rapidPro SVP and rapidPro CTD
Operating Manual

As part of our policy of continuous development, we reserve the right to alter, without prior notice, all specifications, designs, prices and conditions of supply for all our equipment

Contents

1 Introduction

The rapidPro has been developed in two forms for the fast collection of sound velocity and CTD profiles. Designed to optimally operate with the Teledyne rapidCAST underway profiling winch the rapid collection of accurate sensor data is key. The Pro version of the rapid profiler is further developed with a new optimised shape and removable proLogger module that combines a rechargeable lithium ion battery, data logger, a GPS receiver with Bluetooth comms.

1.1 rapidPro SVT

rapidPro SVT

The rapidPro SVT has been developed for the specific collection of sound velocity Profiles, at high fall rates through the water column. Now further developed with a new optimised shape and removable proLogger module that combines a rechargeable lithium ion battery, data logger, GPS receiver and Bluetooth comms module.

proLogger

The world's most accurate Sound Velocity sensor with virtually instantaneous response time, high specification thermistor temperature sensor, data acquisition rates of up to 32Hz housed in a low drag housing result in the highest quality profiles at drop rates over 5 m/s.

Optionally, the rapidPro SVT is designed to operate with the Teledyne OceanScience rapidCAST underway profiling winch to deliver the highest quality SVT casts. While the vessel is underway profiles up to 450m at 6 knots are expected.

1.1.1 Sensor Specifications

The rapidPro SVT is fitted with Valeport's digital time of flight sound velocity sensor, strain gauge pressure transducer and fast response thermistor temperature sensor.

Sound Velocity

Range:	1375 - 1900m/s
Resolution:	0.001m/s
Accuracy:	±0.02m/s

Pressure

Range:	200 Bar (max)
Resolution:	0.001% range
Accuracy:	±0.01% range

Temperature - Thermistor

Range:	-5°C to +35°C
Resolution:	0.001°C
Accuracy:	±0.01°C
Response	50 milliseconds

Data Acquisition

Sample Rate: up to 32 Hz

Electrical

Battery:	Rechargeable Lithium Ion battery module
Battery Life:	approximately 20 hours continuous operation from a fully charged pack

Physical

Materials:	Titanium/PEEK housing Stainless steel 316 nose casting Titanium & composite sensor components
Depth Rating:	2000m
Instrument Size:	Ø62mm x Length 605mm
Weight:	4.5kg (in air)

1.1.2 Dimensions
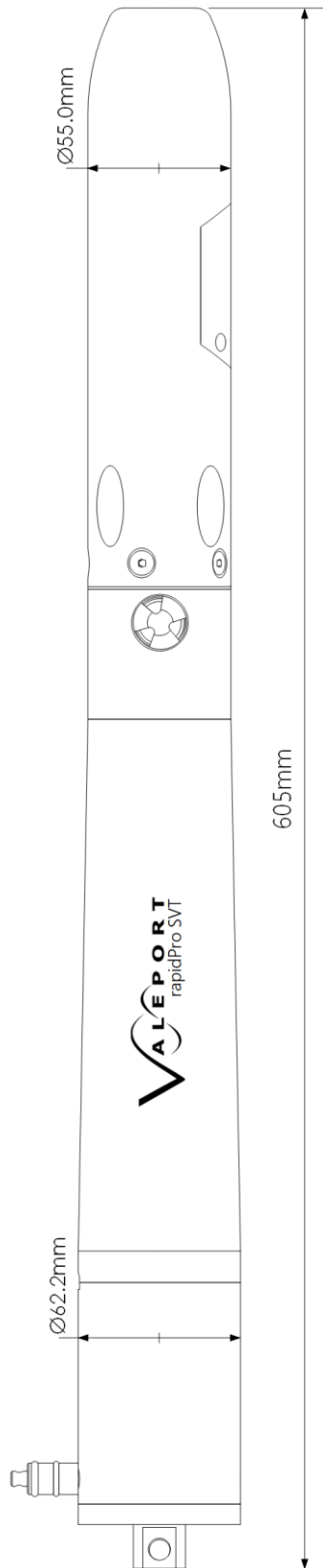
1.2   rapidPro CTD and rapidPro CTDplus

rapidPro CTD

rapidPro CTDplus

The rapidPro CTD and the rapidPro CTDplus, with an optical sensor, has been developed for the collection of conductivity, temperature and depth during fast drop rates through the water column. Now further developed with a new optimised conductivity sensor shape and removable proLogger module that combines a rechargeable lithium ion battery, data logger, GPS receiver and Bluetooth comms.

proLogger

Setup and data download is controlled with Valeport Connect software for PC.

As an option, the rapidPro CTD is designed to operate in conjunction with the Teledyne OceanScience rapidCAST underway profiling winch to deliver the highest quality CTD and optional optical parameter casts. While the vessel is underway profiles to 400m at 6 knots are expected.

1.2.1 Sensor Specifications

Conductivity

Range:	0 - 80 mS/cm
Resolution:	0.001 mS/cm
Accuracy:	±0.01 mS/cm
Response:	30 milliseconds

Pressure

Range:	100 or 200 Bar
Resolution:	0.001% range
Accuracy:	±0.01% range
Response:	1 millisecond

Temperature - Thermistor

Range:	-5°C to +35°C
Resolution:	0.001°C
Accuracy:	±0.01°C
Response:	50 milliseconds to T90

Data Acquisition

Sample Rate: up to 16 Hz

Optical Sensor Options

Chlorophyll a	0-800 µg/l 2 gain settings: 0-40, 0-800
Fluorescein	0-500 ppb 2 gain settings: 0-25, 0-500
Rhodamine WT	0-1000 ppb 2 gain settings, 0-50, 0-1000
Sulforhodamine B	0-1000 ppb 2 gain settings, 0-50, 0-1000
Turbidity	0 to > 6,000 NTU Using nephelometric and OBS techniques
Phycocyanin	

Electrical

Battery:	Rechargeable Lithium Ion battery module
Battery Life:	CTD: approximately 20 hours continuous operation CTDplus: approximately 14 hours continuous operation from a fully charged battery pack

Physical

Materials:	Titanium/PEEK housing Titanium & composite sensor components
Depth Rating:	2000m
Instrument Size:	Ø62mm x Length 605mm
Weight:	4.5kg (in air)

1.2.2 Fluorometers

1.1.1.1 Safety Statement

A Hyperion Fluorometer is classified as Risk Group 1 under standard 62471. As the type is classified as Risk Group 1 solely due to radiation in the visible band a hazard label is not required. However,

- the LED used is in excess of the Exempt Group and that the viewer- related risk is dependent upon how the user installs and operates the equipment.

- the exposure hazard value (EHV) for a Hyperion Fluorometer in terms of distance is 320mm

<div style="border:1px solid red">

Never look directly into the Hyperion aperture

</div>

1.1.1.2 Chlorophyll a

	Performance
Excitation:	470 nm
Detection:	696 nm
Dynamic Range:	0-800 µg/l 2 gain settings: 0-40 and 0-800 (software controlled)
Instrument Detection limit:	0.025 µg/l*
Actual Detection limit:	0.025 µg /l**
Linearity:	0.99 R^2
Response Time:	0.03 to 2 sec

* 3x SD in RO water | ** calibrated against Chlorophyll a in acetone solution

1.1.1.3 Phycocyanin

	Performance
Excitation:	590 nm
Detection:	650 nm
Dynamic Range:	0-9 000 ppb 2 gain settings, 0-45, 0-9 000 (software controlled)
Instrument Detection limit:	<0.01 ppb*
Actual Detection limit:	0.08 ppb**
Linearity:	0.99 R^2
Response Time:	0.03 to 2 s

* 3x SD in RO water | ** Calibrated against Phycocyanin in water\Phosphate buffer solution

1.1.1.4   Fluorescein (Uranine)

	Performance
Excitation:	470 nm
Detection:	545 nm
Dynamic Range:	0-500 ppb 2 gain settings: 0-25 and 0-500 (software controlled)
Instrument Detection limit:	<0.01 ppb*
Actual Detection limit:	0.03 ppb**
Linearity:	0.99 R^2
Response Time:	0.03 to 2 sec

* 3x SD in RO water | ** Calibrated against Fluorescein solution

1.1.1.5   Rhodamine WT

	Performance
Excitation:	520 nm
Detection:	650 nm
Dynamic Range:	0-1000 ppb 2 gain settings, 0-50, 0-1000 (software controlled)
Instrument Detection limit:	<0.01 ppb*
Actual Detection limit:	0.06 ppb**
Linearity:	0.99 R^2
Response Time:	0.03 to 2 s

* 3x SD in RO water | ** Calibrated against Rhodamine WT solution

1.2.3   Sulforhodamine B

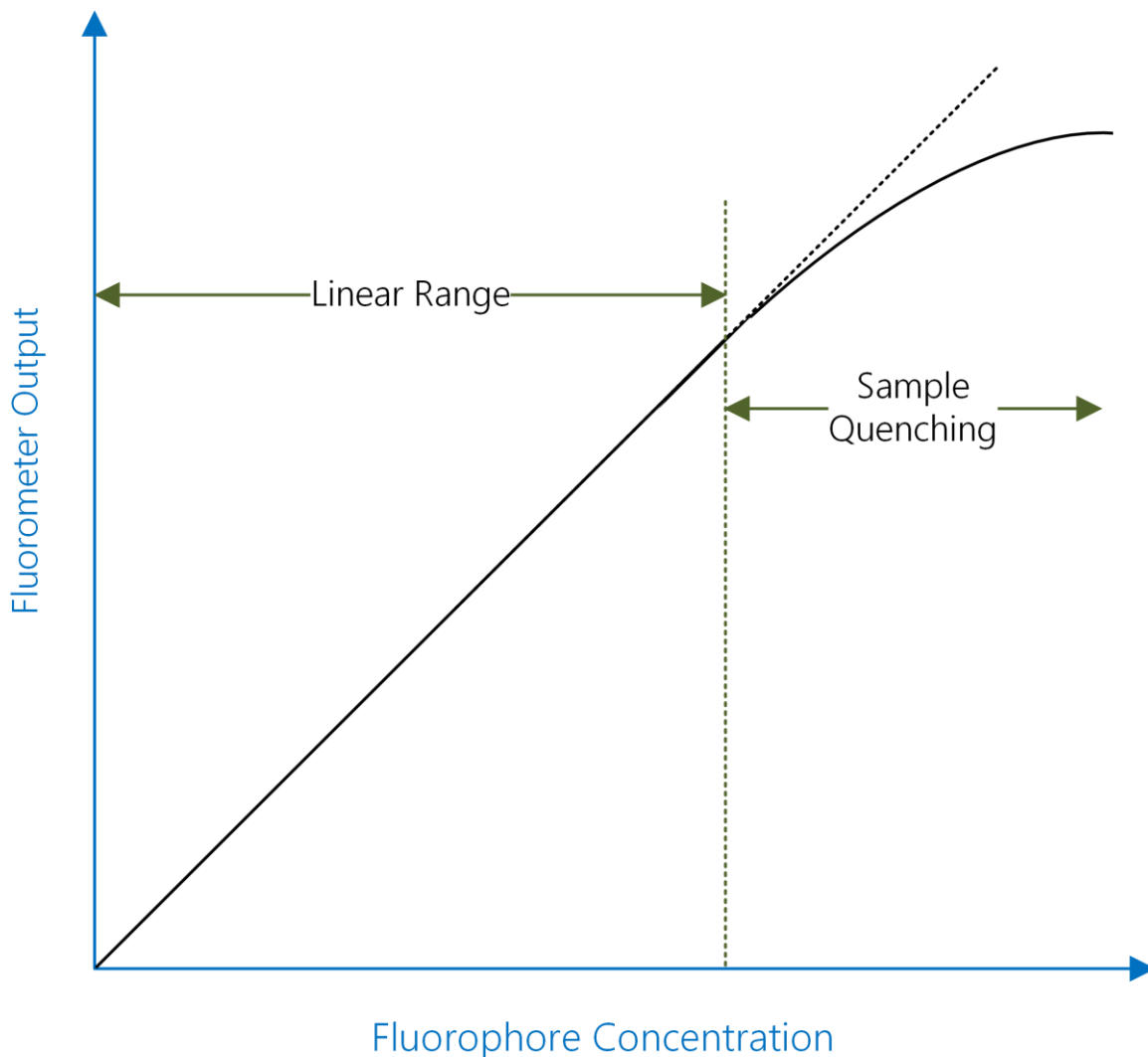|	Performance
Excitation:	520 nm
Detection:	650 nm
Dynamic Range:	0-1000 ppb
Instrument Detection limit:	<0.03 ppb*
Actual Detection limit:	<1 ppb**
Linearity:	0.99 R^2
Response Time:	0.03 to 2 s

* 3x SD in RO water | ** Calibrated against Sulforhodamine B solution

1.2.4 Linear Observation Range

The linear range is the concentration range for which the fluorometer signal is directly proportional to the concentration of the fluorophore. The linear range starts at the minimum detection limit (MDL) and extends to the upper limit of the instrument (dependent on fluorophore properties, optical filters, LED power, sample volume and optical path length).

Hyperion Fluorometers have a calibrated linear response for 2 gain settings (e.g. the ranges 0-40 µg/l (G5) and 0-800 µg/l (G1) for chlorophyll a).   At higher concentrations, unlike analogue devices which generally flat-line at full-scale deflection (e.g. FSD 5V) the Hyperion will continue to output a signal which increases with concentration (i.e. meaningful data), though which is no longer guaranteed to be linear.

At very high fluorophore concentrations, signal quenching can occur, whereby the instrument output does not increase linearly with fluorophore concentration (roll-off) and may decrease at even higher levels.

To perform a quick linearity check, dilute the sample 1:1 with RO water. If the reading decreases by 50%, the sample is in the linear range. If the reading decreases by less than 50% or even increases, the sample is above the linear range.

1.2.5 Quenching

Quenching refers to the reduction in fluorescence of a fluorophore. Several processes can result in quenching:

1. Chloride is known to quench quinine sulphate and Fluorescein. It is, therefore, advisable to prepare any fluorophore solutions with RO* or DI** water.

2. Temperature quenching - as the temperature of the sample increases, the fluorescence decreases, that is, fluorescence is sensitive to temperature. In order to improve accuracy, measure the sample at different temperatures and derive corrections for changes in temperature.

3. Photo-bleaching (or fading) is the (permanent) degradation of a fluorophore molecule by light resulting in lower signal levels. Photo-bleaching is dependent on exposure (intensity of light and duration) and wavelength (UV is more damaging than longer wavelengths). Use of more robust fluorophores is recommended to avoid photo-bleaching.

* Reverse Osmosis

** De-Ionised

1.3 Turbidity

Valeport's Turbidity technology is essentially two sensors in one. The first is a "classic" Nephelometer, using a 90˚ beam angle for turbidity levels between 0 and 2000 NTU. The second sensor uses optical backscatter - OBS (~120˚ beam angle) for turbidity levels beyond 10 000 NTU. Both sensors output data simultaneously, at a programmable rate, so there is no need to switch ranges as conditions vary. Intelligent sampling and the use of a 24 bit ADC eliminates the need to switch gain. The optical head is very compact, measuring just 20mm diameter and is rated to full ocean depth.

Excitation\Detection:	850nm	
Linear Range:	Nephelometer	0 to >1 000 NTU - linear response
	Optical Backscatter:	0 to 6 000 NTU - linear response
	(>6,000 NTU has a non-linear monotonic response that allows derivation of higher values using look-up tables)	
Minimum Detection Level	0.03 NTU	

1.3.1 Safety Statement

Valeport's turbidity sensor uses a near Infra-Red (NIR) LED operating at 850 nm with a reflector producing a fairly narrow output beam. As the photo-response of the eye is low at 850 nm the blink reflex and iris contraction reflex are not activated. NIR LEDs generally produce very low levels of radiation and pose no threat to the human eye. A photometric test report was commissioned by Valeport in accordance with BS EN 62471. For this the LED was set to 25 times the operational power and the sensor was classified as exempt. However, it is best practice to avoid extended exposure to the LED and it is recommended not to look directly into the sensor windows.

> The Turbidity sensor is classified EXEMPT under the standard 62471
> As a Hyperion Turbidity instrument is classified as EXEMPT a hazard label in not required

> Never look directly into the optical aperture

1.3.2 Dimensions

Ø51.0mm

Ø55.0mm

605.0 mm

Ø62.2mm
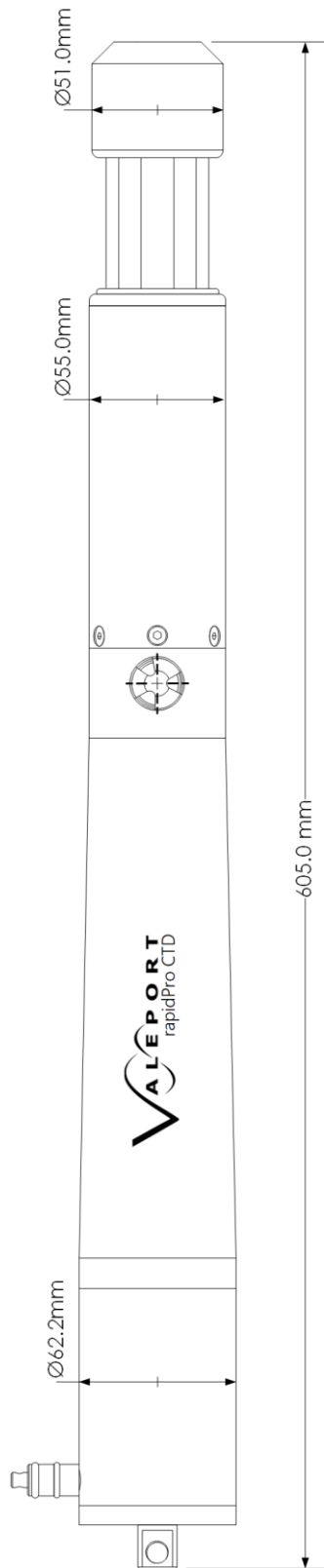
rapidPro CTD and rapidPro CTDplus

1.4   proLogger

The proLogger is a self-contained module that contains a 3.7V, 6.8 Ah rechargeable lithium ion battery, the data logger and Bluetooth comms. The battery powers the data logger, Bluetooth and the rapidPro instrument.

There are two sets of LEDs in the translucent white cap that indicate the status of the GPS and Bluetooth connection. They are only visible when the proLogger is out of the profiler.

Light Status	Description
GPS	
Solid Green	GPS Fix received
Flashing Green	GPS Fix not
Bluetooth	
Green	Unpaired
Blue	Paired

There are a further two sets of LEDs in the connector end cap that indicate the Battery charge status and the Operational status of the proLogger.
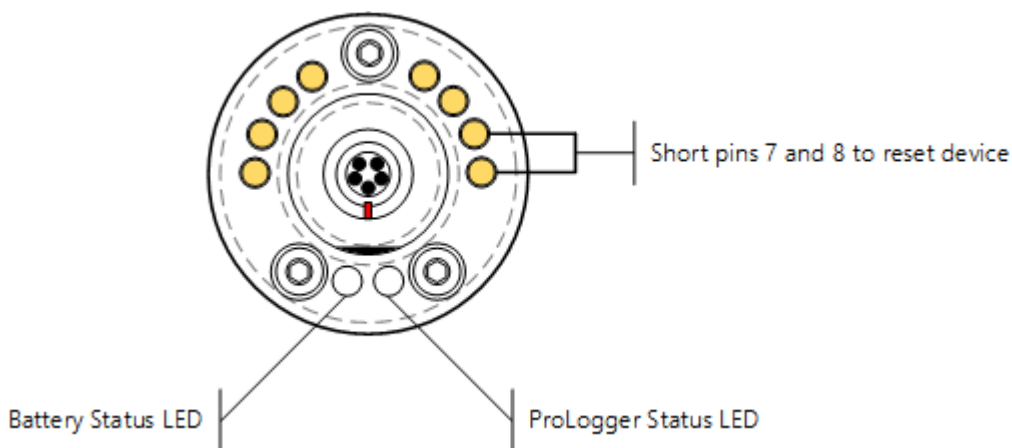
Light Status	Description
Battery Charging Status	
Flashing Red	Charging < 30% capacity
Flashing Amber	Charging at > 30% capacity < 60% capacity
Flashing Green	Charging > 60% capacity
Solid Green	Fully charged

proLogger Operational Status	
Solid Green	Run mode
Flashing Green	Interrupted mode
Amber	Bootloading Mode (only lit when upgrading firmware)

Bootloader Reset

In order to Boot load new firmware into the proLogger the unit has to be reset. In order to do this the Magnetic On/Off key must be placed close to the white, translucent end cap and pins 7 and 8 shorted together. Any Boot loading process must be carried out serially (NOT through Bluetooth) using the USB interface cable direct to a PC.

Outside of a rapidPro the proLogger is not powered. To power the proLogger outside of the instrument it must be powered with the charging/data cable provided using either the charger provided or a PC USB port.

The proLogger is compatible with both a rapidPro SVT and rapidPro CTD and can be swapped between the two.

1.4.1 Changing\Charging the proLogger

- Changing\Charging the proLogger of a rapidPro is a very simple process. All data is saved in non-volatile Flash memory, so data is secure during the process

- Remove the grub screw just below the black rear housing of the RapidPro profiler and then carefully unscrew rear housing

  - An Allen Key that fits the grub screw is provided in the case

- The proLogger can now be carefully removed for charging/data download

  - charging is carried out using the provided cable and charger

  - Data download operations can be carried out using the same charging cable as above but interfaced to a PC's USB port

The proLogger must be correctly 'ejected' from the PC
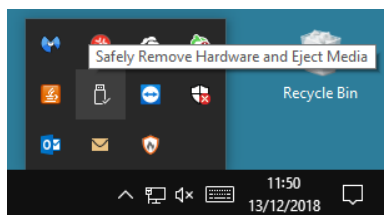
- Check for any water ingress to the instrument that has occurred during this process. Dry if necessary

> Before replacing the proLogger into the rapidPro all LEDs should be off
> If the LEDs are still on, re-interface the unit to the PC and 'eject' correctly

- Replace the proLogger into the instrument - rotating slowly until the location pins align, the proLogger will drop further into the rapidPro indicating that it is correctly sited
- Check the O-ring for damage and debris. Clean it and smear lightly with silicon grease. Replace if necessary

> For planned periods of extended storage, the proLogger should be removed from the instrument

1.4.2 proLogger Dimensions
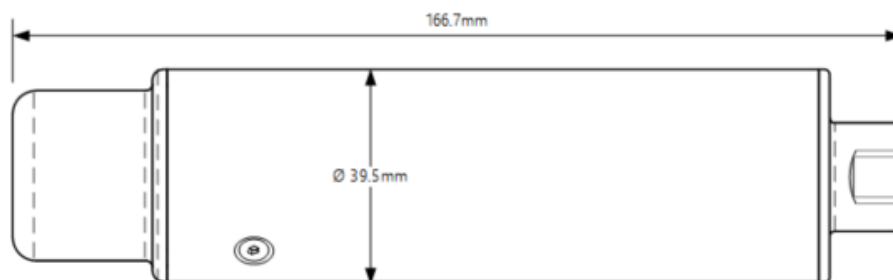
1.4.3 Rechargeable Battery

The proLogger is fitted with a rechargeable battery with the following characteristics:

Battery:	Internal, Rechargeable Lithium Ion Battery Pack
Capacity	6.8 Ah
Charging:	1.5A Charger that is supplied 0.5A Laptop USB port

> There is still current drawn when the rapidPro is switched off or in Sleep Mode and that the current drawn is considerably less when sub surface recording data but the GPS and Bluetooth are off. The GPS and Bluetooth are disabled as the pressure reading passes the trigger depth in Rapid Mode.

The instrument draws power continuously whilst running. Battery life is calculated as though the Bluetooth, GPS and sensor modules are always powered on and based on the following scenario:

- a profile to 200m with a decent rate of 5 ms^{-1}
- a recovery rate of 1 ms^{-1}
- 5 minutes spent on the surface before a new profile is initiated

- rapidPro SVT: 18 hrs operation
- rapidPro CTD: 15 hrs operation
- rapidPro CTDplus: 12 hrs operation

All battery calculation figures are estimated, and may vary according to deployment temperature and the inherent battery variability. Valeport accepts no liability for the failure of a battery to last for the expected lifetime

1.1.1.6 Charging

The battery pack is supplied with a dedicated USB charging and data download interface cable, this must be used.

In order to gain access to the charging socket the proLogger module must be removed from the rapidPro profiler.

The comms end cap has a large thread and is sealed by an O ring within the the Peek cover. In case of pressure build up in the housing the pressure seal is broken long before the thread releases the Peek cover allowing any gases under pressure to be released safely. The thread must be kept clean and clear.

If the rapidPro is used in a manner not specified by Valeport the protection provided by the equipment might be impaired.

The supplied USB charger is capable of charging the battery with a 1.5 A current.

The battery pack has intelligent charging and discharge circuitry. There is no 'memory' to the pack so partial charging sessions will not reduce the capacity or life of the pack. The capacity of the pack will, however, reduce with age.

It is advised that the proLogger battery is never allowed to become fully discharged. In a fully discharged state the battery is open circuit. In order to reduce the chances of battery becoming fully discharged the proLogger will disable all sensors with 1 hour's operational charge left. From disabling the sensors, you have approximately 50 hours to start a charging session to prevent the battery becoming open circuit.

If the battery is completely discharged and, therefore, open circuit it will take 50 minutes, using the supplied 1.5A charger, to start taking on a charge. Please note, during this 50 minute period of charging none of the LEDs will be lit.

It will take approximately 12 hours, using the supplied 1.5A charger, to fully charge the battery from a near flat but not open circuit state.

When the charging session is complete, disconnect the charging cable from the proLogger before disconnecting power from the charger.

When replacing a charged proLogger into a rapidPro with the Mag Key inserted, simply pull the Mag Key out to initialise the instrument. If the Mag Key is not in the instrument when the proLogger is replaced it is necessary to insert the Mag Key and then remove it to initialise the profiler.

1.1.1.7   Battery Life Expectancy

The batteries installed in the proLogger will loose capacity over time. Lithium-ion batteries use the movement of ion particles to create and store an electrical charge. Eventually these ion particles are trapped and can no longer move around. The batteries then lose their capacity to store energy.

Under normal operational conditions the rapidPro battery pack should offer a practical, usable capacity for a period in excess of 4 years.

1.1.1.8   Shipping Your proLogger with Lithium Ion Batteries

The Lithium Ion battery within this product, when packed and shipped in its transit box, conforms to UN3481, PI967 section II and its additional requirements.

No battery handling labels are required.

For further information, please contact Valeport and ask for one of the Dangerous Goods in shipment advisers or visit the IATA website page:

http://www.iata.org/whatwedo/cargo/dgr/Pages/lithium-batteries.aspx

1.1.1.9   Lithium Ion Battery Certification

Supplier´s Declaration of Conformity

SAP No.: 243045 **Model name:** Ll18650-34 1s2p + BQ27541-G1 Fuel Gauge	
☐ Lithium metal	☒ Lithium-ion
☐ cell	☒ battery (pack)

Lithium content or Watt-hour rating:

☐cells ≤ 1g (Lithium metal or Lithium alloy), 20Wh (Li-ion)
☐cells > 1g (Lithium metal or Lithium alloy), 20Wh (Li-ion)
☐batteries ≤ 0.3g(Lithium metal or Lithium alloy), 2.7Wh(Li-ion)
☒batteries ≤ 2g(Lithium metal or Lithium alloy), 100Wh(Li-ion)
☐batteries > 2g(Lithium metal or Lithium alloy), 100Wh(Li-ion)

Test results in accordance with the UN Manual of Test and Criteria ST/SG/AC.10/11 Rev.5/ Amend.2 Section 38.3

Test number	Test item	Results	Remarks
T-1	Altitude	Accepted	
T-2	Thermal cycling	Accepted	
T-3	Vibration	Accepted	
T-4	Shock	Accepted	
T-5	External short circuit	Accepted	
T-6	Impact /Crush	Accepted	
T-7	Overcharge	Accepted	
T-8	Forced Discharge	Accepted	for cell only

We, Jauch Quartz GmbH, hereby certify that above results are confirmed in accordance with the Manual of Tests and Criteria of the UN Recommendations on the Transport of Dangerous Goods, 5th revised edition Amendment 2, section 38.3.

Cell manufacturing as well as battery assembly is done under the quality assurance program of ISO9001:2008.

Name / Title of Signatory   Sönke Zacher / Sales Manager

Signature

Jan 27, 2016

Headquarters: Jauch Quartz GmbH · In der Lache 24 · 78056 Villingen-Schwenningen · Germany
Registry court: Freiburg HRB 602574, Managing Director: Thomas Jauch

As certified above the rapidPro rechargeable, Lithium Ion battery is not subject to any shipping restriction.

2 Communication | Memory | Software

2.1 Communications

The primary operational communications method for the rapidPro is Bluetooth.

When the proLogger is removed from the rapidPro housing a USB serial comms cable can be used directly to a PC. The same cable is used for charging the Logger.

Each proLogger module is interchangeable between rapidPro SVT and CTD instruments and has its own unique serial number.

The rapidPro is supplied with a customised USB Bluetooth dongle and antenna with 10m of cable that should be interfaced to a PC running Connect Software via a USB port.

The Bluetooth module is configured to communicate with the proLogger module and establish an automatic and robust link whenever the proLogger module it is paired with is within range and powered.

Close integration between the winch and the rapidPro can be achieved using built in functionality of Valeport's Connect software. Please contact Valeport for further information.

2.2 Memory

The rapidPro profilers is fitted with a 16GB SD card with more than sufficient capacity if some degree of data file management is used. When the proLogger is connected to a PC via a USB cable, the SD card will be accessible as a flash drive.

2.3 Software

The system is supplied with Valeport Connect PC software, for instrument setup, data extraction and display. Please see here for the Connect software and manual.

There are further function available to closely couple the operation of an automatic winch with the profiler if required. Please contact Valeport for further information.

An iOS App is also available for portable devices from the App store.

Valeport Connect PC software and App are license free

2.4   Qualification and Approvals - Bluetooth Module

EU Declaration of Conformity

rapidPro Profilers have u-blox type ODIN-W2 series stand-alone multiradio module with Wi-Fi and Bluetooth fitted as standard.

The Wi-Fi option is disabled.

It complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU and Restriction of Hazardous Substances (RoHS) Directive 2011/65/E - see below.

FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Radio Frequency Exposure

The OEM Serial Port Adapter contains a small radio transmitter and receiver. During communication with other Bluetooth products the OEM Serial Port Adapter receives and transmits radio frequency (RF) electromagnetic fields (microwaves) in the frequency range 2400 to 2500 MHz. The output power of the radio transmitter is very low.

When using the OEM Serial Port Adapter, you will be exposed to some of the transmitted RF energy. This exposure is well below the prescribed limits in all national and international RF safety standards and regulations.

Potentially Explosive Atmospheres

Turn off your electronic device before entering an area with potentially explosive atmosphere. It is rare, but your electronic device could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fueling areas, such as petrol station, below deck on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

2.4.1   Compliance with RoHS Directive

The ODIN-W2 series modules comply with the "Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

No natural rubbers, hygroscopic materials, or materials containing asbestos are employed.

2.4.2 European Union Regulatory Compliance - Bluetooth Module

EU DECLARATION OF CONFORMITY

SHORT RANGE

To whom it may concern:

Hereby, u-blox AG declares under its sole responsibility that the following product – ODIN-W2 Multiradio modules – comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU and Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU.

Technology	Product name	Hardware release	Software release
Wi-Fi and Bluetooth®BR/EDR and Low Energy	ODIN-W260	04 or later	1.0.0 – 4.0.x *
	ODIN-W262		4.1.0 or later

Essential Requirements Radio Equipment Directive 2014/53/EU	Standards
Safety & Health (Article 3.1a)	IEC 60950-1:2005 (2nd Edition) + A1:2009 + A2:2013 EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + AC:2011 + A2:2013 EN 62311:2008 (Wi-Fi) EN 62479:2010 (Bluetooth)
EMC (Article 3.1b)	EN 301 489-1 V2.1.1 EN 301 489-3 V1.6.1 EN 301 489-17 V3.1.1 IEC 60601-1-2:2014 (Medical Electrical Equipment)
Radio Spectrum Efficiency (Article 3.2)	EN 300 328 V2.1.1 EN 301 893 V2.1.1 (V1.8.1*) EN 300 440 V2.1.1

Essential Requirements RoHS Directive 2011/65/EU	Standards
Prevention (Article 4.1)	EN 50581:2012

*The RED compliance for ODIN-W2 software releases 1.0.0 to 4.0.x is valid until June 12, 2018.

Authorized representative within the European Union
u-blox Malmö AB, Östra Varvsgatan 4, SE-211 75 Malmö, Sweden

Name:	Daniel Ammann
Position:	Director, u-blox AG
Date of issue:	August 16, 2017
Signature:	

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u-blox

Safety Compliance

In order to fulfill the safety standard EN 60950-1, the unit must be supplied by a limited power source.

FCC Compliance

FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and

2. this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

The ODIN-W2 module is for OEM integrations only. The end-user product will be professionally installed in such a manner that only the authorized antennas are used.

Any changes or modifications NOT explicitly APPROVED by u-blox could cause the module to cease to comply with FCC rules and thus void the user's authority to operate the equipment.

Cautions

⚠ Any changes or modification could cause the module to cease to comply with FCC rules part 15 and thus void the user's authority to operate the equipment.

⚠ In case of absence of information to transmit or operational failure the module types ODIN-W2 will automatically discontinue transmission.

Labelling Requirements for End Product

For an end product using the ODIN-W2 modules there must be a label containing, at least, the following information:

> This device contains
>
> FCC ID: PVH0965
>
> IC: 5325A-0965

2.4.3 Bluetooth Qualification Information

The ODIN-W2 series modules have been qualified according to the Bluetooth 4.0 specification.

The ODIN-W2 series module is Bluetooth listed with Declaration ID D028207. For an end product with ODIN-W2 integrated no further qualification is required.

3 Operation

3.1 Operating Modes

3.1.1 Rapid Mode

The rapidPro Profilers have a special mode designed for rapid profiling. Once the instrument is set into run mode:

No data is logged until a trigger depth is reached (e.g. 2 metres below the surface).

When the probe reaches the bottom of the profile and rises by a defined amount (e.g. 3 metres or more than the local sea and swell) the profile file is closed and saved. This is referred to as the Trigger Step**.**

For a new profile to be started, the profiler must return to a depth of less than the Trigger Depth.

> The time stamp stored in Rapid Mode files is defined as when the data was logged from, not when the file was created.

3.1.2 Continuous mode

The rapidPro will log data at the defined rate from when the instrument is set into run mode or switched on. Data will be logged at that rate until the instrument is interrupted or switched off.

When used in conjunction with Connect software, the rapidPro can be operated in an automatic mode, where the presence of the unit on the surface is recognised, after a profile has been observed and that data file is recovered through Bluetooth.

3.2 Switching On/Off

The rapidPro is switched on/off with a magnetic switch in the top of the instrument. The instrument is supplied with two magnetic keys - Mag Keys, for this purpose. When the key is inserted into comms end cap, the instrument will be switched OFF.

To switch the instrument ON, the Mag Key should be removed. It will take ~15 seconds for the instrument to initialise.

If both keys are lost, it will be necessary to remove the proLogger from the instrument in order to turn the power off.

> Note: On removing the key and initialising the instrument a new pressure observation will be taken and used as the default Atmospheric pressure Tare value, recorded in the header with a time stamp and applied to recorded data. See section 'Pressure Tare'.

3.3 Deployment

The rapidPro has been designed to be deployed with the Teledyne OceanScience Underway winch system - rapidCAST. Using this deployment allows the rapidPro to collect profiles to ~400m depth whilst underway at up to 10kts. See OceanScience documentation for guidance on deployment of the instrument.

rapidPro probes that have been supplied with the OceanScience winch will be fitted with an adapter and tail spool for attachment to the winch system.

rapidPro probes can, of course, be deployed using any winch or deployment system. Probes that are supplied independently of the OceanScience winch will be supplied with a tail adapter to fit a shackle for attachment to the deployment line.

3.4 Pressure Tare

A rapidPro has an auto-tare function. Each time the power key is removed from the profiler, the pressure sensor is zeroed to atmospheric pressure. The value and time stamp of the latest Tare reading is recorded in the header of every file. The latest Tare value is applied to recorded data.

A manual Tare can be applied if required using # commands:

#009;	Takes a single reading of the pressure sensor and uses the measured value as a Tare (note the ';' in the command)
#009;nn	Sets the Pressure Tare to 'nn', a user specified value (entered in the chosen units as set with command #018)
	e.g: #009;10.3 sets Pressure Tare to 10.3 dBar, metres or feet.
#010	Instrument responds with current Tare value

Note: a manual Tare value will be overwritten if the instrument is powered down and then back up again using the Mag Key.

3.5 Data Requests and Output Formats

The rapidPro is designed to be used with Valeport's Connect software. However, the instrument will connect as a serial port and respond to a series of text commands that are detailed below. Note that this list is not comprehensive, but will allow the standard functions of the instrument to be accessed. For more detailed information, please contact Valeport Ltd.

- Communication settings of the instrument are:

Baud Rate:	selectable (Bluetooth = 230400)
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	None

- Your Terminal program must be set to 'Send Line Ends with Line Feeds'
  - Valeport recommend their Terminal x2 comms App that is available from the website here.
- All commands must be confirmed using "Carriage Return" or "Enter" on the keyboard, with the exception of the "Stop" command (#).
- All commands are echoed back by the instrument as they are typed

3.5.1 Stop Command

The instrument can be stopped at any time by sending the '#' character.

The instrument returns a '>', and waits for a further command.

3.5.2 Run Commands

#R1	Collects rapid profile at 1 Hz
#R2	Collects rapid profile at 2 Hz
#R4	Collects rapid profile at 4 Hz
#R8	Collects rapid profile at 8 Hz
#R16	Collects rapid profile at 16 Hz
#R32	Collects rapid profile at 32 Hz
#M1	Performs continuous measurement at 1Hz
#M2	Performs continuous measurement at 2Hz
#M4	Performs continuous measurement at 4Hz
#M8	Performs continuous measurement at 8Hz
#M16	Performs continuous measurement at 16 Hz
#M32	Performs continuous measurement at 32 Hz

3.5.3 Rapid Profile Settings

#812;NN.N	Set: Trigger Depth	Logging ON for Down Cast | Logging OFF for Up Cast
#813	Read: Trigger Depth	
#814;NN.N	Set: Trigger Step	Logging OFF when depth decreases by amount for Down Cast
		Logging ON when depth decreases by amount for Up Cast
		(signifies the deepest point of the profile)
#815	Read: Trigger Step	

3.5.4 Site information

| #037;info	Each data file may contain up to 58 characters of information about the deployment. Each file will use the same information until it is updated.
#038	Instrument responds with current site information

3.5.5 Instrument Information

#032	Instrument responds with its software version number
#034	Instrument responds with its serial number
#138	Instrument responds with date of last calibration

4 Bluetooth Adapter - Re-Program and Pair

Complete the following steps:

- Install the Bluetooth Configurator utility (vpBluetoothSetup.exe)

- Ensure that the SWiFT USB cable is disconnected

- Ensure the SWiFT is turned on

- Plug USB Bluetooth adapter into the PC and note the Com port number

- Select the Com port the USB Bluetooth adapter is configured as

  - In order to do this go to the Windows Control Panel > Device Manager > Ports (COM & LPT)
    if the Com port is not obvious, unplug the cable or Bluetooth adapter, the Com will disappear and reappear when the adapter is plugged back in.
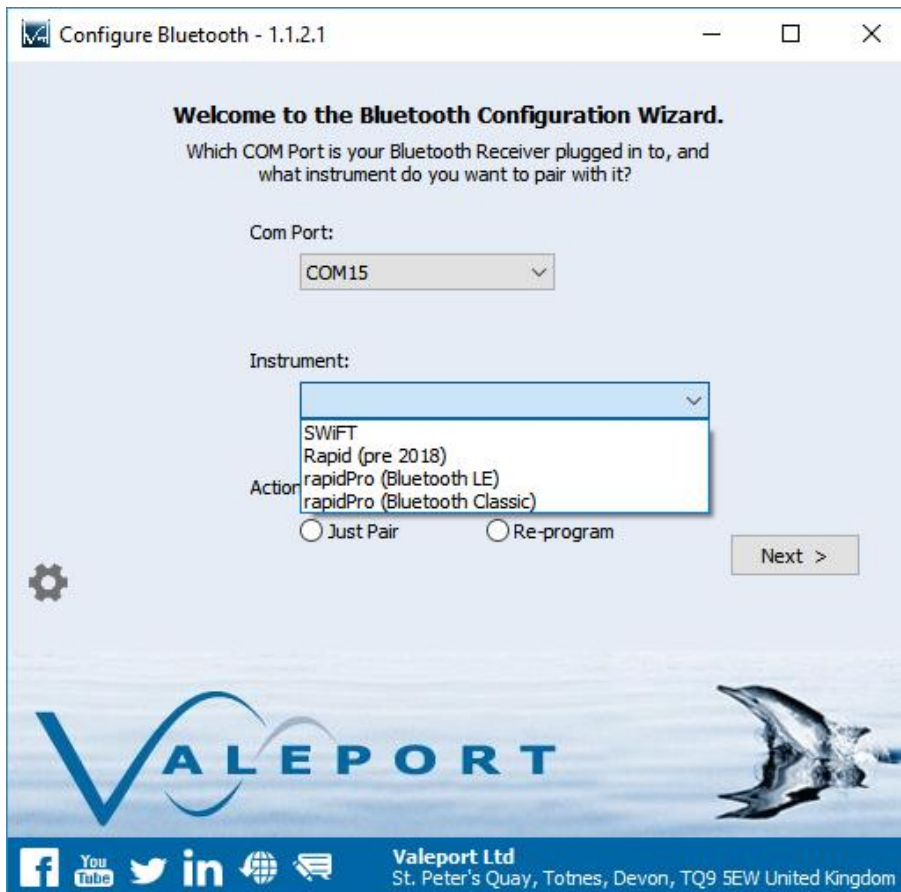
- Select the instrument type:
  - SWiFT: SWiFT SVP and SWiFTplus
  - Rapid: original Rapid, pre 2018
  - Rapid Logger (Bluetooth LE Mode): proLogger Module (rapidPro SVT, CTD and CTDplus) - Factory Default.
  - Rapid Logger (Classic Mode): proLogger Module (rapidPro SVT, CTD and CTDplus).

- Select Re-program if your Bluetooth module is not in the mode required - Classic or LE.

- Select Just Pair if your Bluetooth module is in the correct mode and you simply need to pair with your instrument.
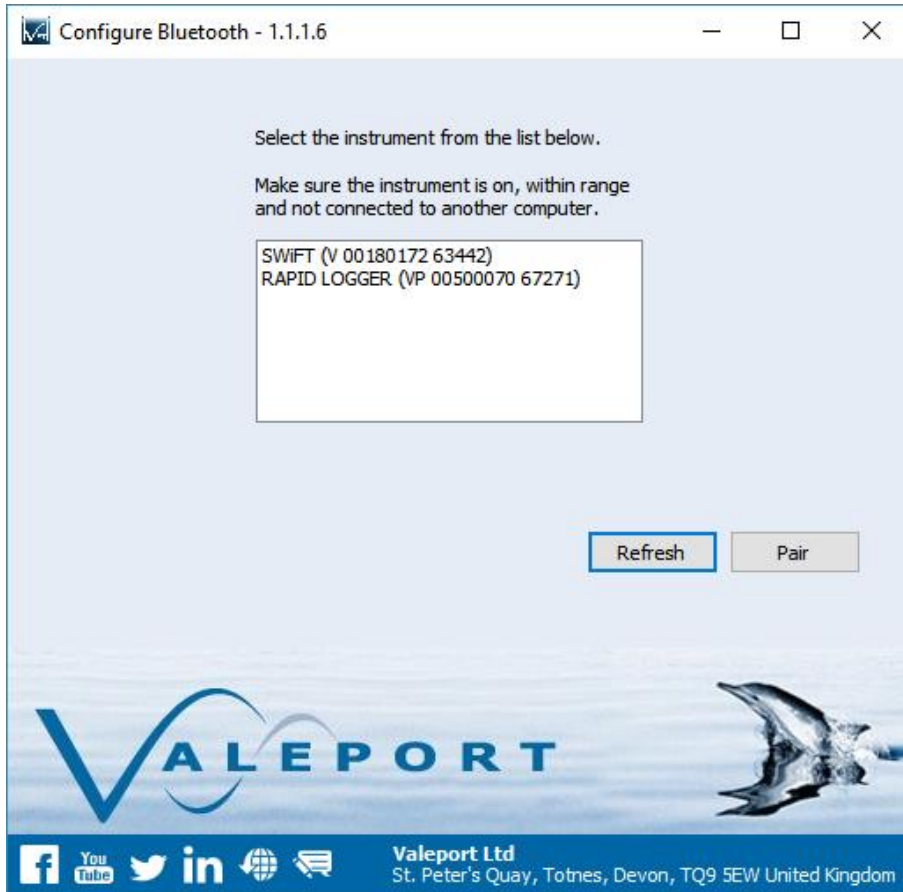
Click   Next >

The status LED on the USB Bluetooth module will change colour a number of times while it is being configured

Once configured, the USB Bluetooth key will scan for devices in range.

Your Instrument should appear in the list, if it doesn't, ensure it is powered up, in range and not connected to another adapter or Bluetooth device and try again:
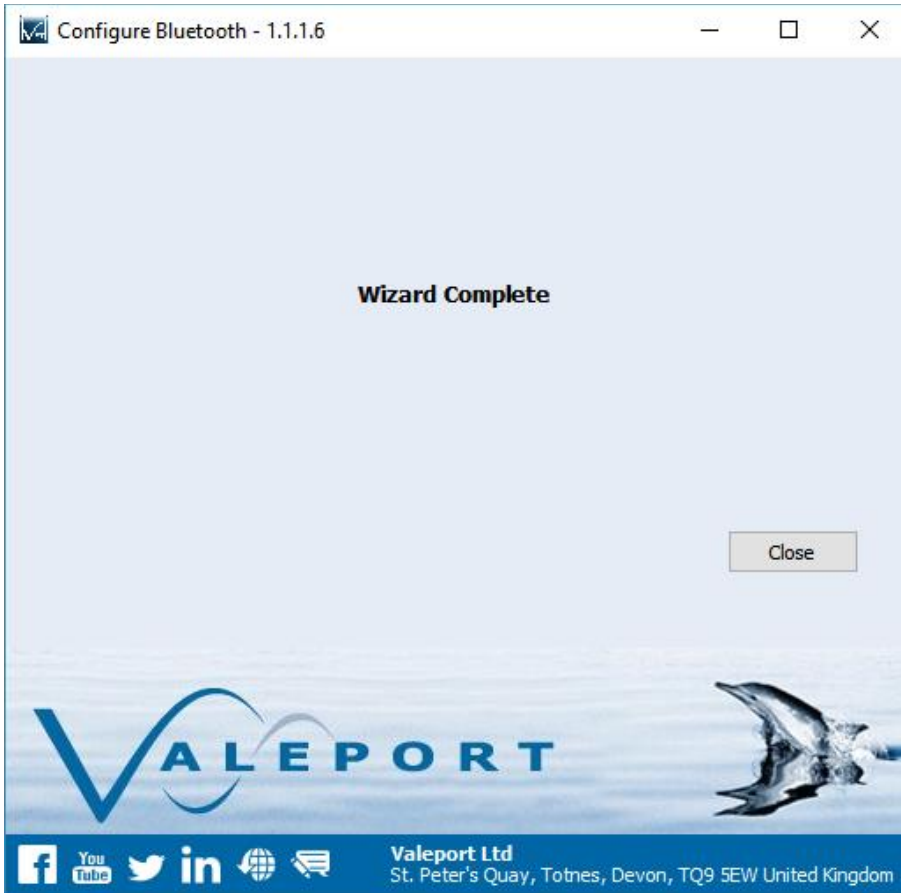
Click on [Refresh]

Select your Instrument from the list and

Click [Pair]

The LED on the adapter should go blue to indicate a successful pairing operation. If your Instrument has a visible Bluetooth LED it should also have turned blue.

Configure Bluetooth - 1.1.1.6

Wizard Complete

Close

Valeport Ltd
St. Peter's Quay, Totnes, Devon, TQ9 5EW United Kingdom

Configure Bluetooth - 1.1.1.6

5 Ordering and Part Numbers

5.1 Ordering and Part Numbers - rapidPro SVT

Part No.	Description
0660046-TS-XX	rapidPro SVT profiler in Titanium/Stainless Steel housing rated to 2000m. Fitted with: 　Sound Speed Sensor 　0.01% FS, Pressure Sensor 　±0.01° C fast response thermistor temperature sensor 　1x proLogger module Supplied with: 2x switch keys Bluetooth module & external antenna with 10m cable Tool kit Connect PC software Operating manual and system transit case.
	Note: XX on code denotes pressure transducer range - select from 100 or 200 bar

5.2 Ordering and Part Numbers - rapidPro CTD

Part No.	Description
0660045-XX	rapidPro CTD profiler in Titanium/stainless steel housing rated to 2000m. Fitted with: 　Pressure Compensated Conductivity Cell 　0.01% FS, Pressure Sensor 　±0.01° C fast response thermistor Temperature Sensor 　1x proLogger module Supplied with: 2x switch keys Bluetooth module & external antenna with 10m cable Tool kit Connect PC software Operating manual and system transit case.
0660045FC-XX	rapidPro CTDplus Profiler with a Fluorometer – Chlorophyll a and a high specification thermistor
0660045FF-XX	rapidPro CTDplus Profiler with a Fluorometer – Fluorescein and a high specification thermistor
0660045FR-XX	rapidPro CTDplus Profiler with a Fluorometer – Rhodamine and a high specification thermistor
0660045FT-XX	rapidPro CTDplus Profiler with a Turbidity Sensor and a high specification thermistor
	Note: XX on code denotes pressure transducer range - select from 100 or 200 bar

5.3 Ordering Part Numbers - proLogger Module

Part No.	Description
0660EA4	proLogger Module comprising: Bluetooth Comms Rechargeable Lithium Ion Battery Logger module for rapidPro CTD, CTDplus and SVT profilers

6 EU Declaration of Conformity - CE Marking

Any changes or modifications to the product or accessories supplied, that are not authorised by Valeport Ltd, could void the CE compliance of the product and negate your authority to operate it. This product has demonstrated CE compliance under conditions that include the use of shielded cables. It is important that you use shielded cables compliant with the product's conformance, to protect from potential damage and reduce the possibility of interference to other electronic devices.

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VALEPORT

EU Declaration of Conformity

CE Marking

Manufacturer:	Valeport Ltd
Address:	St Peter's Quay, Totnes, Devon, TQ9 5EW
Certification marking:	CE
Product Description:	rapidPro SVT/CTD/CTDplus with ProLogger

We the manufacturer declare that the product **rapidPro SVT/CTD/CTDplus with ProLogger**, is in conformity with the following EU Directives and harmonised standard(s):

Radio Equipment Directive 2014/53/EU	Standards
Safety (Article 3.1a)	BS EN 61010-1:2010
EMC (Article 3.1b)	EN 301 489-1 V2.1.1 (Basic Level) EN 301 489-3 V1.6.1 EN 301 489-17 V3.1.1 BS EN 61326-1:2013 (Basic Level)
Radio Spectrum (Article 3.2)	EN 300 328 V2.1.1 EN 301 893 V2.1.1 EN 300 440 V2.1.1 BS EN 62479:2010

RoHS Directive 2011/65/EU	Standards
Prevention (Article 4.1)	BS EN 50581:2012

Additional harmonised standard for **rapidPro CTDplus** profilers with optical sensor fitted:

Harmonised Safety Standards	Standards
Photobiological safety of lamps and lamp systems	BS EN 62471:2008

Name:	Jamie Sims
Position:	Development Engineer
Place of issue:	Valeport Ltd, Totnes, UK
Date of issue:	11th September 2018
Signature:	

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VAT No: GB 165 8753 67 Registered in England No: 1950444

ISO 9001   ISO 14001

Approved antenna

Antenna name	Manufacturer	Comment	Gain
Internal Bluetooth antenna	**ProAnt**	SMD PIFA antenna	2.4GHz +3 5GHz <3