HYDROTRAC II

USER MANUAL
Version: 0.8

Teledyne Odom Hydrographic
1450 Seaboard Avenue
Baton Rouge, Louisiana
USA
70810-6261

Telephone: (225) 769-3051 Fax: (225) 766-5122

email@odomhydrographic.com
http://www.odomhydrographic.com

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ODOM HYDROGRAPHIC
A Teledyne Technologies Company

Revision History

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0.1	03-01-2011	S. Apsey	Initial version – draft
0.2	03-15-2011	S. Apsey	Added firmware revision list Added Annotation Parameter
0.3	03-23-2011	S. Apsey	Revisions for firmware 0.7 Added appendix on interfacing Ethernet with Hypack Added explanation on exiting the maintenance menu
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0.8	11-17-2011	C. Myer	Correction to Appendix C for External GPS jumper configuration. Also added a reference note in section 3.2.3 to Appendix C.

CONTENTS

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to explain the features and operation of the Hydrotrac II.

1.2 Scope

The scope and content of this document is focused on providing useful information to the end-user.

1.3 Glossary

DGPS	Differential Global Positioning System
NMEA	National Marine Electronics Association
VDC	Volts Direct Current
TOH	Teledyne Odom Hydrographic
PPS	Pulse Per Second

2 PRODUCT DESCRIPTION

2.1 Hydrotrac II General Specifications

Frequency Agile
- Operator selectable through menu – 24, 28, 33, 40, 100, 120, 200, 210 and 340 kHz

Output Power
- 600 watts

Power Requirement
- 11-28 V DC

Resolution
- 0.1 ft / 0.01m

Accuracy
- 200 kHz – 1cm (0.1% of depth value (corrected for sound velocity)
- 33 kHz – 10cm 0.1% of depth value (corrected for sound velocity)

Maximum Depth Range
- 600m or 1800 ft.

Environmental Operating Conditions
- 0° - 50° C

Communication
- 2 RS232 ports or 1 RS232 and 1 RS422
- Ethernet port
- 8 bit data
- 1600 samples/ping

Printer
- High resolution 8 dot/mm (203 dpi), 16 gray shades
- 216mm (8.5 in) wide thermal paper
- External ON/OFF switch
- Paper advance control

Dimensions
- 368 mm (14.5 in) H x 419 mm (16.5 in) W x 203 mm (8 in) D

Weight
- 22.5 lbs (10.2 kg)

Display Panel Layout
- 4 Line x 20 Character display
- OFF/STBY/LOW/MED/HI Power Settings
- Chart ON/OFF with LED inside
- Chart Advance
- Sensitivity
- Chart Feed
- Separate Panel Overlays for
- Display and Chart controls
- Keypad (arrow keys)
- Power
- Gain

Sensor I/O
- GPS
- Annotates chart
- Embeds position in Ethernet packet
- PPS
- Embeds UTC time in output string
- MRU
- Heave corrects data
- Outputs MRU data in Ethernet packet
- Remote Display
- RS 422 interface

Internal GPS with WAAS differential corrections and PPS reference signal
- 16-Channel, L1(1575.42 MHz) GPS receiver
- SBAS (WAAS and EGNOS) supported
- Position Accuracy: 0.63 meters, CEP 50% (24hr static)
- 1.31 meters, 95% (24hr static)
- Typical dynamic accuracy 3-5 meters
- Time (PPS): +/_62ns synchronized to UTC time
- Standard NMEA0183 output message

Features
- 8.5 in / 216mm thermal printer (fax paper)
- Annotation printed on chart
- LCD display (1 in. high)
- Sealed keypad controls
- Manual/remote mark command
- Auto scale change (phasing)
- Separate adjustment for power and pulse width
- External GPS input
- Heave input from motion sensor
- Integrated OEM DGPS receiver
- UTC time stamp capability
- TVG curve for side scan and bathymetry
- Output: NMEA, ECHOTRAC, DESO 25, etc.
- Waterproof (with front cover in place)
- Fix mark annotation: date, time, fix no., depth and GPS (if input)
- Flash memory upgradeable
- Waterproof DB9 connector serial ports (standard serial interface cables)
- Built-in simulator
- Serial port function test
- Robust firmware upgrades by SD Card
- E-chart Software included
- Operation and installation manuals provided on CD

Options
- 200 kHz or 340 kHz side scan transducer
- Remote display

2.2 Scope of Material Included

- Hydrotrac II Recorder
- 2 Serial cables
- 1 Crossover Ethernet cable
- 1 DC power cable
- 1 GPS antenna
- 2 rolls thermal paper

3 INSTALLATION

3.1 Transducer Installation

Proper mounting of the transducer is a crucial part of the installation of any "survey" echo sounder. An improperly mounted transducer will result in poor system operation and unacceptable data quality.

3.1.1 General Rules

In the case of temporary installations, the transducer may be mounted over-the-side. In permanent installations and “class 1 surveys", hull mounts are generally preferred and often required. In either case, transducers should be mounted at least 0.3 meters below the waterline. In cases where "over-the-side" mounts are exposed to wave action, ensure that the transducer is mounted sufficiently deep so that it does not break the surface during vessel roll motions.

A preferred mounting location is near the keel of the vessel, in an area where the planning attitude of the hull at speed, and the pitch and roll angles of the vessel in seas, have the least effect. The transducer should be mounted far enough aft of the bow so that bubbles generated by the bow wave will not pass over the face of the unit. Transducers should be located away from sources of turbulence and cavitation bubbles such as propellers, bow thrusters and hull protrusions. Considerations should also be given to sources of mechanical noise generated within the vessel (engines, props, pumps, generators, etc.). In some severe cases of mechanically coupled noise, vibration-isolating mounts may be required to decouple the transducer from the hull.

Transducer mounting can be accomplished in many different ways. To follow is a list of common configurations:

3.1.2 "THROUGH HULL" Installation

The topside of the transducer is accessible from inside the vessel while the transducer face is directly exposed to the water. Care should be taken to protect the transducer from damage and turbulence by installing a faring with a sloping forward edge ahead of the unit. The faring has the dual effect of both minimizing possible strike damage and smoothing the flow of water over the face of the transducer.

3.1.3 "SEA CHEST" Installation

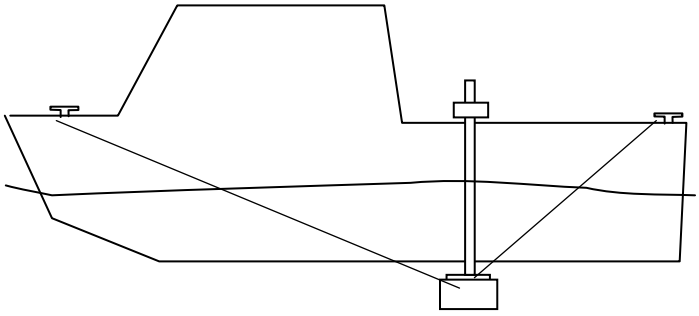
In a "sea chest" mount, a fluid-filled enclosure, large enough to contain the entire transducer, is attached to the outer hull of the vessel. The outer hull is removed within the area of the chest and replaced with an acoustically clear "window", which is mounted flush with the hull immediately below the chest. Depending on construction, the material selected for the acoustic window, and the draft of the vessel, access can often be gained to the transducer from inside the hull without putting the vessel in dry-dock. In most installations, a water-filled standpipe is incorporated into the "sea chest" design in order to provide hydrostatic pressure equalization. Transducer cables generally leave these assemblies through “stuffing tubes” that are designed to maintain the watertight integrity of the chest.

3.1.4 Over The Side Transducer Installation

A mount of this type is frequently constructed from a length of pipe. This fixture should be sized to position the transducer well below the waterline and the pipe then fixed to a sturdy support on the vessel. Lines generally are attached at the mounting pipe and tied off fore and aft in order to maintain a stable, horizontal head attitude. Care

should be taken to assure adequate protection for the transducer cable, particularly at the point where the cable leaves the transducer body. The position of the mounting assembly relative to other peripherals is critical for accurate data collection.

Particular care should be taken to assure that the transducer radiating face remains as parallel to the water surface as much as possible while the vessel is moving.



3.1.5 "HULL MOUNT" Installation

Transducers which are "streamlined" and can be mounted directly to the outside of the hull or transducers which are fitted into a streamlined fairings that are welded or otherwise attached to the outside of the hull, often make for excellent installations. The advantage here is that the radiating face of the transducer is generally below the "bubble stream" in clear water and no acoustic window or transducer tank is involved to create extra reverberation (ringing). This type of installation requires a stuffing tube to be installed in the hull in order to allow the transducer cable to penetrate the hull.

In all of the above installations particular care should be taken to assure that the transducers radiating face remains as nearly parallel to the water surface as possible while the vessel is underway.

3.2 Hydrotrac II Cable Connections

3.2.1 Serial 1

Serial 1 is the main communication port to and from the Hydrotrac II. Use this port to receive depth values, send annotation information and change parameters.

Connector PN:	Pin Number	Signal Description
DB9 Female	2	Transmitted data from Hydrotrac II
	3	Received data to Hydrotrac II
	5	GND

3.2.2 Serial 2

Serial 2 is used for connecting a remote display or motion sensor to the Echotrac MKIII. Serial 2 is the only port that can be configured as either RS232 or RS422.

Connector PN:	Pin Number	Signal Description
DB9 Female	2	Transmitted data from Hydrotrac II

	3	Received data to Hydrotrac II
	5	GND

3.2.3 GPS I/O

The Hydrotrac II has a built in GPS that main functions is to give the Hydrotrac II the UTC time which is used to time stamp the soundings. The GPS I/O port also outputs the NMEA GGA string at 9,600 baud. The internal GPS is not a survey grade GPS.

Connector PN:	Pin Number	Signal Description
DB9 Female	2	Transmitted data from Hydrotrac II
	3	Received data to Hydrotrac II
	5	GND

Note: For external GPS use see Appendix C Internal Jumper Configuration. The use of an external GPS device may require a null modem adaptor. Keep port and string configurations the same as the internal GPS settings.

3.2.4 LAN

The LAN connection is the Ethernet port for the Hydrotrac II.

Connector PN:	Pin Number	Signal Description
10BASE-T	1	TX +
	2	TX -
	3	RX +
	6	RX -

3.2.5 Transducer

TX1 is the main transducer connection port for the Hydrotrac II

Connector PN:	Pin Number	Signal Description
MS3116J14-5P	A	Shield
	B	High Frequency
	C	Low Frequency
	D	Low Frequency
	E	High Frequency

3.2.6 12-24 VDC

The DC connector is used to supply DC input power. The range of the DC power is 18-30 VDC.

Connector PN:	Pin Number	Signal Description
MS3116J12-3S	A	+ 24 Volt DC
	C	GND

3.2.7 FUSE

This 5 Amp fuse protects against the Hydrotrac II drawing too much current from and external power supply.

3.3 Hydrotrac II Recorder Buttons and Knobs

3.3.1 Power/Transmit Power Knob

This knob controls the power to the Hydrotrac II and controls the transmit power to the Hydrotrac II transmitter. When the knob is turned from Off to Stby the LCD will prompt the operator to press a key. Once the key has been pressed the chart will print a initialization message and the LCD will prompt the operator to select current setting, default settings or the maintenance menu. Selecting the current menu will load the last used parameters into the Hydrotrac II. Select the default setting to bring the Hydrotrac II to the original parameter settings. This is equivalent to a reset.

3.3.2 Sensitivity Knob

This knob adjusts the amplification of the signal received from the transducer. Increase the knob in areas with a softer seafloor or less reflectivity of the seafloor.

3.3.3 Keypad

The 10 raised micro-switches are part of the sealed display panel. The keys have excellent tactile feel and high moisture resistance. The keypad is used by the operator for direct parameter entry and functional control of the unit from the front panel. There are four keys under the LCD that control the menus of the Hydrotrac II. These menus are described in a later section of this manual.

3.3.4 LCD

The 4 line, by 20 character Transflective LCD Module with LED Back Lighting was chosen for it's excellent visibility in all light conditions from bright sun to darkened wheel house.

3.3.5 Printer On/Off button

Turns the printer On or Off. The LCD inside the button indicates whether the printer is on (LED ON) or off.

3.3.6 Printer Take-Up button

The Hydrotrac II printer has a slipping clutch that allows the operator to pull chart record that has been wound up. The Take-Up button allows the operator to take up the slack paper. The take-up button is also useful when changing the paper. Note: the Take-Up and Feed buttons work independently to each stepper motor. Pressing the feed button will not trigger the take-up motor.

3.3.7 Printer Feed button

This button can be used to feed blank paper through the print head. This is useful should the operator wish to write information on the chart paper on a blank section of paper. This button is also useful when changing paper.

3.3.8 Printer Mark button

When the Mark button pressed the Hydrotrac II printer will print a line across the chart along with date, time and depth along that line.

3.3.9 Printer Mechanism

The high-resolution thin-film thermal print head (216mm (8.5”) wide, 8 dots per mm (203/in.)) is capable of printing up to 8 gray shades on high quality thermal film. Due to its thin-film construction, it is very energy efficient and produces little excess heat. The paper delivery and re-winding mechanisms contain few moving parts and are built to stand up to the rigors of marine use.

3.4 Chart Paper

General Paper Description: The **Hydrotrac** uses either thermal film or high quality thermal paper as the recording medium for the analog chart. The rolls are 216mm (8.5”) wide and contain approximately 50m (170’) of paper or film. The inside diameter of the core is 12.7mm (½”); the outside diameter of the roll is approximately 64mm (2.5”).

Paper loading is a multi-step process, but it need not be a difficult one if care is taken in assuring that each step is accomplished properly. As in almost any thermal recorder (including FAX machines), paper is sourced from a supply roll, where it passes between alignment posts, and over a rubber roller fig 3.1, which moves the paper past the thermal printhead. Attached to the printhead is a mechanical pressure lever, which when moved to the left, lifts the head away from the roller to assist in the initial loading. In the **Hydrotrac**, printed chart paper is taken-up on an empty core installed at the far left of the chart panel. A precision stepper motor attached to the printhead assembly drive roller pulls paper off the supply roll and moves it past the printhead. The motor that drives the take-up spool does not advance the paper, as is the case in many echo sounders. Since paper drive and take-up are driven by separate mechanisms, previously printed chart can be pulled from the take-up assembly for review and simply re-wound without disturbing the recording process.

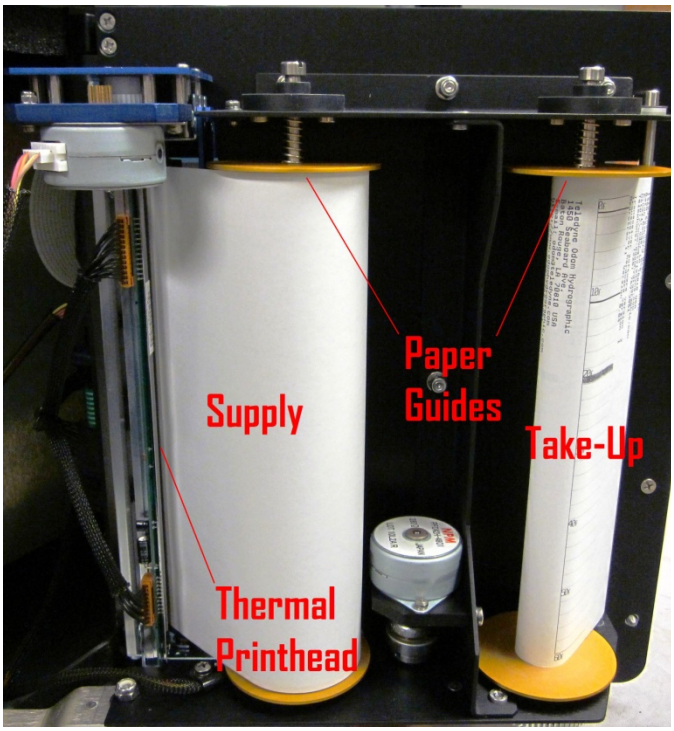


Figure 3.1 Paper Supply & Take-Up Rolls

Figure 3.2 Panel Release

3.4.1 PAPER LOADING

Step 1: In order to gain access to the paper supply and re-wind areas, open the chart panel by unscrewing the two black captive fasteners at the extreme left of the front panel (Figure 3.2). Open the panel by pulling the handle at the left side of the front panel until the support arm engages a stop.
Step 2: If paper has been previously installed in the unit, place the power switch in the STBY position and press the CHART FEED switch (upper right) until sufficient paper has been advanced to clear any previously recorded data. Cut the paper at a convenient point past the recorded data and remove the old chart.
Step 3: Swing the panels completely open to the last stop point on the support arm (Figure 3.3). This will allow access to the paper supply and take-up assemblies located at the rear of the panel.
Step 4: Locate the printhead release lever located below the printhead on the front side of the panel (Figure 3.4). Push the lever all the way to the left in order to raise the printhead away from the paper and roller.
Step 5: Remove any remaining paper from the paper path and remove the spent supply roll from the holder mechanism. Grasp the core and lift it upward and outward at the bottom. The upward motion compresses the upper pressure spring and the outward motion clears the bottom of the core from the lower core-centering stud.
Step 6: Use the same motion in order to remove the take-up roll from its holder mechanism.

3.4.2 Installing a fresh Paper Supply Roll

Figure 3.3
Front Panel Extended

Step 1: On the paper supply side (side closest to the printhead), raise the upper paper guide until the spring is fully compressed.
Step 2: Insert the fresh roll of paper so that the core engages the top paper-centering stud and so that the paper comes off the roll at the rear (as viewed from the front panel side of the unit) and the outside surface of the paper faces the printhead.
Step 3: Align the roll so that it engages the lower centering stud, as it is set onto the lower paper guide.

Feeding Paper past the Printhead

Step 4: Feed paper off the supply roll from the rear and over the paper drive roller (between the printhead and the roller) with the outside surface of the roll toward the printhead. Only the outside surface of the paper will produce an image.
Note: the printhead release lever must be in the released position (far left position) in order to accomplish this task.
Step 5: Once a small amount of paper is fed across the roller past the printhead, pull approximately 450mm (18") through the printer. This can be done easily if the paper is not allowed to engage the rubber paper drive roller with too much tension. Feeding paper manually off the supply roll while pulling it past the printhead will assist in this task. Once sufficient paper is fed past the print head, center the paper manually and **return the printhead release lever to the engaged position** (head locked down on the paper supply roller).

3.4.3 Loading the Paper Take-Up Spool

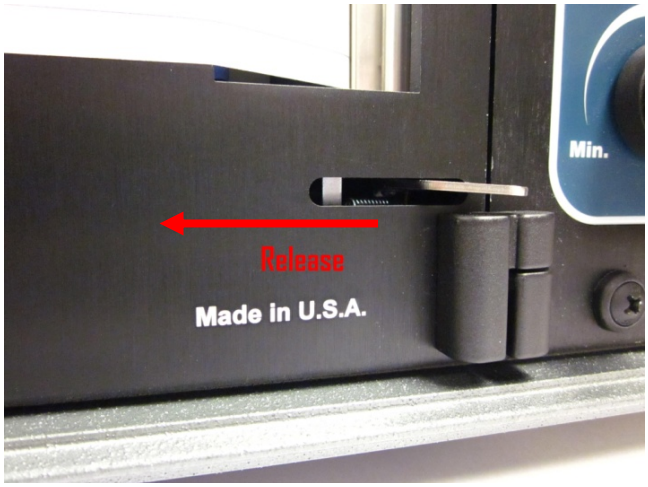
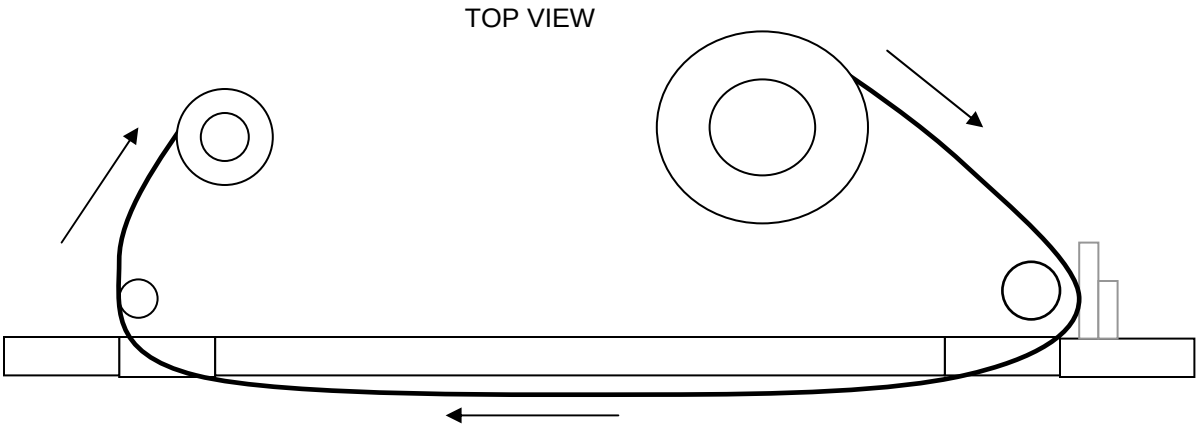


Figure 3.4

Printhead Release Lever

Step1: Guide the end of the paper through the paper entry slot and over the take-up roller bar. Pull the excess paper through the slot.
Step 2: Using a small piece of tape, attach the end of the paper to an empty paper core being sure to align the top and bottom edges of the paper with the ends of the core. Wind the extra paper up tightly onto the core. Note: As shipped from the factory, paper is re-wound on the spent core in the same direction as it is fed off the paper supply roll. This means that the printed image is wound on the outside surface of the recorded roll.
Please note! Best results are derived when a new core is installed on the Take-up spool with each new roll of paper. Repeated use of the same Take-up core will result in the unit's failing to re-wind paper reliably.

Step 3: Employing the same method used in loading the supply roll, install the core (with paper attached) in the Take-up Spool assembly.
Step 4: Close the paper access panel by first releasing the support arm, closing the panel, and then re-tightening the two captive screws. Press the FEED switch (upper right) and observe that paper moves smoothly past the printhead across the paper access panel, and is wound onto the take-up core. At this point the recorder should be ready for normal operation.



4 OPERATION

4.1 Hydrotrac II Parameters

In the **Hydrotrac,** parameters which control the way the echo sounder works—digitizing, printing, or communicating to the outside world, are manipulated using a system of menus and front panel mounted sealed keys. The display is a four line by twenty-character alpha numeric, transflective LCD module. The display is backlighted for nighttime viewing LED's. The keys are made up of 10 embossed micro-switches molded into the display panel overlay. Each key is labeled with its function and provides positive tactile feedback upon actuation. The four keys located directly below the display provide immediate access to the four main menus for which they are labeled (DEPTH, SETUP, CHART, CAL.). The UP, DOWN, LEFT, and RIGHT arrow keys are used to navigate through the individual parameters and to change their associated values. The ENTER key is used to select a parameter who's value is to be changed. Pressing the HELP key provides the operator with an immediate printed explanation of the purpose and use of the selected parameter.

4.1.1 Changing Parameters

The method used to change any parameter value is common to all parameters in the system. To follow is a description and typical example of the procedure: For instance, should we wish to change the internal time of day clock: First press the **Setup** Key, to access to the menu containing the **Time** parameter. Second, ***Select*** the **Time** parameter by moving the arrows (using the UP and Down arrow keys) to the **Time** line and then pressing **Enter**. Once the value for **Time** is selected (the blinking block cursor appears behind one of the digits), use the LEFT or RIGHT arrow keys to choose **Hours**, **Minutes**, or **Seconds** by moving the Cursor to the appropriate digit. Using the UP or DOWN arrow keys, slew in the new value. If necessary, move the cursor to the next digit (using the LEFT and RIGHT arrow keys again) and slew the correct digit into place. Once the displayed **Time** parameter is correct, press **Enter** again. This will cause the new value to become the current time. This method of entering data is common to all parameters.

4.1.2 Depth

Pressing the **DEPTH** key on the front panel results in immediate display of the digitized depth. The large characters incorporate segments from all four lines of the display. This is done in order to achieve the size needed for distant viewing. While **DEPTH** is the Menu most often displayed, it is not necessary to select the **DEPTH** menu in order for the unit to operate normally. The **Hydrotrac II** continues to sound, digitize and display the depth (in the upper right corner of the display) in all of the menus except Maintenance. If the Depth button is pressed twice the Hydrotrac II will display the Latitude and Longitude of the GPS position along with the depth.

4.1.3 Setup

Pressing the **SETUP** key initiates the display of the basic parameters of the unit, which include the following:

Setup	10.01
‣ Blanking	0.0
Units	Meters
↓ Range	100
Serial1	Echotrac I/O
	Nmea DBS Out

	DESO 25 I/O
	Heave Out
Serial2	OFF
	Heave IN
	Remote Disp
Time	15:32:15
Date	10/20/97
Serial1 Baud	19200, 9600, 4800
Serial2 Baud	19200, 9600, 4800
TVG Curve	10,20,40 Log
Frequency	24,28,33,38,40,100, 120,200,210,340
Pulse Length	Short, Medium,Long

4.1.3.1 Blanking

A **Blanking** feature is used to "mask" the transmit pulse, transducer ringing, or other unwanted acoustic returns in the upper water column (such as boat wakes), from the digitizer. It is applied when these acoustic events could be mistaken for returns from the seabed or when the operator needs to force the sounder to "look" below an interference layer. The value for **Blanking** is entered as a distance from the water surface and is indicated on the chart by a solid black line printed at the input depth. **Blanking** is one of the "Key Parameters" printed at sign-on and each time the parameter is changed.

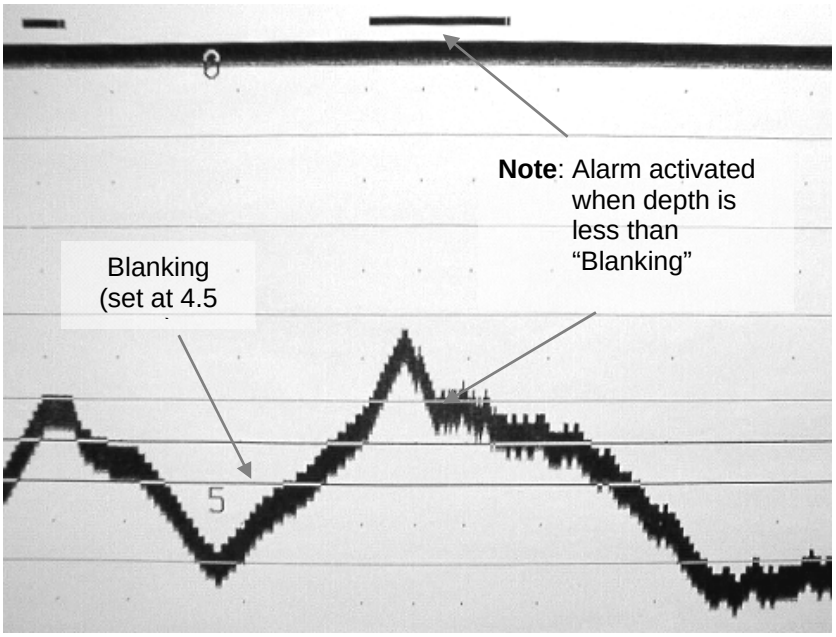


Figure 3.3

Blanking Feature

4.1.3.2 Units

Sets the operating units of the Hydrotrac II. When units are set to meters the Hydrotrac will have centimeter resolution, when set to feet will have 0.1 foot resolution.

4.1.3.3 Range

As the name indicates, the **Range** parameter limits the maximum range of the digitizer. For example, should a **Range** value of 100m be input as a value, then the unit's digitizer will never look deeper than 100m for a valid bottom return. This speeds up the digitizer since it no longer has to expand the tracking gate to include depths greater than 100m. The feature is often used in conditions where the time needed to reacquire the bottom (after a loss of signal) must be minimized. However, care should be taken not to set the **Range** at a value which is too shallow, since it will also inhibit tracking of valid returns deeper than the **Range** value as well.

4.1.3.4 Serial1

This is the primary serial port interface for the Hydrotrac II and should be used to receive depth information. The Hydrotrac II outputs the following strings:

- Echotrac I/O
- Deso25
- NMEA DBS
- Heave
- ET Mark1I/O

When any of the first three formats are output and the Hydrotrac II is receiving data from a motion sensor, these strings will reflect a heave corrected depth. When the Heave string is selected and the Hydrotrac II is receiving data from a motion sensor the depth and heave values will be uncorrected. Details of the formatting of each string can be found under a different section of this manual.

4.1.3.5 Serial2

This port is used by the Hydrotrac to receive data from a motion sensor or output data to a TOH remote display. When the TOH remote display is selected the Hydrotrac II serial port should be set to RS422.

4.1.3.6 Time

An internal real-time clock is used for time and date information even when power is removed from the unit. The correct time of day (or reference time) is entered via this parameter. First **Time** is made the current selection by moving the brackets to the **Time** line and then pressing **Enter**. Once the value for time is selected, use the LEFT or RIGHT arrow keys to chose the appropriate **Hour**, **Minute**, or **Second** digit. The selected digit will be noted by the presence of the blinking Block Cursor. Use the UP or DOWN arrow keys to slew to a new value. Pressing **Enter** again will cause the new value to become the current time.

4.1.3.7 Date

The current **Date** is entered in much the same manner as **Time.** Begin by selecting the proper line and then choose the digit to be changed. Use the UP or DOWN arrow keys to slew to a new value. Pressing **Enter** again will cause the new value to become the current **Date**.

4.1.3.8 Serial1 Baud, Serial2 Baud

Set the baud rate for com 1 and com 2 from 4800 baud to 19,200 baud.

4.1.3.9 TVG Curve

Multiple TVG curves are programmed into unit's transceivers. The 20Log Time Varied Gain curve is the generally accepted standard in single beam vertical echo sounders and the default value for the Hydrotrac II. The 20Log curve includes compensation for both spherical spreading loss and absorption losses. The 40Log curve is the standard for use with the Side Scan option. The 10Log scale is intended for use in shallow water.

4.1.3.10 Frequency

Sets the operating frequency of the Hydrotrac II. This setting should match the frequency used with the Hydrotrac II. The available frequencies are:

- 24 kHz
- 28 kHz
- 33 kHz
- 38 kHz
- 40 kHz
- 100 kHz
- 120 kHz
- 200 kHz
- 210 kHz
- 340 kHz

When using 24kHz – 40kHz the low frequency pin connections should be used and when using 100 kHz and above the high frequency pin connections.

4.1.3.11 Pulse Length

Sets the pulse length of the transmit signal to the transmitter. A rule of thumb is, in shallow water use as few cycles as you can get by with, while in deep water use as many as it takes! Taken together with the Tx Power control setting, pulse width directly influences the total amount of acoustic energy generated.

Frequency(kHz)	Short Pulse Length(usec)	Medium Length(usec)	Large Length(usec)
24	250	500	1000
28	214	428	856
33	189	364	727
38	150	300	600
40	150	300	600
100	100	200	400
120	80	160	320
200	50	100	200
210	94	188	376
340	94	188	376

4.1.3.12 Alarm

When the alarm is turned on and the echo sounder does not detect a valid bottom the Hydrotrac will turn on its sonic alarm.

4.1.3.13 Minimum Depth

The Hydrotrac will turn on the sonic alarm when the depth detected goes below the value entered for this parameter.

4.1.4 Chart

Chart	10.1
‣ Scale End	20
Scale Width	20
Phasing	Auto

4.1.4.1 Scale End

The **Scale End** refers to the depth value at the center of the printed chart. In the **Manual Phasing** mode, **Scale End** is used most often to move the beginning and ending scale values to two points which force the known depth to fall between them. When the **Phasing** parameter is in **AUTO** mode, the **Scale End** value is recomputed each time the digitized depth approaches either scale limit. The **Scale End** can be incremented by any of the displayed whole digits (hundreds, tens, or units in meters).

4.1.4.2 Scale Width

Scale width printed on chart. Scale End value computes listening time and repetition rate. Values: 10,20,40,80 meters; 30,60,120,240 feet.

4.1.4.3 Chart Speed

This parameter is used to control the chart speed of the thermal printer. In SYNC mode the Hydrotrac will advance the paper chart once per sounding period. On the other setting the Hydrotrac will advance the paper chart in centimetres per min.

4.1.4.4 Phasing

The **Phasing** control determines whether or not the sounder will be allowed to automatically recompute the **Scale End** value to avoid losing the bottom off the chart. Two selections are possible; **Auto** and **Manual**. In **Manual**, the **Phase** does not change as the depth changes. It remains fixed at the Scale End value selected. However, in **Auto**, as the bottom approaches the chart limits, a new **Scale End** is recomputed automatically and the **Phase** is adjusted so that the bottom is always plotted on the chart.

4.1.4.5 Annotation

When the Mark button is pressed the Hydrotrac II will either print annotation information with the fix line on not depending on whether this parameter is turned ON or OFF.

4.1.4.6 Print Parameters

When the Enter button is pressed while the menu selection is on PrintParams the Hydrotrac will printout all its parameter settings on the paper chart.

4.1.5 Cal.

Pressing the **CAL**. key initiates the display of the parameters required to accomplish a standard “Bar Check” calibration procedure. Included are the following:

Calibrate	10.01
Bar Depth	10
Draft	1.6
Index	.7
Velocity	1500

Please note that the current depth is displayed in the upper right hand corner of all of the menus as long as the **Hydrotrac** is actively sounding. In the **Cal** menu, it is provided in order to allow the operator to immediately see the effect of changing either **Draft** or **Velocity**. It also makes it easy to confirm that the digitizer is locked either on the “Check Bar”, during the calibration process, or on the bottom when no value for **Bar Depth** is selected. The digitizer gate limits are also printed on the chart.

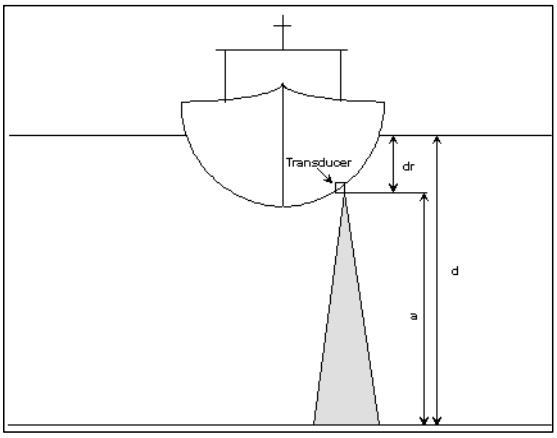


Figure 3.5 Bar Check Calibration

4.1.5.1 Bar Depth

Entering a value other than "0" in the **Bar Depth** parameter puts the **Hydrotrac** in the "Bar Check Calibration Mode". If, for example, the operator enters a value of 5.00m as the Bar Depth parameter, then immediately upon pressing enter, the Digitizer will expect to see a target at that 5.00 meter depth (± 0.5m) while rejecting all other returns (including those from the bottom). At the same time, the printer will begin to print the tracking gate at a total width of 1.00m centered about the **Bar Depth**.

4.1.5.2 Draft & Index

Draft is the correction value added to the measured depth to adjust for the difference between the depth of the transducer and the water's surface ($a + d_r - k$) where: "a" is the measured depth and "d_r" equals the draft (depth of the transducer below the water surface). Index constant "k" is system delays originating in both transducer and echo sounder circuitry. In the accompanying illustration, "d" is equal to the depth of the seabed below the water's surface.

Note: Many users may not be familiar with the parameter "Index" or "k", although it is likely that they have seen the results of combining transducer draft and index constant into one draft figure. If you have noticed that the measured draft, or the distance from the face of the transducer to the water's surface is not the same as the draft value entered into the sounder, then you have seen the result of lumping both together. This phenomenon is most evident when using dual frequency transducers where both high and low elements are in the same housing. Often, the draft values are very different for the two frequencies if no adjustable "k" parameter is incorporated. The difference in "k" or electronic delay between a 200 kHz element and a 24 kHz array is substantial, and is the reason behind the difference between the two "Calculated Drafts".

Once the "k" value is determined, it will not change until either the sounder or the transducer is changed. The Index parameter should be adjusted to make the measured draft and the calculated draft equal. Depth is computed according to the General Formula shown below:

$$d = ½ (v * t) - k + d_r$$

d = depth from water's surface
v = average speed of sound in the water column
t = measured elapsed time of signal travel from transducer to seabed and back to the transducer
k = system index constant
d_r= difference from referenced water surface to transducer (draft)

4.1.5.3 Velocity

This parameter allows the operator to change the speed of sound variable in the depth equation. Having the ability to change the speed of sound increases the accuracy of the system by allowing the sounder to adapt to changing local conditions that affect the propagation speed of sound in the water. Whether derived as a result of the "Bar Check" method of calibration, or taken directly from a velocimeter, **Velocity** is critical to measurement accuracy.

4.1.5.4 Simulator

The simulator is a way of testing the Hydrotrac's interface with the data acquisition computer and also a way for the surveyor to familiarize themselves with the parameter of the Hydrotrac. To use the Simulator, turn this parameter on and then use the sensitivity knob to adjust the depth. Make sure to turn the simulator off before starting a survey.

4.1.6 Start up Menu

When the Hydrotrac II is first powered up the following start up screen shows up in the LCD:

System Startup
Use current setup
Use default setup
Maintenance

This menu allows the operator to choose which parameters are loaded into the Hydrotrac or enter the maintenance menu.

The startup menu is also available when the Hydrotrac II power knob is set to Standby and the operator presses the left arrow key.

4.1.6.1 Use current setup

When current setup is selected the Hydrotrac II will load the last values used by the operator for all the parameters.

4.1.6.2 Use default setup

When default setup is used the Hydrotrac II will load the default parameter list. This is useful to load a know set of parameters if the Hydrotrac II is performing unpredictably.

4.1.6.3 Maintenance Menu

The maintenance menu is used to test the serial ports of print a grey shade test of the printer. When Serial 1 or

Serial 2 is selected the Hydrotrac II will output either the string “Serial 1” or “Serial 2” through the corresponding port. If pins 2 and 3 of either serial port are shorted together the “Serial 1” or “Serial 2” string will display on the LCD. When the Chart test is selected the Hydrotrac II will print a chart test pattern of grey shades. Make sure the Printer ON/OFF button is turned on to use this test.

To exit the Maintenance menu and return to configuration menu press the left arrow key.

4.2 Interfacing

4.2.1 Serial Output Strings – Serial1

4.2.1.1 Echotrac I/O

ECHOTRAC I/O is the standard serial output string first introduced in the Echotrac DF 3200 MKI in 1985. Due to the wide acceptance of this string and the availability of the format in a number of data acquisition systems, the string has been maintained in order to assure continued compatibility.
Please note that characters 2 & 3 are lower case whenever the **Units** parameter selected is **Meters** (centimeter resolution). The foot serial output string varies from the metric string in that characters 2 & 3 are always upper case (tenths of feet).

Char. #	**Description**
1	Normally Space “F” Indicates Fix Mark
2	“E” foot units, tenths res. “e” metric units cm. Resolution
3	“T” foot units, tenths res. “t” metric units cm. Resolution
4	Normally a Space “E” indicates Error
5	Always a space
6	Depth Data (MSD)
7	Depth Data
8	Depth Data
9	Depth Data
10	Depth Data (LSD)
11	Carriage Return

4.2.1.2 Heave

Note that upon selection of **Heave IN** on Comm 2, and **Echotrac I/O** on Com 1, the depth output from Comm 1 is automatically corrected for the received Heave value.
Selection of **Heave Out** on Comm 1 (see Section 3-18) results in an output string containing the raw (uncorrected depth) and the most appropriate heave value. Note this string is identical to the Echotrac DBT string with one channel selected and Heave enabled.

Char. #	Description
1	Normally Space “F” indicates Fix Mark
2	“E” decimeter resolution “e” centimeter
3	“T” decimeter resolution “t” centimeter
4	Normally Space, “E” Indicates Error
5	Frequency Indicator Fixed “H”
6	Always Space
7 - 11	Depth data
12	“+ or –“
13-16	Heave Data
17	Carriage Return

4.2.1.3 DESO 25

The following description applies when DESO25 I/O is selected as the preferred output string under Comm 1.

Char. #	Description
1	Always “D”
2	Always “A” Channel 1
3	Depth Data (MSD)
4	Depth Data
5	Depth Data
6	Depth Data
7	Depth Data
8	Decimal Place (.)
9	Depth Data
10	Depth Data (LSD)
11	Space meters “**F**” **F**eet units
12	“**m**” meters “**t**” fee**t** units
13	Carriage Return
14	Line Feed

4.2.1.4 NMEA String (DBS)

Included in the choices of serial output formats, is the DBS string. This string is included in order to provide a standard global format. It is widely accepted and therefore more easily interfaced to software suites written for applications outside of the Hydrographic community.

The NMEA String as transmitted by the Hydrotrac has the following parameters:
Baud Rate: 9600
Stop Bit: 1
Parity: None
Data Bits: 8
Terminator: Cr/Lf

Char. #	Description
1	Always a "$" Sign
2-6	Always SDDBS
7	Always a comma ","
Next Field	Depth in feet (may be no chars)
Next Char	Always a comma
Next Char	"f" for feet (may be no chars)
Next Char	Always a comma
Next Field	Depth in Meters (may be no chars)
Next Char	Always a comma
Next Char	"M" for meters (may be no chars)
Next Char	Always a comma
Next Field	Depth in fathoms (may be no chars)
Next Char	Always a comma
Next Char	"F" for fathoms (may be no chars)
Next Char	"*hh" numeric checksum char
	<CR><LF>

4.2.1.5 ET Mark1 I/O

This output format is exactly like the Echotrac I/O format. The only difference between the ET Mark1 I/O format and the Echotrac I/O selection is in how the annotation control is processed. When ET Mark1 I/O is selected the Hydrotrac II will send a Hex 02 after it has received the Hex 1 indicating it is ready to receive the annotation characters. The Hydrotrac II will also reply with a Hex 02 when it has received a "CR".

4.2.2 Serial Data Input and Annotation

Information, which in the past had to be handwritten on the chart record, can now be transmitted to the Echotrac via the RS232 input line. Up to 80 ASCII characters per line can be printed on the chart.

4.2.2.1 Event Line (Fix Mark)

A single line across the chart is produced by sending a HEX 06 (ASCII “ACK” or “Control F”). An event line will be printed across the chart at the end of the current sounding cycle. Event lines do not delay or interfere with normal operation of the unit.

Event Annotation

When required, the event line can be annotated with up to 80 characters of information. This is achieved by following the HEX 06 (Fix Mark) with HEX 01 (ASCII “SOH” or “Control A”). As in the earlier models of the Echotrac, the sounder will respond to the “Control A” with a HEX 02 (ASCII “STX” or “Control B”). However, it is **no longer necessary** to wait for the “Control B” before sending annotation data. Data may be sent to the Echotrac immediately after transmission of the “Control A”. The “Control B” was retained in order to remain “downwardly compatible”.

4.2.3 Ethernet Output

The Hydrotrac II has an Ethernet port that outputs the time series of the acoustic data sampled by the analog to digital converter. Each packet from the Hydrotrac II contains 1600 samples if set to meters or 1590 samples if set to feet of 8 bit data. The data output from the Hydrotrac II is UDP and is output on UDP port 1600.

5 CALIBRATION

The principle of echo sounding is based on measuring the time of arrival of an acoustic return (echo) referenced to the time of transmission. The time required for sound to travel from a source (the transducer) to the seafloor or bottom, and back can be measured and multiplied by the velocity of sound in water in order to arrive at the distance the pulse has traveled. Since the transmitted pulse has traveled from the transducer to the bottom and back again, then the distance must be halved in order to obtain the water depth. As shown in the general depth formula below, other factors enter into the equation as well.

$$d = \frac{v \times t}{2} - k + d_r$$

Where:
d - Depth from referenced water surface.
v - Average velocity of sound in the water column.
t - Measured elapsed time from the transducer to the bottom and back to the transducer.
k - System index constant.
d_r - Distance from reference water surface to the transducer (draft)

Since depth measurement accuracy is dependent on the value used for the velocity of sound in water (along with the other factors shown above) it is important that a realistic value for sound velocity be determined. In water, velocity is a function of temperature, salinity and pressure. Understandably then, the local sound velocity may vary widely, thereby resulting in the need to calibrate any type of echo sounder, in order to provide the most accurate depth data at a given location.

The most common calibration technique is the bar check method. This method, when employed properly, has the advantage of correcting for velocity variations, draft variations, and system index errors (all of the constants in the above formula). When calibrating using the bar check method, acoustic returns are generated by a suspended target which is lowered to a known depth between the transducer and the bottom. In this circumstance it becomes desirable to have a method whereby the digitizer will see only the Bar (the target) and be prevented from locking on to actual bottom returns. Since the Hydrotrac employs a dynamic tracking gate or window through which the digitizer looks for echoes from the seabed, manual control of the position and width of the gate is necessary in order to force it to remain fixed around the Bar. This is achieved by using the **Bar Depth** function.

5.1 BAR CHECK CALIBRATION

As indicated in paragraphs 3-23 through 3-24, the Calibrate Menu brings all of the parameters necessary to calibrate the sounder together in one display group. By pressing the Cal key, the operator is presented with the following menu:

Calibrate	10.01
‣ Bar Depth	10
Draft	1.6
↓ Index	.7
Velocity	1500

NOTE: HEAVE IN must be OFF and the unit's power and sensitivity adjusted to levels which provide reliable depth information from the project depth and bottom material.

1. With Bar Depth parameter bracketed, press the Enter key. Enter the first calibration depth. That is, the measured depth of the “Check Bar” at its shallowest calibration depth.

2. Deploy the Check Bar below the transducer to the first calibration depth (for example 2 meters or 10 ft.). Confirm that a return is printed on the chart between the two Bar Depth lines, and that the digitizer is locked to the Bar.
   Select the Draft parameter (bracket it and press ENTER). Slew the Draft value to the depth of the transducer from the water surface.

3. Slew the Index value until the Calibrate Depth equals the depth of the Check Bar (determined from the suspension chain).

4. Lower the Check Bar to the deepest calibration depth, for example 15 meters (40 ft.) and adjust the Bar Depth value to equal the depth of the Check Bar.

5. Select Velocity. Slew the Velocity up or down to the point at which the Calibrate Depth equals the measured depth of the Check Bar.

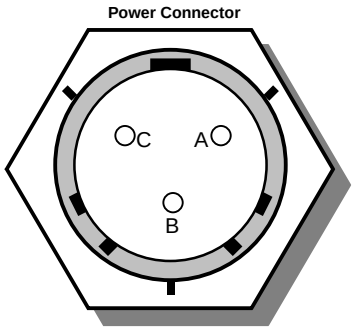
6. Repeat Steps 4 to 5 until the Calibrate Depth equal the Check Bar depth at the shallow and deep checks.

7. IMPORTANT! Adjust Index only when the BAR is at the shallowest depth (where velocity has minimum effect) and VELOCITY only when the BAR is lowered to greater depths (where velocity becomes predominant).

Appendix A. POWER Cable Conn. (DC only)

P/N: MS3114E12-3P

Pin #	Description
A ----------	+12 or 24 VDC
B ----------	No Connection
C ----------	Return



Appendix B. Motion Reference Unit output string

The Hydrotrac II will only read the TSS1 output string. The format of the string is:

The TSS1 data string contains 27 characters in five data fields.

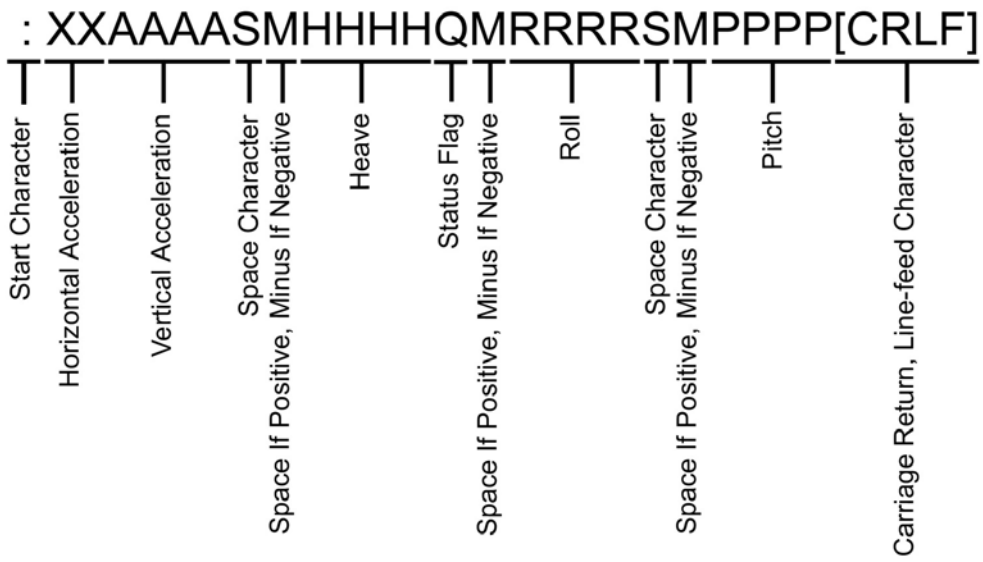
The acceleration fields contain ASCII-coded hexadecimal values. Horizontal acceleration uses units of 3.83cm/s² in the range zero to 9.81m/s². Vertical acceleration uses units of 0.0625cm/s² in the range –20.48 to +20.48m/s².

The motion measurements contained in the data string will be in real time, valid for the instant when the system begins to transmit the string.

Motion measurements include ASCII-coded decimal values.

Heave measurements are in cm in the range –99.99 to +99.99 meters. Positive heave is above datum.

Roll and pitch measurements are in degrees in the range –90.99° to +90.99°. Positive roll is port-side up, starboard down. Positive pitch is bow up, stern down.



Appendix C. Internal Jumper configurations

The communication board inside the Hydrotrac II has a number of jumper settings that can be moved to change the configuration of Com2 from RS232 to RS422 and whether the Hydrotrac II uses the internal GPS or gets data from an external GPS. To change these jumpers remove the four nuts securing the cover over the internal circuit boards. The communication board is the one labeled 2420-0005-REV#.

Jumper Name	Default Jumper setting	Optional Jumper setting
JP1	1-2 (Serial2 set for RS232)	2-3 (Serial2 set for RS422)
JP2	1-2 (Serial2 set for RS232)	2-3 (Serial2 set for RS422)
JP3	Open	none
JP4	2-3 (Serial2 set for RS232)	1-2 (Serial2 set for RS422)
JP5	1-2 (422 120 ohm termination)	
JP6	2-3 (Serial2 set for RS232)	1-2 (Serial2 set for RS422)
JP7	Short (Active GPS antenna)	none
JP8	1-2 (Internal GPS PPS into Hydrotrac II)	2-3 (External GPS PPS into Hydrotrac II)
JP9	1-2 (Internal GPS data into Hydrotrac II)	(External GPS data into Hydrotrac II, see JP10)
JP10	1-2 (Internal GPS data into Hydrotrac II)	JP9 pin 2 – JP10 pin 3 (jumper wire included)
JP11	2-3 (Internal GPS to output through GPS I/O port)	1-2 (External GPS to input through GPS I/O port)
JP12	2-3 (Internal GPS to output through GPS I/O port)	1-2 (External GPS to input through GPS I/O port)

Appendix D. Upgrading Hydrotrac II FPGA and Firmware

The Hydrotrac II is upgradable through a SD card which is located inside the Hydrotrac II next to the connector side of the case. Remove the thumb screw securing the red cover over the SD card socket. There should be a blank SD card in the socket. TOH will send a file with a _sw.flash and _hw.flash extention. Copy the upgraded files received to the SD card. A SD card adaptor might be necessary to transfer the files from the computer to the SD card. Most laptop computers will have a SD card slot to plug the card.

Plug the SD card into the Hydrotrac SD card slot and power up the Hydrotrac II. The LCD screen on the Hydrotrac will stay blank until the upgrade is complete. The upgrade might take up to 30 seconds depending on how much is being upgraded. Once the upgrade is complete the Hydrotrac II LCD menu will start up normally.

To complete the upgrade, delete the files on the SD card and replace the empty card in the socket. Make sure to put back the cover on the socket. Leaving a SD card with the upgraded firmware in the Hydrotrac II to delay starting up as it will always load the firmware from the SD card socket.

Appendix E. Hypack Ethernet Interfacing with the Hydrotrac II

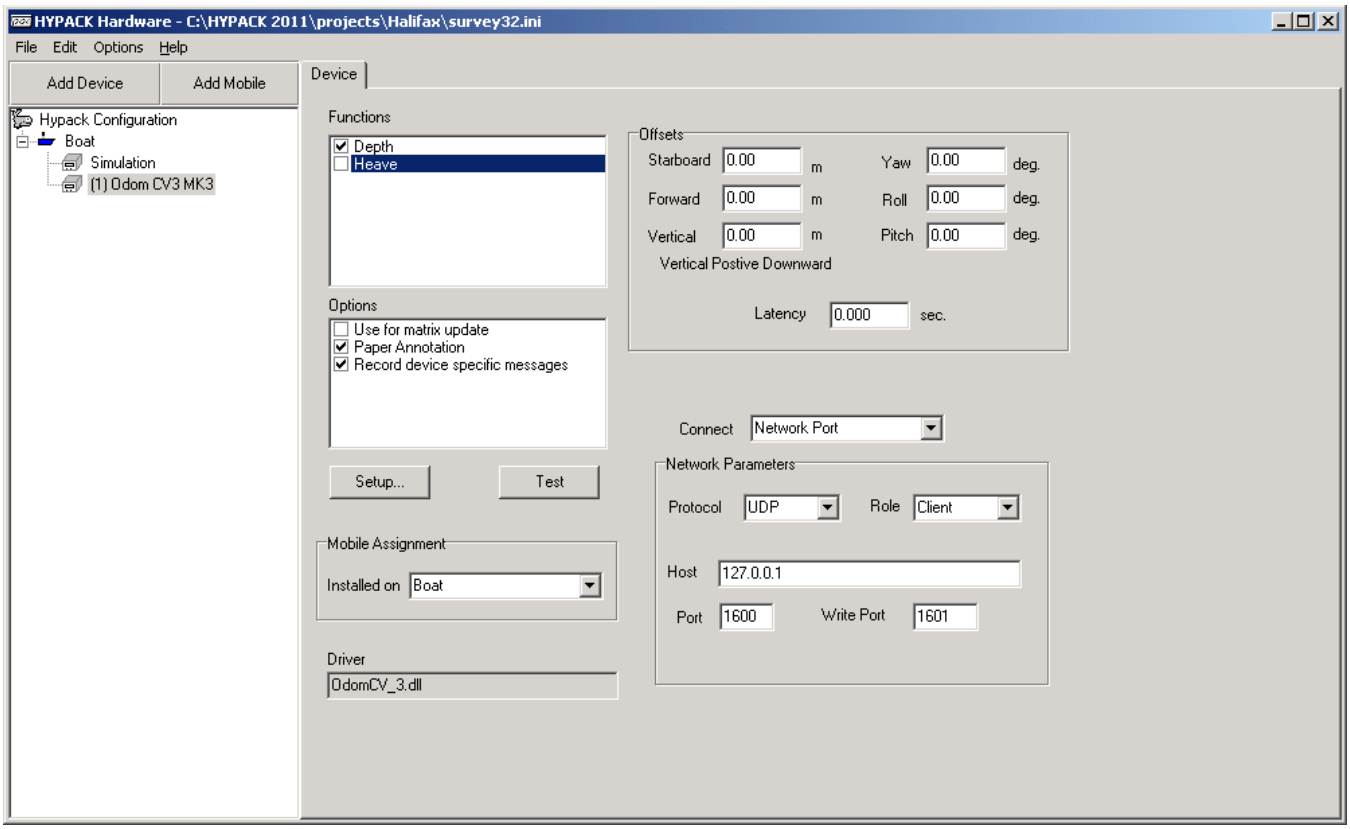
INTRODUCTION

The Hydrotrac II has an Ethernet port that outputs the digitized samples to 8 bits of the acoustic signal from the unit's receivers. This data has normally always been printed on the chart and only the digitized values have been input into the hydrographic software that is logging and editing the data. To fully leverage the power of having all this acoustic data available Teledyne Odom Hydrographic and Hypack have developed an Ethernet driver that will read in the acoustic data into Hypack as well as the digitized values. All the normal fix marks are still printed on the chart. The real power of having the data available in Hypack comes into play when the surveyor goes to review and edit the data. Instead of only having a digitized line on the screen and then having to refer back to the chart for reference, all the acoustic data is in the background. The surveyor can now edit the digitized data with much more precision and confidence. The raw acoustic data is never altered during the editing process.

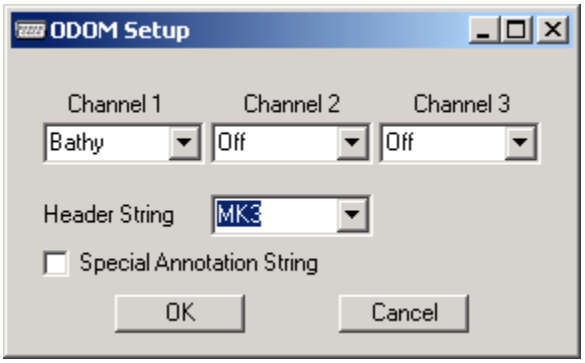
If the Hydrotrac II is going to be connected directly to the computer then a cross over Ethernet cable is required. This is the red Ethernet cable supplied with the Hydrotrac II. If there is a network hub between the computer and the Hydrotrac II then a straight network cable is required from the Hydrotrac II and the network hub.

SETTING UP THE HYPACK DRIVER FOR NORMAL SURVEYING

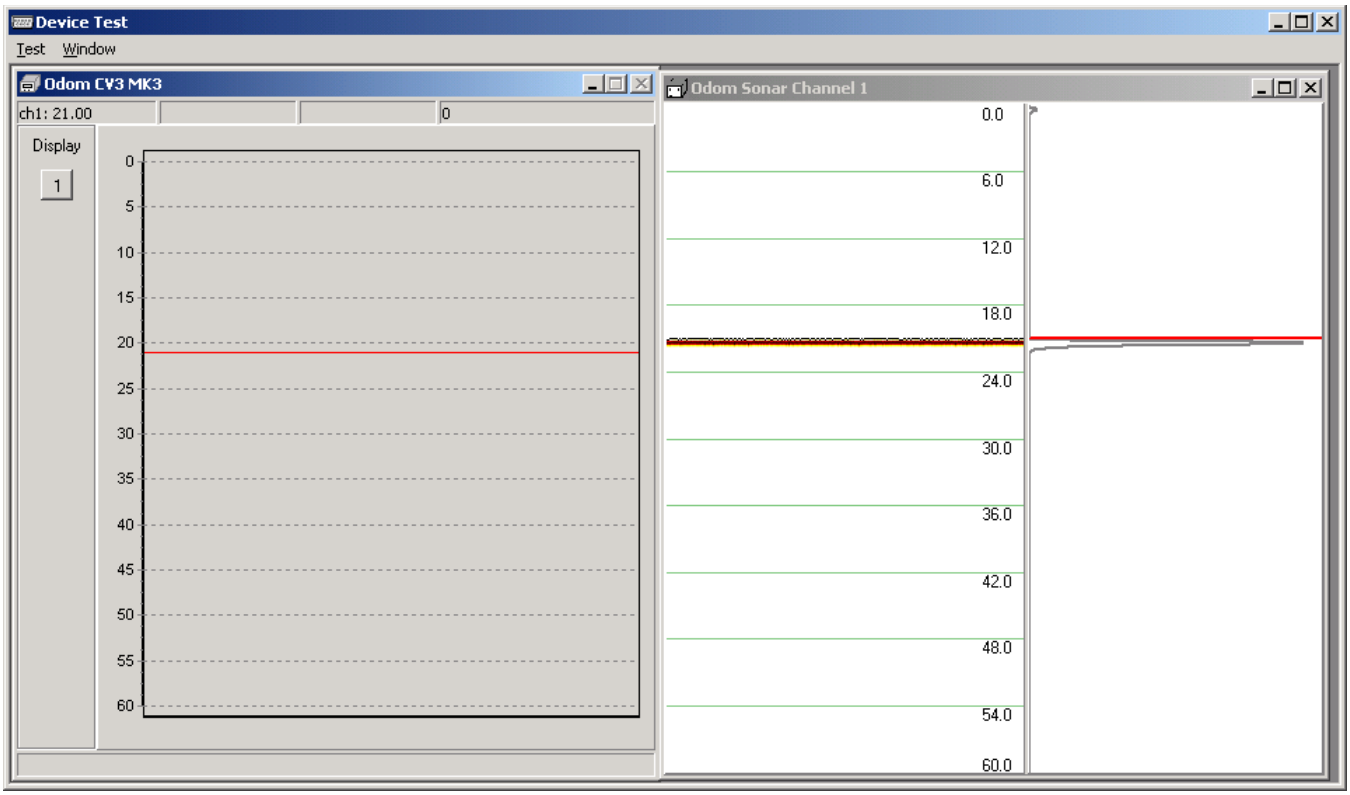
1 - In the Hypack Max menu select Preparation->Hardware->Hypack Hardware.
2- In the Edit menu select Insert->Device.
3- Scroll down the list and select Odom CV3/MK3.
4- Give the driver a name like Hydrotrac.
5- Select Connect and then Network Port.
6- Select **UDP** for Protocol, **Client** for Role and under Port put **1600**. For Write Port put **1601.**
This is what the Hypack Hardware setup should look like at this point



Next click on the Setup… button but make sure the Hydrotrac device is highlighted under the Hypack Configuration menu. Make sure Channel 1 under the setup menu is set to Bathy and all other channels are turned Off.



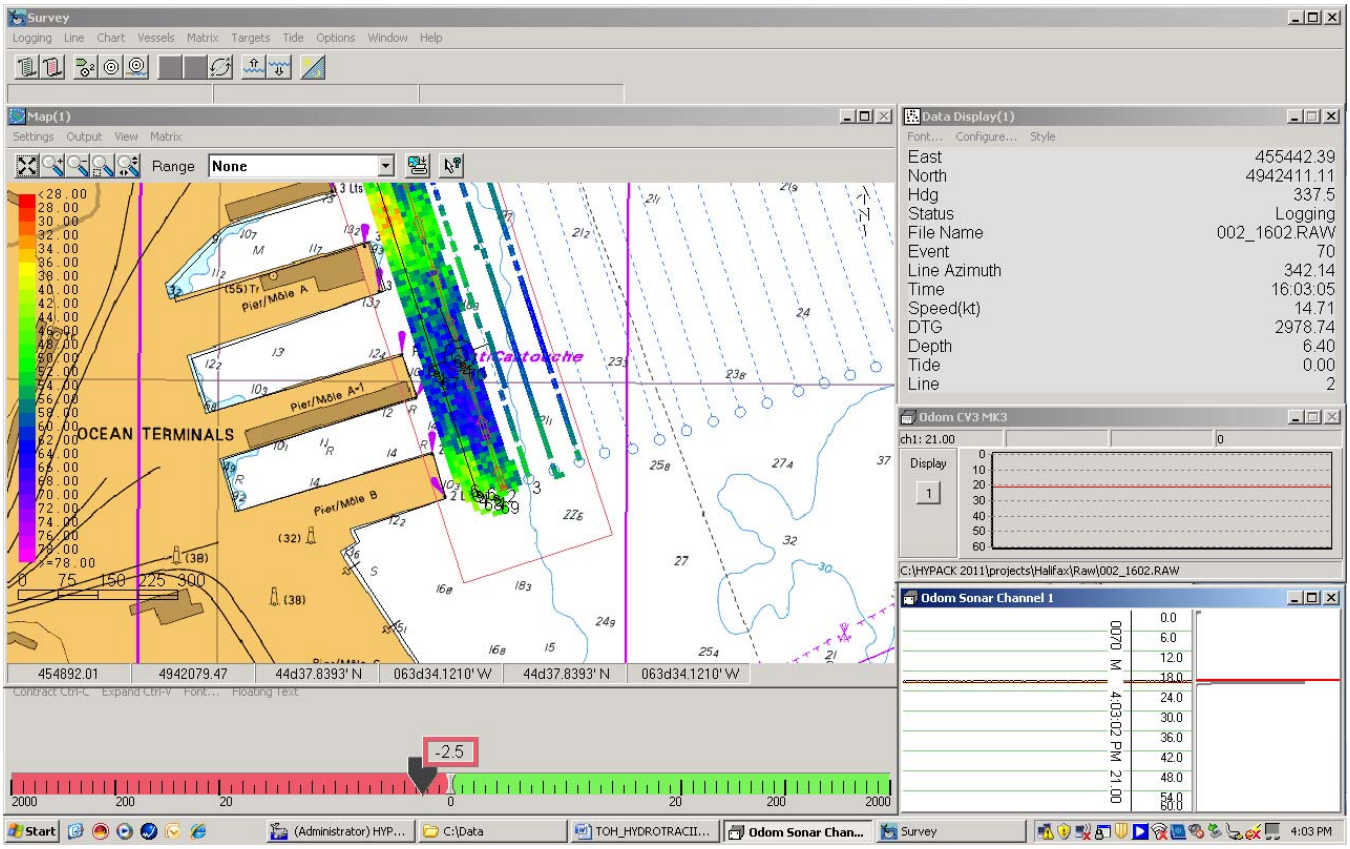
Testing driver: After starting the Hydrotrac II highlight the Hydrotrac device in the Hypack Hardware setup and right click with the mouse, select test.



Initially when starting the test only the window labeled Hydrotrac will open up. Click on the 1 button to display the signal from channel. Click anywhere on the Odom Sonar Channel 1 window and select beam to display the actual signal. Once the data is verified close the window and start Hypack survey.

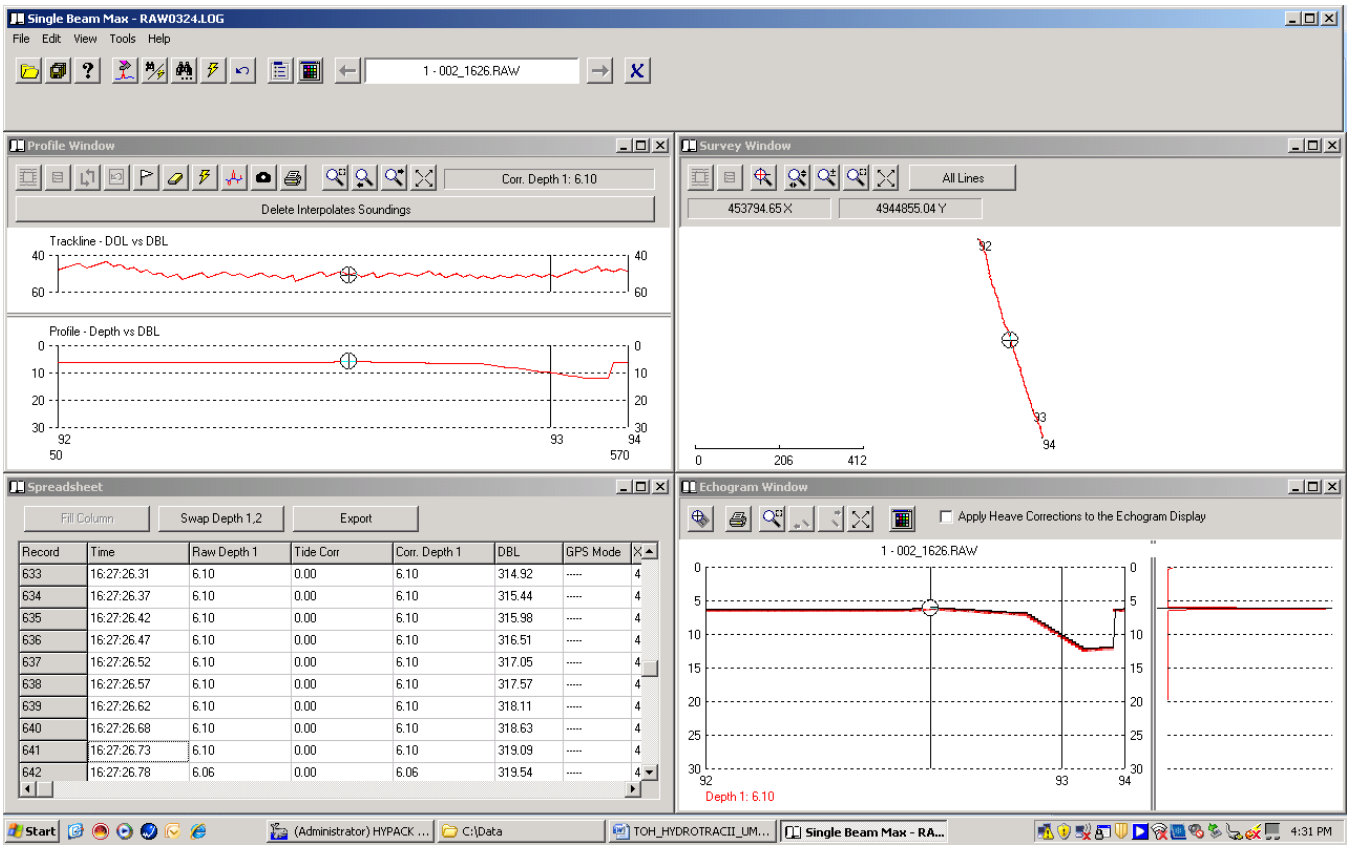
VIEWING THE RAW DATA IN THE SURVEY WINDOW

Once the Survey program is started the operator can select the Hydrotrac window and view the data. Below is an example of what the data should look like.



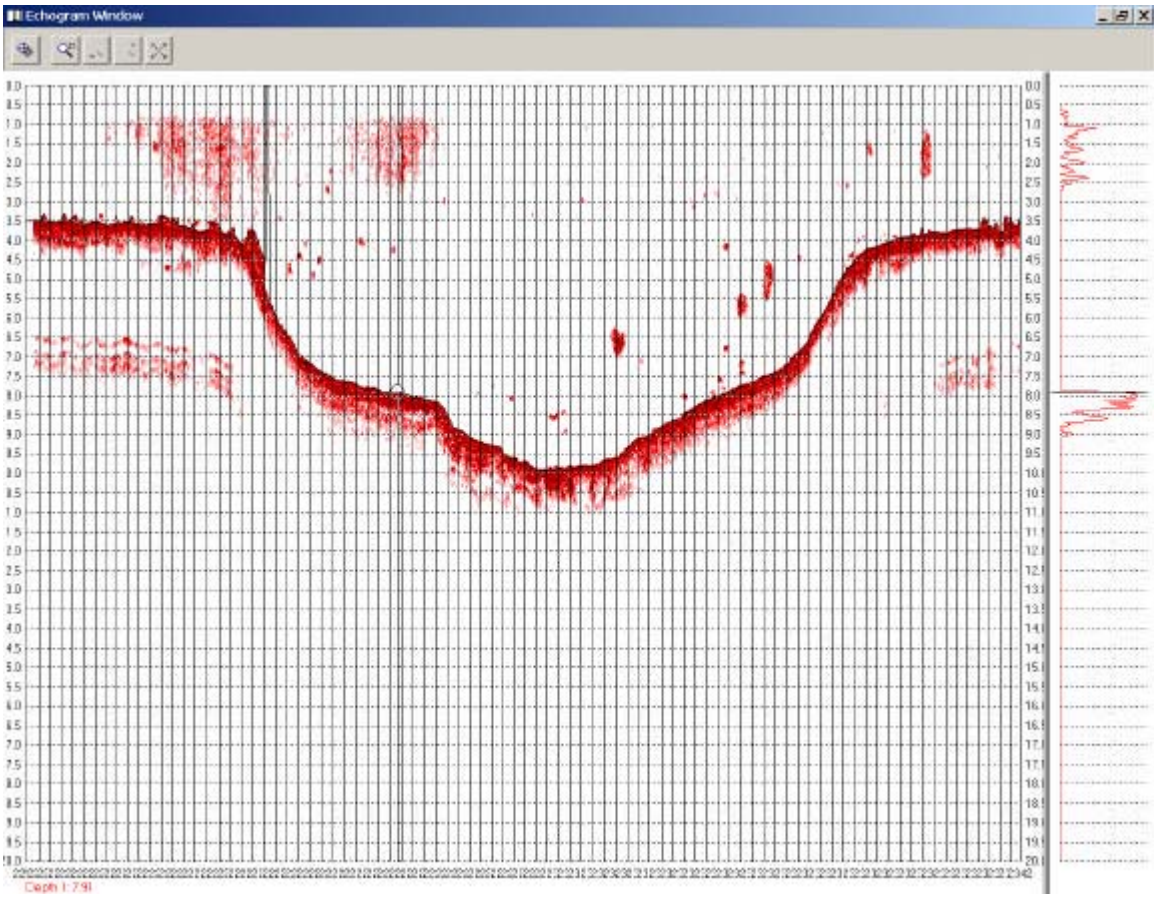
VIEWING AND EDITING THE ECHOTRAC DATA IN THE SINGLE BEAM EDITOR

1- In the Hypack Max menu select Processing->Single Beam Editor.
2- In the Single Beam Editor Max menu select Open and the log file name you created in the survey program.
3- Once you have loaded the lines go to View->Other windows->Echogram in the Single Beam Max window. The echogram data should show up on the screen.
4- You can select whether the data in the echogram window is the high frequency data, low frequency data or both combined. To do this select View->Options in the Single Beam Max menu. See picture below.

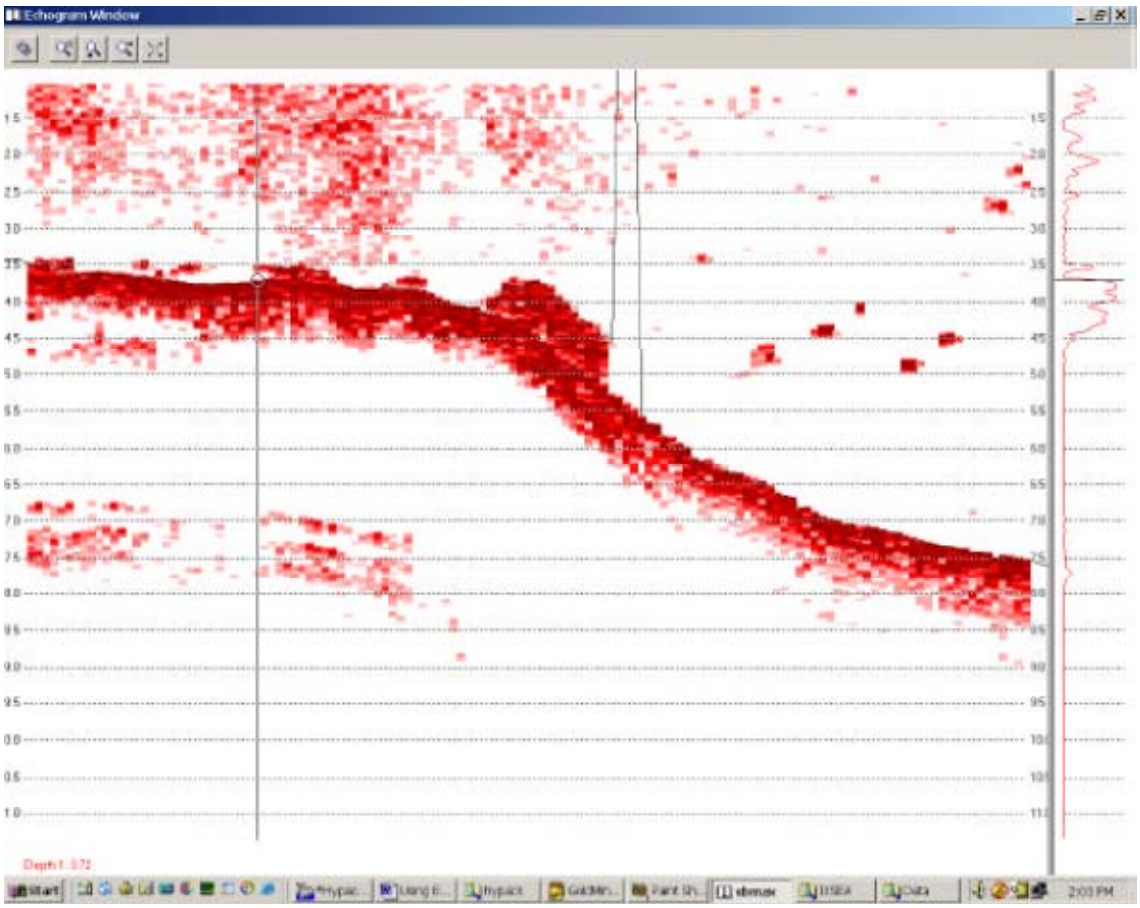


Editing the Data in the Echogram Window

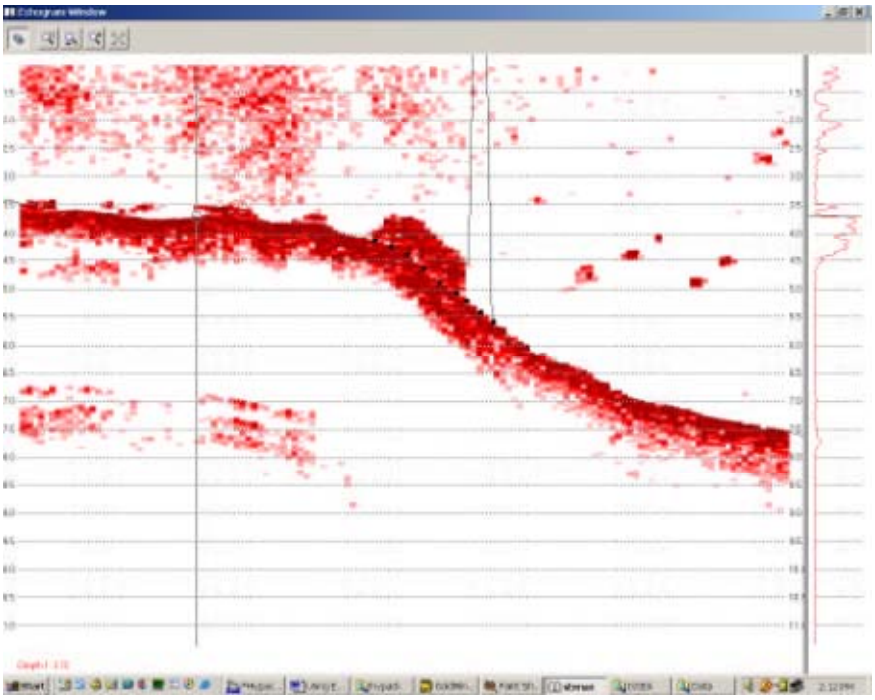
Below is a screen shot of some high frequency data in the Echogram window. If you look closely there is a black line on top of the red trace. This is the digitized value from the Hydrotrac. You can move the mouse and click along the record to show exactly where the digitized values are. You can click on the zoom button and then select the area you want to view better.



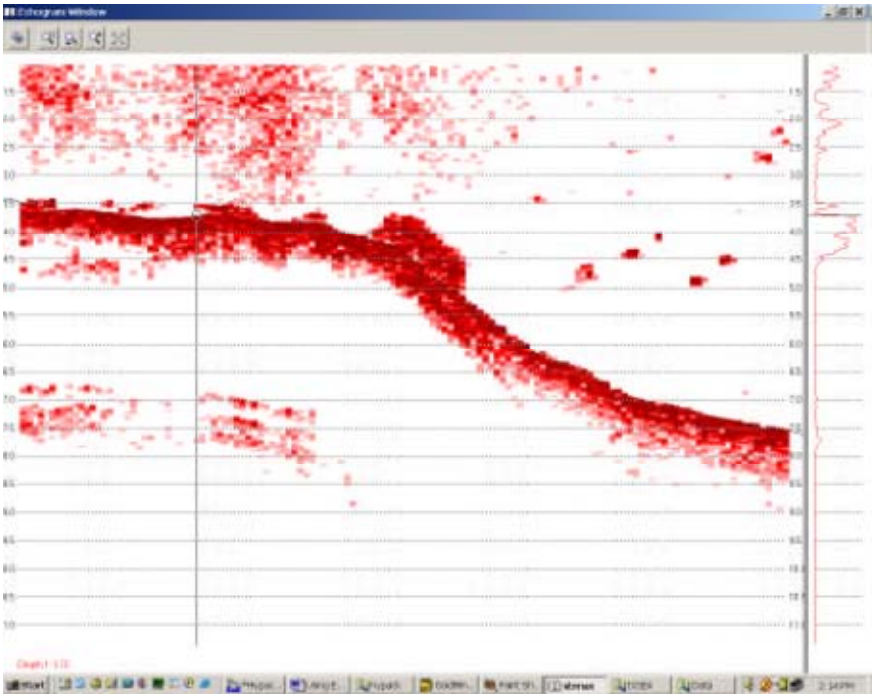
This screen is a zoomed in portion of the above screen. You will notice there appears to be an object on the bottom that we will edit out of the final data.



To edit the data click on the Digitize button and then click with the mouse along where you want the digitizer to go. Black dots will appear along where you clicked with the mouse. When you have finished editing and you meet the original digitized line release the digitize button. The digitizer line will merge with the original line. See the screens below.



Line re-digitized



Appendix F. Firmware Revisions

FGPA firmware	
Version	Description
0.05	• Added heave correction to Serial 2 input • Added remote display output to Serial 2 input • Added data and time to annotation information • Enabled chart test on maintenance menu • Enabled Serial 1 and Serial 2 to maintenance menu • Printer Help menu implemented • Bar depth width adjusted from 2m to 1m and 6ft to 3ft • Changed Com1 and Com1 menu to Serial1 and Serial2 • Remapping of printer intensity • Internal GPS configured to NMEA GGA 9600 baud
0.06	• Fixed bug that was causing menu to lock up • Added Annotation string ON/OFF parameter o When Annotation is on and Mark button pressed fix line and annotation is printed o When Annotation is off and Mark button is pressed only fix line is printed • Added leading 0 to Blanking, Draft and Index Parameters
0.07	• Serial1 and Serial2 port test now outputs data through the port and displays received data on the LCD screen • Fixed fix mark command through the serial port to print fix line • Added display of GPS Lat and Long to the display when depth key is pressed twice • Added GPS Lat and Long to the annotation string when mark is pressed and annotation is enabled. • Fixed bug that was causing stored parameters to get reset to default under certain conditions. • Reduced minimum gate size to 0.5 meter and 2 ft.
0.08	• Added Minimum depth alarm • Added Manual Chart Speed • Added Print Parameters • Added printout of key parameters when they change • Added Sonic Alarm • Changed Parameter storage from Flash to battery backup on RTC • Added more help context in printouts • Changed Ethernet packet size • Fixed bug where scale end could be set less than scale width • Changed auto scale adjustment so scale change happens before depth reaching end of scale value. • Fixed serial annotation so that it would work with GLDD driver • Fixed serial annotation so that it would recognize Carriage Returns that advance the chart. • Change print head burn mapping • Fixed serial annotation to buffer multiple lines of annotation • Added Simulator
0.09	• Fixed take-up button
0.10	• Fixed bug that would cause the bottom record not to print correctly at certain sound velocity settings.
0.11	• Added ET Mark1 I/O to the Serial 1 selections.

Transceiver firmware

Version	Description
1	• Initial version
2	• Changed IF to 100 Mhz

Transceiver hardware	
Version	Description
1	• Initial version