Sentinel V Self-Contained

Sentinel V Real-Time

Operation Manual

P/N 95D-6002-00 (November 2024)

https://www.teledynemarine.com

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LIST OF TABLES

Manual Revision History

November 2024

- Corrected Table 37, page 174 part number 53P2Wx to 53PEWx.

February 2024

- Updated Returning Systems to the TRDI Factory, page 162 Brokerage address.

January 2024

- Added warning that the Sentinel V AC Adapter (97D-6000-00) cannot be used when bottom tracking.

July 2023

- Updated website address.
- Updated cover picture.

May 2023

- Removed the DC power cable 73D-6021-00. This cable is no longer used.

March 2023

- Updated the Deployment checklist screen capture.

January 2023

- Updated EAR statement.
- Deployment guides are now downloaded.

May 2022

- Removed factory calibration recommendation for the pressure sensor.

April 2022

- Corrected desiccant P/N to DES2, was S-3905
- Added external battery case Y cable P/N 73D-3104-00
- 95Z-6007-00 replaces the 90Z-8000-00 CD.

August 2021

- Added link to PD0Decoder.
- Added picture of the Sea Spider bottom mount.

January 2021

- Corrected Table 35 and Table 36, page 174.
- Updated the Customer Support Portal Firmware, Software, and Field Service Bulletins download link.

October 2020

- Added deck box connections.
- Updated Table 5, Option 1 minimum dimension to 188mm.

- Updated Table 37 to include configuration part numbers.
- Updated Outline Installation Drawing to remove the 4-beam configuration (no longer sold).
- Added Dock Side Tests and Sea Acceptance Tests to the testing the Real-Time Sentinel V section

July 2019

- Added 5th beam specifications
- Added IP and Host Name Setting to the troubleshooting section
- Added Serial versus Ethernet Configuration to the troubleshooting Serial Communications section
- Added note that deck box does not support trigger functions
- Corrected first note on the Example Waves Setups, page 53
- Updated requirements for Flashgot®. The manual incorrectly states to use the latest version of Firefox. Flashgot is no longer compatible with later versions of Firefox. Changed to recommend using Firefox 47.0.0
- Corrected range for PT command
- Updated to Teledyne Marine logo

June 2018

- Added Testing the Sensors to the Maintenance chapter
- Added Chapter 1C - Switching RT and SC Modes
- Added Export Administration Regulations (EAR) footers

September 2017

- Added Using Sentinel V RT Utilities software
- Added Ethernet communications
- Added using **.feature* files for upgrades
- Added Using the Trigger
- Added troubleshooting Ethernet communications
- Updated specifications
- Added Sea Chest to Installation chapter
- Combined Commands and Output Data Format guide into the Sentinel V Operation Manual
- Updated BF, BX, and #CM commands
- Added appendix on using Sentinel V Real-Time system with *WinRiver II* software

February 2017

- Updated the inventory list.
- Added RS-422 to RS-232 information to RT system.
- Updated troubleshooting section with troubleshooting serial issues.

January 2017

- Added the Sentinel V Real-Time system.
- Added a Maintenance Schedule, Calibration Items, and Maintenance Items and Inspection tables to the beginning of Chapter 4, Maintenance.
- Updated the pressure sensor oil fill procedure.
- Updated the outline installation drawings.
- Updated the Troubleshooting section.
- Updated the specifications.

September 2015

- Added changing the format type to **Page Source** to save and import files correctly in *Safari*.
- Updated Figure 49, page 97 and Figure 52, page 100 with battery spacer note.
- Added removing the battery spacer to the battery replacement section when using lithium battery packs.
- Added End User License Agreement (EULA).

May 2015

- Updated System Inventory.
- Added an external battery pack overview drawing.
- Added the lithium battery option and how to use the lithium battery.
- Updated Supported Operating Systems and Browsers.
- Updated Chapter 2 to show new ReadyV screens.
- Removed ReadyVLite chapter.
- Updated compass calibration procedures to show new ReadyV screens.
- Updated the specifications.

March 2015

- Added note to not have 50 or more data files on the recorder when deploying.
- Added caution about firmware version 47.16.xx.xx is not backward compatible.
- Added information about using a Gimbal Bottom Mount.

January 2015

- Updated Available Options.
- Updated Supported Operating Systems and Browsers Table 1, page 7 for Internet Explorer 11.
- Added Collecting Waves Data to Chapter 2, Using ReadyV.
- Added real-time serial data output setup to Chapter 4, Installation.
- Added adjusting the screen and font size to the Using the Home Panel section.
- Updated the standard compass calibration procedure in Chapter 5. Added the High-Dip compass calibration procedure and Using the Compass Stand section.
- Updated ReadyV screen captures to 47.14 version firmware.

- Added warning that external battery case batteries are shipped inside the case but not connected.
- Added training video links.

April 2014

- Updated overview graphics Figure 1 and 2 to show pressure sensor oil fill caution.
- Updated Supported Operating Systems and Browsers Table 1, page 7.
- Updated system inventory to show kit part numbers.
- Corrected IP address when connecting via Ethernet port in Chapter 6 (ICN 156).

November 2013

- Updated the System panel to show feature activation in chapter 2.
- Updated the Timing Panel to show Vertical Beam enable in chapter 2.
- Added using the AC Adapter information to chapter 4.
- Updated the compass calibration procedure in chapter 5.
- Updated specifications – V100 maximum cell size changed from 8m to 6m.

August 2013

- Added a flow chart on creating scenarios to Using ReadyV chapter 2.
- Updated Deleting a Scenario section in chapter 2.
- Updated the oil fill procedure in chapter 5.
- Updated the compass calibration procedure in chapter 5.

July 2013

- Added a Compass Calibration Guide and updated the compass calibration procedure.
- Changed input power from +9 to 24VDC to +12 to 20VDC.
- Updated graphics to show longer housing.
- Added table showing supported operating systems and browsers.
- Added IP address 192.168.0.2 to Wireless Connection section.
- Corrected sign convention for the Pitch and Roll table on page 29.
- Updated ReadyV screen captures for data recorder and built-in tests.
- Updated the ReadyVLite chapter.
- Updated specifications and outline installation drawings.
- Updated Troubleshooting section.

December 2012

- Changed time the network is available after power up from three minutes to two.
- Updated ReadyV system panel screen capture.
- Added ReadyVLite chapter.
- Added battery Velcro® strap and updated exploded system views.
- Added creating, opening, and deleting scenario files.

- Added Sentinel V Bandwidth specification.
- Updated description for range.
- Updated applying antifouling paint section.
- Added minimum screen resolution to Computer Considerations section.

March 2012

- Updated Maintenance panel screen capture and log file descriptions.
- Added Recommended Minimum Blank Distance table.

February 2012

- Updated Wireless Connection Common Issues section.
- Updated compass calibration procedure.
- Updated Starting and Stopping Deployments section.
- Updated figure 10 raw roll signs/headings.
- Updated System Setup panel (Orientation removed).
- Changed name of VWeb to ReadyV.
- Added Appendix B - GPL Compliance Notice.

December 2011

- Initial release of the manual.

Exclusions and Omissions

- ReadyV does not have any native support for Windows 8® Internet Explorer 10 Metro Browser. Any ReadyV requests made through the Metro browser is forwarded to the Windows 8 Internet Explorer 10 Desktop browser.
- Users may need to turn off their browser pop-up blockers (either built-in or third party) to access ReadyV.
- When using *Firefox*, a javascript: void(0) message or "Javascript:…" string shows up in the left lower corner in when you mouse over some buttons. These messages can be ignored.

Firmware History

- See the README.TXT file on the V Series Documentation.

Conventions Used in this Manual

Conventions used in the Sentinel V Series Acoustic Doppler Current Profiler (ADCP) Operation Manual have been established to help learn how to use the system quickly and easily.

Menu items are printed in bold: click **Collect Data**. Items that need to be typed by the user or keys to press will be shown as **<F1>**. If a key combination were joined with a plus sign **(<ALT+F>)**, press and hold the first key while pressing the second key. Words printed in italics include program names (*Velocity*) and file names (*default.txt*).

Code or sample files are printed using a fixed font. Here is an example:

```
Maintenance Log:
Compass calibrated: - 05/12/15
↓
Firmware version: 47.xx
Factory maintenance serviced: - 01/05/14
```

There are four other visual aids: Notes, Cautions, Training, References, and Videos.

This paragraph format indicates additional information that may help avoid problems or that should be considered in using the described features.

This paragraph format warns the reader of hazardous procedures (for example, activities that may cause loss of data or damage to the Sentinel V Series ADCP).

This paragraph format tells the reader where they may find additional information.

Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

How to Contact Teledyne RD Instruments

If you have technical issues or questions involving a specific application or deployment 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.

NOTES

Chapter 1

SELF-CONTAINED SENTINEL V OVERVIEW

In this chapter:

Sentinel V Features

The Sentinel V is designed for several-month autonomous current profile deployment from temporary or permanent mounting in the ocean, near-shore, harbors, and lakes.

The Sentinel V Series ADCP consists of an ADCP, battery pack or individual D cell batteries, micro SDHC memory card, and software. Both battery capacity and memory can be increased with upgrades for longer deployments. The Sentinel V Series ADCP requires the addition of a Windows® compatible computer to configure the ADCP and replay collected data.

Figure 1 and Figure 2 only show two of the options and models available with the Sentinel V Series ADCP (see Available Options).

After a deployment, systems need to be cleaned thoroughly before the touch sensor will work.

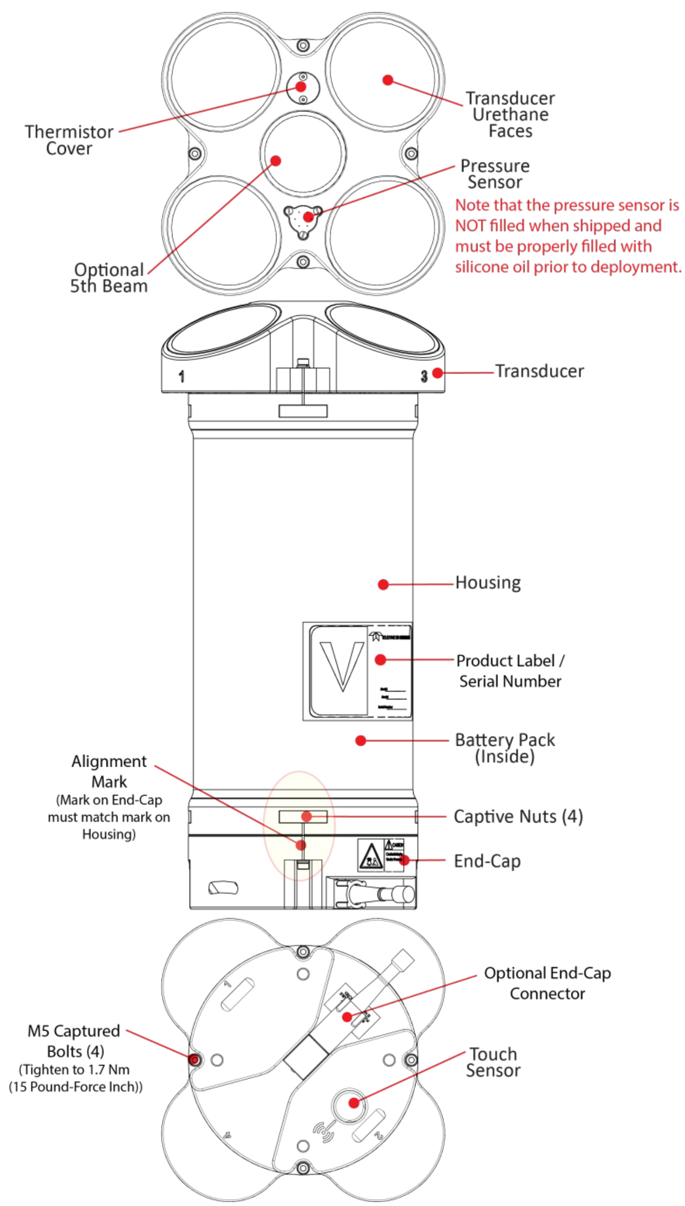


Figure 1. Sentinel V100 5 Beam Overview with Battery Pack and Optional End-Cap Connector

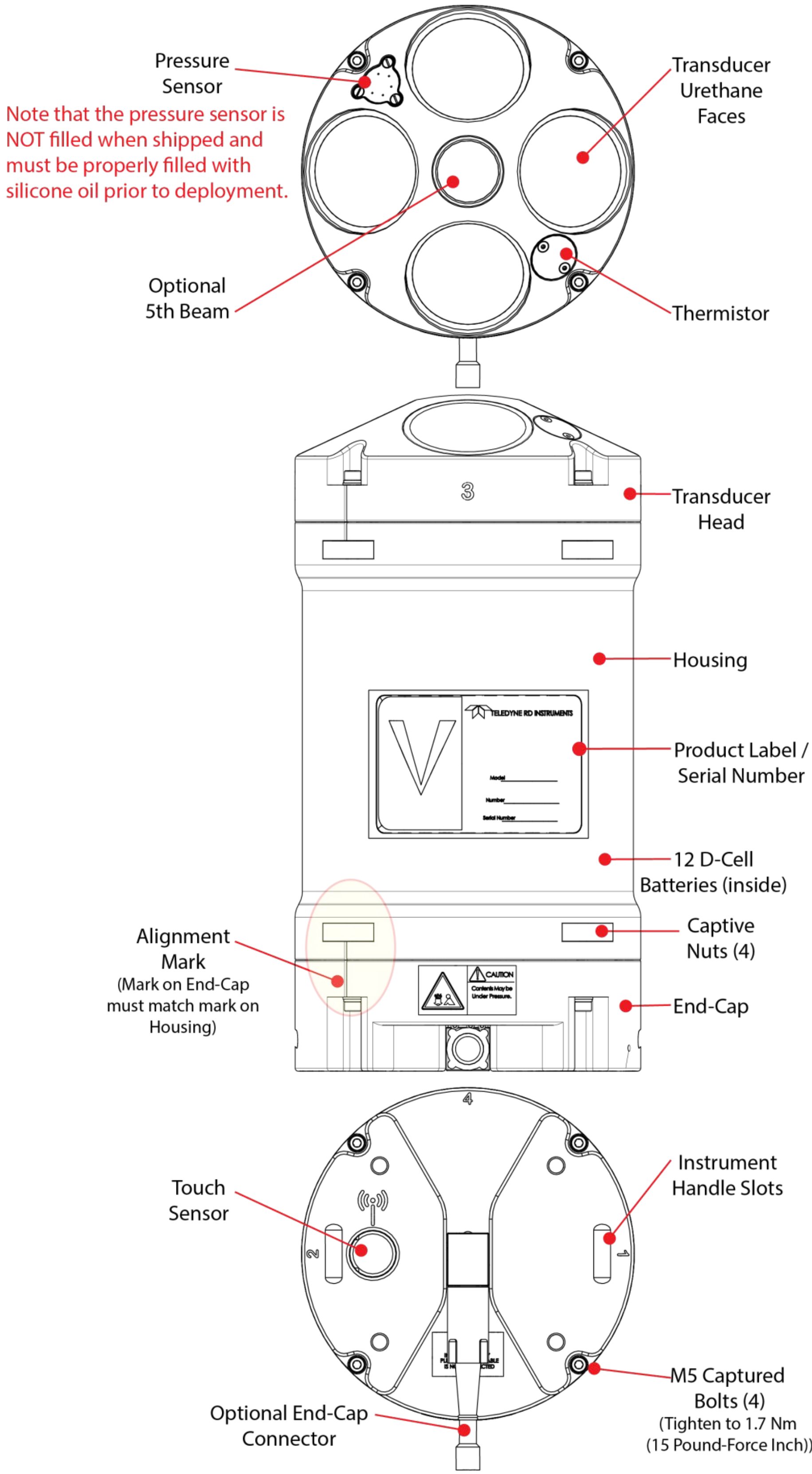


Figure 2. Sentinel V20 with D Cell Batteries and Optional End-Cap call out beam numbers

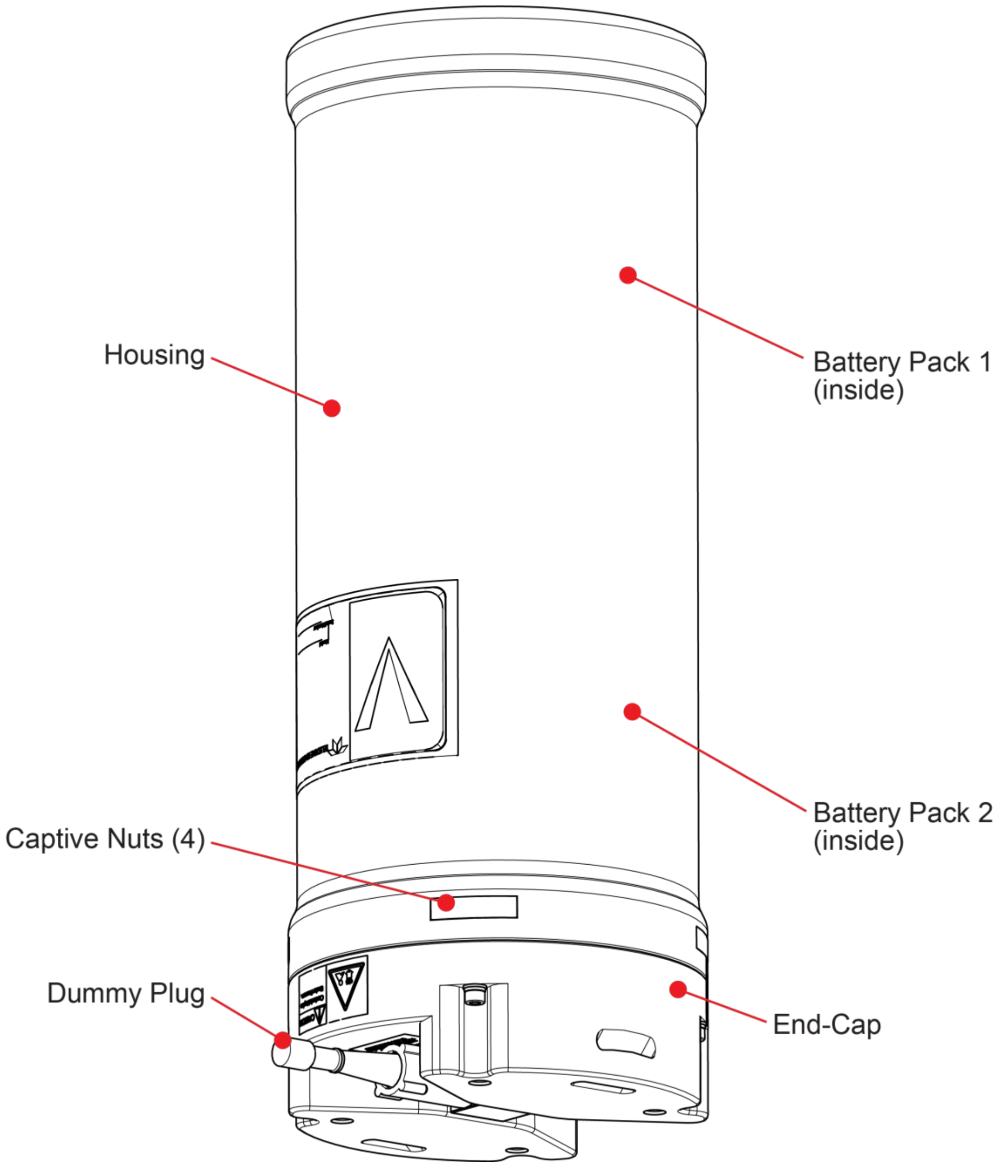


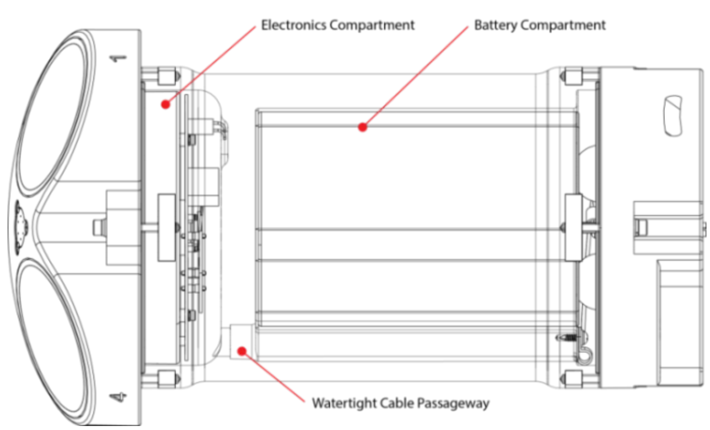
Figure 3. External Battery Case Overview

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect **BOTH** batteries and seal the external battery case before deployment. It is necessary to remove the top battery to connect the bottom battery cable. See Replacing the External Battery Case Packs for details.

Available Options

The following section explains the different options available for Sentinel V Series ADCPs. See the Parts Location Drawings for more information.

- **Transducer** – The standard nominal ranges are 20m (1000 kHz), 50m (500 kHz) and 100m (300 kHz). See the Outline Installation Drawings for dimensions and weights.
- **Vertical Beam** – an optional vertical beam is available.
- **Waves Feature** – Optional feature that provides full water column echo and velocity profiling to make accurate measurements of wave kinematics as well as the confidence to verify that the processed wave statistics are accurate. See Collecting Waves Data for details.
- **End-Cap** – The End-Cap consists of an IEEE 802.11b/g/n WLAN wireless communications Touch Sensor and an optional underwater electrical 8-pin connector.
- **End-Cap Connector** – The optional 8-pin connector can be straight or right-angled. See the Outline Installation Drawings for end-cap configurations.
- **Real-Time Serial Data Output** – If the end-cap has the optional serial port 8-pin connector installed, you can stream PD0 (PD zero, not the letter o) single ping beam coordinate data through the serial port. See Using Real-Time Serial Data Output for details.
- **Internal Batteries** – The Sentinel V can use either pre-assembled battery packs or 12 D cell batteries. The battery pack housing uses a pack of 36 D cell alkaline batteries, physically configured as three stacks of 12 cells for a nominal voltage level of 18 VDC for a fresh battery pack. The D-cell battery configuration housing uses 12 D cell alkaline batteries for a nominal voltage level of 18 VDC for fresh D cell batteries.
- **Lithium Battery Pack** – This battery pack is assembled using lithium battery cells that provide 15.6 VDC with a capacity of approximately 1900 Wh. The battery includes a safety circuit that protects the battery and users against short circuits and provides users the ability to test the pack (see Testing the Lithium Battery Pack). The circuit also turns the battery off at its end of life, before the battery fully discharges. This happens when about 97% of the battery's capacity is depleted.
- **External Battery Case** – The optional external battery case holds two pre-assembled battery packs for a nominal voltage level of 18 VDC.
- **AC Adapter** – The optional AC adapter provides 18 VDC.
- **Housing** – The standard Sentinel V Series ADCP dual-chamber housing allows deployment depths to 200 meters. The dual-chamber design keeps the electronics dry even if the battery chamber floods. See the Outline Installation Drawings for dimensions and weights. The housing type and length will depend on if it uses battery packs or individual D cell batteries, or no batteries.



- **Memory** – The Sentinel V includes a microSDHC memory card.
- **Pressure Sensor** – The pressure sensor (standard 30 Bar) measures water pressure (depth).

System Inventory

Included with the Sentinel V system:

Kit	Part Number	Name	Description
Configuration	S20 S50 S100	Sentinel V SC or RT ADCP with transducer cover	Sentinel V Self-Contained (SC) or Real-Time (RT) ADCP. Depending on housing type: • Sentinel V battery packs are shipped inside the system but not connected. • Sentinel V with D cells are shipped without batteries inside the system. • Sentinel V with no battery housing uses external power.
	See the packing slip for more information on system configuration		SC systems use wireless communications for setup and deployment. This means the system only requires battery power to operate the system. RT systems use serial or Ethernet communications for setup and deployment. This means an end-cap with connector, an underwater cable, and DC power are required to operate the system. The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is insufficient to power the ADCP for long range bottom tracking. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.
Accessories Kit	97D-7000-00 or 97D-7002-00	Shipping Case	Shipping case with foam inserts.
	81D-6002-00	Handle	The handle makes it easier to carry the Sentinel V ADCP. Attach it to the slots on the ADCP's end-cap.
	75DK6001-00	Tools and Spare Parts kit	See Tools and Spare Parts for a list of parts included in this kit.
	95D-6037-00	Sentinel V SC and RT Roadmap	Use this sheet to determine where to start on setting up the Sentinel V SC and RT system.
Documentation Kit	95Z-6007-00	Download instructions	This sheet has instructions for downloading the software and manuals.
	95D-6016-00	Compass Calibration Guide	Printed sheet with instructions on how to calibrate the compass.
	95Z-8005-00	Velocity Activation Code	Activation code that unlocks the Velocity software. Waves processing requires a waves enabled activation code.
	95D-6015-00 95D-6033-00	Deployment Guide	A printed copy of the SC and RT deployment guides.

Software Overview

Sentinel V Self-Contained Software:

	Testing	Planning	Compass Cal	Command & Control	Data Acquisition	Display	Data Convert	Post Process
Waves	ReadyV	WavesMon ReadyV	ReadyV	WavesMon	WavesMon	WavesMon WavesView	WavesMon ReadyV	WavesMon Velocity User Supplied
Currents	ReadyV	ReadyV	ReadyV	ReadyV	ReadyV	Velocity	Velocity	Velocity

Read the Self-Contained Deployment Guide for instructions on installing the software.

Computer Considerations

TRDI designed the Sentinel V Series Self-Contained ADCP to use a Windows® compatible computer. The built-in ReadyV user interface configures the ADCP, and data is displayed through TRDI's *Velocity* program.

Minimum Computer Hardware Requirements:

- Desktop, Laptop, or Netbook computer (see Table 1 for operating system)
- Screen resolution above 1024x768 (see note)
- Internet Brower (see Table 1 for supported browsers)
- Mouse or another pointing device
- Wireless 802.11b/g/n WLAN Interface

Many laptops and netbooks today have built-in WLAN. If not, then a WLAN adapter is required.

Most wireless enabled laptops will be automatically enabled. Consult the instruction manual for your specific device if you are not sure how to do so.

Laptops running on Windows XP® may have display issues when using a screen resolution of 1024x768. A workaround is to change the zoom level in the browser so that the entire ReadyV screen is visible.

ReadyV does not support Windows 8 Internet Explorer® 10 Metro browser.

Users may need to turn off their browser pop-up blockers (either built-in or third party) in order to access ReadyV.

When using *Firefox*, a javascript: void(0) message or a long "Javascript:..." string shows up in the left lower corner in when you mouse over some buttons. These messages can be ignored.

Table 1. Supported Operating Systems and Browsers

Operating System	Internet Explorer 10+	Firefox (Latest)	Safari (Latest)	Chrome (Latest)	Opera (Latest)
Windows® 7, 8.1, 10 (32/64 bit)	✓	✓	⊘	✓	✓
Macintosh OS 10.5.7+ (Intel based)	⊘	✓	✓	✓	✓
Linux (any 32/64 bit distribution)	⊘	✓	⊘	✓	⊘

⊘ Not Supported

Power Considerations

Use the following section to determine the power requirements for the Sentinel V Self-Contained ADCPs.

- The Sentinel V system uses +18 VDC to operate.
- Depending on the type of housing the system is configured with, the ADCP may use a battery pack, lithium battery pack (optional), individual D cell batteries, or external power.
- If the Sentinel V is configured with the optional end-cap connector, then external power can be used. The voltage must be +12 to 20 VDC. The optional AC power adapter provides +18 VDC.

The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

Sentinel V battery pack is shipped inside the system but not connected. Connect the battery and seal the Sentinel V before deployment.

Sentinel V with D cells are shipped without batteries inside the system. Install the batteries and seal the Sentinel V before deployment.

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect **BOTH** batteries and seal the external battery case before deployment. It is necessary to remove the top battery to connect the bottom battery cable. See Replacing the External Battery Case Packs for details.

Transmitted Power

For the Sentinel V, a fresh battery provides +18 VDC. Batteries spend most of their life at a nominal voltage of +14 VDC. Using 18 VDC will increase the range by 5 to 10% depending on conditions.

The optional lithium battery provides 15.6 VDC with a capacity of approximately 1900 Wh. The battery includes a safety circuit that protects the battery and users against short circuits and provides users the ability to test the pack. The circuit also turns the battery off at its end of life, before the battery fully discharges. This happens when about 97% of the battery's capacity is depleted.

Power on Cycle

The power supply or battery pack must be able to handle the inrush current as well. Inrush current is the current required to fully charge up the capacitors when power is applied to the Sentinel V Series ADCP. The capacitors provide a store of energy for use during transmit. The inrush current is as high as 0.8 Amps RMS at 9.2 VDC. The ADCP will draw this amperage until its capacitors are fully charged. If the power supply or battery pack limits the current or the power drop on the cable is significant, then the power on cycle will take longer. It can take up to three minutes. The power must not shut down during the inrush current draw, as this may not allow the Sentinel V Series ADCP electronics to start.

Before using the optional Lithium battery pack, always run the battery self-test. See Testing the Lithium Battery Pack for instructions.

Instruments with high inrush currents occasionally trigger the optional Lithium battery pack short circuit detection, which turns the battery off. If this happens, do the following:

- Disconnect the battery and touch the ADCP's touch sensor for about 45 seconds to one minute. Connect the battery and then the ADCP should power on normally.
- If the ADCP still does not power on, connect the AC adapter and wait for a minute and then connect the battery pack. Once the ADCP is connected and ReadyV started, unplug the AC adapter. The ADCP will work normally after that.

Touch Sensor Response / System Beeps

When the system is configured for SC mode, after power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). During this time span, the touch sensor does not respond or beep if touched. **Wait until the second beep before touching the sensor**. The WLAN is available after the second beep for two minutes. Each touch of the sensor enables the WLAN for two minutes.

During the first power-up of the Sentinel V ADCP, there may be additional beeps. This is due to the touch sensor auto-calibration routine, which should not last longer than five minutes.

When the system is configured for Sentinel V Real-Time and power is applied, there is a long beep. The touch sensor is disabled in Real-Time mode; the touch sensor does not respond or beep if touched.

The touch sensor may stay "triggered" for up to 60 seconds when touched. During this time, the sensor will not respond with a beep when touched again. This is normal and does not affect connecting to the WLAN.

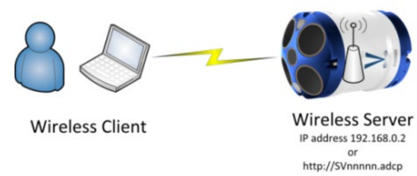
The touch sensor can be saturated to a point where it won't register to touch. This occurs, for example, when the ADCP is submerged in water or covered with biofouling. In extreme cases, the WLAN will not connect. If this occurs:

- Take the system out of the water.
- Rinse the sensor and end-cap with fresh water and then dry the instrument.
- Remove biofouling from the touch sensor and end-cap, and then the housing if problems persist.
- Remove the ADCP from any mounting fixture, especially if it is conductive or metallic.

Connecting to the Sentinel V ADCP

This applies to systems configured for Self-Contained mode. See Switching Modes.

The Sentinel V Self-Contained ADCP includes an 802.11b/g/n WLAN interface and a built-in user interface called ReadyV. The Sentinel V Series ADCP acts as the *server*, along with the connected computer (laptop, tablet, or desktop computer) known as the *client*.



Using the ADCP's DHCP server IP address **192.168.0.2** is recommended. Optionally, on a Windows® based browser use the WLAN address http://SVnnnnn.adcp (where nnnnn is the five or six-character Sentinel V serial number shown on the product label) (see IP and Host Name Setting).

If the computer does not include a built-in 802.11b/g/n WLAN interface, use a USB adapter.

Only one ADCP at a time may be connected. To switch to another ADCP, first disconnect, and then reconnect to the next ADCP.

Using http://*SVnnnnn.adcp* (where *nnnnn* is the five or six-character Sentinel V serial number shown on the product label) will not work on the Macintosh OS.

Using the Wireless Connection

To connect to the ADCP:

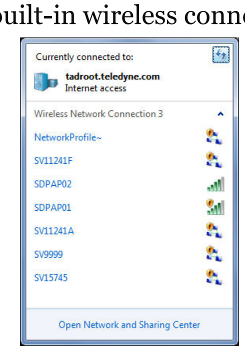
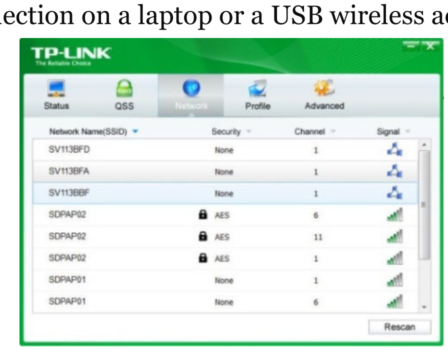
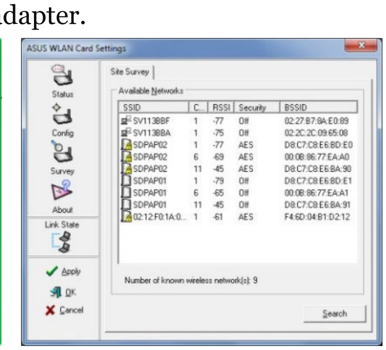
1. Prepare the ADCP by connecting the battery. After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). The WLAN is available after power up for two minutes.

Sentinel V battery pack is shipped inside the system but not connected. Connect the battery and seal the Sentinel V before deployment.

Sentinel V with D cells are shipped without batteries inside the system. Install the batteries and seal the Sentinel V before deployment.

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect BOTH batteries and seal the external battery case before deployment. It is necessary to remove the top battery in order to connect the bottom battery cable.

2. Start the wireless network device on the laptop if it is not automatically enabled. This may be a built-in wireless connection on a laptop or a USB wireless adapter.

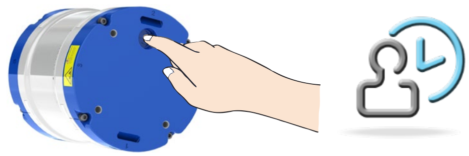




The screen shots in this manual were made with Windows® 7. Depending on the operating system and wireless adapter type, your wireless screen may look different. These differences do not affect the performance of ReadyV.

Touch Sensor

To use the touch sensor:

1. Place a finger over the Touch Sensor. This starts the ADCP's WLAN for five minutes. After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). Wait for the short beep.



Connect

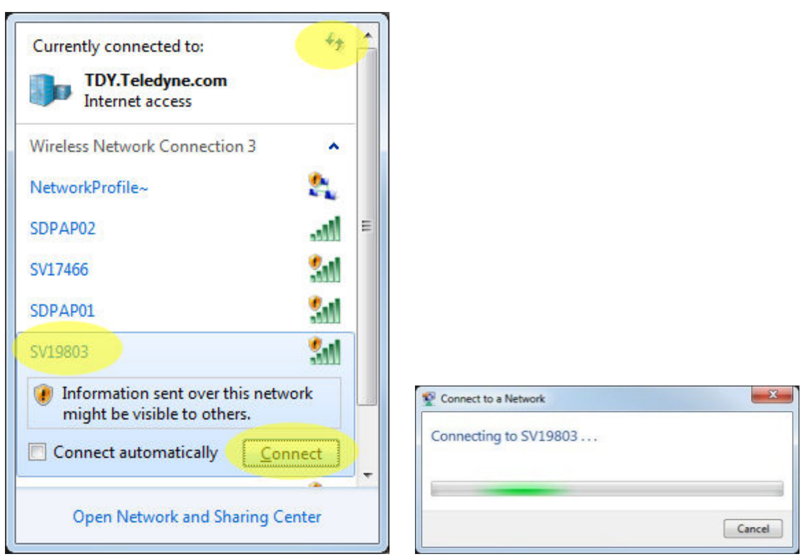
Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

To connect to the ADCP's WLAN:

1. Click on the wireless icon ( ) in the Windows® system tray or if using a wireless USB adapter, start the adapter's interface.
2. Click the **Refresh** icon ( ) to search for connections. Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).

As needed, touch the Touch Sensor, listen for the second beep (see Touch Sensor Response / System Beeps), and then click until the ADCP appears on the list. It may take several attempts of clicking Refresh before the ADCP appears on the list.

3. Select the ADCP on the list by clicking it and then click the **Connect** button. The Connecting to a Network message appears.



Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).

Users who connect to their local network using a wireless connection may lose that connection when connected to the ADCP.

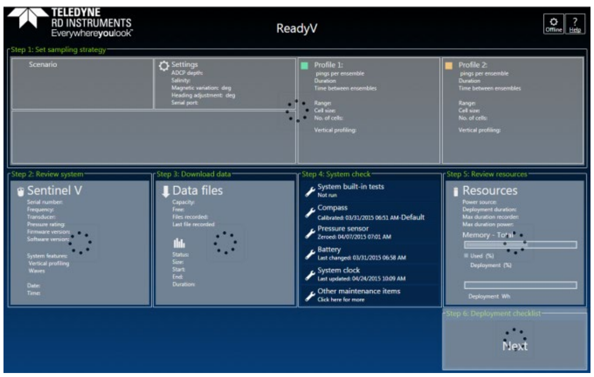
Start ReadyV

To start ReadyV:

1. Open a browser on the laptop (*Internet Explorer*®, *FireFox*®, *Google Chrome*®, or other browsers).
2. Enter the ADCP's IP address **192.168.0.2** into the address bar. Optionally, on a Windows® based browser use the WLAN address http://*SVnnnnn.adcp* (where *nnnnn* is the five or six-character Sentinel V serial number shown on the product label) (see IP and Host Name Setting).

> The DHCP server IP address 192.168.0.2 works for all ADCP serial numbers and all browsers and operating systems.
>
> The address is not case sensitive - enter *SVnnnnn* or *svnnnnn*.
>
> The http:// does not need to be typed on most browsers.
>
> Using http://*SVnnnnn.adcp* will not work on the Macintosh OS.
>
> Add the Sentinel V to the browser's Internet Favorites or Favorites bar for future connections.

3. White panels will appear after the ADCP's address is entered: It can take up to 30 seconds before the ReadyV Home panel fully opens.



> As needed, touch the Touch Sensor, listen for the beep, and then refresh the browser page until ReadyV starts.
>
> Complete step 3 within five minutes of completing step 2.

Figure 4. Using the ReadyV Wireless Connection

The Touch Sensor is NOT a button! Just place a finger into the cavity to activate the sensor.

After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). Wait for the short beep before trying to connect.

The ADCP's WLAN is available after power up for five minutes. Placing a finger over the Touch Sensor starts the WLAN for another five minutes.

Each time the Touch Sensor is touched, a short beep should be heard.

Only one ADCP at a time may be connected. To switch to another ADCP, first disconnect, and then connect to the next ADCP.

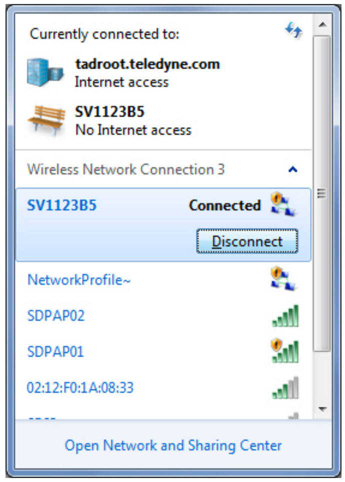
Once ReadyV starts, if no keys are pressed for five minutes, the ADCP will disconnect. After waiting five more minutes, the ADCP will power down. Use the Touch Sensor to restart.

After a deployment, systems need to be cleaned thoroughly before the touch sensor will work.

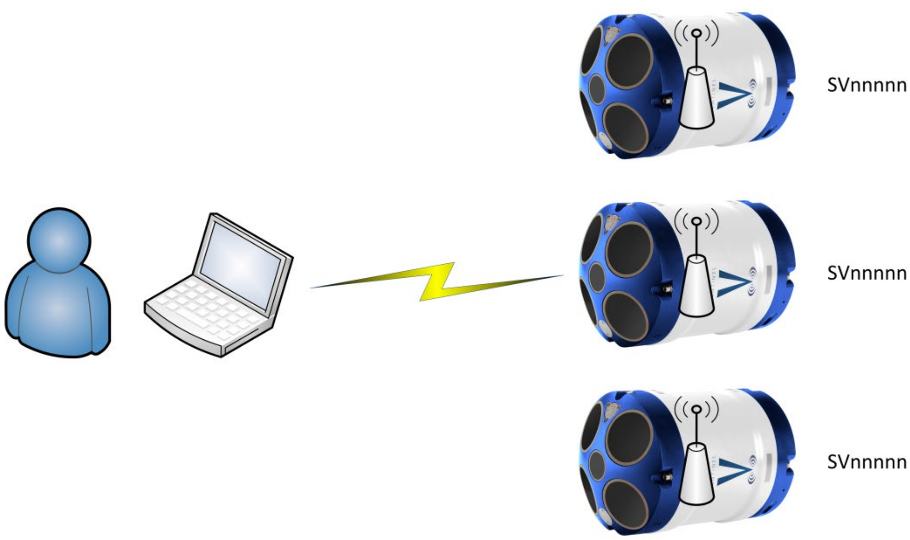
Connecting to another ADCP

To connect to another ADCP:

1. Click on the wireless access-point icon ( ) in the Windows® system tray and select the ADCP on the list that is connected.
2. Click the **Disconnect** button.



3. Now connect to the next ADCP.



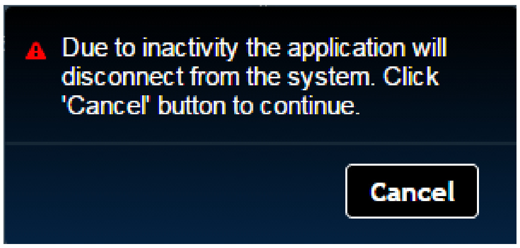
Only one ADCP at a time may be connected. To switch to another ADCP, first disconnect, and then connect to the next ADCP.

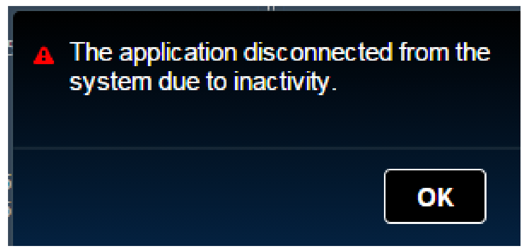
Restoring a ReadyV Lost Connection

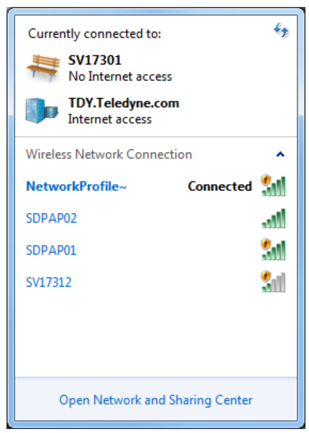
Once ReadyV starts, if no keys are pressed for five minutes, the ADCP will disconnect. After waiting five more minutes, the ADCP will power down. Once the ADCP powers down, the wireless connection is lost.

To reconnect:

1. Close the internet browser page or the browser tab which was running ReadyV.
2. Use the Touch sensor to reconnect (see Connecting to the ADCP).





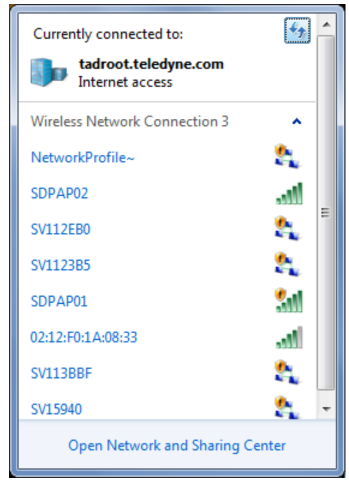


If the ADCP appears on the list but the laptop fails to connect to it, Windows® 7 may have kept the name on the list because it connected to that network in the past. In other words, *this does not mean that the network is actually available*. When in doubt, select the ADCP on the list and use the Disconnect button and then restart the connection.

Wireless Connection Common Issues

The ADCP does not appear on the list of devices:

The ADCP may have timed out. Place a finger over the Touch Sensor again. There is a short beep indicating that the WLAN is enabled on the ADCP. The ADCP's WLAN will remain on for five minutes after the short beep. It may take several attempts of clicking the Refresh icon ( ) before the ADCP appears on the list.



Another computer may already be connected to the ADCP. Only one computer may be connected to an ADCP at a time.

The ADCP does not have power – connect the battery. After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). Wait for the short beep before clicking the Refresh icon ( ).

If the touch sensor is blocked with biofouling, thoroughly clean the sensor cavity first (see Removing Biofouling).

There are no beeps when the touch sensor is touched:

Check that the battery is installed.

If you are using a lithium battery pack, see Power Considerations. Test the lithium battery pack safety circuit. See Testing the Lithium Battery Pack for instructions.

See Touch Sensor Response / System Beeps.

If there are still problems, see Chapter 6 - Troubleshooting.

There are no ADCPs on the list of devices:

Start the wireless network device on the laptop if it is not automatically enabled. This may be a built-in wireless connection on a laptop or a USB wireless adapter.

Look for a hardware switch or special function key on the laptop that can turn the wireless radio on or off. Consult the instruction manual for your specific laptop if you are not sure how to do so.

If the computer uses an external wireless adapter, make sure the adapter is working correctly and is attached and installed properly.

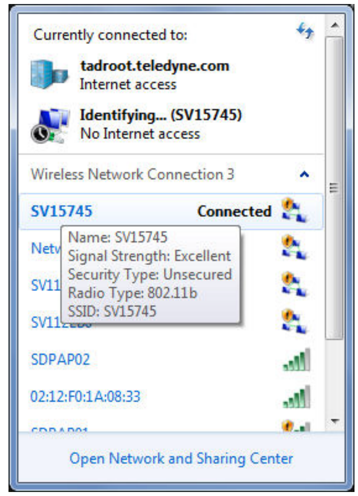
Try using a different USB wireless adapter.

The ADCP is connected, but ReadyV does not start:

Windows 7 may indicate it is connected and the signal strength is excellent even if the wireless connection is lost due to the ADCP going to sleep.

Click on the wireless access-point icon ( ) in the Windows® system tray and click on the ADCP connected to. Click the **Disconnect** button and then click the **Connect** button to reconnect to the network.

Close and then restart the browser.



The ADCP is on the list, but WLAN connection fails:

If the ADCP appears on the list but the laptop fails to connect to it, Windows® 7 may have kept the name on the list because it connected to that network in the past. In other words, *this does not mean that the network is actually available*.

Touch the Wireless Touch Sensor to start the network. Listen for the two beeps: the first one confirms the sensor detected your finger and the second beep confirms the wireless network is ON. Placing a finger over the Touch Sensor starts the network for five minutes. Try to connect again.

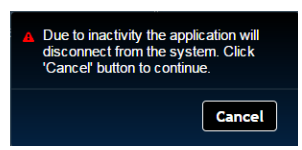
If the touch sensor is blocked with biofouling, thoroughly clean the sensor cavity first (see Removing Biofouling).

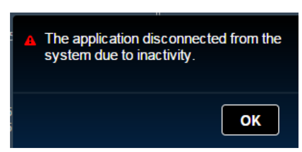
If there are no beeps, make sure that the ADCP is properly powered.

ReadyV Timed-out; the ADCP wireless is ON but refreshing the web page does not work:

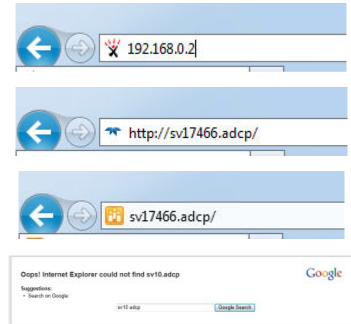
Once the instrument is deployed and no keys are pressed for five minutes, a warning message is displayed, and after another five minutes of no keys being pressed the wireless connection is turned off on the ADCP. Clicking **Cancel** at the first ReadyV info message will leave ReadyV running.

To run ReadyV again and connect to the ADCP, first close the internet browser page or the browser tab which was running ReadyV and then restart the connection.





When the browser is opened, there is a page not found error:



Make sure the IP address **192.168.0.2** is typed in correctly.

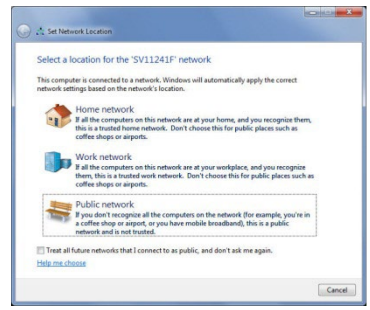
If you are using a Windows ® browser, try using the ADCP's WLAN address *http://SVnnnnn.adcp* into the address bar (where *nnnnn* is the five or six-character Sentinel V serial number) (see IP and Host Name Setting). The address is not case sensitive.

Some browsers may open a search page if the http:// portion in the address bar is not entered.

Check the network connection.

If the computer has both a network cable and wireless, try unplugging the network cable.

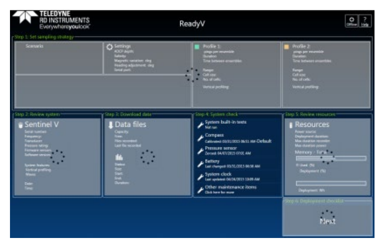
What type of network should be selected?



Windows 7® may display a **Set Network Location** page (Home network, Work network, or Public network page) after connecting to the ADCP.

This page is not needed. Click **Cancel** to close the page.

There are white panels when the ADCP's address is entered:



This is normal. It can take up to 30 seconds for the Home panel to display. Wait for the page to open.

Click on the **Refresh Page** button on the browser.

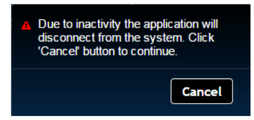
Close the browser and reopen.

Try using a different browser. See Computer Considerations.

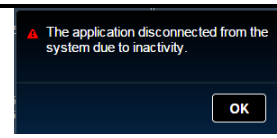
The ADCP is deployed. See Starting or Stopping Deployments.

The connection was lost:

Once ReadyV starts, if no keys are pressed for five minutes, the ADCP will disconnect. After waiting five more minutes, the ADCP will power down. First close the internet browser page or the browser tab which was running ReadyV and then use the Touch sensor to restart.



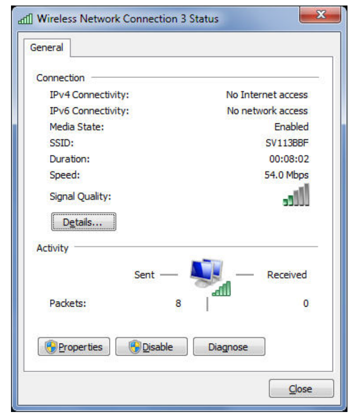
Use the Touch sensor and refresh the browser page. If that does not help, the wireless connection was lost. Click on the wireless access-point icon ( ) in the Windows® system tray and check the connection.



If the firmware was just updated, the browser must be closed and the wireless network must be restarted.

Make sure there are no other devices interfering with the ADCP, such as microwave ovens, cordless phones, or other wireless devices.

Make sure the ADCP is within the wireless range of the computer (typically within 100 feet). Try moving the ADCP closer to the computer. If there is a wall between the ADCP and the computer, try placing the ADCP and computer in the same room. Click the wireless access-point icon ( ) on the status bar and check the signal strength by right-clicking on the connection and selecting **Status**.



NOTES

Chapter 1a

REAL-TIME SENTINEL V OVERVIEW

In this chapter:

Sentinel V Real-Time Features

Sentinel V Real-Time ADCP is designed for real-time applications such as vessel-mount, waves, and turbulence. It is a direct-read capable ADCP based on the Sentinel V hardware. It can be sold as a new unit, or as a field-upgradeable “kit”. Firmware upgrades from Real-Time (and back to) Self-Contained allows dual-application use.

The Sentinel V Real-Time ADCP consists of an ADCP, housing with serial or Ethernet connector, micro-SDHC memory card, and software. The Sentinel V Real-Time Series ADCP requires the addition of a Windows® compatible computer to configure the ADCP and replay collected data.

The figure below shows the no battery Real-Time (RT) housing (see Available Real-Time Options), but any V Series housing with a serial connector can be used. The “no connector” option is not compatible with a Sentinel V Real-Time.

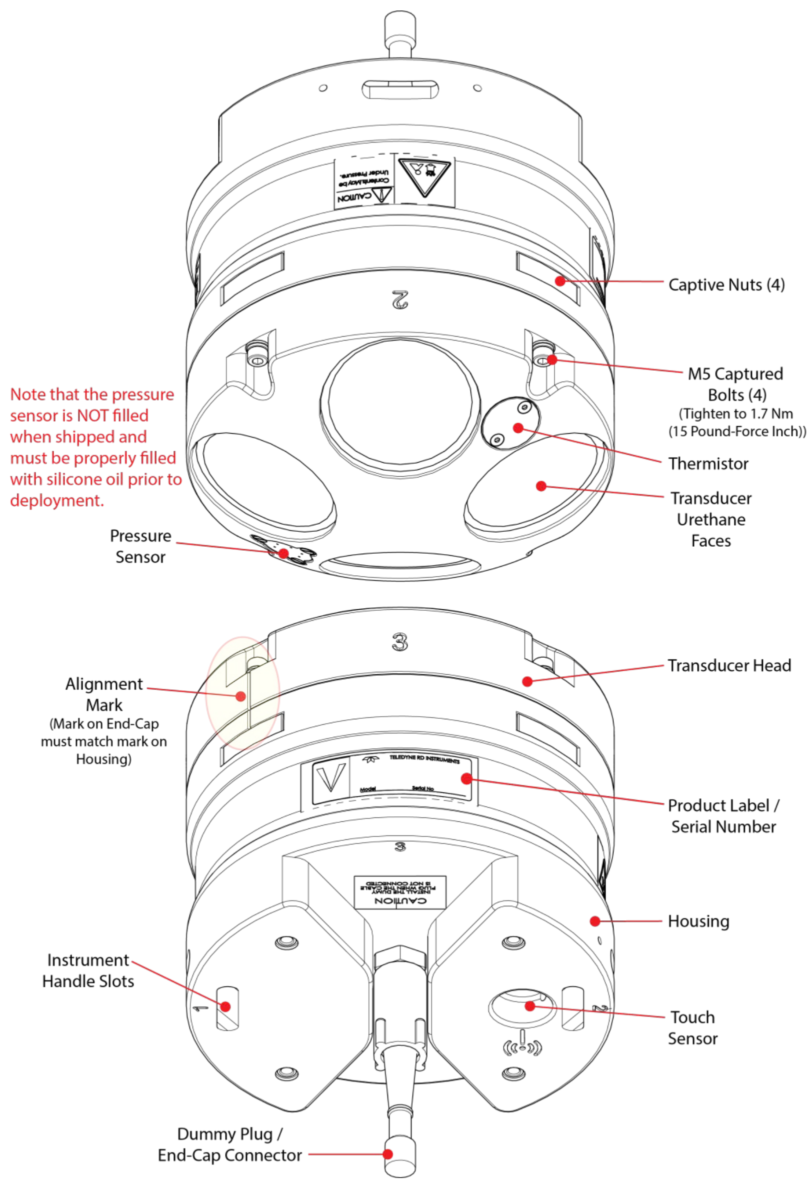


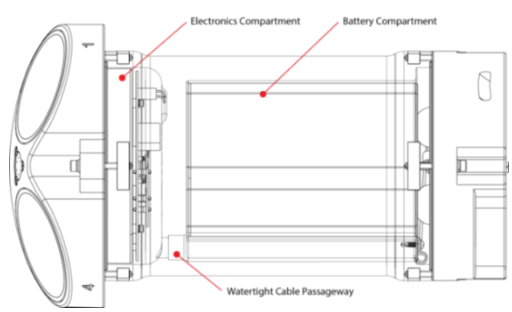
Figure 5. Real-Time (RT) Housing Overview

Available Real-Time Options

The following section explains the different options available for RT ADCPs. See the Parts Location Drawings for more information.

- **Transducer** – The standard nominal ranges are 20m (1000 kHz), 50m (500 kHz) and 100m (300 kHz). See the Outline Installation Drawings for dimensions and weights.
- **Vertical Beam** – an optional vertical beam is available.
- **Waves Feature** – Optional feature that provides full water column echo and velocity profiling to make accurate measurements of wave kinematics as well as the confidence to verify that the processed wave statistics are accurate. Use *Plan* to set up the Sentinel V Real Time ADCP to collect Waves data. See Installing Feature Upgrades for more information.
- **End-Cap** – The End-Cap consists of an IEEE 802.11b/g/n WLAN wireless communications Touch Sensor and underwater electrical 8-pin serial RS-422 connector. Please note that the touch sensor is disabled while in Real-Time mode.
- **End-Cap Connector** – The 8-pin connector can be straight or right-angled. See the Outline Installation Drawings for end-cap configurations.

- **Deck Box** – The Deck Box converts AC power input into 16 VDC output for the Sentinel V RT input power and provides sufficient power to the ADCP for long range bottom tracking. It can convert the computer serial interface from RS232 to RS422.
- **Internal Batteries** – Depending on the type of housing the system is configured with, the Sentinel V Real Time system may use a battery pack, lithium battery pack (optional), individual D cell batteries, external power only, or both external power and batteries.
- **Lithium Battery Pack** – This battery pack is assembled using lithium battery cells that provide 15.6 VDC with a capacity of approximately 1900 Wh. The battery includes a safety circuit that protects the battery and users against short circuits and provides users the ability to test the pack (see Testing the Lithium Battery Pack). The circuit also turns the battery off at its end of life, before the battery fully discharges. This happens when about 97% of the battery's capacity is depleted.
- **External Battery Case** – The optional external battery case holds two pre-assembled battery packs for a nominal voltage level of 18 VDC.
- **AC Adapter** – The AC adapter provides a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is insufficient to power the ADCP for long range bottom tracking. Use a heavy-duty power supply that is capable of supplying 16V at 150W to support a long duration bottom tracking ping like the one used in the Sentinel V deck box.
- **Underwater Cable** – The system includes a 5-meter underwater serial or Ethernet cable. The maximum cable length is 100 meters.



- **Housing** – The Sentinel V Series ADCP dual-chamber housing allows deployment depths to 200 meters. The dual-chamber design keeps the electronics dry even if the battery chamber floods. See the Outline Installation Drawings for dimensions and weights. The housing type and length will depend on if it uses battery packs or individual D cell batteries. The RT (no battery) housing uses a single chamber.
- **Memory** – The Sentinel V includes a microSDHC memory card.
- **Pressure Sensor** – The pressure sensor (standard 30 Bar) measures water pressure (depth).

Health & Environment Monitoring Sensors

The Health and Environment Monitoring (HEM) Sensors monitor the health of the Sentinel V Real-Time system.

- **Operating Time** – The Sentinel V Real-Time system records the total time of operation in minutes where "operation" is defined as the time that the system ping loop is active (CS command has been sent). The record of the total awake time has a maximum value of 33,554,432 minutes, which corresponds to over 500,000 hours of operation. The value of the counter can be read as part of the PS5 command. Although the time is stored in minutes, the operating time is reported in hours with one decimal place.

- **Pressure Cycles** – Sentinel V Real-Time systems with pressure sensors installed record the number of pressure cycles (dives, casts, etc.) to which a unit is exposed during operation. A pressure cycle is defined as "pressure is greater than 40% of maximum, followed by a pressure that is less than 20% of maximum". The pressure cycle counter has a maximum value of 16,384. Use the PS5 command to read the number of pressure cycles.

- **Maximum Pressure** – Sentinel V Real-Time systems with pressure sensors installed monitor the pressure during operation and records the maximum pressure seen during the lifetime of the instrument. This maximum pressure is stored in non-volatile memory. The PS5 output will read N/A if no pressure was measured or recorded. Use the PS5 command to read the maximum pressure seen.

- **Over Pressure** – Sentinel V Real-Time systems with pressure sensors installed monitor water pressure during operation and record the number of events beyond the system's maximum rated pressure value. The system pressure rating is defined as the maximum pressure rating of the installed pressure sensor. The system maintains a flag in non-volatile memory to indicate whenever the pressure exceeds 100% of the maximum rated value, this flag is set to a '1' value, and whenever pressure is less than 80% of the maximum rated value, this flag is cleared to a '0' and the over pressure cycle counter is incremented. Use the PS5 command to read the number of over pressure events seen.

The Sentinel V Real-Time system pressure rating is defined as the maximum pressure rating of the installed pressure sensor.

If an Over Pressure event occurs or the Maximum Pressure seen has exceeded the Sentinel V Real-Time's pressure sensor depth rating, TRDI advises returning the system to us for an inspection before re-deploying.

Example PS5 output:

```
PS5
Operating time: 4327.5 hours
Maximum pressure seen: 652.378 dBar
Over-pressure events: 1
Pressure cycles: 25
```

Comparing Self-Contained & Real-Time

The V Series ADCP can be converted to a Sentinel V Real-Time and vice versa by changing the firmware (see Switching RT and SC Modes).

	Sentinel V Self-Contained	Sentinel V Real-Time
Intended Applications	Self-Contained currents, Waves (Burst)	Real-Time currents, Continuous Waves, Turbulence, Vessel Mount/Moving Platform
Ping Rate	Up to 4Hz	Up to 16Hz (Frequency dependent)
Water Modes	Water profile (WM2)	Water Profile (WM2),
Bottom-Track	No	Yes – requires the Sentinel V deck box or a heavy-duty power supply that is capable of supplying 16V at 150W to support a long duration bottom tracking ping.
Trigger	No	No
Sleep	Yes	No
Data recording	Data Recording	No
Plan Software	*ReadyV*	*Sentinel V RT Utilities*
Profiles	Dual	Single
Config error checking	Profile and schedule in-depth validation	Limited
Saved configurations	Multiple, named	1 user, 1 default
Maintenance log	Yes, user accessible	No
Feature control	Yes, using *Ready V*	Yes, using *Sentinel V RT Utilities*
Burst scheduling	Yes	No
Vertical beam	Profile (Software only; Velocity/WavesMon)	
HEM features	None	Selected
Comms	WLAN control, Serial output RS-422	Serial, RS-422, Ethernet
Firmware upgrade	Wireless, enabled via touch sensor	Wireless, enabled via serial or Ethernet
SC-RT conversion	Firmware change	

Real-Time System Inventory

Included with the Sentinel V system:

Kit	Part Number	Name	Description
Configuration	S20 S50 S100	Sentinel V SC or RT ADCP with transducer cover	Sentinel V Self-Contained (SC) or Real-Time (RT) ADCP. Depending on housing type: • Sentinel V battery packs are shipped inside the system but not connected. • Sentinel V with D cells are shipped without batteries inside the system. • Sentinel V with no battery housing uses external power.
	See the packing slip for more information on system configuration		SC systems use wireless communications for setup and deployment. This means the system only requires battery power to operate the system. RT systems use serial or Ethernet communications for setup and deployment. This means an end-cap with connector, an underwater cable, and DC power are required to operate the system. The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.
Accessories Kit	97D-7000-00 or 97D-7002-00	Shipping Case	Shipping case with foam inserts.
	81D-6002-00	Handle	The handle makes it easier to carry the Sentinel V ADCP. Attach it to the slots on the ADCP's end-cap.
	75DK6001-00	Tools and Spare Parts kit	See Tools and Spare Parts for a list of parts included in this kit.
	95D-6037-00	Sentinel V SC and RT Roadmap	Use this sheet to determine where to start on setting up the Sentinel V SC and RT system.
Documentation Kit	95Z-6007-00	Download instructions	This sheet has instructions for downloading the software and manuals.
	95D-6016-00	Compass Calibration Guide	Printed sheet with instructions on how to calibrate the compass
	95Z-8005-00	Velocity Activation Code	Activation code that unlocks the Velocity software. Waves processing requires a waves enabled activation code.
	95D-6015-00 95D-6033-00	Deployment Guide	A printed copy of the SC and RT deployment guides.

Real-Time Software Overview

Sentinel V Real-Time Software:

	Testing	Planning	Compass Cal	Command & Control	Data Acquisition	Display	Data Con-vert	Post Process
Vessel Mount	Sentinel V Utilities	VmDas Sentinel V RT Utilities	Sentinel V Utilities	VmDas	VmDas	VmDas Velocity WinADCP	Velocity	VmDas Velocity User Supplied
Waves	Sentinel V Utilities	WavesMon Sentinel V RT Utilities	Sentinel V Utilities	WavesMon	WavesMon	WavesMon WavesView	WavesMon Velocity	WavesMon Velocity User Supplied
Currents	Sentinel V Utilities	Sentinel V RT Utilities	Sentinel V Utilities	Sentinel V Utilities	VmDas Sentinel V Utilities User Supplied	Velocity VmDas User Supplied	Velocity	Velocity User Supplied
Turbulence	Sentinel V Utilities	Sentinel V RT Utilities	Sentinel V Utilities	Sentinel V Utilities	User Supplied Sentinel V Utilities	Velocity WinADCP	Velocity	User Supplied

See the Real-Time Deployment Guide for instructions on installing the software.

Real-Time Computer Considerations

TRDI designed the Sentinel V Real-Time Series ADCP to use a Windows® compatible computer. Use *Sentinel V RT Utilities* to configure the ADCP; data is displayed through TRDI's *Velocity* program.

Minimum Computer Hardware Requirements:

- Desktop, Laptop, or Netbook computer (see Table 2 for operating system)
- Screen resolution above 1024x768 (see note)
- Internet Brower (see Table 2 for supported browsers)
- Mouse or another pointing device
- Wireless 802.11b/g/n WLAN Interface (see Using the Sentinel-V Real-Time Utilities Page)
- Ethernet port for RT systems configured with Ethernet communications

Many laptops and netbooks today have built-in WLAN. If not, then a WLAN adapter is required.

Most wireless enabled laptops will be automatically enabled. Consult the instruction manual for your specific device if you are not sure how to do so.

Table 2. Supported Operating Systems and Browsers for Sentinel V Real-Time Utilities Page

Operating System	Internet Explorer 10+	Firefox (Latest)	Safari (Latest)	Chrome (Latest)	Opera (Latest)
Windows® 7, 8.1, or 10 (32/64 bit)	✓	✓	⃠	✓	✓
Macintosh OS 10.5.7+ (Intel based)	⃠	✓	✓	✓	✓
Linux (any 32/64 bit distribution)	⃠	✓	⃠	✓	⃠

⃠ Not Supported

Real-Time Power Considerations

Use the following section to determine the power requirements for the Sentinel V Real-Time ADCPs.

- The Sentinel V Real-Time uses external power through the end-cap connector. The voltage must be +12 to 20 VDC.
- Depending on the type of housing the system is configured with, the ADCP may use a battery pack, lithium battery pack (optional), individual D cell batteries, external power only, or both external power and batteries.

The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect **BOTH** batteries and seal the external battery case before deployment. It is necessary to remove the top battery to connect the bottom battery cable. See Replacing the External Battery Case Packs for details.

- The AC Adapter runs on any standard AC power and supplies +18 VDC, 24 watts to the ADCP. The Sentinel V batteries can be connected or disconnected. If the adapter's input voltage is greater than the battery voltage, then the ADCP will draw all power from the AC adapter even if the battery is installed and connected. Use the AC Adapter when testing the ADCP to conserve the battery power.

The voltage specification of the Sentinel V battery pack is 18V; however, fresh batteries provide a slightly higher voltage. The AC power adapter used for powering the Sentinel V operates at 18V and therefore if a system is connected to the AC power adapter and simultaneously the batteries are connected, the batteries will be depleted until they reach the same voltage as the AC power adapter. While this does not affect the operation of the system, you should be aware of the loss of power that can occur. Once the batteries are discharged to the supplied voltage of the AC power adapter supply, the batteries will no longer be depleted.

If the batteries are above 18V and you wish to preserve the battery charge your options would be:

- Disconnect the battery pack when using the AC power adapter.
- Power the unit with a different power supply (voltage not to exceed 20V).

Transmitted Power

For the Sentinel V, a fresh battery provides +18 VDC. Batteries spend most of their life at a nominal voltage of +14 VDC. Using 18 VDC will increase the range by 5 to 10% depending on conditions.

The optional lithium battery provides 15.6 VDC with a capacity of approximately 1900 Wh. The battery includes a safety circuit that protects the battery and users against short circuits and provides users the ability to test the pack. The circuit also turns the battery off at its end of life, before the battery fully discharges. This happens when about 97% of the battery's capacity is depleted.

Power on Cycle

The power supply or battery pack must be able to handle the inrush current as well. Inrush current is the current required to fully charge up the capacitors when power is applied to the Sentinel V Series ADCP.

The capacitors provide a store of energy for use during transmit. The inrush current is as high as 0.8 Amps RMS at 9.2 VDC. The ADCP will draw this amperage until its capacitors are fully charged. If the power supply or battery pack limits the current or the power drop on the cable is significant, then the power on cycle will take longer. It can take up to three minutes. The power must not shut down during the inrush current draw, as this may not allow the Sentinel V Real-Time Series ADCP electronics to start.

Before using the optional Lithium battery pack, always run the battery self-test. See Testing the Lithium Battery Pack for instructions.

Instruments with high inrush currents occasionally trigger the optional Lithium battery pack short circuit detection, which turns the battery off. If this happens, do the following:

- Disconnect the battery and touch the ADCP's touch sensor for about 45 seconds to one minute. Connect the battery and then the ADCP should power on normally.
- If the ADCP still does not power on, connect the AC adapter and wait for a minute and then connect the battery pack. Once the ADCP is connected and *Sentinel V RT Utilities* started, unplug the AC adapter. The ADCP will work normally after that.

Power for Bottom Track

The Sentinel V Real-Time is capable of Bottom Track if enabled, but the power requirements are different from standard operation. The recommended input voltage is 16V and current up to 8A. There are also specific cable requirements depending on length of cable required, up to 100m (see Specifications, Table 30). Use of the Teledyne RDI supplied Deck Box and cable are highly recommended. Bottom track is not recommended when using battery power.

The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

Real-Time Touch Sensor Response / System Beeps

When the system is configured for Sentinel V Real-Time serial communications and power is applied, there is one long beep. When the system is configured for Sentinel V Real-Time Ethernet communications and power is applied, there is one long beep, a ~15 second delay and then two short beeps. Wait for the short beeps before sending a Break to the system.

The touch sensor is disabled in Real-Time mode; the touch sensor does not respond or beep if touched except during firmware updates or switching modes. See Installing Sentinel-V Real-Time Firmware Upgrades and Switching RT and SC Modes for more information.

Real-Time ADCP Commands

For more information about Sentinel V Real-Time ADCP commands, see Chapter 8 – Real-Time Commands.

Connecting to the Sentinel V Real-Time

This applies to systems configured for Real-Time mode. See Switching RT and SC Modes.

The Sentinel V Real-Time ADCP includes an external serial RS-422 cable connector on the end-cap. The system also includes the 802.11b/g/n WLAN interface and a built-in user interface for firmware upgrades (see Using the Sentinel-V Real-Time Utilities Page).

To set up the Sentinel V Real-Time ADCP:

1. Connect the I/O cable to the Sentinel V Real-Time ADCP.
2. Attach the I/O cable to the computer's communication port.
3. Connect the AC Power Adapter to the power connector. Please note that the AC power adapter only outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is insufficient to power the ADCP for long range bottom tracking. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W to support a long duration bottom tracking ping like the one we supply in the Sentinel V deck box.

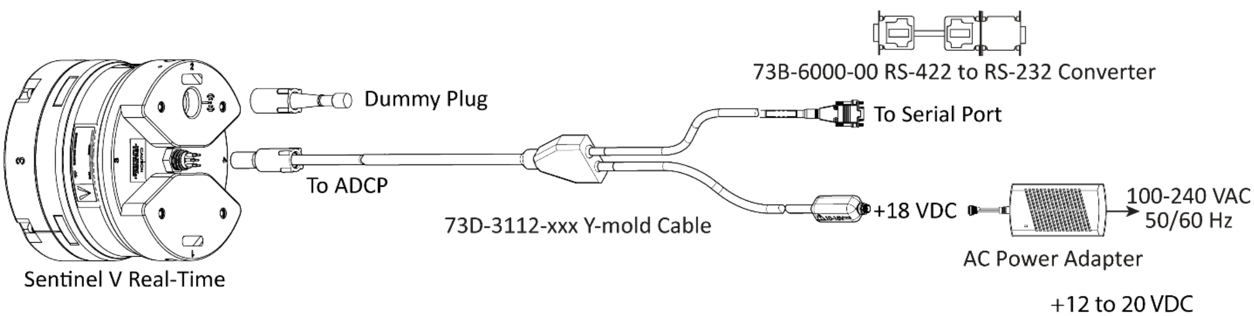


Figure 6. Sentinel V Real-Time Serial Connection

Your computer and the Sentinel V Real-Time ADCP must both be set to the same communication setting. Use the RS-232-to-RS-422 converter if your computer only has a RS-232 COM port.

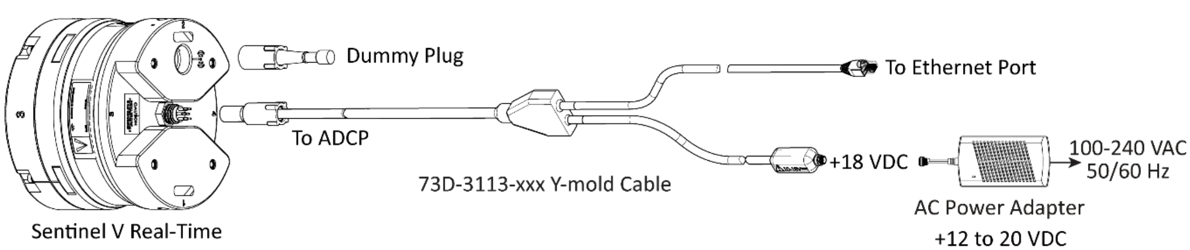


Figure 7. Sentinel V Real-Time Ethernet Connection

You should hear one long beep, a ~15 second delay and then two short beeps when power is applied. Wait for the short beeps before sending a break.

Connecting Using the SVRT Deckbox

The Deck Box converts AC power input into 16 VDC at 150W output for the Sentinel V RT input power. It can convert the computer serial interface from RS232 to RS422 and provides sufficient power to the ADCP for long range bottom tracking.

> The Sentinel V must be Real-Time Ethernet or Real-Time RS-422 to be able to use the Deckbox.

To connect using Serial:

1. Attach the ADCP cable to J1 and to the Sentinel V ADCP.
2. Connect the computer to the Deck Box using the RS-422 (J3), or RS-232 (J4) connector. The Deck Box will convert RS-232 to RS-422. Communications to the ADCP is always RS-422.

> RS-232 or RS-422 can be connected to Deck Box depending on the length of the serial cable. For cables up to 15 meters, use a RS-232 cable connected to the RS-232 connector (J4); for cables over 15 meters, use a RS-422 cable connected to the RS-422 connector (J3) and a 73B-6000-00 RS-422 to RS-232 converter connected to the computer's Com port.

> Only connect one output port, J3 or J4, not both.

3. Attach the power cord to J6 and then press the Power button on the front panel.
4. Use *Sentinel V RT Utilities* software and connect to the system using the Serial port.

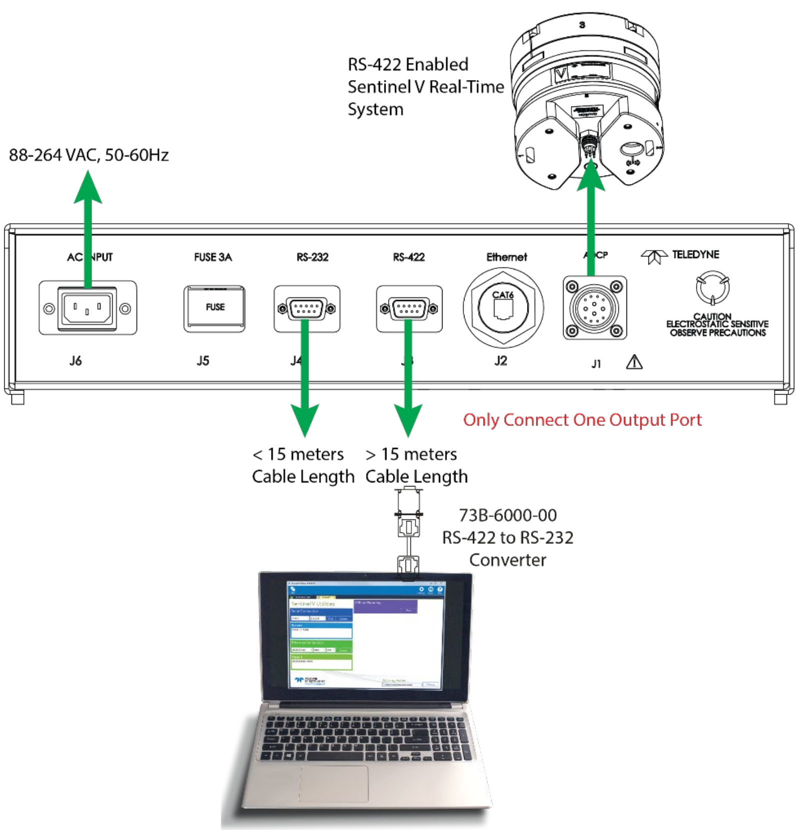


Figure 8. SVRT Deckbox Serial Connection

To connect using Ethernet:

1. Attach the ADCP cable to J1 and the Sentinel V ADCP.
2. Connect the computer to the Deck Box using the Ethernet (J2) connector and CAT6 cable.
3. Attach the power cord to J6 and then press the Power button on the front panel.
4. Use *Sentinel V RT Utilities* software and connect to the system using the Ethernet port.

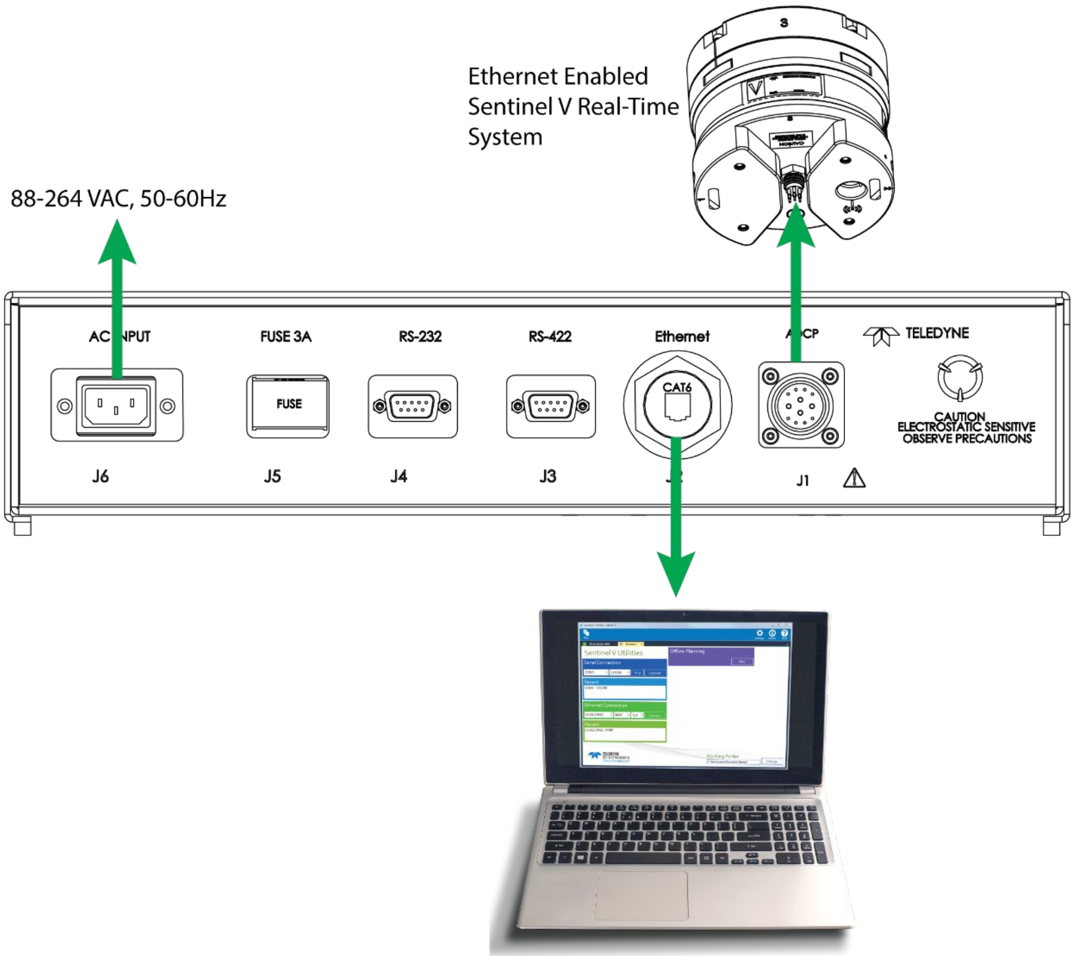


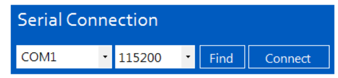
Figure 9. SVRT Deckbox Ethernet Connection

Using Sentinel V RT Utilities

To connect to the Sentinel V Real-Time ADCP using the *Sentinel V RT Utilities* software:

1. Select **New Serial Connection** or **New Ethernet Connection**.
2. Enter the ADCP's communication settings.

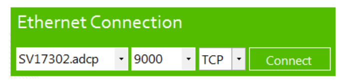
Serial Communications:

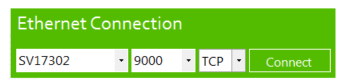


Select the **COM Port** and **Baud Rate** from the drop-down lists.

If you are unsure of the Baud rate, use the default 9600 baud and try to connect. If you have trouble connecting, click the **Find** button.

Ethernet Communications:





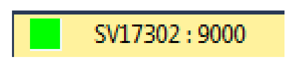
Enter the **IP or host name**. For example, Sentinel V ADCPs host name is SV*nnnnn.adcp* (where *nnnnn* is the five or six character serial number shown on the product label).

Use SV*nnnnn* if the network you are connecting to assigns the IP address (see IP and Host Name Setting).

Enter the **Port Number** 9000.

Select **TCP**.

3. Click the **Connect** button. Once connected, the button will change to **Disconnect** and the tab will show a green box.



4. The *Sentinel V RT Utilities* main screen will open. The screen changes depending on if the connection is Serial or Ethernet. For Serial connections, you will see the **Wireless Status** and Ethernet connections will have **UDP Data Output**.

For more information on *Sentinel V RT Utilities*, click the Help icon ( ) to open the Sentinel V RT Utilities Software help file.

Use the Sentinel V RT quick reference cards to help remember how to connect the Sentinel V system.

Using Ethernet Communications

Sentinel V Real-Time systems, starting in May 2017 supports Ethernet output. These systems must be factory configured or field upgraded. Ethernet systems can be identified by the model number, such as S20-53P**E**WR-16G-200, where **E** stands for Ethernet.

Ethernet can be used for following scenarios:

- Send commands to the ADCP and receive responses on the CMD channel. The CMD channel is used to connect to a Sentinel V RT system and control it using a two-letter command system and must use port 9000. Use *Sentinel V RT Utilities* software to connect to this port using TCP protocols to control the Sentinel V RT system.
- Send data from the ADCP to user equipment such as a PC or a data logging device. The data channel is established over a UDP socket.

UDP Data Output – It is possible to output ensemble data in two ways over a UDP connection:

- Send ensemble data to a specific destination IP and port number, known as *directed UDP output*
- Send ensemble data to a network directed broadcast IP and port number, network directed *UDP broadcast output*

For more information on *Sentinel V RT Utilities*, click the Help icon ( ) to open the Sentinel V RT Utilities Software help file.

If you have problems sending data over UDP, check the Windows® Firewall is not blocking *Sentinel V RT Utilities*. See Troubleshooting UDP Issues for more information.

Using Directed UDP Output

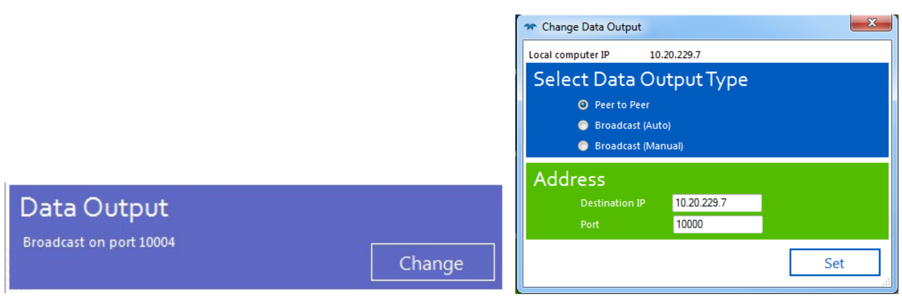
For directed UDP output, the following parameters are required:

- Destination IP address of the remote machine
- Destination Port Number of the remote machine

UDP is a connection-less protocol. Therefore, UDP packets can be lost in an unreliable or highly congested network.

To view Directed UDP data over the Ethernet:

1. Use the **Data Output** box to set the Destination IP address for Data Output. Click on the **Change** button.



2. Select **Peer to Peer** or **Broadcast (Manual)**. Enter the **Destination IP** address. Change the destination **Port** as needed. Click **Set**.
3. Wait 10 to 15 seconds before deploying the ADCP using the **Deploy** button.

Using UDP broadcast Output

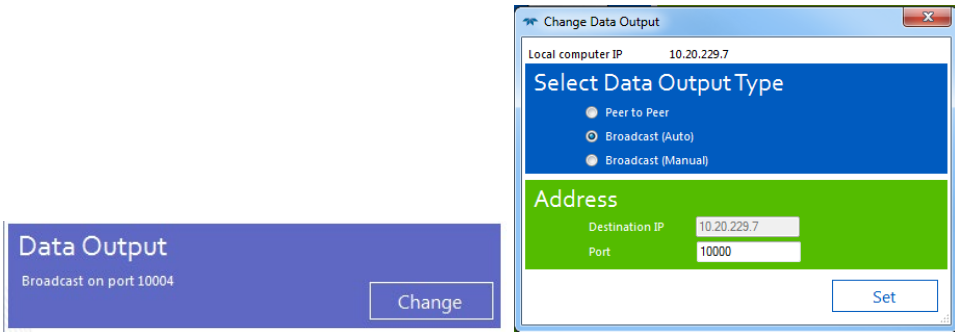
For network directed UDP broadcast output, the following parameters are required:

- Network directed UDP broadcast port

With **Broadcast (Auto)** output, multiple remote machines that are listening on the same transmit UDP port will receive the same data.

To broadcast data over the Ethernet:

1. Use the **Data Output** box to set the Destination IP port. Click on the **Change** button.



2. Select **Broadcast (Auto)**. Change the destination **Port** as needed. Click **Set**.
3. Wait 10 to 15 seconds before deploying the ADCP using the **Deploy** button.

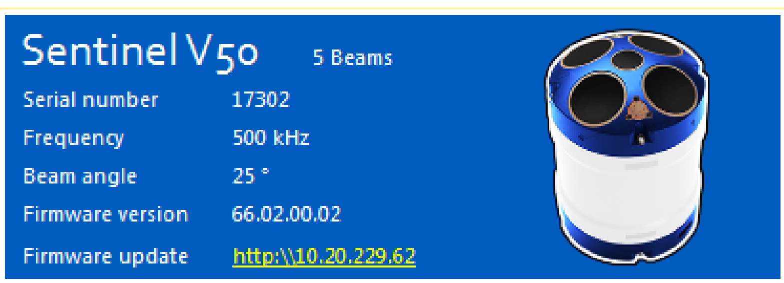
Using the Sentinel-V Real-Time Utilities Page

Installing Sentinel-V Real-Time Firmware Upgrades

Download the firmware from our online customer portal at https://tm-portal.force.com/TMsoftware-portal/s/. Log into your account. Click the **Firmware** link and download the RT firmware. Save the file to the computer and unzip the file. The file will be *sv_66.xx.xx.xx.bin* format where *xxxx* = firmware version.

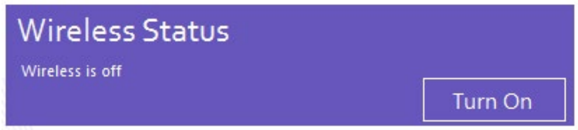
To install a firmware upgrade using a Sentinel V RT Utilities Ethernet connection:

1. Click the link next to **Firmware update**. This link will open the default web browser on the laptop and open the Sentinel-V Utilities page (see Figure 8, page 38).
2. Select **Firmware Update** and then click on **Choose File** to select the Sentinel V firmware binary (*sv_66.xx.xx.xx.xx.bin*). Click the **Update** button.

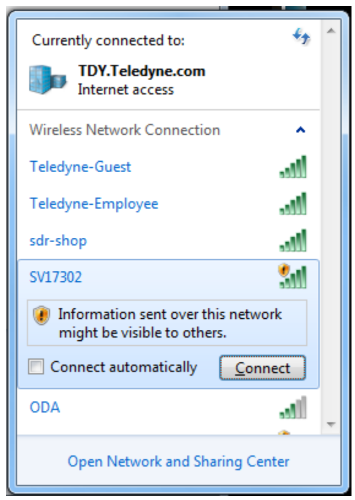


To install a firmware upgrade using a Sentinel V RT Utilities serial connection:

1. Connect to the Sentinel V Real-Time ADCP using *Sentinel V RT Utilities* and a serial port.
2. On the **Wireless Status** box, click the **Turn On** button. Wait for the second short beep before continuing.

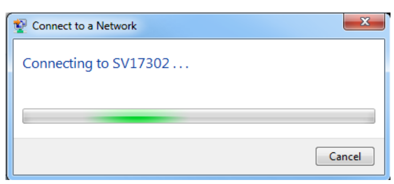


3. Connect to the ADCP's WLAN. Click on the wireless icon (or) in the Windows® system tray or if using a wireless USB adapter, start the adapter's interface.
4. Click the **Refresh** icon () to search for connections. Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).
5. Select the ADCP on the list by clicking it and then click the **Connect** button.



Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).

6. The Connecting to a Network message appears.



7. Click the link next to **Firmware update**. This link will open the default web browser on the laptop and open the Sentinel-V Utilities page.

8. Select **Firmware Update** and then click on **Choose File** to select the Sentinel V firmware binary (*sv_66.xx.xx.xx.xx.bin*). Click the **Update** button.

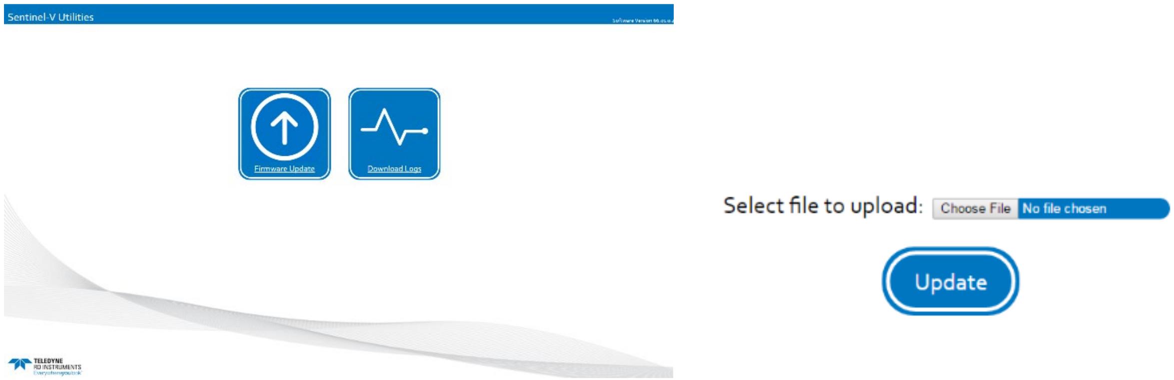


Figure 10. Sentinel V RT Utilities Page

> ⚠ It takes several minutes to load the new firmware and the Sentinel-V Utilities screen may be blank during the update process. Not all browsers will provide feedback during the firmware update. Do not close the browser while the firmware is updating.

9. Once the firmware is loaded into the system, and then the Sentinel V Real-Time system restarts. The wireless connection between the PC/laptop and the Sentinel V Real-Time is disconnected.

Setting up environment for update. Please wait...
Updating Sentinel V Firmware
Stopping existing firmware processes: done
Checking firmware update integrity...OK
Executing firmware update. This will take 2 to 3 minutes...OK
Executing post-install...OK
Cleaning up after install...OK
System will reboot now.
Your wireless network will be disconnected

10. Turn off the wireless status when finished by clicking the **Turn Off** button.

Downloading Sentinel V Real-Time Log Files

To download the Sentinel V Real-Time log file:

1. Connect to the Sentinel V Real-Time ADCP.
2. Connect to the ADCP's WLAN as shown in Installing Sentinel-V Real-Time Firmware Upgrades.
3. Click the link next to **Firmware update**. This link will open the default web browser on the laptop and open the Sentinel-V Utilities page.
4. Click the **Download Logs** button. The file will be named *diagnostic.tar* and can be sent to TRDI customer service to help with troubleshooting.

Installing Feature Upgrades

The feature upgrade installation program is used to install Waves and Bottom Track capabilities in a Sentinel V Real-Time system. Feature upgrades can be sent via a *Sentinel V RT Utilities* *.*feature* file.

Features can only be activated or deactivated when connected to the ADCP and require a Feature file (*.*feature*) that is tied to the ADCP's serial number.

Contact your local sales representative if you are interested in upgrading your system.

Features ordered with the system will be installed by TRDI.

Save the *.*feature* file in a folder that has full read/write permissions. For example, if you save the file to the AppData folder, you may get a file load error.

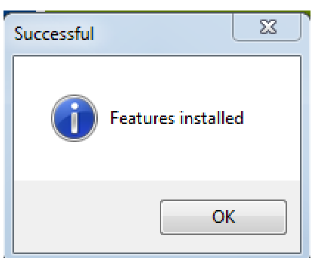
Many feature upgrades require the latest firmware version to be installed in your Sentinel V Real-Time ADCP. If you need to update the firmware, do this before installing the feature upgrade (see Installing Sentinel-V Real-Time Firmware Upgrades).

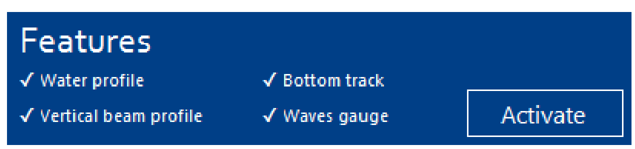
Feature upgrades must be installed in each mode to be available for dual-application use. See Activating and Deactivating Features for SC mode. If you purchased the feature for one mode, contact TRDI field service (rdifs@teledyne.com) to receive the feature for the other mode.

Bottom-Track is only available in Real-Time mode.

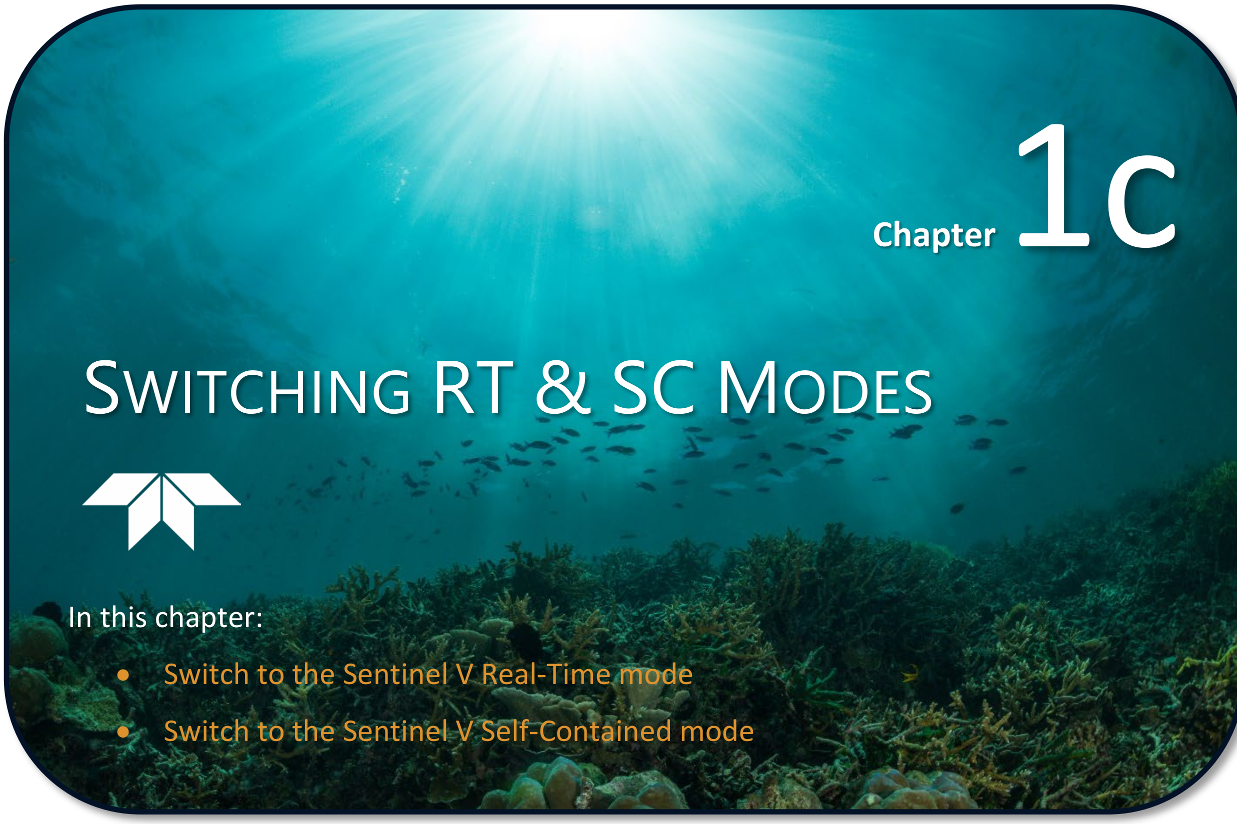
To install a Feature file upgrade:

1. Set up the Sentinel V Real-Time as shown in Connecting to the Sentinel V Real-Time.
2. Start *Sentinel V RT Utilities* and click **Activate**. Locate the feature file and click **Open**.
3. Click **OK**. Verify the new features installed show a check mark.





NOTES



Switching RT and SC Modes

The V Series Self-Contained (SC) ADCPs can be converted to a Sentinel V Real-Time (RT) and vice versa by changing the firmware; changing the firmware allows for dual-application use.

> Feature upgrades must be installed in each mode to be available for dual-application use. See Activating and Deactivating Features for SC mode and Installing Feature Upgrades for RT mode. If you purchased the feature for one mode, contact TRDI field service (rdifs@teledyne.com) to receive the feature for the other mode.

Switching to the Sentinel V Real-Time Mode

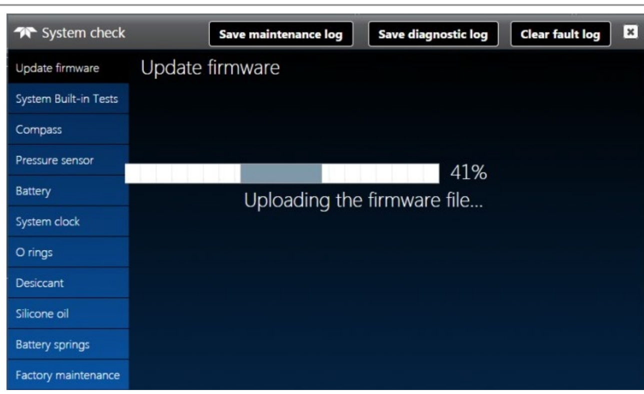
(Sentinel V is currently configured for SC mode):

The Sentinel V Self-Contained system MUST have firmware version 47.19.xx or higher before you can load the Real-Time firmware version 66.xx. If you see the message *“version has to be greater than 44.17”* even though the firmware version is 47.19.xx, press **CTRL+F5** to continue.

The Sentinel V Self-Contained system MUST have a serial connector on the end-cap and the user MUST have the 73D-3112-xxx underwater cable and AC power adapter to be able to switch to the Real-Time mode. If the system does not have the serial connector, underwater cable and AC power adapter, once the 66.xx firmware is loaded, there is no easy way to communicate with the system (see Using an Ethernet Connection). Once 66.xx firmware is installed, the touch sensor is disabled.

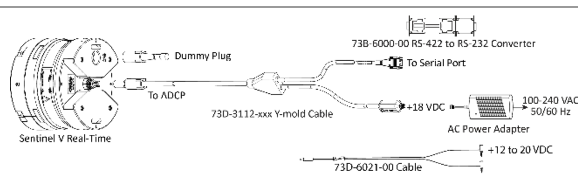
Establish a wireless connection and start *ReadyV*.

Click on the Step 4: System Check panel in *ReadyV*.



Select **Firmware Upgrade** and then select the Sentinel V Real-Time firmware binary (66.xx.*bin*) file. Version 66.xx firmware is loaded into the system and then the Sentinel V Real-Time system restarts.

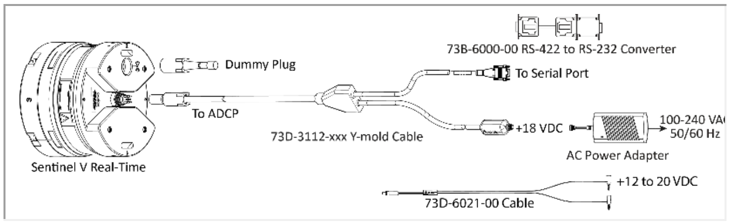
- Previously installed Real-Time features are automatically restored.
- The wireless connection between the PC/laptop and Sentinel V Real-Time is disconnected.



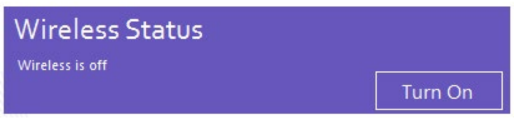
Now connect the Sentinel V Real-Time to a PC/laptop using the serial RS232 cable and *Sentinel V RT Utilities*.

Switching to the Sentinel V Self-Contained Mode

(Sentinel V is currently configured for RT mode):

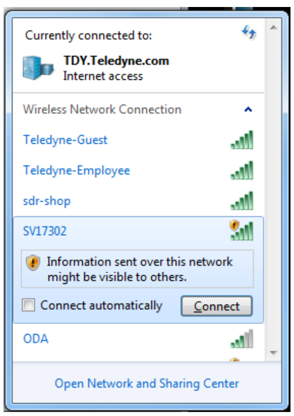


Start *Sentinel V RT Utilities* and establish a serial connection.



Click the Wireless Status **Turn On** button to activate the wireless connection.

Wait for the second short beep.



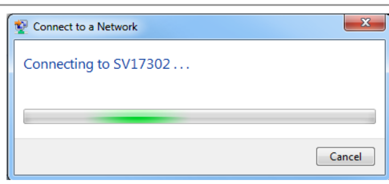
Connect to the ADCP's WLAN:

Click on the wireless icon (or) in the Windows® system tray or if using a wireless USB adapter, start the adapter's interface.

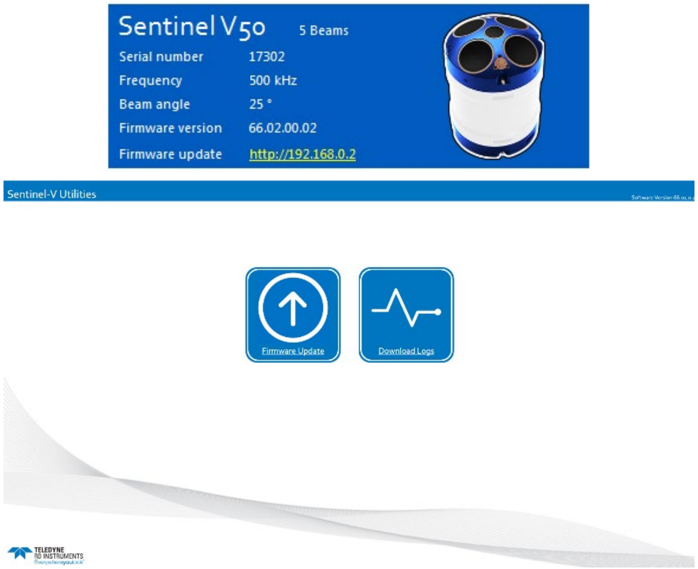
Click the **Refresh** icon () to search for connections. Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).

Select the ADCP on the list by clicking it and then click the **Connect** button.

Sentinel V ADCPs will display as *SVnnnnn* (where *nnnnn* is the five or six-character serial number shown on the product label).



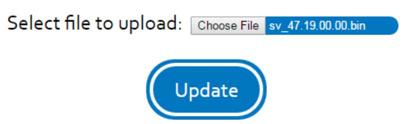
The Connecting to a Network message appears.



Click on the http://192.168.0.2 link. This will open the default browser on the laptop (*Internet Explorer*®, *FireFox*®, *Google Chrome*®, or other browser).

Select **Firmware Update** and then select the Sentinel V firmware binary (*47.xx.bin*).

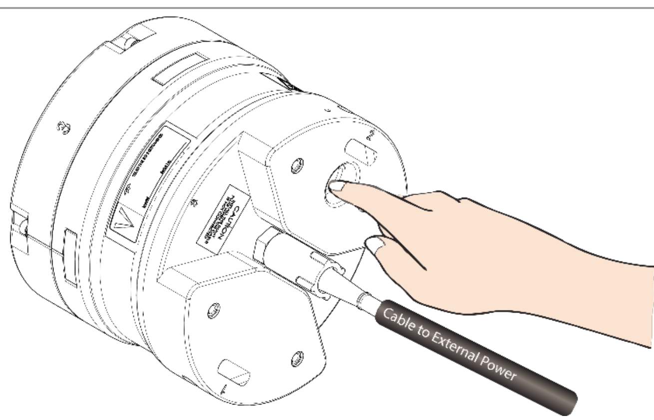
For more information, see Using the Sentinel-V Utilities Page.



Version 47.xx firmware is loaded into the system and then the system restarts:

- Previously installed Self-Contained features are automatically restored
- Previous profiling/sampling configurations are restored
- Wireless connection is now disconnected.

The screen may be blank for up to 5 minutes. Be patient and wait for the firmware update complete message.



Now connect to the Sentinel V using the touch sensor and *ReadyV*.

Chapter 2

USING READYV

In this chapter:

- ReadyV Interface features
- How to use the Home panel
- How to use the Measurement Setup panel
- How to use the System panel
- How to use the Maintenance panel
- How to use the Recorder panel

This chapter applies to Sentinel V Self-Contained ADCP's using 47.xx firmware.

If your ADCP is configured for Sentinel V Real-Time mode using 66.xx firmware, see Chapter 1A for instructions on how to plan your deployment.

ReadyV Interface Features

Onboard Software. The ReadyV software used to configure, deploy, and recover data is resident on the ADCP. All that's needed to communicate with the ADCP is a computer of opportunity and a web browser.

High-speed wireless data download. Wireless functionality allows quick data downloads and instrument re-configuration. This feature also allows for wireless setup and software/firmware updates.

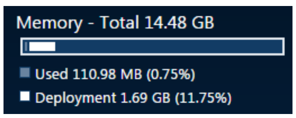
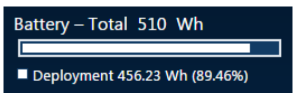
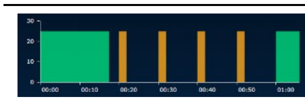
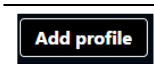
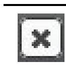
Intuitive Interface. ReadyV has a user-friendly interface for pre-deployment planning to configure the Sentinel V for deployment, running all pre-deployment tests, and starting the deployment properly configured for the task at hand.

Onboard Maintenance Log. When was the last time the compass was calibrated? The batteries changed? O-rings replaced? Now this information and more can be stored on the Sentinel V itself, for ready access whenever connected to the instrument.

Read the Self-Contained Sentinel V Deployment Guide for step-by-step instructions for deploying a SC system.

See the ReadyV Quick Start Card PDF file installed with the Documentation and Software.

ReadyV uses the following icons and buttons:

Icon	Description
	Click on the **Help** button to display a help screen.
	Click to download ReadyV. Once downloaded on the computer, unzip the file and double-click on *index.html* to run ReadyV in the offline mode.
	Once the deployment planning is complete, use the **Deploy** button to deploy the Sentinel V ADCP.
	If the ADCP is deployed, click the **Stop** button to stop the deployment.
	Displays the amount of recorder space.
	Displays the amount of battery power needed for the deployment.
	Displays an overview of the ensemble timing.
	Click the **Import** button to load a scenario (**.txt*) into ReadyV.
	Click the **Export** button to save the scenario (**.txt*) to the computer.
	Click the **Delete** button to delete a scenario (**.txt*).
	Click to add a profile.
	Click to delete a profile.
	Click to close a panel.
	Click the **Activate/Deactivate** button to add or remove features.

Using the Home Panel

Once the computer is connected to the ADCP, the Home panel opens and shows an overview of the Sentinel V ADCP configuration.

Each section on the Home panel acts as a link the respected panel (Set sampling strategy, Review system, Download data, System check, Review resources, and Deployment checklist). As the mouse is hovered over a section, it will change to a lighter blue and the mouse pointer will change to the hand icon ( ). Click to go to the panel.

You can adjust the screen and font size within the Internet Explorer® and Google Chrome® browsers. Use **Ctrl+** to increase zoom, **Ctrl-** to decrease the zoom level. If the mouse has a scroll wheel, use Ctrl+mouse wheel to adjust the zoom level. Use **Ctrl+0** (zero) to return to 100% zoom.

If the Zoom level on the browser is set higher than 100%, the right side of the ReadyV screen may be partially cut off (see Solving Partially Cut Off Screen Issues).

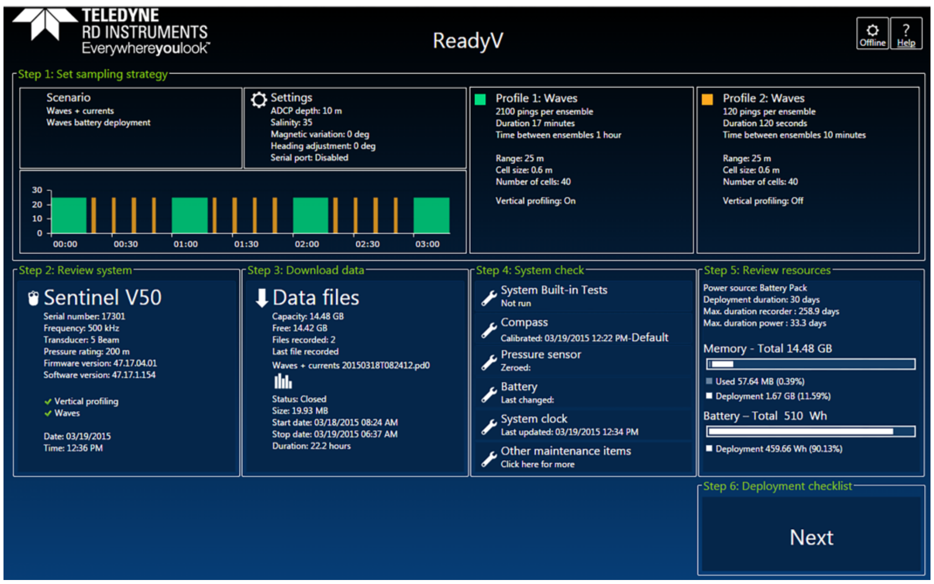
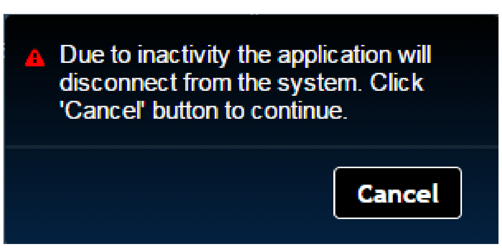
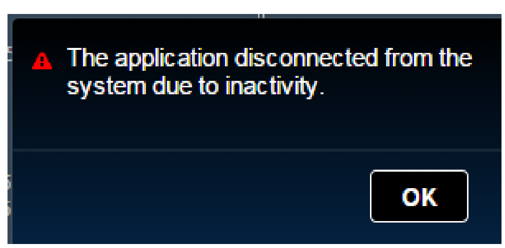


Figure 11. Home Panel

While ReadyV is open and no keys are pressed for five minutes, an inactivity warning is displayed, and after another five minutes of no keys being pressed the wireless connection is turned off on the ADCP.

To run ReadyV again and connect to the ADCP, then the internet browser page or the browser tab which was running ReadyV must first be closed. Then restart the connection.





Using the ReadyV Panels

The panels on ReadyV may be accessed in any order. The recommended path to create a new scenario is shown in Figure 10.

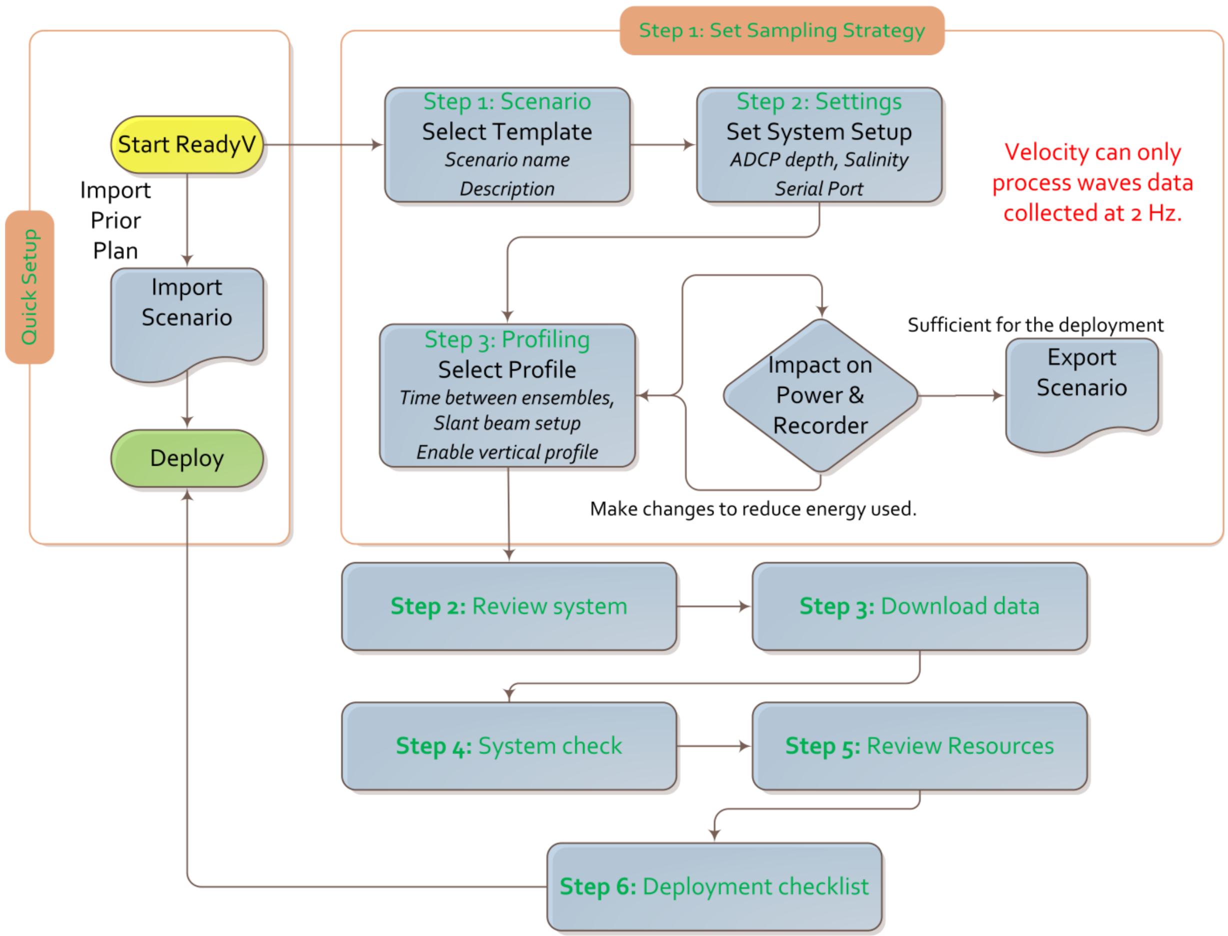


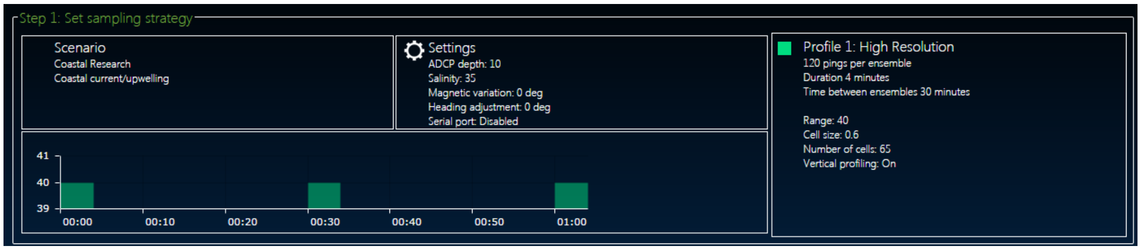
Figure 12. Creating a Scenario Flow Chart

Deployment scenario files are system specific – V20, V50, and V100 files can only be used on the same frequency system.

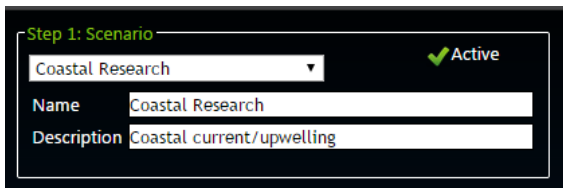
Creating and Saving Scenarios

To create a scenario:

1. Click anywhere on the Step 1 Set sampling strategy section on the **Home** panel.



2. Select a template using the drop-down list. The green checkmark icon indicates the currently selected scenario. Enter a name for the deployment and enter a description.



Selecting one of the templates will overwrite the settings. For example, selecting the Coastal Mooring Template and clicking Save will save the scenario as Coastal Mooring with the default settings from the template.

Changes are saved to the scenario whenever the Save button is selected.

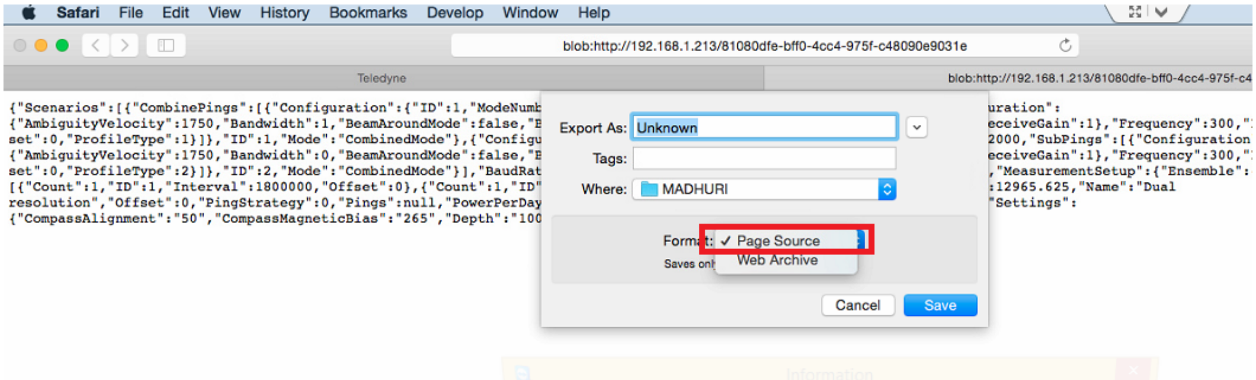
Always use the Step1 Scenario panel to change the name of the scenario and add a description for future use.

3. Use the Step 1 Set sampling strategy panels to adjust the scenario settings:

- Enter a name and description on the Step 1: Scenario panel.
- Click on the Step2 Settings panel to change how the system will be set up during the deployment.
- Click on the Step 3 Profiling panel to change how the water profile and timing will be set up during the deployment.
- Use the resources overview to verify power and data recorder requirements for the deployment.

4. Click the **Export** button on the Step 1 Set sampling strategy panel to save the selected scenario (**.txt*) to the computer. On the **Save As** dialog, name the deployment scenario file (**.txt*). Click the **Save** button.

When saving a file in *Safari*®, the default file format is Web Archive. If you save the file with this format type and try to import it, it will fail. Change the format type to Page Source to save and import files correctly in *Safari*.



Although not recommended, **.txt* files can be viewed with any ASCII/plain text editor such as NotePad®.

Editing the *.txt file using a text editor will allow items that if set incorrectly can cause the data to be bad and uncorrectable even in post processing.

Do not edit **.txt* files in Microsoft Word®.

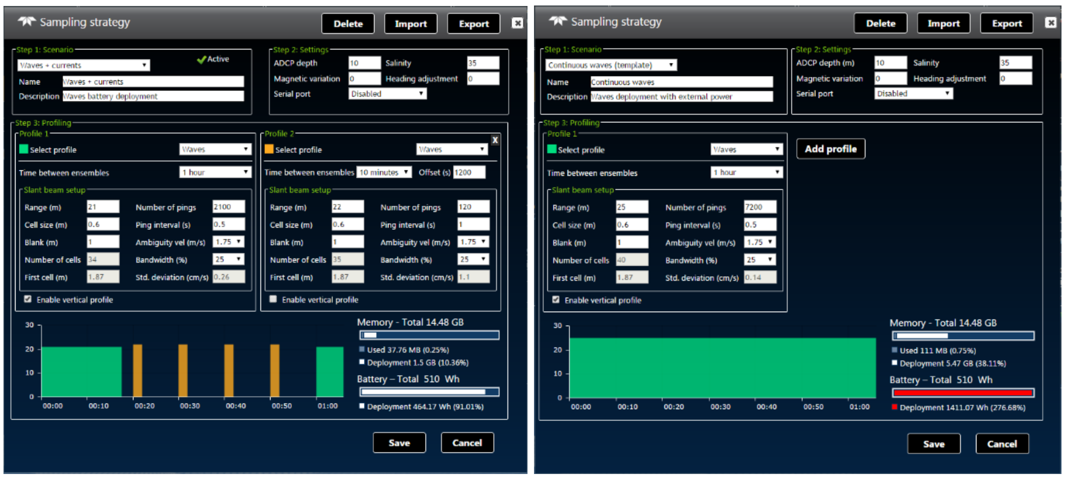
5. Click the **Save** button to save the scenario to the ADCP and return to the **Home** panel. If a measurement file with the same name already exists, it will be overwritten.

Collecting Waves Data

Ensure that the Waves firmware feature is enabled. ReadyV will allow setting a waves scenario, but if the feature is not enabled the data can not be processed.

To create a Waves scenario:

1. Click anywhere on the Step 1 Set sampling strategy section on the **Home** panel (see Figure 9) to use a measurement template. Select the **Waves + Currents** or **Continuous Waves** template using the drop-down list.
2. Click the **Save** button to save the measurement scenario or **Cancel** to return to the previous settings. If a measurement file with the same name already exists, it will be overwritten.



3. Use the Step 1 Set sampling strategy panels to adjust the scenario settings:

- Click on the Step2 Settings panel to change how the system will be set up during the deployment.
- Click on the Step 3 Profiling panel to change how the water profile and timing will be set up during the deployment. TRDI recommends using the Waves Profile setup.
- Use the resources overview to verify power and data recorder requirements for the deployment.

4. Verify the Ping interval is 0.5 seconds. Velocity can only process waves data collected at 2 Hz. The Ping interval must be set to 0.5 s for Water Profile 1.

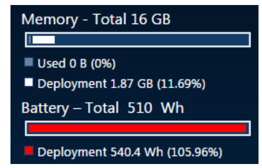
Velocity can only process waves data collected at 2 Hz.

5. Click the **Export** button on the **Home** panel to save the selected scenario (*.txt*) to the computer. On the **Save As** dialog, name the deployment scenario file (*.txt*). Click the **Save** button.
6. Click the **Save** button to save the scenario to the ADCP and return to the **Home** panel.

Example Waves Setups

The Waves + Currents template samples Profile 1 at 2 Hz for the purposes of waves analysis and Profile 2 at 1 Hz for measurement of currents during times when the waves burst is not being sampled.

The **Continuous Waves** template samples at 2 Hz.



If the deployment duration requires >30 days with a V100 system:

- Add an external battery case or Lithium battery

  Or

- Reduce the number of wave pings/burst from 2100 to 1024 while keeping the ping rate at 2 Hz (0.5 seconds/ping).

Reducing the burst duration should not be performed on any western ocean boundaries where you have low frequency ground swell (i.e. Alaska to Chile on the pacific, or UK to Africa in the Atlantic). If you are on the eastern boundary of the ocean, a 1024 ping burst is acceptable.

To profile to a range less than 49.6 meters:

- Change the bin size to <1.2 meters.

To profile to a range of >99 meters, you must:

- Clear the ping collision error by setting the ping rate of the waves burst (Profile 2 only!) to 1.25 seconds
- With 1.25 seconds, the power consumption is much larger, suggestions are to:
  - Add an external battery case or Lithium battery
  - Further reduce the number of pings per wave burst to <1024 to allow 30 days

Version 1.5 of *Velocity* will “zero fill” the burst to deal with non-powers of 2 FFT lengths.

If you make changes to any of the Profile settings, the name of the profile will change to Custom.

Opening a Saved Scenario

To open a saved Scenario:

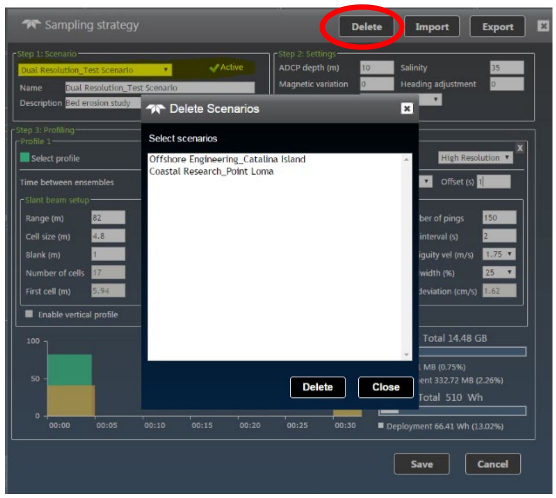
1. Click anywhere on the Step 1 Set sampling strategy section on the **Home** panel.
2. To open a scenario, click the **Import** button. On the Open dialog, select the deployment scenario file (*.txt*). Click the **Open** button.

3. Use the Step 1 Set sampling strategy panels to adjust the scenario settings if needed.
4. If changes are made, click the **Export** button to save the selected scenario (*.txt*) to the computer. On the **Save As** dialog, name the deployment scenario file (*.txt*). Click the **Save** button.

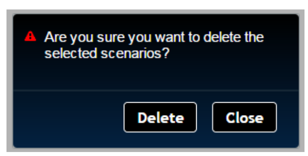
Deleting a Saved Scenario

To delete a saved scenario from the list:

1. Click anywhere on the Step 1 Set sampling strategy section on the **Home** panel.
2. Click the **Delete** button to open the Delete Scenarios panel. Note that the active scenario will not appear on the list of scenarios to delete.



3. Select the scenario to be deleted and click **Delete**.
4. Click the **Delete** button on the message box to delete the saved scenario from the list.



The active scenario and factory included scenario templates cannot be deleted.

To delete the active scenario, first select another template/scenario, click the Save button, and then repeat the process to delete the scenario.

Once the Delete button is clicked, the scenario file is deleted and cannot be recovered.

5. Click the **Close** button to exit the Delete scenario panel.

Using the Set Sampling Strategy Panels

Click anywhere on the Step 1 Set sampling strategy section on the **Home** panel to open the **Sampling strategy** panel.

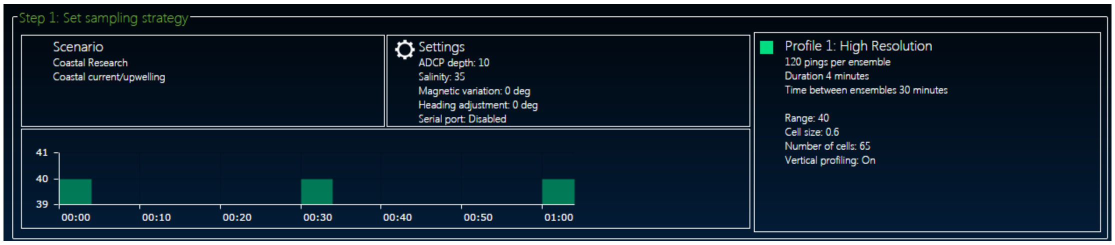
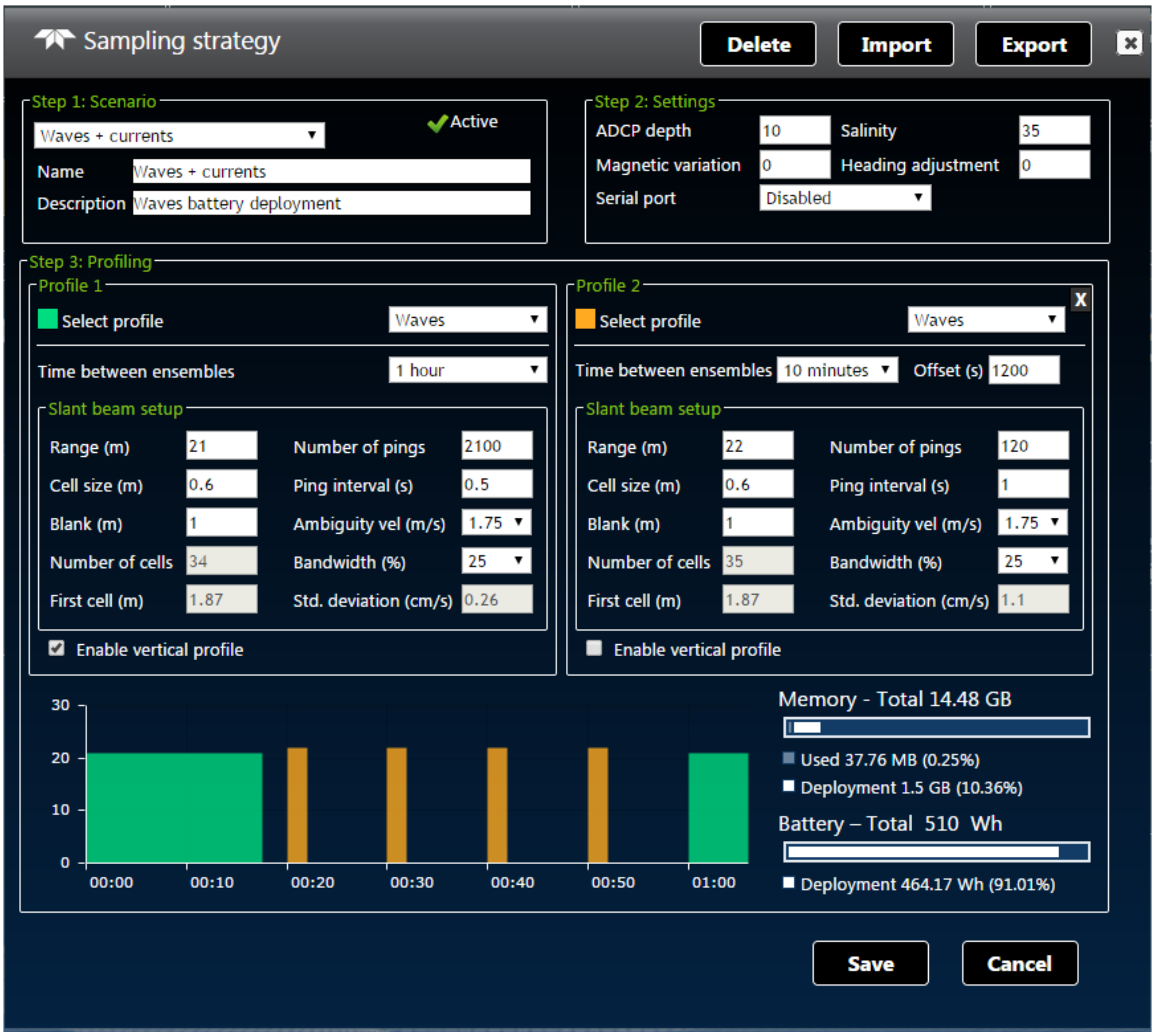
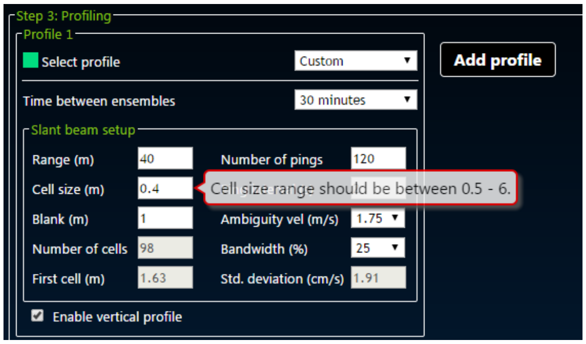


Figure 13. Set Sampling Strategy Panels

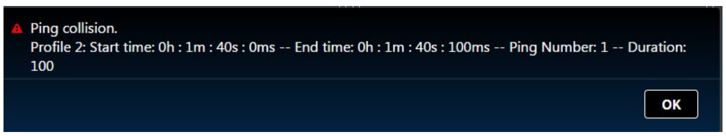


Error Messages

While entering parameters, if a value is entered outside the normal range, an error message appears. For example, entering 0.4 meters for the cell size displays an error because the cell size is too small. The error must be corrected before the setting can be saved.

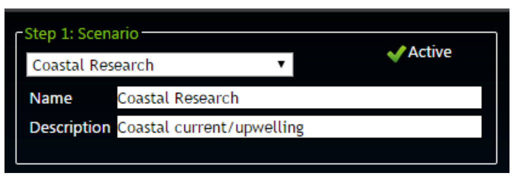


Scenarios with two water pings may have a ping collision error. To clear a ping collision, change the time between pings to the recommended value and then change the time between profile groups so that there is enough time for profile type 1 to finish before profile group 2 starts.



Step 1: Scenario

Use the Scenario setting panel to name the scenario and enter a description. Click **Save** on the Step 1 Set sampling strategy panel to save the settings or **Cancel** to return to the previous settings.



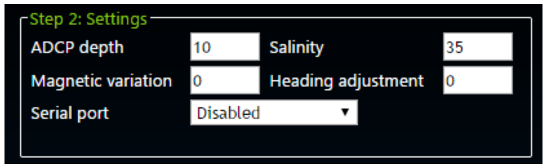
When a scenario is first created, it will use a default name. For example, selecting the Coastal Research (Template) and clicking Save will save the scenario as Coastal Research (see Creating and Saving Scenarios). Make sure to change the name of the scenario and add a description for future use.

Name – Enter the name of the deployment scenario.

Description – Enter a description of the deployment scenario.

Step 2: Settings

Use the Step 2: Settings panel to change how the system will be set up during the deployment. Click **Save** on the Step 1 Set sampling strategy panel to save the settings or **Cancel** to return to the previous settings.



ADCP depth – Enter the depth of the ADCP. The ADCP uses depth in its speed of sound calculations. If the pressure sensor is not available, then the ADCP will use this manual depth setting.

Salinity – Enter the salinity of the water. Fresh water is 0 and salt water is typically 35. Salinity is used to calculate the speed of sound. The speed of sound is used by the ADCP to scale the velocity data properly. If 0 is entered when deployed in 35 salinity water, the data will have a 3% velocity estimate error.

Magnetic variation – Enter the angle between true north and magnetic north. By convention, declination is positive when magnetic north is east of true north and negative when it is to the west. This angle varies depending on position on the Earth's surface, and changes over time. The compass default is to output magnetic heading.

For the greatest accuracy, TRDI recommends checking the National Geophysical Data Center website (below) to find the declination angle based on the latitude and longitude: http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp

Heading adjustment – Corrects for a physical misalignment between the ADCP's Beam 3 and the heading reference. Enter the heading alignment angle (referenced to Beam 3) used as a new zero reference for heading output.

Serial Port – If the ADCP includes the real-time serial output data feature, select the **Serial port** Baud rate from the drop-down list. See Using Real-Time Serial Data Output for details on cable connections.

Using a low baud rate will impact the Ping interval. The time between pings needs to be sufficient to allow time for the data to be output through the serial port before the next ping. If you see an error message, increase either the Baud rate or the Ping interval.

Using Real-Time Serial Data Output

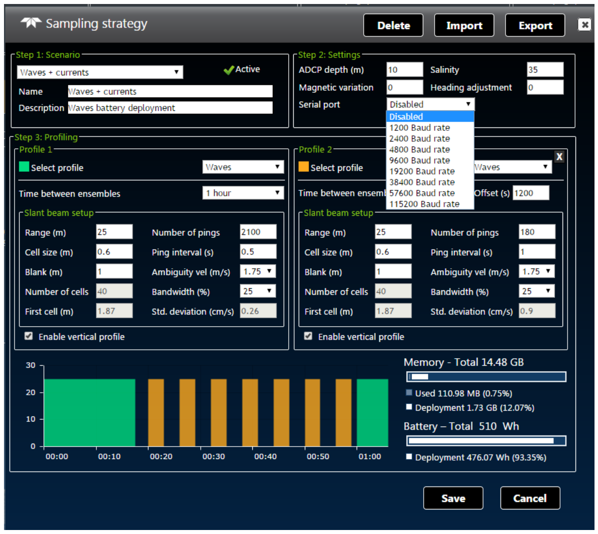
There is no command and control on the serial port on firmware version: 47.xx. The only command and control is through the deployment Web software application ReadyV. For command and control through the serial port, see Switching RT and SC Modes and Connecting to the Sentinel V Real-Time.

The V Series Self-Contained ADCP can include an optional real-time serial data output. This feature must be configured when the system is ordered. The output format is PDO and will be single ping ensembles of beam coordinate profiles with no screening. Use *Sentinel V RT Utilities* or your own software to capture the data to a file as it is output by the Sentinel V. Use the *Velocity* software to properly screen, transform, and average the data just like data collected on the recorder.

To use the real-time serial data output:

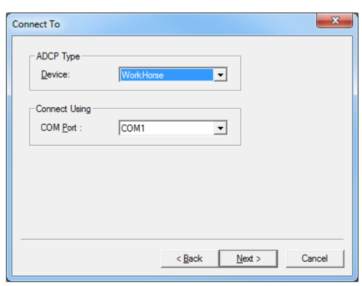
1. Review the Serial Port Application Notes and set the computer's power options to the recommended **High Performance** settings.

2. Remove the dummy plug and connect the Y-mold cable to the Sentinel V.
3. Connect the I/O cable Serial connector to your computer. See Figure 32 page 81 for wiring.
4. Connect the AC Power Adapter output cable to the Y-mold cable.
5. Connect the AC Power Adapter line cord to a 110 to 240VAC, 50 to 60Hz power input.
6. When power is applied, you should hear a long beep, a 10 to 15 second delay, and then a short beep. If you do not hear the beeps, check the cable connection and power before continuing.
7. Connect wireless to *ReadyV* (see Using the Wireless Connection).
8. On the *ReadyV* Sampling strategy panel, adjust the baud rate and timing as needed (see Serial Port Baud Rate).

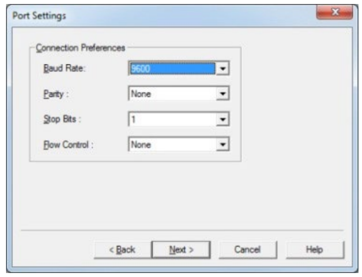


Using a low baud rate will impact the Ping interval. The time between pings needs to be sufficient to allow time for the data to be output through the serial port before the next ping. If you see an error message, increase either the Baud rate or the Ping interval.

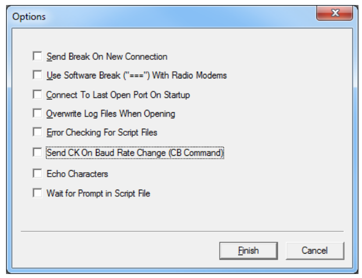
9. Install *Sentinel V RT Utilities* if needed.
10. Start *Sentinel V RT Utilities*. On the **Connect To** screen, select **WorkHorse**. Select the **COM Port** that the Sentinel V ADCP serial cable is connected to. Click **Next**.



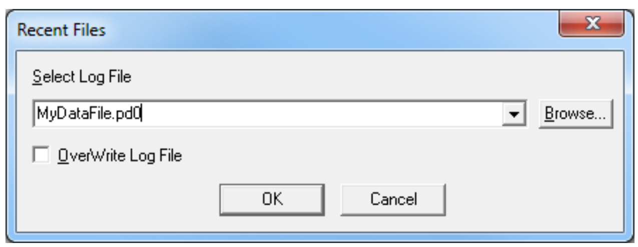
11. Enter the **Baud Rate** to match what is set in the *ReadyV* Timing panel, **Parity** to None, **Stop Bits** to 1, and **Flow Control** to None. Click **Next**.



12. Uncheck all boxes. Click **Finish**.



13. Press **F3** and create a log file. Name the file and use **.pd0* (pd zero, not the letter o) for the file extension.



14. Use *ReadyV* and deploy the ADCP.
15. Process the data file with the *Velocity* software.

Serial Port Application Notes

Serial Port Command and Control – There is no command and control on the serial port on Firmware Version: 47.xx. The only command and control is through the deployment Web software application ReadyV. For command and control through the serial port, see Connecting to the Sentinel V Real-Time.

Serial Port Data Output Format – The data being output is PD0. The data in this file will be single ping ensembles of beam coordinate profiles with no screening (i.e. no screening for fish rejection, correlation, error velocity). To create screened earth coordinate average ensembles, TRDI recommends that you play back the data through the TRDI *Velocity* software program.

Computer Power Options – Set the computer's power options to **High Performance** to reduce lost pings and lost communication issues when the computer sleeps. Use the **Control Panel**, **Hardware and sound**, **Power Options** screen. Click the drop-down list to view the hidden additional plans and select the **High Performance** setting (see Figure 12).

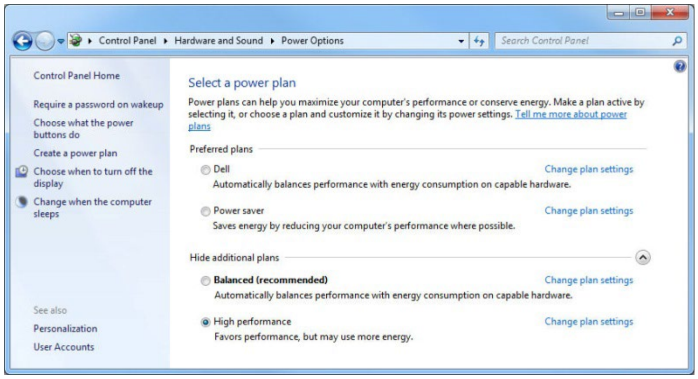


Figure 14. Recommended Computer Power Options Setting for Real-Time Serial Data Output

Serial Output Baud Rate – Using higher baud rates will allow for faster pinging. However, higher baud rates are more susceptible to noise and results in poor communications. Therefore, it is highly recommended when using cables 25m and longer that you use RS422 communications (instead of RS232 communications) or use a baud rate of 9600 or lower.

> It may not be possible to use RS232 communications with long cables (>50m) and therefore you should test your communications setup with the actual cable you intend to use before you deploy.
>
> The serial port type, RS232 or RS422, is determined at the time of purchase. If you are not sure which type of serial port you have or if you wish to change from RS232 to RS422 then please contact our Field Service department at rdifs@teledyne.com.

Serial Output Timing – Enabling the serial output will add time to the completion of an ensemble. Depending on the time between pings (ensembles) it may not be possible for the ADCP to output the serial data string before it is supposed to start the next ping. If this condition occurs, then the ADCP will skip the ping that was to occur and will start the next ping at the interval timing that you have requested.

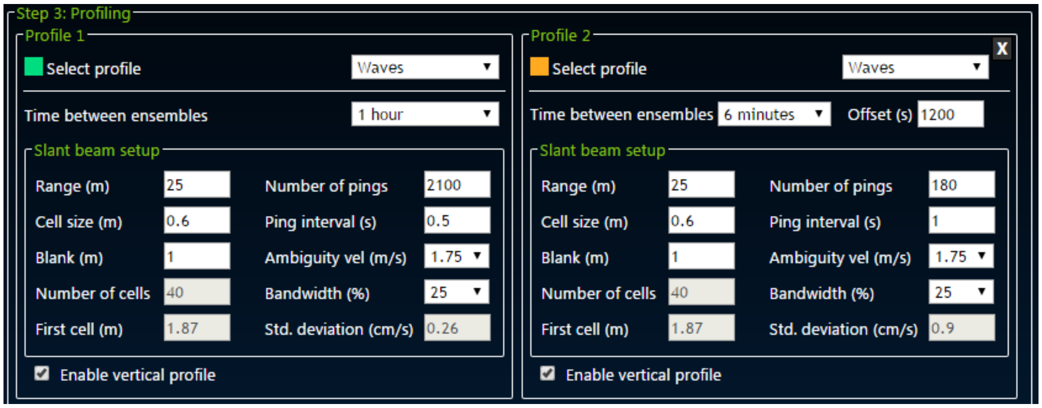
> If you setup the ADCP to have a ping rate of 2hz and greater with a number of depth cells (bins) greater than 50 then it is possible that the ADCP will not be able to respond to the touch sensor. This occurs because the ADCP is not able to sense that the touch sensor interrupt has been enabled. In order to recover from this condition it will be required for you to remove the power from the instrument completely for a period of 60 seconds. Once you connect the power you will need to "press" the touch sensor within 15-30 seconds so that the touch sensor will be latched and the ADCP will allow you to establish communications through the ReadyV deployment software and stop the deployment.

Power Consumption – Enabling the serial output will increase the ADCP's power consumption. This additional power is included in the planning software ReadyV. It is not possible to exactly determine the effect of certain setups and therefore TRDI recommends that you include a 10% safety for deployments that have ping rates of less than 1 second.

Data Recorder and Serial Communications – The Sentinel V will always have the recorder card enabled whether you have serial communications enabled or disabled. If the recorder card fills up during your serial port operations, the Sentinel V will continue to operate and send out serial data. If you stop the deployment (through ReadyV) and the recorder card is full, you will not be able start data collection without first deleting the data file (you can elect to download the data first or not).

Step 3: Profiling

Use the Step 3: Profiling panel to change how the water profile will be set up during the deployment. The Sentinel V ADCP can have two different water profiles. Each water profile can be set independently. If there is one water profile, the **Add profile** button appears. If there are two water profiles, click the white X (X) to delete the second water profile. Click **Save** on the Step 1 Set sampling strategy panel to save the settings or **Cancel** to return to the previous settings.



Select profile – Use the drop-down list to select a water profile from the list. Each water profile can use a default setup or select a predefined profile. If you make changes to any of the settings, the name of the profile will change to **Custom**.

If the data file is collected with two water profiles, Profile 1 and Profile 2 are considered compatible for merging when post-processing the data file with the *Velocity* software if the following are all true:

- Number of cells matches
- Cell size matches
- Blank matches
- Both either have vertical beam OR both do not have vertical beam selected
- Bandwidth must be the same for both profiles

The **Standard deviation** shows the expected standard deviation of the velocity data stored in each ensemble being collected by the Sentinel V ADCP. Most users will want to minimize this value so that they obtain the best data possible (i.e. data containing the least amount of noise). Standard deviation is dependent on cell size, the Number of pings, Ambiguity velocity, and the Bandwidth

Time between ensembles – Select a time between ensembles from the drop down list. Time is based on the start of one ensemble to the start of the next ensemble. When two water profiles are used, set the **Offset between Profile groups** time to avoid ping collisions.

Time between ensembles applies to both water profiles.

Range – Select the range to measure. The default value shown in Table 3 is based on typical range possible based on the system frequency. The actual maximum range is dependent on the absorption in the water based on the Sentinel V ADCP frequency, the water salinity, water temperature and the actual deployment depth of the ADCP.

Cell size – Sets the cell size. Adjust the cell size as necessary as recommended in Table 3. A larger cell size decreases the standard deviation, but shallow water situations may need to use smaller cells to gather more data points.

> It is not recommended to set the cell size below the minimum or above the maximum range shown in Table 3.

Blank – Moves the location of the first cell away from the Sentinel V ADCP transducer head to allow the transmit circuits time to recover before the receive cycle begins. The default value is based on system frequency and it is highly recommended to use this value. Setting a value below the default blank distance may show ringing/recovery problems in the first depth cells.

> It is not recommended to set the blank below the default value shown in Table 3.

Table 3. Blank Distance, Range, and Cell Size

System	Blank Distance (Default)	Range (Default)	Cell Size (Default (Min – Max))
Sentinel V 100m (307.2kHz)	1.6m	**100m**	**4m** (1m - 6m)
Sentinel V 50m (491.52kHz)	1.0m	**50m**	**2m** (0.6m - 4.8m)
Sentinel V 20m (983.04kHz)	0.4m	**20m**	**1m** (0.3m - 2.4)

Number of cells – Sets the number of depth cells. The value will be calculated based on the **Range** and **Cell size**.

First Cell – The range from the transducer face to the middle of the first cell. The **Cell size** and the **Blank** primarily affect where it is located.

Number of pings – Adjust the number of pings to gather the desired Standard Deviation. To increase the expected accuracy of the velocity measurement (reduce the Standard Deviation), increase either the number of pings, cell size, or both.

Ping interval – Sets the time per ping.

Ambiguity velocity – Ambiguity velocity represents the maximum relative velocity (Sentinel V ADCP motion plus the maximum actual water velocity) the ADCP can measure along a beam. Select one of the settings from the drop-down list. This must be set correctly to avoid ambiguity errors. Ambiguity velocity is used to improve the standard deviation: The lower the value of the ambiguity velocity, the lower the single-ping standard deviation.

Bandwidth – Sets the profiling bandwidth and sampling rate. Smaller bandwidths allow the ADCP to profile farther, but the standard deviation is increased by as much as 2.5 times.

Bandwidth	Sample rate	Standard deviation	Profiling range
High (25%)	High	Low	Low
Low (6.25%)	Low	High	High

Standard deviation – This shows the expected standard deviation of the velocity data stored in each ensemble being collected by the Sentinel V ADCP. Most users will want to minimize this value so that they obtain the best data possible (i.e. data containing the least amount of noise). Standard deviation is dependent on cell size, the Number of pings, Ambiguity velocity, and the Bandwidth.

Enable vertical profile – Check this box to enable the vertical beam profile.

The Vertical Beam Feature is optional. Contact your local sales representative if you are interested in upgrading your system.

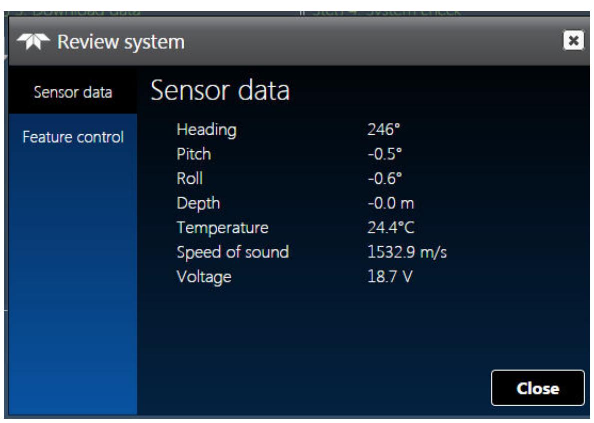
See Activating Features for instructions on how to activate/deactivate features.

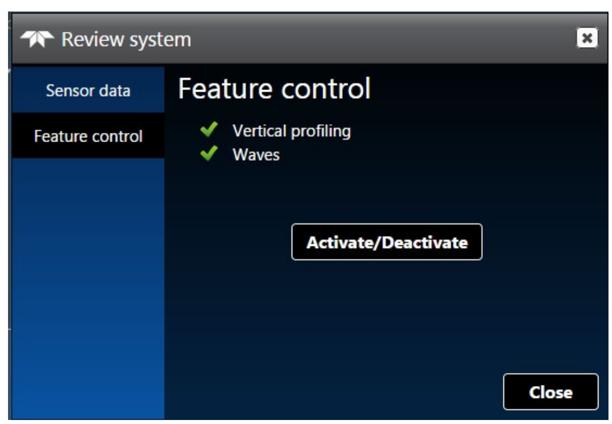
Using the Review System Panel

The System panel shows an overview of the Sentinel V ADCP configuration. Click on the Step 2: Review system panel to open the **Review system** panel as shown below.

- Use the **Sensor data** panel to display the sensor values (see Testing the Sentinel V Self-Contained Sensors).
- Use the **Feature control** panel **Activate/Deactivate** button to activate or deactivate features.

Figure 15. Review System Panel





Activated features will have a green ✓ under Feature control. Deactivated features will have a red X.

See Activating Features for instructions on how to activate/deactivate features.

Activating and Deactivating Features

Use the **Activate/Deactivate** button to add or remove features on the Sentinel V.

Features can only be activated or deactivated when connected to the ADCP and require a license file (**.lic*) that is tied to the ADCP's serial number.

Contact your local sales representative if you are interested in upgrading your system.

Features ordered with the system will be activated by TRDI.

Save the **.lic* file in a folder that has full read/write permissions. For example, if you save the file to the AppData folder, you may get a file load error.

Feature upgrades must be installed in each mode to be available for dual-application use. See Installing Feature Upgrades for RT mode. If you purchased the feature for one mode, contact TRDI field service to receive the feature for the other mode.

To activate or deactivate a feature:

1. Save the *SVnnnnn.lic* file (when *nnnnn* is the ADCP serial number) on your computer.
2. Start *ReadyV*.
3. Click on the Step 2: Review system panel to open the **Review system** panel. Click on **Feature control** and then click the **Activate/Deactivate** button.
4. Select the feature(s) to be activated or deactivated.
5. Click the **Save** button.
6. On the **Open** dialog, locate the **.lic* file.
7. Click the **Open** button. The feature is now activated. Repeating this process will deactivate the feature.

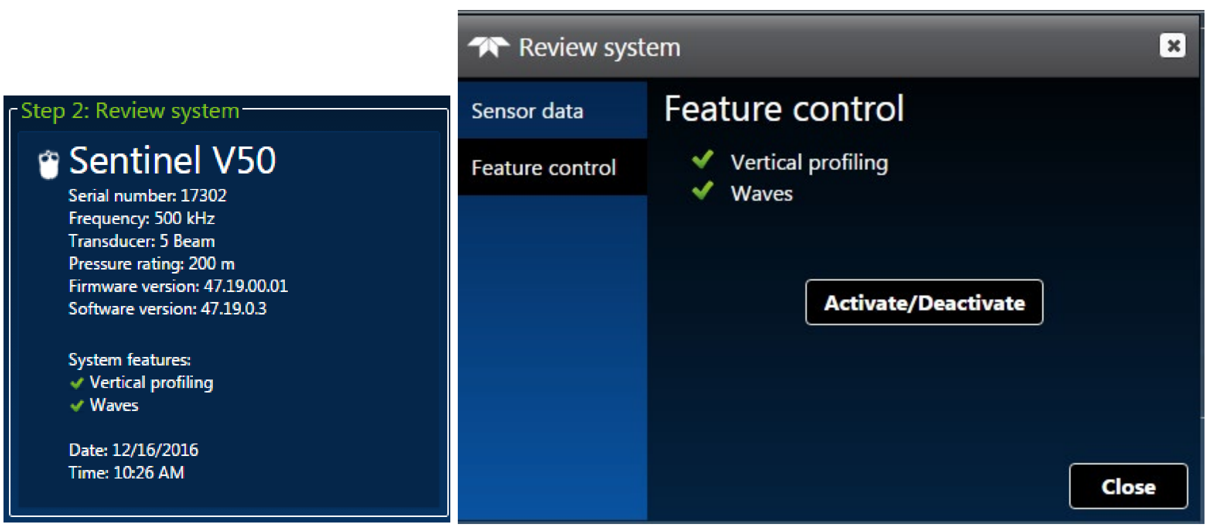


Figure 16. Activating and Deactivating Features

Using the Download Data Panel

Use the Download Data panel to check the status of data files, recover data, and erase the recorder. To select a data file, click on it. Click on the Step 3: Download data panel to open the **Recorder** panel as shown below.

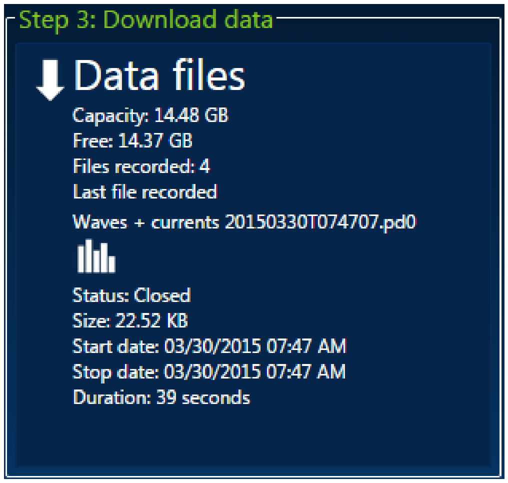
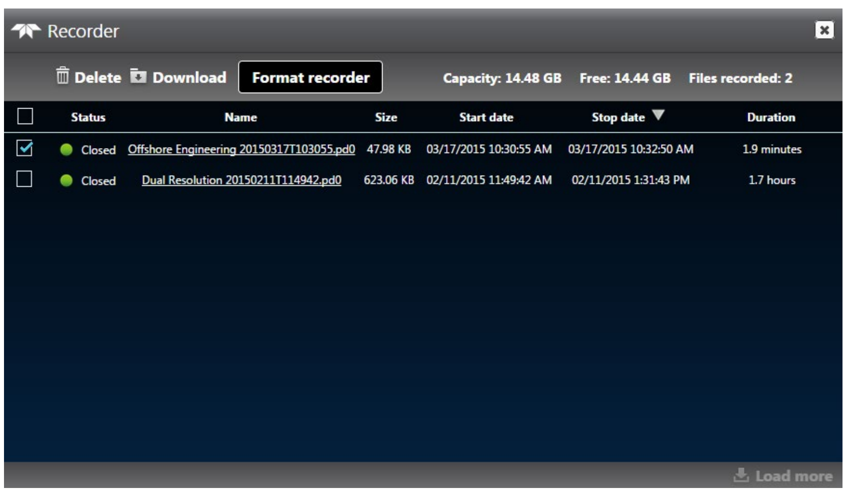


Figure 17. Download Data Panel



If there are 50 or more data files on the recorder, it is best to download and then delete the files before deploying the ADCP.

Status – Closed or Recording. To close a file, click **Stop** (see Starting or Stopping Deployments).

If a data file status is recording, the Delete and Download buttons do not appear.

Name – Shows the file name.

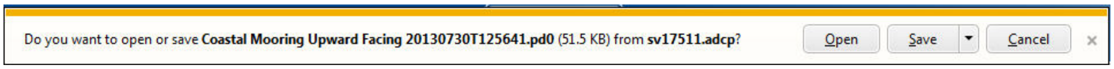
Size – Shows the file size.

Start Date – Shows the date and time the data file was created.

Stop Date – Shows the date and time the data file was closed.

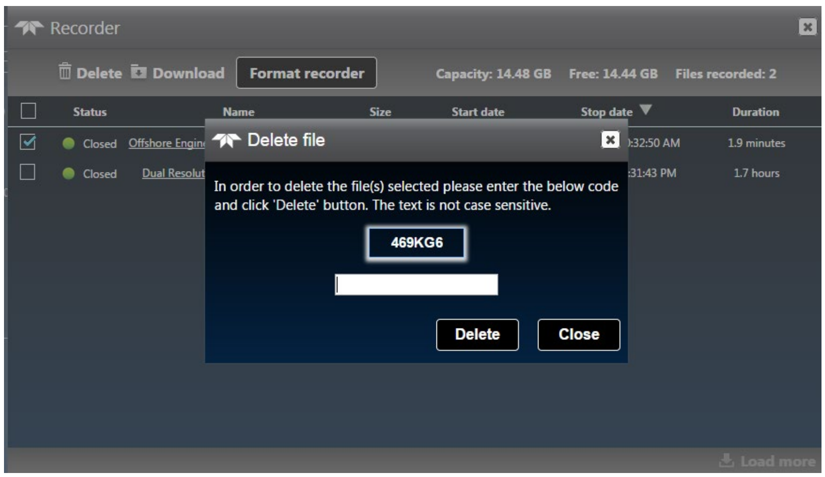
Duration – Shows the duration of the data file.

Download – Click on a data file to select it. Click the **Download** button to save the data file to a folder on the computer. For Windows 7®, click on the ▾ triangle next to the **Save** button to select the folder where the data will be written.

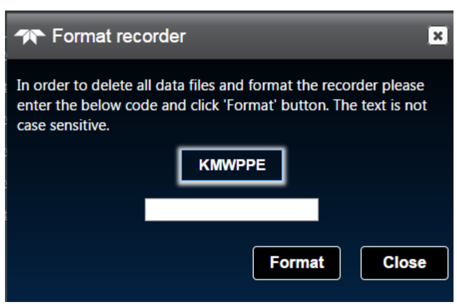


If the Save File dialog box does not appear, make sure you are using a supported browser (see Table 1, page 7).

Delete – Click on a data file to select it. Click the **Delete** button to delete the selected data file. Enter the code and then click the **Delete** button at the prompt. *Once erased, the data is not recoverable.*



Format recorder – Click the **Format recorder** button to delete all data files. Enter the code and then click the **Format** button at the prompt. *Once erased, the data is not recoverable.*

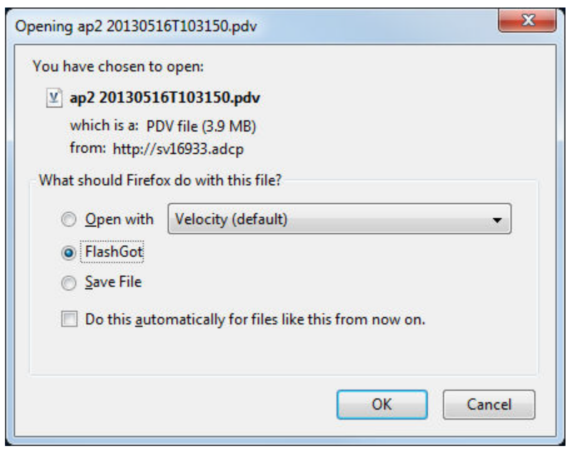


Using Download Managers

Based on the deployment setup parameters such as ping interval, number of bins, etc., and the duration of the deployment, the size of the data file to be downloaded from the Sentinel V ADCP can be in the order of gigabytes. While downloading a large data file from the Sentinel V, the user may close the browser by mistake or the ADCP may disconnect. To recover the data file download from such situations, TRDI recommends using a FireFox® download manager add-on called *FlashGot*®. This add-on will help resume downloads from the last point where the partial download left off. Using *FlashGot*, users may also configure the maximum download speed using any internal and most external download managers.

> Although ReadyV file downloads will work on most external download managers and most browsers (see Computer Considerations for supported platforms), TRDI recommends using Firefox version 47.0.0 (http://www.mozilla.org/en-US/firefox/new/) and the *FlashGot*® plugin (https://addons.mozilla.org/en-US/firefox/addon/flashgot/developers).
>
> Note that the latest version of Firefox does not support *Flashgot*®.

Once *FlashGot*® is installed, when a data file is downloaded the following popup is observed:



Select the **FlashGot** option and click **OK** to download the file.

> It may be noted that even though there are *FlashGot* extensions and plugins for other browsers such as Google Chrome® etc., TRDI has not tested the efficacy of the *FlashGot* plugin in other browser environments.

> Ethernet data download is the fastest. If time is critical for downloading the data and the system does not have an external ethernet cable, see Using Board-Level Ethernet Connection.

Using the System Check Panel

The System checks panel keeps track of when maintenance items were performed on the ADCP and saves log files. Click on the Step 4: System check panel to open the **System check** panel as shown below.

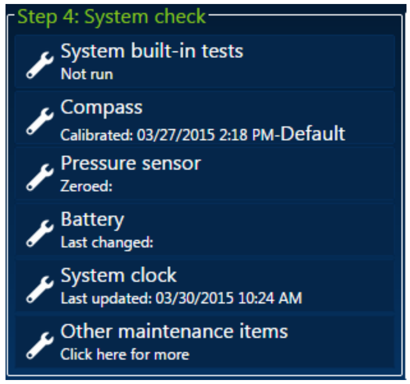
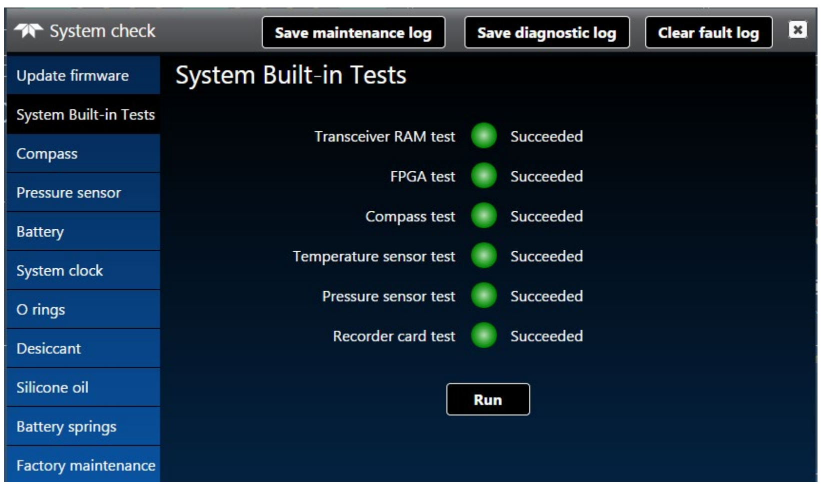


Figure 18. System Check Panel



Click a panel to select a maintenance item:

- **Update Firmware** – this starts the firmware update procedure.
- **System Built-in Tests** – Use this to run the built-in tests on the Sentinel V ADCP. The built-in tests can help isolate problems to a major functional area of the Sentinel V ADCP.
- **Compass** – this starts the compass calibration procedure.
- **Pressure Sensor** – click this to zero the pressure sensor. Zero the pressure sensor before every deployment.
- **Battery** – click this button to set the date that the battery was replaced. Replace the battery before every deployment.
- **System clock** – Click this button to set the Sentinel V ADCP's clock.
- **O-Ring** – click this button to set the date that the O-Ring was replaced. The O-ring(s) should be replaced whenever the system is opened.
- **Desiccant** – click this button to set the date that the desiccant was replaced. The desiccant should be replaced whenever the system is opened.

- **Silicone Oil** – click this button to set the date that the silicone oil was replaced. The oil should be checked whenever the system is ready for a deployment.
- **Battery Springs** – click this button to set the date that the battery springs were replaced. The springs should be checked whenever the individual D cell batteries are replaced.
- **Factory Maintenance** – this button shows a report of the factory maintenance performed. It will be updated once serviced by TRDI. Based on experience, TRDI knows that ***most*** ADCPs need to have the urethane inspected after two to three years of field use. Many users are not familiar with the early signs of urethane failure. The primary damage to the urethane is from bio-fouling and long exposure to the water and sun. Damage occurs on the surface of the urethane and at the edge where the urethane bonds to the cups. By returning the system every two to three years, TRDI can inspect it for early signs of urethane failure and repair it through our Factory Maintenance Service. At the same time, TRDI will make any necessary upgrades to boards, assemblies, and firmware. This routine service period, proper care, and general maintenance ensures optimal Sentinel V ADCP performance.

Installing Firmware Upgrades

To install a firmware upgrade:

1. Download the firmware from TRDI's website customer care page: https://tm-portal.force.com/TMsoftwareportal/s/. Save the file to the computer and unzip the file. The file will be *sv_47xx.xx.xx.xx.bin* format where *xxxx* = firmware version.
2. Connect to the Sentinel V ADCP.
3. On the System checks panel, select **Update firmware**.

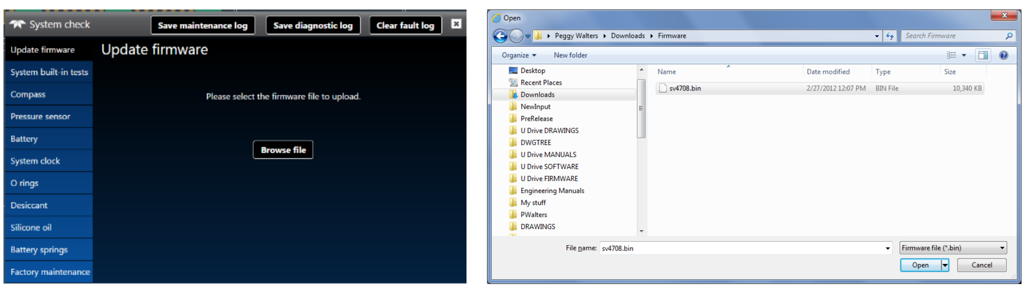


Figure 19. Updating the Firmware

4. Click the **Browse file** button and locate the firmware file *sv_47xx.xx.xx.xx.bin* file downloaded in step 1. Select the file and click **Open**.
5. The firmware will install.
6. Once the firmware update is complete, the ADCP will reboot. Close the browser and reconnect the wireless connection to connect to the ADCP.
7. If the new firmware does not install, contact Customer Service.

ReadyV Log Files

ReadyV creates several log files. Click the corresponding button to save a copy of the log file. The maintenance log files can be opened with any text editor.

Log file name	Description
Save maintenance log	Use the **Save maintenance log** button to create a text file (*.txt) with the date and time maintenance items were completed.
Save diagnostic log	The **Save diagnostic log** is intended for the TRDI engineers to debug issues that may be happening on the instrument. The log file will be saved in a **.tar* format and can be e-mailed to TRDI engineers to aid in troubleshooting the instrument.
Clear fault log	Use the **Clear fault log** button to clear the fault log of all previous entries.

Using the Review Resources Panel

The Resources panel displays the power and data recorder requirements for the deployment. Click on the Step 5: Review resources panel to open the **Review resources** panel as shown below.

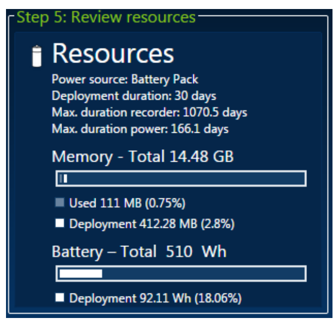
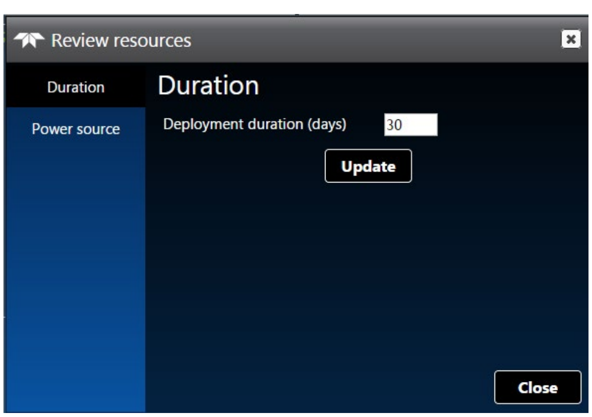
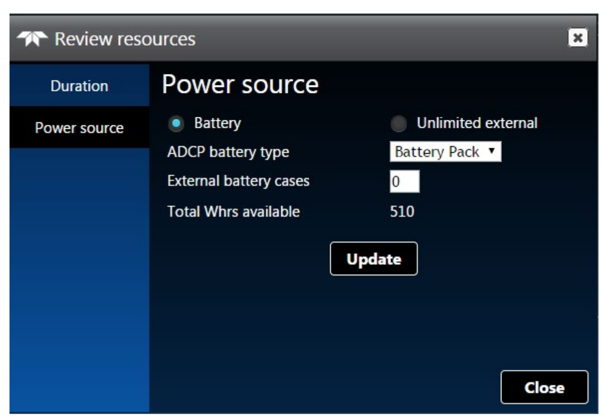


Figure 20. Review Resources Panel

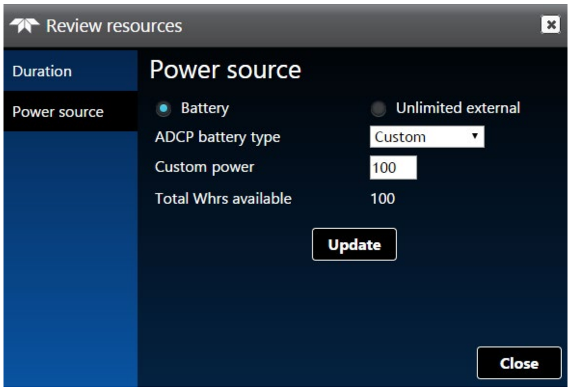




Duration – Enter the expected duration of the deployment from the time of the first measurement ping (either immediately or delayed). This duration does *not* instruct the Sentinel V ADCP to stop data collection; it is for estimating the battery usage and storage required. Click the **Update** button and review the resources panel.

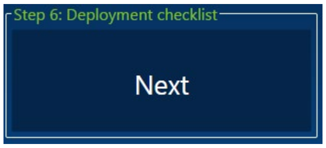
Power source – Select **Battery** or **Unlimited external** as the power source. If **Battery** is selected, use the drop-down list to select the battery type from the list and enter a number in the **External battery**

cases box if you will use an external battery case. If you are using a Lithium battery pack, select **Custom** and then enter the available watt hours in the **Custom power** box. A fresh Lithium battery pack has 1900 Wh available. Click the **Update** button and review the resources panel.



Using the Deployment Checklist Panel

The Deployment checklist panel starts or stops the deployment. Click on the Step 6: Deployment checklist panel to open the **Deployment checklist** panel as shown below.



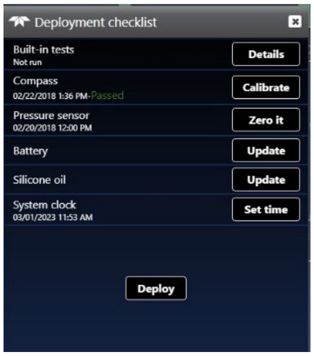


Figure 21. Deployment Panel

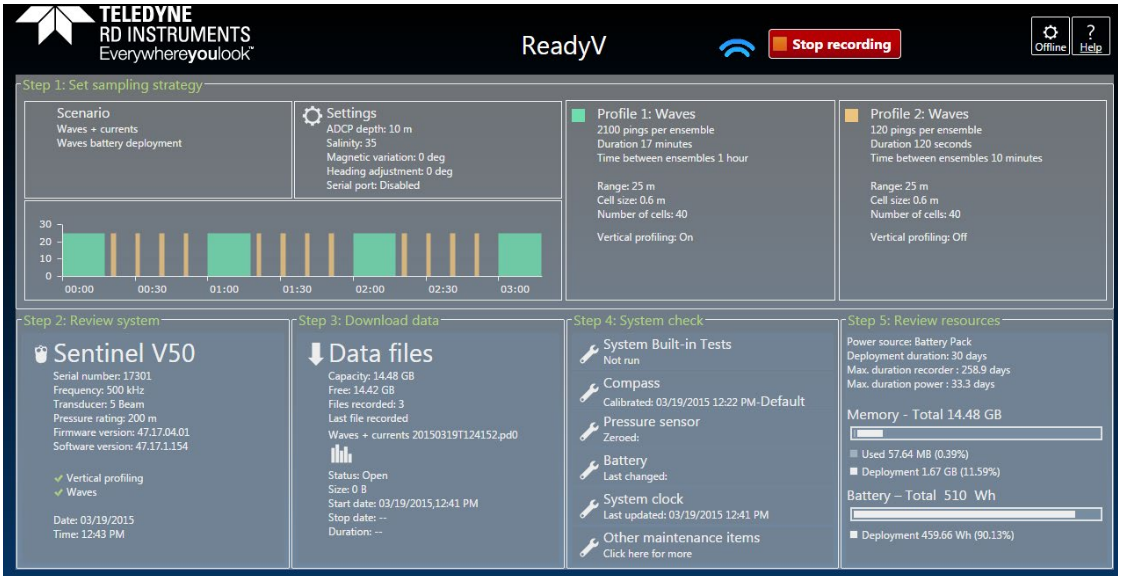
Deployment checklist:

- **Built-in Tests** – The Built-in tests should be run before deploying the system.
- **Compass** – The compass should be calibrated before deploying the system.
- **Pressure sensor** – The pressure sensor should be zeroed before deploying the system.
- **Battery** – The battery should be replaced before deploying the system.
- **Silicone oil** – The oil should be filled before deploying the system.
- **System clock** – The clock should be set before deploying the system.
- **Deploy** – The Sentinel V ADCP will start pinging as soon as the **Deploy** button is clicked.

Starting or Stopping Deployments

To start a deployment:

1. Click on the Step 6: Deployment checklist panel to open the **Deployment checklist** panel.
2. On the **Deployment checklist** panel, click the **Deploy** button to start the ADCP pinging.
3. On the Home panel, verify that is shows the Stop Recording button.



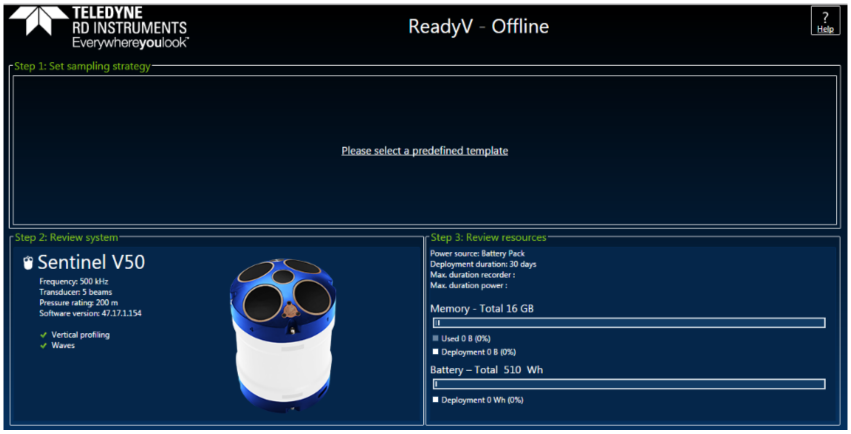
4. Close the browser page.

To stop a deployment:

1. Click the **Stop recording** button.

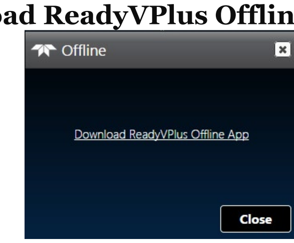
Running ReadyV Offline

ReadyV can be used without requiring access to the Sentinel V ADCP once it is downloaded. The Step 1: Set sampling strategy panel is used to set the Sentinel V ADCP configuration (see Using the Set Sampling Strategy Panels). When running offline, the user must select the Sentinel V ADCP model number, battery type, and deployment duration.



To run ReadyV offline:

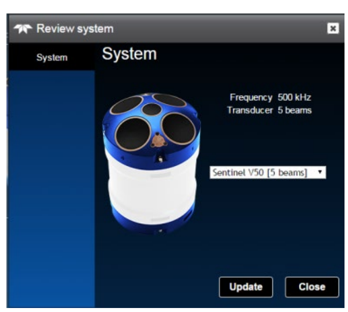
1. Connect to the Sentinel V ADCP and click on the **Offline** button located on the **Home** panel upper right corner. Click **Download ReadyVPlus Offline App**.



2. Select a location to download the file. Unzip the file. To start the app, double-click on *index.html*.

When the ADCP's firmware is updated, delete older offline versions of ReadyV.

3. Click on **Please select a predefined template**. Use the **Import** and **Export** buttons to open and save scenario*.*txt* files. See Creating and Saving Scenarios for details.
4. Click on Step 2: Review system panel. Select the ADCP type from the drop-down list.



5. Click on Step 3: Review resources panel. Select the power source and deployment duration.

Chapter 3

INSTALLATION

In this chapter:

- How to attach the handle
- How to connect/disconnect the I/O cable
- How to connect the optional external battery case
- How to use the real-time serial data out
- Cable wiring diagrams
- Available mounts for the Sentinel V

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

Attaching the Handle

The handle makes it easier to carry the Sentinel V ADCP.

To attach the handle:

1. Thread the ends of the handle through the slots on the end-cap.
2. Use the snap-links to attach the handle to the Sentinel V ADCP.

Figure 22. Handle

Transducer Cover

The Sentinel V ADCP is shipped with a transducer cover to protect the transducer faces.

The transducer cover must be removed before deployment in order to collect good data.

Use the cover when the Sentinel V ADCP is in storage or is being handled.

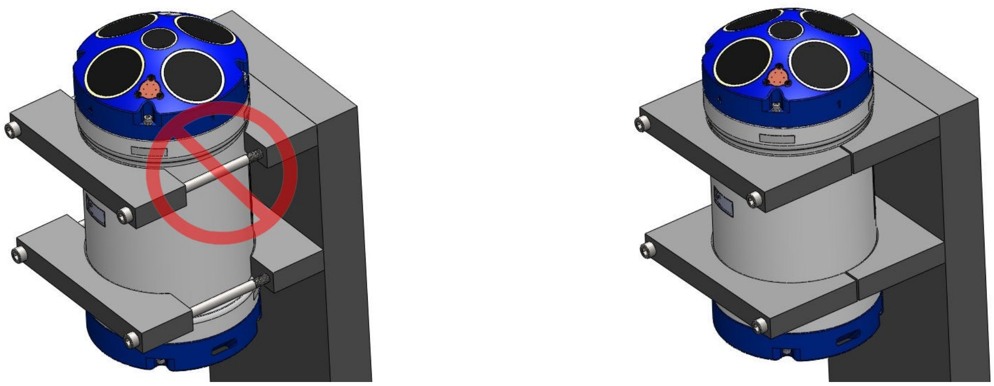
Figure 23. Transducer Cover

Mounting the Instrument

The preferred method of mounting the Sentinel V is using clamps that grip the circumference of the housing. The fallback method of mounting the instrument is to use the holes on the end-cap. See the Outline Installation Drawings for dimensions.

When clamping the Sentinel V to a mount, the clamp must not have a large gap between the front and rear clamp. Using this type of design can cause the housing to deform or even break if the clamps are over tightened. This will cause the ADCP to flood.

Design clamps that fully surround the housing. Design the gap as small as possible so that when the clamp is fully tightened it will not deform the housing or cause excessive pressure on the housing.



Poor Design	Good Design

Figure 24. Mounting the Instrument

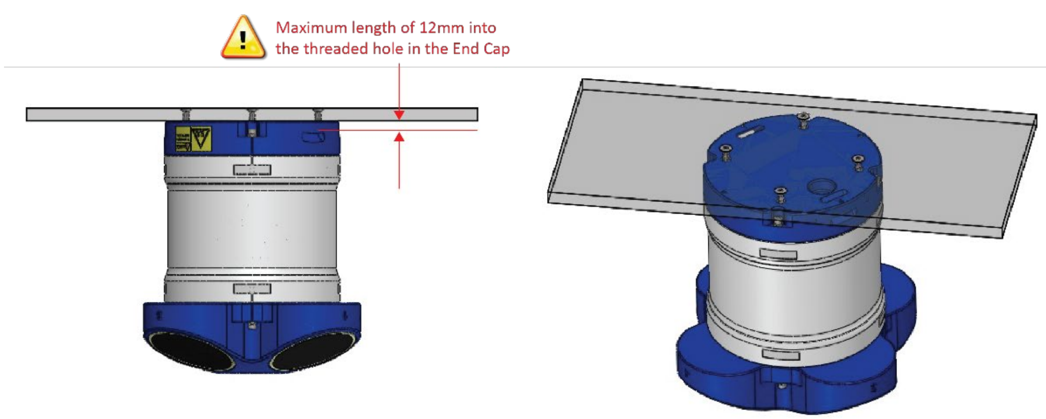


Figure 25. Example Sentinel V End-Cap Mount

Use M6x1.0 bolts with a maximum length of 12mm into the threaded hole in the End Cap.

Only use stainless steel hardware.

The maximum thru-hole diameter in the mounting plate is 6.85 mm (0.270 inch). Using a larger thru-hole could result in the threaded metal inserts on the end-cap being pulled out of the plastic end-cap.

Tighten the bolt to no more than 5.6 Newton-meters (50 pound-inches).

Using longer threads or high torque risks cracking the end cap and/or pulling out the helicoils in the end cap.

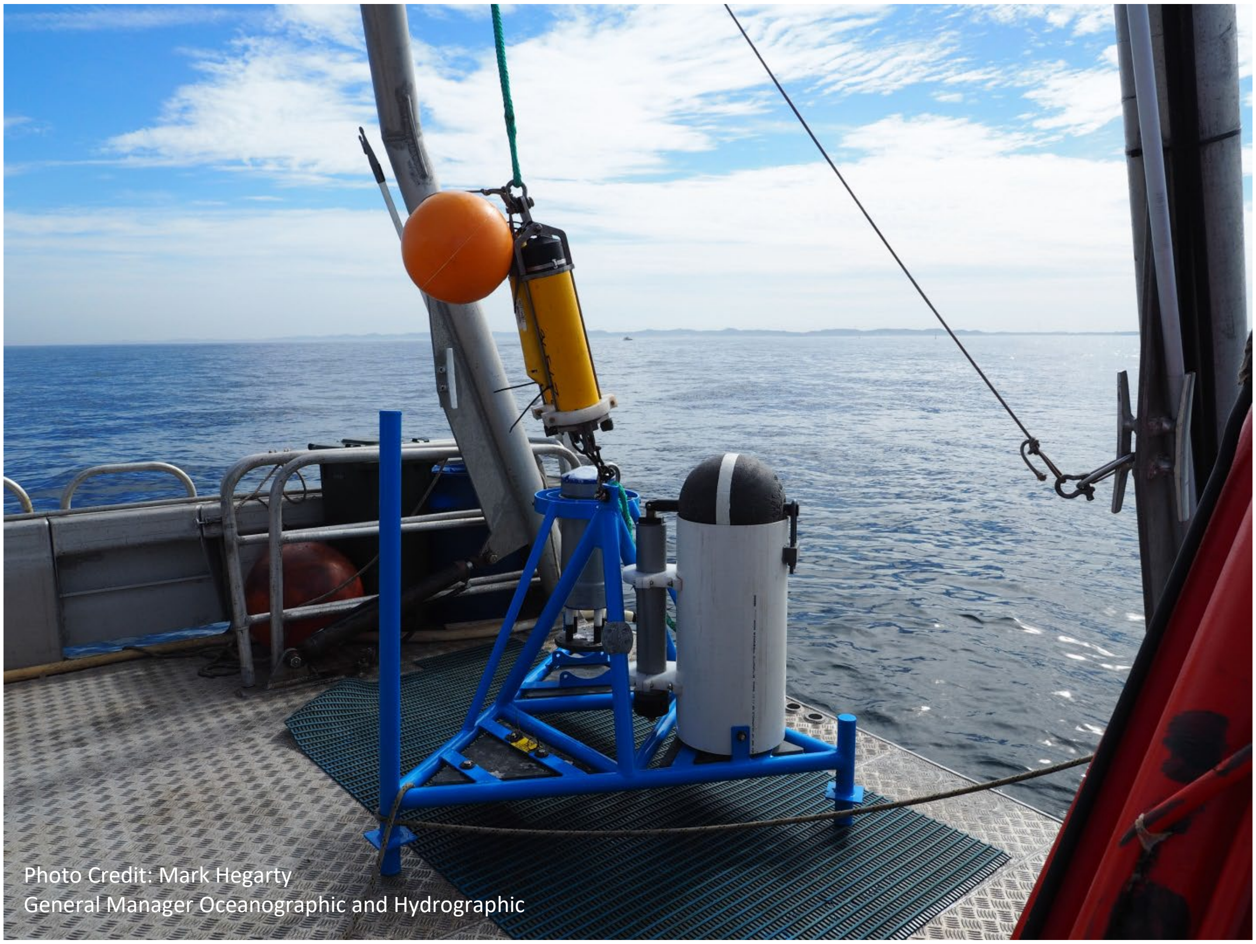


Figure 26. Gimbal Bottom Mount

The end-cap mounting holes can also be used to attach a lead counter-weight to the ADCP when used in a gimbal bottom-mount that holds the ADCP housing. The lead dampens the ability of the instrument to just swing back and forth in the currents. Some movement is required, but the ADCP should not be freely swinging. TRDI recommends using a torque on the M6 helicoils of no more than 5.6 Newton-meters (50 pound-inches) and maximum lead weight of 25 kg (55 lb.).

WorkHorse to Sentinel V Mount Adapter

TRDI has designed two adapters to use an existing WorkHorse mount with the Sentinel V. The 81D-5000-xx adapter (where xx is available for different length housings) includes sleeves to make the Sentinel V fit into a clamp designed for Workhorse ADCPs. The rubber sleeves are textured on one side to provide a better grip on the ADCP and include adhesive on the other side so that the customer can either glue it to the instrument or their clamp. The 81D-5001 kit is a delrin plate with WorkHorse end-cap hole pattern. See the Outline Installation Drawings for Sentinel V dimensions.

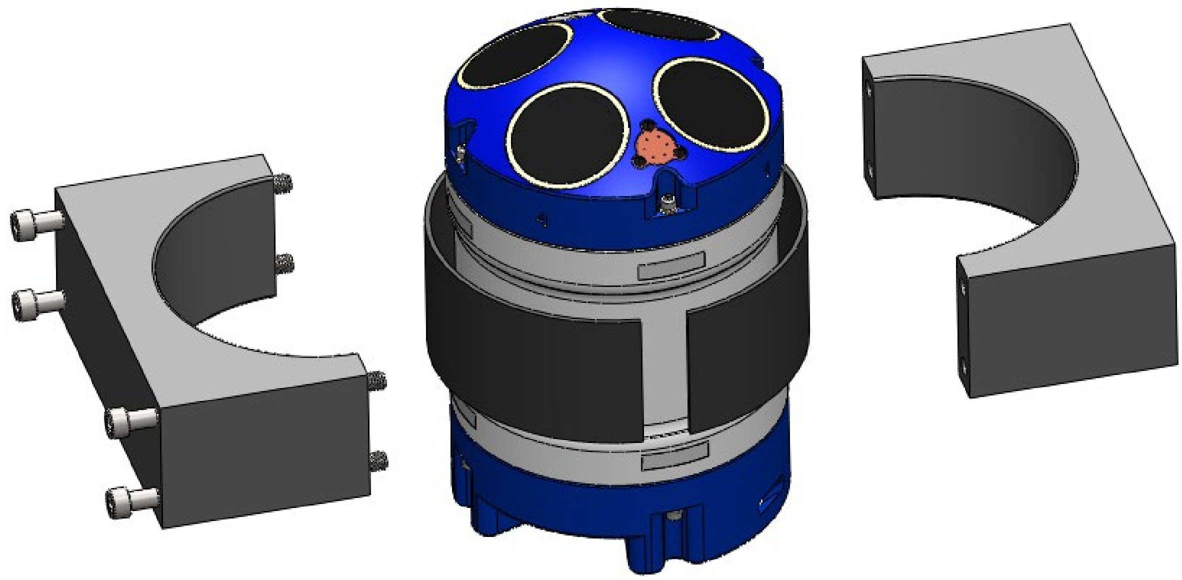


Figure 27. 81D-5000 Mounting Clamp Adapter Kit

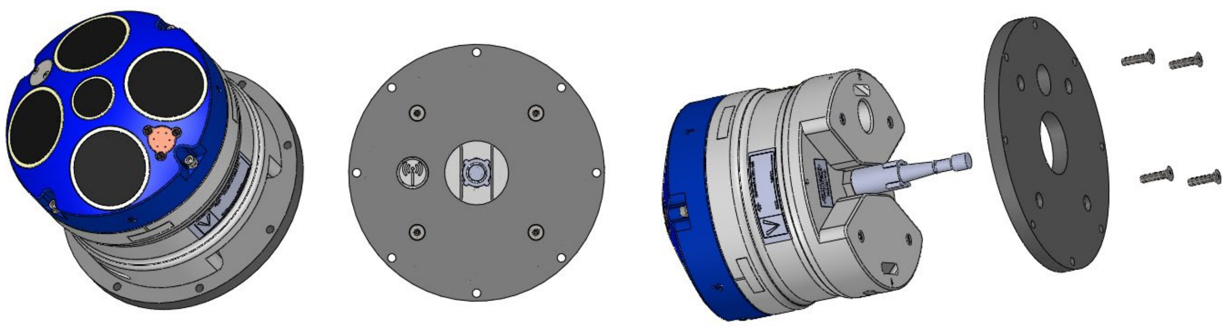


Figure 28. 81D-5001 End-Cap Mounting Plate Adapter Kit

Connecting Cables and Dummy Plugs

Sentinel V ADCPs can be purchased with the optional end-cap connector using either the right-angle or straight connectors.

> The dummy plugs should be installed any time the cable is removed. Use the dummy plug when the Sentinel V ADCP is in storage or is being handled.

To Disconnect the Cable or Dummy Plug:

1. Turn the locking sleeve counterclockwise until it is fully loose and slides back.
2. Grasp the cable or dummy plug close to the housing and pull the cable or dummy plug straight out away from the connector.

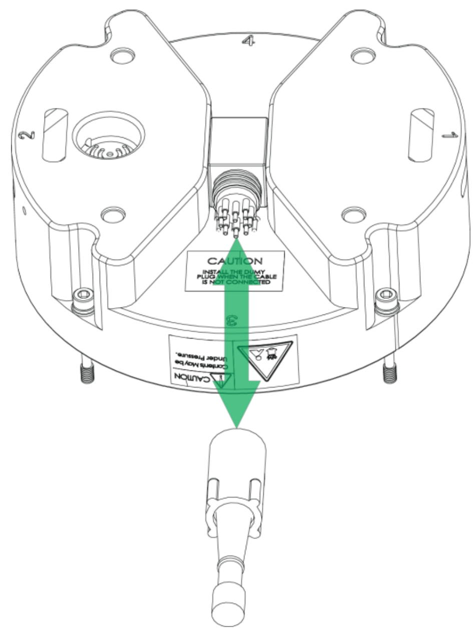


Figure 29. Removing the End-Cap Connector 8-Pin Dummy Plug

To Connect the Cable or Dummy Plug:

1. Spray lubricant on the rubber portion of the connector pins. This will help seat the connector.

> **Use light amounts of aerosol silicone (dry type) lubricant (such as from 3M) to help seat the cable connectors and to protect the neoprene rubber from deterioration. Regular lubrication is required.**

2. Insert the dummy plug / cable onto the connector, rotating it until the keyed portions are properly aligned. While keeping a slight inward pressure on the cable connector and ensuring that the connector is straight, thread the locking sleeve onto the receptacle to complete the connection.

> **Do NOT use any tools to tighten the locking sleeve ring. It should only be “finger tight”.**

Using the AC Power Adapter

The AC Adapter runs on any standard AC power and supplies +18 VDC, 24 watts to the ADCP. The Sentinel V batteries can be connected or disconnected. If the adapter's input voltage is greater than the battery voltage, then the ADCP will draw all power from the AC adapter even if the battery is installed and connected. Use the AC Adapter when testing the ADCP to conserve the battery power.

The voltage specification of the Sentinel V battery pack is 18V; however, most new batteries provide a slightly higher voltage. The AC power adapter used for powering the Sentinel V operates at 18V and therefore if a system is connected to the AC power adapter and simultaneously the batteries are connected, the batteries will be depleted until they reach the same voltage as the AC power adapter. While this does not affect the operation of the system, you should be aware of the loss of power that can occur. Once the batteries are discharged to the supplied voltage of the AC power adapter supply, the batteries will no longer be depleted.

If the batteries are above 18V and you wish to preserve the battery charge your options would be:

- Disconnect the battery pack when using the AC power adapter.
- Power the unit with a different power supply (voltage not to exceed 20V).

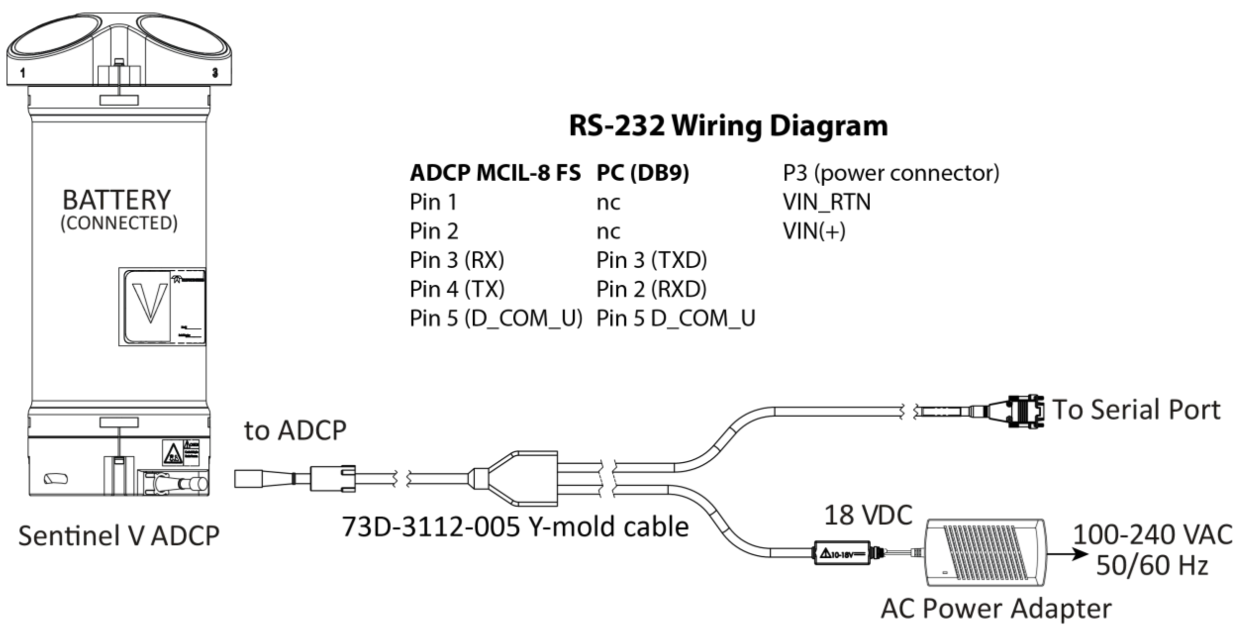


Figure 30. Using the Real-Time Serial Output and AC Power Adapter

Data common and power ground should not be shared to avoid creating a ground loop in water that can cause corrosion.

The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

Cable Wiring Diagrams

This section has information on ADCP cabling. Custom configurations may not be shown here. Deck Box cables are shown in the Sentinel V Deck Box guide.

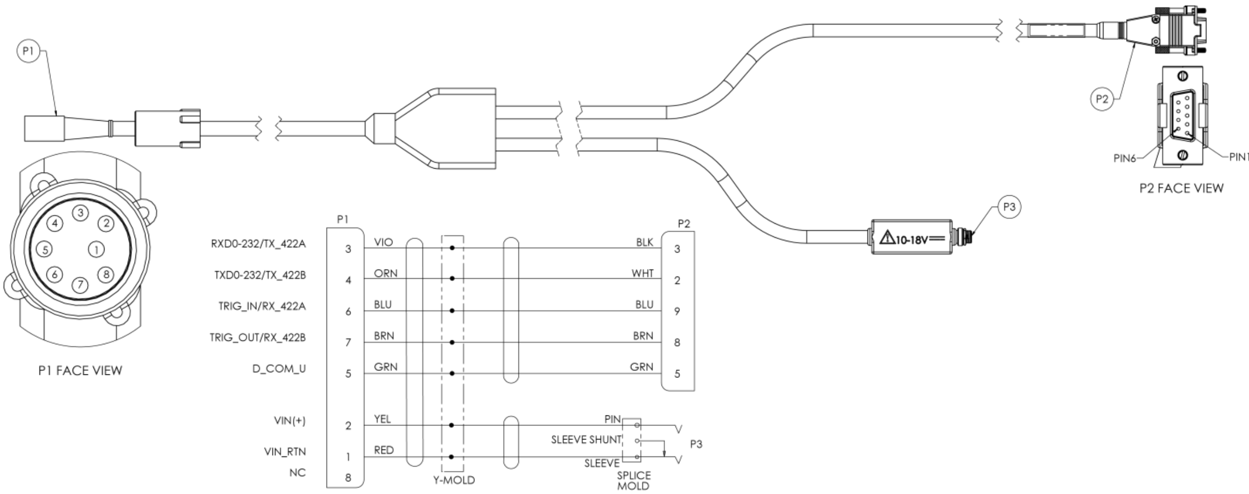


Figure 31. **73D-3112 – Underwater Y-Mold Cable Serial Cable with 8-pin Connector**

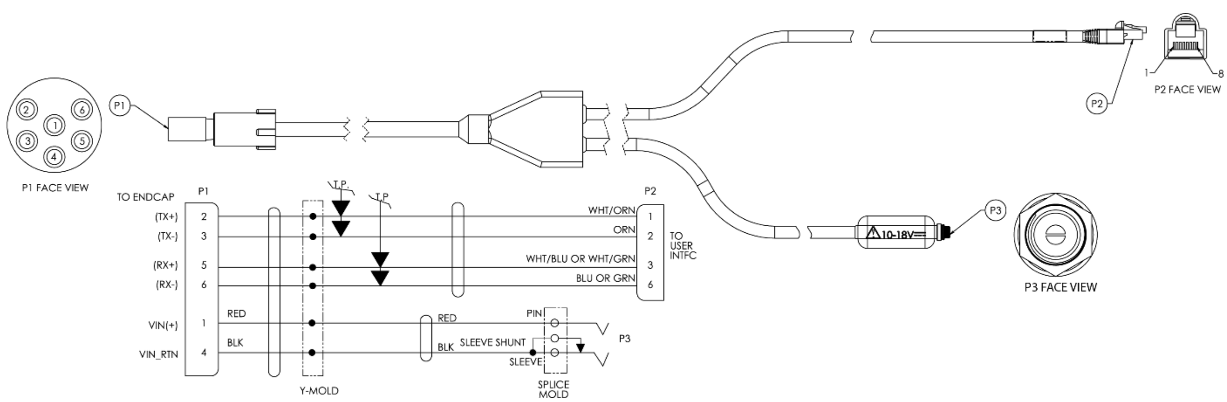


Figure 32. **73D-3113 – Underwater Y-Mold Cable Ethernet Cable**

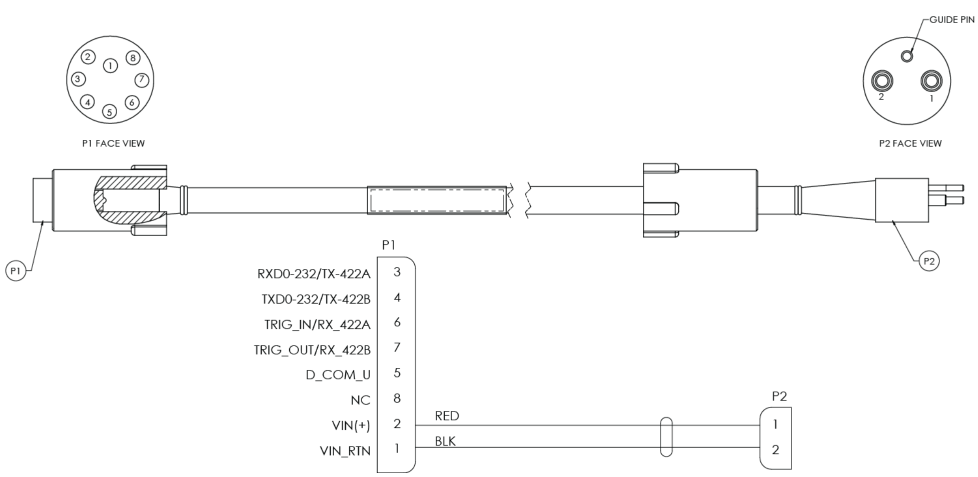


Figure 33. **73D-3101 – External Battery Case Cable with 8-pin Connector**

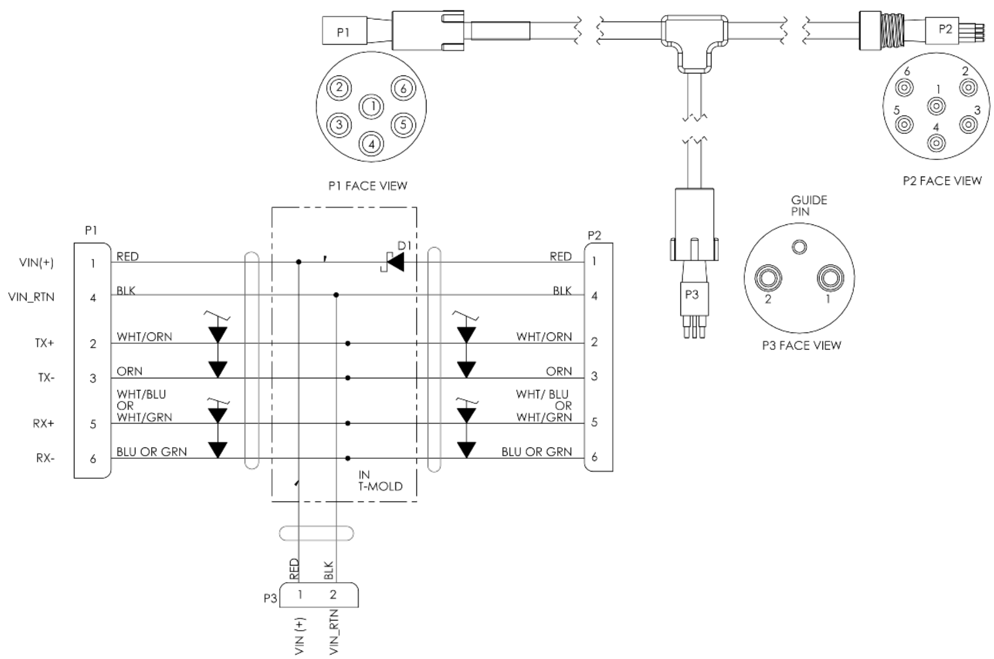


Figure 34. 73D-3104-00 External Battery Case Y-Cable

Connecting the External Battery Case

Sentinel V ADCPs can be purchased with the optional end-cap connector and an external battery case.

> The dummy plugs should be installed any time the external battery case cable is removed. Use the dummy plugs when the Sentinel V ADCP is in storage or is being handled.

To connect the external battery case:

1. Verify that both battery packs are connected (see Replacing the External Battery Case Packs).
2. Remove the dummy plugs on the Sentinel V and external battery case (see Connecting Cables and Dummy Plugs).
3. Connect the external battery case cable.

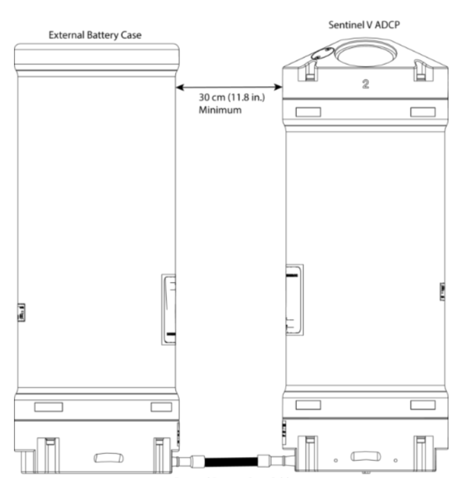


Figure 35. Connecting the External Battery Case

To avoid affecting the compass, place the external battery case at least 30cm (11.8 inches) away from the Sentinel V ADCP.

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect BOTH batteries and seal the external battery case before deployment. It is necessary to remove the top battery to connect the bottom battery cable. See Replacing the External Battery Case Packs for details.

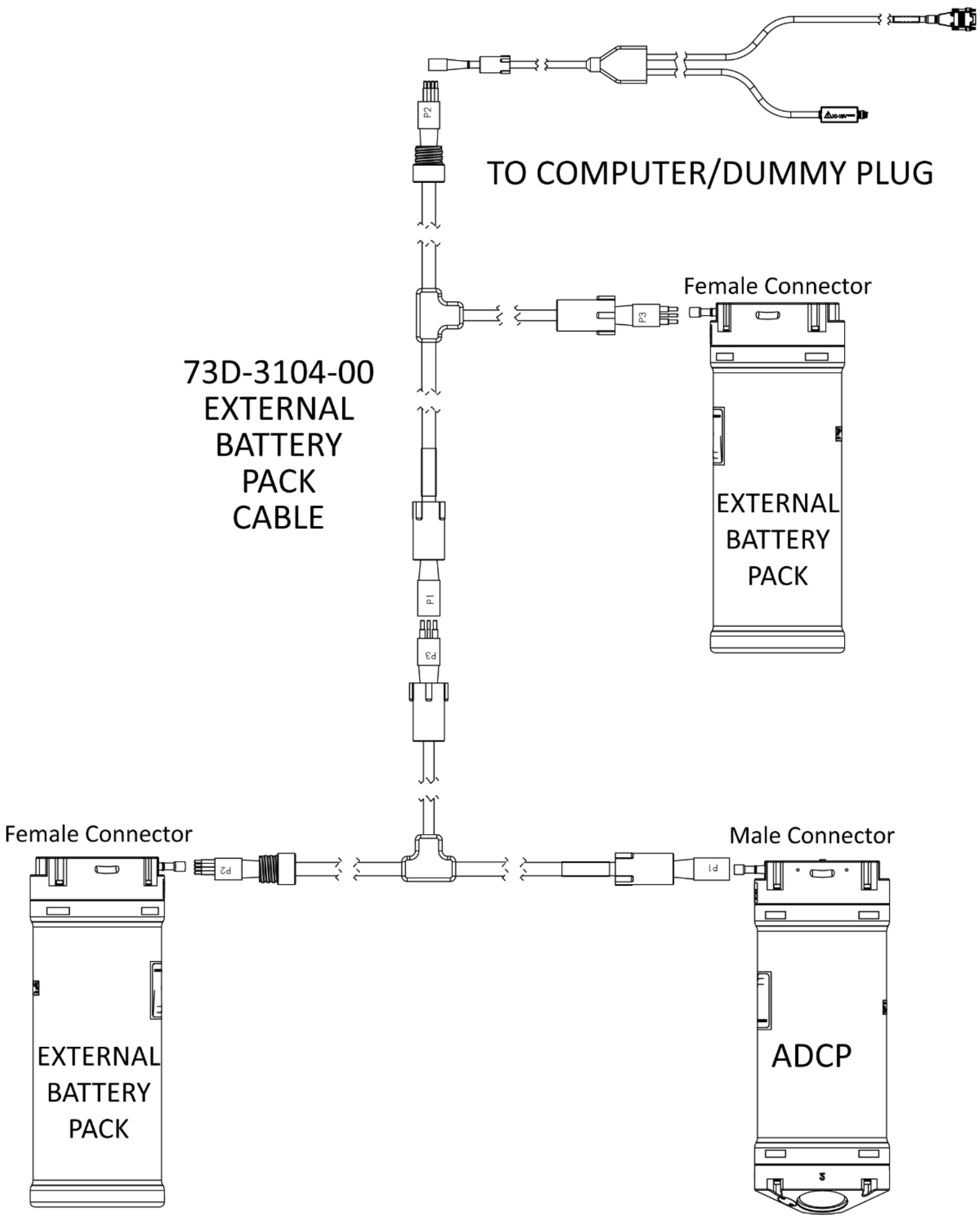


Figure 36. Connecting the External Battery Case with 73D-3104-00 Y-Cable

Using Bottom Mounts

Bottom mounts can range from simple PVC frames to Trawl Resistant Bottom Mounts. Below is an example of some of the types of bottom mounts.

Figure 37. Example of a Teledyne RD Instruments Sea Spider Bottom Mount

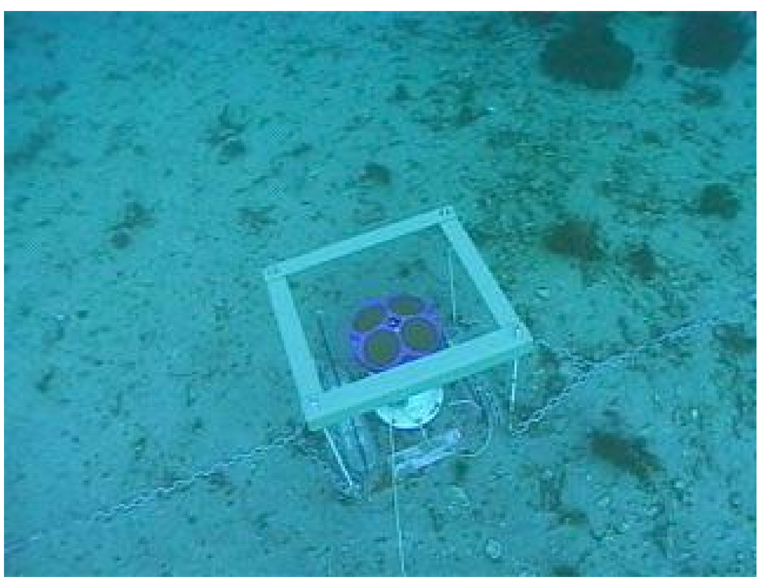


Figure 38. Example of a Bottom Mounted ADCP

Photo courtesy of John Skadberg, US Navy SPAWAR System Center in San Diego, CA. Sent to TRDI by Steve Monismith.

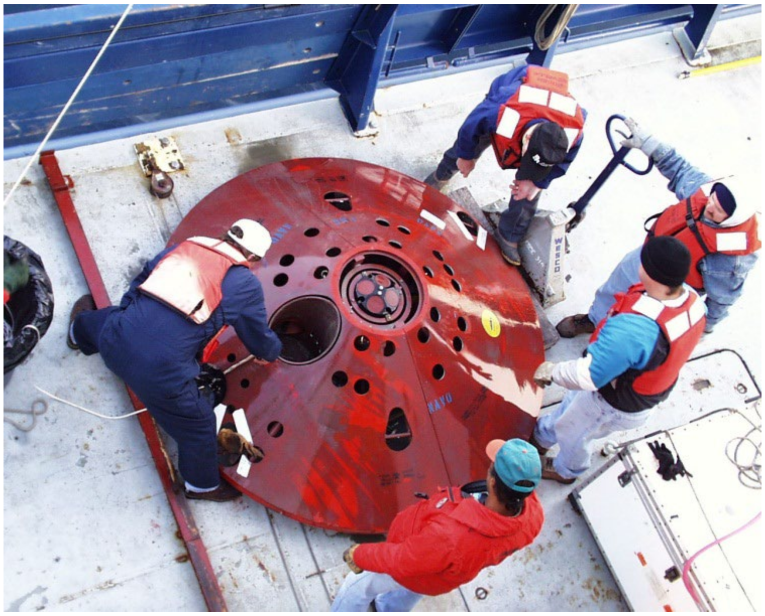


Figure 39. Trawl Resistant Bottom Mount

Photo courtesy of Maureen Wieler, Mooring Systems.

Using Buoy Mounts and Load Cages

Buoy mounts and load cage frames are designed to allow the Sentinel V ADCP to profile unobstructed by the mooring hardware. Below is a sample of some the types of buoy and load cage mounts available.

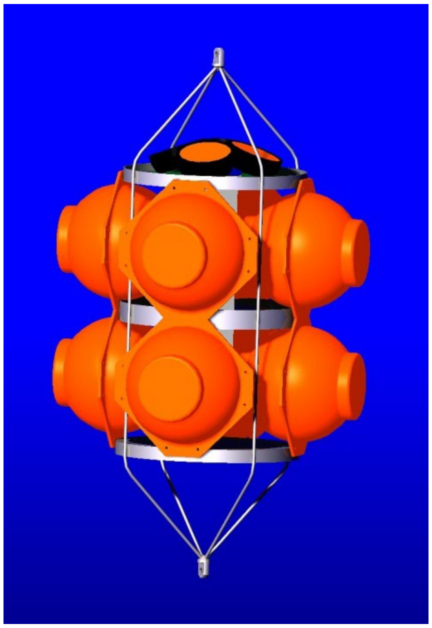


Figure 40. Deep-Water Mount

Photo courtesy of the Oceanscience Group.

Figure 41. Buoy Mount with External Battery

Photo courtesy of Maureen Wieler, Mooring Systems.

Figure 42. Subsurface Buoy

Photo courtesy of Patrick Lefeuvre, Technicap. The Subsurface buoy was developed by BMTI and Technicap.

Figure 43. Buoy Mount

Photo courtesy of Flotation Technologies.

Figure 44. Load Cage
Photo courtesy of Angela Cates, UNM.

Using an Over-the-Side Mount

The over-the-side mount is common when the ability to move the Sentinel V ADCP from one platform to another is needed. The mount must be as rigid as possible to limit the amount of pitch and roll applied to the ADCP. Although the tilt sensor can measure a ±90° influence, anything beyond 15° will cause bias to the data that cannot be removed. No matter what mounting type used, the ADCP must be below the bubble layer. Bubbles will cling to the urethane faces of the ADCP and reduce the range to almost nothing. Usually a mount somewhere aft of amidship is used. A stern mount will cause all sorts of problems due to propeller wake, bubbles and turbulent water conditions.

The most common over-the-side mounting method for ADCPs uses a Kentucky Mount style. For more information, see the following:

- http://hydroacoustics.usgs.gov/movingboat/pdfs/KYMount.pdf
- http://hydroacoustics.usgs.gov/movingboat/mbd_deployments.shtml

Our transducer assembly is sturdy, but TRDI did not design it to withstand collisions with all floating objects. TRDI strongly suggests protecting the Sentinel V ADCP if this is a possibility.

Avoid using ferro-magnetic materials in the mounting fixtures or near the Sentinel V ADCP. They affect the compass. Use titanium or 316 stainless steel hardware.

Over-the-Side Mounting Special Considerations

Use the following suggestions when mounting the Sentinel V ADCP to a platform.

- It is desirable to rigidly mount the Sentinel V ADCP to the platform. Avoid the free spinning of the ADCP in this application. The ADCP must stay in the water at all times.
- The ADCP must be mounted deep enough so that turbulence caused by its movement through the water does not allow air bubbles to be attached to the transducer faces.
- Avoid mounting the ADCP near motors and thrusters. They cause air bubbles and will cause bias to the internal compass.
- Avoid mountings that will cause the ADCP to see severe accelerations.

Routing Cables

The optional External Battery cable connects to the Sentinel V. Teledyne RD Instruments delivers the cable with both connectors attached. Use care when routing this cable through bulkheads, deck plates, cable runs and watertight spaces. Make allowances in cable length and engineering design plans for cable routing. When necessary, use strain reliefs on the cables. Route the cable so:

- Install cables with the connectors attached.
- It does not have kinks or sharp bends. Do not exceed a bend radius of 75 mm (3 in.).
- The cable can easily be replaced it if it fails.
- Protect the cable with abrasion resistant sleeving if zip-ties are used to secure it to structures (see Figure 44 and Figure 45). Secure the cables to the mounting structure in such a way that the cables do not move or vibrate.
- Secure all cables to the mounting structure in such a manor so that no forces are exerted on any connector. Secure the cable as close to the connector as possible without causing any stress to the connector.

Figure 45. Do not use Zip-Ties Directly on Cables

When attaching the Sentinel V ADCP cables to the mount, do not zip-tie the cables directly to the structure. Zip-ties slowly cut through the cable's outer jacket and cause leaks.

Figure 46. Cables Protected with Abrasion Resistant Sleeving

Using a Sea Chest

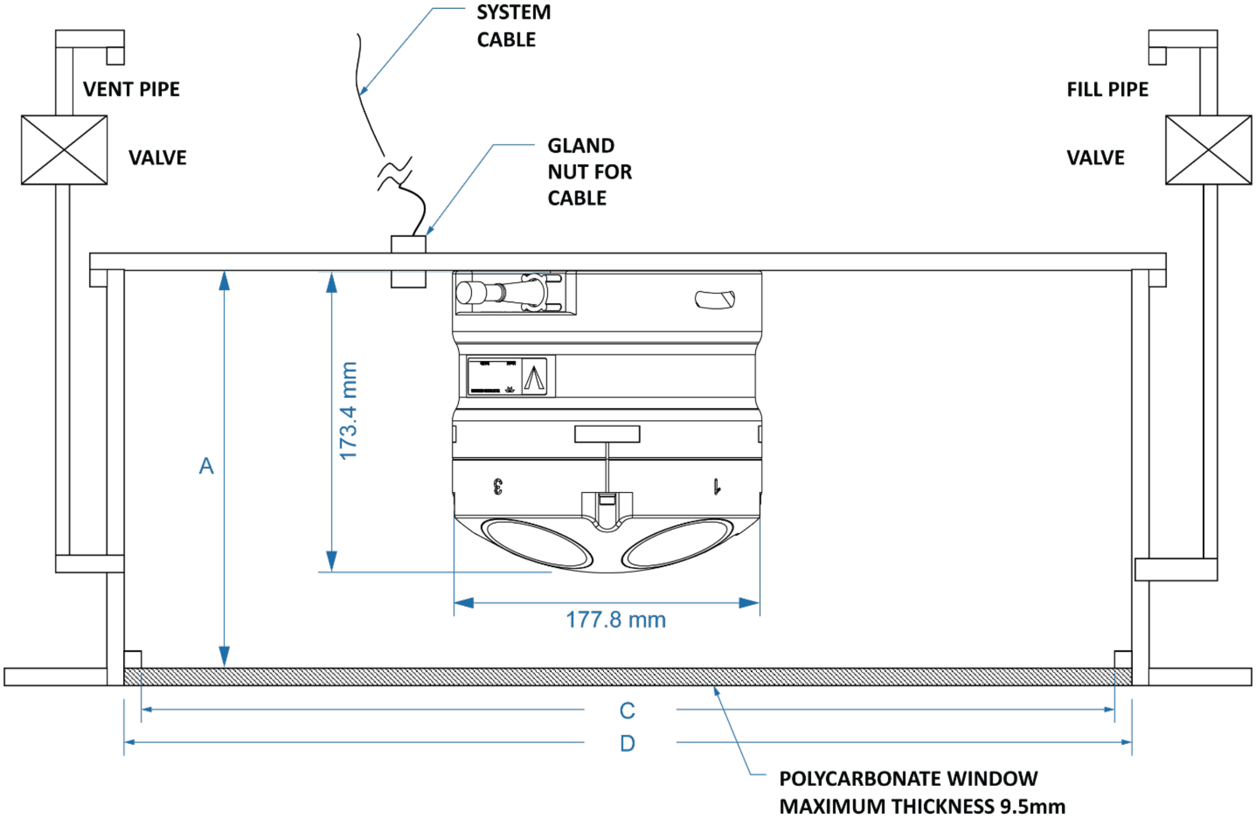


Table 4. Underneath Vessel Mounting of a Sentinel V20/V50 ADCP

DIMENSION LETTER	OPTION 1 MINIMUM DIMENSION	OPTION 2 MAXIMUM DIMENSION
A	179.8mm	186.1mm
C8	204.4mm	215.1mm
D8	255mm	265mm

Special Notes:

1. No liability is assumed by RD Instruments for users using this conceptual well drawing. Users realize that this drawing is provided as a basis for the user to construct their own well. It is expected that the user will have their well design inspected and approved by a naval architect.
2. The top plate of the well is intended as the primary seal for the vessel. The window and transducer can provide additional seal, but should not be considered the primary sealing mechanism for the vessel.
3. The listed minimum and maximum dimensions are recommendations based on maintaining the clearance for the transducer as well as providing the smallest well possible. Transducer dimensions should be confirmed before building well.
4. The gasket material between the adapter plate and the vessel flange should be used that will both seal and provide electrical isolation between the transducer housing and the vessel flange. Typical gasket material used is silicone rubber 3-6.35mm thick.
5. Inserts in the transducer housing mounting holes may be used to provide additional isolation from vessel.
6. The walls of the well should be coated with a material to absorb reflected sound in the well. Material such as 3mm wet suit material glued to the inside well walls is satisfactory for this purpose.
7. Vent and fill pipes should be above the water line of the vessel and it is recommended that a gate valve be installed to seal off these pipes.
8. Window thickness should not exceed 9.5 mm of Polycarbonate material. Thinner Polycarbonate window is OK.
9. Window faces should be at an angle of 20 degrees +/-2 degrees to all of the transducer faces degree for best performance should never exceed +/-5 degrees.

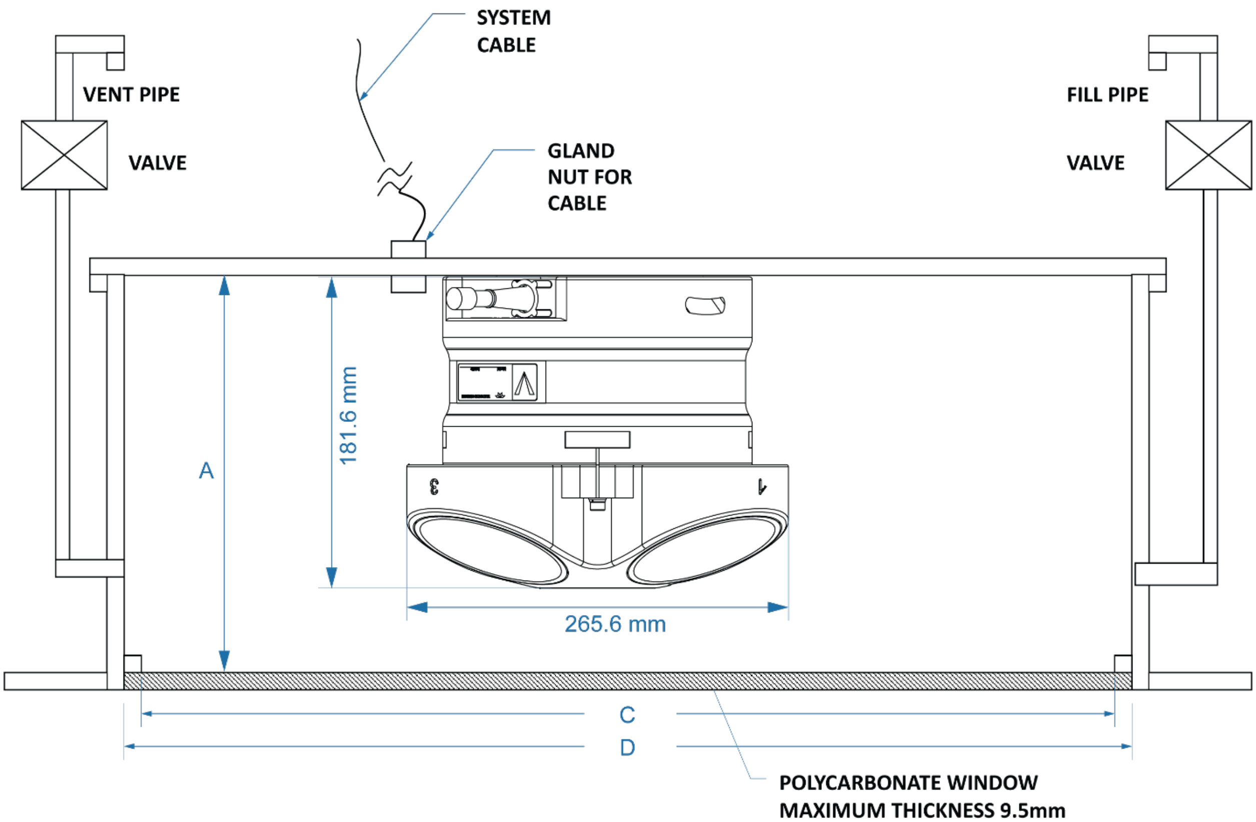


Table 5. Underneath Vessel Mounting of a Sentinel V100 ADCP

DIMENSION LETTER	OPTION 1 MINIMUM DIMENSION	OPTION 2 MAXIMUM DIMENSION
A	188mm	194.3mm
C[8]	292.2mm	302.9mm
D[8]	345mm	355mm

Special Notes:

1. No liability is assumed by RD Instruments for users using this conceptual well drawing. Users realize that this drawing is provided as a basis for the user to construct their own well. It is expected that the user will have their well design inspected and approved by a naval architect.
2. The top plate of the well is intended as the primary seal for the vessel. The window and transducer can provide additional seal, but should not be considered the primary sealing mechanism for the vessel.
3. The listed minimum and maximum dimensions are recommendations based on maintaining the clearance for the transducer as well as providing the smallest well possible. Transducer dimensions should be confirmed before building well.
4. The gasket material between the adapter plate and the vessel flange should be used that will both seal and provide electrical isolation between the transducer housing and the vessel flange. Typical gasket material used is silicone rubber 3-6.35mm thick.
5. Inserts in the transducer housing mounting holes may be used to provide additional isolation from vessel.
6. The walls of the well should be coated with a material to absorb reflected sound in the well. Material such as 3mm wet suit material glued to the inside well walls is satisfactory for this purpose.
7. Vent and fill pipes should be above the water line of the vessel and it is recommended that a gate valve be installed to seal off these pipes.
8. Window thickness should not exceed 9.5 mm of Polycarbonate material. Thinner Polycarbonate window is OK.
9. Window faces should be at an angle of 20 degrees +/-2 degrees to all of the transducer faces degree for best performance should never exceed +/-5 degrees.

Chapter 4

MAINTENANCE

In this chapter:

- Maintenance Schedule
- Where parts are located on the ADCP
- How to spot problems
- How to take the ADCP apart and put it back together
- How to replace the batteries
- How to do periodic maintenance items on the ADCP

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

Maintenance Schedule

To ensure that you continue to receive optimal results from your Teledyne RD Instruments product(s), TRDI recommends that every Sentinel V ADCP be returned to our factory for an inspection every two to three years. We'll provide your unit with a thorough multi-point inspection, and let you know if any refurbishment services are required to properly maintain the unit. To learn more about this service, please contact field service.

Calibration Items

Use the following calibration schedule:

Item	TRDI Recommended Period
Transducer Beam Angle	TRDI recommends return every two to three years for verification of velocity accuracy
Pitch & Roll (Tilt)	
Temperature (Factory)	TRDI recommends return every two to three years for Factory calibration
Heading (Factory)	
Heading (Field Pre-Deploy)	Field Compass Calibration performed prior to each deployment (see Compass Calibration)
Heading (Field Post-Deploy)	

Compass drift effects will accumulate over time. TRDI recommends a factory calibration be done every two to three years. The longer you wait between factory calibrations, the more error (due to drift) you can expect to have.

The fluxgate compasses accumulate an error of approximately 1% over a year.

Maintenance Items and Inspection

Inspect the Sentinel V ADCP before and after each deployment to spot problems:

Item	TRDI Recommended Period
Transducer Beams	The urethane coating is important to Sentinel V ADCP watertight integrity. Many users are not familiar with the early signs of urethane failure. The primary damage to the urethane is from bio-fouling and long exposure to the water and sun. Damage occurs on the surface of the urethane and at the edge where the urethane bonds to the cups. Mishandling, chemicals, abrasive cleaners and excessive depth pressures can also damage the transducer ceramics or urethane coating. Before each deployment, check the urethane coating on the transducer faces for dents, chipping, peeling, urethane shrinkage, hairline cracks and damage that may affect watertight integrity or transducer operation (see Figure 46). **Based on experience, TRDI knows that most systems need to have the urethane inspected after three to five years of field use; shorter periods may be required depending on marine growth.**
O-rings	O-rings should be replaced whenever the system is opened and BEFORE they are showing any signs of wear and tear. For example, when replacing the Sentinel V battery, the end-cap is removed. Replace the end-cap O-ring each time the end-cap is removed. **All O-rings should be replaced every one to two years maximum.**
Housing and End Cap	Inspect for damage and replace as needed before each deployment. Thoroughly clean the exterior of the Sentinel V ADCP after retrieval. See Removing Biofouling for details. **After a deployment, systems need to be cleaned thoroughly before the touch sensor will work.**
Hardware (bolts, etc.)	Check all bolts, washers and split washers for signs of corrosion before each deployment. **TRDI recommends replacement after every deployment or every year whichever is longer.** Damaged hardware should never be used.
Cables and Connectors	Check the end-cap I/O connector for cracks or bent pins before each deployment. Check the cable connectors for cracks or bent pins. Inspect the full length of the cable for cuts, nicks in the insulation, and exposed conductors before each deployment. Repair of the connectors should only be done by TRDI. The connector is made of rubber and as a general maintenance item **TRDI recommends that the connector be replaced every five years or whenever visible signs of wear or corrosion appear**.
Pressure Sensor	Check that the pressure sensor is filled with oil prior to deployment. Zero the pressure sensor before deployment. **This maintenance item must be done before every deployment.**

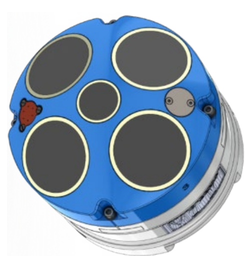


Figure 47. Transducer View

(5-beam model shown)

Figure 48. End-Cap View

(Right-angle connector shown)

Parts Location Drawings

This section is a visual overview of the inside and outside parts of the Sentinel V. Use the following figures to identify the parts used on the system.

Caution label on End-Cap

Wear safety glasses and keep head and body clear of the end-cap while opening. Any system that was deployed may have pressure inside the housing.

Normal maintenance does not require removing the transducer head. If the transducer assembly is removed, replace both the desiccant and O-ring.

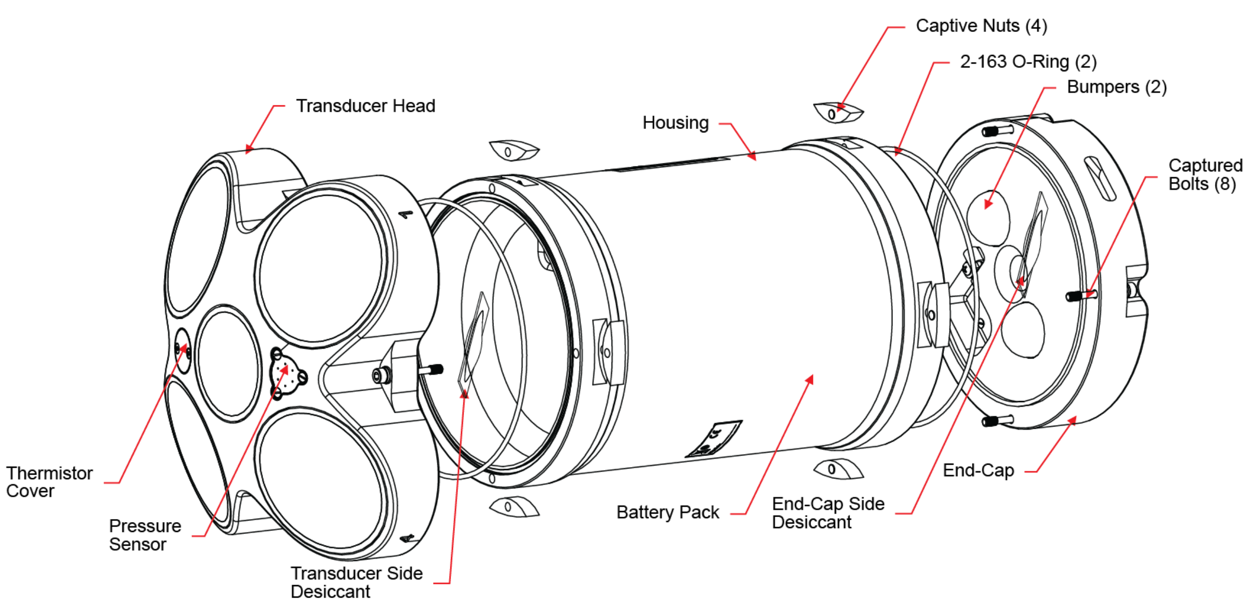
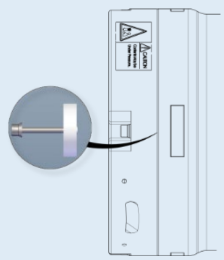
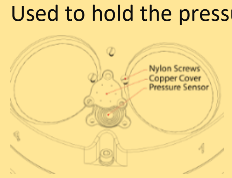


Figure 49. Sentinel V Assembly Overview

Tools and Spares Parts

A set of tools and spare parts are included with the system. For replacement kits, see Table 6 and Table 7.

Table 6. Tools and Spares Parts

Part Number	Description	Where Used
81D-6003-00	O-ring tool	Use the O-Ring tool to remove the 2-163 housing O-ring. 
2-163	2-163 O-ring	The housing O-rings (one each end) prevent the system from flooding.
5020	Silicone lubricant, 4-pack	Lightly coat the 2-163 O-ring with lubricant before installing the O-ring on the housing.
DES2	Desiccant bag	Used inside the housing to prevent water condensation.
6958A14	4mm Hex key	Used to attach the end-cap to the housing. 
81D-4002-00	Captive Nut	
81D-4003-00	M5 Captured bolt with washers	
75DK6009-00	Silicone oil fill kit with syringe, needle, needle cover, and 1 oz. of silicone oil.	Used to fill the Pressure Sensor with oil. **Note that the sensor is NOT filled when shipped and must be properly filled with oil prior to deployment.**
3/16BLADE	Screwdriver	Used to remove the Pressure Sensor cover.
M3X0.5X8FHN	Black nylon flat head screw	Used to hold the pressure sensor cover in place 

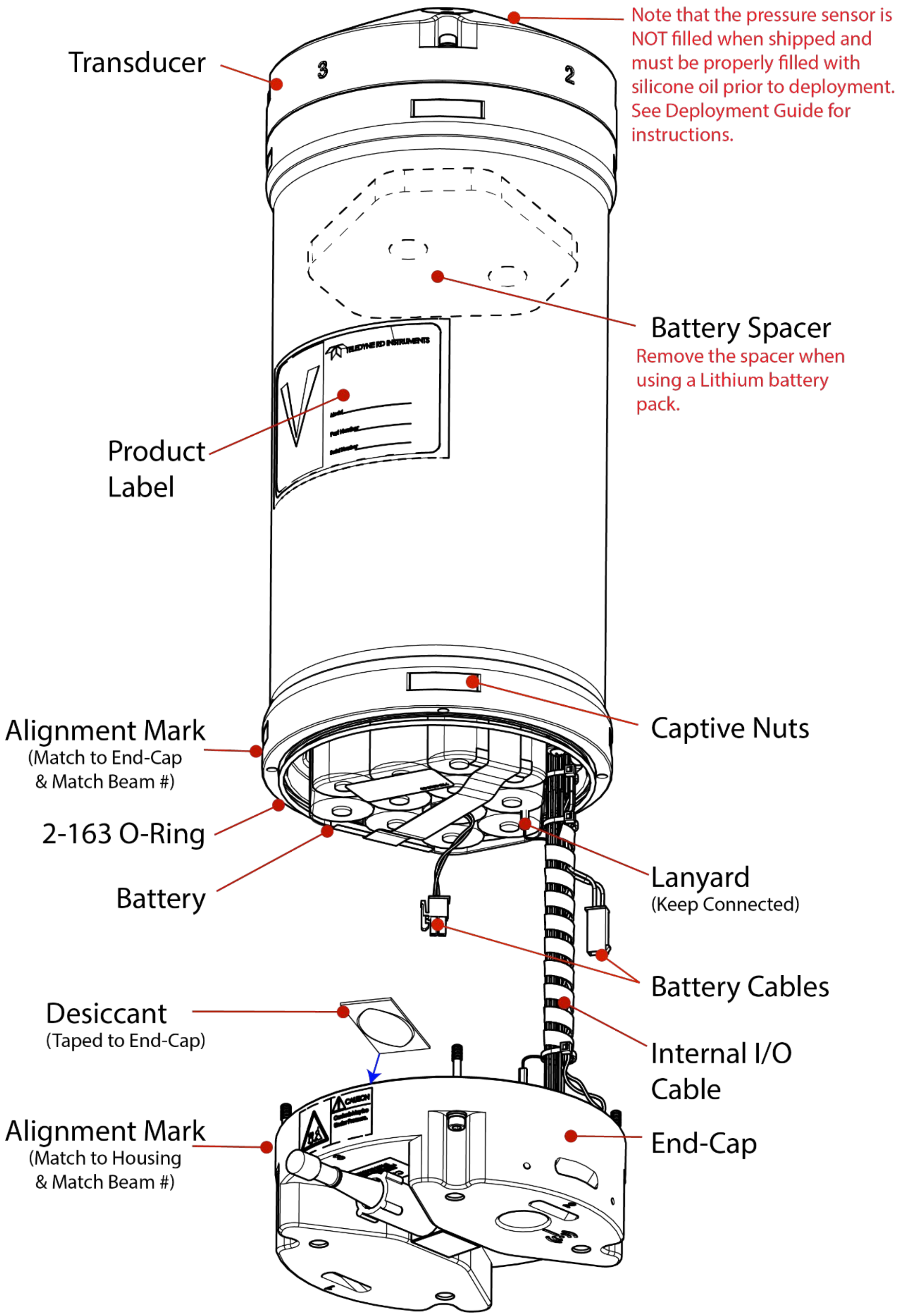


Figure 50. Sentinel V Exploded View (Battery Pack)

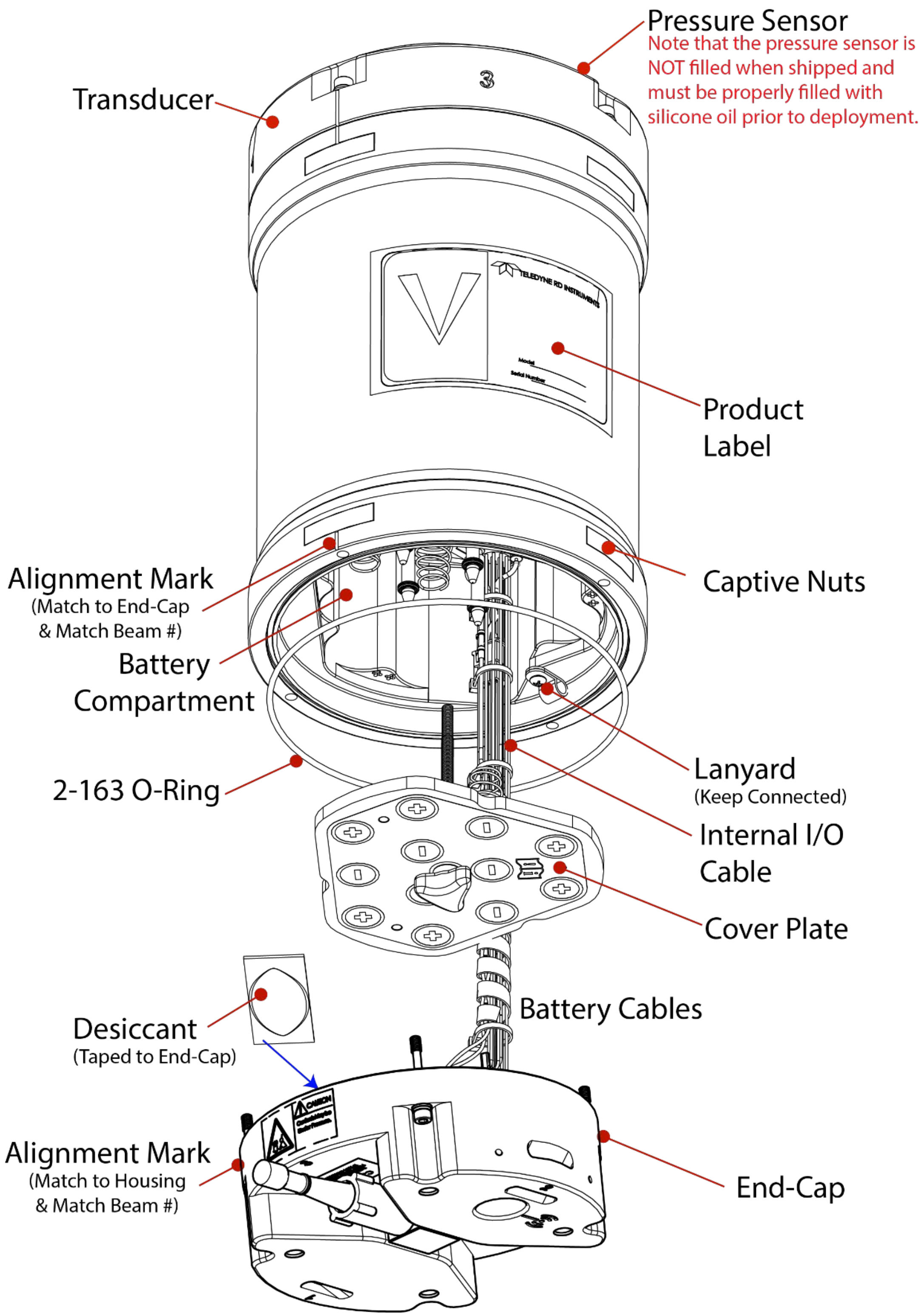


Figure 51. Sentinel V Exploded View (Individual D cell)

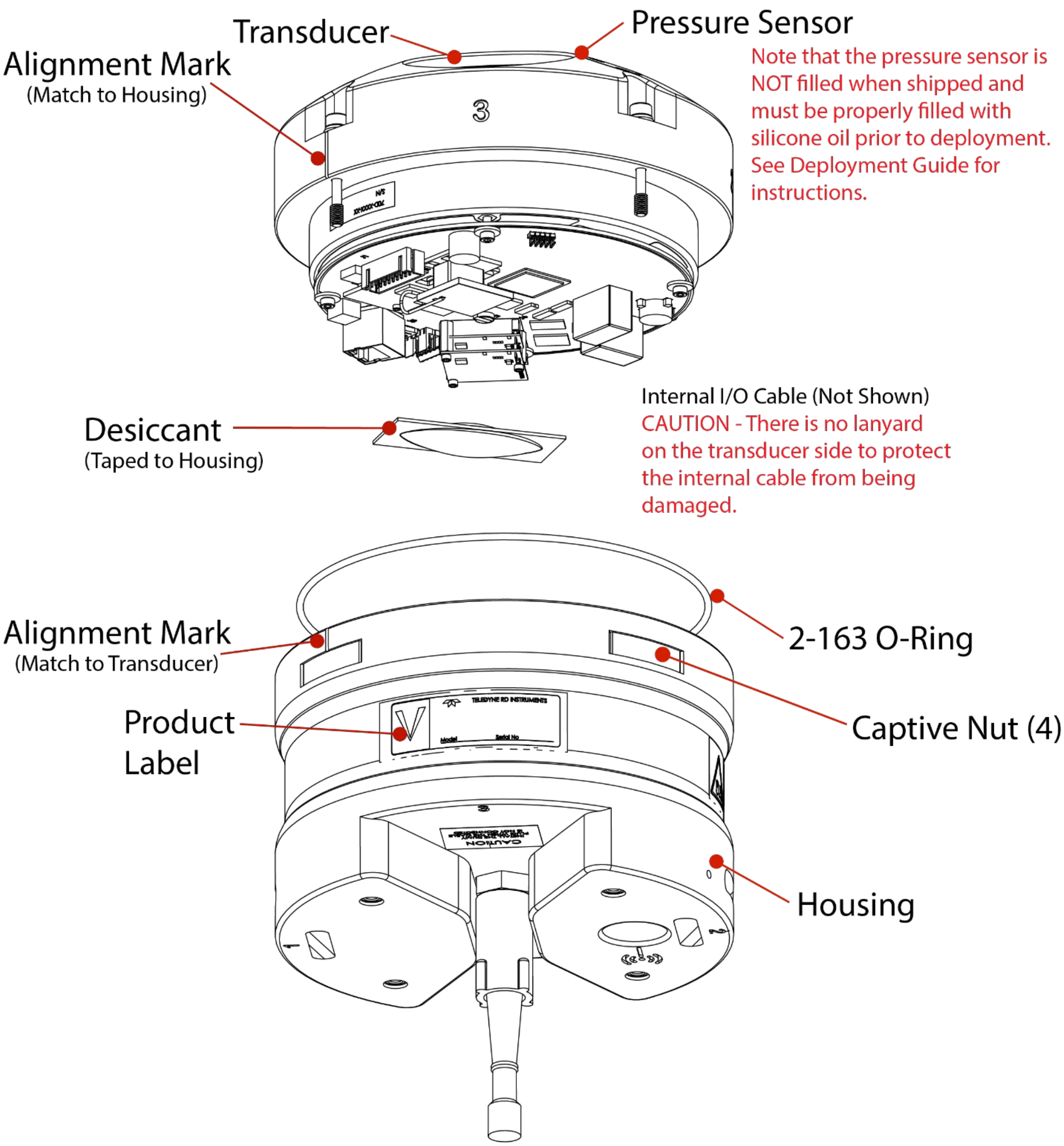


Figure 52. Sentinel V Exploded View (RT Housing)

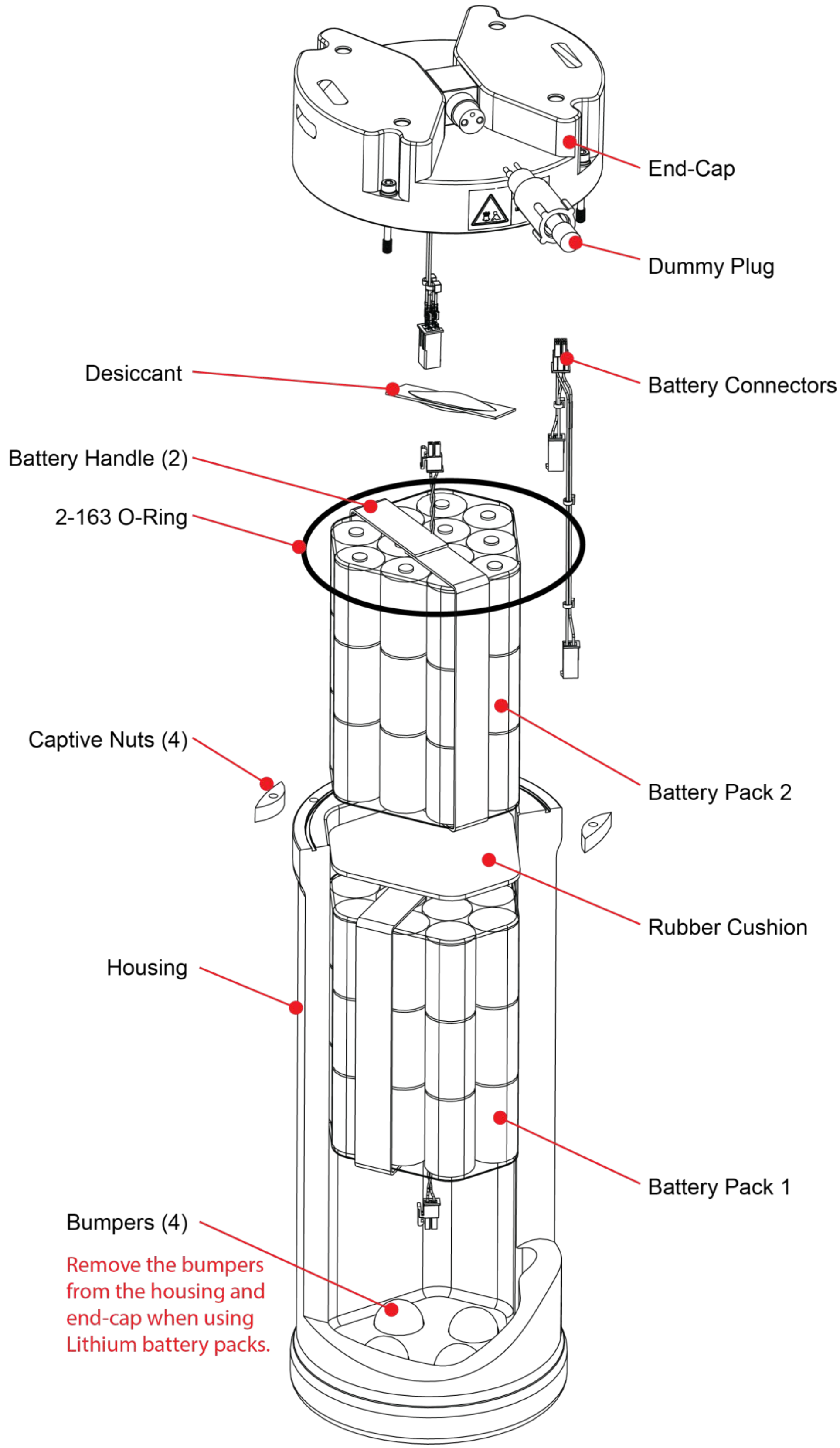


Figure 53. Sentinel V External Battery Case Exploded View

Disassembly and Assembly Procedures

This section explains how to remove and replace the end-cap or transducer head to gain access to the Sentinel V electronics, batteries and digital recorder.

Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

Disassembling the Sentinel V

If the ADCP was just recovered from a deployment, use caution when removing the end-cap or transducer head. If the system leaked, water may be inside the housing and under pressure. To avoid any possible injury always loosen the four bolts to allow any internal pressure to be vented from the system.

Caution label on End-Cap

Wear safety glasses and keep head and body clear of the end-cap while opening. Any system that was deployed may have pressure inside the housing.

Removing the End-Cap

To remove the end-cap:

1. Dry the outside of the Sentinel V ADCP.
2. Disconnect the I/O cable and install the dummy plug (for systems with an end-cap connector).
3. Lay the Sentinel V ADCP on its side on a soft pad.
4. Inspect the end cap bolts for any signs of damage such as bending, stretched bolts, crushed or deformed housing captive nuts, etc. These signs may indicate that there is internal pressure inside the system.
5. Using a 4mm Hex Key, loosen each of the M5 captured bolts (counterclockwise) until the O-ring seal is released.
6. Allow the system the opportunity to vent while the bolts are loose.

   To avoid any possible injury ALWAYS loosen the four end-cap bolts to allow any internal pressure to be vented from the system.

7. Once any possible over-pressure has been released, completely loosen the four M5 retaining bolts.

   The end-cap hardware will stay attached to the end-cap.

   A lanyard connects the end-cap to the housing. This protects the internal I/O cable from being pulled too far away from the Sentinel V ADCP.

8. Carefully lift the end-cap away from the housing. Observe how the internal I/O cable is coiled inside the housing. It must be coiled it the same way when replacing the end-cap.

9. Let the end-cap hang from the lanyard to the side of the ADCP. The lanyard protects the internal I/O cable from being pulled too far away from the Sentinel V ADCP.

Removing the Transducer Head Assembly

Normal maintenance does not require removing the transducer head. Use the following procedures only if directed to do so by TRDI Field Service personnel.

Sentinel V ADCPs contain Electro Static Sensitive Devices. Take accepted ESD prevention measures before opening the transducer head.

If the transducer assembly is removed, replace both the desiccant and O-ring.

For access to the Sentinel V internal battery, remove the end-cap assembly (see End-Cap Removal Procedures).

To remove the transducer assembly from the housing:

1. Dry the outside of the Sentinel V ADCP.
2. Disconnect the I/O cable and install the dummy plug (for systems with an end-cap connector).
3. Lay the Sentinel V ADCP on its side on a soft pad.
4. Inspect the transducer bolts for any signs of damage such as bending, stretched bolts, crushed or deformed housing captive nuts, etc. These signs may indicate that there is internal pressure inside the system.
5. Using a 4mm hex key, loosen each of the M5 captured bolts (counterclockwise) until the O-ring seal is released.
6. Allow the system the opportunity to vent while the bolts are loose.

To avoid any possible injury ALWAYS loosen the four end-cap bolts equally to allow any internal pressure to be vented from the system.

7. Once any possible over-pressure has been released, completely loosen the four M5 retaining bolts.

The transducer hardware will stay attached to the transducer assembly.

8. With an ESD ground-strap on, carefully lift the transducer assembly straight up and away from the housing until the internal I/O cable connector jack is accessible.

Only lift the transducer assembly enough so it can be disconnected the internal I/O cable. **There is no lanyard on the transducer side to protect the internal cable from being damaged.**

9. Gently pull the internal I/O cable connector to release it from the jack. Set the transducer head assembly (transducer face down) on a soft pad.

Reassembling the Sentinel V

To replace the end-cap or transducer head, proceed as follows. Use the Parts Location Drawings for parts identification.

Replacing the End-Cap

To replace the end-cap:

1. Stand the Sentinel V ADCP on its transducer face on a soft pad.
2. Clean the mating surfaces of the end-cap and housing with a lint-free cloth.
3. Inspect, clean and lubricate the O-ring on the housing (see Replacing the O-ring). Ensure that the O-ring is firmly pressed into the groove.

> TRDI recommends using a new end-cap O-ring each time the ADCP is opened.

4. Replace the desiccant (see Replacing the Desiccant).
5. Check the internal I/O connectors are connected.
6. Place the end-cap on the housing, aligning the mating holes and the alignment mark embossed on the end-cap with the alignment mark embossed on the housing. When mating the end-cap with the housing flange, try to apply equal pressure to all parts of the O-rings. Make sure the O-ring remains in its retaining groove. As the end-cap is placed on the housing, check the cables are coiled around the inside of the housing and do not become pinched.

> Check that no wires or any other object is pinched between the end-cap and the housing. If the O-ring is not properly installed or if a wire or other object is pinched, the Sentinel V ADCP will flood.

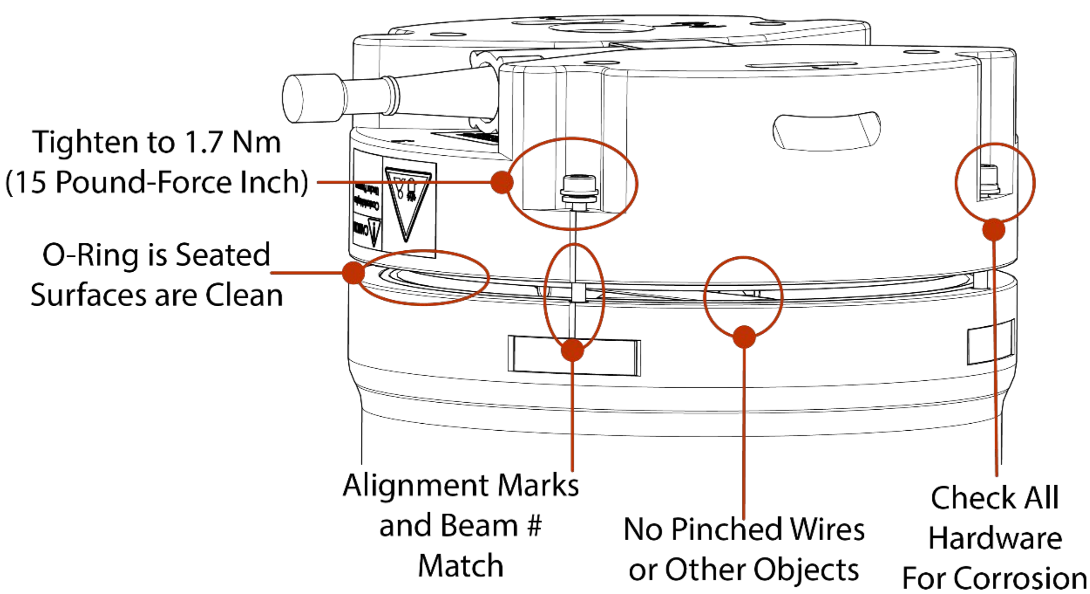


Figure 54. Replacing the End-Cap

> If the Sentinel V ADCP uses an internal battery pack, the rubber bumpers on the end-cap hold the battery in place. Apply a bit of pressure to the end-cap to fully seat it as the end-cap hardware is tightened.

7. Check the housing captive nuts for corrosion and that they are not stripped or worn. Replace as necessary (see Replacing the Captive nuts). Captive nuts snap into place with the small bump facing the housing.
8. Examine the end-cap assembly bolts and washers for corrosion; replace if necessary.

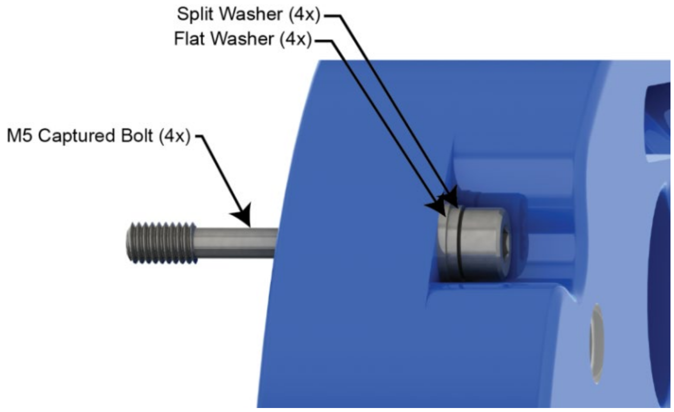


Figure 55. End-Cap Mounting Hardware

9. Install all four sets of hardware until “finger-tight.”
10. Tighten the bolts in small increments in a “cross” pattern until the split washer begins to flatten out.
11. Use a torque wrench to tighten the bolts to the recommended torque value of 1.7 Nm (15 Pound-Force Inch).

Apply equal pressure to the O-ring as the bolts are tightened. If one bolt is tightened more than the others, the O-ring can become pinched or torn. A damaged O-ring will cause the system to flood.

Do not over tighten the bolts that hold the transducer, housing and end cap together. If the bolts are over-tightened, the housing bolts or captive nut threads can strip, crack, or break causing the system to flood. On the other hand, leaving the bolts too loose can cause the system to flood.

Tighten the hardware to 1.7 Nm (15 Pound-Force Inch).

If a torque wrench is not available, tighten the bolt until the split washers are flat, and then turn the bolt ¼ turn more.

Replacing the Transducer Head Assembly

To replace the transducer head assembly:

1. Stand the Sentinel V ADCP on its end-cap on a soft pad.
2. Inspect, clean and lubricate the O-ring on the housing (see Replacing the O-ring). Ensure that the O-ring is firmly pressed into the groove.

> TRDI recommends using a new transducer head O-ring whenever the ADCP is opened.

3. Replace the desiccant (see Replacing the Desiccant). Ensure that the desiccant will not press on the electronics.
4. Reconnect the internal I/O connector.
5. Gently lower the transducer head/electronics assembly into the housing, aligning the mating holes and the alignment mark embossed on the transducer with the alignment mark embossed on the housing. When mating the housing with the transducer head flange try to apply equal pressure to all parts of the O-ring. Make sure the face O-ring remains in the retaining groove.

> Check that no wires or any other object is pinched between the transducer head and the housing. If the O-ring is not in the groove or if a wire or other object is pinched, the Sentinel V ADCP will flood.

6. Examine the transducer head assembly bolts and washers for corrosion; replace if necessary.
7. Check the housing captive nuts are not stripped or worn. Replace as necessary (see Replacing the Captive nuts). Captive nuts snap into place with the small bump facing the housing.
8. Tighten all four sets of hardware until "finger tight."
9. Tighten the bolts in small increments in a "cross" pattern until the split washer begins to flatten out and then use a torque wrench to tighten the bolts to the recommended torque value of 1.7 Nm (15 Pound-Force Inch).

> Apply equal pressure to the O-ring as the bolts are tightened. If one bolt is tightened more than the others, the O-ring can become pinched or torn. A damaged O-ring will cause the system to flood.
>
> Do not over tighten the bolts that hold the transducer, housing and end cap together. If the bolts are over-tightened, the housing bolts or captive nut threads can strip, crack, or break causing the system to flood. On the other hand, leaving the bolts too loose can cause the system to flood.

> If a torque wrench is not available, tighten the bolt until the split washers are flat, and then turn the bolt ¼ turn more.

Replacing the Sentinel V Battery

One of the most often preformed maintenance tasks is battery replacement. The Sentinel V Series ADCP uses battery packs, Lithium battery packs, or individual D cell batteries to provide power. The housing will be different lengths depending on the type of batteries used (see Outline Installation Drawings for dimensions and weights).

When the capacity of a battery pack is 50% used, the voltage falls to approximately 14 volts. However, keep in mind that this voltage is not an accurate predictor of remaining capacity. Batteries should be replaced when the voltage falls below 11 VDC.

Do not leave the battery pack inside the Sentinel V for extended periods. The battery may leak, causing damage to the electronics.

Sentinel V battery packs are shipped inside the system but not connected. Connect the battery and seal the Sentinel V before deployment.

Sentinel V with D cells are shipped without batteries inside the system. Install the batteries and seal the Sentinel V before deployment.

Battery replacement induces both single and double cycle compass errors. The compass should be aligned after replacing the battery pack.

Testing the Lithium Battery Pack

The optional Lithium battery pack includes a safety circuit that turns the battery off at its end of life, before the battery fully discharges. This happens when about 97% of the battery's capacity is depleted. The circuit also protects the battery and users against short circuits and provides users the ability to test the pack. When the battery detects a short circuit, it waits about 300 us, and then it turns itself off. A red LED on the circuit indicates when it detects a short. The circuit monitors the load across the battery and as soon as the load is removed, it displays the results of its self-test.

Before installing the Lithium battery pack run the self-test by shorting the battery's pins with a bent paperclip. The LED display lasts approximately 10 seconds and indicates the battery status:

- A continuous green LED tells you the battery is new.
- A flashing green LED tells you the battery has been used, but can still power an ADCP.
- A continuous red LED tells you the battery has been disconnected at its end of life and cannot be used any more.
- If there is no LED light at all, the circuit is defective and you should not use the battery.

You should run the self-test when you receive new lithium battery packs. This way, there is time to replace defective batteries before you deploy. You should also run the self-test just before installing the battery.

Instruments with high inrush currents occasionally trigger the optional Lithium battery pack short circuit detection, which turns the battery off. If this happens, do the following:

Disconnect the battery and touch the ADCP's touch sensor for about 45 seconds to one minute. Connect the battery and then the ADCP should power on normally.

If the ADCP still does not power on, connect the AC adapter and wait for a minute and then connect the battery pack. Once the ADCP is connected and ReadyV started, unplug the AC adapter. The ADCP will work normally after that.

Replacing the Battery Pack

Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

To replace the battery pack:

1. Remove the end-cap (see Removing the End-Cap).
2. Disconnect the black/red battery cable.
3. Place the ADCP on its end on a table/floor and lift the battery pack out of the housing by the battery handle. **Do not pull out the battery using the battery cable.**

Never pull on the black/red battery pack power cable to remove the battery pack. The cable will break and may cause the battery pack to short.

Do not drop the battery pack.

Run the self-test when you receive new lithium battery packs.

Lithium batteries are approximately ½ inch longer than alkaline batteries. Use the battery spacer with alkaline batteries; remove the battery spacer if you are using a lithium battery pack (see Figure 49, page 97).

Use the battery handle to lift out the battery. Optionally, tip the ADCP on its side to slide the battery pack out.

4. Use the battery spacer with alkaline batteries; remove the battery spacer if you are using a lithium battery pack (see Figure 49, page 97).
5. Slide in the new battery pack. Make sure the I/O cable is not pinched by the battery pack.
6. Connect the battery cable.
7. Replace the desiccant (see Replacing the Desiccant).
8. Install the end-cap (see End-cap Replacement).
9. Use the System checks panel to set the date the battery was replaced.
10. Align the compass (see Compass Calibration).

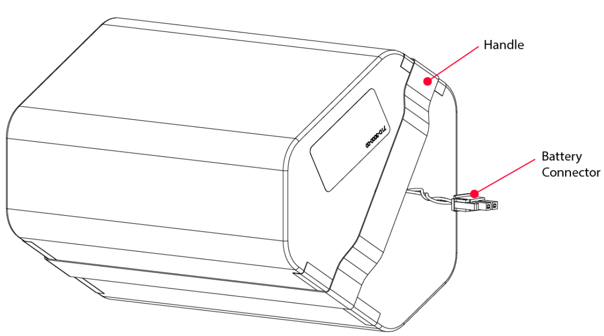


Figure 56. Battery Pack

Disposal of used battery packs should be done in accordance with applicable regulations, which vary from country to country. In most countries trashing of used batteries is forbidden and disposal can be done through non-profit organizations mandated by local authorities or organized by professionals.

Replacing Individual D Cell Batteries

Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

The Sentinel V loose-battery housing uses 12 D cell alkaline batteries.

Ensure that proper polarity is observed when installing batteries.

Do not mix old and new batteries.

Do not mix alkaline with non-alkaline batteries.

Do not use damaged batteries.

Do not mix batteries of different brands.

Do not use expired batteries.

Do not leave the batteries inside the Sentinel V for extended periods. The batteries may leak, causing damage to the electronics.

Store the batteries in a cool, dry location (0 to 21 degrees C).

To replace the D cell batteries:

1. Remove the end-cap (see Removing the End-Cap).
2. Remove the battery cover plate by loosening the knob (rotate counterclockwise).
3. Slide out the used batteries.
4. Slide in the new batteries starting with the three batteries in the center with the negative side up. Next place the other three batteries with the negative side up. Place the last six batteries on the outer edges with the positive side up. See Figure 56 for battery orientation.
5. Ensure all batteries are fully seated by pushing them all the way down into the battery cavity.
6. Position the cover plate over the batteries.
7. Tighten the knob firmly until the cover plate is flush with the surrounding surface to hold the batteries in place.
8. Replace the desiccant (see Replacing the Desiccant).
9. Install the end-cap (see Replacing the End-cap). As the end-cap is placed on the housing, check the cables lay flat and do not become pinched.

   Check that no wires or any other object is pinched between the End-Cap and the housing. If the O-ring is not in the groove or if a wire or other object is pinched, the Sentinel V ADCP will flood.

   If the battery cover is loose, the D cell batteries may make intermittent contact or it may interfere with the end-cap properly closing. Tighten the knob until the cover plate is flush with the surrounding surface.

10. Use the System checks panel to set the date the batteries were replaced.
11. Align the compass (see Calibrating the Compass).

Disposal of used batteries should be done in accordance with applicable regulations, which vary from country to country. In most countries trashing of used batteries is forbidden and disposal can be done through non-profit organizations mandated by local authorities or organized by professionals.

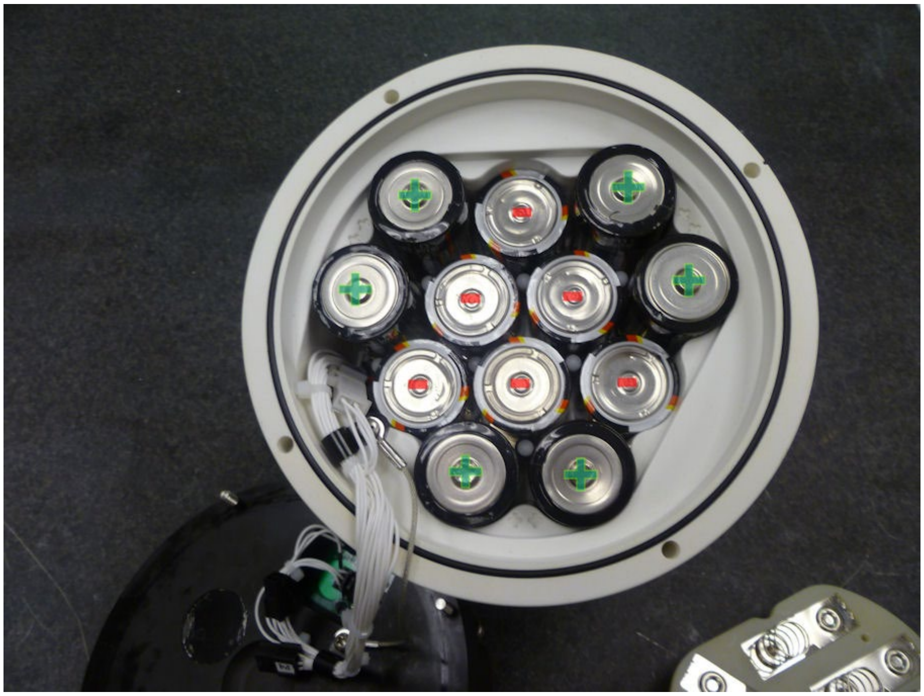


Figure 57. D cell Battery Replacement

Replace the three batteries in the center first to make it easier to maintain the proper spacing between batteries.

Replacing the External Battery Case Packs

The External Battery Case holds two battery packs that are shipped inside the case but not connected. Connect **BOTH** batteries and seal the external battery case before deployment. It is necessary to remove the top battery in order to connect the bottom battery cable.

To replace the external battery case battery packs:

1. Remove the end-cap (see Removing the End-Cap).
2. Disconnect the black/red battery cable on the top battery pack (see Figure 52 and Figure 57).
3. Tip the external battery case on its side to slide out both used battery packs and the rubber pad. **Do not pull out the batteries using the battery cables.**

Never pull on the black/red battery pack power cable to remove the battery packs. The cable will break and may cause the battery pack to short.

Tip the external battery on its side to slide out the used battery packs.

Remove the four bumpers at the bottom of the housing and the two bumpers on the end-cap if you are using lithium batteries.

4. Disconnect the black/red battery cable on the bottom battery pack.
5. Connect the battery cable to the new bottom battery pack and slide it into the case. The battery pack cable of the bottom battery pack faces the bottom of the housing.
6. Slide in the rubber cushion on top of the bottom battery pack.
7. Slide in a second battery pack and connect the battery cable. Make sure the cable is not pinched by the battery pack.
8. Connect the battery cable to the end-cap connector.
9. Replace the desiccant (see Replacing the Desiccant).
10. Install the end-cap (see End-cap Replacement).
11. Use the System checks panel to set the date the batteries were replaced.

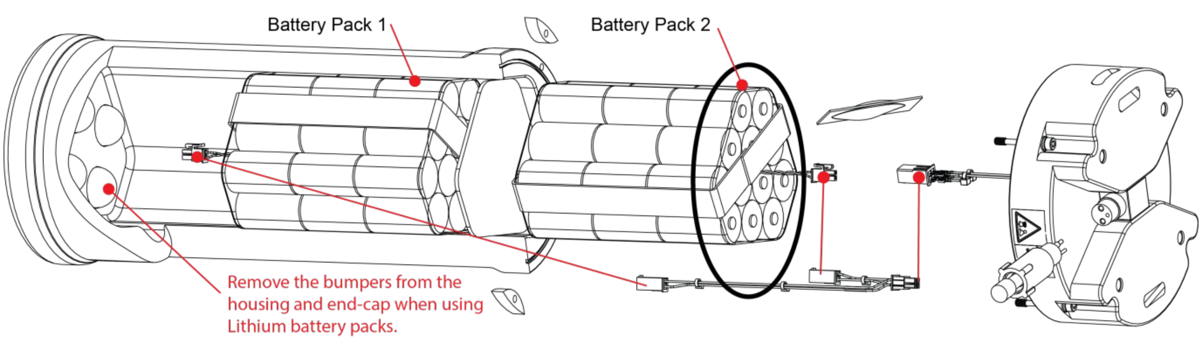


Figure 58. External Battery Case Internal Cable Connections

Calibrating the Compass

The compass calibration is a sequence of 12 rotations and tilts used to correct for distortions in the earth's magnetic fields caused by permanent magnets or ferromagnetic materials near the Sentinel V. These magnetic field distortions, if left uncorrected, will create errors in the heading data from the Sentinel V.

> A compass calibration should be conducted at each measurement location, and whenever the mounting fixture or ancillary equipment such as batteries are changed or rearranged.

The compass calibration for the Sentinel V can be conceptualized as the Sentinel V inside a sphere with twelve equally spaced points located on the sphere. The twelve points are the data collected during the compass calibration to orient the compass in different positions relative to the earth's magnetic field. Each of the twelve calibration points has a large impact on defining the sphere correctly. The calibration score (Table 5) is a measure of how well the measured calibration points combine to represent a uniform and complete sphere.

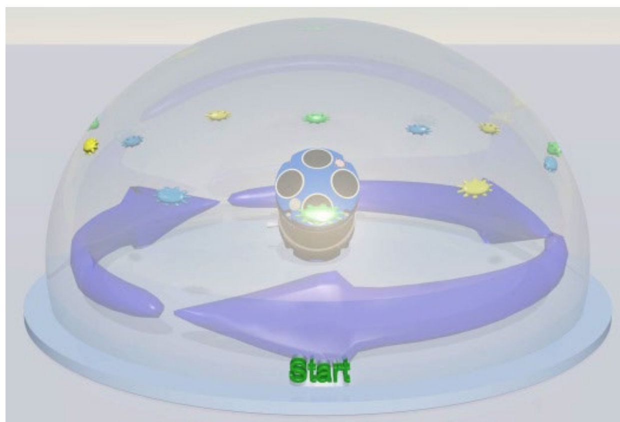


Figure 59. Calibrating the Compass

Be aware of the following items:

- Protect the Sentinel V 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.
- 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 bad calibration score. The exception to this rule is if the system is purposely being calibrated while mounted to a structure or system, and that structure or system is being rotated / manipulated along with the Sentinel V during calibration.
- Use a wood or plastic test platform at least 1 meter (~3 feet) high to move away from metal under the ground.
- The center of rotation for the twelve calibration points is around the transducer head (and therefore the compass). Try using a plastic cart with the system positioned with the transducer head above the fixed (non-swiveling) wheels on the cart. This allows you to spin the cart around to change directions without moving the compass too much around in space.
- The optimal angle of tilt during the standard compass calibration procedure is approximately 40 to 65 degrees. Less tilt during calibration is acceptable if the Sentinel V is not expected to be exposed to much tilt while deployed. This will be reflected in the z-coverage score.

- At high dip angles (which occur at latitudes near the magnetic poles) special care must be taken when calibrating the Sentinel V compass. First, the system must be tilted at a higher angle to ensure that the calibration points provide good coverage of the X, Y, and Z axes. Second, and possibly more important, is that at high dip angles the component of the magnetic field used to determine heading becomes very small. As such the Sentinel V compass becomes highly sensitive to any external influences seen during calibration, so it is important to ensure the calibration is performed in the most magnetically "clean" environment possible. TRDI recommends that if you are having trouble calibrating the Sentinel V compass that you move the system and/or ensure the area around the system is clear of electrical equipment and ferrous materials.
- The precision of the heading during calibration is not as critical as the tilts. Headings can be off by 10 degrees or more for any step. "By hand" and "by eye" calibrations are possible. The tilt angle precisions during calibration are important and should be followed as close as possible.
- If you are not using a calibration fixture, then having two people, one holding/rotating the Sentinel V, one controlling the computer, makes the compass calibration much easier.
- The Sentinel V checks for stability before it takes a calibration point. It should be held still in each position until the point is taken. There can be a delay in the acquisition of a calibration point after the **Take Sample** button is clicked. If the Sentinel V moved during the sample point, cancel the calibration and start over.
- The Sentinel V cannot be adequately calibrated without tilting the system during the compass calibration. A single plane calibration is not advised.
- The Sentinel V should be calibrated in the same orientation (beams-up/beams-down) as it will be deployed. Failure to do so will cause a 2 to 4 degrees RMS error on the compass reading which is outside of the specified heading accuracy for the Sentinel V.
- Calibration data points can be taken out-of-order if desired.
- The Sentinel V compass should be calibrated while mounted to the system or mounting structure whenever possible. The compass can negate hard and soft iron errors, but only if they are accounted for in the calibration.
- The last compass calibration score is shown on the first screen. If the last compass calibration resulted in a failed condition, it will show as Restored to Factory defaults.
- If you calibrate the compass and obtain a passing score and then try a second calibration and end up getting a lower score, there is no way to go back to the first calibration.
- If the compass calibration results in a "fail" condition, ReadyV will automatically reject it and restore the factory calibration.
- The Sentinel V compass should be calibrated after all battery changes.
- Remember that the Sentinel V will time out if no keys are pressed for five minutes and will power down after waiting five more minutes. If the compass calibration freezes, check the wireless connection. Use the Touch Sensor to restart.

Compass Calibration

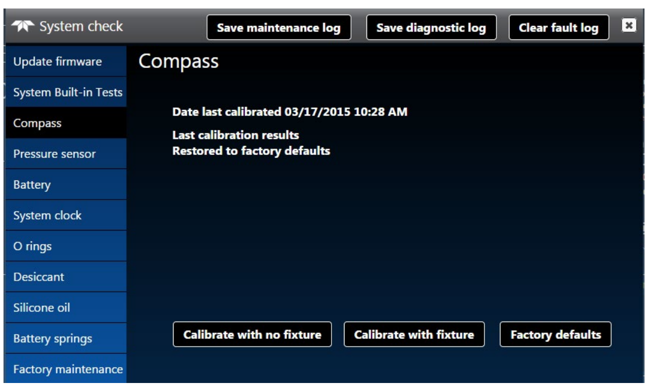
At high dip angles (which occur at latitudes near the magnetic poles) special care must be taken when calibrating the Sentinel V compass. First, the system must be tilted correctly (40 degrees for the first four cardinal directions and 65 degrees for the other eight calibration points) to ensure that the calibration points provide good coverage of the X, Y, and Z axes. Second, and possibly more important, is that at high dip angles the component of the magnetic field used to determine heading becomes very small. As such, the Sentinel V compass becomes highly sensitive to any external influences seen during calibration, so it is important to ensure the calibration is performed in the most magnetically "clean" environment possible.

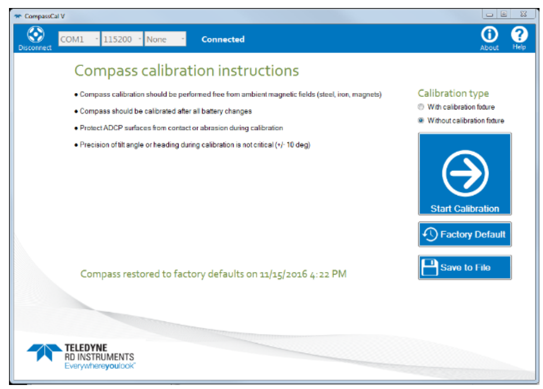
TRDI recommends that if you are having trouble calibrating the Sentinel V compass that you move the system and/or ensure the area around the system is clear of electrical equipment and ferrous materials.

To calibrate the compass:

1. Go outside, away from magnetic materials.
2. For Self-Contained systems, start ReadyV (see Connecting to the ADCP). Use the Step 4: System check panel to start the compass calibration. The last compass calibration score will display. Press the **Calibrate with no fixture** button to start.

   For Real-Time systems, Start *Sentinel V RT Utilities* and connect to the Sentinel V Real-Time (see Connecting to the Sentinel V Real-Time). Click **Compass Calibration**. Under **Calibration type**, select **Without calibration fixture**. Press the **Start Calibration** button to start.





3. Place the Compass Calibration Guide on a wood or plastic test platform at least 1 meter (~3 feet) high to move away from metal under the ground.

> Try using a plastic cart with the system positioned with the transducer head above the fixed (non-swiveling) wheels on the cart. This allows you to spin the cart around to change directions without moving the compass too much around in space.

> Note that the Calibration Step 1/START point of 0 degrees rotation is not an absolute heading direction; it can be in any (arbitrary) direction. For ease of use pick north or south or east or west of some other reference such as straight line(s) on the ground.
>
> Use the beam numbers embossed on the side of the transducer assembly to orient the ADCP.
>
> Use a wood or plastic test platform at least 1 meter (~3 feet) high to get away from metal under the ground.
>
> Place the ADCP on the Compass Calibration Guide or stand in the same orientation as it will be deployed (i.e. up or down).
>
> Use the transducer cover to protect the ADCP transducer faces during calibration.
>
> Have one person hold the ADCP while a second person operates ReadyV.

The optimal angle of tilt during calibration is 40 degrees for the first four cardinal directions (0, 90, 180, and 270) and 65 degrees for the other eight calibration points.

The center of rotation for the twelve calibration points is around the transducer head (and therefore the compass).

4. Place the ADCP on the Compass Calibration Guide in the same orientation as it will be deployed (i.e. up or down) (see Figure 59). Each of the 12 steps has two parts: rotate the ADCP so that beam 1 is pointed toward the correct angle, and then tilt the ADCP 40 degrees for steps 1 through 4 and 65 degrees for steps 5 through 12.

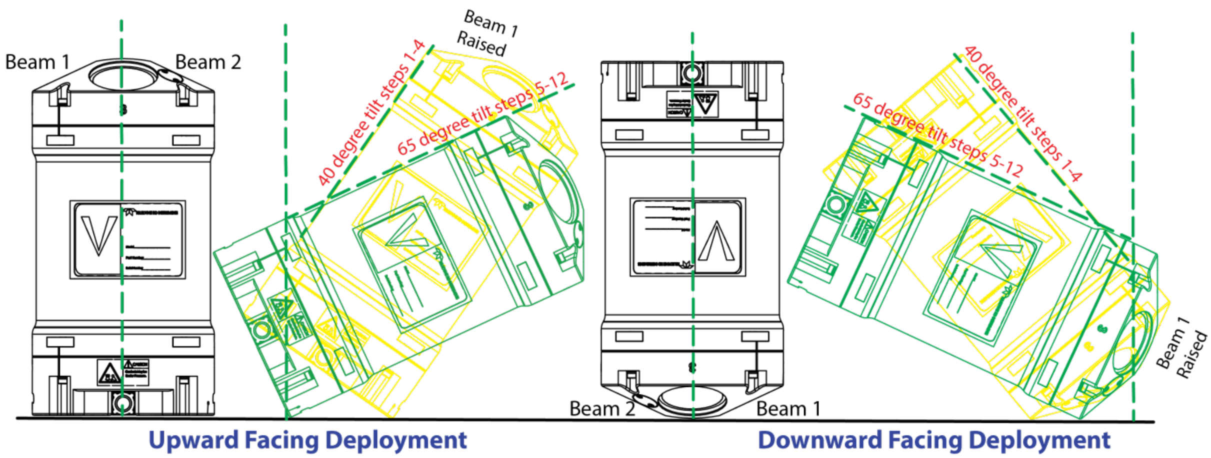


Figure 60. Upward or Downward Facing Deployment Hand-Held Compass Calibration

5. Hold the ADCP as still as possible at each step and click the **Take sample** button. The Sentinel V checks for stability before it takes a calibration point. It should be held still in each position until the point is taken.

There can be a delay in the acquisition of a calibration point after the Take sample button is clicked. If the Sentinel V moved during the sample point, cancel the calibration and start over.

Overview of the 12 steps:

Step 1: You may rotate the ADCP in any direction. This direction will be your "0 degrees". Rotate ADCP so the Beam 1 points to 0°, Tilt the ADCP 40 degrees so that Beam 1 is up.
Click the **Take sample** button.

Step 2: Rotate the ADCP so the Beam 1 points to 90°, Tilt the ADCP 40 degrees so that Beam 2 is up.
Click **Take sample**.

Step 3: Rotate the ADCP so the Beam 1 points to 180°, Tilt the ADCP 40 degrees so that Beam 1 is up.
Click **Take sample**.

Step 4: Rotate the ADCP so the Beam 1 points to 270°, Tilt the ADCP 40 degrees so that Beam 2 is up.
Click **Take sample**.

Step 5: Rotate the ADCP so the Beam 1 points to 30°, Tilt the ADCP 65 degrees so that Beam 2 and Beam 4 are up.
Click **Take sample**.

Step 6: Rotate the ADCP so the Beam 1 points to 60°, Tilt the ADCP 65 degrees so that Beam 1 and Beam 4 are up.
Click **Take sample**.

Step 7: Rotate the ADCP so the Beam 1 points to 120°, Tilt the ADCP 65 degrees so that Beam 1 and Beam 3 are up.
Click **Take sample**.

Step 8: Rotate the ADCP so the Beam 1 points to 150°, Tilt the ADCP 65 degrees so that Beam 2 and Beam 3 are up.
Click **Take sample**.

Step 9: Rotate the ADCP so the Beam 1 points to 210°, Tilt the ADCP 65 degrees so that Beam 2 and Beam 4 are up.
Click **Take sample**.

Step 10: Rotate the ADCP so the Beam 1 points to 240°, Tilt the ADCP 65 degrees so that Beam 1 and Beam 4 are up.
Click **Take sample**.

Step 11: Rotate the ADCP so the Beam 1 points to 300°, Tilt the ADCP 65 degrees so that Beam 1 and Beam 3 are up.
Click **Take sample**.

Step 12: Rotate the ADCP so the Beam 1 points to 330°, Tilt the ADCP 65 degrees so that Beam 2 and Beam 3 are up.
Click **Take sample**.

6. Once the calibration is complete, the Sentinel V ADCP provides a calibration score that indicates the quality of the calibration (see Table 7). If the Calibration Score is 7 or lower, repeat the compass calibration (see Troubleshooting a Bad Calibration Score).
7. Click **Save** to save the calibration results. Click the close button (☒) to exit the System check screen or to exit the *Sentinel V RT Utilities* software.

Using the Compass Calibration Stand

These instructions are fundamentally the same as the hand-held compass calibration instructions, just explained with a different frame of reference and the 12 calibration points are re-ordered to avoid excessive rotations.

1. Go outside, away from magnetic materials.
2. For Self-Contained systems, start ReadyV (see Connecting to the ADCP). Use the Step 4: System check panel to start the compass calibration. The last compass calibration score will display. Press the **Calibrate with fixture** button to start.

   For Real-Time systems, Start *Sentinel V RT Utilities* and connect to the Sentinel V Real-Time (see Connecting to the Sentinel V Real-Time). Click the **Compass Calibration** button. Under **Calibration type**, select **With calibration fixture**. Press the **Start Calibration** button to start.
3. Place the calibration fixture on a flat wood or plastic test platform at least 1 meter (~3 feet) high to get away from metal under the ground.

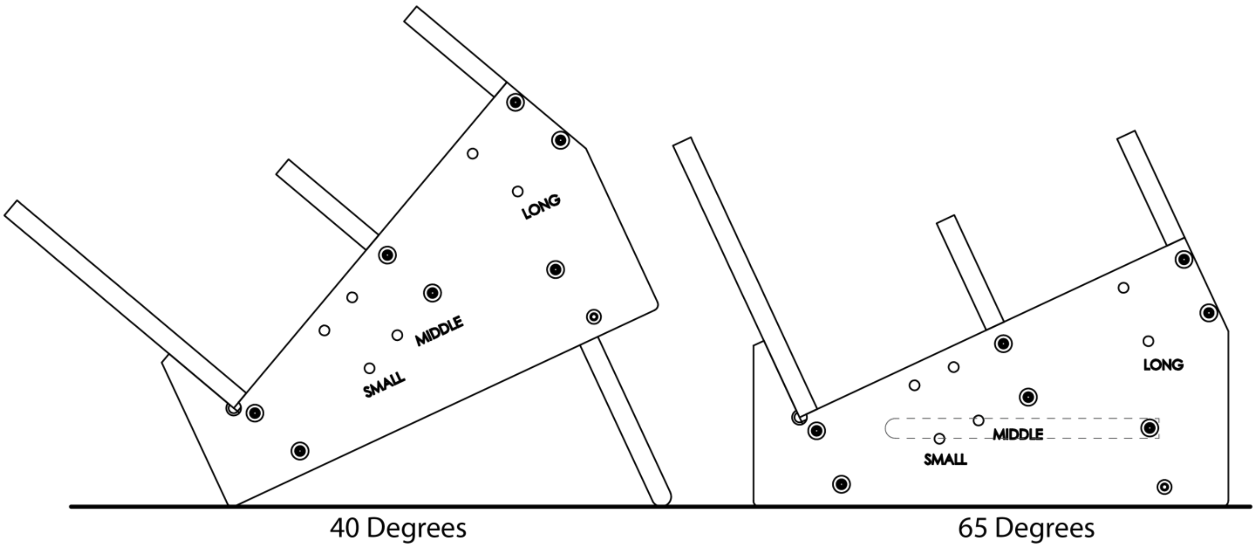


Figure 61. Compass Calibration Stand

4. Place the ADCP on the calibration fixture in the same orientation as it will be deployed (i.e. up or down). Each of the 12 steps has two parts: rotate the fixture so that ADCP transducer head is pointed toward the correct angle and then roll the ADCP on the fixture so that the correct beams are raised.

5. Set up the calibration fixture tilt angle to **40 degrees** by extending the support arm.

   Step 1: You may rotate the fixture in any direction. This direction will be your "0 degrees". Roll the instrument in the fixture so that Beam 1 is up. Click the **Take sample** button.

   Step 2: Rotate the fixture to 90°, roll instrument so that Beam 2 is up. Click **Take sample**.

   Step 3: Rotate the fixture to 180°, roll instrument so that Beam 1 is up. Click **Take sample**.

   Step 4: Rotate the fixture to 270°, roll instrument so that Beam 2 is up. Click **Take sample**.

6. Set up the calibration fixture tilt angle to **65 degrees** by retracting the support arm.

   Step 5: Rotate the fixture to 110°, and then roll instrument ⅛ turn so that Beam 2 and Beam 4 are up. Click **Take sample**.

   Step 6: Leave the fixture to 110°, and then roll instrument ¼ turn so that Beam 1 and Beam 4 are up. Click **Take sample**.

   Step 7: Rotate the fixture to 160°, and then roll instrument ¼ turn so that Beam 1 and Beam 3 are up. Click **Take sample**.

   Step 8: Leave the fixture to 160°, and then roll instrument ¼ turn so that Beam 2 and Beam 3 are up. Click **Take sample**.

   Step 9: Rotate the fixture to 290°, and then roll instrument ¼ turn so that Beam 2 and Beam 4 are up. Click **Take sample**.

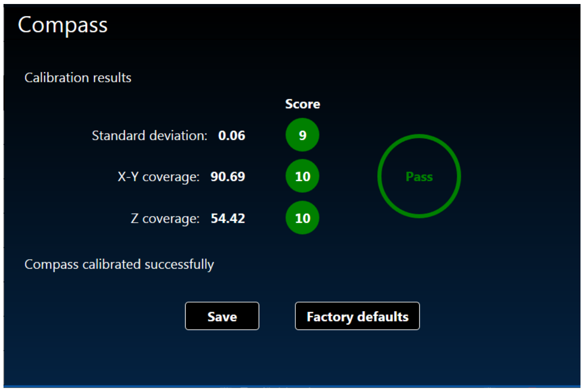
   Step 10: Leave the fixture to 290°, and then roll instrument ¼ turn so that Beam 1 and Beam 4 are up. Click **Take sample**.

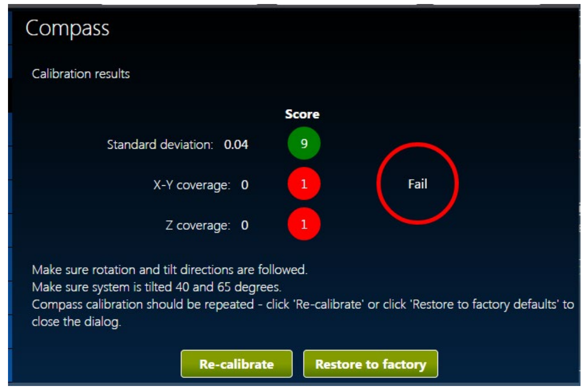
   Step 11: Rotate the fixture to 340°, and then roll instrument ¼ turn so that Beam 1 and Beam 3 are up. Click **Take sample**.

   Step 12: Leave the fixture to 340°, roll instrument ¼ turn so that Beam 2 and Beam 3 are up. Click **Take sample**.

7. Once the calibration is complete, the Sentinel V ADCP provides a calibration score that indicates the quality of the calibration (see Table 7). If the Calibration Score is 7 or lower, repeat the compass calibration (see Troubleshooting a Bad Calibration Score).
8. Click **Save** to save the calibration results. Click the close button (☒) to exit the System check screen or to exit the *Sentinel V RT Utilities* software.

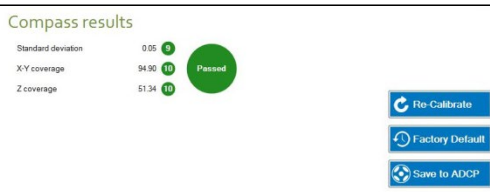
Calibration Score

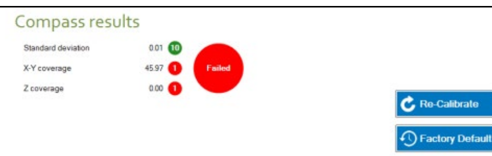




ReadyV Pass

ReadyV Fail





Sentinel V RT Utilities Pass

Sentinel V RT Utilities Fail

Table 7. Compass Calibration Score

Standard Deviation		X-Y Coverage		Z Coverage	
Score	Action	Score	Action	Score	Action
10	**Good field uniformity.**	10	**Good X-Y coverage.**	10	**Good Z coverage.**
9		9		9	
8		8		8	
7	**Moderate field uniformity.** Make sure the area is clear of magnetic materials (steel, iron, magnets, changing magnetic fields).	7	**Moderate X-Y coverage.** Follow the rotation and tilt directions. Use a 40 to 65 degree tilt during calibration.	7	**Moderate Z coverage.** Follow the tilt directions and use a 40 to 65 degree tilt during calibration.
6		6		6	
5	**Poor field uniformity.** Move to a different location outside and away from metal, machines, and electronics and repeat the compass calibration.	5	**Poor X-Y coverage.** ADCP was over-tilted - repeat the compass calibration.	5	**Poor Z coverage.** ADCP was not tilted enough - repeat the compass calibration.
4		4		4	
3		3		3	
2		2		2	
1		1		1	

Troubleshooting a Low Calibration Score

If the calibration score is low:

Remember, a score of 10/10/10 is not required to pass the compass calibration. A score of 8 or 9 in any of the three fields is sufficient to get accurate compass headings.

If the **Standard Deviation** score is 7 or lower, there may be several factors contributing to this problem:

- Nearby sources of dynamic interference – computer monitors, test equipment, etc., that can generate time-varying magnetic interference in the environment.
- Nearby sources of static interference – hard and soft iron in the nearby shelving, rebar, steel, iron, magnets, changing magnetic fields, etc.
- Moving the compass in space between points in the calibration can cause the **Standard Deviation** score to get worse when calibrating in a magnetically noisy environment. Make sure that the compass module is the center of rotation for the instrument in all the various orientations to substantially lower the standard deviation score.
- Remove phones and metal objects from pockets.
- When in doubt, calibrate outside and away from metal, machines, and electronics.

If the **X-Y coverage** score is 7 or lower, make sure the rotation directions and tilts are followed. The compass calibrations procedures use 40 degrees tilt for steps 1 through 4 and 65 degrees for steps 5 through 12 during calibration is desired. Over-tilting can also lower this score.

If the **Z coverage** score is 7 or lower, it usually means the system was not being tilted enough during calibration (a score of 1 means the system was not tilted at all).

Restore to Factory Defaults

If the compass calibration fails after repeated attempts, use the **Restore to factory defaults** button. This will use the factory calibration of the compass module itself as it was shipped from the vendor, not a system level calibration at the time of manufacture at TRDI. This calibration will not take into consideration variables such as magnetic fields from batteries or mounting fixtures. The assumption is a factory calibration may be better than a failed field calibration result.

Periodic Maintenance

Periodic maintenance helps keep the Sentinel V so it is ready for a deployment. Use the following tables to order replacement parts.

Training videos are available on https://www.video.teledynemarine.com/page/RD_INSTRUMENTS.

Table 8: Sentinel V ADCP Spare Parts

Part No	Description	Where Used
2-163	O-Ring, EPDM, DURO 70	See Replacing the O-ring
5020	Silicone Lubricant, 4-Pack	
81D-6003-00	O-Ring Tool	
DES2	Desiccant, Silica Gel, 5 GR, 1 1/16 X 2 3/4"	See Replacing the Desiccant
6958A14	Hex Key, 4mm, Long Arm	See Disassembly and Assembly Procedures
81D-4002-00	Nut-Insert, Housing	
81D-4003-00	Captured Bolt, Housing	
M3X0.5X8FHN	Screw, Flat Head, Nylon, Black	See Filling the Pressure Sensor Cavity with Oil
75BK6004-00	Kit, Fill, Silicone Oil	
71D-3000-00	Battery Pack, 18 VDC, 36 D cell	See Replacing the Battery Pack
TLP83182/D/V3	Lithium Battery Pack, 15.6 VDC	

Table 9: Sentinel V ADCP Repair Kits

Part No	Description	Where Used
75DK6001-00	Tools and Spares Kit	See Disassembly and Assembly Procedures
75DK6015-00	V Series & External Battery Case Close-up Kit	
75DK6002-00	Battery Contact Replacement Kit	See Replacing the Battery Springs
75DK6003-00	Battery Separator Replacement Kit	See Replacing the Battery Separators
75DK6018-00	Touch Sensor Replacement Kit	See instructions included with the kit.
75DK-6016-00	End-Cap Connector Replacement Kit, Right-Angle	See instructions included with the kit.
75DK-6016-01	End-Cap Connector Replacement Kit, Straight	
75DK-6017-00	External Battery Case Connector Replacement Kit, Right-Angle	See instructions included with the kit.
75DK-6017-01	External Battery Case Connector Replacement Kit, Straight	

Running the Built-in Tests

The built-in tests can help isolate problems to a major functional area of the Sentinel V ADCP. For troubleshooting information, see Troubleshooting.

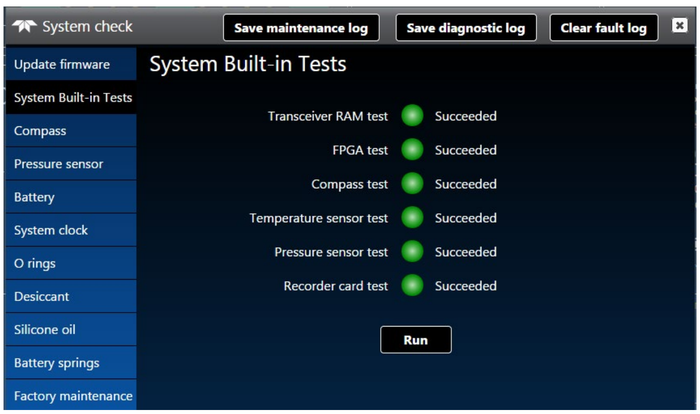
Test the ADCP:

- When the system is first received.
- Before each deployment or every six months.
- When you suspect instrument problems.
- After each deployment.

Testing the Sentinel V Self-Contained

To run the tests on a Self-Contained system:

1. Start ReadyV and Connect to the ADCP.
2. On the Step 4: System check panel, click the **System Built-in Test** tab.
3. To run the tests and view the test results, click the **Run** button.
4. If a test fails, see the Troubleshooting section.



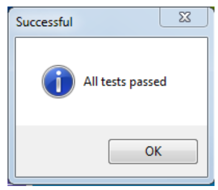
Testing the Sentinel V Real-Time

To run the tests on a Real-Time system:

1. Start *Sentinel V RT Utilities* and connect to the Sentinel V Real-Time ADCP.
2. Click on the System Tests **Run** button.

For help on using *Sentinel V RT Utilities*, see the Sentinel V RT Utilities help file.
For help on Sentinel V Real-Time ADCP commands, see Chapter 8 – Real-Time Commands.

3. Click **OK** at the **All tests passed** screen. If a test fails, see the Troubleshooting section.



Dock Side Tests

The following checks should occur at Dock Side prior to performing the Sea Acceptance Tests. These tests will verify the Sentinel V RT ADCP is ready for the Sea Acceptance Tests and confirm the peripherals attached to the ADCP.

These tests only apply to moving vessel deployments.

Dock Side Diagnostic Test

The following test will confirm the connection of the Deck box to the Transducer or Sentinel V RT ADCP to the computer.

Table 10: Dock Side Test Set Up

Set up	Description
Platform/Vessel	The vessel should be tied to the dock or at anchor. The transducer should be in water. All other sonar devices and equipment should be turned off.
Sentinel V RT	Connect the ADCP as described in Connecting to the Sentinel V Real-Time. The Gyro/Navigation connection may or may not be connected at this point.
Computer	The *TRDI Toolz* program should be running, communications port setting (F5) to match the connection to the PC and Sentinel V RT ADCP baud rate requirements (default 9600,N,8,1).

Use the following steps to interconnect the Sentinel V RT system and to place the ADCP in a known state.

1. Interconnect and apply power to the system as described in Connecting to the Sentinel V Real-Time.
2. Start the *TRDI Toolz* program.
3. Press **End** to wake up the ADCP. Send the PA command to the ADCP.

Dock Side Peripheral Tests

The Sentinel V RT requires (at minimum) input for heading (true north) and for position fixes (GPS). Additionally, the Sentinel V RT can make use of pitch and roll data to correct for the tilt.

Heading can be input and combined with Sentinel V RT data in the computer software *VmDas*. This heading input is done through the communications port of the computer with the NMEA 0183 string $HDT or $HDG as specified in the **Transforms** tab in *VmDas*.

Pitch and Roll can be input and combined with Sentinel V RT data in the computer software *VmDas*. This heading input is done through the communications port of the computer with the TRDI proprietary NMEA string $PRDID.

Navigation data can only be combined with Sentinel V RT data in the computer software *VmDas*. This navigation input is done through the communications port of the computer with the NMEA proprietary strings $GGA and $VTG.

See the VmDas User's Guide and/or the WinRiver II User's Guide for help on integrating NMEA Devices.

Table 11: Dock Side Peripheral Tests Set up

Set up	Description
Platform/Vessel	The Gyro, Navigation, and Pitch/Roll sensors should be attached to the appropriate place on either the Sentinel V RT deck box or the computer communication port. The devices should be on and should stable (in the case of gyros this may require a spin up time of up to 12 hours).
Sentinel V RT	The Sentinel V RT should be connected as described in Connecting to the Sentinel V Real-Time, AC Power connected to the deck box/ADCP, and the power switch turned on.
Computer	The *TRDI Toolz* program should be running, communications port setting (F5) to match the connection to the PC and Sentinel V RT ADCP baud rate requirements (default 9600,N,8,1).
Power	The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

Testing the Navigation Connections to the Compute (VmDas)

Start *VmDas* in the Data Collect mode. On the **View** menu, select **NMEA Communications**. Confirm that the Navigation Device NMEA string is viewable and the $GGA string is present.

The **Navigation Data** window in *VmDas* (see Figure 62) shows a text box of the position and velocity data from a NMEA navigation device. You can use this to verify the navigation connections.

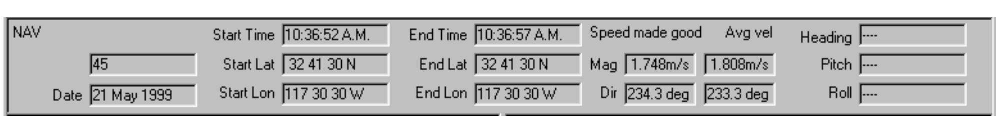


Figure 62. Testing the Navigation Connections

Testing $HDG Heading Connections to the Computer (VmDas)

Start *VmDas* in the Data Collect mode. On the **View** menu, select **Nmea Communications**. Confirm that the Navigation Device NMEA string is viewable and the $HDG string is present. Note that the data for this information may appear on the same communications port as the navigation data or on a separate input port.

Testing $PRDID Heading Connections to the Computer (VmDas)

Start *VmDas* in the Data Collect mode. On the **View** menu, select **Nmea Communications**. Confirm that the Navigation Device NMEA string is viewable and the $PRDID string is present. Note that the data for this information may appear on the same communications port as the navigation data or on a separate input port.

Testing the Navigation Connections to the Computer (WinRiver II)

Start *WinRiver II* in the Acquire mode. On the **View** menu, select **Device Logs**. Confirm that the Navigation Device NMEA string is viewable and the $GGA string is present.

WinRiver II can be used in place of *VmDas* with the following exceptions:

- WinRiver II does not accept any external tilt sensor input.
- WinRiver II does not support Ethernet communications. Use serial communications.

Table 12: Dock Side Peripheral Test Results

Test	Test Criterion
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $GGA string is present.
External Heading NMEA Connection Test	Verify that the Navigation Device NMEA string is viewable and the $HDT or $HDG string is present.
External Heading NMEA Connection Test	Confirm that the Navigation Device NMEA string is viewable and the $PRDID string is present.

Sea Acceptance Tests

This procedure is intended to test the Sentinel V RT at sea. This procedure assumes that the Dock Side Testing (see Dock Side Tests) procedure has been run and that all of the items have passed or been confirmed to be operational. The following tests will not obtain favorable results unless all of this work has been performed.

These tests only apply to blue water moving vessel deployments using *VmDas*. See the VmDas User's Guide for instructions on how to use this program.

The reason for Sea Acceptance Testing is that although the Dock Side Tests confirm the Sentinel V RT is operational, they do not confirm that the system is able to perform to its specifications. The performance of any ADCP relies greatly upon the installation into any platform. Therefore, the system must be tested at sea to understand the effects of the platform on the ADCP performance.

At Sea Testing includes tests for Acoustic Interference, Profiling Range, and Profiling Reasonableness testing. For each of these tests, the following equipment and ADCP set up requirements are recommended.

Equipment Required

- Sentinel V RT V20, V50, or V100 with firmware 66.02.00.05 or greater
- Computer
- *VmDas* Program

- *WinADCP* Program
- Navigation Interface Connected
- Heading Interface Connected

VmDas Set up

1. Start *VmDas*. On the **File** menu, click **Collect Data**. On the **Options** menu, click **Load**. Select the Default.ini file and click **Open**.
2. On the **Options** menu, click **Edit Data Options**. Click the **ADCP Setup** tab. Set the **Ensemble Time** to the **Ping as fast as possible**.
3. On the **Options** menu, click **Edit Data Options**. Click the **Averaging** tab. Set the **Short-Term Average** to 300 seconds (5 minutes). Set the **Long-Term Average** to 600 seconds (10 minutes).

Interference Test

The Sentinel V RT transmits and receives acoustic signals from the water. If other sonar devices are operating on the platform at the same time as the ADCP it is possible for those signals to bias the ADCP data. Therefore, all ADCPs must be tested to ensure that they are not receiving interference from other sonar equipment on board the vessel.

The following Interference Test will determine if there is interference from other devices.

Interference Test Platform Test Set up

This test requires that the platform be in water deeper than the ADCP's maximum expected profiling range. Use the following table to determine the minimum water depth required.

Table 13: Interference Test Minimum Water Depth Requirement

300 kHz ADCP	600 kHz ADCP	1200 kHz ADCP
400 meters	150 meters	60 meters

The platform speed for this test is drifting. The motors may be running if required for platform safety. The test sequence starts with ALL sonar and non-essential electronic equipment turned off. Only the ADCP should be on for the first test. This test establishes a base line for the interference and is critical to the rest of the tests. After a 10-minute period the first sonar device is turned on, transmission started, and the data is reviewed for interference terms. At the end of this 10-minute period the first sonar device is turned off and then the next sonar device is turned on and started pinging for 10 minutes. This process repeats for each of the sonar devices.

Interference Test Computer Screen Display Set up

View the RAW data (*.ENR files) being collected by the *VmDas* program in the *WinADCP* program contour plots for echo intensity data. This data will show the single ping return levels.

How to Identify Interference

If there is an interference term, the echo intensity data will show spurious echo intensity jobs. An example of what an interference term may look like what is shown in Figure 63.

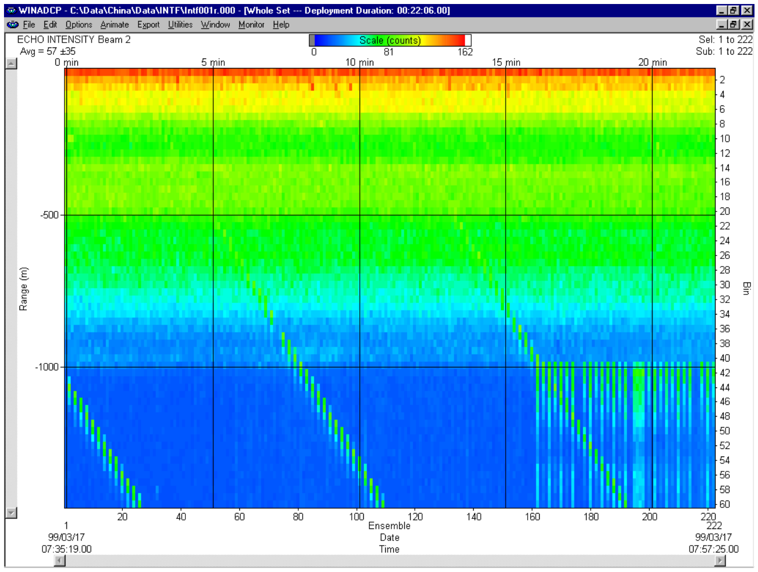


Figure 63. Interference Test

The interference term appears as the periodic green blocks in the data set. The interference is some what lost in the upper part of the profile however it can be seen clearly seen once the system reaches the noise floor (the point where signals are no longer being returned from the water).

Interference terms such as above seen anywhere in the echo intensity profile data will result in a bias to the ADCP data.

Water Profile Range Test

The range of any ADCP is directly dependent on the level of backscattering material in the water, the transmit power into the water, the received sensitivity, and the level of the background noise. Each of these effects the range of the system in different ways, but in the end can result in reduced or extended range as follows.

- The ADCPs transmit power and receive sensitivity are fixed based on the transducer frequency. However, these may be affected by installation of an acoustic window in front of the transducer. A window will absorb both sound transmitted by the ADCP and the sound returned from backscatter in the water.
- The volume of the backscatter in the water will affect the range. All specifications for range assume that there is a certain amount of backscatter in the water. The backscatter volume is not controllable in any way.
- The background noise changes as the platform's speed increases or decreases. There are two types of noise created by the moving platform; first, there is the noise due to propeller and engines; and second, there is the noise created by the rushing water across the platform and ADCP transducer.

This test is used to determine the effects of the background noise on the range of the ADCP. This information can be used to determine the optimum speed of the platform to obtain the desired range required.

Water Profile Range Platform Test Set up

This test requires that the platform be in water deeper than the ADCP's maximum expected profiling range. Use the following table to determine the minimum water depth required.

Table 14: Water Profile Range Test Minimum Water Depth

V100	V50	V20
250 meters	100 meters	40 meters

The platform course for this test is a continuous straight line. The speed of the platform will be varied during this test. At each speed, the system will be set to collect data for a minimum of 10 minutes. The following table lists the recommended speeds.

Table 15: Water Profile Range Test Platform Speed

Test #	Speed
Speed 1	Drifting
Speed 2	3 knots
Speed 3	6 knots
Speed 4	9 knots
Speed 5	12 knots
Speed 6	Maximum Speed

Water Profile Range Computer Screen Display Set up

View the Tabular Display of the Long-Term Average data (10-minute averages) in the *VmDas* program.

How to Determine the Maximum Range of the ADCP

The data collected in the long-term average (10 minutes) tabular display will be used to determine the maximum range of the ADCP. The maximum profiling range of the system is determined by locating the last valid bin and then using that ping to determine the range. To determine the last valid bin the following criterion is used:

- The last bin must be above the bottom side lobe area
- The bin must be > 25% of the sum of 3-beams Solutions (percent good 1) and 4-beams Solutions (percent good 4), [(PG1 + PG4) > 25%].
- The correlation value for at least 3 beams must be above the threshold of 64 counts

Locate the last valid bin for each of the speeds and fill in the table below.

Platform Speed	Last Valid Bin Number	Range to Last Bin	Average RSSI Value at Last Bin

Notes:

- Platform Speed must be input as a measurement from the Bottom Track (if in range) or the GPS speed.
- Range to Last Bin is calculated as follows: ((bin size) * (last bin number)) + (NF command)

- Average RSSI Value at Last Bin is the average of the 4 beams RSSI values in the last bin number

The results from the above test should be compared to the specified nominal range of the system. Assuming that there are sufficient scatterers in the water, the acoustic window is not attenuating the signal, and that that the platform background noise is variable there should be a speed at which the nominal range of the system is obtained.

Ringing Test

The ADCP transmits an acoustic pulse into the water. The main lobe of this pulse bounces off particles in the water and the signals returned from these particles are used to calculate the velocity of the water. The main lobe of the transmitted pulse is what we are using to process and calculate a velocity. The transmitted pulse, however, is made up of many side lobes off the main lobe. These side lobes will come in contact with metal of the transducer beam itself and other items in the water.

The energy from the side lobes will excite the metal of the transducer and anything bolted to the transducer. This causes the transducer and anything attached to it to resonate at the system's transmit frequency. We refer to this as "ringing." If the ADCP is in its receive mode while the transducer is ringing then it will receive both the return signals from the water and the "ringing." Both of these signals are then processed by the ADCP. The ringing causes bias to the velocity data.

All ADCPs "ring" for some amount of time. Therefore, each ADCP requires a blanking period (time of no data processing) to keep from processing the ringing energy. Each ADCP frequency has a different typical ringing duration. A blanking period (time of not processing data) is required at the beginning of each profile. The blanking distances recommended for the typical ringing period for each Sentinel V RT frequency is shown in the following table.

Table 16: Recommended Blanking Distance

System	Blank Distance (Default)
Sentinel V100 (307.2 kHz)	160 cm
Sentinel V50 (491.52 kHz)	100cm
Sentinel V20 (983.04 kHz)	40 cm

Ringing will bias the velocity estimation to a lower value than it should be. However, when the platform motion is removed from the water profile data it will appear as a large velocity, which is the opposite of what it is really doing. This effect is caused because the vessel motion portion of the water profile data has been biased low.

Ringing Test Platform Test Set up

The key to success on this test is that the water velocity and direction does not change over the entire test period of 120 minutes. This may be difficult to adhere to in regions with large tidal effects. The test requires that the platform be within the ADCP bottom tracking range so that valid bottom track can be used. Use the following table to determine the optimum water depth range required.

Table 17: Ringing Test Water Depth Requirement

V100 ADCP	V50 ADCP	V20 ADCP
100-200 meters	50-100 meters	10-20 meters

Platform speed should be held to as fast a speed as possible without losing any bottom tracking data for a period of 30 minutes. Typically, this will be a speed of 6-9 knots. Some experimentation may be required to find the maximum bottom track speed for the given depths above.

Ringing Test Computer Screen Display Set up

The Magnitude and Direction Profile Display of the Long-Term Average data (10 minute averages) will be viewed in the *VmDas* program.

How to Determine the Ringing Test Results

Viewing the Long-Term average of the magnitude and direction profile data, look for unreasonable shears from bin 1 to bin 2 to bin 3 and so on. If an unreasonable shear is seen, this is most likely ringing and your blanking needs to be increased by the following formula:

(bin size) * (last bin number with ringing) * 0.80

*The total blanking period is typical blanking period plus the increased blanking period required. The above value should be used to change both the NF and WF commands in all configuration files for this ADCP.

Transducer Alignment Test

This test only applies to Sentinel V RT systems using an external heading.

The mounting alignment of the transducer to the relative position of the heading input from the vessel is critical in the velocity estimates made by the ADCP. If either of these are not known and corrected for, it will result in both directional and velocity estimate errors in the velocity data.

It is possible to confirm if the transducer alignment is correct by collecting data over the same water in several different directions. If the transducer is aligned, then the both the magnitude and direction of the currents will appear the same in all directions that the platform travels.

Platform Testing Setup

The key to success on this test is that minimal water velocity and direction change over the entire test period. The following test will take a minimum of five hours to collect. This length of time is required in order to obtain enough data samples to reduce the noise sufficiently. This test requires that the platform be within the ADCP bottom tracking range, so that valid bottom track can be used, and that reliable GPS data be available (DGPS is recommended). Use the following table to determine the optimum water depth range required.

Table 18: Transducer Alignment Test Water Depth Requirement

Sentinel V 100	Sentinel V 50
80-160 meters	25-75 meters

The platform speed is to be held at a constant speed. Any speed between 5 to 10 knots is acceptable, however once a speed is selected then the vessel should maintain that speed during the entire course. The course for this test contains a minimum of five legs. Each leg must be a minimum of 30 minutes long (1 to 2 hours per leg is the optimal time). The course of ship travel is shown in Figure 64. All data must be collected in beam coordinates.

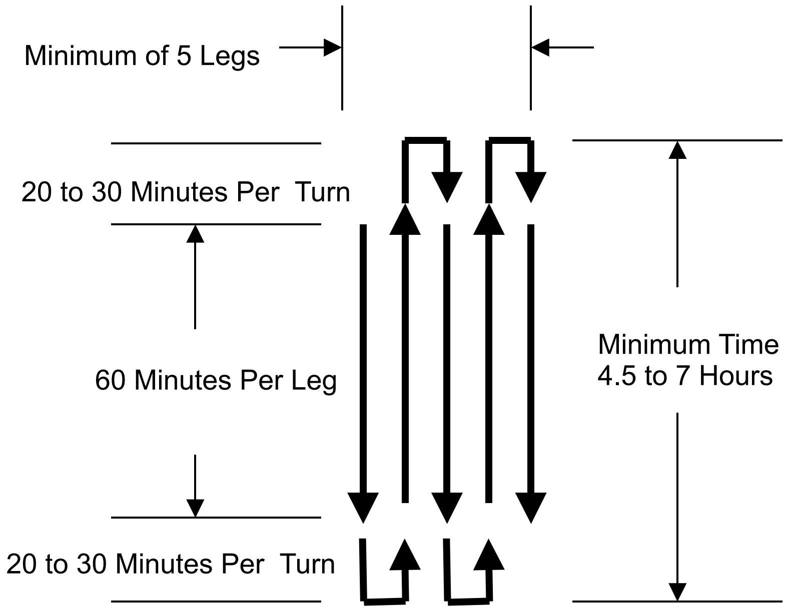


Figure 64. Transducer Alignment Test

Computer Screen Display Setup

View the *VmDas* ship track display of bin 3 with the bottom track reference. The Long-Term Average (5-minute averages) data should be viewed.

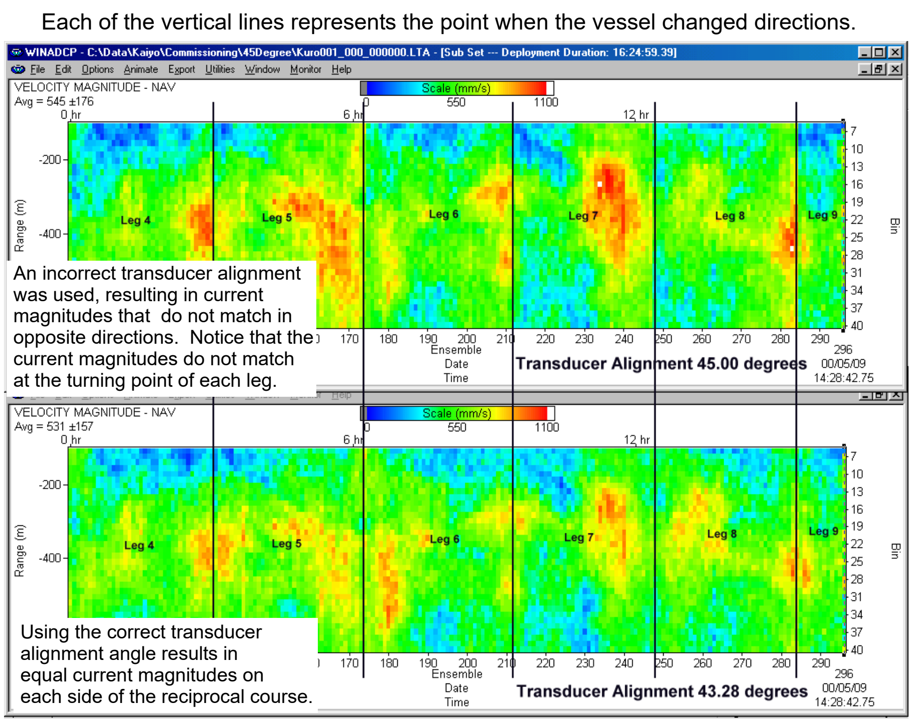


Figure 65. Transducer Alignment Display

Transducer Alignment Results Sheet

A pass condition is if the velocities in each of the ship track plotted directions has the reasonably the same magnitude and direction. It is common to see some wild velocity magnitude and directions. This happens as a result of the effects of the turn on the gyro heading device or the latency of the heading updates for a GPS heading input.

If the direction of the currents is not the same in each of the directions, then it will be necessary to enter in a transducer misalignment angle. The 5-minute averages of both GPS and Bottom Track Direction are compared in at least 2 of the legs traveled. An average direction along each leg is calculated for both the GPS and Bottom Track data. The difference in the average directions is the misalignment angle.

Record the results of this portion of the Transducer Alignment with Bottom Track Reference with the formula:

Misalignment Angle = (GPS Average Direction) – (Bottom Track Average Direction)

Misalignment Angle Required	Degrees

Changing the transducer alignment angle, reprocessing the data, and finally playing back the same data file again allows you to confirm if the misalignment angle correction is correct. A pass condition is if the velocities in each of the ship track plotted directions has the reasonably the same magnitude and direction. It is common to see some wild velocity magnitude and directions.

Record the results of the verification of the Transducer Alignment with Bottom Track Reference:

Alignment Verification	Pass/Fail

Change the data display reference from bottom track to the navigation data in the VMDAS program. A pass condition exists if little to no change in the velocity magnitude and direction occurred when switching to the navigation data reference

Record the results of this portion of the Transducer Alignment with Navigation Reference:

Navigation Verification	Pass/Fail

Water Profile Reasonableness Test

The mounting alignment of the Sentinel V RT transducer to the relative position of the heading input from the vessel is critical in the velocity estimates made by the ADCP. If either of these are not known and corrected for, it will result in both directional and velocity estimate errors in the water velocity data.

It is possible to confirm if the transducer alignment is correct by collecting data over the same water in several different directions. If the transducer is properly aligned, then both the magnitude and direction of the currents will appear the same in all directions that the platform travels.

Water Profile Reasonableness Platform Test Set up

The key to success on this test is that the water velocity and direction does not change over the entire test period of 120 minutes. This may be difficult to adhere to in regions with large tidal effects. The test requires that the platform be within the ADCP bottom tracking range so that valid bottom track can be used. Use the following table to determine the optimum water depth range required.

Table 19: Water Profile Reasonableness Water Depth Requirement

Sentinel V100	Sentinel V50	Sentinel V20
100-200 meters	50-90 meters	10-40 meters

Platform speed is held at a constant 5 knots during the entire course. The course for this test contains 4 legs. Each leg must be approximately 4500 meters (except for leg 2 which will be one half the length of each of the other legs). The course will appear as shown in Figure 66. The actual starting direction is not critical as long as the course completes the pattern shown in Figure 66.

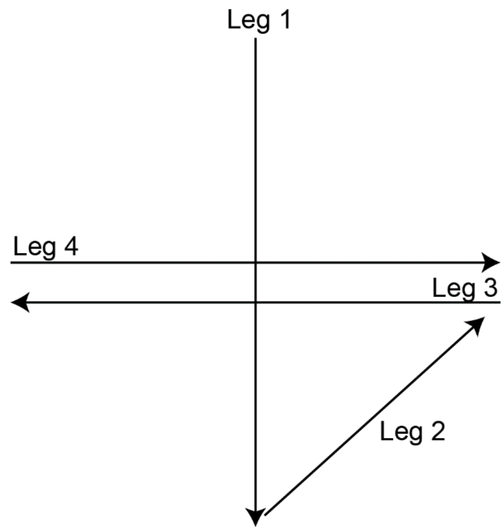


Figure 66. Water Profile Reasonableness Course

Water Profile Reasonableness Display Set up

View the *VmDas* Ship Track display of bin 3 with the bottom track reference. The Short-Term Average (5-minute averages) data should be viewed.

How to Determine Water Profile Reasonableness

A pass condition is if the velocities in each of the ship track plotted directions has reasonably the same magnitude and direction. It is common to see some wild velocity magnitude and directions during turns. This happens as a result of the effects of the turn on the gyro heading device or the latency of the heading updates for a GPS heading input.

If the direction of the currents is not the same in each of the four directions, then it will be necessary to enter in a transducer misalignment angle. Changing the transducer alignment angle and playing back the same data file again allows you to determine the misalignment angle. The best way to perform this check out is to use incremental change of 5-10 degrees at a time.

Assuming that the misalignment angle was not required or could be determined, it is now possible to use the same data just collected to determine how reasonable the navigation data input is. Change the data display reference from bottom track to the navigation data in the *VmDas* program. There should be little to no change in the velocity magnitude and direction if the navigation data is a valid input for a reference.

Bottom Tracking Test

The bottom tracking capability of the ADCP varies depending on the type of bottom (hard, soft, rock, sand, etc.), the slope of the bottom, and the speed of the vessel (background noise).

Before testing the Bottom Track capabilities, the Water Profiling Range Test must be performed. Through the results of this test, determine the platform speed in which the range to the last valid bin obtained the specified nominal range of the ADCP frequency being used.

If it was not possible to reach the specified nominal range during the Water Profiling Range test, then determine the speed at which it allowed the best range possible. Calculate the percentage of the nominal range that was obtained by the system.

Bottom Tracking Platform Test Set up

The key to this test is to operate the system in an area where both the minimum and maximum bottom tracking range can be obtained. The platform will travel over water that is very shallow (<10 meters) to very deep (greater than the maximum bottom track range). It does not matter if the water starts deep and goes shallow or vice-versa.

The course of the platform should be a relatively straight line. The platform speed should be no greater than the velocity recorded in the Water Profiling Range Test.

Bottom Tracking Computer Screen Display Set up

View the raw data display of the *VmDas* bottom track display window.

How to Determine Bottom Tracking Reasonableness

Viewing the bottom track velocity data, record the maximum and minimum average of the bottom track depths in the table below.

Beam Number	Minimum Depth (meters)	Maximum Depth (meters)
Beam 1		
Beam 2		
Beam 3		
Beam 4		

A pass condition is if the maximum depth of the system is equal to the specification for the nominal bottom track range.

> If the system was not able to water profile to the nominal range, then the bottom track range should be reduced to no more than the same percentage as the water profile loss.
>
> If the Bottom Track did obtain the complete range and the Water Profile did not, then it is likely that there is insufficient backscatter in the water to obtain the specified range.

Testing the Sensors

Test the sensors:

- When the system is first received.
- Before each deployment or every six months.
- When you suspect instrument problems.
- After each deployment.

Testing the Sentinel V Self-Contained Sensors

To test the sensors on a Self-Contained system:

1. Start ReadyV and Connect to the ADCP.
2. The System panel shows an overview of the Sentinel V ADCP configuration. Click on the Step 2: Review system panel to open the **Review system** panel as shown below.
3. Use the **Sensor data** panel to display the sensor values. Rotate and tilt the system and verify the Pitch and Roll sensor data is reasonable (see Table 20, page 135 and Figure 68 through Figure 70). 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.
4. If a sensor fails, contact TRDI Field Service.

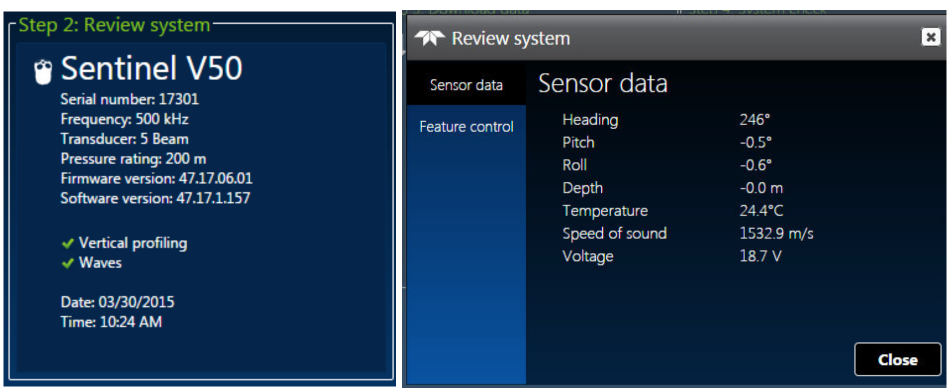


Figure 67. Sensor Data

Testing the Sentinel V Real-Time Sensors

To test the sensors on a Real-Time system:

1. Start *Sentinel V RT Utilities* and connect to the Sentinel V Real-Time ADCP. Start a deployment and select Terminal.
2. Send a break to stop the deployment and use the Terminal screen to send the PC2 command.

See the Real-Time Deployment Guide for information on how to deploy the system.
For help on using *Sentinel V RT Utilities*, see the Sentinel V RT Utilities help file.
For help on Sentinel V Real-Time ADCP commands, see Chapter 8 – Real-Time Commands.

```
>pc2
Sensor data is sampled and displayed in a loop.
An asterisk '*' to the right of a number indicates invalid data.
Press any key to exit the loop.

Count   Temp(C)  Heading    Pitch     Roll  Up/Down Depth(m) Batt(V) Batt(A)
\  9    22.812   340.08    -2.18     1.20     Down    0.000*  11.751   0.156
```

3. Use the **PC2** test to view the sensor values. Rotate and tilt the system and verify the Pitch and Roll sensor data is reasonable (see Table 20, page 135 and Figure 68 through Figure 70). 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 or shows as invalid data, zero the pressure sensor.
4. If a sensor fails, contact TRDI Field Service.

Sensor Data

This section shows the raw pitch, roll, and heading as received by the internal sensor.

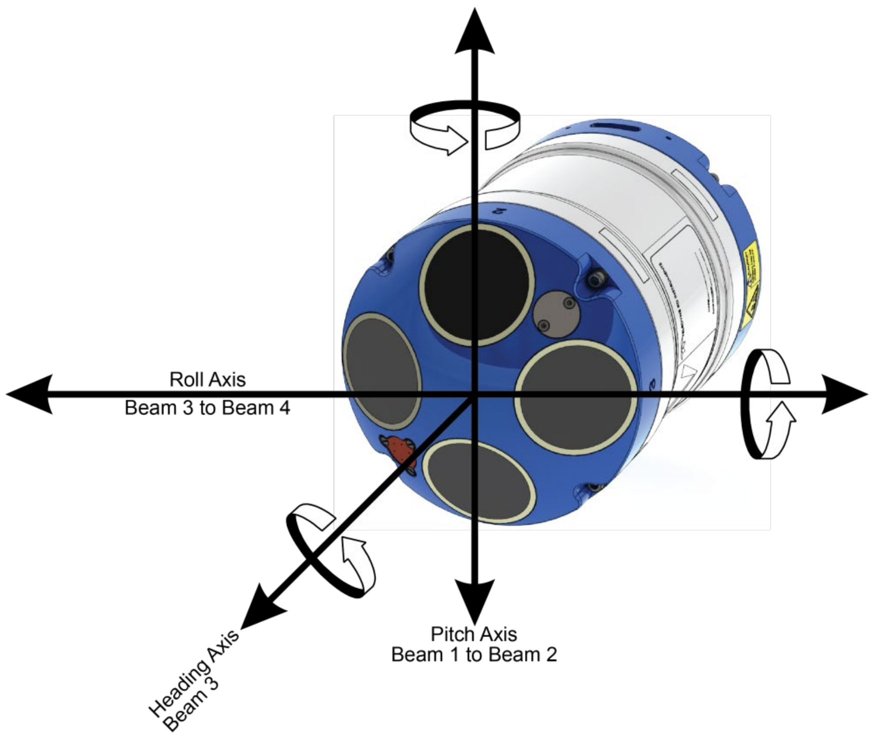


Figure 68. Pitch, Roll, and Heading

Heading - When Beam 3 is pointed toward magnetic north, heading = 0°. If a heading bias of the local declination is applied, then the heading will be true north.

Pitch (Tilt 1) - When the unit is pointed up or down, pitch = 0°. When the unit is on its side, pitch = ±90° (see Figure 69).

Roll (Tilt 2) - When the unit is pointed up or down, roll = 0°. When the unit is on its side, roll = ±90° (see Figure 70).

Raw (unprocessed) Pitch (Tilt1) and Roll (Tilt2) will behave as follow:

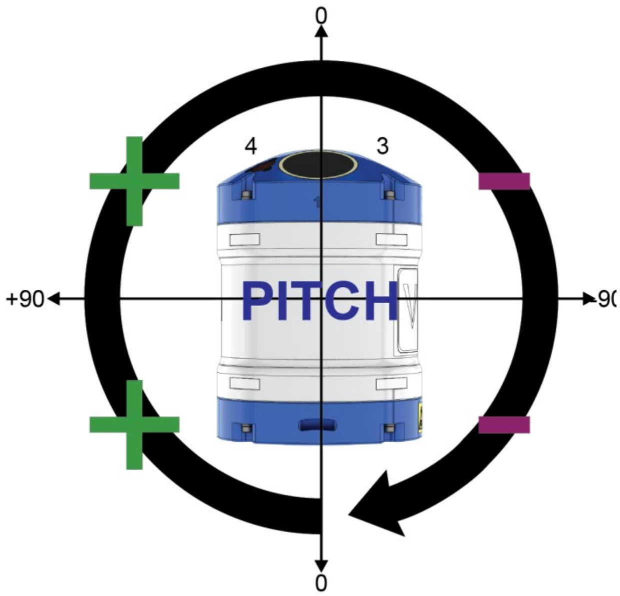


Figure 69. Raw Pitch

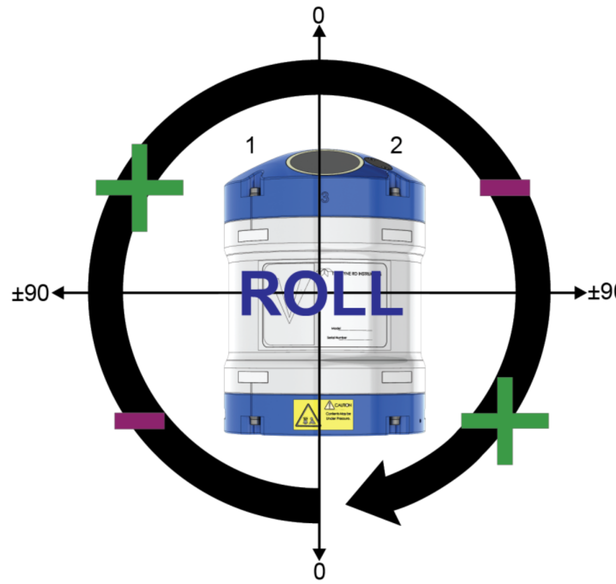


Figure 70. Raw Roll

The following table describes the sign convention for the Pitch and Roll:

Table 20. Pitch and Roll Sign Convention

Sign of Angle for a Unit Facing	Up	Down
Pitch (Tilt 1) - Beam 3 higher than Beam 4	+	+
Roll (Tilt 2) - Beam 2 higher than Beam 1	+	-

Setting the Date and Time

Setting the Date and Time on Self-Contained Systems

To set the date and time on a Self-Contained system:

1. Start ReadyV and Connect to the ADCP.
2. Click the **Set Time** button to set the Sentinel V ADCP's clock.
3. On the Step 4: System check panel, click the **System clock** tab.

- To manually set the time, click on the clock icon. Click on the calendar icon to set the date. Press the **Set Time** button.
- Use the **Sync with PC** button to set both the time and date of the ADCP to match the time and date on the PC.
- Use the **Sync with GMT** button to set both the time and date of the ADCP to match the GMT time and date.

4. Click the **Close** button (☒) to return to the Home panel.

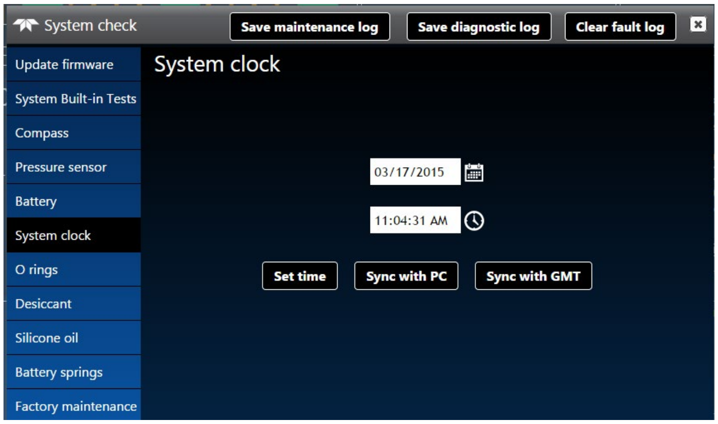


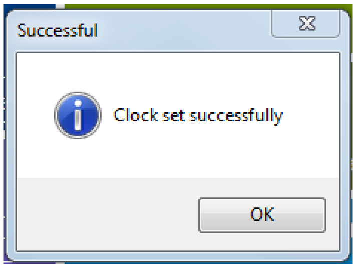
Figure 71. Set the Date and Time

The real-time clock (date and time) within the Sentinel V is backed up by a super-capacitor that maintains the correct time while system power is removed. The clock will continue to maintain the date and time during power outages of 16 to 24 hours. If power is removed for a longer period of time, then the clock will revert to the default value of January 1, 1970 and will need to be reset to the correct time.

Setting the Date and Time on Real-Time Systems

To set the clock on a Real-Time system:

1. Start *Sentinel V RT Utilities* and Connect to the Sentinel V Real-Time ADCP.
2. Click **Set Time**.
3. *Sentinel V RT Utilities* will set the clock to match the PC's time.
4. Click **OK** at the **Clock set successfully** screen.



Replacing the O-Ring

TRDI strongly recommends replacing the O-ring whenever the Sentinel V ADCP is opened. Inspecting and replacing the O-ring should be done before sealing the ADCP.

There is no need to disconnect the end-cap cables or lanyard to replace the O-ring. The O-ring is large enough to stretch over the end-cap.

The O-ring sits in a dove-tail groove. This makes it less likely to fall out when the system is opened. Use the O-ring tool to pry it out of the groove. Never use metal tools as this may damage the O-ring groove or the housing flange.

The O-ring is size 2-163 for both transducer and end-cap side of the housing.

To replace the O-ring:

1. Remove the end-cap or transducer head (see Disassembly and Assembly Procedures).
2. Insert the O-Ring tool tip on the inside edge of the groove and gently slide it around the groove perimeter to lift the O-Ring.

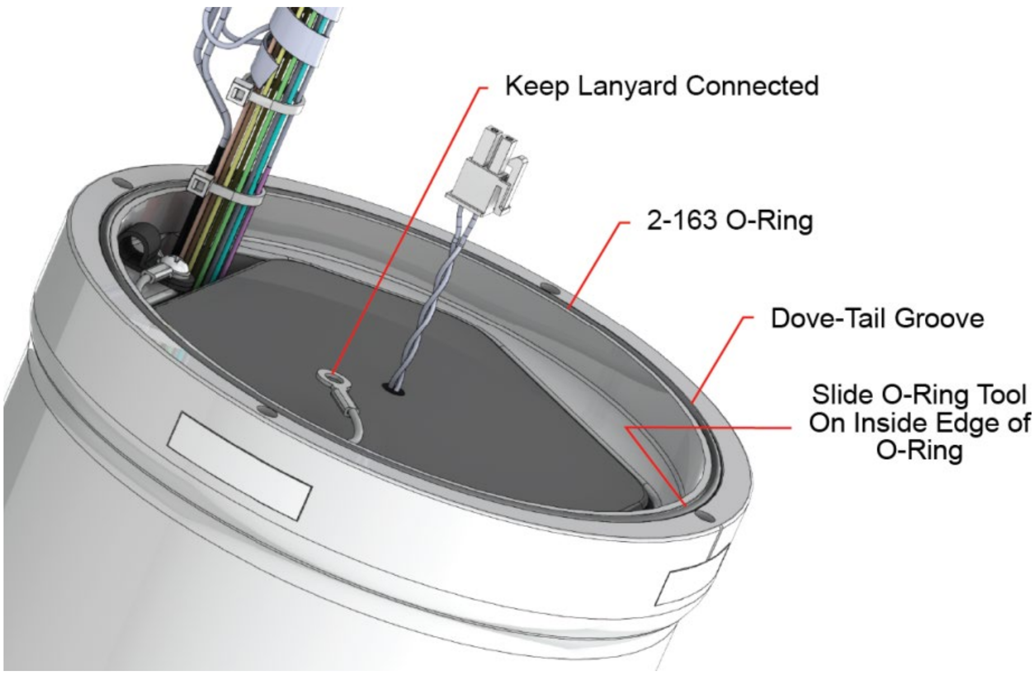


Figure 72. Using the O-Ring Removal Tool

3. Inspect the O-ring. When viewed with an unaided eye, the O-ring must be free of cuts, indentations, abrasions, foreign matter and flow marks. The O-ring must be smooth and uniform in appearance. Defects must be less than 0.1 mm (0.004 in.).

If the O-ring appears compressed from prior use, replace it. Weak or damaged O-rings will cause the Sentinel V ADCP to flood.

4. Clean and inspect the O-ring groove and the plastic housing flange. Also check the mating surface on the transducer and end-cap. Be sure they are free of foreign matter, scratches, indentations, and pitting.

Check the O-ring groove thoroughly. Any foreign matter in the O-ring groove will cause the Sentinel V ADCP to flood.

5. Lubricate the O-ring with a thin coat of silicone lubricant. Apply the lubricant using latex gloves. Do not let loose fibers or lint stick to the O-ring. Fibers can provide a leakage path. Slip the O-ring over the end-cap and press the O-ring into the groove.

> Apply a very thin coat of silicone lube on the O-ring. Using too much silicone lube on the O-ring can be more harmful than using no O-ring lube at all.

6. Use the System checks panel to set the date the O-ring was replaced.

Filling the Pressure Sensor Cavity with Oil

The pressure sensor cavity needs to be filled with oil before deployment to deal with both trapped air and long-term reliability of the pressure sensor. Use Dow Corning Q7-9120 Silicone fluid, 12,500 CST oil. A plastic bottle with silicone oil (part number 75BK6004-00) and a syringe with 10-gauge needle are included in the spare parts kit. The sensor cavity can be filled any time before system installation; however, care should be taken to keep the ADCP from high temperature during this time. High temperatures may cause the oil to leak.

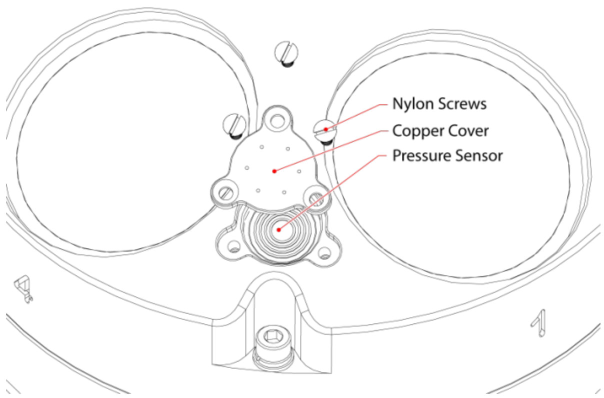


Figure 73. Filling the Pressure Sensor Cavity with Oil

> The pressure sensor cavity is not filled with oil when shipped. This must be done before deploying the Sentinel V ADCP. The Pressure sensor cavity should be checked and if needed refilled between deployments.

To fill the pressure sensor with oil:

1. Place the Sentinel V ADCP so the pressure sensor is facing up and level. Use a soft pad or the shipping case to protect the ADCP.
2. Use a straight-slot screwdriver to remove the three flat-head black nylon M3 screws on the pressure sensor and then lift off the pressure sensor cover. The pressure sensor cover fits tightly and may need to be gently pried out using the screwdriver in one of the screw holes (see Figure 64, page 139).

Figure 74. Pressure Sensor Cavity with Sand

Use extreme caution to not touch or put any pressure on the face of the pressure sensor. The sensor face contains a sensitive membrane that can be easily damaged. If the membrane is damaged the pressure sensor will fail.

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

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

Only use low-flow fresh water to flush out any sand in the sensor cavity.

If the pressure sensor surface looks corroded or is bowed outward, then contact TRDI for servicing. Do not attempt to remove the pressure sensor. It is not replaceable in the field.

3. Attach the 10-gauge needle to the syringe. Draw approximately 2.5 cc of oil into the syringe. As the plunger is drawn back, oil will slowly fill the syringe.
4. Fill the pressure port cavity with oil from the top of pressure sensor to the bottom of the copper cover.

Have an absorbent paper towel on hand to clean up any overflow that may occur.

5. Gently clean out the holes in the pressure sensor cover with a needle. If the holes become enlarged or the cover is corroded, replace the cover. The cover part number is 81D-4000-00.
6. Install the copper cover slowly, allowing time for the oil to pass through the holes. Tighten the screws “finger tight”0.2 Nm (1.8 Pound-Force Inch). Do not over tighten as the threads on the plastic screws may strip. If this happens, replace the screw (spare flat-head black nylon M3 screws are included in the spare parts kit).
7. Use the System checks panel to set the date the oil was filled.

Zero the Pressure Sensor

Use the System checks panel to zero out the pressure sensor at the deployment site. This must be done prior to deploying the Sentinel V ADCP in the water.

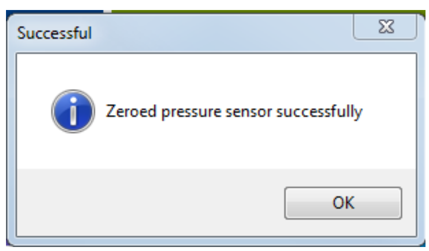
For Sentinel V systems using *ReadyV*:

1. Connect and apply power to the system.
2. On the Maintenance panel, click **Pressure sensor**. This will zero it.
3. Click the **Close** button. The date and time the pressure sensor was zeroed will be updated.

Figure 75. Zero the Pressure Sensor

For Sentinel V Real-Time systems:

1. Start *Sentinel V RT Utilities* and Connect to the Sentinel V Real-Time ADCP.
2. Click **Zero It**. This will zero the pressure sensor.
3. Click **OK** at the **Zeroed pressure sensor successfully** screen.



Cleaning the Thermistor Cover

In order to respond quickly to changes in the water temperature, water must be able to flow over the sensor. Do not block the thermistor cover or paint over it with antifouling paint. Remove any biofouling as soon as possible.

The thermistor is embedded in the transducer head. The sensor is under a stainless-steel cover that is highly resistant to corrosion.

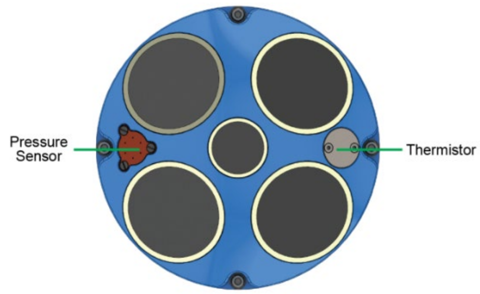


Figure 76. Thermistor and Pressure Sensor

Replacing the Desiccant

Desiccant is used to dehumidify the housing interior. Desiccant is essential in deployments with plastic housings. The factory-supplied desiccant lasts a year at specified Sentinel V ADCP deployment depths and temperatures. Remember that desiccant rapidly absorbs moisture from normal room air. As a minimum, replace the desiccant whenever the ADCP housing is opened.

Do not open the desiccant bag. Contact with the silica gel can cause nose, throat and skin irritation.

Do not puncture or tear the desiccant bag. Do not use desiccant bags that are torn or open.

The Sentinel V ADCP housing has separate cavities for the battery and electronics. If the end-cap is removed, only replace the end-cap desiccant.

To replace the end-cap side desiccant:

1. Remove the end-cap (see End-Cap Removal Procedures).
2. Remove the new desiccant bag from the airtight aluminum bag.
3. Remove the old desiccant bag and install a new one. Use a short piece of double-stick tape and place the desiccant bag on the end-cap as shown in Figure 49 and Figure 50. Ensure that the desiccant will not interfere with other components when the instrument is closed.

Remove the old desiccant with the end-cap away from the housing in case the bag rips.

4. Install the end-cap (see End-cap Replacement).
5. Use the System checks panel to set the date the desiccant was replaced.

Normal maintenance does not require removing the transducer head. If the transducer assembly is opened, replace both the desiccant and O-ring.

To replace the transducer side desiccant:

1. Remove the transducer head (see Transducer Head Assembly Removal).
2. Remove the new desiccant bag from the airtight aluminum bag.
3. Remove the old desiccant bag and install a new one. Place the desiccant bag inside the housing cavity as shown in Figure 49 and Figure 50.

> Ensure that the desiccant will not interfere with other components when the instrument is closed.

4. Install the transducer head (see Transducer Head Assembly Replacement).
5. Use the System checks panel to set the date the desiccant was replaced.

Replacing the Captive Nuts

To replace a captive nut:

1. Press one end of the captive nut to cause the other end to lift slightly out of the housing.
2. Gently pry out the captive nut using a sharp-edged plastic tool (recommended) or a flat thin screw driver.
3. Inspect the threads and check for corrosion. If corroded, replace the captive nut.
4. Captive nuts snap into place with the lip facing the housing.
5. Apply pressure on either ends of the captive nut as necessary to make it flush with the housing.

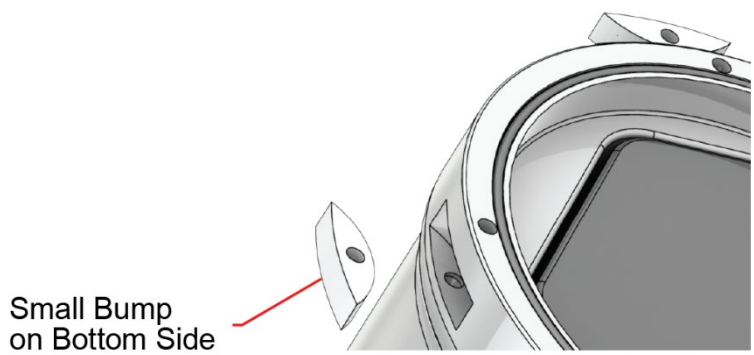


Figure 77. Replacing the Captive Nuts

Replacing the Battery Springs

Replace the individual D cell battery springs when they break or become corroded. Order the battery spring replacement kit part number 75DK6002-00.

TRDI recommends replacing these springs every five years or whenever visible signs of wear or corrosion appear.

To replace the battery springs:

1. Remove the batteries.
2. Using a Phillips screwdriver, remove the screw holding the spring in place.
3. Install the new springs.
4. Replace the batteries.
5. Use the System checks panel to set the date the springs were replaced.

Replacing the Battery Separators

Replace the individual D cell battery separator when they break or become worn. Order the battery separator replacement kit part number 75DK6003-00.

To replace the battery separators:

1. Remove the batteries.
2. Remove the separator by turning it counter-clockwise.
3. Install the new separator.
4. Replace the batteries.

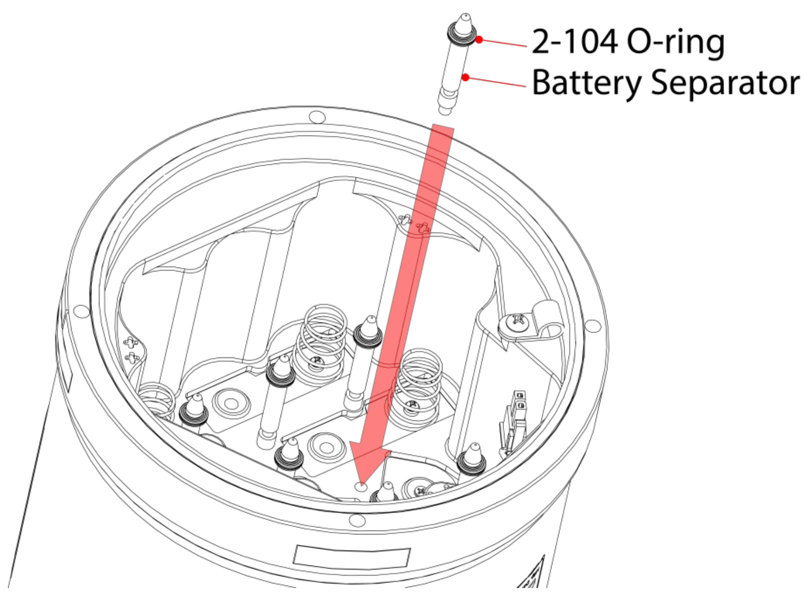


Figure 78. Individual D cell Battery Compartment

Preventing Biofouling

This section explains how to prevent the buildup of organic sea life (biofouling) on the transducer faces. Objects deployed within about 100 meters (≈328 feet) of the surface are subject to biofouling, especially in warm, shallow water. Soft-bodied organisms usually cause no problems, but barnacles can cut through the urethane transducer face causing failure to the transducer and leakage into the Sentinel V ADCP.

The best-known way to control biofouling is cleaning the Sentinel V ADCP transducer faces often. However, in many cases this is not possible. In that case, coat the entire Sentinel V ADCP with the recommended antifouling paint. Make sure that the paint is applied in an even coat over the transducer faces.

> As originally manufactured, the transducer faces have a smooth surface which makes it inhospitable for most biofouling to develop. Preserving this smooth surface is an effective way to prevent heavy bio-growth on the transducer faces. However, if an antifouling coating is desired on the transducer faces, then the faces must be lightly abraded to allow for the antifouling coating to adhere. As a rule, the surface must be kept smooth unless an antifouling coating will be applied.

Most EPA approved anti-fouling paint can be used on the housing and the urethane transducer faces. Contact the antifouling paint manufacturer for preparation and application procedures for this and other antifoulant paints. Interlux is one source of antifouling paint. Contacting this company is done with the knowledge that Teledyne RD Instruments is not recommending them, but only offering this as a source for the anti-fouling paint.

Manufacturer	Contact
Courtalds Finishes	Telephone: +1 (800) 468-7589
Interlux brand paints	Web Page : http://www.yachtpaint.com/usa/

The following tips are only general recommendations. Always follow the anti-fouling paint manufacturer's instructions on how to apply the anti-fouling paint.

1. Transducer Face Surface Preparation - Lightly abrade the surface using Scotch Brite® to remove gloss. Thoroughly clean the areas to be painted with soapy water and dry before applying the anti-fouling paint.
2. Mask as necessary. Do not paint over mounting hardware, thermistor, and pressure sensor.
3. If applying a second coat, allow the first coat to dry. One coat usually lasts one season (3-4 months); two coats might last one year.
4. Be extra careful to apply a smooth, thin coat of paint to the urethane faces.
5. Apply one or two coats of anti-fouling paint at 4-mil per coat.

> Do not block the pressure sensor port. The sensor port has several small holes in the center of the copper disk. During anti-fouling paint application, tape-off the copper disk. Once the anti-fouling paint has cured, remove the tape.
>
> This means that the sensor port is not fully protected and fouling may build up on the copper disk and eventually clog the sensor port. However, the sensor port is surrounded by the antifouling paint and most organisms do not seem to find the copper surface attractive. If it is logistically possible to periodically inspect/clean the pressure sensor, 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.

Removing Biofouling

To remove foreign matter and biofouling:

1. Remove soft-bodied marine growth or foreign matter with soapy water. Waterless hand cleaners remove most petroleum-based fouling.

> Do not use power scrubbers, abrasive cleansers, scouring pads, high-pressure marine cleaning systems or brushes stiffer than hand cleaning brushes on the transducer faces. The urethane coating on the transducer faces could be damaged.

If there is heavy fouling or marine growth, the transducer faces may need a thorough cleaning to restore acoustic performance. Barnacles do not usually affect Sentinel V ADCP operation, but TRDI does recommend removal of the barnacles to prevent water leakage through the transducer face. Lime dissolving liquids such as Lime-Away® break down the shell-like parts. Scrubbing with a medium stiffness brush usually removes the soft-bodied parts. Do NOT use a brush stiffer than a hand cleaning brush. Scrubbing, alternated with soaking in Lime-Away®, effectively removes large barnacles.

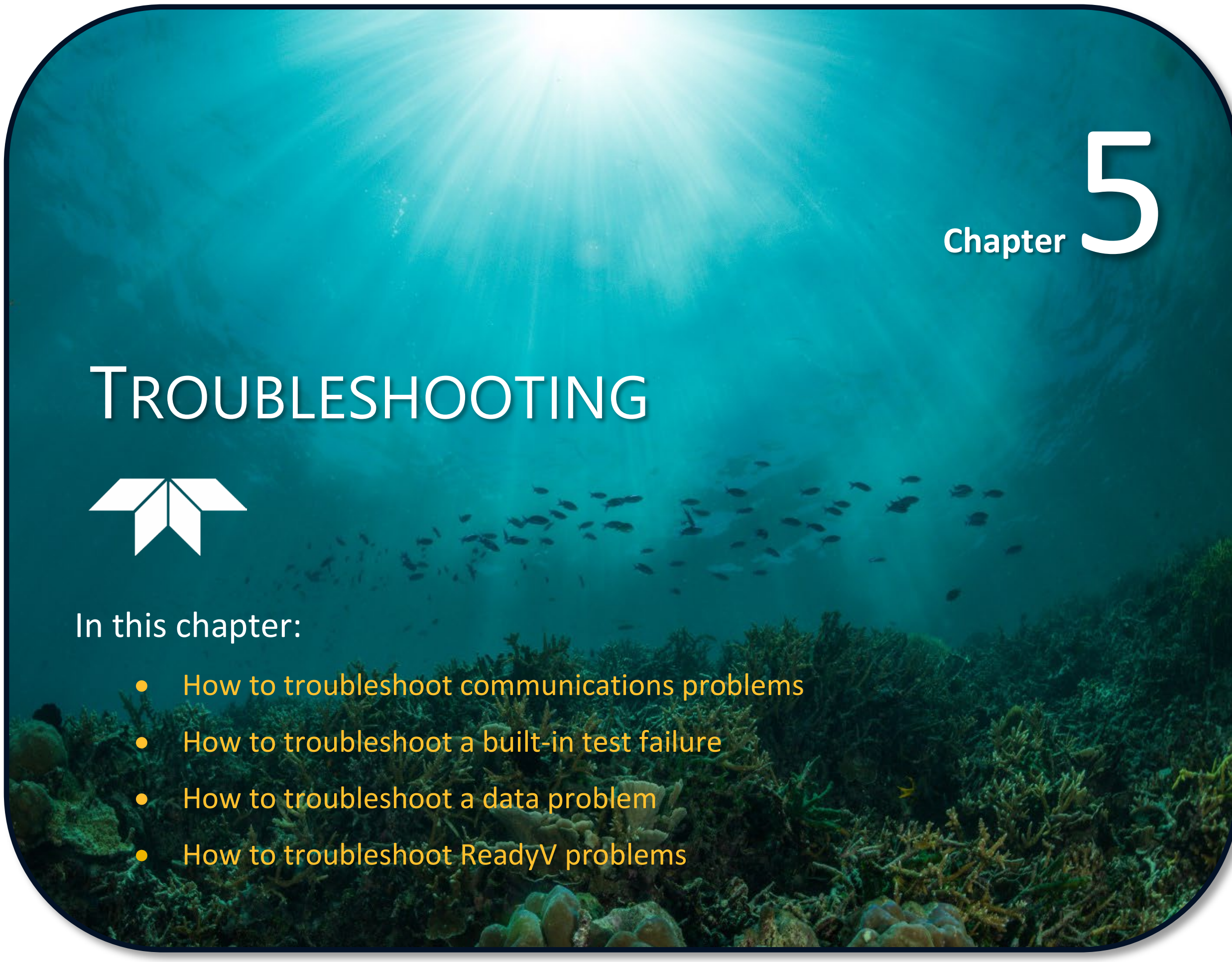
> If barnacles have entered more than 1.0 to 1.5 mm (0.06 in.) into the transducer face urethane, the Sentinel V ADCP should be sent to TRDI for repair. If barnacles cannot be removed without damaging the transducer faces, contact TRDI.

2. Thoroughly clean out any biofouling from the Touch sensor.
3. Rinse with fresh water to remove soap or Lime-Away® residue.
4. Dry the transducer faces with low-pressure compressed air or soft lint-free towels.

> Always dry the Sentinel V ADCP before placing it in the storage case to avoid fungus or mold growth. Do not store the ADCP in wet or damp locations.

Figure 79. Biofouling on a Sentinel V ADCP

> The pressure sensor cavity is not filled with oil when shipped. This must be done before deploying the Sentinel V ADCP. The Pressure sensor cavity should be checked and if needed refilled between deployments.



Chapter 5

TROUBLESHOOTING

In this chapter:

- How to troubleshoot communications problems
- How to troubleshoot a built-in test failure
- How to troubleshoot a data problem
- How to troubleshoot ReadyV problems

This chapter applies to both Sentinel V and Sentinel V Real-Time systems.

Troubleshooting Steps

Symptom	Check
No beeps are heard when power is applied. No communication.	See Troubleshooting Communication Issues.
Beeps are heard when power is applied. No communication.	See Troubleshooting Wireless Issues.
Able to connect, ReadyV won't start.	See Troubleshooting ReadyV Issues.
One or more Built-In Test Fails.	See Troubleshooting a Built-In Test Failure.
There is a problem with my data.	See Troubleshooting Data Problems.

Troubleshooting Communication Issues

If there is a communications issue or no beeps are heard when power is applied:

- Review the Touch Sensor Response / System Beeps section and Real-Time Touch Sensor Response / System Beeps. Clean the ADCP as needed.
- Open the ADCP to check that the internal end-cap cable(s) and battery connector are connected correctly.
- Check the Sentinel V battery pack voltage is above 12 VDC.
- Before using the optional Lithium battery pack, always run the battery self-test. See Testing the Lithium Battery Pack for instructions.
- Instruments with high inrush currents occasionally trigger the optional Lithium battery pack short circuit detection, which turns the battery off. If this happens, do the following:
    - Disconnect the battery and touch the ADCP's touch sensor for about 45 seconds to one minute. Connect the battery and then the ADCP should power on normally.
    - If the ADCP still does not power on, connect the AC adapter and wait for a minute and then connect the battery pack. Once the ADCP is connected and ReadyV started, unplug the AC adapter. The ADCP will work normally after that.
- Remove power to the ADCP for 30 to 45 minutes. Cycling power will cause the system to deplete any stored power and force it to wake up when power is applied.
- While the end-cap is opened and cables connected, place a finger over the wireless sensor. The LED on the touch sensor board should light.
- Ensure that the Sentinel V battery housing is clean and dry.
- Replace the Sentinel V D cell battery springs if their integrity is suspect.
- For systems using the optional External Battery Case, check the I/O cable female connector and the ADCP male connector for bent pins, dirt, or foreign objects. Verify power is reaching the ADCP on the cable connector (see Cable Wiring Diagrams). Open the external battery case to check that BOTH battery connectors are connected correctly. Remember that both battery packs are shipped inside the unit, but NOT connected.
- Open the system and try communications Using Board-Level Ethernet Connection.

Determining if the System is RT or SC

If you do not remember how the system was last configured:

Review the Touch Sensor Response / System Beeps and Real-Time Touch Sensor Response / System Beeps sections.

- If you hear one long beep when power is applied and after 10 to 15 seconds later a second short beep and touching the Touch Sensor makes the system beep again; the system is configured for Self-Contained (firmware version 47.xx is installed). Connect to the system using the WLAN and *ReadyV*.
- If you hear one long beep when power is applied and after 10 to 15 seconds later a second short beep but touching the Touch Sensor does not respond; the system is configured for Real-Time Ethernet (firmware version 66.xx is installed). Connect to the system using the Ethernet and *Sentinel V RT Utilities*.
- If you only hear one long beep when power is applied and touching the Touch Sensor does not make the system beep, the system is configured for Real-Time (firmware version 66.xx is installed). Connect to the system using the serial cable and *Sentinel V RT Utilities*.
- If you only hear one long beep when power is applied, and touching the Touch Sensor does not make the system beep, and the system does not have a serial connector, then open the system and try communications Using Board-Level Ethernet Connection.

The Sentinel V Self-Contained system MUST have a serial connector on the end-cap and the user MUST have the 73D-3112-xxx underwater cable and AC power adapter to be able to switch to the Real-Time mode. If the system does not have the serial connector, underwater cable and AC power adapter, once the 66.xx firmware is loaded, there is no easy way to communicate with the system (see Using Board-Level Ethernet Connection). Once version 66.xx firmware is installed, the touch sensor is disabled.

Troubleshooting Wireless Issues

If there is a communications issue and the beeps are heard when power is applied to the ADCP:

- Review the Wireless Connection Common Issues section.
- Review the Touch Sensor Response / System Beeps and Real-Time Touch Sensor Response / System Beeps sections. Clean the ADCP as needed. If you only hear the one long beep and not the second short beep, the system may be configured for Real-Time. Try connecting to the system using the serial cable.
- Check if a red X or yellow triangle ( ) appears over the wireless network icon in the status bar, the computer reports there is no wireless connection, or a message appears saying there are no wireless networks available. If any of these conditions apply, click the wireless icon and right-click on the connection and select **Connect**.
- Make sure the ADCP is within the wireless range of the computer (typically within 100 feet). Try moving the ADCP closer to the computer. If there is a wall between the ADCP and the computer, try placing the ADCP and computer in the same room.
- Make sure there are no other devices interfering with the ADCP, such as microwave ovens, cordless phones, or other wireless devices.

- If the computer uses an external wireless adapter, make sure the adapter is working correctly and is attached and installed properly.
- If wireless capability is integrated into the computer, make sure the wireless transmitter is turned on. This might also turn the wireless network receiver on and off. Many laptops have an external switch for turning the transmitter on and off. If you aren't sure how to turn it on, check the information that came with the computer or go to the manufacturer's website.
- If the ADCP does not appear on the list of wireless networks available to connect to, make sure the ADCP has not timed out. The network is available after power up for five minutes. Placing a finger over the Touch sensor starts the network again for five minutes. Click on the **Refresh** icon ( ) or use the wireless adapter's interface to search for connections.
- If the ADCP does not appear on the list of wireless networks available to connect to, another computer may already be connected to the ADCP. Only one computer may be connected to an ADCP at a time.
- If the ADCP appears on the list of wireless networks available to connect to but the laptop fails to connect to it, Windows® 7 may have kept the name on the list because it connected to that network in the past. In other words, *this does not mean that the network is actually available*. Touch the Wireless Touch Sensor to start the network. Listen for the two beeps: the first one confirms the sensor detected your finger and the second beep confirms the wireless network is on. Click on the **Refresh** icon ( ) or use the wireless adapter's interface to search for connections and try to connect again.
- The touch sensor may stay "triggered" for up to 60 seconds when touched. During this time, the sensor will not respond with a beep when touched again. This is normal and does not affect connecting to the WLAN.
- The touch sensor can be saturated to a point where it won't register to touch. This occurs, for example, when the ADCP is submerged in water or covered with biofouling. In extreme cases, the WLAN will not connect. If this occurs:
    - Take the system out of the water.
    - Rinse the sensor and end-cap with fresh water and then dry the instrument.
    - Remove biofouling from the touch sensor and end-cap, and then the housing if problems persist.
    - Remove the ADCP from any mounting fixture, especially if it is conductive or metallic.
- The Touch sensor may have failed. Open the system and try communications Using Board-Level Ethernet Connection.

IP and Host Name Setting

Whether to use the IP or host name depends on the LAN connections to the internet. For example, when connected by Ethernet wire to a LAN that connects to the internet, you can only use *SVnnnnn* (where *nnnnn* = the ADCP's serial number) for the hostname (the *.adcp* suffix must be omitted).

When not connected to a LAN that connects to the internet, use host name *SVnnnnn.adcp*, or IP **192.168.0.1**, but not *SVnnnnn*.

Table 21. Troubleshooting IP and Host Name Settings

FW*	ADCP Connection	Laptop Connection	Static IP (192.168.0.1)	SVnnnnn	SVnnnnn.ADCP	Note
SVRT	CAT5 to Laptop	802.11b/g/n WLAN Interface	Pass	Fail	Pass	
SVRT	CAT5 to Laptop	No Network	Pass	Fail	Pass	
SVRT	CAT5 to network	Cat5 to Network	Fail	Pass	Fail	
SVSC	CAT5 to network	Cat5 to Network	Fail	Pass	Fail	
SVSC	CAT5 to network	802.11b/g/n WLAN Interface	Fail	Fail	Fail	This is due to network architecture. The DNS works while on the same subnet (the third field in the IP).
SVSC	CAT5 to Laptop	No Network	Pass	Fail	Pass	
SVSC	CAT5 to Laptop	802.11b/g/n WLAN Interface	Pass	Fail	Pass	
SVSC	802.11b/g/n WLAN Interface to laptop	Cat5 to Network	PASS (192.168.0.2)	Fail	Pass	Note the IP Address last digit changes from .1 to .2
SVSC	802.11b/g/n WLAN Interface to laptop	No Network	PASS (192.168.0.2)	Fail	Pass	

* FW = Firmware version: SVRT (Sentinel V Real-Time) SVSC (Sentinel V Self-Contained)

Observations:

- All the static IP failures are because of the direct connection to the network. The IP is assigned to something else by the DHCP server, so this *would* work if we knew the IP address.
- *SVnnn* should be used when the ADCP is connected to the network.
- *SVnnn.adcp* should be used when the ADCP is connected to the laptop, either by direct Cat5, or by 802.11b/g/n WLAN Interface.
- The fail case noted in red *would* work (pass) on a network where the wireless has the same sub-net as the wired.

Troubleshooting Serial Issues

If there is a communications issue and the beeps are heard when power is applied to the ADCP:

Check the system configuration for RS-422. If the system is configured for RS-422 and connected to a RS-232 port, you may see the wakeup banner, but can not send commands to the ADCP.

How do I know if the system is RS-232 or RS-422? Check the system label for a 232 or 422 label next to the product label.

> Your computer and the Sentinel V Real-Time ADCP must both be set to the same communication setting. Use the RS-232-to-RS-422 converter if the computer only has a RS-232 COM port.

Serial versus Ethernet Configuration

If the RS232 serial connection is not connecting, the system may be waiting for Ethernet communications. Approximately 20 seconds after applying power, whether you are viewing the Sentinel V Real-Time ADCP serial communications output or not, the ADCP outputs this message to the serial port:

```
Enter === within 3 seconds to set communication port to serial:
```

If you do not send === within the time allotted, the Sentinel V Real-Time ADCP outputs this message and continues to Ethernet communications:

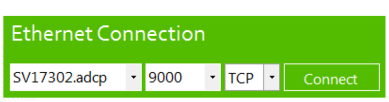
```
Break not received, configuring for Ethernet comms
```

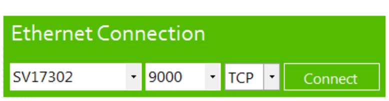
If you need serial communications and missed sending the ===, open a serial communications port in *RDI Toolz* using 9600 baud and software breaks. Apply power so you can catch the === message and send the software break.

> In Real-Time mode, the touch sensor and wireless network are disabled.
>
> In Real-Time mode, the Sentinel V Real-Time ADCP processes software breaks only; i.e. sending a hardware break does nothing.
>
> By default, the serial communications baudrate is 9600 baud.

Troubleshooting Ethernet Issues

During boot/startup for an Ethernet system, you will see the message "Enter === to set communication port to serial:" when you try to connect using a serial port with *Sentinel V RT Utilities*. After this message is displayed, you have three seconds to send a soft break to the system to set the system output type to serial. This is provided for troubleshooting only, and the system will revert to the original state on next reboot or power cycle. For more information, see the #CR command.

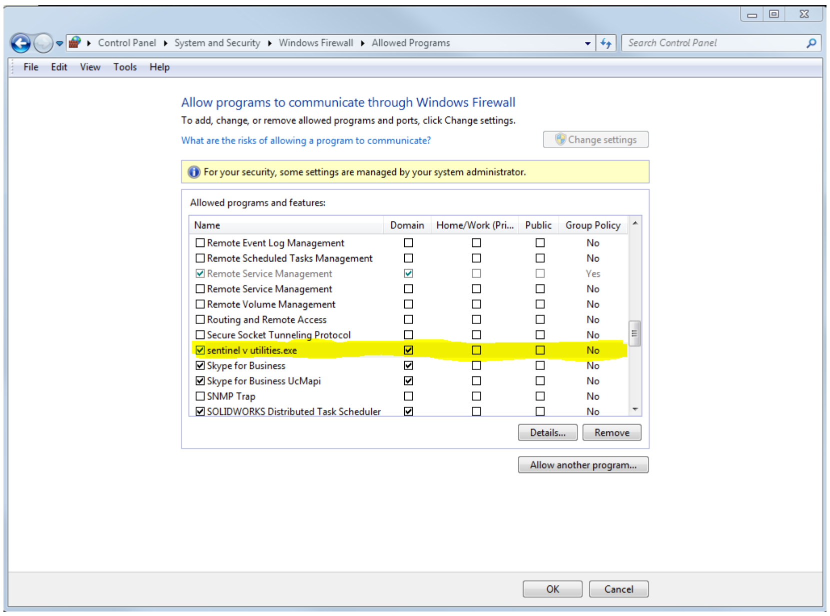




If you have trouble connecting using SV*nnnnn.adcp* (where *nnnnn* is the five- or six-character serial number shown on the product label) try using SV*nnnnn*. Drop the *.adcp* portion if the network you are connecting to assigns the IP address (see IP and Host Name Setting).

Troubleshooting UDP Issues

The Windows® Firewall may block UDP output. Please note that changes to the Firewall requires Administrator privilege to change the settings. Make sure the *Sentinel V RT Utilities* program allows the software to communicate through the Windows firewall for UDP output.



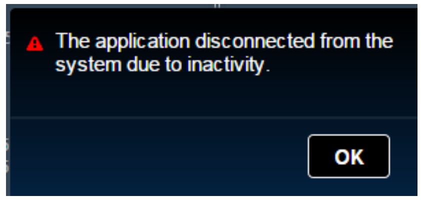
Troubleshooting ReadyV Issues

This section contains tasks that should be performed where experiencing issues with ReadyV.

ReadyV Does Not Start

If ReadyV does not start, check the following:

- Review the Wireless Connection Common Issues section.
- Make sure the IP address 192.168.0.2 is typed in correctly on the browser.
- Try using the ADCP's WLAN address *http://SVnnnnn.adcp* into the address bar (where *nnnnn* is the five or six-character Sentinel V serial number). The address is not case sensitive.
- If the computer has both a network cable and wireless, try unplugging the network cable.
- Try using a different browser. See Computer Considerations for a list of supported browsers.
- Try restarting or refreshing the browser if there is a message that the connection has been lost. If no keys have been pressed for five minutes, the ADCP will disconnect.



- If the firmware was just updated, the browser must be closed and set up the wireless network again.
- Once connected, if no keys are pressed for five minutes, the ADCP will disconnect. After waiting two more minutes, the ADCP will power down. Use the Touch sensor to restart.

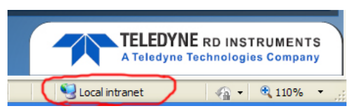
Solving Partially Cut Off Screen Issues

If the Zoom level on the browser is set higher than 100%, the right side of the ReadyV screen may be partially cut off.

To change the zoom level in Internet Explorer®, click **Tools**, **Zoom**. Set the zoom level so that the entire ReadyV screen is visible. Use **Ctrl+** to increase zoom, **Ctrl-** to decrease the zoom level. If the mouse has a scroll wheel, use Ctrl+mouse wheel to adjust the zoom level. Use **Ctrl+0** (zero) to return to 100% zoom.

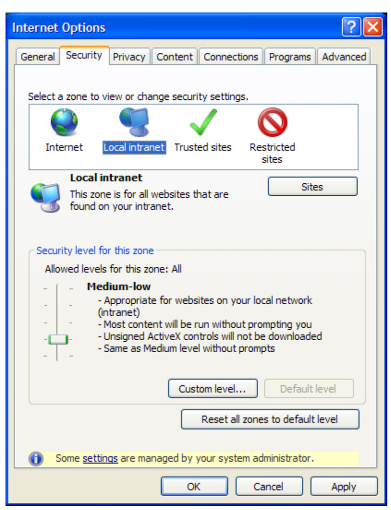
Solving Download Data Issues

When the **Download** button is clicked on the Data Recorder Panel, the message box to choose where to save the data file does not display. The Status bar at the bottom of the ReadyV screen may show **Internet** when using Windows XP® and Internet Explorer 8®. It should be **Local intranet** for both Internet Explorer 8® and Internet Explorer 9® with Windows 7®.

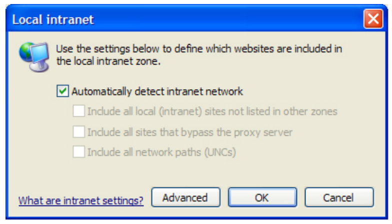


To change to a Local intranet:

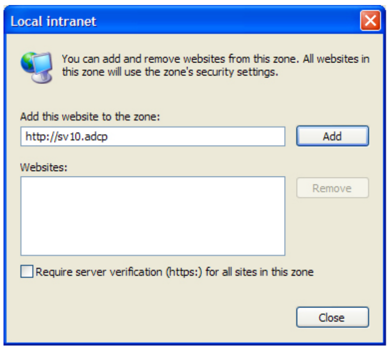
1. On Internet Explorer®, click **Tools**, **Internet Options**.
2. Select the **Security** tab. Select **Local intranet**.

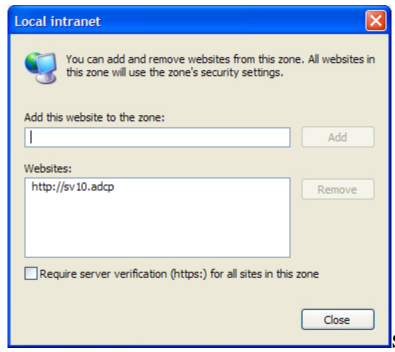


3. Click on the **Sites** button.



4. Make sure the **Automatically detect intranet network** box is checked. Click the **Advanced** button.





s

5. The ADCP's address should be in the **Add this website to the zone** box. Click the **Add** button to move it to the **Websites** area. Click **Close**.
6. Close the Internet Options dialog. Data should now download.

Troubleshooting a Built-In Test Failure

The built-in tests check the major Sentinel V modules and signal paths. If a built-in test fails, use the following steps to provide the needed information to the Teledyne RDI Field Service group to help reduce the investigation process (see How to Contact Teledyne RD Instruments).

1. Repeat the failing test several times rotating the ADCP by 90 degrees each time. By doing so, it may be determined that the failure is directional.
2. If other magnetic, acoustic, or high current systems are in the vicinity of the ADCP, if possible, please power down the equipment and or remove the equipment (at least three meters away) during diagnostic testing; re-run the tests.
3. Use the System checks panel or if the ADCP is configured for Real-Time then use the Utilities Page and save the diagnostic log. Send the files to TRDI field service. This may aid TRDI engineers in troubleshooting the instrument.

Troubleshooting Data Problems

This section contains the different tasks that should be performed on the site where experiencing data quality issue(s).

1. Provide a copy of the deployment file (**.txt*).
2. Provide a description of the environment where the ADCP is deploying; in particular, details on water description (for instance: highly concentrated in sediment waters). Additionally, provide a description of the intended deployment. Please provide details on environment commands, range expected, standard deviation expected, and goal of the mission.

3. Recover the raw data from the instrument and send the complete deployment data together with a description of the issue, and if possible some screenshots or ensemble numbers to locate region(s) showing the unexpected data behavior. As previously mentioned in Troubleshooting a Built-In Test Failure, if other devices are in the vicinity of the ADCP and are suspected to be the origin of the data quality issue, if possible power the device down or remove it from the area (at least three meters) and re-deploy.

Using Board-Level Ethernet Connection

This is meant to be a work-around for applications that require a board-level Ethernet connection with a Sentinel V ADCP, or do not allow wireless or touch sensor operation.

Normal maintenance does not require removing the transducer head. Use the following procedures only if directed to do so by TRDI Field Service personnel.

Sentinel V ADCPs contain Electro Static Sensitive Devices. Take accepted ESD prevention measures before opening the transducer head.

If the transducer assembly is removed, replace both the desiccant and O-ring.

Never remove the digital recorder SD Card. The digital recorder is located on the top circuit board. To recover data, the SD card should be left in the ADCP and accessed using ReadyV.

Open the Transducer

To open the transducer:

1. Follow the directions in Removing the Transducer Head Assembly. Follow all guidelines and warnings about ESD protection and safety.
2. Lay the transducer on a soft pad in a beams-down orientation.
3. Position the housing in a way so that the internal cable (power and I/O) can reach the cable jack on the top board. Make sure to secure the housing so that it does not roll.

If the system has an external Ethernet cable, it is not necessary to open the case as shown below. Rather connect the external Ethernet cable to a powered up laptop. Then repower (or apply power) to the Sentinel V.

Connecting to the ADCP via Ethernet

To connect to the ADCP via Ethernet:

1. Use an Ethernet cable (CAT 5) to connect to the RJ45 jack on the top board (shown in Figure 70 below). Connect the other end of the cable either directly to a computer or to a router network.

Figure 80. Ethernet Connection

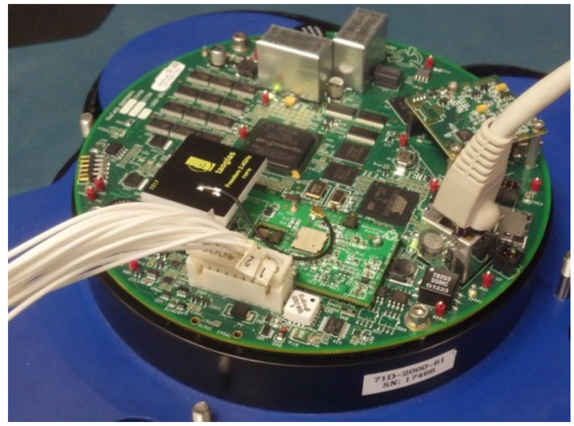


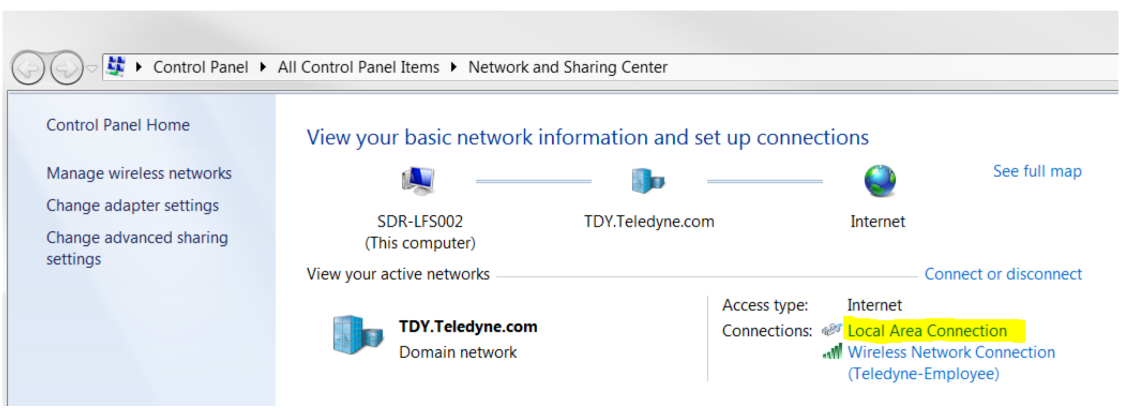
Figure 81. Power I/O Cable Connection

2. Connect the internal power I/O cable to the jack on the top board (see Figure 71). After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep). The LAN is available after power up for five minutes.

You can only change to/from Ethernet or to/from Wireless by repowering the Sentinel V. If you are using an internal battery, this means disconnecting the internal battery in addition to removing the AC Adapter power if applicable.

Steps 3 and 4 must be completed in five minutes to connect to the ADCP. After five minutes, the ADCP's LAN will turn off. In the event that the ADCP's LAN turns off before the connection is complete, simply start from step 2 again.

3. Verify that you have the Local Area Connection displayed under connections (~15 seconds) after you repower.



4. While using Ethernet as a troubleshooting tool, unplug the laptop from any network and connect the Ethernet cable directly from the laptop to the ADCP.

Ping address 192.168.0.1; if the response is good (as shown below) then *ReadyV* should open and work as normal.

```
C:\Users\dmurphy>ping 192.168.0.1

Pinging 192.168.0.1 with 32 bytes of data:
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64
Reply from 192.168.0.1: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\dmurphy>
```

Open a browser on the laptop (*Internet Explorer*®, *FireFox*®, *Google Chrome*®, or other browser). Enter the ADCP's IP address **192.168.0.1** into the address bar.

The Ethernet Port is 192.168.0.1 and the Wireless Port is 192.168.0.2. Make sure to use the Ethernet address.

When using the Ethernet cable to connect to the Sentinel V, it is best to not look at the wireless manager as the ADCP only supports the current type of connection (in this case Ethernet) and so the wireless status will not be meaningful and perhaps can even be confusing.

5. The ReadyV Home panel opens. It can take up to 30 seconds for the Home panel to display. Ready V functions and features are the same using this method of connection. See Chapter 2 – Using ReadyV.

Replacing the Transducer Head Assembly

To replace the transducer head:

1. Remove the Ethernet cable.
2. Replace the transducer side O-ring and desiccant.

Ensure that the desiccant will not press on the electronics.

3. Follow the directions in Replacing the Transducer Head Assembly.

Troubleshooting a System Reset Issue

Contact TRDI Field Service before and during this troubleshooting procedure.

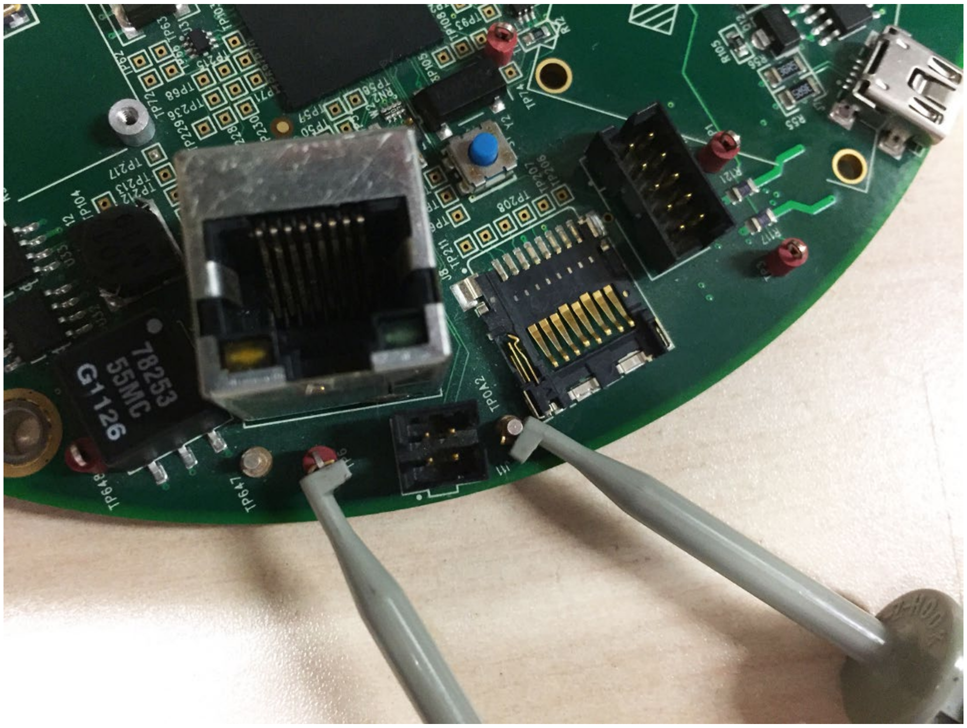
If the system keeps resetting, it is sometime possible to "see" and connect to the WLAN network using *ReadyV* briefly before you hear the long beep (system reboot) and then the network connection is lost. This occurs every one to two minutes.

One possible solution to stop a continuously rebooting system is to disable the watchdog timer and then upgrade the firmware to set the system to a default state.

To disable the watchdog:

1. Make sure all power is removed from the system. Disconnect the battery or AC power adapter.

2. Follow the directions in Removing the Transducer Head Assembly. Follow all guidelines and warnings about ESD protection and safety.
3. On the top circuit board, place a jumper between TP6 and ground (TP0A2).



4. Apply power and try to enable the network interface using Ethernet or WLAN.
5. If successful on connecting to *ReadyV* and the system is not rebooting, install the latest SC or RT firmware. See Installing Firmware Upgrades or Installing Sentinel-V Real-Time Firmware Upgrades.
6. Remove the jumper. Verify the system is not rebooting.
7. Replace the transducer side O-ring and desiccant.

> Ensure that the desiccant will not press on the electronics.

8. Follow the directions in Replacing the Transducer Head Assembly.

NOTES

Chapter 6

RETURNING SYSTEMS TO TRDI FOR SERVICE

In this chapter:

- How to pack and ship the ADCP
- How to get a RMA number
- Where to send your ADCP for repair

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

Shipping the ADCP

This section explains how to ship the Sentinel V ADCP.

Remove all customer-applied coatings or provide certification that the coating is nontoxic if a Sentinel V ADCP is shipped to TRDI for repair or upgrade. This certification must include the name of a contact person who is knowledgeable about the coating, the name, manufacturer of the coating and the appropriate telephone numbers. If the equipment is returned without meeting these conditions, TRDI has instructed our employees not to handle the equipment and to leave it in the original shipping container pending certification. If certification cannot be provided, TRDI will return the equipment or send it to a customer-specified cleaning facility. All costs associated with customer-applied coatings will be at the customer's expense.

The optional Lithium battery packs are restricted to Cargo Aircraft Only since 1 January 2015. Do NOT return ADCP units with the optional Lithium battery pack installed.

When shipping the Sentinel V ADCP through a Customs facility, be sure to place the unit so identifying labels are not covered and can be seen easily by the Customs Inspector. Failure to do so could delay transit time.

TRDI strongly recommends using the original shipping crate whenever transporting the Sentinel V ADCP.

Use the original shipping crate whenever possible. If the original packaging material is unavailable or unserviceable, additional material is available through TRDI.

For repackaging with commercially available materials:

1. Use a strong shipping container made out of wood or plastic.
2. Install a layer of shock-absorbing static-shielding material, 70-mm to 100-mm thick, around all sides of the instrument to firmly cushion and prevent movement inside the container.
3. Seal the shipping container securely.
4. Mark the container FRAGILE to ensure careful handing.
5. In any correspondence, refer to the Sentinel V ADCP by model and serial number.

Returning Systems to the TRDI

When shipping the system to TRDI from either inside or outside the United States, the following instructions will help ensure the Sentinel V ADCP arrives with the minimum possible delay. Any deviation from these instructions increases the potential for delay.

Step 1 - Request a Return Material Authorization

To obtain a Return Material Authorization (RMA) number and shipping instructions for the return of the instrument, do one of the following:

- Contact Customer Service Administration at rdicsadmin@teledyne.com
- Call +1 (858) 842-2700

When requesting a RMA number, please give us the following information:

- What is being shipped (include the serial number)
- When you plan to send the shipment
- What issue(s) need to be corrected
- Name of the Field Service Engineer that knows about the issue
- When you need the instrument returned

TRDI's Customer Service will then respond with the RMA number for the shipment. Please include this number on all packages and correspondence.

Step 2 – Provide a MSDS as necessary

Please provide a Material Safety Data Sheet (MSDS) if the system/transducer is painted with antifouling paint.

Step 3 - Ship via air freight, prepaid

The optional Lithium battery packs are restricted to Cargo Aircraft Only since 1 January 2015.
Do NOT return ADCP units with the optional Lithium battery pack installed.

Urgent Shipments should be shipped direct to TRDI via overnight or priority air services. Do not send urgent airfreight as part of a consolidated shipment. If the system is shipped consolidated, it will cost less, but may lose up to three days in transit time.

Non-urgent shipments may be shipped as part of a consolidated cargo shipment to save money. In addition, some truck lines may offer equivalent delivery service at a lower cost, depending on the distance to San Diego.

Mark the Package(s)

To: Teledyne RD Instruments, Inc. (RMA Number)
14020 Stowe Drive
Poway, California 92064

Airport of Destination = San Diego
UPS Supply Chain Solutions Brokerage
15 E Oregon avenue
Philadelphia PA 19148
USA
Email: phldocreceipt@ups.com
Tel: + 1 (215) 952-1745

Step 4 - Urgent shipments

Send the following information by telephone to TRDI.

Attention:Customer Service Administration

Phone:+1 (858) 842-2700

- Detailed descriptions of what is shipping (number of packages, sizes, weights and contents).
- The name of the freight carrier
- Master Air bill number
- Carrier route and flight numbers for all flights the package will take

Returning Systems to TRDI Europe

When shipping the system to TRDI Europe, the following instructions will help ensure the Sentinel V ADCP arrives with the minimum possible delay. Any deviation from these instructions increases the potential for delay.

Step 1 - Request a Return Material Authorization

To obtain a Return Material Authorization (RMA) number and shipping instructions for the return of the instrument, do one of the following:

- Contact Customer Service Administration at rdiefs@teledyne.com
- Call +33(0) 492-110-930

When requesting a RMA number, please give us the following information:

- What is being shipped (include the serial number)
- When you plan to send the shipment
- What issue(s) need to be corrected
- Name of the Field Service Engineer that knows about the issue
- When you need the instrument returned

TRDI's Customer Service will then respond with the RMA number for the shipment. Please include this number on all packages and correspondence.

Step 2 – Provide a MSDS as necessary

Please provide a Material Safety Data Sheet (MSDS) if the system/transducer is painted with antifouling paint.

Step 3 - Ship via Air Freight, Prepaid

The optional Lithium battery packs are restricted to Cargo Aircraft Only since 1 January 2015. Do NOT return ADCP units with the optional Lithium battery pack installed.

Urgent Shipments should be shipped direct to TRDI via overnight or priority air services. Do not send urgent airfreight as part of a consolidated shipment. If the system is shipped consolidated, it will cost less, but may lose up to three days in transit time.

Non-urgent shipments may be shipped as part of a consolidated cargo shipment to save money.

Mark the package(s) as follows:

To:Teledyne RD Instruments, Inc. (RMA Number)
2A Les Nertieres
5 Avenue Hector Pintus
06610 La Gaude, France

Step 4 - Include Proper Customs Documentation

The Customs statement must be completed. It should be accurate and truthfully contain the following information.

- Contents of the shipment
- Value
- Purpose of shipment (example: "American made goods returned for repair")
- Any discrepancy or inaccuracy in the Customs statement could cause the shipment to be delayed in Customs.

Step 5 - Send the Following Information by Telephone to TRDI

Attention:Sales Administration

Phone:+33(0) 492-110-930

- Detailed descriptions of what is shipping (number of packages, sizes, weights and contents).
- The name of the freight carrier
- Master Air bill number
- Carrier route and flight numbers for all flights the package will take

NOTES

Chapter 7

SPECIFICATIONS

In this chapter:

- What are the Sentinel V specifications
- Sentinel V dimensions and weights

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

Table 22: High Bandwidth Water Profiling

Depth Cell Size[1]	Sentinel V20		Sentinel V50		Sentinel V 100	
Vertical Resolution	Range[2] (m)	Std. dev.[3] (cm/s)	Range[2] (m)	Std. dev.[3] (cm/s)	Range[2] (m)	Std. dev.[3] (cm/s)
0.25m	18.0	19.2				
0.3m	19.3	11.1				
0.5m	20.2	7.1	44.1	19.2		
1.0m	22.1	3.6	50.5	7.1	94.5	10.9
2.0m	24.5	1.7	56.0	3.6	103.5	5.5
4.0m	26.9	0.8	63.1	1.7	114.6	2.7
6.0m			67.4	1.1	121.7	1.8

1. User's choice of depth cell size is not limited to the typical values specified.
2. Range, which depends on cell size, is specified here for High bandwidth mode at 5° C, typical ocean backscatter and nominal 14 VDC battery power; longer ranges are possible. Using 18 VDC will increase the range by 5 to 10% depending on conditions.
3. User selects the bandwidth mode; High = 25% or Low = 6%. High bandwidth mode single water ping per ensemble standard deviation.
5. Table applies to Sentinel V and Sentinel V Real-Time ADCPs.

Table 23: Low Bandwidth Water Profiling

Depth Cell Size[1]	Sentinel V20		Sentinel V50		Sentinel V 100	
Vertical Resolution	Range[2] (m)	Std. dev.[3] (cm/s)	Range[2] (m)	Std. dev.[3] (cm/s)	Range[2] (m)	Std. dev.[3] (cm/s)
0.25m	22.6	36.5				
0.30m	24.0	20.8				
0.5m	24.9	13.4	57.6	36.5		
1.0m	26.9	6.7	64.6	13.5	120.6	20.6
2.0m	29.4	3.2	70.6	6.7	130.4	10.3
4.0m	32.0	1.6	78.2	3.2	142.3	5.2
6.0m			82.8	2.1	151.5	3.3

1. User's choice of depth cell size is not limited to the typical values specified.
2. Range, which depends on cell size, is specified here for Low bandwidth mode at 5° C, typical ocean backscatter and nominal 14 VDC battery power; longer ranges are possible. Using 18 VDC will increase the range by 5 to 10% depending on conditions.
3. User selects the bandwidth mode; High = 25% or Low = 6%. Low bandwidth mode single water ping per ensemble standard deviation.
4. Table applies to Sentinel V and Sentinel V Real-Time ADCPs.

Table 24. Bottom Track Range and Accuracy

	V20 (1000kHz)	V50 (500kHz)	V100 (300kHz)
Accuracy (High Accuracy)	±.5% or ±2cm/sec	±.5% or ±2cm/sec	±.5% or ±2cm/sec
Accuracy (Base Accuracy)	±1.15% ±2cm/sec	±1.15% ±2cm/sec	±1.15% ±2cm/sec
Range	45m	125m	240m

Table 25: Profile Parameters

Item	Specification
Velocity accuracy Sentinel V20 and V50 Sentinel V100	 ± 0.3% of the water velocity relative to the ADCP ± 0.3 cm/s ± 0.5% of the water velocity relative to the ADCP ± 0.5 cm/s
Velocity resolution	0.1 cm/s
Velocity range	± 5m/s (default), ± 20m/s (maximum)
Maximum sample rate (Self-Contained)	2Hz (5-beam) 4Hz (Janus beams only)
Maximum sample (Real-Time)	4 Beam 1000 kHz = 16 Hz 4 Beam 500 kHz = 10 Hz 4 Beam 300 kHz = 6 Hz 5 Beam 1000 kHz = 8 Hz 5 Beam 500 kHz = 5 Hz 5 Beam 300 kHz = 3 Hz

Table 26: Echo Intensity Profile

Item	Specification
Vertical resolution	Depth cell size
Dynamic range	80 dB
Precision	± 1.5dB

Table 27. Real-Time Trigger

Specification	RS-232	RS-422	Ethernet
Supported	Trig-in	Not supported	Not supported
Signal level	3.3V	-	-
Signal length	10ms - 40ms	-	-
Edge detect	Rising	-	-

Table 28: Transducer and Hardware

Item	Specification
Beam angle	25°
Configuration	4 beam, convex, 5th beam vertical
Depth Rating	200 meters
Materials	Transducer, housing, and end-cap: plastic Connector: Metal shell
Internal memory	One 16GB microSD card included (SC use only)
Wireless RT	Firmware upload, IEEE 802.11b/g/n, enabled using command
Wireless SC	Control and data download, IEEE 802.11b/g/n, enabled using touch sensor
Serial SC	Ping Data output, RS-422 (factory configured)
Serial RT	Command and control, data output RS-422 (factory configured)
Ethernet RT	TCP/IP Command & Control, UDP data output direct or broadcast
FCC Certification Industry Canada Certification	FCC ID: S5WV2648273001 IC: 10915A-V2648273001

The user’s body must remain 20 cm (7.8 inches) away from the ADCP during normal operation.

FCC-IC Statements:

This device complies with FCC part 15.247 and IC RSS-210 for license exempt radio apparatus.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept harmful interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

FCC-IC Déclarations:

Cet appareil est conforme à la FCC part 15.247 et IC RSS-210 d'appareils radio exempts de licence.

L’exploitation est autorisée aux deux conditions suivantes:

(1) l’appareil ne doit pas produire de brouillage préjudiciable, et
(2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Tout changement apporté à ce terminal non expressément approuvé par la partie responsable de la conformité est susceptible d'annuler le droit de l'utilisateur à se servir de cet équipement.

Table 29: Standard Sensors

Temperature (mounted on transducer)	
Range	-5° to 45° C
Precision	±0.4° C
Resolution	0.1°
Tilt (MEMS accelerometers)	
Range	±90° pitch, ±180° roll
Accuracy	2° RMS
Precision	0.05° RMS
Resolution	0.1°
Compass (magneto-inductive sensor)	
Accuracy	2° RMS(1)
Resolution	0.1°
Max Dip Angle	85°
Pressure Sensor (mounted on transducer)	
Range	300m
Accuracy	0.1% FS

1. ±2.0° is commonly achieved after field calibration.

Table 30: Sentinel V Battery Power Specifications

Item	Specification
DC input (SC or RT without BT)	12 to 20 VDC external power supply
External DC Input for RT with BT	16VDC, 3A (V20) 16VDC, 6A (V50) 16VDC, 8A (V100)
Max cable length (Real-Time ADCPs)	18AWG up to 100m (V20) 15AWG up to 100m (V50) 15AWG up to 50m. 13AWG up to 100m (V100)
Battery Voltage	Standard Alkaline: 18 VDC (new), 11 VDC (depleted) Optional Lithium: 15.6 VDC (new), safety circuit disconnects the battery when if falls below 12 VDC
Battery Capacity (Pack)	510 watt hours @ 5° C
Optional Lithium Battery Capacity (Pack)	1900 watt hours @ 5° C
Battery Capacity (12 D-cell Commercial Batteries)[1]	100 watt hours @ 0°C
External Battery Case	18 VDC (new), 11 VDC (depleted). Holds two battery packs.

1. For reference only; actual capacity varies by battery manufacturer.

The AC Adapter (97D-6000-00) and bench top test cable (73D-3112-005) outputs a max of 24 watts (18V at 1.33 A at a 10% duty cycle) which is **insufficient to power the ADCP for long range bottom tracking**. TRDI suggests using a heavy-duty power supply that is capable of supplying 16V at 150W like the one we supply in the Sentinel V deck box to support a long duration bottom tracking ping.

Table 31: Environmental Specifications

Item	Specification
Operating temperature with or without batteries	-5° to 45°C
Short Term Storage/Shipping (<45days) temperature (Batteries Installed)	-5° to 45°C
Long Term Storage (>45days) temperature (Batteries Installed)	0° C to 21° C
Long Term Storage (>45days) temperature (Batteries Removed)	-30° to 60°C
Long Term (>45days) Battery Storage	Batteries should be stored in cool dry air with a temperature range of 0° C to 21° C
Battery Shelf Life	Use batteries within 24 months of the manufacture date

Do not deploy the system with batteries that are older than the Deploy By date. It should be noted, that while a battery pack will not be dead after the Deploy By date, the actual performance of the battery is in doubt, and may not have sufficient capacity for the deployment.

Sentinel V battery packs have three dates on them:

Manufacture Date is the date the battery was built and final tested.

TRDI Ship by Date provides the maximum duration that the battery will remain on TRDI's shelves before shipping and is 12 months after the manufacture date.

Deploy By Date provides the last date when the battery should be used to start a deployment and is 24 months from the manufacture date.

Vertical Beam Specifications

Table 32. Vertical Beam Standard Deviation (for high bandwidth water profiling)

Depth Cell Size	Sentinel V20		Sentinel V50		Sentinel V100	
Vertical Resolution	Range (m)	Std. Dev (cm/s)	Range (m)	Std. Dev (cm/s)	Range (m)	Std. Dev (cm/s)
0.25m	14.9	1.68				
0.5m	17.1	0.62	34.2	1.68		
1.0m	19.0	0.31	40.3	0.62	77.7	1.56
2.0m	21.2	0.16	45.7	0.31	90.1	0.58
4.0m			52.0	0.16	103.4	0.26
8.0m					117.4	0.13

Notes:

1. Standard deviation for vertical beam is specified for VERTICAL velocity only. (For Janus beams standard deviation is specified for horizontal velocity)
2. Range is highly dependent on the conditions of the water; estimates are based on 5°C, typical ocean backscatter, and nominal 14VDC battery supply.

Table 33. Vertical Beam Accuracy:

Item	Specification
Velocity Accuracy Sentinel V20 & V50 Sentinel V100	 +/-0.3% of the water velocity relative to the ADCP +/-3mm/s +/-0.5% of the water velocity relative to the ADCP +/-5mm/s
Velocity Resolution	1mm/s
Velocity Range	+/-1.75m/s (nominal)
Number of Depth Cells	1 to 255
Ping Rate	2hz (typical); 4-10hz possible

Notes:

Velocity accuracy for vertical beam is specified for along the beam. If the system is tilted, then both the horizontal and vertical velocities are being measured and reported.

Table 34. Vertical Beam Echo Intensity Profile

Item	Specification
Vertical Resolution	Variable resolution, up to 1024 samples per profile
Dynamic Range	80dB
Precision	+/-1.5dB (relative measurement)

Table 35. Surface Ranging – Maximum Detection Range for Surface

	Janus Beams	Vertical beam
Sentinel V100	250m	255m
Sentinel V50	125m	120m
Sentinel V20	41.8m	40.4m

Notes:

1. Range is highly dependent on the conditions of the surface; these are nominal estimates.
2. Estimates are for surface detection only. Specific applications such as directional waves detection may have other requirements that could further limit the maximum operational range.

Table 36. Beam widths

	Janus beams width	Vertical beam width
Sentinel V100	2.7°	4.0°
Sentinel V50	2.5°	5.0°
Sentinel V20	1.3°	2.5°

Notes:

1. Beam width is specified as the angle between the two -3dB points of the beam pattern
2. Beam width is specified as a two-way beam width; i.e. the beam width of the composite transmit and receive response.

Outline Installation Drawings

The following drawings show the standard Sentinel V dimensions and weights.

Table 37: Outline Installation Drawings

Drawing Number	Description	Sentinel V Configuration (s = RS232 or RS422, x = right or straight connector)
96D-6000	Sentinel V Real-Time Only	S20-50PsWx-16G-200 S50-50PsWx-16G-200 S100-50PsWx-16G-200 S20-50PEWx-16G-200 S50-50PEWx-16G-200 S100-100PEWx-16G-200
96D-6001	Sentinel V with 12 D-Cell Alkaline batteries, with connector	S20-51PsWx-16G-200 S50-51PsWx-16G-200 S100-51PsWx-16G-200 S20-51PEWx-16G-200 S50-51PEWx-16G-200 S100-51PEWx-16G-200

Drawing Number	Description	Sentinel V Configuration (s = RS232 or RS422, x = right or straight connector)
96D-6002	Sentinel V with 12 D-Cell Alkaline batteries, without connector	S20-51PsW0-16G-200 S50-51PsW0-16G-200 S100-51PsW0-16G-200 S20-51PEW0-16G-200 S50-51PEW0-16G-200 S100-51PEW0-16G-200
96D-6003	Sentinel V with Alkaline battery pack, with connector	S20-53PsWx-16G-200 S50-53PsWx-16G-200 S100-53PsWx-16G-200 S20-53PEWx-16G-200 S50-53PEWx-16G-200 S100-53PEWx-16G-200
96D-6004	Sentinel V with Alkaline battery pack, without connector	S20-53PsW0-16G-200 S50-53PsW0-16G-200 S100-53PsW0-16G-200 S20-53PEW0-16G-200 S50-53PEW0-16G-200 S100-53PEW0-16G-200
96D-6005	External Battery Case	All Sentinel V External Battery Cases

Outline Installation Drawings are subject to change without notice. Contact TRDI before building mounts or other hardware.

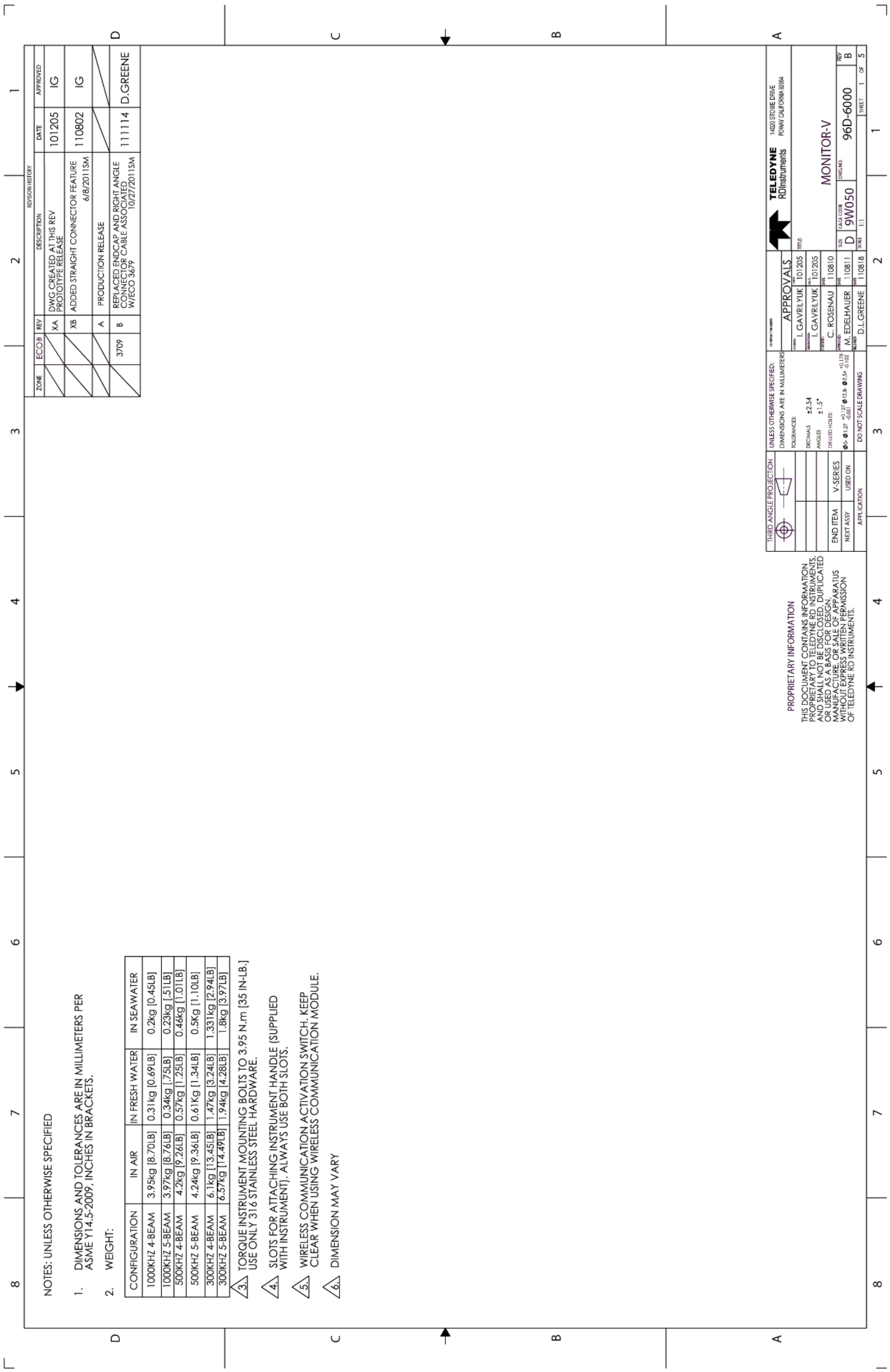


Figure 82. 96D-6000 Sheet 1

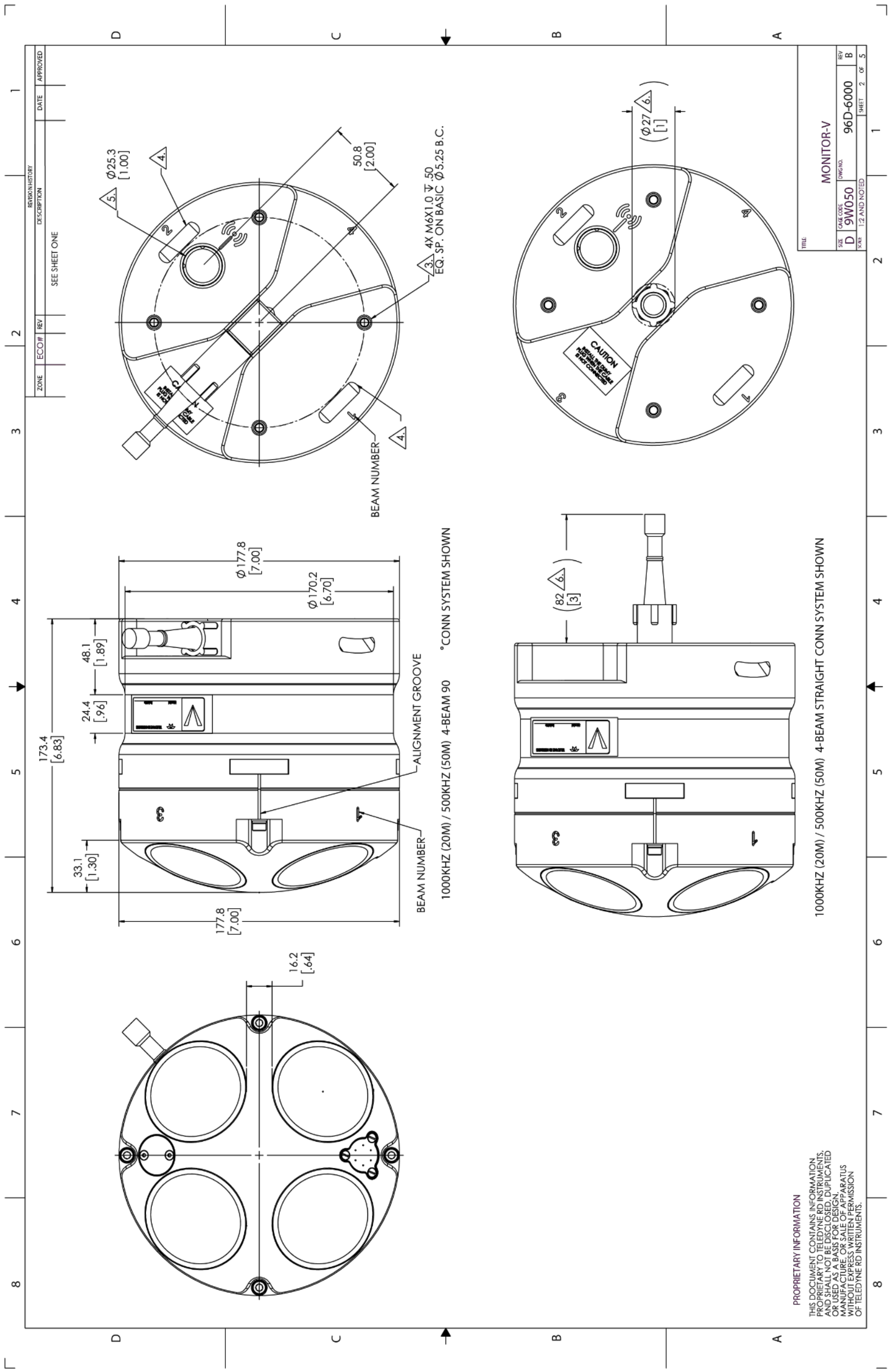


Figure 83. 96D-6000 Sheet 2

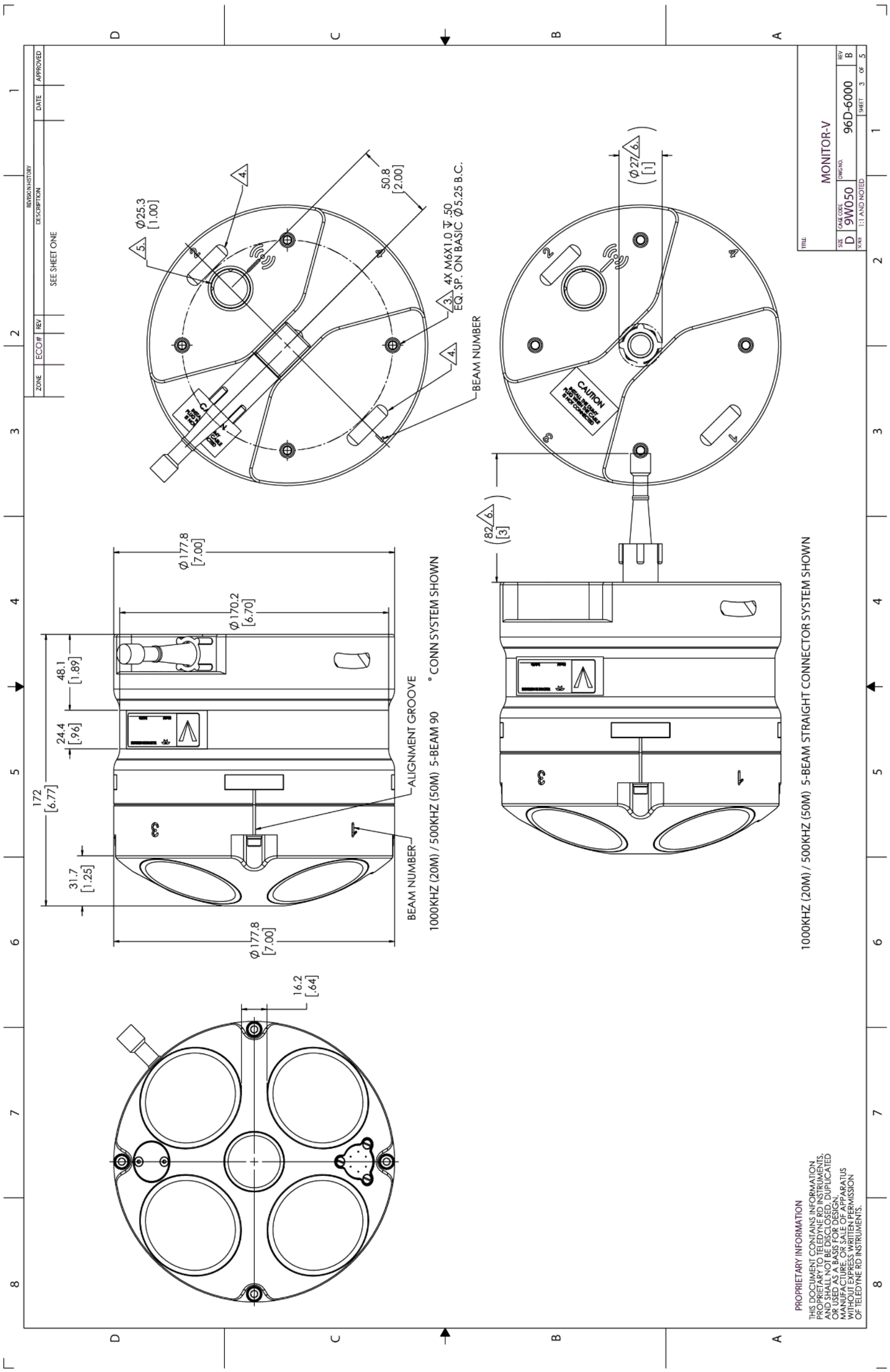


Figure 84. 96D-6000 Sheet 3

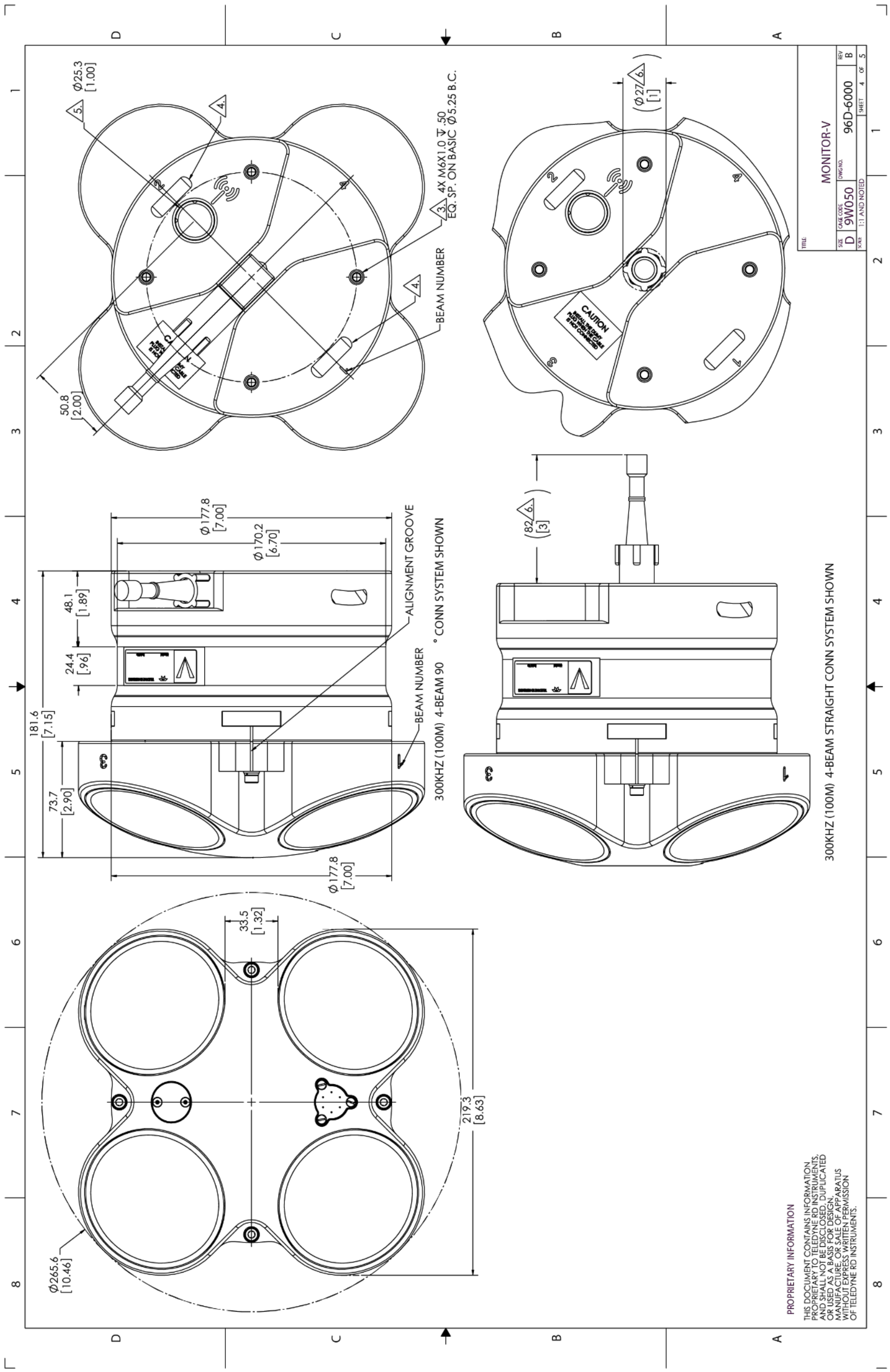


Figure 85. 96D-6000 Sheet 4

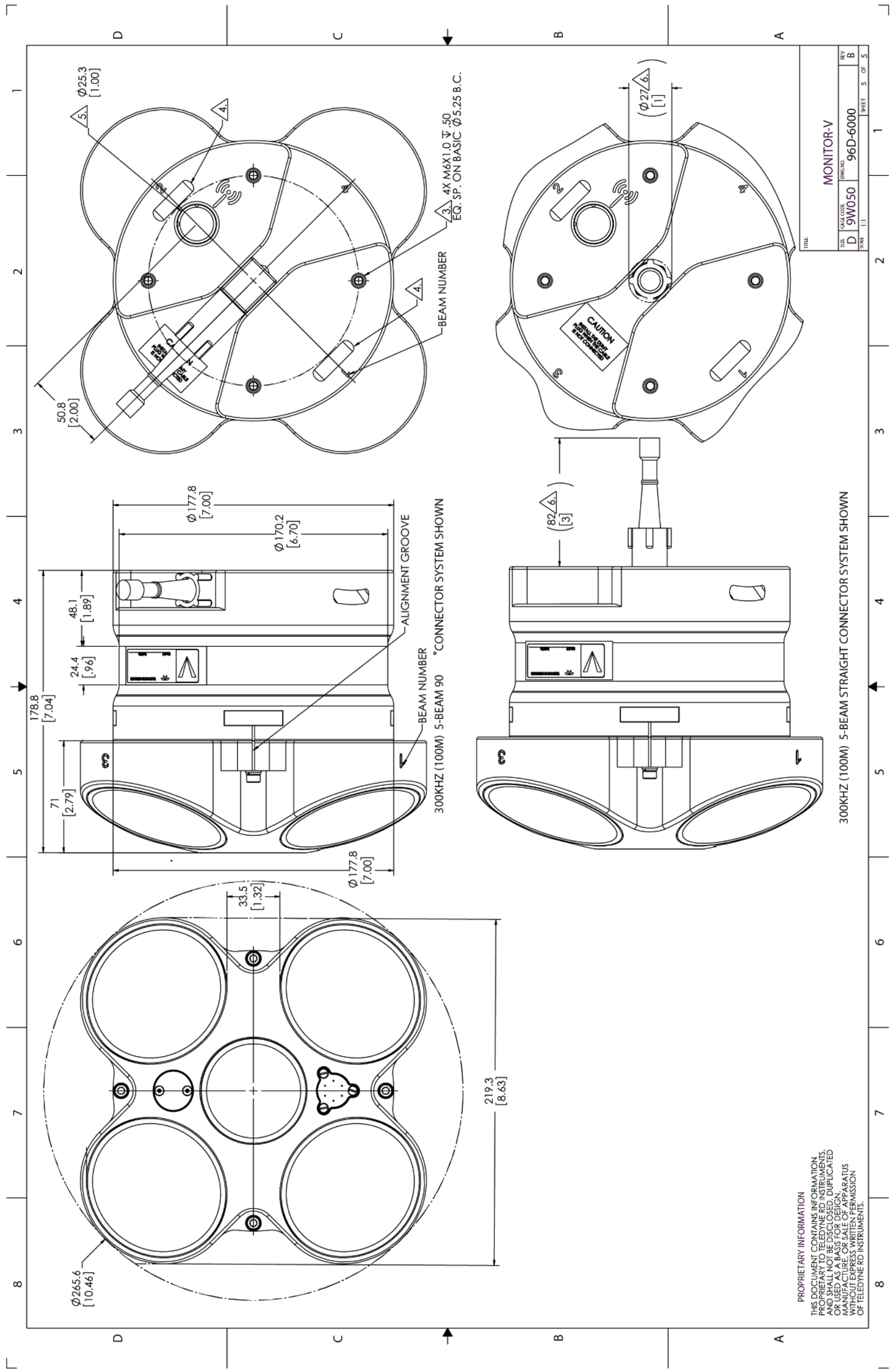


Figure 86. 96D-6000 Sheet 5

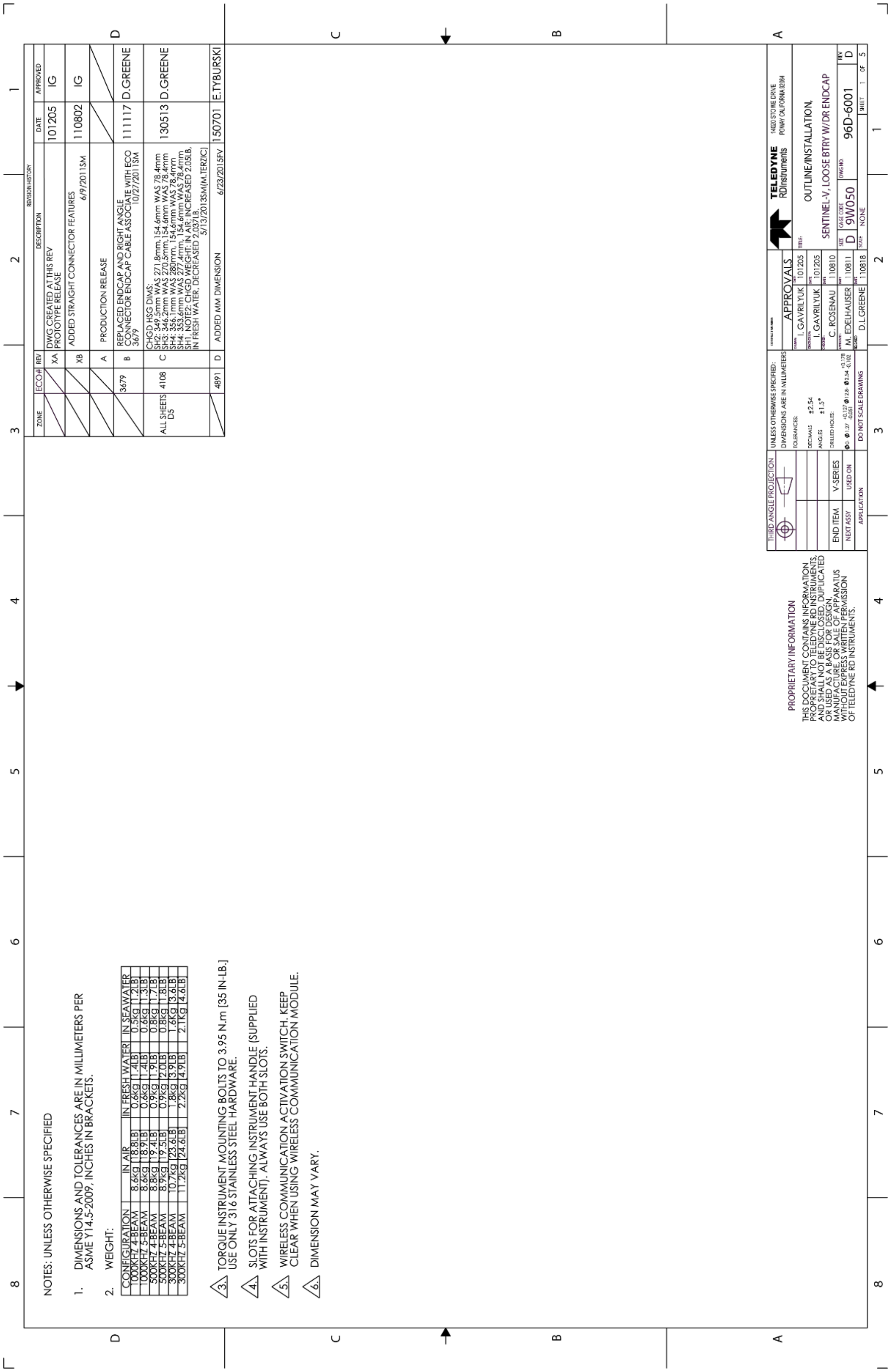


Figure 87. **96D-6001 Sheet 1**

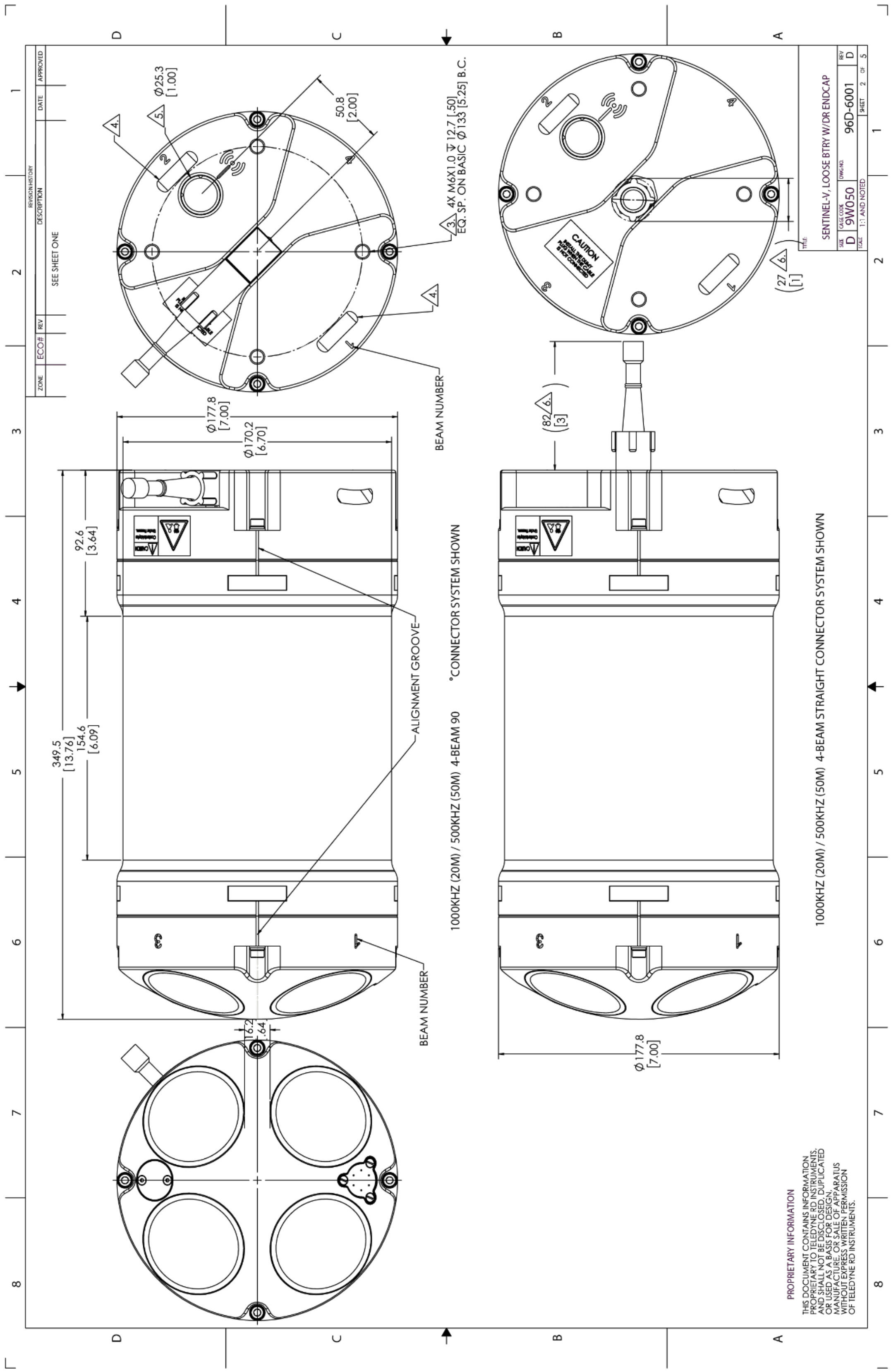


Figure 88. 96D-6001 Sheet 2

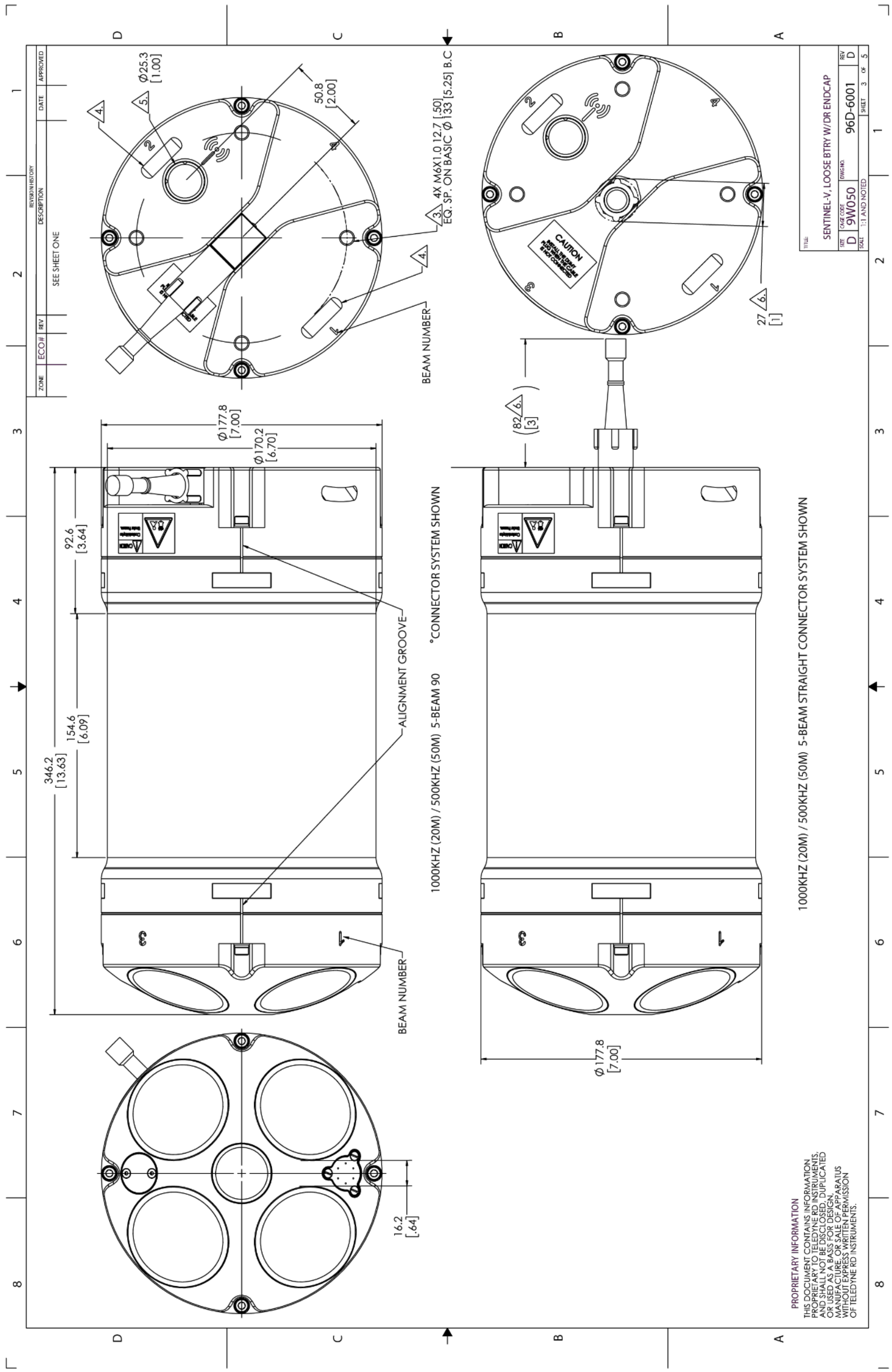


Figure 89. **96D-6001 Sheet 3**

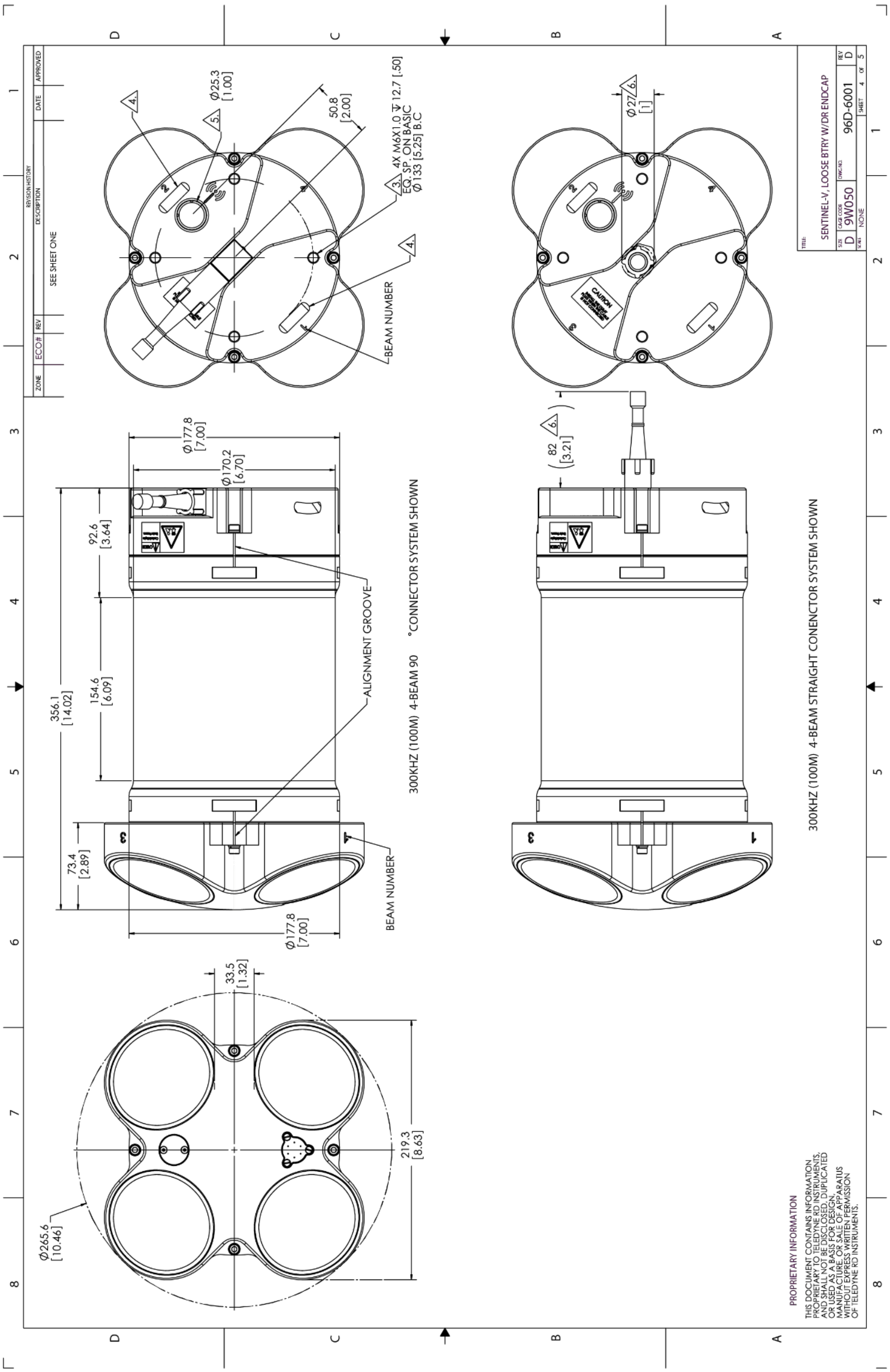


Figure 90. 96D-6001 Sheet 4

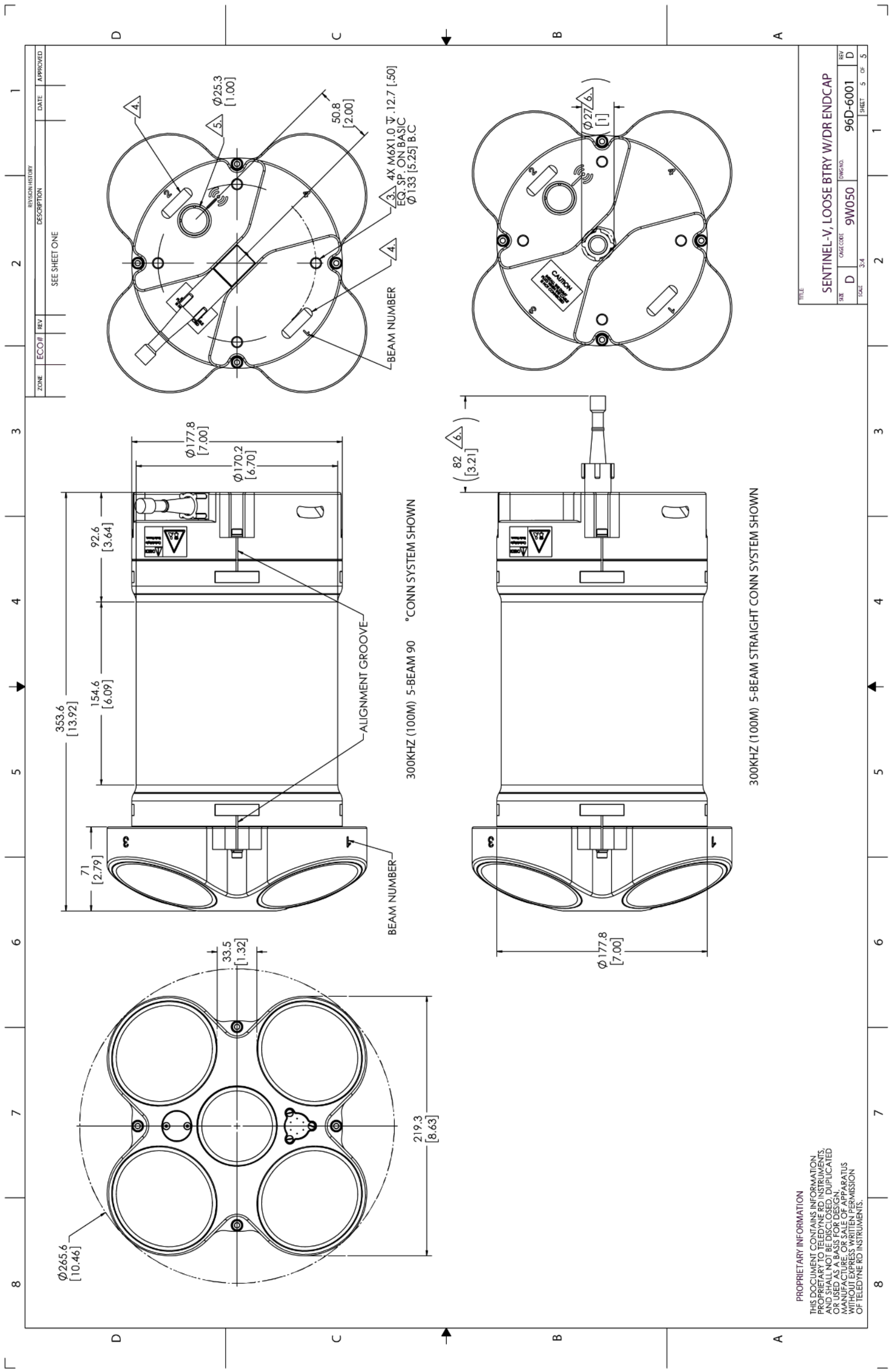
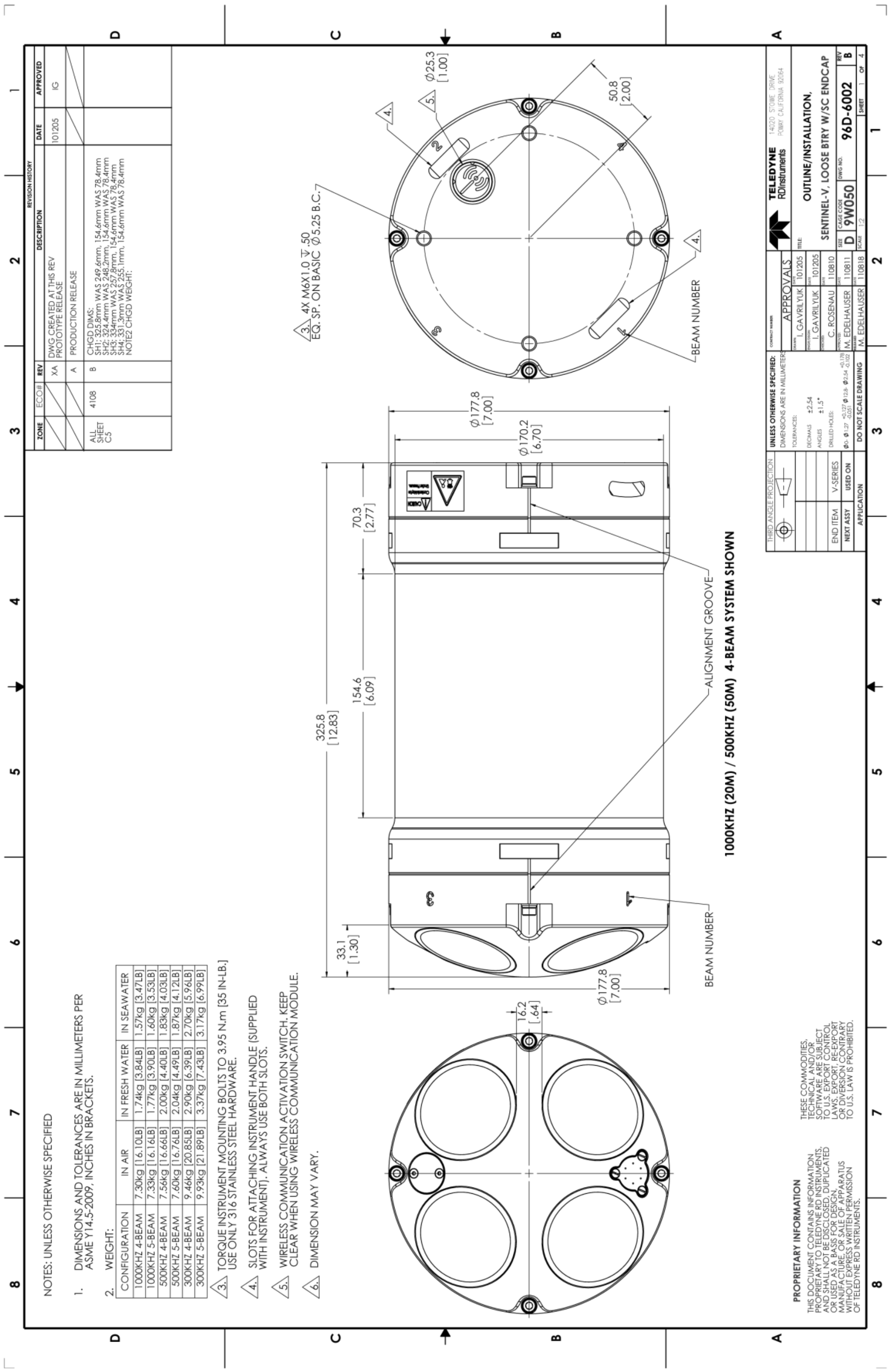


Figure 91. **96D-6001 Sheet 5**



CONFIGURATION	IN AIR	IN FRESH WATER	IN SEAWATER
1000KHZ 4-BEAM	7.30kg [16.10LB]	1.74kg [3.84LB]	1.57kg [3.47LB]
1000KHZ 5-BEAM	7.33kg [16.16LB]	1.77kg [3.90LB]	1.60kg [3.53LB]
500KHZ 4-BEAM	7.56kg [16.66LB]	2.00kg [4.40LB]	1.83kg [4.03LB]
500KHZ 5-BEAM	7.60kg [16.76LB]	2.04kg [4.49LB]	1.87kg [4.12LB]
300KHZ 4-BEAM	9.46kg [20.85LB]	2.90kg [6.39LB]	2.70kg [5.96LB]
300KHZ 5-BEAM	9.93kg [21.89LB]	3.37kg [7.43LB]	3.17kg [6.99LB]

Figure 92. 96D-6002 Sheet 1

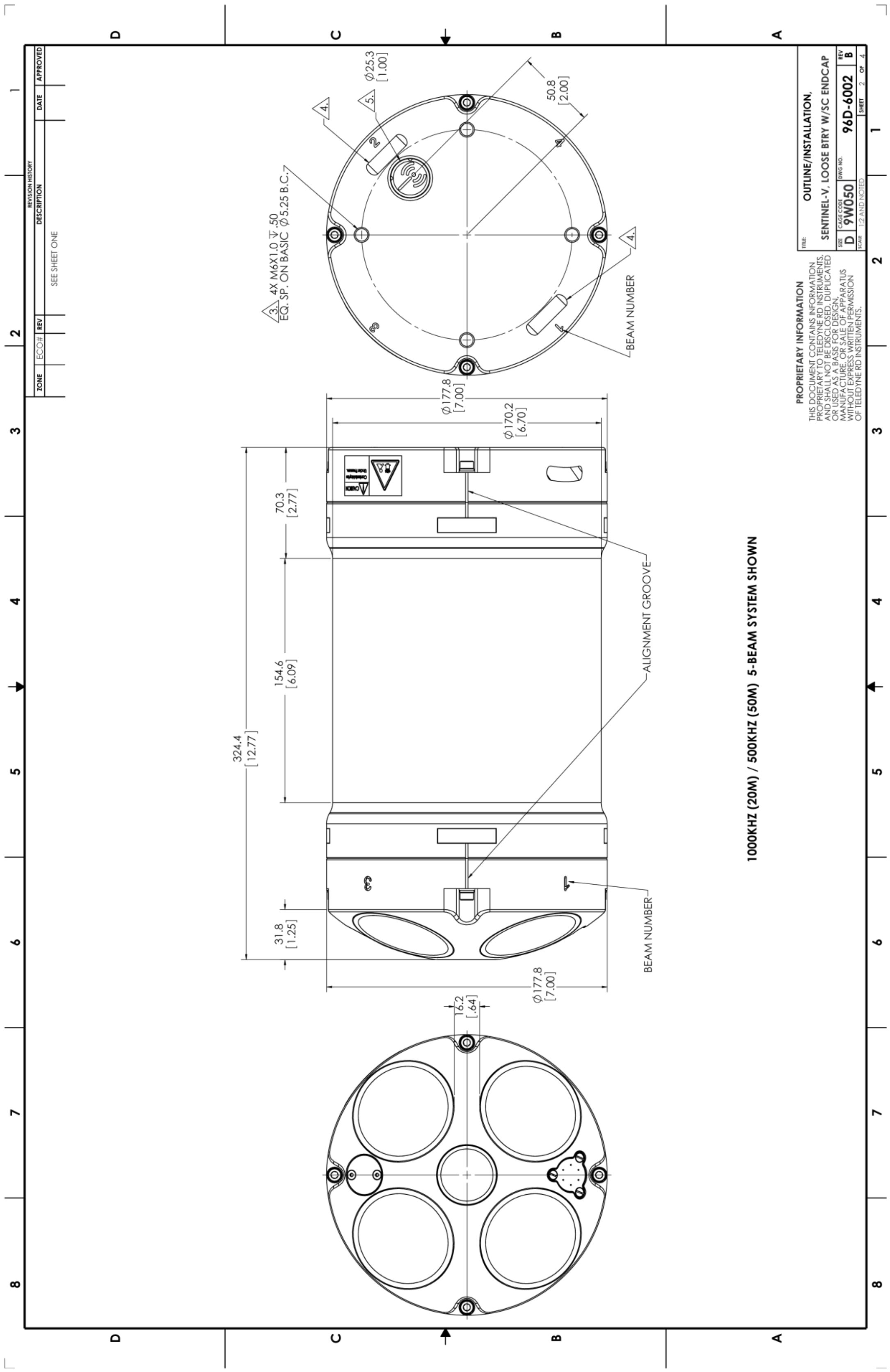


Figure 93. 96D-6002 Sheet 2

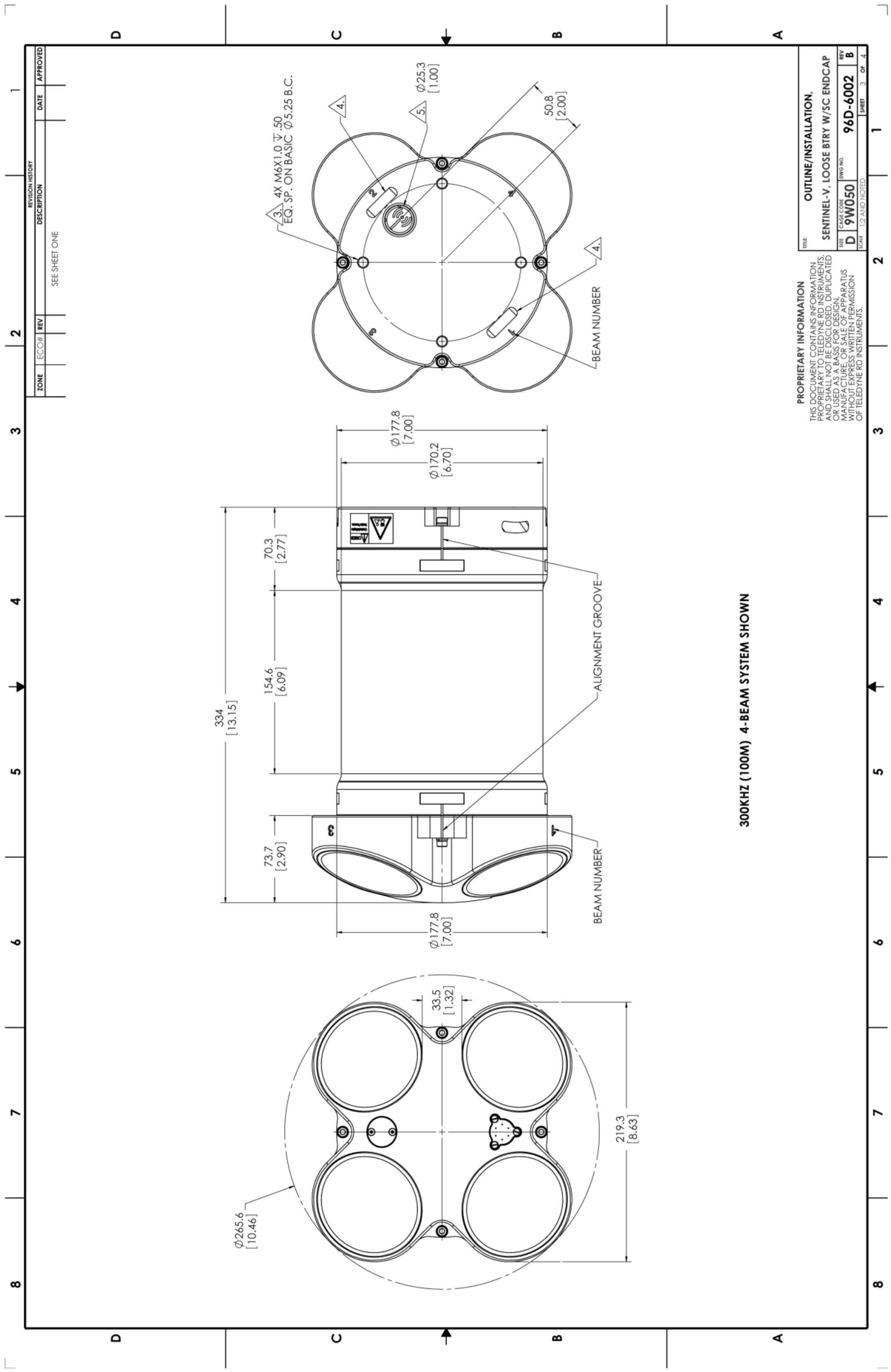


Figure 94. 96D-6002 Sheet 3

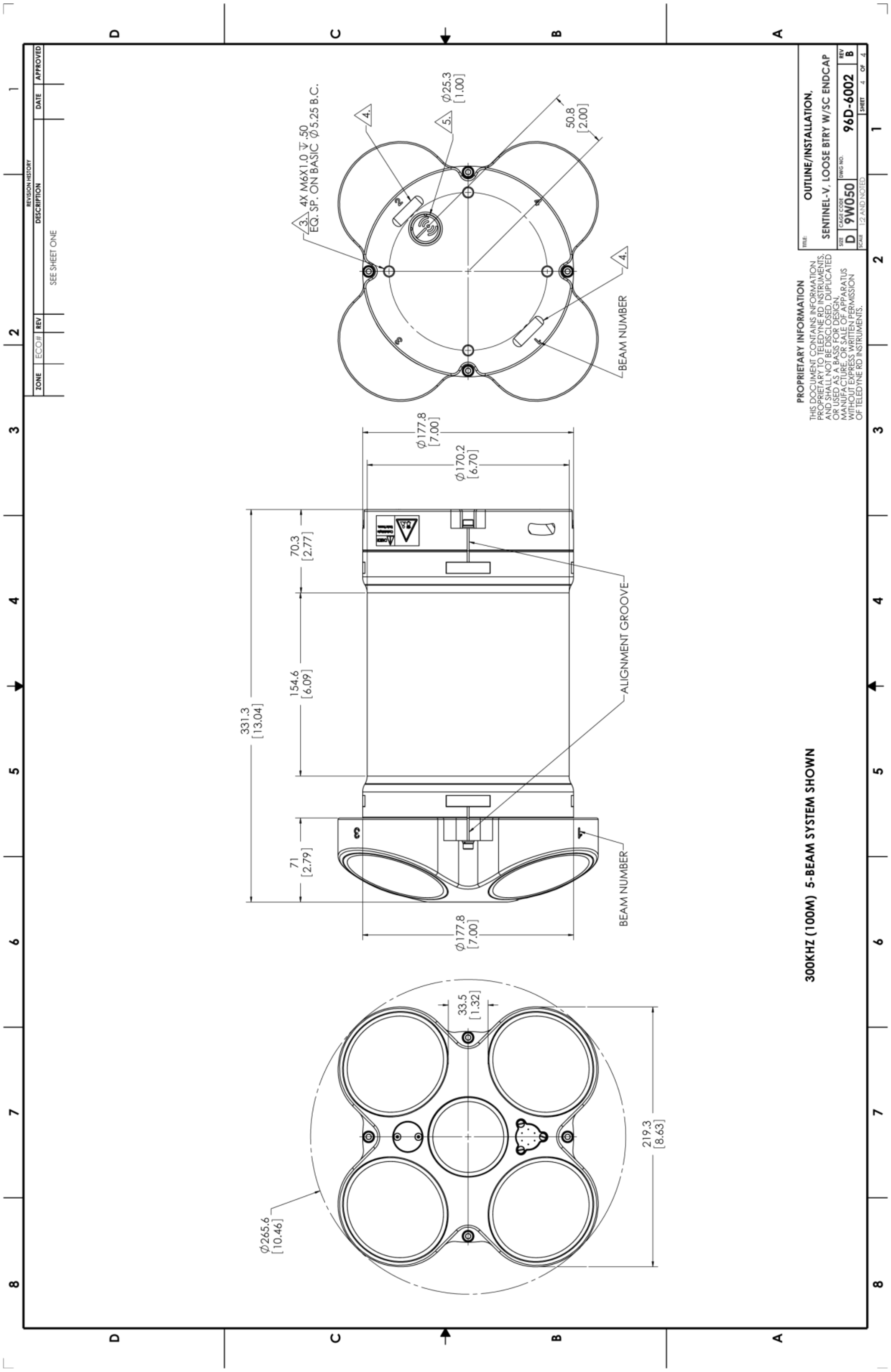


Figure 95. **96D-6002 Sheet 4**

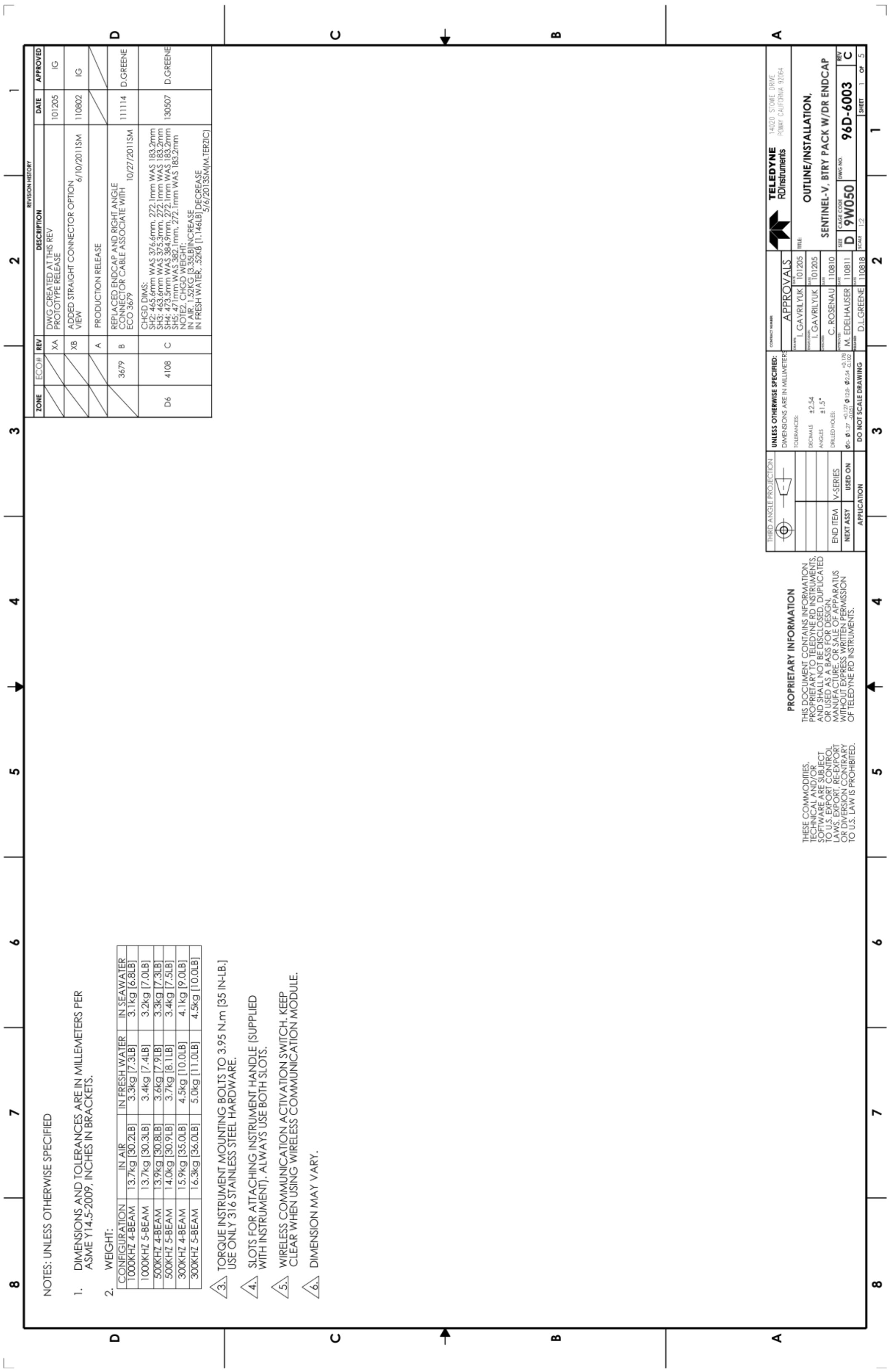


Figure 96. **96D-6003 Sheet 1**

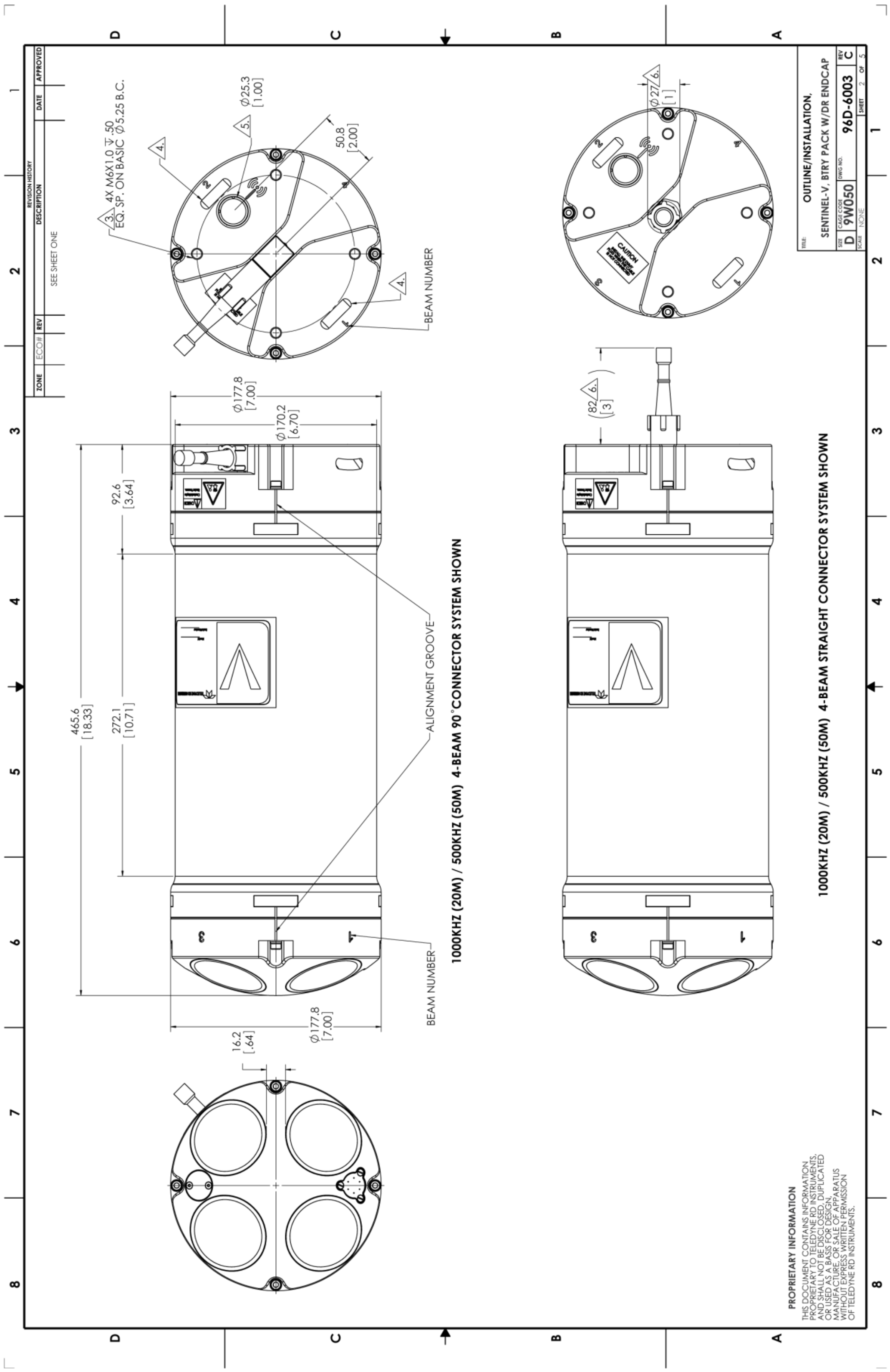


Figure 97. 96D-6003 Sheet 2

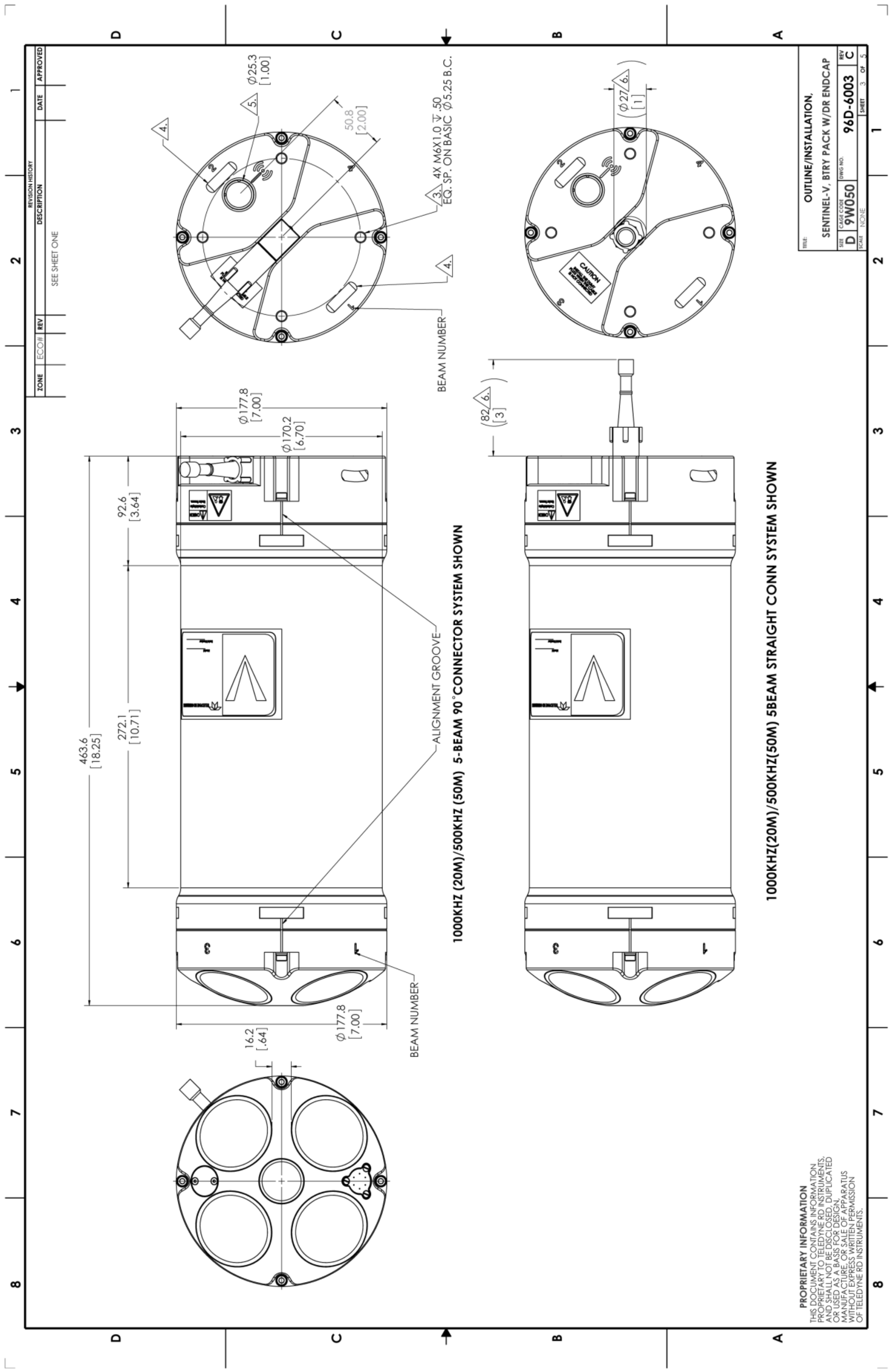


Figure 98. **96D-6003 Sheet 3**

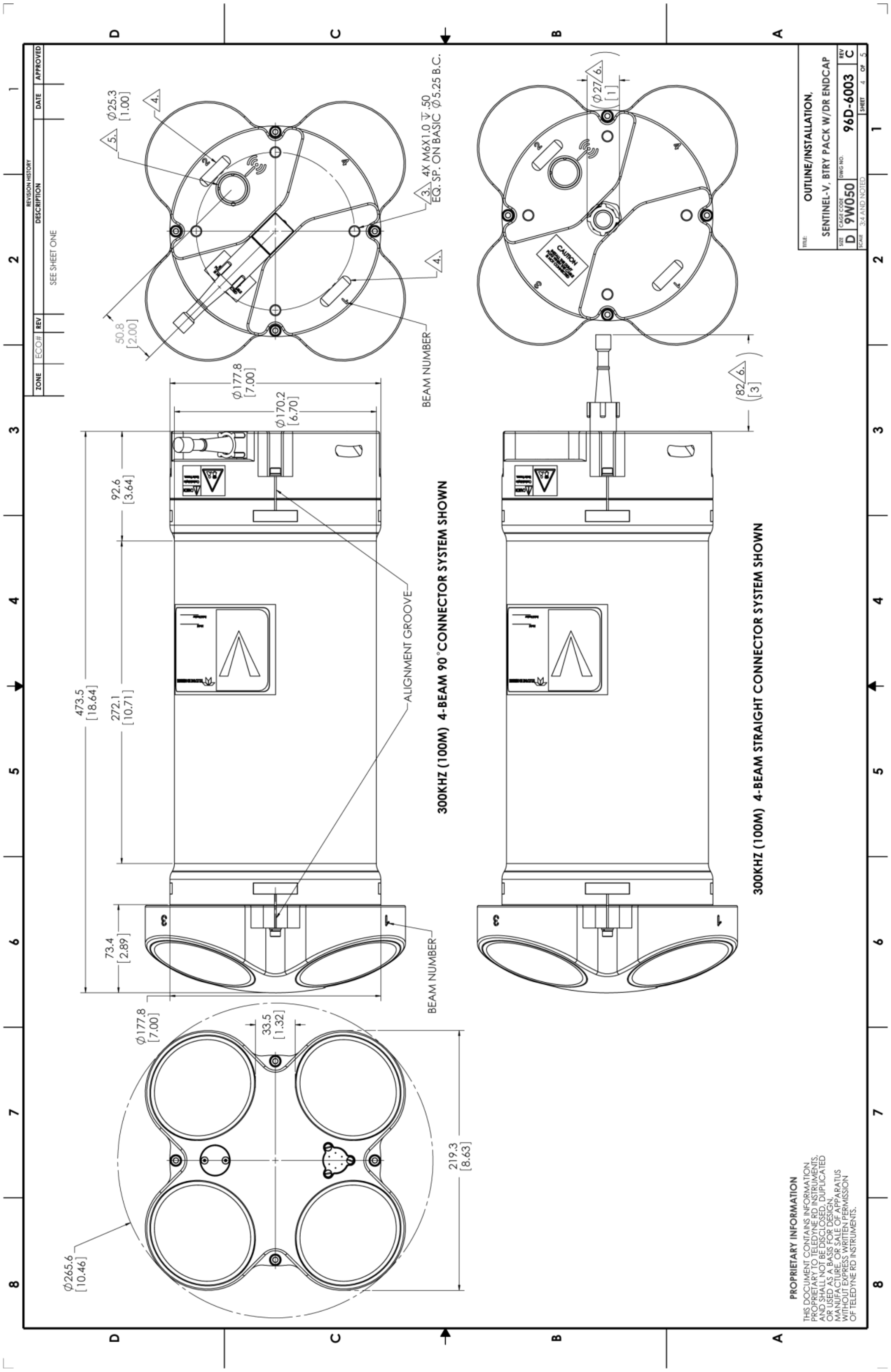


Figure 99. 96D-6003 Sheet 4

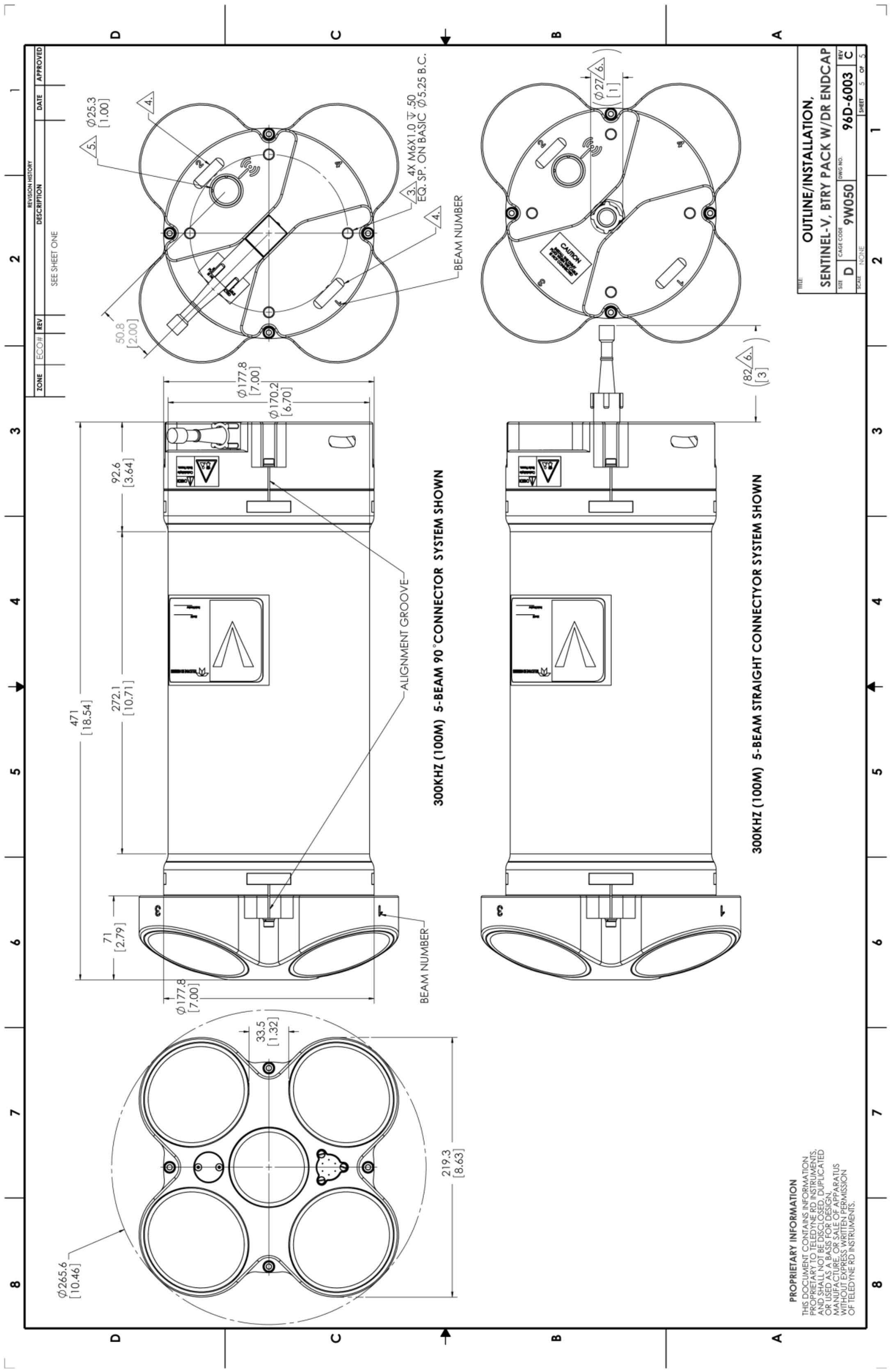


Figure 100. 96D-6003 Sheet 5

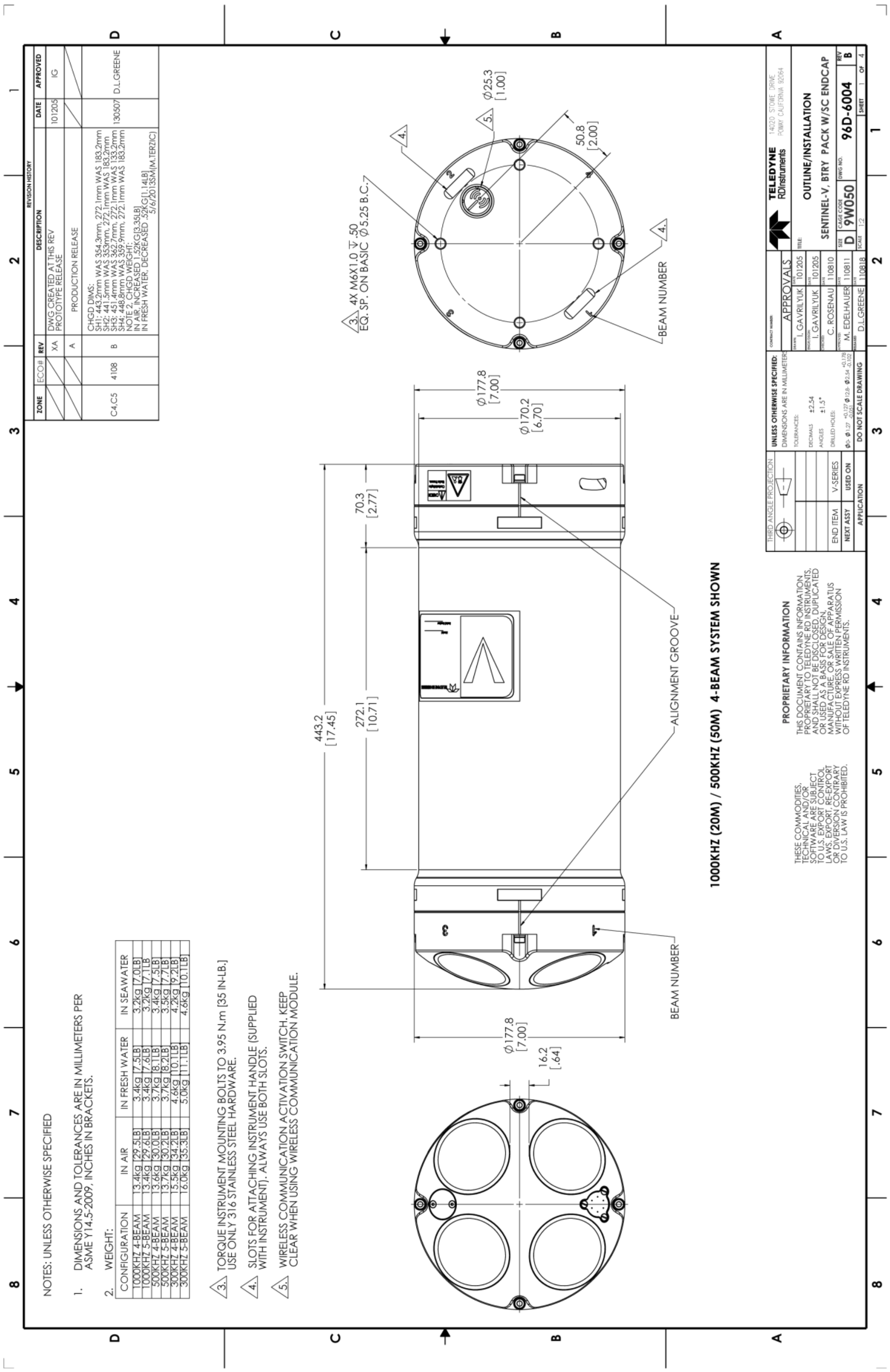


Figure 101. **96D-6004 Sheet 1**

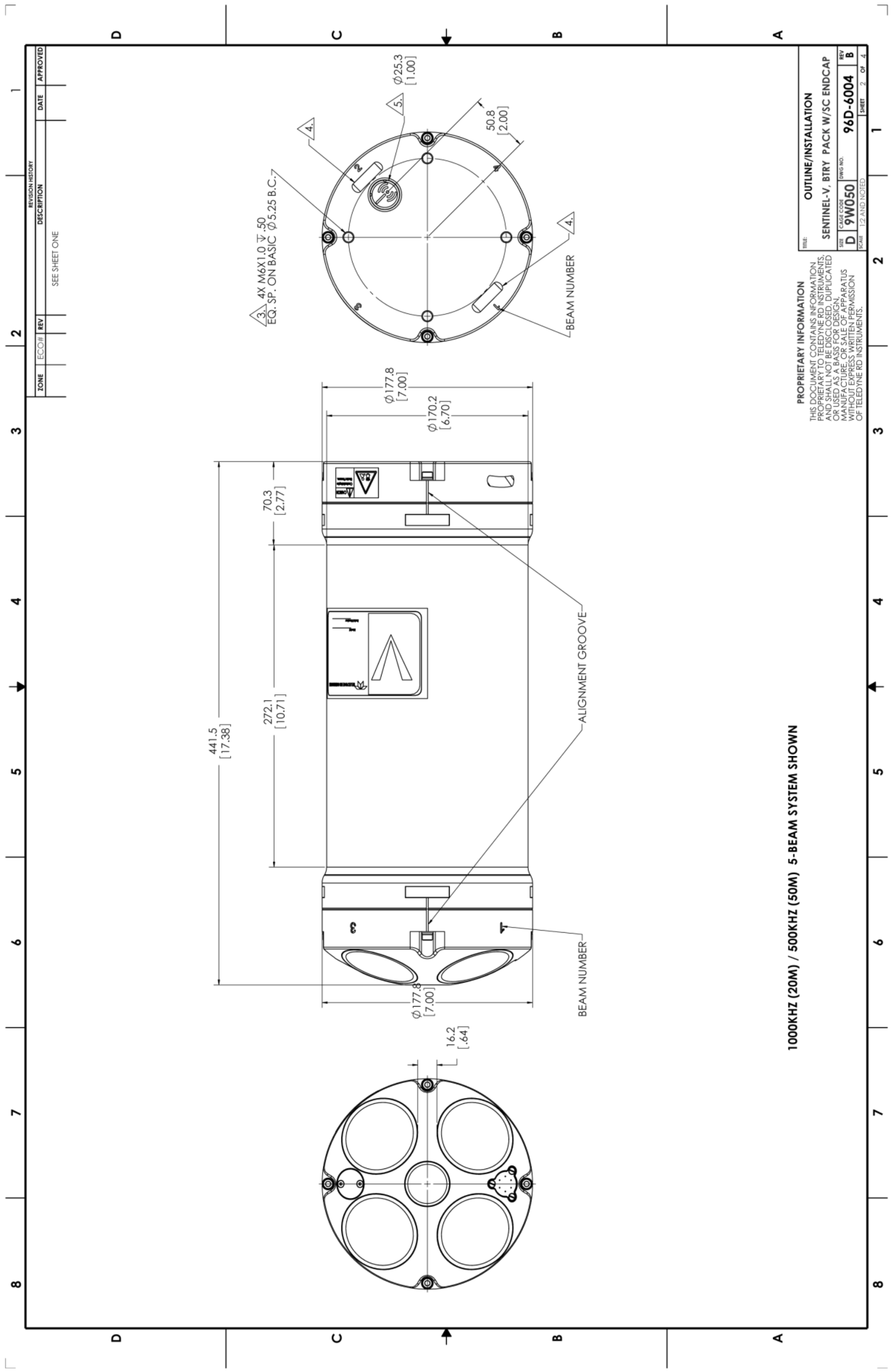


Figure 102. 96D-6004 Sheet 2

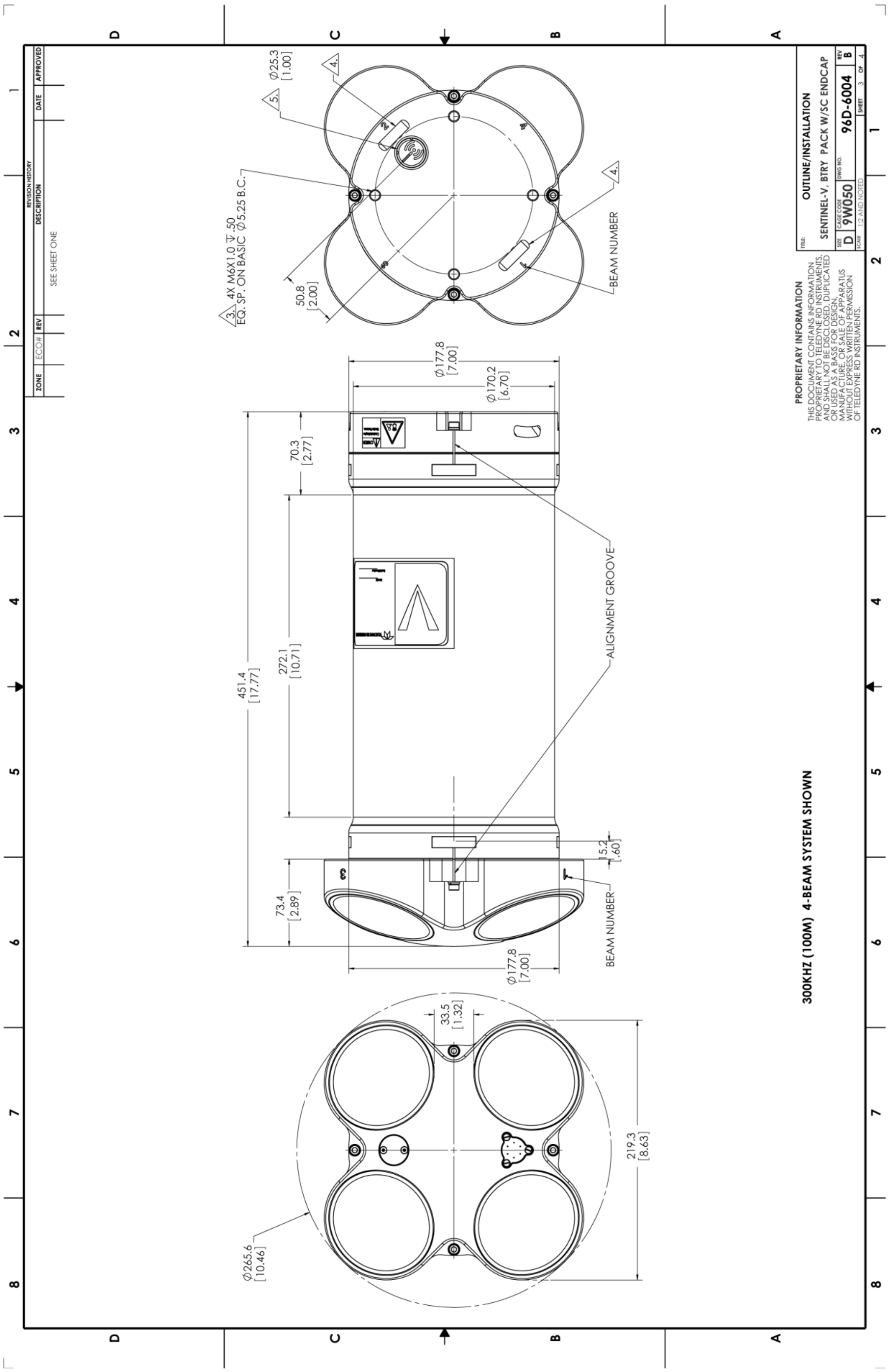


Figure 103. 96D-6004 Sheet 3

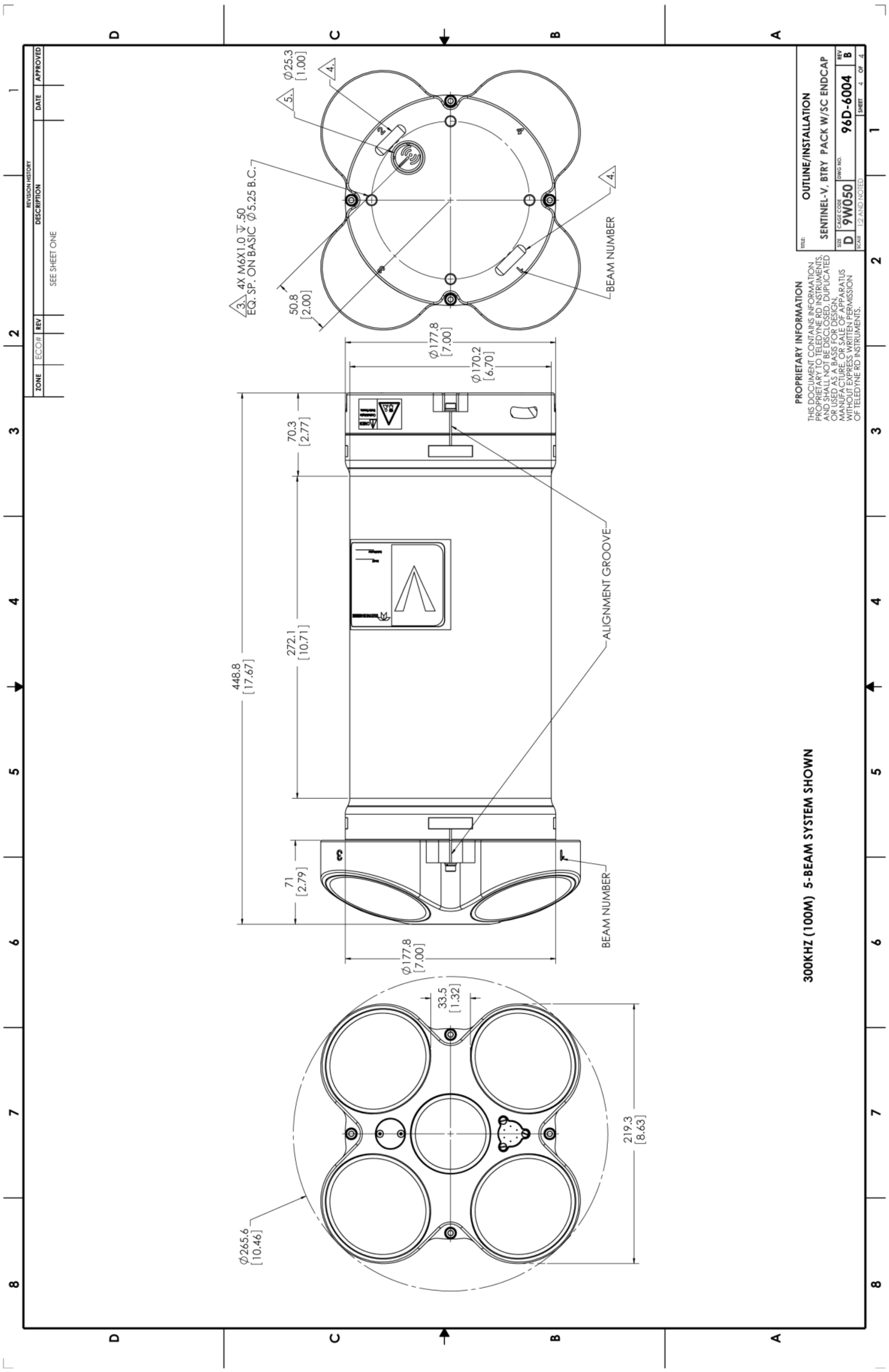


Figure 104. 96D-6004 Sheet 4

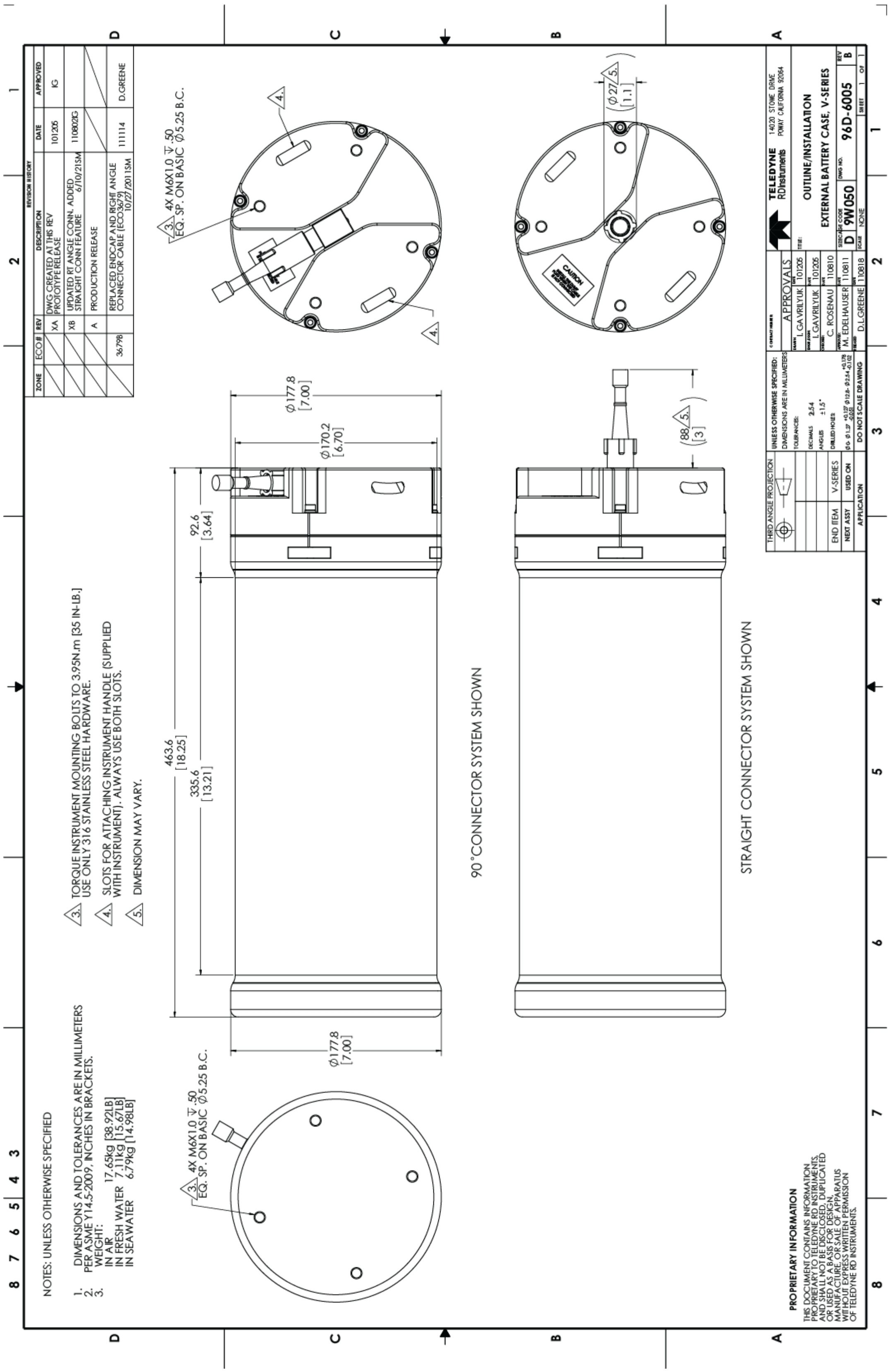


Figure 105. 96D-6005 Sheet 1

Chapter 8

Real-Time Commands

In this chapter:

- Sensor Commands
- Bottom Track Commands
- Control System Commands
- Environmental Commands
- Fault Log Commands
- Performance and Testing Commands
- Sync/Trigger Commands
- Timing Commands
- Water Profiling Commands
- Vertical Beam Profile Commands

This chapter applies to Sentinel V Real-Time firmware 66.xx only. Systems configured with firmware version 47.xx are configured using *ReadyV*. When new firmware versions are released, some commands may be modified, added, or removed. Read the README file on the website. When an addition or correction to this manual is needed, an Interim Change Notice (ICN) or an updated version of the manual will be posted to our web site.

Use our online customer portal at https://tm-portal.force.com/TMsoftwareportal/s/ to download firmware and software updates.

When a Sentinel V ADCP is configured for Real-Time mode, it is configured using *Sentinel V RT Utilities* and uses the following Real-Time commands. Using *Sentinel V RT Utilities* for real-time deployments to develop the command file will ensure that the Sentinel V Real-Time is set up correctly. The commands shown in Table 38 directly affect the range of the Sentinel V Real-Time, the standard deviation (accuracy) of the data, and battery usage.

Most Sentinel V Real-Time command settings use factory-set values (Table 38). If these values are changed without thought, the deployment could be ruined. *Be sure to know what effect each command has before using it*. Call TRDI for help on understanding the function of any command.

Data Communication and Command Format

Enter commands using a Windows compatible computer with a serial interface running TRDI's *TRDI Toolz* or *Sentinel V RT Utilities*. The Sentinel V Real-Time communicates with the computer through the RS-422 serial interface I/O cable or Ethernet. TRDI initially sets the Sentinel V Real-Time at the factory to communicate at 9600 baud, no parity, and one stop bit.

Immediately after power is applied to the Sentinel V Real-Time, it enters the STANDBY mode. Send a software break by sending either "+++" or "===". When the Sentinel V Real-Time first powers up or receives a BREAK signal, it responds with a wake-up message similar to the one shown below. The Sentinel V Real-Time is now ready to accept commands at the ">" prompt from either a terminal or computer program.>break

```
>==
CBREAK
SentinelV
Teledyne RD Instruments (c) 2016
All rights reserved.
Firmware Version: 66.01
>
```

Command Input Processing

Input commands set Sentinel V Real-Time operating parameters, start data collection, run built-in tests (BIT), and asks for output data. All commands are ASCII character(s) and must end with a carriage return (CR). For example,

```
>CR1<CR> [Your input]
```

If the entered command is valid, the Sentinel V Real-Time executes the command. If the command is one that does not provide output data, the Sentinel V Real-Time sends a carriage return line feed <CR> <LF> and displays a new ">" prompt. Continuing the example,

```
>CR1<CR>      [Your original input]
[Parameters set to FACTORY defaults]
>             [Sentinel V Real-Time response to a valid, no-output command]
```

If a valid command is entered that produces output data, the Sentinel V Real-Time executes the command, displays the output data, and then redisplays the ">" prompt. Some examples of commands that produce output data are **?** (help menus), **CS** (start pinging), **PS** (system configuration data), and **PA** (run built-in tests).

If the command is not valid, the Sentinel V Real-Time responds with an error message similar to the following.

```
>CRA<CR>                                       [Your input]
>CRA  ERR 002:  NUMBER EXPECTED<CR><LF>        [Sentinel V Real-Time response]
>
```

After correctly entering all the commands for the application, send the CS-command to put the Sentinel V Real-Time into the ping mode and begin the data collection cycle.

Data Output Processing

After the Sentinel V Real-Time completes a data collection cycle, it sends a block of data called a *data ensemble*. A data ensemble consists of the data collected and averaged during the ensemble interval (see TE command). A data ensemble can contain header, leader, velocity, correlation magnitude, echo intensity, percent good, and status data.

Sentinel V Real-Time output data can be in either hexadecimal-ASCII (Hex-ASCII) or binary format (set by the CF command). The Hex-ASCII mode is useful when using a terminal to communicate with, and view data from the Sentinel V Real-Time. The binary mode is useful for high-speed communication with a computer program. Do not use the binary mode to view data on a terminal since the terminal could interpret some binary data as control codes.

Most of Teledyne RD Instruments' software supports binary PD0 Output Data Format.

When data collection begins, the Sentinel V Real-Time uses the settings last entered (user settings) or the factory-default settings. The same settings are used for the entire deployment. If the user setting are saved (see CK - Keep Parameters) then the Sentinel V Real-Time will always use the user settings until a factory default is recalled, or use the last entered settings, if any, or until power is turned off. The following three rules apply for setting-up the Sentinel V Real-Time:

1. The last entered command of a particular command takes precedence,
2. The last entered commands will be kept in volatile memory until power is shutdown (only CK will keep these in non-volatile memory, see CK - Keep Parameters).
3. The user can recall the factory default-settings at any time (see CR – Retrieve Parameters).

The Sentinel V Real-Time will continue to be configured from volatile memory until it receives a CR-command or until the volatile memory loses its backup power. If the Sentinel V Real-Time receives a CR0 command, it will load into volatile memory the command set last stored in non-volatile memory (semi-permanent user settings) through the CK-command. If the Sentinel V Real-Time receives a CR1, it will load into volatile memory the factory default command set stored in ROM (permanent or factory settings).

Command Summary

Table 38 gives a summary of the Sentinel V Real-Time input commands, their format, and a brief description of the parameters they control, and the factory default command settings.

When newer firmware versions are released, some commands may be removed, modified, or added. Read the README file on the upgrade disk or check TRDI's web site for the latest changes.

Table 38: Sentinel V Real-Time Input Command Summary

Command Default	Description
?	Shows command menu (deploy or system)
+++ or === (Soft Break)	Interrupts or wakes up Sentinel V Real-Time and loads last settings used
Y	Display banner
OI	Install New Feature
OL	Display Feature List
AZ	Zero Pressure Sensor
BA20	Evaluation Amplitude Min (0-255)
BC220	Correlation Magnitude Min (0-255)
BE1000	Max Error Velocity (mm/s)
BF0	Manual Fixed Altitude (0=Auto, 1 to a frequency-dependent maximum) V100 = 2400 V50 = 1250 V20 = 450
BP 0	Pings per Ensemble (0 to 999)
BX nnnnn	Maximum Search Altitude (frequency-dependent) V100 = 2400 V50 = 1250 V20 = 450
#BB5	Bottom Blank (1-65535 = cm)
#BH105,185	Gain Switch Threshold (0-255 counts: lo: hi)
#BI5	Gain Switch Depth (0-999 meters)
#BY20	Transmit length (pct)
CB411	Serial port control (baud rate/parity/stop bits)
CF 111100 (Serial) CF 111001 (Ethernet)	Set Ctrl Flags (EnsCyc; PngCyc; Binary; Serial; Record, Ethernet)
CK	Save Command Parameters to Flash as user defaults
CN	Network Configuration Menu [0=help]
CR	Restore command defaults (0=user, 1=factory)
CS	Start pinging
CSTATE	Pinging State Query
CSTOP	Stop pinging
CT 1	Turnkey (0 = OFF, 1 = ON)
CU 0	Set Update Mode (0 = OFF, 1 = ON)
CW	Output the Last Stored Ensemble

Table 38: Sentinel V Real-Time Input Command Summary

Command Default	Description
#CC	Update global variables with S&P C&C Data
#CG 1	Set Beam Matrix output frequency ([1-65535] ensembles)
#CREBOOT	Reboot System
#CSCT	Set System Communication Mode
EA +00000	Heading alignment (-179.99 to 180.00 degrees)
EB +00000	Heading bias (-179.99 to 180.00 degrees)
EC 1500	Speed of Sound (1400 to 1600 m/s)
ED 00000 -	Transducer Depth (0 to 65535 dm)
EH 00000 -	Heading (000.00 to 359.99 degrees)
EM 0	Disabled beam, 0=none or beam 1..4
EP +00000	Pitch (-70.00 to +70.00 degrees)
ER +00000	Roll (-70.00 to +70.00 degrees)
ES 35	Salinity (0 to 45)
ET 2500	Temperature (-5.00 to +35.00 degrees C)
EU0	System Orientation 1=up,0=down
EX 11111	Coordinate Transformation (Xform:Type; Tilts; 3Bm; Map)
EZ 1111101	Sensor Source (C;D;H;P;R;S;T)
#EE 0	1=Nominal, 0=Raw Beam Calculation
#EF 11	Heading reference frame, [1=ship, 0=instr]
#EI +00000	Roll Misalignment Angle [.01 deg cw]
#EJ +00000	Pitch Misalignment Angle [.01 deg cw]
FC	Clear Fault Log
FD	Display Fault Log
PA	Pre-deployment tests
PC2, PC20	Display Heading, Pitch, Roll, and Orientation Built-in test
PC4, PC40	Display Voltage Monitor
PD0	Set Output Format (0=ensemble)
PF	Results from most recent PA tests
PS0	Display System Configuration
PS3	Display Instrument Transformation Matrix
PS5	HEM feature output
PS6	RSSI calibration output
PT0	Built-In test (0 to 200)
PT3	Receive Path Test
PT4	Transmit Path Test
PT8	Sin Cos Data output for FFT
PT22	FPGA test
PT17	Compass test

Table 38: Sentinel V Real-Time Input Command Summary

Command Default	Description
PT18	Temperature test
PT21	Pressure test
SA00	Synch Before/After Ping/Ensemble
SM0	Mode Select (0=Off, 2=Slave)
ST 60	Slave Timeout (seconds, 0=indefinite)
TE 00:00:00.00	Time per ensemble (hours:minutes:seconds.100th of seconds)
TP 00:05.00	Time between pings (minutes:seconds.100th of seconds)
TS 16/11/16,09:56:00	Set real-time clock (year/month/day, hours:minutes:seconds)
#TM 10	Set minimum time between pings (ms) [0..100]
WB 0	Bandwidth Control
WC 064	Correlation Threshold [0-255]
WD 111 100 001 1	Data Out (Vel;Cor;Amp, PG;St;P0 P1;P2;ADC&Config, beam matrix)
WF xxxx	Blanking Distance (cm) [0-9999] V100 = 1.6m V50 = 1.0m V20 = 0.4m
WM 0002	Water Profiling Mode [2]
WN 030	Number of Bins [1-200]
WP 060	Number of Pings [1-999]
WS xxxx	Bin Size (cm) [50-400] V100 = 4m V50 = 2m V20 = 1m
WV 0175	Ambiguity Velocity [2-700] (cm/s)
#WA 050,1	False Target Threshold 0-255 [, Start bin 0 - 256]
#WB 0	Bandwidth 0=High, 1=low
#WE 2000	Error Velocity Threshold [0-9999] (mm/s)
#WI 0	Bypass phase interpolation (0,1)
#WJ 1	BroadBand Rcvr Gain [0=Lo,1=Hi]
#WL 0 0 0 0	Manual dLag Offset <b1> <b2> <b3> <b4> (+/- samples)
#WT 0000	Transmit Length (cm)
ZP -01	Number of Pings [0-999, -1=WP]
#ZB -1	Bandwidth [0=Wide, 1=Narrow, -1=WB]
#ZC -1	Correlation Threshold (counts) [0..255,-1=WC]
#ZD 0000000001	Data Out [{v;c;a;p;s;*;*;*;*;wd},-1=WD]
#ZF -01	Blanking Distance (cm) [0-9999,-1=WF]
#ZJ -1	Gain [0=low, 1=high,-1=WJ]
#ZM -1	V-Beam Profile Mode [2,-1=WM]
#ZN -01	Number of Bins [1-200,-1=WN]
#ZP -01	Number of Pings [0-999, -1=WP]

Table 38: Sentinel V Real-Time Input Command Summary

Command Default	Description
#ZS -01	Bin Size (cm) [60-480, -1=WS]
#ZV -01	Ambiguity Velocity (cm/s) [2-700,-1=WC/cos(angle)]

The # commands are for expert users, and changing them may have negative consequences for a typical user!

Command Descriptions

Each listing includes the command's purpose, format, default setting (if applicable) range, **Recommended Setting**, and description. When appropriate, we include amplifying notes and examples. If a numeric value follows the command, the Sentinel V Real-Time uses it to set a processing value (time, range, percentage, processing flags). All measurement values are in metric units (mm, cm, and dm).

? – Help Menus

Purpose Lists the major help groups.

Format *x*? (see description)

Description Entering **?** by itself displays all command groups. To display help for one command group, enter **x?**, where *x* is the command group to view. When the Sentinel V Real-Time displays the help for a command group, it also shows the format and present setting of those commands. To see the help or setting for one command, enter the command followed by a question mark. For example, to view the CB command setting, enter **CB?**.

Examples See below.

```
>==
CBREAK
SentinelV
Teledyne RD Instruments (c) 2016
All rights reserved.
Firmware Version: 66.01
>

>?
Available Commands:

A ----------------------- Sensor Commands
C ----------------------- Control Commands
E ----------------------- Environment Commands
F ----------------------- Fault Log Commands
O ----------------------- Feature Commands
P ----------------------- Performance Test Commands
T ----------------------- Time Commands
W ----------------------- Water Profiling Commands
Y ----------------------- Display Banner
Z ----------------------- Vertical Beam Profile Commands
? ----------------------- Display Main Menu>
>
>#?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#A ---------------------- Sensor Expert Commands
```

```
#C ---------------------- Control Expert Commands
#T ---------------------- Time Expert Commands
#W ---------------------- Broadband Profile Expert Commands
#Z ---------------------- Vertical Beam Profile Expert Commands
#? ---------------------- Display #-Command Menu
>
>cb?
CB 411 ------------------ Serial Port Control {baud;parity;stop}
>
```

Vertical Beam commands are only available in 5 beam systems.

Break

Purpose Interrupts the Sentinel V Real-Time without erasing present settings.

Format === or +++

Recommended Setting. Use as needed.

Description Software Breaks can be sent using *TRDI Toolz* or *Sentinel V RT Utilities*. The Sentinel V Real-Time will use the "= = =" or "+ + +" string.

Example === or +++

```
>==
CBREAK
SentinelV
Teledyne RD Instruments (c) 2016
All rights reserved.
Firmware Version: 66.01
>
```

OL – Display Feature List

Purpose Lists the special firmware upgrades that are installed.

Format OL

Recommended Setting. Use as needed.

Description Lists special features that are installed. See Feature Upgrades for information on how to install additional capability in the Sentinel V Real-Time.

Examples See below.

```
>ol                        FEATURES
---------------------------------------------------------------
Feature                                                Installed
---------------------------------------------------------------
Water Profile                                              Yes
Wave Gauge                                                 Yes
Base Accuracy Bottom Track                                 No
High Accuracy Bottom Track                                 No

See your technical manual or contact TRDI for information on
how to install additional capability in your unit.
>
```

Contact your local sales representative if you are interested in upgrading your system.

Base Accuracy (1.15%) Bottom Track (Export-Compliant) and High Accuracy (0.4%) Bottom Track modes are mutually exclusive. Only one may be enabled.

Y – Display Banner

Purpose Displays the Sentinel V Real-Time banner.

Format Y

Recommended Setting. Use as needed.

Description Displays the Sentinel V Real-Time banner.

Example Y

```
>y
SentinelV
Teledyne RD Instruments (c) 2016
All rights reserved.
Firmware Version: 66.01

>
```

Sensor Commands

The following sensor commands are implemented in Sentinel V Real-Time ADCP.

Refer to the *CompassCal V* help file and the Sentinel V Operation manual for information on calibrating the ADCP compass.

Available Sensor Commands

This section lists the available Sensor commands.

```
>a?
Available Commands:

AZ ---------------------- Zero Pressure Sensor
A? ---------------------- Display A-Command Menu

>
```

Standard Sensor Commands

AZ – Zero Pressure Sensor

Purpose Zeros the pressure sensor.

Format AZ

Recommended Setting. Use as needed.

Description Use the AZ command to zero the pressure sensor at the specific location where the Sentinel V Real-Time ADCP will be used.

If the pressure sensor is not installed, using the AZ command will generate the following error.

```
Err: No pressure sensor detected
```

Bottom Track Commands

The Sentinel V RT system uses these commands for bottom-tracking applications. Bottom track commands tell the Sentinel V RT to collect speed-over-bottom data and detected range-to-bottom data. If the Sentinel V RT were facing UP, all bottom-track information would apply to the surface boundary instead of the bottom boundary. The default state of bottom tracking is OFF (BP0) for Sentinel V RT systems. To turn ON the bottom-tracking process, send a BP1 command.

Bottom Track is a feature upgrade for Sentinel V Real-Time systems. For an instrument to be able to Bottom Track, the feature must be installed (see OL – Display Feature List).

Sentinel V Real-Time systems with Bottom Track enabled firmware installed, are controlled under 'Category 6 – Sensors and Lasers' section 6A001 of the Commerce Control List (CCL) by the U.S. Department of Commerce. These products are controlled and require an U.S. Department of Commerce Export License for shipment into certain countries. For any sale, resale, export, or re-export of these Goods, both Seller and Buyer must comply with all applicable U.S. export licensing requirements.

Available Bottom Track Commands

This section lists the available Bottom Track commands.

```
>b?
Available Commands:

BA 020 ------------------- Amplitude Threshold [0..255]
BC 220 ------------------- Correlation Threshold [0..255]
BE 1000 ------------------ Error Velocity Threshold [0..9999] mm/s
BF 00000 ----------------- Manual Fixed Alt (dm) [0=Auto]
BP 0 --------------------- Number of BT Pings in ensemble [0..999]
BX 01250 ----------------- Max Altitude (dm)
B? ----------------------- Display B-Command Menu

>

>#B?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#BB 0005 ----------------- Blanking distance [0..65535] cm
#BH 105,185 -------------- Gain Switch Threshold (0-255cnts:lo;hi)
#BI 010 ------------------ Gain Switch Altitude [0..999] m
#BY 20 ------------------- Transmit Length [0..100] (% of alt)
#B? ---------------------- Display #B-Command Menu

>
```

BA - Evaluation Amplitude Minimum

Purpose Sets the minimum value for valid bottom detection.

Format BA*nnn*

Range *nnn* = 1 to 255 counts

Default BA20

The default setting for this command is recommended for most applications.

Description BA sets the minimum amplitude of an internal bottom-track filter that determines bottom detection. Reducing #BA increases the bottom-track detection range, but also may increase the possibility of false bottom detections.

BC - Correlation Magnitude Minimum

Purpose Sets minimum correlation magnitude for valid velocity data.

Format BC*nnn*

Range *nnn* = 0 to 255 counts

Default BC220

The default setting for this command is recommended for most applications.

Description Sets a minimum threshold for good bottom-track data. Any bottom-track data with a correlation magnitude less than this value will be flagged as bad.

A count value of 255 is a perfect correlation (i.e. solid target).

BE - Error Velocity Maximum

Purpose Sets maximum error velocity for good bottom-track data.

Format BE*nnnn*

Range *nnnn* = 0 to 9999 mm/s

Default BE1000

The default setting for this command is recommended for most applications.

The default setting is set purposely high and as a result effectively disabled. We recommend extreme caution and testing before changing this setting. Data rejected by this command is lost and cannot be regained.

Description The Sentinel V RT uses this parameter to determine good bottom-track velocity data. If the error velocity is greater than this value, the Sentinel V RT marks as bad all four beam velocities (or all four coordinate velocities, if transformed). If three beam solutions are allowed (see EX – Coordinate Transformation) and only three beams are good, then the data is accepted since four good beams are needed for error velocity calculation.

BF - Manual Fixed Altitude

Purpose Sets a manual fixed altitude.

Format BF*nnnnn*

Range *nnnnn* = 1 to Maximum Altitude dm (0 = automatic)

Default BF0

The default setting for this command is recommended for most applications.

Description This command takes values from zero to a frequency-dependent maximum. A setting of zero means that the altitude is to be automatically measured, whereas any value above zero (up to the maximum) specifies a manual, fixed altitude to use for setting up the transmit and receive lengths, and disables bottom search. The maximum values are:

Table 39. Maximum Fixed Altitude

Frequency (kHz)	Max Fixed Altitude (dm)
983.04	450
491.52	1250
307.20	2400

BP – Bottom-Track Pings per Ensemble

Purpose Sets the number of bottom-track pings to average together in each data ensemble.

Format BP*nnn*

The BP command works only without the # sign.

Range *nnn* = 0 to 999 pings

Default BP000

The default setting for this command is recommended for most applications.

Description BP sets the number of bottom-track pings to average together in each ensemble before sending/recording bottom-track data.

The Sentinel V RT interleaves bottom track pings with water track pings, if water-mass layer mode is enabled, and with Profile pings if water profiling is enabled. If BP = zero, the Sentinel V RT will not collect bottom track data or water track data. Also, the Sentinel V RT will not collect water profile data if WP=0, or if the water profile feature is not enabled (see TP – Time Between Pings, WP – Pings Per Ensemble and BK - Water-Mass Layer Mode).

The Sentinel V RT automatically extends the ensemble interval (TE) if BP x TP > TE (see TE – Time Per Ensemble).

BX – Maximum Search Altitude

Purpose Sets the maximum search altitude in bottom-track mode.

Format BX*nnnnn*

The BX command works only without the # sign.

Range See Table 40 below

Default See Table 40 below

Set BX to a depth slightly greater than the expected maximum depth.

Description This command sets the maximum altitude, in dm, that will be searched when searching for the bottom, and is dependent on the system frequency. In addition, there is an associated minimum search altitude, which is not set by command, but is also frequency-dependent. Note that these limits are for the ping configuration, and that the system may acquire and track the bottom at altitudes that are slightly beyond these limits as shown in Table 40.

Table 40. Maximum Search Altitude

Frequency (kHz)	Maximum Search Altitude (dm) / (Default)	Minimum Search Altitude (dm)
983.04	450	3
491.52	1250	3
307.20	2400	6

Example If the maximum depth in the deployment area is 20 meters (200 decimeters), set BX to a value slightly larger than 200 dm; say 210 dm, instead of the default 450 dm. Now if the Sentinel V RT loses track of the bottom, it will stop searching for the bottom at 210-dm (21 m) rather than spend time searching down to 450-dm (45 m).

The BX command limits the search range for bottom tracking. If the Sentinel V RT loses lock on the bottom, it goes into search mode, which iteratively searches increasing ranges until either the bottom is found or the maximum range is reached, and then the process starts over at the minimum range. The BX command will prevent the Sentinel V RT from searching to ranges beyond the BX range value, and can result in shorter search cycles if the bottom is known to be within this range.

In addition to limiting the search range, the BX command indirectly limits the bottom track range. While this does not prevent the Sentinel V RT from bottom tracking to ranges beyond the BX range, use caution in setting this command to less than the expected maximum depth as the Sentinel V RT will be less likely to hold a lock on the bottom if there is any slope beyond the BX range.

Expert Bottom Track Commands

This section lists the expert Bottom Track commands. Commands that start with the # sign are considered "expert" commands.

#BB – Bottom Blank

Purpose	Sets the blanking distance for Bottom Tracking.
Format	#BB*nnnnn*
Range	*nnnnn* = 0 to 65535 cm
Default	#BB0005

The default setting for this command is recommended for most applications.

Description #BB blanks out bad data close to the transducer head, thus creating a window that reduces unwanted data in the ensemble. This allows the Sentinel V RT transmit circuits time to recover before beginning the receive cycle.

#BH – Gain Switch Threshold

Purpose	Sets the RSSI thresholds for switching the receiver gain for a bottom track ping.
Format	#BH *nnn*, *nnn* (lo;hi)
Range	*nnn* = 0 to 255 counts
Default	#BH 105,185

The default setting for this command is recommended for most applications.

Description Receiver gain control for bottom track always uses low gain when the altitude over the sea bottom is less than the Gain Switch Altitude (set by the #BI command). When the altitude is above the Gain Switch Altitude:

- Switch to high gain when RSSI is below the low threshold set by the #BH command.
- Switch to low gain when RSSI is above the high threshold set by the #BH command.

Using two thresholds provides hysteresis, so that the gain does not need to switch on every ping when the RSSI is at some in-between level.

#BI – Gain Switch Altitude

Purpose	Selects the maximum vertical distance from the transducer to the bottom at which the Sentinel V RT operates at low gain.
Format	#BI*nnn*
Range	*nnn* = 0 to 999 meters
Default	#BI005 (1000 kHz), #BI010 (500 kHz), #BI020 (300 kHz)

The default setting for this command is recommended for most applications.

Description When the vertical range to the bottom is less than #BI, the unit operates in low gain. When the vertical range is greater than #BI, internal logic determines which gain (low or high) is optimal. In high backscatter areas, it may be necessary to raise this setting in order to detect bottom throughout the range of the system.

#BY – Transmit Length

Purpose	Scales the bottom mode transmit.
Format	#BY*nn*
Range:	*nn* = 0 to 100 %
Default:	#BY20

> The default setting for this command should never be changed without through testing, as changes to this parameter have the potential to produce incorrect velocity and/or range data.

Description The BY command sets the transmit length for a bottom track ping as a percentage of the altitude over the sea bottom. The default setting has been designed to optimize the tradeoff between energy consumption and the ability to detect the bottom with combined tilt/slope of up to about 15 degrees. Smaller values result in shorter transmits, which use less energy, but which may not fully ensonify the beam on the sea bottom, especially if the instrument is tilted or if the bottom has a slope, resulting in velocity bias. Larger values result in longer transmit pulses (up to a point) which may allow bottom detection at larger values of tilt/slope, but will consume more energy, and may decrease the resolution of the range-to-bottom measurement.

Control System Commands

The Sentinel V Real-Time uses the following commands to control certain system parameters.

Available Control System Commands

This section lists the available Control System commands.

```
>c?
Available Commands:

CB 811 ------------------ Serial Port Control {baud;parity;stop}
CF 11110 ---------------- Set Ctrl Flags {e;p;b;s;*}
CK ---------------------- Save Command Parameters to Flash
CN ---------------------- Network Configuration Menu [0=help]
CR ---------------------- Restore Cmd defaults [0=user,1=factory]
CS ---------------------- Start Pinging
CSTATE ------------------ Pinging State Query
CSTOP ------------------- Stop Pinging
CT 1 -------------------- Turnkey (0 = OFF, 1 = ON)
CU 0 -------------------- Set Update Mode (0 = OFF, 1 = ON)
CW ---------------------- Output the Last Stored Ensemble
C? ---------------------- Display C-Command Menu

>#C?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#CC --------------------- Update global variables with S&P C&C Data
#CG     1 --------------- Set Beam Matrix output frequency ([1-65535] ensembles)
#CR --------------------- Reboot System
#CM --------------------- Set System Communication Mode
#C? --------------------- Display C-Command Menu

>
```

Control System Command Descriptions

CB – Serial Port Control

Purpose Sets the RS-422 serial port communications parameters (Baud Rate/Parity/Stop Bits).

Format CB*nnn*

Range *nnn* = baud rate, parity, stop bits (see description)

Default CB411

Recommended Setting. The default setting for this command is recommended for most applications.

Description The Sentinel V Real-Time and the computer MUST use the same communication parameters to *talk* to each other. After a valid CB parameters are entered, the Sentinel V Real-Time responds with a “>” prompt. Then change the external device’s communication parameters to match the Sentinel V Real-Time parameters <u>before</u> sending another command.

Table 41: Serial Port Control

Baud Rate	Parity	Stop Bits
1 = 1200	1 = None (Default)	1 = 1 Bit (Default)
2 = 2400	2 = Even	2 = 2 Bits
3 = 4800	3 = Odd	
4 = 9600 (Default)	4 = Low (Space, logical 0)	
5 = 19200	5 = High (Mark, logical 1)	
6 = 38400		
7 = 57600		
8 = 115200		

If a BREAK is sent before changing the external device's communication parameters, the Sentinel V Real-Time returns to the communication parameters stored in non-volatile memory (user settings).

CF – Set Control Flags

Purpose Sets various Sentinel V Real-Time data flow-control parameters.

Format CF*nnnnn*

Range Firmware switches (EnsCyc; PngCyc; Binary; Serial; Record, Ethernet)

Default CF111100 (serial) CF111001 (Ethernet)

Recommended Setting. The default setting for this command is recommended for most applications.

Description The CF-command defines whether the Sentinel V Real-Time: generates data ensembles automatically or manually; generates pings immediately or manually; sends serial output data in binary or Hex-ASCII format; sends or does not send output data to the serial or Ethernet interface.

Table 42: Set Control Flags

Command	Description
CF1xxxxx	Automatic Ensemble Cycling – Automatically starts the next data collection cycle after the current cycle is completed. Only a <BREAK> can stop this cycling.
CF0xxxxx	Manual Ensemble Cycling – Enters the STANDBY mode after transmission of the data ensemble, displays the ">" prompt and waits for a new command.
CFx1xxxx	Automatic Ping Cycling – Pings immediately when ready.
CFx0xxxx	Manual Ping Cycling – Sends a < character to signal ready to ping, and then waits to receive an <Enter> before pinging. The <Enter> sent to the Sentinel V Real-Time is not echoed. This feature manually controls ping timing within the ensemble. Note the prompt output by the Sentinel V Real-Time when ready to ping is a less-than symbol (<), to distinguish it from the normal command prompt.
CFxx1xxx	Binary Data Output – Sends the ensemble in binary format, if serial output is enabled (see below).
CFxx0xxx	Hex-ASCII Data Output – Sends the ensemble in readable hexadecimal-ASCII format, if serial output is enabled (see below).
CFxxx1xx	Enable Serial Output – Sends the data ensemble out the RS-422 serial interface.
CFxxx0xx	Disable Serial Output – No ensemble data are sent out the RS-422 interface.
CFxxxx1x	Reserved for future use - Enable recorder
CFxxxx0x	Reserved for future use - Disable recorder
CFxxxxx1	Enable Ethernet Serial Output – Sends the data ensemble out the Ethernet interface.
CFxxxxx0	Disable Ethernet Serial Output – No ensemble data are sent out the Ethernet interface.

CK – Save Command Parameters to Flash

Purpose Stores present parameters to non-volatile memory.

Format CK

Recommended Setting. Use as needed.

Description CK saves the present user command parameters to non-volatile memory on the CPU board. The Sentinel V Real-Time maintains data stored in the non-volatile memory (user settings) even if power is lost. It does not need a battery. Recall parameters stored in non-volatile memory with the CR0-command (see CR – Restore Command Defaults).

Always use the CK command in the configuration files.

The Sentinel V Real-Time ADCP automatically stores the last set of commands used in RAM (volatile memory). The user can store the configuration into non-volatile memory by sending a CK command. Note that the system will restart in the previous configuration even if it was not saved with a CK command as long as the volatile memory's internal battery is not discharged. This can happen after several months without any power applied to the system (Note that this battery will recharge as soon as power is reapplied). If the Sentinel V Real-Time is stopped by removing the power while pinging, it will restart pinging and output data next time power is applied.

CN - Network Configuration Menu

Purpose Configures the Sentinel V Real-Time network.

Format CNn (n= 0 for help)

Recommended Setting. Use as needed.

Description See below.

CN 0

Displays the network configuration menu.

```
>cn0
Network Configuration Menu
  options:
     0  help
     1  Get Local IP
     2  Get Destination IP for Data Output
     3  Set Destination IP for Data Output
     4  Get Destination Port (UDP) for Data Output
     5  Set Destination Port (UDP) for Data Output
     6  Get Broadcast Option for Data Output (UDP)
     7  Set Broadcast Option for Data Output (UDP)
     8  Get CMD Port Time Out
     9  Set CMD Port Time Out
    10  Show Network Information
```

CN 1

Displays the local IP address acquired from a local or remote DHCP server:

```
>cn1

IP:10.20.229.45
```

CN 2

Display the IP address of the remote machine where ensemble data is going to be sent.

```
>cn2
```

```
IP:10.20.229.40
```

CN 3

Specify the IP address of the remote machine where ensemble data is going to be sent.

```
>cn3

Enter IP Address in dot-decimal format: 192.168.0.2
Set IP to 192.168.0.2

Saving Data to NV Memory...Done
Reconfiguring Network...Done
```

CN 4

Displays port number of remote machine where ensemble data is going to sent.

```
>cn4

Port:5000
```

CN 5

Specify the port number of the remote machine where ensemble data is going to sent.

```
>cn5

Enter Port Number: 5000
Set Port to 5000
Saving Data to NV Memory...Done
Reconfiguring Network...Done
```

CN 6

Displays the current broadcast settings.

```
>cn6

Network Directed Broadcast: Disabled
```

With Automatic broadcast IP detection:

```
>cn6

Network Directed Broadcast: Enabled
Automatic Broadcast IP Detection: Enabled
Broadcast IP (Auto Detected):10.20.230.255
```

With Manual Broadcast IP Entry:

```
>cn6

Network Directed Broadcast: Enabled
Automatic Broadcast IP Detection: Disabled
Broadcast IP(Manually Set):192.168.0.255
```

CN 7

Enables or Disables the broadcast option, and optionally selects between an auto-detected broadcast IP or a manually entered broadcast IP address.

Auto-Detected Broadcast Mode:

```
>cn7

Enable Broadcast Option (y/n):y

Set broadcast address automatically (y/n):y
Network Directed Broadcast: Enabled
Automatic Broadcast IP Detection: Enabled
```

```
Saving Data to NV Memory...Done
Reconfiguring Network...Done
```

Manually Entered Broadcast IP Address:

```
>cn7
Enable Broadcast Option (y/n):y

Set broadcast address automatically (y/n):n
Enter Broadcast IP Address in dot-decimal format: 192.168.0.255
Network Directed Broadcast: Enabled
Automatic Broadcast IP Detection: Disabled
Broadcast IP(Manually Set):192.168.0.255

Saving Data to NV Memory...Done
Reconfiguring Network...Done
```

CN 8

Displays the current CMD port timeout. After the CMD port timeout time has elapsed, the CMD session will automatically close due to no activity.

```
>cn8

CMD Port Timeout is 5 minutes
```

CN 9

Sets a new idle timeout in minutes for the CMD port.

```
>cn9

Enter Timeout in minutes (1-1440, 0 - No Timeout):5
CMD Port Timeout is set to 5 minutes
Saving Data to NV Memory...Done
```

CN 10

Displays the basic network information for the physical Ethernet interface.

```
>cn10
Interface Name: eth0
Carrier: Present
IP: 10.20.230.34
Netmask: 255.255.255.0
```

CR – Restore Command Defaults

Purpose	Resets the Sentinel V Real-Time command set to factory settings.
Format	CR*n*
Range	*n* = 0 (User), 1 (Factory)

Recommended Setting. Use as needed.

Description The Sentinel V Real-Time automatically stores the last set of commands used in volatile memory. The Sentinel V Real-Time will continue to be configured from volatile memory unless it receives a CR command or until the volatile memory loses its power.

Table 43: Restore Command Defaults

Format	Description
CR0	Loads into volatile memory the command set last stored in non-volatile memory (user settings) using the CK Command.
CR1	Loads into volatile memory the factory default command set stored in ROM (factory settings).

CR keeps the present baud rate and does not change it to the value stored in non-volatile memory or ROM. This ensures the Sentinel V Real-Time maintains communications with the computer.

CS – Start Pinging (Go)

Purpose Starts the data collection cycle.

Format CS

Recommended Setting. Use as needed. Use *Sentinel V RT Utilities* to create the command file. The CS command will be added to the end of the command file or sent by the software.

Description Use CS to tell the Sentinel V Real-Time to start pinging its transducers and collecting data as programmed by the other commands. If the TF command is set (time of first ping), the Sentinel V Real-Time waits until it reaches the TF time before beginning the data collection cycle.

After a CS command is sent to the Sentinel V Real-Time, no changes to the commands can occur until a <BREAK> is sent.

CState – Pinging State Query

Purpose Displays the status of the Sentinel V Real-Time.

Format CState

Recommended Setting. Use as needed.

Description Displays either “Pinging” or “Not Pinging”, depending on the state of the Sentinel V Real-Time.

```
>CState
Not Pinging
>
>cs
>cstate
Pinging
>
```

CStop – Stop Pinging

Purpose Stops the current deployment.

Format CStop

Recommended Setting. Use as needed.

Description Stops autonomous sampling without resetting the Sentinel V Real-Time.

```
>CStop
>
>CState
Not Pinging
```

CT – Turnkey Mode

Purpose Sets the Turnkey mode.

Format CT*x*

Range *x* = 1 (on), 0 (off)

Default CT1

Recommended Setting. The default setting for this command is recommended for most applications.

Description If the Turnkey mode is enabled, the Sentinel V Real-Time will self-deploy (i.e. start pinging) if it was deployed (pinging) and a power-on event occurs.

If the Turnkey mode is disabled (CT0) the system will NOT restart and you must do a manual restart by sending the CS command.

Table 44. Turnkey Mode Actions

Turnkey (CT)	State	Event	Action
Enabled (1)	Deployed	Soft Break or cstop	Stop deployment
Enabled (1)	Deployed	Power-on	Re-deploy
Enabled (1)	Deployed	Allowed command (other than soft break or cstop)	Respond to command (during deployment)
Enabled (1)	Deployed	Disallowed command	"Command disabled" message (during deployment)
Enabled (1)	Not deployed	Soft Break or cstop	Wait for command (indefinitely)
Enabled (1)	Not deployed	Power-on	Wait for command (indefinitely)
Enabled (1)	Not deployed	Allowed command (other than soft break or cstop)	Wait for command (indefinitely)
Enabled (1)	Not deployed	Any command	Respond to command
Disabled (0)	Deployed	Soft Break or cstop	Stop deployment. Wait for command (indefinitely)
Disabled (0)	Deployed	Power-on	Wait for command (indefinitely)
Disabled (0)	Deployed	Allowed command (other than soft break or cstop)	Respond to command (live)
Disabled (0)	Deployed	Disallowed command	"Command disabled" message (live)
Disabled (0)	Not deployed	Soft Break or cstop	Wait for command (indefinitely)
Disabled (0)	Not deployed	Power-on	Wait for command (indefinitely)
Disabled (0)	Not deployed	Any command	Respond to command

CU - Set Update Mode

Purpose Configures the Sentinel V Real-Time ADCP's WLAN.

Format CUx

Range *x* = 0 = OFF, 1 = Wireless, 2 = Ethernet (debug)

Default CU0

Recommended Setting. Use as needed.

Description Send the CU1 command to enable the Sentinel V Real-Time ADCP's WLAN. Wait for the short beep and then connect to the ADCP's WLAN and then enter **192.168.0.2** in the browser address bar. This will open the Sentinel-V Utilities page, which allows for firmware updates and downloading logs.

```
>cu1
Configuring network interface. Please wait
Use http://SV17302.adcp to access update link
You can also use http://192.168.0.2 to access update link

>
```

```
>cu2
Configuring network interface. Please wait

Network configured. Please connect to SV17302 Ethernet network.
Use http://SV17302 to access update link
You may need to refresh your browser. Hit CTRL F5
You can also use http://10.20.229.11 to access update link.

>
```

The CU command is not needed for Ethernet systems. Access the Sentinel-V Utilities page using Sentinel V RT Utilities software.

Figure 106. Sentinel-V Utilities Page

For information on Firmware Updates and Download Logs, see the Sentinel V_SC_RT Operation Manual, Maintenance chapter, Using the Sentinel-V Utilities Page.

CW – Output the Last Stored Ensemble

Purpose Requests the most recently stored ensemble for output.

Format CW

> Recommended Setting. Use as needed.

Description Recalls the most recently stored ensemble for output. This command is only valid during a deployment when recording is enabled and will give an error message until valid data is available. The CW command is available for PD0 output formats, and follows the CF command setting for binary or Hex-ASCII output.

```
>cf 110100
>cw7F7F7C03000F24006000A2006401C60128028A02AC02DE02F80212032C034E035E03700300004
20183570035041 83C00C80064000240070 1D0070002001F000000007D3D3F01CF00010132011D008
E00000148E14E230000000096430000190080000400100A1309373400000000FD050000198983001
D0023007D090F002B00000000AB00000000000000000000001ED2FFFF8C0300000014100A13093
73400000001008000800080008000800080008000800080008000800080008000800080008000800
08000800080008000800080008000800080008000800080008000800080008000800080008000800
08000800080008000800080008000800080008000800080008000800080008000800080008000800
08000800080008000800080008000800080008000800080008000800080008000800080008000800
08000800080008000800080008000800080008000800080008000800080008000800080008000020
70807080707070707080707060707070707070807070807080707070608070707070707070707070
70807080808070808070707070708070708070807070606070707070808070808070707070808070
80707070707070807080807070707070700032F1B17132F1A17122F1A17122F1A17122F1A17122F1A1
7122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A1
7122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17122F1A17120004000064000
00064000000640000006400000064000000640000006400000064000000640000006400000064000
00064000000640000006400000064000000640000006400000064000000640000006400000064000
000640000000640000006400010F18003C00C8003C010000CB001D00470100000000000000000000000
00000000000000A0080008000800080008000800080008000800080008000800080008000800080008000800
08000800080008000800080008000800080000B090A0A0908090A0809090A0909090A0A0A0A09090A0A0
909000C31313131313131313131313131313131313131313131313131000D0000000000000000000
0000000000000000000000000000032212EDFD10F00F1FFF1FF0F0095D16B2EC40AC40AC80AC80AB
E20BE204DDF4DDF00704201000A00800700C800000000000270AE0609005601B80055017D00CB021
800121028430758DD0100004E9B448E
>
```

Expert Control System Commands

#CC – Update Global Variables

Purpose Updates global variables with S&P C&C Data.

Format #CC

Recommended Setting. TRDI use only.

Description TRDI use only.

#CG – Set Beam Matrix Output Frequency

Purpose Sets the Beam Matrix output frequency.

Format #CG *x*

Range x = 1 to 65535 ensembles

Default #CG1

Recommended Setting. The default setting for this command is recommended for most applications.

Description TRDI use only.

#CR – Reboot System

Purpose Reboots the system.

Format #CR

Recommended Setting. Use as needed.

Description Reboots the Sentinel V Real-Time system without requiring a power cycle.

```
>#cr
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!
If you really want to reboot, enter YES: YES

System will complete reboot in ~15 seconds

>
```

#CM – Set System Communication Mode

Purpose Sets the System Communication Mode.

Format >#CM

Default Set the communication mode to match the part number

Recommended Setting. TRDI use only.

Description Allows the system communication mode to be changed.

```
>#CM
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Output Communication Type is Set to Serial

*** CAUTION: This command is used to change the communication mode
             for your ADCP.  If your ADCP is not wired to use the
             selected mode, you may not be able to communicate with it.


To change the primary mode of communication, enter YES: YES

Select one of the communication modes below:
        To set the communication mode to match the part number enter: PartNumber
        To set the communication mode to Ethernet enter: Ethernet
        To set the communication mode to Serial enter: Serial
Note: Input is Case Sensitive
Enter the communication mode:Ethernet

You have selected Ethernet as the primary communication mode
Completed Setting Primary Communication Mode to Ethernet
**** User must reboot Sentinel V for changes to take effect (Can use #CR) ****
Saving Data to NV Memory...Done

>#CR
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!
If you really want to reboot, enter YES: YES
System will complete reboot in ~15 seconds

>
Enter === within the next 3 seconds to set communication port to serial:
Break not received, configuring for Ethernet comms
```

Switching the communication mode requires that the user have the corresponding Serial or Ethernet I/O cable and matching end-cap. **If this command is improperly set, you may not be able to communicate with the system.**

Ethernet systems use a different end-cap than Serial Real-Time or Wireless Self-Contained systems.

There is a failsafe when the system is configured for Ethernet but you are connected to the system on a Serial port. You will see a prompt to enter === to set the communication port to serial. The === must be sent within three seconds or the system will configure to Ethernet. This failsafe is available again on reboot or power cycle.

Once the === is received, the system will remain in Serial mode until reboot or power-off.

Environmental Commands

The Sentinel V Real-Time uses the following commands to control the environmental and positional information that affects internal data processing.

Available Environmental Commands

This section lists the available Environmental commands.

```
>e?
Available Commands:

EA +00000 --------------- Heading Alignment (0.01 deg)
EB +00000 --------------- Heading Bias (0.01 deg)
EC 1500 ----------------- Speed Of Sound (m/s)
ED 00000 ---------------- Xdcr Depth (deci-meters)
EH 00000 ---------------- Heading (0..35999; 1/100 degrees)
EM 0 -------------------- Disabled beam, 0=none or beam 1..4
EP +00000 --------------- Pitch (+-6000 1/100 degrees)
ER +00000 --------------- Roll (+-6000 1/100 degrees)
ES 35 ------------------- Salinity (ppt)
ET 2500 ----------------- Water Temperature (.01 deg C)
EU 0 -------------------- System Orientation 1=up,0=down
EX 11111 ---------------- Coordinate Transformations (cct3m)
EZ 1111101 -------------- Sensor Source {c;d;h;p;r;s;t}
E? ---------------------- Display E-Command Menu>

>#e?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#EE 0 ------------------- 1=Nominal, 0=Raw Beam Calculation
#EF 11 ------------------ Heading reference frame, [1=ship, 0=instr]
#EI +00000 -------------- Roll Misalignment Angle [.01 deg cw]
#EJ +00000 -------------- Pitch Misalignment Angle [.01 deg cw]
#E? --------------------- Display #E Expert Command Menu
```

Environmental Command Descriptions

EA – Heading Alignment

Purpose	Corrects for physical misalignment between Beam 3 and the heading reference.
Format	EA±*nnnnn*
Range	±*nnnnn* = -17999 to 18000 (-179.99 to 180.00 degrees)
Default	EA00000

Recommended Setting. For systems that are stationary, EA is typically set to zero (default), since Beam 3 is used as the heading reference. This command is added to the command file using *Plan*.

Description EA is a heading alignment angle (referenced to Beam 3) used as a new zero reference for heading output and for transformation to earth coordinates. Use the EB-command to correct for heading bias (e.g., magnetic declination).

Example The Sentinel V Real-Time is mounted in place on a moving ship. Beam 3 has been rotated 45 clockwise (+45) from the ship's centerline. Use the EA command to tell the Sentinel V Real-Time where beam 3 is in relation to the ship's centerline. To convert +45 to an EA-command value, multiply the desired alignment angle in degrees by 100:

```
EA = +45.00 × 100 = +4500 = EA+04500
```

EB – Heading Bias

Purpose Corrects for electrical/magnetic bias between the Sentinel V Real-Time heading value and the heading reference.

Format EB±*nnnnn*

Range ±*nnnnn* = -17999 to 18000 (-179.99 to 180.00 degrees)

Default EB00000

Recommended Setting. Set using the magnetic variation setting in Plan.

Description EB is the heading angle that counteracts the electrical bias or magnetic declination between the Sentinel V Real-Time and the heading source. Use the EA-command to correct for physical heading misalignment between the Sentinel V Real-Time and a vessel's centerline.

Examples A Sentinel V Real-Time is receiving heading from its internal compass. A navigation map for the deployment area shows a declination of 10°10'W 1995 (9'E/year). This means the magnetic offset in the year 2001 at this location is (- (10+10/60) + (9/60*6)) = -9.26666 degrees. Set the EB command value to EB-926.

EC – Speed of Sound

Purpose Sets the speed of sound value used for Sentinel V Real-Time data processing.

Format EC*nnnn*

Range *nnnn* = 1400 to 1600 meters per second

Default EC 1500

Recommended Setting. The default setting for this command is recommended for most applications.

Description EC sets the sound speed value used by the Sentinel V Real-Time to scale velocity data, depth cell size, and range to the bottom. The Sentinel V Real-Time assumes the speed of sound reading is taken at the transducer head. See the primer for information on speed of sound calculations.

If the EZ Speed of Sound field = 0, the Sentinel V Real-Time overrides the manually-set EC value and calculates speed of sound using the values determined by transducer depth (ED), salinity (ES), and transducer temperature (ET). EZ also selects the source for ED, ES, and ET.

ED – Depth of Transducer

Purpose Sets the Sentinel V Real-Time transducer depth.

Format ED*nnnnn*

Range *nnnnn* = 0 to 65535 decimeters (meters x 10)

Default ED00000

Recommended Setting. Set using the ADCP depth setting in *Plan*.

Description ED sets the Sentinel V Real-Time transducer depth. This measurement is taken from water level to the transducer faces. The Sentinel V Real-Time uses ED in its speed of sound calculations. The Sentinel V Real-Time assumes the speed of sound reading is taken at the transducer head. See the primer for information on speed of sound calculations.

If the EZ *Transducer Depth* field = 1, the Sentinel V Real-Time overrides the manually set ED value and uses depth from the internal pressure sensor. If a pressure sensor is not available, the Sentinel V Real-Time uses the manual ED setting.

EH – Heading

Purpose Sets the Sentinel V Real-Time heading angle.

Format EH*nnnnn*

Range *nnnnn* = 0 to 35999 (000.00 to 359.99 degrees)

Recommended Setting. The default setting for this command is recommended for most applications.

Description EH sets the Sentinel V Real-Time heading angle of beam 3. When mounted on a stationary platform, the Sentinel V Real-Time assumes beam 3 points north (0).

Example Convert heading values of 34 and 3.5 to EH-command values.

```
EH = 34.00 × 100 = 3400 = EH03400
EH =  3.50 × 100 =  350 = EH00350
```

If the EZ Heading field = 1, the Sentinel V Real-Time overrides the manually set EH value and uses heading from the transducer's internal sensor. If the sensor is not available, the Sentinel V Real-Time uses the manual EH setting.

EM – Disable Beam

Purpose Used to disable one of the ADCP's beams.

Format EM*n*

Range *n* = 0 to 4 (0 = No beam suppressed, 1 to 4 = number of beam to suppress)

Default EM0

Recommended Setting. The default setting for this command is recommended for most applications.

Description Used to disable a beam that cannot provide useful information, for example, a beam that is permanently obstructed. The disabled beam's ensemble velocity output is set to BAD, -32768 and the correlation and RSSI values are set to zero.

EP – Pitch (Tilt 1)

Purpose Sets the Sentinel V Real-Time pitch (tilt 1) angle.

Format EP±*nnnn*

Range ±*nnnn* = +-6000 1/100 degrees

Recommended Setting. The default setting for this command is recommended for most applications.

Description EP sets the Sentinel V Real-Time pitch (tilt 1) angle.

Example Convert pitch values of +14 and -3.5 to EP-command values.

```
EP = 14.00 × 100 = 1400 = EP01400 (+ is understood)
EP = -3.50 × 100 = -350 = EP-00350
```

If the EZ Pitch field = 1, the Sentinel V Real-Time overrides the manually set EP value and uses pitch from the transducer's internal tilt sensor. If the sensor is not available, the Sentinel V Real-Time uses the manual EP setting.

ER – Roll (Tilt 2)

Purpose Sets the Sentinel V Real-Time roll (tilt 2) angle.

Format ER±*nnnn*

Range ±*nnnn* = +-6000 1/100 degrees

Recommended Setting. Use the EZ-command to default to the sensor module.

Description ER sets the Sentinel V Real-Time roll (tilt 2) angle.

Example Convert roll values of +14 and -3.5 to ER-command values.

```
ER = 14.00 × 100 = 1400 = ER01400 (+ is understood)
ER = -3.50 × 100 = -350 = ER-00350
```

If the EZ Roll field = 1, the Sentinel V Real-Time overrides the manually set ER value and uses roll from the transducer's internal tilt sensor. If the sensor is not available, the Sentinel V Real-Time uses the manual ER setting.

ES – Salinity

Purpose	Sets the water's salinity.
Format	ES*nn*
Range	*nn* = 0 to 45
Default	ES35

Recommended Setting. Set using *Plan*. The default setting for this command is recommended for most applications.

Description ES sets the water's salinity. The Sentinel V Real-Time uses ES in its speed of sound calculations. The Sentinel V Real-Time assumes the speed of sound reading is taken at the transducer head.

ET – Temperature

Purpose	Sets the water's temperature value.
Format	ET±*nnnn*
Range	±*nnnn* = -500 to 3500 (-5 to +35C)
Default	ET2500

Recommended Setting. Set using *Plan*. Use the EZ-command to default to the sensor module.

Description ET sets the temperature value of the water. The Sentinel V Real-Time uses ET in its speed of sound calculations (see the primer). The Sentinel V Real-Time assumes the speed of sound reading is taken at the transducer head.

Example Convert temperatures of +14 C and -3.5 C to ET-command values.

```
ET = 14.00 × 100 = 1400 = ET1400 (+ is understood)
ET = -3.50 × 100 = -350 = ET-0350
```

If the EZ Temperature field = one, the Sentinel V Real-Time overrides the manually set ET value and uses temperature from the transducer's temperature sensor. If the sensor is not available, the Sentinel V Real-Time uses the manual ET setting.

EU – System Orientation

Purpose	Sets the Sentinel V Real-Time system orientation, up or down.
Format	EUn
Range	n = 1 (up), 0 (down)
Default	n = 0

Recommended Setting. Use the EZ-command to default to the sensor module.

Description EU sets the Sentinel V Real-Time system orientation, up or down.

If the EZ Roll field is not zero, the Sentinel V Real-Time overrides the manually set EU value and uses orientation from the transducer's internal tilt sensor. If the sensor is not available, the Sentinel V Real-Time uses the manual EU setting.

EX – Coordinate Transformation

Purpose Sets the coordinate transformation processing flags.

Format EX*xxptb*

Range *xx* = Transformation
p = Pitch and Roll
t = 3 beam solutions
b = Bin mapping

Default EX11111

Recommended Setting. Set using *Plan*. The default setting for this command is recommended for most applications.

Description EX sets firmware switches that control the coordinate transformation processing for velocity and percent-good data.

Table 45: Coordinate Transformation Processing Flags

Setting	Description
EX00xxx	No transformation. Radial beam coordinates, i.e., 1, 2, 3, 4. Heading/Pitch/Roll not applied.
EX01xxx	Instrument coordinates. X, Y, Z vectors relative to the Sentinel V Real-Time. Heading/Pitch/Roll not applied.
EX10xxx	Ship coordinates (Note 1) X, Y, Z vectors relative to the ship. Heading not applied. EA-command used, but not the EB-command. If Bit 3 of the EX-command is a 1, then Pitch/Roll applied.
EX11xxx	Earth coordinates (Note 1) East, North, Vertical vectors relative to Earth. Heading applied. EA and EB-commands used. If Bit 3 of the EX-command is a 1, then Pitch/Roll applied.
EXxx1xx	Use tilts (pitch and roll) in transformation (see Note 2)
EXxxx1x	Allows 3-beam solutions if one beam is below the correlation threshold set by WC
EXxxxx1	Allow bin mapping (see Note 4)

1. For ship and earth-coordinate transformations to work properly, set the Heading Alignment (EA) and Heading Bias (EB) correctly. Also ensure that the tilt and heading sensors are active (EZ).

2. Setting EX bit 3 (Use Tilts) to 0 collects tilt data without using it in the ship or earth-coordinate transformations.

3. Each Sentinel V Real-Time uses its own beam calibration matrix to correct data for beam pointing errors (e.g., if the beams erroneously point toward 21 degrees instead of 20 degrees). Correction is applied when the data are converted from beam coordinates to earth coordinates. If beam-coordinate data is output, you will need to apply the beam corrections yourself to obtain the best possible data.

4. TRDI outputs the Bin 1 position for a level system only. We do not adjust the bin 1 position, or the cell sizes, for any tilt. Bin mapping attempts to combine data from sections of the beams that are at the same depth in the water, and does not make any attempt to calculate how that depth might change for a tilted system. The setting of the EX command has no effect on the reported bin 1 distance or the cell size.

Beam Coordinate Systems

The Sentinel V Real-Time can produce velocity measurements in any of the following four sets of coordinate axes by setting the EX command. Except for the first, they are all right-handed orthogonal systems. The user operational requirements dictate the best coordinate system to be used.

Earth Axis, also known as Geographic or Geodetic Coordinates. (E, N, U) Earth Axis are selected (default setting) with command EX11xxx. These axes are named east, north, and up. Strictly speaking, these terms refer to true orientations, although magnetic orientations are often used instead. This is the most commonly used coordinate system because it provides a stable reference frame for ensemble averaging.

Radial Beam Coordinates. (BM1, BM2, BM3, BM4) Radial Beam Coordinates are selected by the EX00xxx command. These are the "raw" velocity measurements measured independently by each transducer, in units of millimeters per second. The sense is positive when the motion is towards the transducer. These axes are not orthogonal.

Instrument Coordinates. (X, Y, Z) Instrument Coordinates are selected by the EX01xxx command. This set of axes is always oriented the same relative to the transducer head. Looking at the end view of the housing, the transducers are labeled clockwise in the order 3-2-4-1 (Figure 107). When you look at the face of the transducer head, the transducers are labeled clockwise in the order 3-1-4-2 (Figure 108). The X-axis lies in the direction from transducer Beam 1 towards transducer Beam 2 and the Y-axis lies in the direction from transducer Beam 4 towards transducer Beam 3. The Z-axis lies along the axes of symmetry of the four beams, pointing away from the water towards the housing. The internal compass is mounted so that when the X-Y plane is level, the compass measures the orientation of the Y-axis relative to magnetic north.

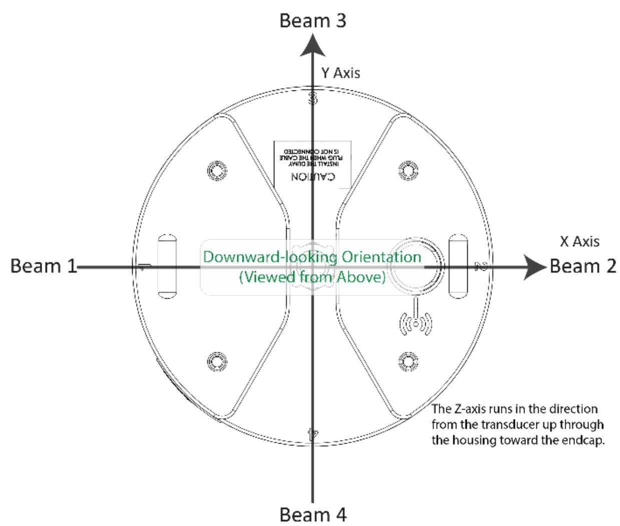


Figure 107. X, Y, and Z Velocities

The PD0 Bottom Track output data format assumes that the instrument is stationary and the bottom is moving.

- If Beam 3 is going forward, then the Y velocity is negative.
- If Beam 2 is going forward, then X velocity is negative.
- If the bottom is going towards the face of a down facing ADCP, then Z is positive.

Ship Coordinates (or Righted Instrument Coordinates). (S, F, M) Ship Coordinates are selected by the EX10xxx command. TRDI uses the names Starboard, Forward, and Mast, although these axes are more commonly called the pitch, roll, and yaw-axes, respectively. Assuming that Beam 3 is aligned with the keel on the forward side of the ADCP, for the downward-looking orientation, these axes are identical to the instrument axes:

$$S = X, F = Y, M = Z$$

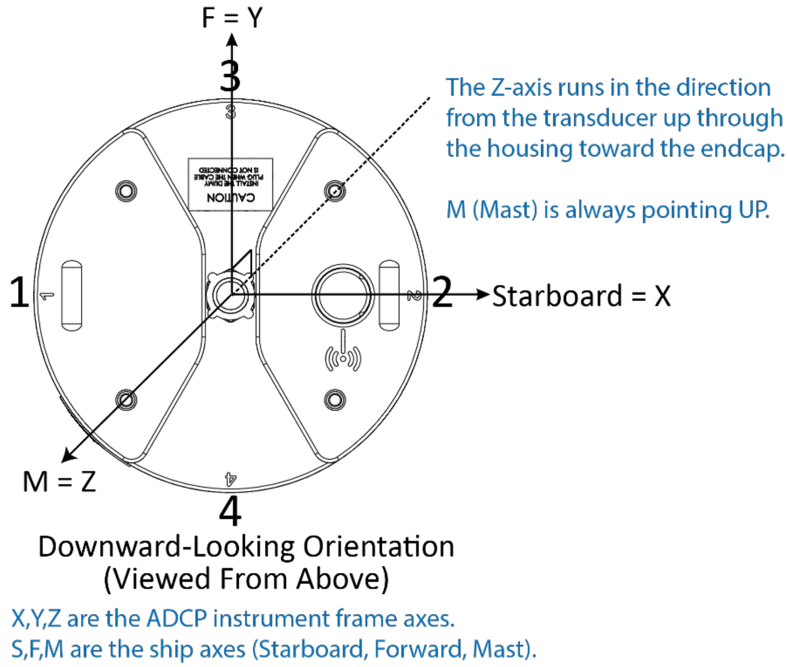


Figure 108. Sentinel V Real-Time Coordinate Transformation

The importance of the ship axis is that the attitude angles (pitch, roll, and heading) measure the orientation of the ship axes relative to the earth axes, regardless of up/down orientation. The sense of internal sensors Tilt 1 (pitch) and Tilt 2 (roll) is positive for counterclockwise tilts respectively about the S and F axes, using the right-hand rule (see Figure 109).

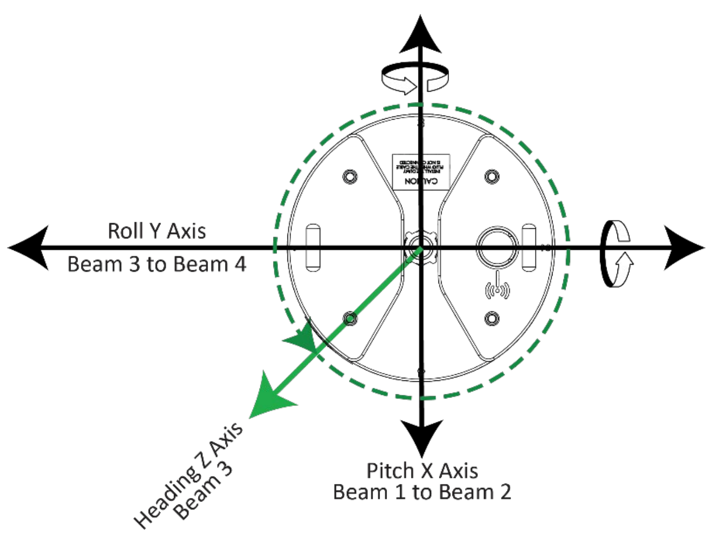


Figure 109. Sentinel V Real-Time Pitch and Roll

Angle of the Sentinel V Real-Time	Sign
Beam 3 higher than Beam 4	Positive Pitch
Beam 1 higher than Beam 2	Positive Roll

EZ – Sensor Source

Purpose Selects the source of environmental sensor data.

Format EZ*cdhprst*

Default EZ1111101

Recommended Setting. The default setting for this command is recommended for most applications.

Range Firmware switches (see description)

Description Setting the EZ-command firmware switches tells the Sentinel V Real-Time to use data from a manual setting or from an associated sensor. When a switch value is non-zero, the Sentinel V Real-Time overrides the manual E-command setting and uses data from the appropriate sensor. If no sensor is available, the Sentinel V Real-Time defaults to the manual E-command setting. The following table shows how to interpret the sensor source switch settings.

Table 46: Sensor Source Switch Settings

	Field	Value = 0	Value = 1
c	Speed Of Sound	Manual EC	Calculate using ED, ES, and ET
d	Depth	Manual ED	Internal Pressure Sensor
h	Heading	Manual EH	Internal Heading Sensor
p	Pitch (Tilt 1)	Manual EP	Internal Pitch Sensor
r	Roll (Tilt 2)	Manual ER	Internal Roll Sensor
s	Salinity	Manual ES	N/A
t	Temperature	Manual ET	Internal Transducer Sensor

Example EZ1111101 means calculate speed of sound from readings, use pressure sensor, transducer heading, internal tilt sensors, and transducer temperature.

Expert Environmental Command Descriptions

```
#EE 0 -------------------- 1=Nominal, 0=Raw Beam Calculation
#EF 11 ------------------- Heading reference frame, [1=ship, 0=instr]
#EI +00000 --------------- Roll Misalignment Angle [.01 deg cw]
#EJ +00000 --------------- Pitch Misalignment Angle [.01 deg cw]
#E? ---------------------- Display #E Expert Command Menu
```

#EI - Roll Misalignment Angle

Purpose Corrects for a physical roll-like misalignment between the x-axis of the instrument and the ship's starboard axis.

Format #EI±*nnnnn*

The #EI command must be sent with the # sign.

Range ±*nnnnn* = -17999 to 18000 1/100ths of a degree

Default #EI0

Set as needed.

Description #EI is a rotation about the ship's forward axis. It is defined as the roll of the ship when the instrument is level.

For systems that have a roll source referenced to ship coordinates (typical for vehicles), use #EI to set the amount of rotation that the instrument's x-axis is physically offset from the ship's starboard axis. For such systems, the #EI command can also be used to align an upward pointing unit (e.g., mounted on a submarine) to the ship's axis by setting it to 18000.

For systems that have attitude referenced to internal coordinates, #EI is typically set to zero since the velocity data is referenced to either beam, instrument or geographic coordinates instead of ship coordinates.

For an upward pointing unit with instrument referenced attitude, use EU to align the instrument attitude data with the ship coordinates for use in velocity transformation.

#EJ - Pitch Misalignment Angle

Purpose Corrects for a physical pitch-like misalignment between the y-axis of the instrument and the ship's forward axis.

Format #EJ±*nnnnn*

The #EJ command must be sent with the # sign.

Range ±*nnnnn* = -17999 to 18000 1/100ths of a degree

Default #EJ0

Set as needed.

Description #EJ is a rotation about the ship's starboard axis. It is defined as the pitch of the ship when the instrument is level.

For systems that are fixed in place on a moving vessel and that have an external pitch source or an internal pitch source, use #EJ to set the amount of rotation that the instrument's y-axis is physically offset from the ship's forward axis.

For systems that are stationary and have an internal compass, #EJ is typically set to zero since the velocity data is referenced to either beam, instrument or geographic coordinates instead of ship coordinates. However, a non-zero value may be used if ship attitude output data is desired for other purposes.

Fault Log Commands

The Sentinel V Real-Time ADCP uses the following commands to aid in troubleshooting and testing.

Available Fault Log Commands

This section lists the most often used Fault Log commands.

```
>f?
Available Commands:

FC ----------------------- Clear Fault Log
FD ----------------------- Display Fault Log
F? ----------------------- Display Fault Log Commands

>
```

Fault Log Command Descriptions

FC – Clear Fault Log

Purpose Clears the fault log.

Format FC

Recommended Setting. Use as needed.

Description Use this command to clear the fault log of all previous entries.

FD – Display Fault Log

Purpose Displays the fault log.

Format FD

Recommended Setting. Use as needed.

Description Displaying the fault log will list why a built-in test failed. This may aid in troubleshooting.

Example >FD

```
Total Unique Faults   =     2
Overflow Count        =     0
Time of first fault:    97/11/05,11:01:57.70
Time of last fault:     97/11/05,11:01:57.70

Fault Log:
Entry #  0 Code=0a08h  Count=    1  Delta=    0 Time=97/11/05,11:01:57.70
 Parameter = 00000000h
  Tilt axis X over range.
Entry #  1 Code=0a16h  Count=    1  Delta=    0 Time=97/11/05,11:01:57.70
 Parameter = 00000000h
  Tilt Y axis ADC under range.
End of fault log.
```

Performance and Testing Commands

The Sentinel V Real-Time uses the following commands for calibration and testing.

Available Performance and Testing Commands

This section lists the available Performance and Testing commands.

```
>P?
Available Commands:

PA ---------------------- Run Go/No-Go Tests
PC ---------------------- Built In Tests [0=help]
PD 0 -------------------- Set Output Format (0=ensemble)
PS ---------------------- System Info [0=config,3=xform,5=HEM,6=RSSI Cal]
PT ---------------------- Built-in-Test Commands; PT0=Help
PF ---------------------- Results from most recent PA tests
P? ---------------------- Display P-Command Menu
>
```

Performance and Testing Command Descriptions

PA – Run Go/No-Go Tests

Purpose Sends/displays results of a series of Sentinel V Real-Time system diagnostic tests.

Format PA

Recommended Setting. Use as needed.

Description These diagnostic tests check the major Sentinel V Real-Time modules and signal paths. These tests check the following boards/paths.

- DSP - RAM, ROM, and DSP-to-CPU Communications.
- Sensors - verifies sensor operation.

Example see below

```
>pa
* indicates override value, selected by EZ command
RTC test............PASS
FPGA test...........PASS
Compass test........PASS  [   1.74,    1.40, -179.55 ]
Temperature test....PASS  [ 25.335 ]
Pressure test.......PASS  [    97.00 ]
GO
>
```

PC – User Interactive Built-In Tests

Purpose Sends/displays results of user-interactive Sentinel V Real-Time system diagnostic tests.

Format PC*nnn*

Range *nnn* = 0, 2, 20, 4, 40 (PC0 = Help menu; see below for others)

Recommended Setting. Use as needed.

Description These diagnostic tests check beam continuity and sensor data. Both tests require user interaction (see examples).

Examples See below.

PC0 – Help Menu

Sending PC0 displays the help menu.

```
>pc0
PC0   = Help
PC2   = Display Sensor Data
PC4   = Display Voltage Monitor ADC Data
PC20  = Display Scrolling Sensor Data
PC40  = Display Scrolling Voltage Monitor Data
>
```

PC2 – Display Sensor Data

Sending PC2 displays temperature, heading, pitch angle, roll angle, depth, and battery voltage in a repeating loop at approximately 0.5-sec update rate. Press any key to exit this command and return to the command prompt. For more information, see Testing the Sentinel V Real-Time Sensors.

```
>pc2
Sensor data is sampled and displayed in a loop.
An asterisk '*' to the right of a number indicates invalid data.
Press any key to exit the loop.

Count   Temp(C)  Heading   Pitch     Roll  Up/Down Depth(m) Batt(V) Batt(A)
\  9    22.812   340.08    -2.18     1.20    Down     0.000*  11.751   0.156
```

The PC2 heading shows the raw (magnetic north) heading only. The EB command (Heading Bias) is not applied.

PC20 – Display Scrolling Sensor Data

Sending PC20 displays temperature, heading, pitch angle, roll angle, depth, and battery voltage in a repeating loop at approximately 0.5-sec update rate. Press any key to exit this command and return to the command prompt.

```
>pc20
Sensor data is sampled and displayed in a loop.
An asterisk '*' to the right of a number indicates invalid data.
Press any key to exit the loop.

Count   Temp(C)  Heading   Pitch     Roll  Up/Down Depth(m) Batt(V) Batt(A)
   1    22.937   339.86    -2.09     1.26    Down     0.000*  11.757   0.156
   2    22.937   340.11    -2.19     1.21    Down     0.000*  11.757   0.161
   3    23.000   340.26    -2.02     1.26    Down     0.000*  11.737   0.164
   4    23.000   340.40    -2.12     1.20    Down     0.000*  11.757   0.158
   5    22.875   340.19    -1.99     1.26    Down     0.000*  11.757   0.153

>
```

PC4 – Display Voltage Monitor ADC Data

The command shows the raw and converted ADC data for the first four channels:

- ADCH0 = Vin (VBATT)
- ADCH1 = Iin
- ADCH2 = Vio
- ADCH3 = Vcore

```
>pc4
Battery ADC data is sampled and displayed in a loop.
Press any key to exit the loop.

Count  Chan0  Chan1  Chan2  Chan3    Vin(cV)  Iin(cA) Vio(cV) Vcore(cV)
\ 93    c088   0d60   9644   fc74   1709.188    6.896  342.340  183.410
>
```

PC40 – Display Scrolling Voltage Monitor ADC Data

PC40 is the same as PC4 except the data is displayed in a repeating loop at approximately 0.5-sec update rate.

```
>pc40
Battery ADC data is sampled and displayed in a loop.
Press any key to exit the loop.

Count  Chan0  Chan1  Chan2  Chan3    Vin(cV)  Iin(cA) Vio(cV) Vcore(cV)
   0    c088   0d60   98a6   f54e   1709.188    6.896  342.438  183.227
   0    c088   0d60   98a6   fc74   1709.188    6.896  342.438  183.410
   0    c088   0d60   9644   fc74   1709.188    6.896  342.340  183.410
   0    c088   089c   9644   0ac0   1709.188    6.774  342.340  183.776
   0    c088   0d60   98a6   f2ec   1709.188    6.896  342.438  183.166
   0    c088   089c   98a6   11e6   1709.188    6.774  342.438  183.959
   0    c088   122e   98a6   f7b0   1709.188    7.019  342.438  183.288
   0    be26   0d60   98a6   fa12   1708.517    6.896  342.438  183.349

>
```

PD – Set Output Format

Purpose Selects the type of ensemble output data structure.

Format PD*n*

Range *n* = 0 (0=ensemble)

Default PD0

Recommended Setting. Use the default setting for this command.

Description PD0 sends the real water-current data set.

PF – Results from most recent PA tests

Purpose Outputs the results of the last PA test.

Format PF

Recommended Setting. Use as needed.

Description This command gives a summary of the last PA test.

Example See below

```
>pf
 Test Results
PA Test last run at: 2016/10/21 09:29:58.84

* indicates override value, selected by EZ command
RTC test........... PASSED
FPGA test.......... PASSED
COMPASS test....... PASSED  [ 351.92,   1.32, -179.69 ]
TEMPERATURE test... PASSED  [ 23.957 ]
Pressure test.......PASSED  [    97.00 ]
GO

>
```

PS – Display System Parameters

Purpose Displays the Sentinel V Real-Time system configuration data.

Format PS*n*

Range *n* = 0 = config, 3 = xform, 5 = HEM, 6 = RSSI Cal (see description)

Recommended Setting. Use as needed.

Description See below.

PS0 – System Configuration

PS0 sends the Sentinel V Real-Time hardware/firmware information. For example, the output may look like this:

```
>ps0
   Serial Number:  17302
       Frequency:  491520 Hz
 Transducer Type:  PISTON
      Beam Angle:  25 Degrees
```

```
     Beam Pattern:  CONVEX
   Vertical Beam:  PISTON
             COM:  RS-422
         Sensors:
             Temperature:       A/D SENSOR
      Heading/Pitch/Roll:        TCM Prime
                Pressure:         KELLER30


     CPU Firmware:  66.01.00.10

     FPGA Version: 2.00.008 year/week 1206 [0x20081206]

Board Serial Number Data:
 8E 00 00 01 48 E1 4E 23   DSP-72D-2001-01E3
 19 00 00 00 D7 CE 20 23   XDR-71D-2000-41B
 76 00 00 01 51 71 B7 23   TRX-72D-2012-03A00
>
```

PS3 – Instrument Transformation Matrix

PS3 sends information about the transducer beams. The Sentinel V Real-Time uses this information in its coordinate-transformation calculations; for example, the output may look like this:

```
>ps3
Profiling Beams:        4
Janus Xdcr Type:        Piston
Janus Beam Angle (deg)  25
Janus Beam Freq (Hz)    491520
Janus Beam Dia (mm)     0
Janus Beam Offset (mm)  0
Instrument Transformation Matrix:
  1.1809 -1.1809  0.0015 -0.0015
 -0.0015  0.0015 -1.1883  1.1883
  0.2756  0.2756  0.2760  0.2760
  0.8382  0.8382 -0.8371 -0.8371

Has V-Beam:       Yes
VBeam Xdcr Type:  Piston
VBeamFreq (Hz)    491520
VBeam Dia (mm)    0
VBeam Offset (mm) 0

>
```

If the Sentinel V Real-Time needs beam angle corrections, a TRDI calibrated beam angle matrix is loaded into the instrument. This is done when the instrument is manufactured. For details, download a copy of the Sentinel V Real-Time Coordinate Transformation booklet (at https://www.teledynemarine.com/support/RDI/technical-manuals).

PS5 - Health and Environment Monitoring Sensors

The PS5 command reports the value of HEM sensors: S1 (operating time), S2 (over-pressure count), S3 (maximum pressure seen), and S7 (total pressure cycles). The PS5 output will read N/A for the Maximum pressure seen reading if no pressure was measured/recorded.

```
PS5
Operating time: 4327.5 hours
Maximum pressure seen: 652.378 dBar
Over-pressure events: 3
Pressure cycles: 25
```

PS6 – RSSI Calibration

PS6 displays the configured RSSI calibration data, scale and offset, for each beam.

```
>ps6
Rssi scale/offset:
  B1=[1.000    0] B2=[1.000    0]
  B3=[1.000    0] B4=[1.000    0]
  B5=[1.000    0]
```

```
>
```

PT – Built-In Tests

Purpose Sends/displays results of Sentinel V Real-Time system diagnostic test.

Format PT*nnn*

Range *nnn* = 0, 16, 17, 18, 21, 22 (PT0 = Help menu)

Recommended Setting. Use as needed.

DescriptionThese diagnostic tests check the major Sentinel V Real-Time modules and signal paths.

```
>pt0

Built In Tests
----------------
  PT0  = Help
  PT16 = Clock Test
  PT17 = Compass Test
  PT18 = Temperature Test
  PT21 = Pressure Test
  PT22 = FPGA Test>
```

PT16 = Clock Test

```
>pt16
RTC test................PASS

>
```

PT17 = Compass Test

```
>pt17
* indicates override value, selected by EZ command
Compass test........PASS  [   2.26,   1.39, -179.56 ]
```

PT18 = Temperature Test

```
>pt18
* indicates override value, selected by EZ command
Temperature test....PASS  [ 25.335 ]
>
```

PT21 = Pressure Test

```
>pt21
* indicates override value, selected by EZ command
Pressure test.......PASS  [   117.00 ]
>
```

PT22 = FPGA Test

```
>pt22
FPGA test...........PASS
```

Sync/Trigger Commands

The Teledyne RD Instruments Sleepy Sensor Synchronization (TRDIS3) protocol allows a Sentinel V RT system to synchronize measurements with another ADCP or any other instrument that adheres to the RDS3 specification.

Available Sync/Trigger Commands

```
>s?
Available Commands:

SA 00 ------------------- Trigger events [0=After][0=Ping,1=Ensemble]
SM 0 -------------------- Trigger Mode [0=off,2=slave]
ST 60 ------------------- Trigger Timeout [seconds, 0 = no timeout]
S? ---------------------- Display S-Command Menu
```

SA – Trigger Events

Purpose Sets the rough timing of the synchronization pulse.

Format SA*xy*

Range *x* = 0 [0=Before]
y = 0, 1 [0=Ping, 1=Ensemble]

Default SA00

Recommended Setting. Special applications only.

This command has no effect unless SM = 2.

Description Use the SA command to set the rough timing of the synchronization pulse. The first parameter must be zero, since “sync before” is the only option. The second parameter sets the event type (0 = ping, 1 = ensemble).

Table 47: Synchronization Parameters

Parameter	Description
SA00	Send (wait for) pulse before a ping.
SA01	Send (wait for) pulse before ensemble.

SM – Trigger Mode

Purpose Sets the RDS3 Mode.

Format SM*n*

Range *n* = 0 (Off), 2 (Slave)

Default SM0

Recommended Setting. Special applications only.

Description SM sets the trigger Mode. SM0 turns off the trigger mode and disables all other commands on this menu. SM2 sets the RDS3 Slave mode and enables the SA and ST commands.

ST – Trigger Timeout

Purpose	Sets the amount of time the ADCP will wait to hear a synch pulse before proceeding on its own.
Format	ST*nnnnn*
Range	*nnnnn* = 0 to 10800 seconds (0 = no timeout)
Default	ST60

Recommended Setting. Special applications only.

Description ST sets the amount of time the ADCP will wait to hear a synch pulse before proceeding on its own. If the ADCP times out, it will automatically ping according to the CF, TP, TE, WP, and BP command settings. This is a fail-safe mechanism designed to allow the ADCP to proceed on its own should communications with the synch pulse fail. Setting ST = 0 tells the ADCP to wait indefinitely.

This command has no effect unless SM = 2

Timing Commands

The following commands set the timing of various profiling functions.

Available Timing Commands

This section lists the available Timing commands.

```
>T?
Available Commands:

TE 00:00:00.00 ---------- Time Between Ensembles
TP 00:05.00 ------------- Time Between Pings
TS 16/10/13,11:19:30.02 - Set System Date and Time (yy/mm/dd,hh:mm:ss)
T? ---------------------- Display T-Command Menu

>#T?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#TM 10 ------------------ Set minimum time between pings (ms) [0..100]
#T? --------------------- Display #T-Command Menu

>
```

Standard Timing Commands

TE – Time Per Ensemble

Purpose	Sets the minimum interval between data collection cycles (data ensembles).
Format	TEhh:mm:ss.ff
Range	*hh* = 00 to 23 hours *mm* = 00 to 59 minutes *ss* = 00 to 59 seconds *ff* = 00 to 99 hundredths of seconds
Default	TE00:00:00.00

Recommended Setting. The default setting for this command is recommended for most applications.

Description	During the ensemble interval set by TE, the Sentinel V Real-Time collects one automatic ensemble. If TE = 00:00:00.00, the Sentinel V Real-Time starts collecting the next ensemble immediately after processing the previous ensemble.
Example	TE01:15:30.00 tells the Sentinel V Real-Time to collect data ensembles every 1 hour, 15 minutes, 30 seconds.

The time tag for each ensemble is the time of the first ping of that ensemble.

TP – Time Between Pings

Purpose Sets the *minimum* time between pings.

Format TP*mm:ss.ff*

Range
mm = 00 to 30 minutes
ss = 00 to 59 seconds
ff = 00 to 99 hundredths of seconds

Default TP00:05.00

Recommended Setting. The default setting for this command is recommended for most applications.

Description The Sentinel V Real-Time pings with an automatic ping setup and adjusts the ping times as required.

Example TP00:00.10 sets the time between pings to 0.10 second.

TS – Set Real-Time Clock

Purpose Sets the Sentinel V Real-Time's internal real-time clock.

Format TS*yy/mm/dd, hh:mm:ss*

Range

yy	= year	00-99
mm	= month	01-12
dd	= day	01-31
hh	= hour	00-23
mm	= minute	00-59
ss	= second	00-59

Recommended Setting. Set using *Sentinel V RT Utilities*.

Example TS16/06/17, 13:15:00 sets the real-time clock to 1:15:00 pm, June 17, 2016.

1. When the Sentinel V Real-Time receives the carriage return after the TS command, it enters the new time into the real-time clock and sets hundredths of seconds to zero.
2. If the entry is not valid, the Sentinel V Real-Time sends an error message and does not update the real-time clock.

Expert Timing Commands

#TM – Set Minimum Time Between Pings

Purpose	Sets the minimum time between pings in ms.
Format	#TM*xx*
Range	xx = 0 to 100 ms
Default	#TM10

Recommended Setting. TRDI use only. Leave at the default setting.

Description Sets the minimum time between pings in ms.

Water Profiling Commands

The following commands define the criteria used to collect the water-profile data.

Available Water Profiling Commands

The available water profiling commands are different for each water mode. The commands listed below show the commands for each water mode. The added commands are highlighted.

```
>w?
Available Commands:

WB 0 -------------------- Bandwidth 0=High, 1=low
WC 064 ------------------ Correlation Threshold [0-255]
WD 1111000011 ----------- Data Out {v;c;a;p;s;*;*;*;i;m}
WF 0100 ----------------- Blanking Distance (cm) [0-9999]
WM 0002 ----------------- Water Profiling Mode [2]
WN 030 ------------------ Number of Bins [1-200]
WP 060 ------------------ Number of Pings [0-999]
WS 0200 ----------------- Bin Size (cm) [50-400]
WV 0175 ----------------- Ambiguity Velocity [2-700] (cm/s)
W? ---------------------- Display W-Command Menu

>

>#W?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

Available Commands:

#WA 050,1 ------------- False Target Threshold 0-255 [, Start bin 0 - 256]
#WB 0 ------------------- Bandwidth 0=High, 1=low
#WE 2000 ---------------- Error Velocity Threshold [0-9999] (mm/s)
#WI 0 ------------------- Bypass phase interpolation (0,1)
#WJ 1 ------------------- BroadBand Rcvr Gain [0=Lo,1=Hi]
#WL   0  0  0  0 -------- Manual dLag Offset <b1> <b2> <b3> <b4> (+/- samples)
#WT 0000 ---------------- Transmit Length (cm)
#W? --------------------- Display #W-Command Menu

>
```

Standard Water Profiling Commands

WB – Bandwidth

Purpose Sets the profiling mode 1 bandwidth (sampling rate). Smaller bandwidths allow the ADCP to profile farther, but the standard deviation is increased by as much as 2.5 times.

Format WB*n*

Range *n* = 0 (High), 1 (Low)

Default WB0

Recommended Setting. The default setting for this command is recommended for most applications.

Description See table below.

Table 48: Bandwidth Control

Bandwidth	Sample rate	Data variance	Profiling range
0 = High (25%)	High	Low	Low
1 = Low (6.25%)	Low	High	High

WC – Correlation Threshold

Purpose Sets the minimum threshold for correlation magnitude that velocity data must meet to be considered valid.

Format WC*nnn*

Range *nnn* = 0 to 255 counts

Default WC 064

Recommended Setting. The default setting for this command is recommended for most applications.

Description The Sentinel V Real-Time uses WC to screen water-track data for the minimum acceptable correlation requirements. The nominal (maximum) correlation depends on system frequency and depth cell size (WS). WC sets the threshold of the correlation below, which the ADCP flags the data as bad and does not average the data into the ensemble.

The default threshold is 64 counts. A solid target would have a correlation of 128 counts.

WD – Data Out

Purpose Selects the data types collected by the Sentinel V Real-Time.

Format WD (v;c;a;p;s;*;*;*;i;m)

Range Firmware switches (see description)

Default WD 111 100 001 1

Recommended Setting. The default setting for this command is recommended for most applications.

Description WD uses firmware switches to tell the Sentinel V Real-Time the types of data to collect. The Sentinel V Real-Time always collects header data, fixed and variable leader data, and checksum data. Setting a bit to one tells the Sentinel V Real-Time to collect that data type. The bits are described as follows:

v = Velocity	*c* = Correlation	*a* = Echo Intensity	*p* = Percent good	s = Status
*= Reserved	*= Reserved	*= Reserved	*i*= ADC&Config	*m* = Beam Correction Matrix

Example WD 1111000011 (default) tells the Sentinel V Real-Time to collect velocity, correlation magnitude, echo intensity, percent-good, ADC and Configuration, and beam correction matrix.

1. Each bit can have a value of one or zero. Setting a bit to one means output data, zero means suppress data.
2. If WP = zero, the Sentinel V Real-Time does not collect water-profile data.
3. Spaces in the command line are allowed.
4. Status data is not used, as it does not mean anything.

WF – Blank after Transmit

Purpose Moves the location of first depth cell away from the transducer head to allow the transmit circuits time to recover before the receive cycle begins.

Format WF*nnnn*

Range *nnnn* = 0 to 9999 cm

Default See Table 49

Recommended Setting. It is not recommended to set the blank below the default value shown in Table 49. If you are using *Plan*, let the software set the WF command setting.

Description WF positions the start of the first depth cell at some vertical distance from the transducer head. This allows the Sentinel V Real-Time transmit circuits time to recover before beginning the receive cycle. In effect, WF blanks out bad data close to the transducer head, thus creating a depth window that reduces unwanted data in the ensemble. The default value is based on system frequency and it is highly recommended to use this value. Setting a value below the default blank distance may show ringing/recovery problems in the first depth cells.

Table 49. Blank Distance

System	Blank Distance (Default)
Sentinel V 100m (307.2kHz)	160 cm
Sentinel V 50m (491.52kHz)	100 cm
Sentinel V 20m (983.04kHz)	40 cm

WM – Water Profiling Mode

Purpose Selects the application-dependent profiling mode used by the Sentinel V Real-Time.

Format WM*nnnn*

Range *nnnn* = 2

Default WM0002

Recommended Setting. The default setting for this command is recommended for most applications.

Description The WM command lets you select an application-dependent profiling mode. The chosen mode selects the types of pings transmitted. The ping type depends on how much the water-current is changing from ping-to-ping and from cell-to-cell.

WN – Number of Bins

Purpose Sets the number of bins (depth cells) over which the Sentinel V Real-Time collects data.

Format WN*nnn*

Range *nnn* = 1 to 200 depth cells

Default WN030

Recommended Setting. Set using *Plan*.

Description The range of the Sentinel V Real-Time is set by the number of depth cells (WN) times the size of each depth cell (WS).

WP – Number of Pings

Purpose Sets the number of pings to average in each data ensemble.

Format WPnnn

Range nnn = 0 to 999 pings

Default WP060

Recommended Setting. Set using *Plan*.

Description WP sets the number of pings to average in each ensemble before sending/recording the data.

1. If WP = zero the Sentinel V Real-Time does not collect water-profile data.
2. The Sentinel V Real-Time automatically extends the ensemble interval (TE) if WP x TP > TE.

WS – Bin Size

Purpose Selects the volume of water for one measurement cell (bin).

Format WS*nnn*

Range *nnn* = 25 to 600 cm

Default See table below

Recommended Setting. It is not recommended to set the cell size below the minimum or above the maximum range shown in Table 50. Set using *Plan*.

Description The Sentinel V Real-Time collects data over a variable number of bins. WS sets the size of each bin in vertical centimeters.

Table 50. Cell Size

System	Cell Size (Default)	Minimum Cell size	Maximum Cell Size
Sentinel V 100m (307.2kHz)	400 cm	100 cm	600 cm
Sentinel V 50m (491.52kHz)	200 cm	50 cm	400 cm
Sentinel V 20m (983.04kHz)	100 cm	25 cm	200 cm

WV – Ambiguity Velocity

Purpose Sets the radial ambiguity velocity.

Format WV*nnnn*

Range *nnnn* = 2 to 700 cm/s

Default WV0175

Recommended Setting. Set using the *Plan*.

Description Set WV as low as possible to attain maximum performance, but not too low or ambiguity errors will occur. Rule of thumb: Set WV to the maximum relative horizontal velocity between water-current speed and Sentinel V Real-Time speed.

The WV command (ambiguity velocity setting) sets the maximum velocity that can be measured along the beam when operating in water mode 1 (WM1). WV is used to improve the single-ping standard deviation. The lower the value of the WV command, the lower the single-ping standard deviation.

Set the WV command based on the maximum apparent velocity (Sentinel V Real-Time motion plus water speed). The following formula is used to determine the setting of the WV command: WV = (Max. Apparent Vel. cm/s) * sin(beam angle) * 1.5, where 1.5 is a safety factor.

Expert Water Profiling Commands

#WA – False Target Threshold

Purpose Sets a false target (fish) filter.

Format #WA*nnn,x*

Range *nnn* = 0 to 255 counts (255 disables this filter)
x = Start bin 0 - 256

Default #WA050,1

Recommended Setting. The default setting for this command is recommended for most applications.

Description The Sentinel V Real-Time ADCP uses the #WA-command to screen water-track data for false targets (usually fish). #WA sets the maximum difference between echo intensity readings among the four profiling beams. If the #WA threshold value is exceeded, the ADCP rejects velocity data on a cell-by-cell basis for either the affected beam (fish detected in only one beam) or for the affected cell in all four beams (fish detected in more than one beam). This usually occurs when fish pass through one or more beams.

A #WA value of 255 turns off this feature.

#WE - Error Velocity Threshold

Purpose Sets the maximum error velocity for good water-current data.

Format WE*nnnn*

Range *nnnn* = 0 to 9999 mm/s

Default #WE2000

Recommended Setting. The default setting is set purposely high. We recommend extreme caution and testing before changing this setting. **Data rejected by this command is lost and cannot be regained.**

Description The #WE-command sets a threshold value used to flag water-current data as good or bad. If the Sentinel V Real-Time ADCP's error velocity value exceeds this threshold, it flags data as bad for a given depth cell. The #WE command screens for error velocities in both beam and transformed-coordinate data. Setting the #WE command to zero (#WE0) disables error velocity screening.

#WJ – BroadBand Receiver Gain

Purpose Allows the Sentinel V Real-Time ADCP to reduce receiver gain by 40 dB.

Format #WJ*n*

Range *n* = 0 (low), 1 (high)

Default #WJ1

Recommended Setting. The default setting for this command is recommended for most applications.

Description #WJ0 tells the Sentinel V Real-Time to reduce receiver gain by 40 dB. This may increase data reliability in shallow-water applications where there is a high content of backscatter material. #WJ1 (the default) uses the normal receiver gain.

#WT – Transmit Length

Purpose Selects a transmit length different from the depth cell length (cell sampling interval) as set by the WS command.

Format #WT*nnnn*

Range *nnnn* = 0 to 3200 cm

Default #WT0000

Recommended Setting. The default setting for this command is recommended for most applications.

Description When #WT is set to zero, the transmit signal is set to the depth cell size (WS-command). This is the default setting. Setting #WT allows selection of a transmit length different than the area depth cell size (sampling length).

Vertical Beam Profile Commands

The following commands define the criteria used to collect the vertical beam profile data.

Vertical beam profiling extends the ping time approximately 25%. Ping time depends on water depth and number of bins.

Available Vertical Beam Profile Commands

This section lists the vertical beam profile commands.

```
>Z?
Available Commands:

ZP -01 ------------------ Number of Pings [0-999, -1=WP]
Z? ---------------------- Display Z-Command Menu

>#Z?
*** CAUTION: These commands are reserved for RDI use
             and may not be currently supported!

Available Commands:

#ZB -1 ------------------ Bandwidth [0=Wide, 1=Narrow, -1=WB]
#ZC -01 ----------------- Correlation Threshold (counts) [0..255,-1=WC]
#ZD 0000000001 ---------- Data Out [{v;c;a;p;s;*;*;*;*;wd},-1=WD]
#ZF -01 ----------------- Blanking Distance (cm) [0-9999,-1=WF]
#ZJ -1 ------------------ Gain [0=low, 1=high,-1=WJ]
#ZM -1 ------------------ V-Beam Profile Mode [2,-1=WM]
#ZN -01 ----------------- Number of Bins [1-200,-1=WN]
#ZP -01 ----------------- Number of Pings [0-999, -1=WP]
#ZS -01 ----------------- Bin Size (cm) [60-480, -1=WS]
#ZV -01 ----------------- Ambiguity Velocity (cm/s) [2-700,-1=WC/cos(angle)]
#Z? --------------------- Display Z-Command Menu
>
```

Standard Vertical Beam Profile Commands

ZP – Vertical Beam Number of Pings

Purpose: Sets the number of vertical beam pings to average in each data ensemble.

Format: #ZP*nnn*

Range: *nnn* = 0 to 999 pings, -1 = same as WP command

Default: #ZP-1

Recommended Setting. The default setting for this command is recommended for most applications.

Description: ZP sets the number of vertical beam pings to average in each ensemble before sending/recording the data. The setting ZP0 disables vertical beam profiling.

Expert Vertical Beam Profile Commands

Changing expert vertical beam commands may result in data analysis, visualization, or serious errors in TRDI software.

#ZB – Vertical Beam Bandwidth

Purpose: Sets the vertical beam profile bandwidth (sampling rate).

Format: #ZB*n*

Range: *n* = 0=Wide (25%), 1=Narrow (6.25%), -1 = same as WB command

Default: #ZB-1

Recommended Setting. The default setting for this command is recommended for most applications. Software warning: Changing this command may cause problems with TRDI display and processing software.

Description: Narrow bandwidths allow the Sentinel V Real-Time to profile farther, but the standard deviation is increased by as much as 2.5 times.

#ZC – Vertical Beam Correlation Threshold

Purpose: Sets the minimum threshold for correlation magnitude that vertical beam profile velocity data must meet to be considered valid.

Format: #ZC*nnn*

Range: *nnn* = 0 to 255 counts, -1 = same as WC command

Default: #ZC-1

Recommended Setting. The default setting for this command is recommended for most applications.

Description: The Sentinel V Real-Time uses #ZC to screen vertical beam profile data for the minimum acceptable correlation requirements. The nominal (maximum) correlation depends on system frequency and vertical beam profile depth cell size (#ZS). #ZC sets the threshold of the correlation below, which the Sentinel V Real-Time flags the data as bad and does not average the data into the ensemble.

The default threshold is 64 counts. A solid target would have a correlation of 128 counts.

#ZD – Vertical Beam Data Out

Purpose: Selects the vertical beam profile data types collected by the Sentinel V Real-Time.

Format: #ZD *v;c;a;p;s;*;*;*;*;wd*, -1 = same as WD command

Range: Firmware switches (see description)

Default: #ZD 0000000001

Recommended Setting. The default setting for this command is recommended for most applications.

Description: #ZD uses firmware switches to tell the Sentinel V Real-Time the types of data to collect and process. The Sentinel V Real-Time always collects header data, fixed and variable leader data, and checksum data. Setting a bit to one tells the Sentinel V Real-Time to collect and process that data type. The bits are described as follows:

v = Velocity	*p*= Percent good	* = Reserved
c = Correlation	s = Status	* = Reserved
a = Echo Intensity	* = Reserved	* = Same as WD command

#ZF – Vertical Beam Blanking Distance

Purpose: Moves the location of first depth cell away from the transducer head to allow the transmit circuits time to recover before the receive cycle begins.

Format: #ZF*nnn*

Range: *nnnn* = 0 to 9999 cm

Default: See Table 51, -1 = same as WF command

> Recommended Setting. The default setting for this command is recommended for most applications.
> Software warning: Changing this command may cause problems with TRDI display and processing software.

Description: #ZF positions the start of the first depth cell at some vertical distance from the transducer head. This allows the Sentinel V Real-Time transmit circuits time to recover before beginning the receive cycle. In effect, #ZF blanks out bad data close to the transducer head, thus creating a depth window that reduces unwanted data in the ensemble.

Table 51. Vertical Beam Blank Distance

System	Blank Distance (Default)
Sentinel V 100m (307.2kHz)	160 cm
Sentinel V 50m (491.52kHz)	100 cm
Sentinel V 20m (983.04kHz)	-1 = same as WF command

#ZJ – Vertical Beam Gain

Purpose: Allows the Sentinel V Real-Time to reduce receiver gain by 40 dB.

Format: #ZJ*n*

Range: *n* = 0 (low), 1 (high), -1 = same as WJ command

Default: #ZJ-1

> Recommended Setting. The default setting for this command is recommended for most applications.

Description: #ZJ0 tells the Sentinel V Real-Time to reduce receiver gain by 40 dB. This may increase data reliability in shallow-water applications where there is a high content of backscatter material. #ZJ-1 (the default) uses the normal receiver gain (same as the WJ command).

#ZM – Vertical Beam Profile Mode

Purpose: Selects the vertical beam profiling mode used by the Sentinel V Real-Time.

Format: #ZM*n*

Range: *n* = 2, -1 = same as WM command (see description)

Default: #ZM-1

Recommended Setting. The default setting for this command is recommended for most applications.

Description: The #ZM command sets an application-dependent profiling mode. The chosen mode selects the types of pings transmitted. The ping type depends on how much the water-current is changing from ping-to-ping and from cell-to-cell.

#ZM2 refers to water mode 2 (WM2) pings for the vertical beam profile ping. WM2 pings are very similar to TRDI's traditional WM1 pings, except that they use 8-bit sampling instead of 1-bit sampling. These pings use a relatively short lag (i.e. large ambiguity velocity), and make the assumption that the velocities being measured will never rise above the ambiguity velocity; i.e. there is no ambiguity resolving being done.

#ZN – Vertical Beam Number of Bins

Purpose: Sets the number of vertical beam profile bins (depth cells) over which the Sentinel V Real-Time collects data.

Format: #ZN*nnn*

Range: *nnn* = 1 to 200 bins, -1 = same as WN command

Default: #ZN-1

Recommended Setting. The default setting for this command is recommended for most applications.

Software warning: Changing this command may cause problems with TRDI display and processing software.

Description: The range of the Sentinel V Real-Time vertical beam is set by the number of bins (#ZN) times the size of each bin (#ZS). The backscatter level is also a factor in determining the range that can be effectively measured by the vertical beam.

#ZS – Vertical Beam Bin Size

Purpose: Sets the vertical length of the bin, which indirectly sets the volume.

Format: #ZS*nnn*

Range: *nnn* = see Table 52, -1 = same as WS command

Default: #ZS-1

Recommended Setting. The default setting for this command is recommended for most applications.

Software warning: Changing this command may cause problems with TRDI display and processing software.

Description: The Sentinel V Real-Time collects data over a number of bins. #ZS sets the size of each bin in vertical centimeters.

Table 52. Vertical Beam Cell Size

System	Cell Size (Default)	Minimum Cell size	Maximum Cell Size
Sentinel V 100m (307.2kHz)	-1 (same as WS command)	100 cm	600 cm
Sentinel V 50m (491.52kHz)	-1 (same as WS command)	60 cm	480 cm
Sentinel V 20m (983.04kHz)	-1 (same as WS command)	30 cm	240 cm

#ZV – Vertical Beam Ambiguity Velocity

Purpose: Sets the vertical beam radial ambiguity velocity.

Format: #ZV*nnn*

Range: *nnn* = 2 to 700 cm/s, -1 = same as WC command/cos(angle)

Default: #ZV -1

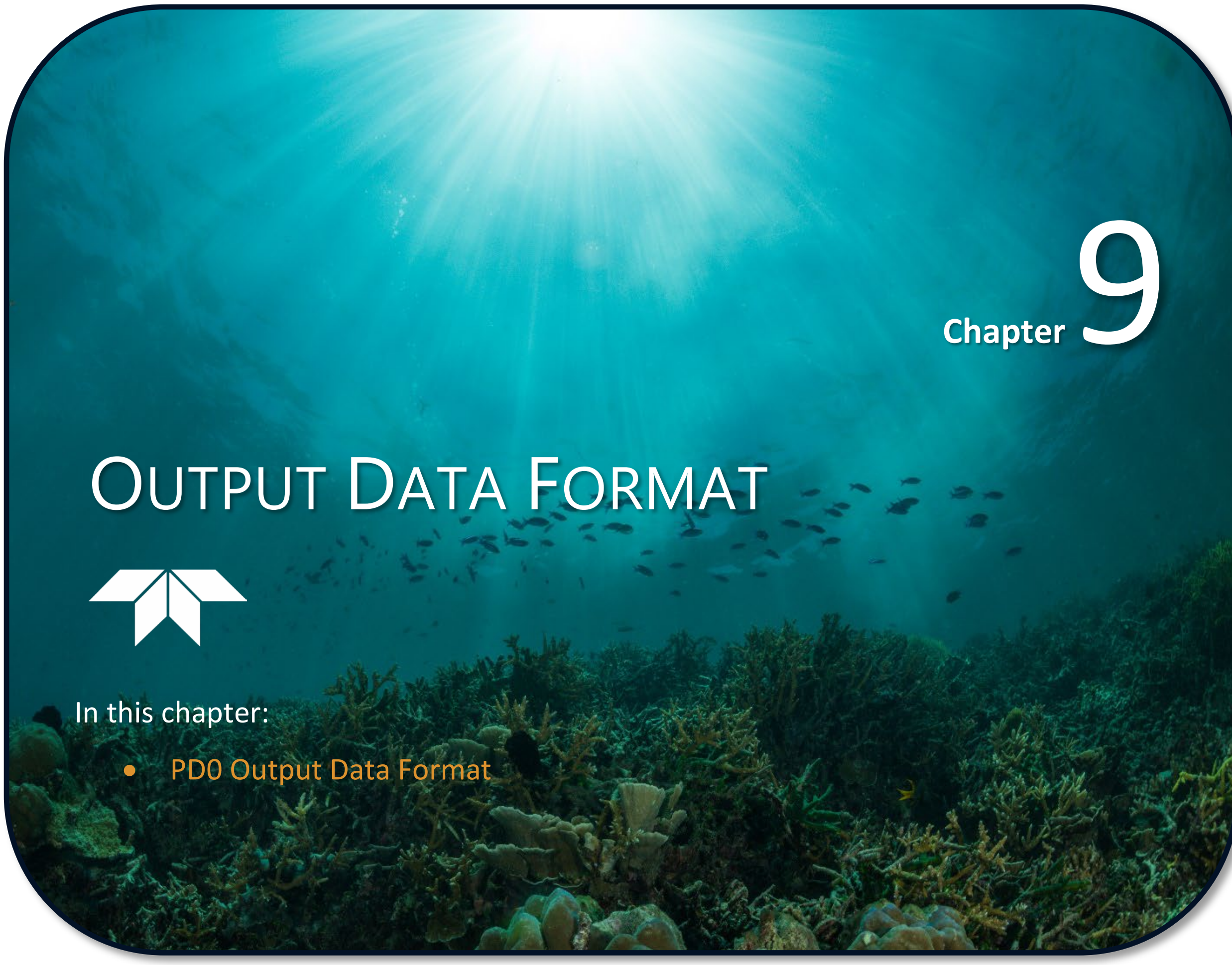
Recommended Setting. The default setting for this command is recommended for most applications.

Software warning: Changing this command may cause problems with TRDI display and processing software.

Description: Set #ZV as low as possible to attain maximum performance, but not too low or ambiguity errors will occur. Rule of thumb: Set #ZV to the maximum relative horizontal velocity between water-current speed and Sentinel V Real-Time speed.

The #ZV command (ambiguity velocity setting) sets the maximum velocity that can be measured along the beam when operating in water mode 2 (#ZM2). #ZV is used to improve the single-ping standard deviation. The lower the value of the #ZV command, the lower the single-ping standard deviation.

Set the #ZV command based on the maximum apparent velocity (Sentinel V Real-Time motion plus water speed). The following formula is used to determine the setting of the #ZV command: #ZV = (Max. Apparent Vel. cm/s) * sin(beam angle) * 1.5, where 1.5 is a safety factor.



Chapter 9

OUTPUT DATA FORMAT

In this chapter:

- PD0 Output Data Format

This chapter defines the output data format used by the Sentinel V ADCPs. Using *ReadyV* or *Sentinel V RT Utilities* to develop the deployment file will ensure that the Sentinel V ADCP is set up correctly. The deployment file directly affects the range of the ADCP, the standard deviation (accuracy) of the data, and battery usage.

> This chapter applies to Sentinel V firmware version 47.19.xx.xx (Sentinel V) and 66.01.xx.xx (Sentinel V Real-Time).
>
> When new firmware versions are released, some commands or output formats may be modified, added, or removed. Read the README file on the upgrade disk. When an addition or correction to this manual is needed, an Interim Change Notice (ICN) or a new PDF version of the manual may be posted to our website.

Comparing Sentinel V PD0 to WorkHorse PD0

The WorkHorse PD0 (pd zero, not the letter o) data (Figure 110, page 263) is not exactly the same as the Sentinel V PD0 output data (Figure 111, page 264);

- The WorkHorse ADCP and Sentinel V Real-Time uses a command file to configure the ADCP using a two-character command. For example, the WS command is used to set the water profile cell size in WorkHorse ADCPs. The Sentinel V Self-Contained ADCPs use *ReadyV* to configure the ADCP. There are no equivalent commands between WorkHorse/Sentinel V RT and Sentinel V SC ADCPs.
- The Sentinel V ADCPs have additional data formats to include the vertical beam data and features.
- The Sentinel V ADCPs PD0 output is always in binary format.
- The Sentinel V ADCPs PD0 output can be read by TRDI's *WinADCP* and *Velocity* software only.

Always Output	**HEADER** (6 BYTES + [2 x No. OF DATA TYPES])
	FIXED LEADER DATA (59 BYTES)
	VARIABLE LEADER DATA (65 BYTES)
WorkHorse WD command WorkHorse WP command	**VELOCITY** (2 BYTES + 8 BYTES PER DEPTH CELL)
	CORRELATION MAGNITUDE (2 BYTES + 4 BYTES PER DEPTH CELL)
	ECHO INTENSITY (2 BYTES + 4 BYTES PER DEPTH CELL)
	PERCENT GOOD (2 BYTES + 4 BYTES PER DEPTH CELL)
	STATUS (2 BYTES + 4 BYTES PER DEPTH CELL)
WorkHorse BP command	**BOTTOM TRACK DATA** (85 BYTES)
Always Output	**RESERVED** (2 BYTES)
	CHECKSUM (2 BYTES)

Figure 110. WorkHorse ADCP PD0 Standard Output Data Buffer Format

For details on the WorkHorse Output Data Format, see the WorkHorse Commands and Output Data Format Guide. This guide can be downloaded our online customer portal at https://www.teledynemarine.com/support/RDI/technical-manuals.

Always Output	**HEADER** (6 BYTES + [2 x No. OF DATA TYPES])
	FIXED LEADER DATA (60 BYTES)
	VARIABLE LEADER DATA (66 BYTES)
Water Profiling	**VELOCITY** (2 BYTES + 8 BYTES PER DEPTH CELL)
	CORRELATION MAGNITUDE (2 BYTES + 4 BYTES PER DEPTH CELL)
	ECHO INTENSITY (2 BYTES + 4 BYTES PER DEPTH CELL)
	PERCENT GOOD(see note) (2 BYTES + 4 BYTES PER DEPTH CELL)
Sentinel V Specific Outputs	**INSTRUMENT TRANSFORMATION MATRIX FORMAT** (34 BYTES)
	SYSTEM CONFIGURATION (16 BYTES)
	PING SETUP (44 BYTES)
	ADC DATA (16 BYTES)
	FEATURES DATA (68(N-1)+90 BYTES)
Vertical Beam Profiling	**VERTICAL BEAM LEADER** (40 BYTES)
	VERTICAL BEAM VELOCITY (2 BYTES + 2 BYTES PER DEPTH CELL)
	VERTICAL BEAM CORRELATION MAGNITUDE (2 BYTES + 1 BYTES PER DEPTH CELL)
	VERTICAL BEAM AMPLITUDE (2 BYTES + 1 BYTES PER DEPTH CELL)
	VERTICAL BEAM PERCENT GOOD DATA (2 BYTES + 1 BYTES PER DEPTH CELL)
Bottom Track	**BOTTOM TRACK DATA** (85 BYTES)
Wave Parameters	**WAVE PARAMETERS** (53 BYTES)
	Sea and Swell (46 BYTES)
Always Output	**EVENT LOG** (8 BYTES + 8 BYTES PER EVENT)
	RESERVED (2 BYTES)
	CHECKSUM (2 BYTES)

Figure 111. Sentinel V Real-Time ADCP PD0 Output Data Buffer Format

Only the averaged PD0 files created by *Velocity* will have Percent Good data.

PD0 Output Data Format

The following description is for the Sentinel V PD0 output data format. The binary output data formats are composed of at least one data type, i.e. a group of bytes all related by their dynamic or field. For instance in the PD0 data format, variables that do not change during the deployment are stored in the Fixed Leader data type of leader ID 0000h, whereas the dynamic variables, except velocities, which dynamically change during the deployment are stored under the Variable Leader data type of leader ID 8000h. This distinction is based on the dynamic; other distinctions are present such as velocity types such as data type of leader ID 0001h which groups all the Water Profile Velocity data. The ADCP sends all the data for a given type for all depth cells and all beams before the next data type begins.

The advantage of using the leader ID is that one can simply scan for them as the binary data is received in real time on the serial lines and then use the output data format description table to jump directly to the desired data. The PD0 Header ID is 7F7Fh, which makes it easy to detect. In the PD0 Header are the number of bytes in the ensemble, the number of data types and the offset respective to each data type location in the binary ensemble. This gives you the choice between jumping down to the data type using the offsets or detecting the data type ID after you have detected the header ID.

PD0 binary output data format provides a Header that describes the data included in the ensemble since some data type presence in the PD0 output are dependent on *ReadyV* or *Plan* parameters. For example, if the vertical beam is not activated, then there will be no vertical beam data type in the ensemble.

Header Data Format

BYTE	7	6	5	4	3	2	1	0	
	BIT POSITIONS								
1	HEADER ID (7Fh)								
2	DATA SOURCE ID (7Fh)								
3	NUMBER OF BYTES IN ENSEMBLE								LSB
4									MSB
5	SPARE								
6	NUMBER OF DATA TYPES								
7	OFFSET FOR DATA TYPE #1								LSB
8									MSB
9	OFFSET FOR DATA TYPE #2								LSB
10									MSB
11	OFFSET FOR DATA TYPE #3								LSB
12									MSB
↓	(SEQUENCE CONTINUES FOR UP TO N DATA TYPES)								↓
2N+5	OFFSET FOR DATA TYPE #N								LSB
2N+6									MSB

See Table 53 for a description of the fields.

Figure 112. Header Data Format

Header information is the first item sent by the ADCP to the output buffer. The Sentinel V ADCP always sends the Least Significant Byte (LSB) first.

Table 53: Header Data Format

Binary Byte	Field	Description
1	HDR ID / Header ID	Stores the header identification byte (7Fh).
2	HDR ID / Data Source ID	Stores the data source identification byte (7Fh for the Sentinel V ADCP).
3,4	Bytes / Number of bytes in ensemble	This field contains the number of bytes from the start of the current ensemble up to, but not including, the 2-byte checksum (Figure 127).
5	Spare	Undefined.
6	No. DT / Number of Data Types	This field contains the number of data types selected for collection. By default, fixed/variable leader, velocity, correlation magnitude, echo intensity, and percent good are selected for collection. This field will therefore have a value of six (4 data types + 2 for the Fixed/Variable Leader data).
7,8	Address Offset for Data Type #1 / Offset for Data Type #1	This field contains the internal memory address offset where the Sentinel V ADCP will store information for data type #1 (with this firmware, always the Fixed Leader). Adding "1" to this offset number gives the absolute Binary Byte number in the ensemble where Data Type #1 begins (the first byte of the ensemble is Binary Byte #1).
9,10	Address Offset for Data Type #2 / Offset for Data Type #2	This field contains the internal memory address offset where the Sentinel V ADCP will store information for data type #2 (with this firmware, always the Variable Leader). Adding "1" to this offset number gives the absolute Binary Byte number in the ensemble where Data Type #2 begins (the first byte of the ensemble is Binary Byte #1).
11,12 thru 2n+5, 2n+6	Address Offsets for Data Types #3-n / Offset for Data Type #3 through #n	These fields contain internal memory address offset where the Sentinel V ADCP will store information for data type #3 through data type #n. Adding "1" to this offset number gives the absolute Binary Byte number in the ensemble where Data Types #3-n begin (first byte of ensemble is Binary Byte) #1).

Fixed Leader Data Format

BYTE	7	6	5	4	3	2	1	0	
1	FIXED LEADER ID								LSB 00h
2									MSB 00h
3	CPU F/W VER.								
4	CPU F/W REV.								
5	SYSTEM CONFIGURATION								LSB
6									MSB
7	REAL/SIM FLAG								
8	LAG LENGTH								
9	NUMBER OF BEAMS								
10	NUMBER OF CELLS								
11	PINGS PER ENSEMBLE								LSB
12									MSB
13	DEPTH CELL LENGTH								LSB
14									MSB
15	BLANK AFTER TRANSMIT								LSB
16									MSB
17	PROFILING MODE								
18	LOW CORR THRESH								
19	NO. CODE REPS								
20	%GD MINIMUM								
21	ERROR VELOCITY MAXIMUM								LSB
22									MSB
23	TPP MINUTES								
24	TPP SECONDS								
25	TPP HUNDREDTHS								
26	COORDINATE TRANSFORM								
27	HEADING ALIGNMENT								LSB
28									MSB

BYTE	BIT POSITIONS 7 6 5 4 3 2 1 0	
29	HEADING BIAS	LSB
30		MSB
31	SENSOR SOURCE	
32	SENSORS AVAILABLE	
33	BIN 1 DISTANCE	
34		
35	XMIT PULSE LENGTH BASED ON	LSB
36		MSB
37	(starting cell) WP REF LAYER AVERAGE (ending cell)	LSB
38		MSB
39	FALSE TARGET THRESH	
40	SPARE	
41	TRANSMIT LAG DISTANCE	LSB
42		MSB
43	SPARE	LSB
↓		↓
50		MSB
51	SYSTEM BANDWIDTH	LSB
52		MSB
53	SYSTEM POWER	
54	SPARE	
55	INSTRUMENT SERIAL NUMBER	
↓		
58		
59	BEAM ANGLE	
60	SPARE	

See Table 54 for a description of the fields

Figure 113. Fixed Leader Data Format

Fixed Leader data refers to the non-dynamic Sentinel V ADCP data that only changes when you change certain commands. Fixed Leader data also contain hardware information. The Sentinel V ADCP always sends Fixed Leader data as output data (LSBs first).

Historically in the WorkHorse firmware, this part of the PD0 data was called the "fixed" leader because it stayed constant from one PD0 ensemble to the next. For the Sentinel V, the fixed leader is not actually constant from one PD0 ensemble to the next.

Table 54: Fixed Leader Data Format

Binary Byte	Field	Description
1,2	FID / Fixed Leader ID	Stores the Fixed Leader identification word (00 00h).
3	fv / CPU F/W Ver.	Contains the version number of the CPU firmware.
4	fr / CPU F/W Rev.	Contains the revision number of the CPU firmware.

5,6	System Configuration	This field defines the Sentinel V ADCP hardware configuration. Convert this field (2 bytes, LSB first) to binary and interpret as follows.
		`LSB`
		`BITS  7 6 5 4 3 2 1 0`
		`      - - - - - 0 0 0   Not used`
		`      - - - - - 0 0 1   Not used`
		`      - - - - - 0 1 0   Sentinel V100 (300kHz)`
		`      - - - - - 0 1 1   Sentinel V50 (500kHz)`
		`      - - - - - 1 0 0   Sentinel V20 (1000kHz)`
		`      - - - - - 1 0 1   Not used`
		`      - - - - 0 - - -   Not used`
		`      - - - - 1 - - -   Not used`
		`      - - 0 0 - - - -   Not used`
		`      - - 0 1 - - - -   Not used`
		`      - - 1 0 - - - -   Not used`
		`      - 0 - - - - - -   Not used`
		`      - 1 - - - - - -   Not used`
		`      0 - - - - - - -   DOWN FACING BEAM`
		`      1 - - - - - - -   UP-FACING BEAM`
		DOWN/UP FACING BEAM is dependent on the roll for the current ping.
		`MSB`
		`BITS  7 6 5 4 3 2 1 0`
		`      - - - - - - 0 0  Not used`
		`      - - - - - - 0 1  Not used`
		`      - - - - - - 1 0  Not used`
		`      - - - - - - 1 1  Not used`
		`      - - - - - 1 1 1  25° BEAM ANGLE (always set)`
		`      - - - - 1 1 0 0  Not used`
		`      0 1 0 0 - - - -  4-BEAM JANUS CONFIG`
		`      0 1 0 1 - - - -  5-BEAM JANUS CONFIG`
		`      1 1 1 1 - - - -  Not used`

7	Real/Sim Flag	This field is set by default as real data (0).
8	Lag Length	Lag Length. The lag is the time period between sound pulses.
9	Number of Beams	This field is always 4, even for 5 beam systems in case of combined mode ensembles (i.e. ensembles with both vertical and slant beam data) and slant beam data only ensembles. This is to ensure backward compatibility with legacy software.
10	Number of Cells	Contains the number of depth cells over which the ADCP collects data. Scaling: LSD = 1 depth cell; Range = 1 to 255 depth cells

Table 54: Fixed Leader Data Format

Binary Byte	Field	Description
11,12	Pings Per Ensemble	This field is always set to 1, to represent raw single ping data. Scaling: LSD = 1 ping; Range = 0 to 16,384 pings
13,14	Depth Cell Length	Contains the length of one depth cell. Scaling: LSD = 1 centimeter; Range = 1 to 6400 cm (210 feet)
15,16	Blank after Transmit	Contains the blanking distance used by the ADCP to allow the transmit circuits time to recover before the receive cycle begins. Scaling: LSD = 1 centimeter; Range = 0 to 9999 cm (328 feet)
17	Signal Processing Mode	This field will always be set to 1 for ProfileMode1. The rest of the lookup values are as follows <table><tr><td>Profile Mode</td><td>Lookup Value</td></tr><tr><td>ProfileMode0</td><td>0</td></tr><tr><td>ProfileMode1</td><td>1</td></tr><tr><td>CombinedMode</td><td>2</td></tr><tr><td>DiagnosticMode1</td><td>3</td></tr></table>
18	Low Corr Thresh	Contains the minimum threshold of correlation that water-profile data can have to be considered good data (WC command). Scaling: LSD = 1 count; Range = 0 to 255 counts
19	No. code reps	Contains the Number of code repetitions for the current ping. Scaling: LSD = 1 count; Range = 0 to 255 counts
20	%Gd Minimum	Contains the minimum percentage of water-profiling pings in an ensemble that must be considered good to output velocity data. Scaling: LSD = 1 percent; Range = 1 to 100 percent
21,22	Error Velocity Threshold	This field contains the actual threshold value used to flag water-current data as good or bad. If the error velocity value exceeds this threshold, the ADCP flags all four beams of the affected bin as bad. Scaling: LSD = 1 mm/s; Range = 0 to 5000 mm/s
23 24 25	Minutes Seconds Hundredths	These fields contain the amount of time between ping groups in the ensemble.
26	Coord Transform	Contains the coordinate transformation processing parameters. These firmware switches indicate how the ADCP collected data. xxx00xxx = NO TRANSFORMATION (BEAM COORDINATES) xxx01xxx = INSTRUMENT COORDINATES xxx10xxx = SHIP COORDINATES xxx11xxx = EARTH COORDINATES xxxxx1xx = TILTS (PITCH AND ROLL) USED IN SHIP OR EARTH TRANSFORMATION xxxxxx1x = 3-BEAM SOLUTION USED IF ONE BEAM IS BELOW THE CORRELATION THRESHOLD SET BY THE WC command xxxxxxx1 = BIN MAPPING USED

Table 54: Fixed Leader Data Format

Binary Byte	Field	Description
27,28	Heading Alignment	Contains a correction factor for physical heading misalignment (EA command). Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees
29,30	Heading Bias	Contains the Magnetic Bias from the Compass Configuration. Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees

31	Sensor Source	Contains the selected source of environmental sensor data. These firmware switches indicate the following.
		`FIELD        DESCRIPTION`
		`x1xxxxxx = Calculates Speed of Sound from Depth, Salinity, & Temp`
		`xx1xxxxx = USES DEPTH SENSOR`
		`xxx1xxxx = USES TRANSDUCER HEADING SENSOR`
		`xxxx1xxx = Not used`
		`xxxxx1xx = Not used`
		`xxxxxx1x = Not used`
		`xxxxxxx1 = Not used`
		The first three flags will be set.

32	Sensor Avail	This field reflects which sensors are available. The bit pattern is the same as listed above for byte 31.
33,34	dis1 / Bin 1 distance	This field contains the distance to the middle of the first depth cell (bin). This distance is a function of depth cell length, the profiling mode, the blank after transmit distance, and speed of sound. Scaling: LSD = 1 centimeter; Range = 0 to 65535 cm (2150 feet)
35,36	Xmit pulse length	This field contains the length of the transmit pulse. Scaling: LSD = 1 centimeter; Range = 0 to 65535 cm (2150 feet)
37,38	WP Ref Lyr Avg (Starting cell, Ending cell)	Contains the starting depth cell (LSB, byte 37) and the ending depth cell (MSB, byte 38) used for water reference layer averaging (WL command). Scaling: LSD = 1 depth cell; Range = 1 to 128 depth cells
39	False Target Threshold	Contains the threshold value used to reject data received from a false target, usually fish. The value for this field is always 255. Scaling: LSD = 1 count; Range = 0 to 255 counts (255 disables)
40	Spare	Spare
41,42	LagD / Transmit lag distance	This field contains the distance between pulse repetitions. Scaling: LSD = 1 centimeter; Range = 0 to 65535 centimeters
43-50	Spare	Spare
51-52	System Bandwidth	Set to 0 for high bandwidth (24%), 1 for low bandwidth (6/25%). Range = 0 to 1
53	System Power	The value for this field is always 255. Range 0 to 255.
54	Spare	Spare
55-58	Serial #	Instrument serial number
59	Beam Angle	Beam angle
60	Spare	Spare

Variable Leader Data Format

BYTE	BIT POSITIONS 7 6 5 4 3 2 1 0	
1	VARIABLE LEADER ID	80h
2		00h
3	ENSEMBLE NUMBER	LSB
4		MSB
5	RTC YEAR	
6	RTC MONTH	
7	RTC DAY	
8	RTC HOUR	
9	RTC MINUTE	
10	RTC SECOND	
11	RTC HUNDREDTHS	
12	ENSEMBLE # MSB	
13	BIT FAULT	LSB
14	BIT RESULT	MSB
15	SPEED OF SOUND	LSB
16		MSB
17	DEPTH OF TRANSDUCER	LSB
18		MSB
19	HEADING	LSB
20		MSB
21	PITCH (TILT 1)	LSB
22		MSB
23	ROLL (TILT 2)	LSB
24		MSB
25	SALINITY	LSB
26		MSB
27	TEMPERATURE	LSB
28		MSB
29	MPT MINUTES	
30	MPT SECONDS	
31	MPT HUNDREDTHS	

BYTE	7	6	5	4	3	2	1	0	
	BIT POSITIONS								
32	HDG STD DEV								
33	PITCH STD DEV								
34	ROLL STD DEV								
35	ADC CHANNEL 0								
36	ADC CHANNEL 1								
37	ADC CHANNEL 2								
38	ADC CHANNEL 3								
39	ADC CHANNEL 4								
40	ADC CHANNEL 5								
41	ADC CHANNEL 6								
42	ADC CHANNEL 7								
43 ↓ 48	RESERVED								↓
49	PRESSURE								LSB
50									
51									
52									
53									
54									MSB
55	RESERVED								
56									
57									
58	RTC CENTURY								
59	RTC YEAR								
60	RTC MONTH								
61	RTC DAY								
62	RTC HOUR								
63	RTC MINUTE								
64	RTC SECOND								
65	RTC HUNDREDTH								
66	SPARE								

Figure 114. Variable Leader Data Format

Variable Leader data refers to the dynamic Sentinel V ADCP data (from clocks/sensors) that change with each ping. The Sentinel V ADCP always sends Variable Leader data as output data (LSBs first).

Table 55: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	VID / Variable Leader ID	Stores the Variable Leader identification word (80 00h).

5-8	3,4	Ens / Ensemble Number	This field contains the sequential number of the ensemble to which the data in the output buffer apply.
			Scaling: LSD = 1 ensemble; Range = 1 to 65,535 ensembles
			NOTE: The first ensemble collected is #1. At "rollover," we have the following sequence:
			`1 = ENSEMBLE NUMBER 1`
			↓
			`65535 = ENSEMBLE NUMBER 65,535 | ENSEMBLE`
			`0 = ENSEMBLE NUMBER 65,536 | #MSB FIELD`
			`1 = ENSEMBLE NUMBER 65,537 | (BYTE 12) INCR.`

9,10 11,12 13,14 15,16 17,18 19,22 21,22	5 6 7 8 9 10 11	RTC Year RTC Month RTC Day RTC Hour RTC Minute RTC Second RTC Hundredths	These fields contain the time from the Sentinel V real-time clock (RTC) that the current data ensemble began. The TS-command (Set Real-Time Clock) initially sets the clock. The Sentinel V does account for leap years.
23-24	12	Ensemble # MSB	This field increments each time the Ensemble Number field (bytes 3,4) "rolls over." This allows ensembles up to 16,777,215. See Ensemble Number field above.
27-28	13	BIT Fault	Fault code for active fault. If more than one fault is active, as indicated by the BIT Count, the active faults codes will cycle on each successive ping. Fault codes include: (see table below)
25-26	14	BIT count	This field contains the current number of active faults detected by the Sentinel V Built-in Test function. A zero code indicates no active faults.

Description	Hex	Decimal
Transmitter under current	0x03	3
Transmitter under voltage	0x04	4
Battery volts too low to ping	0x05	5
Pressure Sensor Fail	0x23	35
Compass init failed	0x29	41
HPR init failed	0x2A	42
HPR failed	0x2C	44
Temperature device init failed	0x2E	46
Temperature failed	0x2F	47
HEM time update failed	0x82	130
HEM pressure update	0x83	131
HEM time read failed	0x84	132
HEM pressure read failed	0x85	133
HEM operating time exceeded max	0x87	135
HEM pressure exceeded sensor limit	0x88	136

Table 55: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
29-32	15,16	EC / Speed of Sound	Contains either manual or calculated speed of sound information (EC-command). Scaling: LSD = 1 meter per second; Range = 1400 to 1600 m/s
33-36	17,18	ED / Depth of Transducer	Contains the depth of the transducer below the water surface (ED-command). This value may be a manual setting or a reading from a depth sensor. Scaling: LSD = 1 decimeter; Range = 1 to 9999 decimeters
37-40	19,20	EH / Heading	Contains the heading angle (EH-command). This value may be a manual setting or a reading from a heading sensor. Scaling: LSD = 0.01 degree; Range = 000.00 to 359.99 degrees
41-44	21,22	EP / Pitch (Tilt 1)	Contains the pitch angle (EP-command). This value may be a manual setting or a reading from a tilt sensor. Positive values mean that Beam #3 is spatially higher than Beam #4. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees
45-48	23,24	ER / Roll (Tilt 2)	Contains the roll angle (ER-command). This value may be a manual setting or a reading from a tilt sensor. For up-facing, positive values mean that Beam #2 is spatially higher than Beam #1. For down-facing, positive values mean that Beam #1 is spatially higher than Beam #2. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees
49-52	25,26	ES / Salinity	Contains the salinity value of the water at the transducer head (ES-command). This value may be a manual setting or a reading from a conductivity sensor. Scaling: LSD = 1 part per thousand; Range = 0 to 40 ppt
53-56	27,28	ET / Temperature	Contains the temperature of the water at the transducer head (ET-command). This value may be a manual setting or a reading from a temperature sensor. Scaling: LSD = 0.01 degree; Range = -5.00 to +40.00 degrees
57,58 59,60 61,62	29 30 31	MPT minutes MPT seconds MPT hundredths	This field contains the Minimum Pre-Ping Wait Time between ping groups in the ensemble.
63,64 65,66 67,68	32 33 34	H/Hdg Std Dev P/Pitch Std Dev R/Roll Std Dev	These fields contain the standard deviation (accuracy) of the heading and tilt angles from the gyrocompass/pendulums. Scaling (Heading): LSD = 1°; Range = 0 to 180° Scaling (Tilts): LSD = 0.1°; Range = 0.0 to 20.0°

Table 55: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
69-70	35	ADC Channel 0	0
71-72	36	ADC Channel 1	Battery Voltage 0.1volts
73-74	37	ADC Channel 2	0
75-76	38	ADC Channel 3	0
77-78	39	ADC Channel 4	0
79-80	40	ADC Channel 5	0
81-82	41	ADC Channel 6	0
83-84	42	ADC Channel 7	0
85-97	43-48	Reserved	Reserved
98-104	49-52	Pressure	Contains the pressure of the water at the transducer head relative to one atmosphere (sea level). Output is in deca-pascals (see How Does the ADCP Sample Depth and Pressure). Scaling: LSD=1 deca-pascal; Range=0 to ± 2147483648 deca-pascals.
105-114	53-57	Reserved	Reserved
115-116	58	RTC Century	These fields contain the time from the Sentinel V's Y2K compliant real-time clock (RTC) that the current data ensemble began. The TT-command (Set Real-Time Clock) initially sets the clock. The Sentinel V does account for leap years.
117-118	59	RTC Year	
119-120	60	RTC Month	
121-122	61	RTC Day	
123-124	62	RTC Hour	
125-126	63	RTC Minute	
127-128	64	RTC Seconds	
129-130	65	RTC Hundredths	
131-132	66	Spare	Spare

How Does the ADCP Sample Depth and Pressure?

The Sentinel V has two options for depth. The first is to use the fixed value the user inputs into the system through the ED command. The second is to calculate the depth based on the pressure sensor that is in the transducer. The Sentinel V will store both the depth (fixed or calculated) AND the pressure sensor raw kPa output.

The *WinADCP* program detects in the data set whether an external pressure sensor or a fixed value have been used for the depth calculation. If a fixed value is used, then it will display/export the depth as found in the data. If a pressure sensor has been used, then it will calculate the depth itself and display/export that value.

1. For each ping, the Analog-to-digital converter (ADC) samples the pressure sensor five times and averages the data. This is an attempt to reduce the Standard Deviation.
2. Using the Pressure coefficients, the pressure data from the ADC is converted to kPa.
3. That data is converted to dm and corrected for salinity with the following equation:

   Depth (dm) = Pressure(kPa) * (1.02-0.00069*ES), where ES is the Salinity setting.

   This is the depth value recorded in the PD0 variable leader when the system is fitted with a pressure sensor and that the EZ command is set to EZx1xxxxx.
4. The pressure data is converted from kPa to deca-Pascals by multiplying it by 100. This value in deca-Pascals is recorded in the PD0 variable leader data.

Converting kPa to Depth

The formula for converting kPa to depth (using *WinADCP*) is as follows:

(kPa(1.02-0.00069*Salinity)*(1000/Fresh Water Density))/10

Velocity Data Format

BYTE	7/S	6	5	4	3	2	1	0	
1	VELOCITY ID								LSB 00h
2									MSB 01h
3	DEPTH CELL #1, VELOCITY 1								LSB
4									MSB
5	DEPTH CELL #1, VELOCITY 2								LSB
6									MSB
7	DEPTH CELL #1, VELOCITY 3								LSB
8									MSB
9	DEPTH CELL #1, VELOCITY 4								LSB
10									MSB
11	DEPTH CELL #2, VELOCITY 1								LSB
12									MSB
13	DEPTH CELL #2, VELOCITY 2								LSB
14									MSB
15	DEPTH CELL #2, VELOCITY 3								LSB
16									MSB
17	DEPTH CELL #2, VELOCITY 4								LSB
18									MSB
↓	(SEQUENCE CONTINUES FOR UP TO MAX # CELLS)								↓
1019	DEPTH CELL #MAX, VELOCITY 1								LSB
1020									MSB
1021	DEPTH CELL #MAX, VELOCITY 2								LSB
1022									MSB
1023	DEPTH CELL #MAX, VELOCITY 3								LSB
1024									MSB
1025	DEPTH CELL #MAX, VELOCITY 4								LSB
1026									MSB

See Table 56 for description of fields

Figure 115. Velocity Data Format

The number of depth cells is set by *ReadyV* or *Plan*. The value will be calculated based on the Range and Cell size.

The Sentinel V ADCP packs velocity data for each depth cell of each beam into a two-byte, two's-complement integer [-32768, 32767] with the LSB sent first. The Sentinel V ADCP scales velocity data in millimeters per second (mm/s). A value of –32768 (8000h) indicates bad velocity values.

All velocities are relative based on a stationary instrument. To obtain absolute velocities, algebraically remove the velocity of the instrument. For example,

```
RELATIVE WATER CURRENT VELOCITY:    EAST 650 mm/s
INSTRUMENT VELOCITY            : (-) EAST 600 mm/s
ABSOLUTE WATER VELOCITY        :     EAST  50 mm/s
```

The Coordinate Transformation determines how the Sentinel V ADCP references the velocity data as shown below. The default coordinate system is beam.

EX-CMD	COORD SYS	VEL 1	VEL 2	VEL 3	VEL 4
EX00xxx	BEAM	TO BEAM 1	TO BEAM 2	TO BEAM 3	TO BEAM 4
EX01xxx	INSTRUMENT	Bm1-Bm2	Bm4-Bm3	TO XDUCER	ERR VEL
EX10xxx	SHIP	PRT-STBD	AFT-FWD	TO SURFACE	ERR VEL
EX11xxx	EARTH	TO EAST	TO NORTH	TO SURFACE	ERR VEL

Positive values indicate water movement toward the ADCP.

Table 56: Velocity Data Format

Binary Byte	Field	Description
1,2	Velocity ID	Stores the velocity data identification word (00 01h).
3,4	Depth Cell 1, Velocity 1	Stores velocity data for depth cell #1, velocity 1. See above.
5,6	Depth Cell 1, Velocity 2	Stores velocity data for depth cell #1, velocity 2. See above.
7,8	Depth Cell 1, Velocity 3	Stores velocity data for depth cell #1, velocity 3. See above.
9,10	Depth Cell 1, Velocity 4	Stores velocity data for depth cell #1, velocity 4. See above.
11-max	Cells 2 – max	These fields store the velocity data for depth cells 2 through maximum (depending on the setting of ReadyV). These fields follow the same format as listed above for depth cell 1.

Correlation Magnitude, Echo Intensity, and Percent-Good Data Format

	BIT POSITIONS								
BYTE	7/S	6	5	4	3	2	1	0	
1	ID CODE (see Table 57 to Table 59)								LSB
2									MSB
3	DEPTH CELL #1, FIELD #1								
4	DEPTH CELL #1, FIELD #2								
5	DEPTH CELL #1, FIELD #3								
6	DEPTH CELL #1, FIELD #4								
7	DEPTH CELL #2, FIELD #1								
8	DEPTH CELL #2, FIELD #2								
9	DEPTH CELL #2, FIELD #3								
10	DEPTH CELL #2, FIELD #4								
↓	(SEQUENCE CONTINUES FOR UP TO Maximum # BINS)								↓
511	DEPTH CELL #Maximum , FIELD #1								
512	DEPTH CELL #Maximum , FIELD #2								
513	DEPTH CELL #Maximum , FIELD #3								
514	DEPTH CELL #Maximum , FIELD #4								

See Table 57 through Table 59 for a description of the fields.

Figure 116. Correlation Magnitude, Echo Intensity, and Percent-Good Data Format

The number of depth cells is set by *ReadyV*. The value will be calculated based on the Range and Cell size.

Correlation magnitude data give the magnitude of the normalized echo autocorrelation at the lag used for estimating the Doppler phase change. The Sentinel V ADCP represents this magnitude by a linear scale between 0 and 255, where 255 is perfect correlation (i.e., a solid target). A value of zero indicates bad correlation values.

Table 57: Correlation Magnitude Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the correlation magnitude data identification word (00 02h).
3	Depth Cell 1, Field 1	Stores correlation magnitude data for depth cell #1, beam #1. See above.
4	Depth Cell 1, Field 2	Stores correlation magnitude data for depth cell #1, beam #2. See above.

Binary Byte	Field	Description
5	Depth Cell 1, Field 3	Stores correlation magnitude data for depth cell #1, beam #3. See above.
6	Depth Cell 1, Field 4	Stores correlation magnitude data for depth cell #1, beam #4. See above.
7 – max	Cells 2 – max.	These fields store correlation magnitude data for depth cells 2 through maximum # cells (depending on the ReadyV setting) for all four beams. These fields follow the same format as listed above for depth cell 1.

The echo intensity scale factor is about 0.45 dB per ADCP count. The Sentinel V ADCP does not directly check for the validity of echo intensity data.

Table 58: Echo Intensity Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the echo intensity data identification word (00 03h).
3	Depth Cell 1, Field 1	Stores echo intensity data for depth cell #1, beam #1. See above.
4	Depth Cell 1, Field 2	Stores echo intensity data for depth cell #1, beam #2. See above.
5	Depth Cell 1, Field 3	Stores echo intensity data for depth cell #1, beam #3. See above.
6	Depth Cell 1, Field 4	Stores echo intensity data for depth cell #1, beam #4. See above.
7 – max	Cells 2 – max	These fields store echo intensity data for depth cells 2 through maximum # of cells (depending on the ReadyV Setting) for all four beams. These fields follow the same format as listed above for depth cell 1.

The Sentinel V ADCP always collects single ping data; therefore, raw data output from the Sentinel V ADCP will not contain % good data. However, the average PD0 files created by *Velocity* will have % good data. The percent-good data field is a data-quality indicator that reports the percentage (0 to 100) of good data collected for each depth cell of the velocity profile. The setting of the Coordinate Transformation (default coordinate system is beam) determines how the Sentinel V references percent-good data as shown below.

EX command	Coord. Sys	Velocity 1	Velocity 2	Velocity 3	Velocity 4
		Percentage Of Good Pings For:			
		Beam 1	BEAM 2	BEAM 3	BEAM 4
xxx00xxx	Beam	Percentage Of:			
xxx01xxx	Instrument	3-Beam Transformations (note 1)	Transformations Rejected (note 2)	More Than One Beam Bad In Bin	4-Beam Transformations
xxx10xxx	Ship				
xxx11xxx	Earth				

Note 1. Because profile data did not exceed correlation threshold.

Note 2. Because the error velocity threshold was exceeded.

At the start of the velocity profile, the backscatter echo strength is typically high on all four beams. Under this condition, the ADCP uses all four beams to calculate the orthogonal and error velocities. As the echo returns from far away depth cells, echo intensity decreases. At some point, the echo will be weak enough on any given beam to cause the ADCP to reject some of its depth cell data. This causes the ADCP to calculate velocities with three beams instead of four beams. When the ADCP does 3-beam solutions, it stops calculating the error velocity because it needs four beams to do this. At some further depth cell, the ADCP rejects all cell data because of the weak echo. As an example, let us assume depth cell 60 has returned the following percent-good data.

```
FIELD #1 = 50, FIELD #2 = 5, FIELD #3 = 0, FIELD #4 = 45
```

In BEAM coordinates, the example values show the percentage of pings having good solutions in cell 60 for each beam based on the Low Correlation Threshold. Here, beam 1=50%, beam 2=5%, beam 3=0%, and beam 4=45%. Note that these are neither typical nor desired percentages. Typically, you would want all four beams to be about equal and greater than 25%.

On the other hand, if velocities were collected in Instrument, Ship, or Earth coordinates, the example values show:

<u>Field 1 – Percentage of good 3-beam solutions</u> – Shows percentage of successful velocity calculations (50%) using 3-beam solutions because the correlation threshold was not exceeded.

<u>Field 2 – Percentage of transformations rejected</u> – Shows percent of error velocity (5%) that was less than the error velocity setting. Error velocity has a default of 2 m/s. This large error velocity setting effectively prevents the ADCP from rejecting data based on error velocity.

<u>Field 3 – Percentage of more than one beam bad in bin</u> – 0% of the velocity data were rejected because not enough beams had good data.

<u>Field 4 – Percentage of good 4-beam solutions</u> – 45% of the velocity data collected during the ensemble for depth cell 60 were calculated using four beams.

Table 59: Percent-Good Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the percent-good data identification word (00 04h).
3	Depth cell 1, Field 1	Stores percent-good data for depth cell #1, field 1. See above.
4	Depth cell 1, Field 2	Stores percent-good data for depth cell #1, field 2. See above.
5	Depth cell 1, Field 3	Stores percent-good data for depth cell #1, field 3. See above.
6	Depth cell 1, Field 4	Stores percent-good data for depth cell #1, field 4. See above.
7-max	Depth cell 2 – max	These fields store percent-good data for depth cells 2 through maximum # of cells (depending on the ReadyV Setting), following the same format as listed above for depth cell 1.

Only the averaged PD0 files created by *Velocity* will have Percent Good data.

Transformation Matrix Format

The Transformation Matrix Format data refers to the non-dynamic ADCP data associated with transforming beam velocity data to instrument coordinates. The ADCP always sends the Instrument Transformation Matrix Format data as output data (LSBs first).

BYTE	7/S	6	5	4	3	2	1	0	
1 2	INSTRUMENT TRANSFORMATION MATRIX ID = 3200								LSB 00h MSB 32h
3 4	X COMPONENT FOR BEAM#1								LSB MSB
5 6	X COMPONENT FOR BEAM#2								LSB MSB
7 8	X COMPONENT FOR BEAM#3								LSB MSB
9 10	X COMPONENT FOR BEAM#4								LSB MSB
11 12	Y COMPONENT FOR BEAM#1								LSB MSB
13 14	Y COMPONENT FOR BEAM#2								LSB MSB
15 16	Y COMPONENT FOR BEAM#3								LSB MSB
17 18	Y COMPONENT FOR BEAM#4								LSB MSB
19 20	Z COMPONENT FOR BEAM#1								LSB MSB
21 22	Z COMPONENT FOR BEAM#2								LSB MSB
23 24	Z COMPONENT FOR BEAM#3								LSB MSB
25 26	Z COMPONENT FOR BEAM#4								LSB MSB

BYTE	7/S	6	5	4	3	2	1	0	
27	E COMPONENT FOR BEAM#1								LSB
28									MSB
29	E COMPONENT FOR BEAM#2								LSB
30									MSB
31	E COMPONENT FOR BEAM#3								LSB
32									MSB
33	E COMPONENT FOR BEAM#4								LSB
34									MSB

Figure 117. Transformation Matrix Format

Table 60. Transformation Matrix Format

Binary Byte	Field	Description
1,2	ID Code	Stores the Instrument Transformation Matrix data identification word 3200 (32 00h). LSB is sent first.
3-10	X Component for Beams #1-4	Horizontal component of velocity (X) for Beams #1-4. LSD = 0.0001
11-18	Y Component for Beams #1-4	Horizontal component of velocity (Y) for Beams #1-4. LSD = 0.0001
19-26	Z Component for Beams #1-4	Vertical component of velocity (Z) for Beams #1-4. LSD = 0.0001
27-34	E Component for Beams #1-4	Error component of velocity (E) for Beams #1-4. LSD = 0.0001

Sentinel V Specific Structures

This section covers the new structures that are required to accommodate new functionality, features, or information specific to supporting the Sentinel V. To minimize potential conflicts with legacy software, these structures are positioned at the end of the PD0 structure as shown in Figure 111, page 264.

Sentinel V System Configuration

The Sentinel V System Configuration data refers to the non-dynamic ADCP data associated with the system hardware and firmware configurations. The ADCP always sends this data as output data (LSBs first).

BYTE	BIT POSITIONS 7 6 5 4 3 2 1 0	
1	SENTINEL V –SYSTEM CONFIGURATION ID (0x7000)	00h
2		70h
3	FIRMWARE VERSION – PRIMARY VERSION NUMBER	
4	FIRMWARE VERSION – SECONDARY VERSION NUMBER	
5	FIRMWARE VERSION – BUILD NUMBER	
6	FIRMWARE VERSION – SERVICE NUMBER	
7	SYSTEM FREQUENCY (Hz)	LSB
8		
9		
10		MSB
11	PRESSURE RATING (m)	LSB
12		MSB
13	SCHEMA MAJOR	
14	SCHEMA MINOR	
15	SCHEMA REV	
16	SPARE	

Figure 118. Sentinel V System Configuration

Table 61. Sentinel V System Configuration

Binary Byte	Field	Description
1,2	ID Code	Stores the Sentinel V System Configuration data identification word 7000 (70 00h). LSB is sent first.
3-6	Firmware Version	Contains the long firmware version (i.e. XX.XX.XX.XX). BYTE Description Primary Version Number Secondary Version Number Build Number Service Number
7-10	System Frequency	The frequency of the system in Hz.
11-12	Pressure Rating	The pressure rating of the system in meters.
13	Schema Major	Reserved for TRDI use. Used for internal configuration versioning.
14	Schema Minor	Reserved for TRDI use. Used for internal configuration versioning.
15	Schema Rev	Reserved for TRDI use. Used for internal configuration versioning.
16	Spare	Spare

Sentinel V Ping Setup

The Sentinel V Ping Setup data refers to the non-dynamic ADCP data associated with the ping setup and configurations. The ADCP always sends this data as output data (LSBs first).

Sentinel V Ping Setup output is included only in systems configured with 47.xx firmware.

BYTE	7	6	5	4	3	2	1	0	
1	SENTINEL V PING SETUP ID (0x7001)								01h
2									70h
3	PING ID								
4									
5	ENSEMBLE INTERVAL (milliseconds)								LSB
6									
7									
8									MSB
9	NUMBER OF PINGS								LSB
10									MSB
11	TIME BETWEEN PINGS (milliseconds)								
12									
13									
14									
15	OFFSET BETWEEN PING GROUPS (milliseconds)								
16									
17									
18									
19	SPARE								
20									
21	SPARE								
22	SPARE								
23	PING SEQUENCE NUMBER WITHIN ENSEMBLE								LSB
24									MSB
25	AMBIGUITY VELOCITY (mm/s)								
26									
27	RX GAIN								

BYTE	7	6	5	4	3	2	1	0	
28	RX BEAM MASK								
29	TX BEAM MASK								
30	SPARE								
31	Ensemble Offset								LSB
32									
33									
34									MSB
35	Ensemble Count								LSB
36									MSB
37	Deployment Start CENTURY								LSB
38	Deployment Start YEAR								
39	Deployment Start MONTH								
40	Deployment Start DAY								
41	Deployment Start HOUR								
42	Deployment Start MINUTE								
43	Deployment Start SECOND								
44	Deployment Start HUNDREDTHS								MSB

Figure 119. Sentinel V Ping Setup

Table 62. Sentinel V Ping Setup

Binary Byte	Field	Description
1,2	ID Code	Stores the Sentinel V – Ping Setup data identification word 7001 (70 01h). LSB is sent first.
3,4	Ping ID	Reserved for TRDI use.
5-8	Ensemble Interval	Time between ensembles set using ReadyV Timing panel. Time is based on the start of one ensemble to the start of the next ensemble.
9-10	Number of Pings	Number of pings set using ReadyV Timing panel.
11-14	Time between Pings	Ping interval set using ReadyV Timing panel.
15-18	Offset between Ping Groups	Ping Offset
19-20	Spare	Spare
21-22	Spare	Spare

Binary Byte	Field	Description
23-24	Ping Sequence Number	This is the ping sequence number within a single ensemble. This number rolls back to 1 at the start of each new ensemble and increments by one for each new ping within an ensemble.
25-26	Ambiguity Velocity	Ambiguity velocity for the current ping in mm/s
27	RX Gain	Reserved for TRDI use. RX/TX fields are used for advanced system diagnostics.
28	RX Beam Mask	Reserved for TRDI use. RX/TX fields are used for advanced system diagnostics.
29	TX Beam Mask	Reserved for TRDI use. RX/TX fields are used for advanced system diagnostics.
30	Spare	Spare
31-34	Ensemble Offset	Ensemble Offset
35-36	Ensemble Count	Ensemble Count
37-44	Deployment Start	Deployment start date and time.

Sentinel V ADC Data

The Sentinel V ADC data refers to the dynamic ADCP data associated with the system hardware and firmware configurations. The ADCP always sends this data as output data (LSBs first).

BYTE	BIT POSITIONS 7 6 5 4 3 2 1 0	
1	SENTINEL V –ADC DATA ID (0x7002)	02h
2		70h
3	Vin	
4		
5	I In	
6		
7	V IO	LSB
8		MSB
9	VCore	
10		
11	V DD1	
12		

	BIT POSITIONS							
BYTE	7	6	5	4	3	2	1	0
13	V Ref							
14								
15	VGG							
16								

Figure 120. Sentinel V ADC Data

Table 63. Sentinel V ADC Data

Binary Byte	Field	Description
1,2	ID Code	Stores the Sentinel V – ADC data identification word 7002 (70 02h). LSB is sent first.
3-4	V In	Reserved for TRDI use. All fields are used for advanced system diagnostics.
5-6	I In	Reserved for TRDI use. All fields are used for advanced system diagnostics.
7-8	V IO	Reserved for TRDI use. All fields are used for advanced system diagnostics.
9-10	V Core	Reserved for TRDI use. All fields are used for advanced system diagnostics.
11-12	V DD1	Reserved for TRDI use. All fields are used for advanced system diagnostics.
13-14	V Ref	Reserved for TRDI use. All fields are used for advanced system diagnostics.
15-16	VGG	Reserved for TRDI use. All fields are used for advanced system diagnostics.

All values are scaled to 0.01 volts input from the ADC.

Sentinel V Features Data

Sentinel V Features Data output is included only in systems configured with 47.xx firmware.

The Sentinel V Features Data refers to the Sentinel V features related header data associated with the firmware configurations. This is used to store the feature keys provisioned by the Sentinel V firmware. The ADCP always sends this data as output data (LSBs first).

This structure is added to only the first ensemble of the Sentinel V PD0 output. If the source PD0 is split by profile group, the Features Data type must be part of all individual output PD0s. If the ADCP does not have any installed features, this data type is still included but it only contains the first four bytes (and byte three is zero).

	BIT POSITIONS								
BYTE	7	6	5	4	3	2	1	0	
1	SENTINEL V – FEATURES HEADER DATA ID (0x7003)								03h
2									70h
3	NUMBER OF FEATURE DATA TYPES								
4	SPARE								
5	FEATURES ID #1								LSB
↓									
37									MSB
38	MAGIC CODE #1								LSB
↓									
78									MSB
79	STATUS #1								LSB
↓									
90									MSB
86(N-1)+5	FEATURES ID #N								LSB
86(N-1)+37									MSB
86(N-1)+38	MAGIC CODE #N								LSB
86(N-1)+78									MSB
86(N-1)+79	STATUS #N								LSB
86(N-1)+90									MSB

Figure 121. Sentinel V Features Data Configuration

Table 64. Sentinel V Features Data

Binary Byte	Field	Description
1,2	ID Code	Stores the Sentinel V – Features Header data identification word 7003 (70 03h). LSB is sent first.
3	Number of Features Types	Contains the number of feature data types configured in firmware
4	Spare	Undefined
5-37	Features ID #1	Unique identifier for the feature, a 33 char null terminated string representing a V4 GUID. LSB is sent first
38-78	Magic Code #1	Magic code.
79-90	Status #1	12 char null terminated string for the feature state viz. Installed, Activated and Deactivated
86(N-1)+5 - 86(N-1)+37	Features ID #N	Unique identifier for the feature, a 33 char null terminated string representing a V4 GUID. LSB is sent first
86(N-1)+38 - 86(N-1)+78	Magic Code #N	Magic code.
86(N-1)+79 - 86(N-1)+90	Status #N	12 char null terminated string for the feature state viz. Installed, Activated and Deactivated

Vertical Beam Data

The Sentinel V Vertical Beam data refers to the dynamic ADCP data associated with the output of raw and processed data from the vertical beam.

Vertical Beam Leader

The Sentinel V Vertical Beam Leader refers to the dynamic ADCP data associated with the output of leader data from the vertical beam. The ADCP always sends this data as output data (LSBs first).

	BIT POSITIONS								
BYTE	7	6	5	4	3	2	1	0	
1 2	VERTICAL BEAM LEADER DATA ID (0x0f01)								01h 0fh
3 4	DEPTH CELLS								
5 6	VERTICAL PINGS								
7 8	DEPTH CELL SIZE								LSB MSB
9 10	FIRST CELL RANGE								
11 12	VERTICAL MODE								
13 14	VERTICAL TRANSMIT								
15 16	VERTICAL LAG LENGTH								
17 18	TRANSMIT CODE ELEMENTS								
19 20	VERTICAL RSSI THRESHOLD								
21 22	VERTICAL SHALLOW BIN								
23 24	VERTICAL START BIN								
25 26	VERTICAL SHALLOW RSSI BIN								

BYTE	7	6	5	4	3	2	1	0
27 28	MAX CORE THRESHOLD							
29 30	MIN CORE THRESHOLD							
31 32	PING OFFSET TIME							
33 34	SURF SPARE1							
35 36	DEPTH SCREEN							
37 38	PERCENT GOOD THRESHOLD							
39 40	VERTICAL DO PROOFING							

Figure 122. Vertical Beam Leader

Table 65. Vertical Beam Leader

Binary Byte	Field	Description
1,2	ID Code	Stores the Vertical Beam Leader identification word 0f01 (0f 01h). LSB is sent first.
3,4	Depth Cells	Number of depth cells in the vertical beam profile.
5,6	Vertical Pings	Number of Pings that were averaged together. Usually 1.
7,8	Depth Cell Size	Size of the depth cell in cm
9,10	First Cell Range	Range to first cell in cm
11,12	Vertical Mode	Vertical Beam Mode: 1 = Low Resolution (same number of depth cells on the slant beams as on the vertical beam), 2 = High resolution (dedicated surface tracking ping with 4:1 transmit/receive ratio or larger)
13,14	Vertical Transmit	Size of the transmit pulse in cm
15,16	Vertical Lag Length	The distance between pulse repetitions in cm Scaling: LSD = 1 centimeter; Range = 0 to 65535 centimeters
17,18	Transmit Code El-ements	The number of transmit code elements.
19,20	Vertical RSSI Threshold	Reserved for future use.

Binary Byte	Field	Description
21,22	Vertical Shallow Bin	Reserved for future use.
23,24	Vertical Start Bin	Reserved for future use.
25,26	Vertical Shallow RSSI Bin	Reserved for future use.
27,28	Max Core Thresh-old	Reserved for future use.
29,30	Min Core Thresh-old	Reserved for future use.
31,32	Ping Offset Time	The time offset between the when the slant beam ping occurred and when the vertical beam ping occurred, in milliseconds. This is a signed two-byte (short) value which is typically positive, but could be negative. **This will be set to 0 unless Sentinel V is setup in the Combined ping mode.**
33,34	Surf Spare1	Reserved for future use.
35,36	Depth Screen	Reserved for future use.
37,38	Percent Good Threshold	Reserved for future use.
39,40	Vertical DO Proofing	Reserved for future use.

Vertical Beam Velocity Data Format

	BIT POSITIONS								
BYTE	7/S	6	5	4	3	2	1	0	
1	VELOCITY ID								LSB 00h
2									MSB 0ah
3	DEPTH CELL #1, VELOCITY								LSB
4									MSB
5	DEPTH CELL #2, VELOCITY								LSB
6									MSB
↓	(SEQUENCE CONTINUES FOR UP TO MAX CELLS)								LSB
↓									MSB
257	DEPTH CELL #MAX, VELOCITY								LSB
258									MSB

Figure 123. Vertical Beam Velocity Data Format

The number of depth cells is set by *ReadyV*. The value will be calculated based on the Range and Cell size.

Vertical Beam Correlation Magnitude, Percent Good Data Format, and Amplitude

These data types are defined in the same way as they are for each of the four Janus beams except they are only one beam of data per depth cell instead of four. The Vertical Beam Data Types is merged in a single ensemble with slant beam Data types though the concept of special modes defined in the Sentinel-V firmware.

	BIT POSITIONS								
BYTE	7/S	6	5	4	3	2	1	0	
1	ID CODE (See Table 66 to Table 68)								LSB
2									MSB
3	DEPTH CELL #1, FIELD #1								
4	DEPTH CELL #2, FIELD #1								
↓	(SEQUENCE CONTINUES FOR UP TO MAX BINS)								↓
258	DEPTH CELL #MAX, FIELD #1								

Figure 124. Vertical Beam Correlation Magnitude, Amplitude, Percent-Good

The number of depth cells is set by *ReadyV*. The value will be calculated based on the Range and Cell size.

Vertical beam correlation magnitude data give the magnitude of the normalized echo autocorrelation at the lag used for estimating the Doppler phase change. The Sentinel V ADCP represents this magnitude by a linear scale between 0 and 255, where 255 is perfect correlation (i.e., a solid target). A value of zero indicates bad correlation values.

Table 66: Vertical Beam Correlation Magnitude Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the vertical beam correlation magnitude data identification word (00 0bh).
3	Depth Cell 1, Field 1	Stores correlation magnitude data for depth cell #1, vertical beam. See above.
4 – max	Cells 2 – max	These fields store correlation magnitude data for depth cells 2 through max (depending on the ReadyV setting). These fields follow the same format as listed above for depth cell 1.

The Vertical Beam Amplitude scale factor is about 0.45 dB per ADCP count. The Sentinel V ADCP does not directly check for the validity of Vertical Beam Amplitude data.

Table 67: Vertical Beam Amplitude Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the Vertical Beam Amplitude data identification word (00 0ch).
3	Depth Cell 1, Field 1	Stores echo intensity data for depth cell #1, vertical beam. See above.
4– max	Cells 2 – max	These fields store vertical beam echo intensity data for depth cells 2 through max (depending on the ReadyV Setting). These fields follow the same format as listed above for depth cell 1.

Table 68: Vertical Beam Percent-Good Data Format

Binary Byte	Field	Description
1,2	ID Code	Stores the vertical beam percent-good data identification word (00 0dh).
3	Depth cell 1, Field 1	Reserved for future use.
4-258	Depth cell 2 – max	Reserved for future use.

Bottom-Track Data Format

BYTE	BIT POSITIONS 7/S 6 5 4 3 2 1 0	
1	BOTTOM-TRACK ID	LSB 00h
2		MSB 06h
3	BT PINGS PER ENSEMBLE {BP}	LSB
4		MSB
5	RESERVED	LSB
6		MSB
7	BT CORR MAG MIN	
8	BT EVAL AMP MIN	
9	RESERVED	
10	BT MODE {BM}	
11	BT ERR VEL MAX	LSB
12		MSB
13	Reserved	
14		
15		
16		
17	BEAM#1 BT RANGE	LSB
18		MSB
19	BEAM#2 BT RANGE	LSB
20		MSB
21	BEAM#3 BT RANGE	LSB
22		MSB
23	BEAM#4 BT RANGE	LSB
24		MSB
25	BEAM#1 BT VEL	LSB
26		MSB
27	BEAM#2 BT VEL	LSB
28		MSB
29	BEAM#3 BT VEL	LSB
30		MSB
31	BEAM#4 BT VEL	LSB

BYTE	BIT POSITIONS 7/S 6 5 4 3 2 1 0	
32		MSB
33	BEAM#1 BT CORR.	
34	BEAM#2 BT CORR.	
35	BEAM#3 BT CORR.	
36	BEAM#4 BT CORR.	
37	BEAM#1 EVAL AMP	
38	BEAM#2 EVAL AMP	
39	BEAM#3 EVAL AMP	
40	BEAM#4 EVAL AMP	
41	BEAM#1 BT %GOOD	
42	BEAM#2 BT %GOOD	
43	BEAM#3 BT %GOOD	
44	BEAM#4 BT %GOOD	
45 ↓ 70	Reserved	
71	BT MAX. DEPTH {BX}	LSB
72		MSB
73	BM#1 RSSI AMP	
74	BM#2 RSSI AMP	
75	BM#3 RSSI AMP	
76	BM#4 RSSI AMP	
77	GAIN	
78	(*SEE BYTE 17)	MSB
79	(*SEE BYTE 19)	MSB
80	(*SEE BYTE 21)	MSB
81	(*SEE BYTE 23)	MSB

Figure 125. Bottom-Track Data Format

This data is output only if the BP-command is > 0. See Table 69 for a description of the fields.

The LSB is always sent first.

Table 69: Bottom-Track Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the bottom-track data identification word (00 06h).
5-8	3,4	BP/BT Pings per ensemble	Stores the number of bottom-track pings to average together in each ensemble (BP-command). If BP = 0, the Sentinel V does not collect bottom-track data. The Sentinel V automatically extends the ensemble interval (TE) if BP x TP > TE. Scaling: LSD = 1 ping; Range = 0 to 999 pings
9-12	5,6	Reserved	This field is always 0.
13,14	7	BC/BT Corr Mag Min	Stores the minimum correlation magnitude value (BC-command). Scaling: LSD = 1 count; Range = 0 to 255 counts
15,16	8	BA/BT Eval Amp Min	Stores the minimum evaluation amplitude value (BA-command). Scaling: LSD = 1 count; Range = 1 to 255 counts
17,18	9	Reserved	This field is always 0.
19,20	10	BM/BT Mode	Stores the bottom-tracking mode (BM-command).
21-24	11,12	BE/BT Err Vel Max	Stores the error velocity maximum value (BE-command). Scaling: LSD = 1 mm/s; Range = 0 to 5000 mm/s (0 = did not screen data)
25-32	13–16	Reserved	Reserved
33-48	17-24	BT Range/Beam #1-4 BT Range	Contains the two lower bytes of the vertical range from the Sentinel V to the water bottom (or surface) as determined by each beam. This vertical range does not consider the effects of pitch and roll. When bottom detections are bad, BT Range = 0. See bytes 78 through 81 for MSB description and scaling. Scaling: LSD = 1 cm; Range = 0 to 65535 cm
49-64	25-32	BT Velocity/Beam #1-4 BT Vel	The meaning of the velocity depends on the EX (coordinate system) command setting. The four velocities are as follows: a) Beam Coordinates: Beam 1, Beam 2, Beam 3, Beam 4 b) Instrument Coordinates: 1->2, 4->3, toward face, error c) Ship Coordinates: Starboard, Fwd, Upward, Error d) Earth Coordinates: East, North, Upward, Error
65-72	33-36	BTCM/Beam #1-4 BT Corr.	Contains the correlation magnitude in relation to the water bottom (or surface) as determined by each beam. Bottom-track correlation magnitudes have the same format and scale factor as water-profiling magnitudes (Table 5).
73-80	37-40	BTEA/Beam #1-4 BT Eval Amp	Contains the evaluation amplitude of the matching filter used in determining the strength of the bottom echo. Scaling: LSD = 1 count; Range = 0 to 255 counts

Table 69: Bottom-Track Data Format

Hex Digit	Binary Byte	Field	Description
81-88	41-44	BTPG/Beam #1-4 BT %Good	Contains bottom-track percent-good data for each beam, which indicate the reliability of bottom-track data. It is the percentage of bottom-track pings that have passed the Sentinel V bottom-track validity algorithm during an ensemble. Scaling: LSD = 1 percent; Range = 0 to 100 percent
89-92 93-96 97 – 100	45,46 47,48 49,50	Reserved	Reserved. These fields are always 0.
101- 116	51-58	Reserved	Reserved. These fields are always 0.
117- 124	59-62	Reserved	Reserved. These fields are always 0.
125- 132	63-66	Reserved	Reserved. These fields are always 255.
133- 140	67-70	Reserved	Reserved. These fields are always 0.
141- 144	71,72	BX/BT Max. Depth	Stores the maximum tracking depth value (BX-command). Scaling: LSD = 1 decimeter; Range = 80 to 9999 decimeters
145-152	73-76	RSSI/Bm #1-4 RSSI Amp	Contains the Receiver Signal Strength Indicator (RSSI) value in the center of the bottom echo as determined by each beam. Scaling: LSD ≈ 0.45 dB per count; Range = 0 to 255 counts
153, 154	77	GAIN	Contains the Gain level for shallow water. See WJ-command.
155-162	78-81	BT Range MSB/Bm #1-4	Contains the most significant byte of the vertical range from the Sentinel V to the water bottom (or surface) as determined by each beam. This vertical range does not consider the effects of pitch and roll. When bottom detections are bad, BT Range=0. See bytes 17 through 24 for LSB description and scaling. Scaling: LSD = 65,536 cm, Range = 65,536 to 16,777,215 cm

Reserved BIT Data Format

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
1	RESERVED FOR TRDI USE								LSB
2									MSB

Figure 126. Reserved BIT Data Format

The data is always output. See Table 70 for a description of the fields.

Table 70: Reserved for TRDI Format

Binary Byte	Field	Description
1,2	Reserved for TRDI's use	This field is for TRDI (internal use only).

Checksum Data Format

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
1	CHECKSUM DATA								LSB
2									MSB

Figure 127. Checksum Data Format

The data is always output. See Table 71 for a description of the fields.

Table 71: Checksum Data Format

Binary Byte	Field	Description
1,2	Checksum Data	This field contains a modulo 65535 checksum. The ADCP computes the checksum by summing all the bytes in the output buffer excluding the checksum.

Diagnostic Structures

The Sentinel V –Diagnostic Structures refers to the dynamic ADCP data associated with fault handling and diagnostics.

Sentinel V Event Log

Sentinel V Event Log output is included only in systems configured with 47.xx firmware.

A new data type has been added to the PD0 to report events including faults. It is a variable length message with entries for each active fault. Faults will only be reported if they are active when the ensemble is sent.

	BIT POSITIONS								
BYTE	7	6	5	4	3	2	1	0	
1	SENTINEL V – EVENT LOG DATA ID (0x7004)								04h
2									70h
3	NUMBER OF FAULTS								
4									
5	FAULT ENTRY ID #1								LSB
6									MSB
7	STATUS CODE (FOR FAULT ENTRY ID #1)								
8	DIAGNOSTICS CODE (FOR FAULT ENTRY ID #1)								
4(N-1)+5	FAULT ENTRY ID #N								LSB
4(N-1)+6	(Repeat Status and Diagnostic Code fields #N …)								MSB

Figure 128. Sentinel V Event Log Configuration

Table 72. Sentinel V Event Log Format

Binary Byte	Field	Description
1,2	ID Code	Stores the Sentinel V Event Log 7004 (70 04h). LSB is sent first.
3,4	Fault Count	Number of faults reported, max 255
5-6	Fault Entry ID #1	Word containing fault code defined by Fault Code structure for Fault ID #1.
7	Status Code	Byte containing status code defined by Fault Status structure for Fault ID #1
8	Diagnostics Code	Byte containing event specific diagnostics info. For Fault ID #1
4(N-1)+5, 4(N-1)+6	Fault Entry ID #N	Word containing fault code defined by Fault Code structure for Fault ID #N

Binary Byte	Field	Description
4(N-1)+7	Status Code	Byte containing status code defined by Fault Status structure for Fault ID #N
4(N-1)+8	Diagnostics Code	Byte containing event specific diagnostics info. For Fault ID #N

Wave Parameter Structures

The Wave Parameter Structures refers to the dynamic Waves data generated by *WavesMon4*.

Wave Parameters

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
1	WAVE PARAMETERS ID (0x000B)								0Bh
2									00h
3, 4	Hs								LSB, MSB
5, 6	Tp								
7, 8	Dp								
9 - 16	(SPARES)								
17, 18	Dm								
19 - 30	(SPARES)								
31, 32	SHmax								
33, 34	SH13								
35, 36	SH10								
37, 38	STmax								
39, 40	ST13								
41, 42	ST10								
43, 44	T01								
45, 46	Tz								
47, 48	Tinv1								
49, 50	S0								
51, 52	(SPARE)								
53	Source								

Figure 129. Wave Parameters

Each parameter is a signed 2-byte field with a value of -1 indicating a bad value.

Table 73. Wave Parameters

Hex Digit	Binary Byte	Field	Description
1-4	1, 2	ID Code	Stores the Sentinel V Event Log 000B (00 0Bh). LSB is sent first.
5-8	3, 4	Hs	Hs – Significant Wave Height
9-12	5, 6	Tp	Tp – Peak Wave Period
13-16	7, 8	Dp	Dp – Peak Wave Direction
17-32	9-16	Spares	Spares
33-36	17, 18	Dm	Dm – Mean Peak Wave Direction
37-60	19-30	Spares	Spares
61-64	31, 32	SHmax	SHmax – Maximum wave height from Zero-crossing analysis of surface track time series
65-68	33, 34	SH13	SH13 – Significant wave height of the largest 1/3 of the waves in the field from Zero-crossing analysis of surface track time series
69-72	35, 36	SH10	SH10 – Significant wave height of the largest 1/10 of the waves in the field from Zero-crossing analysis of surface track time series
73-76	37, 38	STmax	STmax – Maximum Peak Wave Period from Zero-crossing analysis of surface track time series
77-80	39, 40	ST13	ST13 – The period associated with the peak wave height of the largest 1/3 of the waves in the field from Zero-crossing analysis of surface track time series
81-84	41, 42	ST10	ST10 – The period associated with the peak wave height of the largest 1/10 of the waves in the field from Zero-crossing analysis of surface track time series
85-88	43, 44	T01	T01
89-92	45, 46	Tz	Tz
93-96	47, 48	Tinv1	Tinv1
97-100	49, 50	S0	S0
101-104	51, 52	Spare	Spare
105-106	53	Source	Source

Wave Parameters2 – Sea and Swell

BYTE	7	6	5	4	3	2	1	0	
1	WAVE PARAMETERS2 ID (0x000C)								0Ch
2									00h
3, 4	HsSea								LSB, MSB
5, 6	HsSwell								
7, 8	TpSea								
9, 10	TpSwell								
11, 12	DpSea								
13, 14	DpSwell								
15 – 44	(SPARES)								
45, 46	SeaSwellPeriod								

Figure 130. Wave Parameters2 – Sea and Swell

Each parameter is a signed 2-byte field with a value of -1 indicating a bad value.

Table 74. Wave Parameters2 – Sea and Swell

Hex Digit	Binary Byte	Field	Description
1-4	1, 2	ID Code	Stores the Sentinel V Event Log 000C (00 0Ch). LSB is sent first.
5-8	3, 4	HsSea	HsSea – Significant Wave Height in the sea region of the power spectrum.
9-12	5, 6	HsSwell	HsSwell – Significant Wave Height in the swell region of the power spectrum.
13-16	7, 8	TpSea	TpSea – Peak Sea Wave Period - period associated with the largest peak in the sea region of the power spectrum.
17-20	9, 10	TpSwell	TpSwell – Peak Swell Wave Period - period associated with the largest peak in the swell region of the power spectrum.
21-24	11, 12	DpSea	DpSea – Peak Sea Wave Direction - peak sea direction at the peak period in the sea region.
25-28	13, 14	DpSwell	DpSwell – Peak Swell Wave Direction - peak swell direction at the peak period in the swell region.
29-88	15 – 44	SPARES	SPARES
89-92	45, 46	Sea Swell Period	Sea Swell Period – The transition period between sea and swell.

PDDecoder Library in C language

The Teledyne Marine PDDecoder library is an open source library written in C language to decode the PD0 data formats that are commonly output by Teledyne Marine/Teledyne RD Instruments ADCPs.

Available for download from the Teledyne Marine software portal:

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

NOTES

Appendix A

USING WINRIVER II

In this chapter:

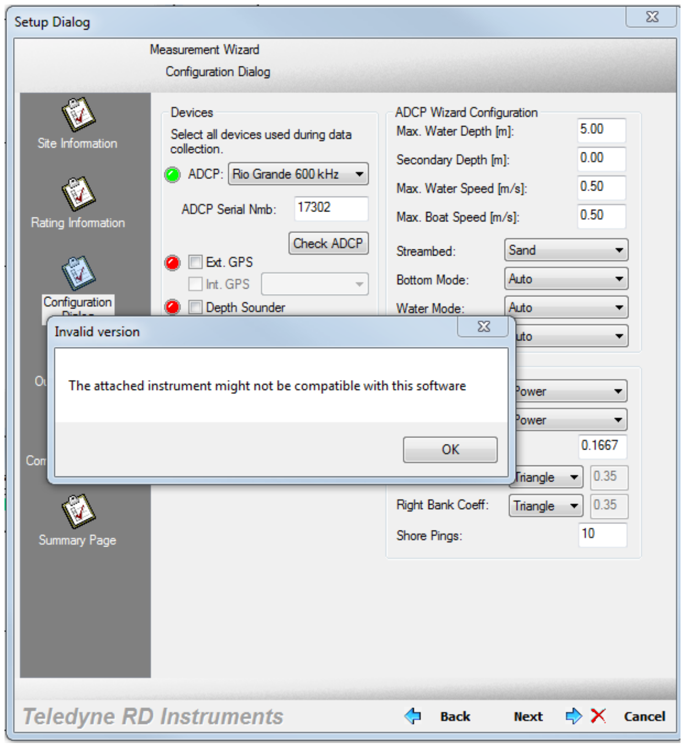
- Coastal survey with SV RT and WinRiver II

This chapter applies to Sentinel V Real-Time systems.

Step 1

Use the WinRiver II Measurement Wizard to setup the Bottom Track enabled Sentinel V Real-Time system, External GPS, and gyro data. Click **OK** when prompted, "*The attached instrument might not be compatible with this software*" and manually enter the ADCP serial number. The ADCP status light should be green, indicating that WinRiver II and the Sentinel V RT system are connected.

Refer to Chapter 2 and Chapter 13 in the WinRiver II User's Guide.



Step 2

Collect transducer misalignment calibration data while moving slowly to minimize errors in bottom track.

Refer to Appendix D in the WinRiver II User's Guide.

Step 3

Use WinRiver II to calculate the misalignment angle. Enter the values on the Offsets page.

Refer to Appendix D in the WinRiver II User's Guide.

Step 4

Perform the survey using the vertical beam data to identify range to bottom and GPS data for speed over ground.

See Chapter 6, Available Displays in the WinRiver II User's Guide.

Appendix B

NOTICE OF COMPLIANCE

In this chapter:

- China RoHS requirements
- Material disclosure table

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

Date of Manufacture

China RoHS requires that all Electrical and Electronic Products are marked with a Date of Manufacture. This is the starting point for the Environmental Friendly Use Period, described below.

Environmental Friendly Use Period (EFUP)

Per SJ/T 11364-2006 – Product Marking, the EFUP is defined as the time in years in which hazardous/toxic substances within Electrical and Electronic Products (EIP) will not, under normal operating conditions, leak out of the Product, or the Product will not change in such a way as to cause severe environmental pollution, injury to health, or great damage to property. TRDI has determined the Environmental Friendly Use Period shall be Ten (10) years.

The purpose of the marking is to assist in determining the restricted substance content, recyclability, and environmental protection use period of our covered products, as required in Chinese law, and does not reflect in any way the safety, quality, or warranty associated with these TRDI products.

Some homogenous substance within the EIP contains toxic or hazardous substances or elements above the requirements listed in SJ/T 11363-2006. These substances are identified in Table 75.

WEEE

The mark shown to the left is in compliance with the Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE).

This symbol indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law or return the unit to one of the TRDI facilities below.

Teledyne RD Instruments USA	Teledyne RD Instruments Europe	Teledyne RD Technologies
14020 Stowe Drive Poway, California 92064	2A Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude, France	1206 Holiday Inn Business Building 899 Dongfang Road, Pu Dong Shanghai 20122 China

CE

This product complies with the European Community Directives:

Electromagnetic Compatibility Directive 2004/108/EC

The following Standards were used to verify compliance with the directives:

EN 61326-1;2006 – EMC Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

Emissions:

EN55011:2009 – Class “A” Radiated Emissions
Immunity:

EN61000-4-2,
EN61000-4-3
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

R&TTE Directive 1999/5/EC:

EN 300 328 V1.8.1 (2012-06) Wideband transmission systems 2.4GHz

Material Disclosure Table

In accordance with SJ/T 11364-2006, the following table disclosing toxic or hazardous substances contained in the product is provided.

Table 75. Toxic or Hazardous Substances and Elements Contained in Product

零件项目(名称) Component Name	有毒有害物质或元素 Toxic or Hazardous Substances and Elements					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr^{6+})	多溴联苯 Polybrominated Biphenyls (PBB)	多溴二苯醚 Polybrominated Diphenyl Ethers (PBDE)
换能器配件 Transducer Assy.	X	X	O	X	O	O
接收机电路板/数据处理器电路板 Receiver PCB/ DSP PCB	O	O	O	O	O	O
微处理器电路板/输入输出口电路板 CPU PCB/PIO PCB	O	O	O	O	O	O
机体装配 Housing Assy.	O	O	O	O	O	O
底座装配 End-Cap Assy.	O	O	O	O	O	O
电池组 Battery Pack	O	O	O	O	O	O
交流电转换器 AC Voltage Adapter	O	O	O	O	O	O
水下专用电缆 Underwater Cable	O	O	O	O	O	O
专用装运箱和泡沫塑料垫 Shipping Case w/Foam	O	O	O	O	O	O

O: 表示该有毒或有害物质在该部件所有均质材料中的含量均在 SJ/T 11363-2006 标准规定的限量要求以下。

O: Indicates that the toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit required in SJ/T 11363-2006.

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Appendix C

GPL Compliance Notice

In this chapter:

- GPL Compliance
- GNU General Public License
- GNU Lesser General Public License

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

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Customer Service
Teledyne RD Instruments
14020 Stowe Drive
Poway, CA 92064

Please include the phrase "Source for Sentinel-V firmware" and the version number in your request.

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That's all there is to it!
```

This chapter applies to both Sentinel V Self-Contained and Sentinel V Real-Time systems.

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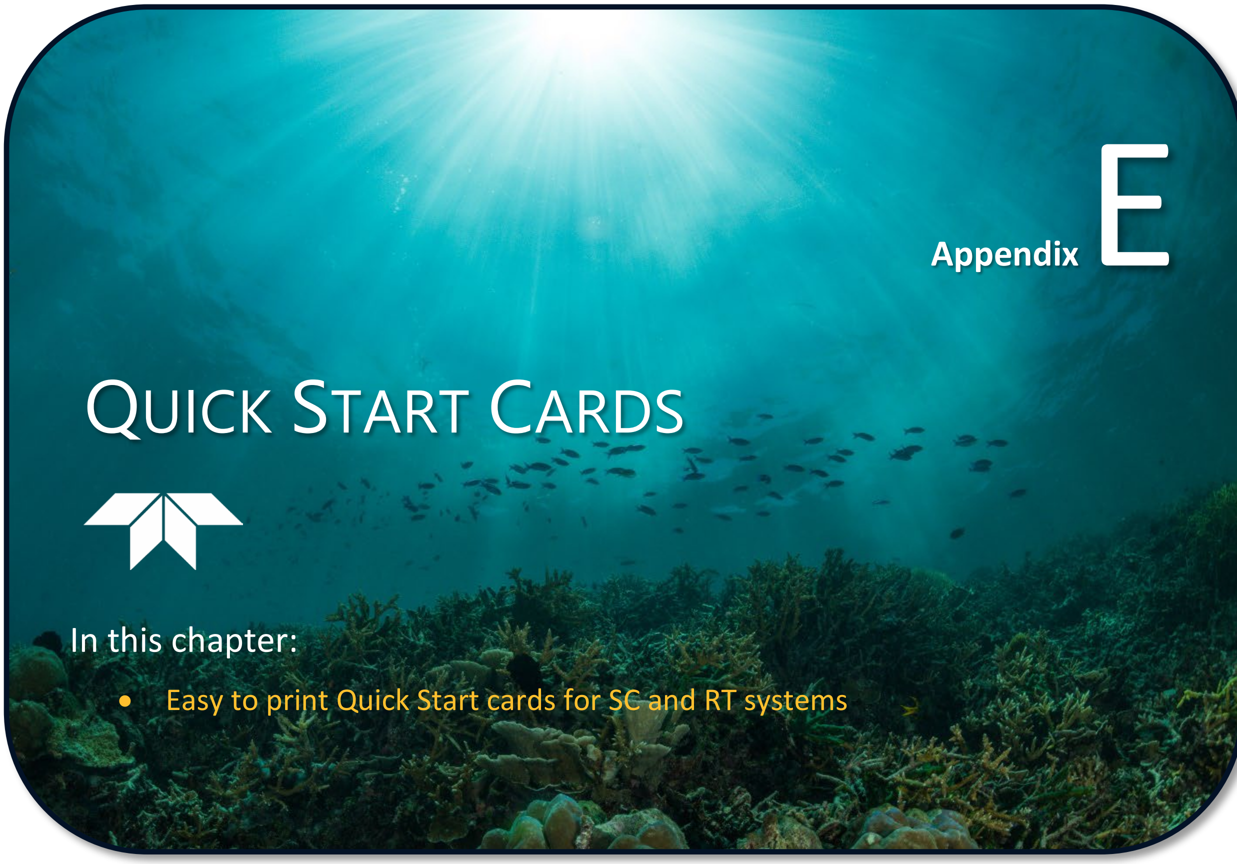


Appendix E

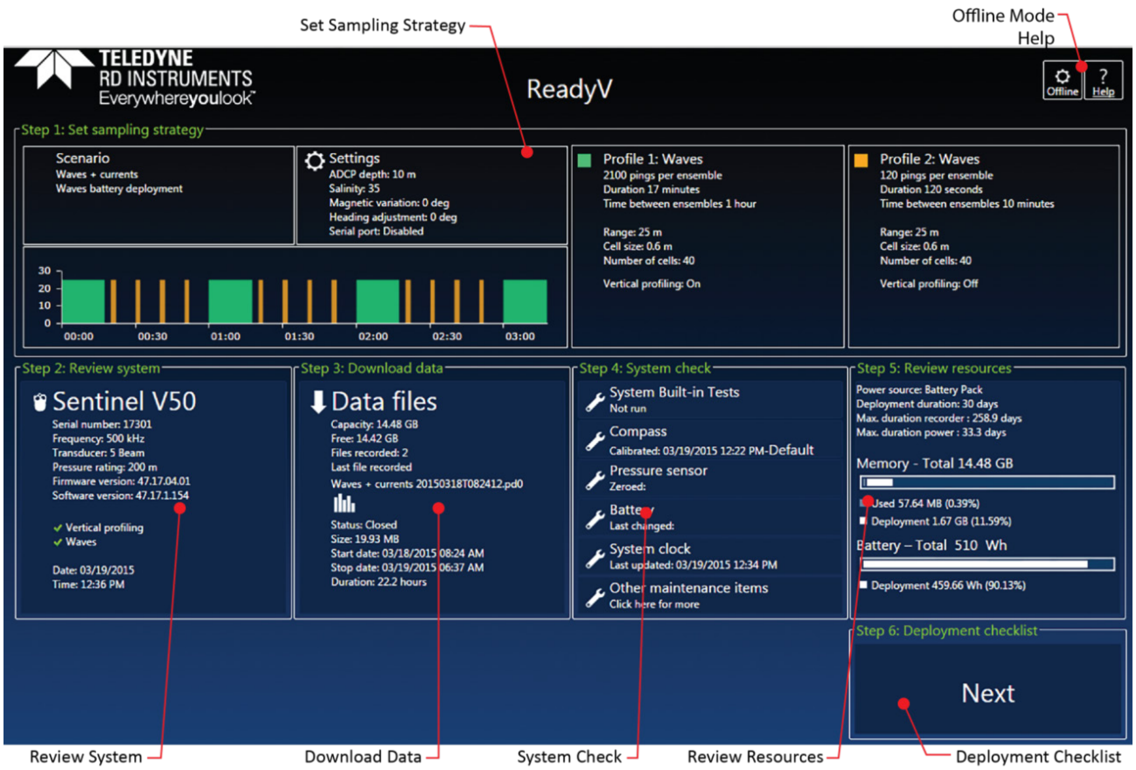
QUICK START CARDS

In this chapter:

- Easy to print Quick Start cards for SC and RT systems

SC ReadyV Quick Start Card for Self-Contained Sentinel V Systems

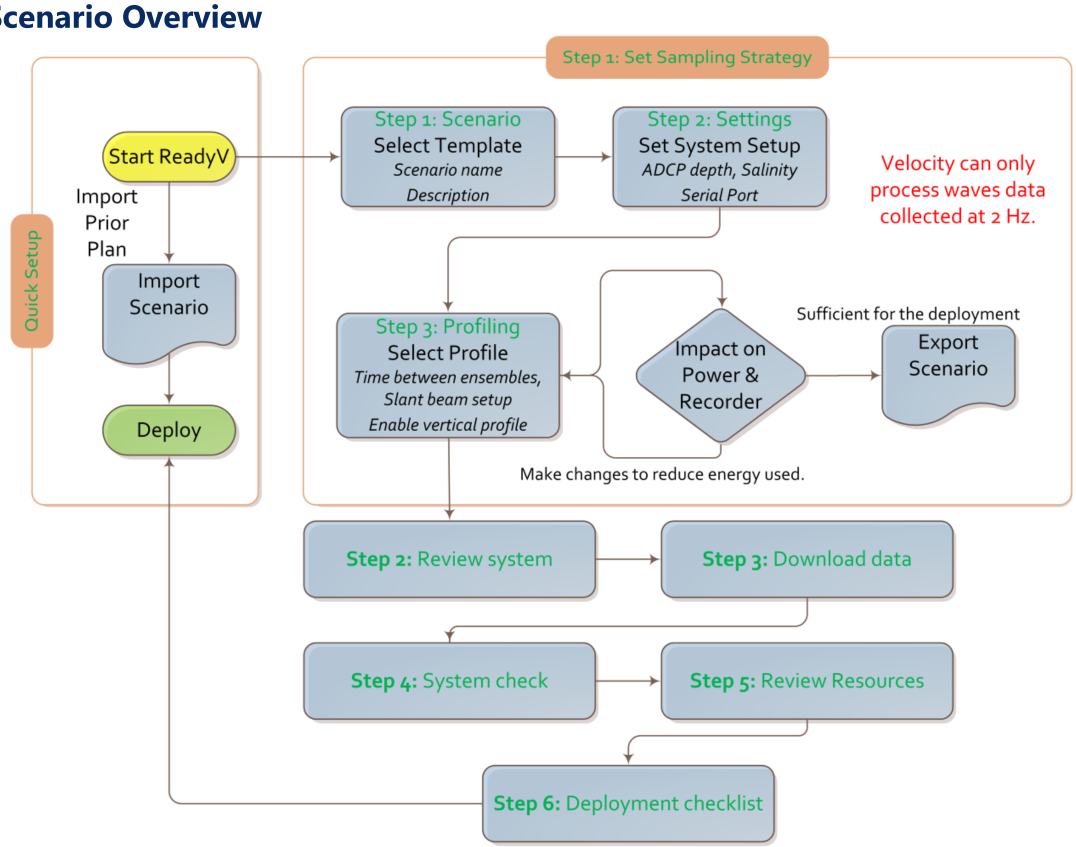
Plan



Home Panel

Each section on the Home panel acts as a link to a secondary control panel with a specific purpose.
The panels can be accessed only when the system is not deployed and when connected to the system.
To save ReadyV to your local computer, click the Offline button and download ReadyV onto the computer.

Creating a Scenario Overview



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ReadyV Quick Start Card for Self-Contained Sentinel V Systems

Plan

Step 1: Set Sampling Strategy

Use the **Step 1: Scenario** panel to:

- Select a template using the drop-down list. Name the deployment and enter a description.

*When a scenario is first created, it will use a default name. For example, selecting the **Coastal Mooring Template** and clicking the **Save** button will save the scenario as **Coastal Mooring**. Make sure to change the name of the scenario and add a description for future use.*

Use the **Step 2: Settings** panel to:

- Set the ADCP depth, water salinity, magnetic variation, and heading adjustment.
- Enable or disable (default) the Serial port and select the Baud rate to stream the data serial real-time. If the serial port connector is not installed “Serial port not present” is displayed.

Use the **Step 3: Profiling** panel to:

- Select a **Profile** using the drop-down list.
- Select the **Range** to measure. The maximum range is dependent on the ADCP frequency, water salinity, water temperature and the depth of the ADCP.
- Set the **Cell size**. Adjust the cell size as necessary. A larger cell size decreases the standard deviation, but shallow water situations may need to use smaller cells to gather more data points.
- The **Number of cells** value will be calculated based on the Range and Cell size.
- The **Blank** setting moves the location of the first cell away from the ADCP transducer head. *The default value is based on system frequency and is highly recommended to use this value.*
- **Ambiguity velocity** represents the maximum relative velocity (ADCP motion plus the maximum actual water velocity) the ADCP can measure along a beam. Select one of the settings from the drop-down list. This must be set correctly to avoid ambiguity errors. Ambiguity velocity is used to improve the standard deviation: The lower the value of the ambiguity velocity, the lower the single-ping standard deviation.
- Set the profiling **Bandwidth** to Low or High. The Low bandwidth allows the ADCP to profile farther, but the standard deviation is increased by as much as 2.5 times.
- Select a **Time between ensembles** from the drop-down list. Time is based on the start of one ensemble to the start of the next ensemble.
- Set the **Ping interval** (time per ping). For a Waves deployment, the **Ping interval** must be 0.5 seconds. *Velocity* can only process waves data collected at 2 Hz.
- Adjust the **Number of pings** to gather the desired Standard Deviation. To increase the expected accuracy of the velocity measurement (reduce the Standard Deviation), increase either the Number of pings, Cell size, or both.
- Checkbox to enable the Vertical Beam (if feature is enabled).
- Click the **Save** button to return to the **Home** panel.

Step 2: Review System

Use the **Review System** panel to:

- View the configuration including software / firmware version.
- View the sensor data.
- Activate/Deactivate features.

Step 3: Download Data

Use the **Download Data** panel to:

- Check the status of data files.
- Download data files.
- Delete data files.
- Format recorder card.

Step 4: System Check

Use the **Maintenance** Panel to:

- Calibrate the compass.
- Zero the pressure sensor.
- Set the date that the battery was replaced.
- Set the date that the O-Ring was replaced.
- Set the date that the desiccant was replaced.
- Set the date that the silicone oil was replaced.
- Set the date that the battery springs were replaced.
- Update Firmware.
- Shows a report of the factory maintenance performed.

Step 5: Review Resources

Use the **Review Resources** panel to:

- Set the ADCP power source and the deployment duration to estimate power usage and recorder requirements.

Step 6: Deployment Checklist

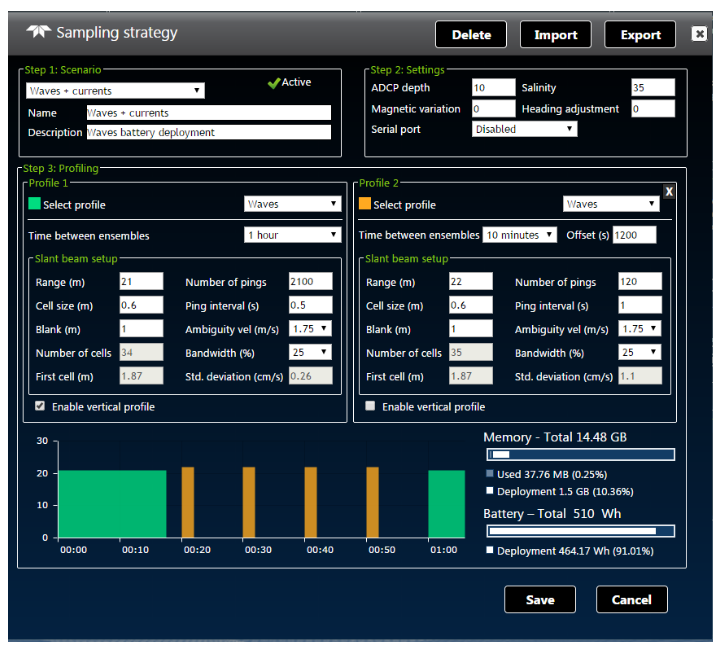
Use the **Deployment Checklist** panel to:

- View deployment checklist.
- Press Deploy button to start a deployment.
- Once deployed, the Stop Recording button displays on the main page. Click the Stop Recording button to stop the deployment.

Import / Export / Delete

These buttons are located on the **Step 1: Sampling strategy** panel

- Use the **Import/Export** buttons to import or export scenarios.
- Use the **Delete** button to remove scenarios from the ADCP.



See Chapter 2 of the Sentinel V SC_RT Operation Manual for details on each setting.

RT **Sentinel V Real-Time Quick Start Card** Eth Ethernet

Prepare ADCP

Preparing the ADCP

To connect the cable:

1. Remove the dummy plug from the ADCP.
2. Connect the external I/O cable connector to the ADCP.
3. Connect the I/O cable Ethernet connector to your computer.
4. Connect the AC Power Adapter to the power connector or use the banana plugs from cable 73D-6021-00 to power the unit with a different power supply (voltage not to exceed 20V).
5. Plug the adapter into a 100-240 VAC 50/50 Hz source.
6. When power is applied, you should hear a long beep. If you do not hear the beep, check the cable connection and power before continuing.

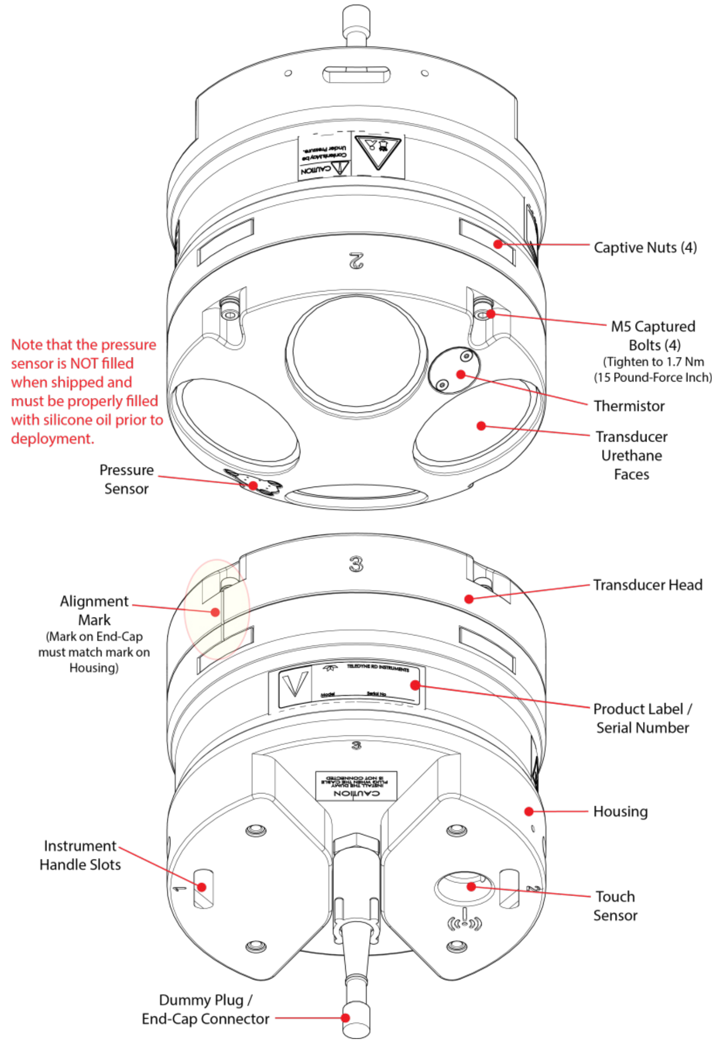
Next step is connecting to the system. Continue to the next page.

If you need help, read the Real-Time Deployment Guide.

How do I know if the system is Ethernet?

Look for the labels next to the product label.
RT = Real-Time, Eth = Ethernet.

RT Eth



Sentinel V Real-Time ADCP with Straight Connector Shown

The figure above shows the no battery RT housing, but any V Series housing with End-Cap connector can be used.

If your system uses batteries, see the corresponding Self-Contained Quick Start Card.

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RT

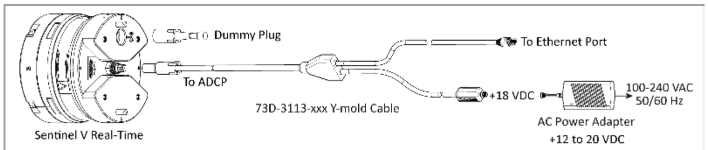
Sentinel V Real-Time Quick Start Card

Eth Ethernet

Connect

Connecting to the ADCP

θ Connect Cable



Connect the ADCP to the Ethernet port on the laptop.

Connect the AC power adapter to cable and to an AC power source.

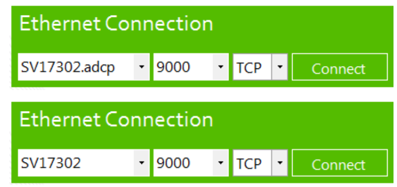
You should hear one long beep, a ~15 second delay and then two short beeps.

Beep(s) heard.

If the beep(s) are not heard, check the AC power adapter voltage.

Check all cable connections are fully seated.

ω Sentinel V RT Utilities



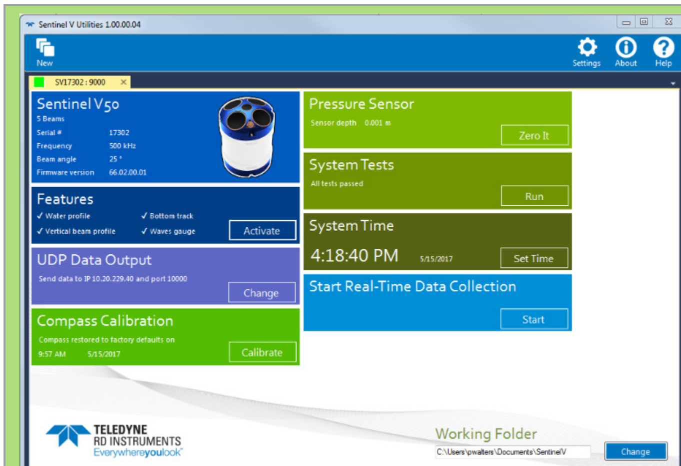
Enter the **IP or host name**. For example, Sentinel V ADCPs host name is SV*nnnnn.adcp* (where *nnnnn* is the five or six character serial number shown on the product label).

Use SV*nnnnn* if the network you are connecting to assigns the IP address.

Enter the **Port Number** 9000.

Select **TCP**.

Click the **Connect** button.



For more information on *Sentinel V RT Utilities*, click the Help icon (Help) to open the Sentinel V RT Utilities software help file.

Continue to the Sentinel V Real-Time Deployment Guide for step-by-step instructions on how to deploy, recover data, and view Real-Time Sentinel V data. See the Sentinel V Operation Manual, Chapter 1a Using Ethernet Communications to see how to view RT data over the ethernet.

RT

Sentinel V Real-Time Quick Start Card

232 422 **Serial RS-232**
Serial RS-422

Prepare ADCP

Preparing the ADCP

To connect the cable:

1. Remove the dummy plug from the ADCP.
2. Connect the external I/O cable connector to the ADCP.
3. Connect the I/O cable Serial connector to your computer.

Your computer and the Sentinel V Real-Time ADCP must both be set to the same communication setting. Use the RS-232-to-RS-422 converter if the ADCP is configured for RS-422 communications and your computer only has a RS-232 COM port.

4. Connect the AC Power Adapter to the power connector or use the banana plugs from cable 73D-6021-00 to power the unit with a different power supply (voltage not to exceed 20V).
5. Plug the adapter into a 100-240 VAC 50/50 Hz source.
6. When power is applied, you should hear a long beep. If you do not hear the beep, check the cable connection and power before continuing.

Next step is connecting to the system. Continue to the next page.

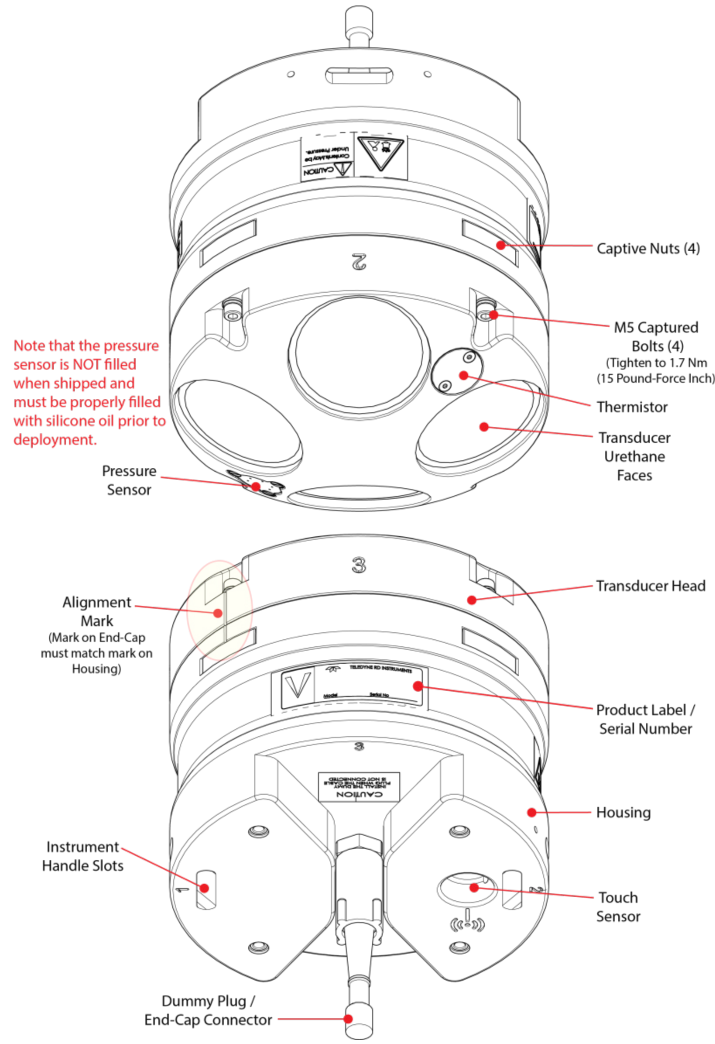
If you need help, read the Real-Time Deployment Guide.

How do I know if the system is RS-232 or RS-422?

Look for the labels next to the product label:

232 422

If the Sentinel V Real-Time system is configured for RS-422, use a RS-232 to RS-422 converter when connecting to the serial port. The serial port on the computer must match the serial communications of the Sentinel V system.



Sentinel V Real-Time ADCP with Straight Connector Shown

The figure above shows the no battery RT housing, but any V Series housing with End-Cap connector can be used.

If your system uses batteries, see the corresponding Self-Contained Quick Start Card.

95D-6032-00 (May 2023)

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Sentinel V Real-Time Quick Start Card

RT

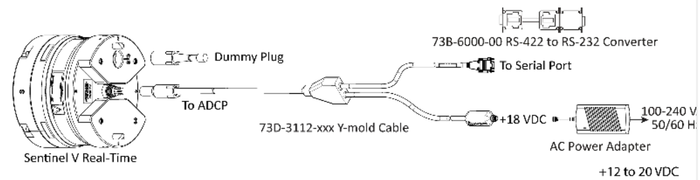
232 422 **Serial RS-232** **Serial RS-422**

Connect

Connecting to the ADCP

To connect to the Sentinel V Real-Time ADCP using the *Sentinel V RT Utilities* software:

θ Connect Cable



Connect the cable to the ADCP and to the serial port on the laptop.

Connect the AC power adapter to the cable and to an AC power source.

You should hear one long beep.

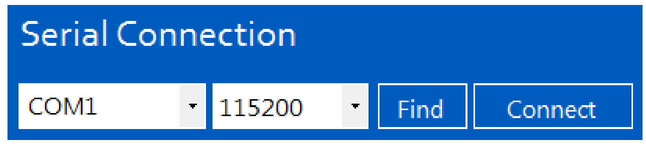
Beep(s) heard.

If the beep is not heard, check the AC power adapter voltage.

Check all cable connections are fully seated.

If the Sentinel V Real-Time system is configured for RS-422, use a RS-232 to RS-422 converter when connecting to the serial port. The serial port on the computer must match the serial communications of the Sentinel V system.

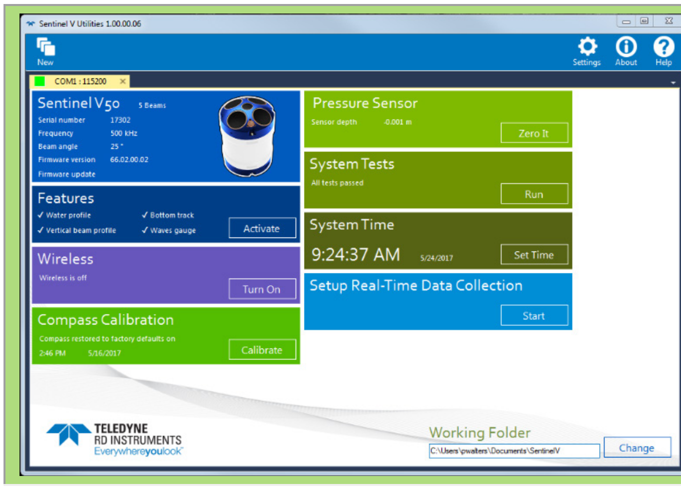
ω Sentinel V RT Utilities



Select **New**, **Serial Connection.**

Select the **COM Port** and **Baud Rate** from the drop down lists.

Click the **Connect** button.



If you are unsure of the Baud rate, use the default 9600 baud and try to connect. If you can not connect, click **Find**.

For more information on *Sentinel V RT Utilities*, click the Help icon (Help) to open the Sentinel V RT Utilities software help file.

Continue to the Sentinel V Real-Time Deployment Guide for step-by-step instructions on how to deploy, recover data, and view Real-Time Sentinel V data.

Sentinel V Self-Contained Quick Start Card

Wireless with Battery Pack

SC

Prepare ADCP

Preparing the ADCP

To connect the battery:

1. Place the Sentinel V ADCP with the end-cap facing up. Use a soft pad or the transducer cover to protect the ADCP.
2. Using a 4mm hex key, loosen the four M5 captured bolts on the end-cap.

   A 4mm hex key is provided in the canvas bag.
   The end-cap hardware will stay attached to the end-cap.
3. Carefully lift the end-cap away from the housing. Observe how the internal I/O cable is coiled inside the housing. It must be coiled exactly the same way when replacing the end-cap.

   A lanyard connects the end-cap to the housing to protect the internal I/O cable. Leave the lanyard connected.
4. Let the end-cap hang from the lanyard to the side of the ADCP.
5. Connect the Red/Black 2-pin battery cable to the 2-pin battery cable connector.

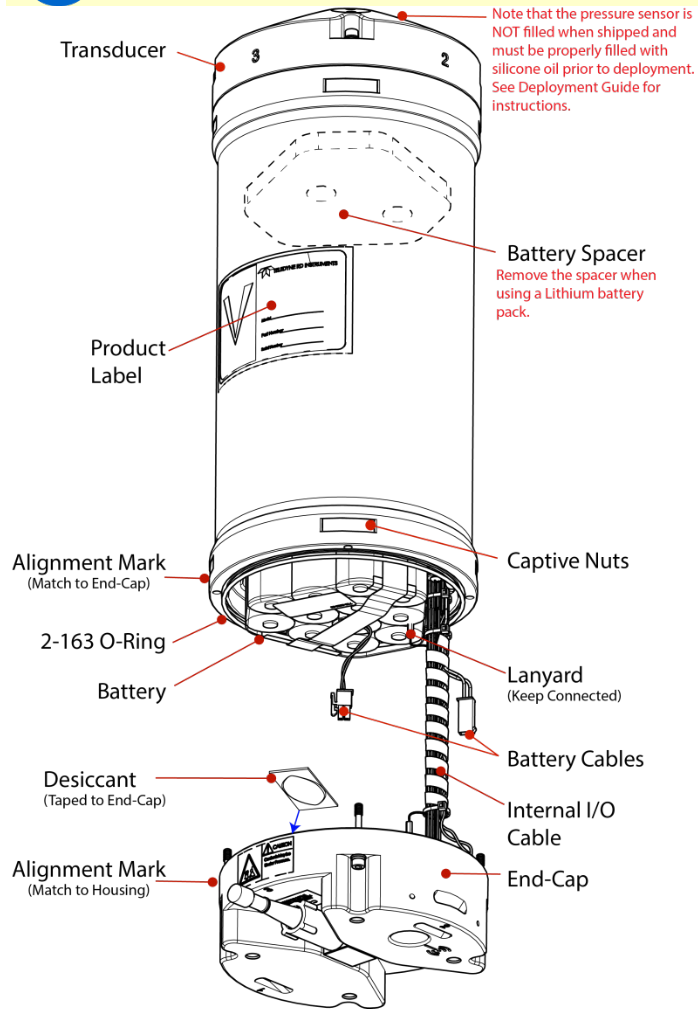
   After power is applied (long beep), there is a 10 to 15 second delay before the network is available (short beep); If you do not hear the beeps, repeat/check step 5 before continuing.

To close the system:

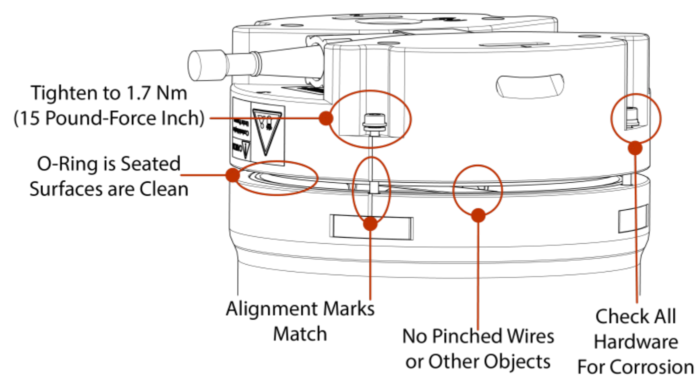
1. Check the O-ring for any fibers or particles. Make sure it is seated in the groove and the surfaces are clean.
2. Verify the desiccant bag is installed and will not interfere with the end-cap when it is installed.

   TRDI recommends replacing both the O-ring and desiccant before each deployment.
3. Match the alignment mark and beam numbers embossed on the end-cap with the alignment mark/beam numbers embossed on the housing to place the end-cap on the housing. Check the cables are coiled around the inside of the housing and do not become pinched.
4. Install all four sets of hardware until “finger-tight.”
5. Tighten the bolts in small increments in a “cross” pattern until the split washer begins to flatten out.
6. TRDI recommends using a torque wrench to tighten the bolts to the recommended torque value of 1.7 Nm (15 Pound-Force Inch). If a torque wrench is not available, tighten the bolts until the split washers are flat, and then turn the bolts ¼ turn more. Do not strip the bolts or captive nut threads.

Read the Self-Contained Deployment Guide.



Sentinel V50 Model with Connector End-Cap Shown



Sentinel V battery packs are shipped inside the system but not connected. Connect the battery and seal the Sentinel V before deployment.

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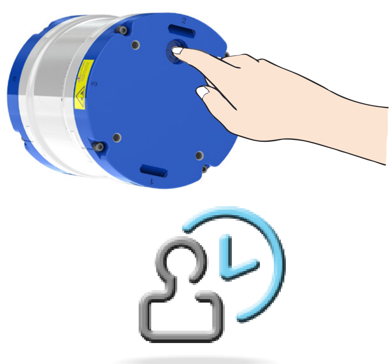
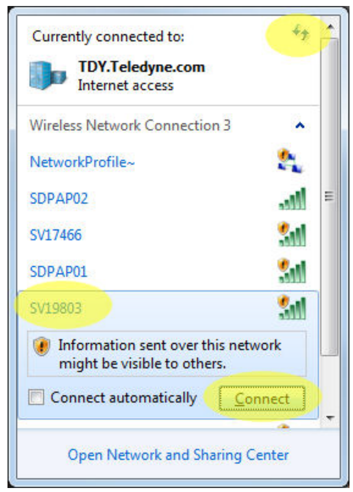
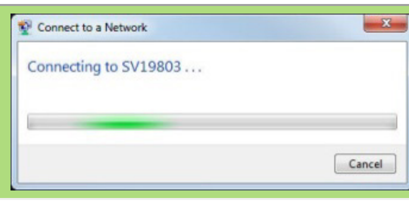
Sentinel V Self-Contained Quick Start Card

Wireless with Battery Pack

SC

Connect

Connecting to the ADCP

Touch Sensor	Connect	Start ReadyV
	 *Sentinel V ADCPs display as SVnnnnn (where nnnnn is the five or six character serial number shown on the product label).*	
Touch the sensor	Click the wireless icon ( ) in the system tray. Click the Refresh icon ( ). Locate the ADCP on the list and click on it. Click **Connect.**	Open a browser. Type **192.168.0.2** in the address bar.
Beep(s) heard.		
If the beep is not heard, check that the battery is installed. Touching the sensor starts the ADCP's WLAN for five minutes.	As needed, touch the Touch Sensor, listen for the beep, and then click until the ADCP appears on the list. It may take several attempts of clicking Refresh before the ADCP appears on the list.	It can take up to 30 seconds for the ReadyV Home panel to display. As needed, touch the Touch Sensor, listen for the beep, and then refresh the browser page until ReadyV starts. Complete step 3 within five minutes of completing step 2.

Read the Self-Contained Deployment Guide and the Sentinel V Operation Manual, Chapter 1 Wireless Connection Common Issues.

SC

Sentinel V Self-Contained Quick Start Card

Wireless with D Cell Batteries

Prepare ADCP

Preparing the ADCP

To install the D cell batteries:

1. Place the Sentinel V ADCP with the end-cap facing up. Use a soft pad or the transducer cover to protect the ADCP.
2. Using a 4mm hex key, loosen the four M5 captured bolts on the end-cap.

   A 4mm hex key is provided in the canvas bag.
   The end-cap hardware will stay attached to the end-cap.
3. Carefully lift the end-cap away from the housing. Observe how the internal I/O cable is coiled inside the housing. It must be coiled exactly the same way when replacing the end-cap.

   A lanyard connects the end-cap to the housing to protect the internal I/O cable. Leave the lanyard connected.
4. Let the end-cap hang from the lanyard to the side of the ADCP.
5. Remove the battery cover plate by loosening the knob (rotate counter-clockwise).
6. Use the battery cover diagram for battery orientation and slide in the D cell batteries. Ensure all batteries are fully seated by pushing them down into the battery cavity. Position the cover plate over the batteries and tighten the knob until the cover plate is flush with the surrounding surface.

   As the cover is installed, there is a long beep, a 10 to 15 second delay, and then a short beep. If you do not hear the beeps, repeat/check steps 5 and 6 before continuing.

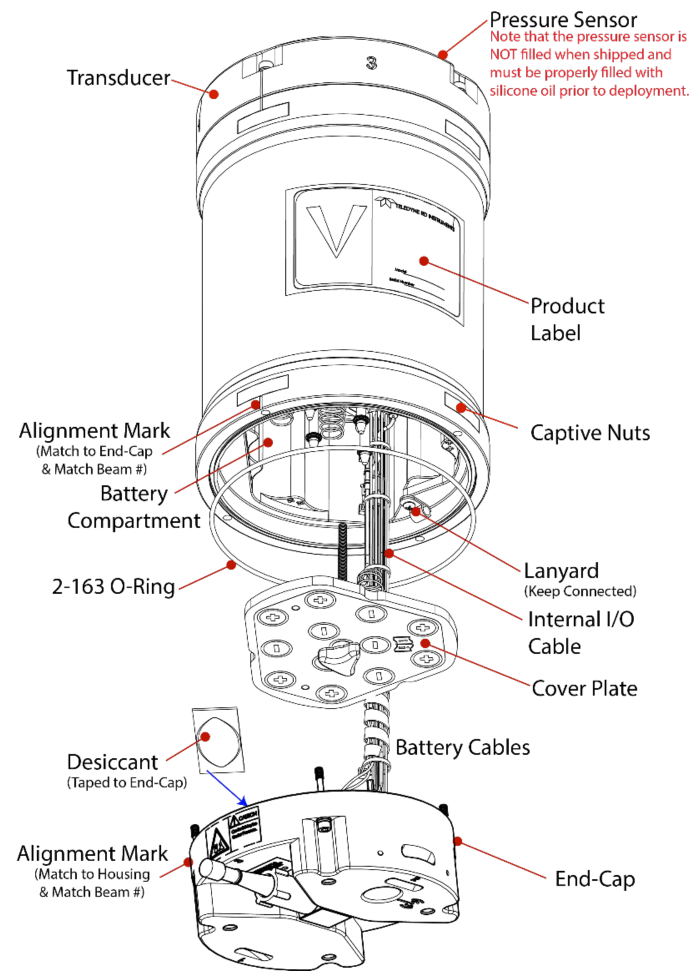
   If the battery cover is loose, the D cell batteries may make intermittent contact or it may interfere with the end-cap properly closing. Tighten the knob until the cover plate is flush with the surrounding surface.

To close the system:

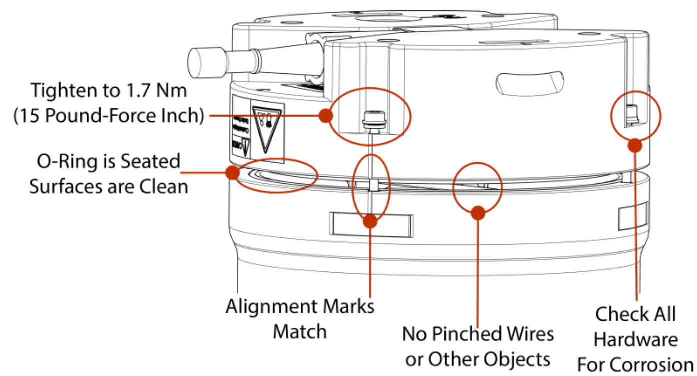
1. Check the O-ring for any fibers or particles. Make sure it is seated in the groove and the surfaces are clean.
2. Verify the desiccant bag is installed and will not interfere with the end-cap when it is installed.

   TRDI recommends replacing both the O-ring and desiccant before each deployment.
3. Match the alignment mark and beam numbers embossed on the end-cap with the alignment mark/beam numbers embossed on the housing to place the end-cap on the housing. Check the cables are coiled around the inside of the housing and do not become pinched.
4. Install all four sets of hardware until “finger-tight.”
5. Tighten the bolts in small increments in a “cross” pattern until the split washer begins to flatten out.
6. TRDI recommends using a torque wrench to tighten the bolts to the recommended torque value of 1.7 Nm (15 Pound-Force Inch). If a torque wrench is not available, tighten the bolts until the split washers are flat, and then turn the bolts ¼ turn more. Do not strip the bolts or captive nut threads.

Read the Self-Contained Deployment Guide.



Sentinel V20 Model with SC End-Cap Shown



Sentinel V with D cells are shipped without batteries inside the system. Install the batteries and seal the Sentinel V before deployment.

95D-6014-00 (February 2023)

TELEDYNE MARINE Everywhereyoulook™

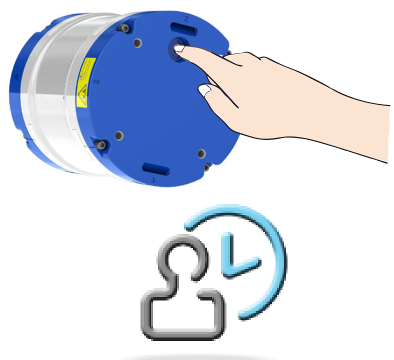
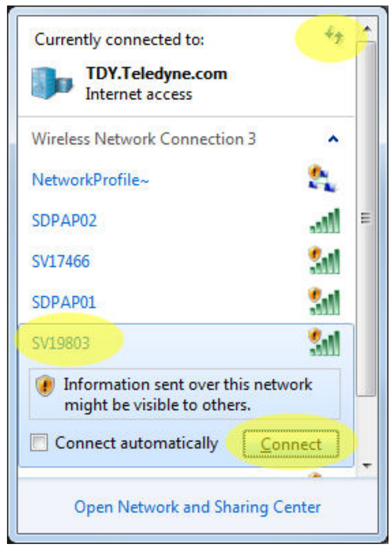
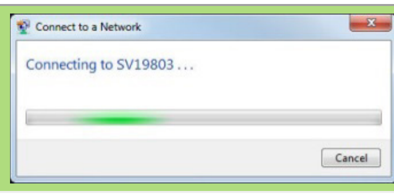
SC

Sentinel V Self-Contained Quick Start Card

Wireless with D Cell Batteries

Connect

Connecting to the ADCP

Touch Sensor	Connect	Start ReadyV
	 *Sentinel V ADCPs display as SVnnnnn (where nnnnn is the five or six character serial number shown on the product label).*	
Touch the sensor	Click the wireless icon ( ) in the system tray. Click the Refresh icon ( ). Locate the ADCP on the list and click on it. Click **Connect.**	Open a browser. Type **192.168.0.2** in the address bar.
Beep(s) heard.		
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Read the Self-Contained Deployment Guide and the Sentinel V Operation Manual, Chapter 1 Wireless Connection Common Issues.