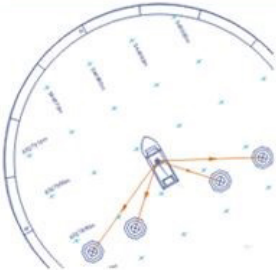


QUICK START GUIDE

 **Sonardyne**
SOUND IN DEPTH

GG 



Micro-Ranger 2

Version 6

Options

AUV Tracking	✓ Backdrops
Extended Range	LUSBL / DP-INS
MRAMS	✓ Multi-AHRS
Multi-User	Riser Profiling
Robotics	✓ USBL

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MICRO-RANGER 2 V6.03 USBL SYSTEM



SAFETY & SUPPORT

Before any activity is carried out on the equipment, it is recommended that the included Sonardyne Safety Manual and all warnings and cautions in this and the equipment manual(s) are read and fully understood. It is recommended the operator complies with the Health and Safety Regulations applicable to the vessel and the region before operating this equipment.

Operators and service personnel must be familiar with the normal operating and safety procedures for subsea equipment.

Documentation must be consulted whenever a  or  warning symbol is found on the equipment, in order to determine the nature of the potential hazard and any actions which must be taken.

If any additional equipment is used, any warnings and cautions in the equipment user manual must be read and fully understood and the equipment must only be used as specified by the manufacturer.

The safety of any system incorporating this equipment is the responsibility of the assembler of the system.

WARNINGS

Personal protection. Appropriate protective equipment such as protective footwear, hard hat and gloves must be worn when handling or carrying out any procedures involving Sonardyne and other equipment.

Heavy equipment. Many Sonardyne products and equipment types, such as transponders, transceivers, cable drums etc. require Manual Handling Equipment (MHE) for lifting due to their heavy weight. If MHE is not available, it is the responsibility of the operator to perform a manual handling risk assessment prior to carrying out manual lifting/handling. Refer to the individual equipment documentation for weight specifications.

Make sure the equipment is clean and dry before removing the connection cover and connecting any cables.

PRODUCT SUPPORT

Email: support@sonardyne.com Telephone: +44 (0) 1252 872288

24 Hour Emergency Helpline: +44 (0) 1252 877600

The Sonardyne 24 hour helpline is answered during normal UK office hours: 08:00–17:00. Outside these hours, your call is automatically transferred to an operator who will log the details of your emergency and alert the appropriate Sonardyne personnel. Our aim is to ensure that emergency requests are dealt with immediately during office hours and are responded to within 30 minutes at all other times. Alternatively, please contact your nearest Sonardyne Office.

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To view third party and open source software licence notices for Micro-Ranger 2, see *UM-8241 "Micro-Ranger 2 USBL User Manual"*.

ABOUT THIS QUICK START GUIDE

This QSG describes the basic installation, configuration and troubleshooting of the Micro-Ranger 2 system in the following steps:

- *Technical Description*
- *Hardware Description*
- *System Installation*
- *Configuration*
- *Beacons*
- *Calibration*
- *Troubleshooting*
- *Support*
- *Definitions*

RELATED PUBLICATIONS

For more information on the Micro-Ranger 2 system, refer to the following user manuals:

- *UM-8241 "User Manual for Micro-Ranger 2"* (included with Micro-Ranger 2)
- *UM-8211 "User Manual for the ESH"* (included with the ESH)
- *UM-8141 "User Manual for Type 8241 Micro-Ranger Transceiver"* (included with the MRT Transceiver)
- *UM-8262 "User Manual for Type 8262 Nano Transponder"* (included with the Nano)
- *UM-8370 "User Manual for Type 8370 WSM 6+"* (included with the WSM 6+)
- *UM-8300-099 "User Manual for 6G Terminal Lite"* (included with 6G Utilities)

PRODUCT SUPPORT VIDEOS

Visit the Sonardyne YouTube channel for additional advice on using your Micro-Ranger 2 system.

INTRODUCTION TO MICRO-RANGER 2

Micro-Ranger 2 is a portable survey-grade Ultra-Short BaseLine (USBL) system designed for inter-coastal operations operated from any vessel type, where up to 10 targets can be tracked at up to 995 m range.

A typical Micro-Ranger 2 system consists of:

- Ethernet Serial Hub (ESH)
- Micro-Ranger Transceiver (MRT) and Nano or other Sonardyne 6G beacon

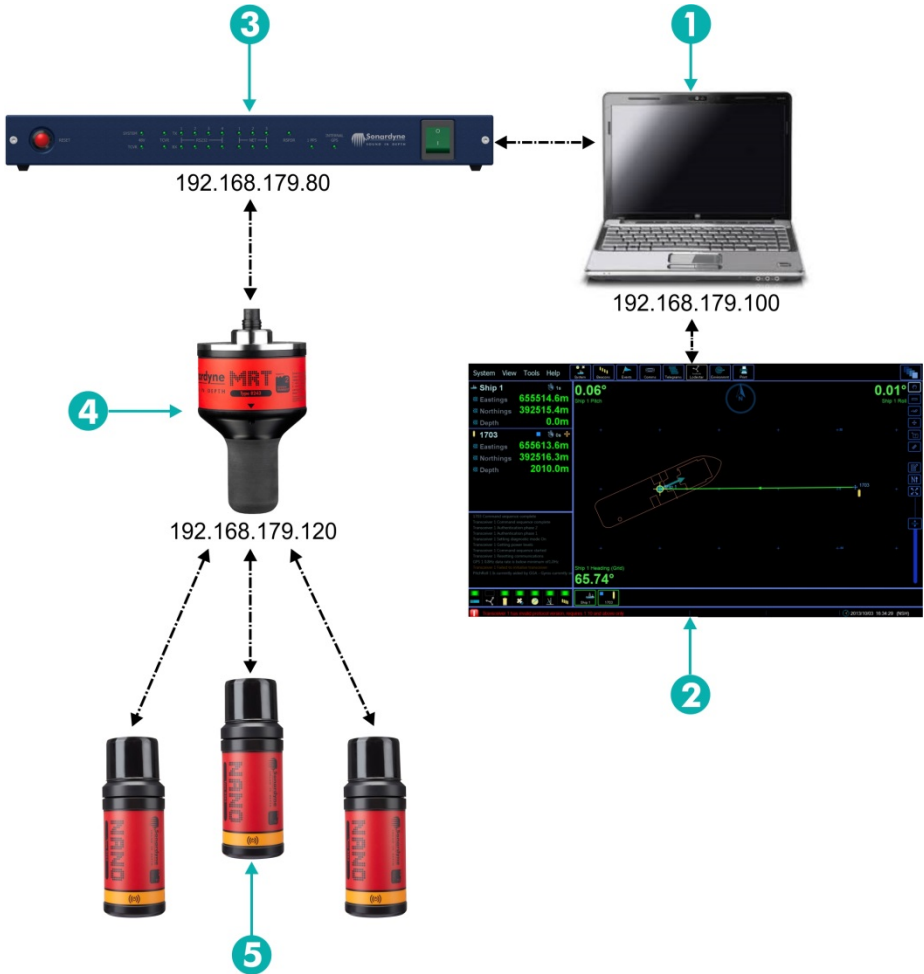
The ESH is the network interface between the in-water acoustic instrument, GNSS and the PC that runs the positioning software and provides power and communications for acoustic transceivers. The ESH supports responder trigger and 1PPS synchronisation across systems.

The MRT has an array ideally suited for high elevation tracking survey operations. The integrated Xsens Magnetic compass and dedicated Ethernet interface delivers a rapid installation and track solution.

An extensive set of tools allows the system performance to be optimised, including real-time visual signal and noise analysis graphs. Sonardyne's CASIUS 6 calibration tool allows correct calibration of transceiver offset and orientation, improving positioning accuracy. Micro-Ranger 2 and Ranger 2 systems share similar beacons and software allowing a simple and cost effective upgrade path as requirements expand.

MICRO-RANGER 2 SYSTEM EQUIPMENT

A typical system comprises of the following components.



1 PC (not supplied)

2 Micro-Ranger 2 Software

3 ESH and Cable

4 Micro-Ranger Transceiver

5 Nano, WSM 6+ or other Sonardyne 6G Beacon

Software Security Key (not shown)

GNSS Aerial (not shown)

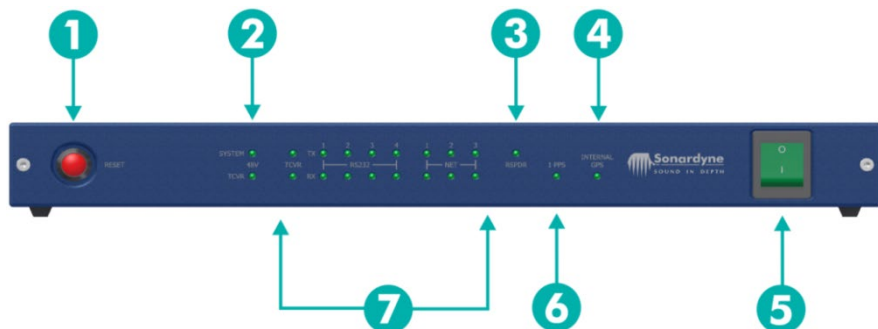
STEP 4

HARDWARE DESCRIPTION

ETHERNET SERIAL HUB

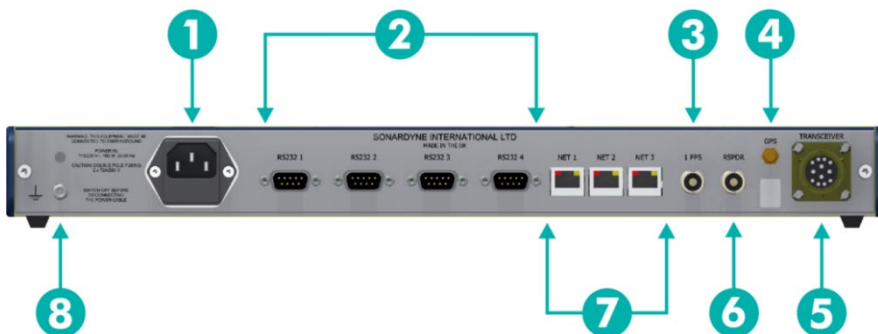
Refer to *UM-8211 "User Manual for ESH"* for more details.

FRONT



- | | |
|------------------------------------|----------------------|
| 1 Reset Button | 5 Power Button |
| 2 Transceiver Supply Status | 6 1 PPS Activity LED |
| 3 Responder Activity LED | 7 I/O Activity LEDs |
| 4 Internal GPS (GNSS) Activity LED | |

REAR



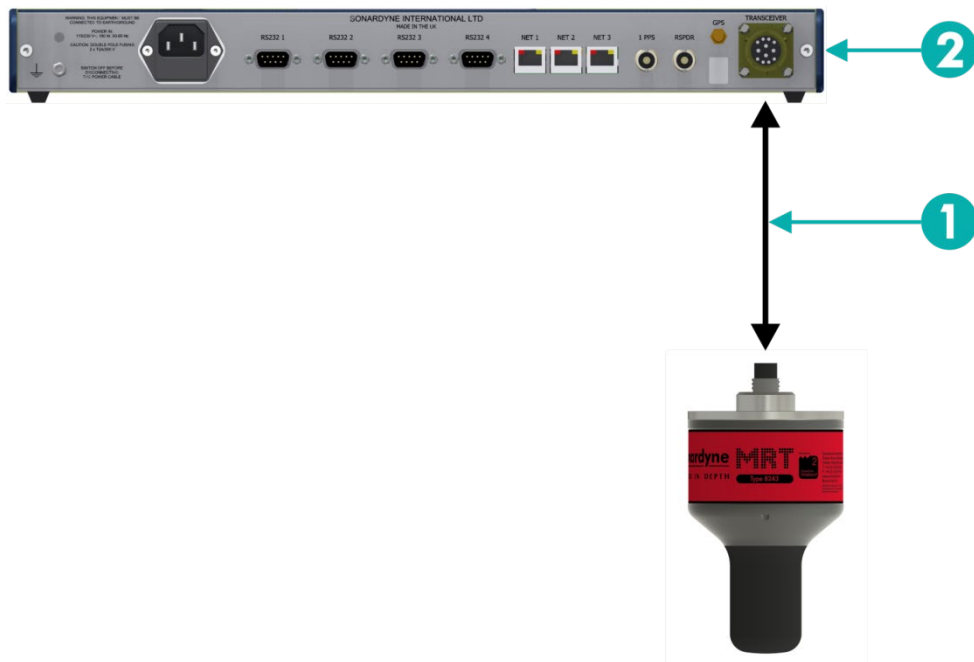
- | | |
|--|---------------------|
| 1 IEC Socket 115/230 V AC | 5 48 V Transceiver |
| 2 RS232 Serial Ports | 6 Trigger Responder |
| 3 1 PPS Input | 7 RJ45 Ethernet |
| 4 External GPS (GNSS) Antenna Connection | 8 Chassis Earth |

STEP 5

HARDWARE DESCRIPTION

MRT CONNECTION

Refer to *UM-8141 "User Manual for Type 8141 Micro-Ranger Transceiver"* for more details.



1 Cable Assembly CPN 820-0373 (10 m)

2 ESH

INSTALLING MICRO-RANGER 2 SOFTWARE

Micro-Ranger 2 software has been tested on Windows® 7 and Windows 10 operating systems. The recommended minimum PC specification to run this software is an Intel® Core i7 2.6 GHz processor, 8 GB RAM, 10 GB of free disk space and a graphics card with Direct-X V10 or later. The prerequisite Windows updates and .NET Framework are included on the installation media and are installed automatically.

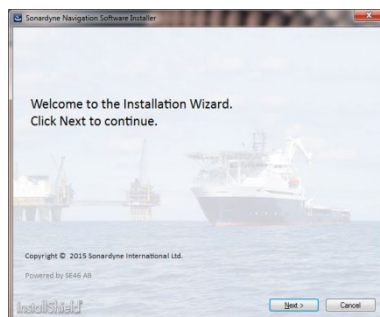
Refer to *UM-8241 "Micro-Ranger 2 User Manual"* for more information on installing and operating the software.

Notes

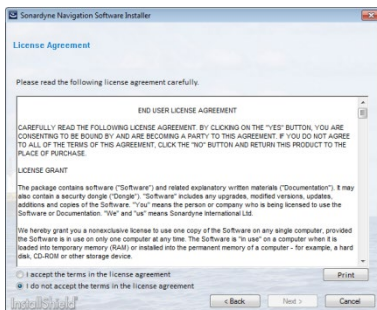


Previous versions of the software must be removed using 'Add and Remove Programs'. The dongle security key must be installed on the PC when installing and operating the system.

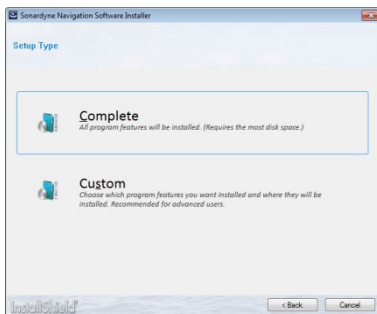
1. Insert the installation media and then navigate to and double-click **Setup.exe**
2. After the Windows Security window opens click **Install** to install the security key drivers.
3. After the security key drivers have finished installing, insert the security key into a USB port on the PC.
4. Click **Next** on the Installation Wizard window to start the installation.



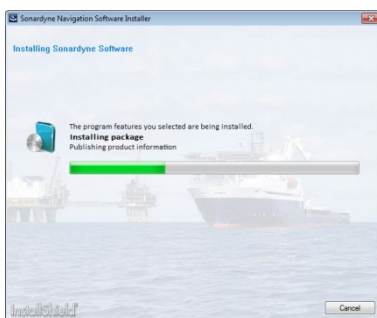
5. Click **Yes** to accept the licence agreement



6. Select either **Complete** (recommended) for a complete installation or **Custom** to install individual components.



7. Click Next to start the installation. A progress bar indicates the installation progress.



8. Click **Finish** to complete the installation.

STEP 8

SYSTEM INSTALLATION

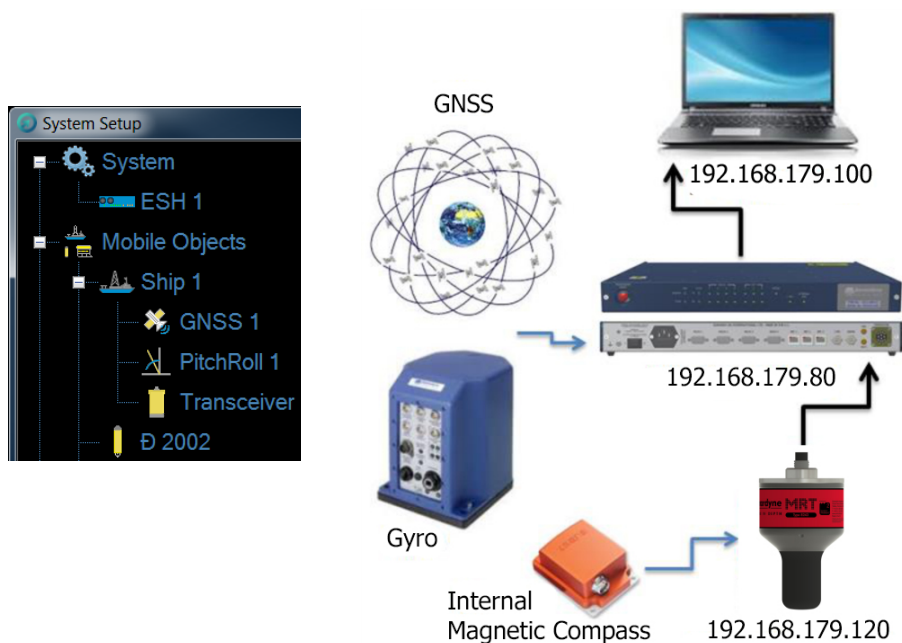
INSTALLING 6G TERMINAL LITE SOFTWARE

6G Terminal Lite software is included on the software utilities media. 6G Terminal Lite is a diagnostic tool for 6G instruments. It displays key information about the 6G instrument being interrogated serially and also allows for setup, diagnostics and testing prior to deployment.

Refer to the *UM-8300-099 "User Manual for 6G Terminal Lite"* for installing and operating 6G Terminal Lite.

TYPICAL SYSTEM SETUP

A typical system setup is shown below. The Micro-Ranger 2 System Setup window is shown on the left with objects configured in the job tree.



CONFIGURING THE NETWORK (PC AND ESH IP ADDRESS)

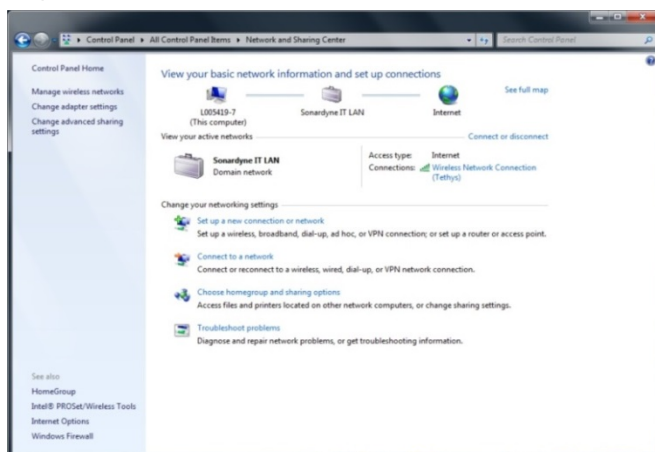
When the ESH is started for the first time, or if the non-volatile memory is restored to the factory settings for any reason, the ESH defaults to a static IP address of 192.168.179.80.

Before starting Micro-Ranger 2 software the PC connecting to the ESH must be configured with the correct IP address on the same subnet.

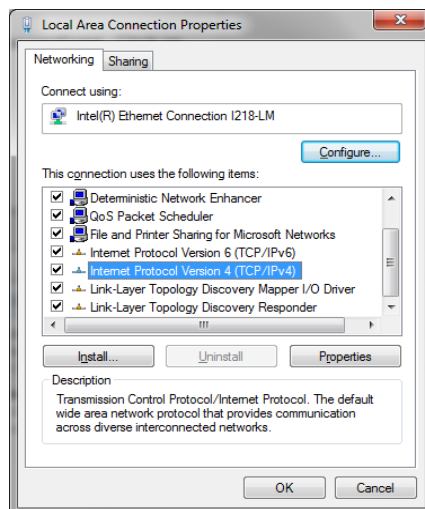
STEP 9

SYSTEM INSTALLATION

1. Connect the ESH to the PC using an Ethernet cable.
2. On the PC, open the **Control Panel** and click **Network and Sharing Center**.



3. On the left pane, click **Change adaptor settings**, right-click the **Local Area Connection (LAN)** and then select **Properties**.
4. On the **Networking** tab, click **Internet Protocol Version 4 (TCP/IPv4)** and then click **Properties**.

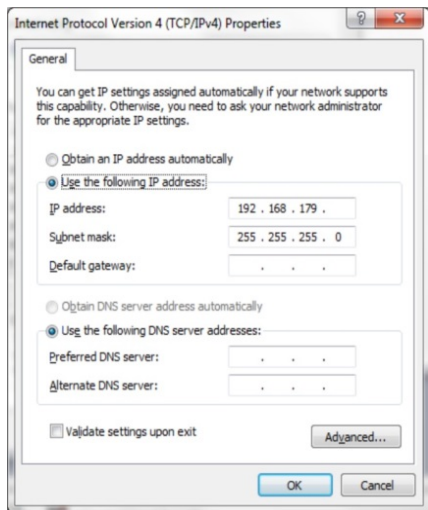


5. Change the IP address to a static address: **192.168.179.X** (where X is any number between **1-255** e.g. **192.168.179.100**, except **50, 51, 80, 150 & 200** as these are used by other Sonardyne instruments.

STEP 10

SYSTEM INSTALLATION

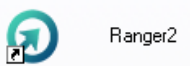
6. Click **OK**.



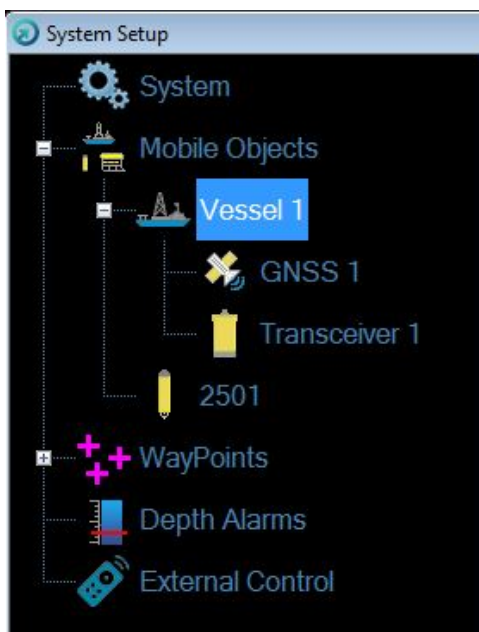
7. The unidentified Local Area Connection will be displayed in the Network Connections.

STARTING MICRO-RANGER 2

Double-click the **Ranger 2** desktop icon to start the software.



For a new installation Micro-Ranger 2 displays the System Setup with GNSS and Transceiver installed.



CONFIGURING A GNSS

Port ESH/5A (baud rate 115200) is hard-wired to a simple internal GNSS (that requires an antenna), which can be used for time synchronisation and basic positioning, see *UM-8212 "User Manual for the ESH"* for more information.

On the job tree, select the **GNSS**.

Ensure the position offsets from the antenna are entered relative to the Common Reference Point (CRP) at water level.

CONFIGURING THE TRANSCEIVER

On the job tree click the **Transceiver** and then click the **Main** tab.

Note



A magnetic compass calibration should be performed for each new transceiver installation (see *STEP 21*).

Click the **Offsets** tab.

As the compass is mounted inside the head it is important to note that this is a magnetic compass and therefore requires a **Magnetic Offset** deviation value to be entered between true north and magnetic north.

STEP 13

CONFIGURATION

On the **Offsets** tab click **Installation Offsets** to enter the transceiver offsets to CRP at water level, or to enter transceiver offsets to compass or vessel. It is recommended that a verification is performed to align the transceiver to the compass (see *STEP 22*).

Transceiver 1 Magnetic Compass Offsets

XYZ Offsets

Ship CRP to Tcvt (Measured)

Starboard 0.000 m

Forward 0.000 m

Down 0.000 m

Orientation Offsets

Compass to Tcvt (Calculated) Ship to Compass (Altitude Calibration) Tcvt to Ship (CASIUS)

Pitch 0.000 0.000 = 0.000 °

Roll 0.000 0.000 = 0.000 °

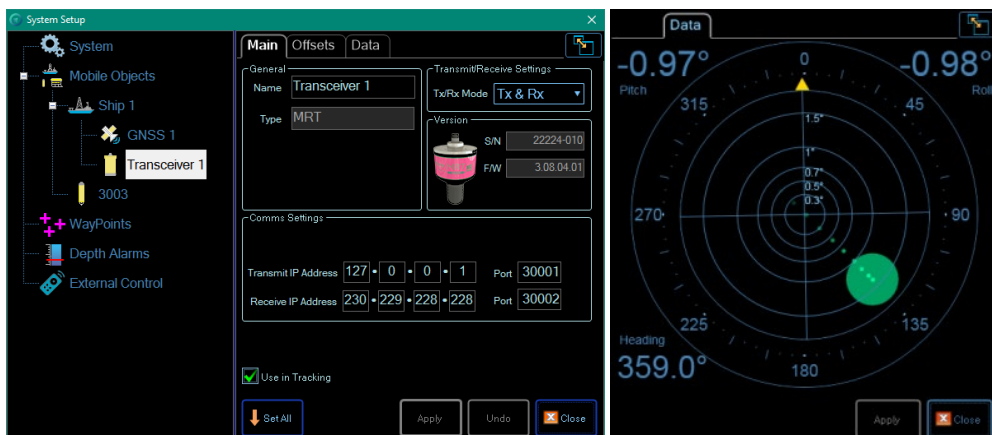
Heading 0.000 0.000 = 0.000 °

Click on the lock icon to lock or unlock fields.

Undo All OK Cancel

Click the **Data** Tab.

The internal magnetic sensor also displays Pitch, Roll and Heading data.

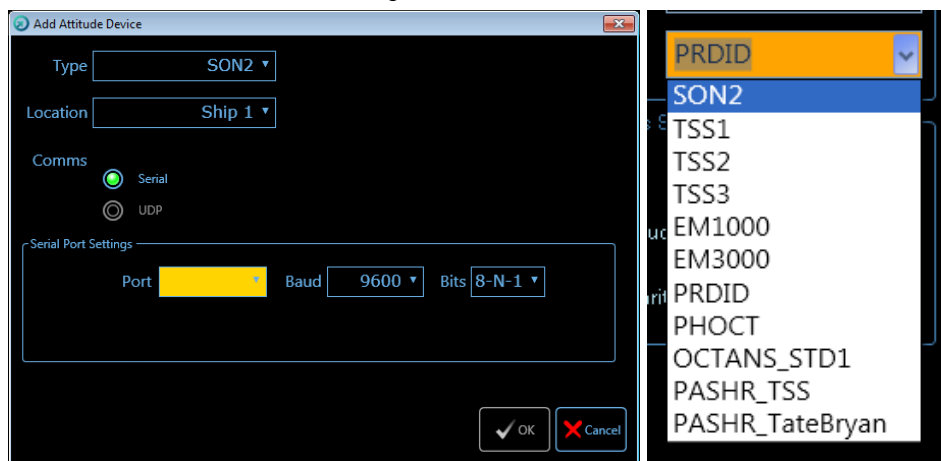


ADDING AN EXTERNAL INSTRUMENT

External instruments can be added to improve precision. ESH ports are preferred over PC serial ports as the timing is more precise and latency is not governed by CPU loading of the computer. Ensure that the vessel sensors are correctly selected otherwise the default is to use the internal magnetic compass.

To add an External instrument:

1. On the job tree, right-click **Ship** and select **Add Attitude**.
2. Select the **Type** and then configure **Serial Port Settings**.



3. On the job tree, click on **Ship**.
4. Select the choice of **Attitude** device from the drop-down list:
 - **Compass**: Internal magnetic compass with MEMS inclinometer (pitch roll and heading device).
 - **Internal**: Auxiliary lower grade MEMS inclinometer (pitch and roll only); will degrade grade USBL precision.
 - **Lodestar**: User named external instrument (appears as added by user).

If an external motion sensor is unavailable or the unit is being used by suspended cable then the internal **Compass** is preferable as it is decoupled from the vessel gyro. If this is the case the GNSS antenna should be located above the USBL.

The screenshot shows a configuration window with two main sections. The 'General' section at the top has a 'Name' field containing 'Ship 1'. The 'Attitude / Heading / Depth Devices used for Tracking' section below it contains three rows of settings. The first row, 'Pitch / Roll', has a dropdown menu with 'Compass' selected. The second row, 'Heading', has a dropdown menu with 'Compass' selected, and a 'Manual Heading' checkbox which is checked, with a text field next to it containing '(true)'. The third row, 'Depth', has a dropdown menu with 'Internal' selected, and a 'Manual Depth' checkbox which is unchecked, with a text field next to it containing 'm'.

General	
Name	Ship 1

Attitude / Heading / Depth Devices used for Tracking	
Pitch / Roll	Compass
Heading	Compass Manual Heading ☒ (true)
Depth	Internal Manual Depth ☐ m

ENVIRONMENTAL SETTINGS

The ranging accuracy will be improved by using a relevant sound speed profile.

To import the appropriate sound velocity information:

1. Click the **Environment** button to open the **Sound Speed** dialog box.
2. Click **Load** and select the profile from those displayed, or
3. Click **Import** and navigate to the sound speed profile import file.

Note



The sound speed profile import file format is a *.PRO file, tab delimited with 5 blank header lines and 2 columns for depth and sound velocity.

Environmental Settings

×

Sound Speed

Select one of the following methods to determine sound speed.

☐ Fixed Values

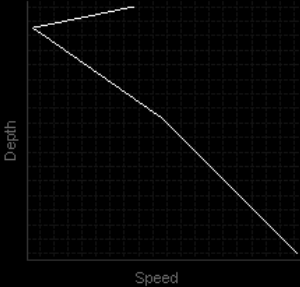
Mean Ranging Sound Speed m/s 

Transceiver Sound Speed m/s 

☒ Sound Speed Profile

Load ...

Estimated Profile



Sound speed profile taken from location:
Latitude: 51.331539
Longitude: -10.835726
Profile taken at : 03/05/2018 16:01:18
Max depth: 850 m
Mean Sound Speed: 1499.1 m/s

☐ Sound Speed Sensor

Pressure to Depth

Atmospheric Pressure kPa

Latitude ° ☒ Use GNSS

Operating Range m

OK

×

Cancel

ADDING AND TRACKING A BEACON USING QUICK TRACK

For simple jobs requiring a small number of 6G beacons, it is easier and faster to add beacons to the job using the Quick Track tool (described below).

For jobs with many beacons/complex acoustic scheduling, it is recommended to add beacons to the job using the Beacons Table (see *STEP 18*).

1. Click **Tools > Quick Track** or click the **Q-Track** shortcut button.



2. Click the required address(es) on the Quick Track tool (clicking the same address again stops that beacon tracking and removes it from the job).

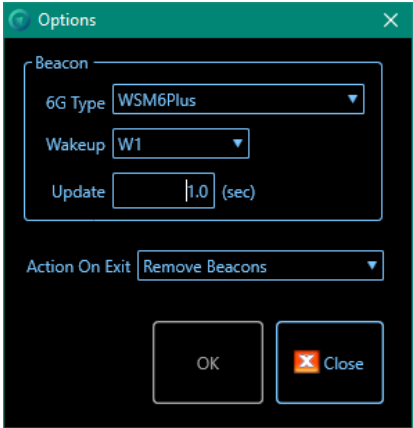
Quick Track Tool

WB2 WB2+ Options ?

1701	1801	1901	2001	2101	2201	2301	2401	2501	2601	2701	2801	2901	3001	3101
1702	1802	1902	2002	2102	2202	2302	2402	2502	2602	2702	2802	2902	3002	3102
1703	1803	1903	2003	2103	2203	2303	2403	2503	2603	2703	2803	2903	3003	3103
1704	1804	1904	2004	2104	2204	2304	2404	2504	2604	2704	2804	2904	3004	3104
1705	1805	1905	2005	2105	2205	2305	2405	2505	2605	2705	2805	2905	3005	3105
1706	1806	1906	2006	2106	2206	2306	2406	2506	2606	2706	2806	2906	3006	3106
1707	1807	1907	2007	2107	2207	2307	2407	2507	2607	2707	2807	2907	3007	3107
1708	1808	1908	2008	2108	2208	2308	2408	2508	2608	2708	2808	2908	3008	3108
1709	1809	1909	2009	2109	2209	2309	2409	2509	2609	2709	2809	2909	3009	3109
1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110
1711	1811	1911	2011	2111	2211	2311	2411	2511	2611	2711	2811	2911	3011	3111
1712	1812	1912	2012	2112	2212	2312	2412	2512	2612	2712	2812	2912	3012	3112
1713	1813	1913	2013	2113	2213	2313	2413	2513	2613	2713	2813	2913	3013	3113
1714	1814	1914	2014	2114	2214	2314	2414	2514	2614	2714	2814	2914	3014	3114

3. A 6G beacon with that address is added to the job (see **Options** below for beacon type).
4. An active Quick Track beacon is shown in green (beacon addresses already allocated are shown in pink).
5. A beacon output telegram is enabled (if there is a telegram setup).

Use **Options** on the Quick Track tool to configure the default **Beacon** type, **Wakeup** tone and **Update** rate.



ADDING A BEACON USING THE BEACONS TABLE

Beacons can be added and configured using the Beacons Table.

- 1. To open the Beacons Table click the **Beacons** button.



- 2. Click **Add** on the **Beacons Table** (alternatively beacons can be imported from an iWAND or Auto Discovered).



- 3. Select the beacon type on the beacon wizard window.

4. Enter the beacon **Address Prefix** (optional) and then click **Next**.

Add Beacon Wizard

1. Select a Beacon Type below. This will be used for all beacons added in the next page.

WSM 6+

WMT

Nano 6

RT 6

AODC

Address Prefix (optional)

(max. 5 characters)

This is applied to all beacons added

Telemetry Transceiver

Transceiver 1

Back

Next

Finish

Cancel

5. Select the beacon **Address(es)** from beacon address table and then click **Finish**.

Add Beacon Wizard

2. You can add several WSM 6+ beacons in one go by selecting address cells below.

WB1WB2WB2+

Wideband 2 is the default for 6th Generation (6G) instruments

1701	1801	1901	2001	2101	2201	2301	2401	2501	2601	2701	2801	2901	3001	3101
1702	1802	1902	2002	2102	2202	2302	2402	2502	2602	2702	2802	2902	3002	3102
1703	1803	1903	2003	2103	2203	2303	2403	2503	2603	2703	2803	2903	3003	3103
1704	1804	1904	2004	2104	2204	2304	2404	2504	2604	2704	2804	2904	3004	3104
1705	1805	1905	2005	2105	2205	2305	2405	2505	2605	2705	2805	2905	3005	3105
1706	1806	1906	2006	2106	2206	2306	2406	2506	2606	2706	2806	2906	3006	3106
1707	1807	1907	2007	2107	2207	2307	2407	2507	2607	2707	2807	2907	3007	3107
1708	1808	1908	2008	2108	2208	2308	2408	2508	2608	2708	2808	2908	3008	3108
1709	1809	1909	2009	2109	2209	2309	2409	2509	2609	2709	2809	2909	3009	3109
1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110
1711	1811	1911	2011	2111	2211	2311	2411	2511	2611	2711	2811	2911	3011	3111
1712	1812	1912	2012	2112	2212	2312	2412	2512	2612	2712	2812	2912	3012	3112
1713	1813	1913	2013	2113	2213	2313	2413	2513	2613	2713	2813	2913	3013	3113
1714	1814	1914	2014	2114	2214	2314	2414	2514	2614	2714	2814	2914	3014	3114

(19kHz)Longer RangeHigh Elev. USBL*USBL(33kHz)

Key:

Already in use

Reserved for Pulse Position Mode

Addresses not recommended

Clear

On finish, perform the following action:

☐ Get None

☒ Get Beacon Identity

☐ Get All Beacon Parameters

Back

Next

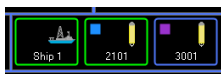
Finish

Cancel

6. Following successful telemetry communication with the beacons, the yellow warning triangles in the **beacons table** will change to green circles.
7. If the yellow warning triangles remain, the acoustic settings on the **Advanced** tab may need adjusting or the beacon addresses may need verifying.

TRACKING A BEACON

The target selection buttons show the beacons being actively tracked with green borders. The buttons can be clicked to toggle the tracking status.



CALIBRATION AND VERIFICATION

It is advisable to perform a calibration for a new vessel to substantiate system performance and correct for any installation misalignments of the transceiver.

If using the internal magnetic compass, a calibration is required to correct for local and regional distortions in the Earth's field and the effects of the vessel and installation pole. If using an external north seeking gyro for heading then a magnetic calibration is not required.

MAGNETIC COMPASS CALIBRATION

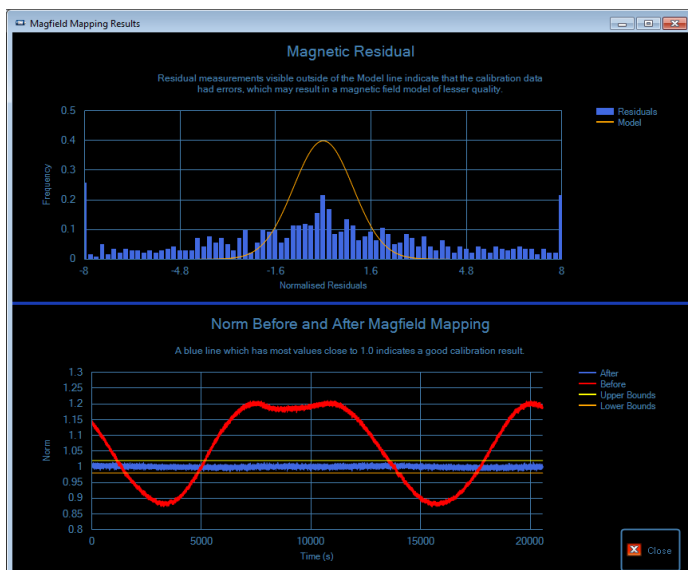
Click **Tools > Advanced > Magnetic Compass Calibration**

During calibration of the magnetic compass, the attitude sensor will no longer output heading data.

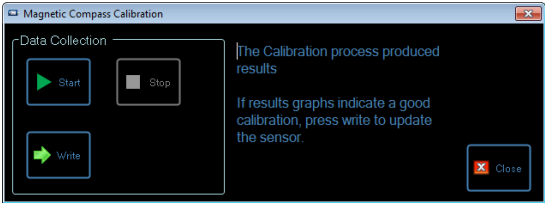
During calibration, the vessel must navigate in a slow complete circle over a period of at least two minutes to ensure enough data is collected.

After data collection the results can be reviewed. The magnetic residual data points should look similar to the following example. Data outside the standard distribution curve suggests more noisy data.

After Magfield mapping, the calibration should sit close between the upper and lower bounds in the region of "1" shown on the bottom graph.



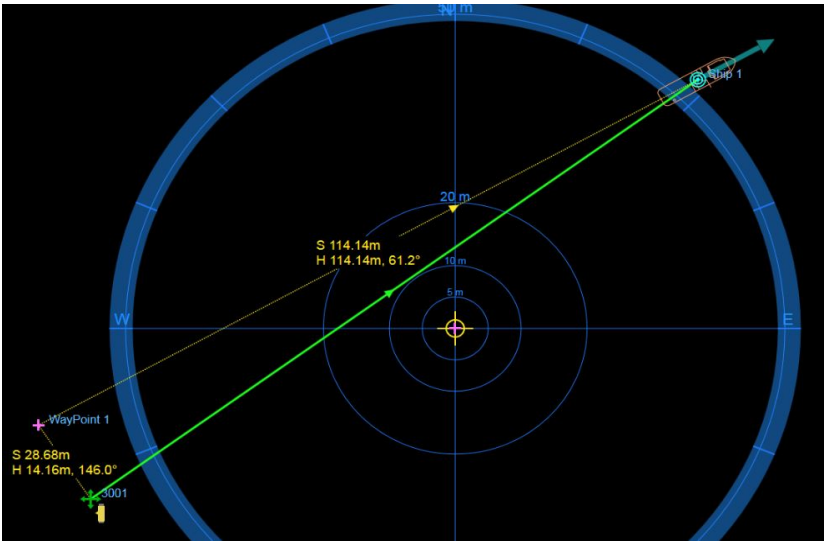
After stopping the calibration process, click **Write** to save the corrections to the magnetic compass.



TRANSCEIVER ALIGNMENT CALIBRATION

MRT alignment error may be determined using a simple procedure based on GNSS position:

1. Ensure the **TCVR to Ship Heading** alignment is set to zero.
2. Position the MRT immediately above a beacon deployed on the seabed.
3. Drop a waypoint as close as possible to the observed beacon position.
4. Move the vessel away from this position for approximately 114 metres¹.
5. Using the ruler measurement tool, determine the apparent horizontal offset (H value in metres) between the measured beacon position and the waypoint.



¹ $\tan 1 \text{ (degree)} = 1/57.3$. This means that if the USBL is misaligned by 1 degree, there will be a 1 m sideways movement for every 57.3 m the vessel moves away from the beacon. If the vessel moves 114 m, then dividing the sideways movement by 2 gives the angular misalignment.

- MRT heading alignment error is this offset divided by 2.

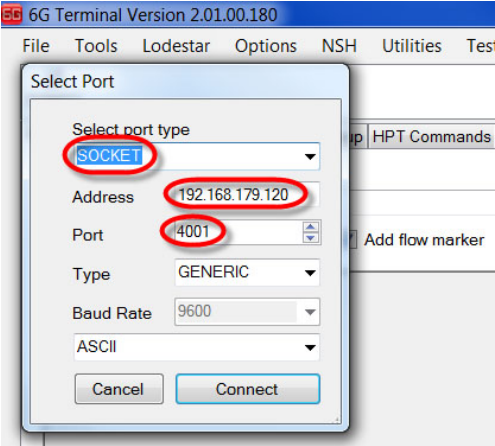
Note

If the Beacon appears to move to Port, the MRT heading correction should be added as a positive number, otherwise it is negative.

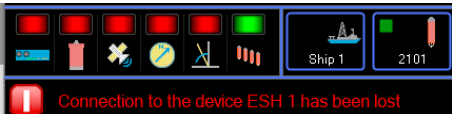
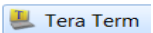
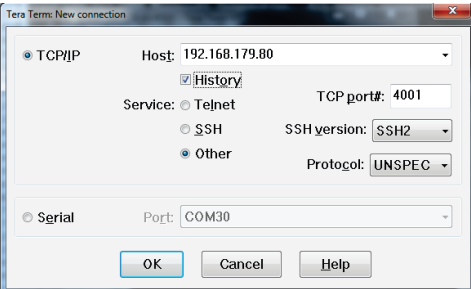
- On the transceiver **Offsets** tab click **Installation Offsets...**
- In the **Orientation Offsets** pane, unlock the **Tcvt to Ship** column by clicking the padlock.
- Enter the **Tcvt to Ship** MRT heading alignment.

- Click **OK**.
- Return to the chart and verify that the offset between the beacon and the waypoint is now zero i.e. the correction has been inserted with the correct polarity. Move slowly away from the beacon and confirm the beacon position remains close to the waypoint.

MRT TROUBLESHOOTING

Fault	Action
Connection to the Transceiver has been lost. 	Press and release the Reset button momentarily to reset the transceiver. 
If resetting the transceiver does not restore the connection.	Check the computer IP address. Start 6G Terminal Lite and connect to a socket to establish a connection as shown below. 
If the IP address is correct.	Check the cable and all connections (the connection to the transceiver is direct and does not require the ESH to have booted or be functioning correctly, only supplying the power). Check that the firewall settings or anti-virus software are not blocking the connection.

ESH TROUBLESHOOTING

Fault Connection to the ESH has been lost. 	Action Press and hold the Reset button for five second to reboot the ESH (the ESH can take up to two minutes to reboot).  You may need to restart Micro-Ranger 2 to establish a connection.
Confirm communications.	Start Tera Term software to confirm communications: Start > Tera Term  Enter the Host: IP address and TCP port and then click OK.  Type port in the Tera Term command window and press return to confirm communications.
If the connection problem still exists.	Power cycle the ESH (this will reset the internal switch). Finally, check that the firewall settings or anti-virus software are not blocking the connection.

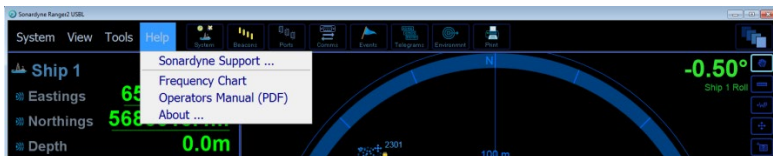
CABLE TROUBLESHOOTING

Transceiver cable Part No. 820-0373 pin details.

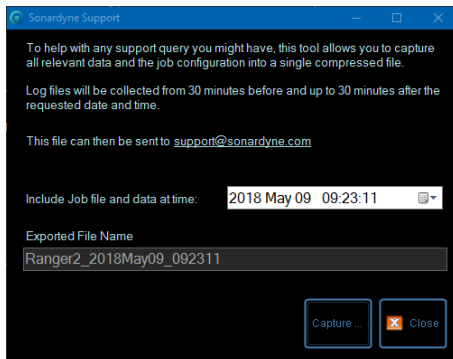
Subcon MCOM8M Connector	Function	12W Amphenol Connector
4	Power	J
1	ETH_Tx +	K
3	ETH_Tx -	L
7	ETH_Rx +	A
8	ETH_Rx -	B
2	Power return	M

SONARDYNE SUPPORT

If any difficulties or problems are encountered when attempting to operate the Micro-Ranger 2 system, click **Help** > **Sonardyne Support**.



1. Select the date and time the event occurred and then click **Capture**.
2. Browse to the desired folder for the output file and then click **OK**.
3. A support log file will be created containing logged data from 30 minutes before to 30 minutes after the target time. The support log file can be sent to Sonardyne Support for analysis.



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Term	Definition
6G®	Sonardyne's sixth generation technology hardware platform
Beacon (Acoustic)	An instrument that emits acoustic signals. Common beacon types are: Transponder, Responder and Pinger.
CASIUS	Calibration of Attitude Sensors in a USBL System. CASIUS is the Sonardyne recommended USBL calibration tool for the determination of accurate transceiver offsets (X, Y and Z) in relation to the GNSS (GPS) antenna and the transceiver Pitch, Roll and Heading errors. It also determines accurate 'through water' sound velocity calculation
CPU	Central Processing Unit
CRP	Common Reference Point
ESH	Ethernet Serial Hub
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HPT	High Performance Transceiver
LAN	Local Area Network
LED	Light Emitting Diode
MEMS	Micro Electro Mechanical System
MRT	Micro-Ranger Transceiver
MRU	Motion Reference Unit
PC	Personal Computer
Sonardyne	Sonardyne International Limited and its affiliates
Sonardyne Wideband®2	6G® transponders and transceivers use Sonardyne Wideband®2 ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deep-water
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
USBL	Ultra Short Base Line Positioning System
UTM	Universal Transverse Mercator
WSM 6+	Wideband Sub-Mini Transponder 6+

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