

Elcometer 2300

Rotational Viscometer and ViscosityMaster Software

Operating Instructions



The Elcometer Rotary Viscometer 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.

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

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SECTION A: VISCOMETER

Thank you for purchasing this Elcometer Rotary Viscometer. 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 Rotary Viscometer 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 VISCOMETER

The Elcometer Rotary Viscometer measures the viscosity of liquids in accordance with ISO 2555 and many ASTM standards.

A spindle fitted with a disc or a cylinder is rotated in the sample to be tested. A spring is connected between the spindle and the motor shaft which rotates at a fixed speed. The angle of deviation between the spindle and the motor shaft is measured electronically and converted to torque. The torque measured by the Viscometer is a function of:

- spindle rotation speed
- spindle geometry (disc/cylinder size)
- viscosity of the test sample

Taking into account the spindle rotation speed and the spindle geometry, viscosity is calculated and displayed directly in SI or CGS units.

A range of spindles is supplied with the Viscometer; the combination of the appropriate spindle and spindle rotation speed allows readings to be taken over a very wide range of viscosity.

Optional accessories enable measurement of:

- Low viscosity samples - at temperatures up to 100°C (212°F)
- Low viscosity samples - at temperatures up to 200°C (392°F)
- Small volumes of sample
- Difficult-to-measure samples such as creams, gels, waxes and pastes, etc.

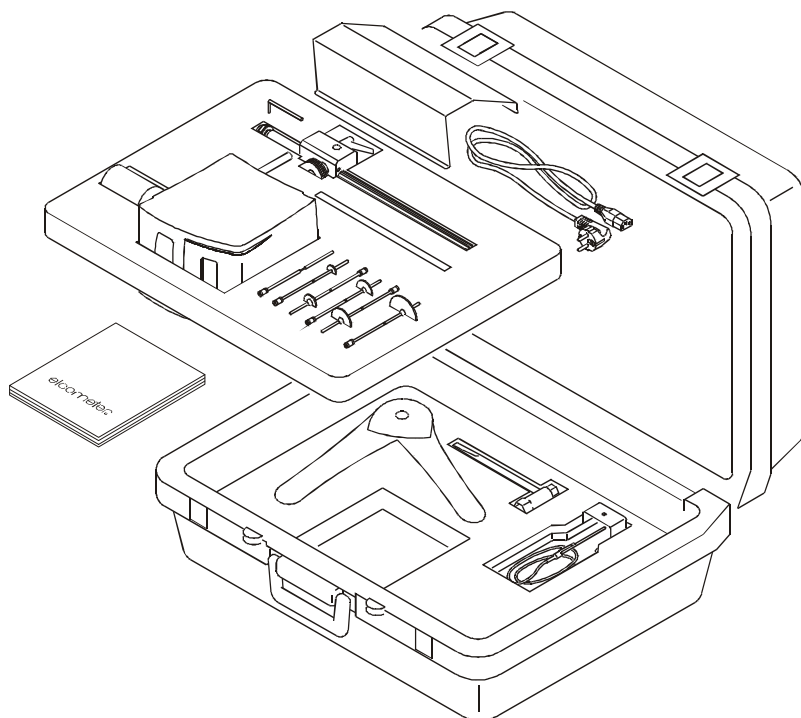
See "Spare parts and accessories" on page 28 for details of all accessories.

1.1 These instructions

These instructions describe the operation of the following Elcometer Rotary Viscometers:

- Elcometer 2300 RV1-L (low to medium viscosity tests)
- Elcometer 2300 RV1-R (medium to high viscosity tests)
- Elcometer 2300 RV2-L (low to medium viscosity tests, PC controlled)
- Elcometer 2300 RV2-R (medium to high viscosity tests, PC controlled)

1.2 What the box contains



- Viscometer head
- Column with head mounting bracket
- Spindles L1 to L4 or R2 to R7 (R2 to R7 shown in illustration)
- Base
- Box spanner tool
- Hexagonal wrench
- Spindle guard
- Power supply cable
- Storage rack
- PT100 Temperature probe
- RS 232 connection cable
- ViscosityMaster software
- Calibration certificate
- Operating instructions
- Carrying case

1.3 Standards

Your Viscometer can be used in accordance with the following National and International Standards:

- BS 3900 A7-2
- ISO 2884-2
- ASTM D2196

1.4 Features of your Viscometer

- 19 speeds from 0.3 rpm to 200 rpm
- PT100 temperature probe
- RS 232 interface (bidirectional on RV2 models)
- Data download software
- Remote control via PC (RV2 models only)
- Audible warning if viscosity reading exceeds the optimum measuring range
- 4 line display showing:
 - Viscosity (cP or mPa•s)
 - Spindle rotation speed
 - % scale (Brookfield)
 - Sample temperature
 - Auto range
 - Shear rate (RV2 models only)
 - Shear stress (RV2 models only)

Your Elcometer Rotary Viscometer 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.

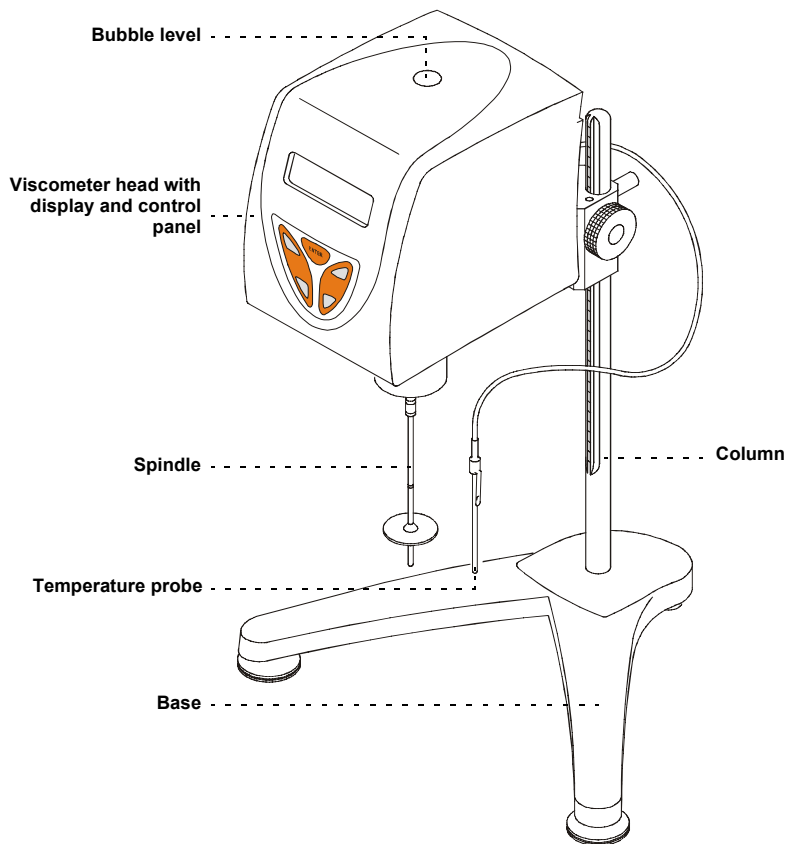
To maximise the benefits of your new Elcometer Rotary Viscometer please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.

GETTING STARTED

2 GETTING STARTED

This section of the instructions is intended for first-time users of the Elcometer Rotary Viscometer. It contains information on the parts and controls of the instrument and advice on safe use of the equipment. When you have finished reading this section you will be ready to start using your Elcometer Rotary Viscometer.

2.1 The parts of the instrument



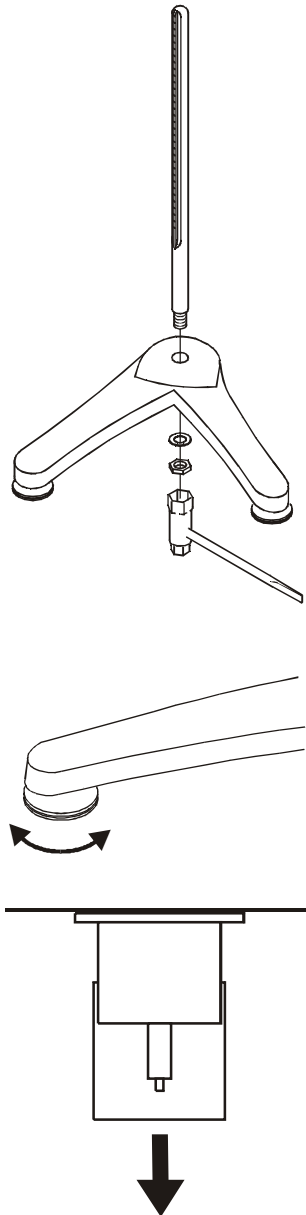
2.2 Assembling the Viscometer

To assemble your Viscometer:

1. Remove the nut from the bottom end of the column.
2. Fit the column onto the base with the slot facing towards the front.
3. Fit the nut onto the bottom of the column and tighten using the box spanner supplied with your Viscometer.
4. Place the base and column on a stable and flat surface.
5. Insert the rear rod of the Viscometer head through the hole in the mounting bracket on the column.
6. Rotate the mounting bracket lever to lock the Viscometer head in position.
7. Rotate the two adjustable legs of the base until the Viscometer is level; use the bubble level on the top of the instrument as a guide.
8. Remove the plastic protection cap from the bottom of the Viscometer; pull the cap vertically down until it is well clear of the drive coupling and then remove to one side.

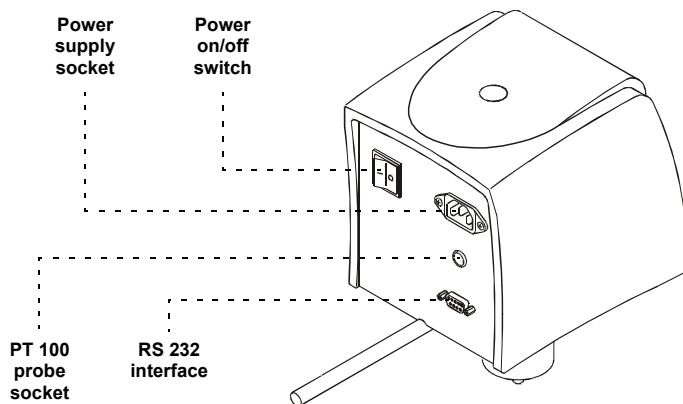
Do not throw the protection cap away. Always replace the protection cap when the instrument is not in use.

9. Connect the instrument to the mains.



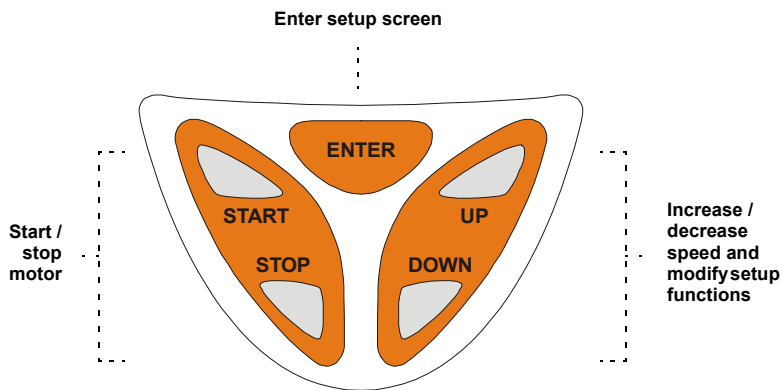
GETTING STARTED

2.3 Rear connections



2.4 Control panel

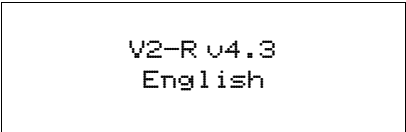
Your Viscometer is controlled^a using the five buttons on the control panel on the front of the Viscometer head.



a. Viscometer models RV2 can be connected to a PC and controlled remotely via the supplied ViscosityMaster software - see the instructions supplied with the software.

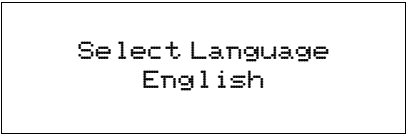
2.5 Configuring your Viscometer

Switch on the Viscometer by pressing the power on/off switch at the rear of the Viscometer head. A welcome message will be displayed for a period of two seconds. The contents of the message will depend upon the model, software version and language setting:



V2-R v4.3
English

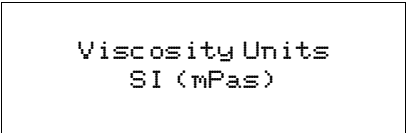
While this message is displayed, press the [START] and then the [ENTER] buttons. The **language** selection screen will appear:



Select Language
English

Using the [UP] or [DOWN] buttons, select the desired language (German, Catalan, Spanish, French, English, Italian or Portuguese). Press [ENTER] to confirm your selection.

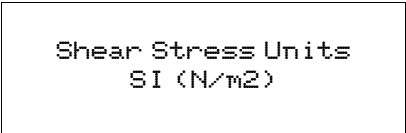
The **viscosity units** selection screen will appear:



Viscosity Units
SI (mPas)

Using the [UP] or [DOWN] buttons, select the viscosity units, SI (mPa•s) or CGS (cP). Press [ENTER] to confirm your selection.

Model RV2 only: The **shear stress units** selection screen will appear:

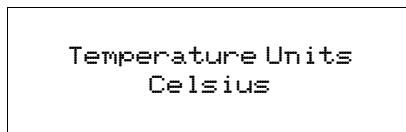


Shear Stress Units
SI (N/m²)

Using the [UP] or [DOWN] buttons, select the shear stress (S.S.) units, SI (N/m²) or CGS (dyne/cm²). Press [ENTER] to confirm your selection.

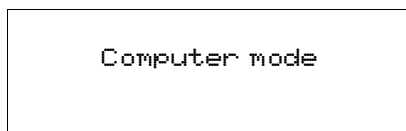
GETTING STARTED

The **temperature units** selection screen will appear:



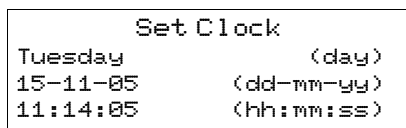
Using the [UP] or [DOWN] buttons, select the temperature units, Celsius or Fahrenheit. Press [ENTER] to confirm your selection.

The **mode** selection screen will appear:



Using the [UP] or [DOWN] buttons, select the required mode, Printer or Computer. Press [ENTER] to confirm your selection.

The **set clock** screen will appear:



The day of the week flashes.

Use the [UP] or [DOWN] buttons to change it, if necessary. Press [ENTER] to confirm your selection.

The first digit of the date flashes.

Use the [UP] or [DOWN] buttons to change it, if necessary. Press [ENTER] to confirm your selection.

And so on, until all date and time values are correct.

The presentation screen will appear for two seconds and immediately afterwards the data screen will be displayed.

If the mode was changed (from Printer to Computer or vice versa), switch off the Viscometer and then switch on again.

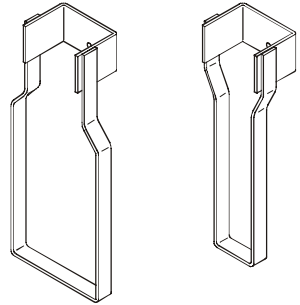
2.6 Fitting the spindle guard

The spindle guard supplied with your Viscometer has two functions:

- It provides physical protection for spindle types L and R.
- It allows accurate measurements to be taken with the large spindles (L1 and R1, R2, R3).

Use of the spindle guard with spindles other than the L1 and R1, R2, R3 is optional.

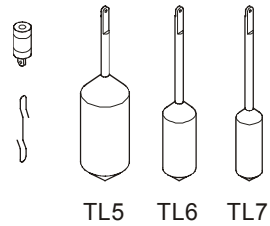
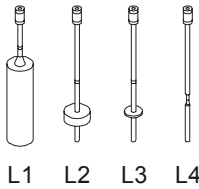
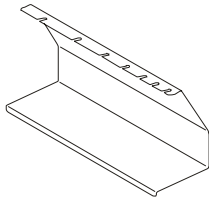
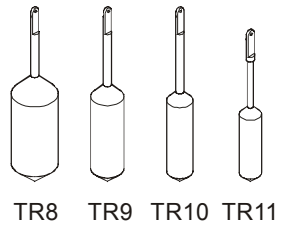
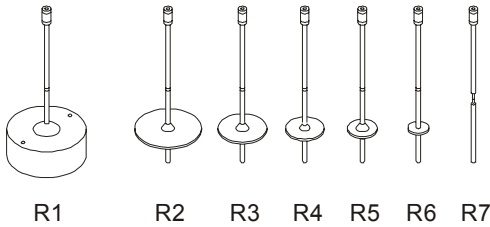
To fit the spindle guard, attach the guard to the Viscometer head using the knurled screw.



GETTING STARTED

2.7 Spindle types

| Spindle type | Use with | Used for measurement of |
|-------------------------------------|--|---------------------------------|
| L (included with Viscometer) | Elcometer 2300 RV1-L Elcometer 2300 RV2-L | Low to medium viscosity fluids |
| R (included with Viscometer) | Elcometer 2300 RV1-R Elcometer 2300 RV2-R | Medium to high viscosity fluids |
| TL (optional accessory) | Elcometer 2300 RV1-L Elcometer 2300 RV2-L + Small sample volume adaptor kit | Small volumes of fluid |
| TR (optional accessory) | Elcometer 2300 RV1-R Elcometer 2300 RV2-R + Small sample volume adaptor kit | Small volumes of fluid |
| LCP (optional accessory) | Elcometer 2300 RV1-L Elcometer 2300 RV1-R Elcometer 2300 RV2-L Elcometer 2300 RV2-R + Low viscosity materials adaptor kit | Low viscosity fluids |



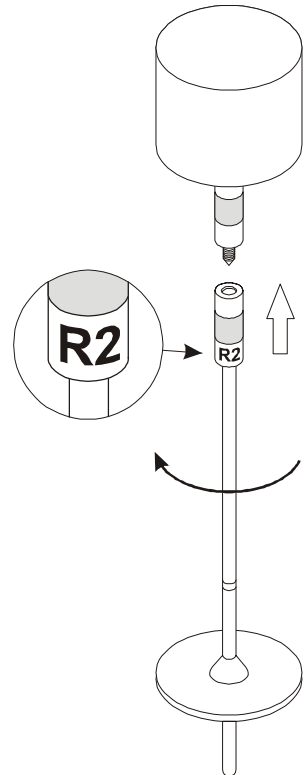
See “Spindle selection tables” on page 19 for further details

2.8 Fitting the spindle



Note: *This operation must be done very carefully to ensure that the spindle is not bent and the motor drive coupling or internal components are not damaged.*

1. Consult "Spindle selection tables" on page 19 to identify the correct spindle to use; the spindle type is stamped into the spindle coupling.
2. Check that the threads and connecting surfaces of the spindle and the motor drive coupling are clean.
3. If the spindle is of a disc type, it should be submerged carefully in the sample to avoid bubbles forming under its lower surface.
4. Grasp the motor drive coupling with one hand, raise it slightly and then screw the spindle onto the coupling gently. *The screw has a left-hand thread.*
5. Adjust the height of the Viscometer head until the spindle is immersed in the sample up to the immersion point, indicated by a groove on the spindle. *Take care to avoid knocking the sample container against the spindle during this operation as this may damage the spindle and motor drive coupling.*



2.9 Caution



The Elcometer Rotary Viscometer has been manufactured with your safety in mind. However, improper use can result in damage to the machine.

Please observe the precautions discussed in these operating instructions.

- To reduce the risk of electric shock, do not open the head of the Viscometer. There are no user-serviceable parts inside.
- To reduce the risk of fire or electric shock, do not expose the Viscometer to rain or excess moisture.
- The mains plug on your Viscometer may be fitted with a fuse. When replacing this fuse, ensure a fuse of the correct rating is used.

USING YOUR VISCOMETER

3 USING YOUR VISCOMETER

This section describes how to take measurements with your Viscometer. The instructions apply to RV1 Viscometers and to RV2 Viscometers under manual operation. For additional instructions on using RV2 Viscometers interfaced to a PC, refer to "ViscosityMaster Software" on page 30.

3.1 Before you start

1. Attach the spindle guard (if necessary) - See "Fitting the spindle guard" on page 9.
2. Attach the spindle - See "Fitting the spindle" on page 11.
3. Lower the spindle into the test sample.
4. Insert the temperature probe connector into the socket on the rear of the Viscometer head and place the probe into the sample.

3.2 Setting spindle type and rotation speed

1. Switch on the Viscometer by pressing the power on/off switch at the rear of the Viscometer head. A welcome message will be displayed for a period of two seconds. The contents of the message will depend upon the model, software version and language setting:

```
V2-R v4.3
English
```

After two seconds, the data screen will be displayed, showing the latest spindle and speed parameters used (these were stored in memory the last time the instrument was used).

```
rpm      60                      R5
mPas
temp                        20.5°C
range                      10000 mPas
```

2. The spindle type flashes. Use the [UP] or [DOWN] buttons to modify the spindle type. Press [ENTER] to confirm your selection.

The rotation speed (rpm) flashes. Use the [UP] or [DOWN] buttons to modify the rotation speed. Press [ENTER] to confirm your selection.

The parameter 'range' indicates the maximum viscosity value which can be measured using the selected combination of spindle and rotation speed.

The message 'press start' will flash on the fourth line of the display, indicating that the Viscometer is now ready to be started.

```
rpm      60                      R5
mPas
temp                        20.5°C
Press start
```


3.3 Starting a measurement

1. Press [START] to start the measurement.

Stable flow conditions are reached quickly and the viscosity readings on the display of the Viscometer can be considered correct within a few seconds (depending on the selected speed and the viscosity of the sample).

If the viscosity reading exceeds the optimum measuring range (<10% and >90% of selected full scale), the instrument will give a warning beep.

The message 'ERROR' appearing on the screen indicates that the maximum viscosity value has been exceeded. In this case, the speed should be reduced or a higher range spindle should be used.

2. When you are satisfied that the reading is stable, press [STOP] to stop the motor. The motor will slow down smoothly until 0 rpm is reached; this protects the delicate parts of the instrument.

The last viscosity reading will be retained on the display.

| | | |
|-------|------|------------|
| rpm | 60 | R5 |
| mPas | 5000 | 50.8% |
| temp | | 20.5°C |
| range | | 10000 mPas |

On pressing [START] again, the Viscometer will restart at the preset speed.

If you are using an RV2 Viscometer

The information shown on the display of an RV2 Viscometer is identical to that shown on an RV1 Viscometer unless the optional accessories are being used.

If the Adaptor for Small Sample Volumes or the Adaptor for Low Viscosity Materials is being used, the bottom two lines of the display will show the Shear Rate (S.R.) and the Shear Stress (S.S.).

| | | |
|------------------|-------|--------|
| rpm | 60 | LCP |
| mPas | 4.05 | 40.9% |
| 1/sec | 73.38 | 20.5°C |
| N/m ² | 3.12 | |

Changing spindle rotation speed and spindle type

To modify the spindle rotation speed and spindle type, while the motor is running, press [ENTER] to return to the data screen.

3.4 Viscosity measurement problems

Unstable viscosity readings may be caused by changes in the temperature of the sample or by the behaviour of the product itself.

If the readings obtained are not stable, the temperature of the sample should be controlled and stabilised. If the readings remain unstable once the temperature has been controlled, the instability is due to the interaction between the product sample and the movement of the spindle.

In this instance, the product is called 'Non-Newtonian' and the behaviour of the product can be described as thixotropic, rheopexy, dilatant, pseudoplastic, etc. The same settings (spindle, speed

PRINTING TEST RESULTS

and temperature) should always be used to test this type of product and additional parameters should be recorded such as the time elapsed before first measurement, sampling interval, etc.

3.5 After use

Clean the instrument and spindle.



Always remove the spindle from the instrument before cleaning. The spindle or motor coupling will almost certainly be damaged if attempts are made to clean the spindle while it is still attached to the instrument.



Do not use very aggressive solvents or wire brushes, metal scrapers, metal files or other metallic tools. Do not use excessive force which might otherwise bend delicate spindles.



Clean the spindle and other parts using a suitable solvent only.

After cleaning and before storing the instrument ensure that all materials are removed and that the instrument is dry.

4 PRINTING TEST RESULTS

Test results from your Viscometer can be printed using two methods:

- ViscosityMaster software
- Printing Mode

Use of **ViscosityMaster** software provides the greatest flexibility and allows for printing, storage and graphical analysis of test results. Full instructions for ViscosityMaster can be found in "ViscosityMaster Software" on page 30.

Printing Mode provides a quick and easy way to print individual test results. Connect your Viscometer to a suitable printer (see "Thermal printer" on page 29), press the START button and the test results will be printed.

To use Printing Mode:

1. Switch on your Viscometer and set it to Printing Mode - see "Configuring your Viscometer" on page 7.
2. Connect your Viscometer to the printer using a null-modem^b cable.
3. Whenever the START button is pressed the test results will be sent to the printer.

ROTATIONAL VISCOMETER

Model: _____

Ser. No. _____

Hour: xx:xx

Date: dd-mm-yy

TEMPERATURE

OF TEST FLUID: _____

OF SPINDLE: _____

OF CUP: _____

TEMP: xx.x "C or "F

Signature: _____

Note: When Printing Mode is OFF, switch off your printer - otherwise a continuous stream of test results will be printed.

b. Null-modem pin connections:

9 pin connector
(male)

25 pin connector
(male)

Pin 7 <.....(ground).....> Pin 5

Pin 2 <.....> Pin 3

Pin 3 <.....> Pin 2

5 USING THE OPTIONAL ACCESSORIES

A number of optional accessories are available which will extend the capabilities of your Viscometer. For ordering information, See "Spare parts and accessories" on page 28

5.1 Adaptor for small sample volumes

The adaptor for small sample volumes allows precise measurement of the viscosity of small sample volumes (8 ml to 13 ml). The adaptor is suitable for use with all models of the Elcometer Rotary Viscometer.

There are two types of this adaptor:

- without an integrated temperature sensor
- with an integrated temperature sensor

Although the following instructions describe the version which does not have an integrated temperature sensor, they may also be used for the version which does have a temperature sensor as it is very similar in design.

The adaptor consists of a water jacket, sample chamber and a mounting bracket. Special spindles types TL or TR are used with this adaptor.

Water from an external heating bath is circulated through the jacket surrounding the sample chamber; this allows the sample to be maintained precisely at a set temperature of -10°C to 100°C (14°F to 212°F).

See also "Small volume samples adaptor kit" on page 28.

Viscosity range

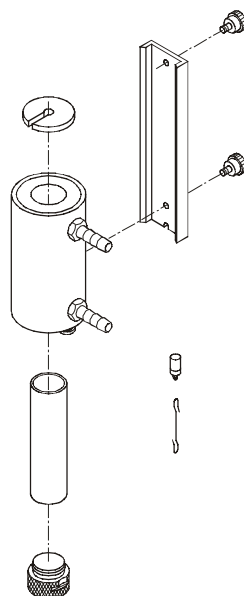
Version L: 3 mPa•s to 200 000 mPa•s

Version R: 40 mPa•s to 3 300 000 mPa•s

Using the adaptor

1. Attach the appropriate spindle to the Viscometer motor drive coupling using the screwed coupling and mounting hook.
2. Attach one end of the mounting bracket to the water jacket, as shown; note the locating pin which allows the bracket to be attached the correct way only.
3. Slide the water jacket slowly and carefully over the spindle and then attach the other end of the bracket to the head of your Viscometer.
4. Fit the end cap to the bottom of the stainless steel sample chamber.
5. Fill the sample chamber with a suitable volume of the fluid to be tested; 8 ml to 13 ml (0.27 oz to 0.44 oz) - depending upon spindle.
6. Slide the sample chamber up into the water jacket and rotate to lock into position.
7. Fit the cover around the spindle hook and lower it onto the top of the sample chamber.
8. Connect the external heating bath to the water jacket inlet and outlet and then leave it operating for a sufficient amount of time for the temperature of the sample to stabilise.

The adaptor for small sample volumes is now ready to use.



USING THE OPTIONAL ACCESSORIES

5.2 Adaptor for low viscosity samples

The adaptor for low viscosity samples allows precise measurement of the viscosity of low viscosity samples (16 ml to 18 ml), both Newtonian and non Newtonian. The adaptor is suitable for use with all models of the Elcometer Rotary Viscometer.

There are two types of this adaptor:

- with water jacket - for indirect heating up to 100°C (212°F)
- without water jacket - for sample temperatures up to 200°C (392°F)

Although the following instructions describe the version which has a water jacket, they may also be used for the unheated version which is very similar in design.

The adaptor consists of a water jacket, sample chamber, a mounting bracket, a column extension piece and a special cylindrical spindle (LCP).

Water from an external heating bath is circulated through the jacket surrounding the sample chamber; this allows the sample to be maintained precisely at a set temperature of -10°C to 100°C (14°F to 212°F).

For ordering information see "Low viscosity adaptor kit - with water jacket" on page 28 and "Low viscosity adaptor kit - without water jacket" on page 28.

Viscosity range

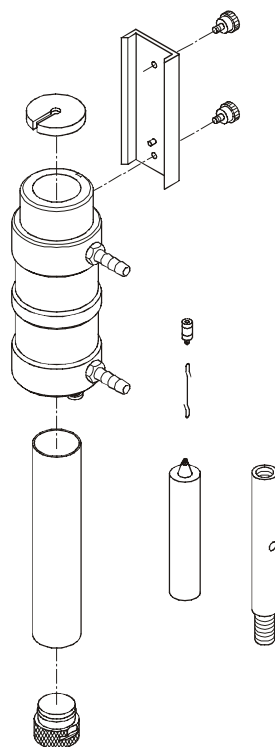
Version L: 0.5 mPa•s to 2000 mPa•s

Version R: 4.8 mPa•s to 21 333 mPa•s

Using the adaptor

1. Fit the extension piece to the column. This raises the Viscometer head sufficiently to allow the adaptor for low viscosity samples to be used correctly.
2. Attach the LCP spindle to the Viscometer motor drive coupling using the screwed coupling and mounting hook.
3. Attach one end of the mounting bracket to the water jacket, as shown; note the locating pin which allows the bracket to be attached the correct way only.
4. Slide the water jacket slowly and carefully over the spindle and then attach the other end of the bracket to the head of your Viscometer.
5. Fit the end cap to the bottom of the stainless steel sample chamber.
6. Fill the sample chamber with a suitable volume of the fluid to be tested; 16 ml to 18 ml (0.54 oz to 0.61 oz).
7. Slide the sample chamber up into the water jacket and rotate to lock into position.
8. Fit the cover around the spindle hook and lower it onto the top of the sample chamber.
9. Connect the external heating bath to the water jacket inlet and outlet and then leave it operating for a sufficient amount of time for the temperature of the sample to stabilise.

The adaptor for low viscosity samples is now ready to use.



5.3 Adaptor for helical movement

The adaptor for helical movement allows precise measurement of the viscosity of samples such as cream, gel, wax, paste, putty, gelatine, etc. The adaptor is suitable for use with all models of the Elcometer Rotary Viscometer.

The adaptor moves the Viscometer head slowly up and down. This movement causes the spindle to trace a helical path through the sample, therefore avoiding the creation of voids in the sample which would otherwise make measurement impossible.

The adaptor consists of:

- drive mechanism with head mounting bracket and mains lead
- spindle clamp/coupling and weight
- spacer tube
- ring clamp, x 2
- set of P series spindles

water jacket, sample chamber, a mounting bracket, a column extension piece and a special cylindrical spindle (LCP).

The adaptor is used with special T-type spindles - PA, PB, PC, PD, PE, PF

See also "Helical movement adaptor kit" on page 29.

Viscosity range

Version L: 156 mPa·s to 3 120 000 mPa·s

Version R: 1660 mPa·s to 33 300 000 mPa·s

Using the adaptor

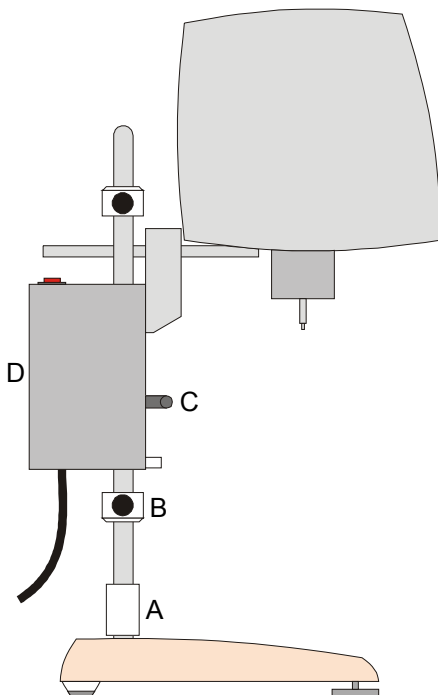
1. Remove the standard head mounting bracket from the column.
2. Slide the spacer tube (A) onto the column until it rests on the base.
3. Slide one of the ring clamps (B) onto the column.
4. Press and hold lever (C) of the drive mechanism upwards and slide the drive mechanism (D) onto the column. Release lever (C) to engage the drive mechanism with the column.



USING THE OPTIONAL ACCESSORIES

5. Slide the second ring clamp onto the column.
6. Insert the rod of the Viscometer head through the hole in the mounting bracket on the drive mechanism and rotate the mounting bracket lever to lock the Viscometer head in position.
7. Screw the weight onto the spindle clamp/coupling.
8. Select the appropriate spindle (See "P series spindles" on page 24) and insert it into the spindle clamp/coupling. Twist the body of the clamp to lock the spindle in position.
9. Attach the spindle clamp/coupling to the Viscometer motor drive coupling - See "Fitting the spindle" on page 11.
10. Adjust the position of the two ring clamps to give the desired amount of vertical movement and clamp into position.

The adaptor for helical movement is now ready to use. Connect to the mains supply and press the power on/off switch to switch it on.



6 SPINDLE SELECTION TABLES

6.1 L and TL Spindles (For use with RV1-L / RV2-L Viscometers).

Table 1: Spindle type L^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | | |
|---------------------|---|---------|----------|-----------|
| | L1 ^c | L2 | L3 | L4 |
| 0.3 | 20 000 | 100 000 | 400 000 | 2 000 000 |
| 0.5 | 12 000 | 60 000 | 240 000 | 1 200 000 |
| 0.6 | 10 000 | 50 000 | 200 000 | 1 000 000 |
| 1 | 6000 | 30 000 | 120 000 | 600 000 |
| 1.5 | 4000 | 20 000 | 80 000 | 400 000 |
| 2 | 3000 | 15 000 | 60 000 | 300 000 |
| 2.5 | 2400 | 12 000 | 48 000 | 240 000 |
| 3 | 2000 | 10 000 | 40 000 | 200 000 |
| 4 | 1500 | 7500 | 30 000 | 150 000 |
| 5 | 1200 | 6000 | 24 000 | 120 000 |
| 6 | 1000 | 5000 | 20 000 | 100 000 |
| 10 | 600 | 3000 | 12 000 | 60 000 |
| 12 | 500 | 2500 | 10 000 | 50 000 |
| 20 | 300 | 1500 | 6000 | 30 000 |
| 30 | 200 | 1000 | 4000 | 20 000 |
| 50 | 120 | 600 | 2400 | 12 000 |
| 60 | 100 | 500 | 2000 | 10 000 |
| 100 | 60 | 300 | 1200 | 6000 |
| 200 | 30 | 150 | 600 | 3000 |
| Resolution | 1 mPa•s | 1 mPa•s | 10 mPa•s | 10 mPa•s |

a. Type L spindles are the standard spindles supplied with RV1-L/RV2-L Viscometers.



- b. The minimum recommended reading is 15% of the full scale value.
- c. The L1 spindle is used for low viscosity measurement. The spindle guard must be used with this spindle in order to obtain correct viscosity readings. For higher accuracy when measuring low viscosity samples, use the Adaptor for Low Viscosity Materials and the special cylindrical spindle (LCP); See "Spare parts and accessories" on page 28.

SPINDLE SELECTION TABLES

Table 2: Spindle type TL^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | |
|---------------------|---|------------------|------------------|
| | TL5 ^c | TL6 ^d | TL7 ^e |
| 0.3 | 10 000 | 100 000 | 200 000 |
| 0.5 | 6000 | 60 000 | 120 000 |
| 0.6 | 5000 | 50 000 | 100 000 |
| 1 | 3000 | 30 000 | 60 000 |
| 1.5 | 2000 | 20 000 | 40 000 |
| 2 | 1500 | 15 000 | 30 000 |
| 2.5 | 1200 | 12 000 | 24 000 |
| 3 | 1000 | 10 000 | 20 000 |
| 4 | 750 | 7500 | 15 000 |
| 5 | 600 | 6000 | 12 000 |
| 6 | 500 | 5000 | 10 000 |
| 10 | 300 | 3000 | 6000 |
| 12 | 250 | 2500 | 5000 |
| 20 | 150 | 1500 | 3000 |
| 30 | 100 | 1000 | 2000 |
| 50 | 60 | 600 | 1200 |
| 60 | 50 | 500 | 1000 |
| 100 | 30 | 300 | 600 |
| 200 | 15 | 150 | 300 |
| Resolution | 0.1 mPa•s | 1 mPa•s | 10 mPa•s |

- a. Type TL spindles are the optional spindles for use with the Adaptor for Small Sample Volumes; See “Spare parts and accessories” on page 28.



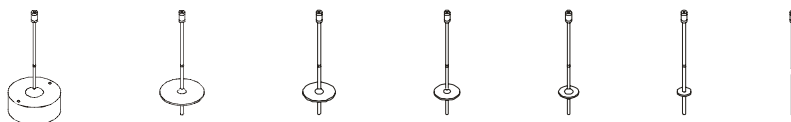
- b. The minimum recommended reading is 15% of the full scale value.
c. TL5 shear rate: 1.32 x rpm with sample volume of 8.0 cm³
d. TL6 shear rate: 0.34 x rpm with sample volume of 10.0 cm³
e. TL7 shear rate: 0.28 x rpm with sample volume of 9.5 cm³

6.2 R and TR Spindles (For use with RV1-R / RV2-R Viscometers)

Table 3: Spindle type R^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | | | | | |
|------------------------|---|---------|----------|----------|-----------|-----------|------------|
| | R1 ^c | R2 | R3 | R4 | R5 | R6 | R7 |
| 0.3 | 33 300 | 133 300 | 333 300 | 666 600 | 1 300 000 | 3 330 000 | 13 300 000 |
| 0.5 | 20 000 | 80 000 | 200 000 | 400 000 | 800 000 | 2 000 000 | 8 000 000 |
| 0.6 | 16 600 | 66 600 | 166 600 | 333 300 | 666 600 | 1 600 000 | 6 600 000 |
| 1 | 10 000 | 40 000 | 100 000 | 200 000 | 400 000 | 1 000 000 | 4 000 000 |
| 1.5 | 6600 | 26 600 | 66 600 | 133 300 | 266 600 | 666 600 | 2 600 000 |
| 2 | 5000 | 20 000 | 50 000 | 100 000 | 200 000 | 500 000 | 2 000 000 |
| 2.5 | 4000 | 16 000 | 40 000 | 80 000 | 160 000 | 400 000 | 1 600 000 |
| 3 | 3300 | 13 300 | 33 300 | 66 600 | 133 300 | 333 300 | 1 300 000 |
| 4 | 2500 | 10 000 | 25 000 | 50 000 | 100 000 | 250 000 | 1 000 000 |
| 5 | 2000 | 8000 | 20 000 | 40 000 | 80 000 | 200 000 | 800 000 |
| 6 | 1600 | 6600 | 16 600 | 33 300 | 66 600 | 166 600 | 666 000 |
| 10 | 1000 | 4000 | 10 000 | 20 000 | 40 000 | 100 000 | 400 000 |
| 12 | 833 | 3300 | 8300 | 16 600 | 33 300 | 83 300 | 333 300 |
| 20 | 500 | 2000 | 5000 | 10 000 | 20 000 | 50 000 | 200 000 |
| 30 | 333 | 1300 | 3300 | 6600 | 13 300 | 33 300 | 133 300 |
| 50 | 200 | 800 | 2000 | 4000 | 8000 | 20 000 | 80 000 |
| 60 | 166 | 660 | 1600 | 3300 | 6600 | 16 600 | 66 600 |
| 100 | 100 | 400 | 1000 | 2000 | 4000 | 10 000 | 40 000 |
| 200 | 50 | 200 | 500 | 1000 | 2000 | 5000 | 20 000 |
| Resolution | 1 mPa•s | 1 mPa•s | 10 mPa•s | 10 mPa•s | 10 mPa•s | 100 mPa•s | 100 mPa•s |

a. Type R spindles are standard spindles supplied with RV1-R/RV2-R Viscometers.



- b. The minimum recommended reading is 15% of the full scale value.
- c. Spindle R1 is used for measurement of samples having low viscosity. The spindle guard must be used with this spindle in order to obtain correct viscosity readings. Because models RV1-R and RV2-R are normally used for medium viscosity ranges, the spindle R1 is not very frequently used, therefore is not supplied as standard equipment with your Viscometer. However, it is available on request; See "Spare parts and accessories" on page 28.

SPINDLE SELECTION TABLES

Table 4: Spindle type TR^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | | |
|---------------------|---|------------------|-------------------|-------------------|
| | TR8 ^c | TR9 ^d | TR10 ^e | TR11 ^f |
| 0.3 | 166 600 | 833 300 | 1 600 000 | 3 300 000 |
| 0.5 | 100 000 | 500 000 | 1 000 000 | 2 000 000 |
| 0.6 | 83 300 | 416 600 | 833 300 | 1 600 000 |
| 1 | 50 000 | 250 000 | 500 000 | 100 000 |
| 1.5 | 33 300 | 166 600 | 333 300 | 666 600 |
| 2 | 25 000 | 125 000 | 250 000 | 500 000 |
| 2.5 | 20 000 | 100 000 | 200 000 | 400 000 |
| 3 | 16 600 | 83 300 | 166 600 | 333 300 |
| 4 | 12 500 | 62 500 | 125 000 | 250 000 |
| 5 | 10 000 | 50 000 | 100 000 | 200 000 |
| 6 | 8300 | 41 600 | 83 300 | 166 600 |
| 10 | 5000 | 25 000 | 50 000 | 100 000 |
| 12 | 4160 | 20 830 | 41 600 | 83 300 |
| 20 | 2500 | 12 500 | 25 000 | 50 000 |
| 30 | 1600 | 8300 | 16 600 | 33 300 |
| 50 | 1000 | 5000 | 10 000 | 20 000 |
| 60 | 830 | 4160 | 8300 | 16 600 |
| 100 | 500 | 2500 | 5000 | 10 000 |
| 200 | 250 | 1250 | 2500 | 5000 |
| Resolution | 10 mPa•s | 100 mPa•s | 100 mPa•s | 100 mPa•s |

- a. Type TR spindles are the optional spindles for use with the Adaptor for Small Sample Volumes; See "Spare parts and accessories" on page 28.



- b. The minimum recommended reading is 15% of the full scale value.
c. TR8 shear rate: $0.93 \times \text{rpm}$ with sample volume of 8.0 cm^3
d. TR9 shear rate: $0.34 \times \text{rpm}$ with sample volume of 10.5 cm^3
e. TR10 shear rate: $0.28 \times \text{rpm}$ with sample volume of 11.5 cm^3
f. TR11 shear rate: $0.25 \times \text{rpm}$ with sample volume of 13.0 cm^3

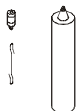
The Shear Rate (S.R.) has been calculated assuming the characteristics of newtonian products.

6.3 LCP Spindle

Table 5: Spindle type LCP^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | |
|---------------------|---|---------------|
| | RV1-L / RV2-L | RV1-R / RV2-R |
| 0.3 | 2000 | 21 333 |
| 0.5 | 1200 | 12 800 |
| 0.6 | 1000 | 10 666 |
| 1 | 600 | 6400 |
| 1.5 | 400 | 4266 |
| 2 | 300 | 3200 |
| 2.5 | 240 | 2560 |
| 3 | 200 | 2133 |
| 4 | 150 | 1600 |
| 5 | 120 | 1280 |
| 6 | 100 | 1066 |
| 10 | 60 | 640 |
| 12 | 50 | 533 |
| 20 | 30 | 320 |
| 30 | 20 | 213 |
| 50 | 12 | 128 |
| 60 | 10 | 106 |
| 100 | 6 | 64 |
| 200 | 3 | 32 |
| Resolution | 0.01 mPa•s | 0.16 mPa•s |

- a. Type LCP spindle is supplied as part of the Adaptor for Low Viscosity Materials kit of parts; See "Spare parts and accessories" on page 28.



- b. The minimum recommended reading is 15% of the full scale value.

Volume of sample container = 18 ml (0.61 oz)

Shear Rate (S.R.) = 1.224 x rpm

SPINDLE SELECTION TABLES

6.4 P series spindles

Table 6: P series spindles for RV1-L and RV2-L Viscometers^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | | | | |
|---------------------|---|---------|---------|---------|-----------|-----------|
| | PA | PB | PC | PD | PE | PF |
| 0.3 | 62 400 | 124 800 | 312 000 | 624 000 | 1 560 000 | 3 120 000 |
| 0.5 | 37 440 | 74 880 | 187 200 | 374 400 | 936 000 | 1 872 000 |
| 0.6 | 31 200 | 62 400 | 156 000 | 312 000 | 780 000 | 1 000 000 |
| 1 | 18 720 | 37 440 | 93 600 | 187 200 | 468 000 | 936 000 |
| 1.5 | 12 480 | 24 960 | 62 400 | 124 800 | 312 000 | 624 000 |
| 2 | 9360 | 18 720 | 46 800 | 93 600 | 234 000 | 468 000 |
| 2.5 | 7488 | 14 976 | 37 440 | 74 880 | 187 200 | 374 400 |
| 3 | 6240 | 12 480 | 31 200 | 62 400 | 156 000 | 312 000 |
| 4 | 4680 | 9360 | 23 400 | 46 800 | 117 000 | 234 000 |
| 5 | 3744 | 7488 | 18 720 | 37 440 | 93 600 | 187 200 |
| 6 | 3120 | 6240 | 15 600 | 31 200 | 78 000 | 156 000 |
| 10 | 1872 | 3744 | 9360 | 18 720 | 46 800 | 93 600 |
| 12 | 1560 | 3120 | 7800 | 15 600 | 39 000 | 78 000 |
| Resolution | 1 mPa•s | 1 mPa•s | 2 mPa•s | 4 mPa•s | 8 mPa•s | 16 mPa•s |

- a. Type P series spindles are the optional spindles for use with the Adaptor for Helical Movement - See "Spare parts and accessories" on page 28.
- b. The minimum recommended reading is 15% of the full scale value.

Table 7: P series spindles for RV1-R and RV2-R Viscometers^a

| Spindle speed (rpm) | Maximum ^b measurable viscosity (mPa•s) | | | | | |
|---------------------|---|-----------|-----------|-----------|------------|------------|
| | PA | PB | PC | PD | PE | PF |
| 0.3 | 666 600 | 1 300 000 | 3 300 000 | 6 600 000 | 16 600 000 | 33 300 000 |
| 0.5 | 400 000 | 800 000 | 2 000 000 | 4 000 000 | 10 000 000 | 20 000 000 |
| 0.6 | 333 300 | 666 600 | 1 600 000 | 3 300 000 | 8 300 000 | 16 600 000 |
| 1 | 200 000 | 400 000 | 1 000 000 | 2 000 000 | 5 000 000 | 10 000 000 |
| 1.5 | 133 300 | 266 600 | 666 600 | 1 300 000 | 3 300 000 | 6 600 000 |
| 2 | 100 000 | 200 000 | 500 000 | 1 000 000 | 2 500 000 | 5 000 000 |
| 2.5 | 80 000 | 160 000 | 400 000 | 800 000 | 2 000 000 | 4 000 000 |
| 3 | 66 600 | 133 300 | 333 300 | 666 600 | 1 600 000 | 3 300 000 |
| 4 | 50 000 | 100 000 | 250 000 | 500 000 | 1 250 000 | 2 500 000 |
| 5 | 40 000 | 80 000 | 200 000 | 400 000 | 1 000 000 | 2 000 000 |
| 6 | 33 300 | 66 600 | 166 600 | 333 300 | 833 300 | 1 600 000 |
| 10 | 20 000 | 40 000 | 100 000 | 200 000 | 500 000 | 1 000 000 |
| 12 | 16 600 | 33 300 | 83 300 | 166 600 | 416 600 | 833 200 |
| Resolution | 5 mPa•s | 10 mPa•s | 25 mPa•s | 50 mPa•s | 125 mPa•s | 250 mPa•s |

- a. Type P series spindles are the optional spindles for use with the Adaptor for Helical Movement - See "Spare parts and accessories" on page 28.
- b. The minimum recommended reading is 15% of the full scale value.

7 CALIBRATION

Your Viscometer was calibrated at the factory before shipment and a calibration certificate was included in the box. Additional calibration checks at regular intervals over the life of the Viscometer are a requirement of quality management procedures, e.g. ISO 9000, and other similar standards. Calibration checks may be carried out by the user of the Viscometer (see instructions below), however if the calibration of the Viscometer is found to need adjustment, please contact Elcometer or your local Elcometer supplier.

Checking Viscometer calibration

The following calibration checking procedure requires the use of the Adaptor for low viscosity samples - See "Spare parts and accessories" on page 28.

Use of this adaptor helps to eliminate fluctuations in the temperature of the sample and variations due to differences in the sample container.

It is recommended that calibrated viscosity oil is used for checking calibration. Oils between 100 mPa·s to 125 mPa·s for version R and 5 mPa·s for version L should be adequate for the calibration procedure.

1. Fit the adaptor for low viscosity samples and fill with the recommended volume of calibration oil - See "Adaptor for low viscosity samples" on page 16.
2. Switch on and start the Viscometer; begin with viscosity readings at the highest speed permitted by the combination of speed/spindle (taking into account the nominal viscosity and temperature values of the calibration oil).
3. Once the desired sample temperature has been reached, check the viscosity reading on the display. If the reading is identical to the nominal viscosity of the calibration oil, your Viscometer is calibrated correctly.

8 MAINTENANCE

The Elcometer Rotary Viscometer is designed to give many years reliable service under normal operating and storage conditions.

The Elcometer Rotary Viscometer does not contain any internal user-serviceable components. In the unlikely event of a fault, the instrument should be returned to your local Elcometer supplier or directly to Elcometer.

Details of Elcometer offices around the world are given on the outside cover of these Operating Instructions. Alternatively visit the Elcometer website, www.elcometer.com

TROUBLESHOOTING

9 TROUBLESHOOTING

The instrument does not operate

Check:

- the connection to the mains electricity supply
- the power on/off switch position at the rear of the Viscometer head

The spindle does not rotate concentrically

Check:

- that the spindle is correctly adjusted to the shaft
- that the union between spindle and shaft is clean

The instrument does not read zero in vacuum

Check:

- that the instrument is levelled correctly

Viscosity reading is not stable or not very accurate

Check:

- that the instrument is levelled correctly
- that the rotation speed/spindle type selection is correct
- that the temperature of the sample is stable

Viscometer head slips down the column

- tighten the two nylon grub screws on the head mounting bracket using the hexagonal wrench supplied

10 TECHNICAL SPECIFICATION

| | | |
|--------------------------------|-------------|--|
| Room temperature: | | 10°C to 40°C (50°F to 104°F) |
| Relative humidity: | | < 80% |
| Speeds: | | 0.3, 0.5, 0.6, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 10, 12, 20, 30, 50, 60, 100, 200 rpm |
| Accuracy (speed): | | > 0.5% of the absolute value |
| Viscosity range, | Version L: | 3 mPa•s to 2 000 000 mPa•s in 76 ranges 19 speeds with 4 spindles. (For low to medium viscosity test fluids) |
| | Version R: | 20 mPa•s to 13 000 000 mPa•s in 114 ranges 19 speeds with 6 spindles. (For medium to high viscosity test fluids) |
| Accuracy (measurement): | | ± 1% of full scale |
| Repeatability: | | ± 0.2% |
| Maximum altitude: | | 2 000 m (6500 ft) above sea level |
| Surge class: | | Class II (domestic/light industry) |
| Contamination: | | Level 2 |
| Thermometer, | Range: | -15°C to +180°C (5°F to 356°F) |
| | Resolution: | 0.1°C (0.1°F) |
| | Accuracy: | ± 0.1°C (0.18°F) |
| Operating voltage: | | UK, 240 V AC 50 Hz EUR, 220 V AC 50 Hz US, 110 V AC 60 Hz |
| Power consumption: | | 23 W |
| Dimensions (of carry case): | | 495 mm x 420 mm x 200 mm (19.5" x 16.5" x 8") |
| Weight (including carry case): | | 9 kg (20 lb) |

SPARE PARTS AND ACCESSORIES

11 SPARE PARTS AND ACCESSORIES

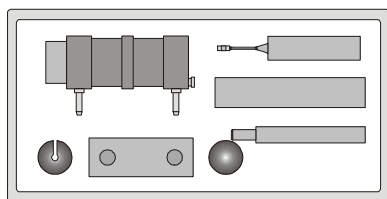
The following spare parts and accessories for your Elcometer Rotary Viscometer are available from your local supplier or direct from Elcometer:

11.1 Standard spindles

| | |
|--|---------------|
| Spindle set, standard, type L (L1 to L4) | KT00230019698 |
| Spindle set, standard, type R (R2 to R7) | KT00230019699 |
| Spindle, R1 | KT00230019700 |

11.2 Low viscosity adaptor kit - with water jacket

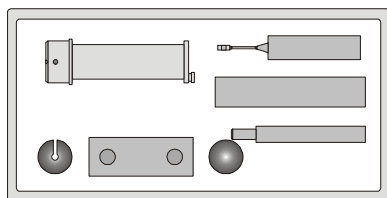
| | |
|--|---------------|
| Adaptor kit for low viscosity samples, with water jacket | KT00230019710 |
| Adaptor kit for low viscosity samples, with water jacket, plus integrated temperature sensor (indirect heating by water up to 100°C) | KT00230020174 |



(This adaptor kit is supplied complete with LCP cylindrical spindle for low viscosity samples)

11.3 Low viscosity adaptor kit - without water jacket

| | |
|--|---------------|
| Adaptor kit for low viscosity samples, without water jacket (for testing of samples up to 200°C) | KT00230019711 |
|--|---------------|

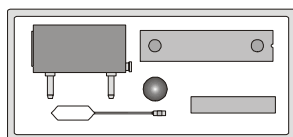


(This adaptor kit is supplied complete with LCP cylindrical spindle for low viscosity samples)

(Comes complete with LCP cylindrical spindle for low viscosity samples)

11.4 Small volume samples adaptor kit

| | |
|--|---------------|
| Adaptor kit for small volume samples | KT00230019702 |
| Adaptor kit for small volume samples + integrated temperature sensor | KT00230019784 |



(This adaptor kit requires a spindle set for small volume samples - see below)

| | |
|--|---------------|
| Spindle set, small volume samples, (TL5, TL6 and TL7) | KT00230019703 |
| Spindle set, small volume samples, (TR8, TR9, TR10 and TR11) | KT00230019704 |

11.5 Helical movement adaptor kit

Helical movement adaptor,

240 V (UK)

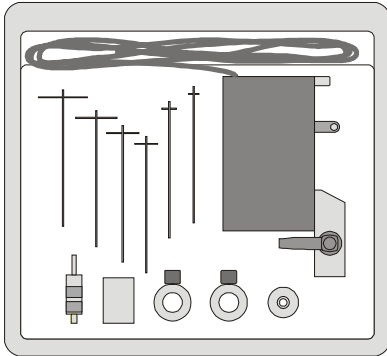
KT00230019705

220 V (EU)

KT00230019706

110 V (USA)

KT00230019707



(This adaptor kit is supplied complete with six special T-type spindles - PA, PB, PC, PD, PE, PF)

11.6 Thermal printer

Thermal printer, null modem cable + adaptor

240 V (UK)

KT00230020179

220 V (EU)

KT00230020178

110 V (USA)

KT00230020180



12 RELATED EQUIPMENT

In addition to the Elcometer Rotary Viscometer, Elcometer produces a wide range of other equipment for determining the physical characteristics of surface coatings.

Users of the Elcometer 2300 may also benefit from the following Elcometer products:

- Elcometer 2000 Muller Laboratory Grinder
- Elcometer Fineness of Grind Gauges
- Elcometer Viscosity Cups
- Elcometer Film Applicators

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

SECTION B: VISCOSITYMASTER SOFTWARE

13 ABOUT VISCOSITYMASTER

ViscosityMaster is powerful but easy-to-use software which simplifies and enhances the use of your Viscometer:

- Design test processes on your PC and upload^a them to your Elcometer 2300 RV2 Rotational Viscometer.
- Download readings data from your Viscometer to the ViscosityMaster data management system.
- Keep your test notes, reports, photographs and all your other test information in one place - ViscosityMaster.
- Create accurate and professional reports configured to allow your data to be understood easily at all levels.
- Create PDF versions of your reports and e-mail direct from ViscosityMaster.

13.1 System Requirements

To use the software on this CD you will need an Elcometer 2300 Rotational Viscometer, a computer and a data transfer cable.

The software will run on PC compatible computers under Windows® 98, 98SE, 2000, ME, NT and XP. The software will not run on Mac OS.

A data transfer cable to connect your Viscometer to the PC is required. This cable is supplied as standard equipment with Elcometer 2300 RV2 Rotational Viscometer. Spare cables are available as an accessory; contact Elcometer or your local supplier for ordering details.

14 GETTING STARTED

This section of the instructions is intended for first-time users of ViscosityMaster. It describes the steps you must take before you can start using the software, how to customise your working environment and where to get help.

14.1 Installing ViscosityMaster

To install ViscosityMaster software on your PC:

1. Place the CD in the CD drive of your PC. The software installation wizard should run automatically. If it does not run automatically:
 - Choose Start > Run
 - Type D:\ViscosityMasterSetup (where 'D' is the letter of your CD drive)
 - Click OK. The software installation wizard will run.
2. Follow the on-screen installation instructions.

a. Uploading of test processes to Elcometer 2300 RV1 models is not possible.

14.2 Uninstalling ViscosityMaster

To uninstall the software follow the usual Windows procedure for removing programs. For Windows XP:

- Choose Start > Control Panel > Add or Remove Programs > ViscosityMaster 1.xx > Remove

14.3 Starting ViscosityMaster

Start ViscosityMaster just as you would any software application:

- Choose Start > Programs > ViscosityMaster > ViscosityMaster

14.4 Connecting your Viscometer

You must connect the Viscometer to your computer if you want to transfer information to and from your Viscometer^b.

To connect your Viscometer:

1. Plug the 9-pin female D-type connector on one end of the data transfer cable into the COM port^c on the PC.
2. Plug the 9-pin connector on the other end of the data transfer cable into the RS232 connector at the rear of the Viscometer.
3. Switch on the Viscometer.

14.5 Preferences

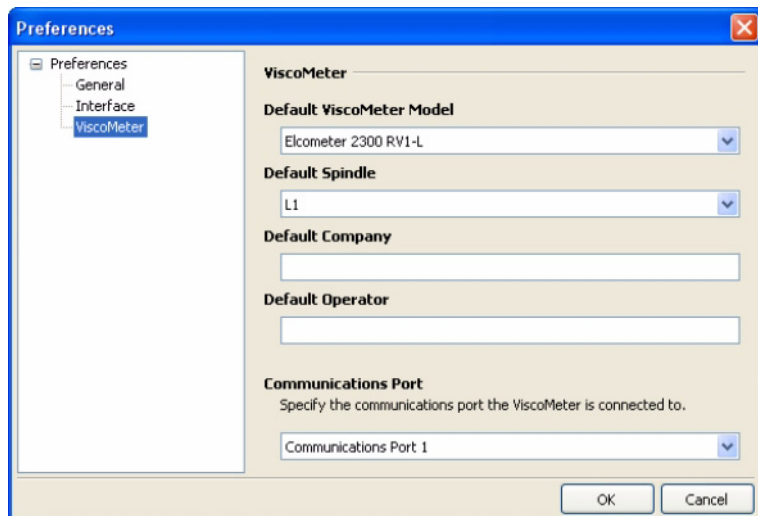
Use this menu to customise your ViscosityMaster working environment. Choose between metric and imperial units of measurement, quality of report page thumbnails and whether e-mail report

b. If your Viscometer is not connected to your computer, you can still use ViscosityMaster to create batch templates, view data downloaded previously and produce reports.

c. An RS232 to USB transfer cable is available which allows you to connect your Viscometer to a USB port on your computer; part number T99916716. Contact Elcometer or your local supplier for ordering details.

GETTING STARTED

format is PDF or JPEG image. Also set default values for Viscometer model, spindle type, company and operator and which COM port your Elcometer 2300 Rotational Viscometer is connected to.



14.6 Help

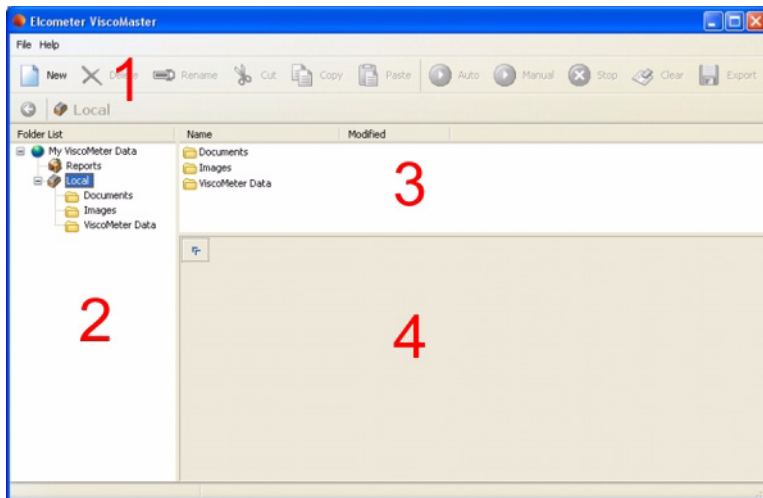
Help for your ViscosityMaster software is provided by this help file. A PDF version of this help file is included on the ViscosityMaster installation CD. If you need to print any sections of this help file, print from the PDF version as this will give a better quality document.


If you need help with your Elcometer 2300 Rotational Viscometer, refer to the operating instructions which were included with your Viscometer.

If you cannot find the answer to your question, please do not hesitate to contact Elcometer or your Elcometer supplier.

15 THE USER INTERFACE

The ViscosityMaster user interface is very similar to a standard Windows Explorer interface:



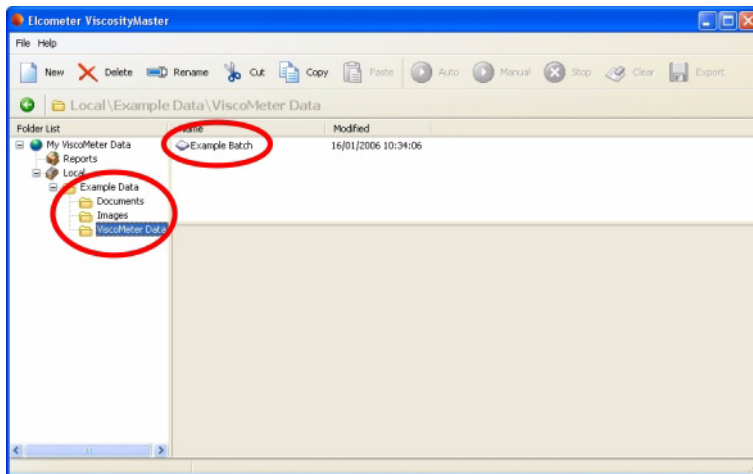
1. **Toolbar:** New, cut, copy, delete, auto, manual, stop, export, etc.
2. **Explorer Window:** Lists the files and folders on your PC and on your ViscosityMaster. All data is stored in \\My Documents\\My ViscosityMaster Data.
3. **List Window:** Lists the files in a folder or the files on your ViscosityMaster.
4. **Report Window:** Displays the contents of a file (click on  to maximise/minimise the window).

Many menu commands and actions can be accessed by clicking using the right mouse button in one of the user interface windows; experiment as you use ViscosityMaster to find which method of working (buttons or right click) you find most comfortable.

EXAMPLE DATA

16 EXAMPLE DATA

When you install Elcometer ViscosityMaster software, a set of example data is loaded into your local folder; click on 'ViscoMeter Data' in the Explorer Window and then look for 'Example Batch' in the List Window.

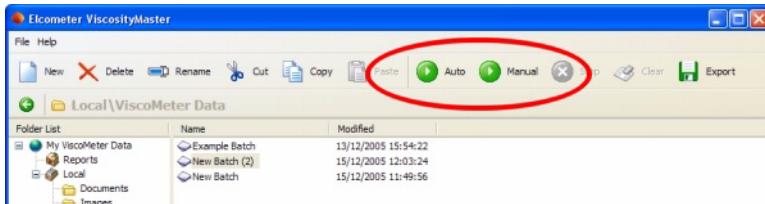


Double click on Example Batch to load the data into the Report Window and spend some time looking at the readings and charts - you will soon learn the basics of ViscosityMaster and what it can do.

Deleting the example data (when you have finished learning about ViscosityMaster, for example) will not affect the operation of your ViscosityMaster software.

17 OPERATING MODES

Your ViscosityMaster software has two operating modes; manual and automatic.



- In **manual mode** your ViscosityMaster software records measurements as they are taken by the instrument but it does not control the operation of the Viscometer.
- In **automatic mode** your ViscosityMaster software records measurements and it controls the operation of the Viscometer.

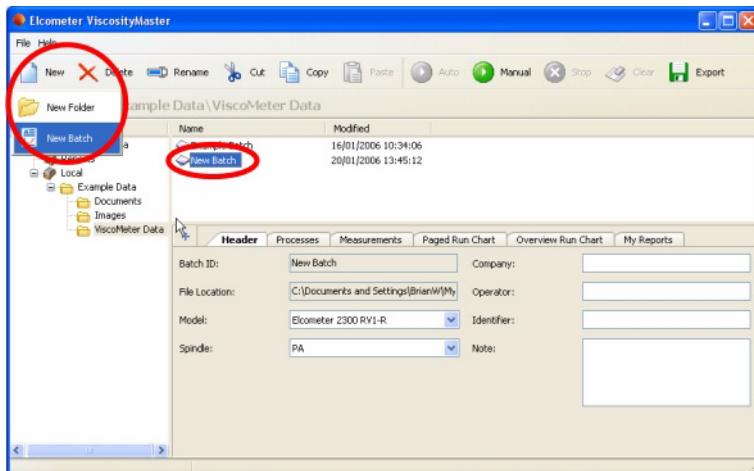
Note: RV1 models can only be used in manual mode. RV2 models can be used in Manual mode and in Automatic mode.

18 INSTRUCTIONS FOR RV1 VISCOMETERS

Note: RV1 Viscometers can only be used in manual mode - they cannot be used in automatic mode.

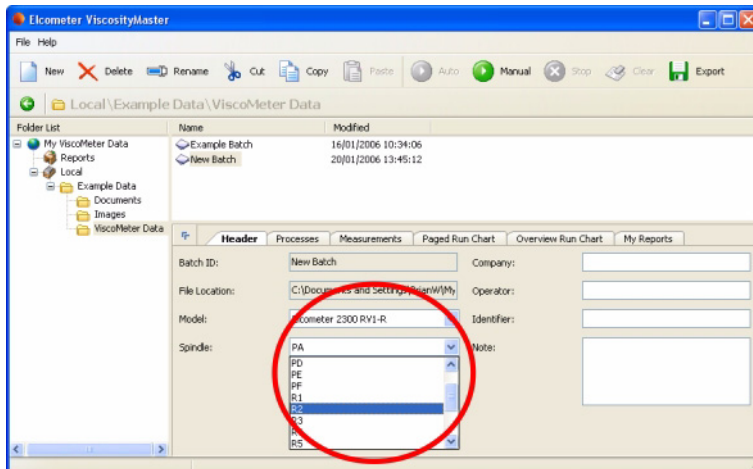
18.1 Setting up a batch

1. Click on 'New' and select 'New Batch'.
2. Type a name for the batch and then press the Return key.



INSTRUCTIONS FOR RV1 VISCOMETERS

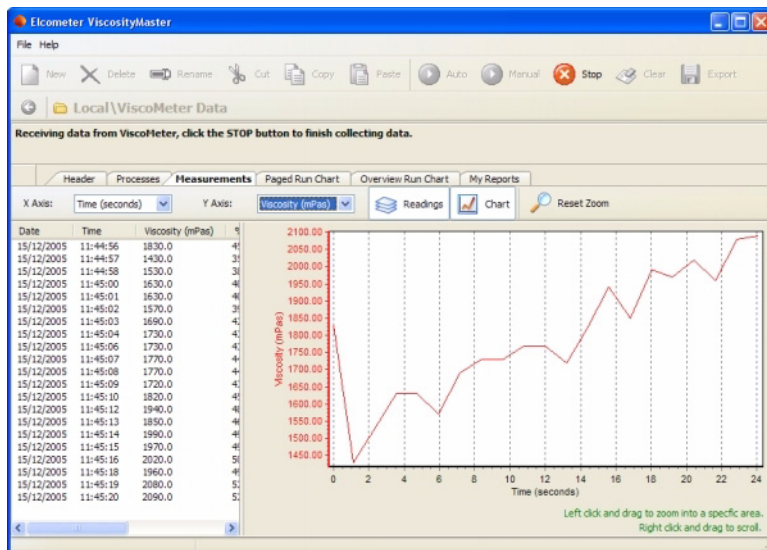
- The Model, Spindle type, Company and Operator will already be set from 'Preferences' when ViscosityMaster was run for the first time. If necessary, amend these details as required.



- Enter details in the Identifier and Notes fields. This information is used later, typically within test reports.

18.2 Running a batch

1. Lower the Viscometer spindle into the test sample.
2. Click on 'Manual' and then press 'Start' on the Viscometer.
3. The measurements and charts will be shown in real time.



4. If necessary, adjust the content of the chart X and Y axes to show the information you require.
5. Click on 'Stop' when you have obtained enough measurements.
6. Review the measurements/charts. If you are not happy with the results, click on 'Clear' to clear the measurements and start the test again.

After you have stopped the test you can:

- review readings
- review charts
- create reports
- export readings to Excel or csv files
- print, create pdf or email charts and reports.

See "Working with Viscometer data" on page 41 for further details.

19 INSTRUCTIONS FOR RV2 VISCOMETERS

Note: The instructions in this section apply to RV2 models only - RV1 models can only be used in manual mode.

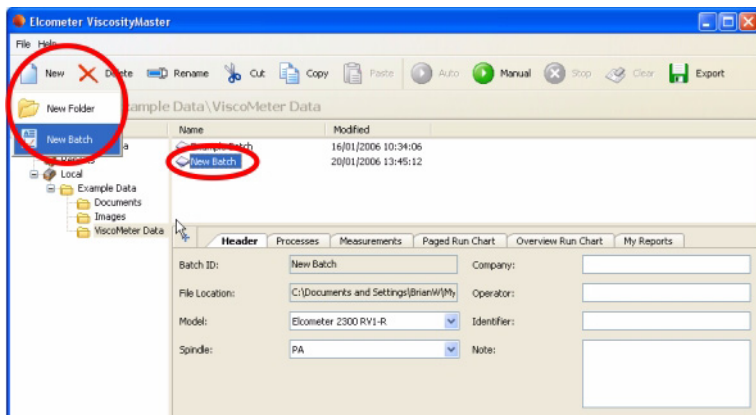
19.1 Setting up a batch

The first section of the procedure is identical to the instructions given for operation in manual mode:

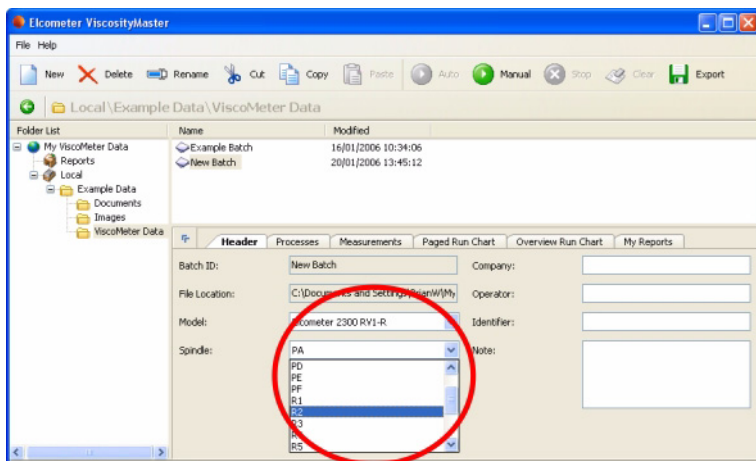
1. Click on 'New' and select 'New Batch'.

INSTRUCTIONS FOR RV2 VISCOMETERS

2. Type a name for the batch and then press the Return key.



3. The Model, Spindle type, Company and Operator will already be set from 'Preferences' when ViscosityMaster was run for the first time. If necessary, amend these details as required.



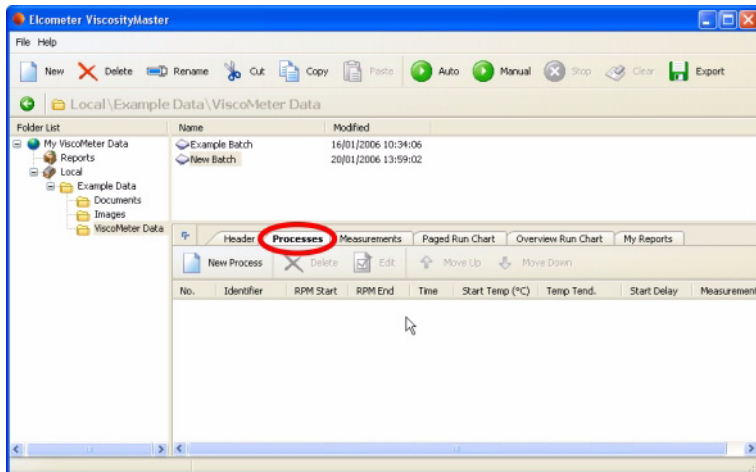
4. Enter details in the Identifier and Notes fields. This information is used later, typically within test reports.

The procedure for automatic mode now differs from the procedure for manual mode because of 'Processes' - see Setting up processes .

19.2 Setting up processes

In automatic mode the Viscometer is controlled using processes. Processes are groups of data which specify settings such as spindle speed, rotation duration, measurement frequency, etc. A single batch can incorporate any number of processes.

1. Click on the 'Processes' tab.



2. Click on 'New Process'.

A Process Wizard will start. Follow the instructions given in the wizard to create a single process. You will be asked to define the following process variables:

| | |
|-------------------|--|
| Identifier | A name or number for the process |
| Start RPM | Spindle speed at the start of the process |
| End RPM | Spindle speed at the end of the process |
| Time | Duration of the process (seconds) |
| Start delay | Time delay before measurements start (seconds) |
| Start temperature | Delay start until when above this temperature, or Delay start until when below this temperature |
| Measurements | Number of measurements to take during the process |

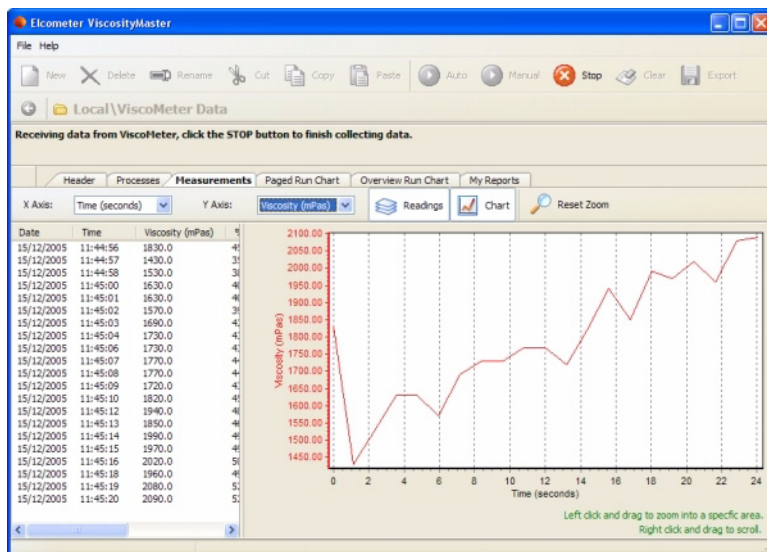
3. Click on 'Finish' at the end of the process.
The process will appear as a line item under the 'Processes' tab.
4. Go on defining as many processes as you need to define the test procedure.

INSTRUCTIONS FOR RV2 VISCOMETERS

19.3 Running a batch

1. Lower the Viscometer spindle into the test sample.
2. Click on 'Automatic'.

The Viscometer will start under control of ViscosityMaster and the measurements and charts will be shown in real time.



3. If necessary, adjust the content of the chart X and Y axes to show the information you require.
4. The Viscometer will stop automatically at the end of the test procedure. Alternatively, click on 'Stop' to stop the procedure at any time.
5. Review the measurements/charts. If you are not happy with the results, click on 'Clear' to clear the measurements and start the test again.

After you have stopped the test you can:

- review readings
- review charts
- create reports
- export readings to Excel or csv files
- print, create pdf or email charts and reports.

See "Working with Viscometer data" on page 41 for further details.

20 WORKING WITH VISCOMETER DATA

This section describes what you can do with your Viscometer batch data once it has been downloaded into ViscosityMaster:

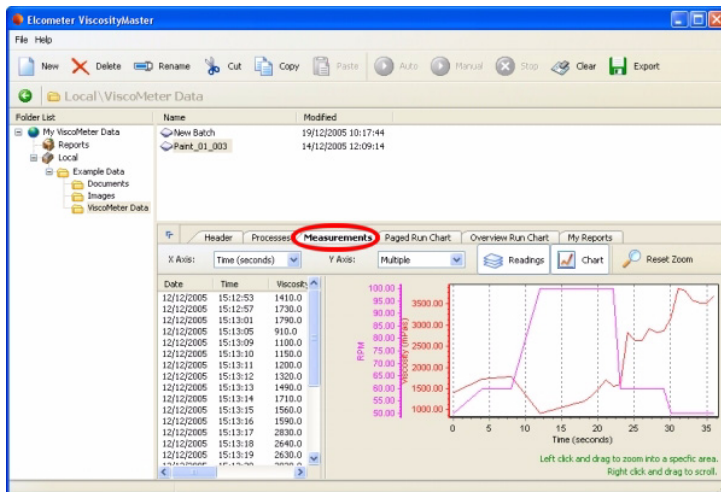
- Viewing Measurement Data and Standard Reports
- Customising report window tabs
- Creating Custom Reports
- Viewing a Custom Report
- Exporting Measurement Data
- Printing, Creating PDF Files and E-mailing from ViscosityMaster

20.1 Viewing Measurement Data and Standard Reports

Viewing measurement data and producing standard reports is quick and easy using ViscosityMaster software.

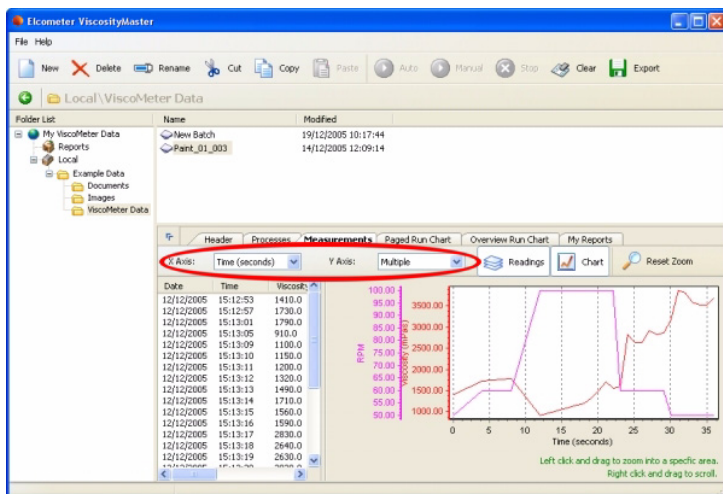
To view measurement data for a batch:

1. In the Explorer Window, navigate to the folder where your data is stored.
2. In the List Window, click on the batch or batches you want to view. To select more than one batch, hold down the 'Ctrl' key and click on the batches required.
3. In the Report Window, click on the Measurements tab.



WORKING WITH VISCOMETER DATA

- Adjust the contents of the chart using the X axis and Y axis drop down lists.

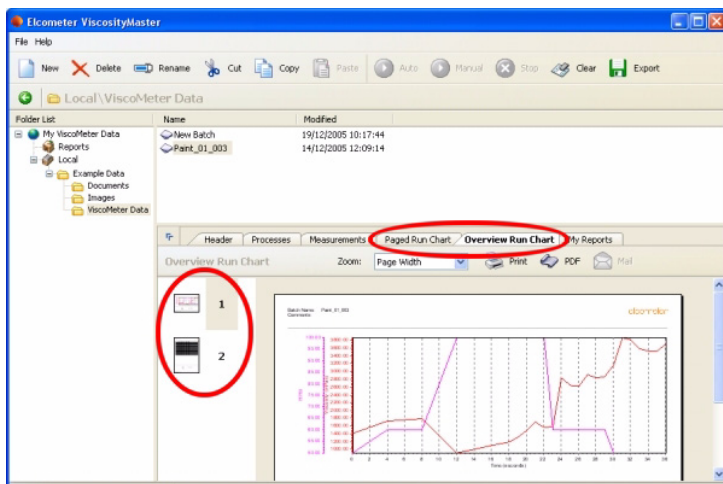


- To zoom in to an area on the chart, use your mouse to left click and drag. To reset the zoom click on the Reset Zoom button.

To scroll the chart, use your mouse to right click and drag

To view standard reports for a batch:



- In the Explorer Window, navigate to the folder where your data is stored.
- In the List Window, click on the batch or batches you want to view. To select more than one batch, hold down the 'Ctrl' key and click on the batches required.
- In the Report Window, click on the tab required: Paged Run Chart, Overview Run Chart.

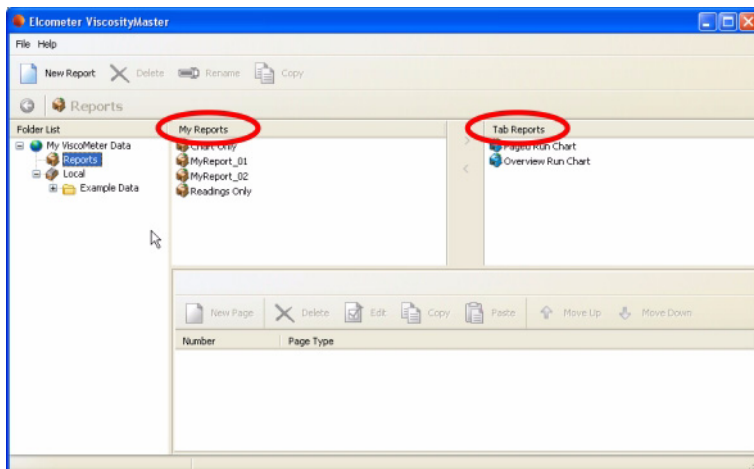


- Click on a thumbnail of a report on the left side of the Report Window to view an individual page of the report. Use the Zoom pull-down list to adjust the size of the report on the screen.

20.2 Customising report window tabs

The Header, Measurements and My Reports tabs are always visible in the Report Window. All other tabs (and user defined tabs) can be added or deleted:

1. In the Explorer Window, click on Reports.
2. In the List Window, all reports in the 'Tab Reports' column will appear as tabs in the Report Window. Use the arrows between the two columns to add or remove reports from this column.
 - All reports with a blue icon  are standard reports which cannot be deleted.
 - All reports with a brown icon  are user defined reports which may be deleted if needed.

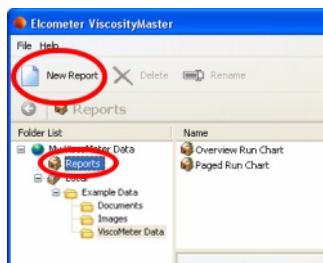


20.3 Creating Custom Reports

ViscosityMaster software includes a built-in report designer which can be used to create reports customised to your requirements.

To create a custom report:

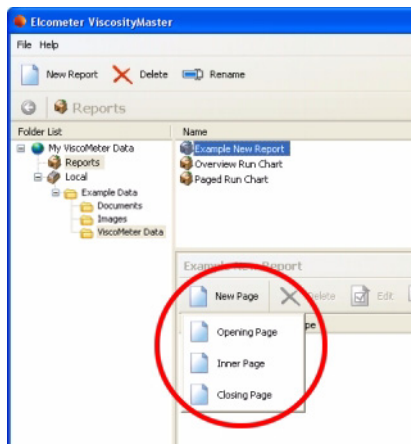
1. In the Explorer Window, click on 'Reports'.
2. In the Toolbar, click 'New Report'.



3. Choose a name for your report and press 'Return'.

WORKING WITH VISCOMETER DATA

4. In the Report Window, click 'New Page' and then choose between 'Opening', 'Inner' and 'Closing' page types.



- **Opening pages:** Typically used for report title page; can contain text, shapes and graphics; cannot be used to display reading data; prints first when printing a report.
- **Inner pages:** Typically used for showing reading data (run charts, measurements); prints in the middle when printing a report.
- **Closing pages:** Typically used for report notes/summary page; can contain text, shapes and graphics; cannot be used to display reading data; prints last when printing a report.

The new page will then appear in the Report Window.

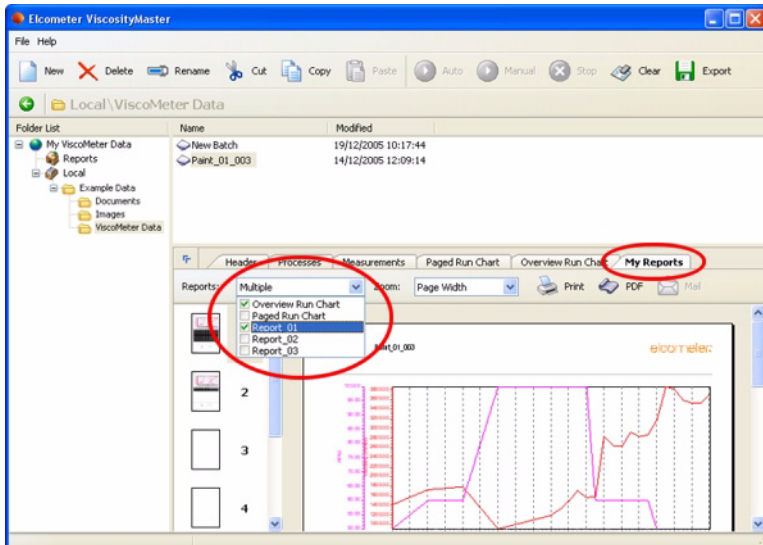
5. Click on the page in the Report Window and then click on the Edit button. The Page Designer will start.
6. Follow the instructions in "The page designer" on page 47 to define your report.
7. Click 'Save' to save your report layout when you are finished.

20.4 Viewing a Custom Report

To view a custom report:

1. In the Explorer Window, navigate to the folder where your data is stored.
2. In the List Window, click on the batch or batches you want to view. To select more than one batch, hold down the 'Ctrl' key and click on the batches required.

3. In the Report Window, click on My Reports tab and then select the report from the Reports drop-down list.

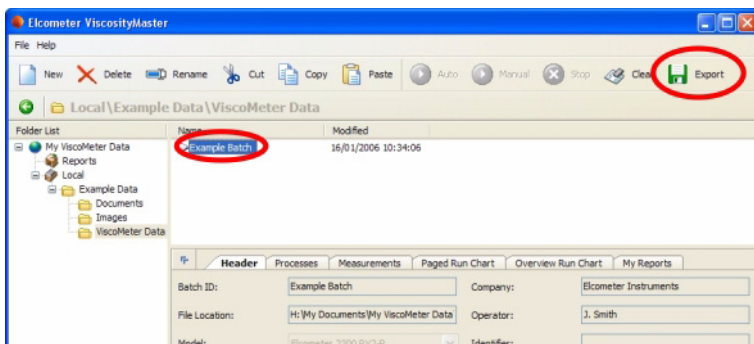


4. Click on a thumbnail of a report on the left side of the Report Window to view an individual page of the report. Use the Zoom drop-down list to adjust the size of the report on the screen.

20.5 Exporting Measurement Data

Measurement data can be exported in Microsoft Excel format and in CSV (comma separated values) format.

Highlight the batch required and then click on 'Export'. Choose between Excel and CSV.



20.6 Printing, Creating PDF Files and E-mailing from ViscosityMaster

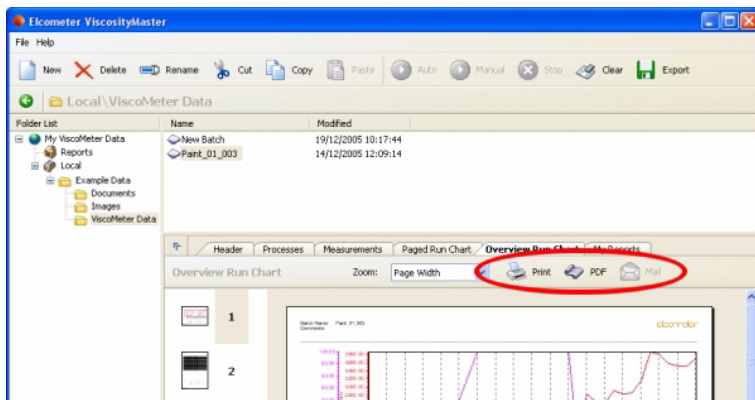
Any report currently displayed in the Report Window can be:

- Printed
- Saved as an Adobe PDF (Portable Document Format) file

USING DOCUMENTS AND IMAGES

- Sent via e-mail as an attachment^d

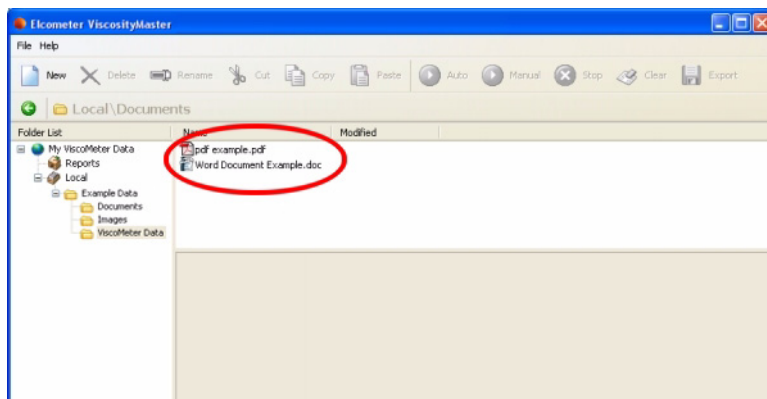
Click the appropriate button in the Report Window and follow the standard Windows instructions which follow.



21 USING DOCUMENTS AND IMAGES

Use ViscosityMaster to store your test notes, reports, spreadsheets and all your other test information. Group these files by product, customer, project, production shift, etc.

To store a document, image or any other type of file, use the standard Windows techniques of 'drag and drop' or 'copy and paste' to place your file in the List Window.

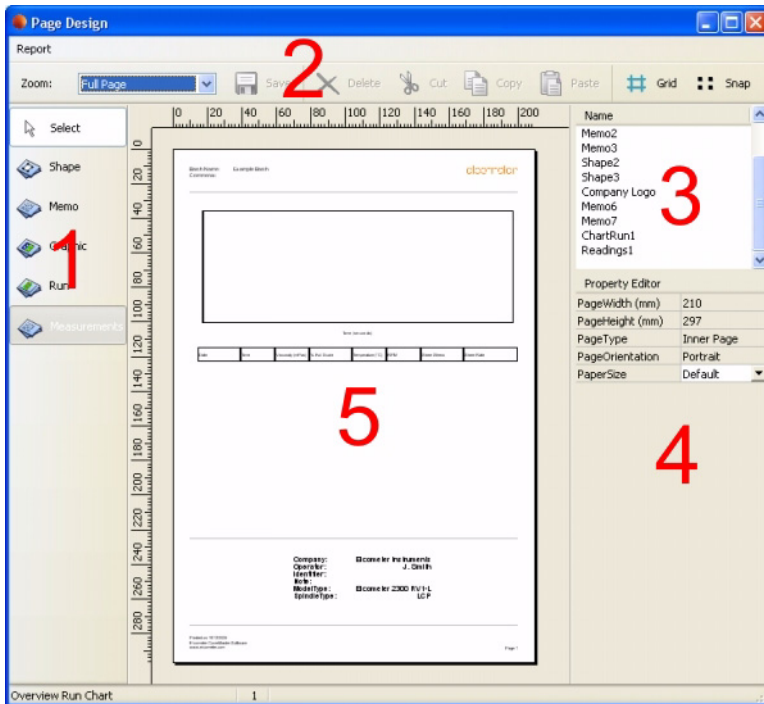


d. Select the format of your e-mail attachment (PDF file or JPEG image) in Preferences .

22 THE PAGE DESIGNER

This section describes how to use the Page Designer - a utility built in to ViscosityMaster which allows you to create your reports:

- Designing a Page
- The Property Editor
- The Text Editor



1. Object Picker Window
2. Toolbar
3. Object Selector Window
4. Property Editor
5. Page Layout Window

THE PAGE DESIGNER

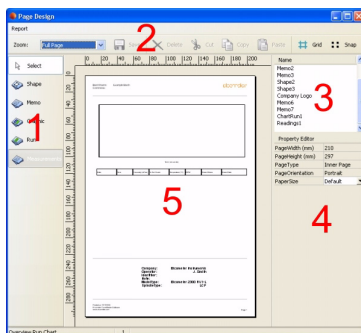
22.1 Designing a Page

The contents of a page are 'Objects' such as shapes, memos, readings, etc. To add an object to the page, choose the object in the Object Picker Window (1), move the cursor to the Page Layout Window (5) and then click and drag the object to the required size. Once the object has been created it can be moved by dragging, and resized by dragging on the handles around the edge of the object.

Precise control over the layout, attributes and content of an object is obtained by modifying the properties of the object in the The Property Editor (4).

When an object is added to the page, the name of the object appears in the Object Selector Window (3).

The buttons on the Toolbar (2) Zoom, Save, Delete, Cut, Copy and Paste using standard Windows techniques.



22.2 The Property Editor

Precise control over the layout, attributes and content of an object is obtained by modifying the properties of the object using the Property Editor.

Object properties which are adjustable using the Property Editor are listed below. The list of properties available depends upon the type of object selected (shape, memo, graphic, overview chart, etc.):

| Property | Description |
|-------------------------|--|
| 3D: | Select between 3 dimensional or 2 dimensional run charts. |
| Alignment: | Alignment of text in a memo block (top, middle, left, right, etc.) |
| Anchor: | Defines how a block is anchored to the page. Anchor position remains constant if page size is changed. |
| AspectRatio: | Defines how a graphic fits within its bounding box. |
| Bold: | Make text in a memo block bold. |
| ColumnWidthDate: | In measurements object - Width of date column (mm) |
| ColumnWidthPercentFS: | In measurements object - Width of percentage of full scale column (mm) |
| ColumnWidthRPM: | In measurements object - Width of RPM column |
| ColumnWidthSheerRate: | In measurements object - Width of Sheer rate column |
| ColumnWidthSheerStress: | In measurements object - Width of Sheer stress column |
| ColumnWidthTemperature: | In measurements object - Width of Temperature column |
| ColumnWidthTime: | In measurements object - Width of Time column |
| ColumnWidthViscosity: | In measurements object - Width of Viscosity column |
| FillColor: | Fill colour of shapes. |
| FillStyle: | Fill style of shapes (solid, diagonals, cross hatched, etc.) |
| FontColour: | Colour of text in a memo block. |
| FontName: | Defines font type (Arial, Times, etc.) |
| FontSize: | Size (in points) of text in a memo block. |
| Graphic: | Selects graphic file. |
| Grid: | Displays grid lines on histogram and run charts. |
| Height (mm): | Height of an object in mm. |
| Italic: | Defines whether text in a memo block is italic or upright. |
| Left (mm): | Defines gap between left edge of page and left edge of block (see also Top). |
| LineColor: | Defines colour of bounding line of shapes. |
| LineStyle: | Defines style of bounding line of shapes (solid, dash, dot, etc.) |
| LineWidth: | Defines thickness of bounding line of shapes. |

THE PAGE DESIGNER

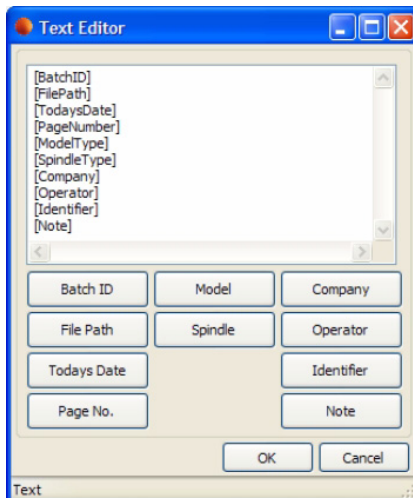
| Property | Description |
|-------------------|---|
| Name: | Defines name of object. Object names are displayed in Object Selector Window. |
| PageWidth (mm): | Defines width of the page in mm. |
| PageHeight (mm): | Defines height of the page in mm. |
| PageType: | Defines page type; Opening, Inner or Closing. |
| PageOrientation: | Portrait (default) or Landscape. |
| PaperSize: | Paper dimensions; A3, A4, Letter, etc. |
| ReadingsPerPage: | Number of readings of a batch displayed on one page of a report. |
| RowsPerPage: | Number of rows of a batch displayed on one page of a report. |
| Shape: | Shape object type; Rectangle, Horizontal Line or Vertical Line. |
| ShowColumnHeader: | Defines whether titles at the top of readings columns are visible. |
| ShowLegend: | Defines whether colour key bar and legend is visible. |
| Strikeout: | Defines text style in a memo block as strikeout (strikeout). |
| Text: | Opens The Text Editor . |
| Top (mm): | Defines gap between top edge of page and top edge of block (see also Left). |
| Underline: | Defines text style in a memo block as underline (<u>underline</u>). |
| Width (mm): | Width of an object in mm. |
| WordWrap: | Defines whether text in a memo block will wrap onto the line below. |

22.3 The Text Editor

Use the Text Editor to enter text and data fields onto the Page Layout Window of The page designer .

- To enter text, click in the text editor window and type your text. Use the carriage return key to enter a new line.

- To enter data fields, click in the text editor window and then click on a data field button. Explanations of the data field buttons are given in “Text Editor Data Field Buttons” on page 51.



When you have finished, click on the OK button to enter your text onto the Page Layout Window.

22.4 Text Editor Data Field Buttons

Descriptions of the data field buttons are given below:

| Data Field Button | Description |
|-------------------|---|
| Batch ID: | The batch name |
| File Path: | The location of the data file on your computer |
| Todays Date: | Today's date |
| Page No. | Page number in the report |
| Model: | Viscometer type (RV1/RV2 etc.) |
| Spindle: | Spindle type (R1, L1, etc.) |
| Company: | Information added in header when creating a New Batch |
| Operator: | Information added in header when creating a New Batch |
| Identifier: | Information added in header when creating a New Batch |
| Note: | Information added in header when creating a New Batch |

23 SUPPORT

For support with this software, information on the Elcometer product range and details of your local supplier, contact any of the Elcometer offices worldwide. Contact details can be found under 'Help' in ViscosityMaster, on the outside cover of these instructions and at www.elcometer.com

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