320B BLACK BOX ECHOSOUNDER

SOFTWARE INSTALLATION/UPGRADE MANUAL

Supports Software Installer Package #: D429-03434

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Revision 3.0
March 22, 2004

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1 INTRODUCTION

1.1 About this manual

This manual provides installation and upgrade details for the software package provided with a 320B Series Black Box Echosounder. It provides descriptions of the Windows software applications, and the embedded firmware. It explains what needs to be installed for a newly delivered system, and what needs to be done to upgrade an existing system.

1.2 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

2 SOFTWARE DEFINITIONS

2.1 Overview

Virtually every aspect of the 320B Series Echosounder's functionality is defined and controlled by software. This software includes the "firmware" which resides in non-volatile FLASH memories within the echosounder itself, and various Windows-compatible support applications which run on the host PC.

2.1.1 Firmware

The term firmware refers to the software which resides in FLASH eproms within the Echosounder. Upgrades and revisions are distributed periodically as ".tag" files which can be re-programmed into the echosounder in the field by the user.

The echosounder preserves its operating parameters in on-board non-volatile memory (NVM), and will restore the stored parameters on power-up. Unless new NVM parameters have been defined in a firmware upgrade, the system can preserve its customized configuration during a system upgrade. If new NVM parameters have been added in an MPM firmware upgrade, the system may have to restore the NVM to factory defaults. It is advisable to assume that a firmware update will cause the NVM to revert back to factory defaults and to record the important unit settings before proceeding with the update.

2.1.2 Windows Support Applications

There are various Windows applications provided with the 320B Series Echosounders for different support purposes. All the programs are Windows compatible, and are installed with a standard Setup.exe process.

2.1.2.1 EchoControl (EchoControl.exe)

This program is an independent Windows application that interfaces to the echosounder via the SCSI interface. The SCSI interface must be connected and functioning for this application to be usable. It provides a scrolling echogram image display with echosounder operating controls, and controls for data logging and recording functions. This application is required for the user to be able to control the 320B.

2.1.2.2 PostSurvey (PostSurvey.exe)

This program is an independent Windows application that provides the user playback and printing capabilities for the echogram data recorded by the Echo Control application.

2.1.2.3 Hypack Device Driver (Kel320Scsi.dll)

This program is provided as a device driver to Coastal Oceanographics HYPACK for Windows hydrographic survey software, in the DLL (Dynamic Link Library) format required by HYPACK. This program is only useful to HYPACK for Windows users. It uses DDE data transfer protocol to interface with the stand-alone EchoControl application.

2.1.2.4 Serial Configuration Utility (SerialControl.exe)

This program is a very simple Windows interface program. It communicates with the echosounder through the serial monitor port (COM3). It works with existing PC com port hardware (no special host adaptors are required), and provides basic configuration functions. It provides access to the serial port configuration controls required to set-up the echosounder to interface with external devices. Once the sounder's configuration parameters have been set, the program can be terminated and the sounder will retain the selected configuration.

2.1.2.5 Serial SerialUpgrade (SerialUpgrade.exe)

This program is a very simple Windows interface program. It communicates with the echosounder through the serial monitor port (COM3). It works with existing PC com port hardware (no special host adaptors required), and provides strictly firmware upgrade capabilities.

3 INSTALLATION / UPGRADE GUIDELINES

3.1 Initial Installation

A newly delivered echosounder has the necessary firmware programmed into it. The user only needs to load the Window's support applications supplied on the CD-ROM. The CD-ROM contains a Setup.exe Windows installation program that creates the directory and copies all the files onto the user's hard disk. See Chapter 4 for a complete description of the installation process.

3.2 System Upgrades

Occasionally, a system that has already been operating out in the field will be provided an upgrade software package to provide additional operating features not available with the existing software. If the Echosounder's firmware is not D40-02000 V5.25 or later, it will need to be upgraded. See Chapters 4 and 5 for detailed descriptions of the installation processes.

NOTE: When performing the upgrade, always perform the Windows upgrade first, as this will extract the necessary ".tag" file onto the hard disk required to proceed with the firmware upgrade.

4 PC SOFTWARE INSTALLATION

4.1 Setup Procedure

The CD-ROM provided either with a new system or in an upgrade package contains a typical Windows Setup.exe installation program. For most Windows systems, this Setup.exe will automatically run (autorun) when the CD-ROM is loaded in the drive. If it does not start automatically simply run the file Setup.exe.

When this program is run, it displays a number of information and configuration prompts to all the user to customize the installation process if desired. Customization of the installation should be undertaken by advanced users only. The normal installation process proceeds as follows:

1. Welcome Box: proceed or cancel
2. Destination Folder: default: C:\Program Files\SounderSuite
3. Program Group: SounderSuite
4. Setup Type: Typical or Custom: typical installs predefined list of components, custom allows the user to select the desired components (advanced users only)
5: Select Components: available on Custom install only. See Table 4.1 for component details.
6. Ready to Install the Program: last chance to cancel before actual installation is performed.
7. ASPI installer: independent installer application which may ask to reboot PC. Select the option to reboot later and proceed with rest of SounderSuite installation
8. Computer Restart: it is recommend to accept the restart option at this time to ensure all drivers and registry modification are properly initialized for use.

If the installation process is being performed for a new unit, the process is now complete. The sounder will have been shipped with the appropriate firmware revisions. If this is an upgrade package, the firmware in the sounder will probably need to be upgraded as well. Please see Chapter 5 for detailed information regarding the firmware upgrade.

Table 4-1: Installation Components

Component	Description
SounderSuite	Windows applications and required support files
Firmware	Firmware TAG files used for system upgrade/restoration.
Sounder Class	For NT-based OSes: Installer for class definition for KEL Echosounders
Thermal Recorder Service	For NT-bases OSes: Installer for service to support parallel-port thermal recorders
ASPI Layer	Installer for necessary ASPI interface layer
Documentation	Manual components in PDF format

4.2 Special Notes regarding Windows NT

Because the installer package needs to install driver services and class components, the installation must be done using an adminstrative account on Windows NT based computers.

5 FIRMWARE INSTALLATION

The firmware installation procedures are only required for system upgrades. Newly delivered systems do not need to have any firmware loaded. Upgrades are performed when new capabilities are added to the echosounder's functionality. Sometimes only the Windows support software is enhanced and firmware remains unaffected. If the Echosounder's firmware is not D40-02000 V5.25 or later, it will need to be upgraded.

The 320B Echosounder Main Processor Module (MPM) has FLASH memories for storing the firmware used to run the system. There is also a FLASH memory used to store the transmit pulse generation codes used for transmitting a ping. Upgrading the 320B involves downloading new firmware into the controller board, and the transmit memory.

5.1 Upgrading the MPM Firmware

There are four possible methods to use to upgrade the MPM firmware; one using the Online SCSI Control application, one using the Serial Configuration Utility, one using the Serial Upgrade application, and one using any other PC communications package interfacing to the sounder's monitor port on COM3. The fastest and easiest method is the one using the Online SCSI Control application. The methods that use the serial link on COM 3 are slower due to the lower throughput rate of the serial link. The method used with the Serial Configuration Utility or the SerialUpgrade is virtually identical to that used with the SCSI once the communications link is established.

NOTE: Sometimes the applications used to perform the firmware upgrade fail to directly reference the directory location for the firmware file(s). For the MPM, the firmware ".tag" can be located in the Firmware\MPM folder located in the destination folder specified during the Windows software installation. If the default location was used, the proper folder would be C:\Program Files\SounderSuite\Firmware\MPM.

5.1.1 Using the SCSI Control Application: EchoControl.exe

(Note: This application is no longer compatible with echosounder firmware versions that pre-date D40-02000 V2.14. If your original firmware version pre-dates this one, please use an alternate method to perform the upgrade.)

Run the EchoControl application; if the firmware version on the echosounder is older than that fully supported by the Echo application, a message box will appear indicating this condition. After the user acknowledges the message, all controls in the program will be disabled except those required for the firmware upgrade. It is possible for extremely old firmware versions that the Echo application may not be able to recognize its configuration properly, and will disable all controls, even those required for the upgrade. In such a case, the user can use one of the other methods described here.

To load the new firmware into the sounder, select the menu option **Upgrades** and its submenu **Load Tag**. Select the appropriate Knnnnnn.tag file required for the upgrade and accept. The application will display a dialogue indicating the progress of the operation.

The **Load Tag** command simply loads the new firmware into the echosounder's SRAM memories. If the

sounder were powered down at this point, the new firmware would be lost and the sounder would power up with its original firmware version. To program the new firmware permanently into the sounder EPROM memories, select the menu option **Upgrades** and the submenu **Program PS**. The application will display an hourglass cursor until the programming has completed. The application will display a dialogue indicating the progress of the operation.

At this point the sounder has the new firmware permanently loaded, but the Transmit EPROM data may not correspond properly with it. To load the Transmit EPROM with matching data, select the menu item **Upgrades** and its submenu **Program TX.** The new firmware itself loads the Transmit EPROM with the appropriate data. The Echo application will display a progress bar until the transmit programming has completed; this can take significantly longer than the **Load Tag** and the **Program PS** operations.

5.1.2 Using Serial Configuration Utility: SerialControl.exe

(**NOTE**: This application is not compatible with echosounder firmware versions that pre-date D40-02000 V1.01. If your original firmware version pre-dates this one, please use an alternate method to perform the upgrade.)

Run the SerialControl application; if the firmware version on the echosounder is older than that fully supported by the application, a message box will appear indicating this condition. After the user acknowledges the message, all controls in the program will be disable except those required for the firmware upgrade. It is possible in the case of extremely old firmware versions that the SerialControl application may not be able to recognize its configuration properly, and will have difficulty determine the correct communications settings to use for the link. If this occurs configure the PC port to match the echosounder manually using the Menu item **Com Ports** , sub menu **PC Port** command. Once the PC port has been properly configured, proceed with the firmware upgrade.

To load the new firmware into the sounder, select the menu option **Upgrades** and its submenu **Download Tag**. Select the appropriate Knnnnnn.tag file required for the upgrade and accept. The application will display a status box indicating the progress of the download process; this can take couple of minutes dependent upon the serial data rate. After the download is complete, the SeriaControl application checks that the new firmware is responding properly, and reports its success or failure. If the tag file has downloaded successfully and the data setup could be successfully read, the user can proceed with the upgrade process.

The **Download Tag** command simply loads the new firmware into the echosounder's SRAM memories. If the sounder were powered down at this point, the new firmware would be lost and the sounder would power up with its original firmware version. To program the new firmware permanently into the sounder EPROM memories, select the menu option **Upgrades** and the submenu **Program PS**. The application will display messages received from the echosounder indicating the progress of the programming task.

At this point the sounder has the new firmware permanently loaded, but the Transmit EPROM data may not correspond properly with it. To load the Transmit EPROM with matching data, select the menu item **Upgrades** and its submenu **Program TX.** The new firmware itself loads the Transmit EPROM with the appropriate data. The application will display messages received from the echosounder indicating the progress of the programming task; this can take significantly longer than the **Program PS** operation.

5.1.3 Using Serial SerialUpgrade: SerialUpgrade.exe

(NOTE: This application is not compatible with echosounder firmware versions that pre-date D40-02000 V1.01 If your original firmware version pre-dates this one, please use an alternate method to perform the upgrade.)

Before trying to use this application, please ensure that the echosounder is not sounding. If it is sounding, the data logging output string that is sent with every ping will confuse the Upgrade application, potentially causing error messages to occur during the upgrade attempt. Turn the transmit off for each frequency channel to avoid this problem.

Run the SerialUpgrade application an select the options for Main Processor Module, the Com port to use, and whether to use auto-detection for the com port settings. It is possible in the case of extremely old firmware versions that the Upgrade application may not be able to recognize its configuration properly, and will have difficulty determine the correct communications settings to use for the link. If this occurs configure the PC port to match the echosounder manually using the Menu item **Com Ports**, sub menu **PC Port** command. Once the PC port has been properly configured, proceed with the firmware upgrade.

To load the new firmware into the sounder, select the menu option **Upgrades** and its submenu **Download Tag**. Select the appropriate Knnnnnn.tag file required for the upgrade and accept. The application will display a status box indicating the progress of the download process; this can take couple of minutes dependent upon the serial data rate. After the download is complete, the SerialUpgrade application checks that the new firmware is responding properly, and reports its success or failure. If the tag file has downloaded successfully and the system configuration could be successfully read, the user can proceed with the upgrade process.

The **Download Tag** command simply loads the new firmware into the echosounder's SRAM memories. If the sounder were powered down at this point, the new firmware would be lost and the sounder would power up with its original firmware version. To program the new firmware permanently into the sounder EPROM memories, select the menu option **Upgrades** and the submenu **Program PS**. The application will display messages received from the echosounder indicating the progress of the programming task.

At this point the sounder has the new firmware permanently loaded, but the Transmit EPROM data may not correspond properly with it. To load the Transmit EPROM with matching data, select the menu item **Upgrades** and its submenu **Program TX.** The new firmware itself loads the Transmit EPROM with the appropriate data. The application will display messages received from the echosounder indicating the progress of the programming task; this can take significantly longer than the **Program PS** operation.

5.1.4 Using the Monitor Port and a Communications Program

Make sure a null modem serial communications cable is attached to the COM3 connector on the 320M's connector panel and set up the baud, parity, and data format on COM3 to match that used by the PC. The typical settings are:

Baud Rate: 19200
Data bits: 8
Parity: none

Step	Action	Keyboard Entry	Expected System Response
1	Start PC Communications Program	(Program Specific)	(Program Specific)
2	Power on 320M	none	SRAM Monitor sign-on message with prompt ">"
3	Switch to ROM	/GR[ENTER]	ROM Monitor sign-on message with prompt "*"
4	Start Download	/DT[ENTER]	"Waiting for TAG file."
5	Start ASCII transfer	(Program Specific)	(Program Specific)
6	Wait for transfer to complete	none	Download complete.
7*	Switch to SRAM	/GT[ENTER]	SRAM Monitor sign-on message with prompt ">"
8	Program permanently into EPROM	/PRGPS[ENTER]	Programming zeroes, erasing, programming, done.
9	Program Transmit EPROM to match new firmware	/PRGTX[ENTER]	Programming zeroes, erasing, programming LF, programming HF, done. (If only one frequency is installed, only the appropriate channel is programmed)

*Note: At this point the new software is in SRAM only. If a system power-down were to occur now, the new software would be lost. It MUST be programmed before the system can be powered down if the new code is to be preserved.

320B SERIES ECHOSOUNDER

HARDWARE MANUAL

D10 - 02096
Revision 5.0
November 9, 1999

KNUDSEN
ENGINEERING LIMITED

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

WARNING!

The 320B series of echosounders are capable of generating hazardous voltages at the outputs of the transmitters.

Transducers, connectors, and cables should not be handled while the sounder is operating.

Protective panels should not be removed except by qualified technical personnel.

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LIST OF FIGURES

1 INTRODUCTION

1.1 About this manual

This manual provides an introduction to the basic hardware of the echosounder with important reference information for both the novice and the advanced user.

1.2 The 320B Black Box Echosounder

The 320B Series Black Box Echosounder was designed and built in Canada by Knudsen Engineering Limited (KEL). The 320B model is distinguished by compact size, and high performance; with the flexibility, versatility and accuracy provided by Digital Signal Processing. The Echosounder is configurable for one or two sounding channels with frequency of operation from 3.5 kHz to 250 kHz .

There are four different package options for the 320B Echosounder series, each designed for different applications and environments.

Model #	Basic Description
320B	Aluminum case, bulkhead-mounted
320B/P	Plastic case, portable
320B-Rackmount	Aluminum case, rack-mounted
320B/R	Aluminum case, rack-mounted, specialized hardware for deep water applications

This manual contains all installation and operating instructions for each type of system. Most information is common to all four types of system; it will be explicitly noted where there are any specialized differences.

The 320B Series Black Box Echosounder is not a stand-alone instrument. It is designed to be used with a personal computer (referred to throughout this manual as the host PC) which provides the user interface, display and data logging functions through special purpose software which is provided with the echosounder.

1.3 Technical Support

KEL can assist with transducer selection, special serial interfacing, and custom 320B functions. In addition, KEL extends the following support services to 320B owners:

- Module swap under warranty
- Module repair, refurbishment or test
- Software modifications via the Internet to your field site
- Emergency 320B Spares
- Diagnostic assistance and consultation

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

2 INSTALLATION

2.1 Shipment, Storage, and Unpacking

All 320B echosounder models are securely packed in rugged shipping/storage cases. In the standard shipment will be the following items:

- 320B Series Black Box Echosounder (320B, 320B/, 320B-Rack, or 320B/R)
- Detachable DC power cable
- Transducer cable connector(s)
- RS-232 null modem serial communications cable
- 320B Series Echosounder User Manual
- Software CD-ROM

The echosounder is ready to be installed and operated immediately upon being unpacked. There are no special procedures to be performed before the unit is packed away for storage or shipping.

2.2 Physical Characteristics

2.2.1 320B

The 320B model is a compact, bulkhead-mountable, aluminum unit designed for permanent shipboard installation. Its significant dimensions and weight are: 240x75x371mm and 7 kg, (9.45" x 2.95" x 14.6" and 15.4 lb).

2.2.2 320B/P

The 320B/P model is a small, portable, water-resistant, plastic unit designed for easy portability and small open boat applications . Its significant dimensions and weight are: 470x371x191mm and 12 kg, (18.5" x 14.6" x 7.5" and 26.4 lb).

2.2.3 320B-Rackmount

The 320B-Rackmount model is a rack-mounted, aluminum unit designed for temporary shipboard installation. Its significant dimensions and weight are: 19" rack, 3U, 19.0"deep and 15.4lb, (483x133x483mm and 7 kg)

2.2.4 320B/R

The 320B/R model is a rack-mounted, aluminum unit designed for deep-water applications. Its significant dimensions and weight are: 19" rack, 5U, 19.0"deep and 40 lb, (483x223x483mm and 18.2kg)

2.3 Electrical Requirements

2.3.1 320B and 320B/P

The 320B and 320B/P echosounders are configured with a DC power input range of 9 to 36V.

Power input: 9 to 36 VDC (nominal 24 VDC) at approximately 40 Watts.

If the power input is connected with the wrong polarity, a protective diode shunts the current to the breaker, causing it to trip. Check the input wiring, then reset the breaker.

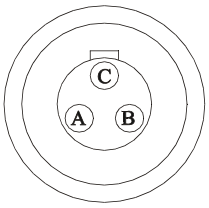
If the power input is accidentally connected to AC power, the large currents involved can cause the protective diode to fail shorted. The diode must be replaced before the system can be properly powered-up.

2.3.2 320B/R and 320B-Rackmount

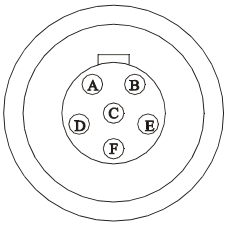
The 320B/R and 320B-Rackmount echosounders are configured with an AC power input range of 85-265 VAC, 47-440Hz.

2.4 Transducer Interface Description

Single Frequency



Dual Frequency



The transducer connection setup is dependent upon the model, the connector panel version installed in the particular model, and the configuration requirements for the particular customer.

Any connector panel that includes only one transducer connector is set with a dual frequency connection. For applications using separate transducers, an optional splitter box assembly is provided to adapt the dual connection to two single connections.

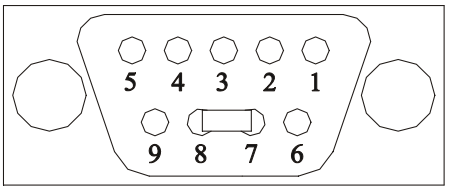
Any connector panel that includes two transducer connectors, can be set up for dual integrated frequency transducer connections or single discrete frequency connections.

Please refer to Figures 2-1 to 2-4 for the connector panel layouts.

2.5 Serial Communications Interface Specifications

All of the communication ports on the echosounder are DB-9M RS-232 ports wired in the same configuration as a PC communication port, but without any of the hardware handshaking lines connected. For most communications programs, hardware handshaking is not required and a standard null modem RS-232 serial cable is all that is required to establish the link between the echosounder and a PC.

2.5.1 RS-232 Com Port Wiring



Pin 2 - RXD Received Data
Pin 3 - TXD Transmitted Data
Pin 5 - GND Signal Ground
Pin 7 - RTS Request To Send: Jumpered to Pin 8
Pin 8 - CTS Clear To Send: Jumpered to Pin 7
Pin 1 ,4 ,6 , & 9 - not connected

2.6 SCSI Interface Specifications

The SCSI connector on the 320B, 320B/R, and 320B-Rackmount systems is a 50 pin Centronics SCSI-1 type connector. On the 320B/P system, the SCSI interface connector is a 50 pin Centronics SCSI-2 type connector.

2.7 Other Interfaces

2.7.1 Fix In/Out

The Fix In connection is available on the 320B/R and the 320B-Rackmount systems. The Fix Mark In can be connected to a TTL signal or a contact closure to initiate a fix mark.

The Fix Out connection is available on the 320B/R system only. The echosounder generates a signal strobe on the Fix Out connector for any fix mark condition including the signal from the Fix In connection. This allows the user access to the same fix signal for more than one device.

2.7.2 Sync In/Out

The Sync In connection is available on the 320B/R package only. The Sync In can be connected to a TTL signal or a contact closure to synchronize the echosounder to an external transmit trigger signal.

The Sync Out connection is available on the 320B/R and the 320B-Rackmount packages. This synchronization signal is generated by the echosounder, based on its own internal timebase-controlled ping cycle or from the external Sync In (320B/R model only). This signal allows the user access to the same trigger signal for more than one device.

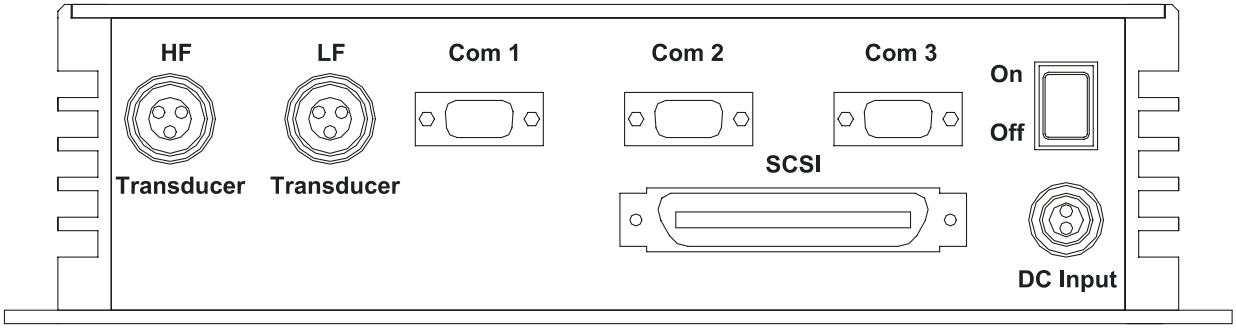
2.7.3 LF/HF In

These are standard BNC connections available on the 320B/R package only. The In connectors are used to inject external analog signals into the echosounder's internal receive circuitry. This is usually the case when external pinger units are used instead of the echosounder's internal transmit circuitry. Used in conjunction with the Sync In signal.

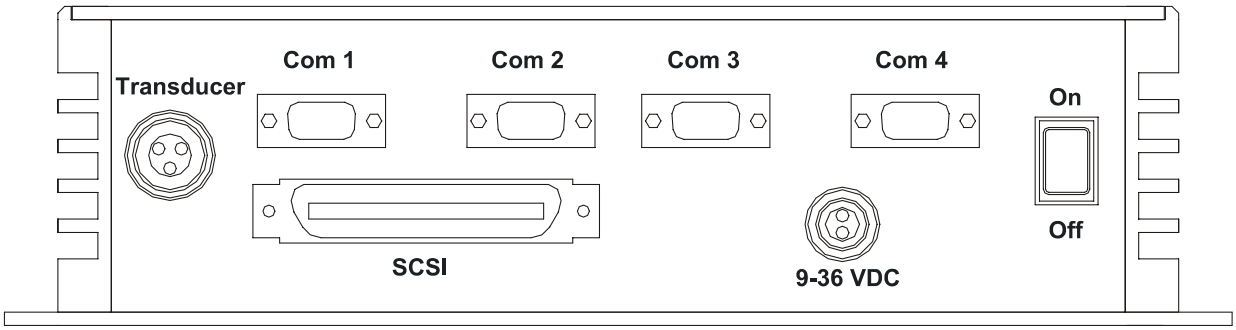
2.7.4 LF/HF Analog

These are standard BNC connections available on the 320B/R and the 320B-Rackmount models only. These connectors provide direct access to the echosounder's internal analog receiver signal after bandpass anti-aliasing filtering. This interface is typically used for external analog data loggers or monitoring with an oscilloscope.

Figure 2-1. 320B Connector Panels

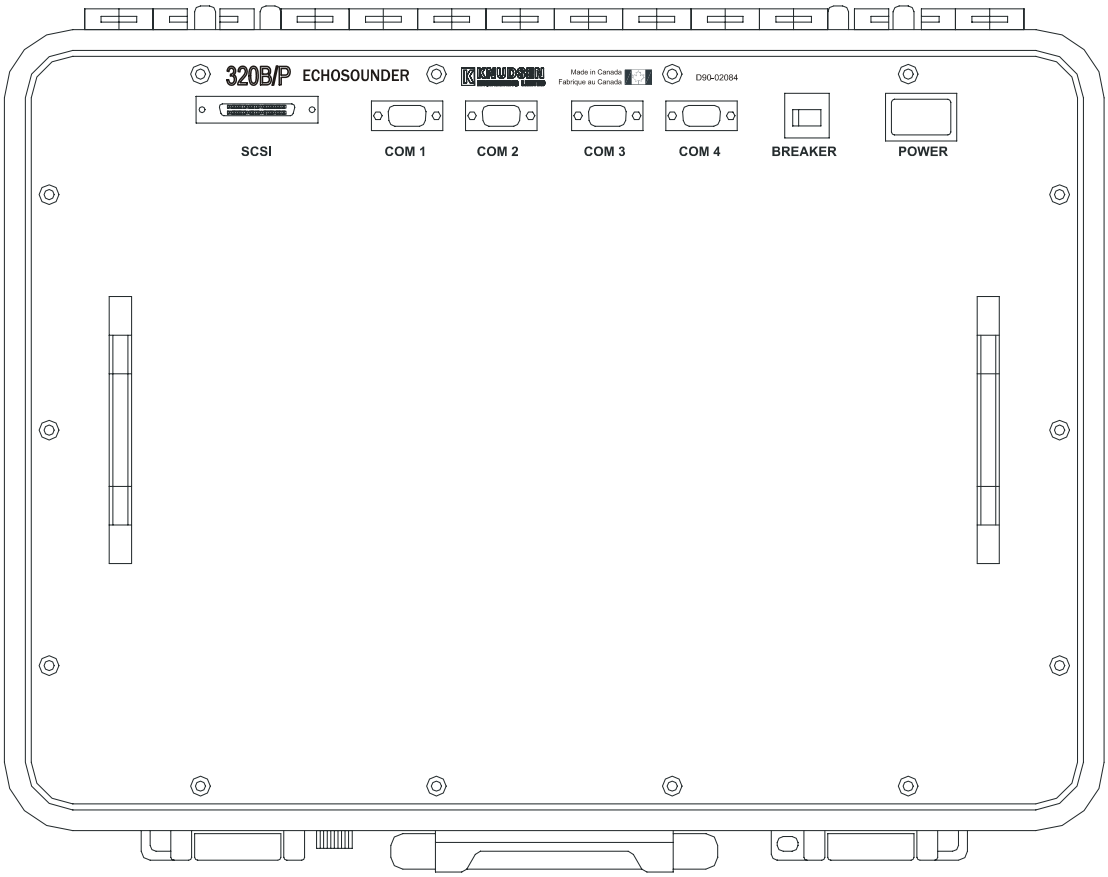


320B DUAL CHANNEL CONNECTOR PANEL

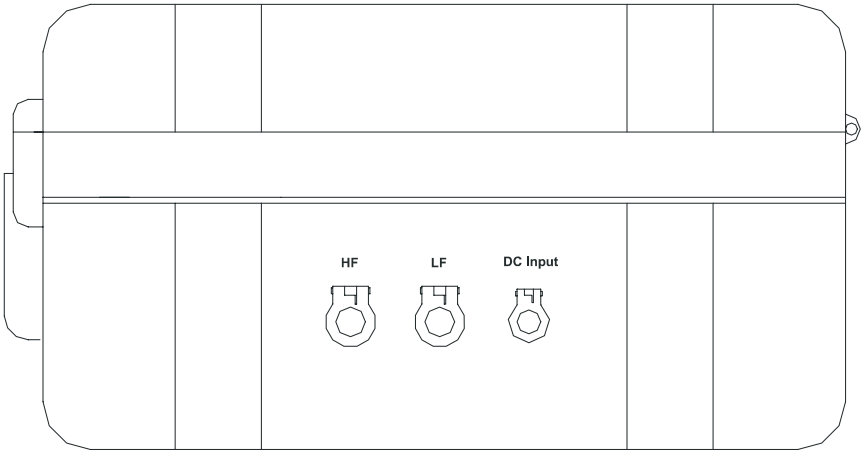


320B SINGLE CHANNEL CONNECTOR PANEL

Figure 2-2. 320B/P Connector Panel - Rev 1 to 4

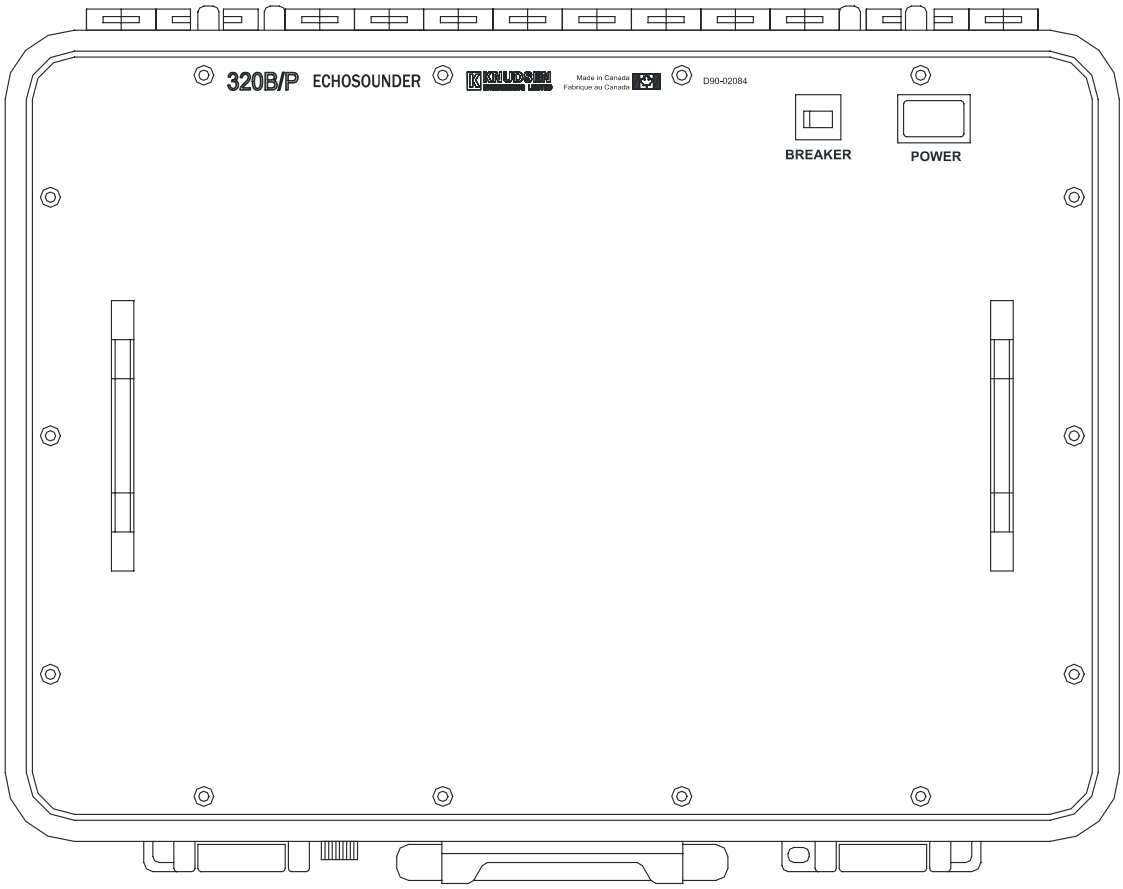


INSIDE VIEW

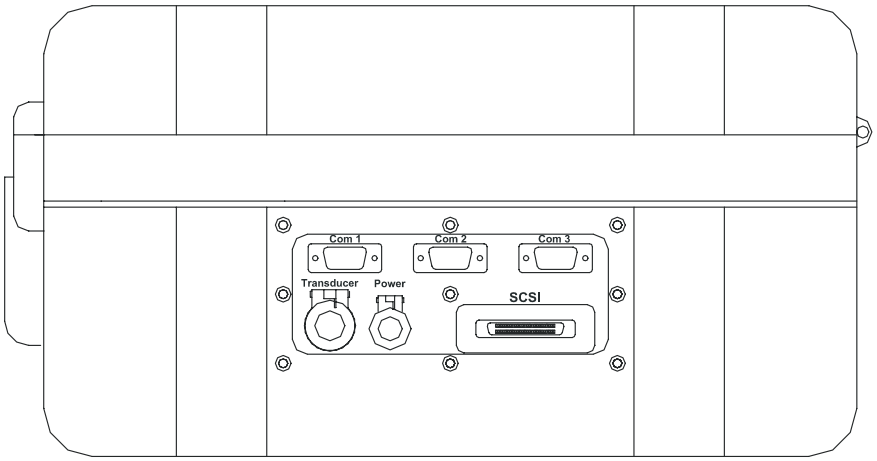


SIDE VIEW

Figure 2-3. 320B/P Connector Panel - Rev 5



INSIDE VIEW



SIDE VIEW

Figure 2-4. 320B/R Deep Water System Connector Panel

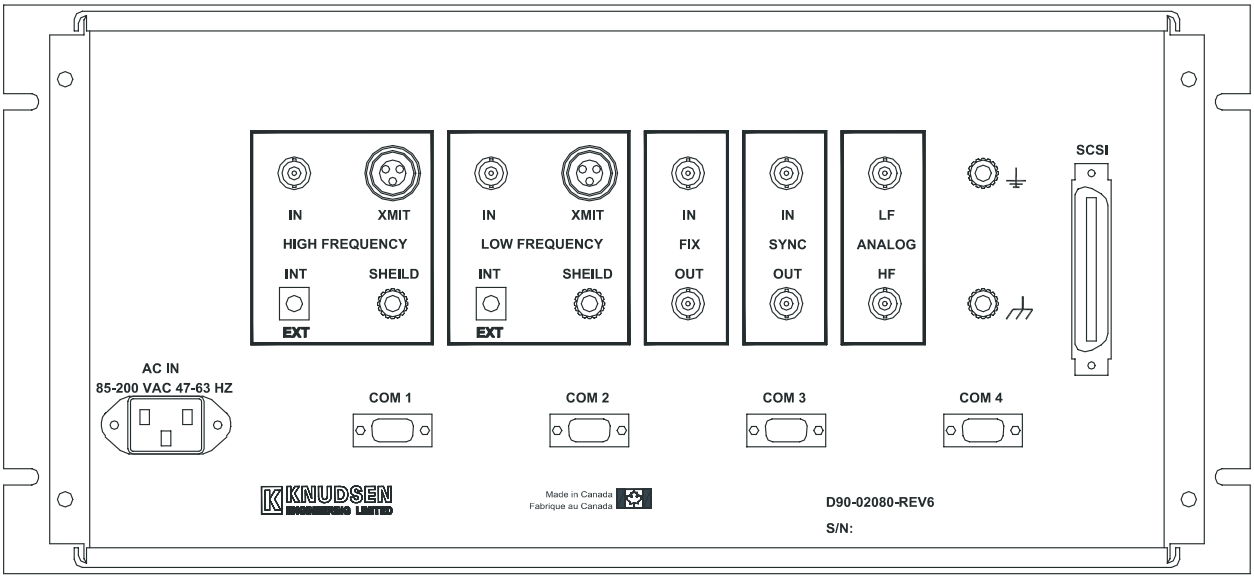
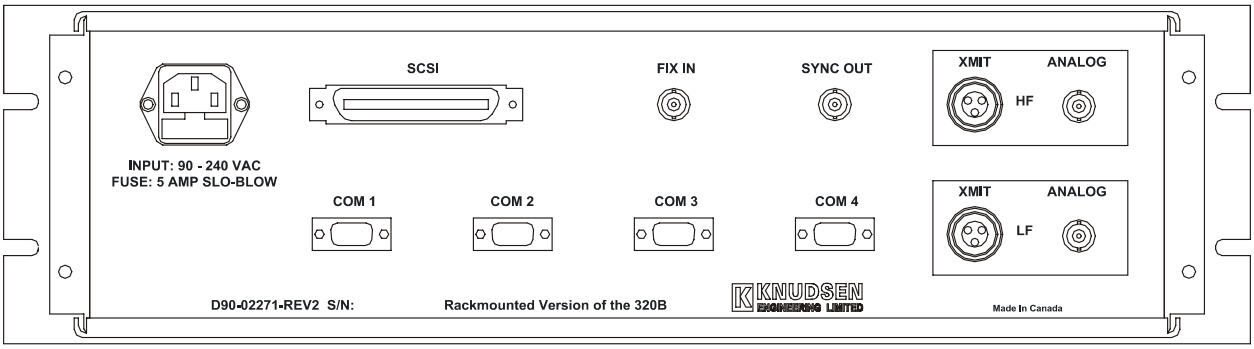


Figure 2-5. 320B-Rackmount Connector Panel



3 BASIC OPERATING INSTRUCTIONS

3.1 Power On

After the echosounder has been installed with the appropriate transducer, power, host PC, and peripheral devices connected, it is ready for operation.

The echosounder is turned on with the **POWER** switch. Immediately upon power-up the echosounder performs a number of self-test diagnostics. These consist of memory tests, and various other internal checks. If an error was detected, the appropriate error code is output via the serial monitor (COM3) port or the SCSI interface.

For users with parallel port SCSI adaptors, the echosounder must be powered on before the host PC. These adaptors get their operational power from the echosounder and must already be powered-up for the host PC to load the necessary drivers.

3.2 Echosounding

Once the echosounder is powered-up and the host PC has booted with the necessary drivers, run the appropriate control program on the host PC. Select the **Sounder: Controls** option from the application menu.

Set **Power** to any power level setting and click the desired Channel button to start the transmission and reception of pings, and the echosounder will attempt to detect bottom echoes. If it is successful, digitized depths will appear on the appropriate frequency channel depth display. Regardless if a bottom is detected, the program will start the real-time greyscale display of the received signal.

Typically, it is simplest to start sounding using the automatic controls and letting the sounder determine its optimum operating parameters. These automatic controls are **Agc** and **AutoPhase**. If the user uses these controls, it will be necessary only to ensure that the **Range** selection has a window setting that includes the expected depth value, and that the **Power** setting is neither too strong nor too weak for the water column being examined.

If stable, reasonable depths do not appear, the echosounder has probably not been able to locate the bottom. The first thing to check is the location in the water column of the *window*, which is controlled by the **Range** and **Phase** controls. The echosounder only looks for the bottom in the window, and only the window is displayed on the greyscale display. The **Range** control defines the size of the window, and the **Phase** control defines its location (or depth), with a 50% overlap between settings.

Start with a **Phase** setting of 1, which puts the window at the top of the water column, and select a **Range** value larger than the expected depth of the water. In all probability a bottom echo will now be visible on the display, and a stable depth value will appear on the digital depth display.

Once an echo is obtained, the **Power** and **Gain** controls should be adjusted for the most satisfactory results. Generally speaking, the lowest value of **Power** which provides a clean bottom record and a stable depth value

should be used. The **Agc** setting will usually provide the best results.

If stable, reasonable results do not appear and a clear bottom trend is not presented on the display, the operator needs to take corrective action. Loss of bottom may be due to several reasons:

- The bottom may be outside the selected **Range**/**Phase** window; adjust the window appropriately for the expected depth. Narrow windows tend to provide good records, but risk losing the bottom unless **AutoPhase** is selected.
- In shallow water, the **Power** and/or the **Gain** may be too high.
- In deep water, the **Power** and/or the **Gain** may be too low.

3.3 Advanced Echosounding

In most instances, the simple instructions provided in the previous section will be fully adequate to operate the echosounder. More advanced operations will require an understanding of the control program and its use. A detailed description and reference for the control program is provided in the Online SCSI Control Software User's Manual.

3.4 Interfacing to the Survey Computer/Datalogger

The 320M's COM3 serial port is the port dedicated to communications with the survey computer. It is a 3-wire (RXD, RXD and GND in a DB-9M connector, no modem control lines) RS-232 interface which requires a null modem cable to connect to a standard PC. This is the port used for serial datalogging, and the port through which the survey computer can initiate event marks and send event mark annotation to the echosounder. It is also the port used for configuration and control of the echosounder, either by the Windows application program "320cfg.exe" supplied with the echosounder, or by the user's own software.

The COM3 serial interface protocol is described in "Serial Configuration Utility Software User's Manual".

3.5 Interfacing to Peripheral Devices

The following steps describe how to connect a standard peripheral device to the echosounder.

1. Connect an RS-232 cable between the peripheral device and one of the comm ports on the echosounder's connector panel. Please note:
   a. all survey computers or data loggers must be connected to Com3 on the echosounder. Other receivers and sensors can be connected to either Com 1, 2 or 4 on the echosounder.
   b. the echosounder can only accept one device of a particular type: ie. it cannot interface to 2 heave sensors at one time, or 2 GPS receivers, but it can interface to 1 heave sensor and 1 GPS receiver simultaneously.
2. Power up the echosounder and wait for the power-up initialization to complete.
3. Run the SCSI control program, Echo Control.exe.
4. Select the Com port setup option for the desired echosounder com port.
5. Select the device driver, communication settings and loopthru options required for the desired peripheral device. If Loopthru is selected(checkmarked) and the selected peripheral device outputs printable ASCII strings, the echosounder will echo these strings upon receipt out Com3 to any

attached survey computer/datalogger.

3.6 Customizing the Serial Data Output

The echosounder can be configured to output serial depth logging strings in special formats. When the system leaves the factory, the default output format is one that is compatible with the Hypack survey program. The Windows-compatible serial utility program, 320CFG.EXE, can be used to selected the desired output format, and to customize the configurable output format.

3.7 Time Synchronization

The Main Processing Module of the 320 series echosounders contains a battery-backed real time clock/calendar device, similar to the one found on PC motherboards. The date and time stored in this clock can be set by the user with the serial utility program "320CFG.EXE" or the SCSI control program Echo Control.exe. Both applications allow the user time synchronization between the survey computer and the echosounder to less than a second.

The serial utility application program, which communicates with the echosounder's COM3 serial port, has a menu command which synchronizes the echosounder to the PC to a hundredth of a second (see command string "$PKEL37: Set Time in milliseconds since midnight" in the "Serial Configuration Utility Software User's Manual"). The SCSI control application also has a menu command that synchronizes the echosounder to the PC to a hundredth of a second.

Note: the real-time-clocks in both the echosounder and the PC are subject to drift, typically up to about a second per hour. It may be necessary to occasionally re-synchronize the echosounder to the PC depending on the requirements of the survey.

4 MAINTENANCE AND TROUBLESHOOTING

4.1 Hardware Architecture

4.1.1 Module Interconnections

The 320B series of Echosounders incorporate a very modular architectural design. The system is composed of the following modules along with their accompanying mechanical and cable assemblies.

MPM: Main Processor Module,
SPM: Signal Processing Module,
STM: Switchmode Transmit Module,
PDM: Power Distribution Module,

The MPM is the host board of the system, the brain of the system, which uses a TMS320C25 as the DSP processor. This board controls all the internal modules as well as providing interfaces to external computers or sensors such as GPS and Heave. This board interfaces with one or two SPMs and STMs depending on single or dual frequency configurations. The MPM takes power from a 5Vdc power cable form the PDM. It interfaces to external devices through three serial port 3-wire cable assemblies and one SCSI port ribbon cable assembly.

Each SPM connects to the MPM as a daughter board using a 36-pin SBX connector, drawing power through this connector in addition to exchanging commands and data with the MPM.

The STMs interface using a 10-pin ribbon cable for transmit drive signals from the MPM, 48Vdc power from the PDM, and a twisted cable for the received analog signal to the SPM.

All cable end connectors are polarized and fitted to avoid improper insertion.

4.1.2 Power Distribution

The PDM provides the various DC voltages (5Vdc and 48Vdc) to power the digital portions of the system (MPM, SPM's, and the STM's). The PDM has limited adjustment over the range of output voltage and comes factory set. There should be no need to adjust the voltage outputs of this module. If you suspect a problem with the PDM or any other part of the system, please do not hesitate to contact the factory.

4.2 USER MAINTENANCE

4.2.1 User-serviceable Components

The only-user serviceable components in the system are the protection fuses located on the MPM, and the STM's. These fuses are standard 5mm x 20mm slow blow glass type. If a module has a blown fuse, check the input power source to confirm the setting is within specification (9-36Vdc). Replace the fuse and test. If the fuse blows again, please consult the factory. If normal functionality is achieved, continue with use. If a module is determined to be faulty, typically a new replacement module is provided in exchange for the faulty one. A board replacement is easily accomplished and allows for faster system repair than trying to find and

repair faulty board components in the field.

4.2.2 Software Upgrades in the Field

There may be a time when a software upgrade is desired, or required to meet a specific user's special requirement. Knudsen Engineering Limited provides Internet FTP downloads so that the user can get new or revised software. The user can then upload this software into the 320M. The Flash Eprom technology allows serial RS232 software transfer and programming thus eliminating the need to replace eproms. Refer to the Software Installation/Upgrade Manual for instructions to complete the upgrade.

4.3 Basic Troubleshooting Procedures

The 320B echosounders can be bench tested with a transducer using in-air echoes from a wall or other hard surfaces. There are no exposed hazards inside the unit, although the Transmitters can generate several hundred volts at the secondary of the output transformer. These points are under a removable protective cover.

With the unit set up, attempt to apply power. Some basic strategy is offered in the following sections.

4.3.1 System Appears Dead

If the system is totally lifeless, start by examining for obvious problems. Remove the cover plate and check the power distribution module. It has two LEDs which should all be ON in order for the unit to operate; one is for +5V and one for +48 V. The power distribution module has a backup fuse inside, check it first.

4.3.2 Breaker Tripped

After resetting the breaker, check the input DC polarity, then remove the cover plate and check the status of the shunt diode across the supply. Then, one by one, start disconnecting power cables at the power distribution module from the STM’s and the MPM until a module is isolated or fault appears.

320 SERIES ECHOSOUNDER

ONLINE SCSI CONTROL SOFTWARE MANUAL

Supports Software: D409-03167 in Standard Functionality mode

D101 - 02139
Revision 4.0
March 30, 2004

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 About this manual

This manual describes the Windows Online SCSI EchoControl Software, D409-03167, EchoControl.exe. It is used to control operational parameters and to record data from 320 Series Echosounders via the sounder's SCSI port.

1.2 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

1.3 Compilation Options

The operational characteristics of the echosounder are completely under software control. On occasion it is convenient to produce versions of this software with different operational characteristics to meet different user requirements. This is done at the software compilation stage so these differences are referred to as compilation options. A small number of compilation options are available for the 320 Echosounder. These are identified and described in the relevant sections of the manual.

Compilation options may be specified by the customer at the time the system is ordered, or subsequently whenever custom software modification is required..

2 OPERATING INSTRUCTIONS - SCSI CONTROL INTERFACE

2.1 Overview

The 320 Echosounder was designed with a SCSI Interface port to provide advanced remote control and signal data acquisition and recording capabilities. KEL has developed a specialized PC control program that runs under Windows. This program allows the user to control the echosounder, display in real-time a greyscale graphic on the PC monitor (similar to a hardcopy record), capture envelope signal data, perform standard depth-logging, and record in real-time to a thermal recorder.

2.2 The Physical SCSI Interface

SCSI (Small Computer System Interface) is a special hardware and software specification designed for high data transfer rates. There is an accepted standard followed by device designers (such as KEL) to allow users to interface numerous types of devices to their PC. Before a user can interface to these devices, there must be a SCSI host adaptor and its driver software installed in the PC.

2.3 ASPI

The 320 Echosounder is designed to be compatible with SCSI (Small Computer System Interface) interfaces which support the industry standard ASPI (Advanced SCSI Programming Interface) protocol. Most SCSI interface products include ASPI support with their distribution software. ASPI support generally requires a device driver for the specific interface hardware, plus ASPI layer driver files (see the Software Installation / Upgrade Manual for details).

2.3.1 SCSI Adaptors

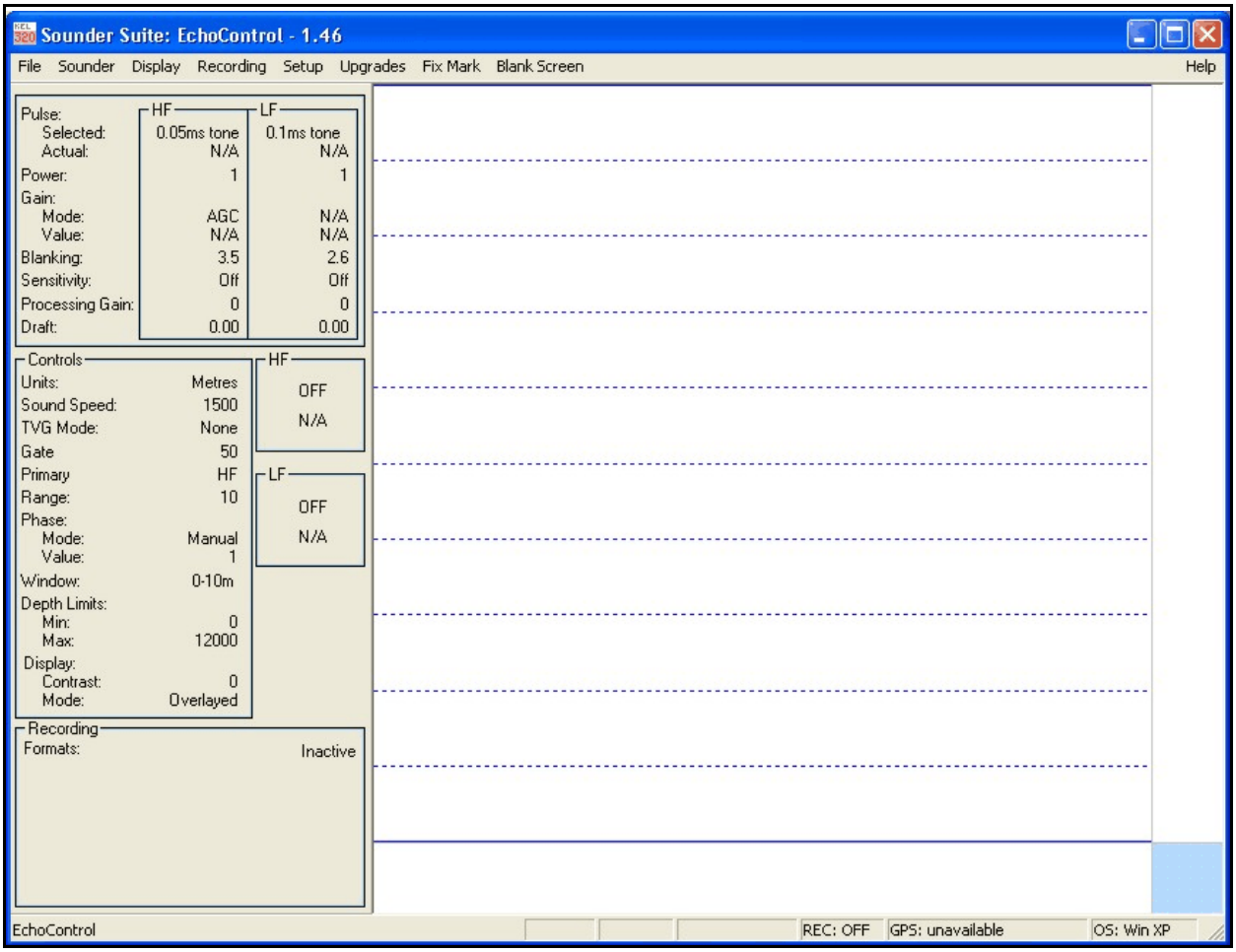
SCSI host adaptors are available in many forms from numerous suppliers. There are internal interface cards, PCMCIA plug-in cards and external parallel-port adaptor cables. This SCSI control software has been used extensively with Adaptec's AHA-1542C, AHA-2920 and AHA-2930 internal interface modules and the APA-1460 PCMCIA model. KEL does not recommend using the echosounder with a parallel-port adaptor.

2.3.1.1 Special Note

For some adaptors, the echosounder must be connected and powered up before the host PC is powered up for the PC to properly load the necessary SCSI drivers. Some external adaptors actually get their operational power from the echosounder; if the sounder is not powered up, the adaptor is not powered and the PC cannot detect the adaptor's presence. For some plug-and-play adaptors, the adaptor may be powered up, but if the sounder is not, the PC may not detect the need to load the necessary drivers. In general, it is usually better to have the sounder powered up before the host PC is started.

3 SOFTWARE OPERATING INSTRUCTIONS

3.1 Description



The Online SCSI Control software is a Windows program that contains all the necessary controls for standard operation of the echosounder and any data recording activities on the PC. When the program is invoked, a window pops up with nine control groups offered on the main menu bar, a blank display area for graphical presentation of real-time received data, and a grid scale bar for the data presentation.

This stand-alone application uses Window's DDE (Dynamic Data Exchange) protocol to interface to a special HYPACK DLL device driver. This DDE interface allows the stand-alone application to pass depth, heave, and eventually other data to the Hypack data logger program and potentially any other Window's data logger.

Before proceeding with the description of the operational controls, it is worth making the distinction between Echosounder controls and Application controls.

Echosounder parameters: The Echosounder has numerous controls that control its performance and

operation. These controls are normal backed up in the echosounder's non-volatile memory (NVM) so that when the sounder is powered up it reads the last configuration out of its NVM. These particular parameters can also be stored by the EchoControl application into a special configuration file.

Application parameters: The EchoControl application has a number of controls that affect the presentation and recording of the data received from the echosounder. These controls have no effect on the performance of the echosounder, just the behaviour of the EchoControl application itself. Most of these controls are preserved in the Windows registry when the application shuts down. Note: none of these controls are preserved in the configuration file used to record the configuration of the Echosounder parameters.

Throughout the following descriptions is a notation indicating if the control parameters being discussed are Echosounder parameters or Application parameter.

3.2 File

3.2.1 Load Config

The **Load Config** option allows the user to select and load a previously saved configuration file (typically a ".cfg" file, but it could have any extension) that has any or all of the system control settings defined to pre-configured values. When the configuration file is loaded, the EchoControl application configures the echosounder to all the new parameter values defined in the file. Thus, if the user has determined optimal parameters settings for a particular mission or site survey, he can save the settings to a configuration file and the next time the unit taken out for the same job conditions, he can restore them from the saved file.

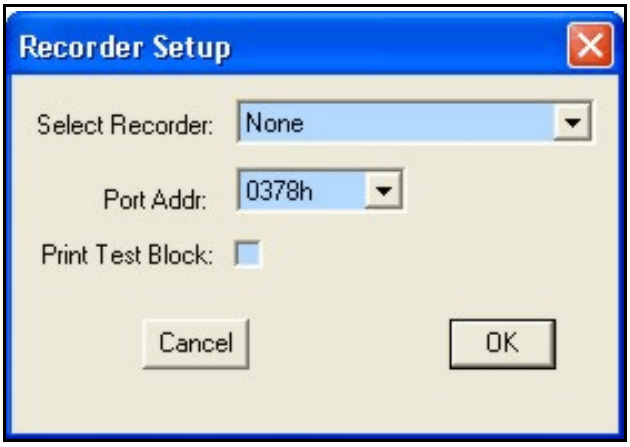
3.2.2 Save Config

The **Save Config** option allows the user to save his current echosounder control settings to a file that can be used to restore the same settings into the sounder at a later date. Any file name can be used, but the application's initial default search condition for loading configuration files is for those with an extension of ".cfg". Note: this save only saves the configuration of control parameters used within the echosounder; it does not save the configuration of the various application parameters such as display settings, recorder options, etc.

3.2.3 Thermal Recorder

3.2.3.1 Select

(Application parameters)



This option brings up a dialogue box that allows the user to select a thermal recorder to be used for making hardcopies.

Table 3-1: Supported Thermal Recorders

Manufacturer	Models
EPC Laboratories	9800, GSP-1086, HSP-100
ODEC	TDU-850
iSys	V8.5e, V12
GeoAcoustics	9315

The **EPC GSP-1086** driver expects the user to have set the following parameters to the values listed via the unit's front panel menus:

DATA INPUT = PARALLEL
SWEEP = FORWARD
SHADES = 064
DATA TYPE = 6BITS
WIDTH = 2048
LPI = 200 nominal (not EXTERNAL)

The **Port Addr** option allows the user to specified the proper output port address for the printer port. For most systems, this value should be 0378h, but for some laptops and secondary printer ports the alternate value of 0278h could be required.

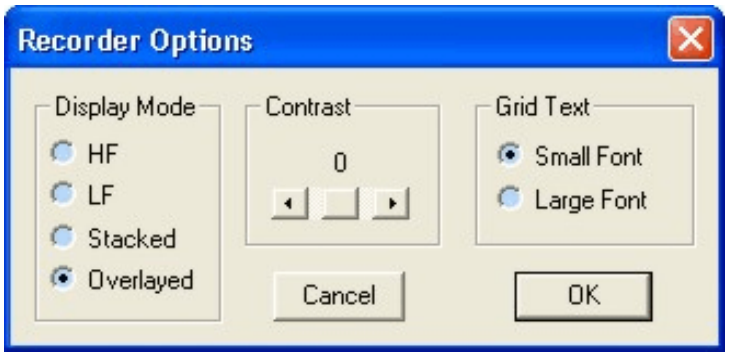
The **Print Test Block** check box allows the user to tell the application to send some test data to the selected thermal recorder to confirm it is interfaced properly. The test block consists of greyscale ramps with samples of imbedded grid and fix annotation text.

The recorder selection and port address settings are stored in the application's registry keys and restored the next time the program is invoked.

Note: the program will only record on the thermal recorder if the Record: Hardcopy menu option is selected (indicated by a check mark beside the menu item).

3.2.3.2 Setup

(Application parameters)



This Recorder Options dialogue box allows the user to format the data presentation on the thermal recorder independently of the monitor display:

Display Mode determines the presentation mode of the echogram data on the chart area.

1. **HF** prints the high frequency channel only, using the entire formatted area height.
2. **LF** prints the low frequency channel only, using the entire formatted area height.
3. **Stacked** prints both channels separately, with the HF channel in the top half of the formatted area, and the LF in the bottom half.
4. **Overlayed** prints both channels, overlayed together, using the entire formatted area height.

Contrast determines the darkness of the thermal chart print out.

The **Grid Text** font size can be adjusted between two options: **Small Font** and **Large Font**. The small font minimizes the interference of the text with the echogram data, but the large font makes the grid information more readable.

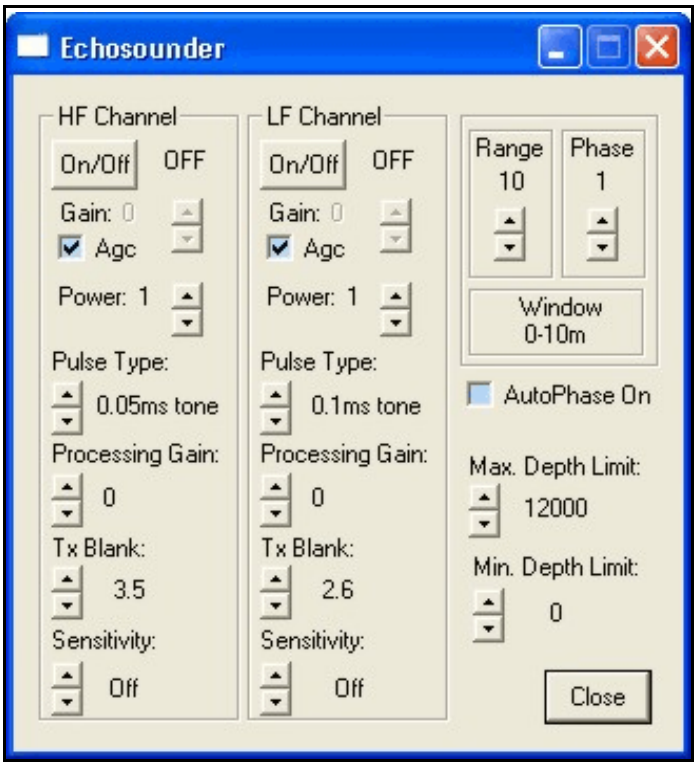
3.2.4 Exit

The user can terminate the EchoControl program using the **Exit** command. The echosounder will continue any sounding operation left active when the control program is terminated.

3.3 Sounder

3.3.1 Controls

(EchoSounder parameters)



The **Controls** option pops up a dialogue box that allows access to the functions that control the physical echosounder unit. The functions accessible from this box are the most commonly modified parameters during a sounding session. The user can minimize this box when it is not being used. The initial values for these controls are read from the echosounder's internal values.

3.3.1.1 On/Off Buttons

The user can start the echosounder sounding on desired channels using the **On/Off** button for the appropriate channel. If the user clicks on one of the buttons, the corresponding channel will acquire, digitize and log data. The display boxes beside the buttons display either OFF or the appropriate digitized depth for the channel.

3.3.1.2 Gain

The **Gain** parameter controls the analog receive gain of the relevant channel. Reducing the analog receive gain is useful when sounding in extremely shallow water. This reduces the overall noise while not seriously affecting echo strength. Increasing the analog gain is useful when sounding in very deep water.

3.3.1.3 Agc

The **Agc** selection invokes automatic gain control of the analog receive gain which is the recommended setting for most operating conditions **Agc** is active when there is a check mark in the check box.

3.3.1.4 Power

The **Power** parameter is used to specify the transmit power level of the pulse being transmitted. Power levels are controlled by changing the duty cycle of the switchmode transmitter output stage. Although high power signals will always give the strongest echoes, they also produce more ringing and reverberation which may obscure the bottom echo in shallow water. Using high receive gain in combination with high transmit power in shallow water may cause signal levels high enough to saturate (overload) the receiver, which will mask any echoes.

3.3.1.5 Pulse Type

The **Pulse Type** parameter allows the user to specify the pulse length (the duration of the transmit pulse) usually specified in milliseconds or fractions of a millisecond. The choices are frequency specific. Generally, the higher frequencies use shorter pulses and vice versa.

By specifying the pulse length, the user indirectly specifies the bandwidth of the digital noise rejection filter applied to the incoming acoustic signal data. The filter bandwidth is usually set to the inverse of the pulse length (this relationship is true for the standard continuous wave (CW) signals, but not necessarily for the CHIRP signals).

Normally, long pulses with narrow bandwidth filters provide better noise rejection in deeper water or noisy conditions, while short pulses with wide bandwidth filters provide better resolution when conditions permit or the water is shallow.

The signal data rate (in samples per second) is also related to the pulse length because of the Nyquist requirement that the sampling frequency be at least twice the signal bandwidth. Under rare extreme conditions where the user has specified a very short pulse in deep water or a very long pulse in shallow water, the echosounder will override the user's **Pulse Type** selection to meet data rate requirements. When this happens, the **Pulse Type** parameter value is not changed, and is used again as soon as the extreme conditions are removed. When the echosounder is overriding the **Pulse Type** selection, the selection in the control box will change from black text to greyed text. When the selected **Pulse Type** is no longer overridden by the echosounder, the text will return to solid black.

3.3.1.6 Processing Gain

The **Processing Gain** parameter provides for additional gain in the digital signal processing software which can be used with very low level signals. It is mainly used for the very low frequency sub-bottom profiling systems (under 10 kHz) where very low amplitude echoes from sub-bottom layers are of interest. The default processing gain value is zero and this should be suitable for almost all conditions. Each level above 0 is effectively a 1-bit left shift in the processed digital data (a 1-bit left shift is equivalent to multiplying the data by a factor of 2).

Improper use of this parameter when not required could cause problems for standard survey users. It is recommended that this control be left at zero unless the analog receive gain cannot be adjusted to provide adequate signal returns for digitization.

3.3.1.7 TxBlank

The **TxBlank** parameter sets the transmit blanking distance used by the echosounder's internal digitizer to avoid false triggering on transmit reverberation.

The **TxBlank** value, or transmit blanking, is the distance, measured from the face of the channel's transducer, to the point in the water column at which the bottom detection software begins to look for the bottom. Transmit blanking must be set large enough that transducer ringing following the tail end of the transmit pulse is not falsely interpreted as the echo from a very shallow bottom, but small enough not to unduly limit the minimum depth capability of the echosounder. The optimum value depends on the expected depth conditions, the pulse length, the transmit power level and the signal frequency. It is best determined by experimentation. Note that transmit blanking has effect only when it extends into the *window*, typically when Phase is 1.

3.3.1.8 Sensitivity

The **Sensitivity** parameter is useful in areas where soft sediments overlay harder materials, and where buried layers may often produce stronger echoes than the real bottom. If **Sensitivity** is **OFF** (the default condition), the bottom detection software will always select the strongest echo in the *window*. With layered bottoms, the strongest echo is not necessarily the shallowest echo. Increasing the **Sensitivity** causes the bottom detection software to accept a weaker but shallower echo. The higher the **Sensitivity**, the weaker the echo, relative to the strongest echo in the *window*, that will be selected. On the other hand, if the **Sensitivity** is too high, the bottom detection software will often trigger on noise or small items in the water column.

3.3.1.9 Range

The **Range** parameter selects the size of the active *window* in the water column. The active *window* is the only part of the water column in which the echosounder operates. It is the portion of the water column which is printed on the hard copy recorder, and in which the bottom detection software looks for the bottom echo. The bottom *must* be in the selected *window* for the echosounder to function. Nine ranges are available: 10, 20, 50, 100, 200, 500, 1000, 2000 and 5000 metres (or feet or fathoms). A box below this selection displays the actual **Window** limits corresponding to the current combination of the **Range** and **Phase** selections (unless in autophase mode in which case it is the maximum window limits for the range selected).

3.3.1.10 Phase

The **Phase** parameter selects the depth, or location in the water column, of the active *window* (see explanation in previous section). The effect of the **Phase** parameter depends on the current **Range** setting. The standard 320 echosounder software compilation provides a 50% overlap between **Phase** settings.

3.3.1.10.1 Small Phase Overlap Compilation Option

A software compilation option is available for a smaller, 20% overlap between phases, but this is only

recommended for the special case where a very small *window* is autophased in an area with extended steep slopes.

3.3.1.11 AutoPhase On

When the **AutoPhase On** box is checked, the phase changes are performed automatically in response to information provided by the primary channel bottom tracking algorithm. The auto phasing software adjusts the phase setting automatically to maintain the bottom in the active *window*. It should be understood that the auto phasing software is critically dependent on the bottom tracking software - if the bottom is not being tracked successfully, auto phasing will not work.

It is helpful to think of the auto phasing software as having two distinct operating states - searching for the bottom and tracking the bottom. When the **AutoPhase Mode** is initially invoked, or whenever the bottom tracking software loses track of the bottom, the auto phasing software shifts into the *bottom search* state. In this state the *window* is opened up to the full extent of the water column from the autophase minimum search depth (**Min. Limit**) to the autophase maximum search depth (**Max. Limit**). The ping rate usually slows down noticeably because of the larger *window*, and the printer stops printing until the bottom is located. When the bottom is found, the auto phasing software selects the appropriate phase and shifts into the *bottom tracking* state.

Once the auto phasing software is in the *bottom tracking* state, it will continue to auto phase as long as the primary channel is being tracked successfully. It will re-enter the *bottom search state* if 5 consecutive samples are declared invalid by the bottom tracking software.

One other parameter is relevant to auto phasing operation - this is the **Primary Channel**, accessible through the **Setup** menu, and described in Section 3.6.3). This parameter can be set to either **HF** (the default) or **LF**. It specifies the channel which is used as the depth reference for phase changes.

3.3.1.12 Max. Limit

The **Max. Limit** parameter allows the user to adjust the autophase maximum search depth to a value that is optimal for the current operating conditions and acquisition requirements. See Section 3.3.1.13.1for the details regarding the use of this parameter.

3.3.1.13 Min. Limit

The **Min. Limit** parameter allows the user to adjust the autophase minimum search depth to a value that is optimal for the current operating conditions and acquisition requirements. See Section 3.3.1.13.1for the details regarding the use of this parameter.

3.3.1.13.1 Bottom Tracking

Although the bottom tracking process is operational at all times, it is discussed here because it becomes critically important when auto phasing is enabled.

Locating and tracking the bottom is one of the more important software functions performed by the

echosounder. The term *bottom tracking* encompasses the process of identifying the bottom echo in the received acoustic signal, locating the precise leading edge of the echo, computing the depth based on travel time and sound speed considerations, and most importantly, deciding whether the result represents a valid depth measurement (it might be a fish, or transducer ringing, or reverberation, or just noise, or even the second echo from the previous ping). The decision must be made immediately, before sending the depth value to the datalogger. The echosounder software, running in real time, does not have the luxury of looking ahead - it can only look back at previous depth samples. The algorithm used in the 320M uses several previous samples, regardless of whether they were determined at the time to be valid or not (the rationale for including invalid samples in the test is the fundamental uncertainty in the validity designation). A variety of "least squares curve fitting" exercises is then carried out using the current sample and all or some of the previous several samples. If at least one of the curves fits the data to within a user-specified **tracking gate** tolerance, the current sample is declared to be valid.

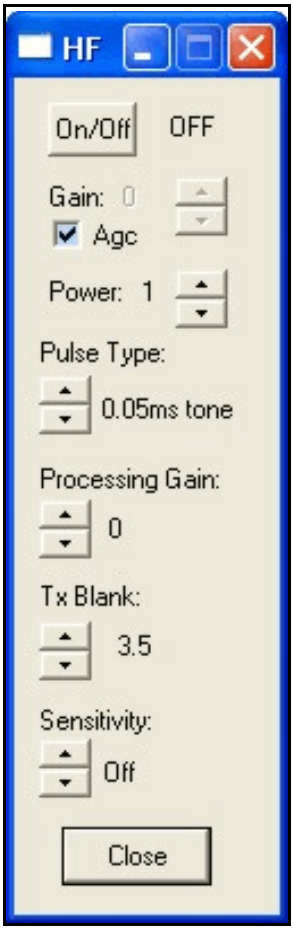
Note that bottom tracking is performed independently for each channel. The depth value used by the auto phasing software is specified by the **primary channel** parameter.

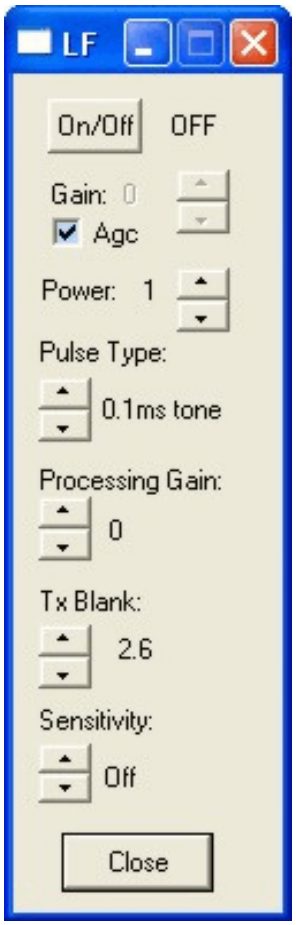
3.3.1.13.2 Extended Phases Compilation Option

On 320M units the manual phase control always is limited to the 7 selections provided by the **PHASE** switch. The standard software compilation provides these same seven phases in **autophase** operation. A compilation option is available which provides up to 254 phases in **autophase** mode. This permits a relatively small window to be used in deep water. If this compilation option is in effect, it is important to set the **autophase maximum search depth** value using the secondary controls menu, otherwise the sounder will appear to shut down while it searches to full ocean depth for the bottom.

3.3.2 HF/LF

(EchoSounder parameters)

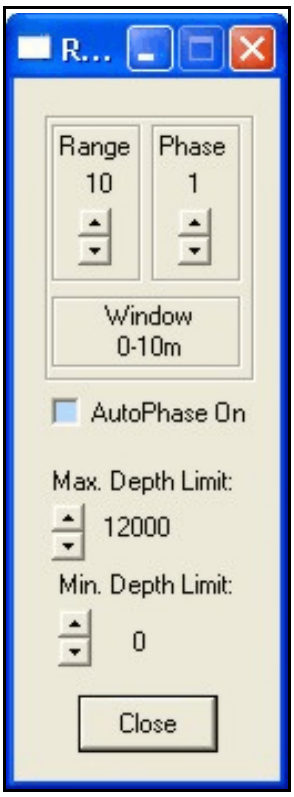




These options bring up dialogue boxes used to control channel specific controls only. These boxes provide independent channel access to the following controls exactly the same as those used in the global **Controls** dialogue box (Section 3.3.1): channel **On/Off**, **Gain**, **Agc**, **Power**, **Pulse Type**, **Processing Gain**, **TxBlank**, and **Sensitivity**.

3.3.3 Range Setup

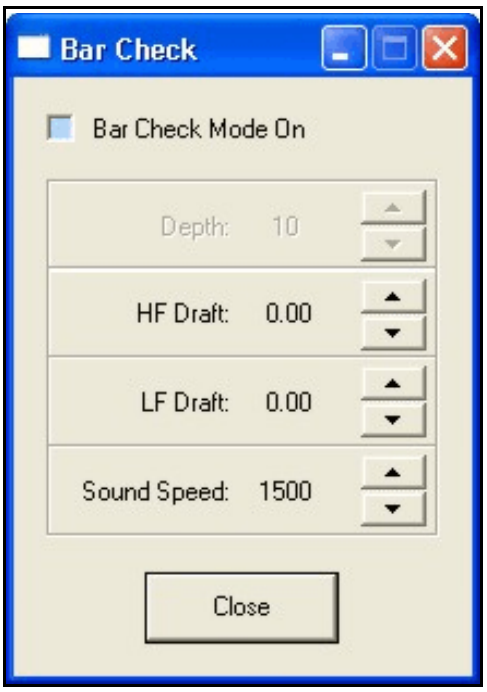
(EchoSounder parameters)



The **Range Setup** option pops up a dialogue box that allows access to the window control parameters only. These are exactly the same controls for **Range**, **Phase**, **AutoPhase Mode**, **Max. Limit** and **Min. Limit**, as those used in the global **Controls** dialogue box (Section 3.3.1).

3.3.4 Bar Check

(EchoSounder parameters)



The **Bar Check** dialogue box access to the primary calibration parameters: sound velocity, HF draft and LF draft. When **Bar Check Mode On** is selected, the echosounder is put into a special bar check mode in which one additional parameter, **Depth**, becomes active in the dialogue box. In the special bar check mode, the digitizer search window is centred on the specified bar **Depth** and is narrowed to the width of the tracking gate (see Section 3.3.5). When the **Bar Check Mode On** option is deselected, the echosounder deactivates the bar check mode and restores the standard digitizer search window; but the user can still modify the sounder speed and draft parameters if desired. If the **Bar Check** dialogue is closed while the **Bar Check Mode On** is selected, the EchoControl application automatically deactivates the bar check mode in the echosounder.

For a description of typical bar check procedures, see D101-02251 Echosounder Concepts Technical Note.

3.3.4.1 Depth

The user adjusts this parameter to centre the digitizer search window around the expected depth of the test bar. The width of the search window around this centre value is determined by the size of the tracking gate (Section3.3.5). The echosounder will digitize on the strongest target that falls within this search window. If no target is found, any of the dialogue boxes that display the depth will indicate an invalid depth return (“0.0” appears in the depth display).

3.3.4.2 HF / LF Draft

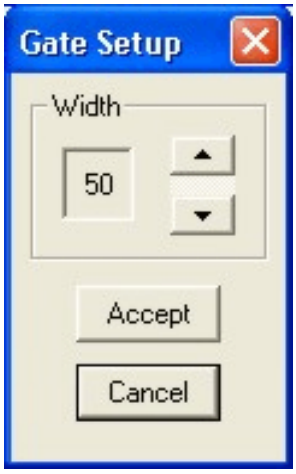
Draft indicates the vertical distance from the surface of the water to the active face of the transducer. Its main use is to ensure that the echosounder's output is corrected for the transducer depth. The draft can be set independently for the low frequency and high frequency channels.

3.3.4.3 Speed of Sound

This feature allows the adjustment of the velocity of sound value used by the echosounder for all depth calculations. The user adjusts this value in the course of a bar check, or enters the average expected velocity of sound over the water column of interest, obtained from a speed sensor.

3.3.5 Tracking Gate

(EchoSounder parameters)



The **tracking gate** parameter is used by the bottom tracking algorithm to determine the validity of the current depth value. It is a depth variability tolerance value, defined as a distance above or below the bottom depth trend established by the current and several previous samples. If the most recent depth value fits this established trend to within the range defined by the **tracking gate**, it is considered valid and is displayed in the appropriate dialogue boxes. If a depth return falls outside of this range, it is deemed invalid and "0.0" is displayed in all the dialogue boxes with depth displays.

For a discussion of the bottom tracking algorithm see Section 3.3.1.13.1.

3.3.6 TVG

(EchoSounder parameters)

This option allows the user to select **TVG** (time varied gain) used on the analog receivers. A check mark indicates the currently selected option. The **OFF** setting provides constant receive gain throughout each pulse-echo cycle (note that receive gain will still vary from ping to ping if **AGC** is on). When set to **20logR**, the receive gain is increased linearly (logarithmically if gain is expressed in decibels) with time and range from

the instant of transmission, to compensate for signal amplitude loss due to spherical spreading. The **40logR** setting provides for spherical spreading of both outgoing and returning signals. The bottom referenced setting (**bottom ref'd**) provides a gain ramp at the bottom (as determined from the previous ping) to provide approximate compensation for attenuation in sub-bottom sediments. The last setting is intended for sub-bottom profiling applications.

TVG may help to prevent the depth digitizer from falsely triggering on fish or other water column targets at the expense of slightly greater susceptibility to locking on the second echo from the bottom.

Note that TVG operates in addition to the **AGC** or **manual gain** settings which are applied independently to each channel, and which effectively define the starting gain for each channel at the instant of transmission.

3.3.7 Sounder Ping Rate

(Application parameters)

As soon as this EchoControl application is activated and establishes contact with the echosounder, it takes over control of the echosounder's ping rate. The user can adjust this ping rate to the optimal value for his application. The echosounder will then ping at this rate if possible; the echosounder has built-in ping rate limitations that may override the basic value selected here. When this EchoControl application is terminated, the echosounder is restored to its internal timebase-controlled ping rate.

Note: if external sync mode has been selected, neither the SCSI-controlled ping rate nor the internal timebase-controlled ping rate options are functional. The sounder will simply wait until an external synchronization signal is applied and not all echosounders are equipped with an external sync input connector.

3.3.8 Check for Sounder

This menu item is usually disabled (greyed out) if the sounder was detected properly when the program was initially started. If the program could not detect the sounder on startup, all sounder control options are disabled and this option is enabled. This gives the user the ability to retry the sounder detection without having to exit and re-invoke the program. Thus, if the echosounder was powered off or disconnected when the program was invoked, the user can power-on or connect the sounder, and simply click on this menu item to detect the sounder and proceed with system operations.

NOTE: Some adaptors require that the sounder be connected and powered up for the necessary drivers to be loaded when the PC boots up. If the message "**ASPIStatus: No ASPI managers are loaded**" appears on program start up, the necessary device drivers are not loaded. The system will have to be re-booted with the

sounder powered up and connected to properly load the drivers.

3.4 Display

This control group allows access to functions that control the greyscale presentation of the real-time received data and any recorded data during playback.

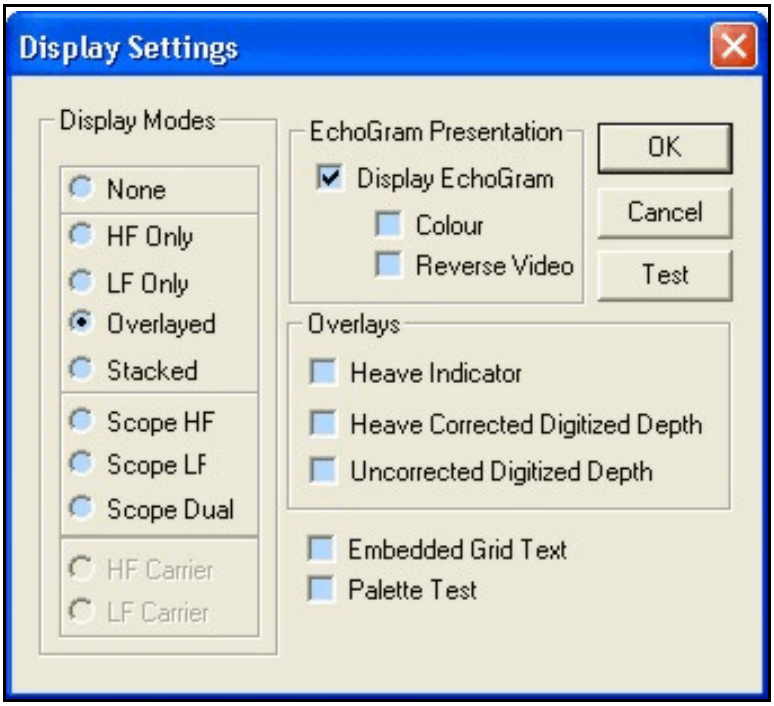
3.4.1 Contrast

(Application parameters)

This option pops up a dialogue box with a single control that allows the user to increase/decrease the contrast of the displayed greyscale data.

This setting is stored in the application's registry keys and restored the next time the program is invoked.

3.4.2 Settings
(Application parameters)



The **Settings** option brings up a dialogue box that allows the user to customize the display presentation to a configuration that suits his personal requirements. All of these settings are stored in the application's registry keys and restored the next time the program is invoked.

NOTE: None of the display options adjusted by this dialogue will affect any of the recorded data. If the echogram data is being recorded to the binary file, the data is always stored in the same form it is received from the echosounder. All display transformations are applied independently from the recorded data.

3.4.2.1 Display Modes

There are eight display mode options available. They include four standard presentational formats, three special purpose formats, two carrier display modes for the appropriate firmware compilation, and the ability to turn the display off (**None**).

1. **HF** only displays the high frequency channel only, using the entire display window height.
2. **LF** only displays the low frequency channel only, using the entire display window height.
3. **Overlayed** displays both channels, if selected, overlayed together, using the entire display window height.
4. **Stacked** displays both channels separately, with the HF channel in the top half of the display and the LF in the bottom half.

5. **Scope HF** provides a graphical presentation for the HF channel similar to an oscilloscope trace.
6. **Scope LF** provides a graphical presentation for the LF channel similar to an oscilloscope trace.
7. **Scope Dual** provides a graphical presentation for both channels similar to an oscilloscope trace, with the HF channel in the top half of the display and the LF in the bottom half.
8. **HF Carrier** displays the "carrier" data for the high frequency channel only, using the entire display window height.
9. **LF Carrier** displays the "carrier" data for the low frequency channel only, using the entire display window height.

3.4.2.2 EchoGram Presentation

3.4.2.2.1 Display EchoGram

The **Display EchoGram** check box allows the user to turn the envelope data presentation on or off. When the box is checked, the actual envelope data is displayed in the window; if this item is not selected, the envelope data is not displayed in the window. For some applications, it may be more useful for the user to simply have the digitized depth overlays displayed instead the entire envelope record.

3.4.2.2.2 Colour

When **Colour** mode is selected (box checked), the envelope data displayed in the program window is presented in 15 colour levels, mapped from lowest to highest levels as follows: White(normal video) or Black (reverse video), Light Grey, Dark Grey, Cyan, Blue, Dark Blue, Dark Cyan, Dark Green, Dark Yellow, Green, Yellow, Magenta, Dark Magenta, Red, Dark Red. If this item is not checked, the envelope data is displayed in levels of grey, where for normal video mode white is the lowest level return and black is the highest. For reverse video mode, white is the highest level return and black is the lowest.

3.4.2.2.3 Reverse Video

When **Reverse Video** mode is selected, the display colours are configured to make black the main background colour. For both colour and greyscale modes, the lowest level return is assigned the colour black. When **Reverse Video** is not selected (normal mode), the lowest level return is assigned the colour white.

3.4.2.3 Overlays

3.4.2.3.1 Heave Indicator

The **Heave Indicator** option allows the user to enable or disable an overlay that shows the amount of heave relative to a nominal position on the graphical display. This overlay is only relevant if a heave sensor is interfaced to one of the input ports on the echosounder.

3.4.2.3.2 Heave Corrected Digitized Depth

The **Heave Corrected Digitized Depth** option allows the user to enable or disable an overlay that shows the positions of the heave corrected digitized depth to surface values for each channel displayed. If there is no heave sensor interfaced to the echosounder, this overlay is equivalent to the **Uncorrected Digitized Depth**

overlay.

3.4.2.3.3 Uncorrected Digitized Depth

The **Uncorrected Digitized Depth** option allows the user to enable or disable an overlay that shows the positions of the digitized depth to surface values for each channel displayed. These depth values are the depth to surface values compensated for draft but not heave.

3.4.2.4 Embedded Grid Text

The **Embedded Grid Text** option allows the user to enable or disable the use of embedded grid text. The current grid scale is always indicated in the block on the right side of the window. For additional information, the user can enable **Embedded Grid Text** (box checked). This will result in grid text being displayed within the envelope data display whenever a range or phase change occurs, or at evenly spaced intervals if no changes have occurred. The embedded text can be disabled for cases when the grid text changes obscure the envelope data. The current scale will still be displayed in the right hand scale block.

3.4.2.5 Palette Test

The **Palette Test** option allows the user to test the display capabilities of the host PC system being used. When the **Palette Test** is selected, for each ping cycle, instead of displaying the echogram data, the application displays a data ramp illustrating the colour or greyscale mapping from the lowest level (starting at the top of the display) to the maximum level. For some older systems, the greyscale levels are limited to as little as 4 levels mapped over the entire 0 to 255 data values; this limited mapping capability can result in poor echogram display especially for weaker echo returns. For such a situation, the colour mode would provide better echogram presentation.

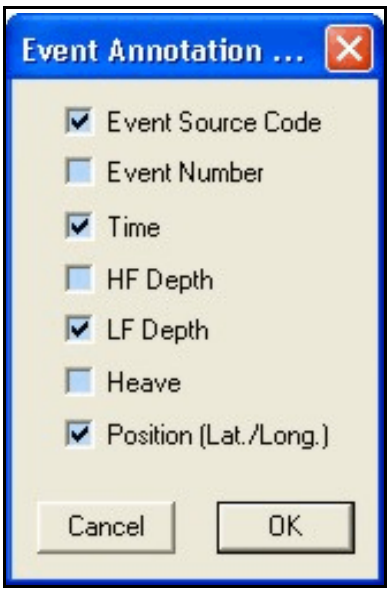
3.4.2.6 Test

The **TEST** button allows the user to test the selected display settings while the dialogue box is still active without having to exit the dialogue box. If the selected settings are not desired, the original settings can be restored if the user presses the **CANCEL** button instead of **OK**.

Note: the sounder must be running for any changes to have an effect; the changes are applied only to new data, not to previously displayed data.

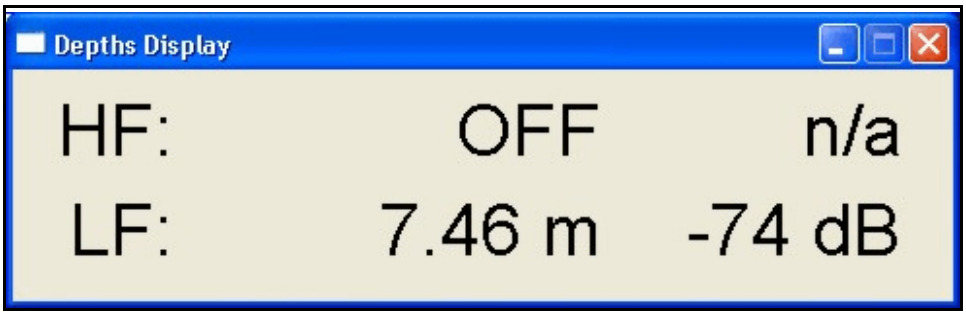
3.4.3 Event Annotation

(Application parameters)



This menu item brings up a dialogue box that allows the user to select which of the available data parameters will be printed out on the event mark annotation line. The selections made here apply to the display, the Windows printer outputs, and the thermal recorder output. The user has no control on the ordering of the parameters; they are output in the order they are listed if they are checked off.

3.4.4 Depths



This option allows the user to enable a large digit depths display dialogue box. This box uses a very large font for easier readability from a distance. This box also displays the echo strength parameter read from the echosounder.

The echo strength is the amplitude of the echo signal, at the transducer connector, in decibels relative to one volt. The echo strength value is meaningful in a relative sense, in that it accurately indicates ping to ping echo strength variations, but has not been calibrated individually for each frequency. The absolute value of the echo strength parameter should not be relied upon.

3.4.5 Controls Status

The Controls Status toggle allows the user to enable or disable the presentation of a side bar presenting detailed information about the echosounder and application operational settings. This information bar summarizes virtually all of the control settings including file recording states, display modes and sounder control selection and feedback about the actual selection in use.

3.4.6 Toolbar

This control allows the user to enable and disable the application's toolbar as desired. The toolbar is a "bar" located at the top of the application's window, just below the main menu bar. When active, it displays pushbutton controls that provide shortcuts to desired menu controls. When the toolbar is active, the effectively usable display area is decreased by the amount used for the toolbar. Disabling the toolbar can give a slightly larger display area in the same size application window.

3.4.7 Status Bar

This control allows the user to enable and disable the application's status bar. The status bar is located at the bottom of the application's window. The status bar provides helpful messages in the left hand corner that describe menu controls, and other helpful items.

3.5 Recording

This control group allows access to functions that control the recording of data from the echosounder onto the PC drive and a hardcopy recorder. All data recording options can be active simultaneously.

3.5.1 Start Line

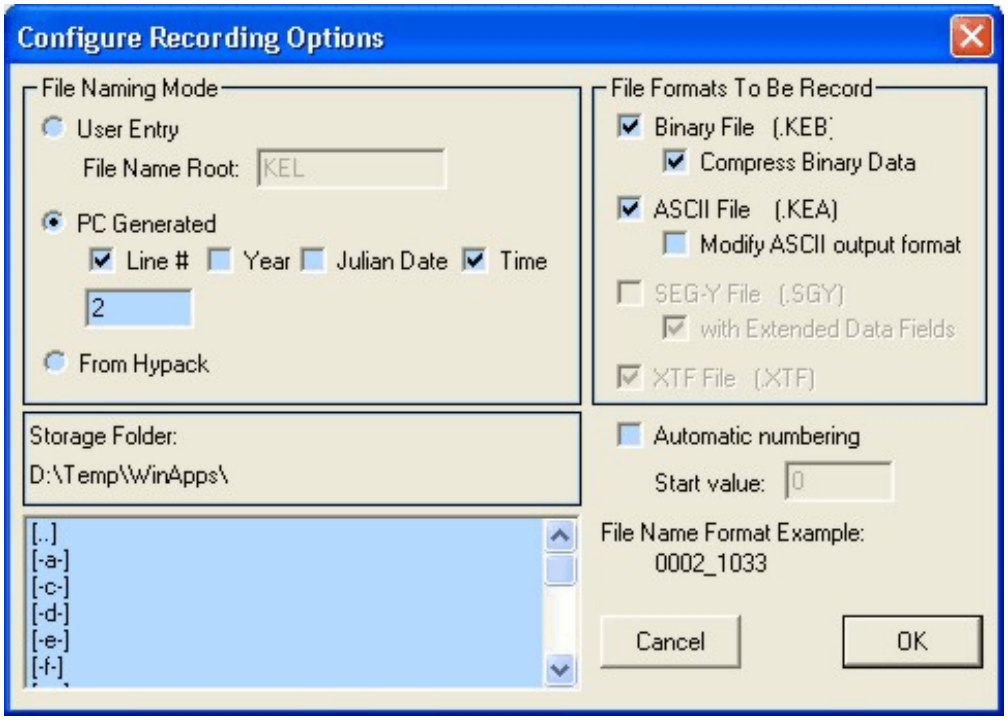
The **Start Line** selection instantly initiates the recording of all the active file formats into the storage folder last selected using the **Configure** option. It is advisable to use **Configure** to verify the setup before initiating the first **Start Line** command.

3.5.2 End Line

The **End Line** selection causes all data file recording to be terminated and all open data files to be closed.

3.5.3 Configure

(Application parameters)



The **Configure** selection pops up a dialogue box that allows the user to select the folder (or directory) where the data file set is to be recorded, the filename format used to identify the data set, and the desired output data formats (all can be active at the same time).

3.5.3.1 File Naming Mode

Based on user input, the filenaming options availanble to the user have been expanded from the original fixed mode used on earlier version of the EchoControl application. With the **User Entry** option, the filename is based on the text entered by the user and an automatic numbering scheme. The user must exercise caution in this mode. Because the application will not allow a file to be overwritten that already exists, the user may not be able initiate file recording if the same name is used every time the application is started withour ensure a different Start value for the automatic numbering. The **PC Generated** format is the most flexible format and the least likely to cause a conflict with identical file names except in the unlikely instance of two **Start Lines** within the same minute. **From Hypack** is only useful if the supporting Hypack DLL is being used to transfer data, file and line info from Hypack Inc.'s Hypack MAX Survey application. When it is employed, the EchoControl application will start and stop recording when Hypack starts and stops logging and it will use the file folder and name root sent from Hypack.

3.5.3.2 Automatic Numbering

This mode is enable by default when the **User Entry** filenaming mode is active. Basically, when this mode is active, the filename is automatically appended with a number that starts at the value entered in the **Start value** box and automatically increments every time one recording file is closed and a new one started. Enable this mode helps to prevent recording problems that occur when a file already exists with a particular file name.

3.5.3.3 Storage Folder

To modify the **Storage Folder** selection, the user simply double-clicks on the [..] to back up from the current directory, or double- clicks on the new directory or drive name desired. The currently selected folder is displayed in the text line above the selection box.

3.5.3.4 File Formats To Be Recorded

There are four possible output file formats: Binary, SEG-Y, ASCII and XTF. The SEG-Y format is only availabe if the Carrier option is compiled in the echosounder firmware. The XTF format is only available when the SIDESCAN functionality mode is active; this mode can only be enabled dependent on the firmware compilation.

3.5.3.4.1 Binary File Format (KEB)

The envelope data for each channel can be recorded in a binary data file for use by post-processing software. Every ping cycle, one record (see Table 3-3) is stored with header information and raw data for each frequency channel. Each record is variable in length with a current maximum possible number of 6772 bytes, and may be compressed using a Huffman compression algorithm. The storage device for these files should have sufficient disk space free to store the vast amounts of data generated, especially when working in shallow water where the faster ping rate results in a larger volume of data being generated.

The binary data files are recorded using the following basic structural format:

File Type Id Preamble (40 bytes)
Data Records comprised of Record Preamble followed by Ping Record (possibly compressed)

The recording program will write data records to one file for up to 20000 pings, then the current file will be closed and a new one will be opened for subsequent data recording.

File Type Id Preamble

The first 40 bytes of the file are used for a file type identification preamble for the playback software to use to determine if the file is in the valid format supported by the version of software being used.

Example:

KEB D409-03167 V1.46 Huffman
(pad unused character locations with spaces)

where, KEB identifies the file as a KEL Binary file,
D409-03167 identifies the part number of the program used to record/convert the data,
V1.46 identifies the version of the program used to record/convert the data.
Huffman indicates that the data is in a compressed format (not present for uncompressed files)

After the File Type Id Preamble, the actual data records are stored as they are received. As soon as a record is received, it is recorded to the disk file. Records are recorded to the file in the same order as they were received (time stamps must be in sequential order). Multiple types of records can be stored in the binary file; ie Envelope data records, serial port sensor data records, configuration records, etc (only Envelope records are actually implemented at this time). The original data record format is shown in Table 3-3. The data can be stored in this format, or the user can enable data compression. When compression is enabled, each data record as shown in Table 3-3 has a Huffman compression algorithm applied to it. The result of the compression is stored in the file. The playback application runs the matching decompression algorithm to access the data records.

Record Preamble

Each data record is preceded by a Record Preamble that provides quick access, particularly for compressed records, to useful info about the record. This data is used by the PostSurvey application for faster analysis of the data statistics. See the following description about the Data Records for some of the field definitions.

Table 3-2: Record Preamble

FIELD DESCRIPTION	DATA TYPE	BYTE COUNT
Record Type Code	BYTE	1
File offset to start of record after the record preamble	long	4
Record Size expressed in bytes	long	4
Event mark code	BYTE	1
Byte Total		10

Table 3-3: Ping Record: Record Type B9: Variable Length Dual Channel Envelope

FIELD DESCRIPTION	DATA FORMAT / RANGE	BYTE COUNT
Record Identification Information		
Record Id	B9h	1
Record Length	data dependent	2
Record Number	0 to 65536	2
# of Channel Records	1-2	1
Reserved Bytes	0	2
	Byte Count: Section Total	8
Sounder Parameters Shared for Each Channel		
Date @ Start of Ping: day	1 to 31	1
Date @ Start of Ping: month	1 to 12	1
Date @ Start of Ping: year	1996 to 2096	2
Time @ Start of Ping: hours	0 to 23	1
Time @ Start of Ping: minutes	0 to 59	1
Time @ Start of Ping: seconds	0 to 59	1
Time @ Start of Ping: milliseconds	0 to 999	2
Working Units Flag	0 = metres 1 = feet 2 = fathoms	1
Speed of sound	1300 to 1700 m/s 4265 to 5577 ft/s 710 to 929 fm/s	2
Start depth	0 to 10000	2
End depth	10 to 12000	2

FIELD DESCRIPTION	DATA FORMAT / RANGE	BYTE COUNT
Minimum Depth Limit	0 to 11000	2
Maximum Depth Limit	20 to 12000	2
Primary Channel	0 = HF, 1 = LF	1
Pinger Mode	0 = off, 1 = 1/8th second sweep 2 = 1/4th second sweep 3 = 1/2th second sweep 4 = 1 second sweep 5 = 2 second sweep 6 = 4 second sweep	1
Mux Enable	0 = off 1 = HF 2 = LF 3 = Both	1
Mux Transducer Number	0 (no multiplexer) 1 to 8	1
Reserved Bytes	0	8
	Byte Count: Section Total	32
Sensor Data Parameters Shared for Each Channel		
Heave (expressed in cm, $^{1}/_{100}$ ft, $^{1}/_{100}$ fm)	data dependent	2
Roll Angle [radians]	data dependent	4
Pitch Angle [radians]	data dependent	4
Heading Angle [radians]	data dependent	4
Roll, Pitch & Heading Latency	max. 9999 ms	2
Roll, Pitch & Heading Quality	0 = invalid 1 = okay	1
Position Format - Lat/Long or X/Y	0 = Latitude/Longitude 1 = X/Y (from Hypack)	1
Latitude (expressed in degrees)	data dependent	8
Longitude (expressed in degrees)	data dependent	8
Position Latency	max. 9999ms	2
Boat Speed (from Hypack)	tba	4
Boat Heading (from Hypack)	tba	4
Reserved Bytes	0	20
	Byte Count: Section Total	64
High Frequency Channel Parameters		

FIELD DESCRIPTION	DATA FORMAT / RANGE	BYTE COUNT
HF SPM Frequency Code	0 to 31 (see Table 3-4)	1
Number of HF Data Samples	0 - 65535 possible (currently fixed at 1600)	2
Sample Data Type	00h indicates 8-bit unsigned data 01h indicates 16-bit unsigned data	1
TxBlank (expressed in dm, $^1/_{10}$ ft, $^1/_{10}$ fm)	0 to 3000 [dm] 0 to 9843 [$^1/_{10}$ ft] 0 to 1640 [$^1/_{10}$ fm]	2
Draft (expressed in cm, $^1/_{100}$ ft, or $^1/_{100}$ fm)	0 to 10000 [cm] 0 to 32808 [$^1/_{100}$ ft] 0 to 5468 [$^1/_{100}$ fm]	2
Transmit power level	frequency specific	1
Analog Rx gain code	0 to 255	1
Pulse length code	frequency specific	1
Filter type code	frequency specific	1
Processing Gain	0 to 8	1
Sensitivity	0 = Off 1 - 100	1
Signal Type Option	0 = CW 1 = chirp	1
Envelope Detection Option	0 = square law detection 1= amplitude detection	1
Filter Bandwidth Option	0 = normal bandwidth 1 = wide bandwidth	1
Depth Okay Flag	0 = 1 =	1
Digitized Depth (expressed in metres, feet, or fathoms)	0.00 to 12000.	4
Echo Strength (expressed in decibels)	-128 to 0	1
Reserved Bytes	0	9
	Byte Count: Section Total	32
High Frequency Signal Data		
Signal Data	0 to 32767	variable*
	Byte Count: Section Total	3200
Low Frequency Channel Parameters		
LF SPM Frequency Code	0 to 31 (see Table 3-4)	1

FIELD DESCRIPTION	DATA FORMAT / RANGE	BYTE COUNT
Number of LF Data Samples	0 - 65535 possible (currently fixed at 1600)	2
Sample Data Type	00h indicates 8-bit unsigned data 01h indicates 16-bit unsigned data	1
TxBlank (expressed in dm, $^1/_{10}$ ft, $^1/_{10}$ fm)	0 to 3000 [dm] 0 to 9843 [$^1/_{10}$ ft] 0 to 1640 [$^1/_{10}$ fm]	2
Draft (expressed in cm, $^1/_{100}$ ft, or $^1/_{100}$ fm)	0 to 10000 [cm] 0 to 32808 [$^1/_{100}$ ft] 0 to 5468 [$^1/_{100}$ fm]	2
Transmit power level	frequency specific	1
Analog Rx gain code	0 to 255	1
Pulse length code	frequency specific	1
Filter type code	frequency specific	1
Processing Gain	0 to 8	1
Sensitivity	0 = Off 1 - 100	1
Signal Type Option	0 = CW 1 = chirp	1
Envelope Detection Option	0 = square law detection 1= amplitude detection	1
Filter Bandwidth Option	0 = normal bandwidth 1 = wide bandwidth	1
Depth Okay Flag	0 = 1 =	1
Digitized Depth (expressed in metres, feet, or fathoms)	0.00 to 12000.	4
Echo Strength (expressed in decibels)	-128 to 0	1
Reserved Bytes	0	9
	Byte Count: Section Total	32
Low Frequency Signal Data		
Signal Data	0 to 32767	variable*
	Byte Count: Section Total	3200
Event Mark Condition		
Event Mark Code	0 to 6	1
Number of Event Mark Data Bytes	0 to 130	1
Event Mark Number	0 to 65536	2

FIELD DESCRIPTION	DATA FORMAT / RANGE	BYTE COUNT
Event Mark Annotation String	data dependent	variable (max = 200)
	Byte Count: Section Total	204
	Byte Count Structure Total	6772

* Although the channel data definition allows for variable number of data samples, currently the number is fixed to 1600 words (3200 bytes) which is the value used to determine byte count totals and data offsets.

SPM Frequency Code Definitions

The SPM Frequency code is the frequency identification code number read from the actual SPM hardware. For the HF channel, the raw 8-bit hex code is used. For the LF channel, the 8-bit hex code is bit-wise "or'ed" with 080h (MSB set to one); this enables the EchoControl and Post Survey applications to distinguish which channel has been recorded when an echosounder is only using one channel for data acquisition. The echosounder only sends the envelope data for the active channel and the EchoControl program only records the one channel; this saves on data transfer times and disk space requirements for the data recording

Table 3-4: SPM Frequency Code Definitions

SPM Frequency	HF Code (raw code)		LF Code (raw code | 80h)	
	Binary	Hexadecimal	Binary	Hexadecimal
3.5	00001000	08	10001000	88h
7.0	00001110	0E	10001110	8E
12	00001001	09	10001001	89
15	00010010	12	10010010	92
24	00000010	02	10000010	82
26	00001111	0F	10001111	8F
28	00000011	03	10000011	83
30	00000111	07	10000111	87
33	00001011	0B	10001011	8B
38	00001010	0A	10001010	8A
41	00001100	0C	10001100	8C
50	00000001	01	10000001	81
100	00010001	11	10010001	91
150	00010000	10	10010000	90
200	00000000	00	10000000	80
208	00001101	0D	10001101	8D
210	00000110	06	10000110	86

Event Mark Code Definitions

Event marks can be initiated from a number of sources; the Event Mark code indicates the source of the event mark as described in Table 3-5. Serial Port and Hypack initiated event marks often have variable-length annotation strings recorded as well.

Table 3-5: Event Mark Code Definitions

Code #	Code Source
0	No Fix
1	Front Panel
2	Serial Port (320M printer uses internal and external annotation)
3	Remote
4	Internal Timebase
5	Serial Port (320M uses external annotation only)
6	SCSI Control Application
7	Hypack

3.5.3.4.2 Compress Binary Data

When the Compress Binary Data box is checked, the application will compress all the binary data records using a Huffman compression algorithm on each record. The File Type Id Preamble in each data file will indicate that Huffman compression has been applied. This control gives the user has the option to store in a compressed or uncompressed format.

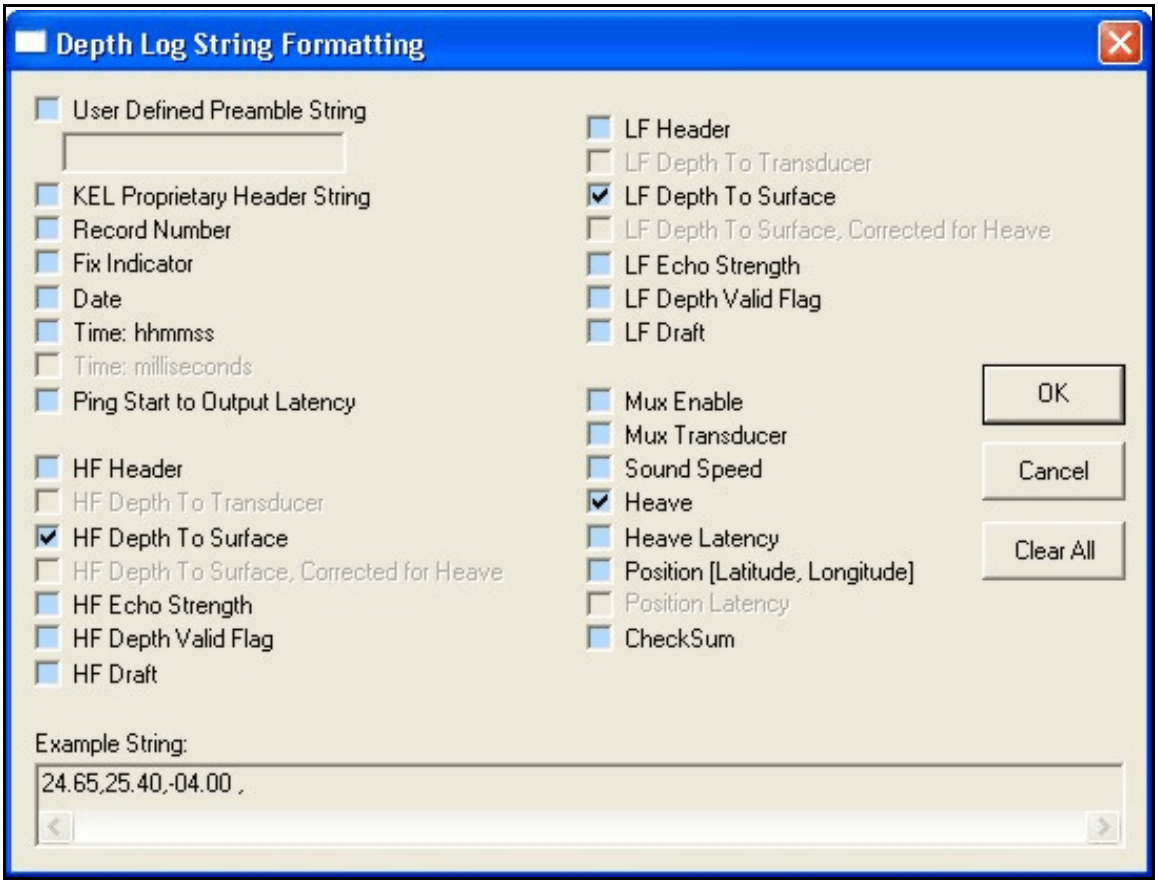
3.5.3.4.3 ASCII File Format

The ASCII output file can be used to log many data fields such as depth, echosounder time, GPS position, heave. Since these files do not contain any of the raw envelope data, they use substantially less disk space than the binary files. Every ping cycle, the application records one output string.

The user can request to modify the desired output data format by checking the **Modify ASCII output format** box. This causes the application to pop up a configuration dialogue box after the Line File Setup dialogue box options have been accepted.

3.5.3.4.4 Modify ASCII output format

When the Modify ASCII output format box is checked, the application will pop up a dialogue box that provides access to the file format configuration items, but only when the Line File Setup selections have actually been accepted (click OK). The modifications made here only apply to the ASCII file output, not the COM3 echosounder output. See the section for **Depth Log** in Section 3.6 for information on modifying the COM3 output.



This dialogue box allows the user to customize the ASCII file format string with certain limitations. The fields can only appear in the order listed (ie header string, HF depth, LF depth, checksum) separated only by commas (except hhmmss and milliseconds), and terminated only at the very end by <CR>< LF>.

As various fields are selected or deselected, the **Example String** at the bottom of the dialogue box changes to illustrate the expected output format.

Some fields can only be selected if other fields are also selected and will be inactive (greyed out) if the required field is not selected. For example, the Position Latency field is an active option only if the Position field is selected.

The format configuration selected is stored in the application's registry keys and restored the next time the program is invoked.

3.5.3.4.5 SEG-Y File Format

The SEG-Y output file format has been defined to meet as accurately as possible the Rev0 format specifications defined by the Society of Exploration Geophysicists.

3.5.3.4.6 SEG-Y Extended Data Fields

The original SEG-Y specification does not account for many useful data fields. If the user selects the option to include the extended data fields, numerous operation controls are recorded in the unassigned bytes at the end of the Rev0 Trace header. Some SEG-Y readers do not recognize files that contain data in these bytes to it is advisable to verify the requirements for the desired reader application before selecting this option.

3.5.3.4.7 XTF File Format

The XTF output file format is a specialized format used to record Sidescan data. The format has been defined to be compatible with the standard as defined by Caris.

3.5.4 Hardcopy

(Application parameters)

The **Hardcopy** selection toggles the state of the hardcopy option on (checkmarked) and off. If a thermal recorder has been selected, the program will send the envelope data to the recorder when the hardcopy option is selected. This setting is stored in the application's registry keys and restored the next time the program is invoked.

3.6 Setup

The sub-menus under this item give the user access to parameters and features not required on a regular basis.

3.6.1 Working Units

(EchoSounder parameters)

The **Working Units** option allows the user to select the desired operating units from three sub-menu options The operating **Units** can be toggled between **Metres**, **Feet**, and **Fathoms**. The currently active selection is indicated by a checkmark on the sub-menu item. When these units are switched, the echosounder recomputes the speed of sound and draft into the appropriate new units.

3.6.2 Sync Mode

(EchoSounder parameters)

The **Sync Mode** option allows the user to select between the echosounder's own internal timebase-controlled ping cycle synchronization, or an external ping cycle synchronization signal.

WARNING: If the **Sync Mode** is toggled to external sync, the echosounder will not ping unless there is an external sync signal fed to the appropriate signal on the sounder. Currently, only the 320B/R provides an external connector for this signal connection. Please contact KEL if you wish to use this feature on any other 320 models.

3.6.3 Primary Channel

(EchoSounder parameters)

The **Primary Channel** parameter defines the frequency channel used as the reference depth for the auto phasing algorithm. The 320M's printing software uses **Primary Channel** data for channel-specific overlays in the case where both channels are superimposed and only one channel's overlays can be printed.

The **Primary Channel** designation only has effect when both channels of a dual-channel echosounder are ON. If only one channel is on, it is automatically considered to be the primary channel.

3.6.4 Time Sync

(Application parameters)

3.6.4.1 Mode

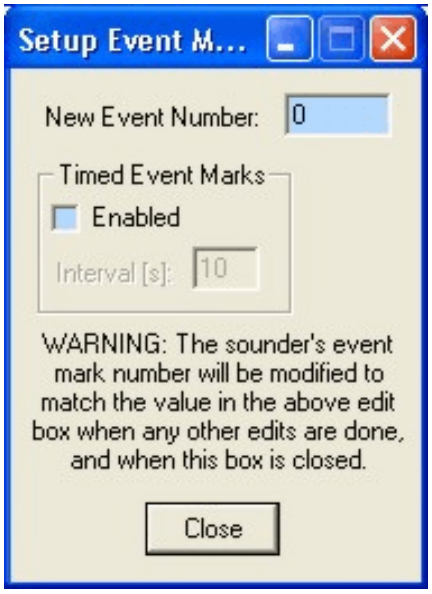
The user can select either **Auto** time syncing or **Manual**. If the **Auto** mode is enabled, EchoControl will attempt sync the echosounder's internal clock, both time and date, to the PC's internal clock every 2 minutes unless in the middle of file recording. If the **Manual** mode is active, the user has to manually initiate a clock synchronization using the **Sync Now** command.

3.6.4.2 Sync Now

This function syncs the echosounder's internal clock, both the time and date, to the survey computer;s clock. It can synchronize the two clocks to within a hundredths of a second.

3.6.5 Event Marks

(EchoSounder parameters)



The **Event Marks** option pops up a dialogue box that allows the user to adjust the event marking options. The **Next Event Number** will set the echosounder's event counter to the desired value. The **Timed Event Marks** check box allows the user to select the echosounder's internally timed event marks. If this box is checked, the echosounder will cause internally generated event mark at the time interval selected in the **Timed Event Interval** box. The units for this interval measurement are seconds.

WARNING: Modification of any data in this dialogue box will always cause the Event Number to be modified in the sounder. This application cannot always monitor what is currently set in the sounder, so it is possible to reset the event number to an undesired value.

3.6.6 Pinger Mode

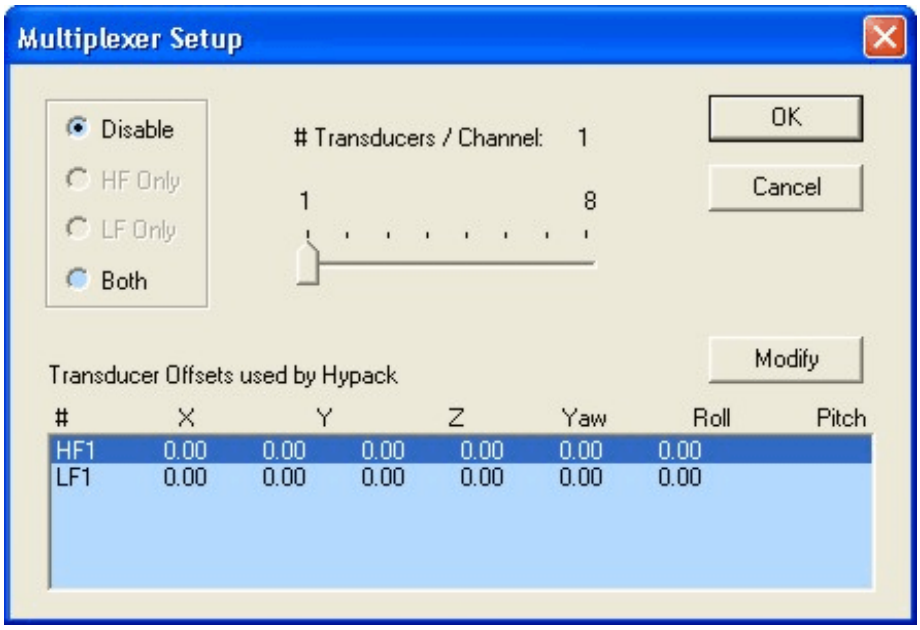
(EchoSounder parameters)

This option allows the user to activate the echosounder's specialized Pinger mode to one of six sweep interval options. It also allows the Pinger time reference to be "skewed" up or down from the current reference.

When the Pinger Mode is on, the echosounder does not transmit at all but simply listens, typically for an external pinger device, and displays the received data based on the time interval selected (ie. 2 second sweep). The only channel controls that have any effect in Pinger Mode are Manual **Gain**,and **Processing Gain**. No other controls are meaningful in this mode.

3.6.7 Multiplexer

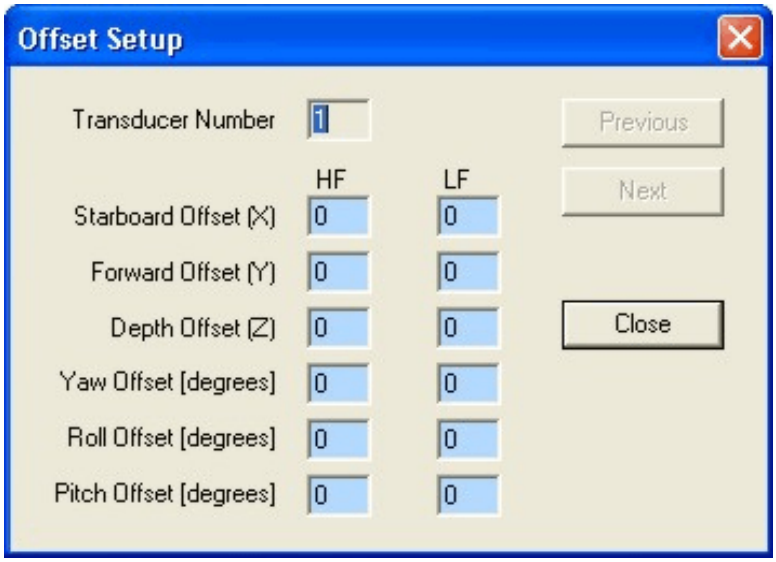
(EchoSounder & Application parameters)



The Multiplexer is a special interface module incorporated in KEL's 320S "Sweep" Echosounders. It allows the existing HF and LF channels on the echosounder to transmit and receive on more than one transducer. Only one transducer can be active at one time on a given channel. This means that if each channel had three transducers connected (six transducers total), it would take three ping cycles to transmit and receive data on each transducer. The echosounder has a special compilation mode that enables it to active each transducer via the multiplexer starting at transducer 1 and cycling through to the maximum indicated using the **#Transducers/Channel** control. If the user wishes to run the system in standard mode, driving one transducer per channel this can easily be done by selecting to **Disable** the multiplexer. This forces the echosounder to activate and use transducer #1 only.

3.6.8 Hypack Offsets

(Application parameters)

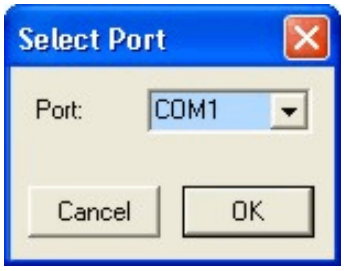


This dialogue can be used to setup the transducer offset parameters used by Hypack Inc.'s Hypack MAX Survey application. Note: none of these offsets are used the echosounder or the EchoControl application..

3.6.9 320 Serial...

3.6.9.1 Comm Ports

(EchoSounder parameters)



The user is first prompted to select which comm port on the sounder is to be configured. Once they select the desired port, a new dialogue appears indicating the setup options available for the given port.

For Comm3, the Device and Loopthru options are not active because it is a specialized port. It cannot be connected to other external devices like the other three ports. It is used for data logging to survey computers, and for remote control from a host PC; thus the only settings to be adjusted on this port are the actual communication settings of baud rate, parity, and data/stop bits.

The remaining comm ports, Comm1, Comm2, and Comm4, can be configured to accept input from external devices. Simply select the desired device driver, and then set up the baud rate, parity, and data/stop bits settings to match those required by the external device.

Note: The Comm4 is not available on 320M models; it is used for the built-in control panel. Due to panel space restrictions, Comm4 is also not available on some of the smaller 320B models.

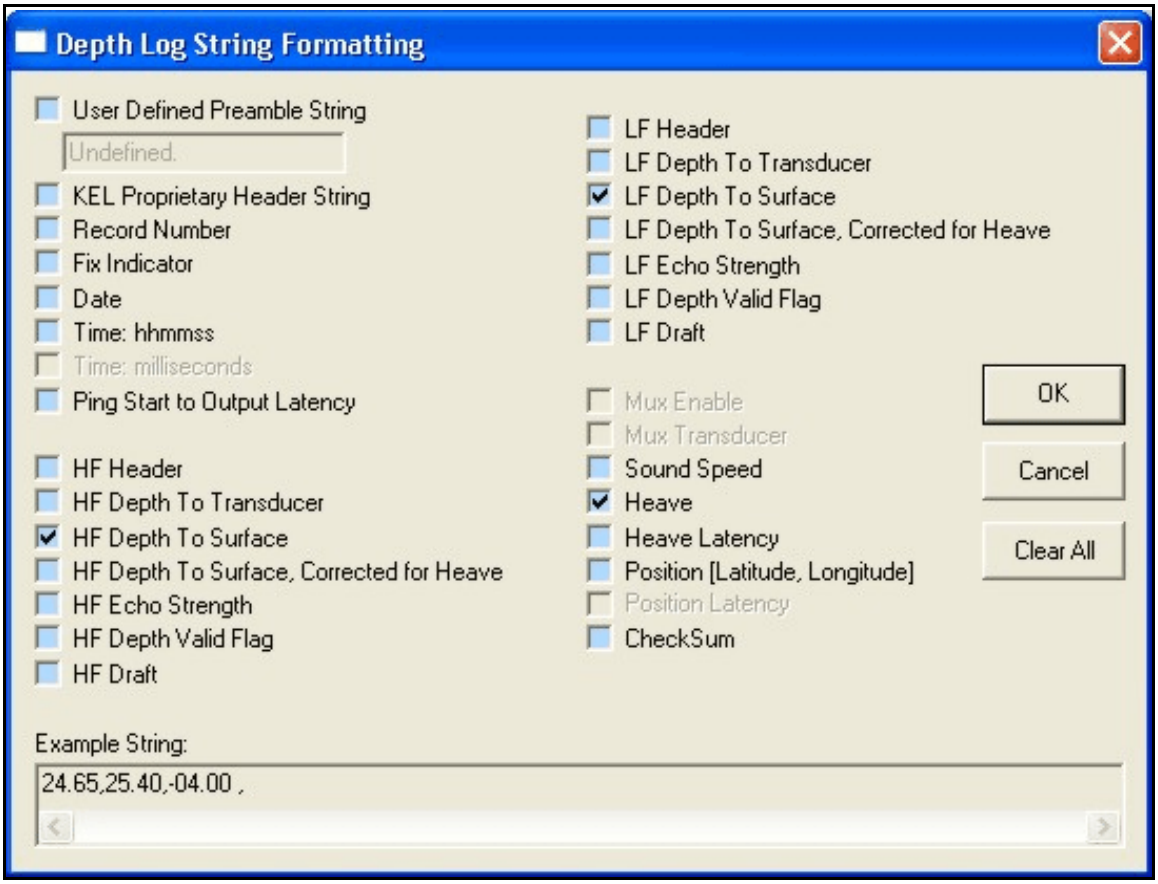
If the **Loop Data to COM3** box is checked and the selected peripheral device outputs printable ASCII strings, the echosounder will echo these strings upon receipt out Com3 to any attached survey computer / data logger.

Note: The echosounder can support only one device of a particular type, such as one heave sensor or one GPS receiver. If one port has already been configured to a particular type of sensor, any attempt to configure another port to the same type of sensor will fail. For example, if Comm1 has been configured for TSS:3xx (a heave sensor), Comm2 cannot be configured for either TSS:3xx or Seatex: MRU (another heave sensor).

3.6.9.2 Depth Log

The echosounder is capable of outputting on the serial port COM3, different types of depth log strings to fit individual customer needs, or to not output any data at all if desired. To select a depth format, simply click on the appropriate menu item; a check mark indicates if a format is selected. Note: only one format can be selected at any given time.

The **None** option simply turns off the serial depth logging on the echosounder.



The **Configure** option pops up a dialogue box that allows the user to customize the depth logging string with certain limitations. The fields can only appear in the order listed (ie., header string, HF depth, LF depth, checksum) separated only by commas (except hhmmss and milliseconds), and terminated only at the very end by <CR>< LF>. As various fields are selected or deselected, the **Example String** at the bottom of the dialogue box changes to illustrate the expected output format.

Some fields can only be selected if other fields are also selected and will be inactive (greyed out) if the required field is not selected. For example, the Position Latency field is an active option only if the Position field is selected.

ISAH: Knudsen selects the depth format shown below. This format outputs the depth to surface uncorrected for heave offset for a dual channel system. (ie. LF and HF channels.)

$PKEL,007,hhmmss,LF,x.x,HF,x.x*hh<cr><lf>

where: hhmmss = 320B system's time
x.x = depth expressed in metres.

ISAH: Elac selects the depth format that will interface with the Elac, STG 721C Depth Digitizer record format option on the ISAH package from Questor Tangent. This format outputs the depth to surface uncorrected for heave offset.

Low Frequency: AxxxxxxO<cr><lf>
High Frequency: ExxxxxxO<cr><lf>

where: xxxxxx = depth expressed in centimetres.

Echotrac Format selects the Echotrac emulation string. This format outputs depth to surface corrected for heave.

HF Frequency only: fcceH xxxxx<CR>
LF Frequency only: fcceL yyyyy<CR>
Both Frequencies: fcceB xxxxx yyyyy <CR>

where: f = space if no event mark, F if event mark condition
cc = ET for [dm], et for [cm]
e = space if depth data okay, E if data bad
H,L,B = data indicators: H=HF, L=LF, B=both
xxxxx = HF channel depth,
yyyyy = LF channel depth

Note: The echosounder only emulates the Echotrac output string. It cannot accept the annotation commands normally sent to an Echotrac system.

Digitrace Format [dm] selects the Digitrace emulation string for units that output the depth to decimetre resolution. This format outputs depth to surface corrected for heave.

HF Frequency only: fDTeH xxxxx<CR>
LF Frequency only: fDTeL xxxxx<CR>

where: f = space if no event mark, F if event mark condition
e = space if depth data okay, E if data bad
H,L = data indicators: H=HF, L=LF
xxxxx = depth

Note: The echosounder only emulates the Digitrace output string. It cannot accept the annotation commands normally sent to a Digitrace system.

Digitrace Format [cm] selects the Digitrace emulation string for units that output the depth to centimetre resolution. This format outputs depth to surface corrected for heave.

HF Frequency only: fDTeH xxxxx<CR>
LF Frequency only: fDTeL xxxxx<CR>

where: f = space if no event mark, F if event mark condition
e = space if depth data okay, E if data bad
H,L = data indicators: H=HF, L=LF
xxxxx = depth

Note: The echosounder only emulates the Digitrace output string. It cannot accept the annotation commands normally sent to a Digitrace system.

Simrad EA200 (6 byte) selects the Simrad EA200 - 6 byte format emulation string. This format outputs depth to surface corrected for heave. Depth value expressed is HF depth value if HF channel is turned on (regardless if LF is on), LF depth value if LF channel only is on.

Dxxxxx

where: xxxxx = depth expressed in decimetres

Note: The echosounder only emulates the Simrad EA200 output string. It cannot accept the annotation commands normally sent to an Simrad system.

SimradEA200 (7 byte) selects the Simrad EA200 - 7 byte format emulation string. This format outputs depth to surface corrected for heave. Depth value expressed is HF depth value if HF channel is turned on (regardless if LF is on), LF depth value if LF channel only is on.

Dxxxx.x

where: xxxx.x = depth expressed in metres

Note: The echosounder only emulates the Simrad EA200 output string. It cannot accept the annotation commands normally sent to an Simrad system.

Deso 20 selects the Deso 20 emulation string. This format outputs depth to surface corrected for heave.

For this emulation mode, the depth log output format supported is as follows:

Both frequencies: DAXXXXX.XX mDBXXXXX.XX m<CR><LF>
High Frequency only: DBXXXXX.XX m<CR><LF>
Low Frequency only: DAXXXXX.XX m<CR><LF>

where: DB = high frequency channel identifier
DA = low frequency channel identifier
X = number 0 .. 9
m = metre units identifier.

The text annotation format supported is as follows:

TXxxxx....xxxx<CR><LF>

where TX = text identifier
x = ASCII character between 20h and 7Fh.

When this line is received by the sounder, the ASCII characters are stored in the event mark annotation buffer. If an invalid character or more than 50 characters are received, the entire data line received is discarded and the event mark annotation buffer is cleared.

EM3<CR><LF>

When this line is received by the echosounder, it creates an event mark with the current contents of the event mark annotation buffer.

NMEA: SDDBT(HF): selects the NMEA depth below transducer format string. This format outputs depth to transducer for the HF channel only, in either feet, metres, or fathoms in the appropriate field location dependent on the current working units.

$SDDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>

NMEA: SDDBT(LF): same format as NMEA:SDDBT(HF) except outputs LF channel data.

Serial to BCD (HF): is a special compilation option that provides interface capability for the 320 echosounder to a specific external Serial-to-BCD converter. This format outputs depth to surface corrected for heave for the HF channel only.

<STX><POL><DATA><L/K><G/N><STATUS><CR><LF>

where: STX = 02h
POL = polarity = 02h for plus, 2Dh for minus
DATA = seven character with embedded decimal point, leading zeros suppressed as 02h
L/K = units: L(4Ch) for pounds, K(4Bh) for kilograms: arbitrarily set to K
G/N =Gross or Net mode: G(47h) or N(4Eh): arbitrarily set to G
STATUS = Space (02h) for normal, M(4Dh) for motion, I(49h) for invalid data,
O(4Fh) for over/under range

Serial to BCD (LF): same format as **SER to BCD(HF**) except outputs LF channel data.

3.6.10 3 Minute Check

(Application parameters)

The 3 Minute Check initiates a specialized mode in the EchoControl application. When the mode is activated, the EchoControl application pops up a dialogue box for opening a configuration file (see Section 3.2.1 for details about configuration files). Once a file has been selected, the EchoControl program continues basic sounder operation as selected by the configuration file; it also starts recording a special ASCII depth log output file. Then, every three minutes the EchoControl application will check the previously selected configuration file to determine if it has changed. If the file has changed, the EchoControl application loads the new version and implements the control changes specified in the file. At the three minute interval, the EchoControl program also closes the current special ASCII depth log file and opens a new one. This was a specialized mode created for a particular customer to allow remote control of the echosounder using a dial-up connection and to allow the user access to the most recently acquired depth readings. This option is available for all users but it is advisable that the user contact KEL personnel for more details regarding system operation in this mode. Disabling the mode (re-selecting the menu option once it is checkmarked) will close all special ASCII file and terminate the three minute check process.

3.7 Upgrades

3.7.1 Load Tag

The **Load Tag** option is used for doing echosounder firmware upgrades. The file selection box that pops up lets the user select the desired tag file to be downloaded to the echosounder. Once a file has been selected by the user, the program downloads it to the echosounder over the SCSI connection. The application displays an hour-glass icon until the download has completed.

3.7.2 Initialize NVM

The **Initialize NVM** option is used to reset the echosounder's non-volatile memory parameters to factory default values. This causes all the sounder's operational parameters to be modified from any user selected values back to the original defaults. The application displays an hour-glass icon until this operation has completed.

3.7.3 Program PS

The **Program PS** option is only needed after a **Load Tag** command has been performed, to program the new firmware permanently into the echosounder's FLASH eproms. If a new tag file has been downloaded, and the echosounder is powered down before a **Program PS** command has been performed, the new firmware is lost and the echosounder will power back up with the old firmware. The application displays an hour-glass icon until this operation has completed.

3.7.4 Program TX

The **Program TX** option is only needed after a **Load Tag** and a **Program PS** command have been performed, to program the Transmit data prom with the internally generated transmit data used by the new firmware.

3.7.5 Verify TX

The **Verify TX** option is used to double check the current status of the transmit data prom on the echosounder and confirm that its contents match those expected for the current echosounder configuration. For users who swap frequency modules on a regular basis, it a way to verify system configuration without performing unnecessary programming cycles on the eprom device. This is desirable since these devices do have a finite number of programming cycles available.

3.8 Fix Mark

The **Fix Mark** control is a special case menu item. It does not display any sub-menus, but causes an event mark when clicked. If there are no other dialogue boxes active, simply pressing **Alt-M** will cause a fix mark.

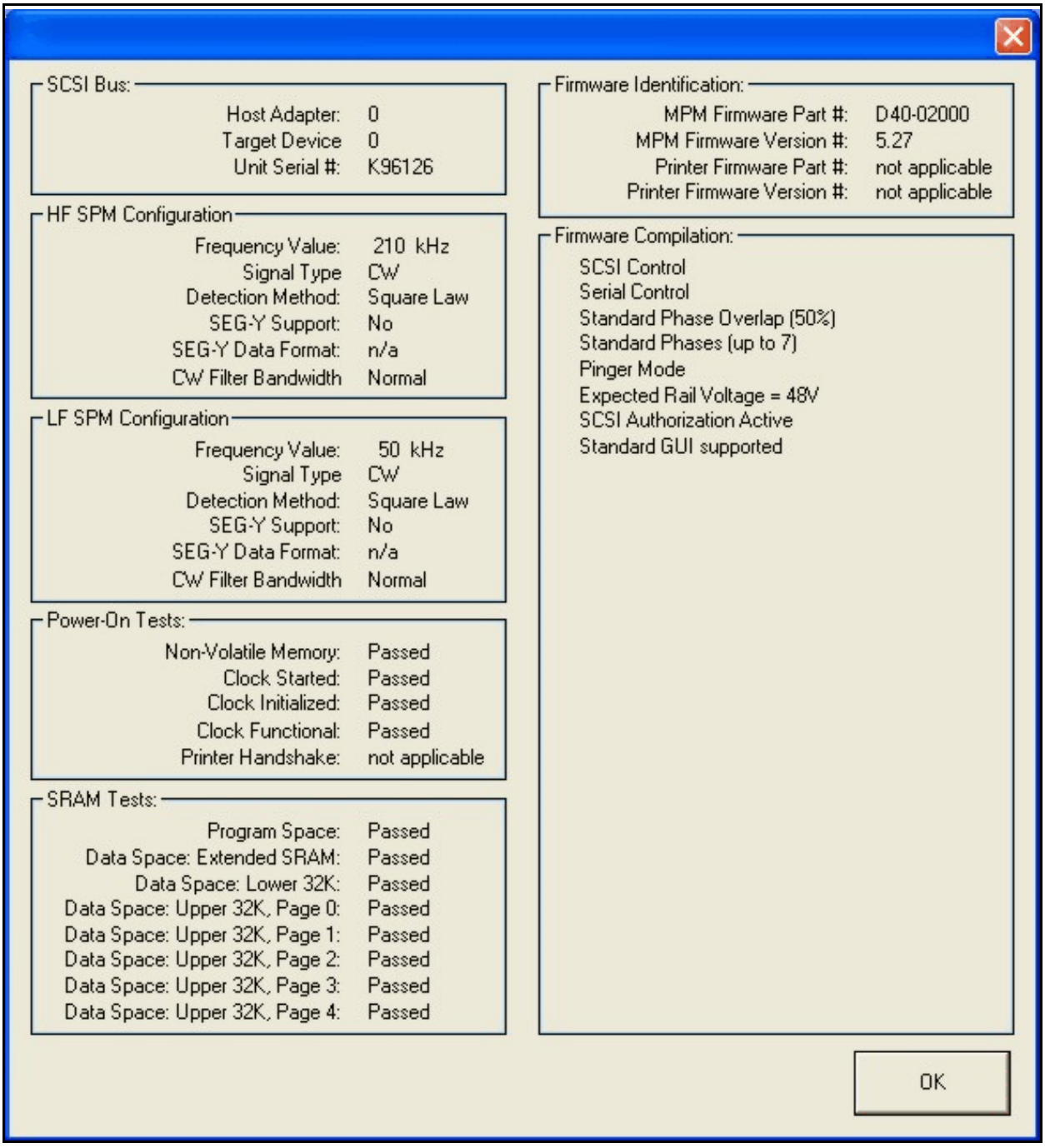
3.9 Blank Screen

The **Blank Screen** control is another special case menu item. It, too, does not display any sub-menus, but causes the greyscale display window to be cleared of any data when clicked. If there are no other dialogue boxes active, simply pressing **Alt-B** will cause the display to clear.

3.10 Help

The **Help** menu provides access to two options that provide the user with system configuration information that is most useful when contacting the factory for technical assistance. There are no other help features implemented at this time.

3.10.1 320 Identification

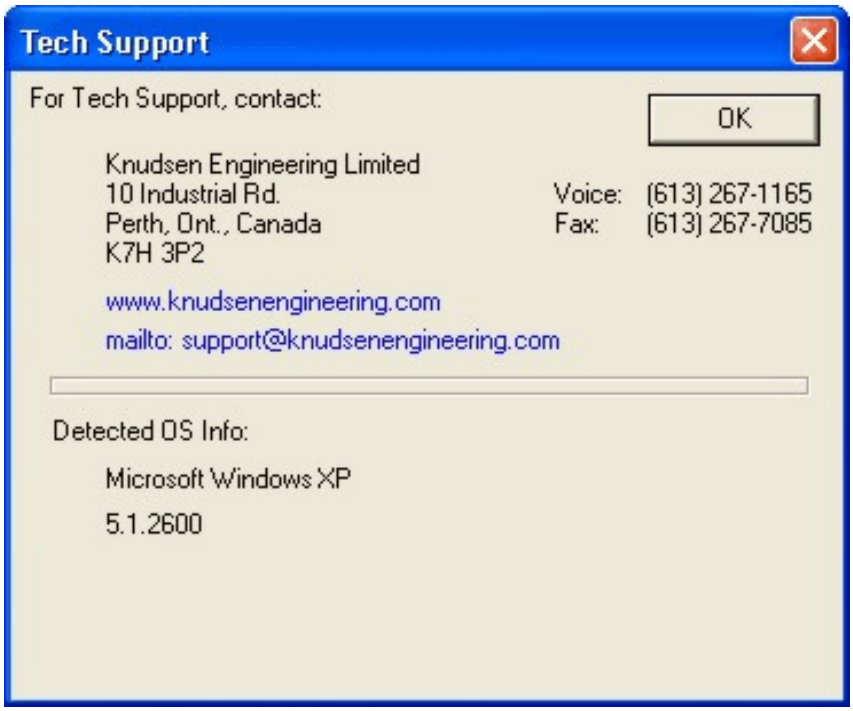


This option pops up a dialogue box that reports the echosounder system information read from the echosounder when the program was invoked and initiated communication with the echosounder. It reports the system's serial number, frequency configuration, and controlling firmware part number and version. It

also reports the firmware configuration options enabled both for the basic operational features as well as the individual signal processing features.

The Power-On and SRAM Tests indicate when problems are occurring in the echosounder. If the user is having trouble with the system and any of the test conditions failed, the user should contact the appropriate technical personnel to determine if the system should be serviced.

3.10.2 Tech Support



This option brings up a simple dialogue box that provides contact information for technical support. It also provides information about the type of Windows operating system the EchoControl program has detected.

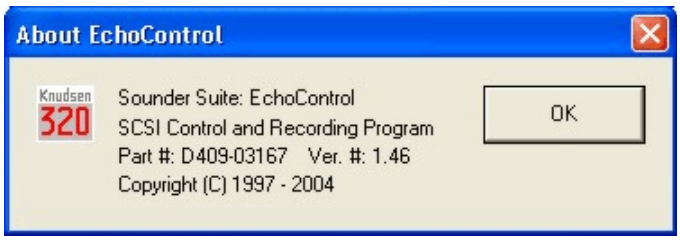
3.10.3 Functionality Mode

Dependent on the firmware compilation in the echosounder, there may be more than one functionality mode available. The functionality modes determine the user interface features and the appropriate control difference available for specialized operational requirments.

1. **Standard**: The default configuration used for most operational conditions.
2. **Navigation**: Enables specialized user interface, limited to a single channel, and with simplified user controls.
3. **Sidescan**: Enables an optimized waterfall display, customized controls for operating sidescan channels, and XTF file recording support

4. **Sweep**: Enables a multi-transducer display mode for up to eight transducers per channel, as well as specialized controls for sweep operation.

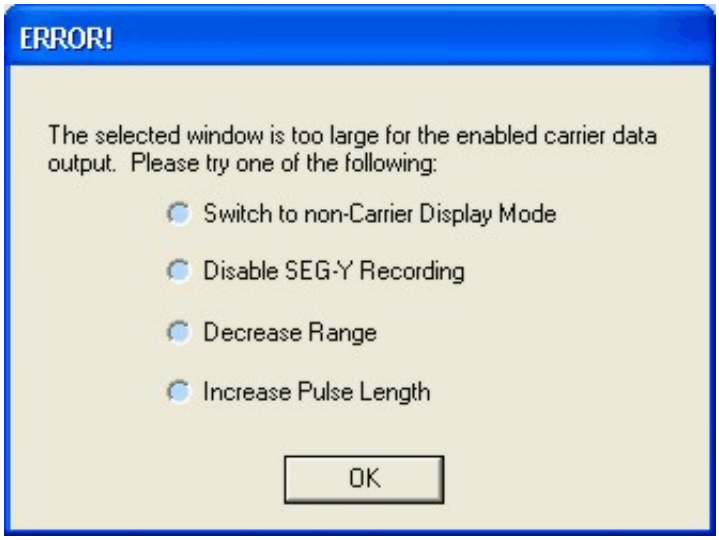
3.10.4 About EchoControl...



The **About ECHO...** menu item brings up a simple dialogue box stating the name of the PC software program, the KEL part number for the program, and the latest revision number.

4 MISCELLANEOUS INTERFACES

4.1 Carrier Buffer Overflow Error



In extreme instances, the data storage buffers used on the echosounder for carrier data handling are not large enough the vast amount of data desired. This usually occurs when echosounder is trying to operate with a very short transmit pulse (which have higher effective data rates) and very large window. When this specific condition occurs there is a potential for lost data in the carrier records (and SEG-Y recording) even though the envelope data appears okay. To prevent the user from getting into a situation where this kind of data loss could occur, the EchoControl application double-checks the configuration and displays an action dialogue to force the user to correct the condition causing the problem. The user should be aware that for carrier data acquisition (such as for SEG-Y recording), the largest window sizes, 2000m and 5000m, simply cannot be supported..

4.2 Multiple SCSI Devices

It is possible to have more than one KEL echosounder connected to the SCSI bus on a single computer with the proper use of termination strips and SCSI ID dipswitch settings. When this physical setup is configured, it is possible to communication with each device using separate instances of the EchoControl application.

When EchoControl detects more than one echosounder on the SCSI bus when it is initializing, it provides a dialogue box to the user to select which device to connect to and control. If there are two sounders connected to the PC, simply run EchoControl and select one of the echosounders listed in the dialogue box. Leave that instance of EchoControl running and start another copy. This time, select the other device listed in the dialogue oox. Now both sounders can be controlled and data recorded on a single PC.

4.3 SCSI Error Messages

Dialogue boxes with SCSI error messages may appear under certain conditions relating to power sequencing. When this occurs, the "OK" boxes should be clicked and the operation (which brought up the dialogue box) repeated.

Some adaptors require that the sounder be connected and powered up for the necessary drivers to be loaded when the PC boots up. If the message "**ASPIStatus: No ASPI managers are loaded**" appears on program start up, the necessary device drivers are not loaded. The system will have to be rebooted with the sounder powered up and connected to properly load the drivers.

4.4 AUTHORIZATION ERRORS

All 320B Series Echosounder users must have the EchoControl application to be able to operate their sounders. For 320M Series Echosounder users, the EchoControl and SCSI interface are only available as options for a licencing fee. The EchoControl application uses a special authorization file to determine a 320M Series Echosounder's eligibility to use the SCSI interface. There are various "error" messages that could occur relating to the authorization file and the eligibility of the sounder to use the SCSI control interface.

4.4.1 Missing file KEL.DAT

If the necessary authorization file, KEL.DAT, is missing from the appropriate search folder, the EchoControl application will display a message indicating the inability to find the file. .If the file is missing, the installation procedure should be repeated to restore it to the proper folder. If the error condition still occurs, contact the appropriate technical support to verify that the sounder is eligible and properly supported by the authorization file.

4.4.2 Authorization Failed

If the EchoControl application cannot verify that the echosounder being used has the SCSI interface enabled or the eligibility to use the interface, the application brings up a dialogue box stating that the authorization has failed. Users need to contact their local representative or the factory to purchase a site licence and an updated authorization file, and perhaps, a new software package will have to be provided to enable the SCSI interface option. If the user has already purchased a site licence for the unit in question, an updated authorization file would be provided to correctly enable the option.

There is an option for a password entry but the password is released only to authorized sales representatives to provide them with the ability to demo the application to prospective customers. All 320M customers desiring the SCSI option must purchase the site licence and they will provided with the appropriate package to enable to the application's functionality.

320 SERIES ECHOSOUNDER

PLAYBACK AND PRINTING SOFTWARE MANUAL

Supports Software: PostSurvey.exe: D409-03171 V1.34

D100 - 03175
Revision 2.2
June 28, 2004

KNUDSEN ENGINEERING LIMITED

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10 Industrial Road
Perth, Ontario, Canada

CONTENTS

1 INTRODUCTION

1.1 About this manual

This manual provides information about the Playback and Printing application,D409-03171, PostSurvey.exe. This program has been designed to review previously recorded 320 Echosounder SCSI envelope data files and to produce hard copies on selected thermal recorders and windows printers.

1.2 Software Description

The 320 Series Echosounders developed and produced by Knudsen Engineering Limited were designed with a SCSI interface for recording detailed envelope data and parameter settings. A specially designed Windows-compatible program was created to play back these data records offline from the sounder and to create hard copy records. In addition to support for the Knudsen Engineering Limited proprietary file format, this software also supports XTF and SEGY Rev. 0 formats.

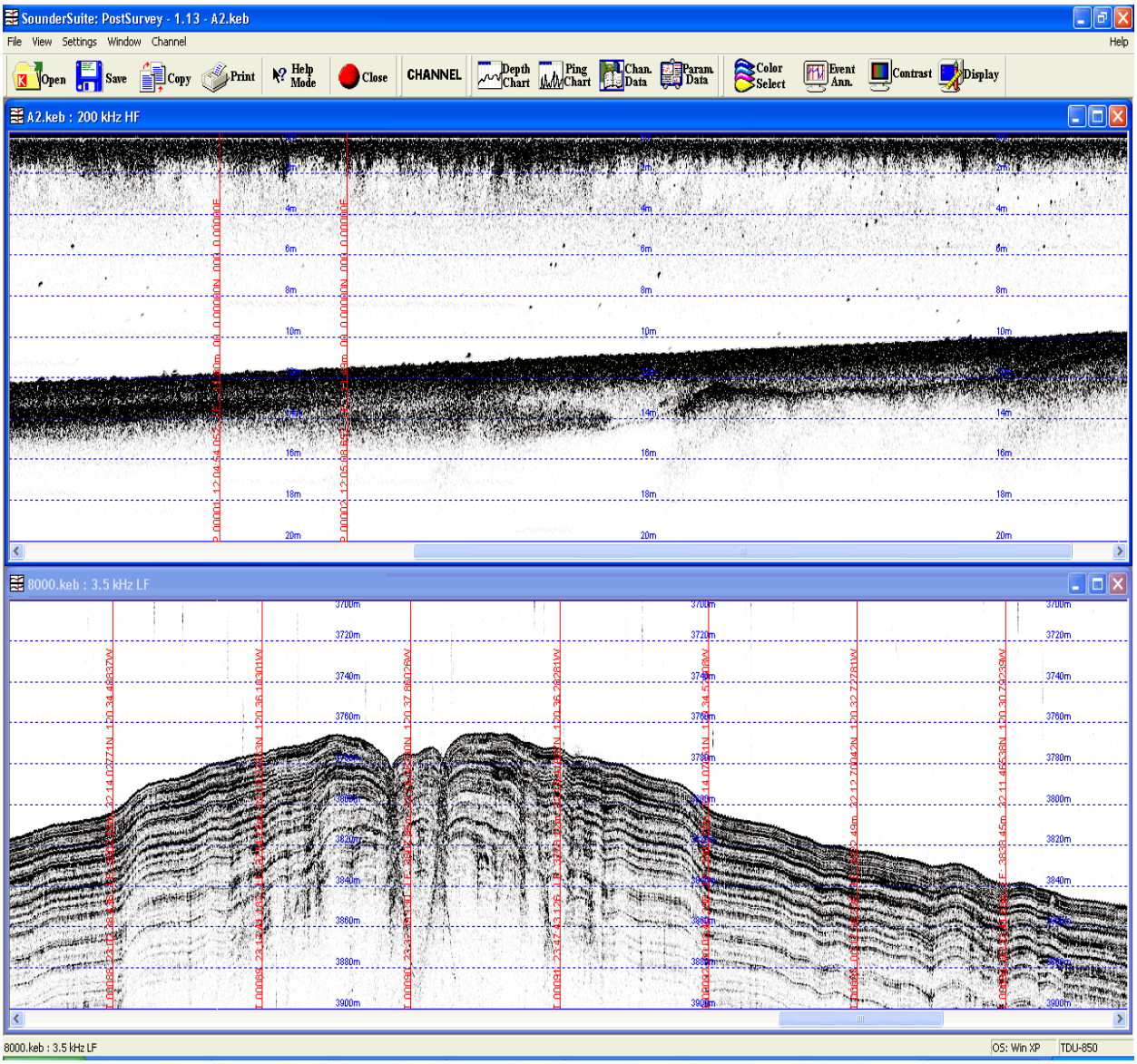
1.3 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

2 OPERATING INSTRUCTIONS



2.1 Description

The Post-Survey software is a multiple document interface Windows program design that provides the capability for data playback and printing of multiple KEL 320 Echosounder, XTF and SEGY data files on the PC. When the program is invoked, a window pops up with three control groups offered on the main menu bar(with limited functionality), a blank display area for greyscale or colour presentation of the data playback. Once a properly formatted KEL (B8 or B9) 320 Echosounder, XTF or SEGY data file has been opened an additional control group is added to the main menu bar and many more options are added to the original control groups.

3 File

3.1 Open

If the **Open** command is selected, the program responds with a File Selection dialogue box to access the files. When a valid file (.keb, .xtf and .sgy) is opened, the data from that line file will be loaded into memory and displayed starting with the first ping in the selected file.

3.2 Close

An opened line file set can be closed using the **Close** command. This option is not active if a file set is not already opened. Using this command will close all windows associated with the currently active data set.

NOTE: An individual window can also be closed by clicking on the close button (X) located on the top right side corner of the active window.

3.3 Copy to Clipboard

This command is used to copy the image within the currently active window to the clipboard in a bitmap format which can then be copied into another graphical program for further editing.

Note: This option only copies what you see on the screen if the user requires more than what is able to be viewed on the screen then they will have to save the image to a bitmap file.

3.4 Save to Bitmap

This command will save the image currently being viewed in the active window to a DIB (.bmp) file. Only the image for a single channel may be saved to a single .bmp file, so if more than one channel is being displayed in the currently active view window the user will be prompted as to which channel they would like to save to the .bmp file. Once a channel has been selected a save as dialogue box will be displayed to allow for the selection of a name and location that the new image will be saved to.

3.5 Save Portion

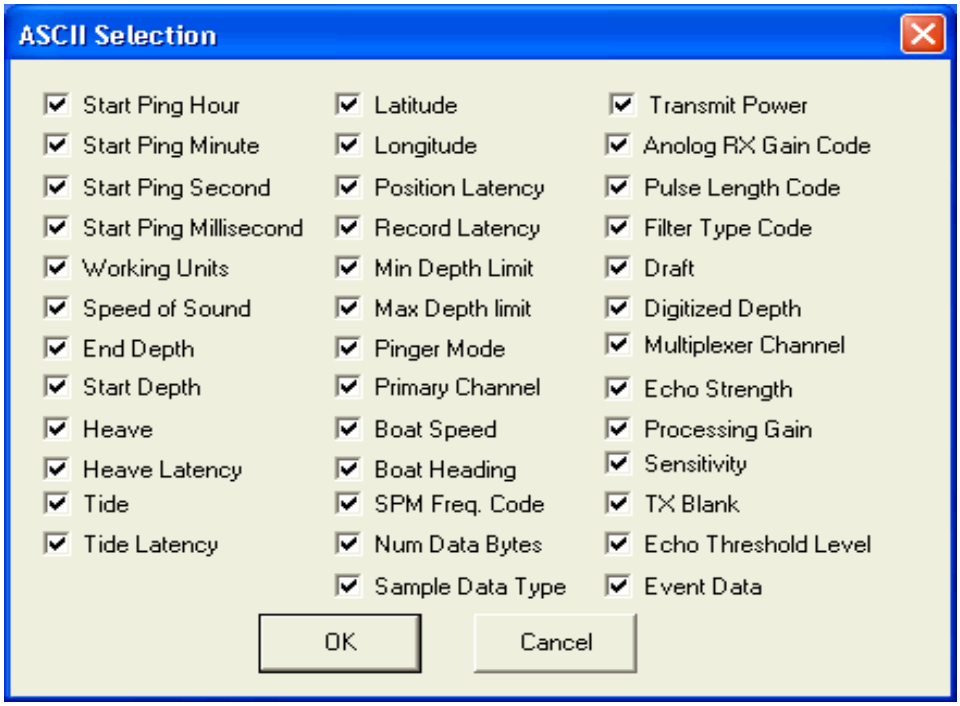
This command allows the user to select a portion of the currently active document that will then be saved to a new file. Once this commmand has been selected the user will be prompted with a save dialogue box to allow them to choose a name and location that the new file will be created in.

3.6 ASCII Dump

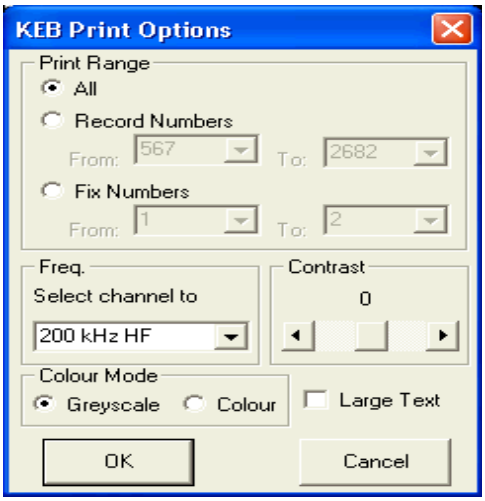
The ASCII Dump option will allow the user to select which fields from the currently active data set that they would like to record into a new standard ASCII file. The new file will have the extension .kea, however the user can select the name and extension through the standard save as dialogue box.

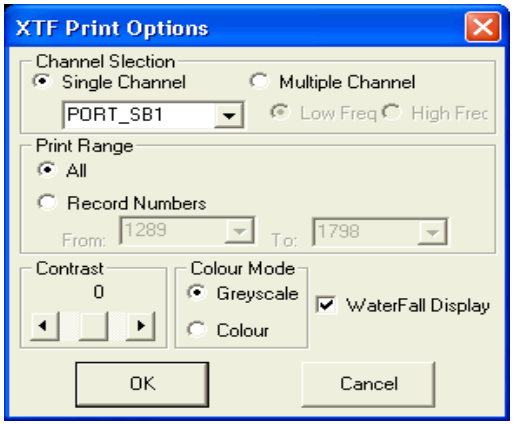
Note: all records in the currently active data set will be recorded to the new file.

The dialogue box that the user is presented with to select which fields will be recorded to the new file looks like the following:

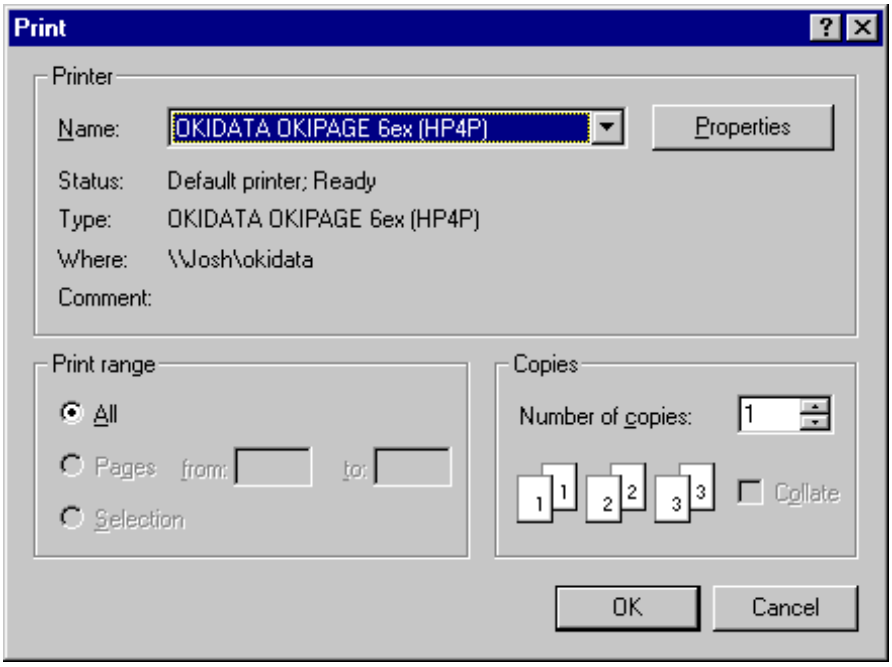


3.7 Print

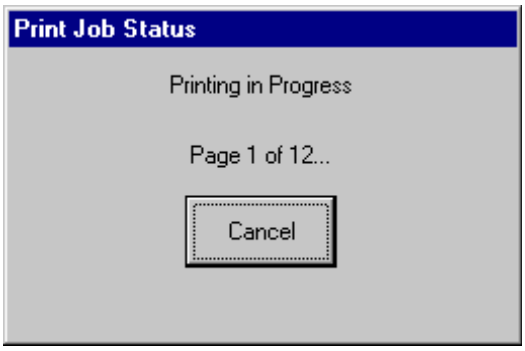




The **Print** option allows the user to print the entire data set or limited sections of the set to any Windows printer. This option is only available if a vaild KEL 320 EchoSounder, XTF or SEGY Data file is opened. When the **Print** option is selected, depending on the format of the currently active view the appropriate dialogue box pops up that allows the user to setup printout presentation options similar to the screen options: Greyscale/colour mode, display mode, contrast (See Section 2.3). It also has an option for the grid overlay with different textures of grids(currently only one option is available, the rest will be added in an upcoming release) and a text annotation toggle. The Print Range option provides the user with the ability to select the entire line file set or only a section of the line file set to print. The printout can be limited to print between Record Numbers or Fix Numbers (if any exist).



Once the print options have been OK'd, the standard print dialogue box appears. This allows the user access to the printer setup to change from current default printer, and to modify printer setup options. Once all the desired selections are made and the user clicks on OK, the printing will begin. Currently, any printer setup selections made for the current print job will be lost on the next, and have to be re-selected.



NOTE: There is a Cancel Print capability but it has limited response capability once the printing procedure has started. Because the printouts are very graphically intensive and most systems print graphics quite slowly, the user should be certain he really wants to proceed before clicking OK in the Print dialogue box.

Note: this menu option is only used to send data to standard Windows printers, not thermal recorders. Use the **Thermal Recorder: Send Data** command to print to thermal recorders.

Important information: The printed envelope output is very graphically intensive. Some printers with on-board memory may have problems with data overflow; reducing the print quality (resolution in dpi) may minimize this problem but it also reduces the quality of the printout. Preliminary testing with a limited number of printers had the best presentational results with the following printer setup options (click Setup in the Print dialogue box to access): Landscape mode, Fine dithering, and the highest resolution available to the printer (this is a printer specific option). For users of Windows 95/98, the spooler options should be setup as follows to avoid creating excessively large temporary files (which can quickly over flow hard drives with limited available space): printing should start after the first page has spooled, and the spool data format should be RAW not EMF. In some cases, it may even be better to disable spooling altogether and send the data directly to the printer.

3.8 Print Preview

This option is not fully implemented at this time. Currently it is only visible if a valid KEL 320 EchoSounder, XTF or SEGY Data file is opened. To be implemented in the near future.

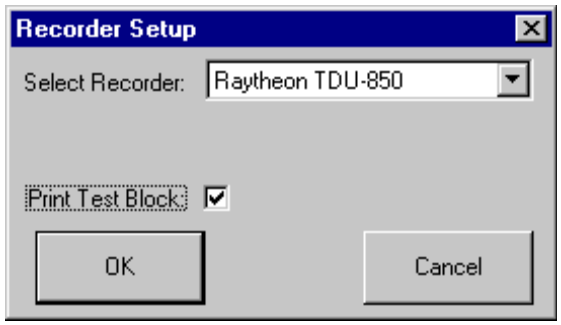
3.9 Print Setup

This option is not fully implemented at this time. Any setup changes made with this command are not preserved for the next print action. To be implemented in the near future.

3.10 Thermal Recorder...

This menu option provides access to two sub-menu items that allow the user to setup and send data to a thermal recorder. This option is only available if a valid KEL 320 Echosounder data file is opened

3.10.1 Setup



This option brings up a dialogue box that allows the user to select a thermal recorder to be used for making hardcopies. The thermal recorders that are currently supported are: **EPC 9800, EPC GSP-1086, EPC HSP-100, ODEC TDU-850 and ISYS V8.5E.**
The **EPC GSP-1086** driver expects the user to have set following parameters to the values listed via the unit's front panel menus:

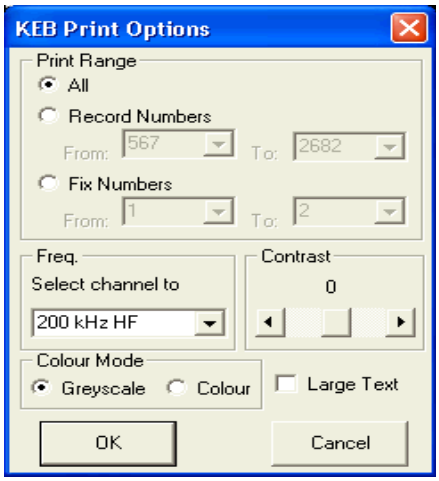
DATA INPUT = PARALLEL
SWEEP = FORWARD
SHADES = 064
DATA TYPE = 6BITS
WIDTH = 2048
LPI = 200 nominal (not EXTERNAL)

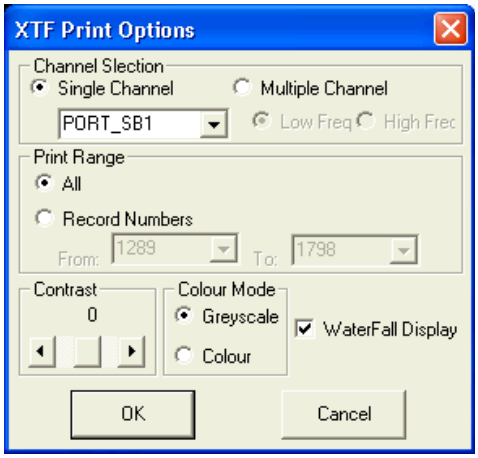
The **Port Addr** option allows the user to specified the proper output port address for the printer port. For most systems, this value should be 0378h, but for some laptops and secondary printer ports the alternate value of 0278h could be required.

The **Print Test Block** check box allows the user to tell the application to send some test data to the selected thermal recorder to confirm it is interfaced properly. The test block consists of greyscale ramps with samples of imbedded grid and fix annotation text.

The recorder selection and port address settings are stored in the application's INI file and restored the next time the program is invoked.

3.10.2 Send Data





The Send Data menu option is used to print the entire line file data or selected portions for the currently active line file. This option is not available if a line file is not already opened. When this item is selected, it first causes a dialogue box to pop up that allows the user to select the presentational parameters desired. If the OK box is clicked, the application then brings up a status display dialogue box indicating the progress of the print job in terms of pings printed relative to the total number in the data set. It also provides the user with the ability to cancel the print job if desired.

Note: this menu option is only used to send data to thermal recorders, not standard Windows printers. Use the Print command to print to standard Windows printers.

3.11 Convert Data Set

3.11.1 To New KEB Format

This option will allow the user to convert a previously recorded line file set into the new B8 file format which is the only file format supported by the post survey playback software.
A line file set is identified by the first three digits of the file name. The actual date files are recorded with the following file name format:

nnn_hhmm.keb

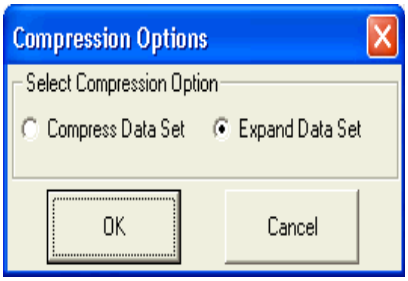
where nnn = line number of the data set
hh = computer's time - hour
mm = computer's time - minutes
keb = extension for KEL binary data files

In addition to the basic data files, there is a very important file, referred to at the data set log file. Its name is recorded using the following format:

nnn_ttt.log

where nnn = line number of the data set
ttt = refer for data output format: keb for binary, kea for ASCII, sgy for SEG-Y
log = extension for log data files

NOTE:The Conversion Utility MUST be run on all line file sets recorded with versions of the Echo Control software previous to D400-03167. The Conversion Utility will convert Types A1,A2,A3,B0,B2 and B5 File Formats to Knudsen Engineering Limited's new B8 standard format. To convert an entire "Bx" type line file set simply select a single file from anywhere within the line file set and the conversion utility will use the associated log file to complete the conversion of that line file set. If no log file exists for that file set only the selected file in that set will be converted. If only a section of a data set is desired for conversion, the log file could be stripped down to the desired files using a hexadecimal editor. The log file may look like an ASCII file, but it uses null fields (00h) instead of space codes (20h) to separate the file names. An ASCII editor would replace the null fields with spaces and the Post-Survey application would not know how to interpret the list properly. To convert an "Ax" type line file set simply select any file from within that set and the conversion utility will find the first file in that set and begin converting all files associated with that line file set.



The Compression Options dialog box is then displayed allowing the user to select whether the resultant line file will be compressed or uncompressed.

3.11.2 To KEL Extended SEGY

This command will allow the user to convert a B8 formatted file to the KEL Extended SEGY file format. The Extended SEGY File Format is a proprietary revision to the SEGY Rev. 0 where by some of the reserved fields in the trace header are populated with sounder specific settings and some other relevant data. It should be noted however that some SEGY viewer are unable to view these files that have data recroded in the reserved fields. The File format specs are freely available on the website for the Society of Exploration Geophysicists.

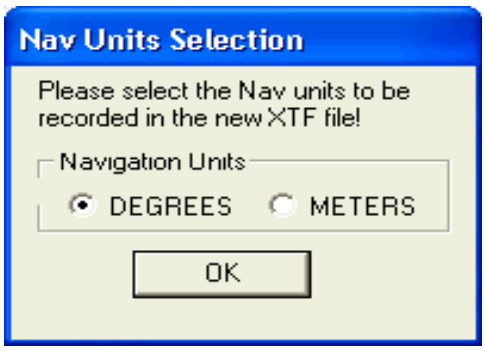
3.11.3 To SEGY Rev.0

This command will convert a B8 formatted file to the SEGY Rev 0 format. The File format specs are freely available on the website for the Society of Exploration Geophysicists.

3.11.4 To Standard XTF

This command will allow the user to convert a B8 formatted file to the Standard XTF file format. Before the conversion begins however the user is presented with a dialog box as shown below.

Note: The user is expected to know what units the KEB B8 file was recorded using in order to properly convert the file.



3.11.5 Uncompress KEB File

This command will allow the user to uncompress a compressed KEB B8 formatted file that was compressed during recording using the Huffman Compression Algorithm to an uncompressed KEB B8 formatted file. The user will be presented with the standard Save As dialog box to allow them to select the name and location of the new file

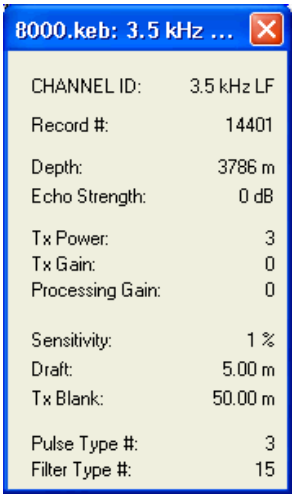
3.11.6 Exit

The user can terminate the Post-Survey program using the **Exit** command. The INI file parameters are recorded as the program is terminated.

4 View

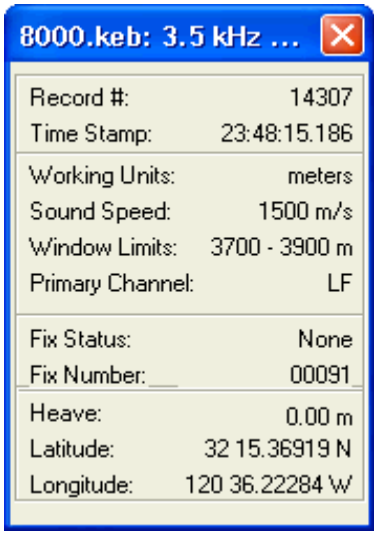
This control group allows access to functions that control the presentation of the envelope data. Most functions within this control group are only available if a valid line file is opened.

4.1 Channel Data



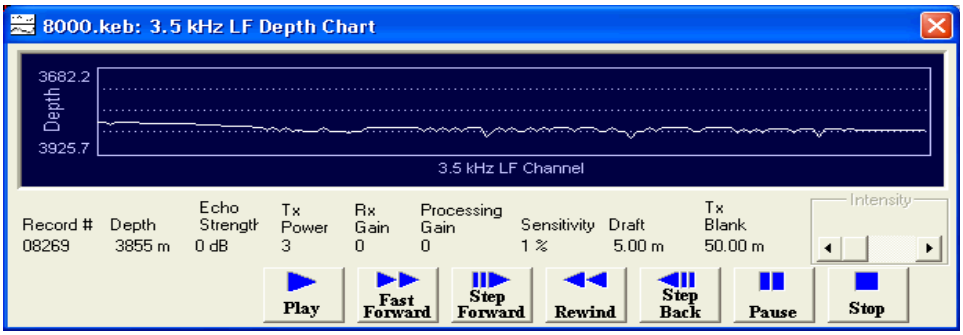
These Channel Data controls allow the user to display or close individual dialogue boxes for each frequency channel. If the user clicks the left mouse button while pointing the cursor to a position of interest on the echogram display window, any active channel data dialogue boxes will display the following data for the ping record represented by that point: record number assigned by the echosounder, the depth and echo strength determined by the echosounder's digitizer, and all of the transmit power, gain, sensitivity, draft, transmit blanking, pulse type and filter type settings used for the ping cycle.

4.2 Parameter Data



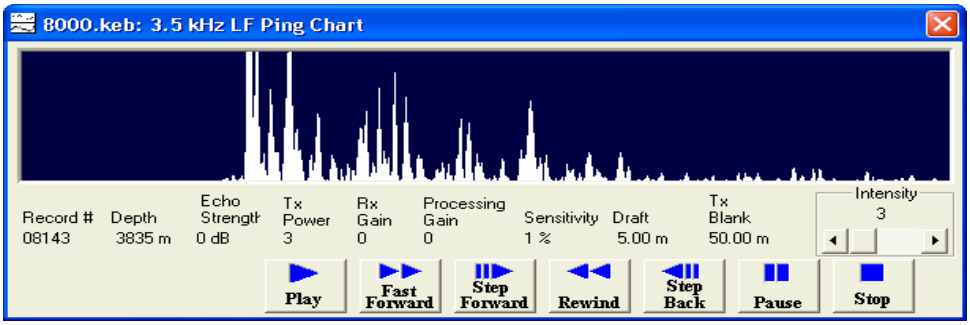
The Parameter Data option provides the user with the ability to display or close a dialogue box that presents the non-channel specific data recorded from the echosounder. If the user clicks the left mouse button while pointing the cursor to a position of interest on the echogram display window, the active parameter data dialogue box will display the following data for the ping record represented by that point: record number assigned by the echosounder, echosounder time stamp at start of the ping cycle, working units and speed of sound being used for calculations, upper and lower limits of the active window being displayed, primary channel used for bottom detection tests, fix status code and fix number if a fix condition exists, and the heave and position data used for the ping cycle.

4.3 Depth Chart



This option allows the user to view the digitized depth value for the entire data set through a line chart. At the bottom of this chart are located many VCR like controls which allow the user various options for viewing the Digitized depth of the data set. Just under the display section of the graph is a parameter data section which displays the configuration parameters for the right most ping if playing forward through the file or the left most ping if playing backwards through the file. In order to close a particular chart you simply select the button that corresponds to the open chart along the Control Bar on the left side of the screen.

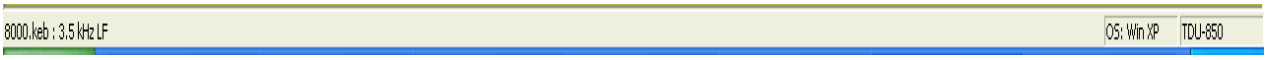
4.4 Ping Chart



These menu items work in the same fashion as the Depth Chart options, however these charts display the intensity of each sample along an entire trace. To the left of the graph is an intensity slider control which will magnify the image in the display area by the factor displayed in the control.

4.5 Status Bar

This control allows the user to enable and disable the application's Main tool bar.



The status bar contains relevant information such as the name of the currently active line file in the left corner. The Windows Operating system is displayed in the box second from the right and the currently available thermal printer is displayed in the box furthest to the right

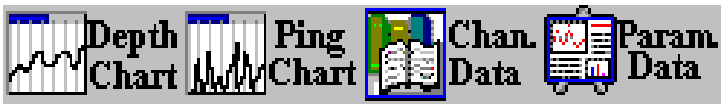
4.6 Main Tool Bar

This control allows the user to enable and disable the application's Main tool bar.

The Main tool bar contains easy access controls which can also be found under the File Menu.

4.7 Info Tool Bar

This control allows the user to enable and disable the application's Info tool bar.



The Info tool bar contains easy access controls which can also be found under the view menu.

4.8 Setting Tool Bar

This control allows the user to enable and disable the application's Settings tool bar.

The Settings tool bar contains easy access controls which can also be found under the settings menu.

4.9 Channel Tool Bar

This control allows the user to enable and disable the application's Chan tool bar.

The Channel tool bar contains one button which allow the user to select the channel within the currently active data set that they would like to view. This tool bar is only active when more than one channel is recorded in the active data set.

4.10 Active Global Scroll

This control is a toggle that is only active if more than one channel is recorded in the currently active data set. Each channel in a given data set will be opened in a separate window. When the Active Global Scroll toggle is set it acts as a master scroll bar and will synchronize all open channel windows associated with the currently active data set.

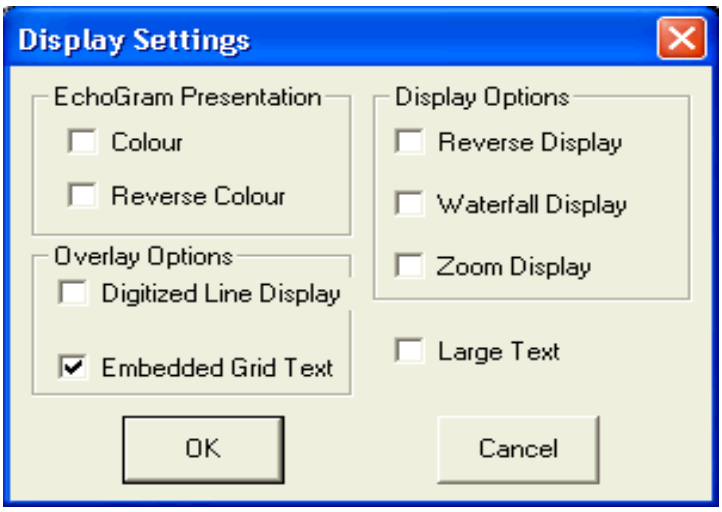
5 Settings

5.1 Contrast

This option pops up a dialogue box with a single control that allow the user to increase/decrease the contrast of the displayed greyscale data. This contrast control also adjusts the contrast of the thermal hardcopy record if the recording option is active. The range of this control is -3 thru +3.

This setting is stored in the application's INI file and restored the next time the program is invoked.

5.2 Display Settings



The **Settings** option brings up a dialogue box that allows the user to customize the display presentation to a configuration that suits his personal requirements. All of these settings are stored in the application's INI file and restored the next time the program is invoked.

5.2.1 Colour

When **Colour** mode is selected (box checked), the envelope data displayed in the program window is in 15

colour levels, mapped from lowest to highest levels as follows: White(normal video) or Black (reverse video), Light Grey, Dark Grey, Cyan, Blue, Dark Blue, Dark Cyan, Dark Green, Dark Yellow, Green, Yellow, Magenta, Dark Magenta, Red, Dark Red. If this item is not checked, the envelope data is displayed in levels of grey, where for normal video mode white is the lowest level return and black is the highest; for reverse video mode white is the highest level return and black is the lowest..

5.2.2 Reverse Video

When **Reverse Video** mode is selected, the display colours are configured to make black the main background colour. For both colour and greyscale modes, the lowest level return is assigned the colour black. When **Reverse Video** is not selected (normal mode), the lowest level return is assigned the colour white.

5.2.3 Digital Overlay

This control allows the user to display a red line over top of the echogram to indicate where the digitized depth was recorded along the trace. This control is only active if HF ONLY or LF ONLY display option is selected in the Display Setting dialog box. This control acts as a toggle to allow the user to switch the Digitized depth overlay on or off.

5.2.4 Embedded Grid Text

The **Embedded Grid Text** option allows the user to enable (box checked) or disable the use of embedded grid text. When this option is enabled, grid text is displayed within the envelope data display whenever a range or phase change occurs, or at evenly spaced intervals if no changes have occurred. The embedded text can be disabled for cases when the grid text changes obscure the envelope data.

5.2.5 Reverse Display

This control will display the data set in Reverse View(last data sample displayed first). This control acts a toggle to allow the user to switch back to Normal View(first data sample displayed first).

5.2.6 Waterfall Display

This control will display the data set along the y axis. This control works as a toggle to allow the user to switch back to standard view(display along the x axis).

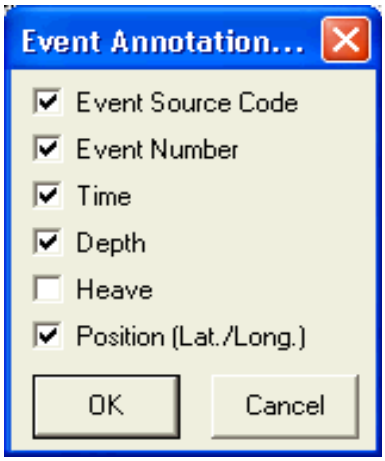
5.2.7 Zoom Display

This control is a primitive zoom control which will magnify the display X2 along which every axis is currently active. This control acts as a toggle to allow the user the switch back to Regular view (1:1)

5.2.8 Large Text

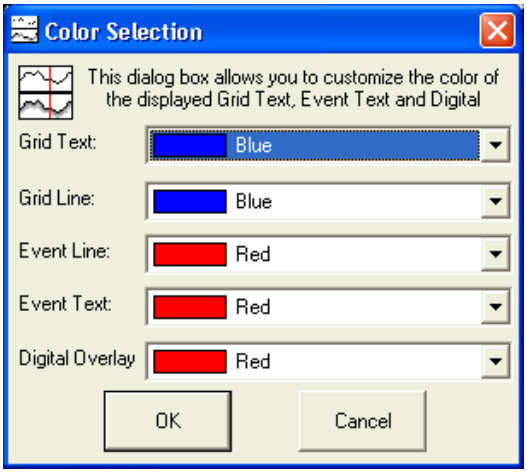
This option will double the size of the viewable text.

5.3 Event Annotation



This menu item brings up a dialogue box that allows the user to select which of the available data parameters will be printed out on the event mark annotation line. The selections made here apply to the display, the Windows printer outputs, and the thermal recorder output. The user has no control on the ordering of the parameters; they are output in the order they are listed if they are checked off.

5.4 Colour Selection



The Colour Selection dialog box allow the user to customize the colour that each individual control listed in the dialog box is shown on screen.

5.5 Alternate Windows Printer

his control is a toggle switch which was included for users having a problem printing to a selected group of windows printers. The default for this control is unchecked. If the grid data for the line file being printed is the only data that is displayed on a print-out then simply checking this control should resolve this problem.

6 Window

This control group is only visible when a vaild 320 EchoSounder line file is opened.. This Control group allows the user to easily arrange the multiple line files they have open. At the bottom of this control group is a list of all open line files. When a line file from this list is selected it then becomes the active file within the display area of the application.

6.1 Cascade

This option will take all open windows and display them in a overlapped format down the display area of the application

6.2 Tile

This option will take all open windows and stretch them across the width of the display area and stack them on top of one another.

6.3 Arrange Windows

This option will arrange all minimized file icon along the bottom of the display area within the application.

7 Channel

The Channel tool bar contains one button which allow the user to select the channel within the currently active data set that they would like to view. This tool bar is only active when more than one channel is recorded in the active data set.

8 Mark Targets

This command is a utility within the post survey program that allows the user to mark targets within the currently active data set. When this command is selected the program enters the target marking mode in which the main menu is replaced with the target marking menu. In order to mark target that will be record the a new standard coma delimited ASCII file simply hover the mouse over the target on the currently active data set and left click. At this point the user may select any valid keyboard character which will be recorded with the previously selected target (as a target code) this is a way the classify the targets selected.

The Target Marking Menu contains the following commands:

8.1 Cancel

Will allow the user to disregard any target that they have selected since entering Target Marking Mode and return to the main program.

8.2 Text

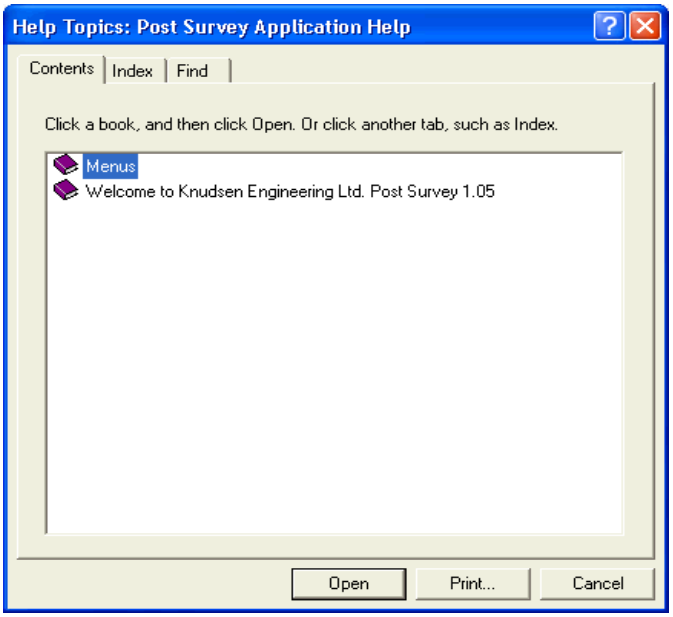
Will display the following dialog box which will allow the user to enter text that will be appended to the new file.

8.3 Write

Will record all the selected target in a new standard coma delimited ASCII file with the extension .kea. When selected the user will be presented with the ASCII selection dilaog box described in section 3.6. After selecting the fields to be recorded and selecting OK the user will then be presented with the standard Save As dialog box that allow them to specify a name and location for the new file.

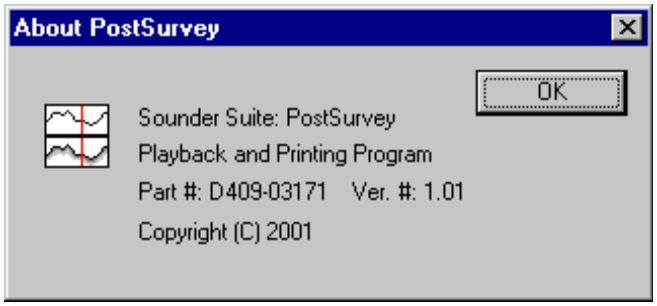
9 Help

9.1 Help Topics



This is an online help menu that contains all the same information as found in this manual only it is available through the application at run time.

9.2 About Post Survey



The **About ECHOPOST...** menu item brings up a simple dialogue box stating the name of the PC software program, the KEL part number for the program, and the latest revision number.

320 SERIES ECHOSOUNDER

SERIAL CONFIGURATION UTILITY SOFTWARE MANUAL

Supports Software: SerialUtility.exe: D40-02347 V2.00

D10 - 02194
Revision 3.0
November 4, 1999

KNUDSEN
ENGINEERING LIMITED

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

CONTENTS

1 INTRODUCTION

1.1 About this manual

This manual provides information about the Windows-based Serial Configuration Utility program, Part #: D40-02347, SerialUtility.exe. This program is designed to communicate with the 320 Series Echosounder to configure mission-specific parameters. This program is essential for users of the 320M series of echosounders since there is no other means of setting some of these parameters.

1.2 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

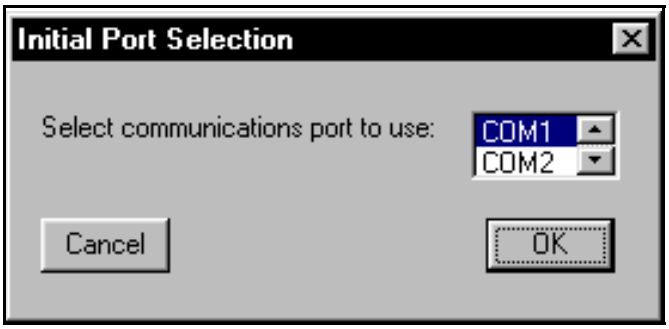
2 OPERATING INSTRUCTIONS

2.1 Overview

The Serial Configuration Utility, SerialUtility.exe, is a specialized Windows communications program designed to link a PC to a 320 series echosounder via the sounder's COM 3 monitor port. The program sends the appropriate control string to the sounder to perform a selected action from the user. (See D10-02390 Serial Computer Interfacing Manual for detailed descriptions of these control strings.)

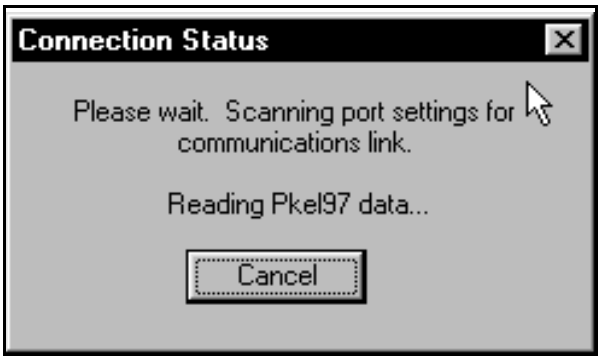
2.2 Description

When the program is invoked, it brings up a dialogue box requesting from the user the PC port to be used to establish the communications link.

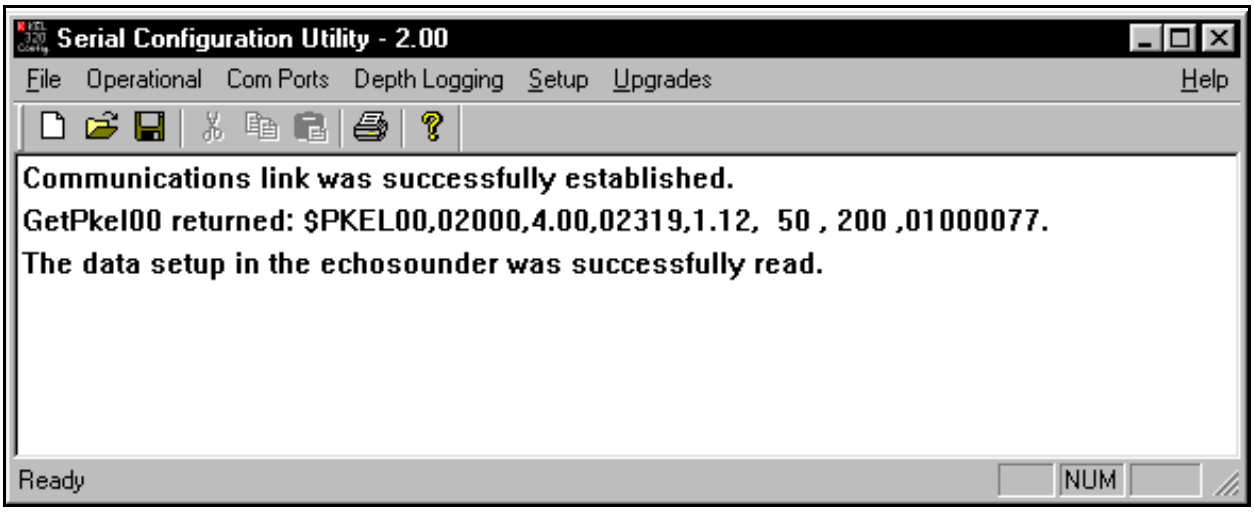


Once the user selects and accepts a particular port, the program confirms that it can initialize the PC port. If port initialization fails, the user will be informed of the failure and the detected fault. Most commonly, the port initialization fails because some other program/device is already using the port.

If PC port initialization passes, the program starts to scan for the actual port configuration settings on the echosounder. It starts with the last configuration stored in the program's main INI file, assuming that the last settings should still be correct. If these settings are no longer correct (PC is now connected to a different sounder perhaps), the program starts to scan all possible combinations of settings supported by the echosounder, starting at the highest baud rate first.



When a working combination of port settings is detected (which may take a while to find), the program then sends data requests to the sounder to determine the current parameter configuration in the sounder. As part of the data request the program runs a verification of the firmware version in the sounder; if the firmware version number is below a certain number, this program cannot interface completely with the echosounder and will inform the user of such a condition.



Once the data configuration has been read, a window pops up with seven control groups on the main menu, and a blank display area used for communications feedback messages.

2.3 File

Echosounder parameter configuration settings can be saved to and loaded from special INI files. The menu items in this group allow access to the saving and loading functions.

2.3.1 Load

When this menu item is selected, the program provides the user with a dialogue box to select the INI file to open. Once a file has been selected and accepted, the program reads the parameter settings and attempts to load them into the echosounder. It reports if an error has occurred during the loading of the echosounder.

2.3.2 Save

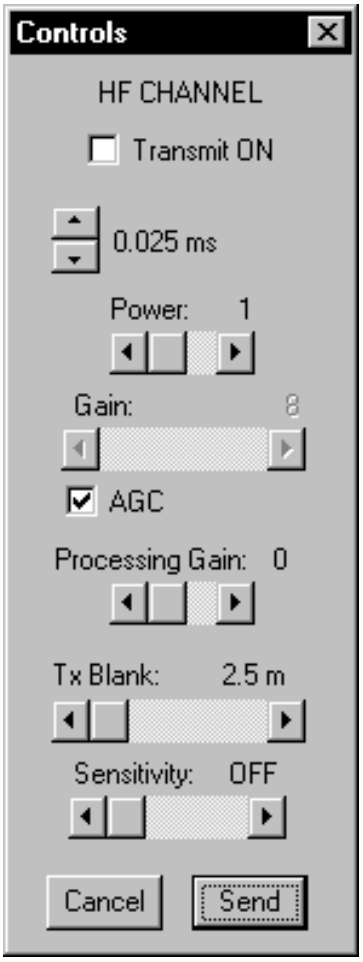
When this menu item is selected, the program provides a dialogue box for the user to select an INI file name to use for saving the data. Once a filename has been entered and accepted, the program takes the current data parameter settings loaded into the PC program, and writes them to the desired file.

2.3.3 Exit

The user can terminate the application using the **Exit** command. The current port configuration settings are saved in the main program INI file and used as a starting reference the next time the application is invoked.

2.4 Operational

2.4.1 HF Controls



The **Transmit On** check box is used to start/stop the HF channel's transmit, receive and datalogging actions.

The next control in the box is the **Pulse Type** parameter. This parameter allows the user a small amount of control over the pulse length used by the transmitter. The echosounder will override the user's selection if the **Range/Phase** selection cannot support it. By specifying the pulse length , the user directly specifies the bandwidth of the digital noise rejection filter applied to the incoming acoustic signal data. The filter bandwidth is usually set to the inverse of the pulse length. Normally, long pulses with narrow bandwidth filters provide better noise rejection in deeper water or noisy conditions, while the short pulses with wide

bandwidth filters provide better resolution when conditions permit or the water is shallow.

The **Power** parameter adjusts the amplitude of the pulse being transmitted by controlling the duty cycle of the switchmode transmitter output stage. Although high power signals will always give the strongest echoes, they also produce more reverberation, which may obscure the bottom echo in shallow water. Using high receive gain in combination with high transmit power in shallow water may cause signal levels high enough to saturate (overload) the receiver, which will mask any echoes. This control is disabled if the **Transmit On** check box is de-selected.

The **Gain** parameter is designed to adjust the sensitivity of the analog receiver. Reducing the analog gain is useful when sounding in extremely shallow water. This reduces the overall noise while not seriously affecting the echo strength. Increasing the analog gain is useful when sounding in very deep water.

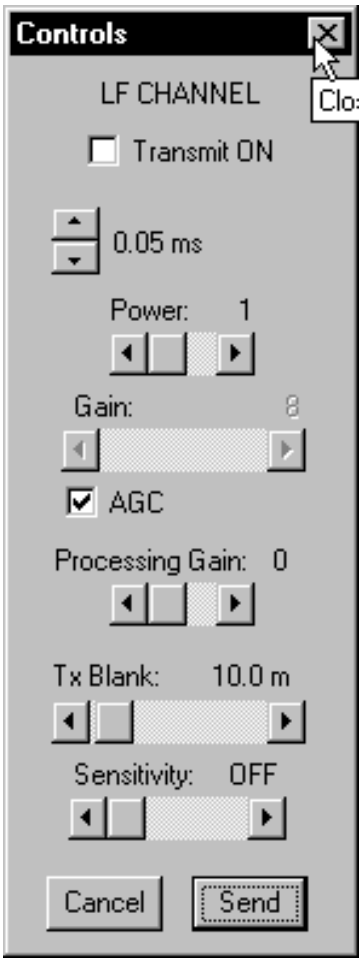
The **AGC** check box invokes automatic gain control. **AGC** is active when there is a check mark in the check box. Under most circumstances, the system should be left in **AGC** mode and the sounder will make the necessary gain changes required for proper data acquisition and presentation.

The **Processing Gain** parameter provides for additional gain in the digital signal processing software which can be used with very low level signals. It is mainly used for the very low frequency sub-bottom profiling systems (under 10 kHz) where very low amplitude echoes from sub-bottom layers are of interest. The default processing gain value is zero and this should be suitable for almost all conditions. Each level above 0 is effectively a 1-bit left shift in the processed digital data (a 1-bit left shift is equivalent to multiplying the data by a factor of 2).

The **Tx Blank** value is the distance, measured from the face of the HF transducer, to the point in the water column at which the bottom detection software begins to look for the bottom. Transmit blanking must be set large enough that transducer ringing following the tail end of the transmit pulse is not falsely interpreted as the echo from a very shallow bottom, but small enough not to unduly limit the minimum depth capability of the echosounder. The optimum value depends on the expected depth conditions, the pulse length, the transmit power level and the signal frequency. It is best determined by experimentation. Note that transmit blanking has effect only when it extends into the *window*, typically when **PHASE** is 1.

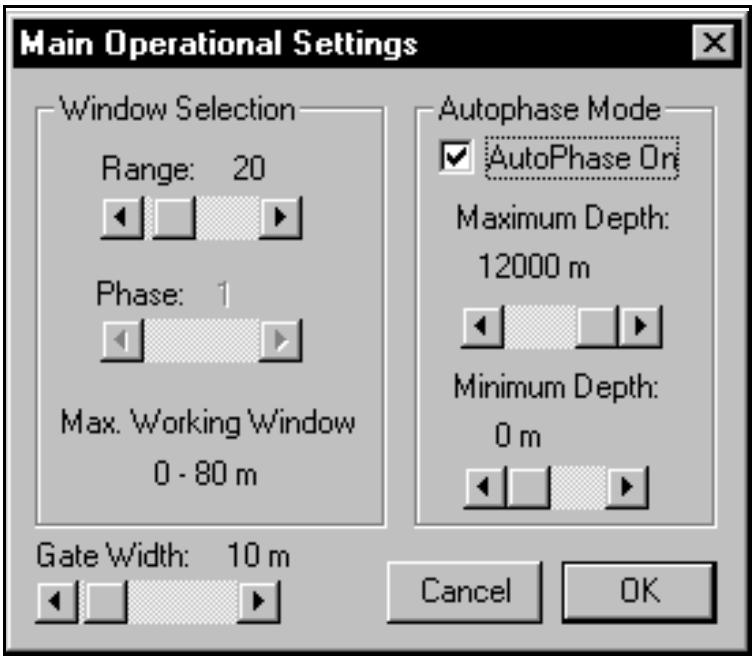
The **Sensitivity** parameter is useful in areas where soft sediments overlay harder materials, and where buried layers may often produce stronger echoes than the real bottom. If **Sensitivity** is **OFF** (the default condition), the bottom detection software will always select the strongest echo in the *window*. With layered bottoms, the strongest echo is not necessarily the shallowest echo. Increasing the **Sensitivity** causes the bottom detection software to accept a weaker but shallower echo. The higher the **Sensitivity**, the weaker the echo, relative to the strongest echo in the *window*, that will be selected. On the other hand, if the **Sensitivity** is too high, the bottom detection software will often trigger on noise or small items in the water column.

2.4.2 LF Controls



The channel controls for the LF channel are identical in performance to the controls for the HF channel.

2.4.3 Main Settings



Window Selection controls:

The **Range** parameter selects the size of the active window in the water column. The active window is the only part of the water column in which the echosounder operates. It is the portion of the water column which is printed on the hard copy recorder, and in which the bottom detection software looks for the bottom echo. The bottom *must* be in the selected *window* for the echosounder to function. Nine ranges are available: 10, 20, 50, 100, 200, 500, 1000, 2000, and 5000 in metres, feet, or fathoms dependent on working units. The **Max. Working Window** description displays the actual limits corresponding to the current combination of the **Range** and **Phase** selections as well as Minimum Depth and Maximum Depth in autophase search mode.

The **Phase** parameter selects the depth, or location in the water column, of the active window. The effect of the **Phase** switch depends on the current range setting. The standard software compilation provides a 50% overlap between **Phase** settings. A software compilation option is available for a smaller 20% overlap between phases, but this is only recommended for the special case where a very small window is autophased in an area with extended steep slopes.

AutoPhase Mode controls:

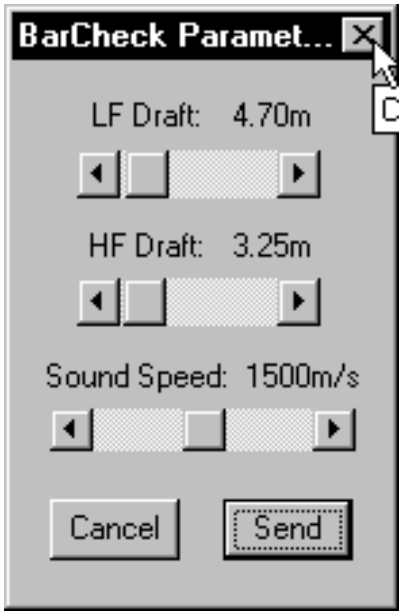
The **AutoPhase On** check box function is used to select or de-select autophase mode. In autophase mode, the echosounder adjusts the phase setting automatically in response to information provided by the primary channel bottom tracking algorithm. The autophasing software adjusts the phase setting automatically to maintain the bottom in the active window, provided the bottom is not deeper than the maximum depth available for the given **Range** selection. The **Max. Working Window** description displays the maximum

limits supported by the current **Range** selection in Autophase Mode.

The **Minimum Depth** and **Maximum Depth** parameters define the search *window* for bottom acquisition during auto phasing. When **AUTO PHASE** is first invoked, or when the bottom tracking algorithm for the **primary channel** loses bottom lock, the auto phasing software opens up the *window* to the full extent of the water column from **autophase minimum search depth** to **autophase maximum search depth** until it finds the bottom. These parameters only have effect during the bottom search phase. They do not limit the auto phasing process once the **primary channel** bottom tracking software has located the bottom.

Gate Width is used by the bottom tracking algorithm to determine the validity of the current depth value. It is a depth variability tolerance value, defined as a distance above or below the bottom depth trend established by the current and several previous samples. If the most recent depth value fits this established trend to within the range defined by the **tracking gate**, it is considered valid and is displayed on the four-digit LCD. If a depth return falls outside of this range, it is deemed invalid and "----" is displayed on the LCD.

2.4.4 BarCheck Parameters



The BarCheck dialogue box provides access to the **Draft** and **Sound Speed** parameters. These parameters are usually adjusted during a bar check.

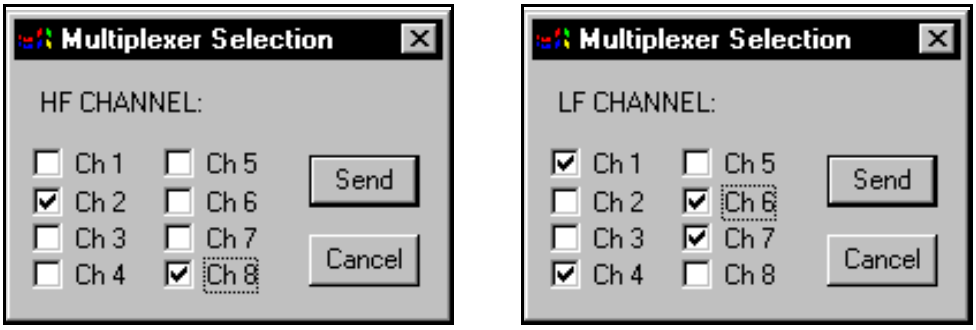
2.4.4.1 Draft

Draft indicates the vertical distance from the surface of the water to the active face of the transducer. Its main use is to ensure that the echosounder's output is corrected for transducer depth. The draft can be set independently for the low frequency and high frequency channels.

2.4.4.2 Sound Velocity

This feature allows the adjustment of the velocity of sound value used by the echosounder for all depth calculations. The user adjusts this value in the course of a bar check, or enters the average expected velocity of sound over the water column of interest, obtained from a sound speed sensor.

2.4.5 Multiplexers: HF/LF



The **Multiplexer** controls are only needed for echosounder systems using the KEL 8:1 Multiplexer box. The Multiplexer allows for more than one transducer channel to be connected to a single echosounder transmitter output. The Multiplexer Selection dialogue box lets the user select which channels of the Multiplexer are to be used. A special compilation code read from the echosounder when this application initializes, indicates if the sounder is configured to use any multiplexer boxes; this application will enable only those control options supported by the sounder.

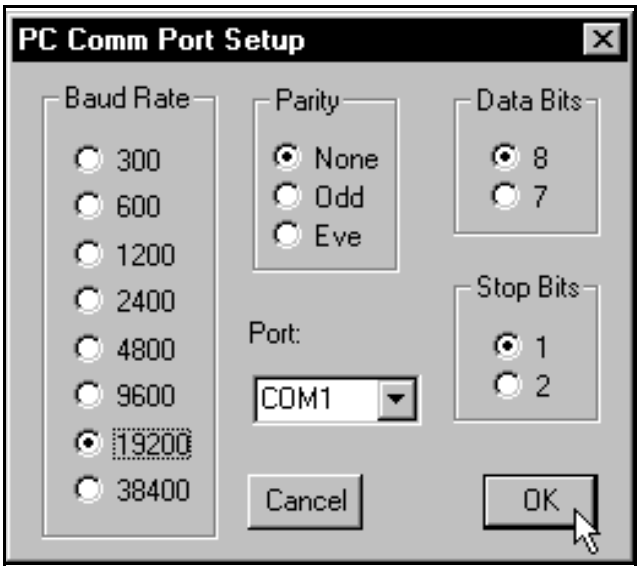
2.4.6 Rescan Sounder Setup

This option can be used to re-read the current settings of all the control parameters in the echosounder.

2.5 Com Ports

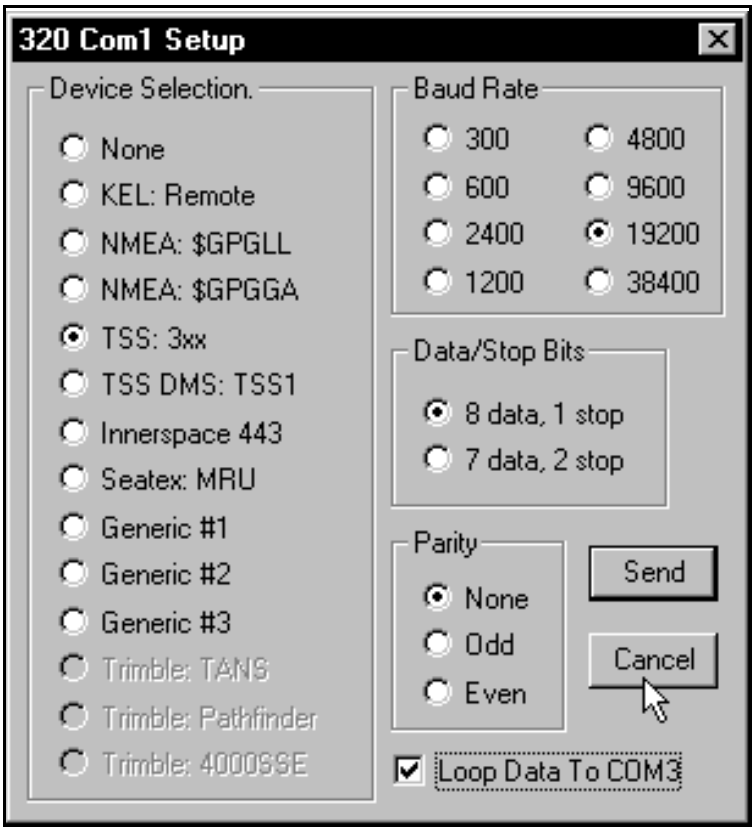
There is one very important connection detail that must be understood to ensure the configuration application works correctly. The PC com port must be configured to match the *current* settings for the echosounder's COM3 port.

2.5.1 PC Port



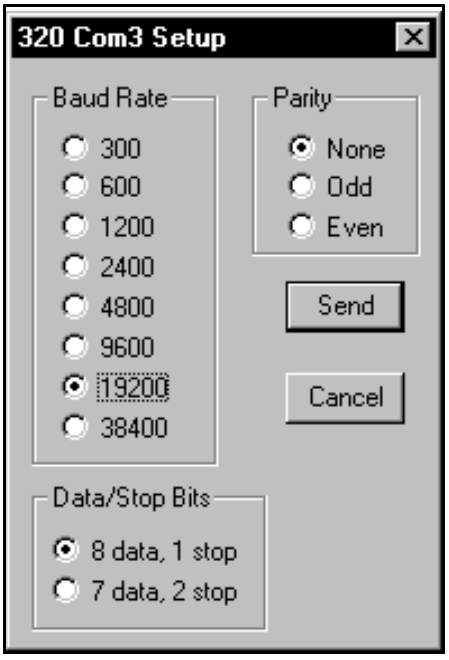
The **PC Port** option pops up a dialogue box that allows the user to select the desired com port to use on the host PC and the communications settings to be used by the selected port. The PC port's communication settings must match those on the echosounder's Com3 port. The echosounder is shipped with the settings at the following defaults: 19200 baud, no parity, 8 data bits, 1 stop bit. Clicking on **OK** accepts the current PC port settings, and the program will initialize the port to the selected settings. Pressing **ESC** or clicking on **CANCEL** eliminates the changes, and restores the original settings.

2.5.2 320 Ports: Com 1/ Com 2/ Com 3/ Com 4



For the menu options for the 320's Com Ports 1, 2, and 4, a dialogue box like the one illustrated above is activated. These three ports can be configured to accept input from external devices. Simply select the desired device driver, and then setup the baud rate, parity, and data/stop bits settings to match those required by the external device. Com Port 4 option will be inactive (greyed out) if the echosounder firmware configuration flags indicate that a front panel is supported (320Ms typically).

If the **Loop Data to COM3** box is check and the selected peripheral device outputs printable ASCII strings, the echosounder will echo these strings upon receipt out Com3 to any attached survey computer/datalogger.



The Com 3 on the echosounder is a special com port. It cannot be connected to other external devices like the other three ports. It is used for data logging to survey computers, and for remote control from a host PC; thus the only settings to be adjusted on this port are the actual communication settings of baud rate, parity, and data/stop bits. When these com settings are modified and accepted, the application automatically attempts to modify the PC port configuration to match the sounder port settings, and tests for successful reconnection.

2.6 Depth Logging

This menu provides access to the echosounder's depth log format options and the data logging rate controls.

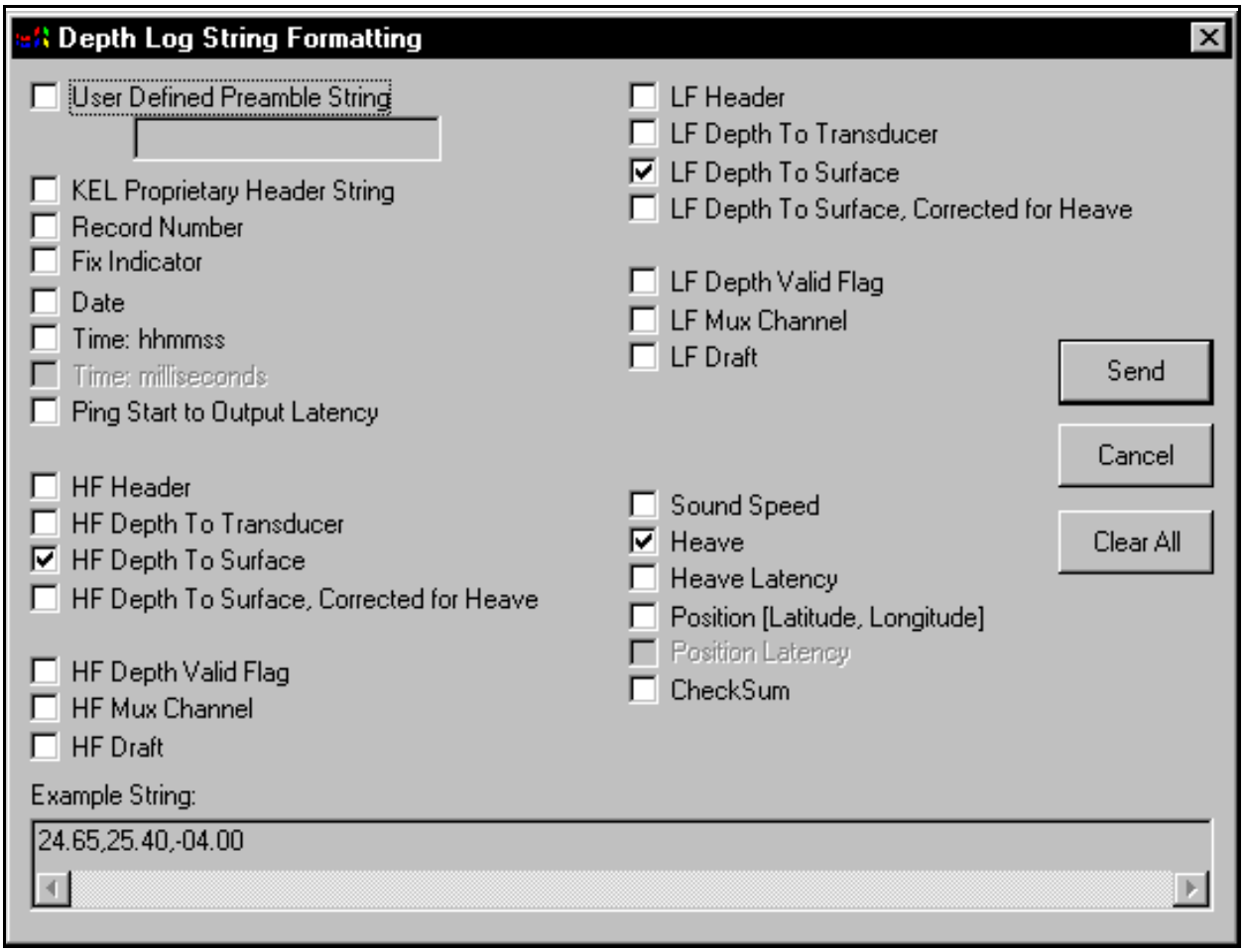
2.6.1 Formats

The echosounder is capable of outputting different types of depth log strings to fit individual customer needs, or to not output any data at all, if desired. To select a depth format simply click on the appropriate menu item; a check mark indicates which a format is selected. Note: only one format can be selected at any given time.

2.6.1.1 None

This option simply turns off the depth logging on the echosounder.

2.6.1.2 Configurable



The **Configurable** option pops up a dialogue box that allows the user to customize the depth logging string with certain limitations. The fields can only appear in the order listed (ie header string, HF depth, LF depth, checksum) separated only by commas (except hhmmss and milliseconds), and terminated only at the very end by <CR>< LF>.

As various fields are selected or deselected, the **Example String** at the bottom of the dialogue box changes to illustrated the expected output format.

Some fields can only be selected if other fields are also selected and will be inactive (greyed out) if the required field is not selected. For example: the Position Latency field is an active option only if the Position field is selected.

2.6.1.3 ISAH: Knudsen

The **ISAH: Knudsen** option selects the depth format shown below. This format outputs the depth to surface uncorrected for heave offset for a dual channel system. (ie. LF and HF channels.)

$PKEL,007,hhmmss,LF,x.x,HF,x.x*hh<cr><lf>

where: hhmmss = 320B system's time
x.x = depth expressed in meters.

2.6.1.4 ISAH: Elac

The **ISAH: Elac** option selects the depth format that will interface with the Elac, STG 721C Depth Digitizer record format option on the ISAH package from Questor Tangent. This format outputs the depth to surface uncorrected for heave offset.

Low Frequency: AxxxxxxO<cr><lf>
High Frequency: ExxxxxxO<cr><lf>

where: xxxxxx = depth expressed in centimetres.

2.6.1.5 Echotrac

The **Echotrac** option selects the Echotrac emulation string. This format outputs depth to surface corrected for heave.

HF Frequency only: fcceH xxxxx<CR>
LF Frequency only: fcceL yyyyy<CR>
Both Frequencies: fcceB xxxxx yyyyy <CR>

where: f = space if no event mark, F if event mark condition
cc = ET for [dm], et for [cm]
e = space if depth data okay, E if data bad
H,L,B = data indicators: H=HF, L=LF, B=both
xxxxx = HF channel depth,
yyyyy = LF channel depth

Note: The echosounder only emulates the Echotrac output string. It cannot accept the annotation commands normally sent to an Echotrac system.

2.6.1.6 Digitrace [dm]

The **Digitrace [dm]** option selects the Digitrace emulation string for units that output the depth to decimeter resolution. This format outputs depth to surface corrected for heave.

HF Frequency only: fDTeH xxxxx<CR>
LF Frequency only: fDTeL xxxxx<CR>

where: f = space if no event mark, F if event mark condition
e = space if depth data okay, E if data bad
H,L = data indicators: H=HF, L=LF
xxxxx = depth

Note: The echosounder only emulates the Digitrace output string. It cannot accept the annotation commands normally sent to a Digitrace system.

2.6.1.7 Digitrace [cm]

The **Digitrace [cm]** option selects the Digitrace emulation string for units that output the depth to centimetre resolution. This format outputs depth to surface corrected for heave.

HF Frequency only: fDTeH xxxxx<CR>
LF Frequency only: fDTeL xxxxx<CR>

where: f = space if no event mark, F if event mark condition
e = space if depth data okay, E if data bad
H,L = data indicators: H=HF, L=LF
xxxxx = depth

Note: The echosounder only emulates the Digitrace output string. It cannot accept the annotation commands normally sent to a Digitrace system.

2.6.1.8 Simrad EA200 (6 byte)

The **Simrad EA200 (6 byte)** option selects the Simrad EA200 - 6 byte format emulation string. This format outputs depth to surface corrected for heave. Depth value expressed is HF depth value if HF channel is turned on (regardless if LF is on), LF depth value if LF channel only is on.

Dxxxxx

where: xxxxx = depth expressed in decimeters

Note: The echosounder only emulates the Simrad EA200 output string. It cannot accept the annotation commands normally sent to an Simrad system.

2.6.1.9 Simrad EA200 (7 byte)

The **Simrad EA200 (7 byte)** option selects the Simrad EA200 - 7 byte format emulation string. This format outputs depth to surface corrected for heave. Depth value expressed is HF depth value if HF channel is turned on (regardless if LF is on), LF depth value if LF channel only is on.

Dxxxx.x

where: xxxx.x = depth expressed in metres

Note: The echosounder only emulates the Simrad EA200 output string. It cannot accept the annotation commands normally sent to an Simrad system.

2.6.1.10 Deso 20

For this emulation mode, the depth log output format supported is as follows:

Both frequencies: DAXXXXX.XX mDBXXXXX.XX m<CR><LF>
High Frequency only: DBXXXXX.XX m<CR><LF>
Low Frequency only: DAXXXXX.XX m<CR><LF>

where: DB = high frequency channel identifier
DA = low frequency channel identifier
X = number 0 .. 9
m = meter units identifier.

The text annotation format supported is as follows:

TXxxxx....xxxx<CR><LF>

where TX = text identifier
x = ASCII character between 20h and 7Fh.

When this line is received by the sounder, the ASCII characters are stored in the event mark annotation buffer. If an invalid character or more than 50 characters are received, the entire data line received is discarded and the event mark annotation buffer is cleared.

EM3<CR><LF>

When this line is received by the echosounder, it creates an event mark with the current contents of the event mark annotation buffer.

2.6.1.11 NMEA: SDDBT (HF)

The **NMEA:SDDBT** option selects the NMEA depth below transducer format string. This format outputs depth to transducer for the HF channel only, in either feet, metres, or fathoms in the appropriate field location dependent on the current working units.

$SDDBT,x.x,f,x.x,M,x.x,F*hh<CR><LF>

2.6.1.12 NMEA: SDDBT (LF)

This is the same format as NMEA: SDDBT (HF) except it outputs LF channel data.

2.6.1.13 Serial to BCD (HF)

The **NMEA:SDDBT** option is a special compilation option that provides interface capability for the 320 echosounder to a specific external Serial-to-BCD converter. This format outputs depth to surface corrected for heave for the Hf channel only.

<STX><POL><DATA><L/K><G/N><STATUS><CR><LF>

where: STX = 02h
POL = polarity = 02h for plus, 2Dh for minus
DATA = seven character with embedded decimal point, leading zeros suppressed as 02h
L/K = units: L(4Ch) for pounds, K(4Bh) for kilograms: arbitrarily set to K
G/N =Gross or Net mode: G(47h) or N(4Eh): arbitrarily set to G
STATUS = Space (02h??) for normal, M(4Dh) for motion, I(49h) for invalid data,
O(4Fh) for over/under range

2.6.1.14 Serial to BCD (LF)

This is the same format as **Serial to BCD (HF**) except it outputs LF channel data.

2.6.2 Logging Rate

The Logging Rate option allows the user to control the output rate of the depth logging string to allow for data loggers unable to cope with the fast ping rates encountered at shallow ranges. There are eight selections available as sub-menu items, with the active selection indicated by a check mark.

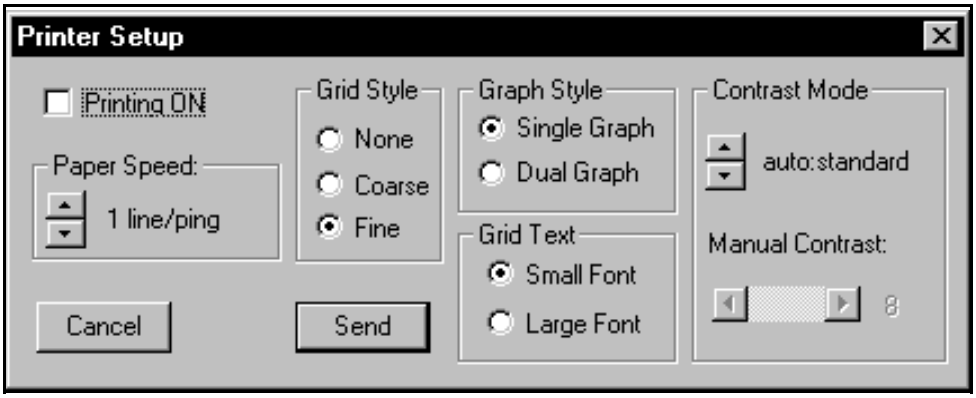
2.7 Setup

This group of menu items allows access to many unrelated parameter controls, most modified only once per survey session.

2.7.1 Printer Setup

This menu item brings up a dialogue box that allows access to 320M printer control parameters. This option is not active (greyed out) if the echosounder firmware configuration flags indicate printer code is not included (for 320B systems)

2.7.1.1 Basic



The **Printing ON** check box is used to start/stop the hardcopy recording on the 320M's thermal printer. If this box is de-selected, all the other printer controls are disabled (greyed out).

The **Paper Speed** control is used to select the desired printing rate; the available options are 1 line/ping, or 8, 16, 32, 128, 215, and 315mm/min.

The **Grid Style** controls allow the user to adjust the grid presentation on the hardcopy recorder. For the single graph format, the coarse grid prints the major division markers and the half division markers; the fine grid prints the tenths division markers as well. For the dual graph format, the coarse grid prints the major division markers only; the fine grid prints the fifths division markers as well. For both modes, the None option simply prints the outside borders.

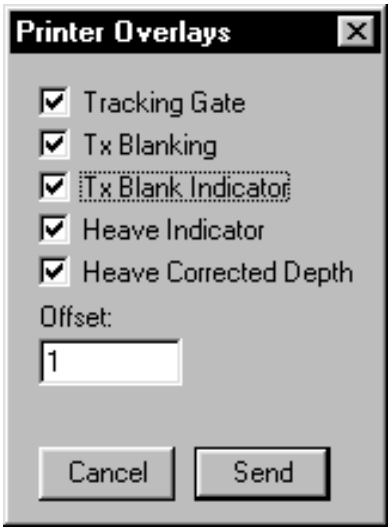
The **Graph Style** controls are used to select the presentation mode for the channel displays. In Single Graph mode, the data for the two channels is "or'ed" together and displayed in one large presentation of 1600 pixels. In the Dual Graph mode, the HF channel data is displayed in the upper 800 pixels and the LF channel data is displayed in the lower 800 pixels.

The **Grid Text** option sets the size of the grid and annotation text characters overlaid on the hardcopy printout. Note: this control has no effect on the upper and lower banner annotation text. Due to space constraints, these lines are always printed in the small font.

The 320M's printer displays data in 32 level greyscale format. The **Contrast Mode** control allows the user to let the system control the scaling of the data for display (auto modes: standard, HF black, black & white, or with depth), or to select a fixed scale factor (manual). When automatic print contrast is on, the system uses the signal returns to determine the best scaling factor to make the most effective use of the greyscale format.

When the manual print contrast mode is selected, the system uses a fixed scale factor on the data, regardless of the return strengths. It is possible to set the scale too high or too low for meaningful hardcopy records, although the fixed scaling can be useful for basic comparative measurements of return signal strengths. When the manual contrast mode is selected, the control for the **Manual Contrast** level control is enabled.

2.7.1.2 Overlays



The **Overlay** controls allow the user to select one or more of the following parameter overlay traces on the hardcopy record.

When **Tracking Gate** is selected (checked), the tracking gate is displayed on the hardcopy record as a pair of solid lines framing the detected bottom. If the system is in Single Graph mode, only the gate overlay for the primary channel is displayed, unless the channel is inactive; then the system will display the overlay for the other channel. If the system is in Dual Graph mode, the gate overlays for each channel are displayed.

When the **Tx Blanking** option is selected the chart record is blanked (set white) up to the Tx Blanking value, if it is visible in the current window. If the system is in Single Graph mode, only the blanking for the primary channel is applied, unless the channel is inactive; then the system will apply the blanking for the other channel. If the system is in Dual Graph mode, the blanking for each channel is applied.

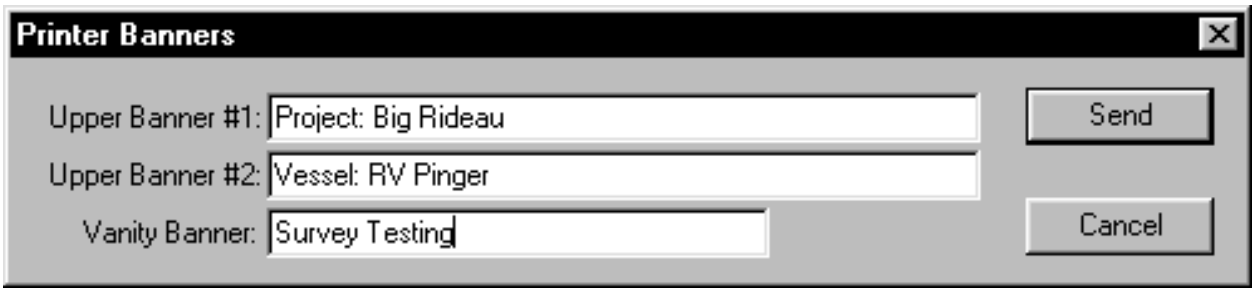
The **Tx Blank Indicator** option allows the Tx Blanking values to be displayed on the hardcopy record as a thin solid line. If the system is in Single Graph mode, only the Tx Blanking overlay for the primary channel is displayed, unless the channel is inactive; then the system will display the overlay for the other channel. If the system is in Dual Graph mode, the overlays for each channel are displayed.

When **Heave** is selected, the heave value received from the sensor is displayed on the hardcopy record as a thin solid line located near the top of the record. The heave line overlay provides a quality indicator via the thickness of the line; a heave data value with a good quality flag is represented by a thin line, and a poor quality value is represented by a thickening of the line.

The **Heave Corrected Depth** option allows the heave-corrected depth for a channel to be displayed on the hardcopy record as a thick line overlay located at the corrected depth position plus some user selected offset. The greyscale record is the uncorrected bottom, (uncorrected in terms of heave, but corrected in terms of draft). The corrected depth overlay is corrected in terms of heave as well as draft. The option for both overlays is accessed only if the printer display selection is set for two graphs.

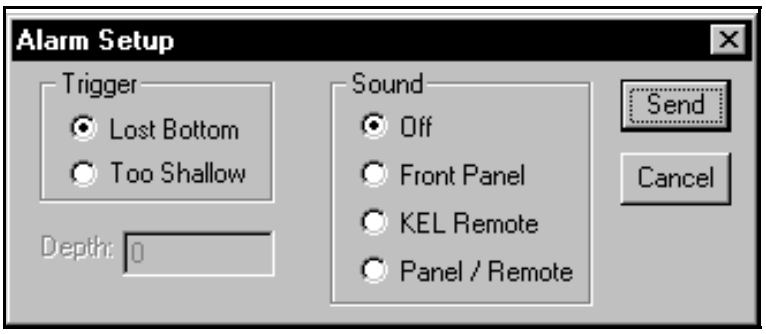
If the **Corrected Depth** option is selected, the **Offset** parameter edit box is made active. This parameter allows the user to select the vertical offset (position) for the corrected depth overlay. The overlay is printed on the graph at the corrected depth plus the offset value. (ie., If the corrected depth = 5m and the offset = -2 m, the overlay will be printed at 3m.)

2.7.1.3 Banners



On the 320M, there are three user-configurable banners on the hardcopy record; two full lines (72 characters) at the very top of the record above the grid (the Upper Banner), and 32 characters inserted in the second line at the very bottom of the record (the Vanity Banner). The banner edit boxes allow the user to set the various text strings to any desired value. The Vanity Banner is preserved in the echosounder's non-volatile memory upon power down, but the Upper Banner lines 1 & 2 are lost in the sounder on power down.

2.7.2 Alarm Setup



This item pops up a dialogue box that allows the user to adjust the alarm trigger and sounding options for 320M systems. There are two alarm trigger conditions available, but only one can be selected at a time.

If **Lost Bottom** is selected, the echosounder will sound its alarm any time the bottom is not located. As soon

as the bottom is re-detected, the alarm will shut off.

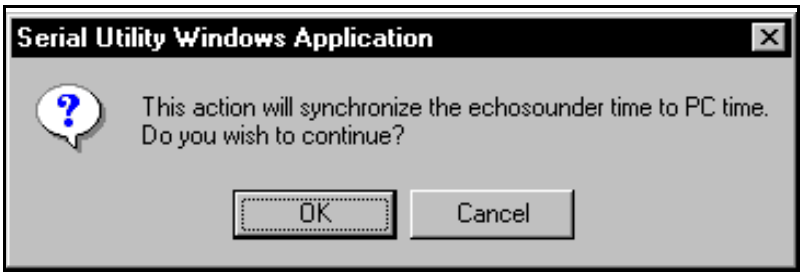
If **Too Shallow** is selected, the echosounder will sound its alarm any time the returned depth is a shallower value than the **Depth** indicated. Once the depth return is deeper again, the alarm will shut off.

2.7.3 Event Marks

The **Event Marks** option pops up a dialogue box that allows the user to adjust the event marking options. The **Next Event Number** will set the echosounder's event counter to the desired value when the **Send** box is clicked. The **Timed Event Marks** check box allows the user to select the echosounder's internally timed event marks. If this box is checked, the echosounder will cause internally generated event mark at the time interval selected in the **Timed Event Interval** box. The units for this interval measurement are seconds.

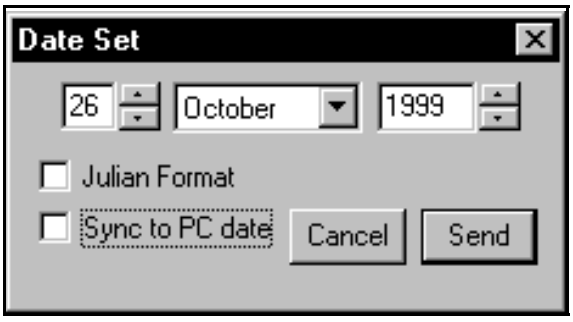
WARNING: Sending the data to the sounder will always cause the Event Number to be modified in the sounder. This application does not monitor what is currently set in the sounder, but simply what was last modified by this application so it is possible to reset the event number to an undesired value.

2.7.4 Set Time



The **Set Time** option brings up a dialogue box that prompts the user to set the echosounder to the current PC time. If the user accepts the action, the sounder is set to PC time to a hundredth of a second.

2.7.5 Set Date



The **Set Date** option brings up a dialogue box that allows the user to set the date manually , or to tell the program to synchronize the echosounder to the current PC date. If the **Sync to PC date** check box is marked, the program ignores the date value displayed in the box and automatically sends the current PC date to the sounder. If the **Julian Format** check box is marked, the application sends the Julian calendar equivalent form of the date to the echosounder, and toggles the echosounder's date format presentation mode to Julian.

2.7.6 Units

There are three selections available in sub-menus of this option: Metres , Feet, or Fathoms. A check mark indicates the currently selected option. The selection can be changed by simply clicking on the desired menu item.

2.7.7 Sync Mode

The **Sync Mode** option allows the user to select between the echosounder's own internal timebase-controlled ping cycle synchronization, or an external ping cycle synchronization signal.

WARNING: If the **Sync Mode** is toggled to external sync, the echosounder will not ping unless there is an external sync signal fed to the appropriate signal on the sounder. Currently, only the 320B/R provides an external connector for this signal connection. Please contact KEL if you wish to use this feature on any other 320 models.

2.7.8 Pinger Mode

This option allows the user to toggle the echosounder's specialized **Pinger Mode** on or off from two sub-menu items. The currently active mode is indicated by a checkmark on the sub-menu item.

The **Pinger Mode** is a special operational mode that is currently only supported on 3.5kHz and 12kHz frequency channels. When the **Pinger Mode** is on, the echosounder does not transmit at all but simply listens, typically for an external pinger device, and displays the received data on one second intervals. The only channel control that has any effect in **Pinger Mode** is Manual **Gain**, (**AGC** must be toggled off). For frequencies that have **Processing Gain** support, the sounder will use the gain value used during the last normal transmit/listen ping cycle; any attempt to modify the parameter during **Pinger Mode** will be ignored.

This menu item is active only if the compilation option is set in the echosounder; this option is made available by customer request.

2.7.9 TVG

This option allows the user to select **TVG** (time varied gain) on the analog receivers. The OFF setting provides constant receive gain throughout each pulse-echo cycle (note that receive gain will still vary from ping to ping if AGC is on). When set to 20 log R, the receive gain is increased linearly (logarithmically if gain is expressed in decibels) with time and range from the instant of transmission, to compensate for signal amplitude loss due to spherical spreading. The 40 log R setting provides for spherical spreading of both outgoing and returning signals. The bottom referenced setting provides a gain ramp at the bottom (as determined from the previous ping) to provide approximate compensation for attenuation in sub-bottom sediments. The last setting is intended for sub-bottom profiling applications.

TVG may help to prevent the depth digitizer from falsely triggering on fish or other water column targets at the expense of slightly greater susceptibility to locking on the second echo from the bottom. TVG operates in addition to the AGC or manual gain settings which are applied to each channel independently, and which effectively define the starting gain for each channel at the instant of transmission. A check mark indicates the currently selected option.

2.7.10 Print Setup on Recorder

This option allows the user to trigger the data parameter print on the echosounder's hardcopy record (320M systems only). This parameter print records the current settings of all the configuration parameters in the echosounder onto the hardcopy record.

2.8 Upgrades

This group of controls is used strictly for echosounder firmware updates and should not be used if no updates are required.

2.8.1 Download Tag

The **Download Tag** option is used for echosounder firmware upgrades. The file selection box that pops up lets the user select the desired tag file to be downloaded to the echosounder. Once a file has been selected by the user, the program downloads it to the echosounder over the serial connection. The transfer time is dependent on the baud rate of the communications link. The tag files are usually a few hundred kilobytes, so faster baud rates such as 19200 or 38400 are recommended.

2.8.2 Initialize NVM

An **Initialize NVM** can be executed at any time to restore all the echosounder's operating parameters to factory default settings.

NOTE: This will cause all previously user-selected parameter values to be lost.

2.8.3 Program PS

The **Program PS** option is only needed after a **Load Tag** command has been performed, to program the new firmware permanently into the echosounder's FLASH eproms. If a new tag file has been downloaded, and the echosounder is powered down before a **Program PS** command has been performed, the new firmware is lost and the echosounder will power back up with the old firmware.

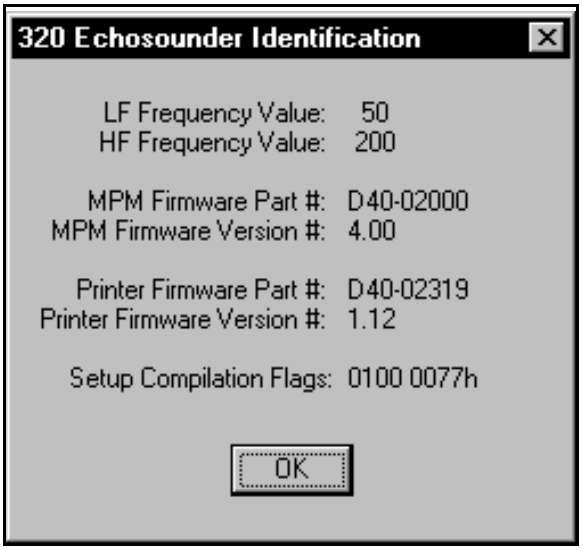
2.8.4 Program Tx

The **Program TX** option is only needed after a **Load Tag** command and a **Program PS** command have been performed, to program the transmit prom data permanently into the echosounder's FLASH eproms. If this command is not executed after a new tag file has been loaded and programmed, the system may not perform properly, since the transmit data in the transmit flash eprom may not be correct.

2.9 Help

The **Help** menu provides access to two options that provide the user with system configuration information that is most useful when contacting the factory for technical assistance. There are no other help features implemented yet.

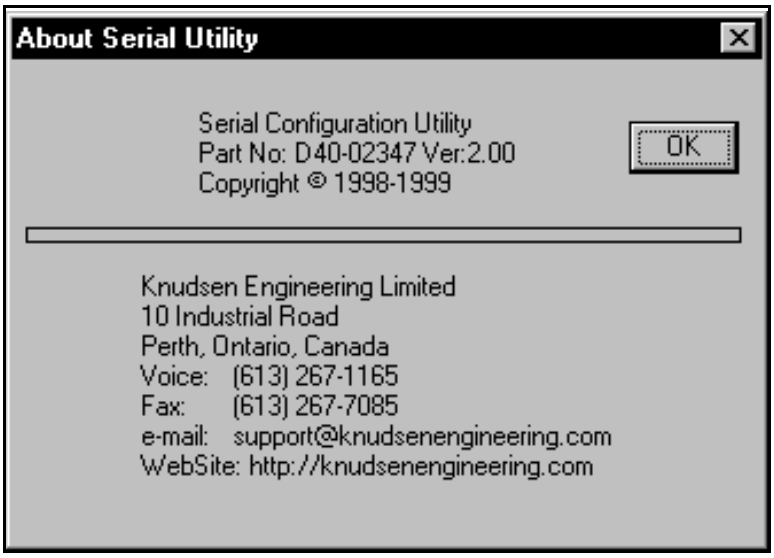
2.9.1 Identification



This option pops up a dialogue box that reports the system information read from the echosounder when the program was invoked and initiated communications with the echosounder. It reports the system's serial number, frequency configuration, and controlling firmware part number and version.

The setup compilation flags are merely an indicator of the particular code options compiled into a user's specific system. This information is really only useful to KEL personnel, and it is helpful if it can be provide when user's contact the factory for assistance.

2.9.2 About Serial Utility...



The **About Serial Utility...** menu item brings up a simple dialogue box stating the name of the PC software program, the KEL part number for the program and the latest revision number, and technical support contact information.

320 SERIES ECHOSOUNDER

SERIAL UPGRADE UTILITY SOFTWARE MANUAL

Supports Software: UpgradeUtility.exe: D40-02346 V2.00

D10 - 02278
Revision 2.0
November 4, 1999

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

CONTENTS

1 INTRODUCTION

1.1 About this manual

This manual provides information about the Windows-based Serial Upgrade Utility program, Part #: D40-02346, UpgradeUtility.exe. This program is designed to communicate with the 320 Series Echosounder's main processing module and printer control module via their serial ports strictly to perform firmware upgrades.

1.2 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

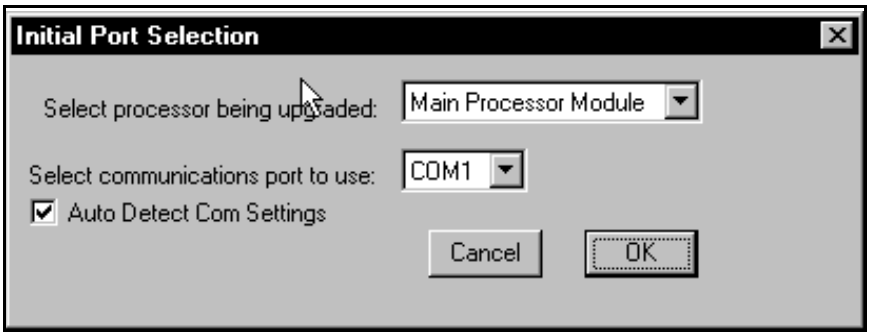
2 OPERATING INSTRUCTIONS

2.1 Overview

The Serial Upgrade Utility, UpgradeUtility.exe, is a specialized Windows serial communications program designed to link a PC to a 320 series echosounder via the sounder's COM 3 serial monitor port. It also links to a 320M series echosounder's thermal printer via its specialized serial com port. This application is designed to provide the user with a standard method for performing firmware upgrades on both modules.

2.2 Description

When the program is invoked, it brings up a dialogue box requesting information from the user about what processing module to upgrade, the PC serial port to be used to establish the communications link, and, for the Main Processor module, whether to let this application auto-detect the processor's serial com port settings.



Once the user selects and accepts particular communication settings, the program first confirms that it can initialize the PC serial port. If port initialization fails, the user will be informed of the failure and the detected fault. Most commonly, the serial port initialization fails because some other program/device is already using the port.

If PC serial port initialization passes and auto-detect is selected, the program starts to scan for the actual serial port configuration settings on the echosounder. It starts with the last configuration stored in the program's main INI file, assuming that the last settings should still be correct. If these settings are no longer correct (PC is now connected to a different sounder perhaps), the program starts to scan all possible combinations of settings supported by the echosounder, starting at the highest baud rate first.

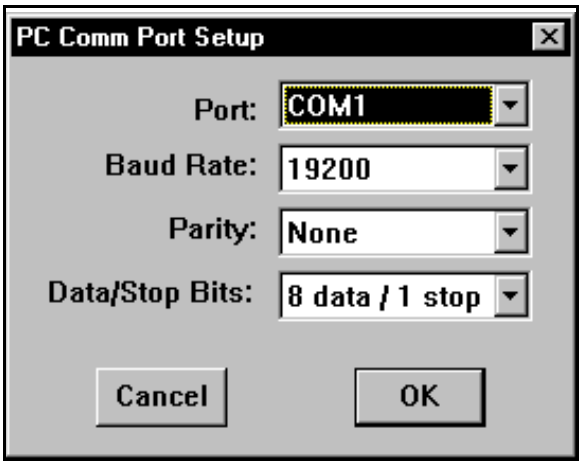
Once serial communications have been established and basic handshaking has been accomplished, a window pops up with four control groups on the main menu, and a blank display area used for communications status messages.

2.3 File

2.3.1 Exit

The user can terminate the application using the **Exit** command. If the Main Processor module was being upgraded, the current serial port configuration settings are saved in the main program INI file and used as a starting reference the next time the application is invoked for a Main Processor upgrade.

2.4 PC Port



The **PC Port** option pops up a dialogue box that allows the user to modify the desired serial com port to use on the host PC and the communications settings to be used by the selected port. The echosounder's Main

Processor module is shipped with the settings at the following defaults: 19200 baud, no parity, 8 data bits, 1 stop bit. The Printer Processor module's com port settings are permanently fixed at: 38400 baud, no parity, 8 data bits, 1 stop bit. Clicking on **OK** accepts the current PC port settings, and the program will initialize the port to the selected settings. Pressing **ESC** or clicking on **CANCEL** eliminates the changes, and restores the original settings.

2.5 Upgrades

2.5.1 Download Tag

The **Download Tag** option is used to send the firmware upgrade file (always a ".tag" filename) to the processor module. The file selection box that pops up lets the user select the desired tag file to be downloaded to the module. Once a file has been selected by the user, the program downloads it to the module's temporary memory over the serial connection. The transfer time is dependent on the baud rate of the communications link and the size of the tag file, but generally it takes about two or three minutes.

NOTE: This command simply loads the new firmware into the processor module's temporary memory. If the echosounder were powered down after this step, the new firmware would be lost and the old firmware would run on power-up. Proceed to the **Program PS** step to store the new firmware permanently in the sounder.

2.5.2 Initialize NVM

This option is only available if the application is being used to upgrade the sounder's Main Processor Module. It loads default parameter values into the NVM (non-volatile memory) on the MPM.

An **Initialize NVM** can be executed at any time to restore all the Main Processor Module's operating parameters to factory default settings.

NOTE: This will cause all previously user-selected parameter values to be lost.

2.5.3 Program PS

The **Program PS** option is needed after a **Download Tag** command has been performed to program the new firmware permanently into the echosounder's FLASH eproms. If a new tag file has been downloaded, and the echosounder is powered down before a **Program PS** command has been performed, the new firmware is lost and the echosounder will power back up with the old firmware.

Program PS causes the program code, which has been downloaded into program SRAM memory on the Main Processor Module, to be copied into FLASH memory (non-volatile program memory).

2.5.4 Program Tx

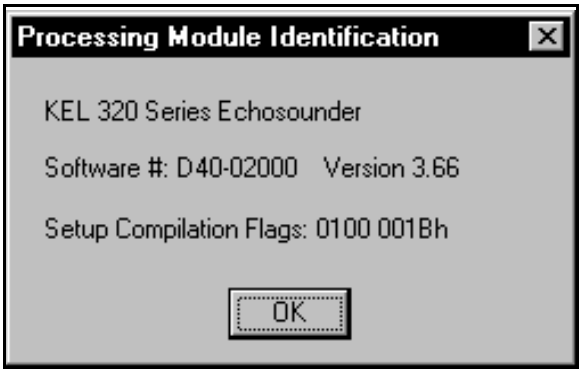
This option is only available if the application is being used to upgrade the sounder's Main Processor module.

The **Program TX** option is needed after a **Load Tag** command and a **Program PS** command have been performed to program the transmit waveform data permanently into the echosounder's FLASH eproms. If this command is not executed after a new tag file has been loaded and programmed, the system may not perform properly, since the old transmit waveform data in the transmit flash eprom may not correspond correctly with the new firmware.

2.6 Help

The **Help** menu provides access to two options that provide the user with system configuration information that is most useful when contacting the factory for technical assistance. There are no other help features implemented yet.

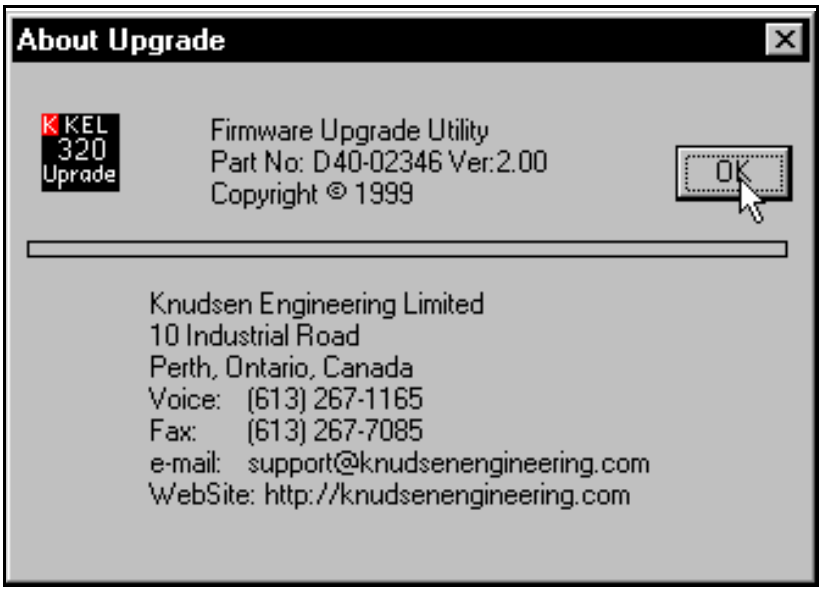
2.6.1 Identification



This option pops up a dialogue box that reports the system information read from the echosounder's processor module when the program was invoked and initiated communications with the module. It reports the module's sign-on message and the firmware part number, version, and compilation configuration loaded in the module. The Main Processor module sign-on message is "KEL 320 Series Echosounder". The Printer Processor module sign-on message is "320M Echosounder Printer".

The setup compilation flags are merely an indicator of the particular code options compiled into a user's specific system. This information is really only useful to KEL personnel, and it is helpful if it can be provide when user's contact the factory for assistance.

2.6.2 About Upgrade...



The **About Upgrade...** menu item brings up a simple dialogue box stating the name of the PC software program, the KEL part number for the program and the latest revision number, and technical support contact information.

320 SERIES ECHOSOUNDER

SERIAL COMPUTER INTERFACING MANUAL

Supports Echosounder Firmware #: D40-02000 V5.27

D10 - 02390
Revision 2.0
April 22, 2004

KNUDSEN
ENGINEERING LIMITED

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 About this manual

This manual provides detailed information about the 320 Series Echosounder serial interface port (COM3) protocols which can be used for data logging, echosounder control, and data loop-through. This information is intended for advanced users with specialized requirements. The following data is supplied for information only; it is not required knowledge for standard system operation.

1.2 Technical Support

For technical support or to report problems please contact your local representative or:

Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085
E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

2 OVERVIEW

The 320 Echosounder was designed with a dedicated serial port (COM 3) for communications with the survey computer. This port is used for transmitting depth log strings to the survey computer or data logger, for re-transmitting ASCII strings received on other com ports if requested (loop-through), and for accepting and for acting upon command strings received from the survey computer or data logger. It is also used for system software upgrades.

The echosounder accepts command strings in two distinct formats. The first format is an ASCII string preceded by '$PKEL'. This indicates that the string is a Knudsen Engineering proprietary NMEA string. These strings are assumed to be coming from some data processing program (such as the Serial Configuration Utility program, SerialUtility.exe) and are accepted by the echosounder without echoing the characters back to the external PC to avoid confusing the program.

The second format is an ASCII string preceded by the '/' character (user commands). These strings are assumed to be coming from user input at the keyboard and are accepted with character echoing enabled for the operator's convenience. Either format can be accessed by a user through any communications program.

Note: Different firmware compilations allow access to different combinations of the control strings listed in the following sections. If you have any questions regarding the firmware compilation for your system, please contact the factory or your local representative.

3 KEL PROPRIETARY CONTROL SENTENCES - INPUT

Table 3-1: PC To 320 Echosounder Control Sentences

KEL PROPRIETARY INPUT STRINGS	
Sentence ID	**Description**
0	Request data output string from MPM
1	Set units flag (meters/feet/fathoms)
2	Cause event marker with external annotation, only
3	Cause event marker with internal and external annotation.
4*	Set range
5*	Set auto phase mode, manual phase code
6*	Set HF Tx on/off, HF Tx power level
7*	Set HF AGC, HF manual Rx Gain
8*	Set HF pulse type
9*	Set LF Tx on/off , LF Tx power level
10*	Set LF AGC, LF manual Rx gain
11*	Set LF pulse type
12*	Set HF & LF Draft
13*	Set speed of sound
14*	Set tracking gate width
15*	Set HF & LF transmit blanking
16*	Set alarm trigger, alarm depth, and sound toggle
17	Set Com 1 device, baud, parity, data/stop bits, and loop-through configuration
18	Set Com 2 device, baud, parity, data/stop bits and loop-through configuration
19	Set Com 3 baud, parity, and data/stop bits
20ϕ	Set Com 4 device, baud, parity, data/stop bits and loop-through configuration
21†	Load printer banner vanity string with the characters in Field 1.
22*†	Set printer on/off, printer speed
23*†	Set print contrast, manual contrast
24*†	Set tracking overlay, heave overlay, corrected depth overlay toggles, tx blank overlay, tx blanking
25*†	Select hardcopy format, grid format, and printer font size
26†	Load data string into line 1 of the upper banner.

KEL PROPRIETARY INPUT STRINGS	
Sentence ID	**Description**
27†	Load data string into line 2 of the upper banner.
28	Set time
29	Set date
30	Set depth log flag, set depth log format, load user-defined preamble
31	Set depth log rate code
32*	Set HF and LF multiplexer codes
33*	Set TVG flag
34*	Set event mark number, auto event mark toggle, auto event interval, event mark format
35*	Set Sync Mode
36*	Set Primary Channel
37*	Set Pinger Mode (available only with 3.5 and 12kHz)
38	Set current echosounder time to value expressed in milliseconds since midnight
39*†	Initiate parameter data print out on the sounder's thermal printer.
40*	Set autophase search mode minimum depth and maximum depth
41*	Set HF & LF sensitivity
42*	Set HF & LF processing gain

* Only available on systems with full SERIAL CONTROL compilations.

† Only available on 320M systems.

ϕ Only available on 320B systems.

3.1 $PKEL00: Request Data Output String

Format: $PKEL00,nn<CR><LF>

where: nn = Data Request code = 00 to 99
<CR> = carriage return
<LF> = line feed

This control string is used to request an information string to be returned to the PC by the sounder. The Data Request Code identifies the data response string for the echosounder to return; see Section 4 for details of the response strings.

3.2 $PKEL01: Set Units Flag

Format: $PKEL01,c<CR><LF>

where: c = units flag: 0 = meters, 1 = feet, 2 = fathoms

This control string is used to set the working units flag in the echosounder to the desired value.

3.3 $PKEL02: Event Marker with External Annotation Only

Format: $PKEL02,c--c<CR><LF>

where: c--c = External Annotation String (max. 68 valid ASCII chars)

This control string is used to trigger an event mark which uses only the external annotation string on the hardcopy record for 320Ms and in the SCSI data record (320Ms and 320Bs).

3.4 $PKEL03: Event Marker with Internal and External Annotation

Format: $PKEL03,c--c<CR><LF>

where: c--c = External Annotation String (max. 68 valid ASCII chars)

This control string is used to trigger an event mark which uses the internally generated and the external annotation string data on the hardcopy record for 320Ms and uses just the external annotation in the SCSI data record (320Ms and 320Bs).

3.5 $PKEL04: Set Range

Format: $PKEL04,c<CR><LF>

where: c = range code: 0=10, 1=20, 2=50, 3=100, 4=200, 5=500, 6=1000, 7=2000, 8=5000
(Units are dependent upon the working units setting: either m, ft or fm.)

This control string is used to set the range code parameter in the echosounder.

3.6 $PKEL05: Set Phase

Format: $PKEL05,a,bbb<CR><LF>

where: a = AutoPhase Mode Flag: 0 = off, 1 = on
bbb = Manual Phase Code: 1 to 7 for 320Ms and shallow water systems
1 to 239 for deep water systems

This control string is used to set the autophase flag and manual phase code parameters in the echosounder.

3.7 $PKEL06: Set HF Tx On/Off, HF Tx Power Level

Format: $PKEL06,a,b<CR><LF>

where: a = HF Tx On/Off: 0 = off, 1 = on
b = HF Tx Power: 1 to 4, or 1 to 8 for newer systems

This control string is used to set the HF channel transmit on/off state and transmit power level parameters in the echosounder.

3.8 $PKEL07: Set HF AGC, HF Manual Rx Gain

Format: $PKEL07,a,bbb<CR><LF>

where: a = HF Rx AGC Toggle: 0 = manual, 1 = auto
bbb = HF Manual Rx Gain: 0 to 255

This control string is used to set the HF channel Rx AGC Toggle, and manual Rx Gain parameters in the echosounder.

3.9 $PKEL08: Set HF Pulse Type

Format: $PKEL08,cc<CR><LF>

where: cc = HF Pulse Type Code: 0 to N where N is frequency code specific

This control string is used to set the HF channel PulseType Code parameter in the echosounder.

3.10 $PKEL09: Set LF Tx On/Off, LF Tx Power Level

Format: $PKEL09,a,b<CR><LF>

where: a = LF Tx On/Off: 0 = off, 1 = on
b = LF Tx Power: 1 to 4, or 1 to 8 for newer systems

This control string is used to set the LF channel transmit on/off state and transmit power level parameters in the echosounder.

3.11 $PKEL10: Set LF AGC, Manual Rx Gain

Format: $PKEL07,a,bbb<CR><LF>

where: a = LF Rx AGC Toggle: 0 = manual, 1 = auto
bbb = LF Manual Rx Gain: 0 to 255

This control string is used to set the LF channel Rx AGC Toggle, and manual Rx Gain parameters in the echosounder.

3.12 $PKEL11: Set LF Pulse Type

Format: $PKEL11,cc<CR><LF>

where: cc = LF Pulse Type Code: 0 to N where N is frequency code specific

This control string is used to set the LF channel Pulse Type Code parameter in the echosounder.

3.13 $PKEL12: Set HF and LF Draft

Format: $PKEL12,aaaaa,bbbbb<CR><LF>

where: aaaaa = HF draft: 0 - 10000cm, 0 - 32808 ($^{1}/_{100}$ths ft), or 0 - 5468($^{1}/_{100}$ths fm)
bbbbb = LF draft: 0 - 10000cm, 0 - 32808 ($^{1}/_{100}$ths ft), or 0 - 5468($^{1}/_{100}$ths fm)

This control string is used to set the draft for the HF and LF channels in the echosounder.

3.14 $PKEL13: Set Speed of Sound

Format: $PKEL13,cccc<CR><LF>

where: cccc = Speed of sound in water: 1300 - 1700m/s, 4265 - 5577ft/s, or 710 - 929 fm/s.

This control string is used to set the speed of sound in the echosounder.

3.15 $PKEL14: Set Tracking Gate Width

Format: $PKEL14,www<CR><LF>

where: www = Tracking Gate Width: 2 to 200 (Units are dependent upon the working units setting: either m, ft or fm.)

This control string is used to set the tracking gate width used by the echosounder.

3.16 $PKEL15: Set HF and LF Transmit Blanking

Format: $PKEL15,aaaa, bbbb<CR><LF>

where: aaaa = HF Transmit Blanking: 0 - 3000dm, 0 - 9843($^1/_{10}$ths ft), or 0 - 1640($^1/_{10}$ths fm)
bbbb = LF Transmit Blanking: 0 - 3000dm, 0 - 9843($^1/_{10}$ths ft), or 0 - 1640($^1/_{10}$ths fm)

This control string is used to set the transmit blanking value used in the echosounder.

3.17 $PKEL16: Set Alarm Trigger, Alarm Depth and Alarm Sound Flag

Format: $PKEL16,a,xxx,c<CR><LF>

where: a = Alarm Trigger Method: 0 = bottom lost, 1 = depth too shallow
xxx = Alarm Depth: 0 to 100 in m, ft or fm dependent on working units
c = Alarm Sound Flag: 0 = no sound, 1 = front panel, 2 = KEL remote display, 3 = front panel and remote

This control string is used to select the alarm trigger mode used by the echosounder, to set the alarm trigger depth (if required) and the alarm sound option.

3.18 $PKEL17: Set Com 1 Configuration

Format: $PKEL17,aa,bbbbb,c,d,e<CR><LF>

where:	aa = Com 1 Device Code:	0 to 10 (13 for old GPS support compilations)
	bbbbb = Com 1 Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200, (38400)
	c = Com 1 Parity Code:	0 = none, 1 = odd, 2 = even
	d = Com 1 Data & Stop Bits Code:	0 = 8 data, 1 stop; 1 = 7 data, 2 stop
	e = Com 1 Loopthru Flag:	0 = none, 1 = on

This control string sets the communication port settings for Com1 on the echosounder.

Table 3-2: Serial Port Device Driver Codes

Device Code	Peripheral Device Driver
0	None
1	KEL Remote
2	NMEA: $GPGLL
3	NMEA: $GPGGA
4	TSS: 33x
5	TSS DMS: TSS1
6	Innerspace 443
7	Seatex: MRU
8	Navy Remote
9	Navy NTDS
10	Generic #1
11	Generic #2
12	Generic #3

3.19 $PKEL18: Set Com 2 Configuration

Format: $PKEL18,a,b,c,d,e<CR><LF>

where:	aa = Com 2 Device Code:	0 to 10 (13 for old GPS support compilations)
	bbbbb = Com 2 Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200, (38400)
	c = Com 2 Parity Code:	0 = none, 1 = odd, 2 = even
	d = Com 2 Data & Stop Bits Code:	0 = 8 data, 1 stop; 1 = 7 data, 2 stop
	e = Com 2 Loopthru Flag:	0 = none, 1 = on

This control string sets the communication port settings for Com2 on the echosounder.

3.20 $PKEL19: Set Com 3 Configuration

Format: $PKEL19,b,c,d<CR><LF>

where:	bbbbb = Com 3 Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200, (38400)
	c = Com 3 Parity Code:	0 = none, 1 = odd, 2 = even
	d = Com 3 Data & Stop Bits Code:	0 = 8 data, 1 stop; 1 = 7 data, 2 stop

This control string sets the communication port settings for Com3 on the echosounder.

3.21 $PKEL20: Set Com 4 Configuration

Format: $PKEL20,a,b,c,d,e<CR><LF>

where:	aa = Com 4 Device Code:	0 to 10 (13 for old GPS support compilations)
	bbbbb = Com 4 Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200, (38400)
	c = Com 4 Parity Code:	0 = none, 1 = odd, 2 = even
	d = Com 4 Data & Stop Bits Code:	0 = 8 data, 1 stop; 1 = 7 data, 2 stop
	e = Com 4 Loopthru Flag:	0 = none, 1 = on

This control string sets the communication port settings for Com4 on the echosounder, if available.

3.22 $PKEL21: Load Banner String

Format: $PKEL21,c--c<CR><LF>

where: c--c = Banner Input String (max. 32 valid ASCII chars.)

This control string sets the Vanity Banner string on the echosounder's lower banner.

3.23 $PKEL22: Set Paper Speed

Format: $PKEL22,a,b<CR><LF>

where:	a = Printer Paper On/Off Code:	0 = off, 1 = on
	b = Printer Paper Speed:	0 = off, 1 = 1 line/ping, 2 = 10mm/min, 3 = 25mm/min, 4 = 50mm/min, 5 = 100mm/min, 6 = 197mm/min, 7 = 295mm/min

This control string toggles the printer on and off, and controls the paper speed when on.

3.24 $PKEL23: Set Print Contrast

Format: $PKEL23,c,xx<CR><LF>

where: c = Print Contrast Mode: 0 = auto:standard, 1 = auto:HF black, 3 = auto:w/depth, 4= manual
xx = Manual Contrast Level: 1 to 16

This control string selects the printing contrast mode, and manual print contrast level if applicable.

3.25 $PKEL24: Set Printer Overlay Toggles

Format: $PKEL24,a,b,c,xxxxxx,d<CR><LF>

where: a = Tracking Gate Overlay Flag: 0 = off, 1 = on
b = Heave Trace Overlay Flag: 0 = off, 1 = on
c = Corrected Depth Overlay Flag: 0 = off, 1 = LF on, 2 = HF on
xxxxxx = Corrected Depth Overlay Offset -5000 to +5000 dm, $^{1}/_{10}$ths ft or $^{1}/_{10}$ths fm
d = Tx Blank Overlay Flag: 0 = off, 1 = on
d = Tx Blanking Flag: 0 = off, 1 = on

This control string selects the desired settings for various hardcopy overlays of applicable.

3.26 $PKEL25: Set Hardcopy Format Options

Format: $PKEL25,a,b,c<CR><LF>

where: a = Hardcopy Format: 0 = single graph, 1 = split dual graph
b = Hardcopy Grid Format: 0 = no grid,1 = coarse grid,2 = fine grid
c = Hardcopy Font Size: 0 = small, 1 = large

This control strings sets the basic printer presentational formatting parameters.

3.27 $PKEL26: Load Upper Banner Line 1

Format: $PKEL26,c--c<CR><LF>

where: c--c = Upper Banner Line 1 (max 78 valid ASCII chars)

This controls string sends the data for the first line in the upper margin banner of the echosounder hardcopy record.

3.28 $PKEL27: Load Upper Banner Line 2

Format: $PKEL27,c--c<CR><LF>

where: c--c = Upper Banner Line 2 (max 78 valid ASCII chars)

This control string sends the data for the second line in the upper margin banner of the echosounder hardcopy record.

3.29 $PKEL28: Set Time

Format: $PKEL28,hhmmss<CR><LF>

where: hh = hours: 00 to 23
mm = minutes: 00 to 59
ss = seconds: 00 to 59

This control string sets the time in the echosounder. (See also $PKEL38.)

3.30 $PKEL29: Set Date

Format: $PKEL29,f,yyyy,mm,dd<CR><LF>

where: f = Date Format Code: 0 = day-month-year, 1 = Julian
yyyy = Year: 1996 - 2096
mm = Month: 01 to 12
dd = Day: 01 - 31

This control string sets the date in the echosounder.

3.31 $PKEL30: Set Depth Log Flag, Depth Log Format

Format: $PKEL30,f,hhhh,xxxx,c--c<CR><LF>

where: f = Depth Log Flag: 0 = none, 1 = PKEL, 2 = ISAH:KEL, 3 = ISAH:Elac, 4 = Echotrac, 5 = Digitrace[dm], 6 = Digitrace[cm], 7 = Simrad (6 byte), 8 = Simrad (6 byte), 9 = Deso20, 10 = SDDBS(HF), 11 = SDDBS(LF), [*12 = SERBCD(HF), 13 = SERBCD(LF)*]
hhhh = PKEL Depth Log Format, LSW: 0000 to FFFF hex
xxxx = PKEL Depth Log Format, MSW: 0000 to FFFF hex
c--c = User defined preamble (max. 16 valid ASCII chars)

This control string selects the echosounder's data logging mode, and configures the user-configurable format including the user-defined header string.

3.32 $PKEL31: Set Depth Log Rate Code

Format: $PKEL31,c<CR><LF>

where: c = Depth Log Rate Code 0 = at ping rate, 1 = 5 per second, 2 = 3 per second, 3 = 2 per seconds, 4 = every second, 5 = every 2 seconds, 6 = every 5 seconds, 7 = every 10 seconds

This control string set the depth logging throttling rate code. The sounder may have a faster ping rate, but will output the serial depth log string at the rate determined by the code.

3.33 $PKEL32: Set Mux Codes

Format: $PKEL32,hh,ll<CR><LF>

where: hh = HF Multiplexer Code: 00 to FF hex
ll = LF Multiplexer Code: 00 to FF hex

This control string sets the multiplexer codes for the HF and LF Channels. This is only applicable if a channel is connected to a KEL 1:8 Multiplexer Box and the multiplexer option is compiled in for the appropriate channel.

3.34 $PKEL33: Set TVG Flag

Format: $PKEL33,c<CR><LF>

where: c = TVG Flag: 0 = off, 1 = on

This control string is used to set the state of the TVG flag.

3.35 $PKEL34: Set Event Number, Auto Event Flag and Interval, Event Format

Format: $PKEL34,nnnnn,a,tttt,f<CR><LF>

where: nnnnn = Event Mark Number: 00001 to 65535
a = Auto Event Mark Flag: 0 = off, 1 = on
t = Auto Event Mark Interval: 6 to 3600 seconds
f = Event Mark Format: 0 = fix number only, 1 = full annotate

This control string sets the event mark number, timebase control option, timebase interval, and annotation parameters.

3.36 $PKEL35: Set Sync Mode

Format: $PKEL35,f<CR><LF>

where: f = Sync Mode Flag: 0 = internal, 1 = external; 2 = PC

This control string sets the echosounder's ping synchronization mode.
WARNING: setting the sounder to external sync mode causes the system to enter a state where it will not perform a transmit/acquisition cycle until it receives a strobe signal from an external source. This can appear as a "lock-up" of the sounder if this mode is improperly toggled on when no external signal is available.

3.37 $PKEL36: Set Primary Channel

Format: $PKEL36,f<CR><LF>

where: f = Primary Channel Flag: 0 = HF, 1 = LF

This control string sets the echosounder's primary channel flag.

3.38 $PKEL37: Set Pinger Mode

Format: $PKEL37,f<CR><LF>

where: f = Pinger Mode Flag: 0 = off, 1 = on

This control string controls the echosounder's pinger mode.

3.39 $PKEL38: Set Time in milliseconds since midnight

Format: $PKEL38,tttttttt<CR><LF>

where: tttttttt = Time in milliseconds since midnight

This control string tells the sounder to set the time to the value expressed in milliseconds since midnight. The sounder compensates this value for the time delay taken to send the data to the sounder based on the current baud rate. (See also $PKEL28.)

3.40 $PKEL39: Initiate Parameter Print on the Sounder's Thermal Printer

Format: $PKEL39,<CR><LF>

This control string sends no data to the echosounder. Receipt of this command string automatically initiates the parameter print out on the echosounder's thermal printer.

3.41 $PKEL40: Set Autophase Search Mode Minimum and Maximum Depths

Format: $PKEL40,aaaaa,bbbbb<CR><LF>

where: aaaaa = Minimum Depth: 0 - 12000
bbbbb = Maximum Depth: 20 - 12000
(Units are dependent upon the working units setting: either m, ft or fm.)

This control string is used to set the autophase search mode's minimum and maximum depths used by the echosounder.

3.42 $PKEL41: Set HF and LF Sensitivity

Format: $PKEL41,aaa,bbb<CR><LF>

where: aaa = HF Sensitivity: 1 - 100, (1 = off)
bbb = LF Sensitivity: 1 - 100, (1 = off)

This control string is used to set the channel sensitivity levels.

3.43 $PKEL41: Set HF and LF Processing Gain

Format: $PKEL41,a,b<CR><LF>

where: a = HF Processing Gain: 0 - 8
b = LF Processing Gain: 0 - 8

This control string is used to set the channel processing gain values.

4 KEL PROPRIETARY CONTROL SENTENCES - OUTPUT

Table 4-1. 320 Echosounder to PC Response Sentences

KEL PROPRIETARY OUTPUT STRINGS	
Sentence ID	**Description**
0	System's software part and version numbers, and SPM frequency configurations
1	Returns current units flag.
4*	Returns current range selection
5*	Returns current phase mode, phase selection
6*	Returns current HF Tx on/off, HF Tx power setting
7*	Returns current HF Rx AGC and manual gain settings
8*	Returns current HF pulse type setting
9*	Returns current LF Tx on/off, LF Tx power setting
10*	Returns current LF Rx AGC and manual gain setting
11*	Returns current LF pulse type setting
12*	Returns current HF & LF Draft settings
13*	Returns current speed of sound setting
14*	Returns current tracking gate width
15*	Returns current HF & LF transmit blanking setting
16*	Returns current alarm trigger, alarm depth and sound toggle
17	Returns Com A's device, baud, parity, data/stop bits, and loop-thru configuration
18	Returns Com B's device, baud, parity, data/stop bits, and loop-thru configuration
19	Returns Com C's baud, parity and data/stop bits
20ϕ	Returns Com D's device, baud, parity, data/stop bits, and loop-thru configuration
21†	Returns current contents of the printer banner vanity string.
22*†	Returns current printer on/off, and paper speed
23*†	Returns current print contrast, manual contrast
24*†	Returns current tracking, heave, corrected depth, and tx blank overlay toggles
25*†	Returns current hardcopy format, grid format, and printer font size
26†	Returns current string contents of line 1 of the upper banner.
27†	Returns current string contents of line 1 of the upper banner.
28	Returns MPM's current time of day

KEL PROPRIETARY OUTPUT STRINGS	
Sentence ID	**Description**
29	Returns MPM's current date
30	Returns current depth log flag, depth log format code, user-defined preamble
31	Returns current depth log rate code
32*	Returns current HF and LF multiplexer codes
33*	Returns current TVG flag
34*	Returns current fix number, auto event mark flag and interval, and fix format flag
35*	Returns current sync mode flag
36*	Returns current primary channel flag
37*	Returns current pinger mode flag
38	Returns current echosounder time expressed in milliseconds since midnight
39*†	Reserved
40*	Returns current autophase search mode minimum and maximum depths
41*	Returns current HF & LF sensitivity settings
42*	Returns current HF & LF processing gain settings
97	Returns number of pulse types available for LF channel and a 10 character identification string for each pulse available
98	Returns number of pulse types available for HF channel and a 10 character identification string for each pulse available
99	Data Logger Output String

* Only available on systems with full SERIAL CONTROL compilations.

† Only available on 320M systems.

ϕ Only available on 320B systems.

4.1 $PKEL00 Response: Software ID and Version

Format: $PKEL00,mmmmm,n.nn,ppppp,v.vv,hhhhhh,llllll,xxxxxxxx<CR><LF>

where: mmmmm = MPM Software Part Number: 02000 - Marine Sounder
n.nn = MPM Software Version Number: 0.00 to 9.99
ppppp = Printer Software Part Number: 02319 - Basic Printer
v.vv = Printer Software Version Number: 0.00 to 9.99
hhhhhh = HF Channel Frequency Configuration (6 chars)
llllll = LF Channel Frequency Configuration (6 chars)
xxxxxxxx = Setup Compilation Flags (hex)

4.2 $PKEL01 to $PKEL38

For format information see the appropriate sections describing the Input Control Strings.

4.3 $PKEL97

Format: $PKEL97,dd,ccccccccccc,ccccccccccc,.....<CR><LF>

where: dd = number of LF pulse types available
ccccccccccc = pulse type identification string,
one for each pulse available expressed in order of pulse codes

4.4 $PKEL98

Format: $PKEL98,dd,ccccccccccc,ccccccccccc,.....<CR><LF>

where: dd = number of LF pulse types available
ccccccccccc = pulse type identification string,
one for each pulse available expressed in order of pulse codes

4.5 PKEL Depth Log Output String

The PKEL depth log output string can be configured by the user to contain any combination of the fields listed in Table 4-2. Note that although this string is referred to in this documentation as the “PKEL” string (KEL’s proprietary NMEA label) it can begin with a user-defined preamble or no preamble. The fields appear in the output string in the same order listed below. If a field is selected but no data is available (ie. heave field selected but no heave device selected), the field position is filled with dashes. All the fields are fixed fields, meaning they do not vary in size regardless of the data. Fields, except Time and Milliseconds, are separated by commas.

Two methods are available for configuring the output string format:

1) A Windows serial utility program, SerialUtility.exe, is provided with the echosounder to allow the users to easily modify the depth log format to suit their individual needs. This program communicates with the echosounder's monitor port on COM3 via a null modem RS-232 serial cable.

2) It is possible to send the appropriate instruction directly to the echosounder monitor using any standard communications package with a simple null modem RS-232 serial cable.

The echosounder uses a 32-bit code to setup the configuration of the depth log string. This code is displayed in the secondary function interface menu as a hexadecimal value. The Windows utility program, SerialUtility.exe, automatically sets this code value and sends it to the echosounder. Users familiar with binary and hexadecimal conversions can easily compute the appropriate code value to send to the echosounder for a given configuration. The bit corresponding to a field in the code word is set to 1 to select the field for output, and is reset to 0 to deselect the field.

Table 4-2. PKEL Depth Log String Format

Field #	Field Description	Field Format	Code Word Bit #
0	User defined preamble string	Printable ASCII chars (max.16)	LSW:0
1	KEL Proprietary String Standard Header	$PKEL99	LSW:1
2	Record Number	rrrrr	LSW:2
3	Fix Indicator	Fnnnn	LSW:3
4	Date	Standard: ddmmyyyy Julian: Jdddyyyy	LSW:4
5	Time at start of ping, to second resolution from MPM Real-Time Clock	hhmmss	LSW:5
6	Milliseconds sync'd to Real-Time Clock (Time field must be selected)	.sss	LSW:6
7	Ping Start to Data Output Latency	ttttt	LSW:7
8	High Frequency Identification Header	HF	LSW:8
9	HF Depth, to transducer (uncorrected for any offsets)	xx.xx or xxx.x or xxxx. or xxxxx	LSW:9
10	HF Depth, corrected for draft	xx.xx or xxx.x or xxxx. or xxxxx	LSW:10
11	HF Depth, corrected for draft and heave	xx.xx or xxx.x or xxxx. or xxxxx	LSW:11
12	HF Echo Strength	xxxx	LSW:12
13	HF Depth validity flag	1 = okay, 0 = bad	LSW:13
14	Undefined	n/a	LSW:14

Field #	Field Description	Field Format	Code Word Bit #
15	HF Draft offset	sxxx.xx	LSW:15
16	Low Frequency Identification Header	LF	MSW:0 (16)
17	LF Depth, to transducer (uncorrected for any offsets)	xx.xx or xxx.x or xxxx. or xxxxx	MSW:1 (17)
18	LF Depth, corrected for draft	xx.xx or xxx.x or xxxx. or xxxxx	MSW:2 (18)
19	LF Depth, corrected for draft and heave	xx.xx or xxx.x or xxxx. or xxxxx	MSW:3 (19)
20	LF Echo Strength	xxxx	MSW:4 (20)
21	LF Depth validity flag	1 = okay, 0 = bad	MSW:5 (21)
22	Undefined	n/a	MSW:6 (22)
23	LF Draft offset	sxxx.xx	MSW:7 (23)
24	Mux Enable	x	MSW:8 (24)
25	Mux Transducer	x	MSW:9 (25)
26	Speed of Sound	xxxx	MSW:10 (26)
27	Heave	shhhhq	MSW:11 (27)
28	Heave Latency (Heave field must be selected)	tttt	MSW:12 (28)
29	Position: Latitude, Longitude	ll ll.llllllN,ooo oo.oooooE	MSW:13 (29)
30	Position Latency (position field must be selected)	tttt	MSW:14 (30)
31	Checksum	hh	MSW:15 (31)

Example 1:

To setup the Hypack (knu320ms.dll) and Trimble HydroPro compatible string, select the following fields: HF depth corrected for draft, LF depth corrected for draft, and Heave. This is the factory-default configuration.

For the 32 bit code:

LSW = 0000 0100 0000 0000b = 0400h
MSW = 0000 1000 0000 0100b = 0804h

Thus the instruction to send to the echosounder would be: $PKEL30,1,0400,0804,<CR><LF>

This would result in a depth log string as follows: xx.xx,xx,xx,shhhhq<CR.<LF>

Example 2:

To setup the Hypack (k320s.dll) compatible string, select the following fields:
User preamble = CHS320M, time, HF header, HF depth corrected for draft, HF validity flag, HF draft, LF header, LF depth corrected for draft, LF validity flag, LF draft , sound speed, and heave.

For the 32 bit code:

LSW = 1010 0101 0010 0001b = A521h
MSW = 0000 1100 1010 0101b = 0CA5h

Thus the instruction to send to the echosounder would be: $PKEL30,1,A521,0CA5,CHS320M<CR><LF>

This would result in a depth log string as follows:

CHS320M,hhmmss,HF,xx.xx,f,sxxx.xx,LF,xx.xx,f,sxxx.xx,xxxx,shhhhq<CR><LF>

Example 3:

For the following code selection:

LSW = 1010 0101 1111 1001b = A5F9h
MSW = 1111 1100 1010 0101b = FCA5h

the resulting instruction would be: $PKEL30,1,A5F9,FCA5,MyString<CR><LF>

and the expected depth log format would be:

MyString,Fnnnn,ddmmyyyy,hhmmss.sss,ttttt,HF,xx.xx,f,sxxx.xx,LF,xx.xx,f,sxxx.xx,xxxx,shhhhq,tttt,ll ll.llllll,ooo oo.oooooo,tttt*hh<CR><LF>

5 USER CONTROL INTERFACE STRINGS

Table 5-1. User Control Input Strings

MONITOR MAINTENANCE INPUT COMMANDS	
Command	**Description**
/?	Show the basic list of the available command set
/GR	Switch program to run out of EPROM
/GT	Switch program to run out of SRAM
/R	Reset program to 'start'
/SBA dec	Set baud rate for COM 1 to 'dec'
/SBB dec	Set baud rate for COM 2 to 'dec'
/SBC dec	Set baud rate for COM 3 to 'dec'
/SBD dec	Set baud rate for COM 4 to 'dec'
/DT	Download TI tag file into SRAM
/VER	Show current software number, version and location where program is running
/ID	Print SCSI ID set by DIP switches
/CCLK	Check the validity bit on the real-time clock
/BAN	Load a string into the banner for the printer
/INVM	Load the non-volatile memory with the defaults values for parameters
/SNVM	Load the non-volatile memory with the current values for parameters
/PRGPS	Program the SRAM contents into EPROM
/PRGTX	Compute and program the pulse data into the TX EPROM

ECHOSOUNDER CONCEPTS

TECHNICAL NOTE

D10 - 02251
Revision 2.0
November 4, 1999

Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario, Canada

CONTENTS

LIST OF FIGURES

1 KEL 320 ECHOSOUNDER ARCHITECTURE

Figure 1-1 shows the basic structural and functional partitioning of the standard 320M Marine echosounder. It is a simple and modular arrangement designed for the best overall compromise between many competing requirements and priorities. All 320 Series Echosounders use some or all of these modular components depending on the desired configuration.

In the 320M Survey Echosounder, each acoustic channel is provided with its own Signal Processing Module (SPM), which contains the analog front end components, digitizer, and a dedicated DSP. The SPMs perform all signal processing up to and including envelope detection, and send processed and decimated digital envelope data to the Main Processor Module (MPM). Off-loading the computationally intensive signal processing task from the main processor reduces the overall complexity of the system software, while increasing processing power.

Putting the user interface functions onto a separate front panel module is also part of an overall strategy of modularizing the system design. Partitioning the system into easily tested functional blocks reduces maintenance costs and facilitates servicing in the field by board level replacement.

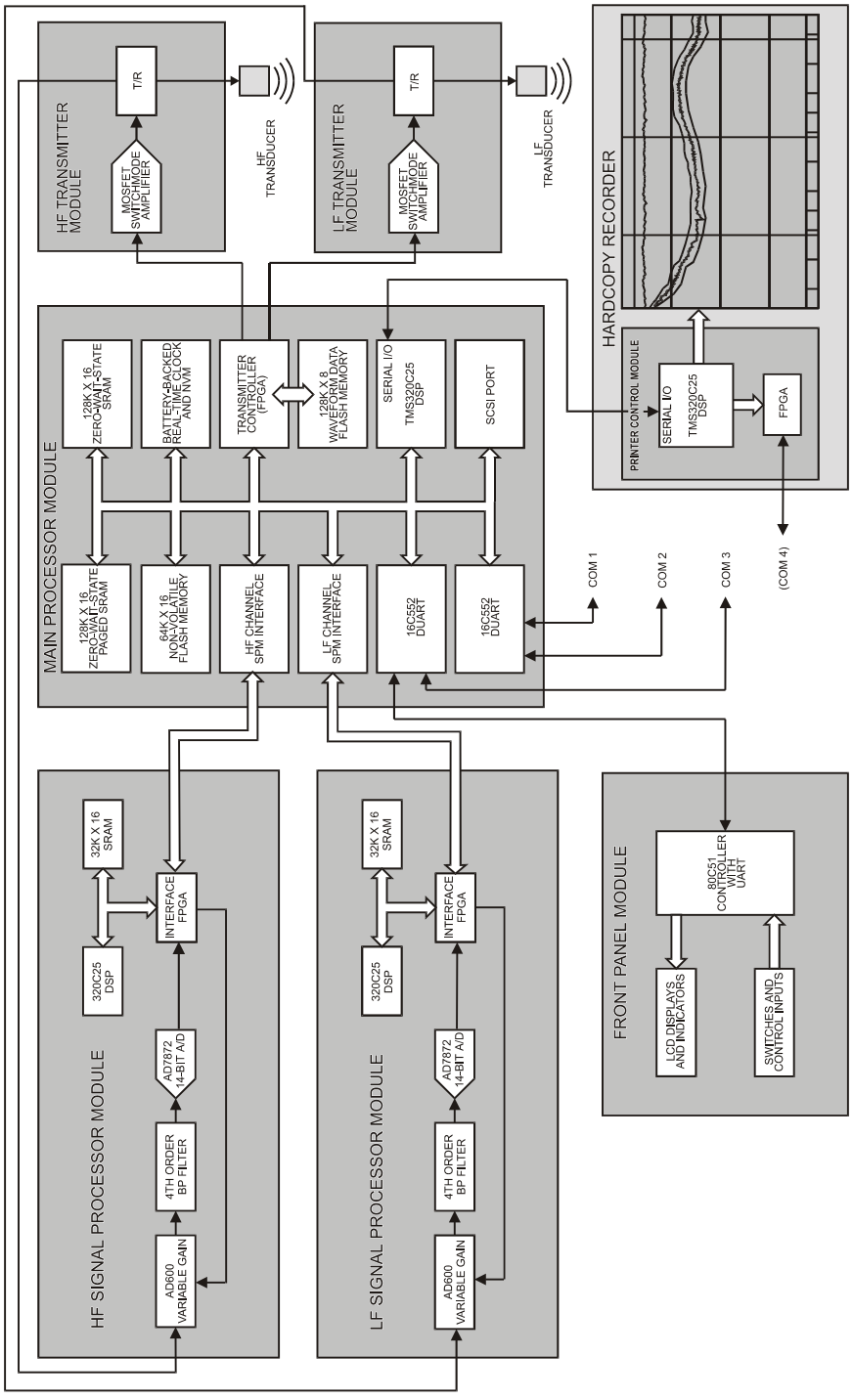
The control panel at the bottom of the unit can be detached as an assembly containing the panel itself, the switches and displays, and the printed circuit Front Panel Module. Removal of the front panel assembly in this manner entails removal of only four screws and four wiring disconnects, and can be accomplished with a Phillips screwdriver.

The thermal hardcopy recorder, which occupies most of the frontal view, is even more modular in execution. The entire printer mechanism, including the printed circuit Printer Control Module, hinges out for access to the paper rolls, and with two wiring disconnects can be lifted entirely off the hinges and removed from the Echosounder as an assembly.

The Transmitter Modules and the Main Processing Module are all mounted to the rear panel of the enclosure with standoffs, and are almost as accessible as the Printer and the Front Panel. The Signal Processing Modules are mounted to the MPM as mezzanine boards. All of these modules are shielded under a protective cover secured with four quarter-turn fasteners.

Finally, the Power Distribution Module mounts directly to a panel which forms part of the external structure of the 320M Echosounder, and which is removable as an assembly with eight screws and several disconnects.

Figure 1-1. The 320M Architecture



2 BASIC ECHOSOUNDER THEORY

2.1 Basic Concepts

The following section is intended for new or occasional operators. It provides a brief introduction to echosounding and to a few of the most important concepts. Experienced users may safely skip this section.

2.2 Pings and Echoes

An echosounder is an acoustic echo ranging device. It measures the depth of the water by transmitting brief pulses of ultrasound downward toward the ocean bottom, and measuring the time it takes for the bottom echo to return. The transmitted pulse, traditionally called a "ping", is a tone of a specified frequency with a duration of anywhere from a sixteenth of a millisecond to four milliseconds. The transducer is mounted through the hull of the ship, near the keel, with its active face pointed straight down. The same transducer is used for both transmitting the ping, and receiving the echo signal. The intensity of the received signal as a function of depth is printed vertically on the graphic recorder. After many repeated pings the bottom is visible as a horizontal black line, which follows the contours of the bottom. The sharpness and clarity of the line depend on the strength and quality of the echo, which depends on many factors, including bottom characteristics, pulse length, depth of the water, and the amount of ambient noise (noise "pollution", which comes from many sources and is unavoidable). The location of the strongest echo is "detected" by software and displayed/recorded as a depth in metres. Each frequency has its own independent display/record.

Echosounder operation is affected by many factors - some much more dominant in their effect than others. Several of the more important factors and their effects are discussed below.

2.3 Bottom Characteristics

The strength of the received echo is strongly affected by the type of bottom. The strongest echoes are produced by rock, gravel or sand (such bottoms are said to exhibit high "target strength"). Mud or silt surfaces have low target strength and produce weaker echoes.

The bottom characteristics can often be deduced from a graphic record, as a result of penetration of the ping into the ocean bottom. Echoes from harder layers a few decimeters beneath the surface of the sea floor often show up as a characteristic layering effect on the graphic record. This is particularly evident in the case of silt overlying rock.

2.4 Pulse Length

The 320 Echosounder's receiver processes the received signal with a bandpass filter with a passband centred at the transducer frequency. This filter allows the received echo to pass through, but rejects ambient noise at all other frequencies. It would seem logical to use the narrowest possible bandwidth, to achieve the greatest possible noise rejection, and thus detect the weakest echoes of the transmit pulse. Unfortunately, it isn't that easy. A signal pulse has a bandwidth approximately equal to the inverse of its duration - thus a one millisecond pulse needs a receive filter with a bandwidth of at least 1 kHz, or it will be attenuated along with the out-of-band noise. The shortest pulses need the widest bandwidth (and achieve poorest noise rejection)

while the longest pulses can use the narrowest filters, with the best noise rejection.

On the other hand, the short pulses produce better "range resolution", which permits more accurate depth measurement, and shows more detail on the bottom. Generally, short pulses are used in shallow water, where resolution is important, and where echoes are strong, while long pulses are used in deep water where echoes are weaker, and the noise rejection capability of narrowband filtering is more important.

2.5 Sound Speed

Because the 320 Echosounder is a digital system with a quartz crystal timebase, it does not require internal recalibration due to aging or temperature, and can measure the return time of the echo with a great deal of accuracy. The ultimate accuracy of the depth measurement also depends on the accuracy of the sound speed value used in the computation.

The speed of sound is not a constant, but depends on several factors, most importantly the salinity and the temperature of the water. Normally, the variations in sound speed from location to location are small enough that only occasional adjustments to this parameter are required, such as when transiting from fresh water to salt water. If maximum accuracy is important however, velocity measurements must be made and the sound speed value entered into the echosounder. Since sound speed can vary significantly with depth (as a result of temperature or salinity gradients) it may be necessary to enter an average velocity based on a measured sound velocity profile.

2.6 Draft

Draft is the nautical term used for the depth of the keel (the deepest point) of the vessel below the surface of the water. In echosounders it generally refers to the depth of the transducer below the water surface. The echosounder compensates for the effect of draft, both in the graphic record and in the digital depth display.

The amount of draft varies from time to time as a result of vessel loading, or a transit from fresh water to salt water, and a new value must periodically be entered into the echosounder.

2.7 Bar Check

A "bar check" is a test procedure used to set-up the appropriate speed of sound and draft settings for a sounding session. Typically, a bar check would be performed as follows.

A "bar" (a target which will return a distinct echo)is lowered to a known short distance below the surface. The draft is then adjusted until the depth return from the bar equals the known value. After the draft has been adjusted, the bar is then lowered to a deeper known depth. The sound speed is then adjusted until the depth return from the bar equals the known value. This procedure must be repeated several times until both elements are calibrated. After this procedure, the system will calibrated for the current water conditions and can be left unmodified for the remainder of the sounding session.

3 ACCURACY OF THE KNUDSEN 320 SERIES ECHOSOUNDERS

Note: We are frequently asked to specify the "accuracy" of the 320 series echosounders, and the answer is never straightforward. Although the following discussion does not provide the definitive response, it may shed light on some of the issues.

3.1 Introduction

Although modern echosounders can be sophisticated and complex, the principle on which they operate is simple - transmit a "ping" and listen for the echo. The time it takes for the bottom echo to return is directly proportional to the round trip distance, or twice the water depth. The accuracy of the depth value depends on a great many factors, some intrinsic to the echosounder and some, the local speed of sound for example, which are environmental factors beyond the control of the echosounder designer. This report discusses those factors which are affected by the design and operation of the echosounder.

Sources of error can conveniently be divided into three categories; repeatability, scale and offset. Repeatability is a fundamental limitation - there is no point in calibrating scale and offset to centimetres if the ping-to-ping variability is measured in decimetres. A brief discussion of some of the factors affecting repeatability and some of the design measures taken to enhance this characteristic is provided below.

Deterministic scale and offset errors which are amenable to calibration represent the main focus of this report. Echosounders are traditionally provided with offset and scale adjustments (in the form of draft and sound speed controls) which permit the user to calibrate the unit for his specific transducer installation and local water conditions. The user can set these two parameters by performing a bar check at two different depths (draft is set at the shallow depth, and sound speed at the deeper depth) and iterating the procedure as necessary to refine the values. Alternatively, the user can measure the draft and sound speed directly and enter the values into the echosounder. In this latter case, the user is trusting that the echosounder manufacturer has calibrated the unit correctly (particularly the draft) at the factory. This report discusses the technical aspects of echosounder calibration and accuracy.

3.2 Repeatability

3.2.1 Background

As already mentioned, ping-to-ping repeatability of the measured depth value is a fundamental limitation to echosounder accuracy. It is important to realize that the typical variability in the echo time-of-arrival measurement is much smaller than the total duration of the echo. The problem is not so much to locate the echo but to locate the precise point in the echo, time after time, which represents the calibrated depth value. Repeatability of the depth measurement therefore hinges on repeatability of the echo itself, at the transducer, and also on the repeatability of the process by which the depth determination is made within the echosounder.

3.2.2 Amplitude Effects

The depth determination invariably involves measurement of the precise instant at which the echo amplitude exceeds some threshold. For this to produce repeatable results, the echo amplitude has to be repeatable in relation to the threshold. Obviously echo amplitude varies widely depending on transmitted power, water depth, bottom reflectivity and receiver gain, and so amplitude normalization is a basic requirement of precision echosounding. Traditionally, amplitude normalization has been accomplished with a combination of automatic gain control (when available) and a considerable reliance on operator attention to control settings.

Amplitude normalization in the KEL 320 Echosounders starts with an assessment of the amplitude of each received echo. This is performed in software, after the signal has been digitized, filtered and envelope detected. The details of the algorithm are beyond the scope of this report, but basically it involves increasing the sample frequency of the envelope record by a factor of four with a cubic spline interpolation, and then cross-correlating the upsampled signal with a replica of the leading edge of the expected echo (this is also part of the bottom-picking algorithm). The correlation peak is scaled to produce a very accurate estimate of echo amplitude. Another filter is used with the correlation results to obtain the background noise level. A threshold is then computed as a specified fraction of the echo amplitude (usually 50%). The point in the sample record at which the envelope signal crosses the threshold is computed using polynomial interpolation and floating point arithmetic. The end result of this process is to decouple the depth measurement from both amplitude variations and sample rate limitations.

3.2.3 Bottom Type

Different bottom types can affect not only the amplitude of the return echo but also its shape. A very smooth, flat bottom provides an almost specular reflection with a well defined leading edge and very little off-axis return. A rough bottom, on the other hand, returns a considerable amount of off-axis scattering which tends to elongate the pulse and shift the point of peak amplitude downward. Generally speaking, bottom type effects are more difficult to compensate in the design of the echosounder than the simple amplitude effects mentioned above. The template-matching correlation scheme used in the 320 Echosounders for both bottom picking and amplitude normalization is very effective in minimizing sensitivity to bottom type.

3.2.4 Sample Rate Effects and Truncation Noise

This repeatability issue is peculiar to digital echosounders. It refers to the errors which accumulate whenever a timebase parameter is truncated or rounded off to the nearest sample interval or improperly interpolated. It ultimately places limits on the achievable resolution and therefore the repeatability of the time delay measurement. In early designs it tended to show up in the form of A/D converter sample-rate limitations. In modern echosounder designs it is more likely to be the result of fixed-point arithmetic or poorly written software.

The only practical solution to truncation and round-off noise is to use floating point arithmetic for all timebase related computations, and to use continuous polynomial interpolation when working with time-sampled data. This is the approach taken in all current releases of KEL 320 software. Digital timebase errors are essentially nonexistent in KEL 320 Echosounders.

3.2.5 Pulse Length Effects

If properly implemented, different transmit pulse lengths are matched to different receive filters, with short pulses matched to wide bandwidth filters, and vice versa (there is very little point in transmitting a long pulse unless the receive filter has an appropriately narrow noise bandwidth). The "group delay" of an analog or digital filter is inversely related to the bandwidth and can be quite considerable in a narrowband filter. Fortunately this is a deterministic effect and can be corrected (see the section on offset calibration). A more fundamental repeatability issue arises from the simple observation that long, narrowband pulses have a much longer rise time than short, wideband pulses, and the threshold crossing instant is more sensitive to minor amplitude variations. This is just another way of stating the well-known fact that longer pulses provide poorer range resolution than short pulses.

3.2.6 Frequency Effects

Hydrographic surveyors are well acquainted with the fact that low frequency sound penetrates soft sediments more readily than high frequency signals. They are also aware that the bottoms of oceans, lakes and rivers are often characterized by one or more layers of soft sediments (sometimes very soft, as in "fluff", which may be more liquid than solid) overlying harder, more acoustically opaque materials. Echoes are generated at the interface between substances of low acoustic impedance (such as water) and higher acoustic impedance (sediment). An even greater acoustic impedance difference may exist between buried layers of soft and hard sediment. A low frequency echosounder will often identify a buried layer of hard sediment as the "real" bottom, while a two-channel echosounder will often detect the shallowest interface on the high frequency channel, and a deeper layer on the low frequency.

If the digitized depth values are consistent under these conditions, the results with a two-channel echosounder can provide useful information about the type of bottom. More often, the depth values "bounce" back and forth between one interface and another, producing misleading data.

3.3 Scale Errors

Modern echosounders use extremely precise quartz crystal timebase control, so in theory calibration error in the scale parameter (sound speed) is effectively zero and can safely be disregarded. In practice, the theoretically achievable accuracy can be compromised by errors in the digital processing of timebase parameters, mostly as a result of fixed-point arithmetic or truncation errors. However, this is a software issue, and is easily resolved with good programming practice and floating-point arithmetic as used in the KEL 320 Echosounders.

Note that the scale parameter calibration error referred to here is the accuracy of the correction applied to the depth value by the echosounder to compensate for the speed of sound value entered by the user, either in the course of a bar check or from a sound velocimeter. The depth accuracy still depends ultimately on the accuracy of the sound velocity value provided by the user. In practice, errors in the sound velocity value account for virtually all of the scale effects on the accuracy of the depth measurement.

3.4 Offset Errors

The offset (draft) parameter is calibrated to zero at the factory to account for all of the small time delays built into the signal paths in the echosounder, by far the largest component of which is group delay through digital filters. The group delay through a transversal digital filter depends on the sampling interval and the number of taps, which varies inversely with the filter bandwidth, which is different for each filter. The important point to note here is that this offset calibration must be carried out independently for each of the different receive filters (or for each different pulse length) for each frequency.

This actually represents one of the big advantages of the digital signal filters used in the KEL 320 products, over the multiple analog filters used in other "digital" echosounders. The group delay values of the digital filters are defined precisely in software, and are compensated for in software, once, for all echosounders using that frequency. No "tuning" of pots or coils in individual echosounders is involved, and of course software never drifts.

It should be noted that all of the digital filtering in KEL 320 Echosounders is performed with transversal, or finite impulse response (FIR) filters which are unconditionally stable.

The two-way group delay of the transducer itself contributes a very small amount to this offset error, varying slightly from transducer to transducer, and so the factory offset calibration (zeroing the draft value) is inherently less precise than the scale calibration.

3.5 Factory Calibration Procedures

3.5.1 Introduction

Factory calibration of the offset (or draft) parameter consists of determining the amount of correction required, for each filter, to zero the draft control. These correction values are entered into the software source code and become part of echosounder firmware. The echosounder then applies these corrections when calculating depth values. The correction values are maintained as 32-bit floating point numbers and have units of echogram envelope sample intervals.

The first step in the calibration procedure is to set all of the corrections to zero in source code, and to compile and load this code into an echosounder. A test is then carried out to measure the draft error for each filter. The required correction values are computed from the measured errors, and entered into the source code, which is then re-compiled and loaded into the echosounder. The final step is to carry out tests to confirm the accuracy of the corrections.

Two somewhat different test procedures are used at Knudsen Engineering. Both are briefly described below.

3.5.2 EDI Calibration Procedure

The primary calibration tests are performed with an EDI DSTS-4A Digital Sounder Test Set manufactured by Electronic Devices Inc. This instrument connects to the transducer output of the echosounder and returns a simulated echo signal after an interval corresponding to a depth value which is set by the operator. The echosounder sound speed parameter is set to the value (1500m/s) used by the DSTS-4A, and draft is set to

zero. The difference between the depth value preset by the operator (d_1) and the depth value reported by the echosounder (d_2) is then converted to a floating point value in units of sample intervals (the sample frequency of each filter is derived from the sounder's highly stable and accurate 40MHz quartz crystal oscillator):

$$n=(2f_e/1500)(d_2-d_1)$$

where f_e is the envelope sampling frequency.

This value (n) is then entered into source code as a floating point draft correction for that filter.

3.5.3 Two-point Calibration Procedure

As a check on the accuracy of the EDI instrument, and in cases where the EDI unit is not ideally suited (eg, chirps or very short pulses), an alternative procedure is sometimes used.

The preliminary steps of zeroing the calibration corrections in source code, loading the code into the echosounder, setting sound speed to 1500m/s and draft to zero are carried out as above. The echosounder is then connected to a suitable transducer set up a precisely measured distance from a target. The echosounder is turned on, and depth values are recorded for all filters. The transducer/target separation is then changed to a second carefully measured value, and the test repeated. Given the two carefully measured ranges (r_1 and r_2), and the two depth values reported by the echosounder (d_1 and d_2), the draft correction can be calculated as follows:

$$n=(2f_e/1500)(r_2d_1-r_1d_2)/(r_2-r_1)$$

where f_e is the envelope sample frequency.

3.6 Summary

To summarize the discussion above:

1) The **scale** error contributed by the echosounder is essentially zero. Scale accuracy is normally controlled by the accuracy of the speed of sound value which is entered by the operator, usually in the course of a bar check.

2) The **offset** error contributed by the echosounder is dependent upon the quality of the factory calibration of each of the filters for zero draft. If present, this error will show up as a change in the depth value when the pulse length is changed, and so its existence and magnitude is easily evaluated. Factory calibrations are carried out under controlled conditions and residual offset or draft errors will invariably be less than the repeatability of the depth measurements.

3) The **repeatability** errors contributed by the echosounder are difficult to measure, because under

normal operating conditions they are dominated by instabilities in the propagation medium, which is of course outside the control of the echosounder.

4 DIGITIZED DEPTH VERSUS PRINTED ECHOGRAM

We are often asked about discrepancies between the digital depth value and the printed echogram. Most often, the printed echogram shows the leading edge of the bottom echo to be shallower than the digitized depth. This note addresses the reason for this apparent discrepancy.

In the early days of echosounders, before digitizers, the printed record was the only record. The hydrographer adjusted the draft and sound speed during a bar check using the depths he scaled directly from the printed record, based on his visual determination of the location of the leading edge of the echo. There were two problems with this approach. First, the hydrographer would have noticed that the depth was slightly dependent on receiver gain. By cranking up the gain he could "thicken" the bottom line and decrease the apparent depth slightly. Reducing the gain had the opposite effect. Second, the person who digitized the printed record back in the shop may have had a slightly different view of the precise location of the leading edge of the echo - a bias toward a lighter or darker shade of grey as the threshold point.

Both of these problems result from the fact that the leading edge of the echo is not a distinct event. The echo arrives as an increase in signal strength from the background noise level to the echo peak over a finite period of time. The rise time of the echo has a minimum duration of about half the transmitted pulse length. To put this into perspective, the duration of the leading edge of the echo from a 0.1 ms transmit pulse (a typical pulse length for high frequency shallow water work) is equivalent to almost 4 centimetres of depth. The longer pulses used in deeper water have longer rise times. In practice, however, the echosounder is more accurate than these rise times would lead us to believe.

In the days before digitizers, the easiest way to deal with the rise time problem was to operate the sounder with receive gain increased to the point where the background noise just started to show, and the bottom echo was strongly saturated. This has the effect of setting the detection threshold very low, almost at the noise level, and it works well because the human brain is very good at distinguishing echo from noise. The repeatability (and accuracy) of depths scaled by hand from such records is typically a fraction of the nominal pulse length.

The digitizer software, on the other hand, is designed to set its threshold at the midpoint of the leading edge, at the 50% amplitude point, because this is the value that provides optimum detection performance.

The problem is that hydrographers tend to set their visual threshold at the point in the echogram where the echo first becomes visible, which is often somewhat shallower. The difference between the digitized depth and what the hydrographer sees on the printed record is more pronounced at the high print contrast levels many users prefer, and with longer pulse lengths.

Two points are worth noting. First, the fact that the digitizer threshold is set at the 50% point rather than at some lower (but still visible on the echogram) value does not mean that the echosounder has a built-in error equal to half the rise time of the echo (or a quarter of the pulse length). In fact, the echosounder software is carefully calibrated at the factory to account for this difference. Separate calibrations are performed for each pulse length, and for each frequency. The results of these calibrations, which are equivalent to "zeroing" the draft parameter, are incorporated in the echosounder firmware.

Second, the point at which the echo becomes visible on the echogram is highly dependent on the print

contrast mode which is used (see the user manual for an explanation of these modes). With most print contrast modes (particularly including manual contrast), the relationship between the greyscale echogram and the digitized depth is subject to interpretation.

In summary, the digitized depth is most likely correct, even if the printed record appears to be slightly shallower. This should only be a matter for concern if the depth discrepancy is much greater than about a quarter of a pulse length.

KNUDSEN ENGINEERING LIMITED

CUSTOMER SERVICE REQUEST

D10-02252 R2.0

Report problems to:
Technical Support
Knudsen Engineering Limited
10 Industrial Road
Perth, Ontario
K7H 3P2

Voice: (613) 267-1165 8:30 am to 5:00 pm E.S.T. Core Hours
Fax: (613) 267-7085

E-Mail: support@knudsenengineering.com
WebSite: http://knudsenengineering.com/

IN ORDER TO HELP YOU QUICKLY, WE NEED THE FOLLOWING:

Customer #: _____
Customer Name: _____
Contact Person: _____
Phone: _____ **Fax:** _____
E-Mail: _____

Unit Serial #: _____
Firmware Part #: _____ **Version #:** _____
PC Software: Part #: _____ **Version #:** _____

Echosounder settings at failure (if available):

Units: ☐ Meters or ☐ Feet or ☐ Fathoms
Range: ☐10 ☐20 ☐50 ☐100 ☐200 ☐500 ☐1000 ☐2000
Phase: ☐Auto ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
Autophase Limits: **Min:** _____ **Max:** _____
Primary Channel: ☐ HF ☐ LF

	HF CHANNEL (if available)	LF CHANNEL (if available)
Pulse Length:		
Draft:		
Rx Gain:	☐AGC ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7	☐AGC ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7
Tx Power:	☐1 ☐2 ☐3 ☐4 Other____	☐1 ☐2 ☐3 ☐4 Other____
Tx Blank:		
Sensitivity:		
Processing Gain:		

Peripheral Equipment being used (if any):

GPS Receiver: _____ **Heave Sensor:** _____
Data Logger: _____ **Other:** _____

DESCRIBE PROBLEM:

HOW CAN YOU PROVOKE PROBLEM?

CUSTOMER SERVICE REQUEST