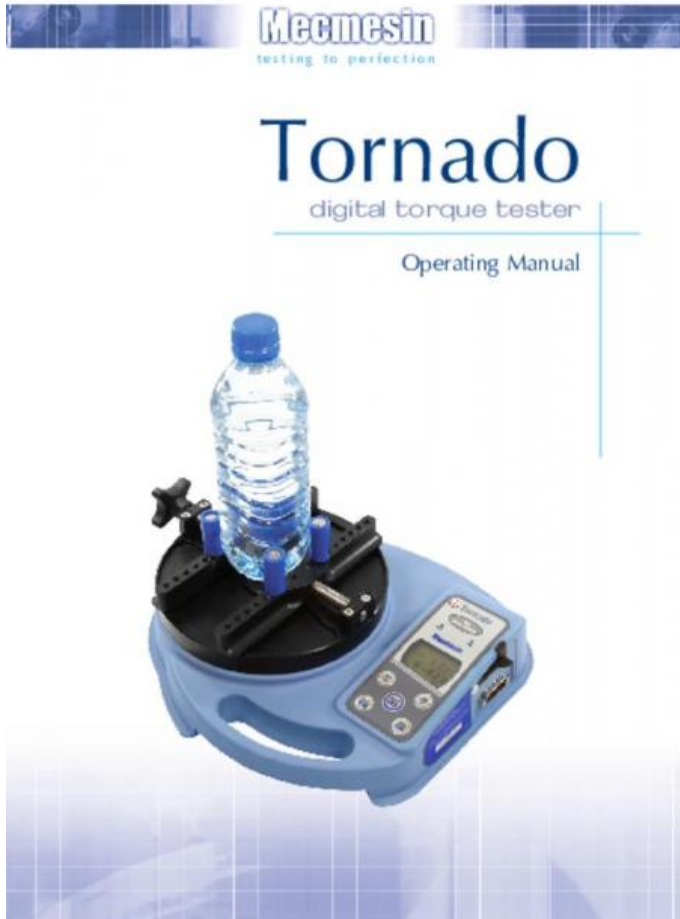


Support / Product / Tornado

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1 Introduction

Thank you for choosing Mecmesin's Tornado Digital Torque Tester. With correct use and regular re-calibration it will give many years of accurate and reliable service.

The Tornado has been specifically designed as a high-accuracy, portable instrument for measuring clockwise and counter-clockwise torques. Using the latest integrated circuit technology and intuitive programming, the Tornado is easy to use by all operators.

2 Before Use

Upon receiving the unit please check that no physical damage has occurred to the packaging material, plastic case or the instrument itself. If any damage is evident please notify Mecmesin immediately.

3 Operation

The most commonly used features, such as displaying torque, zeroing the display, transmitting data and changing the displayed units of measurement can all be done by pressing single dedicated keys on the front panel.

To configure the advanced features of the Tornado, a full menu-driven system is accessible using the keys identified on the front panel with blue text - see page 11, Advanced Menu Options.

4 Maintenance

When cleaning the keypad care must be taken to avoid liquids, especially alcohols, seeping around the edge of the membrane. Therefore, we recommend the use of a lightly dampened cloth to avoid liquid spillage onto the membrane.

4.1 Assembly of the Tornado 6N.m and 10N.m

Unscrew the top plate handle so that the peg holders move towards the outside edge of the plate. Align the top plate with the torque drive so that the handle is on the left-hand side of the top plate. Using the 2.5mm Allen key (provided), tighten the four socket countersunk screws hand tight.

When Tornado is in transit, the top plate is removed to avoid damage to the torque cell.

4.1.1 Fitting Instructions for the Torn Top Plate

Step 1: Tornado with torque drive shown.

>>> PICTURE <<<

Step 2: Align top plate with torque drive. The handle is positioned to the left.

>>> PICTURE <<<

Step 3: Tighten screws hand-tight only.

>>> PICTURE <<<

Step 4: For use of Tornado with handle at front, repeat steps 1 to 3 but position top plate accordingly during step 2.

>>> PICTURE <<<

4.2 Assembly of the Tornado 1.5N.m and 3N.m

Unscrew the top plate handle so that the peg holders move towards the outside edge of the plate. Align the top plate with the torque drive so that the handle is on the left-hand side of the top plate. Using the 2.5mm Allen key (provided), tighten the four socket countersunk screws hand tight.

N.B. Do not overtighten as this may cause damage to the delicate sensor.

When Tornado is in transit, the top plate is removed to avoid damage to the torque cell.

4.2.1 Fitting Instructions for the Tornado Top Plate

Step 1: Tornado with torque drive shown.

>>> PICTURE <<<

Step 2: Align top plate with torque drive. The handle is positioned to the left.

>>> PICTURE <<<

Step 3: Tighten screws finger-tight only.

>>> PICTURE <<<

Step 4: For use of Tornado with handle at the front, repeat steps 1 to 3 but position top plate accordingly during step 2.

>>> PICTURE <<<

4.3 Powering the Tornado

The Tornado is supplied with a set of 5 Nickel Metal Hydride AAA rechargeable batteries, which are supplied fully charged to allow use straight from the box. Do not use any other battery charger other than that supplied with the torque tester.

4.3.1 Replacing rechargeable batteries

Under normal circumstances these rechargeable batteries will not need to be replaced. However, if required, to replace the rechargeable batteries you must first remove the base plate on the base of the torque tester by removing the 6 retaining screws. This will reveal a retaining plate. Remove this by releasing the 2 screws on the retaining plate. Remove the fitted rechargeable batteries and fit the 5 new rechargeable batteries in the battery holder, ensuring that you observe polarity and the batteries are placed on top of the 'release tag' and they will be freed from the spring-loaded contacts.

Refit the retaining plate and tighten the 2 screws. Refit the base plate and tighten the 6 retaining screws.

Connect the mains adaptor/charger to the Tornado charger socket located at the right hand side of the torque tester next to the display and charge the new set of rechargeable batteries for 14 - 16 hours. Only use the adaptor/charger supplied. A fully charged battery pack will provide approximately 20 hours constant use between charges.

4.3.2 Low battery warning

A low battery symbol will appear in the display approximately 2 minutes before the gauge powers down automatically. See Fig. 1, below.

>>> PICTURE <<<

4.3.3 Mains operation

The Tornado may also be powered directly from the mains. Simply maintain the mains adaptor/charger connection to your mains supply as above. Only use the adaptor/charger supplied.

4.4 Using the Tornado

4.4.1 Fitting accessories

The Tornado is supplied with 4 pegs which grip the sample during testing.

Screw the pegs into the runners on the top fixture equally spaced to ensure the sample is securely gripped when the runners are brought together using the star handle on the end of the lead screws.

Ensure that the pegs are finger tight and the sample securely clamped otherwise rotation in the fixture will occur during testing.

When using the Tornado 1.5N.m, take care not to overtighten the sample in the pegs to avoid damaging the torque sensor.

4.4.2 Powering up

As shown in Fig. 2 the control panel has 6 keys:

To power up the Tornado press the red >>> PICTURE <<< key. A short self test runs during which the display will show the capacity in 'N.m' (newton metres).

>>> PICTURE <<<

After the self test, providing no torque has been applied to the instrument, the display will show all zeros. This is because the Tornado re-zeros itself during the self test routine.

If a torque is applied rotationally via the fixture, the reading on the display will register the applied torque.

Do not overload the torque sensor, as this could cause irreparable damage.

Loads greater than 120% of full-scale will produce an audible beep until the load is released and an OL symbol will appear on the display **for 30 seconds**.

Loads greater than 150% of full-scale will produce an audible beep until load is released and an OL symbol will appear **permanently** on the display. Consult your supplier to arrange repair.

□

To power down the Tornado press the red >>> PICTURE <<< key.

4.5 Basic Functions

4.5.1 Clockwise and counter-clockwise values

Clockwise torque is displayed on the Tornado and recognised by the symbol shown in Fig. 3.

Counter-clockwise torque is displayed on the Tornado and recognised by the symbol shown in Fig. 4c.

>>> PICTURE <<<

A torque indicator bar alerts the operator to how much load has been applied to the torque sensor. As the load approaches the maximum rating of the torque sensor, the indicator bar changes appearance when above approximately 80% of the rated capacity. This warns the operator that steps should be taken to prevent excessive torque being applied.

When applying clockwise torque, the indicator bar begins solid in appearance, then becomes striped when the capacity is approached. When applying counter-clockwise torque, the indicator bar begins striped, then becomes solid (see Fig. 4b & 4c).

If the Tornado has suffered a serious overload condition, the torque indicator bar will be partially displayed even when no torque is present. This is a warning that the torque sensor is damaged and you should immediately contact your supplier to arrange repair.

4.5.2 Zeroing the Tornado

During operation of the Tornado it is sometimes necessary to zero the display - e.g. when you wish to tare out a displayed torque applied by the sample, so it does not become part of the measured reading. Press and release the **ZERO** key.

4.5.3 Changing the unit of measurement

You can choose from the following units of measurement depending on the capacity of your Tornado: N.m, N.cm, mN.m, gf.cm, kgf.cm, kgf.m, lbf.ft, lbf.in, ozf.in.

To change the display units press and release the **UNITS** key. Each successive key press will select the next available units until the Tornado returns to its original setting. The Tornado automatically converts readings as new units of measure are selected.

4.5.4 Max (peak) readings

The Tornado detects and stores maximum (peak) torque in both clockwise and counter-clockwise directions.

Note: the following max display modes do not apply when the % TAMP EV function is enabled. See page 19 for alternative modes.

4.5.5 Max Mode

Press the **MAX** key. The display will show the word **MAX** together with the highest counter-clockwise torque and the highest clockwise torque detected during the test. The current load being applied to the torque sensor is also displayed - see Fig. 4a.

4.5.6 Dual Max

>>> PICTURE <<<

4.5.7 Max clockwise torque

Press the **MAX** key again and the display will show the maximum clockwise torque identified by its symbol.

>>> PICTURE <<<

4.5.8 Max counter-clockwise torque

Press the **MAX** key again and the display will show the maximum counter-clockwise torque identified by its symbol.

>>> PICTURE <<<

Note: When % TAMP EV function is enabled, different max modes are shown, see page 19.

4.5.9 'Normal' mode

Press the **MAX** key again and the word MAX has now disappeared from the display. The display will now indicate torques applied in both directions as they are applied to the torque sensor and maintain a 'running' display.

Press the **RESET** key to clear both maximum registers and prepare for detecting the next maximum readings.

4.5.10 Data output

(See also COMMS section of Advanced Menu Options on page 23)

4.5.10.1 Analogue output

An uncalibrated analogue output is available from the 'D type' connector marked 'coms' for use with chart recorders, oscilloscopes or any other devices requiring analogue inputs. See technical specifications on pages 47 - 49 for details.

4.5.10.2 RS232 and Digimatic output signals

It is possible to transmit the displayed reading to peripheral devices (e.g. PC, printer) via the communications port, by pressing and releasing the **TXD** key.

Displayed readings can also be requested individually from a PC via the RS232 interface by sending a "?" character. See page 32.

A full range of interface cables are available to connect your Tornado to peripheral devices - see page 49 for details.

4.5.10.3 Continuous data transmission

For sending a continuous data stream to a PC, printer, etc press and hold the **TXD** key for 2 seconds then release. TX will now appear in the display to indicate that data is being sent, (see figure 5). To stop sending data, simply press and release the **TXD** key, at which point TX will disappear from the display.

>>> PICTURE <<<

Please note that the continuous data output only starts when the load threshold default of 2% of the rated capacity of the Tornado is reached. This threshold can be set from 0-100% (see page 24).

The continuous data stream rate is 25Hz, unless 115200 Baud is selected, when it is 50Hz.

When using continuous transmission over RS232 only, select the TX METHOD as RS232 (see page 24). If DIGIMATIC or DUAL is selected, and no digimatic device is connected, the display will periodically freeze.

4.5.11 PC Communication or other RS232 input device, eg. PLC

Hold down the Ctrl key on the PC keyboard and press:

a to simulate pressing the **TXD** key*

b to simulate pressing the **UNITS** key

c to simulate pressing the **MAX** key

d to simulate pressing the **RESET** key

e to simulate pressing the **ZERO** key

See page 32 for full table.

* Note that the continuous transmission mode cannot be entered via this method.

Tornado uses 9600, 19200, 57600 or 115200 Baud, 8 data bits, 1 start bit, 1 stop bit, no parity and no flow control. (See Advanced Menu Options for setup details).

4.6 Advanced Menu Options

The Tornado Advanced Menus are navigated using the blue text on the function keys.

4.6.1 Navigating the menus

Press and hold the **MENU** key for approximately 3 seconds to access page 1 of the main-menu, (see Fig. 6). Pressing the **MENU** key again takes you to pages 2 and 3 of the main menu in turn. To move between the options listed on the 3 main-menu pages, press the **UP** and **DOWN** keys to move the cursor. Press the **ENTER** key to select sub-menus, activate features and enter values. Within sub-menus the **UP** and **DOWN** keys will also change numerical values. Press the **ESC** key to return to the relevant main-menu page and **ESC** again to return to the main display.

4.6.2 MAIN MENU PAGE 1

>>> PICTURE <<<

4.7 ALARM

The Tornado has an audible and visual pass/fail alarm feature. A band of acceptable torque result values can be appointed, and the alarm set to trigger when recorded values fall outside of, or within this band.

Up to 5 alarm settings may be stored, but only one setting may be used at any one time.

To set an alarm, press and hold the **MENU** key until page 1 of the main-menu appears. The cursor arrow will point to ALARM. Press the **ENTER** key.

Alarms will not trigger in the first 1% of full-scale use.

4.7.1 ALARM sub-menu 1 (SETTING SELECTION)

The display will show ALARM OFF, and 5 separate alarms, which may each be set up independently and stored by the user for easy access when changing test routines. The cursor will be positioned against the current alarm in use, or against ALARM OFF if no alarm is selected.

To activate an alarm, move the cursor to the desired alarm and press **ENTER**.

4.7.2 ALARM sub-menu 2 (ALARM SET)

This will access the ALARM sub-menu 2, however this alarm has now been activated, and you can return to the main display by pressing the **ESC** key twice. The main display will now show an alarm 'bell' symbol accompanied by the number of the alarm selected, indicating that that alarm is activated (see Fig. 7).

If, however, you wish to change the settings of the selected alarm, choose SET by pressing the **ENTER** key in ALARM sub-menu 2.

>>> PICTURE <<<

4.7.3 ALARM sub-menu 3 (ALARM LIMITS)

The display will now show the two limits - LIMIT 1 (lower limit) and LIMIT 2 (upper limit) - plus the value they are set to and whether they are in a clockwise (CW) or counter-clockwise (CCW) direction. A diamond cursor indicates which value is selected. Use the **UP** and **DOWN** keys to change the value, press and hold to scroll values. When the correct value is reached, press the **ENTER** key to set.

LIMIT 1. Repeat procedure for LIMIT 2 (see Fig. 8) **Note:** The alarm limits are not active below 1% of the capacity of the tester.

>>> PICTURE <<<

4.7.4 ALARM sub-menu 4 (ALARM INDICATOR)

The display shows AUDIBLE, LED and BOTH with the arrow cursor indicating which feature is selected. This menu selects how the PASS/FAIL status of a value will be indicated.

AUDIBLE - Only the audible alarm will be activated when the value is a pass/fail.

LED - The PASS LED will illuminate green to indicate a pass status, the FAIL LED will illuminate orange or red to indicate low or high failures respectively.

BOTH - Both the LED and the audible alarm will be activated.

Use the **UP** and **DOWN** keys to move the cursor and press the **ENTER** key to select the desired feature.

4.7.5 ALARM sub-menu 5 (ALARM BAND)

The display shows OUT BAND and IN BAND. This menu selects which values are to be considered.

OUT BAND - Any value falling outside the set limits LIMIT 1 and LIMIT 2.

IN BAND - Any value falling between the set limits LIMIT 1 and LIMIT 2.

Use the **UP** and **DOWN** keys to move the cursor and press **ENTER** key to select the desired feature.

4.7.6 ALARM sub-menu 6 (ALARM PASS/FAIL)

The display shows PASS or FAIL. This menu sets the OUT BAND criteria.

PASS - Values, which fall either OUT BAND (or IN BAND, if selected), are a PASS and will cause an audible beep, illuminate an LED or both.

FAIL - Values, which fall either OUT BAND (or IN BAND, if selected), are a FAIL and will cause an audible beep, illuminate an LED or both.

Use **UP** and **DOWN** keys to move the cursor and press **ENTER** key to select the desired feature.

4.7.7 ALARM sub-menu 7 (ALARM BUZZER MODE)

The display shows BUZZER ON, CONTINUOUS and PULSE. This menu selects the length of time that the buzzer will sound, if AUDIBLE or BOTH has been selected in sub-menu 5.

CONTINUOUS - The buzzer sounds at a pre-set alarm value and stays on until the load falls below that pre-set.

PULSE - The buzzer pulses for a fixed time of one second every time the load crosses over each of the presets.

Use the **UP** and **DOWN** keys to move the cursor and press the **ENTER** key to select the desired feature.

The display will now return to the main menu page 1, press **ESC** to return the main display.

4.7.8 Fast Selection of Alarms

In order to quickly and easily switch between pre-set alarms, it is possible to instantly access an ALARM SELECT page by holding down the RESET key for 3 seconds whilst in the main display.

The ALARM SELECT page is similar to the ALARM sub-menu 1- the display will show ALARM SELECT; OFF, and the 5 separate alarms. The cursor will be positioned against the current alarm in use, or against ALARM OFF if no alarm is selected.

To activate an alarm, move the cursor to the desired alarm (or to OFF to deactivate alarms) and press **ENTER**. Alternatively, to cancel the command, press **ESC**.

The screen will return to the main display.

4.8 PLC (Programmable Logic Controller)

For PLC applications, this function requires an external cable with a built-in solid-state relay - see Specifications on pages 47-48 for details of the signal.

To configure the signal output of the Tornado, press and hold the **MENU** key until page 1 of the main menu appears. Press the **DOWN** key to move the arrow cursor to PLC and press **ENTER**.

4.8.1 PLC sub-menu 1

The display will show PLC OUTPUT:

OFF - Indicates PLC function status

AT LIMITS - Will set PLC signal at specified load limits

AT ALARM - Will tie in PLC signal with the Tornado alarm settings

4.8.2 AT LIMITS sub-menu 1

The display will show:

RESET - When the load limit is reached, the output signal triggers and the **RESET** key must be pressed to clear the line before

starting the next test.

CONTINUOUS - The output signal will be activated every time the load limit is reached and will remain on whilst the load exceeds the set limit.

PULSE - The output signal will be activated momentarily when the load limit is reached. The **RESET** key must be pressed before starting the next test.

Select the desired function and press the **ENTER** key.

4.8.3 AT LIMITS sub-menu 2

The display will show SET and a default load limit at which the output signal will trigger. To set the required load limit use **UP** and **DOWN** keys to adjust the value and the **ENTER** key to confirm the selection.

4.8.4 AT ALARM sub-menu 1

The display will show STATE:

HIGH - Will set PLC signal high at Tornado's alarm.

LOW - Will set PLC signal low at Tornado's alarm.

Select the desired function and press the **ENTER** key.

The display will revert back to PLC sub-menu 1 and PLC ON will now be displayed.

Press **ESC** key to return to the main menu page 1.

4.9 PASSWORD

Once the desired settings for the Tornado have been established, it is possible to password protect the menu pages, so that no further changes may be made without authorised access.

To access the PASSWORD function, press and hold the **MENU** key until page 1 of the main-menu appears. Using the **UP** and **DOWN** keys, move the arrow cursor to PASSWORD, and press **ENTER**.

4.9.1 PASSWORD sub-menu 1

The display shows MENU PASSWORD:

OFF - Enables access to menu pages.

ON - Requires a password be entered to access the menu pages.

Use the **UP** and **DOWN** keys to move the arrow cursor against the desired selection and press **ENTER**, then press the **ESC** key twice to return to the main display.

If the PASSWORD function has been enabled, and the **MENU** key is held down to access the menu pages from the main display, a screen showing 0000 will appear, and the menu password '6284' must be entered to proceed. Use the **UP** and **DOWN** keys to select the first number, followed by **ENTER** to move on to the next number, and so on. If the password is entered incorrectly, the display will return to the main display.

4.10 FREEZE

This feature is used to 'freeze' the main-display when an external signal is received. The Tornado can be configured to freeze when going either low 1-0, falling edge (LO) or high 0-1, rising edge (HI). This is particularly useful for applications where an event occurs (e.g. rotary switch testing). To clear the display press the **RESET** key.

To configure this function, press and hold the **MENU** key until main menu page 1 appears. Press the **DOWN** key to move the arrow cursor to FREEZE and press the **ENTER** key.

4.10.1 FREEZE sub-menu 1

Select the desired LO or HI function using **UP** or **DOWN** arrow keys and press **ENTER** to select. When set, the sub-menu will display FREEZE ON. To disable the FREEZE function, align the cursor with FREEZE ON and press the **ENTER** key. FREEZE OFF will now be displayed. Press **ESC** to return to the main menu page 1.

Use pins 7 & 10 for this function – page 48 for details. When unconnected, pin 7 is pulled high internally.

4.11 % TAMP EV

When testing tamper-evident caps and seals, the Tornado enables the value at both the slip torque (1st peak) and bridge torque (2nd peak) to be measured and displayed. Once calculated, either result or both can be transmitted to a peripheral device (see COMMS on page 23).

Different designs for tamper-evident seals can produce slightly different profiles when tested. To accommodate this, the Tornado has an adjustable feature (% drop) to ensure the correct values are calculated on different types of seal.

>>> PICTURE <<<

The % drop feature is based on the capacity of the Tornado unit, and refers to the amount that the 1st peak to be calculated must drop before the software starts to look for the 2nd peak. The default setting is based on a drop of 5% (see Fig. 9). This can be adjusted depending upon the profile of the cap to be tested.

To enable the % TAMP EV function, press and hold the **MENU** key until page 1 of the main menu appears. Press the **DOWN** key to move the cursor to % TAMP EV and press the **ENTER** key.

4.11.1 % TAMP EV sub-menu 1 (SET)

The display will show % DROP OFF and SET. Press the **ENTER** key to change OFF to ON. Press the **DOWN** key to move the arrow cursor to SET and press the **ENTER** key.

4.11.2 % TAMP EV sub-menu 2 (PERCENTAGE)

Use the **UP** and **DOWN** keys to set the percentage to the desired value and press the **ENTER** key.

4.11.3 % TAMP EV sub-menu 3 (TX PEAKS)

The values which are to be transmitted to a peripheral device when using the **TXD** key on a dual max screen must now be selected. The following display will appear.

TX 1st PEAK - Sets the Tornado to transmit the slip torque (1st peak) only.

TX 2nd PEAK - Sets the Tornado to transmit the bridge torque (2nd peak) only.

TX BOTH - Sets the Tornado to transmit both the slip torque (1st peak) and the bridge torque (2nd peak).

Use the **UP** and **DOWN** keys to move the arrow cursor to the desired selection and press **ENTER**.

The display will return to the % TAMP EV sub-menu 1. Press **ESC** to return to the main menu page 1, and again to return to the main display.

4.11.4 Max Modes with % TAMP EV function enabled

When the % TAMP EV function has been enabled, pressing the **MAX** key will scroll through the following max display modes, in order:

1. 1st and 2nd clockwise peaks
2. 1st clockwise peak only
3. 1st and 2nd counter-clockwise peaks (see Fig. 10).
4. 1st counter-clockwise peak only
5. Current 'live' reading

Mode 3) is required for measurement of tamper-evident closure slip and bridge release torques.

>>> PICTURE <<<

Testing Hints:

Where possible, apply torque to tamper evident closures in a smooth single turn. This will ensure that accurate peaks for both slip torque (1st peak) and bridge torque (2nd peak) are calculated.

When setting up the Tornado, a graphical representation of the test provides a clear insight into the % drop factor required. Please contact Mecmesin or your approved supplier for details on DataPlot graphical charting software.

4.12 AV/TIME

>>> PICTURE <<<

This function allows the average load reading to be displayed. The average starts being calculated when the START threshold (% of full-scale) is reached and stops being calculated when the load passes through the STOP threshold.

To set average over time, press and hold the **MENU** key until page 1 of the main menu appears. Using the **UP** and **DOWN** keys, move the arrow cursor to AV/TIME and press **ENTER**.

The maximum duration of AV/TIME calculation is approx. 22 minutes.

4.12.1 AV/TIME sub-menu 1 (SET)

The display will show AV/TIME OFF and SET. Press the **ENTER** key to change OFF to ON. Press the **DOWN** key to move the arrow cursor to SET and press the **ENTER** key.

The display will now show the START and STOP thresholds and the values to which they are set (as a % of full-scale).

4.12.2 AV/TIME sub-menu 2 (PERCENTAGE START/STOP)

Any load reading above the START threshold will be averaged over time. Averaging stops when the load reading passes through the STOP threshold.

A diamond cursor will indicate which value is selected.

Use the **UP** and **DOWN** keys to change the value, press and hold to scroll values. When the correct value is reached press the **ENTER** key to set START. Repeat procedure for setting STOP. The display will revert back to AV/TIME sub-menu 1.

To disable the AV/TIME function, press the **ENTER** key when the cursor arrow is aligned with ON in AV/TIME sub-menu 1. It will now display OFF.

Press the **ESC** key to return to the main menu page 1, and again to return to the main display.

The maximum duration of AV/TIME calculation is approx. 22 minutes. When the time limit expires, 'AT' is displayed in the main display, and the **MAX** key must be pressed in order to clear 'AT' and continue use of the Tornado.

4.12.3 MAIN MENU PAGE 2

>>> PICTURE <<<

4.13 RATE

This function allows the selection of the Tornado data capture rate, i.e. the amount of averaging performed by the internal electronics before the load reading is displayed. Data are sampled at 5000Hz and averaged to 2 levels:

MEDIUM - 80Hz (Default)

HIGH - 2000Hz

To set RATE, press and hold the **MENU** key until the main menu page 1 appears. Press and release the **MENU** key to access the main menu page 2. Using the **UP** and **DOWN** keys move the arrow cursor to RATE, and press **ENTER**.

4.13.1 RATE sub-menu 1

Using the **UP** and **DOWN** keys select the relevant level (MEDIUM or HIGH) and press the **ENTER** key.

Press the **ESC** key to return to the main menu page 2, and again to return to the main display.

4.14 FOOTSWITCH 1

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