VALEPORT LIMITED

miniSVP, miniCTD, miniTIDE

Operating Manual

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CHAPTER DESCRIPTION PAGE

1 INTRODUCTION

This manual covers the basic specifications, deployment and maintenance procedures for the following products:

- miniSVP *Sound Velocity Profiler*
- miniCTD *CTD Profiler*
- miniTIDE *Underwater Tide Gauge / Level Recorder*

These products have been designed to operate with Valeport's own DataLog Express operating software; details of this software are given in a separate manual. The instruments can also be controlled by sending commands directly, using a suitable terminal emulation program such as HyperTerminal.

The instruments are based on Valeport's existing "mini" sensor range, with the addition of an internal battery and logging facility to allow autonomous self recording operation, as well as additional operating modes to suit profiling and moored applications.

Each product in the range is available in either 500m rated acetal or 6000m rated titanium housing. This manual highlights where this may result in specification variations, but the housing material has no effect on instrument function or operation. Where illustrations show plastic housing, it may be taken that the instructions apply equally to a titanium housing, and vice versa.

The products have been designed to be simple to use and maintain, as well as being small and lightweight for easy handling and deployment. Overall, they represent a very cost effective method of data collection for applications where the sophistication of Valeport's larger instruments is not required.

2 SPECIFICATIONS

Dimensions:

	Housing Ø	Sensor bulkhead Ø	Overall length	Weight (acetal)	Weight (titanium)
miniSVP	48mm	54mm	435mm	0.8kg	1.6kg
miniCTD	48mm	54mm	370mm	1.0kg	1.8kg
miniTIDE	48mm	48mm	270mm	0.7kg	1.4kg

Connections:

Subconn type MCBH10F (titanium on titanium housings, brass on acetal housings).

Wiring Information is in Section 6.

Materials:

Part	*miniSVP*	*miniCTD*	*miniTIDE*	Material
Main housing	●	●	●	Titanium (6000m) or acetal (500m)
Sensor bulkhead	●	●	●	Titanium (6000m) or acetal (500m)
Space Rods	●			Carbon Composite
Acoustic Reflector	●			Titanium
SV Transducer	●			Ceramic transducer behind polycarbonate window.
Conductivity Sensor (6000m)		●		Titanium structure, polyurethane coating, ceramic core
Conductivity Sensor (500m)		●		Acetal structure, ceramic core
Pressure Transducer	●	●	●	Stainless steel diaphragm with acetal protective cover.
Temperature sensor	●	●		PRT in titanium housing with polyurethane backing.

Power:

External 9 – 28v DC input *(NB: battery should still be fitted even if external power is being used, to maintain clock function)*

miniSVP / miniCTD <250mW (20mA @12v)

miniTIDE <200mW when sampling (16mA @12v)

Internal Single “C” cell, either 1.5v alkaline or 3.6v Lithium

miniSVP / miniCTD 30 hours operation (alkaline)/90 hours operation (Lithium)

miniTIDE 38 days @ 40 sec / 10 min sampling (alkaline)

67 days @ 40 sec / 10 min sampling (Lithium)

Acoustic Frequency (miniSVP):

Single sound pulse of 2.5MHz frequency.

Memory:

Each instrument is fitted with a 256Mb solid state memory. Capacity is over 10m lines of data for miniSVP and miniCTD, over 25m lines for miniTIDE.

Output:

Units are fitted with both RS232 and half-duplex RS485 communications as standard, selected by pin choice on the output connector. Protocol is 8 data bits, 1 stop bit, no parity, no flow control.

Baud rate is factory set to 115200. User may choose between 38400, 57600, 115200. (Note that fast data rates may not be possible with low baud rates).

Operating Modes:

miniSVP Continuous output at 1, 2, 4 or 8Hz
Profiling mode, every n.nn dBar, where n.nn is user defined

miniCTD Continuous output at 1, 2, 4 or 8Hz
Profiling mode, every n.nn dBar, where n.nn is user defined

miniTIDE Continuous output at 1 or 2Hz
Burst mode, using a choice of pre-defined patterns (refer to Section 3.2)

Performance:

Sensor		miniSVP	miniCTD	miniTIDE
Sound Velocity	*Range*	1400 – 1600m/s		
	Accuracy	±0.03m/s		
	Resolution	0.001m/s		
Conductivity	*Range*		0 – 80mS/cm	
	Accuracy		±0.01mS/cm	
	Resolution		0.001mS/cm	
Pressure	*Range*	10, 50, 100, 300, 600Bar	10, 50, 100, 300, 600Bar	10, 30, 100, 300, 600Bar
	Accuracy	±0.05% range	±0.05% range	±0.01% range
	Resolution	0.001% range	0.001% range	0.001% range
Temperature	*Range*	-5 to +35°C	-5 to +35°C	
	Accuracy	±0.01°C	±0.01°C	
	Resolution	0.001°C	0.001°C	

Certain features of the sensors used in the “mini” range are designed specifically to enable high quality data to be delivered:

Sound Velocity (miniSVP)	
Carbon Composite Rods:	The carbon composite material used for the sensor spacer rods has been specifically selected to provide 3 features: a) Excellent corrosion resistance b) Very high strength c) Virtually zero coefficient of thermal expansion This last point is particularly important; accurate sound velocity measurement relies on measuring the time taken for a pulse of sound to travel a known distance. The material selected does not measurably expand over the operating temperatures of the instrument, ensuring the highest possible accuracy at all times.
Digital Sampling Technique:	Enables a timing resolution of 1/100th of a nanosecond, equivalent to about 0.5mm/sec speed of sound on a 25mm path sensor, or 0.125mm/sec on a 100mm sensor. In practice, the output is restricted to 1mm/sec resolution. Linear sensor performance allows easy calibration.
Conductivity (miniCTD)	
Construction Materials:	The materials used in the Valeport Conductivity sensor have been specially chosen to resist compression at high pressure, This unique approach ensures that it performs within specification under even the harshest of field conditions.
Digital Sampling Technique:	A new digital sampling technique allows the Valeport conductivity sensor to operate with significantly less noise and greater long term stability than traditional inductive cells.
Pressure (miniTIDE)	
Temperature Compensation:	A new temperature compensated piezo-resistive pressure sensor allows performance levels traditionally associated with costly resonant crystal sensors.

3 DATA REQUESTS AND OUTPUT FORMATS

The “mini” range of products described in this manual is designed to be used with Valeport’s DataLog Express software. However, the instruments respond to a series of text commands that are detailed here, for those users who wish to interface the products to other systems. 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.

Notes

- 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

3.1 STOP COMMAND

The instrument can be stopped at any time by sending the ‘#’ character. The instrument returns a ‘>’, and waits for a further command.

3.2 BAUD RATES

#059;{baud_rate};1 Sets the units baud rate. Options are

e.g. #059;115200 38400, 57600, 115200

3.3 RUN COMMANDS (MINITIDE ONLY)

M1 Performs continuous measurement at 1Hz

M2 Performs continuous measurement at 2Hz

M Performs continuous measurements at previously used rate

B1 Burst sampling pattern of 30 seconds / 1 minute

B2 Burst sampling pattern of 40 seconds / 5 minutes

B3 Burst sampling pattern of 40 seconds / 10 minutes

B4 Burst sampling pattern of 40 seconds / 15 minutes

B5 Burst sampling pattern of 60 seconds / 30 minutes

3.4 RUN COMMANDS (MINISVP & MINICTD ONLY)

S Performs Single measurement

M1 Performs continuous measurement at 1Hz

M2 Performs continuous measurement at 2Hz

M4 Performs continuous measurement at 4Hz

M8 Performs continuous measurement at 8Hz

M Performs continuous measurements at previously used rate

P*n.nn* Performs profile at a depth increment of n.nn, as set by the operator, in the current profiling units (see command #018).
e.g.: P0.25 takes a reading every 0.25 dBar, metres or feet as appropriate

3.5 PRESSURE UNITS

#018;0 Pressure is output in dBar

#018;1 Pressure is output in metres, calculated using simplified UNESCO formula

#018;2 Pressure is output in feet, calculated using simplified UNESCO formula

3.6 PRESSURE TARE

#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

3.7 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

#016;*lat* Sets the instrument deployment latitude in decimal degrees, for use in pressure / depth conversion algorithm

3.8 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

3.9 LOGGER CONTROL

$DIR Outputs file table (list of data files)

$CLR Clears memory (use with caution!)

$OCLK Reads Current Date & Time

$ICLK*;DD;MM;CC;YY;HH;MM;SS*

Sets Date & Time

e.g.: $ICLK;03;02;20;08;14;30;00

sets clock to 14:30:00 on 3rd February 2008

$DEL*;filename* Deletes specific file e.g.: $DEL;File1

$EXTT*;filename* Performs simple text output data contained in specific file

$EXTZ*;filename* Performs Zmodem extraction of data contained in specific file

$RN*;filename;newfilename*

Renames a file e.g.: $RN;File1;MyData

$FREE Outputs amount of free memory

$VOLT Reads internal and external voltage levels

3.10 DATA FORMATS

Each time the instrument is turned on (or a new file started in Burst mode on the miniTIDE), it will output a file header in the following format. Each logged file therefore contains this header information.

Now: 19/02/2008 14:55:00 *The current date and time*
Battery Level: 1.4V *Internal battery level (guide only)*
MiniTide: S/N 27838 *Instrument Type and Serial Number*
Site info: VALEPORT TEST SITE *Site information*
Calibrated: 14/01/2008 *Date of last calibration*
Latitude: 52.999286 *Latitude for Pressure / Depth conversion*
Mode: B1 *Current operating mode*
Tare: 0 *Current Pressure Tare value*
Pressure units: dBar *Current Pressure Units (dBar, metres or feet)*

Logged and real time data follow the same formats, described below.

miniSVP example	10.351	21.488	1506.739
miniCTD example	10.128	19.786	46.554
miniTIDE example	0012.345		

- The data separator is a tab (this may be altered if required).

- Data is presented in the order: Pressure, Temperature, SV / Conductivity
- For the miniSVP and miniCTD, pressure data format is dependent on sensor range, and may be any of the following. Leading zeroes are included, so it is a fixed length string:
    - PPPP.P (e.g. 0123.4 dBar)
    - PPP.PP (e.g. 012.34 dBar)
    - PP.PPP (e.g. 12.345 dBar)
- For the miniTIDE, pressure data is a fixed length string, 3 decimal places, including leading zeroes.
- The temperature data (miniSVP & miniCTD) is given to 3 decimal places. Value is in °C and leading zeroes are included; signed if negative:
    - 21.456
    - 02.769
    - -01.174
- Sound Velocity (miniSVP) is given in m/s, as a fixed length string with 3 decimal places. In air, the sensor reads 0000.000
- Conductivity (miniCTD) is given in mS/cm, as a fixed length string with 3 decimal places, and leading zeroes if appropriate.

4 DEPLOYMENT

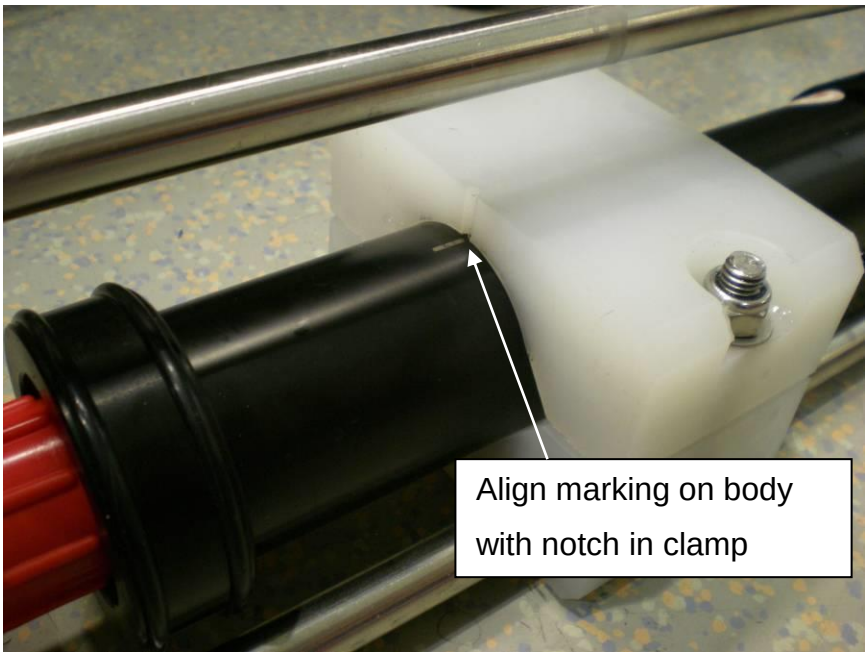
The mini product range is supplied as standard installed in the deployment cage. The choice of deployment frame will affect the conductivity readings of the MiniCTD. The nature of inductive conductivity cells means that objects that interact with the cells inductive field will affect the conductivity readings. For this reason MiniCTD's are factory calibrated in the standard cage.

If the MiniCTD is to be deployed without the cage, the conductivity readings will be affected. To compensate for this an adjustment will have to be made to the calibration parameters. Contact Valeport for further details.

4.1 CAGE

The deployment cage is a rugged deployment method, providing physical protection to the instrument. The cage is supplied with a wire strop which should be attached to the cage at the end nearest the instrument connector. This strop should be fixed to the end of the deployment wire or rope. Shackles are provided for the end of the cage nearest the sensors, should additional weight be required to aid deployment.

If the instrument is removed from the deployment cage for any reason, it should be reinstalled securely, taking note of the alignment markings on the housing (See photo) and polypropylene clamp.



4.2 CLAMP

The clamp system is primarily designed for hand deployment use from small vessels. It should be fitted around the main tube of the instrument, at a point that allows the instrument to balance horizontally. The clamp features fixing points for the deployment wire or rope, and also for a small weight to be added below the instrument, to alleviate streaming.

Whichever deployment system is used, it is important to note that if the data is being monitored in real time via a Valeport signal cable, the Subconn connector system is not designed to be weight bearing. Suspend the instrument either from the dedicated eye in the cable, or from a separate strain wire. Do not allow the weight of the instrument to be taken through the connector itself.

5 BATTERIES

5.1 BATTERY LIFE

5.1.1 MINISVP & MINICTD

The units draw power continuously whilst running. Battery life is calculated as follows:

Alkaline cells have a nominal capacity of 6000mAh. We assume 77% efficiency, giving a usable life of 4620mAh. With a 1.5v alkaline C cell, the current drain is 120mA.
4620mAh / 120mA = 38½ hours

Lithium cells have a nominal capacity of 7700mAh. We assume 66% efficiency, giving a usable life of 5082mAh. With a 3.6v lithium C cell, the current drain is 50mA.
5082mAh / 50mA = 101 hours (approx)

5.1.2 MINITIDE

In continuous output mode, the instrument draws power continuously whilst running:

Alkaline cells have a nominal capacity of 6000mAh. We assume 77% efficiency, giving a usable life of 4620mAh. With a 1.5v alkaline C cell, the current drain is 62mA.
4620mAh / 62mA = 74½ hours

Lithium cells have a nominal capacity of 7700mAh. We assume 66% efficiency, giving a usable life of 5082mAh. With a 3.6v alkaline C cell, the current drain is 24mA.
5082mAh / 24mA = 212 hours (approx)

In Burst mode, the unit cycles between 'Run' and 'Sleep' modes, making calculations more complex. The table summarises the battery life in each of the preset patterns:

Mode	Pattern	Alkaline	Lithium
B1	30 seconds per 1 minute	6 days	17 days
B2	40 seconds per 5 minutes	21 days	46 days
B3	40 seconds per 10 minutes	38 days	67 days
B4	40 seconds per 15 minutes	52 days	80 days
B5	60 seconds per 30 minutes	64 days	87 days

Note that 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.

5.2 CHANGING BATTERIES

Changing batteries in the mini range of products is very simple process, which may be completed in under a minute. Note that all data is saved in non-volatile Flash memory, so data is secure during the battery change process.

The system clock does require battery power in order to maintain the current date and time settings, but the instrument is fitted with a capacitor system to maintain a supply to the clock for a period of not less than 20 minutes after the removal of the battery. This should be more than sufficient to allow the battery to be changed. In the event that clock settings are lost during battery change, or after an extended period of storage with no battery fitted, then please use DataLog Express or the # codes defined in Section 3.9 to reset the clock.

- Disconnect any external connections, including the switch plug, from the instrument's Subconn connector.
- Loosen the acetal lock ring at the top of the instrument housing – this should be achievable by hand.
- Pull the logger pack from the top of the instrument.
- Replace the single C cell in the instrument; note that the cell should be inserted with the positive end upwards. Although it is possible to insert the battery incorrectly, it will not make contact.
- Check the o-ring on the logger pack for damage and debris. Clean it and smear lightly with silicon grease.
- Replace the logger pack, rotating slowly until the location pins align. Push the logger pack home.
- Replace the acetal lock ring – hand tight is sufficient.

Note that for planned periods of extended storage, the battery should be removed from the instrument to prevent accidental leakage.

6 OPTIONAL BLUETOOTH LOGGER

6.1 BLUETOOTH MINILOGGER PACK

The Bluetooth miniLogger pack has been designed as a direct replacement for the standard subconn miniLogger pack.

The bluetooth miniLogger is rated to 500m and is secured using the same lock ring as used by the standard logger pack.

On first installation, it will require 2 mins initialise, during this period the magnetic switchkey should be removed.

After this period of initialisation the switchkey can be used to turn the instrument on and off in the same manner as the subconn switchcap is used on the standard logger pack. Every time the switch is removed, the instrument will start a new file.

Using a standard C-cell battery, the MiniSVP/CTD fitted with abluetooth logger should have an endurance of ~12 hours continuous operation.

6.2 USB BLUETOOTH RECEIVER

To ensure the reliability of the bluetooth communications, the logger pack is supplied with a dedicated bluetooth receiver. The logger and receiver are paired in the factory and will automatically connect whenever active and in range. The receiver is supplied with a stubby aerial, but can also be supplied with a weatherproof magnetic mount antenna for outside mounting.

The receiver will install as a USB serial port adaptor and should install automatically on most windows PC's. If the receiver will not automatically install, drivers can be downloaded from:

http://www.ftdichip.com/Drivers/VCP.htm

Once installed, the device will scan for the paired logger, with the LED cycling from green to purple. When the logger pack is detected, the LED will go blue. If data is being transmitted then the LED will flash blue.

Once the device is connected, it can be communicated with as though connected with a cable. When using Datalog Express, the Bluetooth option should be checked.

For use with hyperterminal, the connection is 57600 baud, 8 N 1.
For use with Datalog Express, select the Bluetooth Comms option which fixes the baud rate to 57600 baud, 8 N 1.

7 CARE AND MAINTENANCE

There are no user serviceable parts within the mini series other than changing batteries. See section 5.2. The instruments are 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.

7.1 SUBCONN CARE

The following handling procedures should be adopted when using Subconn connectors:

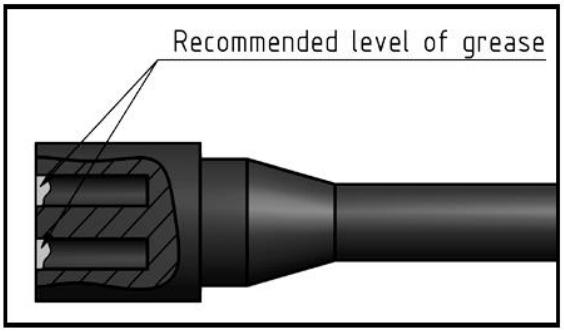
- The connector should not be exposed to long term heat or sunshine.
- If this occurs, and the connectors are very dry, soak in fresh water before use.
- Ensure the connectors are lubricated - the recommended lubricant is:

  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.

7.2 GREASING AND MATING ABOVE WATER (DRY MATE)



- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector

- The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets
- To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector
- When disconnecting, pull straight, not at an angle

8 WIRING INFORMATION

Wiring colours are correct at the time the manual was printed. However, it is advised that continuity checks are performed prior to all terminations.

8.1 INSTRUMENT CONNECTOR

Subconn MCBH10F	Function
1	Power Ground
2	Power +V
3	RS485 A
4	RS485 B
5	Mode Pin 2
6	Mode Pin 1
7	RS232 Tx (To PC)
8	RS232 Rx (From PC)
9	RS232 Ground
10	Internal Battery Enable Link to RS232 Ground

Mode Pins:

Pins 5 and 6 on the output connector are designated as Mode Pins. By grounding a combination of these pins, the instrument can be automatically set to adjust its output protocol to suit different communications options. The pins should be grounded (closed) via a 1000Ω resistor.

Output Mode	Mode Pin 1	Mode Pin 2	Notes
RS232	open	open	Default baud rate 115200
RS485	open	closed	Fixed baud rate 38400, with transmission delays
Blue Tooth	closed	closed	Fixed baud rate 57600, with transmission delays

8.2 SWITCH PLUG

10 Way Male Subconn	Function
1	Link to Pin 10
2	NC
3	NC
4	NC
5	NC
6	NC
7	NC
8	NC
9	NC
10	Link to Pin 1

8.3 3M Y LEAD (RS232)

10 Way Subconn	Function	3m Cable	1m Power Cable	4mm Banana Plugs	1m Data Cable	9 Way D Type
1	Power Ground	WHITE	BLUE	BLACK		
2	Power +V	PINK	BROWN	RED		
3		N/C				
4		N/C				
5		N/C				
6		N/C				
7	RS232 Tx (To PC)	GREY			YELLOW	2
8	RS232 Rx (From PC)	BLUE			BLUE	3
9	RS232 Ground	GREEN			GREEN	5 (link to 1,6,8,9)
		SCREEN			SCREEN	SHELL
10	Internal Battery Enable Link to RS232 Ground	YELLOW				