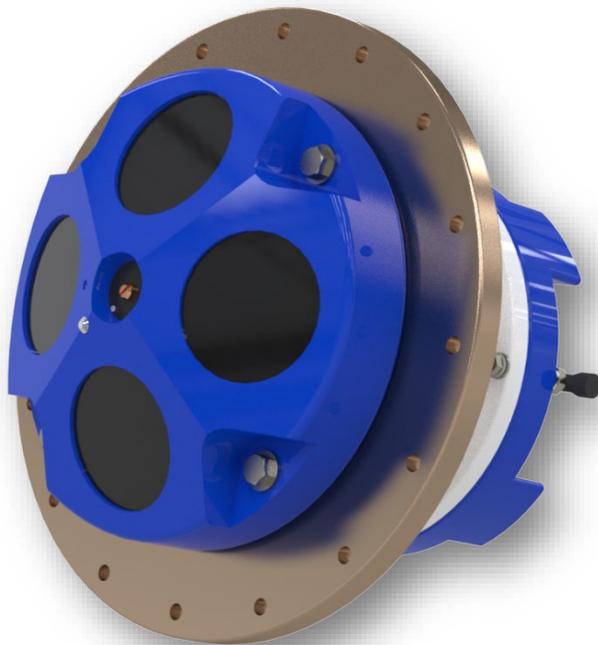


WORKHORSE II

MARINER

DEPLOYMENT GUIDE



P/N 957-6301-00 (October 2023)

© 2023 Teledyne RD Instruments, Inc. All rights reserved.



<https://www.teledynemarine.com>

Use and Disclosure of Data

Information contained herein is classified as EAR99 under the U.S. Export Administration Regulations. Export, reexport or diversion contrary to U.S. law is prohibited.

TABLE OF CONTENTS

PREPARING THE ADCP	1
CONNECTING TO THE ADCP	5
PRE-DEPLOYMENT CHECKS	7
PLANNING THE DEPLOYMENT.....	11
REAL-TIME DEPLOYMENTS.....	12
POST-PROCESSING DATA	15
CONCLUSION.....	16

HOW TO CONTACT TELEDYNE RD INSTRUMENTS

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

Teledyne RD Instruments	Teledyne RD Instruments Europe
14020 Stowe Drive Poway, California 92064	2A Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude, France
Phone +1 (858) 842-2600	Phone +33(0) 492-110-930
Sales – rdisales@teledyne.com	Sales – rdie@teledyne.com
Field Service – rdifs@teledyne.com	Field Service – rdiefs@teledyne.com

Client Services Administration – rdicsadmin@teledyne.com

Web: <https://www.teledynemarine.com>

For all your customer service needs including our emergency 24/7 technical support, call +1 (858) 842-2700

Self-Service Customer Portal

Use our online customer portal at <https://www.teledynemarine.com/support/RDI/technical-manuals> to download manuals or other Teledyne RDI documentation.

Teledyne Marine Software Portal

Teledyne RD Instruments Firmware, software, and Field Service Bulletins can be accessed only via our Teledyne Marine software portal.

To register, please go to <https://tm-portal.force.com/TMsoftwareportal> to set up your customer support account. After your account is approved, you will receive an e-mail with a link to set up your log in credentials to access the portal (this can take up to 24 hours).

Once you have secured an account, use the Teledyne Marine software portal to access this data with your unique username and password.

If you have an urgent need, please call our Technical Support hotline at +1-858-842-2700.

Preparing the ADCP

PREPARING THE ADCP INCLUDES THE FOLLOWING STEPS:

- ✔ Checking you have all the Mariner parts
- ✔ Installing the documentation and software

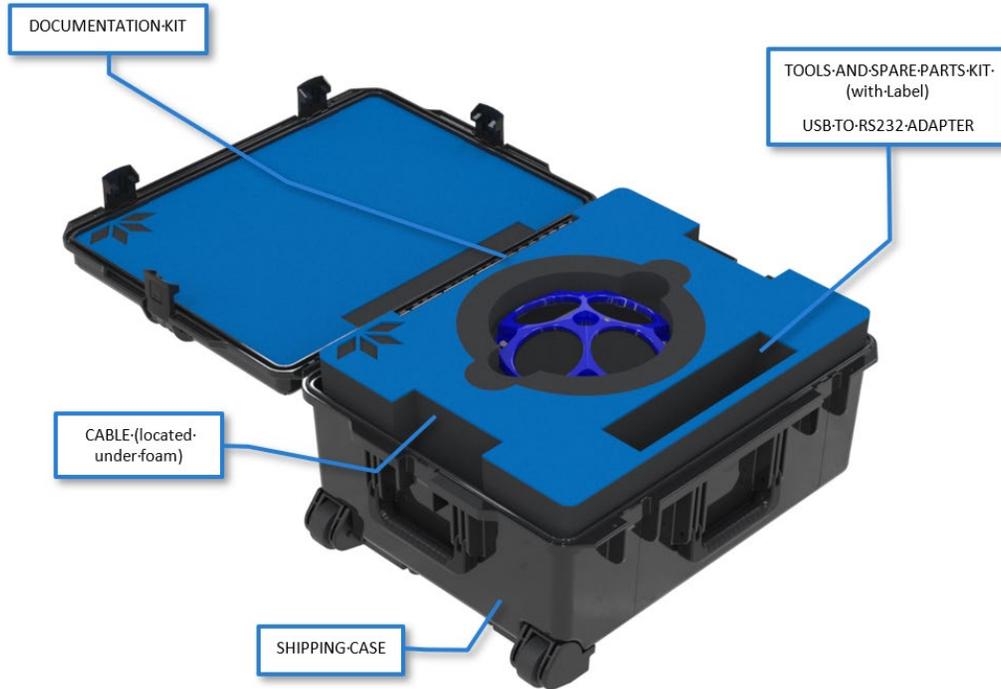
Identifying what's in the Box

Included with the Workhorse II Mariner system:

Part Number	Name	Description
WHMVMII1200-I WHMVMII600-I WHMVMII300-I	Mariner system	The Workhorse II Mariner system includes the transducer, Deck Box, dummy plug, and protective cap. When unpacking, use care to prevent physical damage to the transducer face and connector. Use a soft pad to protect the transducer.

Included with the Workhorse II Accessories Kit:

Part Number	Name	Description
977-7015-00	Shipping case (ADCP)	Shipping case with custom foam cutouts.
974-6012-00	Shipping case (Deckbox)	
757K6060-01	Adapter Plate	Optional bronze adapter plate kit.
737-3177-xxx	Underwater cable	The I/O cable is used for serial communications between the ADCP and Deckbox. Note the cable is located under the foam in the shipping case.
97Z-6190-00	USB to Serial Adapter	The USB adapter appears as an additional serial COM port.
730-6003-00	Cable kit	RS-232 cable connects the Deckbox to the computer.
957-6302-00	Getting Started	A printed sheet showing Workhorse II Mariner set up.
95Z-6007-00	Download instructions	This sheet has instructions for downloading the software and manuals.
957-6305-00 (part of 757K6189-00)		
Download from website	TRDI Toolz Workhorse II Plan ISM Compass Calibration Compass Post Calibration WinADCP	Use <i>TRDI Toolz</i> to test the ADCP, send deployment commands, and recover data. The <i>Workhorse II Plan</i> program creates a deployment configuration file. Use <i>ISM Compass Calibration</i> to calibrate the internal compass. Use <i>Compass Post Calibration</i> to correct heading/velocity data in a PDO data file. Use <i>WinADCP</i> to review data files.
	VmDas Software	<i>VmDas</i> is a real-time data collection software package for use with vessel mounted ADCPs. This software package supports the Workhorse II PDO Binary Output Data Formats for data collection, playback, and reprocessing.
	WinRiver II Software	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.
757K6194-00	Spare parts and tools	Contains O-Rings and close-up hardware.



Tools and Spare Parts

A set of tools and spare parts are included with the system (located in the canvas bag).

Workhorse II Spare Parts

Part Number	Item Name	Where Used:
5020	Silicone Lubricant	Housing
97Z-6052-00	O-Ring, 2-260 (200-meter housing)	
97Z-6084-00	O-RING, 2-015 .070DIAx.551 ID, EPDM, DURO 90A, VENT PLUG	
97Z-6084-01	O-RING, 3-904, .072DIAx.351 ID, EPDM, DURO90A, VENT PLUG	
M6WASHSPLTI	Washer, 6MM Split Lock, Titanium	
M6WASHSTDTI	Washer, Flat, Titanium 12.5MM OD	
M6X1.0NUTTI	Nut, Hex, Titanium 10MM	
M6X1.0X50HHTI	Screw, Hex Head, Titanium	
M8WASHSPLTI	Washer, Split Lock, Titanium	
M8WASHSTDTI	Washer, Flat, Titanium 22.9MM OD	
M8X1.25NUTTI	Nut, Hex, Titanium 13MM	
M8X1.25X65HHTI	Screw, Hex Head, Titanium Full Threads Length	
GMA-3A	Fuse, 5MM X 20MM 3R 250V	
DES3	Desiccant, Sealed Bag	Inside Housing
817-1067-00	Screw, Pressure Sensor	Pressure Sensor
97Z-6190-00	Adapter, USB to RS232, with FT232R chipset, 0.1m Cable Length	Connecting to system
M8X1.25X45SH	Screw, SKT HD.SST 316	Adapter Plate Hardware
M8WASHSPL	Washer, Split Lock, SST316	
M8WASHSTD	Washer, Flat 16MMOD,SST316	
M6X1.0X25SH	Screw, SKT HD, SST 316	
M6WASHSPL	Washer, Split Lock SST316	
M6WASHSTD	Washer, Flat,12.5MMOD SST 316	

Installing Documentation and Software

The Workhorse II software and manuals are downloaded.

1. Follow the instruction sheet on downloading TRDI software and manuals.
2. Software is available on <https://tm-portal.force.com/TMsoftwareportal>.

Download *TRDI Toolz*, *Workhorse II Plan*, *ISM Compass Calibration*, *Compass Post Calibration*, and *WinADCP*. These programs are required for set up, testing, and data review.

Download application software *VmDas* or *WinRiver II* as needed.



3. Use our online customer portal at <https://www.teledynemarine.com/support/RDI/technical-manuals> to download manuals or other Teledyne RDI documentation. Download the Workhorse II Operation manual and Workhorse ADCP Commands and Output Data Format Guide. PDF versions of all Workhorse II documentation are available for download.



Workhorse II Operation Manual

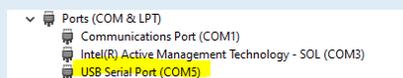


Workhorse ADCP Commands and Output Data Format Guide

Installing the USB to Serial Adapter Driver

If there is an available internet connection, Windows 10/11 will install the USB driver on first connection. If necessary, install the Virtual COM port (VCP) driver to make the USB adapter appear as an additional COM port. The free FTDI driver download page is available here: <https://ftdichip.com/drivers/>

Use Windows Device Manager® to determine the USB to Serial adapter COM port number. Remove the adapter, wait a moment, note the list of ports, reinsert the adapter and note the new port.



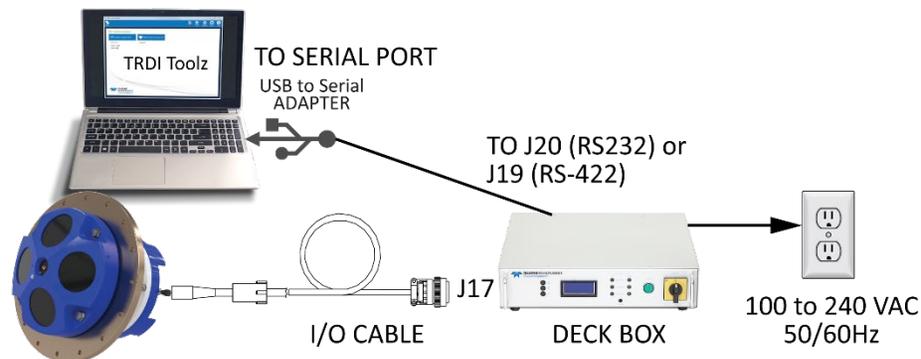
Quick Review

	
<ul style="list-style-type: none"> ✔ Check that you have all the Mariner parts. 	<ul style="list-style-type: none"> 🔗 If you are missing parts, contact TRDI support rdifs@teledyne.com or call +1 (858) 842-2700.
<ul style="list-style-type: none"> ✔ Check that the software and documentation are installed. ✔ The software is available for download on https://tm-portal.force.com/TMsoftwareportal 	<ul style="list-style-type: none"> 🔗 Install TRDI Toolz, Workhorse II Plan, ISM Compass Calibration. 🔗 Install Compass Post Calibration, and WinADCP. 🔗 Install application software VmDas and WinRiver II as needed.

Connecting to the ADCP

CONNECTING TO THE ADCP INCLUDES THE FOLLOWING STEPS:

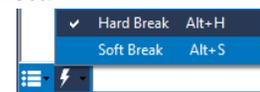
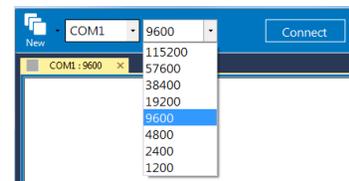
✓ Using TRDI Toolz



Connecting to the ADCP

To establish communications with the Workhorse II Mariner:

1. Lubricate the cable connector and connect to the ADCP. Attach the cable to the deck box J17. Attach the USB adapter to a spare USB port and connect to J20. Apply power to the deck box.
2. Start the *TRDI Toolz* software.
3. Select **New Serial Connection**.
4. Enter the ADCP's communication settings. Select the **COM Port** the serial cable is connected to and set the **Baud Rate** from the drop-down lists.
5. Click the **Connect** button. Once connected, the button will change to **Disconnect**.
6. From the **Break** button drop down menu, select **Hard Break** (shortcut **Alt+H**). Click the **Break** (⚡) button. The wakeup banner will display in the terminal window.



If you are unsure of the ADCP's baud rate, use **Tools, Find ADCP**. *TRDI Toolz* will try different baud rates until it connects to the ADCP.

```
>{i7φ²∩||z²jñ~ªñδgJ Checking 9600 baud rate
Checking 115200 baud rate
==
Workhorse II Broadband ADCP Version 77.xx
Teledyne RD Instruments (c) 1996-2021
All Rights Reserved.
>
```

Use *Windows Device Manager*® to determine the USB to Serial adapter COM port number. Remove the adapter, wait a moment, note the list of ports, reinsert the adapter and note the new port.

Quick Review

	
<p>✔ Verify the wakeup banner displays</p>	<ul style="list-style-type: none"> <li data-bbox="824 478 1424 625">  If you are unsure of the ADCP's baud rate, use Tools, Find ADCP. <i>TRDI Toolz</i> will try different baud rates until it connects to the ADCP. <li data-bbox="824 646 1424 762">  The default factory set communications for Mariner is RS-422, 9600-baud, no parity, 8 data bits and 1 stop bit. <li data-bbox="824 783 1424 877">  For help on using <i>TRDI Toolz</i>, click the  icon. <li data-bbox="824 898 1424 1003">  If you have any problems connecting, see the <u>Workhorse II Operation manual</u>, Chapter 6.
<p>✔ Install the USB to Serial adapter Virtual COM Port (VCP) driver</p>	<ul style="list-style-type: none"> <li data-bbox="824 1039 1424 1108">  The free FTDI driver download page is available here: https://ftdichip.com/drivers/

Pre-Deployment Checks

PRE-DEPLOYMENT CHECKS INCLUDES THE FOLLOWING STEPS:

- ✓ Setting the ADCP clock
- ✓ Testing the ADCP
- ✓ Calibrating the Compass

Pre-Deployment Checks

Use *TRDI Toolz* for running the pre-deployment tests and setting the Mariner real-time clock.



Refer to the [Workhorse and Workhorse II Command Guide](#) for a listing of all direct commands and their format.

Setting the ADCP Clock

The real-time clock (date and time) within the Mariner maintains the correct time while system power is removed. The clock is powered by a lithium battery on the WHP board.

To set the ADCP's clock to match the PC time:

1. Setup the communication parameters between *TRDI Toolz* and the ADCP.
2. Wake up the ADCP by pressing the  button.
3. Click **Tools, PC Time to ADCP**.
4. *TRDI Toolz* will send the **TS** command to set the clock.

```
[BREAK Wakeup A]
Workhorse II Broadband ADCP Version 77.xx
Teledyne RD Instruments (c) 1996-2021
All Rights Reserved.
>TS 21/06/17 09:50:34
>
```

Testing the ADCP

To run the Built-in tests:

1. Setup the communication parameters between *TRDI Toolz* and the ADCP.
2. Wake up the ADCP by pressing the  button.
3. Enter the **PA** direct command to send to the ADCP and then press the **Enter** key or click on **Send**.



If any of the tests fail, read Chapter 6 in the [Workhorse II Operation Manual](#).

Testing the Sensors

To test the sensors:

1. Setup the communication parameters between *TRDI Toolz* and the ADCP.
2. Wake up the ADCP by pressing the  button.
3. Enter the **PC2** direct command to send to the ADCP and then press the **Enter** key or click on **Send**.

Press any key to quit sensor display ...

Heading	Pitch	Roll	Up/Down	Attitude Temp	Ambient Temp	Pressure
301.01°	-7.42°	-0.73°	Up	24.35°C	22.97°C	0.0 kPa
300.87°	-7.60°	-0.95°	Up	24.36°C	22.97°C	0.0 kPa

4. Rotate and tilt the system and verify the Pitch and Roll sensor data is reasonable. Rotate the system clockwise and verify the heading increases. Validate the accuracy at 0, 90, and 180 degrees. If the heading is off by more than 2 degrees, calibrate the compass. If the Depth sensor is not zero, zero the pressure sensor.
5. If a sensor fails, contact TRDI Field Service.



See the [Workhorse II Operation Manual](#), Chapter 5 for details on testing the sensors.

Zero the Pressure Sensor

Zero the pressure sensor at the deployment site, prior to deploying the Mariner ADCP in the water.

To zero the pressure sensor:

1. Setup the communication parameters between *TRDI Toolz* and the ADCP.
2. Wake up the ADCP by pressing the  button.
3. Enter the **AZ** direct command to send to the ADCP and then press the **Enter** key or click on **Send**.

Calibrating the Compass

To achieve the best possible field calibration of the compass, the compass calibration should be performed:

- In a “magnetically clean” environment, i.e., in an area free from stray magnetic fields (electronics, power lines, etc.) and magnetic materials such as iron.
- As close as possible to the actual deployment site (so that during calibration the instrument is measuring a magnetic field intensity and dip angle that are as close as possible to the as-deployed environment)
- With a large variety of instrument orientations (ideally tilting the instrument by 30 degrees or more during orientation).
- TRDI recommends that if you are having trouble calibrating the Workhorse II ADCP compass that you move the system and/or ensure the area around the system is clear of electrical equipment and ferrous materials.

In an oil & gas environment, it is typically impossible to meet the first two requirements above. Oil fields are full of metal structures that preclude a “magnetically clean” environment. Even in standard oceanography, for example a deep-water deployment in the open ocean, it is not possible to meet both requirements because any location reasonably near the deployment site is aboard a ship, which will be a decidedly magnetically dirty environment. Therefore, the customer typically must choose between calibrating a long way away from the deployment site or use the factory default calibration.

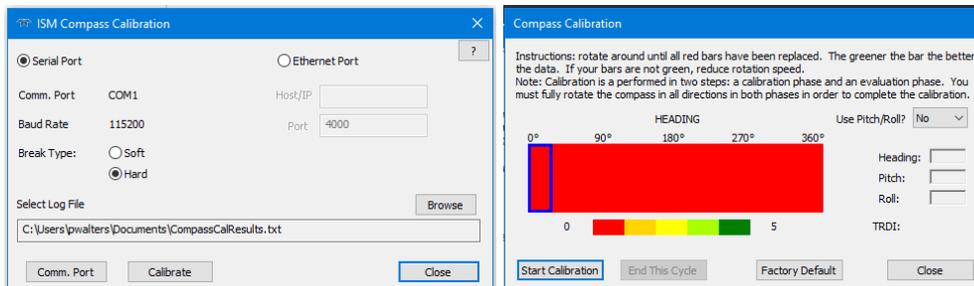
To calibrate the internal compass:

4. Go outside, away from magnetic materials.
5. Start the *ISM Compass Calibration* software and set up the communication parameters between the software and the ADCP.



Communication errors may occur during calibration when using a slow communication Baud rate. If you receive a *Failed to get calibration data...* message, try increasing the Baud rate (115200 Baud is recommended). The Workhorse II uses a Hard break.

6. Click the **Calibrate** button.



7. Select **Use Pitch/Roll?**

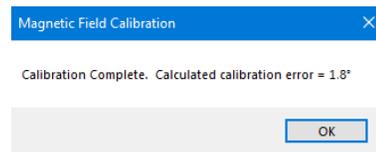
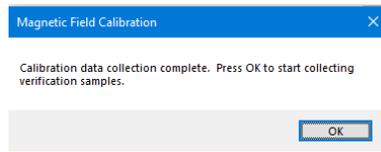
- Select **No**. This calibration requires two rotations (one for calibration and one for verification).
- Select **Yes**. This calibration requires eight rotations (four for calibration and four for verification).

8. Click the **Start Calibration** button.

9. As you rotate the system, the bars will change color. The Blue bar indicates where you are in the rotations.



- Green – Good
 - Light Green – Acceptable
 - Yellow – Within parameters (one or two yellow bars for the entire rotation is OK)
 - Orange – Unacceptable - Rotate slower!
 - Red – Not measured
10. When the first rotation(s) are complete, click **OK** on the message box to continue with the verification samples.
 11. When the second rotation(s) are complete, click **OK** on the message box. The calibration error should be less than 2 degrees.



Stability of the instrument during the calibration process, as well as a non-magnetic calibration site is essential to getting the lowest overall error value.

Removing the Transducer Cover

The Mariner ADCP is shipped with a transducer cover to protect the transducer faces. Remove the cover when deploying the ADCP.



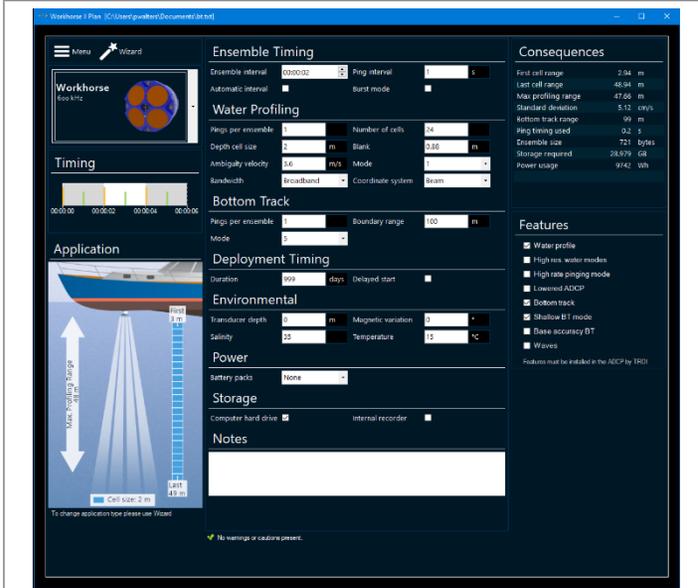
You **MUST** remove the cover to collect good data.



Planning the Deployment

PLANNING THE DEPLOYMENT INCLUDES THE FOLLOWING STEPS:

- ✓ Creating a command file using Workhorse II Plan

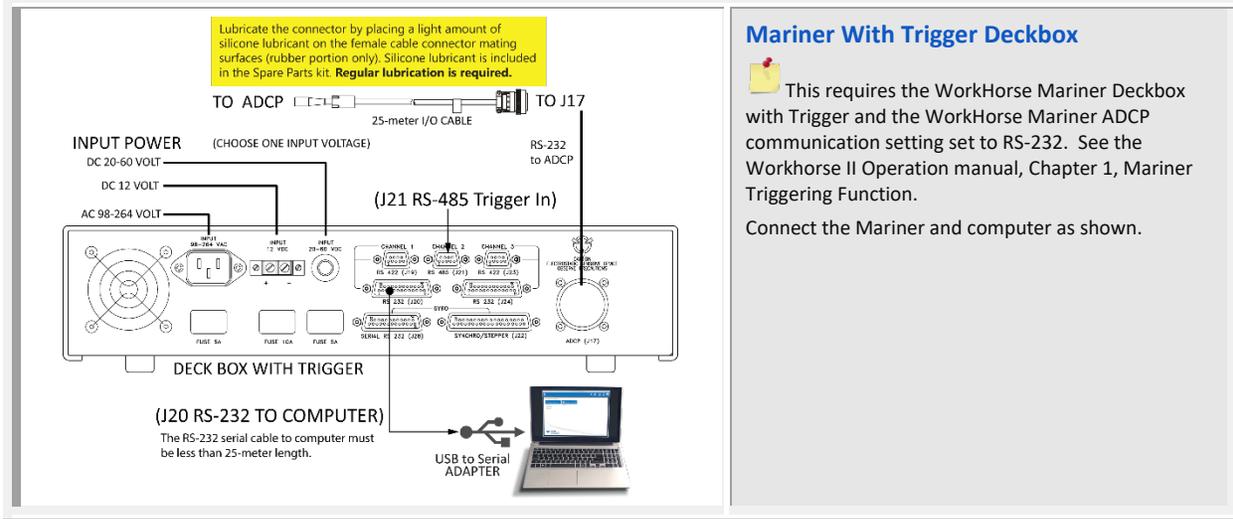


Use *Workhorse II Plan* to create a command file. Review the consequences.

 See the Workhorse II Plan help file for details.

Quick Review

	
<p>✓ Check that the resources for the deployment are acceptable.</p>	<p>👤 Use Workhorse II Plan wizard screens and verify all consequences.</p>



Mariner With Trigger Deckbox

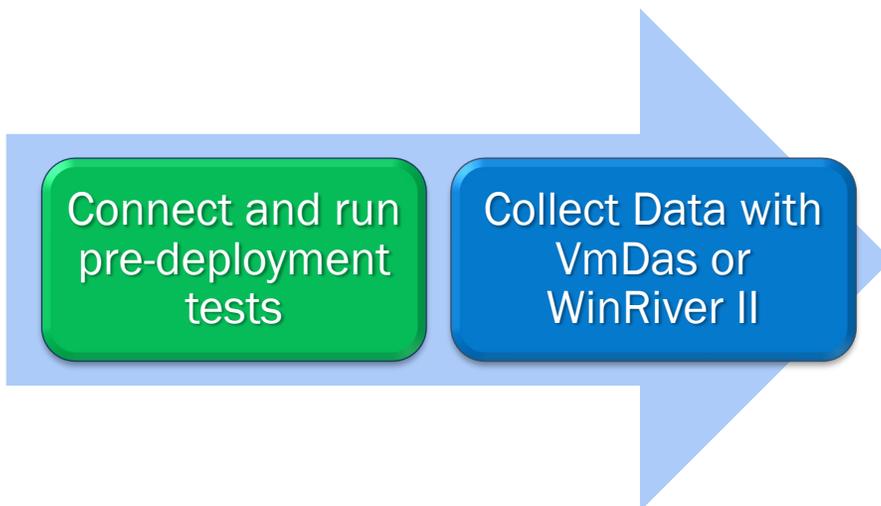
This requires the WorkHorse Mariner Deckbox with Trigger and the WorkHorse Mariner ADCP communication setting set to RS-232. See the Workhorse II Operation manual, Chapter 1, Mariner Triggering Function. Connect the Mariner and computer as shown.

Real-Time Deployments

Workhorse II deployments in real time collect, view, and process data collected using the *VmDas* or *WinRiver II* software.

The typical Direct-Reading deployment involves the following tasks:

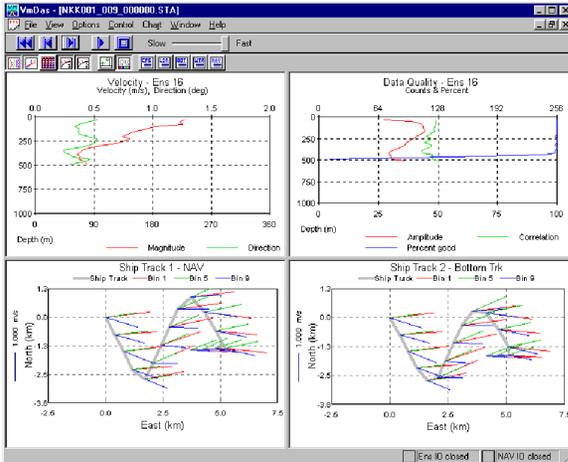
1. Connect to the ADCP using *TRDI Toolz*. Use *TRDI Toolz* to run the pre-deployment tests.
2. Use *VmDas* or *WinRiver II* to collect data.



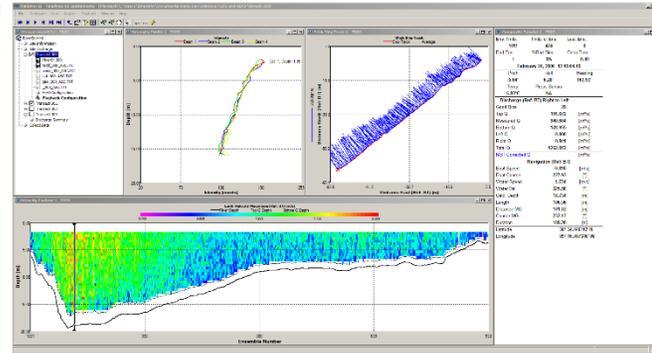
All real-time data is collected, viewed, processed, and played back using *VmDas* or *WinRiver II*. No data is recorded to the Workhorse II internal recorder. Data is recorded to the computer folder selected in *VmDas* or *WinRiver II*.



For information on *VmDas* or *WinRiver II*, clicking Help in the software will open the software user's guide.



VmDas Display



WinRiver II Display

Quick Review

	
<ul style="list-style-type: none"> ✓ All maintenance items (as needed) were done including zero pressure sensor, and compass calibration. 	<ul style="list-style-type: none"> ⓘ TRDI recommends that if you are having trouble calibrating the Mariner compass that you move the system and/or ensure the area around the system is clear of electrical equipment and ferrous materials. ⓘ You MUST remove the transducer cover to collect good data. ⓘ Read Chapter 2 in the Workhorse II Operation Manual for information on how to install/mount the ADCP for a deployment.
<ul style="list-style-type: none"> ✓ The transducer cover is removed. 	
<ul style="list-style-type: none"> ✓ Use VmDas or WinRiver II to send the commands to the ADCP 	

Post-processing Data

POST-PROCESSING DATA INCLUDES THE FOLLOWING STEPS:

- ✔ Viewing data using the *WinADCP* software

Viewing Data

Real-Time data files can be reviewed using *VmDas* or *WinRiver II*. *WinADCP* can also be used to view data.

To open a data file:

1. Start *WinADCP*.
2. Click **Open** and select a data file.



The original *.pd0 file is never changed, moved, or overwritten.

For information on using *WinADCP*, click the  icon.

PDDecoder Library in C language

The Teledyne Marine PDDecoder library is an open-source library written in C language to decode the PDO data formats that are commonly output by Teledyne Marine/Teledyne RD Instruments ADCPs. The definition and details of the PDO format can be found in the Workhorse II Commands and Output Data Format guide. Available for download from the Teledyne Marine software portal:

<https://tm-portal.force.com/TMsoftwareportal>.

Quick Review

	
<ul style="list-style-type: none"> ✔ Check and process the data 	<ul style="list-style-type: none"> 📖 Read the <i>WinADCP</i> help file for information on how to check and process data.

Conclusion

Congratulations! You have completed the Mariner Deployment Guide. Read the following chapters in the Workhorse II Operation Manual for more detailed information.

Workhorse II Operation Manual

-  **Chapter 1 – Overview**
This chapter includes an overview of the Workhorse II features, options, computer, power requirements, and connecting to the Mariner ADCP.
-  **Chapter 2 – Installation**
Use this chapter to plan your installation requirements.
-  **Chapter 3 – Data Collection**
Use this chapter for an overview of collecting data.
-  **Chapter 4 – Maintenance**
This chapter covers maintenance. Use this section to make sure the Mariner ADCP is ready for a deployment.
-  **Chapter 5 – Testing the Workhorse II**
Use this chapter to test the Mariner ADCP is functioning correctly.
-  **Chapter 6 – Troubleshooting**
This chapter covers how to troubleshoot the Mariner ADCP. If the Mariner fails a built-in test or you cannot communicate with the system, use this information to help locate the problem.
-  **Chapter 7 – Returning Systems to TRDI for Service**
Use this information to obtain a Return Material Authorization (RMA) number if the Mariner ADCP needs to be returned to TRDI.
-  **Chapter 8 – Specifications**
This chapter includes specifications and dimensions for the Workhorse II Mariner ADCP (including outline installation drawings).

Workhorse II Commands and Output Format Guide

-  **Chapter 1 – Introduction to Commands**
This chapter explains how commands used by the Workhorse II.
-  **Chapter 2 – Command Descriptions**
This chapter defines the commands used by the Workhorse II.
-  **Chapter 3 – Advanced Commands**
This chapter defines the Sound Velocity Smart Sensor, Waves, Lowered ADCP, and Ping Synchronization commands used by the Workhorse II.
-  **Chapter 4 - Output Data Format**
This chapter explains the PDO output data format used by the Workhorse II.
-  **Chapter 5 – Special Output Data Formats**
This chapter explains the PD3 through PD18 output data formats used by the Workhorse II.