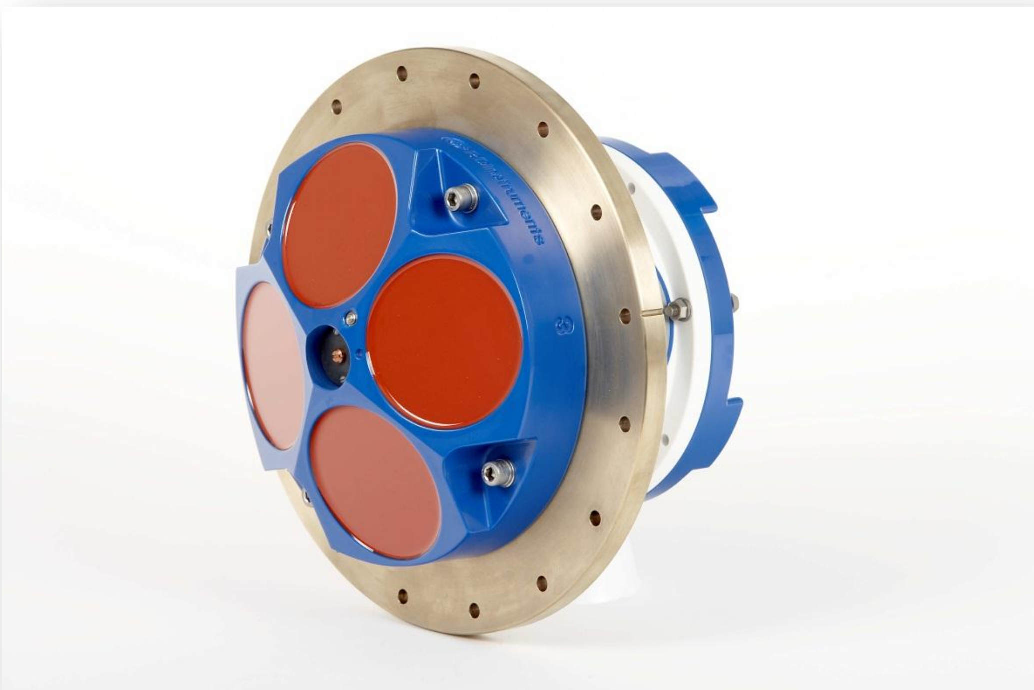
WorkHorse Mariner ADCP User's Guide



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Mariner User's Guide

Introduction

Thank you for purchasing the Teledyne RD Instruments (TRDI) WorkHorse Mariner Acoustic Doppler Current Profiler (ADCP). This User's Guide will lead you through the steps required for a successful deployment. Please read the entire guide, and then follow the instructions in the order they are presented. Additional information can be found in the WorkHorse Technical Manual that is supplied on CD-ROM.

NOTE. To purchase a printed copy of the WorkHorse documentation (includes the WorkHorse Technical Manual and software guides), contact our Customer Service department at rdifs@teledyne.com or call (858) 842-2600 and order the WorkHorse Manual kit.

Technical Support

If you have technical issues or questions involving a specific application or deployment with your instrument, contact our Field Service group:

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Overview

The first step is to become familiar with the Mariner ADCP. Read the short descriptions of the hardware and software that comes with the WorkHorse.

This Section Covers:

- Hardware Overview
- Deck Box Overview
- Power Overview
- Serial Communication Overview
- Deployment Overview
- Software Overview
- Installing the Software

Hardware Overview

The Mariner ADCP system consists of a WorkHorse Monitor ADCP with Bottom Track mode, cables, Deck Box, Mounting Plate, and software. The Mariner system requires the addition of a Windows® compatible computer to collect data.

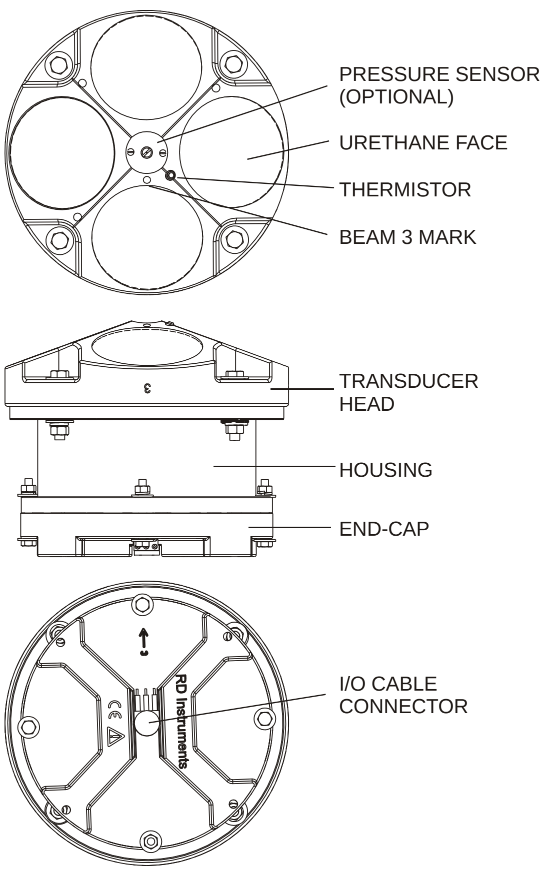


Figure 1. WorkHorse Mariner Overview

The transducer assembly contains the transducer ceramics and electronics. Standard acoustic frequencies are 600 and 1200 kHz. See the outline drawings in the WorkHorse Technical Manual for dimensions and weights.

I/O Cable Connector – Input/Output (I/O) cable connects the WorkHorse ADCP to the computer.

Beam-3 Mark – The Beam-3 mark shows the location of Beam-3 (Forward).

Urethane Face – The urethane face covers the transducer ceramics. Never set the transducer on a hard surface. The urethane face may be damaged.

Housing – The WorkHorse housing allows deployment depths to 200 meters.

Thermistor – The Thermistor measures the water temperature.

Pressure Sensor – The optional pressure sensor measures water pressure (depth).

Transducer Head – The WorkHorse electronics and transducer ceramics are mounted to the transducer head. The numbers embossed on the edge of the transducer indicates the beam number. When assembling the unit, match the transducer beam number with the Beam 3 mark on the end-cap.

End-Cap – The end-cap holds the I/O cable connector. When assembling the unit, match the Beam 3 mark on the end-cap with beam 3 number on the transducer.

Deck Box Overview

The deck Box contains all interfaces to/from the ADCP, computer/terminal, optional vessel gyrocompass, and power.

Power Switch – The power switch is a combination switch/circuit breaker. The **Power Status** LED next to the circuit breaker lights when power is applied to the Deck Box.

Reset Button – Pushing the **Reset** button sends a break to the ADCP.

Data In/Out LEDs – **Channel 1 In** indicates data transmission from the computer to the ADCP. **Channel 1 Out** indicates data transmission from the ADCP to the computer.

Gyro Display – The LCD Display shows the vessel's gyro heading.

NOTE. The Gyro Interface is optional. If you do not have a Gyro Interface board installed, the LCD display will be blank.

Gyro Offset Controls – Use the **Up**/**Down**/**Set** buttons to set the Gyro Offset for systems with the optional Gyro Interface board installed. The Offset Control buttons are **Up**, **Set**, and **Down**, as depicted by the upward arrow, the square box, and the downward arrow respective.

For example, to set a heading offset for a multi-rate gyro, push the up or down button and set button simultaneously, using two small aids such as a pencil. When the desired offset is obtained, release the buttons. To prevent accidental re-adjustment, the buttons are recessed.

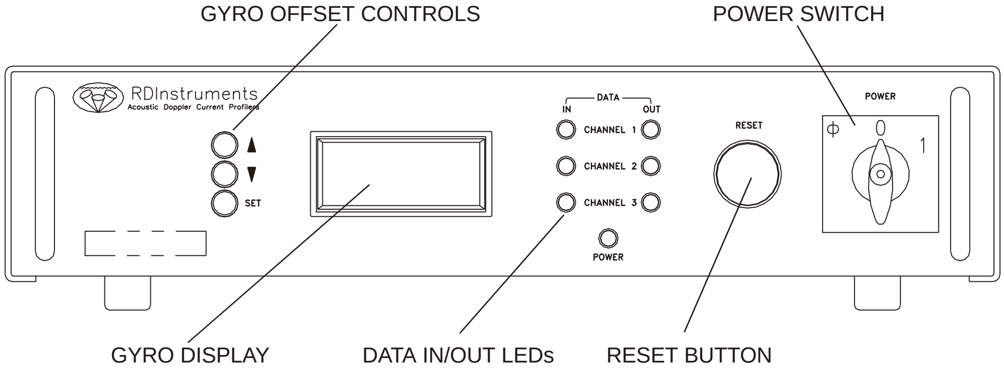


Figure 2. Deck Box (Front View)

ADCP (J17) – Connects the ADCP to the deck box.

Channel 1 RS 422 (J19) – Connects the computer's RS-422 port to the deck box. Use this only if your computer has a RS422 serial port. If you computer has a RS-232 serial port (standard), use J20.

Channel 1 RS 232 (J20) – Connects the computer RS-232 port to the deck box.

Gyro Synchro/Stepper (J22) – Optional Gyrocompass (gyro) interface connects the ship's gyro to the Deck Box. The WorkHorse Technical Manual lists gyro requirements.

Gyro Serial RS 232 (J28) – Supplies serial, ASCII navigation data to the computer via our *VmDas* program. See the *VmDas* help file for requirements. This is an option for some ADCP applications. When working in areas where bottom-track detection is not possible, you need this equipment to remove ADCP (Ship) motion from the data. The output from the J28 deck box connector is a serial data string of gyro heading, pitch, and roll. The format of this string is: *$PRDID,±ppp.pp,±rrr.rr,hhh.hh* (where *p* is pitch, *r* is roll, and *h* is heading; all scaled in decimal degrees).

AC Power Input – The deck box accepts input voltages of 98-264 VAC, 50-60Hz (J27). This input voltage will be converted to 48 VDC. This is the voltage supplied to the ADCP.

DC 12-Volt Input – Use a 12 VDC car battery (J26) when AC power is not available. The deck box converts the voltage to 48 VDC. This is the voltage supplied to the ADCP. Use the largest rated amp-hour battery as possible. A car battery should last one to two days powering a 1200-kHz ADCP.

DC 20 to 50 Volt Input – If you are using an external DC power supply connected to the deck box on J25 (20 to 50 VDC, 3.0 A), the voltage from the external power supply is sent *directly* to the ADCP. This is useful if you want to increase (higher voltage level) or decrease (lower voltage level) the range of the ADCP. The current requirement for the power supply is listed as a reference. Using a lesser-rated power supply can cause the voltage level to drop. The ADCP will draw only the current it needs.

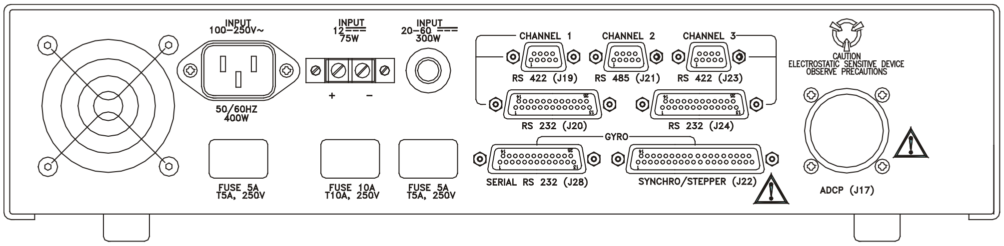


Figure 3. Deck Box (Rear View)

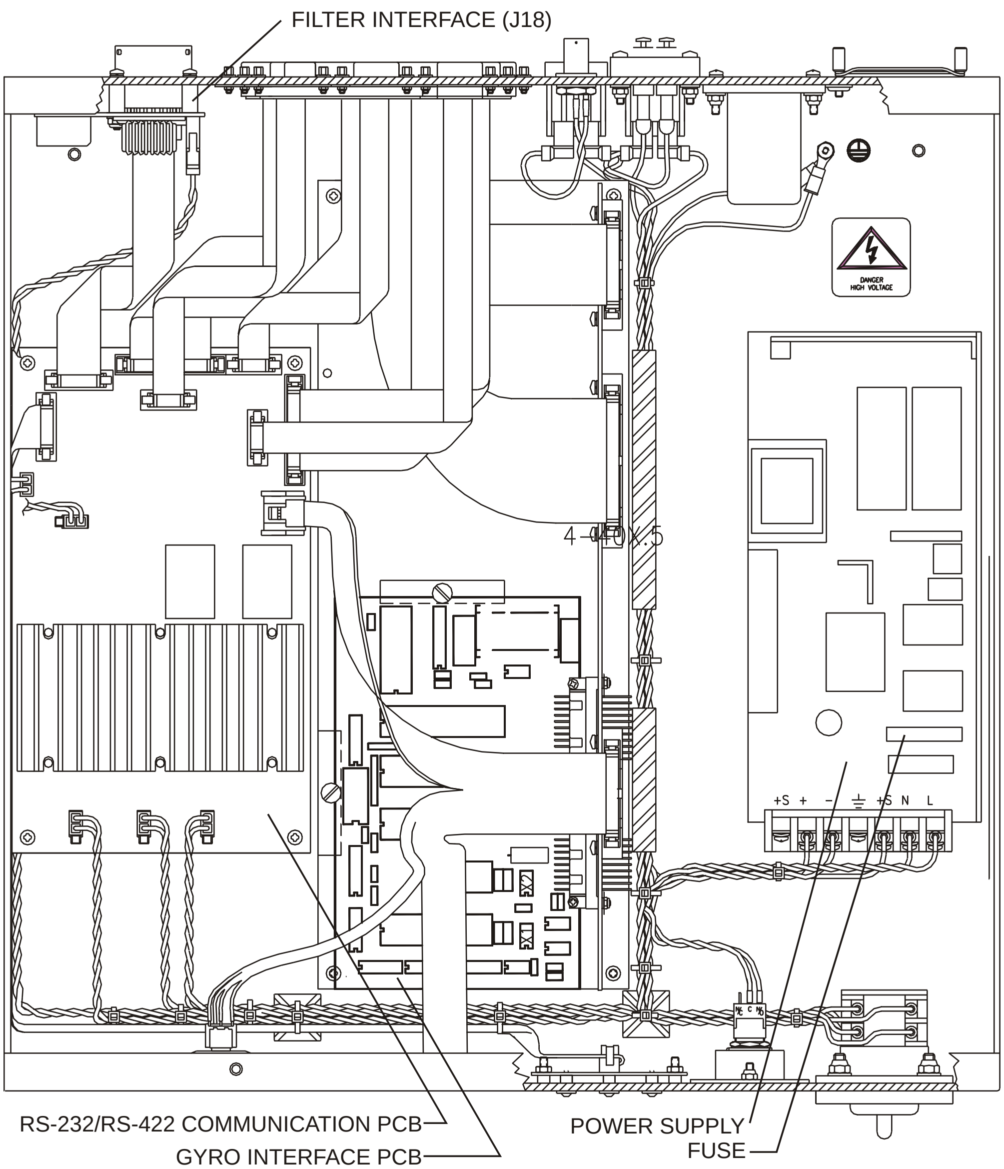


Figure 4. Deck Box (Top View)

Power Overview

The Mariner deck box automatically scales the input voltage to the proper level. No special jumpers or switch settings are required to select the input voltage. If more than one power source is connected to the deck box, the highest voltage source will be used. Although this is not recommended, it will not damage the deck box.

AC Power. The deck box accepts input voltages of 98-264 VAC, 50-60Hz (J27). This input voltage will be converted to 48 VDC. This is the voltage supplied to the ADCP.

12 VDC Car Battery. Use a 12 VDC car battery (J26) when AC power is not available. The deck box converts the voltage to 48 VDC. This is the voltage supplied to the ADCP. Use the largest rated amp-hour battery as possible. A car battery should last one to two days powering a 1200-kHz ADCP.

DC Power Supply. If you are using an external DC power supply connected to the deck box on J25 (20 to 50 VDC, 3.0 A), the voltage from the external power supply is sent *directly* to the ADCP. This is useful if you want to increase (higher voltage level) or decrease (lower voltage level) the range of the ADCP. The current requirement for the power supply is listed as a reference. Using a lesser-rated power supply can cause the voltage level to drop. The ADCP will draw only the current it needs.

NOTE. Transmitted power increases or decreases depending on the input voltage. Higher voltage to the ADCP (within the voltage range of 20 to 50 VDC) will increase the transmitted power. The transmitted power is increased 6 DB if you double the input voltage from 24 VDC to 48 VDC. For a 300kHz WorkHorse ADCP, each additional DB will result in an increase in range of one default depth cell.

ADCP Internal Batteries. If you want the ADCP to use internal battery power (Sentinel Workhorse ADCP or external battery pack) rather then the deck box power, do the following.

a. Turn OFF or disconnect all power to all ADCP system equipment.

b. Remove the screws on the top cover of the deck box. Lift the cover off.

c. Locate the Filter Interface board (see Figure 4). Locate connector J18 and disconnect the twisted black and white cable plugged into this connector. The power from the deck box to the ADCP has now been disabled. Only the batteries are powering the ADCP.

Mounting Plate Overview

The Mounting Plate is a bronze plate that helps mount the transducer head to a vessel. For installation instructions, see the WorkHorse Technical Manual.

The overall dimension of the mounting plate is ∅311.1 (12.25 inches) and the bolt hole pattern is 16 equally spaced ∅8.20 through holes on a ∅285.75 bolt circle.

NOTE. See the WorkHorse Technical Manual outline installation drawings for the exact dimensions and weights.

Optional Flash Memory Card

Memory cards are not included with the Mariner ADCP. Two PCMCIA memory card slots (see Figure 5) are available. The maximum memory for each slot is 2GB, with the total memory capacity not to exceed 4GB. The PC Card recorder is located on the Digital Signal Processor (DSP) board inside the Workhorse's electronics. To recover data, the card can be removed and used in a personal computer (PC), or left in the Workhorse, and accessed by using *WinSC* (see the WinSC and PlanADCP User's Guide).

NOTE. The WorkHorse Mariner does not come with flash memory, but has the same capacity as a WorkHorse Sentinel.

NOTE. *WinSC* is not provided with WorkHorse Mariner systems, but is available for free download at www.rdinstruments.com.

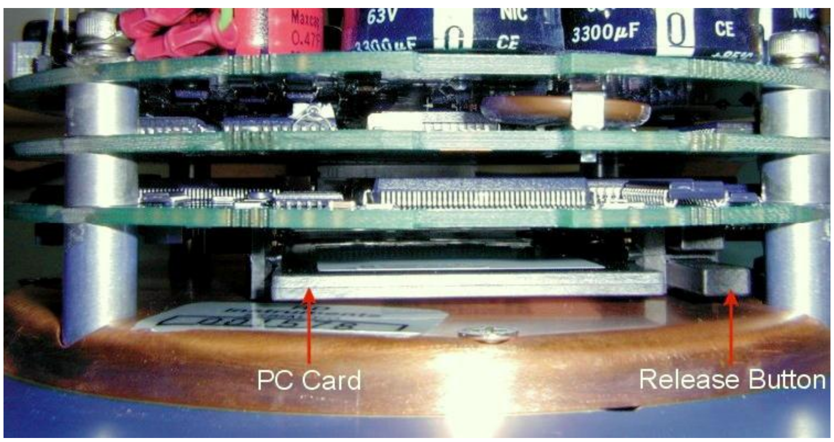


Figure 5. Memory Card Overview

Serial Communication Overview

The standard communications settings for the WorkHorse Mariner is RS-232, 9600-baud, no parity, 8 data bits and 1 stop bit. Self-contained applications receive no benefit from setting a faster baud rate.

You can set the WorkHorse for baud rates other than 9600 baud using the CB command (see the WorkHorse Technical Manual). If you make the new baud rates permanent with the CK command, *WinSC* and *BBTalk* will search for the correct settings if you use the **Auto Detect** function, which searches for the WorkHorse's current serial port and baud rate (see Connecting to the WorkHorse). If you tell the programs these settings, you will save time required for searching. Both *WinSC* and *BBTalk* will use the last communication setting for future use.

Change Communication Setting. Changing a switch setting on the PIO board will change the communication setting between RS-232 and RS-422. The switch is in plain view on the top circuit board, near the cable connectors. Its settings are plainly marked on the board. If the serial protocol is set for RS-422 and your computer expects RS-232, you will need an RS-232 to RS-422 adapter between the ADCP cable and your computer. This user's guide assumes that you use RS-232. There is no reason to use RS-422 for Self-Contained operations.

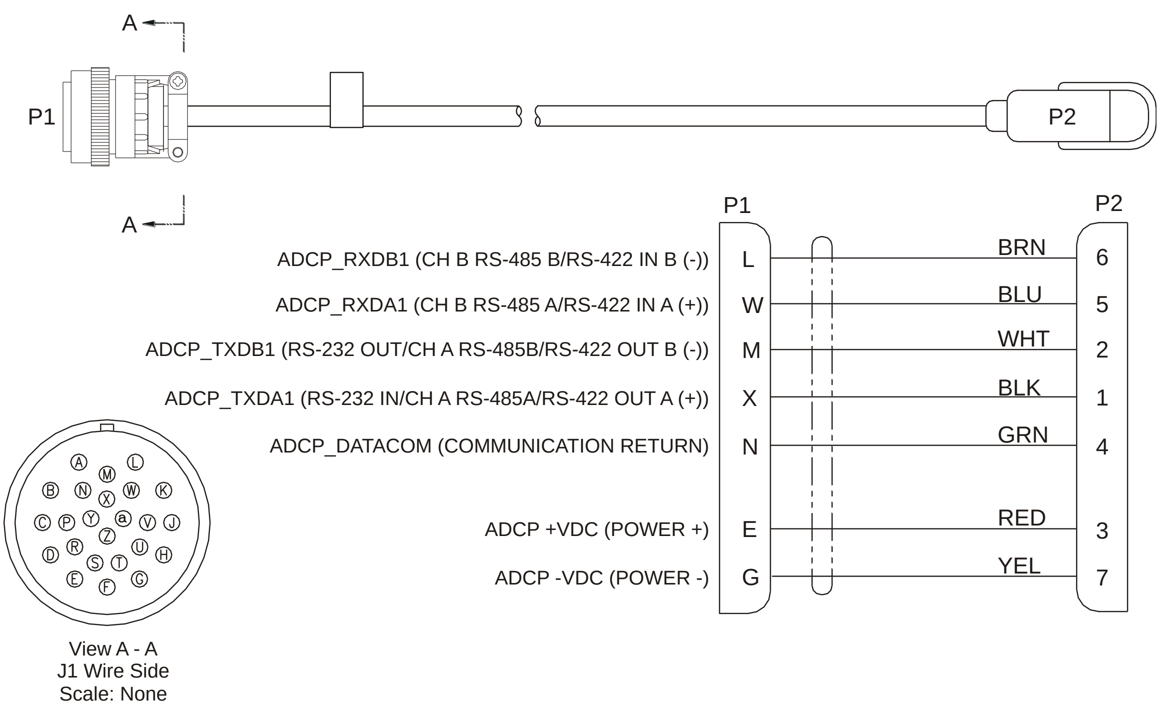


Figure 6. I/O Cable Wiring Diagram

Deployment Overview

The WorkHorse Mariner is designed to measure real-time current profiles of coastal, inshore, and open ocean water current structures from temporary or permanent mounting in a vessel. It gives fine along-track resolution thanks to RDI's superior low-noise data, including bottom tracking. The Mariner ADCP's small size and light weight makes hull mounting an easier process and a more reasonable expense. The Deck Box is designed to team up with the vessel's DGPS input to integrate ADCP readings with precise position information. *WinRiver* is the most often used software package for ADCP setup, river discharge data collection, and data review. For detailed information on how to use *WinRiver*, see the WinRiver User's Guide.

Table 1: WorkHorse Mariner River Application Guide

Mariner using WinRiver
• River, stream and channel discharge
• Suspended sediment load estimation
• Plume tracking
• Bridge scouring
• Simultaneous bathymetry discharge, flow structure

The WorkHorse Mariner ADCP can also be used in other moving vessel real time applications that take advantage of the Mariner's bottom tracking abilities. *WinRiver II* is the most often used software package for Mariner ADCP setup, river discharge data collection, and data review. TRDI also offers the *VmDas* program for ADCP setup, real-time data collection, and data review. For detailed information on how to use *VmDas*, see the VmDas User's Guide.

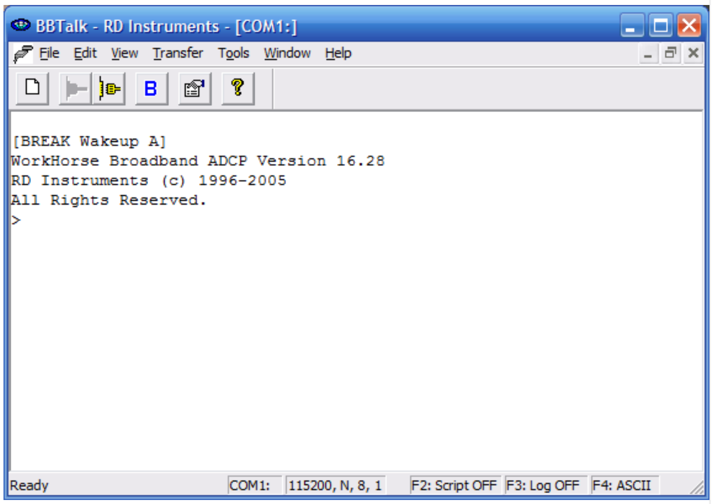
Table 2: WorkHorse Mariner Real-Time Application Guide

Application	Blue Water	Costal and Continental Shelf
Real-Time deployment	**Mariner using VmDas**	**Mariner using VmDas**
	• Oil production platforms	• Port and harbor monitoring
	• Current mapping	• Water quality studies
Vessel Mount (permanent)	**Mariner using VmDas**	**Mariner using VmDas**
	• Oceanography	• Costal engineering
	• Boundary layer studies	• Cable and pipe laying
	• Fisheries	• Circulation/model studies
	• Plankton biomass	
	• Seismic streamer positioning	
Boat Mount (portable)	**Mariner using VmDas**	**Mariner using VmDas**
	• Oceanography	• Plume tracking
	• Boundary layer studies	• Environmental surveys
	• Fisheries	• Planning new ports
	• Plankton biomass	• Current mapping
Offshore oil and gas	**Mariner using VmDas**	
	• Seismic prospecting	
	• Exploration drilling	
	• Field development	
	• Production	

Software Overview

TRDI provides several software programs to test and collect data with the WorkHorse ADCP.

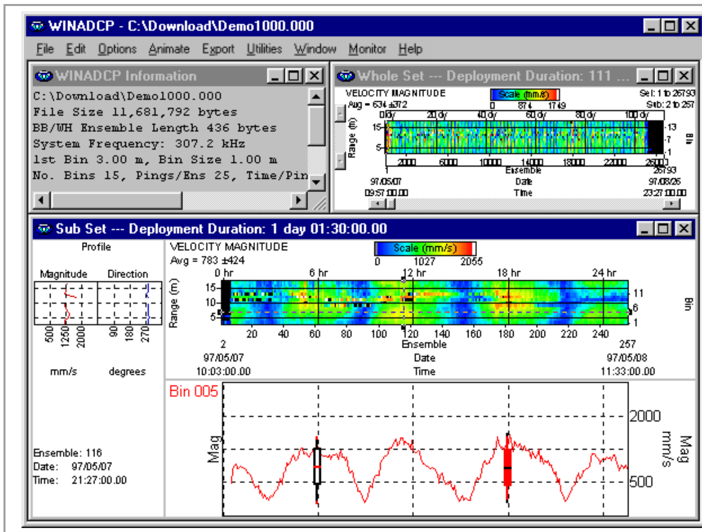
Included Software



BBTalk

BBTalk is a terminal emulator that allows your computer to communicate with the WorkHorse via RS422 or RS232.

This guide does not go into detail about the operation of *BBTalk*. For more information see the RDI Tools User's Guide.



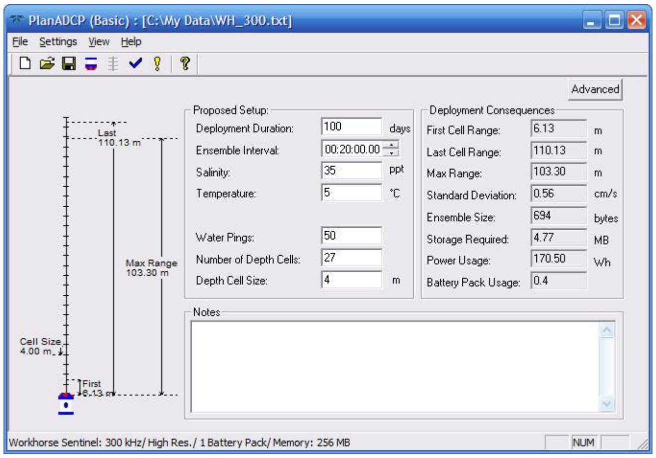
WinADCP Main Screen

WinADCP gives users a visual display of the entire set of data. You can zoom in on a portion of the data for closer analysis and export data to text or MatLab files.

Use *WinADCP* to view color contour and time-series plots of data collected with a WorkHorse Mariner in real-time.

For detailed information on how to use *WinADCP*, see the WinADCP User's Guide.

Optional Software

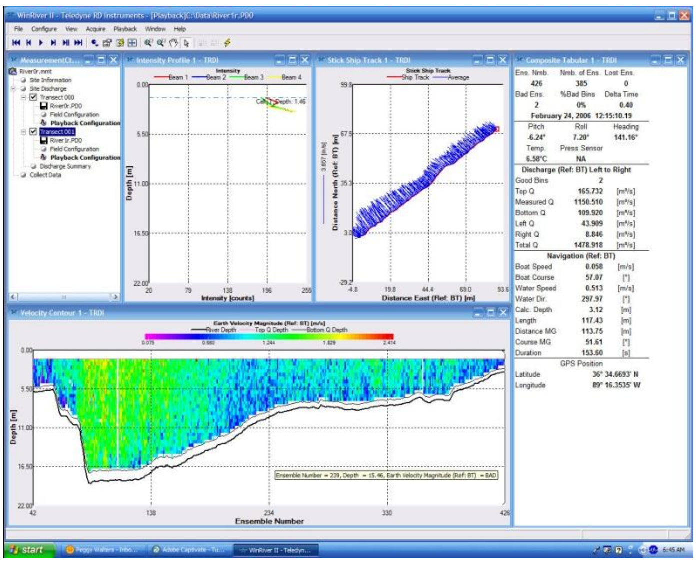


PlanADCP

The *PlanADCP* screen shows you an overview of your setup and the resulting consequences of your deployment.

For more information see the *WinSC* and *PlanADCP* User's Guide.

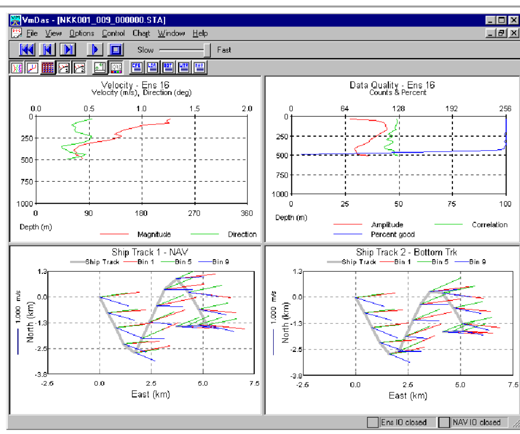
PlanADCP is not provided with Work-Horse Mariner systems, but is available for free download at www.rdinstruments.com.



WinRiver II

WinRiver II is TRDI's river and coastal data acquisition software package where the primary use is for discharge calculation. Although this is its primary function, it can be used for general coastal survey applications.

For detailed information on how to use *WinRiver II*, see the WinRiver II User's Guide.



VmDas

VmDas is designed for real-time data collection and processing of data gathered by an ADCP for users on a moving vessel. The displays are designed to make evaluation of the currents at a glance.

For detailed information on how to use *VmDas*, see the VmDas User's Guide.

Installing the Software

You will be installing several software packages. These will be required for testing and deployments.

TRDI software requires a Windows® compatible computer with the following specifications:

- Windows XP® or Windows 7®
- Pentium III 600 MHz class PC (higher recommended)
- 1GB of RAM (2GB RAM recommended)
- 50 MB Free Disk Space plus space for data files (A large, fast hard disk is recommended)
- One Serial Port (two or more High Speed UART Serial Port recommended)
- Minimum display resolution of 1024 x 768, 256 color (higher recommended)
- CD-ROM Drive
- Mouse or other pointing device

Software Installation

a. Insert the compact disc into your CD-ROM drive and then follow the browser instructions on your screen. If the browser does not appear, complete Steps "b" through "d."

b. On the Windows task bar, click the **Start** button, and then click **Run**.

c. Type <drive>:launch. For example, if your CD-ROM drive is drive D, type d:launch.

d. Follow the browser instructions on your screen

WorkHorse Preparation

Proper WorkHorse ADCP preparation is critical for a successful deployment. In this section we will prepare the WorkHorse Mariner ADCP for deployment.

Deployment Checklist

- ❑ **Visually inspect the WorkHorse**
  - ❑ Check the I/O Cable and connector pins for damage
  - ❑ Check the housing condition for damage
  - ❑ Check the transducer faces are clean and free from defects
- ❑ **Seal the WorkHorse for deployment**
  - ❑ Check Recorder PC card is installed (optional)
  - ❑ Use fresh desiccant (2 bags) inside WorkHorse ADCP
  - ❑ Install new o-rings; use silicone lubricant
  - ❑ Check all mounting hardware is installed and free of corrosion
- ❑ **Bench Tests**
  - ❑ Test the WorkHorse using *BBTalk*
  - ❑ Verify the compass alignment using *BBTalk*; if necessary, re-calibrate
  - ❑ Check the recorder status using *BBTalk* (if memory cards are used)
- ❑ **Final Preparation for Deployment**
  - ❑ Are biofouling precautions needed?
  - ❑ Clean the optional pressure sensor port copper screw
  - ❑ Zero the pressure sensor (optional) at deployment site with AZ-command

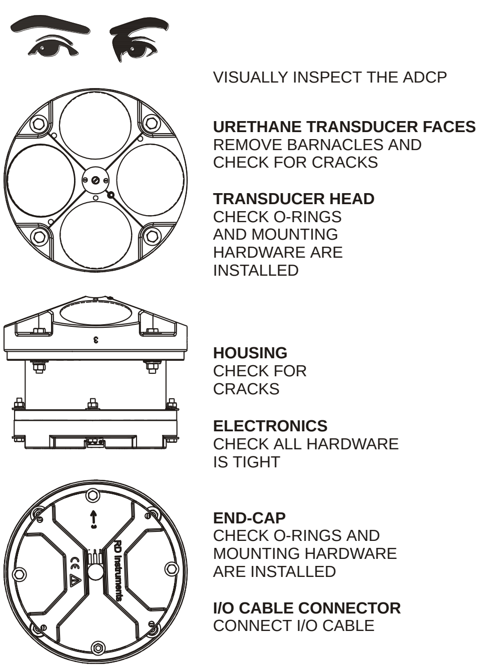
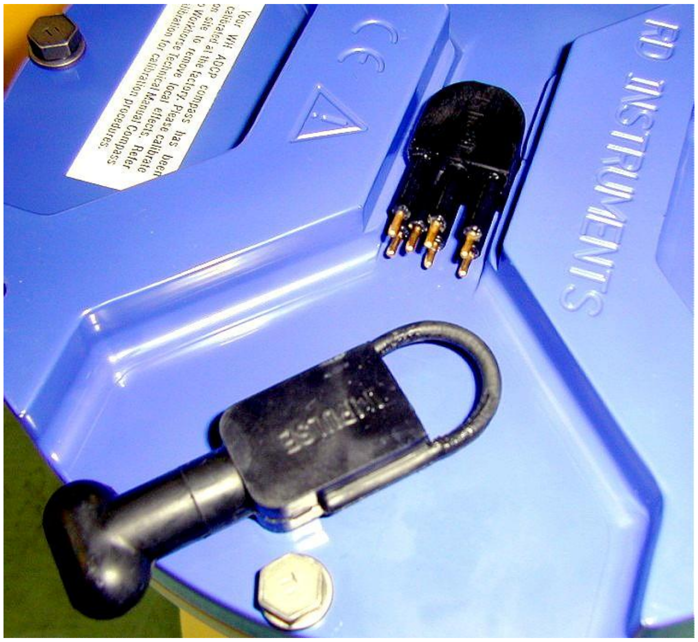


Figure 7. Visual Inspection Checklist

Visual Inspection

Before connecting the WorkHorse ADCP, make a quick visual inspection of the components to make sure nothing is damaged.



Check the I/O Cable and connector pins for damage

Roll the I/O cable rubber retaining strap up so that it does not hinder plug removal.

Remove the dummy plug or cable by pulling with a straight-out motion. Do not wiggle the connector up; this can damage the connector pins. A slight side-to-side wiggle as you are pulling on the cable is OK.

Inspect the pins for damage. Make sure that they are straight and that there is no corrosion on the metal surfaces.

Check the WorkHorse for damage

Inspect the WorkHorse ADCP for damage. There should be no cracks or peeling surfaces.

<u>Check the transducer faces are clean and free from defects</u>

Inspect the WorkHorse ADCP for damage. There should be no cracks or peeling surfaces.

Seal the WorkHorse for Deployment

Before you put the WorkHorse ADCP into the water, you must prepare it for deployment.

- Replace the desiccant
- Replace the desiccant inside the WorkHorse
- Install new o-rings; use silicone lubricant
- Check all mounting hardware is installed

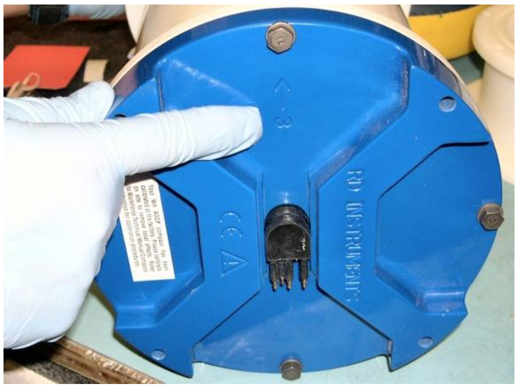
NOTE. Only the end-cap removal instructions are included in this Quick Start Guide. If you need access to the WorkHorse electronics, the transducer head must be removed. Please refer to the WorkHorse Technical Manual for instructions.

Replace the Desiccant

To install the WorkHorse Mariner desiccant, do the following steps. Read the WorkHorse Technical Manual for details.

CAUTION. Any system that was deployed may have pressure inside the housing.

Wear safety glasses and keep head and body clear of the end-cap while opening.



Make note of the location of Beam 3. The Beam 3 mark on the end cap should be aligned with the label on the housing and the Beam 3 mark on the transducer.

Place the WorkHorse Mariner ADCP on its side.

Inspect the housing and end cap bolts for any signs of damage such as bending, stretched bolts, crushed or deformed bushings, etc. These signs may indicate that there is internal pressure inside the system.

To avoid any possible injury it is ALWAYS recommended that you loosen but do not remove the four end-cap bolts to allow any internal pressure to be vented from the system. **Loosen the end-cap bolts two turns each in a cross-pattern. Repeat until the face seal O-ring is not compressed and the system has the opportunity to vent.** If you note that the end cap moves as you loosen the bolts then this may indicate that internal pressure is present. Be sure to only loosen the bolts far enough to allow the system to vent.

Once all four end-cap bolts have been loosened and you are sure that there is no internal pressure, remove the bolts from the end-cap.

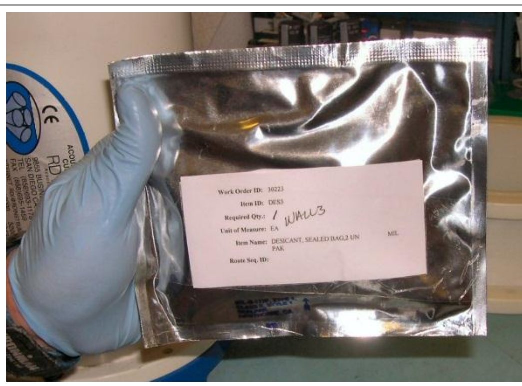
Gently slide the end-cap assembly out of the housing. The cables are long enough to allow the assembly to be placed next to the housing.

Clean the O-ring groove. Be sure the groove is free of foreign matter, scratches, indentations, or pitting. Use lint free wipes or a wood scraper to clean the groove.

Never use Q-tips to clean the O-ring groove; loose fibers or lint can provide a leakage path.

Place a small amount of silicone lube on the O-ring and spread it over the entire O-ring surface. The O-ring should appear “shiny”. Wipe off any excess lube.

Place the O-ring in the O-ring groove on the housing.



Place a new desiccant pack and moisture indicator into the housing. Desiccant bags are used to dehumidify the housing interior.

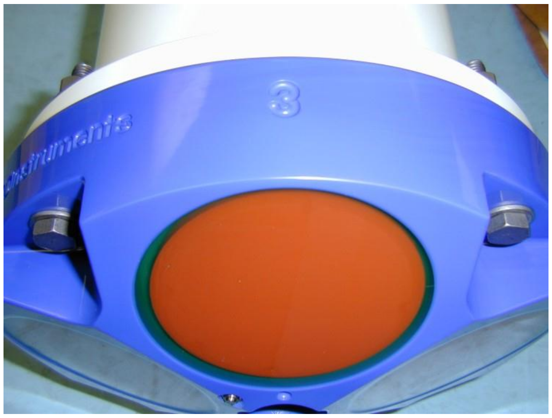
Remove the new desiccant bags from the airtight aluminum bag.

Remove the old desiccant bags and install two new ones. Place the desiccant bags under the rubber bands on the battery pack or place on top of the PC boards.

	Slide the end-cap onto the housing making sure that the beam 3 mark is aligned with the label on the housing and the beam 3 mark on the transducer head. Make sure that no wires become pinched and that the O-ring does not fall out of the groove. It may be easier to tip the ADCP on the transducer head when connecting the end-cap to the housing. Make sure to protect the transducer faces and prevent the ADCP from tipping over.
	Install all four sets of hardware until "finger-tight."
	Tighten the bolts in small increments in a "cross" pattern until the split washer flattens out, and then tighten each bolt ¼ turn more to compress the face seal O-ring evenly. Tighten the bolts to the recommended torque value of 5.6 Newton-meters (50 pound-inches).

Check all Mounting Hardware is Installed

If the housing is not properly sealed prior to deployment, the WorkHorse ADCP will be destroyed.



Transducer Head to Housing Seal

Visually inspect the mating surfaces of the housing to transducer head to ensure that there are no obstructions. The faces should be parallel to one another and there should be no gaps. Check to ensure that the titanium fasteners holding the housing together are tight.

The recommended torque value for the transducer head 8-mm bolts is 9.6 Newton-meters (85 pound-inches).

End-Cap to Housing Seal

Visually inspect the mating surfaces of the end-cap to housing to ensure that there are no obstructions. The faces should be parallel to one another and there should be no gaps. Check to ensure that the titanium fasteners holding the housing together are tight.

The recommended torque value for the end-cap 6-mm bolts is 5.6 Newton-meters (50 pound-inches).

CAUTION. Do not replace the titanium hardware with any other hardware. Corrosion will result.

If the WorkHorse was opened, read the WorkHorse Technical Manual – Maintenance section for details on WorkHorse re-assembly.

Bench Test

The bench-testing process ensures that the WorkHorse ADCP is working properly before you put it in the water. The bench-test procedure will involve powered tests that will verify that the WorkHorse ADCP's electronics and transducers are functioning.

This Section Covers:

- Setup the Marnier ADCP
- Test the Marnier ADCP
- Compass alignment

Setup the Marnier ADCP

You will now connect the ADCP to a power supply and a computer with the TRDI software installed.

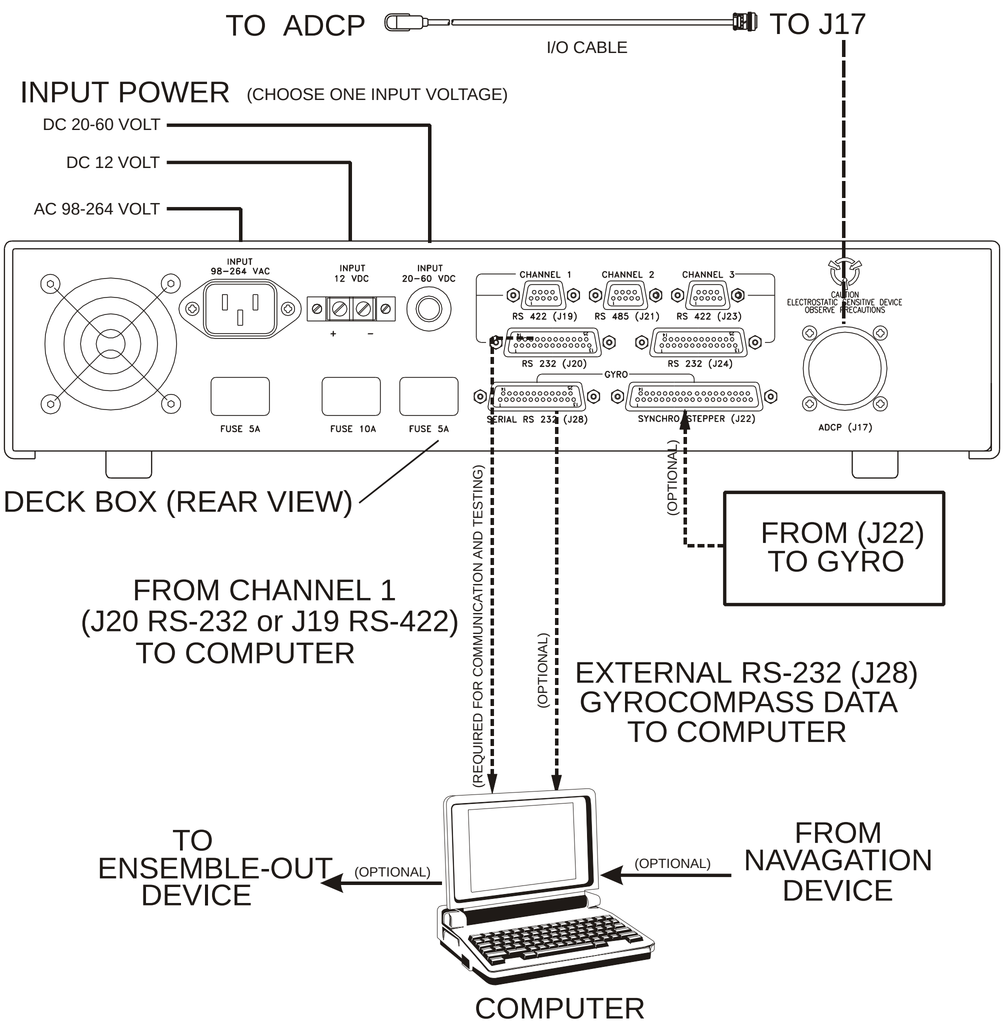
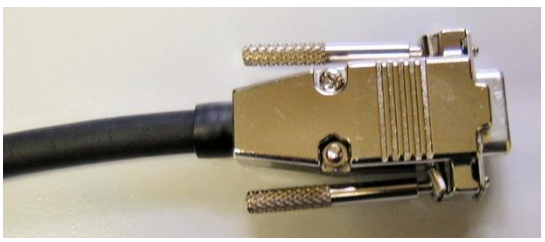


Figure 8. Mariner Connections

Connect the I/O Cable to WorkHorse

If you have not done so, connect the I/O cable to the WorkHorse ADCP. Do so by pushing straight in against the connector. Roll the retaining strap over the connector.

Place a light amount of silicone lubricant on the connector pins (rubber portion only). This will make it easier to connect or remove the I/O cable and dummy plug.



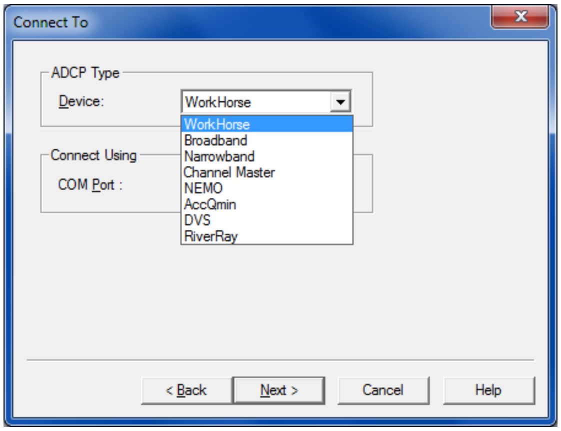
Connect the I/O Cable to Computer and Power Supply

Attach the I/O cable to your computer's communication port. The standard communications settings are RS-232, 9600-baud, no parity, 8 data bits and 1 stop bit.

Connect power to the deck box.

Connecting to the WorkHorse

Use these next steps to “talk” to the WorkHorse ADCP.



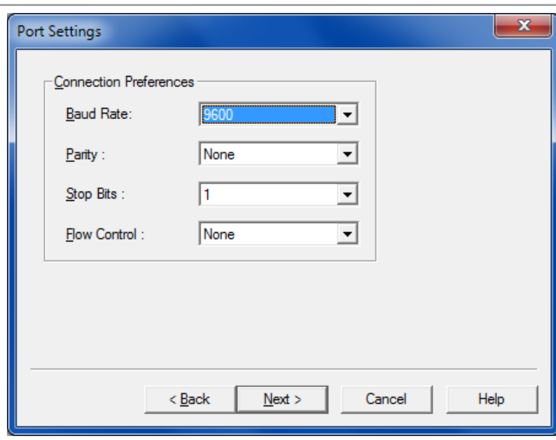
Start BBTalk

Start the *BBTalk* program (for help on using *BBTalk*, see the RDI Tools User's Guide).

On the **Connect To** screen, select **WorkHorse**.

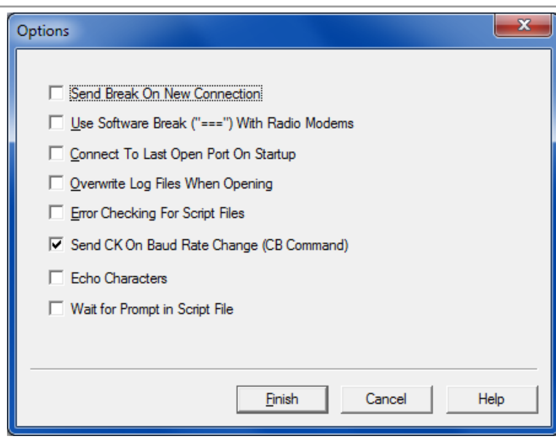
Select the COM port the WorkHorse ADCP cable is connected to.

Click **Next**.

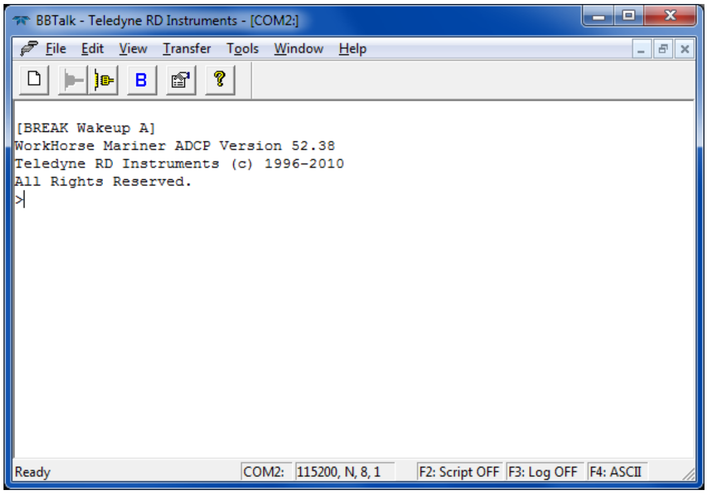


Enter the **Baud Rate**, **Parity**, **Stop Bits**, and **Flow Control**. If you are unsure of the settings, leave them at the default settings.

Click **Next**.



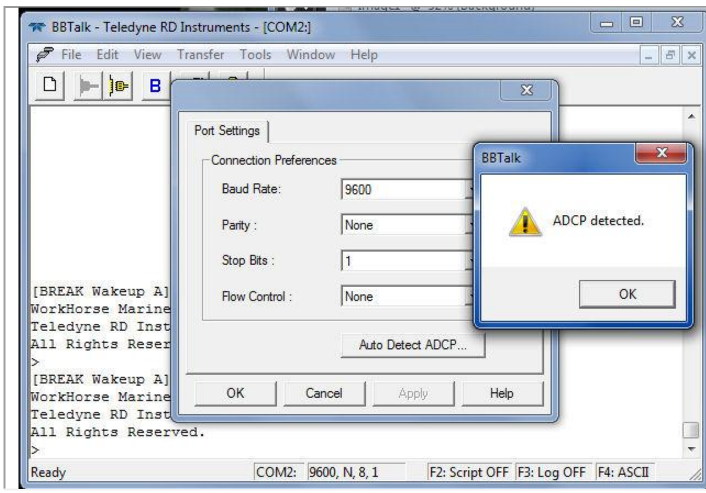
Click **Finish**.



Wakeup Message

On the **File** menu, click **Break** (you can also press the **End** key to send a break or press the **B** button on the Toolbar).

You should see the wakeup message appear on the log file window.



If the wakeup message is not readable or visible, do the following.

On the **File** menu, click **Properties**.

Click the **Auto Detect ADCP** button.

Click **OK** when the WorkHorse is detected. Try to wake up the WorkHorse again.

Both *BBTalk* and the ADCP must use the same Baud rate.

What if the WorkHorse Does Not Respond

If your WorkHorse ADCP does not respond, check the serial port, cables, AC power, and Deck Box connections. If necessary, refer to the Troubleshooting section in the WorkHorse Technical Manual.

Changing the Baud Rate in the ADCPs

The ADCP can be set to communicate at baud rates from 300 to 115200. The factory default baud rate is always 9600 baud. The baud rate is controlled via the CB-command. The following procedure explains how to set the baud rate and save it in the ADCP. This procedure assumes that you will be using the program *BBTalk* that is supplied by Teledyne RD Instruments.

```
[BREAK Wakeup A]
WorkHorse Mariner ADCP Version 52.38
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>cr1
[Parameters set to FACTORY defaults]
```

Connect the ADCP to the computer and apply power.

Start the *BBTalk* program and establish communications with the ADCP. Wakeup the ADCP by sending a break signal with the **End** key.

At the ">" prompt in the communication window, type **CR1** then press the Enter key. This will set the ADCP to the factory default settings.

BAUD RATE	CB-command
300	CB011
1200	CB111
2400	CB211
4800	CB311
9600	CB411 (Default)
19200	CB511
38400	CB611
57600	CB711
115200	CB811

Send the CB-command that selects the baud rate you wish. The table on the left shows the CB-command settings for different baud rates with no parity and 1 stop bit.

For example, to change the baud rate to 115200, at the ">" prompt in the communication window, type **cb811** then press the Enter key.

The CB? command will identify the communication setting.

```
>cb?
CB = 411 ----------------- Serial Port Control (Baud
[4=9600]; Par; Stop)
>cb811
>CK
[Parameters saved as USER defaults]
>cb?
CB = 811 ----------------- Serial Port Control (Baud
[8=115200]; Par; Stop)
>
```

BBTalk will send the command **CK** to save the new baud rate setting.

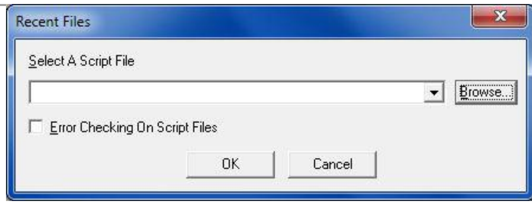
Exit *BBTalk*.

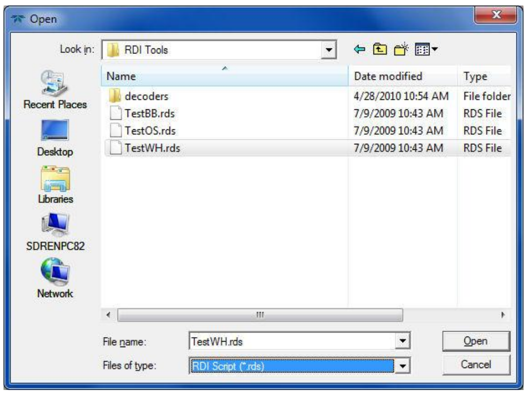
The ADCP is now set for the new baud rate. The baud rate will stay at this setting until you change it back with the CB-command.

Exit *BBTalk* so the communication port is available for use with other programs.

Testing the WorkHorse

Before deploying the WorkHorse ADCP, it is a good idea to make sure that it is working properly. This simple test checks that the WorkHorse ADCP is able to communicate with the computer and runs the diagnostic tests.





Testing the WorkHorse

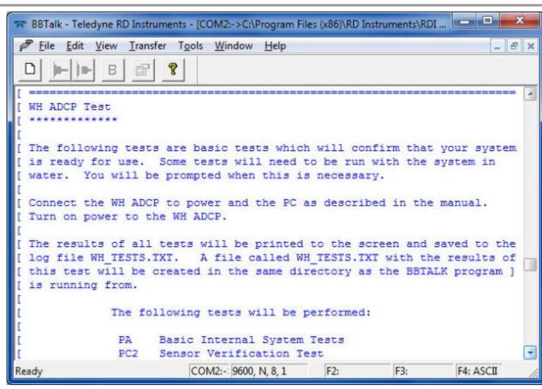
Using *BBTalk*, click **File**, **Send a Break** to send the wakeup command (BREAK) to the WorkHorse ADCP.

On the **File** menu, click **Send Script File**. Click the **Browse** button "...".

On the **Files of Type** box select **RDI Script (*.rds)**.

Select the *TestWH.rds* script file and click **Open**.

These script files (*.rds) were copied into the same directory as *BBTalk* when you installed the RDI Tools software.



Follow the prompts on the screen.

To review the test results, open the *WH_Test.txt* results log file (*.txt) with any text editor (i.e. NotePad).

NOTE. Windows 7® will save the log file to C:\Users\username\AppData\Local\VirtualStore\Program Files (x86)\RD Instruments\RDI Tools.

Using Windows XP®, the *BBTalk* program saves the test results file to different locations based on how the program was started. When you start *BBTalk* from the desktop icon and run the test script file, the result log file is created on the desktop. If you run *BBTalk* from the start menu, the results file is put in C:\Documents and Settings\All Users\Start Menu\Programs\RD Instruments\RDI Tools. It is only when you double-click the *.rds file in the RDI Tools folder that the results are saved to the RDI Tools folder.

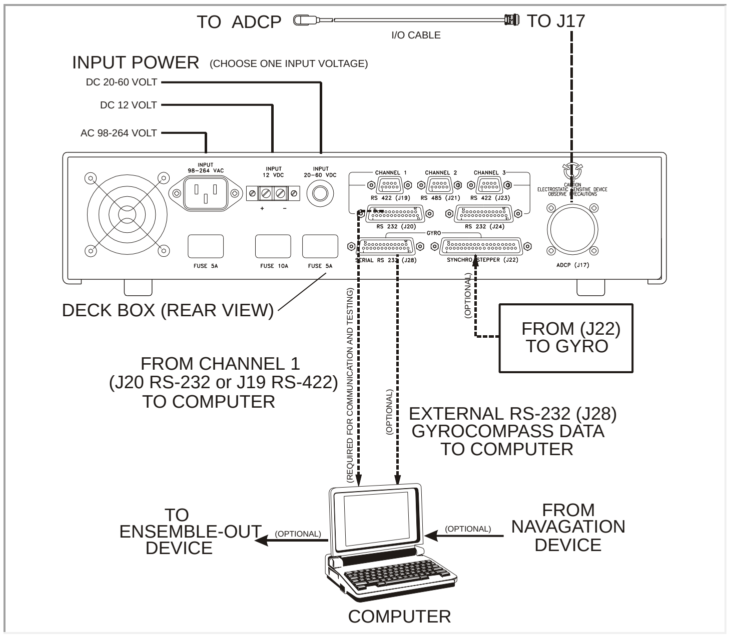
To make sure the result file is always saved to the same location, see the RDI Tools User's Guide.

Compass Alignment

The main reason for compass calibration is battery replacement. Each new battery carries a different magnetic signature. The compass calibration algorithm corrects for the distortions caused by the battery to give you an accurate measurement. You should be aware of the following items:

- We recommend **against** calibrating the WorkHorse while on a ship. The ship's motion and magnetic fields from the hull and engine will likely prevent successful calibration or **will provide an improper calibration for the heading sensor once the ADCP operates away from the ship.**
- If you think your mounting fixture or frame has some magnetic field or magnetic permeability, calibrate the WorkHorse inside the fixture. Depending on the strength and complexity of the fixture's field, the calibration procedure may be able to correct it.
- A good compass calibration requires slow, smooth movement to allow the compass to collect data at each point.
- Calibrate the compass as close to the location that it will be deployed and as far away as possible from objects that have magnetic fields that could result in a poor calibration. **Common objects to avoid calibrating the compass near include steel reinforced concrete, buildings, and automobiles.**
- **Completing the calibration rotation(s) does not guarantee an acceptable compass error.** Compass error is based not only on the quantity of measurements made during the calibration but also the quality of the magnetic environment. Attempting to calibrate the compass in a poor environment, e.g., near fixed ferrous objects, will likely result in an unacceptable compass error regardless of how well the calibration is performed.
- The Single-tilt calibration is intended for applications where tilting the unit is not practical. **This calibration is only applicable to the tilt orientation the unit is rotated about during the calibration**.

Preparing for Calibration



Connect the WorkHorse Mariner as shown.

Mount the ADCP in the boat as it will be used to acquire data.

NOTE. If you will deploy your WorkHorse Mariner looking up, calibrate it looking up. If you will deploy it looking down, calibrate it looking down.

CAUTION. If you calibrate the compass in one direction (up or down) and deploy the WorkHorse Mariner in the opposite direction (i.e. calibrate it in a downward position and deploy it in an upward position) the compass calibration will be invalid. Compass errors in excess of 5 degrees may occur.

Compass Calibration Verification

Compass calibration verification is an automated built-in test that measures how well the compass is calibrated. The procedure measures compass parameters at every 5º of rotation for a full 360º rotation. When it has collected data for all required directions, the WorkHorse computes and displays the results.

[BREAK Wakeup A] WorkHorse Mariner ADCP Version 52.38 Teledyne RD Instruments (c) 1996-2010 All Rights Reserved. >	Using *BBTalk*, send a Break to wake up the WorkHorse ADCP (press the **END** key).

```
>AX
----------------------------------------------------------------------
                    RDI Compass Error Estimating Algorithm

   Press any key to start taking data after the instrument is setup.
   Rotate the unit in a plane until all data samples are acquired...
   rotate less than 5°/sec.  Press Q to quit.
N      NE      E       SE      S       SW       W        NW       N
^              ^               ^                ^                 ^
```

At the > prompt, type **AX** and press the **Return** key.

```
HEADING ERROR ESTIMATE FOR THE CURRENT COMPASS CALIBRATION:
   OVERALL ERROR:
      Peak Double + Single Cycle Error (should be < 5():  ( 1.55(
   DETAILED ERROR SUMMARY:
      Single Cycle Error:                             ( 1.54(
      Double Cycle Error:                             ( 0.07(
      Largest Double plus Single Cycle Error:         ( 1.61(
      RMS of 3rd Order and Higher + Random Error:     ( 0.31(
```

Rotate the WorkHorse ADCP slowly 360 degrees (approximately 5 degrees per second). Pay particular attention to the Overall Error.

If the overall error is less than 2°, the compass does not require alignment. You can align the compass to reduce the overall error even more (if desired).

Single-Tilt Compass Calibration Procedure

This procedure is used to correct the ADCP's internal flux-gate compass for one-cycle deviation errors. The compass correction procedure given here can be used in place of the hard iron error (single cycle) or hard and soft iron error (single + double cycle) compass calibration procedures (see the WorkHorse Technical Manual for details).

During this procedure, the ADCP must be rotated in a complete 360 circle no faster than 5 degrees per second. This calibration can be done in the water (recommended) or on shore. It is important to reduce any pitch and roll effects during the turn and avoid any acceleration.

CAUTION. This calibration is intended for applications where tilting the unit is not practical. **This calibration is only applicable to the tilt orientation the unit is rotated about during the calibration.**

```
>AR
Do you really want to write over the active fluxgate
calibration
   data [y or n]?Y

Fluxgate Calibration Matrices Updated with Factory
Original Values.

>
```

Mount the ADCP in the boat as it will be used to acquire data.

Start *BBTalk*.

At the ">" prompt, type **AR** and press the **Return** key. Type **Y** to return the Fluxgate Calibration Matrices with the factory original values.

```
Field Calibration Procedure
Choose calibration method:
a.  Remove hard iron error (single cycle) only.
b.  Remove hard and soft iron error (single + double cycle).
c.  Calibration for a single tilt orientation (single + double cycle).
d.  Help.
e.  Quit.
c
```

At the ">" prompt, type **AF** and press the **Return** key.

Select option "c" Calibration for a single tilt orientation (single + double cycle).

```
HEADING ERROR ESTIMATE FOR THE CURRENT COMPASS CALIBRATION:
   OVERALL ERROR:
      Peak Double + Single Cycle Error (should be < 5ø):  ñ 1.73ø
   DETAILED ERROR SUMMARY:
      Single Cycle Error:                                 ñ 1.70ø
      Double Cycle Error:                                 ñ 0.42ø
      Largest Double plus Single Cycle Error:             ñ 2.12ø
      RMS of 3rd Order and Higher + Random Error:         ñ 0.77ø
      Orientation:     Down
      Average Pitch:  -0.18ø         Pitch Standard Dev:    0.37ø
      Average Roll:    0.35ø         Roll Standard Dev:     0.45ø

Successfully evaluated compass performance for the current compass
calibration.

Press C to display Percent Horizontal Field Components
     Relative to Calibration or any other key to continue....
Calibration parameters have been updated in NRAM.

>
```

During the calibration, drive the boat in a continuous small circle. You can accomplish this by adjusting the throttle to just above idle and steering either hard left or hard right.

While you continue to drive the boat in circles, press any key to start the compass calibration. Follow the on screen prompts.

Press **D** for details.

You can now use the ADCP with its corrected compass.

NOTE. Reduce any pitch and roll effects during the turn. Do not move about the boat as this may cause the boat to change how it sits in the water. Avoid any accelerations during the calibration. If you are working on a river, you will find that you drift downstream as you perform the circles. This will not affect the calibration.

Optional Pressure Sensor Preparation

In order to read the water pressure (depth), water must be able to flow through the copper screw on the pressure sensor. Antifoulant paint will block the sensor's port (a small hole that is drilled through the copper screw). You should tape off the screw during anti-fouling paint application.

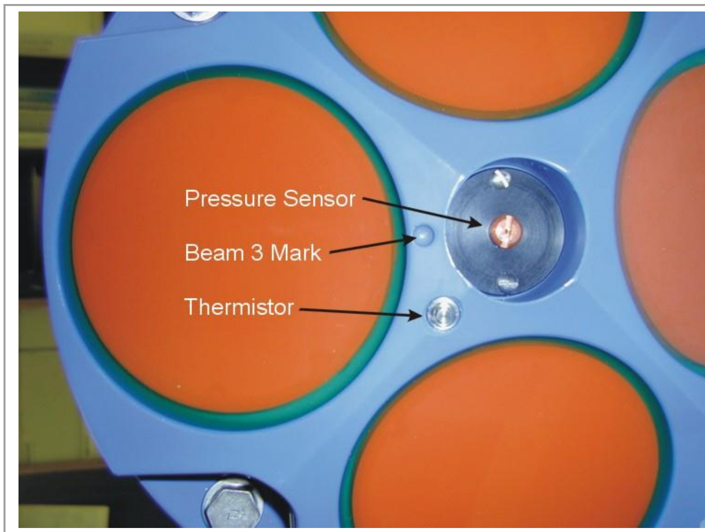
This means that the sensor port is not fully protected from bio fouling. The sensor port is surrounded by the antifouling paint, but bio fouling may build up on the screw, and eventually clog the sensor port. However, most organisms do not seem to find the small amount of unpainted surface attractive. If it is logistically possible to periodically inspect/clean the pressure sensor screw, it is highly recommended. This tradeoff situation must be analyzed for individual deployments. Unfortunately, the location of the deployment site usually dictates action in this regard.

NOTE. The pressure sensor is optional. It may not be included on your system.

CAUTION. The pressure sensor is filled with silicone oil. Never poke a needle or other object through the copper screw while the screw is installed over the pressure sensor. You will perforate the sensor, causing it to fail.

Do not remove the cover disc or attempt to clean the surface of the pressure sensor. The diaphragm is very thin and easy to damage.

Do not remove the pressure sensor. It is not field replaceable.



Use the following procedure to clean the screw.

Place the WorkHorse on its' end-cap. Use a soft pad to protect the WorkHorse.

Use a straight-slot screwdriver to remove the copper screw.

Gently clean out the hole in the copper screw with a needle.

Install the copper screw. Tighten the screw "finger tight" (0.226 N-m, 2 lbf-in).

CAUTION. Do not over tighten the copper port screw or you may strip the threads on the plastic cover disc. If this happens, return the WorkHorse ADCP to TRDI for repair.

Zero the Pressure Sensor

```
[BREAK Wakeup A]
WorkHorse Mariner ADCP Version 52.38
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>AZ
>
```

Use the AZ-command to zero out the pressure sensor at the deployment site, before putting the WorkHorse into the water.

Connect and apply power to the system.

Start *BBTalk* and wakeup the WorkHorse ADCP (press the **END** key).

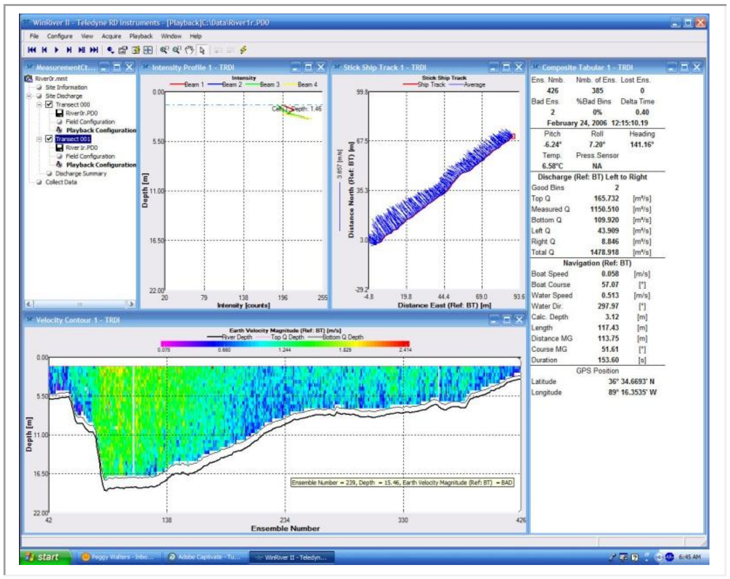
Type **AZ** and press the Return key.

Exit *BBTalk*.

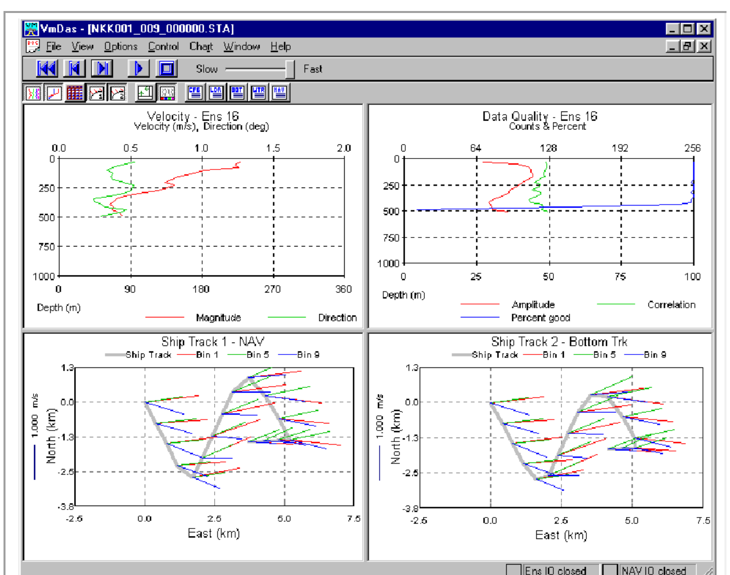
Collecting Real-Time Data

WinRiver II is the most often used software package for Mariner ADCPs. *WinRiver II* is TRDI's river and coastal data acquisition software package where the primary use is for discharge calculation. Although this is its primary function, it can be used for general coastal survey applications.

TRDI also offers the *VmDas* program. *VmDas* is designed for real-time data collection and processing of data gathered by an ADCP on a moving vessel. The displays are designed to make evaluation of the currents at a glance.



For detailed information on how to use *WinRiver II*, see the WinRiver II User's Guide.



For detailed information on how to use *VmDas*, see the VmDas User's Guide.

Where to Find More Information

Congratulations! You have completed the WorkHorse Mariner User's Guide. For more detailed information, see the following sections in the WorkHorse Technical Manual.

Installation. Use this section to plan your installation requirements. This guide includes specifications and dimensions for the WorkHorse Mariner ADCP (including outline installation drawings).

Maintenance. This section covers WorkHorse Mariner ADCP maintenance. Use this section to make sure the WorkHorse is ready for a deployment.

Test. Use this section to test the WorkHorse Mariner ADCP.

Troubleshooting. This section includes a system overview and how to troubleshoot the WorkHorse Mariner ADCP. If the WorkHorse fails a built-in test or you cannot communicate with the system, use this section to help locate the problem.

Commands and Output Data Format Guide. This guide contains a reference for all commands and output data formats used by the WorkHorse Mariner ADCP.

NOTES