

Elcometer 355

Coating Thickness Gauge

Top Model

Operating Instructions



This product meets the Electromagnetic Compatibility Directive. This 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 products 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.

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A copy of this Instruction Manual is available for download on our Website via www.elcometer.com.

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Thank you for your purchase of this Elcometer 355 Coating Thickness 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 355 Coating Thickness 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 355 Coating Thickness Gauge is a handheld gauge for fast and accurate measurement of the thickness of coatings.

With a memory of up to 10 000 readings in multiple batches and accuracy to $\pm 1\%$, your gauge is a measuring system packed with time saving and cost cutting features.

1.1 STANDARDS

The Elcometer 355 can be used in accordance with the following National and International Standards:

FERROUS (F)

ASTM B 499, ASTM D 1186-B, ASTM G 12, BS 3900(C5), BS 5411 (11), DIN 50981, IMO MSC.215 (82), IMO MSC.244(83), ISO 1461, ISO 2063, ISO 2808-7C, *supersedes ISO 2808-6A, BS 3900-C5-6A, BS 5411-11, DIN 50981*, ISO 2808-12, ISO 19840, NF T30-124, SSPC-PA2.

For the IMO PSPC^a, the thickness of coatings should be recorded. Your Elcometer 355 can be used for this.

NON-FERROUS (NF)

ASTM D 1400, BS 3900 (C5), BS 5411 (3), BS 5599, DIN 50984, ISO 2360 *supersedes BS 5411-3*, ISO 2808-7D *supersedes BS 3900-C5-6B, BS 5411-3, DIN 50984, ISO 2808-6B*, ISO 2808-12, ASTM B244 (probes N1, N4).

FERROUS AND NON-FERROUS (FNF)

AS 2331.1.4, AS 3894.3-B, AS/NZS 1580.108.1, ASTM D 7091 *supersedes ASTM D 1186, ASTM D 1400*, ASTM E 376, EN 13523-1 *supersedes ECCA T1*, ISO 2808-12, US NAVY NSI 009-32, US NAVY PPI 63101-000.

a. International Marine Organisation, Performance Standard for Protective Coatings.

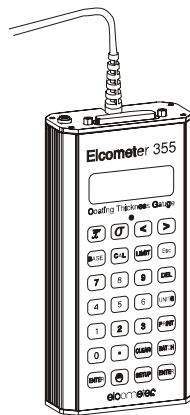
1.2 WHAT THE BOX CONTAINS

- Elcometer 355 Top Gauge
- Leather carry case
- Precision Hand Grip
- Earpiece
- CD containing data collection software
- PC Cable
- Batteries
- Operating instructions

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

To maximise the benefits of your new Elcometer 355, please take some time to read these Operating Instructions.

Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.




2 GETTING STARTED

2.1 REMOVING THE CASE

To remove the leather case to gain access to the module and battery compartments, undo the retaining screw located on the bottom of the case and remove the gauge by pushing it through the hole.

2.2 FITTING BATTERIES

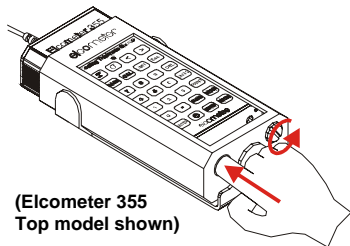
Batteries are located under the cover at the rear of the gauge. Fit three LR6 (AA), alkaline dry batteries, or rechargeable equivalent; take care to ensure correct battery polarity.

When the battery symbol  is shown on the display, the batteries should be replaced. When the symbol starts flashing, the batteries will last approximately one more hour.

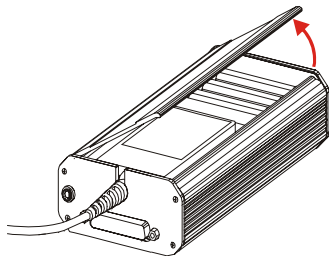
Note: Remove the batteries from the instrument if it is to remain unused for a long period of time. This will prevent damage to the instrument in the event of malfunction of the batteries.

Note: All 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.




(Elcometer 355
Top model shown)



2.3 CONNECTING A PROBE MODULE

1. Ensure the probe is suitable for the measurements to be made.
2. Switch off the gauge.
3. Open the cover at the back of the gauge.
4. Insert the probe module.
5. Replace the cover.

2.4 SWITCHING THE GAUGE ON AND OFF

- To switch your gauge on, press and hold [].

The red LED flashes, the gauge clicks and all segments of the display are illuminated with the backlight on. The Software Version Number is then displayed.

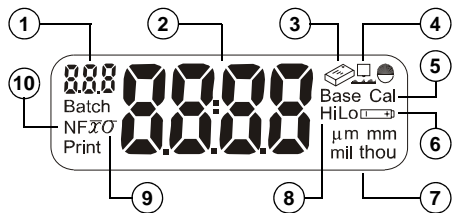
The instrument will then start up in the mode last used.

Completion of start-up is indicated by one long beep and the red LED flashing.

- To switch your gauge off, press and hold [ENTER] for three seconds.

Your gauge can also be set to switch off automatically - see “Date and time” on page 18.

2.5 THE DISPLAY



1. Reading number
2. Reading/menu item/value
3. Service required
4. Rough surface
5. Calibration type
6. Battery condition
7. Units
8. Limits
9. Average/Standard deviation
10. Non-ferrous/Ferrous

2.6 INTERFACE

A data output interface is located on the top of your gauge.

2.7 SELECTING A LANGUAGE

The Elcometer 355 has a number of languages built-in. To select a language, see “Language function” on page 22.

2.8 CHANGING UNITS

Your gauge can display coating thickness in μm^b (microns), mm, mil and thou.

To change units, press [UNITS].

Note: When units are set to mm, the resolution of the display is such that only 1 μm resolution may be shown, e.g. 10.8 μm would be displayed as ‘0.011’ mm.

b. μm will not be available as an option on probes which have a range greater than 9999 μm

3 TAKING A READING

Switch on the gauge.

Place the probe on the surface to be measured. The reading may be inaccurate if the probe is not held as shown.

The green LED will flash and a beep will sound when a valid reading within limits has been taken.

If a red LED flashes while taking a reading, this indicates that the reading is outside of the set limits.

The coating thickness is shown on the display.

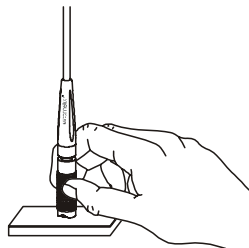
If the reading is just above the range of the module, the display shows:

In certain base conditions a negative over range can occur, indicated by:

In either of these two cases, check and re-calibrate if necessary - see "Calibration - BASE and CAL" on page 9.

In some conditions, the display may show error codes 'E14', 'E15', etc. For details of these error codes, see "Fault Finding / Error Codes" on page 33.

To save readings into memory (batching), refer to the instructions given in "Batches and memory" on page 10.



4 CALIBRATION - BASE AND CAL

1. Press [BASE] for low end calibration on a zero plate or low value foil and [CAL] for higher foil.
If the password mode has been enabled (see "Password function" on page 20) then '- -' is displayed and the password will have to be entered.
2. Take a number of readings on the required calibration thickness. (Uncoated material for zero or base, a thin foil for rough surface or unusual materials and a thick foil for cal).
(A wide range of foils is available - see "Foils" on page 38.)

The foil value shown on the label applies to a measurement position as indicated:

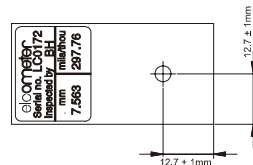
The display will show an average value - indicated by the $[\bar{x}]$ symbol.

3. When the base or cal value shown on the display is stable, then adjust the display to the required value e.g. '0' or the foil value; enter the required number using the keypad and then press [ENTER].

The 'base' or 'cal' symbols and $[\bar{x}]$ will now be removed from the display.

If a base value greater than zero is entered, the rough surface symbol will be displayed.

This symbol will disappear from the display if the base is reset to zero (0).



Note: If 'base' or 'cal' are used with regular values, the [BASE] or [CAL] keys may be pressed to recall the last value entered to the display in order to save re-entering the numeric data. [ENTER] is used to confirm the display value in memory.

5 BATCHES AND MEMORY

5.1 SELECTING A BATCH

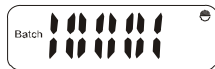
With the instrument switched on, press [BATCH].

Use the keypad to enter the batch number (up to 7 digits).

Press [ENTER].

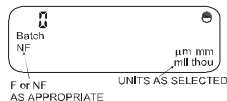
An indication of the remaining memory will be displayed:

Bars will be removed from this display as the memory is filled. The upper bars show approximately 11% increments and the lower bars approximately 1% increments.



If data already exists in the batch selected, the last reading will be displayed together with the reading number in the small display. If a mistake is made during any number entry, [DEL] will delete a single number or [CLEAR] will clear the whole number entered.

If the batch is new, the display will be blank and '0' will be displayed as the reading no:



Alternatively, the batch numbers in memory may be displayed for selection by pressing [BATCH] a number of times. The batch numbers will be displayed in the order in which they were created. When all batch numbers have been displayed, the first batch number entered will be displayed again. The batch required is selected by pressing [ENTER].

Immediate mode is designated as 'BATCH 0'. Returning to immediate mode from batch mode clears all previous immediate mode data and starts at reading '0'.

The time and day/month will always be stored at the time when the first reading is taken.

In addition, if the time stamp mode is enabled (see "Date and time" on page 18) it will also be stored within the batch data whenever the instrument is:

- switched off automatically
- switched on again
- instructed that the batch is closed, normally by opening another batch.

5.2 VIEWING BATCH DATA

Data within the current batch may be viewed by pressing [BATCH] and [.] . Other batches may only be viewed by first selecting them. Viewing always starts at the beginning of the batch.

Use [<] and [>] to scroll through the data.

Embedded within data, and shown in the reading number display, are 'OP' which indicates when the batch was opened, 'On' to indicate when the instrument was switched on and 'CL' to indicate when the batch was closed, along with the time and date (month and day only) alternately flashing. (The date format may be either mm:dd or dd:mm - see "Date and time" on page 18).

Also embedded are any base or cal functions which are completed within the batch. The beginning of the viewed data may be selected by pressing [BASE], the middle by pressing [CAL] and the end by pressing [LIMIT].

Note: *The beeper is switched off automatically so that only a click sounds when scrolling through the data.*

5.3 CLEAR/DELETE BATCH DATA

Data within a batch may be 'cleared' leaving the batch number, calibration and limits. Alternatively, the batch data and its associated number may be 'deleted'.

CLEARING CURRENT BATCH DATA

Select the batch to be cleared - see "Selecting a batch" on page 10.

Press [BATCH] and [CLEAR] (or simply press [CLEAR] to go straight to the alternating displays further on):

Press [ENTER] and the display will alternate between 'Clr' and 'batch no' as shown (batch number 14 in this example).

Press [ENTER] to clear the selected batch or [Esc] to cancel the operation.



DELETING CURRENT BATCH

Select the batch to be cleared - see "Selecting a batch" on page 10.

Press [BATCH] and [DEL]:



Press [ENTER] and the display will alternate between 'dEL' and 'batch no' as shown (batch number 14 in this example).

Press [ENTER] to delete the batch or [Esc] to cancel the operation.



CLEARING DEFINED BATCH DATA

Press [BATCH] and [CLEAR]:

Enter the 'batch number' and then press [ENTER]; the display will alternate between 'Clr' and 'batch no' as shown (batch number 14 in this example).

Press [ENTER] to clear the selected batch or [Esc] to cancel the operation.



If the defined batch has never contained any readings to clear, the display will show:



DELETING DEFINED BATCH

Press [BATCH] and [DEL]:



Enter the 'batch number' and then press [ENTER]; the display will alternate between 'dEL' and 'batch no' as shown (batch number 14 in this example).

Press [ENTER] to delete the batch or [Esc] to cancel the operation.



CLEARING ALL BATCHES

This function is only available in immediate mode. It will clear all batch data, but leave the batch numbers intact.

Press [BATCH] and [CLEAR]:

Press [ENTER]; the display will alternate between 'Clr' and 'ALL?'

Press [ENTER] to clear all batches or [Esc] to cancel the operation.



DELETING ALL BATCHES

This function is only available in immediate mode. It will clear all batch data and all of the batch numbers.

Press [BATCH] and [DEL]:



Press [ENTER]; the display will alternate between 'dEL' and 'ALL?'.
Press [ENTER] to delete all batches or [Esc] to cancel the operation.



6 LIMITS

If limits are set and a reading is taken which is outside the limits, the red LED will show and a longer beep will be given (1 second instead of 0.5 seconds).

Limits may be set in immediate mode where they will act as reference values or in batch mode before readings are taken, or after readings are cleared. If readings exist within a batch, then the current low limit will be displayed followed by the current high limit for a period of 1 second each.

6.1 TO SET LIMITS

1. Press [LIMIT] followed by [<] for low, or [>] for high. The current value will be displayed - 'Lo' symbol is displayed for low limit and 'Hi' symbol for high limit.
2. The value may now be changed to a new value, and then press [ENTER].
Once one limit is set, the other will be displayed; either accept the value and press [ENTER], or change to a new value and then press [ENTER].

6.2 TO RESET (CANCEL) LIMITS

To reset the limits to values outside the range of the module, press [CLEAR]. With these settings, limits will not normally operate.

Note: Reasonable limits are set at a default value of 20% of the effective range, less or greater than the low or high limits respectively. These values may be adjusted - see "Reasonable limits function" on page 23.

Setting the reasonable limit to 99% will switch the reasonable limit function off.

When a reasonable limit is reached for a reading value, the reading display will flash, the red LED will flash and the beep will sound a number of times. This prompts the user to accept the reading by pressing [ENTER] or reject the reading by pressing [DEL] (as for deletion of last reading).

7 SETUP

The setup mode enables the User to adjust a number of different functions to suit the way the instrument is operated. The setup mode is based around 10 functions, each of which has sub-functions.

After pressing [SETUP], Function No 10 (SEL) will be displayed:

This function is used to select the Data Collection/Statistical modes, i.e. Statistics, Average or Counted Average - see "Statistics" on page 26.



Other functions may be selected by using [<] or [>] to go through the list or by pressing the relevant number. If [<] or [>] are pressed the individual functions are displayed and [ENTER] must then be pressed to select that function for modification. Using the number keys, the sub-function is more quickly selected and is thus a quick entry method for experienced users.

Once a function is entered, [<] or [>] are used to either select the alternatives, or modify the value.

Sub-functions are displayed using a second number in the 'n' display. e.g. '11' for baud function within 'Prnt'. Select the required value for the function or sub-function by pressing [ENTER]. Exit the function by pressing [0] or [SETUP] the required number of times (or [Esc]) to step back through the Sub Menus.

This display signifies the end of each menu's options.

The following sections describe each function (in numerical order).



7.1 PRINTER SETUP FUNCTIONS

Having pressed [SETUP] use [<] or [>] to select:

Press [ENTER].

Printer SetUp Sub-Functions

For serial printing, the printer's baud rate must be selected in the range 300-38,400.

Press [ENTER] and use [<] or [>] to select one of the options which are available e.g.

Press [ENTER] to set this option to required rate and return to the Printer SetUp Menu, or [Esc] to cancel the operation.

Continue stepping through the Printer SetUp Menu by using [>]. Press [ENTER] at the required option and use [<] and [>] to select within that option ([Esc] cancels the operation):

End of line character is Cr or CrLF.

Selects 80 or 42 column printing (42 col. for Elcometer Portable Printer).



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Page length 0-100 lines (0 for continuous printing).

0-10 spaces of indentation from left (not available with 42 column printer).

Type of report: Full or PArt (no readings).



7.2 DATE AND TIME

When setting the date and time, the display flashes a 2 digit pair for day, month, hours or minutes. These may be adjusted up or down by using [<] and [>] respectively. The year is a 4 digit number with limits of 1994 and 2093 and is adjusted using the [<] and [>] keys as before.

Having pressed [SETUP], use [<] or [>] to select, followed by [ENTER]:

Date and Time Sub Functions.

Use [<] or [>] to select any of the following five sub functions:

Date format by Country

There are two date formats available:

or

d:M for Day:Month (UK)



M:d for Month:Day (USA)

Press [ENTER] or [Esc] to return to the 'Coun' display.

Continue stepping through the time and date functions by using [>]. Press [ENTER] at the required option and use [<] and [>] to select within that option ([Esc] cancels the operation):

Set day/month and year).



Set time of day.



Time stamp.



Select time stamp: off or on



Switch off timeout period in minutes (1-30) or 0 for none.



7.3 BEEPER FUNCTION

Having pressed [SETUP], use [<] or [>] to select:

Press [ENTER], and set beeper volume level using [<] or [>] (1 - 4 or 0 for none).

Press [ENTER] to return to the 'bBEEP' display or [Esc] to cancel the operation.



7.4 PASSWORD FUNCTION

Having pressed [SETUP], use [<] or [>] to select:

Password Function

Press [ENTER] and then enter the current password to gain access. The default password is '0000'.

As each number is pressed, 'o' will show in the upper half of the display.



If an incorrect password has been entered, the display will show 'no'. If this happens, press any key to return to the 'PASS' display.



Once the correct password has been entered, there are two options available (select using [<] and [>]): 'uSE' and 'not uSE'.



If 'uSE' is selected, then a password is prompted within base and cal functions.

The current password is required to access these functions. When 'uSE' is

selected, the current password will be flashed on the main display. A new password may be entered at this point. As the new number is entered, the digits stop flashing until all 4 digits are entered and the 'PASS' function is re-displayed.



If 'not uSE' is selected, then the current password is not prompted within base and cal functions.

Press [ENTER] to set and return to 'PASS' display, or [Esc] to cancel the operation.



7.5 AUTO MEASUREMENT MODE FUNCTION

Having pressed [SETUP], [<] or [>] selects:

This mode takes readings automatically and displays them digitally in the chosen units giving a form of analogue display. Press [ENTER] and use [<] and [>] to toggle between:

no - Normal digital Coating Thickness mode.

YES - Produces readings automatically.

The beeper should be turned off to stop it sounding continuously. Press [ENTER] to set this option or [Esc] to cancel the operation.



7.6 BATTERY FUNCTION

Having pressed [SETUP], use [<] or [>] to select:

Press [ENTER] to show the battery level as a number of units. New alkaline batteries should display approximately 220 units. New Rechargeable batteries should display approximately 180 units. All batteries need to be replaced at readings of approximately 145. Note that Elcometer supplied rechargeable batteries should give a life of 1hr. between a flashing and a constant battery symbol, but alkaline batteries should last for a number of hours.



Press any operations key to return to the 'bAtt' display.

7.7 BACKLIGHT FUNCTION

Having pressed [SETUP], use [<] or [>] to select:

Backlight Enable/Disable.

Press [ENTER] and use [<] and [>] to toggle between:

on - Ensures the backlight is on at all times when required, but timed to maximise battery life.

oFF - The backlight will be off at all times except for power up display test.

Press [ENTER] to set this option or [Esc] to cancel the operation.



7.8 LANGUAGE FUNCTION

Having pressed [SETUP], use [<] or [>] to select:

Language formats used on printouts.

Press [ENTER] to see which language version is active.

The following languages are available:

English German

French Portuguese



Swedish Danish

Press [SETUP], [ENTER] or [Esc] to return to the 'LAN' display.



7.9 REASONABLE LIMITS FUNCTION

Reasonable limits can be set between 0% and 99% of the range between the high and low limits, and apply above the high limit and below the low limit.

For example, if the low limit is 100 μm and the high limit is 150 μm , the range is $(150 - 100) = 50 \mu\text{m}$. Therefore if the reasonable limits are 20%, then the value applied is $(50 \times 0.2) = 10 \mu\text{m}$.

Therefore, readings outside the range $(100 \mu\text{m} - 10 \mu\text{m})$ or $(150 \mu\text{m} + 10 \mu\text{m})$ will cause the reading to flash and the unit to hold until the reading is either accepted by pressing [ENTER], or rejected by pressing [DEL].

If reasonable limits are set to 0%, every reading outside the high and low limits will require user action. If reasonable limits are set to 99%, the reasonable limit function is switched off. A different value can be applied to each limit.

To set reasonable limits, press [SETUP] and use [<] or [>] to select:



The display will show 'Hi'

Press [ENTER] and use [<] or [>] to adjust the value up or down.

Press [ENTER] to set the correct value (or [Esc] to cancel the operation).



The display will show 'Lo'

Press [ENTER] and use [<] or [>] to adjust the value up or down.



Press [ENTER] to see the correct value (or [Esc] to cancel the operation).

Press [SETUP] or [Esc] to return to the menu.

7.10 DATA COLLECTION/STATISTICAL FUNCTIONS

After pressing [SETUP], Function No 10 (SEL) will be displayed:

Select normal, averaging or counted average mode and their associated setups.

For a description of average and counted average, see "Statistics" on page 26

Press [ENTER] and use [<] or [>] to step through the sub-functions:

Press [ENTER] to select normal mode.



Press [ENTER] to select average mode.



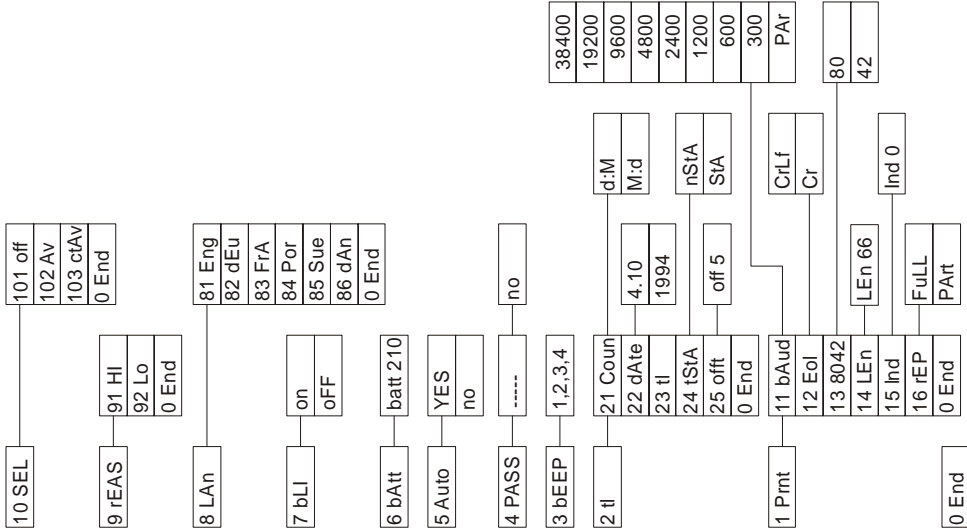
Press [ENTER] to view and modify the number of readings used for the counted average (use [<] and [>] to adjust the value) The minimum value is 1, the maximum value is 99.



Press [ENTER] to accept the new number of readings or [Esc] to return to the 'SEL' display.



7.11 SETUP CHART



8 STATISTICS

These modes operate within batches and can be selected from the setup menu - see “Data collection/Statistical functions” on page 24. There are 3 modes available:

8.1 STATISTICS MODE

The stats keys [\bar{x}], [σ], [$<$] and [$>$] will display (for 1 second or for as long as the key is pressed) mean, standard deviation, lowest and highest readings whether in immediate or batch (statistics) mode.

In averaging or counted average mode, the keys have different functions at different times within the function. These two modes are only available within a batch. Default settings may be setup in immediate mode. These may be modified for a specific batch by adjusting the settings before taking any readings after selecting the batch.

8.2 AVERAGE MODE

Average mode allows the user to take a number of readings to obtain an average value (viewed using the [\bar{x}] key), and store it as a reading in the batch. Individual readings are displayed as taken. The average value may be stored by a single press of the [ENTER] key. At this point, the display will show the average value being stored (with the [\bar{x}] symbol) and how many averages have been stored. Whilst taking an individual reading, the readings display will show how many readings have been taken so far and the [\bar{x}] symbol flashes to show that the instrument is in averaging mode.

The statistics keys will show the statistics for the individual reading until the [ENTER] key is pressed. When pressed, they will show the batch statistics.

8.3 COUNTED AVERAGE MODE

The user predetermines how many readings should be taken to produce the average. This number is set within the SEL mode of Setup.

As readings are taken, the reading number display shows 'n' and the number of readings taken so far. The [\bar{x}] symbol indicates that the main display is a true average. When the pre-determined count is reached, a double beep will sound (the second beep will be extended and the red LED will show if the stored reading is out of limits). At this point, the reading number displays the number of averages stored, and the main display shows the last average saved. The statistics keys will show the batch statistics at all times in this mode.

9 TRANSFERRING READINGS TO A COMPUTER

Your gauge comes complete with software which allows data to be transferred to a PC using a cable. The CD supplied with your gauge includes the following software.

- **Elcometer Data Transfer Software (EDTS⁺ Excel Link).** This software allows the user to transfer data from the memory of the gauge into Microsoft Excel using the PC connection cable. The data can then be processed in software such as Word or Excel.
- **ElcoMaster Software for Measurement Data.** This software allows the user to transfer data from the memory of the gauge to a PC for archiving, analysis and reporting. Data is transferred using the PC connection cable. ElcoMaster includes all the charts that you may need together with a report designer to let you design your reports the way you wish to see these.
- **ElcoMaster Data Conversion Software.** This software converts existing measurement data to ElcoMaster format. The following types of measurement data can be converted; Elcometer EDCS Win, EDCS Plus and EDCS.

All this software can also be downloaded from the Elcometer website www.elcometer.com

9.1 TRANSFERRING USING A PC CABLE

1. Connect your gauge to your PC COM port using the cable supplied. For USB, use the optional adapter, sales part number T99916716.
2. Switch on your gauge.
3. Start the software and follow the instructions included with the software.

10 PRINTING

The Elcometer 355 can be used with EPSON compatible serial and parallel printers with the appropriate interface leads. The setup mode may be used to select either the baud rate for serial printers or the parallel output printing mode. If the Elcometer portable mini printer is being used, the 42 column mode should be selected with the 8042 sub-function within the Prnt function of setup - see "Printer setup functions" on page 17. The Full report can be shortened to PArt, which has statistics and histogram (not Batch 0).

10.1 PRINTER COMMANDS

Press [PRINT] to access the printing functions:

Use [<] or [>] to move between Print modes, [ENTER] to set a particular option or [Esc] to exit. (Alternatively, enter the required print menu numbers directly using the keyboard.)



Press [ENTER] to print statistics and histogram for current batch* or immediate mode data.



Press [ENTER] for continuous printing mode as readings are taken.



Press [ENTER] to print a selected F batch*. Type in the batch number. Press [ENTER] to print.



Press [ENTER] to print all F batches* in the order in which they were used.



Press [ENTER] to print all F and then all N batches* used.



Press [ENTER] to print a selected N batch*. Type in the batch number. Press [ENTER] to print.



Press [ENTER] to print all N batches* in the order in which they were used.



Press [ENTER] to select specific transfer mode which may be used to transfer data to Elcometer's ElcoMaster™ Software or to other data collectors.



Type in the required sub-function number.

70 - 'Cont' mode off

71 - Not available

Sub-functions 72 to 76 (incl.) mimic print functions 2 to 6 shown previously.

Press [SETUP] or [Esc] to return to the 'trAn' display.

Continue with [>] to view



Press [ENTER] to print out a 'directory' of all batches stored within the instrument. Data will include probe type, scale and number of readings. Press [ENTER], [SETUP] or [Esc] to exit this option.



Press [ENTER] to view a number of software related functions.

Type in the required sub-function number (numbers 91 to 96 incl.) as follows:



Press [ENTER] to display the software issue and version no. in form V.xx where x = issue no.



Press [ENTER] to display the probe type and scale number.



Press [ENTER] to display the current time, with the seconds in the small reading number display. Press any key to exit.



Press [ENTER] to print out the current setup parameters as detailed in 'Setup'.



Press [ENTER] to show all display segments and show the backlight is working. Press [ENTER], [Esc] or [SETUP] to end.



Press [ENTER] to turn the Elcometer 355 off, or [Esc] or [SETUP] to return to the 'SoFt' display.

Note: The batch symbol may be displayed if the instrument is in batch mode when the [PRINT] key is pressed. Also the units symbol will be dependent upon the units in use. For simplicity, μm are shown in all of the above displays.

* Detail depends on the setting of Report - whether it is Full or PArt.

11 FAULT FINDING / ERROR CODES

To cancel any error code press [ENTER] or [Esc]:

Code	Explanation
E01	Calibration has been lost.
E02	Cal difference error is too large/small.
E03	A base value with too great a difference to that currently stored.
E04	Cal was attempted with too large a value.
E05	Base was attempted with too large a value.
E06	Number of readings is greater than 999.
E07	Too many readings stored.
E08	The printer is off-line. (There may be a delay of approximately 30 seconds before receiving this message).
E09	The low limit is greater than the high limit.
E10	The memory is full.

Code	Explanation
E11	No readings were taken before trying to enter a base or cal factor.
E12	Limits cannot be changed in a batch with readings.
E13	Batch number entered cannot be found or Selected batch type not available.
E14	The probe module currently used is different to when this batch was created.
E15	The probe module is not responding or is not plugged in.
E16	Maximum number of batches exceeded.
E17	The limit set exceeds the range of the probe module in use.
E18	Calibration Factor error. Too large a value has been entered for a Cal Factor.
E99	Cannot complete standard deviation calculation

12 STORAGE



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.

13 MAINTENANCE

You own one of the finest hand-held coating thickness gauges in the world. If looked after, it will last a lifetime.

If you are not sure if your gauge is performing correctly, please contact Elcometer or your local Elcometer supplier for advice.

If during calibration the  symbol appears, this indicates that servicing is required.

If the  symbol is flashing, the instrument can still be used, but it should be returned for service at the next convenient opportunity.

If the symbol remains solid on the display while the instrument is switched on, then the instrument cannot be calibrated and should be returned for servicing immediately.

If you return your Elcometer 355 for any reason, please describe why as fully as possible. Make sure that you include any probe modules that are associated with the condition, as most faults are associated with the consumable item (the probe) and an alternative module may allow further use of your gauge. Regular checks of the probe module performance are therefore recommended.

The gauge 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.

Contact details can be found:

- on the outside cover of these operating instructions
- at www.elcometer.com

14 ACCESSORIES

A range of optional accessories is available for your Elcometer 355 Coating Thickness Gauge. For more information, or to place an order, please contact Elcometer or your local Elcometer supplier.

Consult the following sections for details of:

- probe modules
- foils
- precision hand grip
- probe placement jig
- protective covers
- rechargeable batteries
- dry batteries
- headphones/earpiece

14.1 PROBE MODULES

Elcometer's unique Probe Modules allow versatile application of the Elcometer 355 Coating Thickness Gauges. Probe Modules can be freely interchanged as required on both ferrous (F) and non-ferrous (NF) metal substrates. Most Probe Modules are capable of an accuracy of $\pm 1\%$ of the reading on a variety of coatings and surfaces.

Probe type	Part number	Range	Accuracy	Resolution	in range
F1 Standard	T35511952	0 μm to	$\pm 1\%$ or $\pm 1 \mu\text{m}$	0.1 μm	0 μm to 200 μm
F1 Right Angle	T35511953	1500 μm	$\pm 1\%$ or $\pm 0.04 \text{ mil}$	0.05 μm	200 μm to 500 μm
F1 Telescopic	T35511959	0 mils to 60 mils		1.0 μm	500 μm to 1500 μm
F1 A (Automotive)	T35512400			0.005 mils	0 mils to 8 mils
				0.02 mils	8 mils to 20 mils
				0.05 mils	20 mils to 60 mils
F2 Standard	T35511954	0 mm to 5 mm	$\pm 1\%$ or $\pm 5 \mu\text{m}$	2 μm	0 μm to 0.5 mm
F2 Right Angle	T35511955	0 mils to 200	$\pm 1\%$ or $\pm 0.2 \text{ mil}$	5 μm	0.5 mm to 5 mm
F2 Telescopic	T35511960	mils		0.1 mils	0 mils to 20 mils
				0.2 mils	20 mils to 200 mils
F3 Standard	T35511956	0 mm to 13 mm	$\pm 2\%$ or $\pm 30 \mu\text{m}$	5 μm	0 μm to 1mm
		0 mils to 500	$\pm 1\%$ or $\pm 1 \text{ mils}$	10 μm	1 mm to 13 mm
		mils		0.2 mils	0 mils to 40 mils
				0.5 mils	40 mils to 500 mils
F4 Standard	T35511950	0 μm to 250 μm	$\pm 1\%$ or $\pm 1 \mu\text{m}$	0.1 μm	0 μm to 250 μm
F4 Right Angle	T35511951	0 mils to 10 mils	$\pm 1\%$ or $\pm 0.04 \text{ mil}$	0.005 mils	0 mils to 10 mils

Probe type	Part number	Range	Accuracy	Resolution	in range
F5 (Rebar)	T35511962	0 μm to 800 μm 0 mils to 32 mils	$\pm 1\%$ or $\pm 2 \mu\text{m}$ $\pm 1\%$ or $\pm 0.08 \text{ mil}$	1 μm 0.1 mils	0 μm to 800 μm 0 mils to 32 mils
F6 Standard	T35511964	0 mm to 25 mm 0 mils to 1000 mils	$\pm 2\%$ or $\pm 100 \mu\text{m}$ $\pm 1\%$ or $\pm 4 \text{ mils}$	10 μm 50 μm 0.5 mils 2 mils	0 mm to 5 mm 5 mm to 25 mm 0 mils to 200 mils 200 mils to 1000 mils
N1 Standard	T35511982	0 μm to 1500 μm	$\pm 1\%$ or $\pm 1 \mu\text{m}$ $\pm 1\%$ or $\pm 0.04 \text{ mil}$	0.1 μm 0.05 μm	0 μm to 200 μm 200 μm to 500 μm
N1 Right Angle	T35511983	0 mils to 60 mils		1.0 μm 0.005 mils 0.02 mils 0.05 mils	500 μm to 1500 μm 0 mils to 8 mils 8 mils to 20 mils 20 mils to 60 mils
N2 Standard	T35511984	0 mm to 5 mm 0 mils to 200 mils	$\pm 1\%$ or $\pm 15 \mu\text{m}$ $\pm 1\%$ or $\pm 0.6 \text{ mil}$	2 μm 5 μm 0.1 mils 0.2 mils	0 mm to 0.5 mm 0.5 mm to 5 mm 0 mils to 20 mils 20 mils to 200 mils
N4 (Anodisers)	T35511980	0 μm to 250 μm 0 mils to 10 mils	$\pm 1\%$ or $\pm 1 \mu\text{m}$ $\pm 1\%$ or $\pm 0.04 \text{ mil}$	0.1 μm 0.005 mils	0 μm to 250 μm 0 mils to 10 mils

14.2 Foils

Each probe module is supplied with an appropriate set of precision foils measured using a linear displacement transducer with an accuracy of 1% or 1 μm (whichever is the greater) of the reading.

These sets are consumable items and will need replacing on a regular basis depending on their use and the care taken during use and storage.

If required, these foil sets or individual foils can be supported at the time of purchase by an optional Calibration Certificate with traceability to National Standards. Foil set sales part numbers are as follows:

Foil Set	Part Number	
	Without Certificate	With Certificate
Scale 1 : 1500 μm (60 mils)	T99022255-1	T99022255-1C
Scale 2 : 5000 μm (200 mils)	T99022255-2	T99022255-2C
Scale 3 : 13 mm (500 mils)	T99022255-3	T99022255-3C
Scale 4 : 250 μm (10 mils)	T99022255-4	T99022255-4C
Scale 5 : 800 μm (32 mils)	T99022255-5	T99022255-5C
Scale 6: 25 mm (980 mils)	T99022255-6	T99022255-6C

Also available on request are Certified Coated Thickness Standards on ferrous or non ferrous metal substrates, consisting of a zero plate and 4 thickness values to Customer's requirements and measured to an accuracy of 1% or 1mm whichever is the greater. These Standards are all supplied with a Calibration Certificate.

14.3 Precision hand grip

The Elcometer 355 is supplied with a precision hand grip for use with the F1, F2 and N1 standard style probes. The grip is designed to help control the placement of the probe on surfaces in a repeatable way so that the optimum accuracy capability can be achieved. The grip controls the cable and positions the tip at

right angles to the substrate to avoid any errors that are introduced by variations in these parameters. The probe can be used without the grip where the smaller diameter probe is advantageous, but some effect on accuracy may result from the probe twisting between measurements or not being truly set at right angles to the substrate. If a replacement Hand Grip is required, use Sales Part Number T35512026.

14.4 Probe placement jig

A probe stand which can be used to position a range of probes on small components is available. Use Sales Part Number T95012880.

14.5 Protective covers

The Elcometer 355 is supplied with some clear plastic, disposable sheets which protect the unit from overspray. Additional covers are available in lots of 10. Use Sales Part Number T35512051.

14.6 Re-chargeable batteries

The Elcometer 355 can be operated using 3 x 1.2 V nickel metal hydride (NiMH) cells which are charged externally. Suitable chargers are available for all voltage options.

14.7 Dry batteries

The Elcometer 355 can be powered by 3 x 1.5 V (LR6) AA alkaline cells. Zinc carbon batteries will give a shorter operating life.

14.8 Headphones/earpiece

The Elcometer 355 has a 3.5mm jack socket fitted to the top end plate next to the 25 way D socket. This may be used with an earpiece with volume control (Part No. T35512220) or with headphones (Part No. T35512216) so that the beeper signals can be heard in high ambient noise environments.

15 TECHNICAL SPECIFICATION

For specification details of probe modules please see the separate probe Module Data Sheet.

Instrument Dimensions:	175 mm x 83 mm x 42 mm (6.9" x 3.3" x 1.6")
Weight:	650 g (1.43 lbs) (incl. probe module and batteries)
Operating Temperature:	0°C to 50°C (32°F to 120°F)
Storage Temperature:	-10°C to 60°C (14°F to 140°F)
Batteries:	3 x 1.5 V AA cells alkaline or 3 x 1.2 V NiMH re-chargeable cells
Battery Life:	Alkaline 40 hours minimum NiMH 20 hours minimum

16 RELATED EQUIPMENT

Elcometer produces a wide range of coating thickness gauges and associated paint inspection equipment. Users of the Elcometer 355 may also benefit from the following Elcometer products:


- Elcometer 550 Uncured Powder Thickness Gauges
- Elcometer 157 Coating Thickness Gauge
- Elcometer 211 Coating Thickness Gauge
- Elcometer 101 Coating Thickness Gauge

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

17 TUTORIAL

This tutorial is intended to demonstrate the features of the Elcometer 355 Standard instrument and is designed to work with an F1 module fitted to an unused Elcometer 355. If other modules are used, or if information is stored from previous operations, the response of the instrument to the commands below may be different. It is also intended to familiarise the User with of the functions of the Elcometer 355, but actual use of the instrument depends on application and requirements of the process.

17.1 Switch ON

To switch on press and hold []. Note display of all segments and software identification.



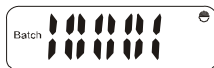
The instrument 'wakes up' in the mode last used. To switch off, press and hold [ENTER] for approximately 3 seconds).



Note: The instrument will normally switch off automatically after 1 minute if no operation is carried out - see "Date and time" on page 18 to adjust.

17.2 Select Immediate Mode (Batch 0)

Press [BATCH] and the display will flash:



Press [0], [ENTER] and the display will show:



17.3 Display some Statistics

Take a set of up to five readings on a foil on a mild steel surface. (e.g. 935 microns).

The number of readings increments in the top left hand corner as each reading is displayed. The last reading is held on the display.

Press and hold:

[\bar{x}] to read mean



[σ] to read standard deviation



[<] to read lowest reading



[>] to read highest reading



17.4 Operate in different Units

Change units by pressing [UNITS] once for mm, again for mil, again for thou, again for return to µm, Note the change in value of the reading as the units change.

17.5 Set CALibration and BASE Values

Ensure the display shows 'µm'. Press [CAL] and the display will show:

Take a set of readings on a known value of foil on a steel substrate. The display will show the running mean for the set of readings.

Modify the reading to be the actual value of the foil using the [>] or [<] and press [ENTER]. 'Cal' will disappear and the reading display will blank.

Press [BASE] and the display will show:

Take a set of readings on the bare steel substrate.

Enter zero either by accepting '0.0' in the display by pressing [ENTER], or by modifying the value in the display to read 0.0 by using the [>] or [<] keys and then pressing [ENTER].



17.6 Send Readings to Memory

Set up Batch 1 by pressing [BATCH] [1] [ENTER]. The display will show:

Take a set of readings and view \bar{x} , σ , < and > as before.



17.7 Show use of 'DEL' and 'CLEAR' Controls

Set up Batch 123465 by pressing [BATCH] [1] [2] [3] [4] [6] [5].

Note how this batch number scrolls across the display. (The 'batch' symbol will always flash until [ENTER] is pressed).

Press [DEL] twice to delete the '5' and the '6' from the end of the display.



Now press [5] and [6]. The display will show:

Press [CLEAR] to remove the batch number from the display.

Press [1] [2] [3] and [ENTER] to create batch 123.

Take readings into batch 123 and use [DEL] to delete the last reading. Note how the readings and value displays update.

Repeat the base routine (from section 17.5) within the batch and take some more readings.



17.8 To review the batch

Press [BATCH] and [.]

The display will flash the time and date. This is for the time and date the batch was opened.



Press [>] once to show the probe module information. Then press [>] to review the batch from reading 1. Use [<] and [>] to move backwards and forwards through the batch.



To exit review mode, press [ENTER] twice or [Esc] twice.

17.9 To see which batches exist

Press [BATCH] and repeat to show each batch number in the order in which they were entered.

17.10 To clear a specific batch

Select the batch number (in this example, batch number 14) and press [CLEAR]:



Press [ENTER] and the display will alternate between 'Clr' and 'batch no' as shown.



alternating with

Press [ENTER] to clear the selected batch (i.e. remove all readings) and return to the readings mode, or press [Esc] to cancel the operation.

**17.11 To delete a specific batch**

Select the batch number (in this example, batch number 14) and press [DEL]:



Press [ENTER] and the display will alternate between 'dEL' and 'batch no' as shown.



alternating with

Press [ENTER] to delete the selected batch and return to the readings mode, or press [Esc] to cancel the operation.



Review the batch numbers again (see section 17.9) and note that batch number 14 no longer exists.

To re-select immediate mode, press [BATCh] [0] and [ENTER].

17.12 To set limits

Press [LIMIT] and the display shows:

Press [<] to display current low (Lo) limit.

The low limit software default values for all modules depends on the module, but will be a negative number. Enter a limit close to, but below the foil value being used and then press [ENTER].

Current high (hi) limit will then be displayed.

The high limit software default values for all modules depends on the module, but will be a number above the range of the module. Enter a limit close to, but above the foil value and press [ENTER].

Create a new batch '1234' and take readings. Take the readings on the uncoated substrate and on two foils together.

Note: Note the high and low warnings. Limits will be carried forward to new batches unless changed. Limits can only be changed in a batch where no readings have been recorded (i.e. a new batch, batch 0 or a batch with data cleared).

Press [BATCH] [0] [ENTER] to return to immediate mode.

17.13 SETUP FUNCTIONS

Press [SETUP] and the display will show:



Use [>] twice to get to the Printer Setup Menu.

Press [ENTER] to select the printer setup, and the display will show:



Press [>] to step through the baud rate selections to:



This selects 80 column format (A4) or 42 column format (Elcometer Portable Printer). Press [ENTER]. [<] and [>] will toggle between 80 and 42. Select 42 and press [ENTER].



Press [SETUP] or [Esc] to return to the 'Prnt' display.

Press [>] to select the time and date option:



Press [ENTER].

Use [>] to select 'dAtE' and press [ENTER]. The day number will flash. Press [ENTER] and the month number will flash; [ENTER] again and the year flashes.



Press [ENTER] again to return to the Sub Menu. Press [SETUP] or [Esc] to return to:



Press [>] to step through the Main Menu to the beeper volume option:

Press [ENTER] to display the current volume, 0-4. (0=Off, 4=Loudest). Press [<] or [>] to step through these options. Press [ENTER] to select choice and return to the 'bEEP' display (or [Esc] to cancel the operation).



Press [>] to step through to Password Select option:



Press [ENTER] to display:



Enter '0000' (default password) to show:



[<] or [>] will toggle between:



and:

not uSE = Password protection not activated.

uSE = Password protection activated.

Press [ENTER] and use [>] to step through to backlight option:



Pressing [ENTER] displays current status - 'oFF' or 'on'. [<] or [>] toggles between these two options. [ENTER] selects the chosen status and returns to the 'bLi' display.



Press [>] to step through to mode selection option:



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Press [ENTER] and use [>] to step through the sub-functions to counted average option:



Press [ENTER] to view the number of readings used for the counted average (use [<] and [>] to adjust the value).

Press [ENTER] to accept the new number of readings or [Esc] to return to the 'SEL' display.

Press [SETUP] or [Esc] to return to immediate mode.


17.14 To demonstrate counted average

Create a new batch number - batch 10

Note: *Counted average and average modes only function within a batch.*

Take some readings (at least 20) and note the effect of the counted average. Connect to a printer (use the Elcometer portable printer) and print the batch by pressing [PRINT] [2] and 'batch number' followed by [ENTER].

18 QUICK REFERENCE GUIDE

[]	Switch on
[ENTER]	Enter data or batch mode / Switch off - hold key down
[\bar{x}]	Display mean
[σ]	Display standard deviation
[<]	Display lowest reading
[>]	Display highest reading
[BASE]	Set lowest calibration point
[CAL]	Set highest calibration point
[LIMIT]	Set high and low limits
[Esc]	Escape from function
[DEL]	Delete last reading or readings and statistics from a batch
[UNITS]	Select units - μm , mm, mil, thou
[PRINT]	Select print modes
[CLEAR]	Clears immediate mode and readings and statistics from a batch
[BATCH]	Start batch mode
[SETUP]	Setup User defined values e.g. batch selection

Calibration

In the following section [n] or [n.n] is a number.

[BASE]	Select mode	[CAL]
[0], [n.n]	Enter value	[n.n]
or		or
[BASE]	Select previous value	[CAL]
[ENTER]		[ENTER]

Setting Limits

[LIMIT]	Select mode
[<] or [>]	High or low limit
[n.n] [ENTER]	Enter value (high or low)
[n.n] [ENTER]	Enter value (high or low)

Batch Mode

[BATCH]	Select mode
[BATCH]	Scroll through batches
or [n...]	or enter number
[ENTER]	Select batch

Batch view

[BATCH][.]

To view current batch

or

[BATCH] [n] [ENTER] [BATCH] [.]

To view 'n' batch

Batch Clear

[BATCH] [CLEAR] [ENTER] [ENTER]

To clear current batch

[BATCH] [CLEAR] [n] [ENTER] [ENTER]

To clear specified batch

[BATCH] [CLEAR] [ENTER] [ENTER]

To clear all batches (only when in immediate mode)

Batch Delete

[BATCH] [DEL] [ENTER] [ENTER]

To delete current batch

[BATCH] [DEL] [n] [ENTER] [ENTER]

To delete specified batch

[BATCH] [DEL] [ENTER] [ENTER]

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To delete all batches (only when in immediate mode)

SetUp Mode

[SETUP] [<] or [>] then [ENTER]

To select required function

or [SETUP] [n]

To select required function

Then use: [<] or [>] [ENTER]

For sub-function

or [n]

[<] or [>] [ENTER]

To change sub-function

[SETUP] (+ [SETUP] or [Esc] as necessary)

To exit

Printing Mode

[PRINT] [<] [>] [ENTER]

To select print mode

or [PRINT] [n] ([n]) ([BATCH] as necessary)

Switch Instrument Off

Hold down [ENTER] for more than 3 seconds

Note: *The Elcometer 355 will automatically switch off after 60 seconds (User selectable between 1 and 30 minutes - see "Date and time" on page 18).*