Cygnus 3 Data Logger

Operating & Accessories Manual

Doc No. M4-CYG3-M-ENG_Iss3.doc
8 December 2013
(Mk4 Cygnus 3 Gauges)

QUALITY POLICY STATEMENT

"Cygnus Instruments is committed to being a premier supplier of niche test and measurement instruments. Cygnus is dedicated to customer satisfaction. Cygnus will always provide products and service of exceptionally high quality. We will listen to our customers and be both market-led and technology driven. And by utilising a formal Operations Management System that complies with industry standards, we will continually improve what we do and how we do it."

Cygnus is an ISO-9001 accredited company.
The scope of our accreditation covers all our products and services.

Contents

1. Introduction 7
Cygnus 3 Thickness Gauge 7
Multiple Echo Measurements 8
Triple Echo Verification 8
Cygnus Instruments 9
2. Gauge Kit Contents 10
3. Gauge Preparation 11
Fitting the Batteries 11
Connecting the Probe 12
Fitting the Protective Sleeve 13
Fitting the Neck Strap 14
Optional Krusell Belt Attachment 14
4. Gauge Operation 15
Gauge Controls 15
Display and Automatic Backlight 16
Function Keys 16
Numeric Keys 17
Signal LED 17
Turning the Gauge On 17
Turning the Gauge Off 18
Automatic Power Off 18
Taking a Thickness Measurement 19
Echo-Strength Indicators 19
Coupling Strength Indicator 20
Battery Life 21
Battery Life Gauge 22
Low Battery Warning 22
5. Probes & Membranes 23
Probe Selection 23
Changing the Membrane 24
Membrane Temperatures 25
Probe Selection & Specifications 25
Probe Frequency Identification 25
Automatic Probe Frequency Setting 26
6. Gauge Setup 27
Gauge Menu Diagram 27

Measurement Units 28
Resolution Setting 29
Minimum Thickness Alarm Function. 30
Deep Coat Function 31
Deep Coat Warning Message 33
Valid Thickness 'Beep' Function 33
Setting the Time and Date 34
7. Calibration 37
Calibrating the Gauge 37
Calibration Menu 38
Calibrating to a Known Thickness (Single Point) 39
Setting the Velocity of Sound 40
Displaying the Velocity Menu 40
'Adjust' Velocity Menu Option 41
'Type In' Velocity Menu Option 42
'Velocity Table' Menu Option 42
Customising the Velocity Table 43
8. Data Logging 45
The Data Logging Process 46
Contents of a Record File 46
Record File Names 47
User Entered File Names 47
Auto File Name 47
GaugeID Number 48
Data Logger Menu 49
Quick Log Record Files 50
Creating a Quick Log Record File 50
Grid Point Record Files 52
Creating a Grid Point Record File 54
Template Record Files 57
Creating a Record File from a Template 57
Data Logging Functions and Management 61
Stopping, Suspending and Resuming Data Logging 61
Logging an Obstruction or No-Reading Point 62
Moving Position in the current Record File 63
Adding Additional Measurement Points 64
How to add Additional Radial Points 65
Adding a Comment while Data Logging 66
Displaying the Current Record File Details 67
Reviewing Template File User Fields 67

Opening a Record File....68
Protecting Record Files....69
Deleting Record Files....69
Deleting all Record Files....70
Changing the Velocity or Calibration while Data Logging....71
Auto-Log Function....71
Using the Auto Log Feature....72
9. Cygnus 3 Data Logger Manager....73
Overview....73
Installation....73
Connecting the Data Logger to the Computer....74
Setting Options....76
Transferring Record Files from the Data Logger....76
Creating and Printing a Report....78
Deleting a Record File....81
Template Files....81
User Fields....82
User Field 'List' Type....83
Measurement Points....83
Creating a Template File....83
Template Form....85
Transferring Template Files to the Data Logger....90
10. Microsoft Excel Add-In....92
Overview....92
Installing the Add-In....92
Microsoft Office Excel 2000, XP, 2003....92
Microsoft Excel 2007....93
Creating an Excel Report....95
Additional Measurements....97
11. Data Logging Template Tutorial....99
Create the Excel® Spreadsheet....99
Create the Data Logger Template....101
Transferring the Template to the Cygnus 3 Gauge....105
Carry out the Survey with the Cygnus 3....107
Transfer the Completed Survey Record to Computer....107
Creating the Excel Report....108
12. General Points On Thickness Gauging....111
13. Troubleshooting....112
The Gauge will not Switch On....112

Difficulty obtaining a Reading 112
If Readings are Erratic or Unstable 112
14. The 4 Point Check 113
15. Care and Servicing 114
Cleaning the Gauge..... 114
Batteries 114
Environmental..... 114
Repairs 114
Returning the Gauge for Servicing..... 115
16. Information..... 116
Technical Specifications 116
Table of Sound Velocities 118
Reading Conversions 119
17. Accessories List..... 120
Remote Probes with 1.35m (4'6") Lead 120
Marinised Probes with Cable Length to Order 121
Probe Spares and Membranes..... 121
Cables and Leads..... 122
Miscellaneous Spares 122
Carry Cases 122
18. Recycling and Disposal (EC Countries) 123
19. Index 124

1. Introduction

Cygnus 3 Thickness Gauge

The **Cygnus 3 Multiple-Echo Ultrasonic Thickness Gauge** is a rugged, handheld, battery-powered instrument designed for high-reliability thickness measurement using the multiple-echo technique.

The Gauge can be used with a choice of single-crystal Ultrasonic Probes, depending on the thickness and type of material that is to be measured.

Measurements can be displayed in Metric (mm) or in Imperial (inch) units and measurement resolution can be selected for 0.1 or 0.05 mm, (0.005 inch or 0.002 inch). The Gauge has a large LCD which can be easily read in sunlight and in low-light situations using a white LED backlight.

The Gauge has the facility to record thickness measurements to internal Flash memory, these measurements can be easily transferred to a computer via a USB connection which then can be used to generate survey reports.

Crystal-controlled Calibration provides stability and accuracy. The Gauge can easily be calibrated to a known thickness or to a known Velocity of Sound. Velocity of Sound is displayed in either m/s or in/µs, depending on the current selection for Measurement Units.

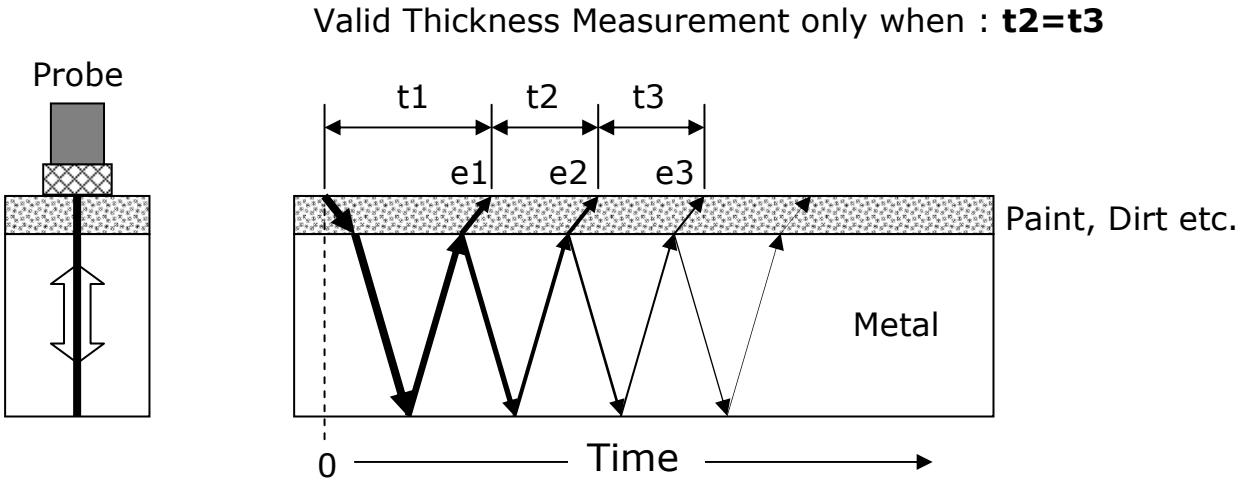
The Gauge is able to operate accurately in a wide range of ambient temperatures and is environmentally sealed to IP65 for use in wet or dusty conditions.

The Gauge is a solid-state electronic instrument which, under normal operating conditions, will give many years of active service.

Although designed for ease of operation the first time user should carefully read this manual to familiarise themselves with the features of the Gauge.

Multiple Echo Measurements

The Gauge works on the pulse-echo principle. The Probe transmits a very short pulse of ultrasound which enters the test piece. The Probe then acts as a receiver listening for return echoes, converting them into electrical signals which are processed to produce timing information that can be used to determine the material thickness.



The *multiple-echo* beam travel is depicted above, spread out in time, to illustrate the timing method. In reality the beam path is straight and perpendicular to the surface as the ultrasonic energy reverberates up and down within the metal (shown on the left). Each time an echo is reflected back down, a small portion of the energy comes up through the coatings and is detected by the Probe which acts as a receiver (e1, e2 and e3).

The delay between echoes at the Probe-face (t2 and t3) is exactly equal to the time taken to pass through the metal twice, therefore coatings such as paint are ignored and the measurement displayed is the metal thickness only.

Triple Echo Verification

The Gauge requires 3 equi-spaced return echoes in order to calculate a thickness measurement value (t2=t3). This method ensures the Gauge only displays valid thickness values, the three echoes provide a reliable method of signal verification. This process is referred to as Triple Echo Verification.

Cygnus Instruments

Cygnus Instruments Limited, founded in 1983, was the pioneer in the development of the Digital *Ultrasonic Multiple-Echo Technique* used for measurement through coatings. This has long been the industry standard to ensure that accurate measurements are taken without the need to zero the Gauge or remove any coatings.

Our philosophy is to work closely with our customers to provide high quality products, engineered to serve heavy industry & harsh environments. Cygnus Ultrasonic thickness gauges are designed to be reliable and simple to use. We have an unrivalled reputation in over 45 countries around the world.

CYGNUS Instruments Ltd.

Cygnus House, 30 Prince of Wales Road,
Dorchester, Dorset DT1 1PW England.

Tel: +44 (0) 1305 265533 Fax: +44 (0) 1305 269960

www.cygnus-instruments.com sales@cygnus-instruments.com

CYGNUS Instruments Inc.

1993 Moreland Parkway, Suite 202.
Annapolis, Maryland 21401, USA.

Tel: +1 410 267 9771

Fax: +1 410 268 2013

www.cygnusinstruments.com

sales@cygnusinstruments.com

CYGNUS Singapore (S) Pte. Ltd.

63 Jalan Pemimpin #05-01,
Pemimpin Industrial Building.
577219 Singapore.

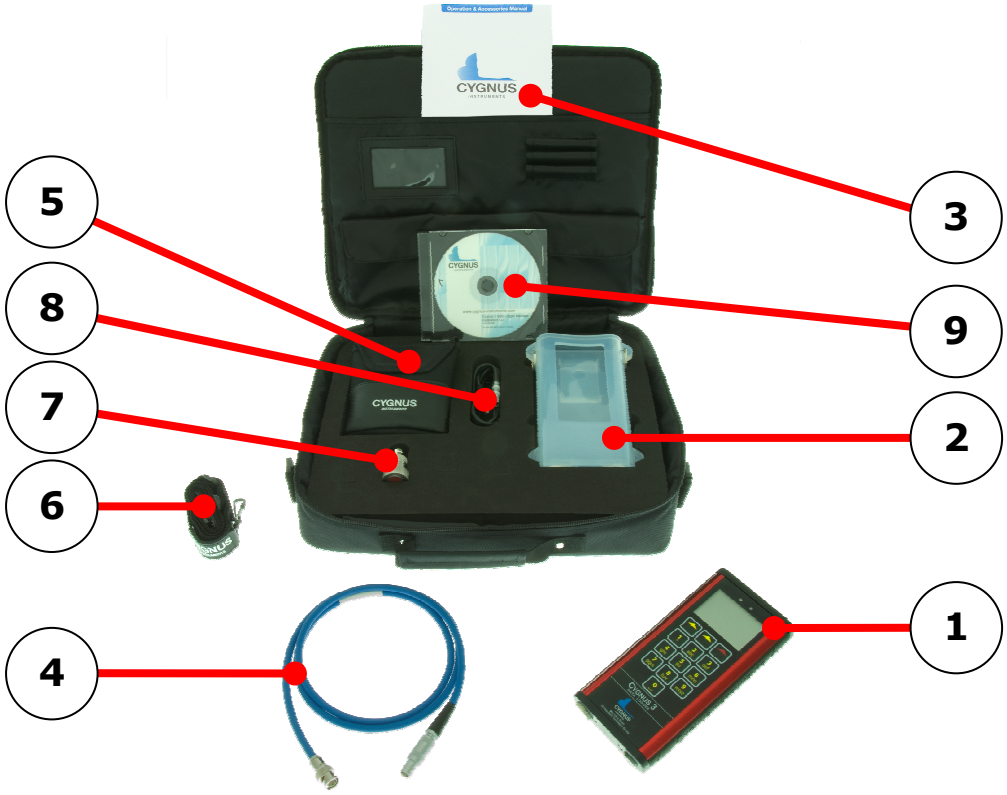
Tel : +65 6252 5909

Fax : +65 6251 1318

www.cygnus-instruments.sg

sales@cygnus-instruments.sg

2. Gauge Kit Contents



1. Cygnus 3 Data Logger Gauge
2. Protective Silicone Sleeve
3. Cygnus 3 Operation Manual
4. Blue High-Flex Probe Cable, 1.5 m (4½ ft) *
5. Accessory Pouch, containing Couplant Gel, Spare Membranes, Membrane Couplant, Membrane Locking Ring Key, 15 mm (or 1/2 inch) Test block and 3 x AA Procell Batteries
6. Adjustable Neck Strap *
7. Probe(s)
8. USB Cable
9. CD/USB memory stick – Cygnus 3 Data Logger Manager

* The adjustable neck strap and probe cable will be stored in either the inside or outside pockets.

3. Gauge Preparation

The Gauge is supplied ready to use out of the box. Just insert the batteries, connect the probe to the Gauge, turn on the power and you are ready to take thickness measurements.

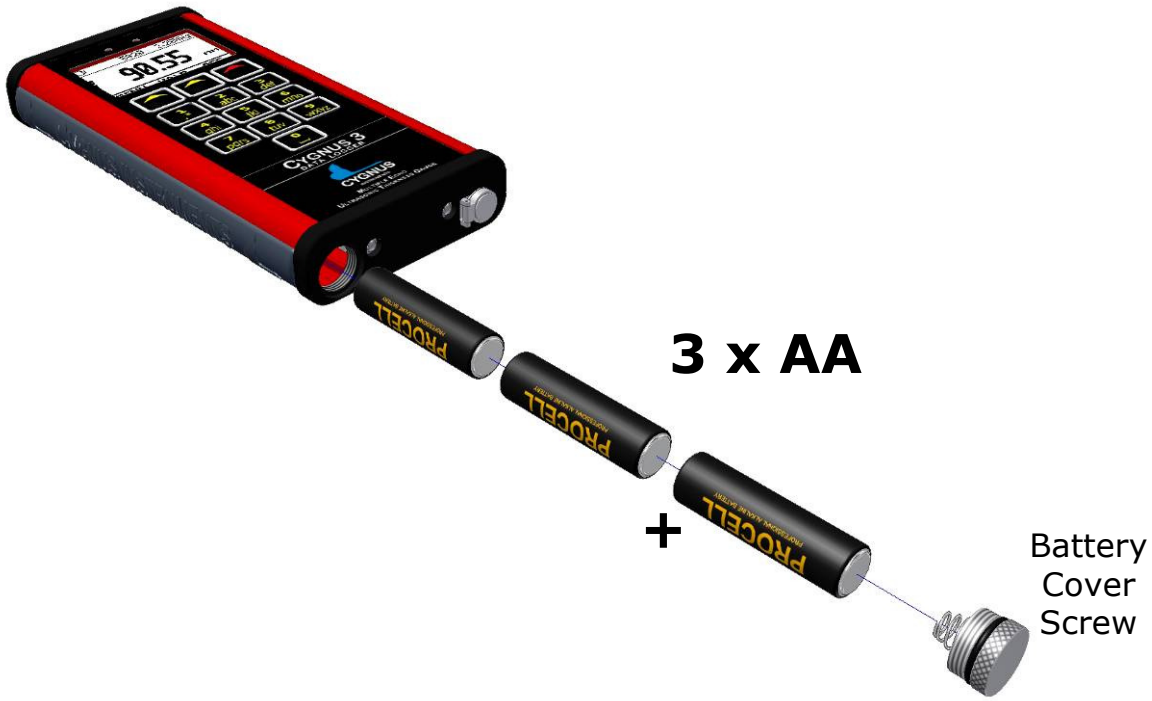
Fitting the Batteries

The Gauge requires 3 x AA/LR6/UM3 Batteries. Cygnus supplies and recommends Duracell Procell Alkaline batteries.

The batteries are located behind a cover at the bottom of the Gauge. Unscrew this cover to replace the batteries. The batteries are inserted '+' or 'pip' first.

When refitting the battery cover screw ensure it is done up tightly by hand only. A drop of membrane-oil on the threads will help to ensure smooth operation and a good seal.

The Gauge is protected against damage from incorrect battery insertion.



The Gauge can be fitted with NiCad or NiMH rechargeable batteries but this may reduce the specified operating time.

Connecting the Probe

The Probe is connected to the Gauge with the supplied Probe Cable as shown below. The Lemo 1 connector is removed by pulling back on its body, not the cable.

Fitting the Protective Sleeve

The Gauge is supplied with a protective Silicone Sleeve that fits over the Gauge. This sleeve is designed to protect the Gauge against bumps, scratches and dirt while in use whilst still allowing Gauge operation and battery replacement.

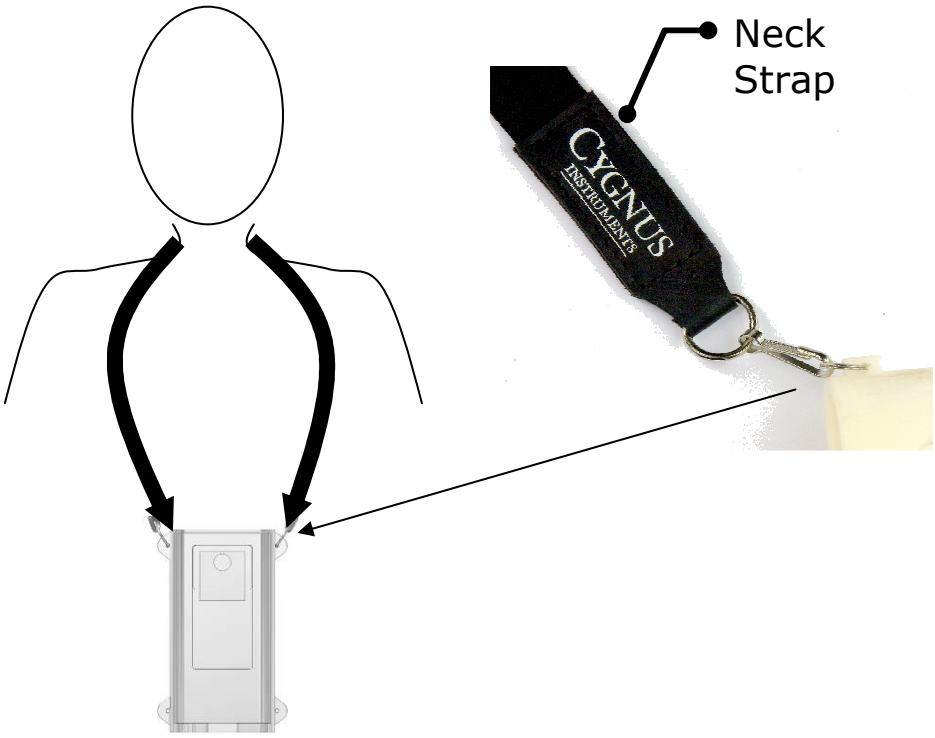
To insert the Gauge simply push the Gauge down into the sleeve, a lip at the top of the sleeve will retain the Gauge once fully inserted.

The Gauge is removed by pushing it out from the bottom.

The sleeve also allows the Gauge to be worn on a belt or suspended from the Neck Strap included in the kit.

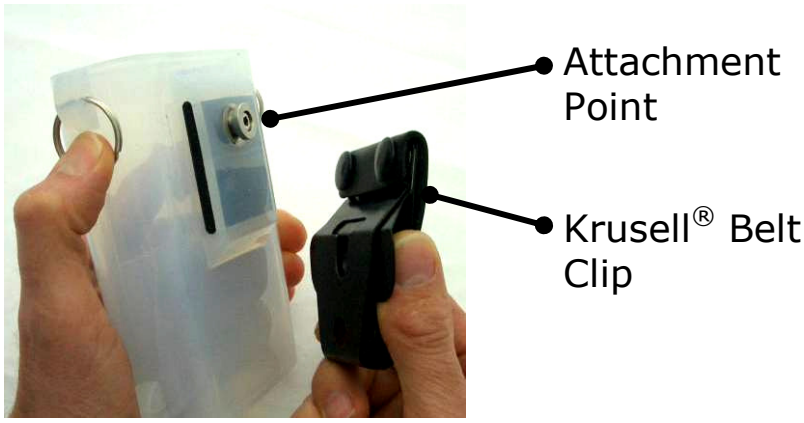
Fitting the Neck Strap

The Gauge is supplied with an adjustable Neck Strap. The ends of the neck strap clip onto rings at the top of the protective silicone sleeve.



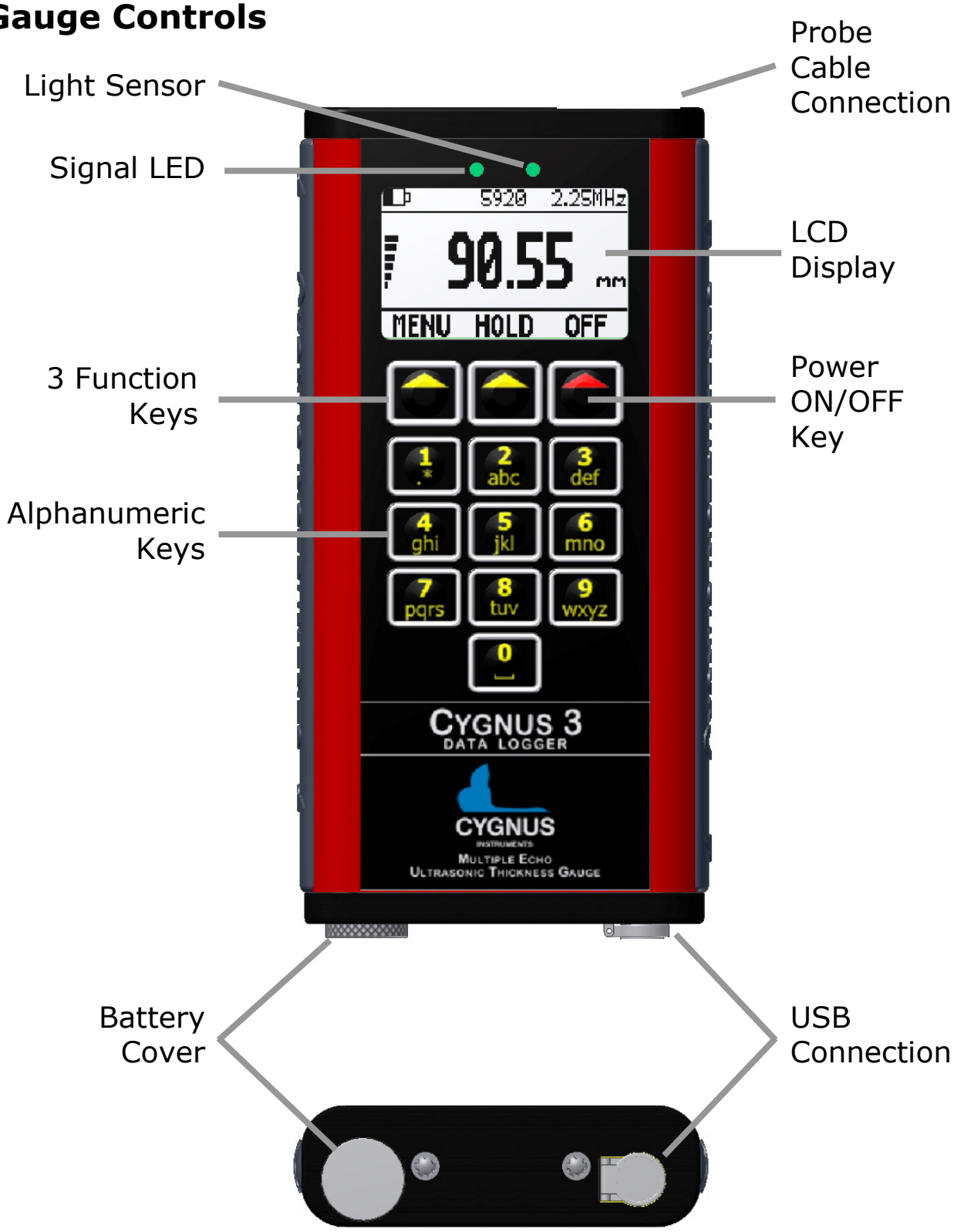
Optional Krusell Belt Attachment

For attaching the silicone sleeve to a belt or harness we offer an optional Krusell® belt clip. The belt clip is attached to the protective silicone sleeve as shown below. This enables the Gauge to be easily taken on and off the belt clip.



4. Gauge Operation

Gauge Controls



Display and Automatic Backlight

The Gauge uses a monochrome graphic LCD with 128 x 64 pixel resolution. The LCD can be viewed in bright sunlight, and in low light conditions a white-LED backlight is provided.

The LCD backlight is turned on automatically when the light level drops below a pre-set level. The backlight will be also be turned off after the gauge has been idle for 20 seconds (idle means no keys pressed and no echoes detected).

Function Keys

The Gauge has three keys under the LCD screen with an upward pointing triangle. The function of each key corresponds to the word or symbol above it on the screen.

In the measuring screen the three keys are used for:

MENU	HOLD*	OFF
Pressing this key displays the gauge Menu.	Pressing this key holds the displayed thickness measurement on the screen.	Pressing this key turns off the gauge if the key is then held for 1 second.

When in the menu and other screens the function of these three keys change. The word or symbol displayed above the key on the screen denotes the key's function.

*When data-logging the middle key changes to the **LOG** function.

Numeric Keys

The Gauge has ten keys for alphanumeric data entry. Text and numbers are entered by repeatedly pressing the key with the required character, similar to entering text on a mobile phone keypad.

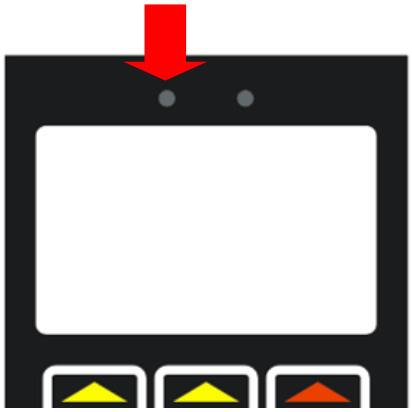
The [1] key also provides these characters; **+ - . ***

Example

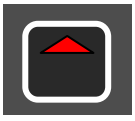
To input the letter 'S' you would press the [7] key four times.

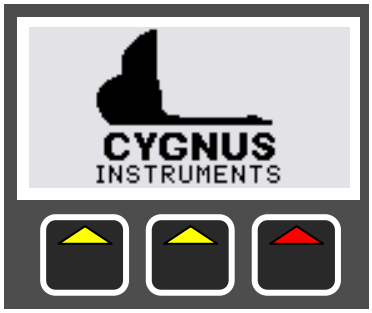
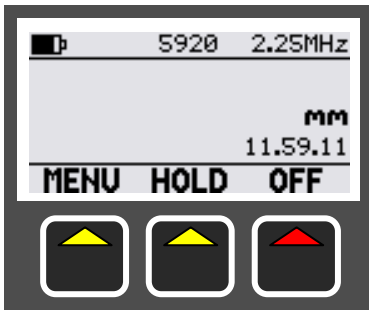
Signal LED

The Gauge has a red/green signal LED that illuminates when data-logging.

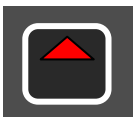
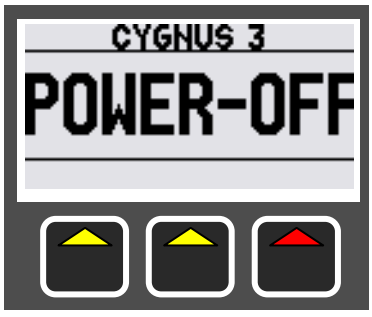


Turning the Gauge On

1.	Press the Power key (red Triangle key)	

2.	The Cygnus Instruments logo is briefly displayed	
3.	The software and hardware version information is briefly displayed	
4.	The measurement screen is then displayed	
5.	The Gauge is ready to use	

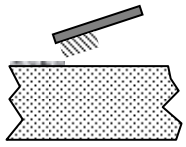
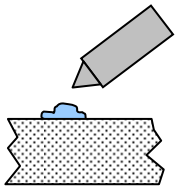
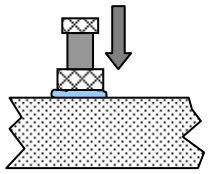
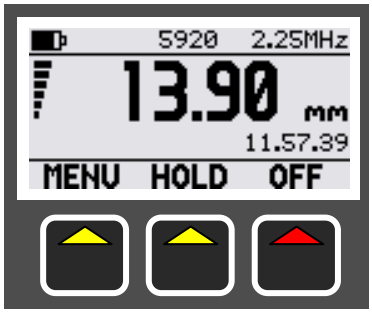
Turning the Gauge Off

1.	Press & Hold the Power button for 1 second	
2.	The display shows 'POWER OFF' then the Gauge turns off	

Automatic Power Off

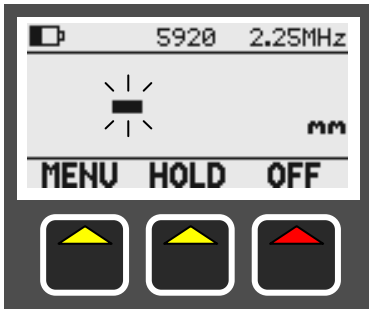
The Gauge will turn off automatically 5 minutes after the last thickness measurement was taken.

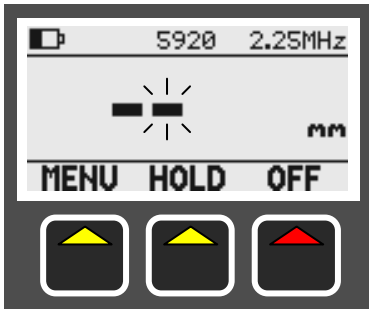
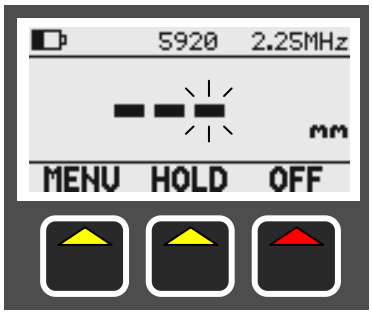
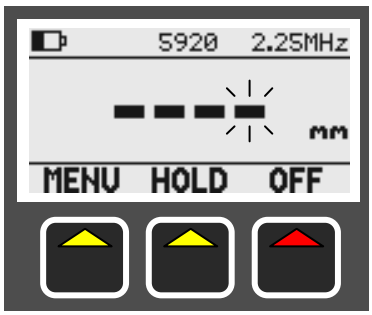
Taking a Thickness Measurement

1.	Remove all scale, rust, dirt or loose coatings and brush the test area clean	
2.	Apply couplant to the test surface	
3.	Place the probe-face on the clean, lubricated test surface and make firm contact applying gentle pressure	
4.	The Gauge will display a thickness measurement or an indication of Echo Strength if no valid measurement has been found.	

Echo-Strength Indicators

Should the Gauge be unable to detect a stable multiple-echo signal it displays an Echo Strength indication to help the operator locate a suitable position.

1.	1 Bar Flashing: No echoes detected	

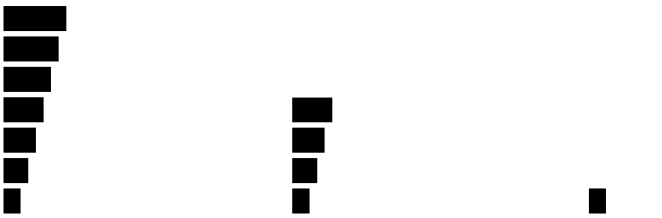
2.	1 steady + 1 Bar Flashing: Only 1 echo detected	
3.	2 steady + 1 Bar Flashing: Only 2 echoes detected	
4.	3 steady + 1 Bar Flashing: 3 echoes detected but they are not related	

To help obtain a multiple echo reading the operator should continue to move the probe around to locate a suitable reflector, using a slight rocking motion.

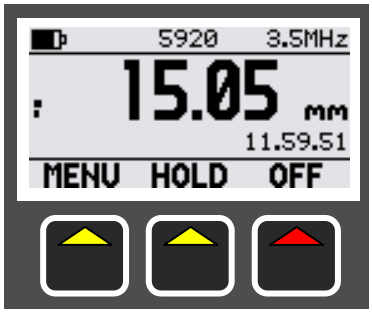
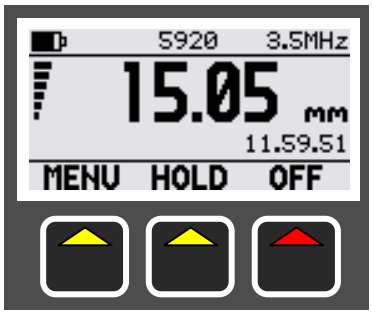
Coupling Strength Indicator

When the Gauge displays a valid thickness measurement there is a vertical coupling strength indicator displayed on the left side of the screen. This shows the strength of the return echo signal giving the user an idea of

a) How well the probe is coupled to the test material.
b) How attenuative the material and coating is.

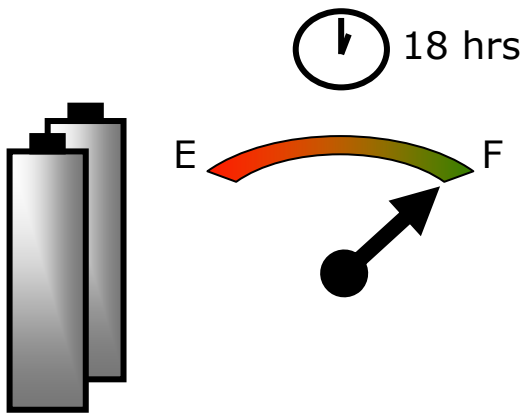


Strong Signal | Average Signal | Weak Signal

1.	This coupling strength indicator shows a **weak** signal is being received.	
2.	This coupling strength indicator shows a **strong** signal is being received.	

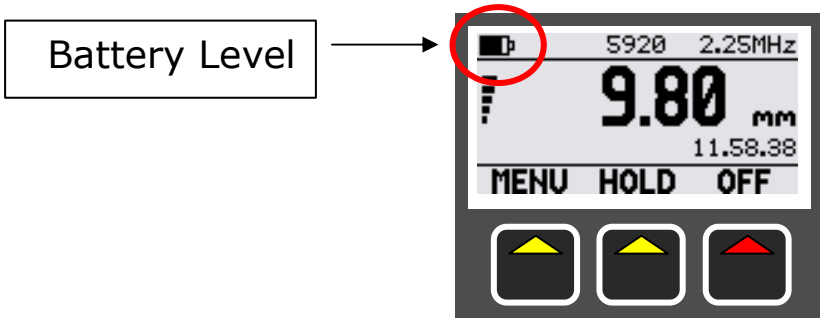
Battery Life

The Gauge will operate continuously for approximately 18 hrs when fitted with Duracell Procell Alkaline 1500 mAh batteries.



Battery Life Gauge

The battery level is displayed on the measuring screen at the top left of the screen.



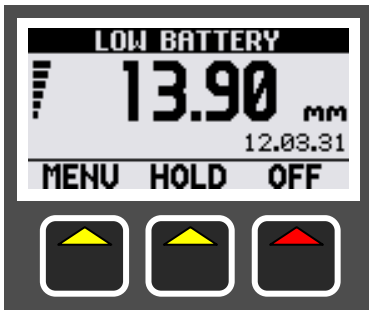
New Battery – Full.

Half Used battery.

Almost Flat battery.

Low Battery Warning

The Gauge will flash a Low Battery warning message at the top of the screen when the battery level is below 15% capacity. This means you have between 1 to 2 hours of gauge operation time remaining.



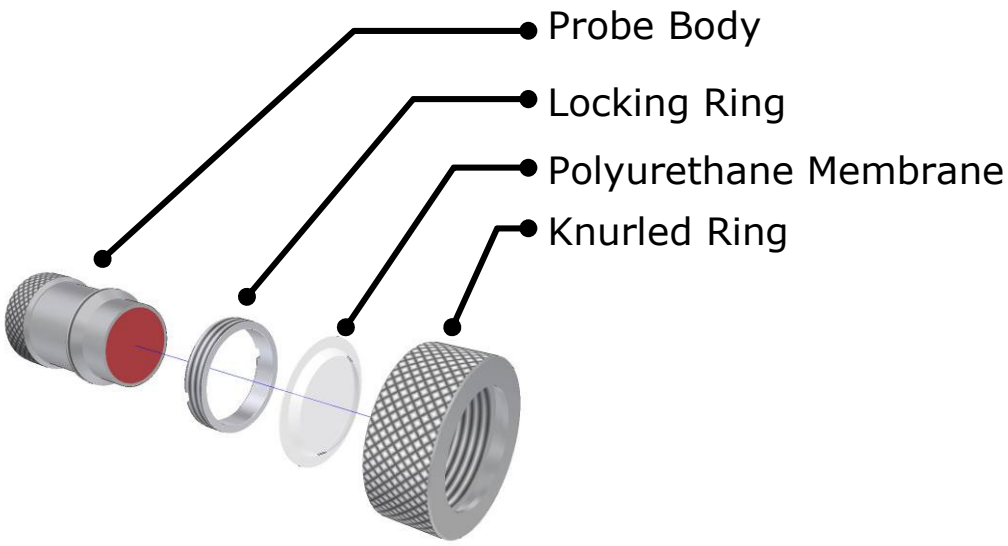
Low Battery warning message.

5. Probes & Membranes

The Gauge should only be used with Soft-Faced probes supplied by Cygnus Instruments.

Cygnus Soft-Faced probes are fitted with a Polyurethane Membrane which provides better contact on rough surfaces and protects the probe face from wear, prolonging the life of the probe.

Check the membrane regularly as it is important the membrane is changed as soon as it shows any signs of wear.

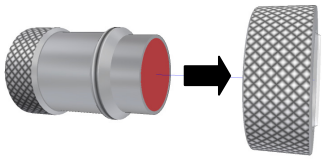
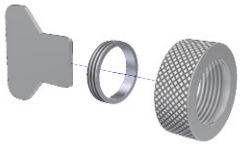
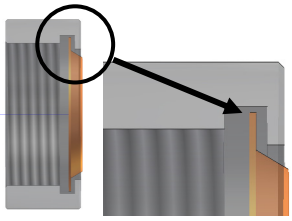
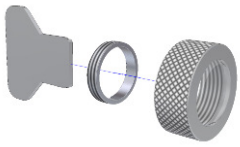
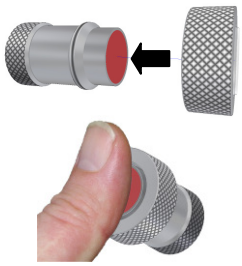


Probe Selection

Apart from the physical limitation of the probe size, the diameter of the probe face (crystal) and the frequency affect the probe performance, generally:

- Large diameter probes produce more energy which gives better performance on heavily corroded materials.
- Higher Frequency probes produce a narrower focused beam which is better when looking for small features or on thin materials.

Changing the Membrane

1.	Unscrew the Knurled Ring from the end of the Probe	
2.	Use the Locking Ring Key to unscrew the Locking Ring from inside the Knurled Ring. The old membrane can then be removed and discarded.	
3.	Place a new membrane into the end of the Knurled Ring ensuring it locates in the groove.	
4.	Screw the Locking Ring back inside the Knurled Ring and tighten with the Locking Ring Key.	
5.	Place a few drops of Membrane Couplant on to the probe face.	
6.	Screw the Knurled Ring back onto the probe. Use your thumb to squeeze the couplant from under the membrane as you tighten the Knurled Ring down	
7.	The membrane should have a very thin film of couplant between itself and the probe face with no air bubbles.	

Membrane Temperatures

The standard polyurethane membranes are suitable for measuring surfaces with temperatures up to 75°C.

For measuring on higher surface temperatures Teflon membranes are available, they are suitable for temperatures up to 150°C. See accessories on page 121.

When measuring hot surfaces reduce the probe contact time to a minimum to avoid damaging the probe face and crystal.

Probe Selection & Specifications

Crystal Diameter	Frequency	Measurement Range	Application
13 mm ½ inch	2¼ MHz	3.0 – 250 mm[1] 0.12 – 10 inch	**This is the standard probe – suitable for most applications.**
13 mm ½ inch	3½ MHz	2.0 – 150 mm 0.08 – 6 inch	Suitable for measurement on thinner sections where surfaces are relatively rough
6 mm ¼ inch	5 MHz	1.0 – 50 mm 0.04 – 2 inch	The higher frequency and narrower beam makes this Probe ideal for measuring small-bore tubing, thin section plate and other areas where access is limited.
13 mm ½ inch	5 MHz	1.0 – 50 mm 0.04 – 2 inch	Ideal for thin sections without heavy corrosion.

Lower frequency probes offer better penetration on heavy corrosion/coatings.

Probe Frequency Identification

The frequency of Cygnus probes is indicated by colour;

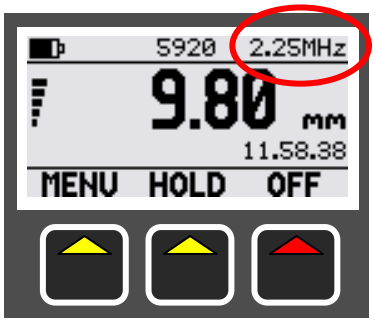
Red = 2.25 MHz	Orange = 3.5 MHz	Black = 5.0 MHz

[1] To measure thicknesses on tall thin cylinders or columns the height-width ratio should be no less than 1.0:0.6 (Height:Width) otherwise side reflections prevent measurement.

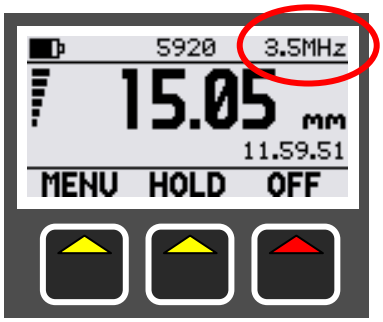
Old Style Probes	Inox Probes with BNC Connectors	Inox Remote Probes
Coloured Probe Face	Coloured Ring under BNC connector	Coloured Band on Probe Cap

Automatic Probe Frequency Setting

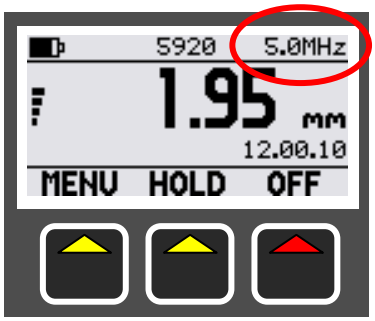
The Gauge will automatically detect the frequency of the probe connected and set the Gauge accordingly. The probe frequency is displayed in the top right corner of the screen.



2.25 MHz Probe Detected.



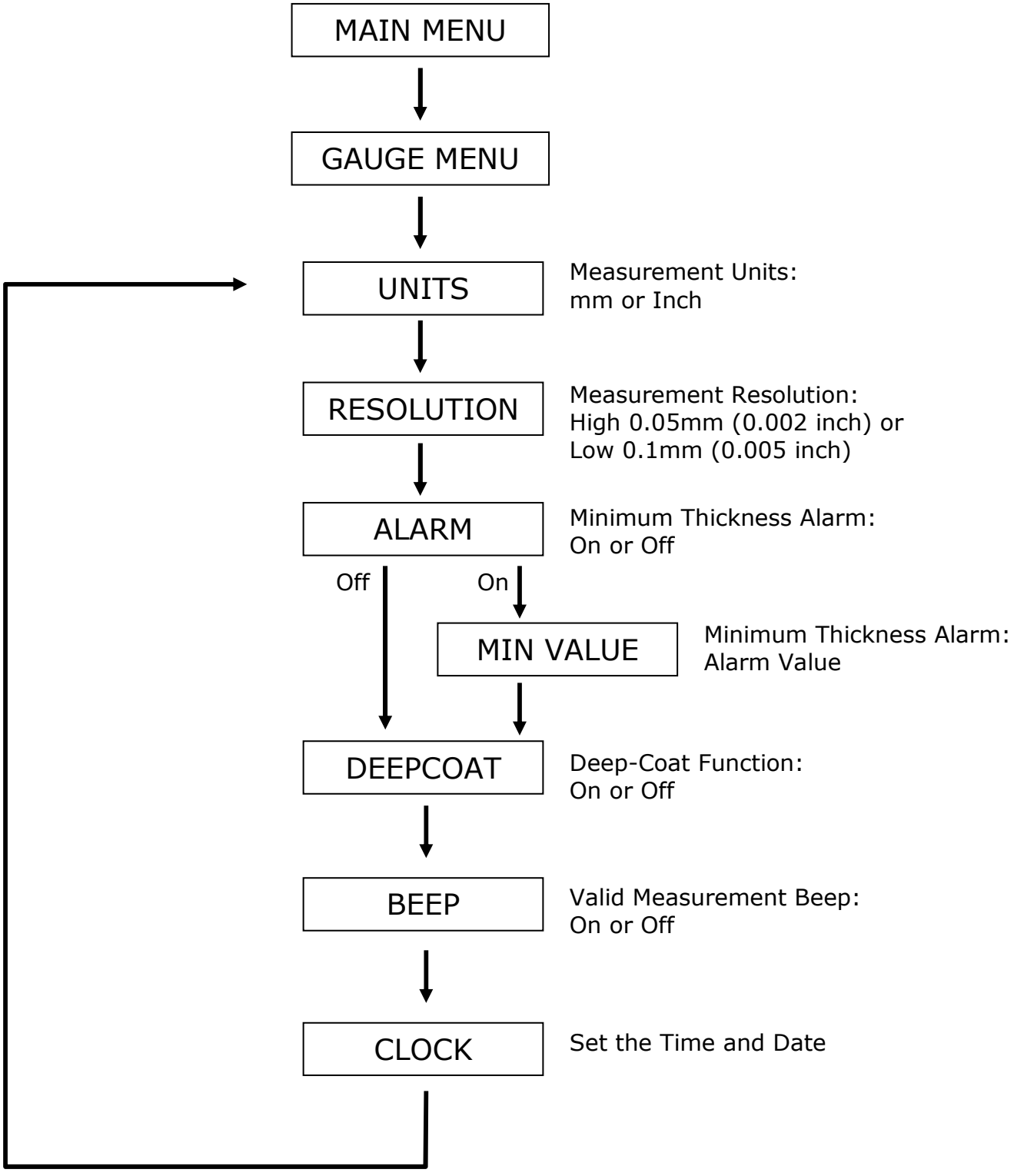
3.5 MHz Probe Detected.



5.0 MHz Probe Detected.

6. Gauge Setup

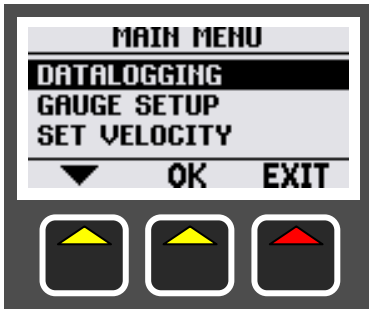
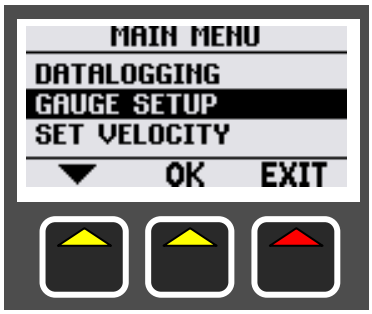
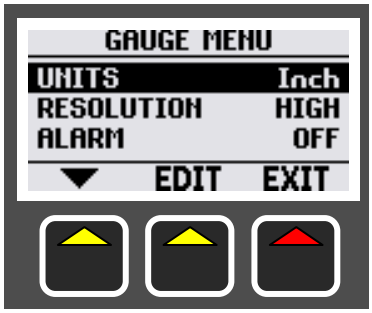
Gauge Menu Diagram



Measurement Units

The Gauge can display thickness measurements in either Metric (mm) or Imperial (inch). Changing the measurement units does not affect the calibration.

When data logging you can't change the measurement units.

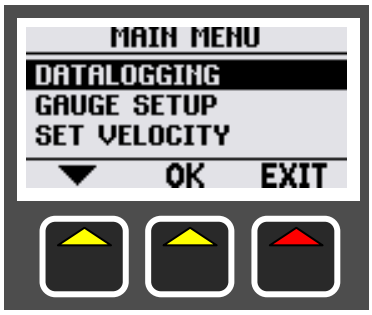
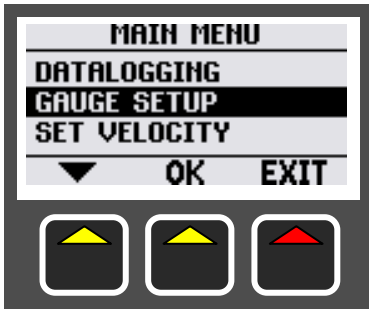
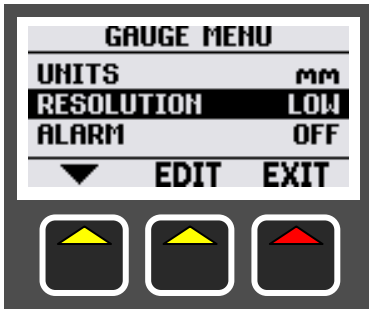
1.	Press the MENU key to display the MAIN MENU	
2.	Scroll down to GAUGE SETUP then press OK	
3.	UNITS should be highlighted	
4.	Press the EDIT key to change the UNITS setting: mm to inch inch to mm	
5.	The gauge will automatically go back to the measuring screen.	

Resolution Setting

The Gauge can display the thickness measurements in two resolutions:

- High Resolution : 0.05 mm / 0.002 inch
- Low Resolution : 0.1 mm / 0.005 inch

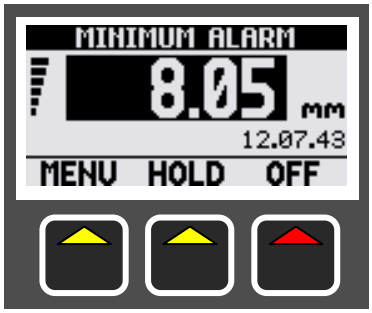
To change the Resolution setting:

1.	Press the MENU key to display the MAIN MENU	
2.	Scroll down to GAUGE SETUP then press OK	
3.	Scroll down to RESOLUTION	
4.	Press the EDIT key to change the RESOLUTION setting: High to Low Low to High	

5.	The gauge will automatically go back to the measuring screen.	

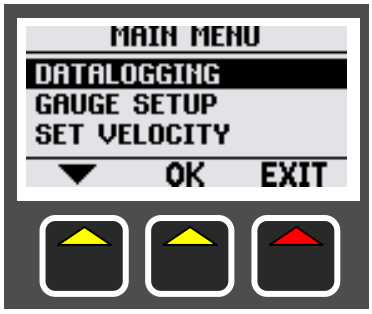
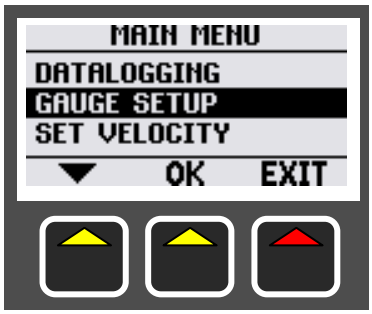
Minimum Thickness Alarm Function.

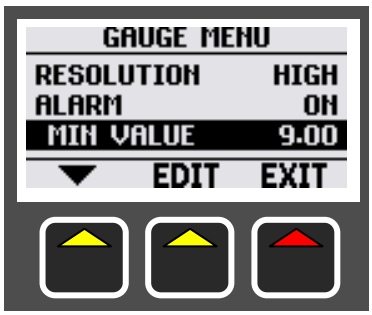
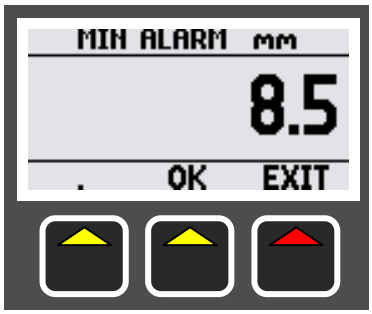
The Gauge has a Minimum Thickness Alarm function that can be used to alert the operator when the measured thickness value is less than the set minimum value.



The Gauge will alert the operator with a triple 'beep', light the RED Led, display the thickness value in a black box and display a MINIMUM ALARM message at the top of the screen

To turn the Alarm function on or off:

1.	Press the MENU key to display the MAIN MENU	
2.	Scroll down to GAUGE SETUP then press OK	

3.	Scroll down to ALARM	
4.	Press the EDIT key to change the ALARM setting from On to Off: When the ALARM is ON the MIN VALUE setting is shown.	
5.	To change the MIN ALARM value scroll down to MIN VALUE Then press the EDIT key to change the MIN ALARM setting.	
6.	Use the number keys to enter in the minimum thickness value as required. Press the OK key to save the new MIN ALARM value.	
7.	The gauge will automatically go back to the measuring screen.	

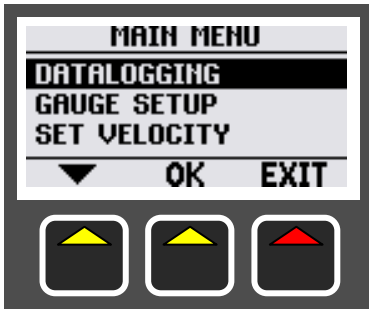
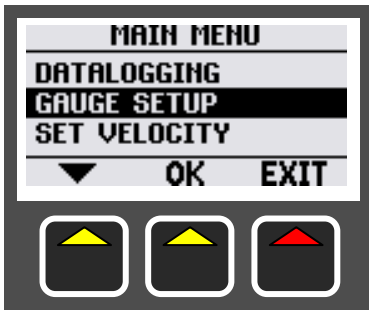
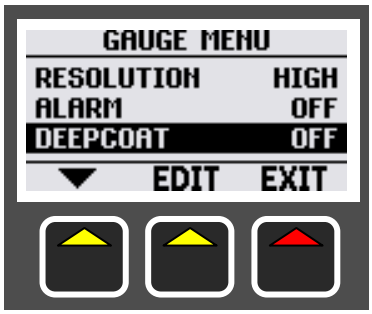
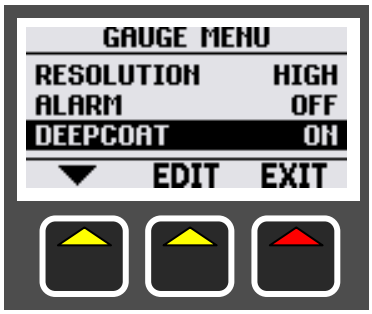
Deep Coat Function

The Gauge can normally measure metal thickness through protective coatings up to 6 mm thick[2], however using the Deep-Coat function the Gauge can measure through coatings up to 20 mm thick[2].

[2] Depending on the properties of the coating and its velocity of sound.

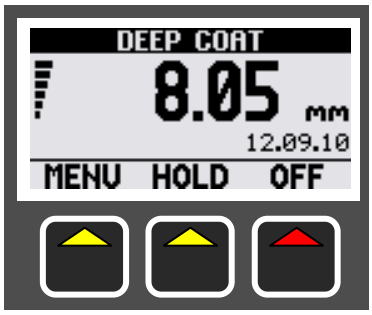
Only operate the Gauge with Deep-Coat turned On when measuring through protective coatings thicker than 6 mm. Make sure Deep-Coat is turned Off when measuring metal with coatings less than 6mm.

To turn the Deep-Coat function on or off:

1.	Press the MENU key to display the MAIN MENU	
2.	Scroll down to GAUGE SETUP then press OK	
3.	Scroll down to DEEPCOAT	
4.	Press the EDIT key to change the DEEPCOAT setting:	
5.	The gauge will automatically go back to the measuring screen.	

Deep Coat Warning Message

When the Deep Coat function is turned on a warning message is flashed at the top of the display.



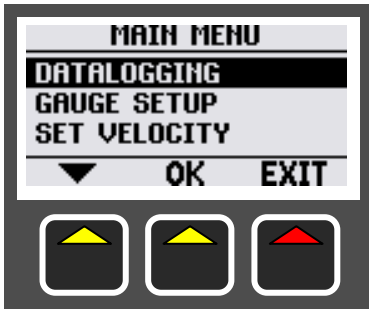
Deep Coat warning message.

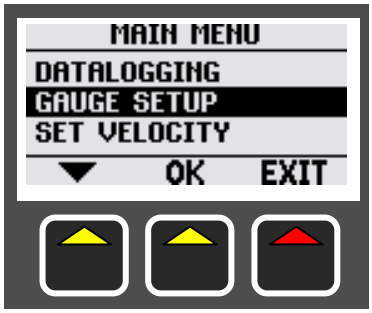
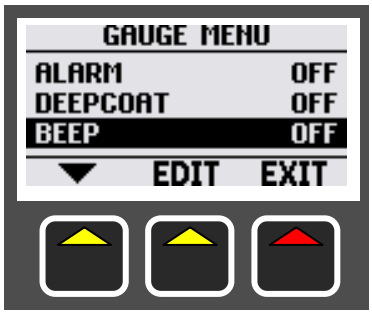
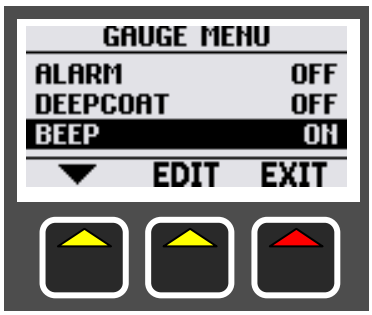
<u>Deep Coat mode must not be used when measuring through coatings less than 6 mm.</u>

Valid Thickness 'Beep' Function

The gauge can provide an audible 'beep' whenever a valid thickness measurement is taken. This means the operator can concentrate on probe positioning and listen for the 'beep' to signal that a thickness measurement has been taken.

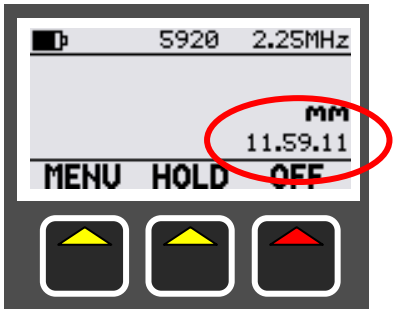
To turn the Beep function on or off:

1.	Press the MENU key to display the MAIN MENU	

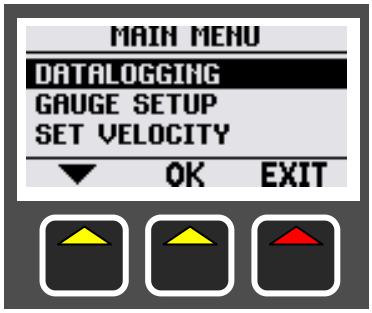
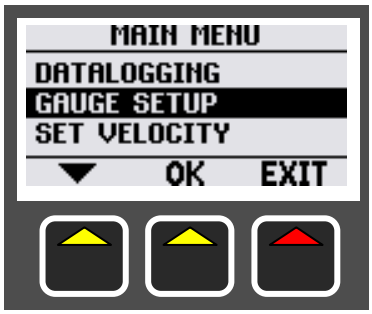
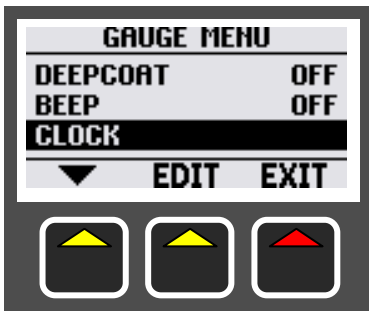
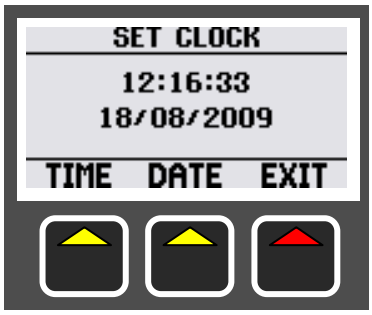
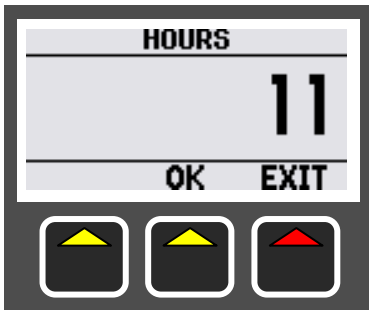
2.	Scroll down to GAUGE SETUP then press OK	
3.	Scroll down to BEEP	
4.	Press the EDIT key to change the BEEP setting	
5.	The gauge will automatically go back to the measuring screen.	

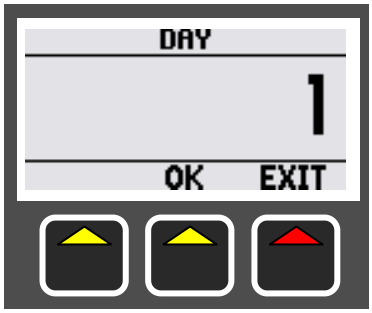
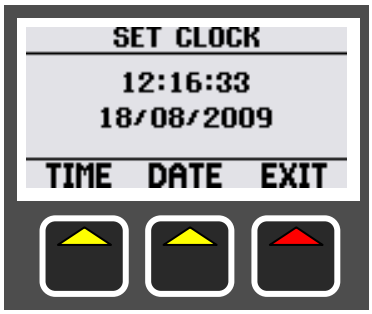
Setting the Time and Date

The Gauge has an internal clock to maintain the time and date for the Data-logging functions. When not data logging the current time is displayed on the measuring screen.



To set the time and date;

1.	Press the MENU key to display the MAIN MENU	
2.	Scroll down to GAUGE SETUP then press OK	
3.	Scroll down to CLOCK and press EDIT	
4.	The current time and date is displayed	
5.	Press TIME to set the time Enter in Hours, Minutes & Seconds followed by the OK key each time.	

6.	Press DATE to set the date Enter in Day, Month & Year followed by the OK key each time.	
7.	When finished press EXIT to return to the measuring screen	

7. Calibration

Calibrating the Gauge

The Gauge is supplied tested and calibrated to BS EN 15317:2007. The Gauge will have been calibrated to measure thickness through steel (grade S355JO).

Either a 15 mm or 1/2 ” test block is supplied with the kit so the Gauge can be quickly checked for correct operation. Note, this test block is not intended to be used for calibration of the Gauge.

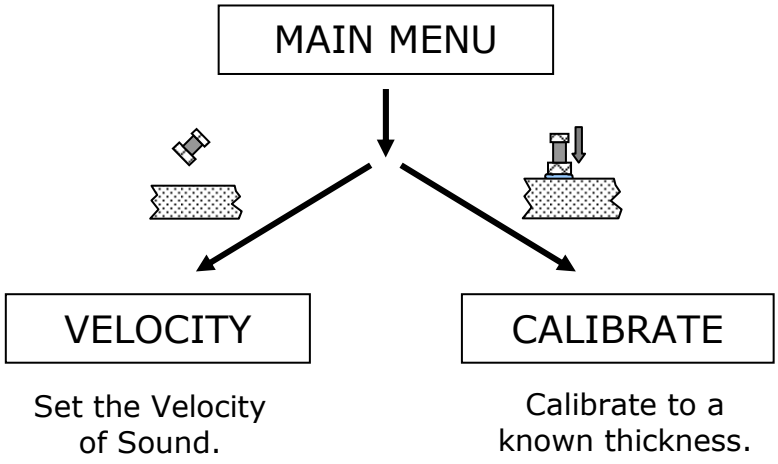
The best way to calibrate the Gauge is to Calibrate using a Known Thickness (see page 39) using a sample of the material you intend to measure. This method determines the velocity of sound for the material sample, which will always be more accurate that using a ‘general’ velocity value. For calibration instructions see page 38.

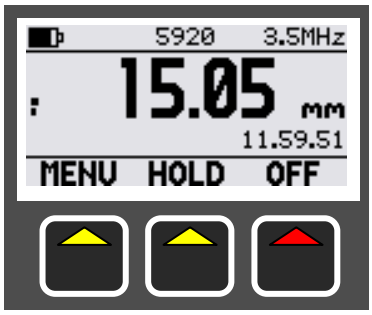
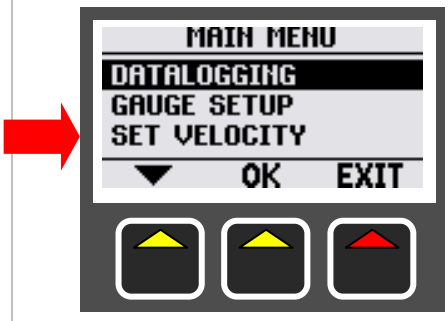
If there is no test sample available the Gauge can be calibrated by Setting the Velocity of Sound directly (see page 40). A table on page 118 at the back of this manual lists common materials and their velocity of sound value.

A third method is to leave the Gauge set to its factory-preset value for Steel [5920 m/s or 0.2332 in/us], and then use a Conversion Factor from the table of velocities on page 118.

When data logging you can’t change the velocity or calibration settings.

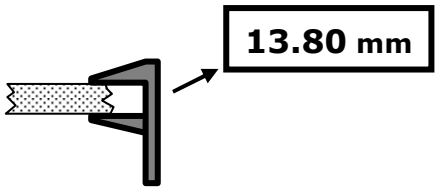
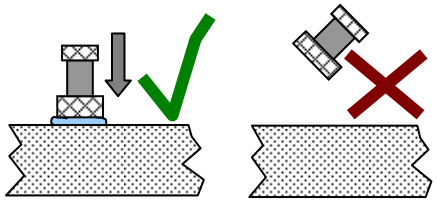
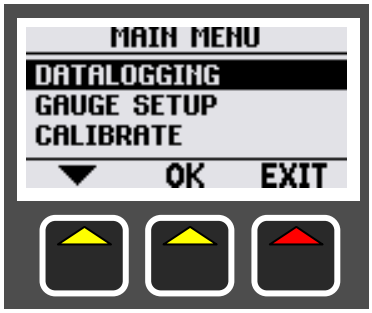
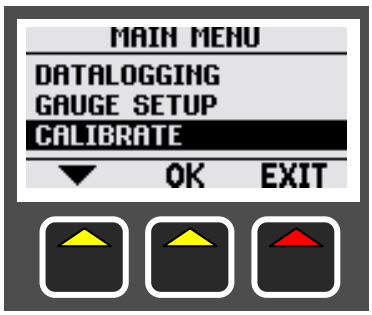
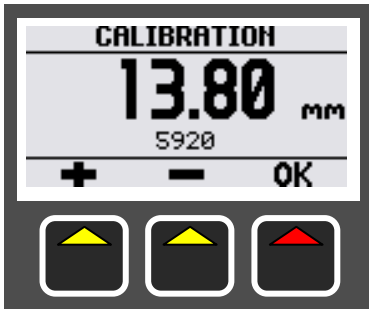
Calibration Menu



1.	To access the Calibration and Velocity settings simply press the MENU key	
2.	Either CALIBRATE or SET VELOCITY will be shown	
3.	When data logging you can't change the velocity or calibration settings.	

Calibrating to a Known Thickness (Single Point)

This method of calibrating the Gauge is the most accurate as the Gauge calculates the velocity of sound for the sample material.

1.	Accurately measure the thickness of your sample material.	
2.	Place the Probe on the sample so the Gauge is displaying a thickness value.	
3.	Press the MENU key to display the MAIN MENU	
4.	Scroll down to CALIBRATE then press the OK key	
5.	Use the **+** **−** keys to change the thickness value as required, shown in large numbers. The Velocity of Sound is shown at the bottom of the screen.	
6.	Press the OK key to save the calibration values and exit.	

Setting the Velocity of Sound

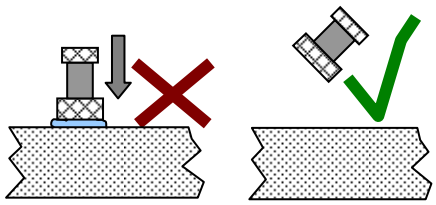
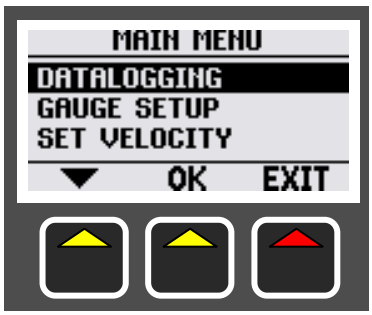
The Gauge uses the Velocity of Sound value to calculate the material thickness from the matched triple-echo time. A table on page 118 of this manual lists velocity of sound values for common material.

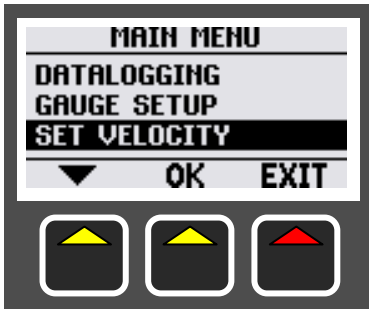
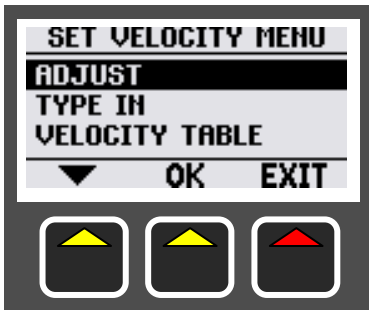
The current velocity of sound value is displayed in the centre at the top of the measuring screen. In the screen below '5920' means a velocity of 5920 m/s as the gauge is in metric.

There are three options for setting the velocity of sound value;

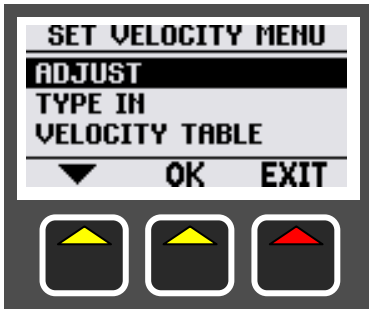
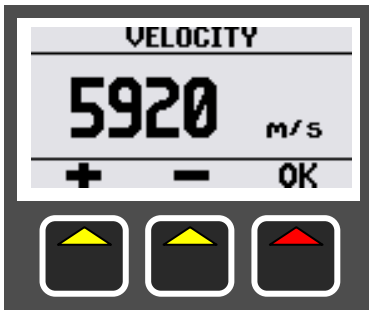
1. Adjust the current value slightly using + and - keys
2. Type in a new velocity value using the number keys
3. Choose a velocity from a list of common materials

Displaying the Velocity Menu

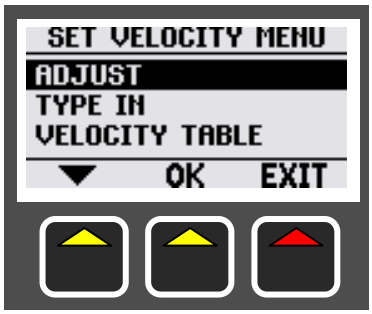
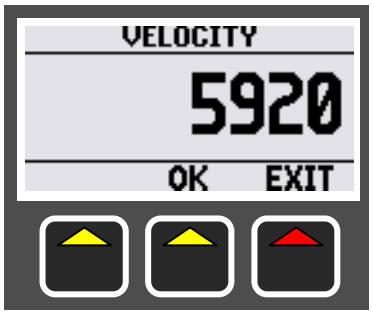
1.	Ensure the probe is not touching anything so the Gauge is not displaying a thickness value	
2.	Press the MENU key to display the MAIN MENU	

3.	Scroll down to SET VELOCITY then press the OK key	
5.	The SET VELOCITY MENU is displayed. Use the arrow key to select the desired option and press the OK key	

'Adjust' Velocity Menu Option

1.	From the VELOCITY MENU select the ADJUST option and press the OK key.	
2.	The ADJUST option lets you change the current velocity value using **+** **−** keys. Press the OK key to exit.	

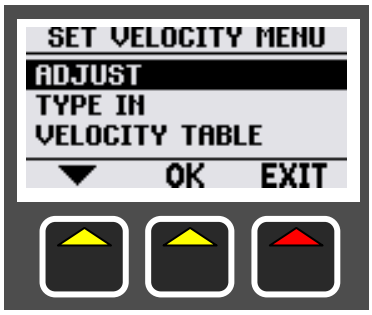
'Type In' Velocity Menu Option

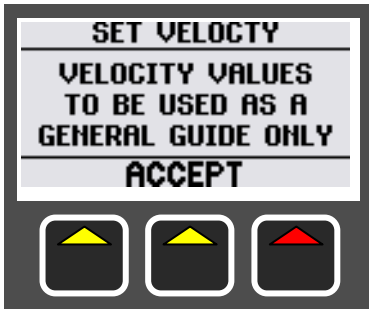
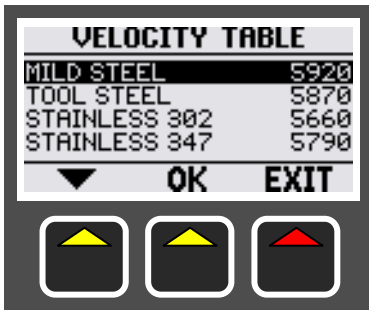
1.	From the VELOCITY MENU select the TYPE IN option and press the OK key.	
2.	You can now type in the required velocity using the numeric keys, followed by the OK key to exit.	

'Velocity Table' Menu Option

The VELOCITY TABLE option displays a list of common materials along with their velocity of sound values in either metric (m/s) or imperial (in/us * 10000) depending on the gauge units setting.

The built in velocity table is intended to used as a guide only. Wherever possible, the Gauge should always be calibrated on the material under test. These velocities are given in good faith and are believed to be accurate within the limits described above. No liability is accepted for errors.

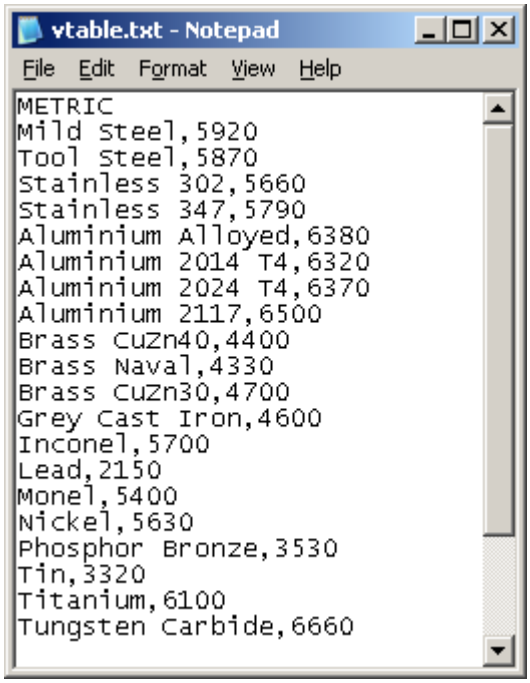
1.	From the VELOCITY MENU select the VELOCITY TABLE option and press the OK key.	

2.	An information message is first displayed to alert the user that the velocity values should only be used as a general guide. You must press the ACCEPT key to continue.	
3.	Use the arrow key to select the required material then press the OK key to exit. You will be asked to confirm your selection.	

Customising the Velocity Table

The velocity table gets its names and values from a file on the internal memory card in the gauge. You can modify this file to add, remove or edit the velocity table contents as required.

To view the velocity table file first connect the gauge to a computer using the USB cable. Locate the file on the gauge called 'vtable.txt', you can open it with Notepad.



'vtable.txt' File in Notepad

The format of the file is;

for Metric Velocities	for Imperial Velocities
METRIC name,velocity Mild steel,5920	IMPERIAL name,velocity Mild Steel,0.2331

"name comma velocity new-line" – no spaces after the comma

There can be up to 20 velocity entries in the table.
Each name can be up to 20 characters in length.

8. Data Logging

The Cygnus 3 Gauge has the facility to store thickness measurements on an internal memory card, this data may then be transferred to a computer for producing thickness survey reports. The Gauge has a USB port to allow data transfer between Gauge and computer. When connected to a computer running Microsoft Windows operating system the Gauge appears like a standard USB memory stick allowing files to be easily transferred without requiring driver installation. The memory is non-volatile and will retain its contents during power off and battery removal.

There are three types of data logging Record Files which the Gauge user can create:

QUICK LOG	This is a list of thickness measurements in a linear format
GRID POINT	This is an X-Y grid of thickness measurements. You need to specify the number of rows and columns.
TEMPLATE	This is a record file based on a template. The template details how many thickness points must be taken as well as their name along with reference and minimum thickness values. A template may also contain up to 40 user defined data fields, e.g. “Surveyor” or “Date” or “Serial No”. A company may issue a selection of templates one for each type of survey in use.

The Data Logging Process

The process of creating a new Record File, taking thickness measurements, transferring to computer and finally creating a report is straightforward, as illustrated below:

1. Create a new Record File on the Gauge
2. Start logging thickness measurements
3. Complete the thickness survey and close the Record File
4. Connect the Gauge to the computer
5. Transfer the Record File from Gauge to computer
6. Create paper or PDF reports on the computer

Windows software, "Cygnus 3 Data Logger Manager", is supplied to transfer Record Files and to create reports. It is also used to create Template Files and to transfer these to the Gauge, see page 73.

An Excel spreadsheet Add-In is provided to automate the process of inserting Record File data into spreadsheet reports, see page 92.

Contents of a Record File

Each Record File contains the following information:

Item	Description	Notes
Name	The name of the record file	
Units	Either mm or inch units	
Velocity	The velocity of sound used	
Probe Type	The probe type used	2.25 / 3.5 / 5.0 MHz
Create Date	The time and date the record was created.	
Comment	Any user comments	
Gauge ID	The gauge serial number	

Template files contain the following additional information:

Item	Description	Notes
Template file	Name of spreadsheet template file	
Worksheet	The worksheet on the template file	
User Field 1 to User Field 10	Additional User Fields for extra information.	

Each measurement point contains the following information:

Item	Description	Notes
Name	The name of the measurement point	
Reference	The reference thickness	optional
Minimum	The minimum thickness	optional
Measurement	The measured thickness value	
Time	The time the measurement was made	
Cell Location	The spreadsheet cell location for the measurement value	optional

Record File Names

When you first create a new Record File it will need a file name like any file on a computer. The gauge has two options for getting this file name:

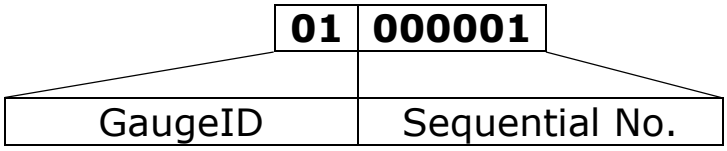
User Entered	The user must type in a file name
Auto File Name	The gauge creates a unique numeric file name for you

User Entered File Names

This assumes the user will choose a unique and appropriate file name. The file name could represent the name or number of the structure being surveyed.

Auto File Name

The file name is a combination of the GaugeID number and a sequential 6 digit number as follows:



The sequential number is increased by 1 each time a new Record File is created. When it reaches 999999 it will roll-over back to 000000 - after 999999 record files have been created.

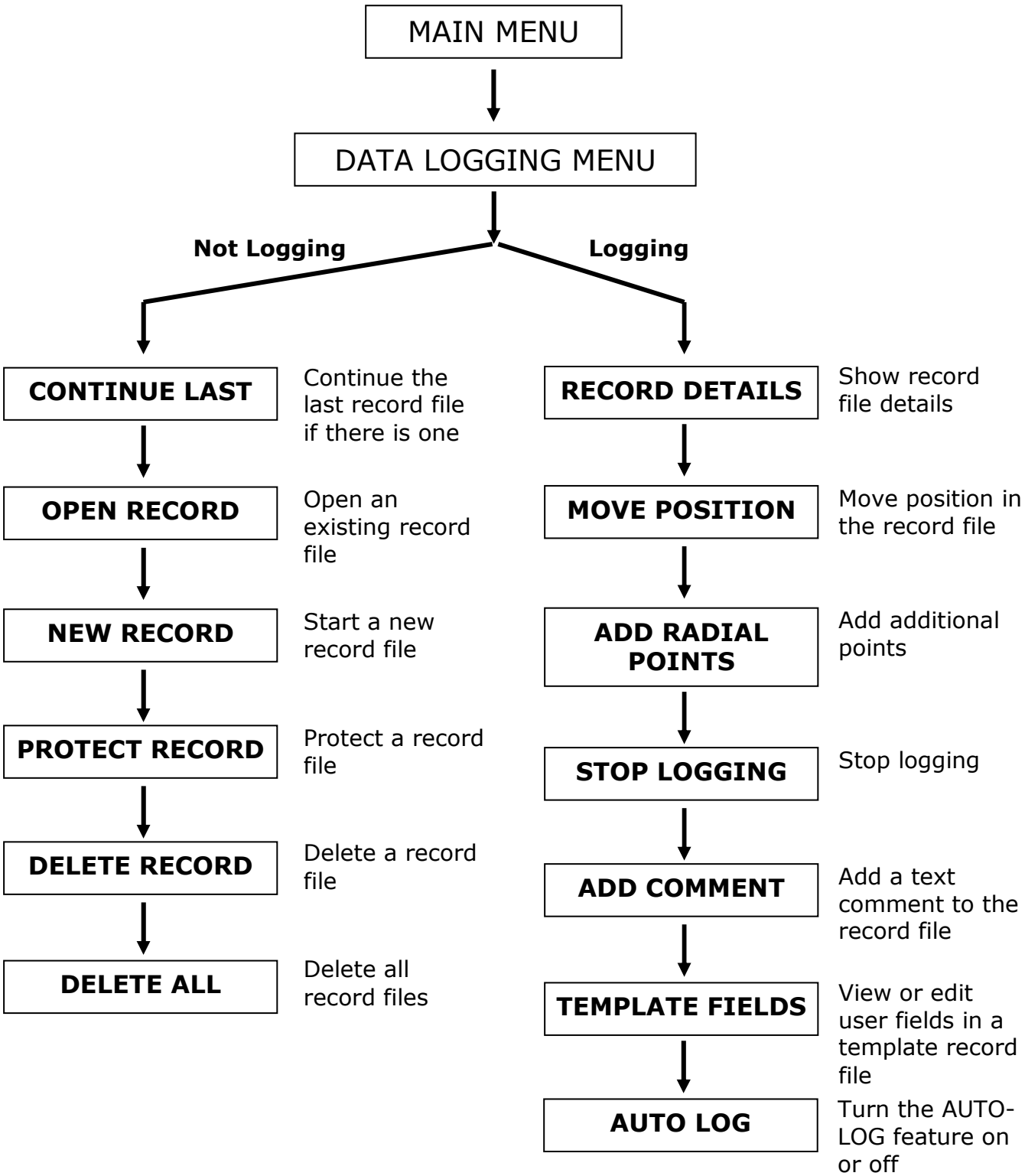
GaugeID Number

The GaugeID number is a number between 01 and 99 that can be assigned to each gauge. When more that one gauge is used by a company each gauge would be given a unique GaugeID number (i.e. 1, 2, 3..) so Record Files from all the gauges can exist in the same folder and be identified.

The GaugeID number can be changed in the Factory Menu screen.

Data Logger Menu

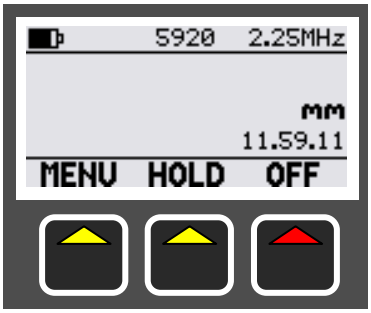
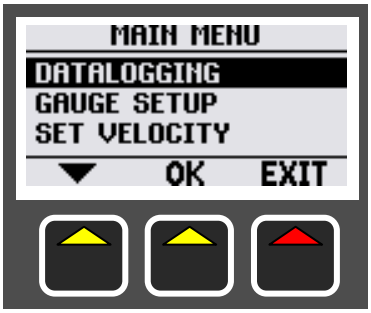
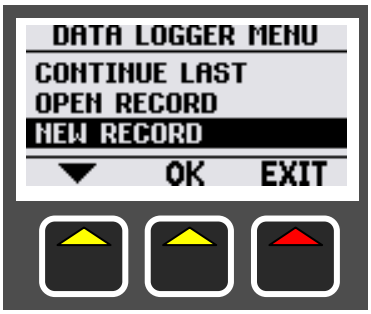
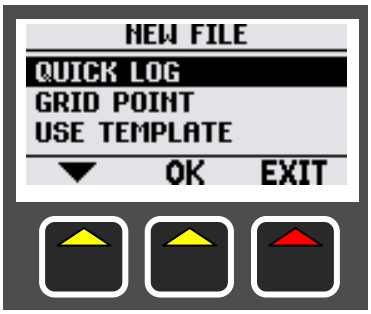
The Data Logger Menu has two paths depending on whether the Gauge is data logging or not.

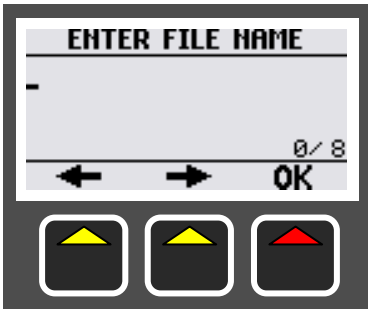
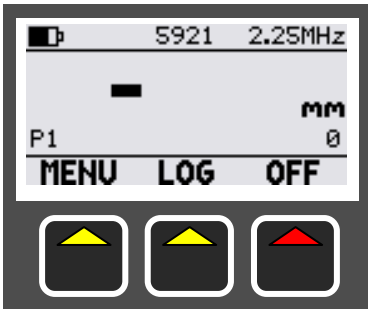
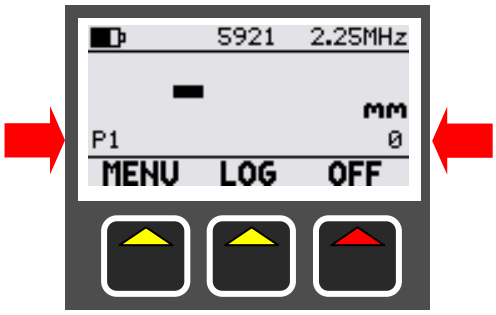


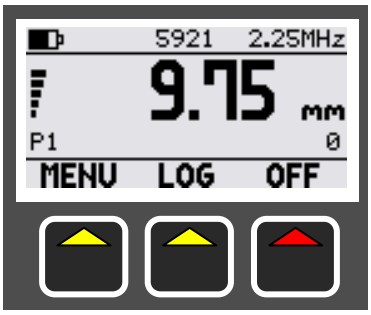
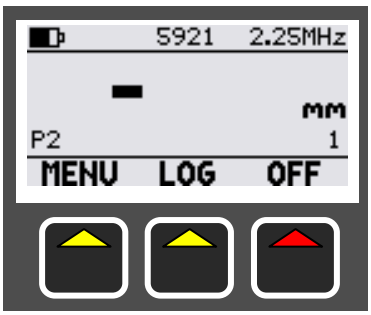
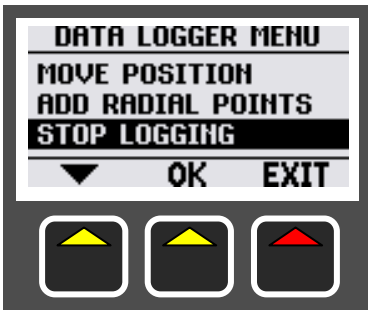
Quick Log Record Files

Quick Log Records contain a linear list of thickness measurement points. To create a Quick Log Record only the filename needs to be entered in before measurements can be logged. When the thickness survey is completed the Quick Log Record is closed by stopping data logging. The maximum number of measurement points that can be stored in each record file is 5000.

Creating a Quick Log Record File

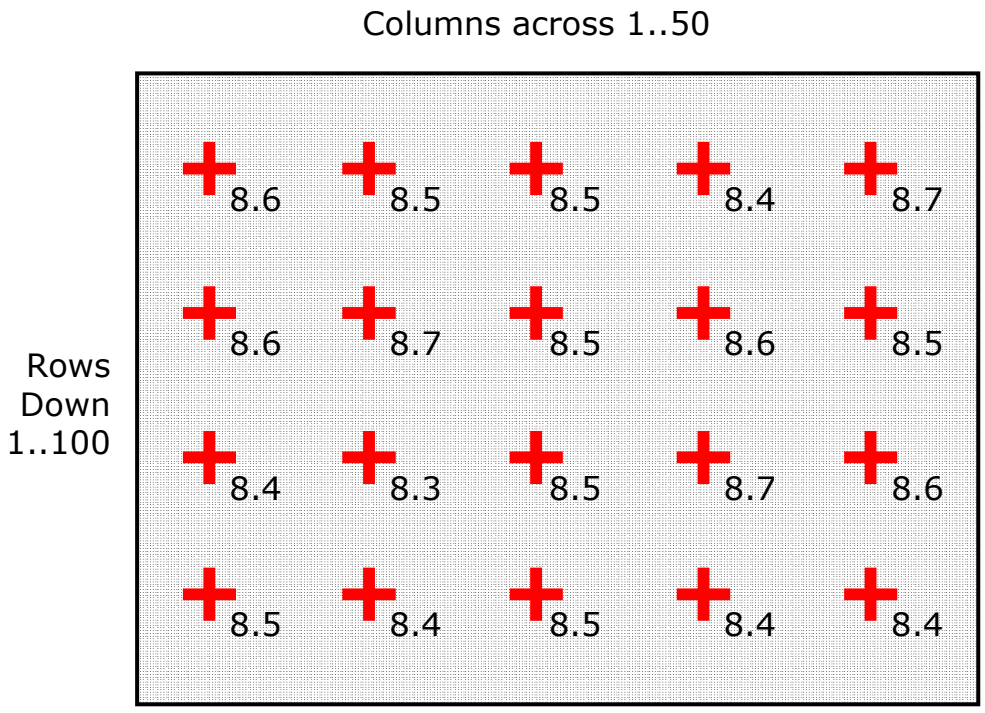
1.	Press the MENU key to display the MAIN MENU	
2.	DATALOGGING should be highlighted – press OK	
3.	Scroll down to NEW RECORD – press OK	
4.	QUICK LOG should be highlighted – press OK	

5a.	If Auto-Filename is turned off then you must type in a filename for the new record (up to 8 characters maximum) (If the filename already exists the user will be prompted to enter another) Press OK when done	
5b.	If Auto-Filename is turned on then you need only confirm the filename created by the gauge by pressing the OK key	
6.	The new blank record is created. A bar-graph shows the progress	
7.	The gauge is now ready to start logging thickness measurement results Note the middle function key is now **LOG** – this key is used to log the thickness measurement.	
8.	The number of thickness measurements that have been logged is shown on the right of the screen The name of the current measurement point is shown on	

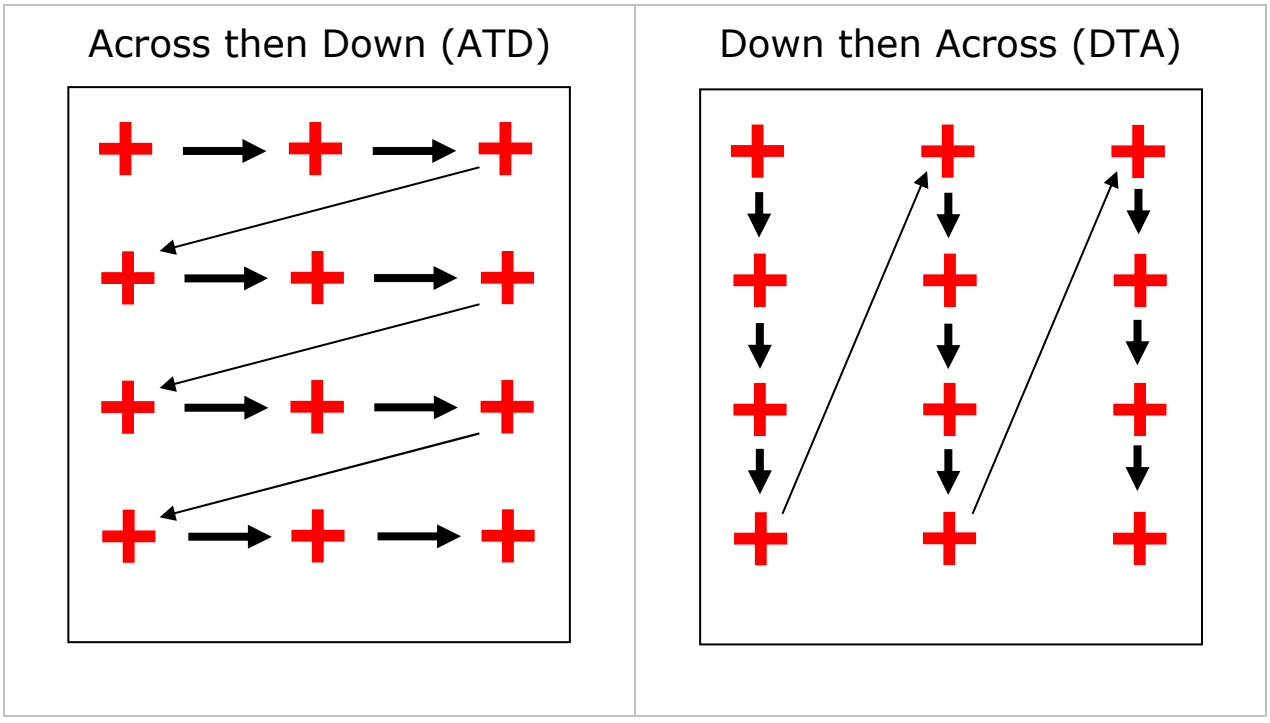
	the left, i.e. “P1” for Point 1.	
9.	To log the displayed thickness measurement press the LOG key The gauge will give a BEEP and the display will flash-black. When the data has been saved the green LED will flash.	
10.	The gauge is now waiting for the next thickness measurement. Note the number of logged measurements and next point name have moved on.	
11.	When all the thickness measurements points have been logged close the record by selecting STOP LOGGING from the DATA LOGGER MENU (see page 61)	

Grid Point Record Files

Grid Point record files are used to organise thickness measurements across a two dimensional grid. The grid can be applied to flat plate or cylinders alike.



You can also choose which direction measurements will be taken:



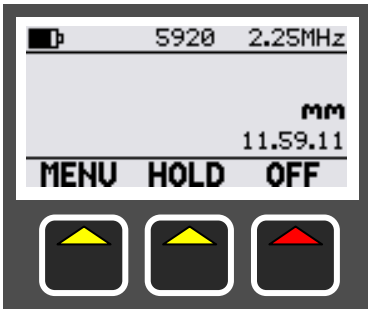
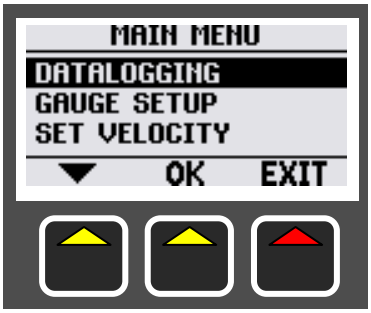
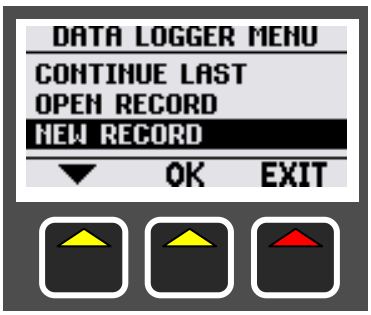
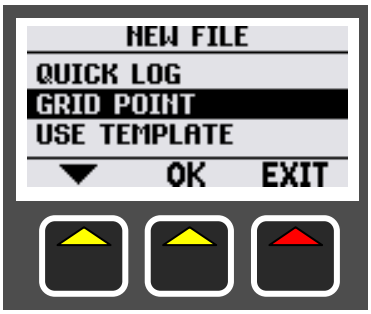
When a Grid Point record is created the measurement point names are assigned as follows:

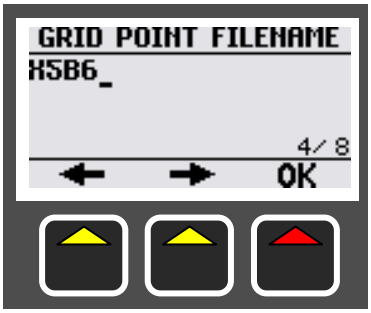
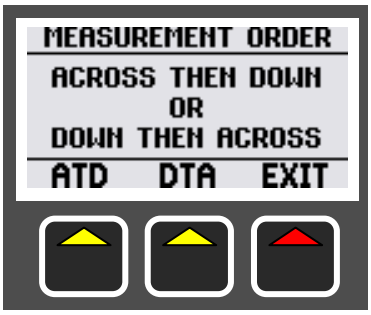
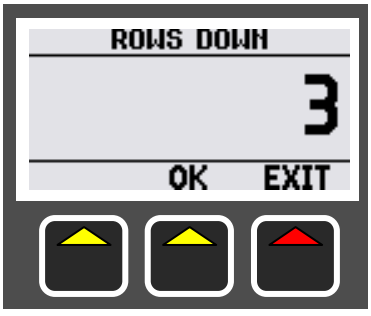
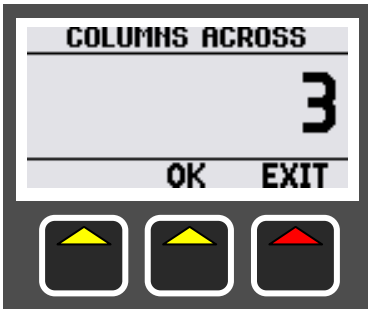
1. ROW1 COL1
2. ROW1 COL2

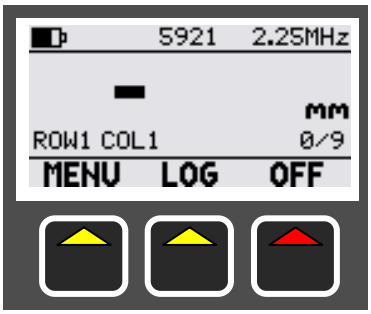
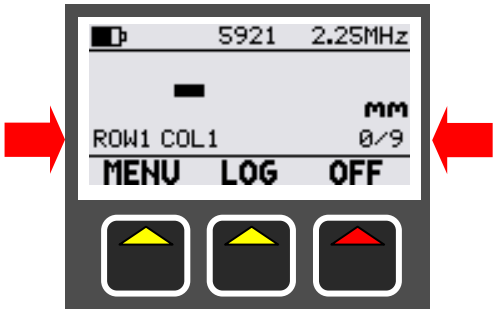
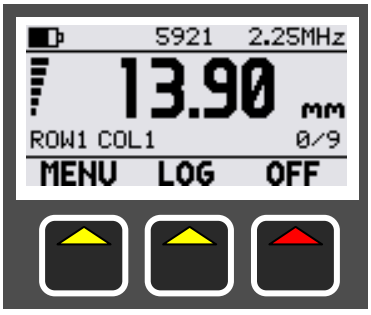
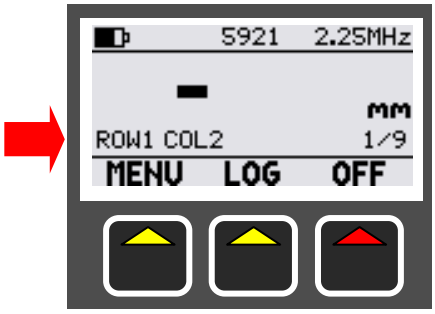
3. ROW1 COL3 etc.

The maximum number of rows and columns is 50 columns and 100 rows.

Creating a Grid Point Record File

1.	Press the MENU key to display the MAIN MENU	
2.	DATALOGGING should be highlighted – press OK	
3.	Scroll down to NEW RECORD – press OK	
4.	Scroll down to GRID POINT – press OK	

5a.	If Auto-Filename is turned off then you must type in a filename for the new record (up to 8 characters maximum) (If the filename already exists the user will be prompted to enter another) Press OK when done	
5b.	If Auto-Filename is turned on then you need only confirm the filename created by the gauge by pressing the OK key	
6.	Next choose the required measurement direction (see page 54)	
7.	Next enter the number of Rows down your grid Maximum = 100	
8.	Next enter the number of Columns across your grid Maximum = 50	

9.	The new Grid Point record file is now created	
10.	The gauge is now ready to start logging thickness measurement results Note the middle function key name is now **LOG** – this key is used to log the thickness measurement.	
11.	The number of thickness measurements that have been logged is shown on the right of the screen followed by the total number required in your grid. The name of the current measurement point is shown on the left	
12.	To log the displayed thickness measurement press the LOG key The gauge will give a BEEP and the display will inverse. When the data has been saved the green LED will flash	
13.	The gauge is now waiting for the next thickness measurement The name of the current measurement point has moved to the next grid point location	

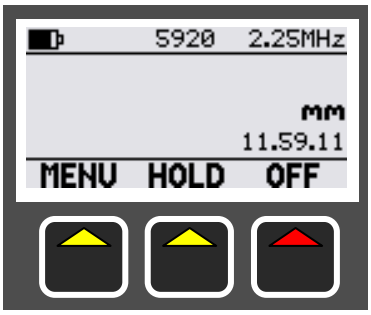
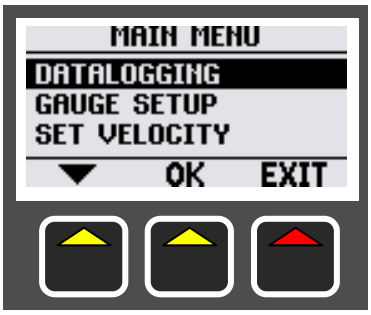
14.	When the last grid point measurement has been entered a message alerts the user the record has been completed. Press OK.	

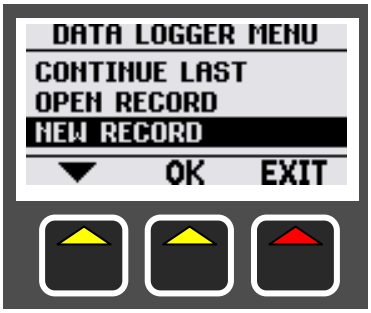
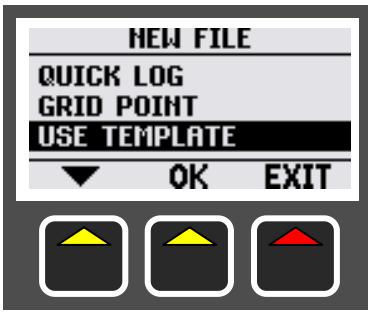
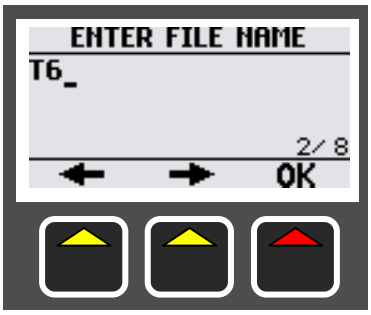
Template Record Files

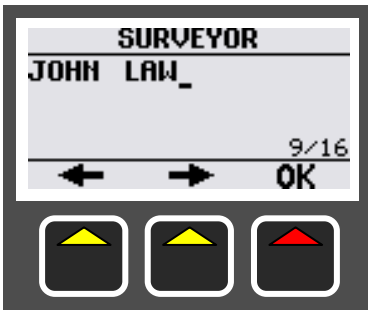
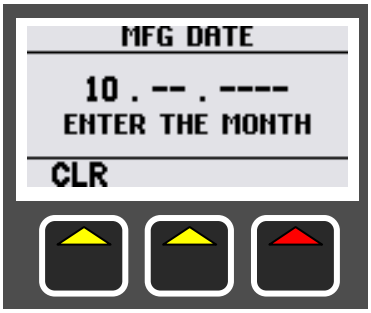
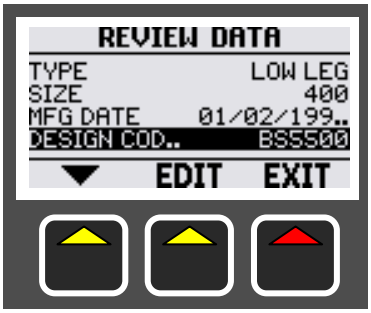
Template Files are created on a computer and describe the whole thickness measurement survey, defining each measurement point along with a name, reference thickness, minimum thickness and destination cell in a spreadsheet. Additional information can also be specified with 40 User Fields that can be used to prompt the user when each survey begins. Template Files are normally created to cover a specific type of survey and the actual Template File would be distributed to all the Cygnus 3 gauges in use within your company.

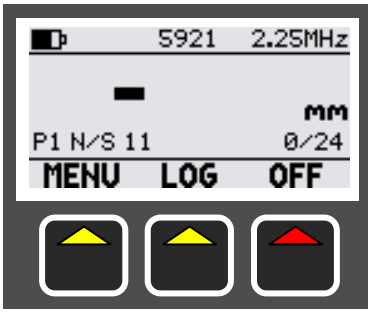
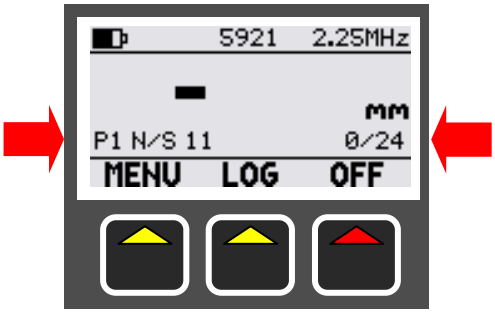
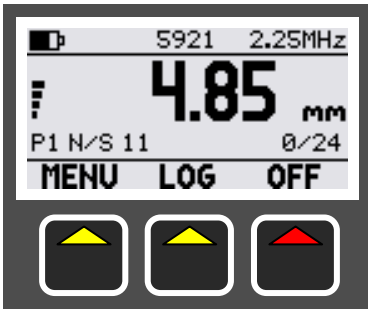
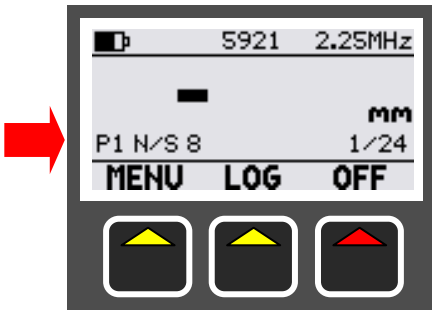
Read more about creating Template Files on page 81.

Creating a Record File from a Template

1.	Press the MENU key to display the MAIN MENU	
2.	DATALOGGING should be highlighted – press OK	

3.	Scroll down to NEW RECORD – press OK	
4.	Scroll down to USE TEMPLATE – press OK	
5.	Next scroll to select the required Template File – then press OPEN	
6.	Confirm Yes or No	
7.	Next enter in a file name for the new record file (up to 8 characters) (If the filename already exists the user will be prompted to enter another)	

8.	The blank record file is now created This process may take a few seconds to complete	
9.	If the template has any of the 40 User Fields specified then the user will be prompted to enter in data for each field. For example the Surveyor's name..	
10.	pick the Manufacturer from a list of names.. Scroll to the required name then press SELECT.	
11.	enter the Manufacture Date..	
12.	When all the User Fields have been entered you have the option to review them and make any corrections if you need to. When correct press the EXIT key to continue.	

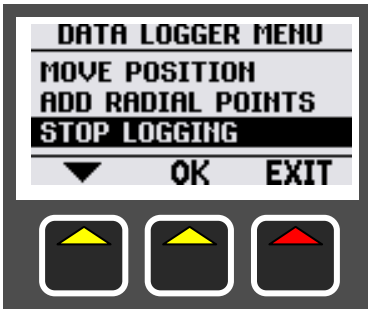
13.	The gauge is now ready to start logging thickness measurement results Note the middle function key name is now **LOG** – this key is used to log the thickness measurement.	
14.	The number of thickness measurements that have been logged is shown on the right of the screen followed by the number required in the template. The name of the current measurement point is shown on the left	
15.	To log the displayed thickness measurement press the LOG key The gauge will give a BEEP and the display will inverse. When the data has been saved the green LED will flash	
16.	The gauge is now waiting for the next thickness measurement The name of the current measurement point has moved to the next location	

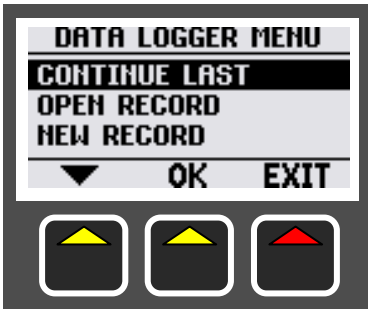
17.	If any logged thickness measurement is below the minimum thickness specified the user is alerted by a message, a beep and the RED LED is illuminated	
18.	When the last thickness measurement has been entered a message alerts the user the record has been completed. Press OK.	

Data Logging Functions and Management

Stopping, Suspending and Resuming Data Logging

Any Record File can easily be stopped and later resumed. When data logging is stopped the Gauge will operate as normal except thickness measurements can't be logged. When using a Quick Log Record data logging must be stopped to complete the record, as there is no pre-set number of measurement points.

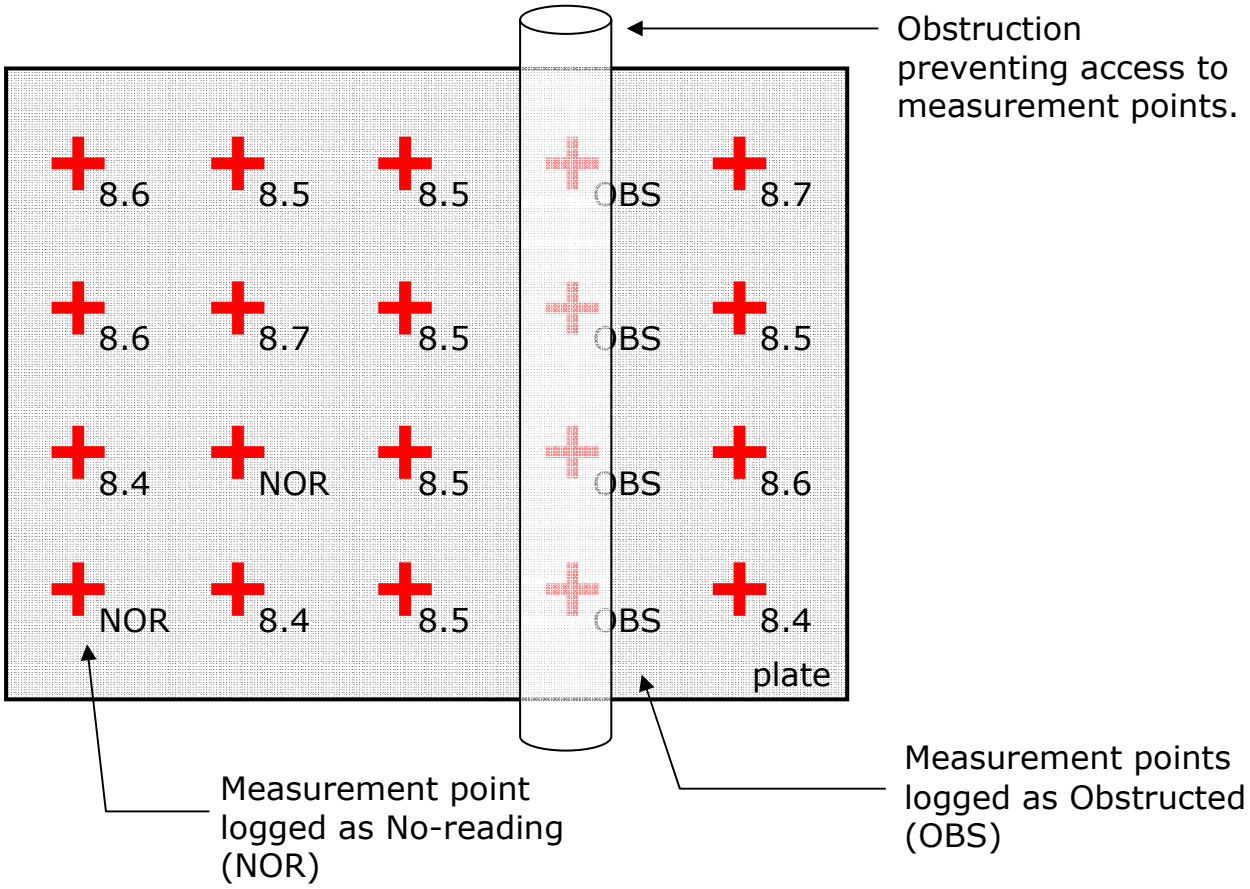
1.	To stop or suspend data logging select STOP LOGGING from the DATA LOGGER MENU You will be asked to confirm if you want to Stop Logging.	
2.	Once suspended the gauge can be used as normal	

3.	To resume the last record file select CONTINUE LAST from the DATA LOGGER MENU	
4.	Confirm OK or EXIT	

Logging an Obstruction or No-Reading Point

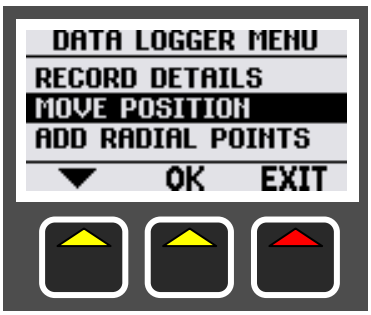
When surveying there may be measurement points that are inaccessible due to an object being in the way or there may be points where thickness readings can't be obtained (due to excessive corrosion for example). The Gauge allows the user to record either a No-Reading or Obstructed measurement point as required.

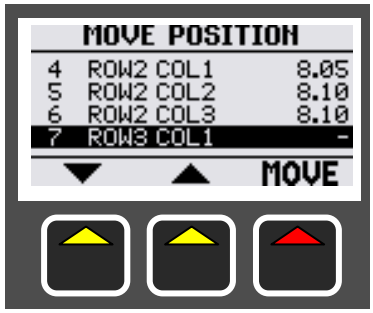
Pressing the LOG key when no thickness value is displayed gives the option to select either an Obstruction or a No-Reading or Exit to cancel.	



Moving Position in the current Record File

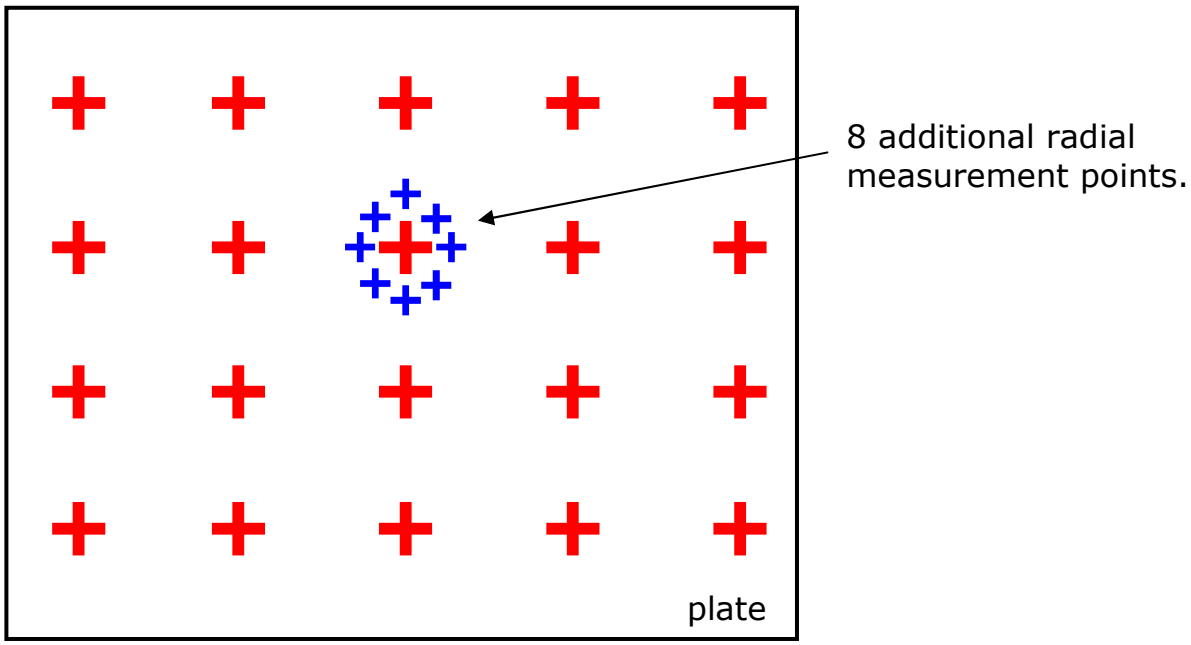
While data logging, the position where the next thickness measurement will be saved can be moved back to overwrite an existing value. It is not possible to move forward beyond the last thickness measurement logged.

1.	To move position the gauge must be in data logging mode.	
2.	To move position select MOVE POSITION from the DATA LOGGER MENU	

3.	Use the arrow keys to move the highlight bar to the position/measurement value to be overwritten. Press MOVE when done. Press any number key to Cancel.	
4.	The gauge will continue to log thickness measurement values from this point forward.	

Adding Additional Measurement Points

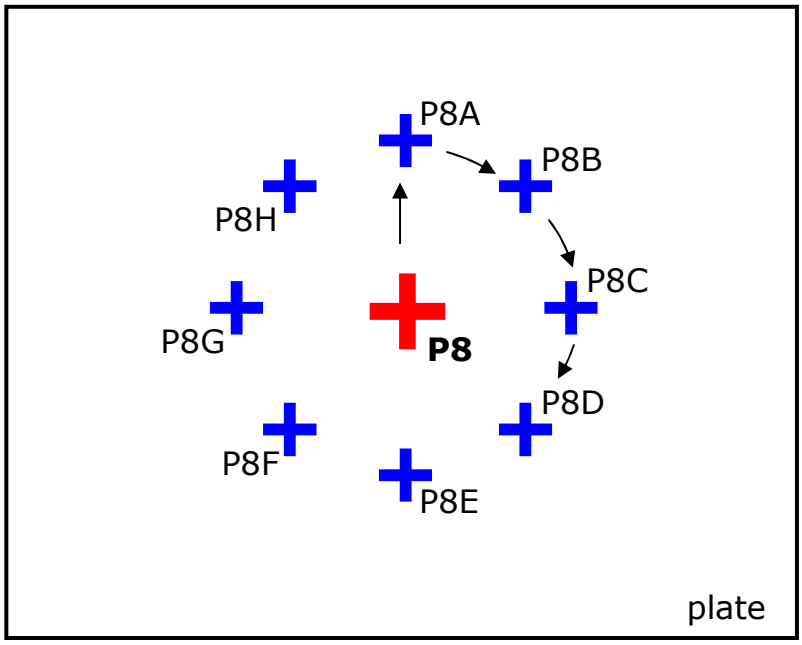
When logging thickness measurements on a pipe, tank or plate it is sometimes necessary to add additional measurement points radially around a badly corroded or thin point to detail the extent of the thinning or corrosion.



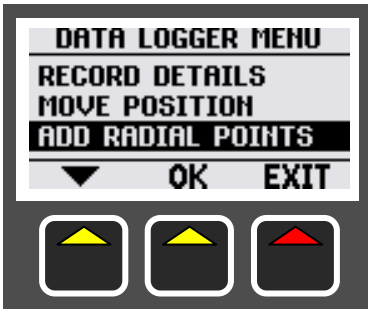
For Quick Log and Grid Point records the Gauge has a facility to add 4 to 12 additional radial measurement points linked to the measurement just taken. When additional radial points are added the parent point name is suffixed with A, B, C, D etc. linking the radial points to the parent thickness measurement.

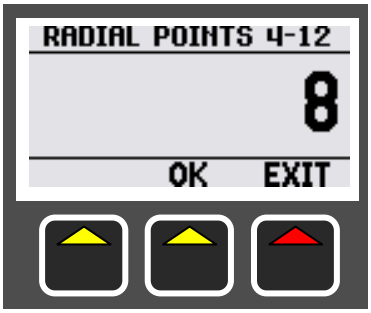
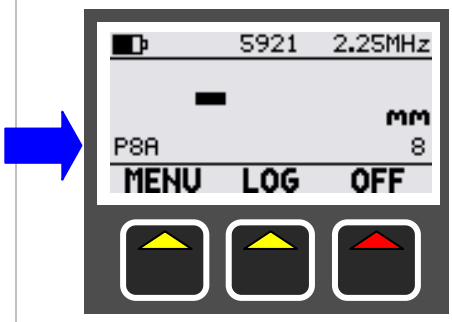
Example:

Parent Thickness Point Name = P8
Radial Point 1 Name = P8A
Radial Point 2 Name = P8B
Radial Point 3 Name = P8C
Radial Point 4 Name = P8D
Radial Point 5 Name = P8E
Radial Point 6 Name = P8F
Radial Point 7 Name = P8G
Radial Point 8 Name = P8H



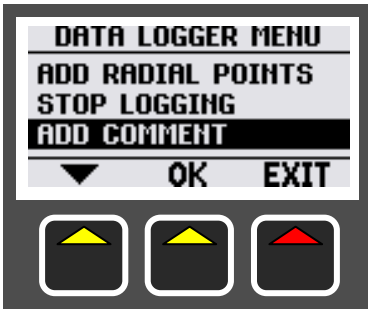
How to add Additional Radial Points

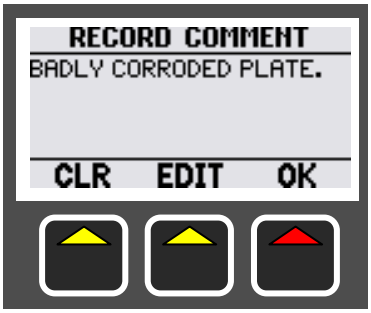
1.	To add Radial Points the gauge must be in logging mode with either a Quick Log or Grid Point record	
2.	Select ADD RADIAL POINTS from the DATA LOGGER MENU	

3.	Enter in the number of additional points required, from 4 to 12. Then press OK	
4.	The gauge is ready to start logging the additional thickness values Note the measurement point names have suffix A, B, C etc.	
5.	Once all the additional points have been logged a message alerts the user	

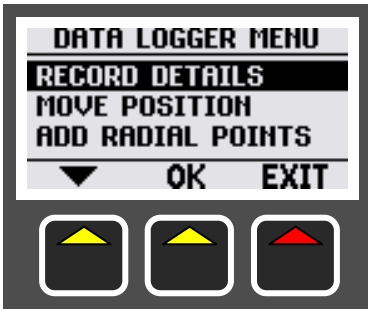
Adding a Comment while Data Logging

A text comment can be added to the current Record File. This comment will be included in the report printout.

1.	To add a comment the gauge must be in logging mode	
2.	Select ADD COMMENT from the DATA LOGGER MENU	

3.	The current text comment is displayed if there already is one. To edit this comment or add a new one press the EDIT key. To remove the comment press the CLR key	

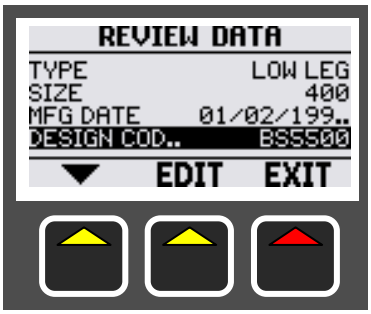
Displaying the Current Record File Details

1.	To view the record details the gauge must be in data logging mode.	
2.	To view record details select RECORD DETAILS from the DATA LOGGER MENU	
3.	The screen shows the record details. Press OK to close.	

Reviewing Template File User Fields

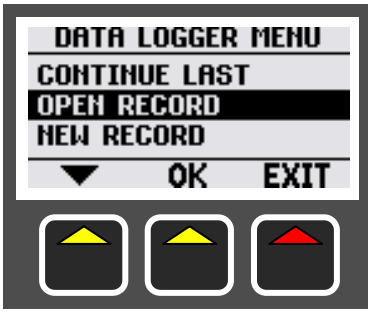
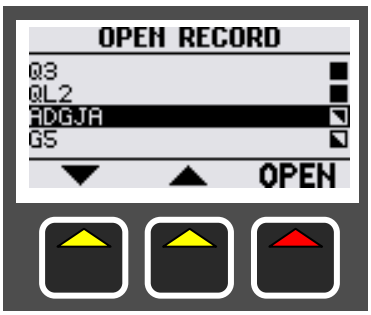
When a Record File has been created using a Template File there may be up to 40 user fields contained in the record. Normally these User Fields will have been completed when the Record File was created but this data can also be viewed and edited while the record file is open.

1.	To view the User Field data the gauge must be in logging mode with a Template record file	

2.	Select TEMPLATE FIELDS from the DATA LOGGER MENU	
3.	The current values are displayed. To edit scroll to the required field and press the EDIT key.	

Opening a Record File

An existing Record File can be opened to continue data logging from the last position.

1.	To open a record file the gauge must <u>not</u> be in data logging mode.	
2.	To open a record file select OPEN RECORD from the DATA LOGGER MENU	
3.	The screen shows a list of record files. Scroll to the record to open and press the OPEN key. Padlock icon = protected Empty box = empty record Half box = started record Black box = complete record	

4.	Note. Protected records can't be opened.	

Protecting Record Files

Record Files can be locked to prevent deletion or any accidental changes being made.

1.	To protect record files the gauge must <u>not</u> be in data logging mode.	
2.	To protect a record file select PROTECT RECORD from the DATA LOGGER MENU	
3.	The screen shows a list of all the record files. **Padlock icon = protected** Empty box = empty record Half box = started record Black box = complete record	
4.	To change the protection scroll to the record file to change and press the CHANGE key	

Deleting Record Files

Un-protected Record Files can be deleted from the Gauge's memory. Template Files are not deleted.

1.	To delete record files the gauge must <u>not</u> be in data logging mode.	

2.	To delete a record file select DELETE RECORD from the DATA LOGGER MENU	
3.	The screen shows a list of all the record files. Padlock icon = protected Empty box = empty record Half box = started record Black box = complete record	
4.	To delete scroll to the record file and press the DELETE key Confirm OK or EXIT	

Deleting all Record Files

Un-protected Record Files can be deleted from the Gauge's memory in one step. Template Files are not deleted.

1.	To delete record files the gauge must <u>not</u> be in data logging mode.	
2.	To delete a record file select DELETE ALL from the DATA LOGGER MENU	

3.	Confirm OK or EXIT	
4.	Confirm OK or EXIT again	
5.	The number of records deleted will be shown	

Changing the Velocity or Calibration while Data Logging

While data logging the velocity of sound or the calibration can't be changed.

When a Record File is created the current velocity value is copied into the record file, the velocity value is then locked while data logging. The velocity value will be included in the report print out.

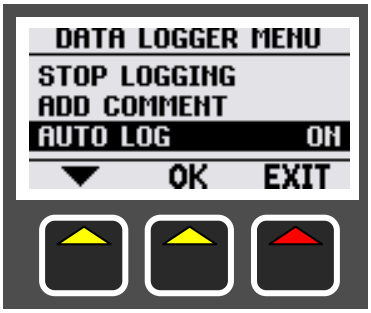
Auto-Log Function

The Auto-Log function will automatically 'LOG' thickness measurements to the current record file each time the probe is coupled and a valid and stable thickness measurement is taken and held.

This feature can speed up data logging as you don't need to keep pressing the LOG key each time enabling you to quickly progress along the object being surveyed.

Sometimes however you may need the flexibility to choose when to 'LOG' the thickness measurement, so the Auto-Log function is not required.

You can turn the Auto-Log function on or off as required from the Data Logging Menu when data logging.

1.	The gauge must be in data logging mode.	
2.	To change the Auto-Log feature scroll down to the AUTO LOG item in the DATA LOGGER MENU.	
3.	Press the OK key to change the value.	

Using the Auto Log Feature

The Auto Log feature requires the user to position, hold and move the probe in a certain time for it to automatically log the thickness values, follow this pattern to auto log the thickness points;

1. Place the probe on the surface to be measured until you get a thickness reading that is stable.
2. Hold the probe, and the thickness measurement until you get a beep and the screen signals the measurement has been logged – look for the green LED to light.
3. Release the probe and don't attempt another measurement for 1 second minimum.
4. Repeat from step 1 again.

9. Cygnus 3 Data Logger Manager

Overview

The Cygnus 3 Data Logger Manager is a Windows® application for managing the records on a Cygnus 3 Gauge. It provides the following functions:

1. Transfer of Record Files from Gauge to computer
2. Creation of thickness survey reports for printing (or PDF)
3. Creation of Template Files
4. Transfer of Template Files from computer to Gauge

It provides a simple intuitive interface for managing your thickness survey data and creating reports and templates.

Installation

The installation of the Cygnus 3 Data Logger Manager application is simple and straightforward. The application does however require the 'Windows® .NET' framework to be installed but this is included in the installation package provided in the gauge kit so additional downloading should not be required.

To start installing insert the supplied CD/USB memory stick and either choose to install the Cygnus 3 Data Logger Manager from the menu or locate the setup.exe file on the CD/USB memory stick and open it. A 'Welcome' install screen is displayed, shown in Fig. 9.1. Follow the instructions and allow the application to install. A desktop icon will be created along with a program folder.

If the .NET framework needs to be installed the CD/USB memory stick Installer Package will automatically start this installation.

To run Cygnus 3 Data Logger Manager double click the desktop icon:

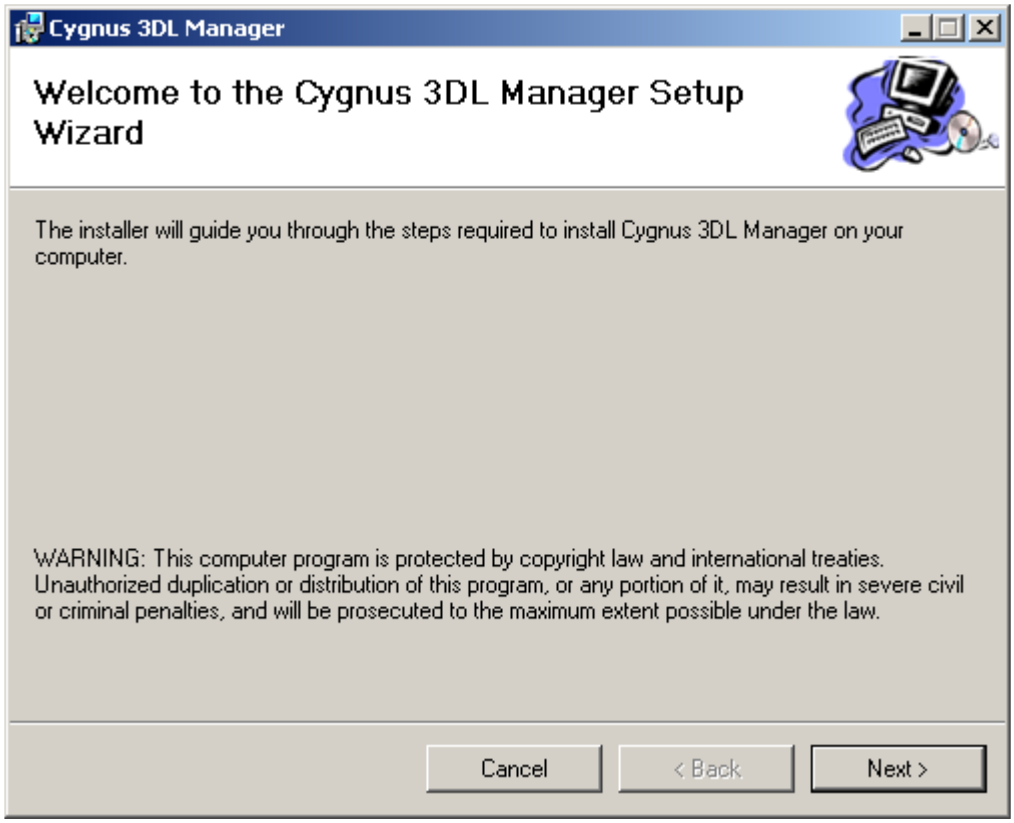


Fig 9.1 'Welcome' Install Screen

Connecting the Data Logger to the Computer

The Gauge is connected to any free USB port on the computer or USB Hub with the special cable supplied (Note this is not a standard USB cable as it has a 'Lemo 0' connector at the Gauge end). The USB connector on the Gauge is located on the bottom plate opposite the battery screw, it is covered by a hinged dust cover shown below in Fig 9.2

Fig 9.2 Gauge USB Connection

When the Gauge is connected to the computer and the USB link has been established the screen on the Gauge will display "USB CONNECTED" and the backlight will be turned off.

On the computer the Gauge will be shown as a new 'Removable Disk' when viewing 'My Computer' as shown below in Fig 9.3. (On the computer click 'Start' then 'My Computer').

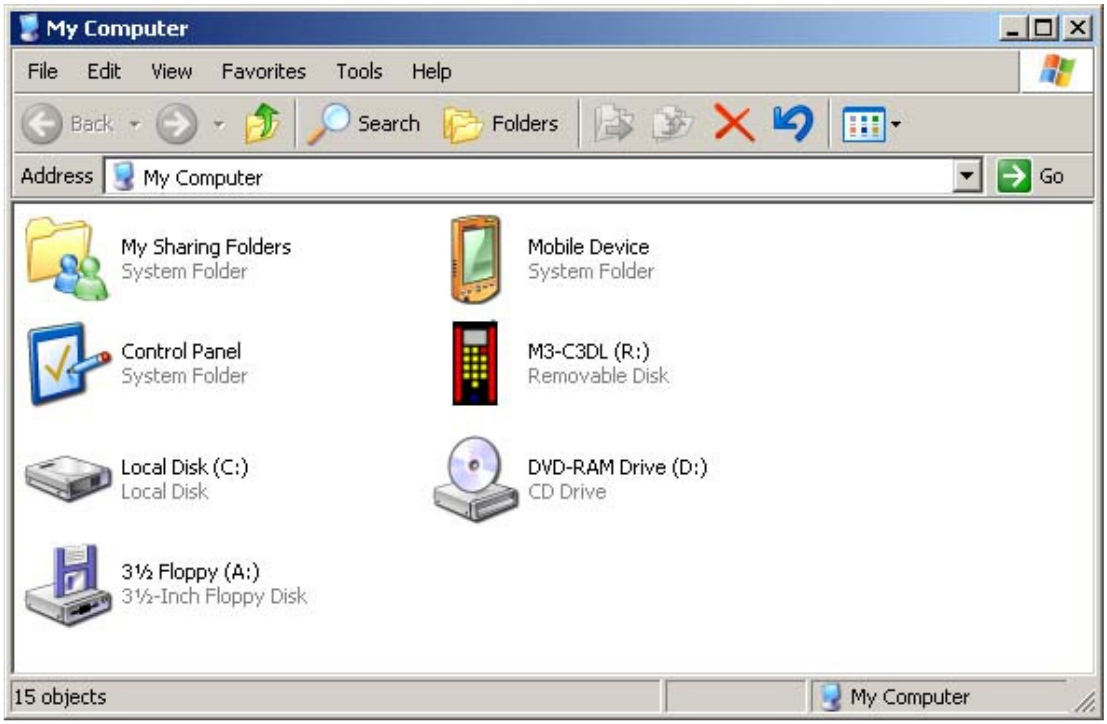


Fig 9.3 'My Computer' (Windows XP)

Setting Options

When the Gauge is connected to the computer you must determine the drive letter that Windows® has assigned for the Gauge. In Fig. 9.3 above the drive letter assigned is '**R:**'.

To set this in Cygnus 3 Data Logger Manager menu bar click on '**File**' then '**Options**', the dialog box will be displayed as shown in Fig 9.4. Set the '**Data Logger Drive Letter**' as required, click '**Browse**' to check the letter is correct.

The location of the folder that will hold the Record File and Template Files can also be changed. By default a folder called '**Datalogger**' is created in the '**My Documents**' folder ('**Documents**' on Microsoft Vista). This '**Datalogger**' folder contains three sub-folders called:

1. Record Files	Folder for Record Files
2. Template Files	Folder for Template Files
3. Add-In	Folder for Excel Add-In file

When done click on '**Save**' to save these settings.

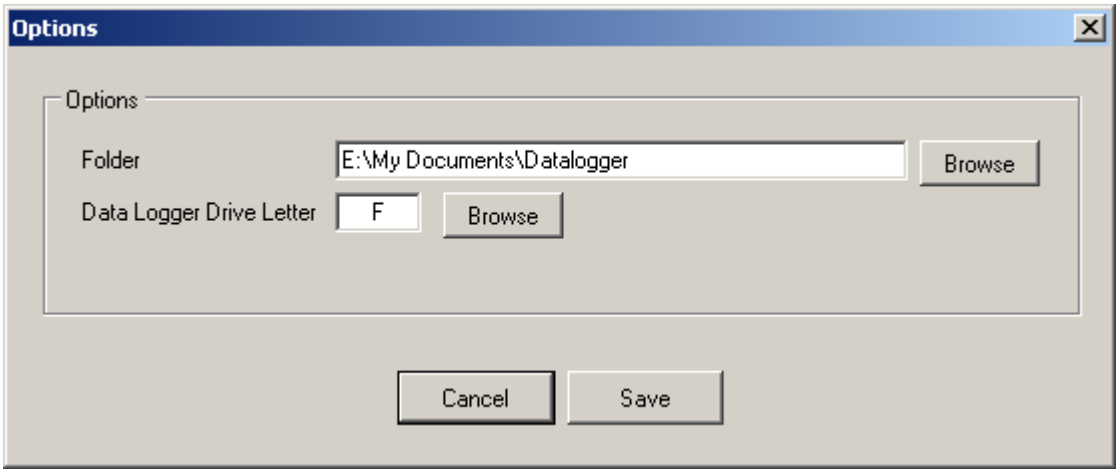


Fig 9.4 Options

Transferring Record Files from the Data Logger

To transfer record files from Gauge to computer, from the Cygnus 3 Data Logger Manager menu bar click '**Data Logger**' then

'**Transfer Records from Gauge**'. The '**Transfer Records from Data Logger**' dialog box will be displayed, Fig 9.5.

The drive letter should be correct, but it can be changed here using the drop-down list.

When a Gauge has been detected the Record File List in the dialog box will populate with all the record files on the Gauge's memory card.

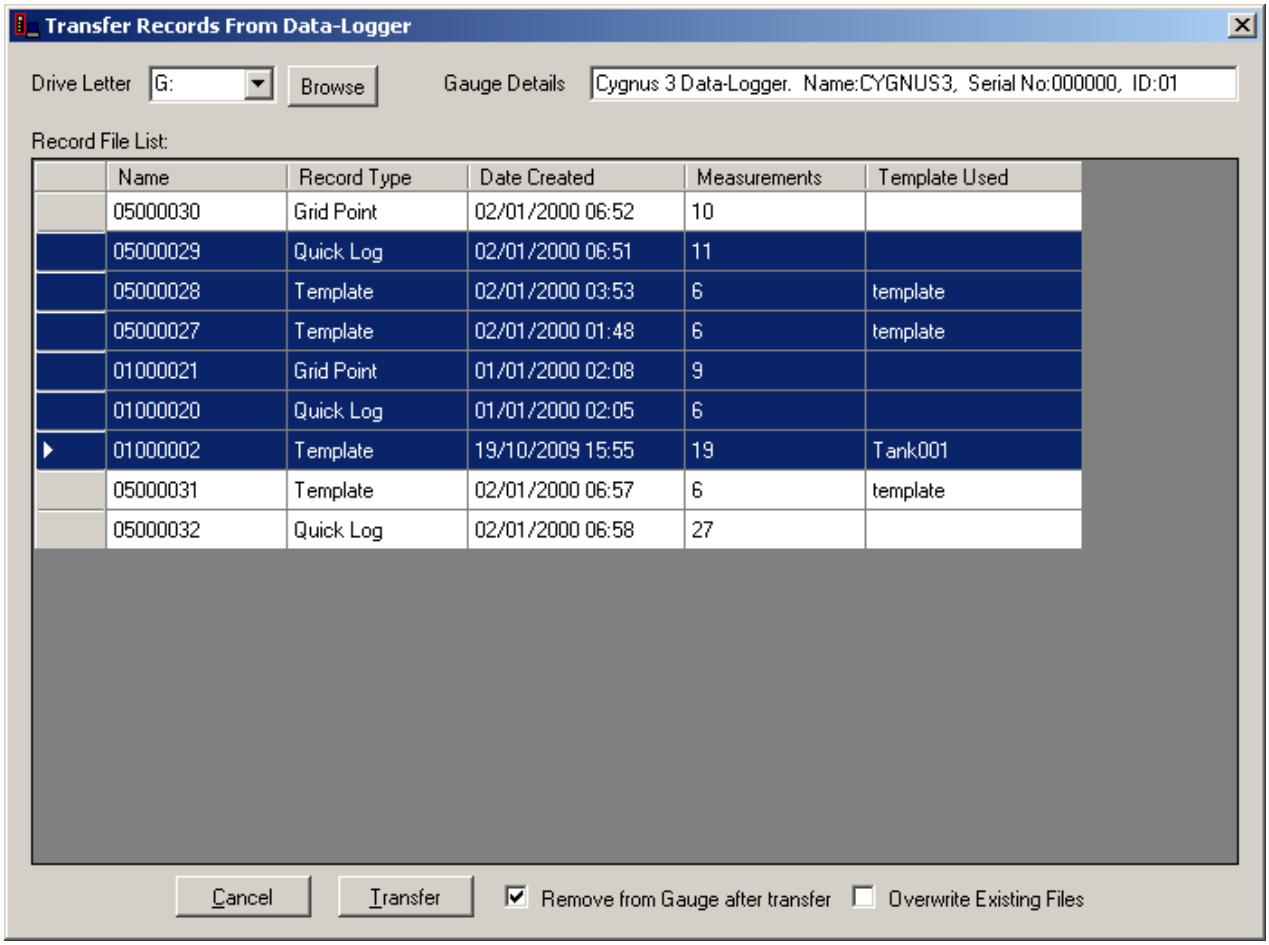


Fig 9.5 Transfer Records from Data Logger

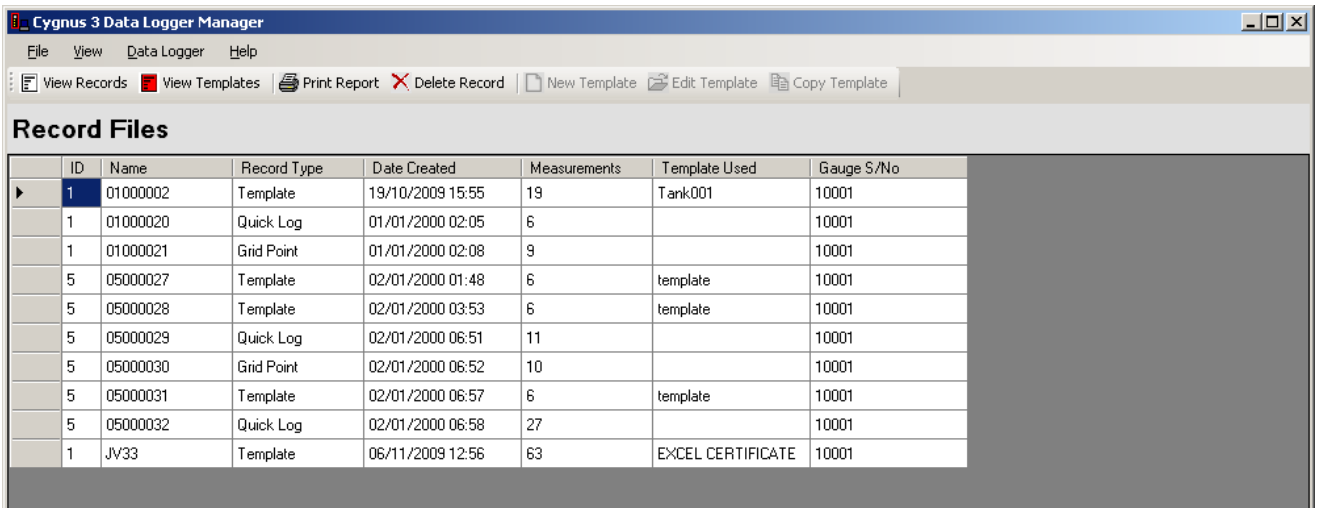
Simply select the records to transfer by clicking on their 'Row Selectors' - hold the shift key to select multiple records. Then click '**Transfer**', the selected record files will then be copied from the Gauge's memory card to the computer.

There is also the option to remove the transferred record files from the Gauge and to overwrite any existing files on the computer.

Creating and Printing a Report

Once records have been transferred from the Gauge a report can be created that can be printed or saved as a PDF (if PDF creation software has been installed).

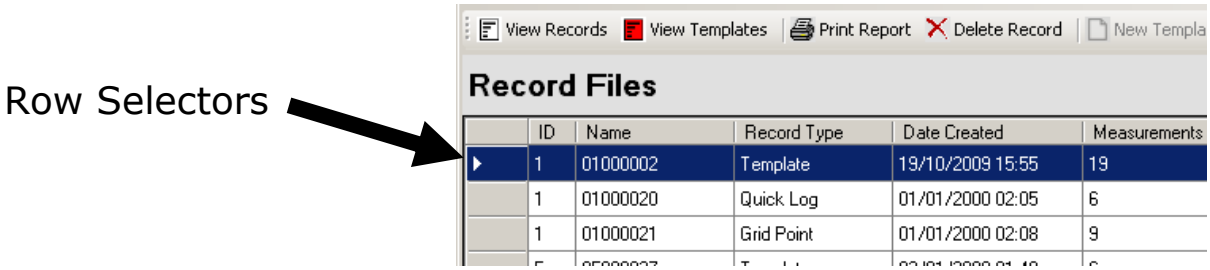
In Cygnus 3 Data Logger Manager click on the '**View Records**' button and the screen should list all the record files found, shown below in Fig 9.6.



	ID	Name	Record Type	Date Created	Measurements	Template Used	Gauge S/No
▶	1	01000002	Template	19/10/2009 15:55	19	Tank001	10001
	1	01000020	Quick Log	01/01/2000 02:05	6		10001
	1	01000021	Grid Point	01/01/2000 02:08	9		10001
	5	05000027	Template	02/01/2000 01:48	6	template	10001
	5	05000028	Template	02/01/2000 03:53	6	template	10001
	5	05000029	Quick Log	02/01/2000 06:51	11		10001
	5	05000030	Grid Point	02/01/2000 06:52	10		10001
	5	05000031	Template	02/01/2000 06:57	6	template	10001
	5	05000032	Quick Log	02/01/2000 06:58	27		10001
	1	JV33	Template	06/11/2009 12:56	63	EXCEL CERTIFICATE	10001

Fig 9.6 Record Files List

Select a record by clicking the grey 'Row Selector' on the left and then click on the '**Print Report**' button in the toolbar.



	ID	Name	Record Type	Date Created	Measurements
▶	1	01000002	Template	19/10/2009 15:55	19
	1	01000020	Quick Log	01/01/2000 02:05	6
	1	01000021	Grid Point	01/01/2000 02:08	9

A dialog box is displayed that allows optional report details to be added at the top of the report when the tick-box '**Include in Report**' is checked. See Fig 9.7.

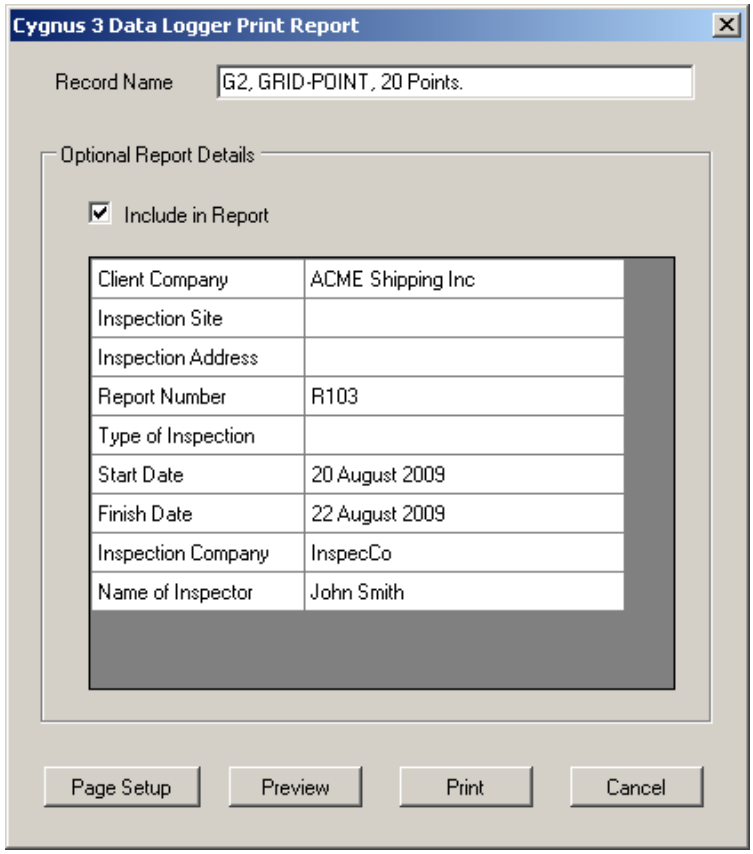


Fig 9.7 Optional Report Details

Next click either '**Preview**' or '**Print**' as required. Fig 9.8 shows a typical paper report layout in the Print Preview window.

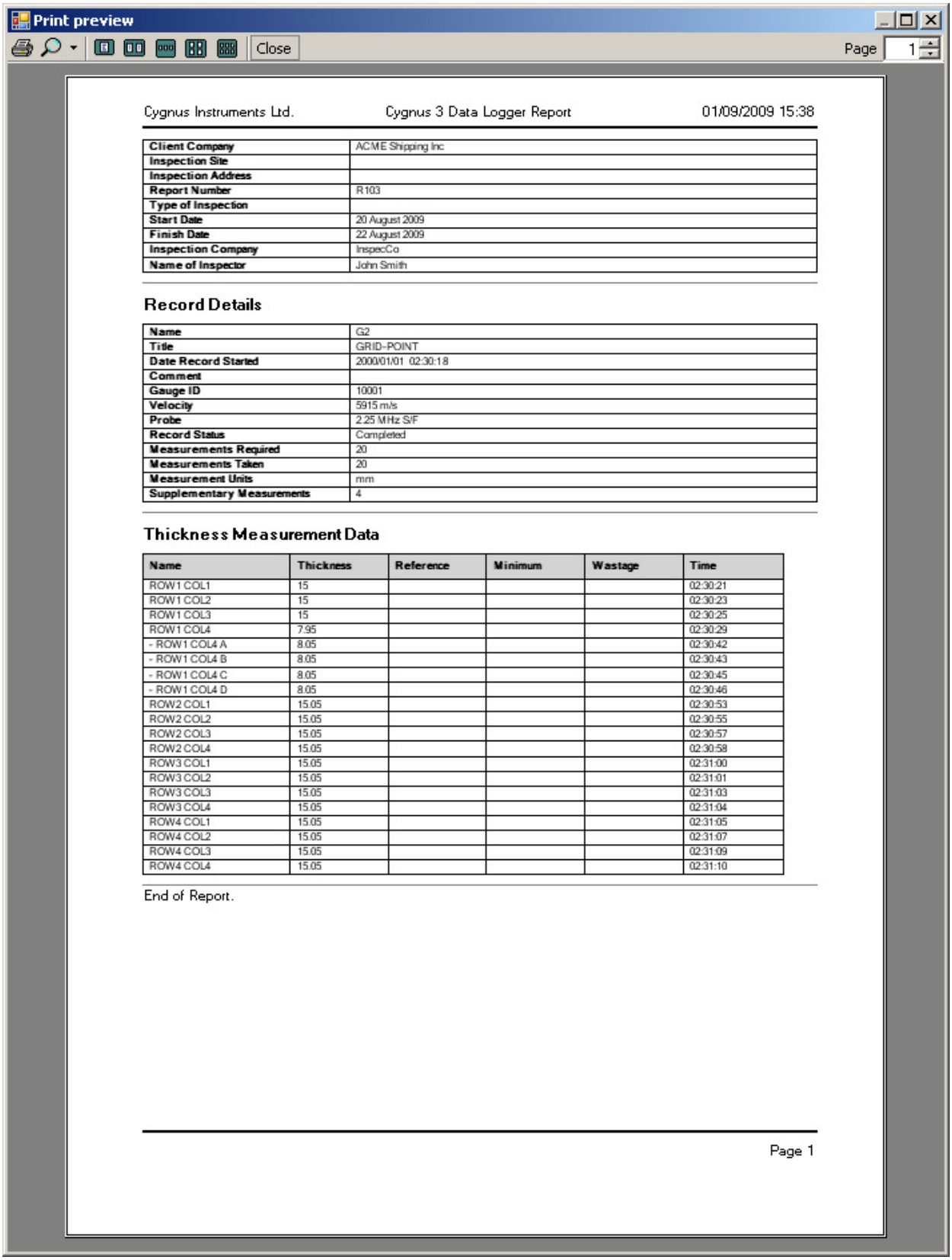
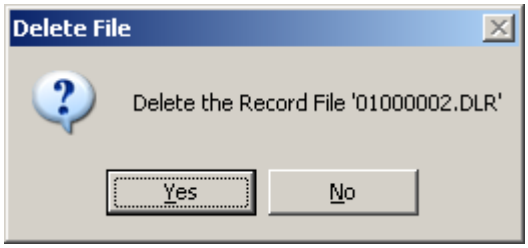


Fig 9.8 Report Layout – Print Preview

Deleting a Record File

You can delete a Record File from the computer by first clicking on the row selector of the record you want to delete then clicking the "**Delete Record**" button in the toolbar. You must then confirm you wish to delete this record.

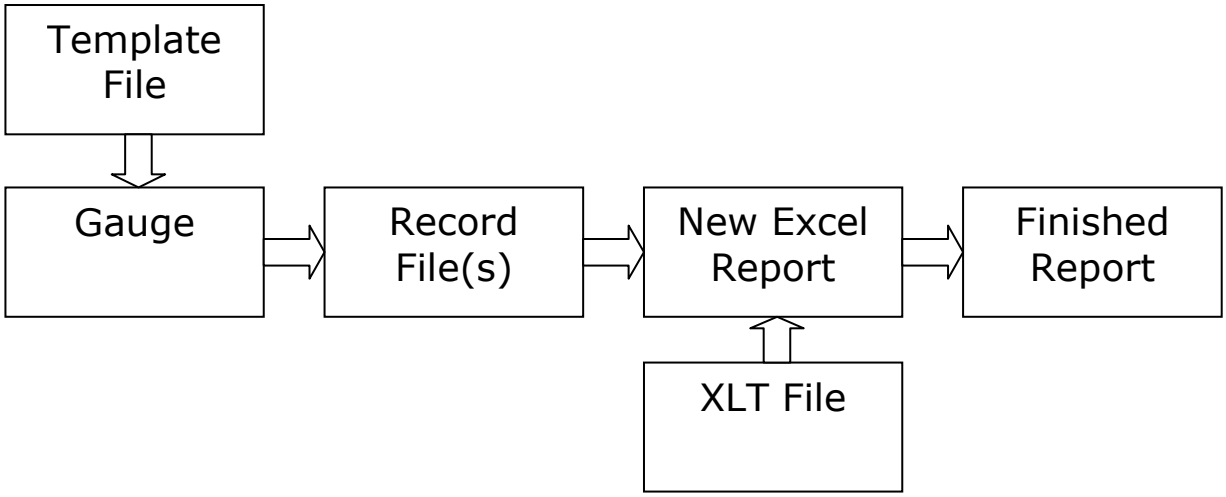


Template Files

Template Files allow structured data logging of thickness measurements when repeatedly surveying identical or similar objects. A Template File is first created using Cygnus 3 Data Logger Manager then the file is copied to each Gauge ready for use.

The data in a Record File produced from a Template file is intended to be inserted into an Excel® Spreadsheet (or it can just be printed out in a report) so each piece of data has a destination cell reference – this is the spreadsheet cell the data will be copied into, i.e. cell 'D12'.

An XLT file (Excel® Template) can be specified to be used as a template for the Excel document produced. So a company report, as an XLT file, can be used to create each new blank report document that will then receive the thickness measurement and other data collected by the Gauge.



User Fields

Template Files can contain up to 40 User Fields which can be used to collect extra information from the Gauge user when they start a new record from a template.

Each User Field can prompt for the following types of data;

1. Alphanumeric	i.e. "ABC123"
2. Number	i.e. "245.6"
3. Date (dd-mm-yyyy)	i.e. "21-07-2008"
4. Date (mm-dd-yyyy)	i.e. "07-21-2008"
5. List	i.e. "Red, Blue, Yellow, Green.."
6. Yes/No Choice	

Each User Field has: a 'Name' field, this is used to prompt the Gauge user to enter in information, and a 'Value' field to hold the information. An optional 'Cell Ref.' field to specify where the Value should be inserted in the spreadsheet.

For example;

If the User Field Type = Alphanumeric
If the User Field Name = 'Vessel Name'
If the User Field Cell Ref = 'Sheet 1!E20'

When the Gauge user starts a new record they will be prompted to enter in a 'Vessel Name'.

The vessel name the user types in will be stored against the 'Vessel Name' field and be included in the report data.

As the 'cell ref.' was also specified the vessel name will be inserted into the spreadsheet report into cell 'E20' on 'Sheet 1'.

See how this appears on the Gauge screen starting on page 57.

User Field 'List' Type

When the User Field type is set to List you must provide a list of text choices that will be presented to the gauge user. This list can contain up to 40 items of 16 characters in length.

Measurement Points

Template Files contain measurement points for each thickness measurement required. Each measurement point consists of a "Name", a "Reference Thickness", a "Minimum Thickness", a "Cell Reference" and the "Thickness Measurement" itself.

The "Reference" and "Minimum Thickness" are optional, but when included they allow wastage calculations in reports and minimum alarm functions when measuring. See minimum alarm function starting on page 57.

Creating a Template File

From the Cygnus 3 Data Logger Manager click the '**View Templates**' button in the menu bar. The screen will display any existing templates found, shown in Fig 9.9.

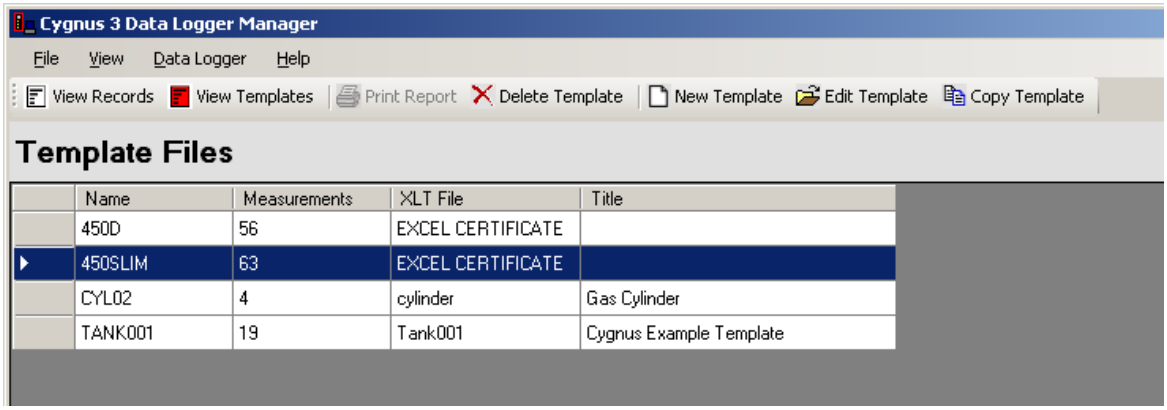


Fig 9.9 Template List

To create a new template click the '**New Template**' button. A '**New Template**' dialog box will be displayed, Fig 9.10. Next choose between the three types of template:

1. Blank Template – just open the template form with blank fields so you can add your own
2. Single Point Record – a list of measurement points
3. Grid Point Record – a 2D grid of measurement points

This dialog box can help to speed up the creation of Template Files by creating the measurement points for you, based on the parameters detailed below.

Template File Name	A filename for the template file
Template Type	Choose the type that suits your application
Units	Specify the measurement units required
Measurements, Prefix	For a Single Point record specify the number of measurements required and the prefix, i.e. P1, P2, P3..
Rows, Prefix	For a Grid Point record specify the number of Row measurements required and the prefix, i.e. R1, R2, R3..
Columns, Prefix	For a Grid Point record specify the number of Column measurements required and the prefix, i.e. C1, C2, C3..
Minimum Thickness	Specify an optional minimum thickness value
Reference Thickness	Specify an optional reference thickness value
Starting Cell Ref.	Specify the starting Excel spreadsheet cell for the first measurement, i.e. D10
Measurement Order	For a Grid Point record specify the direction the grid points will be measured

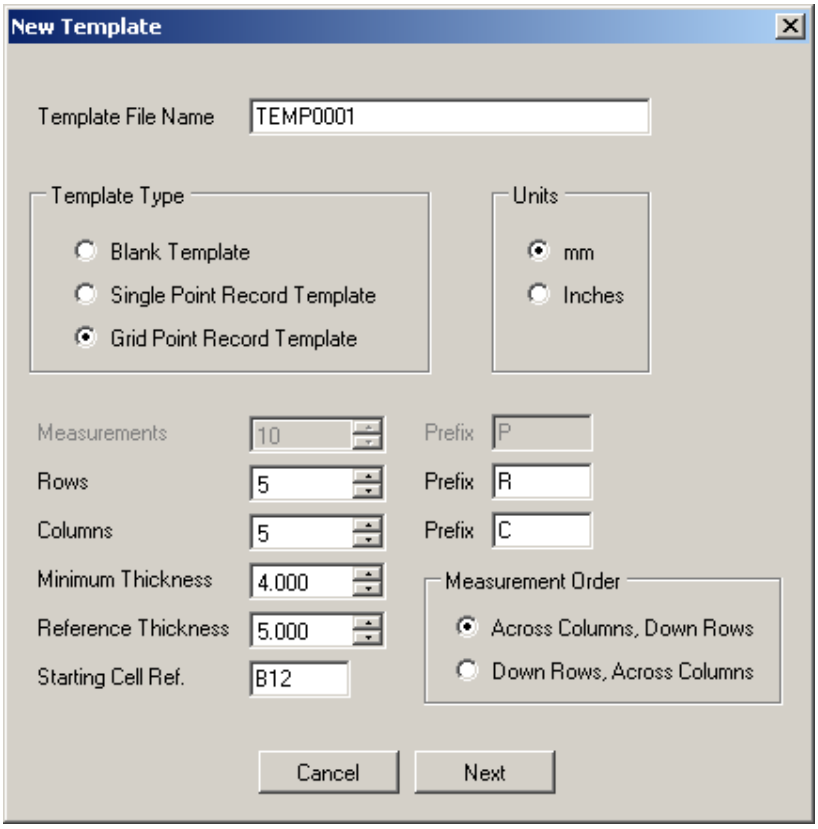


Fig 9.10 New Template dialog

Once completed click the '**Next**' button.

Template Form

The Template Form is displayed with thickness measurement points added as selected, shown in Fig 9.11. These thickness measurement points can be edited as required. Each section is described in the tables that follow.

The Template Form has three 'Tabs' for:

1. Template Details
2. Thickness Measurement Points
3. User Fields

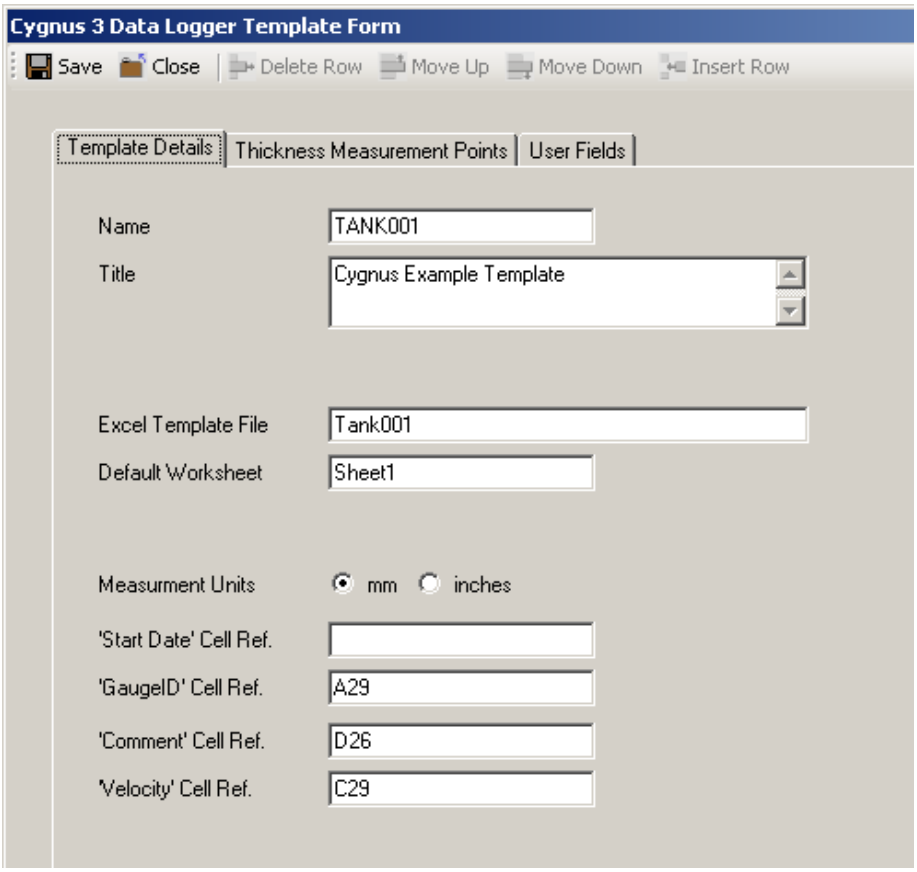
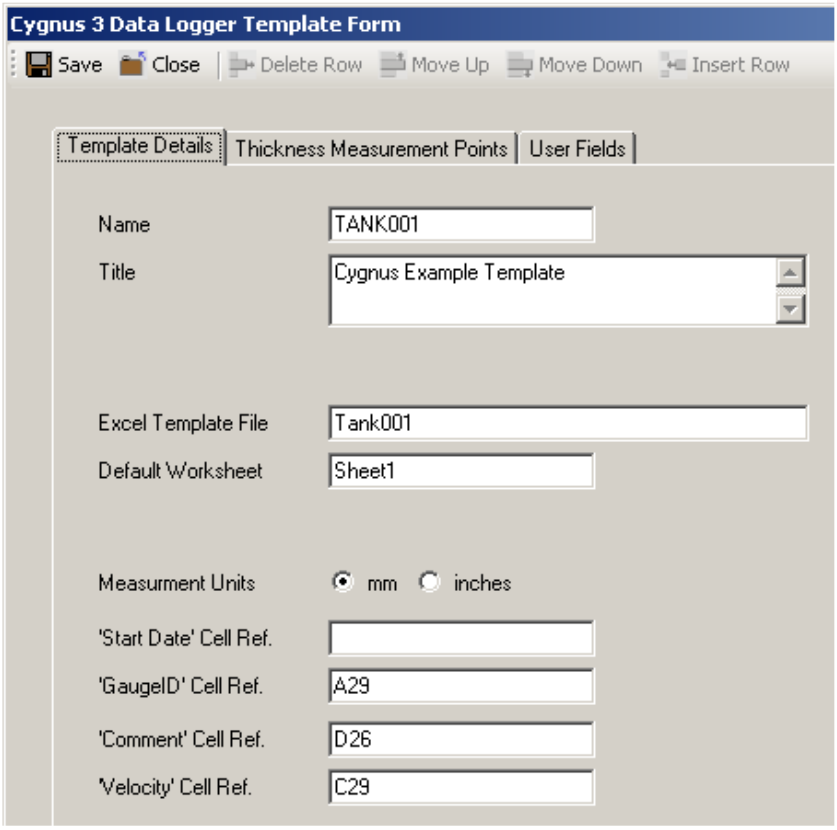
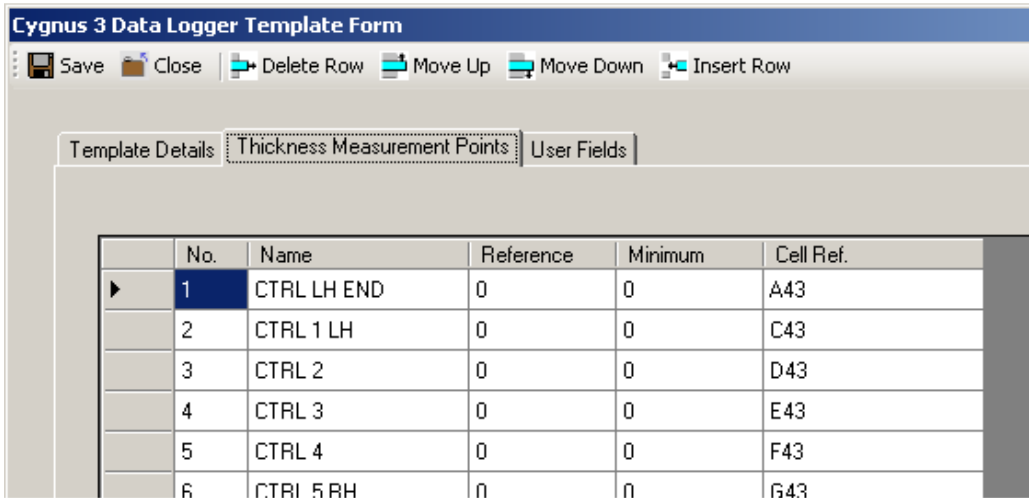


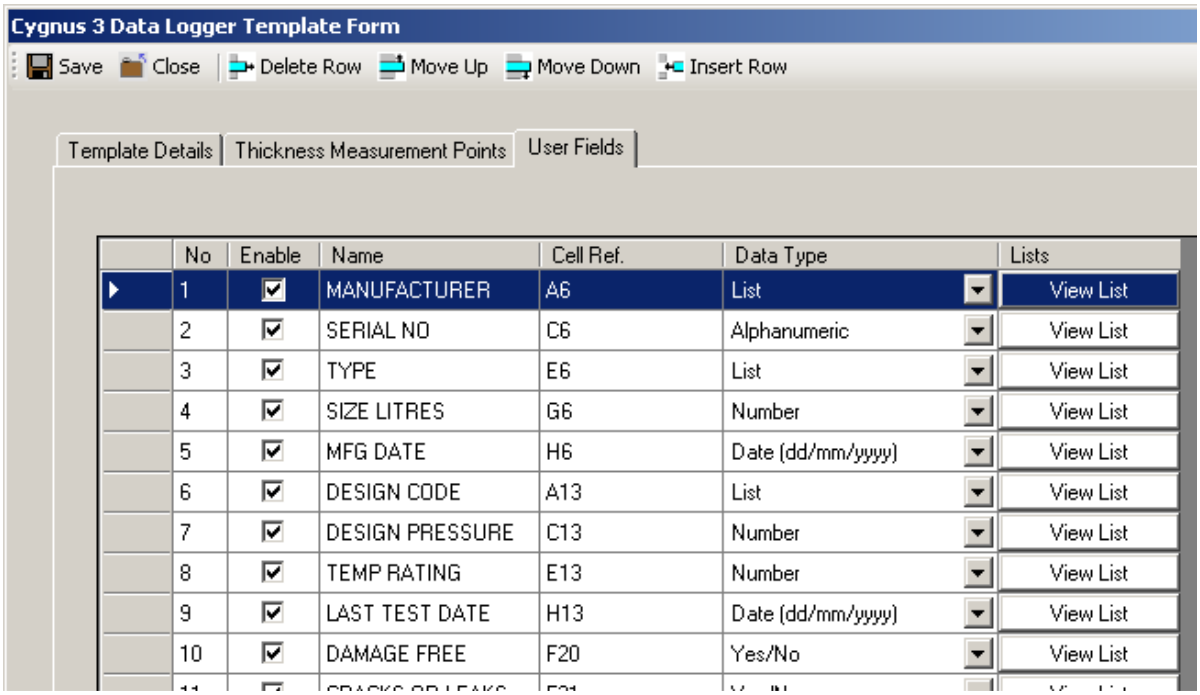
Fig 9.11 Template Form

Template Details Tab

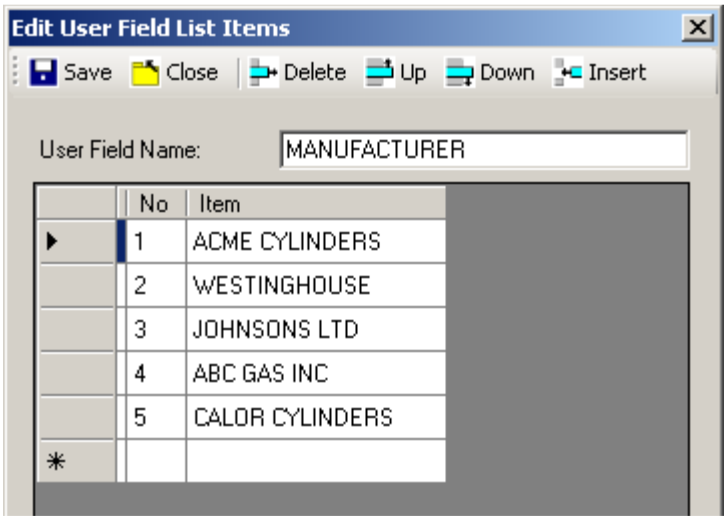


Name	The name of this template file (up to 8 characters long)
Title	A descriptive title of the template
Template File	An Excel® XLT filename that will be used to create the final report (omit the XLT extension)
Worksheet	The worksheet name in the XLT file
Measurement Units	The required measurement units
Start Date Cell Ref.	The Excel spreadsheet cell that the Record Start Date must be copied into
GaugeID Cell Ref.	The Excel spreadsheet cell that the GaugeID must be copied into
Comment Cell Ref.	The Excel spreadsheet cell that the gauge operator's Comment must be copied into
Velocity Cell Ref.	The Excel spreadsheet cell that the Velocity of Sound value must be copied

	into
Thickness Measurement Points Tab	
	
No.	Measurement number, 1 to 5000
Name	The name of the measurement point (up to 15 characters long)
Reference	The reference thickness (100% or original thickness)
Minimum	The minimum thickness below which an alert will be raised to the gauge operator
Cell Ref.	The Excel® spreadsheet cell that the measured thickness value must be copied into
User Fields Tab	



No.	User Field number, 1 to 40
Enable	When ticked this field will be requested from the gauge operator each time a new record file is started
Name	Name of the User Field that will be shown to the gauge operator (up to 15 characters long)
Cell Ref.	The Excel® spreadsheet cell that the entered data must be copied into
Data Type	Choose from; • Alphanumeric • Number • Date • List • Yes/No
Lists	When the Data Type is set to List you can view and edit each list with this button.

User Fields List View	
	
No.	List Item number, 1 to 40
Item	List item that will be shown to the gauge operator (up to 15 characters long)

Once you have finished creating the Template File click the '**Save**' button to save the data, then click the '**Close**' button to close the form.

Transferring Template Files to the Data Logger

To transfer template files from computer to Gauge on the Cygnus 3 Data Logger Manager menu bar click '**Data Logger**' then '**Transfer Templates to Data Logger**', the '**Transfer Templates to Data Logger**' dialog box will be displayed, Fig 9.12.

The drive letter should be correct, but it can be changed here using the drop-down list.

The Template List will populate with all the template files on the computer. Simply select the templates to transfer and then click '**Transfer**', the selected files will be copied to the Gauge's memory card.

There is the option to overwrite existing template files that may already be on the Gauge's memory card.

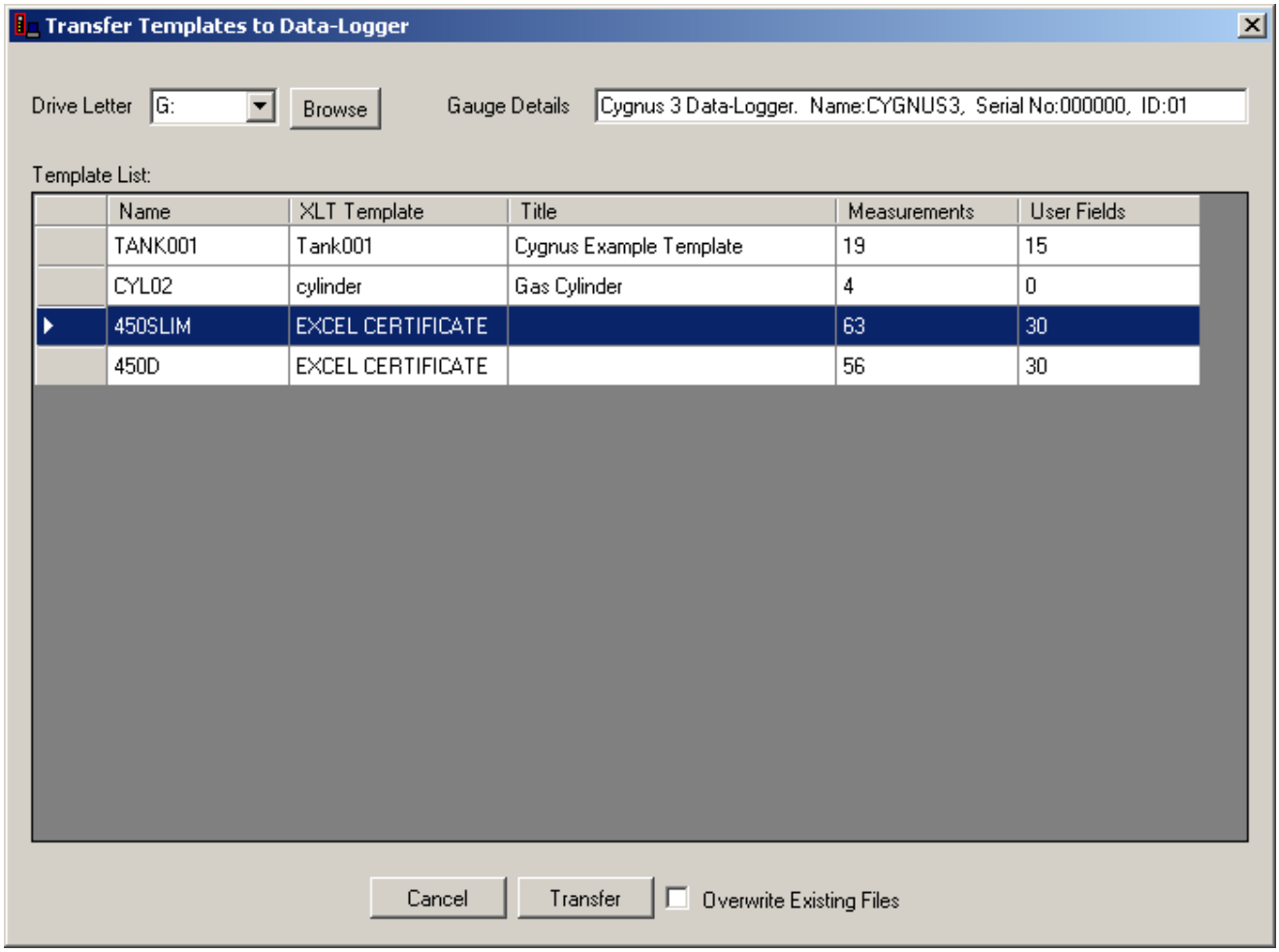


Fig 9.12 Transfer Templates to Data Logger

10. Microsoft Excel Add-In

Overview

A Excel Add-In is provided that can automate the process of inserting the data from a record file into a spreadsheet. The Add-In is particularly useful when using record files based on templates as it will open the specified Excel XLT template file before inserting the data into the specified cells.

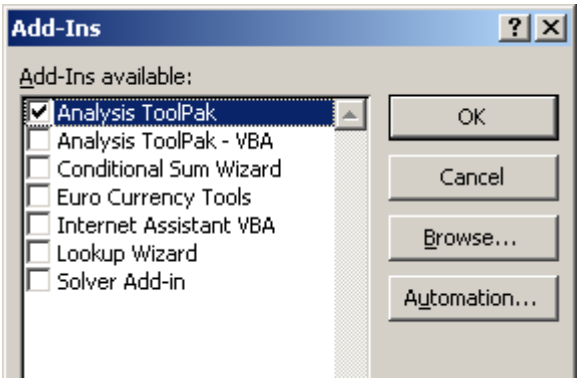
Installing the Add-In

When the Cygnus 3 Data Logger Manager application is installed a '**Cygnus Import Tools.xla**' file is also copied into '**Documents\Datalogger\Add-In**' folder. This XLA file contains the Excel Add-In code.

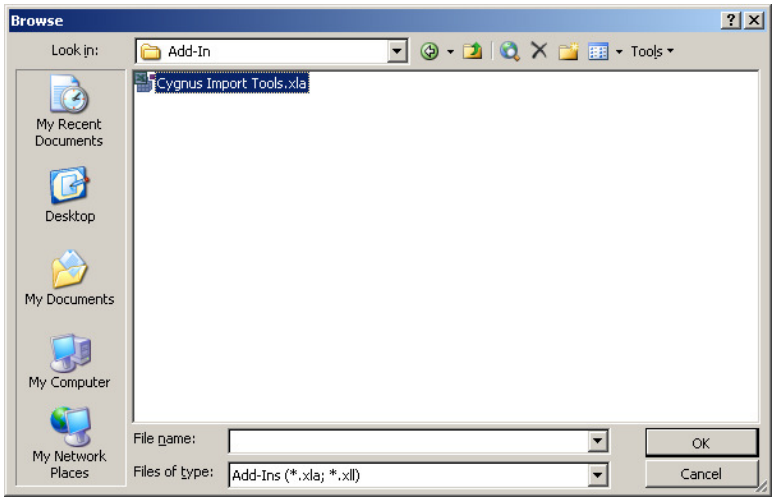
To install the Add-In using:

Microsoft Office Excel 2000, XP, 2003

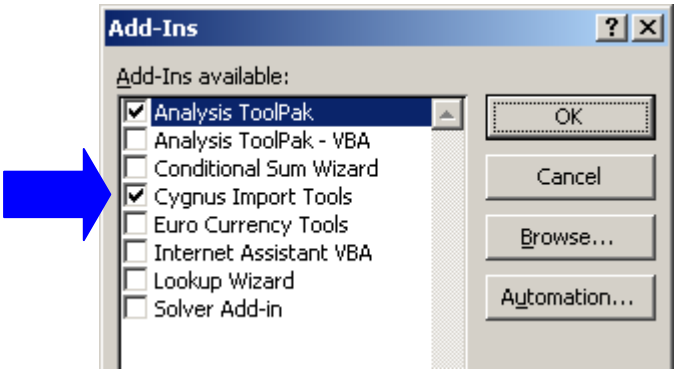
1. Start up Excel
2. On the main menu click '**Tools**', then '**Add-Ins**'
3. The '**Add-Ins**' dialog box is displayed



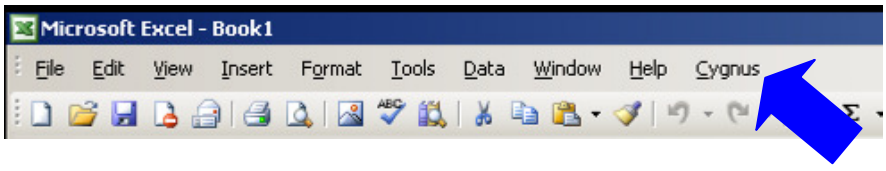
4. Click the '**Browse**' button
5. Browse to '**My Documents\Datalogger\Add-In**' and select the '**Cygnus Import Tools.xla**' file by clicking the '**Ok**' button.



6. The Cygnus Import Tools Add-In should now be listed and ticked in the Add-Ins dialog box;



7. Click the '**OK**' button and a new menu item '**Cygnus**' should be displayed in the main Excel menu on the right.



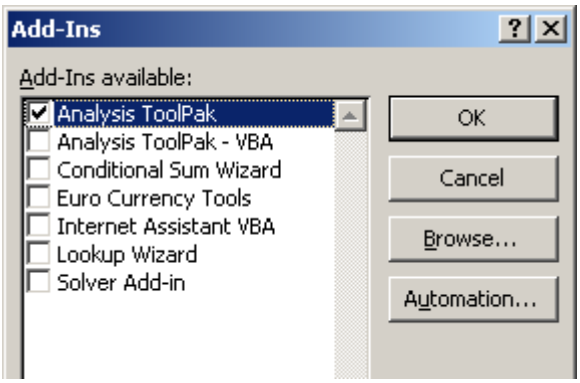
Microsoft Excel 2007

1. Start up Excel

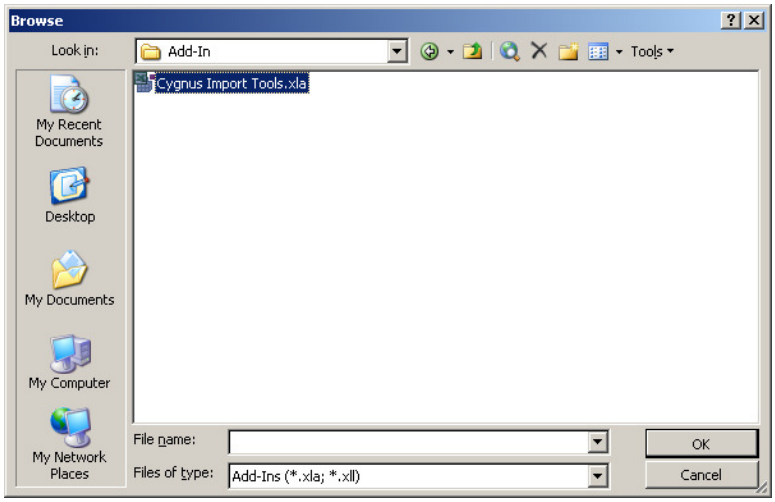
2. Click the Microsoft Office Button, and then click '**Excel Options**'.

3. Click the Add-Ins category. In the Manage box, click '**Excel Add-Ins**', and then click '**Go**'.

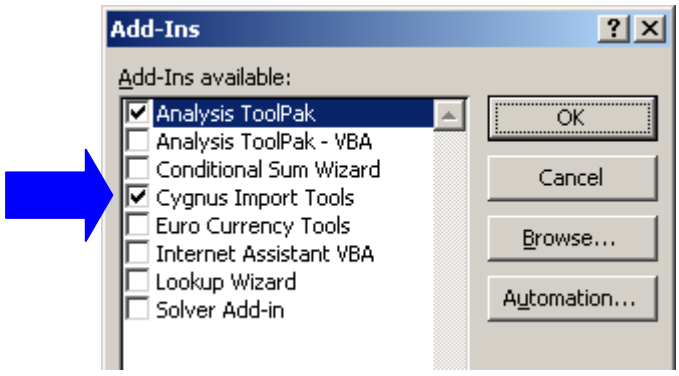
4. The '**Add-Ins**' dialog box is displayed



5. Click the '**Browse**' button
6. Browse to '**My Documents\Datalogger\Add-In**' and select the '**Cygnus Import Tools.xla**' file by clicking the '**Ok**' button.



7. The Cygnus Import Tools Add-In should now be listed and ticked in the Add-Ins dialog box:



8. Click the '**OK**' button and a new item '**Cygnus**' should be displayed in the Add-In ribbon commands on the left.

Creating an Excel Report

First transfer any Record Files from the Gauge to computer using the Cygnus 3 Data Logger Manager, see page 76.

Start by clicking on the '**Cygnus**' item in the Excel main menu bar (or in the Add-In ribbon for Office 2007) then the '**Select a Cygnus 3 Record File to Import'** dialog box will be shown as in Fig 10.1.

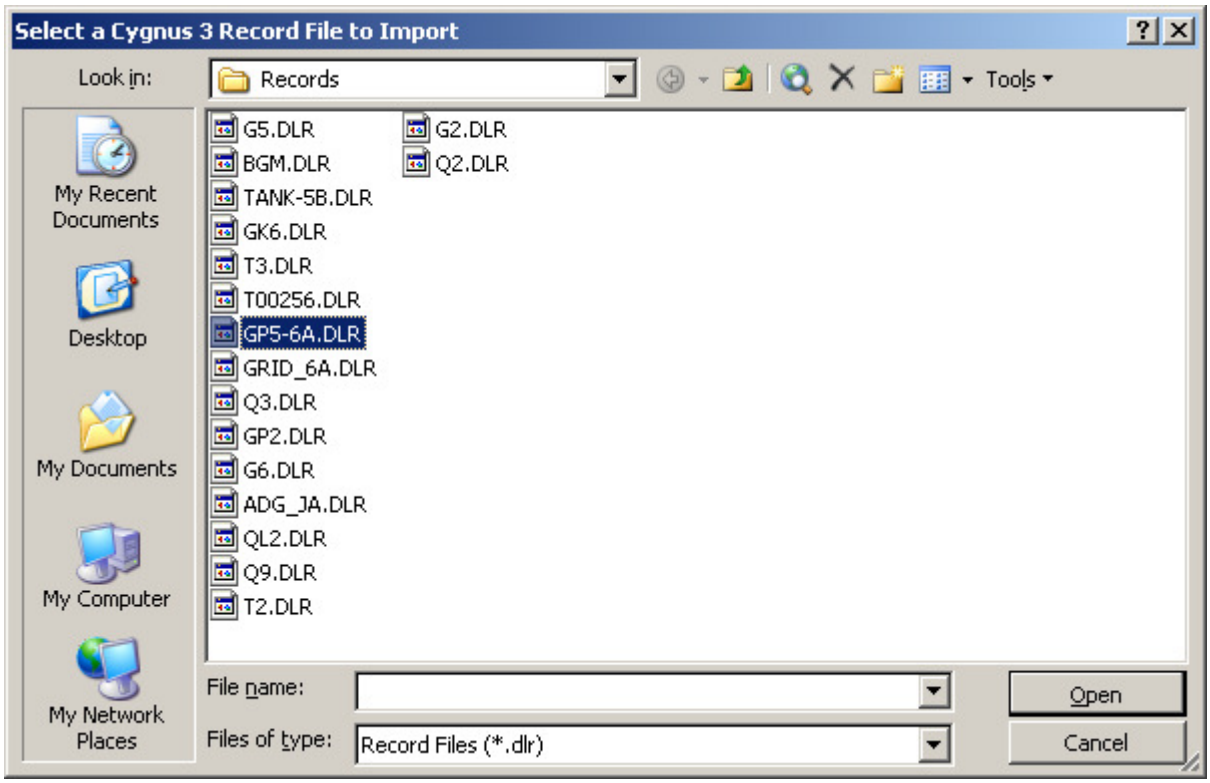


Fig 10.1 Select Record File to Import

Select the required record file and click the '**Open**' button. Another form will be displayed that allows optional report details to be entered that will be added to the top of the spreadsheet report, shown in Fig 10.2.

These optional details can be included in the report by ticking the '**Include in Report**' box.

If any of the optional fields have been changed they can be saved for next time by ticking the '**Save Details**' box.

To proceed and create the report click the '**Ok**' button.

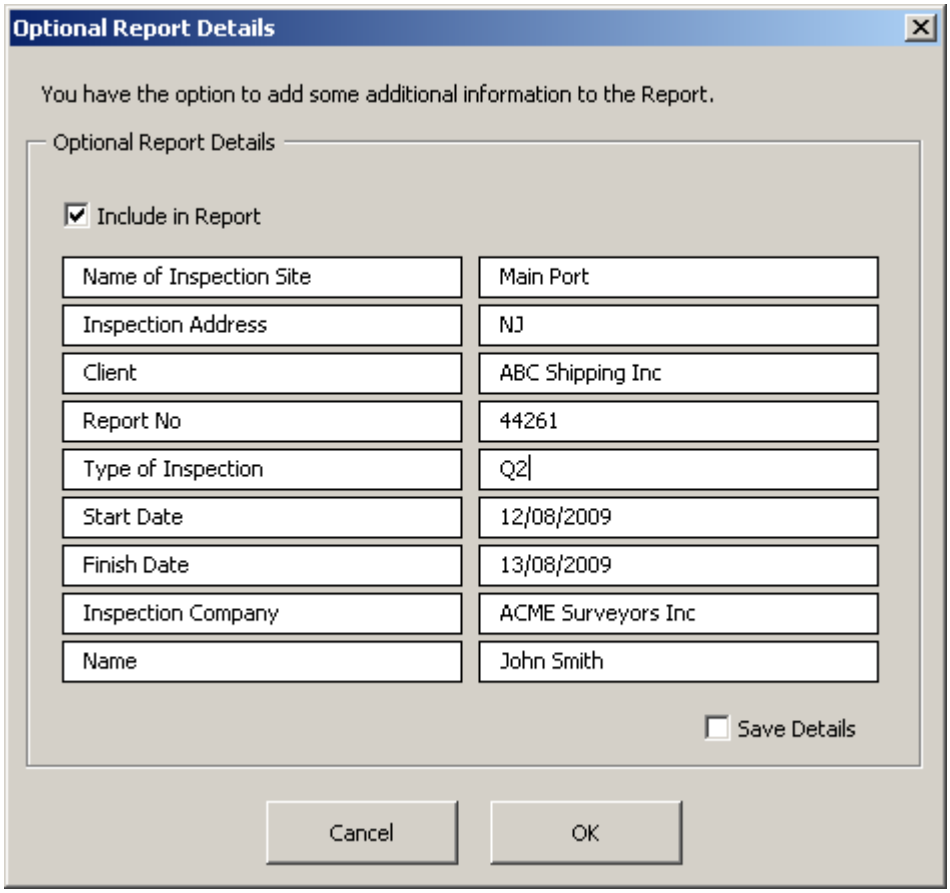


Fig 10.2 Optional Report Details

If the Record File has a Grid Point layout a dialog box will ask if the thickness measurement values should be arranged in a grid layout – select '**Yes**' or '**No**' as required, shown in Fig 10.3.

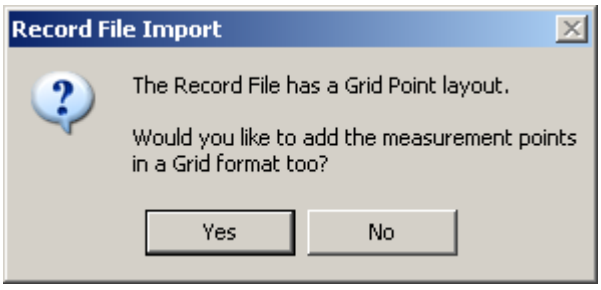
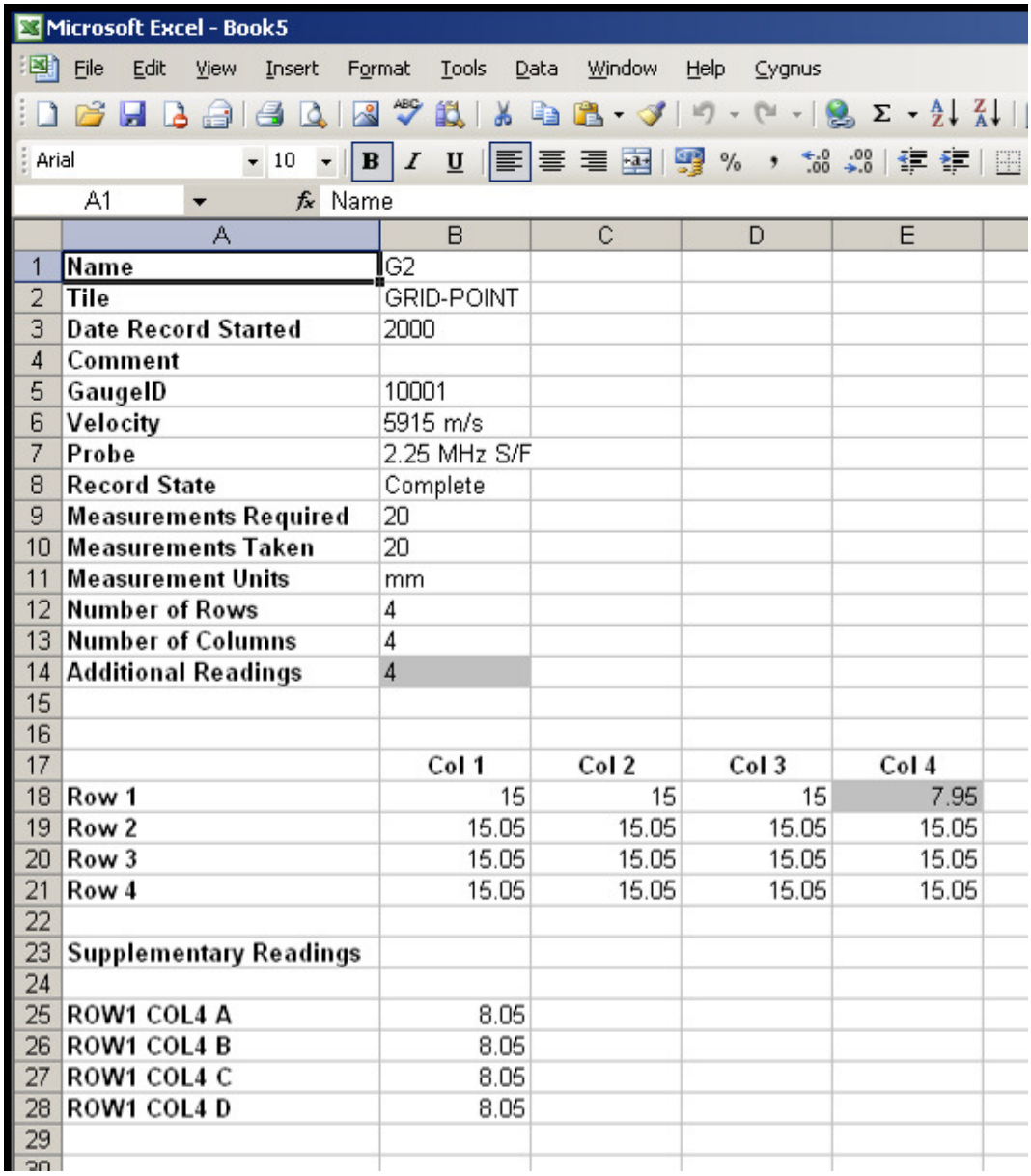


Fig 10.3 Grid Layout Option

The data from the selected record file is now inserted into a new Excel® worksheet. Fig 10.4 shows an example Grid Point record file that also contains additional radial points.



Microsoft Excel - Book5

File Edit View Insert Format Tools Data Window Help Cygnus

Arial 10 B I U

A1 fx Name

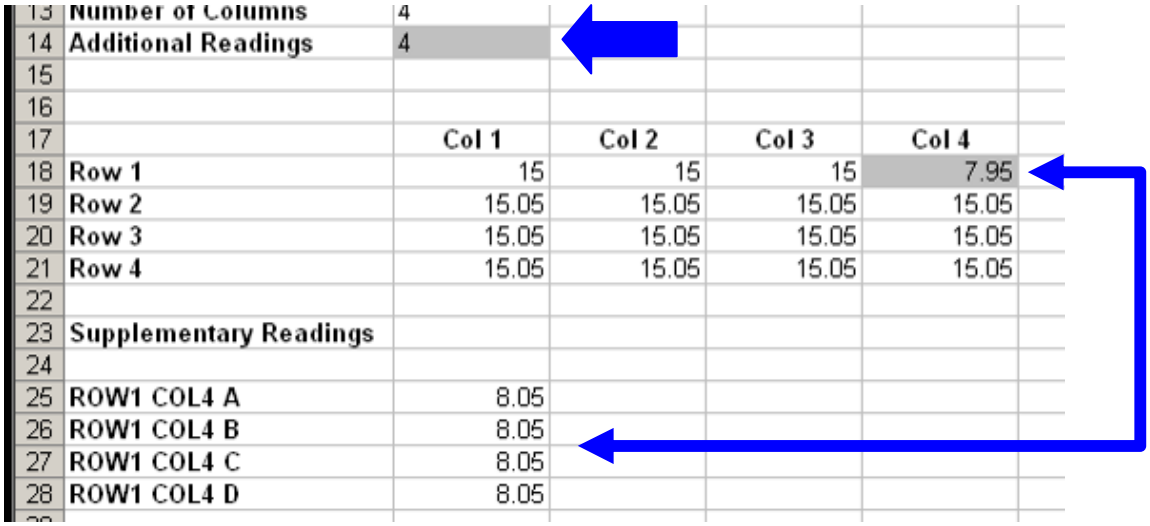
	A	B	C	D	E
1	**Name**	G2			
2	**Tile**	GRID-POINT			
3	**Date Record Started**	2000			
4	**Comment**				
5	**GaugeID**	10001			
6	**Velocity**	5915 m/s			
7	**Probe**	2.25 MHz S/F			
8	**Record State**	Complete			
9	**Measurements Required**	20			
10	**Measurements Taken**	20			
11	**Measurement Units**	mm			
12	**Number of Rows**	4			
13	**Number of Columns**	4			
14	**Additional Readings**	4			
15					
16					
17		**Col 1**	**Col 2**	**Col 3**	**Col 4**
18	**Row 1**	15	15	15	7.95
19	**Row 2**	15.05	15.05	15.05	15.05
20	**Row 3**	15.05	15.05	15.05	15.05
21	**Row 4**	15.05	15.05	15.05	15.05
22					
23	**Supplementary Readings**				
24					
25	**ROW1 COL4 A**	8.05			
26	**ROW1 COL4 B**	8.05			
27	**ROW1 COL4 C**	8.05			
28	**ROW1 COL4 D**	8.05			
29					

Fig 10.4 Grid Point Layout Example in Excel

Additional Measurements

Any measurement points that have Additional Measurements have a grey background, the additional measurements are then listed below, shown in Fig 10.5.

For more information on Additional Measurements see page 64.



13	Number of Columns	4			
14	Additional Readings	4			
15					
16					
17		Col 1	Col 2	Col 3	Col 4
18	Row 1	15	15	15	7.95
19	Row 2	15.05	15.05	15.05	15.05
20	Row 3	15.05	15.05	15.05	15.05
21	Row 4	15.05	15.05	15.05	15.05
22					
23	Supplementary Readings				
24					
25	ROW1 COL4 A	8.05			
26	ROW1 COL4 B	8.05			
27	ROW1 COL4 C	8.05			
28	ROW1 COL4 D	8.05			

Fig 10.5 Additional Measurements.

11. Data Logging Template Tutorial

This tutorial goes through the steps required to create a new Template that will ultimately populate an Excel® spreadsheet with thickness measurements and user field data that has been logged on the Cygnus 3 gauge. This will introduce the concepts behind the template system so you can go on to create your own templates.

Create the Excel® Spreadsheet

Consider we are a surveying company and have an Excel® spreadsheet where we need to record 8 thickness measurement values for a water tank along with additional information for: date of survey, name of surveyor, location of tank and the tank size. The spreadsheet could look like fig. 11.1.

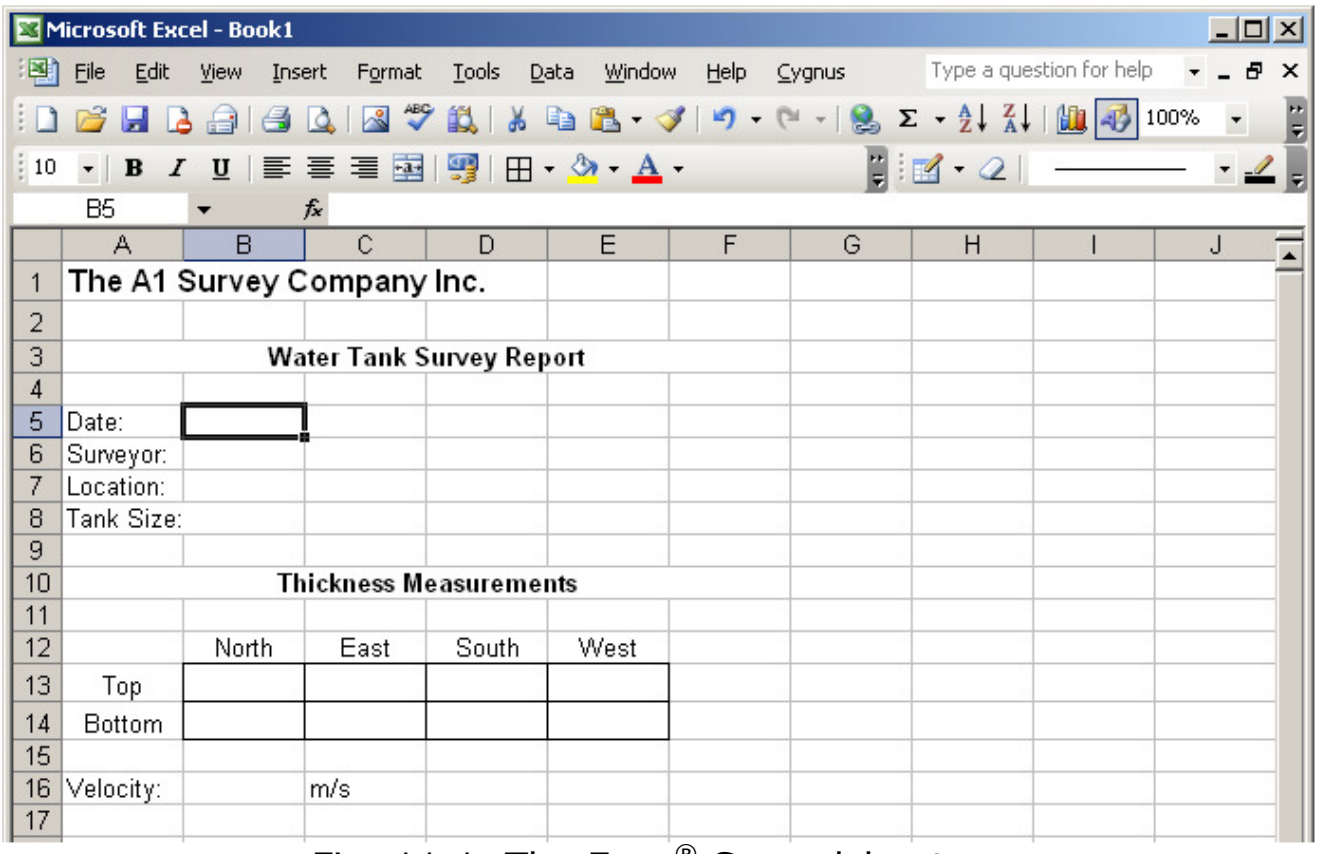


Fig. 11.1. The Exce® Spreadsheet.

This spreadsheet has been saved as an Excel® Template (.XLT) file as shown in fig. 11.2. Note "Save as type" is set to Template (*.xlt).

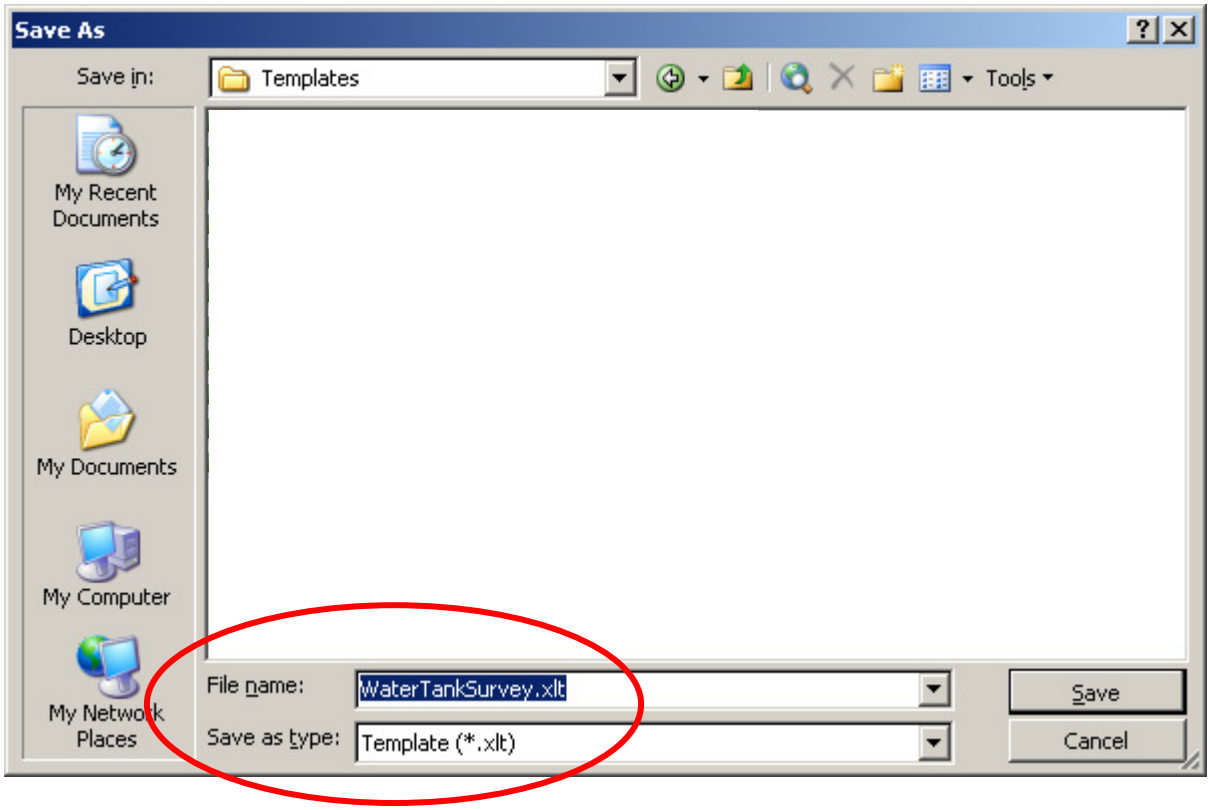


Fig. 11.2. Saving the Excel® Spreadsheet as XLT

We will need to keep a copy of this spreadsheet handy for when we create the Data Logger Template, we will need to identify the cell locations where we want the thickness measurement values and other information to go, fig. 11.3. shows these cells highlighted.

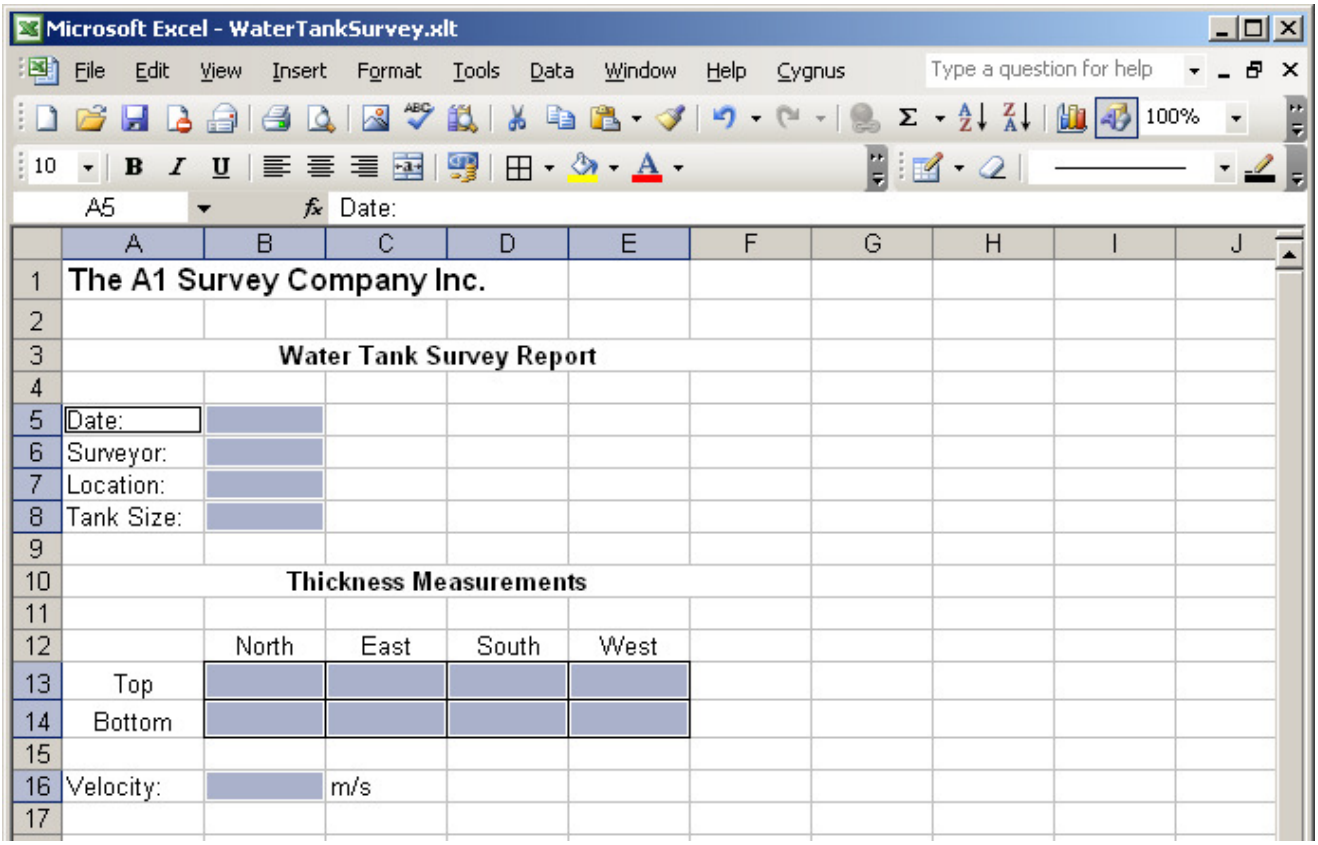


Fig. 11.3. Cells Highlighted where we must Insert Values.

Create the Data Logger Template

Run the Cygnus 3 Data Logger Manager software, then:

1. Click on the **View Templates** button in the toolbar
2. Click on the **New Template** button
3. You should see the **New Template** dialog, fig. 11.4.
4. Type in "WTSURVEY" in the **Template File Name** box
5. Click on **Single Point Record Template**
6. Change **Measurements** to 8
7. The **New Template** dialog should look like fig. 11.4
8. Finally click the **Next button.**

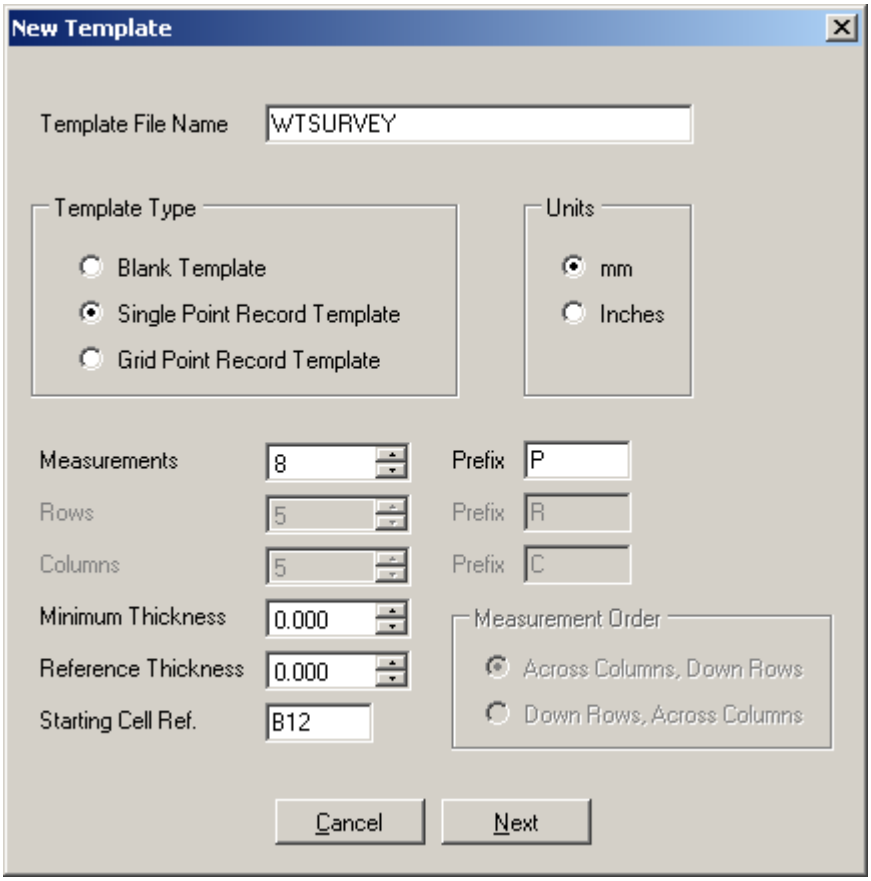


Fig. 11.4. Completed New Template Dialog.

You should now see the **Cygnus 3 Data Logger Template Form**, shown in fig 11.5. Fill in the following fields:

1. **Title** – add a brief description of the template.
2. **Excel® Template File** – this is the name of the Excel® spreadsheet we just created – "WaterTankSurvey" (Note, you don't need the .xlt extension)
3. **Default Worksheet** – type in "Sheet1" as this is the name of the only worksheet we are using on the Excel® spreadsheet.
4. **Start Date Cell Ref.** – this is the cell name where we want the survey Start Date to be entered, in our example enter "B5".
5. **Velocity Cell Ref.** – this is the cell name where we want the velocity value to be entered, in our example enter "B16".
6. We leave the other fields blank as we don't want to use them in this example.

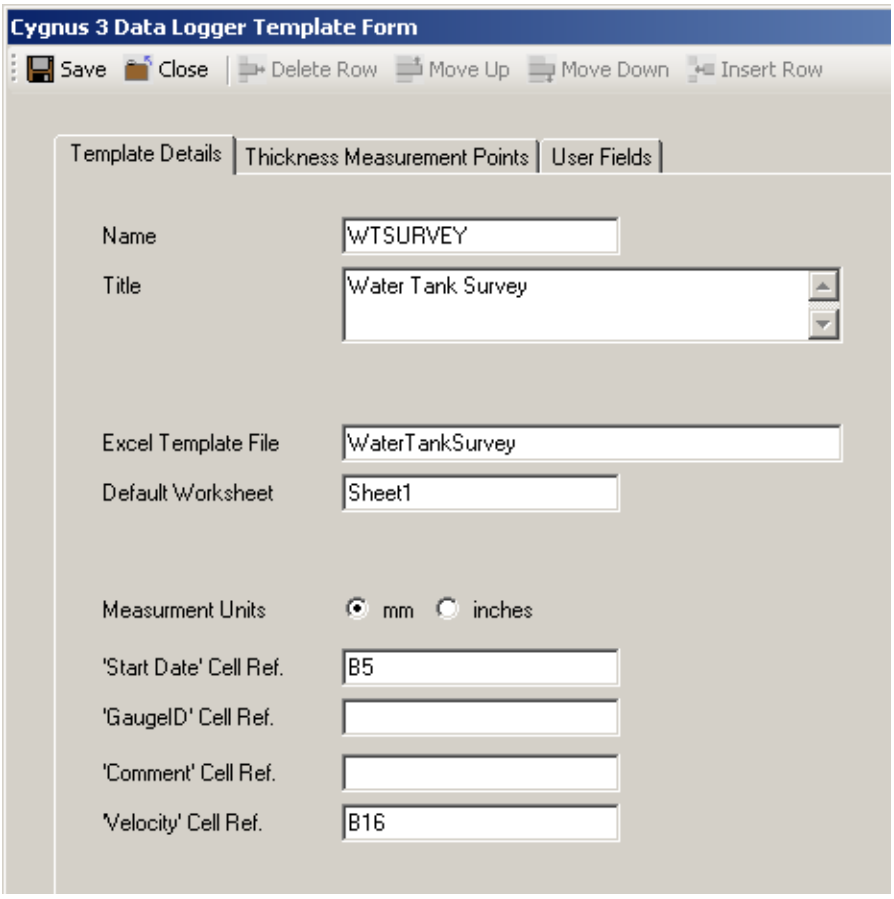
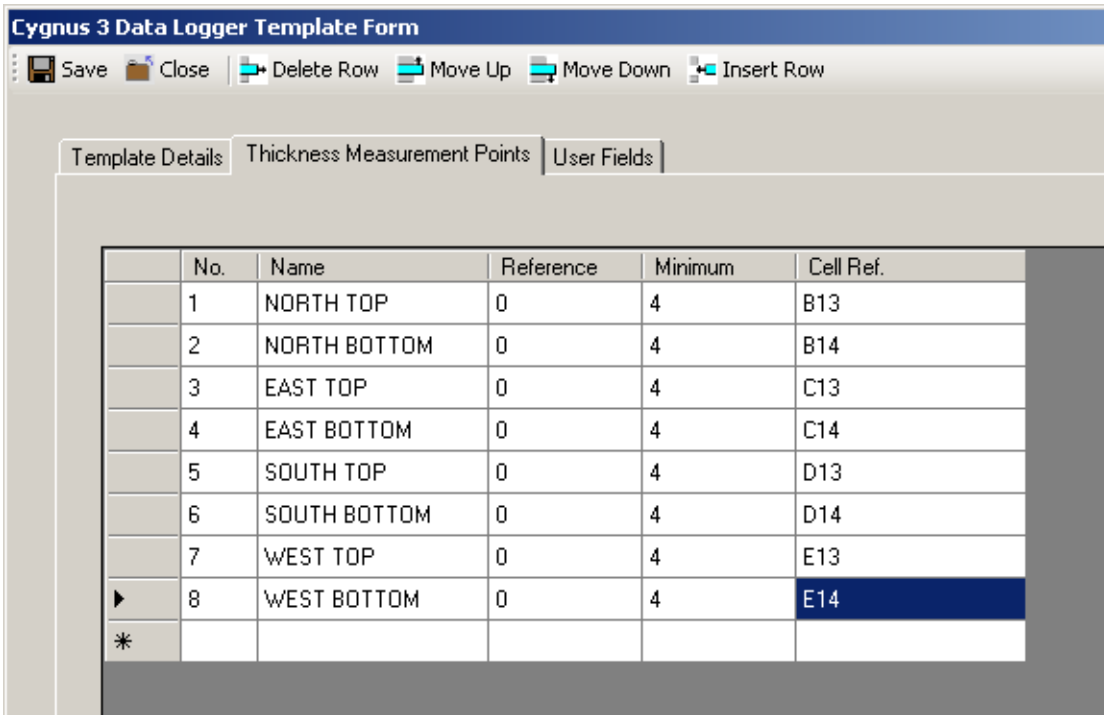


Fig. 11.5.Template Details Tab

Next click on the **Thickness Measurement Points** tab. You should see 8 measurement points called P1 to P8. Fig. 11.6 shows the completed form, follow these steps:

1. Rename the 8 measurement point **Names** "NORTH TOP", "NORTH BOTTOM", etc to match the spreadsheet names.
2. Enter the 8 **Cell Ref.** names so the measurement values will be put in the correct place in the spreadsheet.
3. We want to alert the surveyor if any thickness measurement is less than 4mm, so enter "4" for each **Minimum** value.
4. In this example there are no **Reference** thickness values required so they are left at zero, but you could enter in thickness values if you needed to.



	No.	Name	Reference	Minimum	Cell Ref.
	1	NORTH TOP	0	4	B13
	2	NORTH BOTTOM	0	4	B14
	3	EAST TOP	0	4	C13
	4	EAST BOTTOM	0	4	C14
	5	SOUTH TOP	0	4	D13
	6	SOUTH BOTTOM	0	4	D14
	7	WEST TOP	0	4	E13
▶	8	WEST BOTTOM	0	4	E14
*					

Fig. 11.6. Thickness Measurement Points.

Next click on the **User Fields** tab. We will create the 3 User Fields to collect values for "Surveyor, "Location" and "Tank Size". Fig. 11.7 shows the completed form, follow these steps:

1. Type in the three names, SURVEYOR, LOCATION and TANK SIZE in the **Name** fields. This will create 3 User Fields.
2. Type in the three cell names in the **Cell Ref.** fields.
3. The **Data Type** for SURVEYOR and LOCATION can be left as Alphanumeric as we want the surveyor to enter both letters and numbers.
4. Change the **Data Type** for TANK SIZE to List. We are going to enter in a list of tank sizes we want the surveyor to choose from.
5. Click on the View List button for the TANK SIZE User Field, you will see the **Edit User Field List Items** dialog, shown in fig. 11.8.
6. Type in the three tank size names in the **Item** field, like in fig. 11.8. Note these are only text labels used for this example, you could type anything up to 40 characters long.
7. Close and Save the Item List dialog.

8. Close and Save the Template Form.
9. If you click on **View Templates** you will see the new template listed.

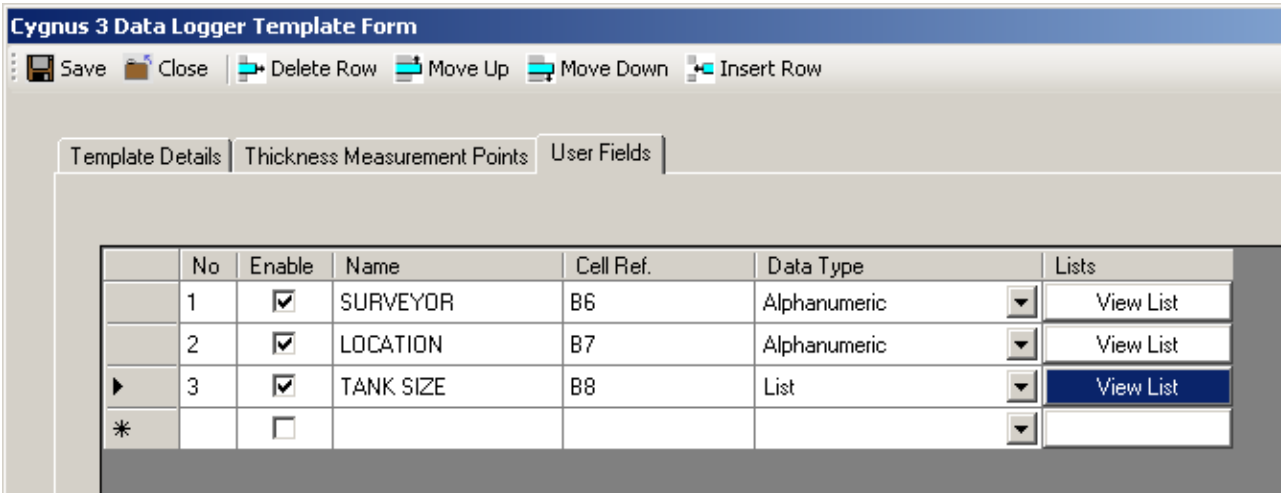


Fig. 11.7. User Fields

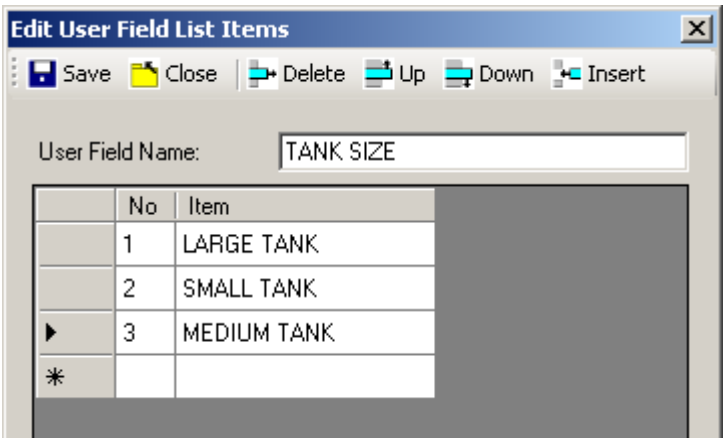


Fig. 11.8. User List Field Items

Transferring the Template to the Cygnus 3 Gauge

Now we have created the Template File we need to copy it onto a Cygnus 3 gauge so we can carry out a survey of a water tank. Follow these steps:

1. Turn on the Cygnus 3 gauge and connect it to the computer with the USB cable.
2. Click on **Data Logger** in the menu bar (fig. 11.9)
3. Click on **Transfer Template to Datalogger**

4. You should see the **Transfer Templates to Data-Logger** dialog, fig. 11.10.
5. Select the "WTSURVEY" template by clicking on its grey row selector on the left of the row.
6. Click on the **Transfer** button to transfer the template to the gauge.
7. You should get a message confirming the transfer was successful.

Fig. 11.9. Data Logger Menu Options.

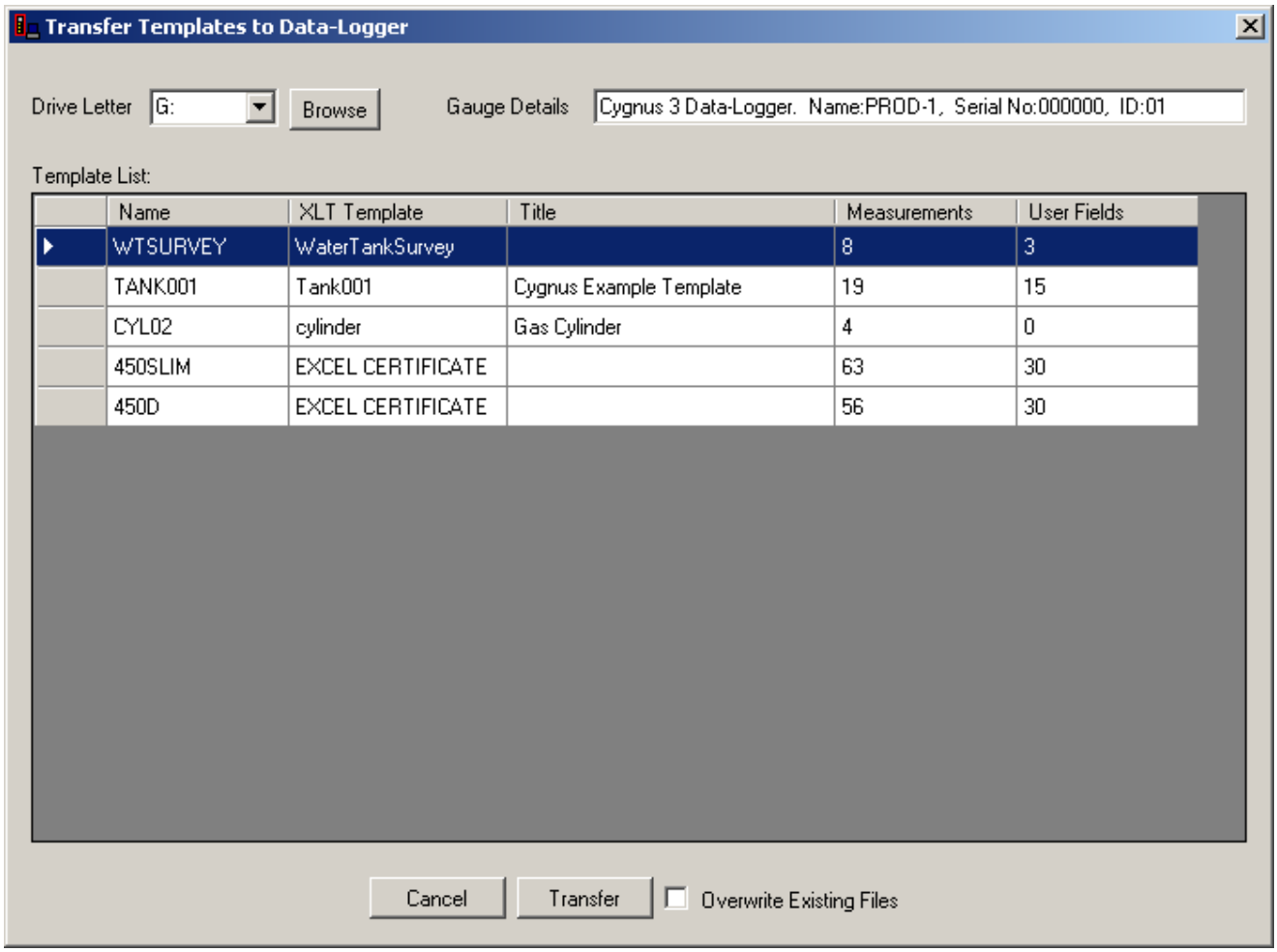


Fig. 11.10. Transfer Templates to Data Logger dialog.

Carry out the Survey with the Cygnus 3

Now you can disconnect the Cygnus 3 Gauge from the computer and create a new Record File using the template we have just transferred. For details on how to do this see page 57 onwards.

Transfer the Completed Survey Record to Computer

Now we have created Record File(s) on the Cygnus 3 Gauge we need to copy them back to the computer so we can produce the survey report. Follow these steps:

1. Turn on the Cygnus 3 gauge and connect it to the computer with the USB cable.
2. Click on **Data Logger** in the menu bar (fig. 11.11)
3. Click on **Transfer Template to Datalogger.**
4. You should see the **Transfer Records from Data-Logger** dialog, fig. 11.12.
5. Select the "01000011" Record by clicking on its grey row selector on the left of the row, see fig. 11.12. We can see this Record has been created today using the "WaterTankSurvey" template.
6. Click on the **Transfer** button to transfer the Record File to the computer.
7. You should get a message confirming the transfer was successful.

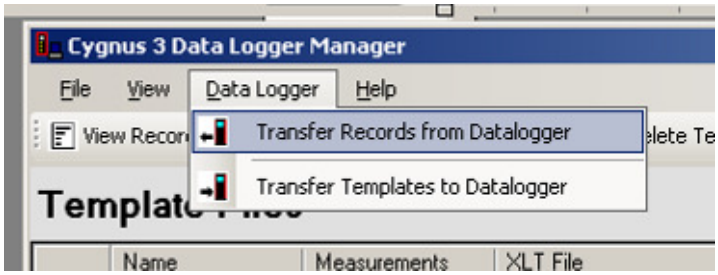


Fig. 11.11. Data Logger Menu Options.

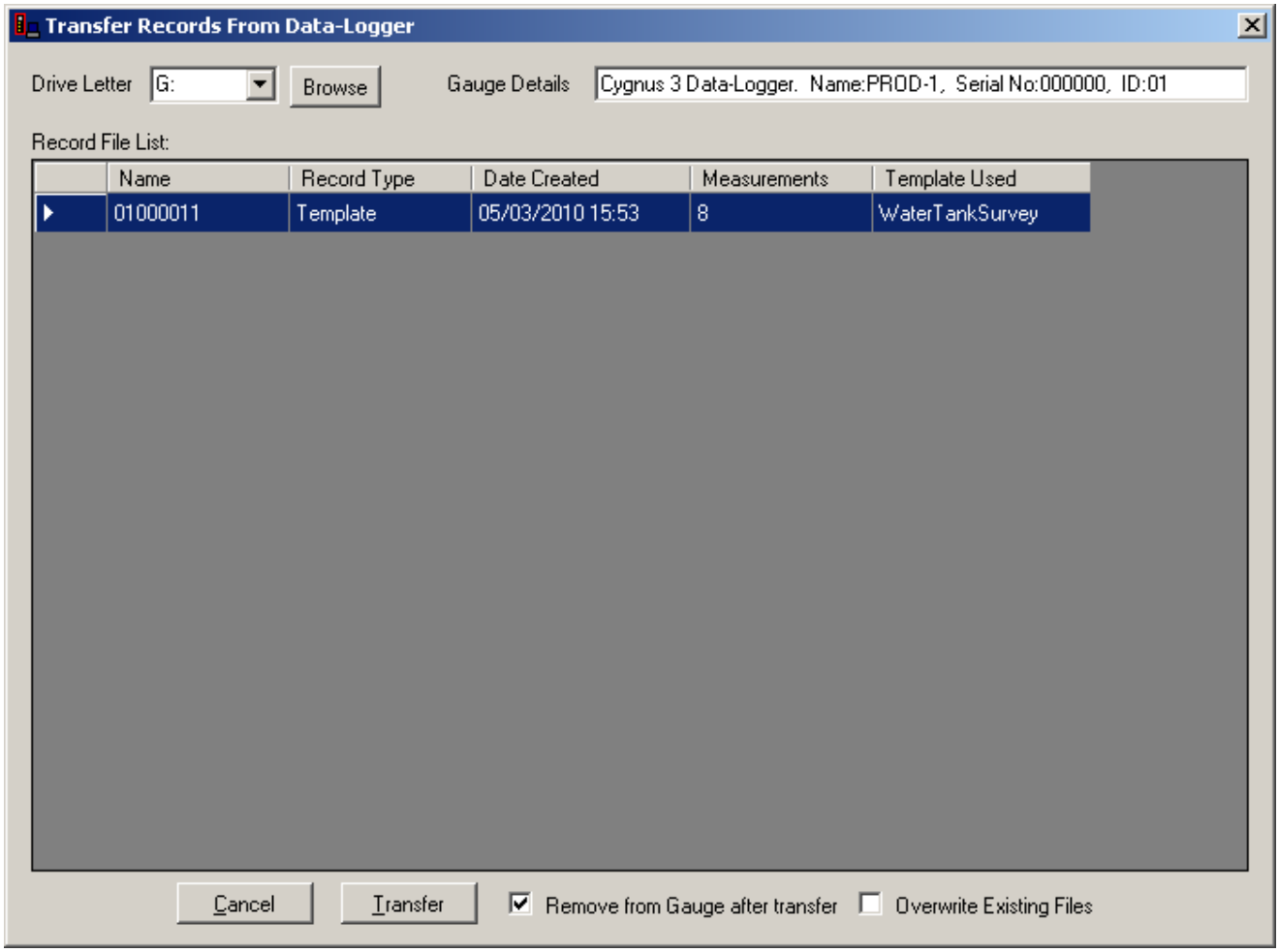


Fig. 11.12. Transfer Records from Data Logger.

Creating the Excel Report

Finally we can use the Record File to create a new Water Tank Survey report in Excel. To do so follow these steps:

1. Open Excel and click on the **Cygnus** Menu bar option, fig. 11.13.
2. Select **Open Record File**
3. You should see the **Select a Cygnus Record File to Import** dialog, fig. 11.14.
4. Select the "01000011.DLR" file, click **Open**
5. A new spreadsheet will open using The Water Tank Survey template and the values collected by the Cygnus 3 Gauge are inserted into the correct cells, fig. 11.15.

6. That's it, you can now print, save or email the spreadsheet report as required.

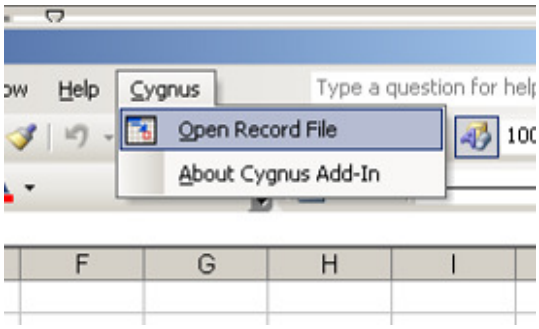


Fig. 11.13 Excel Menu Bar – Cygnus Add-In.

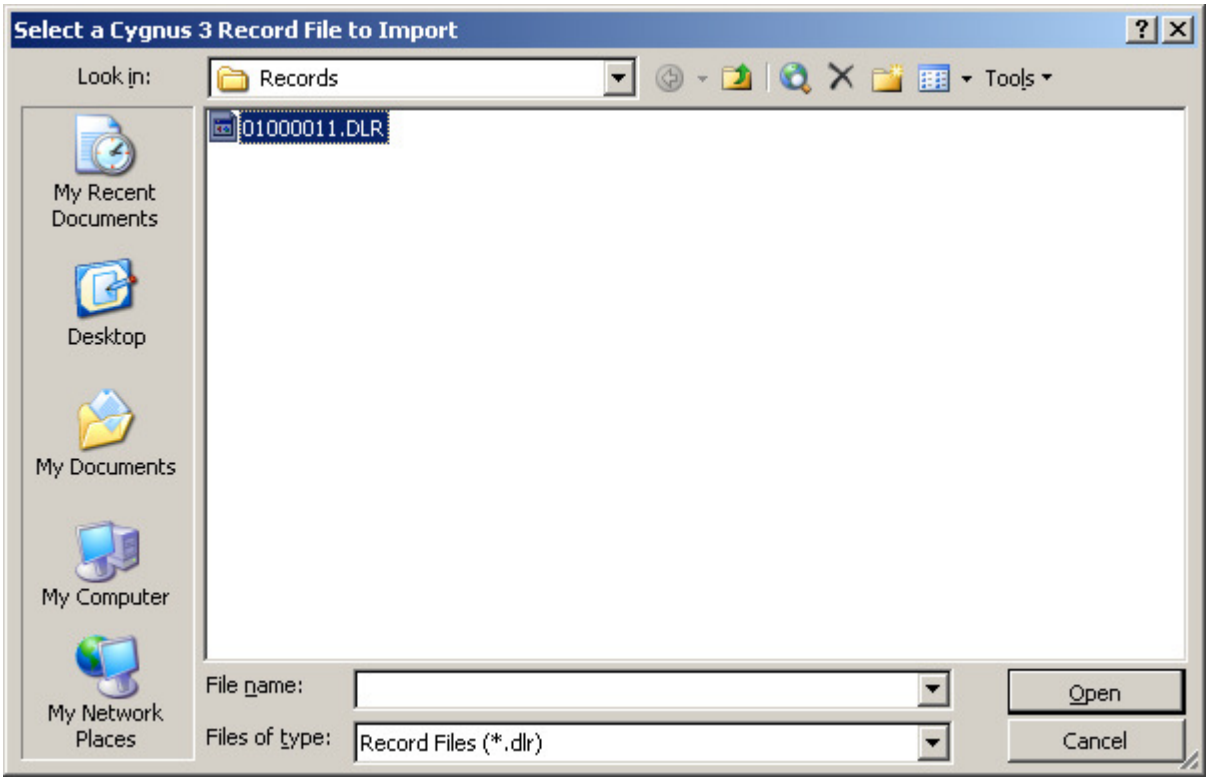


Fig. 11.14. Select a Cygnus Record File to Import.

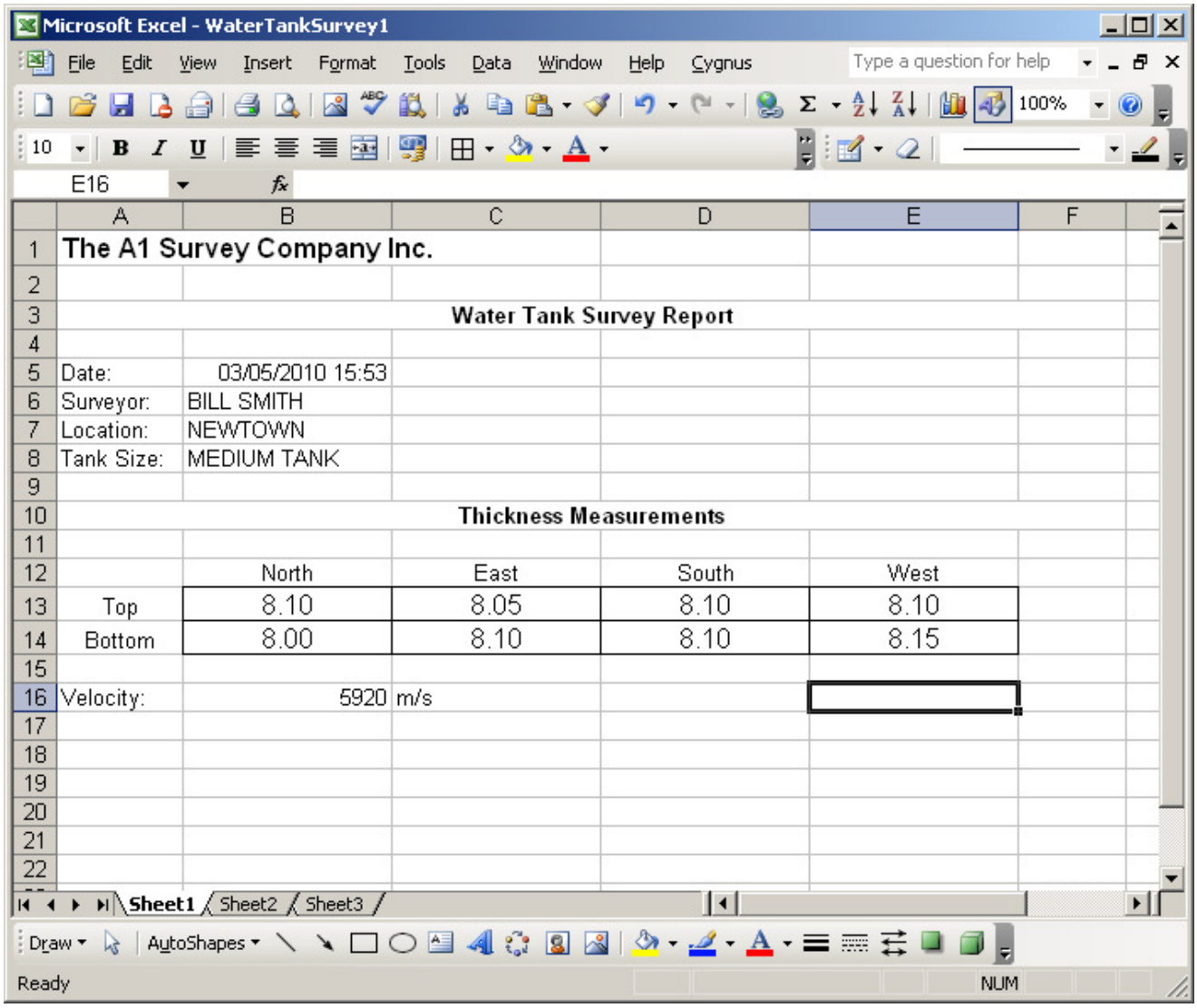


Fig. 11.15. The Completed Water Tank Survey in Excel.

12. General Points On Thickness Gauging

On very rough surfaces and especially if both sides are badly corroded, it is often necessary to move the Probe around to locate a back wall reflector. Sometimes a slight rocking movement can help find reflectors which are otherwise impossible.

Badly corroded sections can also be soaked with a light lubricating oil to improve ultrasound coupling through to the good material.

Always ensure that there is plenty of couplant present for good contact, but beware that on a pitted surface the Gauge may just measure the couplant-filled pit, always avoid measuring directly over external pits.

Beware that in extreme conditions or if the plate is of poor quality and contains many inclusions the ultrasound will be scattered to such an extent that measurement may not be possible.

Beware that the multiple-echo technique will not work if the front and back surfaces of the material being measured are not close to parallel. Also note that long narrow bars cannot be gauged along their length with the multiple-echo method.

The Gauge should not be used near arc-welding equipment, as this affects its performance.

13. Troubleshooting

The Gauge will not Switch On

- Are the batteries dead?
- Check the batteries are inserted correctly.

Difficulty obtaining a Reading

If there is 1 single flashing bar on the display - this means the Gauge is not receiving any echoes:

- Check that the Probe-lead is properly connected to both Probe and Gauge.
- Check the condition of the lead, replace if necessary.

If there is mostly 1 fixed bar plus 1 flashing bar this means that the Gauge is having difficulty obtaining more than one echo:

- Check the Probe and its membrane are properly assembled.

If there are up to 3 fixed bars plus 1 flashing bar, but never any reading - this means the Gauge is receiving unrelated echoes from more than one reflector:

- On heavily corroded areas this is often a problem, note this as a problem area and try taking measurements in adjacent areas of the same material.
- Check the Gauge and Probe together on a test block, if there is still no reading the Gauge may require servicing.

If Readings are Erratic or Unstable

- Check that the Probe-lead is properly connected to both Probe and Gauge.
- Check that the Probe and its membrane are correctly assembled with sufficient couplant between the probe face and membrane.
- Check the Probe-frequency is suitable for the probable minimum thickness of the material being measured. Probe frequencies too low cause doubling and tripling of the actual thickness.
- Check the gauge is not in Deep Coat mode.

14. The 4 Point Check

The most frequent reasons found to cause difficulty getting readings are:

1. **Is the Probe-membrane fitted correctly?**
   - Check that there is a thin layer of oil between the membrane and Probe-face, and with no air-bubbles trapped. See Changing the Membrane on Page 24.

2. **Is the Probe-lead OK?**
   - Check the probe lead is in good condition and is correctly inserted into the Probe and the Gauge. See Connecting the Probe on Page 12

3. **Is there adequate couplant applied to the material being measured, and is the surface properly prepared?**
   - Check there is plenty of couplant gel applied and there are no air-gaps between the Probe and the material when measuring. See Taking a Thickness Measurement on Page 19.

4. **Is the material measurable at all?**
   - Are the front and back faces of the material parallel?
   - Is the material too heavily corroded?
   - Is the material too thin for the Probe being used?

It is often worth confirming that the Gauge is operating OK using a test sample, and also to confirm that the material can actually be measured by ultrasonic multiple-echo thickness measurement.

15. Care and Servicing

Cleaning the Gauge

- ✓ Clean the Gauge and accessories with a damp cloth. Use water with a mild detergent household cleaner.
- ✗ Do not use solvents to clean the Gauge.
- ✗ Do not use any abrasive cleaner, especially on the display window.
- ✗ Do not immerse the Gauge in liquid when cleaning.

Batteries

- ✓ Always remove the batteries if the Gauge will not be used for more than a few days.
- ✓ Only use leak-proof batteries, Cygnus recommends Duracell Procell batteries.

Environmental

- ✗ Do not immerse the Gauge in liquids.
- ✗ Do not subject the Gauge to temperatures greater than 60°C (140°F).
- ✗ Do not store the Gauge for long periods in conditions of high humidity.

Repairs

- ✗ There are no user serviceable parts inside the Gauge. Therefore all repair work should be carried out by Cygnus Instruments or by an Authorised Cygnus Service centre.

Returning the Gauge for Servicing

A full Manufacturer's Factory Service is available from Cygnus Instruments.

The Complete Kit should always be returned for Service or Repair, including all Probes and Leads.

Cygnus Gauges are renowned for their reliability, very often problems with getting measurements are simply due to the way the Gauge is being used. See Troubleshooting on Page 112.

However, if you do need to return your Gauge for Repair please let us know the details of the problem, to help us guarantee the best possible service:

- Is the problem Intermittent Behaviour?
- Is there a problem turning the Gauge On?
  Or a problem with the Gauge turning itself Off?
- Does the Gauge constantly give Incorrect Readings, or Unsteady Readings?
- Is it not possible to Calibrate the Gauge?

16. Information

Technical Specifications

General Attributes		
Size	85 mm x 170 mm x 25 mm (3.3” x 6.7” x 1.0”)	
Weight	400 g (14.1 oz) Including Batteries	
Power Supply	3 x AA Cells (Alkaline or NiMH)	
Probe Sockets	Lemo 1	
Battery Operation Time	Approximately 18 hrs with alkaline 1500 mA/hr batteries	
Battery Voltage Range	Min 3.1 V dc, Max 4.5 V dc	
Operating Temperature Range	-10°C to +50°C (14°F to 122°F)	
Storage Temperature Range	-10°C to +60°C (14°F to 140°F)	
Low Battery Indication	Display shows a battery level gauge and flashes a Low Battery warning message	
PRF	602 Hz	
Monitor Outputs	N/A	
Through Coating Measurement	Coatings up to 6 mm thick as standard Coatings up to 20 mm thick in **Deep Coat**[3] mode	
Materials	Sound Velocity from 2000 m/s to 7000 m/s [0.0800 in/us to 0.2780 in/us]	
Measurement Range	Measurement Ranges in Steel[4]: 2¼ MHz probe 3 mm to 250 mm [0.120 in. to 10.00 in.] 3½ MHz probe 2 mm to 150 mm [0.080 in. to 6.000 in.] 5 MHz probe 1 mm to 50 mm [0.040 in. to 2.000 in.]	
Accuracy	±0.05 mm (±0.002”)	High Resolution Mode
	±0.1 mm (±0.005”)	Low Resolution Mode
Resolution	0.05 mm (0.002”)	High Resolution Mode
	0.1 mm (0.005”)	Low Resolution Mode
Display		
Type of Display	Graphic LCD, 128 x 64 pixels, Monochrome. White LED Backlight	
Display Size	Active Area 28 mm high x 47 mm wide	
Transmitter		
Shape of Pulse	Square	
Pulse Energy : Voltage (peak-to-peak)	30 V p-p	

[3] To use **Deep Coat** mode see page 31.
[4] Tested using 150mm square test blocks.

Pulse Energy : Rise Time	25 ns (max)
Pulse Energy : Pulse Duration	110 ns / 135 ns / 230 ns (5 MHz, 3.5 MHz, 2.25 MHz)
Receiver	
Gain Control	Automatic Gain Control up to pre-set Maximum Gain value
Frequency Range	1.5 MHz to 5.0 MHz (-6dB)
Other Information	
Data Output and Storage	Internal storage on Flash Memory Card. Data output via USB connection
Data Logger	Maximum number of measurement points per Record : 5000 Maximum number of Records : 100 Maximum Grid Record size : 100 rows x 50 columns Maximum number of User Data Fields : 40
Calibration setting storage	Calibration data stored in non-volatile EEprom memory
Calibration Mechanisms	N/A (Multiple Echo Gauge)
Display & Recall Facilities	N/A
Display Response Time	500 ms
Printer Output	N/A
Environmental Rating	IP65
Compliance	CE Marked RoHS Compliant BS EN 15317:2000

Specifications are subject to change for product improvement.

Table of Sound Velocities

Velocities will vary according to the precise grade and processing conditions of the material being measured.

This table is included as a guide only.
Wherever possible, the Gauge should always be calibrated on the material under test.

These Velocities are given in good faith and are believed to be accurate within the limits described above.
No liability is accepted for errors.

Velocities given are the compressional wave velocity c_l.

Material	Velocity of Sound (V)		Conversion Factor (f)
	m/s	in/us	
Aluminium (alloyed)	6380	0.2512	1.078
Aluminium (2014)	6320	0.2488	1.068
Aluminium (2024 T4)	6370	0.2508	1.076
Aluminium (2117 T4)	6500	0.2559	1.098
Brass (CuZn40)	4400	0.1732	0.743
Brass (Naval)	4330	0.1705	0.731
Brass (CuZn30)	4700	0.1850	0.794
Copper	4700 - 5000	0.1850 – 0.1969	0.794 – 0.845
Grey Cast Iron	4600	0.1811	0.777
Inconel	5700	0.2244	0.963
Lead	2150	0.0846	0.363
Monel	5400	0.2126	0.912
Nickel	5630	0.2217	0.951
Phosphor Bronze	3530	0.1390	0.596
Mild Steel	5920	0.2331	1.000
Tool Steel	5870	0.2311	0.992
Stainless Steel 302	5660	0.2228	0.956
Stainless Steel 347	5790	0.2279	0.978
Tin	3320	0.1307	0.561
Titanium	6100 - 6230	0.2402 – 0.2453	1.030 – 1.052

Tungsten Carbide	6660	0.2622	1.125
Epoxy Resin	2500	0.0986	0.422
Acrylic	2730	0.1076	0.461
Nylon (Polyamide)	2620	0.1032	0.443

Reading Conversions

If only a few measurements are to be taken on a material other than Steel, it may be easier to leave the calibration set for Steel and merely convert the readings by multiplying by the Conversion Factor for the material being measured.

This method avoids unnecessary recalibration.

Example.

The Gauge is calibrated for Steel [5920 m/s], but the reading is being taken on Copper [4700 m/s] :

$T = t \times V_{COPPER} / V_{STEEL}$
$= t \times 4700 / 5920$
$= t \times 0.794$

thus : **$T = t \times f$** [where: $f = V_{COPPER} / V_{STEEL}$]

where : **T = true thickness of Copper being measured**
t = actual reading obtained
f = Conversion Factor (from table)
V_{COPPER} = Sound Velocity in Copper : 4700 m/s
V_{STEEL} = Sound Velocity in Steel : 5920 m/s

The **Conversion Factor f**: is given for various materials relative to steel in the Table of Sound Velocities on page 118.

17. Accessories List

Remote Probes with 1.35m (4’6”) Lead

All probes are fully assembled and include a spare membrane pack, knurled ring locking key and probe cable.

Part No.	Description
004-9310	Remote Probe 2.25MHz 13mm (1/2”) BNC
004-9313	Remote Probe 3.5MHz 13mm (1/2”) BNC
004-9314	Remote Probe 5.0MHz 6mm (1/4”) Lemo 00
004-9316	Remote Probe 5.0MHz 13mm (1/2”) BNC

Lower frequency probes offer better penetration on heavy corrosion/coatings. Please refer to page 25 for correct probe selection.

Marinised Probes with Cable Length to Order

For divers taking underwater thickness measurements down to 60m (approx 200ft) maximum whilst keeping the Cygnus 3 on the surface. Alternatively please visit: www.cygnus-instruments.com/english/cygnus1uw.html for full details on the Underwater thickness gauge.

Part No.	Description
002-9387	Marinised Probe 2.25MHz 13mm (1/2”) UW remote probe with Lemo 1 plug
002-9388	Marinised Probe 2.25MHz 19mm (3/4”) UW remote probe with Lemo 1 plug
002-9389	Marinised Probe 3.5MHz 13mm (1/2”) UW remote probe with Lemo 1 plug
002-9390	Marinised Probe 5.0MHz 6mm (1/4”) UW remote probe with Lemo 1 plug
002-9391	Marinised Probe 5.0MHz 13mm (1/2”) UW remote probe with Lemo 1 plug

Lower frequency probes offer better penetration on heavy corrosion/coatings. Please refer to page 25 for correct probe selection.

Note: Cygnus 3 is not intended for underwater use.

Probe Spares and Membranes

Part No.	Description
001-3702	Standard Membranes (polyurethane) (20pk) 6mm (1/4”)
001-3701	Standard Membranes (polyurethane) (20pk) 13mm (1/2”)
001-3700	Standard Membranes (polyurethane) (20pk) 19mm (3/4”)
001-4873	Teflon Membranes (10pk) (High Temperature) 6mm (1/4”)

001-4874	Teflon Membranes (10pk) (High Temperature) 13mm (1/2”)
001-4875	Teflon Membranes (10pk) (High Temperature) 19mm (3/4”)
001-3706	Membrane Couplant
001-3707	UCA-2M Ultrasonic Couplant Gel (1 litre tub)
001-3708	UCA-2M Ultrasonic Couplant Gel (100 ml)

Cables and Leads

Part No.	Description
004-0406	Probe Cable: Blue High-Flex BNC to Lemo 1 (STD) – 1.35m (4’6”) As supplied with standard probe.
004-0401	Probe Cable: Lemo 00 to Lemo 1 (STD) – 1.35m (4’6”). For use with 6mm 5 MHz probe.
003-8215/4	USB Cable for Mk4 Cygnus 3 Gauge

Miscellaneous Spares

Part No.	Description
001-4850	Steel Test Block 15mm
001-4851	Steel Test Block 1/2”
001-4852	Coated Test Block
001-4856	Carbon Steel Step Block 5-25mm in 5mm steps set in Perspex supplied with material type and dimensional accuracy traceable certificate.

Carry Cases

Part No.	Description
002-4834/3	CYGNUS 3 Mk4 carry case with foam
002-4835/3	CYGNUS 3 Mk4 Silicone instrument sleeve with belt clip stud
002-4836/3	CYGNUS 3 Mk4 Belt clip
002-4837/3	CYGNUS 3 Mk4 Fabric Accessories Pouch

18. Recycling and Disposal (EC Countries)

The WEEE Directive (Waste Electrical and Electronic Equipment 2002/96.EC) has been put into place to ensure that products are recycled using best available treatment, recovery and recycling techniques to ensure human health and high environmental protection.

The Gauge has been designed and manufactured with high quality materials and components which can be recycled and reused. It may contain hazardous substances that could impact health and the environment. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on natural resources we encourage you to dispose of this product correctly.

DO NOT dispose of this product with general household waste.

DO dispose of the complete product including cables, plugs and accessories in the designed WEEE collection facilities.

This product may also be returned to the agent or manufacturer who supplied it for safe end-of-life disposal.

19. Index

Accessories, 120
  Membrane Couplant, 122
  Silicone instrument sleeve, 122
  Teflon Membranes, 122
  UCA-2M Ultrasonic Couplant Gel, 122
Alarm, 30
  Minimum Thickness Alarm, 30
Auto Log Feature, 72
Automatic Power Off, 18
Batteries
  Fitting, 11
  Incorrect Insertion, 11
  Life, 21
  Low Battery Warning, 22
  NiCad, 11
  NiMH, 11
Beep, 33
BS EN 15317:2007, 37
Calibration, 37
  Conversion Factor, 119
  Known Thickness, 37
  Single Point, 39
  Velocity of Sound, 40
Cleaning, 114
coupling strength, 20
Data Logging, 45
  Adding Comments, 66
  Additional Measurements, 64
  Grid Point Records, 52
  Menu, 49
  No Readings, 62
  Obstructions, 62
  Quick Log Records, 50
  Record File, 46
  Template Files, 57
Deep-Coat
  Function, 31
  Warning Message, 33
Disposal, 123
Echo Strength, 19
Gauge Controls, 15
Gauge Menu, 27
Imperial, 28
Keys, 16
  Alphanumeric, 17
  function, 16
LCD, 16
  backlight, 16
Measuring
  narrow bars, 111
  pitted surface, 111
  rough surfaces, 111
Metric, 28
Neck Strap, 14
Power button, 17
Probes
  Frequency, 26
  Knurled Ring, 24
  Locking Ring Key, 24
  Membrane, 23
  Membrane Couplant, 24
  Probe Cable, 12
  Selection, 23
  Specifications, 25
problems, 115
pulse-echo, 8
Recycling, 123
Repair, 115
Resolution, 29
Service, 115
Silicone Sleeve, 13
Sound Velocities, 118
Specifications, 117
test block, 37

Thickness Measurement, 19
Triple Echo Verification, 8
Troubleshooting, 112
Units, 28
unrelated echoes, 112
Velocity
  Adjust Velocity, 41
  Velocity Menu, 41
  Velocity Table, 42
WEEE Directive, 123