

VALEPORT LIMITED
Model 106
Self Recording/Direct Reading Current Meters
Installation & 8008 CDU
Operation Manual

Document Ref.: 0106800B.doc

This confidential document was prepared by the staff of Valeport Limited, the Company, and is the property of the Company, which also owns the copyright therein. All rights conferred by the law of the copyright and by virtue of international copyright conventions are reserved to the Company. This document must not be copied, reprinted or reproduced in any material form, either wholly or in part, and the contents of this document, and any method or technique available therefrom, must not be disclosed to any other person whatsoever without the prior written consent of the Company.

Valeport Limited,
St Peters Quay,
TOTNES,
Devon, TQ9 5EW,
UK

Tel: +44 (0)1803 869292
Fax: +44 (0)1803 869293
e-mail: sales@valeport.co.uk
Web: www.valeport.co.uk

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.

Copyright © 2000

CONTENTS	PAGE NO.
1 INTRODUCTION	5
1.1 General Description.....	5
2 SYSTEM DESCRIPTION	6
2.1 Instrument.....	6
2.2 Surface units	6
2.3 Equipment supplied	6
2.4 Customer Supply.....	7
3 INSTALLATION	8
3.1 Mechanical Installation	8
3.2 Electrical Connections.....	8
3.2.1 Direct RS232 - PC operation only	9
3.2.1.1 Direct Reading Mode.....	9
3.2.1.2 Self Recording Mode.....	9
3.2.2 Digital Current Loop	9
3.3 Serial data format.....	10
3.4 Batteries.....	10
3.4.1 8008 - CDU.....	10
4 OPERATION USING 8008 CDU.....	11
4.1 Operating Procedure.....	11
4.2 POINTS TO NOTE ABOUT CDU LOGGING	13
4.3 Data Replay	14
4.4 External Connections	14
4.5 Printer output.....	15
4.5.1 106 Printer string	15
4.6 Storage capacity.....	16
5 MAINTENANCE.....	17
5.1 Battery replacement	17
5.2 Battery replacement - 8008 CDU	17
5.3 Impeller	18
5.4 General.....	18
5.5 O-Ring Sizes	19
5.6 Lithium BackUP Battery	19
6 CALIBRATION	20
APPENDIX 1 SPECIFICATION.....	21
APPENDIX 2 FIGURES.....	22
FIGURE 1: Model 106 Interconnections.....	22
FIGURE 3: Model 106 Sensor Layout	23
APPENDIX 3 CABLE WIRING SCHEMES	24
"Y"-LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS	24
SUB-SEA LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS	25
DECK LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS.....	25
DIGITAL CURRENT LOOP / 8008 SURFACE UNIT CONNECTORS	26
DC INPUT	26
RS232	26
DECK LEAD	26
APPENDIX 4 PRE-DELIVERY CHECKLIST.....	27
APPENDIX 6 GUARANTEE CERTIFICATE and EQUIPMENT SUPPLIED CHECKLIST	31

1 INTRODUCTION

This document covers the installation and operation of Model 106 Self-Recording/Direct Reading Current Meter, when used with the 8008 Control Display Unit.

It also covers general maintenance procedures, and the calibration data of the units. Operation of the Meters with Windows PC software is covered in the supplementary DataLog software manual.

1.1 GENERAL DESCRIPTION

The Model 106 is an impeller-based meter measuring speed and direction, with optional temperature and depth parameters.

As standard, they are Self-Recording only instruments, but a Direct Reading capability can be fitted as an option. All units can be operated directly via PC; alternatively the Model 8008 Control Display Unit can be used for controlling Direct Reading operation:

Self Recording Mode:

Sample setup and data extraction can be carried out using deck lead from PC to internal 9 Way D-type connector. It is not possible to control or read data from a Self-Recording only unit whilst it is deployed.

Direct Reading Mode:

Over short cable lengths (up to 50m) RS232 communications are possible via the external 4 Way Mil-Spec connector and PC.

Over longer cable lengths, communications are via Digital Current Loop. The 8008 CDU has an integral current loop adapter, so direct use of the instruments with this unit is possible. If it is required to use the meters with a PC over long cable lengths, a separate Digital Current Loop Adapter will be required.

Power to the Model106 may be taken from their internal battery, from the 8008 CDU (if used) or from a surface battery or power supply.

When power is taken from the internal battery (1.5V alkaline D cell), battery life is approximately 30 days at 10 second sampling rate, or 56 days at 5-minute sample rate.

Using a 3.6V Lithium D cell, life is approximately 90 days at 10-second sample rate, or 180 days at 5-minute sample rate.

The units are fitted with a 512kbyte memory. This equates to storage of over 8000 speed and direction records for the 106 (over 4000 if temperature and depth are also fitted).

2 SYSTEM DESCRIPTION

A general overview of the system and the different hardware options which are available are shown in Figure 1 (Appendix 2), and general specifications are given in Appendix 1.

2.1 INSTRUMENT

Model 106

The instrument contains all of the measurement sensors and electronics. The current meter works on a basic 1-second cycle, during which the impeller counts are taken and a single compass heading reading is made. From this, East and North velocity vectors are calculated, which are then summed over the averaging period. The additional parameters of temperature and pressure (if fitted) are sampled once every sample period, and averaged over the averaging period.

Note that at very low flow speeds (of the order of a few centimetres per second), it will be necessary to set a reasonably long averaging period to improve the resolution and accuracy of the flow measurements.

The Model 106 is fitted with a data acquisition micro-controller, operating at 12-bit resolution. The temperature and depth sensors operate on a basic 16 Hz sampling rate and the samples are sequential.

When in Self-Recording mode, the instrument logs raw data. In real time mode, the calibration constants in the fish software are used to calculate the actual temperature and pressure readings within the instrument, and the 8008 Surface Unit or PC reads this data. When logged data is extracted, the raw data is transferred to the PC and then the Windows software automatically converts the data to engineering units. This operation is covered in the supplementary software manual. Note that it is not possible to upload logged data to a Surface Unit.

The additional optional sensors that can be fitted are a Thermistor temperature sensor and strain gauge pressure transducer. The type and range of transducer actually fitted is defined in the calibration sheet [Appendix 4].

2.2 SURFACE UNITS

If operating the Model 106 via PC, it is possible to achieve direct RS232 communications over short cable lengths (up to about 50m). If longer cable lengths are being used, it will be necessary to use a Digital Current Loop Adapter (DCL). The DCL adapter enables data on power communications over a single pair of conductors.

If operation is with a Model 8008 Surface Unit, a DCL adapter will not be necessary, since the 8008 has this communication method built in, with selection defined by the cable connections.

2.3 EQUIPMENT SUPPLIED

The equipment supplied is defined in the equipment checklist, Appendix 5.

2.4 CUSTOMER SUPPLY

The customer will need to supply the computer for data capture of recorded data and setup of a Self-Recording only unit. The Windows software will require an IBM compatible computer fitted with 386SX processor or above, Windows version 3.1 or above, and 8Mbyte RAM. The system will operate with 4Mbyte, but opening too many Windows may cause the system to 'hang up'. It is also necessary to have a single 3.5" floppy disk drive and an RS232C serial port, and a mouse will enable more convenient control of the software.

3 INSTALLATION

3.1 MECHANICAL INSTALLATION

The instrument is provided with a suspension assembly for users to attach to a suspension or mooring line. If the Valeport polyurethane covered multi-core cable is being used, then this has a maximum working load of 100kgf, and if a sinker weight is being used, it is important that this load is not exceeded.

For correct operation of the impeller, two procedures must be performed prior to deployment:

1. The inner part of the impeller should be filled with clean water. This is achieved by unscrewing the impeller nose cap, and submerging the impeller to allow water to fill the inside. While it is still underwater, refit the nose cap to seal the water inside.
2. The meter must be balanced so that it is suspended horizontally in the water. Due to the fact that the meter is made from materials of different densities, the balance of the meter will be slightly affected by different salinities. For this reason, the suspension assembly can be moved along the main body to compensate.
 - First, tilt the assembly to expose the black lock ring around the main body.
 - Slightly loosen the 2.5mm socket countersunk 316 titanium screw, until the lock ring can be slipped along the surface of the body.
 - Immerse the meter, and adjust the position of the suspension assembly until the unit sits horizontally in the water.
 - Finally, tighten the 2.5mm screw to fix the lock ring in place. Do not over tighten.

Failure to observe these points will result in decreases in operating efficiency, accuracy and impeller life.

3.2 ELECTRICAL CONNECTIONS

See also Figure 1 (Appendix 2) for equipment interconnections, and Appendix 3 for cable wiring details.

The Model106 incorporates a seawater switch mechanism, so that the unit will not operate unless submerged. If carrying out workshop testing of the unit, this switch must be bypassed using the artificial switch mechanism (crocodile clips attached to two short pins) provided.

The artificial switch is in the form of a short lead with a croc clip at each end (supplied). Simply connect this across the two stainless pins at the back of the instrument. Use the upper two pins – the lower, rounded pin (if fitted) is the temperature sensor (refer to Appendix 2, Figures 2 & 3). The seawater switch is now effectively closed. Alternatively, place rear end of unit into a bucket of water.

NOTE: The switch should be removed before deployment.

3.2.1 Direct RS232 - PC operation only

Over short lengths of cable in Direct Reading mode and for setting up recording scenario and replay of data via the 3m-data/power lead in Self-Recording mode, the instrument RS232 communications can be used.

3.2.1.1 Direct Reading Mode

In Direct Reading mode, connect the fish to the PC via the signal cable and 3m-power/data lead. The data lead should be plugged into a serial port on the PC (9-way D type connector). The software sets up the serial port of the PC to 4800 baud, 8 data, 1 stop, no parity.

NOTE: Some older PCs have 25 way serial ports, in which case it will be necessary to use a 9 to 25 way adapter.

Although the D cell battery in the fish is capable of driving the RS232 communications, battery life will be significantly reduced, and it is recommended that external power is used (see over).

If external power is being used it must be in the range of 12 to 30V DC and the consumption is approximately 40mA depending on the parameters. The red lead should be connected to the +ve terminal and the black lead should be connected to the -ve terminal of the power supply or external battery.

3.2.1.2 Self Recording Mode

In Self-Recording mode, connect the fish to the PC for setting up recording scenario and data extraction. If the fish is fitted with an external 4-way Mil-Spec connector, this can be achieved using the 3m data/power lead. If the fish is a Self-Recording only unit, PC connection must be via the internal 9-way D type socket, using the communication lead supplied.

To gain access to the internal socket, remove the 3 M3 titanium countersunk screws on the impeller side of the central bulkhead. Gently slide the outer housing and impeller assembly off the bulkhead, taking great care not to scratch or damage the internal bore of the housing. The main battery board will now be exposed, and the internal communications socket is situated adjacent to the battery.

Once communications have been completed, replace the outer housing, again taking care not to damage the bore. A small amount of silicon grease smeared on the O ring will ease subsequent removal of the housing. Replace the 3 screws and tighten.

3.2.2 Digital Current Loop

In Direct Reading Mode, where cable lengths are in excess of 50m, it will be necessary to communicate via Digital Current Loop. This is done automatically by the Model 8008 Surface Unit, but if operation is via PC a Digital Current Loop adapter (Part Number 0300-001) will be required. The unit requires 12-24V DC external power, and takes approximately 120 mA. Connection is via the Deck Lead (Part Number 0300-010-03) to the main signal cable, and via data interface lead (Part Number 0300-012) to the RS232 communications port on the PC. A variety of power cables are offered as options.

3.3 SERIAL DATA FORMAT

The serial data format as transmitted from either the 106 depends on the parameters fitted. The serial data string below shows the data string for a 106 with all parameters fitted. If temperature and pressure are not fitted, only speed and direction are transmitted.

S=s.sssD=ddd.ddP=sppp.pppT=tt.ttt<cr><lf>

Where

S denotes Speed

D denotes Direction

P denotes Pressure

T denotes Temperature

s.sss	=	Speed reading
ddd.dd	=	Flow heading
sppp.ppp	=	Pressure reading where s is the sign
tt.ttt	=	Temperature reading

3.4 BATTERIES

The internal battery contains one D cell (either alkaline or Lithium), which has a capacity of 10.5 Ah if a high-grade cell is used. The overall current consumption of the unit depends on the sampling set up. Typical battery life figures are shown below.

When power is taken from the internal battery (1.5V alkaline D cell), battery life is approximately 30 days at 10 second sampling rate, or 56 days at 5-minute sample rate.

Using a 3.6V Lithium D cell, life is approximately 90 days at 10-second sample rate, or 180 days at 5-minute sample rate.

To aid the user in determining how much battery life remains, the battery voltage is displayed in DataLog.

3.4.1 8008 - CDU

The 8008 contains 8 "C" cells, giving an operating lifetime for the batteries in excess of 40 hours continuous use. See Section 5.2 for details of how to change these. The 8008 CDU can also be operated from a 12vDC external supply.

4 OPERATION USING 8008 CDU

The 8008 CDU is of ABS construction with graphics LCD and backlight, membrane keys and integral battery compartment. The unit is sealed to IP67 (10 seconds at 0.3 metres).

The 8008 CDU is designed to allow real time display of data from an underwater unit, and to enable the setting of parameters for a Model106 fitted with Direct Reading capability. It is possible to connect the 8008 to a printer for a permanent record of the data, and it has an optional logging facility of its own. ***However, this does not allow uploading of logged data from the memory of the fish, or communication with a Self-Recording Model106; a PC is required for both of these functions.***

4.1 OPERATING PROCEDURE

Connect the CDU to the Current Meter using the Deck Lead and cable for Direct Reading or Both modes, or the 3m 'Y' Lead for Self-Recording mode. Then follow the procedure laid out below:

Press ON	Unit switches on with introductory display
Press any key to continue	Unit displays RUN, SETUP, TOGGLE B'LIGHT, SET TIME/DATE, CDU MEMORY
Set TIME/DATE	Probably the most important as all timing references are made from this including the setting of fish time. Use INCREASE/DECREASE keys to alter figures and NEXT key to move on to next figure. EXIT will set and escape to previous menu.
TOGGLE B'LIGHT	Switches back light on or off.
CDU MEMORY	Controls the logging facility on the 8008 CDU. Pressing this key reveals the CDU LOGGING MENU. Full details of this menu are covered later, but the most important function in this menu is turning the logging facility ON and OFF. This function is completely independent of the fish; i.e. it is possible to have the CDU logging but not the fish, or vice versa, or both or neither.
SET UP	Allows set up of sample and averaging periods. Press SETUP key. PLEASE WAIT RESETTING FISH!! is displayed followed by INTERRUPTING FISH - PLEASE WAIT. Display will now show instrument type and serial number and prompts you to acknowledge by pressing O.K. key.

The following functions are revealed:

SET SAMPLE PERIOD	Sample frequency is set using the CHANGE key to alter figures and TOGGLE key to move to next figure. The sample period can be incremented in periods of 1 second, to a maximum of 59:59 minutes. EXIT to set and return to previous menu.
SET AVERAGING PERIOD	Averaging period is set as multiples of sample period. Use INCREASE/DECREASE keys to change as required. EXIT to set and return to previous menu.
SET TARE VALUE	Used to take reading at surface of pressure (if sensor fitted) before deployment and subtracts figure from readings when instrument is in use to show correct depth. Upon pressing key the statement "PRESS ANY KEY WHEN TRANSDUCER IS AT SURFACE LEVEL" is revealed. Press any key. Tare value is automatically set.

SET FISH TIME	Pressing SET FISH TIME sets fish to surface unit time already pre-set. Press O.K. key to set and return to previous menu.
CLR FISH MEM	Resets memory to zero. Press O.K. key to set and return to previous menu.
RUN	The user is presented with the option to select DIR , BOTH or LOG modes, although only LOG mode will be available to logging only instruments. Select DIR for direct reading, LOG for logging or BOTH for direct reading and logging, using NEXT key. RUN key will set. It should be emphasised that selecting LOG or BOTH sets the fish only to log data. If it is required that the CDU also logs data, this must be set independently using the optional CDU MEMORY function in the opening menu. When in RUN mode, EXIT key will allow return to main menu.
<i>PROFILE MODE</i>	This mode is accessed by pressing the bottom left key (NOT the ON/OFF key) in the RUN screen, <i>but note that the key is not labelled</i> . If a pressure sensor is fitted to the instrument, this mode will display the pressure value only, updated at 1-second intervals. This allows the user to raise or lower the instrument to the required depth for profiling operations. Pressing the EXIT key in the Profile screen returns the unit to the Run screen, and automatically begins sampling at the preset rate.
DISPLAY	The display is updated every averaging period, and will show: - <p style="text-align: center;">SPEED in m/s TEMP [temperature] in Deg C PR [pressure] in dBar DIR [direction] in degrees</p> <p>The additional parameters of Conductivity, Salinity, Density and Speed of Sound are not available on the Model106, and no value will be displayed for these. The time of the last reading will be shown in the top right hand corner of the screen.</p> <p>If the CDU logging facility is set, the record and file number will be displayed at the top left hand corner of the screen.</p> <p>If the fish is set to Log only mode, no data will be displayed on the screen during Run.</p>
CDU MEMORY	Pressing this key in the opening menu reveals the CDU LOGGING MENU, which contains: FILE TABLE , LOGGING ON/OFF , MEMORY FREE , EXTRACT CDU DATA , ERASE MEMORY , EXIT .
FILE TABLE	This key reveals a display showing the total number of files stored (maximum 100), the size of each file, the sample and averaging period of the data, and the time/date of the first record in each file. A new file is created each time the unit is set to Run. To move between files, use the NEXT and LAST keys. Press EXIT to return to the previous menu.
LOGGING ON/OFF	As stated previously, this key toggles between logging on and off, for the CDU only.
MEMORY FREE	Displays the total unused memory space in bytes, and the number of files currently stored. Press EXIT to return to previous menu.
ERASE MEMORY	Clears CDU memory. This will not affect the fish memory.

EXTRACT CDU DATA

Use this key to upload data stored in the CDU to a PC. Connect the 8008 CDU to a PC using the interface lead provided. Before pressing **UPLOAD**, run the data extraction program 104EXT.EXE that is provided on floppy disk. Do this by inserting the disk to the PC's A drive and typing `a:\104ext<cr>`. Enter the correct Comms port, and then press **UPLOAD** on the CDU. Immediately afterwards, press any key on the PC keyboard. The data will now be uploaded. This process happens at 19200 baud, compared to the default 4800 baud at which the rest of the software operates.

Once the data has been uploaded to PC, the 104EXT software will ask if the data is to be translated into calibrated data, as opposed to the binary data that the unit stores. The user must select the number of lines that the data will be stored in, from 100 to 16360. This is because the data will be stored in a format that can be imported in to Spreadsheet packages for analysis, and 16360 is the maximum number of lines in most packages (Microsoft Excel will only produce graphs if the number of lines is 4090 or less).

The data files will be stored in the local directory, and will be named ?DATA.BIN (original binary data) or ?DATA.??? (calibrated data), where ? signifies the file number, and ??? the number of calibrated files for each file. For example, if the user sets the number of lines to be 100, but file 3 contains 700 records, 7 data files will be created for the original binary file 3DATA.BIN, i.e. 3DATA.000 to 3DATA.006

4.2 POINTS TO NOTE ABOUT CDU LOGGING

1. Only 100 files can be stored, but each file can contain as many records as space will allow.
2. A new file will be created every time the unit is set to Run, and will be given an index 1 more than the last file stored.
3. Setting the CDU to log will not affect the logging facility of the fish itself.
4. It is not possible to Upload data from the fish to the CDU. To upload data from the fish, the user must use the DataLog Windows software supplied. For details of how to do this, see Section 5.
5. When uploading CDU logged data, the 104EXT.EXE program will automatically name the files as above, and will overwrite any existing files of the same name within the same directory.

Press **ON** key to toggle unit off when finished operations.

4.3 DATA REPLAY

A PC is required to recover data stored in the instrument following deployment. Refer to separate DataLog manual for Windows software operation.

Note that all data in a file has to be extracted for that file to be read.

4.4 EXTERNAL CONNECTIONS

The 8008 CDU has three external connections

EXT DC IN	3 WAY
DATA INTERFACE	4 WAY
FISH CONNECTION	10 WAY

External DC in requires 12vDC input. Valeport cables, part numbers 0300-014 or 0300-013 are used for this purpose.

Data interface provides an RS232 output for printer use or for Upload of stored data to PC. In Direct Reading mode, output is always transmitted and displays surface unit data. Valeport cable, part number 0300-012 is used.

Fish connection, for direct connection or via cable reel to fish. Valeport cable, part number 0104-010-03 is used.

4.5 PRINTER OUTPUT

The printer output string provided by the 8008 CDU is formatted to drive an Epson FX-850 or compatible. The serial data string format varies with the options fitted to the 106. The 106 data strings are shown below. The parameters, which are not fitted, are simply removed from the transmitted string.

4.5.1 106 Printer string

```
<ff>VALEPORT LTD.<cr><lf>
DATE: DD/MM/YYYY <cr><lf>
SAMPLE PERIOD=Xs <cr><lf>
Rec no.<t>TIME<t><t>SPEED<t>DIR<t>PRESS<t>TEMP<t><cr><lf>
<t><t><t>M/S<t>Deg<t>dbar<t>DegC<t><cr><lf>
nnnnn<t>hh:mm:ss<t>f.fff<t>ddd.d<t>sppp.ppp<t>stt.ttt<t><cr><lf>
nnnnn<t>hh:mm:ss<t>f.fff<t>ddd.d<t>sppp.ppp<t>stt.ttt<t><cr><lf>
nnnnn<t>hh:mm:ss<t>f.fff<t>ddd.d<t>sppp.ppp<t>stt.ttt<t><cr><lf>
:
:
etc for 57 Records
```

Where

<ff>	=	Form feed
<cr>	=	Carriage return
<lf>	=	Line feed
<t>	=	Tab
DD	=	Day of month
MM	=	Month of year
YYYY	=	Year
X	=	Sample period
nnnn	=	Record number
hh	=	Hour of day
mm	=	Minute of hour
ss	=	Second of minute
f.fff	=	Flow reading
ddd.d	=	Flow heading
sppp.ppp	=	Pressure reading where s is the sign
stt.ttt	=	Temperature reading where s is the sign

4.6 STORAGE CAPACITY

If the 8008 CDU is fitted with the logging option the maximum storage space available is 131072Bytes.
The maximum number of records that may be stored depends on the configuration of the fish and can be worked out from the following table.

Data storage format per file.

Header = 14 Bytes

Data.

Data.

:

:

Data is made up from the following:-

Speed = 2 Bytes

Direction = 2 Bytes

Pressure = 4 Bytes

Temperature = 4 Bytes

Therefore for a single file containing data from a 106 with Temperature and Pressure the maximum number of records is

$$(131072 - 14)/12 = 10921 \text{ Records}$$

5 MAINTENANCE

5.1 BATTERY REPLACEMENT

The single D cell battery (alkaline or Lithium) is housed within the instrument at the front end. The procedure to replace the battery is as follows:

1. Remove the three M3 titanium countersunk screws on the impeller side of the central bulkhead.
2. Gently slide the outer housing and impeller assembly off the bulkhead, taking great care not to scratch or damage the internal bore of the housing.
3. The battery cage accepts a single D cell. It is advisable to use an alkaline cell as this gives increased life and leakage protection. The batteries should be inserted with the contacts towards the front, making sure that the connector lead is firmly in place before clipping the battery into the holder.
4. Before replacing the housing, check the condition of the O-rings, which should be free of cuts or perishing. Also check the condition of the sealing bores of the housing which should be free of scratches. Finally smear a light coating of silicon grease on the O-rings and housing sealing bores to aid refitting and subsequent removal.
5. Further reassembly is a reversal of the disassembly process.

Should any of the M3 countersunk screws be lost it is imperative that they are only replaced with titanium M3 x 6 countersunk screws, otherwise there is a risk that galvanic corrosion will occur which could seriously damage the housing.

5.2 BATTERY REPLACEMENT - 8008 CDU

The batteries are housed within the CDU under the battery cover. The procedure for replacing these is as follows:

1. Remove the battery cover.
2. Remove the top PCB by undoing the retaining screw to reveal the battery cells.
3. The battery accepts 8 "C" cells [LR14 or equivalent]. It is advisable to use alkaline cells as this gives increased life and leakage protection. The batteries should be inserted -ve end against the spring and the top PCB should then be screwed back into place.
4. Before replacing the battery cover; check the condition of the O-rings, which should be free of cuts or perishing. Also check the condition of the sealing bores of the battery cover which should be free of scratches. Finally smear a light coating of silicon grease on the O-rings and battery cover sealing bores to aid refitting and subsequent removal.

5.3 IMPELLER

The impeller should be free to rotate. Positioning the instrument vertically and spinning the impeller can test this. Note that when the instrument is horizontal and not in water, the bearings are dry and the impeller is not neutrally buoyant, so the impeller may not rotate freely.

To remove the impeller:

1. Remove the impeller guard by unscrewing the guard away from the main body.
2. Remove the impeller nose cap [yellow]
3. Remove the two M3 nuts from the impeller shaft
4. Slide the impeller off the shaft

Cleaning:

Wash the inside of the impeller, and clean any residue from the impeller shaft.

Impeller shaft:

If it is required to reset the impeller shaft, it is necessary to set its position to ensure correct operation:

1. Position the instrument with the shaft pointing upwards with the shaft in approximately the correct position
2. Without the guard fitted, replace the impeller on the shaft with the nose cone fitted
3. Unscrew the nose cone to allow the impeller to rest against the instrument body hub face
4. Lightly hold down the impeller down against the hub face, and slowly screw down the nose cone until it tightens and thereby wants to lift the impeller away from the hub face
5. Check the clearance between nose cone and impeller end face and adjust the shaft so that the clearance is 0.5 to 0.75mm. Ensure the shaft and lock nut are tightened and recheck the gap.
6. Refit the nose cone and impeller.

Refitting impeller

This is a reversal of removal.

5.4 GENERAL

The external parts of the meter are manufactured from titanium and polymers and are therefore corrosion resistant. The titanium will become dull in appearance with use. The sensor end should be kept clean from mud and debris to maintain accuracy of sensors. Washing off with clean water is therefore advised after use. After use the impeller should be washed, and it is recommended that the impeller assembly is removed and washed through to prevent the creation of salt deposits which will effect the subsequent performance of the impeller.

Should problems be encountered with the instrument, then Valeport Limited should be contacted immediately. Valeport will then be pleased to advise on the correct course of action.

Tel: +44(0)1803 834031
Fax: +44(0)1803 834320
E-Mail: sales@valeport.co.uk

5.5 O-RING SIZES

Line connector	1 x 200-016-4470
Bulkhead connector pro-cap	1 x 200-016-4470
Bulkhead Connector/Housing	2 x 200-115-4470
End Cap, sensor end	1 x 200-128-4470 plus 1 x 128 anti-extrusion rings
Centre section/housings	2 x 200-129-4470 plus 2 x 129 anti-extrusion rings

Note that anti-extrusion backing rings are used on the sensor end O-rings and the O-rings should be placed on the pressure [seawater] side of the anti-extrusion ring.

The Dowty seal used in the temperature sensor is type 303.

5.6 LITHIUM BACKUP BATTERY

The memory back-up lithium battery, (Type T047BA9, 3.6V), should be replaced at least every 5 years. If the memory and or clock settings are lost then the battery should be replaced. It is recommended that the instrument be returned to Valeport Limited for replacement of this battery, however if urgent renewal is required then the replacement procedure is as follows:

The battery is housed within the battery/internal connection part of the housing.

1. Remove the front battery housing section, as in Section 5.2 'Battery Replacement'.
2. The battery is connected to board 0104502 by wire, but is situated within the main bulkhead. It is therefore necessary to remove the board.
3. Do this by removing the screws in the two PCB support bars. This should allow the board to be gently removed, with the Lithium battery sliding out of the main bulkhead.
4. Remove the heat shrink tube around the battery, and desolder the old cell. Fit and solder the wires to the new battery, and replace the heat shrink tube (19mm bore).
5. Reassembly is a reversal of the above procedure. Before replacing the rear tube, check the condition of the O-rings, which should be free of cuts or perishing. Also check the condition of the sealing bores of the main tube which should be free of scratches. Finally smear a light coating of silicon grease on the O-rings and rear tube sealing bores to aid refitting and subsequent removal.

6 CALIBRATION

The instruments are calibrated at the factory using industry standard methods, and the calibration certificate is in Appendix 4.

The impellers are group calibrated at HR Wallingford, allowing impellers to be changed at any time without the need for recalibration. Refer to Section 5.3 for details of how to do this.

The following is the seventh order polynomial used for the group calibration of the 106 impeller current meter:

$$y = a_7x^7 + a_6x^6 + a_5x^5 + a_4x^4 + a_3x^3 + a_2x^2 + a_1x^1 + a_0$$

where

a7=+7.07192656496855E-13

a6=-1.77441548834011E-10

a5=+1.23103627071919E-08

a4=-2.76434849230036E-09

a3=-2.417253365201895E-05

a2=+8.0250814202725E-04

a1=+2.80829724067969E-01

a0=+1.72164197365799E-02

If users require to recalibrate the instrument, then the calibration constants held within the instrument can be changed. Please refer to the factory regarding the method of carrying out this procedure.

APPENDIX 1 SPECIFICATION

APPENDIX 2 FIGURES

FIGURE 1: MODEL 106 INTERCONNECTIONS

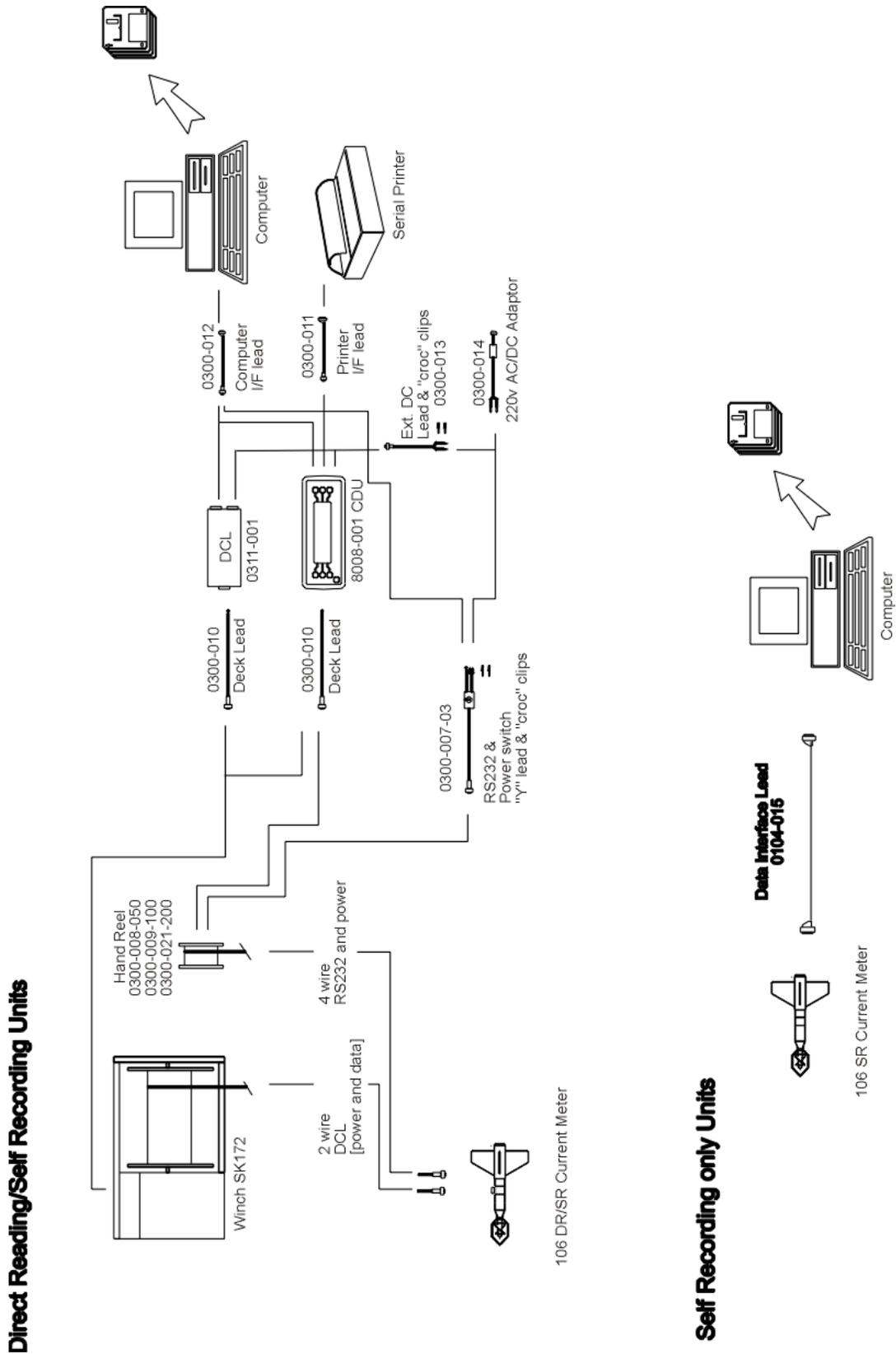
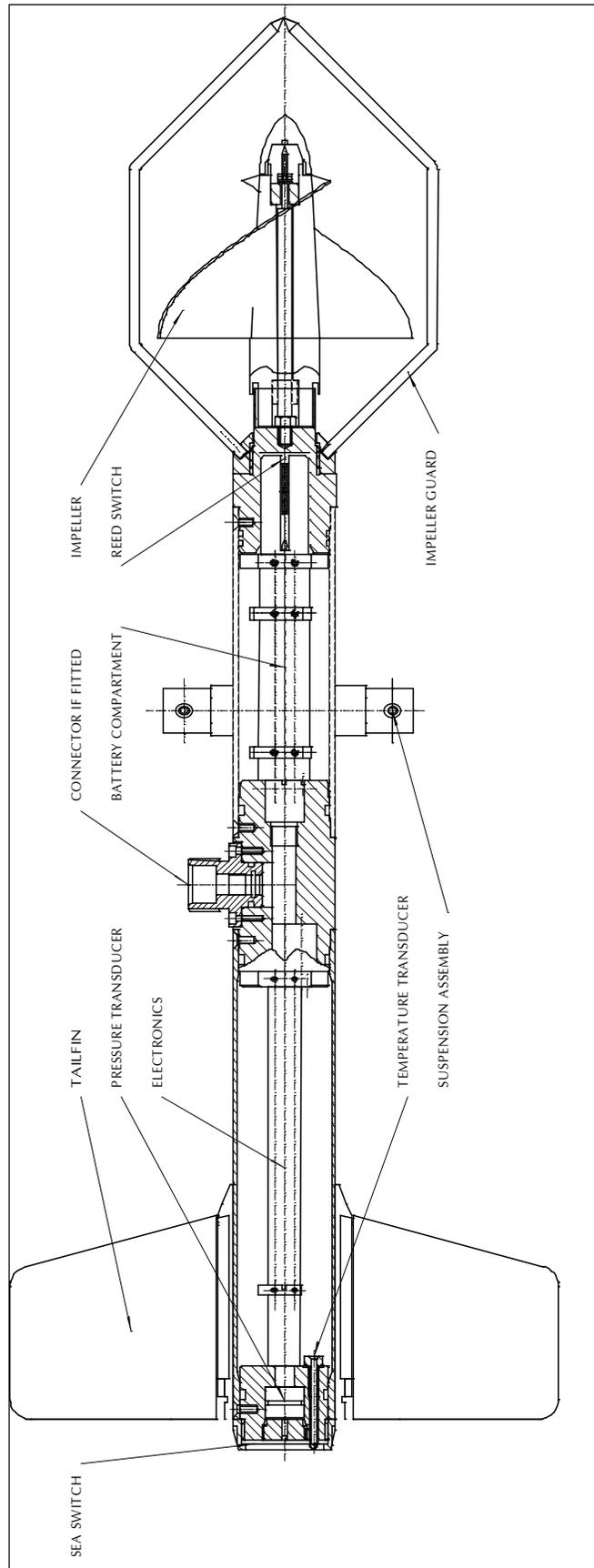


FIGURE 3: MODEL 106 SENSOR LAYOUT



APPENDIX 3 CABLE WIRING SCHEMES

"Y"-LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS

MIL SPEC 4 WAY LINE CONNECTOR PIN No.	FUNCTION	9 WAY 'D' TYPE FEMALE	BLACK BANANA PLUG	RED BANANA PLUG	WIRE COLOUR POWER	WIRE COLOUR COMMS
A (RED)	C/LOOP IN & EXT SUPPLY	N/C	N/C	1	RED	
B (WHITE)	RS232 IN TO FISH (RX 232)	3	N/C	N/C		RED
C (GREEN)	GND & BATT -VE	5	1	N/C	BLACK	GREEN
D (BLUE)	RS232 OUT FROM FISH (TX232)	2	N/C	N/C		YELLOW

SUB-SEA LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS

SUB-SEA 4 WAY LINE CONNECTOR SKT No	FUNCTION	CABLE REEL 4 WAY BULKHEAD CONNECTOR PIN No
A (RED)	C/LOOP IN & EXT SUPPLY	A (RED)
B (WHITE)	RS232 IN TO FISH (RX232)	B (WHITE)
C (GREEN)	GND & BATT -VE	C (GREEN)
D (BLUE)	RS232 OUT FROM FISH (TX 232)	D (BLUE)

DECK LEAD CONNECTION DETAILS FOR MODEL106 CURRENT METERS

MIL SPEC 10 WAY CONNECTOR PIN No	FUNCTION	SUB SEA 4 WAY LINE CONNECTOR SKT No
A (RED)	C/LOOP IN & EXT SUPPLY	A (RED)
B (WHITE)	RS232 IN TO FISH (RX232)	B (WHITE)
C (GREEN)	GND & BATT -VE	C (GREEN)
D (BLUE)	RS232 OUT FROM FISH (TX 232)	D (BLUE)
E	N/C	
F	N/C	
G	N/C	
H	N/C	
J	N/C	
K	N/C	

DIGITAL CURRENT LOOP / 8008 SURFACE UNIT CONNECTORS

DC INPUT

CONNECTOR TYPE	PIN	WIRE
3 WAY PLUG 0833 MNO	A	RED +V in
	B	GREEN 0V in
	C	N/C

RS232

CONNECTOR TYPE	PIN	WIRE
RS232 OUT 4 WAY SKT	A	N/C
	B	WHITE/RED - RS232 in
	C	GREEN - COMMON
	D	WHITE/BLACK - RS232 out

DECK LEAD

FISH INPUT 12-10-FNO	PIN	WIRE
	A	PINK - EXT POWER IN +VE
	B	N/C
	C	GREEN - EXT POWER IN GND
	D	N/C
	E	N/C
	F	N/C
	G	N/C
	H	LINK TO J
	J	LINK TO H
	K	N/C

APPENDIX 4 PRE-DELIVERY CHECKLIST

Serial No.	Model No. 106
Customer:	Con Number:
.....	Customer Ref.:
.....	Del. Note:.....
.....	Calibration Cert.: C-

ITEM	Items Required		Quantity	Serial Number	Part Number
	YES	NO			
				8011-	
106 SR/DR (speed & direction) Unit			1		0106001
106 SR/DR (speed) Unit		X			0106002
Temperature option (Thermistor)		X			0105003
Pressure option (200dbars)			1		0105004
8008 Surface Unit			1		8008001
8008 surface Unit Batteries			1		
Y Lead (unswitched)			1		0105013
Sealing Pro-cap			1	Fitted to 106	
3 Metre Deck Lead			1		0105014
50 metre cable on reel		X			0105015
200 metre cable on reel		X			0105016
SU to PC Lead (metre)		X			0300012
106 to PC Lead		X			
SU Ext. DC Lead		X			0300013
SU AC/DC Adapter		X			0300014
Transit case (self-recording)			1		
Transit Case (Cable reel 100mt)			1		
<i>Software</i>					
DataLog			1	0300742S	
CDU Express Disc				CDU7117A1	

<i>Documentation</i>					
Manual			2	106 +D/Log	
<i>Tools and Spares</i>					
106 Battery			1	(D Cell)	
Shaft spanners (2)			2		0105018
Spare 'O' Rings			1 SET		0105017
Screwdriver/Allen Key/Spare screws			1 SET		0105018
Sea Switch (croc. clip +lead)			1		0105022
Sinker weight (in case)		X			
Spare Impeller Shaft		X			
Spare Guard		X			
Spare impeller		X			0001005

SIGNED.....

DATE.....

APPENDIX 5 CALIBRATION DATA

Calibration Certificate Number:

Instrument type:
 Communications: RS232, Set for 4800
 Serial Number:
 Software version:

Velocity: Impeller

Pressure sensor: Range and precision
 Type
 Serial number

Temperature sensor: Type
 Serial number

PCBs: Micro
 PSU
 A-D
 Compass

Calibration Equipment: Pressure Budenburg, Ser. No. 480L/24175/317E/3295
 Temperature AEA F26 resistance bridge. ASL-F26-14-005

Temperature Calibration [deg C]

Date: 02/12/11

Coefficients: Polynomial order 2nd
 Constant
 N
 N2

PRE-CAL DATA		POST-CAL DATA		
Counts	Temperature °C	Actual °C	Reading °C	Error °C

Date: 12/02/11

Signed:

APPENDIX 5 CALIBRATION DATA [continued]

Instrument type:
 Serial Number:
 Software version:

Pressure Calibration [dBar]

Date 02/12/11
 Temperature °C.
 Atmospheric pressure mmHg.
 Grid reference 286362 East, 051466 North
 Height above sea level 122 metres
 Gravity, local 9.81095
 Gravity, standard 9.80665 for barometer

Coefficients: polynomial order 2nd
 Constant
 N
 N2

dwt pressure dBar	Atmospheric dBar	Total pressure dBar	Counts	Calculated	Residual % FS

Date: 12/02/11

Signed:

APPENDIX 6 GUARANTEE CERTIFICATE AND EQUIPMENT SUPPLIED CHECKLIST

GUARANTEE CERTIFICATE

All goods are subject to a 12-month guarantee against faulty materials and bad workmanship.
Any faults to be declared within 12 months from date of despatch, in writing to Valeport Limited, who will replace or repair (at their option) any faulty items caused by bad workmanship or materials, (except displays and semiconductors, which are only guaranteed for a 3-month period).

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 person's 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 106 S/D..... SERIAL NUMBER

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