MVP CONTROLLER
SOFTWARE
MANUAL
(Version 2.21)

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[OM-0010-0-03-221] **February, 2004**

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1 MVP Controller Software

NOTE: The MVP Controller Software is configured at the factory for the towcable length that is delivered with the MVP system. If the towcable length is changed please contact BOT or your MVP representative for a software upgrade.

2 User Interface Screens

The MVP Controller Software has four main screens with various indicators and buttons. The four screens are:

1. Main Operator screen
2. View Data screens
3. Manual Control screen
4. System Configuration screen

2.1 Main Operator Screen

When the MVP icon on the Windows Desktop is activated (double-clicked), the Main Operator screen appears, as shown in Figure 1. It has three pull-down menus and five distinct areas called 'panels.'

Figure 1: Main Operator Screen

2.1.1 Pull-Down Menus

There are three pull-down menus at the top of the Main Operator screen window.

2.1.1.1 File Menu

The File menu contains the following options:

- *Select New Log File*. This function allows the operator to change raw data file name and/or the directory in which subsequent data files will be stored. The naming convention for file names is described in section 3.

- *Print Panel*. A copy of the Main Operator Screen is sent to a Windows system printer. This feature should not be used during critical times, such as during a cast, as it takes time away from the controller's primary task.

- *Exit MVP*. This is an exit from the program.

2.1.1.2 View Menu

The View pull-down menu has the following options:

- *Manual Control.* This option enables the "Manual" control screen for system maintenance.

- *Configure System*: This option enables the Configuration Screen.

- *View SV.* This is a user-selected toggle. When selected, the system will display the most recent Sound Velocity profile whenever a "View Graphs" condition exists.

- *View Temp.* This is a user-selected toggle that is enabled if the instrument is a CTD and the temperature data file is generated. When selected, the system will display the most recent Temperature vs. Depth profile whenever a "View Graphs" condition exists.

- *View Salinity*. This is a user-selected toggle that is enabled if the instrument is a CTD and the salinity data file is generated. When selected, the system will display the most recent Salinity vs. Depth profile whenever a "View Graphs" condition exists.

- *View Density*. This is a user-selected toggle that is enabled if the instrument is a CTD and the density data file is generated. When selected, the system will display the most recent Density vs. Depth profile whenever a "View Graphs" condition exists.

- *View Sensor (mV)*. This is a user-selected toggle that is enabled if a DTM/Mux is used and one or more 0-5V sensor data files are generated. When selected, the system will display the most recent sensor output (0-5000 mV) vs. Depth profile whenever a "View Graphs" condition exists.

- *View Tension*. This is a user-selected toggle. When selected, a time series of tension is displayed as shown in Figure 4. The chart overlays the main control display and should only be used intermittently. If there is no tension sensor installed in the system, the chart will still appear but will not contain tension data.

- *View LOPC*. This is a user-selected toggle. When selected, the system will display the most recent profile of 'particles' whenever a "View Graphs" condition exists. This feature is only available when an LOPC is connected to the system.

- *Raw Nav*. This is a user-selected toggle. When selected, a window appears that contains the NMEA navigation data as received from the ship. This window is provided to assist in the setting up and testing of the NMEA serial port configuration. See Section 2.4.4

- *Raw Control*. This is a user-selected toggle. When selected, a window appears that contains the status streams from the embedded controller in the winch. This window is provided to assist in the setting up and testing of the Controller serial port configuration.

- *Raw Probe*. This is a user-selected toggle. When selected, a window appears that contains data as received from the free fall fish instrument(s). If a multi-sensor fish with a DTM/Mux is used, data from the main CTD/SVP and the support instrumentation are multiplexed together and transmitted to the surface. This window is provided to assist in the setting up and testing of the Instrument serial port configuration.

2.1.1.3 Help Menu

The Help Menu displays information about the software version number and contact information for Brooke Ocean Technology.

Figure 2: Help Menu

2.1.2 Depth Chart Panel

The *Depth Chart panel* is a strip chart display of depth vs. time (Depth Chart); sound velocity vs. time (Sound Velocity Chart); and towcable tension vs. time (Tension Chart).

Within the Depth Chart, three depths are plotted when the system is running:

1. *towbody depth (blue)* - the depth of the instrumented fish as measured by its pressure sensor

2. *bottom depth (red)* - the depth of the bottom surface as measured by the ships sounder (red)

3. *depth off the bottom (yellow)* - it is a 'safety' zone which tracks the bottom depth values reported by the ship's sounder. It is set through the 'Depth Off Bottom' on the *Deployment Criteria panel* on the Main Operator Screen.

When a free-fall deployment is underway, the system "locks in" a minimum bottom depth which appears as a green line on the chart. This minimum depth is derived from the minimum bottom depth recorded in the last 30 seconds before the deployment began and the depth off bottom safety zone. If the water becomes shallower during a cast, the green line will follow it. If the water becomes deeper during the cast, the green line will remain fixed at the minimum-recorded depth.

This feature is used to ensure that if the bottom depth is varying rapidly under the ship, the fish, which is some distance astern, will always choose the safest possible depth reading. See Figure 1.

The *Sound Velocity Chart* has a single trace, which displays sound velocity (m/s) vs. real time.

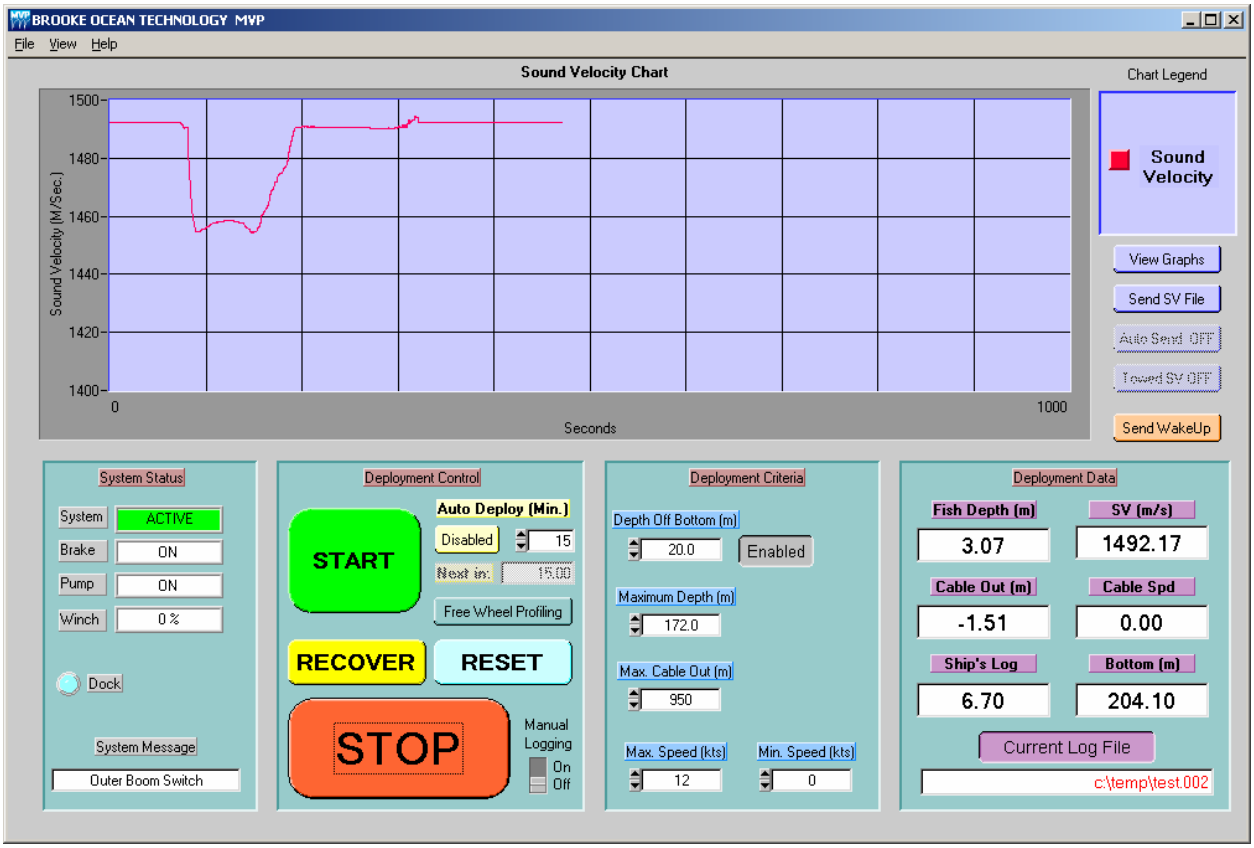

Figure 3: Main Operator Screen with Sound Velocity Chart

The depth and sound velocity strip charts overlay each other. They can be viewed sequentially by clicking the left mouse button while the mouse cursor is anywhere within the strip chart boundaries. Right clicking on either chart will display a “pop-up” menu, which will enable the operator to select the alternative chart. This pop-up menu also allows the operator to change the vertical scale for the currently selected chart. This procedure will also clear the selected chart, but will not alter any other chart. If the operator wishes to synchronize all three charts, this can be accomplished with the “RESET” button in the *Deployment Control* panel.

The *Tension Chart* (Figure 4) has a single trace, which displays towcable tension (pounds) vs. real time. Selecting “View Tension” in the “View” pull down menu enables this chart. . If there is no tension sensor installed in the system, the chart will still appear but will not contain tension data.

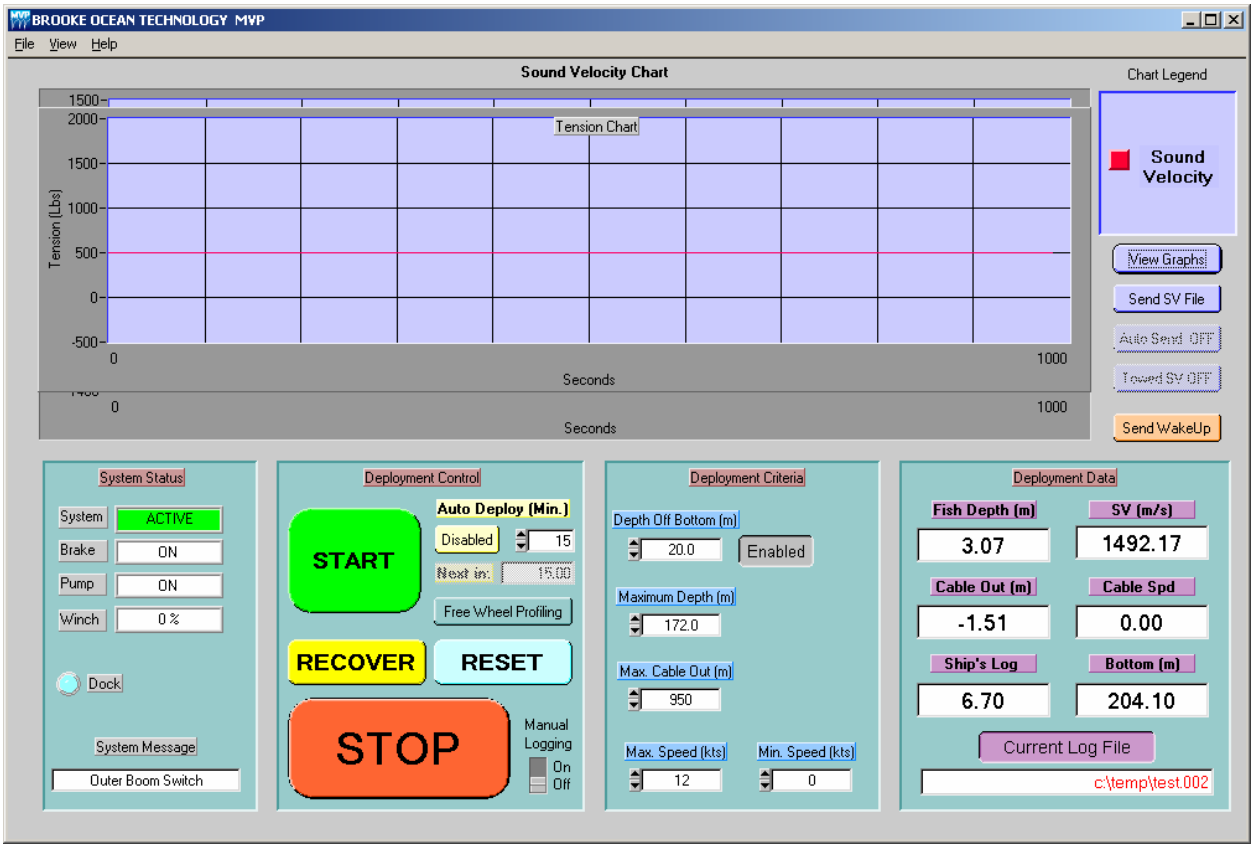

Figure 4: Main Operator Screen with Tension Chart

2.1.3 System Status Panel

The *System Status panel* shows the status of various system functions and sensors. Four indicators give the status of the winch embedded control system, the winch brake, the hydraulic pump motor and the winch speed setting.

The System status indicator shows the state of the system, which can be:

- NO_CTLR: indicates that the MVP Controller is not receiving status information from the embedded controller.
- EM_STOP: indicates that the hardware emergency stop circuits have been activated. The main controls at the winch must be reset to clear the ESTOP.
- HALTED: indicates that the MVP operations have been halted by a hardware error or user intervention; STOP button pressed.
- ACTIVE: indicates that a cast is underway.
- READY: indicates that the system is ready to begin a cast.

- HAND_MODE: indicates that the *Hand/Off/Auto* switch on the Main Control Box is set to the *Hand* position.

The Brake indicator is either ON or OFF, reflecting the state of the brake.

The Pump indicator is either ON or OFF, reflecting the state of the hydraulic power unit motor on the winch. The MVP30 uses an electric drive.

The Winch indicator shows the percentage of full stroke that is set for the pump. Normal winch operations take place between 40 and 50 %. For the MVP30, the speed is controlled at the winch; this is set to 0% or 100%.

The Dock indicator is reset twice per profile. At the surface, it is reset at the beginning of the cast and turns “On” after the first messenger passes the outer sheave.

The dock messenger is needed to stop the winch when the fish returns to the dock position. At the bottom of the cast, a check is made to ensure that the dock messenger was detected. If not detected, the software will not proceed with an automatic recovery. The fish will need to be manually recovered and the towcable inspected for the dock messenger.

The Dock indicator is reset before the system begins to recover the fish. During recovery, the control system continuously checks for the messenger. Recovery is terminated when the messenger passes through the outer-sheave/dock limit switch. The Dock indicator turns on to signal that a messenger was detected.

The System Message field is used to provide information to the operator, such as the reason for ending the deployment phase of a cast (Depth of Bottom, Max Sensor Depth or Max Cable Out)

2.1.4 Deployment Control Panel

The *Deployment Control* panel controls the automatic deployment of the instrumented fish.

The *START* button initiates a Moving Vessel Profile (MVP). At the start of a deployment, the cable counter and the dock indicator are reset.

The *Auto Deploy* function allows a series of MVP casts to be performed automatically. The time field, sets the wait time interval (minutes) between casts.

The E*nabled/Disabled* button turns the automatic deployment function on or off. The button can be toggled in the middle of a cast to turn off Auto Deployment. The fish will recover normally and return to the towed position.

The *Next In:* displays the time in minutes and seconds to the next Auto deployment.

The *Free Wheel Profiling* button, is a toggle that switches the profiling mode between free wheel and stationary. Moving-Vessel-Profiling is conducted with the winch operated in the Free Wheel Profiling mode. The winch drum is allowed to free wheel as the fish travels down through the water column. The Stationary Profiling mode is used when a slower, more controlled downcast profiling rate is required. This feature allows conventional CTD casts to be performed. When selected, the fish is lowered through the water column under winch control. The downcast profiling speed is set in the Configuration screen.

When Stationary Profiling is selected, the toggle turns red. This serves as a warning that Stationary Profiling mode has been selected. Cable tension must be maintained at all times during the cast as the cable is released under winch control.

The *RESET* button, resets the cable counter and Dock indicator. It clears all strip charts and returns the system to a "Ready" status.

The *STOP* button puts the system into a safe mode. The winch speed is set to zero, the brake is turned ON, and the winch is taken out of freewheel. (MVP30 – the brake is turned ON and the clutch is disengaged.)

The *Manual Logging* switch allows data to be logged for test purposes or to do a manual cast like a conventional CTD cast. When logging is enabled, a window will appear, asking the User to confirm the new file name. With the winch in Hand mode, the fish can be lowered while data is logged to file. When logging is stopped/disabled, the file formats selected in the Configuration screen (see Section 2.4) are generated. This feature can also be enabled in the Manual Control screen.

2.1.5 Deployment Criteria Panel

The *Deployment Criteria* panel contains five settings, any one of which will terminate the deployment and start recovery of the fish.

CAUTION: These criteria will NOT terminate deployment when operating in manual mode!

These values can be adjusted by clicking the up/down arrows or by double-clicking the value and typing a new value.

2.1.5.1 Depth Off Bottom

The *Depth Off Bottom* setting is typically set to 10-20 meters above the bottom. It establishes a safety zone to prevent bottom collisions. The fish depth, as measured by the pressure sensor located in the fish, is compared to the bottom depth from the ship's depth sounder. If bottom avoidance is enabled, the cast will terminate when the fish enters the safety zone (i.e. the fish depth >= (bottom depth – depth off bottom setting)).

2.1.5.2 Bottom Avoidance Enable

If bottom avoidance is disabled, bottom depth data from the ship's sounder is ignored. This is useful when profiling in deep water where the ship's sounder has trouble maintaining contact with the bottom. When bottom avoidance is disabled, the cast will terminate when the fish reaches the Maximum Depth or the towcable out exceeds the Maximum Cable Out setting. When bottom avoidance is enabled, the cast will also terminate when the fish enters the safety zone as described above.

2.1.5.3 Maximum Depth

The *Maximum Depth* setting is the maximum depth the fish is allowed to reach, as measured by the pressure sensor in the fish. Note that this setting must be less than or equal to the depth rating of the instrument, as defined in the configuration screen. See Section 2.4

2.1.5.4 Maximum Cable Out

The *Maximum Cable Out* setting limits the amount of towcable that can be deployed during a cast. A cast will terminate when the amount, reported by the cable counter, exceeds this value.

This setting is less than or equal to cable that is installed on the winch:

- 125 m for a model MVP30
- 300 m for a model MVP100
- 600 m for a model MVP200
- 1700m for a model MVP300-1700
- 3400 m for a model MVP300-3400
- A specific towcable length installed at the factory

In addition to being limiting by the amount of installed cable, the *Maximum Cable Out* setting is automatically reduced as the *Maximum Vessel Speed* is increased. At higher vessel speeds, drag forces on the towcable and fish, limit the amount of cable that can be output during a cast.

The following table lists performance specifications for the MVP family. The table shows the Maximum Cable Out values at various survey speeds, for each of the MVP models. The range of *Maximum Cable Out* values is automatically limited according to the table.

MVP Performance Specifications[1]

Speed (Knots)	MVP30		MVP100 (SSFF)		MVP200 (SSFF)		MVP300-1700		MVP300-3400	
	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)
0	125	125	300	300	600	600	1700	1700	3400	3400
1	105	125	270	300	530	600	1400	1700	2650	3400
2	90	125	240	300	475	600	1200	1700	2250	3400
3	78	125	220	300	430	600	1050	1700	1900	3400
4	70	125	200	300	390	600	920	1700	1680	3400
5	60	125	185	300	360	600	830	1700	1500	3400
6	55	125	170	300	335	600	760	1700	1250	3110
7	50	125	160	300	310	600	690	1700	1000	2650
8	46	125	150	300	295	600	600	1700	730	1990
9	43	125	140	300	275	600	575	1630	575	1640
10	40	125	120	266	260	600	460	1360	460	1360
11	38	125	90	207	245	600	370	1130	370	1130
12	30	102	70	244	220	557	300	950	300	950
13	20	70	50	122	180	466	240	780	240	780
14	14	51	36	91	150	400	200	670	200	670
15	8	30	26	68	130	355	160	550	160	550
16	4	16	16	43	110	307	130	460	130	460
17	0	0	8	22	90	256	110	400	110	400
18	0	0	0	0	80	234	90	340	90	340
19	0	0	0	0	70	210	70	270	70	270
20	0	0	0	0	55	165	60	240	60	240

[1]*Subject to change without notice. (Source date 27/07/01)*

2.1.5.5 Maximum Vessel Speed

The *Maximum Vessel Speed (kts)* is the maximum speed at which MVP casts will be performed. Whenever a new speed is entered, the *Maximum Cable Out* setting is automatically set to its limiting value. (If less cable out is desired, it can be reduced after the *Maximum Vessel Speed* value has been set.)

This setting can affect the system's ability to achieve a desired profile depth. If the value is set too high, the maximum cable out may be limited, preventing a cast to the desired depth. The *Maximum Vessel Speed* should be set to a value slightly greater than the expected vessel speed.

The Default value for this setting is set at the Configuration Screen.

2.1.5.6 Minimum Vessel Speed

The *Minimum Speed (kts)* is the minimum vessel speed that is allowed. If the vessel speed drops below this setting, the cast will terminate and the fish is recovered. This is useful when operating in a current that would cause the ship to drift over the towcable during a deployment, or if the ship had to suddenly reverse direction.

2.1.6 Deployment Data Panel

The *Deployment Data* panel provides data about the winch and fish during deployment / recovery.

2.1.6.1 Fish Depth

Fish Depth is the depth of the fish, in meters. Pressure readings from the main instrument in the fish, are offset corrected and converted to depth values. Pressure offset and latitude correction parameters are defined in the Configuration screen.

If there is no communication with the fish, this field will have a red background and a value of 99999.99. The system must be receiving valid data from the fish for a deployment to proceed. If communications fail during a deployment, the value toggling to 99999.99 will terminate the cast and initiate the recovery sequence.

2.1.6.2 Sound Velocity

Sound Velocity is the real-time sound velocity as measured by the fish at its current depth. In the case of a SV&P sensor, it is a direct measurement. If a CTD is used, the value is calculated.

2.1.6.3 Cable Out

Cable Out indicates the amount of winch towcable that has passed through the outer sheave.

In the event of a communications failure with the embedded controller, this field will have a red background and be set to 99999.99 m. If communications fail during a deployment, the cast will automatically terminate.

2.1.6.4 Cable Speed

Cable Speed is the current winch in/out speed, in m/s.

2.1.6.5 Ships Log

Ship's Log is the ship speed through the water, in knots, as provided by the ship's log or GPS through the NMEA data port.

2.1.6.6 Bottom Depth

Bottom Depth is a display of depth reported by the ship's sounder through the NMEA data port. If a new sounding has not been received within the specified timeout interval specified on the Configuration Screen, this field will be set to red with a value of –99999.99 m. (See section 2.4.4)

If Bottom Avoidance is turned on, and a deployment is underway when the sounder times out, the cast will terminate and the system will attempt to recover the fish.

2.1.6.7 Logging Enable

Logging Not Enabled is a toggle button. When logging is on (enabled), the data collected by the fish, is streamed to the indicated filename during a cast.

2.1.6.8 Data File

The *Data File* name field is visible when logging is enabled. The window shows the current raw data file name. Other data file names are derived from the raw data file name as described in Section 3.1.

The data file name may be changed between casts, using the *File* pull down menu or by entering the path and filename directly.

2.1.7 Send SV File

The *Send SV File* function is used to manually send the current SV profile to an external device such as a multibeam sounder. The target file format is defined in the Configuration screen (see section 2.4). This is the same function as the Send File in the Sound Velocity vs. Depth chart, except the profile is not displayed.

A window (see Figure 5) will appear showing the status of the file transfer. It will disappear when the transfer is complete.

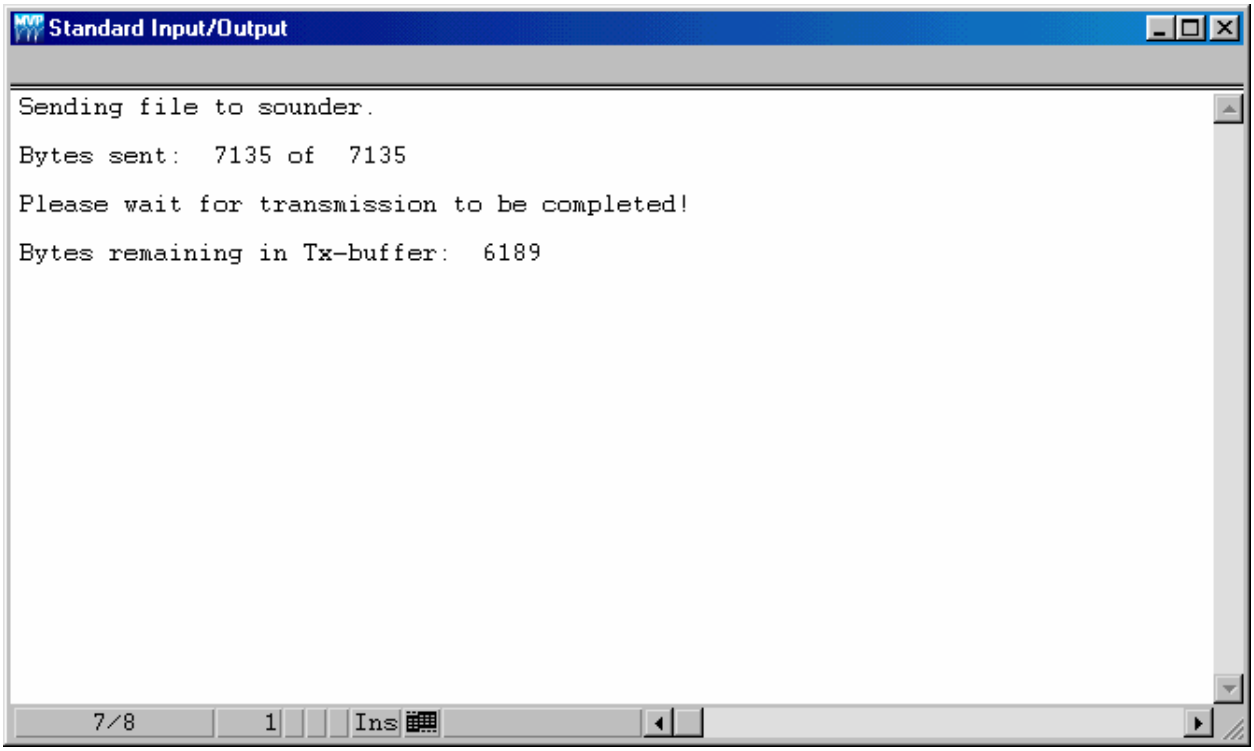

Figure 5: Send SV File status window

2.1.8 Auto Send

The *Auto Send* function allows SV profiles to be automatically uploaded to a sounder.

If this function is disabled in the Configuration screen, the Auto Send button is dimmed and disabled. Auto Send can not be enabled if the Towed SV function is enabled and using the same serial port that is used to send profiles to the sounder

If the Auto Send function is enabled in the Configuration screen, this toggle is enabled and can be used to turn the Auto Send function on and off at the Main Operator screen.

When enabled, prior to the recovery portion of the cast, the SV profile is generated and automatically sent to the sounder. The auto-recovery portion of the cast then proceeds.

2.1.9 Towed SV

This function allows sound velocity (SV) data to be output continuously while the fish is in the towed position between casts.

If this function is disabled at the Configuration screen, the Towed SV button is dimmed and disabled. If the Towed SV function is enabled at the Configuration screen, this toggle is enabled and can be used to turn the Towed SV function on and off at the Main Operator screen.

2.1.10 Send WakeUp

This function is used to send wakeup character(s) to the free-fall fish instrument.

The character(s) defined in the Configuration screen (see Section 2.4), are output every 200 ms for a 5 second period. After the 5-second transmission period, the program waits 25 seconds for the instrument to wake-up.

A window will appear displaying the characters being output to and any characters received from the instrument. See Figure 6.

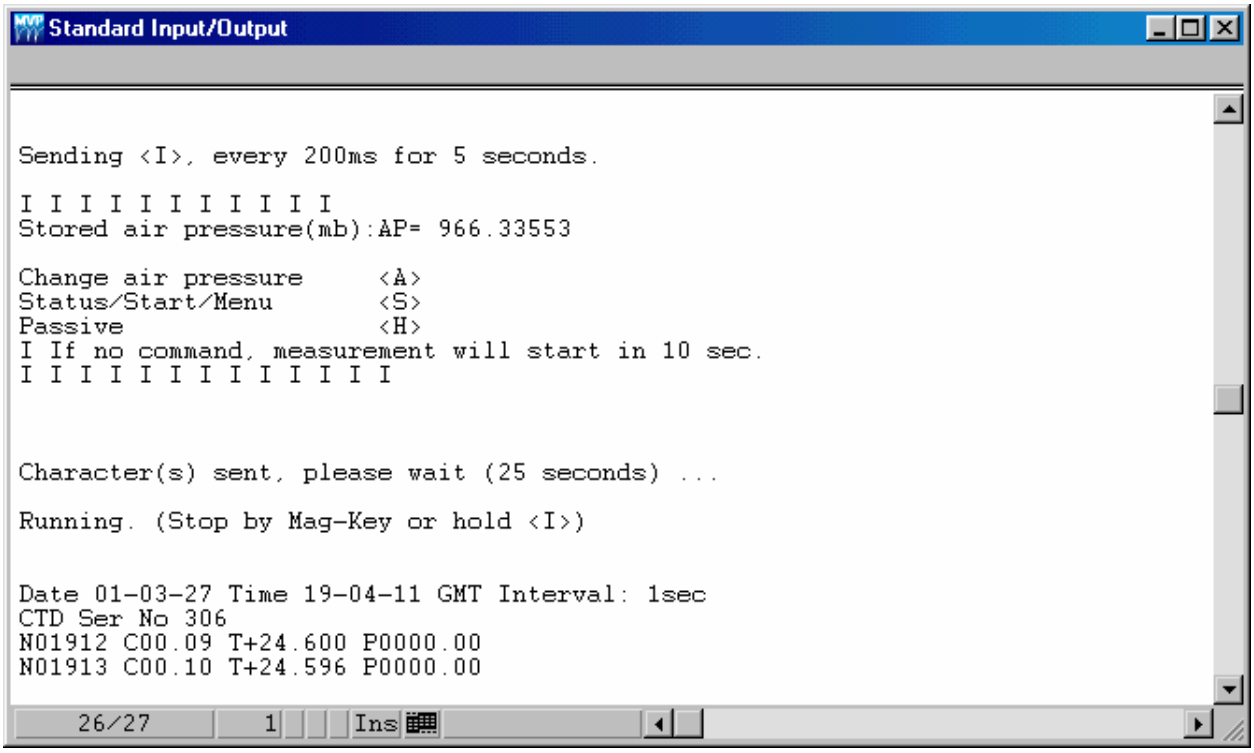

Figure 6: Send WakeUp status window

2.2 View Data Screens

Clicking the VIEW GRAPHS button on the Main Operator Screen activates the View Data screens. They graphically display the data from the files logged during a cast.

The graphs may also be automatically displayed at the end of a cast if the “View Files Automatically” toggle is set in the Configuration Screen.

The following parameters can be graphically displayed using this function:

1. Sound Velocity vs. Depth

2. Temperature vs. Depth

3. Salinity vs. Depth

4. Density vs. Depth

5. Sensor (mV) vs. Depth

6. LOPC vs. Depth

The graphs that are displayed are determined by the sensor type and the selections made in the “View” pull down menu. All graphs have the feature of being able to display two profiles in the same graph. Data from the most recent cast is displayed in yellow while data from a previous cast is displayed in red. In the view screens it is possible to pick other files for the red and yellow plots.

The graphs may be printed by clicking on the Print control on each graph.

2.2.1 Sound Velocity vs. Depth Graph

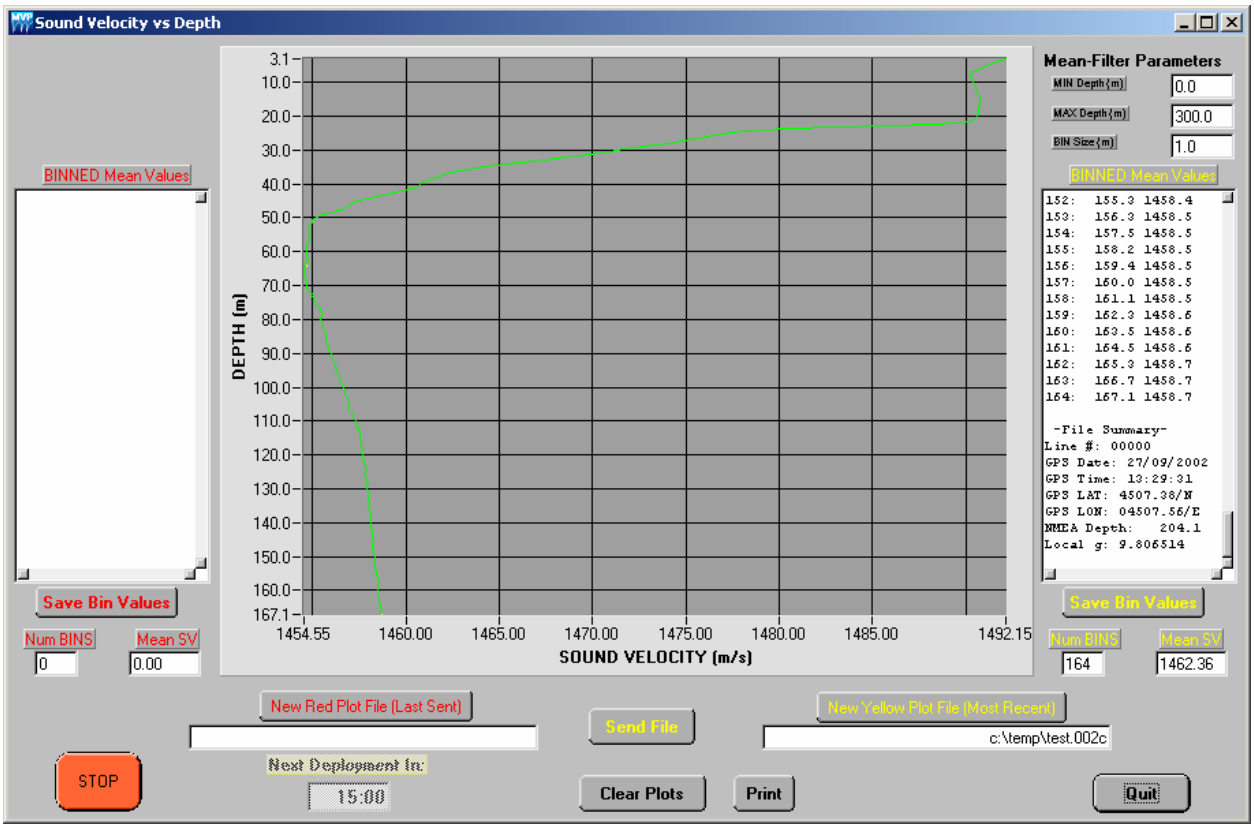

Figure 7: Sound Velocity vs. Depth Graph

The *Sound Velocity vs. Depth* (Figure 7) graph is slightly different from the other graphs. It displays two sound velocity profiles, the most recent is in yellow while the last profile uploaded to the sounder is in red.

Data is 'bin-averaged' according to the *Mean-Filter Parameters* that are entered. The results of the averaging are displayed in the text window(s) on the side(s) of the graph. The results are also plotted. The Yellow File bin values are plotted in green while the Red file bin values are plotted in blue.

The filtered data can be stored to file by clicking on the *Save Bin Values* button. This generates a 2 column ascii SV file. The output filename is generated from the input filename. For example 'sample1.001c' will produce an ascii SV file 'sample1_bin.001d'.

The operator can forward the displayed sound velocity profile to an external device such as a multibeam sounder by selecting *Send File*. The SV file format that is displayed and output, defaults to the format chosen in the Configuration screen. (See section 2.4.5) A continuously updated timer displays the time remaining until the next deployment, if Auto Deploy is enabled. The STOP button has the same function as the STOP in the main panel.

2.2.2 Temperature vs. Depth Graph

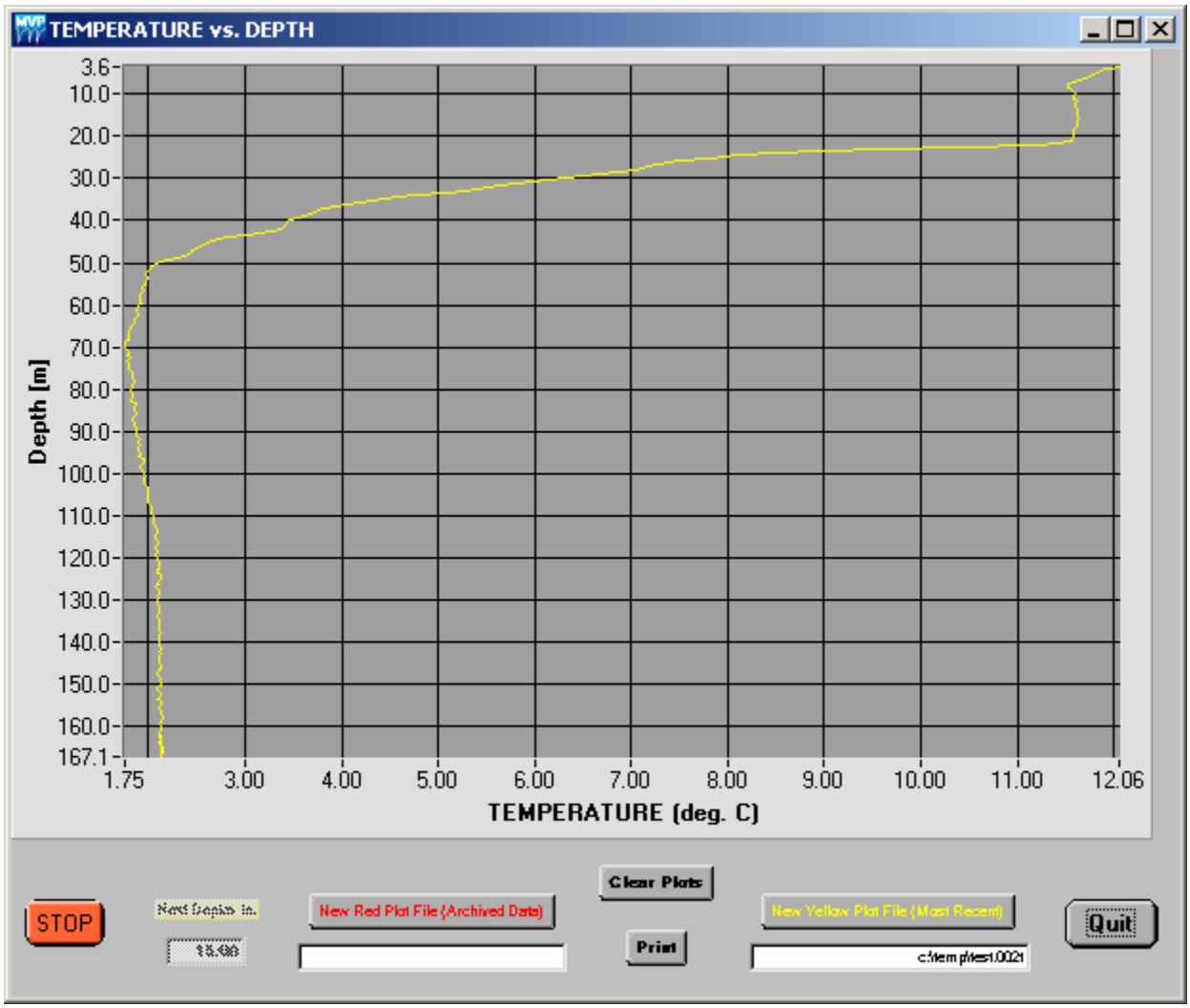

Figure 8: Temperature vs. Depth Graph

The *Temperature vs. Depth* graph (Figure 8) - the most recent cast is shown in yellow while an archived cast is shown in red. The plot is auto-scaled and includes provision to print the plot.

2.2.3 Salinity vs. Depth Graph

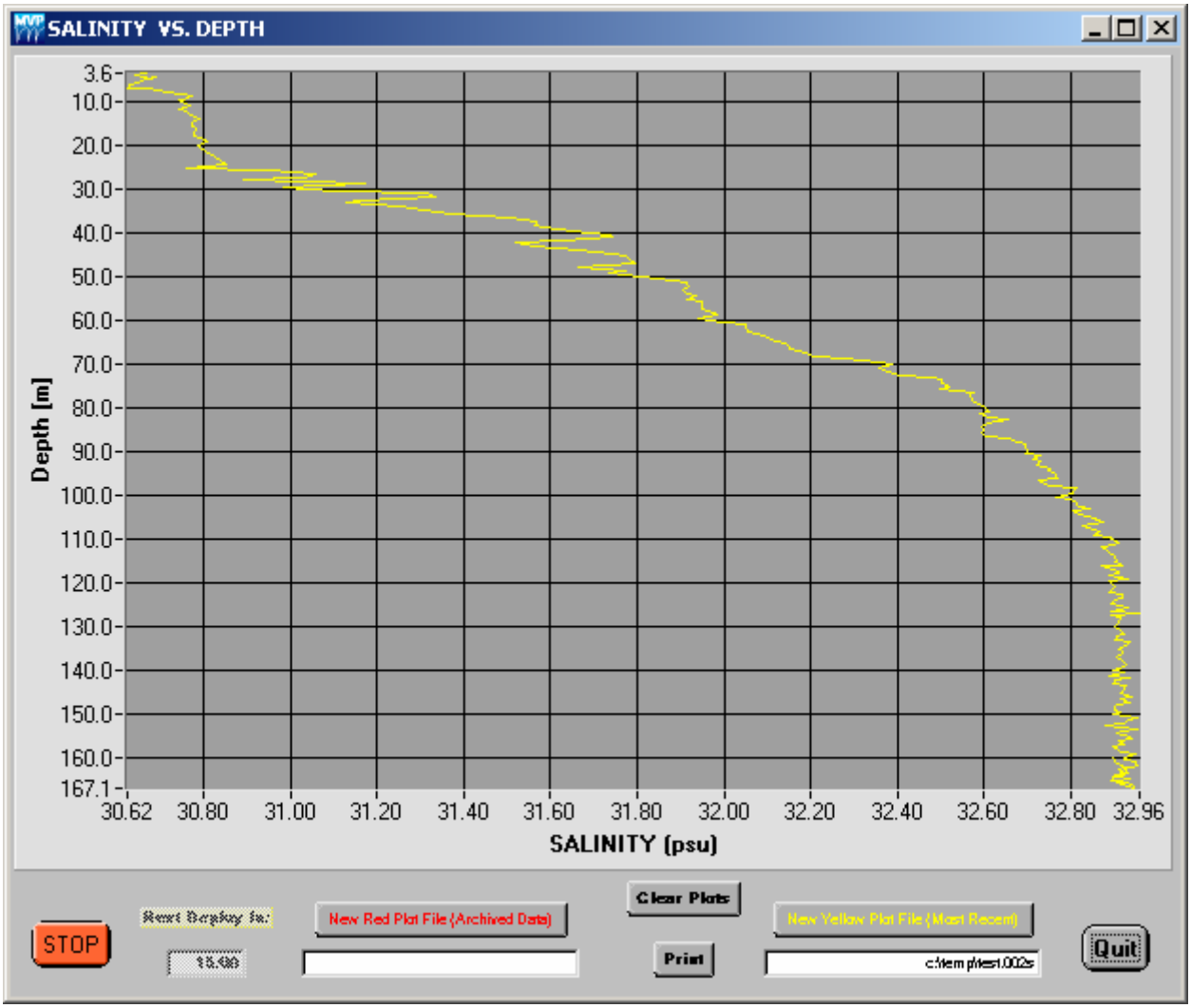

Figure 9: Salinity vs. Depth Graph

The *Salinity vs. Depth* graph (Figure 9) - the most recent cast is shown in yellow while an archived cast is shown in red. The plot is auto-scaled and includes provision to print the plot.

2.2.4 Density vs. Depth Graph

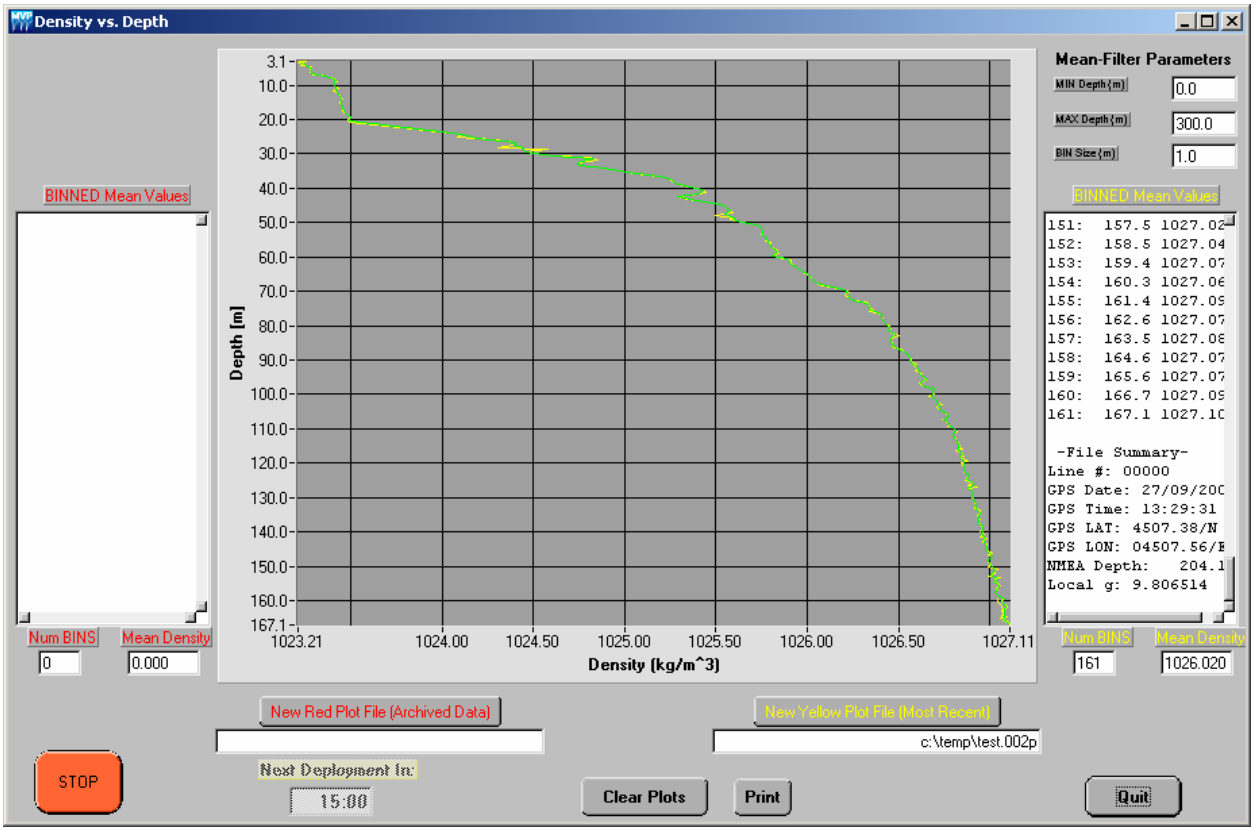

Figure 10: Density vs. Depth Graph

The *Density vs. Depth* graph (Figure 10) - the most recent cast is shown in yellow while an archived cast is shown in red. The plot is auto-scaled and includes provision to print the plot.

Data is 'bin-averaged' according to the *Mean-Filter Parameters* that are entered. The results of the averaging are displayed in the text window(s) on the side(s) of the graph. The results are also plotted. The Yellow File bin values are plotted in green while the Red file bin values are plotted in blue.

2.2.5 Sensor (mV) vs. Depth Graph

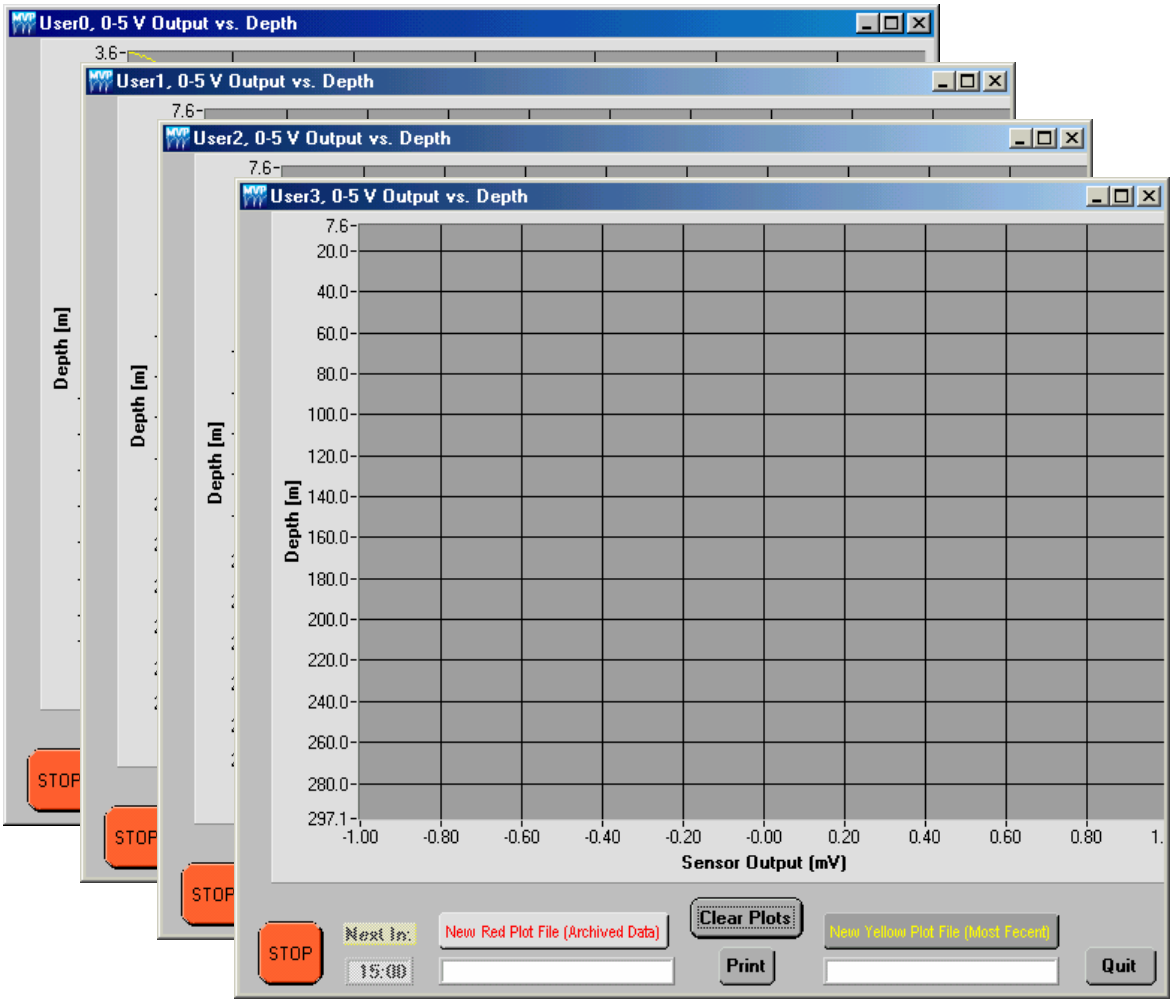

Figure 11: Sensor (mV) vs. Depth Graph

Sensor (mV) vs. Depth graphs (Figure 11) is a plot of the raw voltage(s) output by the 0-5V auxiliary sensors. The AML CTD+ (special order) accepts 1 auxiliary 0-5V sensor that is designated as User0. A multi-sensor fish and DTM/Mux can accept up to 3 x 0-5V sensors (User1 – User3). The output of each auxiliary sensor is displayed in its own graph.

The most recent cast is shown in yellow while an archived cast is shown in red. The plot is auto-scaled and includes provision to print the plot.

2.3 Manual Control Screen

The *Manual Control Screen* is displayed by selecting ***Manual Control*** from the View pull down menu at the Main Operator screen, or by pressing ***CTRL-M***. A password is required to enter the Manual Control Screen the first time. This feature prevents unauthorized access to the manual control functions that could damage the equipment and/or injure personnel. Figure 12 shows the password dialog. The password is "BOTMvp"

Figure 12: Manual Control Password Dialog

Figure 13 shows the Manual Control Screen. This screen is intended **ONLY** as a diagnostic tool for the MVP system. It is **NOT** to be used to operate the winch manually from the computer. *All manual operations are to be performed using manual controls at the winch **ONLY***.

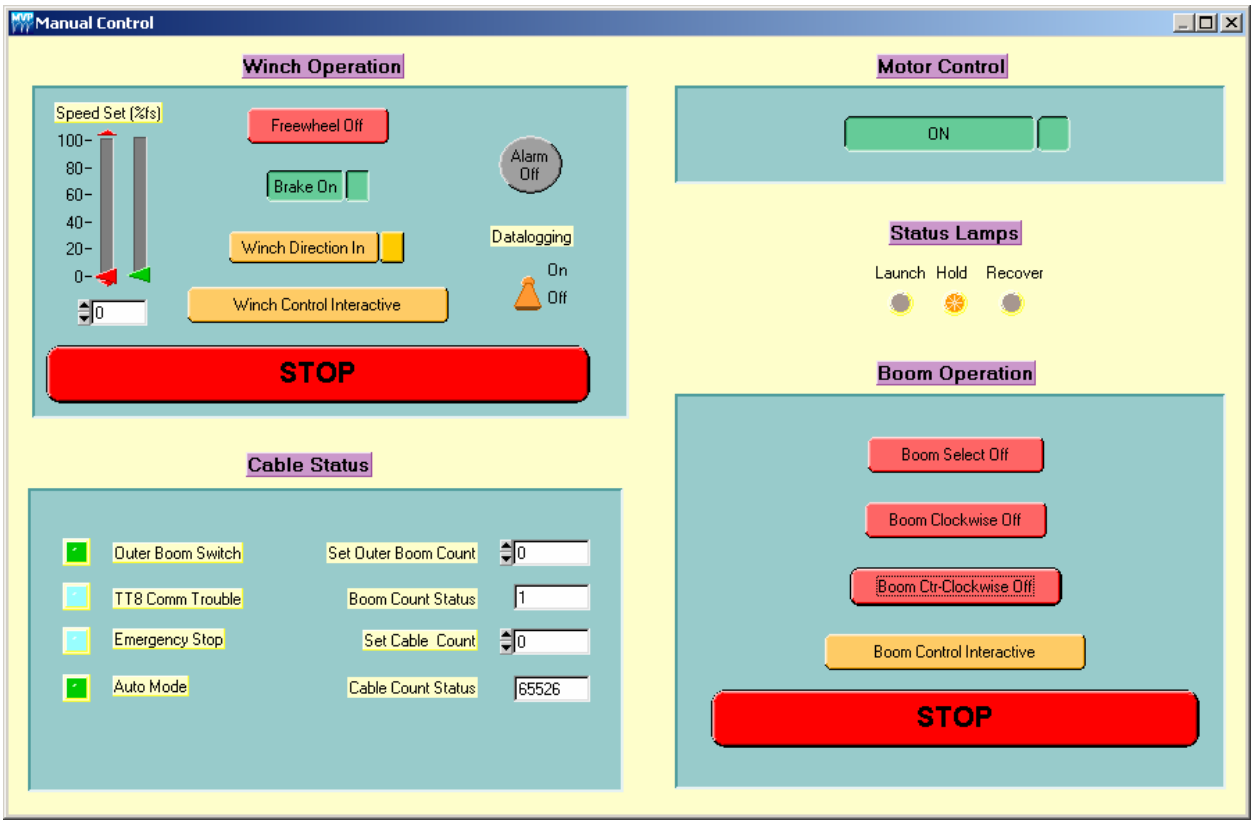

Figure 13: Manual Control Screen

When exercising Manual Control functions, the operator must ensure that he has good communication with the deck either with line of site, video camera/display and/or voice communications with on-deck personnel.

There are four panels on the Manual Control Screen.

2.3.1.1 Winch Operation Panel

The *Winch Operation* panel contains the controls for operating the winch.

The MVP control software supports the full MVP family of profiling systems, which are predominantly hydraulically driven. The MVP30 is driven by an electric motor. Its motor is enabled/disabled using the Pump On/Off control. The MVP30 does not have status lamps or a Boom. Boom controls are disabled.

2.3.1.1.1 Freewheel Button

CAUTION: The fish will drop when the MVP is placed in freewheel mode; if it is hanging above the deck at time, personal injury may occur!

The *Freewheel* button toggles between “Freewheel On” and “Freewheel Off”. When “Freewheel On” is selected, the following happen automatically:

a) The brake is turned OFF (disengages)

b) The winch speed is set to 0%

c) The winch motor is put into 'freewheel' mode

When clicked "OFF", the brake is turned on (engaged), the winch motor is engaged and the winch speed is set to 0%.

2.3.1.1.2 Alarm Button.

The *Alarm* button activates the audible alarm in the Main Control Box. It toggles between "Alarm On" and "Alarm Off".

2.3.1.1.3 Brake Control

The *Brake* control toggles between ON and OFF. The small square at the right end of the control is a confirmation from the embedded controller that it has acknowledged the command.

NOTE: If an Emergency Stop condition exists, it will not be possible to release the brake until the Emergency Stop condition is cleared.

2.3.1.1.4 Winch Direction

The *Winch Direction* button toggles between "Winch Direction In" and "Winch Direction Out". It sets the direction the winch will turn when the winch speed is set. The small square at the right end of the control is a confirmation from the embedded controller. It reflects the state of the winch direction inside the controller.

2.3.1.1.5 Speed Set

The *Speed Set* control sets the winch speed as a percentage of full modulation of the hydraulic control valve that controls the hydraulic pump swash plate angle.

When the setting is above 0% the pump motor will start, the brake will release and the winch drum rotates. The control consists of two vertical sliders. The left-hand slider is the operator control while the right hand slider is a confirmation from the embedded controller in the Main Control Box.

The *Speed Set* control can be activated by the following:

- Double clicking on the numerical value, typing in a new value and hitting ENTER
- Clicking the up and down arrows next to the numerical display
- Moving the slider on the display
- Clicking the arrows at the top and bottom of the slider

CAUTION: Be careful when clicking the arrows at the top of the slider; if the mouse cursor is slightly below the arrow, the winch motor will be set to 100% speed.

The MVP30 winch speed is controlled through a variable speed drive mounted on the winch. The Hand and Auto mode winch speed is varied using the speed adjust knob on the main control box. The winch speed is not adjustable under software control. In software, a speed setting of > 25% is required to make the winch motor operate.

2.3.1.1.6 Winch Stop button

The *STOP* button sets the winch speed to 0%, and sets the brake to full on.

2.3.1.1.7 Winch Interactive button

CAUTION: The Winch Control button should always read "Winch Control Interactive". It is ONLY to be toggled to Winch Control Independent under the direction of BOT personnel. The Winch Control Independent setting is for diagnostic use only.

WARNING: Serious system damage may result when operating the winch in this mode!

The interactive mode integrates a number of winch functions such as making sure that freewheel mode is disabled before attempting to drive the winch. It is possible to disable these interlocks by disabling "Interactive" mode.

This should not be done without specific instructions from BOT personnel due to the possibility of causing serious harm to the system.

2.3.1.1.8 Datalogging Switch

The *Datalogging* switch allows data to be logged for test purposes or to do a manual cast like a conventional CTD cast.

When logging is enabled, a window will appear, asking the User to confirm the new file name. With the winch in Hand mode, the fish can be lowered while data is logged to file. When logging is stopped/disabled, the file formats selected in the Configuration screen (see Section 2.4) are generated.

Further details on the file formats may be found in Section 3.

2.3.1.2 Motor Control Panel

The *Motor Control* panel contains one button, ***Pump On/Off***. The MVP30 is driven by an electric motor. Its motor drive is enabled/disabled using the Pump On/Off control. The small square to the right of the control is a confirmation from the embedded controller.

2.3.1.3 Status Lamps

The Main Control Box has three status lamps. The state of these lamps is reflected in the indicators on the Manual Control Panel. It is possible to toggle each of these lamps by clicking on the associated indicator. The MVP30 does not have status lamps on its main control box.

2.3.1.4 Boom Operation

The *Boom Operation* panel contains the controls for operating the boom. The MVP30 does not have a Boom. Boom controls are disabled when the software is configured for MVP30 operation.

2.3.1.4.1 Boom Select

The *Boom Select* button toggles On/Off and activates the valves that direct hydraulic oil flow to the boom rotator motor and away from the winch. This does not start boom rotation.

2.3.1.4.2 Boom Clockwise

The *Boom Clockwise* button toggles between “Boom Clockwise On” and “Boom Clockwise Off”. When *Boom Clockwise On* is selected, Boom Select is set to On, the Pump is set to On and the Winch Direction is set to “In”. This effectively rotates the boom clockwise, as viewed from above the MVP winch. Clicking the button again stops the boom rotation.

2.3.1.4.3 Boom Counterclockwise

The *Boom Counterclockwise* button toggles between “Boom Ctr-Clockwise On” and “Boom Ctr-Clockwise Off”. When Boom Counterclockwise On is selected, Boom Select is set to On, the Pump is set to On and the Winch Direction is set to Out. This effectively rotates the boom counter-clockwise, as viewed from above the MVP winch. Clicking the button again stops the boom rotation.

Note: The speed at which the boom rotates is set at the factory and cannot be changed.

When the STOP button is clicked the boom will stop rotating as the boom directional control valves are closed. This will also turn off the hydraulic pump.

2.3.1.4.4 Boom Control Interactive

CAUTION: The Boom Control button should always read "Boom Control Interactive.” It is ONLY to be toggled to Boom Control Independent under the direction of BOT personnel. The Boom Control Independent setting is for diagnostic use only.

WARNING: Serious system damage may result when operating the winch in this mode!

2.3.1.5 Cable Status Panel

The C*able Status* panel shows the status of the towcable and controls.

2.3.1.5.1 Outer Boom (Sheave Limit) Switch

The outer boom (sheave limit) switch, or “Dock Switch” is activated by a towcable messenger passing the outer sheave. This indicator is reset at the start of a deployment and at the start of a recovery. It turns on when the first messenger passes the switch.

2.3.1.5.2 TT8 Comm Trouble

This indicator reports when the TT8 embedded controller reports it is having trouble with the messages coming from the MVP Controller. If this occurs, the automatic winch operations will shut down and the operator must recover the system manually.

2.3.1.5.3 Emergency Stop

The *emergency stop* indicator is activated when the embedded controller detects that the Emergency Stop circuitry has been activated. All automatic functions are disabled while an emergency stop condition exists. The system must be reset at the Main Control Box after the emergency stop condition has been cleared.

2.3.1.5.4 Auto Mode

This indicator shows the status of the *Hand/Off/Auto* switch on the Main Control Box. If activated, it means that the switch is in the *Auto* position and embedded controller is in full control of the system. If reset, it means that the switch is in the *Hand* position and the embedded controller can report on conditions but cannot control the system.

2.3.1.5.5 Set Outer Boom Count

The *Set Outer Boom (Sheave) Count* allows the user to preset the current switch count from the outer boom ‘Dock’ limit switch. Each time a messenger passes through the switch, the count is incremented.

It can be set by double clicking the numerical display and entering a value or by clicking the up or down buttons.

2.3.1.5.6 Boom Count Status

The *Boom Count Status* displays the actual switch count as reported by the embedded controller. Note: this count should update after the Set Outer Boom Count has been changed.

2.3.1.5.7 Set Cable Count

The *Set Cable Count* allows the user to preset the current count from the metering sheave cable count sensor. Note that this is a count of the number of magnets passing by the sensor and has not been converted to meters in the main control box. It can be set by double-clicking the numerical display, entering a value or by clicking the up or down buttons.

2.3.1.5.8 Cable Count Status

The *Cable Count Status* displays the magnet sensor count reported by the embedded controller. These values are in counts and not calibrated in meters. Note: this count should update immediately, after the Set Cable Count has been changed.

2.4 MVP Configuration Screen

The MVP Configuration screen is displayed by selecting ***Configure*** from the View menu at the Main Operator screen, or by pressing ***CTRL-C***. Winch operations are halted when the configuration screen is entered. The screen is shown in Figure 14.

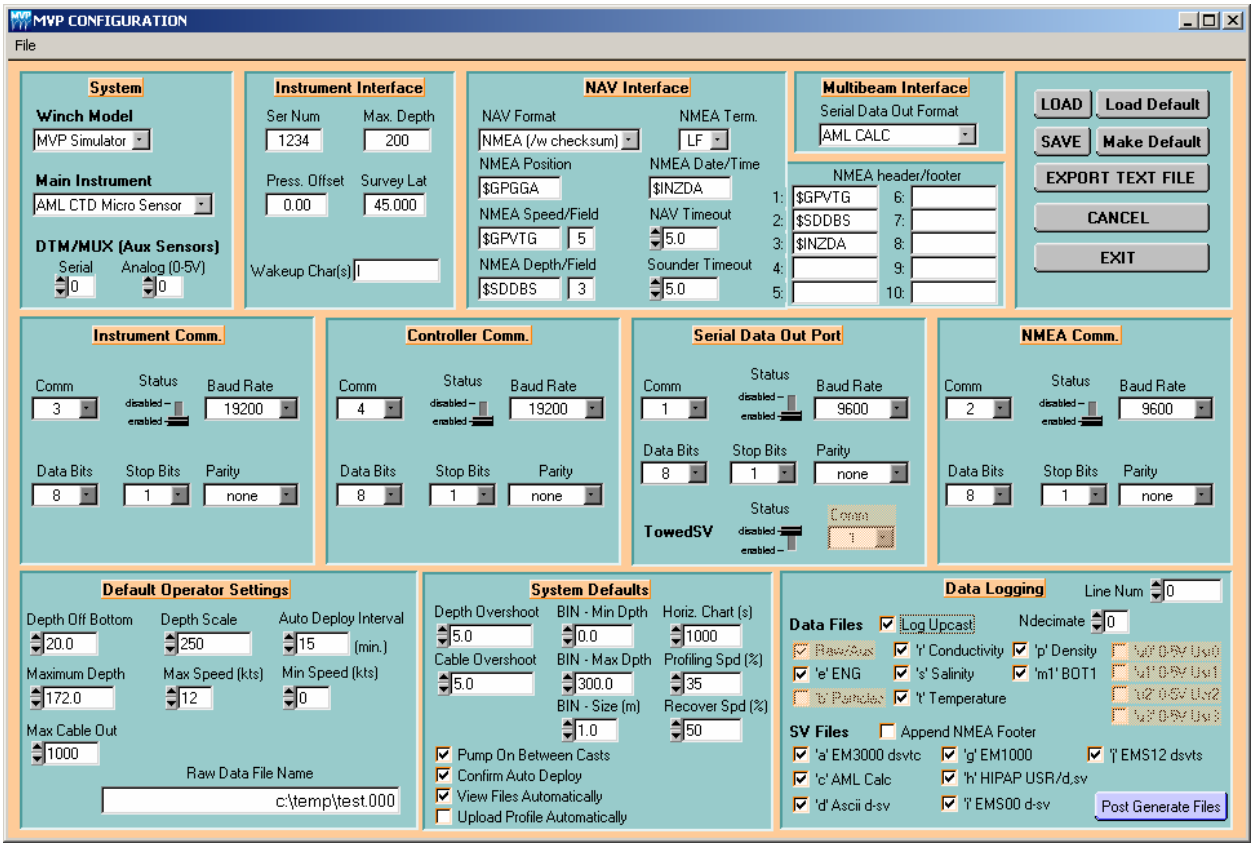

Figure 14: Configuration Screen

The MVP Configuration screen consists of 1 pull down menu and 11 configuration specific panels:

1. System
2. Instrument Interface
3. NAV Interface
4. Multibeam Interface

5. Instrument Comm.
6. Controller Comm.
7. Serial Data Out Port
8. NMEA Comm.
9. Default Operator Settings
10. System Defaults
11. Data Logging

2.4.1 File Menu

The “File” pull down menu allows the operator to Load the Default or any configuration, Save the configuration as the Default or to some other file, Print a copy of the screen and Exit back to the Main Panel. These same controls are available in the top right hand corner of the Configuration screen.

2.4.2 System Panel

The *System* panel has 3 settings relating to overall system configuration.

Winch Model
The operating software is common to the entire line of MVP products. The model selection field defines the hardware that the software must interact with. Some winch operations are model specific. For example, an MVP300 will not operate properly if an MVP30 is selected. This parameter must be set correctly for proper MVP winch operations.

One of the selections is the MVP Simulator.

NOTE: DO NOT configure the software to use the simulator when the MVP Winch hardware is active.

Main Instrument
This setting defines the type of CTD or SV&P probe that is installed as the main instrument in the free-fall fish. Instruments supported:

- AML SVP Smart Sensor
- AML CTD Micro Sensor
- SAIV SD204 CTD

- FSI MicroCTD2
- AML CTD+ Micro Sensor (AML CTD with 1 analog input – special order)
- SBE911 + CTD

DTM/Mux (Aux Sensors)
If a multi-sensor free-fall fish with a DTM/Mux is being used, this field defines the number of auxiliary serial and 0-5V sensors that are being multiplexed with the data scans coming from the main instrument. For connection of auxiliary analog/digital sensor, custom modification of the DTM in the fish may be required.

Serial – number of serial sensors

Num 0-5V Sensors – number of analog sensors

2.4.3 Instrument Interface Panel

Serial Number
The main instrument's serial number is recorded in data file headers.

Max. Depth
This field defines the maximum depth rating of the instrumentation.

This field is extremely important. If it is set too high, an instrument could output constant pressure readings once its depth rating has been exceeded. If a cast depth exceeds an instrument's rating, the system could continue to pay-out towcable because false fish depths are fed back to the winch control system.

If the maximum Sensor Depth field is changed, the operator must exit and re-enter the program before the change takes effect.

Pressure Offset
This value is used to correct a pressure gauge offset in the main instrument so that depth readings are zero at the surface. This value should be set to the instrument pressure reading at 0m depth.

Survey Lat.
Latitude of the survey area, required for conversion of pressure readings to depth values. (Reference: Unesco technical papers in marine science, 44)

Wakeup Char(s)
Instrument initialization character(s). The character(s) are output every 200 ms for a 5 second period when the 'Send WakeUp' button in the main control screen is activated. See Section 2.1.10

2.4.4 NAV Interface Panel

NAV Format
Sets the data format for the navigation data interface. Generic NMEA covers most marine electronic devices and is the only selection currently available.

- NMEA (/w checksum) – NMEA with checksums. NMEA telegrams for position, time, speed and bottom depth must include the proper checksums else they are not decoded.

- NMEA (/wo checksum) – NMEA without checksums. NMEA telegrams do not require checksums. The telegrams can include checksums but they are ignored.

Many of the NAV interface settings are derived from the standard NMEA 0183 interface protocol and the instructions for loading these are common to all. The following paragraphs apply to all NMEA settings:

1) NMEA Address is the NMEA Address Field for information from the source. This should typically include the Start of Sentence character '$', followed by the two character Talker, followed in turn by the three character Sentence Formatter. At the very least, this setting must include all three characters of the Sentence Formatter. If the user enters only the Sentence Formatter characters, the '$' should not be included. For example: '$SDDBT' or 'DBT' are valid settings for "Depth Below Transducer" as received from a sounder source, however "$DBT" is not valid.

This setting will also accommodate systems where the NMEA instrumentation is multiplexed through a commercial RS232 multiplexer box. For example,

1$GPVTG,083.7,T,104.3,M,00.8,N,01.5,K*48
2$SDDBS,0534.0,f,0163.0,M,089.0,F
are typical strings for heading (and speed) and depth from the output of a commercial RS232 multiplex box. In this case, the first string is derived from channel 1 (as indicated by the ASCII '1' preceding the '$') of the multiplexer and the second string is derived from channel 2 (as indicated by the ASCII '2' proceeding the '$'). The user would still enter:

- ***$GPVTG***, for NMEA Address for Ship Speed, and
- ***$SDDBS*** for Sounder.

2) Field defines the position in the NMEA telegram from which data is extracted. Click the up/down arrows to select the field number. Data fields are delimited by ASCII commas. The first field is the data that immediately follows the first comma after an NMEA Address. Blank fields (i.e. two commas together with no information in between them) must be counted. For example, in the following NMEA string for "Depth Below Surface":

- $SDDBS,0534.0,f,0163.0,M,089.0,F

the Field would be set at '3', for depth in meters.

NMEA Term.
ASCII character at the end of the NMEA telegram. Click on the arrow to choose LF (line feed) or CR (carriage return). It is typically set to 'LF' for most standard NMEA configurations. The program allows the used to change this setting to accommodate some non standard NMEA instruments, or systems where the NMEA instrumentation is multiplexed through a commercial RS232 multiplex box and the terminating character is changed.

NMEA Position
Identifies the NMEA address of the telegram that contains the position information - from the GPS, LORAN etc. This telegram is decoded and recorded in data file headers.

NMEA Date/Time
Identifies the NMEA address of the telegram that contains the Date/Time information - from the GPS, or other source. This telegram is decoded and recorded in data file headers.

NMEA Speed/Field
Identifies the NMEA address of the telegram that contains speed information as well as the field in the string where the speed **in knots** is recorded. This telegram is decoded and the information is used to determine if the ship's speed is within the operating envelope determined by the user Max Speed and Min Speed settings on the Main Operator screen.

NAV Timeout
The number of seconds that the system will wait for an update of general NMEA telegrams. If a telegram is not received within the specified time, the telegram buffer is initialized to 0 so that outdated telegrams are not used.

NMEA Depth/Field
Identifies the NMEA address of the telegram that contains the depth information as well as the field in the string where the depth **in meters** is recorded. This telegram is decoded and the depth value is displayed on the main control screen. This telegram is required if bottom avoidance is enabled. If there is no depth sounder information for a specific installation, the bottom avoidance must be disabled otherwise this function will not allow the fish to be deployed.

Sounder Timeout
The number of seconds that the system will wait for an update of the NMEA depth telegram which is used for bottom avoidance. If no update is received within the specified time, the bottom depth is automatically set to -99999.99, which is above the

water surface. If bottom avoidance is enabled, the deployment is terminated and the fish is recovered.

NMEA Header
Up to 10 individual NMEA telegrams can be stored in the 'Raw' data file header. Each telegram is defined by its NMEA address. These telegrams are recorded as ACSII strings. (See Appendix SW1 – 'sample1.000')

View Raw Nav can be used to verify the NAV interface configuration. Figure 15 is an example of what would appear when properly configured.

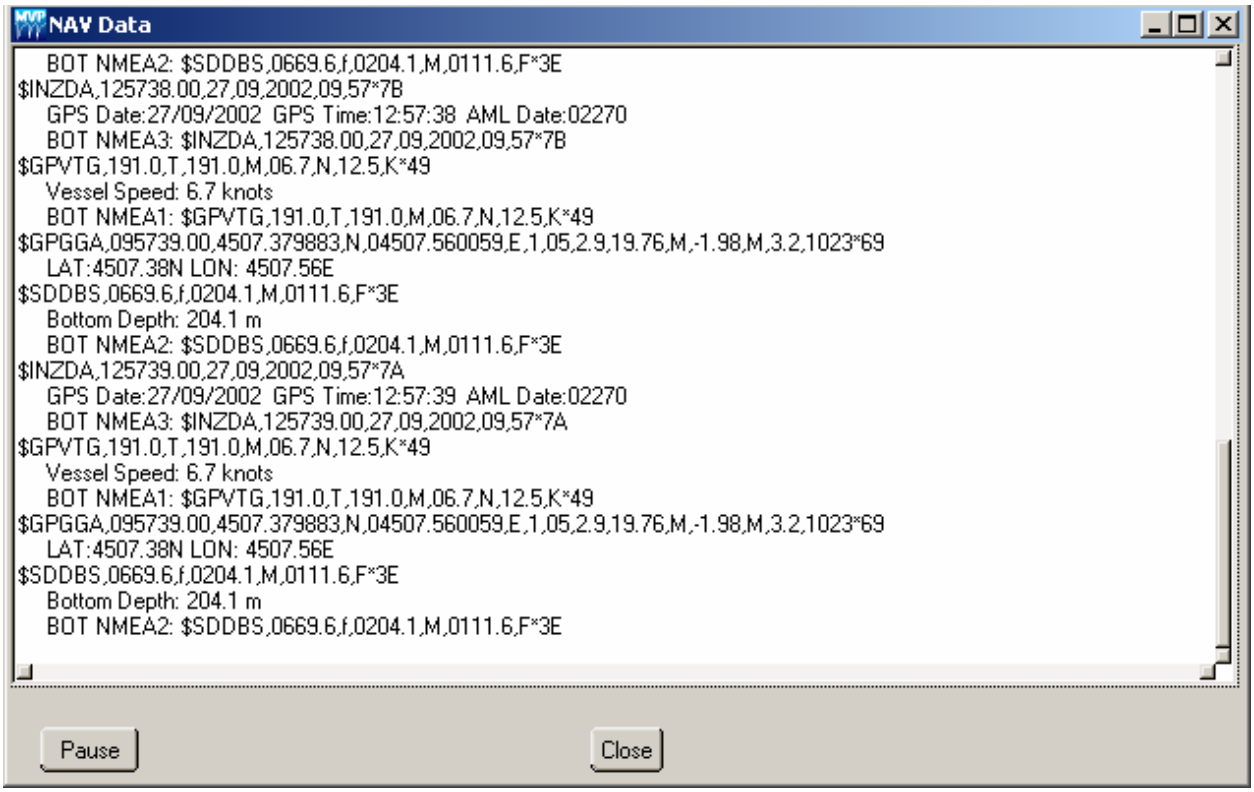

Figure 15: View Raw NAV (correct setup)

When View Raw Nav is enabled, each telegram is displayed on the screen as it is received. If the telegram is decoded properly, the results are displayed on the line(s) following the telegram. For example, the depth telegram

$SDDBS,1004.3,f,0306.1,M,0167.4,F*37,

is decoded with the results:
Bottom Depth: 306.1 m
BOT NMEA2: $SDDBS,1004.3,f,0306.1,M,0167.4,F

Figure 16 is an example of the View Raw NAV window when the NMEA address for bottom Depth was set incorrectly. ($SDDBT instead of the $SDDBS) The line “Bottom Depth: xxxx.xx” which indicates that the bottom depth telegram was decoded properly, no longer appears in the window.

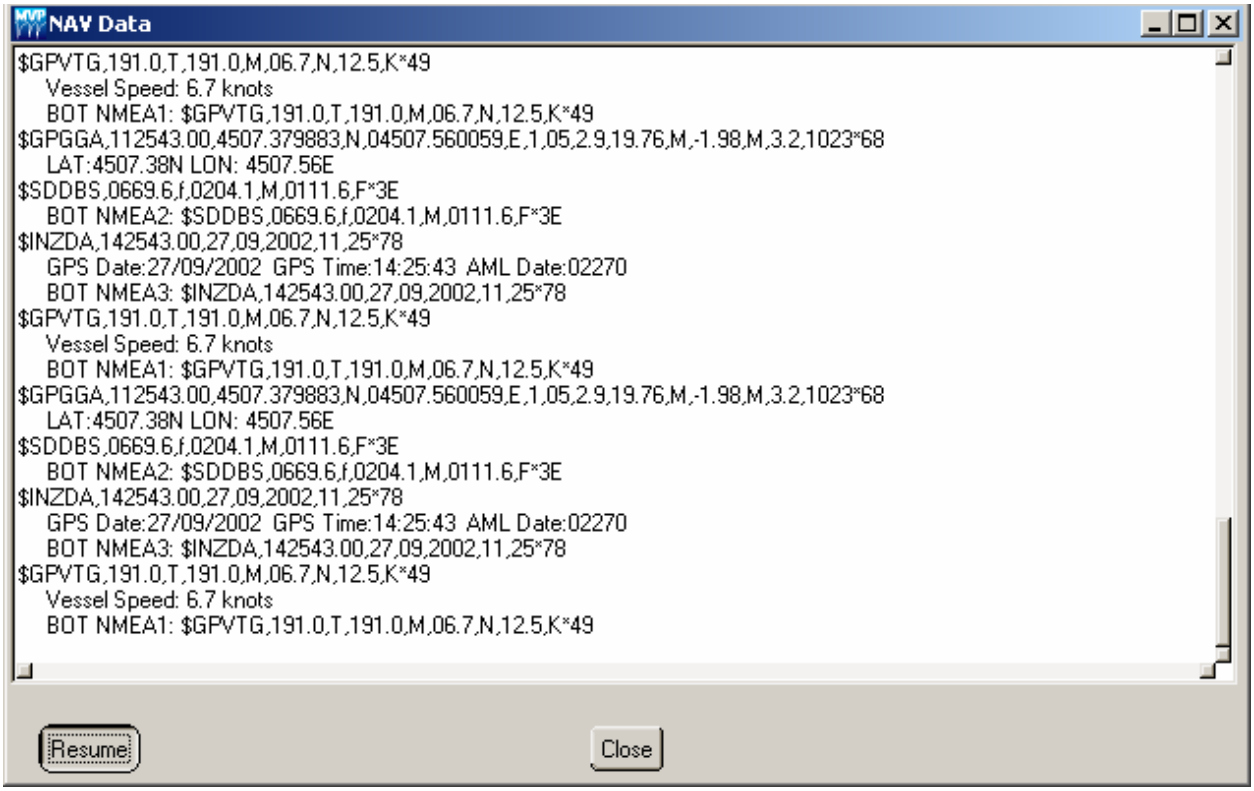

Figure 16: View Raw NAV (incorrect setup)

2.4.5 Multibeam Interface Panel

Serial Data Output Format

Defines the default SV file format that is sent out the Serial Data Out port. SV file formats are listed below.

- EM1000 (‘g’ file extension)
- EM3000 D,SV (‘h’ file extension)
- EM3000 D,SV,T,C (‘a’ file extension)
- HIPAP D,SV (‘h’ file extension)
- HIPAP D,SV,T,C (‘a’ file extension)
- AML CALC (‘c’ file extension)

- ASCII D,SV (‘d’ file extension)

- EMS00 D,SV (‘i’ file extension)

2.4.6 Instrument Communications Panel

Comm
The COM port assigned to the instrument in the free-fall fish. Instrument communications is RS422 format. Connection to the MVP controller is either on a RS422 port or through a RS422 to RS232 converter (in the controller interface box).

Baud Rate/Data Bits/Stop Bits/Parity
Selected by clicking on the arrow and choosing the appropriate setting.

Status
Allows the port to be enabled or disabled. If the MVP software cannot open a port, it is automatically disabled.

2.4.7 Controller Communications Panel

Comm
The COM port assigned to the embedded controller in the Main Control box at the winch. Controller communications is RS422 format. Connection to the MVP controller is either on a RS422 port or through a RS422 to RS232 converter (in the controller interface box).

Baud Rate/Data Bits/Stop Bits/Parity
Selected by clicking on the arrow and choosing the appropriate setting.

Status
Allows the port to be enabled or disabled. If the MVP software cannot open a port, it is automatically disabled.

2.4.8 Serial Data Out Port Panel

Comm
The COM port assigned to the multibeam or other instrument that is receiving sound velocity profiles from the MVP controller.

Baud Rate/Data Bits/Stop Bits/Parity
Selected by clicking on the arrow and choosing the appropriate setting.

Status
Allows the port to be enabled or disabled. If the MVP software cannot open a port, it is automatically disabled.

There is an enable/disable status toggle for the Towed SV function. If the Serial Data Out Port is not enabled, the Towed SV function is automatically disabled. The Towed

SV function can be assigned to the same COM-port as the output to the Sounder or to a separate port if available. The port settings default to those used by the Serial-Out port.

2.4.9 NMEA Communications Panel

Comm
The COM port assigned to NMEA 0183 strings from the ship's navigational instruments (GPS, Doppler log, etc.). The standard NMEA protocol uses 4800 baud/8 bits/1 stop/no parity. Some vessels have integrated navigation instruments that broadcast the data at other speeds.

Baud Rate/Data Bits/Stop Bits/Parity
Selected by clicking on the arrow and choosing the appropriate setting.

Status
Allows the port to be enabled or disabled. If the MVP software cannot open a port, it is automatically disabled.

NOTE: The NMEA 0183 signals, as produced by navigational instruments, are not compatible with RS232. They must be conditioned to bring them to RS232 levels. Some NMEA 0183 multiplexers provide RS232 format. Otherwise an adapter such as the B&B Electronics Model 183V2C may be used.

All RS232 COM ports may be interchanged but the user should not assign two COM ports to the same function, even if they are disabled.

2.4.10 Default Operator Settings Panel

The *Default Operator Settings* are default values for the Main Operator screen control parameters. The default settings are loaded every time the MVP software is started and every time the Configuration screen is viewed.

2.4.10.1 Depth Off Bottom.

The *Depth Off Bottom* sets the maximum cast depth safety margin.

2.4.10.2 Maximum Depth

The *Maximum Depth* setting is the maximum allowable cast depth. The value must be less than or equal to the instrument Maximum Sensor Depth setting described in Section 2.1.5.3 above.

2.4.10.3 Maximum Cable Out

The *Maximum Cable Out* setting limits the amount of towcable that can be deployed during a cast. A cast will terminate when the amount, reported by the cable counter, exceeds this value.

This setting is less than or equal to cable that is installed on the winch:

- 125 m for a model MVP30
- 300 m for a model MVP100
- 600 m for a model MVP200
- 1700m for a model MVP300-1700
- 3400 m for a model MVP300-3400
- A specific towcable length installed at the factory

In addition to being limiting by the amount of installed cable, the *Maximum Cable Out* setting is automatically reduced as the *Maximum Vessel Speed* is increased. At higher vessel speeds, drag forces on the towcable and fish, limit the amount of cable that can be output during a cast.

The following table lists performance specifications for the MVP family. The table shows the Maximum Cable Out values at various survey speeds, for each of the MVP models. The range of *Maximum Cable Out* values is automatically limited according to the table.

MVP Performance Specifications[1]

Speed (Knots)	MVP30		MVP100 (SSFF)		MVP200 (SSFF)		MVP300-1700		MVP300-3400	
	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)	Model Depth (m)	Max. Cable (m)
0	125	125	300	300	600	600	1700	1700	3400	3400
1	105	125	270	300	530	600	1400	1700	2650	3400
2	90	125	240	300	475	600	1200	1700	2250	3400
3	78	125	220	300	430	600	1050	1700	1900	3400
4	70	125	200	300	390	600	920	1700	1680	3400
5	60	125	185	300	360	600	830	1700	1500	3400
6	55	125	170	300	335	600	760	1700	1250	3110
7	50	125	160	300	310	600	690	1700	1000	2650
8	46	125	150	300	295	600	600	1700	730	1990
9	43	125	140	300	275	600	575	1630	575	1640
10	40	125	120	266	260	600	460	1360	460	1360
11	38	125	90	207	245	600	370	1130	370	1130
12	30	102	70	244	220	557	300	950	300	950
13	20	70	50	122	180	466	240	780	240	780
14	14	51	36	91	150	400	200	670	200	670
15	8	30	26	68	130	355	160	550	160	550
16	4	16	16	43	110	307	130	460	130	460
17	0	0	8	22	90	256	110	400	110	400
18	0	0	0	0	80	234	90	340	90	340
19	0	0	0	0	70	210	70	270	70	270
20	0	0	0	0	55	165	60	240	60	240

[1]*Subject to change without notice. (Source date 27/07/01)*

2.4.10.4 Depth Scale

The *Depth Scale Set* is the default vertical scale on the Depth vs. Time strip chart in the Main Panel.

2.4.10.5 Auto Deploy Interval

The *Auto Deploy Interval* is the default time interval between casts.

2.4.10.6 Max Speed (kts)

The *Maximum Speed (kts)* is the maximum speed at which MVP casts will be performed. Whenever a new speed is entered, the *Maximum Cable Out* setting is automatically set to its limiting value. (If less cable out is desired, it can be reduced after the *Maximum Vessel Speed* value has been set.)

This setting can affect the system's ability to achieve a desired profile depth. If the value is set too high, the maximum cable out may be limited, preventing a cast to the desired depth. The *Maximum Vessel Speed* should be set to a value slightly greater than the expected vessel speed.

2.4.10.7 Min Speed (kts)

Sets the minimum vessel speed that is allowed. If the vessel speed drops below this setting, the cast will terminate and the fish is recovered. This is useful when operating in a current that would cause the ship to drift over the towcable during a deployment, or if the ship has to suddenly reverse direction.

2.4.10.8 Raw Data File Name

The Raw Data File Name shows the path and name of the last raw data file recorded. The next cast will use the next file name in the sequence, which is described in section 3.

2.4.11 System Defaults Panel

The *System Defaults panel* contains configuration items that cannot be accessed by other means. These can be set by clicking the up/down arrows or by double clicking the numeric display and typing in a new value and enter.

2.4.11.1 Depth Overshoot

Depth Overshoot is a pre-trigger value, in meters, applied to the Maximum Depth termination setting. The pre-trigger value is used to compensate for the delay in brake operation. If a cast is terminated by the Maximum Depth criteria, the brake is applied when the fish depth is greater than (Maximum_Depth – Depth_OverShoot). This setting is typically 4-5 m.

2.4.11.2 Cable Overshoot

Cable Overshoot is a pre-trigger value, in meters, applied to the Maximum Cable Out termination setting. The pre-trigger value is used to compensate for the delay in brake operation. If the Maximum Cable Out criteria terminates a cast, the brake is applied when the cable-out is greater than (Maximum_Cable_Out – Cable_OverShoot). This setting is typically 4-5 m.

2.4.11.3 BIN – Min Dpth

Minimum depth value for which to compute BIN averages. Used to filter SV data by grouping into bins and computing the mean value for each bin. See section 2.2.1

2.4.11.4 BIN – Max Dpth

Maximum depth value for which to compute BIN averages. Used to filter SV data by grouping into bins and computing the mean value for each bin. See section 2.2.1

2.4.11.5 BIN – Size (m)

BIN size for which to compute BIN averages. Used to filter SV data by grouping into bins and computing the mean value for each bin. See section 2.2.1

2.4.11.6 Horiz. Chart (s)

Time scale for the Main screen strip charts.

2.4.11.7 Profiling Speed (%)

Speed at which cable is output when the winch is operated in 'Stationary' profiling mode. A setting of 30 - 35 % results in a profiling rate of approximately 1 m/s.

2.4.11.8 Recovery Speed (%)

Speed of winch during automatic recovery - freewheel and stationary profiling modes. This should be set around 50%.

CAUTION: Cable tension is a function the amount of cable out, the vessel speed, and the winch recovery speed. Setting this value incorrectly could overstress the cable during recovery. The MVP is designed for a cable recovery speed <= 1.5 m/s.

2.4.11.9 Pump On Between Casts

Pump On Between Casts is a toggle that permits the hydraulic pump to be left on when doing repetitive casts at short intervals, preventing the wear caused by constant starting and stopping of the electric motor.

2.4.11.10 Confirm Autodeploy

Confirm Auto Deploy is a toggle that, when selected, will display a confirmation window to the user before each cast when in auto deploy mode. This gives the operator the chance to abort the cast.

CAUTION: The default mode is always to request confirmation, and the user should exercise caution when disabling this feature, as deployments will continue until the Auto Deployment feature has been disabled.

2.4.11.11 View Files Automatically

View Files Automatically is a toggle which, when enabled will automatically display the profile graphs at the end of each cast.

2.4.11.12 Upload Profile Automatically

Toggle that enables the Auto Send function (see Section 2.1.8). This function can be toggled on and off at the Main Operator screen only if Upload Profile Automatically is enabled.

2.4.12 Data Logging Panel

The Data Logging configuration panel defines which files are generated with each cast. When data logging is enabled, a 'Raw' data file and a sounder-dependent SV file are generated by default. The remaining file formats are User selectable.

SV files contain down cast data only. Data files are more general, logging of upcast data can be enabled if required. To reduce the amount of data collected during the upcast/recovery-cycle, the data can be decimated.

2.4.12.1 Line Num

Survey line reference number that is stored in file headers.

2.4.12.2 Ndecimate

Number of instrument scans to skip during the upcast/recovery–cycle.

- If set to 1, 1 out of 2 scans is skipped
- If set to 2, 2 out of 3 scans are skipped
- If set to 9, 9 out of 10 scans are skipped

2.4.12.3 Data Files

This section contains a series of toggles that select which Data files are generated at the end of an MVP cast. The 'Raw' data file is generated by default. Some of the file formats are instrument dependent and can only be selected if a CTD is used. See section 3 for format descriptions.

2.4.12.4 SV Files

This section contains a series of toggles that select which SV files, are generated. A minimum of one SV file, determined by the Serial Data Out Format, is generated. See section 3 for format descriptions.

2.4.12.5 Append NMEA Footer

The 'Raw' file header contains up to 10, user defined NMEA telegrams that were recorded at the time the profile was performed. If selected, the 10 NMEA telegrams are appended to the end of the SV files that are generated.

2.4.12.6 Post Generate Files

Using the 'Raw' data file, individual Data and SV files can be generated after the survey period.

This function was written for 'Raw' files generated with MVP Controller software versions 2.11 and later. The file header contains the information on the instrument type and specifications needed to decode the raw data. This function will also work with 'Raw' files generated with an earlier version of the software. In this case, the required parameters are input from the current configuration screen:

- Main instrument type
- Number of the 0-5 V instruments
- Instrument pressure offset
- Survey latitude

Output files are generated according to the selections made in the Data Logging configuration panel.

Note: This function does not check if a file already exists. For example, if a salinity file is generated using this function, it will overwrite the salinity file that was generated during a cast – if it is in the same directory.

The GPS position and time telegrams that were stored in the 'Raw' file header are used in the SV files.

Steps to post generate files:

1. In Main System configuration panel, select the instrument used to collect the 'Raw' data file. This will enable the file selection controls for the appropriate instrument.
2. In the Default Operator Settings configuration panel, enter the root path and filename for the 'Raw' data file.
3. Under the Data logging configuration panel, select the Data and SV file format(s) to generate.
4. Select the Post Generate Files button.

2.4.13 Save and Exit Panel

The *Save and Exit* panel contains seven buttons:

- *Load* allows the operator to load a previously saved configuration file.
- *Load Default* allows the operator to load the default configuration file "config.pnl" in the program director.
- *Save* allows the operator to save a copy of the configuration to a file.
- *Make Default* allows the operator to overwrite the current default configuration file with the settings in the configuration screen.
- *Export Text File* allows the operator to export a copy of the current configuration to a text file for archival purposes.
- *Cancel* resets any changes in the configuration settings to their values before entering the Configuration Panel and returns to the Main Panel.
- *Exit* prompts the user to save the configuration settings and returns to the Main Panel.

CAUTION: The configuration files, config.pnl, etc. are binary files that cannot be edited. The only way to change the system configuration is through the System Configuration screen. This file must be present on the MVP software directory (usually c:\mvp) for the operator options/defaults to be loaded. If this file is not present, or is corrupt, the operator is informed by a pop-up window and default values will be loaded. It will then be up to the operator to reset all of the operating options/defaults and save the new settings. Once the configuration settings have been entered and saved (by clicking the Save and Exit button,) a backup copy of this file should be made. This will make it much easier to reset certain options/defaults for a particular installation or in the case of file problems.

3 Electronic Log Files

When 'Data logging' is enabled, the MVP software creates a series of output files for each cast. The files are divided into 3 groups:

- Main Instrument data files
- Auxiliary serial instrument data files
- Sound Velocity files

Soon after power up, instrument data from the MVP's free-fall fish is continuously streamed to the surface. The following figures are examples of data that is streamed.

Figure 17 is an example of data output from an MVP fish with an AML CTD installed.

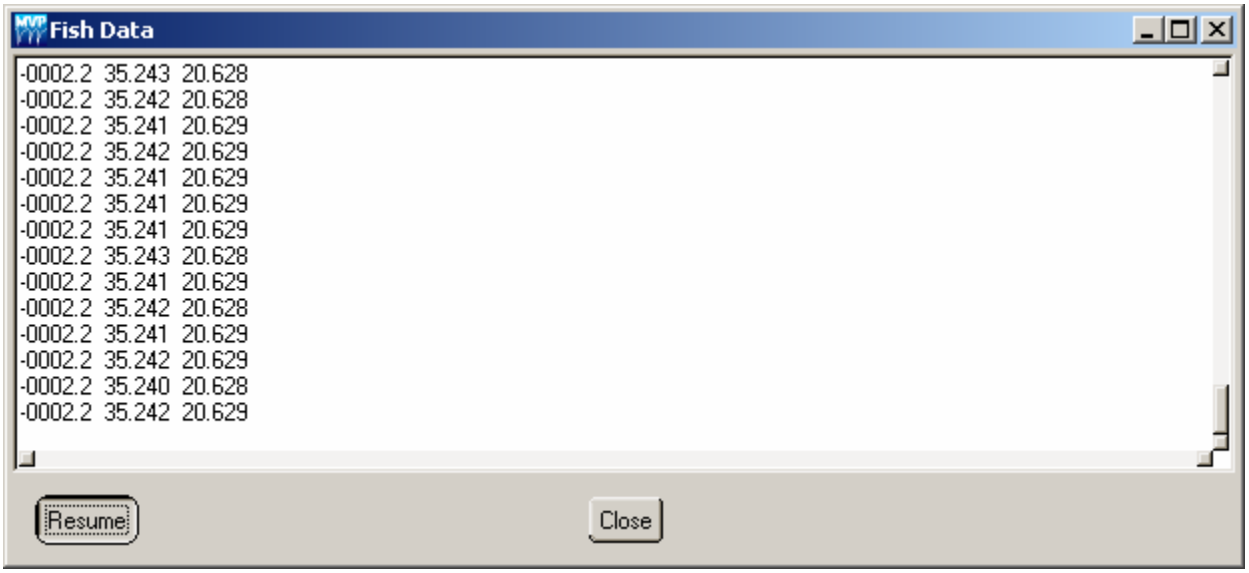

Figure 17: AML CTD data stream

Figure 18 is an example of the data output from a multi-sensor fish with a CTD as its main instrument (lines preceded by the letter 'M') and an auxiliary SVP (lines preceded by the letter 'A').

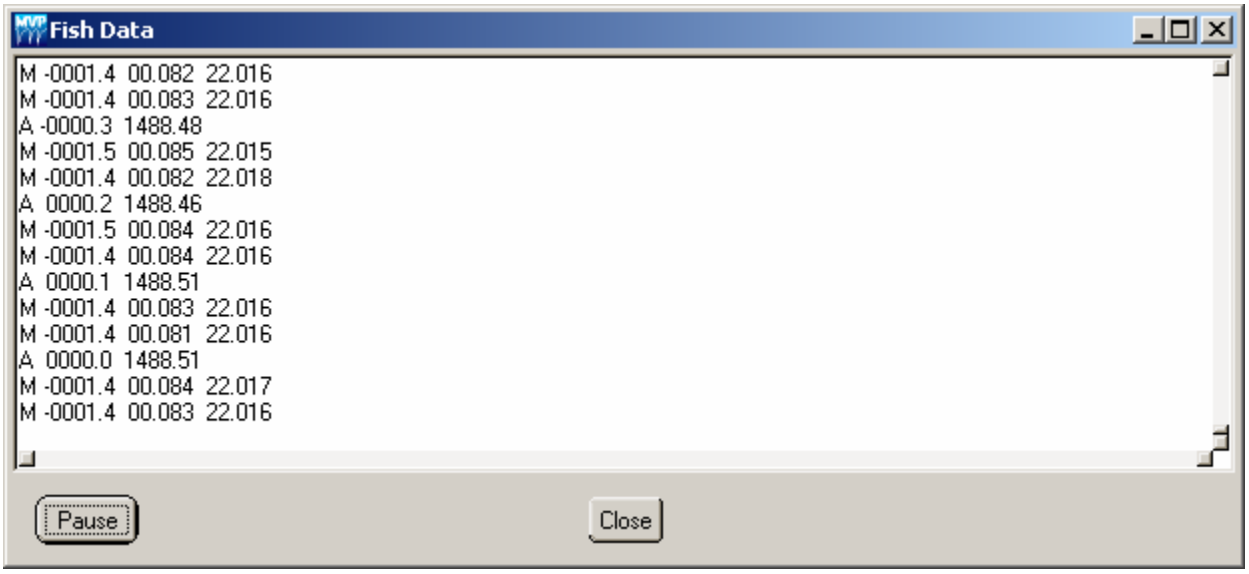

Figure 18: AML CTD + AML SVP data stream (using DTM/Mux)

The data that is streamed to the surface is written to the 'Raw' data-file as it is received from the free-fall fish. If logging of upcast data is enabled, the file is open for the full MVP cast, else the file is closed at the bottom of the cast. When logging is stopped, the 'Raw' file is used to generate the remaining Data files chosen in the Configuration screen - sound velocity, salinity, density, etc.

If a DTM/Mux is used with one or more auxiliary serial sensors, only data from the main instrument is processed. Data from auxiliary serial instrumentation are output to separate raw data files labeled with an 'aux1', 'aux2' or 'aux**n**' file extension suffix, for post analysis by the User.

Sound Velocity files consist of down cast data only. Data is sorted – monotonic. Data outside the following ranges is discarded:

- 0 <=Depth<=12000.0 (m)
- 1400.0 <= SV <= 1700.0 (m/s)
- -5 <= Temp <= 45 (deg C)
- 0 <= Cond <= 70 (mmho/cm)
- 0 <= Cond <= 7 (S/m)

3.1 Naming Convention

All the files for a particular cast have the same root name and 3-digit extension. In addition to the 3-digit extension, there is a 1-4 character file suffix which defines the file type and format.

none	RAW **data-file**
'aux1'	Auxillary Sensor 1, RAW **data-file**
'aux2'	Auxillary Sensor 2, RAW **data-file**
'a'	EM3000/HI-PAP D,SV,T,C **sound-velocity-file**
'b'	BUG **data-file**
'c'	AML Calc **sound-velocity-file**
'd'	ASCII D,SV **sound-velocity-file**
'e'	Engineering **data-file**
'g'	EM1000 **sound-velocity-file**
'h'	EM3000/HI-PAP D,SV **sound-velocity-file**
'l'	EMS00 D,SV **sound-velocity-file**
'm1'	BOT1 ***data file***
'p'	*Density* ***data file***
'r'	Conductivity ***data***
's'	Salinity **data-file**
't'	Temperature **data-file**
'u0'	User defined 0 **data-file** (AML CTD+ 0-5V output)
'u1'	User defined 1 **data-file** (DTM/MUX Sensor 1, 0-5V output)
'u2'	User defined 2 **data-file** (DTM/MUX Sensor 2, 0-5V output)
'u3'	User defined 3 **data-file** (DTM/MUX Sensor 3, 0-5V output)

Sample filename – Nov2099.000c
Root name : Nov2099
3 digit ext: 000
File type: c – AML Calc

The 3 digit extension is incremented for each subsequent cast/profile.

3.2 File Formats

The following table lists the various file formats that can be generated for each cast. The first column lists the file suffix and format types. The second column lists the tow fish instrumentation that is required in order for the file format to be generated. The third column lists the serial data out configuration(s) that will produce each format. Selection depends on the instrument being used. The last column is a brief description of each format. All files are ASCII text.

File Suffix/ Type	Instrument Type	Serial Data Out Cfg.	File Format
No-suffix Raw Data File	Any	Any	File contains the raw data as received from the free-fall fish instrument. If a DTM/Mux is used, the file also contains the multiplexed 0-5V sensor data. A general header is added which includes time, date, position, bottom depth, and ship speed at the time the start button was pressed. Since version 2.11, the raw file header has been enhanced to include several configuration parameters and up to 10 user selected NMEA telegrams. Units: **Cond** – mmho/cm (mS/cm), CTD only **Temp** – degrees Celsius CTD only **Pressure** – dbar, SV&P or CTD **SV** – m/s, SV&P only **U0** - 0.000 - 5.000 (0-5V Sensor #0, AML CTD+) **U1*** - A/D cnt 0-4095 (0-5V Sensor #1, 1.221mV/LSB) **U2*** - A/D cnt 0-4095 (0-5V Sensor #2, 1.221mV/LSB) **U3*** - A/D cnt 0-4095 (0-5V Sensor #3, 1.221mV/LSB) * DTM/Mux required **Bug** – BugTotal (OPC only) **Format Spec**: see file *sample1.000*
'aux1' 'aux2' 'aux3' … Auxiliary Serial Instrument Raw Data FileS	Any DTM/Mux Required	Any	File contains the raw data from the free-fall fish – auxiliary serial instrumentation. A DTM/Mux is required. The file formats are defined by the output format of the individual instruments connected.
'a' EM3000/ HI-PAP D,SV,T,C Sound Velocity File	CTD	EM3000 D,SV,T,C HI-PAP D,SV,T,C	Simrad 'S13' format. Includes time and position encoding, depth vs. SV profile, with T and C. (Format is a beta version) Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s, computed from CTD **Temp** – degrees celsius **Cond** – S/m (CTD probe Cond mmho/cm converted to S/m) Sound velocity values are computed. Computation of Sound Velocity – Reference: Sound speed in seawater after Millero and Chen 1977, JASA, 62, 1129-1135 **Format Spec**: see file *sample1.000a.*

File Suffix/ Type	Instrument Type	Serial Data Out Cfg.	File Format
'b' Bug Data File	LOPC	Any	Two columns of data – depth in m and total particles. Units : **Depth** – m, (instrument pressure is converted to depths) **Bug** – BugTotal **Format Spec**: see file *sample1.000b*
'c' AML Calc Sound Velocity File	SV&P CTD	AML Calc	AML Calc format Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s Depth values are binned in 1m increments. Interval is fixed at 1 m. No template is used. Sound velocity values are either computed (CTD instrument) or measured directly (SV&P instrument). A position is tacked on the end of the file – after the AML Calc file termination characters - position footer information. PCdate also appended to end of file. **Format Spec**: see file *sample1.000c*
'd' ASCII D,SV Sound Velocity File	SV&P CTD	ASCII D,SV	Two columns of data – depth in m and sound velocity in m/s. If the sensor is a CTD, sound velocities are computed using UNESCO Equations of State. Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s Sound velocity values are either computed (CTD instrument) or measured directly (SV&P instrument). **Format Spec**: see file *sample1.000d*
'e' MVP ENG. Data File	*Any	*Any	File contains system status information to assist in assessing system performance. Each scan consists of Engineering data from embedded controller plus probe depth, bottom depth and ship's speed. Data is written to file as it is received from the embedded controller with the current probe depth, bottom depth, and ship's speed appended. The embedded controller's scan rate is 5 Hz. **Format Spec**: see file *sample1.000e*

File Suffix/ Type	Instrument Type	Serial Data Out Cfg.	File Format
'g' EM1000 Sound Velocity File	SV&P CTD	EM1000	100 point AML Calc file - decimated version of the AML Calc format. EM1000 can only handle 100 depth bins. A template file is used to define the depths, else 1-100 is chosen by default. File will contain 100 data points or less. Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s Template file ***simtable.txt*** must exist in the MVP program directory. If there is an error in loading or the file can not be found, default values are used. Template file must contain a minimum of 100 points else default values are used. Sound velocity values are either computed (CTD instrument) or measured directly (SV&P instrument). A position is tacked on the end of the file – after the AML Calc file termination characters – position footer information. PCdate also appended to end of file. **Format Spec**: see file *sample1.000g*
'h' EM3000/ HI-PAP D,SV Sound Velocity File	SV&P CTD	EM3000 D,SV HI-PAP D,SV	Simrad "S01" format - depth vs. SV profile. (Format is a beta version) Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s Sound velocity values are either computed (CTD instrument) or measured directly (SV&P instrument). **Format Spec**: see file *sample1.000h*
'i' EMS00 D,SV Sound Velocity File	SV&P CTD	EMS00 D,SV	Simrad 'S00' format - Depth vs. SV profile. (Format is a beta version) Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s Sound velocity values are either computed (CTD instrument) or measured directly (SV&P instrument). **Format Spec**: see file *sample1.000I*
'j' EMS12 D,SV,T,S Sound Velocity File	CTD	EMS12 D,SV,T,S	Simrad 'S12' format - Depth vs. SV profile with temperature and salinity. (Format is a beta version) Units: **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s **Temp** – degrees celsius **Sal** – psu, Sal78 PSS-78 Sound velocity values are computed. **Format Spec**: see file *sample1.000j*

File Suffix/ Type	Instrument Type	Serial Data Out Cfg.	File Format
'm1' BOT1 'ALL' Data File	CTD	Any	All file includes RAW file header, column header labels, and columns of data: pressure, conductivity, temperature, depth, sound velocity, salinity and density. *If an AML CTD+ and/or a DTM/Mux are used, file also includes the 0-5V sensors readings. Units: **Pressure** – dbar **Cond** – mmho/cm (mS/cm) **Temp** – degrees Celsius **Depth** – m, (instrument pressure is converted to depths) **SV** – m/s **Sal** – psu, Sal78 PSS-78 **Density** – kg/m^3 ***mV0** - mV (0.0 to 5000.0) ***mV1** - mV (0.0 to 5000.0) ***mV2** - mV (0.0 to 5000.0) ***mV3** - mV (0.0 to 5000.0) **Format Spec**: see file *sample1.000m1*
'p' Density Data File	CTD	Any	Two columns of data – depth and density Units: **Depth** – m, (instrument pressure is converted to depths) **Density** – kg/m^3 Computation of Density - Reference: UNESCO technical paper in marine science, 44, Algorithms for computation of fundamental properties of seawater, Unesco 1983 **Format Spec**: see file *sample1.000p*
'r' COND Data File	CTD	Any	Two columns of data – depth and conductivity Units: **Depth** – m, (instrument pressure is converted to depths) **Cond** – mmho/cm (mS/cm) **Format Spec**: see file *sample1.000s*
's' SAL. Data File	CTD	Any	Two columns of data – depth in m and salinity in psu. Units: **Depth** – m, (instrument pressure is converted to depths) **Sal** – psu, Sal78 PSS-78, Computation of Salinity - References: UNESCO Report No. 37, 1981, Practical Salinity Scale 1978, E. L. Lewis, IEEE JOE Jan 1980 **Format Spec**: see file *sample1.000s*

File Suffix/ Type	Instrument Type	Serial Data Out Cfg.	File Format
't' TEMP. Data File	CTD	Any	Two columns of data – depth in m and temperature in degrees C. Units: **Depth** – m, (instrument pressure is converted to depths) **Temp** – degrees Celsius **Format Spec**: see file *sample1.000t*
'u0' User-Defined0 Data File	AML CTD+	Any	Two columns of data – depth in m and User Sensor 0 Output, 0-5000.0 mV. Units: **Depth** – m, (instrument pressure is converted to depths) **Sensor 0 Output** – 0 – 5000 mV ***Format Spec****: see file* sample1.000u0
'u1' User-Defined1 Data File	DTM/Mux + 1-3 sensors	Any	Two columns of data – depth in m and User Sensor 1 Output, 0-5000.0 mV. Units: **Depth** – m, (instrument pressure is converted to depths) **Sensor 1 Output** – 0 – 5000 mV ***Format Spec****: see file* sample1.000u1
'u2' User-Defined2 Data File	DTM/Mux + 2-3 sensors	Any	Two columns of data – depth in m and User Sensor 2 Output, 0-5000.0 mV. Units: **Depth** – m, (instrument pressure is converted to depths) **Sensor 2 Output** – 0 – 5000 mV ***Format Spec****: see file* sample1.000u2
'u3' User-Defined3 Data File	DTM/Mux + 3 sensors	Any	Two columns of data – depth in m and User Sensor 3 Output, 0-5000.0 mV. Units: **Depth** – m, (instrument pressure is converted to depths) **Sensor 3 Output** – 0 – 5000 mV ***Format Spec****: see file* sample1.000u3

Sample files can be found in Appendix SWI.

3.2.1.1 Simrad Sound Velocity Template Files

The Simrad EM1000 sounder will accept a maximum of 100 SV data points. A template file method has been adopted to allow the user to choose the points to send to the EM1000. The template file, "SimTable.txt" must exist in the MVP directory (usually c:\mvp) before the deployment, or a default template will be used (1 to 100 meters at 1-meter increments). The software will warn the user if the default template is being used.

Template files are simple ASCII files created in Notepad etc. They may contain 1 line of header information, which is for information only and is completely ignored by the MVP

software. The rest of the file contains 100 depth points (in ascending order,) which the MVP software will use to log the next SV point for the file. The file must contain a minimum of 100 points else the default values are used.

The only method to choose a new template file is to overwrite the current template file with a new one. The MVP software will always use the template file with the name "SimTable.txt". Other template files ("SimTab_1-300.txt" etc.) will have to be copied/renamed to "SimTable.txt" for the new template to take effect. This can be done with the windows explorer program.

3.2.1.2 Default Configuration File

The MVP uses a configuration file to set up default settings whenever the program is loaded. The configuration can get rather cumbersome, especially if you have not written down all of the RS232 port settings, NMEA strings etc. The software will always look for a file named "config.pnl" on the MVP directory (usually c:\mvp) whenever the program is started. If there is no file with that name in the directory, "hard coded" defaults will be used. The user may then enter the View/Configure System menu and change these values. When the "Exit" button is pressed, a new "config.pnl" file will be written. It is strongly recommended that a backup copy of this configuration file be made on a separate floppy in case the file in the MVP directory gets corrupted, or accidentally erased. Thirty seconds of effort now may save you hours later.

NOTE: A copy of the template files (SimTable.txt) should also be made at this time.

APPENDIX SW1

Sample Data Files

sample1.000 (*RAW data-file****)***

PC Time: 14:01:45
PC Date: 09-27-2002
GPS Position: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
GPS Time:
Bottom Depth: 194.2
Ship Speed: 3.5
****
Version: 2.17
Line Number: 00000
Instrument Type: 2, AML_CTD_Micro_Sensor
Serial Number: 1234
Press Offset: 0.0
AUX. Serial Sensors: 0
Number 5V Inputs: 3
Survey Latitude: 45.000
BOT F1: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F2: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F3: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F4: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F5: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F6: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F7: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F8: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F9: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F10: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
Ndecimate: 0
****

0003.1 35.670 12.115 0010 0001 0000
0003.1 35.621 12.116 0020 0002 0000
0003.3 35.633 12.099 0030 0003 0001
0003.4 35.585 12.095 0040 0004 0001
0003.5 35.578 12.060 0050 0005 0002
0003.6 35.565 12.056 0060 0006 0002
0003.8 35.548 12.033 0070 0007 0002
0004.1 35.488 11.994 0080 0008 0003
0004.2 35.436 11.925 0090 0009 0003
0004.7 35.421 11.874 0100 0010 0004
0004.6 35.424 11.861 0110 0011 0004
0005.1 35.379 11.833 0120 0012 0004
0005.4 35.340 11.797 0130 0013 0005
0006.0 35.292 11.752 0140 0014 0005
0006.4 35.225 11.702 0150 0015 0006
0006.9 35.166 11.636 0160 0016 0006
0007.2 35.167 11.576 0170 0017 0006
0007.8 35.165 11.525 0180 0018 0007
0008.4 35.203 11.530 0190 0019 0007
0008.9 35.262 11.566 0200 0020 0008
0009.6 35.245 11.574 0210 0021 0008
0009.8 35.265 11.607 0220 0022 0008
0010.6 35.253 11.579 0230 0023 0009
0011.2 35.276 11.586 0240 0024 0009
0011.8 35.269 11.613 0250 0025 0010
0012.4 35.280 11.605 0260 0026 0010

0013.2 35.281 11.593 0270 0027 0010
0013.8 35.307 11.612 0280 0028 0011
0014.3 35.336 11.629 0290 0029 0011
0015.1 35.315 11.628 0300 0030 0012
0015.8 35.321 11.632 0310 0031 0012
0016.3 35.328 11.628 0320 0032 0012
0017.2 35.310 11.616 0330 0033 0013
0018.0 35.291 11.592 0340 0034 0013
0018.7 35.302 11.590 0350 0035 0014
0019.4 35.311 11.578 0360 0036 0014

sample1.000a (*EM3000/HI-PAP D,SV,T,C sound-velocity-file)*

```
$MVS13,0,31,14,01,52,27,09,2002
   3.07,1492.15,12.11, 3.57
   3.27,1492.07,12.10, 3.56
   3.37,1492.01,12.10, 3.56
   3.47,1491.91,12.06, 3.56
   3.57,1491.89,12.06, 3.56
   3.77,1491.82,12.03, 3.55
   4.07,1491.66,11.99, 3.55
   4.17,1491.43,11.93, 3.54
   4.66,1491.29,11.87, 3.54
   5.06,1491.15,11.83, 3.54
   5.36,1491.02,11.80, 3.53
   5.95,1490.86,11.75, 3.53
   6.35,1490.66,11.70, 3.52
   6.84,1490.44,11.64, 3.52
   7.14,1490.30,11.58, 3.52
   7.74,1490.18,11.52, 3.52
   8.33,1490.24,11.53, 3.52
   8.83,1490.41,11.57, 3.53
   9.52,1490.42,11.57, 3.52
   9.72,1490.53,11.61, 3.53
  10.51,1490.46,11.58, 3.53
  11.11,1490.51,11.59, 3.53
  11.70,1490.58,11.61, 3.53
  12.30,1490.58,11.60, 3.53
  13.09,1490.57,11.59, 3.53
  13.69,1490.65,11.61, 3.53
  14.18,1490.74,11.63, 3.53
  14.98,1490.72,11.63, 3.53
  15.67,1490.75,11.63, 3.53
  16.17,1490.76,11.63, 3.53
  17.06,1490.72,11.62, 3.53
4503.29,N,6055.60,W,MVP,/
```

sample1.000c *(AML Calc sound-velocity-file)*

CALC,0000,09-27-2002,1,meters
AML SOUND VELOCITY PROFILER S/N:01234
DATE:02270 TIME:1401
DEPTH OFFSET (M):00000.0
DEPTH (M) VELOCITY (M/S) TEMP (C)
3.07 1492.15 12.11
4.07 1491.66 11.99
5.06 1491.15 11.83
6.35 1490.66 11.70
7.14 1490.30 11.58
8.33 1490.24 11.53
9.52 1490.42 11.57
10.51 1490.46 11.58
11.11 1490.51 11.59
12.30 1490.58 11.60
13.09 1490.57 11.59
14.18 1490.74 11.63
15.67 1490.75 11.63
16.17 1490.76 11.63
17.06 1490.72 11.62
18.55 1490.67 11.59
19.24 1490.66 11.58
20.04 1490.65 11.58
0 0 0
$GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
PCdate: 09-27-2002

sample1.000d *(ASCII D,SV sound-velocity-file)*

3.07 1492.15
3.27 1492.07
3.37 1492.01
3.47 1491.91
3.57 1491.89
3.77 1491.82
4.07 1491.66
4.17 1491.43
4.66 1491.29
5.06 1491.15
5.36 1491.02
5.95 1490.86
6.35 1490.66
6.84 1490.44
7.14 1490.30
7.74 1490.18
8.33 1490.24
8.83 1490.41
9.52 1490.42
9.72 1490.53
10.51 1490.46
11.11 1490.51
11.70 1490.58
12.30 1490.58
13.09 1490.57
13.69 1490.65
14.18 1490.74
14.98 1490.72
15.67 1490.75
16.17 1490.76
17.06 1490.72

sample1.000e *(Engineering data-file)*

PC Time: 14:01:45
PC Date: 09-27-2002
GPS Position: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
GPS Time:
Bottom Depth: 194.2
Ship Speed: 3.5
****
Version: 2.17
Line Number: 00000
Instrument Type: 2, AML_CTD_Micro_Sensor
Serial Number: 1234
Press Offset: 0.0
AUX. Serial Sensors: 0
Number 5V Inputs: 3
Survey Latitude: 45.000
BOT F1: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F2: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F3: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F4: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F5: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F6: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F7: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F8: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F9: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F10: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
Ndecimate: 0
****

CblCtr, CblSpd, Tens, HPress, Boom, Pot, DocSw, Pumpa, Pumpb, Brk, HrtBt, EStop, Auto, FW, WOP, MS0, RWin, RWOut, Mot, Dir, FDpth, BDpth, Spd

000011 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.07 194.50 3.5
000022 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.07 194.53 3.5
000033 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.07 194.53 3.5
000044 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.27 194.55 3.5
000055 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.37 194.55 3.5
000066 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.47 194.55 3.5
000077 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.57 194.58 3.5
000088 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 3.77 194.58 3.5
000099 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 4.07 194.60 3.5
000110 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 4.17 194.60 3.5
000121 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 4.66 194.60 3.5
000132 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 4.56 194.62 3.5
000143 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 5.06 194.62 3.5
000154 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 5.36 194.65 3.5
000165 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 5.95 194.65 3.5
000176 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 6.35 194.65 3.5
000187 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 6.84 194.68 3.5
000198 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 7.14 194.68 3.5
000209 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 7.74 194.70 3.5
000220 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 8.33 194.70 3.5
000231 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 8.83 194.70 3.5
000242 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 9.52 194.73 3.5
000253 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 9.72 194.73 3.5

000264 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 10.51 194.75 3.5
000275 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 11.11 194.75 3.5
000286 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 11.70 194.75 3.5
000297 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 12.30 194.78 3.5
000308 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 13.09 194.78 3.5
000319 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 13.69 194.80 3.5
000330 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 14.18 194.80 3.5
000341 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 14.98 194.80 3.5
000352 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 15.67 194.83 3.5
000363 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 16.17 194.83 3.5
000374 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 17.06 194.85 3.5
000385 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 17.85 194.85 3.5
000396 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 18.55 194.85 3.5
000407 021000 1000 1000 1000 1000 01 00000 00000 0 0 0 0 1 1 1 1 1 1 0 19.24 194.88 3.5

Embedded Controller Data Strings

The embedded controller provides system status information to the MVP Controller every 200ms. The data consists of the following fields:

aaaaaa bbbbbb cccc dddd eeee ffff gg hhhhh iiiii j k l m n o p q r s t<cr><lf>, where:

aaaaaa is the current cable counter count - in “magnets” having passed the sensor
bbbbbb is the time since the last magnet passed the counter, in usec. (times beyond 99999 are set to zero)
cccc is the current reading from the strain gage (AIN[0] in mV)
dddd is the current reading from the hydraulic pressure gage (AIN[0] in mV)
eeee is the current reading from the boom position potentiometer (AIN[0] in mV)
ffff is the current reading from the “speed adjust” pot on the TT8 embedded controller board (AIN[0] in mV)
gg is the current count from the Outer Boom (“Dock”) switch
hhhhh is the current setting for the Pump A pulse width modulation system (0 to 16383)
iiiii is the current setting for the Pump B pulse width modulation system (0 to 16383)
j is the status of the brake (1 = “On”)
k is the status of the HeartBeatStopFlag (1=error)
l is the status of the Emergency Stop circuit (SPI_2[7], 1 = tripped)
m is the status of the Hand/Off/Auto switch (SPI_2[6], 1 = Hand)
n is the status of the F/W switch (SPI_2[5], 1 = F/W)
o is the status of the WOP switch (SPI_2[4], 1 = WOP)
p is the status of the MS0 switch on the embedded controller board (SPI_2[3], 1=Heartbeat Enabled)
q is the status of the RWIN switch (SPI_2[2], 1 = RWIN)
r is the status of the RWOUT switch (SPI_2[1], 1 = RWOUT)
s is the status of the motor contactor in the High Power Box (SPI_2[0], 1= Motor On)
***t** is the winch direction (1= Out)*

sample1.000g *(EM1000 sound-velocity-file)*

```
CALC,0000,09-27-2002,1,meters
AML SOUND VELOCITY PROFILER S/N:01234
DATE:02270 TIME:1401
DEPTH OFFSET (M):00000.0
DEPTH (M) VELOCITY (M/S) TEMP (C)
 3.07  1492.15  12.11
 4.07  1491.66  11.99
 5.06  1491.15  11.83
 6.35  1490.66  11.70
 7.14  1490.30  11.58
 8.33  1490.24  11.53
 9.52  1490.42  11.57
10.51  1490.46  11.58
11.11  1490.51  11.59
12.30  1490.58  11.60
13.09  1490.57  11.59
14.18  1490.74  11.63
15.67  1490.75  11.63
16.17  1490.76  11.63
17.06  1490.72  11.62
18.55  1490.67  11.59
19.24  1490.66  11.58
20.04  1490.65  11.58
 0  0  0
$GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
PCdate: 09-27-2002
```

sample1.000h *(EM3000/HI-PAP D,SV sound-velocity-file)*

$MVS01,0,35,14,01,52,27,09,2002
3.07,1492.15
3.27,1492.07
3.37,1492.01
3.47,1491.91
3.57,1491.89
3.77,1491.82
4.07,1491.66
4.17,1491.43
4.66,1491.29
5.06,1491.15
5.36,1491.02
5.95,1490.86
6.35,1490.66
6.84,1490.44
7.14,1490.30
7.74,1490.18
8.33,1490.24
8.83,1490.41
9.52,1490.42
9.72,1490.53
10.51,1490.46
11.11,1490.51
11.70,1490.58
12.30,1490.58
13.09,1490.57
13.69,1490.65
14.18,1490.74
14.98,1490.72
15.67,1490.75
16.17,1490.76
17.06,1490.72
17.85,1490.65
18.55,1490.67
19.24,1490.66
20.04,1490.65
4503.29,N,6055.60,W,MVP,/

sample1.000i *(EMS00 D,SV sound-velocity-file)*

```
$MVS00,00000,0035,140152,27,09,2002,    3.07,1492.15,,,
   3.27,1492.07,,,
   3.37,1492.01,,,
   3.47,1491.91,,,
   3.57,1491.89,,,
   3.77,1491.82,,,
   4.07,1491.66,,,
   4.17,1491.43,,,
   4.66,1491.29,,,
   5.06,1491.15,,,
   5.36,1491.02,,,
   5.95,1490.86,,,
   6.35,1490.66,,,
   6.84,1490.44,,,
   7.14,1490.30,,,
   7.74,1490.18,,,
   8.33,1490.24,,,
   8.83,1490.41,,,
   9.52,1490.42,,,
   9.72,1490.53,,,
  10.51,1490.46,,,
  11.11,1490.51,,,
  11.70,1490.58,,,
  12.30,1490.58,,,
  13.09,1490.57,,,
  13.69,1490.65,,,
  14.18,1490.74,,,
  14.98,1490.72,,,
  15.67,1490.75,,,
  16.17,1490.76,,,
  17.06,1490.72,,,
  17.85,1490.65,,,
  18.55,1490.67,,,
  19.24,1490.66,,,
  20.04,1490.65,,,
4503.29,N,06055.60,W,
*56\
```

sample1.000j (EMS12 D,SV,T,S sound-velocity-file)

$MVS12,00000,0033,140152,27,09,2002, 3.07,1492.15, 12.11,30.72,
3.27,1492.07, 12.10,30.69,
3.37,1492.01, 12.10,30.65,
3.47,1491.91, 12.06,30.67,
3.57,1491.89, 12.06,30.66,
3.77,1491.82, 12.03,30.67,
4.07,1491.66, 11.99,30.64,
4.17,1491.43, 11.93,30.65,
4.66,1491.29, 11.87,30.67,
5.06,1491.15, 11.83,30.67,
5.36,1491.02, 11.80,30.66,
5.95,1490.86, 11.75,30.65,
6.35,1490.66, 11.70,30.63,
6.84,1490.44, 11.64,30.62,
7.14,1490.30, 11.58,30.67,
7.74,1490.18, 11.52,30.71,
8.33,1490.24, 11.53,30.75,
8.83,1490.41, 11.57,30.77,
9.52,1490.42, 11.57,30.75,
9.72,1490.53, 11.61,30.74,
10.51,1490.46, 11.58,30.75,
11.11,1490.51, 11.59,30.77,
11.70,1490.58, 11.61,30.74,
12.30,1490.58, 11.60,30.76,
13.09,1490.57, 11.59,30.77,
13.69,1490.65, 11.61,30.78,
14.18,1490.74, 11.63,30.79,
14.98,1490.72, 11.63,30.77,
15.67,1490.75, 11.63,30.77,
16.17,1490.76, 11.63,30.78,
17.06,1490.72, 11.62,30.78,
17.85,1490.65, 11.59,30.78,
18.55,1490.67, 11.59,30.79,
4503.29,N,06055.60,W,
**73*

sample1.000m1 *(BOT1 data-file)*

PC Time: 14:01:45
PC Date: 09-27-2002
GPS Position: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
GPS Time:
Bottom Depth: 194.2
Ship Speed: 3.5
****
Version: 2.17
Line Number: 00000
Instrument Type: 2, AML_CTD_Micro_Sensor
Serial Number: 1234
Press Offset: 0.0
AUX. Serial Sensors: 0
Number 5V Inputs: 3
Survey Latitude: 45.000
BOT F1: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F2: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F3: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F4: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F5: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F6: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F7: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F8: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F9: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
BOT F10: $GPGGA,185910,4503.2858,N,6055.598,W,2,6,1.2,15.1,M,-20,M,2,334
Ndecimate: 0
****

P(dbar),C(mmho/cm),T(degC),Dpth(m),SV(m/s),S(PSS-78),Rho(kg/m^3),U1(mV),U2(mV),U3(mV)
3.10, 35.670, 12.115, 3.07, 1492.15, 30.716, 1023.257, 0012.2, 0001.2, 0000.0
3.10, 35.621, 12.116, 3.07, 1492.09, 30.668, 1023.220, 0024.4, 0002.4, 0000.0
3.30, 35.633, 12.099, 3.27, 1492.07, 30.693, 1023.244, 0036.6, 0003.7, 0001.2
3.40, 35.585, 12.095, 3.37, 1492.01, 30.651, 1023.212, 0048.8, 0004.9, 0001.2
3.50, 35.578, 12.060, 3.47, 1491.91, 30.673, 1023.236, 0061.1, 0006.1, 0002.4
3.60, 35.565, 12.056, 3.57, 1491.89, 30.664, 1023.230, 0073.3, 0007.3, 0002.4
3.80, 35.548, 12.033, 3.77, 1491.82, 30.666, 1023.237, 0085.5, 0008.5, 0002.4
4.10, 35.488, 11.994, 4.07, 1491.66, 30.640, 1023.226, 0097.7, 0009.8, 0003.7
4.20, 35.436, 11.925, 4.17, 1491.43, 30.647, 1023.244, 0109.9, 0011.0, 0003.7
4.70, 35.421, 11.874, 4.66, 1491.29, 30.675, 1023.277, 0122.1, 0012.2, 0004.9
4.60, 35.424, 11.861, 4.56, 1491.26, 30.688, 1023.289, 0134.3, 0013.4, 0004.9
5.10, 35.379, 11.833, 5.06, 1491.15, 30.668, 1023.281, 0146.5, 0014.7, 0004.9
5.40, 35.340, 11.797, 5.36, 1491.02, 30.660, 1023.282, 0158.7, 0015.9, 0006.1
6.00, 35.292, 11.752, 5.95, 1490.86, 30.650, 1023.286, 0170.9, 0017.1, 0006.1
6.40, 35.225, 11.702, 6.35, 1490.66, 30.627, 1023.278, 0183.2, 0018.3, 0007.3
6.90, 35.166, 11.636, 6.84, 1490.44, 30.624, 1023.290, 0195.4, 0019.5, 0007.3
7.20, 35.167, 11.576, 7.14, 1490.30, 30.674, 1023.341, 0207.6, 0020.8, 0007.3
7.80, 35.165, 11.525, 7.74, 1490.18, 30.715, 1023.384, 0219.8, 0022.0, 0008.5
8.40, 35.203, 11.530, 8.33, 1490.24, 30.747, 1023.411, 0232.0, 0023.2, 0008.5
8.90, 35.262, 11.566, 8.83, 1490.41, 30.774, 1023.428, 0244.2, 0024.4, 0009.8
9.60, 35.245, 11.574, 9.52, 1490.42, 30.751, 1023.412, 0256.4, 0025.6, 0009.8
9.80, 35.265, 11.607, 9.72, 1490.53, 30.743, 1023.401, 0268.6, 0026.9, 0009.8
10.60, 35.253, 11.579, 10.51, 1490.46, 30.754, 1023.418, 0280.8, 0028.1, 0011.0
11.20, 35.276, 11.586, 11.11, 1490.51, 30.770, 1023.432, 0293.0, 0029.3, 0011.0
11.80, 35.269, 11.613, 11.70, 1490.58, 30.741, 1023.407, 0305.2, 0030.5, 0012.2

12.40, 35.280, 11.605, 12.30, 1490.58, 30.758, 1023.424, 0317.5, 0031.7, 0012.2
13.20, 35.281, 11.593, 13.09, 1490.57, 30.768, 1023.438, 0329.7, 0033.0, 0012.2
13.80, 35.307, 11.612, 13.69, 1490.65, 30.778, 1023.445, 0341.9, 0034.2, 0013.4
14.30, 35.336, 11.629, 14.18, 1490.74, 30.791, 1023.455, 0354.1, 0035.4, 0013.4
15.10, 35.315, 11.628, 14.98, 1490.72, 30.771, 1023.443, 0366.3, 0036.6, 0014.7
15.80, 35.321, 11.632, 15.67, 1490.75, 30.774, 1023.447, 0378.5, 0037.9, 0014.7
16.30, 35.328, 11.628, 16.17, 1490.76, 30.784, 1023.458, 0390.7, 0039.1, 0014.7
17.20, 35.310, 11.616, 17.06, 1490.72, 30.776, 1023.458, 0402.9, 0040.3, 0015.9
18.00, 35.291, 11.592, 17.85, 1490.65, 30.777, 1023.467, 0415.1, 0041.5, 0015.9
18.70, 35.302, 11.590, 18.55, 1490.67, 30.789, 1023.480, 0427.4, 0042.7, 0017.1
19.40, 35.311, 11.578, 19.24, 1490.66, 30.807, 1023.500, 0439.6, 0044.0, 0017.1

sample1.000p *(Density data-file)*

3.07 1023.257
3.07 1023.220
3.27 1023.244
3.37 1023.212
3.47 1023.236
3.57 1023.230
3.77 1023.237
4.07 1023.226
4.17 1023.244
4.66 1023.277
4.56 1023.289
5.06 1023.281
5.36 1023.282
5.95 1023.286
6.35 1023.278
6.84 1023.290
7.14 1023.341
7.74 1023.384
8.33 1023.411
8.83 1023.428
9.52 1023.412
9.72 1023.401
10.51 1023.418
11.11 1023.432
11.70 1023.407
12.30 1023.424
13.09 1023.438
13.69 1023.445
14.18 1023.455
14.98 1023.443
15.67 1023.447
16.17 1023.458
17.06 1023.458
17.85 1023.467
18.55 1023.480
19.24 1023.500

sample1.000r *(Conductivity data-file)*

3.07 35.670
3.07 35.621
3.27 35.633
3.37 35.585
3.47 35.578
3.57 35.565
3.77 35.548
4.07 35.488
4.17 35.436
4.66 35.421
4.56 35.424
5.06 35.379
5.36 35.340
5.95 35.292
6.35 35.225
6.84 35.166
7.14 35.167
7.74 35.165
8.33 35.203
8.83 35.262
9.52 35.245
9.72 35.265
10.51 35.253
11.11 35.276
11.70 35.269
12.30 35.280
13.09 35.281
13.69 35.307
14.18 35.336
14.98 35.315
15.67 35.321
16.17 35.328
17.06 35.310
17.85 35.291
18.55 35.302
19.24 35.311

sample1.000s *(Salinity data-file)*

3.07 30.716
3.07 30.668
3.27 30.693
3.37 30.651
3.47 30.673
3.57 30.664
3.77 30.666
4.07 30.640
4.17 30.647
4.66 30.675
4.56 30.688
5.06 30.668
5.36 30.660
5.95 30.650
6.35 30.627
6.84 30.624
7.14 30.674
7.74 30.715
8.33 30.747
8.83 30.774
9.52 30.751
9.72 30.743
10.51 30.754
11.11 30.770
11.70 30.741
12.30 30.758
13.09 30.768
13.69 30.778
14.18 30.791
14.98 30.771
15.67 30.774
16.17 30.784
17.06 30.776
17.85 30.777
18.55 30.789
19.24 30.807

sample1.000t *(Temperature data-file)*

```
 3.07  12.115
 3.07  12.116
 3.27  12.099
 3.37  12.095
 3.47  12.060
 3.57  12.056
 3.77  12.033
 4.07  11.994
 4.17  11.925
 4.66  11.874
 4.56  11.861
 5.06  11.833
 5.36  11.797
 5.95  11.752
 6.35  11.702
 6.84  11.636
 7.14  11.576
 7.74  11.525
 8.33  11.530
 8.83  11.566
 9.52  11.574
 9.72  11.607
10.51  11.579
11.11  11.586
11.70  11.613
12.30  11.605
13.09  11.593
13.69  11.612
14.18  11.629
14.98  11.628
15.67  11.632
16.17  11.628
17.06  11.616
17.85  11.592
18.55  11.590
19.24  11.578
20.04  11.578
20.73  11.571
21.42  11.561
```

sample1.000u0 *(0-5V Sensor0 data-file)*

```
 3.07   0.0
 3.07   0.0
 3.27   0.0
 3.37   0.0
 3.47   0.0
 3.57   0.0
 3.77   0.0
 4.07   0.0
 4.17   0.0
 4.66   0.0
 4.56   0.0
 5.06   0.0
 5.36   0.0
 5.95   0.0
 6.35   0.0
 6.84   0.0
 7.14   0.0
 7.74   0.0
 8.33   0.0
 8.83   0.0
 9.52   0.0
 9.72   0.0
10.51   0.0
11.11   0.0
11.70   0.0
12.30   0.0
13.09   0.0
13.69   0.0
14.18   0.0
14.98   0.0
15.67   0.0
16.17   0.0
17.06   0.0
17.85   1.0
18.55   1.0
19.24   1.0
20.04   1.0
20.73   1.0
21.42   1.0
```