EXPLORER

INTEGRATION GUIDE

TELEDYNE
MARINE
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P/N 95B-6146-00 (July 2023)

https://www.teledynemarine.com

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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:

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

Self-Service Customer Portal

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

Teledyne Marine Software Portal

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

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

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

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

NOTES

Getting Started

Identifying what's in the Box

ExplorerDVL Inventory

Kit	Part Number	Name	Description
Standard Explorer Systems	70B-1002-03 70B-1003-03	Explorer PA DVL	The ExplorerDVL system includes the transducer, electronics chassis and cables. When unpacking, use care to prevent physical damage to the transducer face and connectors. Use a soft pad to protect the transducer.
	70B-1001-03	Explorer Piston DVL	
	71B-2010-03	Electronics chassis	
	73B-2002-xxx	Receiver cable	
	73B-2004-xxx	Transmit cable	
	95B-6148-00	ExplorerDVL Getting Started	A printed quick start sheet showing test setup is included.
Self-Contained Explorer Systems	70B-9001-00	Self-Contained EXP600 PA	The Explorer Self-Contained DVL system includes the transducer and cables.
	70B-9008-00	In-Line Self-Contained EXP600 PA	
	737-3055-005	Self-contained Pigtail cable	The DVL PWR/COMM cable connects the ExplorerDVL to the computer and external power supply.
	737-3114-005	Self-Contained test cable	The DVL/Power/Comm test cable is used for serial communications and power.
	73B-6037-005	Self-contained Sensor Comm Pigtail cable	Sensor Communication Cable connects the ExplorerDVL to the sensors.
	95B-6147-00	ExplorerDVL SC Getting Started	A printed quick start sheet showing test setup is included.
75BK6092-00 Documentation Kit	95Z-6007-00	Download instructions	This sheet has instructions for downloading the software and manuals.
75BK6016-00 75BK6030-00 Accessories Kit		Tools and Spare Parts kit Shipping Case	See Chapter 4, Maintenance in the ExplorerDVL Guide for a list of parts included in this kit.

See the packing slip for additional options. If you are missing parts, contact TRDI support rdifs@teledyne.com or call +1 (858) 842-2700.

Installing Documentation and Software

The ExplorerDVL documentation and software are downloaded.

1. Follow the instruction sheet on downloading TRDI software and manuals.

2. Software is available on https://tm-portal.force.com/TMsoftwareportal. Install *TRDI Toolz*.

3. Use our online customer portal at https://www.teledynemarine.com/support/RDI/technical-manuals to download manuals or other Teledyne RDI documentation. Download the ExplorerDVL Guide. PDF versions of all ExplorerDVL documentation are available for download.

ExplorerDVL Guide

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. The definition and details of the PD0 format can be found in any of the manuals under the section, Output Data Format.

Available for download from the Teledyne software portal:

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

Connecting to the ExplorerDVL

Power Overview

The ExplorerDVL requires a DC supply between 12 and 28 VDC with a minimum inrush capability of 3A. Either an external DC power supply or battery can provide this power. Sonar performance depends on supply voltage, but not very strongly. The processing electronics use a DC/DC converter, so their function is independent of the supply voltage over the 12 to 28 volt range. However, the raw supply voltage is provided directly to the transmitter so that the transmitted acoustic power is proportional to Vin^2. Many customers have successfully operated the ExplorerDVL using 24 volts. It may be worth the cost of providing a higher supply voltage to achieve the maximum bottom-tracking range.

The self-contained Explorer can accept custom power input with the inclusion of a custom power conversion board. Please contact a TRDI sales representative for further details on this capability.

Power on Cycle

The power supply must be able to handle the inrush current as well. Inrush current is the current required to fully charge up the capacitors when power is applied to the ExplorerDVL. The capacitors provide a store of energy for use during transmit. The inrush current is as high as three Amps rms. The ExplorerDVL will draw this amperage until its capacitors are fully charged.

If the power supply limits the current or the power drop on the cable is significant, then the power on cycle will take longer. It can take up to one minute. If the power shuts down during the inrush current draw, this may not allow the ExplorerDVL electronics to start.

Bench Testing the ExplorerDVL System
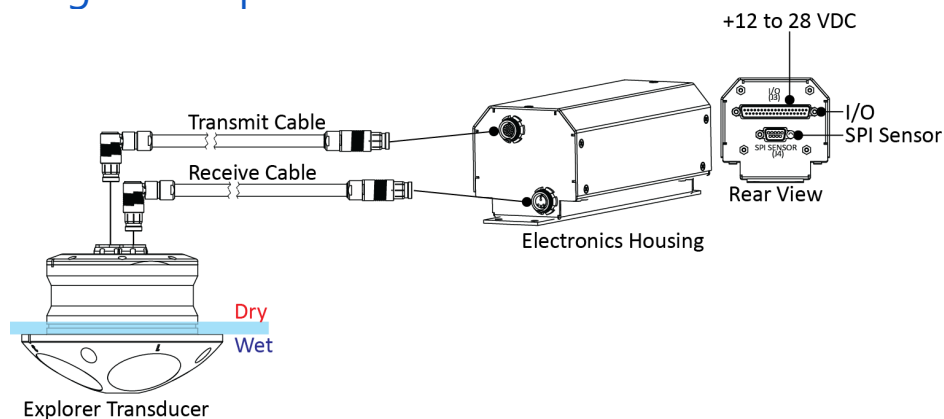
Connecting the ExplorerDVL:

Figure 1.   **ExplorerDVL Connections**

To set up the ExplorerDVL:

1. Connect the Transmit and Receive cables to the electronics housing and transducer.

> Match the red dots to connect the Transmit and Receive cables.

2. Wire the I/O cable to the computer's communication port (see Input Power and Communications Cable Wiring).

3. Connect +12 to 28 VDC power.

The Input Power and Communications Interface Connector (J3) uses a DB37M (Amp 747375-2) connector. Use the following table to make the minimum RS-232 connections required to test the ExplorerDVL.

> See the ExplorerDVL Operation Manual, (Table 1) for the full wiring diagram.

DB37 Male Connector / I/O Bus		DB9 Female Connector / SPI Bus (Sensor)	
Pin 1	RX1	Pin 3	Transmit Data
Pin 3	TX1	Pin 2	Receive Data
Pin 5	COMM 1_2	Pin 5	Communication Return
Pin 34/35	Power +	N/A	N/A
Pin 36/37	Power -	N/A	N/A

> I/O Bus COM port 1 (pins 1, 3, and 5) is reserved for communicating to and controlling the ExplorerDVL. This port will not support sensors. I/O Bus COM ports 2, 3, 4 and the SPI bus port are for sensors.
>
> This setup is for systems with RS-232 on I/O Bus COM port 1 (the master port) only. For systems with RS-422 on I/O Bus COM port 1, refer to the manual for setup and wiring.

Connecting the Self-Contained ExplorerDVL:

To disconnect the cable/Dummy Plug:

1. Release the retaining strap/Cable Clip with O-Ring by pulling it over the connector.

2. Grasp the cable close to the connector. Pull the cable straight out away from the housing with a gentle rocking motion. Do not apply any upward force on the connector as it is being disconnected.

> The dummy plug should be installed any time the Communications /Power cable is removed. Use the dummy plug when the ExplorerDVL is in storage or is being handled.

To connect the cable:

1. Check all pins for signs of corrosion (greenish oxidation, black deposits, or pitting).

2. Use light amounts of silicone lubricant (such as 3M™ Silicone Lubricant (Dry Type) ID No: 62-4678-4930-3) on both the male pins and female socket to help seat the cable connectors. Wipe off excessive silicone spray from the metal portions of the pins. **Regular lubrication is required**: Apply dry type silicone lubricant prior to each connection.

> When the cable is connected without any lubricant, excessive force is needed to fully seat or remove the connector. This can cause several serious problems:
>
> - The neoprene rubber portion of the contact pin may tear from the metal pin.
> - Wiggling the cable side-to-side to overcome the friction as it is connected or disconnected may cause the neoprene rubber to tear or create pin-holes on the side of the connector.
>
> Any damage to the neoprene rubber may cause corrosion on current carrying pins or leakage into the DVL.

3. Gently push the cable straight in toward the connector. Do not apply any upward force on the connector as it is being connected.

4. Roll the retaining strap/Cable Clip with O-Ring over the connector.

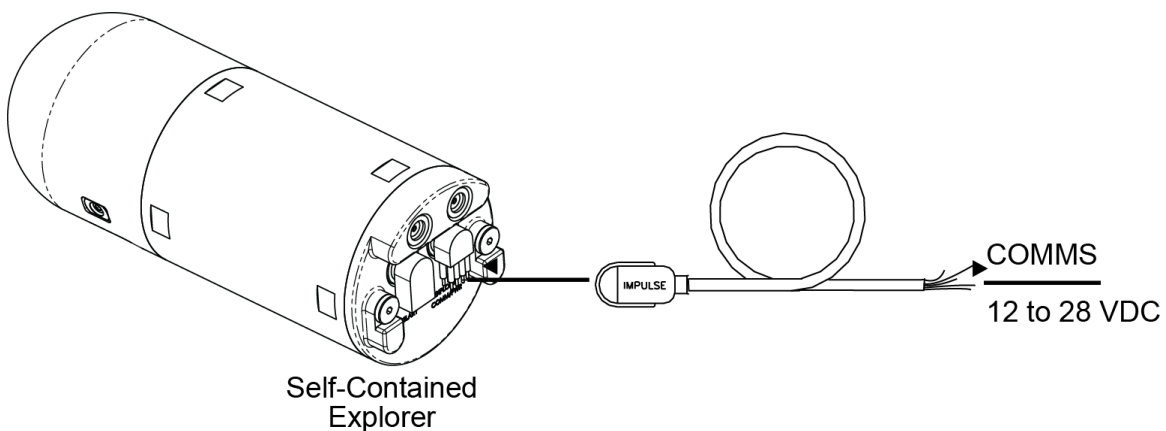5. Connect +12 to 28 VDC power.

Figure 2.   Self-Contained ExplorerDVL Connections with Optional Test Cable shown.

Use this figure to wire the ExplorerDVL pigtail cable. Refer to the ExplorerDVL Operation Manual for more details on system interconnections.
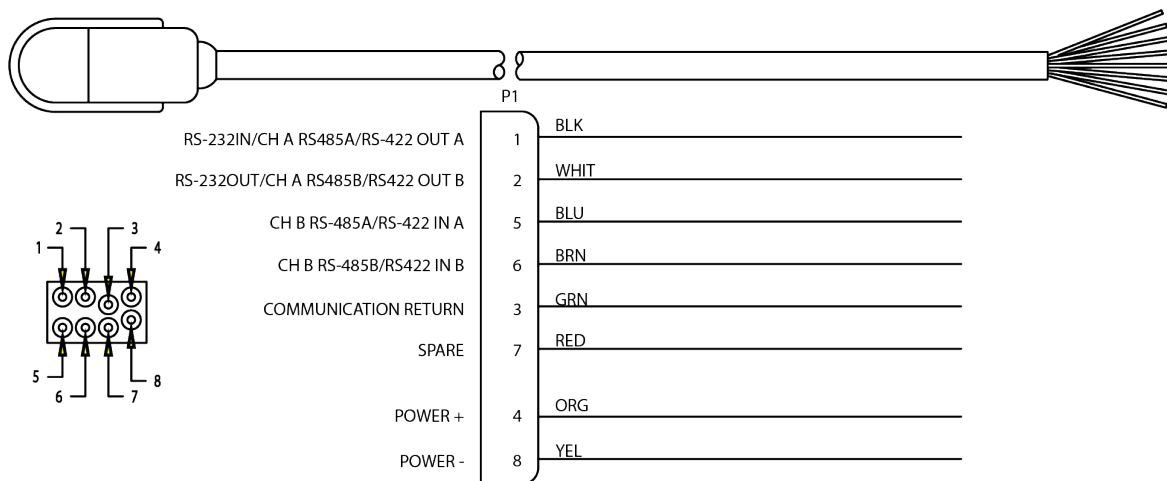

Figure 3.   Self-Contained ExplorerDVL Comm/Power Cable P/N 737-3055

Communicate with the ExplorerDVL:

To establish communications with the ExplorerDVL:

1. Connect the system and apply power.

2. Start the *TRDI Toolz* software.

3. Select **New Serial Connection**.

4. Enter the Pathfinder's communication settings.

    Serial Communications:

    Select the **COM Port** the serial cable is connected to and set the **Baud Rate** from the drop down list to 115200

5. Click the **Connect** button. Once connected, the button will change to **Disconnect**.

6. Click the **Break** (⚡) button. From the **Break** button drop down menu, select **Soft Break** (= = =). The wakeup banner will display in the terminal window.
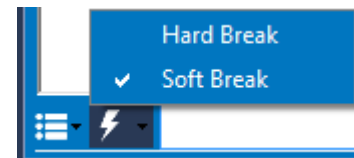
```
ExplorerDVL
Teledyne RD Instruments (c) 2015
All rights reserved.
Firmware Version: 57.01
>
```

Changing the Baud Rate to the highest baudrate:

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

Connect and power the system as shown in Figure 1.

Use *TRDI Toolz* to send the CB command that selects the baud rate. The table on the left shows the CB command settings for different baud rates with no parity and 1 stop bit.

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

💡 The **CB?** command will identify the communication setting.

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

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

The ExplorerDVL is now set for the new baud rate. The baud rate will stay at this setting until changed again with the CB command.

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Testing the ExplorerDVL:

```
>PA
ROM Test...PASS  [ 3aad ]
RAM test...PASS
FRAM test...PASS
Receive Buffer Test...PASSED
XMIT RAM Test....PASSED
Receive Path Test (Hard Limited)...PASSED
Transmit/Receive Continuity Check...PASSED

Composite Result:
    GO for Deployment
```

⚠ Submerge the transducer face in a few inches of water. The PA test may fail in air. Only a failure with the transducer in water is a relevant test.

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

At the ">" prompt in the communication window, enter the command **CK** then press the **Enter** key. This will save the factory default setting.

Place the ExplorerDVL in a bucket of water (at least a few inches to cover the transducer face).

At the ">" prompt in the communication window, enter the command **PA** then press the **Enter** key. This will run the ExplorerDVL deployment test.

Testing the Sensors:

```
>ps0
    Serial Number:  0
        Frequency:  614400 Hz
    Configuration:  ExplorerDVL : 4-beam ve-
locity.
 Transducer Type:  PISTON
       Beam Angle:  30 Degrees
     Beam Pattern:  CONVEX
          Sensors:  TEMP  PRESS  TILTS

     CPU Firmware:  34.xx
     FPGA Version:  3.00.005
  Sensor Firmware:  33.03

Board Serial Number Data:
 53 00 00 00 15 5A 04 28
 4F 00 00 00 34 A7 60 23    BFP72B-1102-03X
 DC 00 00 00 41 51 C4 23    DSP72B-2102-00X
 E6 00 00 00 41 7E A6 23    PER72B-2104-00X
 F0 00 00 00 34 A7 89 23    BFT72B-1101-03X
 8F 00 00 00 3D 07 1B 23    RCV72B-2103-03X
 A1 00 00 00 32 00 67 23    SNS72B-1000-00A
 4B 00 00 00 34 A6 5F 23    PIO72B-2101-00X
```

At the ">" prompt in the communication window, enter the command **PS0** then press the **Enter** key. This will display the ExplorerDVL system configuration data.

Note the sensors attached to your system.

```
>sr

Initializing sensor 12 on port 3.

>pc2
NOTE: Depth sensor source currently configured to manual
settings.
See EZ command.

Sensor data is sampled and displayed in a loop.
The number to the right of each backslash indicates the
ID of the
  sensor used for that data.
Press any key to exit the loop.

   Temp(degC)   Press(kPa)   Depth(m)   Hdg(deg)
Pitch(deg)   Roll(deg)   Vin
/  23.12/ 8    0.000/ 0    0.000/ 0    2.48/12     0.27
/12   -0.19/12   25.84

>
```

At the ">" prompt in the communication window, enter the command **SR** then press the **Enter** key. This will initialize all the sensors attached.

At the ">" prompt in the communication window, enter the command **PC2** then press the **Enter** key. This will display real-time data from all the sensors attached.

Press any key to exit the test.

The /12 on the Heading, Pitch, and Roll output indicates that the sensor information is from the AHRS sensor.

Mechanical Integration

Alignment

The mechanical alignment of the transducer head is important to DVL data accuracy. Mechanically mount the head as close as possible to your reference point. You also must mount the transducer head as level as possible using the ship's roll and pitch references.

> TRDI recommends mounting the transducer head with Beam 3 (instrument Y-axis) rotated 45° relative to the ship forward axis.

Mounting the transducer head with Beam 3 (instrument Y-axis) rotated 45° relative to the ship forward axis causes the magnitude of the signal in each beam to be about the same. This improves error rejection, reduces the effect of ringing, and increases the ExplorerDVL's effective velocity range by a factor of 1.4. If Beam 3 is aligned at an angle other than zero, use the EA command to describe the rotation between instrument Y-axis (beam 3) and ship forward axis.
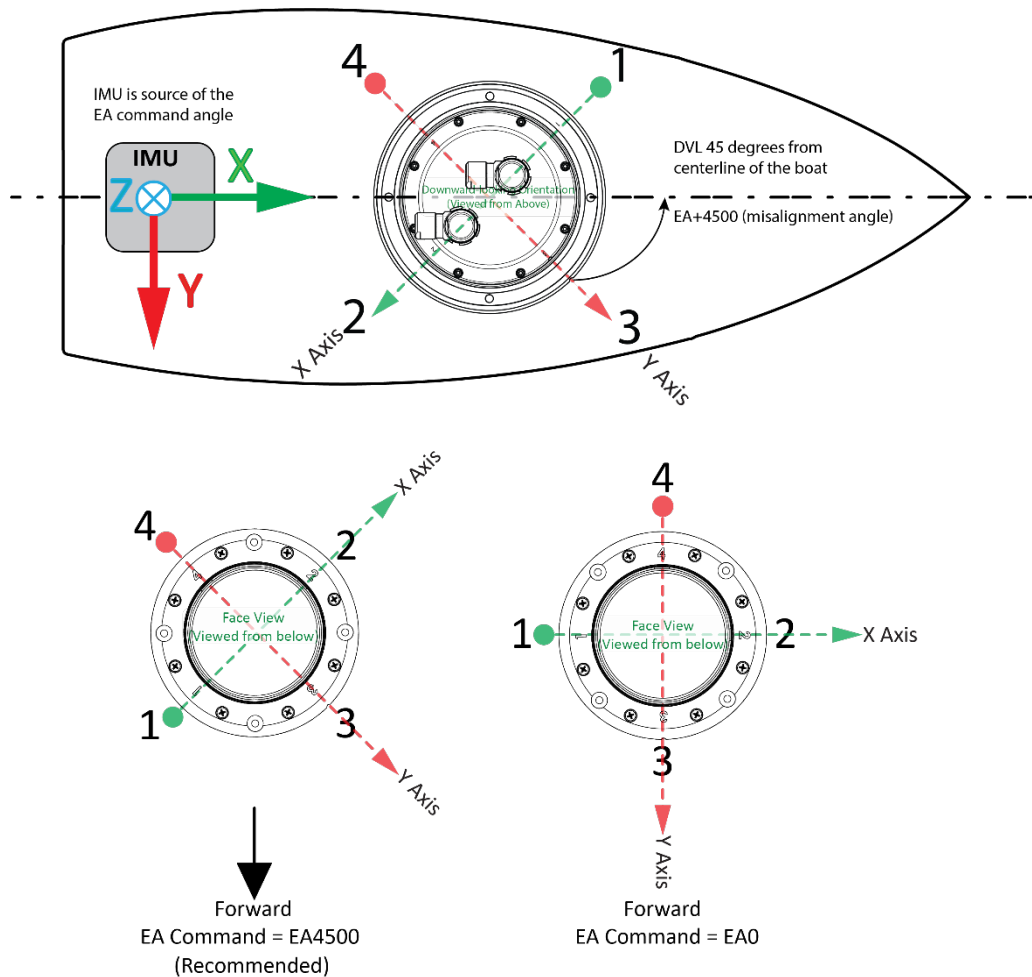
Transducer Alignment Reference Points

Installing the DVL on the ROV

Internal Clamp

The preferred method of mounting the transducer is using a clamp that grips the beveled edge on the circumference of the housing near the end-cap. This feature is provided so that when a mating beveled feature is clamped to it, the transducer is forced up and into the housing. This, in turn, loads up the face O-ring seal on the transducer flange and provides a watertight seal.

The advantage of this method is that no threaded connection outside the vehicle is needed, which should improve corrosion resistance and eliminates the need for the outer face O-ring on the flange. The disadvantages are slightly greater mechanical complexity and possible ringing depending on shape and material of the clamp.
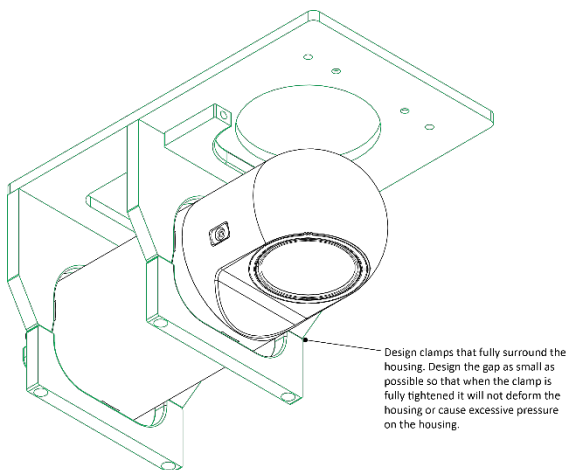

Bolted Connection

The fallback method of mounting the transducer is to use the clearance holes in the flange of the transducer. Cap screws that thread into the vehicle should have their heads sealed with urethane (manufacturer BJB, part number 753). The anodized area of the counter bore should be primed (manufacturer Chemglaze, part number 9944A/B) prior to application of the urethane.

The advantage of this method is simplicity. The disadvantage is that it is more difficult to repair/replace and possibly poses an increased risk of flooding if the urethane fails and the threads in the vehicle corrode.

> ⚠️ Whatever mounting solution chosen, particular attention should be paid to acoustic coupling that would increase the ringing of the transducer head and corrupt the collected data. The PA test should result in a No-Go for deployment in this case.

The preferred method of mounting the Self-Contained ExplorerDVL is using two clamps that grip the notches on the circumference of the housing.

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

> ⚠️ Your ExplorerDVL transducer housing is made of aluminum that is protected by sacrificial anodes and a hard anodize coat. **Do not connect other metal to the DVL.** Other metals may cause corrosion damage.
>
> Use M6 isolating bushings and washers when mounting the DVL to a metal structure. Keep this in mind when fabricating a fixture, which materials to use, or deciding how to place it on the vehicle.

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Electrical Integration

Grounding Issues

Multiple grounds connected to a vehicle hull or to a vehicle chassis can have undesirable consequences. Grounding problems can be avoided by implementing prudent grounding schemes.

The DVL has three isolated grounds in order to achieve the desired performance levels of the instrument. The grounding systems are as follows:

- Communication ground
- Power ground
- Chassis ground

Bypassing or shorting the DVL isolation / ground noise filter circuit will increase the sensitivity of the DVL to vehicle noise, which will increase noise floor in the instrument and in the data, thereby resulting in a reduced operational range and data contamination from interference. Additionally, bypassing of the DVL isolation/ground filter can lead to accelerated corrosion.

> ⚠️ Your ExplorerDVL transducer housing is made of aluminum that is protected by sacrificial anodes and a hard anodize coat and paint. **Do not connect other metal to the DVL.** Other metals may cause corrosion damage.
>
> Use M6 isolating bushings and washers when mounting the DVL to a metal structure. Keep this in mind when fabricating a fixture, which materials to use, or deciding how to place it on the vehicle.

Electro-Magnetic Interference (EMI)

The main sources of EMI are induced voltages from signal and power lines that are located in proximity to the effected component or signal. These problems are avoided or minimized by the proper routing of wires, proper shielding of wires and proper location of individual systems components. EMI is also caused by unwanted differences in potential on signal or ground electronic lines.

> 📖 For more information, see the ExplorerDVL Guide, Chapter 2 – System Integration, Identifying EMI.

Acoustic Integration

The following items must be taken into consideration when using the ExplorerDVL.

Flow Noise – Water flowing over the transducer faces increases the acoustic noise level, which in turn decreases the operational range of the DVL. Flow noise can be reduced across the transducer faces by mounting the DVL behind a sea chest, fairing, or acoustic window. Flow noise can also be reduced by optimizing the transducer head type and design to conform to the platform hull form being used.

Cavitation – Cavitation is the formation of air bubbles due to the reduction of ambient pressure because of hydrodynamic flow conditions. Cavitation at the edges of the transducer or surrounding area near the transducer often results in increased acoustic noise, and a corresponding reduction in operating range. As with flow noise, cavitation can also be reduced by optimizing the transducer head type and design to the platform hull form being used.

Ringing – Ringing occurs in DVLs when the energy from the side lobes of the transmitted signal excites the metal portion of the DVL transducer such that a resonant condition occurs. This causes the transducer and anything attached to it to resonate at the system's transmit frequency. While some ringing is normal in DVLs, its magnitude must be minimized.

Windows Use Considerations – Windows can be used to produce overall performance improvements in vessel-mounted DVLs. There are several advantages and disadvantages to consider before using an acoustic window.

Advantages
- Prevents air bubbles caused by the ship moving through the surface water.
- Flow noise is reduced.
- The well can be filled with fresh water to limit corrosion.
- Barnacles cannot grow on the transducer faces. Barnacle growth is the number one cause of failure of the transducer beams.
- The transducer is protected from debris floating in the water.

Disadvantages
- The range of the DVL may be reduced because the window can and will absorb some of the transmit and receive energy.
- The transmit signal could be reflected into the well, causing the well to "ring". This will cause the data being collected during the ringing to be biased. Some vessels have reported a loss in range as great as 50 meters. As noted, the ringing may be damped by applying sound absorbing material on the well walls (standard neoprene wet suit material has been found to work well).
- The transmit signal could be reflected off the window and back into the other beams.

SONAR Interference Considerations – Interference from other acoustic and electromagnetic devices can cause velocity and direction bias. In extreme cases, interference may prevent the DVL from operating.

For more information, see the ExplorerDVL Guide, Chapter 2 – System Integration.

Operational & Setup Integration

The following items must be taken into consideration when using the ExplorerDVL.

Unfavorable Environments – There are certain environmental conditions where the DVL's errors may be large or where the instrument does not function at all.

- In the surf zone where waves are actively breaking, the acoustic beams may not be able to penetrate the bubble clouds, and even if they do, the speed sound may be significantly affected by the high concentration of bubbles. This changes the Doppler scale factor.

- The dense growth of weeds or kelp on the bottom may prevent the DVL from detecting the true bottom. If the DVL locks onto the top of the weeds by mistake, they may have motion relative to the bottom due to wave action, which would give inaccurate velocity measurements.

- In areas of high salinity (>35ppt), the absorption of the sound by the water column will reduce the altitude capability of the DVL. Absorption (maximum range) can also be affected by water temperature.

- In areas where the salinity varies as a function of location and/or time, the Doppler scale factor will be varying and it may be necessary to integrate a speed-of-sound sensor into the navigation system to keep the velocity measurement errors to an acceptable value. Temperature gradients can cause similar issues. This is only for the Z-axis velocity, as Speed of Sound does not impact 2D Horizontal velocities on a Phased Array Transducer.

Triggering – There are two methods for triggering the DVL:

- **Sending ASCII Character through Serial Port**. When the system is interfaced to a serial port (e.g. a navigation computer), the system can be setup to wait for an input before each ping. To setup the DVL in this fashion, clear the Auto Ping Cycle bit in the CF command by sending CFx0xxx, where the x's represent the settings of the other parameters. Start the DVL pinging with the CS command. The DVL will output a '<' before each ping and wait for input. Send any valid ASCII character to trigger the ping. The instrument will not enter sleep mode while it is waiting for the trigger.

- **Using Triggering**. The trigger methods shown above all have latencies ranging from a few milliseconds to a few hundred milliseconds, which may be excessive for high-precision applications. Consequently, TRDI has developed a low-latency trigger method (see CX command). To configure the DVL for low-latency triggering, set the CX command to enable trigger input. Start the DVL pinging with the CS command. The DVL will then wait for a trigger before each ping. Setting the trigger lines to a break state for no less than 10 microseconds sends the trigger. The DVL will then ping within 1 millisecond of the leading edge of the break pulse. Note that it is possible through the CX command settings to set a timeout for the DVL to wait for a Trigger and then if no Trigger occurs during that time, it will either Self Deploy and never look for Trigger again or Ping once and then go back to waiting for a Trigger. The input trigger voltage is 3.3VDC to 7VDC.

For more information, see the ExplorerDVL Guide, Chapter 2 – System Integration and Chapter 7 - Commands.

Choosing a Data Format

Deciding on which output data format to use depends on the needs of the deployment. The following describes the basics of the formats available.

- **PD0** – PD0 is Teledyne RD Instrument's standard format. PD0 is a binary output format. It provides the most information possible including a header, fixed and variable leader, bottom track, and water profile information. The fixed and variable leader is a recording of time, DVL setup, orientation, heading, pitch, roll, temperature, pressure, and self-test diagnostic results. Data fields to be output are user selectable. PD0 has distance made good in the output if the Bottom Track High Resolution Velocity Output Format is selected. This format is selected via the #BJ command.

- **PD3** – PD3 is a binary output format of bottom track speed over the bottom, speed through the water, and range to bottom information. If PD3 is selected, there is no data written to the recorder.

- **PD4** – PD4 is a binary output format of bottom track speed over the bottom, speed through the water, and range to bottom information.

- **PD5** – PD5 is a superset of PD4 and includes information on salinity, depth, pitch, roll, heading, and distance made good.

- **PD6** – PD6 is a text output format. Data is grouped into separate sentences containing system attitude data, timing and scaling, and speed through the water relative to the instrument, vehicle, and earth. Each sentence contains a unique starting delimiter and comma delimited fields.

For more information, see the ExplorerDVL Guide, Chapter 8 – Output Data Formats.

The PD0 Bottom Track output data format assumes that the instrument is stationary and the bottom is moving. See the EX – Coordinate Transformation command and Beam Coordinate Systems for details.
- If Beam 3 is going forward, then the Y velocity is negative.
- If Beam 2 is going forward, then X velocity is negative.

The PD0 Bottom Track High Resolution Velocity Output (velocity in 0.01mm/s) and PD3 through PD6 data formats assume that the bottom is stationary and that the DVL or vessel is moving.
- If Beam 3 is going forward, then the Y velocity is positive.
- If Beam 2 is going forward, then X velocity is positive.

PD0 has distance made good in the output if the Bottom Track High Resolution Velocity Output Format is selected. This format is selected via the #BJ command.

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Want to know more?

Congratulations! You have completed the ExplorerDVL Integration Guide. Read the following chapters in the ExplorerDVL Guide for more detailed information.

🕑 **Chapter 1 – At a Glance**
This chapter includes an overview of the ExplorerDVL features, options, computer and power require-ments, and connecting to the ExplorerDVL.

🕑 **Chapter 2 – Installation**
This chapter covers in detail how to integrate the ExplorerDVL onto your vehicle.

🕑 **Chapter 3 – Collecting Data**
Use this chapter to create a command file, setup external sensors, and start data collection.

🕑 **Chapter 4 – Maintenance**
This chapter covers ExplorerDVL maintenance. Use this section to make sure the ExplorerDVL is ready for a deployment.

🕑 **Chapter 5 – Returning Systems to TRDI for Service**
If the ExplorerDVL needs to be returned to TRDI, use this information on how to obtain a Return Mate-rial Authorization (RMA) number.

🕑 **Chapter 6 – Specifications**
This chapter includes specifications and dimensions for the ExplorerDVL (including outline installation drawings).

🕑 **Chapter 7 – Commands**
This chapter defines the commands used by the ExplorerDVL.

🕑 **Chapter 8 – Output Data Format**
This chapter defines the output data formats used by the ExplorerDVL.

🕑 **Chapter 9 – External Sensors**
This chapter includes special considerations that need to be made when using external sensors with the ExplorerDVL.

NOTES

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