NXIC CTD

High Accuracy Conductivity, Temperature and Depth Meter with Direct Digital Output and Internal Data Logging

User Manual

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Falmouth Scientific, Inc.
1400 Route 28A
Cataumet, MA 02534

Tel: (508) 564-7640
Fax: (508) 564-7643

Falmouth Scientific, Inc.

IMPORTANT!

The NXIC CTD is rated for a maximum operating depth that is based on the pressure transducer selected. Consult the manufactured configuration sheet supplied with the instrument for its maximum operating depth. <u>Do not</u> exceed 125% of full scale when using or calibrating the instrument as permanent damage <u>will occur</u>. As with all high pressure instrumentation, observe caution while using the NXIC CTD or after exposing it to high pressures.

System Configuration Requirements

The system configuration required for CTDPro to operate properly includes the following:

- Microsoft Windows 98® or higher
- Pentium® processor
- Minimum 32 MB of RAM
- Monitor, 800 x 600 (minimum), 1024 x 768 (recommended)
- CD-ROM drive
- 10 MB free space

Pull-Down Menus

Like most programs, CTDPro uses pull-down menus, which are opened from the menu bar in the program's Main window by pointing to the item with the mouse pointer and clicking the left mouse button. When the menu is open, you can select an item from it in the same manner.

In many of the procedures presented in this manual, the ➤ symbol is used to represent a sequence of menu item selections. For example, "Choose File ➤ Open" means select File from the menu bar, and then choose Open from the File menu when it opens.

Customer Service

FSI welcomes your feedback. Please contact FSI customer service to offer any comments or suggestions or to request technical support. FSI can be contacted using any of the following means:

Mail

Falmouth Scientific, Inc.
P.O. Box 315
Cataumet, MA 02534
U.S.A.

E-mail

fsi@falmouth.com

Telephone or Facsimile

Telephone: (508) 564-7640
Facsimile: (508) 564-7643

Table of Contents

SECTION 1: Introduction

The Falmouth Scientific NXIC CTD is a ruggedized, extremely durable CTD that is designed to collect high precision, scientific quality salinity data by measuring conductivity, temperature and pressure. The instrument measures conductivity using a patented inductively coupled highly stable NXIC (Non-eXternal Inductive Conductivity) sensor that is designed for long term, low maintenance deployments, even in coastal regions where biological fouling is a problem. Temperature is measured with an aged, high accuracy thermistor mounted directly in the water flow path of the conductivity sensor. And pressure is measured using a fully temperature compensated precision micro-machined silicon transducer.

The NXIC CTD optionally includes four additional DC input channels and an RS-232 channel. Included with this option are additional connectors for connecting external sensors. The DC input channels interface with 0–5 VDC output sensors, including dissolved oxygen, pH, chlorophyll, light transmission, and others, and the RS-232 channel interfaces with any external sensor that provides an RS-232 serial connection. Two of the DC channels include two logic outputs for controlling sensor gains or other sensor functions. The NXIC CTD also provides power for the sensors.

Measured conductivity, temperature and pressure data, along with calculated salinity and sound velocity and external sensor data, are continuously recorded to internal memory at selectable sample rates from 1 to 15 Hz. For each sample the time and date are also recorded. All data are saved to a file which can be downloaded to a computer after retrieval of the instrument. Multiple files for multiple deployments can be recorded to memory and downloaded separately.

The NXIC CTD is configured using CTDPro, a Microsoft Windows® based software program included with the instrument. With CTDPro you can configure and deploy the instrument, download and save the data from the instrument, view and print graphs of the data, and export the data to a text or spreadsheet file. In addition, the data can be exported to FSIPost, a post processing software program available from FSI that provides a means of processing, displaying, graphing, printing, and saving processed CTD data.

Main External Components

The main external components of the NXIC CTD are shown in Figure 1-1. The conductivity, temperature and pressure sensors are located on the top end cap. The conductivity sensor is free flushing with no exposed electrodes that can foul or

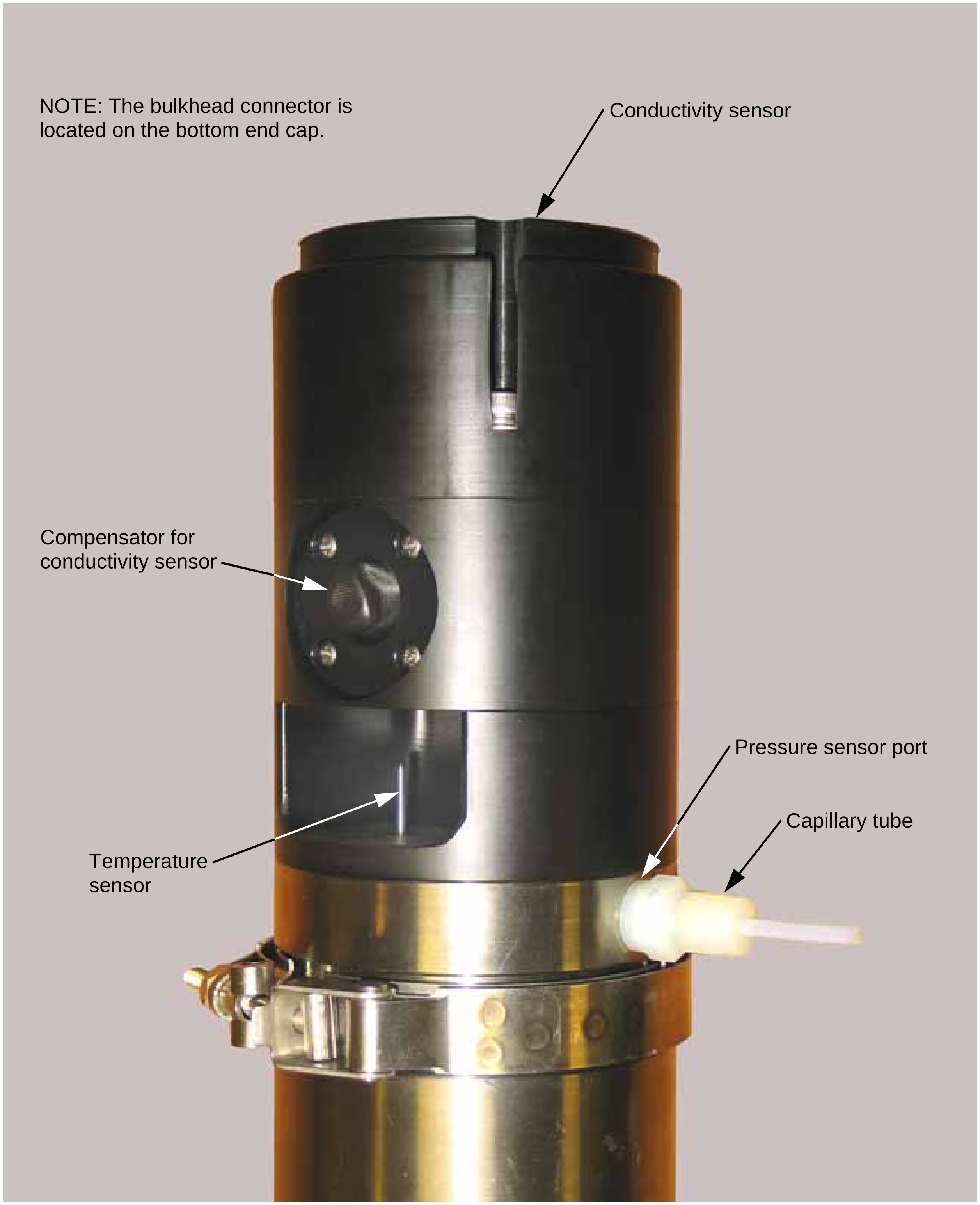


Figure 1-1: ***The Location of the NXIC CTD Main External Components***

external fields that can affect calibration. The temperature sensor is aged and therefore highly stable and is directly in the water flow path of the conductivity sensor. The pressure sensor is exposed to ambient pressure through a pressure port and an oil-filled capillary. The oil provides the required pressure coupling and is an electrical insulator that prevents corrosion due to the dissimilar metal compositions of the transducer and instrument housing. Capillary action ensures the oil remains contained in the pressure port. A single 4-pin bulkhead connector on the lower end cap provides RS-232, RS-485 or CMOS TTL level digital communications and inputs external power.

Specifications

Below are the general specifications for the NXIC CTD along with the specifications for the conductivity, temperature and pressure sensors.

Note: *These specifications are subject to change without notice.*

General

Power requirements:	Internal battery pack or 7–35 VDC @ 500 mA maximum when externally powered
External sensor power:	11 VDC nominal @ 50 mA maximum for any sensor; 150 mA maximum total for all the sensors
Depth rating:	500 m standard, Delrin housing
	7000 m optional, 64-AVL titanium housing
Sample rate:	1–15 S/sec, selectable
Resolution:	20 bits
Bulkhead connector:	Subconn MCBH4F, mates with MCIL4M
Real time clock:	Programmable alarm/sleep functions
Real time clock stability:	±5 ppm initial accuracy, ±12 ppm/year
Communication interface:	RS-232, RS-485 or CMOS TTL
Baud rate:	1200, 9600, 19200, 38400, 57600, and 115200
Data format:	8 data bits, 1 stop bit

Salinity calculation:	PSU-78
Sound velocity calculation:	UNESCO44
Warm up:	3 seconds after power up
Internal memory:	128 MB; 256 MB optional
Battery pack:	16 welded alkaline "C" cells; 3.2 V (nominal) at 40 A·h

Conductivity

Sensor type:	Non-external inductive cell
Range:	0–9.0 S/m (0–90 mS/cm)
Accuracy:	±0.0002 S/m (±0.002 mS/cm)
Stability:	±0.00005 S/m/month (±0.0005 mS/cm/month)
Resolution:	0.00001 S/m (0.0001 mS/cm)

Temperature

Sensor type:	Aged thermistor
Range:	-2–32°C standard, -5–45°C optional
Accuracy:	±0.002°C
Stability:	±0.0005°C/month
Resolution:	0.0001°C
Response:	100 msec

Pressure

Sensor type:	Precision micro-machined silicon transducer
Range:	Customer specified
Accuracy:	±0.02% of full scale
Stability:	±0.004% of full scale/month
Resolution:	0.001% of full scale
Response:	25 msec

SECTION 2: Unpacking the NXIC CTD and Connecting It to Your Computer

Before deploying a NXIC CTD, it must be connected to an available serial port of a computer running CTDPro and configured for deployment. It is also required to connect the instrument to the computer when downloading data. The default serial port that CTDPro uses is COM1, and the default baud rate is 9600 bits/sec. However, any serial port from COM1 to COM16 can be used, and baud rates of 1200 and 19200–115200 bits/sec are additionally available. This section provides instructions on how to unpack the NXIC CTD and connect it to your computer using an RS-232 or RS-485 interface, how to install and start CTDPro on your computer, how to change the serial port that CTDPro uses, and how to change the baud rate at which the computer and instrument communicate.

Unpacking the NXIC CTD

Before unpacking the NXIC CTD, check the shipping container for signs of external damage. If the container appears damaged, report the damage to FSI and to the freight carrier.

When unpacking the NXIC CTD, inspect all the items for any apparent damage and verify that all the items listed in the packing list are included in the shipment. Report any damage or missing items to FSI.

Battery Pack

An internal alkaline battery pack is used to power the NXIC CTD when the instrument is deployed autonomously. However, if a battery pack was ordered with the NXIC CTD, it will *not* be installed to prevent possible damage to the instrument from an unexpected battery discharge. The battery pack comprises 16 welded alkaline "C" size cells.

> ***Note:*** *Although a battery pack is required for an autonomous deployment, it is not required when configuring the NXIC CTD.*

Standard Items

The following items are included with the shipment of a NXIC CTD:

- **NXIC CTD instrument**
- **CTDPro for Windows CD**
- **Test cable with power supply and AC line cord**
- **Dummy connector and locking sleeve**
- **This manual**
- **Alkaline battery pack (with autonomous models only)**

Optional Items

Optional items typically include the following:

- **Additional test cable**
- **RS-485/RS-232 converter**
- **Additional alkaline battery pack**

These items are available from FSI and are listed with their part numbers in Table 2-1 below. (See “Customer Service” on page iii for information on how to contact FSI to order any of these items.)

Optional Items Available from FSI	
ITEM	**FSI PART NUMBER**
Test Cable	NXIC-OP-CAB-PWR
RS-485/RS-232 Converter	3201-RS232-485
Alkaline Battery Pack	B176-030

Table 2-1: ***Optional Items Available from FSI***

Note: *Spares kits are also available from FSI. Contact FSI for more information on these items.*

Installing CTDPro and Selecting the NXIC CTD

The NXIC CTD is configured using the CTDPro software which must be installed on the computer to which the instrument will be connected. In addition, you must start CTDPro and select the NXIC CTD or verify that it is already selected. Once selected the NXIC CTD remains selected until changed.

Installing CTDPro

To install CTDPro:

1. Exit all programs and turn off any virus protection or screen saver software.
2. Insert the CTDPro for Windows CD into your CD-ROM drive.
3. Select Start ➤ Control Panel ➤ Add or Remove Programs.

   The Add or Remove Programs dialog box opens.
4. Click Add New Programs, and then click CD or Floppy and follow the instructions to install the software.

Selecting the NXIC CTD

To select the NXIC CTD:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.
2. Choose File ➤ Properties.

   The Properties dialog box shown in Figure 2-1 opens.
3. In the Properties dialog box, select NXIC CTD from the Product drop-down list box, and then click OK.

   The Properties dialog box closes, the NXIC CTD is selected and the CTD menu appears in the menu bar to the right of the File menu in the CTDPro Main window.

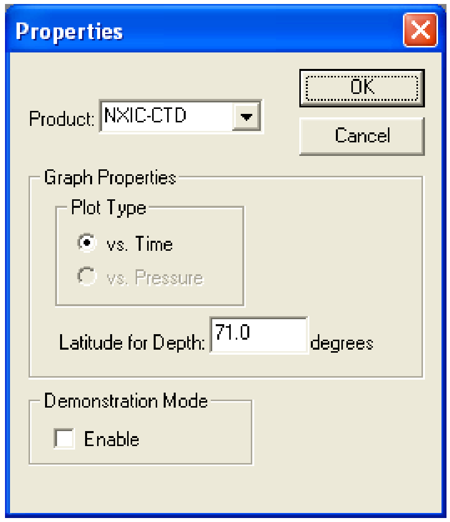


Figure 2-1: ***The Properties Dialog Box***

Communication Interfaces

The NXIC CTD includes three communications interfaces for configuring and downloading data from the instrument. The instrument is normally wired for an RS-232 serial interface but can be wired for an RS-485 or CMOS serial interface. The serial tag on the instrument identifies which communications interface is factory installed. For instructions on how to change the wiring for an interface other than what was factory installed, contact FSI. (See “Customer Service” on page iii for information on how to contact FSI.)

RS-232 Interface

The RS-232 serial interface requires that your computer provide true RS-232 data levels. Some older laptop computers do not support the negative output voltages provided by the RS-232 standard and these computers may not work properly with the instrument.

RS-485 Interface Option

The optional RS-485 serial interface comprises the RS-485/RS-232 converter.

CMOS Interface Option

The optional CMOS serial interface provides TTL level signal outputs. Consult FSI directly for more information about this option.

Connecting the NXIC CTD to Your Computer

The following items are required to connect a NXIC CTD to your computer:

- Test cable with power supply and AC line cord
- RS-485/RS-232 converter, for RS-485 interface connection only
- An available serial port on the computer

Note: *If you will be fabricating your own cable for connecting the NXIC CTD to your computer, see "APPENDIX B: Bulkhead Connector Wiring," for information on the NXIC CTD bulkhead connector components and wiring.*

Note: *Although any serial port from COM1 to COM16 can be used, use COM1 if it is available, as it is the default serial port setting of CTDPro. If you use any other serial port, you must select it in CTDPro as described in "Changing the Serial Port" on page 2-7.*

Connecting to the RS-232 Interface

A NXIC CTD with an RS-232 interface is shown set up with a laptop computer in Figure 2-2.

To connect a NXIC CTD with an RS-232 interface to your computer:

1. Disconnect the dummy connector from the bulkhead connector on the instrument.

2. Connect the test cable to the bulkhead connector on the instrument and to the serial port on your computer.

3. Connect the power supply to the POWER connector on the test cable.

4. Connect the AC line cord to the power supply and to a 110–240 VAC, 50–60 Hz power source.

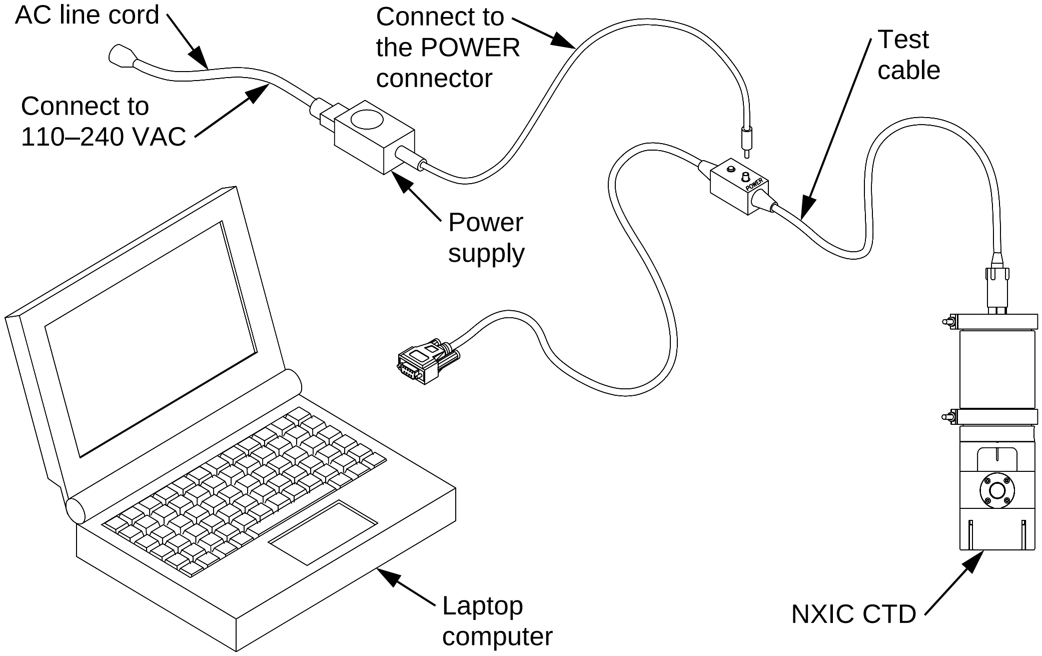


Figure 2-2: ***NXIC CTD Setup—with RS-232 Interface***

Connecting to the RS-485 Interface

A NXIC CTD with an RS-485 interface is shown set up with a laptop computer in Figure 2-3.

To connect a NXIC CTD with an RS-485 interface to your computer:

1. Disconnect the dummy connector from the bulkhead connector on the instrument.
2. Connect the test cable to the bulkhead connector on the instrument and to the RS-485 connector of the RS-485/RS-232 converter.
3. Connect the RS-232 connector of the RS-485/RS-232 converter to the serial port on your computer.
4. Connect the power supply to the POWER connector on the test cable.
5. Connect the AC line cord to the power supply and to a 110–240 VAC, 50–60 Hz power source.

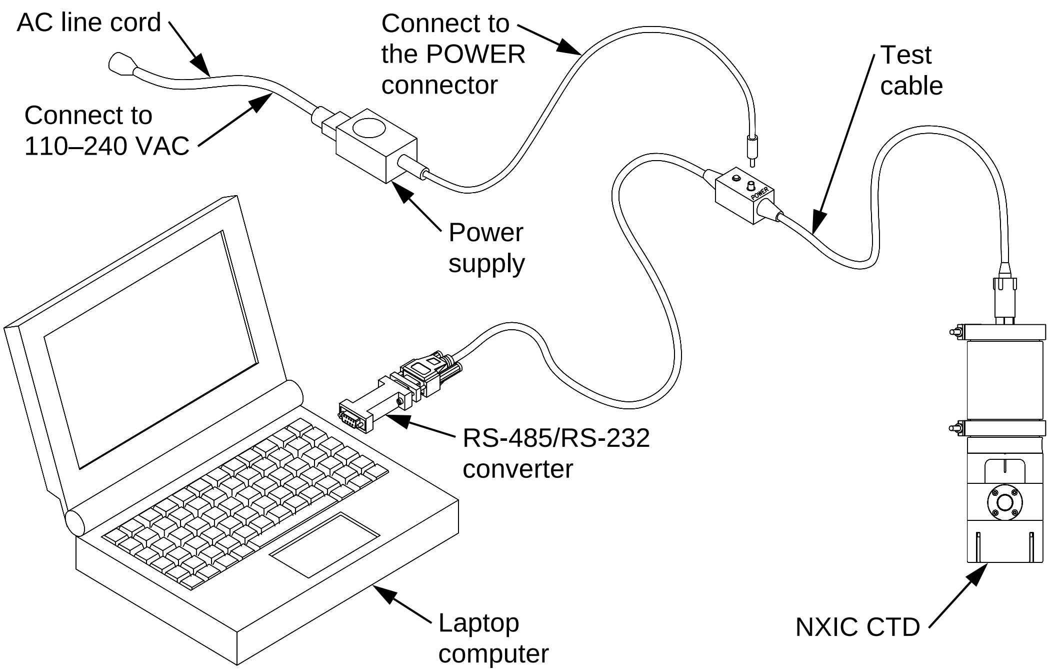


Figure 2-3: *NXIC CTD Setup—with RS-485 Interface*

Changing the Serial Port

The default serial port for CTDPro is COM1. However, any one of 16 serial ports from COM1 to COM16 can be selected.

To change the serial port:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose CTD ➤ Communications ➤ Setup.

   The Communication Properties dialog box shown in Figure 2-4 opens.

3. Enter the new serial port number in the Comport Number text box.

   Caution: *Do not change the baud rate. (See “Changing the Baud Rate” on page 2-8 for instructions on how to change the baud rate of the NXIC CTD and the serial port to which it is connected.)*

4. Click OK to save the new serial port selection and close the Communication Properties dialog box.

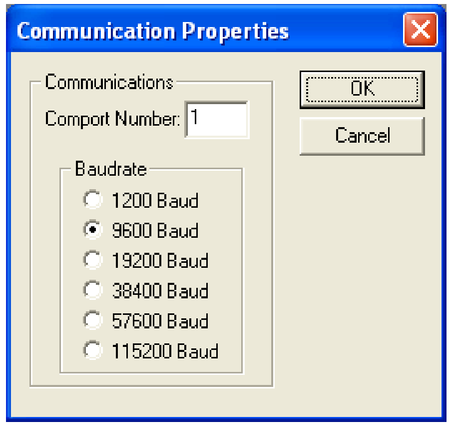


Figure 2-4: ***The Communication Properties Dialog Box***

Changing the Baud Rate

The default baud rate for the NXIC CTD and CTDPro is 9600 bits/sec with one stop bit, eight data bits and no parity. However, you can use CTDPro to change the baud rate at which the computer and the instrument communicate in the following three ways:

Change the baud rate of the serial port where CTDPro changes the baud rate of the computer's serial port to the selected baud rate without affecting the baud rate of the NXIC CTD. This allows communications with multiple instruments, each of which have different baud rates. The baud rates of the instruments must be known.

Automatically change the baud rate of the serial port to the baud rate of the NXIC CTD where CTDPro automatically determines the baud rate of the instrument and then changes the baud rate of the computer's serial port to the same. The baud rate of the instrument is not changed. This allows communications with the instrument without knowing its baud rate.

Change the baud rate of the NXIC CTD and the serial port where CTDPro first changes the baud rate of the NXIC CTD to the selected baud rate and then automatically changes the baud rate of the computer's serial port to the same. This allows communications with an instrument at any of the available baud rates. The baud rate of the instrument remains changed.

Changing the Baud Rate of the Serial Port

To change the baud rate of the serial port:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose CTD ➤ Communications ➤ Setup.

   The Communication Properties dialog box shown in Figure 2-4 on page 2-8 opens.

3. In the Baudrate area of the Communication Properties dialog box, select the baud rate.

4. Click OK to save the new baud rate selection and close the Communication Properties dialog box.

Automatically Changing the Baud Rate of the Serial Port to the Baud Rate of the NXIC CTD

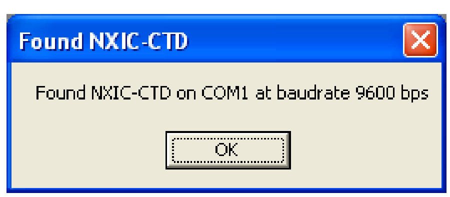
To automatically change the baud rate of the serial port to the baud rate of the NXIC CTD:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose CTD ➤ Communications ➤ Find CTD.

   CTDPro determines the baud rate of the instrument and then changes the baud rate of the serial port to the same. When changed, the Found NXIC-CTD window opens confirming the serial port to which the instrument is connected and the selected baud rate:



3. Click OK in the Found NXIC CTD window to close the window.

Changing the Baud Rate of the NXIC CTD and the Serial Port

To change the baud rate of the NXIC CTD and the serial port:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose CTD ➤ Communications ➤ Baud Rate.

   The Communication Rate dialog box shown in Figure 2-5 opens.

3. In the Baudrate area of the Communication Rate dialog box, select the baud rate.

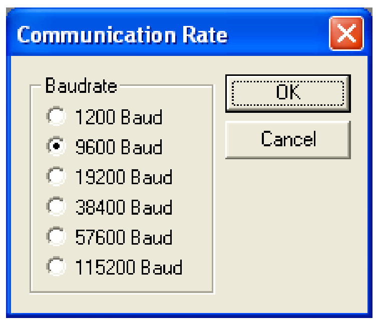


Figure 2-5: ***The Communication Rate Dialog Box***

4. Click OK to save the baud rate selection and close the Communication Rate dialog box.

   A NXIC CTD window opens confirming the selected baud rate:

5. Click OK in the NXIC CTD window to close it.

Connecting and Setting up Communications with a GPS

If you have a global positioning system (GPS), you can connect it to your computer. With the GPS connected you can have CTDPro include the latitude, longitude and time of day with the data. A NEMA GPGGA string is required.

To connect a GPS connect the RS-232 output of the GPS to an available serial port on your computer. Once connected you can set up communications with the GPS.

To set up communications with a GPS:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose NAV ➤ Setup.

   The Navigation Setup dialog box shown in Figure 2-6 opens.

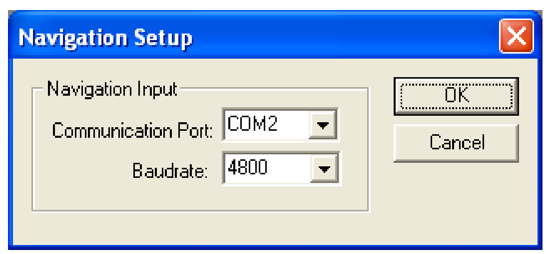


Figure 2-6: ***The Navigation Setup Dialog Box***

3. Select the serial port to which the GPS is connected from the Communication Port drop-down list box.

4. Select the baud rate for the serial port from the Baudrate drop-down list box.

   The default baud rate is 4800 bits/sec and is typically the baud rate used.

5. Click OK to save the settings and close the Navigation Setup dialog box.

SECTION 3: Checking, Configuring and Deploying the NXIC CTD

You can configure and deploy the NXIC CTD under its own internal battery power and store all the data in the instrument's internal memory. After recovering the instrument, you can retrieve and save the data. This section describes the configuration settings for the NXIC CTD and provides instructions on how to perform some predeployment checks and how to configure and deploy the NXIC CTD in each of four different running modes. In addition, instructions are provided on how to select from some available communications options that affect the operation of the instrument and the data output format.

Note: *Before you can configure the NXIC CTD, you must select it in CTDPro as described in "Selecting the NXIC CTD" on page 2-3. The CTD menu will not be displayed unless the NXIC CTD is selected.*

NXIC CTD Configuration Settings

Configuring the NXIC CTD requires that you make the following settings:

- Select the running mode.
- Select the instrument run times, if required.
- Select whether to average the data.
- Select the instrument sampling rate.
- Reset the local time and date.

The NXIC CTD is configured from the NXIC CTD Configuration dialog box when deploying the instrument as described in "Configuring and Deploying the NXIC CTD" on page 3-14. The NXIC CTD Configuration dialog box is shown in Figure 3-1 and is opened by choosing CTD ➤ Configure and Deploy. The NXIC CTD Configuration dialog box also displays the serial number and the time and date settings of the connected instrument. The time and date settings can be reset directly from the dialog box to that of the connected computer.

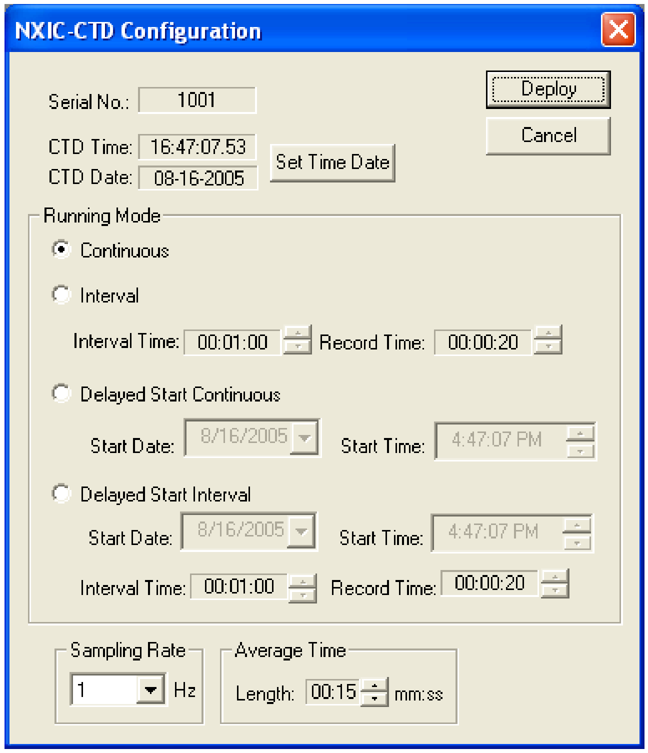


Figure 3-1: ***The NXIC CTD Configuration Dialog Box***

Running Modes

There are four running modes for acquiring and storing data:

Continuous mode where data are continuously acquired and stored at the selected sampling rate. This mode is recommended only for short deployments as it quickly depletes the battery pack and fills memory.

Interval mode where data are acquired and stored at the selected sampling rate for specified periods—the Record Time, at repeated intervals—the Interval Time.

Delayed Start Continuous mode similar to Continuous mode, but where the instrument begins acquiring and storing data at a future date and time—the Start Date and Start Time. This mode allows the instrument to be set up on shore, after which data are not collected until the specified time and date.

Delayed Start Interval mode similar to Interval mode, but where the instrument begins acquiring and storing data at a future date and time—the Start Date and Start Time. This mode allows the instrument to be set up on shore, after which data are not collected until the specified time and date.

The running mode is selected in the Running Mode area of the NXIC CTD Configuration dialog box.

A run time diagram that illustrates one Interval Time cycle is shown in Figure 3-2. The Interval Time and Record Time are entered in the Running Mode area of the NXIC CTD Configuration dialog box in the following scroll boxes:

Interval Time: The time in hours, minutes and seconds between the start of each Record Time.

Record Time: The time in hours, minutes and seconds beginning at the start of each Interval Time during which the instrument is on and collecting data.

Note: *The Record Time must be less than the Interval Time.*

The Start Date and Start Time are entered in the Running Mode area in the following scroll boxes:

Start Date: The date as the month, day and year on which the instrument will turn on and begin collecting data at the Start Time.

Start Time: The time in hours, minutes and seconds, and AM or PM, at which the instrument will turn on and begin collecting data on the Start Date.

Averaged Data

To save memory, data that are collected continuously or during the Record Time can be averaged over a specified interval—the Average Time. The Average Time is entered in minutes and seconds in the Length scroll box, which is in the Average Time area of the NXIC CTD Configuration dialog box. Average Times are shown in the run time diagram in Figure 3-2. The minimum Average Time is 5 seconds; the maximum, 59 minutes, 59 seconds. Enter 4 seconds or less for no averaging.

Note: *When running in Interval or Delayed Interval mode, the Average Time should be set to an integer number that is evenly divisible into the Record Time. For example, if the Record Time is 10 minutes, the Average Time should be set to 1, 2, 5, or 10 minutes. Otherwise the last Average Time in each interval will be automatically shortened.*

Sampling Rate

The NXIC CTD sampling rate is selected in the Sampling Rate area of the NXIC CTD Configuration dialog box. The sampling rate determines the frequency at which the NXIC CTD measures and stores the data. There are 15 sampling rates, 1 Hz through 15 Hz in 1-Hz increments.

Note: *The faster the sampling rate the faster the available memory will be filled.*

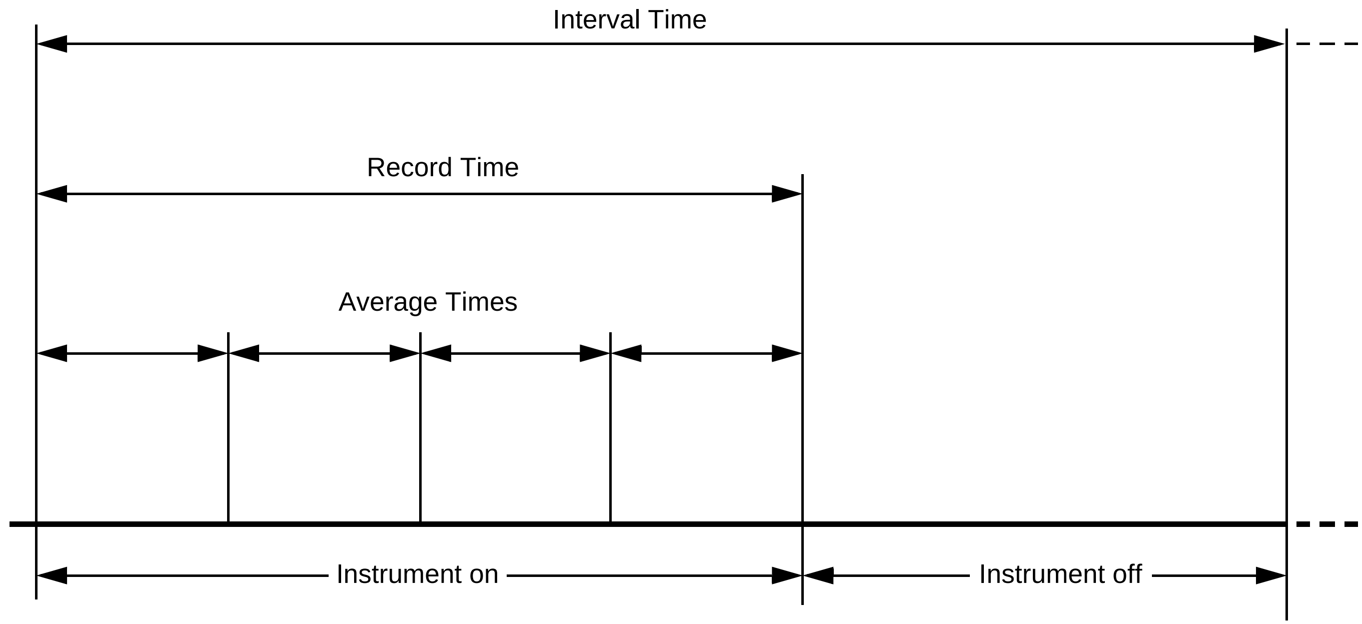


Figure 3-2: ***Run Time Diagram, Including Average Times, for One Interval Time Cycle***

Time and Date

The NXIC CTD time and date are displayed in the CTD Time and CTD Date displays in the NXIC CTD Configuration dialog box. The time and date can be reset at any time to that of the computer on which CTDPro is running by clicking Set Time Date.

Serial Number

The serial number of the NXIC CTD is displayed in the Serial No. display in the NXIC CTD Configuration dialog box and is acquired directly from the instrument.

Communications Options

Communications options can be selected in the Advanced Settings dialog box shown in Figure 3-3. To open the Advanced Settings dialog box, choose CTD ➤ Communications ➤ Options.

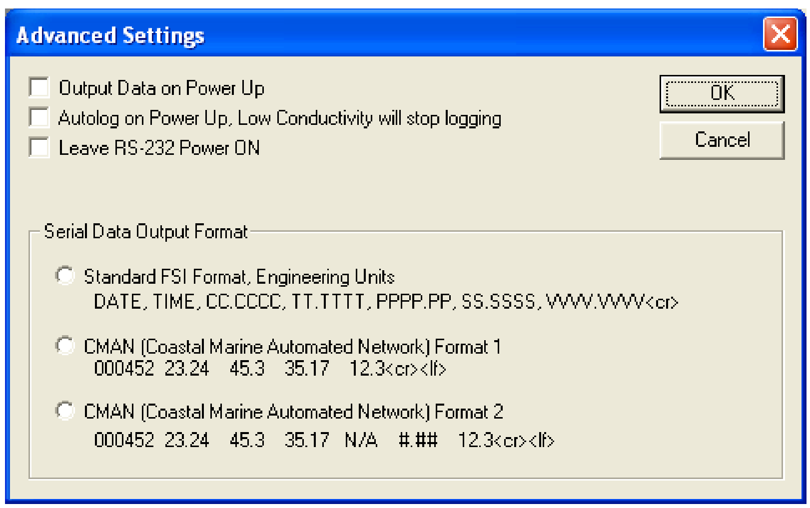


Figure 3-3: ***The Advanced Settings Dialog Box***

The Advanced Settings dialog box allows you to modify the standard operation of the NXIC CTD, including some hardware functions and the data output format. After making the selections, click OK to save the selections and close the Advanced Setting dialog box.

The hardware functions that can be modified are the following:

Output Data on Power Up causes the instrument to immediately output data when power is applied.

Autolog on Power Up, Low Conductivity will stop logging causes the instrument to begin recording data when power is applied and stop recording data when conductivity is below a specified threshold. This feature allows continuous, multiple casts to be made.

Leave RS-232 Power ON ensures the instrument will function properly with RTS/CTS handshaking.

The data output format selections are the following:

Standard FSI Format, Engineering Units uses standard FSI data output formatting.

CMAN (Coastal Marine Automated Network) Format 1 uses CMAN Format 1 formatting.

CMAN (Coastal Marine Automated Network) Format 2 uses CMAN Format 2 formatting.

Predeployment Checks

Before configuring and deploying the NXIC CTD, you should perform some predeployment checks. These checks comprise verifying adequate battery and memory capacity for the required length of deployment and running the diagnostic tests on the instrument.

Verifying Battery Pack Capacity and Memory Requirements

Before deploying the NXIC CTD you should verify that the battery pack capacity is sufficient for the intended deployment period and that there is enough memory to store all the data acquired during this period. CTDPro provides an estimator which calculates the available running days based on the selected running mode and the known—or measured—battery pack capacity in the instrument. In addition, the estimator calculates the number of days at which the memory will fill based on the selected running mode and sampling rate. The calculated results are displayed and can be printed and saved to a file.

To verify sufficient battery pack capacity and enough memory for a deployment:

1. If you want CTDPro to measure the battery pack capacity in the instrument when calculating the available running days, connect the instrument to your computer.

   If you want to enter the battery pack capacity directly to calculate the available running days, you do not have to connect the instrument to your computer.

2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

3. Choose CTD ➤ Battery Life.

   The Battery Life dialog box shown in Figure 3-4 opens.

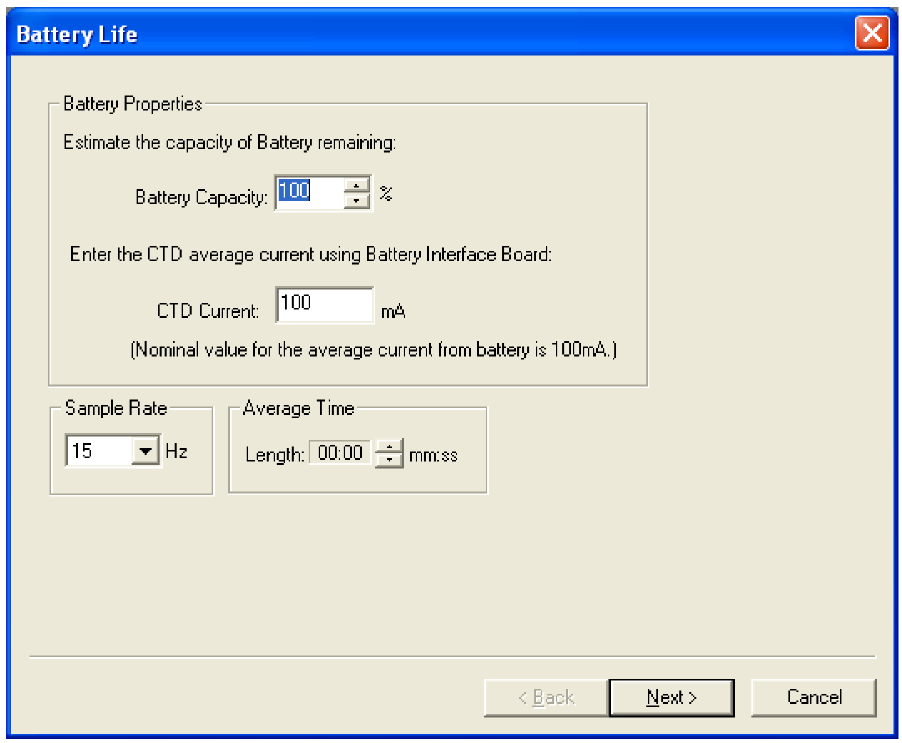


Figure 3-4: ***The Battery Life Dialog Box—Entering the Battery Pack Capacity Sample Rate and Average Times***

4. If you want to enter the battery pack capacity directly, enter it in percent in the Battery Capacity scroll box in the Battery Properties area of the Battery Life dialog box. Or click the up or down arrow in the scroll box to enter the capacity. Otherwise, if the instrument is connected, you can allow CTDPro to measure and enter the capacity automatically.

Caution: *Do not enter the measured current drawn from an external power supply in the CTD Current text box. The entry in the CTD Current text box is the average current drawn from an installed battery pack only.*

Note: *The entry in the CTD Current text box normally should not be changed as this value is factory measured. However, if the NXIC CTD is supplying power to optional external sensors, the entered value should include the current drawn by these sensors.*

5. If you want to change the measured current drawn by the instrument, enter the current in mA in the CTD Current text box.

6. In the Sample Rate area, select the desired sampling rate in hertz of the instrument from the drop-down list box.

7. In the Average Time area, use the up and down arrows in the Length scroll box to enter the Average Time in minutes and seconds (mm:ss).

8. Click Next.

   The Battery Life dialog box shown in Figure 3-5 opens.

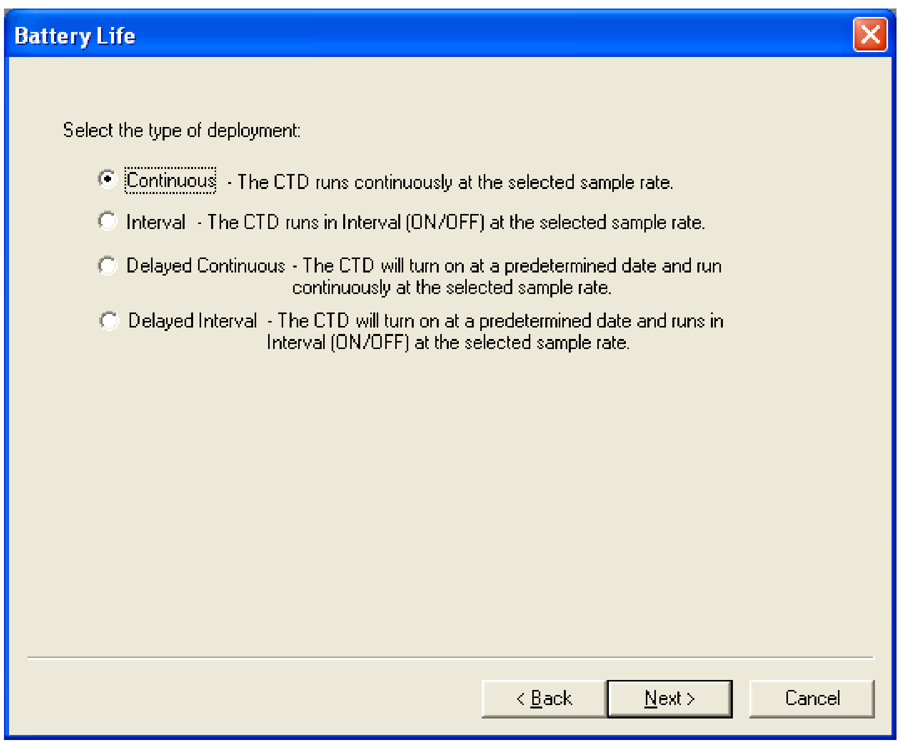


Figure 3-5: ***The Battery Life Dialog Box—Selecting the Running Mode***

9 Do one of the following;

- Select Continuous.
- Select Interval, click Next, and then enter the Interval Time and Record Time.
- Select Delayed Continuous, click Next, and then enter the Start Date and Start Time.
- Select Delayed Interval, click Next, and then enter the Interval Time, the Record Time, the Start Date, and the Start Time.

10 Click Next.

The Battery Life dialog box shown in Figure 3-6 opens displaying the deployment summary, which includes the number of available running days under "BATTERY STATISTICS," the number of days at which memory will fill under "MEMORY STATISTICS," and additional information.

11 To print the information, click Print, select the printer to use, and then click OK.

12 To save the information, click Save.

The Save As dialog box for battery pack information files shown in Figure 3-7 opens. This dialog box is used to create the file in which to save the battery pack and memory information.

13 Click the arrow in the Save in drop-down list box and select the folder in which to save the battery pack information file.

14 In the File name text box enter the name of the file in which to save the battery pack information. The extension *.txt* is added automatically.

15 Click Save.

The Save As dialog box for battery pack information files closes and the battery pack information is saved to the specified file. The file can be opened in any text editor for viewing and printing.

16 Click Finish.

The Battery Life dialog box closes.

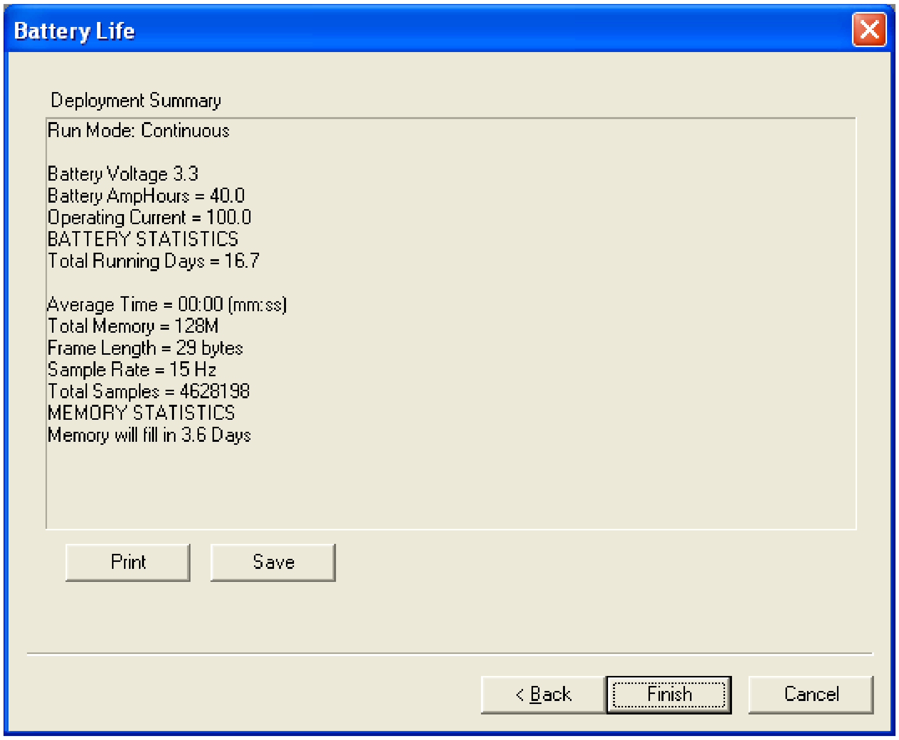


Figure 3-6: ***The Battery Life Dialog Box—Deployment Summary***

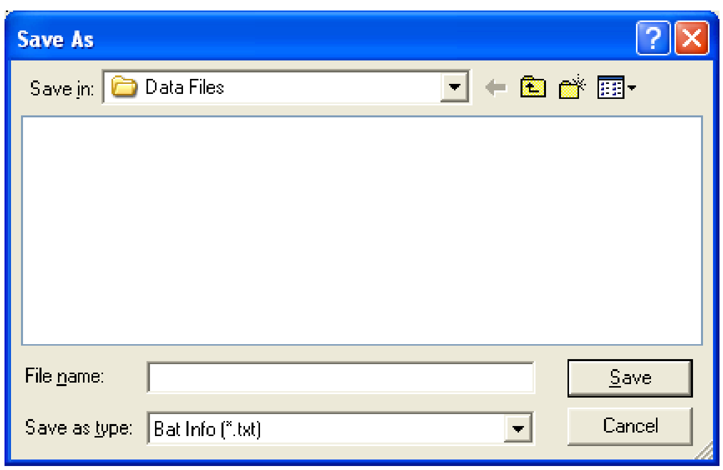


Figure 3-7: ***The Save As Dialog Box for Battery Pack Information Files***

Running the Diagnostic Tests

Before deploying the NXIC CTD you should run the diagnostic tests on the instrument. These tests are provided by CTDPro and encompass pass/fail checks of the conductivity, pressure and temperature readings of the analog-to-digital converter (A/D); the conductivity, pressure and temperature data quality; and a number of operational parameters. In addition, you can verify calibration of the NXIC conductivity sensor with a conductivity loop test device.

Note: *Diagnostic testing of the NXIC CTD must be performed in air.*

To run the diagnostic tests on the NXIC CTD and verify calibration of the NXIC conductivity sensor:

1. Connect the NXIC CTD to your computer.

2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

3. Choose CTD ➤ Diagnostics.

   The Diagnostics dialog box shown in Figure 3-8 opens and displays, in the CTD Information area, the serial number of the NXIC CTD and the firmware version that is installed in the instrument.

4. Click Run.

   The Save As dialog box for diagnostics data files shown in Figure 3-9 opens. This dialog box is used to create the file in which to save the diagnostics data.

5. Click the arrow in the Save in drop-down list box and select the folder in which to save the diagnostics data file.

6. In the File name text box enter the name of the file in which to save the diagnostics data. The extension *.txt* is added automatically.

7. Click Save.

   The Save As dialog box for diagnostics data files closes. CTDPro performs diagnostic testing of the NXIC CTD and the results are displayed as check marks in the appropriate Pass and Fail check boxes in the A/D Readings, Data Quality and Operation areas of the Diagnostics dialog box as shown in Figure 3-10 on page 3-13. In the Operation area the Internal Supply,

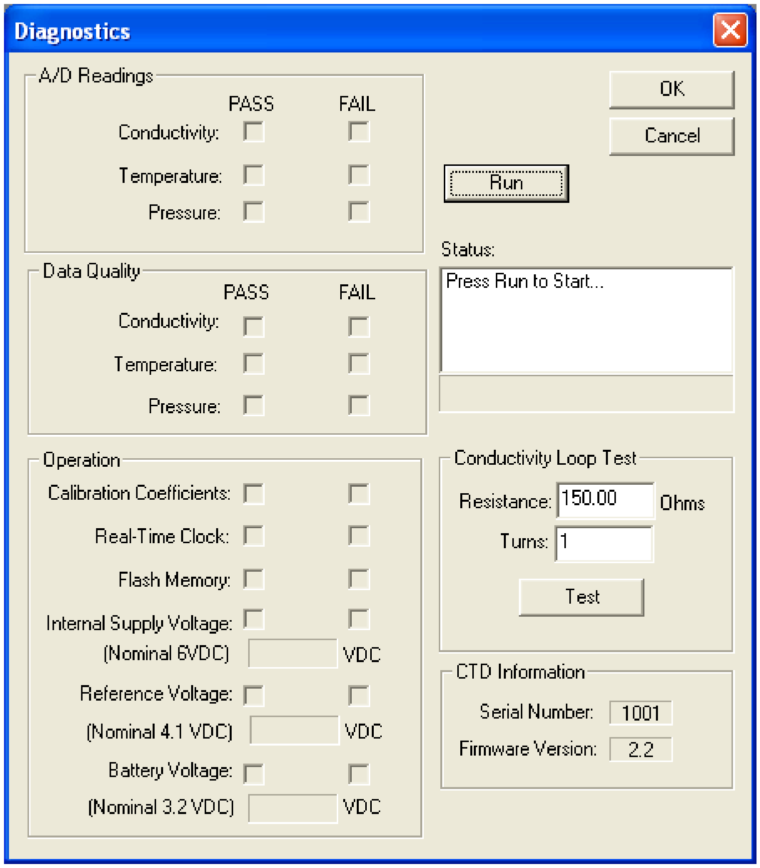


Figure 3-8: ***The Diagnostics Dialog Box***

Referenc and Battery Voltage displays display the measured voltages. In addition, the Status display displays the diagnostics data acquired during testing along with a progress bar indicator.

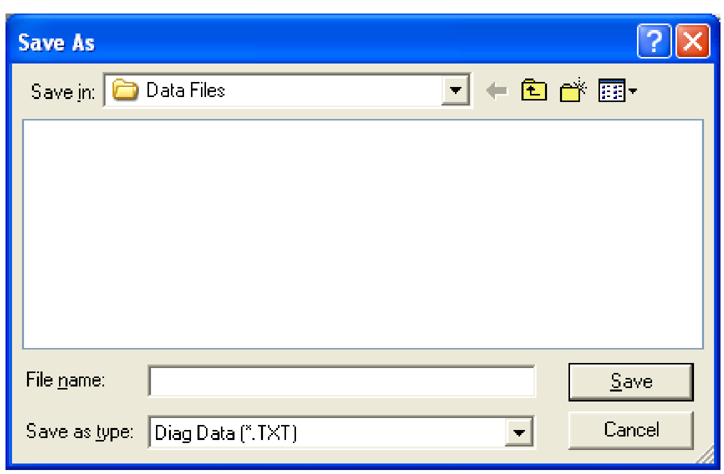


Figure 3-9: ***Save As Dialog Box for Diagnostics Data Files***

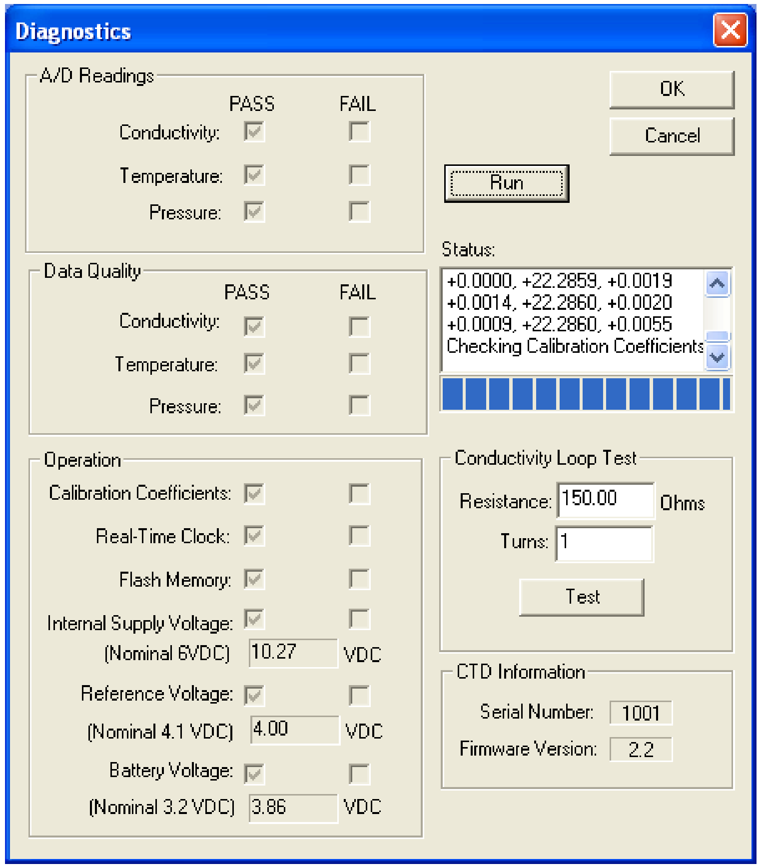


Figure 3-10: ***Results of Diagnostic Testing in the Diagnostics Dialog Box***

After diagnostic testing is complete, the diagnostics data is saved in the diagnostics data file. The file can later be opened in any text editor for viewing and printing.

8 Enter the conductivity loop test device resistance in the Resistance text box in the Conductivity Loop Test area of the Diagnostics dialog box. The resistance is printed on the label of the conductivity loop test device.

The default resistance is 150 ohms.

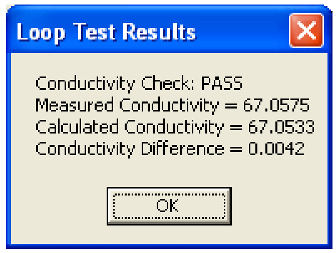
9 Insert the conductivity loop test device cable through the NXIC conductivity sensor and connect the two connectors of the loop together.

10 Enter the number of loops through the sensor in the Turns text box.

The default number of turns is 1.

11. Click Test.

    CTDPro checks the resistance of the conductivity loop test device and displays the results plus the difference between the entered value and the measured value in the Loop Test Results window:



12. Click OK in the Loop Test Results window to close it.

13. Click OK in the Diagnostics dialog box to close it.

Configuring and Deploying the NXIC CTD

The NXIC CTD is configured and deployed in one of the four running modes: Continuous, Interval, Delayed Start Continuous, or Delayed Start Interval. In addition, in all modes you can select to average the data over the Average Time.

Note: *When selecting to average the data, the Average Time should be evenly divisible into the Record Time.*

Configuring and Deploying the NXIC CTD in Continuous Mode

To configure a NXIC CTD for deployment and to acquire and store data in Continuous mode:

1. If necessary, replace the battery pack in the NXIC CTD. (See “Replacing the Battery Pack” on page 6-1 for instructions on how to replace the battery pack.)

    Note: *Replacing the battery pack will not affect the instrument’s configuration, stored data or time and date settings.*

2. Connect the NXIC CTD to your computer.

3 Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

CTDPro starts and the CTDPro Main window opens.

4 Choose CTD ➤ Configure and Deploy.

If the NXIC CTD is currently logging data, a NXIC CTD window opens asking if you want to stop logging:

5 Click Yes to stop data logging, or click No to continue.

If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

If you click yes, data logging stops, the NXIC CTD window closes and the NXIC CTD Configuration dialog box shown in Figure 3-1 on page 3-2 opens.

6 If the local time and date require setting, click Set Time Date in the NXIC CTD Configuration dialog box.

The Set Time window opens displaying the time and date as acquired from the computer on which CTDPro is running, along with the difference in time between that of the computer and the instrument.

7 Click OK to save the new time and date and close the Set Time window.

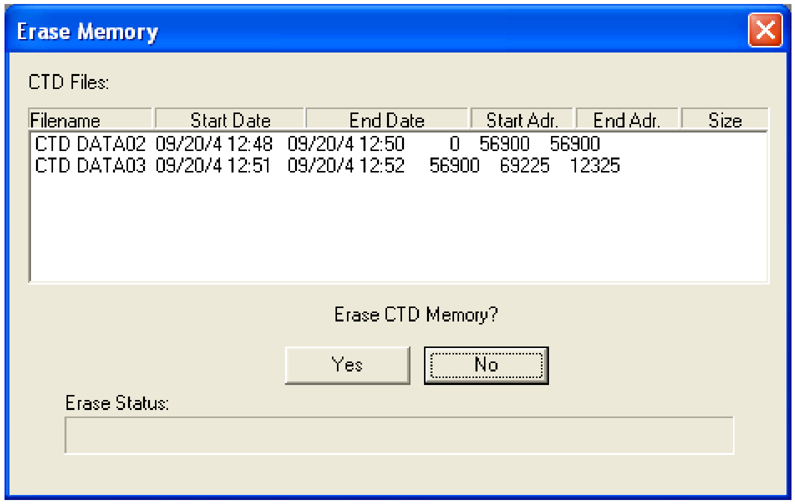
8 In the Running Mode area of the NXIC CTD Configuration dialog box, select Continuous.

9 In the CTD Sampling Rate area, select the desired sampling rate in hertz of the NXIC CTD from the drop-down list box.

10 In the Average Time area, use the up and down arrows in the Length scroll box to enter the Average Time in minutes and seconds (mm:ss).

11 Click Deploy.

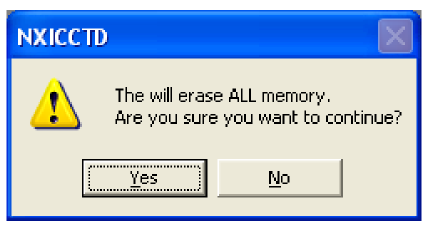
The Erase Memory window opens:



Note: *Clicking No in the Erase Memory window will append the new data file to the last data file stored in memory. No memory will be erased.*

12 To erase all of memory, click Erase.

A NXIC CTD window opens asking if you want to erase all of memory:

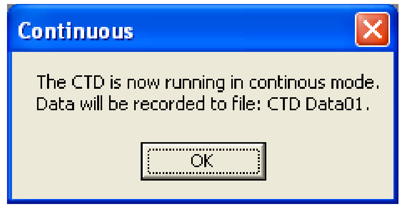


13 Click Yes to confirm that you want to erase all of memory.

The memory is erased as indicated by the Erase Status progress bar in the Erase Memory window, and then the Data Filename window opens:

14 Enter the data file name (10 characters maximum) in the Enter the filename to store the CTD data text box, and then click OK.

The Continuous window opens indicating that the CTD is running in Continuous mode:



15 Click OK.

The Continuous window and the NXIC CTD Configuration dialog box close. Data will continue to be acquired and stored until data logging is stopped, the memory is full or the battery pack is depleted.

16 Disconnect the test cable from the instrument and install the dummy plug.

Caution: *Failure to install the dummy plug will cause the connector pins to corrode and may cause damage to the instrument.*

17 Deploy the instrument in the required manner.

Configuring and Deploying the NXIC CTD in Interval Mode

To configure a NXIC CTD for deployment and to acquire and store data in Interval mode:

1 If necessary, replace the battery pack in the NXIC CTD. (See “Cleaning the NXIC CTD and Replacing the Battery Pack” on page 6-1 for instructions on how to replace the battery pack.)

Note: *Replacing the battery pack will not affect the instrument’s configuration, stored data or time and date settings.*

2 Connect the NXIC CTD to your computer.

3 Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

CTDPro starts and the CTDPro Main window opens.

4 Choose CTD ➤ Configure and Deploy.

If the NXIC CTD is currently logging data, a NXIC CTD window opens asking if you want to stop logging:

5. Click Yes to stop data logging, or click No to continue.

   If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

   If you click yes, data logging stops, the NXIC CTD window closes and the NXIC CTD Configuration dialog box shown in Figure 3-1 on page 3-2 opens.

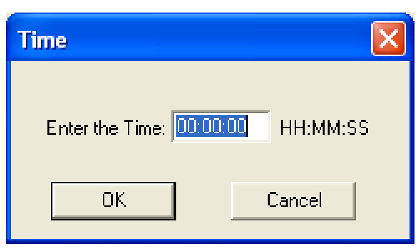
6. If the local time and date require setting, click Set Time Date in the NXIC-CTD Configuration dialog box.

   The Set Time window opens displaying the time and date as acquired from the computer on which CTDPro is running, along with the difference in time between that of the computer and the instrument.

   Click OK to save the new time and date and close the Set Time window.

7. In the Running Mode area of the NXIC CTD Configuration dialog box, select Interval.

8. Using the up and down arrows in the Interval Time and Record Time scroll boxes, enter the Interval Time and Record Time in hours, minutes and seconds (hh:mm:ss). Or instead, click inside each of the scroll boxes, one at a time, to open a Time window:



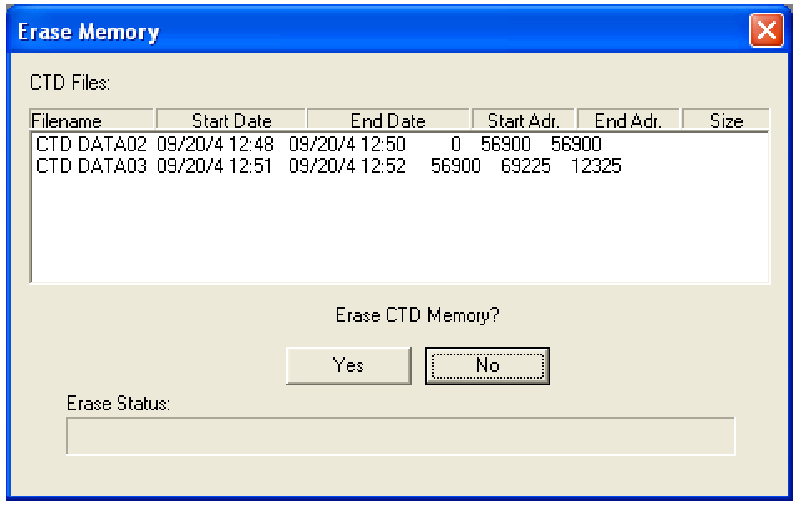
   Enter the time in hours, minutes and seconds (hh:mm:ss) in the Enter the Time text box, and then click OK. The minimum Record Time is 10 seconds.

9. In the Sampling Rate area, select the desired sampling rate in hertz of the NXIC CTD from the drop-down list box.

10 In the Average Time area, use the up and down arrows in the Length scroll box to enter the Average Time in minutes and seconds (mm:ss).

11 Click Deploy.

The Erase Memory window opens:



Note: *Clicking No in the Erase Memory window will append the new data file to the last data file stored in memory. No memory will be erased.*

12 To erase all of memory, click Erase.

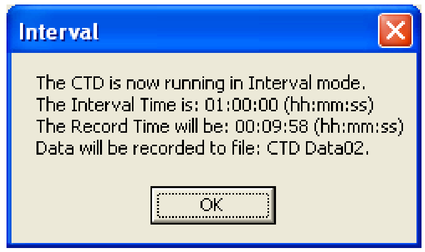
A NXIC CTD window opens asking if you want to erase all of memory:

13 Click Yes to confirm that you want to erase all of memory.

The memory is erased as indicated by the Erase Status progress bar in the Erase Memory window, and then the Data Filename window opens:

14 Enter the data file name (10 characters maximum) in the Enter the filename to store the CTD data text box, and then click OK.

The Interval window opens indicating that the CTD is running in Interval mode:



15 Click OK.

The Interval window and the NXIC CTD Configuration dialog box close. Data will continue to be acquired and stored until data logging is stopped, the memory is full or the battery pack is depleted.

16 Disconnect the test cable from the instrument and install the dummy plug.

Caution: *Failure to install the dummy plug will cause the connector pins to corrode and may cause damage to the instrument.*

17 Deploy the instrument in the required manner.

Configuring and Deploying the NXIC CTD in Delayed Start Continuous Mode

To configure a NXIC CTD for deployment and to acquire and store data in Delayed Start Continuous mode:

1 If necessary, replace the battery pack in the NXIC CTD. (See “Cleaning the NXIC CTD and Replacing the Battery Pack” on page 6-1 for instructions on how to replace the battery pack.)

Note: *Replacing the battery pack will not affect the instrument’s configuration, stored data or time and date settings.*

2 Connect the NXIC CTD to your computer.

3 Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

CTDPro starts and the CTDPro Main window opens.

4 Choose CTD ➤ Configure and Deploy.

If the NXIC CTD is currently logging data, a NXIC CTD window opens asking if you want to stop logging:

5 Click Yes to stop data logging, or click No to continue.

If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

If you click yes, data logging stops, the NXIC CTD window closes and the NXIC CTD Configuration dialog box shown in Figure 3-1 on page 3-2 opens.

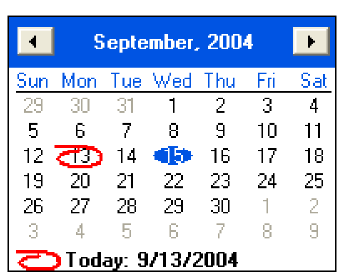
6 If the local time and date require setting, click Set Time Date in the NXIC-CTD Configuration dialog box.

The Set Time window opens displaying the time and date as acquired from the computer on which CTDPro is running, along with the difference in time between that of the computer and the instrument.

Click OK to save the new time and date and close the Set Time window.

7 In the Running Mode area of the NXIC CTD Configuration dialog box, select Delayed Start Continuous.

8 Enter the Start Date in months, days and years (mm/dd/yyyy) in the Start Date scroll box by clicking the month, day and year digits, one at a time, and then entering the information directly. Or instead, click the down arrow to open a calendar:



Click the left or right arrow to select the month and year, and then click the day.

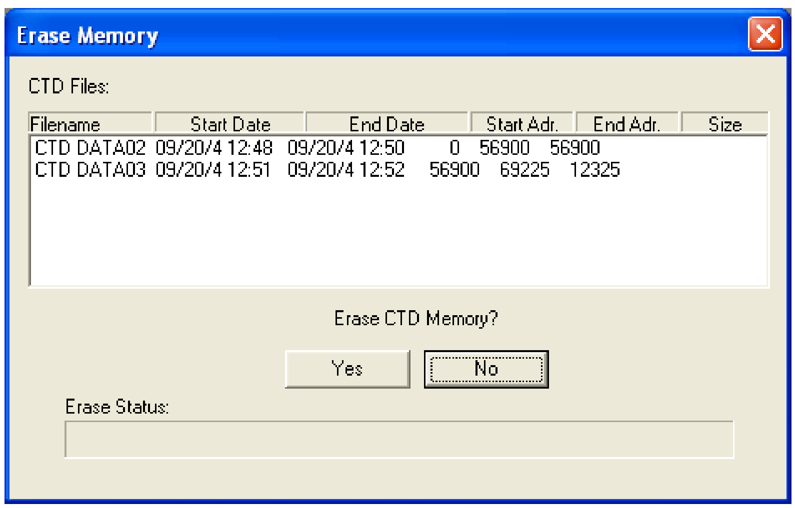
9 Enter the Start Time in hours, minutes and seconds (hh:mm:ss) in the Start Time scroll box by clicking the hours, minutes and seconds digits, one at a time, and then clicking the up and down arrows or entering the information directly. Enter "a" or "A" for AM or "p" or "P" for PM or use the up and down arrows.

10 In the CTD Sampling Rate area, select the desired sampling rate in hertz of the NXIC CTD from the drop-down list box.

11 In the Average Time area, use the up and down arrows in the Length scroll box to enter the Average Time in minutes and seconds (mm:ss).

12 Click Deploy.

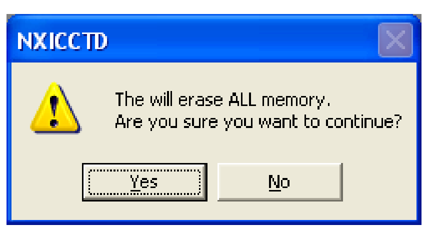
The Erase Memory window opens:



Note: *Clicking No in the Erase Memory window will append the new data file to the last data file stored in memory. No memory will be erased.*

13 To erase all of memory, click Erase.

A NXIC CTD window opens asking if you want to erase all of memory:



14 Click Yes to confirm that you want to erase all of memory.

The memory is erased as indicated by the Erase Status progress bar in the Erase Memory window, and then the Data Filename window opens:

15 Enter the data file name (10 characters maximum) in the Enter the filename to store the CTD data text box, and then click OK.

The Delayed Start Continuous window opens indicating that the CTD is running in Delayed Start Continuous mode:

16 Click OK.

The Delayed Start Continuous window and the NXIC CTD Configuration dialog box close. Data will continue to be acquired and stored until data logging is stopped, the memory is full or the battery pack is depleted.

17 Disconnect the test cable from the instrument and install the dummy plug.

Caution: *Failure to install the dummy plug will cause the connector pins to corrode and may cause damage to the instrument.*

18 Deploy the instrument in the required manner.

Configuring and Deploying the NXIC CTD in Delayed Start Interval Mode

To configure a NXIC CTD for deployment and to acquire and store data in Delayed Start Interval mode:

1. If necessary, replace the battery pack in the NXIC CTD. (See “Cleaning the NXIC CTD and Replacing the Battery Pack” on page 6-1 for instructions on how to replace the battery pack.)

   Note: *Replacing the battery pack will not affect the instrument’s configuration, stored data or time and date settings.*

2. Connect the NXIC CTD to your computer.

3. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

4. Choose CTD ➤ Configure and Deploy.

   If the NXIC CTD is currently logging data, a NXIC CTD window opens asking if you want to stop logging:

5. Click Yes to stop data logging, or click No to continue.

   If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

   If you click yes, data logging stops, the NXIC CTD window closes and the NXIC CTD Configuration dialog box shown in Figure 3-1 on page 3-2 opens.

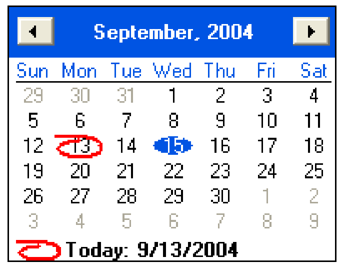
6. If the local time and date require setting, click Set Time Date in the NXIC-CTD Configuration dialog box.

   The Set Time window opens displaying the time and date as acquired from the computer on which CTDPro is running, along with the difference in time between that of the computer and the instrument.

   Click OK to save the new time and date and close the Set Time window.

7 In the Running Mode area of the NXIC CTD Configuration dialog box, select Delayed Start Interval.

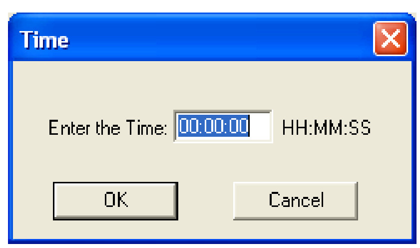
8 Enter the Start Date in months, days and years (mm/dd/yyyy) in the Start Date scroll box by clicking the month, day and year digits, one at a time, and then entering the information directly. Or instead, click the down arrow to open a calendar:



Click the left or right arrow to select the month and year, and then click the day.

9 Enter the Start Time in hours, minutes and seconds (hh:mm:ss) in the Start Time scroll box by clicking the hours, minutes and seconds digits, one at a time, and then clicking the up and down arrows or entering the information directly. Enter "a" or "A" for AM or "p" or "P" for PM or use the up and down arrows.

10 Using the up and down arrows in the Interval Time and Record Time scroll boxes, enter the Interval Time and Record Time in hours, minutes and seconds (hh:mm:ss). Or instead, click inside each of the scroll boxes, one at a time, to open a Time window:



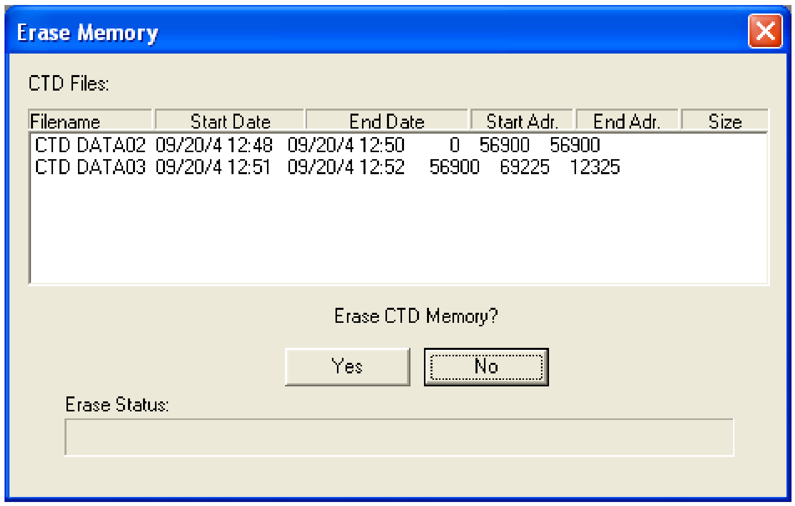
Enter the time in hours, minutes and seconds (hh:mm:ss) in the Enter the Time text box, and then click OK. The minimum Record Time is 10 seconds.

11 In the CTD Sampling Rate area, select the desired sampling rate in hertz of the NXIC CTD from the drop-down list box.

12. In the Average Time area, use the up and down arrows in the Length scroll box to enter the Average Time in minutes and seconds (mm:ss).

13. Click Deploy.

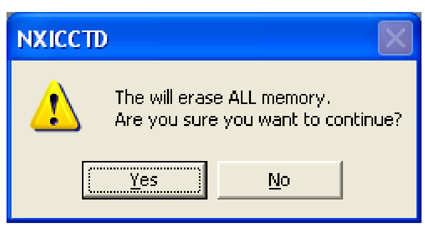
    The Erase Memory window opens:



Note: *Clicking No in the Erase Memory window will append the new data file to the last data file stored in memory. No memory will be erased.*

14. To erase all of memory, click Erase.

    A NXIC CTD window opens asking if you want to erase all of memory:

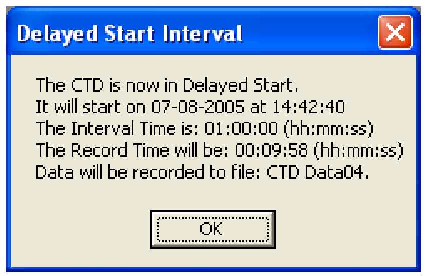


15. Click Yes to confirm that you want to erase all of memory.

    The memory is erased as indicated by the Erase Status progress bar in the Erase Memory window, and then the Data Filename window opens:

16. Enter the data file name (10 characters maximum) in the Enter the filename to store the CTD data text box, and then click OK.

    The Delayed Start Interval window opens indicating that the CTD is running in Delayed Start Interval mode:



17. Click OK.

    The Delayed Start Interval window and the NXIC CTD Configuration dialog box close. Data will continue to be acquired and stored until data logging is stopped, the memory is full or the battery pack is depleted.

18. Disconnect the test cable from the instrument and install the dummy plug.

Caution: *Failure to install the dummy plug will cause the connector pins to corrode and may cause damage to the instrument.*

19. Deploy the instrument in the required manner.

SECTION 4: Retrieving and Displaying Data from the NXIC CTD

D**ata** that are stored in the NXIC CTD can be downloaded file by file to your computer. Once downloaded the data can be exported to a text or spreadsheet file for viewing and printing, or to FSIPost for post processing. The data can also be viewed on graphs and the graphs printed and saved. This section provides instructions on how to download and save data that are stored in the NXIC CTD, and once saved, how to export the data for viewing, printing and processing. Instructions are also provided on how to erase all the data in the instrument.

Note: *The NXIC CTD always records measured conductivity, temperature and pressure, along with calculated salinity and sound velocity, the date and time, the battery voltage, and the optional external sensor data. In addition, when exporting data to a text or spreadsheet file, or to FSIPost, you can choose to have CTDPro calculate additional parameters from the measured parameters as described in "Exporting Saved Data" on page 4-4. The measured parameters, the parameters calculated by the NXIC CTD and the parameters calculated by CTDPro are listed and described in "APPENDIX A: Measured and Calculated Parameters."*

Downloading and Saving Data from the NXIC CTD

Data that are stored in the NXIC CTD can be downloaded file by file to your computer and saved as CTD files, files with extension *.ctd*. Once downloaded the data can be exported to a text or spreadsheet file for viewing and printing, or to FSIPost for post processing.

To download data from a NXIC CTD:

1. Connect the NXIC CTD to your computer.

2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

3 Choose CTD ➤ Memory ➤ View Files.

If the NXIC CTD is currently logging data, a NXIC CTD window opens asking if you want to stop logging:

4 Click Yes to stop data logging, or click No to continue.

If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

If you click yes, data logging stops, the NXIC CTD window closes and the Download dialog box shown in Figure 4-1 opens.

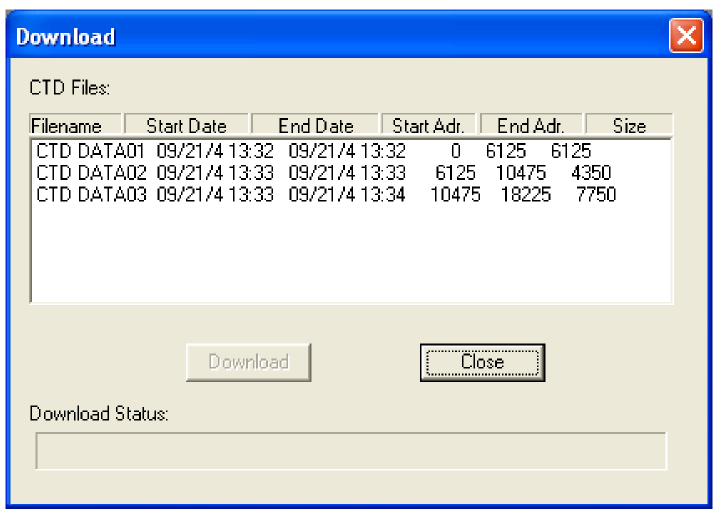


Figure 4-1: ***The Download Dialog Box***

5 Click the file you want to download, and then click Download.

The Save As dialog box for CTD data files shown in Figure 4-2 opens. This dialog box is used to create the file in which to save the retrieved data.

6 Click the arrow in the Save in drop-down list box and select the folder in which to save the data file.

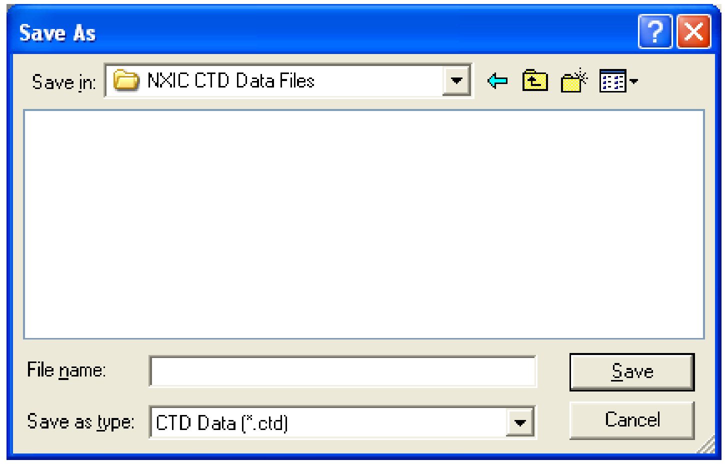
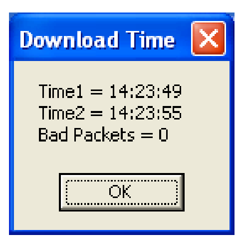


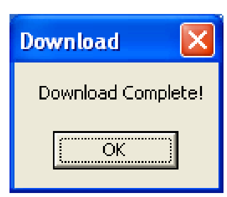
Figure 4-2: ***The Save As Dialog Box for CTD Data Files***

7 In the File name text box enter the name of the file in which to save the data. The extension *.ctd* is added automatically.

8 Click Save.

The Save As dialog box for data files closes and the data are downloaded and saved. The download process is indicated by the Download Status bar in the Download dialog box, and after the download is complete, the Download Time and Download windows open:





9 Click OK in the Download Time and Download windows to close them.

10 Select another file to download or click Close in the Download dialog box to close it.

Exporting and Viewing Saved Data

After data have been downloaded from the NXIC CTD and saved to a CTD data file, the data in the CTD file can be exported to a text file, a file of extension *.txt*, and viewed. The data can also be exported to a spreadsheet file or to FSIPost. The specific parameters to be exported can be selected, including calculated parameters and the date and time. You can view a text file directly in CTDPro or by using a text editor program installed on your computer. A spreadsheet program is required to view and process the data in a spreadsheet. When exporting to FSIPost, CTDPro creates three files: DAT, C00 and HDR. These files have extensions *.dat*, *.c00* and *.hdr*, respectively, and are used by FSIPost for processing.

> ***Note:*** *For the most accurate depth calculation, enter the latitude at which the NXIC CTD was deployed, if available, in the Latitude for Depth text box in the Properties dialog box. The Properties dialog box is shown in Figure 2-1 on page 2-4. To open the Properties dialog box choose Properties from the File menu.*

Exporting Saved Data

To export saved data as a text file, spreadsheet file or FSIPost file:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose File ➤ Export.

   The Export dialog box shown in Figure 4-3 opens:

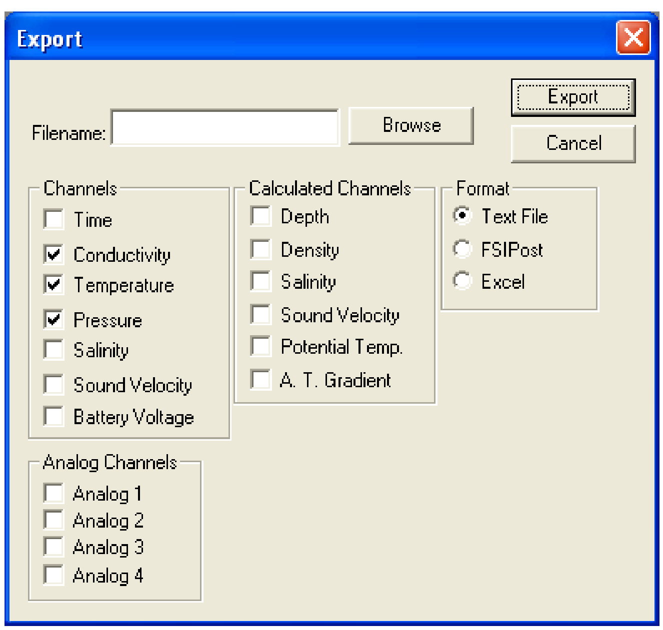


Figure 4-3: ***The Export Dialog Box***

3. In the Channels, Calculated Channels and Analog Channels areas of the Export dialog box, select the corresponding check boxes for the data that you want to export. Clear the check boxes for the data that you do not.

Note: *Parameters in the Channels area of the Export dialog box are measured or calculated by the NXIC CTD, parameters in the Calculated Channels area are calculated by CTDPro, and parameters in the Analog Channels area are the optional external sensor DC outputs.*

4. In the Format area select the type of file to which to export.

5. Click Browse.

The Open dialog box for CTD data files shown in Figure 4-4 opens. If the file you want to export is not visible, it may be in a different folder than the one shown. In this case, click the arrow in the Look in drop-down list box and select the folder in which the file is located.

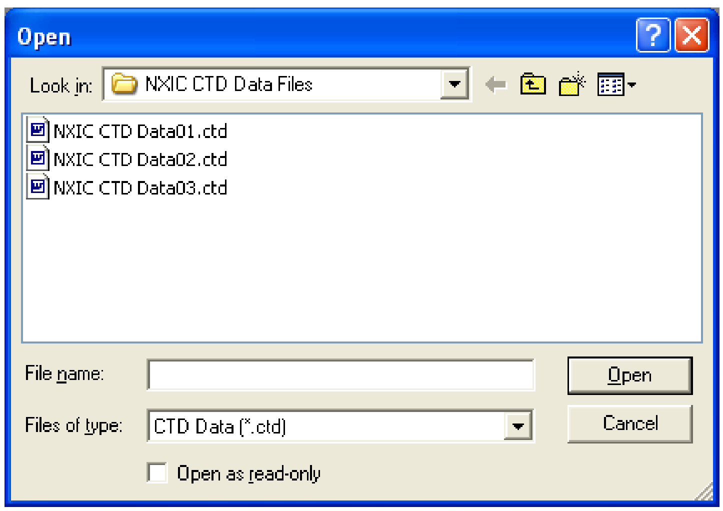


Figure 4-4: ***The Open Dialog Box for CTD Data Files***

6. Click the CTD data file you want to export, and then click Open.

The Open dialog box for CTD data files closes and the file name is displayed in the Filename text box.

7. Click Export in the Export dialog box.

The data are exported to a file of the same file name and placed in the same directory as the original data file. The appropriate extension is also added to the file name, depending on whether it is a text file, spreadsheet file or an FSIPost file.

Viewing Data That Have Been Exported to a Text File

To view data that have been exported to a text file, choose File ➤ View Text File, select the file from the Open dialog box for Text files, and then click Open. Or use Windows Explorer to navigate to the file and double-click it. Data are displayed in columns as shown in the example NXIC CTD data file printout in Figure 4-5.

CTD Data01.txt

DATE mm-dd-yyyy	TIME hh:mm:ss	COND (mmho/cm)	TEMP (C)	PRES (dbar)	SALT (PSU-78)	SV (m/s)	POT TEMP (C)
09-02-2004	22:54:35,	0.0069,	21.5036,	0.0000,	0.0121,	1486.8956,	21.5036
09-02-2004	22:54:35,	0.0070,	21.5044,	0.0000,	0.0122,	1486.8981,	21.5044
09-02-2004	22:54:35,	0.0069,	21.5050,	0.0000,	0.0121,	1486.8999,	21.5050
09-02-2004	22:54:35,	0.0069,	21.5058,	0.0000,	0.0121,	1486.9022,	21.5058
09-02-2004	22:54:35,	0.0070,	21.5065,	0.0000,	0.0121,	1486.9043,	21.5065
09-02-2004	22:54:36,	0.0068,	21.5069,	0.0346,	0.0121,	1486.9059,	21.5069
09-02-2004	22:54:36,	0.0069,	21.5074,	0.0225,	0.0121,	1486.9073,	21.5074
09-02-2004	22:54:36,	0.0068,	21.5080,	0.0000,	0.0121,	1486.9086,	21.5080
09-02-2004	22:54:36,	0.0068,	21.5080,	0.0494,	0.0121,	1486.9094,	21.5080
09-02-2004	22:54:36,	0.0067,	21.5082,	0.0038,	0.0120,	1486.9091,	21.5082
09-02-2004	22:54:37,	0.0067,	21.5081,	0.0000,	0.0120,	1486.9088,	21.5081
09-02-2004	22:54:37,	0.0069,	21.5085,	0.0000,	0.0121,	1486.9104,	21.5085
09-02-2004	22:54:37,	0.0066,	21.5082,	0.0000,	0.0120,	1486.9091,	21.5082
09-02-2004	22:54:37,	0.0067,	21.5070,	0.0000,	0.0120,	1486.9055,	21.5070
09-02-2004	22:54:37,	0.0066,	21.5058,	0.0044,	0.0120,	1486.9022,	21.5058
09-02-2004	22:54:38,	0.0067,	21.5041,	0.0000,	0.0120,	1486.8972,	21.5041
09-02-2004	22:54:38,	0.0066,	21.5029,	0.0000,	0.0120,	1486.8934,	21.5029
09-02-2004	22:54:38,	0.0067,	21.5017,	0.0000,	0.0120,	1486.8901,	21.5017
09-02-2004	22:54:38,	0.0068,	21.5005,	0.0000,	0.0121,	1486.8866,	21.5005
09-02-2004	22:54:38,	0.0069,	21.4989,	0.0000,	0.0121,	1486.8818,	21.4989
09-02-2004	22:54:39,	0.0067,	21.4969,	0.0181,	0.0120,	1486.8762,	21.4969
09-02-2004	22:54:39,	0.0069,	21.4944,	0.0000,	0.0121,	1486.8685,	21.4944
09-02-2004	22:54:39,	0.0065,	21.4919,	0.0253,	0.0120,	1486.8616,	21.4919
09-02-2004	22:54:39,	0.0065,	21.4900,	0.0599,	0.0120,	1486.8564,	21.4899
09-02-2004	22:54:39,	0.0065,	21.4874,	0.0144,	0.0120,	1486.8478,	21.4874
09-02-2004	22:54:40,	0.0064,	21.4849,	0.0082,	0.0119,	1486.8406,	21.4849
09-02-2004	22:54:40,	0.0069,	21.4828,	0.0544,	0.0121,	1486.8353,	21.4828
09-02-2004	22:54:40,	0.0070,	21.4804,	0.0500,	0.0121,	1486.8282,	21.4804
09-02-2004	22:54:40,	0.0070,	21.4788,	0.0000,	0.0121,	1486.8228,	21.4788
09-02-2004	22:54:40,	0.0070,	21.4774,	0.0211,	0.0121,	1486.8188,	21.4774
09-02-2004	22:54:41,	0.0070,	21.4761,	0.0060,	0.0121,	1486.8146,	21.4761
09-02-2004	22:54:41,	0.0068,	21.4748,	0.0471,	0.0121,	1486.8115,	21.4748
09-02-2004	22:54:41,	0.0069,	21.4721,	0.0078,	0.0121,	1486.8030,	21.4721
09-02-2004	22:54:41,	0.0070,	21.4712,	0.0152,	0.0121,	1486.8005,	21.4712
09-02-2004	22:54:41,	0.0068,	21.4690,	0.0000,	0.0121,	1486.7938,	21.4690
09-02-2004	22:54:42,	0.0069,	21.4663,	0.0000,	0.0121,	1486.7858,	21.4663
09-02-2004	22:54:42,	0.0069,	21.4633,	0.0000,	0.0121,	1486.7769,	21.4633
09-02-2004	22:54:42,	0.0071,	21.4609,	0.0000,	0.0122,	1486.7699,	21.4609
09-02-2004	22:54:42,	0.0069,	21.4579,	0.0000,	0.0121,	1486.7611,	21.4579
09-02-2004	22:54:42,	0.0067,	21.4554,	0.0000,	0.0120,	1486.7535,	21.4554
09-02-2004	22:54:43,	0.0069,	21.4539,	0.0002,	0.0121,	1486.7491,	21.4539
09-02-2004	22:54:43,	0.0068,	21.4527,	0.0000,	0.0121,	1486.7455,	21.4527
09-02-2004	22:54:43,	0.0069,	21.4518,	0.0039,	0.0121,	1486.7428,	21.4518
09-02-2004	22:54:43,	0.0070,	21.4516,	0.0000,	0.0122,	1486.7424,	21.4516
09-02-2004	22:54:43,	0.0069,	21.4517,	0.0210,	0.0121,	1486.7428,	21.4517
09-02-2004	22:54:44,	0.0070,	21.4523,	0.0257,	0.0121,	1486.7449,	21.4523
09-02-2004	22:54:44,	0.0070,	21.4523,	0.0273,	0.0121,	1486.7449,	21.4523
09-02-2004	22:54:44,	0.0070,	21.4532,	0.0000,	0.0121,	1486.7472,	21.4532
09-02-2004	22:54:44,	0.0071,	21.4541,	0.0000,	0.0122,	1486.7498,	21.4541
09-02-2004	22:54:44,	0.0068,	21.4550,	0.0000,	0.0121,	1486.7523,	21.4550
09-02-2004	22:54:45,	0.0065,	21.4560,	0.0000,	0.0120,	1486.7550,	21.4560
09-02-2004	22:54:45,	0.0065,	21.4569,	0.0000,	0.0120,	1486.7577,	21.4569
09-02-2004	22:54:45,	0.0067,	21.4579,	0.0166,	0.0120,	1486.7611,	21.4579
09-02-2004	22:54:45,	0.0068,	21.4583,	0.0803,	0.0121,	1486.7632,	21.4583
09-02-2004	22:54:45,	0.0067,	21.4584,	0.0000,	0.0120,	1486.7623,	21.4584
09-02-2004	22:54:46,	0.0068,	21.4588,	0.0000,	0.0121,	1486.7634,	21.4588
09-02-2004	22:54:46,	0.0068,	21.4587,	0.0000,	0.0121,	1486.7633,	21.4587
09-02-2004	22:54:46,	0.0068,	21.4586,	0.0000,	0.0121,	1486.7629,	21.4586
09-02-2004	22:54:46,	0.0068,	21.4584,	0.0000,	0.0121,	1486.7623,	21.4584
09-02-2004	22:54:46,	0.0067,	21.4576,	0.0000,	0.0120,	1486.7599,	21.4576
09-02-2004	22:54:47,	0.0068,	21.4575,	0.0180,	0.0121,	1486.7600,	21.4575

Page 1

Figure 4-5: ***Example NXIC CTD Data File Printout***

Displaying, Printing and Saving Graphs

After the data have been downloaded from the NXIC CTD and saved to a CTD data file, the data in the CTD file can viewed on graphs in a graphics display, and the graphs can be printed and saved. CTDPro provides graphs of the parameters that are measured and calculated by the NXIC CTD and the parameters that are calculated by CTDPro.

The parameters measured or calculated by the NXIC CTD are the following:

- Conductivity
- Temperature
- Pressure
- Salinity
- Sound Speed
- Battery Voltage

The parameters calculated by CTDPro are the following:

- Conductivity and Temperature versus Pressure
- Salinity
- Sound Velocity
- Density
- TS Plot

Displaying Data Versus Pressure or Time

You can display data either versus pressure or versus time on the horizontal axis of a graph. This selection is made in the Properties dialog box, which is shown in Figure 2-1 on page 2-4. To open the Properties dialog box, choose File ➤ Properties. To select time for the horizontal axis, select the vs. Time option in the Plot Type area of the Properties dialog; to select pressure select the vs. Pressure option.

Viewing Data on a Graph

To view data on a graph:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose File ➤ Open.

   The Open dialog box for CTD data files shown in Figure 4-4 on page 4-5 opens. If the file you want to open is not visible, it may be in a different folder than the one shown. In this case, click the arrow in the Look in drop-down list box and select the folder in which the file is located.

3. Click the CTD data file for which you want to display graphs, and then click Open.

   The Open dialog box for CTD data files closes and the graphics display shown in Figure 4-6 opens to the Conductivity graph.

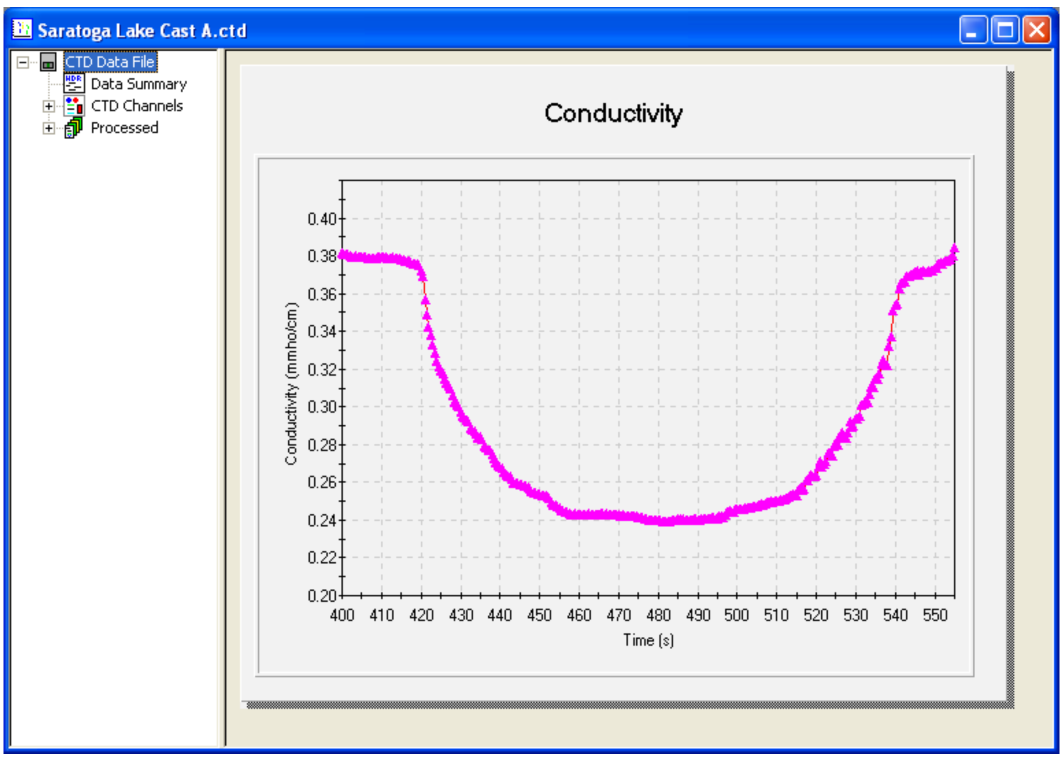


Figure 4-6: ***The Graphics Display Opened to the Conductivity Graph***

4. To display a list of available CTD Channels data parameters, click the plus sign (+) to the left of CTD Channels.

   To display a list of available Processed data parameters, click the plus sign (+) next to Processed.

5 To display a graph of any parameter in the CTD Channels data parameters list or the Processed data parameters list, click the parameter in the list.

Note: *The Conductivity graph is always displayed initially by default.*

The selected graph is displayed in the graphics display as shown Figure 4-8 for the temperature data and in Figure 4-9 for the pressure data.

Zooming in and Out of a Graph

To zoom in on a graph, press and hold the Shift key and click and hold the left mouse button while drawing a box around the area you want to zoom in on, and then release the mouse button.

To zoom out to the full view of the graph, type "R."

Setting up a Graph

The graph in the graphics display can be set up, allowing you to select the scaling, the labeling, the colors, the style, and a number of other settings. To set up a graph, view the graph as described in “Viewing Data on a Graph” on page 4-7, and then right click anywhere in the graph. The 2D Chart Control Properties dialog box shown in Figure 4-7 opens. All the graph settings are made in the 2D Chart Control Properties dialog box. For complete instructions on how to set up the graph, click Help in the dialog box.

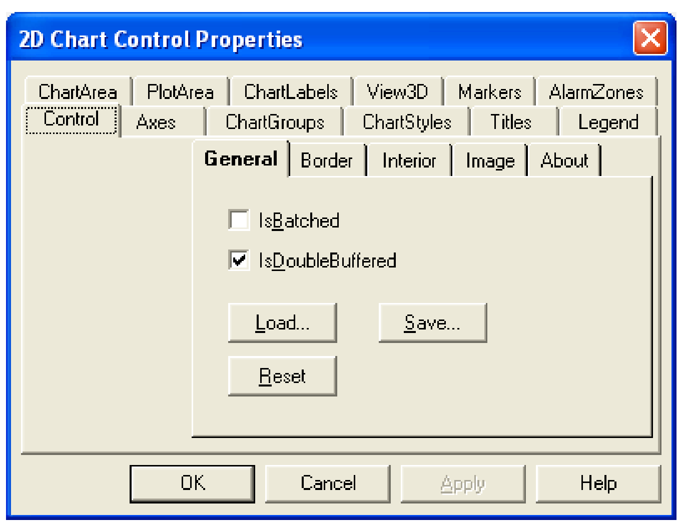


Figure 4-7: ***The 2D Chart Control Properties Dialog Box***

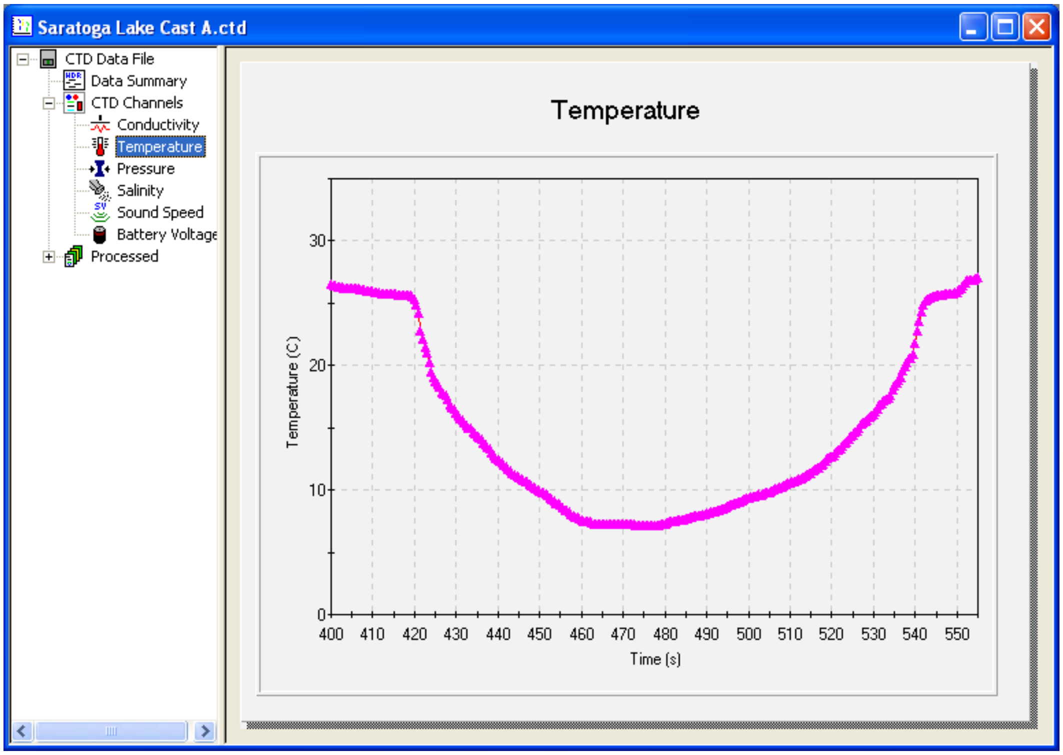


Figure 4-8: ***The Temperature Graph***

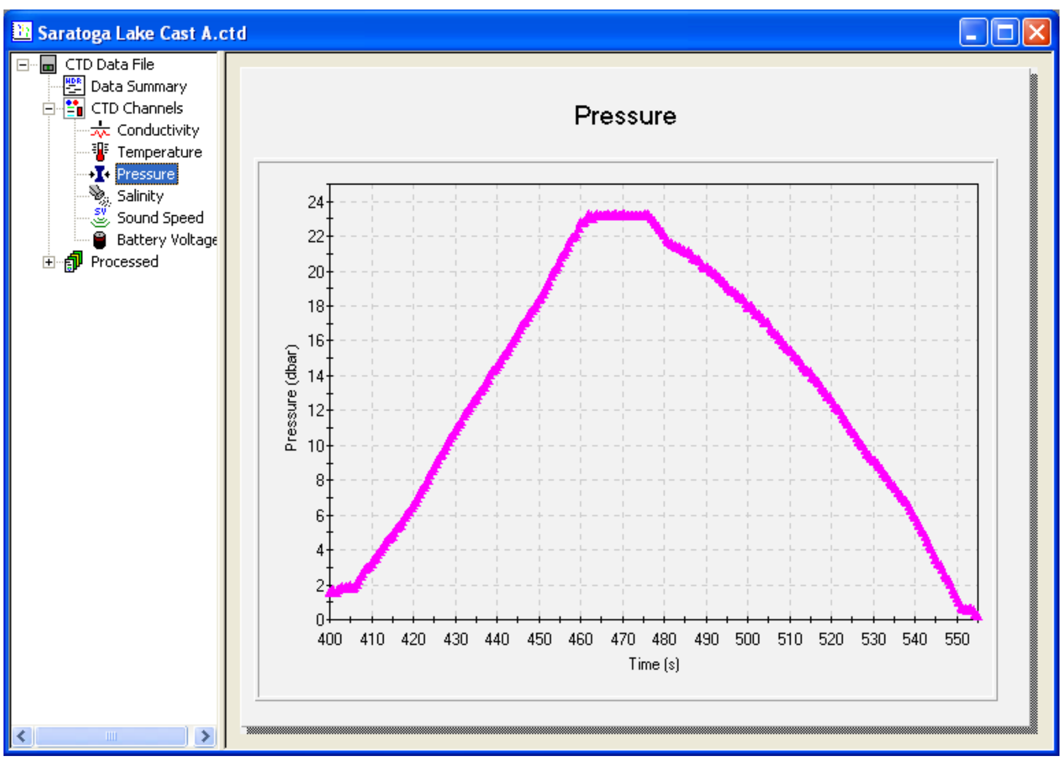


Figure 4-9: ***The Pressure Graph***

Saving a Graph

Graphs can be saved as JPG files, files of extension *.jpg*, and opened in any photo editor.

To save a graph:

1. View the graph as described in “Viewing Data on a Graph” on page 4-7.

2. Choose File ➤ Save Graph.

   The Save Graph dialog box shown in Figure 4-10 opens.

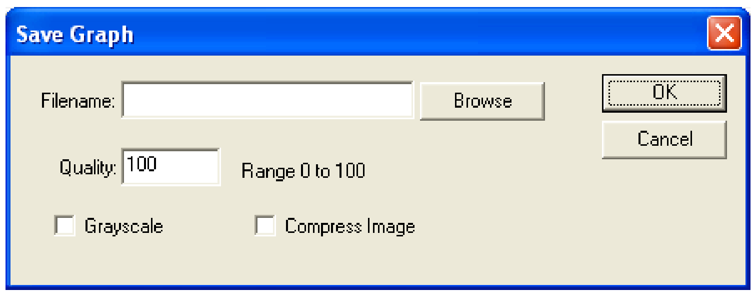


Figure 4-10: ***Save Graph Dialog Box***

3. Click Browse

   The Save As dialog box for image files shown in Figure 4-11 opens. This dialog box is used to create the file in which to save the image file.

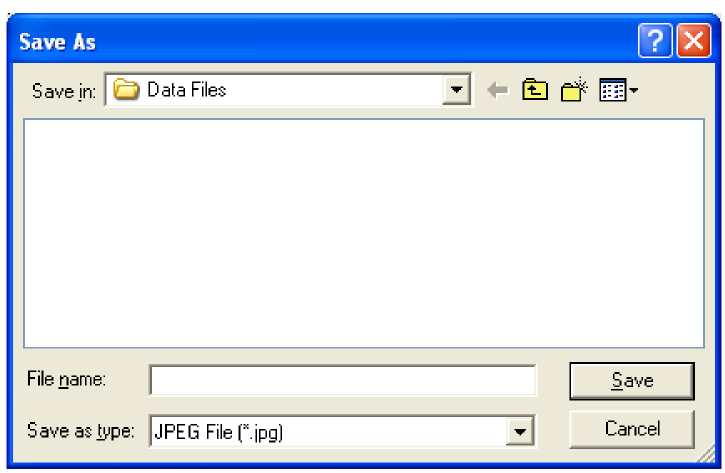


Figure 4-11: ***The Save As Dialog Box for Image Files***

4. Click the arrow in the Save in drop-down list box and select the folder in which to save the image file.

5. In the File name text box enter the name of the file in which to save the data. The extension *.jpg* is added automatically.

6. Click Save.

   The Save As dialog box for image files closes.

7. Enter the quality of the image—as an integer from 0 to 100—in the Quality text box in the Save Graph dialog box. The higher the number the higher the quality and the larger the file size.

8. If a grayscale image is desired, select the Grayscale check box.

9. To compress the image and reduce the file size, select the Compress Image check box.

10. Click OK.

    The graph is saved and can be opened in any image editor.

Previewing and Printing a Graph

To print a graph without previewing, view the graph as described in “Viewing Data on a Graph” on page 4-7, choose File ➤ Print, and then follow the printing instructions for your printer. To set up the printer or select a different one, choose File ➤ Print Setup.

To preview the printed graph, choose File ➤ Print Preview.

Viewing File Information

To view file information about the data file, view the graph as described in “Viewing Data on a Graph” on page 4-7, and then click Data Summary. The File Information window shown in Figure 4-12 opens. The File Information window displays information particular to the opened file, including serial number, the calibrations date, the sample rate, the running mode, the run times, and the total number of recorded scans. To close the File Information window, click OK.

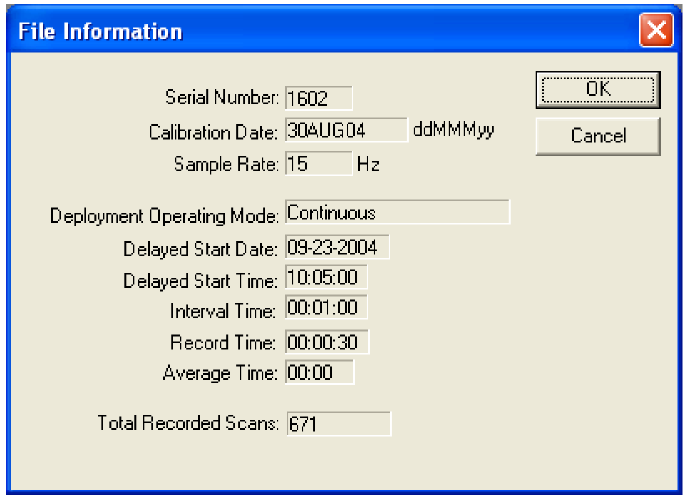


Figure 4-12: ***The File Information Window***

Erasing All the Data Files

All the data files that stored in the NXIC CTD can be erased if the instrument is not logging data.

To erase all the data files in the NXIC CTD:

1. Connect the NXIC CTD to your computer.

2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

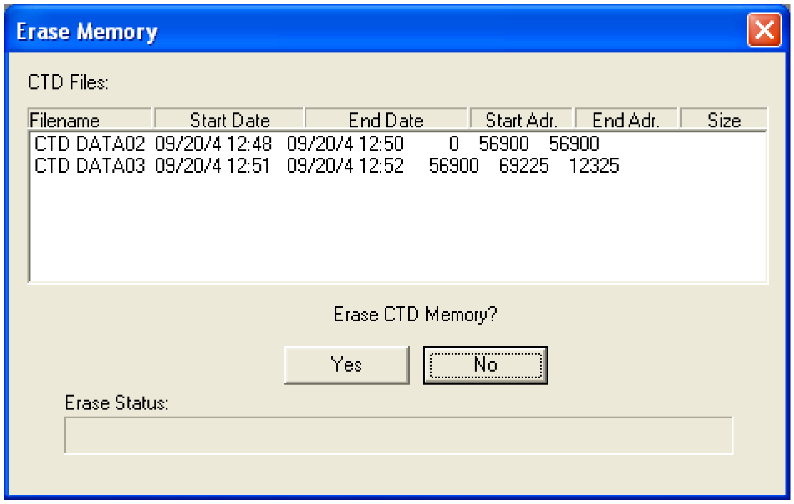
3. Choose CTD ➤ Memory ➤ Erase.

   If the NXIC CTD is currently logging data, the CTD Logging window opens:

4. Click Yes to stop data logging, or click No to continue.

   If you click No, the NXIC CTD window closes and data acquisition continues without interruption.

If you click yes, data logging stops, the NXIC CTD window closes and the Erase Memory window opens:



5 Click Yes to erase all of memory.

A NXIC CTD window opens asking if you want to erase all of memory:

6 Click Yes to confirm that you want to erase all of memory.

The memory is erased as indicated by the Erase Status progress bar in the Erase Memory window, and then the Erase Memory window closes.

SECTION 5: Acquiring, Displaying and Saving Data in Real Time

Data acquired by the NXIC CTD can be displayed and saved in real time by running the instrument directly from the test cable, or the test cable can be replaced with a sea cable for running up and down casts or remotely deploying the instrument. (See “APPENDIX B: Bulkhead Connector Wiring” for information on the bulkhead connector wiring.) You can connect as many instruments as there are available serial ports on the computer, up to 16. For each instrument the data are displayed numerically in a table and as plots on a graph, and recording is directly to disk on your computer. The data are saved to a DAT file, a file of extension *.dat*, which is in ASCII format and can be opened and viewed in any text editor.

> ***Note:*** *Before deploying the NXIC CTD, you should run the diagnostic tests as described in “Running the Diagnostic Tests” on page 3-11 with the test cable or sea cable that will be used in the deployment connected.*

This section provides instructions on how to acquire data in real time and how to display and save the data.

Starting Data Acquisition

To start data acquisition and to save and display the data:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose CTD ➤ Communications ➤ Channels.

   The Channel Configuration dialog box shown in Figure 5-1 opens.

3. In the Select Channels area of the Channel Configuration dialog box, select the parameters that you want to save and display.

4. Choose CTD ➤ Acquisition.

   The NXIC CTD Acquisition window shown in Figure 5-2 opens.

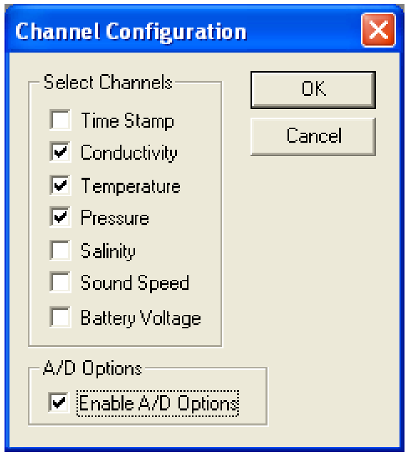


Figure 5-1: ***The Channel Configuration Dialog Box***

Note: *You can open as many NXIC CTD Acquisition windows as there are connected instruments. The instruments must connect to separate serial ports.*

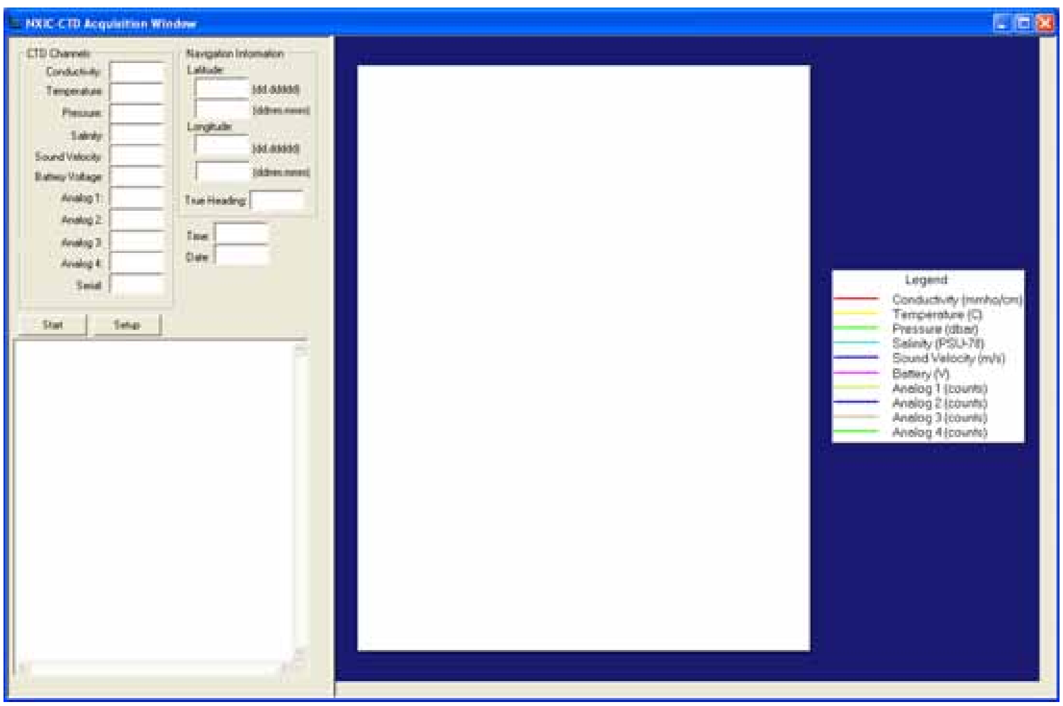


Figure 5-2: ***The NXIC CTD Acquisition Window***

Note: *To view more of the Text Window in the NXIC CTD Acquisition window, click and drag the vertical window divider to the right or drag the scroll box in the horizontal scroll bar to the right.*

5 In the NXIC CTD Acquisition dialog box, click Setup.

The Acquisition Setup dialog box shown in Figure 5-3 opens.

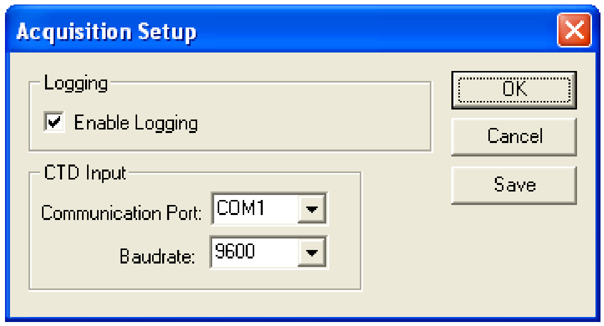


Figure 5-3: ***The Acquisition Setup Dialog Box***

6 In the Logging area of the Acquisition Setup dialog box, select the Enable Logging check box if you want to save the data to a file.

7 In the CTD Input area select the serial port to which the NXIC CTD is connected from the Communication Port drop-down list box.

8 Select the baud rate from the Baudrate drop-down list box.

9 Click OK to save the selections and close the Acquisition Setup dialog box.

10 Click Start.

The Save As Dialog Box for ASCII data files shown in Figure 5-4 opens. This dialog box is used to create the file in which to save the real-time data.

11 Click the arrow in the Save in drop-down list box and select the folder in which to save the data file.

12 In the File name text box enter the name of the file in which to save the data. The extension *.dat* is added automatically.

13 Click Save.

The Save As dialog box for ASCII data files closes and the data are displayed and saved in real time.

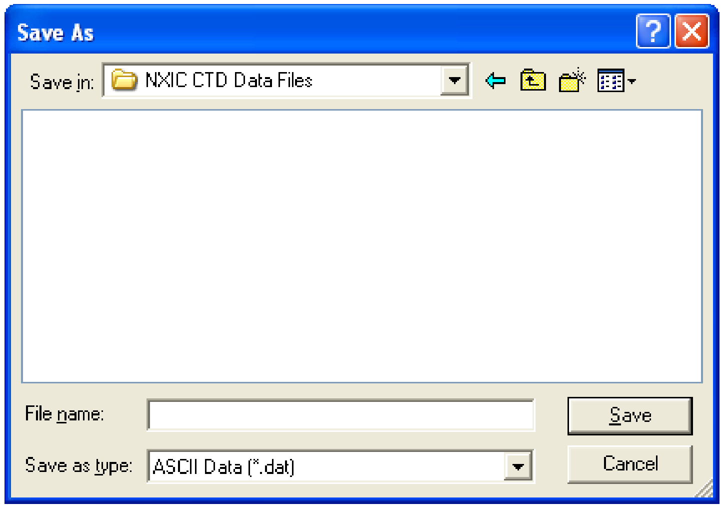


Figure 5-4: ***The Save As Dialog Box for ASCII Data Files***

Stopping Data Acquisition

To stop data acquisition, click Stop in the NXIC CTD Acquisition window.

Viewing Saved Data

To view data that have been saved, choose File ➤ View Text File, select All Files from the Files of type drop-down list box in the Open dialog box, select the file, and then click Open. Or use Windows Explorer to navigate to the file and double-click it.

NXIC CTD Acquisition Window Displays

The NXIC CTD Acquisition window provides digital displays of the conductivity, temperature, pressure, salinity, and sound velocity data in the CTD Channels area of the window. The four analog channels, Analog 1 to Analog 4, and the RS-232 channel, Serial, are also displayed if optional external sensors are installed. The data are also displayed in tabular format in the Text Window and as plots in the graph. The graph includes a legend to identify the plots. In addition, if a GPS is connected as described in “Connecting and Setting up Communications with a GPS” on page 2-11, the latitude, longitude and heading of the NXIC CTD is displayed in the Navigation Information area. Latitude and longitude are displayed both in degrees decimal and in degrees/minutes decimal. An example of real-time data displayed in the NXIC CTD Acquisition window is shown in Figure 5-5.

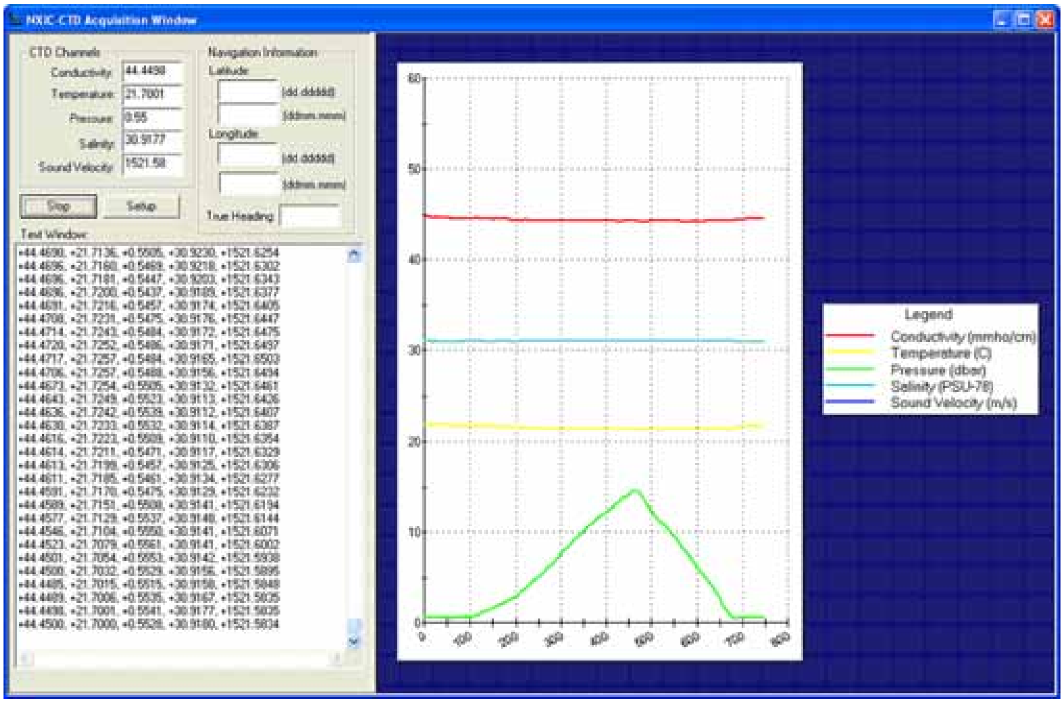


Figure 5-5: ***The NXIC CTD Acquisition Window with Real-Time Displays of Data***

Note: *You can zoom in on the graph in the same manner as described in "Zooming in and Out of a Graph" on page 4-9, and you can set up the graph as described in "Setting up a Graph" on page 4-9.*

SECTION 6: Cleaning the NXIC CTD and Replacing the Battery Pack

To ensure your NXIC CTD continues to provide you with accurate data, you should inspect and clean the instrument after each use. This section provides some inspection and cleaning recommendations and instructions on how to replace the battery pack.

Cleaning and Inspecting the NXIC CTD

After recovering the NXIC CTD, wash the instrument with clean, fresh water and remove any debris that may be attached to the sensors or lodged in the pressure port. If necessary, clean the conductivity sensor with a mild, non-abrasive detergent, and then rinse it thoroughly in fresh water.

After cleaning the instrument, check it carefully for signs of damage. Check the bulkhead connector for looseness or other signs of damage. Check the pins of the bulkhead connector. They should be kept clean at all times. Clean the connector pins and sockets with an alcohol wipe, and when reconnecting, lubricate the pins with an O-ring quality silicone or barium based lubricant. If one or more optional sensors are installed, the end cap includes, in addition to the 4-pin bulkhead connector, an Options 1 and Options 2 connector. For information on these connectors and the optional sensors, refer to “APPENDIX C: Optional Sensors.”

Replacing the Battery Pack

Replacing the battery pack requires removal and reinstallation of the end cap on the instrument housing.

To replace the battery pack:

1. Using a 3/8-inch hex nut driver, loosen the self-locking nut on the band clamp that secures the end cap as shown in Figure 6-1.

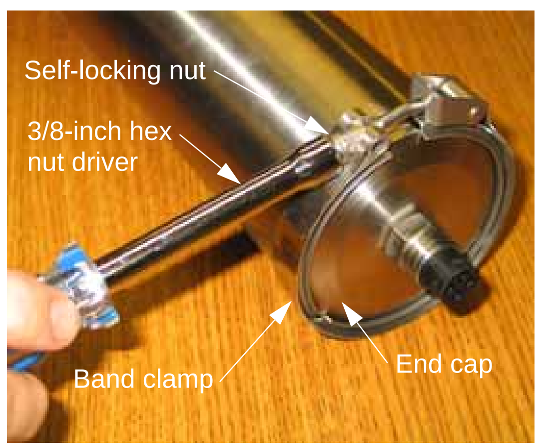


Figure 6-1: ***Loosening the Self-Locking Nut on the Band Clamp***

2 Release the band clamp catch as shown in Figure 6-2, and then remove the band clamp by spreading the band slightly and sliding it over the end cap.

Caution: *Do not use a sharp metallic object, such as a screwdriver or putty knife, to pry open the end cap as damage to the end cap, housing or O-ring could occur.*

Figure 6-2: ***Releasing the Band Clamp Catch***

3 Carefully remove the end cap by grasping the housing in one hand and the end cap connector in the other as shown in Figure 6-3 and pulling straight out. It may be necessary to twist the end cap slightly while pulling. If necessary, a flat plastic, nonmetallic tool can be used to pry the end cap from the housing.

Figure 6-3: ***Removing the End Cap***

4 Disconnect the in-line connectors JP3 and JP4 and remove the foam pad as shown in Figure 6-4, exposing the battery pack. If the Option 1 and Option 2 connectors are installed, refer instead to Figure 6-5.

Note: *The Option 1 and Option 2 in-line connectors in Figure 6-5 are shown disconnected for identification purposes. You do not have to disconnect these connectors if you are only replacing the battery pack.*

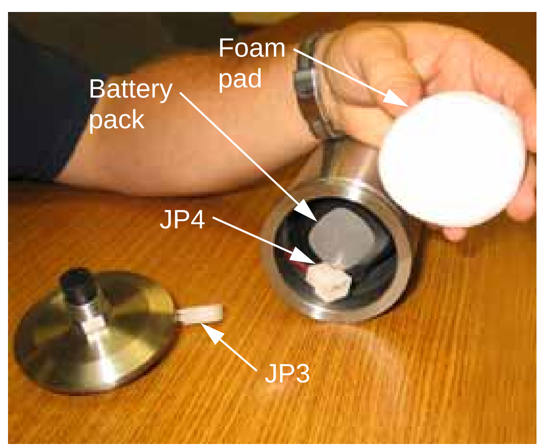


Figure 6-4: ***Disconnecting the JP3 and JP4 In-Line Connectors***

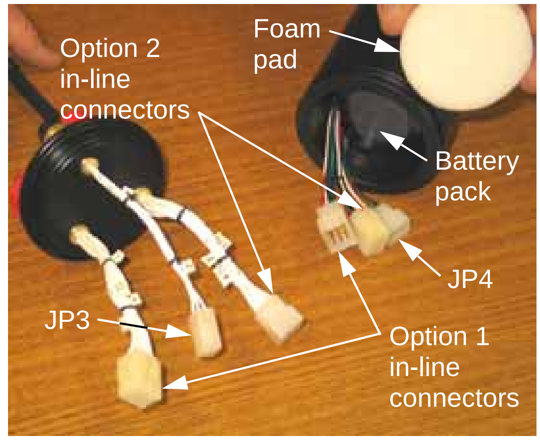


Figure 6-5: ***Disconnecting the JP3 and JP4 In-Line Connectors, with Options Connectors***

5. Remove the battery pack and another foam pad as shown in Figure 6-6. If the Option 1 and Option 2 connectors are installed, refer instead to Figure 6-7.

6. Disconnect the battery pack in-line connector, and then connect a fresh battery pack.

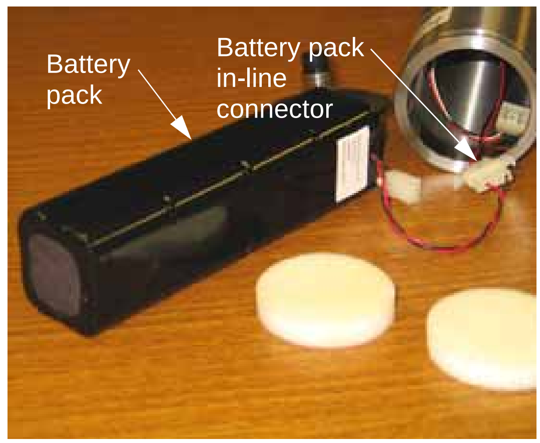


Figure 6-6: ***Removing the Battery***

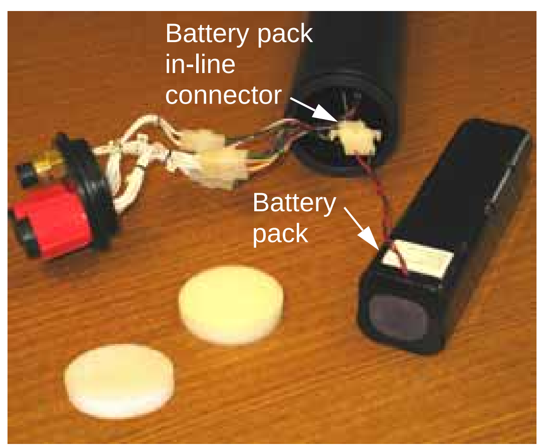


Figure 6-7: ***Removing the Battery, with Options Connectors***

7. Insert a foam pad followed by the battery pack, wire end first, part way into the housing. Then insert the battery pack in-line connector between the housing and the battery pack as shown in Figure 6-8. If the Option 1 and Option 2 connectors are installed, refer instead to Figure 6-9.

Figure 6-8: ***Inserting a Battery***

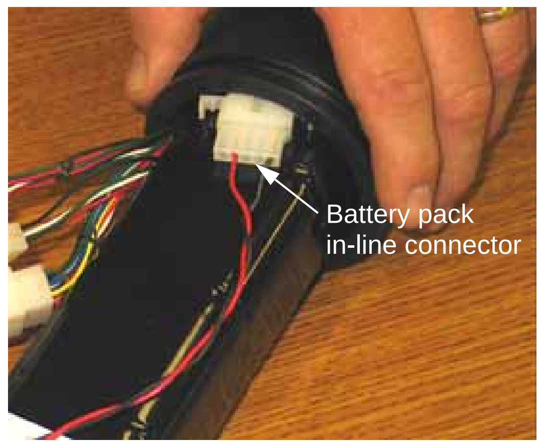


Figure 6-9: ***Inserting a Battery, with Options Connectors***

8. Push the battery pack into the housing as far as it will go, and then insert the second foam pad over the battery pack and connect the in-line connectors JP3 and JP4 as shown in Figure 6-10. If the Option 1 and Option 2 connectors are installed, refer instead to Figure 6-11.

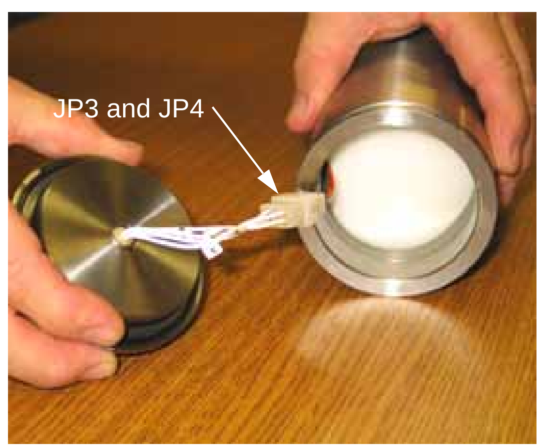


Figure 6-10: ***Connecting the JP3 and JP4 In-Line Connectors***

9. Clean the O-rings on the end cap and the O-ring surface on the housing with a lint-free cloth or paper towel, and after carefully inspecting the O-rings for any nicks or scratches, apply a thin coat of silicone grease.

   Note: *There are two O-rings installed in the O-ring groove on the end cap: a backing O-ring, which has a flat side and a round side, and a standard round O-ring. As shown in Figure 6-12, the backing O-ring is installed with the flat side facing toward the inside of the housing and the round side facing toward the outside of the housing. The round O-ring is installed against the round end of the backing O-ring.*

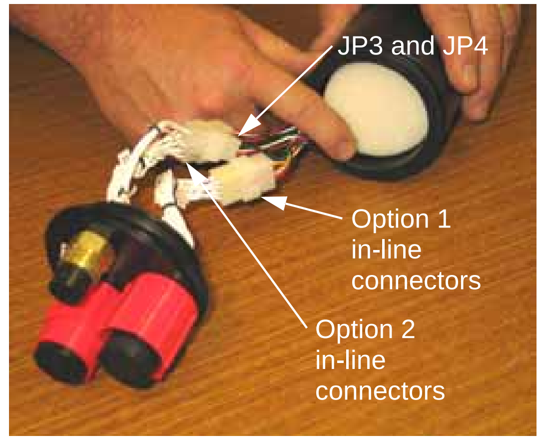


Figure 6-11: ***Connecting the JP3 and JP4 In-Line Connectors, with Options Connectors***

10. If nicks or scratches are found on an O-ring, replace it. When replacing the O-ring, first clean the O-ring surface on the end cap with a lint-free cloth or paper towel. Then lightly lubricate the new O-ring with silicone grease and install it onto the end cap.

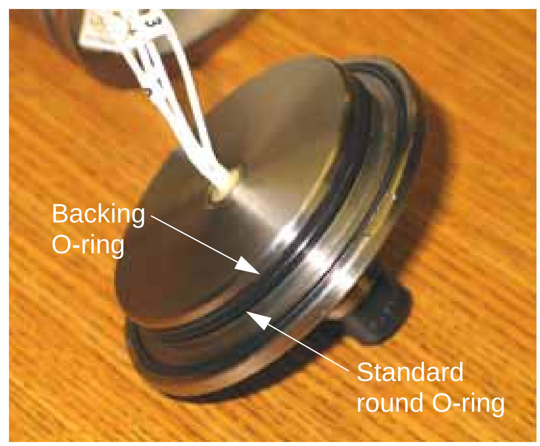


Figure 6-12: ***Backing and Standard Round O-rings Installed in O-ring Groove in End Cap***

11. Press the end cap into the housing, being careful not to pinch the wires.

12. Spread the band clamp slightly, and then install it over the end cap and housing such that it straddles the groove in the housing and the lip of the end cap, holding the housing and end cap together.

13. Latch the band clamp catch, and then tighten the self-locking nut until it is snug. Do not overtighten.

APPENDIX A: Measured and Calculated Parameters

Conductivity, temperature and pressure are measured directly by the NXIC CTD. In addition, the instrument calculates salinity and sound velocity. All these parameters are recorded to internal memory along with the time and date and the battery voltage for each sample, and they are retrieved when downloading the data from the instrument and saving the data to a file. When exporting the saved data to a text or spreadsheet file, or to FSIPost, CTDPro can calculate additional parameters from the measured parameters. Any combination of the measured and calculated parameters, including those calculated by CTDPro, can be exported. (See “Exporting Saved Data” on page 4-4 for instructions on how to export data to a file.)

Parameters Measured by the NXIC CTD

The parameters directly measured by the NXIC CTD are the following:

Conductivity:	The measured water conductivity in mmho/cm.
Temperature:	The measured water temperature in °C.
Pressure:	The measured water pressure in dbars.
Battery Voltage:	The measured battery voltage in volts.

Parameters Calculated by the NXIC CTD

The parameters calculated by the NXIC CTD are following:

Salinity:	The water salinity in PSU-78 units.
Sound Velocity:	The sound velocity in water in m/sec.
Time and Date:	The time in hours, minutes and seconds, and the date in month, day and year on which the selected parameters are output and stored for each sample.

Parameters Calculated by CTDPro

The parameters calculated by CTDPro are the following:

Depth:	The water depth in meters.
Density:	The water density in kg/m^3.
Salinity:	The water salinity in PSU-78 units.
Sound Velocity:	The sound velocity in water in m/sec.
Potential Temperature:	The water temperature without the effects of pressure in °C.
Adiabatic Temperature Gradient:	The water adiabatic temperature gradient in °C/dbar.

APPENDIX B: Bulkhead Connector Wiring

The NXIC CTD includes a Subconn MCBH4F bulkhead connector on the lower end cap for connecting to a computer and to power. This connector and its associated components are listed in Table B-1.

Bulkhead Connector Components		
ITEM	**SUBCONN PART NUMBER**	**FSI PART NUMBER**
Bulkhead Connector	MCBH4F	2106-MCBH4F
Pigtail	MCIL4M	2106-MCIL4M
Dummy Plug	MCDC4M	2106-MCDC4M
Locking Sleeve	MCDLSF	2106-MDLSF

Table B-1: ***Bulkhead Connector Components***

Refer to Table B-2 for the required connections from the bulkhead connector to the computer, and to Table B-3 for the connections from the connector to the power supply. Figure B-1 shows the bulkhead connector pin orientation as viewed from the face.

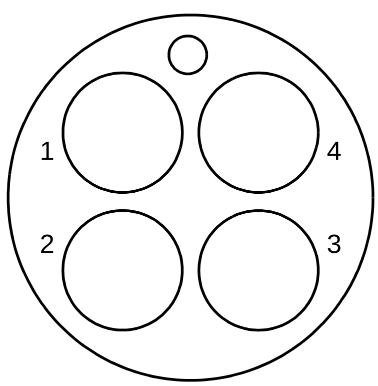


Figure B-1: ***Bulkhead Connector Face View***

NXIC CTD Bulkhead Connector to Computer Connections		
PIN	LABEL	FUNCTION
1	GND	Ground
2	RXD/RS-485A	Received Data from Computer
4	TXD/RS-485B	Transmitted Data to Computer

Table B-2: ***NXIC CTD Bulkhead Connector to Computer Connections***

NXIC CTD Bulkhead Connector to Power Supply Connections		
PIN	LABEL	FUNCTION
1	GND	Ground
3	Power(+)	Instrument Power

Table B-3: ***NXIC CTD Bulkhead Connector to Power Supply Connections***

APPENDIX C: Optional Sensors

The NXIC CTD optionally includes two 12-pin bulkhead connectors together with the standard 4-pin bulkhead connector on the lower end cap as shown in Figure C-1. These are the Option 1 and Option 2 connectors which are used to connect to optional external sensors. The Option 1 connector is specifically provided for connecting to Seapoint turbidity and fluorometer sensors. It outputs power and gain control signals to the sensors and inputs the sensor signals. The Option 2 connector provides power, two 0–5 VDC input channels and one RS-232 serial interface. The Option 1 connector is identified by its female locking collar; the Option 2 connector, by its male locking collar.

> ***Note:*** *The power available for the external sensors is 11 VDC nominal at 50 mA maximum for any sensor; 150 mA maximum total is available for all the sensors.*

The Option 1 and Option 2 connectors and their associated components are listed in Table C-1. Figure C-2 shows the pin orientation for the two connectors, and the connector wiring information is shown in Table C-2 on page C-3 for the Option 1 connector and Table C-3 on page C-4 for the Option 2 connector.

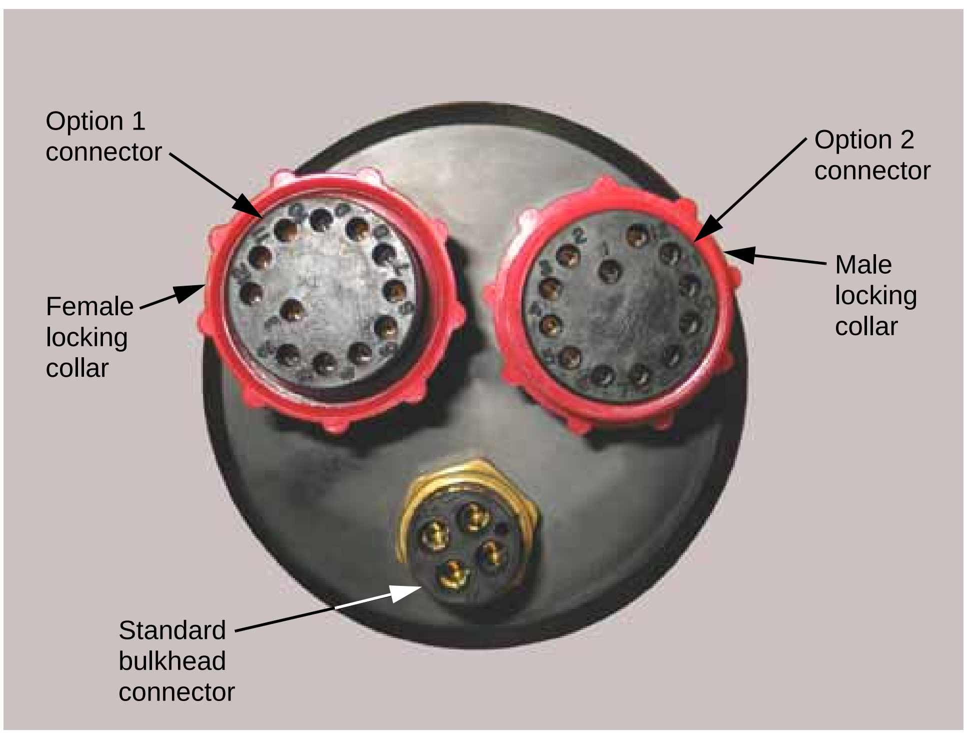


Figure C-1: ***Option 1 and Option 2 Connectors with Standard Bulkhead Connector on Lower End Cap***

Option Connectors Components		
ITEM	**SUBCONN PART NUMBER**	**FSI PART NUMBER**
Bulkhead Connector	MCBH12F	2106-MCBH12F
Pigtail	MCIL12M	2106-MCIL12M
Dummy Plug	MCDC12M	2106-MCDC12M
Locking Sleeve (male)	DLSA-M	2106-DLSA-M
Locking Sleeve (female)	DLSA-F	2106-DLSA-F

Table C-1: ***Option Connectors Components***

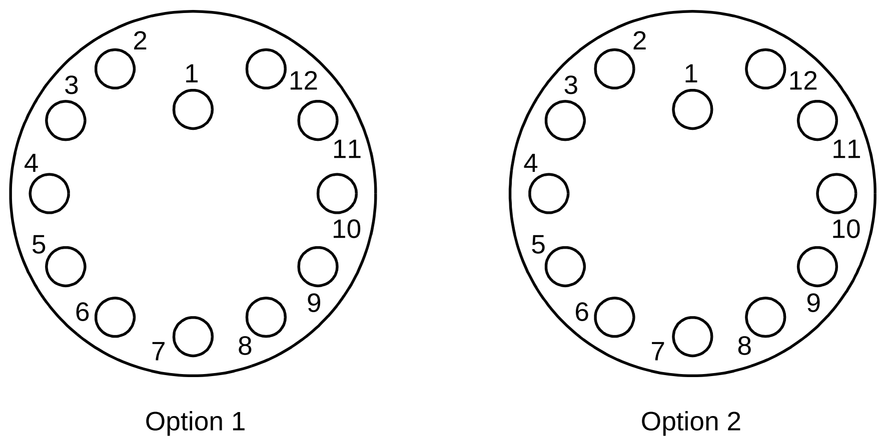


Figure C-2: ***Option 1 and Option 2 Connectors Face View***

Option 1 Connector Connections			
PIN	Channel	LABEL	FUNCTION
1	DC Channel 1 (Turbidity Sensor)	GND	Power Ground
2		Signal (+)	Sensor Signal
3		Power (+)	Sensor Power
4		Signal (-)	Sensor Signal Ground
5		Gain0_0	Gain Control A
6		Gain0_1	Gain Control B
7	DC Channel 2 (Fluorometer Sensor)	GND	Power Ground
8		Signal (+)	Sensor Signal
9		Power (+)	Sensor Power
10		Signal (-)	Sensor Signal Ground
11		Gain1_0	Gain Control A
12		Gain1_1	Gain Control B

Table C-2: ***Option 1 Connector Connections***

Option 2 Connector Connections			
PIN	**Channel**	**LABEL**	**FUNCTION**
1	DC Channel 3	GND	Power Ground
2		Signal (+)	Sensor Signal
3		Power (+)	Sensor Power
4		Signal (-)	Sensor Signal Ground
5	DC Channel 4	GND	Power Ground
6		Signal (+)	Sensor Signal
7		Power (+)	Sensor Power
8		Signal (-)	Sensor Signal Ground
9	RS-232 Channel 5	GND	Power Ground
10		RXD	Received Data
11		Power (+)	Sensor Power
12		TXD	Transmitted Data

Table C-3: ***Option 2 Connector Connections***

Turbidity Sensor

The turbidity sensor is a Seapoint Turbidity Meter manufactured by Seapoint Sensors, Inc. The sensor detects the light scattered by suspended particles in water and outputs a voltage proportional to the amount of suspended solids. The turbidity sensor is shown connected to the Options 1 connector on a NXIC CTD in Figure C-3.

The turbidity sensor has four range selections which allow you to choose the best resolution for measuring clean to very turbid water. You can select the range in CTDPro by choosing the corresponding gain in accordance with Table C-4. CTDPro also allows you calibrate the sensor by immersing it in several known standards.

For more information about the turbidity sensor, refer to the Seapoint Turbidity Meter user manual provided with the option.

Turbidity Sensor Range Selections		
Gain	**Resolution**	**Range**
1X	2 mV/FTU	<750 FTU
5X	10 mV/FTU	500 FTU
20X	400 mV/FTU	125 FTU
100X	200 mV/FTU	25 FTU

Table C-4: ***Turbidity Sensor Range Selections***

Selecting the Range for the Turbidity Sensor

To select the range for the turbidity sensor:

1. Connect the NXIC CTD to your computer.
2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

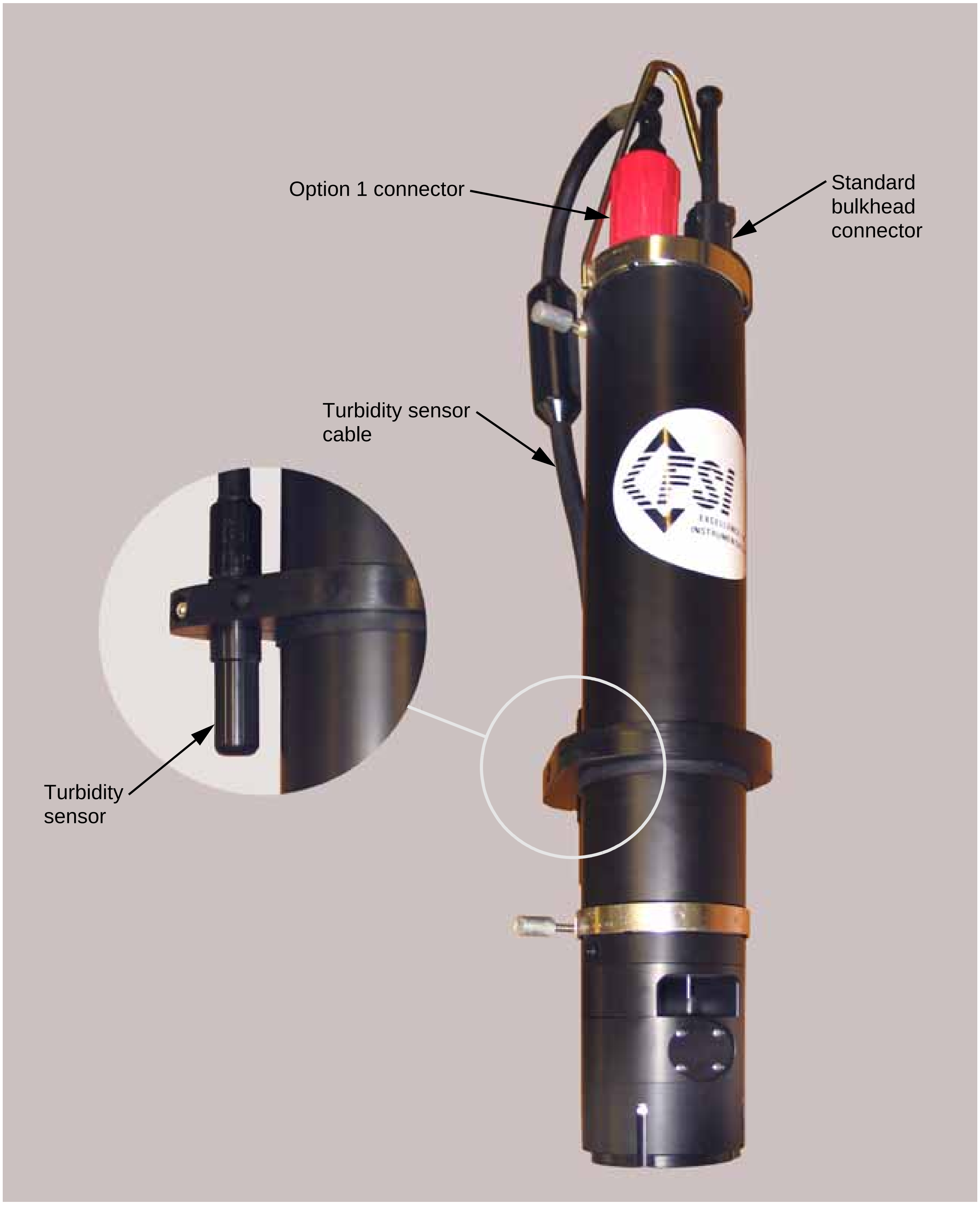


Figure C-3: ***NXIC CTD with Turbidity Sensor Connected to the Option 1 Connector***

3 Choose Sensors ➤ Setup.

The Sensor Setup dialog box shown in Figure C-4 opens.

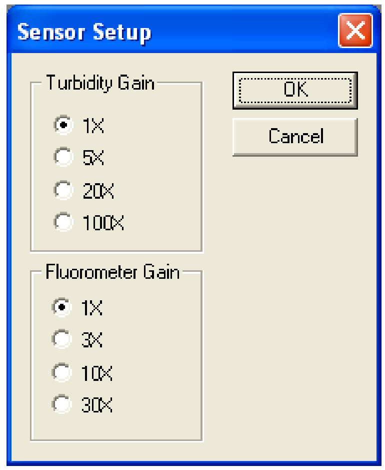


Figure C-4: ***The Sensor Setup Dialog Box—Selecting Turbidity Sensor Range***

4 In the Turbidity Gain area of the Sensor Setup dialog box, select the desired option in accordance with Table C-4 on page C-5.

5 Click OK to close the Sensor Setup dialog box and save the range setting.

Calibrating the Turbidity Sensor

Before calibrating the turbidity sensor, select the desired range as described in “Selecting the Range for the Turbidity Sensor” on page C-5.

To calibrate the turbidity sensor, refer to “Calibrating the External Sensors” on page C-10.

Fluorometer Sensor

The fluorometer sensor is a Seapoint Chlorophyll Fluorometer manufactured by Seapoint Sensors, Inc. The sensor measures chlorophyll *a* over a wide dynamic range in a wide variety of conditions. The fluorometer sensor connects to the Options 1 connector on a NXIC CTD.

The fluorometer sensor has four range selections which allow you to choose the best resolution for the application. You can select the range in CTDPro by choosing the corresponding gain in accordance with Table C-5. CTDPro also allows you calibrate the sensor by immersing it in several known standards.

For more information about the fluorometer sensor, refer to the Seapoint Chlorophyll Fluorometer user manual provided with the option.

Fluorometer Sensor Range Selections		
Gain	**Resolution**	**Range**
1X	0.033 V/(µg/l)	150 µg/l
3X	0.1 V/(µg/l)	50 µg/l
10X	0.33 V/(µg/l)	15 µg/l
30X	1.0 V/(µg/l)	5 µg/l

Table C-5: ***Fluorometer Sensor Range Selections***

Selecting the Range for the Fluorometer Sensor

To select the range for the fluorometer sensor:

1. Connect the NXIC CTD to your computer.
2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

3 Choose Sensors ➤ Setup.

The Sensor Setup dialog box shown in Figure C-4 opens.

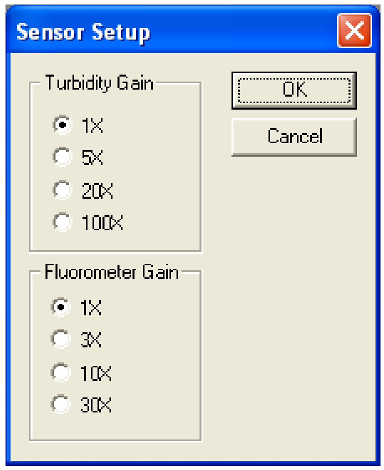


Figure C-5: ***The Sensor Setup Dialog Box—Selecting Fluorometer Sensor Range***

4 In the Fluorometer Gain area of the Sensor Setup dialog box, select the desired option in accordance with Table C-5 on page C-8.

5 Click OK to close the Sensor Setup dialog box and save the range setting.

Calibrating the Fluorometer Sensor

Before calibrating the fluorometer sensor, select the desired range as described in “Selecting the Range for the Fluorometer Sensor” on page C-8.

To calibrate the fluorometer sensor, refer to “Calibrating the External Sensors” on page C-10.

Calibrating the External Sensors

CTDPro allows you to calibrate optionally installed external sensors. You must provide the means to set up the sensor to expose it to stimuli at its low and high range of operation and, if required, points in between. If the external sensor to be calibrated is a turbidity or fluorometer sensor, select the desired range as described in “Selecting the Range for the Turbidity Sensor” on page C-5 or “Selecting the Range for the Fluorometer Sensor” on page C-8 before calibrating the sensor.

> ***Note:*** *You can also select the desired range by setting the Channel 1 (turbidity sensor) Gain_0 and Gain_1 outputs, or the Channel 2 (fluorometer sensor) Gain_0 and Gain_1 outputs. For instructions on how to make these settings, refer to “Displays or sets the Gain0_0 and Gain0_1 outputs” on page D-109 and to “Displays or sets the Gain1_0 and Gain1_1 outputs” on page D-111. The settings must conform to a specified truth table as provided in the Seapoint Turbidity Meter or Chlorophyll Fluorometer user manual.*

To calibrate an external sensor:

1. Connect the NXIC CTD to your computer.
2. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.
3. Choose Sensors ➤ Calibrate.

   The Calibrate Sensor dialog box shown in Figure C-6 opens.

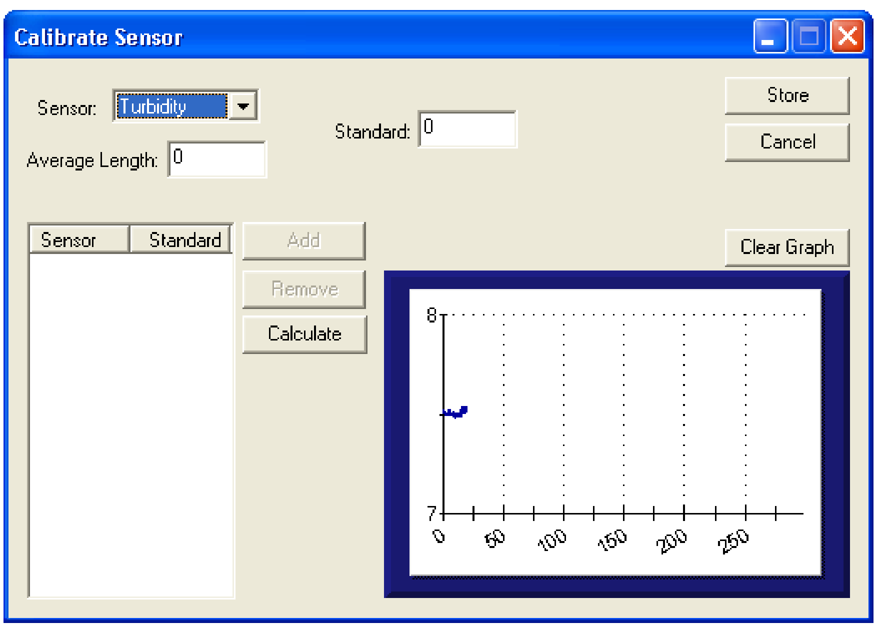


Figure C-6: ***The Calibrate Sensor Dialog Box—Selecting the Sensor***

4 In the Calibrate Sensor dialog box, select the sensor from the Sensor drop-down list box.

5 Set up a low point standard for the sensor. For example, if calibrating a turbidity sensor, cover the turbidity sensor’s optical window with black electrical tape to block out all light entering the sensor.

6 Enter 0 in the Standard text box.

Note: *You have to enter “0” even if "0" is already displayed. Entering 0 again enables the Add button.*

7 Click Add.

The sensor is added along with the entered standard to the table as shown in Figure C-7. A corresponding graph is also displayed.

Note: *If an error is made, click Remove and repeat Steps 6 and 7. Allow the data to stabilize before clicking Add.*

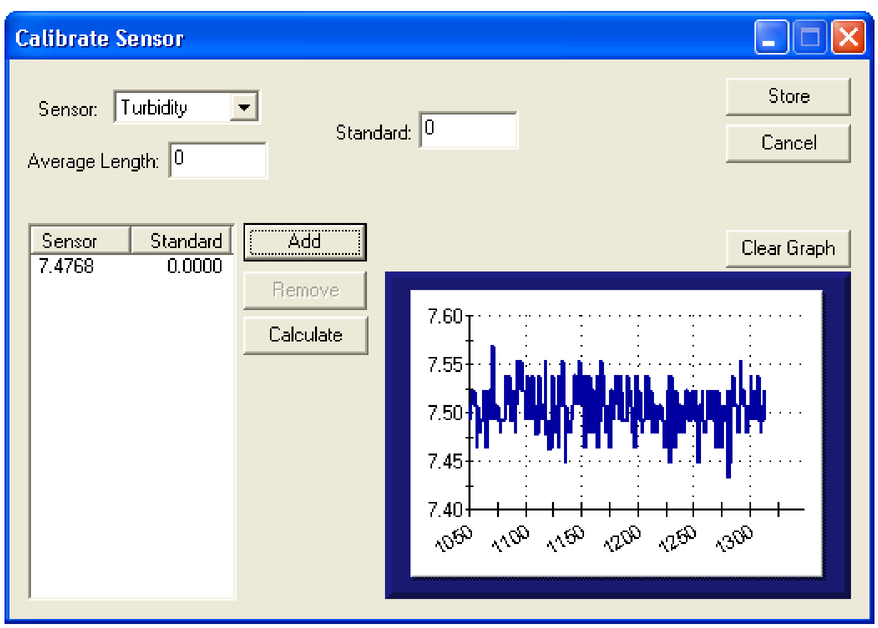


Figure C-7: ***The Calibrate Sensor Dialog Box—Setting the Low Point Standard***

8. Set up a high point standard for the sensor. For example, if calibrating a turbidity sensor, expose the sensor to a liquid of known high clarity.

9. Enter the high point standard in the Standard text box. For example, the standard might be 200 for a turbidity sensor.

10. Click Add.

    The second standard is added to the table.

11. If required, repeat the setup and standard entries for as many additional standards as desired in between the high and low standards.

    The standards are added to the table and the graph as shown in Figure C-8.

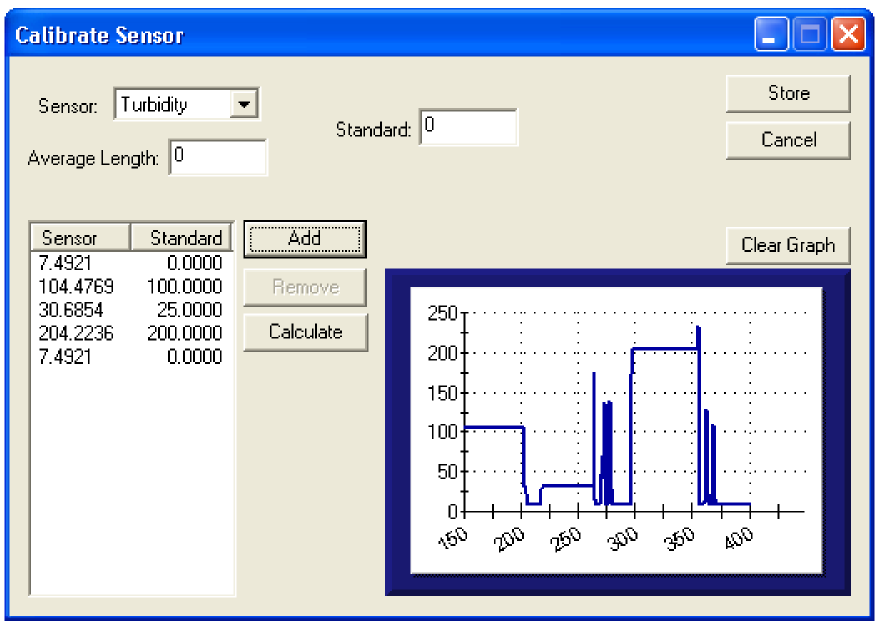


Figure C-8: ***The Calibrate Sensor Dialog Box—Setting Additional Standard Points Including the High Point Standard***

12. Click Calculate.

    The Calibration Results window opens as shown in Figure C-9 displaying the calibration equation coefficients.

13. Click Store to write the calibration coefficients to the NXIC CTD.

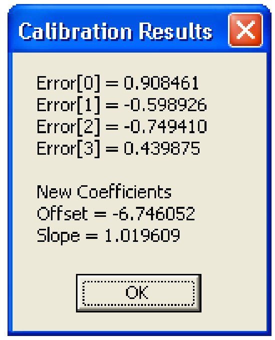


Figure C-9: ***The Calibration Results Window***

APPENDIX D: NXIC CTD Commands

All NXIC CTD commands are entered in the Terminal window by typing the commands directly from the keyboard of your computer. To enter commands CTDPro must be installed and running on your computer with the NXIC CTD connected to it. (See “Installing CTDPro and Selecting the NXIC CTD” on page 2-3 and “Connecting the NXIC CTD to Your Computer” on page 2-5.)

The NXIC CTD commands are listed in Table D-1 on page D-3. Also listed in the table are the page references to where detailed descriptions of the commands are provided.

NXIC CTD Operating Modes

The NXIC CTD always runs in one of three operating modes. Each command applies specifically to one or more of these modes. The NXIC CTD can be placed into any operating mode by entering the appropriate command. The NXIC CTD operating modes are the following:

Run mode is the normal operating mode in which data are acquired and stored. There are three Run modes: Continuous, where data are acquired continuously; Interval, where data are acquired at specified intervals for specified periods; and Delayed Start, where data acquisition begins at a specified time and date in the future in Continuous or Interval mode. The instrument normally powers up in Run mode.

Open mode is used to update calibration and other operational parameters.

Calibration mode provides certain functions that are used when the instrument is calibrated.

Command Properties

All the NXIC CTD commands exhibit the following common properties:

- A command is executed only after a carriage return <CR> or a line feed <LF> character is received.
- Additional characters received after a <CR> or <LF> character are ignored until the command is executed.
- Unless specified otherwise, a command can be entered in either upper or lower case letters.

- All displays are followed by a <CR> and a <LF> character at the end of each line.
- A command is invalid if it is not recognized for the specific operating mode or if it is entered incorrectly or incompletely.
- If an entered command is invalid, the message "BAD COMMAND, TYPE ?+Enter" is displayed. Typing “?,” and then pressing Enter, lists some common commands and their descriptions.

Entering Commands

To enter a NXIC CTD command:

1. Choose Start ➤ All Programs ➤ FSI Applications ➤ CTDPro.

   CTDPro starts and the CTDPro Main window opens.

2. Choose View ➤ Terminal.

   The Terminal window shown in Figure D-1 opens.

Figure D-1: ***The Terminal Window***

3. Click anywhere in the Terminal window.

4. Type the command in accordance with the commands listed in Table D-1.

COMMAND	OPERATIING MODE			FUNCTION	PAGE NO.
	R	O	C		
START	–	•	–	Starts data acquisition	D-7
***R	–	•	–	Go to the Run operating mode	D-9
***O	•	–	•	Go to the Open operating mode	D-11
***C	–	•	–	Go to the Calibration operating mode	D-13
***I	–	•	–	Go to Interval mode	D-15
***D	–	•	–	Go to Delayed Start mode	D-17
***E	–	•	–	Save the EE data base	D-19
CDATE	–	•	–	Displays and sets the calibration date	D-21
SRATE	•	•	•	Displays and sets the instrument sampling rate	D-23
DTIME	–	•	–	Displays and sets the delayed start time	D-25
DDATE	–	•	–	Displays and sets the delayed start date	D-27
ITIME	–	•	–	Displays and sets the interval time	D-29
OTIME	–	•	–	Displays and sets the on time	D-31
RCAL	–	•	–	Displays the calibration constants	D-33
SCKO	–	•	–	Enables checksum operation	D-35
CCKO	–	•	–	Disables checksum operation	D-37
RCKO	–	•	–	Displays the checksum setting	D-39
SSOT	–	•	–	Enables scaled output mode	D-41

Table D-1: ***NXIC CTD Commands***

NXIC CTD Commands

COMMAND	OPERATIING MODE			FUNCTION	PAGE NO.
	R	O	C		
CSOT	–	•	–	Disables scaled output mode	D-43
RSOT	–	•	–	Displays the scaled output setting	D-45
SCOP	–	•	–	Enables continuous on power up	D-47
CCOP	–	•	–	Disables continuous on power up	D-49
RCOP	–	•	–	Displays the continuous on power up setting	D-51
SB	–	•	–	Sets the baud rate	D-53
MODE	•	•	•	Displays the current mode	D-55
SAOP	–	•	–	Sets the address operation	D-57
CAOP	–	•	–	Clears the address operation	D-59
RAOP	–	•	–	Displays the address operation setting	D-61
TIME	–	•	–	Displays and sets the RTC time	D-63
DATE	–	•	–	Displays and sets the RTC date	D-65
DIAG	–	•	–	Runs diagnostics	D-67
ZMEM	–	•	–	Erases the entire flash memory	D-69
FDMP	–	•	–	Dumps a file in ASCII	D-71
AVGI	–	•	–	Sets the averaging interval	D-73
CHKF	–	•	–	Checks the flash memory	D-75
DDMP	–	•	–	Outputs scans from memory in ASCII	D-77

Table D-1: ***NXIC CTD Commands (Continued)***

COMMAND	OPERATIING MODE			FUNCTION	PAGE NO.
	R	O	C		
BDMP	–	•	–	Outputs scans from memory in binary	D-79
DLEN	–	•	–	Sets the number of scans to output	D-81
LOG	–	•	–	Sets the position of the logging pointer	D-83
S/N	–	•	–	Displays the serial number	D-85
ROP	•	•	•	Displays the current operational settings	D-87
VER	–	•	–	Displays the firmware version number	D-89
WHO	•	•	•	Displays the device name	D-91
ADR	–	•	–	Displays or sets the instrument address	D-93
RDM	•	•	•	Displays the channel names	D-95
DIR	•	•	•	Displays the file directory	D-97
C	•	•	•	Displays the current mode	D-99
?	•	•	•	Displays the Help menu	D-101
S	•	–	•	Closes the current file	D-103
SC	•	–	•	Sets continuous output	D-105
SFRM	–	•	–	Closes the current file	D-107
GAIN0	–	•	–	Displays or sets the Gain0_0 and Gain0_1 outputs	D-109
GAIN1	–	•	–	Displays or sets the Gain1_0 and Gain1_1 outputs	D-111

Table D-1: ***NXIC CTD Commands (Continued)***

START

Starts data acquisition

Usage

START <filename> <CR> or <LF>

Operating Modes

Open

Description

The START command creates a file in the instrument and immediately begins acquiring and saving data to the file. Data are recorded at the sample rate set by the SRATE command.

Returns

<CR><LF>

Entering a <CR> or <LF> character a second time and every time thereafter displays a scan of data followed by a <CR><LF>.

See Also

S, SC, SRATE

***R

Go to the Run operating mode

Usage

***R <CR> or <LF>

Operating Modes

Open

Description

The ***R command sets the instrument into the Run operating mode. In Run mode the instrument acquires data in Continuous, Interval or Delayed Start mode. Data are recorded at the sample rate set by the SRATE command.

In Continuous mode, data are acquired continuously.

For the instrument to acquire data in Interval mode, valid interval and on times must have been entered. In Interval mode the instrument turns on and data are acquired at the beginning of each interval time as set by the ITIME command for the on time as set by the OTIME command. The instrument turns off at the end of each on time.

For the instrument to acquire data in Delayed Start mode, a valid delayed start time and date must have been entered. In Delayed Start mode data are acquired in either Continuous or Interval mode commencing at the time specified by the DTIME command and the date specified by the DDATE command.

Returns

<CR><LF>

Entering a <CR> or <LF> character a second time and every time thereafter displays a scan of data followed by a <CR><LF>.

See Also

ITIME, OTIME, DTIME, DDATE, S, SC, SRATE

***O

Go to the Open operating mode

Usage

***O <CR> or <LF>

Operating Modes

Run, Calibration

Description

The ***O command sets the instrument into the Open operating mode. In Open mode data are not acquired and operational settings and calibration constants can be displayed and edited.

Returns

<CR><LF>

Entering a <CR> or <LF> character a second time and every time thereafter displays the following:

Open Mode

***C

Go to the Calibration operating mode

Usage

***C <CR> or <LF>

Operating Modes

Open

Description

The ***C command sets the instrument into the Calibration operating mode. In Calibration mode reference data and raw data can be displayed.

Returns

<CR><LF>

Entering a <CR> or <LF> character a second time and every time thereafter displays a scan of data followed by a <CR><LF>.

See Also

S, SC

***I

Go to Interval mode

Usage

***I <filename> <CR> or <LF>

Operating Modes

Open

Description

The ***I command creates a file in the instrument and sets the instrument into the Interval operating mode of the Run mode if valid interval and on times have been entered. In Interval mode the instrument turns on and acquires and saves data to the file at the beginning of each interval time as set by the ITIME command for the on time as set by the OTIME command. Data are recorded at the sample rate set by the SRATE command. The instrument turns off at the end of each on time.

Returns

<CR><LF>
Time = 10:51:41.54 Date = 08-12-2005
This ON Time Ends 11:11:40 08-12-2005
The NEXT Interval Starts 11:51:40 08-12-2005

Entering a <CR> or <LF> character a second time and every time thereafter displays a scan of data during the on time only followed by a <CR><LF>.

See Also

ITIME, OTIME, S, SC, SRATE

***D

Go to Delayed Start mode

Usage

***D <filename> <CR> or <LF>

Operating Modes

Open

Description

The ***D command creates a file in the instrument and sets the instrument into the Delayed Start mode of the Run operating mode if a valid delayed start time and date have been entered. In Delayed Start mode the instrument turns on and acquires and saves data to the file in the Continuous or Interval mode of the Run operating mode beginning at the time specified by the DTIME command and date specified by the DDATE command. Data are recorded at the sample rate set by the SRATE command.

In Continuous mode, data are acquired continuously.

For the instrument to acquire data in Interval mode, valid interval and on times must have been entered. In Interval mode data are acquired at the beginning of each interval time as set by the ITIME command for the on time as set by the OTIME command. The instrument turns off at the end of each on time.

Returns

<CR><LF>
Time = 11:22:54 Date = 08-12-2005
Normal Run Starts
Delayed Start Ops Active
11:25:00 08-12-2005
bye_bye

See Also

DTIME, DDATE, ITIME, OTIME, SRATE

***E

Save the EE data base

Usage

***E <CR> or <LF>

Operating Modes

Open

Description

The ***E command causes all calibration constants and operational settings to be written to flash memory.

> ***Caution:*** *The ***E command overwrites the current calibration constants and operational settings in flash memory. Before using the ***E command, use the RCAL command to verify that the calibration constants are correct.*

Returns

<CR><LF>

See Also

RCAL

CDATE

Displays and sets the calibration date

Usage

CDATE <CR> or <LF>

CDATE=ddmmmyy <CR> or <LF>

Operating Modes

Open

Description

The CDATE command displays and allows you to set the calibration date of the instrument.

When setting the calibration date, use the ddmmmyy date format:

dd:	Day—01 to 31
mmm:	Month—JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, and DEC. Capitol letters only.
yy:	Year—00 to 99 for 2000 to 2099

Returns

See examples below.

Examples

Enter CDATE <CR> or <LF>

The instrument displays the current date:

CDATE=12AUG05 <CR><LF>

Enter CDATE=30AUG05 <CR> or <LF>

The instrument sets the new date to August 30, 2005 followed by a <CR><LF>.

SRATE

Displays and sets the instrument sampling rate

Usage

SRATE <CR> or <LF>

SRATE=nn <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The SRATE command displays and allows you to set the sampling rate of the instrument in Hz. The range of sampling rates is from 1 to 15 Hz.

The nn format is 1 to 15 for 1 to 15 Hz.

> ***Note:*** *Entering a number higher than 15 will be saved as 15.*

Returns

See examples below.

Examples

Enter SRATE <CR> or <LF>

The instrument displays the current instrument sampling rate:

SRATE=4 Hz <CR><LF>

Enter SRATE=8 <CR> or <LF>

The instrument sets the new instrument sampling rate followed by a <CR><LF>.

DTIME

Displays and sets the delayed start time

Usage

DTIME <CR> or <LF>

Operating Modes

Open

Description

The DTIME command displays and allows you to set the delayed start time of the instrument.

> ***Note:*** *The time set by the DTIME command must be later than the current time and date by at least one minute.*

When setting the delayed start time, use the hh:mm:ss format:

hh:	Hours—01 to 24
mm:	Minutes—00 to 59
ss:	Seconds—00 to 59

Returns

See Examples below.

Examples

Enter DTIME <CR> or <LF>

The instrument displays the current delayed start time and allows you to enter a new time:

```
Delayed Start Time = 11:25:00
Enter time [hh:mm:ss]:
```

Enter a <CR><LF> to leave the delayed start time as is, or enter the time in hours, minutes and seconds, and then enter a <CR><LF>.

See Also

DDATE, TIME, DATE

DDATE

Displays and sets the delayed start date

Usage

DDATE <CR> or <LF>

Operating Modes

Open

Description

The DDATE command displays and allows you to set the delayed start date of the instrument.

When setting the delayed start date, use the mm-dd-yy format:

mm:	Month—01 to 12
dd:	Day—01 to 31
yy:	Year—00 to 99

Returns

See Examples below.

Examples

Enter DDATE <CR> or <LF>

The instrument displays the current delayed start date and allows you to enter a new date:

```
Delayed Start Date = 09-12-2005
Enter date (mm-dd-yy):
```

Enter a <CR><LF> to leave the delayed start date as is, or enter the date in days, months and years, and then enter a <CR><LF>.

See Also

DTIME, TIME, DATE

ITIME

Displays and sets the interval time

Usage

ITIME <CR> or <LF>

Operating Modes

Open

Description

The ITIME command displays and allows you to set the interval time of the instrument. The interval time is the time in hours, minutes and seconds between the start of each on time.

> ***Note:*** *The time set by the ITIME command must be longer than the time set by the OTIME command by at least five seconds.*

When setting the interval time, use the hh:mm:ss format:

hh:	Hours—01 to 24
mm:	Minutes—00 to 59
ss:	Seconds—00 to 59

Returns

If no interval time has been set:

NO Interval time

Enter time (hh:mm:ss):

If an interval time has been set:

Interval Time = 01:00:00
Enter time (hh:mm:ss):

Examples

Enter ITIME <CR> or <LF>

The instrument displays the current interval time and allows you to enter a new time:

```
Interval Time = 01:00:00
Enter time [hh:mm:ss]:
```

Enter a <CR><LF> to leave the interval time as is, or enter the time in hours, minutes and seconds, and then enter a <CR><LF>.

See Also

OTIME, TIME, DATE

OTIME

Displays and sets the on time

Usage

OTIME <CR> or <LF>

Operating Modes

Open

Description

The OTIME command displays and allows you to set the on time of the instrument. The on time is the time in hours, minutes and seconds beginning at the start of each interval time during which the instrument is on and collecting data.

> ***Note:*** *The time set by the OTIME command must be shorter than the time set by the ITIME command by at least five seconds.*

When setting the on time, use the hh:mm:ss format:

hh:	Hours—01 to 24
mm:	Minutes—00 to 59
ss:	Seconds—00 to 59

Returns

If no on time has been set:

```
NO ON time

Enter time (hh:mm:ss):
```

If an on time has been set:

```
ON Time = 00:00:20
Enter time (hh:mm:ss):
```

Examples

Enter OTIME <CR> or <LF>

The instrument displays the current on time and allows you to enter a new time:

ON Time = 00:00:20
Enter time [hh:mm:ss]:

Enter a <CR><LF> to leave the on time as is, or enter the time in hours, minutes and seconds, and then enter a <CR><LF>.

See Also

ITIME, TIME, DATE

RCAL

Displays the calibration constants

Usage

RCAL <CR> or <LF>

Operating Modes

Open

Description

The RCAL command displays all of the instrument calibration constants.

> ***Note:*** *The ***E command must be entered to save any changed calibration constants. In addition, the instrument serial number and the version number of the firmware cannot be changed.*

Returns

See Examples below.

Examples

Enter RCAL <CR> or <LF>

The instrument displays the calibration constants:

```
S/N=1001
Firmware Version 2.2
CDATE=Not Set
A1=0.0
B1=9.000000E-05
C1=0.0
D1=0.0
KFAC=1.360000
A2=0.0
B2=5.000000E-01
C2=0.0
D2=0.0
E2=0.0
F2=0.0
```

```
G2=0.0
H2=0.0
I2=0.0
A03=0.0
B03=0.0
C03=0.0
A503=1034.000000
B503=0.0
C503=0.0
A1003=2068.000000
B1003=0.0
C1003=0.0
A3=0.0
PS0=1.000000E-01
PS50=1034.400024
PS100=2068.800049
```

See Also

***C, ***E

SCKO

Enables checksum operation

Usage

SCKO <CR> or <LF>

Operating Modes

Open

Description

The SCKO command enables the output of the checksum result with the data.

> ***Note:*** *The SCKO command must be followed by the ***E command to save the setting.*

With the checksum output enabled, a checksum in hexadecimal format, is saved with each scan of data. The checksum is shown in the rightmost column of each row of data when displaying the data.

Returns

checksum output set

See Also

***E, CCKO, RCKO

CCKO

Disables checksum operation

Usage

CCKO <CR> or <LF>

Operating Modes

Open

Description

The CCKO command disables the output of the checksum result with the data.

> ***Note:*** *The CCKO command must be followed by the ***E command to save the setting.*

With the checksum output disabled, a checksum is not saved with the data or displayed when displaying data.

Returns

checksum output cleared

See Also

***E, SCKO, RCKO

RCKO

Displays the checksum setting

Usage

RCKO <CR> or <LF>

Operating Modes

Open

Description

The RCKO command displays the checksum setting.

Returns

If the checksum is not set:

    checksum output cleared

If the checksum is set:

    checksum output set

See Also

SCKO, CCKO

SSOT

Enables scaled output mode

Usage

SSOT <CR> or <LF>

Operating Modes

Open

Description

The SSOT command enables the scaled output of the data over a range of 0 to 65535 counts.

> ***Note:*** *The SSOT command must be followed by the ***E command to save the setting.*

Returns

scaled output set

See Also

***E, CSOT, RSOT

CSOT

Disables scaled output mode

Usage

CSOT <CR> or <LF>

Operating Modes

Open

Description

The CSOT command disables the scaled output of the data.

> ***Note:*** *The CSOT command must be followed by the ***E command to save the setting.*

Returns

scaled output cleared

See Also

***E, SSOT, RSOT

RSOT

Displays the scaled output setting

Usage

RSOT <CR> or <LF>

Operating Modes

Open

Description

The RSOT command displays the scaled output setting.

Returns

If the scaled output is not set:

scaled output cleared

If the scaled output is set:

scaled output set

See Also

SSOT, CSOT

SCOP

Enables continuous on power up

Usage

SCOP <CR> or <LF>

Operating Modes

Open

Description

The SCOP command enables continuous output of data immediately after power up. Data are output at the instrument sampling rate as set by the SRATE command and the baud rate as set by the SB command.

> ***Note:*** *The SCOP command must be followed by the ***E command to save the setting.*

Returns

Continuous set

See Also

***E, CCOP, RCOP, SRATE, SB

CCOP

Disables continuous on power up

Usage

CCOP <CR> or <LF>

Operating Modes

Open

Description

The CCOP command disables continuous output of data immediately after power up.

> ***Note:*** *The CCOP command must be followed by the ***E command to save the setting.*

Returns

Continuous cleared

See Also

***E, SCOP, RCOP

RCOP

Displays the continuous on power up setting

Usage

RCOP <CR> or <LF>

Operating Modes

Open

Description

The RCOP command displays the continuous on power up setting.

Returns

If the continuous output is not set:

```
Continuous cleared
```

If the continuous output is set:

```
Continuous set
```

See Also

SCOP, CCOP

SB

Sets the baud rate

Usage

SBnn <CR> or <LF>

Operating Modes

Open

Description

The SB command sets and displays the baud rate of the instrument.

> ***Note:*** *The SB command must be followed by the ***E command to save the setting.*

> ***Warning:*** *If you change the baud rate of the instrument, you will not be able to communicate with the instrument until you set the baud rate of your computer to the same.*

When setting the baud rate, use the nn format as follows:

15:	Sets the baud rate to 115000
57:	Sets the baud rate to 57600
38:	Sets the baud rate to 38400
19:	Sets the baud rate to 19200
96:	Sets the baud rate to 9600
12:	Sets the baud rate to 1200
30:	Sets the baud rate to 300

Returns

See Examples below.

Examples

Enter SB19 <CR> or <LF>

The instrument sets and displays the baud rate setting:

Unit now communicates at 19200 baud

See Also

***E

MODE

Displays the current mode

Usage

MODE <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The MODE command displays the current operating mode of the instrument.

Returns

If the instrument is in Open mode:

    Open Mode

If the instrument is in Run mode:

    Run Mode

If the instrument is in Calibration mode:

    Cal Mode

See Also

***R, ***O, ***C

SAOP

Sets the address operation

Usage

SAOP <CR> or <LF>

Operating Modes

Open

Description

The SAOP command enables address operation where the instrument will initially enter the Open mode until a # character is sent at which time the instrument will only re-enter Open mode when its valid address has been received.

> ***Note:*** *The SAOB command must be followed by the ***E command to save the setting.*

Returns

Address op set, Adr = 00<CR><LF>

See Also

***E, CAOP, RAOP, ADR

CAOP

Clears the address operation

Usage

CAOP <CR> or <LF>

Operating Modes

Open

Description

The CAOP command disables address operation.

> ***Note:*** *The CAOB command must be followed by the ***E command to save the setting.*

Returns

Address op cleared

See Also

SAOP, RAOP, ADR

RAOP

Displays the address operation setting

Usage

RAOP <CR> or <LF>

Operating Modes

Open

Description

The RAOP command displays the address operation setting.

Returns

If address operation is not set:

Address op cleared

If the address operation is set:

Address op set, Adr = 00

See Also

SAOP, CAOP, ADR

TIME

Displays and sets the RTC time

Usage

TIME <CR> or <LF>

Operating Modes

Open

Description

The TIME command displays and allows you to set the current time of the real time clock in the instrument.

When setting the current time, use the hh:mm:ss format:

hh:	Hours—01 to 24
mm:	Minutes—00 to 59
ss:	Seconds—00 to 59

Returns

```
Time = 18:00:15.80
Enter time (hh:mm:ss):
```

Examples

Enter TIME <CR> or <LF>

The instrument displays the current time and allows you to enter a new time:

```
Time = 18:00:15.80
Enter time (hh:mm:ss):
```

Enter a <CR><LF> to leave the time as is, or enter the time in hours, minutes and seconds, and then enter a <CR><LF>.

See Also

DATE

DATE

Displays and sets the RTC date

Usage

DATE <CR> or <LF>

Operating Modes

Open

Description

The DATE command displays and allows you to set the current date of the real time clock in the instrument.

When setting the current date, use the mm-dd-yy format:

mm:	Month—01 to 12
dd:	Day—01 to 31
yy:	Year—00 to 99

Returns

Date = 08-12-2005

Enter date (mm-dd-yy):

Examples

Enter DATE <CR> or <LF>

The instrument displays the current date and allows you to enter a new date:

Date = 08-12-2005

Enter date (mm-dd-yy):

Enter a <CR><LF> to leave the date as is, or enter the date in days, months and years, and then enter a <CR><LF>.

See Also

TIME

DIAG

Runs diagnostics

Usage

DIAG <CR> or <LF>

Operating Modes

Open

Description

The DIAG command runs the instrument diagnostics and displays the results.

Returns

See Examples below.

Examples

Enter diag <CR> or <LF>

The instrument displays the diagnostics:

```
Running diagnostics...
EEPROM OK
Real-Time Clock: Passed
Marker Code = 236 (0xEC)
Device Code = 218 (0xDA)
Size Code = 21 (0x15)
Flash Status = 224 (0xE0)
Clearing block table...
Regulated Supply Voltage (6 V) = 10.29 VDC
4V Reference = 4.00 VDC
Battery = 3.25 VDC
```

ZMEM

Erases the entire flash memory

Usage

ZMEM <CR> or <LF>

Operating Modes

Open

Description

The ZMEM command erases all of the data stored in the flash memory of the instrument. The calibration constants are not erased. In addition, the memory pointers are reset after the data are erased.

Returns

See Examples below.

Examples

Enter ZMEM <CR> or <LF>

The instrument asks if you want to erase the data:

    Erase the File Table?

Entering a <CR><LF> erases the data:

    Memory erased.<CR><LF>

See Also

BERA, DLEN, DDMP

FDMP

Dumps a file in ASCII

Usage

FDMP <filename> <CR> or <LF>

Operating Modes

Open

Description

The FDMP command dumps a file in ASCII.

Returns

See Examples below.

Examples

Enter FDMP <filename> <CR> or <LF>.

The instrument dumps the file in ASCII:

```
Read sequence, please wait...
File Type: Continuous
Sampling Rate: 10Hz
A/D Rate: 55Hz
Delayed Start 00:00:00  00-00-00
Averaging Interval Time = 00:00
Interval Time = 00:00:00
ON Time = 00:00:00
1123871932.255, +188.7436, -999.9000, +2303535.0000, +00.0389,
+1710583808.4294957295, 3.52
1123871932.255, +188.7436, -999.9000, +2303535.0000, +00.0389,
+1710583808.4294957295, 3.52
1123871932.255, +188.7436, -999.9000, +2303535.0000, +00.0389,
+1710583808.4294957295, 3.52
1123871932.255, +188.7436, -999.9000, +2303535.0000, +00.0389,
+1710583808.4294957295, 3.52
1123871933.255, +188.7436, -999.9000, +2303535.0000, +00.0389,
+1710583808.4294957295, 3.52
```

AVGI

Sets the averaging interval

Usage

AVGI <CR> or <LF>

Operating Modes

Open

Description

The AVGI command displays and allows you to set the averaging interval of the instrument. The averaging interval is the time during the Continuous or Interval mode of the Run Operating mode that data are averaged. In Interval mode data are averaged during the on time only.

> ***Note:*** *The time set by the AVGI command must be 5 seconds or longer. Enter 4 seconds or less for no averaging.*

When setting the interval time, use the mm:ss format:

mm:	Minutes—00 to 59
ss:	Seconds—00 to 59

Returns

See Examples below.

Examples

Enter AVGI <CR> or <LF>

The instrument displays the current averaging interval and allows you to enter a new interval:

```
Averaging Interval Time = 00:00
Enter interval (mm:ss):
```

Enter a <CR><LF> to leave the averaging interval as is, or enter the interval in minutes and seconds, and then enter a <CR><LF>.

See Also

DATE, TIME, ITIME, OTIME, DTIME

CHKF

Checks the flash memory

Usage

CHKF <CR> or <LF>

Operating Modes

Open

Description

The CHKF command checks the flash memory.

Returns

See Examples below.

Examples

Enter CHKF <CF> or <LF>.

The instrument checks the flash memory and displays the results:

```
Marker Code = 236 (0xEC)
Device Code = 218 (0xDA)
Size Code = 21 (0x15)
Flash Status = 224 (0xE0)
Clearing block table...
Checking Blocks...
Invalid Block: 0, Addres = 137216
Invalid Block: 2, Addres = 407552
```

DDMP

Outputs scans from memory in ASCII

Usage

DDMP <CR> or <LF>

Operating Modes

Open

Description

The DDMP command outputs and displays scans of recorded data in ASCII. The number of scans output and displayed is specified by the DLEN command.

> ***Note:*** *To determine which parameters have been logged, and in which order they were logged, enter the RDM command. The RDM command displays the number of bytes per scan.*

Returns

See Examples below.

Examples

Enter DDMP <CR> or <LF>

The instrument outputs the number of scans specified by the DLEN command.

See Also

DLEN, BDMP, RDM, LOG

BDMP

Outputs scans from memory in binary

Usage

BDMP <CR> or <LF>

Operating Modes

Open

Description

The BDMP command outputs and displays scans of recorded data in binary. The number of scans output is specified by the DLEN command. The data are output in IEEE Standard 4-byte binary form.

> ***Note:*** *To determine which parameters have been logged, and in which order they were logged, enter the RDM command. The RDM command displays the number of bytes per scan.*

Returns

See Examples below.

Examples

Enter BDMP <CR> or <LF>

The instrument outputs and displays the number of scans specified by the DLEN command.

See Also

DLEN, DDMP, RDM

DLEN

Sets the number of scans to output

Usage

DLEN=nnnn <CR> or <LF>

Operating Modes

Open

Description

The DLEN command sets the number of scans of recorded data to output and display when using the DDMP or BDMP command.

The nnnn format is 1 to 9999.

Returns

See Examples below.

Examples

Enter DLEN=1200 <CR> or <LF>

The instrument sets the number of scans of recorded data to output to 1200 followed by a <CR><LF>.

See Also

DLEN, DDMP, BDMP, RDM, LOG

LOG

Sets the position of the logging pointer

Usage

LOG=nnnnn <CR> or <LF>

Operating Modes

Open

Description

The LOG command sets the value of the logging pointer. The value of the logging pointer is the location of the next byte in memory to be written to flash memory.

The nnnn format is 1 to 99999.

Returns

See Examples below.

Examples

Enter LOG=1400 <CR> or <LF>

The instrument sets the position of the logging pointer to 1400 followed by a <CR><LF>.

See Also

DLEN, DDMP, BDMP, RDM

S/N

Displays the serial number

Usage

S/N <CR> or <LF>

Operating Modes

Open

Description

The S/N command displays the serial number of the instrument.

Returns

See Examples below.

Examples

Enter S/N <CR> or <LF>

The instrument displays its serial number:

```
S/N=1001
```

See Also

VER

ROP

Displays the current operational settings

Usage

ROP <CR> or <LF>

Operating Modes

Run, Open, Calibration.

Description

The ROP command displays all the current calibration constants and operational settings for the instrument.

Returns

See Examples below.

Examples

Enter ROP <CR> or <LF>

The instrument displays all the current calibration constants and operational settings:

```
S/N=1001
Open Mode
Continuous cleared
Address op cleared
scaled output cleared
checksum output cleared
CH0(TIME)=ON
CH1(COND)=ON
CH2(TEMP)=ON
CH3(PRES)=ON
CH4(SALT)=ON
CH5(SNDV)=ON
CH6(BATT)=ON
ARATE=7
SRATE=10 Hz
N=1
Autologging OFF
```

VER

Displays the firmware version number

Usage

VER <CR> or <LF>

Operating Modes

Open

Description

The VER command displays the version number of the firmware in the instrument.

Returns

See Examples below.

Examples

Enter VER <CR> or <LF>

The instrument displays the version number of the firmware:

```
Firmware Version 2.2
```

See Also

S/N

WHO

Displays the device name

Usage

WHO <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The WHO command displays the device name. The device is the connected instrument.

Returns

See Examples below.

Examples

Enter WHO <CF> or <LF>

The instrument displays the device name:

NXIC CTD

ADR

Displays or sets the instrument address

Usage

ADR <CR> or <LF>

and

ADR=nn <CR> or <LF>

Operating Modes

Open

Description

The ADR command displays or sets the address of the instrument.

> ***Note:*** *The ADR command must be followed by the ***E command to save the setting.*

The nn format is 00 to 99.

Returns

See Examples below.

Examples

Enter ADR <CR> or <LF>

The instrument displays the address of the instrument:

ADR=05 <CR> or <LF>

Enter ADR=67 <CR> or <LF>

The instrument sets its address to 67 and outputs a <CR><LF>.

See Also

SAOP, CAOP, RAOP, ROP

RDM

Displays the channel names

Usage

RDM <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The RDM command displays the on or off status of each of the six data channels.

The six data channels are the following:

TIME:	Time
COND:	Conductivity
TEMP:	Temperature
PRES:	Pressure
SALT:	Salinity
SNDV:	Sound velocity
BATT:	Battery

Returns

See Examples below.

Examples

Enter RDM<CR>

The instrument displays the six channels and the on or off status of each:

```
CH0(TIME)=ON
CH1(COND)=ON
CH2(TEMP)=ON
CH3(PRES)=ON
CH4(SALT)=ON
CH5(SNDV)=ON
CH6(BATT)=ON
```

DIR

Displays the file directory

Usage

DIR <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The DIR command displays the file directory on the instrument.

Returns

See Examples below.

Examples

Enter DIR <CR> <LF>

The instrument displays the file directory:

```
Number of files: 3
Name        Start Time       End Time        Start   End     Size
CTD DATA01  08/14/5 15:37   08/14/5 15:37       0    6235    6235
CTD DATA02  08/14/5 15:38   08/14/5 15:38    6235   10411    4176
File: CTD DATA03 is currently open.
CTD DATA03  08/14/5 15:38   08/14/5 15:38   10411   12847    2436
End of files.
```

C

Displays the current mode

Usage

C <CR> or <LF>

Operating Modes

Run, Open, Calibration

Description

The C command displays the current operating mode of the instrument.

Returns

If the instrument is in Open mode:

```
Open Mode
```

If the instrument is in Run mode:

```
Run Mode
```

If the instrument is in Calibration mode:

```
Cal Mode
```

See Also

***R, ***O, ***C

?

Displays the Help menu

Usage

? <CR> or <LF>

Operating Modes

Open

Description

The ? command displays a Help menu, which lists many of the available commands. For detailed information on how to use these and other commands, refer to the information provided in this section.

Returns

Help menu.

S

Closes the current file

Usage

S

Operating Modes

Run, Calibration

Description

The S command stops the output of data in the Continuous mode of the Run operating mode. No <CR> or <LF> character is required.

> ***Note:*** *The S command must be entered as an upper case character.*

Returns

None.

See Also

SC

SC

Sets continuous output

Usage

SC <CR> or <LF>

Operating Modes

Run, Calibration

Description

The SC command sets the instrument into the Continuous mode of the Run operating mode. The instrument outputs the data as soon as it is available.

Returns

Data are displayed one scan at a time.

See Also

S

SFRM

Closes the current file

Usage

SFRM <CR> or <LF>

SFRM=n <CR> or LF>

Operating Modes

Open

Description

The SFRM command allows you to select the output format of the data from a list of available formats, including standard FSI format. The output selections are available for special customer requirements and can be customized in accordance with customer needs.

> ***Note:*** *The SFRM command must be followed by the ***E command to save the setting.*

Returns

See Examples below.

Examples

Enter SFRM 1 <CR> or <LF>

The instrument displays the current output format:

    SFMR=1: 000452 23.24   45.3   35.17   12.3

Enter SFRM=1 <CR> or <LF>

The instrument sets the new output format followed by a <CF<LF>.

See Also

***E

GAIN0

Displays or sets the Gain0_0 and Gain0_1 outputs

Usage

GAIN0 <CR> or <LF>

and

GAIN0=n <CR> or <LF>

Operating Modes

Open

Description

The GAIN0 command displays or sets the Gain0_0 and Gain0_1 outputs. These are logic outputs on the Option 1 connector; they correspond to Gain Control A and Gain Control B, respectively, for Channel 1 as shown in Table C-2 on page C-3.

> ***Note:*** *The Gain0_0 and Gain0_1 outputs should be connected to +5 VDC through a 10-Kohm resistor for standard TTL logic.*

> ***Note:*** *The Gain0_0 and Gain0_1 outputs are set <u>only</u> after the instrument is set into either the Run or the Calibration operating mode.*

There are four possible output setting combinations for Gain0_0 and Gain0_1 where an ON setting corresponds to an output of 0 volts and a OFF setting to an output of +5 VDC:

Gain0=0:	Gain0_0 = 0FF, Gain0_1 = OFF
Gain0=1:	Gain0_0 = ON, Gain0_1 = OFF
Gain0=2:	Gain0_0 = OFF, Gain0_1 = ON
Gain0=3:	Gain0_0 = ON, Gain0_1 = ON

> ***Note:*** *The GAIN0 command must be followed by the ***E command to save the setting.*

Returns

See Examples below.

Examples

Enter GAIN0 <CR> or <LF>

The instrument displays the gain setting:

GAIN0
Gain0_0: ON
Gain0_1: ON

Enter GAIN0=2 <CR> or <LF>

The instrument sets the Gain0_0 output to OFF (+5 VDC) and the Gain0_1 output to ON (0 volts) for Channel 1.

See Also

***E

GAIN1

Displays or sets the Gain1_0 and Gain1_1 outputs

Usage

GAIN1 <CR> or <LF>

and

GAIN1=n <CR> or <LF>

Operating Modes

Open

Description

The GAIN1 command displays or sets the Gain1_0 and Gain1_1 outputs. These are logic outputs on the Option 1 connector; they correspond to Gain Control A and Gain Control B, respectively, for Channel 2 as shown in Table C-2 on page C-3.

> **Note:** *The Gain1_0 and Gain1_1 outputs should be connected to +5 VDC through a 10-Kohm resistor for standard TTL logic.*

> **Note:** *The Gain1_0 and Gain1_1 outputs are set only after the instrument is set into either the Run or the Calibration operating mode.*

There are four possible output setting combinations for Gain1_0 and Gain1_1 where an ON setting corresponds to an output of 0 volts and a OFF setting to an output of +5 VDC:

Gain1=0:	Gain1_0 = 0FF, Gain1_1 = OFF
Gain1=1:	Gain1_0 = ON, Gain1_1 = OFF
Gain1=2:	Gain1_0 = OFF, Gain1_1 = ON
Gain1=3:	Gain1_0 = ON, Gain1_1 = ON

> **Note:** *The GAIN1 command must be followed by the ***E command to save the setting.*

Returns

See Examples below.

Examples

Enter GAIN1 <CR> or <LF>

The instrument displays the gain setting:

```
GAIN1
Gain1_0: ON
Gain1_1: ON
```

Enter GAIN1=2 <CR> or <LF>

The instrument sets the Gain1_0 output to OFF (+5 VDC) and the Gain1_1 output to ON (0 volts) for Channel 2.

See Also

***E

APPENDIX E: Warranty, Liability and RMA Return Procedure

Falmouth Scientific, Inc. Limited Warranty

Falmouth Scientific, Inc. (FSI) guarantees its products to be free from defects in materials and workmanship for a period of one year from the date of shipment. In the event a product malfunctions during this period, FSI's obligation is limited to the repair or replacement, at FSI's option, of any product returned to the FSI factory. Products found defective should be returned to the factory freight prepaid and carefully packed, as the customer will be responsible for any damage during shipment.

Repairs or replacements, parts, labor, and return shipment under this warranty will be at no cost to the customer. This warranty is void if, in FSI's opinion, the product has been damaged by accident or mishandled, altered, or repaired by the customer, where such treatment has affected its performance or reliability. In the event of such mishandling, all costs for repair and return freight will be charged to the customer. All products supplied by FSI that are designed for use under hydrostatic loading have been certified by actual pressure testing prior to shipment. Any damage that occurs as a direct result of flooding is NOT covered by this warranty.

If a product is returned for warranty repair and no defect is found, the customer will be charged a diagnostic fee plus all shipping costs. Incidental or consequential damages or costs incurred as a result of a product's malfunction are not the responsibility of FSI.

Equipment not manufactured by FSI is supported only to the extent of the original equipment manufacturer's (OEM) original warranties. All OEM sensors that utilize electrodes (oxygen cartridges, pH, ORP, etc.) are warranted at the time of shipment, and shall perform upon initial installation within stated specifications. If the product proves to be defective within the OEM's warranty, FSI will replace the product or defective part with a similar model, product or part, but only to the extent that the OEM warrants.

All returned products must be accompanied by a Returned Material Authorization (RMA) number issued by FSI. Shipments without an RMA number will not be accepted.

Liability

FSI shall not be liable for incidental or consequential damages, injuries, or losses as a result of the installation, testing, operation, or servicing of FSI products.

RMA Return Procedure

Before returning any equipment to FSI, you must contact FSI and obtain a Returned Material Authorization (RMA) number. The RMA number assists FSI in identifying the origin and tracking the location of returned items.

When returning items to FSI from outside the United States, follow the checklist presented below to prevent any delays or additional costs.

❏ Include with all shipments two copies of your commercial invoice showing the value of the items and the reason you are returning them. Whenever possible, send copies of the original export shipping documents with the consignment.

❏ Route via courier (FedEx or UPS).

❏ If there is more than one item per consignment, include a packing list with the shipment. It is acceptable to combine the commercial invoice and packing list with the contents of each carton, clearly numbered and identified on the commercial invoice.

❏ If it is necessary to ship via air freight, contact FSI for specific freight forwarding instructions. You will be charged for customs clearance and inbound freight.

❏ Insure the items for their full value.

❏ Refer to the FSI issued RMA number on all documents and correspondence.

❏ Prepay the freight.