two for lifting the main bed section, or 2 people with a mechanical lifting aid.**

1. Carefully remove the machine items from the packing crate. Check parts for any damage.
2. Place the main bed section on the floor taking care not to rest it on the control box (if the control box is already attached).
3. Assemble the two machine upright supports.
  - Attach the horizontal box sections to the upright sections using two M10 bolts each.



- Attach the two triangle plate brackets to the outside faces of the stands using two M10 bolts and 4 M4 bolts.
- Attach two M8 levelling feet to each of the horizontal feet box sections. Tighten the M8 nut to lock off the required height.



- Fit the crossbar between the upright legs.



4. Support the machine main body on a pair of chairs or similar with the aluminium sliding track facing downwards. **Please note: Take care not to scratch or damage the aluminium track.**
5. With one person holding the machine main body to make sure it doesn't move, attach the legs to the rear of the main body using the 4 M8 bolts provided in the top of the upright stand sections.
6. With two or more people, carefully lift the machine into the correct orientation.
7. Attach the cable run channel to the stand uprights using the two short M4 bolts.



8. Prop the machine on a block of wood or similar (one stand at a time) to gain access to the M8 levelling feet mounts beneath the horizontal box sections.
9. Attach two M8 levelling feet to each of the horizontal feet box sections. Tighten the M8 nut to lock off the required height.
10. Check that the machine is horizontal front to back and left to right using a spirit level and adjust the levelling feet as necessary.
11. Attach the transducer shelf to the rear of the main bed using three M8 bolts.



12. Attach the Control Box to the end of the machine using the four long M4 bolts (this may already be attached on the machine for shipping).
13. Attach the control box end of the cable chain to the cable run channel using the two M6 bolts and nuts.



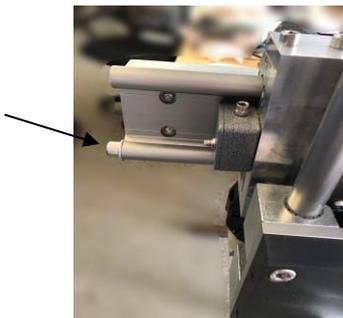
14. Attach the reaction rod assembly in the hole beneath the transducer cassette using an 8 or 10mm spanner.



15. Slide the main carriage onto the track, ensuring that the connector box for the Travel Limit Sensors is facing away from the Control Box end of the machine.



16. Attach the M12 bolt to the rear of the main track.



17. Carefully insert the reaction rod into the right-hand hole on the black carriage plate.  
This is to stop the cross carriage swinging freely during further steps.
18. Remove two M8 bolts from the lower rear of the cross carriage.



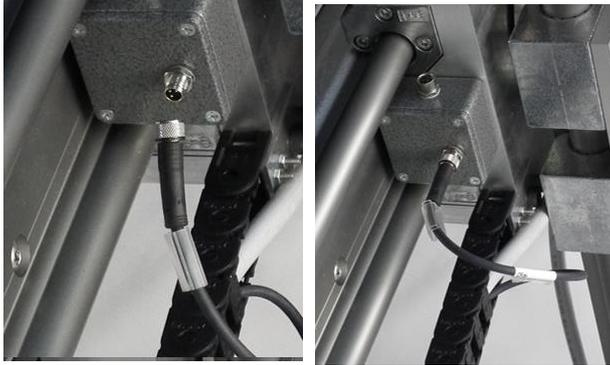
19. Attach the Cable chain plate where the M8 bolts were removed using the same bolts.



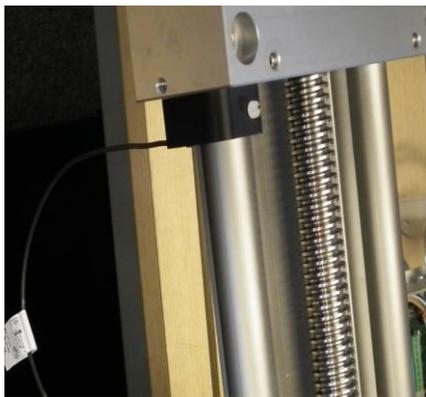
20. Connect the grey motor cable to the stepper motor.



21. Connect the sensor cable from the control box to the lid of the Travel Limit Sensor box on the rear of the main carriage.



22. Clip the Black Travel Limit Sensor housings onto the main cross track (with the sensor facing inwards) and tighten the nylon screw to prevent them from sliding. Connect the other end of the sensor cables to each side of the travel limit sensor box. (Located at the rear of the main carriage)



23. (**Automatic mode only**) Attach the Tool Tester Input cable 1058 with the D-Sub 9 connector to the “**Tool Tester Input**” on the rear of the control box.

- If using an AWS Transducer Switch Box, connect the main D-Sub 9 connector to the rear of the Transducer Switch Box. Connect the AWS PTD-1010 Display using the Male-Female D-Sub 9 lead 1059. The Transducer Switch Box can be connected to the PC used to run Kepler 4 Conformity and Calibration Software in order to use its fast input function.
- If not, connect the tool tester input cable 1058 to the rear of the AWS PTD-1010 Display. The second D-Sub 9 on the Tool Tester Input Cable can be connected to the PC used to run Kepler 4 Conformity and Calibration Software in order to use its fast input function.

24. Connect the handheld controller cable to the “**Controller**” connection on the front of the control box.

25. Connect the IEC mains power cable to rear of the control box.

### Fixed NITT Transducer Cassettes

1. Fit the transducers into the appropriate square drive spline. These splines can be moved to different positions and rotated in increments of 30 degrees to suit the user's requirements.
2. Tighten the aluminium teardrop clamp over the circlip to prevent the transducer dropping.
3. Refit the top plate, using the small collar adapter if necessary.
4. Connect the transducer to the display or Transducer Switch Box via its transducer cable and switch on the display.
5. Tighten the Transducer Retaining Screw to hold the transducer in place.

### Fixed AWS IITT (Intelligent Inline Torque Transducer) Cassettes

1. Fit the transducers into the appropriate square drive spline and attach using 4x M5 cap head screws (provided). These splines can be rotated in increments of 30 degrees to suit wrenches with fixed drives and customer requirements.



2. Tighten the Transducer Retaining Screw to hold the transducer in place.
3. Tighten the aluminium teardrop clamp over the circlip to prevent the transducer dropping.

## Wrench setup (All wrench types)

1. Select the appropriate **Torque Transducer** for the Wrench Under Test (WUT). Insert into the Universal Torque Wrench Calibration Machine (UTWCM).
2. Tighten the transducer clamp screw to secure the transducer.
3. On the main carriage of the UTWCM, untighten the Reaction Rod Clamp Screw to allow the main carriage to move freely.
4. Insert the Reaction Rod into the correct carriage hole position:
  - a. For Clockwise operation of the WUT, insert the Reaction Rod into the upper (clockwise) carriage hole position.
  - b. For Anti-Clockwise operation of the WUT, insert the Reaction Rod into the lower (anti-clockwise) carriage hole position.
5. Depending on the length of the WUT, screw in the extension pieces to the end of the reaction rod.
6. Insert the WUT into the Torque Transducer, using adapters as necessary. Step the **Torque Transducer** around by 30° if necessary to locate the drive correctly.
7. Select the appropriate Reaction Pillar:
  - a. For WUT with a handle centre length of less than 170mm, use the front Reaction Pillar.
  - b. For WUT with a handle centre length of 170mm or greater, use the central Reaction Pillar.
8. Slide the Outer Shaft on to the selected Reaction Pillar, and slide the Cotton Reel on to the Outer Shaft.
9. Slide the Force Application Carriage along the main track, inserting the handle of the WUT into the centre of the Cotton Reel.
10. Tighten the fastening screw located in the 'U' shaped handle, ensuring the U bracket is clamped in the centre of the handle of the WUT.
11. Tighten the Reaction Rod Clamp Screw on the torque application carriage, ensuring the carriage cannot freely move along the main track.

The dial on the controller is used to set the motor speed suitable for the range of the torque wrench being calibrated:

- a. “<10 Nm” –  $\geq 0.5s$  to get from 80% to 100% load.
- b. “10 Nm – 100Nm” –  $\geq 1s$  to get from 80% to 100% load.
- c. “100 Nm – 1000 Nm” –  $\geq 1.5s$  to get from 80% to 100% load.
- d. “> 1000 Nm” –  $\geq 2s$  to get from 80% to 100% load.

# Operation

The operational procedure to run the UTWCM is dependent on the type of wrench being calibrated:

- Type 2 Click wrenches
- Type 2 Slipper wrenches
- Type 1 Dial, Bending Beam or Electronic wrenches

**Please note: See ISO 6789 standards for a description of the wrench types.**

The below processes are repeated as required to meet the calibration requirements.

**Please note: When changing transducer cassette, the bolts attaching the cassette to the main body of the machine require a torque of 60Nm for correct operation.**

## Operating Instructions for Type 2 Click Wrenches

### Manual Mode

1. Select required settings for the Torque Transducer Display Instrument.
2. Check the Handheld controller is switched to “**Ascend**”.
3. When the required settings have been chosen. Press and hold the “**Yellow Button**” for 0.5s and release to run the machine.
4. When the torque transducer display shows you have reached 80% of the target torque, press the “**Yellow Button**”. This will slow the UTWCM down to the correct rate to meet the standard (BS EN ISO 6789:2017).
5. When the torque wrench has clicked, press the “**Red Button**” to stop the machine.

**Please note applying too much torque could damage a click type torque wrench.**

6. Switch the controller to “**Descend**” and press the “**Yellow Button**”.
7. When the torque has reached zero, press the “**Red Button**” to stop. Switch the controller back to “**Ascend**” and press the “**Yellow Button**” to repeat the process.

### Automatic Mode

Automatic operation requires an AWS PTD-1010 Professional Transducer Display.

1. Mechanically set up the UTWCM as per the *Mechanical Setup Prompt Card*.
2. Switch on **Professional Transducer Display** (PTD), and follow the on-screen setup below:
  - a. When prompted “**Use previous set-up?**”, select “**No**”.
  - b. When prompted “**SELECT MODE**”, select “**First Peak**”.
  - c. When prompted “**1<sup>st</sup> Peak Auto Cancel?**”, select “**Yes**”.

- d. When prompted “**SELECT UNITS**”, select the correct units for the Wrench Under Test (WUT).
- e. When prompted “**Set Limits?**”, select “**Yes**”.
- f. When prompted “**SET TARGET TORQUE**”, select the correct value. This is the required torque for the setting being tested.
- g. When prompted “**SET UPPER LIMIT**”, select a value (this defaults to 110% of the transducer’s full-scale value). When the torque reaches the upper limit, the machine stops to prevent overloading of the transducer.

**Please note applying too much torque could damage a click type torque wrench.**

- h. When prompted “**SET LOWER LIMIT**”, select a value (this defaults to 50% of the Target Torque Limit). The machine will not detect any 1<sup>st</sup> Peaks below this limit.
3. Switch on the UTWCM, and set up the Handheld controller as follows:
  - a. Select “**Ascend**”.
  - b. Select “**CW/CCW**” as appropriate.
  - c. Set the Range with the Rotary Switch to match the Target Torque.
4. Check the PTD is set to zero, using the “**Tare**” button if necessary.
5. With the Handheld controller, use the “**JOG**” joystick to adjust the WUT position to take up any slack if necessary.
6. Press & hold the “**Yellow Button**” for 0.5s and release to run the machine.
7. When the PTD has reached 80% of the Target Torque, the machine will slow down to the correct rate to meet the standard (BS EN ISO6789:2017).
8. When the WUT clicks, the machine will stop and reverse automatically until the torque reaches zero, and residual torque has been removed.
9. The PTD will capture the First Peak (indicated in green on the display), and will hold it for 5 seconds, before re-setting (and transmit it by RS232). The PTD will not capture a further peak until the applied torque has returned to zero for 2 seconds.
10. To run again, press & hold the “**Yellow Button**” for 0.5s and release.

To change the Target Torque, use the back button to repeat steps 2.f. to 2.h.

## Operating Instructions for Type 2 Slipper Wrenches

### Manual Mode

1. Mechanically set up the UTWCM as per page 12.
2. Select required settings for the Torque Transducer Display Instrument.
3. Check the Handheld controller is switched to “**Ascend**”.
4. When the required settings have been chosen Press and hold the “**Yellow Button**” for 0.5s and release to run the machine.
5. When the torque transducer display shows you have reached 80% of the target torque, press the “**Yellow Button**”. This will slow the UTWCM down to the correct rate to meet the standard (BS EN ISO 6789:2017).
6. When the torque reading on the display peaks, press the “**Yellow Button**” again to speed up the TWCM until the wrench clicks.
7. When the torque wrench has clicked, press the “**Red Button**” to stop the machine.
8. Switch the controller to “**Descend**” and press the “**Yellow Button**”.
9. When the torque wrench has returned to the start position, press the “**Red Button**” to stop. Switch the controller back to “**Ascend**” and press the “**Yellow Button**” to repeat the process.

### Automatic Mode

Automatic operation requires an AWS PTD-1010 Professional Transducer Display.

1. Mechanically set up the UTWCM as per the *Mechanical Setup Prompt Card*.
2. Switch on **Professional Transducer Display** (PTD), and follow the on-screen setup below:
  - a. When asked “**Use previous set-up?**” select “**No**”.
  - b. When asked “**SELECT MODE**”, select “**Peak**”.
  - c. When asked “**SELECT UNITS**”, select the correct units for the Wrench Under Test (WUT).
  - d. When asked “**Set Limits?**”, select “**Yes**”.
  - e. When asked “**SET TARGET TORQUE**”, select the correct value. This is the required torque for the setting being tested.
  - f. When asked “**SET UPPER LIMIT**”, select a value (this defaults to 110% of the transducer’s full-scale value). When the torque reaches the upper limit, the machine stops to prevent overloading of the transducer.

**Please note: Whilst overloading a cam type wrench is unlikely, an Upper Limit must be set in case the wrench is faulty.**

- g. When prompted “**SET LOWER LIMIT**”, select a value (this defaults to 50% of the set Target Torque Limit). The machine will not detect any Peaks below this limit.

3. Switch on the UTWCM, and set up the Handheld controller as follows:
    - a. Select “**Ascend**”.
    - b. Select “**CW/CCW**” as appropriate.
    - c. Set the Range with the Rotary Switch to match the Target Torque.
  4. Check the PTD is set to zero, using the “**Tare**” button if necessary.
  5. With the Handheld controller, use the “**JOG**” joystick to adjust the WUT position to take up any slack if necessary.
  6. Press & hold the “**Yellow Button**” for 0.5s and release to run the machine
  7. When the WUT has reached 80% of the Target Torque, the machine will slow down to the correct rate to meet the standard (BS EN ISO6789:2017).
  8. Once the machine has slowed, press and hold the “**Yellow Button**”. When the peak is detected, the machine will speed up to run on to the click. The “**Yellow Button**” can be released once the peak has been detected and the speed has increased again.
  9. If the peak is captured before you press and hold the “**Yellow Button**”:
    - a. Press and hold “**Stop**” to stop the machine from automatically returning.
    - b. Set the Handheld controller to “**Descend**”, then change the direction (**CW/CCW**) on the Handheld controller.
    - c. Press & hold the “**Yellow Button**” and it will run on to the click.
  10. When the WUT clicks, press the “**Red Button**” to stop the machine. The PTD will capture the Peak (indicated in green on the display), and will hold it until manually reset.
  11. If you used step 8 above, the machine will then reverse automatically. Stop the machine with the “**Red Button**” when it has travelled back far enough to give you the mechanical travel required to operate the WUT again.
  12. If you used step 9 above, to reverse the machine:
    - a. Change the direction (**CW/CCW**) on the handheld controller.
    - b. Press & hold the “**Yellow Button**” and the machine will reverse.
    - c. Press the “**Red Button**” when the UTWCM has travelled back far enough to give you the mechanical travel required to operate the WUT again.
    - d. Change the direction (**CW/CCW**) on the handheld controller back to the original setting (in step 3b), and set it to “**Ascend**”.
  13. Press “**Reset**” on the PTD to clear the recorded peak value (and transmit it by RS232).
  14. To run again, press & hold the “**Yellow Button**” for 0.5s and release.
- To change the Target Torque, use the back button to repeat steps 2.e. to 2.g.

## Operating Instructions for Type 1 Dial Type, Bending Beam or Electronic Torque Wrenches

### Manual Mode

1. Mechanically set up the UTWCM as per page 12.
2. Select required settings for the Torque Transducer Display Instrument.
3. Check the Handheld controller is switched to “**Ascend**”.
4. When the required settings have been chosen, press and hold the “**Yellow Button**” for 0.5s and release to run the machine.
5. When the torque transducer display shows you have reached 80% of the target torque, press the “**Yellow Button**” again. This will slow the UTWCM down to the correct rate to meet the standard (BS EN ISO 6789:2017).
6. When the torque wrench indicates 100% torque, press the “**Red Button**” to stop the machine.

### Please note applying too much torque could damage the torque wrench.

7. Switch the controller to “**Descend**” and press the “**Yellow Button**”.
8. When the torque has reached zero, press the “**Red Button**” to stop. Switch the controller back to “**Ascend**” and press the “**Yellow Button**” for 0.5s and release to repeat the process.

### Automatic Mode

Automatic operation requires an AWS PTD-1010 Professional Transducer Display.

1. Mechanically set up the UTWCM as per the *Mechanical Setup Prompt Card*.
2. Switch on **Professional Transducer Display** (PTD), and follow the on-screen setup below:
  - a. When prompted “**Use previous set-up?**”, select “**No**”.
  - b. When prompted “**SELECT MODE**”, select “**Peak**”.
  - c. When prompted “**SELECT UNITS**”, select the correct units for the Wrench Under Test (WUT).
  - d. When prompted “**Set Limits?**”, select “**Yes**”.
  - e. When prompted “**SET TARGET TORQUE**”, select the correct value. This is the required torque for the setting being tested.
  - f. When prompted “**SET UPPER LIMIT**”, select a value (this defaults to 110% of the transducer’s full-scale value). When the torque reaches the upper limit, the machine stops to prevent overloading of the transducer.
  - g. When prompted “**SET LOWER LIMIT**”, select a value (this defaults to 50% of the set Target Torque Limit). The machine will not detect any Peaks below this limit.

3. Switch on the UTWCM, and set up the Handheld controller as follows:
  - a. Select “**Ascend**”.
  - b. Select “**CW/CCW**” as appropriate.
  - c. Set the Range with the Rotary Switch to match the Target Torque.
4. Check the PTD is set to zero, using the “**Tare**” button if necessary.
5. If necessary, use the “**JOG**” joystick on the Handheld controller to adjust the WUT position to take up any slack.
6. Press & hold the “**Yellow Button**” for 0.5s and release to run the machine.
7. When the WUT has reached 80% of the Target Torque, the machine will slow down to the correct rate to meet the standard (BS EN ISO6789:2017).
8. When the WUT indicates the Target Torque, press the “**Red Button**” to stop the machine.

**Please note applying too much torque could damage the wrench.**

9. If necessary, use the “**JOG**” joystick on the Handheld controller to precisely move the WUT position until it indicates the Target Torque.
10. To remove the torque, switch the Handheld controller to “**Descend**”, and press the “**Yellow Button**”.
11. The PTD will capture the Peak (indicated in green on the display), and will hold it until manually reset.
12. When the WUT indicates that the applied torque has returned to zero, press the “**Red Button**” to stop.
13. Press “**Reset**” on the PTD to clear the recorded peak value (and transmit it by RS232).
14. Switch the Handheld controller to “**Ascend**”.
15. To run again, press & hold the “**Yellow Button**” for 0.5s and release.

To change the Target Torque, use the back button to repeat steps 2.e. to 2.g.

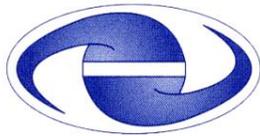
## Troubleshooting

- If the power light is on but machine is not running listen for the hum of the motor and then check that the emergency stop button is not pushed in. To release the emergency stop twist the button.
- If the machine does not respond straight away when the yellow button is pressed gently jog it back and forwards to clear the fault and then press the yellow button again.
- Travel limit sensors will stop the machine if the top carriage reaches the end of the track. To clear the fault, jog the machine in the direction opposite to which the fault occurred.
- If the motor doesn't respond after trying all of the above, switch the machine off, wait 5 seconds, and switch it on again.

**If the problem persists please contact Advanced Witness Systems Ltd**

## Maintenance

- The main carriages move along the tracks without the need for lubrication, if they are not sliding freely please contact Advanced Witness Systems Ltd.
- Regularly check UTWCM for loose bolts and tighten as necessary.
- Prevent the machine from gathering dust when not in use.



**AWS**

**Advanced Witness Systems Ltd.**

*Torque Measurement & Calibration*

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