

**Elcometer 400**

**Novo-Curve™ Glossmeter  
for Curved Surfaces**

**Operating Instructions**



**CE** The Elcometer 400 Novo-Curve Glossmeter has been tested in accordance with EU regulations governing Electro-magnetic compliance and it meets the required directives.

**Note:** Gauge readings may be affected if the unit is operated within a radio frequency electromagnetic strength of greater than 3 V/m.

elcometer® is a registered trademark of Elcometer Instruments Ltd.

Novo-Curve and Novo-Soft are trademarks of Rhopoint Instruments Ltd.

All other trademarks acknowledged.

© Copyright Elcometer Instruments Ltd. 2006.

All rights reserved. No part of this Document may be reproduced, transmitted, transcribed, stored (in a retrieval system or otherwise) or translated into any language, in any form or by any means (electronic, mechanical, magnetic, optical, manual or otherwise) without the prior written permission of Elcometer Instruments Ltd.

## CONTENTS

Section	Page
<b>1 About your Glossmeter</b> .....	<b>2</b>
1.2 What the box contains .....	3
<b>2 Getting started</b> .....	<b>4</b>
2.1 Set the voltage .....	4
2.2 Position the support posts .....	4
2.3 Instrument front control panel .....	4
<b>3 Using your Glossmeter</b> .....	<b>5</b>
3.1 Switching on .....	5
3.2 Taking readings .....	5
3.3 Deleting data .....	7
3.4 Calibration .....	8
3.5 Statistics .....	9
3.6 Output data .....	10
3.7 Calibration reset .....	10
3.8 Disable statistics .....	11
3.9 Software version .....	11
<b>4 Novo-Soft™ software</b> .....	<b>12</b>
<b>5 Gloss measurement overview</b> .....	<b>13</b>
<b>6 Maintenance</b> .....	<b>14</b>
6.1 Calibration tile .....	14
6.2 Gauge .....	14
6.3 Lamp replacement procedure .....	14
<b>7 Technical specification</b> .....	<b>15</b>
<b>8 Storage and transit</b> .....	<b>15</b>
<b>9 Related equipment</b> .....	<b>16</b>

**T**hank you for purchasing this Elcometer 400 Novo-Curve 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.

The Elcometer 400 Novo-Curve 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](http://www.elcometer.com)

## **1 ABOUT YOUR GLOSSMETER**

The Elcometer 400 Novo-Curve Glossmeter is a desktop gauge for measuring the gloss on curved surfaces from matt to mirror finishes.

Gloss is measured by directing a light beam at an angle of 60° to the test surface and monitoring the light reflected at the same angle.

Your Glossmeter includes readings memory, statistical analysis of readings and a PC interface to allow the data to be transferred to a PC or printer. Novo-Soft™ software is included for analysis and archiving on a PC.

The user can calibrate the Elcometer 400 using a certified calibration tile which is supplied with the gauge.

### **1.1 Features**

- Machined aluminium optical block - ensures the integrity of the  $\pm 0.1^\circ$  angular tolerance specified by international measuring standards.
- Auto-stabilisation circuit - allows continuous readings to be made.
- Auto-ranging (0.0 to 1000 gloss units at 60°) - makes possible measurement on surfaces even with ultra-high gloss, such as polished metal.
- Memory for 199 readings.
- Full statistics showing Minimum, Maximum, Mean, Standard Deviation and Coefficient of Variation of stored values.
- RS232C output to Windows based PC software or printer available.
- Capability to operate in any one of six languages (English, Français, Deutsch, Italiano, Español or Nederlands).

The Elcometer 400 Novo-Curve Glossmeter is both accurate and user friendly, allowing Statistical Process Control of gloss to be conducted quickly.

## 1.2 What the box contains

- Elcometer 400 Novo-Curve Glossmeter
- Black glass (high gloss) and black foam (zero) calibration standards in wooden box
- Foot operated switch
- Four removable support posts
- NOVO-SOFT™ software package on 3½" diskette
- PC interface cable
- Spare lamp assemblies, x 2
- Mains electricity cable
- 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.

**To maximise the benefits of your new Elcometer 400 please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.**



**Figure 1. Elcometer 400 Novo-Curve Glossmeter**

## 2 GETTING STARTED

### 2.1 Set the voltage

Ensure that the voltage selector wheel on the rear panel is set to the correct mains input voltage to suit your supply. For supply of 100 V to 120 V, the selector should be set to 115 V; for supply of 220 V to 240 V, the selector should be set to 230 V. The mains lead and foot switch both connect to the rear panel of the instrument.

### 2.2 Position the support posts

The four support posts slide into the grooves around the edge of the platen, and should be adjusted to suit the object being measured. They are intended to facilitate the positioning of like objects in such a way that the same spot may be measured on each. If the support posts are not required, they may be removed to prevent them getting in the way.

### 2.3 Instrument front control panel

Figure 2 shows the front panel of the Elcometer 400, which is controlled by five buttons.

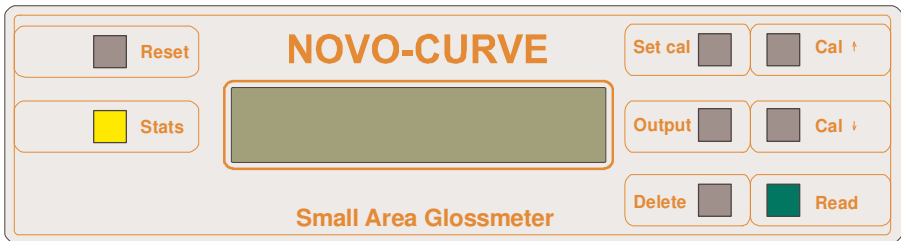


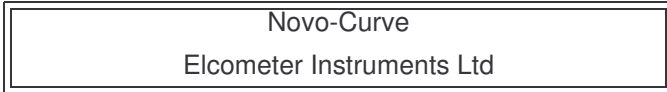
Figure 2. Control panel of your Elcometer 400

### 3 USING YOUR GLOSSMETER

These instructions should be read in conjunction with the unit conveniently to hand, and assume that the unit is working in English.

#### 3.1 Switching on





Once connected to the mains, the instrument is activated using the switch on the rear panel. The instrument will switch on with a confirmation display:



There is a short delay of 5 to 6 seconds whilst the instrument boots. When the instrument is ready to operate the display will change to a format similar to that below.

The screen displays four numbers while you are taking readings:

ANGLE	VALUE	STORE	CV
60°	0.0	0	0.000

			
Current operating angle (fixed)	The last value of gloss units (GU) read.	The number of stored readings at the angle displayed.	The Coefficient of Variation of the stored readings.

The information shown on the display will change, depending upon which functions are selected.

The current operating angle is that at which measurements will be taken, and is fixed at 60° for the Elcometer 400. The value read and number of stored readings are explained in section 3.2, and a definition for coefficient of variation is given in section 3.5.

#### 3.2 Taking readings

Glossmeters and reflectometers work by shining a beam of light on to a surface, and measuring how much is reflected. Readings are taken over the area covered by the aperture on the top of the instrument. When an object is placed

on the instrument over the aperture the aperture is hidden, but can be pinpointed by the intersection of the white cross hair marked into the top of the sample plate.

To take a reading either press the green READ button or the foot switch (if connected). The unit will now start to take a reading. Whilst the button/foot switch is held the unit will continually update the current reading. When the button/foot switch is released the value shown in the display at that moment will be entered into memory, and the number of stored readings will increase by one. It is recommended that the button/foot switch be held until a stable reading is observed. All readings on the Elcometer 400 are given in Gloss Units (GU), as defined by standards such as ASTM D523. The sequence of events on the display is as follows:

*Initial Display*

ANGLE	VALUE	STORE	CV
60°	28.2	9	0.058

*Read/Foot switch Pressed*

ANGLE	VALUE	STORE	CV
60°		9	0.058

*Read/Foot switch Held*

ANGLE	VALUE	STORE	CV
60°	32.9	9	0.058

*Read/Foot switch Released*

ANGLE	VALUE	STORE	CV
60°	32.9	10	0.073

Holding down the green READ button/foot switch will continually monitor the gloss level. If the sample is simultaneously moved across the aperture (i.e. at the *Read Held* stage), the operator will quickly be able to ascertain the appearance variation of the surface under investigation. This enables anomalous areas to be identified easily without the need to take numerous individual readings.



When the green READ button/foot switch is released, the value currently displayed is stored, and all the Statistical information is updated automatically.

### 3.3 Deleting data

In the event of an anomalous or accidental reading (usually causing the coefficient of variation to become unexpectedly high) the last value stored can be deleted. This is achieved by pushing the grey DELETE button at the back left of the control panel. The unit will automatically recalculate all the statistical information of the remaining data, and the previous reading will be displayed. Repeatedly pressing the DELETE button will progressively remove data from memory in reverse order to that in which it was stored. The sequence of events on the display is as follows:

*Initial Display*

ANGLE	VALUE	STORE	CV
60°	32.9	10	0.073

*Delete Pressed/Released*

ANGLE	VALUE	STORE	CV
60°	28.2	9	0.058

To delete ALL of the readings stored in memory, for the displayed angle only, in a single operation, the reset function is used:

*Initial Display*

ANGLE	VALUE	STORE	CV
60°	32.9	10	0.073

Reset Pressed

ARE YOU SURE? PRESS YELLOW BUTTON
--------------------------------------

Stats Pressed

ANGLE	VALUE	STORE	CV
60°	0	0	0

Pushing any button other than STATS at the final stage will cancel the operation and result in no data being deleted.

**3.4 Calibration**

Instrument calibration should be checked regularly, adjusting if necessary. Before commencing, check that the standard tile is clean, in good condition, and has a valid calibration certificate. Position the tile on the instrument, taking care to align the arrows with the white gridlines on the platen, and take a reading. Compare the value displayed with the value assigned to the tile for the matching measurement angle. If the values differ by more than  $\pm 0.5$  (GU or %) it will be necessary to adjust the calibration. This should be done with the instrument in place on the tile. Holding the CAL  $\uparrow$  button will incrementally increase the value, whilst the CAL  $\downarrow$  button will decrease it. Releasing the button will set calibration at the displayed value, e.g. if instrument reads too high:

*Initial Display*

ANGLE	VALUE	STORE	CV
60°	93.2	10	0.590

*Cal  $\downarrow$  Held . . .*

ANGLE	VALUE	STORE	CV
60°	93.1	CAL DOWN	

*. . . Cal  $\downarrow$  Held*

ANGLE	VALUE	STORE	CV
60°	92.1	CAL DOWN	

*Cal  $\downarrow$  Released*

ANGLE	VALUE	STORE	CV
60°	92.1		

Once the calibration has been adjusted to the appropriate level it can be checked by pressing the READ button/foot switch again. The calibration value is stored in memory when the unit switches off, so there is no need to re-calibrate each time the instrument is switched on. The calibration configuration of your Elcometer 400 allows use of any standard.

### 3.4.1 Software zero

The Elcometer 400 has two methods of zeroing the system. One is by adjusting an internal potentiometer. The second method uses a sequence of button presses to Zero the instrument. The way that this is achieved is by placing the calibration tile foam side down onto the measuring aperture, pressing the **Read** button and then pressing the **Set Cal** button. The instrument will indicate that it is now **Zero**.

Please note that if you reset the calibration of the instrument, you will need to Re-Zero the instrument again before adjusting the Calibration. (As per section 3.7 calibration)

### 3.5 Statistics

Holding down the yellow STATS button for about 1 second will divert the instrument into statistics mode.

In statistics mode the display shows the angle of operation and the minimum (MIN), maximum (MAX) and mean (MEAN) values of the data currently stored. If the STATS button is continually held down, or held again whilst in statistics mode, the display scrolls to the left so that the angle and minimum are no longer shown, and the standard deviation of the stored data appears at the right of the display. Releasing the STATS button scrolls the text back to the right again, reverting to the normal statistics display.

*Initial Display*

ANGLE	VALUE	STORE	CV
60°	26.1	9	0.058

*Stats Held . . .*

ANGLE	MIN	MAX	MEAN
60°	26.1	31.0	28.38

... Stats Held

MAX	MEAN	SD
31.0	28.38	1.634

Stats Released

ANGLE	MIN	MAX	MEAN
60°	26.1	31.0	28.38

Statistics mode may be exited by pressing the STATS button once (activating the 2nd function), and then a second time. Alternatively, pressing any of the function keys, such as READ or OUTPUT, will exit statistics mode and perform that function. If the instrument switches off whilst in statistics mode it will automatically return to normal mode on switching on again.

Statistics are defined below. For this purpose the individual readings are defined as values  $x_1, x_2, \dots, x_n$ , and  $x_i$  is any data point:

- Statistical sample population,  $n$  - the current number of stored readings (STORE), on which the statistical analysis is based.
- Maximum (MAX) - the highest reading.
- Minimum (MIN) - the lowest reading.
- Mean (MEAN) - the sum of all readings divided by the total number.
- Standard deviation (SD),  $s$  - the square root of the sum of squared deviations from the mean.
- Coefficient of variation (CV),  $c$  - the standard deviation divided by the mean, a measure of data scatter.

### 3.6 Output data

Pressing the grey OUTPUT button will send all the data in memory to the RS 232C output port, to which either a PC running NOVO-SOFT or a serial printer may be connected. Each data point is briefly displayed as it is output, even if no interface hardware is connected. This is useful if you wish to quickly scan through all the data currently in memory. The display will revert to normal mode on completion.

### 3.7 Calibration reset

Pressing the grey SET CAL button restores the calibration value to an internally pre-set optimum. This function is primarily intended for calibrating on a tile

immediately after bulb replacement. It is also useful when calibrating an instrument which reads a value largely differing to that assigned to a calibration tile.

### 3.8 Disable statistics

Sometimes you may wish to make readings without adding to those already stored in memory. This can be done by disabling statistics. With the instrument switched off hold down the Output button, then switch the unit back on. After about 1 second the instrument display will be filled with a message which flashes between 'PRESS YELLOW BUTTON' and 'ARE YOU SURE?'. Pressing the yellow button will send the instrument into non-stats mode, pressing any other button will send it into the normal operating mode.

*Cal↓/On Held*

Inst. Non Stats Mode `PRESS YELLOW BUTTON`
---

*Stats Pressed*

ANGLE	VALUE
60°	0.0

In non-stats mode, readings are not stored, and so no statistical functions are available.

To escape from non-stats mode and return to normal operating mode, carry out the same procedure when switching on, but instead of pressing the yellow button to confirm, press one of the other buttons. Any statistics previously stored will still be held in memory, and will once again be available.

#### 3.8.1 Single reading output

In non-stats mode the last measurement can be transmitted down the serial port by pressing the output button.

### 3.9 Software version

The software version of your instrument is displayed for a few seconds before switching off.

## 4 NOVO-SOFT™ SOFTWARE

The Elcometer 400 Novo-Curve Glossmeter is supplied with Novo-Soft™ Quality Control Software. This software allows the user to upload and store reading data from the gauge.

### 4.1 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.

### 4.2 Interfacing to your PC

An RS232 data cable is supplied with the kit.

1. Plug the 9-pin female D-type connector on one end of the RS232 data cable into the COM port on the PC.

*Note: If the PC has USB ports and no COM port then an RS232 to USB adaptor will be required; contact Elcometer or your Elcometer supplier to order.*

2. Plug the jack connector on the other end of the RS232 data cable into the RS232 data connection socket on the gauge.

### 4.3 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:



## 4.4 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 default directories labelled '20degree', '45degree', etc.

## 4.5 Uploading and analysing readings

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

## 5 GLOSS MEASUREMENT OVERVIEW

Gloss is measured by integrating the total amount of light reflected in the specular direction (i.e. the equal and opposite angle) from a test area on a sample surface. The dimensions of this area are 2 mm x 2 mm (0.08" x 0.08").

Gloss is also a directional phenomenon, and materials such as fabrics, wood and brushed finish metals, may appear more glossy when measuring along the fibres or grain, than across.

It is important that the test area is free of dust, dirt, fingerprints, etc. as these will affect gloss measurements.

Your Glossmeter integrates all the light going to the receptor, so if there is poor covering of the measuring aperture, and ambient light is able to get in, this will be detected and will result in anomalous high readings. When measuring translucent materials, such as plastic or glass, ambient transmitted light must be excluded by either working in a dark room, or by shielding with opaque cloth.

The optics inside the Glossmeter are focused to the plane of the instrument, so the test surface must be in contact with the base plate to obtain accurate readings. This applies also to silver backed glass mirrors, where the instrument will be separated from the primary reflecting surface by the thickness of the glass.

When measuring textured materials such as leather, gloss readings may be slightly lower than expected after a visual examination. This is because the measurement is an integral of highlighted areas, and apparently dark 'valleys'. For similar reasons, gloss measurement on very uneven surfaces will be unreliable. Care must also be taken when looking at curved surfaces. Best results on cylinders are obtained when measuring parallel to the axis. The Elcometer 400 Novo-Curve Glossmeter should be able to give accurate gloss measurement on surfaces of radius as low as 12 mm. With care, it can be used to give comparative readings on surfaces with radii down to 4 mm.

## 6 MAINTENANCE

The Elcometer 400 Novo-Curve Glossmeter is designed to give many years reliable service under normal operating and storage conditions.

With the exception of replacement of the lamp(s) the gauge does not contain any user-serviceable components. In the unlikely event of a fault, the Elcometer 400 should be returned to your local Elcometer supplier or direct to Elcometer. Contact details can be found on the outside cover of these instructions and at [www.elcometer.com](http://www.elcometer.com)

### 6.1 Calibration tile

Calibration standards (Gloss Tiles) should be kept scrupulously clean and should be stored safely when not in use. The surface should never be touched with fingers or wiped with a solvent cloth.

Cleaning should be carried out using the dry cloth provided or using dry, compressed air. If necessary the tile may be wiped with a cloth moistened with warm soapy water and dried with a lint-free cloth.

Any marks on the surface, such as scratches, grease, dust or finger marks, will invalidate the calibration value assigned to the standard.

It is important that the 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. The tile must be calibrated at both angles when it is to be used with dual angle gauges.

Standards can be re-calibrated by returning the standard to Elcometer, your local Elcometer supplier or to a recognised gloss calibration facility such as BAM (Germany) or NRC (Canada).

### 6.2 Gauge

The Elcometer 400 Novo-Curve Glossmeter should always be checked to ensure that the metal measuring surface is clean. Care must be taken to ensure that the measuring surface remains free of any damage. The optical cavities and lenses must also be free of dust or any other contamination.

### 6.3 Lamp replacement procedure

1. Disconnect instrument from main supply.
2. Remove the four retaining screws for the back panel.
3. Pull the red and black wires for the lamp out of the case.



4. Pull the connector apart and remove the lamp and reflector by pulling on the base of the bulb.
5. Insert new lamp and reflector by pushing fully into the locating hole and twisting until it locks firmly into place.
6. Re-connect the connector for the bulb.
7. Replace the back panel and secure with screws and washers.
8. Connect instrument to mains supply.
9. Press the set cal button followed by the yellow stats button.
10. Put the standard on the instrument lining up all the arrows with the white lines on the sole plate.
11. Take a reading of the standard.
12. If the reading is not as stated on the standard use the CAL ↑ and the CAL ↓ buttons to re-calibrate the instrument to the standard.

## 7 TECHNICAL SPECIFICATION

Measurement range:	0 GU to 1000 GU
Measurement area:	2 mm x 2 mm (0.08" x 0.08")
Accuracy:	± 1.0 GU
Repeatability (24 Hours):	1.0 GU
Memory:	199 readings
Interface:	RS 232
Lamp life:	200 hours, nominal
Dimensions:	260 mm x 220 mm x 100 mm (10" x 8½" x 4")
Weight:	2.5 kg (5.5 lb)
Operating voltage:	UK, 240 V AC 50 Hz EUR, 220 V AC 50 Hz US, 110 V AC 60 Hz

## 8 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.

## 9 RELATED EQUIPMENT

In addition to the Elcometer 400 Novo-Curve Glossmeter, Elcometer produces a wide range of other equipment for measuring the appearance of surface coatings. Users of the Elcometer 400 may also benefit from the following Elcometer products:

- Elcometer Novo-Gloss™ Portable Glossmeters
- Elcometer Haze, Shade and Opacity Meters
- Elcometer RAL Colour Charts
- Elcometer Spectrophotometers (portable and benchtop)
- Elcometer Colour Analysis Software

For further information contact Elcometer, your local Elcometer supplier, or visit [www.elcometer.com](http://www.elcometer.com)