StreamPro

ADCP Guide

TELEDYNE MARINE
Everywhereyoulook™

P/N 95B-6003-00 (February 2024)

https://www.teledynemarine.com

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REVISION HISTORY

February 2024

- Updated Returning Systems to the TRDI Factory, page 29 Brokerage address.

January 2024

- Q-View software no longer requires a registration code.

July 2023

- Updated website address.
- Added Geode GPS information.

February 2023

- Added firmware installation instructions.

January 2023

- Updated EAR statement.
- Deployment guide now download only.
- Added Figure 15. Replaceable Parts, page 17.

April 2022

- 95Z-6007-00 replaces the 90Z-8000-00 CD

November 2021

- Updated Appendix A

August 2021

- Updated contacting TRDI table
- Added link to PD0Decoder
- Replaced float with tethered trimaran

July 2019

- Updated the assembly guidelines with the note that the compass is inside the electronics
- Updated TRDI contact information
- Added information about spacer on Using the GPS Mounting Kits
- Updated logo

June 2018

- Added a deployment guide to the documentation
- Replaced Quick Start Card with a Getting Started sheet
- Updated the inventory section
- Added figure showing compass location and orientation
- Added Export Administration Regulations (EAR) footers

September 2015

- Updated the inventory section
- Updated the PS0 example output
- Updated the power specification

May 2013

- Updated inventory section

April 2012

- Changed name of manual from StreamPro ADCP Operation Manual to StreamPro ADCP Guide.
- Update fonts and styles used throughout the manual.
- Corrected ED command Range from 0 to 65535 decimeters (meters x 10) to 0 to 200 decimeters (meters x 10) (see ICN 132).
- Corrected Velocity Profiling Specifications: The 1st Cell start specification and velocity range was corrected and the wording revised to be consistent with the StreamPro brochure (see ICN 133).
- Corrected EX command default (with compass) from EX10xx0 to EX101x1 (See ICN 136).
- Corrected WF command range from 0 to 50 cm to 0 to 9999 cm.
- Added note that some Bluetooth devices may ask for a pin code. The pin code is 0 (zero, not the letter O). Some Bluetooth devices may ask for a Pin code, Pair code, Pairing code, Security code, or Bluetooth code. In all cases, the code is zero.
- Moved outline installation drawings to the end of the specifications.
- Added StreamPro ADCP Options.
- Added Appendix A and B.
- Moved Notice of Compliance information to Appendix C.

November 2009

- General update to match version 3.33 software.

Exclusions and Omissions

- This manual covers the StreamPro ADCP hardware and firmware. For information on how to use the Windows 8 tablet and *WinRiver II* or *SxS Pro* software, see the Windows 8 Tablet Setup Card.
- For instructions on using a laptop computer with Bluetooth running the *WinRiver II* or *SxS Pro* software, see the appropriate software user's guide.
- For instruction on using the Parani UD100 USB Bluetooth device, see the instructions included with the device and the WinRiver II User's Guide.
- For instruction on using the SENA SD1000U Bluetooth device, see the WinRiver II User's Guide and the WinRiver II SD1000U Bluetooth Setup Card.
- For instructions on using the SXBlue II-L GPS for OmniSTAR, see FST-043.

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
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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.

CONVENTIONS USED IN THIS MANUAL

Conventions used in the StreamPro documentation have been established to help you learn how to use the StreamPro quickly and easily.

Software menu items are printed in bold: **File** menu, **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),** you would press and hold the first key while you press the second key. Words printed in italics include program names (*StreamPro*) and file names (*default.txt*).

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

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

```
StreamPro ADCP
Teledyne RD Instruments (c) 2015
All rights reserved.
Firmware Version: 31.xx

>?
```

You will find two other visual aids that help you: Notes and Cautions.

This paragraph format indicates additional information that may help you 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 StreamPro ADCP).

NOTES

Chapter 1

AT A GLANCE

This chapter includes:

- StreamPro ADCP overview
- Inventory of parts
- StreamPro ADCP options
- StreamPro ADCP assembly
- Caring for your StreamPro ADCP

StreamPro ADCP Overview

The StreamPro ADCP is designed to measure real-time velocity and discharge measurements in shallow streams. The StreamPro system consists of a transducer, electronics housing, tethered trimaran, and software.

Transducer Assembly – The transducer assembly contains the transducer ceramics and the electronics. See Specifications for dimensions and weights. The transducer ceramics are mounted to the transducer. The thermistor is embedded in the transducer head and measures the water temperature.

Tethered trimaran, Boom, and Tow Arm – The tethered trimaran, deployment boom and tow arm are designed to maintain the transducer at a constant depth in the water with minimal water flow disturbance.

Electronics Housing – The blue and white plastic housing protects the electronics and is "splash proof" (i.e., it can be submerged in depths to one to two meters for short periods of time as you retrieve the StreamPro).

Power Switch and LEDs – The power switch is located on the electronics housing. The amber LED on the electronics housing indicates power on; the blue LED indicates that a Bluetooth link has been acquired. A blinking amber LED indicates the battery level is low.

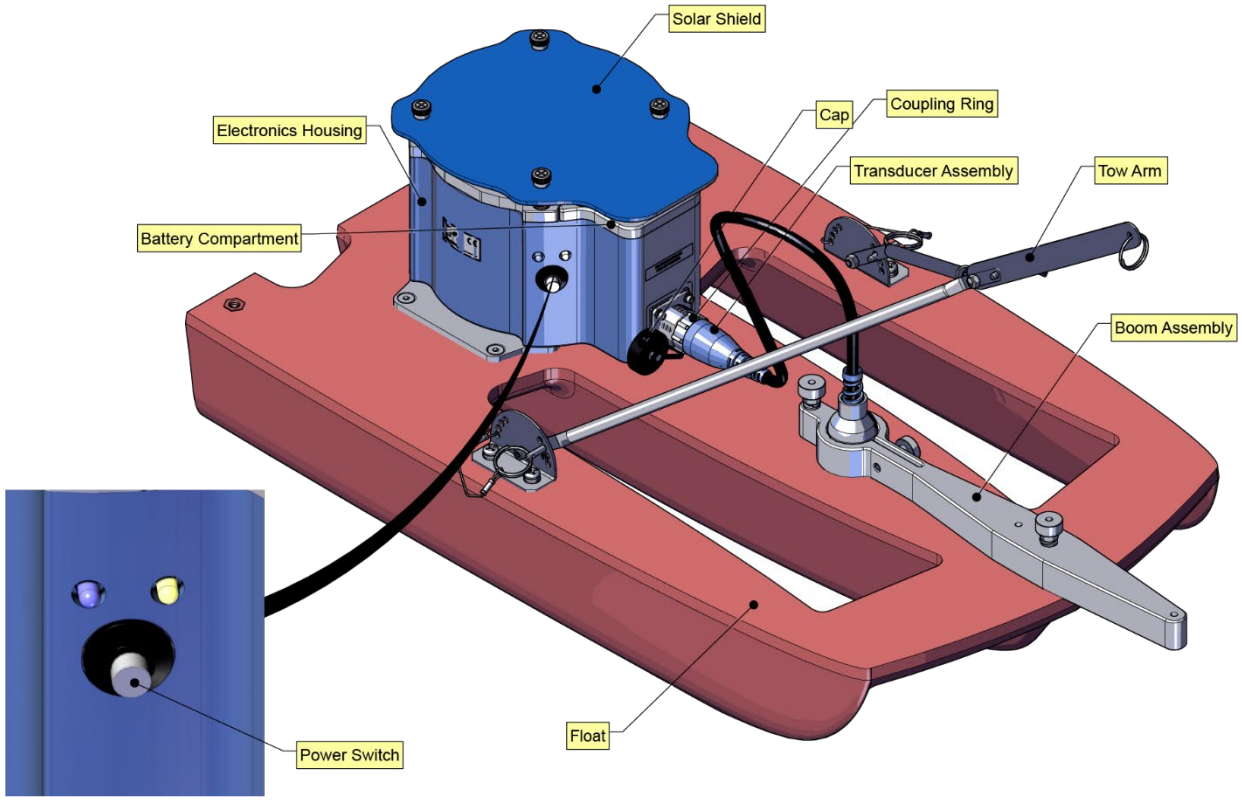


Figure 1. StreamPro ADCP Overview

Inventory

Included with the StreamPro system:

Part Number	Name	Description
SPADCP-I	StreamPro system	The StreamPro system includes the transducer and electronics housing. When unpacking, use care to prevent physical damage to the transducer and connector. Use a soft pad to protect the transducer.

Included with the StreamPro Accessories Kit (SPADCP-A):

Part Number	Name	Description
1650	Shipping case	Shipping case with custom foam cutouts.
SPFLOAT	Tethered trimaran arm assembly	Tri-hull tethered trimaran and arm assembly for tethered deployments. Various GPS/GNSS mounts, and kits are available. For more information on GPS/GNSS mounting kits, see Appendix B.
75BK6007-00	Solar Shield	Protects the electronics housing from the sun/overheating.
PC1500	AA batteries	16 AA batteries
95Z-6007-00	Download instructions	This sheet has instructions for downloading the software and manuals.
	WinRiver II Software	TRDI's river and coastal data acquisition software package where the primary use is for discharge calculation. Although this is its primary function, it can be used for general coastal survey applications.
	TRDI Toolz Software	Utility and testing software that can be used to test the StreamPro.
	SxS Pro Software (optional)	Section-by-Section (SxS) Pro is a stationary ADCP discharge data collection and processing program (registration code is required to collect data).
	Q-View Software (optional)	*Q-View* is designed for customers using *WinRiver II* software to have easy access to an evaluation of the quality of collected data while they are still in the field and back in the office.
75BK6057-00	Windows Tablet (optional)	Optional Windows tablet and tablet setup card.
95B-6128-00	StreamPro Getting Started	A printed reference card showing how to get started with the StreamPro.
SD1000U DAT5-G01R	USB Bluetooth device	USB Bluetooth device SD1000U and Sena DAT5-G01R antenna.
75BK6003-00	Spare parts kit	See Table 1, page 17 for a list of parts included.

For instructions on using the SD1000U USB Bluetooth device, see the WinRiver II or SxS Pro Software User's Guide and the instructions included with the device.

When WinRiver II is installed, shortcuts to the WinRiver II Software User's Guide and quick reference cards are added to the Windows Start menu.

For information on how to set up the tablet and *WinRiver II* or *SxS Pro* software, see the Windows 8 Tablet Setup Card.

StreamPro ADCP Options

The StreamPro has several options:

Riverboat SP – The Oceanscience Riverboat SP provides a stable platform for the StreamPro ADCP in high-flow water.

The standard StreamPro tethered trimaran works well in flows to 1.5 meters/second. The Riverboat SP can be used in flows to approximately 4.5 meters/second (condition dependent).

For more information, see Appendix A

Photo credits - The Oceanscience Group

Figure 2. Riverboat SP by Oceanscience

Q/Z 1250 Power Trimaran – The Q/Z 1250 is designed specifically for shallow water applications. This one-man portable remote vehicle is easy to set up, easy to operate, and accepts most industry standard ADCPs.

Figure 3. Q/Z 1250 Power Trimaran

SXBlue II GPS and Mounting Kits – The GPS/GNSS mounting kit is designed to hold the GENEQ SXBlue II GPS unit to either the standard StreamPro tethered trimaran or the Riverboat SP. The mounting kit is available from TRDI. The SXBlue II GPS/GNSS system may be purchased separately from TRDI or other sources.

Figure 4. SXBlue II GPS/GNSS with Mounting Kit

Additional SX Blue GPS/GNSS receivers with extended capabilities are available – contact TRDI with your requirements for more information.

For more information on GPS/GNSS mounting kits, see Appendix B.

For information on the SX Blue GPS/GNSS, see http://www.sxbluegps.com/welcome.html.

SxS Pro – The *SxS Pro* software running on a laptop with a Bluetooth connection can be used in place of the *WinRiver II* software. For more information, see the SxS Pro User's Guide.

- *SxS Pro* software can be downloaded from https://tm-portal.force.com/TMsoftwareportal
- To purchase a registration code to enable the software's full capability, please contact field service at: e-mail: rdifs@teledyne.com | Tel. +1-858-842-2700.

Q-View Software – *Q-View* is designed for customers using TRDI's discharge measurement products such as the RiverRay, RiverPro/RioPro, StreamPro, and Rio Grande ADCPs with the *Win-River II* software to have easy access to an evaluation of the quality of collected data while they are still in the field and back in the office. To purchase a registration code to enable the software, please contact field service.

Windows Tablet –Use the optional tablet to collect data using the *WinRiver II* or *SxS Pro* software. The tablet also supports using *Q-View*.

StreamPro ADCP Care

This section contains a list of items you should be aware of every time you handle, use, or deploy your StreamPro. *Please refer to this list often.*

General Handling Guidelines

- Never set the transducer on a hard or rough surface. **The urethane faces may be damaged.**
- Do not expose the transducer faces to prolonged sunlight. **The urethane faces may develop cracks.** Cover the transducer faces on the StreamPro if it will be exposed to sunlight.
- Do not store the StreamPro ADCP in extreme temperatures (see Table 28). **The urethane faces may be damaged.**
- Do not lift or support a StreamPro by the external cable. **The connector or cable will break.**
- Do not leave the batteries inside the StreamPro ADCP 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).

Assembly Guidelines

- Read the Maintenance section for details on StreamPro assembly. **Loose, missing, stripped hardware, or damaged O-rings can lead to water ingress and damage to the StreamPro ADCP.**
- Do not connect or disconnect the transducer cable with power applied. When you connect the cable with power applied, you may see a small spark. **The connector pins may become pitted and worn.**
- **The StreamPro's compass is in the Electronic Chassis**. Beam 3 orientation is toward the power switch and the connector should be facing forward if the Electronic Chassis is mounted on a different tethered trimaran/boat.

Deployment Guidelines

- **Bluetooth communications will not work if the internal temperature of the StreamPro ADCP is above 50 degrees C.** If you are having communication problems and are operating in a hot, sunny climate, allow the StreamPro ADCP to cool before continuing.

Chapter 2

StreamPro ADCP Assembly

This chapter includes:

- Attaching the electronics housing to the tethered trimaran
- Attaching and removing the solar shield
- Assembling the boom arm
- Adjusting the towing harness angle
- Storing the StreamPro ADCP

This section shows how to assemble the StreamPro tethered trimaran and attach the transducer to the deployment boom.

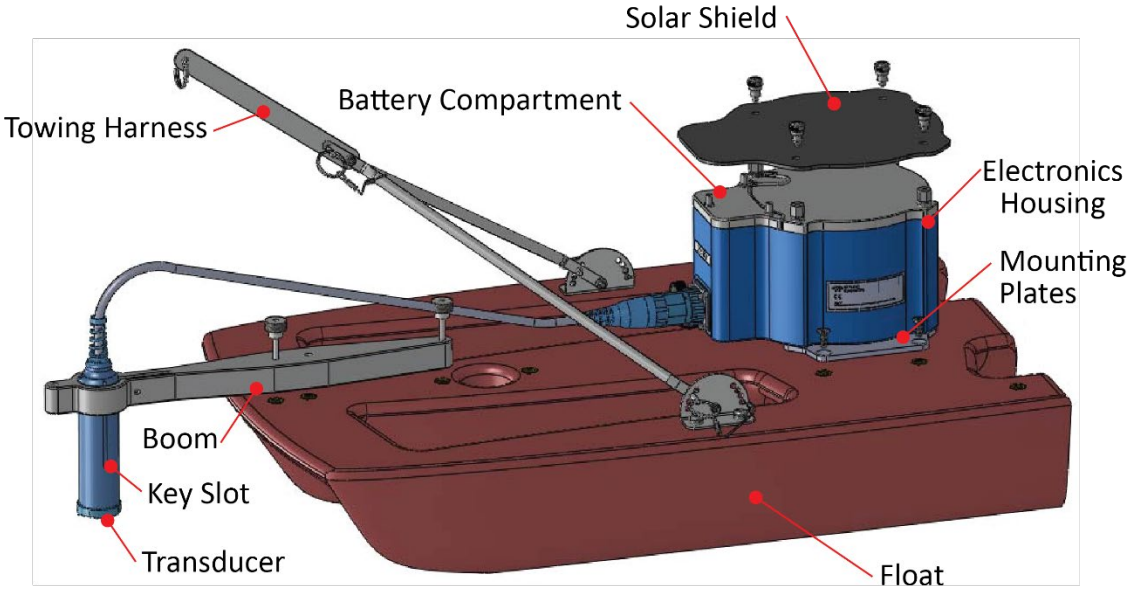


Figure 5. StreamPro ADCP Assembly – Boom in Extended Position

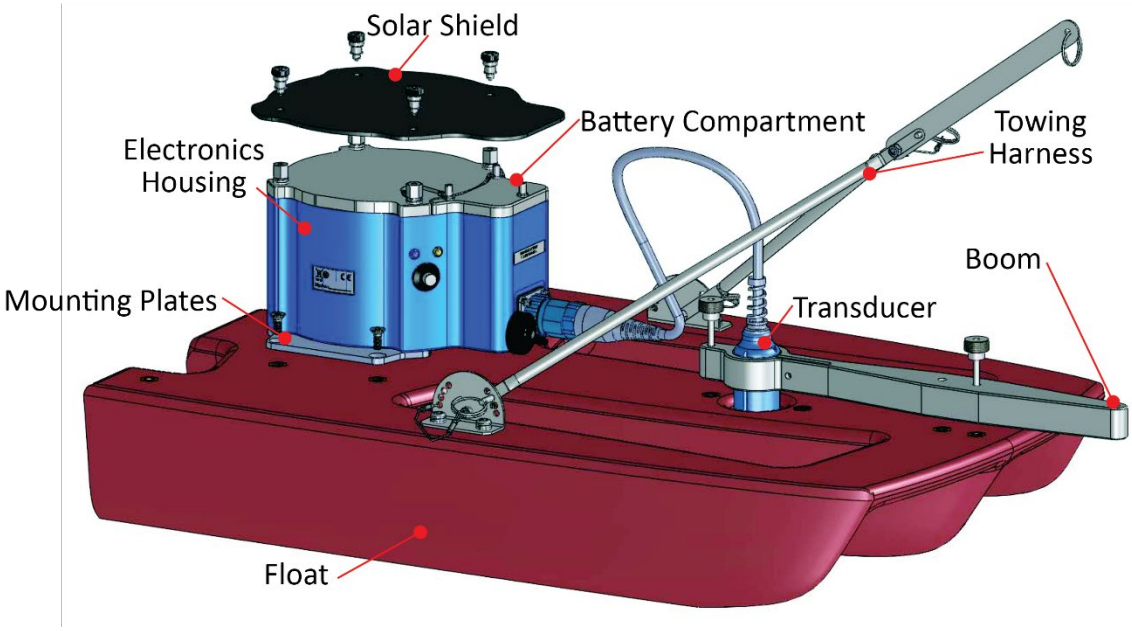


Figure 6. StreamPro ADCP Assembly – Boom in in-hull Position

The StreamPro's compass is in the Electronic Chassis. Beam 3 orientation is toward the power switch and the connector should be facing forward if the Electronic Chassis is mounted on a different tethered trimaran/boat.

Attaching the Electronic Housing

To attach the electronic housing to the tethered trimaran:

1. Attach the mounting plates to the electronic housing using the four flat head screws.
2. Attach the mounting plates to the tethered trimaran using the four flat head screws. The I/O cable connector should be facing toward the front of the tethered trimaran.

The electronic housing may be pre-installed.

Attaching / Removing the Solar Shield

To attach the solar shield:

1. Attach the solar shield to the standoff bolts on the electric housing cover plate using the attached thumbscrews.
2. Tighten the thumbscrews “finger tight”. Do not over tighten.

It is important to only gently finger tighten the sunshield screws when placing the sunshield back on the electronic housing M6 standoff bolts. Should any movement occur on the M6 standoff bolts due to over tightening the sun shield screws, the Loctite seal will be broken, and thus allowing the M6 standoff bolts to subsequently become loose (see Figure 7).

To remove the solar shield:

1. Remove the solar shield by loosening the attached thumbscrews connected to the M6 standoff bolts on the electric housing cover plate.
2. Lift the shield off of the M6 standoff bolts.

Removing the sunshield can possibly lead to the four M6 standoff bolts on the top of the electronic housing to become loose, and therefore compromising the water seal integrity. **Always check that the M6 standoff bolts that the solar shield attaches to are secure** (see Figure 7).

If one or more of the M6 standoff bolts are loose, remove the cover plate and check the O-ring condition (see Replacing the Electronic Housing O-Ring).

Only loosen the thumbscrews enough to remove the solar shield – do not remove the thumbscrews from the shield.

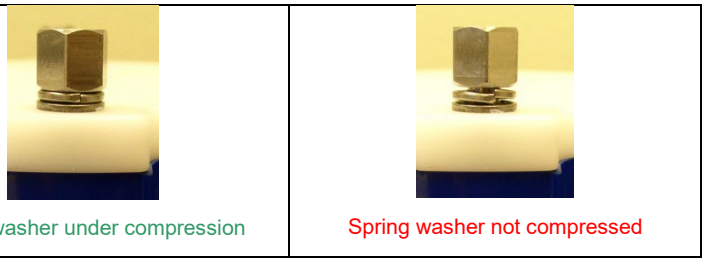


Figure 7. M6 Standoff Bolt on Electronic Housing Cover Plate

Assembling the Boom

To attach the boom to the tethered trimaran:

1. Loosen the clamp thumbscrew on the boom. Feed the transducer cable up through the bottom of the clamp.
2. Attach the transducer cable to the electronics housing. To make the connection, remove the protective cap from the receptacle on the electronics housing. Insert the cable connector into the receptacle, 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 coupling ring onto the receptacle **until it clicks** to complete the connection.

Do NOT turn the coupling ring any further once it clicks into place. Over-tightening the coupling ring will cause the locking teeth to break.

Do NOT use any tools to tighten the coupling ring. It should only be “finger tight”.

When fully seated and locked, the coupling ring is NOT flush against the transducer housing. This is normal.

3. Attach the boom to the tethered trimaran using the supplied thumbscrews. The boom can be installed in the in-hull or extended positions. For fast moving water or where there is a chance of the transducer hitting rocks, use the in-hull position. Slow moving streams can use the extended position. For either position, make sure the embossed arrow on the top edge of the transducer is pointing to the front of the tethered trimaran (see Figure 10).

Transducers manufactured prior to August 2009 use a counterweight. If you mounted the boom in the in-hull position, attach the counterweight to the front thumbscrew. This helps balance the tethered trimaran.

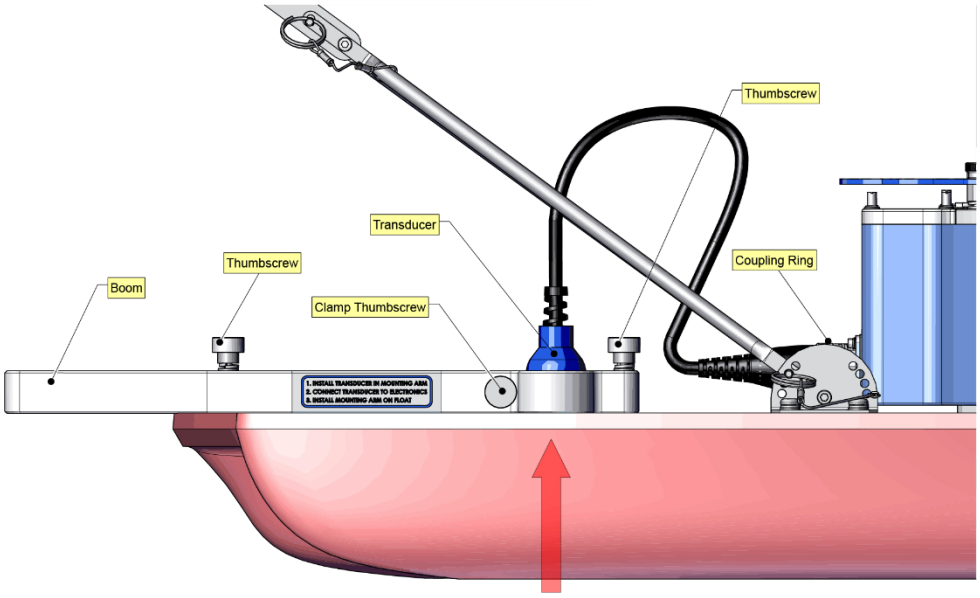


Figure 8. In-Hull Position

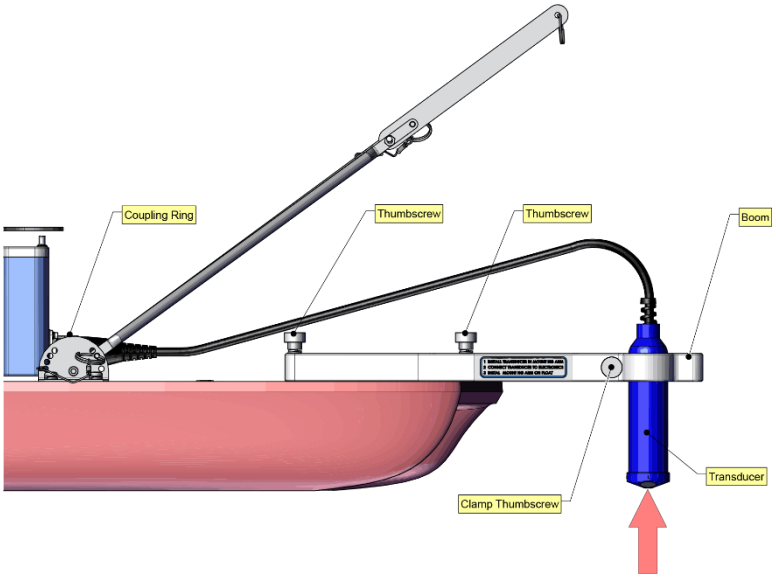


Figure 9. Extended Position

Adjusting the StreamPro Transducer

To adjust the transducer angle and depth:

1. Locate the embossed arrow on the top edge of the transducer and rotate the transducer so that the arrow is pointing to the front of the tethered trimaran.

Beam 3 should remain pointed forward and at the 45-degrees angle for both the in-hull and extended positions.

Transducers manufactured prior to August 2009 are not keyed. If the transducer is not keyed, locate the embossed number three on the edge of the transducer. This identifies Beam 3. Rotate the transducer so that Beam 3 is forward and at a 45-degree angle to the tethered trimaran.

The StreamPro's compass is in the Electronic Chassis. Beam 3 orientation is toward the power switch and the connector should be facing forward if the Electronic Chassis is mounted on a different tethered trimaran/boat.

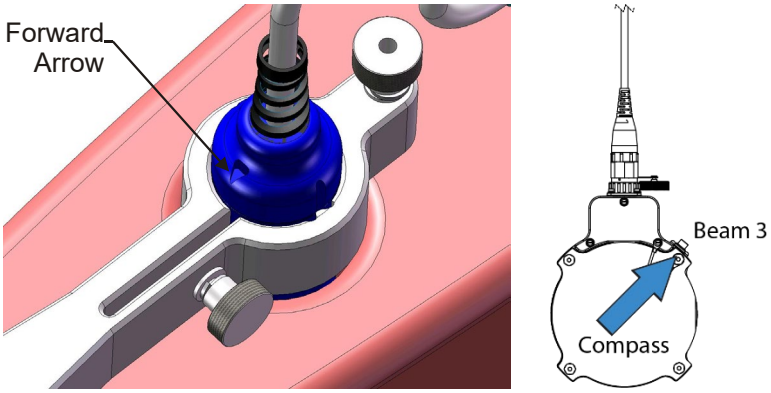


Figure 10. Forward Mark on Transducer

Make sure the arrow is pointing to the front of the tethered trimaran to ensure that Beam 3 is pointed forward and at the 45-degrees angle for both the in-hull and extended positions.

2. For the in-hull position, the transducer needs to be pushed into the arm until the line is as shown Figure 11. This will ensure the transducer is recessed approximately 5mm. This helps protect the transducer; it will not be damaged if it is dragged along the ground.

   For the extended position (see Figure 12), adjust the transducer depth as shallow as possible.

3. Tighten the clamp thumbscrew to hold the transducer in place.

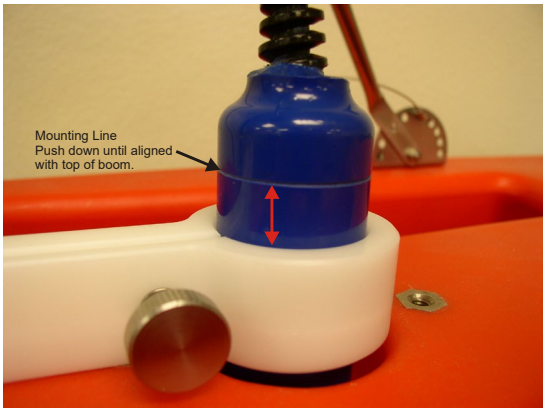


Figure 11. Transducer Adjustment for In-Hull

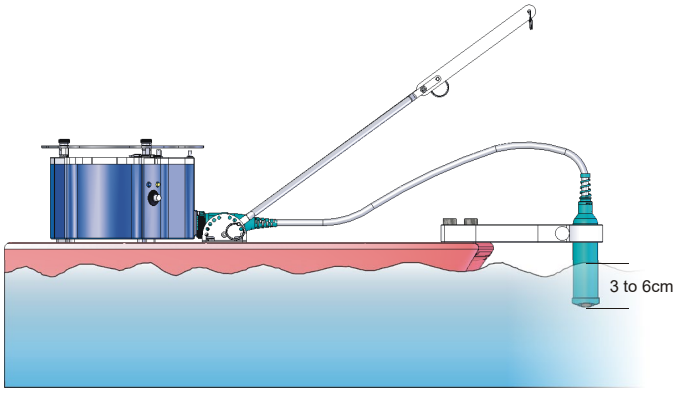


Figure 12. Transducer Adjustment for Extended Boom

Adjusting the Towing Harness Angle

To adjust the towing harness:

1. Attach the towing harness to the tethered trimaran using the four provided screws, split washers, and flat washers.
2. Adjust the angle of the towing harness as needed by pulling both pins and lifting the arm. Make sure both pins are engaged and equally positioned.

> The towing harness may be pre-installed.

Storing the StreamPro ADCP

Store the StreamPro in the original shipping crate whenever possible:

1. Remove the batteries from the battery holder.
2. Remove the transducer from the boom arm and disconnect the transducer cable. Place the protective cap on the electronic housing transducer cable connector.
3. Dissemble the boom arm from the tethered trimaran.
4. Place the transducer and boom arm in the foam cutouts in the bottom of the shipping case.
5. The electronic housing/tethered trimaran assembly fits in the case with the electronic housing held in place by the cutout in the foam. Use the other cutout to store the manuals and spare parts.

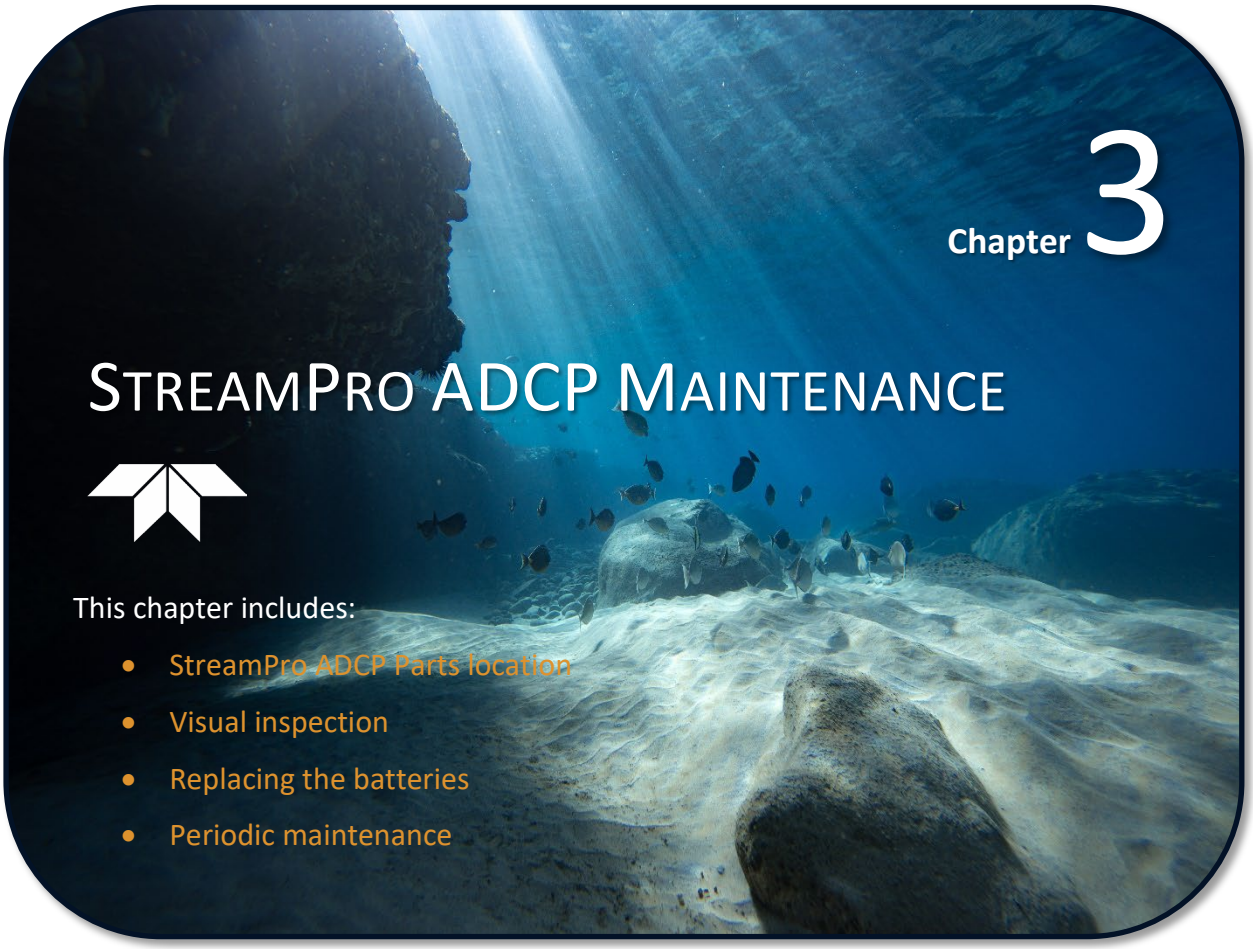
Figure 13. StreamPro Shipping Case

Always dry the StreamPro before placing it in the storage case to avoid fungus or mold growth. Do not store the StreamPro ADCP in wet or damp locations.

Do not leave the batteries inside the StreamPro ADCP 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).

The protective cap should be installed any time the transducer cable is removed. Use the cap when the StreamPro is in storage or is being handled.

NOTES



Chapter 3

StreamPro ADCP Maintenance

This chapter includes:

- StreamPro ADCP Parts location
- Visual inspection
- Replacing the batteries
- Periodic maintenance

StreamPro ADCP Parts Locations

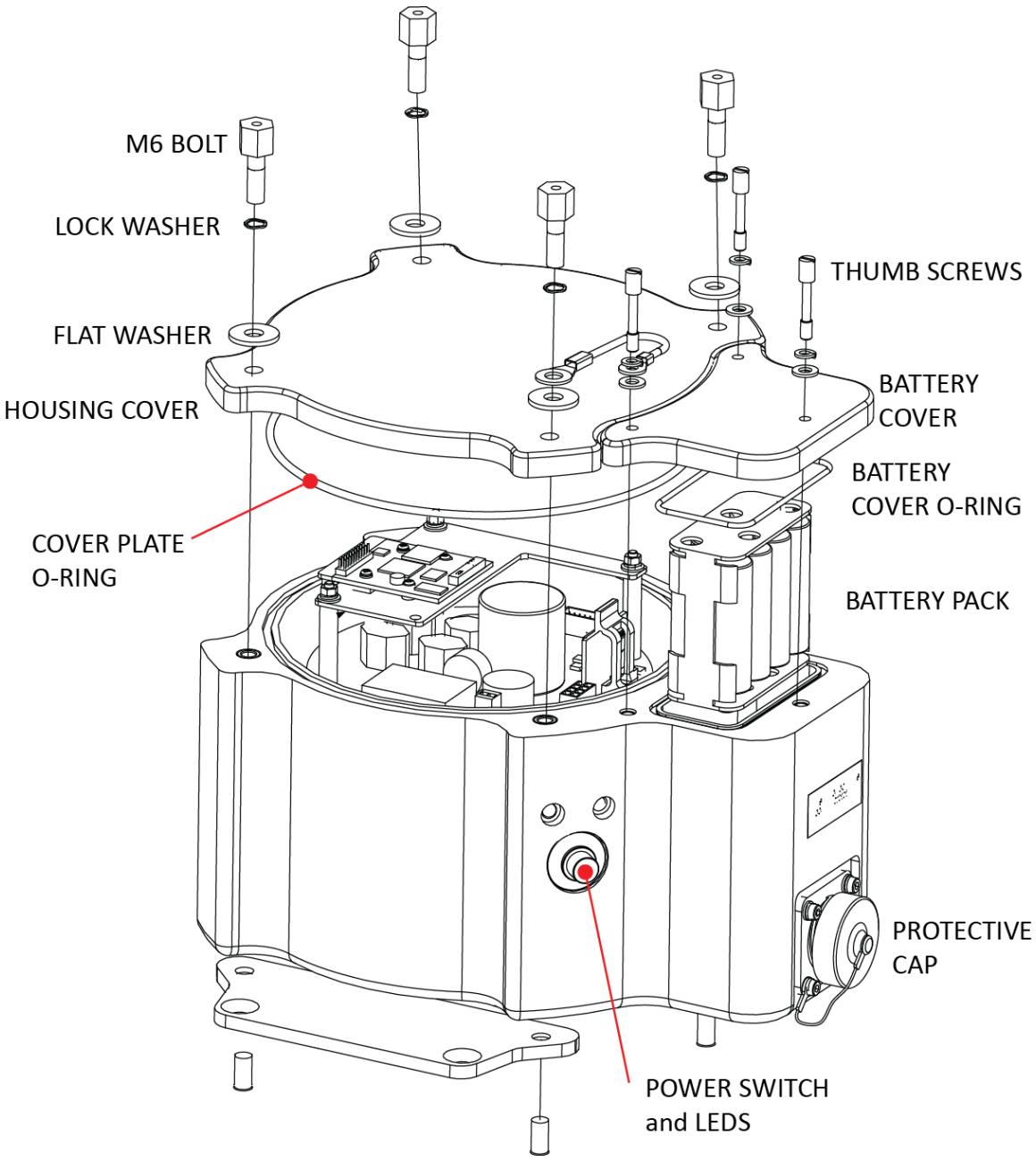


Figure 14. StreamPro ADCP Electronic Housing Assembly

Spare Parts

The following parts are included in the spare parts kit.

Table 1: Spare Parts

Description	Part number	Where Used
O-ring, housing cover, 2-162	97Z-6033-00	Replacing the Electronic Housing O-Ring
O-ring, battery cover, 2-036	97Z-6025-00	Replacing the Battery Compartment O-Ring
Silicone Lubricant	5020	O-ring replacement
Battery Holder, 8 AA Cells	12BH381	Replacing Batteries
Thumb Screw, M4	81B-4018-00	Battery cover
Washer, Small OD, 8MM SST	M4WASHSMOD	Electronic chassis cover plate
Washer, Split Lock, SST	M4WASHSPL	Electronic chassis cover plate

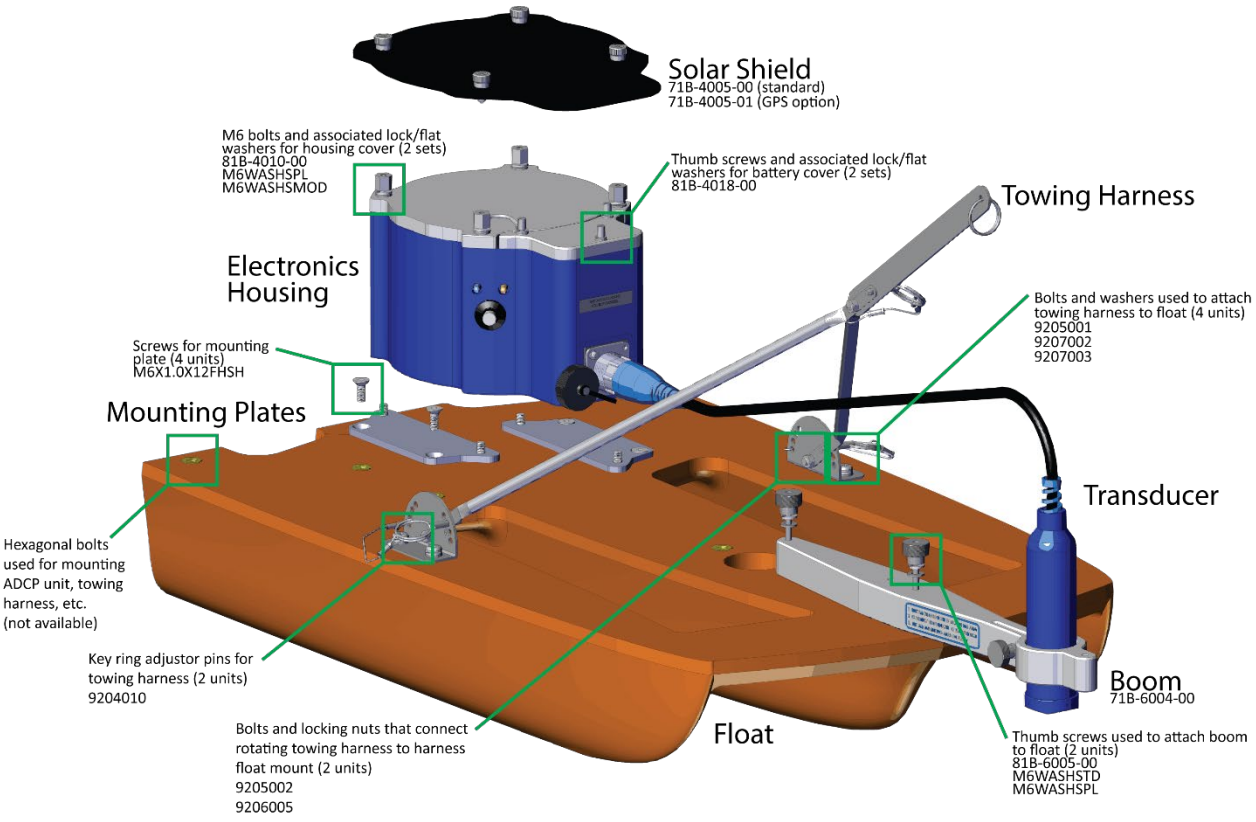


Figure 15. Replaceable Parts

Replacing Batteries

The StreamPro requires 12 VDC nominal. Use eight AA Alkaline batteries or eight AA Rechargeable Nickel-metal hydride batteries. For the longest continuous operation time, use eight AA Lithium batteries (see Table 29).

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 (See battery exp. Date)

Do not leave the batteries inside the StreamPro ADCP 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).

When using eight AA cells, check that the battery voltage is above 11.5 Volts DC. StreamPro ADCPs will work at 11.5 volts; however, batteries with voltages below 11.5 volts are at or near their end of life and are approaching uselessness.

A blinking amber LED indicates the battery level is low.

To replace the batteries:

1. Turn the power switch OFF.
2. Remove the solar shield by loosening the four thumbscrews.
3. Open the battery compartment door by loosening the three thumbscrews.

   Only loosen the thumbscrews enough to remove the cover – do not remove the thumbscrews from the battery cover.

4. Remove the battery holder.
5. Remove all the old batteries.
6. Replace with eight new Alkaline AA batteries. Match the battery polarity as shown on the battery holder.
7. Observe that the inside of the battery housing area is dry and clean. Thoroughly clean both the cover plate and the blue surface area around the O-ring.
8. Place the battery holder in the housing making sure the battery contacts on the holder match the two springs inside the housing (see Figure 16).
9. The battery compartment O-ring is normally held in place because the groove it sits in is dove-tailed. Should the O-ring ever fall out or it appears dry or hard, replace it and apply the smallest amount possible of the silicone lubricant included in the tool kit. Beware that too much lubricant attracts dirt; therefore, apply it exceedingly sparingly. Use a lint free cloth to remove any excess lubricant (see Replacing the Battery Compartment O-Ring).
10. Close the battery compartment door and tighten the thumbscrews. As you tighten all three thumbscrews, tilt the housing to see that the O-ring has not moved out of the O-ring slot (see Figure 17). Tighten all three thumbscrews in rotation a couple turns at a time so that the cover comes down evenly and squarely on the housing. Only tighten the battery cover thumbscrews finger tight.

Although each thumbscrew has a screwdriver slot, do NOT use any tools to tighten the screws. Over-tightening can cause the threads to strip.

11. Replace the solar shield (see Attaching / Removing the Solar Shield).
12. Align the compass.

The compass must be aligned each time the batteries are replaced. See the WinRiver or SxS Pro Software User's Guide for details on aligning the compass.

Figure 16. StreamPro Battery Replacement

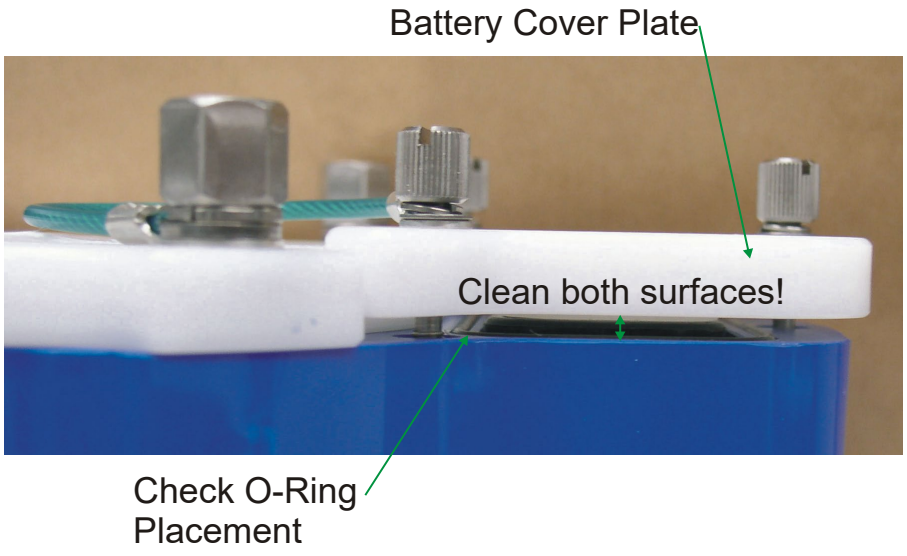


Figure 17. Closing the Battery Cover

Periodic Maintenance

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 your 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. With proper care, general maintenance, and this routine service period, you will ensure that the StreamPro ADCP lasts for a minimum of 10 years with no loss in performance.

Firmware Installation

The firmware for StreamPro systems can be downloaded from https://tm-portal.force.com/TMsoftware-portal.

To establish communications with the StreamPro ADCP:

1. Download and unzip the firmware file. The file name will be *SProXX.xx.zip* where XX.xx is the firmware version.
2. Plug in the SD1000U device to a USB port and use *Windows Device Manager*® to determine the Com port.

For instructions on using the USB Bluetooth device, see the WinRiver II Software User's Guide and the instructions included with the device.

When WinRiver II is installed, shortcuts to the WinRiver II Software User's Guide and quick reference cards are added to the Windows Start menu.

3. Start the *TRDI Toolz* software.
4. Select **New Serial Connection**.
5. Enter the ADCP's communication settings. Select the **COM Port** the Bluetooth is connected to and set the **Baud Rate** (115200) from the drop-down lists.
6. Click the **Connect** button. Once connected, the button will change to **Disconnect**.
7. Click the **Break** ( ) button. From the **Break** button drop down menu, select **Soft Break** (= = =). The wakeup banner will display in the terminal window.


```
StreamPro ADCP
Teledyne RD Instruments (c) 2023
All rights reserved.
Firmware Version: 31.xx

>?
```

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

```
>{¡ɿφ²∩⅄⅄²²jñ~ªñδgJ Checking 9600 baud rate
Checking 115200 baud rate
==
StreamPro ADCP
Teledyne RD Instruments (c) 2023
All rights reserved.
Firmware Version: 31.xx

>
```

8. Click **Tools**, **Firmware Update**.
9. Select the **.m0* firmware update file downloaded in step 1.
10. If the new firmware does not install, contact Customer 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 the WinRiver II User's Guide for Compass Calibration procedure)
Heading (Field Post-Deploy)	Field Compass Verification performed **post each deployment**

Compass drift effects will accumulate over time. TRDI recommends a factory calibration be done every two to three years. Expect to have more error (due to drift) if a longer period is between factory calibrations.

Visual Inspection of the StreamPro

Inspect the StreamPro using Table 2 and Figure 1. If you find any discrepancies, call TRDI for instructions. Repair of the transducer faces or connector should only be done by TRDI.

Table 2: Visual Inspection Criteria

Item	Inspection Criteria
Transducer	The urethane coating is important to StreamPro 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. **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. Replace the electronic chassis cover O-ring each time the cover is removed. The battery pack cover O-ring should be cleaned whenever the battery cover is opened and replaced **BEFORE** it is showing any signs of wear and tear. **All O-rings should be replaced every one to two years maximum.**
Housing	Inspect for damage and **remove biofouling before each deployment**.
Hardware (bolts, etc.)	Check all bolts, washers, and split washers for signs of corrosion before each deployment. **TRDI recommends replacement every one to two years maximum.** Damaged hardware should never be used.

Item	Inspection Criteria
Cables and Connectors	Check the transducer connector for cracks or bent pins before each deployment. Check the transducer cable for cracks or bent pins. Inspect the full length of the cable for cuts, nicks in the insulation, and exposed conductors **before each deployment**.

Never set the transducer on a rough surface; always use foam padding to protect the transducer.

Figure 18. StreamPro Transducer Assembly and Cable Connector

The Transducer assembly is a molded one-piece unit. Do not attempt to dissemble or remove the cable from the transducer. The cable connector on the electronic housing is a factory-installed item. TRDI does not recommend removing it for any routine maintenance.

The cable connector is keyed to ensure proper connection.

The protective cap should be installed on the connector any time the cable is removed from the electronic housing. Use the cap when the StreamPro is in storage or is being handled.

Removing Biofouling

Before storing or shipping the StreamPro, remove all foreign matter and biofouling. Remove soft-bodied marine growth or foreign matter with soapy water. Waterless hand cleaners remove most petroleum-based fouling. Rinse with fresh water to remove soap residue. Dry the transducer faces with low-pressure compressed air or soft lint-free towels. Dry the tethered trimaran and electronics housing with towels.

The urethane coating on the transducer faces is easily damaged. 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.

Always dry the StreamPro before placing it in the storage case to avoid fungus or mold growth. Do not store the StreamPro ADCP in wet or damp locations.

Replacing the Battery Compartment O-Ring

The battery compartment O-ring is normally held in place because the groove it sits in is dovetailed. Should the O-ring ever fall out or it appears dry or hard, replace it.

To replace the Battery Compartment O-Ring:

1. Turn the power switch OFF.
2. Remove the solar shield by loosening the four thumbscrews.
3. Open the battery compartment door by loosening the thumbscrews.
4. 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 StreamPro to flood.

5. Clean and inspect the O-ring groove and the surface around the O-ring. Be sure the groove is free of foreign matter, scratches, indentations, corrosion, and pitting. Run your fingernail across damaged areas. If you cannot feel the defect, the damage may be minor; otherwise, the damage may need repair. Clean the battery cover plate with a lint free cloth.

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

6. 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.

   Be aware that too much lubricant attracts dirt; therefore apply it exceedingly sparingly. Use a lint free cloth to remove any excess lubricant.

7. Check that the battery compartment O-ring is in the O-ring groove (see Figure 17).
8. Close the battery compartment door and tighten the thumbscrew. Only tighten the battery cover thumbscrews finger tight.

   Although each thumbscrew has a screwdriver slot, do NOT use any tools to tighten the screws. Over-tightening can cause the threads to strip.

Replacing the Electronic Housing O-Ring

The electronic housing O-Ring should be replaced whenever the electronic housing is opened or every three years.

Follow all the steps for the electronic housing O-Ring replacement. The watertight integrity of the StreamPro depends on this seal.

To Remove the Cover Plate:

1. Turn the power switch OFF.
2. Remove the transducer cable and place the cap on the cable connector (see Transducer Assembly).
3. Remove the solar shield by loosening the four thumbscrews.
4. Open the battery compartment door and remove the battery pack (see Battery Replacement).
5. Loosen (do not remove) the four standoff bolts (M6) to vent the system.
6. Once all four bolts have been loosened, remove the four bolts that attach the housing cover to the housing assembly. Check inside the housing for any discoloration or water damage. If in doubt, contact TRDI.

To replace the O-Ring:

1. Clean the O-ring mating surfaces with a soft, lint-free cloth. Inspect the surfaces for damage.
2. 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 StreamPro to flood.

3. Clean and inspect the O-ring groove. Be sure the groove is free of foreign matter, scratches, indentations, corrosion, and pitting. Run your fingernail across damaged areas. If you cannot feel the defect, the damage may be minor; otherwise, the damage may need repair.

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

4. If a scratch is on the plastic housing flange O-ring groove, it may be gently sanded using 600-grit (wet) sandpaper. Use care not to cause further damage.
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. Place the O-Ring into the O-Ring 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.

To replace the Electronic Housing Cover Plate:

1. Gently place the cover onto the housing assembly, aligning the mating holes. When mating the cover with the housing flange try to apply equal pressure to all parts of the O-ring. Make sure the O-ring remains in the retaining groove.

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

2. Examine the housing assembly standoff bolts, split washer, and flat washers (M6) for corrosion: replace if necessary. All hardware items are needed to seal the StreamPro properly.
3. Place one drop of Loctite 425 on the M6 standoff bolts during reassembly.
4. Install all four sets of hardware until “finger tight.”
5. Tighten the standoff bolts in small increments until there is no gap between the cover plate and housing, and then tighten each standoff bolt ¼ turn more to compress the face seal O-ring evenly. Tighten the M6 standoff bolts to 10 pound-inch (1.13 Nm).

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

Do not over tighten the bolts that hold the cover plate and housing together. If you tighten too much, you can crack or deform the plastic cover. On the other hand, leaving the bolts too loose can cause the system to flood. Tighten the M6 standoff bolts to 10 pound-inch (1.13 Nm).

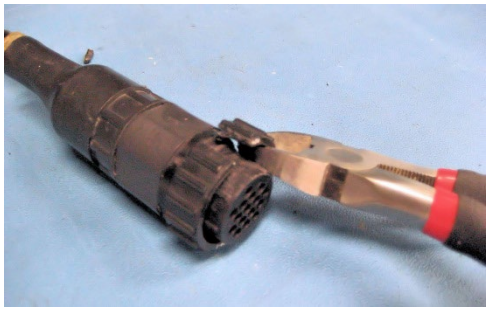
6. Slide the battery pack into the compartment and check that the battery compartment O-ring is in the retaining groove. Close and tighten the battery compartment door.

Transducer Cable Connector Repair

The locking teeth on the transducer cable coupling ring can become stripped, making it difficult or impossible to make a watertight connection to the StreamPro electronic housing. Spare coupling rings are available for purchase: AMP/Tyco Electronics, Coupling Ring Shell size 17, part number 925485-1 (CPC-KUPPLUNGSRING).

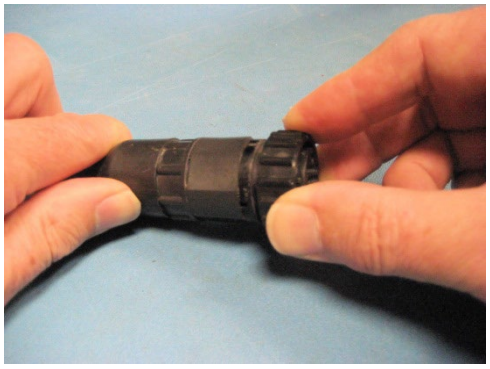
To replace the transducer cable coupling ring:

1. Cut off the old coupling ring using a sharp wire cutter.



Wear eye protection! Do not damage the pins.

2. Clean off any dirt/residue from the transducer cable connector.
3. Push the new locking ring onto the connector.



4. The cable is now ready to be connected to the electronics housing.

Chapter 4

RETURNING SYSTEMS TO TRDI FOR SERVICE

This chapter includes:

- How to pack and ship the ADCP
- How to get a RMA number
- Where to send your ADCP for repair

Shipping the ADCP

This section explains how to ship the StreamPro ADCP.

Remove all customer-applied coatings or provide certification that the coating is nontoxic if you are shipping a StreamPro ADCP 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 you return the equipment 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 you cannot provide certification, we will return the equipment to you or to a customer-specified cleaning facility. All costs associated with customer-applied coatings will be at the customer's expense.

When shipping the StreamPro 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 StreamPro ADCP.

If you need to ship the StreamPro 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 from 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 StreamPro ADCP by model and serial number.

Returning Systems to the TRDI Factory

When shipping the system to TRDI from either inside or outside the United States, the following instructions will help ensure the StreamPro 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 your 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

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 you ship 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 you are 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 Factory

When shipping the system to TRDI Europe, the following instructions will help ensure the StreamPro 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 your 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

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

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 you ship 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.

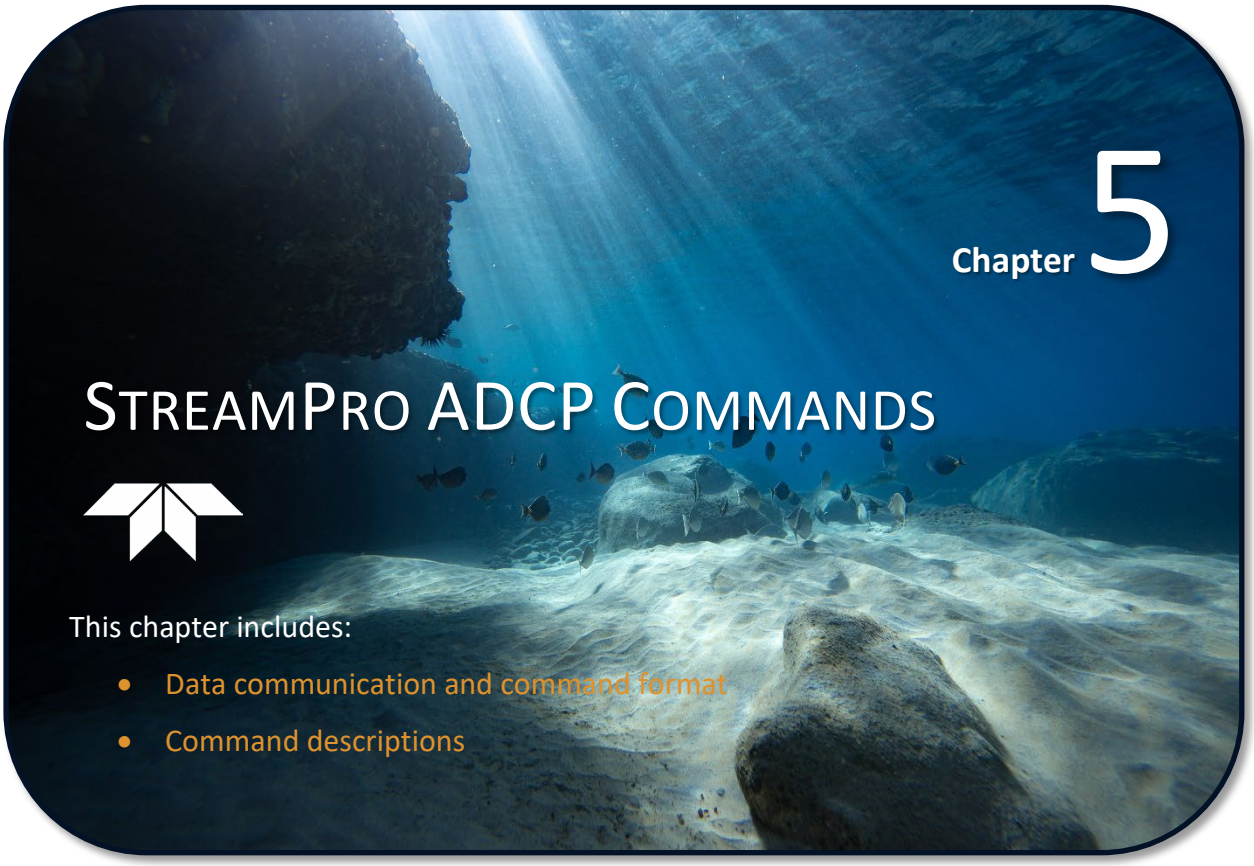
Step 5 - Send the Following Information by Telephone to TRDI

Attention: Sales Administration

Phone: +33(0) 492-110-930

- Detailed descriptions of what you are 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 5

StreamPro ADCP Commands

This chapter includes:

- Data communication and command format
- Command descriptions

This section defines the commands used by the StreamPro ADCPs. These commands let you set up and control the StreamPro. The commands directly affect the range of the StreamPro and the standard deviation (accuracy) of the data. Most StreamPro settings use factory-set values. If you change these values without thought, you could ruin your deployment. *Be sure you know what effect each command has before using it*. Call TRDI if you do not understand the function of any command.

Data Communication and Command Format

You can enter commands with an Windows® compatible computer with a Bluetooth interface running TRDI's *BBTalk*. The StreamPro communicates with the computer through the Bluetooth interface.

Immediately after you apply power to the StreamPro, it enters the standby mode. Send a = = = signal using *BBTalk*. When the StreamPro receives a = = = signal, it responds with a wake-up message similar to the one shown below. The StreamPro is now ready to accept commands at the ">" prompt.

```
StreamPro ADCP
Teledyne RD Instruments (c) 2012
All rights reserved.
Firmware Version: 31.xx

>
```

Command Input Processing

Input commands set StreamPro 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,

```
>WP0001<CR> [Your input]
```

If the entered command is valid, the StreamPro executes the command. If the command is one that does not provide output data, the StreamPro sends a carriage return line feed <CR> <LF> and displays a new ">" prompt. Continuing the example,

```
>WP00001<CR>     [Your original input]
>                [StreamPro response to a valid, no-output command]
```

If you enter a valid command that produces output data, the StreamPro 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 StreamPro responds with an error message similar to the following.

```
>WPA<CR>                                    [Your input]
>WPA  ERR 002:  NUMBER EXPECTED<CR><LF>     [StreamPro response]
>
```

After correctly entering all the commands for your application, you would send the CS-command to begin the data collection cycle.

Data Output Processing

After the StreamPro 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. A data ensemble can contain header, leader, velocity, correlation magnitude, echo intensity, and percent good.

StreamPro output data can be in either hexadecimal-ASCII (Hex-ASCII) or binary format. The Hex-ASCII mode is useful when you use a terminal to communicate with, and view data from the StreamPro. The binary mode is useful for high-speed communication with a computer program. You would not use the binary mode to view data on a terminal because the terminal could interpret some binary data as control codes.

All of Teledyne RD Instruments' software supports binary PD0 Output Data Format only.

When data collection begins, the StreamPro uses the settings last entered (user settings) or the factory-default settings. The same settings are used for the entire deployment.

The StreamPro automatically stores the last set of commands used in RAM. The StreamPro will continue to be configured from RAM until it receives a CR-command or until the RAM loses its backup power. If the StreamPro receives a CR0 it will load into RAM the command set you last stored in non-volatile memory (semi-permanent user settings) through the CK-command. If the StreamPro receives a CR1, it will load into RAM the factory default command set stored in ROM (permanent or factory settings).

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 StreamPro uses it to set a processing value (time, range, percentage, processing flags). All measurement values are in metric units (mm, cm, and dm).

Miscellaneous Commands

? – Help Menus

Purpose — Lists the major help groups.

Format — *x*? (see description)

Description — Entering a "?" by itself displays all command groups. To display help for one command group, enter x?, where *x* is the command group you wish to view. When the StreamPro 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.

```
>?
Available Commands:

C ---------- Control
E ---------- Environment
P ---------- Performance
T ---------- Time
W ---------- Water Profiling
? ---------- This Menu
```

V - Display Banner

Purpose Displays the banner.

Format V?

Recommended Setting. Use as needed.

Description Displays the banner with firmware version information.

Example See below

```
>V?
V ---------- Display Banner
>V
StreamPro
Teledyne RD Instruments (c) 2009
All rights reserved.
Firmware Version: 31.xx
```

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 the StreamPro Software User's Guide for information on how to install additional capability in your StreamPro.

Examples See below.

```
>OL                      FEATURES
------------------------------------------------------------
Feature                                              Installed
------------------------------------------------------------
Bottom Track                                             Yes
Water Profile                                            Yes
Long Range Profile                                       No
SxS                                                      No

See your technical manual or contact TRDI for information on
how to install additional capability in your StreamPro.

>
```

Control System Commands

The StreamPro uses the following commands to control certain system parameters.

CK - Keep Parameters

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 StreamPro maintains data stored in the non-volatile memory (user settings) even if power is lost. It does not need a battery. You can recall parameters stored in non-volatile memory with the CR0-command.

CR – Retrieve Parameters

Purpose Resets the StreamPro command set to factory settings.

Format CR*n*

Range *n* = 0 (User), 1 (Factory)

Recommended Setting. Use as needed.

Description The StreamPro automatically stores the last set of commands used in RAM. The StreamPro will continue to be configured from RAM unless it receives a CR-command or until the RAM loses its power.

Table 3: Retrieve Parameters

Format	Description
CR0	Loads into RAM the command set last stored in non-volatile memory (user settings) using the CK Command.
CR1	Loads into RAM the factory default command set stored in ROM (factory settings).

CS – Start Pinging (Go)

Purpose Starts the data collection cycle.

Format CS

Recommended Setting. Use as needed. Use *WinRiver II* 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 StreamPro to start pinging its transducers and collecting data as programmed by the other commands.

After a CS-command is sent to the StreamPro, no changes to the commands can occur until a = = = is sent.

Environmental Commands

The StreamPro uses the following commands to control the environmental and positional information that affects internal data processing.

EB - Heading Bias

Purpose — Corrects for electrical/magnetic bias between the ADCP heading value and the heading reference.

Format — EB±*nnnnn*

Range — ±*nnnnn* = -17999 to 18000 (-179.99 to 180.00 degrees)

Default — EB00000

> Recommended Setting. Use EB to counteract the effects of magnetic declination at the deployment site. Set using *WinRiver*.

Description — EB is the heading angle that counteracts the electrical bias or magnetic declination between the ADCP and the heading source.

Examples — 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 ADCP data processing.

Format — EC*nnnn*

Range — *nnnn* = 1400 to 1600 meters per second

Default — EC1500

> Recommended Setting. The default setting for this command is recommended for most applications.

Description — EC sets the sound speed value used by the ADCP to scale velocity data, depth cell size, and range to the bottom. The ADCP 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 = 1, the ADCP 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 ADCP transducer depth.

Format — ED*nnnnn*

Range — *nnnnn* = 0 to 200 decimeters (meters x 10)

Default — ED00000

> Recommended Setting. Set using WinRiver II.

Description ED sets the ADCP transducer depth. This measurement is taken from water level to the transducer faces. The ADCP uses ED in its speed of sound calculations. The ADCP assumes the speed of sound reading is taken at the transducer head. See the primer for information on speed of sound calculations.

Note If the EZ *Transducer Depth* field = 1, the ADCP overrides the manually set ED value and uses depth from the internal pressure sensor. If a pressure sensor is not available, the ADCP uses the manual ED setting.

EH - Heading

Purpose Sets the ADCP heading angle.

Format EH*nnnnn*

Range *nnnnn* = 0 to 35999 (000.00 to 359.99 degrees)

Recommended Setting. Use the EZ-command.

Description EH sets the ADCP heading angle of beam 3. When mounted on a stationary platform, the ADCP 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 = one, the ADCP overrides the manually set EH value and uses heading from the transducer's internal sensor. If the sensor is not available, the ADCP uses the manual EH setting.

EP - Pitch (Tilt 1)

Purpose Sets the ADCP pitch (tilt 1) angle.

Format EP±*nnnn*

Range ±*nnnn* = -6000 to 6000 (-60.00 to +60.00 degrees)

Recommended Setting. Use the EZ-command.

Description EP sets the ADCP pitch (tilt 1) angle. The Pitch and Roll axes are the instruments axes of the transducer.

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 ADCP overrides the manually set EP value and uses pitch from the transducer's internal tilt sensor. If the sensor is not available, the ADCP uses the manual EP setting.

ER - Roll (Tilt 2)

Purpose Sets the ADCP roll (tilt 2) angle.

Format ER±*nnnn*

Range ±*nnnn* = -6000 to 6000 (-60.00 to +60.00 degrees)

Recommended Setting. Use the EZ-command.

Description ER sets the ADCP roll (tilt 2) angle. The Pitch and Roll axes are the instruments axes of the transducer.

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 = one, the ADCP overrides the manually set ER value and uses roll from the transducer's internal tilt sensor. If the sensor is not available, the ADCP uses the manual ER setting.

ES – Salinity

Purpose Sets the water's salinity value.

Format ES*nn*

Range *nn* = 0 to 45

Default ES0

Recommended Setting. The default setting for this command is recommended for most applications.

Description ES sets the water's salinity value. The StreamPro uses ES in its speed of sound calculations. The StreamPro 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* = -5.00 C to +40.00 C

Default ET2500

Recommended Setting. Use the EZ-command.

Description ET sets the temperature value of the water. The ADCP uses ET in its speed of sound calculations (see the primer). The ADCP 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
```

Note If the EZ Temperature field = one, the ADCP overrides the manually set ET value and uses temperature from the transducer's temperature sensor. If the sensor is not available, the ADCP uses the manual ET setting.

EX – Coordinate Transformation

Purpose Sets the coordinate transformation processing flags.

Format EX*nnnnn*

Range EX00xxx or EX01xxx (where x = don't care, 0=off, and 1=on)

Default EX01xx0 (Do not use compass)
EX101x1 (Use compass (optional compass is installed))

Recommended Setting. 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 4: 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 ADCP. Heading/Pitch/Roll not applied.
EX10xxx	Ship coordinates (Note 1) X, Y, Z vectors relative to the ship. Heading not applied. If Bit 3 of the EX-command is a 1, then Pitch/Roll applied.
EX11xxx	Transformation to Earth is supported.
EXxx1xx	Apply tilt in rotation matrix.
EXxxx1x	N/A
EXxxxx1	Allow bin mapping.

Each StreamPro 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 instrument coordinates. If you output beam-coordinate data, you will need to apply the beam corrections yourself if you want the best possible data.

EZ - Sensor Source

Purpose Selects the source of environmental sensor data.

Format EZ*CxHPRxT*

Default EZ1x000x1 (where x = don't care, 0 = off, and 1 = on)
EZ1x111x1 (optional compass selected)

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 ADCP to use data from a manual setting or from an associated sensor. When a switch value is non-zero, the ADCP overrides the manual E-command setting and uses data from the appropriate sensor. If no sensor is available, the ADCP defaults to the manual E-command setting. The following table shows how to interpret the sensor source switch settings.

Example See below

```
EZ 1011101 -- Sensor {CxHPRxT}
```

Table 5: Sensor Source Switch Settings

	Field	Value = 0	Value = 1
C	Speed Of Sound	Manual EC	Calculate using ED, ES, and ET
x	Depth	Manual ED	Manual ED
H	Heading	Manual EH	Optional Internal compass
P	Pitch (Tilt 1)	Manual EP	Optional Internal compass
R	Roll (Tilt 2)	Manual ER	Optional Internal compass
x	Salinity	Manual ES	Manual ES
T	Temperature	Manual ET	Internal Transducer Sensor

The EZ command will only allow the HPR fields to be enabled if the StreamPro has a compass.

Fault Log Commands

The StreamPro ADCP uses the following commands to aid in troubleshooting and testing.

LC – Clear Fault Log

Purpose Clears the fault log.

Format LC

Description Use this command to clear the fault log of all previous entries.

LD – Display Fault Log

Purpose Displays the fault log.

Format LD

Description Displaying the fault log will list why a built-in test failed. This may aid in troubleshooting.

Example

```
>LD  No faults recorded.
```

Table 6: Fault log Error Codes

Fault log	Description
ERR_SPURIOUSRESET	RESET
ERR_PGAFAIL	FPGA
ERR_FPGAVERSFAIL	WRONG FPGA VER
ERR_RTCBATTLO	RTC BATTERY LOW
ERR_RTCPWRFAIL	RTC POWER
ERR_RTCCALFAIL	RTC CAL
ERR_CLOCKSYNC	CLOCK SYNC
ERR_CLOCKDRIFT	CLOCK DRIFT
ERR_COMTIMEOUT	COM TIMEOUT
ERR_BUFTIMEOUT	BUFFER OUT
ERR_BLUETOOTHNOTDETECTED	BLUETOOTH NOT DETECTED
ERR_RAMFAULT	RAM FAULT
ERR_ROMFAULT	ROM FAULT
ERR_MALLOCFAIL_SP	SP MALLOC FAIL
ERR_MALLOCFAIL_ISM	ISM MALLOC FAIL
ERR_ISMWRONGTYPE	WRONG HPR INSTALLED
ERR_MALLOCFAIL_SPBT	SPBT MALLOC FAIL
ERR_MALLOCFAIL_CO	CO MALLOC FAIL
ERR_MALLOCFAIL_OW	OW MALLOC FAIL
ERR_GYROCOMFAIL	GYRO COM
ERR_GYROCSUMINV	GYRO CKSUM
ERR_COMPCOMFAIL	COMP COM
ERR_COMPCSUMINV	COMP CKSUM
ERR_TEMPINITFAIL	TEMP INIT
ERR_TEMPREADFAIL	TEMP READ
ERR_TEMPRANGE	TEMP RANGE
ERR_SYSCONFINV	SYS CONFIG
ERR_CMDPARMINV	CMD PARAMS
ERR_COMPARMINV	COM PARAMS
ERR_ISMNOTFOUND	ISM NOT FOUND
ERR_NOCODE	NO FAULTS RECORDED

Performance and Testing Commands

The StreamPro uses the following commands for calibration and testing.

PC – Built-in Tests

Purpose Sends/displays results of user-interactive system diagnostic tests.

Format PC*nnn*

Range *nnn* = 0, 2 (PC0 = Help menu; see below for others)

Recommended Setting. Use as needed.

Description This diagnostic test checks the sensor data.

Examples See below.

PC0 – Help Menu

Sending PC0 displays the help menu.

```
User Interactive, Built In Tests
--------------------------------
PC0 = Help
PC1 = Serial Number
PC2 = Sensor Data
```

PC1 – Display Serial Number and Firmware Version

PC1 displays the serial number and firmware version of the compass.

```
>pc1
PC1 Test

Part number      :SNR71B-1048-52
Serial number    :0x235D2F7B 0x00000067
Firmware version :45.03

>
```

PC2 – Display Heading, Pitch, Roll, and Orientation

Sending PC2 displays heading, pitch angle, roll angle, up/down orientation and attitude temperature in a repeating loop at approximately 0.5-sec update rate. Press any key to exit this command and return to the command prompt.

```
>pc2
PC2 Test
  Heading      Pitch      Roll Up
   212.26       3.55      0.40  0
   212.43       3.47      0.39  0
   212.63       3.36      0.46  0
   212.37       3.50      0.59  0
   212.38       3.53      0.47  0
```

The PC2 heading shows the raw (magnetic north) heading only. The EB command (Heading Bias) is not applied.

PS – Display System Parameters

Purpose Sends/displays StreamPro system configuration data.

Format PS*n*

Range *n* = 0, 3 (see description)

Recommended Setting. Use as needed.

Description See below.

PS0 – System Configuration

PS0 sends the StreamPro hardware/firmware information. For example, the output may look like this:

```
>ps0
   Serial Number:  672
       Frequency:  2000000 Hz
   Configuration:  4 BM, JANUS
      Beam Angle:  20 DEGREES
    CPU Firmware:  31.05_ER0r
    FPGA Version:  3.00.005
         Compass :  Not Installed

ROM_ID:   6B 00 00 00 3F 26 60 28
Part Num:
ROM_ID:   6F 00 00 00 8D BC 30 23
Part Num: PER72B-2006-00A
ROM_ID:   03 00 00 00 7C 09 CC 23
Part Num: DSP72B-2002-12C
ROM_ID:   D2 00 00 00 0E A2 92 23
Part Num: XDR82B-1003-0XC
ROM_ID:   B8 00 00 00 84 FC 52 23
Part Num: RCV72B-2003-12A
ROM_ID:   67 00 00 00 84 73 6B 23
Part Num: PIO72B-2001-12B

>
```

PS3 – Instrument Transformation Matrix

PS3 sends information about the transducer beams. The StreamPro uses this information in its coordinate-transformation calculations; for example, the output may look like this:

```
>ps3
-1.4619  1.4619  0.0000  0.0000
 0.0000  0.0000 -1.4619  1.4619
 0.2660  0.2660  0.2660  0.2660
 1.0337  1.0337  1.0337  1.0337
```

If the StreamPro has beam angle errors, they are reflected in the instrument transformation matrix. This matrix, when multiplied by the raw beam data gives currents in the *x*, *y*, *z*, and *e* directions.

PT - Built-In Tests

Purpose Sends/displays results of ADCP system diagnostic test.

Format PT*nnn*

Range *nnn* = 0 to 200 (PT0 = Help menu)

Recommended Setting. Use as needed.

Description These diagnostic tests check the major ADCP modules and signal paths.

PT0 - Help

The PT0 command displays the test menu (shown below). As implied by the note, adding 100 to the test number repeats the test continually until the StreamPro receives a = = =. Sending PT200 runs all tests continually until the StreamPro receives a = = =.

```
>pt0
Built In Tests
----------------
 PT0   = Help
 PT1   = NA
 PT2   = Show Sensors
 PT3   = Receive Path Test
 PT10n = auto (n) test repeat
 PT200 = auto cycle All tests
```

PT2 – Show Sensors

This test displays the values for ambient temperature sensor. This sensor is imbedded in the transducer head, and is used for water temperature reading.

```
>pt2
03/03/03 20:07:57.05  23.1875 C
```

PT3 - Receive Path

This test displays receive path characteristics. This test has three parts.

- Part 1 - The ADCP pings without transmitting and displays the result of an autocorrelation function performed over eight lag periods. Ideally, we should see high correlation at near-zero lags, and then see decorrelation as the lags get longer. High correlation values at longer lags indicate interference is present.
- Part 2 - The ADCP displays the hard limited duty cycle (should be near 50%).
- Part 3 - The ADCP displays the RSSI value.

```
>pt3
Mag (%)    Lag Bm1 Bm2 Bm3 Bm4
             0 100 100 100 100
             1  56  59  57  51
             2   9  18   8  10
             3   6   9   8   4
             4   3   3   5   2
             5   4   6   5   3
             6   9   8   6   9
             7   9   7   5  11
Sin Duty(%)     49  52  50  45
Cos Duty(%)     53  54  50  53
RSSI (counts)   71  62  59  86

>
```

Sensor Commands

The StreamPro uses the following commands for the sensors.

SA – Compass

Purpose Sets the Integrated Sensor Module (ISM) mode.

Format SAx

Range x = 0, 1, 2 (0 = help, 1 = Pass through Mode, 2 = ISM Module Info)

Default SA0002

Recommended Setting. The default setting for this command is recommended for most applications.

Description This command is used by the *StreamPro* and *WinRiver II* software programs.

Example See below

```
>sa?
SA 0002 ----- Compass Commands
>sa0

ISM Commands:
  SA0 ---------- Display ISM Commands
  SA1 ---------- Pass Through Mode
  SA2 ---------- ISM Module Info

>sa2
ISM Part Num: SNR71B-1048-52
ISM firmware version: 45.03
ISM serial number: 235D2F7B 00000067
```

SZ - Sensor Installed

Purpose Displays the sensors available.

Format SZ?

Range N/A

Default N/A

Recommended Setting. Use as needed.

Description Shows which sensors are installed.

Example See below

```
SZ?
SZ 200 ------ Sensor Installed [Compass, Temperature, GPS]
```

Timing Commands

The following commands let you set the timing of various profiling functions.

TS – Set Real-Time Clock

Purpose Sets the StreamPro'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 *WinRiver II*.

Example TS12/06/17, 13:15:00 sets the real-time clock to 1:15:00 pm, June 17, 2012.

1. When the StreamPro 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. The internal clock *does* account for leap years.
3. If the entry is not valid, the StreamPro sends an error message and does not update the real-time clock.

Water Profiling Commands

The following commands define the criteria used to collect the water-profile data.

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 — WF0003

Recommended Setting. The default setting for this command is recommended for most applications.

Description — WF positions the start of the first depth cell at some vertical distance from the transducer head. This allows the StreamPro 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.

1. The distance to the middle of depth cell #1 is a function of blank after transmit (WF), depth cell size (WS), and speed of sound. The fixed leader data contains this distance.
2. Small WF values may show ringing/recovery problems in the first depth cells that cannot be screened by the StreamPro.

WM - Profiling Mode

Purpose — Selects the profiling mode used by the StreamPro.

Format — WM*n*

Range — *n* = 8, 12, 13 (see description)

Default — WM12

Recommended Setting. This command is automatically set by the *StreamPro* or *WinRiver II* software.

Description — This command is set by the *StreamPro* and *WinRiver II* software programs. The WM- 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.

Using the *StreamPro* software, if the **Maximum Stream Depth** is ≤ 1.0 meters and the **Maximum Stream Velocity** is < 0.25 m/s, a new option is displayed called **Low Noise Mode.** Selecting this box will set the StreamPro ADCP to Water Mode 13.

Using *WinRiver II* and selecting **Water Mode 13** will set the **Max Water Depth** to 1.0 meters and the **Maximum Water Speed** and **Maximum Boat Speed** to 0.24 m/s.

Table 7: Water Modes

Mode	Description
WM8	Very Shallow Water, used in low flow
WM12	Normal StreamPro Operation
WM13	Low Noise Mode

WN – Number of Bins

Purpose Sets the number of bins over which the StreamPro collects data.

Format WN*nnn*

Range *nnn* = 0 to 20 bins (0 to 30 bins with Long Range feature)

Default WN020

Recommended Setting. Set using *StreamPro* or *WinRiver II* software.

Description The range of the StreamPro is set by the number of depth cells (WN) times the size of each depth cell (WS).

WP – Pings per Ensemble

Purpose Sets the number of pings to average in each data ensemble.

Format WP*nnnnn*

Range *nnnnn* = 1 or 6 pings

Default WP6 - Water Mode 12
WP1 - Water Mode 13

Recommended Setting. This command is automatically set by the *StreamPro* or *WinRiver II* software.

Description This command is set by the *StreamPro* and *WinRiver II* software programs. WP sets the number of pings to average in each ensemble before sending/recording the data.

WS – Depth Cell Size

Purpose Selects the volume of water for one measurement cell.

Format WS*nnnn*

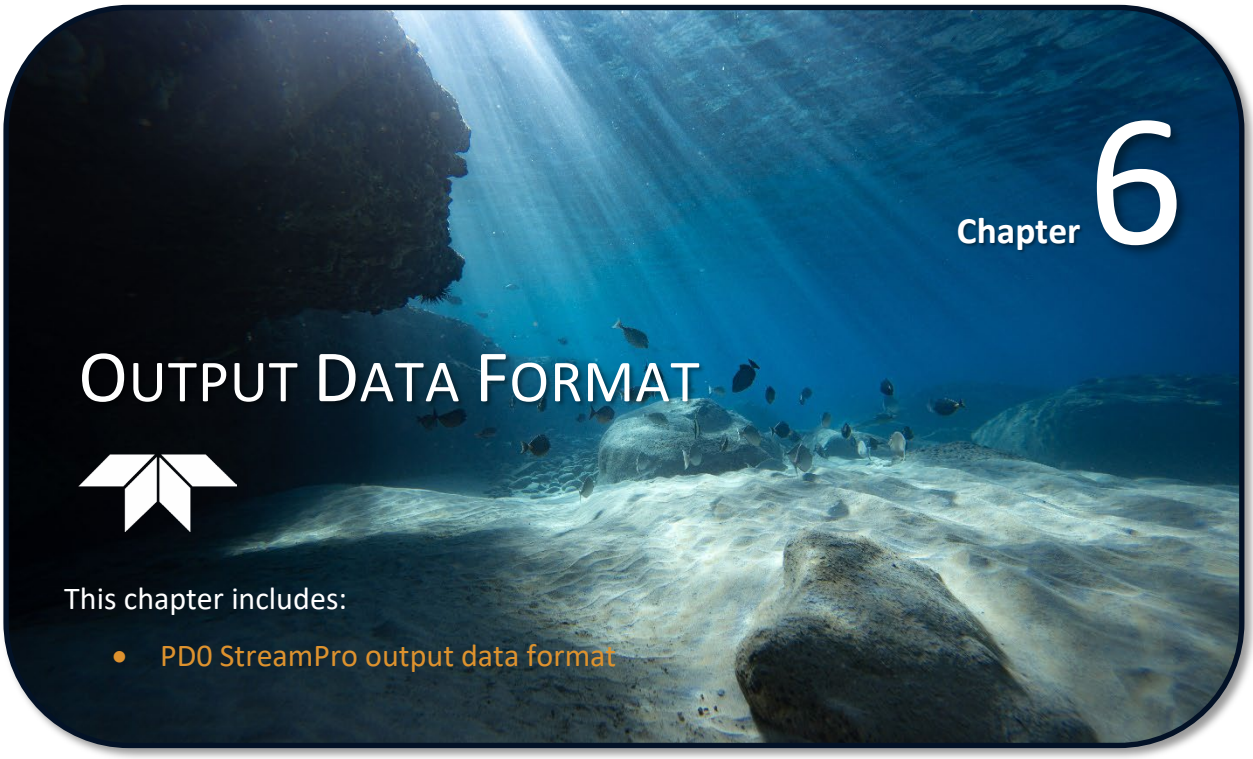
Range *nnnn* = 2 to 10 cm,
nnnn = 2 to 20 cm (Long Range feature enabled)

Default WS0010

Recommended Setting. Set using *StreamPro* or *WinRiver II* software.

Description The StreamPro collects data over a variable number of depth cells. WS sets the size of each cell in vertical centimeters.

If you set WS to a value less than its minimum value or greater than its maximum value, the StreamPro will accept the entry, but uses the appropriate minimum or maximum value.



Chapter 6

OUTPUT DATA FORMAT

This chapter includes:

- PD0 StreamPro output data format

Introduction to Output Data Format

This section shows the output data format of the StreamPro. We explain the output data formats in enough detail to let you create your own data processing or analysis programs (see PDDecoder Library in C language).

The following description is for the standard PD0 StreamPro output data format. Figure 20 through Figure 30 shows the ASCII and binary data formats for the StreamPro PD0 mode. Table 9 through Table 21 defines each field in the output data structure.

After completing a data collection cycle, the StreamPro immediately sends a data ensemble. The following pages show the types and sequence of data that you may include in the StreamPro output data ensemble and the number of bytes required for each data type. The StreamPro sends all the data for a given type for all depth cells and all beams before the next data type begins.

The StreamPro by default is set to collect velocity, correlation data, echo intensity, and percent good data. The data, preceded by ID code 7F7F, contains header data (explained in Table 9). The fixed and variable leader data is preceded by ID codes 0000 and 0080, (explained in Table 10 and Table 11). The StreamPro always collects Header and Leader. The table below shows some of the most common IDs.

Table 8: Data ID Codes

ID	LSB	MSB	Description
0x7F7F	7F	7F	Header
0x0000	00	00	Fixed Leader
0x0080	80	00	Variable Leader
0x0100	00	01	Velocity Profile Data
0x0200	00	02	Correlation Profile Data
0x0300	00	03	Echo Intensity Profile Data
0x0400	00	04	Percent Good Profile Data
0x0600	00	06	Bottom Track Data
0x5000	00	50	StreamPro Leader
0x3200	00	32	Instrument Transformation Matrix
0x3800	00	38	Compass Matrix

The StreamPro always sends the Least Significant Byte (LSB) first.

Always Output	**HEADER** (6 BYTES + [2 x No. OF DATA TYPES])
	FIXED LEADER DATA (59 BYTES)
	VARIABLE LEADER DATA (60 BYTES)
WD command 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)
BP command	**BOTTOM TRACK DATA** (89 BYTES)
Always Output	**INSTRUMENT TRANSFORMATION MATRIX** (34 BYTES)
	COMPASS MATRIX (ONLY OUTPUT IF COMPASS INSTALLED) (20 BYTES)
	STREAMPRO LEADER (23 BYTES)
	RESERVED (2 BYTES)
	CHECKSUM (2 BYTES)

Figure 19. PD0 Standard Output Data Buffer Format

Some data outputs are in bytes per depth cell. For example, if the WN-command (number of depth cells) = 30 (default), and the following data are selected for output, the required data buffer storage space is 917 bytes per ensemble.

```
WD-COMMAND = WD 111 100 000 (default), WP-COMMAND > 0, BP-COMMAND > 0
     20   BYTES OF HEADER DATA (6 + [2x Number Of Data Types])
     59   BYTES OF FIXED LEADER DATA (FIXED)
     60   BYTES OF VARIABLE LEADER DATA (FIXED)
    242   BYTES OF VELOCITY DATA (2 + 8 x 30)
    122   BYTES OF CORRELATION MAGNITUDE DATA (2 + 4 x 30)
    122   BYTES OF ECHO INTENSITY (2 + 4 x 30)
    122   BYTES OF PERCENT-GOOD DATA (2 + 4 x 30)
     89   BYTES OF BOTTOM TRACK DATA (FIXED)
     34   BYTES OF INSTRUMENT TRANSFORMATION MATRIX
     20   BYTES OF COMPASS MATRIX (FIXED) ONLY OUTPUT IF COMPASS INSTALLED
     23   BYTES OF STREAMPRO LEADER (FIXED)
      2   BYTES OF RESERVED FOR TRDI USE (FIXED)
      2   BYTES OF CHECKSUM DATA (FIXED)
    917   BYTES OF DATA PER ENSEMBLE
```

In order to keep PD0 compatibility with TRDI's software, some commands are listed in the tables, even though they are not adjustable for the StreamPro. For a full description of the commands, see the WorkHorse Commands and Output Data Format guide.

Header Data Format

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
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 9 for a description of the fields.

Figure 20. Binary Header Data Format

Header information is the first item sent by the ADCP to the output buffer. The StreamPro always sends the Least Significant Byte (LSB) first.

Table 9: Header Data Format

Hex Digit	Binary Byte	Field	Description
1,2	1	HDR ID / Header ID	Stores the header identification byte (7Fh).
3,4	2	HDR ID / Data Source ID	Stores the data source identification byte (7Fh for the StreamPro).
5-8	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 30).
9,10	5	Spare	Undefined.
11,12	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).
13-16	7,8	Address Offset for Data Type #1 / Offset for Data Type #1	This field contains the internal memory address offset where the StreamPro 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).
17-20	9,10	Address Offset for Data Type #2 / Offset for Data Type #2	This field contains the internal memory address offset where the StreamPro 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).
21-24 thru 2n+13 to 2n+16	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 StreamPro 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

BIT POSITIONS									
BYTE	7	6	5	4	3	2	1	0	
1	FIXED LEADER ID = 0000								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	SPARE								
9	NUMBER OF BEAMS								
10	NUMBER OF CELLS {WN}								
11	PINGS PER ENSEMBLE {WP}								LSB
12									MSB
13	DEPTH CELL LENGTH {WS}								LSB
14									MSB
15	BLANK AFTER TRANSMIT {WF}								LSB
16									MSB
17	PROFILING MODE {WM}								
18	LOW CORR THRESH {WC}								
19	NO. CODE REPS								
20	%GD MINIMUM								
21	ERROR VELOCITY MAXIMUM {WE}								LSB
22									MSB
23	TPP MINUTES								
24	TPP SECONDS								
25	TPP HUNDREDTHS {TP}								
26	COORDINATE TRANSFORM {EX}								
27	HEADING ALIGNMENT {EA}								LSB
28									MSB
29	HEADING BIAS {EB}								LSB
30									MSB
31	SENSOR SOURCE {EZ}								
32	SENSORS AVAILABLE								

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
33	BIN 1 DISTANCE								
34									
35	XMIT PULSE LENGTH BASED ON {WT}								LSB
36									MSB
37	(starting cell) WP REF LAYER AVERAGE {WL} (ending cell)								LSB
38									MSB
39	FALSE TARGET THRESH {WA}								
40	SPARE								
41	TRANSMIT LAG DISTANCE								LSB
42									MSB
43	CPU BOARD SERIAL NUMBER								LSB
↓									↓
50									MSB
51	SYSTEM BANDWIDTH {WB}								LSB
52									MSB
53	SPARE								
54									
55	ADCP SERIAL NUMBER								
↓									
58									
59	SPARE								

See Table 10 for a description of the fields

Figure 21. Fixed Leader Data Format

In order to keep PD0 compatibility with TRDI's software, some commands are listed in the tables, even though they are not adjustable for the StreamPro. For a full description of the commands, see the WorkHorse Commands and Output Data Format guide.

Fixed Leader data refers to the non-dynamic StreamPro data that only changes when you change certain commands. Fixed Leader data also contain hardware information. The StreamPro always sends Fixed Leader data as output data (LSBs first).

Table 10: Fixed Leader Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	FID / Fixed Leader ID	Stores the Fixed Leader identification word 0000 (00 00h). LSB is sent first.
5,6	3	fv / CPU F/W Ver.	Contains the version number of the CPU firmware.
7,8	4	fr / CPU F/W Rev.	Contains the revision number of the CPU firmware.
9-12	5,6	Sys Cfg / System Configuration	This field defines the StreamPro 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 75-kHz SYSTEM - - - - - 0 0 1 150-kHz SYSTEM - - - - - 0 1 0 300-kHz SYSTEM - - - - - 0 1 1 600-kHz SYSTEM - - - - - 1 0 0 1200-kHz SYSTEM - - - - - 1 0 1 2400-kHz SYSTEM - - - - 0 - - - CONCAVE BEAM PAT. - - - - 1 - - - CONVEX BEAM PAT. - - 0 0 - - - - SENSOR CONFIG #1 - - 0 1 - - - - SENSOR CONFIG #2 - - 1 0 - - - - SENSOR CONFIG #3 - 0 - - - - - - XDCR HD NOT ATT. - 1 - - - - - - XDCR HD ATTACHED 0 - - - - - - - DOWN FACING BEAM 1 - - - - - - - UP-FACING BEAM MSB BITS 7 6 5 4 3 2 1 0 - - - - - - 0 0 15E BEAM ANGLE - - - - - - 0 1 20E BEAM ANGLE - - - - - - 1 0 30E BEAM ANGLE - - - - - - 1 1 OTHER BEAM ANGLE 0 1 0 0 - - - - 4-BEAM JANUS CONFIG 0 1 0 1 - - - - 5-BM JANUS CFIG DEMOD) 1 1 1 1 - - - - 5-BM JANUS CFIG.(2 DEMD) Example: Hex 5249 (i.e., hex 49 followed by hex 52) identifies a 150-kHz system, convex beam pattern, down-facing, 30E beam angle, 5 beams (3 demods).
13,14	7	PD / Real/Sim Flag	This field is set by default as real data (0).
15,16	8	Spare	Undefined.
17,18	9	#Bm / Number of Beams	Contains the number of beams used to calculate velocity data (not physical beams). The StreamPro needs only three beams to calculate water-current velocities. The fourth beam provides an error velocity that determines data validity. If only three beams are available, the StreamPro does not make this validity check. Table 15 (Percent-Good Data Format) has more information.

Table 10: Fixed Leader Data Format

Hex Digit	Binary Byte	Field	Description
19,20	10	WN / Number of Cells	Contains the number of depth cells over which the StreamPro collects data (WN-command). Scaling: LSD = 1 depth cell; Range = 1 to 128 depth cells
21-24	11,12	WP / Pings Per Ensemble	Contains the number of pings averaged together during a data ensemble (WP-command). If WP = 0, the StreamPro does not collect the WD water-profile data. Note: The StreamPro automatically extends the ensemble interval (TE) if the product of WP and time per ping (TP) is greater than TE (i.e., if WP x TP > TE). Scaling: LSD = 1 ping; Range = 0 to 16,384 pings
25-28	13,14	WS / Depth Cell Length	Contains the length of one depth cell (WS-command). Scaling: LSD = 1 centimeter; Range = 1 to 6400 cm (210 feet)
29-32	15,16	WF / Blank after Transmit	Contains the blanking distance used by the StreamPro to allow the transmit circuits time to recover before the receive cycle begins (WF-command). Scaling: LSD = 1 centimeter; Range = 0 to 9999 cm (328 feet)
33,34	17	Signal Processing Mode	Contains the Signal Processing Mode. This field will always be set to 1.
35,36	18	WC / 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
37,38	19	cr# / No. code reps	Contains the number of code repetitions in the transmit pulse. Scaling: LSD = 1 count; Range = 0 to 255 counts
39,40	20	WG / %Gd Minimum	Contains the minimum percentage of water-profiling pings in an ensemble that must be considered good to output velocity data (WG-command). Scaling: LSD = 1 percent; Range = 1 to 100 percent
41-44	21,22	WE / Error Velocity Threshold	This field, initially set by the WE-command, contains the actual threshold value used to flag water-current data as good or bad. If the error velocity value exceeds this threshold, the StreamPro flags all four beams of the affected bin as bad. Scaling: LSD = 1 mm/s; Range = 0 to 5000 mm/s
45,46 47,48 49,50	23 24 25	Minutes Seconds Hundredths	These fields, set by the TP-command, contain the amount of time between ping groups in the ensemble. NOTE: The StreamPro automatically extends the ensemble interval (set by TE) if (WP x TP > TE).

Table 10: Fixed Leader Data Format

Hex Digit	Binary Byte	Field	Description
51,52	26	EX / Coord Transform	Contains the coordinate transformation processing parameters (EX-command). These firmware switches indicate how the StreamPro 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
53-56	27,28	EA / Heading Alignment	Contains a correction factor for physical heading misalignment (EA-command). Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees
57-60	29,30	EB / Heading Bias	Contains a correction factor for electrical/magnetic heading bias (EB-command). Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees
61,62	31	EZ / Sensor Source	Contains the selected source of environmental sensor data (EZ-command). These firmware switches indicate the following. FIELD DESCRIPTION x1xxxxxx = CALCULATES EC (SPEED OF SOUND) FROM ED, ES, AND ET xx1xxxxx = USES ED FROM DEPTH SENSOR xxx1xxxx = USES EH FROM TRANSDUCER HEADING SENSOR xxxx1xxx = USES EP FROM TRANSDUCER PITCH SENSOR xxxxx1xx = USES ER FROM TRANSDUCER ROLL SENSOR xxxxxx1x = USES ES (SALINITY) FROM CONDUCTIVITY SENSOR xxxxxxx1 = USES ET FROM TRANSDUCER TEMPERATURE SENSOR NOTE: If the field = 0, or if the sensor is not available, the StreamPro uses the manual command setting. If the field = 1, the StreamPro uses the reading from the internal sensor or an external synchro sensor (only applicable to heading, roll, and pitch). Although you can enter a “2” in the EZ-command string, the StreamPro only displays a 0 (manual) or 1 (int/ext sensor).
63,64	32	Sensor Avail	This field reflects which sensors are available. The bit pattern is the same as listed for the EZ-command (above).
65-68	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 (WS), the profiling mode (WM), the blank after transmit distance (WF), and speed of sound. Scaling: LSD = 1 centimeter; Range = 0 to 65535 cm (2150 feet)

Table 10: Fixed Leader Data Format

Hex Digit	Binary Byte	Field	Description
69-72	35,36	WT Xmit pulse length	This field, set by the WT-command, contains the length of the transmit pulse. When the StreamPro receives a <BREAK> signal, it sets the transmit pulse length as close as possible to the depth cell length (WS-command). This means the StreamPro uses a WT command of zero. However, the WT field contains the actual length of the transmit pulse used. Scaling: LSD = 1 centimeter; Range = 0 to 65535 cm (2150 feet)
73,74 75,76	37,38	WL / 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
77,78	39	WA / False Target Threshold	Contains the threshold value used to reject data received from a false target, usually fish (WA-command). Scaling: LSD = 1 count; Range = 0 to 255 counts (255 disables)
79,80	40	Spare	Spare
81-84	41,42	LagD / Transmit lag distance	This field, determined mainly by the setting of the WM-command, contains the distance between pulse repetitions. Scaling: LSD = 1 centimeter; Range = 0 to 65535 centimeters
85-100	43-50	CPU Board Serial Number	Contains the serial number of the CPU board.
101-105	51-52	WB / System Bandwidth	Contains the WB-command setting. Range = 0 to 1
106-109	53-54	Spare	Spare
110-119	55-58	Serial number	ADCP serial number
120, 121	59	Spare	Spare

Variable Leader Data Format

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
1	VARIABLE LEADER ID = 0080								LSB 80h
2									MSB 00h
3	ENSEMBLE NUMBER								LSB
4									MSB
5	RTC YEAR {TS}								
6	RTC MONTH {TS}								
7	RTC DAY {TS}								
8	RTC HOUR {TS}								
9	RTC MINUTE {TS}								
10	RTC SECOND {TS}								
11	RTC HUNDREDTHS {TS}								
12	ENSEMBLE # MSB								
13	SPARE								
14									
15	SPEED OF SOUND {EC}								LSB
16									MSB
17	DEPTH OF TRANSDUCER {ED}								LSB
18									MSB
19	HEADING {EH}								LSB
20									MSB
21	PITCH (TILT 1) {EP}								LSB
22									MSB
23	ROLL (TILT 2) {ER}								LSB
24									MSB
25	SALINITY {ES}								LSB
26									MSB
27	TEMPERATURE {ET}								LSB
28									MSB
29	MPT MINUTES								
30	MPT SECONDS								
31	MPT HUNDREDTHS								

BYTE	BIT POSITIONS 7	6	5	4	3	2	1	0	
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	ERROR STATUS WORD (ESW) {CY?}								LSB
44									
45									
46									MSB
47	SPARE								
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

See Table 11 for a description of the fields.

Figure 22. Variable Leader Data Format

Variable Leader data refers to the dynamic StreamPro data (from clocks/sensors) that change with each ping. The StreamPro always sends Variable Leader data as output data (LSBs first).

Table 11: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	VID / Variable Leader ID	Stores the Variable Leader identification word 0080 (80 00h). LSB is sent first.

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 StreamPro's real-time clock (RTC) that the current data ensemble began. The TS-command (Set Real-Time Clock) initially sets the clock. The StreamPro 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.
25-28	13,14	Spare	Spare
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 StreamPro 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 StreamPro 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 StreamPro roll angle (ER-command). This value may be a manual setting or a reading from a tilt sensor. For up-facing StreamPro ADCPs, positive values mean that Beam #2 is spatially higher than Beam #1. For down-facing StreamPro ADCPs, positive values mean that Beam #1 is spatially higher than Beam #2. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees

Table 11: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
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	29	MPT minutes	This field contains the Minimum Pre-Ping Wait Time between ping groups in the ensemble.
59,60	30	MPT seconds	
61,62	31	MPT hundredths	
63,64	32	H/Hdg Std Dev	These fields contain the standard deviation (accuracy) of the heading and tilt angles from the gyrocompass/pendulums.
65,66	33	P/Pitch Std Dev	
67,68	34	R/Roll Std Dev	Scaling (Heading): LSD = 1°; Range = 0 to 180° Scaling (Tilts): LSD = 0.1°; Range = 0.0 to 20.0°
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
85-86	43	Error Status Word	Contains the long word containing the bit flags for the CY? Command. The ESW is cleared (set to zero) between each ensemble. Note that each number above represents one bit set – they may occur in combinations. For example, if the long word value is 0000C000 (hexadecimal), then it indicates that both a cold wake-up (0004000) and an unknown wake-up (00008000) occurred. Low 16 BITS LSB BITS 07 06 05 04 03 02 01 00 x x x x x x x 1 WP Xmit shutdown x x x x x x 1 x WP Xmit under voltage x x x x x 1 x x BT Xmit shutdown x x x x 1 x x x BT Xmit under voltage x x x 1 x x x x Not Used x x 1 x x x x x Not Used x 1 x x x x x x Not Used 1 x x x x x x x Not Used
87-88	44		Low 16 BITS MSB BITS 15 14 13 12 11 10 09 08 x x x x x x x 1 Pinging x x x x x x 1 x Not Used x x x x x 1 x x Not Used x x x x 1 x x x Not Used x x x 1 x x x x Not Used x x 1 x x x x x Not Used x 1 x x x x x x Cold Wakeup 1 x x x x x x x Unknown Wakeup

Table 11: Variable Leader Data Format

Hex Digit	Binary Byte	Field	Description
89-90	45		High 16 BITS LSB BITS 24 23 22 21 20 19 18 17 x x x x x x x 1 Clock Read Error x x x x x x 1 x Not Used x x x x x 1 x x Not Used x x x x 1 x x x Not Used x x x 1 x x x x Not Used x x 1 x x x x x Not Used x 1 x x x x x x Not Used 1 x x x x x x x Not Used
91-92	46		High 16 BITS MSB BITS 32 31 30 29 28 27 26 25 x x x x x x x 1 Not Used x x x x x x 1 x Not Used x x x x x 1 x x Not Used x x x x 1 x x x Not Used x x x 1 x x x x Not Used x x 1 x x x x x Spurious UART IRQ x 1 x x x x x x Spurious CLOCK IRQ 1 x x x x x x x Power Failure
93-120	47-60	Reserved	Reserved for TRDI use.

Velocity Data Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	VELOCITY ID = 0100								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 128 CELLS)								↓
1019	DEPTH CELL #128, VELOCITY 1								LSB
1020									MSB
1021	DEPTH CELL #128, VELOCITY 2								LSB
1022									MSB
1023	DEPTH CELL #128, VELOCITY 3								LSB
1024									MSB
1025	DEPTH CELL #128, VELOCITY 4								LSB
1026									MSB

See Table 12 for description of fields

Figure 23. Velocity Data Format

The number of depth cells is set by the WN command.

The StreamPro 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 StreamPro 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 setting of the EX-command (Coordinate Transformation) determines how the StreamPro references the velocity data as shown below.

EX-CMD	COORD SYS	VEL 1	VEL 2	VEL 3	VEL 4
xxx00xxx	BEAM	TO BEAM 1	TO BEAM 2	TO BEAM 3	TO BEAM 4
xxx01xxx	INST	Bm1-Bm2	Bm4-Bm3	TO XDUCER	ERR VEL
xxx10xxx	SHIP	PRT-STBD	AFT-FWD	TO SURFACE	ERR VEL
xxx11xxx	EARTH	TO EAST	TO NORTH	TO SURFACE	ERR VEL

POSITIVE VALUES INDICATE WATER MOVEMENT

Table 12: Velocity Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	Velocity ID	Stores the velocity data identification word 0100 (00 01h). LSB is sent first.
5-8	3,4	Depth Cell 1, Velocity 1	Stores velocity data for depth cell #1, velocity 1. See above.
9-12	5,6	Depth Cell 1, Velocity 2	Stores velocity data for depth cell #1, velocity 2. See above.
13-16	7,8	Depth Cell 1, Velocity 3	Stores velocity data for depth cell #1, velocity 3. See above.
17-20	9,10	Depth Cell 1, Velocity 4	Stores velocity data for depth cell #1, velocity 4. See above.
21-2052	11-1026	Cells 2 – 128 (if used)	These fields store the velocity data for depth cells 2 through 128 (depending on the setting of the WN-command). These fields follow the same format as listed above for depth cell 1.

Correlation Magnitude, Echo Intensity, and Percent-Good Data Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	ID CODE								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 128 BINS)								↓
511	DEPTH CELL #128, FIELD #1								
512	DEPTH CELL #128, FIELD #2								
513	DEPTH CELL #128, FIELD #3								
514	DEPTH CELL #128, FIELD #4								

See Table 13 through Table 15 for a description of the fields.

Figure 24. Binary Correlation Magnitude, Echo Intensity, and Percent-Good Data Format

The number of depth cells is set by the WN-command.

Correlation magnitude data give the magnitude of the normalized echo autocorrelation at the lag used for estimating the Doppler phase change. The StreamPro 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 13: Correlation Magnitude Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the correlation magnitude data identification word 0200 (00 02h). LSB is sent first.
5,6	3	Depth Cell 1, Field 1	Stores correlation magnitude data for depth cell #1, beam #1. See above.
7,8	4	Depth Cell 1, Field 2	Stores correlation magnitude data for depth cell #1, beam #2. See above.
9,10	5	Depth Cell 1, Field 3	Stores correlation magnitude data for depth cell #1, beam #3. See above.
11,12	6	Depth Cell 1, Field 4	Stores correlation magnitude data for depth cell #1, beam #4. See above.
13 – 1028	7 – 514	Cells 2 – 128 (if used)	These fields store correlation magnitude data for depth cells 2 through 128 (depending on the WN-command) 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 StreamPro count. The StreamPro does not directly check for the validity of echo intensity data.

Table 14: Echo Intensity Data Format

Hex Digit	Binary Byte	Field	Description
1 – 4	1,2	ID Code	Stores the echo intensity data identification word 0300 (00 03h). LSB is sent first.
5,6	3	Depth Cell 1, Field 1	Stores echo intensity data for depth cell #1, beam #1. See above.
7,8	4	Depth Cell 1, Field 2	Stores echo intensity data for depth cell #1, beam #2. See above.
9,10	5	Depth Cell 1, Field 3	Stores echo intensity data for depth cell #1, beam #3. See above.
11,12	6	Depth Cell 1, Field 4	Stores echo intensity data for depth cell #1, beam #4. See above.
13 – 1028	7 – 514	Cells 2 – 128 (if used)	These fields store echo intensity data for depth cells 2 through 128 (depending on the WN-command) for all four beams. These fields follow the same format as listed above for depth cell 1.

The percent-good data field is a data-quality indicator that reports the percentage (0% or 100%) of good data collected for each depth cell of the velocity profile.

Table 15: Percent-Good Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the percent-good data identification word 0400 (00 04h). LSB is sent first.
5,6	3	Depth cell 1, Field 1	Stores percent-good data for depth cell #1, field 1. See above.
7,8	4	Depth cell 1, Field 2	Stores percent-good data for depth cell #1, field 2. See above.
9,10	5	Depth cell 1, Field 3	Stores percent-good data for depth cell #1, field 3. See above.
11,12	6	Depth cell 1, Field 4	Stores percent-good data for depth cell #1, field 4. See above.
13-1028	7-514	Depth cell 2 – 128 (if used)	These fields store percent-good data for depth cells 2 through 128 (depending on the WN-command), following the same format as listed above for depth cell 1.

Bottom-Track Data Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	BOTTOM-TRACK ID = 0600								LSB 00h
2									MSB 06h
3	BT PINGS PER ENSEMBLE {BP}								LSB
4									MSB
5	RESERVED								LSB
6									MSB
7	BT CORR MAG MIN {BC}								
8	BT EVAL AMP MIN {BA}								
9	RESERVED								
↓									↓
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
32									MSB
33	BEAM#1 BT CORR.								
34	BEAM#2 BT CORR.								
35	BEAM#3 BT CORR.								
36	BEAM#4 BT CORR.								

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
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
82 ↓ 85	RESERVED								
86	BEAM 1 (Fraction) DEPTH								
87	BEAM 2 (Fraction) DEPTH								
88	BEAM 3 (Fraction) DEPTH								
89	BEAM 4 (Fraction) DEPTH								

Figure 25. Binary Bottom-Track Data Format

This data is always output. See Table 16 for a description of the fields.

The PD0 output data format assumes that the instrument is stationary and the bottom is moving.

The LSB is always sent first.

Table 16: Bottom-Track Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the Bottom-Track data identification word 0600 (06 00h). LSB is sent first.
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 ADCP does not collect bottom-track data. The ADCP 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	Reserved
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
17-32	9-16	Reserved	Reserved
33-48	17-24	BT Range/Beam #1-4 BT Range	Contains the two lower bytes of the vertical range from the ADCP to the sea 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 sea 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 16: 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 ADCP's bottom-track validity algorithm during an ensemble. Scaling: LSD = 1 percent; Range = 0 to 100 percent
89-140	45-70	Reserved	Reserved
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 ADCP to the sea 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
163-170	82-85	Reserved	Reserved
	86-89	BT depth LSB 4 bytes	Contains one byte of the fractional part of the vertical range from the ADCP to the sea 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 and bytes 17 through 24 for the two lower bytes. Scaling: LSD = 1/255 cm; Range = 0 to 1 cm

StreamPro Leader Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	STREAMPRO LEADER ID = 5000								LSB 00h
2									MSB 50h
3	LONG LAG								LSB
4									MSB
5	SHORT LAG								LSB
6									MSB
7	PERCENT GOOD								LSB
8									MSB
9	SUB PINGS								LSB
10									MSB
11	LAST BIN								LSB
12									MSB
13	CORRELATION THRESHOLD								
14	BIN MID								LSB
15									MSB
16	BIN SIZE								LSB
17									MSB
18	BIN SPACING								LSB
19									MSB
20	TRANSMIT								LSB
21									MSB
22	SPARE								LSB
23									MSB

Figure 26. Binary StreamPro Leader Format

This data is always output. See Table 17 for a description of the fields.

Table 17: StreamPro Leader Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the StreamPro Leader data identification word 5000 (50 00h). LSB is sent first.
5-9	3,4	LLag	Long Lag Length. The lag is the time period between sound pulses.
10-14	5,6	SLag	Short Lag Length. The lag is the time period between sound pulses.
15-19	7,8	PGood	Contains the minimum percentage of water-profiling pings in an ensemble that must be considered good to output velocity data.
20-24	9,10	SubPings	Stores the Water Mode 12 number of subpings
25-29	11,12	LastBin	Stores the distance to the last bin in centimeters.
30,31	13	CorThres	Contains the minimum threshold of correlation that water-profile data can have to be considered good data
32-36	14,15	BinMid	Stores the distance to the middle of first bin in centimeters.
37-41	16,17	BinSize	Stores the bin size in centimeters.
42-46	18,19	BinSpacing	Stores the distance between bins in centimeters.
47-51	20,21	Xmit	Contains the length of the transmit pulse.
52-56	22,23	Spare	Reserved

Instrument Transformation Matrix Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	INSTRUMENT TRANSFORMATION MATRIX ID = 3200								LSB 00h
2									MSB 32h
3	X COMPONENT FOR BEAM#1								LSB
4									MSB
5	X COMPONENT FOR BEAM#2								LSB
6									MSB
7	X COMPONENT FOR BEAM#3								LSB
8									MSB
9	X COMPONENT FOR BEAM#4								LSB
10									MSB
11	Y COMPONENT FOR BEAM#1								LSB
12									MSB
13	Y COMPONENT FOR BEAM#2								LSB
14									MSB
15	Y COMPONENT FOR BEAM#3								LSB
16									MSB
17	Y COMPONENT FOR BEAM#4								LSB
18									MSB
19	Z COMPONENT FOR BEAM#1								LSB
20									MSB
21	Z COMPONENT FOR BEAM#2								LSB
22									MSB
23	Z COMPONENT FOR BEAM#3								LSB
24									MSB
25	Z COMPONENT FOR BEAM#4								LSB
26									MSB
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 27. Instrument Transformation Matrix Format

This data is always output. See Table 18 for a description of the fields. The LSB is always sent first.

Table 18: Instrument Transformation Matrix Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the Instrument Transformation Matrix data identification word 3200 (32 00h). LSB is sent first.
5-20	3-10	X Component for Beams #1-4	Horizontal component of velocity (X) for Beams #1-4. LSD = 0.0001
21-36	11-18	Y Component for Beams #1-4	Horizontal component of velocity (Y) for Beams #1-4. LSD = 0.0001
37-52	19-26	Z Component for Beams #1-4	Vertical component of velocity (Z) for Beams #1-4. LSD = 0.0001
53-68	27-34	E Component for Beams #1-4	Error component of velocity (E) for Beams #1-4. LSD = 0.0001

The PS3 command can also be used to display the most current instrument transformation matrix in ASCII format.

Compass BIT Status Word Format

BYTE	BIT POSITIONS 7/S	6	5	4	3	2	1	0	
1	COMPASS BIT STATUS WORD ID = 3800								LSB 00h
2									MSB 38h
3	RESERVED FOR TRDI USE								
↓									↓
20									

Figure 28. Compass BIT Status Word Format

The data is output only if the StreamPro includes a compass. See Table 19 for a description of the fields.

Table 19: Compass BIT Status Word Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the Compass BIT Status Word identification word 3800 (38 00h). LSB is sent first.
5-40	3-20	Reserved	Reserved

Reserved BIT Data Format

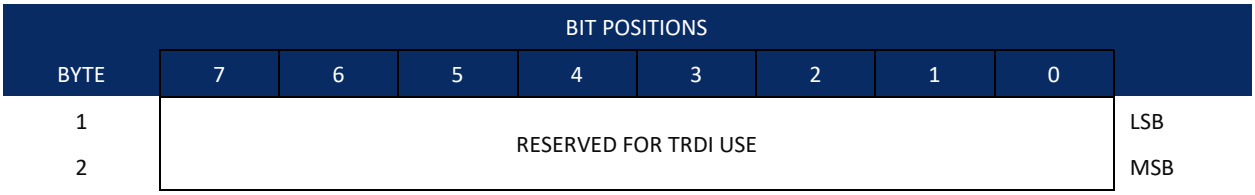


Figure 29. Reserved BIT Data Format

The data is always output. See Table 20 for a description of the fields.

Table 20: Reserved for TRDI Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	Reserved for TRDI's use	This field is for TRDI (internal use only).

Checksum Data Format

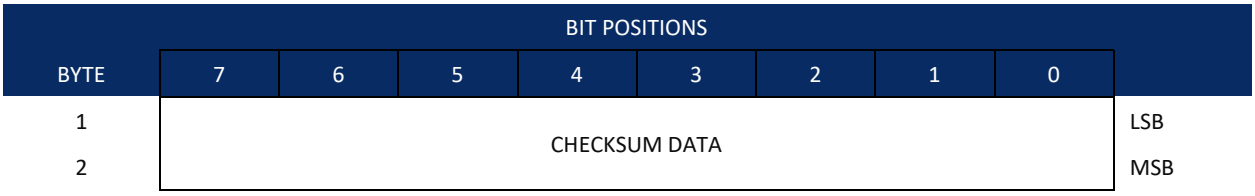


Figure 30. Checksum Data Format

The data is always output. See Table 21 for a description of the fields.

Table 21: Checksum Data Format

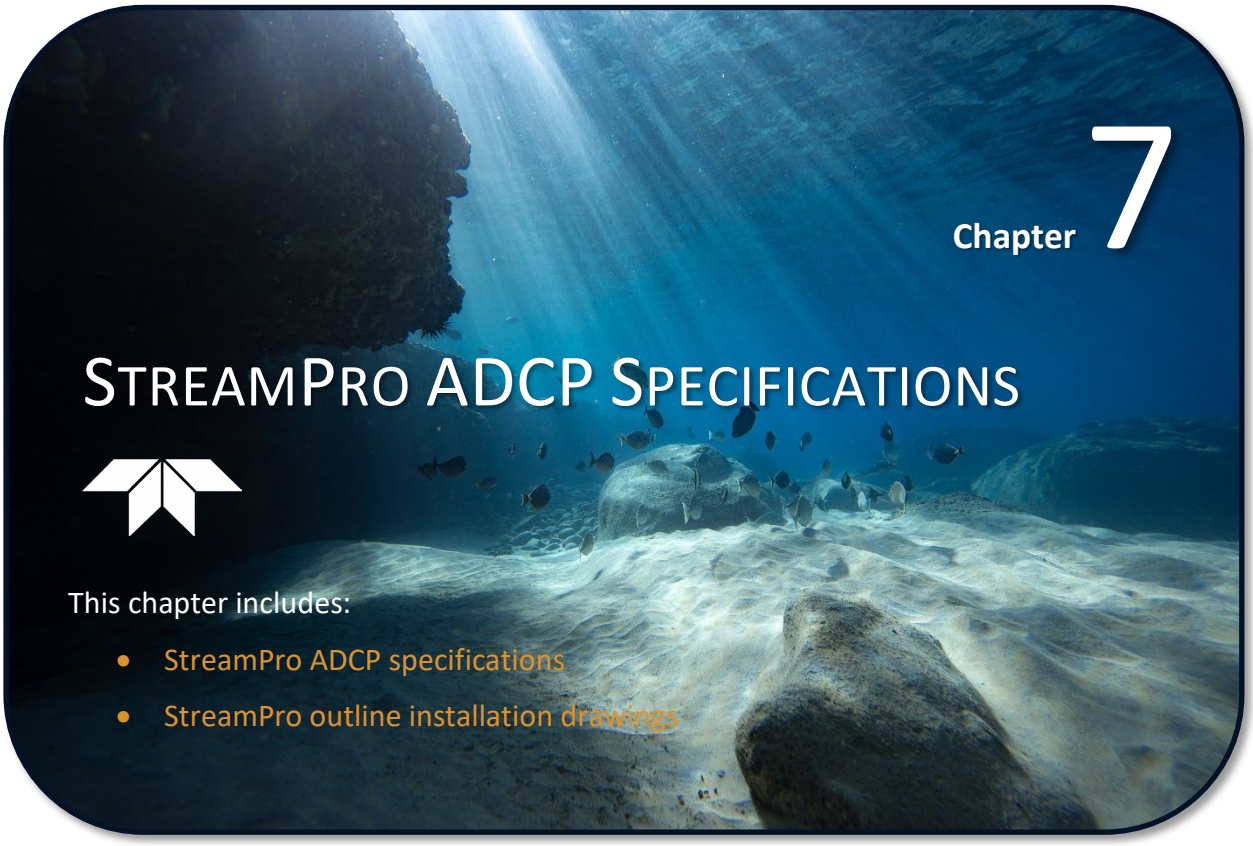
Hex Digit	Binary Byte	Field	Description
1-4	1,2	Checksum Data	This field contains a modulo 65535 checksum. The StreamPro computes the checksum by summing all the bytes in the output buffer excluding the checksum.

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

NOTES



Chapter 7

StreamPro ADCP Specifications

This chapter includes:

- StreamPro ADCP specifications
- StreamPro outline installation drawings

Table 22: Velocity Profiling Specifications

Water Velocity Profiling	
Profiling range	0.1m[1] to 2m standard or 6m[2] with upgrade
Velocity range	±5m/s[3]
Accuracy	±1% of water velocity relative to ADCP, ±2mm/s
Resolution	1mm/s
Number of cells	1–20 standard or 1–30 with upgrade
Cell size	2cm to 10cm standard or 20cm with upgrade
Blanking distance	3cm
Data output rate	1Hz
Bottom Tracking	
Depth range	0.1m–7m[2]
Accuracy	±1.0% of bottom velocity relative to ADCP, ±2mm/s
Resolution	1mm/s
Depth Measurement	
Range	0.1m–7m[2]
Center of 1st Cell (cm) Standard mode: High precision mode:	 9 to 25 (Water Mode 12) 4 to 13 (Water Mode 13, blank is 3cm and transmit is always 1cm)
Accuracy	1%[4]
Resolution	1mm

[1] Assume one good cell (minimum cell size) with high precision profiling mode, range measured from the transducer surface.

[2] Assume fresh water, actual range depends on temperature and suspended solids concentration.

[3] 2m/s for standard tethered trimaran; 3.5m/s for optional high-speed tethered trimaran.

[4] Assume uniform water temperature and salinity profile

Table 23: Long Range Mode Specifications

	Maximum Settings	Default Settings	Max Water Profiling Range (m)	Max Bottom-Track Range (m)
Standard StreamPro	WN=20 WS=10	WN=20 WS=10	2.0	4.0
Long Range Feature	WN=30 WS=20	WN=20 WS=10	6.0	7.0

Table 24: Transducer Specifications

Parameter	Specification
Frequency:	2.0 MHz
Geometry:	4 beams, ±20° beam angle
Beam Width:	3.0 degrees
Material:	Cast polyurethane with stainless hardware

Table 25: Standard Sensors Specifications

Parameter	Specification
Temperature:	Thermistor in metallic housing in direct contact with the water
Range:	-4° to 45°C
Accuracy:	±0.5°C
Resolution:	0.01°

Table 26: Optional Compass Specifications

Compass	Specification
Accuracy after Field Calibration:	±2°
Precision:	±0.25°
Resolution	0.1°
Maximum tilt:	±45°
Tilt (Pitch and Roll)	
Pitch Range:	±90°
Roll Range:	±180°
Accuracy:	±0.3°
Precision:	0.1°
Resolution:	0.06°

Table 27: Communications Specifications

Parameter	Specification
Bluetooth Wireless	
Baud Rates:	115,200 BPS

FCC Compliance - This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any 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.

Table 28: StreamPro ADCP Environmental Specifications

Parameter	Specification
Operating temperature	-5° to 45°C (internal temperature of the StreamPro ADCP must be under 50°C)
Storage temperature	-20° to 50°C (with battery pack removed)
Battery Storage	Batteries should be stored in dry air with a temperature range of O° C to 21° C.
Battery Shelf Life	Use within one month.

Table 29: StreamPro ADCP Power Specifications

Parameter		Specification
Voltage		10.5 to 18 VDC
Deployment Duration (Continuous operation)		Battery Used for Test
8 AA cells, Lithium (2900mAh @ 1.5vdc)	≈21 hours	Energizer Lithium L91
8 AA cells, Rechargeable Nickel-metal hydride (1850mAh @ 1.2vdc)	≈12.75 hours	Rayovac 15 minute IC3
8 AA cells, Alkaline (2850mAh @ 1.5vdc)	≈7.5 hours	Energizer Alkaline and Duracell Procell

Battery tests were done pinging in air, five meters separation between the StreamPro ADCP and laptop (direct line of sight), and using the default setup for *WinRiver II*. Battery temperature was between 2° C ± 2° and the system temperature was at 20 to 22° C.

Blocking the direct line of sight path between the Stream Pro ADCP and the laptop will reduce battery life. Even shielding the line-of-site path with your body increases transmissions and increases power consumption slightly.

Table 30: StreamPro ADCP Physical Properties

Parameter	Specification
Weight in Air	Electronic Housing w/Mounting Brackets without Battery-5.20 lbs Transducer with cable----------0.65 lbs Arm, Transducer----------0.65 lbs Solar Shield----------0.35 lbs Battery Pack----------0.55 lbs Tethered trimaran with Bridle----------5.50 lbs Total weight----------12.90 lbs
Construction	Cast polyurethane with stainless hardware
Dimensions:	See Outline Installation Drawings (next page)

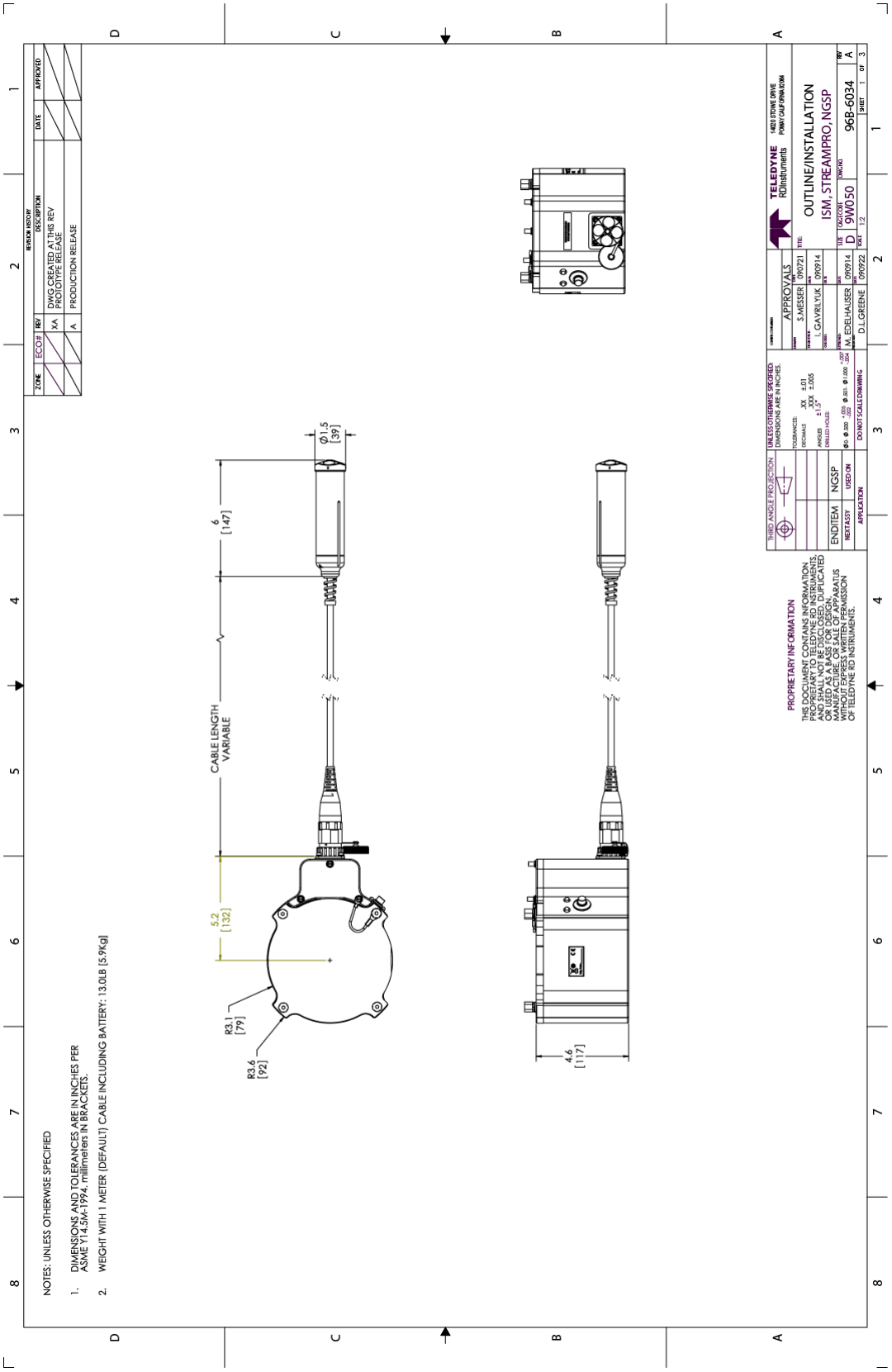


Figure 31. Outline Installation Drawing 96B-6034 – Sheet 1 of 3

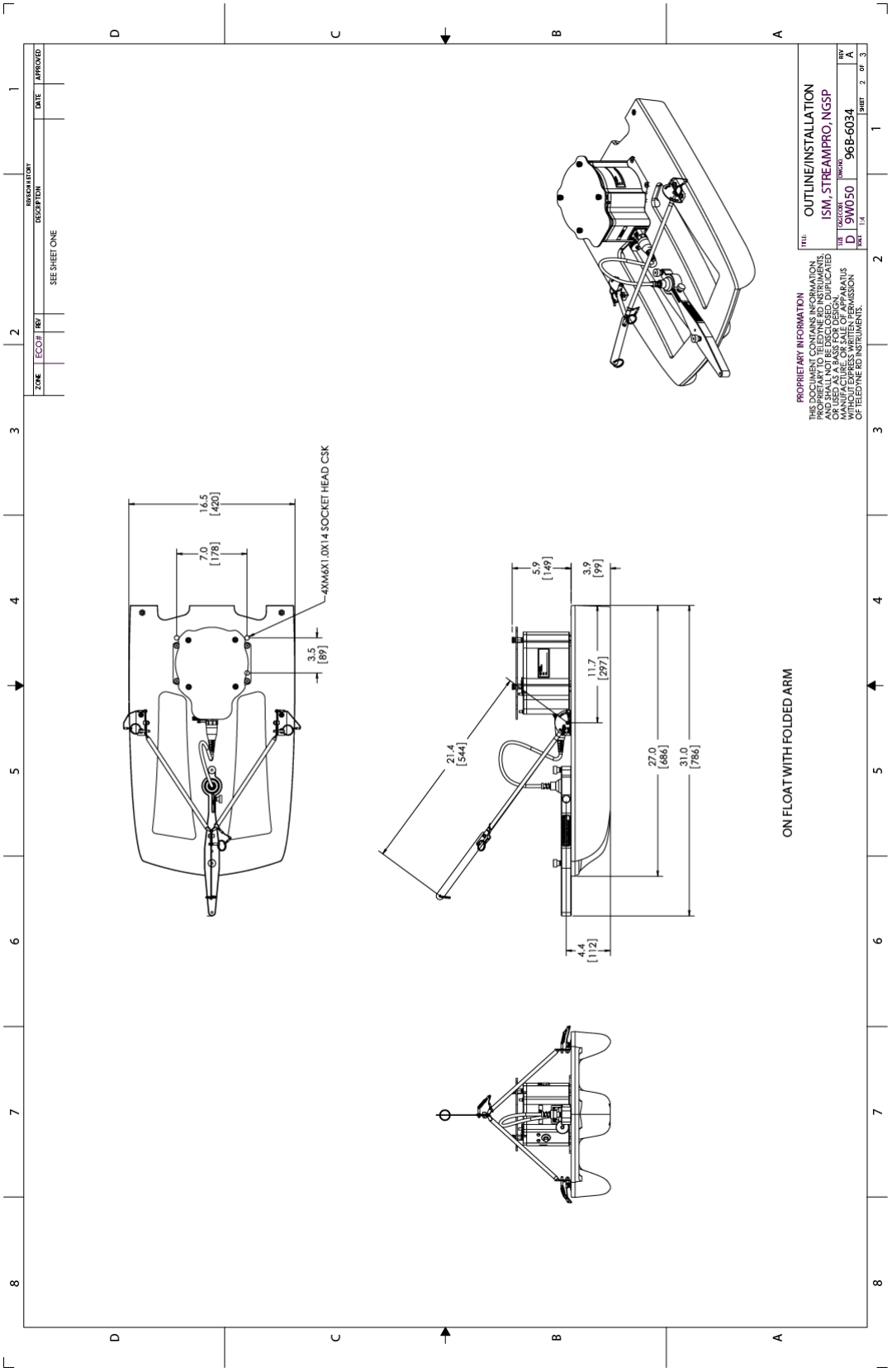


Figure 32. Outline Installation Drawing 96B-6034 – Sheet 2 of 3

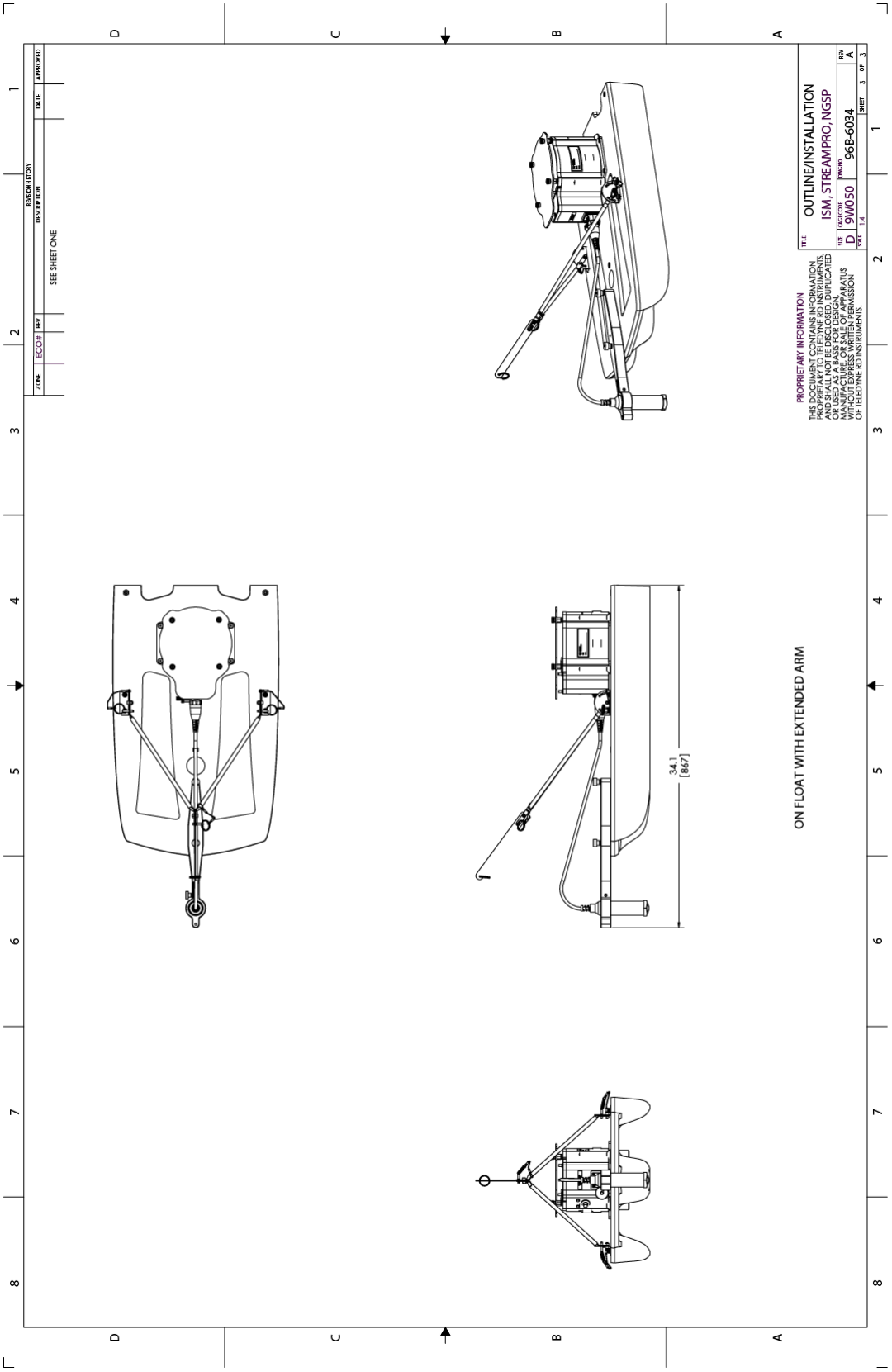


Figure 33. Outline Installation Drawing 96B-6034 – Sheet 3 of 3

NOTES

Appendix A

USING THE RIVERBOAT SP-C

This chapter includes:

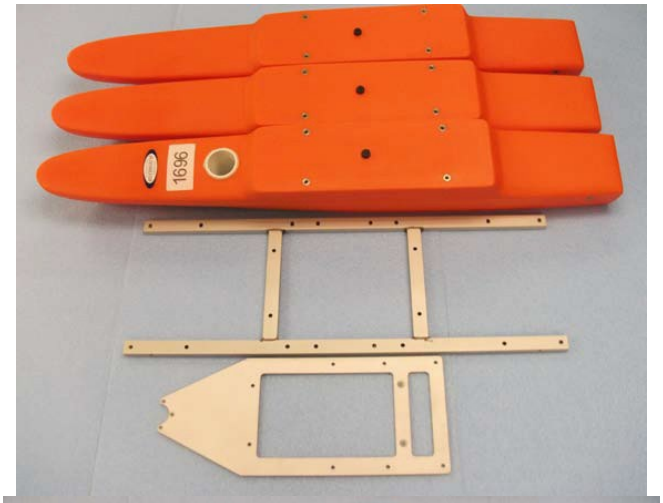
- How to mount the StreamPro transducer and electronics chassis on the Oceanscience tethered trimaran

This appendix shows how to assemble the StreamPro SP-C. The Riverboat SP-C is a rugged corrosion- resistant boat for easy measurement of discharge with acoustic Doppler profilers. Designed especially for the TRDI StreamPro with compass, the Riverboat SP-C is light, stable and capable of operation in very high flows.

Getting Started

Please identify the following components before beginning the assembly process.

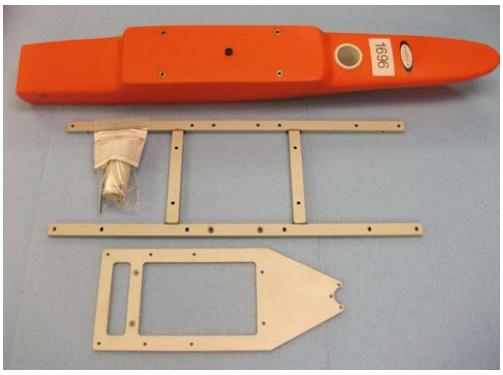
- (1) Main hull with instrument well
- (2) Outrigger hulls
- (1) Crossbar
- (1) Instrument mounting plate
- (2) Large drag fins
- (1) Wire rope bridle hardware bag
- (1) Riverboat SP assembly hardware bag
- (1) Fin assembly hardware bag
- (1) SP-C instrument clamp hardware bag
- (1) Strap handle hardware bag
- (1) Electronics case hardware bag

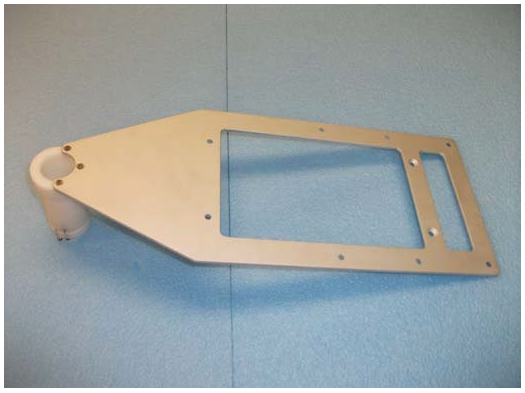


Transducer Assembly

Required Components:

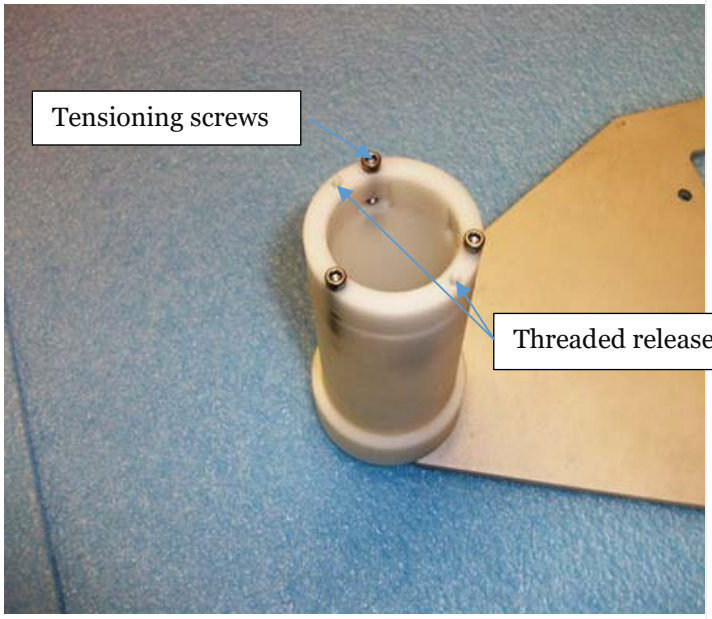
- (1) Main hull with instrument well
- (1) Crossbar
- (1) Instrument plate
- (1) SP-C instrument clamp hardware bag





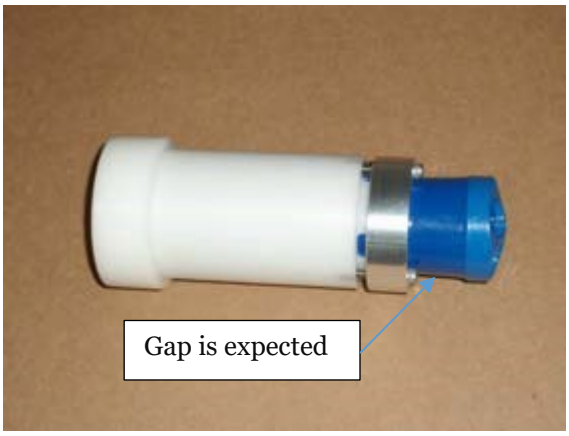
Step 1

Begin by attaching the SP-C instrument clamp assembly to the instrument plate using three 8-32 x ½-in. flat head screws provided in the SP-C instrument clamp hardware bag.



Step 2

Loosen the three tensioning screws on the instrument clamp assembly using the 7/64- in. hex driver (provided), allowing the transducer to slide in easily.

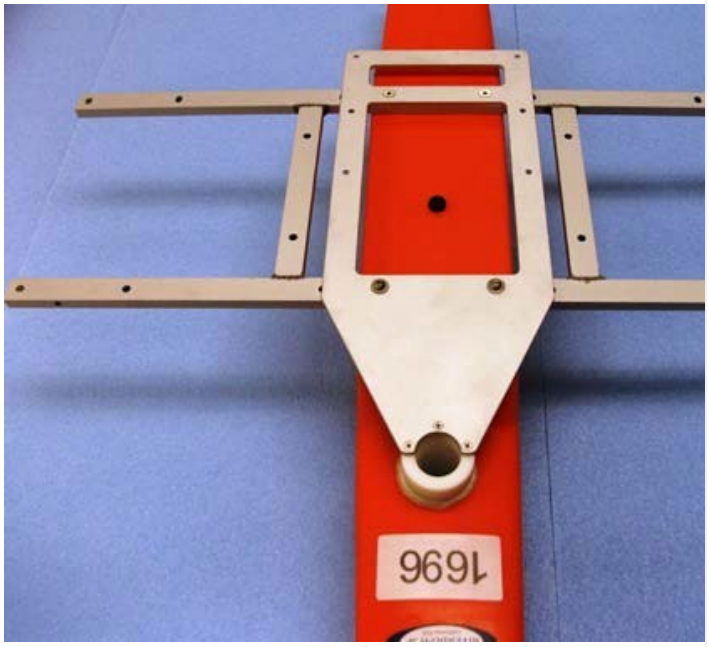


Step 3

Slide the transducer into the instrument clamp.

IMPORTANT: do not over tighten!

This ring needs to be tightened gently by hand until hand snug.

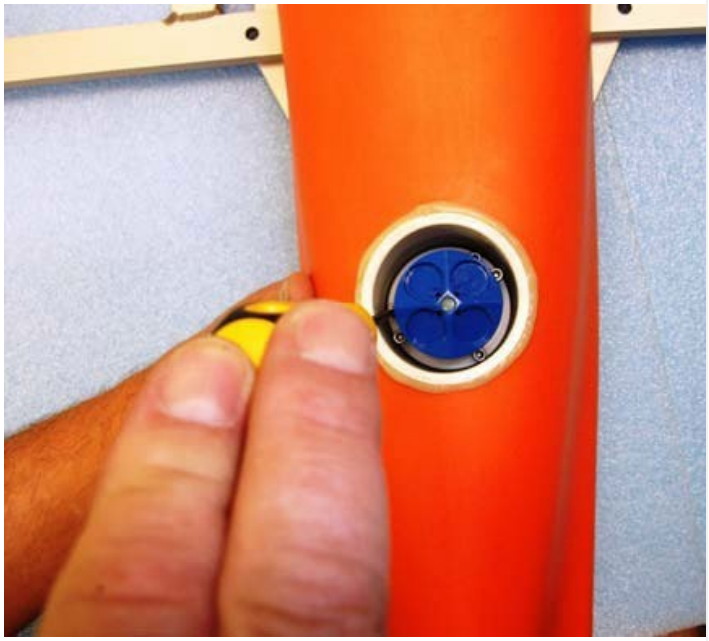


Step 4

Attach the crossbar and instrument plate to the main hull using the ¼-20 x 1-in. button head screws and flat washers in the front two holes and the ¼-20 x 1-in. flat head screws in rear.

Step 5

Turn the main hull assembly upside down. Align the arrow on the transducer facing toward the bow of the Riverboat. Then slide the transducer into the instrument clamp assembly. Be sure to align the groove on the transducer with the key inside the instrument clamp.



Step 6

Adjust the transducer to the desired height and tighten the three tensioning screws. The transducer is now locked in position.

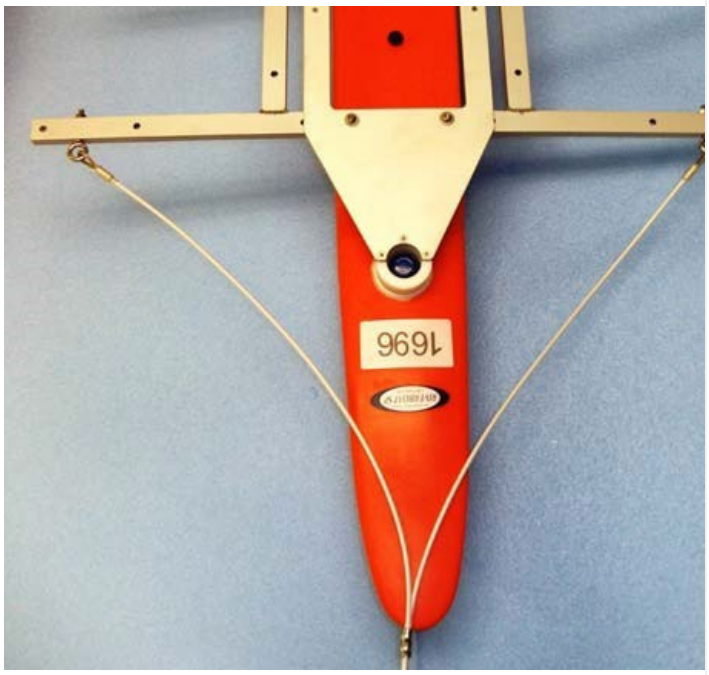
Step 7

To remove the transducer, loosen the three tensioning screws, then thread the extra 6-32 x 1-in. screws into the threaded release holes, tightening them evenly until the clamp releases the transducer.

Wire Rope Bridle, Outrigger, and Strap Handle Assembly

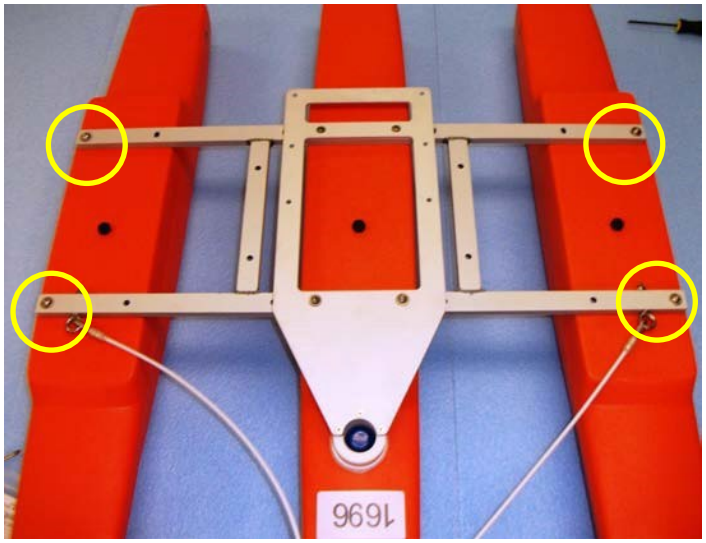
Required Components:

- (2) Outrigger hulls
- (1) Wire rope bridle hardware bag
- (1) Riverboat SP hardware Bag
- (1) Strap handle bag



Step 1

Install the wire rope bridle as shown being sure to align the eye nuts horizontally.



Step 2

Install the outriggers by attaching the crossbar at the four outermost threaded inserts using the ¼-20 x 1-in. button head screws and flat washers provided in the Riverboat SP hardware bag.

Step 3

Place a fender washer (Strap Handle Bag) over the inside Outrigger mounting holes.

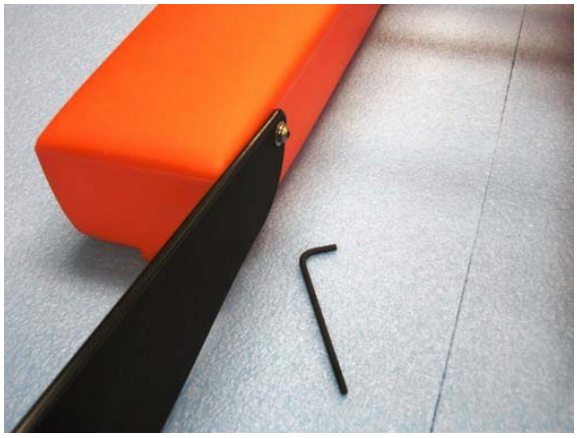
Step 4

Place the strap handles over the fender washers and attach them with the 1 ¼ - in. x ¼-20 button head screws and flat washers provided in the strap handle hardware bag.

Drag Fin Assembly

Required Components:

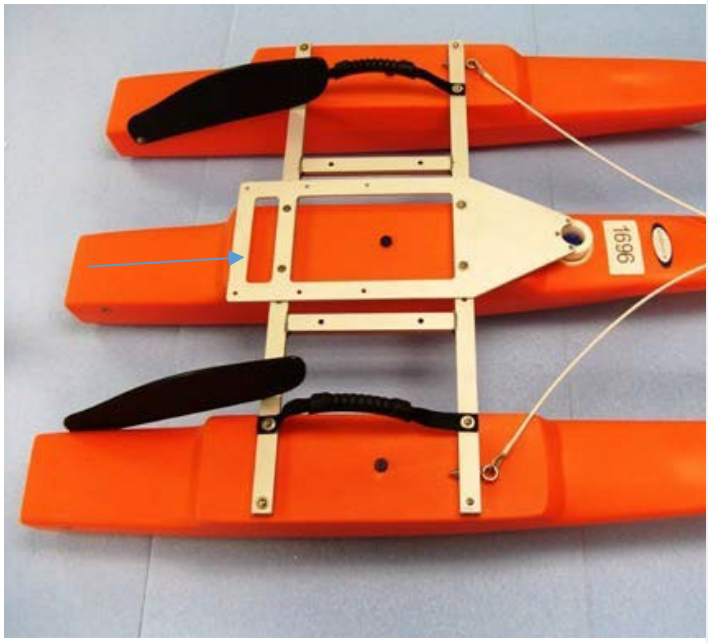
- (2) Drag Fins
- (1) Fin assembly hardware bag



Step 1

Attach the drag fins to the outriggers at the inner threaded inserts using the ¼-20 x ¾ - in. patch screws, flat, and lock washers. The fins can rotate from storage to deployment position. Ensure the patch screws are snug before deploying the boat.

Instrument Electronics Case



Install the electronics case as far aft as possible on the instrument mounting plate using the hardware provided in the electronics case hardware bag.

Note: Please ensure all hardware is tightened properly before deployment.

Appendix B

USING THE GPS MOUNTING KITS

This chapter includes:

- Attaching the GPS mounting kit to the tethered trimaran

Moving boat ADCP discharge measurements require a navigation (boat speed) reference to separate ADCP motion from the measured data to determine the true water velocity relative to earth, and to track the movement of the ADCP across the section of interest. The ADCP's bottom track data at times cannot be used for that purpose due to factors such as bottom vegetation or other conditions interfering with the bottom track measurement, or high sediment/bed loads causing bias in the bottom track data. In those cases, GPS/GNSS data is often used to track the motion of the ADCP for use in processing and discharge calculations.

GPS/GNSS units used with the StreamPro ADCP must provide their own power source and communications links. Two such units are the Geneq SX Blue II and the Juniper Systems Geode GNS3M systems. These GPS/GNSS units are commonly used as they provide acceptable accuracy (~0.6m 2d RMS where SBAS is available) in a package light and small enough to be used on the standard StreamPro float, are battery powered, and include Bluetooth comms. The Geode GNS3M is also capable of receiving Atlas corrections via satellite; an Atlas Basic (H100) activation maintains sub-meter accuracy worldwide and thus is suggested for use in regions where SBAS corrections are not available.

This guide provides instructions for using GPS with the StreamPro ADCP and the WinRiver II software. Included are instructions for mounting the Geode GNS3M on the StreamPro float and Riverboat SP. Instructions for mounting the SX Blue II are provided in documents 95B-6080-00 (Riverboat SP) and 95B-6081-00 (standard float). Other brands and models can also be used; the general setup and configuration concepts presented herein apply equally to comparable units.

GPS stands for Global Positioning System as operated by the U.S. government. GNSS stands for Global Navigation Satellite System, a more generic term that includes GPS, GLONASS (Russia), Beidou (China), Galileo (EU) and other systems. For simplicity, the term GPS will be used throughout the remainder of this document.

Mounting the Geode on a StreamPro

The Geode GNS3M is normally mounted on the sunshield assembly of the StreamPro electronics. The kit supplied by Teledyne RDI includes a modified sunshield with mounting holes for the Geode. Simply attach the Geode to the sunshield using the 2 supplied #6-32 screws with flat and lock washers, then mount the sunshield on the StreamPro electronics assembly. Orientation of the Geode on the sunshield does not matter for GPS operation, however it may be convenient to have the LEDs of the GPS facing the front of the StreamPro.

Best practice requires mounting the GPS as close to directly above the ADCP as practical to avoid parallax errors between GPS antenna and ADCP motion. The mounting position of the GPS on top of the StreamPro electronics maintains the stability and operability of the float, and the small distance between the StreamPro transducer and the GPS position minimizes potential parallax errors. WinRiver II does contain provisions for entering the GPS position offset if desired; please contact TRDI Field Service for more information if desired.

Capturing Data from a GPS

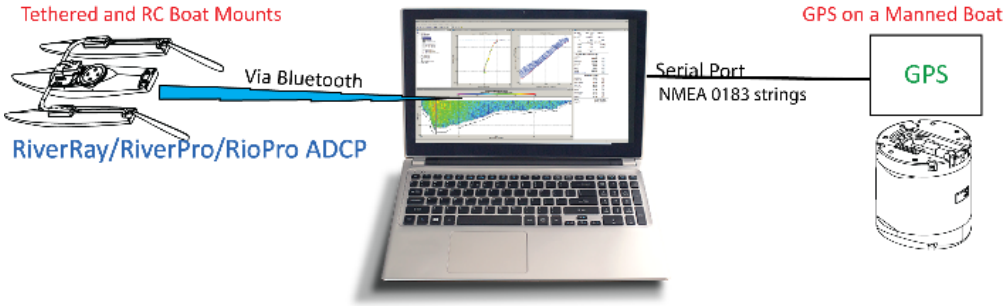
StreamPro and GPS data will typically be captured directly in the WinRiver II software using Bluetooth communications. The GPS system must output its data as NMEA 0183 strings, typically using only the GGA and VTG strings at a 1Hz rate which is consistent with the nominal StreamPro 1hz ensemble rate. The WinRiver II software requires separate Bluetooth comm ports for the StreamPro and GPS data streams.

Geode Bluetooth Connection

The Geode (and SX Blue II) GPS kits offered by Teledyne RDI include a SENA Parani SD1000U Bluetooth-USB adapter and high gain antenna. This adapter appears to the data collection computer as a USB serial port with the Bluetooth functionality embedded in the adapter. Configuration of the adapter and establishment of a Bluetooth connection is normally accomplished using the ParaniWin Software, available from the SENA Industrial web site here: Parani-SD1000U Bluetooth USB Adapter. Suggested configuration for the SD1000U is to set a fixed baud rate of 115,200 with no flow control using the DIP switches, then using ParaniWin to select Mode 1 operation with authentication and encryption unchecked, then pairing with the GPS. These settings will ensure that the SD1000U automatically reconnects with the GPS if power is cycled, or the Bluetooth connection is dropped for whatever reason.

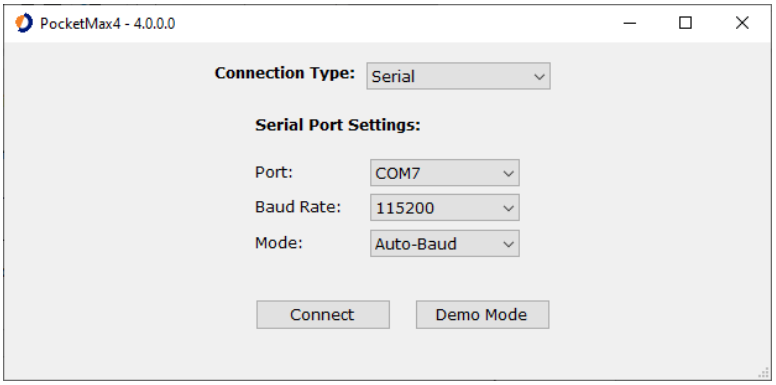
GPS System Configuration

Both the Geode and SX Blue II GPS systems use Hemisphere brand GPS modules, and configuration is normally accomplished using the Hemisphere PocketMax software and a computer. Current (Feb 2023) PocketMax version is 4.0.0.0. Software is available from the Hemisphere GNSS web site here: https://www.hemispheregnss.com/firmware-software/. Alternatively, you may using the SXBlueConfig software for the SX Blue II available from SXblue GPS, or the Geode Connect software with the Geode available from Juniper Systems, Inc.

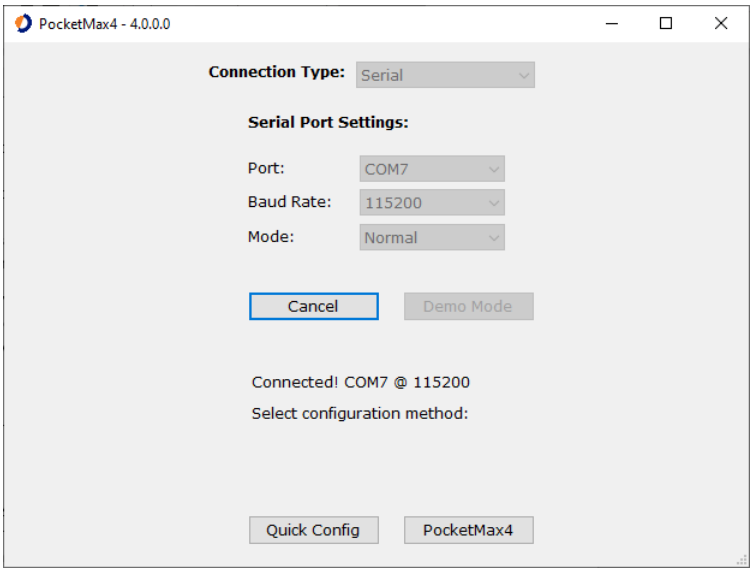


To configure the GPS for use with an ADCP and WinRiver II:

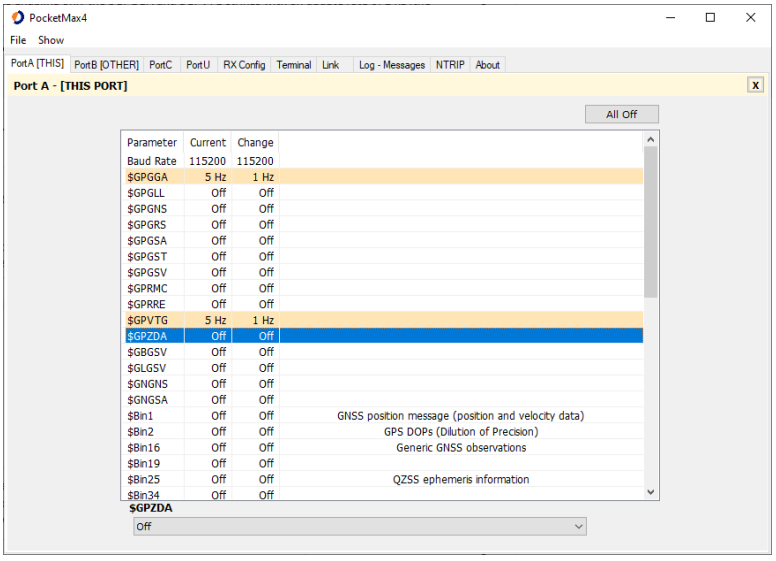
1. Install the PocketMax software on your computer.
2. Turn on the power to the GPS. Connect the computer to the GPS system using the SD1000U Bluetooth adapter and ParaniWin software as described above.
3. Run the PocketMax software. You will see a connection window similar to the one shown. Select the appropriate COM port and select the Auto-Baud mode as shown. Then click the Connect button.



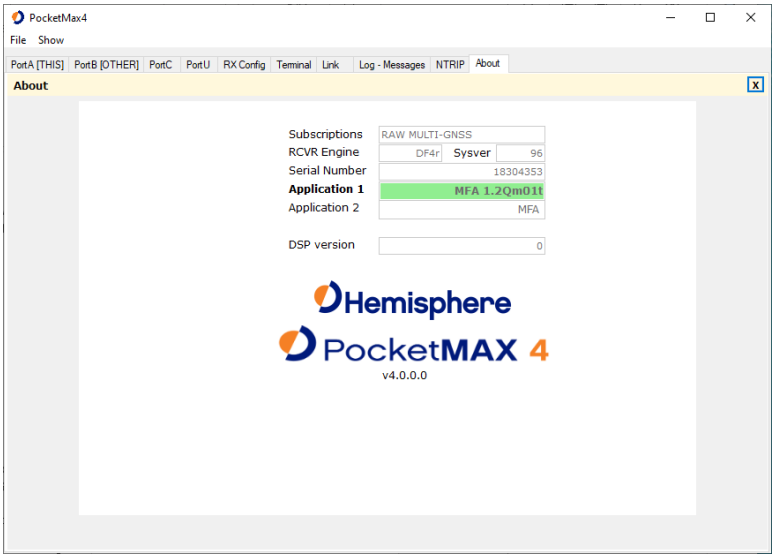
4. The software will attempt to connect to the GPS, initially using the specified port and baud rate and then at varying baud rates. If the software is not able to communicate with the GPS verify that the GPS is powered on, the Bluetooth adapter has a valid connection, and that you are using the proper serial (COM) port. The following window will be displayed once the software has established communications with the GPS. Either configuration option can be selected, but the Quick Config option is recommended unless you need to review advanced GPS operational characteristics. The GPS can be configured indoors but must be outside with a clear view of the sky if you wish to monitor GPS performance.



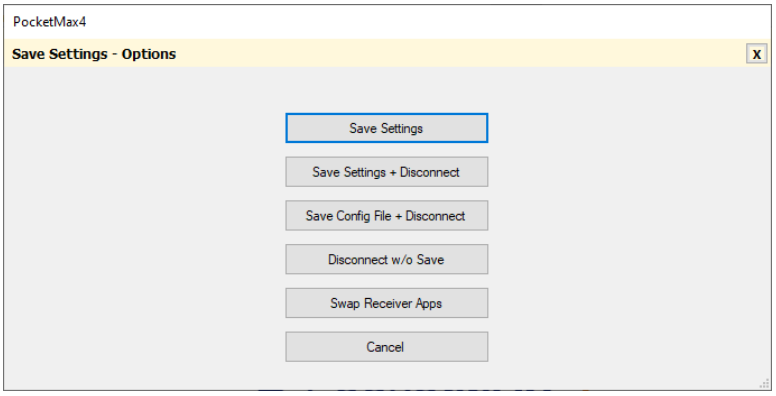
5. Select the PortA tab from the following window. DO NOT change the baud rate setting here – it will not affect the Bluetooth data transfer rate. TRDI recommends enabling only the $GPGGA and $GPVTG strings with an update rate of 1 hz (the maximum rate supported by the Geode in its default configuration) to match the StreamPro 1hz update rate, with all other strings set to OFF. Optionally, the $GPZDA string may be configured for 1hz output rather than off; this string can be used in WinRiver II to set the StreamPro time from GPS rather than from the computer's clock if desired.



6. If desired, select the About tab to confirm the application name and firmware version in use by your GPS. Updating the firmware in the Geode is normally not required.



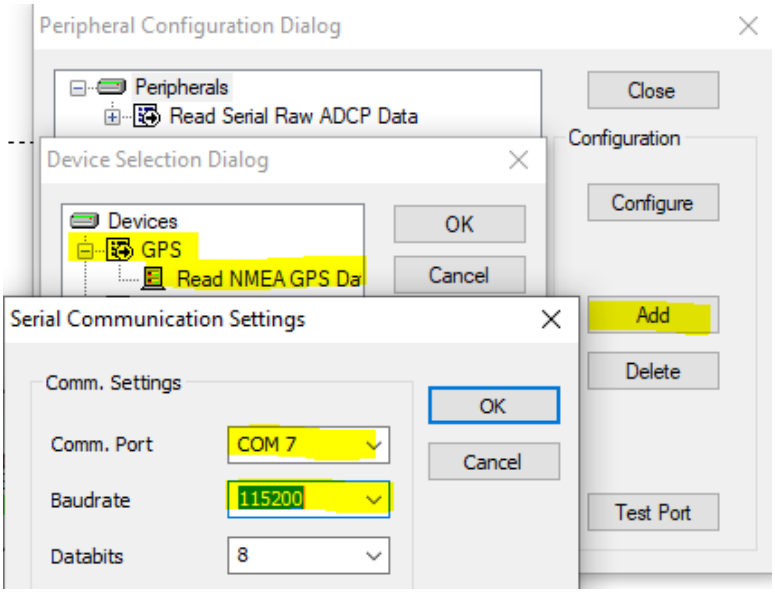
7. Save your changes by clicking on File, Exit or the red 'X' close button in the upper right corner of the program window. Select Save Settings + Disconnect from the following window. When the software finishes saving the settings, the software will return to the connection window.



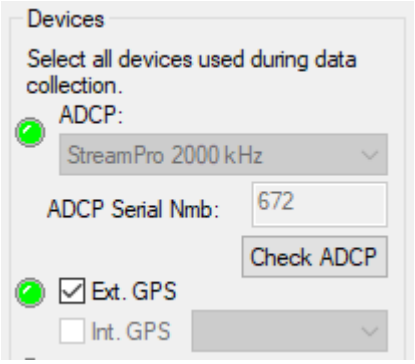
8. Re-connect to the GPS and confirm that all your changes were properly saved. If you wish to monitor the performance of the GPS, use the PocketMax3 option. You must be outdoors with a clear view of the sky if you wish to monitor the GPS performance.
9. Disconnect from the GPS again and close the PocketMax software. You are now ready to deploy the GPS with your ADCP.

Configuring WinRiver II

You will first need to configure WinRiver II with that port using the peripheral configuration dialog as shown:



Next, when creating a new measurement using the new measurement window, check the box for 'Ext. GPS' as shown:



Then continue with the measurement as you normally would, selecting the navigation (boat speed) reference as desired.

Appendix C

NOTICE OF COMPLIANCE

This chapter includes:

- China RoHS requirements
- Material disclosure table

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 31.

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 14020 Stowe Drive Poway, California 92064	**Teledyne RD Instruments Europe** 2A Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude, France	**Teledyne RD Technologies** 1206 Holiday Inn Business Building 899 Dongfang Road, Pu Dong Shanghai 20122 China

CE

This product complies with the Electromagnetic Compatibility Directive 89/336/EEC, 92/31/EEC. The following Standards were used to verify compliance with the directives: EN 61326(1997), A1(1998), A2(2001) – Class “A” Radiated Emissions.

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 31: 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	O	O	O	O	O
机体装配 Housing Assy.	X	O	O	O	O	O
接收机电路板 Receiver PCB	X	O	O	O	O	O
数据处理器电路板 DSP PCB	X	O	O	O	O	O
输入输出口电路板 PIO PCB	X	O	O	O	O	O
通讯接口板 Personality Module	X	O	O	O	O	O
蓝牙电路板 Bluetooth PCB	X	O	O	O	O	O
电池组 Battery Pack	X	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.

X: 表示该有毒或有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 标准规定的限量要求。

X: Indicates that the toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T 11363-2006.

NOTES