Elcometer 224

Digital Profile Gauge

Operating Instructions

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English

The following table associates the relevant 224 model number with its Japanese Mutual Recognition Agreement Law identifiers.

E224----T	R 205 WW 2009017

The Top version of the product meets the Radio and Telecommunications Terminal Equipment Directive and the Standard version of the product meets the Electromagnetic Compatibility Directive.

The product is Class B, Group 1 ISM equipment according to CISPR 11.

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.

Class B product are 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.

For compliance to FCC Part 15, Radio Frequency Devices add the following three statements in the inside cover page area.

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.

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.

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

This Class B digital apparatus complies with Canadian ICES-003.

CONTENTS

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Thank you for your purchase of this Elcometer 224 Digital 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 Digital 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 our website at www.elcometer.com.

1 ABOUT YOUR GAUGE

The Elcometer 224 Digital Profile Gauge is a handheld gauge for fast and accurate measurement of the peak-to-valley height of the surface profile of blast cleaned surfaces.

The gauge is available in two versions; Standard and Top. This manual describes the operation of both versions of the gauge; any differences between the function of the two versions are highlighted in the text as [TOP] or [STANDARD].

Your gauge features an easy-to-use menu driven graphical interface which guides the user through tasks such as zeroing and gauge configuration.

To maximise the benefits of your new Elcometer 224, please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.
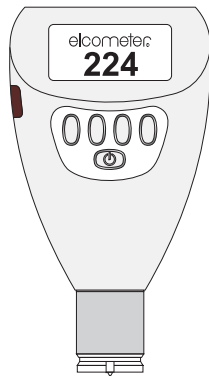
1.1 FEATURES

- Menu-driven graphical user interface
- Statistics
- RS232 interface
- [TOP] Bluetooth® interface
- [TOP] High/low limits
- [TOP] Memory of up to 50 000 readings in up to 999 batches
- [TOP] Display backlight

1.2 STANDARDS

Your Elcometer 224 Digital Profile Gauge can be used in accordance with the following National and International Standards, ASTM D 4417-B, SANS 5772, US Navy NSI 009-32, US Navy PPI 63101-000.

For IMO PSPC[a], the surface profile of metal surfaces should be measured and recorded. Your Elcometer 224 Digital Profile Gauge can be used for this.

1.3 CHECKING THE CONTENTS OF THE BOX

- Elcometer 224 Gauge
- Glass zero plate
- Gauge carrying pouch
- Probe tip protection cap
- Batteries
- [TOP] CD containing data collection software
- Operating instructions

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a. International Marine Organisation, Performance Standard for Protective Coatings

1.4 PACKAGING

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

1.5 CONVENTIONS IN THESE INSTRUCTIONS

The Elcometer 224 is controlled using a simple menu structure which helps you get the most from your gauge - see page 9.

As an example, the LANGUAGES option which is in SETUP from the MAIN MENU would be shown in these instructions as MENU>SETUP>LANGUAGES.

These instructions include images of Elcometer 224 screens with units set to microns (µm). Similar screens will be seen when the gauge is set to other units (mils or thou).
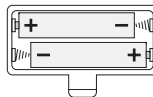
2 GETTING STARTED

Before you use your gauge for the first time, remove the paper strip from the battery compartment.
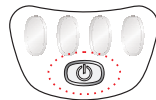
2.1 BATTERIES

Batteries are located under the cover at the rear of the gauge. Use two LR03 (AAA), alkaline dry batteries, or rechargeable equivalent; take care to ensure correct battery polarity.

2.2 ON / OFF

To switch your gauge on, press ⓞ.

The gauge switches off automatically after 60 seconds; to switch off manually, press and hold ⓞ.

2.3 KEYPAD

The gauge is controlled by four 'softkeys'.

The function of these softkeys varies and is described by symbols and words on the bottom line of the screen.
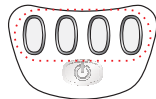
2.4 INTERFACE

A serial interface is located on the side of your gauge. Connect the optional gauge-to-PC connection cable[b] between your gauge and your PC and then transfer readings and statistics (see page 27) and download welcome screens into your gauge (see page 31).

[TOP] Your gauge also has a Bluetooth® interface. Connect your gauge to your PC using Bluetooth® for quick and easy data transfer and welcome screen download (see page 28).
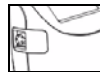
2.5 LANGUAGE

The Elcometer 224 has over 20 languages built-in.

Note: When the gauge is switched on for the first time after batteries have been fitted, the display will show the language selection screen. Press ↑ or ↓ to locate your language, then press SEL. *The gauge operates in the new language until changed.*

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b. Gauge-to-PC connection cable - see "Accessories" on page 33.

CHOOSING LANGUAGE

Either:

1. Switch gauge off.
2. Press and hold left hand softkey.
3. Press ⊙ to switch on gauge.
4. Release left hand softkey.
5. Press ↑ or ↓ to locate your language, then press SEL. The gauge operates in the new language until changed.

Or:

Select MENU>SETUP>LANGUAGES

2.6 ZEROING YOUR GAUGE

Before taking measurements, always zero your gauge on a hard flat surface; use the glass plate supplied with your gauge or a similar flat surface such as window glass.

1. Press ZERO.
2. When indicated by the display, place the probe on the glass plate.

   The display will show 0 (zero) and is ready to use immediately.

Note: If a glass plate is not available, use the factory zero:

Select MENU>RESET>FACTORY ZERO.

3 TAKING A READING

3.1 BEFORE YOU START

- *Have you zeroed the gauge?* . . . . .See "Zeroing your gauge" on page 6.
- *Do you require statistics?* . . . . See "Statistics" on page 17.
- *[TOP] Do you want to save readings?* . . . .See "[TOP] Batching" on page 21.
- *What units of measurement do you want?* .See "UNITS - Select from μm, mil or thou." on page 16.

3.2 PROCEDURE

1. Switch on the gauge.
2. Hold the gauge with the probe pressed firmly[c] against the surface you are measuring such that the tip of the probe reaches into the bottom of the profile valley.
3. Read the depth shown on the display.

   The display also shows the measurement units (μm, mil or thou).

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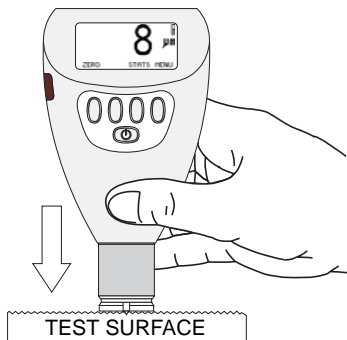
c. The reading may be inaccurate if the probe is not held flat against the surface.

4 THE DISPLAY

The display shows measurement data, menus and gauge settings. The display shown here is a typical TOP reading screen.

The reading screen changes depending upon units, [TOP] memory, softkeys locking and whether extended menus are selected.

To maximise the size of the reading value on the display, ensure that Softkeys Locked is deactivated - see page 17.

Peak to valley height

Battery status

Units

14 µm

ZERO DATA STATS MENU

Zero gauge

[TOP] View readings data (memory)

View readings statistics

Setup menus

- ZERO - Press to zero the gauge (using a glass zero plate).

- [TOP] DATA - Press to access, configure and review gauge memory (batching) - see page 21.

- STATS - Press to view statistical analysis of readings - see page 17.

- MENU - Press to access the setup menus and configure your gauge - see page 9.

- [TOP] ✳ - If ✳ is displayed flashing next to the battery status symbol, it indicates that your gauge and your PC have established a Bluetooth® connection - see page 29.
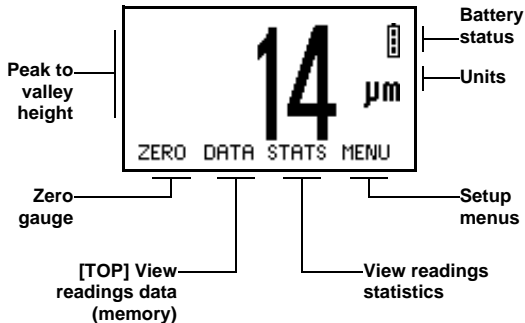
5 THE MENUS

Gauge configuration and measurement functions are controlled using menus. Most menus contain the following boxes and softkeys:

- TICK BOX ❑ - Indicates menu items which can be switched on or off (activated or deactivated). A tick in the box indicates the function is on (activated).
- SEL - Selects the option displayed and in some cases toggles the status of a tick box off/on.
- Up/Down ↑↓ - Moves the cursor up or down menus. The menus scroll up/down and a line across the screen indicates the start and end of the menu.
- BACK - Returns the gauge to a previous screen. Holding this softkey down will exit quickly from any menu and return to the reading screen.

Your gauge has two menu structures; Extended menu off and Extended menu on:

5.1 EXTENDED MENU OFF

The gauge is shipped from the Elcometer factory with extended menu switched off. In this simple menu mode the gauge can be zeroed and used to take measurements. This is the ideal setting for users who do not require access to advanced features of the gauge.

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5.2 EXTENDED MENU ON

When the extended menu is switched on, additional items are added to the menu which give access to more advanced functions, and the STATS softkey is activated.

[TOP] When the extended menu is switched on the DATA softkey is also activated.

To toggle extended menu on/off, press MENU>EXTENDED MENU.

```
              MENU
►BACKLIGHT
 ZERO LOCKED
 EXTENDED MENU
 PRINT/OUTPUT
 DELETE
 SETUP
 BACK     ↑     ↓     SEL
```

5.3 [STANDARD] MENU

PRINT/OUTPUT
Current statistics

MENU
Backlight ☐
Zero locked ☐
Extended menu ☑
Print/Output ●
Delete ●
Setup ●
About ●
Reset ●

DELETE
Last reading

STATISTICS
Select stats ●
Softkey enabled ☐

SELECT STATS
No. of readings ☐
Mean ☐
Std deviation ☐
Highest reading ☐
Lowest reading ☐

SETUP
Statistics ●
Units ●
Auto switch off 1
Output ●
Beep volume 3
Languages
Large fonts ☐
Softkeys locked ☐
Opening screen ☐

UNITS
µm ☑
mil ☐
thou ☐

STATS
Enlarge Stats
Stats on LCD ☐
Clear Stats ☐
Select Stats

BAUD RATE
1200 ☐
2400 ☐
4800 ☐
9600 ☐
14400 ☐
19200 ☐

ABOUT
Gauge information
Contact
Help

OUTPUT
Baud rate ●
RS232 bit image ☐
RS232 plain text ☐

ZERO
Zero gauge

RESET
Factory zero

SHADED = EXTENDED MENU 'ON'

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5.4 [TOP] MENU

PRINT/OUTPUT
Single batch
All batches
Current statistics

MENU
Backlight ☐
Zero locked ☐
Extended menu ☑
Print/Output ●
Delete ●
Setup ●
About ●
Reset ●

DELETE
Last reading
Single batch
All batches

STATS
Enlarge stats
Stats on LCD ☐
Clear Stats ☐
Select Stats

SETUP
Statistics ●
Data ●
Units ●
Auto switch off 1
Output ●
Beep volume 3
Languages
Large fonts ☐
Softkeys locked ☐
Opening screen ☐

DATA
Exit batching
Open new batch
Open existing batch
Review batches
Set limits
Free memory

STATISTICS
Select stats ●
Softkey enabled ☐

DATA
Softkey enabled ☐
Deleted reading ●

UNITS
µm ☑
mil ☐
thou ☐

ZERO
Zero gauge

ABOUT
Gauge information
Contact
Help

OUTPUT
Bluetooth PC reply ●
Baud rate ●
RS232 bit image ☐
RS232 plain text ☐

SELECT STATS
No. of readings ☐
Mean ☐
Std deviation ☐
Highest reading ☐
Lowest reading ☐

DELETED READING
Tag ☐
Delete ☐

BAUD RATE
1200 ☐
2400 ☐
4800 ☐
9600 ☑
14400 ☐
19200 ☐

RESET
Factory zero

SHADED = EXTENDED MENU 'ON'

6 GAUGE CONFIGURATION AND FUNCTIONS - EXTENDED MENU OFF

When extended menu is switched off, the following items are displayed on the screen:

6.1 BACKLIGHT

Toggle tick box to activate/deactivate. When activated, the display backlight switches on while the gauge is being used and switches off during periods of inactivity.

Note: Battery life is reduced by about one third when the backlight is activated.

6.2 ZERO LOCKED

Protects against inadvertent adjustment of zero. Toggle the tick box to activate/deactivate. If ZERO softkey is pressed while ZERO LOCKED is activated the gauge displays ZERO LOCKED USE MENU TO UNLOCK. The message disappears after 3 seconds.

6.3 EXTENDED MENU

Provides access to additional features. Toggle tick box to activate/deactivate.

6.4 ABOUT

Provides information on Gauge, Probe, Contact information and Help:

- GAUGE INFORMATION - Elcometer 224 model, software versions, [TOP] Bluetooth® PIN code, etc.
- CONTACT - Details of Elcometer offices worldwide and, if programmed, the contact details for the Supplier or Local Distributor.
- HELP - Explains symbols used on the display.

7 GAUGE CONFIGURATION AND FUNCTIONS - EXTENDED MENU ON

When extended menu is switched on, the following *additional* items are displayed on the screen:

7.1 RESET

Resets the gauge to factory settings:

- FACTORY ZERO - Returns gauge to zero setting created at time of manufacture of the probe.

  Factory zero will not necessarily restore a precise zero. The gauge should always be zeroed before use using the glass plate supplied.

7.2 PRINT/OUTPUT

Outputs statistics ([TOP] and batch data) to the optional Elcometer miniprinter[d] via the RS232 interface.

Note: To use this function, first setup using MENU>SETUP>OUTPUT - see page 16. If no printers have been setup (Bit image or Plain text), PRINT/OUTPUT will display a NOT AVAILABLE message.

- [TOP] SINGLE BATCH - Outputs a single batch of readings. Use the Right/Left softkeys ← → to locate the batch to be output and then press OK.
- [TOP] ALL BATCHES - Outputs all batches of readings. If there is no data stored in the memory the gauge displays NOT AVAILABLE DATA MEMORY EMPTY.
- CURRENT STATISTICS - Outputs the current statistics.

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d. Elcometer Miniprinter - see "Accessories" on page 33.

7.3 DELETE

Deletes readings. If there is no reading to delete, the gauge displays LAST READING NOT AVAILABLE.

- LAST READING - Deletes last reading only. Gauge displays ARE YOU SURE? Select YES to confirm or NO to cancel.
- [TOP] SINGLE BATCH - Deletes the batch data. Use the Right/Left softkeys ← → to locate the batch to be deleted and then press OK. Gauge displays ARE YOU SURE? Select YES to confirm or NO to cancel.
- [TOP] ALL BATCHES - Deletes all batches. Gauge displays ARE YOU SURE? Select YES to confirm or NO to cancel.

7.4 SETUP

Selects, changes or activates the following gauge features:

- STATISTICS - Configures statistical analysis of readings - see "Statistics" on page 17:
  - SELECT STATS - Choose which statistics are shown on the display.
  - SOFTKEY ENABLED - Allows STATS softkey to be turned off when EXTENDED MENU is active.
- [TOP] DATA - Activates DATA softkey and selects the DELETED READING menu.
  - [TOP] SOFTKEY ENABLED - Allows DATA softkey to be turned off when EXTENDED MENU is active.
  - [TOP] DELETED READING - Allows readings to be tagged or deleted:
    [TOP] TAG - Readings still appear in the batch (with a tag-deleted symbol 🔖), but they are not included in statistical calculations.
   [TOP] DELETE - Readings are deleted permanently.

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- UNITS - Select from µm, mil or thou.
- AUTO SWITCH OFF - Changes delay before gauge switches off.

  Minimum = 1 minute (default); Maximum = 10 minutes; 'Off' = disabled
- OUTPUT - Selects [TOP] Bluetooth® PC Reply option, baud rate and activates data output via the interface - see "Interface" on page 5.
  - [TOP] BLUETOOTH PC REPLY - Toggle tick box to activate/deactivate. When activated, and a Bluetooth® connection is established between your gauge and a PC, the gauge will expect a reply from the PC after each reading is taken. See page 30 for further information.
  - BAUD RATE - Sets baud rate between 1200 and 19200. The default value is 9600 baud.
  - RS232 BIT IMAGE - Toggle tick box to activate/deactivate. When activated, readings are sent to the RS232 interface as they are taken. All images and characters are output as bit-maps.
  - RS232 PLAIN TEXT - Toggle tick box to activate/deactivate. When activated, readings are sent to the RS232 interface as they are taken. The gauge sends standard ASCII characters from the Courier New font set[e]. This allows printing on devices such as RS 232 printers or PC via Elcometer software (page 28) or via HyperTerminal (or similar programs).
- BEEP VOLUME - Changes volume. 0 = off; 5 = loudest; Default = 3.
- LANGUAGES - Selects menu language.
- LARGE FONTS - Toggle tick box to activate/deactivate. When activated, all menus and screens are displayed using double height, single width fonts (for improved legibility, if needed).

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e. When RS232 Plain Text is selected the following languages will be output as English: Chinese, Greek, Hebrew, Japanese, Korean, Russian, Lithuanian, Farsi.

- SOFTKEYS LOCKED - Toggle tick box to activate/deactivate. When activated, the softkey functions will always be displayed on the screen.

  When deactivated, the softkey functions disappear automatically from the reading screen and the reading value is expanded to maximum size as shown in the illustration. To view the functions again, press any of the softkeys.
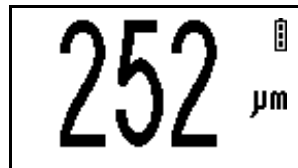
  Note: Softkey functions are always visible in menus.

- OPENING SCREEN - Toggle tick box to activate/deactivate. When activated, an opening (welcome) screen is displayed[f] when the gauge is switched on.

8 STATISTICS

The Elcometer 224 has a Statistics feature (STATS) which calculates and displays a statistical analysis of readings as they are taken. [TOP] The statistical calculations are also applied to the readings stored within a single batch in memory.

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f. The welcome screen will only be displayed if it has been downloaded into the gauge (see page 31).

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When **EXTENDED MENU** is active, press **STATS** softkey to access **STATS MENU.**

The statistical values available are:
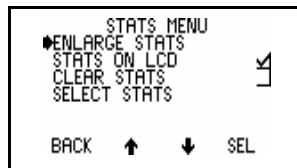
n: Number of Readings

$\overline{x}$: Mean

σ: Standard Deviation

Hi: Highest Reading

Lo: Lowest Reading

For more information see:

- "Select stats" on page 20
- "Statistics terminology" on page 33

```
         STATS MENU
 ▸ENLARGE STATS
   STATS ON LCD       ◹
   CLEAR STATS
   SELECT STATS

   BACK    ↑    ↓    SEL
```

Statistics Menu


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8.1 ENLARGE STATS

Displays the chosen statistical values as double-height characters. The example screens (below) appear when all the statistical values are selected. The **Up/Down** softkeys can be used to move through the list. The **OK** softkey returns the gauge to the Reading Screen.
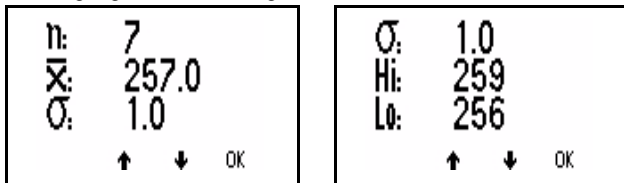
Enlarged Statistics

8.2 STATS ON LCD

Activates the presentation of the chosen statistical values on the reading screen.
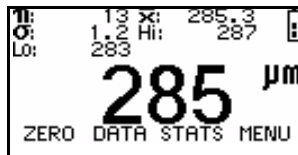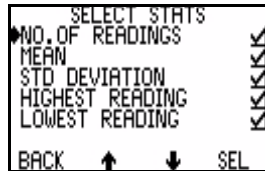

Reading Screen with all statistics

8.3 CLEAR STATS

Resets to zero all statistical values.

8.4 SELECT STATS

Allows the user to chose which statistical values are displayed. The default condition is all values.

Use **Up/Down** softkeys to move cursor and **SEL** softkey to select or deselect the statistical values.

```
     SELECT STATS
►NO.OF READINGS      ✓
 MEAN                ✓
 STD DEVIATION       ✓
 HIGHEST READING     ✓
 LOWEST READING      ✓

 BACK    ↑    ↓    SEL
```

Select Stats Menu
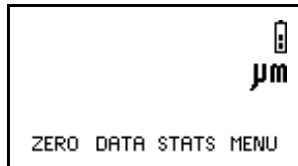
9 [TOP] BATCHING

(Batching is the term used to describe saving readings in gauge memory.)

This section (9) applies to Elcometer 224 Top gauges only.

The Elcometer 224 Top operates in one of two modes; immediate or batch.

9.1 IMMEDIATE MODE

The gauge takes readings and calculates statistics, but does not store any readings in memory (this is known as 'rolling statistics').

Immediate mode

9.2 BATCH MODE

The gauge takes readings and calculates statistics and stores readings in memory. The gauge stores readings in one of up to 999 separate batches.

Batch mode (batching) allows readings to be collected in groups to allow easier analysis of large structures or complex assemblies.

The Elcometer 224 Top has memory capacity of up to 50 000 readings in up to 999 batches.
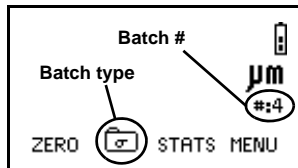
Batch mode

9.3 USING YOUR GAUGE MEMORY

The memory in your gauge is accessed using the DATA MENU.

To access the DATA MENU press the DATA, ⌑ or ⌑ softkey (these softkeys are only displayed with EXTENDED MENU on).

The functions in the DATA MENU are described below:

```
              DATA MENU
►EXIT BATCHING
 OPEN NEW BATCH
 OPEN EXISTING BATCH
 REVIEW BATCHES
 SET LIMITS
 FREE MEMORY
 BACK      ↑      ↓      SEL
```

EXIT BATCHING

Returns the gauge to immediate mode and no further readings are stored in memory. The Reading Screen is displayed.

OPEN NEW BATCH

Opens (creates) a new batch using the next available batch number.

- To create a batch with new settings use OPEN NEW BATCH in immediate mode.
- To create a batch with a copy of the settings from another batch use OPEN NEW BATCH in batch mode (known as cloning[g] a batch).

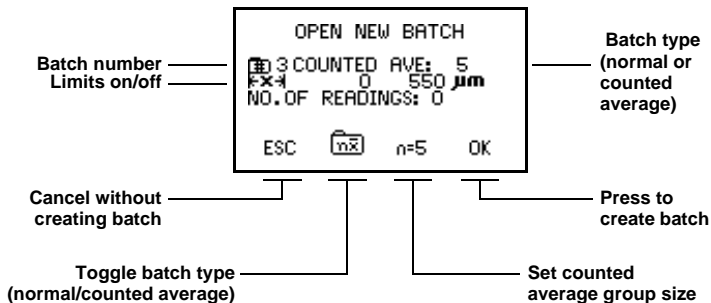### Opening new batch in immediate mode

1. Ensure that a batch is not already open and then press DATA>OPEN NEW BATCH.

   Wait a few seconds while the batch is set up.

---

g. Cloning is typically used when several areas are being tested. Cloning allows the settings for an area to be quickly and easily duplicated.

The OPEN NEW BATCH screen is then displayed.

Batch number —

Limits on/off —

```
         OPEN NEW BATCH
  ⊞ 3 COUNTED AVE:  5
  ⊢×⊣      0   550 μm
  NO.OF READINGS: 0

   ESC   ⌐nx⌐  n=5   OK
```

Batch type (normal or counted average) —

Cancel without creating batch —

Press to create batch —

Toggle batch type (normal/counted average) —

Set counted average group size —

OPEN NEW BATCH - Immediate mode

2. Choose batch type (normal or counted average)

   To toggle between the batch types press ⌐☞⌐ or ⌐nx⌐ .

   • **NORMAL** (⌐☞⌐) - Each reading is added to the number of readings and contributes to the statistical calculation.

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- **COUNTED AVE: (⬚)** - Readings are taken in preset groups, the default being 5 readings per group (n=5). At the end of each group the gauge beeps and calculates the average for the group and stores this average value, which is used for the statistical calculation. The individual readings in the group are not stored. The value for n can be changed by pressing the **n=5**[h] softkey.

3. Upper and lower Limits for the batch can be changed at any time once the batch has been created - see "Set limits" on page 26.

4. Press OK to create the batch

Opening new batch in batch mode

Opening a new batch in batch mode duplicates (clones) an existing batch.

Cloning copies the following settings to the new batch:

- Limits
- Batch type
- Zero setting

Note: Batch type cannot be changed once the cloned batch has been created. Limits and zero setting can be changed after the batch has been created - see "Zeroing your gauge" on page 6 and "Set limits" on page 26.

1. Open the batch which you want to clone and then press DATA>OPEN NEW BATCH.

   Wait a few seconds while the batch is set up.

---

h. The value for 'n' shown on the softkey can be any number between 2 and 255.

The OPEN NEW BATCH screen is then displayed (note the 'clone' symbol at top right).
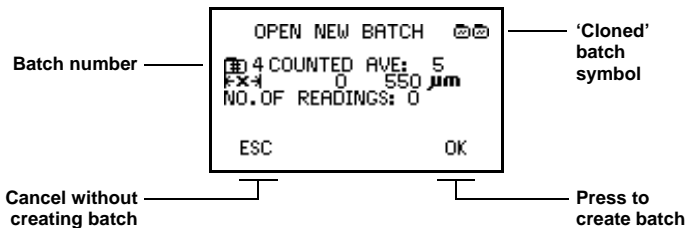
OPEN NEW BATCH - Batch mode (cloning)

2. Press OK to create the batch

Batch numbering

The gauge automatically allocates the next batch number when a new batch is created. Up to 999 batches can be active at any time. Deleted batches are removed from the list so that batch numbers above 999 are valid. A deleted batch number cannot be reused until all the batches are deleted, when the batch number count starts again at 1.

OPEN EXISTING BATCH

Opens any batch to add more readings. If the gauge is switched off with the batch open, the current batch will re-open when the gauge is switched back on.
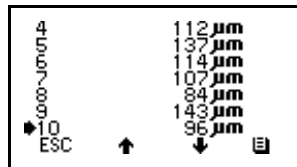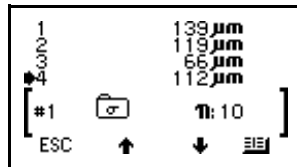
elcometer

REVIEW BATCHES

Displays contents of any batch.

Press the left/right arrows to select the batch you want to review, then press OK.

The status area in the bottom half of the screen displays the batch number, batch type and number of readings in the batch.

Press ⅢⅢ to switch the status area on/off.

Press the up/down arrows to scroll.

1	139 μm
2	119 μm
3	66 μm
►4	112 μm

#1   🗀   �: 10

ESC   ↑   ↓   ⅢⅢ

4	112 μm
5	137 μm
6	114 μm
7	107 μm
8	84 μm
9	143 μm
►10	96 μm

ESC   ↑   ↓   ⅢⅢ

SET LIMITS

Upper and lower values can be set by the user to monitor specification values.

To activate limits tick the LIMITS ON box.

To set the UPPER and LOWER limit values move the cursor to the limit required and press SEL.

SET LIMITS

►LIMITS ON   ✓
HIGH   550 μm
LOW   0 μm

BACK   ↑   ↓   SEL

The gauge will display the current settings.

Adjust the values with Up/Down softkeys. When the correct value is displayed, press OK to enter.

With LIMITS ON activated, an out-of-limits reading will be indicated by a triple beep. A reading within limits is indicated by a single beep. Out-of-limits symbols ⊤ and ⊥ will be stored in the batch and can be seen when the batch is reviewed.

26
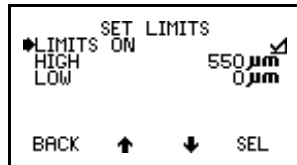
FREE MEMORY

This option displays the amount of free memory available for storage of readings.

10 [STANDARD] TRANSFERRING READINGS TO A COMPUTER OR PRINTER

This section (10) applies to Elcometer 224 Standard gauges only.

Measurement data can be transferred from your gauge to a PC or to the optional Elcometer miniprinter[i] as the readings are taken. It is also possible to transfer the current statistics to the miniprinter.

- To transfer measurement data to a PC as the readings are taken, go to MENU>SETUP>OUTPUT and tick either 'RS232 BIT IMAGE' or 'RS232 PLAIN TEXT' (see page 16). Connect the gauge to your PC using the optional gauge-to-PC connection cable and run 'HyperTerminal' or a similar program. As each reading is taken, it will then be sent to your PC via the RS232 interface.

- To transfer measurement data to the Elcometer miniprinter as the readings are taken, go to MENU>SETUP>OUTPUT and tick 'RS232 PLAIN TEXT' (see page 16). Connect the gauge to your PC using the optional gauge-to-printer connection cable and switch on your printer. All readings will then be sent to your printer via the RS232 interface as they are taken.

- To transfer the current statistics to the Elcometer miniprinter, Connect the gauge to your PC using the optional gauge-to-printer connection cable and switch on your printer. Now select MENU>PRINT/OUTPUT>CURRENT STATISTICS. The current statistics will then be sent to your printer via the RS232 interface.

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i. Elcometer Miniprinter - see "Accessories" on page 33.

This section (11) applies to Elcometer 224 Top gauges only.

11.1 SOFTWARE

Your gauge is supplied with ElcoMaster and ElcoMaster Mobile software. ElcoMaster allows you to:

- Monitor measurements remotely via Bluetooth
- Download readings data from your gauge to the ElcoMaster data management system
- Keep your survey notes, inspection reports, photographs and all your other inspection information in one place - ElcoMaster
- Create accurate and professional reports configured to allow your data to be understood easily at all levels
- Create PDF versions of your reports and e-mail direct from ElcoMaster
- Create a user screen and upload it to your gauge (see page 30).

ElcoMaster and ElcoMaster Mobile are on the CD supplied with your gauge and they can also be downloaded, together with any subsequent upgrades, from the Elcometer website www.elcometer.com

Your gauge is also fully compatible with ElcoShip - see www.elcoship.com for further details.

To use ElcoMaster for data transfer, the software must be installed on your PC and your gauge must be connected to your PC using Bluetooth or the USB cable.

11.2 INSTALLING ELCOMASTER SOFTWARE

1. Place the CD in your PC.

   The software installation wizard should run automatically. If it does not run automatically:

- Click Start > Run
- Type D:AutoCIS (where 'D' is the letter of your CD drive)
- Click OK. The software installation wizard will run.

2. Follow the on-screen installation instructions.

Follow the instructions included with ElcoMaster to interface your gauge with your PC.

If at any time ElcoMaster requests a PIN number for your gauge, press Menu>Bluetooth. The Bluetooth PIN is displayed next to Authentication. Note that each gauge has a unique PIN - use only the PIN for your gauge.

11.3 CABLE CONNECTION

1. Connect your gauge to your PC using the optional gauge-to-PC connection cable.
2. Switch on your gauge and ensure the Reading Screen is displayed.
3. Start the software and follow the instructions included with the software.

11.4 BLUETOOTH® CONNECTION

Full instructions on how to interface your gauge with ElcoMaster and download data are included in the ElcoMaster help file supplied with the software.
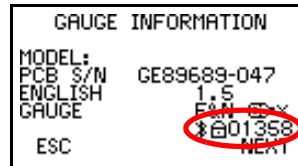
BLUETOOTH® CONNECTION ICON ⑂

When a Bluetooth® connection is established between your gauge and a PC, the gauge beeps twice (high tone) and shows a flashing Bluetooth® icon ⑂ next to the battery status symbol on the display. When the connection is closed or lost, the gauge beeps twice (low tone) and the icon is removed.

BLUETOOTH® PIN

If at any time ElcoMaster requests a PIN number for your gauge, select MENU>ABOUT>GAUGE INFORMATION. The display will show the Bluetooth® PIN in the bottom right corner (in the example shown, '01358'):

Each gauge has a different PIN - use the PIN shown on your Gauge Information screen.

```
          GAUGE INFORMATION
MODEL:
PCB S/N      GE89689-047
ENGLISH           1.5
GAUGE
              ✻🔒01358
  ESC                  NEXT
```

TRANSFERRING MEASUREMENTS AS THEY ARE TAKEN

Measurement data can be transferred from your gauge to ElcoMaster via a Bluetooth® connection as the readings are taken.

Your gauge includes a feature which checks that a reading taken by the gauge has arrived successfully at your PC. If the reading does not arrive at your PC, an error message is displayed on your gauge and further readings cannot be taken until it is cleared.

To use this feature, tick the Bluetooth® PC Reply box under MENU>SETUP>OUTPUT - see page 16. When the box is ticked, and a Bluetooth® connection is established between your gauge and a PC, the gauge will expect a reply from the PC after each reading is taken.

If this reply is not received within half a second of sending the reading, an error message is displayed.

If the Bluetooth® connection is still established and the reply is received after half a second then the message will clear automatically, (this indicates that the Bluetooth® connection is operating at the limit of its range). If the Bluetooth® connection has been lost, then the error message will remain on the screen until a key is pressed.

12 PERSONALISED WELCOME SCREEN

A personalised welcome screen can be created and downloaded into the gauge.

Screen dimensions are 128 pixels x 64 pixels. The welcome screen is typically used to personalise the gauge with a logo, serial number, user name, etc. This is the first screen displayed when the gauge is switched on.

12.1 [STANDARD] GAUGES

Download the Elcometer 'Welcome Screen Wizard' software from www.elcometer.com/downloads

CREATING THE SCREEN

1. Connect your gauge to your PC using the optional gauge-to-PC connection cable.
2. Switch on the gauge.
3. Run 'Welcome Screen Wizard' software and follow the on-screen instructions.

DELETING THE SCREEN

1. Run the 'Welcome Screen Wizard' software.
2. Click 'Next'.
3. Select 'Create a new screen setup'.
4. Click 'Next'.
5. Select 'Disabled'.
6. Click 'Next'.

Follow the remaining on-screen instructions to delete the welcome screen.

12.2 [TOP] GAUGES

Use your Bluetooth® interface or the optional gauge-to-PC connection cable with ElcoMaster software to create and upload the screen - see the instructions included with ElcoMaster.

13 STORAGE AND TRANSIT

This gauge incorporates a Liquid Crystal Display (LCD). If the display is heated above 50°C (120°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 it is not being used.

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.

14 MAINTENANCE

You own one of the finest hand-held Digital Profile Gauges in the world. If looked after, it will last a lifetime.

The gauge does not contain any user-serviceable components except for the probe tip which can be replaced by the user - see "Accessories" on page 33. 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 instrument has been opened. Contact details are stored in the gauge - MENU>ABOUT>CONTACT. Worldwide: sales@elcometer.com, or USA/Canada: inc@elcometer.com

15 STATISTICS TERMINOLOGY

Symbol	Term	Meaning
Hi	HIGHEST READING	The value of the maximum thickness in a group of readings.
Lo	LOWEST READING	The value of the minimum thickness in a group of readings.
$\bar{x}$:	MEAN	The average of a group of readings; the sum of the individual readings divided by the number of readings.
n:	NO. OF READINGS	Number of Readings. The running value for the number of readings taken in a group.
σ:	STD DEVIATION	Standard Deviation. A statistical measure of the spread of values in a group of readings.

16 ACCESSORIES

The following accessories are available from Elcometer, or your local Elcometer supplier:

Pack of 2 Spare Probe Tips, Dust Seals and Fixing Tool	T22420053
Pack of 2 Spare Probe Tips and Dust Seals	T22420054
Pack of 5 Spare Probe Tips and Dust Seals	T22420095
Probe Tip Protection Cap	T22419793
Soft Pouch	T22420050
Zero Plate with Wallet	T22420072

Soft Pouch	T22420050
LCD Window Protection Film, Pack of 50	T99916651
Gauge-to-PC Connection Cable[j] (9-pin):	T99916217
RS232 to USB converter cable:	T99916716
Miniprinter[k], 230 V (UK Plug):	X4569964B
Miniprinter, 230 V (European Plug):	X4569964C
Miniprinter, 110 V (US Plug):	X4569964D
Miniprinter, gauge-to-printer connection cable (25-pin):	T99916267
Miniprinter ribbon cassettes (pack of 5):	T9769992-
Miniprinter paper rolls (Box of 20):	T9999993-
[TOP] USB Bluetooth® Module:	T99920130

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j. A 9-pin to 25-pin adapter may be required for certain PC RS232 ports.
k. 42 column, rechargeable battery powered Miniprinter complete with charger.

17 TECHNICAL DATA

Range:	0 µm to 500 µm (0 mils to 20 mils)
Accuracy:	±5% or ±5 µm[l] (±0.2 mil)
Resolution:	1 µm (0.1 mils)
Measurement speed:	>40 readings per minute
Weight:	180 g (5.7 oz)
Dimensions:	140 mm x 75 mm x 35 mm (5.5" x 3" x 1.38")
Operating temperature:	0°C to 50°C (32°F to 120°F) (ambient[m])
Storage temperature:-	-10°C to 55° (14°F to 130°F)
Relative Humidity:	0% to 95
Case:	High impact ABS
Batteries:	2 x LR03 (AAA), alkaline[n] dry batteries or rechargeable[o] equivalents

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l. Whichever is the greater.
m. Operation outside these limits depends upon climatic conditions. If required, contact Elcometer for further information.
n. Alkaline batteries must be disposed of carefully to avoid environmental contamination. Please consult your local environmental authority for information on disposal in your region.
   Do not dispose of any batteries in fire.
o. Rechargeable batteries can be used if they are charged outside the gauge.

18 RELATED EQUIPMENT

Elcometer produces a wide range of surface testing equipment and other associated paint inspection equipment. Users of the Elcometer 224 may also benefit from the following Elcometer products:

- Elcometer Mechanical surface profile gauges
- Elcometer Surface replica tape (Testex)
- Elcometer Surface comparators
- Elcometer Material thickness gauges
- Elcometer Surface cleanliness test kits

Other Bluetooth® products within the Elcometer product range include :

- Elcometer 456 Dry Film Thicknes Gauges
- Elcometer 319 Dewpoint Meter

These gauges are ideal for connection to PDA's wirelessly, ideal for ElcoMaster and ElcoShip Mobile software.

For further information contact Elcometer, your local Elcometer supplier or visit www.elcometer.com or www.elcoship.com