Cygnus ROV Mountable Ultrasonic Thickness Gauge

Models M5-ROV-2K, M5-ROV-4K

Operation Manual and Accessories List

Doc No. M5-ROV-M-ENG_Iss13.docx

October 2026

(Mk5 Cygnus ROV Gauges)

Contents

1. Introduction 6
Cygnus ROV Mountable Thickness Gauge 6
Multiple Echo Measurements 7
Triple Echo Verification 7
Cygnus Instruments 8
Contact Details 8
2. Gauge Kit Contents 9
Data Conversion Items 10
Top Side Repeater (TSR) Remote Display Unit 11
3. Gauge Preparation 12
Electrical Connections to the Gauge 12
Power Supply 12
Data Output 12
Electrical Connections to the Surface 12
Connection to a Computer 12
Connection through a Multiplexer 13
Connection to the TSR Remote Display Unit 13
Connecting the Probe to the Gauge 13
Automatic Probe Frequency Setting 13
Gauge Options 13
Deep Coat Mode 13
Measuring Through a Water Gap 14
4. Displaying the Thickness Measurements 15
Data Logging 15
Video Overlay 15
5. Calibration 16
6. Using the TSR Remote Display Unit 17
Turning the Unit On 17
Changing the Displayed Units 17
Setting the Velocity of Sound 17
Calibrating to a Known Thickness using a TSR 18
Display Hold Function 18
Automatic Display Backlight 18
Video Overlay Facility 18
Connecting the Video Signal 19
Positioning the On-Screen Display (OSD) 19

Testing the Link....20
Troubleshooting - Error Messages....21
7. CygLink Surface Display and Control Kit....22
Kit Contents....22
Connection Diagram....23
Connector Details and Signals....23
Installing CygLink....23
COM Port Numbers....24
Setting the COM Port Manually....24
Finding your COM Port Number....24
To Change the COM Port number assigned by Windows®....25
Opening Device Manager....25
Running CygLink Application....27
Connecting to the ROV Gauge....27
Changing Gauge Settings....28
Material Velocity List....28
Calibrating to a Known Thickness using CygLink....29
CygLink Surveys and Data Logging....30
Editing the Survey Details....31
Editing the Survey Group Details....32
Reference and Minimum Thickness Criteria....32
Producing a Survey Report Document....33
Logging Measurements Directly in CygLink....33
Pre-Set Measurement Comments List....33
Adding Comments or Notes to a Measurement....34
CygLink Trouble Shooting....34
Connection Problems – USB Drivers....34
Wiring Problems....35
8. Probes & Membranes....36
Probe Selection....36
Changing the Membrane....37
Probe Selection & Specifications....38
Probe Frequency Identification....38
Mounting the Ultrasonic Probe....39
Cygnus Probe Handling Solutions....39
9. Gauge End Plate Removal....40
End Plate Removal Instructions....40
Changing the Options....41
Changing the Fuse....41

Testing the Gauge for Operation 42
End Plate Refitting Instructions 42
10. General Points on Thickness Gauging 44
11. Troubleshooting 45
Difficulty obtaining a Reading 45
If Readings are Erratic or Unstable 45
12. The 3 Point Check 46
13. Care and Servicing 47
Cleaning the Gauge 47
Environmental 47
Repairs 47
Returning the Gauge for Servicing 47
14. Information 49
Technical Specifications 49
Design Pressure Test Certificates 50
15. Serial Data Format 51
Protocol 51
Valid Thickness Measurement Packet Arrangement 51
No Thickness Measurement Packet Arrangement 51
Status-byte Structure 52
Data-bytes Arrangement 52
Interpreting the Readings sent from the Gauge 53
16. Table of Sound Velocities 54
Reading Conversions 55
17. Accessories List 56
Underwater Probes with 5 Meter Lead 56
Probe Spares and Membranes 56
Knurled Rings 57
Cables and Leads 57
Electronic Bodies Only 58
Miscellaneous Spares 58
Carry Case 58
Software 58
18. Recycling and Disposal (EC Countries) 59
19. Warranty Information 60
20. Pressure Test Statement 61
21. Schematic for RS-422 to Computer USB 62

22. Schematic for RS-232 to Multiplexer.....63
23. Schematic for RS-232 to Multiplexer to TSR 64
24. Schematic for RS-422 to TSR 65
25. Index.....66

1. Introduction

Cygnus ROV Mountable Thickness Gauge

The Cygnus ROV Mountable Thickness Gauges are rugged, compact instruments designed for high-reliability ultrasonic thickness measurement using the multiple-echo technique.

The Cygnus ROV Mountable Thickness Gauges are fully sealed pressure rated units designed to be mounted on submersible ROV craft. There are two models with different pressure ratings, a 2000 m (6,561 ft) model and a 4000 m (13,123 ft) model. Both gauges take their power from the ROV craft and output thickness measurement data as serial data in either RS-422/485 or RS-232 format. The thickness measurement data can be viewed top-side a number of ways, by using CygLink software or using the optional Remote Display Unit with Video Overlay facility. The CygLink software also provides Data Logging facilities.

Measurements can be displayed in Metric (mm) or Imperial (inch) units; measurement resolution can be selected for either 0.1 or 0.05 mm, (0.005 inch or 0.002 inch).

Crystal-controlled Calibration provides stability and accuracy. The thickness measurement can easily be calibrated to a known thickness or to a known Velocity of Sound.

The Gauges are able to operate accurately in adverse environmental conditions both underwater and above the sea.

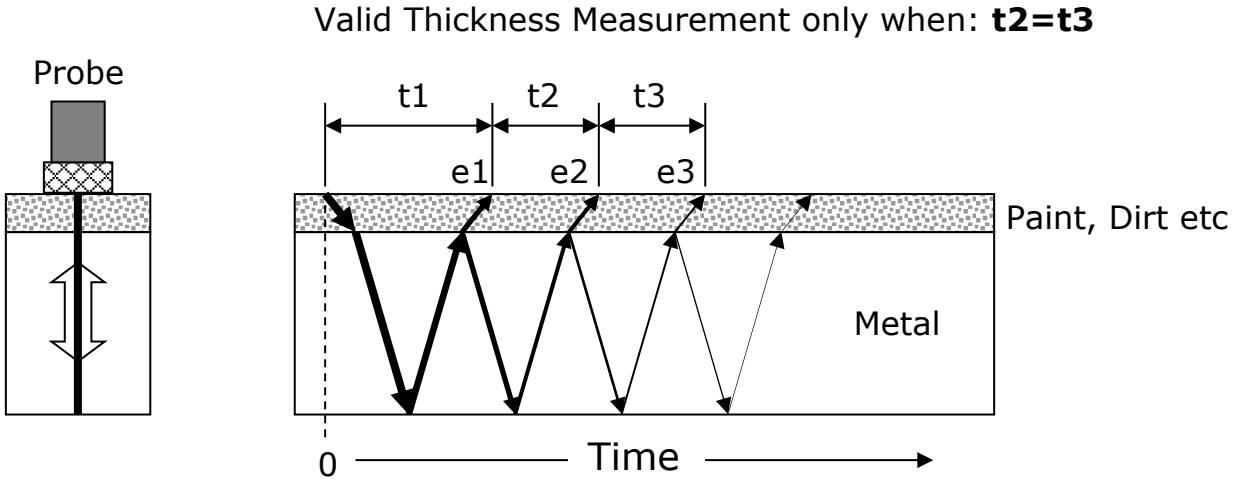


The Gauge is a solid-state electronic instrument which, under normal operating conditions, will give many years of active service.

Although designed for ease of operation first time users 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, pioneered the development of the Digital *Ultrasonic Multiple-Echo Technique* used for measurement through coatings. This has long since been the standard required to ensure that accurate measurements are taken without the need to zero the gauge or remove any coatings first.

Our philosophy is to work closely 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.

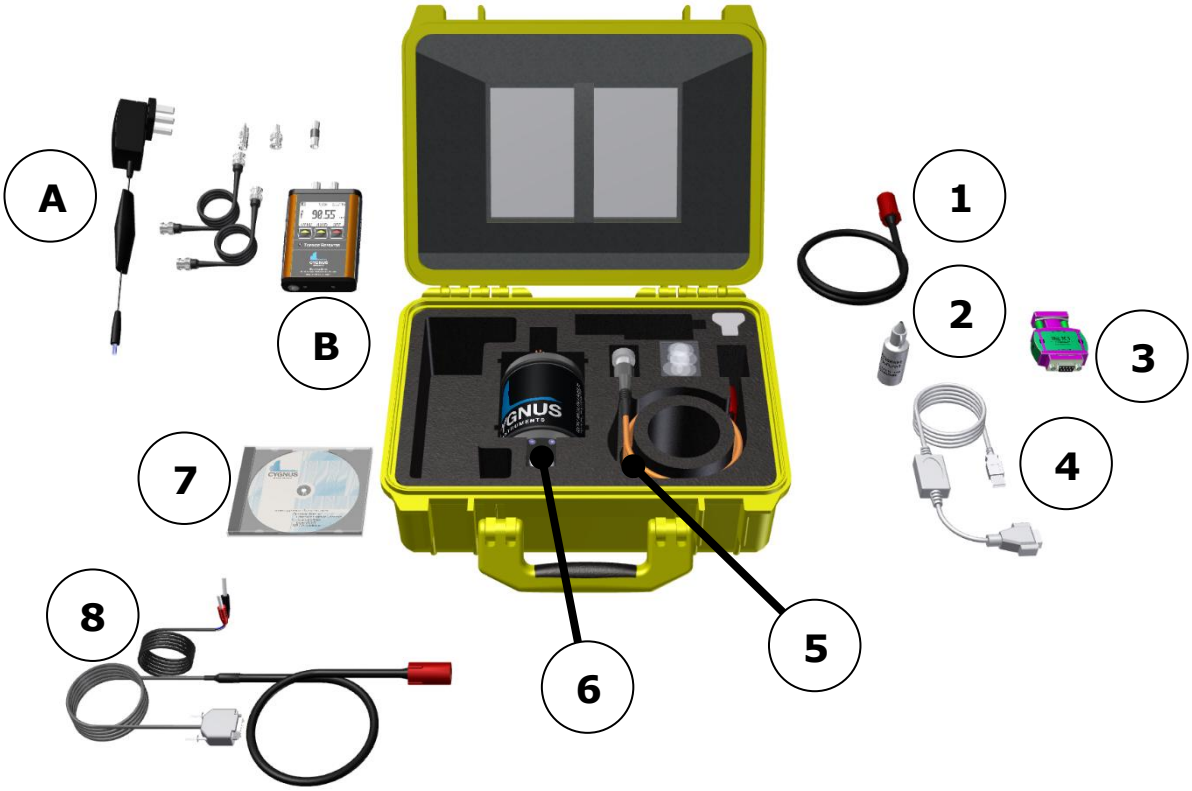
Contact Details

CYGNUS Instruments Ltd.
Cygnus House, 30 Prince of Wales Road,
Dorchester, Dorset, DT1 1PW England.
Website: www.cygnus-instruments.com
Tel: 00 44 (0) 1305 265533
sales@cygnus-instruments.com

For all Cygnus offices and Authorised Cygnus Service Centres and Distributors around the world please refer to the Cygnus website Worldwide Distribution page.

https://cygnus-instruments.com/about-us/worldwide-distributors/

2. Gauge Kit Contents



1. ROV Power & Data cable with flying leads
2. Membrane Couplant
3. 'K3' RS-422/485 to RS-232 Converter
4. RS-232 to USB Converter
5. ROV Probe Cable with Heavy Duty Remote Probe (5 m)
6. Cygnus ROV Gauge
7. USB Flash Drive CygLink Installation and Operating Manual in PDF format
8. ROV Power & Data Test cable and connectors

A. [1]*Top Side Repeater Video Cables and 12 V Power Supply*

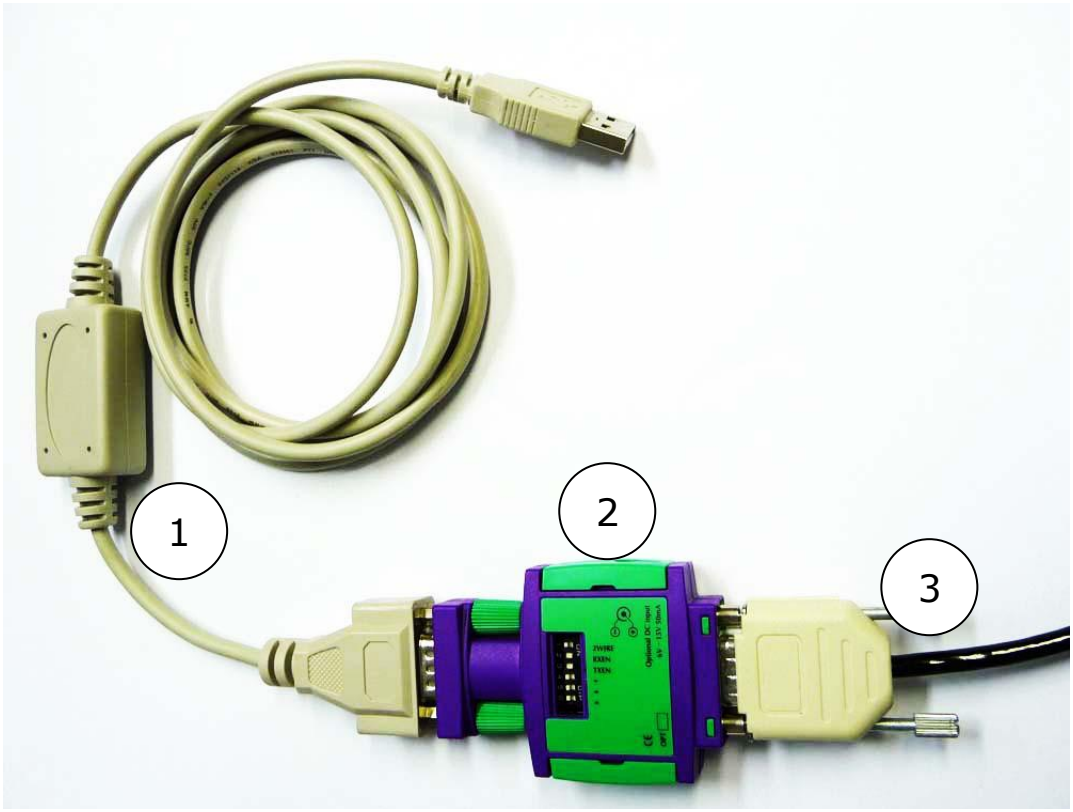
B. *Top Side Repeater (TSR) Remote Display Unit*

Accessories in case: Spare O-Rings, Spare Membranes, Membrane Locking Ring Key, 15 mm (½") Test block, Spare 1A Fuses, 3mm

[1] A & B are Optional Accessories to the Gauge Kit.

Allen Key, Silicone Grease Sachets. Documentation is attached in the lid of the case.

Data Conversion Items



1. RS-232 to USB Converter Module & Cable
2. 'K3' RS-422/485 to RS-232 Converter Module
3. Connection from ROV subsea link

Top Side Repeater (TSR) Remote Display Unit

Optional Accessory to the Gauge Kit



3. Gauge Preparation

The Gauge is supplied ready to use. All that is required is to make the necessary electrical connections between the Gauge and the ROV Craft and the chosen top side display.

There are no controls or display on the gauge, calibration is performed at the surface using the top side display.

Electrical Connections to the Gauge

See pages 62, 63, 64 & 65 for schematic connection details.

Power Supply

The Gauge requires a DC supply voltage between 7 and 30 volts with a current consumption less than 150 mA. There is an internal 1 Amp fuse and crowbar circuit to protect the instrument from over-voltage surges, the supply input is also protected against accidental reverse polarity connection. There is no on/off switch, the Gauge will operate continuously while the power is connected.

Data Output

The Gauge outputs its status and thickness measurements as serial data, there is the option to set the output as RS-422 or RS-232. The RS-232 output option would normally be used when the Gauge is connected to a fibre-optic multiplexer. The RS-422 output option can transmit the serial data up to 1200 m (4,000 ft) along a twisted pair cable. The serial output drivers have ESD protection to ±15 kV. See Serial Data Format on Page 51.

Electrical Connections to the Surface

Connection to a Computer

When connecting the Gauge output to a computer you will either connect to a free RS-232 serial port, or if the computer does not have one use the RS-232 to USB converter supplied in the kit.

When the Gauge outputs data in RS-422 mode you will need to convert the RS-422 signal to RS-232 first. There is a ‘K3’ converter supplied in the kit to do this.

See Schematic for RS-422 to Computer USB on page 62.

Connection through a Multiplexer

The Gauge serial output can be connected to a multiplexer, you can select RS-232 output and change the baud rate from 2400 to 9600 baud. See Schematic for RS-422 to Computer USB on page 62.

Connection to the TSR Remote Display Unit

The TSR Unit has an input for the RS-422 serial data directly from the Gauge. See Schematic for RS-422 to TSR on page 65.

If you have used a multiplexer to transmit the data from the ROV craft to the surface you will need to send RS-422 to the TSR. You can also use the 'K3' converter to convert from RS-232 to RS-422 if required. See Schematic for RS-232 to Multiplexer to TSR on page 64.

Connecting the Probe to the Gauge

The Probe is connected to the Gauge using a SubConn® Micro Series 2 way connector pair.

Automatic Probe Frequency Setting

The Gauge will automatically detect the frequency of the probe connected and set the Gauge accordingly.

Gauge Options

There are three options that can be set by the user, these are;

1. Serial Data Format : RS-422 or RS-232
2. Serial Baud Rate : 2400 or 9600
3. Deep Coat Mode : On or Off

To change any of these options the Gauge's end cover plate must be removed to give access to the option switches. For details on removing the end cover plate see Gauge End Plate Removal on page 40.

Deep Coat Mode

Deep Coat mode can be used to take thickness measurement through extra thick coatings above 3mm thick and up to 20mm

thick[2]. In normal mode (Deep Coat off) the gauge will measure through coatings up to approximately 3mm thick[3].

Although Deep Coat may provide useful when attempting to measure through thick coatings, ultimately the acoustic impedance of the coating will determine if the gauge will be able to detect the three echoes required for a valid thickness measurement.

Deep Coat mode should not be used for measuring coatings less than 3mm thick.

It is advised to only consider using Deep Coat mode where necessary – do not leave the gauge in Deep Coat with the intent of a "measure all" solution.

Measuring Through a Water Gap

In ROV applications the water can be considered to be a coating thus it is possible to measure steel thickness through a small water gap. As the velocity of sound for sea water is approximately 1500m/s this equates to a maximum sea water gap of 1.3mm in normal mode (Deep Coat off).

Although Deep Coat may be used to measure through larger water gaps the performance of the gauge may suffer as a result. It is advised that trials are carried out first to verify the effectiveness of this approach to the application.

[2] Depending on material's acoustic impedance
[3] Assuming a velocity of sound around 2000m/s for the coating

4. Displaying the Thickness Measurements

The Gauge transmits the thickness measurement data to surface as a serial data, to display the thickness value and provide a means of calibration Cygnus provide two options;

1. Using a Cygnus Top-Side Repeater (TSR) unit
2. Using a computer with CygLink software

It is also possible for a third party application to read the serial data and process the thickness measurement data. For more information on the Serial Data Format, to enable use of your own software, see page 51.

Data Logging

The CygLink software also provides the facility to Data Log the thickness measurements as they are taken and to generate a report document for the survey.

Video Overlay

The optional TSR unit has a Video Overlay or On-Screen Display facility where the thickness measurements can be superimposed on to a video signal feed before the monitor and/or video recorder. The video overlay will work with PAL or NTSC video signals.

5. Calibration

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

Either a 15mm or ½" 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 and may not indicate an exact 15.00 mm.

The best way to calibrate the Gauge is to calibrate using a Known Thickness of a sample piece of the material you intend to measure. This method determines the velocity of sound for the material sample, which will always be more accurate than using a 'general' velocity value.

For calibration instructions using CygLink see Calibrating to a Known Thickness using CygLink on page 29, or with the TSR see Calibrating to a Known Thickness using a TSR on page 18.

If there is no test sample available the Gauge can be calibrated by setting the Velocity of Sound directly. A table on page 54 lists common materials and their velocity of sound values. For instructions on setting the velocity of sound using CygLink see page 29, or with the TSR see page 17.

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 54.

6. Using the TSR Remote Display Unit

The Cygnus Top Side Repeater (TSR) is a small handheld display unit that can display the thickness measurement values from the Gauge on its LCD display. It provides the ability to calibrate the Gauge's output to suit the material or to a specific velocity of sound. A video overlay facility is also included that allows the thickness measurements to be superimposed on to a video signal before the monitor or video recording device.

Turning the Unit On

1.	Press the red **ON** key
2.	The Cygnus Logo screen appears
3.	If not connected to a Gauge the display shows "NO CONNECTION" This is normal – it just means no data has being received yet

Changing the Displayed Units

1.	Press the **MENU** key to display the **MENU**
2.	Press the **DOWN ARROW** key to scroll down to **UNITS** the current units are displayed
3.	Press the **EDIT** key to toggle between **mm** and **Inch**

Setting the Velocity of Sound

The velocity of sound value is displayed at the top of the screen in either m/s or inch/us.

1.	Press the **MENU** key to display the **MENU**
2.	The **VELOCITY** menu option should be selected at the top
3.	Press the **EDIT** key to adjust the velocity of sound value Press the **OK** key to save and exit

Calibrating to a Known Thickness using a TSR

The TSR display can be calibrated to a known thickness by using the Gauge to measure a sample of the material that will be measured. This method ensures the velocity of sound is set for the actual material being measured rather than using a "generic" value.

1.	Place and hold the Gauge's ultrasonic probe on the material sample using couplant if out of the water You should have a stable thickness measurement on the display
2.	Press the **MENU** key to display the **MENU**
3.	The **CALIBRATE** menu option should be selected at the top
4.	Press the **EDIT** key to adjust the measurement value to the known thickness of the sample being measured Press the **OK** key to save and exit
5.	Repeat from step 1 to check the calibration is stable.

Display Hold Function

The middle key HOLD can be used to freeze the display and hold the current thickness measurement.

1.	Press the **HOLD** key to freeze the display
2.	Press the **HOLD** key again to un-freeze the display

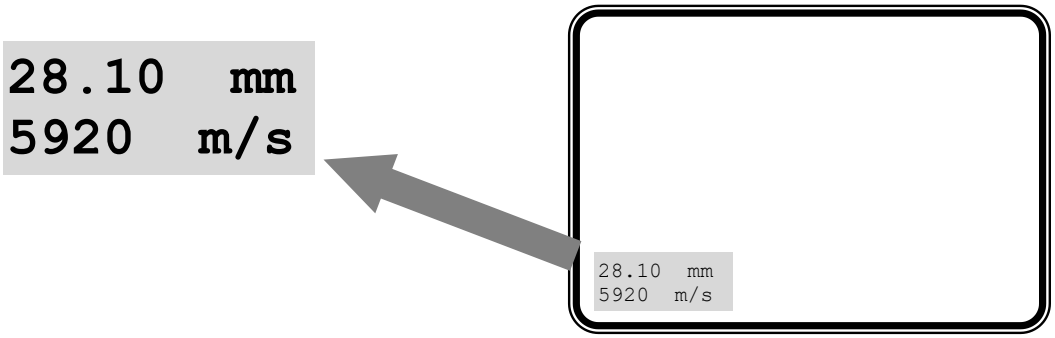
Automatic Display Backlight

The display backlight automatically turns off in bright light conditions, it will automatically turn on when the ambient light level drops.

Video Overlay Facility

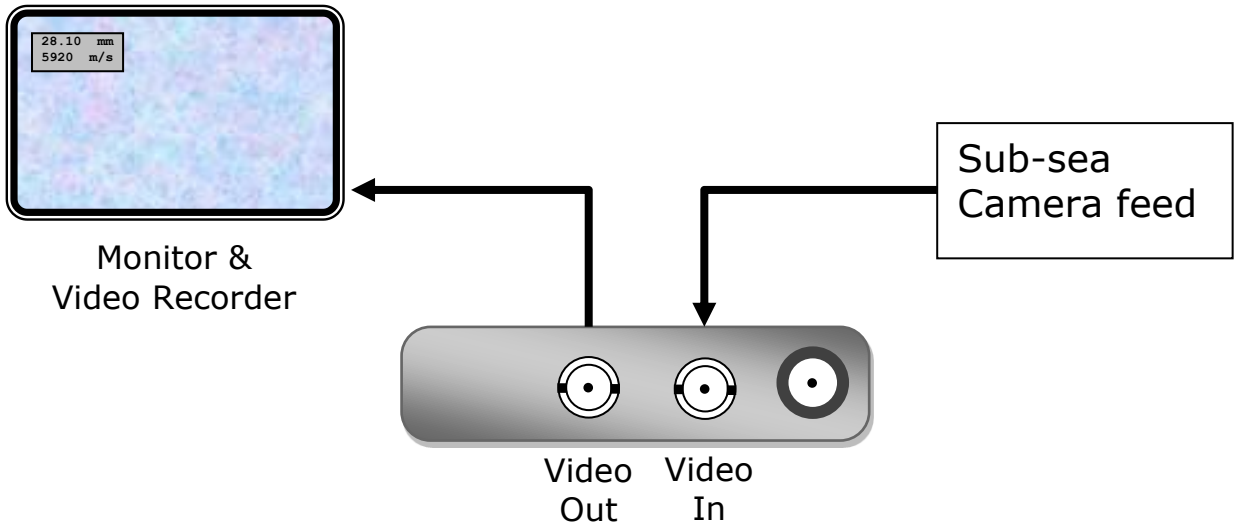
The TSR can superimpose the thickness measurement on to a video signal to display it on the monitor screen, and also on the

video recording of the survey. This provides a thickness measurement that can be linked to a position or place in the video.



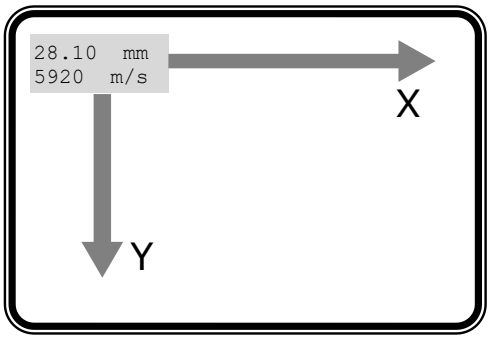
Connecting the Video Signal

The TSR has two BNC sockets on its top panel; Video In and Video Out. The video feed to the monitor and video recorder is fed through the TSR. The TSR will automatically detect and adjust for PAL or NTSC video signals, it will work with colour or monochrome images.



Positioning the On-Screen Display (OSD)

Because there is usually other information displayed on the video screen the TSR has the facility to move the thickness measurement display 'box' anywhere on the screen using X, Y coordinates. The position selected will be stored in the TSR memory during power off.



1.	Press the **MENU** key to display the **MENU**
2.	Press the **DOWN ARROW** key to scroll down to **OSD X POS**
3.	Press **EDIT** to adjust the X screen position Press **EXIT** to save and exit
4.	Press the **DOWN ARROW** key to scroll down to **OSD Y POS**
5.	Press **EDIT** to adjust the Y screen position Press **EXIT** to save and exit
6.	Press **EXIT** again to exit the menu screen

Testing the Link

Before use on a job it is recommended to test the link between the Gauge and the TSR. To do this simply power on both the display and the gauge then measure the test block – the TSR should display the correct test block thickness.

Troubleshooting - Error Messages

1.	NO CONNECTION	The TSR has not received any valid data since power-up Check that the Gauge is turned-on and displaying either a measurement or the echo strength bar-chart Check all cable connections are secure

7. CygLink Surface Display and Control Kit

CygLink is a Windows® application for PCs that allows remote viewing, control and data logging of the ROV gauge. The software can provide the following functionality:

1. Surface display of thickness measurements
2. Remote setting of the velocity of sound
3. Remote setting of the units
4. Data Logging of thickness measurements into a Survey report

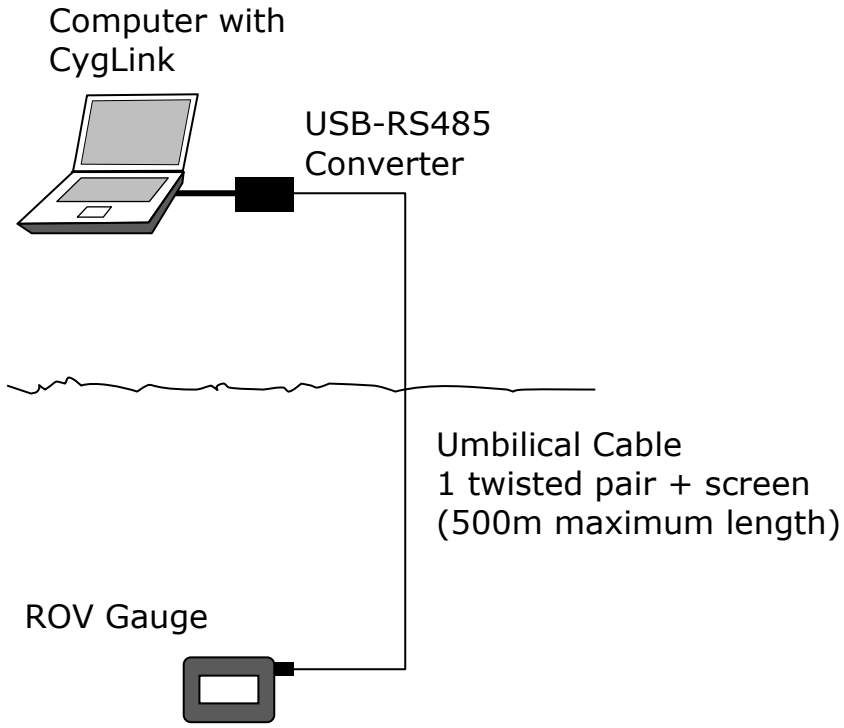
Kit Contents

The CygLink kit comprises of the following items:

1. USB-RS485 Converter Cable
2. CygLink Software Installer on USB Flash Drive

You will also need an Umbilical cable and connectors to connect the ROV gauge to the top side. Cygnus can supply the complete umbilical cable with connectors fitted, or the customer can make their own umbilical cable using connectors supplied with cable tails.

Connection Diagram



Connector Details and Signals

See Page 62, 63, 64, 65 for wiring details.

Installing CygLink

CygLink is supplied on a USB Flash Drive or can be downloaded from a web link emailed from Cygnus Instruments. Installation of CygLink follows normal software installation conventions after running the setup.exe program and following instructions.

To install from a flash drive, connect it to a free USB port on your computer. Navigate to the flash drive in Windows® Explorer and open the folder present in the root of the drive. Run the application named setup.exe to begin the installation process. You will need to accept the End User Licence Agreement in order to complete the installation and a summary of its terms is provided at the start. We advise opting for the typical setup option for the smoothest installation experience.

COM Port Numbers

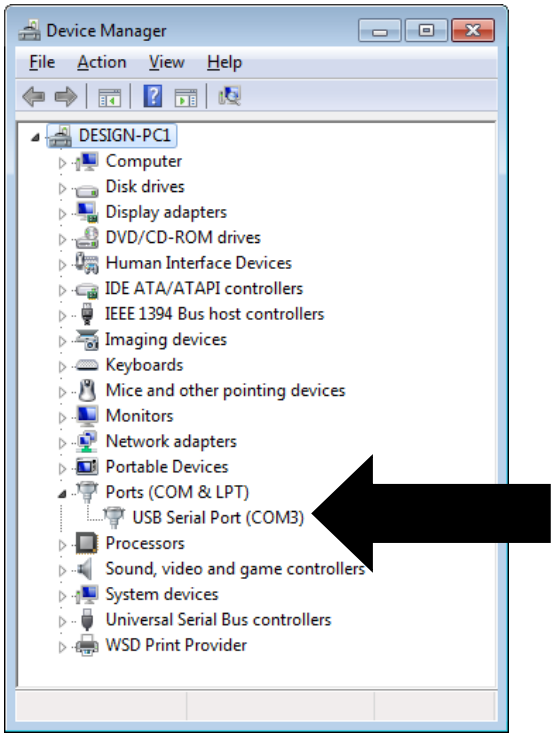
CygLink should automatically find the COM port number assigned to the USB converter when you click "Connect", "Discover New Gauge and Connect" so you don't need to search for the port number Windows has assigned.

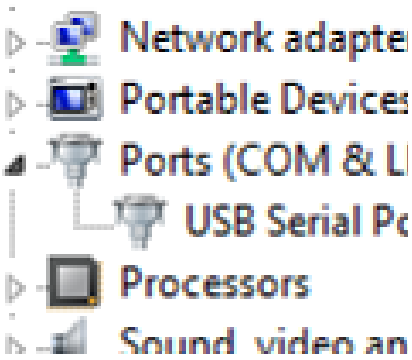
Setting the COM Port Manually

If CygLink fails to locate the correct COM port number you can set in manually from the **File** -> **Communications Options** menu item. Just tick the **Manual Setup** box and select the correct COM port number.

Finding your COM Port Number

With the USB-RS485 Converter plugged into your computer, open Windows Device Manager – to do this press the Windows® key and the '**R**' key together, then type "**devmgmt.msc**" into the prompt followed by enter key. In the **Ports** section, look for the USB Serial Port entry. Remember the COM number listed, as this will need to be selected within CygLink's settings menu.





Windows® Device Manager

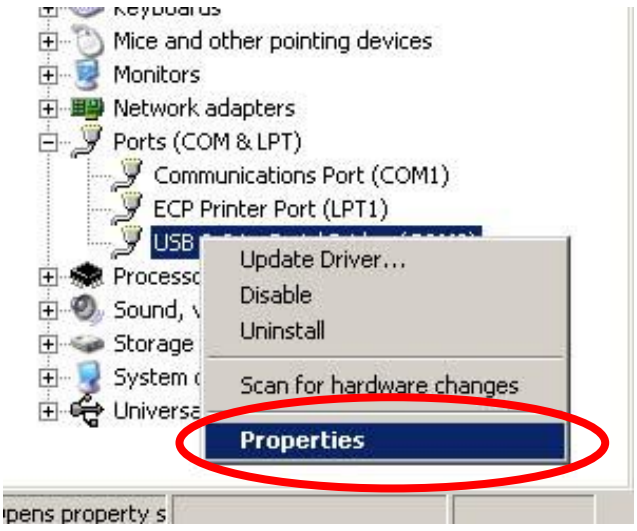
To Change the COM Port number assigned by Windows®

Depending on a variety of factors, Windows® may sometimes assign a COM Port number that is too high or unusual to be easily remembered. You may change the number assigned to the port by following these steps:

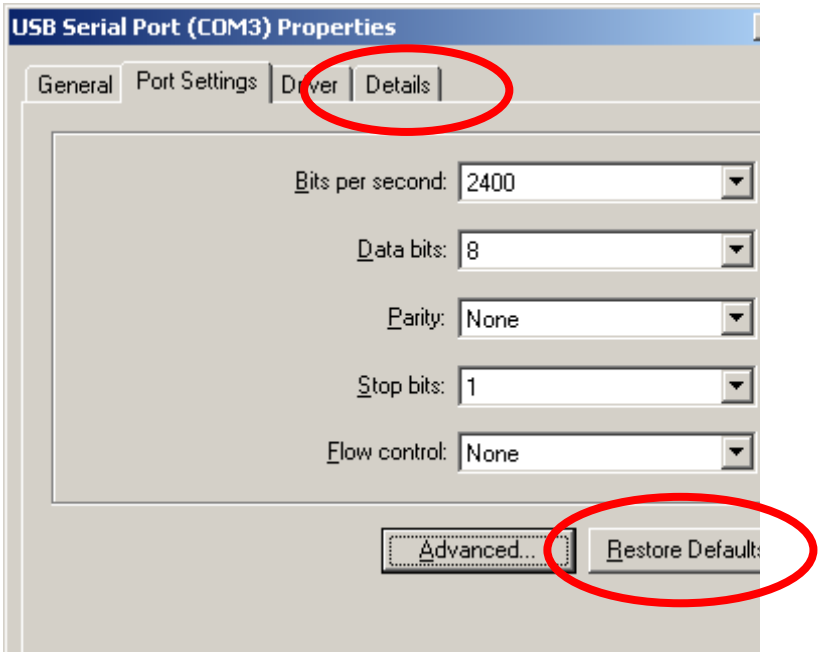
Opening Device Manager

Each version of Windows has a slightly different procedure for opening Device Manager. The most direct route is to press + R, type "devmgmt.msc" and press Enter.

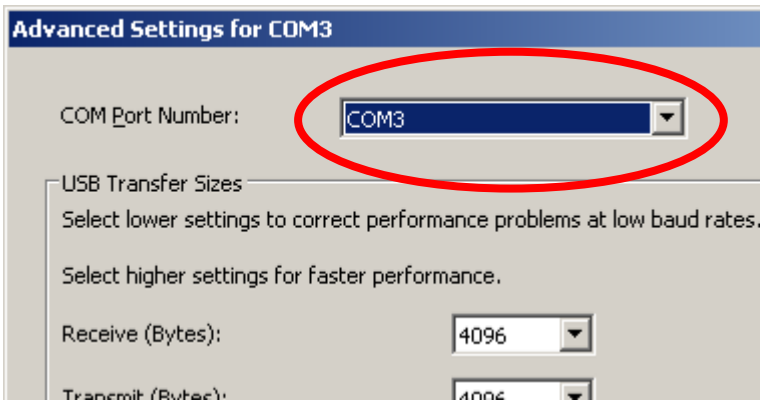
1. Select the "**USB Serial Port**" device and right click to display its context menu, Click "**Properties**".



2. On the Properties form select the "**Port Settings**" tab, then click the "**Advanced**" button.

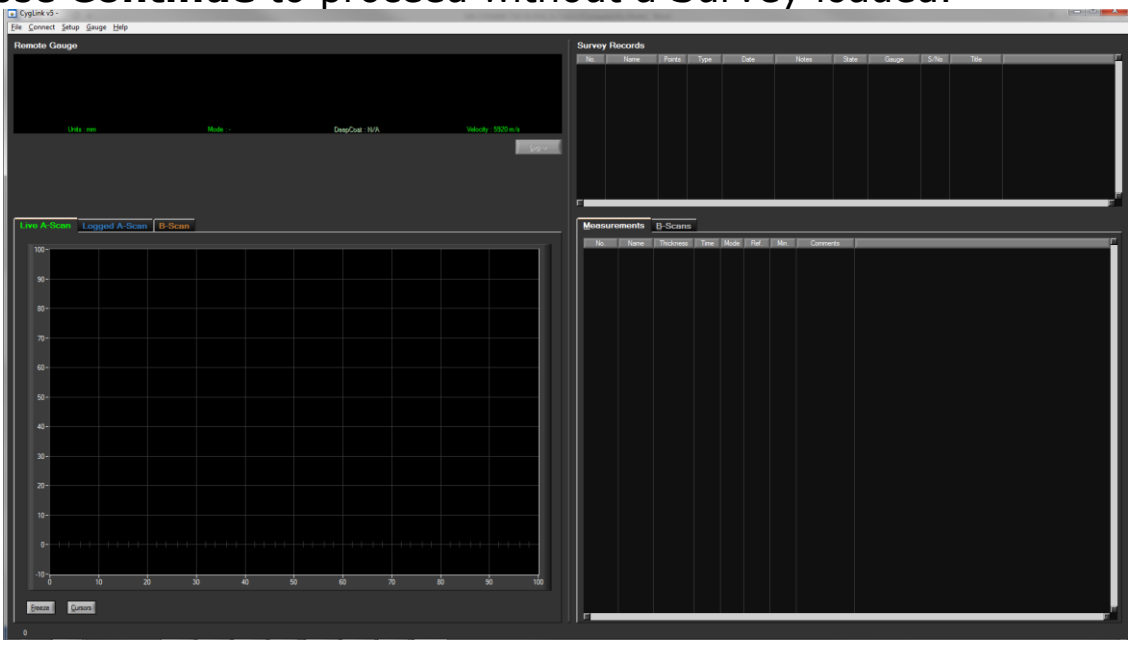


3. On the "**Advanced Settings**" form you can change the COM Port number. Finish by clicking the "**OK**" button.



Running CygLink Application

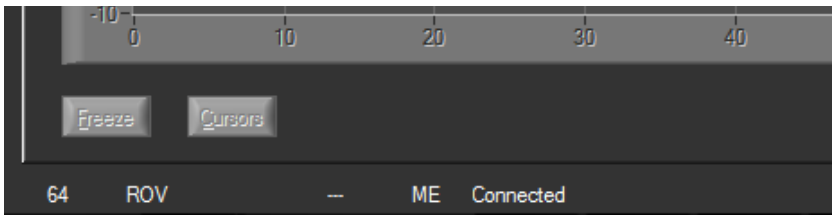
Once installed CygLink will place shortcuts in the start menu and on the desktop. Click either to start CygLink. You are first asked to either **Create New Survey**, **Open Survey** or **Continue** - choose **Continue** to proceed without a Survey loaded.



CygLink Main Screen with No Connection

Connecting to the ROV Gauge

To connect to the ROV gauge, assuming the gauge is connected and turned on, from the menu click **Connect** then **Discover New Gauge and Connect**



Bottom Left of CygLink Main Screen with Connection to Gauge

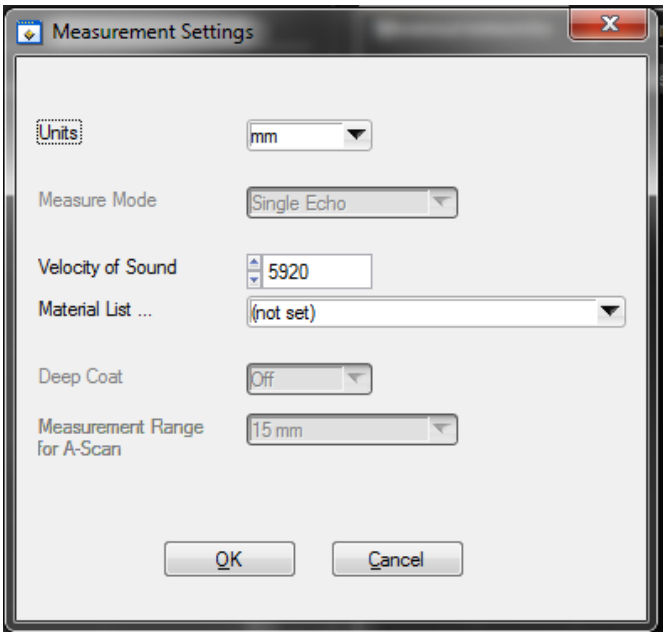
The Connection Status is shown in the status bar at the bottom left. Shown in the status bar are:

- An incrementing number
- The Gauge type (M4-ROV)
- The Echo Mode (Multiple Echo)

- Connected

Changing Gauge Settings

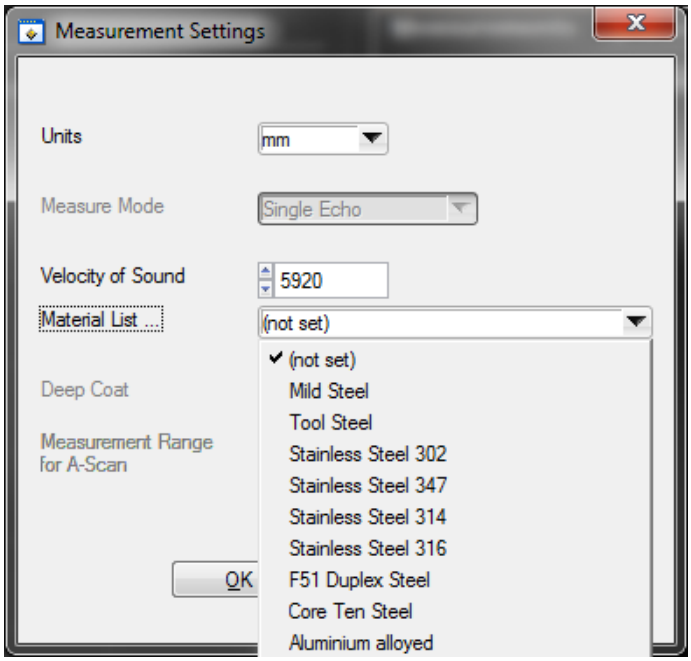
To change the gauge settings click **Setup** -> **Measurement Setup**. You can change the Units and Velocity.



Measurement Settings Screens

Material Velocity List

You can select the Velocity from a list of common materials. In the Measurement **Settings** click on the **[▼]** next to **Material List** and a drop down list will appear click on the desired material.

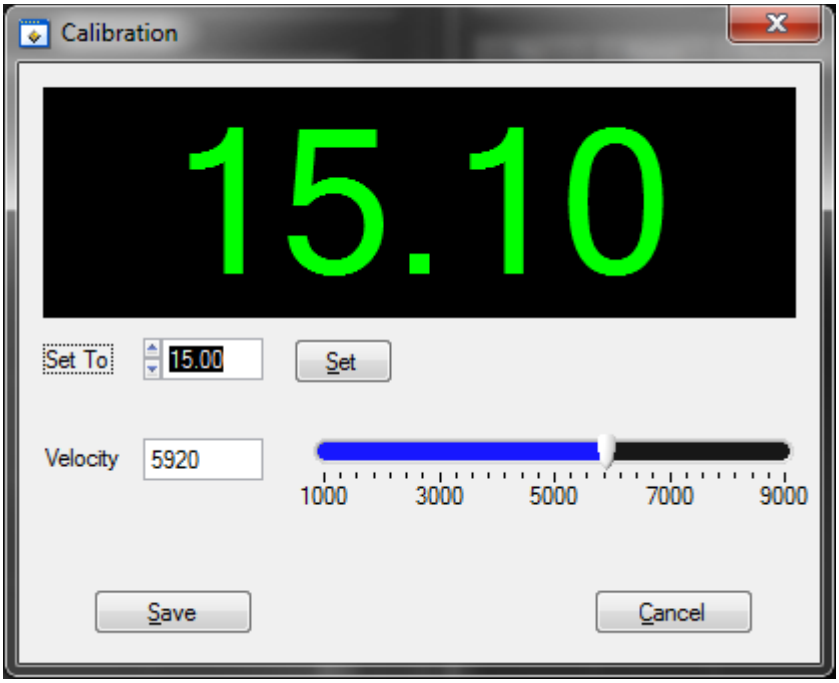


Velocity List

Calibrating to a Known Thickness using CygLink

The CygLink display can be calibrated to a known thickness by using the Gauge to measure a sample of the material that will be measured. This method ensures the velocity of sound is set for the actual material being measured rather than using a "generic" value.

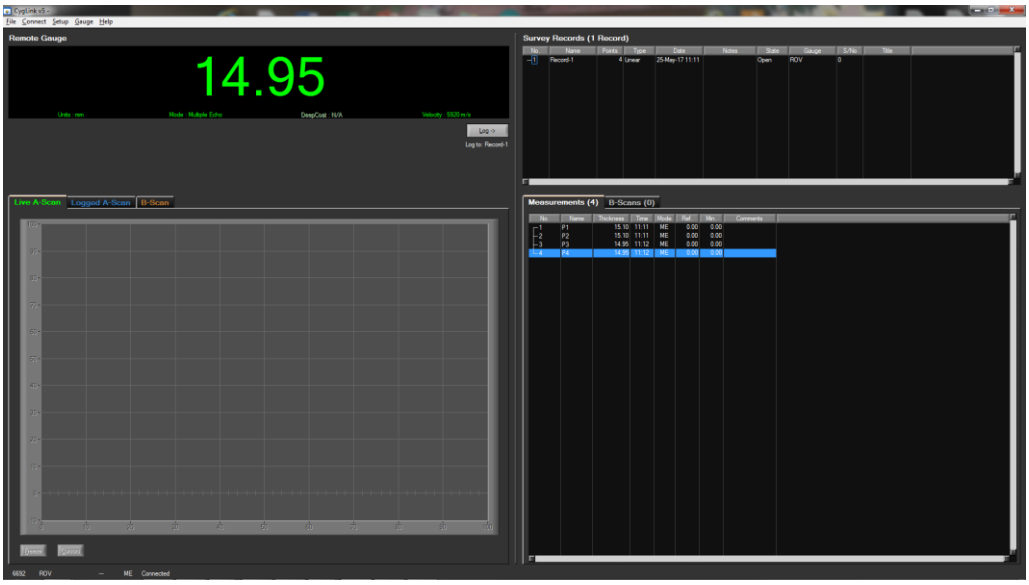
1.	Place and hold the Gauge's ultrasonic probe on the material sample using couplant if out of the water You should have a stable thickness measurement on the display
2.	Click **Setup** -> **Calibrate Thickness Measurement**. With the probe still held on the material sample.

	 Calibration Menu
3.	Select the value in the Thickness box and enter the known thickness of the sample being measured Press the **Set** and then **Save**
4.	Repeat from step 1 to check the calibration is stable.

CygLink Surveys and Data Logging

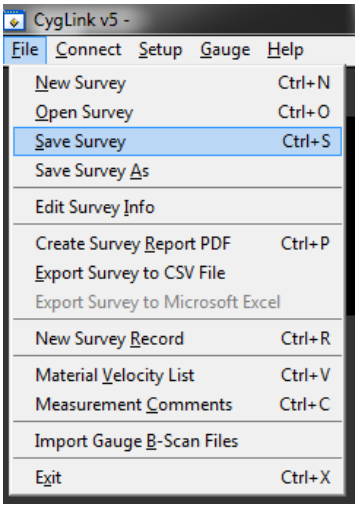
CygLink has the facility to store logged thickness measurements in a single Survey file. These measurements are organised into Survey Groups, each Survey Group can contain any number of thickness measurements. The whole Survey can be saved to a single file which can be emailed, or turned into a PDF paper report.

Survey	1 Survey
Groups	(1 to many groups)
Measurements	(1 to many measurements)



Right side of CygLink Main Screen with a Survey Group with Measurements.

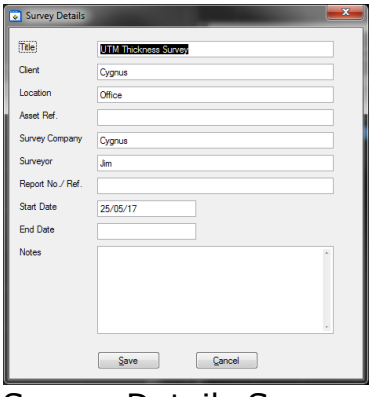
You can Save, Open or Create new Surveys from the File menu;



File Menu.

Editing the Survey Details

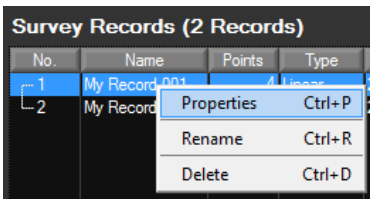
The Survey contains all the Groups and is used to save all the data. You can also add details to the Survey that will be printed at the beginning of the PDF report. To create or edit the Survey details click **File** -> **Edit Survey Details**.



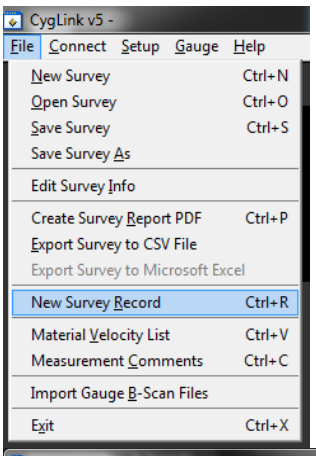
Survey Details Screen.

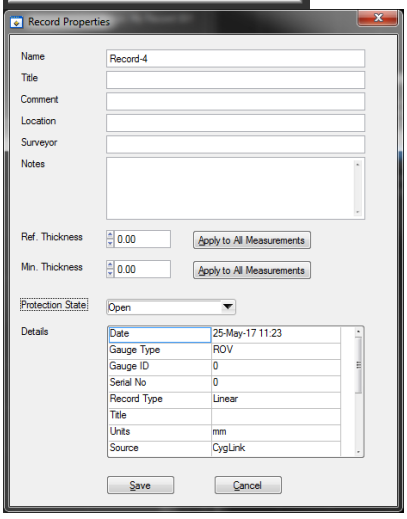
Editing the Survey Group Details

To view and edit the survey Group details right click the Survey Group and select properties.



To create a new survey record click File and select **New Survey Record**. Here you can set and related information such as a Reference Thickness and Minimum Thickness.





Reference and Minimum Thickness Criteria

You can set a Reference Thickness and Minimum Thickness for each survey Group in the **Survey Group Details** screen. This will be applied to all measurements in the Group.

The Reference Thickness is the thickness of metal when new.

The Minimum Thickness is the minimum thickness – any measurement below this will be highlighted Red on the screen and in the survey report.

Producing a Survey Report Document

A PDF report can be produced containing all the Groups and thickness measurements in the Survey, grouped by each Survey Group. From the **File** menu select **Create Survey Report PDF**. You will be prompted for a filename first for the report first.

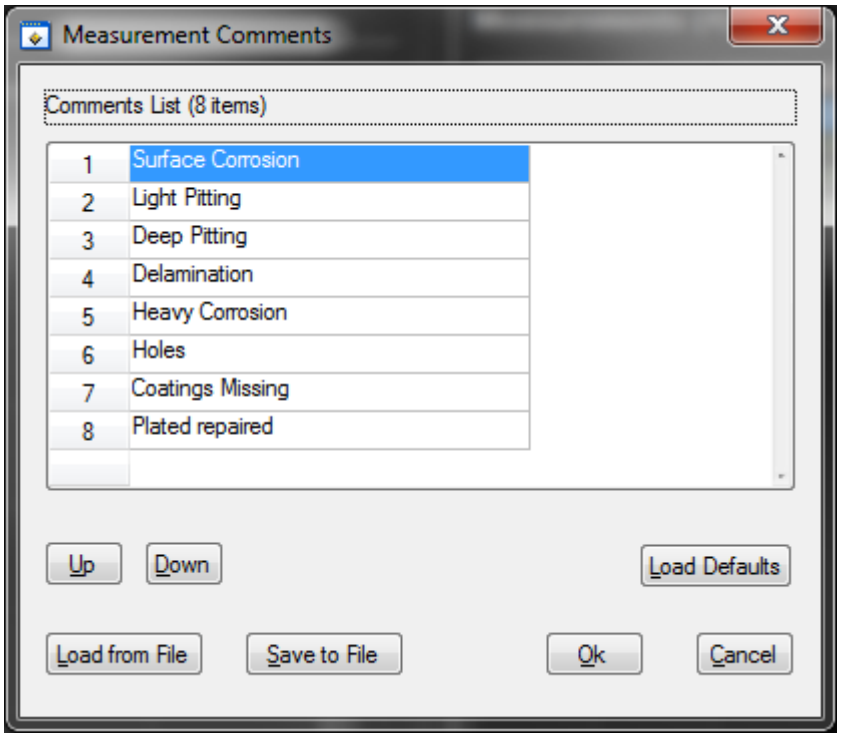
Once the export process is complete, your report will automatically be displayed in your installed PDF viewer. The export may take a few seconds, depending on the number of logged measurements.

Logging Measurements Directly in CygLink

You can use CygLink to log the displayed topside thickness measurements into a Survey so they can be presented in the Survey report. To do this click the **Log** button below the thickness measurement.

Pre-Set Measurement Comments List

You can add up to 8 short text comments that can then be used to append to a thickness measurement. To setup your comments click **File** -> **Measurement Comments**.

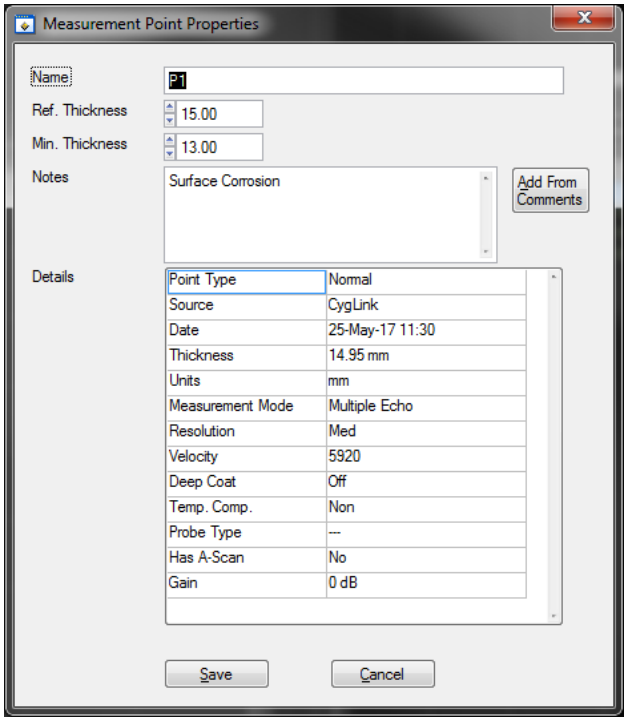


Measurement Comments Screen.

Adding Comments or Notes to a Measurement

You can add your own quick text Notes to any logged thickness measurement, just select the measurement point in the list and right click to display more options.

Click **Add Note** to type in a brief text note.



CygLink Trouble Shooting

Connection Problems – USB Drivers

If you are unable to get a connection the first thing to try is updating the USB drivers for the Serial to USB converter. Windows is constantly being updated and as a result drivers also need to be updated to keep track of changes.

The Serial to USB converter used for the ROV gauge is manufactured by KK Systems and uses Prolific drivers. You can search the web for the latest drivers from Prolific;

Type this into Google search "**KK SYSTEMS USB232**"

Or follow this link directly to the KK Systems website;

http://www.kksystems.com/english/html_files/software.htm
Follow the instructions for USB232 Windows Drivers;

Wiring Problems

Sometimes the cable between the ROV gauge and the USB converter is damaged, or has been repaired incorrectly. Although there are only 2 data wires they must be connected the correct way around. Double check the connections from the gauge's connector to the serial converter connection.

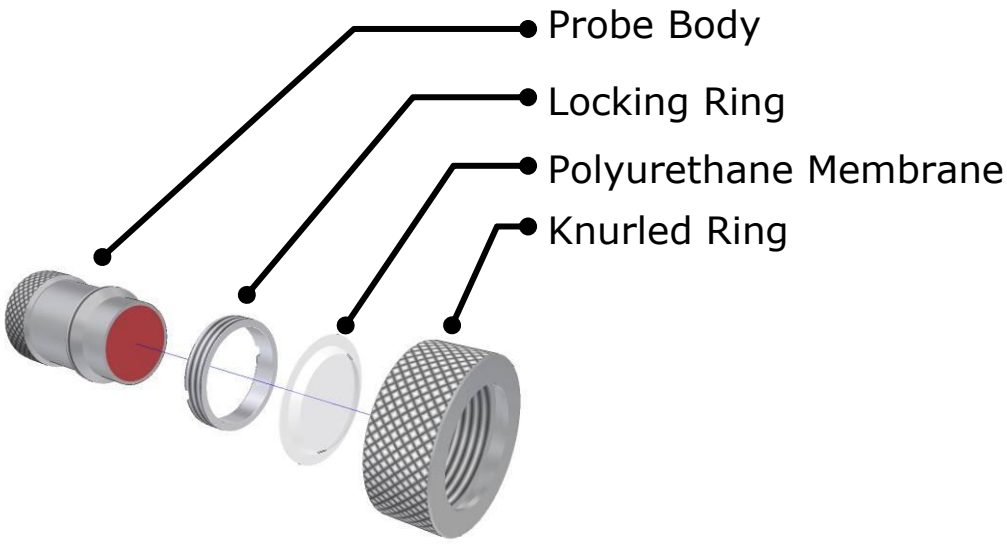
If you have the short serial to USB interface cable – check the gauge can connect to CygLink using this cable – if it works then the USB driver must be ok, the problem may lie in the long umbilical cable.

8. 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.

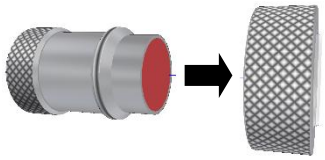
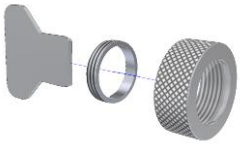
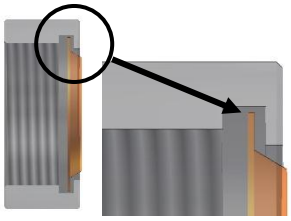
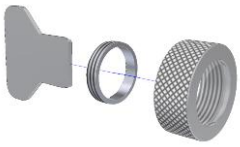
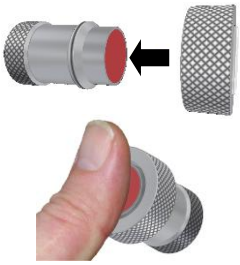


Probe Selection

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

- Large diameter probes produce more energy which gives better performance on heavily corroded or coated 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.	You should see the membrane has a very thin film of couplant between itself and the probe face with <u>no air bubbles</u>	

Probe Selection & Specifications

Crystal Diameter	Frequency	Measurement Range	Application
13 mm ½ inch	2¼ MHz	3.0 – 250 mm[4] 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;

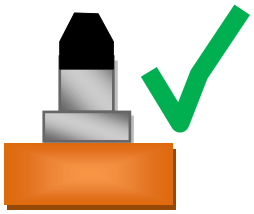
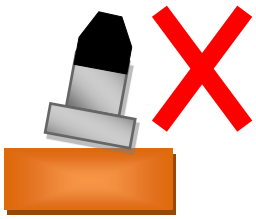
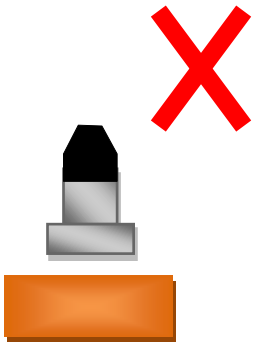
Red = 2.25 MHz	Orange = 3.5 MHz	Black = 5.0 MHz

ROV Probes
Coloured Probe Face


[4] 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.

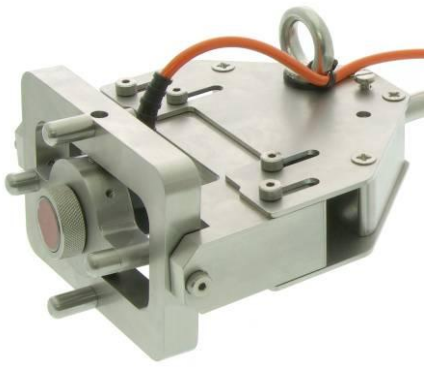
Mounting the Ultrasonic Probe

The Ultrasonic Probe is responsible for generating then transmitting and receiving the ultrasonic signal through the material being measured. To ensure the ultrasonic probe has the best chance of detecting the return echoes there are some basic rules that need to be considered when designing the probe holding tooling;

1.	The probe face must be presented flat/perpendicular to the surface being measured		
2.	Apply gentle pressure to the probe while measuring to maintain contact with the surface		

Cygnus Probe Handling Solutions

Cygnus Instruments has designed tooling for Work Class ROVs specifically to enable the ultrasonic probe to be held in three or four jaw manipulators whilst offering shock protection and automatic alignment of the probe face.

The Cygnus W1 Work Class Probe Holder 'T' and Fishtail Handles allow holding in common manipulator jaws.	

9. Gauge End Plate Removal

The Gauge has a removable end cover plate which allows access to the Option Switch and Fuse.

The End Plate has the pressure relief valve and the securing eye fitted to it (NOT the SubConn® connectors).



The end cover plate must be removed and re-fitted exactly as directed in this manual. Failure to re-fit the cover plate correctly could result in damage to the Gauge when submerged.

End Plate Removal Instructions

1.	Place the Gauge on a clean work bench and remove the large O-ring from the outside of the Gauge	
2.	Using a 3mm hex drive or Allen key gradually loosen each bolt Remove the 12 bolts	

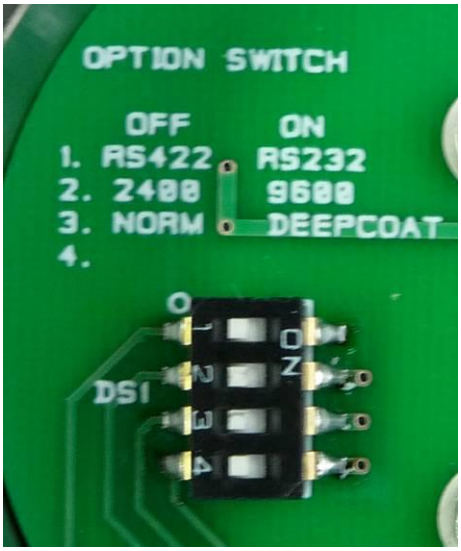
3.	The end plate can be removed exposing the Options Switch, Fuse and Status LED	

Changing the Options

The DIP Switch (DS1) is used to set the three options as required. Use a small screwdriver and gently slide the white slider left or right as required. The ON position is to the right (marked ON on the switch).

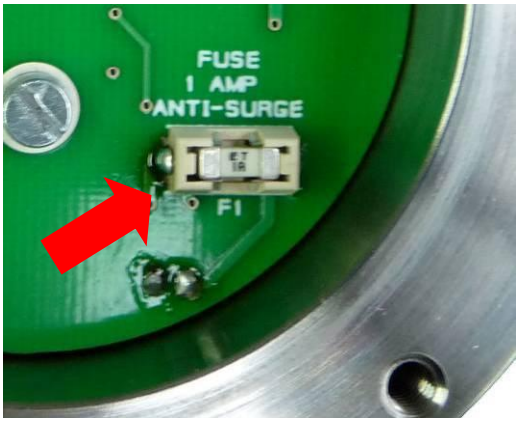
The default position is all options OFF.

Options;		
Position	**OFF**	**ON**
1	RS-422	RS-232
2	2400 Baud	9600 Baud
3	Normal	Deep Coat
4	(not used)	



Changing the Fuse

The Gauge is protected by a 1 Amp anti-surge cartridge fuse. Should you suspect the fuse has blown and wish to replace it a spare fuse is included in the Gauge kit. If you wish to order additional fuses they are available from a Cygnus outlet or larger electronic suppliers.

The fuse is removed with a pair of small needle nose pliers. Littelfuse, Part No. : 0452001.MRL Farnell stock number : 992-2342 RS Stock No. : 541-3625	

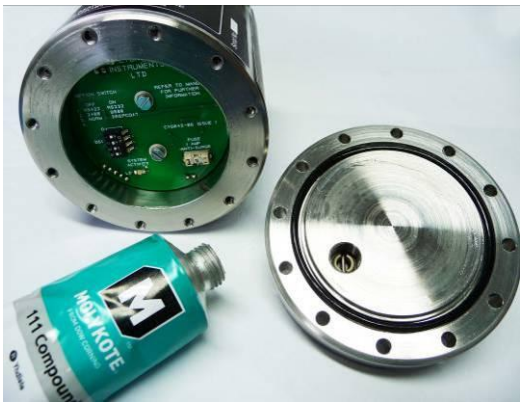
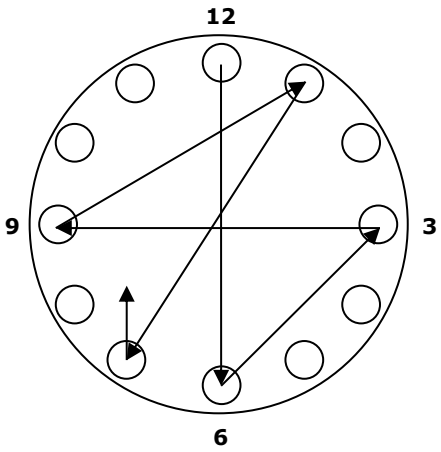
Testing the Gauge for Operation

There is a small red Status LED which pulses when the Gauge is operating. You can check the operation of the Gauge by applying power to the Gauge and looking for the LED operation.

When the Gauge is idle the LED will flash at 0.5 second intervals. When the Gauge is measuring thickness the LED will flash at 0.25 second intervals.	

End Plate Refitting Instructions

1.	Clean the mating faces of the Gauge and the end plate removing any old silicone grease Check the O-Ring – if it shows any signs of damage or ageing replace it	

2.	Apply a thin coat of Silicone Grease to the clean mating face of the Gauge Coat the O-Ring with Silicone Grease and fit in to the end plate groove	
3.	Fit the end plate to the Gauge ensuring the O-Ring stays in place Screw the 12 bolts in <u>finger tight</u> only.	
4.	Using a Torque Wrench gradually tighten the 12 bolts in the following sequence; 12, 6, 3, 9, 1, 7, 11, 5, 2, 8, 10, 4 Torque Settings; **M5-ROV-2K Black Gauge : 1.3 to 1.5 Nm (max)** **M5-ROV-4K Silver Gauge : 2.8 to 3.0 Nm (max)**	
5.	Finally re-fit the large outer O-Ring by rolling over the body	

10. 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.

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.

11. Troubleshooting

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, try and take 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 which are too low cause doubling and tripling of the actual thickness.

12. The 3 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 37.

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 to the Gauge on Page 12

3. **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? (See page 38)

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.

13. Care and Servicing

Cleaning the Gauge

- ✘ Do not use solvents to clean the Gauge
- ✘ Do not use any abrasive cleaners

Environmental

- ✘ Do not subject the Gauge to temperatures greater than 60°C (140°F)
- ✘ Do not store the Gauge and its kit for long periods in conditions of high humidity

Repairs

- ✘ Apart from the fuse 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 dealer

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 45.

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 of an Intermittent Nature?
- Is there a problem turning the Gauge On?
  Or a problem with the Gauge turning itself off?
- Does the Gauge consistently give Incorrect or Unsteady Readings?

- Is it not possible to calibrate the Gauge?

14. Information

Technical Specifications

General Attributes		
Size	127 mm long x 90 mm diameter (5 in x 3.5 in)	
Weight In Air	Model M5-ROV-2K 900 g (2 lb) Model M5-ROV-4K 4100 g (9 lb)	
Power Supply	External 7 to 30 V DC 150mA Supply	
Probe Sockets	SeaCon / SubConn Micro Series 2 Way Connector MCBH2F / MCIL2M	
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)	
PRF	602 Hz	
Monitor Outputs	N/A	
Through Coating Measurements.	Coatings up to 3 mm thick as standard. Coatings up to 20 mm thick in **Deep Coat**[5] 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: 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 and measurement <100.0 mm
	±0.1 mm (±0.005”)	Low Resolution Mode or measurement >99.95 mm
Resolution	0.05 mm (0.002”)	High Resolution Mode and measurement <100.0 mm
	0.1 mm (0.005”) Selectable.	Low Resolution Mode or measurement >99.95 mm
Display		
Type of Display	Remote Display Unit	
Display Size	N/A	
Transmitter		
Shape of Pulse	Square	

[5] To use **Deep Coat** mode consult Cygnus Instruments Ltd.

Pulse Energy : Voltage (peak-to-peak)	30 V p-p
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.	RS-422 or RS-232 serial data output, 2400 or 9600 Baud
Power & Data Connector	SeaCon / SubConn Micro Series 6 Way Connector MCBH6M / MCIL6F
Calibration setting storage.	Calibration performed at Remote Display Unit
Calibration Mechanisms.	N/A (Multiple Echo Gauge)
Display & Recall Facilities.	N/A
Display Response Time.	250ms/500 ms
Printer Output.	N/A
Environmental Rating.	Model M5-ROV-2K IP68 Rated to 2000m (6,562 ft) continuous immersion in sea water Model M5-ROV-4K IP68 Rated to 4000m (13,123 ft) continuous immersion in sea water
Compliance.	RoHS Compliant.
Designed for	BS EN ISO 16831.

Design Pressure Test Certificates

Model	Certificate Details
M5-ROV-2K	Testing Company : Atlas Elektronik UK, Winfrith Newburgh Test Date : 19/01/2011 Certificate Number : PTC893 Test Pressure : 300 bar
M5-ROV-4K	Testing Company : MacArtney, Aberdeen Test Date : 02/09/2010 Certificate Number : 1923 Test Pressure : 600 bar

15. Serial Data Format

The CygLink program and TSR are provided to automatically decode the measurement data sent from the Gauge, and to provide a calibrated display of the results. For users who want to display and log the data using their own software such as StarFix®, this section describes the arrangement of the data sent from the Gauge.

Note the ROV Gauge has a fixed Velocity of Sound value of 6400 m/s, you must re-scale the received thickness value for the velocity of sound required.

For example when measuring carbon steel with a velocity of 5920 m/s you will need to apply the following conversion factor;

True Thickness = Received Thickness * 5920/6400

Protocol

1. Unidirectional - Gauge transmits only
2. Eight Data bits, 1 Start bit, 1 Stop bit, No Parity; 2400 baud
3. Four packets per second
4. *Valid-Reading* packet-length : 7 bytes
5. *No-Reading* packet-length : 3 bytes

Valid Thickness Measurement Packet Arrangement

Byte	1	2	3	4	5	6	7
Name	SOH	Status	Data1	Data2	Data3	Data4	ETB
Type	1h		ASCII	ASCII	ASCII	ASCII	17h

No Thickness Measurement Packet Arrangement

Byte	1	2	3
Name	SOH	Status	ETB
Type	1h		17h

Status-byte Structure

Bit	Name	Details
7	Gauge Type	=1 (always)
6	Resolution	1 = High Resolution 0 = Low resolution
5	Units	0 = Metric mm 1 = Imperial Inch
4	Reading Range	1 = High Range 0 = Low Range
3, 2	Echo Count	Number of echoes found (0..3)
1	Calibration	1 = Remote (always)
0	No-Reading	1 = No Thickness Reading 0 = Valid Thickness Reading

Data-bytes Arrangement

The four data bytes are ASCII-encoded, decimal thickness value. Data byte 0 is most-significant. Leading-zeroes are replaced by ASCII Space [hex 20]. Decimal points are implied from the Status-byte – Units, Resolution and Range bits:

Reading-type	Hi-Range	Lo-Range
Imperial, Lo-Resolution	**x x . x x**	**x . x x x**
Metric, Lo-Resolution	**x x x . x**	**x x x . x**
Imperial, Hi-Resolution	**x x . x x**	**x . x x x**
Metric, Hi-Resolution	**x x x . x**	**x x . x x**

Interpreting the Readings sent from the Gauge

Decimal Point position	Decimal Point position is implied from the combination of Range, Resolution, and Units bits in the Status byte of each Reading [see table above]
Range	The Gauge returns all Readings in a 4-byte decimal string Readings which require 5-bytes [e.g. 100.00+mm, or 10.000+inch] are auto-ranged to the 4 most significant bytes Range bit for every Reading must be read from the Status-byte
Resolution	The Gauge is factory set to Lo-Resolution setting: 0.1 mm, or 0.005 inch but may be changed by the user to Hi-Resolution setting : 0.05 mm, or 0.002 inch as required
Units	The Gauge has a default Metric Units-setting. The Units bit must be read from the Status-byte

16. 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 compression 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
Stainless Steel 314	5715	0.2250	0.965
Stainless Steel 316	5750	0.2264	0.971

F51 Duplex Steel UNS S31803	5715 - 5750	0.225 – 0.2264	0.956 – 0.971
Core Ten Steel EN12223 S355-J0	5920	0.2331	1.00
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 in the Table of Sound Velocities

17. Accessories List

Underwater Probes with 5 Meter Lead

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

Part No.	Description
001-9393	ROV Remote Probe 2.25 MHz 13 mm (1/2”)
001-9395	ROV Remote Probe 2.25 MHz 19 mm (3/4”)

Lower frequency probes offer better penetration on heavy corrosion/coatings. Please refer to page 38 for correct probe selection.



Probe Spares and Membranes

Polyurethane Membranes are for normal use on surface temperatures up to 75°C.

Teflon Membranes are for use on surface temperatures up to 150°C

Part No.	Description
001-3702	Standard Membranes (Polyurethane) (20pk) 6 mm (1/4”)
001-3701	Standard Membranes (Polyurethane) (20pk) 13 mm (1/2”)
001-3700	Standard Membranes (Polyurethane) (20pk) 19 mm (3/4”)
001-4873	Teflon Membranes (10pk) (High Temperature) 6 mm (1/4”)
001-4874	Teflon Membranes (10pk) (High Temperature) 13 mm (1/2”)
001-4875	Teflon Membranes (10pk) (High Temperature) 19 mm (3/4”)
001-3706	Membrane Couplant

Knurled Rings

Part No.	Description
001-2611	Probe Knurled Ring Locking Key 13 mm (1/2”)
001-2610	Probe Knurled Ring Locking Key 19 mm (3/4”)
001-3704	Probe Knurled Ring Assembly 13 mm (1/2”)
001-3705	Probe Knurled Ring Assembly 19 mm (3/4”)

Cables and Leads

Part No.	Description
001-0431	SeaCon 6way In Line Socket with flying lead
001-0439	Data Test & Power Cable RS232/422 for use with M5-ROV's

Electronic Bodies Only

Part No.	Description
001-7189/5	Cygnus ROV Mountable 2000m Gauge Body
001-7191/5	Cygnus ROV Mountable 4000m Gauge Body
001-7182/4	Cygnus Topside Repeater Display Unit with OSD

Miscellaneous Spares

Part No.	Description
001-4850	Steel Test Block 15 mm
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.
001-8308	'K3' RS-232 to RS-422 Isolated Converter
003-0422	RS-232 to USB Converter
001-3719	Spares Kit (O Rings, Silicone Grease, Fuses)

Carry Case

Part No.	Description
001-4813-ROV	Pelican Carry Case for Cygnus ROV Gauge Kit

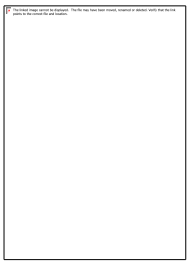
Software

Part No.	Description
001-8212	CygLink Topside Data Logging Program for Windows

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. Warranty Information

LIMITED THREE YEAR WARRANTY
FOR CYGNUS ULTRASONIC THICKNESS GAUGES

1. Cygnus Instruments Limited ("CYGNUS") warrants that, subject as set out below, the Products manufactured by it (excluding consumables, batteries, probes, leads, microphones and telescopic extensions) will be free from defects in materials and workmanship for a period of three years from the date of purchase either from CYGNUS or from an Authorised CYGNUS Distributor. Batteries, probes, leads, microphones and telescopic extensions are warranted for 6 months. This warranty is limited to the original Purchaser of the Product and is not transferable. During the warranty period, CYGNUS will repair, replace or refund, at its option, any defective Products at no additional charge, provided that the product is returned by the original Purchaser, shipping prepaid, to CYGNUS or an Authorised CYGNUS Distributor. If shipped by mail or any common carrier, the Purchaser must insure and accept all liability for loss or damage to the Product and must use shipping containers equivalent to the original packaging. Replacement products or parts will be furnished on an exchange basis only. All replaced products or parts become the property of CYGNUS.

2. Any defects in materials or workmanship must be notified to CYGNUS by the Purchaser within seven days after the discovery of the defect or failure.

3. Dated proof of purchase must be provided by the Purchaser when requesting warranty work to be performed or making any other claim under this warranty. CYGNUS will not be liable under this warranty unless the total price for the Product was paid by the due date for payment.

4. This warranty does not extend to any products which have been damaged as a result of, accident, misuse or abuse, natural or personal disaster, service, modification or repair by anyone other than CYGNUS or an Authorised CYGNUS Service Centre, failure to properly store or maintain the Product, negligence, abnormal working conditions, fair wear and tear, or failure to follow the instructions issued by CYGNUS in relation to the Product.

5. Except as expressly set forth above or in the CYGNUS Terms of Sale, subject to which the Products were purchased, all warranties, conditions or other terms implied by Statute or Common Law are extended to the fullest extent permitted by law.

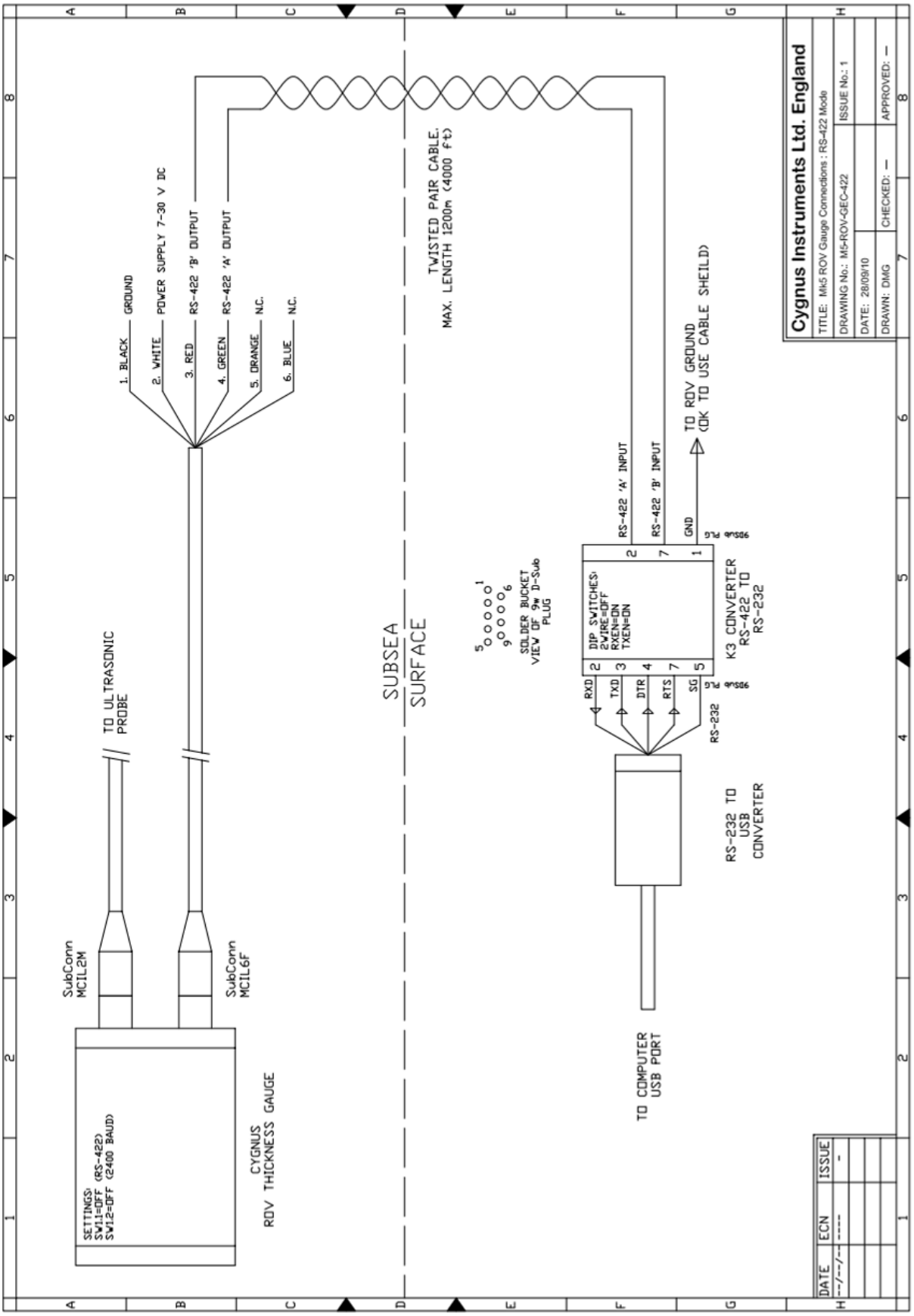
6. Except in respect of death or personal injury caused by the negligence of Cygnus, Cygnus shall not be liable to the Purchaser or to any other person by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law, or under the express terms of the contract for purchase of the Products, for loss of profit or for any indirect, special or consequential loss or damage, costs, expenses or other claims for compensation whatsoever (whether caused by the negligence of Cygnus, its employees or agents or otherwise) which arise out of or in connection with the supply of the Products or their use or resale by the Purchaser or by any other person. The entire liability of Cygnus under or in connection with the Products shall not exceed the price paid for the Products, except as expressly provided in this warranty.

20. Pressure Test Statement

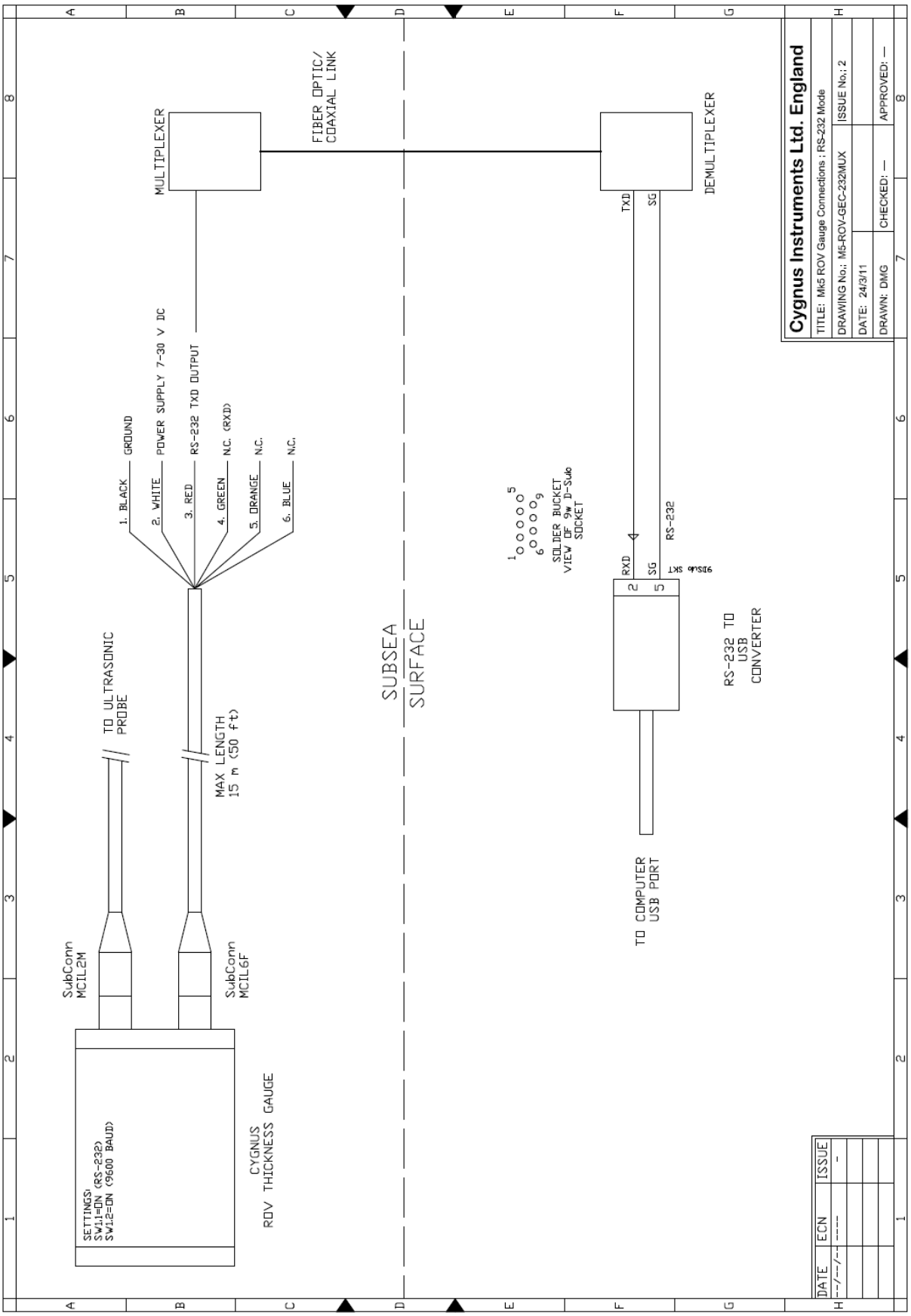
All MINI ROV gauges are pressure tested in water as part of our test procedures.

Please refer to the environmental rating section for further information.

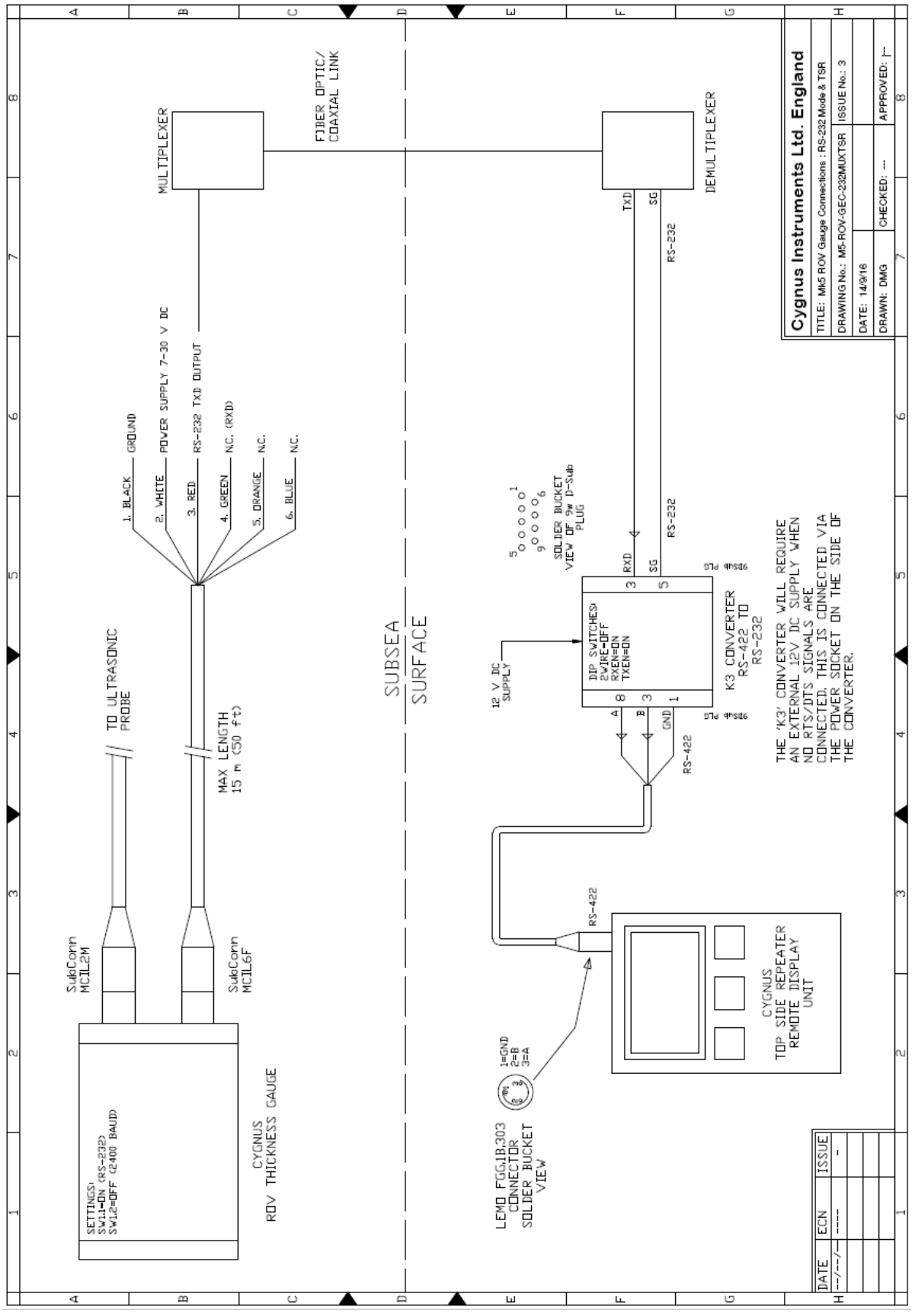
21. Schematic for RS-422 to Computer USB



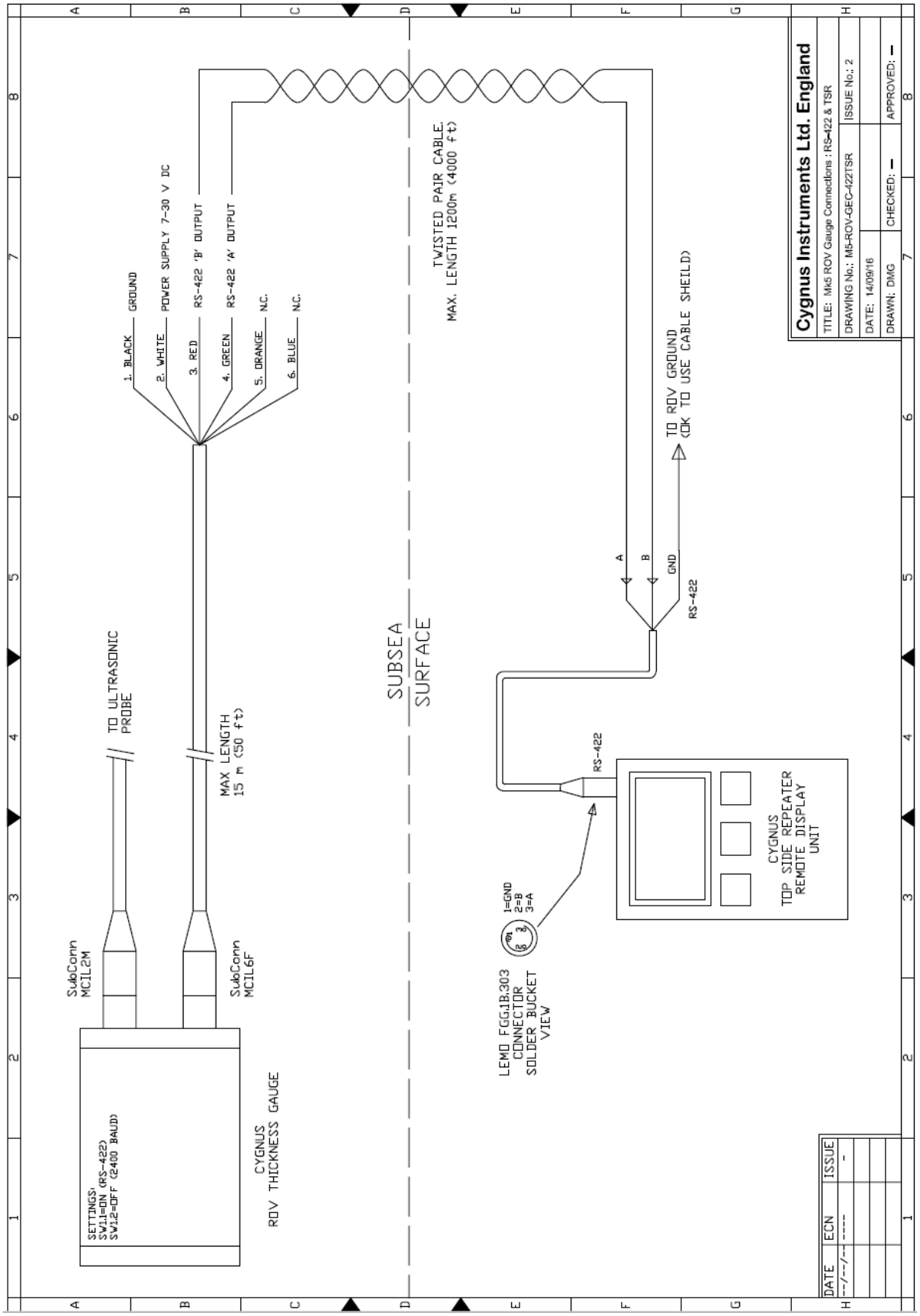
22. Schematic for RS-232 to Multiplexer



23. Schematic for RS-232 to Multiplexer to TSR



24. Schematic for RS-422 to TSR



25. Index

Accessories
  Cables and Leads, 57
  Carry Case, 58
  Electronic Bodies, 58
  Knurled Rings, 57
  Membrane Couplant, 57
  Miscellaneous Spares, 58
  Probe spares and mambranes, 56
  Software, 58
  Teflon Membranes, 57
Automatic Probe Frequency Setting, 13
Calibration
  Conversion Factor, 55
  Known Thickness, 16
Cleaning, 47
CygLink
  COM Port, 24
  Comment List, 33
  Comments, 34
  Connection to Gauge, 27
  Gauge Settings, 28
  Installation, 23
  Logging, 33
  Material Table, 28
  PDF, 33
Data Output, 12
Deep Coat, 13, 49
DIP Switch, 41
Disposal, 59
Fuse, 41
Gauge Options, 13
Measuring Through Water, 14
Multiplexer, 13
Nosecone
  Fitting, 13
Power Supply, 12
Probes
  Knurled Ring, 37
  Locking Ring Key, 37
  Membrane Couplant, 37
  Polyurethane Membrane Membrane, 36
  Selection, 36
  Specifications, 38
Problems, 47
Pulse-echo, 7
Recycling, 59
Repair, 47
Rough surfaces, 44
Serial Data Format, 51
Service, 47
Sound Velocities, 54
Specifications, 54
Test block, 16
Top Side Repeater, 17
Topside Repeater
  Automatic Display Backlight, 18
  Display Units, 17, 18, 29
  HOLD, 18
Torque Settings, 43
Triple Echo Verification, 7
Troubleshooting, 45
Unrelated echoes, 45
Video Overlay, 18
Warranty, 60
WEEE Directive, 59