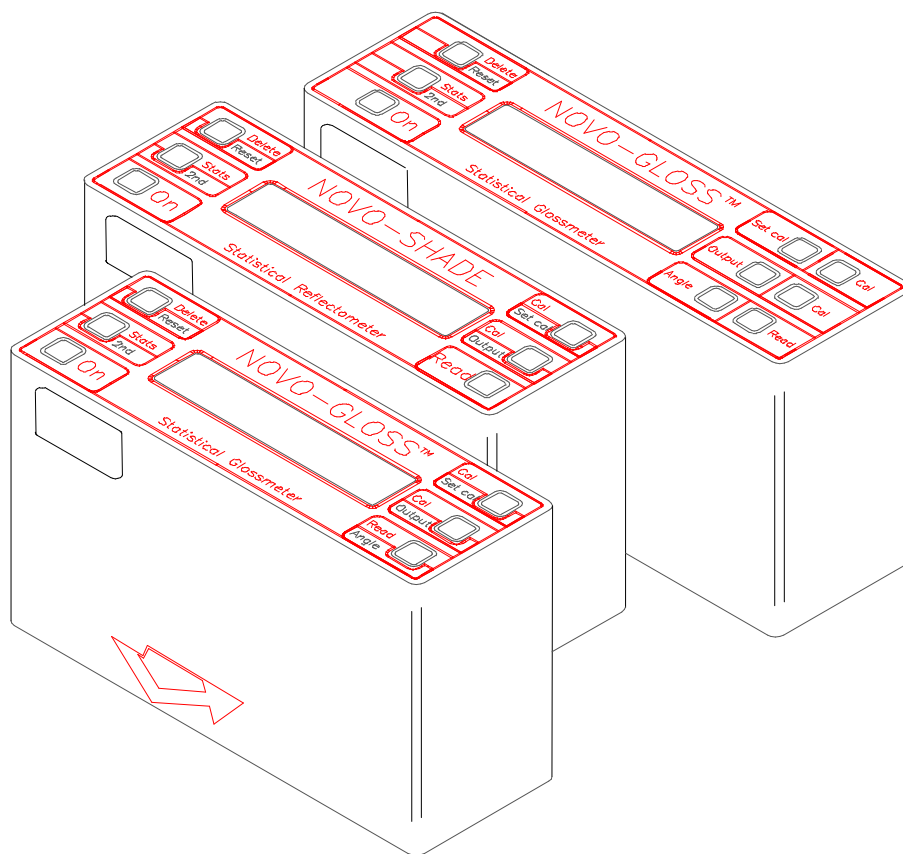# NOVO-GLOSS™

Statistical Glossmeters

NOVO-SHADE

Statistical Reflectometers

NOVO-HAZE

Hazemeters

Also featuring:

NOVO-SOFT - Windows based PC software

OPERATING INSTRUCTIONS

Contents

Due to the similarity in operation of Statistical NOVO-GLOSS™, Statistical NOVO-SHADE and NOVO-HAZE instruments, this manual describes in parallel the operation of all three.

Changes are periodically made to the information herein, these changes will be incorporated in any future editions of this publication.

1 INTRODUCTION

Congratulations on purchasing a Rhopoint™ optical instrument - the Statistical NOVO-GLOSS™; Statistical NOVO-SHADE and NOVO-HAZE represent the most technically advanced portable instruments of their type in the world. Features include:

- Machined aluminum optical block - ensures the integrity of the $\pm 0.1°$ angular tolerance specified by international measuring standards (e.g. ISO 2813 for gloss)
- Auto-stabilisation circuit - this unique feature, patented by Rhopoint™, allows continuous readings to be made, and also compensates for filament sag in the lamps when reading with the instrument sideways or upside-down
- (Statistical NOVO-GLOSS™/NOVO-HAZE only) Auto-ranging (0.0 to 1999 gloss units at 20°) - Makes possible measurement on surfaces even with ultra-high gloss, such as polished metal
- Memory for 200 readings per angle
- Full statistics showing Minimum, Maximum, Mean, Standard Deviation and Coefficient of Variation of stored values
- RS232C Output with Windows based PC software or printer available
- Capability to operate in any one of six languages (English, Français, Deutsch, Italiano, Español or Nederlands)

Your instrument is supplied in a lightweight carry case, the contents of which are as follows:

1. Statistical NOVO-GLOSS™/NOVO-SHADE/NOVO-HAZE unit
2. Statistical NOVO-GLOSS™/NOVO-HAZE: Black glass (high gloss) and foam (zero) calibration standards in wooden box
                        OR
Statistical NOVO-SHADE: White pad (high reflectance) and black glass (zero) calibration standards in wooden box
3. NOVO-SOFT 3¼" floppy diskette
4. Serial RS232 PC interface cable
5. Guarantee card - fill in and return for free extended warranty
6. Operating instructions
7. Battery charger
8. Spare lamp (s)
9. Cleaning cloth

Rhopoint™ Statistical instruments are both accurate and user friendly, allowing Statistical Process Control of gloss, haze or reflectance to be conducted quickly and easily at any location.

We recommend that the whole of this manual is read before commencing measurements. These instructions should be read with the instrument conveniently to hand, and assume that the unit is working in English with the Statistical functions enabled.

2 GETTING STARTED

2.1 Battery Charging

The battery charger for your Statistical instrument plugs into the aperture marked **DC**. It is important to connect the charger to the instrument before switching on the mains. The unit is initially supplied without power, and will take 16 hours to fully charge. It is possible to operate the instrument whilst it is on charge, but readings will fluctuate depending on environnmental conditions and obviously charging time will increase. To maximise the lifetime of the batteries, the instrument should be operated until the low battery warning is observed in the LCD.

2.2 Instrument Front Control Panel

The control panel of your instrument will vary according to which model you have, as will the operating instructions.

The figure 2.2.1 shows the front panel for a single or dual angle glossmeter, which is controlled by six buttons. Figure 2.2.2 shows the control panel for a triple angle glossmeter, which is controlled by nine buttons.

☐	Delete Reset	**NOVO-GLOSS™**		Cal↑ Set cal	☐
☐	Stats 2nd			Cal↓ Output	☐
☐	**On**	**Statistical Glossmeter**		Read Angle	☐

Fig. 2.2.1. Control panel of single and dual angle glossmeters

☐	Delete Reset	**NOVO-GLOSS™**	Set cal	☐	☐	Cal↑
☐	Stats 2nd		Output	☐	☐	Cal↓
☐	**On**	**Statistical Glossmeter**	Angle	☐	☐	Read

Fig. 2.2.2. Control panel of triple angle glossmeter

Figure 2.2.3 shows the front panel of a reflectometer, which is also operated by six buttons, and is similar to a single/dual angle glossmeter. Figure 2.2.4 shows the front panel for a hazemeter, again operated by six buttons, and based directly on the single/dual angle glossmeter.

☐	Delete Reset	**NOVO-SHADE**	Cal↑ Set cal	☐
☐	Stats 2nd		Cal↓ Output	☐
☐	**On**	**Statistical Reflectometer**	Read	☐

Fig. 2.2.3. Control panel of reflectometer

☐	Delete Reset	**NOVO-HAZE**	Cal↑ Set cal	☐
☐	Stats 2nd		Cal↓ Output	☐
☐	**On**	**Hazemeter**	Read Mode	☐

Fig. 2.2.4. Control panel of hazemeter

As can be seen, some buttons have two functions, the primary function is shown in normal text, the secondary function is shown in reverse text. The second function is operated by first pressing the 2nd function button, and then the appropriate dual function button, similar to a pocket calculator. For example, to activate the Reset function you would press the Stats/2nd button, followed by the Delete/Reset button. This would be written in the text in this manual as 2nd/RESET. To activate the DELETE function you would only press the Delete/Reset button, which would be written in this manual as DELETE.

Statistical NOVO-GLOSS™ and Statistical NOVO-SHADE both utilise the same software and electronics, and the only difference is the angles at which the instrument optics are set. For this reason the words NOVO-GLOSS appear in the instrument display on powering up (section 3.1) for both NOVO-GLOSS™ and NOVO-SHADE instruments.

NOVO-HAZE is also a statistical instrument, but does not bear the statistical title as, unlike NOVO-GLOSS™ and NOVO-SHADE, it does not have a non-statistical counterpart. NOVO-HAZE is a glossmeter with special software which automatically calculates *haze index (H)* according to ASTM D4039, which gives the definition of gloss at 60° (G_{60}) minus gloss at 20° (G_{20}), i.e.

$$H = G_{60} - G_{20}$$

As well as functioning as a hazemeter, NOVO-HAZE can also be used directly as a dual angle glossmeter, and is sometimes referred to as such elsewhere in this manual.

3 OPERATION

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

3.1 Power Up

Hold and release the red ON button. The instrument will power up with a display showing the instrument type, and manufacturer, e.g.:

```
        NOVO-GLOSS
R h o p o i n t   I n s t r u m e n t a t i o n
```

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

Current operating angle	Last value read	Number of stored readings	Coefficient of variation of stored values
⬇	⬇	⬇	⬇

```
ANGLE     VALUE     STORE        CV
 60°       0.0        0         0.000
```

The unit will automatically power down approximately 2 minutes after the last button is pressed. If, however, you wish to power down instantly, press and release the second function button, then hold down the ON button. The instrument will shut down after about two seconds.

The current operating angle is that at which measurements will be taken, and may be 20°, 45°, 60°, 75° or 85° for statistical NOVO-GLOSS™, 45°/0° for statistical NOVO-SHADE, or 20°, 60° or HAZE for NOVO-HAZE. The angle is fixed on reflectometers and single angle glossmeters, but may be successively changed on dual angle glossmeters by pressing 2nd/ANGLE, on hazemeters by pressing 2nd/MODE, or on triple angle glossmeters by pressing ANGLE. 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, reflectometers and hazemeters 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 base of the instrument. When the instrument is stood on a surface the aperture is hidden, but can be pinpointed by the intersection of the arrows marked at the bottom of the instrument case on the front with those on the side.

To take a reading press the green READ button. The unit will now start to take a reading. Whilst the button is held the unit will continually update the current reading. When the button is released the value shown in the display at that moment will entered into memory, and the number of stored readings will increase by one. It is recommended that the button is held until a stable reading is observed. All gloss readings are given in Gloss Units (GU), as defined by the relevant national or international standards (e.g. ISO 2813, TAPPI T480, etc.). Reflectance readings are given in Reflectance Units (%), also defined by appropriate standards (e.g. ISO 2814). Haze index according to ASTM D4039 has no specified units. The sequence of events on the display during a reading is as follows:

Initial Display

ANGLE	VALUE	STORE	CV
60°	28.2	9	0.058

Read Pressed

ANGLE	VALUE	STORE	CV
60°		9	0.058

Read Held

ANGLE	VALUE	STORE	CV
60°	32.9	9	0.058

Read Released

ANGLE	VALUE	STORE	CV
60°	32.9	10	0.073

Holding down the green READ button will continually monitor the gloss/reflectance level. If the unit is simultaneously moved across a sample (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, and is a feature unique to Rhopoint™ Statistical instruments. However, please note that NOVO-HAZE instruments must not be moved when making measurements in haze mode. This is because the two readings taken to calculate haze must be made in the same spot. As these readings are taken consecutively, rather than simultaneously, moving the instrument before the result is displayed will cause the measurements to be taken in different places, and the reading will be meaningless.

When the green READ button 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

2nd Pressed

SECOND FUNCTION ENABLED

Delete Pressed

ARE YOU SURE?
PRESS YELLOW BUTTON

Stats/2nd Pressed

ANGLE	VALUE	STORE	CV
60°	0	0	0

Pushing any button other than STATS/2nd 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 instrument on the tile 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 ±0.5 (GU) it will be necessary to adjust the calibration.

3.5 Calibration on Zero

The glossmeter has two methods of zeroing the system. One is by adjusting the Pot internally. The second method uses a sequence of button presses to Zero the instrument. The way that this is achieved is by placing the tile foam side down, 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.

This procedure should be done before tile calibration (Section 3.6 Cal on tile).

3.6 Calibration on Tile

This should be done with the instrument in place on the tile. Holding the CAL ↑ button will incrementally increase the value, whilst the CAL ↓ 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 ↓ Held . . .

ANGLE	VALUE	STORE	CV
60°	93.1	CAL DOWN	

. . . Cal ↓ Held

ANGLE	VALUE	STORE	CV
60°	92.1	CAL DOWN	

Cal ↓ 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 again. The calibration value is stored in memory when the unit powers down, so there is no need to re-calibrate each time the instrument is switched on. The calibration configuration of Rhopoint™ Statistical instruments allows use of any standard.

NOVO-HAZE instruments cannot be calibrated in haze mode. Instead you must cycle through the gloss measuring modes using the 2nd/MODE button, and calibrate at both 20° gloss AND 60° gloss before returning to HAZE mode to take measurements. If

you wish to later make gloss measurements, re-calibration is not necessary.

3.7 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. Dual and triple angle glossmeters have separate sets of data and statistics for each angle. 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 powers down whilst in statistics mode it will automatically return to normal mode on powering up again.

Statistics are defined below. For this purpose the individual readings are defined as values x_1, x_2, ... 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), $\bar{x}$ - The sum of all readings divided by the total number, $\bar{x} = \sum_{i=1}^{i=n} \dfrac{x_i}{n}$

- Standard deviation (SD), *s* - Square root of the sum of squared deviations from the mean, $s = \sum_{i=1}^{i=n} \left(\dfrac{x_i^2 - \bar{x}^2}{(n-1)} \right)^{\frac{1}{2}}$

- Coefficient of variation (CV), *c* - Standard deviation divided by the mean, a measure of data scatter, $c = \dfrac{s}{\bar{x}} = \sum_{i=1}^{i=n} \dfrac{n}{x_i} \left(\dfrac{x_i^2 - \bar{x}^2}{(n-1)} \right)^{\frac{1}{2}}$

3.8 Output Data

Pressing the grey OUTPUT button (on triple angle glossmeters), or 2nd/OUTPUT (on hazemeters, reflectometers and dual or single angle glossmeters) will send all the data in memory for the current measurement angle *only* 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.

3.9 Calibration Reset

Pressing the grey SET CAL button (on triple angle glossmeters), or 2nd/SET CAL (on hazemeters, reflectometers and dual or single angle glossmeters) restores the calibration value to an internally preset optimum, for ALL angles. 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. This also clears the zero offset. (Section 3.5 Cal on zero).

3.10 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 Cal↓ button, then hold down the On button to power up. 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 powering up, 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.

3.10.1 Single Reading Output

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

PRINTER OR COMPUTER SETTINGS

4.1 NOVO-SOFT

Interfacing your Rhopoint™ Statistical instrument with a PC is simple when using NOVO-SOFT, a Windows based software package specially written by Rhopoint™ for handling gloss and reflectance data. Version 1.3 is available from your instrument supplier, and full instructions are given in section 9.

When running, NOVO-SOFT will automatically collect data from your instrument via a serial port, and can collect up to 999 readings. Data may be plotted, in order of measurement, in either a standard 2D, or eye-catching and easy to analyse 3D form. Statistical graphs in the form of a histogram or normal distribution are also possible. Full numerical statistical analysis can be made on the entire sample population, with the option to either delete data, or only work with a selected portion. Data files may be stored on a hard drive, allowing permanent records to be kept, and hard copies may also be produced. There is also a report producing facility which allows graphs, experimental notes and statistical analyses to be printed. Data can also be exported to other packages, such as Lotus or Excel. Future versions of the software are planned which will include batching facilities, and simultaneous analysis.

4.2 Configuration of Computer

Instead of using NOVO-SOFT you may wish to interface your instrument with a PC using an alternative method. The instrument outputs data serially at 4800 baud, 8 data bits, 1 stop bit and no parity. Using the RS232 lead supplied it is possible to download data into a MS DOS based computer having set up the computer using the following command:

Mode Com2:48,n,8,1

If you are using a communication port other than Com2, then you will need to amend this command accordingly. It is now possible to download data directly into any appropriate software.

4.3 Configuration of Printer

Your instrument is also capable of directly driving a serial printer, such as that available from Rhopoint™. Please note that your printer must have line feeds enabled with carriage returns, otherwise all data will be printed in the same place and be illegible (see printer hand book). If the OUTPUT function is engaged, all data stored in memory will be printed. Alternatively, it is possible to print measurements as they are taken.

5 CHANGE LANGUAGES

Your instrument is configured to operate in one of six languages - English, Français, Deutsch, Italiano, Español or Nederlands. Usually it is set to the language most relevant to the country of supply, but it can be changed to another, if preferred.

To prevent accidental change, the language is set by means of internal dip switches. To change language, follow the instructions below:

1. Ensure the mains lead is disconnected from the supply.

2. Remove the four crosshead screws from the bottom of the case.

3. Slide the bottom of the case off.

4. Locate the bank of four dip switches located by the mounting pillar at the front right corner of the central PCB.

5. Use a blunt instrument, such as a pen, to push the numbered dip switches to the required positions, as indicated in the table below. 'Up' is away from you, 'down' is towards you.

Language	Switch 1	Switch 2	Switch 3	Switch 4
English	down	down	down	down
Français,	down	down	down	up
Español	down	down	up	down
Deutsch,	down	down	up	up
Italiano	down	up	down	down
Nederlands	down	up	down	up

6. Once the required language is selected, replace the instrument case and retaining screws.

The instrument will now operate in the new language. To change the language again, repeat the steps above.

6 SOFTWARE VERSION

The software version of your instrument is displayed for a few seconds before power down. Instruments from 1997 onwards are running EEPROM version 2.00 and up.

7 TROUBLE SHOOTING & SIMPLE REPAIRS

The Rhopoint™ Statistical instruments are designed to be field serviceable, and much of the maintenance can be performed without returning the instrument to your supplier. If you require assistance in self-servicing, please either contact your supplier, or Rhopoint™ direct, stating the following:

1. Instrument type

2. Serial number

3. Exact nature of fault

7.1 Diagnosis

The most common problems are shown below:

SYMPTOM	POSSIBLE CAUSE	ACTION REQUIRED
LCD display blank	NiCad battery flat	either recharge instrument or operate using mains adapter
	faulty charger	if possible check output of charger using a voltmeter
	blown internal fuse	replace square black fuse located at rear of lower PCB, just over one third distance from left (see section 8.4 for PCB removal)
	fault on PCB	remove the PCB's to identify which appears defective, and replace (section 8.4)
erratic, rapidly fluctuating readings	blown lamp	replace lamp (section 8.3)
reads low or zero	set cal function not operated	follow instructions for calibration reset (section 3.7)
	dirt/dust on optics	clean with compressed air or soft cloth

7.2 Case removal and refitting

1. Ensure the mains lead is disconnected from the supply.

2. Remove the four crosshead screws from the bottom of the case.

3. Slide the bottom of the case off.

4. Refitting is reverse of removal.

7.3 Lamp replacement

1. Remove instrument case (section 8.2).

2. Identify the blown bulb, which will have a broken filament, and may also be blackened. Remove the two retaining screws (fig. 8.3.1), so that it may be released.
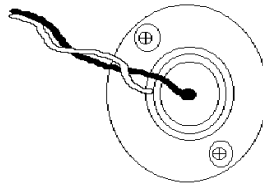

Fig. 8.3.1. Bulb retaining screws.

3. Fit the new bulb, aligning it so that the filament is perpendicular to the angle at which the beam will be directed (fig.8.3.2).
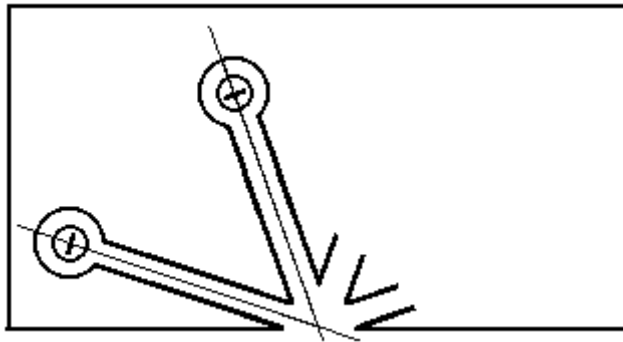

Fig. 8.3.2. Perpendicular filament alignment.

4. Replace and tighten the two retaining screws.

5. With the case still off, power on the unit and push 2nd/SET CAL (section 3.8).

6. Place the instrument on a calibration tile and hold down the green READ button. Use a small screwdriver to adjust the internal calibration screw(s), located at the left hand end of the bottom PCB (fig. 8.3.3). The appropriate screw is determined using the table below. Please note that R49 is not found on dual angle glossmeters, and neither R49 nor R50 is found on single angle glossmeters or reflectometers.

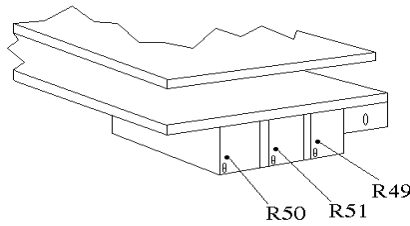|	Single angle	Dual angle		Triple angle		
	20/45/60/75/85°	20°	60°	20°	60°	75/85°
R49						•
R50			•		•	
R51	•	•		•		

Fig. 8.3.3. Location of Calibration screws on bottom PCB.

7. When the correct value is reached, do not adjust the screw any further, and release the green READ button.

8. On dual and triple angle instruments, move through the angles, using the ANGLE button, to check calibration for each, adjusting if necessary.

9. Refit case.

7.4 PCB replacement

1. Remove instrument case (section 8.2).

2. Remove the three screws in the corners of the top PCB, which holds the LCD.

3. Hold the top PCB at the far left end (battery pack facing you) with one hand, and grip the middle board beneath where you are holding with the other. Ease off the top PCB by pulling straight up and gently rocking back and forth.

4. Remove the three crosshead screws from the central PCB (two are located at right of board, between switches; one is located in the centre of the board, a third of the way from the left). Both the central and bottom PCB will now be loose.

5. Separate the central PCB from the bottom PCB by easing apart the connection at the front left of the boards.

6. Faulty boards are usually identified by burned tracks or components, and should be replaced with a new one, available from your supplier. Blown fuses may be replaced by de-soldering the faulty part, and soldering in the new one.

7. Refitting of boards is reverse of removal, but be sure that the fibre washers are correctly replaced.

7.5 Battery Performance Test.

A battery performance test can be carried out in order to either test or restore the battery capacity. Also, the procedure below will show you how to discharge the battery before transportation.

1. To see if the battery is functioning properly, it must be discharged first and then recharged for *16* consecutive hours.

2. Once charged, it must be left running for the observation of number of samples taken.

3. To start this sequence, on a *Single* or *Dual* Novo-Gloss, press *Delete/Reset & Stats/2nd Function* buttons simultaneously with the *Angle/Read* button.

4. To start this sequence, on a *Triple* Novo-Gloss, press *Delete/Reset & Stats/2nd Function* buttons simultaneously with the *Angle* button

5. Observe the screen on the instrument. The display will show the total number of samples after every *25* samples. With a fully charged battery, the instrument should take in the excess of *2000* samples after which the battery will be discharged. The instrument will automatically power down once it detects that the battery is low.

6. Once the battery has discharged, it has to be recharged again for *16* hours. The number of samples the instrument took the previous time can be viewed by repeating step 3, but only this time holding the buttons down for few seconds. The the display will show the number of samples.

You may wish to repeat the above procedure in order to either test or restore the battery capacity.
Please discharge the equipment before transportation using the above sequence.

8 NOVO-SOFT VERSION 1.5

8.1 Introduction

8.1.1 About NOVO-SOFT

NOVO-SOFT was originally produced at the request of existing users of Statistical NOVO-GLOSS™ and Statistical NOVO-SHADE instruments, and many of the programs features were requested. It is the policy of Rhopoint Instrumentation Ltd to meet customer demands, so if there are further features you would like included in future versions of NOVO-SOFT, please contact us and we will be glad to help.

<div align="center">

NOVO-SOFT Helpline
☎ **+44/0 1424 214291**
Dr Eric Tan or Mr Barry Ingham

</div>

Version 1.5 of NOVO-SOFT was released on 14 April 1997.

8.1.2 Installation

NOVO-SOFT requires a minimum of 3.4 MB of hard disk space. It may be installed by typing the following command from Run in the Windows File Menu:

a:\install.exe

An image of a gloss measurement being taken from a car will appear, and you will be prompted for further information on where you wish the software installed.

8.1.3 Sample Data

To enable you to test some of the features of NOVO-SOFT before down-loading any real data, two files containing sample data are installed with the software. They are labeled test1.res and test2.res, and are found in the 45 degree sub-directory. To open them you must first be in the NOVO-SOFT Results window.

8.2 Configuration

8.2.1 Communications Connections

Connect the jack plug end of the RS232 interface cable to the Statistical NOVO-GLOSS™ output port, and the 9 pin connector to a spare Coms port at the rear of your PC.

8.2.2 Software

On running NOVO-SOFT for the first time you will directed straight into the Quick Start help function. The help function may be exited

from either the File Menu or by pressing Alt+F4. This will send you to the *System* Window, featuring the yellow sports car, which you will enter directly on running NOVO-SOFT on all future occasions.

From the *System* Window select the Configure option from the Mode Menu, which can be done simply by pressing the _ button. This will open the *Configuration* Window (fig. 8.2.3). Using the mouse select the Coms port to which you have connected to the interface cable, and indicate the type of instrument you are using. As a general rule, NOVO-GLOSS™ units which are pre-1997 will be up to v1.7, those from 1997 onwards will primarily be v2.0 up.

Once you click OK all settings will be adjusted and saved for when you next run NOVO-SOFT. You are now ready to down load data.

8.2.3 Configuration Window

The *Configuration* Window (fig. 8.2.3) is reached either from the Mode Menu in the *System* Window or by pressing the _ button. If, when saving data in NOVO-SOFT format, you also wish to simultaneously save it in a comma delimited format, check the Save *.CSV files box also. Files will have the same name as that selected for the NOVO-SOFT data, only with the *.CSV file extension. Data can also be exported at any time during editing and analysis using the Export option in the *Results* Window.

The Document Header box contains the text that will be printed at the top of reports, and may be adjusted by the user, as desired.
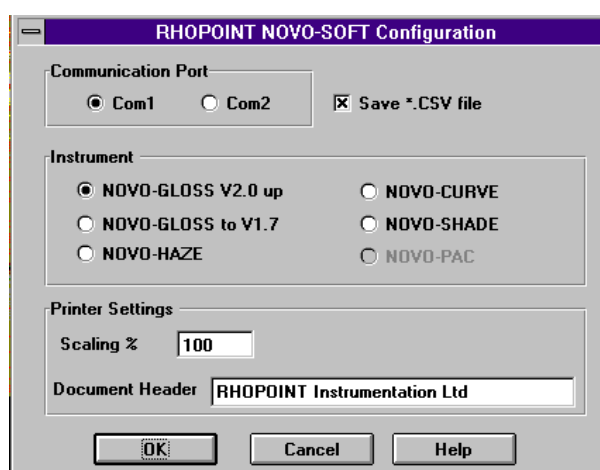

Fig. 8.2.3. The *Configuration* Window.

8.3 System Window

8.3.1 General

The *System* Window (fig. 8.3.1), displaying the yellow sports car, is the first entered on running NOVO-SOFT. From here you may configure the communications channels, receive data from an

interfaced instrument, or enter the data analysis section of the software. It is also possible to enter the Help function directly, or to browse through a guide to other Rhopoint™ products. Moving the pointer over the function buttons will display their designation on the help bar at the bottom of the Window.
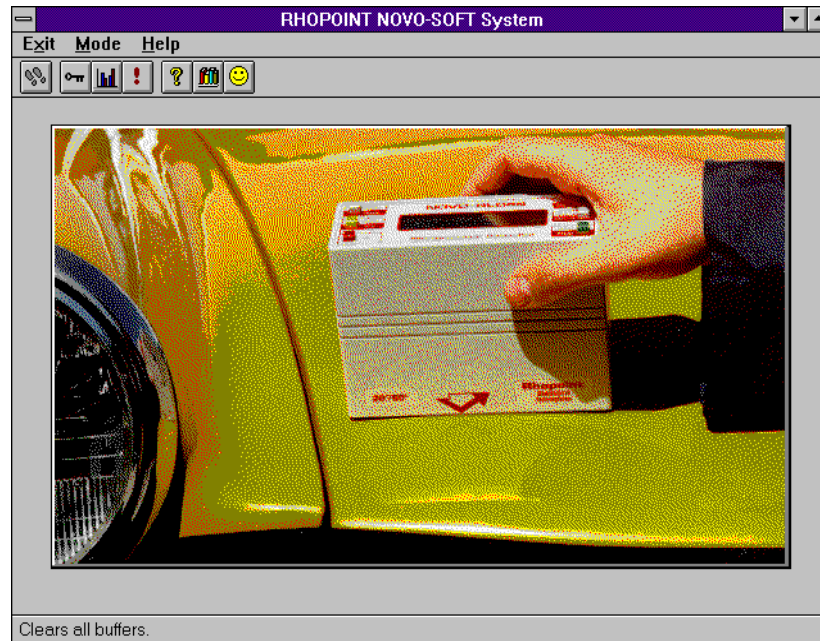

Fig. 8.3.1. The *System* Window.

8.3.2 Down Loading Data

Once the communications channel has been configured (see section 8.2), NOVO-SOFT is ready to receive data from within the *System* Window. Attempting to receive data from elsewhere in the NOVO-SOFT program will result in an error message, and any data sent will not be stored. However, this data is not lost as it is still stored in the instrument, and you should move to the *System* Window before attempting to down load again.

To send data from your instrument, make sure that it is powered up, and push its yellow 2nd function button (except on triple angle glossmeters), followed by the output button. All data resident in the memory of your glossmeter will be sent to your PC, and NOVO-SOFT will automatically collect it before prompting you for a filename under which to save it. Data is saved in a format recognised by NOVO-SOFT, which uses a *.RES filename extension. If the Save *.CSV files box in the *Configuration* Window has been checked, data is also saved in this format under the same filename, and may be easily imported by other applications, such as Lotus or Excel.

8.3.3 Flushing

The flush option in the Mode Menu (or ! button) is used to clear the communications channel if there has been a problem receiving data. Selecting this function will empty the serial buffers, and you should try down loading again.

8.4 File Management

When NOVO-SOFT is installed it automatically generates it own directory tree corresponding to the various angles at which glossmeter measurements can be made. On receiving data, the angle at which measurements were taken is automatically detected, and the appropriate sub-directory becomes the default location to save data. Of course, you may save data where you wish, though if you do it is recommended that you include the measurement angle in the filename. If you have chosen to save data as *.CSV files also, these will be saved in the same directory.

8.5 Results Window

8.5.1 General

The *Results* Window (fig. 8.5.1) is where numerical data is displayed and may be tagged or edited. Although there may be up to 999 data points in any set, only 72 may be displayed on the screen at any one time. Moving through the data is achieved using the buttons at the bottom of the Window. Page Up and Page Down will cycle through the data in blocks of 72 points. Home will return to the beginning of the data set, and End will transfer to the final page. At the top of the *Results* Window the following parameters are displayed:

- Angle - The angle at which measurements were taken ($20°$, $45°$, $60°$, $75°$, or $85°$ for glossmeters, $45°/0°$ for reflectometers).

- Total Samples - The number of data points currently in memory.

- Date and Time - When data was first down loaded to NOVO-SOFT.

- Filename - Remember that NOVO-SOFT uses the *.RES file extension.

- Comment - First line of user defined statement pertaining to the data set. May only be edited from the *Statistics* Window.

Data may be saved or retrieved from the File menu, using the Save and Open options, in the normal Windows environment way.

Fig. 8.5.1. The *Results* Window.

The user may also return to the *System* Window, or enter the *Statistics*, *Graph*, or *Statistical Graphs* Windows from the options bar at the top of the screen.

The current data may also be saved or exported at any time.

8.5.2 Deleting Results

Results may be deleted using the delete menu in the *Results* Window. You may either specify single results to be deleted, or whole blocks. Once data is deleted it can not be recovered, so ensure you have adequate backups. If you only wish to 'delete' data temporarily, you should consider tagging instead.

8.5.3 Tagging & Untagging

You may wish to perform some analyses on only part of your data, without deleting the remainder. This can be achieved by tagging. NOVO-SOFT will ignore any tagged files, and will only work with those which are not tagged, i.e. untagged. Tagged results are indicated by a # symbol directly after the data number, and others around the data itself (see points 41-45 in fig. 8.5.1). When data is first down loaded to NOVO-SOFT it is all initially untagged, hence no # symbols appear.

Tagging is achieved through the Tag/Untag menu. It is possible to tag, and again untag, individual results, a block, or all results. The tagging status of results is stored when data is saved.

The 'Tag all results' option may at first seem a little pointless, but is useful if you only wish to work with a small number or batch of readings within a large population. Simply tag all results, then untag the ones you wish to work with. Untagging all results returns them to their original status, enabling you to work with the entire population.

When tagging a block, you are asked to specify a range. The range specified is inclusive, and all results falling in this block will be tagged, or untagged, as specified, regardless of their original tagging status.

When single result is selected, the tagging status of the selected result is inverted, i.e. a tagged result will become untagged, and an untagged result will become tagged.

Invert tags will invert the tagging status of the entire data population.

8.5.4 Exporting

Data may be exported in *.CSV file format using the Export function. This is useful if you prefer to edit and analyse the data using your own software package, which will be able to recognise this file format. The file will be given the same name as that used for NOVO-SOFT data, but with the *.CSV file extension. If you have checked the box in the *Configuration* Window, the original data will already be saved in *.CSV form, but this will be overwritten if you have made any changes.

8.6 Statistics Window

8.6.1 General

The *Statistics* Window (fig. 8.6.1) displays a full analysis of all currently untagged files.   Statistics available are maximum, minimum, mean, variance, standard deviation and coefficient of variation. The comment box displays text which may be edited by the user. As in the *Results* Window, the relevant gloss measuring angle is automatically displayed, as are the date and time at which the data was initially down loaded.

8.6.2 Comment

The comment statement is used to record any information particular to the results displayed, such as the conditions under which measurements were made, sample history, etc. It may be up to 10 lines long, and is edited by placing the cursor in the box. The comment can also be viewed one line at a time from the *Results* Window.

Fig. 8.6.1. The *Statistics* Window.

8.6.3 Statistics

The statistical parameters displayed are defined below. For this purpose the data are defined as values x_1, x_2, ... x_n, and x_i is any data point (*c.f.* section 3.5).

- Statistical sample population, n - the current number of untagged samples, on which the statistical analysis is based.

- Maximum - the highest untagged reading.

- Minimum - the lowest untagged reading.

- Mean, $\bar{x}$ - The sum of all untagged readings divided by the total number, $\bar{x} = \sum_{i=1}^{i=n} \frac{x_i}{n}$

- Variance, s^2 - Sum of squared deviations of untagged readings from the mean, $s^2 = \sum_{i=1}^{i=n} \frac{x_i^2 - \bar{x}^2}{(n-1)}$

- Standard deviation, s - Square root of the variance, $s = \sum_{i=1}^{i=n} \left(\frac{x_i^2 - \bar{x}^2}{(n-1)} \right)^{\frac{1}{2}}$

- Coefficient of variation, c - Standard deviation divided by the mean, a measure of data scatter, $c = \frac{s}{\bar{x}} = \sum_{i=1}^{i=n} \frac{n}{x_i} \left(\frac{x_i^2 - \bar{x}^2}{(n-1)} \right)^{\frac{1}{2}}$

8.7 Graph Window

8.7.1 General

The *Graph* Window (fig. 8.7.1) enables display of all results in a simple *x-y* plot of reading vs. gloss. There are both 2D and 3D graph options, report printing facilities, and options for exporting graphics to other software.
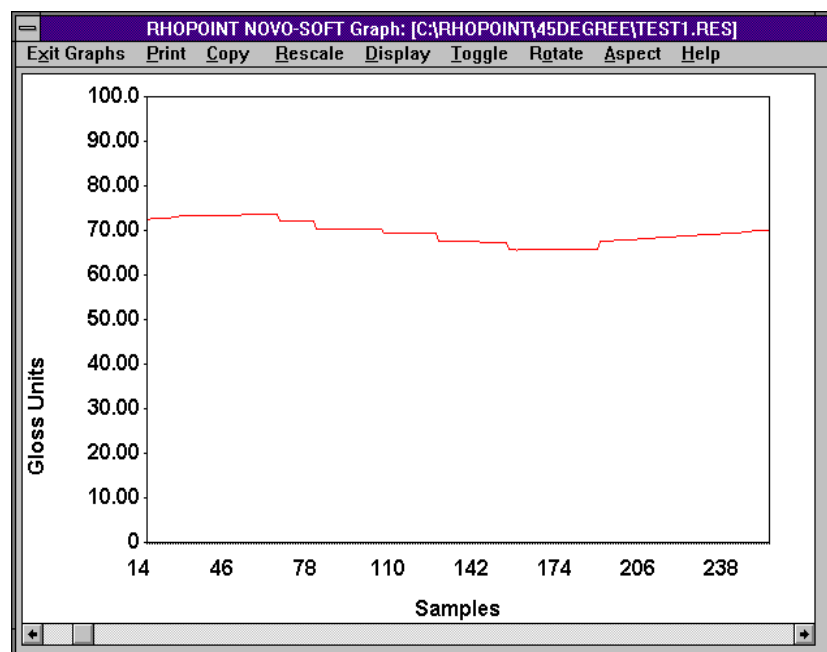

Fig. 8.7.1. The *Graph* Window.

8.7.2 2D Graphs

On entering the *Graph* Window you will always be in 2D display. Graphs are initially plotted by NOVO-SOFT on an automatic scale which accommodates all data. The *y*-axis can be redefined from the Rescale menu, which will prompt you for new maximum and minimum values accordingly. The Display menu allows you to move between 2D and 3D graph mode. An example of a NOVO-SOFT 2D graph is shown in fig. 8.7.1.

Each data point is represented on the graph by a square. As the graph starts to become crowded when dealing with large sample populations, the squares are not used when there are more than 50 data points, and a simple line graph appears. Only 330 data points may be shown on the screen at one time, and a scroll option appears when this number is exceeded.

8.7.3 3D Graphs

On entering the *Graph* Window you will always be in 2D display. The 3D graph mode is reached through the Display menu. The scale currently defined in 2D display is preserved when switching to 3D. Changes in 3D mode are likewise preserved on switching back. A large number of effects are possible in 3D graph mode, an example of which is shown in fig. 8.7.3.
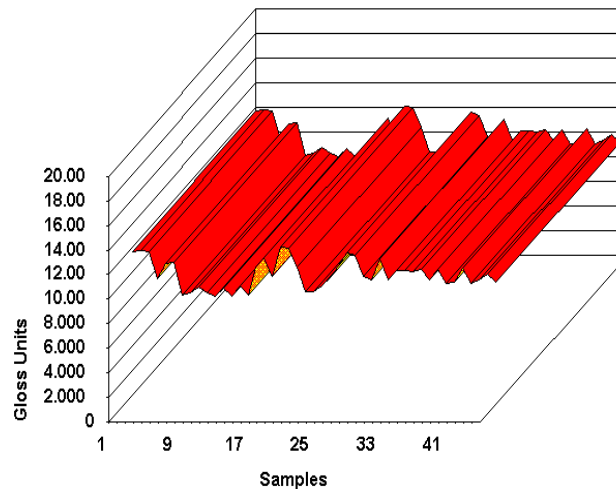

Fig. 8.7.3. An example of a typical 3D plot produced by NOVO-SOFT.

Rescaling 3D graphs is the same as for 2D graphs, but additional options affecting the appearance of the graph on the screen are given below:

- Toggle - When handling large volumes of data, 3D viewing may become a little confused. Toggle enables you to view the graph in more manageable portions.

- Rotate - Changes the horizontal angle at which you view the graph from.

- Aspect - Changes the vertical angle at which you view the graph from.

The effects of both Rotate and Aspect are best discovered by experimenting with the software.

8.7.4 Report Printing

The print option will produce a hardcopy report comprising the graph currently displayed, the comment and the statistical information. The text contained in the Document Header box in the *Configuration* Window (see section 8.2.3) appears at the top of the report.

8.7.5 Exporting Graphics

Copy will copy the graph as it currently appears (2D or 3D) to the clipboard. This is useful if you wish to produce your own graphical

reports, and it may be saved as a *.CLP file, or pasted directly into another application, as was done in producing this manual.

8.8 Statistical Graphs Window

8.8.1 General

The *Statistical Graphs* Window (fig. 8.8.1) can be reached from either the *Results* or *Statistics* Windows. Data is displayed both as a Bar Chart (Histogram) and as a Normal Distribution. The limits for both charts are preset, though future versions of NOVO-SOFT will allow greater versatility. The Copy option can be used to copy either graph to the clipboard, as outlined in section 8.7.5.
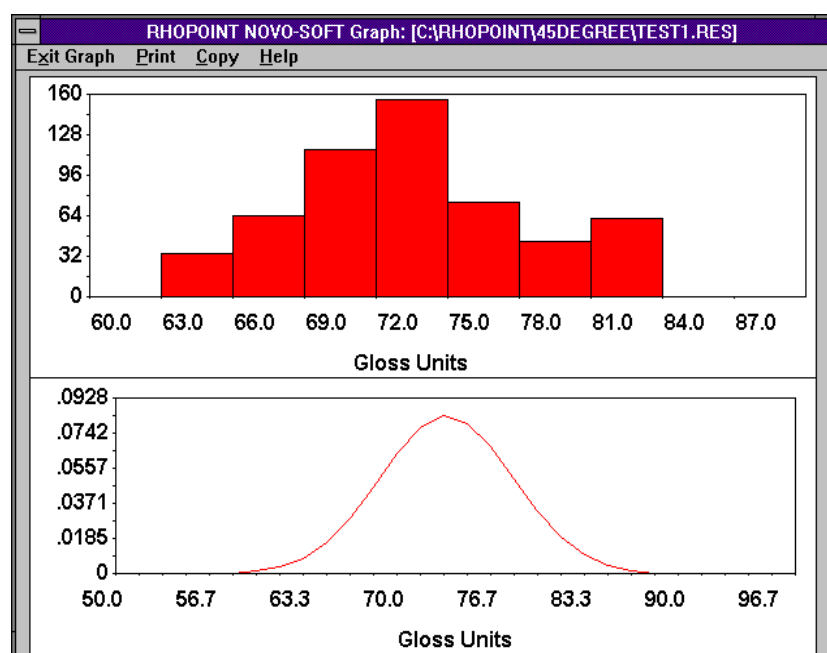

Fig. 8.8.1. The *Statistical Graphs* Window.

8.8.2 Histogram

The histogram produced by NOVO-SOFT (fig. 8.8.2) is always divided into ten bars. The values represented are all those from the value under the bar up to the value of the next. As the bars are equispaced, the final bar will cover the same size range as the others.   The catchment area of each bar is automatically determined, as is the frequency scale on the *y*-axis. If your sample population contains any rogue data points which are greatly different in value from the mean (see section 8.6.3), it is better to tag (see section 8.5.3) these points to produce a useful histogram.
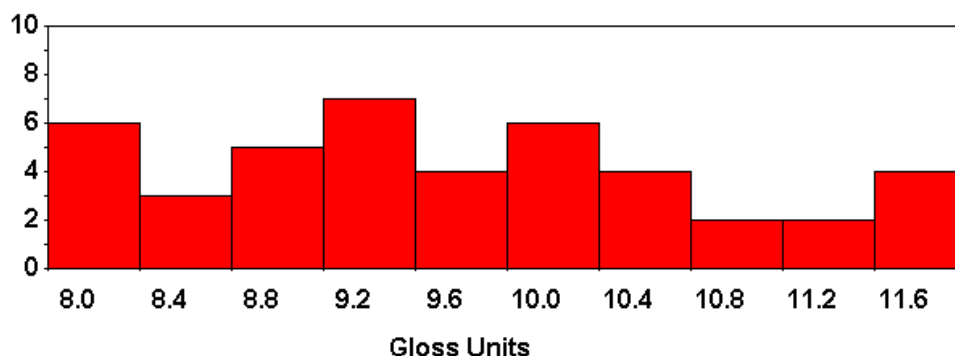
Fig. 8.8.2. A typical histogram produced by NOVO-SOFT.

8.8.3 Normal Distribution

The shape of a normal distribution (fig. 8.8.3) gives a measure of data scatter. The broader the peak, the more diverse the data. The scale on the *y*-axis is determined from the fact that, by definition, the area under a normal curve is always equal to unity. It will tend to be scaled to larger values when the data is less diverse.
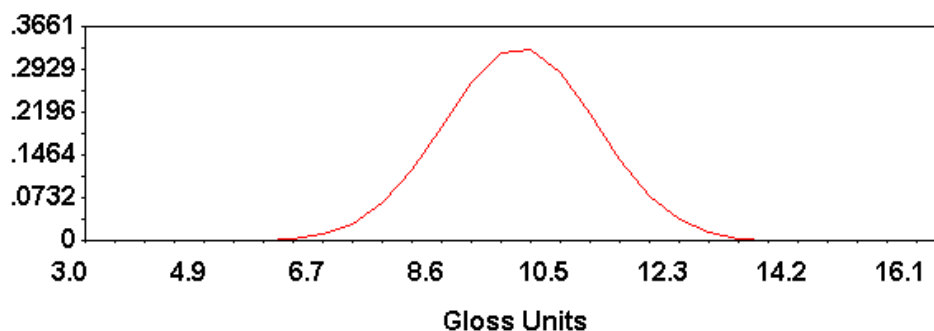

Fig. 8.8.3. A typical normal distribution graph produced by NOVO-SOFT.

9 OPTIMISING MEASUREMENTS

9.1 General Measurement Tips

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

Reflectometers, hazemeters and glossmeters integrate 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/reflectometer/hazemeter 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/reflectance/haze 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/haze, and to a lesser extent reflectance, measurement on very uneven surfaces will be unreliable. Care must also be taken when looking at curved surfaces. The 85° and 75° geometries are totally unsuited to this purpose, and should be used only on flat surfaces. The 60°, 45°, 45°/0° and 20° geometries get progressively better at this task, but will still only give reliable readings on curved surfaces of >125 mm radius. Best results are obtained on cylinders when measuring parallel to the axis. For accurate gloss measurement on surfaces of radius as low as 12 mm, a special instrument, NOVO-CURVE, is available.

9.2 Gloss and Haze Measurement Only

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 determined by the angle, which is, for example, in the case of a 60° glossmeter, an ellipse measuring 10×20 mm.

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.

Since haze combines two gloss readings, the effects for gloss are compounded when measuring this parameter.

9.3 Reflectance Measurement Only

Reflectance is measured by integrating the light emitted vertically (0°) from a sample illuminated from the side at an angle of 45°. Since this is not the natural direction for reflected light to travel, reflectance measurement requires some degree of surface roughness to scatter light. A highly polished reflector will appear black to the instrument, and it is for this reason that a polished black tile is used as a zero calibration standard.

9.4 Care of Calibration Standards

Calibration standards should be kept scrupulously clean, and stored safely when not in use. The surface should never be touched or wiped with a cloth or solvents. Cleaning should only be carried out using dry, compressed air. Any marks on the surface, such as scratches, grease or dust, will invalidate the calibration value assigned to the standard. Standards should be calibrated every year by returning either directly to a recognised calibration house, such as BAM (Germany) or NRC (Canada), or to a dealer using standards traceable to these institutions, such as Rhopoint.

☺ Produced by Dr Graham J Sewell, February 1997, Revised November 1997

Statistical NOVO-GLOSS™, Statistical NOVO-SHADE and NOVO-HAZE are manufactured in the UK by:

RHOPOINT INSTRUMENTATION LTD

Rhopoint Instrumentation Ltd
Beeching Road
Bexhill-on-Sea
East Sussex
TN39 3LG, UK

Tel: +44/0 1424 214291
Fax: +44/0 1424 730600
Email: instruments@rhopoint.co.uk
Website: www.rhopoint.co.uk

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