

profiler

**Instrument and
Software Guide**

Revision 29/03/06

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Section 1: Introduction

Congratulations on purchasing the profiler instrument.

The profiler instrument and associated PRTC module caters for:

- Commutator and slip ring surface profiling
- Temperature -10 °C to 1000 °C (14 to 1830) °F with optional K type thermocouple
- Current measurement up to 1000 Amperes DC with optional current probe

Collected data can be transferred to a PC where it can be analyzed in detail using the MAS Windows-based software supplied in the kit.

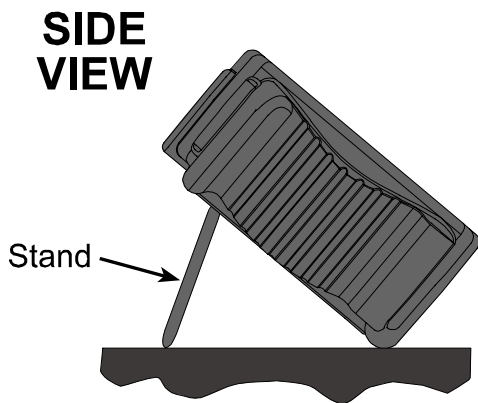
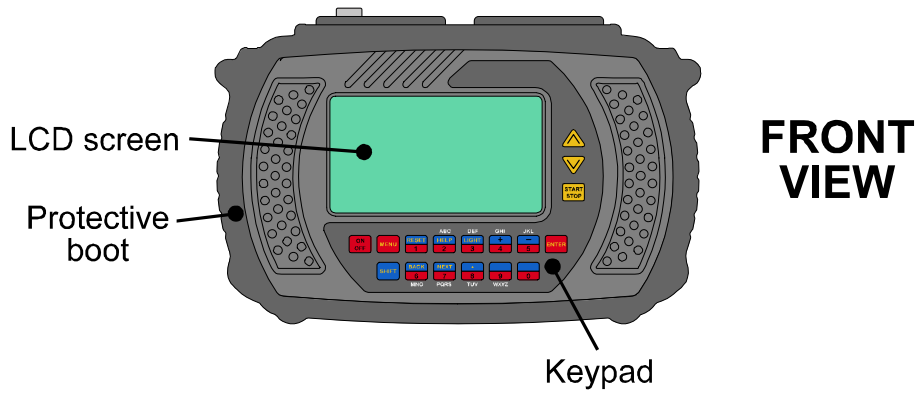
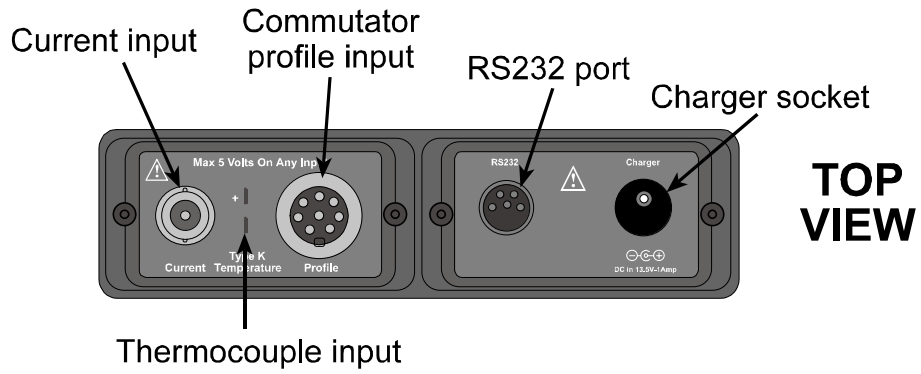
Standard Features

- 24-bit A/D converter providing high-precision measurements
- 512 KB non-volatile memory capable of storing up to 400 000 sample points
- Time and date stamped recordings
- Temperature compensated graphical LCD (liquid-crystal display) with 240 x 128 pixels
- Electro-luminescent LCD backlight
- Built-in battery charger and conditioner
- 1500 mAh Ni-Cad (Nickel-Cadmium) battery pack
- Upgradable firmware
- RS232 interface to communicate with a PC
- Windows-based MAS analysis software
- Time and date stamped recordings

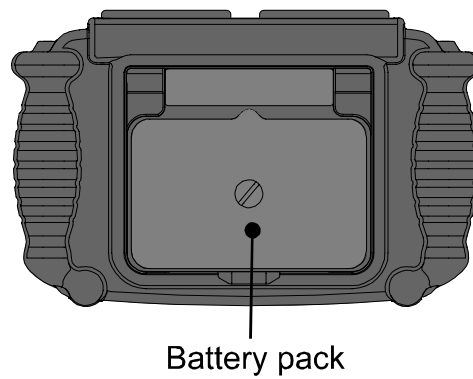
Standard Kit Items

- Profiler instrument
- Sensor complete with clamp and sleeve
- Power adapter
- Felt pen
- Flashlight
- G Clamp
- Sensor spacer set
- Download cable
- Printer cable
- DPU-414-30B serial interface printer
- Printer power adapter
- Profiler MAS software
- Instrument and Software Guide

Summary of Parts



BACK VIEW (stand removed)

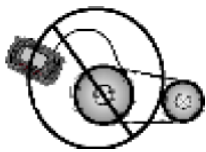


Precautions

Please read and understand this section before operating your instrument. Heed all warnings and recommendations to prevent data loss, data inaccuracy, damage to the instrument, or injury to yourself.



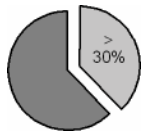
To avoid electrical shock, do not attach any sensor to a high voltage i.e. a voltage that exceeds 50 V DC or 32 V AC or the 'safety extra low voltage' (SELV) defined by your local power authority.



Ensure the cables and bootstrap cannot become entangled with any rotating or moving machinery.

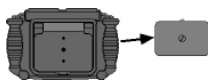


Do not operate the instrument in an explosive environment.



Charge the battery pack up to at least 30% capacity before taking a recording. If using the instrument for 4 hours or more, first ensure that the battery pack is fully charged.

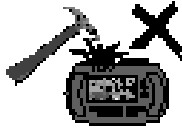
Constantly charging the battery when it is not fully drained will create a 'Memory' effect and eventually shorten the amount of charge that the battery can hold.



Do not detach the battery pack from the instrument for more than 2 hours as data and settings may be lost from the instrument.



Transfer data stored in the instrument to a PC before reprogramming the instrument. *PROFLASHING* the instrument with new firmware may erase all data stored in the instrument.



Do not expose the instrument to heavy impacts or pressure.



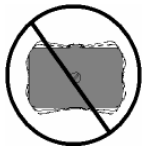
To clean the instrument use a mild detergent diluted in warm water. Do not use abrasive or polishing substances, hydrocarbons, petrochemicals or solvents as they degrade the plastic.



Do not place the instrument in a hot place where the temperature exceeds 140 °F (60 °C). Otherwise, the battery pack will degrade.



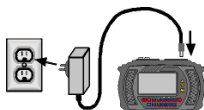
Although the instrument has a rugged construction, do not expose it to wet conditions or store it in a damp place where the relative humidity exceeds 95%.



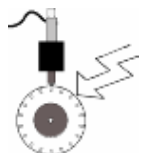
Ensure that the battery pack is securely fastened (but not over-tightened) to the instrument before operating.



If the instrument malfunctions, return it to an authorized dealer. Do not attempt to repair the instrument yourself as this will invalidate the warranty.



Use only an approved instrument power transformer 13.5 V \pm 1.5 V DC, 1 A output, center positive, and ensure its voltage and frequency rating matches that of your mains AC power.



Never mount the commutator sensor in a live motor.



When the profiler instrument is connected to a PC via the RS232 cable, its negative internal supply is connected to ground. The thermocouple may then be used **only** on surfaces isolated from ground.

Recommendations

- Use the Peak height option for general commutator and slip ring maintenance.
- Use the Shape option for commutator and slip ring measurement *only* when the measurements are to be downloaded to a PC using the MAS software.
- Print the Bar shape only when necessary. Printing Bar shape on the thermal printer takes a considerable amount of time due to the extra data required.
- The sensor has been constructed to withstand *normal* handling. To avoid damage, the sensor head, wheels and support assemblies must still be treated with care at all times.

Guidelines for Commutator Testing

The profiler instrument has a significant advantage over Dial Indicators for commutator testing. In addition to TIR readings the instrument can also produce Bar-to-Bar deviation readings and high mica detection (insufficient mica undercut depth). This enables you to diagnose the condition of the commutator or slip ring.

Interpreting Profiles

The following information is based on recommendations for commutator condition provided courtesy of:

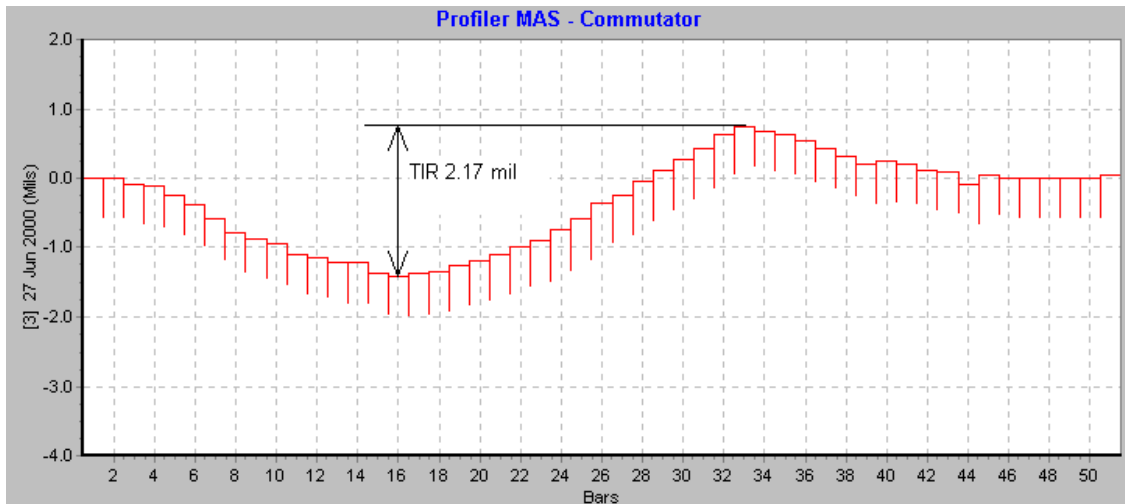
National Electrical Carbon Products Inc.
Greenville, South Carolina
USA

Situation	Runout (TIR)	Bar-to-Bar Variance	Undercut Depth
New	Less than 1.5 mil or 40 μm	Less than 0.2 mil or 5 μm	Greater than 50 mil or 1.25 mm
In Service	Less than 3 mil or 75 μm	Less than 0.3 mil or 7.5 μm	Greater than 20 mil or 0.5 mm
Needs Repair	Greater than 3 mil or 75 μm	Greater than 0.3 mil or 7.5 μm	Less than 10 mil or 0.25 mm

Note: 'mil' is the US term for one thousandth of an inch.

A Good Commutator Profile

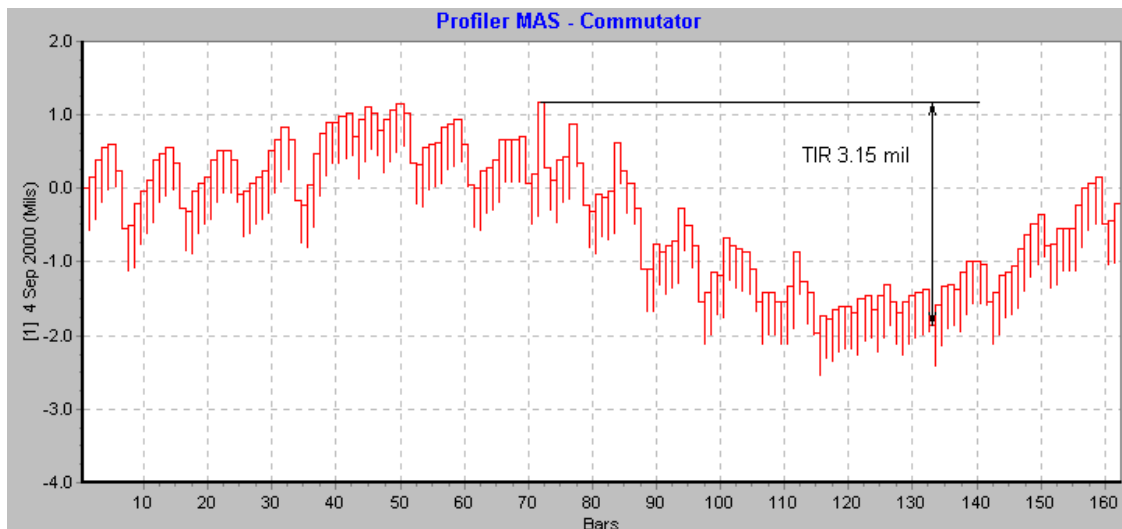
The following is an example of a good profile recording.



This recording passes all of the required specifications for a commutator that is in service. This recording has a Total Indicated Runout of 2.17 mil and a maximum Bar-to-Bar runout of 0.24 mil.

A Bad Commutator Profile

The following is an example of a bad profile recording.



This recording fails both the Total Indicated Runout, and Bar-to-Bar specifications for a commutator that is in service. Its TIR value of 3.15 mil is only just outside the specifications; however, the maximum Bar-to-Bar height difference of 0.98 mil is three times the recommended limit. During service you are likely to see visible sparking at the brushes and also hear brush clatter.

Section 2: Basic Operation




This section describes the procedures for performing basic operations on your instrument.

You will learn to:


- Use the instrument menu system
- Set up measurements
- Measure data without saving it
- Record data
- Review recorded data
- Change the recording and data display options

Warning: Read the previous sections Precautions (page 10) and Recommendations (page 12) before operating your instrument.

Powering Up

- Press the  key to power up the instrument. The Initialization screen is displayed.
- Press  to display the Main Menu.
- To power down press  and follow the on-screen instructions.


Accessing the Main Menu

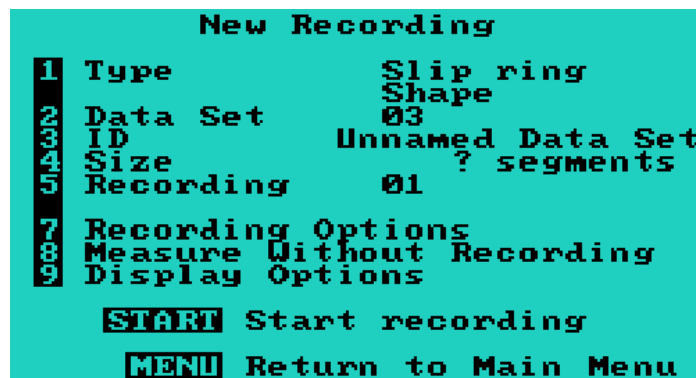
- The Main Menu can be accessed at any time from any screen by pressing the  key. You may need to press this key more than once to return to the Main Menu.

Selecting an Option




- Press the numbered key that corresponds to the option you want to select.

Example:






- To select the New Recording option, from the Main Menu press 



The New Recording Menu shows the options available for taking a recording.

In some screens you may need to press  or  to highlight an option then press  to select the option.






Example:

- To select a Data Set press   Data Set.
- Use the  or  keys to highlight a Data Set then press  to select it.





- To return to the Main Menu press 

Editing Data Set ID's

- To enter characters in the Edit Name window select New Recording from the Main Menu then select   ID to edit the Data Set name.
- To clear the 'Unnamed Data Set' name press   
- Repeatedly press the key with the character you want until it appears above the flashing cursor.


Example:

To enter the word BED

- Press   three times until the 'B' is displayed. The cursor advances automatically when you press the next key.











A screenshot of a terminal window with a black background and a cyan border. The letter 'B' is displayed in cyan at the beginning of a line. Below the line is a horizontal cursor bar.

- To enter the letter 'E' press   three times until the 'E' is displayed.



A screenshot of a terminal window with a black background and a cyan border. The letters 'BE' are displayed in cyan at the beginning of a line. Below the line is a horizontal cursor bar.

- If the next letter of the word is on the same key just pressed, press   to advance the cursor position e.g. press   then press key   until the letter 'D' appears. (The cursor can be moved backwards by pressing  ).



A screenshot of a terminal window with a black background and a cyan border. The letters 'BED' are displayed in cyan at the beginning of a line. Below the line is a horizontal cursor bar.

Note:  and   can be used to enter the space character.




You can open a list of all the Data Set names in memory. This allows you to easily name Data Sets that have similar names by selecting the closest match from the list then editing the appropriate characters.



- Press   to display the list.

- Use  and  to select a name from the list.
















```
      Edit Name
> Data Set Four
  Data Set Three
  Data Set Two
  Data Set One

      ^ v Select
  ENTER Continue
```

- Pressing  will change the currently selected letter to lowercase if it is currently uppercase. Otherwise it will change to the previous letter in the alphabet in uppercase.
- Pressing  will change the currently selected letter to uppercase if it is currently lowercase. Otherwise it will change to the next letter in the alphabet in lowercase.
- Pressing  when the currently selected character is a space will cycle through the various symbols that can be used then begin cycling through numbers.

Note: If you cycle through to the letters it is not possible to use  or  to get back to any symbol characters.

Short Cut Keys for Editing

-  Cancel the edit screen and retain the original name
-   Clear all text
-   Move cursor forward
-   Move cursor back
-   Insert a space
-   Delete a character
-   Enter a space at the cursor position
-   List the Data Set names in memory

Total Indicated Runout (TIR)

The Total Indicated Runout for commutator and slip ring tests is the difference between the minimum bar (or segment) height and the maximum bar height. The TIR is also referred to as 'out of roundness'.

Maximum Bar-to-Bar Height (MBTB)

The Maximum Bar-to-Bar Height for commutator and slip ring tests is the maximum height difference between two consecutive bars (or segments).

High Micras for Commutator Tests

High Micras occur when there appears to be no gap between two consecutive bars. High Micras will be indicated as a bar number in the Edit Recordings window.



Setting up a Measurement

The instrument is capable of performing measurements in:



- Displacement
- Temperature
- Current

Measurement Setup Menu

Before taking a measurement you need to specify a sensor type so that the instrument knows what type of measurement to take.


- From the Main Menu select   Measurement Setup. The Measurement Setup menu changes depending upon the sensor that is selected.



- Press   Sensor to cycle through the available sensors for the instrument.

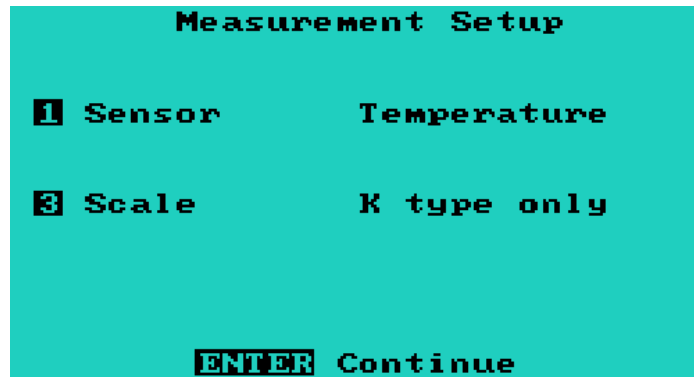
There are three possible sensor types that can be used with the PRTC module:

Temperature
Current
Displacement

- Once the Sensor, Type, and Mode have been adjusted accordingly (as described in the following pages) press  to display the Measure Without Recording Menu. This menu will allow you to make other setup adjustments before performing an actual recording.

Temperature Sensor

There are no options that can be changed when using the Temperature sensor type. You must use a type K thermocouple for measuring temperature.



Current Sensor

When using the Current sensor type you can select the Input Range and the Scale.




Input Range

- Press **HELP** **2** to cycle through the three input ranges for the Current sensor.

The values available are:

- 0 mV to 100 mV
- 0 V to 1.0 V
- 0 V to 5.0 V

Scale



- Press  to change between the two Scales available: 1 mV/amp and 10 mV/amp.

Displacement Sensor

When using the Displacement sensor type you can select the type of Machine and the Mode to profile in.



Note: Do not plug a Thermocouple into the PRTC Module while the profiling sensor is connected.

- Press  to change between Commutator and Slip ring machine types.
- Press  to change between Peak height and Shape profiling Modes.

Type

The Sensor and Machine type is saved with the Data Set. These will always be restored to the saved type in subsequent recordings. You cannot change the Machine and Sensor types (as described above) after recording one or more recordings without also changing the Data Set number. This is because the instrument expects the same Data Set type for each successive recording. The instrument automatically selects the next highest compatible Data Set number when the Machine or Sensor type is altered.

Mode

The **Peak height mode** records one value per bar (or segment), this being the peak height of multiple samples taken across the entire bar or segment. Since the high points of the bar determine the deflection of the brushes, these values are of most relevance when comparing heights of adjacent bars.

The **Shape mode** records a value in steps of approximately 0.5 mm as it travels around the commutator bars or slip ring segments. Using these values Shape mode will generate a shape of the commutator or slip ring.

The Peak heights are measured using the maximum resolution and accuracy of the instrument. The Shape mode does not measure displacement with any greater accuracy. The Shape mode records a larger number of samples across each bar, thus enabling a profile of the bar to be recorded, which allows wear patterns and irregularities to be inspected.

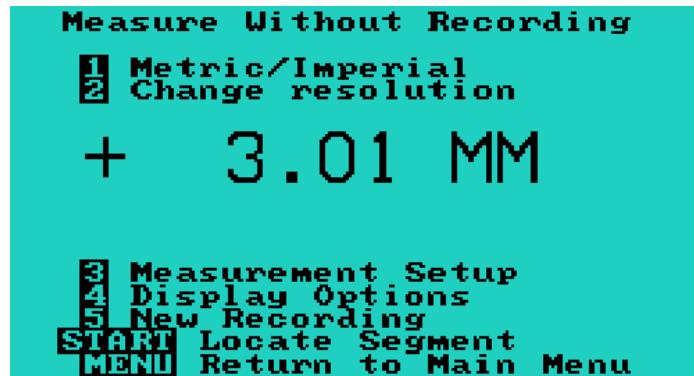
Since recording in Shape mode stores multiple samples for each bar, this Mode uses up the available memory much quicker than with Peak height recording.

Printouts of Bar Shape take considerably longer than those of Peak height. A 300 bar commutator will take more than two hours to print out on the supplied thermal printer. It is strongly suggested that, should you require to see bar shape, you download the data to the MAS software for analysis. Bar Shape is not necessary for general maintenance procedures.

Note: Recordings using Shape mode can be confusing as even very small variations will be shown. Typically these small variations have no relevance for general maintenance and are useful only in laboratory situations.


Measure Without Recording

This menu allows you to complete the setup before performing an actual recording.




Use this menu to set up the Displacement sensor for its zero position. Refer to Displacement Measurement Setup (page 33) for more information on how to set up the Displacement sensor.

Modifying the Units

- Press  Metric/Imperial to change between metric and imperial units.

Note: You can only change units for Temperature and Displacement sensors. Current can only be measured in amperes.

Changing Resolution

- Press  to change the resolution of the displayed measurement.

Note: To change the resolution for Displacement measurements you must set the sensor at fewer than 0.2 mm (8 mil). Refer to Positioning the Sensor Head (page 34) for details on sensor positioning.



The resolution options are:

Sensor	Metric / Imperial	Resolution
Displacement	Metric	0.01 mm or 1 μm (micron)
	Imperial	1 Mil or 0.01 Mil
Temperature	Metric	1 °C or 0.1 °C
	Imperial	1 °F or 0.1 °F

Note: You cannot change the resolution of Current measurements.

Measurement Zero

This option is only available for Current sensor measurements.

- Press   Measurement Zero to set the zero point for a measurement.

Display Options

The Display Options Menu allows you to change the way the data is displayed on screen.

- Press   Display Options to display this menu.

```
Display Options
1 Display type Graphic
2                 solid
3 Update at      100 ms

ENTER Continue
```

Display Type

This option is used to change the appearance of the measured data.

- Press **RESET** **1** Display type to change between a Graphic or Digital display.
- In Graphic display mode press **HELP** **2** to change from Solid to Line mode.

Update at

For Temperature and Current type measurements you can change the update speed.

- Press **LIGHT** **3** Update at, to cycle through the update speeds (50, 100, 250, 500, 1000, 2000) ms.

New Recording




Enter the settings for a new recording in the New Recording screen.

To display the New Recording Menu:

- From the Measure Without Recording Menu press **F2** **5**
- OR
- From the Main Menu press **LIGHT** **3**





Type

This option will take you back to the Measurement Setup Menu where you can change the type of sensor that is being used for the measurement.

- Press  1 Type to display the Measurement Setup Menu.
- Press  to display the Measure Without Recording Menu where you can complete the setup for the measurement.
- To return to the New Recording Menu press  5 New Recording.

Data Set


This option allows you to select a Data Set to store the recordings. The number of the currently selected Data Set is displayed next to this option.

- From the New Recording Menu press  2 Data Set.
- Use  and  to highlight a Data Set then press  to select it.

Note: Each Data Set can only store the same types of recordings. If you change the setup of the sensor and/or the type of recording to be taken the instrument will move to the next highest available Data Set to store the recordings in.


ID

This option lets you rename any Data Set. The name can be up to 16 characters in length.

- From the New Recording Menu press  3 ID to display the Edit Name Menu. See Editing Data Set ID's (page 17) for details of how to edit a Data Set name.


Size

This option lets you specify the number of samples/segment/bars for the measurement.

- Press  Size to enter the number of samples/segments/bars.

Recording




This option lets you specify the recording number of the measurement that is to be taken. If the recording number is not changed it will progress through the Data Set from recording 1 to recording 50 automatically.

- Press  Recording to change the recording number.


Note: Only numbers that have no measurements associated with them are available for selection.

Sample at

This option sets the sampling interval for Current and Temperature recordings.

- Press  Sample at.
- Press  and  to select the range of the sampling interval.






The available ranges are hours, minutes, seconds and milliseconds.

- Enter the desired sampling interval using the numeric keys. The available sampling interval is from 100 milliseconds to 60 hours.
- Press  to save your settings and continue.


Recording Options

The Recording Options Menu allows you to toggle the Autosize and Sample beep features ON and OFF.

To display the Recording Options Menu:

- From the Measure Without Recording Menu press  
- OR*
- From the Main Menu press  
- Press  Recording Options.


AutoSize

AutoSize sets the Size value to the total number of samples/segments/bars recorded when the  button is pressed to stop the recording.

- Press   AutoSize to toggle this option ON and OFF.

Sample Beep

Sample beep will cause the instrument to beep when each sample is recorded.

- Press   Sample beep to toggle this option ON and OFF.

Section 3: Taking Measurements

This section describes the procedures for performing advanced operations on your instrument.






You will learn to:

- Take Displacement measurements
- Take Current measurements
- Take Temperature measurements
- Review a recording in a Data Set
- Print and download a Data Set to a PC

Measuring Displacement - Profiles

Displacement Measurement Setup

Before a profile recording can be made the machine type must be known. Machine type is defined as a slip ring (or any other smooth surface) or a commutator that is to be profiled.

- From the Main Menu press   Measurement Setup.
- Change the Sensor to Displacement and select the desired Type of machine that is to be profiled.
- Select the Mode that you wish to record in - Peak height or Shape.
- Press  to display the Measure Without Recording Menu.
- Select the preferred display units (metric or imperial) and the display Resolution required.
- Setup the Display Options by pressing   Display Options.

Notes

The units selected have no effect on the data recorded and the units can be changed at any time without any change to the data.

The preferred units can be set as the default as the setting is saved permanently, provided the internal backup battery is not allowed to go flat.

The selected resolution has no effect on the recorded data as the highest resolution is always used.

When viewing the data in Graphic display type it is easier to read the data when the solid option is selected.

If you are recording using Peak height mode you will still see the actual shape of the bars displayed on the LCD if you have the Display Type set to Graphic.

Tips

After using Shape mode to record a machine you can print data (or send data to the software) using the standard resolution (only the Peak heights are printed). The reverse is not possible for Peak height recordings.

Recordings can be converted from Shape to Peak height mode (or vice versa) before being printed or sent to the MAS software. See Printing Options (page 46) for more information.

Positioning the Sensor Head

For best accuracy and greatest measurement range the sensor head should be positioned in the brush holder mid-way of its displacement. The Measure Without Recording Menu assists with the positioning of the sensor head by displaying the actual displacement. The optimum displacement is ± 0.00 mm (± 0 mil) however anywhere between ± 0.2 mm (± 8 mil) is acceptable.

- Fully retract the clamp by rotating the clamp knob anti-clockwise.
- Fit the sensor head into a vacant brush box with the appropriate number of packing pieces to loosely retain the sensor head – do not tighten yet. The sensor should be positioned square in the brush box (like a brush) and on a bar (if a commutator is being measured), not in the gap between bars.
- Mark the armature of the machine under test with the felt pen provided.



- Now rotate the machine to position the sensor adjacent to the reference mark. If you are measuring a commutator, position the sensor wheel approximately in the center of the marked bar - not in a gap between bars. This ensures that the bars are correctly detected when recording (the instrument expects abrupt steps as caused by the gaps between commutator bars).
- When the sensor head is approximately in position, tighten the clamp sufficiently in order to hold the sensor head in position by turning the knob clockwise (do not use any tools or levers as overtightening may damage the sensor and clamp).

The sensor must be located in the brush box so the display reads ± 0.2 mm or ± 8 mil or less.

Tips










- Position the sensor at around -0.3 mm (-12 mil) then tighten the sensor while watching the display. The sensor will naturally pull itself in towards zero.
- In situations that require external mounting of the sensor head, use the sensor sleeve and C clamp supplied. **Under no circumstances should the sensor head be clamped directly with any form of clamp.**
- Finally, rock the armature back and forth slightly to stabilize the sensor mechanism.
- After ensuring the sensor is still located approximately in the middle of the marked bar, check the display still reads ± 0.2 mm (± 8 mil) or less.


Measure without Recording

- To count the bars or check the shape without recording press 
- When you have finished press 

Recording a Profile

To start recording a new profile while in the Measure Without Recording Menu:

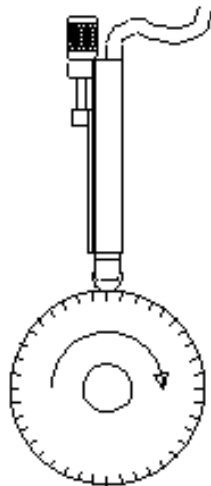
- Press   New Recording.
- Select the desired Data Set to store the recording(s) by pressing   Data Set.
- Give the Data Set a meaningful name such as the type of data it will store.
- Press   ID to access the Edit Name Menu and enter a new ID name for the Data Set.
- Edit the Size of the recording to be taken by pressing   Size. (The number of bars or segments set for the previous recording will be displayed.)
- If the number of bars or segments is unknown press  when setting the Size until ? appears.

If the number of bars is preset by specifying the Size, the recording will automatically be terminated when that number of bars/segments is reached. If the Size is set to ? then recording must be terminated manually by pressing 

The present recording number is displayed and will be incremented on subsequent recordings.

- If another Recording number is required press **F2** **5** Recording, and select the next Recording number from the list.
- Press **9** Display Options if you wish to display the recording in a different view from the one selected in the Measure Without Recording Menu.
- Ensure the sensor head is adjacent to the reference mark made earlier on the commutator then press **START STOP** to begin the recording.

When recording a profile the commutator/slip ring must be rotated from front (clamp side) to the rear of the sensor head, as shown in the following diagram.



Direction of Rotation



As the machine is rotated the screen will display the number of bars or segments detected. The number displayed indicates the previous bar or segment. The recording will automatically stop when the preset number of bars has been recorded.

- If the number of bars was not entered you will need to manually stop the recording by pressing **START STOP** when you reach the desired point.

Tips

The Data Set number can be changed to any number from 1 to 50 (excluding any numbers assigned to existing recordings with the same measurement type as the proposed new Data Set). The cursor will automatically skip incompatible Data Sets when selecting a new Data Set.




When assigning names to individual Data Sets (Data Set ID) we recommend that you use descriptive titles (up to 16 characters) for future identification and review, as up to 50 Data Sets may be recorded and stored.

You can change the Graph type by pressing   at any time during graphical display. The change only applies to bars or segments recorded from that point on.

Measuring Temperature

Temperature Measurement Setup

Note: Do not plug the Displacement Sensor into the PRTC module while the thermocouple is connected.

- Connect the K type thermocouple to the PRTC module
- From the Main Menu press   Measurement Setup.
- Change the Sensor to Temperature.
- Press  to display the Measure Without Recording Menu.
- Select the preferred display units as Metric (Celsius °C) or Imperial (Fahrenheit °F), and the display Resolution required.





Notes


The units selected have no effect on the data recorded and the units can be changed at any time without any change to the data.





The preferred units can be set as the default as the setting is saved permanently provided the internal backup battery is not allowed to go flat.







The selected resolution also has no effect on the recorded data as the highest resolution is always used.

Recording Temperature Data

- Press  New Recording.
- Press  Data Set to change the currently selected Data Set if required.
- Press  ID to display the Edit Name Menu and change the ID name of the selected Data Set.
- Set the number of samples by pressing  Size and enter the number of samples that are required. If the Size has not been entered, or there have been no previous recordings in the selected Data set then the Size will be ?



If the Size is defined as a number of samples, the recording will automatically be terminated when that number of samples is detected. If the Size is not defined as a number of samples (? samples) then the recording must be terminated manually by pressing 

- To change the Recording number press  Recording.
- Set the Sampling interval for the measurement by pressing  Sample.
- The sampling interval can be set from 100 milliseconds to 60 hours by selecting the range using  and , then entering the numerical value with the number keys.

- Press  to return to the New Recording Menu.
- Setup the Display Options by pressing  Display Options.
- Change the Update at option by pressing  to cycle through the values of (50, 100, 250, 500, 1000, 2000) ms. This is the speed at which the display is updated.
- Press  to return to the New Recording Menu.
- Before starting your recording ensure you have plugged the K type thermocouple into its socket on the PRTC module and fastened the sensor end to the object under test. **Do not connect the thermocouple to any live surface.**
- Press  to initiate the recording. When the number of preset samples has been reached the recording will be terminated automatically.
- If at anytime you need to terminate the recording press 

Notes

The Beeper will not work when the sampling interval is set for milliseconds.

- If you require the instrument to Beep each time it takes a sample you can do this by turning on the Sample beep option in the Recording Options Menu. To display the Recording Options Menu press  Recording Options from the New Recording Menu.
- Toggle the Beeper on or off during recording by pressing 

Measuring Current

Current Measurement Setup

- From the Main Menu press **RESET** **1** Measurement Setup.
- Change the Sensor to Current.
- Select the Input Range of the current sensor by pressing **HELP** **2** Input Range to cycle through the options of, 0 mV to 100 mV, (0 to 1.0) V and 0 V to 5.0 V.
- Select the Scale of the input by pressing **LIGHT** **3** Scale to change between 1 mV/amp or 10 mV/amp.
- Press **ENTER** to display the Measure Without Recording Menu.

Sensor Setup

The DC Current sensor must be plugged into the instrument and turned on in order to zero the instrument display. **Ensure the sensor is not connected to the load at this point.**






- Plug the DC Current sensor into the PRTC module.
- Press **HELP** **2** Measurement Zero to zero the displayed current.

Recording Current Data

The procedure for recording Current data is identical to that for recording Temperature data. Please refer to Recording Temperature Data (page 39) for information on how to carry out this procedure.





Ignore the reference to using the K type thermocouple as this does not apply to Current recordings.

Reviewing a Data Set

- To review a recording on the instrument, from the Main Menu press   Review Data Set.
- Use  and  to select the Data Set that you wish to review.
- Press  to accept the selection of the Data Set and display the Review Data Set Menu.

Dataset Number (No.)

This option allows you to change the number of the Data Set that is being reviewed.

- To change the current Data Set press   No. and use  and  to select the Data Set that contains the recordings you wish to review.





ID

This option allows you to change the Data Set ID of the currently selected Data Set.

- To change the ID of the Data Set press   ID to display the Edit Name Menu.

Recording


This option allows you to select the recording in the data set to be reviewed.

- Press   Recording then use  and  to select the recording to be reviewed.

Display Options



This option allows you to change some of the Display Options to different values than those used to take the recording that you are reviewing.

You can change the Display type and Unit type (Metric/Imperial) but not the resolution.

- Press  Display Options and change the options as required.

Print or Download Data Set


This option allows you to change from the Review Data Set Menu to the Print or Download Data Set Menu.

- Press  Print or Download Data Set to open the Print or Download Data Set Menu.
- To return to the Review Data Set Menu press  Review Data Set.

Refer to Print or Download Data Sets (page 45) and the topics that follow it for more information on printing.













Start at

This option allows you to specify a starting point for reviewing the selected recording. This is useful for examining the measurements around a known position of a recording that contains a substantial number of samples/segments/bars.



- Press  Start at, to display the Start at Menu.
- Press the numerical keys to enter the number of the sample/segment/bar to start at. The total number of samples/segments/bars is also displayed on the screen.

Note: If you enter a number that is larger than the number of samples/segments/bars, a ? character is displayed as the Start at position. If you then return to the Review Data Set Menu the Start at position will be set to the first sample/segment/bar.

Reviewing the Recording


- Press  to start reviewing the selected recording.
- Press   to clear the screen and return to the specified Start at point.
- Press  to cycle through the recorded samples/segments/bars. You can scroll through the data progressively faster by holding down .
- Press   to zoom out the displayed recording. When you reach the maximum zoom out point the display will return to the closest possible view.
- Press   to zoom in on the displayed recording. When you reach the maximum zoom in point the display will return to the furthest possible view.
- Press  and  to move the y axis up and down on the screen.
- Press  to stop reviewing the selected recording and return to the Review Data Set Menu.

Reviewing Short Cut Keys


  Clear the screen and return to the Start at sample/segment/bar

  Zoom out

  Zoom in

 Move up the y axis

 Move down the y axis

 Move through the recording one sample/segment/bar at a time. Holding down this key makes the data scroll progressively faster.






 Exit the Review Menu

Print or Download Data Sets

This set of menus is almost identical to the Review Data Set menus. Please refer to Reviewing a Data Set (page 42) for definitions of the options displayed on screen.

Printing Options

This is the only option that is different to the Review Data Set Menu. It allows for various printer and printing setups to be selected.

- Press  Print or Download Data Set from the Main Menu.
- Press  Printing Options.
- Press  Printer to cycle through the supported printer types.
- Commutator and slip ring recordings can be converted from Shape to Peak height mode (or vice versa) before being printed or sent to the MAS software. Press  Mode to toggle the mode before sending recordings to the printer or a PC.
- Press  Metric/Imperial to change between metric or imperial units before printing.

Notes

The Seiko DPU type printers are not designed for fast operation e.g. a Shape printout of 300 bars will take over 2 hours to complete. We suggest that you download any Shape recordings to the software.

A Shape printout is not possible if the Data Set has been recorded using Peak Height.

Printing from the Instrument

Warning: When using the DPU-414-30B printer, use only the Seiko power adapter provided (6.5 V output). Printer damage will occur if any other power adapter is used.

Note: When using the DPU-414 printer, ensure that the internal battery is charged prior to operation. If the battery is flat the printer will switch itself 'Off Line' and printing will cease.

The profiler instrument supports three different printer types:

The Seiko DPU-411-00SU dot matrix thermal printer


The Seiko DPU-411-043














The Seiko DPU-414-30B (serial interface)

The printer type must be 'known' by the instrument as the three different types respond differently to character and control codes sent by the instrument. The instrument stores the selected printer type as the default eliminating the need for routine printer type selection if the same printer type is always used.

The profiler instrument comes standard with the DPU-414-30B serial interface printer.

Regardless of which printer you use, the instrument transmits data in serial form. To use any of listed the printer types, you will require the supplied male 9-pin D-type downloading cable.

- Plug the printer cable 'D' connector into the printer serial input and the 5 pin connector plug into the instrument's RS232 port.
- Switch the printer on and ensure the ON LINE indicator (green) is on (press the ON LINE button if necessary).
- From the Main Menu press  Print or Download Data Set.

- Select the Data Set that contains the recordings that you wish to print by using  and  then press  to select the Data Set.
- Select the recording(s) to be printed by pressing  Recording.
- Use  and  to select an individual recording or to select the All option. Press  to accept the selection.
- Press  Printing Options.
- Press  Printer to select the Printer type connected to the instrument.
- Press  Metric/Imperial to toggle the printed units from metric to imperial.
- Press  to return to the Print or Download Data Set Menu.
- Press  to begin printing. During printing, the current Data Set and recording number is displayed on screen.
- To stop printing press .

Note: The instrument will display a 'No Printer' message on the screen if the printer runs out of paper, the cable is not connected, the printer has flat batteries or the printer has a fault.

Printer Setup and Information

Note: The DPU-411-00SU and DPU-414-30B printers do not feature a quick charge facility. We recommend you discharge the printer battery prior to charging, by leaving the instrument switched on until the battery is completely drained. The printer can then be charged using the correct power transformer provided. The printer battery should be charged for 10 to 16 hours.

Printer DIP Switch settings

Model DPU-411-00SU (serial only)

Switch	Function	Switch Setting	Status
1	Input Selection	ON - 8 bits	Essential
2	Parity Permission	ON - Without	Essential
3	Parity Setting	ON - odd	Essential
4	Baud Rate	OFF - 9600	Essential
5	Baud Rate	OFF - 9600	Essential
6	Baud Rate	OFF - 9600	Essential
7	Auto line feed	OFF -	Essential
8	Zero Form	OFF -	Optional

Model DPU-411-043 (serial/parallel)**8 way DIP switch**

Switch	Function	Switch Setting	Status
1	Input Format	OFF- Serial	Essential
2	Auto Line Feed	OFF	Essential
3	# of Columns	ON - 80	Essential
4	Characters	OFF (Std) ON ('Type II')	
5	Zero Form	ON	Optional
6	International Chr's	OFF	Optional
7	International Chr's	ON	Optional
8	International Chr's	ON	Optional

6 way DIP switch

Switch	Function	Switch Setting	Status
1	Data Bit	ON - 8	Essential
2	Parity Permission	ON - Without	Essential
3	Parity Setting	ON - odd	Essential
4	Baud Rate	OFF - 9600	Essential
5	Baud Rate	OFF - 9600	Essential
6	Baud Rate	OFF - 9600	Essential

DPU-414-30B Printer Setup

The DPU-414-30B has a virtual DIP SW which should be set up the first time the printer is used. You may need to reset operational settings if the supply voltage is interrupted.

Caution: Never turn the printer off while it is writing the new setting to memory. Always wait until DIP SW setting complete !! is printed before turning the power off.

To set the virtual DIP SW, begin with the DPU-414-30B switched off and complete the following procedures:

- Slide the power switch to ON while pressing the ON LINE button.
- Release the ON LINE button after a list of the current settings starts printing out.

The printout of the current settings is followed by the prompt:

Continue ? :Press On-line SW
Write ? :Press Paper feed SW

- To change the DIP SW settings press the ON LINE button.
- To leave the DIP SW settings unchanged press the FEED button.

After pressing the ON LINE button, DIP SW1 is printed, prompting the input of new settings for switch numbers 1 through 8 of DIP SW1. Refer to the following table for the required settings to print from the instrument. Always input either ON or OFF for every setting for switch numbers 1 through 8 because DIP SW Set mode cannot be cancelled once it is initiated.

- ON can be set by pressing the ON LINE button once and OFF by pressing the FEED button once

The setting is printed out after the ON LINE or FEED button is pressed to confirm the new setting.

As soon as switch number 8 is set the printer once again prompts Continue ? or Write ?. Continue ? (ON LINE) allows DIP SW2 and DIP SW3 to be set in turn, and Write ? (FEED) exits DIP SW setting mode.

After the FEED button is pressed, the ON LINE and OFF LINE lamps alternately blink and the new settings are written to memory. When the printer finishes writing everything to memory, 'DIP SW setting complete !!' is printed out and the printer returns to the ON LINE mode.

As soon as switch number 8 of DIP SW3 is set, the printer writes the settings to memory regardless of which button is pressed.

DPU-414-30B 'Virtual' DIP Switch Settings

DIP SW	Switch No.	Function	Switch Settings	Status
DIP SW1	1	Input = Serial	OFF	Essential
	2	Printing Speed = High	ON	Optional
	3	Auto Loading = ON	ON	Essential
	4	Auto Line Feed = OFF	OFF	Essential
	5	Setting Command = Enable	ON	Essential
	6	Printing	ON	Optional
	7	Density	OFF	Optional
	8	= 93%	OFF	Optional
DIP SW2	1	Print Columns = 40	ON	Essential
	2	User Font Backup = ON	ON	Optional
	3	Character Select = Ordinary	ON	Essential
	4	Zero = Normal	ON	Optional
	5	International	ON	Essential
	6	Character	ON	Essential
	7	Set	OFF	Optional
	8	= England	OFF	Essential
DIP SW3	1	Data Length = 8 bits	ON	Essential
	2	Parity Setting = No	ON	Essential
	3	Parity Condition = Odd	ON	Essential
	4	Busy Control = H/W Busy	ON	Essential
	5	Baud	OFF	Essential
	6	Rate	ON	Essential
	7	Select	ON	Essential
	8	9600 bps	ON	Essential

Section 4: Utilities

This section describes how to use the utility functions of your instrument.

You will learn to:

- Adjust the LCD
- Set the clock
- Manage the battery pack
- Manage memory usage

Adjusting the LCD Screen

Adjusting the Contrast

- From the Main Menu press  to darken the LCD. To lighten the LCD press .

If the screen flickers when cursors are moved make the LCD darker.






Restoring the Default Contrast

- From the Main Menu press   to restore the default contrast.

Turning the Backlight On

- To toggle the backlight ON and OFF press  .

Setting the Date and Time


- From the Main Menu press  Date & Time.
- To cycle to a particular item press . The item will flash to show that it is selected.
- Use  and  to change the value of the currently selected item.
- Press  to save changes and exit.

All recordings are date and time stamped according to the clock shown in the Date & Time Menu.

Battery Management

The instrument is powered by a rechargeable Nickel-Cadmium (Ni-Cad) battery pack. The normal operating range is 6.0 V to 8.5 V. The Battery Management Menu displays the current percentage of full battery charge available.

Some automatic features have been built into the instrument to help ensure that the battery pack is always sufficiently charged.

Below 6.6 Volts, the instrument displays a flashing  icon at the top left corner of the screen and beeps once every minute as a reminder that the battery pack needs to be charged. In the Battery Management Menu a flashing 'Low Battery' message is also displayed.

Below 6.1 Volts, the instrument automatically turns off the backlight to prevent further power draining.

Below 80% battery capacity, the instrument automatically begins to charge the battery pack if external power is supplied.

At 5.5 Volts, the instrument automatically powers down. The power saver is another feature that helps conserve power.

The instrument is equipped with an internal backup component that protects data and settings in case the battery pack is momentarily removed from the instrument. The backup component is kept charged by the battery pack if the battery pack is functioning normally.

Warning: Do not detach the battery pack from the instrument for more than 2 hours as this will drain the backup component, thereby causing data and setting to be lost.

Warning: Before charging the battery pack, ensure that the power transformer used is an approved instrument power transformer 13.5 V \pm 1.5 V DC, 1 A output, center positive, and that the voltage and frequency of your mains AC power matches that of the power transformer.

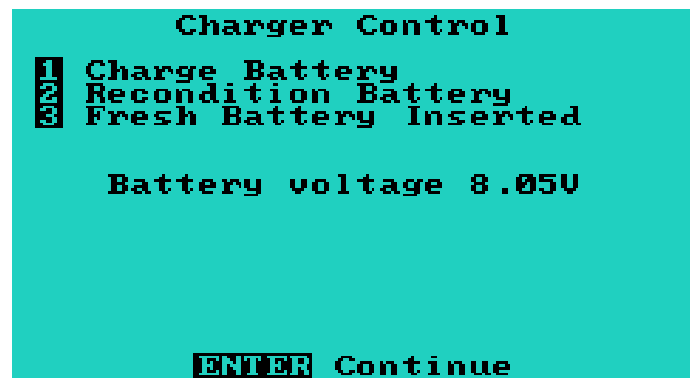
The battery pack can be charged by supplying 13.5 V ± 1.5 V DC, 1 A power to the instrument charger socket. The power transformer supplied in the kit provides this DC voltage. The optional car adapter charging lead may also be used to charge the battery pack in a vehicle with a 12 V negative-chassis power system.

Checking the Battery Charge and Voltage

- From the Main Menu press **8** Battery Management. The remaining battery charge and voltage are displayed.

Charger Control

This menu allows manual control of the battery charge function. The current battery voltage and charging state are displayed.



RESET
1

Charge Battery

Manually begins battery charging cycle.

HELP
2

Recondition Battery

Fully discharges, and then automatically recharges the battery.

LIGHT
3

Fresh Battery Inserted

Resets the battery capacity scale percentage to 100% at the current battery voltage.

These options are explained in detail in the following pages.






Recharging the Instrument

Warning: Read the warnings in the Battery Management section before charging the battery.


- Plug the power transformer into a standard power outlet and the connector to the instrument's charger socket.

If the battery charge level is less than 80% the battery will begin charging automatically. You can continue to use the instrument while the battery pack is being charged.

If the battery does not begin charging automatically follow the instructions below to begin charging.

- From the Main Menu press  Battery Management.
- Press   Charger Control.
- Press   to begin charging. A flashing 'CHARGING' message will be displayed.

If there is no power coming from the power transformer, a flashing 'NO CHARGER' message will be displayed. If this happens check that the mains power is turned on.






Charging stops automatically when complete or you can press  when in the Charger Control Menu to stop it. A full charging cycle takes approximately 2 1/2 hours. All other functions are usable while the battery pack is being charged.

Reconditioning the Battery Pack

Warning: Read the warnings in Battery Management (page 56), before performing this operation.

Battery reconditioning is the process of first discharging and then recharging batteries. It reduces the undesirable memory effect in the Ni-Cad battery. The battery pack should be reconditioned the first time it is used and at least once a month thereafter to prevent battery degradation. The recondition process will take up to two hours, depending on initial battery charge.

Caution: If the battery pack is not reconditioned the first time it is used, the battery charge displayed may be incorrect.

- Plug the instrument power transformer to a standard power outlet and its connector to the instrument charger socket.
- From the Main Menu press  Battery Management.
- Press   Charger Control.
- Press   to recondition the battery. Discharging is indicated by the flashing 'DISCHARGING' message on the screen.

The instrument automatically proceeds to charge the battery once the battery pack is fully discharged.

Fresh Battery Inserted



This resets the battery capacity scale percentage to 100% at the current battery voltage. This option should be used when a new, fully recharged battery is exchanged for a discharged battery.

Caution: If this selection is made when the attached battery is not fully charged the battery capacity scale will no longer be set accurately. Performing a Recondition Battery will recharge the battery and reset the scale.

Power Saver

Power saver is a feature that helps conserve power in the instrument. Power saver will turn the LCD display off after 8 minutes of inactivity (no key presses). The instrument will continue to function and any key press will turn the LCD on to the previously displayed screen. After 15 minutes of inactivity Power saver will power down the instrument. If the battery is being recharged, only the LCD screen will be turned off and the instrument will remain on until charging is complete.

The Power saver is automatically turned on every time the instrument is powered up. You may turn it off temporarily by toggling Power saver OFF from the Battery Management Menu.

- To turn off Power saver, from the Main Menu press  Battery Management.
- Press  to toggle Power saver ON and OFF.

Replacing the Battery Pack

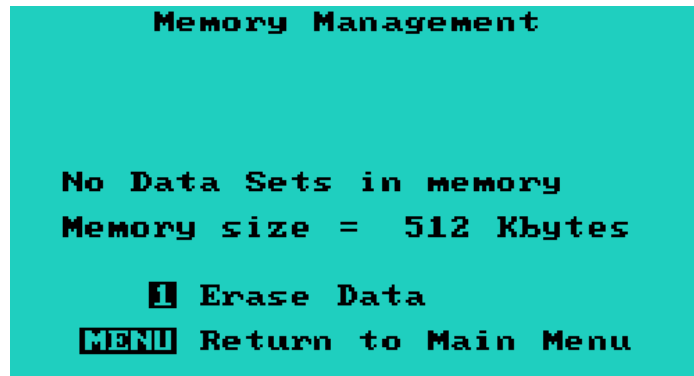
- Lift the boot stand.
- Unscrew the battery pack using a suitable screwdriver and screw in the new one.

Warning: Ensure that the battery pack is securely fastened but not over-tightened.

Memory Management

The Memory Management Menu allows for checking the amount of memory used by recordings and the deletion of recordings, Data Sets and even the entire memory contents.







- From the Main Menu press  Memory Management.



The amount of memory currently used is displayed on screen in a percentage format, along with the total memory size and the number of Data Sets that are being or have been used.

Erasing a Data Set







To erase a complete Data Set and leave all other Data Sets and Settings intact:

- From the Main Menu press  Memory Management.
- Press  Erase Data.
- Press  Select Data Set and use  and  to select the Data Set to be erased.
- Press  to delete the selected Data Set.

Warning: The instrument will not ask for confirmation when deleting a single Data Set.

Erasing a Recording

To erase a single recording from a Data Set and leave all other recordings intact:




- From the Main Menu press  Memory Management.
- Press  Erase Data.
- Press  Select recording and use  and  to select the recording to be erased.
- Press  to delete the selected recording.

Warning: The instrument does not ask for confirmation when deleting a single recording.

Erase All Memory

Warning: Following the procedure below erases **ALL** folders and **ALL** recordings in the instrument.


Before erasing data you may wish to archive it on your PC. See Transferring Data to a PC (page 70), for more information.



- To erase all data sets and recordings, from the Main Menu press  Memory Management.
- Press  Erase Data.
- Press  twice to erase the memory of the instrument.

Warning: Erase All Memory will reset the instrument to factory default settings.

Section 5: Troubleshooting

Resetting the Instrument

If the electrostatic discharge exceeds 8 kV the instrument may not respond to any key presses (including  presses). In such cases you must reset the instrument as soon as possible as it will continue to draw power until it is reset and turned off.

- In any screen hold down  and press  then release to reset the instrument.

Resetting the instrument does not erase data or settings stored in the instrument.

Data Problems

Symptom	Cause	Remedy
Data lost when battery pack detached for more than 2 hours	Flat backup battery	Charge battery pack Send instrument to authorized dealer for servicing
Data lost when battery pack replaced	Flat backup battery	Send in for servicing
'Insufficient memory' displayed	No memory space left for recordings	Erase obsolete recordings (transfer to computer first if necessary)
Measured data seems incorrect	Sensor wired wrongly Faulty sensor	Wire as recommended Replace sensor
Beeps when recording, 'Memory nearly full' displayed	Only 200 samples approximately left free in memory	Delete obsolete records
'Memory full' displayed	No memory left for recording	Delete obsolete records

Data-Transfer Problems

Symptom	Cause	Remedy
'No PC?' displayed, and data cannot be transferred to the PC	Data-transfer cable not properly connected Data-transfer cable connected to the wrong PC COM port Baud rate setting in MAS software too high	Re-secure cable connections Test COM port availability and use available port Select a lower baud rate in MAS software
MAS software unable to transfer data and 'Transfer failed' or 'MAS Error Dialog' displayed on PC	Baud rate setting in MAS software too high	Select a lower baud rate in MAS software

Power Problems

Symptom	Cause	Remedy
Instrument cannot power up	Low battery level Electrostatic discharge (ESD exceeding 8 kV)	Charge battery pack Reset instrument
Instrument powers down when backlight is turned on	Low battery level	Charge battery pack
Instrument powers down shortly after powering up	Low battery level	Charge battery pack

Printing Problems

Symptom	Cause	Remedy
Stops or will not start Printing	Flat Printer battery	Charge printer battery
Wrong characters in printout	Wrong printer selected or incompatible type	Select alternative type
Will not print, 'No Printer ?' displayed	Printer not on-line, off, or not connected	Turn on, select 'on-line' connect printer Check connection

Other Problems

Symptom	Cause	Remedy
instrument does not respond to any key press	Electrostatic discharge exceeds 8 kV	Reset the instrument
'Module Fault' displayed	Module loose Module damaged	Tighten Send in for servicing
'Switch off then connect module' is displayed	Module has worked itself loose (n.b. the module is where sensors are plugged in). Module is damaged	Switch off the instrument and press firmly on the module or use an allen key to tighten it Reset instrument Test for module damage - switch off the instrument and plug in the battery charger. From the battery management menu press the 'menu' key. The main menu should appear without the model number (instrument3000/2000/1000). This will confirm that the main instrument is OK and that the module is faulty. Send instrument to an authorized dealer for servicing.
Data corrupted, 'MEMORY ERROR' displayed	Electrostatic discharge exceeds 8 kV	Reset instrument
Locks up when touched	Electrostatic discharge exceeds 8 kV	Reset instrument
Continuously beeps when recording, 'High mica' displayed	Wrong machine type, or very narrow bar gaps	Select slip ring type
Beeps when recording, 'Speed' displayed	Commutator turned too fast	Reduce rotational speed
Spurious steps in profile recording	Sensor head moved	Re-secure sensor clamping
Regular oscillation in instrument recording (every 3 or more bars)	Sensor wheel damaged	Send in for servicing

Symptom	Cause	Remedy
Erratic readings	Dust on commutator	Clean commutator or slip ring
'Memory partition full' displayed	No memory left for recording	Delete obsolete records

Section 6: Analysis Software

Recordings made on your instrument can be transferred to the profiler MAS software running on a Windows-based PC. MAS stands for Measurement Analysis Software. The MAS software can be used to store, graph, analyze, print and export your recordings.

It is assumed that the user of MAS is already familiar with basic Windows commands. Please refer to the appropriate literature on Windows if clarification is needed on mouse and keyboard commands.

Tips

- When running the software press F1 on your keyboard to open a comprehensive, topic-specific Help screen.
- Click the right mouse button anywhere in the MAS software to open a shortcut menu of the applicable commands.

Installing Profiler MAS

System Requirements

The following are the minimum PC system requirements for installing the software:

- Pentium processor or better
- 32 MB RAM (64 MB recommended)
- 10 MB hard disk space
- CD-ROM drive
- Windows 95, 98, Me, NT 4.0 (SP6) or 2000 operating system
- Windows compatible display and printer
- Windows compatible mouse or other pointing device
- An unused COM port for communicating with the instrument

Installing MAS

- Close all programs on your PC.
- Insert the MAS CD-ROM into the CD-ROM drive.
 - Wait for the MAS installation program to automatically start.

OR

- Run the MAS Install.exe program located on the CD-ROM.
- Follow the on-screen instructions to complete the installation.

Starting the Software

When you install the software, program shortcuts will be created on the Desktop and in the Windows Start menu.

- Double-click the MAS desktop icon.
- OR*
- Click the Windows Start Menu then choose **Programs>Profiler MAS>Profiler MAS 5.00.**

Configuring a PC COM Port

To allow data transfer between the instrument and the PC, you must first configure your PC COM port as follows:

- Connect the instrument to a COM port using the data-transfer cable then power up the instrument.
- From the MAS main menu click **Tools>Configure COM port**.
- Select the COM port that the instrument is connected to.
- Select a baud rate. The baud rate is the speed (in bits/second) at which data is transferred. The lower the baud rate the less likely that data-transfer errors will occur. 'Automatic' is the default choice and is sufficient for normal transfers.
- Click **Test port**.
- Click **Yes** in the Confirm window to test the connection. If the connection fails see sub-heading 'Causes of connection failure' at the end of this topic. If the connection is good continue as follows:
- Click **OK** in the second Confirm window to acknowledge that the instrument is attached to the COM port.
- Click **OK** to exit the MAS Configuration window.



Causes of connection failure

If your PC fails to detect your instrument check the following:

- The instrument is powered on
- You have selected the correct COM port that the data-transfer cable is connected to
- The data-transfer cable is plugged in firmly
- The PC COM port is correctly configured (ask your IT help person for assistance with this)

Transferring Data to the PC

Data transferred to the PC is stored in MAS files. These are text files and have a .mas extension.

- To transfer data from the instrument to the PC power up the instrument.
- Check the battery charge and if it is less than 30% charge the battery pack (see Recharging the Instrument on page 58).
- Connect the RS232 port of the instrument to the configured PC COM port using the data-transfer cable.
- Start the software and click the **Receive** button.
- On the instrument's Main Menu press  Print or Download Data Set.
- Select the data set and recording(s) to transfer.
- Press  to begin the transfer. Once the data-transfer is complete the data will appear in the current file in the software or, if no files were open, the data will appear in a new file.
- To append more data from the instrument to the current file click **Receive**.
- Alternatively, to receive more data but in its own new file click **File>Receive from Profiler>Transfer to a New File**.
- To save the data in the current file (i.e. with the same name and in the same location) click **Save** twice. To save the file with a new name or location click **Save** once then change the name/location as required and click **Save** again.

Using Help

An extensive Help file is included with the MAS software. The Help system contains a wealth of detailed information not included in this reference guide and incorporates many screen shots to help illustrate procedures and concepts. If you have any difficulty understanding the procedures described in this reference guide or are unclear on some of the features of the software, please consult the Help file.

- To access the Help file, from the Main Menu click **Help>Contents**.

Managing Data

The remainder of this reference guide will teach you how to view and manipulate your collected data. A sample data file has been included with the MAS software for you to experiment with. This file is called:

Demo data.mas

To work with this file use the instructions in the following topics to open, view and manipulate its contents.

Opening a File

- On the toolbar click **Open**.
- Select your file and click **Open**.

Merging Two Files

- Open one of the files by clicking the toolbar **Open** button.
- Select your file and click **Open**.
- Click **File>Import & Merge a file** and select the other file to be merged into the open file. The merged data can be viewed but is not automatically saved on the PC.

- To save the file using the current name click **File>Save** or choose **Save As** to rename the file before saving.

Using the Navigator

When a file is open the navigator is displayed. The navigator consists of two panes on the left of the screen. The top pane shows all the folders in the file. The bottom pane shows all the recordings in the selected (highlighted) folder.

Deleting Data from a Folder

- Select the folder in the top (Datasets) section of the navigator.
- In the bottom navigator (Recordings) select the individual recordings and/or channels to be deleted.
- Click **File>Delete Records** or press the **Delete** key.
- You will be prompted to confirm the deletion. Click **Yes** to confirm.

Editing Recording Details

- Select a folder to display the recordings contained within it then select the recordings and/or channels to be edited.
- In the main window click the 'Info' tab to access the Info page. Here you can edit the User Details (e.g. Company Name, MMS serial number) Folder Name, and the Recording Details (e.g. recording name, remarks, channel labels and units).
- In the 'User Details' section you can edit the Default User Details. These values are written to all future recordings while they are being transferred from the instrument.

Viewing and Printing Data

- Open the file and use the navigator to select the recordings and/or channels to be viewed and/or printed.
- Click the 'Values' tab. The data in the selected recordings and/or channels can now be viewed.
- To change the value in a cell click the cell twice slowly and type in the new value.

Note: For high-resolution (shape) profile recordings, each recording contains several sub-samples. These are all displayed but may not be edited.

- To reduce the amount of data by averaging click **Average** (only available for data logger recordings).
- To print the data click **Print**.
- To copy the values to a spreadsheet program such as Excel click **Copy** (to clipboard), open your spreadsheet program and use its **Paste** command (this will normally be available from an **Edit** menu).
- To print a report on the data click **File>Summary Report** or **Generate Full Report** and select the print option in the Data Summary or Report Generator window that appears.

The Summary report produces a data summary of the selected recordings/channels. For more information consult the MAS Help file, which is available under **Help>Contents**.

Exporting data

- In the navigator select the folders or recordings to be exported as a .mas file.
- Click **File>Export** and select the option required.
- Enter a name and choose a location for the export file then click **Save**.

Calculating Data

You can perform calculations on your data logger recordings by creating new 'calculated' channels.

Note: You cannot perform calculations on profile recordings.

- Open the file and use the navigator to select the recordings and/or channels to be used in calculations.
- Click the 'Values' tab to display the data then click the toolbar **Calculate** button to open the Calculate window.

Each channel is automatically given a 'tag' character that is used to identify the channel. It is a letter of the alphabet that can be used to reference the values of a recording for use in calculations.

Expressions can then be derived using the provided functions and the channel tags, for example:

TempChange = ChangePerHr(B) with units degC/hr

This example will create a channel called 'TempChange' which is calculated as the rate of change per hour of the Channel which has tag 'B'.

Constants can also be used in calculations. You may need to use constants in your expressions.

Example:

To find the 'difference from the mean value' for a particular channel represented by 'tag' 'D'.

- Define a constant to provide the mean value of channel 'D'.

'K0 = Mean(D)'

This constant is then used in the expression:

'DiffFromMean = D – K0'

See Appendix B: Profiler MAS Math (page 89) for a complete list of the functions available.

Plotting Data

Plotting Single and Individual Charts

- Open the file and use the navigator to select the recordings and/or channels to be plotted.
- Select the 'Chart' tab and click **Plot**. You can also plot a recording or channel by double-clicking it in the navigator.
- To display the selected recordings and/or channels on individual charts, on the toolbar click **Individual** (available for data logger recordings only, not profiles).
- To change the format of charts click **Adjust** to open the Adjust Axes & Colors window. This window allows you to change the axes and colors of the plotted recordings displayed on the chart.
- To clear all plotted recordings, from the main menu select **Chart>Clear Chart**.
- To retain existing plots when adding to the chart click **Hold** then double-click additional recordings to add them to the chart. A maximum of 16 plots can be displayed at a time

- To align Profile recordings click **Rotate**. Refer to Analyzing Profiles (page 80) for more details.
- To enlarge a chart you can hide the legend by going to the main menu and de-selecting **Chart>Show Legend**. You can also Hide the navigator by selecting **Window>Show Navigator**.

Note: If any recording(s) are plotted on either the 'Chart', 'Histogram', or 'Radial' tabs, the recording(s) will also be on the other tab views.

Zooming and Panning

Zooming and panning is available in the 'Chart', 'Histogram', and in restricted form 'Radial' tabs.

To zoom in on any part of a chart

- Left-click a place on the left side of the chart section you wish to zoom.
- Hold down the mouse button while you drag a rectangle *across and down to the right*.
- Release the mouse button to perform the zoom.

To zoom in horizontally

- Proceed as above, but only move the mouse directly *left or right* to select the area to be enlarged. Two vertical lines will be displayed across the chart to indicate the selection.

To zoom in vertically

- Proceed as above, but only move the mouse directly *up or down* to select the area to be enlarged. Two horizontal lines will be displayed across the chart to indicate the selection.

To unzoom from any view

- Left-click any place in the chart and drag a rectangle *across and up to the left* to display a rectangle with a cross in it. When you release the mouse button the chart will return to its original size and location.

Panning

The chart can be dragged in any direction to display sections that are hidden from view.

- To pan around the chart click anywhere and hold down the *right* mouse button in the chart display. The cursor will turn into a pointing hand icon. Drag the mouse pointer in the direction that you wish to move the chart.

If you move the cursor off the chart you will have to release the right mouse button and return it to within the chart boundaries to continue panning.

Printing Charts

- On the toolbar click **Print** while the chart is displayed and click the **Print** button in this window to print the chart.

Changing the color scheme

- Choose the color scheme for printing by selecting a different scheme from the drop-down box (e.g. Black & White, Full Color or Color on White background).

Creating report titles and headers

- To add your own title and header click the **Headers** button.
- Tick the boxes as required to allow text entry into the 'Report title' and 'Subheading' fields.
- Type your headings then click **OK**.

Previewing the report without printing

- To see how your report will look when printed out click **Preview**.
- When you have finished previewing the report click **Close**. Make further adjustments to the setup if required (changing the orientation etc) then preview again or click **Print** when you are satisfied.

Reading and Comparing Values

To place cursors on charts to read the data values on curves:

- Plot the recordings and/or channels on a single chart.
- To place a cursor at a particular point on a curve, place the mouse cursor at that point, follow the curve until a crosshair appears then click the left mouse button. If the default cursor options are used, the cursor comprises a horizontal and a vertical dashed line, and the values indicated by the cursor are displayed at the edge of the chart next to the dashed lines.
- To move the cursor to a different point on the same curve press the horizontal arrow keys. To move in small steps hold down the **CTRL** key when pressing the horizontal arrow keys. You can also move the cursor by clicking the left mouse button on the new point (first allowing a crosshair to appear).
- To move the cursor to a different curve press the vertical arrow keys. Alternatively, click the left mouse button on the new curve or on the appropriate symbol on the legend.

Placing a second cursor on the chart

- Place the mouse cursor at the point of interest, follow the curve until a crosshair appears, and then click the *right* mouse button. If the default cursor options are used, the difference between the values indicated by the cursors is shown at the top right corner of the chart. Cursor A corresponds to left mouse button and cursor B to the right.

Toggling between cursors

- To toggle the focus between the cursors press the space bar - a cursor must be focused before it can be moved using the arrow keys. A cursor is focused if it has a rectangular target.

Removing the Cursors

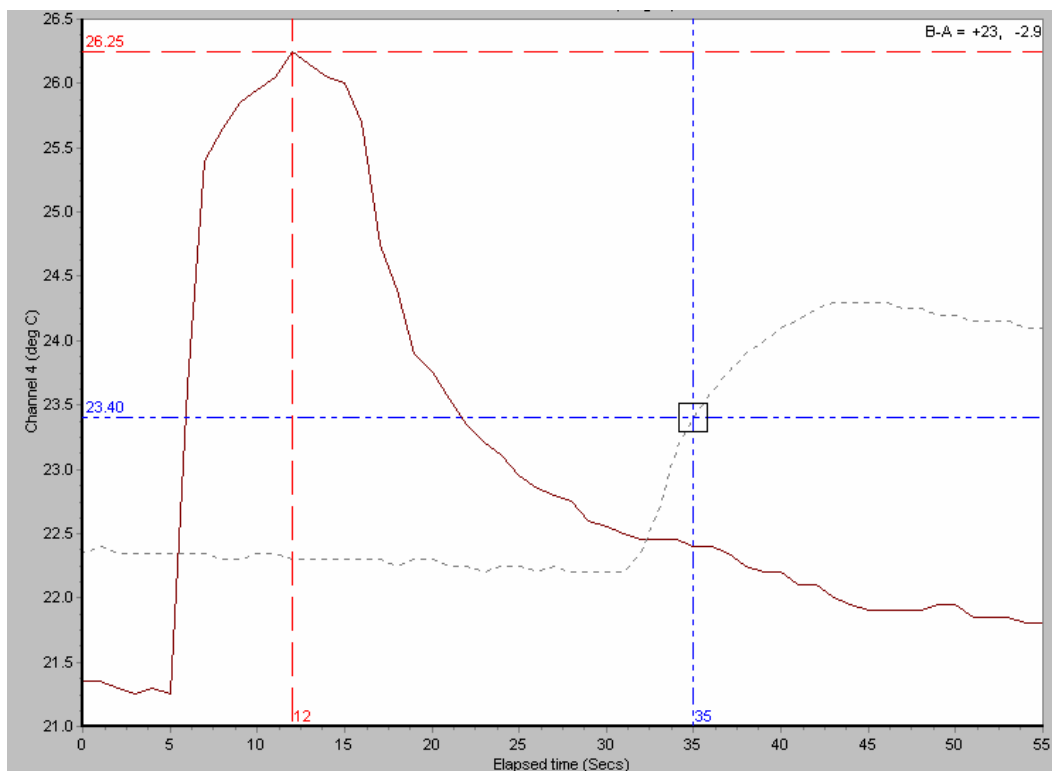
- To clear the cursors press the **Esc** key.

Changing cursor options

- To change cursor options click **Chart>Cursor Options**.

Example

The pictured two-channel temperature recording has both cursors displayed (using the default cursor options).



Each cursor displays the x and y axis values and the difference in both the x and y axis values of the two cursors in the top right hand side of the chart.

Note: This feature is available on the Chart page only.

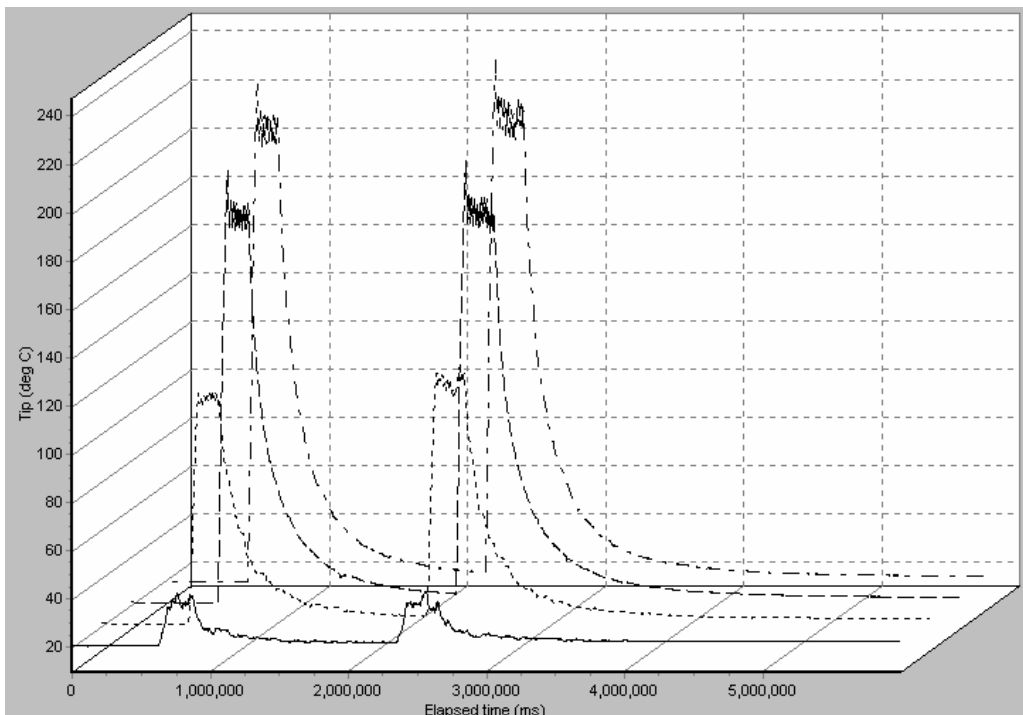
Plotting Waterfall Charts

- Plot the recordings and/or channels on a single chart.
- Click **Chart>Waterfall Chart** and select the depth required.

Waterfall charts are useful for trending data behaviour. Cursor and zooming functions can be used on waterfall charts.

Example

The four curves on the waterfall chart below correspond to three sets of data pertaining to the same measurement point. This shows that the peak value has a rising trend.



Note: This feature is available on the Chart page only.

Analyzing Profiles

Histogram Chart

The 'Histogram' tab lets you display profile recordings as bar-to-bar height (for commutator recordings) and segment-to-segment height (for slip ring recordings).

- To plot the data for a commutator or slip ring on the Histogram select the recording(s) to be plotted.
- Select the 'Histogram' tab and click **Plot**. You can also plot a recording or channel by double-clicking it in the navigator while having the 'Histogram' tab selected.

Note: If any recording(s) are plotted on either the 'Chart', 'Histogram', or 'Radial' tabs, the recording(s) will also be on the other tab views.

Radial Chart

The 'Radial' tab lets you display profile recordings in a radial form. This view of recordings displays the data in a more natural way displaying the true shape of the commutator or slip ring (with a highly amplified radial scale).

- To plot the data for a commutator or slip ring on the Radial Chart select the recording(s) to be plotted.
- Select the 'Radial' tab and click **Plot**. You can also plot a recording or channel by double-clicking it in the navigator while having the 'Radial' tab selected.

To adjust the Radial scale

- Click **Adjust**, select the Radial axis options and enter the required value into the Radial scale box.

Notes

The scale of the Radial chart does not automatically change its range like the Chart or Histogram charts. This allows for easy comparison between recordings.

If any recording(s) are plotted on either the 'Chart', 'Histogram', or 'Radial' tabs, the recording(s) will also be on the other tab views.

The Radial Chart has restricted zooming options. All zooming to be performed is done in a square and not a rectangle. There are also no horizontal or vertical zoom options available on a Radial Chart.

If more than one revolution was recorded on a commutator this can be corrected by setting the 'Actual Num Bars'. You can set the 'Actual Num Bars' on the 'Info' page and this will cause the tail end of the recording to wrap around on the Radial chart.

Rotating Profiles

The Rotate button is available for the Chart and Radial pages This option allows you to align profiles that were taken from different starting positions.

- To rotate or flip a profile recording plot the recordings in the Chart or Radial page.
- Click **Rotate**. The Rotate & Flip window will be displayed.
- Select the recording to be manipulated.
- Perform the required change by clicking the associated button to perform the manipulation required.

If a recording was performed with the sensor clamped in an opposite direction to previous recordings, clicking the **Flip** button will flip the selected recording so it matches the other recordings.

Alarms

Setting up Alarms

Profiler MAS can check your commutator and slip ring recordings for the following alarm conditions:

Total Indicated Runout (TIR) – the difference between the highest and lowest points on the profile.

Maximum Bar-to-Bar (MBTB) – the difference in height between adjacent commutator bars.

Maximum Segment to Segment (MSTS) – the difference in height between adjacent Slip Ring segments. Note that a segment is simply a lineal distance equal to $4 \text{ mm} \pm 0.5 \text{ mm}$ (160 ± 20) mil.

High Mica – lists any Mica insulators (between commutator bars) which are not recessed below the bar surface.

To edit the alarm settings

- On the 'Info' page click **Edit** in the 'Alarms Settings' section. You must have commutator or slip ring recording(s) selected to display the 'Alarms Settings' on the 'Info' page.

The setting values of the alarms can be edited for the selected recording(s).

MBTB and MSTS alarms have a Range setting. The default value of 1 means that adjacent bars or segments are compared. You can increase the value if you want to perform the check over a wider group of bars or segments.

- To set up a default set of alarms for your recordings click **Edit Defaults**.

Notes

If you check the 'Apply these defaults to future recordings' box, these alarm settings will be applied to all profile recordings received from the instrument.

You can also Save and Load various previous alarm settings using the **Save** and **Load** buttons.

Checking Alarms

The icon for each recording in the navigator will change color to red if the recording has generated one or more alarms. This will only occur if Enable Auto Alarms has been set.

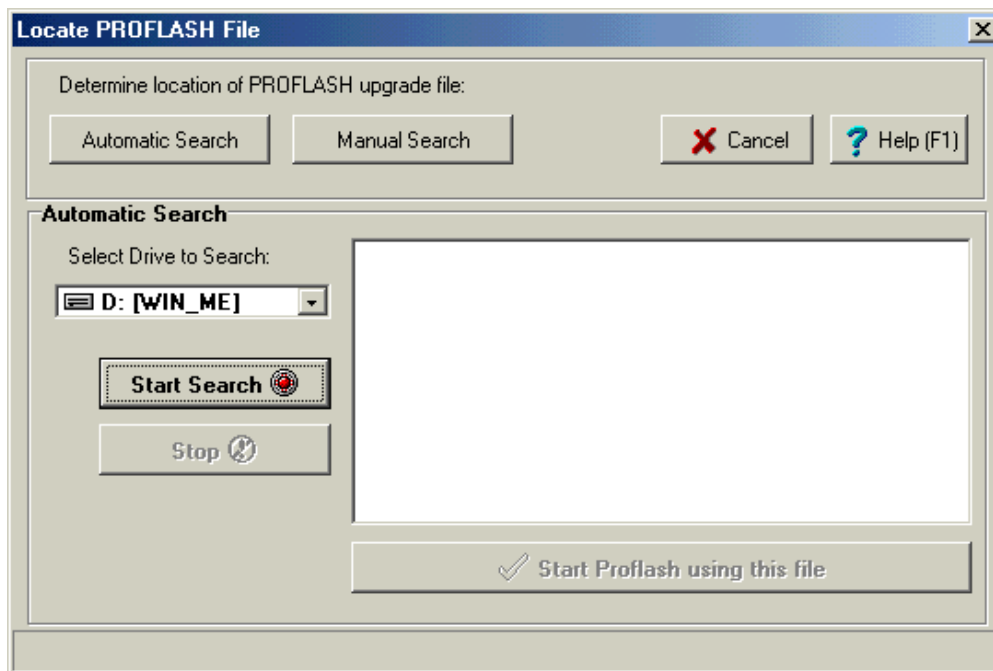
- To enable Auto Alarms select **Tools>Auto Alarms**. Alternatively click the toolbar **Alarms** button and select 'Enable Auto Alarms'.
- To check the alarms for recordings select the recording(s) you wish to check.
- On the toolbar click **Alarms** to display the list of alarms that have been triggered by the recording(s).
- To obtain more information about each alarm condition, click on its button. This will display a detailed report about the recording that can be printed or copied to the clipboard and pasted into another application.

Upgrading Firmware Using PROFLASH

When an upgraded instrument firmware version is available it will be posted on the Commtest Instruments Ltd website www.commtest.com under **Downloads>Profiler**. Once you have obtained the firmware file the firmware can be upgraded using the *PROFLASH* procedure below.

Warning: Upgrading the firmware erases **all** data in the instrument.

- With the instrument powered on, connect and turn on the battery charger.
- Connect the RS232 port of the instrument to the configured PC COM port using the data-transfer cable.
- Transfer any data you wish to keep to the MAS software.
- In the MAS software click **Tools>PROFLASH Profiler**.
- In the *PROFLASH* window click **PROFLASH** then **Automatic search**.



- Click the drop-down box **Select Drive to Search** and select the drive where the new firmware version is located.
- Click **Start Search** and when the search is completed select the new firmware file.
- Click **Start Proflash using this file**.

Once the reprogramming is complete the instrument will beep and the Initialization screen will appear. If an error occurs, check that the data-transfer cable has been connected properly and that the instrument is powered on.

Appendix A: Specifications

The following are the specifications for:

- Instrument firmware version 1.53
- Profiler MAS software version 5.00

These specifications may be changed in future versions.

Specifications	Model PRTC Profiling - Temperature - Current	Remarks
Range Displacement Temperature Current	± 16 mil (± 400 µm) 14 °F to 1830 °F (-10 to 1000) °C 0 amp to 1000 amp DC	Imperial / Metric is user-selectable °F / °C is user-selectable, K-type thermocouple with optional current probe
Resolution Displacement Temperature Current	0.04 mil (1 µm) 0.1 °F (0.1 °C) 1 amp	
Accuracy Displacement Temperature Current	± 2% ± 0.16 mil (4 µm) ± 1% of reading ± 2 °F (1 °C) ± 1% of reading ± 1 amp	At ambient Temperature of 73 °F ± 9 °F (23 ± 5) °C Battery voltage not less than 6.5 V Does not include thermocouple error Does not include current probe error
Sampling Interval Displacement Temperature and Current	Maximum recording speed 4 in/s (100 mm/s) 0.1 seconds to 60 hours	Slip ring segment size 160 mil ± 20 mil (4 ± 0.5) mm Recordings taken in 'Shape' mode are sampled at 20 mil (0.5 mm) across the bar or segment Selectable in steps of 0.1 second, 1 second, 1 minute, or 1 hour
Memory Data Storage Capacity Data Set Name	Up to 50 named Data Sets Up to 50 recordings per Data Set Up to 9999 samples per recording 512 kilobytes – approximately 100 000 individual samples Up to 16 alphanumeric characters	Each recording has unique time/date stamp. Total number of samples depends on the number of Data Sets Non-volatile memory (battery backup). Number of samples depends on the number of recordings and the variability of the readings
Display Resolution Viewing area Backlight	Graphic LCD 240 x 128 pixels 4.3" x 2.3" (110 x 60) mm Electro-luminescent	
PROFLASH	Allows internal firmware to be upgraded via built-in serial port	Download firmware service packs via the Internet
Communications Baud rate	RS232 9600, 19 200, 57 600 bits per second	15 kV ESD protected. Cable with DB9 connector Automatic baud rate selection
Termination Displacement Temperature Current Communications	8 pin round plug Socket accepts miniature thermocouple with twin blade BNC Connector 5 pin round plug	Blades spaced 5/16" (7.9 mm) center-to-center
Battery Type Voltage Capacity Operating time (typical)	Custom Nickel-Cadmium pack 7.2 V nominal 1500 mAh nominal 13 hours nominal with backlight off 7 hours nominal with backlight on	
Charger and Conditioner Fast Charge rate Discharge rate	Built-in dual rate charger – automatic and manual control 0.7 A nominal 0.5 A nominal	Power transformer with 13.5 V ± 1.5 V DC, 1 A output included in kit 2.5 hours for complete charge nominal Combats NiCad battery memory effect
Mechanical Size Weight	9.7" W x 6.1" L x 3.0" H (247 x 154 x 75) mm 4.4 lb (2 kg)	Including protective boot Including protective boot and strap
Environmental Temperature/Humidity Operating Storage EMC	32 °F to 122 °F (0 to 50) °C 80% RH 32 °F to 86 °F 70% RH 86 °F to 122 °F 14 °F to 140 °F (-10 to 60) °C 95% RH EN50081-1 EN50082-1	Non-condensing Non-condensing Radiated and conducted emissions RF field, ESD and fast transient immunity

Revised 2001. While every effort has been made to provide the most accurate information we advise that information in this document may contain technical inaccuracies or typographical errors. Commtest Instruments Ltd may at any time and without notice make improvements and/or changes in the product described in this information.

Appendix B: Profiler MAS Math

The following are the mathematical functions and operators that can be used in Profiler MAS-3000 calculations.

The symbols A, B, C... represent channel tags; and L1, L2 ... Ln represent logical expressions (e.g. $\text{int}(A) > 3$).

The notation used for functions and operators is similar to that used in common computer-programming languages and spreadsheet programs.

Functions

Mathematical Functions

Function	Meaning
Abs(A)	Absolute value
Cos(A)	Cosine
Deg(A)	Convert from radians to degrees
DegC_to_DegF(A)	Converts Celsius to Fahrenheit
DegF_to_DegC(A)	Converts Fahrenheit to Celsius
Exp1	Base of natural logarithm, e (constant)
Exp(A)	Exponent
Frac(A)	Fractional part
Int(A)	Integer part
Ln(A)	Natural logarithm
Log(A)	Base-10 logarithm
Max(A, B, ...)	Return the maximum value
Min(A, B, ...)	Return the minimum value
N	Sample number (starting from zero)
Pi	π (constant)
Power(<i>base</i> , <i>power</i>)	<i>base</i> to the power of <i>power</i> e.g. Pow(A,3) gives A^3 Pow(3,k1) Pow(A,B)
Rad(A)	Convert from degrees to radians
Round(A)	Rounded value
Sgn(A)	Sign (-1 if negative; +1 if positive; 0 if zero)
Sin(A)	Sine

Function	Meaning
Sqr(A)	Square
Sqrt(A)	Square root
Tan(A)	Tangent
ChangePerDay(A)	Rate of change (differentiation) e.g. If channel 'A' changes smoothly from 10 to 25 over a 1 minute period, then ChangePerMin(A) will be 15 over that period.
ChangePerHrs(A)	
ChangePerMin	
ChangePerSec	
SumOverDays	Summation over time (integration) e.g. If channel 'A' is a 2hr recording with all values = 3.5, then SumOverHrs(A) changes smoothly from 0 to 7 over the recording.
SumOverHrs	
SumOverMins	
SumOverSecs	

Iterative Functions

The following iterative functions can be used for constants only. Cell-level expressions cannot contain iterative functions.

Function	Meaning
Count(A)	Number of samples
Maxsample(A)	Maximum sample value
Mean(A)	Mean
Minsample(A)	Minimum sample value
Stddev(A)	Standard deviation
Sum(A)	Sum

Logical Functions

Function	Meaning
AND(L1, L2, ..., Ln)	Logical AND e.g. AND($n = 10$, $k_2 > 0.5$, $k_3 > 0.5$, $k_2 \neq k_3$)
False	Logical constant, has value 0
OR(L1, L2, ..., Ln)	Logical OR e.g. OR($k_0 = \text{True}$, $k_1 < 3$, $n \geq 30$)
True	Logical constant, has value 1
AOR(L1, L2, ..., Ln)	Logical AOR (exclusive OR) e.g. AOR($k_0 = \text{True}$, $k_1 < 3$, $n \geq 30$)
NOT(L1, L2, ..., Ln)	Logical NOT e.g. NOT($k_1 = \text{True}$, $k_2 < 10$, $n > 30$)

Conditional Functions

Function	Meaning
IF(L1, <i>true result</i> , <i>false result</i>)	If logical expression L1 is true, execute <i>true result</i> , otherwise execute <i>false result</i> e.g. IF($k_2 > k_3$, $k_2 * A$, $k_3 * A$) IF($k_0 = \text{True}$, n , $n * 2$) IF($n < 10$, n , $\text{Log}(n)$)

Date and Time Functions

In profiler MAS the date and time value when a sample is taken is a floating-point number. The integer part of the number represents the date: this is the number of days since the first day of 1 AD. The fractional part of the number represents the time: this is the proportion of time that has passed since the beginning of the day.

Function	Meaning
Date(<i>year, month, day</i>)	Return the date in profiler MAS format e.g. Date(1999, 07, 25)
Time(<i>hour, minute, second, ms</i>)	Return the time in profiler MAS format e.g. Time(16, 59, 31, 965)
Elapsed(<i>sample number</i>)	Return the date and time of the sample in profiler MAS format e.g. DAT(36)
SampleDate(n)	Date of the nth sample
SampleTime(n)	Time of the nth sample

Operators

Logical Operators

Operator	Meaning
<	Less than
<=	Less than or equal to
<>	Not equal to
=	Equal to
>=	Greater than or equal to
>	Greater than

Arithmetic Operators

Operator	Meaning
+	Addition
-	Subtraction
/	Division
*	Multiplication

Profiler MAS uses the standard arithmetic order of precedence i.e. division and multiplication take precedence over addition and subtraction. An operand between two operators of different precedence is bound to the operator with higher precedence. An operand between two equal operators is bound to the one on its left. Expressions within parentheses are evaluated before being treated as a single operand.