SVP 70
Sound Velocity Probe

OPERATOR'S MANUAL

Part Number 904-63-0802-00 (904-63-0833-00)
Firmware Version 20110131092506

Version 10

February 2024

Teledyne Confidential; Commercially Sensitive Business Data

Use and Disclosure of Data

EU Uncontrolled Technology:

Information contained herein is uncontrolled under the EU-regulation no. 821 of 20 May 2021. However, export, reexport or diversion contrary to law is prohibited.

Copyright Teledyne RESON A/S 2003-2024

Copyright Statement	All rights reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, as per the copyright laws of Denmark.
	SVP 70 Operator's Manual written by:
	Teledyne RESON A/S Fabriksvangen 35 3550 Slangerup Telephone: +45 47 38 00 22 Facsimile: +45 47 38 00 66
	Web: http://www.teledynemarine.com/reson E-mail: reson-support@teledyne.com
Notice	The information contained in this document is subject to change without notice. Teledyne RESON makes no warranty of any kind with regard to this material, including (but not limited to) the implied warranties of merchant liability and fitness for a particular purpose. Teledyne RESON shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.
Copyright Release	No part of this manual may be copied or distributed, transmitted, transcribed, stored in a retrieval system, or translated into any human or machine readable language, in any form or by any means for disclosure to third parties without the express written consent of Teledyne RESON A/S.
Version	February 2024 Version 10
	Teledyne RESON strives to maintain up-to-date information and may, as necessary, review and revise this manual. If the information contained in this manual is unclear, please contact your nearest Teledyne RESON office for clarification.
Firmware Version	**20110131**092506
	This manual is consistent with the firmware version released on the indicated date. Format: YYYYMMDDxxxxxx.
Electronic File Version	This manual is available from Teledyne RESON in the Adobe® Acrobat® Portable Document Format (PDF). The selected PDF process preserves the interactive index and cross-reference features of the original Microsoft Word document.

PREFACE – ABOUT THIS MANUAL

This manual is designed to give detailed procedures for the correct installation, operation, and maintenance of the SVP 70 and is equally useful for both the first time user and the experienced technician.

Read this manual thoroughly and follow the steps provided to maintain optimal safety standards and to obtain the best system performance.

If you require additional information or need clarification of any part of this document, please contact Teledyne RESON Customer Support for assistance at reson-support@teledyne.com.

Document Conventions

The following information will make it easier for the reader to interpret the document content.

Convention	Definition
Hyperlink	Indicates a cross-reference to click to reach the specified item.
Numbered list	Indicates stepwise instructions to be followed in a particular order.
Bulleted list	Indicates items of a list without any particular order.

Notes, Cautions, and Warnings

Notes, Cautions, and Warnings are included to provide valuable information and to help the operator prevent damage to the SVP or to personnel. These are the formats:

NOTE
Note boxes provide explanatory information that may be useful to the operator, but is not necessarily vital to the operation of your Teledyne RESON system.

CAUTION
Caution boxes provide important information regarding your Teledyne RESON system. Disregarding Cautions may result in accidental misuse or damage to the system.

WARNING!
Warning boxes provide important information regarding your Teledyne RESON system. Disregarding Warnings may prove harmful to personnel working with or near the system.

Conversion of Units of Measurement

Metric Conversion

All measurements in this manual are referenced in metric terms.

Use this reference table to convert between metric (e.g. cm, m, and km) and imperial (e.g. in, ft, and yd) measurements.

Metric Unit	Imperial Unit
Millimeter (mm)	0.0394in
Centimeter (cm)	0.3937in
Meter (m)	1.0936yd
Kilometer (km)	0.6214mi
Kilogram (kg)	2.2046lb

Temperature Conversion

All temperatures in this manual are referenced in degrees Celsius.

This is the formula for converting Celsius (°C) to Fahrenheit (°F).

Formula: °F = 1.8 x °C + 32
Example:
If Temperature = 30°C, then:
°F = 1.8 x 30° + 32
°F = 86°

Glossary of Terms

Entry	Definition
7k	SeaBat 7000 series of multibeam sonars
AUV	Autonomous Underwater Vehicle
DWG	Drawing
FPGA	field-programmable gate array, a semiconductor device whose functionality can be reconfigured after manufacturing
GND	ground
LED	light-emitting diode
MBES	multibeam echosounder
N/A	not available or not applicable
pcs.	pieces
PN	Part Number
RMA	Return Material Authorization
ROV	Remotely Operated Vehicle
Rx (or R)	receiver
SB	SeaBat
SOS	speed of sound
SV	surface vessel
SVP	Sound Velocity Probe
TBD	To Be Defined
Tx (or T)	transmitter
UUV	Unmanned Underwater Vehicle
WEEE	Waste Electrical and Electronic Equipment Directive

TABLE OF CONTENTS

1 Introduction 1
2 Safety Precautions 2
2.1 Operator Safety 2
2.2 Equipment Safety 2
2.2.1 Safe Handling 2
2.2.2 Cleaning and Maintenance 3
2.3 Corrosion Avoidance 3
2.4 Electrical Isolation 4
2.5 Safe Disposal of Waste (WEEE Directive) 4
2.6 CE Marking 5
3 Getting Started 6
3.1 Unpack the SVP 70 6
3.2 Set Up a PC and Power Supply 6
3.3 Connect the Units 6
3.3.1 Testing with Standard PC 6
3.3.2 Testing with SeaBat T/F-Series Surface Vessel Systems 7
3.4 Start the PC Program 7
3.5 Start the Probe 9
3.6 Change Communications Parameters (Com and Baud Rate) 9
4 Operation 11
4.1 Configuration Mode 11
4.1.1 Enter Configuration Mode 11
4.1.2 Configuration Menu Options 11
4.2 Operation Modes (Output Setup) 13
4.2.1 Mode 2 AML Output 13
4.2.2 Mode 3 Valeport Output 13
4.2.3 Mode 4 RESON Output 13
4.2.4 Mode 5 SVP 70 Mode 14
4.2.5 Mode 6 NMEA Output Mode 19
5 SVP Principles 20
5.1 SVP 70 Output 20
5.2 SVP Applications 20
5.2.1 Multibeam Correction 20
5.2.2 Echosounder Correction 21
5.2.3 Positioning System Correction 21
6 Installation 22
6.1 Mechanical Installation 22
6.1.1 Sound Path 23
6.1.2 Fixing Bolts Before Mounting 23
6.1.3 Placement of SVP 70 23
6.1.4 Cable Installation 24
6.2 Electrical Installation 24
6.2.1 Power Source 24
6.2.1 Serial Interface 25
6.3 Integration with SeaBat T/F-Series Multibeam Echosounders 26
6.3.1 Connector SVP 70 27
6.3.2 Cable Converter 28
6.3.3 Recommended RS-232 Cable 28
6.3.4 Recommended High Grade RS-422 Cable 28

Teledyne Confidential; Commercially Sensitive Business Data

Uncontrolled Technology Subject to Restrictions Contained on the Cover Page.

7 Troubleshooting 29
Appendix A Technical Specifications 30
A.1 SVP 70 Specifications 30
A.2 SVP 70 Data Formats 31
Appendix B Additional Cable Options 32
B.1 Standard Test Cable for SVP 70 32
Appendix C Drawings 33
C.1 SVP 70 Dimensions 34
C.2 SVP 70 Test Cable 35
C.3 SVP 70 Cable to Pigtail 36
C.4 SVP 70 Cable for SeaBat T/F-Series Surface Vessel MBES 37
C.5 Cable Converter for Use with Fischer Terminated Installation Cables 38
C.6 SVP 70 Cable for SeaBat Subsea Sonar Processor 39
Appendix D SVP 70 Scope of Supply 40
Appendix E Standard Warranty Information 41
E.1 Limited Warranty 41
E.2 Warranty Exclusions 41
E.3 Warranty Disclaimer 41
E.4 Servicing During Warranty Period 41
E.5 Equipment Return Procedure 42
E.6 Teledyne RESON Support 42

LIST OF FIGURES

Figure 1: Change of Com Port and Baud Rate, CONFIG Menu 10
Figure 2: CONFIG Menu 11
Figure 3: Mode 4 RESON Output Format 14
Figure 4: Output Configuration 15
Figure 5: User Menu 16
Figure 6: Pole Mounting 22
Figure 7: Example of SVP Installation 22
Figure 8: Sound Path of SVP 23
Figure 9: O-Rings Retain Mounting Bolts 23
Figure 10: Water Flow 23
Figure 11: Pinout of Fischer Connector at Processor Unit 26
Figure 12: SVP 70 Dimensions 34
Figure 13: SVP 70 Test Cable 35
Figure 14: SVP 70 Cable to Pigtail 36
Figure 15: SVP 70 Cable for SeaBat T/F-Series Surface Vessel MBES 37
Figure 16: Cable Converter for Use with Fischer Terminated Installation Cables 38
Figure 17: SVP 70 Cable for SeaBat Subsea Sonar Processor 39

LIST OF TABLES

Table 1: Special Character Entry 15
Table 2: Interface Guidelines 25
Table 3: Suggested Max. Baud Rates for RS-232 Interface 25
Table 4: SVP 70 Underwater Connector and Standard Underwater Cable 27
Table 5: DB9 Connections on SVP 70 Cable Converter for T/F-Series System 28
Table 6: DB9 Connections on SVP 70 Test Cable 32
Table 7: SVP 70 Drawings 33
Table 8: SVP 70 Scope of Supply 40

1 INTRODUCTION

This manual covers the SVP 70 sound velocity probe:

- Its robust titanium design eases cleaning in environments with considerable marine growth, which is crucial for permanent installations. The wet mate connector is also constructed from titanium, ensuring the highest possible resistance to corrosion.

For more details, see *Appendix A Technical Specifications.*

The SVP 70 probe is a direct reading sound velocity probe for professional applications. It employs state of the art correlation techniques in an FPGA implementation for finding the speed of sound in the medium with the highest accuracy.

The probe has a very compact design without sacrificing the length of the signal path, which is of utmost importance in returning accurate results. On an overall length of 160mm the sound transmission path is 125mm.

The innovative design of the SVP allows for simpler integration with less disturbances of the water flow, yielding a low emission of noise into nearby sensors like echosounder, sonar systems, Doppler logs etc. Ping synchronization allows for low integration risk.

The electrical interface includes wide input power (9 to 55V, approx. 2W) and dual serial interfaces according to RS-232 and RS-422 (full standard voltage swings, >500m range). There is no galvanic connection between the power input and the serial output.

Measurements can run at a user specified sampling frequency or can be synchronized to an external trigger to ensure no acoustic interference problems, which would otherwise be present.

Selectable processing includes outlier removal and low pass filtering for use when the unfiltered measurements are not adequate.

Teledyne Confidential; Commercially Sensitive Business Data

Uncontrolled Technology Subject to Restrictions Contained on the Cover Page.

2 SAFETY PRECAUTIONS

CAUTION
Use of the equipment in a manner not specified by the manufacturer may affect warranty situation (see *Appendix E Standard Warranty Information*).

2.1 Operator Safety

The sound velocity probe should be handled with attention to operator safety. General precautions include:

- **DO NOT** connect or disconnect cables with the power on.
- **DO NOT** attempt to open and service the SVP.

2.2 Equipment Safety

Each SVP 70 component is sufficiently robust for shipboard storage while in its own transit case or shipping box.

2.2.1 Safe Handling

To ensure safe handling of the equipment:

- Inspect each transit case or shipping box for physical damage prior to opening, and each component for physical damage before installation.
- Use original shipping boxes to provide adequate packaging and shock absorption when shipping or storing the equipment.
- Do not drop the equipment.
- Ensure that the equipment is properly secured before putting out to sea.
- Do not exceed operating and storage temperature limits.
- Use dummy plugs to protect connectors when no cables are attached.
- Do not leave the probe at voltages in the range 6 to 9V for extended periods of time, as this may cause permanent damage to the device.
- Treat cables with care:
    - Maintain the appropriate bend radius.
    - Do not pull on cables.
    - Lubricate connectors to decrease the required mating force.

2.2.2 Cleaning and Maintenance

2.2.2.1 Protection and Care

The following recommendations are made to protect the SVP while in use or storage.

- Sand or water in the female connector should be removed with fresh water.
- Rinse the SVP with fresh water after every use.

CAUTION
The acoustic window molded over the front of the transducer is made of potting compounds that may be damaged by a long range of chemicals, which include, but are not limited to: • Acids • Automotive brake fluid • Base • Grease • Halogenated hydrocarbons (carbon tetrachloride, trichloroethylene) • Hydraulic fluids • Ketones (MEK, acetone) • Nitro hydrocarbons (nitrobenzene, aniline) • Oil • Ozone • Petrol • Phosphate ester

2.2.2.2 Wet-End Connectors

Use the wet connector lubrication kit (PN 1007252) to protect the wet-end connectors. Follow these guidelines:

- Lubricate female connectors and dummy plugs with a silicone oil or equivalent (silicone oil based). Observe the instructions provided with the lubrication kit
- Lubrication intervals depend on mission type and frequency.
    - Lubricate every 5 matings.
    - Lubricate at regular intervals, even if the connectors are not mated/unmated, in particular for UUVs where the dive tends to rub and wash out the lubricant.
    - Lubricate twice a year when equipment is in storage.
- DO NOT grease mating surface.
- Avoid nicks and cuts around contacts, as these are the sealing surfaces.
- Elastomers can be seriously degraded if exposed to direct sunlight or high ozone levels for extended periods of time.
- Do not overtighten bulkhead nuts.
- Grip main body of connector during mating or unmating. Do not pull on cable to disconnect.
- Avoid sharp bends at cable entry to connector.

2.3 Corrosion Avoidance

All metal parts of the SeaBat™ exposed to seawater are made of corrosion-resistant alloys. This is to ensure long operational life of the system. Combining these noble and corrosion-resistant metals with less noble metals in a saline environment will cause a cathodic reaction.

We therefore recommend electrical isolation between the probe and mounting structure.

CAUTION
Do not use sacrificial anodes on a SeaBat™ bracket. Sacrificial anodes lead to unwanted cathodic reaction and does not offer electrical isolation.
CAUTION
Damaged cables must be replaced (and not repaired). Otherwise the result may be corrosion and/or debonding. Noncompliance may affect warranty situation (see *Appendix E Standard Warranty Information*).

2.4 Electrical Isolation

Electrical isolation for titanium components may be achieved by using nonconductive bushings, washers, and isolation plates to insulate them from the mounting brackets. Materials such as FR4, G-10, and G-Etronax EP11 are ideal, as they combine high mechanical strength with a complete electrical isolation. Unreinforced plastic materials such as PVC, Delrin, and polyamide will work from an electrical point of view but offer limited mechanical strength and have a tendency to relax over time causing interfaces to become loose.

NOTE
Contact Teledyne RESON for additional information on schemes for electrical isolation.

2.5 Safe Disposal of Waste (WEEE Directive)

The use of the crossed-out dustbin logo indicates that this product is subject to directive 2012/19/EU, known as the Waste Electrical and Electronic Equipment Directive. The WEEE Directive specifies that used electric/electronic equipment may not be treated as household waste, but must be sorted separately for disposal. These rules concern all your Teledyne RESON products (computer, monitor, transducer, processor, probe, etc.) and all accessories (keyboard, mouse, etc.). By ensuring this product is disposed of correctly, you will help protect the environment.

For detailed information about the recycling of this product, please contact your local authority, your household waste disposal service provider, or Teledyne RESON Customer Support (reson-support@teledyne.com).

2.6 CE Marking

This product carries the CE mark that indicates that it conforms to the essential health, safety, and environmental requirements of the relevant European Directives.

EC DECLARATION OF CONFORMITY

We Teledyne RESON A/S
Fabriksvangen 13
3550 Slangerup
Denmark

in accordance with the following directive(s):

2014/30/EU	Electromagnetic Compatibility (EMC)
2011/65/EU	Restriction of Hazardous Substances in Electrical and Electronic Equipment (ROHS 2)

and in accordance with the following regulation(s):

(EC) 1907/2006	Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

hereby declare that the following equipment:

Teledyne RESON SVP 70

is in conformity with the applicable requirements of the following standards:

REF. NO.	TITLE	EDITION/DATE
EN 60945	Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results.	2002

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all applicable essential requirements of the directives.

Location: Slangerup, Denmark

Date: 15 January 2024

Name: Ole Søe-Pedersen

Position: Vice President & General Manager

CE 24

Document No. CERT25352

Signature:

Teledyne Confidential; Commercially Sensitive Business Data

3 GETTING STARTED

The best way to familiarize yourself with the SVP 70 is to unpack it in the office and connect it to a PC; deploy it in a bucket of water, and get readings into the PC.

Testing of SVP 70 probe prior to installation on vessel will require the following:

- SVP 70 probe
- Installation cable supplied with probe
- SVP 70 conversion cable (for testing with standard PC)
- PC or SeaBat T/F-Series surface vessel unit
- Power supply
- Bucket of water

NOTE
For exhaustive guidance, refer to the following sections: *4 Operation* for configuration and operation modes. *5 SVP Principles* for theories and applications of SVPs. *6 Installation* for mechanical and electrical installation instructions.

3.1 Unpack the SVP 70

Unpack the SVP 70 and make sure all accessories indicated on the packing list are included (see also *Appendix D SVP 70 Scope* of Supply*)*.

3.2 Set Up a PC and Power Supply

In addition to the probe and accessories you will need a PC with a normal serial port connector (Sub-D 9 pin male) and, if not included in the delivery, a power supply or a fully charged 12 or 24V lead-acid battery.

3.3 Connect the Units

3.3.1 Testing with Standard PC

1. Connect the SVP 70 to the installation cable (cable terminated with Fischer connector) or to the SVP 70 test cable.

CAUTION
Be careful not to pull on the cable.

2. Attach the SVP 70 conversion cable (only required when using the Fischer terminated installation cable).
3. Connect the serial port (also called com port) of the PC to the black 9-pin female connector on the conversion cable or test cable.
4. Connect the black wire of the conversion cable to the negative power supply terminal.

5. For a while leave the red wire unconnected.
6. Put the probe into a bucket of water.

For SVP 70 conversion cable connections, see *section 6.3.2 Cable Converter*.

3.3.2 Testing with SeaBat T/F-Series Surface Vessel Systems

1. Connect the SVP 70 to the installation cable.

CAUTION
Be careful not to pull on the cable.

2. Connect the installation cable using the Fischer connector to the SVP port on the rear panel of the sonar processor. Note that the SVP port of the sonar processor will conveniently supply power to the SVP 70 probe.
3. Put the probe into a bucket of water.

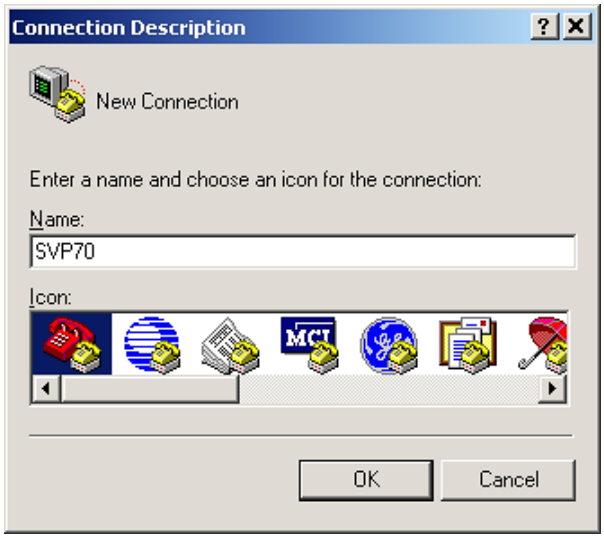
For details on SVP 70 and T/F-Series SV processor cable connections, see the appropriate system Operator's Manual or Quick Reference Guide.

3.4 Start the PC Program

Users familiar with serial communications may prefer to use another program instead of HyperTerminal.

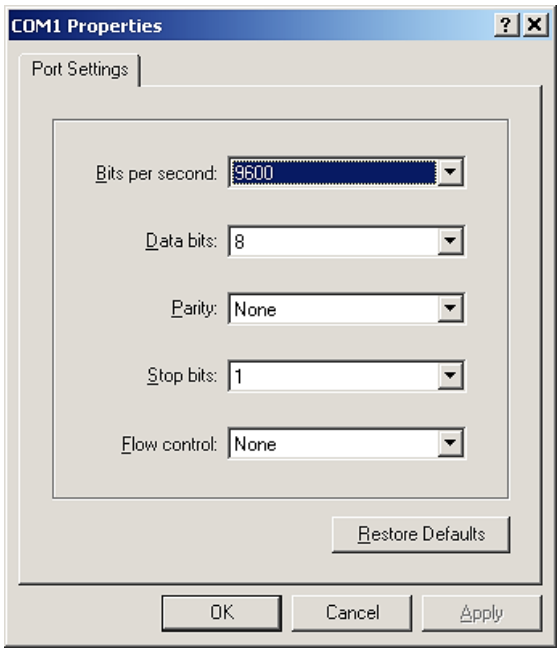
NOTE
Make sure to disable handshake control (use neither hardware nor software handshake).

1. On the PC, click the Start button to select the program HyperTerminal: Start > All Programs > Accessories > Communications > HyperTerminal.
2. In the Connection Description dialog, enter a name (SVP70) and click OK.



3. In the Connect To dialog, select the appropriate port (the one connected to the connector with the cable attached) from the Connect using drop-down menu. This is typically COM1 or COM2 on PCs.

4. In the COM Properties dialog, configure the serial port as shown above and click OK.

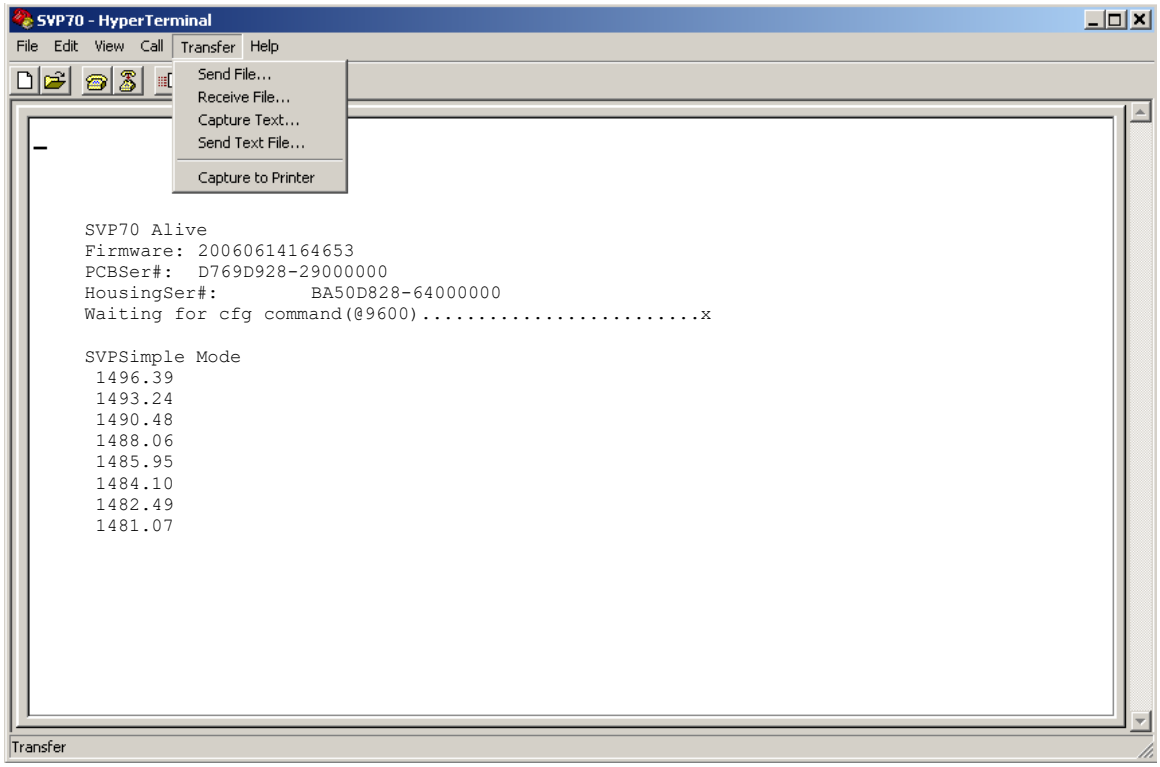


3.5 Start the Probe

1. Now connect the red wire to the positive power supply terminal and switch it on.

   You will now see data from the SVP on the screen.

2. You can save these data to a file using the Transfer menu. (Or for now just let them scroll across the screen.)



NOTE
In the event that no sound velocity data appears on the screen, try another port. In the event that odd characters appear on the screen, try different baud rate settings in HyperTerminal. In the event that sound speed readings show 1350m/s it is likely that air bubbles are trapped on the black transducer surface. Wipe it with a finger.

3.6 Change Communications Parameters (Com and Baud Rate)

On startup the probe will listen for approximately 5 seconds for the configuration command. During this time it is possible to enter the configuration menu by typing CON; (four characters).

The probe will enter configuration mode and show the CONFIG menu (see *Figure 1*).

```
SVP70 Alive
Firmware:       20060614164653
PCBSer#:        BBA6F428-1A000000
HousingSer#:    BAC74628-20000000
Waiting for cfg command(@9600).............x

*CONFIG*
E Save
e Don't Save
B Boot
a ShowAliveMsg:     1
o OpMode:    5
c ComRxDisable:     0
b Baud Rate  9600
s SerChan     0
u UserMenuCmdChar: M
t PingOnceTriggerCmd: T
****
```

Figure 1: Change of Com Port and Baud Rate, CONFIG Menu

NOTE
The CONFIG menu is only available on RS-232 at 9600,n,8,1.

With the CONFIG menu it is possible to change the hardware setup of the probe.

- **s** = To change the com port from RS-232 to RS-422 press s.
  The menu item SerChan will change to 1.
  - **0** = RS-232 for operation mode communications.
  - **1** = RS-422 for operation mode communications.
- **b** = To change the communications baud rate for operation mode press b. A prompt will appear showing the allowable range.

```
Enter Baud Rate: in range[  110:115200] Current
Setting: 9600
```

  - Select a setting and press Enter.
    The menu item Baud Rate will change to the entered value.

NOTE
The settings you have changed will only take effect when you press Shift-e to save. Once this is done the text `Config saved` will appear and the CONFIG menu will echo the new settings. To discard changes made in the CONFIG menu, press e.

To exit configuration mode you must restart the probe by cycling the power or selecting the option Boot (Shift-b) in the CONFIG menu. Approximately 5 seconds after startup the operation mode will automatically be entered.

For details on the configuration mode, see *section 4.1 Configuration Mode.*

NOTE
You will always be able to get in contact with the probe on startup on RS-232 at 9600,n,8,1.

4 OPERATION

The probe has two main modes:

- **Configuration mode:** This mode can be entered just after starting the probe and is normally exited after saving parameters
- **Operation mode:** This mode is entered upon startup if the special configuration key strokes are not entered within a few seconds after power up. Additional settings are available in this mode.

It is not possible to switch directly between these modes later.

4.1 Configuration Mode

4.1.1 Enter Configuration Mode

No special software is needed, but CRT from www.vandyke.com is a good alternative to Windows® HyperTerminal for control and logging of data. Connect the probe, start your terminal program (e.g. HyperTerminal) as described in *section 3.4 Start the PC Program.*

The probe starts, optionally by transmitting a sign-on message (see *section 4.1.2 below*), and listens at RS-232 9600,n,8,1.

To enter configuration mode press CON; (4 characters). If this command is not sent to the probe within 5 seconds of startup, it automatically resumes its previous operation mode, which may use another port/baud rate for input/output!

Press the ESC key on the keyboard to start operation mode directly after startup without delay.

The CONFIG menu is shown below:

```
*CONFIG*
E Save
e Don't Save
B Boot
a ShowAliveMsg:     1
o OpMode:    5
c ComRxDisable:     0
b Baud Rate  9600
s SerChan     0
u UserMenuCmdChar: M
t PingOnceTriggerCmd: T
****
```

Figure 2: CONFIG Menu

4.1.2 Configuration Menu Options

Each menu option is prefixed by a control character, always a letter. Each character denotes the key to press on the keyboard to access the option or send a command, e.g.:

- **o** > press o (for lowercase o)
- **O** > press Shift-o (for uppercase O)

Save
Press Shift-e to save all changes. Changes will not take effect, if you exit without using this command.

Don't Save
Press e to discard all changes.

Reboot Probe (Boot)
Press Shift-b to reboot the probe. This has the same result as restarting the probe by turning the power off and on again. This option is intended to help configuration of the probe before its first use.

Sign-On Message (ShowAliveMsg)
Press a to set the probe sign-on message. The sign-on message is displayed after startup and helps identify the probe and validate a proper connection to the software.

- **0** = Sign-on message will not be shown.
- **1** = Sign-on message will be shown.

If the probe is used with survey software that does not accept the sign-on message, set the sign-on message to 0.

Operation Mode (OpMode)
Press o[1] to set the operation mode. This option selects the operation mode that will be run automatically on startup.

- **0** = Configuration mode.
- **1** = Configuration mode (same as 0).
- **2** = Emulates AML Smart Probe output format (see *section 4.2.1 below*).
- **3** = Emulates Valeport Probe standard output format (see *section 4.2.2 below*).
- **4** = Emulates old RESON standard output format (see *section 4.2.3 below*).
- **5** = SVP 7x mode (see *section 4.2.4 below*).
- **6** = NMEA output format (see *section 4.2.5 below*).

Com Port Receive Disable (ComRxDisable)
Press c to set the receiver communications port. Activating this option disables all software handling of the receiver part of the serial communication. This is useful in setups where the probe is connected to a communication channel with lots of irrelevant data on it, which causes some instruments to freeze.

- **0** = Disable function not activated.
- **1** = Disable function activated.

The serial channel Rx can be re-enabled by cycling power off and back on and entering the CONFIG menu, or by sending the special command sequence "wakeup314159265" to the probe on the active communication port.

Baud Rate
Press b to set the communications baud rate for operation mode. A prompt will appear showing the allowable range.

```
Enter Baud Rate: in range[  110:115200] Current Setting: 9600
```

[1] Note that o is the letter character (and not zero) on the keyboard.

Select a setting (non-standard values are allowed) and press Enter. The entered value will appear in the Baud Rate setting.

Press Enter without entering a value, if you want to keep the old setting.

If you select a setting that is too big or too small the value will be set to the respective maximum or minimum value and a warning text will be shown.

NOTE
If you make a mistake and enter a value that you later forget, you can always get in contact with the probe during startup at baud 9600 on the RS-232 port.

Serial Port (SerChan)
Press s to set the serial channel to be used for operation mode.

- **0** = RS-232 will be used.
- **1** = RS-422 will be used.

Character To Activate User Menu (UserMenuCmdChar)
Press u to select the character that accesses the User Menu in operation mode.

Character To Trigger Measurement (PingOnceTriggerCmd)
Press t to select the character that triggers one reading when the probe is in the externally triggered mode, i.e. when Sample Period is set to zero in the User Menu.

4.2 Operation Modes (Output Setup)

4.2.1 Mode 2 AML Output

In AML output mode, the probe generates data in the format:

<SPACE>SOS in m/s with 2 decimals<SPACE><CR><LF>

Example: `1543.39`

The probe does not respond to any commands and has a fixed output repetition rate of 10Hz.

4.2.2 Mode 3 Valeport Output

In Valeport output mode, the probe generates data in the format:

<SPACE><SOS in millimeters><CR><LF>

Example: `1543390`

The probe does not respond to any commands and has a fixed output repetition rate of 10Hz.

4.2.3 Mode 4 RESON Output

In RESON output mode, the probe generates data in the format used by all Teledyne RESON's Sound Velocity Probe products:

<SOS><Pressure><Temperature><Bat Voltage><Memory Count><CR><LF>

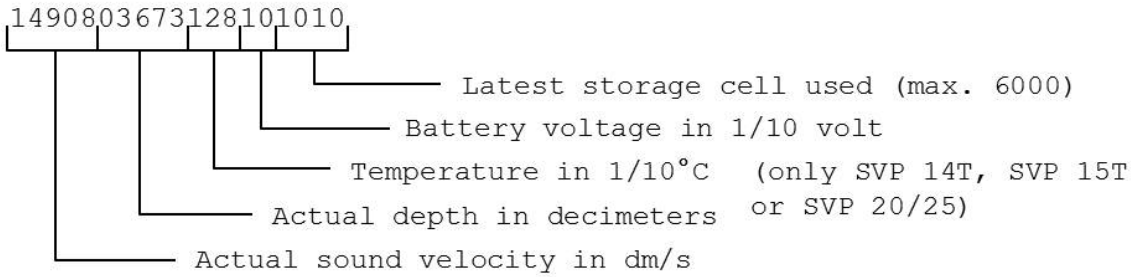


Figure 3: Mode 4 RESON Output Format

- Pressure depth in decimeters
- Temperature in Celsius with one decimal

NOTE! Battery voltage = 10V always

NOTE! Memory count = 1010 always

Example: 0343300000277101010

NOTE
The SVP does not have a dedicated survey grade pressure sensor, so pressure readings should therefore not be used when an accurate reference is required.

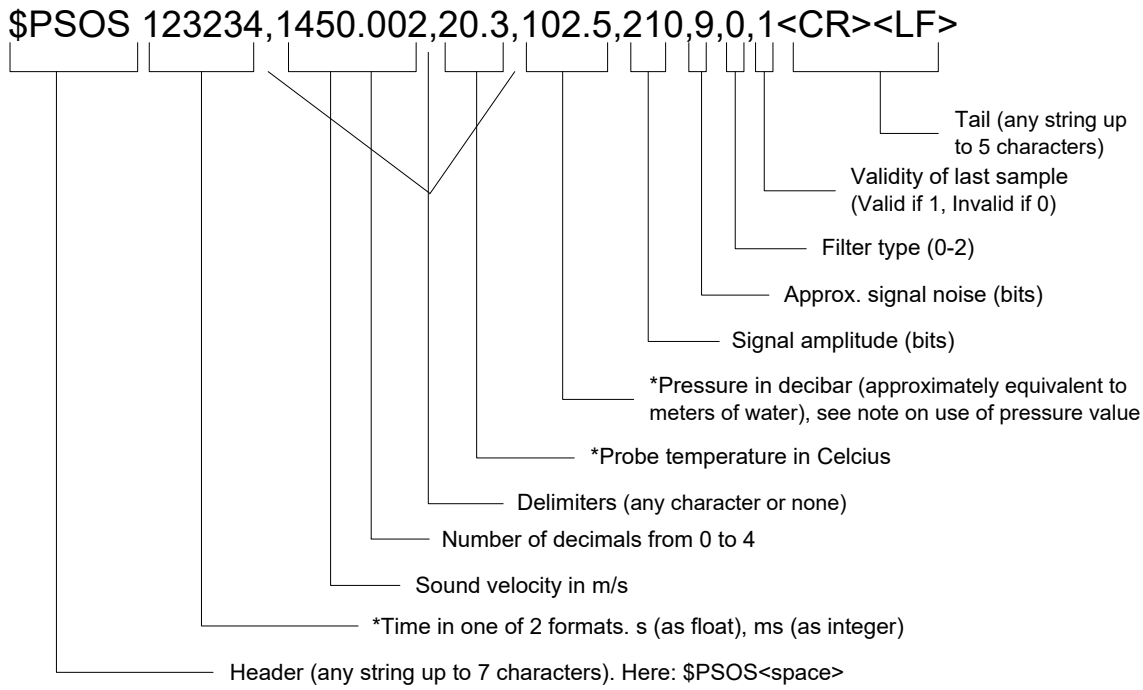
The probe does not respond to any commands and has a fixed output repetition rate of 10Hz.

4.2.4 Mode 5 SVP 70 Mode

SVP 70 mode gives the operator detailed control of all operation parameters, including the format of the output data, configurable in the User Menu (see *section 0 below*).

4.2.4.1 Output Configuration

By turning on and off the various fields it is possible to construct almost any desirable output format.



Use \n to enter <LF>, \t to enter TAB, \r to enter CR, \0 to enter no character.
"*" designates optional outputs

Figure 4: Output Configuration

NOTE
It is not possible to change the order of the fields.

Special character entry
The user may want to enter special characters easily confused with control characters (access or command characters prefixing various menu options). Refer to *Table 1* to enter special characters[2]:

Table 1: Special Character Entry

To enter	Press[3]	Meaning	Character (ASCII decimal)
<CR>	\r	The carriage return character	
<LF>	\n	New line (line feed)	
<TAB>	\t or <TAB> key	Tabulator	
<SPACE>	<SPACE> key	Space character	
NULL	\0	No character	#00

4.2.4.2 User Menu Options

When the probe is running (in OpMode 5) it is possible to enter the User Menu by pressing Shift-m (the access character is configurable in the CONFIG menu, see *section 4.1.2 above*). The options in this menu control the output configuration of the probe in operation mode (see *Figure 4*). All changes made will be displayed in the menu.

[2] Users familiar with the C programming language will find this familiar.
[3] Special characters \r and \n display “as they are” and thus may distort the menu display slightly.

```
**SIMPLE MENU**
M Menu
E Save and Exit
e Exit no saving
b Baud Rate 9600
H Header $SVP
T Tail ;

D Delimiter
W Data width    3
S SOS digits    3
F Filter 0
I Time 0
r RawData    0
s Sample Period 1000
--Print flags:--
p Pres    1
t Temp    1
a Amp    1
n Noise    1
f Print Filter    1
v DataValid    1
d All delims    1
```

Figure 5: User Menu

Save and Exit
Press Shift-e to save all changes and exit the menu. Changes only take effect once the menu is exited.

Exit no saving
Press e to discard all changes and exit the menu.

Baud Rate
Press b to set the communications baud rate for operation mode. A prompt will appear showing the allowable range.

```
Enter Baud Rate: in range[  110:115200] Current Setting: 9600
```

Select a setting and press Enter. The entered value will appear in the Baud Rate setting. Press Enter without entering a value, if you want to keep the old setting.

If you select a setting that is too big or small the value will be set to the respective maximum or minimum value and a warning text will be shown.

Header
Press Shift-e to define the header. The header is a combination of any 7 characters, excluding the null character. Press Enter to terminate. The header is displayed in the menu exactly as entered. The appearance in the menu will be “confusing” if <CR> is used, as it will overwrite previous key strokes.

Examples:
```
something
$PSVP,
$PSVP <TAB>
```

Tail
Press Shift-t to define the tail. The tail is entered as the header. Ensure that the use of <CR> and <LF> is in accordance with the receiving program. Some programs convert, skip, or insert extra <CR> and <LF> characters, which lead to wrong appearance. The tail may include the <TAB> character.

Delimiter
Press Shift-d to set the delimiter character. The delimiter is inserted between all the fields in the output string, except after the header[4] and in front of the tail. For easiest copy/pasting into Excel use the <TAB> character as delimiter.

Data width
Press Shift-w to set the data width. This parameter controls the minimum width of all data output fields: sound velocity, temperature, pressure, signal amplitude, and signal noise. Default value is 3.

Sound Velocity Decimals (SOS digits)
Press Shift-s to set the number of decimals to show in the sound velocity measurement reading. The available range is from 0 to 3. The decimal separator is always a decimal point (not a comma). No decimal point is shown when the parameter is set to 0 digits.

Filter
There are a number of filters available to filter the sound velocity output.

Press Shift-f to toggle between the available filter types in the menu.

- **0** = No filtering (direct output)
- **1** = Low pass filtering (with approximately 5 second time constant)
- **2** = Median filtering (5 taps, removing up to 2 consecutive false readings)
- **3** = Combined Median and Low pass (not yet implemented)

Time Stamp (Time) (Optional)
Press Shift-i to set the time stamp. The millisecond counter starts counting when the probe is started.

Press Shift-o to toggle between the three output options:

- **0** = No time stamp
- **1** = Seconds with 3 digits
- **2** = Milliseconds (without decimals)

RawData
Press r to toggle raw data samples on and off. This option toggles the output of the raw data samples used to calculate the speed of sound.

- **0** = User-defined SVP output string
- **1** = User-defined SVP string with trailing raw sample values

This option should only be used for debugging an installation. A high baud rate will be required, as a lot of data is generated. The raw data is generated behind the Tail of the output string and is always <TAB>-delimited.

[4] If required, include the same delimiter as part of the header string.

Sample Period
Press s to set the sample period. A prompt will appear showing the allowable range.

```
Enter Sample Period(ms): in range[    0:100000] Current Setting:  100
```

Select a setting and press Enter. The entered value will appear in the Sample Period setting. The value in milliseconds is the time between successive samples. Remember to increase the baud rate of the communications interface when generating data at high rates.

Pressure (Pres) (Optional)
Press p to toggle the pressure output on or off.

- **0** = Pressure not printed
- **1** = Pressure printed

The probe generates pressure output in decibar, which corresponds to approximate depth in meters. The pressure reading is very inaccurate and should only be used for guidance.

Temperature (Temp) (Optional)
Press t to toggle the temperature output on or off.

- **0** = Temperature not printed
- **1** = Temperature printed

The probe generates its own temperature in Celsius with 2 digits. The temperature corresponds to the water temperature, but should not be used as a replacement for an accurate water temperature reading, as the sensor is mounted inside the housing of the probe.

The temperature output is NOT intended as a survey parameter due to its low pass filtered and delayed readings.

Amplitude (Amp)
Press a to toggle the output of the amplitude of the return signal on or off.

- **0** = Amplitude not printed
- **1** = Amplitude printed

Noise
Press n to toggle the noise output on and off.

- **0** = Noise not printed
- **1** = Noise printed

Print Filter
Press f to define whether or not the selected filter type is printed.

- **0** = Filter not printed
- **1** = Filter printed

It is important to realize that filtering (both low pass and median) introduces an inherent delay in the data. To avoid data being too old, the filters are turned off, if the time between samples is larger than 800ms. This can be verified by printing the filter type used in the output string.

DataValid
The Data Valid option is a validity label, which indicates the status of the current output sample.

- **0** = Sample not valid
- **1** = Sample valid within the defined speed of sound interval

This is useful when using filtering to establish the number of samples that are out of the allowed range, and can be useful for investigating installation where noise is a challenge.

All Delimiters (All delims)
Press d to toggle all delimiters on or off.

- **0** = Off
- **1** = On

When enabled, all delimiters will be printed, even if this means that some of the output fields will be empty.

4.2.5 Mode 6 NMEA Output Mode

In NMEA output mode, the probe generates data in the format:

<$PRSOS><SOS in m/s with 3 decimals><*78>

Example: `$PRSOS,1350.000*78`

The probe does not respond to any commands and has a fixed output repetition rate of 10Hz.

5 SVP PRINCIPLES

The SVP 70 measures the sound speed in a direct measurement by transmitting a sound pulse and detecting its time to travel a well-defined path length.

The transmitted signal is generated using waveform techniques that yield optimal conditions for timing the arrival of the returning signal, which is digitized at high frequency and high resolution. The timing is established using a high-stability clock oscillator.

The path length is defined by the distance from the transmission transducer to a reflector plate and back again to the transducer, which then acts as a receiver.

The traditional way of establishing a known path length is to use spacers made from a metallic alloy commonly known as INVAR. However, INVAR is not resistant to corrosion and endurance is limited, though its life can be prolonged.

The spacers of the SVP 70 are made from titanium and compensate its temperature and pressure sensitivity by measuring its temperature and stress and applying calibrated factors for the small path length changes.

The use of titanium for the SVP 70 model limits corrosion to a great extent.

Due to the direct measurement technique used, the speed of sound echo return time result will in no way depend on formulas assuming a certain relationship between conductivity, salinity, temperature, and pressure.

5.1 SVP 70 Output

The speed of sound output is selectable between instant direct readings, outlier filtered readings, and low pass filtered (see *section 0*
User Menu Options).

Instant, direct readings will immediately show any change in sound velocity due to air-bubbles, objects, or marine life. Some applications may find the direct, unfiltered readings useful, but others only use the SVP to estimate speed of sound near the probe and will therefore find the filtered output useful for reducing outliers in the data.

The primary output of the SVP 70 is the instant speed of sound. To measure the sound speed the SVP 70 internally measures the temperature of the probe and the pressure. These two measurements can also be generated from the probe and give indicative values for temperature and pressure. These values are, however, not meant to satisfy regular survey requirements for pressure (depth) and temperature.

5.2 SVP Applications

5.2.1 Multibeam Correction

Multibeam sonars frequently need speed of sound input for positioning the beams (beam steering). The sound speed accuracy required for multibeam sonar correction is typically in the order of 0.25m/s to 0.5m/s.

5.2.2 Echosounder Correction

Sound velocity probes are used for calibration/correction of echosounders. As echosounders measure the time for a signal to propagate to the seabed and back and thereby calculate the distance to the seabed, it is necessary to know the speed of sound in the water.

*Sound travel Distance=2*Depth= Echo time* sound speed*

As speed of sound is greatly influenced by salinity, temperature, and pressure it is of paramount importance that an accurate speed of sound value is used as opposed to an approximate value from reference tables. Most echosounders therefore allow input of sound velocity, either by electrical connections or via keyboard entry.

5.2.3 Positioning System Correction

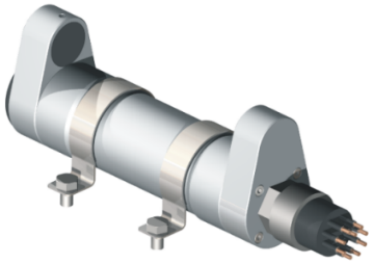
Acoustic navigation systems like LBL and USBL systems use travel time of acoustic signals to determine the distance between acoustic transducers. For very accurate LBL and USBL navigation the systems typically use sophisticated (Kalman) filters for improvement of the accuracy. Adequate accuracy of the sound velocity used in these systems is typically 0.25m/s.

Doppler logs use the speed of sound for calculating the sensor speed. Accurate sound speed is mandatory for obtaining accurate sensor speed.

Uncontrolled Technology Subject to Restrictions Contained on the Cover Page.

6 INSTALLATION

Installation of the SVP is very flexible. It must focus on ensuring that the water flows without excessive turbulence and away from any air bubbles that may be caught by vessel movement. For installation reference, see *Appendix C Drawings*.



6.1 Mechanical Installation

The SVP 70 should be mounted using the two brackets/metal bands supplied with the unit or similar shaped bands.

CAUTION
Use brackets less than 2mm thickness and keep any suspension gear outside the acoustic path (see *Figure 6*).

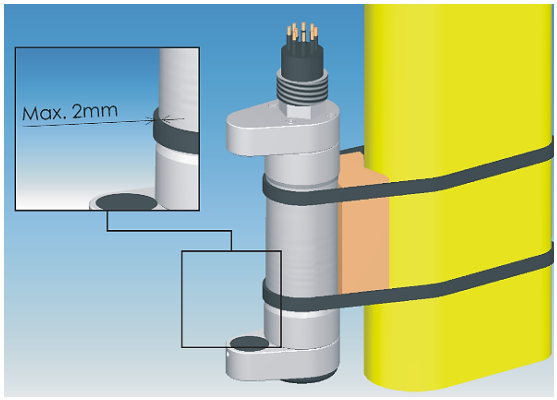


Figure 6: Pole Mounting

To reduce flow noise impacting other sensors the SVP may be retracted/buried into a sea chest as in *Figure 7*.

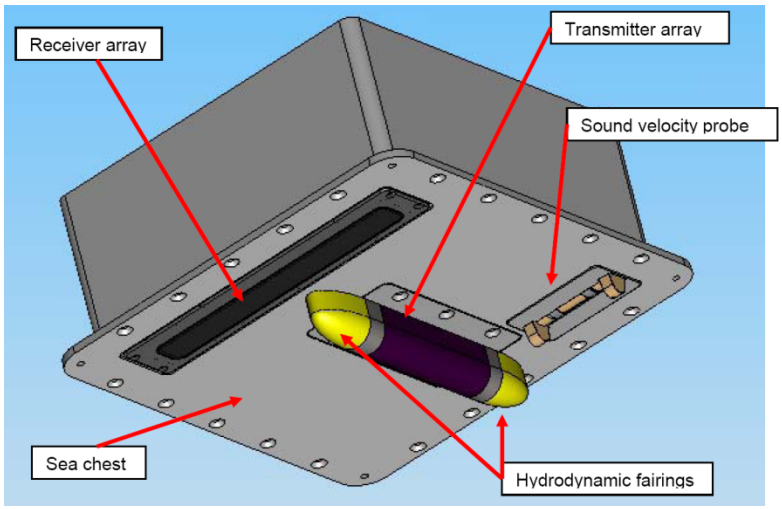


Figure 7: Example of SVP Installation

6.1.1 Sound Path

The sound path is shown in *Figure 8*. The measurement quality relies on this sound path being completely free from obstacles like mounting harness, cables, or other items, and it must be completely submerged in water without air bubbles.

Figure 8: Sound Path of SVP

NOTE
Even though it is important to ensure that the water flow to the sound path is free, it is still possible to put protection or hydrodynamic fairings around the probe as long as the sound path is not disturbed.

6.1.2 Fixing Bolts Before Mounting

To aid installation 4 O-rings included in the accessory kit can be used as retention rings for the mounting bolts. This will stop the bolts from falling off the brackets, when the SVP is mounted under water, thus making installation by divers easier.

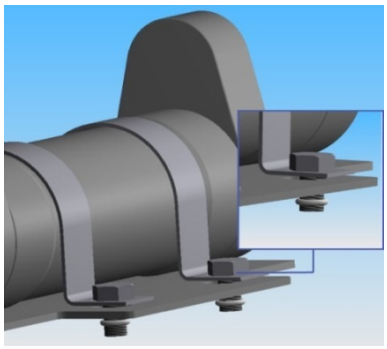


Figure 9: O-Rings Retain Mounting Bolts

6.1.3 Placement of SVP 70

Hydrodynamics and flow must be taken into account when placing the SVP 70.

The water flow should be perpendicular to the sound path to give the optimum performance.

The water should not come from the “back” of the housing (see *Figure 10*).

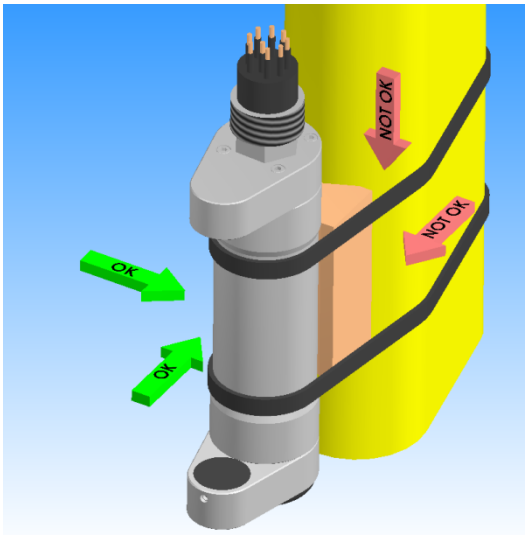


Figure 10: Water Flow

6.1.4 Cable Installation

- Secure the cable in a fixed position using cable ties or similar with a maximum of 4cm free spans between support points.

CAUTION
Be aware of the bend radius of the cable: Keep the radius above 7.5cm at any place in fixed installations. When repeated mounting/dismounting is foreseeable, keep the radius above 15cm.

- Lubricate the connector on a regular basis to facilitate assembly. Use the supplied silicone based lubricant[5].
- Pull the connector straight apart from the probe when dismounting it.

CAUTION
Be careful not to pull on the cable.

- For the T-Series ASV systems, the SVP cable interfaces to the ASP via a bulkhead cable.

CAUTION
One ferrite[6] must be mounted around the SVP cable as close to the water as possible.

6.2 Electrical Installation

6.2.1 Power Source

The requirements for the power source for the SVP 70 are flexible. The power input is compatible with DC power supplies ranging from 9V to 55V; the power supply should be rated for 2W or more. Very long cables may require more power due to the cable load.

CAUTION
The SVP 70 has under-voltage power detection, which disables the probe if the input voltage is inadequate. However, leaving the probe at voltages in the range 6 to 9V for extended periods may cause permanent damage to the device.

The SVP 70 has been specifically designed for compatibility with standard power supplies of 24V and 48V +/-10% and lead-acid batteries on nominal 12V, 24V, and 48V. A fully charged 48V lead-acid battery typically has a voltage below 52V.

CAUTION
While charging a 48V lead-acid battery its voltage can easily reach 58V, which is beyond the DC input specification of the SVP 70. Using a 10V, 1W zener diode in series with the positive supply line will allow operation from a 48V battery in both charging and discharging conditions.

[5] Molykote 44 Medium: Use sparingly. Half a match head dose per contact is adequate.
[6] Ferrite included in the delivery (Würth Elektronik: PN 74272222).

6.2.1 Serial Interface

The SVP 70 is as standard fitted with two serial interfaces, RS-232 and RS-422. Only one interface can be active at a time. Certain configuration options, including changing baud rate and serial interface, can only be accessed via the RS-232 interface. None of these options need to be changed when the probe is installed and should not influence the operator's selection of interface during installation.

The RS-232 is based on the MAX232ECSE IC, which generates true RS-232 signals with voltage swings and rise time limitations according to the RS-232 specification.

The RS-422 is based on the MAX3084ECSA IC, which generates true RS-422 signals with voltage swings and rise time limitations according to the RS-422 specification. The SVP 70 has a built-in 100 ohm termination resistor on its RS-422 input. Equipment connected to the RS-422 interface should also include a termination resistor across RXA and RXB.

Both serial interfaces are isolated from the probe power input. This prevents otherwise frequent problems with ground loops, common impedances, and it makes it possible to install the SVP 70 in systems with a power design prohibiting connection between analog (or signal) ground and power ground.

To avoid excessive voltages between the two ground systems, a surge protector connects them with high impedance at voltages up to 50V. Consequently, the voltage difference between the ground systems must NOT exceed this voltage.

6.2.1.1 Guideline for Choosing Interface

The numbers in *Table 2* are meant only as an introductory guide to the subject of selecting between RS-232 and RS-422[7]. Actual values depend on numerous factors.

Table 2: Interface Guidelines

Interface	Speed vs. cable length		Noise immunity	Cost	Complexity
	5m	500m			
RS-232	115200	2400	Bad	Low	Low
RS-422	115200	115200	Excellent	Higher	Higher

For laboratory use and for setting up the probe, where only a few meters of cable is required, it is recommended that RS-232 is used because it allows interface to most regular PCs without adding extra hardware.

For practical usages, our experience is that conservative max. communication rates should typically be applied (see *Table 3*).

Table 3: Suggested Max. Baud Rates for RS-232 Interface

RS-232 Interface	10m cable	25m cable	50m cable
Baud rate	64400	19200	9600

For use on larger ships it is recommended that RS-422 is used as it allows for longer cables and for better noise immunity.

[7] Several web sites discuss the subject. Suppliers like B&B Electronics (www.bbelectronics.com) can supply devices for the interfaces along with advice on the subject.

Once the system is set up and the cable installed, it is recommended that a test is performed with the baud rate set at a higher level to ensure that there is sufficient noise margin.

6.2.1.2 Additional Hints

Some suppliers sell converters for interfacing RS-232 to the USB ports of PCs. Even though some of these devices may actually work in some circumstances, it is not recommended to use them without ensuring that they work in the application. Check both the transmitter function AND the receiver function.

Professional converters between Ethernet and RS-232 or RS-422 exist (www.nationalinstruments.com) and work with the SVP 70. However, connection to an Ethernet used for signals other than the SVP may cause significant uncontrolled transmission delays, which ruin the overall performance of the system. Networks used for backups, servers, and printers are especially prone to major delays.

The RS-422 does not work if the P and N lines on either transmission or reception are crossed. It is a prerequisite for operation that TXP is connected to RXP and TXN is connected to RXN.

Wiring of RS-232 is often done casually without proper care resulting in accidental swapping of TX and RX.

To identify an RS-232 transmitter observe a negative voltage (more than 3V) from the transmitter pin to the signal ground pin. The receiver typically has a voltage less than 0.5V.

6.3 Integration with SeaBat T/F-Series Multibeam Echosounders

The SeaBat T/F-Series processor unit introduces a convenient plug and play Fischer connector for the SVP 70 probe which provide both power and communication. It is also possible to input sound velocity data via the RJ-45 Com port connection, but this will require use of the SVP70 converter cable and an external power supply, so direct connection to the SVP port on the sonar processor is recommended.

The pinout of the Fischer connector (processor unit side) is as shown in *Figure 11*. See *Table 4* for the pinouts of the connector at the SVP 70.

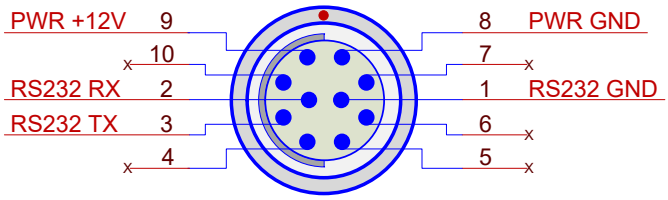


Figure 11: Pinout of Fischer Connector at Processor Unit

For information on other cable options, see *Appendix B Additional Cable Options*.

For cable references, see *Appendix C Drawings*.

6.3.1 Connector SVP 70

Table 4: SVP 70 Underwater Connector and Standard Underwater Cable

SVP 9-pole pin	MCBH9M	Standard cable wire color (underwater cable only)
1	COMMS GND	Screen/Drain wire
2	RS-232T	Black
3	RS-232R	White
4	RS-422TXP	Red
5	RS-422TXN	Green
6	RS-422RXP	Yellow
7	RS-422RXN	Blue
8	Ground (battery -)	Brown
9	Power (battery +)	Orange

- The connector is manufactured by Birns[8].
- Use mating connector MC9F.
    - Available as a pigtail from Teledyne RESON.
      The pigtail is shielded, the shield being connected to pin 1.
    - Available from Birns with various cable length options.
- The connector can be submerged in (clean) sea water without being mated, and it is designed to allow mating under water.

CAUTION
Protective caps, dummy plugs, must be used if the probe is submerged for extended periods without a cable attached.

For reference, see *Figure 15: SVP 70 Cable for SeaBat T/F-Series Surface* Vessel MBES.

[8] www.birns.com or www.aquamate.biz

6.3.2 Cable Converter

The cable converter is useful when one wishes to connect the SVP 70 probe to a standard PC com port using the Fischer terminated installation cable.

Table 5: DB9 Connections on SVP 70 Cable Converter for T/F-Series System

Black hooded Sub-D (DB9) female connector	
Pin	**RS-232 signal name**
1	Not connected
2	RS-232T
3	RS-232R
4	Not connected
5	COMMS GND
6	Not connected
7	Not connected
8	Not connected
9	Not connected

Red hooded Sub-D (DB9) male connector	
Pin	**RS-422 signal name**
1	RS-422RXN
2	RS-422RXP
3	RS-422TXP
4	RS-422TXN
5	COMMS GND
6	Not connected
7	Not connected
8	Not connected
9	Not connected

- Connects to installation cable.
- Provides interface for SVP 70 to standard PC com port for test purposes.
- Provides easy access to RS-422 port on red D-Sub connector.

For reference, see *Figure 16: Cable Converter for Use with Fischer Terminated Installation Cables*.

6.3.3 Recommended RS-232 Cable

- May be used for baud rates up to 9600 baud and cable lengths up to 30m in reasonably shielded conditions.
- May use straight wires, preferably (but not necessarily) shielded.
- Cable manufactured by Belden[9] type 8418 is ideally suited for submerged applications using RS-232.

6.3.4 Recommended High Grade RS-422 Cable

Use this cable for applications requiring one or more of the following characteristics:

- High baud rate
- Long cabling
- High noise immunity

Standard Ethernet cable CAT-5 is electrically well suited for RS-422 applications. Use the same wiring as for the conversion cable.

[9] www.belden.com – please obtain datasheet directly from Belden.

7 TROUBLESHOOTING

Problem	Cause
Bad characters received from SVP	SVP and receiver not set for same baud rate.
	COMMS GND connection not established between SVP pin 1 and receiver.
Nothing received from SVP	Bad connection to receiver.
	SVP not set (RS-232/RS-422) according to wiring.
Reading 1350.00m/s	Probe not properly submerged, air trapped on transducer surface, or significant amount of bubbles in sound path.
Fluctuating readings	Air bubbles trapped on the transducer surface or the reflector plate. If bubbles exist in the sound path, the SVP will at best return the average sound speed, but not the sound speed of the (air-free) medium.

APPENDIX A TECHNICAL SPECIFICATIONS

A.1 SVP 70 Specifications

	SVP 70
Range	1350 to 1800m/s
Resolution	0.01m/s
Accuracy (0-50m)	±0.05m/s
Accuracy (0-6000m)	±0.25m/s
Sampling rate	20Hz and lower, programmable
Sampling mode	On request, continuous
Connector	Birns MCBH9M
Output	True RS-232 and RS-422
Baud rate	2400-115200
Galvanic isolation	Yes
Output options	Direct, filtered, validity
Output formats	Programmable ASCII
Supply	9-55VDC
Power	1.1W typical, 1.5W maximum
Depth rating	6000m (640 bar)
Temperature	-20° to +55°C powered on
Temperature for specified accuracy	-3° to +40°C
Housing	Titanium
Diameter Length (excl. connector) End cap height	44mm (max) 165mm 69mm (max)
Weight in air	1kg
Weight in freshwater	740g
Buoyancy due to volume	260g ±10g

A.2 SVP 70 Data Formats

The formats below are all supported by the SVP 70. They are only a few examples of a multitude of possibilities. See *section 4.2 Operation Modes* for details.

In the examples the sound velocity is 1478.32m/s, and time since probe start is 12039ms.

AML output
1478.32<CR><LF>

Valeport output
1478320<CR><LF>

Previous RESON SVPs' output
14783<CR><LF>

SVP 70 User Mode Default output[10]
1478.32<CR><LF>

SVP 70 User Mode configurable output format
$PSOS<TAB>12039<TAB>1478.32<TAB><CR><LF>

SVP 70 NMEA-similar output formats
$PRSOS,1478.320*78<CR><LF>

NMEA output
$PRSOS,1350.000*78<CR><LF>

[10] Compatible with SeaBat sonar systems

APPENDIX B ADDITIONAL CABLE OPTIONS

NOTE
This appendix provides details of older generation cables for installation on 8k SeaBat systems or ROV and AUV versions of 7k and T/F-Series SeaBat systems.

B.1 Standard Test Cable for SVP 70

NOTE
The SVP 70 Test Cable may not be included in the standard scope of supply. For example, when the SVP is purchased with a SeaBat surface vessel (T/F-Series) system, the SVP kit includes the converter cable to be used when testing with a standard PC. (Note: The Fisher terminated installation cable is supplied with the SeaBat T/F-Series systems, the converter cable connects between installation cable and PC; see also *Figure 16: Cable Converter for Use with Fischer Terminated Installation Cables*). Contact Teledyne RESON if further information is required.

Use this cable for setting up the SVP 70, debugging installations, and small tasks. Only one of the computer connectors can be used at a time (restricted by the SVP 70). Both can, however, be connected at the same time.

The standard test cable consists of 1.5m PVC cable spliced onto 1.5m Neoprene cable which is molded directly to a wet mate connector. For reference, see *Figure 13: SVP 70 Test Cable*.

Table 6: DB9 Connections on SVP 70 Test Cable

Black hooded Sub-D (DB9) female connector	
Pin	**RS-232 signal name**
1	Not connected
2	RS-232T
3	RS-232R
4	Not connected
5	COMMS GND
6	Not connected
7	Not connected
8	Not connected
9	Not connected

Red hooded Sub-D (DB9) female connector	
Pin	**RS-422 signal name**
1	RS-422TXP
2	RS-422TXN
3	RS-422RXP
4	RS-422RXN
5	COMMS GND
6	Not connected
7	Not connected
8	Not connected
9	Not connected

APPENDIX C DRAWINGS

The following drawings are provided for reference purposes.

Table 7: SVP 70 Drawings

Document Title	Document Number
Outline dimension SVP70	7211M011
SVP 70 Test Cable	7211G022
Reson SVP70 Cable Assy	PARTD12831
Cable Assy, SVP70 to TXCVR (SVP70 to sonar processor (incl. rack-mounted, portable)	85002222B011
Cable Assembly – Part no. 904-63-0812-00 (cable converter SVP70 SV)	7211G031
Cable Assy, MCIL-9-FS to MCIL-6-MP, for SVP70 to wet SVP interface (to subsea sonar processor)	PARTD16102

C.1 SVP 70 Dimensions

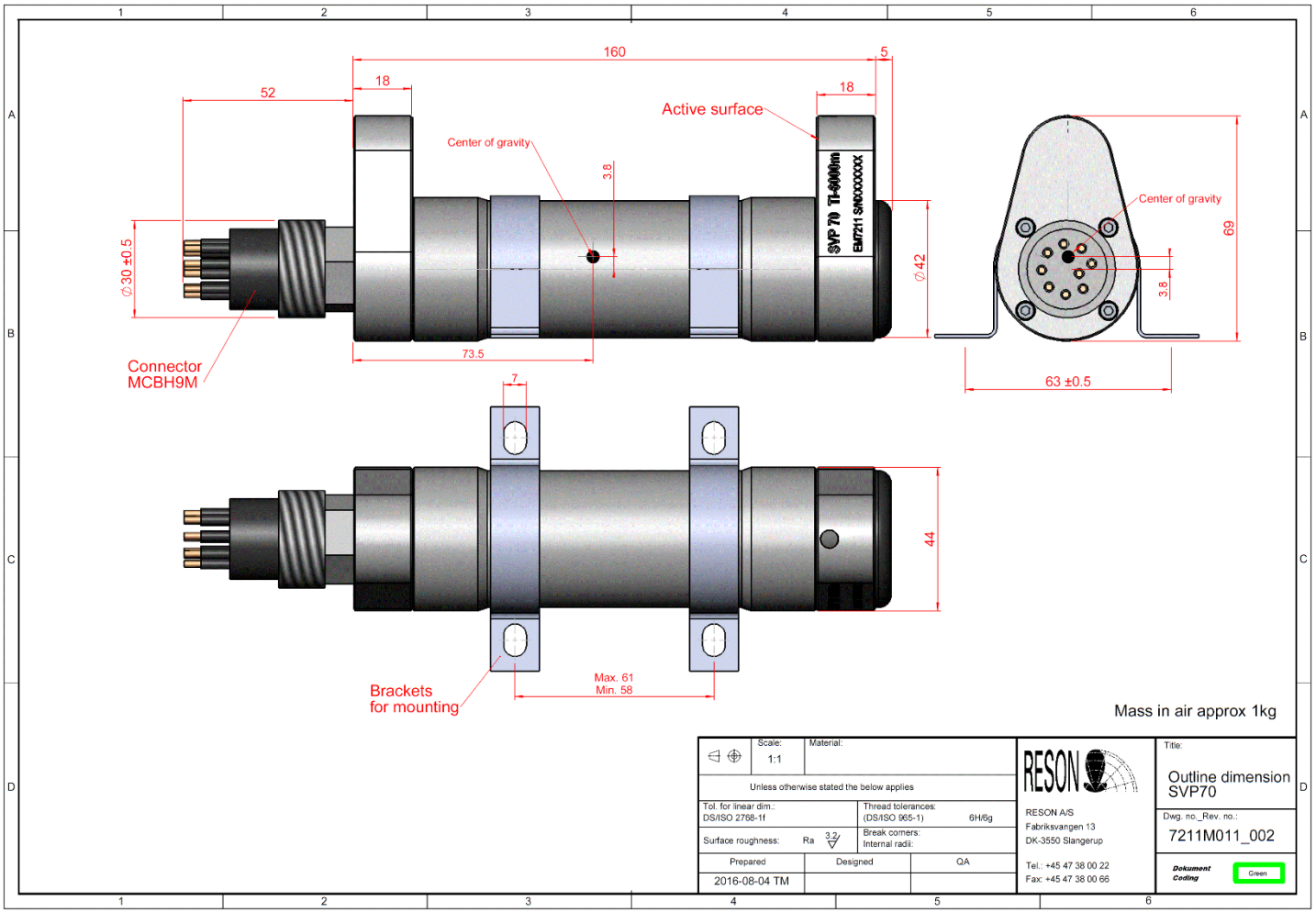


Figure 12: SVP 70 Dimensions

C.2 SVP 70 Test Cable

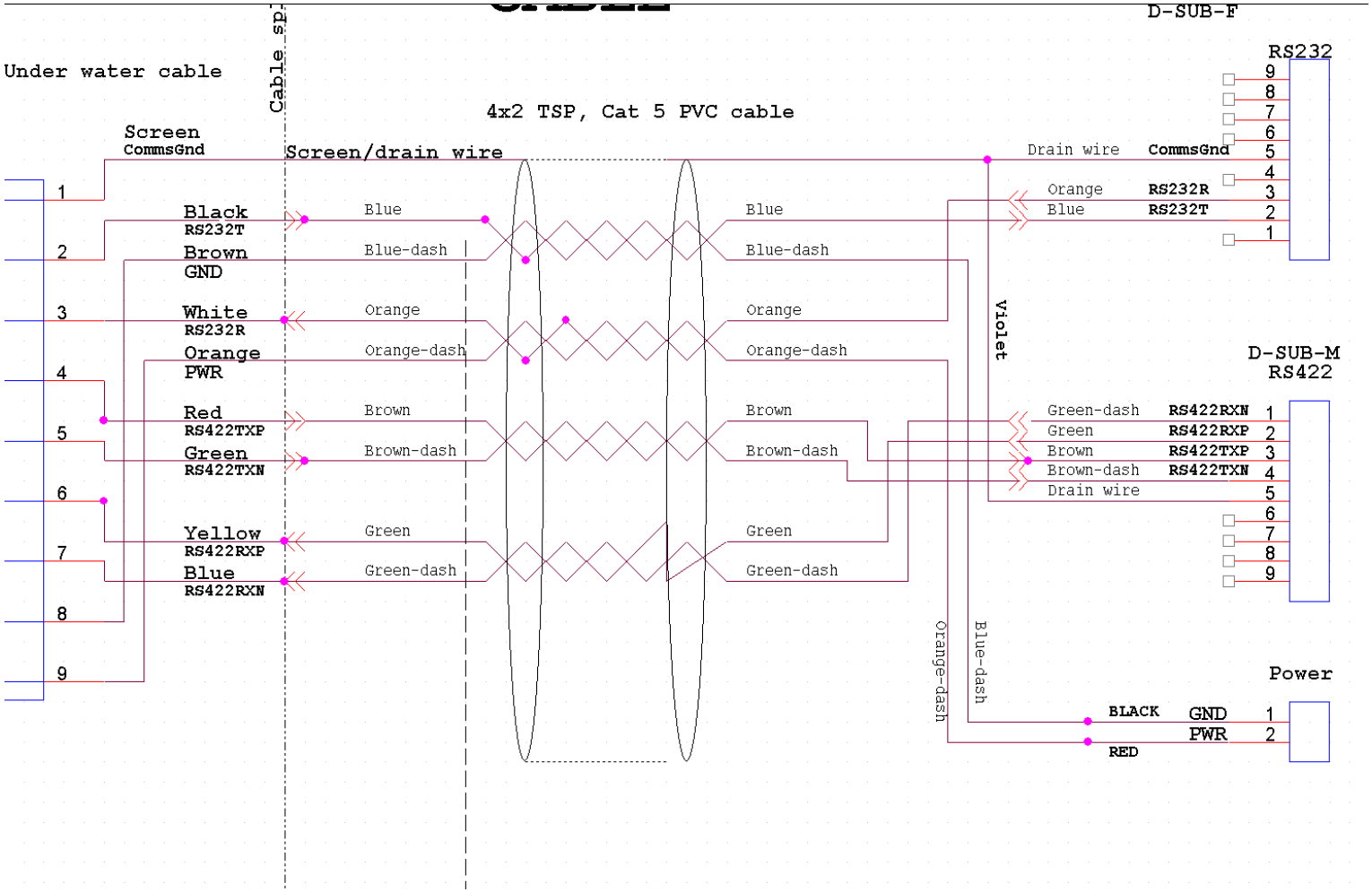


Figure 13: SVP 70 Test Cable

C.3 SVP 70 Cable to Pigtail

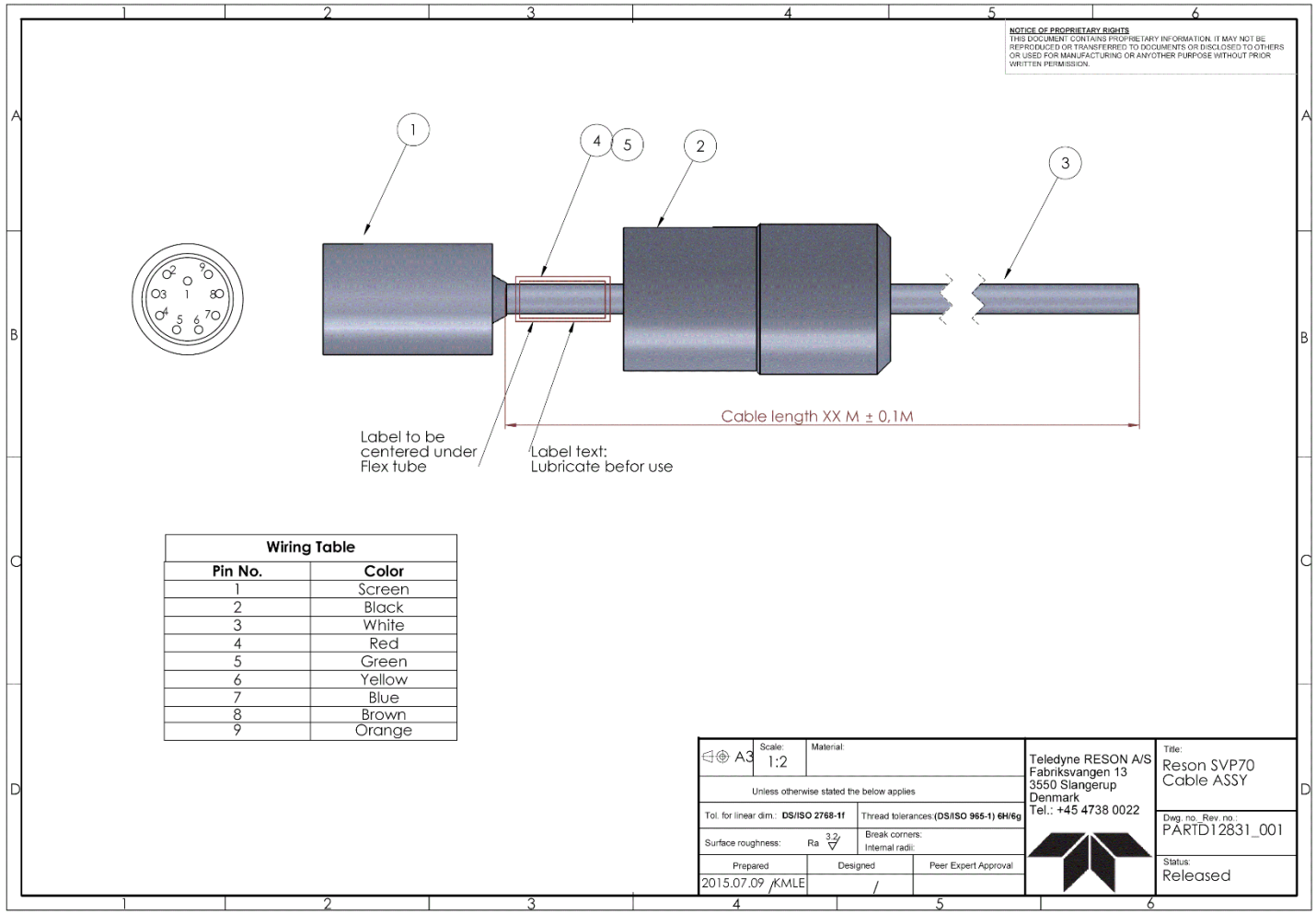


Figure 14: SVP 70 Cable to Pigtail

C.4 SVP 70 Cable for SeaBat T/F-Series Surface Vessel MBES

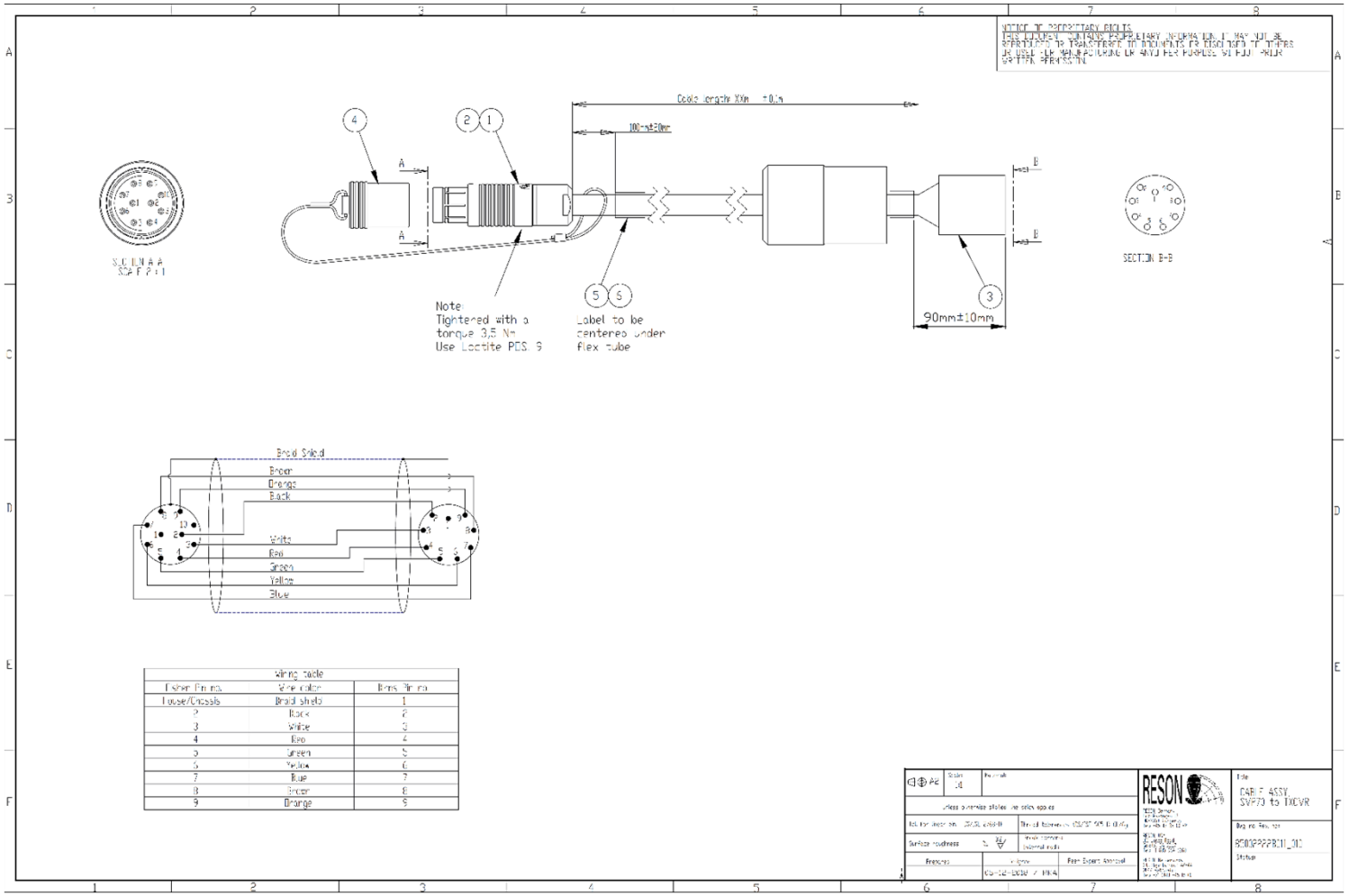


Figure 15: SVP 70 Cable for SeaBat T/F-Series Surface Vessel MBES

C.5 Cable Converter for Use with Fischer Terminated Installation Cables

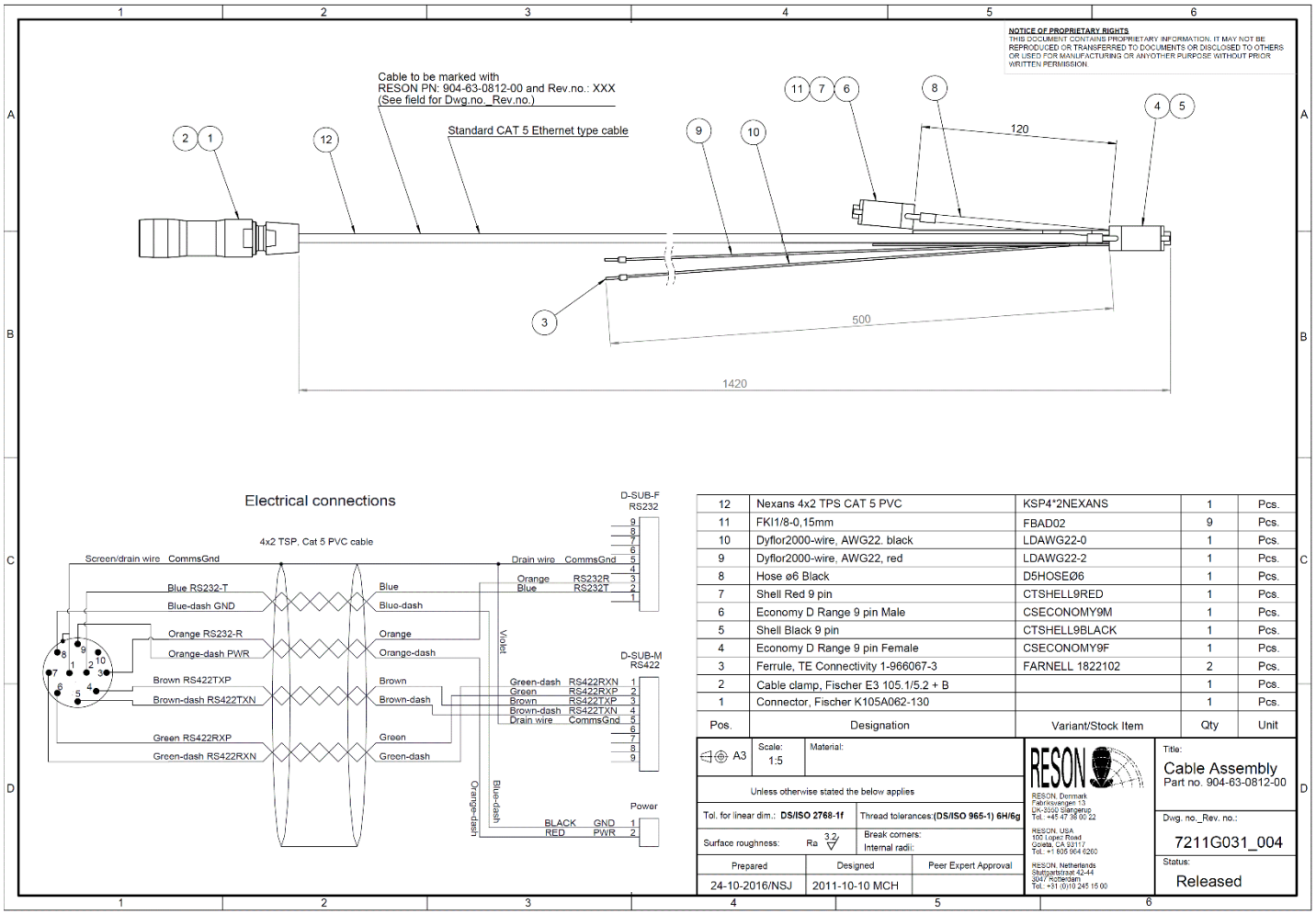


Figure 16: Cable Converter for Use with Fischer Terminated Installation Cables

C.6 SVP 70 Cable for SeaBat Subsea Sonar Processor

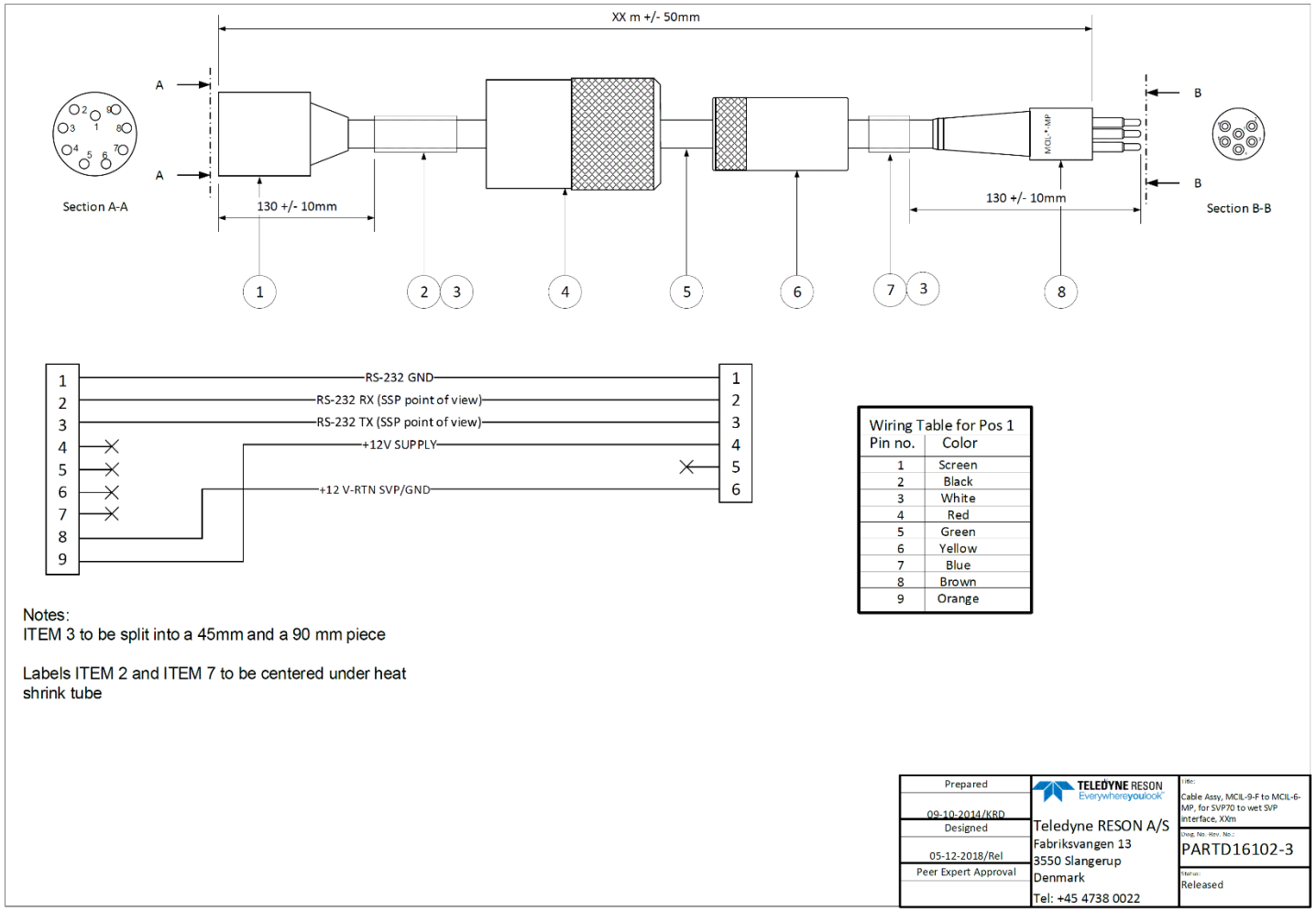


Figure 17: SVP 70 Cable for SeaBat Subsea Sonar Processor

APPENDIX D SVP 70 SCOPE OF SUPPLY

Table 8: SVP 70 Scope of Supply[11]

Part name	Description and scope of supply
Part number: 900-63-1000-20	
SOUND VELOCITY PROBE, SVP 70, 6000m	SVP 70 system with accessories, SV, excl. installation cable, incl. converter cable. Scope of supply includes • SVP70 Probe • Accessory cleaning kit, screws, mounting O-rings • Operator's Manual • Quick Reference Manual • Cable converter, SVP7x SV to D-sub +power • Mounting bracket with rubber membrane • MCA Female locking sleeve
Note: This is the configuration typically supplied when purchased together with SeaBat sonars with RSP or PSP processors. When placing the order for the SVP 70 together with a SeaBat sonar, it is possible to select the SVP 70 cable length that corresponds to SeaBat cable lengths. The cable selected connects directly between the SeaBat processor and the SVP 70.	
Part number: 88090070	
SOUND VELOCITY PROBE, SVP 70, 6000m, Pigtail only for ROV	SOUND VELOCITY PROBE, SVP 70, 6000m. Accessories, incl. terminated test cable. Scope of supply includes • SVP 70 Probe • Accessory cleaning kit, screws, mounting O-rings • Test cable 1.5m long terminated with RS232 and RS232 D-sub connections • CABLE ASSY, SVP 70 to pigtail, 25m • Mounting bracket with rubber membrane • MCA Female locking sleeve
Note: This is the configuration typically purchased for use on ROVs or when not used specifically with a SeaBat RSP or PSP processor.	

[11] Configurations and scope of supply subject to change without notice.

APPENDIX E STANDARD WARRANTY INFORMATION[12]

E.1 Limited Warranty

Teledyne RESON warrants our systems against defects in materials and workmanship for a period of one year from the date of Teledyne RESON's original shipment, unless Teledyne RESON has specified a longer standard warranty period for this particular product or offered an extended warranty.

During the warranty period, Teledyne RESON will, at its sole option, either repair, replace, or issue a credit for the original price of the defective system. Such repair, replacement, or credit shall be the sole remedy for a defective system. For full information about the warranty provisions, please refer to the section "Limited Warranty" in our General Terms and Conditions of Sale.

Teledyne RESON systems must be serviced by Teledyne RESON or one of Teledyne RESON's authorized service providers. Any return of nonconforming or defective systems is subject to Teledyne RESON's current return authorization process and procedures (see *section E.5 below*).

E.2 Warranty Exclusions

The warranty on Teledyne RESON systems does not apply to defects arising from:

- Improper installation, operation, or maintenance.
- Improper handling, storage, or transportation.
- Unauthorized modifications, alterations, or repairs.
- Failure to comply with Teledyne RESON's safety precautions.
- Accidental damage.
- Normal wear and tear.

E.3 Warranty Disclaimer

No warranties of merchantability or fitness for a particular purpose is intended or given.

E.4 Servicing During Warranty Period

If your SVP should encounter technical issues during the warranty period, please contact Teledyne RESON Support (see *section E.6 below*) to protect your warranty rights.

[12] Please refer to Teledyne RESON's General Terms and Conditions of Sale, available at http://www.teledynemarine.com/reson/ > Terms and Conditions.

E.5 Equipment Return Procedure

Before returning any equipment for service, you must follow the Teledyne RESON equipment return authorization procedure stated below:

1. Contact Teledyne RESON Support (see *section E.6 below*) to obtain an approved Return Material Authorization (RMA) number. Equipment shall not be returned without Teledyne RESON's prior authorization.
2. Follow the instructions in the supplied document and pack the equipment in the original shipping containers.
3. Ship the equipment, transportation and insurance prepaid, according to the instructions issued by Teledyne RESON.
4. Ensure that the RMA number is included on all shipping documents and, most importantly, marked on the shipping container's address label.
5. Include a note which identifies the model or part number, and serial number (if applicable) along with a brief, but thorough, description of the problem.

E.6 Teledyne RESON Support[13]

If you are experiencing difficulty with your Teledyne RESON system, please contact Teledyne RESON Support for further instructions:

EUROPE
Tel: +45 20 999 088
e-mail: Marine-supportDK@Teledyne.com (Denmark)
Marine-supportGE@Teledyne.com (Germany)
Marine-supportNL@Teledyne.com (The Netherlands)
Marine-supportUK@Teledyne.com (United Kingdom)

UNITED STATES
Tel: +1 805 233 3900
e-mail: Marine-supportUS@Teledyne.com

Teledyne PDS support
Tel: +31 10 245 15 00
e-mail: Marine-supportNL@Teledyne.com

[13] Refer also to http://www.teledynemarine.com/support.

SVP 70 Operator's Manual

Produced by

Teledyne RESON A/S
Fabriksvangen 13
3550 Slangerup
Denmark

Tel: +45 47 38 00 22
Fax: +45 47 38 00 66

Document Number: OM11762-10
Part Number: 904-63-0802-00

Teledyne Confidential; Commercially Sensitive Business Data