MIDAS SVX Combined CTD & SVP

Section 1 - Mechanical Operation

CHAPTER DESCRIPTION PAGE

1 INTRODUCTION

This section of the manual describes the specification, construction, wiring diagrams and basic maintenance procedures of the Valeport MIDAS SVX Combined CTD & Sound Velocity Profiler.

As standard, the MIDAS SVX system consists of the following components:

- Titanium housed instrument
- Stainless steel deployment cage
- 3m Y lead (interface to PC)
- Switching Plug
- Basic maintenance tools and spare o-rings
- DataLog 400 Software
- Operating Manual
- Transit case

In addition, the following components may be supplied as optional extras:

- RS485 communications adaptor
- RS422 communications adaptor
- FSK modem communications adaptor (includes pcb in instrument)
- Various lengths & types of signal cable are also available

Please refer to Section 2 of this manual for details of software operation.

2 SPECIFICATIONS

2.1 SENSOR SPECIFICATIONS

The unit is fitted with the following sensors:

Sound Velocity

Type:	Valeport "time of flight" sound velocity sensor
Range:	1400 to 1600m/s standard. Factory fit option of 1600 to 1850m/s is available
Accuracy:	± 0.03m/s (rms)
Resolution:	0.001m/s

Conductivity

Type:	Valeport inductive coil
Range:	0.1 to 80mS/cm
Accuracy:	± 0.01mS/cm
Resolution:	0.002mS/cm (up to 4Hz sampling, 0.006mS/cm at 8Hz)

Pressure (standard)

Type:	Strain Gauge
Range:	500Bar absolute (approx 5000m water depth) standard. Others available.
Accuracy:	± 0.04% Full scale
Resolution:	0.005% Full scale

Pressure (option)

Type:	Resonant Quartz
Range:	Various up to 10,000 psi.
Accuracy:	± 0.01% Full scale
Resolution:	0.001% Full scale

Temperature

Type:	Fast response PRT
Range:	-5 to +35°C
Accuracy:	± 0.01°C
Resolution:	0.002°C

2.2 MECHANICAL SPECIFICATIONS

Materials

Housing:	Titanium
Exceptions:	Sound velocity sensor uses carbon fibre composite rods. Note that some earlier systems used treated Invar rods and zinc anode instead.
Cage:	Stainless steel (316 grade) with polypropylene clamping brackets
Dimensions:	Instrument - 210mm Ø, 590mm long (including connector)
Weight:	15kg (air), 8kg (water)
Depth Rating:	5000m (unless smaller pressure sensor fitted)

Connectors

Instrument:	10 pin female Subconn bulkhead type (MCBH10F) with lock ring, data and power
Comms Cable:	Valeport 3m Y lead. 10 pin male Subconn line type (MCIL10M) to instrument, 2 x 4mm banana plugs to external power, 9 pin female D type to PC.
Switching Plug:	10 pin male Subconn line type (MCIL10M), with lock ring. Note that the switch cap contains wiring links to activate the instrument – it is not a dummy plug.

2.3 PERFORMANCE SPECIFICATIONS

Memory:	8Mbyte solid state memory (upgradeable in 8 Mbyte steps to 32 Mbyte)
Internal Power:	8 x 1.5v alkaline D cells. The unit will accept 8 x 3.6v Lithium D cells with no alterations required. Do not mix battery types.
External Power:	Between 8 and 30v DC.
Current Drain:	60mA at 12v when running, and 0.25mA when in sleep mode.
Sampling Rate:	1, 2, 4 or 8Hz (synchronised)
Data Output:	RS232, RS485 or RS422, depending on pin selection. Baud rate is user selectable from 2400 to 115200

2.4 SAMPLE LIFETIME CALCULATIONS

2.4.1 BASED ON MEMORY

Lifetime based on memory is simple to calculate. Conductivity, temperature and pressure values use 2 bytes of memory per sample, and sound velocity uses 4 bytes. Therefore total memory used per record is 4 + (3 x 2) = 10 bytes. Note that in Trip mode, each record is also assigned a date/time stamp, which uses a further 7 bytes.

The 8 Mbyte memory actually contains 8,388,608 bytes. Allowing a small amount of memory usage for header files, the memory will store over 490,000 records in Trip sampling mode, and over 830,000 records in all other modes.

The length of time that this will last for obviously depends on sampling scenario. Here are three examples:

Continuous data sampling, 8Hz:

Memory used per second is 8 x 10 bytes = 80 bytes.

Total memory fitted is 8,388,608 bytes.

Number of seconds before memory full is 8,388,608 / 80 = (approx) 104,500 seconds.

This is equivalent to 29 hours.

This period can be doubled by sampling at 4Hz.

Burst sampling, 4Hz, sampling for 1 minute every 10 minutes, recording all data points:

Memory used per burst is 10 bytes x 4Hz x 60 seconds = 2400 bytes.

The memory will therefore be full after 8,388,608 / 2400 bursts = 3495 bursts. At a 10 minute cycle time, this is 34950 minutes, which is equivalent to 24 days.

Trip sampling, 5000m cast, measuring every 1 metre:

In this example, the instrument will take 1 reading every metre of both descent and ascent. This means 5000 data points descending, and a further 5000 ascending. Each record consists of 10 bytes of data and 7 bytes of time stamp. Each record therefore uses 17 bytes. A single cast will take 10,000 such records, and will therefore use 170,000 bytes.

The 8Mbyte memory will therefore hold approximately 49 casts of data.

2.4.2 BASED ON BATTERIES

The Model SVXtra will function with a voltage supply of between 9 and 30vDC. The voltage output of the 8 x D cell battery pack will vary according to the type of cell fitted. The most likely cells to be used will be standard alkaline type (1.5v each) or Lithium cells (3.6v each), giving a 12v nominal output for alkaline cells, or 28.8v nominal for Lithium cells. The following calculations are based on the same sampling scenarios as the memory calculations, using figures for a 12v alkaline battery pack. Each example also gives a figure for a Lithium battery pack, calculated from a basic ratio of alkaline to Lithium performance.

In all examples, it is taken that an 8 D cell alkaline battery pack will have a nominal capacity of 14Ah, and will be 75% efficient (total available charge, 10.5Ah), and that an 8 D cell Lithium pack will have a nominal capacity of 17.5Ah, and will be 95% efficient (total available charge, 16.6Ah).

Continuous data sampling, 8Hz:

At 12v, the instrument draws 60mA when sampling.

Total charge available is 10500mAh.

Number of hours available is therefore 10500mAh / 60mA = 175 hours.

This is equivalent to just over 7 days.

For Lithium cells, a similar calculation gives over 27 days.

Note that the instrument is effectively operating continuously when in Trip sampling mode, so similar calculations will apply.

Burst sampling, 4Hz, sampling for 1 minute every 10 minutes:

At 12v, instrument draws 60mA when sampling, plus 60mA for 5 seconds at the start of each burst. It draws 0.25mA when in sleep mode between bursts.

In this scenario then, the instrument will draw 60mA for 65 seconds, and then 0.25ms for 535 seconds. On average, it will draw:

$$\frac{(60 * 65) + (0.25 * 535)}{(65 + 535)} = 6.72\text{mA}$$

Total charge available is 10500mAh.

Number of hours available is therefore 10500mAh / 6.72mA = 1562 hours.

This is equivalent to approx 65 days.

For Lithium cells, a similar calculation gives approx 156 days.

Note that the above examples are intended as guides only. Valeport accepts no responsibility for variation in actual performance. Note that performance of individual battery cells is not always consistent.

3 INSTALLATION

The standard system is supplied in an ABS transit case, together with any communications adaptors ordered. Any additional lengths of signal cable are packed separately.

3.1 COMMUNICATIONS WITH PC

The MIDAS SVX can be set up and interrogated using the DataLog 400 software supplied. Please refer to Section 2 of this manual for details of how to use the software.

To connect the instrument directly to a PC for RS232 communications, use the 3m Y lead supplied. This lead is fitted with a 10 pin Subconn type connector, which should be plugged directly into the connector on the top of the housing (or to a length of signal cable). The lead also features 2 x 4mm banana plugs for application of external power if required and a 9 way D type connector which should plug directly into a spare comm port on the back of the PC. Note that a 9 - 25 way adaptor may be required, depending on PC configuration.

If non-RS232 communications are to be used, via the optional RS485, RS422 or FSK methods, then the appropriate adaptor should be used. Each adaptor is supplied with a switched 3m Y lead (different to the standard RS232 Y lead), which should be connected as follows:

Comms Method	Adaptor Part no.	Connections
RS485	0400029	Connect 15 pin D type and 4mm plugs from Y lead into adaptor. Connect 9 pin D type from adaptor to PC, and 4mm plugs from adaptor to external power, as indicated on adaptor housing.
RS422	0400030	Connect 15 pin D type and 4mm plugs from Y lead into adaptor. Connect 9 pin D type from adaptor to PC, and 4mm plugs from adaptor to external power, as indicated on adaptor housing.
FSK	0400005	Connect 4mm plugs from Y lead into adaptor, leaving D types unconnected (FSK uses power and signal on just two wires). Connect 9 pin D type from adaptor to PC, and 4mm plugs from adaptor to external power, as indicated on adaptor

3.2 DEPLOYING THE MIDAS SVX

All parts of the standard system (with the exception of the top part of the 3m Y lead) are designed for immersion. All communications adaptors (RS485, RS422, FSK) are splash proof, but should be sited in a dry place, as close to the PC as possible.

The MIDAS SVX is supplied with a stainless steel protective cage, but care should still be taken not to damage the instrument. For profiling work, the recommended deployment method is to suspend the instrument using the stainless steel wire strop. For fixed deployments, the user may wish to remove the steel cage, and use the grooves in the titanium instrument housing as clamping points.

3.2.1 REAL TIME OPERATION

For real time data output, connect the signal cable to the 10 pin Subconn connector on the instrument. All Valeport signal cables include a suspension point for strain relief, and a similar arrangement is recommended for other cable types. Connect the top end of the cable to a PC using the appropriate method as described above.

3.2.2 SELF RECORDING OPERATION

For self recording only deployments, the instrument is switched on by insertion of the Subconn style switch plug. This plug must be inserted for the unit to operate.

3.3 RECOVERY

On recovery, data can be extracted to PC via the 3m Y lead. This is covered in Section 2.

To prolong the lifetime of the instrument the following procedures should be carried out once the instrument has been recovered:

- Remove any significant growth from the instrument, taking care not to damage transducer face or reflector plate of the sound velocity sensor. A high pressure water jet or stiff (not metal) brush is recommended.
- Remove any significant growth from the pressure sensor port. Take care not to introduce any sharp objects onto the sensor face – this may result in sensor damage.
- Remove any growth from the conductivity cell
- Check instrument for signs of damage.
- Rinse the instrument in fresh water
- Dry the instrument if possible, paying particular attention to the sensors and connector.
- Repack the instrument in the transit cases provided.

4 MAINTENANCE

The MIDAS SVX is completely solid state, and therefore requires very little maintenance. Other than keeping the instrument relatively clean, the only procedure that the customer will be required to carry out on a regular basis is to change the batteries. This Chapter also covers replacement of the zinc anode fitted to some earlier models, and details of the o-rings that are fitted to the instrument, and which should be checked regularly for damage and replaced if necessary.

4.1 CHANGING BATTERIES

The MIDAS SVX accepts 8 x D cells, of either 1.5v alkaline or 3.6v Lithium type. These cells are arranged in series, so the output voltage is 12v (alkaline) or 28.8v (Lithium). Some example scenarios for lifetime of these batteries are given in Chapter 2.4.2.

The batteries are located in a holder in the top of the instrument, and should be accessed by removing the connector bulkhead.

1. Remove the instrument from the protective cage by loosening the M10 nuts on the polypropylene clamps. Gently lever these clamps apart, using a screwdriver if necessary.

2. Slide the instrument out of the cage, in either direction.

3. Remove the 3 M5 x 20 socket cap screws in the connector bulkhead, using the Allen key provided. Note that these screws are titanium, and should be replaced with titanium screws if lost. Other materials will suffer galvanic corrosion and may be destroyed.

4. Without twisting or putting undue stress on the Subconn connector slide the bulkhead and attached battery pack out of the main housing. A slot between the tube and the bulkhead allows levering with a screwdriver if necessary. Take care not to scratch the bore of the tube.

5. A lead connects the battery pack to the electronics inside the tube. This may be disconnected at the battery pack if required, for ease.

6. Replace the batteries.

7. Check the condition of the bore seal o-rings, and apply a light coating of silicon grease. Ensure that both they and the anti-extrusion rings sit in the groove correctly, and are free from damage.

8. Reattach the connector to the electronics if necessary, and gently slide the battery pack back into the tube, ensuring that the fixing holes are correctly aligned. Again, take care not to scratch the bore.

9. Replace the 3 x M5 titanium screws, using a small amount of copper grease (supplied). Do not force the screws, just tighten firmly.

10. Finally, slide the instrument back into the protective cage. Note that the clamping brackets are offset, and that the sensor end of the instrument should lie at the long end of the cage.

4.2 O-RING SIZES

The Model SVXtra is kept watertight by using o-ring seals. Double o-ring seals are used at each end of the titanium housing, although the customer should have no reason to open any seal other than that at the battery end. To help preserve the watertight nature of the equipment, please observe the following guidelines:

- Ensure that all o-rings are free from cuts, abrasions or perishing.
- Ensure that all-o-rings are free from dirt, grit, sand, hair and other foreign objects.
- Ensure that an anti-extrusion ring is fitted on the pressure side of each o-ring. With the concave surface towards the o-ring.
- Whenever an o-ring seal is opened (e.g. when changing batteries), ensure that a light coating of silicon grease is applied to the o-ring before the seal is closed.
- Ensure that all o-ring protected seals are tightened.

A set of spare o-rings and anti-extrusion rings is included with the equipment. If an o-ring needs replacing, be sure to use the correct size. If obtaining further spare o-rings from an alternative source, be sure to obtain the correct material (signified by the last 4 digits of the o-ring code number).

O-ring size:	200-158-4470
Anti-extrusion ring size:	158

4.3 ZINC ANODE

The Valeport "time of flight" sound velocity sensor relies on having a very precisely defined path length between the transducer face and the reflector plate. This is now achieved by using a carbon fibre composite material for the rods, which has a thermal expansion coefficient of practically zero. This means that the path length is maintained, irrespective of the environmental temperature.

Earlier versions of the sensor were designed to automatically compensate for variations in sensor length caused by thermal expansion of materials, rather than eliminating the effects altogether. Part of this design required the use of a material called Invar for the rods of the sensor. A drawback of using Invar, which is a steel type alloy, is that it is susceptible to corrosion. For this reason, all Invar rods are plated and coated to inhibit corrosion. As an additional safeguard, however, a zinc anode was positioned on the end of the sensor. From time to time this may require replacement – the frequency of replacement will depend very much on operating environment and usage.

To replace the zinc anode, simply unscrew the M5 x 10 socket cap head screw holding it in place, and replace the anode with a new one. Note that this screw is made from titanium, and should be replaced with like if it is lost.

Please note that while every effort is made to safeguard the condition of the Invar, the user may notice rust spots on the rods after a period of time. These have no effect on sensor performance or recalibration, but will be replaced as a matter of course during service and recalibration procedures at Valeport.

The user may also help to maintain the Invar rods in good condition by rinsing the sensor with fresh water after deployment.

No maintenance at all is required on carbon fibre rods, other than cleaning after deployment.

5 WIRING INFORMATION

5.1 3M Y LEAD (RS232)

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

5.2 3M SWITCHED Y LEAD (RS485 & RS422)

10 Way Male Subconn	3m Blue Polyurethane Cable	SWITCH BOX	1m White Cable	4mm Banana Plugs	1m Grey Cable	15 Way D Type	0.2m Grey Cable	9 Way D Type	Function
1	WHITE		BLUE	BLACK					Power Ground
2	PINK		BROWN	RED					Power +V
3	RED				RED	9			RS422 TxA
4	BLACK				BLACK	10			RS422 TxB
5	ORANGE				VIOLET	11			RS422 RxA
6	BROWN				BROWN	12			RS422 RxB
7	GREY				YELLOW		YELLOW	2	RS232 Tx (To PC)
8	BLUE				BLUE		BLUE	3	RS232 Rx (From PC)
9	GREEN				GREEN	5	GREEN	5 (link to 1,6,8,9)	RS232 Ground
	SCREEN				SCREEN	SHELL	SCREEN	SHELL	
10	YELLOW								Internal Battery Enable

6 CALIBRATION INFORMATION

Inserted After This Page

7 EQUIPMENT CHECKLIST

Serial No.	Model No. .....
Customer:	Con Number: .....
.....	Customer Ref: .....
.....	Del. Note: .....
.....	Calibration Cert.: .....

ITEM	Quantity	Serial Number	Initials
Hardware			
MIDAS SVX Sound Velocity Profiler	1		
1.5v alkaline cells fitted	8		
Stainless steel deployment frame	1		
3m Y Lead Standard / Switched	1		
Switching Plug	1		
Tools and Accessories Kit	1		
Comms Adaptor FSK / RS485 / RS422			
Signal cable on hand reel (m)			
Transit Case			
Software			
DataLog 400 CDROM	1		
Documentation			
Operating Manual	1		
Calibration Certificate Enclosed	1		

SIGNED …… **DATE ……**

8 GUARANTEE CERTIFICATE

The following guarantee periods shall apply:

Pressure Transducers and semiconductors	*12 months from date of despatch*
All other system components	*36 months from date of despatch*

During the above periods, Valeport Limited warrants that (at their option), they will replace or repair any faulty items caused by bad workmanship or materials.

Any such claims must be submitted in writing during the above warranty periods.

Valeport Limited shall be under no liability for:

1) Any consequential loss or damage of any kind whatsoever.

2) For any defect or deficiency judged by Valeport Limited to be caused by wear and tear or of improper or unskilled handling of the goods or by any repair or attempted repair or dismantling by any one other than Valeport Limited or persons authorised to do so by Valeport Limited.

3) Batteries and other consumables supplied with the equipment, which are not covered by this guarantee.

Due to the specialised nature of the instrument it should, if possible, be returned to the factory for repair or servicing. The type and serial numbers of the instrument should always be quoted, together with full details of any fault or the service required.

Equipment returned to Valeport Limited for servicing must be adequately packed, preferably in the special box supplied and shipped with transportation charges prepaid. Return transport charges are also to the account of the customer.

Note: Any items supplied as part of a system which are not manufactured by Valeport Limited are covered by the individual manufacturer's guarantee of the equipment supplied.

MODEL NUMBER ..... SERIAL NUMBER .....

DATE OF DESPATCH ..... SIGNATURE.....