

VALEPORT LIMITED**Model 602
CTD****Operation Manual**

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1. INTRODUCTION

This manual covers the operation of the Valeport Model 602 CTD.

The Model 602 is a direct reading CTD system designed for Continental Shelf operation and permits the accurate measurement of seawater Conductivity and Temperature against a Depth profile. Salinity, Density and Speed of Sound are derived within the Control Display Unit, which also has data logging within it.

2. EQUIPMENT

The system supplied includes

- Probe
- Cable on cable reel
- Deck cable
- Control Display Unit

3. DESCRIPTION

3.1 Probe

All the measurements are performed by sensors situated in the probe. The power for the probe is provided by the surface unit and the output from the probe is in the form of 0-4v analogue voltages which are read by the Control Display Unit.

3.1.1 Conductivity

The inductive conductivity sensor consists of two dual inductive coils, one of which injects a signal through the seawater into the other coil. The seawater acts as a single turn resistive coupling loop. The magnitude of the signal detected in the second coil is proportional to the seawater conductivity. This method avoids all electrical contact with the seawater and hence all problems associated with electrode fouling. The electronic circuitry (all of which is housed within the probe), derives a DC output voltage proportional to the conductivity of the medium linking the two coils. The output is scaled in the range 0 to 4v corresponds to 0 to 60 mS/cm.

3.1.2 Temperature

A linearised thermistor composite is used as a temperature sensor giving a high output signal and sufficient linearity and stability for the required specification. The sensor element is physically small and is mounted in a small probe situated within the head of the probe. Its construction offers a good compromise between speed of response and robustness. The output is scaled in the range -0.5 to +4v corresponds to -5 to +40 degC.

3.1.3 Pressure

Water pressure is derived from a strain gauge pressure transducer also mounted within the head of the probe. The output is 0 to 3.976v corresponding to 0 to FS for the transducer in dBar.

3.2 Control Display Unit

The CDU has its own internal batteries, and has bulkhead connectors for external DC power, data interface to PC and the sensor. There is also a waterproof pressure equalising valve, to compensate for changes in temperature and atmospheric pressure that would otherwise cause the display membrane to distort. The connectors have waterproof pro-caps for when not in use. The CDU is designed for operation in rain conditions and for temporary immersion in water to 0.3m for 10 seconds, provided all connectors or pro-caps are fitted.

The CDU provide power to the probe and measures the Conductivity, Temperature and Pressure voltage outputs from the probe once every second, and calculates the Salinity [using the SAL78 formula], Density [using EOS-80 formula] and Speed of Sound [using Chen & Millero 1977 formula] for each set of readings. The average values are computed as the average of the one second real time values over the averaging period which has been set [maximum period of 600 seconds]. If an average period is terminated early, then the calculation is based on the time since the average was started.

There are 3 types of Averaging Modes:

Fixed average:

The unit performs one average over the period set. At the end of the averaging period the unit stops and displays the average data for each parameter. It will commence another averaging period when requested by pressing START.

Free running:

This is fixed average with automatic restart of averaging period at the end of each period. The averages from the previous period are displayed and held during the subsequent period, until updated. If the user is carrying out a depth profile then this is the averaging method used, with the averaging period set to 1 second.

Moving average:

The averages are calculated over the averaging period set, and are updated every second. When STOP is selected, the display is frozen at the last average.

If the measurement period is terminated prematurely [by pressing the STOP key], the average values will be calculated over the time since the start of the current averaging period.

The data is available for direct interfacing to a PC in real time [see Section 4.6.3. for interfacing information]:

In fixed average a data string of average data is outputted at the end of averaging period.

In moving average the last saved average is outputted when the user presses the STOP key.

In free running mode the data is outputted at the end of each fixed average period and also when the user presses the STOP key.

The CDU can log up to 999 averages for subsequent display and/or transfer to a PC.

4. SYSTEM OPERATION

4.1. Setting up and Operation Overview

1. Remove the equipment from its carrying case.
2. Insert batteries into CDU [8 off C type cells], if external power not being used. It is recommended that alkaline type cells are used for maximum life.
3. Fit the cable suspension eye into the clamp that is fitted to the probe.
4. Remove the connector protective caps from the probe and the cable and check that the exposed connectors are clean and the 'O' ring is undamaged. A light smear of silicon grease round the 'O' ring will ensure a good seal. (Take care not to lose the protective caps when the instrument is in use.)
5. Attach a Valeport Columbus Sinker Weight to the lower side of the suspension clamp if required. Do not exceed a weight of 50kg in air, without using an additional strain cable. (Standard Series 600 signal cable has a breaking strain of 100kg.)
6. Connect the surface end of the signal cable to the surface readout unit using the 3m deck interconnection cable.
7. Switch on and check unit is operational. Carry out a pressure tare if required.
8. Lower the probe into the water and pay-out cable as required.

4.2. Switch on

ON

Switch unit On using ON button. This is acknowledged by a beep from the unit. This key is also used to switch the unit Off at any point during operation. Switching the unit On causes the following display to appear:

```
      V A L E P O R T   M O D E L   6 0 2   C T D
                                     V E R S I O N   1 . 0 0
< < < O P T I O N S   S E T U P                               C O N T I N U E > > >
```

CONTINUE

Places the unit in Run Mode. See Section 4.3.

OPTIONS SET-UP

This key selects the OPTIONS menu, which allows the user to set up various hardware configurations [Logging On/Off, Beeper On/Off and Backlight On/Off]. This menu also allows access to the LOGGING MENU [for reading of logged data] and the PRESSURE SETTINGS for setting Pressure Tare and the Sensor pressure used. For further information refer to Section 4.5.

4.3. Running the unit

Pressing **CONTINUE** at the title screen, or pressing **EXIT** at any of the OPTION SET-UP screens [see Section 3.6] reveals the main data display screen [note that until **START** is pressed and an averaging period has been completed, no data is displayed].

```

TTT / SSS SECS MOVING HH : MM : SS # F F F R
CONDUCTIVITY XX . XXX mS / cm STOP >>>
TEMPERATURE + XX . XXX deg C
PRESSURE + XXX . XXX dBAR SETUP >>>
SALINITY XX . XXX PSU
DENSITY + XXXX . XX kg / M ^ 3
SPEED OF SOUND XXXX . XX M / S START >>>
LOW BATT

```

The top line of the display indicates:

- Count down in averaging period [for Fixed and Free modes]
- Averaging period set
- Averaging method is being used [Fixed, Moving or Free Running]. An explanation of the different averaging modes can be found in the Description, Section 3.
- CDU time
- Last record number logged

SETUP Press this key to alter current sampling regime. See Section 4.4.

START Pressing this button commences sampling. In Free Running and Fixed Average modes, the count down within the average period is displayed. If the unit is in logging mode, the current record number will be displayed at the top right hand side of the screen. If the data interface lead is connected, the end of average values will also be sent to the PC.

STOP Press to cease sampling. This will force an early end to an averaging period at the next second.

LOW BATT When there is approximately 6 hours of battery life remaining [with backlight], this message will be displayed at the bottom right hand corner of the screen. The message will remain until batteries are replaced. See Section 5. for more information on power consumption and battery life.

4.3.1 Real Time Data Output

At the end of each averaging period, the data is output on the data interface.

Connect the unit to a PC via the data interface lead supplied. Connection details are given in Section 6. Run a terminal emulation program on the PC, ensuring that communications are correctly set to 4800 baud, 8 data bits, 1 stop bit, NO parity bits. If the data is to be saved on the PC, make sure that the data is directed to a file name. It is uploaded as a text file, with "Tab" delineators, so it can subsequently be read into a word processor or spreadsheet application. The data format is as follows:

C	60.000	T	0.001	P	-0.007	SAL	79.701	DEN	1064.55	SOS	1510.39	AV PERIOD SECS	5
C	60.000	T	0.002	P	-0.008	SAL	79.699	DEN	1064.55	SOS	1510.39	AV PERIOD SECS	5
C	60.000	T	0.002	P	-0.010	SAL	79.698	DEN	1064.55	SOS	1510.39	AV PERIOD SECS	5
C	59.999	T	0.002	P	-0.008	SAL	79.698	DEN	1064.55	SOS	1510.39	AV PERIOD SECS	5
C	59.999	T	0.001	P	-0.007	SAL	79.700	DEN	1064.55	SOS	1510.39	AV PERIOD SECS	5

4.4. Setting Averaging Mode and Averaging Period

Selecting **SET-UP** in the Run Menu reveals the following display.

```

                R U N   M E N U   S E T U P
                                O P T I O N S > > >
< < < F I X E D   M O V I N G   F R E E           A C C E P T > > >

< < < A V E R A G E   P E R I O D           S S S       S E C S
    
```

FIXED MOVING FREE

Toggles the averaging mode between the three states. Refer to Section 3 for further details.

AVERAGING PERIOD

The Averaging Period which has been set is displayed. If it is required to change this, then press the key to move to the "Change Sampling" page. Refer to Section 4.4.1.

OPTIONS

Press this key to return to the OPTIONS menu [Section 4.5.]

ACCEPT

When the sampling regime is correctly set up, press this key to return to the RUN menu [Section 4.3.].

4.4.1. Changing Averaging Period

Selecting **AVERAGING PERIOD** in the RUN SET UP screen reveals the following display:

```
                C H A N G E   S A M P L I N G
< < < 1 0 0 ' S
< < < 1 0 ' S           I N C R   D E C R > > >
                S S S   S E C O N D S
< < < 1 ' S           E X I T > > >
```

- INCR DECR** Toggles between increasing and decreasing the number of seconds when the relevant key is pressed.

- 100'S** Changes the number of 100's of seconds in the averaging period.

- 10'S** Changes the number of 10's of seconds in the averaging period.

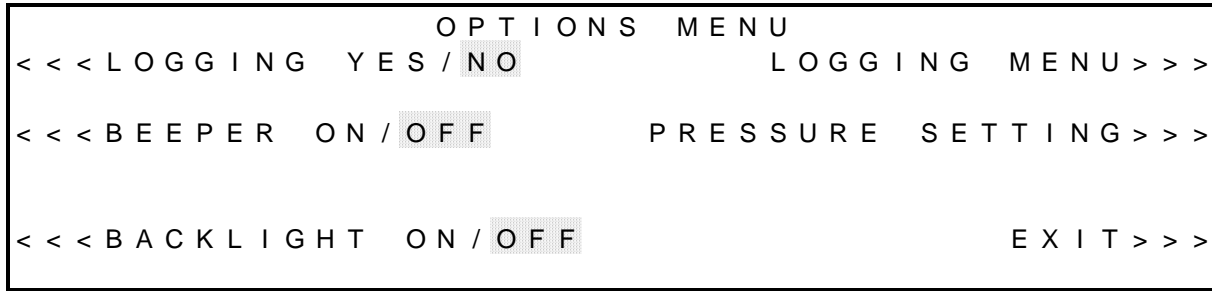
- 1's** Changes the number of 1's of seconds in the averaging period.

- EXIT** Returns to the RUN MENU SETUP screen [Section 4.4].

Note that "000" seconds cannot be set, and the maximum is 600 seconds.

4.5. OPTIONS menu [Logging, Beeper, Backlight, Pressure Settings]

Pressing **OPTIONS SET-UP** at the Title Screen or **OPTIONS** in the Run Menu Setup screens reveals the following display.



- LOGGING YES/NO** This key switches the logging facility On and Off. Up to 999 records may be stored.

- BEEPER ON/OFF** Toggles audible indication [once per second] that measurements are being made.

- BACKLIGHT ON/OFF** This key toggles it On and Off. Refer to POWER CONSUMPTION, Section 5 for details of battery life with and without backlight.

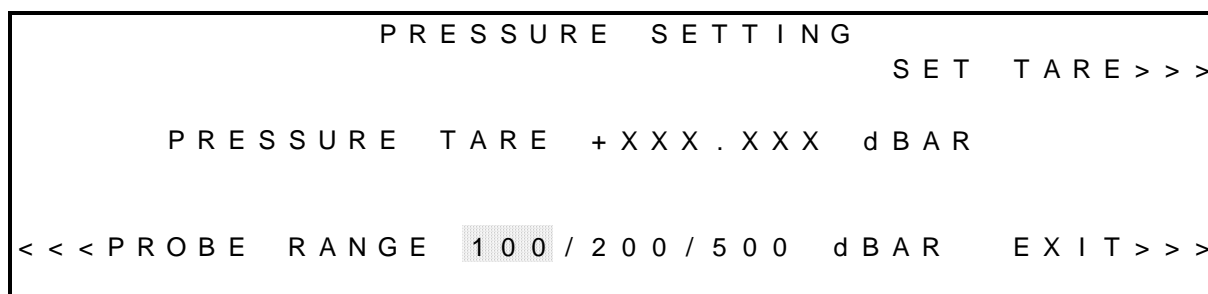
- LOGGING MENU** Allows access to LOGGING MENU. This enables the user to view or erase stored data, to extract it to a PC [via data interface lead], and to set the unit date and time. Refer to Section 4.6.

- PRESSURE SETTING** This enables the user to set the CDU for working with particular CTD probe and also to set the Pressure Tare to the current pressure. See Section 4.5.1.

- EXIT** Puts the unit into Run Mode, using the hardware configurations selected [see Section 4.3].

4.5.1 Pressure Setting

Pressing **Pressure Setting** in the Options Menu reveals the following display.



PROBE RANGE

Valeport 600MkII and 602 probes are available with either 100, 200 or 500 dBar pressure transducer, and this key toggles between the probe ranges. The probe range is indicated by the colour ring painted in the groove at the sensor end of the probe.

100 dBar	=	Brown
200 dBar	=	Red
500 dBar	=	Green

PRESSURE TARE

This key makes the CDU take a pressure reading and this is then taken at the Tare or Zero pressure. All subsequent readings are referenced to this pressure. Typically a user would take a tare reading before deployment so that atmospheric pressure changes are taken and the unit reads zero in air.

4.6. LOGGING menu

Selecting **LOGGING MENU** at the **OPTIONS MENU** reveals the following display.

```
          LOGGING MENU
< < < S E T   D A T E / T I M E           E X T R A C T   D A T A > > >
< < < R E S E T   # I D E N T             E R A S E   M E M O R Y > > >
< < < V I E W   D A T A                   E X I T > > >
```

- SET DATE/TIME** Allows access to the CHANGE DATE/TIME screen. This allows the user to alter the unit's internal clock, for the purpose of correctly time stamping the recorded data. See Section 4.6.1.

- RESET #IDENT** Sets the memory pointer to record #1 and updates the series letter. For example, a second series of records would begin with record #001B.

- VIEW DATA** Allows user to see logged data. See Section 4.6.2.

- EXTRACT DATA** Allows user to upload stored data to a PC. See Section 4.6.3.

- ERASE MEMORY** Clears all stored data from the unit and resets data series identification to "A"; it does not reset #IDENT to zero which has to be done by the RESET #IDENT key, which should be done first otherwise the series B identification will be set. A screen will appear, requesting confirmation that the user wishes to erase memory. Press **YES** to continue, or **EXIT** to return to LOGGING MENU. If **YES** is pressed, a message will confirm that memory has been erased. Press **EXIT** to return to LOGGING MENU.

- EXIT** Returns user to OPTIONS MENU. Refer to Section 4.5.

4.6.1. Change Date/Time

Selecting **SET DATE/TIME** at the LOGGING MENU reveals the following display.

```
                C H A N G E   D A T E / T I M E
< < < N E X T                                I N C R E A S E > > >
T I M E :   H H : M M                          D E C R E A S E > > >
D A T E :   D D / M M / Y Y Y Y
                                                    E X I T > > >
```

- INCREASE** Increases the currently selected number by 1.

- DECREASE** Decreases the currently selected number by 1.

- NEXT** Selects the next number in the time/date sequence.

- EXIT** Returns user to LOGGING MENU. Refer to Section 4.6.

4.6.2. Viewing stored data

Selecting **VIEW DATA** at the LOGGING MENU reveals a display similar to that shown below. If no data has been stored, the message NO DATA STORED will be displayed.

```

# I D E N T   F F F R                               U P > > >
RUN  M O D E   X X X X X X X X X X X X X X       D O W N > > >
D D / M M / Y Y Y Y   H H : M M : S S
T A R E   P R E S S U R E       + X X X . X X X   d B A R
< < < V I E W                                       E X I T > > >

```

The display shows the record number, run mode, and date/time at which the record was stored [i.e. the end of the averaging period].

UP Toggles the record to be viewed up by one.

DOWN Toggles the record to be viewed down by one

VIEW Allows user to view the record currently selected. A display of the format shown below will be seen. Press **EXIT** on this screen to return to the VIEW DATA screen, allowing another record to be seen.

EXIT Returns to the LOGGING MENU. Refer to Section 4.6.

```

# I D E N T   F F F R       A V   P E R I O D   S E C S       S S S
C O N D U C T I V I T Y       X X . X X X   m S / c m
T E M P E R A T U R E       + X X . X X X   d e g C
P R E S S U R E       + X X X . X X X   d B A R
S A L I N I T Y       X X . X X X   P S U
D E N S I T Y       + X X X X . X X   k g / M ^ 3
S P E E D   O F   S O U N D   X X X X . X X   M / S e c       E X I T > > >

```


4.6.3. Extracting data

Selecting **EXTRACT DATA** at the LOGGING MENU reveals the following display.

```

      E X T R A C T   D A T A
                                     U P L O A D > > >

      P L E A S E   C O N N E C T   P C

                                     E X I T > > >

```

Connect the unit to a PC via the data interface lead supplied. Connection details are given in Section 6.

Run a terminal emulation program on the PC, ensuring that communications are correctly set to 4800 baud, 8 data bits, 1 stop bit, NO parity bits. If the data is to be saved on the PC, make sure that the data is directed to a file name. It is uploaded as a text file, with "Tab" delineators, so it can be read into a word processor or spreadsheet application.

UPLOAD Begins to upload data to PC. Screens similar to those shown below will appear, and during uploading the #IDENT will increment.

EXIT Returns to LOGGING MENU. Refer to Section 4.6.

```

      U P L O A D I N G   D A T A

      # I D E N T   F F F R

```

When data uploading is finished, the following screen appears, showing the #IDENT of the last record to be uploaded.

```

      F I N I S H E D   U P L O A D I N G   D A T A

      # I D E N T   F F F R

                                     E X I T > > >

```

EXIT Returns to LOGGING MENU. Refer to Section 4.6.

5. POWER SUPPLY

5.1. Changing batteries

The 8 "C" cells are housed in the battery compartment in the bottom of the CDU. Access is gained by unscrewing the central retaining screw and pulling out the end cap and pcb assembly. The cells can then be removed. When putting in new cells, be careful to ensure they are inserted the correct way. Labels are located in the compartment to indicate the correct way [note the large springs touch the -ve end on each cell, small springs the +ve end].

5.2. Battery Life

The current consumption of the units is as follows [all measured at 10vDC]:

	Backlight On	Backlight Off
Standby	57 mA	20 mA
Run	154 mA	117 mA

The battery life, based on good quality alkaline cells but assuming only 75% capacity, operating at approximately 15 degC [note performance can reduce with low temperatures] with unit on is:

	Backlight On	Backlight Off
Running time [hours]	37	49

5.3. External power

The unit will operate on an input voltage range of 7 to 15 vDC. The optional External DC power cable has 4mm plugs [Red +ve, Black -ve]. If these are connected using the wrong polarity, an internal fuse will blow. Refer to factory for instructions for repair.

Connection details are given in Section 6.

6. EXTERNAL CONNECTIONS

The external connections to the surface readout unit, signal cable and probe are as detailed below.

6.1 Probe to Control Unit

10 way connectors are used throughout the interconnections between probe and CDU, and pin allocations are as follows:

Pin	Function
A	+ve12 Volts DC from CDU to Probe
B	
C	Power Zero from CDU to Probe
D	Pressure Output Volts from Probe to CDU
E	-ve12 Volts DC In from CDU to Probe
F	Temperature Output Volts from Probe to CDU
G	Conductivity Output Volts from Probe to CDU
H	Signal Common from Probe to CDU
I	Not used

6.2 Data Lead

The data lead connector information is:

CDU end	Function	PC end
4 way in-line Male MilSpec connector [LMH06F 08 04 PN] [pins]		9 way "D" type female [sockets]
Pin A	RTS from PC [not used]	Socket 7
Pin B	Tx RS232 from PC to CDU	Socket 3
Pin C	Gnd	Socket 5
Pin D	Rx RS232C to PC	Socket 2

6.3 External DC

The External DC power cable connection details are:

CDU end	Function	Free End
3 way in-line Male MilSpec connector [LMH06F 08 33 SN] [sockets]		4mm "banana" plugs
Pin A	+ve	Red
Pin B	-ve	Black

7. CARE AND MAINTENANCE

While the instrument has been designed for field use, it is not indestructible and care should be taken not to damage either the sensor, cable or Control Display Unit.

In principle the calibration is for life, but as with most instruments it is advisable that check calibrations should be carried out on an annual basis.

APPENDIX 1

GUARANTEE CERTIFICATE

All goods are subject to a 36 month guarantee against faulty materials and bad workmanship. This does not apply to batteries and consumables Any faults are to be declared within 36 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.

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 by 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 that 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.....

Appendix 2

Equipment Supplied

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

Item		Items Required		Quantity	Serial Number	Checked by	Date
		Yes	No				
		Model 602 CTD Sensor	602				
100 dBar Pressure sensor							
200 dBar Pressure sensor							
500 dBar Pressure sensor							
50m Cable on hand reel							
100m Cable on hand reel					-		
200m Cable on hand reel					-		
500m Cable on hand reel					-		
Control Display Unit	8008/602				-		
Operating manual					-		
TERM.EXE disc							
Computer interface lead					-		
External DC power cable					-		
Carrying case							
(m) Deck Lead.							

Appendix 3

Calibration Information