English

Elcometer 406L

Statistical Glossmeter

Operating Instructions

elcometer

English

CE This 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 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.

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 406L Statistical Glossmeter. Welcome to Elcometer.

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

Your Elcometer 406L Statistical Glossmeter is a world beating product. With the purchase of this product 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 406L Statistical Glossmeter is a handheld gauge for measuring the specular gloss of flat surfaces from matt to mirror finishes. The gauge is available in two versions; single angle measurement (60°) or dual angle measurement (20°/60°).

The gauge can perform statistical analysis of gloss readings stored in internal memory.

The Elcometer 406L contains an LED light source, a light detector and a system of lenses. A parallel beam of light illuminates the specimen at a set angle of incidence. The light detector at the opposite angle measures the light reflected from the specimen. Gloss is computed and displayed in Gloss Units (GU). Specular reflectance (%) can be calculated from this.

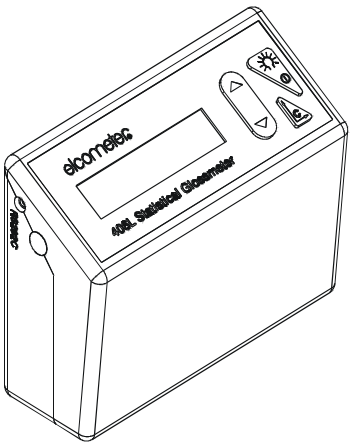
The gauge is calibrated using a certified calibration tile.

The Elcometer 406L is supported by Novo-Soft™ software - a data cable connects the gauge to a PC via an USB connection.

The gauge is powered by internal dry cell batteries.

1.1 GAUGE FEATURES

- Measures at 20° and 60° angles (dual angle models only)
- Simultaneous reading of both angles (dual angle models only)
- Simultaneous calibration of both angles (dual angle models only)
- Auto-ranging - measures matt to mirror finish.
- Move-and-read feature for checking large surfaces quickly
- Statistical analysis gives an instant indication of batch quality
- RS232 output to PC
- Download, analyse and store readings in Novo-Soft
- Calibrate to any gloss standard
- Long-life light source; over 10 years under normal operating conditions
- Accurate and reliable



1.2 STANDARDS

Your Elcometer 406L Statistical Glossmeter can be used in accordance with the following National and International Standards, AS/NZS 1580.602.2, ASTM C 584, ASTM D 523, ASTM D 1455, ASTM D 2457, EN 12373-11, EN 13523-2 *supersedes ECCA T2,* ISO 2813, ISO 7668, JIS Z 8741, TAPPI T 653.

1.3 WHAT THE BOX CONTAINS

- Elcometer 406L Statistical Glossmeter (single angle model or dual angle model)
- Certified calibration tile in a case
- Tile cleaning cloth
- Calibration certificate for tile
- CD-ROM containing Novo-Soft™ software package
- USB cable
- 5 x LR03 (AAA) alkaline batteries
- Posi-Drive screwdriver
- Carrying case
- Operating instructions

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

The display is covered with a protective film on dispatch from the factory. This film may be removed and discarded before first use.

To maximise the benefits of your new Elcometer 406L 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

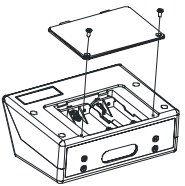
2.1 FITTING BATTERIES

The Elcometer 406L uses dry cell batteries only. Sealed alkaline batteries are recommended.

5 x LR03 (AAA) alkaline batteries are supplied in the kit.

To fit or replace the batteries:

1. Locate the two screws which retain the battery compartment cover at the rear of the gauge.
2. Use the screwdriver supplied to remove the screws and then lift off the battery compartment cover.
3. Place the batteries in the battery holders ensuring correct polarity.
4. Replace the battery compartment cover and tighten the retaining screws.



Note: *Remove the batteries from the gauge if it 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.*

Note: *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.

2.2 SWITCHING ON/OFF

To switch on, press  . The display will show:

```
Last Certified:
24/10/2006
```

It is not possible to switch off the Elcometer 406L manually. The unit will automatically switch off XX seconds after the last key press, where XX is user-defined between 30 and 120 seconds (see “Changing settings using Novo-Soft™” on page 23).

2.3 CHANGING DISPLAY LANGUAGE

The Elcometer 406L can display menus in the following languages; English, French, Spanish, German, Italian and Dutch.

To select language using the keypad, see “Language - Selecting” on page 21.

Display language can also be changed by the Novo-Soft™ package included with your gauge.

1. Install and run Novo-Soft™ package. See “Novo-Soft™ software” on page 21.
2. Connect Elcometer 406L to PC and switch gauge on. See “Interfacing to your PC” on page 22.
3. Select required display language. See “Changing settings using Novo-Soft™” on page 23.

2.4 THE CONTROLS

The Elcometer 406L is a menu-operated gauge and it has three control keys:

READ/SELECT

This key has three functions:

Power: This key is used to switch the gauge on.

Read: In the measurement mode, press and release to take a single measurement or press and hold for continuous measurement.

Select: When navigating the set-up menus this key selects an item or confirms a previous selection.

SCROLL UP/DOWN

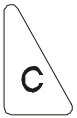
This key has four functions:

View statistics: In single angle measurement mode, press the UP key to view the statistics for the selected angle.

Delete: In single angle measurement mode press the DOWN key to enter the delete mode.

Scroll Up/Down: In the set up menu use the UP/DOWN key to scroll through the available options.

Set Calibration value: In Set Calibration Mode press the UP/DOWN key to adjust the calibration value.



CHANGE ANGLE/CALIBRATE/CANCEL

This key has two (single angle models) or three (dual angle models) functions;

Change Angle (dual angle models only): In measurement mode press the C key to toggle between the measurement angles 20° > 60° > 20°/60°.

Calibrate: In measurement mode press the C key for 2 seconds to initiate the calibration process.

Cancel: During calibration press the C key to cancel the process and revert to previously stored calibration constants.

2.5 WHICH ANGLE SHOULD I USE? (DUAL ANGLE MODELS ONLY)

Each angle is suitable for different situations:

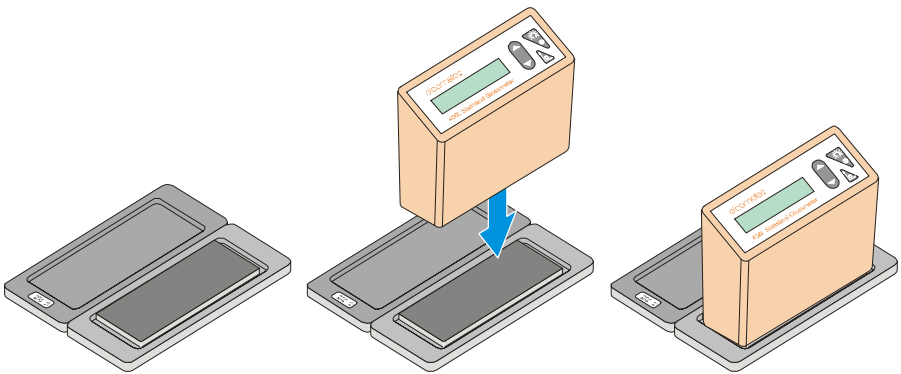
Angle	Used for measurement of	Suggested range
20°	High gloss surfaces	Surfaces that measure more than 70GU when measured at 60° such as automotive paint finish, polished metals and plastics
60°	All gloss levels	Initial investigation of any surface

3 TAKING A READING

Before you start taking readings, always check the calibration of the gauge:

3.1 CHECK THE CALIBRATION VALUE

1. Place the gauge onto the gloss calibration tile ensuring that the body of the gauge fits within the recess in the foam.

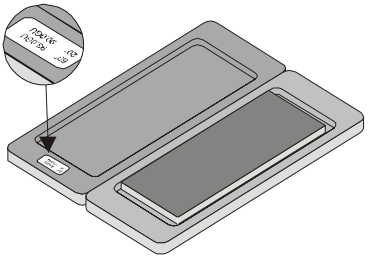


2. Dual angle models only: In measurement mode, select the required angle, pressing the C key to cycle through the angles 20° > 60° > 20° /60° .

3. Take a reading by pressing the READ/SELECT key.
4. Compare the reading for the angle chosen with the gloss value of the tile at that angle - look for the sticker inside the calibration tile case.

   If the reading taken by the gauge matches the gloss value of the tile, the gauge is within calibration limits and is ready for use.

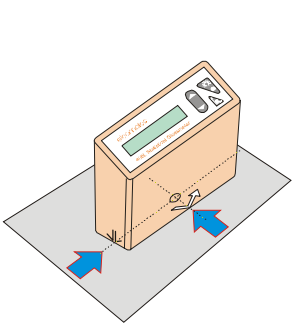
   If the reading taken by the gauge does not match the gloss value of the tile, calibrate the gauge - see “Calibration” on page 15.

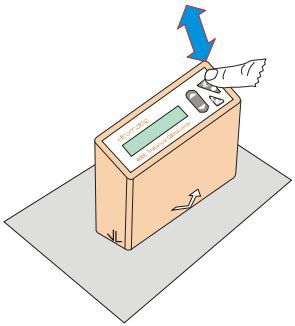


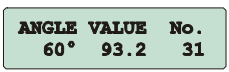
3.2 TO TAKE A MEASUREMENT AT A SINGLE POSITION

1. Position the gauge using the arrows on the front and side to line up with the area to be measured.
2. Dual angle models only: In measurement mode, select the required angle, pressing the C key to cycle through the angles 20° > 60° > 20° /60° .
3. Press and release the READ/SELECT key. The gauge will now start to take a reading and >> will be shown on the display.

4. The angle, gloss value and reading number[a] are shown on the display and stored in memory.







Each press and release of the READ/SELECT key takes a further measurement. Each time a measurement is taken the number of readings stored increases by one. If an erroneous reading is taken it can be deleted - see “Deleting data” on page 13.

3.3 REFLECTANCE

Your Elcometer 406L Statistical Glossmeter reads in Gloss Units (GU). To convert to Percent (%) Reflectance, See Table 1 on page 12.

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a. Reading number is not displayed or stored in memory if Stats Mode is switched off - see “Statistics - Switching IT on/off” on page 19

Table 1:

Angle Degrees	Percent Reflectance
20	Gloss reading x 0.05
60	Gloss reading x 0.10

3.4 TO MEASURE A LARGE SURFACE

The Elcometer 406L has a special feature which allows large surfaces to be checked quickly - 'Move-and-Read'.

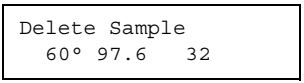
1. While taking measurements, press ***and hold*** the READ/SELECT key.
   The gauge will start to take a measurement.
2. Continue to hold the READ/SELECT key and slide the gauge carefully to the next area to be measured.
   The display updates in real time to show the measurement value under the aperture.
3. When the READ/SELECT key is released the last reading will be displayed. This will be the value stored in the memory.

Note: *Sliding the gauge across a product may cause damage to the surface unless care is taken.*

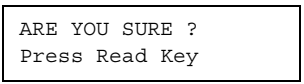
Note: *A 30 second 'Move-and-read' mode can be selected using the Novo-Soft software included with your gauge - see "Changing settings using Novo-Soft™" on page 23.*

4 DELETING DATA

1. While the gauge is in measurement mode, press the SCROLL DOWN key. The following message is displayed:



2. Press the READ/SELECT key.
   The display will show:



3. Press the READ/SELECT key to confirm. The LAST reading will be deleted and the gauge will prompt for further deletions. If necessary, continue to delete further readings by pressing the READ/SELECT key.
4. To delete all ALL readings for the displayed angle, press and hold READ/SELECT key[b].
5. When you have finished deleting, press the C key to return to the measurement screen.

5 VIEWING MEASUREMENT STATISTICS

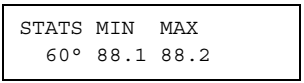
Your gauge calculates a statistical[c] analysis of readings as they are taken.

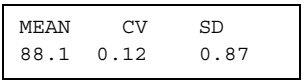
To view the statistics:

b. Stored data can also be cleared from the gauge using the Delete Data function in Novo-Soft™ when the gauge is connected to the PC. See see “Novo-Soft™ software” on page 21.

c. An explanation of the statistical analysis is given in “Statistics terminology” on page 25.

1. While the gauge is in measurement mode, press the SCROLL UP key to display the angle, minimum (MIN) and maximum (MAX) values for the stored data.
2. Press the READ/SELECT key to display the other statistical values for the data; the mean (MEAN), the Coefficient of Variation (CV) and the Standard Deviation (SD).
3. To return to measurement mode after viewing statistics, press the SCROLL DOWN key once.





6 CALIBRATION

In conditions where the temperature and humidity are stable the instrument will only need occasional calibration. Check the calibration every 6-8 hours.

Calibrate your Elcometer 406L using the certified calibration tile supplied with your gauge. The black foam in the lid of the case provides a zero gloss value.

The one-point calibration is sufficient for most applications and is selected by default.

Two-point calibration may be used for greater accuracy of measurement. See section 7.2.

6.1 CERTIFIED CALIBRATION TILE

The calibration tile is supplied certified to the BAM standards in a clean and defect-free condition. Look for smears or damage before each calibration as a dirty or defective tile may lead to inaccurate measurements. The instrument will check the tile during calibration, see 6.4. If an error message is displayed, clean the tile and repeat the calibration. See “Maintaining your calibration tile” on page 24.

6.2 TO CALIBRATE YOUR GAUGE (ONE-POINT)

1. Visually inspect the surface of the calibration tile for smears or defects - if necessary, clean the tile using warm soapy water and dry with a soft lint-free cloth.
2. Place the gauge onto the gloss calibration tile ensuring that the body of the gauge fits within the recess in the foam.
3. Dual angle models only: In measurement mode, select the required angle, pressing the C key to cycle through the angles 20° > 60° > 20° /60° . To calibrate two angles simultaneously, select the two angle measurement mode '20° /60° '.

4. Press and hold the C key to begin the calibration procedure. The display will show:

```
CALIBRATE ANGLE 60°.
Press Read Key
```

5. Press the READ/SELECT key. After a short delay during which a 'Please Wait' message appears, the display will show:

```
CALIBRATE
Sample High Ref
```

6. Press[d] the READ/SELECT key. After a short delay during which a ‘Please Wait’ message appears, the display will show:

```
 60° Angle
Completed
```

The gauge will then return to the measurement mode and is ready for use.

d. If the READ/SELECT key is not pressed at this stage the calibration will be cancelled.

6.3 CALIBRATE YOUR GAUGE (TWO-POINT)

Place the gauge on the zero reference first and go to step 3 above and follow the on-screen instructions.

The Elcometer 406L has an automatic calibration tile check routine. If the calibration tile is dirty or damaged and the value does not conform to that stored in the memory the display will show the following warning messages:

```
Poss. Cal. Error
Check Calib Tile
```

The tile should be cleaned and the measurement of the calibration tile repeated.

```
Accept new
Calibration?
```

6.4 CALIBRATION ERROR

If scratches or permanent marks are seen, press the C key. The calibration tile will be required if permanent marks are present.

```
ARE YOU SURE?
Press Read Key
```

7 SYSTEM SET-UP

Use system set-up to configure your gauge to suit the way you work.

To enter system set-up:

Press and hold the DOWN button. While continuing to press the DOWN button, press and hold the C button until the display shows:

```
System Set-up
```

Now use the SCROLL UP/DOWN key to scroll through the set-up options - see paragraphs 7.1 to 7.5.

7.1 CALIBRATION VALUE - CHANGING

The gloss value(s) of the calibration tile supplied with your gauge are stored within the gauge at the time of manufacture. To see these value(s), look for the sticker inside the calibration tile case.

Normally these value(s) do not need to be changed, however if it becomes necessary to modify the stored value(s), for example if the calibration tile is re-calibrated, or a different calibration tile is used, use the following procedure:

1. Enter system set-up and then press the SCROLL UP/DOWN key until the display shows:

```
SET STD CAL VAL.
  60°  88.1
```

2. Press the READ/SELECT key to enter this menu option. The display will show:

```
SET STD CAL VAL.
CAL Mode Active
```

3. Use the SCROLL UP/DOWN key to adjust the value until it matches the value shown on the calibration tile in use.

```
SET CAL UP
  60°  88.2
```

4. When the displayed value matches that shown on the calibration tile, press the READ/SELECT key to store the value. The gauge will confirm this with the following message:

```
CAL DATA SAVED
Completed
```

5. The gauge will then return to the measurement mode and the gauge must be re-calibrated before it is used for gloss measurements - see “Calibration” on page 15.

7.2 ZERO CALIBRATION - SWITCHING IT ON/OFF

Calibration between two points (high gloss and zero gloss) can be selected as an option.

To switch zero calibration on or off use the following procedure:

1. Enter system set-up and then press the SCROLL UP/DOWN key until the display shows:

```
Zero Calib. Off
Press Read Key
```

2. Press the READ/SELECT key to toggle zero calibration on/off.

```
Zero Calib. On
Press Read Key
```

3. Press the C key to exit set-up mode.

Note: *To calibrate your gauge with zero calibration switched on, follow the calibration procedure given in 6.2 on page 15. However when the gauge prompts ‘Sample Zero Ref’, place the gauge onto the black foam in the lid of the calibration tile case and then press READ/SELECT. The gauge will calibrate to zero and then continue with the standard calibration procedure.*

7.3 STATISTICS - SWITCHING IT ON/OFF

For simplified operation, statistical analysis of the readings can be switched off. When statistics are switched off, measurements are not stored in gauge memory and all functions except read and calibrate are disabled. To switch statistics on or off use the following procedure:

1. Enter system set-up and then press the SCROLL UP/DOWN key until the display shows:

```
Stats. Mode
Press Read Key
```

2. Press the READ/SELECT key to toggle statistics on/off.
3. Press the C key to exit set-up mode.

```
Non Stats. Mode
Press Read Key
```

7.4 BACKLIGHT - SWITCHING IT ON/OFF

To extend the life of the batteries it is possible to switch the backlight off. The backlight can be switched on and off using the following procedure:

1. Enter system set-up and then press the UP/DOWN key until the display shows:

```
Back Light Ops
Press Read Key
```

2. Press the READ/SELECT key to toggle the backlight on/off.
3. Press the C key to exit set-up mode.

7.5 LANGUAGE - SELECTING

The Elcometer 406L can display menus in the following languages; English, French, Spanish, German, Italian and Dutch. To select language, use the following procedure:

1. Enter system set-up and then press the SCROLL UP/DOWN key until the display shows:

```
Select Language
Press Read Key
```

2. Press the READ/SELECT key.
3. Use the UP/DOWN key to select required language.
4. Press the READ/SELECT key to activate the selected language.
5. Press the C key to exit set-up mode.

8 NOVO-SOFT™ SOFTWARE

The Elcometer 406L Statistical Glossmeter is supplied with Novo-Soft™ Quality Control Software. This software allows the user to:

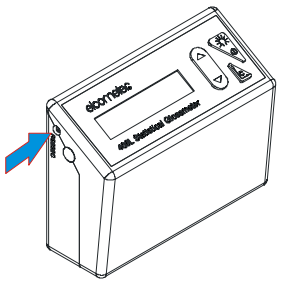
- transfer readings data from the gauge to a PC
- adjust some of the features of the gauge

8.1 INSTALLING THE PROGRAM

Close all running applications in your PC before installing Novo-Soft software. Insert the supplied CD-ROM in your CD-ROM drive. If the installation wizard does not start automatically, search for and then run the 'ElcometerNovoSoftInstall.exe' file on the supplied CD-ROM and follow the installation instructions.

8.2 INTERFACING TO YOUR PC

1. Connect the USB cable to a free COM port on your PC.
2. Connect the other end of the cable to the instrument.



8.3 RUNNING THE PROGRAM

If you accepted the default directory, the program will be installed in:

C:\Program Files\Novo-Soft

On Windows XP, the installation program creates an entry on the start menu. To run the program:

Click > Start > All programs > Novo-Soft > Novo-Soft

The following screen will appear:

8.4 SAMPLE DATA

To enable you to test some of the features of Novo-Soft before downloading any real data, files containing sample data are installed with the software.

To access the data, click on 'Load' and look for the '.res' files in the directories labelled '20degree', '60degree', etc.

8.5 UPLOADING AND ANALYSING READINGS

For instructions on how to upload and analyse data from the gauge, click on the HELP icon in Novo-Soft™.

8.6 CHANGING SETTINGS USING NOVO-SOFT™

Certain gauge operating setting can be altered using the Novo-Soft software when the gauge is connected to the PC.

From the Novo-Soft main screen, click on 'Set Up' and select 'Software Preferences'. The settings that can be altered are: Language; Stored calibration values; Choice of Automatic or Manual Calibration; Automatic switch off delay time; Read on-time[e].

e. When the 'Read on-time' option is ticked the gauge will go into 'Move-and-read' mode for 30 seconds whenever the READ/SELECT key is pressed.

9 STORAGE AND TRANSIT

This gauge incorporates a Liquid Crystal Display. 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 case when it is not being used and during transit. If the gauge is to remain unused for long periods of time, remove the batteries and store them separately.

10 MAINTENANCE

The Elcometer 406L Statistical Glossmeter is designed to give many years reliable service under normal operating and storage conditions.

Regular calibration checks over the life of the gauge and the certified calibration tile are a requirement of quality management procedures, e.g. ISO 9000, and other similar standards. The date of last certification of the gauge is shown when the gauge is switched on. For checks and certification contact your local Elcometer supplier.

The gauge does not contain any user-serviceable components. In the unlikely event of a fault, the Elcometer 406L 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 can be found on the outside cover of these instructions, or on the Elcometer website, www.elcometer.com

10.1 MAINTAINING YOUR CALIBRATION TILE

The tile should be checked on a regular basis to ensure that it is clean and in good condition. If necessary clean the tile using warm soapy water and dry with the soft lint-free cloth supplied.

It is important that a calibration tile has an up-to-date certificate and the normal renewal period is 12 months. However, it should be noted that if successive calibration certificates give the same value for the tile, extension of the renewal period to 24 months is permitted.

10.2 MAINTAINING YOUR GAUGE

Before use, check that the metal base of your gauge is clean and free of any damage. The optical cavities and lenses must also be free of dust or any other contamination.

When the battery voltage falls below the required level to operate the gauge, the display will briefly show a warning message and then switch itself off. Fit new batteries.

11 STATISTICS TERMINOLOGY

For this purpose the individual readings are defined as values x_1, x_2, --- x_n and x_i is any reading in the data set.

- Statistical sample population, n: The current number of stored readings (STORE), on which the statistical calculations are based.
- Maximum (MAX): The highest reading in the data set.
- Minimum (MIN): The lowest reading in the data set.
- Mean (MEAN): The average value for the data set. The sum of all the individual readings divided by the total number of readings.
- Standard Deviation (SD): Square root of the sum of squared deviations from the mean.
- Coefficient of variation (CV): Standard deviation divided by the mean; a measure of the data scatter that can be compared for different mean values.

12 TECHNICAL SPECIFICATION

Resolution:	0.1 GU
Repeatability[a]:	0.1%
Reproducibility[b]:	0.5%
Memory capacity:	200 readings per angle
Measurement area:	60°, 15 mm x 10 mm (0.59" x 0.39") ellipse 20°, 10 mm (0.39") diameter spot
Display:	Liquid Crystal Display (LCD)
Display languages:	English, French, Spanish, German, Italian and Dutch
Operating Temperature:	0°C to 50°C (32°F to 120°F)
Dimensions:	125 mm x 100 mm x 50 mm (5" x 4" x 2")
Weight (incl. dry batteries):	446 g (15.7 oz)
Battery Type:	Dry Batteries: 5 x LR03 (AAA)
Battery Life:	20 000 readings (less when ‘Move-and-Read’ mode is used).

a. Repeatability - The variation given by a single instrument on an area of known gloss.
b. Reproducibility - The variation given by several instruments measuring an area of known gloss.

13 SPARE PARTS AND ACCESSORIES

The following replacement and optional items are available from Elcometer or your local supplier.

Description	Sales Part No.
60° Gloss Calibration Tile with Certificate:	T99918533
20°/60° Gloss Calibration Tile with Certificate:	T99918534
USB Cable:	T99920093
Posi-Drive Screwdriver	T99918585

A range of intermediate Gloss Calibration Tiles is available - contact Elcometer for details.

14 RELATED EQUIPMENT

In addition to the Elcometer 406L Statistical Glossmeter, Elcometer produces a wide range of other equipment for measuring the appearance of surface coatings. Users of the Elcometer 406L Statistical Glossmeter may also benefit from the following Elcometer products:

- Elcometer 400 Novo-Curve™ Glossmeter for curved surfaces
- Elcometer 407 Statistical Glossmeter (3 angles)
- Elcometer 6210 RAL Colour Charts
- Elcometer Spectrophotometers (portable and benchtop)
- Elcometer X-RiteColor™ Master Software (colour analysis)

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