



**SAL NAVIGATION**

# **User Manual**

**SAL R200**

*STW Speed Log*



## Included documents

Description	Doc. ID
<b>1 List of items</b>	<b>891620</b>
<b>2 STW speed log user manual</b>	<b>2400300</b>
<b>3 Appendix – STW Calibration</b>	<b>2400301</b>

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## List of items

### Standard items for a system

Unit number	Name	Description
80.11.04	SAL TIC TRU Interface Cabinet	Transducer Interface Unit
80.12.03	SAL SD4-3	Speed Log Display
5493419	JBX EW1	Junction Box for transducer cable
2492322	TRU EW1 ET 50kHz Lower Part	Transducer for tank – part 1 of 2
2492326	TRU EW1 ET 50kHz Upper Part	Transducer for tank – part 2 of 2

### Optional transducers

2492330	TRU EW1 SV 200kHz	Transducer for sea valve
2492342	TRU EW1 ET 200kHz Lower Part	Transducer for tank – part 1 of 2
2492346	TRU EW1 ET 200kHz Upper Part	Transducer for tank – part 2 of 2
2492341	TRU EW1 ET 200kHz Upper Part WTC	Transducer for tank – part 2 of 2
2492310	TRU EW1 SV 50kHz	Transducer for sea valve
2492322	TRU EW1 ET 50kHz Lower Part	Transducer for tank – part 1 of 2
2492326	TRU EW1 ET 50kHz Upper Part	Transducer for tank – part 2 of 2
2492321	TRU EW1 ET 50kHz Upper Part WTC	Transducer for tank – part 2 of 2

#### Notes:

- Only one transducer is necessary for operation, i.e., one transducer for sea valve or one set of Lower and Upper part for tank installation
- “EW1” = combined transducer for echosounder and speed log (STW).
- “SV” = for Sea Valve mount
- “ET” = an Easy Tank transducer, a complete tank solution with integrated transducer
- “WTC” = Water Tight Cable

### Optional items

Unit number	Name	Description
80.12.04	SAL SD4-4	Serial digital general display
704080	SD4 BMB	Bulkhead mounting box for display.
704110	SD4 EB	Extension board for display.
704120	SD4 ED	External dimmer for display.
80.19.02	SD4 SDR2	Display remote control.
2493391	FLANGE ET 116 STEEL	Steel bottom flange for TRU EW1 ET 200 kHz
2493392	FLANGE ET 116 ALU 5883	Aluminium bottom flange for TRU EW1 ET 200 kHz

2400004	MSSBSV EW1	Mounting Set Single Bottom with Sea Valve without Bottom Flange.
5413200	SAL R1E / T Bottom Flange SB	Steel bottom flange for single bottom
2400005	MSDBSV EW1	Mounting Set Double Bottom with Sea Valve without Bottom Flange.
2400008	SAL T Bottom Flange MSDBSV	Steel bottom flange for double bottom
2493427	TUB G1 D35 Extension Tube 350mm	Transducer Extension Tube for MSDBSV
2493424	TUB G1 D35 Extension Tube 500mm	Transducer Extension Tube for MSDBSV
2493426	TUB G1 D35 Extension Tube 800mm	Transducer Extension Tube for MSDBSV
2493425	TUB G1 D35 Connecting Tube	Transducer Connecting Tube

## Table of Contents

1	About this manual.....	1
1.1	General .....	1
1.2	Symbols used in the manual .....	2
1.3	Foreword.....	2
1.4	Abbreviations .....	3
1.5	Features.....	3
1.6	Specifications.....	3
2	System overview .....	4
2.1	Principle of operation for measuring STW .....	4
2.2	Remarks on usage .....	5
3	Operation of the Display .....	6
3.1	Overview .....	6
3.2	Basic Function.....	6
3.3	Local Display Settings .....	7
3.4	WTU Menus Settings .....	11
4	Test Methods .....	13
4.1	TRU Mounting Inspection .....	13
4.2	TRU Sensor Surface Inspection .....	14
5	Maintenance.....	15
5.1	Preventive .....	15
5.2	Transducer/Sensor.....	15
5.3	Fuses .....	15
5.4	Dry-docking procedures .....	16
5.5	Calibration .....	16
6	Troubleshooting.....	16
6.1	Speed log indicates wrong speed.....	16
6.2	Three dashes (- - -) shown intermittently .....	16
6.3	Three dashes (- - -) are shown continuously.....	17

## 1 ABOUT THIS MANUAL

### 1.1 General

The purpose of this manual is to give written instructions for every-day use.

- The operator of the product described in this user manual must read and follow the descriptions in this manual. Inaccurate operation or maintenance can cancel the warranty or cause injury.

- The contents of this manual and equipment specifications can change without notice.
- The image examples shown in this manual can be different from the views you see on your display.
- Your system configuration and equipment settings may affect what you see.
- Save this manual for future reference.
- Any modification of the equipment, including software, by people not authorized by the manufacturer cancels the warranty.

**Risk Assessment:**

We, as a manufacturer, evaluate that those applicable standards cover all reasonably foreseeable risks.

**Note!**

The setting up, installation and service procedure, which must be performed by specially-trained technicians, is described elsewhere.

**Danger!**

Hazardous voltage!

Do not remove covers! Only authorized personnel are allowed to do so.

## 1.2 Symbols used in the manual

**Danger!**

Risk of serious or fatal injury to the user and/or severe damage to the product if the instructions are not followed.

**Caution!**

Risk of minor or moderate personal injury. Risk of equipment damage, loss of data, extra work or unexpected results if the instructions are not followed.

**Note!**

To alert about important facts and conditions.

**Information!**

To direct to specific instructions, such as where to find additional information and to tell how to perform a certain operation in an easier way.

## 1.3 Foreword

Please carefully read and follow the safety information, and the operating and maintenance instructions in this manual before starting to operate the equipment and conduct any maintenance.

The speed log system is designed to fulfil the latest rules and regulation set by authorities for vessels above 300 GT and those with STW (Speed Through Water) requirement.



## 1.4 Abbreviations

NMEA0183	IEC 61162-1 serial interface standard
STW	Speed Through the Water
WTU	Water Track Unit
TRU	Transducer Unit
TIC	Transducer Interface Cabinet

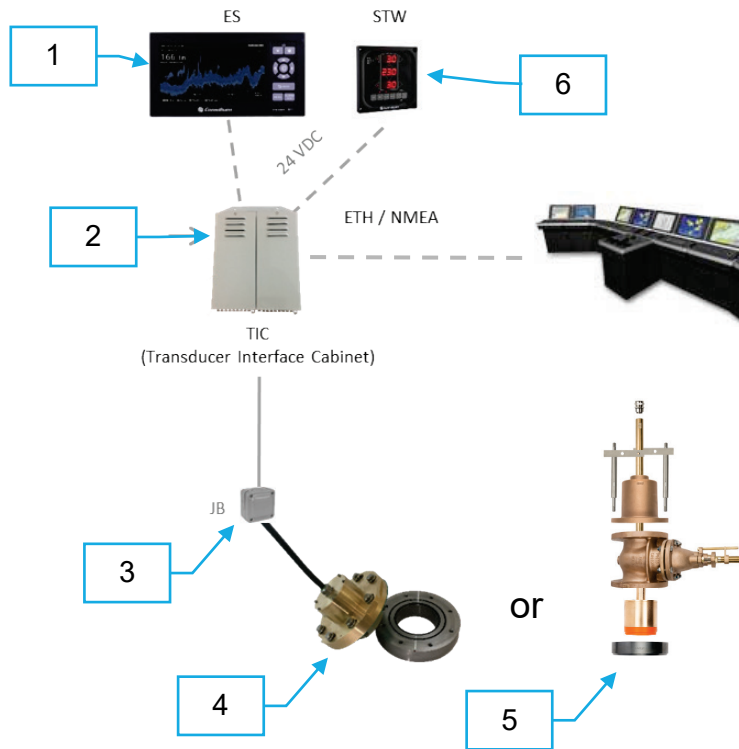
## 1.5 Features

- Speed and distance measurement information.
- Easy set-up and calibration procedures.
- Flexible calibration allows very accurate reading over the speed range.
- The tank solution is approved as a “closed ended” installation - no need for water tight compartment or piping above waterline.
- Small-sized bottom arrangement – two functions in one TRU – for easy installation.
- Serial communication directly from TRU enables long distance to electronic cabinet.
- No high voltage cabling from TRU (only 36 VDC and signal cables).
- Low power acoustic transmission.

## 1.6 Specifications

Working principle:	Acoustic correlation
Operating frequency:	4 MHz
Measuring distance:	130 mm from the surface of the TRU
Speed Range:	+/- 50 knots.
Speed Accuracy:	Better than 1% or 0.1 knots, whichever is greater
Distance Accuracy:	Better than 1%
Minimum water depth:	3 metres below the transducer
External interfaces:	IEC 61162-1 and 61162-450 transmitting VBW and VLW

## 2 SYSTEM OVERVIEW



1. Echo Sounder Display
2. Transducer Interface Cabinet – TIC
3. Junction box
4. Transducer: Easy Tank option
5. Transducer: Sea Valve option
6. Speed Log Display



### Note!

The image above shows a multi-functional system for STW speed log and Echo sounder. Single function systems for only STW or echo sounder are also available.



### Note!

It is optional to use the existing integrated bridge-system displays to show STW in addition to the speed log display.

### 2.1 Principle of operation for measuring STW

The speed log works by using two small crystals generating bursts of high frequency sound into the water, and comparing the echoes from particles in the water close to the hull. The measuring is based on the so-called Acoustic Correlation Principle, which is very dependable and reliable in all kinds of waters. For instance, it is independent of water temperature and salinity.

The correlation speed log uses acoustic pressure waves in the water. Waves are transmitted from the crystals of the TRU into the water in order to hit water particles. The water particles then reflect the signal back to the crystals.

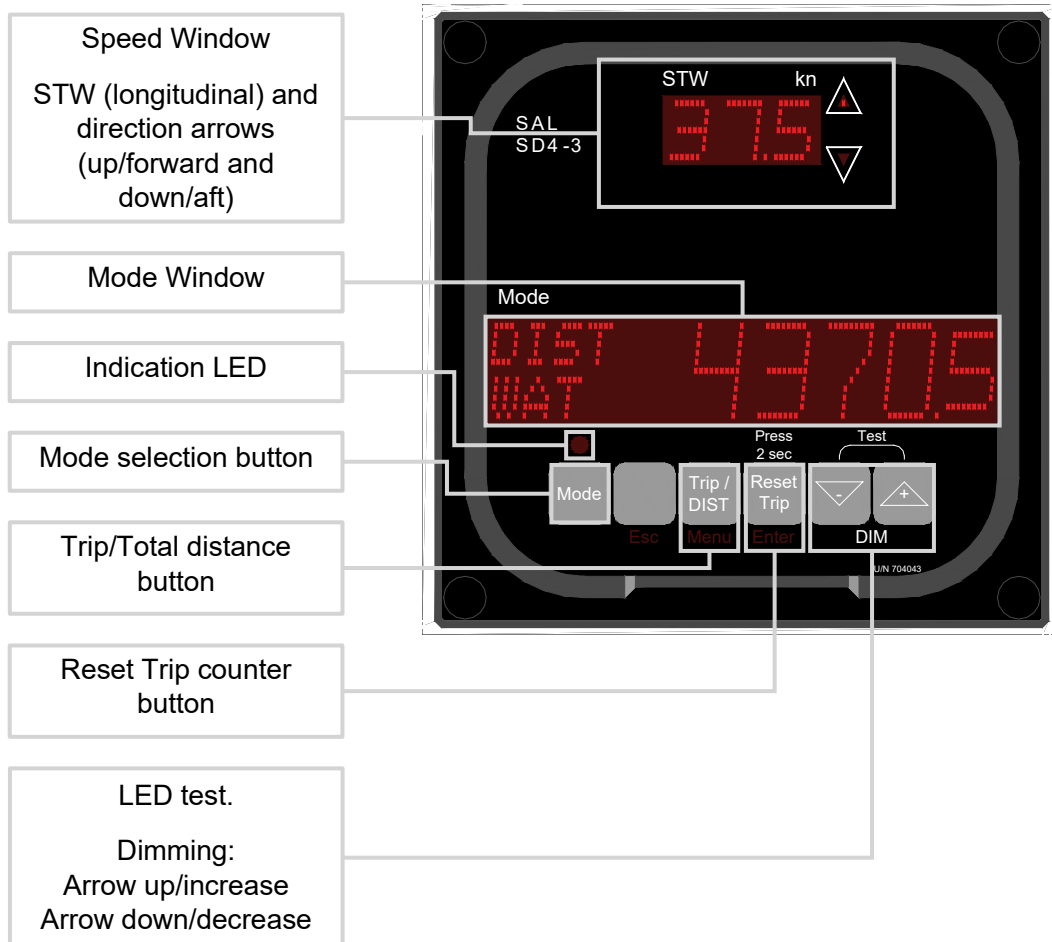
Using correlation technique, it is possible to compare how much the signals differ in time. Knowing the distance between the crystals, it is then easy to calculate the speed of the ship through the water.

## 2.2 Remarks on usage

1. In order to interpret the echoed signal, it is anticipated that the TRU is aligned longitudinally.
2. If the TRU has been installed at a non-preferred location of the hull, the water flow might be at an angle or turbulent at the site of the TRU, or heavily aerated blocking the acoustic TRU echoes. Under these conditions there is no guarantee for the log to work properly.
3. Longer periods of slow steaming at low speed and/or extended periods of idling/berthing/anchoring (weeks/months), specifically in tropical waters, tend to result in rapid build-up of marine growth in the TRU vicinity as well as on the sensor surface, thus the TRU should be retracted for inspection/cleaning and/or diver assisted under hull cleaning. See section for maintenance.
4. When making speed through the water, the ship will push and drag water in the travelling direction. The effect is that water close to the hull moves slower relative to the ship than water further away. The affected layer with lower relative speed is called the *boundary layer*. Depending on ship dimensions and the TRU location the measured volume may lie within the boundary layer of the ship and necessitate speed calibration.
5. When the ship is in shallow water, the boundary layer may be different from normal. This physical effect will affect all logs measuring relative speed.
6. Calibration may be needed to compensate the measured speed if the measured water volume is within the boundary layer. The calibration may be set at one speed, called *single point calibration*, or more than one speed, called *multipoint calibration*.

## 3 OPERATION OF THE DISPLAY

### 3.1 Overview



### 3.2 Basic Function

The Speed Window shows the longitudinal Speed Through the Water in knots. The upward-pointing arrow is lit when the direction is ahead. The downward-pointing arrow is lit when the direction is astern.



#### Note!

Only ahead motion is added to these distance counters.

The Mode Window shows as default the total distance the ship has sailed in nautical miles, indicated as DIST WAT. The Mode Window can also show the trip counter, indicated as TRIP WAT.

### 3.2.1 To access the trip counter

Press the TRIP/DIST button once.

### 3.2.2 To reset the trip counter to 0.00 nautical miles

Press the Reset Trip button for at least 2 seconds.

## 3.3 Local Display Settings

The Mode Window can also show the Local Display Settings with a number of different menus and submenus.



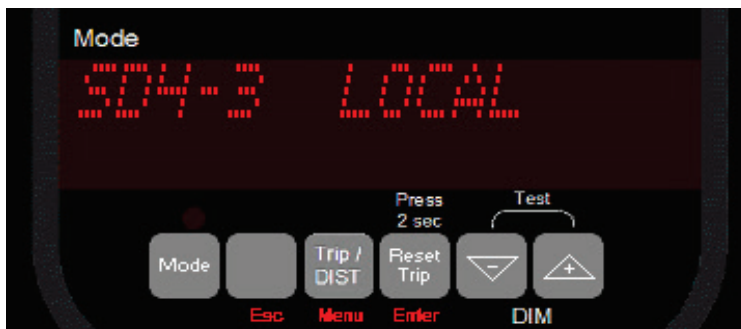
### Caution!

If no button is pressed within 3 minutes when being in the Local Display Settings, the Mode Window will return to normal operation mode.

### 3.3.1 To access the Local Display Settings

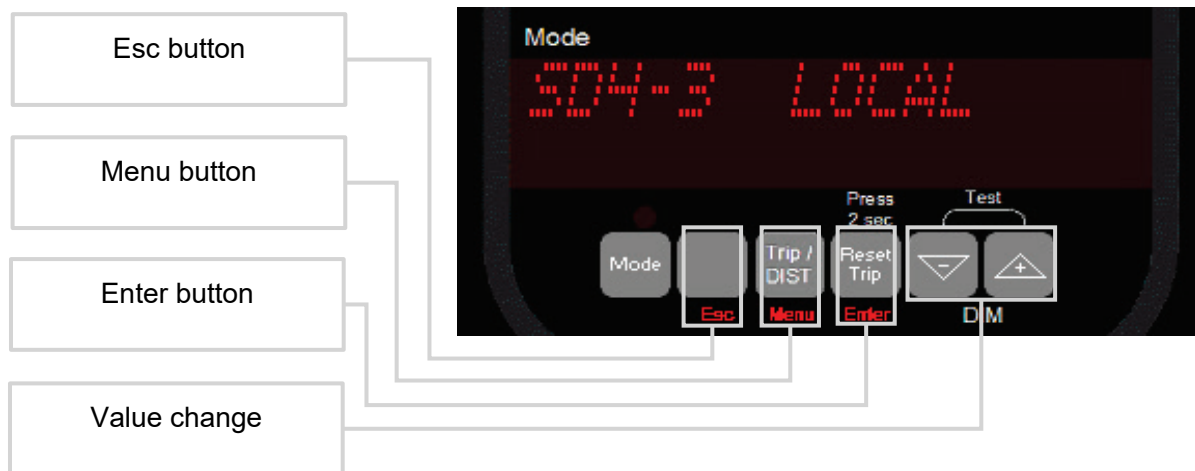
1. Press the Mode button for at least 5 seconds until PRESS ENTER FOR MENU is shown in the Mode Window.
2. Press the Reset Trip button (Enter) once within 5 seconds.

The following view is shown:



Three buttons below the Mode Window have now changed to alternative functions. These functions are lit in red text below each of the three buttons (see picture above).

### 3.3.2 Menu control buttons and functions



**Mode** (Mode button): The Mode button is used to enter the Local Display Settings.

**Esc** ("Blank" button): Press Esc to move up one menu level.



**Note!**

Menu and Enter pressed simultaneously is to be used instead of Esc to move up one menu level when the display is remotely connected to the WTU Menu system (see 3.4.1).

**Menu** (Trip/DIST button): Press Menu to take a step forward to show the next menu on the same menu level.

Press Menu and Arrow down (-) simultaneously to take a step back on the same menu level to show the previous menu.

**Enter** (Reset Trip button): Press Enter to move down one menu level to submenus, or to save changed values or settings.

**Arrow down (-) and Arrow up (+)** (DIM buttons): Press to change values or settings, and to switch between WRITE ACCESS OFF/ON. To do a LED test: Press both DIM buttons simultaneously to light all LED diodes.

### 3.3.3 Write and read-only access



**Caution!**

Do not activate WRITE ACCESS [ON] without having special training for the purpose of changing parameters. Be careful to only change intended parameters.

To change and store values in the submenus of the display's Local Menu Settings (see 3.3.4), the write-access function must be activated. Default for submenus is read-only access and the Mode Window shows WRITE ACCESS [OFF].

To change WRITE ACCESS [OFF] to WRITE ACCESS [ON]:

1. Press the Arrow up (+) button
2. Press Enter

When leaving submenus, the write access is automatically set to OFF.

### 3.3.4 Local Display Settings Menu



#### Caution!

Do not activate WRITE ACCESS [ON] without having special training for the purpose of changing parameters. Be careful to only change intended parameters.

The four main menus of the Local Display Settings:

- SD4-3 LOCAL:** This is the start menu when entering the Local Display Settings. If another display, or displays, is/are remotely dimmed from this display, this menu shows a second text line (REMOTE DIM [OFF]). The remote dimming function can be turned ON or OFF by using the DIM Arrow up (+) or Arrow down (-).
- LP0 PROPERTIES:** This menu contains submenus for the local setting-up of the display.
- LS0 REMOTE SETUP:** This menu contains submenus for setting-up when the display is used as a Speed Log Master Display.



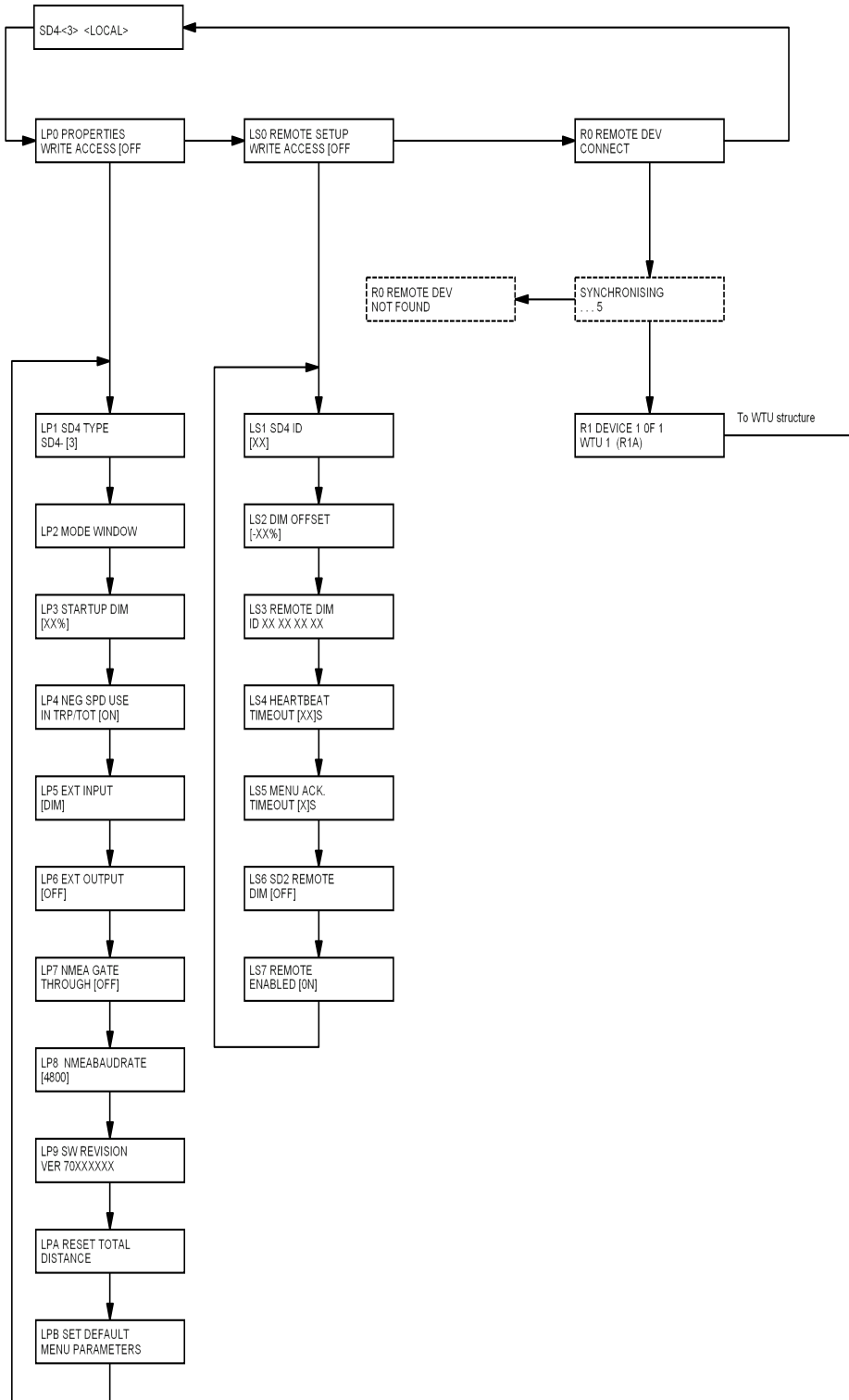
#### Note!

Verify the setting in menu LS7, normally ON is default.

- R0 REMOTE DEV:** On a designated Speed Log Master Display, this menu provides access to the menu system of another device in the speed log system, a so-called *remote device*, such as the TRU or an electronic cabinet.

Simplified structure for the display's Local Menu Settings:

**SD4-3 MENU STRUCTURE**





### 3.4 WTU Menu Settings



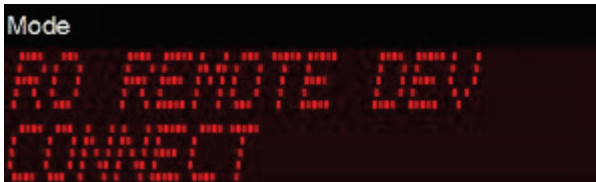
**Caution!**

Do not access the WTU Menu Settings without having special training for the purpose of changing parameters. Be careful to only change intended parameters.

The R0 REMOTE DEV CONNECT menu provides access to another device of the speed-log system onboard, such as the WTU Menu Settings in the TRU.

#### 3.4.1 To access the remote WTU Menu Settings

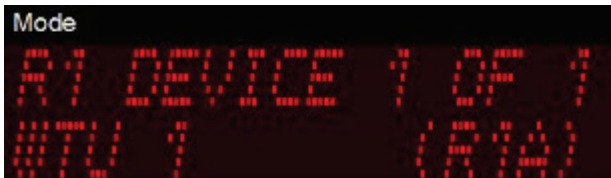
In the Local Display Settings Menu go to:



Press Enter:



After a couple of seconds the following is shown:



**Caution!**

If needed to go back from this menu to R0 REMOTE DEV CONNECT, only use buttons **Menu and Enter simultaneously** to move up one menu level instead of using Esc. Using the **Esc** button breaks the connection to the device, such as the TRU.

Press Enter:



The user has now accessed the WTU Menus Settings.



**Note!**

Values displayed in this menu is only an example.

### 3.4.2 To access Calibration



**Caution!**

Do not access the to C0 Calibration submenus without having special training for the purpose of changing parameters. Be careful to only change intended parameters.

When having accessed the WTU Menus Settings, press Menu to step forward to C0 Calibration to carry out a speed log calibration, see Appendix about WTU Calibration menus.

### 3.4.3 Structure of the WTU Menus



## 4 TEST METHODS

### 4.1 TRU Mounting Inspection

To verify that the TRU is in the correct downward/flush seated/aligned position:

**Note!**

This inspection is only valid for sea-valve installations

- Make a reference mark on the Connecting Tube close to where it enters the Valve top cover.
- Loosen and take of the two nuts and spring washers holding the bracket assembly down. Be aware of outside sea water pressure, i.e., firmly handhold the Tube bracket/Connecting Tube!
- Raise the Tube Bracket/Connecting tube out from the threaded rods and turn 90 degrees and then push firmly downwards again to firm stop. A slight splash of sea water will temporarily occur when the slots are passing the water seals in the Valve top cover.
- The brackets shall not rest on the bolt heads; there shall be a gap of approx. 3mm when the TRU is in the lowest position – stopped by the Guide ring and the stop shall have the same height as the mark to be in the same position/level as before. If not, re-adjustment will be needed. Refer to Installation Manual.
- Return the Connecting Tube/Tube Bracket to its normal position considering possible adjustments as above.
- Verify that the alignment/flat mark (SB) on the Connecting Tube is facing towards starboard and aligned parallel with ship's keel/longitudinal line. If not, readjustment will be needed. Refer to Installation Manual.
- After necessary checks/adjustments assure that the Tube Bracket clamping screws and top nuts are tightened in proper position.

## 4.2 TRU Sensor Surface Inspection

**Note!**

This TRU Sensor Surface Inspection is only valid for installations with a sea valve.

- Also here recommend making a reference mark on the Connecting Tube close to where it enters the Valve top cover.
- Loosen and take of the two nuts and spring washers holding the bracket assembly down. Be aware of outside sea water pressure, i.e., firmly handhold the Tube bracket/Connecting Tube!
- Raise the Connecting Tube/Tube Brackets 150 mm, the plastic part of the TRU is then ~ 40mm over the Valve cover top. **Do not lift higher before the Sea Valve is closed!** A slight splash of sea water will temporarily occur when the slots are passing the water seals in the Valve top cover.
- Close the Sea Valve (assuring the retracted position of the TRU as above!), approximately 14 full turns of the hand wheel from fully open to fully closed valve. Observe the position indicator pin and feel the resistance when the valve gate comes to closed position.
- Carefully lift out the TRU assembly from the Sea Valve assuring that sea water is not severely pouring out from the Sea Valve. If so, again insert the TRU tip as a plug and try to close the valve more rigidly and/or yank the valve gate back and forth a few times in the closing position to try improve tightness.
- Verify as needed by lifting out the TRU and continue as intended.

- Carefully inspect and clean the TRU sensor surface from overgrown algae/marine growth. Do **NOT** use any sharp/metallic tool that may damage to the TRU sensor surface. Plastic or wooden scraper or cloth rag is normally enough for rubbing off and cleaning.
- Check that the TRU sensor surface is undamaged, i.e. no scratches or indents.
- Provided actions are completed, or TRU has been exchanged, re-install the TRU assembly in the Sea Valve carefully considering above retraction/dismounting precautions avoiding touching/reaching the valve gate.
- Fully open the Sea Valve (14 full turns to fully opened position) while holding the TRU Connecting Tube against water pressure.
- Push the TRU firmly downwards engaging the Tube Bracket to its operating position.
- Check that the alignment mark on the Connecting Tube is facing towards starboard and aligned parallel with ship's longitudinal/keel line.
- After necessary checks/adjustments assure that the Tube Bracket clamping screws and top nuts are tightened in proper position.

## 5 MAINTENANCE

### 5.1 Preventive

Check regularly that the displays are clean and remove dust from the display units. Wipe with damp cloth and mild detergent.

### 5.2 Transducer/Sensor

Carefully inspect and clean the TRU sensor surface from algae/marine growth.



#### Caution!

Do not use any sharp/metallic tool that may damage to the TRU sensor surface. Plastic or wooden scraper or cloth rag is normally enough for rubbing off and cleaning.

### 5.3 Fuses

Before power-up carefully verify the Mains power voltage and the integrity of the fuses.



#### Note!

There are no exchangeable fuses in the TIC. Disconnect the fuses in the fuse cabinet, which serves the TIC to disconnect the power.

## 5.4 Dry-docking procedures

Always inspect the bottom parts in connection with dry docking.

## 5.5 Calibration

If the speed deviates, follow the instructions in the Calibration Appendix.



### Note!

The STW speed log measures the ship speed relative to the *water* and cannot be compared with a SOG device such as GPS that measures the speed relative to the *ground*.

# 6 TROUBLESHOOTING

## 6.1 Speed log indicates wrong speed

Reason	Action
The TRU is not aligned longitudinal	Check the TRU according to TRU Mounting Inspection (See Test Methods)
The log is set to wrong speed calibration (WTU-menu C1, C3).	Change calibration alternative. See Calibration Appendix.
The log is set to wrong TRU calibration (WTU-menu C4).	Check TRU calibration. See Calibration Appendix
The speed calibration is not relevant to present conditions.	Make a new calibration. See Calibration Appendix.
The TRU signal is disturbed by turbulent and/or aerated water.	Check TRU location.

## 6.2 Three dashes (- - -) shown intermittently

If the speed log indicates speed only intermittently, and in between, three dashes (- - -) are shown in the Speed Window:

**Note!**

The speed log is primarily a longitudinal speed measuring system. Accordingly, this behaviour may be normal due to sharp/hard turning manoeuvring, for instance.

Reason	Action
The TRU is not aligned longitudinal or not in working position.	Check the TRU according to TRU Mounting Inspection described below.
TRU cable shield not connected in Speed log cabinet gland may cause disturbances.	Check that the TRU cable shield is firmly connected in the ELC cable gland.
The TRU sensor surface is covered by algae/marine growth.	Check the TRU according to TRU Sensor Surface Inspection described below.

### **6.3 Three dashes (- - -) are shown continuously**

If the speed log continuously indicates no speed, and only three dashes (- - -) in the Speed Window:

Reason	Action
The TRU is not aligned longitudinal or not in working position.	Check the TRU according to TRU Mounting Inspection described below.
The TRU sensor surface is covered by algae/marine growth.	Check the TRU according to TRU Sensor Surface Inspection described below.

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## APPENDIX – STW speed log calibration

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### Note!



The STW speed cannot be compared with the speed from a SOG device, such as a GPS.

Two dedicated speed runs, from A to B and then B to A, in calm waters gives the best result. The longitudinal distance travelled through the water is then compared to the longitudinal distance travelled over the ground.

## Overview

There are two different types of calibration available in the STW speed log. These are referred to as: “*Point calibration*” and “*Draught calibration*”.

- The *Point calibration* is used to set the STW calibration using either one single calibration factor or up to 10 different calibration factors for 10 different speeds.
- *Draught calibration* is used to compensate for vessel's different draught or load conditions; *Full load*, *Ballast 1* and *Ballast 2*.

The two types may be used simultaneously and will then be added together in the calculation of the output speed.

The most common type of calibration is a Single Point calibration. For a Single-point calibration, use the Full load draught condition.

A calibration factor is set in percent (%), and is calculated as following examples:

Assume an actual speed of 25 kn but the speed log indicates 23 kn:

$25 / 23 = 1.087$ , i.e.,  $108.7 - 100 = +8.7\%$

The calibration factor is +8.7%

If the speed log instead indicated a too high speed of 27 kn:

$25 / 27 = 0.926$ , i.e.,  $92.6 - 100 = -7.4\%$

The calibration factor is -7.4%

It is important to know that if a calibration value is already set, add or subtract the calculated value to/from the already stored value.



## To set and adjust the Single- or Multi Point calibration

See user manual how to access the **WTU Menu Settings**.

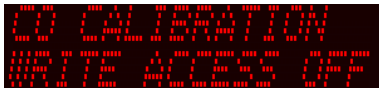
The user has accessed the WTU Menu Settings when the following view is shown:



*Values displayed as examples only!*

### Enter the calibration menu

Press **Menu** two times:



Press arrow **DIM “+”**:



Press **Enter**:



*Values displayed as examples only!*

### Single Point calibration

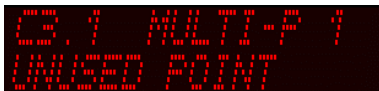
Note! The Single- and Multi Point calibration share the same menu “C3 MULTI-P CAL”. The only difference is that the Single Point calibration only use one of the ten possible calibration points.

Press **Menu**:



If “DISABLED” press arrow **DIM “+”** to “ENABLED”

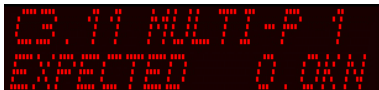
Press **Enter**:



Press **DIM “+”**:



Press **Enter**:



Press arrow **DIM “+”** or **“-”** to set the expected / true speed value for the first point.

Press **Enter** to confirm the set speed:



Values displayed as examples only!

Press arrow **DIM “+”** or **“-”** to set the calibration factor for first point:



Values displayed as examples only!

Press **Enter** to confirm the set calibration factor.

### ***Multi Point calibration (optional)***

Press **Menu** to move on to the next point (C3.2) and continue as described above.

You can use all 10 points or you can choose to only use a few of them to cover the vessel's speed range. In order to disable one point to "UNUSED POINT", simply set the speed value and calibration factor to "0.0".

### ***Exit the calibration***

Leave the menu system by pressing **Menu** and **Enter** simultaneously three times. Break the connection to WTU by pressing **Esc** three times until you reach SD4 normal operations mode.

## To adjust and set the Draught calibration (optional)

See user manual: **To access the WTU Menus Settings**

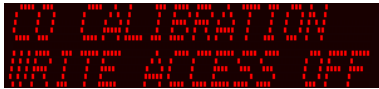
The user has accessed the WTU Menus Settings when the following view is shown:



Values displayed as examples only!

### Enter the calibration menu

Press **Menu** two times:



Press arrow **DIM '+'**:



Press **Enter**:



Pressing **Menu** at this point will toggle between pre-set draught calibrations.

Press **Enter** to select draught calibration and accessing submenu for adjusting calibration factor.

### Calibrate for a draft condition

Press **Enter**:



Press arrow **DIM** “+” or “-” to set the calibration factor:



Values displayed as examples only!

Press **Enter** to store new setting:



After pressing enter to store new setting, menu automatically moves up one level to “C1 DRAUGHT COND”

Press **Menu** and **Enter** simultaneously twice in order to reach WTU normal operations mode.

Press **Esc** to break the connection to WTU and return to the local menu system of the display.

Press **Menu** and **Enter** simultaneously twice to exit the menu system and return to the normal operations mode of the display.