

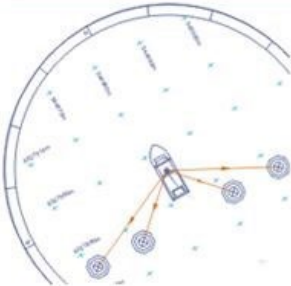
Operation Guide

Micro-Ranger 2 V6.04

Portable USBL System

 **Sonardyne**
SOUND IN DEPTH



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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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.

PRODUCT SUPPORT: Email: support@sonardyne.com Telephone: +44 1252 872288

24 Hour Emergency Helpline: +44 1252 877600

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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"*.

Contents

This Quick Start Operation Guide (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"* (supplied with Micro-Ranger 2)
- *UM-8243 "User Manual for the Type 8243 Micro-Ranger Transceiver"* (supplied with the MRT)
- *UM-8262-V2 "User Manual for Type 8262 Nano Transponders and Transceivers"* (supplied with the Nano and AvTrak Nano)
- *UM-8300-099 "User Manual for 6G Terminal Lite"* (supplied 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 portable system consists of:

- Micro-Ranger 2 Portable, including:
- Micro-Ranger Transceiver (MRT)
- Control Hub (integrated into the portable case)
- GNSS
- Nano or other Sonardyne 6G beacon

Note



Micro-Ranger 2 is also available as a 19" rack mount with rack mounted Ethernet Serial Hub (ESH), Micro-Ranger Transceiver (MRT) and Nano.

Micro-Ranger 2 contains all the equipment needed for a simple USBL tracking job. The portable topside contains an ESH which 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.

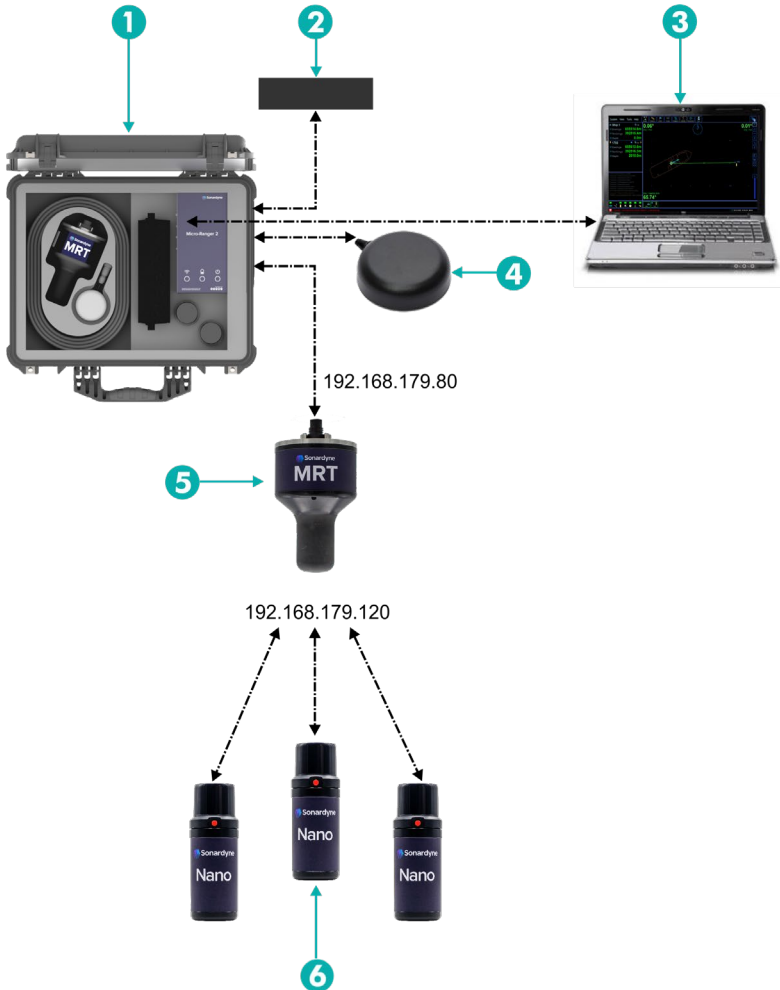
The MRT has an array ideally suited for high elevation tracking survey operations. The integrated Xsens Magnetic compass and dedicated Ethernet interface delivers a rapid installation and track solution.

An extensive set of tools allows the system performance to be optimised, including real-time visual signal and noise analysis graphs. Micro-Ranger 2 and Ranger 2 systems share similar beacons and software allowing a simple and cost-effective upgrade path as requirements expand.

Technical Description

Micro-Ranger 2 Portable System Equipment

A typical system comprises of the following components.

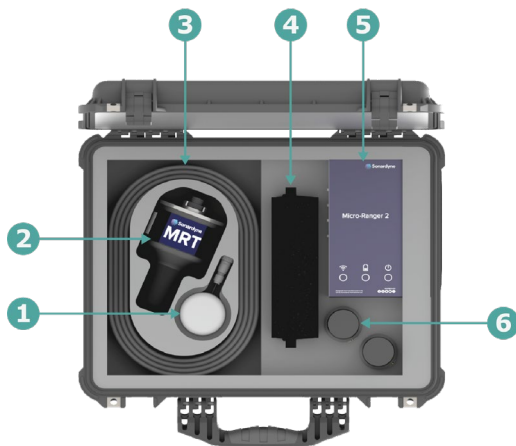


- | | |
|--|---|
| 1 Micro-Ranger 2 Portable Case | 5 MRT (supplied) |
| 2 24 V dc Power Supply (supplied) | 6 Nano Transponder (supplied x2) |
| 3 PC (not supplied) | - Software Security Key (supplied, not shown) |
| 4 GNSS Receiver (supplied) | |

Micro-Ranger 2 Portable Hardware

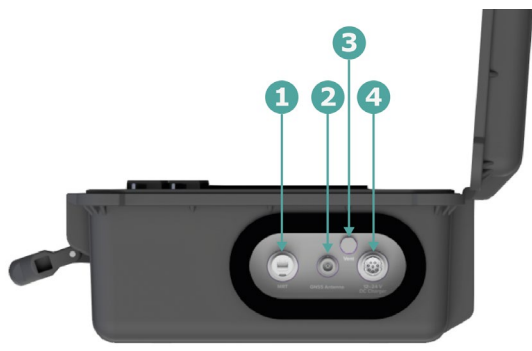
Micro-Ranger 2 is supplied in a protective waterproof case as described below.

Case Contents



- | | |
|------------------------|-----------------------------------|
| ❶ GNSS Antenna | ❺ Control Hub |
| ❷ MRT | ❻ Nano Transponder x2 |
| ❸ Transceiver Cable | Software Security Key (not shown) |
| ❹ 24 V dc Power Supply | |

Case Connectors



- | | |
|------------------|---------------------------------|
| ❶ MRT Connection | ❸ Case Pressure Equaliser Valve |
| ❷ GNSS Antenna | ❹ 12/24 V dc |

Hardware Description

Control Hub

The Control Hub layout is described below.



- 1 Power On/Off
- 2 Battery Status/Disconnect
- 3 Wi-Fi On/Off
- 4 USB Port x2 (power output only)
- 5 Ethernet Port

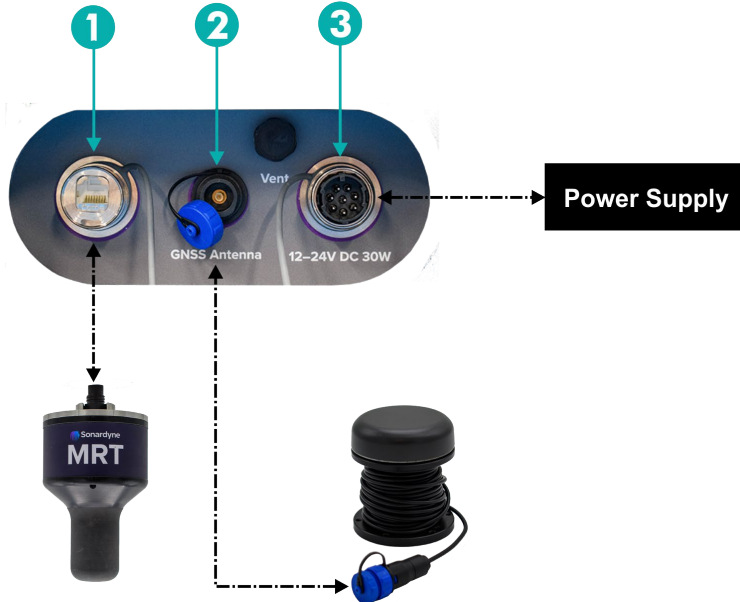
Control Hub Functions

The Control Hub button functions are described below.

Button	Function	Status	Indication
Power 1	Short press (1 sec)	Power on	Solid white
	Long press (10 sec)	Power down	Flashing white
Battery Status 2	Short press (1 sec) = check battery	>50% charged	Flashing green
		>25% charged	Flashing amber
		>10% charged	Flashing red
		<10% charged	Flashing red (continuously)
		Fully charged/dc power	Solid green
		Charging/dc power	Solid amber
		Charger fault	Solid red
	Long press (10 sec) = disconnect battery	Disconnects battery for shipping	n/a
Wi-Fi 3	Short press (1 sec)	Turn on/off	Blue
	Long press (10 sec)	Reset Wi-Fi to default settings	n/a

MRT, GNSS and Power Supply Connection

The MRT, GNSS antenna and power supply are connected to the portable case as shown below.



1 MRT (Ethernet)

2 GNSS Antenna

3 Power Supply 12/24 V dc

Installing Micro-Ranger 2 Software

Micro-Ranger 2 software is supported on Windows® 10 x64 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

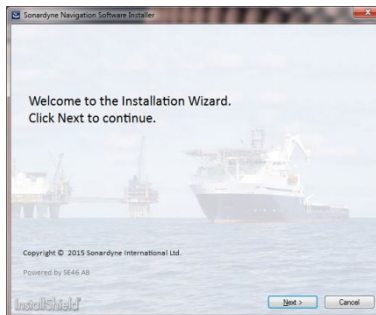


Previous versions of the software must be removed using 'Add and Remove Programs'.

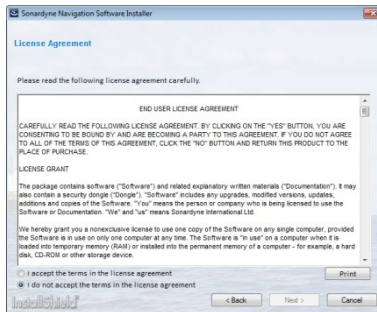


The yellow security key must be installed on the PC when installing and operating the system

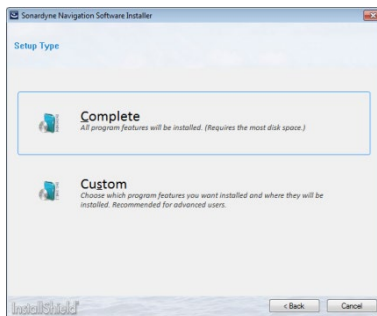
1. Insert the installation media and then navigate to and double-click **Setup.exe**
2. After the Windows Security window opens, click **Install** to install the security key drivers
3. After the security key drivers have finished installing, insert the security key into a USB port on the PC.
4. Click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



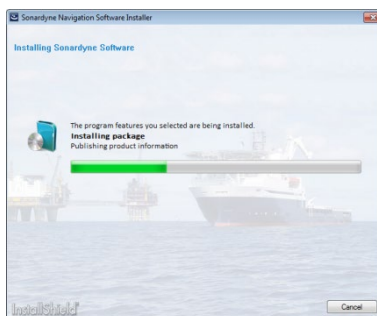
- Click **Yes** to accept the licence agreement



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



- Click **Next** to start the installation (a progress bar indicates the installation progress).

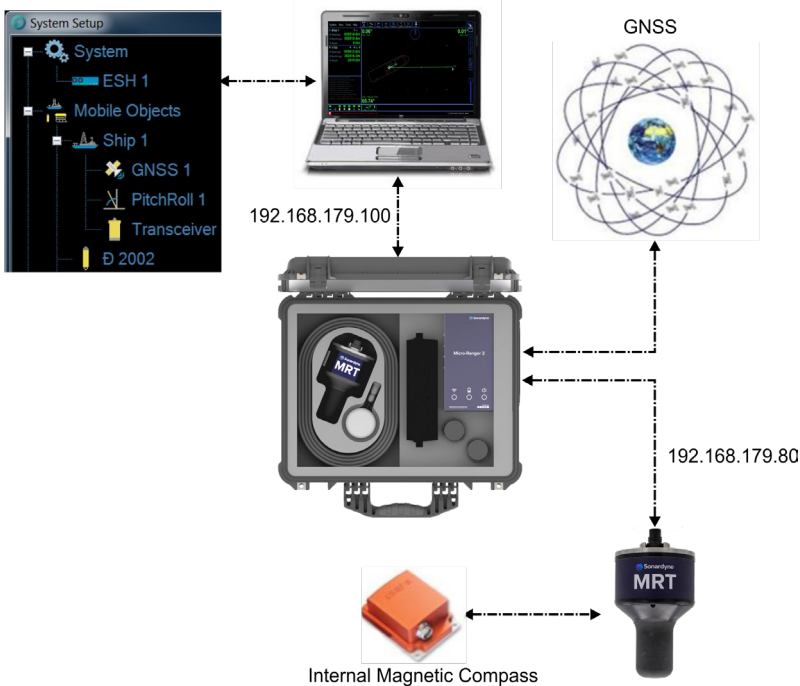


- Click **Finish** to complete the installation.

System Installation

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.



Connecting to the Micro-Ranger 2 System

Wi-Fi

When the system is started for the first time, a Wi-Fi network will be created with the following parameters:

- SSID: MESH-XXXX (XXXX replaced with system id)
- Password: password

This connection uses DHCP and will automatically configure the WIFI settings required to use the system.

Notes

 For security reasons it is recommended to change the default Wi-Fi password; see *UM-8241 "User Manual for Micro-Ranger 2"* for more information.

IP Addresses

The default IP addresses for the key parts of the system are:

- Micro-Ranger 2 topside: 192.168.179.80
- Micro-Ranger 2 transceiver: 192.168.179.120

When connecting via cabled Ethernet, network settings for the PC's Ethernet adapter must be configured as shown below:

Internet Protocol Version 4 (TCP/IPv4) Properties

General Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☒ Obtain an IP address automatically

☐ Use the following IP address:

IP address:

Subnet mask:

Default gateway:

☒ Obtain DNS server address automatically

☐ Use the following DNS server addresses:

Preferred DNS server:

Alternate DNS server:

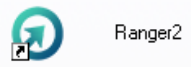
☐ Validate settings upon exit

Advanced...

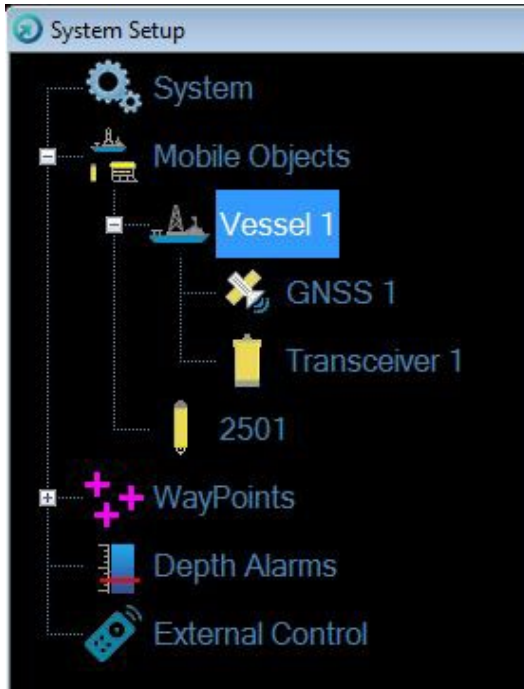
OK Cancel

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 dialog box, with GNSS and Transceiver installed.



Configuring a GNSS

Internal port ESH/5A (baud rate 115200) is hard-wired to the GNSS port. This GNSS is 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.

Main Data

General

Name: GNSS 1

Type: GPBGA

Comms Settings

Port: ESH\1A

Baud Rate: 115200

Data-Parity-Stop: 8-N-1

Distance from Vehicle CRP

Starboard: 0.00 m

Forward: 0.00 m

Up: 0.00 m

Main Data

Device Data

Latitude: 51° 19' 47.6532" N

Longitude: 0° 50' 11.4384" W

Configuring the Transceiver

To configure the transceiver:

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

System Setup

System

Mobile Objects

Ship 1

GNSS 1

Transceiver 1

3003

WayPoints

Depth Alarms

External Control

Main Offsets Data

General

Name: Transceiver 1

Type: MRT

Transmit/Receive Settings

Tx/Rx Mode: Tx & Rx

Version

S/N: 22224-010

F/W: 3.08.04.01

Comms Settings

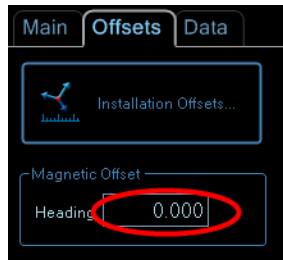
Transmit IP Address: 127.0.0.1 Port: 30001

Receive IP Address: 230.229.228.228 Port: 30002

☒ Use in Tracking

Set All Apply Undo Close

- On the Offsets tab, enter a **Magnetic Offset** deviation value to be entered between true north and magnetic north.



Notes



Magnetic declination for the globe is available from NOAA at: <https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml> Easterly corrections should be entered as positive numbers, with Westerly as negative

- On the **Offsets** tab click **Installation Offsets** to **Offsets** to enter the offset from ship CRP to transceiver. Orientation offsets can also be entered here, although it may be simpler to orientate physically the transceiver until it faces forward on the vessel.



Environmental Settings

The ranging accuracy will be improved by using a relevant sound speed profile. For simple tracking jobs, there are three options:

1. **Estimated profile** (from a Sonardyne internal database) can be used by selecting **Estimated Profile**.
2. A **Fixed value** valid at the transceiver and through the water column.
3. An externally supplied **Sound Speed Profile**:

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

Depth

Speed

Sound speed profile taken from location:
Latitude: 51.329932
Longitude: -10.834806
Profile taken at: 03/05/2018 09:27:54
Max depth: 850 m
Mean Sound Speed: 1499.1 m/s

☒ Sound Speed Sensor

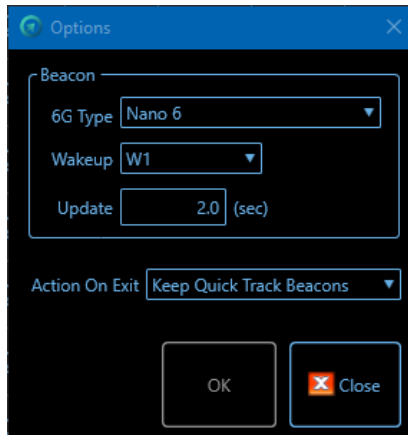
Pressure to Depth

Atmospheric Pressure kPa

Latitude ☒ Use GNSS

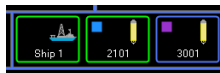
Operating Range m

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



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.

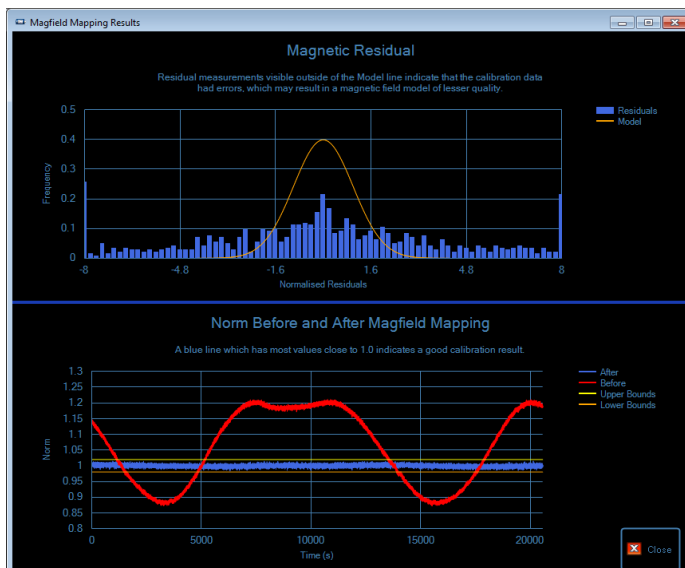
Magnetic Compass Calibration

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

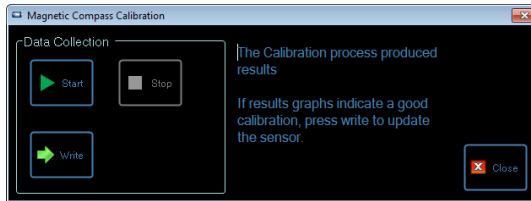
During calibration, the vessel must navigate in a slow complete circle over a period of at least two minutes to ensure enough data is collected.

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 or dunked from a pontoon/stationary object.
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.

Transceiver 1 Magnetic Compass Offsets

XYZ Offsets

Ship CRP to Tcvt (Measured)

Starboard m

Forward m

Down m

Orientation Offsets

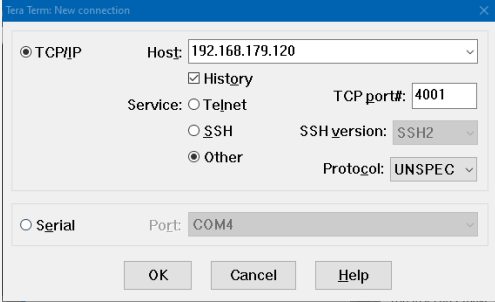
	Compass to Tcvt (Calculated)	Ship to Compass (Attitude Calibration)	Tcvt to Ship (CASIUS)
Pitch	0.000	0.000	0.000
Roll	0.000	0.000	0.000
Heading	7.100	0.000	-7.1

Click on the to lock or unlock fields.

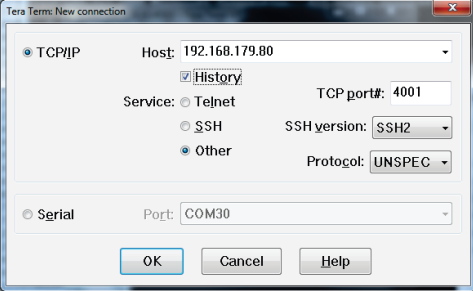
Undo All OK Cancel

- 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

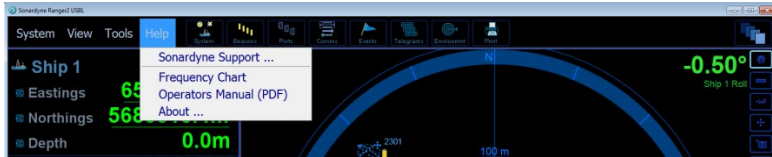
Fault	Action
Connection to the Transceiver has been lost. 	Power the system off/on.
If powering the system off/on does not restore the connection	Start Tera Term software to confirm communications: Start > Tera Term  Enter the Host: IP address and TCP port and then click OK. Type port in the Tera Term command window and press return to confirm communications. The system should respond with the following output: PORT:2702,P0;BR115200;CF0
If connection is successful	The IP address is correct and the software can communicate with the Transceiver. Start Ranger 2 software and delete and re add the Micro-Ranger Transceiver. If problems persist refer to the user manual or contact Sonardyne.
If connection is not successful	Check the cable and all connections are free from damage. Check the firewall settings or anti-virus software are not blocking the connection.

ESH Troubleshooting

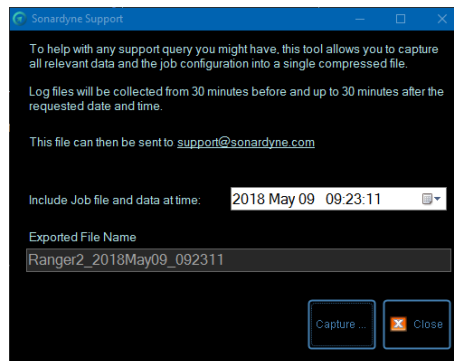
Fault	Action
Connection to the ESH has been lost. 	Power the system off/on.
Confirm communications.	Start Tera Term software to confirm communications: Start > Tera Term  Enter the Host: IP address and TCP port and then click OK. Type port in the Tera Term command window and press return to confirm communications. The system should respond with the following output: PORT:2702,P0;BR115200;CF0
If connection is successful	The IP address is correct and the software can communicate with the ESH. Start Ranger 2 software and delete and re-add the ESH. If problems persist refer to the user manual or contact Sonardyne.
If connection is not successful	Check the Wi-Fi or physical Ethernet connection. Check the firewall settings or anti-virus software are not blocking the connection.

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
6+	Sonardyne instruments that can use Wideband 3 enabling sensor data to be embedded in navigation range replies e.g. Compatt 6+ 6+ instruments are also backward compatible with Wideband 2.
6G®	Sonardyne's sixth generation technology hardware platform
Beacon (Acoustic)	An instrument that emits acoustic signals. Common beacon types are: transponder, responder and pinger.
Control Hub	The Control Hub is integrated into the Micro-Range 2 portable topside case and performs a similar function to the ESH
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
Sonardyne Wideband®3	Telemetry protocol available with 6G "+" devices that enables sensor data to be embedded in navigation range replies
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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