Workhorse II Board Stack Installation Instructions

This Instruction Sheet shows how to replace the original Workhorse board stack with the new Workhorse II board stack. The Spare Boards Kit has been set up so that you will replace all the boards at once. This is done so that you do not have to risk damaging the individual boards while swapping in individual boards.

> ⚠️ Before handling either the Spare Board Kit or the original board set, **always wear an earth-grounding static protection strap**. The electronics in the Workhorse II are very sensitive to static discharge. Static discharge can cause damage that will not be seen immediately and will result in early failure of electronic components.
>
> TRDI assumes that a qualified technician or equivalent will perform all the following work.

The Spare Boards Set will allow your system to perform to the same velocity specifications as your original set. However, you must perform the ISM Compass Calibration procedure after the installation of the batteries.
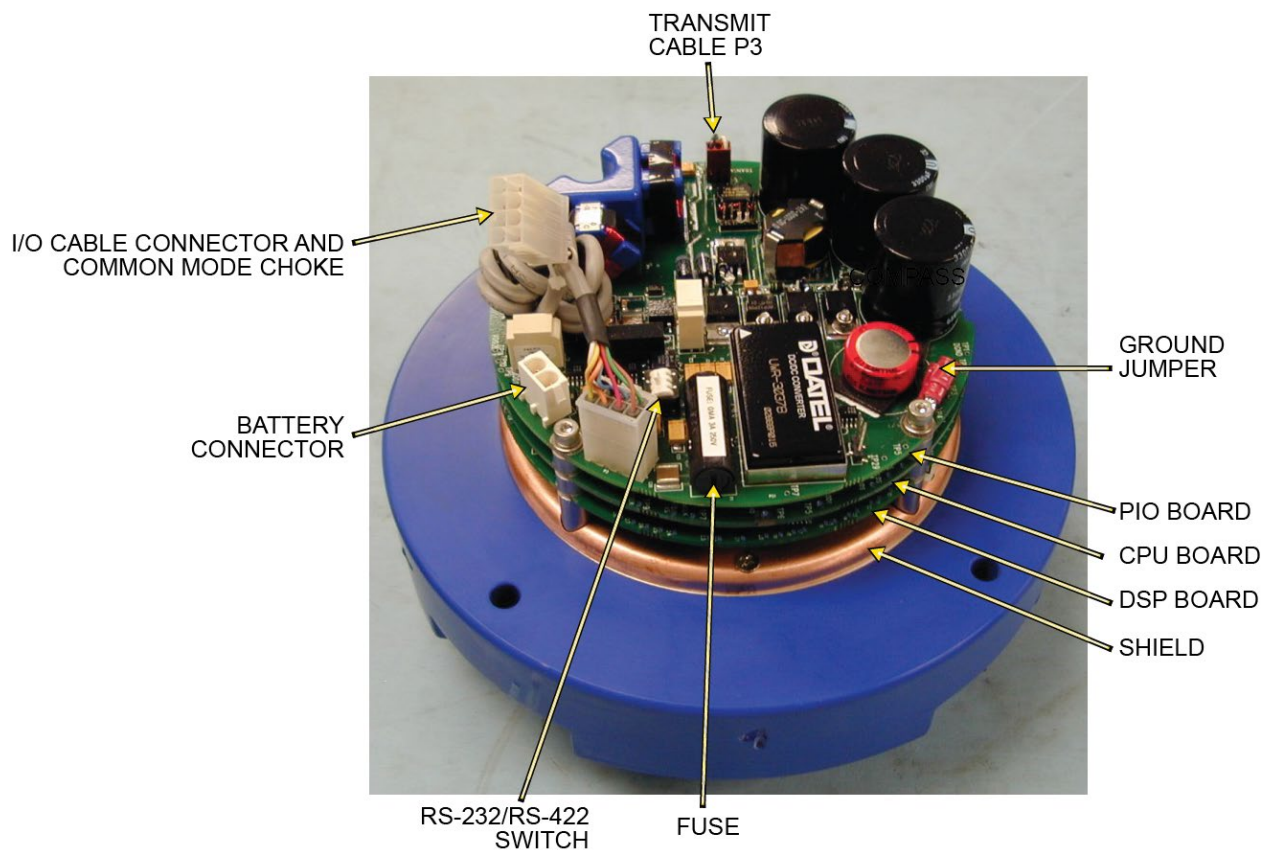

Figure 1. **Original Workhorse Board Stack**

Remove the Original Set of Boards

To remove the original boards:

1. Remove the Transducer assembly from the pressure case. Refer to the Workhorse Technical Manual, Chapter 4, Transducer Head Assembly Removal for instructions.

2. With your earth-ground static protection strap on, use a 3mm Allen wrench to remove the four M4 bolts that secure the three original Workhorse boards to the Transducer assembly.

3. Note the orientation of the transmit cable connector as it is plugged into the PIO board and to the Receiver board (see Figure 2).

    This cable must be removed, and it has a very tight fit. To remove this cable, lift straight up on the three boards and tilt slightly (no more than 2 cm) toward the cable. This should allow you enough slack to unplug the cable from the PIO board. If this is not possible you may unplug the cable from the Receiver board. Be sure to note its orientation before unplugging.
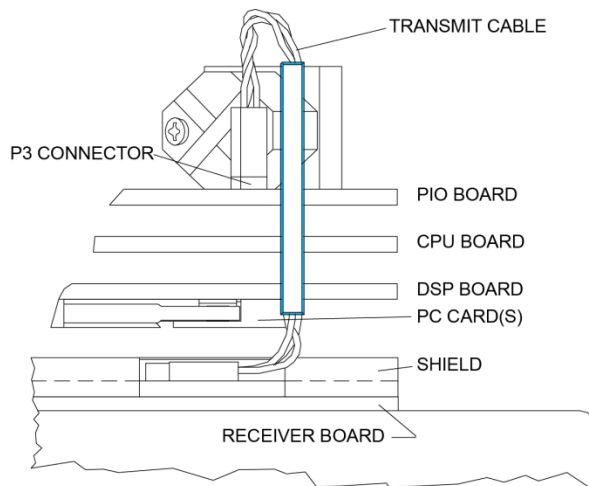

Figure 2.   **Transmit Cable**

4. Once the transmit cable has been disconnected you may now remove the top three boards as a set by lifting the set straight up.

    These top three boards are connected to each other via connectors and will remain as one piece (see Figure 3). The DSP board connects to the Receiver board through a 26-pin header. The 26-pin header is a series of male pins. The 26-pin header may or may not stay connected to the DSP board when you remove the top three boards. If you see that there are male pins sticking out of the DSP board when you finish removing the board set, then the header has remained attached to the DSP board. If this happens remove it and place it into the Receiver board. To remove it, gently rock it back and forth while pulling it away from the DSP board. Once removed, align it with the connector on the Receiver board and press it into place.
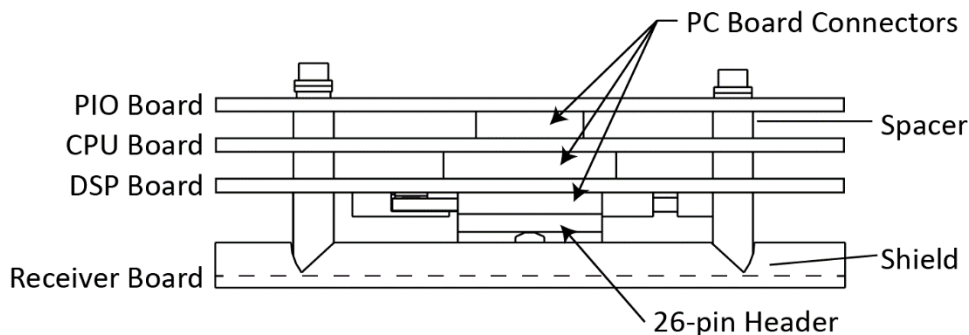

Figure 3.   **PC Board Connectors**

5. Remove all PCMCIA cards from the original set of boards and keep for use in other ADCPs. They can not be used in the Workhorse II system as this uses a CompactFlash card.

6. Set the original board set to the side for now.

Installing the Workhorse II Board Kit

To install the Workhorse II board kit:

1. With your earth-ground static protection strap on, remove the Workhorse II Board Kit from the anti-static bag.

TRANSMIT CABLE P3
ISM COMPASS
I/O CABLE CONNECTOR AND COMMON MODE CHOKE
BATTERY CONNECTOR
RS-232/RS-422 SWITCH
FUSE
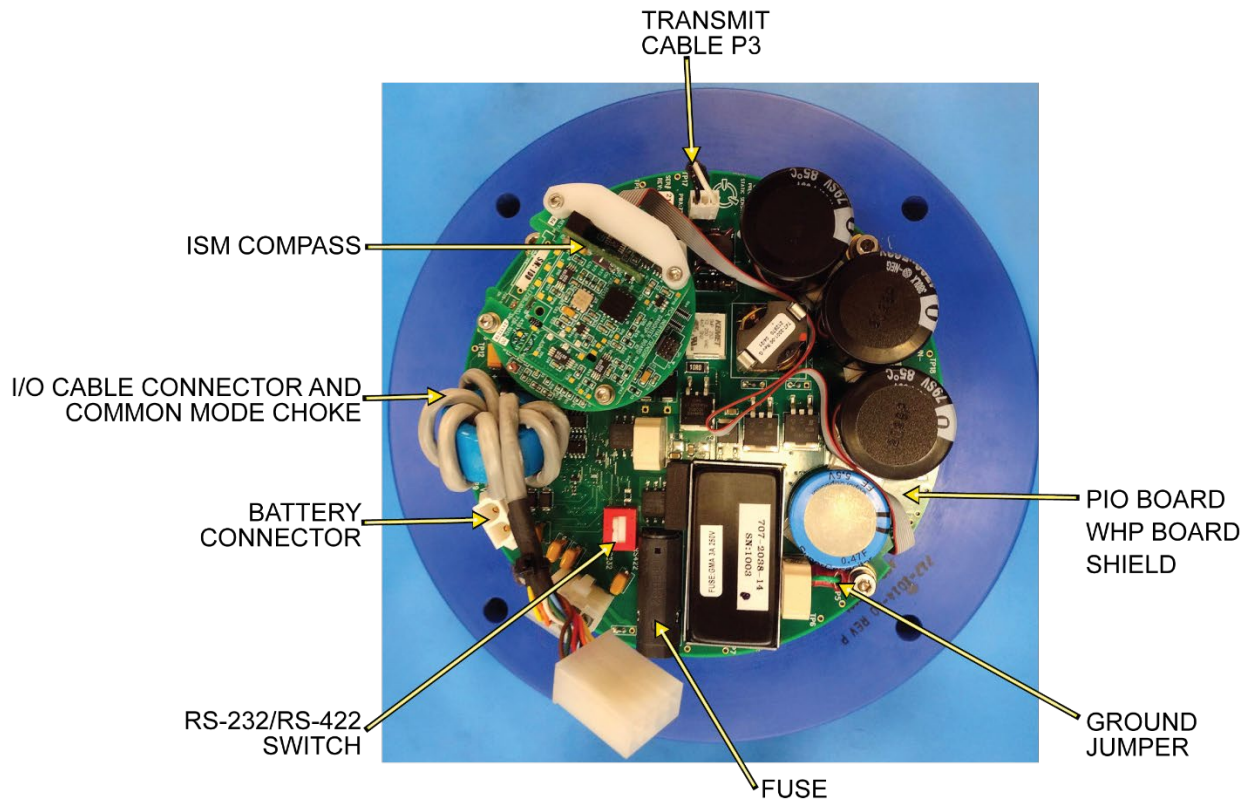PIO BOARD
WHP BOARD SHIELD
GROUND JUMPER

Figure 4.   Workhorse II Board Stack

2. Remove the four brass thumbnuts from the M4 bolts that secure the Workhorse II boards together. You will be using these bolts to secure the boards in your system. DO NOT change the position of any of the bolts. The bolt containing the felt washers and ground jumper must remain in the same position (see Figure 5 and Figure 6).
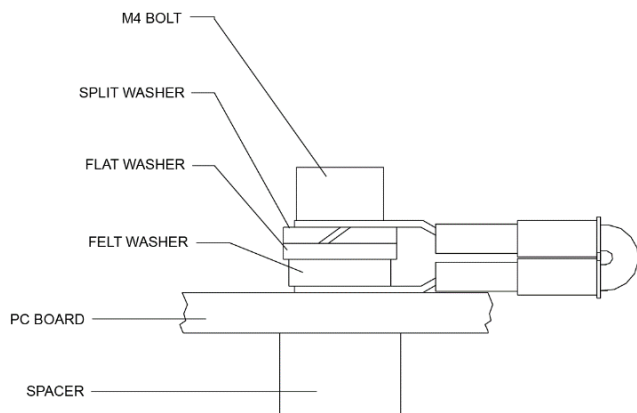

M4 BOLT
SPLIT WASHER
FLAT WASHER
FELT WASHER
PC BOARD
SPACER

M4 BOLT
SPLIT WASHER
FLAT WASHER
FELT WASHER
PC BOARD
SPACER

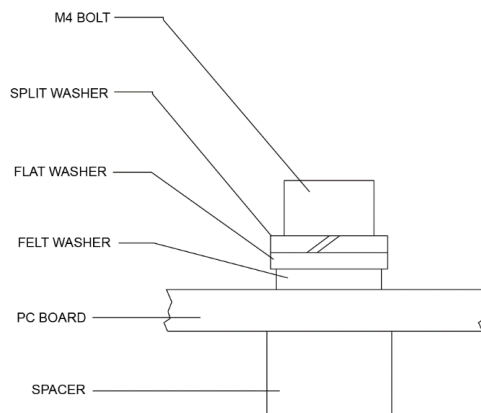**Figure 5.   Ground Jumper**   **Figure 6.   Mounting Hardware**

3. Place the thumbnuts (just removed in step 2) on the four bolts of your original set of boards and then place the boards into the anti-static bag.

4. Connect the Workhorse II board stack to the Receiver board. Align the boards to the 26-pin header connected to the Receiver board. As you connect the board stack, connect the transmit cable to the Receiver PCB in the same orientation as was installed on the original board set.

5. Tighten the four M4 bolts to 1.20 N.m. (10.6 In-LB).

6. Check the CompactFlash Memory Card is fully seated into the connector located on the WHP PCB.

7. Check the ISM cable connector is fully seated into the connector on the WHP PCB.

8. Install the Transducer into the Pressure Case. See the Workhorse Technical Manual, Chapter 4 for Re-assembly instructions. Use the included new O-Rings and desiccant.

Installing the Beam Cosine Matrix

The beam cosine matrix table corrects small transducer beam misalignment angles that occur during manufacturing. Contact TRDI Field Service to have the file emailed to you. This file will be pre-installed if the ADCP serial number was known when the board stack was ordered.

To install the beam cosine matrix:

1. Connect the ADCP I/O cable and apply power.

2. Start *TRDI Toolz* and confirm that the Workhorse II ADCP is communicating normally.

3. Run the script file *xxxx BEAM COSINE MATRIX.txt* (where xxxx is your system serial number). The Beam Cosine Matrix table will automatically be updated.

4. You can verify the beam cosine matrix loaded by viewing the PS3 results under the label Q14.

```
>ps3
↓
Instrument Transformation Matrix (Down):    Q14:
   1.4691   -1.4705    0.0078   -0.0067      24069  -24092      127     -109
  -0.0068    0.0078   -1.4618    1.4606       -111     127   -23950    23930
   0.2663    0.2657    0.2657    0.2661       4363    4354     4353     4359
   1.0367    1.0350   -1.0359   -1.0374      16985   16957   -16972   -16996
Beam Angle Corrections Are Loaded.
↓
>
```

Installing the Pressure Sensor Coefficients

If the ADCP included a pressure sensor, the pressure sensor coefficients must be loaded. Contact TRDI Field Service to have the file emailed to you. This file will be pre-installed if the ADCP serial number and original pressure coefficients were known when the board stack was ordered.

To install the pressure sensor coefficients:

1. Connect the ADCP I/O cable and apply power.

2. Start *TRDI Toolz* and confirm that the Workhorse II ADCP is communicating normally.

3. Run the script file *xxxxx WH2 PRESSURE SENSOR COEFFICIENTS.txt* (where xxxx is your system serial number) to install the pressure sensor coefficients appropriate to the system. The Pressure coefficients will automatically be updated.

4. You can verify the pressure sensor coefficients loaded by viewing the PS0 results.

```
>ps0
↓
Pressure Sens Coefficients:
          c3 = +2.1725004E-212
          c2 = +2.013757E-08
          c1 = +8.240925E-02
       Offset = +1.264614E-01
↓
>
```

Testing the System after replacing the boards

To test the system after replacing the boards:

1. Connect the I/O cable and power and test the ADCP as shown in the Workhorse Technical Manual, Chapter 5, Testing the Workhorse. All PA tests should pass when run in water and the PC tests should pass with the ADCP out of water.

2. To test that the transmit cable is connected properly, run the PT4 test. The test failure example shown below is what you would see for a missing or improperly attached transmit cable.

```
[BREAK Wakeup A]
Workhorse II Broadband ADCP Version 77.xx
Teledyne RD Instruments (c) 1996-2021
All Rights Reserved.
>pt4

IXMT    =       0.0 Amps rms  [Data= 0h]
VXMT    =      19.3 Volts rms [Data=4ch]
  Z     =     999.9 Ohms
Transmit Test Results = $C0 ... FAIL
>
```

3. Perform a field calibration of your ISM compass (see ISM Compass Calibration, page 6).

4. If the ADCP included optional feature upgrades, verify the features are installed by sending the OL command.

> If the features were not pre-installed, contact TRDI Field Service to have the file emailed to you. See the Workhorse Technical Manual, Chapter 4, Installing Feature Upgrades for instructions

Workhorse II Software

The Workhorse II requires the *TRDI Toolz*, *ISM Compass Calibration, Compass Post Calibration,* and *Workhorse II Plan* software.

To download the software:

1. Use the Teledyne Marine software portal https://tm-portal.force.com/TMsoftwareportal to access the software.

2. Download the *TRDI Toolz*, *Workhorse II Plan, ISM Compass Calibration*, and *Compass Post Calibration* software.

3. Unzip the files and install by double-clicking on the exe files.
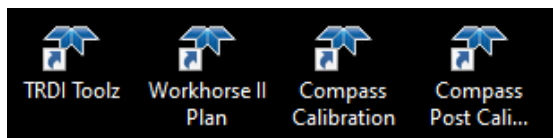
Format the CompactFlash Memory Card

The CompactFlash Memory Card should be formatted before a deployment.

To format the recorder:

1. Start *TRDI Toolz*.

2. Send the command RE ErAsE <volume label>. RE ErAsE erases and formats the CompactFlash memory card. This command *is* case sensitive. Use RE ErAsE < volume label > to assign a volume label. The default volume label is "NO NAME ".

3. To recover data, leave the card in the Workhorse II and use *TRDI Toolz*. Click **Tools**, **Download Data**.

> Once erased, data is not recoverable. Do not format or delete files from the CompactFlash card using Windows®. This may leave hidden files on the card. Always use the ADCP's RE ErAsE command to format and delete data from the CompactFlash card recorder.

ISM Compass Calibration

The ISM compass must be calibrated before a deployment.

To prepare for compass calibration:

1. Protect the Workhorse II surfaces from contact or abrasion during calibration. Use the transducer cover to protect the ADCP transducer faces during calibration if the calibration is in a face down orientation.

2. Compass calibration should be performed free from ambient magnetic fields. Choose a calibration location outside, away from magnetic materials. Nearby steel, iron, magnets, and other magnetic fields will degrade the calibration and accuracy and will provide a poor calibration.

3. Use a wood or plastic test platform at least 1 meter (~3 feet) high to move away from metal under the ground. If you are using a calibration stand, place the ADCP in the stand in the same orientation as it will be deployed.

To calibrate the ISM compass:

1. Start the *ISM Compass Calibration* software by clicking on the *CompassCal* desktop icon.

2. Set up the communication parameters between *ISM Compass Calibration* and the ADCP by clicking on the **Comm. Port** button. For **Break Type**, select **Soft**.
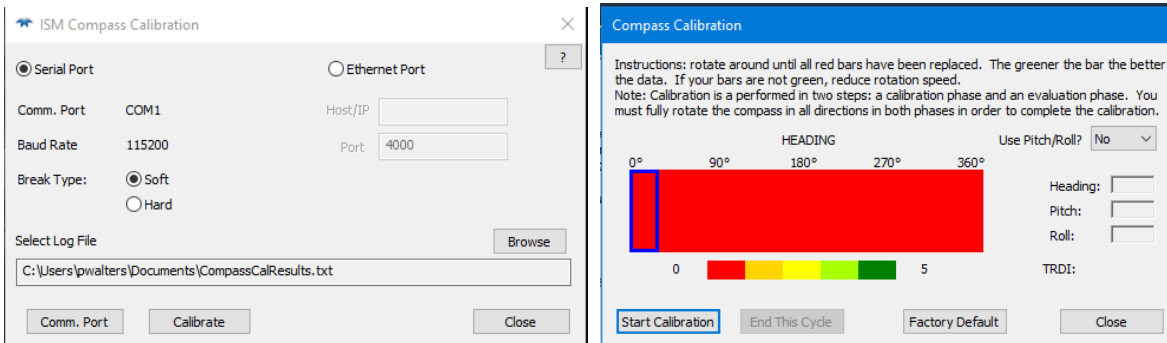

3. Click the **Calibrate** button.

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

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

   - Select **Yes**. This calibration requires four rotations (two for calibration and two for verification).

> TRDI recommends calibrating with a large variety of instrument orientations (ideally tilting the instrument by 30 degrees or more during orientation).

5. Click the **Start Calibration** button.

6. As you rotate the Workhorse II, 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
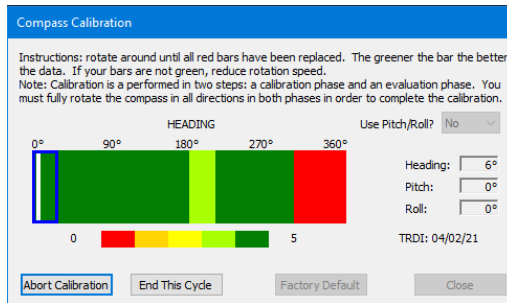
7. When the first rotation(s) are complete, click **OK** on the message box to continue with the verification samples.
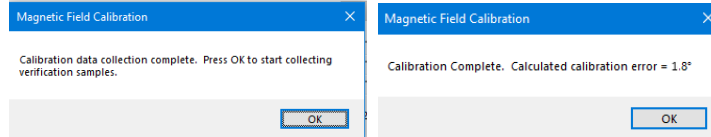
8. When the second rotation(s) are complete, click **OK** on the message box. The calibration error should be less than two degrees.

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.

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Self-Service Customer Portal

Use our online customer portal at http://www.teledynemarine.com/rdi and click on the **Support** link 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.