



HYPERION OPTICAL SENSORS OPERATING MANUAL



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1 Introduction - Hyperion Optical Sensor

Valeport's range of Hyperion optical instruments delivers high performance optical measurements for the following fluorometers parameters:

- Chlorophyll a
- Fluorescein (Uranine)
- Phycocyanin
- Rhodamine WT
- Sulforhodamine B
- Crude Oil

and

- Turbidity

in a compact & robust package ideal as a standalone sensor, for ROV and AUV integration or used as part of a multi-sensor array with a data logger.

Offered as standard in a 6000m depth rated, titanium housing the Hyperion mini type Optical Instrument has a wide range (9 - 28V DC) isolated power supply, data output up to 16Hz and RS232, RS485 and Modbus RT communication protocols.

The Hyperion sensors can also be integrated into Valeport's SWiFT, rapidPro CTD and fastCTD profilers and interfaced to MIDAS CTD+ (400 series) type instruments.

The Hyperion has an accurate single channel detector that can be used for many different fluorophores. It is designed for integration into systems providing electrical power and delivers a signal that has been correlated to a known concentration of fluorophore.

1.1 Fluorophore & Nomenclature

"C"	Chlorophyll a
"F"	Fluorescein (Uranine)
"PC"	Phycocyanin
"R"	Rhodamine WT
"SRB"	Sulforhodamine B
"F4"	Crude Oil

More Fluorophores will become available in the Hyperion family of products - please check with Valeport for availability.

Other optical, non-fluorescent technology:

"TU"	Turbidity
------	-----------

1.2 PCB Update

1.2.1 November 2020

From November 2020 (serial numbers > 75100) a new PCB was introduced to the Hyperion Fluorometer. The new MK2 PCB offers the same performance as the MK1 but no longer requires the gain to be adjusted to achieve the full sensing range performance.

1.3 Calibration Update

From firmware version 903707A22 a new 2nd order calibration fit was introduced to improve linearity at higher concentrations to counter some of the effects of quenching.

2 Sensors

An optical sensor must be kept clean to operate correctly. Ensure that the unit is powered down before cleaning the sensor.

- Use warm soapy water with a soft bristled brush to remove any light fouling
- For heavy fouling use a solvent (e.g Isopropyl alcohol) and a soft bristled brush
- Always rinse thoroughly after every use in clean, fresh water.

2.1 Fluorometers

2.1.1 Chlorophyll a

	Performance
Excitation:	470 nm
Detection:	696 nm
Dynamic Range:	0-800 µg/l (pre SN 75100: 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

2.1.2 Fluorescein (Uranine)

	Performance
Excitation:	470 nm
Detection:	545 nm
Dynamic Range:	0-500 ppb (pre SN 75100: 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

2.1.3 Phycocyanin

	Performance
Excitation:	590 nm
Detection:	650 nm
Dynamic Range:	0-9 000 ppb (Pre SN 75100: 2 gain settings, 0-45, 0-9000 (software controlled))
Instrument Detection limit:	<2 ppb*
Actual Detection limit:	2.08 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

2.1.4 Rhodamine WT

	Performance
Excitation:	520 nm
Detection:	650 nm
Dynamic Range:	0-1000 ppb (pre SN 75100: 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

2.1.5 Sulforhodamine B

	Performance
Excitation:	520 nm
Detection:	650 nm
Dynamic Range:	0-1000 ppb
Instrument Detection limit:	<0.02 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

2.1.6 Crude Oil

	Performance
Excitation:	365 nm
Detection:	410-600 nm
Dynamic Range:	0-1500 ppb
Instrument Detection limit:	<0.2 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 PTSA standard solution

2.1.7 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.

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.

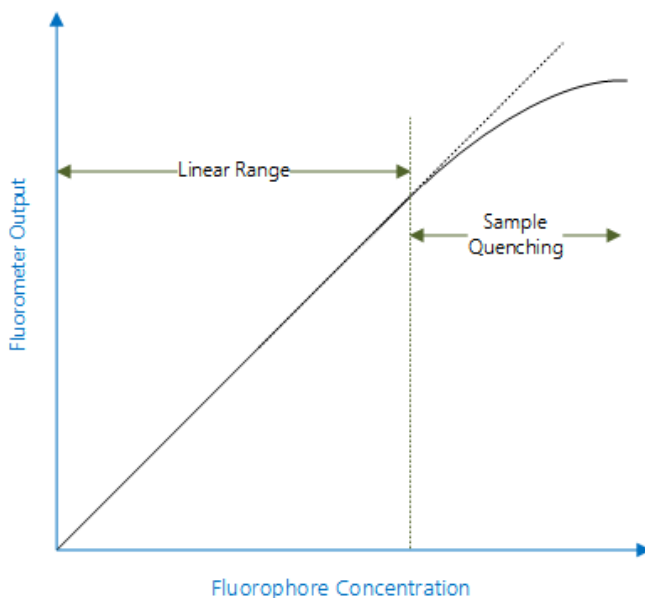
Never look directly into the optical aperture when the unit is powered

2.2 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).

Prior to November 2020 (Serial No: 75100) Hyperion Fluorometers had a calibrated linear response for 2 gain settings (e.g. the ranges 0-40 $\mu\text{g/l}$ (G5) and 0-800 $\mu\text{g/l}$ (G1) for chlorophyll a). Post November 2020, a single gain setting for full scale was introduced. 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.

2.3 Quenching

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

Chloride is known to quench quinine sulphate and Fluorescein. It is, therefore, advisable to prepare any fluorophore solutions with water prepared by Reverse Osmosis or De-Ionised water.

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.

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.

2.4 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 4 000 NTU - linear response (>4000 NTU has a non-linear monotonic response that allows derivation of higher values using look-up tables)
Minimum Detection Level	0.03 NTU

2.4.1 Turbidity Units

Turbidity is traditionally measured in NTU - Nephelometric Turbidity Units. These are the units that the Hyperion Turbidity sensor is calibrated to. The Nephelometric sensor data is labelled NTU while the Backscatter sensor data is labelled as BTU - Backscatter Turbidity Units. This is done purely to clarify the difference in sensor technology. BTU is not an industry recognised unit but can be considered to be equivalent to the NTU because both sensors are calibrated with the same standard solutions source. Please contact Valeport for further clarification if required.

2.4.2 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 is not required

Never look directly into the optical aperture when the unit is powered

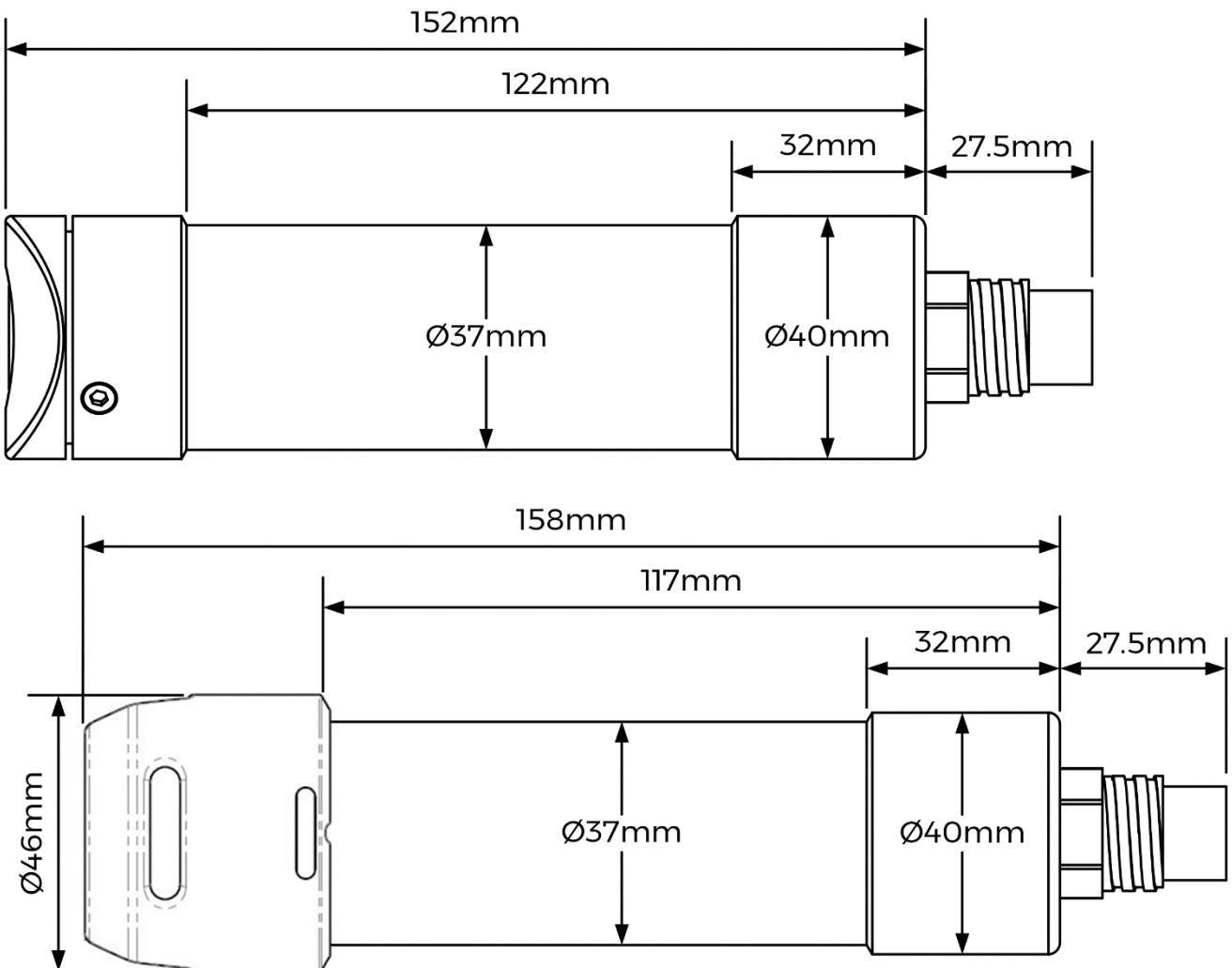
2.5 Physical Characteristics

Materials:	Titanium with sapphire / glass window Polymer optical fibre
Depth Rating:	6000m
Dimensions:	40mmØ x 179.5mm (including connector)
Weight	0.50 kg (in air) 0.26 kg (in water)
Operating Temperature:	60°C max (without damaging the optical sensor)

2.5.1 Dimensions

As part of a 'mini' type instrument

An optional sensor guard is shown on the second drawing.



3 Data Acquisition

Hyperion optical sensors are designed for both static monitoring and profiling operations either as a standalone instrument or as part of a profiling multi sensor instrument.

The optical sensor should be mounted with the window on the front face of the instrument and therefore, the beam of excitation light directed into the water body to be analysed. During the synchronised observation period ambient light is measured while the Hyperion LED is off and again when the LED is on in order to cancel out the ambient light effects.

If very high ambient light levels are encountered, e.g. bright sunlight, in shallow water where there is a light coloured / reflective bottom, the receiver may become saturated and return negative number results. If this happens some form of shading will be required and the sensor not mounted so it points directly at the bottom.

Valeport can provide an Ambient Light Shield (0901SA7). Please contact Valeport for details.



3.1 Output Rate

The signal output can be configured between 0.5 Hz and 16 Hz (free running) using software control.

The unit is factory pre-set to the maximum synchronous averaging period (0.5 Hz or 2 secs) in order to be able to resolve the minimum detection limit.

Fast data rates should only be used where good signal levels are encountered, otherwise features may be lost in the background noise. In very low signal conditions, signal:noise ratio issues will, therefore, limit the maximum vertical speed and resolution when running profiles.

3.2 Operating Modes

Hyperion can operate in a number of modes.

The set-up of these modes uses a macro like format where a command C02 or M16 will set the unit into a particular mode and configure multiple filter settings appropriately for that mode and update period.

Other operational modes and filter settings are available - please contact Valeport with your specific requirements.

3.2.1 Mode C - Continuous

Mode C is the default setting for Hyperion.

Command example: #039;C02

In this mode the instrument will be set into a continuous output cycle of appropriately averaged and filtered data.

Mode C02: (C zero 2) will output a reading every 2 seconds. This is the maximum synchronous observation measurement period.

Mode C04: (C zero 4) will output a reading every 4 seconds but that will be a mean of 2, 2 second synchronous observation measurement periods.

Setting	Measurement period (sec)	Synchronous sample interval (secs)	Number of samples
C01	1	1	1
C02	2	2	1
C04	4	2	2
C06	6	2	3
Cxx	xx	2	xx/2

3.2.2 Mode M - Continuous Measurement

Mode M will perform a measurement and data output at the rate specified up to 16Hz.

Command example: #039;M8

Filter settings are appropriately set for the update rate.

M1: performs continuous measurements at 1Hz

M2: performs continuous measurements at 2Hz

...

M16: performs continuous measurements at 16Hz

Setting	Measurement period (sec)	Synchronous sample interval (secs)	Number of samples
M1	1	1	1
M2	0.5	0.5	1
M4	0.25	0.25	1
M8	0.125	0.125	1
M16	0.0625	0.0625	1

3.2.3 S Mode

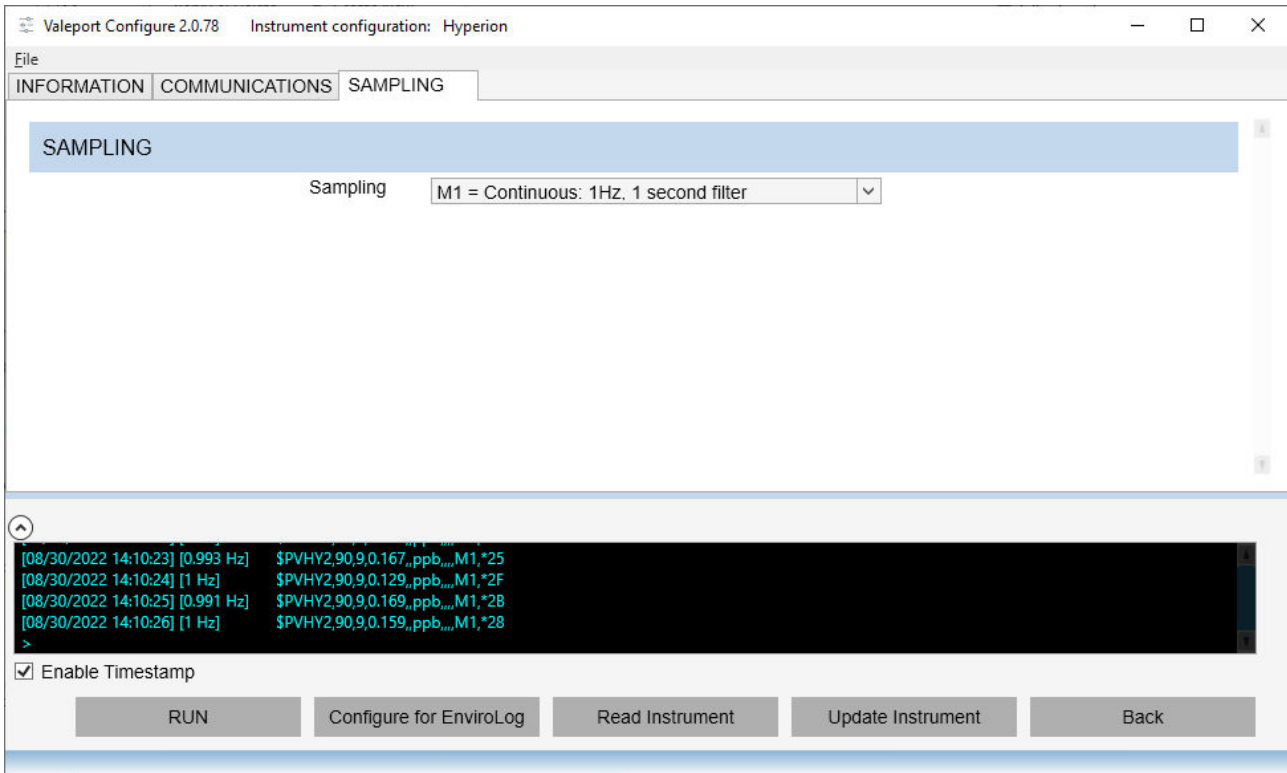
Single observation on run command (#028)

Command example: #039;S2

Setting	Measurement period (sec)	Synchronous sample interval (secs)	Number of samples
S1	1	1	1
S2	2	2	1
S4	4	2	2
S6	6	2	3
Sxx	xx	2	xx/2

4 Functional Check

To perform a functional test connect the Hyperion to both power and PC using the supplied Y lead. Run up the Configure App and check that data is being received in the Terminal window. The data display will be in the selected output format, at the rate selected in the sampling option:



Now check the following:

The LEDs are on and light is being emitted from the fibres.

The magnitude of the data received increases when the supplied fluorescent target is held at 45° to the sensor window:



By altering the angle of the target, the magnitude of the reading should change thereby showing the correct operation of the sensor.

If the test target is missing then a piece of good quality white paper can be used.

4.1 User Calibration Factor and Offset

From firmware version 903707A15 a new feature became available – User Calibration factors. A combined command consisting of a separate Gain factor (a multiplication factor) and an Offset value (this value is added). Parameters of 1;0 will cause no effect to the Valeport calibrated value. It is recommended that this function is switched off when not in operation using command #086;0 or setting the factor to OFF using the Configure App.

On updating firmware insure that all parameters are correctly configured – with special attention given to the User Calibration factor and offset that should be re-entered manually:

Channel 1 write: #094;gain;offset

#094;1;0<CR>

Channel 2 write: #096;gain;offset

#096;1;0<CR>

User Cal status OFF

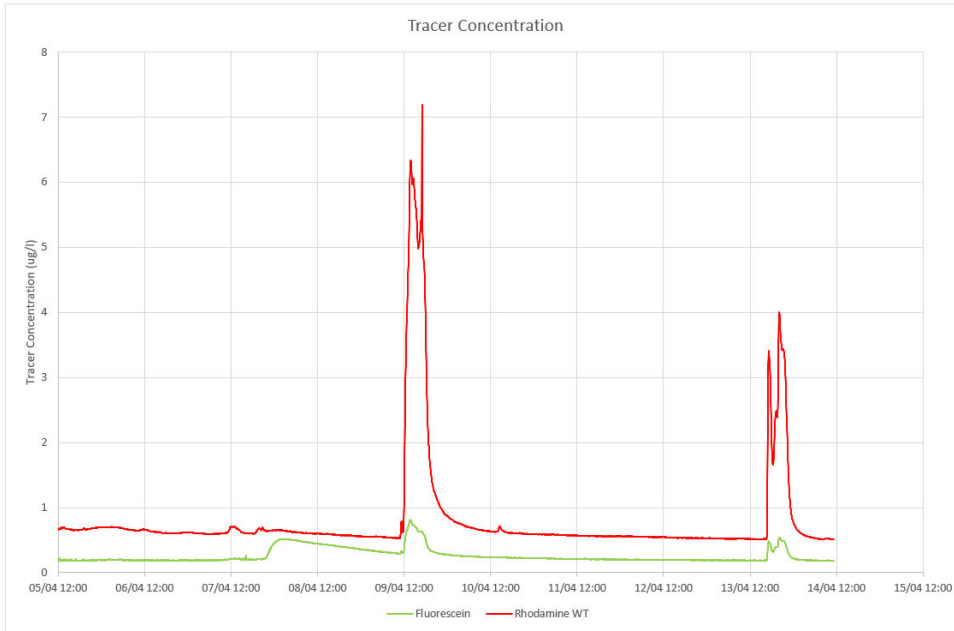
#086;0<CR>

Then reset from scratch.

5 Operation with Multiple Dye Types

If your survey calls for dye tracing with more than one dye in the same water body, at the same time please contact Valeport for the compatibility of those dyes operating together.

For example see below, using Rhodamine and Fluorescein together. It is possible that the Fluorescein fluorometer will give a false positive to the Rhodamine dye:



6 Operation with 400 Series Instruments

If the Hyperion Instrument is used with a 400 series Instrument e.g. MIDAS CTD+ it should be configured using Configure software as follows:

Baud Rate: 38400 (#059 38400)
Mode: Continuous

- The 400 series Instrument must be configured using DataLog Pro ver 04007125F1 or later
- Ensure the 400 unit internal Power source (from 0400550) for the Hyperion is connected as per cable form 0400C321.
- Ensure the latest version of Hyperion interface code (04007181) is installed in the Quartzonix Board (0400513)

7 Communications

The instrument will operate in real time, with setup performed by direct communications with PC before and after deployment.

Both RS232 and RS485 (including Modbus) outputs are available, selected by command code.

RS232 data may be taken directly into a PC over cables up to 200m.

RS485 is suitable for longer cables, up to 500m, and allows for multiple addressed units on a single cable.

Baud Rate	2400 - 115200
Protocol	8 data bits, 1 stop bit, No parity, No flow control

7.1 Data Output Format \$PVHYP (Pre November 2020)

The Hyperion outputs a single NMEA style data string – Fluorometers pre SN 75100

Example: \$PVHYP,01,01,1234.45, 1.2345, 01, C02,*7F

Where:

Field Number	Description	Type	Description
1	NMEA Header	String	Valeport HYPerion
2	Instrument ID	Integer	
3	Parameter ID	Integer	1 = Chlorophyll a 2 = Fluorescein (Uranine) 3 = Rhodamine 4 = Crude Oil 7 = Phycocyanin (freshwater Blue Green Algae) 8 = Turbidity 9 = Sulforhodamine B
4	Parameter Mean	Float	
5	Parameter SD	Float	
6	Parameter Units	Units	ug/l for Chlorophyll a ppb for Fluorescein
7	Operating Mode	String	C02 (default)
8	Check Sum		An exclusive OR sum between all characters between the '\$' and the '*' of the string

7.2 Data Output Format \$PVHY2 (Post November 2020)

The Hyperion outputs a single NMEA style data string – post November 2020 (Serial No: 75100) this will be a \$PVHY2 format string.

Example - Turbidity: \$PVHY2,01,8,0.48705,0.012,NTU,141.65588,0.023,NTU,M1,*6D

Example – Fluorometer: \$PVHY2,01,1,0.816,0.012,ug/l,,,,C02,*24

Please note that fields with no data e.g. 2nd parameter data in a fluorometer will be empty but delimited, as above.

Where:

Field Number	Description	Type	Description
1	NMEA Header	String	Valeport HYperion2
2	Instrument Address	Integer	Identifies the instrument
3	Parameter ID	Integer	1 = Chlorophyll a 2 = Fluorescein (Uranine) 3 = Rhodamine 4 = Crude Oil 7 = Phycocyanin (freshwater Blue Green Algae) 8 = Turbidity 9 = Sulforhodamine B
4	1 st Parameter Mean	Float	
5	1 st Parameter SD	Float	
6	1 st Parameter Units	String	ug/l for Chlorophyll a NTU for turbidity nephelometer
4	2 nd Parameter Mean	Float	
5	2 nd Parameter SD	Float	
6	2 nd Parameter Units	String	NTU for turbidity backscatter
7	Operating Mode	String	C02 (default)
8	Check Sum	Char	An exclusive OR sum between all characters between the '\$' and the '*' of the string

If the sampling that has been setup such that only one measurement is used to produce a reading then no Standard Deviation is generated and the output becomes:

Turbidity - \$PVHY2,01,8,0.48705,,NTU,1.65588,,NTU,M1,*6D

Fluorometer - \$PVHY2,01,1,0.816,,ug/l,,,,C02,*24

Otherwise:

Turbidity - \$PVHY2,01,8,0.48705,0.012,NTU,141.65588,0.023,NTU,M1,*6D

Fluorometer - \$PVHY2,01,1,0.816,0.012,ug/l,,,,C02,*24

7.3 Hash (#) Codes

Hash codes are used to configure the instrument. They can be applied using a Terminal program or Configure software. This list is correct for firmware version: 0903707A15.

# Code	followed by	Description
#001	;address_485<CR><LF>	Set the address value for addressed system This is also the Modbus address for the instrument
#002	<CR><LF>	Reads the address value for addressed system
#005	;address_mode<CR><LF>	Turns on or off address mode 0 = OFF 1 = ON
#006	<CR><LF>	Reads address mode ON or OFF
#015	<CR><LF>	Request last measurement – MK1 PCB
#022	<CR><LF>	Reads ASCII string of the last calibration date: Format – day;month;year
#028	<CR><LF>	Place unit into run mode
#030	<CR><LF>	Report the latest data in the output format set by Output mode
#032	<CR><LF>	Reads the firmware version and date installed in the instrument
#034	<CR><LF>	Reads the serial number of the instrument
#037	;site_info<CR><LF>	Enter site information
#038	<CR><LF>	Read the site information
#039	;sampling mode <CR><LF>	Set the last sampling mode set without running
#040	<CR><LF>	Read last sampling mode set
#059	;baud_rate<CR><LF>	Baud rate. 2400,4800,9600,19200,115200 or 230400
#060	<CR><LF>	Read Baud rate
#082	;rs_485_selected<CR><LF>	Selects if in RS485 mode. Usually done with control line (MK1 PCB only)
#083	<CR><LF>	Read status
#086	;secondary_calibration_enabled <CR><LF>	Secondary calibration status 0 = disabled, 1 = enabled.
#087	<CR><LF>	Read Secondary calibration 0 = disabled, 1 = enabled.
#094	;gain;offset<CR><LF>	Set offset and gain coefficient for a user secondary calibration - optics channel 1
#095	<CR><LF>	Read offset and gain coefficient
#096	;gain;offset<CR><LF>	Set offset and gain coefficient for a user secondary calibration optics channel 2 (when used)
#097	<CR><LF>	Read offset and gain coefficient
#098	;modbus_allow_hash_command <CR><LF>	Set to 1 if a # command is detected by the Modbus system and setup mode entered
#099	<CR><LF>	Read # recognition status
#102	user_output	Enter output item
#103	<CR><LF>	Read output item
#104	user_format	Enter 'c' style format string
#105	<CR><LF>	Read format string
#126	<CR><LF>	Read optical parameter id
#128	<CR><LF>	Read units

# Code	followed by	Description
#134	<CR><LF>	Read Serial number of the optical head assembly
#222	;averaging_constant<CR><LF>	Set the number of samples to average
#223	<CR><LF>	Read the averaging length
#400	;fluoro_gain<CR><LF>	Set fluorometer gain – MK1 PCB Redundant for Hyperions purchased after Nov 2020 (serial numbers below 75100)
#401	<CR><LF>	Read Fluorometer gain – MK1 PCB
#433	<CR><LF>	Read Background light intensity warning level. Light level that can cause loss of accuracy/quality
#437	<CR><LF>	Read Time for LED stabilisation (inhibits output)
#700	;modbus_enabled<CR><LF>	Set Modbus communication mode and parity, Modbus mode 0;0 = disabled 1;0 = enabled – No Parity 1;1 = enabled – Even Parity
#701	<CR><LF>	Read Modbus communication mode and parity
#702	;uart_parity<CR><LF>	Set 0 for No Parity and 1 for Even parity in all Uart communication (ascii and Modbus)
#703	<CR><LF>	Read Parity for all UART communication (ascii and Modbus)

7.4 Modbus Operation

The Modbus implementation in Hyperion is as follows:

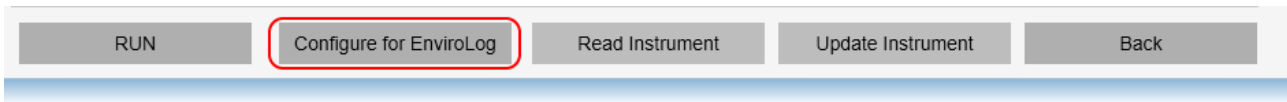
- Half duplex
- The holding registers are Modbus RTU compliant - 16 bit
- Byte order is high byte and high word first
- Read with function code 3

The address and number formats for each of the different available registers can be found in the [Modbus Register Lookup Table](#) below.

In order to operate using Modbus protocols, with a logger that will power the Hyperion on for the duration of an observation and then power down again, the following settings should be sent to the Hyperion. This can be achieved using the “Configure for EnviroLog” button in Configure:

#098;1,
#005;0,
#059;19200,
#200;21;3;9;15;1;25;11,
#204;2,
#091;2,
#222;4,
#031;1,
#700;1;1

Configure’s tool ribbon when set up for Hyperion:



EnviroLog is Valeport’s name for a number of loggers and telemetry systems that use Modbus configuration. This particular configuration is designed for a scenario where the instrument is powered up, observation taken and then powered down again. This scenario is discussed in more detail below.

Instrument addresses of 1-99 (note: 35 is hidden and protected) are supported.

If there is a particular requirement please contact Valeport for more advice.

Scenario: Power Up → Observe → Report → Power Down

As set above, on being powered the Hyperion will start to make an observation, suitably timed and filtered. The Control/Logging system should wait for the stabilisation period followed by the observation period, after which the data will be available in the designated register. If Modbus is enabled and a logger requests a reading before the first measure is available the Hyperion will reply with a standard Modbus error packet.

Start-up stabilisation.

Each type of optical sensor has a characteristic ‘warm-up’ phase before stabilising after initially power up. This is set at build time in seconds, read: #437.

Warm-up period for a Fluorometer = 8 seconds

Warm-up period for Turbidity = 4 seconds

As set up above there will be an observation period of 4 seconds – 2 observations of 2 seconds and averaged.

The instrument should then be powered down until the next observation as scheduled.

Modbus read example

01,03,40,00,00,08,94,0B

01 = Modbus address

03 = 0x03 – modbus read command

40,00 = Modbus register

00,08 = number of 2 byte registers*

94,0B = check sum

*Modbus read access to readings_table:

Optics channel 1 mean; channel 1 SD; channel 2 mean; channel 2 SD

Only Turbidity has 2 Channels, Fluorimeters have 1 Channel

If only a Fluorometer is interfaced then only 4, 2 byte registers need be read

Type	Modbus Register Hex	Modbus Register Dec	Number of Modbus 2 byte registers	Reply timing @ 19200 Baud (in ms)
F_DOUBLE	0x0FA0	4000	8	<40

See full listing of Modbus registers below.

7.4.1 Modbus Register Lookup Table

# Code	followed by	Description	Type	Modbus Register Hex	Modbus Register Dec	Number of Modbus 2 byte registers	Reply timing @ 19200 Baud (in ms)
#001	;address_485<CR><LF>	Set the address value for addressed system This is also the Modbus address for the instrument	F_UCHAR	0x0022	34	1	<40
#002	<CR><LF>	Reads the address value for addressed system	F_UCHAR	0x0022	34	1	<40
#005	;address_mode<CR><LF>	Turns on or off address mode 0 = OFF 1 = ON	F_UCHAR	0x0023	35	1	<40
#006	<CR><LF>	Reads address mode ON or OFF	F_UCHAR	0x0023	35	1	<40
#022	<CR><LF>	Reads ASCII string of the last calibration date: Format – day;month;year	F_UCHAR	0x0002	2	2	<40
#034	<CR><LF>	Reads the serial number of the instrument	F_ULONG	0x0030	48	2	<40
#037	;site_info<CR><LF>	Enter site information	F_ASCII	0x0020	32	30	<40
#038	<CR><LF>	Read the site information	F_ASCII	0x0020	32	30	<40
#039	;sampling mode <CR><LF>	Set the last sampling mode set without running	F_ASCII	0x001F	31	4	<40
#040	sampling mode	Read last sampling mode set	F_ASCII	0x001F	31	4	<40
#059	;baud_rate<CR><LF>	Baud rate. 2400,4800,9600,19200,115200 or 230400	F_ULONG	0x001A	26	2	<40
#060	<CR><LF>	Read Baud rate	F_ULONG	0x001A	26	2	<40
#082	;rs_485_selected<CR><LF>	Selects if in RS485 mode. Usually done with control line (MK1 PCB only)	F_UCHAR	0x0024	36	1	<40
#083	<CR><LF>	Read status	F_UCHAR	0x0024	36	1	<40
#086	;secondary_calibration_enabled <CR><LF>	Secondary calibration status 0 = disabled, 1 = enabled.	F_USHORT	0x0038	56	1	<40
#087	<CR><LF>	Read Secondary calibration 0 = disabled, 1 = enabled.	F_USHORT	0x0038	56	1	<40
#094	;gain;offset<CR><LF>	Set offset and gain coefficient for a user secondary calibration - optics channel 1	F_EXP	0x0036	54	4	<40
#095	<CR><LF>	Read offset and gain coefficient	F_EXP	0x0036	54	4	<40

# Code	followed by	Description	Type	Modbus Register Hex	Modbus Register Dec	Number of Modbus 2 byte registers	Reply timing @ 19200 Baud (in ms)
#096	;gain;offset<CR><LF>	Set offset and gain coefficient for a user secondary calibration optics channel 2 (when used)	F_EXP	0x0037	55	4	<40
#097	<CR><LF>	Read offset and gain coefficient	F_EXP	0x0037	55	4	<40
#098	;modbus_allow_hash_command<CR><LF>	Set to 1 if a # command is detected by the Modbus system and setup mode entered	F_USHORT	0x0027	39	1	<40
#099	<CR><LF>	Read # recognition status	F_USHORT	0x0027	39	1	<40
#126	<CR><LF>	Read optical parameter id	F_UCHAR	0x0015	21	1	<40
#128	<CR><LF>	Read units	F_ASCII	0x0016	22	5	<40
#134	<CR><LF>	Read Serial number of the optical head assembly	F_ULONG	0x0018	24	2	<40
#200	;operation_sequence<CR><LF>	Sets Operational Configuration Normally automatically set by Macro commands like M16 or C02 or S002	F_UCHAR	0x0009	9	4	<40
#201	<CR><LF>	Read setting for #200	F_UCHAR	0x0009	9	4	<40
#433	<CR><LF>	Read Background light intensity warning level. Light level that can cause loss of accuracy/quality	F_UCHAR	0x0005	5	1	<40
#437	<CR><LF>	Read Time for LED stabilisation (inhibits output)	F_UCHAR	0x0033	51	1	<40
#700	;modbus_enabled<CR><LF>	Set Modbus communication mode and parity, Modbus mode 0;0 = disabled 1;0 = enabled – No Parity 1;1 = enabled – Even Parity	F_UCHAR	0x002C	44	1	<40
#701	modbus_enabled;<CR><LF>	Read Modbus communication mode and parity	F_UCHAR	0x002C	44	1	<40
#702	;uart_parity<CR><LF>	Set 0 for No Parity and 1 for Even parity in all Uart communication (ascii and Modbus)	F_USHORT	0x002D	45	1	<40
#703	uart_parity;<CR><LF>	Read Parity for all UART communication (ascii and Modbus)	F_USHORT	0x002D	45	1	<40

# Code	followed by	Description	Type	Modbus Register Hex	Modbus Register Dec	Number of Modbus 2 byte registers	Reply timing @ 19200 Baud (in ms)
		Modbus read access to build version	F_ASCII	0x07D0	2000	15	<40
		Modbus read access to operational state (read and write)	F_ULONG	0x0BB8	3000	2	<40
		Modbus read access to readings_table: optics channel 1 mean; channel 1 SD; channel 2 mean; channel 2 SD (channel 2 Turbidity only)	F_DOUBLE	0x0FA0	4000	8	<40

8 Electrical

Voltage:	9 - 28V DC isolated
Power:	40mA @ 12V DC

8.1 Interface Cable – 0901EA2

END 1: 6 Way Male SubConn SCMCIL6M.5	END 3: 7Way Male Souriau UTS6JC10E7P	FUNCTION
PIN	PIN	
1	G	RS485 GND
2	C	Tx RS232 out of instrument RS485A(-)
3	D	Rx RS232 into Instrument RS485B(+)
4	B	+V (9 - 28 V)
5	E	Select 232/485 Link to Pin G for RS485
6	A	-V
-	F	Screen

Note: to enable RS485 comms, link pins 1 and 5.

8.2 0400 Series Interface Cable

END 1: Hyperion SUBCON MCBH6F	END 2: 0400513 (Quartzonix Interface PCB)	END 3: 0400550 (PSU Switching PCB)	FUNCTION
PIN	CONNECTOR	PIN	CONNECTOR
1	J3, 6 WAY FCI	2	
2		3	
3		1	
4			J2, 2 way FCI
5	NO CONNECTION (Blank off to prevent shorting)		
6			J2, 2 way FCI

9 Care and Maintenance

In order to make accurate and repeatable measurements, the sensor window must be kept clean.

Cleaning the optical window should be performed using warm soapy water and optical tissue, then rinsed with clean water. No abrasives should be used

Organic solvents should not be used to clean the Hyperion
Strong acids and bases should be avoided
If fouling of the window is considerable, the unit should be returned to Valeport for servicing

The instrument should be washed in fresh water before storage in the equipment case.

9.1 Fitting a Sensor Guard

The sensor guard fits over the sensor end cap of the Hyperion in order to reduce the chances of the sensor window being damaged by impact against a hard surface.

Slide the guard over the sensor endcap and ensure it is lined up correctly as shown below – you should be able to see the instrument serial number through the **opening** in the guard.



Now gently push the securing cord into the slot at the base of the guard and using a pair of pliers push the cord through the slot and around the Hyperion housing, ensuring that it is contained within the groove on the inside of the guard.



It is very tight and difficult to get all the way around the Hyperion housing. A spot of silicone grease will help.

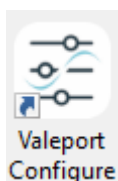
If the cord is inserted by 30mm, that is enough to hold the guard in place. Trim the cord so it fills but is contained within the slot to prevent snagging. You will need the tail to pull the cord out if the guard has to be removed.

10 Software

10.1 Valeport Configure App

Available since April 2021 Configure is a generic app into which you load an instrument specific configuration file that allows you to interact with and set up that instrument. A configuration file can be saved to load into other instruments or as a company specific configuration. Special configurations can be set up and associated with a button such as 'Configure for EnviroLog' see section 0 that will set the Hyperion up for operation with an EnviroLog system.

Configure is available from Valeport. Download search for Hyperion from the dropdown list download and install, the software is licence free.



The Configure App will check for the software installed on the device and alter the functionality available as required.

As a minimum you must have version 0903707 or higher to use the App. If not, you will see a warning: "Warning! 0903707 Firmware Required"

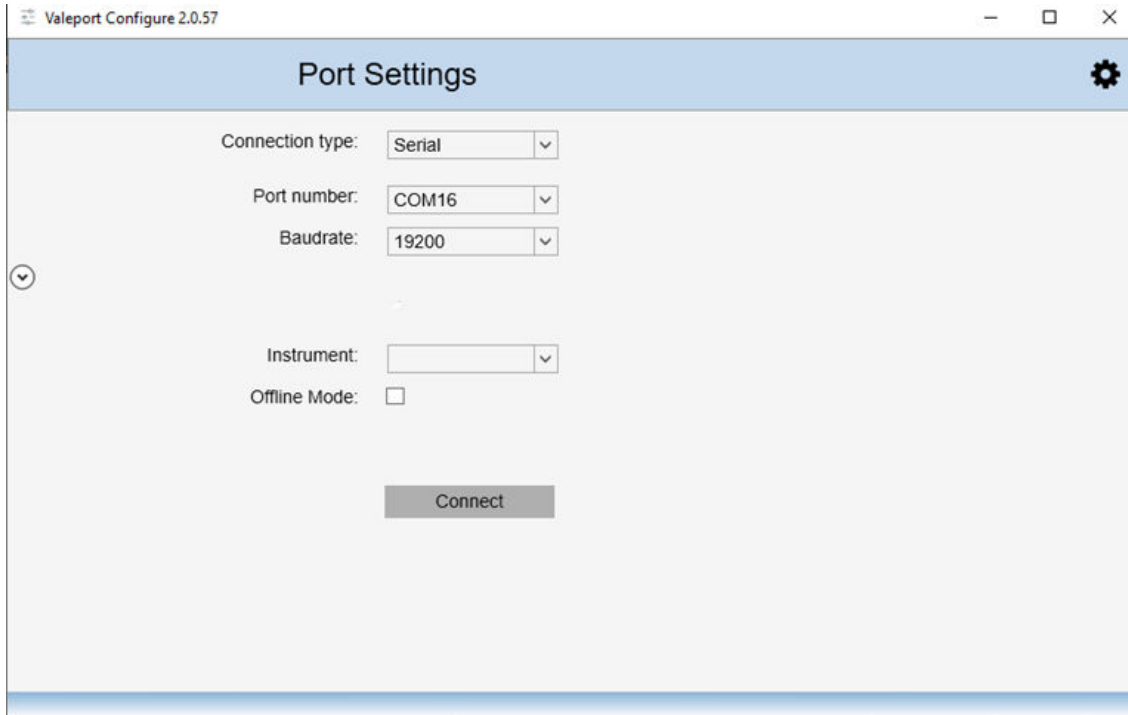
Contact Valeport for information on how to upgrade your firmware should it be required.

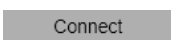
There is a separate installation manual available for the Configure App available on the Valeport website

10.1.1 Interface to the Hyperion

Open Connect and interface the Hyperion to a suitable comm port and power using the provided Y lead.

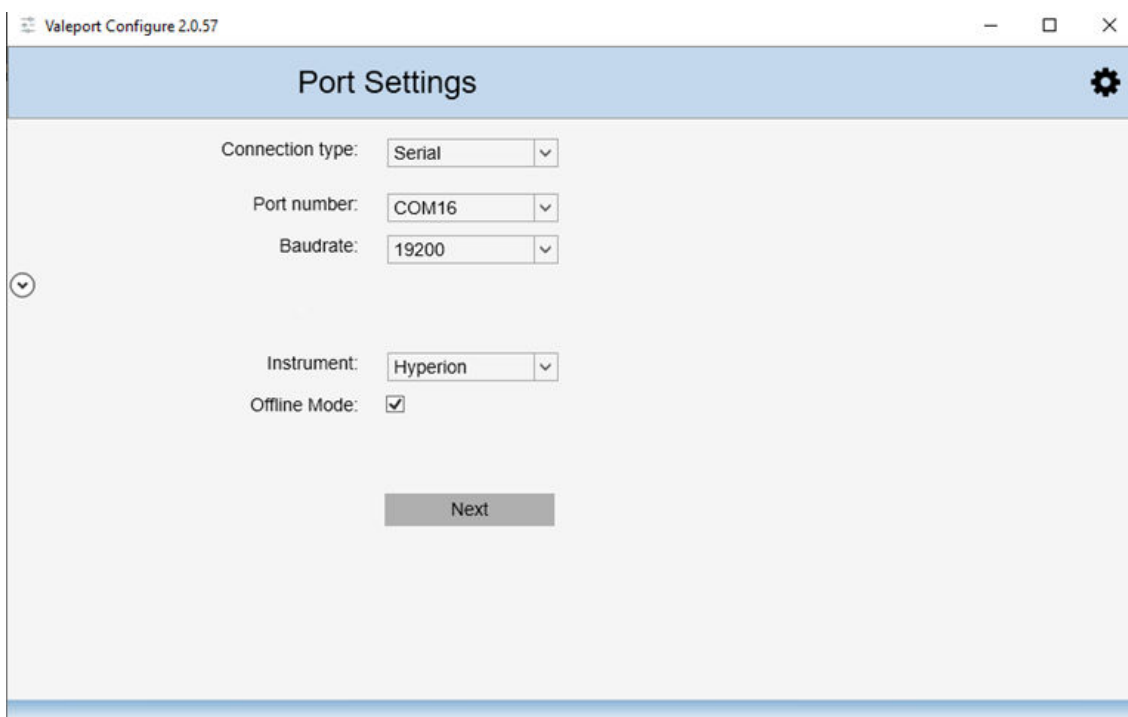
Use the drop-down lists to select your port, baud rate and Instrument as required.



Click the  button.

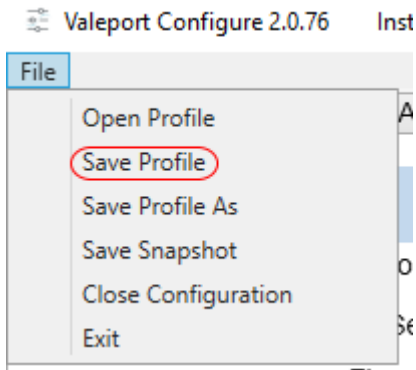
10.1.1.1 Valeport Configure App Without an Instrument

If you do not have an instrument or would like to setup a configuration file to load into another instrument in preparation for a future deployment, select the tick box on the opening dialogue – Offline Mode:

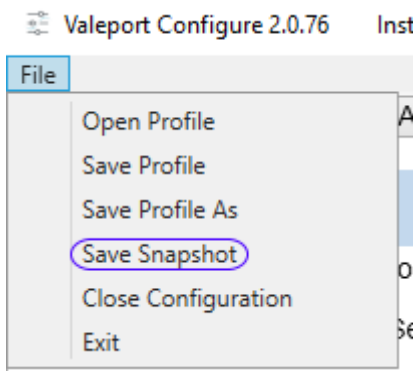


This will give you access to all the configuration options and allow you to store a configuration Profile (*.vps) file for later upload to an instrument. This profile data includes on those fields that can be configured

Once you have prepared the Configure App configuration use the File menu to store the configuration Profile

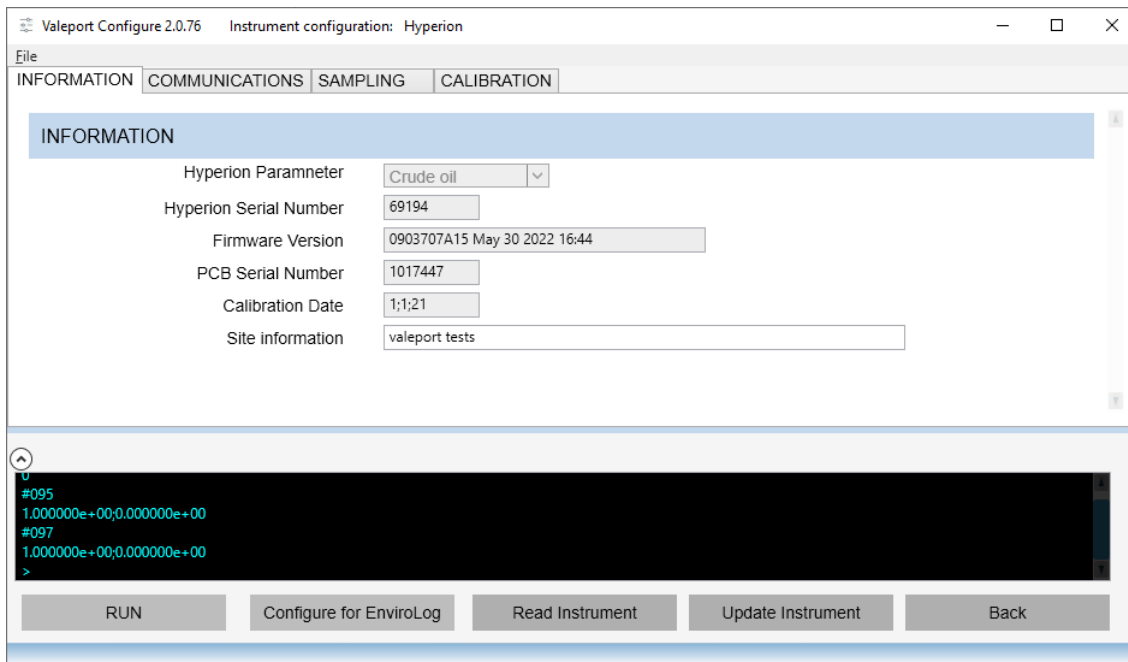


A new feature for ver 2.0.76 is the Snapshot. This, unlike the Profile is a text file that includes all details about the instrument including those that are not an instrument setting such as serial numbers, calibration dates and site information



10.1.2 Configure the Instrument

On connecting to a Hyperion the Information Tab will open. It contains read only fields that will display relevant information on the interfaced unit.



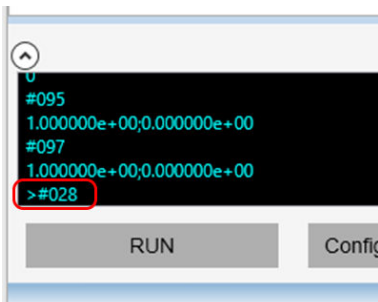
Press the **Read Instrument** button to interrogate the instrument to upload all the current settings.

You can follow the interrogation and replies from the instrument in the Terminal Window across the bottom of the screen. If the terminal window is not visible, click on the down arrow to show it:

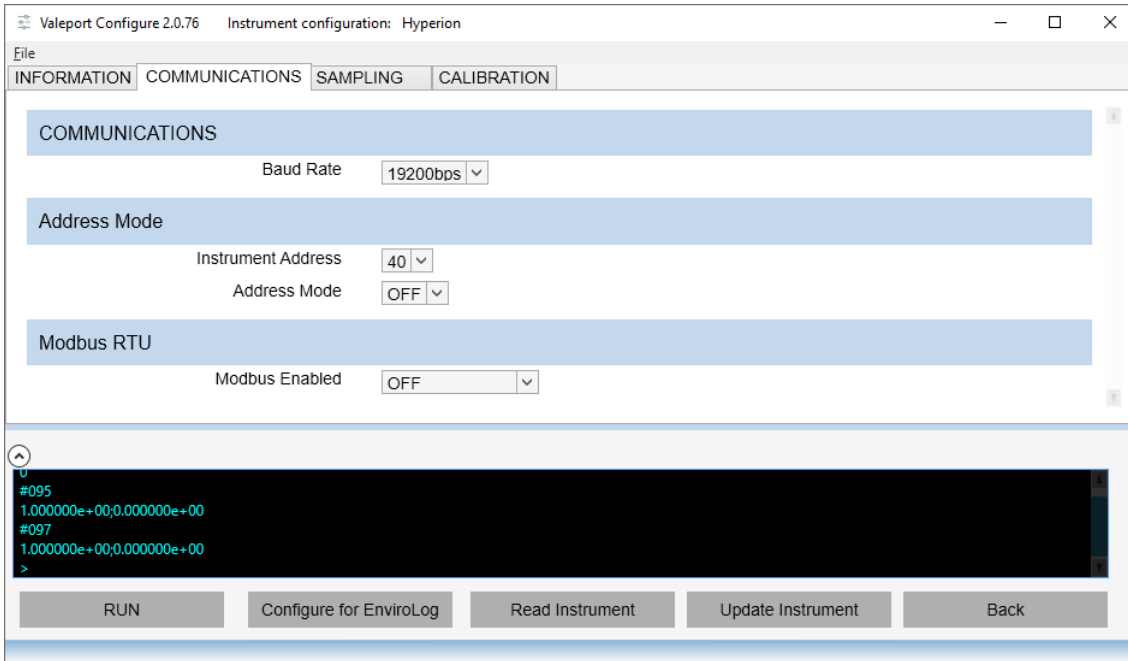


You may have to click and drag the window to show all data fields and the terminal window

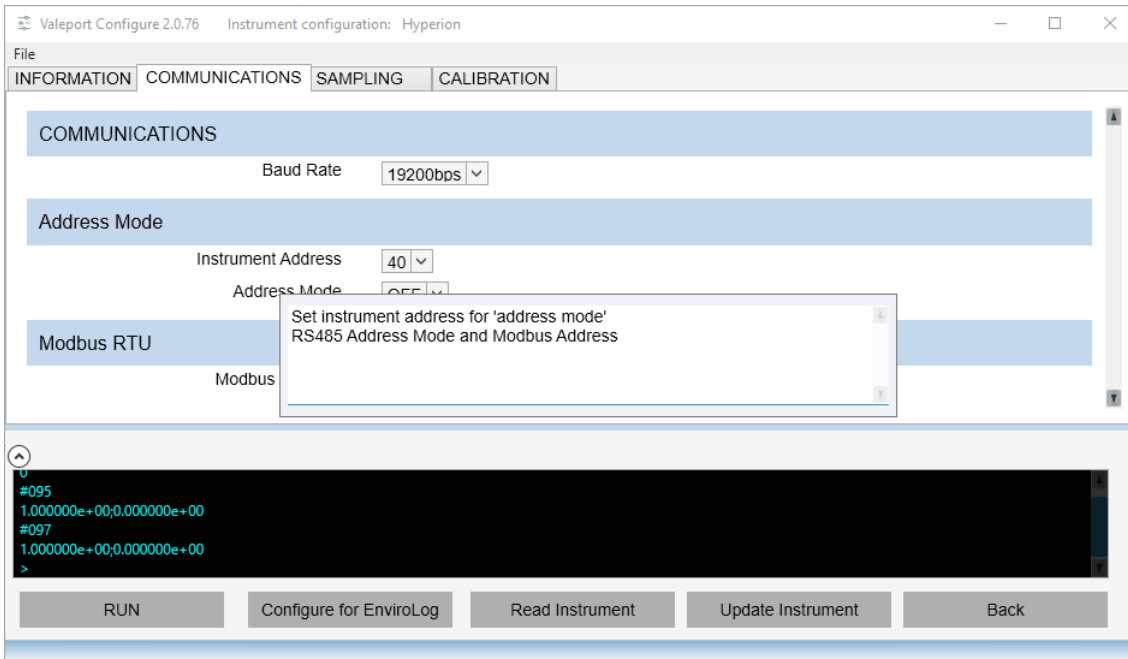
The Terminal window can also be used to send specific # commands to the instrument should that be necessary. Type the command at the prompt in the terminal window and press ENTER for example #028 to put the instrument into run mode.



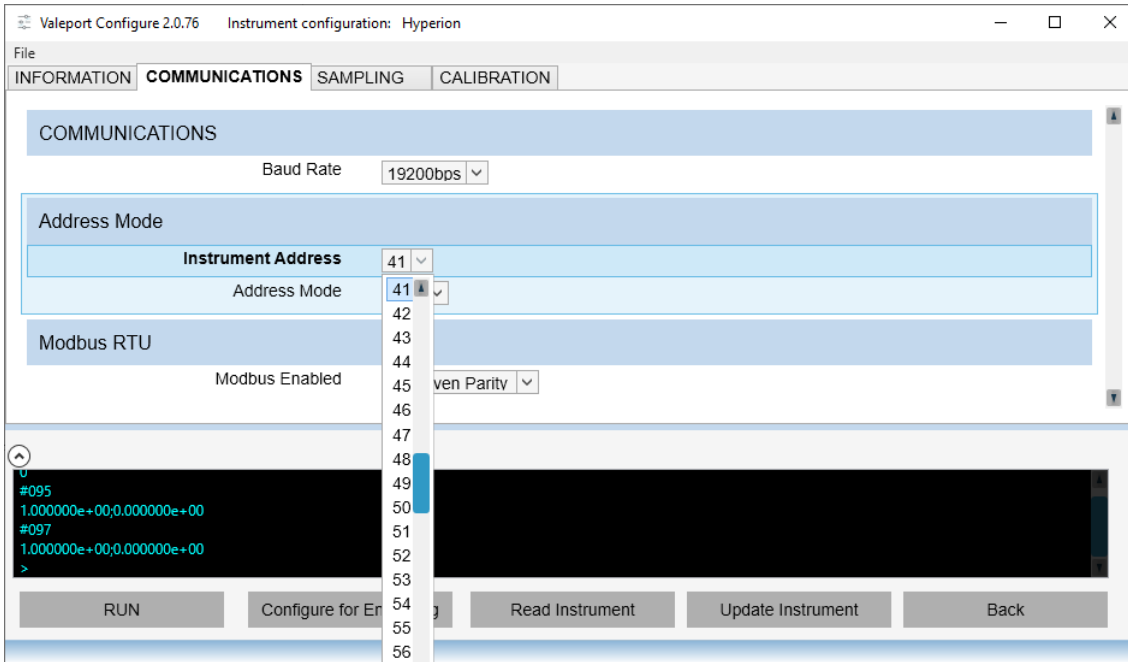
Click on the other Tabs to see relevant information and fine tune your set up, for example COMMUNICATIONS:



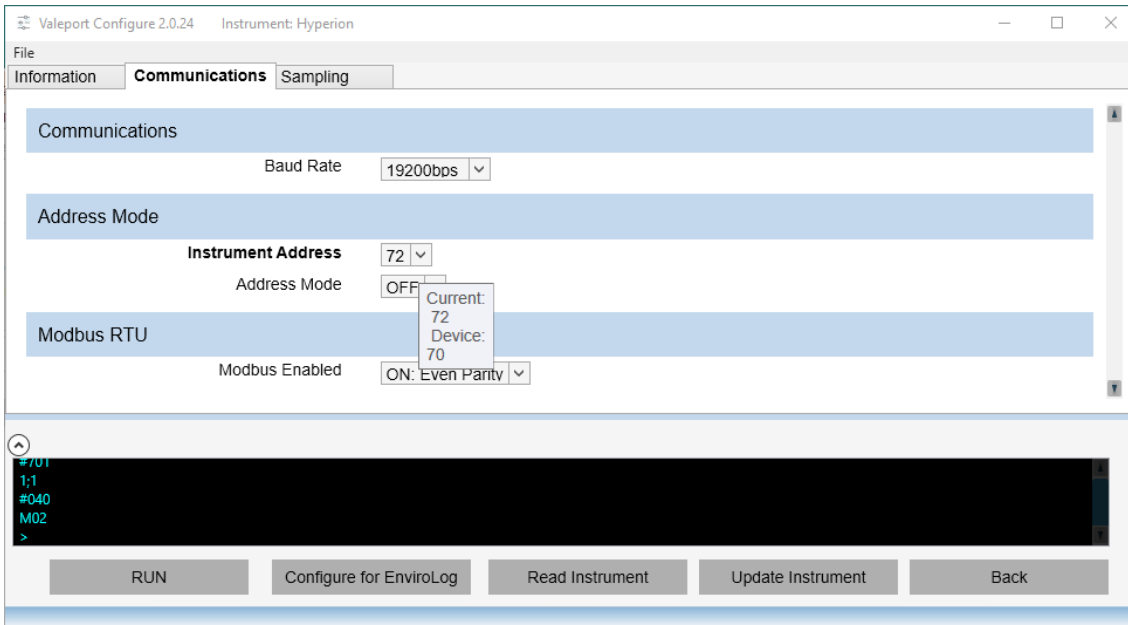
Hover over the label with your mouse to see the pop-up information window on a particular field:



In the example below select a new Instrument Address and the field label and Tab title will be **bold** to indicate the change.



Hover over the field you have just updated to see what the current setting is and what is set in the instrument (Device):



Once you have made all your changes press **Update Instrument** to upload the new configuration into the instrument

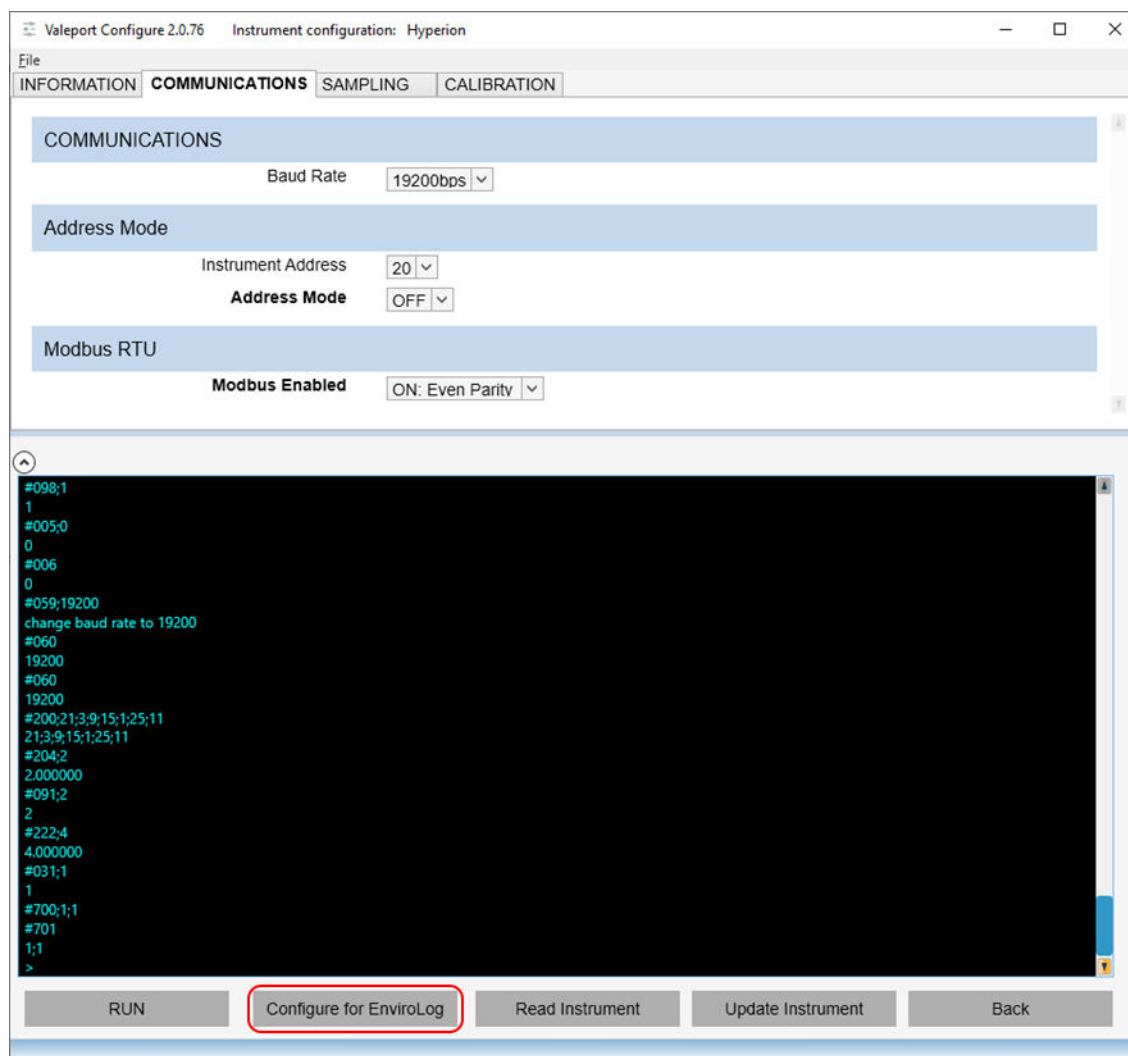
To set the instrument into a Run Mode select the **RUN** button at the bottom of the screen.

10.1.3 Configure with Operation as Part of an EnviroLog System

If you are going to operate the Hyperion with an EnviroLog system or similar, simply click on the **Configure for EnviroLog** button.

This will put the system into a Modbus mode with an appropriate configuration.

You can follow the setup commands in the terminal window:



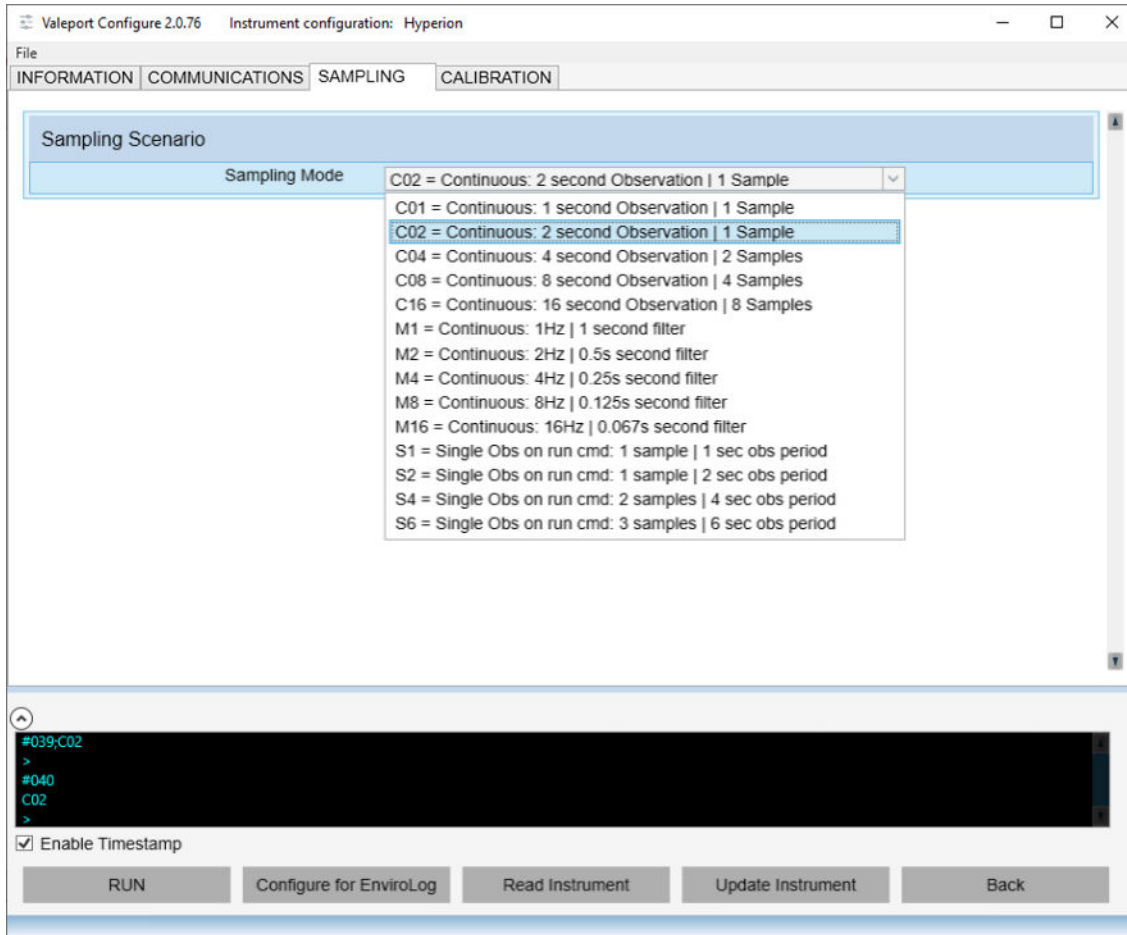
Once complete the Hyperion is setup and ready to be interfaced to the EnviroLog system. You must ensure that if you are using multiple instruments each has a different Address.

If you disable Modbus mode and try to run the Hyperion in a standard serial ASCII mode it will not run until you put it in a new Sampling Mode, select from the dropdown menu:

10.1.4 Sampling Scenario

See section [Operating Modes](#), above.

If the sampling scenario you require is not part of the dropdown list, use a manual, terminal command to set it up.

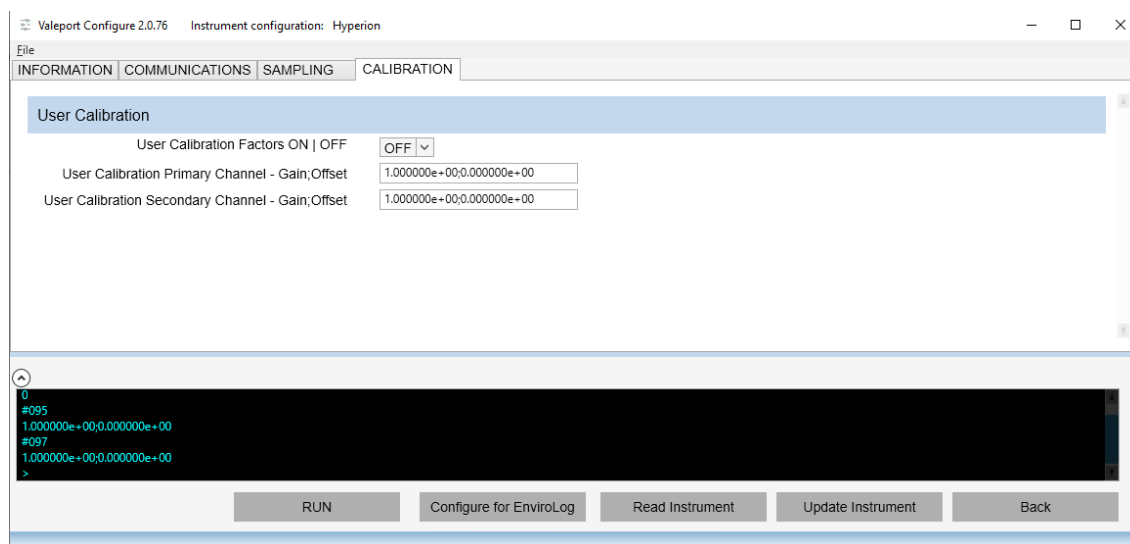


10.1.5 Calibration

There is an option to input your own calibration factors for both Primary and Secondary channels. The Secondary channel is only valid for Turbidity instruments.

First set the parameter to ON using the dropdown menu.

Input your parameters GAIN;OFFSET, separated with a “;”. Although reported in an engineering format, the values can be input in decimal.



If you are running a firmware version pre-A14, you will not have this option.

11 Setting the Gain (Units with a Serial Number earlier than 75100)

Prior to November 2020 (Serial No: 75100) a Hyperion was set to the default range, for its specific analyte, before leaving Valeport. After November 2020 MK2 PCBs were installed in all Hyperions and that removed the need to set the gain. If you bought your Hyperion after November 2020 you can ignore this section.

The default range for any analyte will be its low range and, therefore, the instrument will be set to maximum sensitivity and gain. This will allow the measurement of low concentrations of the analyte. Within this range there will be a linear response over 3 orders of magnitude

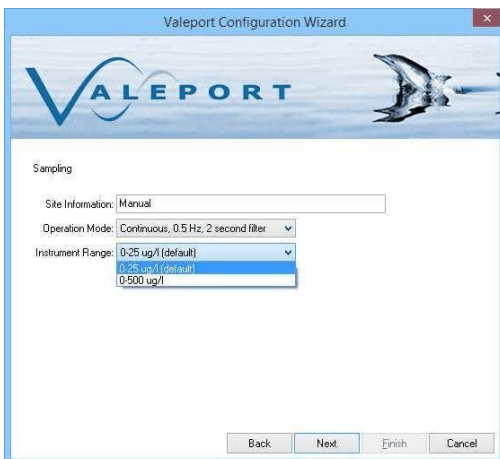
For Example:

In the case of Chlorophyll, the default range is: 0.025 µg/l (MDL) to 25.0 µg/l (FSD)

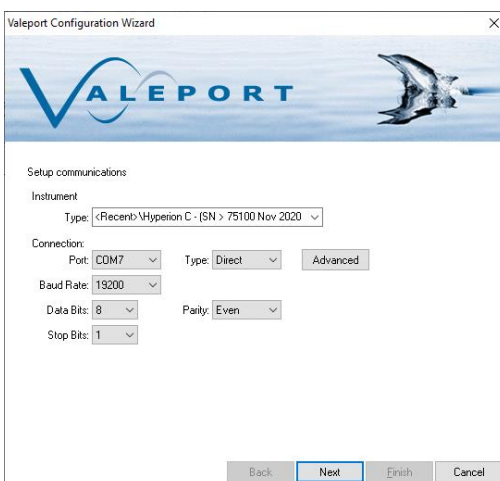
In the case of Fluorescein, the default range is: 0.01 ppb (MDL) to 25 ppb (FSD)

If high fluorophore concentrations are encountered, the range should be set to the non-default setting to allow a linear response over a far wider range.

The gain can be set as part of the set-up wizard in DataLog x2:



For dye tracing applications, we recommend using the Hyperion at the default range, that is, high gain/sensitivity to reduce the quantity of dye required and, therefore, the visibility / load on the environment and or disposal costs.



This setting has no effect on Hyperion Fluorometers with MK2 PCBs. All Hyperions supplied after November 2020 (Serial No: 75100) have MK2 PCBs. If you get an error concerning #400 commands change the instrument to: **Hyperion X - .SN > 75100 Nov 2020** in the drop down menu.

If you have a MK2 PCB and attempt to set the gain using DataLog x2 the error will look like this:

Do not worry – you have not changed any setting, simply use the back button and select the correct Hyperion

```
>#034
0
>#022
1;1;19
>#002
1
>#126
8
>#128
NTU
>#040
M1
```

```
>#032
0903705A9 hyperion Nov 2 2020 14:03
>#038
Valeport tests
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#401
ERROR PROTECTED
>#
ERROR
>#
ERROR
>#400;5
ERROR PROTECTED
```

12 Ordering and Part Numbers

12.1 Fluorometer

Part No.	Description
0901001-C	Hyperion-C, Chlorophyll a Fluorometer. Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case
0901001-F	Hyperion-F, Fluorescein Fluorometer Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case
0901001-SRB	Hyperion-SRB, Sulforhodamine B Fluorometer Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case
0901001-R	Hyperion-R, Rhodamine WT Fluorometer Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case
0901001-PC	Hyperion-PC, Phycocyanin Fluorometer Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case
0901001-F4	Hyperion-F4, Crude Oil Fluorometer Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case

12.2 Turbidity

Part No.	Description
0901002-TU	Hyperion-T, Turbidity Sensor Titanium housed, 6000m rated Supplied with: Y lead - power and comms Manual and transit case

12.3 Accessories

Part No.	Description
0901SA7	Ambient Light Shield
0901251	Hyperion Sensor Guard Set

13 Declarations of Conformity

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.

13.1 UK Declaration of Conformity - UKCA Marking

UK Declaration of Conformity

Manufacturer:	Valeport Ltd
Address:	St Peter's Quay, Totnes, Devon, TQ9 5EW
Certification marking:	UKCA
Product Description:	Hyperion 0901001 Hyperion 0901002 Hyperion 0901009

We the manufacturer declare that the product **Hyperion 0901001/0901002/0901009** is in conformity with the following UK Statutory requirements and designated standard(s):

Electromagnetic Compatibility Regulations 2016	Standards
EMC (SI 2016 No.1091)	BS EN 60945:2002 BS EN 61326-1:2013 (Basic Level)

ROHS Regulations 2012	Standards
SI 2012 No. 3032	BS EN IEC 63000:2018

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

Name:	Surya Dinesh
Position:	Product Support Manager
Place of issue:	Valeport Ltd, Totnes, UK
Date of issue:	26 August 2021
Signature:	

Valeport Limited
 St. Peter's Quay, Totnes,
 Devon TQ9 5EW UK

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 sales@valeport.co.uk
 www.valeport.co.uk

VAT No. GB 165 8765 67
 Registered in England No. 1950444

13.2 EU Declaration of Conformity - CE Marking



EU Declaration of Conformity

Manufacturer:	Valeport Ltd
Address:	St Peter's Quay, Totnes, Devon, TQ9 5EW
Certification marking:	CE
Product Description:	Hyperion 0901001 Hyperion 0901002 Hyperion 0901009

We the manufacturer declare that the product **Hyperion 0901001/0901002/0901009** is in conformity with the following EU Directives and harmonised standard(s):

EMC Directive 2014/30/EU	Standards
EMC (Article 3.1b)	BS EN 60945:2002 BS EN 61326-1:2013 (Basic Level)

ROHS Directive 2015/863/EU	Standards
Prevention (Article 4.1)	BS EN IEC 63000:2018

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

Name:	Surya Dinesh
Position:	Product Support Manager
Place of issue:	Valeport Ltd, Totnes, UK
Date of issue:	26 August 2021
Signature:	

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