224 Digital Surface Profile Gauge

Operating Instructions

The New Elcometer 224
Surface Profile Gauge

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ANDROID APP ON
Google play

Made for
iPod iPhone iPad

Gauge Dimensions: Integral: 168 x 73 x 37mm (6.61 x 2.87 x 1.46");
                      Separate: 141 x 73 x 37mm (5.55 x 2.87 x 1.46")
Gauge Weight: Integral: 218g (7.69oz) including batteries;
                      Separate: 161g (5.68oz) including batteries.

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WELCOME

Thank you for your purchase of this Elcometer 224 Surface Profile Gauge. Welcome to Elcometer.

Elcometer are world leaders in the design, manufacture and supply of coatings inspection equipment. Our products cover all aspects of coating inspection, from development through application to post application inspection.

The Elcometer 224 Surface Profile Gauge is a world beating product. With the purchase of this gauge you now have access to the worldwide service and support network of Elcometer.

For more information visit www.elcometer.com

ABOUT YOUR GAUGE

The Elcometer 224 Surface Profile Gauge is a handheld gauge for fast and accurate measurement of surface profile.

The gauge is available in two models; Model B and T.

This manual describes the operation of both Elcometer 224 models and indicates, where necessary, which specific model(s) the feature is available on in brackets after the feature.

All versions of the gauge feature an easy-to-use menu driven graphical interface which guides the user through tasks such as gauge configuration and calibration adjustment.

The gauge is available either with a built-in integral probe or as a separate probe version. A range of probes is available to suit requirements.

CONVENTIONS IN THESE INSTRUCTIONS

The Elcometer 224 is operated using a simple menu structure which helps you get the most from your gauge.

As an example, the Languages option is located within Setup which is under the Menu softkey and is shown in these instructions as:

Menu/Setup/Language

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1 GAUGE OVERVIEW AND BOX CONTENTS

Gauge Overview

1   LED Indicators - Red (left), Green (right)
2   Colour Screen
3   Multifunction Softkeys
4   On/Off Key
5   Separate Probe Connection
6   Internal Probe
7   Wrist Strap Connection
8   Battery Compartment (¼ turn open/close)
9   USB Data Output Socket (below cover)

Box Contents

- Elcometer 224 Surface Profile Gauge
- Calibration Test Foils; Nominal Values 125 & 500µm and Glass Zero Tile (Integral gauges)[a]
- Test Certificate
- Wrist Harness
- Protective Case (Model B & T); Transit Case (Model T)
- 1 x Screen Protector
- Probe Protection Cap (Integral gauges)[a]
- 2 x AA Batteries
- USB Cable & ElcoMaster™ 2.0 Software (Model T)
- User Guide

[a] For separate gauges, the test foils, glass zero tile and probe protection cap are supplied with the separate probe.

Packaging

The gauge is packed in cardboard packaging. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Please Consult your Local Environmental Authority for further guidance.

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2 GETTING STARTED

Fitting the batteries

Your gauge is supplied with batteries ready to fit. To insert or replace the batteries:

1. Lift the latch at the back of the gauge and rotate anticlockwise.
2. Remove the battery compartment cover.
3. Insert 2 batteries (type LR6/AA) taking care to ensure correct battery polarity.
4. Replace battery compartment cover and rotate the latch clockwise to close.

The battery condition is indicated by a symbol in the top right of the display:

- Full symbol (orange) = batteries at full capacity
- Empty symbol (red, flashing) = batteries at lowest sustainable level

To maximise battery life, ensure that Auto Screen Brightness is selected, or the screen brightness is low via **Menu/Setup/Screen Settings/Screen Brightness** and the Bluetooth (Model T) is disabled (if you are not using it) via **Menu/Bluetooth** and uncheck the **Enable Bluetooth** radio button.

Connecting the probe (separate gauges only)

1. Rotate the probe plug to align the pins
2. Screw in the collar - clockwise

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Fitting the wrist harness

A wrist harness is supplied with each gauge. This can be fitted into the right hand side of the gauge using the wrist strap connection. To fit the harness, pass the harness loop through the wrist strap connection, pass the main wrist harness through the loop and pull.

Switching the gauge on/off

- To switch on, press on/off key for more than 0.5 seconds.
- To switch off, press and hold on/off key until the screen blanks.

The gauge will switch off automatically after 5 minutes of inactivity. To switch off this feature, press **Menu/Setup** and uncheck the **Gauge Auto Off** radio button.

Selecting a language

When the gauge is switched on for the first time after dispatch from the Elcometer factory the display will show the language selection screen:

1. Select your language using the ↑↓ softkeys
2. Follow the on screen menus

To access the language menu when in a foreign language:

1. Switch the gauge OFF
2. Press and hold the left softkey and switch the gauge ON
3. Select your language using the ↑↓ softkeys

The language can also be changed via **Menu/Setup/Language**

Selecting units

The Elcometer 224 can display readings in both metric and imperial measurement units (microns, millimetres, mils or inches). The appropriate measurement unit can be changed via **Menu/Setup/Units**

Selecting Manual or Auto Screen Brightness Adjustment

When the language has been selected following first switch on, or after a gauge reset, the display will ask the user to select either a manual or automatic screen brightness adjustment.

Selecting **Manual** will guide the user to manually adjust the screen brightness before returning to the reading screen.

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Selecting Auto will enable the gauge to automatically select the appropriate brightness for the surrounding light conditions using the internal light sensor.

Screen brightness can also be changed via **Menu/Setup/Screen Settings/Screen Brightness**.

Note: Manually increasing the screen brightness will reduce battery life.

Adjusting the beep volume

Each time a measurement is taken, the gauge will beep. The beep volume can be adjusted and can even be switched off via **Menu/Setup/Beep Volume**.

3 TAKING A READING

1. Hold the gauge (integral) or the probe by its sleeve (separate gauge)
2. To take a reading, bring the probe down onto the surface whilst holding it perpendicular
3. For subsequent readings, lift the probe off and then replace it onto the surface
4. To accurately assess the surface profile 5-10 readings should be taken over a surface area of 150mm^2 (6 sq. in.). The average of these readings will indicate the surface profile peak-to-valley height of that area.

▶ Users can pre-define the number of readings using the counted average function. When in batching (Model T), press **Batch/New Batch/Batch Type**, select "**Counted Average**" and set the number of readings as required. The average of this pre-defined number will be saved into the batch, but the individual readings within the counted average are not saved. When not in batching (Model B & T), press **Display/Statistics/Counted Average** and set the number of readings as required. When using counted average, the gauge switches between displaying statistics based on individual readings to statistics based on the counted average, as each set of reading are taken.

✓ **DO**	✗ **DO NOT**
• Hold the probe by the probe sleeve	• Drag the probe over the surface
• Firmly place the probe onto the surface	• Bang the probe down hard onto the surface
• Allow the metal base to make contact with the surface - to improve accuracy	• Swing the probe by its cable

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4 CALIBRATING AND TESTING THE GAUGE CALIBRATION

Calibrating the gauge is the process of zeroing the gauge on a smooth glass "zero" tile. Calibration foils can be used to check the accuracy of the gauge across its measurement range. The Elcometer 224 has on screen instructions to guide the user through the calibration method.

To calibrate:
1. Press the **Cal** softkey
2. Select **Calibrate** (T)
3. When prompted place the probe onto the glass zero tile.

▸ If the **Cal** softkey is flashing, the gauge should be calibrated.

To calibrate using the factory calibration (B):
1. Press the **Menu** softkey
2. Select **Reset/Gauge/Metric Gauge** or **Imperial Gauge**

To calibrate using the factory calibration (T):
1. Select **Cal/Factory Calibration** and follow the on screen instructions

▸ The factory calibration returns the gauge to the calibration set up during manufacture and final test using factory reference probes. Factory calibration is not as accurate as a gauge calibration but gives the user the ability to calibrate when no zero tile is available.

To test the calibration (T):
1. Press the **Cal** softkey
2. Select **Test Calibration**
3. When prompted, place the probe on the glass zero tile or on the centre of a foil resting on the glass tile, making sure the pin goes through the hole in the centre of the foil.

90°
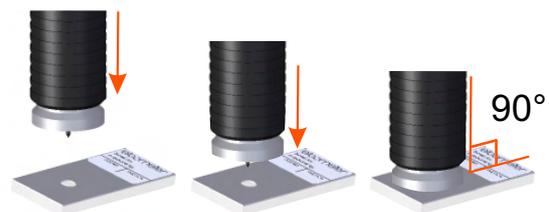
▸ The calibration can be checked at any time without affecting any statistics or batch memory by following the above procedure and comparing the reading value display with the glass zero or measured foil value.

After continued use, the surface of the glass zero tile will begin to wear. If a repeatable zero can not be obtained the tile should be replaced, order part number T22420072.

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The precision manufactured probe tip will wear after continued use. This is a consumable item which can be replaced by the user. (See Gauge & Probe Accessories on page 59.)

A 2-point factory recalibration is required after a tip replacement to ensure the continued accuracy of the gauge.

To calibrate after probe tip replacement (T):
1. Press the **Cal** softkey
2. Select **Factory Calibration** and using the calibration test foils supplied with the gauge / probe, follow the on screen instructions

To calibrate after probe tip replacement (BT):
1. Select **Menu/Reset/Factory Calibration** and using the calibration test foils supplied with the gauge / probe, follow the on screen instructions

When a new probe is connected, the re-calibration procedure will start automatically.

Selecting "Yes" will start the calibration procedure. If the user chooses not to recalibrate, the **Cal** softkey will continue to flash until the gauge is recalibrated.
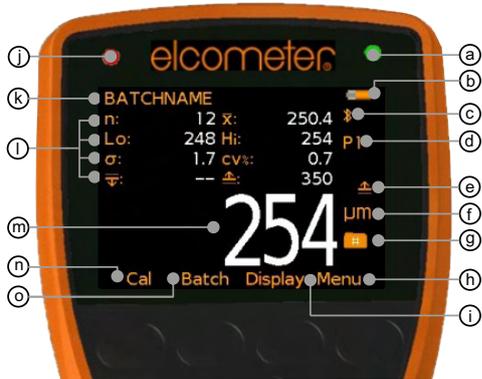
5 THE DISPLAY

The Elcometer 224 gauge has a colour display:
• White characters: All measurement and statistical values.
• Orange characters: All menu items, statistical parameters and symbols.
• Red: A measurement value which is outside set limits; a limit symbol when the limit value has been exceeded (Model T).
• - - - indicates reading outside range of probe.

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		Model
a	Green LED	BT
b	Battery Life Indicator	BT
c	Bluetooth On	T
d	Probe Scale	BT
e	Upper Limit On	T
f	Units of Measurement (µm, mils, mm, inch)	BT
g	Batch Type (normal, counted average)	T
h	Menu Softkey	BT
i	Display Softkey	BT
j	Red LED (Reading outside limit)	T
k	Batch Name (displayed when in batching)	T
	Date & Time (displayed when not in batching)	T
l	User Selectable Statistics (4 rows)	BT
m	Reading Value	BT
n	Calibration Softkey	BT
o	Batch Softkey	BT
p	Bar Graph (highest, lowest & average reading)	BT
q	Lower Limit On	T
r	Softkeys	BT
s	Run Chart (last 20 readings)	T
t	Upper and Lower Limits On	T

For a complete list of icons, see "Gauge Icons" on page 54 - 55

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Reading display size

The character size of the measurement value on the display increases or decreases depending on the number of statistics that are displayed; or if a graph is displayed on the measurement screen. To maximise the reading size, either:

- reduce the number of statistical values that are displayed via **Display/Statistics/Select Statistics**, or
- display the reading only by checking the **Display/Readings Only** radio button.

6 THE GAUGE FEATURES

The Elcometer 224 Surface Profile Gauge has a number of easy to use features and functions to help the user be more efficient. These include:

Fast reading rate (BT)

The Elcometer 224 is capable of taking up to 60 accurate, repeatable and reproducible measurements every minute.

Easy to use menu structure in more than 30 languages (BT)

Designed to be intuitive, the Elcometer 224 menus and calibration instructions are available in multiple languages via **Menu/Setup/Language**.

Bright colour screen (BT)

Each gauge is supplied with a scratch and solvent resistant 2.4" (60mm) TFT colour screen which clearly displays the reading. The screen brightness can be adjusted manually - via **Menu/Setup/Screen Settings/Screen Brightness/Manual** or automatically using the gauge's ambient light sensor which can be switched on via **Menu/Setup/Screen Settings/Screen Brightness/Auto.**

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Battery or USB Powered (BT)

Each gauge can be powered either using 2 x AA lithium, alkaline or rechargeable batteries or by connecting the Elcometer 224 to your PC via a USB cable.

Two year gauge warranty (BT)

The Elcometer 224 gauge is supplied with a 1 year warranty against manufacturing defects. To extend this warranty to 2 years, simply register your gauge via the elcometer.com website.

Emergency light mode (BT)

If all the lighting fails during an inspection in dark environments, the gauge is fitted with an emergency light feature - once selected (**Menu/Emergency Light**), the display turns bright white. To switch off this function either press and hold the **Esc** softkey or power off the gauge.

Automatic rotating display (BT)

Using the internal accelerometer, the gauge will automatically rotate the display to allow you to easily read the thickness value in any orientation - 0°, 90°, 180° & 270°.

This function can be switched off by un-checking **Menu/Setup/Display/Auto Display Rotation**

Gauge firmware updates (BT)

Using Elcometer's free data management software, ElcoMaster™ 2.0, users can receive prompts when there is a gauge firmware update available for their model version.

When the Elcometer 224 is connected (via USB), to any computer with an internet connection and with ElcoMaster™ 2.0 installed, ElcoMaster™ 2.0 highlights the availability of a firmware update, identifies to the user the new features and guides the user through the gauge firmware update process.

Caution, before upgrading your gauge firmware, ensure that you have downloaded all inspection readings from the gauge. For more information regarding ElcoMaster™ 2.0 see page 27 Downloading Data.

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Bluetooth® (T) and USB Data output (BT)

Elcometer 224 gauges have the ability to transfer data via USB to a computer or wirelessly via Bluetooth® technology to PC's, PDA's or mobile phones which are Bluetooth® enabled using ElcoMaster™ 2.0 or ElcoMaster™ Mobile Apps.

Bluetooth® data output can be switched on via **Menu/Bluetooth/Enable Bluetooth**. For more information regarding ElcoMaster™ 2.0 see page 27 Downloading Data.

ElcoMaster™ 2.0 Data output (BT)

Users can download data from any Elcometer gauge directly into ElcoMaster™ 2.0 by connecting the gauge to the PC and following the on screen prompts.

Once the data has been transferred to the computer, the user can produce professional reports in seconds. Data can also be transferred into programs, such as Excel®, in a similar manner.

For more information regarding ElcoMaster™ 2.0 see page 27 Downloading Data.

Calibration Lock (T)

To avoid accidental amendments to the calibration settings switching on the **Cal/Calibration Lock** feature' locks' the user from undertaking any changes to the calibration without first un-checking the **Cal/Calibration Lock** feature.

When the Calibration Lock is enabled, users can still test the calibration via **Cal/Test Calibration** but will be unable to validate or re-calibrate the gauge.

Counted Average (BT)

Users can pre-define the number of readings using the counted average function. When in batching (T), select **Batch/New Batch/Batch Type/Counted Average** and set the number of readings as required. The average of this pre-defined number will be saved into the batch, but the individual readings within the counted average are not saved. When not in batching (B & T), select **Display/Statistics/Counted Average** and set the number of readings as required.

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When using counted average, the gauge switches between displaying statistics based on individual readings to statistics based on the counted average, as each set of reading are taken.

On Screen Statistics (BT)

User selectable statistical and general measurement information can be displayed on the gauge. The information to be displayed can be selected and managed by selecting the **Display** softkey.

- Up to 8 statistics can be selected to be displayed on the reading screen via **Display/Statistics/Select Statistics**
- Ensure that **Display/Readings & Selected Stats** is also checked.
- To view all statistics select **Display/Statistics/View All**

The following statistical and general information can be displayed on your gauge:

Symbol / icon	Model	Description
η	BT	The number of readings taken
$\bar{x}$	BT	Mean (average)
σ	BT	Standard deviation
Hi	BT	Highest reading taken
Lo	BT	Lowest reading taken
CV%	BT	Coefficient of variation; The COV is defined as the ratio of the standard deviation to the mean and is a normalised measure of dispersion - when comparing batches with widely different means, one should use the coefficient of variation for comparison instead of standard deviation (σ).
⟰	T	High Limit
⟱	T	Low Limit
⟰ₙ	T	Number of readings above the high limit
⟱ₙ	T	Number of readings below the low limit
		User definable warning limits can be set. Once the reading exceeds the limit the gauge notifies the user by turning the reading and relevant limit icon red, flashing the red LED, and sounding the alarm beep. For more information see Limits on page 17.
N	T	Nominal Value

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Analogue Bar Graph (BT)

By selecting **Display/Readings & Bar Graph** the user can view an analogue representation of the current reading together with the highest (Hi), lowest (Lo) and average (x) reading. The graph is updated automatically when each reading is taken.

The values on the top left and right of the bar signify the measurement range from zero to the thick calibration foil value plus 10%. If calibrated using the factory calibration, the probe scale range plus 10% is used. If limits are set, the limit values ±10% are used and the relevant limit icon is displayed above the bar in the appropriate position.

With Limits: The current measurement is displayed as a white or red bar; white if within set limits, and red if outside set limits.

If below the lower limit, the left arrow head is also filled red and if above the upper limit, the right arrow head is filled red.

If the next measurement taken is within set limits, the left or right arrow outline will remain red to signify that the previous reading was outside set limits.

Without Limits: The current measurement is displayed as a white bar.

If outside the measurement range, the left or right arrow head is also filled white.

▸ Users can choose to show **Readings & Selected Stats** (BT) - see On Screen Statistics on page 14**, Readings & Run Chart** (T) - see Run Chart on page 15-16, **Readings & Bar Graph** (BT) or **Readings Only** (BT). **Readings & Run Chart** is only available when in Batching.

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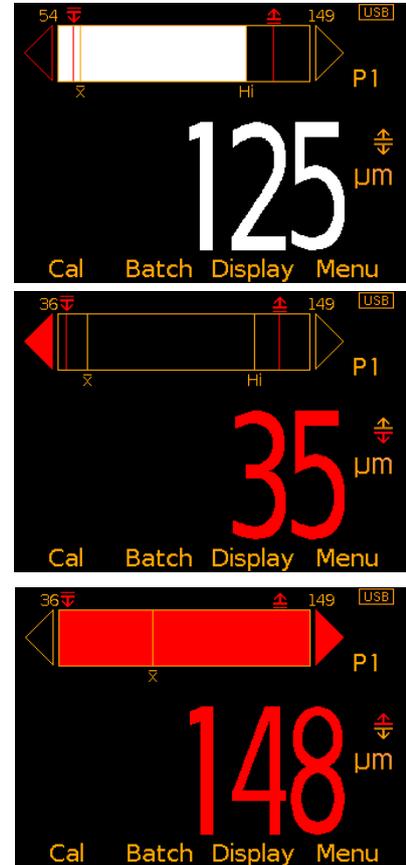
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Run Chart (T)

By selecting **Display/Readings & Run Chart** the user can view a line trend graph of the last 20 measurements. The graph is updated automatically when each reading is taken.

Up to five horizontal axes are displayed representing different values / statistics as follows:

- Highest reading in the batch "Hi"
- Lowest reading in the batch "Lo"
  (for batches of more than one reading)
- Mean of readings in the batch "$\overline{x}$"
  (for batches of more than one reading)
- High limit for the batch "⬕" (when enabled)
- Low limit for the batch "⬔" (when enabled)
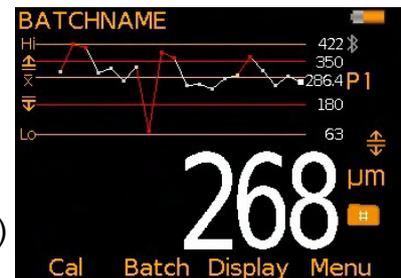
The readings are displayed as white or red points; white if a reading is within limits (or no limits have been set), and red if outside set limits.

▸ Users can choose to show **Readings & Selected Stats** (BT) - see On Screen Statistics on page 14, **Readings & Run Chart** (T), **Readings & Bar Graph** (BT) - see Analogue Bar Graph on page 15 or **Readings Only** (BT). **Readings & Run Chart** is only available when in Batching.

Time and date (T)

Once the appropriate time and date has been set (**Menu/Setup/Time and Date**), the user can display the time and date at the top of the Elcometer 224 display via **Menu/Setup/Time and Date/Display Time and Date**.

- The time format can be set to either the 12 hour or 24 hour clock via **Menu/Setup/Time and Date/Set Format/Set Time Format**
- The date format can be set to either dd/mm/yyyy, mm/dd/yyyy or yyyy/mm/dd via **Menu/Setup/Time** and **Date/Set Format/Set Date Format**

▸ Please note that the time and date is replaced by the batch name when the gauge is in Batch mode.

When a batch is created, re-opened (or when the gauge is switched on whilst in batch mode) and when each reading is taken, the time and date details are stored within the batch - allowing the user to have an accurate record of when the measurements were taken. The time and date stamp for each reading is displayed in the **Batch/Review Batch** reading screen or ElcoMaster™ 2.0.

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Gauge Memory (T)

The Elcometer 224 versions are supplied with a varying level of memory:

Model B: The Model B gauge's 'rolling statistics' provides accurate statistical values for all measurements taken since the statistics were last cleared (**Display/Clear Statistics**). The last 5 readings, however, can be displayed by pressing the **Data** softkey.

Model T: A total of 150,000 readings can be stored into the gauge's memory either in a single batch or in up to 2,500 batches (see Batching on page 18). Each batch can be individually named.

Limits (T)

During the inspection process surfaces can often have specified minimum and/or maximum profile values.

Users can program upper and/or lower warning limits into the Elcometer 224 gauge by selecting **Menu/Set Limits/Set Upper** or **Menu/Set Limits/Set Lower**.

To switch the limits on, the user should ensure that the **Enable Limits** radio button is checked.

•   When an Upper Limit has been set up and enabled the "⫞" icon is displayed.

•   When a Lower Limit has been set up and enabled the "⫟" icon is displayed.

•   If both Upper and Lower limits have been set up and enabled then the two icons are displayed together as "⫢".

When the Elcometer 224 gauge takes a reading which is outside the set limits the following occurs:

•   The Red LED flashes

•   The reading is displayed in red

•   The alarm beeps 3 times

•   The associated limit icon turns red

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In addition, the number of readings above limit (or below limit as applicable) statistic is incremented when readings are stored into memory, the reading is tagged with either the high or low icon as appropriate. For more information see Batching on page 18.

To switch off a particular limit go to **Menu/Set Limits/Set Upper** or **Menu/Set Limits/Set Lower** and set the limit value to Off using the up and down soft keys.

The programmed limit values can be displayed on the reading screen via **Display/Statistics/Select Statistics** and checking the appropriate radio button. The maximum number of statistics that can be displayed on the reading screen at the same time is 8.

If a low limit has been set up, the upper limit value cannot be lower than the pre-set lower limit.

Individual limits can also be set up for each batch on Model T gauges. For more information see Batching on page 18.

Gauge Welcome Screen (ST)

Users can adjust the start up screen on their Elcometer 224 gauges via the ElcoMaster™ 2.0 software - see page 50 for more information.

7 BATCHING (T)

The Elcometer 224 Model T has two measurement modes:
Immediate mode: Where readings are taken, rolling statistics calculated (and displayed), but individual values are not stored in the memory; and
Batching: Where readings are stored into memory in batches. Batches allow the user to collate readings for easier analysis of large structures or complex assemblies. The Elcometer 224 Model T gauge can store a total of 150,000 readings in up to 2,500 batches and has the following batching functions:

- Create a new batch; **Batch/New Batch**
- Open an existing batch; **Batch/Open Existing Batch**
- Rename an existing batch; **Batch/Edit Batch/Rename Batch**

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- Copy a batch - including all calibration and limit setups; **Batch/Copy Batch**
- Clear all the readings within the batch - but leaving all calibration and limit setups; **Batch/Edit Batch/Clear Batch**
- Review the readings, statistics, calibration, batch information and a graph of the readings; **Batch/Review Batch**
- Delete a Batch or all batches, entirely from the gauge; **Batch/Edit Batch/Delete Batch**
- Delete the last reading entirely or delete the reading, but mark the reading as deleted in the batch memory - **Batch/Deleted Reading/Delete With Tag** and **Batch/Deleted Reading/Delete Without Tag** respectively.

Creating a new batch

When using batching for the first time, or when you wish to open a new batch, press **Batch/New Batch**. The user can now:

- Open the batch and take readings; **Batch/New Batch/Open Batch 1**
- Rename the batch - before opening it via **Batch/New Batch/Rename Batch 1**. (See Alpha numeric naming Batches on page 19)
- Choose the type of batch (normal or counted average) before opening it via **Batch/New Batch/Batch Type** (see Batch Types on page 24)
- Set up specific batch limits via **Batch/New Batch/Batch Limits** (see Limits on page 17)
- Set up a fixed batch size via **Batch/New Batch/Fixed Batch Size** (see Fixed Batch Size on page 25)

Once all the batch settings have been created, press **Batch/New Batch/Open Batch 1 -** where 'Batch 1' may now be a re-named as required.

Alpha numeric naming batches

When in batching the user can rename the batch to a more appropriate name.

When a new batch is created, the gauge automatically names it 'Batch n' - where 'n' is the next unused batch number; e.g. Batch 1, Batch 2, Batch 3, etc.

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To rename a batch either:

- when creating a new batch press **Batch/New Batch/Rename Batch 1**; or
- press **Batch/Edit Batch/Rename Batch** and select the Batch to be renamed from the list of existing batches

The current name of the batch is in white in the middle of the display with a yellow 'cursor' icon to the right of the name.

Using the left arrow, right arrow and Select softkeys, the user can rename the batch as required.

The yellow, raised character or function is the item that will be 'chosen' by pressing the Select soft key.

Character	Action
OK	Stores the name and returns the user to the previous screen
⟨X⟩	Deletes the last character of the name
A, B, C...	Selects the character A, B or C, etc.
⎵	Inserts a space
123	Changes the selection characters to: 1 2 3 4 5 6 7 8 9 0
ABC	Changes the selection characters to: A B C D E F G H J K L M N O P Q R S T U V W X Y Z
ÀÇü	Changes the selection characters to: À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï Ð Ñ Ò Ó Ô Õ Ö Ù Ú Û Ü Ý Þ ß µ m
$%&	Changes the selection characters to: ! # ' £ $ € % & * [ ] _ - + / \ < > : @ ; "

Pressing the **Esc** softkey at any time cancels the whole operation without making any changes to the original name.

To store the re-named 'name' highlight OK and press the Select softkey.

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Opening an existing batch

By selecting **Batch/Open Existing Batch**, the user will find a list of all the batches that have already been created, together with the number of readings stored in each batch.

To open a particular batch use the up and down arrow softkeys and select the appropriate batch.

The Elcometer 224 will return the gauge to the main reading screen and the selected batch name will be shown at the top of the display (together with a unique gauge batch id number - allowing no two batches to have exactly the same name).

Copying an existing batch

By selecting **Batch/Copy Batch** the user will find a list of all the batches that have already been created, together with the number of readings stored in each batch.

To copy a particular batch use the up and down arrow softkeys and select the appropriate batch.

The Elcometer 224 will then copy all the batch settings - batch type, warning limits, and the batch name - and then ask the user whether they wish to rename the batch.

Pressing the **Yes** softkey the user will then be asked to rename the batch using the renaming procedure described on pages 19 - 20.

Pressing the **No** softkey (or pressing the **Esc** softkey whilst in the renaming procedure) will make the Elcometer 224 copy the existing batch name to the new batch - thereby two batches will have the same batch name.

Copying a batch does not copy the individual readings within that batch.

Clearing an existing batch

By Selecting **Batch/Edit Batch/Clear Batch**, the user will find a list of all the batches that have already been created, together with the number of readings stored in each batch.

To clear a particular batch's individual readings only, use the up and down arrow softkeys and select the appropriate batch.

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After a request for confirmation, the gauge will clear the readings from the selected batch and return the gauge to the list of batches.

To clear another batch, repeat the procedure. To return the gauge back to the previous menu, press the Back softkey.

The user can clear all batches via **Batch/Edit Batch/Clear Batch/All Batches**.

Reviewing an existing batch

By selecting **Batch/Review Batch** the user will find a list of all the batches that have already been created, together with the number of readings stored in each batch.

To review a particular batch use the up and down arrow softkeys and select the appropriate batch.

The Elcometer 224 will then open up the Review Batch menu, allowing the user to:

- Review the statistics of the batch
- Review the batch information, including:
    - the date and time the batch was created
    - the batch type - normal or counted average
    - the probe type and serial number used to take the readings
    - the batch limits (if set)
- Review the batch's calibration information, including:
    - the date and time the batch was last calibrated or verified
    - the probe type and serial number
- Review the individual readings. The Elcometer 224 displays:
    - the readings in numerical order, the first reading is at the top
    - icons indicating a reading above "≜" or below "⩯" the limit
    - deleted readings icon "⊘" is displayed if "Delete With Tag" selected
- Review a graph of all individual readings within a batch (Batch Reading Graph), .

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Batch Readings Graph

By selecting **Batch/Review Batch/Batch Graph** the user can review all readings in the selected batch as a graph.

Up to five horizontal axes can be displayed representing different values / statistics as follows:

- Highest reading in the batch "Hi"
- Lowest reading in the batch "Lo" (for batches of more than one reading)
- Mean of readings in the batch "$\overline{X}$" (for batches of more than one reading)
- High limit for the batch "$\triangleq$"(when enabled)
- Low limit for the batch "$\overline{\underline{\underline{\overline{\vee}}}}$"(when enabled)

The readings are displayed as white or red vertical bars; white if a reading is within limits (or no limits have been set), and red if outside set limits.

If there are more readings in the batch than can be displayed on a single screen, multiple readings will be combined into one bar. Should a single reading within the 'combined bar' be outside the enabled limits, the whole bar will be red.

Pessing the **Zoom+** softkey, allows each individual reading to be displayed, thereby showing the individual readings outside the limits.

When zoomed in, the graph will always display the first 25 readings. Pressing the ← softkey will display the last 25 readings taken. Subsequent presses of the ← softkey will scroll backwards, pressing the → softkey will scroll forwards through the readings, 25 readings at a time.

Pressing the **Zoom-** softkey returns to the original overview graph of all readings in the batch.

To return the gauge to the Batch Review menu, press the **Back** softkey.

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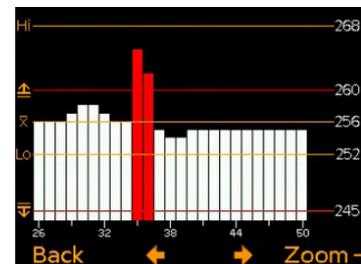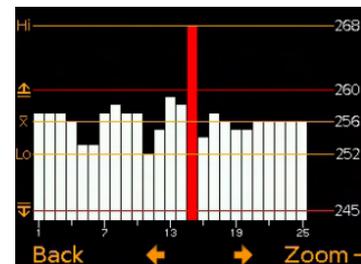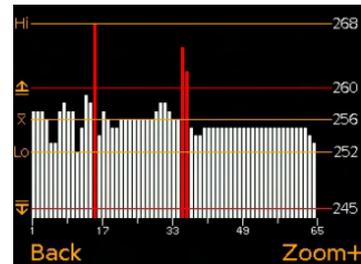
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Delete an existing batch

By Selecting **Batch/Edit Batch/Delete Batch** the user will find a list of all the batches that have already been created, together with the number of readings stored in each batch.

To delete a particular batch's individual readings only use the up and down arrow softkeys and select the appropriate batch.

After a request for confirmation, the gauge will delete the selected batch and return the gauge to the list of batches.

To delete another batch, repeat the procedure, to return the gauge back to the previous menu, press the **Back** softkey.

The user can delete all batches from the gauge by selecting **Batch/Edit Batch/Delete Batch/All Batches**.

Exit Batching

To stop using the Batching Mode and return to the Immediate mode select **Batch/Exit Batching**.

Batch Types

When saving readings into a batch you have a choice of how the readings are managed within the gauge:

Normal: Each reading is saved into memory.
Press **Batch/New Batch/Batch Type** and then select **Normal**.

Counted Average: The average of a predefined number of readings is saved into memory. For example a counted average of 3 means:

The average of [Reading 1 + Reading 2 + Reading 3] is stored as the first measurement saved in the memory.

Likewise the average of readings 4 - 6 are stored as the second measurement in the memory, etc.

The individual readings within the counted average (1.2.3, 4.5.6, etc.) are not saved.

Press **Batch/New Batch/Batch Type** and then select **Counted Average.**

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The Elcometer 224 then asks the user to set the counted average value. Using the up and down arrow softkeys, set the counted average from 2 - 99 and press the **Ok** softkey.

This returns the user to the previous screen. Press the **Back** softkey to continue setting up the new batch as required before opening the new batch.

If Statistics are displayed whilst measuring using the counted average function (CAF) when taking the readings used to calculate the CAF measurement, the gauge will display the rolling statistical calculations of the individual readings until all the readings that go into calculating the CAF measurement are taken. At this point the statistics then display the values of the stored CAF measurements.

Note: The batch type can only be changed when creating a new batch.

Fixed Batch Size

When creating a new batch, by selecting **Batch/New Batch** and checking the **Fixed Batch Size** radio button, users can pre-define the number of readings that are to be stored into the batch using the up and down arrow softkeys.

Once the batch has been opened and readings are being taken, the Elcometer 224 will notify the user when the fixed batch size is complete and ask if another batch is to be opened.

If the user selects No, then the gauge closes the batch and exits batching - returning the gauge to the Immediate mode. If the user selects Yes, then the gauge automatically:

- Appends a '_1' to the original batch name
- Opens a new batch - copying all the batch setup and calibration information
- The new batch is named as the original batch, with a '_2'

For example:

- A fixed batch is created and named "Component A".
- When the batch is full, a new fixed batch 'Component A_2' is created
- 'Component A' becomes 'Component A_1'

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Appending the batch name in this way allows the user to quickly identify - or link - similar batches together.

Once a fixed batch size batch has been filled, no additional readings can be added to that batch; a partially completed fixed batch size batch, however, can be re-opened and completed at a later date.

To continue a batch link, press **Batch/Open Existing Batch** and select the last batch in the link. If the batch is full, the gauge will prompt the user to open a new batch before continuing. If the batch is partially complete the user can complete the batch before continuing to a new batch.

When downloading linked batches into ElcoMaster™ 2.0; the original batch name will be displayed (Component A in the above example). Selecting this batch name will download all linked batches into ElcoMaster™ 2.0 at the same time. For more information on downloading batches see page 27.

Note: Once a fixed batch size batch has been created and data has been stored into the memory, the user cannot rename the batch name within the gauge. The batch name can be amended using the ElcoMaster™ 2.0 software.

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8 DOWNLOADING DATA USING ELCOMASTER 2.0 (BT)

Measurements from the Elcometer 224 Model T can be downloaded to a computer using the ElcoMaster™ 2.0 software (supplied with Model T gauges, downloadable from the Elcometer website for Model B gauges), or the older versions of ElcoMaster™.

This instruction book explains how users can download data using ElcoMaster™ 2.0.

Installing ElcoMaster™ 2.0

To install ElcoMaster™ 2.0 insert the supplied mini-CD into your CD ROM drive. The software will automatically begin the install procedure.

If it does not, or you have downloaded the software from the Elcometer website, run the **SetupElcoMaster2.exe** file.

The ElcoMaster Setup Wizard will then begin.

Follow the on screen wizard

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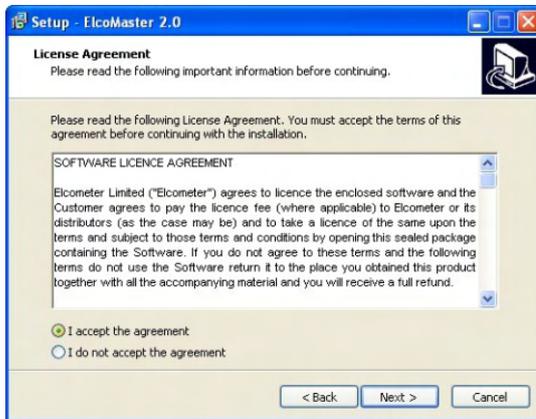
It is important to read the License Agreement carefully and if the terms are acceptable, select the 'I accept this agreement' radio button and click 'Next >'
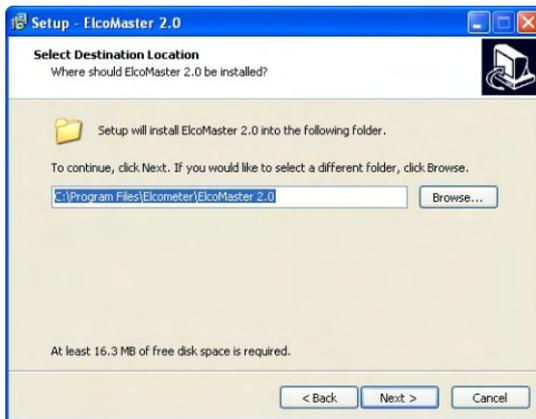
ElcoMaster 2.0 will automatically select a default destination location for the software to be installed.

Click the 'Browse...' button to select an alternate file location.

Click 'Next >' to continue
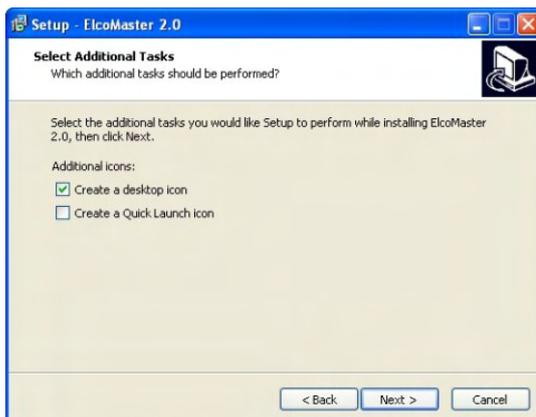
Choose any additional tasks, by selecting the appropriate check box and press 'Next >' to continue

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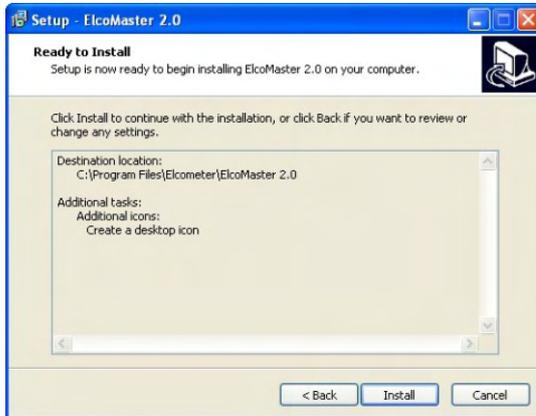
The ElcoMaster™ 2.0 wizard now provides a list of the settings that have been selected.

Click 'Install' to undertake the installation or '< Back' to review or alter any settings.

ElcoMaster™ 2.0 will now install.

Press 'Finish' to exit Setup.
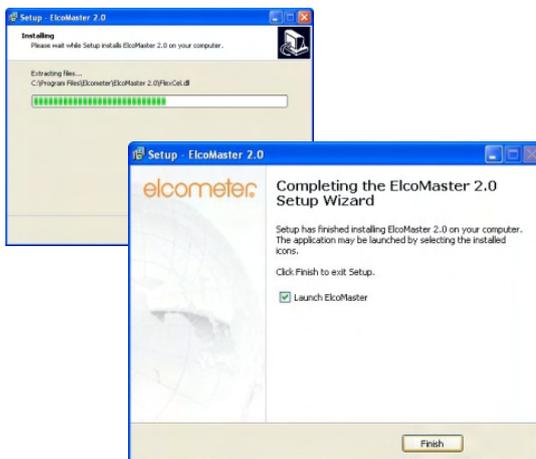
Upgrading data from older version of ElcoMaster™

ElcoMaster™ 2.0 is fitted with an internal database upgrade facility which will automatically check to see if there are any original ElcoMaster™ database files and ask if the user would like to upgrade the data to the new ElcoMaster™ 2.0 format.

Upgrading can occur at any time by selecting Menu/Import/Import ElcoMaster 1.x Data and selecting the relevant database file.

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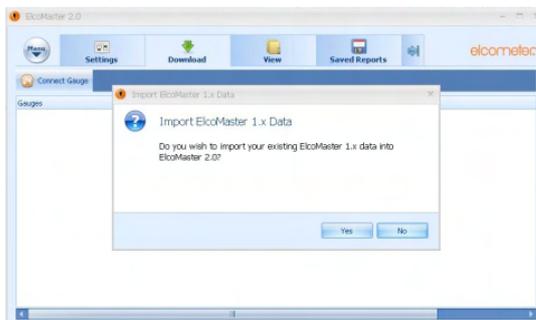
The ElcoMaster™ 2.0 Software

ElcoMaster™ 2.0 is a simple - yet powerful - data management software solution that has been designed to allow users to generate professional reports in seconds - with the minimum of fuss.

It has three operating modes; Excel Link, Standard and Advanced Mode. ElcoMaster™ is set to Standard Mode on first install.

Across the top of the software is a Menu button, 'Action Tabs' and an expand arrow.

Menu Button   Action Tabs   Expand Arrow
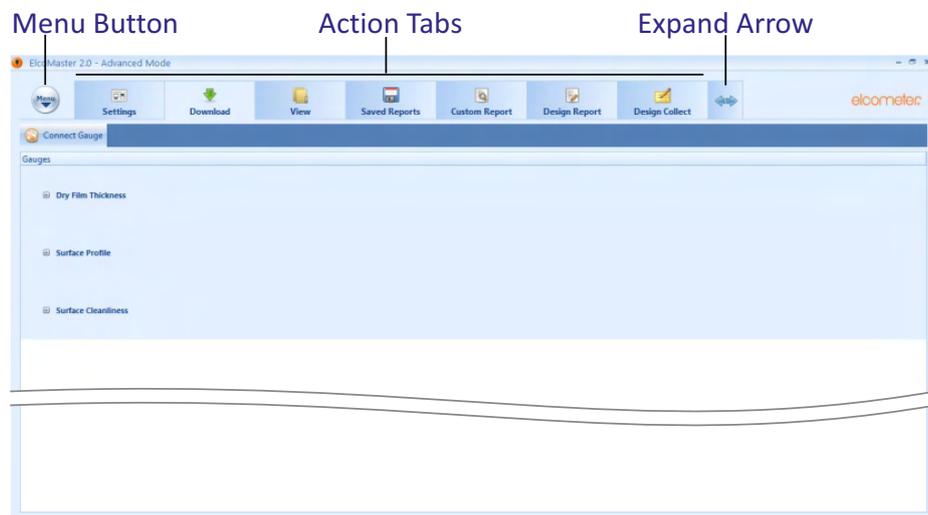
Pressing the **Menu** button opens up a drop down list of options:

- **Help** :   Provides Elcometer contact details and information about ElcoMaster™ 2.0.

- **Update** : Provides users with:
    - the ability to update the ElcoMaster™ 2.0 software to the latest release - connection to the internet is required for this function.
    - the ability to upgrade the firmware of the:
        - Elcometer 224 Digital Surface Profile Gauge (Model B & T)
        - Elcometer 456 Digital Coating Thickness Gauge (Model B, S & T)
        - Elcometer 130 Salt Contamination Meter (Model S & T)

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- **Import:** Allows users to import a database from an earlier version of ElcoMaster™- version 1.x (not applicable to the new Elcometer 130)
- **Exit:** Allows users to shut down the software

The **Action Tabs** available depend on the operating mode in use as follows:

Excel Link Mode

- **Settings** : Allows users to adjust:
  - The *language* of ElcoMaster™ 2.0
  - The *units* of measurement by gauge type
  - Customise the default *reports* to include a user logo or image, together with footer information
  - Adjust the normal distribution type for the histogram *chart*
  - Alter the colour settings of the user *interface*
  - The text file separator used when *exporting* files
  - Select an alternate location to *store* the database
  - Enable or disable the *auto update* option (where access to the internet is prohibited).
- **Download**: Allows users to connect all their Elcometer gauges via USB, Bluetooth®, or RS 232 where appropriate.

Standard Mode: All the features of Excel Link Mode plus;

- **View:** Allows users to:
  - View measurement data, gauge information, measurement statistics, set limits, add notes and labels and view photographs and other documents
  - Print, email or PDF standard reports
  - Export data to Excel or other software packages as required
  - Archive (and restore) old data

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- **Saved Reports:** Once a user has generated a PDF report from within the View action tab, the report is automatically saved within the Saved Reports action tab - for reference and review.

Advanced Mode: All the features of Excel Link and Standard Mode plus;

- Design custom reports
- View data in standard forms - predefined within the Design Report action tab or by Elcometer.
- Design a collection template to guide inspectors where, and in which order, readings should be taken - see page 46 for further details.

Users can switch between operating modes at any time by pressing the Expand Arrow and selecting the mode required.

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Connecting an Elcometer gauge to ElcoMaster™2.0 (BT)

In order to download any gauge readings from the Elcometer 224 the user must first 'Connect the gauge' by clicking the 'Connect Gauge' button on the Download action tab.
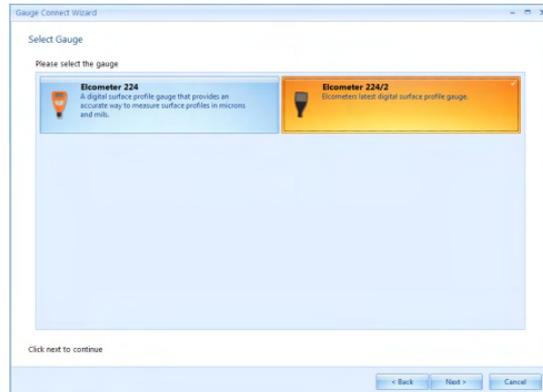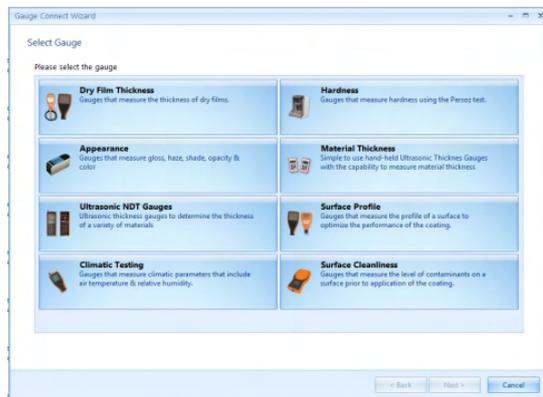
Clicking 'Connect Gauge' starts the ElcoMaster™ 2.0 Gauge Connect Wizard.

The ElcoMaster™ 2.0 data management software allows users to download readings from a wide range of Elcometer inspection gauges.

Measurements such as surface profile, surface cleanliness temperature, dewpoint, delta T, gloss, material thickness and dry film thickness can all be downloaded, stored and reported using the ElcoMaster™ 2.0 software.

These instructions will inform the user how to download data from an Elcometer 224 surface profile gauge. All appropriate Elcometer gauges can be downloaded in a similar way.

- Select the Surface Profile tab and press 'Next >'

ElcoMaster™ 2.0 supports the new Elcometer 224 (identified in the software as Elcometer 224/2) and the old style Elcometer 224.

- Select the Elcometer 224/2 tab and press 'Next>'

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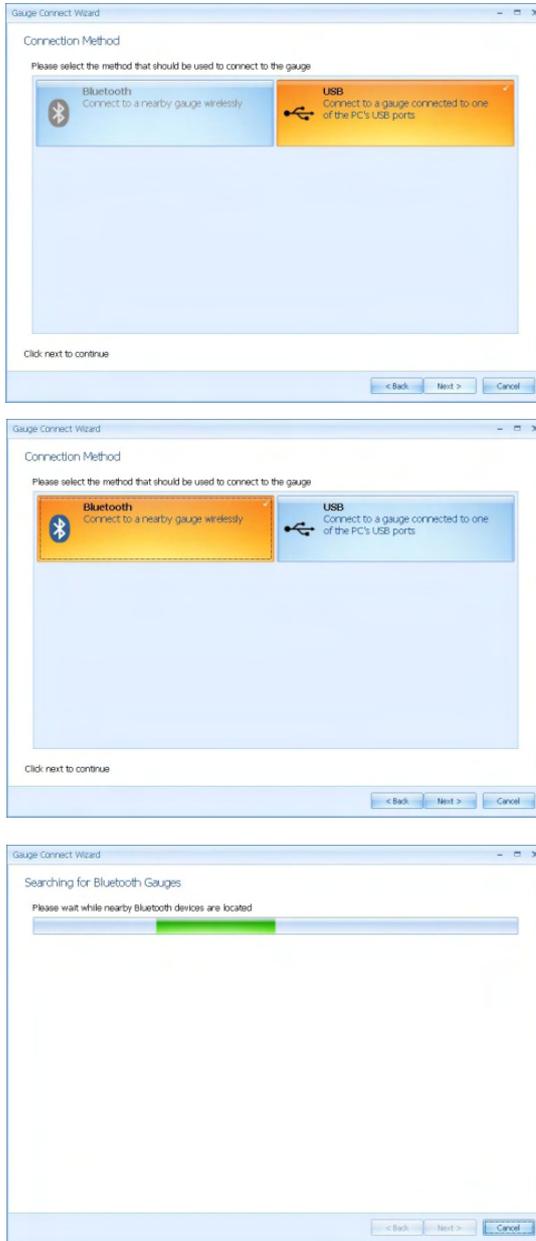
- Select the appropriate connection method for the gauge

Elcometer 224 Model B has USB data output, the Model T has both USB and Bluetooth data output.

Users can purchase a USB Bluetooth Adaptor from Elcometer (Part number T99924797) which will provide a Bluetooth solution to computers without internal bluetooth fitted.

If ElcoMaster™ 2.0 is installed onto a computer without Bluetooth capability, however, the Bluetooth tab is greyed out (as displayed in top image).

- Select the appropriate connection method

- Switch on the Elcometer 224

- Connect the USB cable or make sure that Bluetooth is switched on in the gauge via **Menu/Bluetooth/Enable Bluetooth** (T)

- Bluetooth users should return their gauge to the main reading screen before continuing

- Press 'Next >'

- After a screen prompt ElcoMaster™ 2.0 will search for and list all Elcometer 224 gauges.

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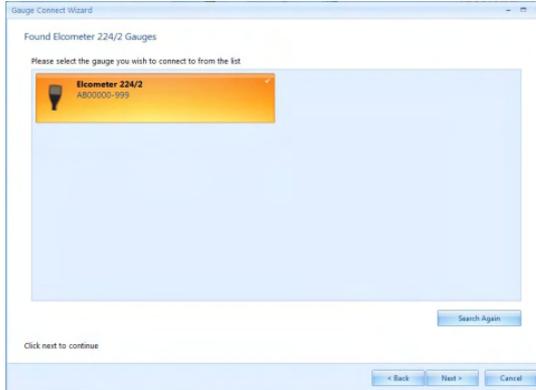
Each surface profile gauge connected is now listed.

- Select the appropriate gauge and press 'Next >'

If connecting via Bluetooth, the gauges are identified using the Bluetooth ID - which can be seen on the bottom of the **Menu/Bluetooth** screen.
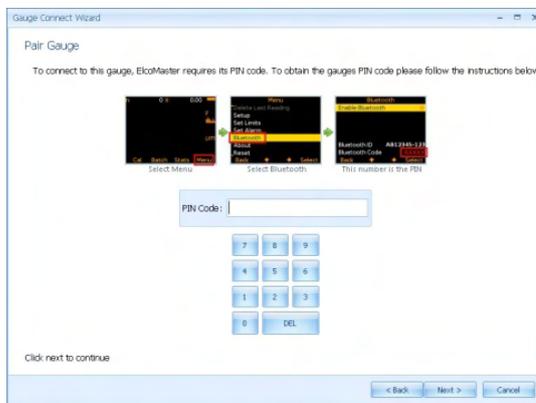
Connecting via Bluetooth now requires the gauge to be 'Paired' by keying in the gauge's unique Bluetooth PIN Code. This code can be found on the bottom of the **Menu/Bluetooth** screen.

- Type in the Bluetooth PIN Code and press 'Next >'

(See Section 9 on page 47 for information on connecting via Bluetooth to a mobile device using ElcoMaster™ Mobile Apps.)
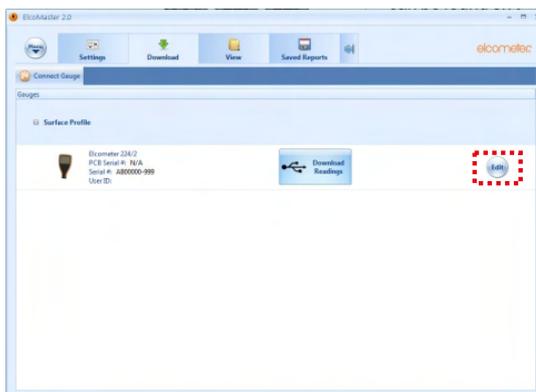
ElcoMaster™ 2.0 will now validate the connection, press Finish when complete.

The gauge is now connected and ElcoMaster™ 2.0 will return the user to the Download action tab, and display the connected gauge.

The same gauge can be connected by more than one method. Repeat the 'Connect Gauge' and follow the on screen prompts.

By clicking on the **Edit** button, users can Delete the gauge from ElcoMaster™ 2.0, name the gauge by a more familiar identification (Enter a User ID) or set up the gauge power up display screen (Change the Welcome screen). See Changing the Welcome Screen on page 50.

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Downloading Data from the Elcometer 224 (T)

Once the gauge has been connected to ElcoMaster™ 2.0 (see pages 33 - 35), switch on your gauge and click the 'Download from Gauge' button for the relevant gauge and connection method.
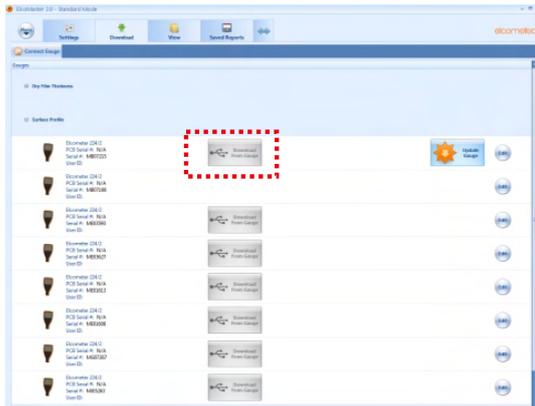
The Download Wizard will now guide the user through the simple download readings process.

ElcoMaster™ 2.0 allows users to download their gauge readings:

- Directly into ElcoMaster™ 2.0
- Directly into an Excel Spreadsheet, bypassing ElcoMaster 2.0
- into a text file for use in other software programs, or
- into a CQATK XML file
- Select the appropriate option
- Select or create a new project folder as required (ElcoMaster Batch File users)
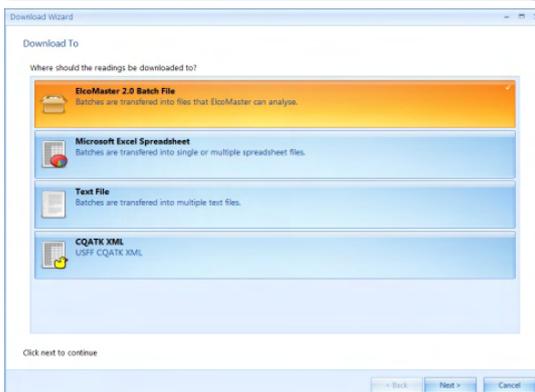
Users wishing to export directly into Excel will also be asked to select a single or multiple spreadsheet option. Single; all batches selected will be downloaded into a single spreadsheet. Multiple; each batch will be downloaded into a separate spreadsheet tab.
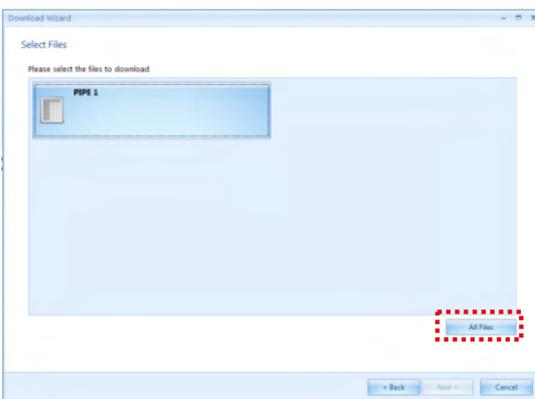
- Select one or more individual batches or click on 'All Files' and press 'Next >'

When downloading data into ElcoMaster™ 2.0 (as opposed to directly into a spreadsheet or a text file), downloaded data is stored in Projects - allowing users to clearly identify inspections.

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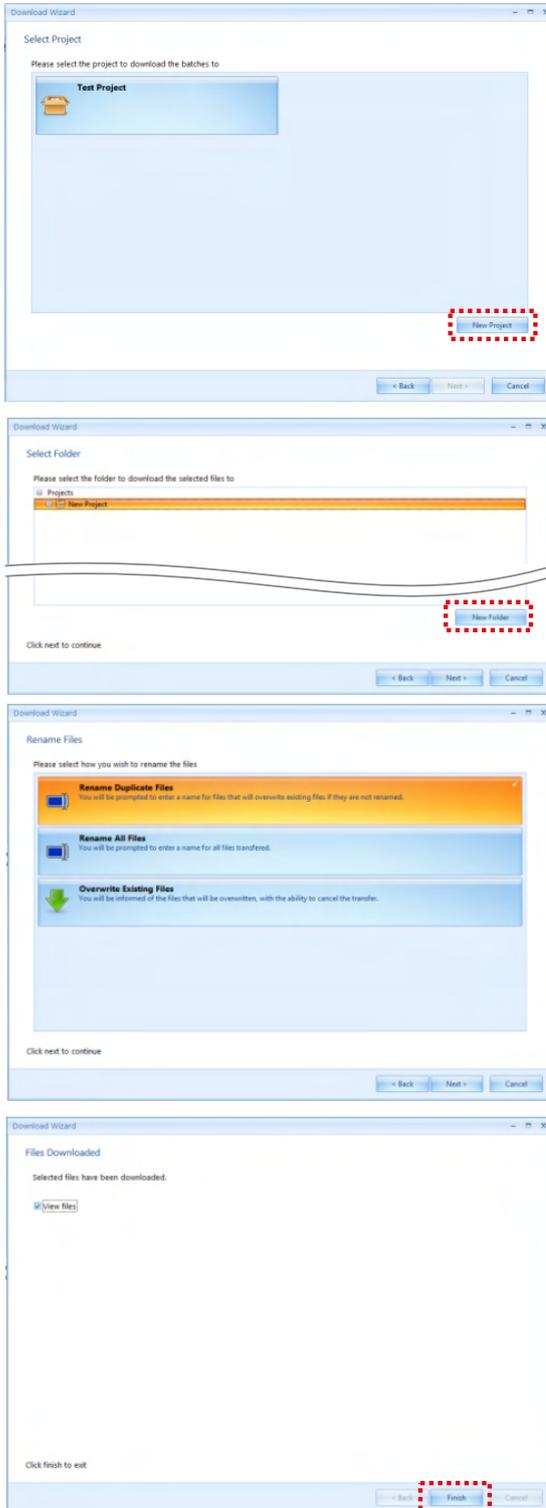
The User will be asked to select a project name from the list. Alternatively the user can create a New Project name.

- Select or create a new project and press 'Next >'

- Select a single or multiple batches from the list or click on 'All Files' as required, then press 'Next >'

- Select or create a new folder to save the gauge's data to

In some cases users may have re-used an existing batch name in the gauge. The user should now chose either to select:

- Rename Duplicate Files

- Rename All Files or

- Overwrite Existing Files

- Select as required and press 'Next >'

The selected batches will now download. Once the data download has been completed, the user can check the 'View Files' box and click 'Finish'.

Alternatively, click 'Finish' and select the 'View Action Tab'

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Viewing Data in ElcoMaster™ 2.0

ElcoMaster™ 2.0 not only allows users to view and analyse data from a wide range of Elcometer gauges, but also allows users to manually input data as required.

This instruction book provides a brief summary of some of the features of ElcoMaster™ 2.0, however users should read the ElcoMaster™ 2.0 help file for a complete guide.

Data Tree   Command Tabs   Template Tabs

Live Reading Tab   Measurement Data Window   Graph Window

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By selecting the 'View Action Tab', users can instantly see their data. The 'View Action Tab' can be broken down into 6 distinct areas:

- **Data Tree** Batches can be stored within folders (📁) in unique Project files (🗃).

  By clicking on the Project filename, users can then complete unique project tags and batch tags as required.

  Each batch of data is identified by the type of inspection:

  - 🌤 Climate Batch
  - 〰 Surface Profile Batch
  - 💧 Surface Cleanliness Batch
  - 🔴 Dry Film Thickness Batch
  - 〜 Material / Ultrasonic NDT Batch

  Clicking the computer mouse's right button over a file or folder provides the user with the following functions:

  - **New:**
    Allows users to:
    - create a new **Project (🗃)**
    - create a new **Folder (📁)**
    - import an **Image (🖼)**
    - import a PDF **Document (📄)**
    - create a new batch type

  - **Cut, Copy & Paste:**
    Cut, copy & paste inspection files and folders into other files or folders within the data tree.

  - **Delete, rename & move to:**
    Allows delete, rename or move a file

  - **Combine & Split:**
    Combine batches of the same type or split a batch into equal sizes or by type

  - **Archive & Restore:**
    Archive and restore inspection data

  - **Print, PDF, E-mail & Export:**
    Print, generate a PDF, e-mail or export to Excel or a tab separated text file; the selected batch report

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- **Command Tabs**

  There are 6 command tabs, which are the key functions required by the user.

  New:
  Allows users to:
  - create a new **Project ( )**
  - create a new **Folder ( )**
  - import an **Image ( )**
  - import a PDF, .edf, .txt. **Document ( )**
  - create a new batch type

  Move to:
  Moves the selected items to a different folder

  Print:
  Prints a report of the selected items

  PDF:
  Generates a PDF report of the selected items

  Email:
  Generates a PDF report of the selected items and attaches it to an email

  Export:
  Allows the user to export the selected items into Excel or as a text or CQATK XML file

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• **Template Tabs & Graph Window**

There are currently 2 graphs within ElcoMaster™ 2.0; individuals and histogram. Clicking a template tab displays the relevant graph in the **Graph Window**
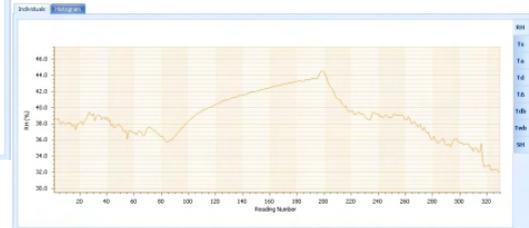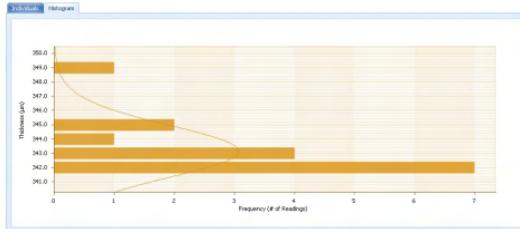
When the Individuals Graph is displaying climate data, additional tabs appear on the right hand side, allowing the user to select a measurement to view from the following:

RH: Relative Humidity

Ts: SurfaceTemperature

Ta: AirTemperature

Td: Dewpoint Temperature

TΔ: Delta T, (Ts-Td)

Tdb: Dry Bulb Temperature

Twb: Wet bulb Temperature

SH: Specific Humidity

Right mouse click on the individuals graph allows users to select the x-axis value between:

Date & Time   Relative Time (seconds)

Reading Number   Relative Time (minutes)

Left clicking and dragging the mouse across the individuals chart allows users to zoom in on a specific area of the graph. The zoom can be reset by clicking on the 🔍 icon.

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- **Measurement Data Window**

    The measurement data window provides the user with a range of information under 7 tabs:

    - **Details**

        Provides useful information about the measurement gauge, serial number, batch name, date the batch was created, date and time of the first and last reading, etc.

    - **Statistics**

        Provides the user with a wide range of statisitical calculations - mean, minimum and maximum reading, standard deviation, ±3σ, coefficient of variation, relevant information regarding the IMO PSPC analysis (coating thickness gauge readings only).

        Users can display the values on the graph by clicking the (☒▼) icon and selecting a colour.

    - **Measurements**

        Displays all the individual readings. Users can alter the display order (Date & Time, Relative Time (seconds), Relative Time (minutes) and Reading Number) by clicking on the column title.

        Individual measurements can be excluded/ included by right clicking on the specific measurement within the table. Measurements can also be amended by overtyping the relevant reading.

        Comments can be added to any measurement by clicking on, and then typing into, the relevant cell within the comments column.

    - **Limits**

        Shows any limits that were used whilst taking the readings or allows users to apply limits. When set, measurements outside the limits are highlighted within the measurement tab.

        Users can display the values on the graph by clicking the (☒▼) icon and selecting a colour.

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- **Measurement Data Window (continued)**

  - **Notes**

    Type and format a comment or note regarding the batch.

  - **Labels**

    When a project has been set up with individual Project and Batch labels users can amend or input the appropriate details. Project labels are applied to each file, folder and batch within the project; Batch labels apply to a specific batch. Both project and batch labels are fully user definable, however examples of project and batch labels are listed below:

    Project Label Examples:
      Client name, Structure name, Structure location,
    Batch Label Examples:
      Inspector name, shift number, area under consideration, strutt number, etc.

  - **Photos**

    Photographs of the area under inspection, specific defects, etc can be attached to the measurement batch - simply by clicking the (Add Photo) icon within the Photos tab.

    Descriptions or comments can be added below each image added.

    Double clicking on any photo opens up a view window allowing the user to copy the photo to clipboard (for pasting in another program, or save the photograph to another file.

Data, photographs, labels etc. added within the measurement window tabs is automatically included on any reports, exports, pdf and emails generated.

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- **Live Gauge Readings (BT)**

    ElcoMaster™ 2.0 allows users to transfer data from a gauge as the readings are taken, to be stored in a batch within ElcoMaster™ 2.0

    Live gauge readings can be recorded via Bluetooth (T) or USB (BT) connections

Once the gauge has been connected to ElcoMaster™ 2.0 (see pages 33 - 35), switch on your gauge and click the 'Live Readings' button on the View Action Tab

- Select the appropriate batch (or create a new batch) for the readings to be recorded into

ElcoMaster™ 2.0 will now open up the Live Readings display, and ask the user to 'Connect Gauge'

- Click on the Connect Gauge
- Select a gauge from the list
- Select the relevant connection method (if more than one connection method has been set up (see pages 33 - 35)

ElcoMaster™ 2.0 will then link with the selected gauge and, when ready display the gauge information within the Live Readings window.

- At any time the user can select a different batch to change where the next reading is taken.
- Click the Disconnect button or switch of the gauge to disconnect

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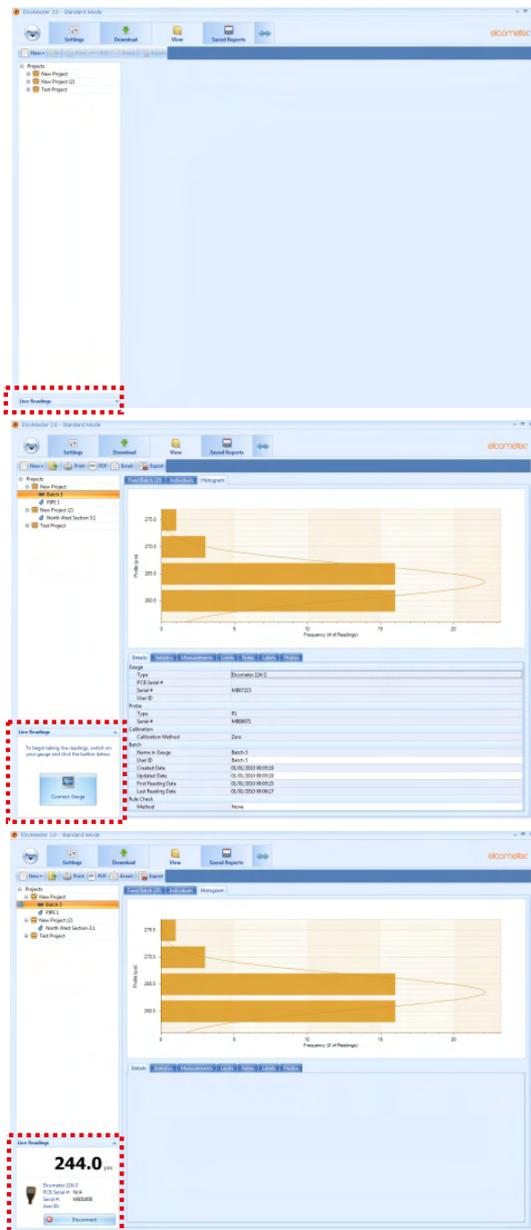
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- **Design Collect**

    The 'Design Collect' function allows users to set up a collection template to guide Inspectors where, and in which order, readings should be taken. This image can be used as a collection guide in ElcoMaster™ 2.0[‡] or transferred to an Android mobile phone or tablet using ElcoMaster™ Mobile, see pages 47 - 48.
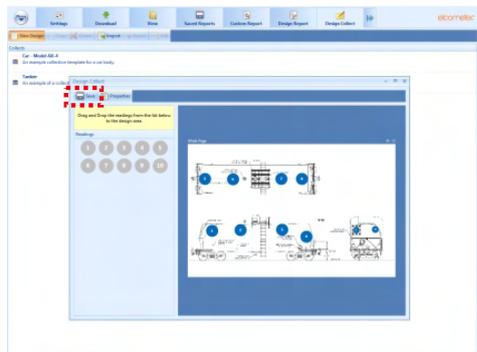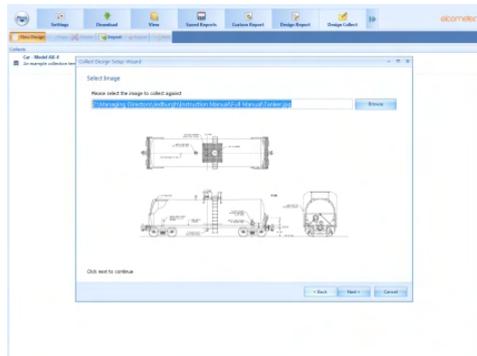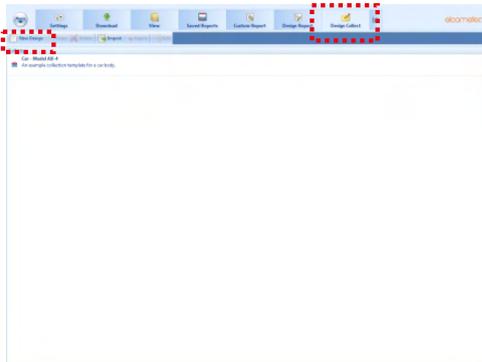
- Click on the Design Collect tab and select an existing template or click 'New Design'

    When creating a new design you will be asked to:
    - Enter a name and description
    - Select the Batch Type; Profile, Material Thickness, DFT or Surface Cleanliness
    - Add the required image to collect readings against
    - Specify the number of readings to be collected
    - Enter relevant Limits
    - Request a prompt to begin the next set of readings or begin automatically
    - Choose to create a new batch for each set of readings or create a single batch with multiple reading sets

- Click 'Finish' to begin the design

To design the 'collect' image sequence, simply click and hold each 'reading' circle in turn, drag onto the image where readings are to be taken and adjust the size accordingly.

Once complete click 'Save' and click the 'X' button in the top right to close the design window

[‡] To use Design Collect, switch ElcoMaster™ 2.0 to Advanced Mode by clicking on the Expand Arrow, and selecting 'Start Advanced Mode'.

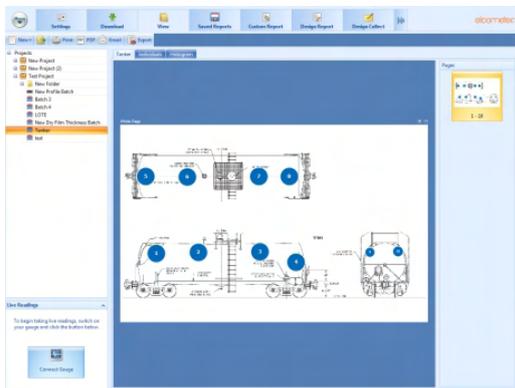**45**   www.elcometer.com

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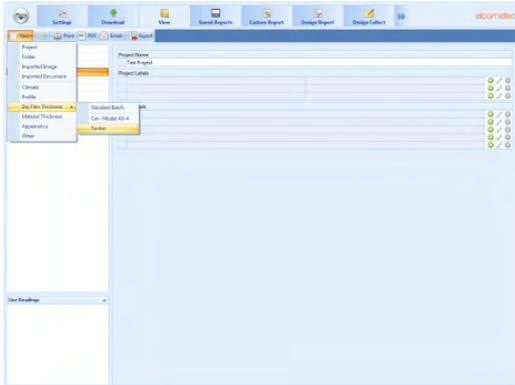
Using a Collect Design

- Select the 'View' tab

- Select a folder or project and click the 'New' button

- Move the cursor to relevant batch type, an additional window will appear, select the required Collect Design

A new batch will be created. Unlike standard batches it will have an additional tab with the same name as the Collect Design, click on this to show your design. To begin collection,

- Click on 'Connect Gauge' in the 'Live Readings' window

- Select a gauge from the list[a]

- Select the relevant connection method
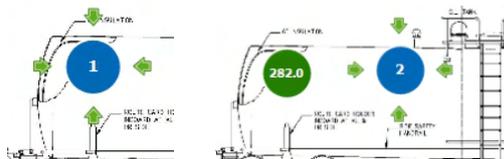
ElcoMaster™ 2.0 will link the selected gauge and, when ready, display the gauge information within the Live Readings window.

Once connected, green arrows will flash around the first 'reading' circle to measure. When a measurement is taken, the 'reading' circle will change to show the measured value[b], and the green arrows will move to the next reading.

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[a] The gauge must be connected to ElcoMaster™ 2.0 before it will appear in the list, see pages 33 - 35

[b] The 'reading' circle will be green if the measurement is within set limits and red, if outside limits.

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9 ELCOMASTER MOBILE APPS (T)

Ideal when out in the field or on-site, live readings can be stored directly onto a mobile device and saved into batches. Inspection data can be transferred from mobile to PC for further analysis and reporting.

ElcoMaster™ Mobile Apps features include:

- Store live readings directly on to a mobile device and save into batches.

- Download batches straight to a mobile device allowing data analysis immediately on site.

- Transfer inspection data to PC for further analysis and reporting.

- Analyse data via sequential readings, statistics, charts & histograms or on images.

- Download collection images created using the 'Design Collect' function within ElcoMaster™ 2.0 to indicate where and in which order readings should be taken.

- Take photographs and add them to batch readings at the click of a button.

- Map readings on to maps, photographs or diagrams.

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Compatible with smart phones and tablets running Android 2.1 or above. To install, download using the Google Play™ Store app, and follow the on screen instructions.

Made for iPhone 5S, iPhone 5C, iPhone 5, iPhone 4S, iPhone 4, iPad (4th generation), iPad mini, iPad 2, and iPod touch (4th and 5th generation). To install, download via the App Store, and follow the on screen instructions.
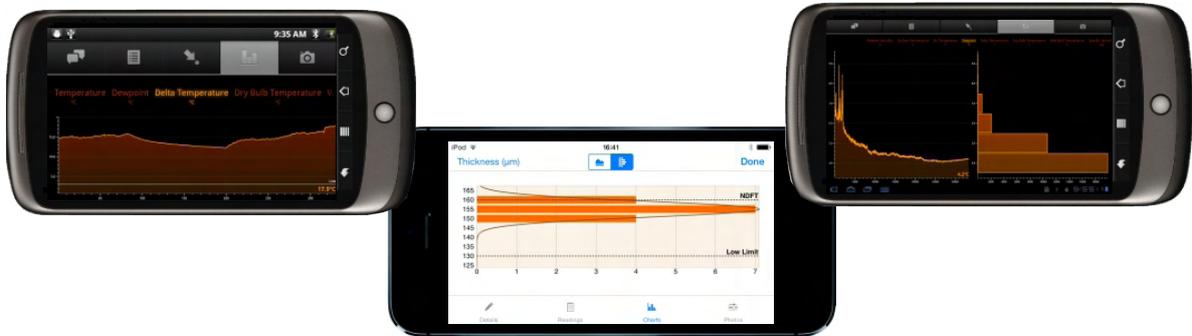
Connecting via Bluetooth to a Mobile Device

To use ElcoMaster™ Mobile Apps, the Elcometer 224 gauge must be 'paired' with mobile device via Bluetooth:

1. Switch on the Elcometer 224 and ensure that Bluetooth is enabled via **Menu/Bluetooth/Enable Bluetooth**. Return the gauge to the main reading screen before continuing.
2. Switch on the mobile device and enable Bluetooth (usually via 'Settings' – refer to the operating instructions for the mobile device).
3. The mobile device will search for and list all Elcometer 224 gauges with Bluetooth enabled. Each gauge is identified as "E-224/2" followed by the serial number.
4. Select the Elcometer 224 gauge required. The mobile device now will attempt to 'pair' with the selected gauge.
5. A 'Bluetooth' pairing request will appear on both the mobile device and gauge. Accept the pairing request on both.

The mobile device and Elcometer 224 gauge are now 'paired'.

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10 CLOUD COMPUTING WITH ELCOMASTER 2.0 (T)

ElcoMaster 2.0 is now compatible with Cloud Computing.

- Create a Cloud account via a Cloud service provider e.g. Dropbox, Google Drive™, Skydrive or your own cloud based FTP server.
- All approved users of the cloud account will have instant access to all inspection data in real time.
- Data can be accessed by authorised users via secure log-in from any computer or mobile device anywhere in the world via Bluetooth®, USB, WiFI or 3G/4G.
- Using the ElcoMaster™ instant messaging feature, job instructions can be sent or stored in specific job files.
- Wherever you are in the world, ElcoMaster™ Mobile allows you to instantly upload to the cloud via 3G/4G or WiFi.

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11 GETTING THE MOST OUT OF ELCOMASTER 2.0

ElcoMaster has been designed to be a very intuitive method of developing professional reports, it is however extremely versatile. Here are just a few ways ElcoMaster™ can be used in the day-to-day activities of a coating professional.

1. Gauge to PC to Excel

Transferring inspection data straight into Microsoft Excel via Bluetooth® or USB is simple and easy.

2. Gauge to PC data transfer into ElcoMaster™ 2.0

Using Bluetooth® or USB, ElcoMaster™ transfers inspection data in seconds, archiving data and generating reports at the click of a button.

3. ElcoMaster™ Mobile App for immediate data transfer from site to office
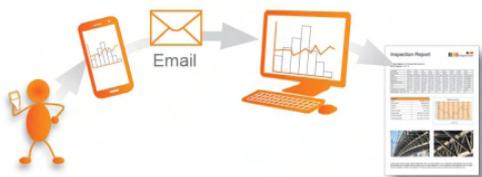
Transfer inspection data straight to mobiles and tablets via Bluetooth® when on site for instant analysis, then e-mail them back to the office for storing, review and QA reporting.

4. Upload to a cloud for real time analysis anywhere

Using ElcoMaster™ Mobile App you can upload inspection data, photos, notes and GPS coordinates direct to a Cloud account of your choice via 3G/4G or WiFi.

All data is instantly visible to other approved users of the account - through a secure log-in on any computer or mobile device anywhere in the world.

5. Seamlessly link multiple sites or production lines

ElcoMaster™ 2.0 gives you real time quality control monitoring from multiple inspection projects in any location. You can compare and combine inspection data from different production lines or different locations, to produce specific Project Inspection Reports quickly and easily.
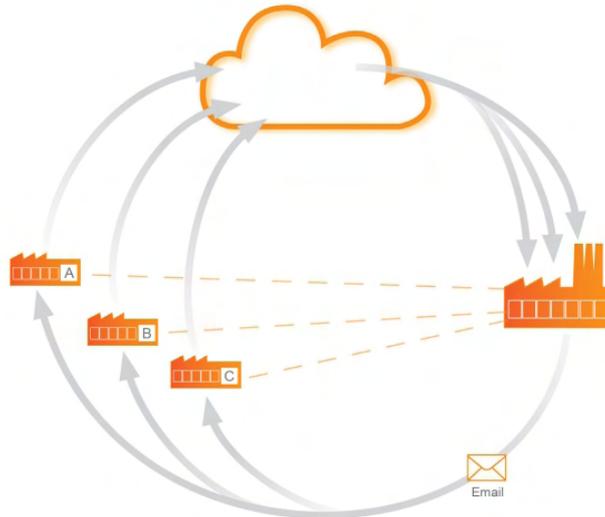
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11 GETTING THE MOST OUT OF ELCOMASTER 2.0

6. Real time collaboration for multi-site projects

Email

Real time collaboration for multi-site projects

When working with manufacturers of sub-assemblies across the globe ElcoMaster™ can collate all inspection data from each site, assembly line and project into one shared location. Contractors can then:

- Accept or reject parts before shipment from sub-assembly plants.
- Combine all data from sub assembly and final assembly inspection to generate Project Inspection Reports for quality management, both during and after completion of the project.
- Have real time in progress visibility across the whole project, no matter where the sub-assembly manufacturing is in the world.
- Have multi-site collaboration, real time dialogue and decision making to improve efficiency and quality throughout the production process.

Real time communication

Featuring instant messaging the ElcoMaster™ Mobile App lets you add messages to inspection data, projects and files, allowing you to immediately discuss key points with your colleagues, managers or clients, send work instructions and store messages within the project file.

Your data - your choice - your control

ElcoMaster™ 2.0 allows you to decide which Cloud service provider to use. It is your data, it is secure as only approved users can have access, no third parties can see your data.

ElcoMaster™ Mobile App is compatible with a range of cloud service providers and FTP servers including: Google Drive, FTP Server, Dropbox.

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12 CHANGING THE WELCOME SCREEN (BT)

Each time the Elcometer 224 gauge is switched on, the Elcometer logo is displayed. Users can add their own logo, image or identification details as required via ElcoMaster™ 2.0.
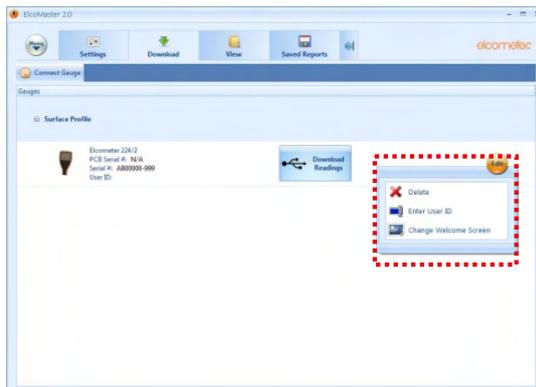
Once the gauge has been connected to ElcoMaster™ 2.0 (see pages 33 - 35), to add a user welcome screen

- Switch on your gauge

- Select the Download Action Tab

- Click the 'Edit' button on the right hand side of the appropriate gauge

- Select 'Change Welcome Screen' from the drop down menu

- Select the required image, and or add user specific text.

- Select 'Stretch Image' or 'Centre Image' as required and press 'Next >'

- Select the appropriate connection method and press 'Next >'

ElcoMaster™ 2.0 will now download the selected image into the gauge. This may take some time.

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13 GAUGE FIRMWARE UPDATES (BT)

Each time the Elcometer 224 gauge is connected to ElcoMaster™ 2.0 (see pages 33 - 35); if the computer has access to the internet, ElcoMaster™ 2.0 automatically checks to see if there are any gauge firmware updates for the connected gauge.
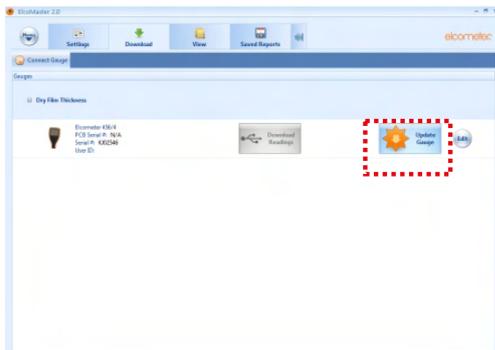
ElcoMaster™ 2.0 will inform the user when there are any firmware updates available for the connected gauge by displaying the 'Update Gauge' button.

Please note that users can update the gauge firmware via a USB connection only.
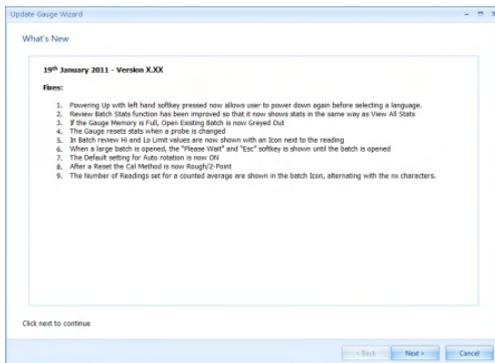
Clicking the 'Update Gauge' button will display a list of the 'Fixes' in all the updates that have been released since the gauge's last upgrade.

- Press 'Next >' to continue.

Warning - updating the gauge firmware will result in all readings, batches, statistics and calibrations being deleted. The gauge will also be returned to the factory default settings.
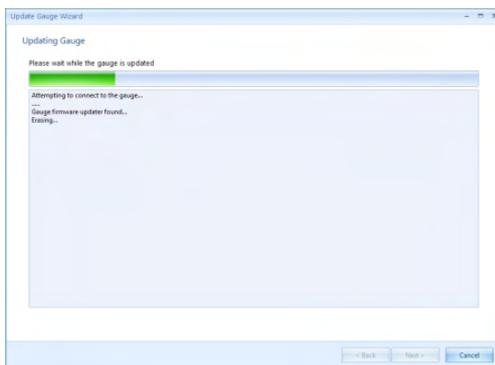
- Press 'Next >' to commence downloading the latest firmware to the Elcometer 224

Warning - Do not switch off the computer or disconnect the gauge during the gauge upgrade.

Typical firmware updates include gauge enhancements, amendments, language updates, etc. Users cannot upgrade a Model B to a Model T.

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14 GAUGE ICONS & ERROR MESSAGES (BT)

Icon	Description	Model
n:	Number of Readings	BT
x̄:	Mean (average)	BT
σ:	Standard Deviation	BT
Hi:	Highest Reading	BT
Lo:	Lowest Reading	BT
CV%:	Coefficient of Variation	BT
nx̄	Counted Average (when not in Batching)	BT
⊽	Low Limit Set	T
⊼	High Limit Set	T
⇕	High and Low Limit Set	T
⊽ₙ:	Number of readings below Limit	T
⊼ₙ:	Number of readings above Limit	T
⊼	High Limit Set: Reading outside High Limit	T
⊽	Low Limit Set: Reading outside Low Limit	T
⇕	Low & High Limit Set: Reading outside High Limit	T
⇕	Low & High Limit Set: Reading outside Low Limit	T
🔒	Calibration Lock	T
#	Batch Type: Normal	T
nx̄	Batch Type: Counted Average	T
USB	USB Connected	BT
*	Bluetooth: On, Not Connected (Grey)	T
*	Bluetooth: On; Connected (Orange)	T

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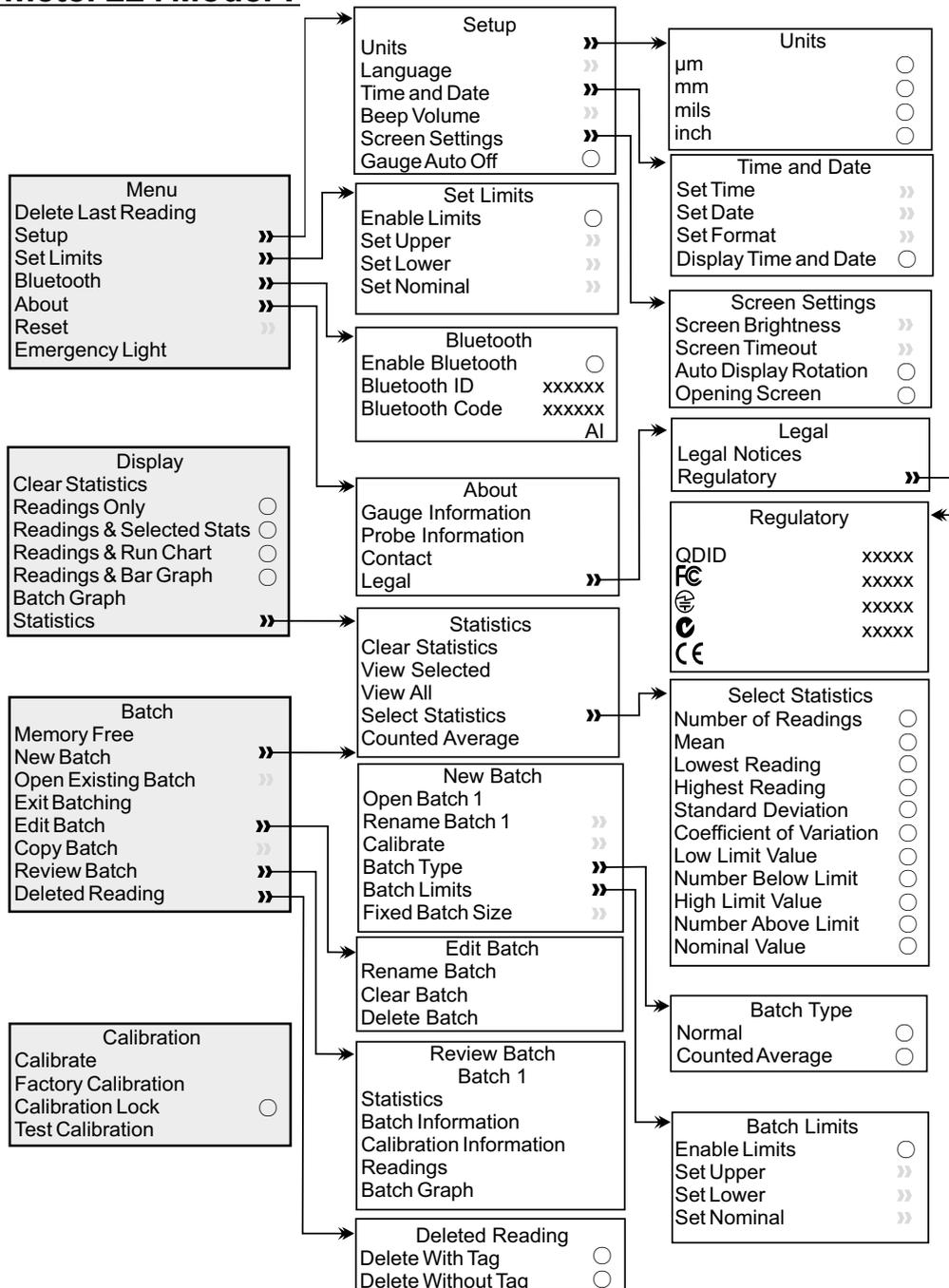| Icon	Description	Model
🔶 🔶	Battery Life Indicator	BT
🔴	Replace Batteries	BT
○	User Selectable Feature: Switched Off	BT
◉	User Selectable Feature: Switched On	BT
◁◀◀	Beep Volume Setting	BT
- - -	Measurement over range	BT

Error Messages

Under certain conditions, the gauge will display error messages. The cause of the error should be corrected before proceeding.

Message	Cause / Action
#1 - Probe	Probe to gauge communication failure. Integral Gauges: Contact Elcometer. Separate Gauges: Remove probe and refit. If error persists, contact Elcometer.
#3 - Probe	Internal Error - contact Elcometer.
No Probe	No probe connected. Connect probe.
Probe Unsupported	Wrong probe connected. Connect correct probe.
Probe Changed	Probe has been changed during a calibration or whilst batching.
Unstable Reading	External electromagnetic interference or gauge is faulty. Isolate from electromagnetic interference. If error persists, contact Elcometer.
Value Too Large	Calculated value is too large to be displayed. Contact Elcometer.
Calibration Error	Incorrect calibration calculation. Re-calibrate. If error persists, contact Elcometer.
Bluetooth PC Reply	Bluetooth link working at limit of its range. PC is busy running other applications. Interference. PC application doesn't send replies. Move gauge closer to PC. Shutdown other applications. Remove source of interference. If error persists, contact Elcometer.
Error - EEPROM Write	Gauge EEPROM communication error. If problem persists, contact Elcometer.
Gauge Memory Full	Batch memory full. Delete one or more batches

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15 GAUGE MENU STRUCTURES (BT)

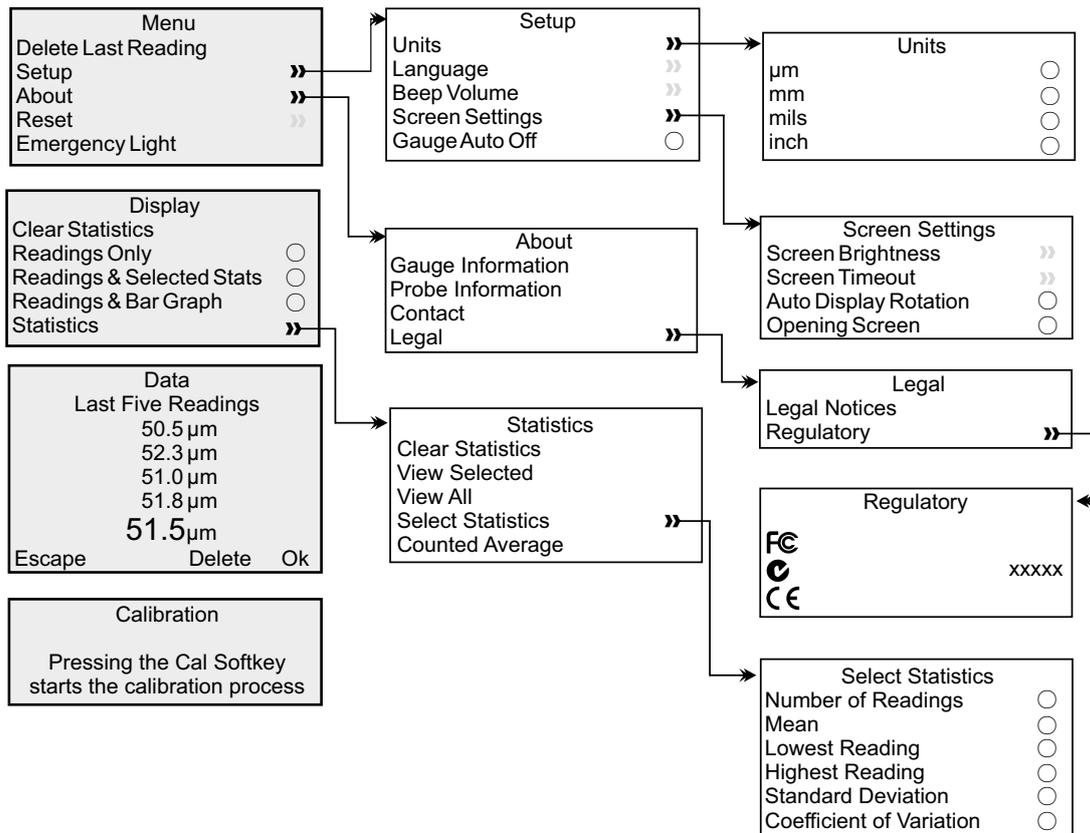Please find below a simplified diagram of each Elcometer 224 model's menu structures.

Elcometer 224 Model T

Menu
Delete Last Reading
Setup　》
Set Limits　》
Bluetooth　》
About　》
Reset　》
Emergency Light

Setup
Units　》
Language　》
Time and Date　》
Beep Volume　》
Screen Settings　》
Gauge Auto Off　○

Units
μm　○
mm　○
mils　○
inch　○

Set Limits
Enable Limits　○
Set Upper　》
Set Lower　》
Set Nominal　》

Time and Date
Set Time　》
Set Date　》
Set Format　》
Display Time and Date　○

Bluetooth
Enable Bluetooth　○
Bluetooth ID　xxxxxx
Bluetooth Code　xxxxxx
　　　AI

Screen Settings
Screen Brightness　》
Screen Timeout　》
Auto Display Rotation　○
Opening Screen　○

Display
Clear Statistics
Readings Only　○
Readings & Selected Stats　○
Readings & Run Chart　○
Readings & Bar Graph　○
Batch Graph
Statistics　》

About
Gauge Information
Probe Information
Contact
Legal　》

Legal
Legal Notices
Regulatory　》

Regulatory
QDID　xxxxx
FC　xxxxx
⊕　xxxxx
C　xxxxx
CE

Statistics
Clear Statistics
View Selected
View All
Select Statistics　》
Counted Average

Select Statistics
Number of Readings　○
Mean　○
Lowest Reading　○
Highest Reading　○
Standard Deviation　○
Coefficient of Variation　○
Low Limit Value　○
Number Below Limit　○
High Limit Value　○
Number Above Limit　○
Nominal Value　○

Batch
Memory Free
New Batch　》
Open Existing Batch　》
Exit Batching
Edit Batch　》
Copy Batch　》
Review Batch　》
Deleted Reading　》

New Batch
Open Batch 1
Rename Batch 1　》
Calibrate　》
Batch Type　》
Batch Limits　》
Fixed Batch Size　》

Batch Type
Normal　○
Counted Average　○

Edit Batch
Rename Batch
Clear Batch
Delete Batch

Calibration
Calibrate
Factory Calibration
Calibration Lock　○
Test Calibration

Review Batch
Batch 1
Statistics
Batch Information
Calibration Information
Readings
Batch Graph

Batch Limits
Enable Limits　○
Set Upper　》
Set Lower　》
Set Nominal　》

Deleted Reading
Delete With Tag　○
Delete Without Tag　○

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15 GAUGE MENU STRUCTURES CONTINUED (BT)

Elcometer 224 Model B

Menu
Delete Last Reading
Setup »
About »
Reset »
Emergency Light

Setup
Units »
Language »
Beep Volume »
Screen Settings »
Gauge Auto Off ○

Units
μm ○
mm ○
mils ○
inch ○

Display
Clear Statistics
Readings Only ○
Readings & Selected Stats ○
Readings & Bar Graph ○
Statistics »

About
Gauge Information
Probe Information
Contact
Legal »

Screen Settings
Screen Brightness »
Screen Timeout »
Auto Display Rotation ○
Opening Screen ○

Data
Last Five Readings
50.5 μm
52.3 μm
51.0 μm
51.8 μm
51.5 μm
Escape   Delete   Ok

Statistics
Clear Statistics
View Selected
View All
Select Statistics »
Counted Average

Legal
Legal Notices
Regulatory »

Regulatory
FC
C
CE   xxxxx

Calibration

Pressing the Cal Softkey
starts the calibration process

Select Statistics
Number of Readings ○
Mean ○
Lowest Reading ○
Highest Reading ○
Standard Deviation ○
Coefficient of Variation ○

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16 GAUGE TECHNICAL SPECIFICATIONS (BT)

Display Information	60mm (2.4") QVGA colour TFT display, 320 x 240 pixels
Battery Type	2 x AA dry cell batteries, rechargeable batteries can also be used
Battery Life	~24 hours of continuous use at 1 reading per second *Using default settings & lithium batteries, alkaline or rechargeable batteries may differ*
Gauge Dimensions (h x w x d)	Integral: 16.8 x 7.30 x 3.70cm (5.61 x 2.87 x 1.46")
	Separate: 14.1 x 7.30 x 3.70cm (5.55 x 2.87 x 1.46")
Gauge Weight (with supplied batteries)	Integral: 218g (7.69oz)
	Separate: 161g (5.68oz)
Probe Tip	Tungsten carbide tip 60° angle 50µm (2mil) tip radius
Operating Temperature	-10 to 50°C (14 to 122°F)
Storage Temperature	-10 to 60°C (14 to 140°F)

17 PROBE TECHNICAL SPECIFICATIONS (BT)

All Elcometer surface profile probes are fitted with a tough tungsten carbide user replaceable tip as standard, suitable for up to 20,000 readings.

Supplied with either a standard cable or armoured metal reinforced heavy duty cable, all probes are supplied with an Elcometer test certificate, glass zero tile and calibration test foils; nominal values 125µm (5mil) & 500µm (20mils).

Range	0 - 500µm (0 - 20mils)
Resolution	1µm (0.1mil)
Accuracy	±5% or ±5µm (±5% or ±0.2mil)

Probe Design	Minimum Headroom	Minimum Sample Diameter
Separate Flat Surface Profile Probe: Standard	125mm (4.92")	25mm (1")
Separate Flat Surface Profile Probe: Armoured	165mm (6.50")	25mm (1")
Separate Convex Surface Profile Probe: Standard[†]	135mm (5.31")	75mm (3")[‡]
Separate Convex Surface Profile Probe: Armoured[†]	175mm (6.89")	75mm (3")[‡]
Gauge with Integral Probe	185mm (7.28")	25mm (1")

[†] Patent Applied For   [‡] Minimum Pipe Diameter

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18 GAUGE & PROBE ACCESSORIES (BT)

Description	Part Number	
	Separate Gauges	Integral Gauges
Protective Case	T99923369	T22423368
Plastic Transit Case	T22423371	T22423370
Replacement Tip (Pack of 2) with Fixing Tool	T22420053	T22420053
Replacement Tip (Pack of 5)	T22420095	T22420095
Probe Tip Protection Cap	T22419793	T22419793
Glass Zero Tile with Wallet	T22420072	T22420072
Certified Calibration Test Kit: 125µm & 500µm (5 & 20mils) Calibration Foils, Glass Zero Tile & Calibration Certificate	T22421882C	T22421882C
USB Cable	T99921325	T99921325
USB Bluetooth Adaptor - for PC's without Bluetooth	T99924797	T99924797
Self Adhesive Screen Protectors (x10)	T99922341	T99922341

19 ADDITIONAL REFERENCE INFORMATION

Standards

The Elcometer 224 can be used in accordance with the following National and International Standards:

ASTM D4417-B   SANS 5772   US Navy NSI 009-32   US Navy PPI 63101-000

Certification

Every Elcometer 224 gauge and separate probe is supplied with a Test Certificate free of charge. For separate gauges, the test measurements are generated using factory reference probes. Each probe test certificate is generated using factory reference gauges.

Comprehensive Calibration Certificates, traceable to National Standards (UKAS and NIST) are also available and should be requested at the point of order. Please speak to your Elcometer representative for further information.

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Warranty and Maintenance

The Elcometer 224 does not contain any user serviceable components. In the unlikely event of a fault, the gauge should be returned to your local Elcometer supplier or directly to Elcometer. The warranty will be invalidated if the gauge has been opened.

The Elcometer 224 gauge is supplied with a 1 year warranty against manufacturing defects. To extend this warranty to 2 years, register your gauge via the www.elcometer.com website.

Probes are consumable items and have a 1 year warranty from the date of purchase against manufacturing defects only. After continued use, the precision manufactured probe tip will wear, increasing the tip size and will then need to be replaced. This is a user replaceable item - see Gauge and Probe Accessories on page 59.

This gauge incorporates a Liquid Crystal Display (LCD). If the display reaches a temperature above 70°C (158°F) it may be damaged. This can happen if the gauge is left in a car, parked in strong sunlight.

Always store the gauge in its carrying pouch when not in use.

Remove the batteries from the gauge and store them separately if the gauge is to remain unused for a long period of time. This will prevent damage to the gauge in the event of malfunction of the batteries.

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20 LEGAL NOTICES & REGULATORY INFORMATION

The Elcometer 224 Model T meets the Radio and Telecommunications Terminal Equipment Directive. The Model B meets the Electromagnetic Compatibility Directive. This product is Class B, Group 1 ISM equipment according to CISPR 11. Class B product: Suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. Group 1 ISM product: A product in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.

Elcometer 224 Models B & T: The ACMA compliance mark can be accessed via: Menu/About/Legal/Regulatory

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Elcometer 224 Model T: The Giteki mark, its ordinance number and the FCC ID can be accessed via: Menu/About/Legal/Regulatory

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- -- Reorient or relocate the receiving antenna.
- -- Increase the separation between the equipment and receiver.
- -- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- -- Consult the dealer or an experienced radio/TV technician for help.

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Modifications not expressly approved by Elcometer Limited could void the user's authority to operate the equipment under FCC rules.

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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20 LEGAL NOTICES & REGULATORY INFORMATION (continued)

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This Class B digital apparatus complies with Canadian ICES-003

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