

UM-8275

User Manual for Type 8275 Syrinx DVL

Issue B Rev 2

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Note



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Amendment History

The amendment history records all amendments and additions made to this manual.

Issue	Revision	Date	Comments	Section	Page
A	1	14/12/2015	Initial issue	All	All
A	2	27/07/2016	Open source software licence notices and terms updated Additions for new functionality. Some protocol command definitions updated Appendix added for Ethernet connectivity issues General update	App E All App D All	All All All All
A	3	29/11/2016	Type 8275-000-9903 DVL variant added.	All	All
A	4	29/06/2017	Internal water block bulkhead description added DVL File Manager log file management updated General update	3 6.3.7 All	9 27–31 All
A	5	11/07/2018	8275-000-9904 variant added General update	All	All
A	6	09/05/2019	3,000 m variant with aluminium housing removed 8275-000-4531/6531 variants added (supersedes 4530/6530) Non-standard Syrinx DVL variants removed	All	All
A	7	31/07/2020	ADCP component added Definitions updated General Update	6, App B All	All All All
A	8	15/10/2020	Message definitions added (Sections B2–B6)	App B	116–126
B	1	01/03/2021	Syrinx DVL 400 kHz version added Manual updated with new branding	All	All
B	2	12/05/2022	9903/9904/9905 variants added in new Appendix A Syrinx DVL weights revised by EMD	App A 13.1	All 77

Section 1 – Introduction

1.1 Scope of this Manual

This User Manual defines the safe installation and operation of the Type 8275 Syrinx 600 kHz DVL. The information and procedures within this manual are based on Sonardyne's knowledge and experience.

1.2 Purpose of this Manual

This manual contains information for personnel involved in Syrinx DVL system operations. It includes technical information to deploy, configure, operate and maintain these devices, and specific information concerning Syrinx DVL 400 kHz and 600 kHz products supplied by Sonardyne.

To make sure the safety of the installer and operator is maintained it is important that all warnings and cautions in *Section 2 "Safety"* of this manual and in any related manuals are read and fully understood.

1.3 Related Publications

To make sure the equipment is operated safely, a Sonardyne Safety Manual is supplied with this user manual. It is important that the Sonardyne Safety Manual is read and fully understood before proceeding with any activity on the equipment.

Table 1–1 Related Publications

Publication	Title
<i>Sonardyne Safety Manual</i>	<i>Operational and Safety Precautions</i>
<i>QSG-OG-8275</i>	<i>Quick Start Guide for Syrinx DVL</i>
<i>UM-8300-099</i>	<i>User Manual for 6G Terminal Lite</i>

1.4 Conventions

Table 1–2 Conventions used in this Manual

Format	Conventions
Boldface Type	User Input, Menu Options, Keys, e.g. Click OK
<i>Italic Type</i>	References to Figures, Tables, Sections and other internal/external source
Arrow (>)	Selection of an additional menu item e.g. File>Save

Section 2 – Safety

2.1 Introduction

Before any activity is carried out on this system, it is recommended that the included *Sonardyne Safety Manual* and all warnings and cautions in this manual are read and fully understood.

It is recommended that the operator complies with the Health and Safety Regulations applicable to the vessel and the region before operating this equipment.

Operators and service personnel must be familiar with the normal operating and safety procedures for the subsea equipment being operated.

Documentation must be consulted whenever a  or  warning symbol is found on the equipment, in order to determine the nature of the potential hazard and any actions which must be taken.

If any additional equipment is used with this system, any warnings and cautions in the equipment user manual must be read and fully understood.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The safety of any system incorporating this equipment is the responsibility of the assembler of the system.

2.2 Safety Procedures

2.2.1 Warnings

 **Personal protection.** Appropriate protective equipment such as protective footwear, hard hat and gloves must be worn when handling or carrying out any procedures involving Sonardyne and other equipment.

 **Heavy equipment.** Many Sonardyne products and equipment types, such as transponders, transceivers, cable drums etc. require Manual Handling Equipment (MHE) for lifting due to their heavy weight. If MHE is not available, it is the responsibility of the operator to perform a manual handling risk assessment prior to carrying out manual lifting/handling. Refer to the individual equipment documentation for weight specifications.

 **Risk of fire.** Ensure the power rating of any cables used is not exceeded.

 **Risk of crush injury.** Do not stand underneath suspended equipment.

 **Risk of toxic gases and Corrosive Liquids.** Do not stand in direct line with the end of the unit when operating the pressure relief vent valve. Sudden release of high pressure gases could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the pressure relief vent valve.

 **High internal pressure.** Make sure the pressure relief vent valve is manually operated to release any internal pressure before attempting to dismantle the equipment.

 **Ensure the work environment is well ventilated.** Toxic gases may be released when operating the pressure relief vent valve.

 **Risk of burns.** Do not carry out maintenance on the DVL if the housing is hot. Lower the DVL into cold water and wait for the housing to cool.

 **Dismantling.** This instrument must only be accessed internally and dismantled by qualified

Sonardyne personnel.

 **Lithium-ion Battery Pack.** This instrument contains a backup lithium-ion battery pack. Refer to the Sonardyne Safety Manual for safety information for lithium-ion batteries.

2.2.2 Cautions

 **Molykote 44** is a mild irritant. When lubricating the connector faces, personal protective equipment such as gloves and goggles must be worn.

 **Risk of equipment damage.** Teledyne Impulse cables (used with Type 8275-4530/6530) are not interchangeable with Subconn cables (used with Type 8275-4531/6531). Using the incorrect cable will damage the Syrinx DVL connector.

 **Risk of equipment damage.** Do not deploy the Syrinx DVL using only the plastic isolation plate. The titanium plate is required if the isolation plate is used for strengthening purposes.

 **Risk of equipment damage.** All instruments must be maintained according to their individual operating manuals. Failure to follow recommended procedures could result in instrument failure, and loss of system integrity.

 **Risk of damage to connector pins.** The Impulse connectors must not be mated without lubrication as this will lead to delamination of the rubber from the connection pins and connector failure.

 **Risk of damage to connectors and seals.** Failure to clean sand or silt correctly could result in damage to the connectors and O-ring seals.

 **Risk of damage to protective coating.** Do not use any abrasive brushes or sharp tools to clean the DVL and remove any marine growth, this will damage the protective coating and increase the risk of corrosion.

 **Risk of equipment malfunction.** Minimise any sources of high-level acoustic noise in the 600 kHz band ± 150 kHz. Examples of such noise sources include such devices as multi-beam echo sounders or other DVLs. Other vessels using similar devices may also cause acoustic interference. High noise levels can disrupt the acoustic measurements and lead to loss of system integrity.

 **Risk of equipment malfunction.** Mandatory software, embedded software and firmware update notices must be applied as soon as practically possible.

 **Do not deploy the Syrinx DVL using only the plastic isolation plate.**

Section 3 – Technical Description

3.1 Introduction

Syrinx DVL is a navigation grade Doppler Velocity Log (DVL) designed for use on subsea or surface vehicles as a standalone navigation sensor or as an aiding sensor for a navigation system such as an Inertial Navigation System (INS).

Syrinx DVL is a 4-beam Janus-style array DVL available with a titanium non-corrosive housing (4,000 m and 6,000 m housings only).

Syrinx DVL provides self-optimising bottom lock to provide the highest accuracy positioning at all altitudes. Syrinx DVL is available in two frequencies; 600 kHz or 400 kHz for higher altitude tracking up to 230 m.

Syrinx DVL switches between Doppler velocity measurements and a different velocity measurement principle based on temporal correlation which allows the DVL to maintain velocity estimation precision at very low altitude.

Syrinx DVL can optionally capture Acoustic Doppler Current Profile (ADCP) data to measure water currents as a function of distance from the device.

Syrinx can be configured either by Ethernet connection or serial connection. Ethernet connectivity allows configuration of the device without the requirement for software, using the Embedded DVL Manager software (DVL Manager). Alternatively, Syrinx DVL can also be configured through a terminal package utilising the serial connection.

3.2 Syrinx DVL Types

3.2.1 Type 8275-000 Syrinx DVL 400/600 kHz

The Type 8275-000 Syrinx DVL 400 kHz and 600 kHz is the standard DVL sensor with a transducer array of 4 beams in a Janus formation with 30° beam angle from vertical.

3.2.2 Type 8275 Syrinx DVL Standard Variants

The Type 8275 Syrinx DVL standard variants are described below; see *Section 3.3 "Mechanical Description"* for more information.

Table 3–1 Syrinx DVL Standard Variants

Type	Variant	Description
8275-000-4531	600 kHz 4,000 m	4,000 m rated with titanium housing, Subconn connectors, no sensors
8275-000-4561	400 kHz 4,000 m	4,000 m rated with titanium housing, Subconn connectors, no sensors
8275-000-6531	600 kHz 6,000 m	6,000 m rated deep water titanium housing, Subconn connectors, no sensors
8275-000-4530	600 kHz 4,000 m	4,000 m rated with titanium housing, Teledyne Impulse connectors, no sensors (superseded by 8275-000-4531)
8275-000-6530	600 kHz 6,000 m	6,000 m rated deep water titanium housing, Teledyne Impulse connectors, no sensors (superseded by 8275-000-6531)

3.2.3 Type 8275 Syrinx DVL Non-Standard Variants

The Type 8275 Syrinx DVL non-standard variants are described below; see *Section 3.3 "Mechanical Description"* for more information.

Table 3–2 Syrinx DVL Non-Standard Variants

Type	Variant	Description
8275-000-9903	600 kHz 300 m	300 m rated with male connectors and plastic housing
8275-000-9904	600 kHz 4,000 m	4,000 m rated with titanium housing and male Seacon 5507-1508-0004 connectors
8275-000-9905	600 kHz 4,000 m	4,000 m rated with titanium housing and Seagnet 101-5260 connectors

3.3 Mechanical Description

3.3.1 Type 8275-000-4531/4561/6531

The type 8275-000-4531/4561/6531 Syrinx DVL supersedes the Type 8275-4530/6530 and incorporates an integrated mounting plate in a smaller lighter, titanium housing, fitted with Subconn connectors (the Type 8275-4530/6530 uses Teledyne Impulse connectors). The cables for these variants are not interchangeable.

The titanium housing prevents corrosion and provides strength and robustness. The cylindrical housing mates with the transducer endcap assembly using three alignment dowels for correct and repeatable orientation.

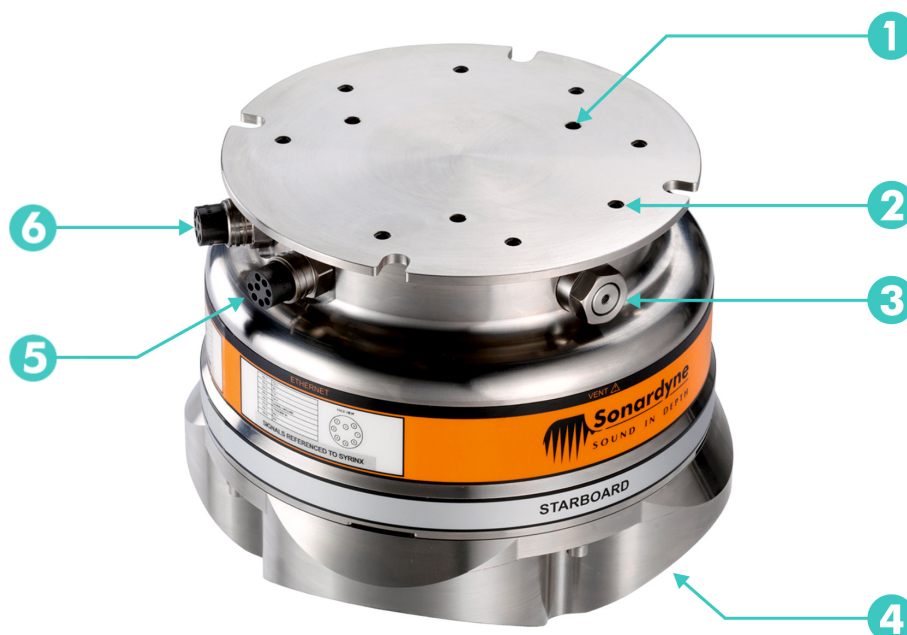
CAUTION



Teledyne Impulse cables (used with Type 8275-4530/6530) are not interchangeable with Subconn cables (used with Type 8275-4531/4561/6531). Using the incorrect cable will damage the Syrinx DVL connector.

Figure 3-1 describes the Type 8275-000-4531/4561/6531.

Figure 3-1 Type 8275-000-4531/4561/6531 Syrinx DVL 400/600 kHz 4,000/6,000 m



Item	Description
1	Lodestar Mounting Dowel Holes x3
2	Interface Plate Mounting Holes x8
3	Pressure Release Vent Valve
4	Transducer Face x4 (obscured)
5	Ethernet Connector
6	Serial Connector

3.3.2 Type 8275-000-4530/6530

The superseded type 8275-000-4530/6530 has a separate mounting plate and is fitted with Teledyne Impulse connectors.

Figure 3-2 describes the Type 8275-000-4530/6530.

Figure 3-2 Type 8275-000-4530/6530 Syrinx DVL 600 kHz 4,000/6,000 m



Item	Description
1	Lodestar Mounting Dowel Holes x3
2	Interface Plate Mounting Holes x8
3	Transducer Face x4 (obscured)
4	Ethernet Connector
5	Pressure Release Vent Valve
6	Serial Connector

3.3.3 Type 8275-000-9903

This is a non-standard variant; see *Appendix A "Non-Standard Syrinx DVL Variants"* for more information.

3.3.4 Type 8275-000-9904

This is a non-standard variant; see *Appendix A "Non-Standard Syrinx DVL Variants"* for more information.

3.3.5 Type 8275-000-9905

This is a non-standard variant; see *Appendix A "Non-Standard Syrinx DVL Variants"* for more information.

3.4 Housing Labelling

Waterproof labels on the housing uniquely identify the instrument as follows:

- SERIAL No 213245-006
- TYPE No 8275-XXXX
- Housing Limit 4,000 m max
- UNIT ID 00047D

3.4.1 Serial Number

The serial number identifies the transponder and should be quoted in all communications with Sonardyne International Ltd or their agents.

3.4.2 Type Number

The first four digits consist of the Type number and the last four digits indicate the depth rating, material, housing size and transducer type as indicated in the table below: e.g. 8275-000-4531.

- 8275
- 4= Depth rating (4,000 m)
- 5 = Material (Titanium)
- 3 = Transducer Type (600 kHz)
- 1 = Sensors (None)

Table 3–3 Type Number Identification

No	Depth Rating	Material	Transducer Type	Sensors
1	<1,000 m	Aluminium 6082		No sensor
2	2,000 m	Aluminium 7075		Xsens Sensor
3	3,000 m	S/Duplex	600 kHz	
4	4,000 m	Aluminium Bronze		
5	5,000 m	Titanium		
6	6,000 m	Stainless Steel	400 kHz	
7	7,000 m	Composite		
8	>8,000 m	ABS/Plastic		
9	Special	Special	Special	
0	No Code	No Code	No Code	No Sensor, Teledyne Impulse Connector

3.4.3 Housing Limit

This is the nominal pressure rating of the sensor housing.

3.4.4 Unit ID

The unit ID box shows the unique identification number for the sensor. The unit ID number is required to upgrade the functionality of the sensor. The unit ID cannot be changed and is stored on the CPU/Rx board.

3.5 Transducers

The housing contains four transducers that are recessed for physical protection. Each transducer is paired with another of similar acoustic characteristics to ensure consistent performance.

3.6 Connectors

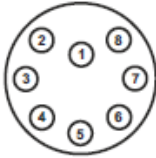
Syrinx uses two 8-pin female wet mate connectors, one providing two serial RS232 communication lines, the other providing Ethernet connectivity. Power and trigger inputs can be provided on either port.

3.6.1 Type 8275-000-4531/4561/4530/6531/6530 Serial Connector Wiring Details

Table 3–4 Serial Connector Wiring Details

Female Pin Number	Function (Rx/Tx With Relation To Syrinx)
1	RS232 Rx Primary
2	Power in 0 V
3	RS232 Tx Primary
4	Power in 24 V
5	Signal Ground
6	Trigger In
7	AUX RS232 Rx
8	AUX RS232 Tx

FACE VIEW

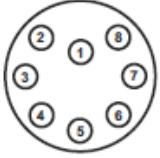


Pin 1	RS232 RX
Pin 2	0V
Pin 3	RS232 TX
Pin 4	24V
Pin 5	SIGNAL GROUND
Pin 6	TRIGGER IN
Pin 7	AUX RS232 RX
Pin 8	AUX RS232 TX

SIGNALS REFERENCED TO SYRINX

3.6.2 Type 8275-000-4531/4561/4530/6531/6530 Ethernet Connector Wiring Details

Table 3–5 Ethernet Connector Wiring Details

Female Pin Number	Function (Rx/Tx With Relation To Syrinx)	<table><tr><td>Pin 1</td><td>TX +</td></tr><tr><td>Pin 2</td><td>0V</td></tr><tr><td>Pin 3</td><td>TX -</td></tr><tr><td>Pin 4</td><td>24V</td></tr><tr><td>Pin 5</td><td>SIGNAL GROUND</td></tr><tr><td>Pin 6</td><td>TRIGGER IN</td></tr><tr><td>Pin 7</td><td>RX +</td></tr><tr><td>Pin 8</td><td>RX -</td></tr></table> FACE VIEW 	Pin 1	TX +	Pin 2	0V	Pin 3	TX -	Pin 4	24V	Pin 5	SIGNAL GROUND	Pin 6	TRIGGER IN	Pin 7	RX +	Pin 8	RX -
Pin 1	TX +																	
Pin 2	0V																	
Pin 3	TX -																	
Pin 4	24V																	
Pin 5	SIGNAL GROUND																	
Pin 6	TRIGGER IN																	
Pin 7	RX +																	
Pin 8	RX -																	
1	Ethernet Tx Data +	SIGNALS REFERENCED TO SYRINX																
2	Power in 0 V																	
3	Ethernet Tx Data -																	
4	Power in 24 V																	
5	Signal Ground																	
6	Trigger In																	
7	Ethernet Rx Data +																	
8	Ethernet Rx Data -																	

3.7 Pressure Relief Vent Valve

A pressure relief vent valve is fitted to automatically release any build-up of pressure inside the instrument during deployment. This could be caused by water ingress during deployment and/or the degassing of a battery.

If there is any reason to suspect there may still be pressure inside the instrument, the pressure relief vent valve should be operated. The pressure relief vent valve should always be operated before performing any maintenance work; see *Section 8.6.1 "Operating the Pressure Relief Vent Valve"*.

3.8 Internal Water Block Bulkhead

An internal bulkhead is fitted to protect the main chamber (containing the internal electronics) from water ingress should a transducer become badly damaged.

Note

 **The internal bulkhead does not protect water entering the chamber from an open pressure relief vent valve. Before deploying, ensure the pressure relief vent valve is closed; see *Section 8.6.1 "Operating the Pressure Relief Vent Valve"*.**

3.9 Power and Communications

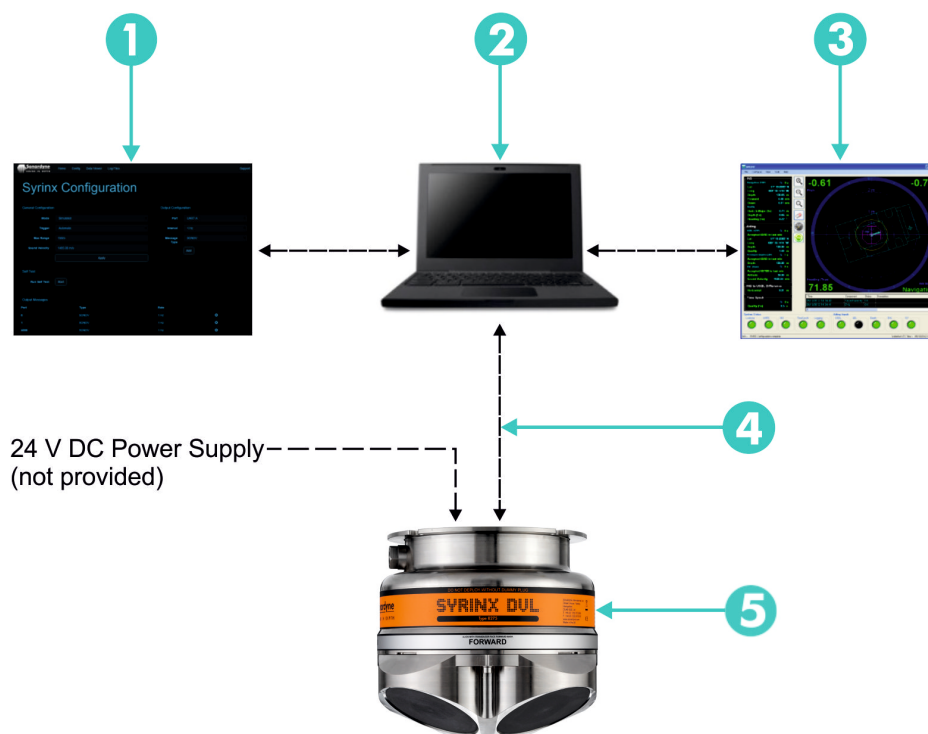
A test Ethernet box is provided to connect to and configure the Syrinx DVL. A cable tail is also provided.

The Syrinx DVL is powered by a 24 V $\pm 10\%$ external power supply. Communications are performed by Ethernet via DVL Manager or terminal package, or by RS232 using a terminal package. An additional RS232 data channel is provided for expansion of data outputs.

Ethernet and RS232 serial operation is used with 8-pin connectors. See *Section 3.6 "Connectors"* for wiring details.

3.10 Typical Syrinx DVL Navigation System

A typical DVL integrated into a navigation system includes the following components:

Figure 3–3 Typical DVL Navigation System

Item	Description
1	Syrinx Embedded DVL Manager (available through Ethernet connection only)
2	PC (not supplied)
3	Navigation software e.g. SPRINT (not supplied)
4	Ethernet vehicle cabling to topside. Ethernet test box can be used for surface testing (CPN 641-0468)
5	Syrinx DVL

3.11 Syrinx DVL Operation

The Syrinx DVL is a complete digital signal processor controlled acoustic transmitter and receiver device with 400 kHz and 600 kHz options operating within a ± 130 kHz bandwidth. Transmission is either by self-triggering or on receipt of an external trigger signal.

The main functions of the Syrinx DVL are:

- Transmit digital acoustic signals.
- Reception of reflected digital acoustic signals.
- Measurement of time and Doppler shift in the received reflected acoustic signal either from the seabed, or from mid-water scatterers within the water column.
- ADCP for standalone profiling, or concurrent DVL navigation and velocity profiling. This capability can be used without sacrificing navigation accuracy when combined with an INS.

- Provide output telegrams via Ethernet or serial which contain instrument or beam level velocity information.
- At low altitudes, the Syrinx DVL switches to a different operating mode. In this mode it uses a different velocity measurement principle based on temporal correlation which allows the Syrinx DVL to maintain velocity estimation precision at very low altitude.
- Transformation from beam orientation Doppler shift measurements into specific output frame velocities.
- The DVL can be operated in air during testing without any known adverse effects.

The electronic components are as follows:

- Voltage regulation circuits.
- Digital signal processing module.
- Transmit circuit controlled by the processor.
- Receiver circuit controlled by the processor.
- Communications module providing dual RS232 and Ethernet communications.

Section 4 – Installation and Configuration

4.1 Introduction

Before installing and configuring the equipment, make sure *Section 2 – Safety* is read and fully understood.

The Syrinx DVL can either be configured before or after mounting to the vehicle.

Syrinx does not require any software installation in order to connect to and configure. Syrinx DVL is configured in a web browser using DVL Manager.

If configuring the Syrinx DVL by Ethernet, connect to DVL Manager; see *Section 6.2 "Ethernet Connectivity"*.

4.2 Mounting the Syrinx DVL

The Syrinx DVL is mounted to the vehicle as follows (see the technical drawings in *Section 13.4 "Technical Drawings"*).

Note



The Type 8275-4531/4561/6531 incorporates the mounting plate in the housing and does not require the separate mounting plate (CPN 800-0302).

1. (Optional) Affix the titanium mounting plate (CPN 800-0302) to the Syrinx DVL. The mounting plate then allows the Syrinx DVL to be attached to existing Syrinx DVL mounting arrangements. If isolation is required, affix the plastic isolation plate (CPN 800-0294) in between existing DVL mounting arrangements and the Syrinx DVL assembly.

CAUTION



Types 8275-4530/6530 only: Do not deploy the Syrinx DVL using only the plastic isolation plate.

2. Where possible and depending on application, align the Syrinx DVL forward mark (machined groove on housing or forward label) with the forward direction of the vehicle.
3. Mount the Syrinx DVL to the vehicle in desired location and secure with 8 x M6 bolts (4 x M8 bolts when using interface plates).
4. Fit the required Syrinx DVL cables to the Syrinx DVL (Power & trigger can be provided to the Syrinx DVL on either Ethernet or Serial connectors, or through both without damaging the device).
5. Hand-tighten the locking caps to ensure cables are not unintentionally removed.

4.3 Syrinx DVL Interconnections

The Syrinx DVL Type 8275-4531/4561/6531 supersedes the Type 8275-4530/6530 and uses Subconn connectors. The cables for these variants are not interchangeable.

CAUTION



Teledyne Impulse cables (used with Type 8275-4530/6530) are not interchangeable with Subconn cables (used with Type 8275-4531/6531). Using the incorrect cable will damage the Syrinx DVL connector.

The Syrinx DVL is provided with one cable tail. The tail can be used in either connector of the Syrinx DVL. The wiring details from the Syrinx DVL connector on the Syrinx DVL for both serial and Ethernet connectors are shown in *Section 3.6 "Connectors"*.

Labels showing the wiring details are also displayed on the Syrinx DVL housing.

4.4 Offsets/Transformations

Offsets for Yaw, Pitch and Roll can be entered to transform the data from the default instrument frame to a vehicle frame output. The values can be entered in the DVL Manager Config page and should be the gross differences between the vehicles forward direction & 0° orientation of pitch and roll and the mounting orientation of the Syrinx DVL. Alternatively, offsets can be entered in the OFS command; see *Section 6.7.4 "OFS – Offset Command"*.

Note



Refer to CFG command VRF setting for reference mode (must be in Vessel or Earth reference frame for offsets to be applied).

4.4.0.1 Syrinx Rotation Conventions:

- Positive Yaw = Positive heading change
- Positive Pitch = Bow up
- Positive Roll = Starboard down

4.4.0.2 Syrinx applies transformations to the velocity data in the following order:

- 1st: Yaw
- 2nd: Roll
- 3rd: Pitch

Notes



PD0, PD3, PD4, PD5, PD6 and PD13 output telegrams automatically use the same instrument frame as RDI (assume Port-Fwd beam is facing direction of travel). If the Forward mark of the Syrinx DVL is facing direction of travel, a +45° Yaw value is required.

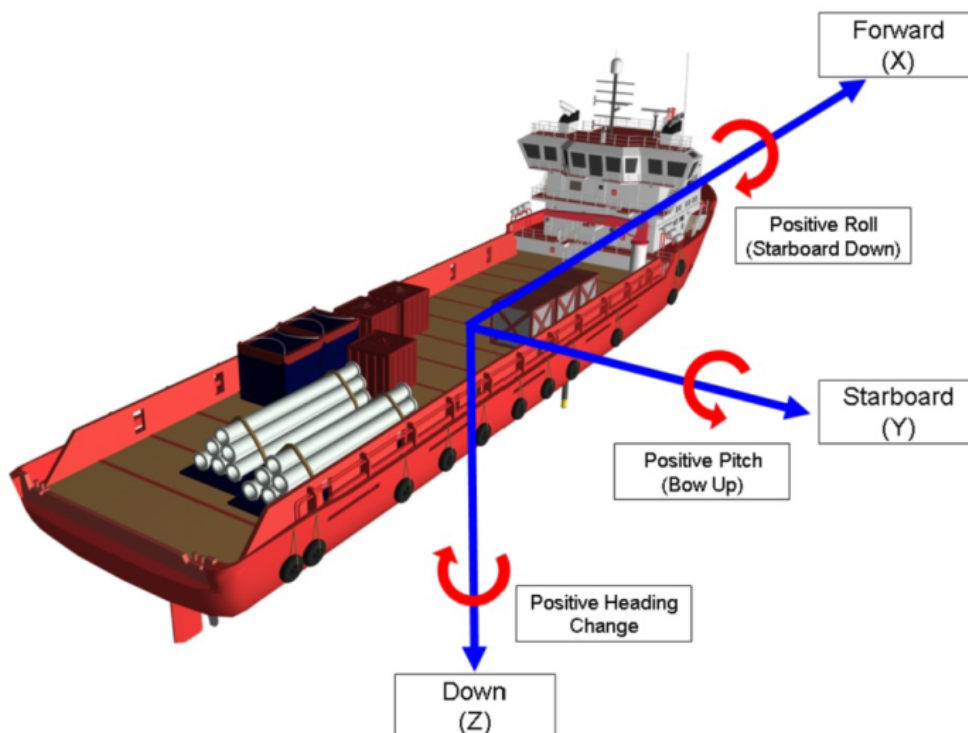


All velocity conventions assume transducers are facing down to the seabed.

4.5 Sonardyne Telegrams Velocity Direction Conventions

- Positive X = Forward
- Positive Y = Starboard
- Positive Z = Down

Figure 4–1 Syrinx DVL Direction Conventions



4.5.1 Conventions for RDI Message Outputs

When a PD0, PD3, PD4, PD5, PD6 or PD13 message output is configured, Syrinx automatically applies the same instrument frame and velocity conventions as would be used in an RDI DVL (assuming Port-Fwd beam is facing direction of travel). If forward mark of Syrinx housing is facing direction of travel, a +45° Yaw value must be added in the DVL Manager or using the OFS command; see *Section 6.7.4 "OFS – Offset Command"*. This is the same configuration as would be required in an RDI DVL (e.g. RDI command: EA+04500).

Note

 Refer to CFG command VRF setting for reference mode (must be in Vessel or Earth reference frame for offsets to be applied).

4.5.1.1 RDI Velocity Direction Conventions:

- Positive X = Starboard
- Positive Y = Forward
- Positive Z = Up

Note

 The conventions above are used by Syrinx DVL when outputting PD0, PD3, PD4, PD5, PD6 and PD13 format telegrams.

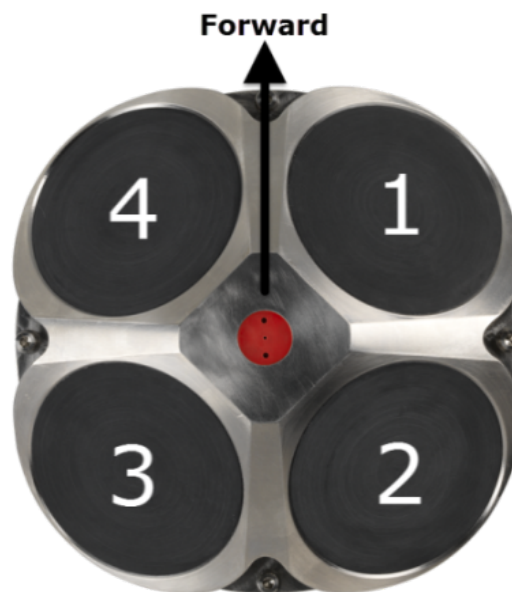
4.6 Lever Arm Measurements

Any lever arm measurements to/from the Syrinx DVL should be measured from the central measurement point (shown as a red circle in *Figure 4-2*, where all output instrument/ship frame velocities are valid for; see *Section 13.3* for the central measurement point dimensions).

4.7 Beam Numbering

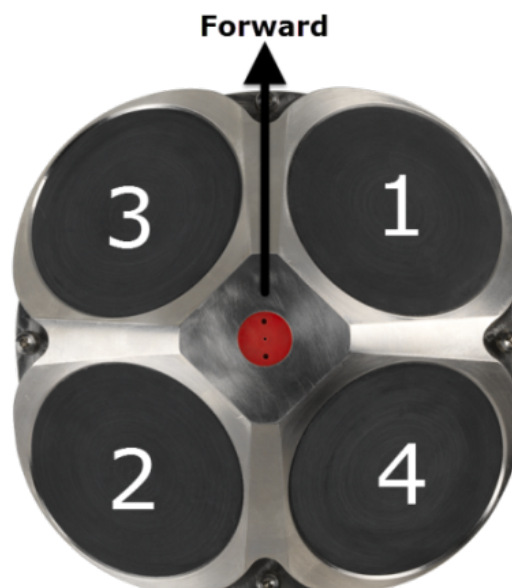
When operating Syrinx DVL under normal conditions (DVL Manager & Sonardyne telegram outputs), the beams are numbered as shown in *Figure 4-2*.

Figure 4-2 Syrinx DVL Beam Numbering



When operating Syrinx DVL using RDI output telegrams (PD0, PD3, PD4, PD5, PD6 or PD13), the beams are numbered in the same pattern as RDI DVLs as shown below:

Figure 4-3 Syrinx DVL PD4 & PD0 Beam Numbering



4.8 Trigger Specification

Syrinx requires a rising or falling edge trigger. The positive level should be between 3.3 V and 12 V. The minimum pulse width should be 500 μ s.

A configurable delay of acoustic transmission after trigger is available via the CFG command; see *Section 6.7.1 "CFG Command"*.

Section 5 – Deployment

5.1 Introduction

Before deploying the equipment, ensure *Section 2 – Safety* is read and fully understood.

The deployment method for the Syrinx DVL is important to ensure correct operation while minimising any interference from external sources and objects.

5.2 Pre-Deployment Checks

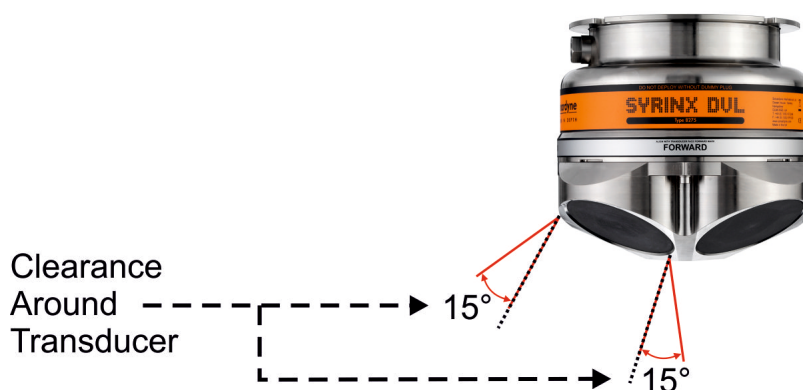
1. Inspect the Syrinx DVL for any signs of mishandling, external damage or leakages; see *Section 8.5 "Inspection"*
2. If necessary, clean the Syrinx DVL; see *Section 8.4 "Cleaning"*.
3. Check that the sensor bung (central between transducers) is not blocked.
4. Check the pressure relief vent valve is flush with the housing face; see *Section 8.6 "Pressure Relief Vent Valve"*.
5. Verify that either a connector or blanking plug is fitted into both connectors with hand-tightened locking sleeve prior to deployment.

DVL Type	Blanking Plug Part Number
8275-4531/6531	317-5197
8275-4530/6530	317-5393

5.3 Deployment Guidelines

When deploying the Syrinx DVL, the following guidelines should be used to determine where and how the DVL is mounted for optimal performance.

1. The Syrinx DVL requires clear line of sight below the vehicle on which it is mounted (for conventional downward-facing mounting arrangements).
 - This includes 15° clearance around the direction that is orthogonal to the transducer face. The transducer face is orientated at 30° azimuth from the vertical (downward) direction, with each beam at a 90° offset in yaw respective to one another, and all beams rotated 45 degrees in yaw from the forward mark.



2. The Syrinx DVL should be mounted at the greatest distance possible away from the seabed (taking into account *Step 1* above).

- This is to offset the minimum altitude of operation of the Syrinx DVL of <0.4 m.
 - If the Syrinx DVL can be mounted 0.4 m or greater above the bottom of the vehicle with clear line of sight, bottom lock should rarely be lost even if the vehicle settles on the seabed.
3. The Syrinx DVL is deployed with the interface plate and isolation plate attached to electrically isolate the device from the vehicle, however the electrical isolation is not a necessity.
 4. The orientation of the Syrinx DVL is also important and can affect performance in certain scenarios.
 - For most operations, the desired orientation is to line up the Syrinx DVL forward mark (label or machined groove on housing) with the forward heading of the vehicle.
 - For following pipelines where altitude measurements above the pipe are very important, the Syrinx DVL can be rotated by 45 degrees so that beams then face forward, aft, port and starboard rather than inter-cardinal directions. This will result in the forward and aft beams being directed onto the pipe surface.
 - If the Syrinx DVL is mounted at a known angle offset, ensure that the correct offsets are applied for yaw, pitch and roll either in the Syrinx DVL or the navigation software to ensure velocities are used in the correct direction.
 - The Syrinx DVL must be configured to the correct reference frame; see *Section 6.7.1 "CFG Command"*.
 5. If the Syrinx DVL is not the Central Reference Point (CRP) of the vehicle, measure the physical lever arms from the Syrinx DVL central measurement point (see *Section 4.6 "Lever Arm Measurements"*) to the CRP of the vehicle. The lever arms may be required in navigation systems to ensure the reference location of the velocity outputs is known and accounted for.

Section 6 – Operation

6.1 Introduction

Before operating the equipment, ensure *Section 2 – Safety* is read and fully understood.

6.2 Ethernet Connectivity

The Syrinx DVL is designed to be configured and communicated with via Ethernet where possible. It is recommended that Ethernet connection is used when the vehicle communication infrastructure allows for this. If Ethernet connectivity is not possible, serial communications can be used as an alternative. The Syrinx supports 10 Base T Full Duplex Ethernet connections only.

6.2.1 Internet Browser Recommendations

Syrinx DVL has been tested on the Windows® 7 operating system using the following web browsers:

- Google Chrome® (75.0.3770.90)
- Microsoft Edge (42.17134.1098.0)
- Internet Explorer (11.1304.17134.0)

Other HTML5 compatible browsers may be used but have not been thoroughly tested. It is recommended to install and use the latest version of the internet browser for communicating with DVL Manager.

Note

 **It is not recommended to view DVL Manager using Windows® XP (and previous versions of Windows) as this may cause issues with connectivity and the display of the DVL Manager interface.**

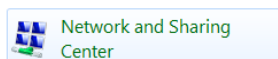
6.3 DVL Configuration

6.3.1 DVL Manager Connection

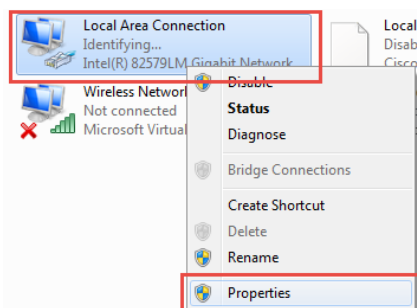
The following steps show how to configure a computer to connect to the Syrinx DVL when configured to the default static IP address. If using DHCP functionality, the IP address of the Syrinx DVL must be known and the network must be configured correctly to allow communications.

To connect to the Syrinx DVL from DVL Manager:

1. Connect the Ethernet cable from the PC to the Syrinx DVL (if the test PC is already configured to communicate with Syrinx DVL via Ethernet, skip to *Step 10*).
2. To configure the network settings, click **Start > Control Panel**.
3. Click **Network and Sharing Center**.



- On the left pane, click **Change adapter settings**, right-click the **Local Area Connection** and then select **Properties**.

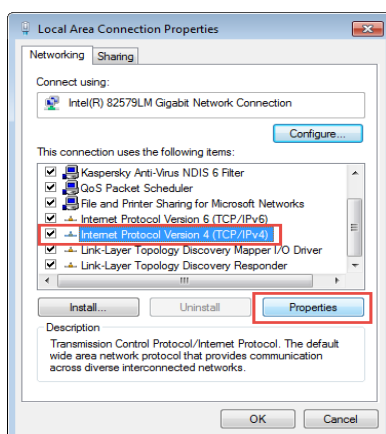


Note

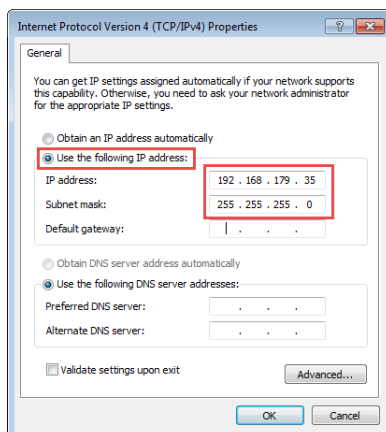


The correct port can often be identified by the connection specifying “Identifying” if the port is currently set to obtain an IP address automatically.

- On the **Networking** tab, click **Internet Protocol Version 4 (TCP/IPv4)** and then click **Properties**.

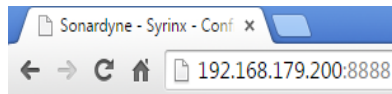


- Select **Use the following IP address** and then enter an IP address with the following values:
192.168.179.xxx (where xxx is any value between 1-254 other than **1, 50, 51, 100, 150 & 200** as these are used by other Sonardyne instruments).



- Enter the Subnet mask **255.255.255.0**.

8. Click **Ok** and then click **Close**.
9. In the internet browser, enter the IP address of the DVL (**192.168.179.200**) and press enter:



10. The Embedded DVL Manager will open.

Note

 **The first time a connection to DVL Manager is made, the “Home” page will be displayed. This page displays the DVL details including serial number and internal hardware. On subsequent connections, DVL Manager will automatically display the “DVL Config page”.**

6.3.2 DVL Manager Home Page

The DVL Manager Home page displays information about the Syrinx DVL:

- Serial number
- Unique Identification Number (UID)
- PCB serial numbers
- Embedded software versions

Click **Support** to open the Syrinx DVL User Manual.

Figure 6–1 DVL Manager Home Page



Syrinx - Details

WebUI Version: 2.1.5.11
Serial Number: 999991-037
Drawing Number: 8275-4530
Unique ID: 005146
Function Level: 000D

Hardware

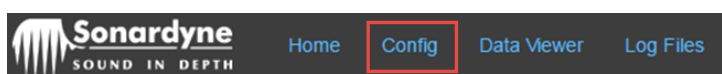
DVL Array Drawing Number: 8275-041-01-A1
DVL Array Serial Number: 1214972-017
DVL Backplane Drawing Number: 8275-038-01-B1
DVL Backplane Serial Number: 315747-012
DVL CPU Drawing Number: 8275-036-01-C2
DVL CPU Serial Number: 303893-004
DVL PREAMP Drawing Number: 8275-039-01-B2
DVL PREAMP Serial Number: 315815-001
DVL PSU Drawing Number: 8275-037-01-A2
DVL PSU Serial Number: 303992-015

Embedded Software

SWU: Syrinx_Rel2_RevD_23
DSP: V2.01.00.19
FPGA: V1.00.00.11
PIC: V2.01.00.04
SYS: V3.02.11.00

6.3.3 DVL Manager Configuration Page

If DVL Manager opens on the Home page, click **Config**.



The DVL Manager Configuration page is shown below.

Figure 6–2 DVL Manager Configuration Page

The screenshot shows the Syrnix Configuration page with the following sections and numbered callouts:

- General Configuration** (Callout 1-9):
 - Mode: Combined Track (1)
 - Velocity Calculation: Automatic (Default) (2)
 - Vehicle Reference Frame: Vessel (Default) (3)
 - Trigger: Automatic (4)
 - Max BT Range: 150m (5)
 - Water Track Start range: 10m (6)
 - Water Track bin width: 8.1m (7)
 - Sound Velocity: 1500.00 m/s (8)
 - Apply button (9)
- Self Test** (Callout 10):
 - Run Self Test button (10)
- Output Configuration** (Callout 11-14):
 - Port: TCP 4000 (11)
 - Interval: 2 Hz (12)
 - Message Type: SONDV (13)
 - Add button (14)
- Output Messages** (Callout 15):

Port	Type	Rate
4000	SONDV	2 Hz
- Time Configuration** (Callout 16):
 - Current Time: 14.02.34 18/06/18 (16)
 - Set button (17)
 - Instrument Time: 006579.142177
- Offset Configuration** (Callout 18):
 - YAW(deg): 0.00
 - PITCH(deg): 0.00
 - ROLL(deg): 0.00
 - Apply button (19)
- Port Configuration** (Callout 20):

Port	Type	Configuration
RS232	RS232	115200 (21)
AUX RS232	RS232	115200 (21)
4000	TCP	N/A
4001	TCP	N/A
4002	TCP	N/A
4003	TCP	N/A
4004	TCP	4004 (22)
30010	UDP	N/A
30011	UDP	N/A
30012	UDP	30012 (23)

Table 6–1 DVL Manager Configuration Page Features

Item	Description
1	Operating Mode Control
2	Velocity Calculation Control
3	Vehicle Reference Frame Control
4	Automatic/Triggered Operation Control
5	Maximum Bottom Track Range Control (mode dependent)
6	Water Track Start Range (mode dependent)
7	Water Track Bin Width (mode dependent)
8	Sound Velocity Control
9	Apply Configuration Changes
10	Self-Test
11	Telegram Output Port Control
12	Telegram Output Interval Control (N/A if triggered)
13	Output Message Type Control
14	Add Output Telegram (as specified by controls 11, 12 & 13)
15	List of Output Messages
16	Time Configuration Control
17	Set Time Control
18	Offset Configuration Controls
19	Apply Offset Configuration Settings
20	List of Port Configurations
21	Baud Rate Controls for RS232 and AUX RS232 Ports
22	TCP Configurable Port Number Control
23	UDP Configurable Port Number Control

6.3.4 Example Steps to Configure DVL via Ethernet

The below example shows steps to configure the DVL for:

- Free running operation in bottom track mode (No external trigger input)
- Maximum range of 150 m
- Sound velocity of 1500 m/s
- PD4 telegram output @ 5 Hz on Ethernet TCP port 4001.

To configure the Syrinx DVL:

1. On the **General Configuration > Mode** drop-down list **1**, select **Bottom Track**.
2. On the **Velocity Calculation** drop-down list **2**, select **Automatic**.
3. On the **Vehicle Reference Frame** drop-down list **3**, select **Vessel**.
4. On the **Trigger** drop-down list **4**, select **Automatic**.
5. On the **Max BT Range** **5**, enter **150m**.
6. The **Sound Velocity** **8** value default is **1500 m/s** (this value can be left as it is).
7. Click **Apply** **9**.
8. On the **Output Configuration > Port** drop-down **11** select **TCP 4001**.
9. On the **Interval** drop-down list **12** select **2 Hz**.
10. On the **Message Type** drop-down list **13** select **SONDV**.
11. Click **Add** **14**.
12. The telegram output will now appear in the **Output Messages** **15** list.

Note

 **Syrinx DVL is configured as a TCP server for the purpose of transmitting data via TCP Ethernet communications.**

6.3.5 DVL Manager Data Viewer

To open the live Data Viewer, click **Data Viewer**.

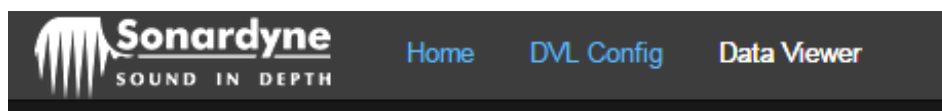
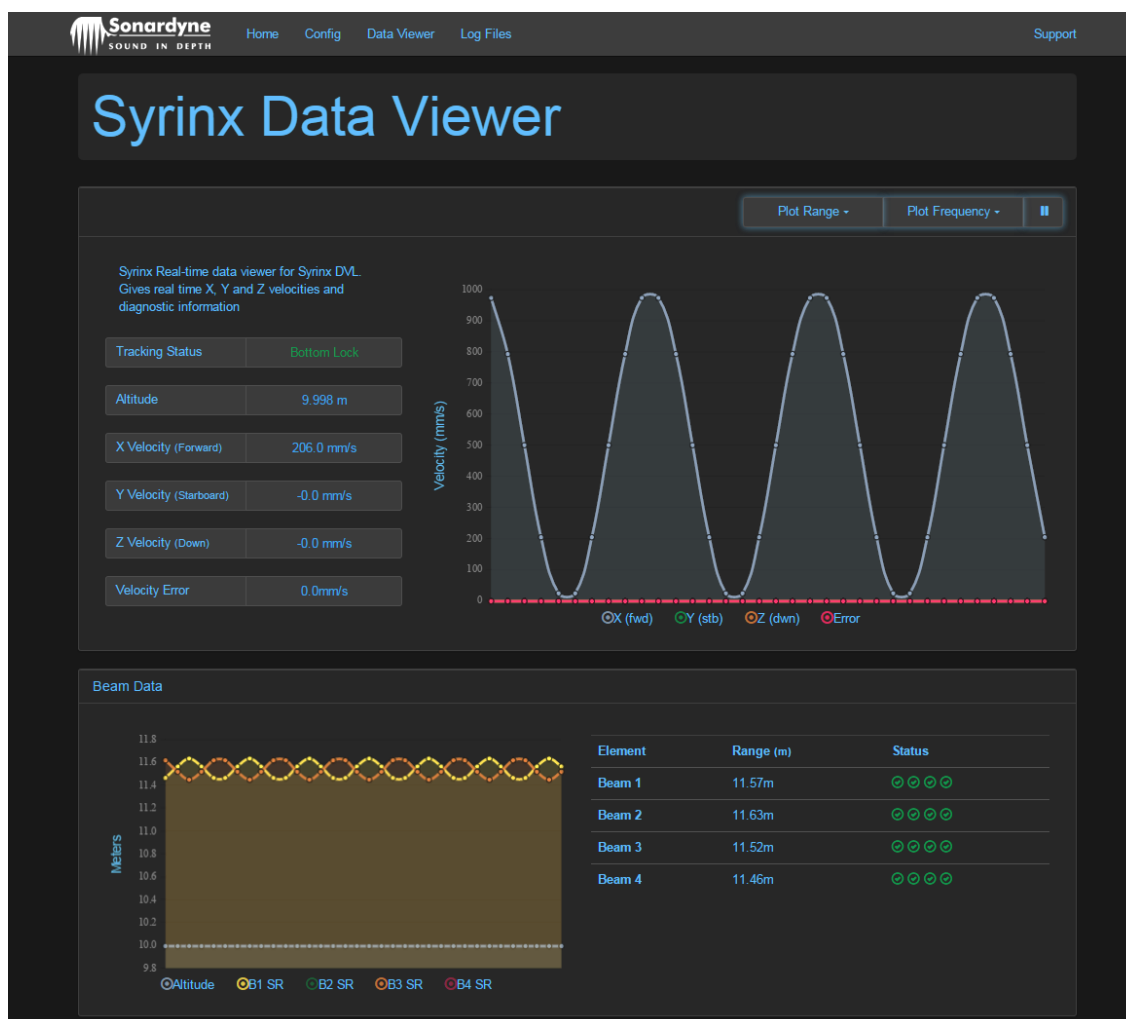


Figure 6–3 DVL Manager Data Viewer



The Data Viewer will automatically start displaying data if the unit is in free running mode (and able to collect valid data in water, or is configured to simulate mode), or if configured for trigger input and a trigger is being provided. Controls for the graph are located in the upper right corner of the graph.

Plot Range changes the number of data points being displayed on the chart.

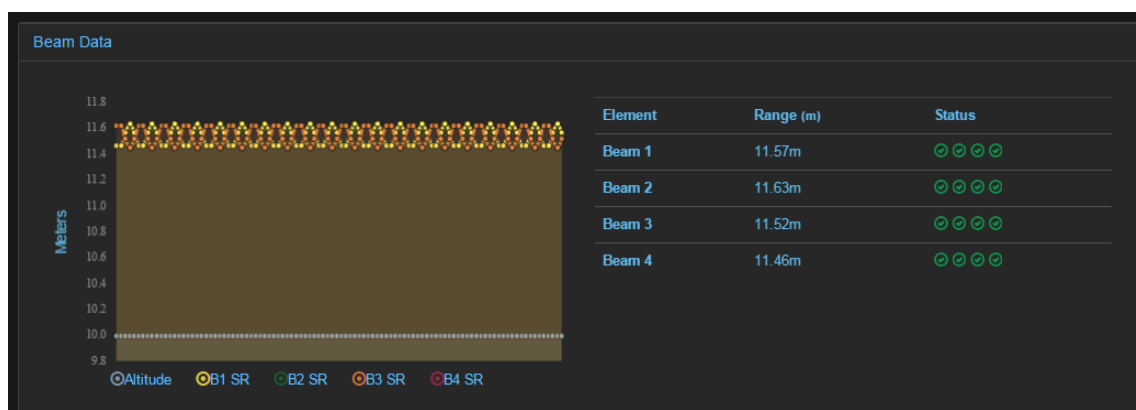
Plot Frequency changes the update rate of the chart data display.

Play/Pause pauses the display. This will not stop the data stream to the chart, and when play is pressed, previous data will no longer be displayed on the chart as the chart will update to show the most recent data.

The **Beam Data** contains slant range and diagnostic information for each of the beams as shown below as well as a chart showing beam slant ranges and altitude.

Beam slant range and altitude plots can be enabled and disabled on the chart by selecting the coloured icons beneath the chart.

Figure 6–4 Beam Diagnostics



- Slant range (direct distance from transducer to reflector)
- Status indicators for:
 - Used status (whether the beam is used in the velocity solution)
 - Error status (whether the error value on the beam exceeds the threshold for quality)
 - Correlation score (quality of returned signal)
 - Signal strength (strength of returned signal)

Each status indicator will show a green tick, or an orange cross depending on the data.

Table 6–2 Beam Diagnostics Details

Symbol	Used Status	Error Status	Correlation Score	Signal Strength
	Beam used in velocity calculation	Error value low – data is reliable	Correlation score high – signal return is as expected	Signal strength is high – external noise is not affecting operations
	Beam not used in velocity calculation	Error value high – data is less reliable	Correlation score low – signal return is sub-optimal	Signal strength is low – external noise is affecting operations

See *Section 11 "Troubleshooting"* for detailed explanations of issues and possible resolutions.

6.3.6 DVL Manager Configuration

The advanced controls on the **Config** tab should only be changed by an experience operator with a complete understanding of the consequences once changes have been made.

WARNING

The following settings can have adverse effects on navigation if used incorrectly. Advanced settings should only be changed by an experienced operator who fully understands the consequences of changes being made. If in doubt, contact Sonardyne Support.

Offset Configuration:

Offsets for Yaw, Pitch and Roll can be entered to transform the data from instrument frame to a vehicle frame output. The values entered should be the gross differences between the vehicles forward direction & 0° orientation of pitch and roll and the mounting orientation of the Syrx DVL.

Offset Configuration			
YAW(deg)	0.00	PITCH(deg)	0.00
ROLL(deg)	0.00	Apply	

Notes

 **PD0, PD3, PD4, PD5, PD6 or PD13 output telegrams automatically use the same instrument frame as RDI (assume Port-Fwd beam is facing direction of travel). If the FORWARD mark of the Syrx DVL is facing direction of travel, a +45° Yaw value is required.**

 **Refer to CFG command VRF setting for reference mode (must be in Vessel or Earth reference frame for offsets to be applied).**

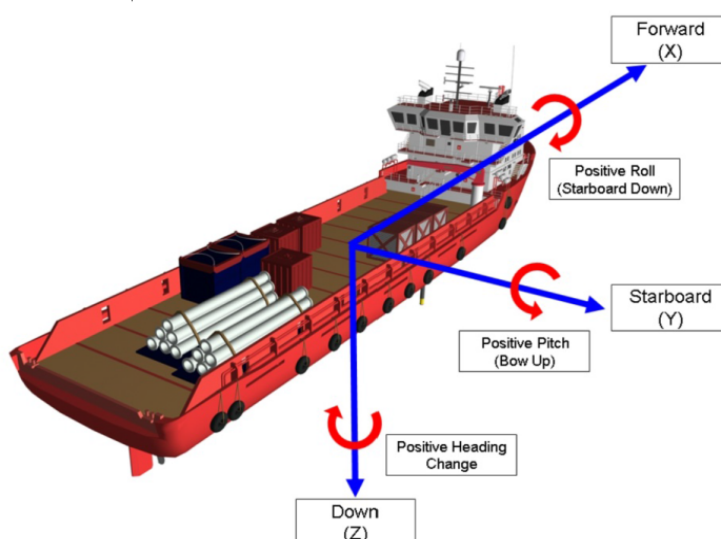
Conventions (assuming transducers facing down):

- Positive Yaw = Positive heading change
- Positive Pitch = Bow up
- Positive Roll = Starboard down

Syrinx applies transformations to the velocity data in the following order:

- 1st: Yaw
- 2nd: Roll
- 3rd: Pitch

Figure 6–5 Syrx DVL Sign Conventions



Conventions for RDI Message Outputs

When a PD0, PD3, PD4, PD5, PD6 or PD13 message output is configured, Syrinx automatically applies the same instrument frame and velocity conventions as would be used in an RDI DVL (assuming Port-Fwd beam is facing direction of travel). If forward mark of Syrinx DVL housing is facing direction of travel, a **+45° Yaw** value must be added in the DVL Manager or using the OFS command; see *Section 6.7.4 "OFS – Offset Command"*. This is the same configuration as would be required in an RDI DVL (e.g. RDI command: EA+04500).

Note

 **Refer to CFG command VRF setting for reference mode (must be in Vessel or Earth reference frame for offsets to be applied).**

6.3.7 DVL Manager Log Files

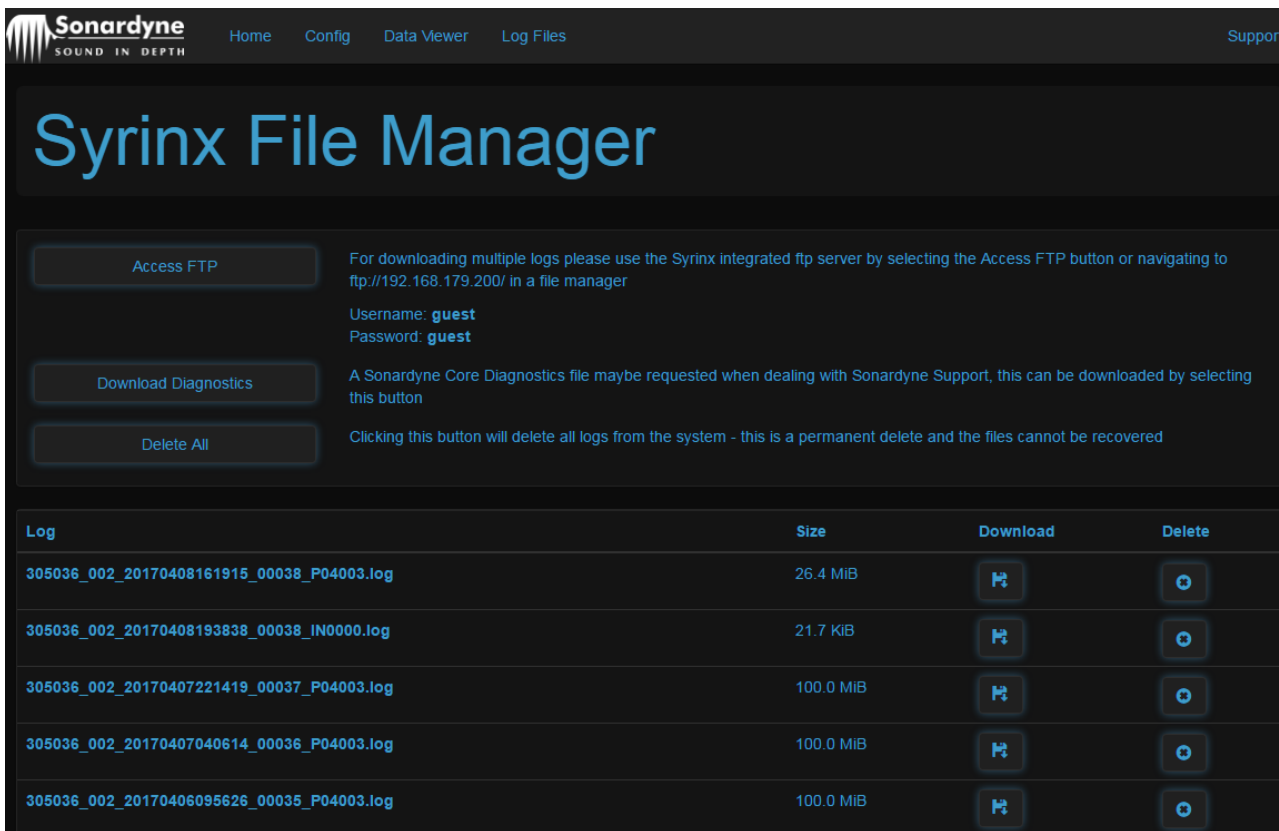
The Syrinx DVL automatically logs all user configured output telegrams as well as all user actions, plus some diagnostic information for Sonardyne support analysis.

The DVL File Manager allows log files to be downloaded and deleted, either individually or multiple file downloads via read only ftp as described below.

6.3.7.1 Download an Individual File

To download an individual file:

Click the file's corresponding  icon, browse to a location and then click **OK** to save the file.



Log	Size	Download	Delete
305036_002_20170408161915_00038_P04003.log	26.4 MiB		
305036_002_20170408193838_00038_IN0000.log	21.7 KiB		
305036_002_20170407221419_00037_P04003.log	100.0 MiB		
305036_002_20170407040614_00036_P04003.log	100.0 MiB		
305036_002_20170406095626_00035_P04003.log	100.0 MiB		

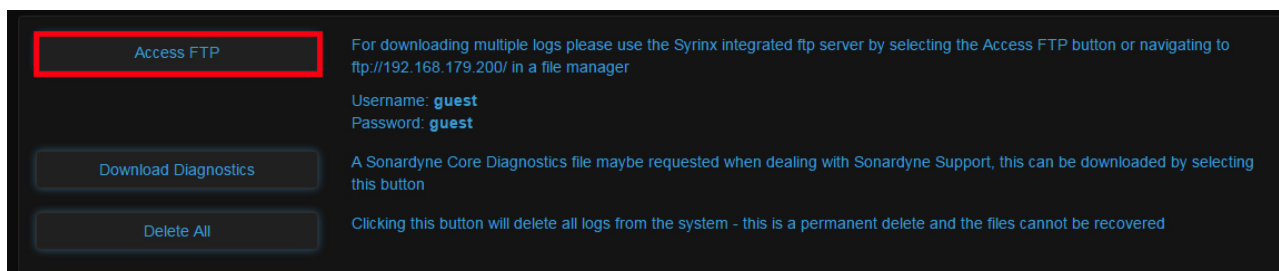
6.3.7.2 Download Multiple Files using an FTP Client

To download multiple log files via ftp, click **Access FTP** on the DVL File Manager or use your preferred FTP client to access the server with the following details:

Server address: The IP address of the DVL (default **192.168.179.200**)

Username: **guest**

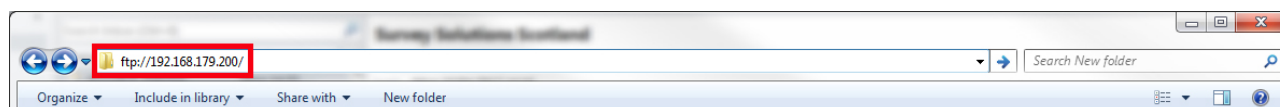
Password: **guest**



6.3.7.3 Download Multiple Files using Windows Explorer as an FTP Client

The following example uses Windows Explorer as an FTP client (it is assumed the DVL's IP address has not been changed from the default 192.168.179.200).

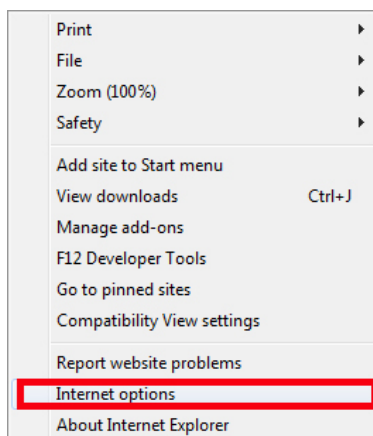
1. Open a Windows Explorer window, enter **ftp://192.168.179.200/** and then press Enter.



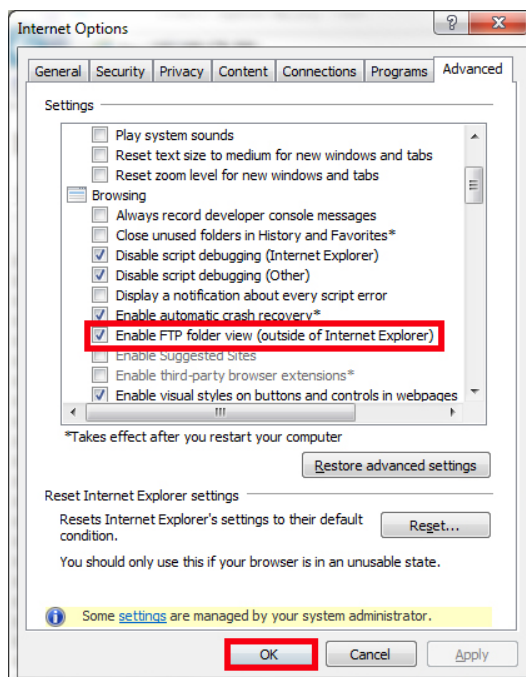
Note

 If an Internet Explorer window opens instead of the FTP Log On window, change the Internet Options settings; follow step 2, otherwise skip to step 4.

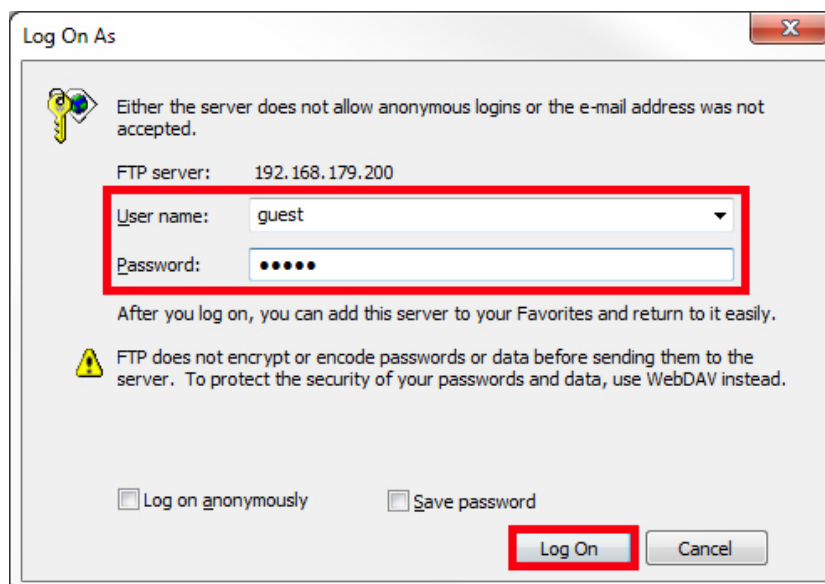
2. Click the settings icon  on the Internet Explorer browser and select **Internet Options**.



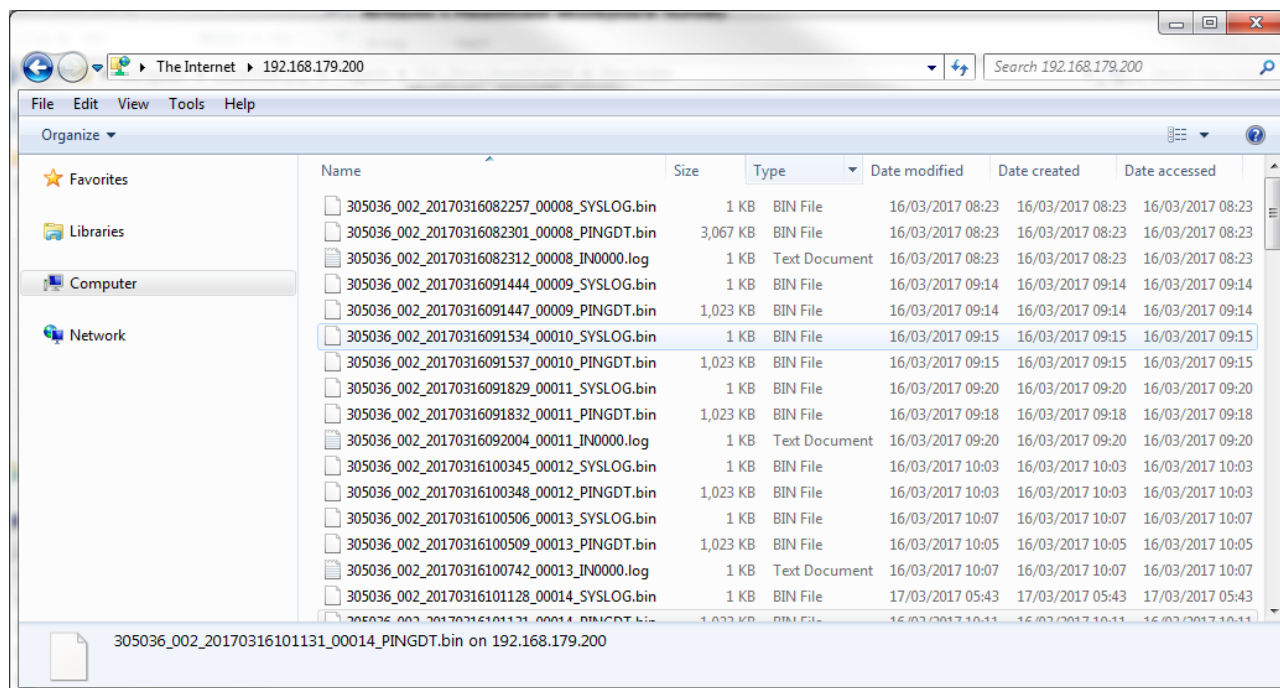
3. On the **Advanced** tab, select **Enable FTP folder view (outside of Internet Explorer)** and then click **OK**.



4. Enter the FTP user credentials
 - a. User name : **guest**
 - b. Password: **guest**
5. Click **Log On**.



6. A directory listing of the DVL Logs will be displayed in Windows Explorer.



7. Select and copy the required files to the new location.

6.3.7.4 Delete an Individual File

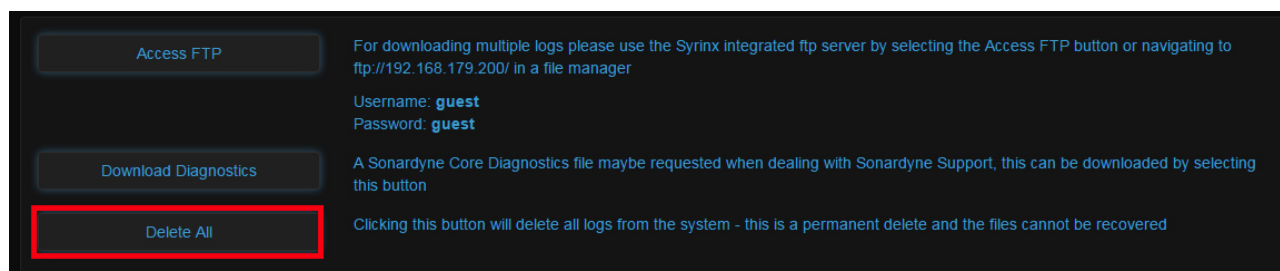
Click the file's corresponding  icon.

Notes

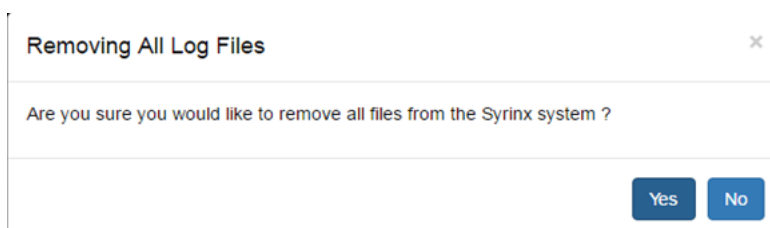
-  If the file is currently in use the contents will be cleared but the file will not be deleted.
-  Be aware that once the  icon is clicked the file will be deleted without any further confirmation required.

6.3.7.5 Delete All Files

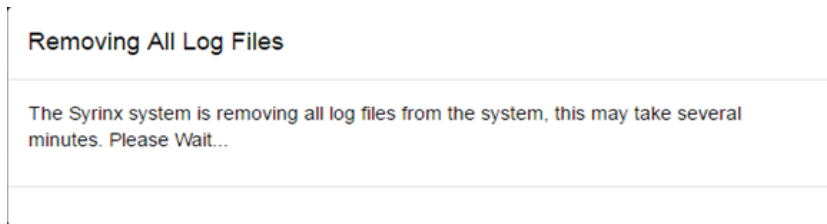
1. Click **Delete All**.



2. Click **Yes** to confirm removal of all files.

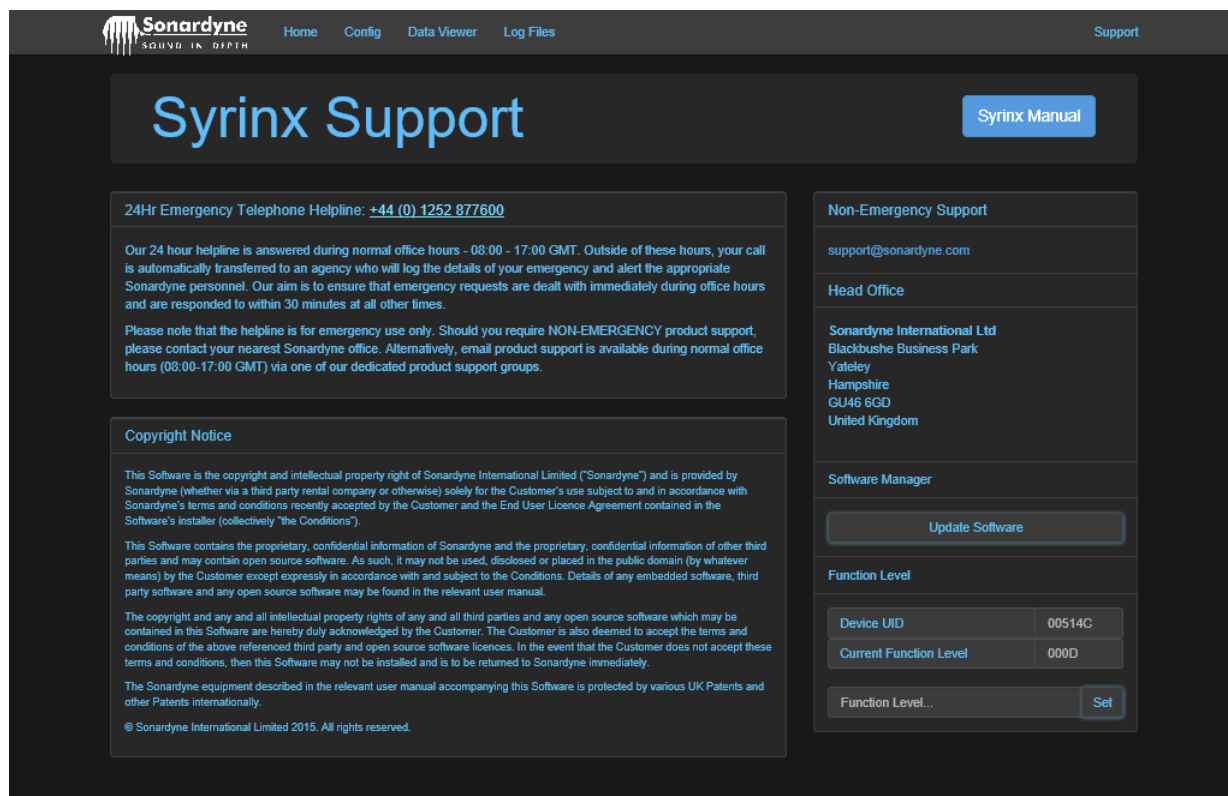


3. The Syrinx system will confirm that the files are being removed.



6.3.8 DVL Manager Support Page

Click **Support** to open the support page similar to the support page shown below.



The support page contains a link to the Syrinx DVL user manual that can be displayed in the browser or downloaded to the PC. Embedded software (firmware) updates to the Syrinx DVL are performed on the support page of the DVL Manager; see *Section 9 "Software Update for Syrinx DVL Manager"* for instructions on how to update Syrinx DVL embedded software.

Functionality updates are also performed on the support page; see *Section 9.5 "Functionality Update"* for instructions on how to update the functionality.

To contact Sonardyne Support, click the email address hyper link on the **Non-Emergency Support** pane. This will open your default email software and generate an email containing hardware and other details of your device required for effective support of the product.

Note

 Internet Explorer web browser can operate in a “protected mode” which can prevent the email link from working as intended. To disable “protected mode”, click Tools>Internet Options, click the Security tab and then clear the Enable Protected Mode check box. Restart your browser and re-check if the email link works. Contact Sonardyne Support if the problem persists.

6.4 ADCP Configuration

6.4.1 ADCP Functionality

Acoustic Doppler Current Profiling (ADCP) capability can be enabled for Syrinx via a firmware upgrade. This capability allows water currents to be measured at different depths, also known as current profiling.

If ADCP functionality is enabled on your Syrinx DVL, two additional modes are available: ADCP and DVL+ADCP.

Note

 To confirm if ADCP functionality is enabled on your Syrinx DVL, either:
1 Click "Support" on the menu bar and check the functionality level, or
2 Click "Config" on the menu bar; if ADCP functionality is enabled, the modes "ADCP" and "DVL+ADCP" will be present in the drop-down list.

6.4.2 Mode Types

Both ADCP and DVL+ADCP modes produce ADCP data in the industry standard PD0 format (see *Appendix C* for a full description of the PD0 format). The PD0 data is logged to file on the device for later retrieval and can optionally be streamed out of one of the ports; see *Section 6.5* and *6.6*.

Similarly to bottom tracking, ADCP velocities can be specified in Beam, Instrument, Vessel or Earth frame.

6.4.2.1 ADCP Mode

In ADCP mode, every ping from Syrinx is optimised for measuring current profiles. The seabed is not bottom tracked, though an estimate of the bottom track velocity may be performed if the seabed is in range of the ADCP ping. Water profile data is captured as PD0 format data packets, written to disk, and (optionally) exported live. In this mode, the maximum range of profile is limited to the capability of the hardware. The maximum profile range is 80 m (600 kHz variant) and 120 m (400 kHz variant).

6.4.2.2 DVL+ADCP Mode

In DVL+ADCP mode, the standard bottom tracking pings used in Auto mode are alternated with ADCP pings. The bottom track pings attempt to acquire and then track the seabed exactly as in standard DVL operation. DVL+ADCP mode therefore allows simultaneous navigation using bottom tracking and the capture of current profile data. The bottom track and ADCP pings are merged into a single PD0 ensemble, written to disk, and (optionally) exported live. In this mode, the profile range is limited to the maximum bottom tracking range as specified in *Section 6.3.4 "Example Steps to Configure DVL via Ethernet"*.

6.4.2.3 Configuration Options

When Syrinx is put into ADCP or DVL+ADCP mode, the number of depth cells and the width of each cell must be specified. The PD0 data produced contains current velocity data for the specified number of depth cells, where the velocity in each depth cell is an average of the velocity over the depth range encompassed by the cell.

In either mode, additional configuration options are available on the Config page in the ADCP Configuration panel (see the figure below).

In ADCP or DVL+ADCP mode, the WT start range and WT bin width reflect the start and extent of the profile respectively. In particular, the WT bin width is equal to the product ADCP bin width x number of ADCP bins.

6.4.3 ADCP Configuration Steps

The following example shows how to configure the ADCP profile data to use 125 bins, each of vertical width 0.25 m, for a profile depth of 31.25 m. The Syrinx transducers are at depth 1.5 m, so the actual depth of water profiled is from 1.5 m to 32.75 m.

Connect to the Syrinx DVL as described in *Section 6.3 "DVL Configuration"* and then configure the ADCP as described below.

In the following DVL Manager configuration page example, four pings are averaged per PD0 ensemble to increase the accuracy of the velocity data:

Bins	125
Depth Cell Width(cm)	25
Pings To Average	4
Transducer Depth(cm)	150
Apply	
Depth Range(m)	32.75
Velocity Limit(m/s)	1.40
Velocity Error(cm/s)	0.71

1. **ADCP Configuration > Bins**, enter **125**.
2. **ADCP Configuration > Depth Cell Width (cm)**, enter **25**.
3. **ADCP Configuration > Pings To Average**, enter **4**.
4. **ADCP Configuration > Transducer Depth (cm)**, enter **150**.
5. Click **Apply**.

After clicking Apply, ADCP data is logged to the device as PD0 files (these are identified on the Log Files page by having the .pd0 extension).

Notes

 Each time the ADCP configuration is changed (e.g. by changing the bin width) the current .pd0 file is closed and a new .pd0 file will be opened.~

 The Depth Range, Velocity Limit and Velocity Error are not modifiable, but are all updated after clicking Apply.

To stream ADCP data from the device, configure an output port to use PD0 messages via the **Output Configuration > Message** Type drop-down list. In the example below, PD0 data is streamed by a TCP server listening on port 4001:

Output Messages			
Port	Type	Rate	
4001	PD0	2 Hz	

After clicking **Apply**, ADCP data is logged to the device as PD0 files (these are identified on the Log Files page by having the .pd0 extension). File sizes are limited to 16 MB; a new file is created when this limit is exceeded.

6.4.4 Downloading ADCP Data

To download ADCP data, see *Section 6.3.7 "DVL Manager Log Files"*.

6.4.5 External Sources of Data

Syrinx DVL can import data from other devices to improve the value of the captured current profiles. The imported data falls into two categories: ASCII strings, and binary messages from the Sonardyne Lodestar navigation system. A Syrinx set up to import ASCII strings should not be configured to import Lodestar messages at the same time, and vice versa.

6.4.5.1 ASCII Strings

All ASCII strings can be imported from any available port on Syrinx, for example, Serial port, TCP, or UDP. The available ports are listed under **Port Configuration** on the Web UI Config page; see *Figure 6-2*.

NMEA Strings

NMEA strings are imported in order to specify the geographical position of Syrinx and its heading.

- GGA strings are used to inform Syrinx of its geographical position, i.e. its Latitude and Longitude. The GGA data is embedded into the PD0 data produced by Syrinx when in ADCP mode.
- VTG strings are used to inform Syrinx of its heading and its speed over ground. The VTG data is embedded into the PD0 data produced by Syrinx when in ADCP or DVL+ADCP mode.

SON2

The SON2 message is used to inform Syrinx of its pitch, roll and heading from an external attitude sensor. The SON2 data is embedded into the PD0 data produced by Syrinx when in ADCP or DVL+ADCP mode.

6.4.5.2 Lodestar Messages

If Syrinx DVL is in use as part of a Sonardyne SPRINT Nav hybrid navigator system, it can import Lodestar messages from SPRINT. Currently, only multiplexed binary LNAV messages are supported. LNAV messages contain a solution for the vehicle's position, speed, heading and attitude obtained from an inertial navigation system (INS). The INS is normally guided by bottom tracking measurements or USBL/LBL range data.

LNAV messages should not be output to Syrinx if the ASCII string messages above are already present; in any case, NMEA strings and the SON2 message will take precedence over any LNAV data.

For Syrinx to receive LNAV messages, the SPRINT-Nav system must be configured to output multiplexed LNAV messages on a TCP server with port 5000. A message rate of 5 Hz is recommended. See the SPRINT-Nav user manual for details on how to perform this configuration.

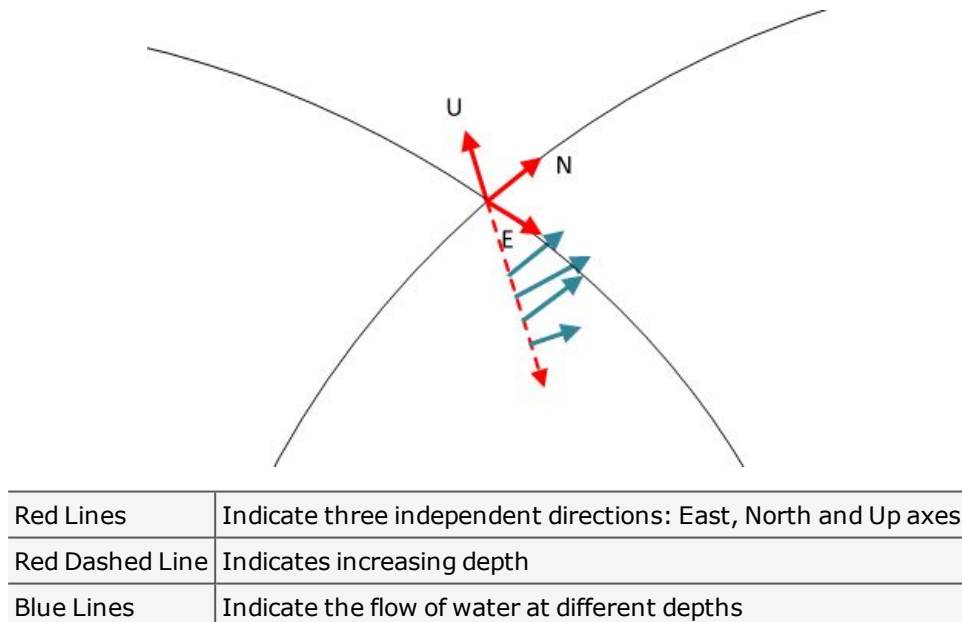
6.4.6 Frames of Reference

Syrinx ADCP velocities may be produced in one of four reference frames: Earth, Vessel, Instrument, and Beam. The coordinate system used for each frame follows the convention set out in PD0; see *Appendix C* for details. Different frames of reference may be best suited for different applications. The desired frame of reference may be selected with the CFG command (see 6.7.1 "CFG Command"), via the Web UI (see 6.3.3 "DVL Manager Configuration Page"), or using the Sonardyne Echo Observer software.

6.4.6.1 Earth Frame

In Earth frame, velocities are expressed in terms of Eastward, Northward, and Upward (ENU) components. Each component is reported in the PD0 data for each depth cell according to the PD0 definition in *Appendix C*. Earth frame velocities are often used to express how the currents are moving with respect to geographic location, such as in estuarine surveys.

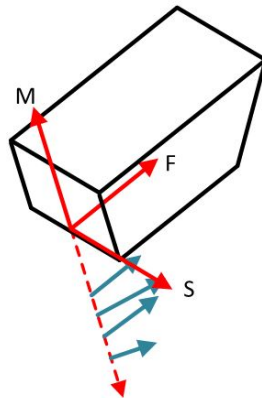
Figure 6–6 ADCP Velocities Measured in Earth Frame



6.4.6.2 Vessel Frame

In Vessel frame, velocities are expressed in terms of Starboard, Forward and Mast (SFM) components. Each component is reported in the PD0 data for each depth cell according to the PD0 definition in *Appendix C*. Vessel frame is often used to express how the currents are moving with respect to the vessel, such as in station keeping applications.

Figure 6–7 ADCP Velocities Measured in Vessel Frame

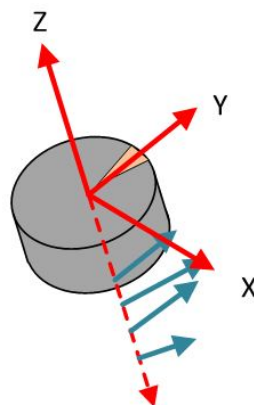


Red Lines	Indicate three independent directions: Starboard, Forward and Mast axes
Red Dashed Line	Indicates increasing depth
Blue Lines	Indicate the flow of water at different depths

6.4.6.3 Instrument Frame

In Instrument frame, velocities are expressed in terms of X, Y and Z coordinates. Each component is reported in the PD0 data for each depth cell according to the PD0 definition in *Appendix C*.

Figure 6–8 ADCP Velocities Measured in Instrument Frame

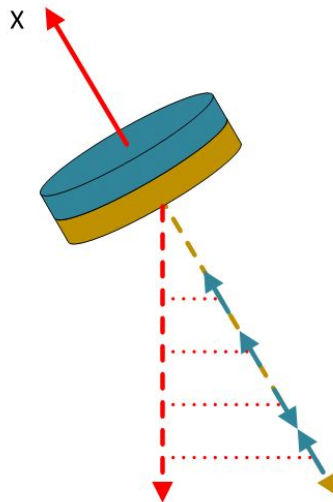


Syrinx DVL Grey Cylinder	Orange triangle indicates the forward notch (transducers are facing downwards)
Red Lines	Indicate three independent directions: X, Y and Z axes
Red Dashed Line	Indicates increasing depth
Blue Lines	Indicate the flow of water at different depths

6.4.6.4 Beam Frame

In Beam frame, velocities are expressed in the direction of the principal acoustic axis of the transducer. The principal acoustic axis is the direction of greatest sensitivity of the transducer. By convention, the direction of positive water flow is along the principal acoustic axis towards the transducer.

Figure 6–9 ADCP Velocities Measured in Beam Frame for one Transducer



Yellow	Active face of the transducer
Red Line	Principal acoustic axis of the device
Yellow Dashed Line	Direction in which water velocities are measured
Red Dashed Line	Indicates increasing depth
Blue Lines	Indicate the flow of water at different depths

6.5 Ethernet Connection via Terminal Software

Syrinx can be communicated with over Ethernet through terminal software either using TCP or UDP connections. There are 4 fixed TCP ports, one configurable TCP port, 2 fixed UDP ports and one configurable UDP port.

The default IP address of the Syrinx DVL is:

- 192.168.179.200

Fixed TCP ports available for connection are as follows:

- 4000
- 4001
- 4002
- 4003

The UDP connection to the Syrinx DVL is not symmetrical. UDP Unicast is used to send data to the Syrinx DVL on its own IP address (default 192.168.179.200), while UDP Multicast is used to transmit data from the Syrinx DVL to the Multicast address: 230.229.228.227. The fixed UDP ports used are the same for both Unicast receive and Multicast transmit as follows:

- 30010
- 30011

The configurable TCP and UDP ports can be configured via the PORT command (see *Section 6.7.5 "PORT Command"*)

6.6 Serial Connectivity

6.6.1 Serial Configuration

Syrinx supports the following configurable Baud rates:

- 2400, 4800, 9600, 19200, 38400, 57600, 115200

The Syrinx DVL has a fixed serial configuration of:

- Data Bits: 8
- Parity: None
- Stop Bits: 1

6.6.2 Serial Reset

There are two main methods of resetting the Syrinx DVL, the first is a serial break and the second is by sending an UNLK command.

- A serial break of length greater than 50 milliseconds will force the instrument to reset.
- If the serial sequence of characters "UNLK" is sent (with a carriage return) at 9600 baud then the instrument will reset. The UNLK command must be sent at 9600 baud regardless of the current configured baud rate of the instrument.
- Following a serial reset the instrument will output the serial response defined for the PORT Command from the serial ports. This response is always sent at 9600 baud and so can be used to identify the baud rate of the Syrinx DVL should it not be known.

Example:

<UNLK or Serial BREAK

>PORT:PID0,P0;BR57600,P1;BR19200

Port 0 (P0) is configured to 57600 baud and P1 is configured to 19200 baud.

6.7 Manual Syrinx DVL Configuration

Syrinx DVL can also be configured manually either via serial connection or through a TCP or UDP Ethernet connection when using a terminal package to view and transmit communications.

Notes



All commands must be appended with a Carriage Return Line Feed (CRLF) at the end of each message.



When using SYS software version 1.00.18.00 or earlier, all commands must be sent with all characters capitalised. For later versions, capitalisation is not required.

6.7.1 CFG Command

The CFG command is used to set the operating mode of the Syrinx DVL, i.e. auto/water track, trig/free-running.

Command:	<CFG:{ AUTO , WT , WBT , SIM , ADCP , DVLADCP },{ FREE , TRIG+ , TRIG- }, WLS ; { AUTO , 3BEAM , JANUS , DISx }, Rxx , SVxx , TDxx.xx	
	<CFG Requests the set operating mode	
Reply:	>CFG:AUTO,TRIG+,WLS;AUTO,R150,SV1500.00,WTSR31,WTBW52,TD1.174,VRF;INST	
Parameter:	Configuration mode	How the DVL will be configured: AUTO The DVL will automatically adjust it's power/gain/signal WT The DVL will operate in Water-track mode (i.e. not bottom-lock, the user can adjust settings via the CONFIG command WBT Sets the unit to flip flop mode between AUTO and WT with a 50:50 duty cycle SIM The DVL will operate in simulate mode and bottom-track (N.b if required functionality level is set) ADCP Acoustic Doppler Current Profiling mode (only allowed if functionality set to ADCP) DVLADCP Sets the unit to flip flop mode between AUTO and ADCP with a 50:50 duty cycle (only allowed if functionality set to ADCP)
	Trigger mode	Sets the unit's trigger mode: TRIGx Sets the unit into externally triggered mode + sets the DVL to trigger on a positive edge - sets the DVL to trigger on a negative edge FREE Sets the unit into free-running mode. The OUT command will set the rate, if no outputs set then the unit will default to 1 second updates (internal diagnostic only as no actual output configured)
	WLS	Weighted Least Squares Mode sets the internal mode for the velocity solution. Options are: AUTO Use 4 or 3 beams automatically depending on acoustic data 3BEAM only use 3 Beam solution, i.e. exclude worst beam JANUS Only use 4 Beam solution DISx Do not use an element (i.e. if one is known to be faulty) pass in 1→4 for the element number
	Rxx	This field specifies the bottom track maximum search range of the unit in meters.

SVxx	Sound Velocity in m/s
WTSR	Water Track Start Range. This sets the start range for the water track measurement. The unit will adjust the value and report the actual value used based on what is acoustically possible. This is in deci-meters.
WTBW	Water Track Bin Width. This parameter sets the bin width for the water track measurement. The unit will adjust the value and report the actual value used based on what is acoustically possible. This is in deci-meters.
TDxx.xx	The minimum delay between triggering the unit and acoustic transmission in milliseconds. Depending on mode there is up to a 512 μ s variance in transmit time starting from the minimum value. Tigger Delay has a minimum value of 1.174 ms and can be set in whole milliseconds only. NOTE: The actual minimum delay may differ to the requested value by up to +255 μ s due to system limitation
VRF (Vehicle Reference Frame)	Sets the Vehicle Reference Frame mode of the unit. BEAM Where applicable use beam velocities in output messages INST Output velocities in the instrument reference frame, ignoring offsets VESSEL (default) Output velocities in the Vessel reference frame (Forward, Starboard, Down), taking into account offsets EARTH Output velocities in the Earth reference frame (North, East, Down), taking in to account offsets, Heading, Pitch and Roll

CFG command example:

<CFG:AUTO,TRIG+

Set the Syrinx DVL to configure its own power/gain/signal. Set the Syrinx DVL to be triggered externally by a positive going pulse.

>CFG:AUTO,TRIG+,WLS;AUTO,R150,SV1500.00,WTSR139,WTBW28,TD1.174,VRF;VESSEL

6.7.2 ADCP Command

The ADCP command is used to configure the ADCP mode on the Syrinx DVL.

Command:	<ADCP: BINSxx, WIDTHxx, AVGxx, TRDPxx	
	<ADCP Requests the sensor configuration of available sensors	
Reply:	>ADCP:BINS50,WIDTH80,AVG5,TRDP120,VL5.58,SD18.08	
Parameter:	BINSxx	Number of bins in the output PD0 data.
	WIDTHxx	Width of bins in centimeters, i.e. 80 = 0.8m Command capping (See ADCP operation for logical process): Minimum = 10cm Maximum = 200cm
	AVGxx	Number of pings to average per PD0 ensemble, i.e. 5. Command capping (See ADCP operation for logical process): Minimum = 1 ping Maximum = 32 pings
	TRDPxx	Transducer depth The value is in cm
	VLxx.xx	Beam frame Velocity Ambiguity Limit as determined by the unit. Ensure the water velocity (relative to the Syrinx) remains under this limit The value is in m/s
	SDxx.xx	Beam frame standard deviation of the velocity measurement in each PD0 bin as determined by the unit. Note that this value takes ping averaging and depth cell width into account The value is in cm/s

ADCP command example:

<ADCP

>ADCP:BINS10,WIDTH80,AVG5,TRDP120,VL5.58,SD18.08

ADCP set to use 10 bins of 0.8 m in length, with the transducer depth set to 1.2 m. Five pings will be averaged into a PD0 ensemble.

If Syrinx is in DVL+ADCP mode, the total ADCP range (bin width x number of bins) must be less than or equal to the maximum bottom track search range set by the CFG command. If this is not the case, the requested number of ADCP bins will be reduced so that this condition is satisfied.

6.7.3 SCFG Command

The SCFG command is used to configure the various sensors available on the Syrinx DVL.

Command:	<SCFG: PR;OFSxxxx.xx,SV;{ DER,EXT,MAN}	
	<SCFG Requests the sensor configuration of available sensors	
Reply:	>SCFG: PR;OFS101.33,SV;MAN,SAL35.000	
Parameter:	PR	If the optional pressure sensor is fitted this allows configuration of the pressure offset. Reply contains the currently configured offset TARE Use a current pressure reading from the on board pressure sensor as the offset value OFS can be passed with an optional pressure offset, if an offset is provided then this value is used as the offset value (E.g. OFS101.33, to offset the unit in air) if no value is provided (OFS) then a current pressure reading is taken and used for the offset instead, same as TARE RST Resets the pressure offset to 0
	SV	Sets the Sound Velocity source to be used by the Syrinx DVL. DER Use a derived solution for sound velocity. This requires the optional pressure sensor to be fitted to the unit EXT Use an external Sound Velocity supplied to the DVL (Valeport, PSONSS) MAN Use the manually set Sound Velocity (Value can be set via CFG command)
	SALxx.xx	This is the value used for manual Salinity (ppt) when calculating derived Sound Velocity

SCFG command example:

<SCFG:PR;RST,SV;MAN,SAL38

Reset the pressure offset to 0, set the Sound Velocity mode to use the manually configured sound velocity and set a manual salinity value of 38ppt.

>SCFG:PR;OFS0.00,SV;MAN,SAL38.000

6.7.4 OFS – Offset Command

The OFS (OffSet) command is used to set the Syrinx DVL offsets as shown below. The offsets are applied in the Sonardyne reference frame as described in *Section 4.4 "Offsets/Transformations"*.

To add security to the command the UID will be needed to program the offsets to avoid unintentional overwriting of the values.

Command:	<OFS:Uxxxxxx,YAWxx.xx,PITCHyy.yy,ROLLzz.zz	
	<OFS	
Reply:	> OFS:Uxxxxxx,YAW0,PITCH0,ROLL0	
Parameter:	YAW	Yaw angle in degrees, Starboard positive
	PITCH	Pitch angle in degrees, Bow up positive
	ROLL	Roll angle in degrees, Starboard down positive

OFS command example:

<OFS:U004531,YAW45.00,PITCH0.00,ROLL0.00

Set yaw offset to +45° pitch & roll offsets to 0°.

>OFS:U004531,YAW45.00,PITCH0.00,ROLL0.00

Negative degree offsets can be applied by inserting a "-" prior to the offset value.

6.7.5 PORT Command

The PORT command is used to set the baud rate of any serial ports on the instrument. It is also used to display Ethernet port information, and to configure the two configurable Ethernet ports.

Command:	<PORT: Px;BRddddd,TCPeeee (sets the serial and Ethernet port(s))	
	<PORT: Requests port information	
Reply:	>PORT:PIDx,Px;BRddddd,Px;{TCP,UDP},Px;{TCP,UDP};CFGx	
Parameter:	PIDx	Port ID of the current port.
	Px	Port number: 0. See above for details of ports
	BRx	Baud Rate 9600 default, other options, 2400,4800,9600,38400,115200
	TCP or UDP	Identifies the port type if not a serial port.
	TCPx or UDPx	Used to configure the configurable TCP and UDP ports where x is the new port number.
	CFGx	Indicates a configurable Ethernet port, where x indicates which config port is being referred to (currently always 1 as there is only one TCP configurable port and one UDP configurable port).

Port command example:

Set Port 0 to a Baud Rate of 57600

<PORT:P0;BR57600

Reply:

>PORT:PID0,P0;BR57600,P1;BR9600,P4000;TCP,P4001;TCP,P4002;TCP,P4003;TCP,P30010;UDP,P30011;UDP,P5555;TCP;CFG1,P30013;UDP;CFG1

Set configurable TCP port to 5005:

<PORT:TCP5005

Reply:

>PORT:PID0,P0;BR57600,P1;BR9600,P4000;TCP,P4001;TCP,P4002;TCP,P4003;TCP,P30010;UDP,P30011;UDP,P5005;TCP;CFG1,P30013;UDP;CFG1

The Baud rate must be specified exactly as shown in the table above otherwise no change will be made to this field.

ERR[BAUDRATE] is output when the requested baudrate does not match the bandwidth requirements of the currently set-up output messages for that port.

ERR[INUSE] is output when the requested Ethernet port is already in use when configuring the Ethernet ports.

Notes



The PORT command response is sent out of both serial ports at 9600 Baud, following a hard reset.



Serial port baud rates are monitored to maintain output integrity. If a requested command would cause the bandwidth of a port to be less than its current total output, the error ERR[BAUDRATE] is returned e.g. >PORT:ERR[BAUDRATE].



It is recommended to use the highest possible baud rate when operating the Syrinx DVL at high update rates (>5 Hz) to ensure data communication is not lost/delayed through bitrate limitation.

6.7.6 OUT – Output Command

The OUT (OUTput) command is used to set the different output types on certain ports. Multiple outputs can be produced on the same port.

Supported fixed ports include:

P0: RS232 Port 0

P1: AUX RS232 Port 1

P4000: Ethernet TCP Port 4000

P4001: Ethernet TCP Port 4001

P4002: Ethernet TCP Port 4002

P4003: Ethernet TCP Port 4003

P30010: Ethernet UDP Port 30010

P30011: Ethernet UDP Port 30011

Outputs can be configured to the configurable TCP and UDP ports by specifying the port number chosen for example for port 5432, the port can be specified as P5432.

Command:	<OUT:Px;MSG@x.x;MSG@y.y,Pz;MSG@z.z <OUT:Px;MSG@NONE <OUT:Px;NONE <OUT:NONE <OUT:NONE;ALL	
	<OUT Requests information	
Reply:	> OUT:Px;SONDV@z.z;MSG@z.z	
Parameter:	Px	Port number: See above for details of ports, examples are 0,1,4000,4001,4002,4003,30010,30011
	MSG	This is the identifier; MSG itself is not a valid mnemonic. SONDV – Sonardyne basic DVL output (ASCII) ASONDV – Sonardyne advanced output (BINARY) TIME – Sonardyne TIME message (BINARY) SNS – Sonardyne SNS message (BINARY) PD0 – RDI PD0 message output PD3 – RDI PD3 message output PD4 – RDI PD4 message output PD5 – RDI PD5 message output PD6 – RDI PD6 message output PD13 – RDI PD13 message output APD0 – Hexadecimal ASCII representation of RDI PD0 APD3 – Hexadecimal ASCII representation of RDI PD3 APD4 – Hexadecimal ASCII representation of RDI PD4 APD5 – Hexadecimal ASCII representation of RDI PD5 DBT – NMEA Depth Below Transducer message
	z.z	Interval between outputs in fractional seconds. Note this may not be valid for the message selected, if not the value is ignored. Value also ignored if DVL configured to triggered mode. If not specified, the default interval of 0.2 seconds (5Hz is used). This can be set to "MAX" to output the message at the highest achievable rate. This rate will vary with operating altitude.
	None	Depending on where in the message chain this is placed it will remove message outputs. OUT:NONE Removes all output messages on the port that the message was sent in on. OUT:Px;NONE Removes all output messages on port x. OUT:Px;MSG@NONE Removes message type MSG from port x. OUT:NONE;ALL Removes all output messages on all ports, excluding webserver and Lodestar ports 8000, 8010 and 8011 .

OUT command example:-

<OUT:P0;SONDV@0.5,P4001;PD4

Output Sonardyne proprietary DVL output on port 0 at 2 Hz (1 message every 0.5 seconds), PD4 message on port 4001.

>OUT:P0;SONDV@0.5,P4001;PD4@0.2

Notes

 Serial port baud rates are monitored to maintain output integrity. If a requested command would cause the total output on a port to exceed its bandwidth, the error ERR[BAUDRATE] is returned e.g. >OUT:ERR[BAUDRATE].

 The default interval for configured messages is 0.2 seconds (5 Hz) if not specified when set.

 The default output port will be the port the message is received on if not specified e.g. OUT:SONDV@1 would output a SONDV message at 1 Hz on the port the message received on.

 MAX update rate can be set to instruct the Syrinx DVL to output data at the highest possible rate.

Sending NONE disables messages on the respective level it is used at:

<OUT:NONE

Removes all output messages on the port the command was sent to the Syrinx DVL on.

<OUT:NONE;ALL

Removes all output messages currently configured on any port of the Syrinx DVL.

<OUT:P4001;NONE

Removes all output messages currently setup on port 4001.

<OUT:P4001;PD4@NONE

Removes the PD4 message setup on P4001.

6.7.7 TIME Command

The TIME command is used to set or get the Real Time Clock (RTC) date and time of the Syrinx DVL Instrument. The date and time can be set based on the first character of the serial / Ethernet command.

Command:	<TIME:[TDhh.mm.ss;dd/mm/yy]	
	<TIME:[TRIG]	
Reply:	>TIME:TDhh.mm.ss;dd/mm/yy,ITFxxxxxx.yyyyyy	
Parameter:	TDx	Time Date
	TRIG	Optional input parameter and instructs the unit to output the time on the next trigger input. Nb. The time cannot be set on a trigger input. NB: An immediate acknowledgement is returned of format >TIME:OK
	ITFxxx.yyy	Instrument time frame in decimal is reported on every time command but cannot be set. Where: xxxx = seconds yyyyyy = micro seconds (i.e. 6d.p) Note: ITF is not on the same time domain as the TDS string. The TDS string sets the RTC clock, whereas the ITF is the monotonically increasing count in the FPGA – see section on Time system for further information.

Time command example:-

<TIME:TD09.06.56;04/06/09 Set time and date (Command)
>TIME:TD09.06.56;04/06/09,ITF13.111321 Time and as set. (Response)
<TIMEGet time and date (Command)
>TIME:TD09.07.10;04/06/09,ITF13.111321 Current Time and date (Response)
<TIME:TRIG Get time and date (Command)
>TIME:OK Request acknowledgement (Response)
>TIME:TD09.07.10;04/06/09,ITF13.111321 Current Time and date (Response) on a trigger

Note

 **If the trigger input is used and no trigger is received the time will not be set. There is no time out on this best effort attempt, however any new TIME commands will override the original request to set the time.**

6.7.8 RSFD – Reset Settings Factory Default Command

The RSFD (Reset Settings Factory Default) command is used to set the Syrinx DVL back to the default factory mode.

Command:	<RSFD:SERIAL,ETHERNET	
Reply:	>RSFD:OK	
Parameter:	SERIAL	Optional parameter, if present resets the serial ports to 9600 baud
	ETHERNET	Optional parameter, if present resets the units network settings to default (static IP 192.168.179.200 subnet 255.255.255.0) and resets the configurable UDP and TCP ports.

RSFD command example:

<RSFD

>RSFD:OK

Settings will have been reset to the defaults. The settings will depend on current firmware.

<RSFD:SERIAL

>RSFD:OK

Settings will have been reset to the defaults. The settings will depend on current firmware however the serial ports will default back to their default rate.

<RSFD:SERIAL,ETHERNET

>RSFD:OK

Settings will have been reset to the defaults. The settings will depend on current firmware however the serial ports will default back to their default rate and network and Ethernet port settings have been reset.

When an RSFD command is sent to the Syrinx DVL, the following settings will be applied:

Offsets: Yaw +0°, Pitch +0°, Roll +0°

Outputs: All will be removed

Serial Settings: Serial ports will be reset to 9600 Baud rate

Ethernet Settings: Resets the units network settings to default (static IP 192.168.179.200 subnet 255.255.255.0) and resets the configurable UDP and TCP ports.

Configuration: Syrinx DVL will be set to Bottom track mode, free running, 3&4 beam solutions, maximum operating range based on system hardware, Vessel Reference Frame, trigger delay set to minimum, water track start range 100 dm, water track bin width 20 dm.

Sensor Configuration: Sound velocity set to manual 1500 m/s, 35 ppt salinity, 0 pressure offset.

Optional:

Serial Settings: Serial ports will be reset to 9600 Baud rate.

Ethernet Settings: Resets the unit's network settings to default (static IP 192.168.179.200 subnet 255.255.255.0) and resets the configurable UDP and TCP ports.

Note



The setting changes above may differ subtly between firmware versions, depending on available functionality (such as configurable ports).

Real Time Clock

The Real Time Clock (RTC) fitted within the Syrinx DVL has a backup battery life of ~3 hours. If the RTC has not been set (or has lost its time during power down) then the last known Syrinx time (an internal log of the last known RTC time) will be retrieved from file and used to source the RTC and the system time.

6.7.9 ETH – Ethernet Command

The ETH (ETHERnet) command is used to configure persistent changes to the Ethernet/IP networking configuration.

Command:	<ETH:IPxxx.xxx.xxx.xxx,SUBNETxxx.xxx.xxx.xxx ...OR... DHCP_ (EN/DIS)ABLE;Rx;Tx	
Reply:	>ETH:IP192.168.179.150,SUBNET255.255.255.0,MAC8CE7B3002F17,DHCP_ <ENABLED DISABLED>;R3;T6,CABLE_ <(DIS)CONNECTED>	
Parameter:	IPxxx.xxx.xxx.xxx	Set the IP address of the unit. Dotted decimal format with bytes in 1-254 range (e.g. 192.168.179.200) This field will be set to 0.0.0.0 if no IP address has been allocated.
	SUBNETxxx.xxx.xxx.xxx	Set the subnet mask of the subnet (dotted decimal format with each byte within a 0-255 range; The default is 255.255.255.0). This field will be set to 0.0.0.0 if no IP address has been allocated.
	DHCP_(EN/DIS)ABLE	Enable /Disable DHCP
	Rx	Optional number of retries when trying to contact the DHCP server (default 3) max: 20
	Tx	Optional timeout (seconds) when trying to contact the DHCP server (default 6). Max 30
	MACxxxxxxxxxxx	MAC address of the unit, which cannot be changed. (Hexadecimal format).
	CABLE_ <(DIS)CONNECTED>	PHY link enabled or disabled

ETH command example:

<ETH

>ETH:IP192.168.179.200,SUBNET255.255.255.0,MAC8CE7B3345678,DHCP_DISABLED;R3;T6,CABLE_CONNECTED

<ETH:IP192.168.179.199,SUBNET255.255.254.0

>ETH:IP192.168.179.199,SUBNET255.255.254.0,MAC8CE7B3345678,DHCP_DISABLED;R3;T6,CABLE_CONNECTED

<ETH:DHCP_ENABLE;R10;T2

>ETH:IP192.168.89.84,SUBNET255.255.254.0,MAC8CE7B3345678,DHCP_ENABLED;R10;T2,CABLE_CONNECTED

<ETH:DHCP_DISABLE

>ETH:IP192.168.179.200,SUBNET255.255.255.0,MAC8CE7B3345678,DHCP_DISABLED;R3;T6,CABLE_CONNECTED

Setting no parameters returns a status information string.

Setting a dotted decimal format IP address or subnet disables any existing DHCP configuration. If either the IP or subnet parameter is missing when switching from DHCP to static IP then default values are used for the omitted parameter (IP: 192.168.179.200, subnet: 255.255.255.0).

Use the 'DHCP_ENABLE' parameter to enable DHCP and disable static IP configuration. Optional sub-parameters; R (retires) and T (timeout) can be used to configure the DHCP client retries and timeout settings. Defaults of R3 and T6 are used when no value specified.

'DHCP_DISABLE' will return the unit to its default static IP and subnet (IP192.168.179.200, Subnet 255.255.255.0).

Cable connection status is always returned whether the PHY detects a physical link connection or not. The unit should be power-cycled after applying network changes.

Notes



Setting a dotted decimal format IP address disables an existing DHCP configuration.



An IP address can also be set with an optional update of its associated subnet mask. The default subnet mask is 255.255.255.0. Omitting the subnet mask will use the last saved subnet mask.

6.7.10 CKHW – Check Hardware Command

The CKHW (Check HardWare) command is used to perform a hardware check on the Syrinx DVL.

Command:	<CKHW
Reply:	> CKHW:PASS[RTC;PASS,PIC;PASS,AFE;PASS,DSP;PASS,ONEWIRE;PASS,TEMP;PASS]
Parameter:	none

All items in square brackets are subject to change and give diagnostics as to which hardware component passed or failed. Although may change they are always in the following form so a generic parse can be used.

ID;PASS or ID;FAIL

Example:

<CKHW

>CKHW:PASS [RTC;PASS,PIC;PASS,AFE;PASS,DSP;PASS,ONEWIRE;PASS,TEMP;PASS]

6.8 Advanced Settings

6.8.1 DHCP Mode

It is recommended to operate with a static IP address where possible to keep network integration as simple as possible. If DHCP is required, this can be enabled via the ETH command.

Enabling DHCP mode through the ETH command (see *Section 6.7.9 "ETH – Ethernet Command"*) will then allow a DHCP network to assign an IP address and subnet to the instrument.

Setting an IP address through the ETH command will disable DHCP mode.

DHCP Option 60

Syrinx DVL also supports DHCP option 60, where a Vendor Class Identifier is provided to identify the Syrinx DVL to the DHCP server. Syrinx will provide the following under DHCP option 60:

Syrinx DVL 8275-4530:

Length: 23

Vendor Class Identifier: SONARDYNE_TYPE8275-4530

Syrinx DVL 8275-6530

Length: 23

Vendor Class Identifier: SONARDYNE_TYPE8275-6530

Section 7 – Retrieval and Storage

7.1 Introduction

Before retrieving the Syrinx DVL, ensure *Section 2 – Safety* is read and fully understood.

7.2 Retrieval

1. Clean the Syrinx DVL; see *Section 8.4 "Cleaning"*.
2. Inspect the Syrinx DVL; see *Section 8.5 "Inspection"*.

7.3 Storage

On completion of all checks in the previous section the Syrinx DVL can be placed in storage as described below. See *Table 7-1* for the recommended storage conditions.

1. Replace the transducer protection cover.
2. Store the instrument in its transit case.
3. Equipment must be kept in a dry, non-condensing atmosphere (20% to 80% humidity), free from corrosive agents and isolated from sources of vibration.
4. The packaging should be stored on solid, level and damp proof floors. It must not be stored directly on damp or dirt floors or areas prone to flooding. In this case suitable shelving raised off the floor should be used.
5. It is recommended to visually inspect the equipment at least annually.
6. When equipment is taken from low temperature storage for immediate use its temperature should be raised to normal operating temperature before use.

Table 7-1 Storage Conditions

Item	Specification
Storage Temperature	-20 to 55°C (see note below)
Relative Humidity	20 to 80% (non-condensing)

Note

 To prolong the life of the lithium-ion backup battery, it is recommended to store the instrument in the temperature range of 0° to 30°C.

Section 8 – Maintenance

8.1 Introduction

Before performing any maintenance, ensure *Section 2 – Safety* is read and fully understood.

To make sure the Syrinx DVL provides long and effective service, it is important to carry out general and scheduled maintenance.

8.2 Retrieval from the Water

See *Section 7 "Retrieval and Storage"*.

8.3 Dismantling

Dismantling of the Syrinx DVL should only be carried out by Sonardyne qualified personnel.

8.4 Cleaning

Note



Do not use any abrasive brushes or sharp tools to remove marine growth when cleaning the instrument as this will damage the protective coating and increase the risk of corrosion.

1. Thoroughly wash the instrument in warm clean fresh water to remove accumulations of salt, sand/silt and marine growth, paying particular care to electrical connectors and transducer faces.
2. Remove any attached cabling or dummy plugs/protective caps and wash the external connectors.
3. Check that the sensor bung (central between transducers) is not blocked.
4. Dry the instrument with a clean lint free cloth.
5. Replace any attached dummy plugs/protective caps.

8.5 Inspection

Regularly inspect the Syrinx DVL for the following:

1. Inspect the pressure relief vent valve; *Section 8.6 "Pressure Relief Vent Valve"*.
2. Inspect the housing for signs of damage. At full working depth, the instrument housing is at risk of failure if damage is not repaired.
3. Check the security of the connectors. Any movement will require attention and the connector to be secured.
4. Inspect the connector contacts for signs of corrosion.
5. Inspect all cables and connections for signs of abrasion, cracks or splits.

8.6 Pressure Relief Vent Valve

The pressure relief vent valve should be flush with the housing face. If the pressure relief vent valve is not flush it should be operated to check for and release any internal pressure.

8.6.1 Operating the Pressure Relief Vent Valve

Note

 See Warnings in **Section 2 – Safety** “high internal pressure, risk of toxic gases and corrosive liquids”.

1. Screw an M4 bolt into the pressure relief vent valve.
2. Slowly pull the M4 bolt to withdraw the vent valve and wait for any internal pressure to be released.
3. With the pressure relief vent valve pulled out inspect the O-rings for any signs of damage.
4. Apply a small amount of petroleum jelly to lubricate the O-rings.
5. The valve should retract back into place; remove the M4 bolt and check the valve is flush with the Syrinx DVL housing.

8.7 Lubrication

The connectors and O-rings should be cleaned and lubricated using the manufacturer’s recommended procedures and lubricants as described below.

Table 8–1 Lubricants

Part	Lubricant
Subconn Connector	Molykote 44 Medium
Teledyne Impulse Connector	3M Silicon Spray or equivalent
Teledyne ‘O’ ring seals	Dow Corning 111 Valve Lubricant or equivalent
Seacon Connector	Dilectric compound (DC) grease, silicon based
Seacon O-rings	Suitable grease

8.7.1 Subconn Connectors

The connectors should be cleaned and lubricated using the manufacturer’s recommended lubricant “Molykote 44 Medium” before each mating.

CAUTION

 **Molykote 44 is a mild irritant. When lubricating the connector faces, personal protective equipment such as gloves and goggles must be worn.**

1. Make sure the connectors are clean and dry.
2. Clean using a spray based contact cleaner (isopropyl alcohol).
3. Lubricate the connectors as follows:
4. Apply a layer of grease to the female connector corresponding to a minimum 1/10th of socket depth.
5. The inner edge of all sockets should be completely covered, and a thin layer of grease left visible on the face of the connector.
6. After greasing, fully mate the male and female connector to optimise distribution of the grease on pins and in sockets.

7. Confirm that the grease has been sufficiently applied by de-mating and checking that grease is present on every male pin.
8. Re-mate the connectors.

8.7.2 Teledyne Impulse Connectors

The connectors and O-rings should be cleaned and lubricated using the manufacturer's recommended lubricant "3M Silicon Spray or equivalent (connector) and Dow Corning 111 Valve Lubricant or equivalent (O-ring) on a regular basis.

1. Clean and lubricate the connector mating surface using the manufacturer's "3M Silicon Spray" or equivalent.
2. Lubricate the O-ring with Dow Corning 111 Valve Lubricant or equivalent.
3. Replace O-rings when re-using connectors).
4. Avoid nicks and cuts to O-rings (replace if necessary).

8.8 Corrosion

The titanium housing is highly resistant to corrosion. Under normal use the housing should not show any signs of corrosion and no maintenance is necessary.

8.9 Scheduled Maintenance

The following table identifies the scheduled maintenance and the frequency of the activity.

Table 8–2 Scheduled Maintenance Timetable

Maintenance Schedule		
Task	Before/ After each Deployment	6 Monthly
Clean and inspect; see <i>Section 8.4</i> and <i>Section 8.5</i> .	X	
Run Self-Test; see <i>Section 10.3 "Self-Test"</i> .		X

Section 9 – Software Update for Syrinx DVL Manager

9.1 Introduction

The following sections explain how to update the embedded DVL Manager software from a web browser.

Note

 **Sonardyne Support and the Sonardyne website will provide details when a software update becomes available.**

9.2 Prerequisites

To update the firmware, the following prerequisites must be met:

- The new embedded software file (.SWU file).
- A web browser; see *Section 6.2.1 "Internet Browser Recommendations"* for more information on web browsers.

9.3 Connections

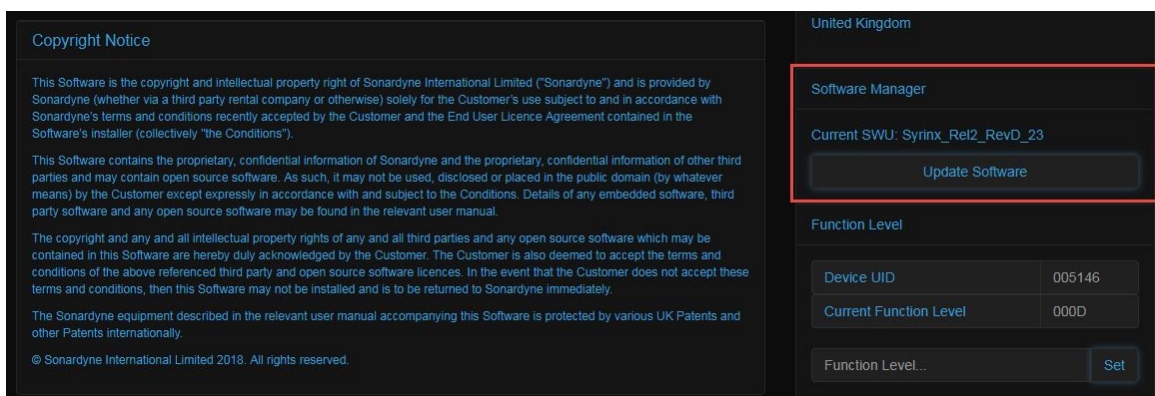
- An Ethernet connection to the Syrinx DVL either direct or through a network
- The PC updating the embedded software must be configured correctly for displaying DVL Manager; see *Section 6.3.1 "DVL Manager Connection"* for step by step instructions on connecting to the DVL Manager.

9.4 Updating the Software

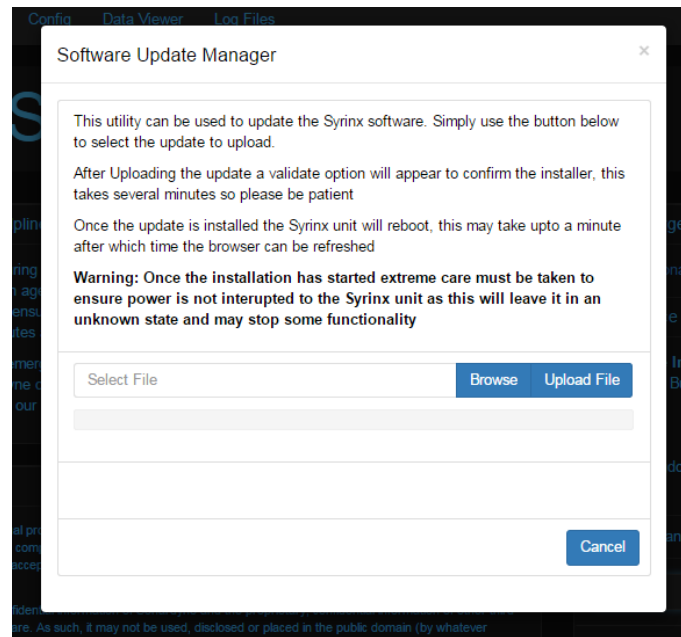
1. Save the updated software file (*.swu format) to a folder on the PC e.g. **Downloads**.
2. Connect to DVL Manager; see *Section 6.3.1 "DVL Manager Connection"*.
3. On the DVL Manager Home page, click **Support**.



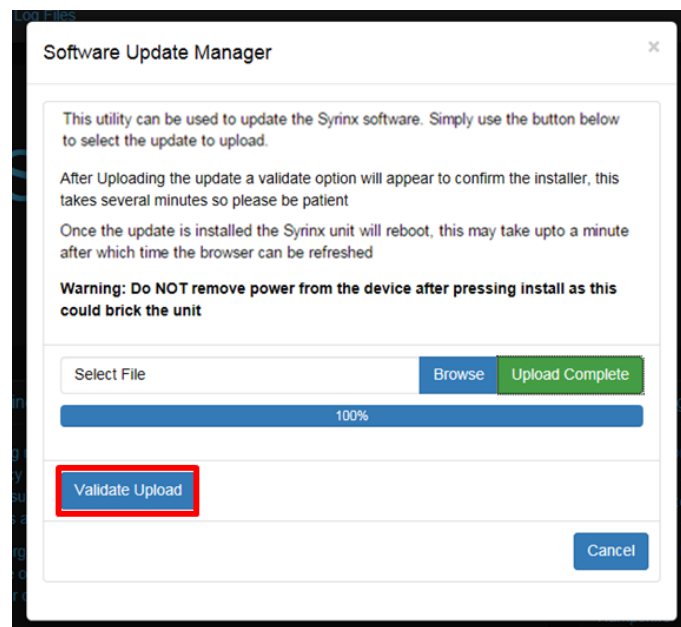
4. On the DVL Manager Support page, click **Update Software**.



- On the **Software Update Manager** popup, click **Browse** and navigate to the new software file (ensure that the file type .swu as provided by Sonardyne support).

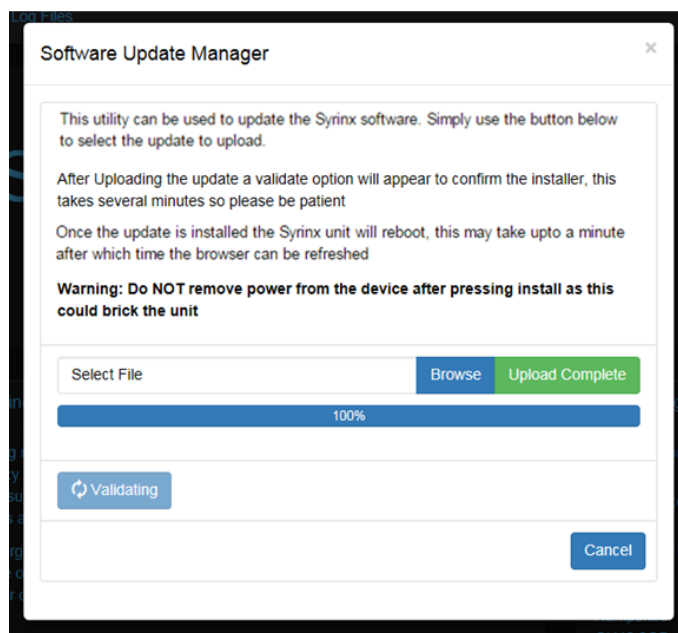


- Select the new software file and then click **Open**.
- Click **Upload File** to copy the file to the Syrinx DVL (a progress bar shows the status).
- Once the file is uploaded, click **Validate Upload** (this will request the Syrinx DVL to confirm that the file uploaded isn't corrupted and the installer is compatible with the current firmware version).



Note

The validation process can take a few minutes to complete.



9. After validation, click **Install** to start the installation process.

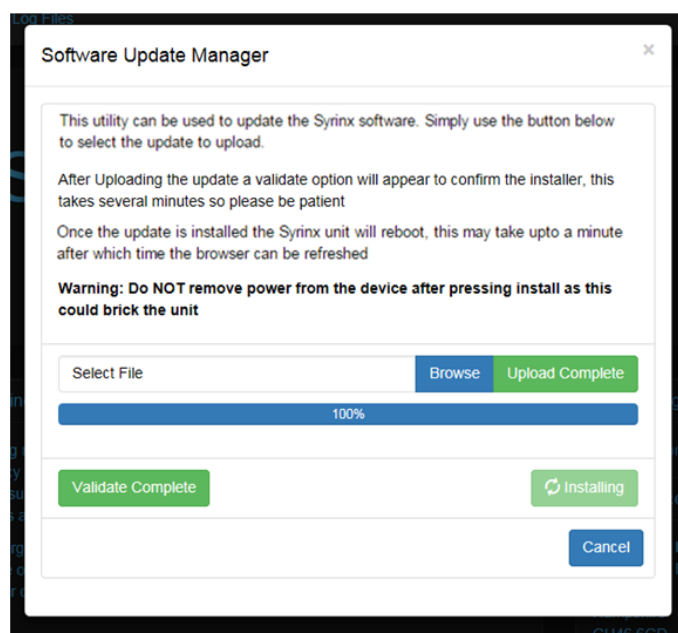
Note

 After the installation has started extreme care must be taken to ensure power is not interrupted to the Syrinx DVL or PC as this will leave the unit in an unknown state and may stop some functionality.

10. The installation can be cancelled at any point by clicking **Cancel**.

Note

 If an installation continues to fail contact Sonardyne Support.



11. Once the install is complete the web browser page will refresh.
12. The new software version can be verified on the DVL Manager home page.

If any problems are encountered during the software update, see *Section 11 "Troubleshooting"*

9.5 Functionality Update

9.5.1 Introduction

The following sections explain how to update the Syrinx DVL functionality using a web browser.

9.5.2 Prerequisites

Before updating the functionality, ensure the following are available:

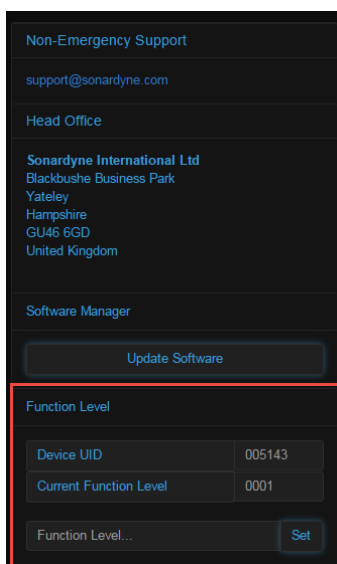
- The new functionality string (provided by Sonardyne Support). Sonardyne Support will require the Device UID in order to generate this string(see step 3 below to locate the Device UID).
- A web browser; see *Section 6.2.1 "Internet Browser Recommendations"* for more information on web browsers.

9.5.3 Connections

- An Ethernet connection to the Syrinx DVL either direct or through a network.
- The PC updating the functionality must be configured correctly for displaying DVL Manager; see *Section 6.3.1 "DVL Manager Connection"* for step by step instructions on connecting to the DVL Manager.

9.5.4 Updating the Functionality

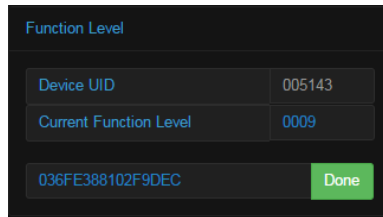
1. Connect to DVL Manager; see *Section 6.3.1 "DVL Manager Connection"*.
2. On the DVL Manager Home page, click **Support**.
3. On the **Function Level** pane, type the provided code into the **Current Function Level** box and then click **Set**.



The screenshot displays the DVL Manager interface. At the top, there is a 'Non-Emergency Support' section with the email 'support@sonardyne.com' and the 'Head Office' address: 'Sonardyne International Ltd, Blackbushe Business Park, Yateley, Hampshire, GU46 6GD, United Kingdom'. Below this is a 'Software Manager' section with an 'Update Software' button. The 'Function Level' section is highlighted with a red box and contains a table with the following data:

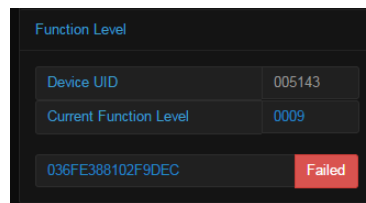
Function Level	
Device UID	005143
Current Function Level	0001
Function Level...	Set

4. If the code is correct and entered correctly, the **Set** button will display **Done**.



The screenshot shows a dark-themed interface titled "Function Level". It contains two rows of labels and values: "Device UID" with value "005143" and "Current Function Level" with value "0009". Below these is a text input field containing the code "036FE388102F9DEC". To the right of the input field is a green button labeled "Done".

5. If the code is incorrect, entered incorrectly or applied again once already completed, the **Set** button will display **Failed**.



The screenshot shows the same "Function Level" interface as above, but the button next to the code "036FE388102F9DEC" is red and labeled "Failed".

6. If the test fails, verify the code has been entered correctly and that the code is only used once. If this is the case and **Failed** is still displayed, contact Sonardyne Support.
7. Once completed, any additional functionality will be available immediately, without the need to restart the device.

Section 10 – Functional Testing

10.1 Introduction

To ensure the Syrinx DVL functions correctly, a number of functions can be tested using the Ethernet test box provided with the instrument.

10.2 Test Equipment

The following equipment is required for functional testing to be completed.

- Ethernet test box
 - Part number 641-0468 (8275-000-4530/4531/6530/6531)
- Web browser; see *Section 6.2.1 "Internet Browser Recommendations"* for browser recommendations
- Test PC with Ethernet capability
- Cat5/6 cable to connect to test PC
- 24 V power supply (into 4 mm sockets on test box)

10.3 Self-Test

Before testing, provide 24 V power to the test box 4 mm sockets and connect the Ethernet cable to the test box and test PC.

1. Connect to the DVL Manager; *Section 6.3.1 "DVL Manager Connection"*.
2. On the **Config** page, click **Run Self-Test** to start the Syrinx DVL built in self-test.
3. The results will be displayed once complete.

Note



If the Self-Test fails for any reason, contact Sonardyne Support.

Figure 10–1 DVL Manager Configuration Page

Syrinx Configuration

General Configuration

Mode: Bottom Track

Velocity Calculation: Automatic (Default)

Vehicle Reference Frame: Vessel (Default)

Trigger: Automatic

Max BT Range: 150m

Sound Velocity: 1500.00 m/s

Apply

Self Test

Run Self Test Start

Output Configuration

Port: RS232

Interval: 1 Hz

Message Type: APD0

Add

Output Messages

Port	Type	Rate
4000	SONDV	2 Hz

Time Configuration

Current Time: 14.35.29 18/06/18 Set Instrument Time: 008554.108044

10.4 Functional Test using Ethernet Connection

This functional test verifies that the Syrinx DVL can be connected to through the vehicle wiring using Ethernet and can be used to verify acoustic operation.

Note



The test assumes the DVL is deployed in water.

If the connection to the DVL requires configuring, follow *Steps 1 to 10 of Section 6.3.1 "DVL Manager Connection"* and then go to *Step 1* below.

1. On the Syrinx Configuration page, click **Config** on the top menu.
2. On the **General Configuration > Mode** drop-down list, select:
 - a. **Auto**, if the Syrinx DVL is less than 140 m altitude from the seabed, or
 - b. **Water Track**, if the Syrinx DVL is greater than 140 m altitude from the seabed.
3. On the **Velocity Calculation** drop-down list, select **Automatic**.
4. On the **Trigger** list, select:
 - a. **Automatic** if not using an external trigger to operate the Syrinx DVL.
 - b. **Trig+** or **Trig-** if using an external trigger to operate the Syrinx DVL.

5. If in bottom track mode, on the **Max BT Range** box, select the appropriate maximum range for bottom lock or, if in water track mode set appropriate water track settings covering the area to measure water velocities at, using the **Water Track Start Range** and **Water Track Bin Width** boxes.
6. Click **Apply**.
7. Click the **Data Viewer** on the menu bar.
8. The Data Viewer will open and the graph in the centre of the screen should display live data if the Syrinx DVL is functioning correctly; see *Figure 10-2*.

Notes

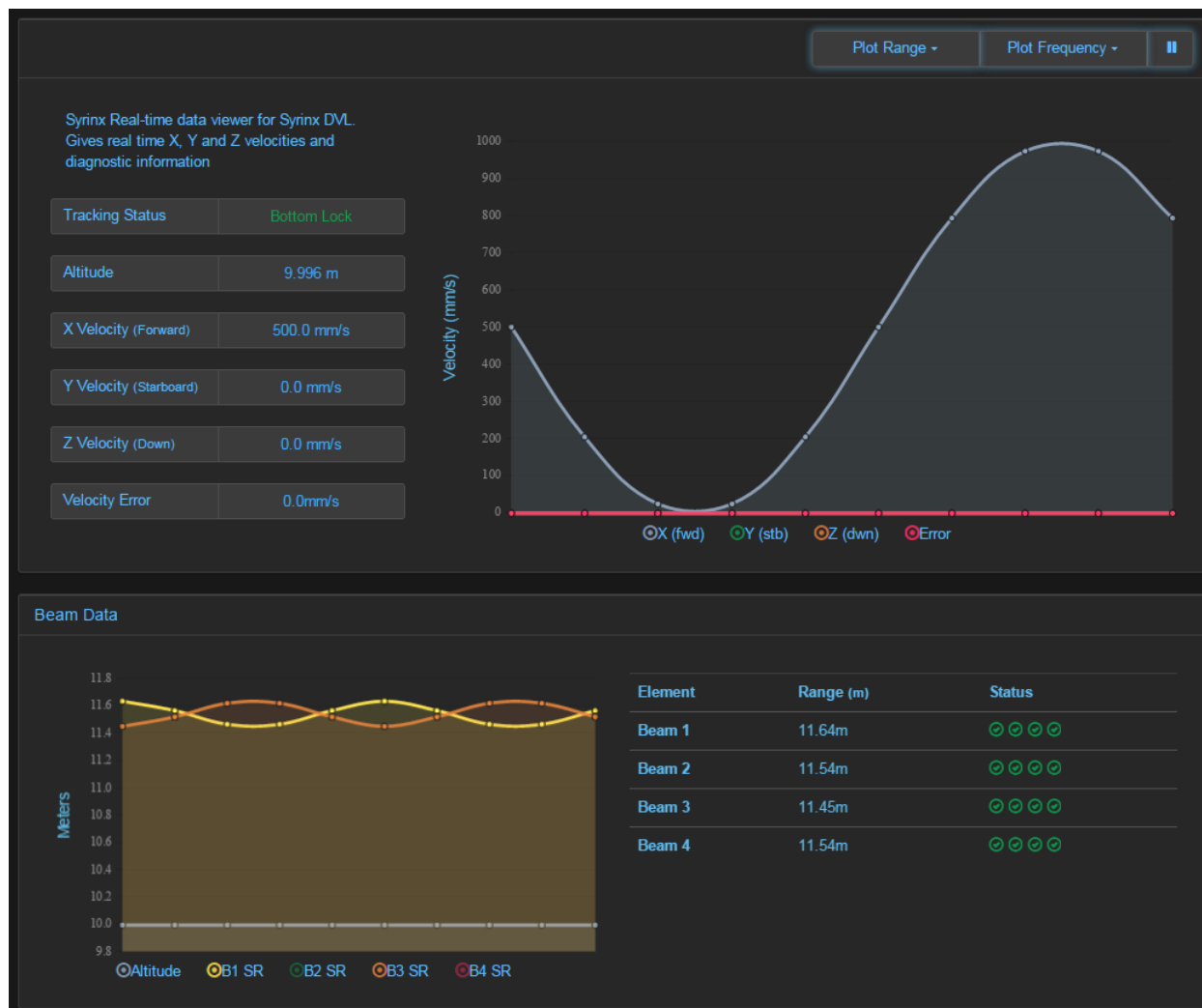
If no data is observed in Auto mode, verify the Syrinx DVL is between 0.4 m & 140 m altitude and repeat the test (altitudes of up to 175 m can be achieved with certain seabed types).



If no data is observed and the Syrinx DVL is configured to Trig+ or Trig- mode, verify input trigger to Syrinx DVL is working correctly and repeat the test.

9. The Data Viewer update rate can be changed on the **Plot Frequency** drop-down list on the upper right corner of the chart.
10. The Data Viewer can display larger or smaller numbers of data points on the **Plot Range** drop-down list on the upper right corner of the chart.

Figure 10–2 Syrinx DVL Data Viewer



10.5 Functional Test using Serial Connection

This functional test verifies that the Syrinx DVL can be connected to through the vehicle wiring with a serial connection and can be used to verify acoustic operation.

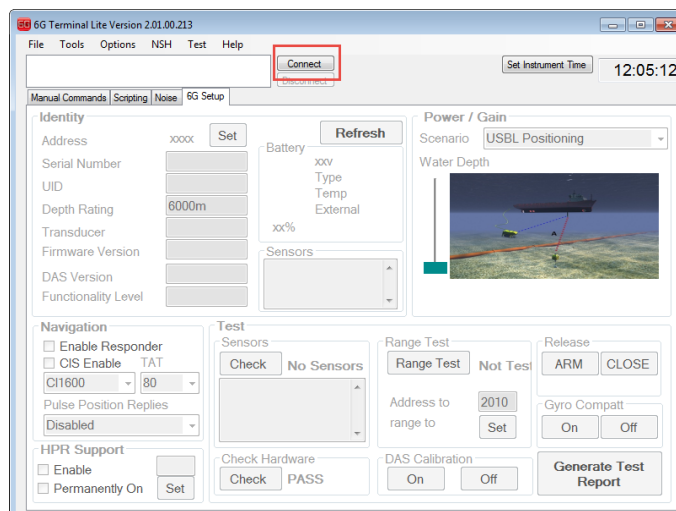
Note

 The test assumes the DVL is deployed in water.

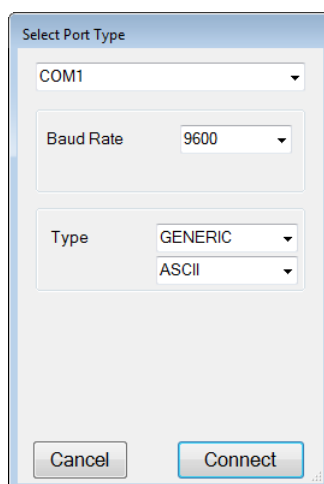
1. Double-click the **6G Terminal Lite** desktop icon to start the software.



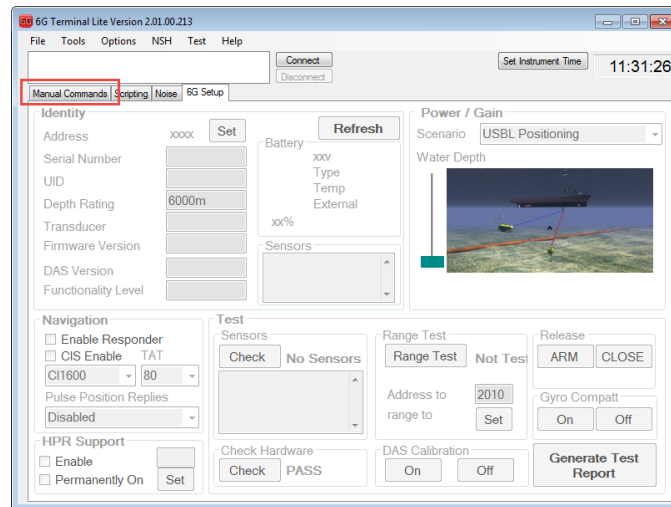
2. On the **6G Setup** tab, click **Connect**.



3. On the drop-down lists, select the **Baud Rate** of the serial connection and the **Type** as **Generic** and **ASCII**.



4. A "PORT" command will be sent to the DVL. If the communications are successful, a "PORT" reply will display in blue font in the comms window.
5. On the **Manual Commands** tab configure the DVL to either **Water Track** or **Bottom Track** mode:
 - a. To configure and test **Water Track** mode: send the command **CFG:WT,WTSR100,WTBW80,FREE** to the Syrnix DVL (this will configure the Syrnix DVL to water track mode, operating with an internal trigger and collecting velocity data at 100 dm start range and measure across an 80 dm bin width measuring the water velocity 10 m to 18 m from the Syrnix DVL).
 - b. To configure and test **Bottom Track** mode: send the command **CFG:AUTO,R150,FREE** to the Syrnix DVL. This will configure the Syrnix DVL to bottom track mode up to the maximum range (this is the default setting) using an internal trigger.



- To verify that the Syrinx DVL is tracking correctly, configure a "SONDV" telegram output on the connected port using the following command:

OUT:P0;SONDV@1

Note



In the command above, "P0" assumes the connection is the primary serial port. If using the secondary serial port, replace "P0" with "P1" as shown in the following example:
"OUT:P1;SONDV@1"

- If the Syrinx DVL is collecting valid velocity measurements, a SONDV telegram output message can be observed on the 6G Terminal Lite comms viewer. An example of the SONDV telegram message is shown below:

SONDV:TS;BL,VX+13.1,VY+23.1,VZ+0.1,JVE+0.12,B1R14.14,B2R14.23,B3R12.11,B4R16.02

Note



If ">SONDV:TS;ABL" is observed when configured to bottom tracking mode, this indicates that the DVL has not acquired bottom lock. Verify the DVL is between 0.4 m & 140 m altitude and repeat the test.

- To disable the output telegram, send the command **OUT:NONE**
- To perform a built in Self-Test, send the command **CKHW** and verify that the reply displays **PASS** in all tests.

Note

If the Self-Test fails for any reason, contact Sonardyne Support.

10.6 Checking the Syrinx DVL Hardware Configuration

The Syrinx DVL comes in a number of configurations to cover multiple applications. The hardware configuration can be checked using 6G Terminal Lite as described below.

To retrieve the Syrinx DVL configuration details either an Ethernet or Serial can be used.

To connect using a serial or Ethernet connection:

1. Open 6G Terminal as described in *Section 10.5*
2. For a serial connection:
 - a. Select the **Baud Rate** of the serial connection.
 - b. Select the **Type** as **Generic** and **ASCII**.

Select Port Type

COM1

Baud Rate 9600

Type GENERIC

ASCII

Cancel Connect

3. For an Ethernet connection:
 - a. Select **Socket** and configure the **IP** and **Port** to:
 - **192.168.179.200**
 - **4000**
 - b. Select the **Type** as **Generic** and **ASCII**.

Select Port Type

SOCKET

IP 192.168.179.200

Port 4000

Type GENERIC

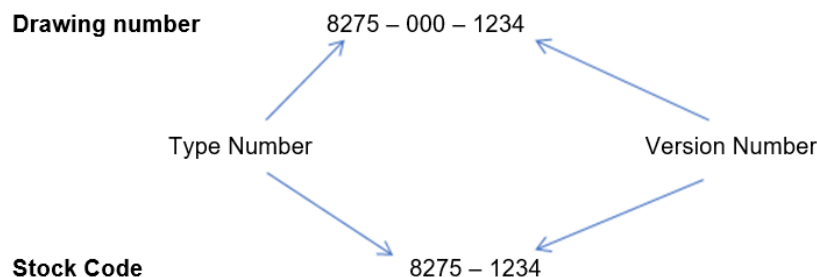
ASCII

Cancel Connect

4. On the **Manual Commands** tab, send the command **FS** to the Syrinx DVL.
5. The reply will look similar to the text string below, showing details of several of the SYRINX DVL's configuration/hardware.

>FS:U006B1E,FL0001,**TYPE8275-4561**,SN330615-001,VERPIC;V2.01.00.04,VERFPGA;V1.00.00.14,VERSYS;V3.02.26.00,VERDSP;V2.01.01.06

6. Using the **TYPE** number listed, you can reference the table below to confirm the configuration.



The reported TYPE number shown in step 5 above is **8275-4561**:

- **8275** refers to the product type (SYRINX),
- **4561** refers to the version configuration which, using the table below is:
 - **4** - 4000m
 - **5** - Titanium
 - **6** - 400kHz
 - **1** - Subcon Connectors

Number	Depth Rating	Material	Tdr Type	Other
1	<1000 m	Aluminium 6082		Subconn Connectors
2	2000 m	Aluminium 7075		
3	3000 m	S/Duplex	600 kHz	
4	4000 m	Ali Bronze		
5	5000 m	Titanium		
6	6000 m	Stainless Steel	400 kHz	
7	7000 m	Composite		
8	>8000 m	ABS/Plastic		
9	Special	Special	Special	Special
0	No Code	No Code	No Code	No Code

Section 11 – Troubleshooting

11.1 Introduction

If the Syrinx DVL system fails to operate, refer to the following fault diagnosis table to determine the possible cause and action to take. If the Syrinx DVL still fails to operate, contact Sonardyne Support.

11.2 No communication from the DVL

Table 11–1 Fault Diagnosis Table

Fault	Action
Connection to the Syrinx DVL has been lost.	Remove the power supply for 5 seconds and then reapply power to the Syrinx DVL.
If resetting the Syrinx DVL does not restore the connection and the error shown below is displayed in your web browser.	Check the PC IP address and subnet mask; see <i>Section 6.2</i> .
If the IP address and subnet mask is correct but there is still no connection.	Check the cable and all connections. Verify power supplied to DVL is 24 V +- 10% and allows current draw of up to 600 mA. If using a custom cable, verify that pins are wired up correctly; see <i>Section 3.6.2</i>. Check the firewall settings or anti-virus software is not blocking the connection. If using a custom network, connect to the Syrinx DVL directly through the Ethernet test cable provided with Syrinx DVL to determine if the fault lies with the unit or the network.
No communication with Syrinx DVL via serial connection.	Verify that the serial port settings are correct. Connect to the serial port on 9600 Baud rate and power cycle the DVL. The Syrinx DVL will output a PORT message @ 9600 Baud Rate including the Baud rate the port is set to. The serial port will then be configured to this Baud rate.
To remove all data output from a port.	Send an OUT:NONE <CR><LF> command on the port.
To remove all data output from all ports.	Send an OUT:NONE;ALL <CR><LF> command on any port.

11.3 Acoustic Data Analysis

The **Data viewer** page displays status indicators: a green tick, or an orange cross depending on the data returned from Syrinx DVL.

A likely explanation for the  symbol is shown below.

Symbol	Used Status	Error Status	Correlation Score	Signal Strength
	Beam used in velocity calculation	Error value low – data is reliable	Correlation score high – signal return is as expected	Signal strength is high – external noise is not affecting operations
	Beam not used in velocity calculation	Error value high – data is less reliable	Correlation score low – signal return is sub-optimal	Signal strength is low – external noise is affecting operations
Explanation	Beam not used due to poor quality signal. See other diagnostic information for details	Error may be high if data from a single beam does not fit with the results from the other 3 beams. May be due to a partial reflection, or a reflection from an object in the water column (such as marine life)	Low correlation score may be due to multipath replies, scattered reflections from an uneven seabed, reflections from other matter in the water column (including marine life) or external noise.	Signal strength may be low due to operation at very high altitudes, poor reflections from certain seabed types, or other devices causing noise around the operating frequency band of the Syrinx DVL.

11.4 Ethernet & Serial Connector Troubleshooting

See *Section 6.2 "Ethernet Connectivity"* and *Section 6.6 "Serial Connectivity"*.

For connector wiring details, see *Section 3.6 "Connectors"*.

11.5 Ethernet Connection Troubleshooting

See *Appendix E "Ethernet Connection Troubleshooting Flowchart"* for a detailed flowchart to assist in the diagnosis of possible Ethernet connection issues.

11.5.1 Fixing Ethernet Communication Speed

Depending on cabling configurations, auto-negotiating the communication speed of the PC connected to the Syrinx DVL or fixing the speed to 100 Mb/s or 1 Gb/s may cause connection issues.

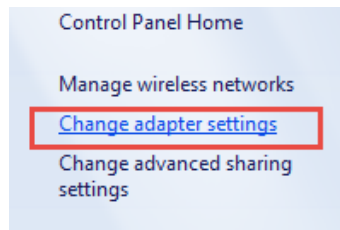
The instructions on how to fix the connection speed (for Windows® 7) are shown below.

1. Open the **Control Panel** and select **Network and Sharing Center**.

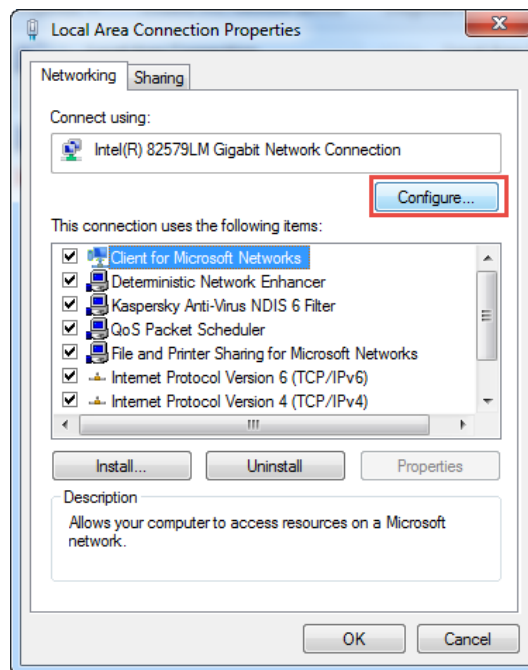


Network and Sharing
Center

2. Click **Change Adapter Settings**.

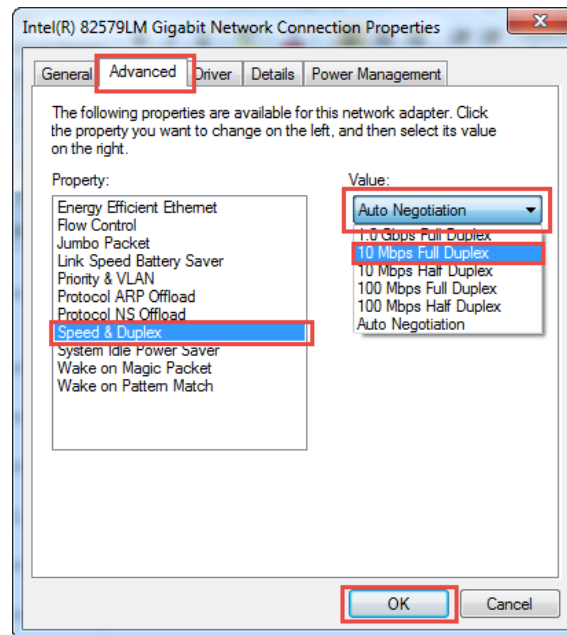


3. Right-click on the Local Area Connection (connected to the Syrinx DVL) and select **Properties**.
4. Click **Configure**.



5. Click the **Advanced** tab and select **Speed and Duplex** on the **Property:** pane.

6. Select **10 Mbps Full Duplex** on the **Value:** drop-down list and then click **OK**.



11.6 Downloading Log Files for Support Analysis

Log files can be downloaded through an Ethernet connection to the Syrinx DVL and sent to Sonardyne Support for analysis; see *Section 6.3.7 "DVL Manager Log Files"*.

The files that may be required include:

- Output message telegram log files
- User action log files
- Raw data log files
- Diagnostics file

Sonardyne support will provide instructions on any files that may be required to help diagnose any issues.

Section 12 – Spares

12.1 Introduction

When ordering spare parts, please provide the part number (CPN) and a description.

Enquiries about, or orders for spare parts should be directed to your local Sonardyne office or agent. For addresses and contact details, see the back page of this manual or visit our website:

<https://www.sonardyne.com/get-in-touch/>.

12.2 Type 8275-000-4531/4561/6531 Recommended Spares

Part Number	Description	Qty
214-1936	Mounting/Interface plate bolt	8
312-6574	Subconn cable tail 1 metre (Ethernet)	1
317-2672	Subconn locking sleeve	4
317-5197	Subconn 8-pin male dummy plug	2
800-0294	Syrinx DVL isolation plate	1
641-0468	DVL Ethernet text box	1
810-0101	DVL array protector	1

12.3 Type 8275-000-4530/6530 Recommended Spares

Part Number	Description	Qty
214-1936	Mounting/Interface plate bolt	8
317-5384	Impulse cable tail	1
317-5385	Impulse locking sleeve	4
317-5393	Impulse 8-pin male dummy plug	2
800-0294	Syrinx DVL isolation plate	1
800-0302	Syrinx DVL mounting plate titanium	1
641-0468	DVL Ethernet text box	1
810-0101	DVL array protector	1

Section 13 – Technical Specifications

13.1 Type 8275-000-4531/4561/6531 Specifications

Parameter		Type 8275-4531/6531 600 kHz	Type 8275-4561 400 kHz
Operational Frequency		600 kHz	400 kHz
Bottom Velocity – Single Ping Precision (Standard Deviation @ 1 m/s*)		±0.22 cm/s	±0.28 cm/s
Long Term Accuracy		±0.12% ±0.1 cm/s	±0.22% ±0.1 cm/s
Minimum/Maximum Altitude		0.4/175 m**	0.4/230 m
Velocity Range		>10 m/s	>10 m/s
Velocity Resolution		0.01 cm/s	0.01 cm/s
Data Output Rate		25 Hz maximum	25 Hz maximum
Water Reference Velocity	Accuracy	±0.2% ±0.1 cm/s	±0.2% ±0.1 cm/s
	Layer Size Minimum/Maximum Range	Selectable 0.4 m/80 m	Selectable 0.4 m/120 m
ADCP	Profiling Range	0.4–80 m	0.4–120 m
	Velocity Range & RMS (along beam)	Up to ±11.2 m/s ±0.4% of measured value	Up to ±11.2 m/s ±0.4% of measured value
	Maximum Number of Cells	255	255
	Maximum Ping Rate	4 Hz (ADCP) or 2.5 Hz (DVL+ADCP)	4 Hz (ADCP) or 2.5 Hz (DVL+ADCP)
Acoustics	Beam Width	±1.0 Degrees	±1.3 Degrees
	Beam Angle	30 Degrees	30 Degrees
	Maximum Transmit Source Level (dB re 1 uPa @ 1 m)	217 dB (maximum)	217 dB (maximum)
Sensors	Temperature	-5° to 40°C/s	
	Pitch/Roll (Optional)	±0.5°	
	Pressure (Optional)	±0.1% full scale	
Configuration	Array	4-beam array @ 30° beam angles	
Communication and Logging	Communications	Dual RS232, multi-port Ethernet (TCP and UDP)	
	Trigger Inputs	3–12 V rising or falling edge configurable	
	Internal Logging	32 GB internal memory	
Output	Output Telegrams	Sonardyne proprietary, PD0, PD3, PD4, PD6, PD13, SDDBT	
		Simultaneous telegram output	
Power	Voltage Range (dc Input)	24 V (±10%)	
	Average Power (Typical)	10 W nominal	
Environmental	Depth Rating	4000 m/6000 m	
	Operating Temperature	-5 to 55°C	
	Storage Temperature	-20 to 55°C	

Parameter		Type 8275-4531/6531 600 kHz	Type 8275-4561 400 kHz
Mechanical	Construction	Titanium	
	Connector Type	Subconn	
	Dimensions (Height x Max Diameter)	189 x 225 mm (4,000 version) 204 x 225 mm (6,000 version)	189 x 225 mm (4,000 version) n/a
	Weight in Air/Water**	12.0/9.1 kg (4,000 m version) 14.4/10.9 kg (6,000 m version)	11.3/8.5 kg (4,000 m version) n/a

* Standard deviation refers to proven single-ping true horizontal velocity precision, specified at 20–30 m altitude.

**150 m bottom acquire range, up to 175 m once bottom locked in optimal seabed conditions.

**Estimated weights.

13.2 Type 8275-000-4530/6530 Specifications

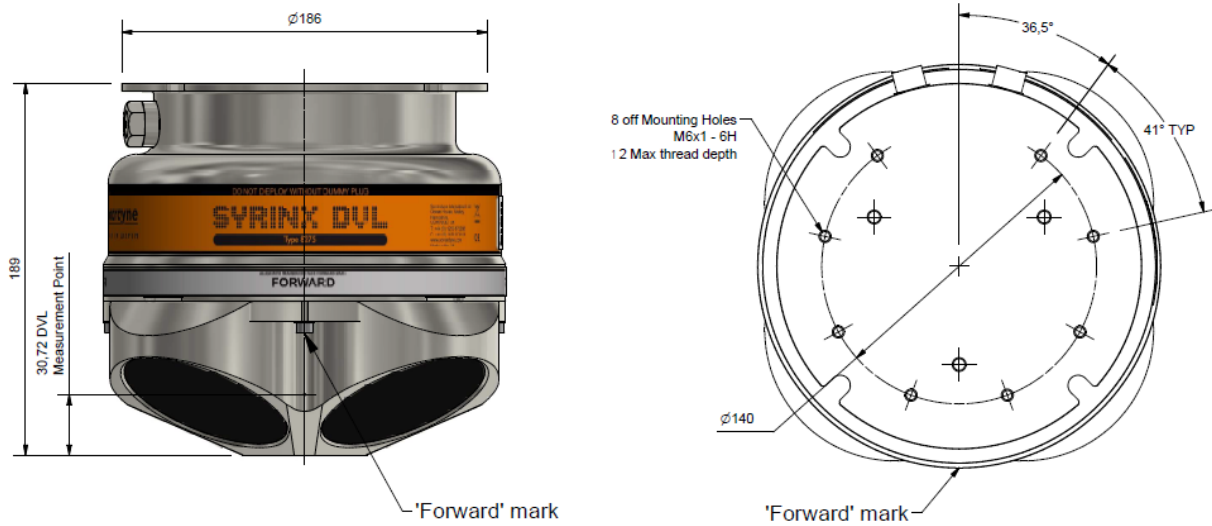
The Type 8275-000-4530/6530 specifications are identical to the Type 8275-000-4531/6531 apart from the following parameters.

Parameter	Type 8275-000-4530	Type 8275-000-6530
Operational Frequency	600 kHz	600 kHz
Connector Type	Teledyne Impulse	Teledyne Impulse
Diameter (Max)	225 mm (8.9 in)	225 mm (8.9 in)
Overall Length	196 mm (7.4 in)	208 mm (8 in)
Weight in Air*	12 kg (26 lb)	15 kg (33 lb)
Weight in Water*	~7 kg (~15 lb)	~9 kg (~20 lb)

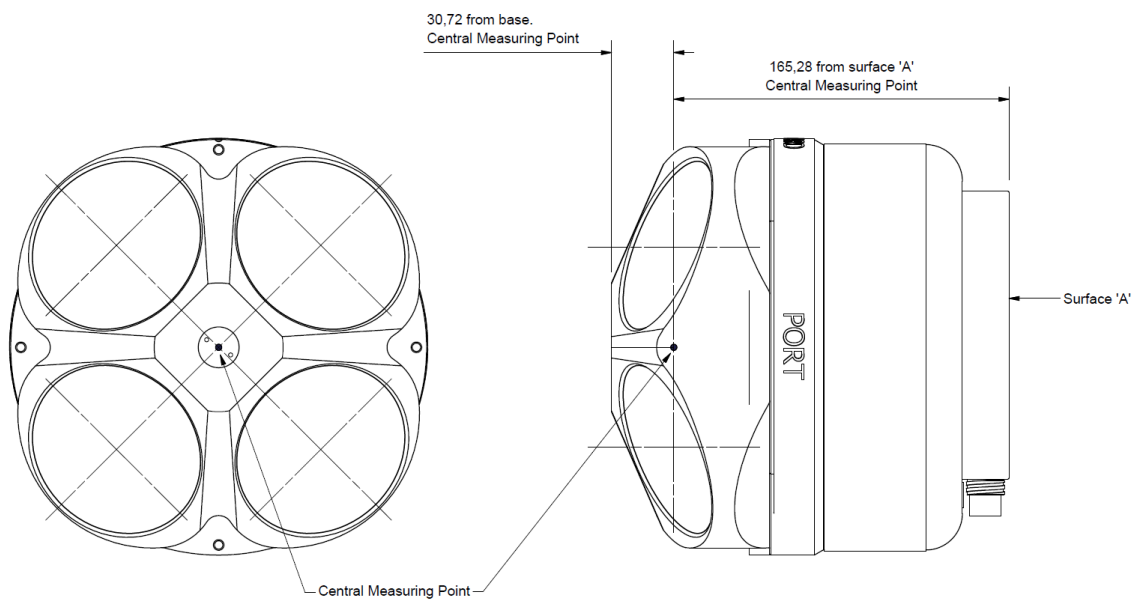
*Estimated weights

13.3 Central Measurement Point Dimensions

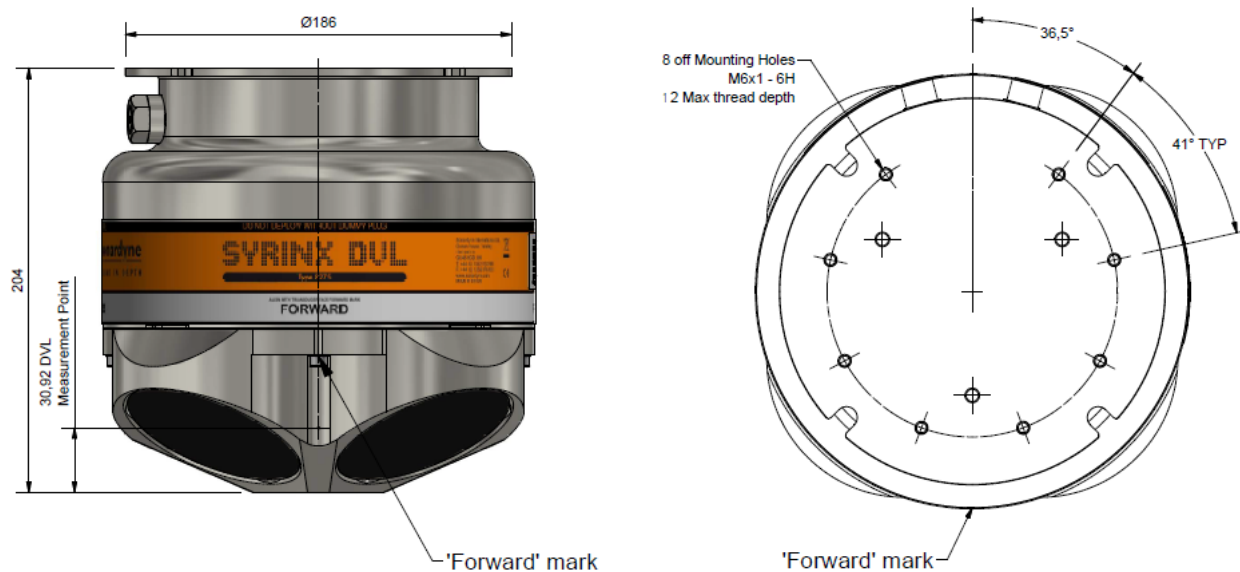
13.3.1 Type 8275-000-4531/4561



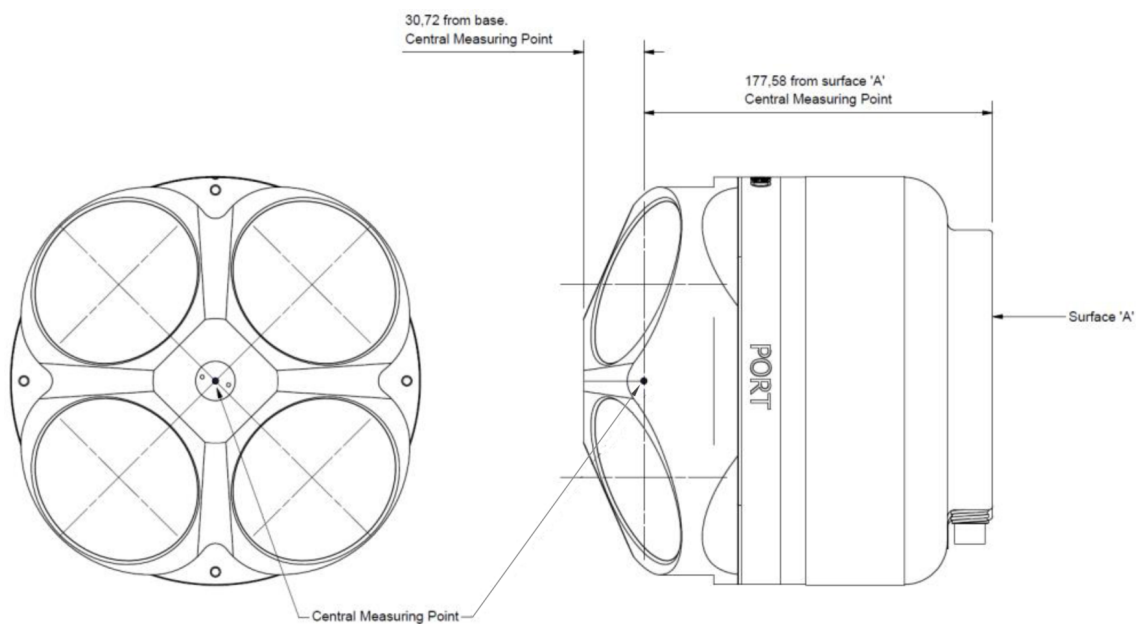
13.3.2 Type 8275-000-4530



13.3.3 Type 8275-000-6531

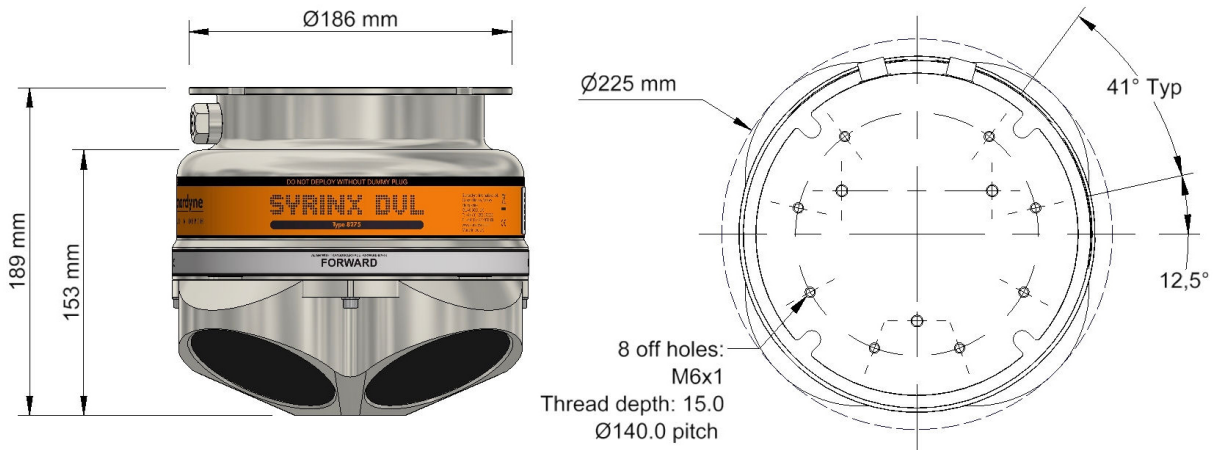


13.3.4 Type 8275-000-6530

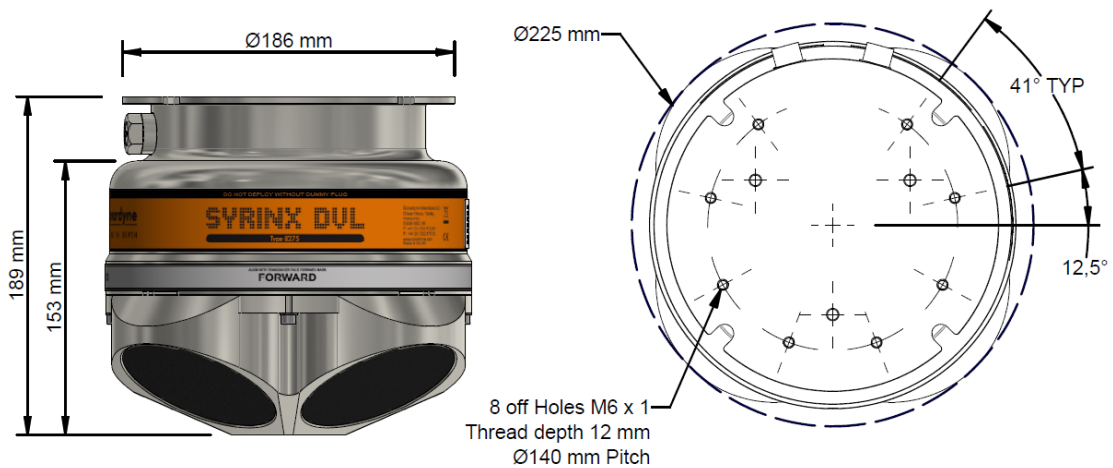


13.4 Technical Drawings

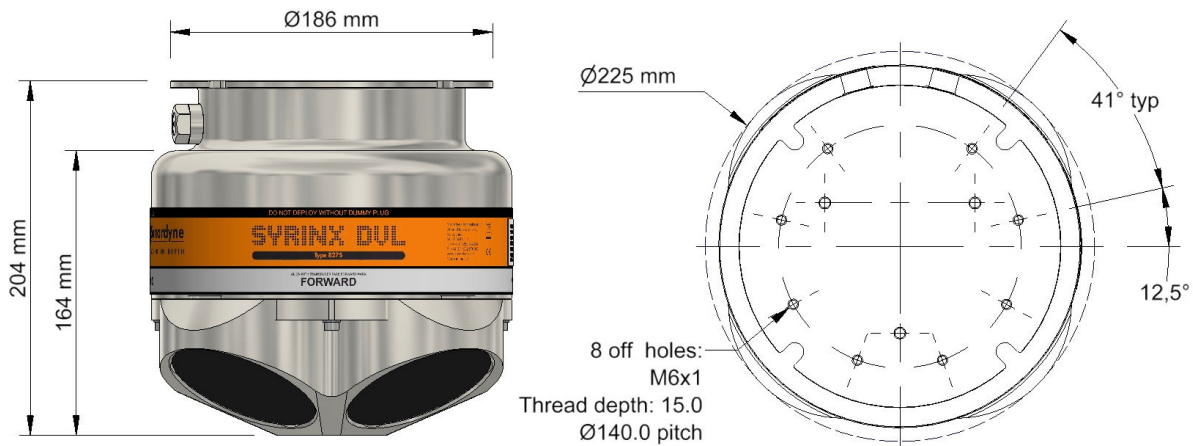
13.4.1 Type 8275-000-4531



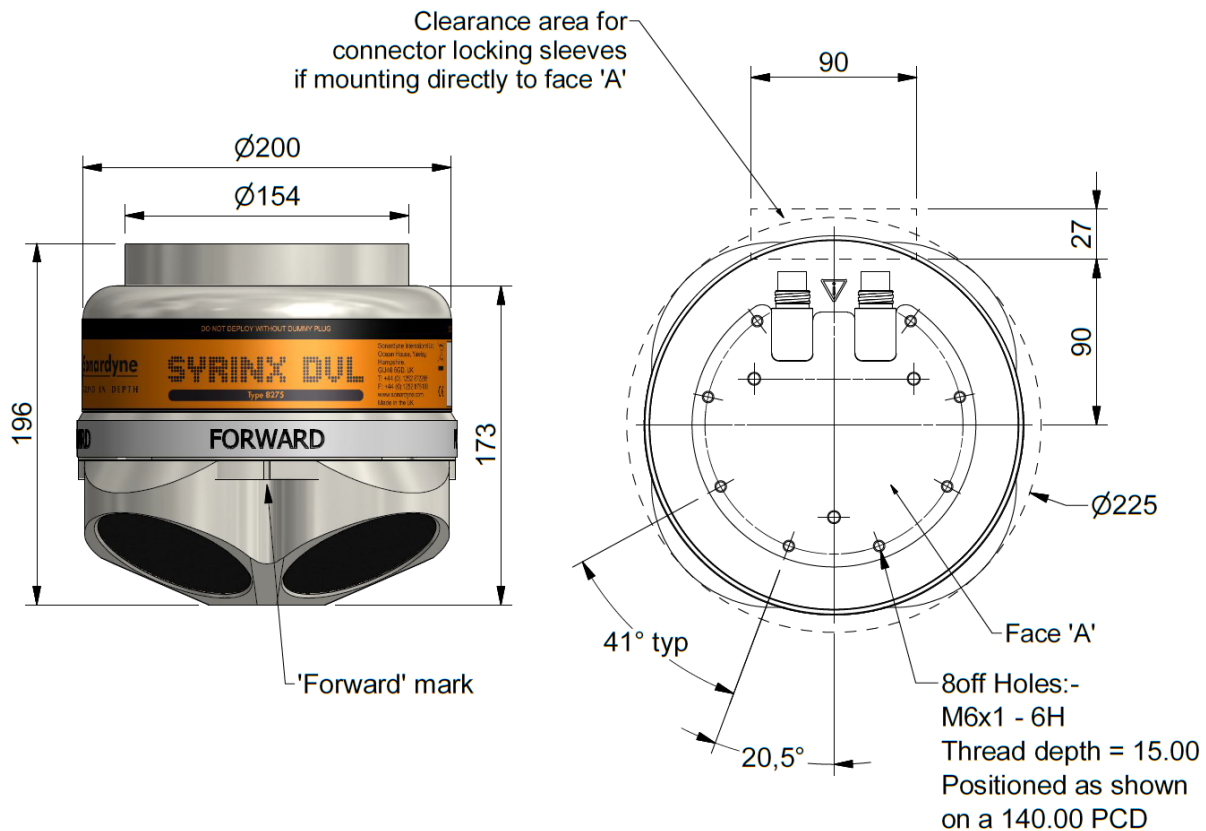
13.4.2 Type 8275-000-4561



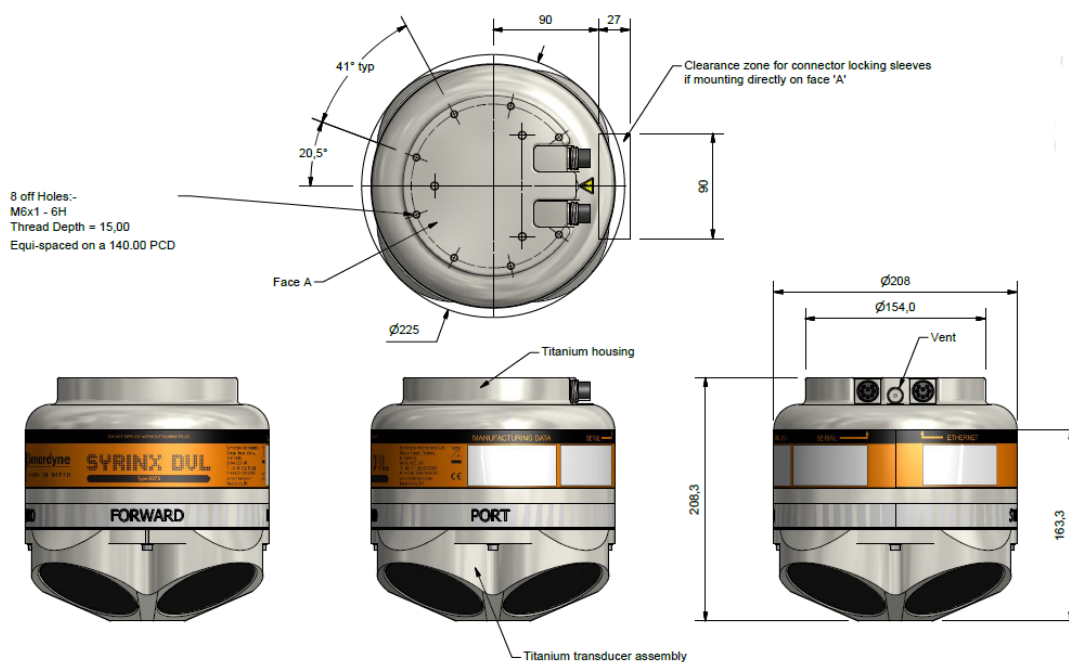
13.4.3 Type 8275-000-6531



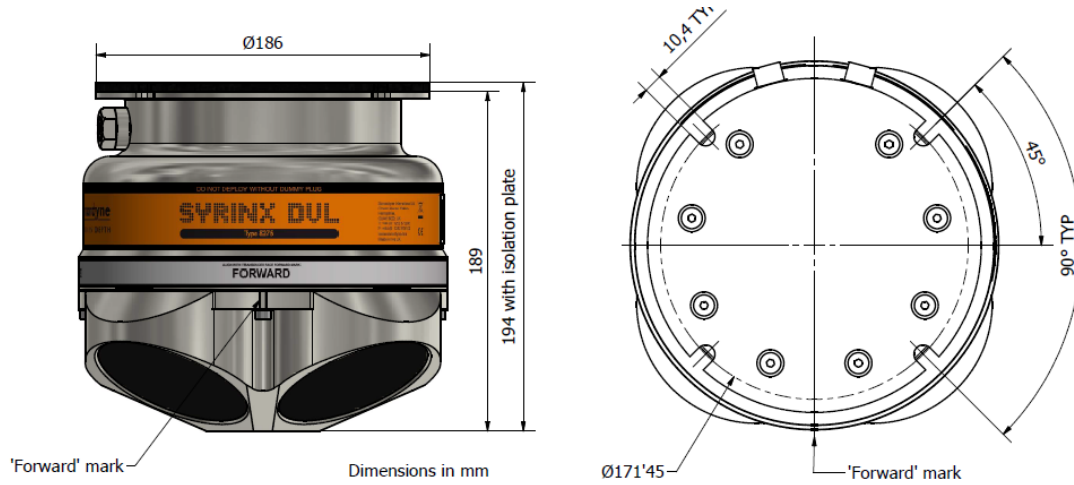
13.4.4 Type 8275-000-4530



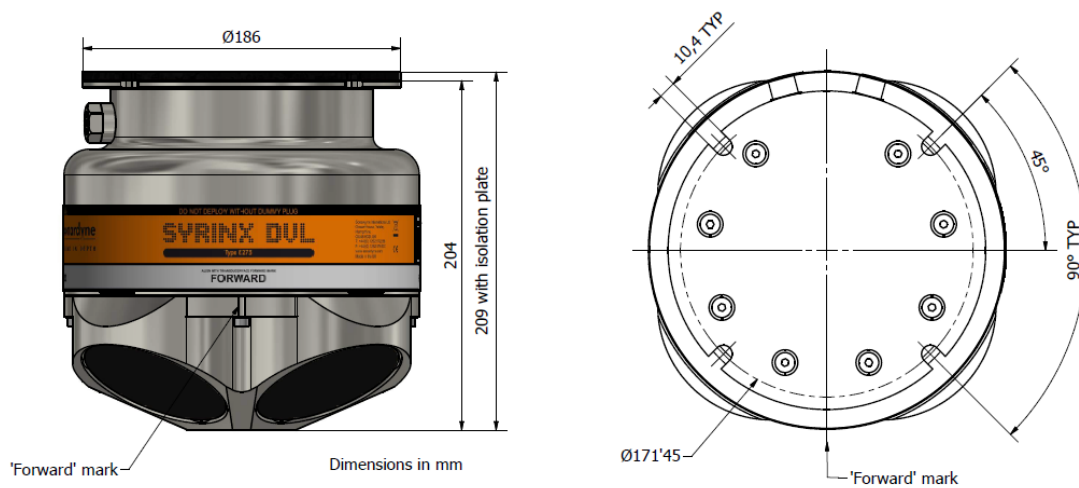
13.4.5 Type 8275-000-6530



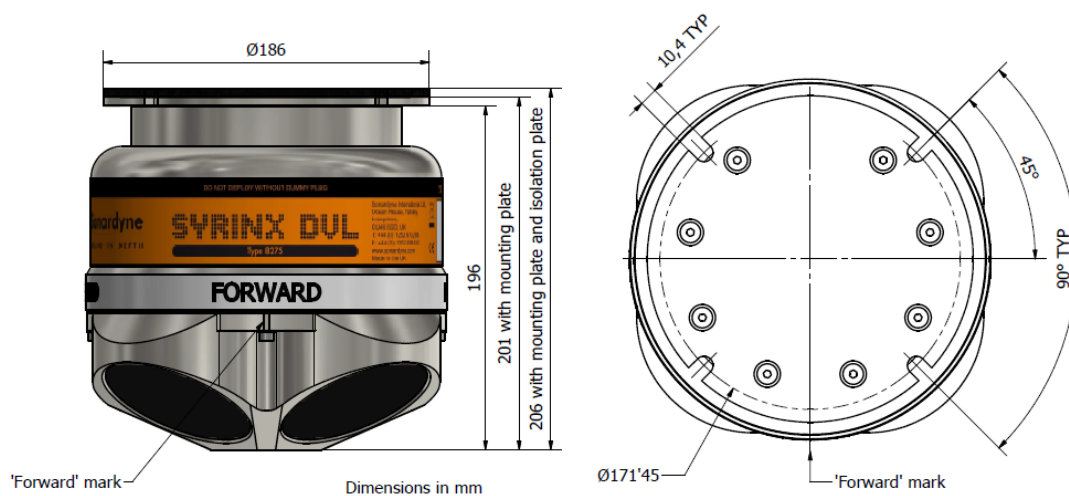
13.4.6 Type 8275-000-4531 with Isolation and Mounting Plates



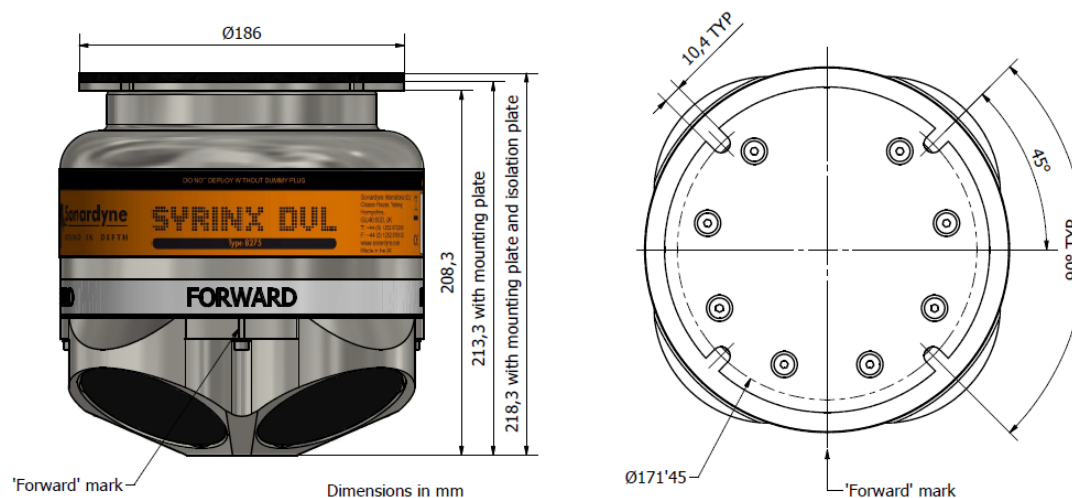
13.4.7 Type 8275-000-6531 with Isolation and Mounting Plates



13.4.8 Type 8275-000-4530 with Isolation and Mounting Plates



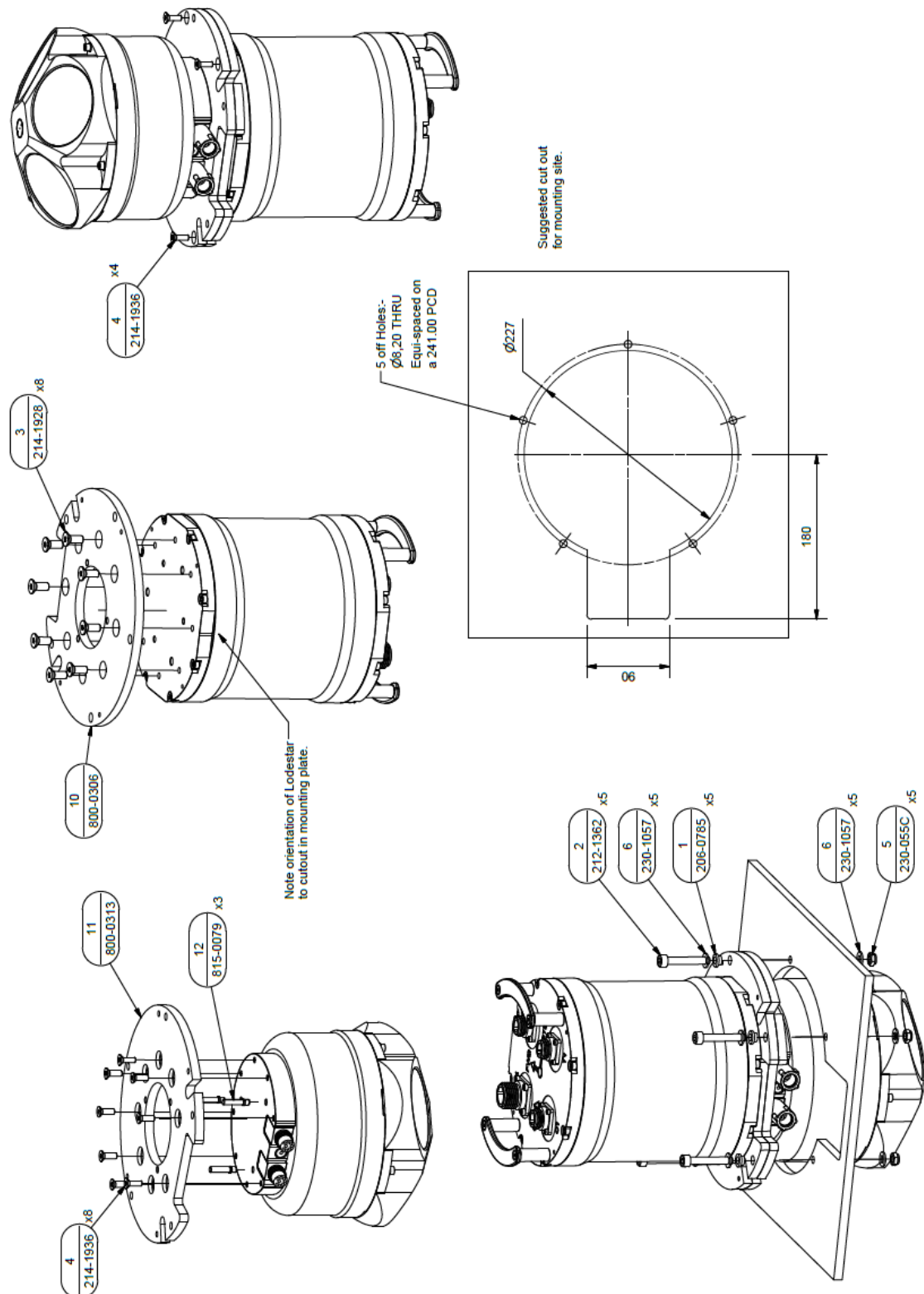
13.4.9 Type 8275-000-6530 with Isolation and Mounting Plates



13.4.10 Syrinx DVL to Lodestar Mounting Kit (8084-454)

Note

The separate mounting plate CPN 800-0313 shown below is not required for Type 8275-4531/6531.



Appendix A – Non-Standard Syrinx DVL Variants

A.1 Introduction

This Appendix describes non-standard Syrinx DVL variants that have been designed to a specific customer specification.

The Type 8275 Syrinx DVL non-standard variants are described below.

Table A-1 Non-Standard Syrinx DVL Variants

Type	Variant	Description
8275-000-9903	600 kHz 300 m	300 m rated with Teledyne Impulse male connectors and plastic housing
8275-000-9904	600 kHz 4,000 m	4,000 m rated with titanium housing and male Seacon 5507-1508-0004 connectors
8275-000-9905	600 kHz 4,000 m	4,000 m rated with titanium housing and Seanet 101-5260 connectors

A.2 Type 8275-9903

A.2.1 Technical Description

Type 8275-000-9903 utilises the 4,000 m titanium endcap to ensure robustness, damage resistance and rigidity. The cylindrical housing is made from plastic, designed to withstand pressures of 300 m water depth and keep total weight to a minimum. The housing and endcap is aligned by three alignment dowels for correct and repeatable orientation.

A.2.2 Specifications

Parameter		Type 8275-9903 600 kHz
Operational Frequency		600 kHz
Bottom Velocity – Single Ping Precision (Standard Deviation @ 1 m/s*)		±0.22 cm/s
Long Term Accuracy		±0.12% ±0.1 cm/s
Minimum/Maximum Altitude		0.4/175 m**
Velocity Range		>10 m/s
Velocity Resolution		0.01 cm/s
Data Output Rate		25 Hz maximum
Water Reference Velocity	Accuracy Layer Size Minimum/Maximum Range	±0.2% ±0.1 cm/s Selectable 0.4 m/80 m
ADCP	Profiling Range Velocity Range & RMS (along beam) Maximum Number of Cells Maximum Ping Rate	0.4–80 m Up to ±11.2 m/s ±0.4% of measured value 255 4 Hz (ADCP) or 2.5 Hz (DVL+ADCP)
Acoustics	Beam Width Beam Angle Maximum Transmit Source Level (dB re 1 uPa @ 1 m)	±1.0 Degrees 30 Degrees 217 dB (maximum)

Parameter		Type 8275-9903 600 kHz
Sensors	Temperature Pitch/Roll (Optional) Pressure (Optional)	-5° to 40°C/s ±0.5° ±0.1% full scale
Configuration	Array	4-beam array @ 30° beam angles
Communication and Logging	Communications Trigger Inputs Internal Logging	Dual RS232, multi-port Ethernet (TCP and UDP) 3–12 V rising or falling edge configurable 32 GB internal memory
Output	Output Telegrams	Sonardyne proprietary, PD0, PD3, PD4, PD6, PD13, SDDBT Simultaneous telegram output
Power	Voltage Range (dc Input) Average Power (Typical)	24 V (±10%) 10 W nominal
Environmental	Depth Rating Operating Temperature Storage Temperature	300 m -5 to 55°C -20 to 55°C
Mechanical	Construction	Plastic
	Connector Type	Teledyne Impulse
	Dimensions (Height x Max Diameter)	196 x 225 mm
	Weight in Air/Water**	9.4/~6 kg

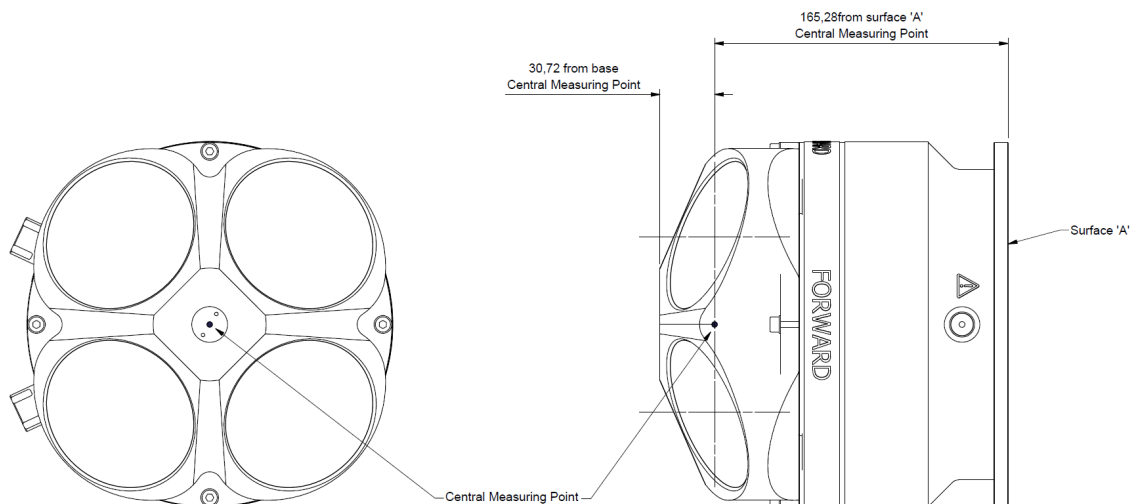
* Standard deviation refers to proven single-ping true horizontal velocity precision, specified at 20–30 m altitude.

**150 m bottom acquire range, up to 175 m once bottom locked in optimal seabed conditions.

**Estimated weights.

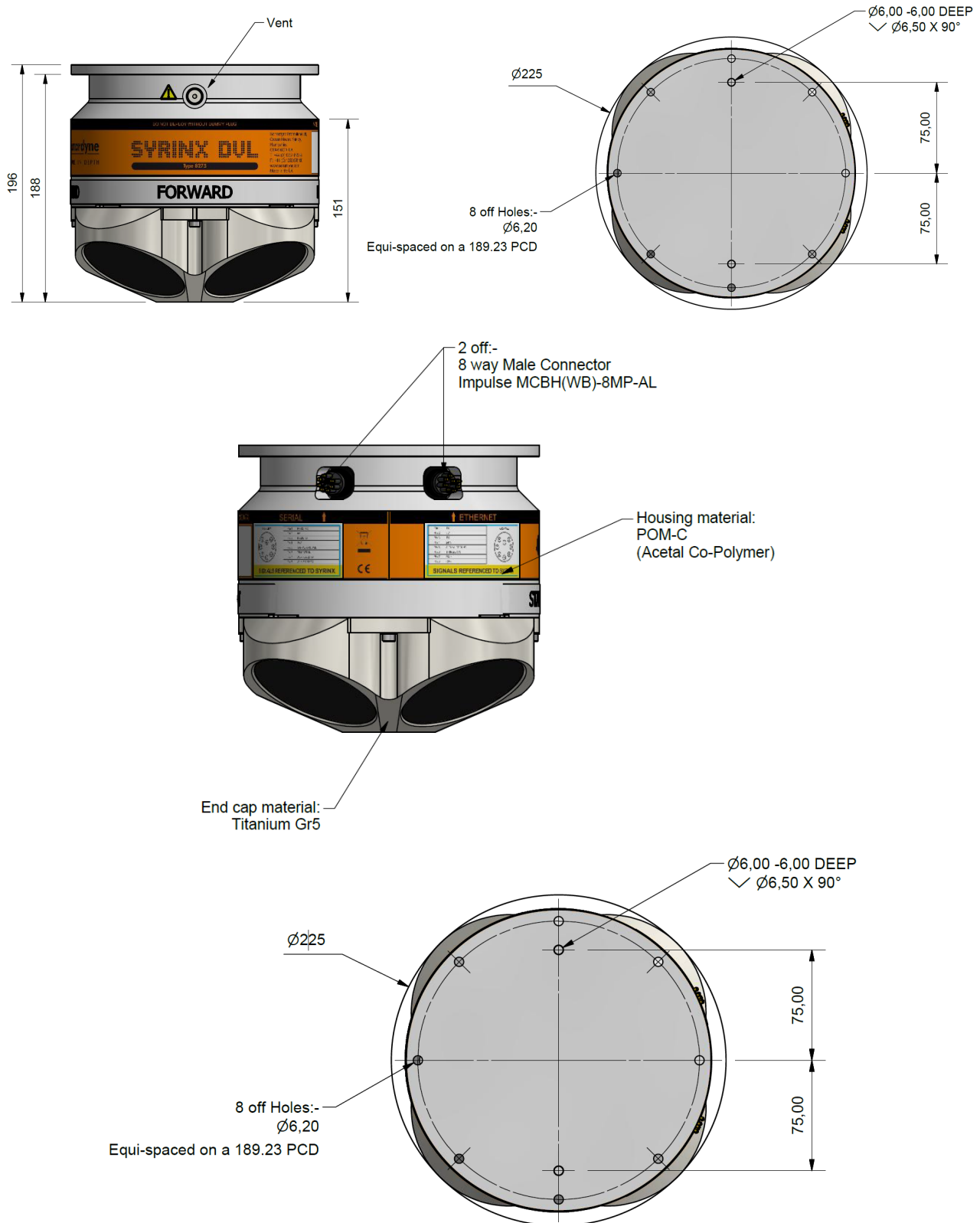
A.2.3 Central Measurement Point Dimensions

A.2.3.1 Type 8275-000-9903



A.2.4 Technical Drawings

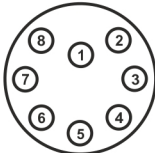
A.2.4.1 Type 8275-000-9903 300 m



A.2.5 Wiring Details

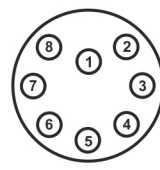
A.2.5.1 Type 8275-000-9903 Serial Connector Wiring Details

Table A-2 Serial Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	FACE VIEW  <table><tr><td>Pin 1</td><td>RS232 RX</td></tr><tr><td>Pin 2</td><td>0V</td></tr><tr><td>Pin 3</td><td>RS232 TX</td></tr><tr><td>Pin 4</td><td>24V</td></tr><tr><td>Pin 5</td><td>SIGNAL GROUND</td></tr><tr><td>Pin 6</td><td>TRIGGER IN</td></tr><tr><td>Pin 7</td><td>AUX RS232 RX</td></tr><tr><td>Pin 8</td><td>AUX RS232 TX</td></tr></table> SIGNALS REFERENCED TO SYRINX	Pin 1	RS232 RX	Pin 2	0V	Pin 3	RS232 TX	Pin 4	24V	Pin 5	SIGNAL GROUND	Pin 6	TRIGGER IN	Pin 7	AUX RS232 RX	Pin 8	AUX RS232 TX
Pin 1	RS232 RX																	
Pin 2	0V																	
Pin 3	RS232 TX																	
Pin 4	24V																	
Pin 5	SIGNAL GROUND																	
Pin 6	TRIGGER IN																	
Pin 7	AUX RS232 RX																	
Pin 8	AUX RS232 TX																	
1	RS232 Rx Primary																	
2	Power in 0 V																	
3	RS232 Tx Primary																	
4	Power in 24 V																	
5	Signal Ground																	
6	Trigger In																	
7	AUX RS232 Rx																	
8	AUX RS232 Tx																	

A.2.5.2 Type 8275-000-9903 Ethernet Connector Wiring Details

Table A-3 Ethernet Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	<table><tr><td>Pin 1</td><td>TX +</td></tr><tr><td>Pin 2</td><td>0V</td></tr><tr><td>Pin 3</td><td>TX -</td></tr><tr><td>Pin 4</td><td>24 V</td></tr><tr><td>Pin 5</td><td>SIGNAL GROUND</td></tr><tr><td>Pin 6</td><td>TRIGGER IN</td></tr><tr><td>Pin 7</td><td>RX +</td></tr><tr><td>Pin 8</td><td>RX -</td></tr></table> FACE VIEW 		Pin 1	TX +	Pin 2	0V	Pin 3	TX -	Pin 4	24 V	Pin 5	SIGNAL GROUND	Pin 6	TRIGGER IN	Pin 7	RX +	Pin 8	RX -
Pin 1	TX +																		
Pin 2	0V																		
Pin 3	TX -																		
Pin 4	24 V																		
Pin 5	SIGNAL GROUND																		
Pin 6	TRIGGER IN																		
Pin 7	RX +																		
Pin 8	RX -																		
1	Ethernet Tx Data +	SIGNALS REFERENCED TO SYRINX																	
2	Power in 0 V																		
3	Ethernet Tx Data -																		
4	Power in 24 V																		
5	Signal Ground																		
6	Trigger In																		
7	Ethernet Rx Data +																		
8	Ethernet Rx Data -																		

A.2.6 Type 8275-000-9903 Recommended Spares

Part Number	Description	Qty
317-5383	Impulse female cable tail	1
317-5385	Impulse locking sleeve	4
317-5394	Impulse 8-pin female dummy plug	2
641-0528	DVL Ethernet text box	1
810-0101	DVL array protector	1

A.3 Type 8275-9904

A.3.1 Technical Description

Type 8275-000-9904 utilises the 4,000 m titanium endcap and cylindrical housing from the 8275-000-4531. It also features an integrated mounting plate as well as male Seacon 5507-1508-0004 Ti Gr5 connectors. The housing and endcap is aligned by three alignment dowels for correct and repeatable orientation.

A.3.2 Specifications

Parameter		Type 8275-9904 600 kHz
Operational Frequency		600 kHz
Bottom Velocity – Single Ping Precision (Standard Deviation @ 1 m/s*)		±0.22 cm/s
Long Term Accuracy		±0.12% ±0.1 cm/s
Minimum/Maximum Altitude		0.4/175 m**
Velocity Range		>10 m/s
Velocity Resolution		0.01 cm/s
Data Output Rate		25 Hz maximum
Water Reference Velocity	Accuracy Layer Size Minimum/Maximum Range	±0.2% ±0.1 cm/s Selectable 0.4 m/80 m
ADCP	Profiling Range Velocity Range & RMS (along beam) Maximum Number of Cells Maximum Ping Rate	0.4–80 m Up to ±11.2 m/s ±0.4% of measured value 255 4 Hz (ADCP) or 2.5 Hz (DVL+ADCP)
Acoustics	Beam Width Beam Angle Maximum Transmit Source Level (dB re 1 uPa @ 1 m)	±1.0 Degrees 30 Degrees 217 dB (maximum)
Sensors	Temperature Pitch/Roll (Optional) Pressure (Optional)	-5° to 40°C/s ±0.5° ±0.1% full scale
Configuration	Array	4-beam array @ 30° beam angles
Communication and Logging	Communications Trigger Inputs Internal Logging	Dual RS232, multi-port Ethernet (TCP and UDP) 3–12 V rising or falling edge configurable 32 GB internal memory
Output	Output Telegrams	Sonardyne proprietary, PD0, PD3, PD4, PD6, PD13, SDDBT Simultaneous telegram output
Power	Voltage Range (dc Input) Average Power (Typical)	24 V (±10%) 10 W nominal
Environmental	Depth Rating Operating Temperature Storage Temperature	4,000 m -5 to 55°C -20 to 55°C

Parameter		Type 8275-9904 600 kHz
Mechanical	Construction	Titanium
	Connector Type	Seacon
	Dimensions (Height x Max Diameter)	197 x 225 mm
	Weight in Air/Water**	12.3/9.3 kg

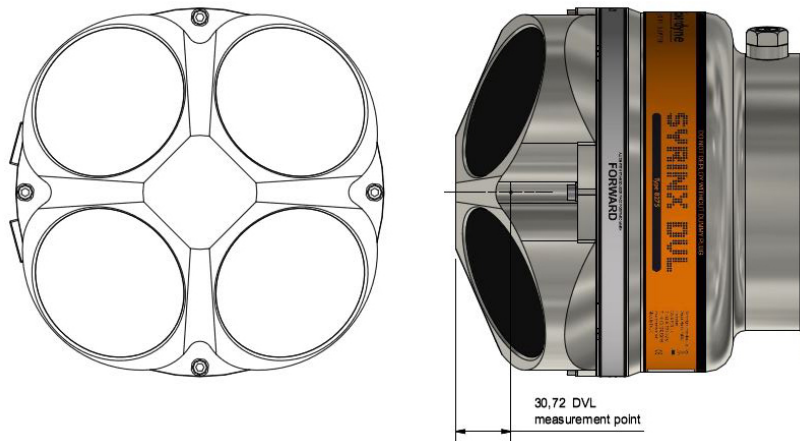
* Standard deviation refers to proven single-ping true horizontal velocity precision, specified at 20–30 m altitude.

**150 m bottom acquire range, up to 175 m once bottom locked in optimal seabed conditions.

**Estimated weights.

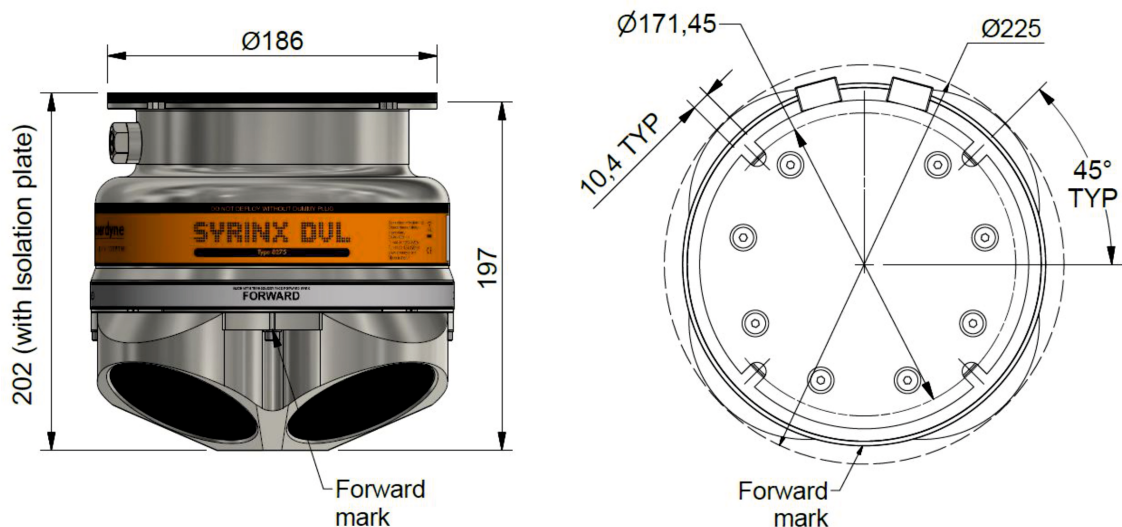
A.3.3 Central Measurement Point Dimensions

A.3.3.1 Type 8275-000-9904



A.3.4 Technical Drawings

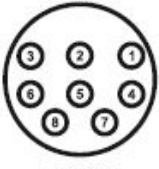
A.3.4.1 Type 8275-000-9904



A.3.5 Wiring Details

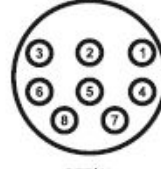
A.3.5.1 Type 8275-000-9904 Ethernet Connector Wiring Details

Table A-4 Ethernet Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	FACE VIEW 	Pin 1 Pin 2 Pin 3 Pin 4 Pin 5 Pin 6 Pin 7 Pin 8	TWISTED PAIR - A TWISTED PAIR - B TWISTED PAIR - C TWISTED PAIR - D	RX DATA + (ETHERNET) RX DATA - (ETHERNET) 0V & SIGNAL GND POWER IN +24 V TX DATA + (ETHERNET) TX DATA - (ETHERNET) RS232 TX SECONDARY (FROM DVL) RS232 RX SECONDARY (TO DVL)
1	Ethernet Rx Data +	ETHERNET	SIGNALS REFERENCED TO SYRINX		
2	Ethernet Rx Data -				
3	0 V & Signal Ground				
4	Power in 24 V				
5	Ethernet Tx Data +				
6	Ethernet Tx Data -				
7	RS232 Tx Secondary (From DVL)				
8	RS232 Rx Secondary (To DVL)				

A.3.5.2 Type 8275-000-9904 Serial Connector Wiring Details

Table A-5 Serial Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	Pin 1 Pin 2 Pin 3 Pin 4 Pin 5 Pin 6 Pin 7 Pin 8	TRIGGER + (RESERVED N/C) TRIGGER GND (RESERVED N/C) 0V POWER IN +24V 0V SCREEN & SIGNAL GND RS232 TX PRIMARY (FROM DVL) RS232 RX PRIMARY (TO DVL)	FACE VIEW 
1	Trigger +	SIGNALS REFERENCED TO SYRINX		
2	Trigger Ground			
3	0 V			
4	Power in 24 V			
5	0 V			
6	Screen & Signal Ground			
7	RS232 Tx Primary (From DVL)			
8	RS232 Rx Primary (To DVL)			

A.3.6 Type 8275-000-9904 Recommended Spares

Part Number	Description	Qty
214-1936	Mounting/Interface plate bolt	8
317-5482	Seacon cable tail	1
317-5485	Seacon 8-pin dummy plug	2
641-0568	DVL Ethernet test box	1
810-0101	DVL array protector	1

A.4 Type 8275-9905

A.4.1 Technical Description

Type 8275-000-9905 utilises the 4,000 m titanium endcap and cylindrical housing from the 8275-000-4531. It also features an integrated mounting plate as well as Seanet 101-5260 connectors. The housing and endcap is aligned by three alignment dowels for correct and repeatable orientation.

A.4.2 Specifications

Parameter		Type 8275-9905 600 kHz
Operational Frequency		600 kHz
Bottom Velocity – Single Ping Precision (Standard Deviation @ 1 m/s*)		±0.22 cm/s
Long Term Accuracy		±0.12% ±0.1 cm/s
Minimum/Maximum Altitude		0.4/175 m**
Velocity Range		>10 m/s
Velocity Resolution		0.01 cm/s
Data Output Rate		25 Hz maximum
Water Reference Velocity	Accuracy Layer Size Minimum/Maximum Range	±0.2% ±0.1 cm/s Selectable 0.4 m/80 m
ADCP	Profiling Range Velocity Range & RMS (along beam) Maximum Number of Cells Maximum Ping Rate	0.4–80 m Up to ±11.2 m/s ±0.4% of measured value 255 4 Hz (ADCP) or 2.5 Hz (DVL+ADCP)
Acoustics	Beam Width Beam Angle Maximum Transmit Source Level (dB re 1 uPa @ 1 m)	±1.0 Degrees 30 Degrees 217 dB (maximum)
Sensors	Temperature Pitch/Roll (Optional) Pressure (Optional)	-5° to 40°C/s ±0.5° ±0.1% full scale
Configuration	Array	4-beam array @ 30° beam angles
Communication and Logging	Communications Trigger Inputs Internal Logging	Dual RS232, multi-port Ethernet (TCP and UDP) 3–12 V rising or falling edge configurable 32 GB internal memory
Output	Output Telegrams	Sonardyne proprietary, PD0, PD3, PD4, PD6, PD13, SDDBT Simultaneous telegram output
Power	Voltage Range (dc Input) Average Power (Typical)	24 V (±10%) 10 W nominal
Environmental	Depth Rating Operating Temperature Storage Temperature	4,000 m -5 to 55°C -20 to 55°C

Parameter		Type 8275-9905 600 kHz
Mechanical	Construction	Titanium
	Connector Type	Seanet
	Dimensions (Height x Max Diameter)	217 x 225 mm
	Weight in Air/Water**	13.3/10.0 kg

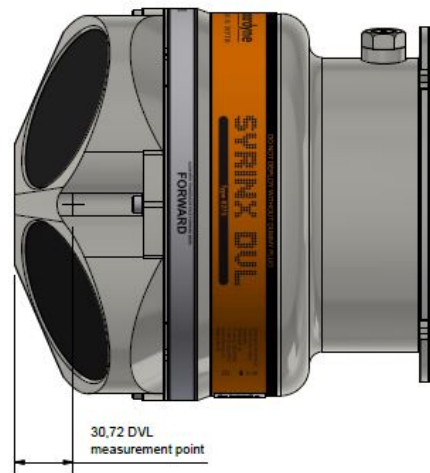
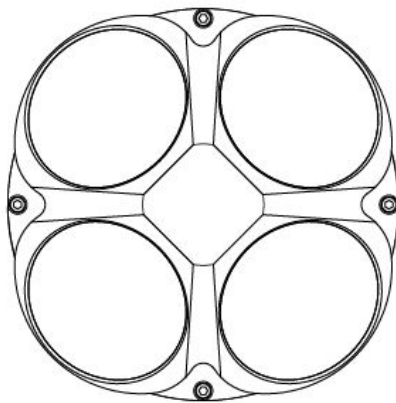
* Standard deviation refers to proven single-ping true horizontal velocity precision, specified at 20–30 m altitude.

**150 m bottom acquire range, up to 175 m once bottom locked in optimal seabed conditions.

**Estimated weights.

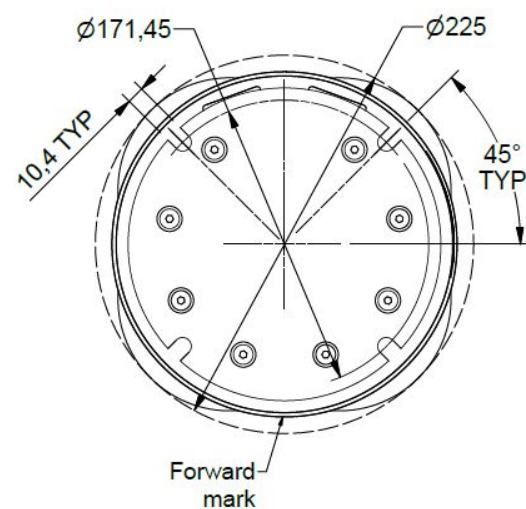
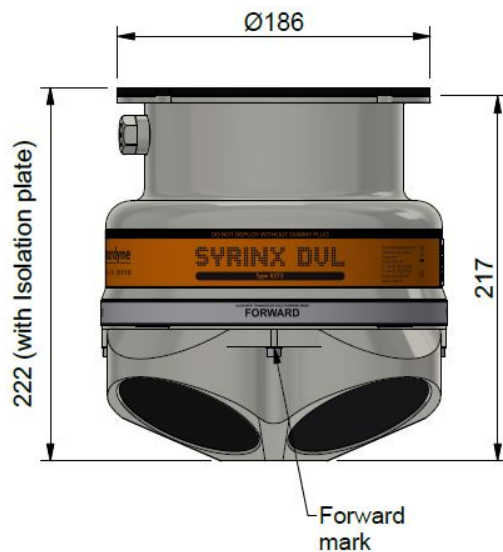
A.4.3 Central Measurement Point Dimensions

A.4.3.1 Type 8275-000-9905



A.4.4 Technical Drawings

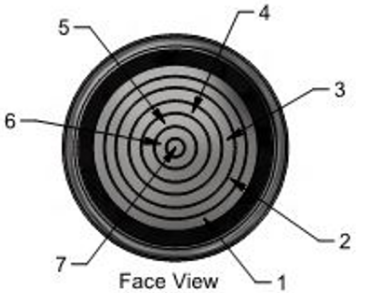
A.4.4.1 Type 8275-000-9905



A.4.5 Wiring Details

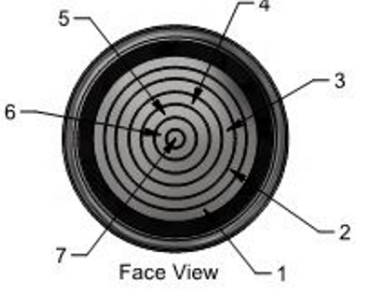
A.4.5.1 Type 8275-000-9905 Ethernet Connector Wiring Details

Table A-6 Ethernet Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	Pin Details
1	Power in 24 V	
2	0 V & Signal Ground	
3	N/C	
4	Ethernet Tx Data -	
5	Ethernet Tx Data +	
6	Ethernet Rx Data -	
7	Ethernet Rx Data +	

A.4.5.2 Type 8275-000-9905 Serial Connector Wiring Details

Table A-7 Serial Connector Wiring Details

Male Pin Number	Function (Rx/Tx With Relation To Syrinx)	Pin Details
1	Power in 24 V	
2	0 V & Signal Ground	
3	N/C	
4	NC	
5	RS232 Tx - Port x	
6	RS232 Rx - Port x	
7	N/C	

A.4.6 Type 8275-000-9905 Recommended Spares

Part Number	Description	Qty
214-1936	Mounting/Interface plate bolt	8
317-5482	Seacon cable tail	1
317-5485	Seacon 8-pin dummy plug	2
641-0568	DVL Ethernet test box	1
810-0101	DVL array protector	1

Appendix B – Telegram Message Formats

B.1 Sonardyne ASCII Messages

B.1.1 SONDV message (ASCII)

The SONDV message is the Sonardyne basic Syrinx DVL message, containing bottom referenced velocity and altitude info only.

Message:	> SONDV :TSxx, ITFxxx.yyy,VX±xx.x,VY±xx.x,VZ±xx.x,JVE±xx.x,B1Rxx.xxSyy, B2Rxx.xxSyy,B3Rxx.xxSyy,B4Rxx.xxSyy, SVxx.xx	
Parameter:	TS;xx	Tracking status where xx can be: ABL Acquiring bottom lock BL Bottom lock WT Water track BD Bad data
	ITFxxxxxx.yyyyyy	Instrument time frame of the transmission of the acoustic pulse from the Syrinx. xxxx = seconds yyyyyy = micro seconds (i.e. 6d.p)
	VX±xx.x	Velocity along X-axis, mm/s
	VY±xx.x	Velocity along Y-axis, mm/s
	VZ±xx.x	Velocity along Z-axis, mm/s
	JVE±xx.x	Janus Velocity error, mm/s
	BnRxx.xx;Sy	Beam n, where n is the beam the data refers to. Fields are: xx.xx Slant range in meters (using SV output in the message) Syy Binary Status as follow: xxxxxxx1 indicates used in Janus solution xxxxxxx1x indicates BVE high xxxxx1xx indicates correlation is low xxxx1xxx indicates signal strength low xxx1xxxx indicates signal to noise is low
	SVxxxx.xx	Sound Velocity set in Syrinx DVL in m/s to two decimal places (value used in calculating janus velocities)

TS;BD indicates bottom lock has been acquired but the data has been rejected due to failing internal quality metric checks. The number of low quality beams before data is rejected is dependent on the WLS mode.

Should TS be either ABL or BD then the rest of the parameters are not output as the data is invalid.

SONDV message example:-

```
>SONDV:TS;BL,ITF2314.000123,VX505.6,VY-0.1,VZ-
0.0,JVE0.1,B1R24.07;S01,B2R23.09;S01,B3R22.10;S01,B4R23.09;S01,SV1500.00
```

```
>SONDV:TS;BD
```

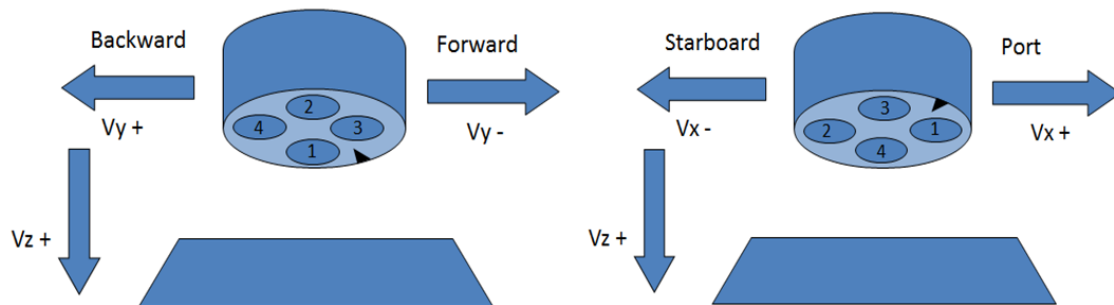
>SONDV:TS;ABL

B.2 Teledyne RDI Binary Messages

B.2.1 Teledyne RDI PD0 Message

Syrinx supports the Teledyne RDI PD0 output message. With Syrinx DVL output transformation offsets set to Yaw = 0, Pitch = 0, Roll = 0, the velocity conventions are as follows:

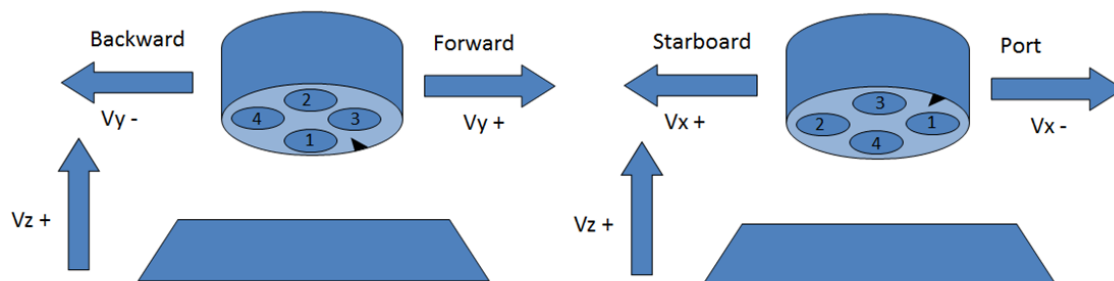
Figure B-1 PD0 Velocity Conventions



B.2.2 Teledyne RDI PD4 Message

Syrinx supports the Teledyne RDI PD3, PD4, PD6 & PD13 output messages. With Syrinx DVL output transformation offsets set to Yaw = 0, Pitch = 0, Roll = 0, the velocity conventions are as follows:

Figure B-2 PD3, PD4, PD6 & PD13 Velocity Conventions



Appendix C – Third Party PD0/PD3/PD4/PD5/PD6/PD13 Definitions

Note



Applicable to Syrinx DVL V2.00 or later

C.1 Teledyne RDI DVL Binary Data Format (PD0)

PD0 is an industry-standard binary data format that is commonly used to describe the configuration of the DVL or ADCP device, bottom-tracking information, profile information such as velocities and intensities, and any external data such as NMEA strings.

An overview of a typical PD0 message and its substructure is shown below.

Table C–1 PD0 Structure Overview

ALWAYS OUTPUT	HEADER (6 BYTES + [2 x No. OF DATA TYPES])
	FIXED LEADER DATA (59 BYTES)
	VARIABLE LEADER DATA (65 BYTES)
ADCP-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)
CFG-command	BOTTOM TRACK DATA (85 BYTES)
General NMEA	General NMEA (14 BYTES + msg body)
NMEA Strings	GPS GGA (97 BYTES)
	GPS VTG (45 BYTES)
ALWAYS OUTPUT	RESERVED (2 BYTES)
	CHECKSUM (2 BYTES)

Note that the PD0 specification can vary slightly in other manufacturers' instruments. The following sections specify how PD0 messages are formatted by Sonardyne instruments.

C.1.1 ID Codes for PD0

Table C-2 shows the unique ID for each section of PD0 data. The flexibility of the format means that not all sections are necessarily present in a PD0 message.

Table C-2 Section Unique IDs

Description	ID hex. (Little Endian)	Supported Modes
Header ID	0x7F7F	All
Fixed Leader Data ID	0x0000	All
Variable Leader Data ID	0x0080	All
Velocity ID	0x0100	ADCP, DVL+ADCP
Correlation Magnitude ID	0x0200	ADCP, DVL+ADCP
Echo Intensity ID	0x0300	ADCP, DVL+ADCP
Percentage Good ID	0x0400	ADCP, DVL+ADCP
Bottom Track Data ID	0x0600	All
NMEA Data		
General binary data	0x2022	ADCP, DVL+ADCP
DBT ASCII ID	0x2100	ADCP, DVL+ADCP
GGA ASCII ID	0x2101	ADCP, DVL+ADCP
VTG ASCII ID	0x2102	ADCP, DVL+ADCP
HDT ASCII ID	0x2104	ADCP, DVL+ADCP
Sonardyne Extensions		
System Configuration	0x6060	ADCP, DVL+ADCP
Variable Leader	0x6160	ADCP, DVL+ADCP

C.1.2 PD0 Structure Specifications

This section describes each of the PD0 structures in detail.

C.1.2.1 PD0 Header

Table C-3 PD0 Header Summary

	Bit Positions								
Byte	7	6	5	4	3	2	1	0	
1	Header ID = 0x7F								
2	Data Source ID = 0x7F								
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

Table C–3 PD0 Header Summary (continued)

	Bit Positions	
11	Offset for data type #3	LSB
12		MSB
2N + 5	Offset for data type #N	LSB
2N + 6		MSB

Each section in *Table C–3* is described in detail below.

Table C–4 PD0 Header Field Descriptions

Hex Digit	Binary byte	Field	Description
1,2	1	Header ID	Stores the Header ID byte (0x7F).
3,4	2	Data Source ID	Stores the Data Source ID byte (0x7F for Syrinx).
5-8	3,4	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 (see <i>Table C–3</i>).
9,10	5	Spare	Undefined.
11,12	6	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	Offset for Data Type #1	This field contains the internal memory address offset where Syrinx 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	Offset for Data Type #2	This field contains the internal memory address offset where Syrinx 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	Offset for Data Type #3 through #n	These fields contain internal memory address offset where Syrinx 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 Type #1 begins (the first byte of the ensemble is Binary Byte #1).

C.1.2.2 PD0 Fixed Leader

Table C-5 PD0 Fixed Leader Summary

Bit Positions									
Byte	7	6	5	4	3	2	1	0	
1	Fixed Leader ID = 0x00								LSB 00h
2									MSB 00h
3	CPU F/W VER.								
4	CPU F/W REV.								
5	System Configuration								LSB
6									MSB
7	Real/Sim flag								
8	Lag length								
9	Number of beams								
10	Number of cells								
11	Pings per ensemble								LSB
12									MSB
13	Depth cell length								LSB
14									MSB
15	Blank after transmit								LSB
16									MSB
17	Profiling mode								
18	Low Corr Thresh								
19	No. code reps								
20	%GD minimum								
21	Error velocity maximum								LSB
22									MSB
23	TPP Minutes								
24	TPP Seconds								
25	TPP Hundredths								
26	Coordinate transform								
27	Heading alignment								LSB
28									MSB
29	Heading bias								LSB
30									MSB
31	Sensor source								
32	Sensors available								
33	Bin 1 distance								LSB
34									MSB

Table C-5 PD0 Fixed Leader Summary (continued)

	Bit Positions	
35	Xmit pulse length based on	LSB
36		MSB
37	(starting cell) WP ref layer average (ending cell)	LSB
38		MSB
39	False target thresh	
40	Spare	
41	Transmit lag distance	LSB
42		MSB
43	CPU board serial number	LSB
↓		↓
50		MSB
51	System bandwidth	LSB
52		MSB
53	System power	
54	Spare	
55	Instrument serial number	LSB
↓		↓
58		MSB
59	Beam angle	

Each section in *Table C-5* is described in detail below.

Table C-6 PD0 Fixed LeadeDescriptionr Field Descriptions

Hex Digit	Binary Style	Field	Description
1-4	1,2	Fixed Leader ID	Stores the Fixed Leader identification word (0x0000).
5,6	3	CPU F/W Ver	Contains the version number of the CPU firmware
7,8	4	CPU F/W Rev	Contains the revision number of the CPU firmware
9-12	5,6	System Configuration	This field defines the Syrinx 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 cfg (demod)
			1 1 1 1 - - - - 5-bm Janus cfg. (2 demd)
			- - - - - 0 0 15E Beam angle
			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).

Hex Digit	Binary Style	Field	Description
13,14	7	PD/Real/Sim flag	This field is set by default as real data (0)
15,16	8	Lag length	The lag time is the time period between sound pulses.
17,18	9	Number of beams	Contains the number of beams used to calculate velocity data (not physical beams). Syrinx 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, Syrinx does not make this validity check.
19,20	10	Number of cells	Contains the number of depth cells over which Syrinx collects data. Scaling: LSD = 1 depth cell; Range = 1 to 256 depth cells
21-24	11,12	Pings per ensemble	Contains the number of pings averaged together during a data ensemble. Scaling: LSD = 1 ping; Range = 0 to 16384 pings
25-28	13,14	Depth cell length	Contains the length of one depth cell. Scaling: LSD = 1 centimetre; Range = 1 to 16384 cm
29-32	15,16	Blank after transmit	Contains the blanking distance used by Syrinx to allow the transmit circuits time to recover before the receive cycle begins. Scaling: LSD = 1 centimetre; Range = 0 to 16384 cm
33,34	17	Signal processing mode	Contains the signal processing mode. This field will always be set to 1.
35,36	18	Low corr thresh	Contains the minimum threshold of correlation that water-profile data can have to be considered good data. Scaling: LSD = 1 count; Range = 0 to 255 counts
37,38	19	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	%Gd Minimum	Contains the minimum percentage of water-profiling pings in an ensemble that must be considered good to output velocity data. Scaling: LSD = 1 percent; Range = 1 to 100 percent
41-44	21,22	Error velocity threshold	This field contains the actual threshold value used to flag water-current data as good or bad. If the error velocity value exceeds this threshold, Syrinx flags all four beams of the affected bin as bad. Scaling: LSD = 1mm/s; Range = 0 to 5000 mm/s
45,46	23	Minutes	These fields contain the amount of time between ping groups in the ensemble.
47,48	24	Seconds	
49,50	25	Hundredths	
51,52	26	Coord transform	Contains the coordinate transformation processing parameters. These firmware switches indicate how Syrinx collected data. xxx00xxx = No transformation (beam coordinaes) 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 xxxxxxx1 = Bin mapping used

Hex Digit	Binary Style	Field	Description
53-56	27,28	Heading Alignment	Contains a correction factor for physical heading misalignment Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees
57-60	29,30	Heading Bias	Contains a correction factor for electrical/mechanical heading bias Scaling: LSD = 0.01 degree; Range = -179.99 to 180.00 degrees
61,62	31	Sensor Source	Contains the selected source of environmental sensor data. These firmware switches indicate the following: x1xxxxxx = Calculates speed of sound from depth, salinity and temperature sensors xx1xxxxx = Uses depth sensor xxx1xxxx = Uses transducer heading sensor xxxx1xxx = Uses pitch sensor xxxxx1xx = Uses roll sensor xxxxxx1x = Uses conductivity sensor for salinity xxxxxxx1 = Uses transducer temperature sensor Note: If the field = 0, or if the sensor is not available, Syrinx uses the manual command setting. If the field = 1, Syrinx uses the reading from the internal sensor or an external synchro sensor (only applicable to heading, roll and pitch).
63,64	32	Sensor Avail	This field reflects which sensors are available. The bit patter is the same as listed above.
65-68	33,34	Dis 1 / Bin 1 distance	This field contains the distance to the middle of the first depth cell (bin). This distance is a function of the depth cell length, the blank after transmit distance, and the speed of sound. Scaling: LSD = 1 centimetre, Range = 0 to 65535 cm (2150 feet)
69-72	35,36	WT Xmit pulse length	This field contains the length of the transmit pulse. Scaling: LSD = 1 centimetre, Range = 0 to 65535 cm (2150 feet)
73-76	37,38	Ref Lyr Ang (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. Scaling: LSD = 1 centimetre, Range = 1 to 128 depth cells
77,78	39	False target threshold	Contains the threshold value used to reject data received from a false target, usually fish. Scaling: LSD = 1 count; Range = 0 to 255 counts (255 disables)
79,80	40	Spare	Range = 0 to 5
81-84	41,42	Transmit lag distance	This field contains the distance between pulse repetitions. Scaling: LSD = 1 centimetre; Rand = 0 to 65535 centimetres
85-100	43-50	CPU Board Serial Number	Contains the serial number of the CPU board.
101-105	51-52	System Bandwidth	Contains the bandwidth of the system.
106-107	53	System Power	Contains the power mode setting for Syrinx. Range 0 to 255.
108-109	54	Spare	Spare
110-119	55-58	Serial #	Instrument serial number
120-121	59	Beam angle	Beam angle

C.1.2.3 PD0 Variable Leader

The PD0 Variable Leader contains information that may change between ensembles.

Table C-7 PD0 Variable Leader Summary

	Bit Positions								
Byte	7	6	5	4	3	2	1	0	
1	Variable Leader ID								80h
2									00h
3	Ensemble Number								LSB
4									MSB
5	RTS YEAR								
6	RTS MONTH								
7	RTS DAY								
8	RTS HOUR								
9	RTS MINUTE								
10	RTS SECOND								
11	RTS HUNDREDTHS								
12	ENSEMBLE # MSB								
13	BIT RESULT								LSB
14									MSB
15	SPEED OF SOUND								LSB
16									MSB
17	DEPTH OF TRANSDUCER								LSB
18									MSB
19	HEADING								LSB
20									MSB
21	PITCH (TILT 1)								LSB
22									MSB
23	ROLL (TILT 2)								LSB
24									MSB
25	SALINITY								LSB
26									MSB
27	TEMPERATURE								LSB
28									MSB
29	MPT MINUTES								
30	MPT SECONDS								
31	MPT HUNDREDTHS								
32	HDG STD DEV								
33	PITCH STD DEV								
34	ROLL STD DEV								

Table C-7 PD0 Variable Leader Summary (continued)

	Bit Positions	
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		LSB
44	ERROR STATUS WORD (ESW)	
45		
46		MSB
47	SPARE	
48		
49		LSB
50	PRESSURE	
51		
52		MSB
53		LSB
54	PRESSURE SENSOR VARIANCE	
55		
56		MSB
57	SPARE	
58	RTC CENTURY	
59	RTC YEAR	
60	RTC MONTH	
61	RTC DAY	
62	RTC HOUR	
63	RTC MINUTE	
64	RTC SECOND	
65	RTC HUNDREDTH	

Each section in *Table C-7* is described in detail below.

Table C-8 PD0 Variable Leader Detailed Description

Hex Digit	Binary byte	Field	Description
1-4	1,2	Variable Leader ID	Stores the Variable Leader identification word (0x8000).
5,8	3,4	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 65535 ensembles NOTE: The first ensemble collected = #1. At 'rollover', we have the following sequence: 1 = Ensemble number 1 ↓ 65535 = Ensemble number 65535 Ensemble 0 = Ensemble number 65536 # MSB field 1 = Ensemble number 65537 (Byte 12) Incr.
9,10 11,12 13,14 15,16 17,18 19,20 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 Syrinx's realtime clock (RTC) that the current data ensemble began.
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	BIT / BIT Result	This field contains the results of Syrinx's Built-in Test (BIT) function. A zero code indicates a successful BIT result. Byte 13 Byte 14 (reserved for future use) 1xxxxxxx xxxxxxxx = Reserved x1xxxxxx xxxxxxxx = Reserved xx1xxxxx xxxxxxxx = Reserved xxx1xxxx xxxxxxxx = Demod 1 Error xxxx1xxx xxxxxxxx = Demod 0 Error xxxxx1xx xxxxxxxx = Reserved xxxxxx1x xxxxxxxx = Timing card error xxxxxxx1 xxxxxxxx = Reserved
29-32	15,16	Speed of Sound	Contains either manual or calculated speed of sound information. Scaling: LSB = 1 m/s; Range = 1400 to 1600 m/s
33-36	17,18	Depth of Transducer	Contains the depth of the transducer below the water surface. This value is a manual setting. Scaling: LSD = 1 decimetre; Range = 1 to 9999 decimetres

Table C-8 PD0 Variable Leader Detailed Description (continued)

Hex Digit	Binary byte	Field	Description
37-40	19,20	Heading	Contains Syrinx heading angle. This value is taken from NMEA VTG or HDT strings, or a Sonardyne INS SON2 or LNAV message. Scaling: LSD = 0.01 degree; Range = 000.00 to 359.99 degrees
41-44	21,22	Pitch	Contains Syrinx pitch angle. This value is taken from a tilt sensor or Sonardyne INS SON2 or LNAV message. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees
45-48	23,24	Roll	Contains Syrinx roll angle. This value is taken from a tilt sensor or Sonardyne INS SON2 or LNAV message. It is assumed that Syrinx is always downward facing. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees
49-52	25,26	Salinity	Contains the salinity value at the transducer head. This is a manual setting. Scaling: LSD = 1 part per thousand; Range = 0 to 40 ppt
53-56	27,28	Temperature	Contains the temperature of the water at the transducer head. This is taken 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	Hdg Std Dev	These fields contain the standard deviation (accuracy) of the heading and tilt angles from the tilt sensor. Scaling (Heading): LSD = 1°; Range = 0 to 180°. Scaling (Tilts): LSD = 0.1°; Range = 0 to 20°.
65,66	33	Pitch Std Dev	
67,68	34	Roll Std Dev	
85-86	43	Error Status Word	Contains the long word containing bit flags. 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 Bus error exception x x x x x x 1 x Address error exception x x x x x 1 x x Illegal instruction exception x x x x 1 x x x Zero divide exception x x x 1 x x x x Emulator exception x x 1 x x x x x Unassigned exception x 1 x x x x x x Watchdog restart occurred 1 x x x x x x x Batter saver power
87-88	44		Low 16 bits

Table C-8 PD0 Variable Leader Detailed Description (continued)

Hex Digit	Binary byte	Field	Description
			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
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 Unexpected alarm x x x x x 1 x x Clock jump forward x x x x 1 x x x Clock jump backward 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 Power fail (unrecorded) x x x 1 x x x x Spurious lev. 4 intr (DSP) x x 1 x x x x x Spurious lev. 5 intr (UART) x 1 x x x x x x Spurious lev. 6 intr (CLK) 1 x x x x x x x Level 7 interrupt occurred
93-96	47-48	Reserved	Reserved for Sonardyne use.
97-104	49-52	Pressure	Contains the pressure of the water at the transducer head relative to one atmosphere (sea level). Output is in deca-pascals. Scaling: LSD = 1 deca-pascal; Range= 0 to 4,294,967,295 deca-pascals.
105-112	53-56	Pressure variance	Contains the standard deviation of the pressure sensor data. Output is in deca-pascals.

Table C-8 PD0 Variable Leader Detailed Description (continued)

Hex Digit	Binary byte	Field	Description
			Scaling: LSD = 1 deca-pascal; Range= 0 to 4,294,967,295 deca-pascals.
113-114	57	Spare	Spare
115-116	58	RTC Century	These fields contain the time from Syrinx real-time clock (RTC) that the current data ensemble began.
117-118	59	RTC Year	
119-120	60	RTC Month	
121-122	61	RTC Day	
123-124	62	RTC Hour	
125-126	63	RTC Minute	
127-128	64	RTC Seconds	
129-130	65	RTC Hundredths	

C.1.2.4 PD0 Velocity Data

The PD0 Velocity Data contains the measured velocities of each beam for each depth cell.

Table C–9 PD0 Velocity Data Summary

		Bit Positions								
Byte		7/S	6	5	4	3	2	1	0	
1	Velocity ID									LSB 00h
2										MSB 01h
3	Depth Cell #1, Velocity 1									LSB
4										MSB
5	Depth Cell #1, Velocity 2									LSB
6										MSB
7	Depth Cell #1, Velocity 3									LSB
8										MSB
9	Depth Cell #1, Velocity 4									LSB
10										MSB
11	Depth Cell #2, Velocity 1									LSB
12										MSB
13	Depth Cell #2, Velocity 2									LSB
14										MSB
15	Depth Cell #2, Velocity 3									LSB
16										MSB
17	Depth Cell #2, Velocity 4									LSB
18										MSB
↓	Sequence continues for up to 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

Syrinx packs ADCP velocity data for each depth cell of each beam into a two-byte, two's complement integer in the range [-32768, 32767] with the LSB sent first. Syrinx scales the velocity data in millimetres per second (mm/s). A value of -32768 (8000h) indicates bad velocity values.

All velocities are relative to 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

Changing the coordinate frame of reference changes the interpretation of the velocity data in PD0:

Coord System	Vel 1	Vel 2	Vel 3	Vel 4
Beam	To Beam 1	To Beam 2	To Beam 3	To Beam 4
Instrument	Bm1 – Bm3	Bm4 – Bm2	To Xducer	Err Vel
Vehicle	Port – Stbd	Aft – Fwd	To Surface	Err Vel
Earth	To East	To North	To Surface	Err Vel

Positive values of velocity indicate water movement toward Syrinx.

Each section in *Table C-9* is described in detail below.

Table C-10 PDO Velocity Data Description

Hex Digit	Binary byte	Field	Description
1-4	1,2	Velocity ID	Stores the velocity data identification word (0x0001h).
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.
21-4100	11-2050	Cells 2-256 (if used)	These fields store the velocity data for depth cells 2 through 256 (depending on the setting of the ADCP command) for all four beams. These fields follow the same format listed above for depth cell 1.

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

The PD0 Correlation Magnitude, Echo Intensity and Percent-Good contain the respective values of each beam for each depth cell.

Table C-11, *Table C-12* and *Table C-12*: Correlation Magnitude, Echo Intensity, Percent-Good Data Summary

Correlation magnitude data give the magnitude of the normalised echo autocorrelation at the lag used for estimating the Doppler phase change. Syrinx 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 C-11 Correlation Magnitude Data Format

Hex Digit	Binary byte	Field	Description
1-4	1,2	ID Code	Stores the correlation magnitude data identification word (0x0002h).
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.

Table C–11 Correlation Magnitude Data Format (continued)

Hex Digit	Binary byte	Field	Description
11-12	6	Depth Cell 1, Field 4	Stores correlation magnitude data for depth cell #1, beam 4. See above.
21-2052	11-1026	Cells 2-256 (if used)	These fields store the correlation magnitude data for depth cells 2 through 256 (depending on the setting of the ADCP command) for all four beams. These fields follow the same format listed above for depth cell 1.

The echo intensity scale factor is about 0.45 dB per Syrinx ADCP count. Syrinx does not directly check for the validity of echo intensity data.

Table C–12 Echo Intensity Data Format

Hex Digit	Binary byte	Field	Description
1-4	1,2	ID Code	Stores the echo intensity data identification word (0x0003h).
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.
21-2052	11-1026	Cells 2-256 (if used)	These fields store the echo intensity data for depth cells 2 through 256 (depending on the setting of the ADCP command) for all four beams. These fields follow the same format listed above for depth cell 1.

The percent-good data field is a data-quality indicator that reports the percentage (0 to 100) of good data collected for each depth cell of the velocity profile. The coordinate frame used by Syrinx determines how percent-good data are interpreted, as shown below:

Coord System	Vel 1	Vel 2	Vel 3	Vel 4
Percentage Of Good Pings For:				
Beam	Beam 1	Beam 2	Beam 3	Beam 4
Instrument	3-Beam	Xforms	More than	4-Beam
Vehicle	Xforms	Rejected	One beam	Xforms
Earth	(Note 1)	(Note 2)	Bad in bin	

1. Shows the percentage of successful velocity calculations (50%) using 3-beam solutions
2. Shows percent of error velocity (5%) that was higher than the default setting.

At the start of the velocity profile, the backscatter echo strength is typically high on all four beams. Under this condition, Syrinx uses all four beams to calculate the orthogonal and error velocities. As the echo returns from far away depth cells, echo intensity decreases. At some point, the echo will be weak

enough on any given beam to cause Syrinx ADCP to reject some of its depth cell data. This causes Syrinx ADCP to calculate velocities with three beams instead of four beams. When Syrinx does 3-beam solutions, it stops calculating the error velocity because it needs four beams to do this. At some further depth cell, Syrinx ADCP rejects all cell data because of the weak echo. As an example, let us assume depth cell 60 has returned the following percent-good data:

Field #1 = 50, Field #2 = 5, Field #3 = 0, Field #4 = 45

If Syrinx is set to use beam coordinates, the example values show the percentage of pings having good solutions in cell 60 for each beam based on the low correlation threshold. Here, beam 1=50%, beam 2=5%, beam3=0% and beam4=45%. These are not typical nor desired percentages. Ideally, all four beams should be equal and above 25%.

If Syrinx is set to use Instrument, Vehicle or Earth coordinates, the example value show:

Field #1 – Percentage of good 3-beam solutions – shows the percentage of successful velocity calculations (50%) using 3-beam solutions.

Field #2 – Percentage of transformations rejected – Shows percent of error velocity (5%) that was higher than 5000mm/s. This large value prevents Syrinx from rejecting data based on error velocity.

Field #3 – Percentage of more than one beam bad in bin – 0% of the velocity data were rejected because not enough beams had good data

Field #4 – Percentage of good 4-beam solutions – 45% of the velocity data collected during the ensemble for depth cell 60 were calculated using four beams.

Table C-13 Percent-Good Data Format

Hex Digit	Binary byte	Field	Description
1-4	1,2	ID Code	Stores the percent-good data identification word (0x0004h).
5-6	3	Depth Cell 1, Field 1	Stores percent-good data for depth cell #1, beam 1. See above.
7-8	4	Depth Cell 1, Field 2	Stores percent-good data for depth cell #1, beam 2. See above.
9-10	5	Depth Cell 1, Field 3	Stores percent-good data for depth cell #1, beam 3. See above.
11-12	6	Depth Cell 1, Field 4	Stores percent-good data for depth cell #1, beam 4. See above.
21-2052	11-1026	Cells 2-256 (if used)	These fields store the percent-good data for depth cells 2 through 256 (depending on the setting of the ADCP command) for all four beams. These fields follow the same format listed above for depth cell 1.

C.1.2.5 PD0 Bottom Track

The PD0 Bottom Track section contains information regarding bottom-tracking. This information may change between ensembles.

Table C-14 PD0 Bottom Track Summary

	Bit Positions								
Byte	7/S	6	5	4	3	2	1	0	
1	Bottom-Track ID								LSB 00h
2									MSB 06h

Table C-14 PD0 Bottom Track Summary (continued)

	Bit Positions	
3	BT pings per ensemble	LSB
4		MSB
5	BT delay before re-acquire	
6		
7	BT corr mag min	
8	BT eval amp min	
9	BT percent good min	
10	BT mode	
11	BT err vel max	LSB
12		MSB
13	Reserved	
14		
15		
16		
17	Beam #1 BT range	LSB
18		MSB
19	Beam #2 BT range	LSB
20		MSB
21	Beam #3 BT range	LSB
22		MSB
23	Beam #4 BT range	LSB
24		MSB
25	Beam #1 BT vel	LSB
26		MSB
27	Beam #2 BT vel	LSB
28		MSB
29	Beam #3 BT vel	LSB
30		MSB
31	Beam #4 BT vel	LSB
32		MSB
33	Beam #1 BT corr	
34	Beam #2 BT corr	
35	Beam #3 BT corr	
36	Beam #4 BT corr	
37	Beam #1 eval amp	
38	Beam #2 eval amp	
39	Beam #3 eval amp	

Table C-14 PD0 Bottom Track Summary (continued)

	Bit Positions	
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	Ref layer min	LSB
46		MSB
47	Ref layer near	LSB
48		MSB
49	Ref layer far	LSB
50		MSB
51	Beam #1 ref layer vel	LSB
52		MSB
53	Beam #2 ref layer vel	LSB
54		
55	Beam #3 ref layer vel	LSB
56		MSB
57	Beam #4 ref layer vel	LSB
58		MSB
59	Beam #1 ref corr	
60	Beam #2 ref corr	
61	Beam #3 ref corr	
62	Beam #4 ref corr	
63	Beam #1 ref int	
64	Beam #2 ref int	
65	Beam #3 ref int	
66	Beam #4 ref int	
67	Beam #1 ref % good	
68	Beam #2 ref % good	
69	Beam #3 ref % good	
70	Beam #4 ref % good	
71	BT max depth	LSB
72		MSB
73	Beam #1 RSSI amp	
74	Beam #2 RSSI amp	
75	Beam #3 RSSI amp	
76	Beam #4 RSSI amp	

Table C-14 PD0 Bottom Track Summary (continued)

	Bit Positions	
77	Gain	
78	(*see byte 17)	MSB
79	(*see byte 19)	MSB
80	(*see byte 21)	MSB
81	(*see byte 23)	MSB
82	Reserved	
83		
84		
85		

Each section in *Table C-14* is described in detail below.

Table C-15 Bottom Track Data Format

Hex Digit	Binary Byte	Field	Description
1-4	1,2	ID Code	Stores the bottom-track data identification word (00 60h)
5-8	3,4	BT pings per ensemble	Stores the number of bottom-track pings to average together in each ensemble. Scaling: LSD = 1 ping; Range = 0 to 999 pings
9-12	5,6	BT delay before re-acquire	Stores the number of ADCP ensembles to wait after losing the bottom before trying to re-acquire it. Scaling: LSD = 1 ensemble; Range = 0 to 999 ensembles
13,14	7	BT corr mag min	Stores the minimum correlation magnitude value. Scaling: LSD = 1 count; Range = 0 to 255 counts
15,16	8	BT eval amp min	Stores the minimum evaluation amplitude value. Scaling: LSD = 1 count; Range = 1 to 255 counts
17,18	9	BT % good min	Stores the minimum percentage of bottom-track pings in an ensemble that must be good to output velocity data.
19,20	10	BT mode	Stores the bottom-tracking mode
21-24	11,12	BT err vel max	Stores the error velocity maximum value. Scaling: LSD = 1 mm/s; Range = 0 to 5000 mm/s (0 = did not screen data)
25-32	13-16	Reserved	
33-48	17-24	Beam #1-4 BT range	Contains the lower two bytes of the vertical range from Syrinx to the sea bottom 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	Beam #1-4 BT vel	The meaning of the velocity depends on the selected coordinate system. The four velocities are as follows: 1. Beam coordinates: Beam 1, Beam 2, Beam 3, Beam 4

Table C-15 Bottom Track Data Format (continued)

Hex Digit	Binary Byte	Field	Description
			2. Instrument coordinates: 1→2, 4→3, toward face, error 3. Ship coordinates: Starboard, Fwd, Upwards, error 4. Earth coordinates: East, North, Upward, error
65-72	33-36	Beam #1-4 BT corr	Contains the correlation magnitude in relation to the seam bottom as determined by each beam. Bottom-track correlation magnitudes have the same format and scale factor as water-profiling magnitudes.
73-80	37-40	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 counts; Range = 0 to 255 counts
81-88	41-44	Beam #1-4 BT % good	Contains bottom-track percentage-good data for each beam, which indicate the reliability of bottom-track data. It is the percentage of bottom-track pings which have passed Syrinx's bottom-track validity algorithm during an ensemble. Scaling: LSD = 1 percent; Range = 0 to 100 percent
89-92 93-96 97-100	45,46 47,48 49,50	Ref Layer (Min, Near, Far)	Stores the minimum layer size, the near boundary, and the far boundary of the BT water-reference layer. Scaling (minimum layer size): LSD = 1dm; Range = 0-999 dm Scaling (near/far boundaries): LSD = 1dm; Range = 0-9999 dm
101-116	51-58	Beam #1-4 Ref Layer Vel	Contains velocity data for the water reference layer for each beam. Reference layer velocities have the same format and scale factor as water-profiling velocities.
117-124	59-62	Beam #1-4 Ref Corr	Contains correlation magnitude data for the water reference layer for each beam. Reference layer correlation magnitudes have the same format and scale factor as water-profiling magnitudes.
125-132	63-66	Beam #1-4 Ref Int	Contains echo intensity data for the reference layer for each beam. Reference layer intensities have the same format and scale factor as water-profiling intensities.
133-140	67-70	Beam #1-4 Ref % Good	Contains percent-good data for the water reference layer for each beam. They indicate the reliability of reference layer data. It is the percentage of bottom-track pings that have passed a reference layer validity algorithm during an ensemble. Scaling: LSD = 1 percent; Range = 0 to 100 percent
141-144	71,72	BT Max Depth	Stores the maximum tracking depth value. Scaling: LSD = 1 decimetre; Range = 80 to 9999 decimetres
145-152	73-76	Beam #1-4 RSSI Amp	Contains the Receiver Signal Strength Indicator (RSSI) value in the centre of the bottom echo as determined by each beam. Scaling: LSD = 0.45dB per count; Range = 0 to 255 counts
153,154	77	Gain	Contains the Gain level for shallow water.

Table C–15 Bottom Track Data Format (continued)

Hex Digit	Binary Byte	Field	Description
155-162	78-81	Beam #1-4 BT Range MSB	Contains the most significant byte of the vertical range from Syrinx to the sea bottom 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

C.1.2.6 NMEA Data within PDO

This document only describes the NMEA messages that Syrinx understands and how those messages are embedded within a PDO message. For more details, see the NMEA specification at <http://www.nmea.org>

C.1.2.7 PDO General NMEA

PDO General NMEA data are binary messages corresponding the NMEA strings from which they derive. Each PDO General NMEA message starts with a 14-byte header as described below:

Table C–16 General NMEA Header Fields

General ID	Specific ID	Msg Size	Delta Time	Message Body
0x2022	See below			
2 bytes	2 bytes	2 bytes	8 bytes	N bytes

The Specific ID header field in *Table C–17* encodes the identity of the data held in the Message Body as follows:

Table C–17 General NMEA Specific IDs

NMEA Message	Specific ID
GGA	104
VTG	105
DBT	106
HDT	107

The content of the GGA binary message is shown below.

Table C–18 General NMEA GGA Binary Format

Binary Byte	Field	Description
1-7	szHeader	NMEA GGA string, i.e \$GPGGA
8-17	szUTC	UTC Timestamp
18-25	dLatitude	Latitude of GPS receiver in decimal degrees

Table C–18 General NMEA GGA Binary Format (continued)

Binary Byte	Field	Description
26	tcNS	Character to describe latitude hemisphere, i.e. N = North, S = South
27-34	dLongitude	Longitude of GPS receiver in decimal degrees
35	tcEW	Character to describe longitude hemisphere, i.e. E = East, W = West
36	ucQuality	GPS Quality indicator: 0 = fix not available or invalid 1 = GPS fix 2 = Differential GPS fix 3 = GPS PPS Mode, fix valid 4 = Real Time Kinematic. System used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers 6 = Estimated (dead reckoning) mode 7 = Manual Input Mode 8 = Simulaor mode 9 = Position computed using almanac This shall not be a null field.
37	ucNmbSat	GPS Number of satellites used in fix, 00-12
38-41	fHDOP	Horizontal dilution of precision
42-45	fAltitude	Altitude of GPS receiver above/below mean-sea-level (geoid)
46	tcAltUnit	Units of Altitude measurement, M = metres
47-50	fGeoid	Geoidal separation. The difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid); a negative value indicates that the mean-sea-level below the ellipsoid
51	tcGeoidUnit	Units of Geoidal Separation measurement, M = metres
52-55	fAgeDGPS	Age of differential GPS. Time in seconds since last SC104 Type 1 or 9 update, null field when DGPS is used
56-57	sRefStationId	Differential reference station ID, 0000-1023

The content of the VTG binary message is shown below.

Table C–19 General NMEA VTG Binary Format

Binary Byte	Field	Description
1-7	szHeader	NMEA VTG string, i.e \$GPVTG
8-11	fCOGTrue	Course-over-ground, degrees true
12	tcTrueIndicator	T
13-16	tCOGMagn	Course-over-ground, degrees magnetic
17	tcMagnIndicator	M
18-21	fSpdOverGroundKts	Speed over ground measured in knots
22	tcKtsIndicator	N

Table C–19 General NMEA VTG Binary Format (continued)

Binary Byte	Field	Description
23-26	fSpdOverGroundKmh	Speed over ground measured in km/h
27	tcKmhIndicator	K
28	tcModeIndicator	Mode indicator: A=Autonomous mode D=Differential mode E=Estimated (dead reckoning) mode) M=Manual input mode S=Simulator mode N=Data not valid This shall not be a null field

The content of the DBT binary message is shown below.

Table C–20 General NMEA HDT Binary Format

Binary Byte	Field	Description
1-7	szHeader	NMEA DBT string, i.e \$XXDBT
8-11	fWaterDepth_ft	Water depth in feet
12	tcFeetIndicator	f
13-16	fWaterDepth_m	Water depth in Metres
17	tcMeterIndicator	M
18-21	fWaterDepth_F	Water depth in Fathoms
22	tcFathomIndicator	F

The content of the HDT binary message is shown below.

Table C–21 General NMEA HDT Binary Format

Binary Byte	Field	Description
1-7	szHeader	NMEA DBT string, i.e \$XXDBT
8-15	dHeading	Heading, Degrees true
16	tcFeetIndicator	T

C.1.2.8 PDO NMEA Strings

PDO NMEA strings are messages containing the ASCII content of a NMEA string received from an external sensor.

Each PDO NMEA string starts with a 14-byte header as described below.

Table C–22 NMEA String Header Fields

Message	General ID	Specific ID	Msg Size	Delta Time	Message Body
GGA	0x2101	100	98		

Table C-22 NMEA String Header Fields (continued)

Message	General ID	Specific ID	Msg Size	Delta Time	Message Body
VTG	0x2102	101	60		
DBT	0x2100	102	43		
HDT	0x2104	103	32		
	2 bytes	2 bytes	2 bytes	8 bytes	N bytes

The message body contains the NMEA string.

All NMEA strings start with \$ followed by a message identifier – this will hereafter be referred to as the message start delimiter. This delimiter is five characters long, with the first two characters identifying the NMEA talker, and the last three of those characters identifying the type of message. For example, a GGA string starts with \$XXGGA, where XX identifies the NMEA talker.

The NMEA message then consists of a fixed number of fields, each of which is separated by a comma.

Each NMEA string end is delimited by an asterisk * followed by a two-byte checksum (hereafter denoted by hh and a carriage-return <CR> and line-feed <LF>. The asterisk will hereafter be referred to as the message end delimiter.

Each NMEA string supported by Syrinx is described below.

The content of the GGA string is as follows:

\$XXGGA,hhmmss.ss,IIII.II,a,yyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>

The fields between the message start and end delimiters are shown below.

Table C-23 NMEA GGA String Description

	Width in Bytes	Description
hhmmss.ss	Variable	UTC of position – 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds, and a variable number of digits for decimal-fraction of seconds. Leading zeros are always included for hours, minutes, and seconds to maintain fixed length. The decimal point and associated decimal-fraction are optional if full resolution is required.
IIII.II	Variable	Latitude – 2 fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 4 characters. The decimal point and associated decimal-fraction are optional if full resolution is not required.
a	1	Latitude hemisphere. N or S.
IIII.II	Variable	Longitude – 3 fixed digits of degrees, 2 fixed digits of minutes, and a variable number of digits for decimal-fraction of minutes. Leading zeros are always included for degrees and minutes to maintain fixed length of the first 5 characters. The decimal point and associated decimal-fraction are optional if full resolution is not required.
a	1	Longitude hemisphere. E or W.
x	1	GPS Quality indicator: 0 = fix not available or invalid 1 = GPS fix 2 = Differential GPS fix

Table C-23 NMEA GGA String Description (continued)

	Width in Bytes	Description
		3 = GPS PPS Mode, fix valid 4 = Real Time Kinematic. System used in RTK mode with fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers 6 = Estimated (dead reckoning) mode 7 = Manual Input Mode 8 = Simulator mode 9 = Position computed using almanac This shall not be a null field.
xx	2	GPS Number of satellites used in fix, 00-12
x.x	3	Horizontal dilution of precision
x.x	3	Altitude of GPS receiver above/below mean-sea-level (geoid)
M	1	Units of Altitude measurement, M = metres
x.x	3	Geoidal separation. The difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid); a negative value indicates that the mean-sea-level below the ellipsoid
M	1	Units of Geoidal Separation measurement, M = metres
x.x	3	Age of differential GPS. Time in seconds since last SC104 Type 1 or 9 update, null field when DGPS is used
xxxx	4	Differential reference station ID, 0000-1023

The content of the VTG string is as follows:

\$XXVTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

The fields between the message start and end delimiters are shown below.

Table C-24 NMEA VTG String Description

	Width in Bytes	Description
x.x	Variable	Track, degrees True
T	1	T
x.x	Variable	Track, degrees Magnetic
M	1	M
x.x	Variable	Speed, knots
N	1	N
x.x	Variable	Speed, km/hr
K	1	K

The content of the DBT string is as follows:

\$XXDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>

The fields between the message start and end delimiters are shown below.

Table C-25 NMEA DBT String Description

	Width in Bytes	Description
x.x	Variable	Water depth in feet
f	1	f
x.x	Variable	Water depth in Metres
M	1	M
x.x	Variable	Water depth in Fathoms
F	1	F

The content of the HDT string is as follows:

\$XXHDT,x.x,T*hh<CR><LF>

The fields between the message start and end delimiters shown below.

Table C-26 NMEA HDT String Description

	Width in Bytes	Description
x.x	Variable	Heading, degrees True
T	1	T

C.1.2.9 Sonardyne PD0 System Configuration

This structure is a PD0 extension specific to Sonardyne devices. It contains information which will not change unless the system configuration is updated by the user.

Table C-27 Sonardyne System Configuration Description

Binary Byte	Field	Description
1,2	ID Code	Sonardyne System Configuration ID, 0x6060 LSB
3,4	Type number	Sonardyne Device Type number, i.e. 8275-3130
5,6	Sub Type Field 1	i.e. 8275-3130
7,8,9	Serial Number	First part of the Sonardyne serial number 313735-002
10	Sequence number	First part of the Sonardyne serial number 313735-002
11-14	DSP Firmware	DSP firmware version, 4 bytes, xx.xx.xx.xx
15-18	ARM Firmware	ARM firmware version, 4 bytes, xx.xx.xx.xx
19-22	FPGA Firmware	FPGA firmware version, 4 bytes, xx.xx.xx.xx
23-26	Webserver	Webserver firmware version, 4 bytes, xx.xx.xx.xx
27-30	Offset X GPS (float32)	Lever arm X for GPS
31-34	Offset Y GPS (float32)	Lever arm Y for GPS
35-38	Offset Z GPS (float32)	Lever arm Z for GPS
39-42	Pitch Offset (float32)	In degrees
43-46	Roll Offset	In degrees

Table C-27 Sonardyne System Configuration Description (continued)

Binary Byte	Field	Description
	(float32)	
47-50	Heading Offset (float32)	In degrees

C.1.2.10 Sonardyne PD0 Variable Leader

This structure is a PD0 extension specific to Sonardyne devices. It contains information which may change depending on the mode of operation of the instrument and may change from ping to ping.

Table C-28 Sonardyne Variable Leader Description

Binary Byte	Field	Description
1,2	ID Code	Sonardyne Variable Structure, 0x6160 LSB
3	Status	Bit
		Definition
		0,1,2,3
		Version of the message. Current Version: 3 Updated 22/01/20
		4,5,6
		Mode of instrument:
		0 Searching for bottom lock
		1 Bottom Ambiguity Resolve
		2 Acquired bottom lock / tracking
4	Ping ID	3 Water track mode
		4 Manual mode
		5 ADCP mode
		6 Test Mode1
		7 Test Mode2
4	Ping ID	Sequential ID which will wrap around, this allows different messages to be output from the same data and combined later. i.e. advanced diagnostics may be turned on which is contained in a separate message. Valid range is 0–255.
5,6,7,8,9,10	T0 Time	Time of start of acoustic transmission expressed in the instrument time frame in units of microseconds. Note: The instrument time frame is a free running monotonically increasing count from the time the unit was powered up. Drift rate is < 1e-4.
11,12,13,14	Waveform	Bit
		Definition
		0,1,2,3,4,5
		Ping BT product. Valid range 1–63.
		6,7,8,9,10,11
		Number of code repeats. Valid range 1–63
		12,13,14,15
		Number of Beams. Valid range 1–15
		16,17,18,19
		Transmit bandwidth. See bandwidth modes below

Table C-28 Sonardyne Variable Leader Description (continued)

Binary Byte	Field	Description
		Value
		0
		1
		2
		3
		4
		5
		6-15
		Rx Bandwidth = 2*TxBandwidth For example: TxBw = 2 = 15.625 kHz RxBw = 2*15.625 kHz = 31.25 kHz
	20,21,22,23	Beams used in solution This field contains the beams used by the DSP for bottom tracking. Bits 20 to 23 = beams 1 to 4 in order. Set (1) = beam used in tracking algorithms.
	24-31	reserved
15,16	Rx Gain	Receiver gain during this ping
17,18	Tx Gain	Transmitter gain during this ping
19	Sensor Data validity	If sensor data has not been received in last 2 seconds the flag will be cleared to show the data is not valid. Bit 0: GGA available / valid Bit 1: VTG velocity available / valid Bit 2: INS position available / valid Bit 3: AHRS data available / valid
20,21	INS Beam 0 velocity	Signed 16-bit integer: The meaning of the velocity depends on the selected coordinate system. The four velocities are as follows: 1. Beam coordinates: Beam 1, Beam 2, Beam 3, Beam 4 2. Instrument coordinates: 1→2, 4→3, toward face, unused 3. Ship coordinates: Starboard, Fwd, Upwards, unused 4. Earth coordinates: East, North, Upward, unused
22,23	INS Beam 1 velocity	
24,25	INS Beam 2 velocity	
26,27	INS Beam 3 velocity	
28,29	INS Heading	Unsigned 16-bit integer: INS vessel heading; units are $2^{-15} \times 180$ deg
30,31	INS Pitch	Signed 16-bit integer: INS vessel pitch; units are $2^{-15} \times 180$ deg
32,33	INS Roll	Signed 16-bit integer: INS vessel roll; units are $2^{-15} \times 180$ deg

Table C–28 Sonardyne Variable Leader Description (continued)

Binary Byte	Field	Description
34,35	Beam Velocity Ambiguity Limit	Unsigned 16-bit integer: Beam-frame velocity ambiguity limit; units are mm/s
36	Beam Velocity Noise	Unsigned 8-bit integer: Beam-frame velocity noise; units are mm/s
37, 38	(Reserved)	For future use.

C.1.2.11 Checksum Format

The checksum is used to verify the integrity of the received PD0 message.

Table C–29 Checksum Summary

	Bit Positions								
Byte	7	6	5	4	3	2	1	0	
1	Checksum data								LSB
2									MSB

The checksum is described below.

Table C–30 Checksum Format Details

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

C.2 Teledyne RDI DVL Binary Data Format (PD3)

The DVL sends this data format only when the PD3 command is used. In multiple byte parameters, the least significant byte always comes before the more significant bytes.

Hex Digit	Binary Byte	Field	Description
1,2	1	DVL Data ID	Stores the DVL (speed log) identification word (7Eh)
3,4	2	Data Structure	These byte contains the Data Structure. Bit # 0 = Ship or Earth BT Velocity 1 = Vertical BT Velocity 2 = Water Velocity 3 = Beam Vertical Range to Bottom 4 = Average Vertical Range to Bottom 5 = Reserved 6 = Reserved 7 = Sensor/Other Data Byte

Hex Digit	Binary Byte	Field	Description
5-8	3,4	X-Vel Btm	† Bit #0: Always output. If the data bit is set to 0, than Ship coordinates are used. If the data bit is set to 1, than Earth coordinates are used. These fields contain the velocity of the vessel in relation to the bottom in mm/s. Positive values indicate vessel motion to (X) Starboard/East, (Y) Forward/North, (Z) Upward.
9-12	5,6	Y-Vel Btm	
13-16	7,8	Z-Vel Btm	† Bit #1: Vertical velocities.
17-20	9,10	X-Vel Water	† Bit #2: These fields contain the velocity of the vessel in relation to the water reference layer in mm/s. Positive values indicate vessel motion to (X) Starboard/East, (Y) Forward/North, (Z) Upward.
21-24	11,12	Y-Vel Water	† Bit #2: These fields contain the velocity of the vessel in relation to the water reference layer in mm/s. Positive values indicate vessel motion to (X) Starboard/East, (Y) Forward/North, (Z) Upward.
25-28	13,14	Z-Vel Water	† Bit #1 and Bit #2
29-32 33-36 37-40 41-44	15,16 17,18 19,20 21,22	Bm1 Bm2 Rng to Bm3 Bottom Bm4	† Bit #3: These fields contain the vertical range from the DVL to the bottom as determined by each beam. This vertical range does not compensate for the effects of pitch and roll. When a bottom detection is bad, the field is set to zero. Scaling: LSD = 1 centimeter; Range = 0 to 65535 cm
45-48	23,24	Avg Rng to Btm	† Bit #4: These fields contain the average vertical range from the DVL to the bottom as determined by each beam.
49-80	25-40	Spare	Spare
81,82	41	Sensor/Other Data	† Output if Bit #7 of "Data to Follow" byte is set. These fields contain the Sensor/Other data. Bit # 0 = Time 1 = Heading 2 = Pitch 3 = Roll 4 = Temperature 5 = Active Built-In-Test
83-90	42	Time: HH	† Sensor/Other Data Bit #0: These fields contains the time of the ping in Hours, Minutes Seconds, Hundredths of seconds respectively. Time (Hours)
	43	TIME; MM	Time (Minutes)
	44	Time: SS	Time (Seconds)
	45	TIME; HH	Time (Hundredths)
91-94	46,47	Heading	† Sensor/Other Data Bit #1: this field contains the Heading in hundredths of degrees.
95-98	48,49	Pitch	† Sensor/Other Data Bit #2: this field contains the Pitch in hundredths of degrees.
99-102	50,51	Roll	† Sensor/Other Data Bit #3: this field contains the Roll in hundredths of degrees.

Hex Digit	Binary Byte	Field	Description
103-106	52,53	Temp	‡ Sensor/Other Data Bit #4: this field contains the Temperature in hundredths of degrees.
107-110	54,55	BIT results	‡ Sensor/Other Data Bit #5: this field contains the Built-In-Test results. Each bit specifies the result of built-in-test during an ensemble. If the bit is set, the test failed. BYTE 54 BYTE 55 (BYTE 55 RESERVED FOR FUTURE USE) 1xxxxxxx xxxxxxxx = RESERVED x1xxxxxx xxxxxxxx = RESERVED xx1xxxxx xxxxxxxx = RESERVED xxx1xxxx xxxxxxxx = DEMOD 1 ERROR xxxx1xxx xxxxxxxx = DEMOD 0 ERROR xxxxx1xx xxxxxxxx = RESERVED xxxxxx1x xxxxxxxx = DSP ERROR xxxxxxxx1 xxxxxxxx = RESERVED
111-114	56,57	Checksum	This is the 16-bit checksum of all the preceding binary bytes.

† This block of data is only output if the bit is set to 1 in the Data Structure byte.

‡ This block of data is only output if the bit is set to 1 in the Sensor/Other Data byte.

C.3 Teledyne RDI DVL Binary Data Format (PD4)

Notes



The data structure type determines whether PD4.



System Config field used to identify DVL as Syrinx (xxxxx111)

Hex Digit	Binary Byte	Field	Description	Used By Sonardyne (Value given if not used)
1,2	1	DVL Data ID	Stores the DVL (speed log) identification word (7Dh).	Used
3,4	2	Data Structure	Identifies which data pattern will follow based on the Pdcommand. 0 = PD4 = Bytes 1 through 47. 1 = PD5 = Bytes 1 through 45 and bytes 46 through 88 from PD5 table	Used
5-8	3,4	No. of Bytes	Contains the number of bytes sent in this data structure, not including the final checksum.	Used (0x002D as always PD4)
9,10	5	System Config	Defines the DVL hardware/firmware configuration. Convert to binary and interpret as follows. BIT 76543210 00xxxxxx BEAM-COORDINATE VELOCITIES	Currently fixed with Instrument Co-ordinate bit (01xxxxxxx even with offsets)

Hex Digit	Binary Byte	Field	Description	Used By Sonardyne (Value given if not used)
			01xxxxxx INSTRUMENT-COORDINATE VELOCITIES 10xxxxxx SHIP-COORDINATE VELOCITIES 11xxxxxx EARTH-COORDINATE VELOCITIES xx0xxxxx TILT INFORMATION NOT USED IN CALCULATIONS xx1xxxxx TILT INFORMATION USED IN CALCULATIONS xxx0xxxx 3-BEAM SOLUTIONS NOT COMPUTED xxx1xxxx 3-BEAM SOLUTIONS COMPUTED xxxxx010 300-kHz DVL xxxxx011 600-kHz DVL xxxxx100 1200-kHz DVL Note: Field used for Syrinx identifier: xxxxx111 Syrinx DVL	0 for tilt information as not used 3-Beam bit to be set when 3 beam mode enabled ID bits set to xxxxx111 To identify Sonardyne Syrinx DVL
11-14	6,7	X-Vel Btm	These fields contain the velocity of the vessel in relation to the bottom in mm/s. Positive values indicate vessel motion to east (X), north (Y), and up (Z). LSD = 1 mm/s (see NOTES at end of this table).	Used : -32768 = error
15-18	8,9	Y-Vel Btm		Used : -32768 = error
19-22	10,11	Z-Vel Btm		Used : -32768 = error
23-26	12,13	E-Vel Btm		Used, only valid if 4-beam solution output.
27-30	14,15	Bm1	These fields contain the vertical range from the ADCP to the bottom as determined by each beam. This vertical range does not compensate for the effects of pitch and roll. When a bottom detection is bad, the field is set to zero. Scaling: LSD = 1 centimetre; Range = 0 to 65535 cm	Used : 0 = error
31-34	16,17	Bm2 Rng to		Used : 0 = error
35-38	18,19	Bm3 Bottom		Used : 0 = error
39-42	20,21	Bm4		Used : 0 = error
43,44	22	Bottom Status	This field shows the status of bottom-referenced correlation and echo amplitude data. Convert to binary and interpret as follows. A zero code indicates status is OK. BIT 76543210 1xxxxxxx BEAM 4 LOW ECHO AMPLITUDE x1xxxxxx BEAM 4 LOW CORRELATION xx1xxxxx BEAM 3 LOW ECHO AMPLITUDE	Not Used Value = 0

Hex Digit	Binary Byte	Field	Description	Used By Sonardyne (Value given if not used)
			xxx1xxxx BEAM 3 LOW CORRELATION xxxx1xxx BEAM 2 LOW ECHO AMPLITUDE xxxxx1xx BEAM 2 LOW CORRELATION xxxxxx1x BEAM 1 LOW ECHO AMPLITUDE xxxxxxx1 BEAM 1 LOW CORRELATION	
45-48	23,24	X-Vel Ref Layer	These fields contain the velocity of the vessel in relation to the water-mass reference layer in mm/s. Positive values indicate vessel motion to east (X), north (Y), and up (Z). LSD = 1 mm/s (See NOTES at end of this table.)	0x8000
49-52	25,26	Y-Vel Ref Layer		0x8000
53-56	27,28	Z-Vel Ref Layer		0x8000
57-60	29,30	E-Vel Ref Layer		0x8000
61-64	31,32	Ref Layer Start	These fields contain the starting boundary (near surface) and the ending boundary (near bottom) of the water-mass reference layer (BL-command). If the minimum size field is zero, the ADCP does not calculate reference-layer data. Scaling: LSD = 1 dm; Range = 0-9999 dm	Used if in water track or combined mode
65-68	33,34	Ref Layer End		Used if in water track or combined mode
69,70	35	Ref Layer Status	This field shows the status of reference layer depth and correlation data. Convert to binary and interpret as follows. A zero code indicates status is OK. BIT 76543210 xxx1xxxx ALTITUDE IS TOO SHALLOW xxxx1xxx BEAM 4 LOW CORRELATION xxxxx1xx BEAM 3 LOW CORRELATION xxxxxx1x BEAM 2 LOW CORRELATION xxxxxxx1 BEAM 1 LOW CORRELATION	Not Used Value = 0
71,72	36	TOFP Hour	These fields contain the time of the first ping of the current ensemble.	Used
73,74	37	TOFP Minute		Used
75,76	38	TOFP Second		Used
77,78	39	TOFP Hundredth		Used
79-82	40,41		BIT Results These fields contain the results of the ADCP's Built-in Test function. A zero code indicates a successful BIT result. BYTE 40 BYTE 41 (BYTE 41 RESERVED FOR FUTURE USE) 1xxxxxxx xxxxxxxx = RESERVED x1xxxxxx xxxxxxxx = RESERVED	Not Used Value = 0 (See Functional Test for information on how to run Syrinx Self-test.

Hex Digit	Binary Byte	Field	Description	Used By Sonardyne (Value given if not used)
			xx1xxxxx xxxxxxxx = RESERVED xxx1xxxx xxxxxxxx = DEMOD 1 ERROR xxxx1xxx xxxxxxxx = DEMOD 0 ERROR xxxxx1xx xxxxxxxx = RESERVED xxxxxx1x xxxxxxxx = DSP ERROR xxxxxxx1 xxxxxxxx = RESERVED	
83-86	42,43	Speed of Sound	Contains either manual or calculated speed of sound information (EC-command). Scaling: LSD = 1 metres per second; Range = 1400 to 1600 m/s	Used See SCFG for SV settings
87-90	44,45		Temperature Contains the temperature of the water at the transducer head. Scaling: LSD = 0.01 C; Range = -5.00 to +40.00C	Used
91-94	46,47	Checksum	This field contains a modulo 65536 checksum. The DVL computes the checksum by summing all the bytes in the output buffer excluding the checksum. NOTE: This field contains the checksum only when the PD4-command is used. If PD5 is used, the remaining bytes are explained in <i>Section C.4</i> .	Used

C.4 Teledyne RDI DVL Output Data Format (PD5)

Hex Digit	Binary Byte	Field	Description
91,92	46	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
93-96	46,48	Depth	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
97-100	49,50	Pitch	Contains the DVL 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
101-104	51,52	Roll	Contains the DVL roll angle (ER-command). This value may be a manual setting or a reading from a tilt sensor. For up-facing DVLs, positive values mean that Beam #2 is spatially higher than Beam #1. For down-facing DVLs, positive values mean that Beam #1 is spatially higher than Beam #2. Scaling: LSD = 0.01 degree; Range = -20.00 to +20.00 degrees
105-108	53,54	Heading	Contains the DVL 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

Hex Digit	Binary Byte	Field	Description
109-116	55-58	DMG/Btm East	These fields contain the Distance Made Good (DMG) over the bottom since the time of the first ping after initialization or <BREAK>. Scaling: LSD = 1 dm; Range = -10,000,000 to 10,000,000 dm
117-124	59-62	DMG/Btm North	
125-132	63-66	DMG/Btm Up	
133-140	67-70	DMG/Btm Error	
141-148	71-74	DMG/Btm Ref East	These fields contain the distance made good over the watermass reference layer since the time of the first ping after initialization or <BREAK>. Scaling: LSD = 1 dm; Range = -10,000,000 to 10,000,000 dm
149-156	75-78	DMG/Ref North	
157-164	79-82	DMG/Ref Up	
165-172	83-86	DMG/Ref Error	
173-176	87,88	Checksum	This field contains a modulo 65536 checksum. The DVL computes the checksum by summing all the bytes in the output buffer excluding the checksum

C.5 Teledyne RDI DVL Output Data Format (PD6)

The Syrinx DVL sends this data format only when the PD6 output is used. The Syrinx DVL may not sent all data lines dependent on operating mode.

Line	Description
1	SYSTEM ATTITUDE DATA :SA,±PP.PP,±RR.RR,HH.HH <CR><LF> where: PP.PP = Pitch in degrees RR.RR = Roll in degrees HHH.HH = Heading in degrees
2	TIMING AND SCALING DATA :TS,YMMDDHHmmsshh,SS.S,+TT.T,DDDD.D,CCCC.C,BBB <CR><LF> where: YMMDDHHmmsshh = Year, month, day, hour, minute, second, hundredths of seconds SS.S = Salinity in parts per thousand (ppt) TT.TT = Temperature in C DDDD.D = Depth of transducer face in meters CCCC.C = Speed of sound in meters per second BBB = Built-in Test (BIT) result code
3	WATER-MASS, INSTRUMENT-REFERENCED VELOCITY DATA :WI,±XXXXX,±YYYYY,±ZZZZZ,±EEEE,S <CR><LF> where: ±XXXXX = X-axis vel. data in mm/s (+ = Bm1 Bm2 xdcr movement relative to water mass)

Line	Description
	±YYYYY = Y-axis vel. data in mm/s (+ = Bm4 Bm3 xdcr movement relative to water mass) ±ZZZZZ = Z-axis vel. data in mm/s (+ = transducer movement away from water mass) ±EEEE = Error velocity data in mm/s S = Status of velocity data (A = good, V = bad)
4	WATER-MASS, SHIP-REFERENCED VELOCITY DATA :WS,±TTTT,±LLLL,±NNNN,S <CR><LF> where: ±TTTT = Transverse vel. data in mm/s (+ = Port Stbd ship movement rel. to water mass) ±LLLL = Longitudinal vel. data in mm/s (+ = Aft Fwd ship movement rel. to water mass) ±NNNN = Normal velocity data in mm/s (+ = ship movement away from water mass) S = Status of velocity data (A = good, V = bad)
5	WATER-MASS, EARTH-REFERENCED VELOCITY DATA :WE,±EEEE,±NNNN,±UUUU,S <CR><LF> where: ±EEEE = East (u-axis) velocity data in mm/s (+ = DVL movement to east) ±NNNN = North (v-axis) velocity data in mm/s (+ = DVL movement to north) ±UUUU = Upward (w-axis) velocity data in mm/s (+ = DVL movement to surface) S = Status of velocity data (A = good, V = bad)
6	WATER-MASS, EARTH-REFERENCED DISTANCE DATA :WD,±EEEEEEE.EE,±NNNNNNNN.NN,±UUUUUUUU.UU,DDDD.DD,TTT.TT <CR><LF> where: +EEEEEEE.EE = East (u-axis) distance data in meters +NNNNNNNN.NN = North (v-axis) distance data in meters +UUUUUUUU.UU = Upward (w-axis) distance data in meters DDDD.DD = Range to water-mass center in meters TTT.TT = Time since last good-velocity estimate in seconds
7	BOTTOM-TRACK, INSTRUMENT-REFERENCED VELOCITY DATA :BI,±XXXX,±YYYY,±ZZZZ,±EEEE,S <CR><LF> where: ±XXXX = X-axis velocity data in mm/s (+ = Bm1 Bm2 xdcr movement relative to bottom) ±YYYY = Y-axis velocity data in mm/s (+ = Bm4 Bm3 xdcr movement relative to bottom) ±ZZZZ = Z-axis velocity data in mm/s (+ = transducer movement away from bottom) ±EEEE = Error velocity data in mm/s S = Status of velocity data (A = good, V = bad)
8	BOTTOM-TRACK, SHIP-REFERENCED VELOCITY DATA :BS,±TTTT,±LLLL,±NNNN,S <CR><LF> where: ±TTTT = Transverse vel. data in mm/s (+ = Port Stbd ship movement relative to bottom) ±LLLL = Longitudinal vel. data in mm/s (+ = Aft Fwd ship movement relative to bottom) ±NNNN = Normal velocity data in mm/s (+ = ship movement away from bottom) S = Status of velocity data (A = good, V = bad)
9	BOTTOM-TRACK, EARTH-REFERENCED VELOCITY DATA :BE,±EEEE,±NNNN,±UUUU,S <CR><LF> where:

Line	Description
	±EEEEEE = East (u-axis) velocity data in mm/s (+ = DVL movement to east) ±NNNNN = North (v-axis) velocity data in mm/s (+ = DVL movement to north) ±UUUUU = Upward (w-axis) velocity data in mm/s (+ = DVL movement to surface) S = Status of velocity data (A = good, V = bad)
10	BOTTOM-TRACK, EARTH-REFERENCED DISTANCE DATA :BD,±EEEEEEEE.EE,±NNNNNNNN.NN,±UUUUUUUU.UU,DDDD.DD,TTT.TT <CR><LF> where: +EEEEEEEE.EE = East (u-axis) distance data in meters +NNNNNNNN.NN = North (v-axis) distance data in meters +UUUUUUUU.UU = Upward (w-axis) distance data in meters DDDD.DD = Range to bottom in meters TTT.TT = Time since last good-velocity estimate in seconds

The PD6 output does not pad spaces with zeroes. The spaces are left intact. The example below shows a realistic output from a scenario where the Syrinx DVL is locked onto the bottom.

```
:SA, -2.31, +1.92, 75.20
:TS,04081111563644,35.0,+21.0, 0.0,1524.0, 0
:WI,-32768,-32768,-32768,-32768,V
:BI, +24, -6, -20, -4,A
:WS,-32768,-32768,-32768,V
:BS, -13, +21, -20,A
:WE,-32768,-32768,-32768,V
:BE, +17, +18, -20,A
:WD, +0.00, +0.00, +0.00, 20.00, 0.00
:BD, -0.02, -0.03, +0.02, 7.13, 0.21
```

C.6 Teledyne RDI DVL Data Output Format (PD13)

The Syrinx DVL sends this data format only when the PD13 output is used. The Syrinx DVL may not sent all data lines depending on operating mode.

Line	Description
1	SYSTEM ATTITUDE DATA :SA,±PP.PP,±RR.RR,HH.HH <CR><LF> where: PP.PP = Pitch in degrees RR.RR = Roll in degrees HHH.HH = Heading in degrees
2	TIMING AND SCALING DATA :TS,YMMDDHHmmssh,SS.S,+TT.T,DDDD.D,CCCC.C,BBB <CR><LF> where: YMMDDHHmmssh = Year, month, day, hour, minute, second, hundredths of seconds SS.S = Salinity in parts per thousand (ppt) TT.TT = Temperature in C DDDD.D = Depth of transducer face in meters CCCC.C = Speed of sound in meters per second

Line	Description
	BBB = Built-in Test (BIT) result code
3	PRESSURE AND RANGE TO BOTTOM DATA :RA,PPP.PP,RRRR.RR,RRRR.RR,RRRR.RR,RRRR.RR where: PPP.PP = Pressure in kPa RRRR.RR = Range to the bottom in deci-meters Beam 1, Beam 2, Beam 3, Beam 4
4	WATER-MASS, INSTRUMENT-REFERENCED VELOCITY DATA :WI,±XXXXX,±YYYY,±ZZZZ,±EEEE,S <CR><LF> where: ±XXXXX = X-axis vel. data in mm/s (+ = Bm1 Bm2 xdcr movement relative to water mass) ±YYYY = Y-axis vel. data in mm/s (+ = Bm4 Bm3 xdcr movement relative to water mass) ±ZZZZ = Z-axis vel. data in mm/s (+ = transducer movement away from water mass) ±EEEE = Error velocity data in mm/s S = Status of velocity data (A = good, V = bad)
5	WATER-MASS, SHIP-REFERENCED VELOCITY DATA :WS,±TTTT,±LLLL,±NNNN,S <CR><LF> where: ±TTTT = Transverse vel. data in mm/s (+ = Port Stbd ship movement rel. to water mass) ±LLLL = Longitudinal vel. data in mm/s (+ = Aft Fwd ship movement rel. to water mass) ±NNNN = Normal velocity data in mm/s (+ = ship movement away from water mass) S = Status of velocity data (A = good, V = bad)
6	WATER-MASS, EARTH-REFERENCED VELOCITY DATA :WE,±EEEE,±NNNN,±UUUU,S <CR><LF> where: ±EEEE = East (u-axis) velocity data in mm/s (+ = DVL movement to east) ±NNNN = North (v-axis) velocity data in mm/s (+ = DVL movement to north) ±UUUU = Upward (w-axis) velocity data in mm/s (+ = DVL movement to surface) S = Status of velocity data (A = good, V = bad)
7	WATER-MASS, EARTH-REFERENCED DISTANCE DATA :WD,±EEEEEE.EE,±NNNNNNNN.NN,±UUUUUUUU.UU,DDDD.DD,TTT.TT <CR><LF> where: +EEEEEE.EE = East (u-axis) distance data in meters +NNNNNNNN.NN = North (v-axis) distance data in meters +UUUUUUUU.UU = Upward (w-axis) distance data in meters DDDD.DD = Range to water-mass center in meters TTT.TT = Time since last good-velocity estimate in seconds
8	BOTTOM-TRACK, INSTRUMENT-REFERENCED VELOCITY DATA :BI,±XXXXX,±YYYY,±ZZZZ,±EEEE,S <CR><LF> where: ±XXXXX = X-axis velocity data in mm/s (+ = Bm1 Bm2 xdcr movement relative to bottom) ±YYYY = Y-axis velocity data in mm/s (+ = Bm4 Bm3 xdcr movement relative to bottom) ±ZZZZ = Z-axis velocity data in mm/s (+ = transducer movement away from bottom) ±EEEE = Error velocity data in mm/s S = Status of velocity data (A = good, V = bad)

Line	Description
9	BOTTOM-TRACK, SHIP-REFERENCED VELOCITY DATA :BS,±TTTTT,±LLLLL,±NNNNN,S <CR> <LF> where: ±TTTTT = Transverse vel. data in mm/s (+ = Port Stbd ship movement relative to bottom) ±LLLLL = Longitudinal vel. data in mm/s (+ = Aft Fwd ship movement relative to bottom) ±NNNNN = Normal velocity data in mm/s (+ = ship movement away from bottom) S = Status of velocity data (A = good, V = bad)
10	BOTTOM-TRACK, EARTH-REFERENCED VELOCITY DATA :BE,±EEEE,±NNNNN,±UUUUU,S <CR> <LF> where: ±EEEE = East (u-axis) velocity data in mm/s (+ = DVL movement to east) ±NNNNN = North (v-axis) velocity data in mm/s (+ = DVL movement to north) ±UUUUU = Upward (w-axis) velocity data in mm/s (+ = DVL movement to surface) S = Status of velocity data (A = good, V = bad)
11	BOTTOM-TRACK, EARTH-REFERENCED DISTANCE DATA :BD,±EEEEEEEE.EE,±NNNNNNNN.NN,±UUUUUUUU.UU,DDDD.DD,TTT.TT <CR> <LF> where: +EEEEEEEE.EE = East (u-axis) distance data in meters +NNNNNNNN.NN = North (v-axis) distance data in meters +UUUUUUUU.UU = Upward (w-axis) distance data in meters DDDD.DD = Range to bottom in meters TTT.TT = Time since last good-velocity estimate in seconds

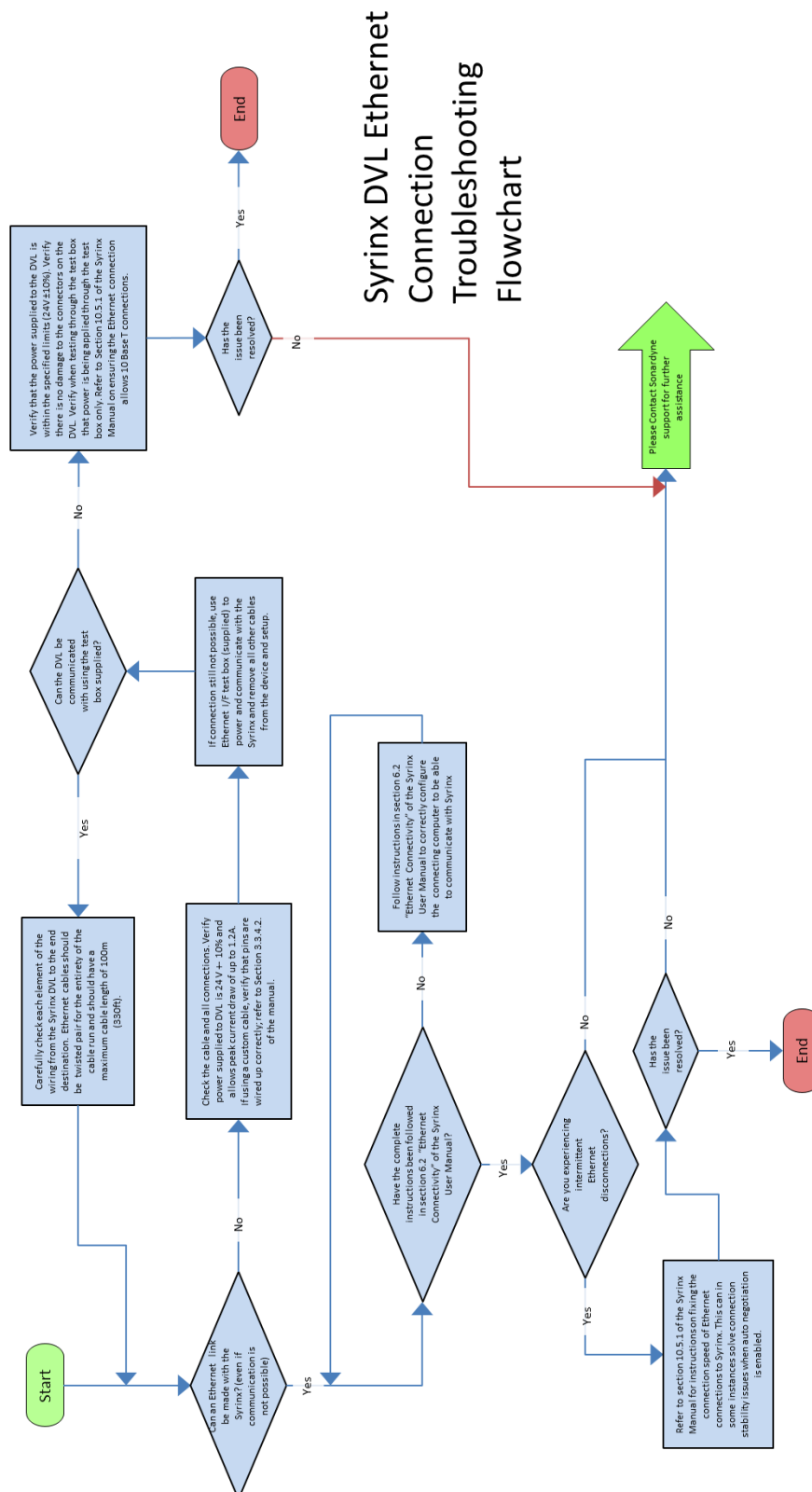
Appendix D – NMEA Definitions (Applicable to Syrinx DVL V1.00)

D.1 DBT NMEA Message

This message is an ASCII message and reports the Depth Below Transducer.

\$DBT,x.x,f,y.y,M,z.z,F*hh	
x.x	Depth in feet
y.y	Depth in meters
z.z	Depth in fathoms.
hh	Checksum, eight-bit exclusive OR (no start or stop bits) of all characters in the sentence, including ",", and "^" delimiters, between but not including the "\$" or "!" and the "*" delimiters. The hexadecimal value of the most significant and least significant four bits of the result is converted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first.

Appendix E – Ethernet Connection Troubleshooting Flowchart



Appendix F – Open Source Software Licence Notices and Terms

The system contains the following open source software and their corresponding license notices and terms.

F.1 Open Source Software

F.1.1 Yocto Linux Operating System

This product uses an Arrow revised build of the Altera (OpenEmbedded-derived) Yocto Linux Operating system which is distributed under GPLv2 licence terms.

Please refer to the Yocto OpenEmbedded website <http://www.yoctoproject.org/>

See the LICENSES section for the GPLv2 license terms.

Corresponding source code is available on request for a period of three years after our last shipment of this product, which will be no earlier than 08/12/2018.

Please contact Sonardyne support for further details regarding purchase costs of the physical media and postage and packaging charges.

Sonardyne International Ltd
Blackbushe Business Park
Yateley
Hampshire
GU46 6GD
United Kingdom

Telephone: +44 (0) 1252 872288

Email: support@sonardyne.com

You may also find a copy of the source at the following git server <http://git.rocketboards.org/linux-socfpga.git>

The manifest of application packages in this build and their corresponding links are as follows and source code is available on request (or downloadable via their respective URLs), See the licencing section for the full corresponding licences.

Package	Version	Licence	URL
autoconf	2.69	GPLv2 GPLv3	www.gnu.org/software/autoconf/
base-files	3.0.14	GPLv2	https://packages.debian.org/search?keywords=base-files
base-passwd	3.5.26	GPLv2+	http://packages.debian.org/search?keywords=base-pa
bash	4.2	GPLv3+	www.gnu.org/software/bash/
binutils	2.22	GPLv3	http://www.gnu.org/software/bfd/
binutils-symlinks	2.22	GPLv3	http://www.gnu.org/software/bfd/
busybox	1.20.2	GPLv2 bzip2	http://www.busybox.net/
busybox-syslog	1.20.2	GPLv2 bzip2	http://www.busybox.net/
busybox-udhcp	1.20.2	GPLv2 bzip2	http://www.busybox.net/
diffutils	3.2	GPLv3+	https://www.gnu.org/software/diffutils/
dtc	1.3.0+git1+033089f29099bdf5c2d6986cdb9fd07b16cfde0	GPLv2 BSD	https://git.kernel.org/cgit/utis/dtc/dtc.git

Package	Version	Licence	URL
e2fsprogs	1.42.1	GPLv2 LGPLv2 BSD MIT	http://e2fsprogs.sourceforge.net/
e2fsprogs-badblocks	1.42.1	GPLv2	http://e2fsprogs.sourceforge.net/
elfutils	0.148	GPL-2+ Elfutils- Exception	https://fedorahosted.org/elfutils/
ethtool	3.5	GPLv2+	https://www.kernel.org/pub/software/network/ethtool/
gator	1	GPLv2	https://github.com/ARM-software/gator
gawk	4.0.1	GPLv3	https://www.gnu.org/software/gawk/
gawk-common	4.0.1	GPLv3	https://www.gnu.org/software/gawk/
gdb	7.5	GPLv2 GPLv3 LGPLv2 LGPLv3	https://www.gnu.org/software/gdb/
gdbserver	7.5	GPLv2 GPLv3 LGPLv2 LGPLv3	https://www.gnu.org/software/gdb/
gnu-config	20111111	GPLv2	http://savannah.gnu.org/projects/config
grep	2.9	GPLv3	https://www.gnu.org/software/grep/
gsrd-altera	1	BSD	http://git.rocketboards.org/poky-socfpga.git
i2c-tools	3.1.0	GPLv2	https://packages.debian.org/wheezy/i2c-tools
initramfs-altera	1	MIT	https://github.com/sgstreet/meta-altera/blob/master/recipes-core/initrdscripts/initramfs-altera_1.0.bb
initscripts	1	GPLv2	https://github.com/altera-opensource/meta-altera-refdes/tree/master/recipes-gsrd/altera-gsrd-initscripts
initscripts-altera	1	BSD	https://github.com/altera-opensource/meta-altera-refdes/blob/master/recipes-gsrd/altera-gsrd-initscripts/altera-gsrd-initscripts.bb
iptables	1.4.15	GPLv2+	https://packages.debian.org/wheezy/iptables
iputils	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-arping	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-ping	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-ping6	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-tracepath	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-tracepath6	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
iputils-traceroute6	s20101006	BSD GPLv2+	https://github.com/iputils/iputils
kernel-3.13.0-00298-g3c7cbb9	3.13	GPLv2	https://github.com/altera-opensource/linux-socfpga
kernel-image-3.13.0-00298-g3c7cbb9	3.13	GPLv2	https://github.com/altera-opensource/linux-socfpga
kernel-module-ansi-cprng	3.13	GPLv2	https://www.kernel.org/
kernel-module-g-mass-storage	3.13	GPLv2	https://www.kernel.org/
kernel-module-gpio-altera	3.13	GPLv2	https://www.kernel.org/
kernel-module-krng	3.13	GPLv2	https://www.kernel.org/
kernel-module-libcomposite	3.13	GPLv2	https://www.kernel.org/
kernel-module-rng	3.13	GPLv2	https://www.kernel.org/
kernel-module-rng-core	3.13	GPLv2	https://www.kernel.org/
kernel-module-usb-f-mass-storage	3.13	GPLv2	https://www.kernel.org/
kernel-modules	3.13	GPLv2	https://www.kernel.org/
kernel-vmlinux	3.13	GPLv2	https://www.kernel.org/

Package	Version	Licence	URL
kmod	9	GPL-2.0+ LGPL-2.1+	https://www.kernel.org/
libblkid1	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://packages.debian.org/search?keywords=libblkid1
libbz2-0	1.0.6	bzip2	https://packages.debian.org/search?keywords=libbz2-1.0
libc6	2.18-r2013.10.2	MIT	https://packages.debian.org/wheezy/libc6
libc6-dbg	2.18-r2013.10.2	MIT	https://packages.debian.org/wheezy/libc6-dbg
libcom-err2	1.42.1	GPLv2 LGPLv2 BSD MIT	https://packages.debian.org/wheezy/libcomerr2
libcrypto1.0.0	1.0.0j	openssl	https://packages.debian.org/wheezy/libcrypto1.0.0-udeb
libe2p2	1.42.1	GPLv2 LGPLv2 BSD MIT	https://packages.debian.org/wheezy/libe2p2
libexpat1	2.1.0	MIT	http://e2fsprogs.sourceforge.net/
libext2fs2	1.42.1	GPLv2 LGPLv2 BSD MIT	http://e2fsprogs.sourceforge.net/
libgcc-s1	2013.03	MIT	http://www.gnu.org/software/gcc/
libkmod2	9	LGPL-2.1+	https://packages.debian.org/wheezy/libkmod2
liblzo2-2	2.06	GPLv2+	https://packages.debian.org/wheezy/liblzo2-2
libncurses5	5.9	MIT	https://packages.debian.org/wheezy/libncurses5
libncursesw5	5.9	MIT	https://packages.debian.org/wheezy/libncursesw5
libpci3	3.1.10	GPLv2+	https://packages.debian.org/wheezy/libpci3
libpcre	8.31	BSD	https://packages.debian.org/wheezy/libpcre++-dev
libpcreposix0	8.31	BSD	https://packages.debian.org/wheezy/libpcrecpp0
libperl5	5.14.2	Artistic-1.0 GPL-1.0	https://packages.debian.org/wheezy/libperl5.14
libpopt0	1.16	MIT	https://packages.debian.org/wheezy/libpopt0
libreadline6	6.2	GPLv3+	https://packages.debian.org/wheezy/libreadline6
libss2	1.42.1	GPLv2 LGPLv2 BSD MIT	https://packages.debian.org/wheezy/libss2
libssl1.0.0	1.0.0j	openssl	https://packages.debian.org/wheezy/libssl1.0.0
libstdc++6	2013.03	MIT	https://packages.debian.org/wheezy/libstdc++6
libsysfs2	2.1.0	LGPLv2.1	https://packages.debian.org/wheezy/libsysfs2
libthread-db1	2013.03	MIT	http://git.savannah.gnu.org/cgit/hurd/libpthread.git/
libtinfo5	5.9	MIT	https://packages.debian.org/wheezy/libtinfo5
libusb-1.0-0	1.0.8	LGPLv2.1+	https://packages.debian.org/wheezy/libusb-1.0-0
libuuid1	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://packages.debian.org/wheezy/libuuid1
libwrap0	7.6	BSD	https://packages.debian.org/wheezy/libwrap0
libz1	1.2.8-r0.2	Zlib	zlib.net/
libz-dbg	1.2.8-r0.2	Zlib	zlib.net/
lighttpd	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-access	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-accesslog	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-cgi	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-dirlisting	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-indexfile	1.4.31	BSD	https://www.lighttpd.net/
lighttpd-module-staticfile	1.4.31	BSD	https://www.lighttpd.net/

Package	Version	Licence	URL
m4	1.4.16	GPLv3	http://www.gnu.org/software/m4/m4.html
make	3.82	GPLv3 LGPLv2	https://www.gnu.org/software/make/
minicom	2.6.1	GPLv2+	https://packages.debian.org/wheezy/comm/minicom
mtt-utils	1.5.0	GPLv2+	https://packages.debian.org/wheezy/mtt-utils
ncurses-terminfo-base	5.9	MIT	http://www.gnu.org/software/ncurses/
net-tools	1.60-23	GPLv2+	https://packages.debian.org/wheezy/net-tools
netbase	5	GPLv2	https://packages.debian.org/wheezy/netbase
openssh	6.0p1	BSD	http://www.openssh.com/
openssh-keygen	6.0p1	BSD	http://www.openssh.com/
openssh-scp	6.0p1	BSD	http://www.openssh.com/
openssh-sftp-server	6.0p1	BSD	http://www.openssh.com/
openssh-ssh	6.0p1	BSD	http://www.openssh.com/
openssh-sshd	6.0p1	BSD	http://www.openssh.com/
openssl	1.0.0j	openssl	https://www.openssl.org
oprofile	0.9.7	LGPLv2.1+ GPLv2	http://oprofile.sourceforge.net/news/
pciutils	3.1.10	GPLv2+	https://github.com/gittup/pciutils
pciutils-ids	3.1.10	GPLv2+	https://github.com/gittup/pciutils
perl	5.14.2	Artistic-1.0 GPL-1.0	www.perl.org
pio-interrupt-altera	0.1	GPL-2.0	git://git.rocketboards.org/linux-refdesigns.git
portmap	6	BSD	https://packages.debian.org/wheezy/rpcbind
sed	4.2.1	GPLv3+	https://www.gnu.org/software/sed/manual/sed.html
setserial	2.17	GPLv2.0	https://packages.debian.org/wheezy/setserial
shadow	4.1.4.3	BSD Artistic-1.0	http://downloads.isee.biz/pub/denzil-build/tmp/work/igep00x0-poky-linux-gnueabi/shadow-securetty-4.1.4.3-r1/packages-split/shadow-securetty/
shadow-securetty	4.1.4.3	MIT	http://downloads.isee.biz/pub/denzil-build/tmp/work/igep00x0-poky-linux-gnueabi/shadow-securetty-4.1.4.3-r1/packages-split/shadow-securetty-dev/
strace	4.7	BSD	https://packages.debian.org/wheezy/strace
sysfsutils	2.1.0	GPLv2	https://packages.debian.org/wheezy/sysfsutils
sysvinit	2.88dsf	GPLv2+	http://savannah.nongnu.org/projects/sysvinit
sysvinit-inittab	2.88dsf	GPLv2	http://savannah.nongnu.org/projects/sysvinit
sysvinit-pidof	2.88dsf	GPLv2+	http://savannah.nongnu.org/projects/sysvinit
tinylogin	1.4	GPLv2	http://tinylogin.burysbox.net/
update-modules	1	GPLv2	https://www.kernel.org/pub/linux/utils/kernel/modutils/
update-rc.d	0.7	GPLv2+	https://packages.debian.org/wheezy/sysv-rc
usbutils	6	GPLv2+	https://packages.debian.org/wheezy/usbutils
usbutils-ids	6	GPLv2+	https://packages.debian.org/wheezy/usbutils
util-linux	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://packages.debian.org/wheezy/util-linux
util-linux-cfdisk	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://github.com/karelzak/util-linux
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util-linux-mkfs	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://github.com/karelzak/util-linux

Package	Version	Licence	URL
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util-linux-sfdisk	2.21.2	GPLv2+ LGPLv2.1+ BSD	https://github.com/karelzak/util-linux
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wget	1.14	GPLv3	https://www.gnu.org/software/wget/
poky	6.0.1	GPLv2/MIT	http://www.pokylinux.org/getit/
cracklib-dbg	2.9.0-r0.2	LGPL2.1	https://packages.debian.org/sid/libpam-cracklib-dbgsym
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F.1.6 jQuery JavaScript Library v2.1.4

Includes Sizzle.js

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F.1.7 YAML-cpp 0.5.2

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F.1.8 Pyyaml 3.1.1

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F.1.9 Bootstrap 3.3.5

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F.1.10 chart.js 1.0.2

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F.1.11 Futures 3.0.3

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F.1.12 jquery-cookie 1.4.1

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Definitions

Term	Definition
6G®	Sonardyne's sixth generation technology hardware platform
6G Terminal Lite	Sonardyne Diagnostic Tool for 6G Instruments.
AAINS	Acoustically Aided Navigation System.
Acoustic Signal	Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length.
Acoustic Transducer	A device that converts electrical signals into acoustic signals and vice versa.
ADCP	Acoustic Doppler Current Profiler
AHRS	Attitude and Heading Reference System. An inertial sensor that provides outputs of heading, pitch and roll.
DVL	Doppler Velocity Log. Uses acoustic measurements to capture bottom tracking velocity measurements and can be used to calculate distance travelled.
DVL Manager	Embedded DVL Manager software
Heading, Roll and Pitch (HRP)	Is a compensated vessel frame. This is a frame sharing the same origin as the vessel frame but with the z axis vertical and the y axis parallel with a meridian passing through the origin (points true north).
Inertial Navigation System (INS)	A navigation aid that uses a PC, motion sensors and rotation sensors to continuously calculate the position, orientation and velocity of moving object without the need for external references.
IP	Internet Protocol
Janus	A formation of array whereby 4 beams are directed 45 degrees rotated from Fwd, Stbd, Aft and Port. Commonly used in DVL devices to provide 3 dimensional velocity data.
PCB	Printed Circuit Board
ROV	A remotely operated vehicle controlled and powered by a cable connection so it can travel between the sea surface and seabed.
RTC	Real Time Clock
Scatterers	Particles within the water column which reflect the acoustic transmissions from the Syrinx DVL
Sonardyne	Sonardyne International Limited and its affiliates.
Sonardyne Wideband®2	6G® transponders and transceivers use Sonardyne Wideband® 2 which has ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deep-water
Sonardyne Wideband®3	Telemetry protocol available with 6G "+" devices that enables sensor data to be embedded in navigation range replies
SPRINT	Subsea Precision Reference Inertial Navigation Technology. An Acoustically aided inertial navigation system for subsea vehicles. The system extends the operating limits of USBL and improves the operational efficiency of LBL by using sparse arrays.
UTC	Universal Time Co-ordinate. The primary time standard by which the world regulates clocks and time. Closely related successor to Greenwich Mean Time (GMT).
UID	Unique ID Number. Each product contains a unique 24 bit address electronically coded into the software. It is denoted by 6 hexadecimal characters.

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