VA500 Altimeter 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 VA500 altimeter has been designed with the objective of providing an accurate, reliable and robust measurement of range from surface and underwater platforms. State of the art signal processing offers unrivalled range and performance from a 500kHz transducer.

- millimetre precision
- 0.1m – 100m range
- RS232 and RS485 serial outputs
- 0-5V & 0-10V analogue outputs
- wide range power supply - 9 to 28 volts DC
- Low power - <125 mA @ 12V

all address the needs of the ROV, AUV and Hydrographic community in a compact and robust package.

The option of integrating a high accuracy pressure sensor (0.01%) as used in the miniIPS offers an unbeatable package for your underwater positioning requirements.

2 Specifications

2.1 Acoustic

State of the art signal processing technology provides stable, repeatable readings while allowing the range to be extended to unrivalled distances for a 500kHz altimeter.

Type:	500 kHz broadband transducer
Range:	0.1m – 100m
Resolution:	1mm
Beam Angle:	±3°

2.1.1 Acoustic Footprint

The acoustic beam angle of the VA500 is, for practical purposes ±3°.

The beam pattern is a cone extending from the face with that angle so the foot print diameter is approximately 10% of the range as described in the table below:

Range(m)	Footprint Ø (m)
1	0.10
2	0.21
5	0.52
10	1.05
20	2.10
50	5.24
100	10.48

2.2 Pressure

The optional pressure sensor fitted to the Altimeter is a temperature compensated piezo-resistive sensor, which delivers the performance previously only available from a resonant quartz sensor at a more cost-effective price.

Type:	Temperature compensated piezo-resistive
Range:	10, 30, 100, 300 or 600 Bar
Accuracy:	±0.01% FS
Resolution:	0.001% FS

2.3 Data Acquisition

Sampling:	Continuous or data on demand (by serial command/TTL trigger).
Data Rate:	1, 2 or 4 Hz

2.4 Communications

Digital Output:	RS232 & RS485 fitted as standard
Protocol:	4800 to 115200 baud, (8,1,N)
Formats:	Valeport NMEA / Tritech / Kongsberg / $SDDBT / NMEA
Analogue output:	0-5/0-10 V fitted as standard

RS485 is enabled by grounding pin 9 to pin 5 in the communications lead
see Wiring Information

2.5 Power Requirements

Input:	9 - 28 volts DC (isolated power supply)
Power:	<125 mA @ 12V

3   Physical Characteristics

Housing:	Titanium (6000m rated)
Size:	48mm max Ø
	43mm main body Ø
	215mm length (including connector)
	248mm length with pressure module fitted
Weight:	0.95 kg (air)/ ~0.7 kg (in water)
Connector:	SubConn MCBH10F (titanium)

3.1   Dimensions

3.1.1   Standard VA500 Altimeter
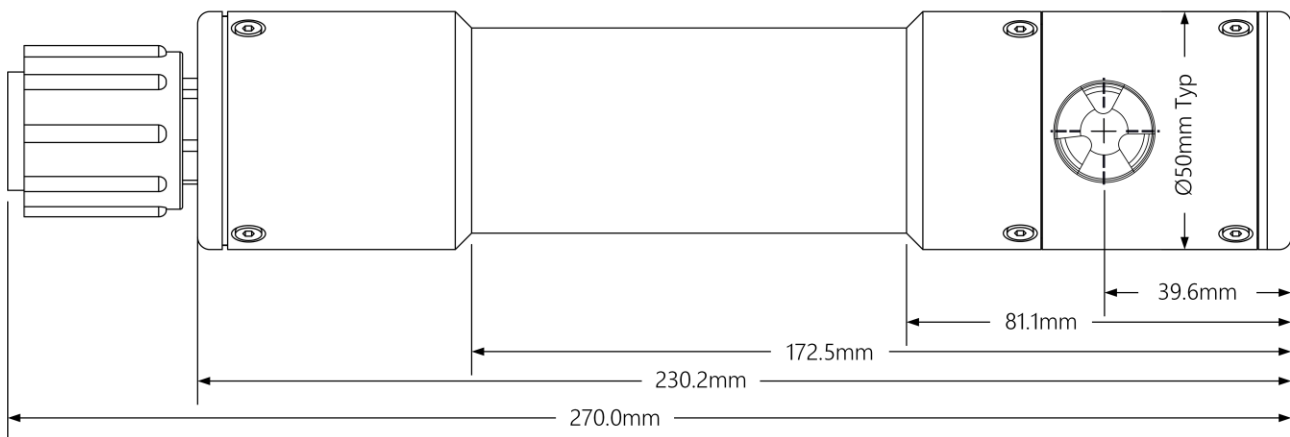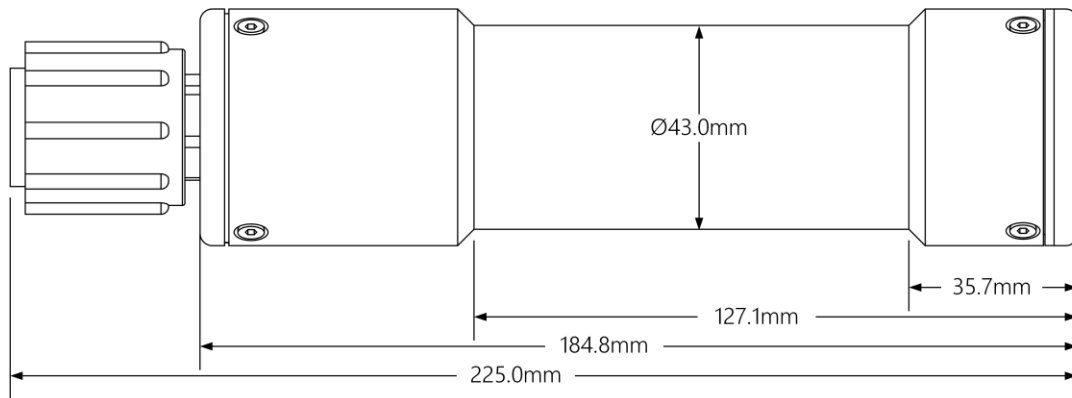
3.1.2 VA500 Altimeter with 90° Transducer
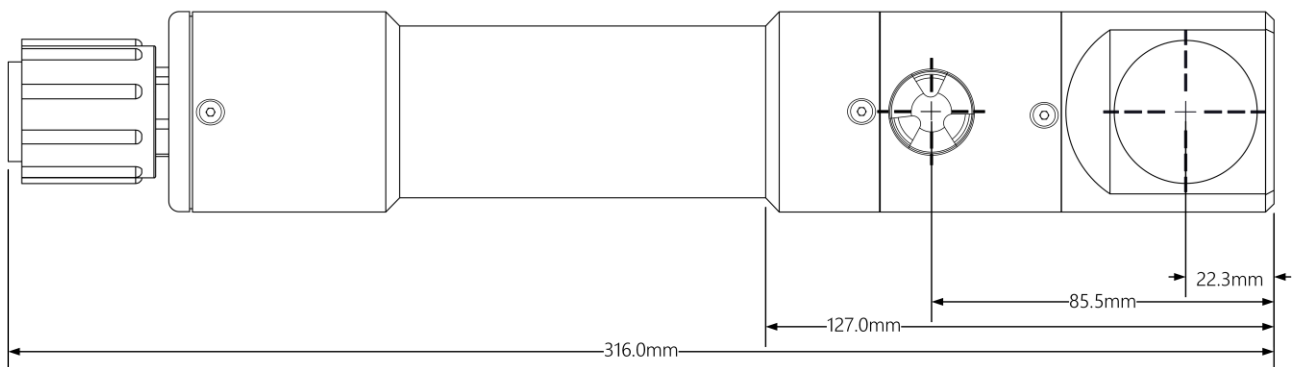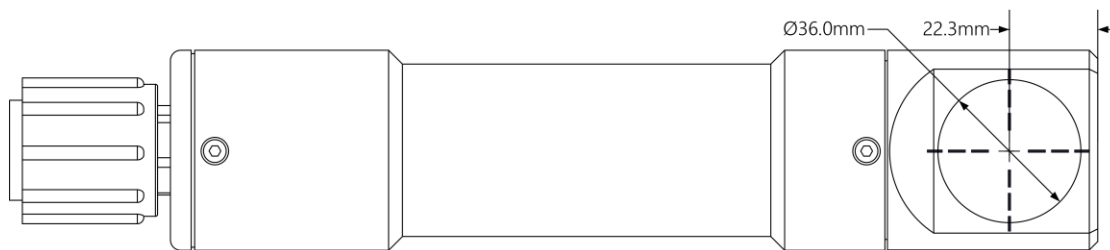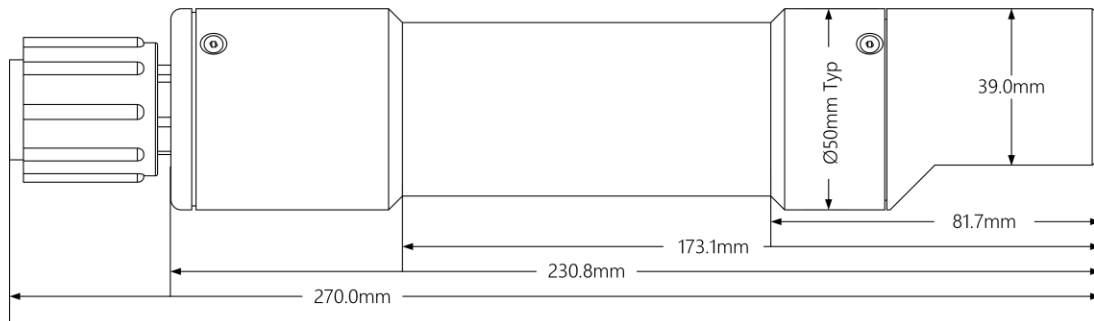
4 Configuration and Operation

The VA500 is supplied with a Valeport Terminal, a terminal communications program and configuration tool designed specifically for use with Valeport instruments.

Install the program by opening the install package on the supplied CD and follow the on screen instructions. Once installed, launch the terminal program

4.1 Using the Configuration Wizard

Valeport Terminal can be used to manually connect and configure the VA500 or can be used in the configuration wizard mode. Click on the configure button to launch the wizard.	
Select the COM port the VA500 is connected to. The wizard is configured with the default settings of the unit but can be altered if the unit has been modified.	
Default ASCII settings are pre-configured and should not need changing.	

Select the VA500 altimeter from the drop down list. Select the Read Configuration from the instrument to determine current settings Or Open previously saved configuration file to load a predefined setup.	
The first wizard screen will give information about the instrument. These are settings that are set at the factory.	
The next page defines: Communications settings. Analogue mode and limits.(See wiring schedule in section 6 for analogue outputs) Analogue range can be 0-5V or 0-10V Analogue limit is the distance that equates to full scale voltage output. Serial Data format (see data format section for definition of formats)	
The next page defines: Output units, can be seconds, metres, feet or fathoms. Minimum range allows fixed returns close to the VA500 to be filtered out. Maximum range allows filtering of spiking in noisy environments or in the presence of multiple echoes. Sound speed is set to 1500m/s. To improve accuracy then the local sound speed should be measured and applied here. Error is the value returned when no echo is detected or it is outside the minimum and maximum ranges defined.	
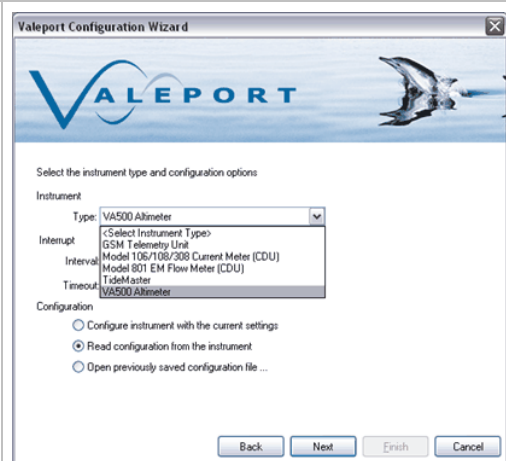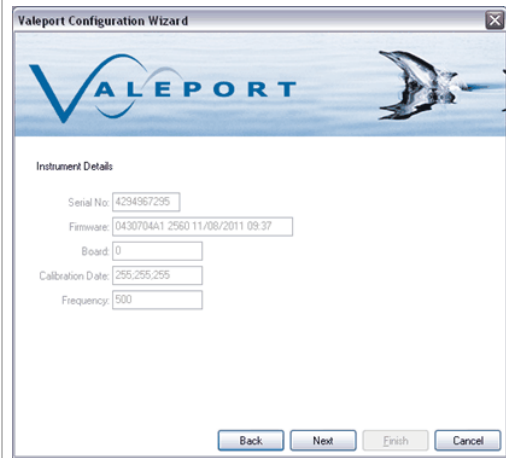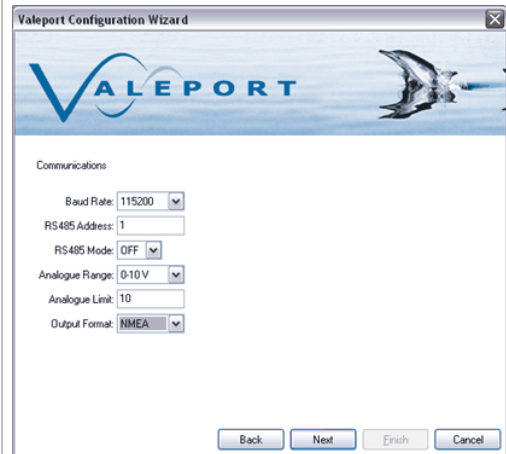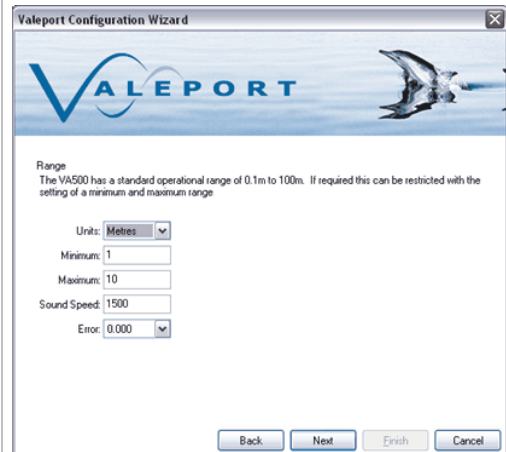
If the Altimeter is fitted with the optional pressure sensor, this can be configured here.

Units can be dBar, metres or feet.

Tare allows the pressure sensor to be zeroed to atmospheric pressure.

Latitude is used in the conversion from pressure to depth.
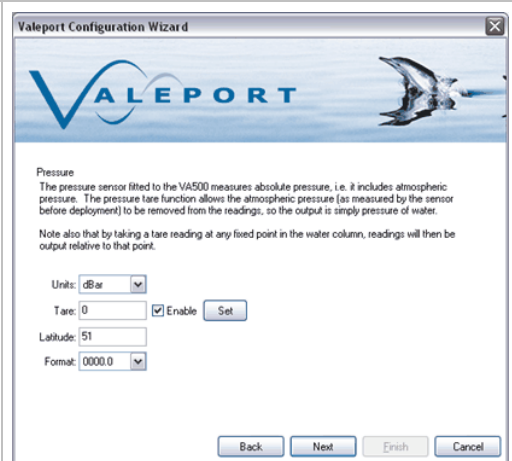
Continuous output rates can be 1,2 or 4 Hz

Alternatively the VA500 can be triggered with a serial command (S followed by a carriage return) or via TTL (see wiring schedule in section 6)
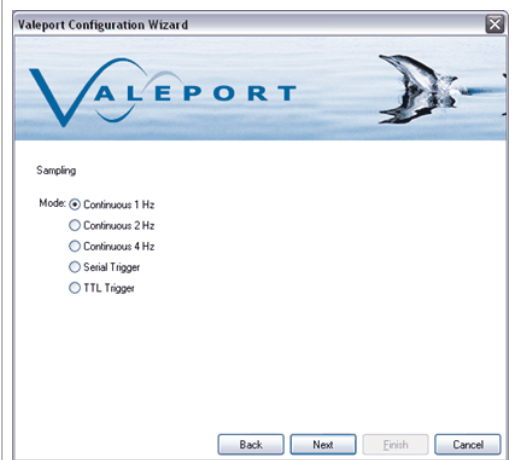
Once configuration is complete, the wizard will summarise the commands to be sent to the instrument.

The configuration can also be saved to file for later use or reference.

If the Run mode check box is ticked the instrument will start outputting data into the terminal window behind once the configuration is complete.
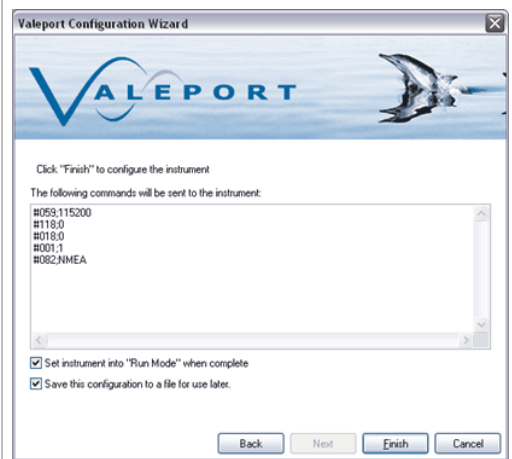
4.2   Manually Configuring the Unit

Alternatively, the VA500 Altimeter can be manually configured via serial communications using a series of # code commands. This can be with Valeport terminal or an alternative terminal program such as HyperTerminal.

Valeport Terminal is preconfigured with the required settings, but for reference the settings required to communicate with the VA500 are:

Baud Rate:	115200 (can be 9600-115200)
Data Bits:	8
Parity:	none
Stop Bits:	1
Flow Control:	none

Send line ends with line feed

The unit can be stopped at any time by sending the '#' character. The unit returns a '>', and waits for a further command. The unit can then be interrogated or configured using the following codes.

Note that all commands must be "sent" by pressing the Enter (carriage return) key, with the exception of the single '#' character required to enter setup mode

Note that there is a "watchdog" function here – if the unit is interrupted with the '#' character, and no further command is received for a period of 5 minutes, the sensor will automatically begin sampling data using the existing settings.

4.3   Instrument Settings

# code	Followed By:	Operation
#032	<CR>	Returns the software version number.
#034	<CR>	Returns the units serial number
#136	<CR>	Read PCB serial number
#138	<CR>	Send calibration date
#839	<CR>	Reads the transducer frequency

4.4 Range Settings

The VA500 has a standard operational range of 0.1m to 100m. If required this can be restricted with the setting of a minimum range and maximum range.

> minimum and maximum ranges are set in metres regardless of the units programmed by setting #021

The default setting for sound speed used to calculate range is 1500 m/s

# code	Followed By:	Operation
#021	;Range_units	Set to either 0 – Seconds 1 – Metres 2 – Feet 3 – Fathoms
#022	<CR>	Read range units set above
#118	;0 or 1 or 2<CR>	Set Altimeter Error output message Where 0=zero (0.000), 1=-999, 2=NR
#119	<CR>	Reads Altimeter Error output message
#823	;maximum range<CR>	set the maximum range that is considered when processing data (acoustic returns beyond maximum range are ignored)
#824	<CR>	Reads maximum range
#840	;minimum range<CR>	set the minimum range that is considered when processing data (acoustic returns before minimum range are ignored)
#841	<CR>	Reads minimum range
#830	; Value, <CR>	Variable to change the Speed of Sound ms-1
#831	<CR>	Reads the sound speed

4.5   Communications Settings

The full-scale DAC range is set in metres regardless of the units programmed by setting #021

# code	Followed By:	Operation
#059	;baud_rate<CR>	Sets the units baud rate 2400,4800,9600,19200,38400, 57600,115200
RS485 is enabled by grounding a pin in the communications lead - see Wiring Information		
#001	;ALTIMETER_address<CR>	Sets the 485 address
#002	<CR>	Returns the address
#005	;ON<CR> or ;OFF<CR>	Turns ON or OFF address mode
#006	<CR>	Returns ON or OFF for address mode
Analogue Settings:		
#094	;analogue_range<CR>	Sets the analogue output voltage range $0 - 0 - 5V$ $1 - 0 - 10V$
#095	<CR>	Reads analogue output voltage range set above
#096	;counts<CR>	Analogue output test.
#097	;Analogue range limit<CR>	Sets the range equivalent to full scale DAC output
#098	<CR>	Reads the range equivalent to full scale DAC output

4.6   Sampling Regime

# code	Followed By:	Operation
S	<CR>	Performs Single measurement
M	rate<CR>	Performs continuous measurement at set rate. If rate is omitted then instrument performs continuous measurements at previous rate. 1,2, or 4 Hz
#039	;ModeValue<CR>	Set mode without putting unit into run mode Where Mode = M Value = 1,2 or 4 for Normal mode (M) Mode = S for serial trigger single shot measurement Mode = T for TTL trigger measurement
#040	<CR>	Read operating mode.
#028	<CR>	Puts unit into run mode

4.7   Output Format

See section 4 for detailed description of output formats

#089	<CR>	Reads current output format
#082	;SDDBT<CR> ;TRITEC<CR> ;BENTHOS<CR> ;NMEA<CR>	Sets output format (see section on output strings)

4.8   Pressure Settings

The pressure sensor fitted to the VA500 measures absolute pressure, i.e. it includes atmospheric pressure. The pressure tare function allows the atmospheric pressure (as measured by the sensor before deployment) to be removed from the readings, so the output is simply pressure of water. Note also that by taking a tare reading at any fixed point in the water column, readings will then be output relative to that point.

# code	Followed By:	Operation
#009	;<CR> or ;VALUE<CR>	Sets the tare value in systems with pressure fitted. ;<CR> = Makes device take a reading to use as tare. ;VALUE<CR> = User entered value in units as set by #018 command.
#010	<CR>	Returns the tare value
#011	;ON<CR> or ;OFF<CR>	Turns Tare function ON/OFF
#012	<CR>	Reads Tare mode
#016	;Latitude <CR>	Sets Latitude
#017	<CR>	Reads Latitude
#018	;Pressure units<CR>	Set to either 0 – dBar 1 – Metres 2 – Feet
#019	<CR>	Read pressure units
#083	;0 or 1 or 2 or 3	Setup the pressure output format Where 0=not fitted, 1=PPPP.P, 2=PPP.PP, 3=PP.PPP
#084	<CR>	Returns the set pressure range

4.9   Appended DigiQuartz Data String (VA500P)

The VA500P can be configured to output an additional DigiQuartz type telegram appended to the conventionally selected and configure telegram. This allows a separate pressure data telegram to be broadcast to an INS, for example.

This DigiQuartz type telegram contains the instrument pressure reading in PSI, not corrected for latitude and the tare NOT applied, i.e. PSIA.

In addition, the psia unit can be included in the telegram if required.

These commands are not part of DataLOG x2. You will need to use a Terminal program to configure the telegram

See section Appended DigiQuartz Telegram (VP500P)

# Code	Followed By	Operation
#042	;0 or ;1	Enable\Disable DigiQuartz output telegram (appended to existing output)
#043	<CR>	Read DigiQuartz output (on or off)
#044	;0 or ;1	Enable\Disable DigiQuartz units (psia) text appended to DigiQuartz output telegram
#045	<CR>	Read DigiQuartz units (psia) text appended to DigiQuartz output telegram (on or off)

5 Output Data String Formats

If the optional pressure sensor is fitted and enabled then the only data format that supports this is the Valeport NMEA format. A number of other formats have been implemented to provide compatibility with existing systems.

5.1 Valeport NMEA Data String ($PRVAT)

$PRVAT, xx.xxx,M, xxxx.xxx, dBar*hh<CR><LF>

Field Number:

1. Range from transducer
2. Units
3. Pressure
4. Units
5. Checksum

Example:
$PRVAT,00.115,M,0010.100,dBar*39
$PRVAT,00.116,M,0010.000,dBar*3d

5.2 $SDDBT Data String

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

Sounder, Depth: Depth below transducer

Field Number:
1. Depth, feet
2. f = feet
3. Depth, meters
4. M = meters
5. Depth, Fathoms
6. F = Fathoms
7. Checksum

Example:
$SDDBT,0.4,f,0.1,M,0.1,F*02
$SDDBT,0.4,f,0.1,M,0.1,F*02

This format limits the resolution of the altimeter to 0.1m

5.3 Tritech Data String

xx.xxxm<CR><LF>

Example:
00.126m
00.124m

5.4 Benthos Data String

Rxx.xx<cr><lf>
where xx.xx can range from 0.10 to 99.99. If no echo was received the output
will be R99.99E<cr><lf>.

Example:
R00.13
R00.12

5.5 Appended DigiQuartz Data String (VP500P)

The VA500P can be configured to output an additional DigiQuartz type data string appended to the
conventionally selected and configure telegram. This allows a separate pressure data telegram to be
broadcast to an INS, for example.

This DigiQuartz type telegram contains the instrument pressure reading in PSI, not corrected for latitude
and the tare NOT applied, i.e. PSIA.

In addition, the psia unit can be included in the telegram if required. See section 4.9 for details on how to
configure the data telegram.

Without units:
*0001xx.xxx<CR><LF>
*   = Start Character
00   = Destination ID (ID of Host - fixed)
01   = Source ID (ID of Device responding - fixed)
xx.xxx   = Data – NO TARE applied (psi**a**)
<CR><LF>

Telegram example:
Valeport NMEA telegram appended by the DigiQuartz type telegram (without psia units)
>#042;1 (enable DQ output)
>#028 (run)
$PRVAT,05.432,M,0010.076,dBar*39
*000114.614

With units:
*0001xx.xxxpsia<CR><LF>
*   = Start Character
00   = Destination ID (ID of Host)
01   = Source ID (ID of Device responding)
xx.xxx   = Data – NO TARE applied
psia   = units
<CR><LF>

Telegram example:
Valeport NMEA telegram appended by the DigiQuartz type telegram (with psia units)
>#044;1 (enable units)
>#028(run)
$PRVAT,04.321,M,0010.084,dBar*34
*000114.626psia

6   Care and Maintenance

There are no user serviceable parts within the VA500. The VA500 is remarkably robust, being primarily constructed of titanium. The only maintenance required, other than periodic recalibration as necessary, is to keep the sensor as clean as possible.

After use, rinse all parts in fresh water removing any growth or debris as necessary, but take exceptional care not to touch or damage the pressure diaphragm itself if fitted.

6.1   Connector Care

The following handling procedures should be adopted when using connectors:

- The connector should not be exposed to long term heat or sunshine.
- If this occurs, and the connectors are very dry, soak in fresh water before use.
- Ensure the connectors are lubricated - the recommended lubricant is:
  Loctite 8021 in a spray can
  or
  Molykote 44 Medium - but use very sparingly.

- Any accumulation of sand or mud in the female contact should be removed with fresh water. Failure to do so could result in the splaying of the female contact and damage to the O-ring seals.
- When using bulkhead connectors ensure that there are no angular loads as this destroys the connector.
- When disconnecting, pull straight, not at an angle.

7 Wiring Information

It is advised that continuity checks are performed prior to all terminations.

7.1 SubConn MCBH10F

SubConn MCBH10F Pin	Function
1	Power Ground
2	Power +V
3	Analogue +'Ve
4	Analogue -'Ve
5	Enable 485 Link to Pin 9 for RS485. N/C for RS232
6	TTL trigger +Ve
7	RS232 Tx (To PC) / RS485A
8	RS232 Rx (From PC) / RS485B
9	RS232 Ground
10	TTL Trigger -'Ve

7.1.1 Extended Y Lead - Power/232 Comms / Analogue

END1: SubConn MCIL10M + DLSA-M	END 2:	END 3: 9 Way D Socket	FUNCTION
Pin	Connector	Pin	
1	Black 4mm Plug RS 444-797		-Ve
2	Red 4mm Plug RS 444-832		+Ve
3			Analogue +ve
4			Analogue -ve
5			Enable 485
6			Trigger +ve
7		2	RS232 TX (out of sensor)/RS485A
8		3	RS232 RX (into sensor)/RS485B
9		1, 5, 6, 8, 9, SHELL	RS232 GND
10			Trigger -ve

7.2 Non Standard Instrument Connectors

7.2.1 6 Way Impulse MCBH 6 MP Pinout

6 way Impulse MCBH-6-MP	Function
1	RS232 Rx (into sensor / From PC)
2	Power Ground
3	RS232 Tx (from sensor / into PC)
4	Analogue +Ve
5	Analogue –Ve/ RS232 Ground
6	Power +V

7.2.2 Test Lead with 6 way Female Impulse Connector

END 1: 6 Way In Line Female Impulse	END 2: Power In	END 3: Analogue Out	END 4: 9 Way D Socket	
Pin	Connector	Connector	Pin	FUNCTION
2	Black 4mm Plug			-Vin
6	Red 4mm Plug			+Vin
4		Green 4mm Plug		Analogue +ve
5		Black 4mm Plug		Analogue -ve
3			2	RS232 TX (out of sensor)
1			3	RS232 RX (into sensor)
5			1,5,6,8,9	RS232 Gnd

7.2.3 6 Way XSG-6-BCL Pinout

6 way XSG-6-BCL Pin	Function
1	RS232 Rx (into sensor / From PC)
2	Power Ground
3	RS232 Tx (from sensor / into PC)
4	Analogue +Ve
5	Analogue –Ve/ RS232 Ground
6	Power +V

7.2.4   Test Lead with 6 Way Female RMG-6-FS Connector

To mate to XSG-6-BCL connector

END 1: 6 Way In Line Female Impulse	END 2: POWER IN	END 2: ANALOGUE OUT	END 3: 9 Way D Socket	FUNCTION
Pin	Connector	Connector	Pin	
2	Black 4mm Plug			-ve in
6	Red 4mm Plug			+ve in
4		Green 4mm Plug		Analogue +ve
5		Black 4mm Plug		Analogue -ve
3			2	RS232 TX (out of sensor)
1			3	RS232 RX (into sensor)
5			1,5,6,8,9	RS232 Gnd

7.2.5   6 Way MCBH6M SubConn Pinout

Please Note: Wiring below refers to customer specific VA500RAP with item number 0430006-xx-MCBH6M

6 way MCBH6M Pin	Function
6	-'Ve
4	+'Ve
2	RS232 TX (out of sensor)
3	RS232 RX (into sensor)
1	'RS232 GND
5	-

7.2.6   Test Lead for 6 way SubConn MCIL6F Connector

To mate to a SubConn MCBH6M

End 1: SubConn MCIL6F + DLSA-F	End 2	END 3: 9 Way D Type	FUNCTION
PIN		PIN	
6	Black 4mm Plug		-'Ve
4	Red 4mm Plug		+'Ve
2		2	RS232 TX (out of sensor)
3		3	RS232 RX (into sensor)
1		1, 5, 6, 8, 9, SHELL	RS232 GND
5			-

Wiring above refers to customer specific VA500RAP with item number 0430006-xx-MCBH6M

8   EU Declaration of Conformity - CE Marking

Please note: 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.

EU Declaration of Conformity

Manufacturer:	Valeport Ltd
Address:	St Peter's Quay, Totnes, Devon, TQ9 5EW
Certification marking:	CE
Product Description:	Altimeter Altimeter with Pressure Right Angled Altimeter Right Angled Altimeter with Pressure

We the manufacturer declare that the **Altimeter** product range, is in conformity with the following EU Directives and harmonised standard(s):

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

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

Name:	Jason Horsell
Position:	Development Engineer
Place of issue:	Valeport Ltd, Totnes, UK
Date of issue:	13 February 2019
Signature:	