



CTD-ES & CTD-ER

High Accuracy Real Time Conductivity, Temperature,
and Depth Profiler

Technical Manual



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Table of Contents

Introduction.....	1
Maximum Operating Depth.....	1
System Configuration Requirements.....	2
Pull-Down Menus	2
Customer Service.....	3
Main External Components.....	4
CTD-E Options.....	5
Specifications.....	6
Outline Installation Drawings	8
Unpacking and Setting up the CTD-E.....	10
Unpacking the CTD-E	10
Standard Items	10
Optional Items.....	10
Installing and Starting CTDAcq	11
Installing CTDAcq	11
Starting CTDAcq	11
Communication Interfaces	12
RS-232 Interface.....	12
RS-485 Interface.....	12
Connecting the CTD-E to Your Computer.....	12
Connecting to the RS-232 Interface.....	13
Connecting to the RS-485 Interface.....	14
Changing the Serial Port	15
Checking and Configuring the CTD-E	16
Checking the CTD-E	16
Configuring the CTD-E	17
Selecting the Parameters to be Output.....	19
Selecting the CTD-E Sampling Rate	20
Selecting Scaled Output	20
Selecting to Average Collected Data	20
Selecting to Output Data on the RS-232 Serial Port.....	20
Setting the Local Time and Date	21
Saving the CTD-E Configuration to a File	21
Configuring the CTD-E from a Saved File	22
Printing the Configuration File	24
Acquiring, Displaying and Saving Data in Real Time.....	25
Real-Time Operating Modes.....	25
Acquiring Real-Time Data in Profile Mode	25
Acquiring Real-Time Data in Towed Acquisition Mode	28
Acquiring Real-Time Data in Run Continuous Mode	30
Resetting and Firing a Water Sampler	31
Setting up the Graphics Displays	31
Setting up the Graph in the Cast Graphics Display.....	32
Zooming in and Out of the Cast Graph.....	35
Listing the Data with the Cast Graph.....	35
Opening the Coordinates Window in the Cast Graphics Display.....	36
Setting up the Graphs in the Towed Acquisition Graphics Display	36
Displaying the Cast Graph in the Towed Acquisition Graphics Display	38
Setting up the Cast Graph from the Towed Acquisition Graphics Display	38
Opening the Coordinates Window in the Towed Acquisition Graphics Display	39
Zooming in and Out of the Cast Graph in the Towed Acquisition Graphics Display.....	39
Listing the Data in the Towed Acquisition Graphics Display	39
Scrolling Through the Pressure Graph Scans.....	39
Previewing and Printing Graphs	40

Previewing and Printing the Cast Graph	40
Previewing and Printing the Pressure Graphs	40
CTD-E Maintenance	42
Recommended Maintenance	42
Cleaning the CTD-E	43
Oil Fill Procedure and Capillary Tube Installation	44
APPENDIX A: Measured and Calculated Parameters	47
Parameters Measured by the Instrument	47
Parameters Calculated by the Instrument.....	47
Parameters Calculated by CTDAcq	48
APPENDIX B: Changing the Baud Rate.....	49
APPENDIX C: Connector and Test Cable Wiring.....	50
Bulkhead Connector Wiring.....	51
Test Cable Wiring.....	52
APPENDIX D: Warranty, Liability and RMA Return Procedure.....	53
Teledyne RD Instruments Limited Warranty	53
Liability	53
Returning CTDs to TRDI for Service	54
Domestic Shipments.....	54
European Shipments	55

List of Figures

Figure 1.	The Location of the CTD-ES Main External Components	4
Figure 2.	CTD-ES Setup—with RS-232 Interface	13
Figure 3.	CTD-ES Setup—with RS-485 Interface	14
Figure 4.	The Configuration COM Setup Dialog Box	15
Figure 5.	The Main Window after Checking the CTD-ES.....	17
Figure 6.	The Configure CTD-E Dialog Box.....	18
Figure 7.	The DC Channel Setup Dialog Box	20
Figure 8.	The Save As Dialog Box for Configuration Files.....	22
Figure 9.	The Open Dialog Box for Configuration Files	23
Figure 10.	Example CTD-E Configuration File Printout	24
Figure 11.	The CTDAcq Acquisition Window	26
Figure 12.	The Save As Dialog Box for Data Files.....	27
Figure 13.	The Cast Information Window	28
Figure 14.	The CTDAcq Acquisition Window—Towed Acquisition	29
Figure 15.	The CTD-E Run Continuous Mode Window	31
Figure 16.	The Graph Setup Dialog Box for Data Acquisition.....	33
Figure 17.	The Cast Graphics Display with Real-Time Plots of Parameter Data	35
Figure 18.	The Coordinates Window.....	36
Figure 19.	The Pressure Graph 1 Setup Dialog Box for Towed Acquisition	37
Figure 20.	The Towed Acquisition Display with Four Real-Time Pressure Plots of Parameter Data.....	39
Figure 21.	The Communications Window	49
Figure 22.	The Configuration COM Setup Dialog Box	50
Figure 23.	Bulkhead Connector—Face View Female	51
Figure 24.	Pigtail Connector for Bulkhead Connector—Face View Male	52

List of Tables

Table 1:	Optional Items Available from TRDI	11
Table 2:	Recommended Maintenance	42
Table 2:	Bulkhead Connector Components.....	50
Table 3:	Computer Connections	51
Table 4:	Power Supply Connections.....	51
Table 5:	Test Cable Wiring	52

Revision History

February 2017

- Added a recommended maintenance list to the maintenance chapter.
- Updated cleaning procedure.
- Updated Oil Fill Procedure and Capillary Tube Assembly.
- Updated Outline Installation Drawings.
- Updated TRDI website address to <http://www.teledynemarine.com/rdi>

June 2014

- Corrected how to request a Return Material Authorization (RMA)
- Updated fonts and styles

November 2011

- Updated outline installation drawing 96F-6004 to rev XB
- Updated conductivity specifications for accuracy and drift
- Corrected part number for oil fill capillary body assembly.

March 2012

- Updated Cleaning the CTD-E section
- Corrected part number for oil fill procedure syringe
- Changed “The water salinity in PSU-78 units” to “The seawater salinity in accordance to PSS78 (Practical Salinity Scale 1978)”.

NOTES



CTD-ES and CTD-ER Technical Manual

Introduction

The Teledyne RD Instruments CTD-E (includes CTD-ES and CTD-ER models) is designed to collect and output, in real time, high precision salinity data. The instrument can also interface with optional sensors, such as light, pH, and Oxygen sensors, and output data from these sensors along with the CTD data. The instrument measures conductivity using a highly stable inductively coupled conductivity sensor calibrated over the oceanographic range of 0–70 mmho/cm (0–7.0 S/m). Temperature is measured with a high accuracy platinum resistance thermometer mounted in a protective sheath. And pressure is measured using a fully temperature compensated precision micro-machined silicon transducer.

Any one or more of the measured parameters, along with the calculated parameters, which are salinity and sound velocity, can be selected for output. The time and date on which the parameters are output can also be included with each sample. Similarly, up to six DC input channels can be selected for output of the optional sensor data. The measured and calculated parameter data are output in calibrated ASCII physical units; the DC channels, as counts.

The CTD-E is configured using CTDAcq, a Microsoft Windows[®] based software program included with the instrument. With CTDAcq you can configure the instrument and acquire, graph and save to a file in real time the selected parameter data obtained by the instrument during a cast. CTDAcq creates three files for each cast: a data file with extension .dat, a calibration file with extension .c00 and a header file with extension .hdr. All the files are in ASCII format. The three files can be input to CTDPost, a post processing software program available from TRDI that provides a means of processing, displaying, graphing, printing, and saving processed CTD data.

Maximum Operating Depth

IMPORTANT! The CTD-E 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. Do not exceed 125% of full scale when using or calibrating the instrument as permanent damage will occur. As with all high pressure instrumentation, observe caution while using the CTD-E or after exposing it to high pressures.

System Configuration Requirements

TRDI software requires a Windows® compatible computer with the following specifications:

- Windows XP® or Windows 7®
- Pentium III 600 MHz class PC (higher recommended)
- 1GB of RAM (2GB or more RAM recommended)
- 50 MB Free Disk Space plus space for data files (A large, fast hard disk is recommended)
- One Serial Port (two or more High Speed UART Serial Port recommended)
- Minimum display resolution of 1024 x 768, 256 color (higher recommended)
- CD-ROM Drive
- Mouse or other pointing device

Pull-Down Menus

Like most programs, CTDAcq 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 File menu when it opens.

Customer Service

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

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Self-Service Customer Portal

Use our online customer portal at <http://www.teledynemarine.com/rdi> and click on the **Support** link to download manuals, firmware updates, software, or other Teledyne RDI documentation. Log into your account and then click the **Software/Firmware** link or **Documentation** link.

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Main External Components

The main external components of the CTD-ES are shown in Figure 1. A single bulkhead connector on the lower end cap provides either RS-232 or RS-485 communications and inputs external power. The conductivity, temperature, and pressure sensors are located on the top end cap. The CTD-ER model conductivity sensor and thermometer are at a right-angle from the housing.

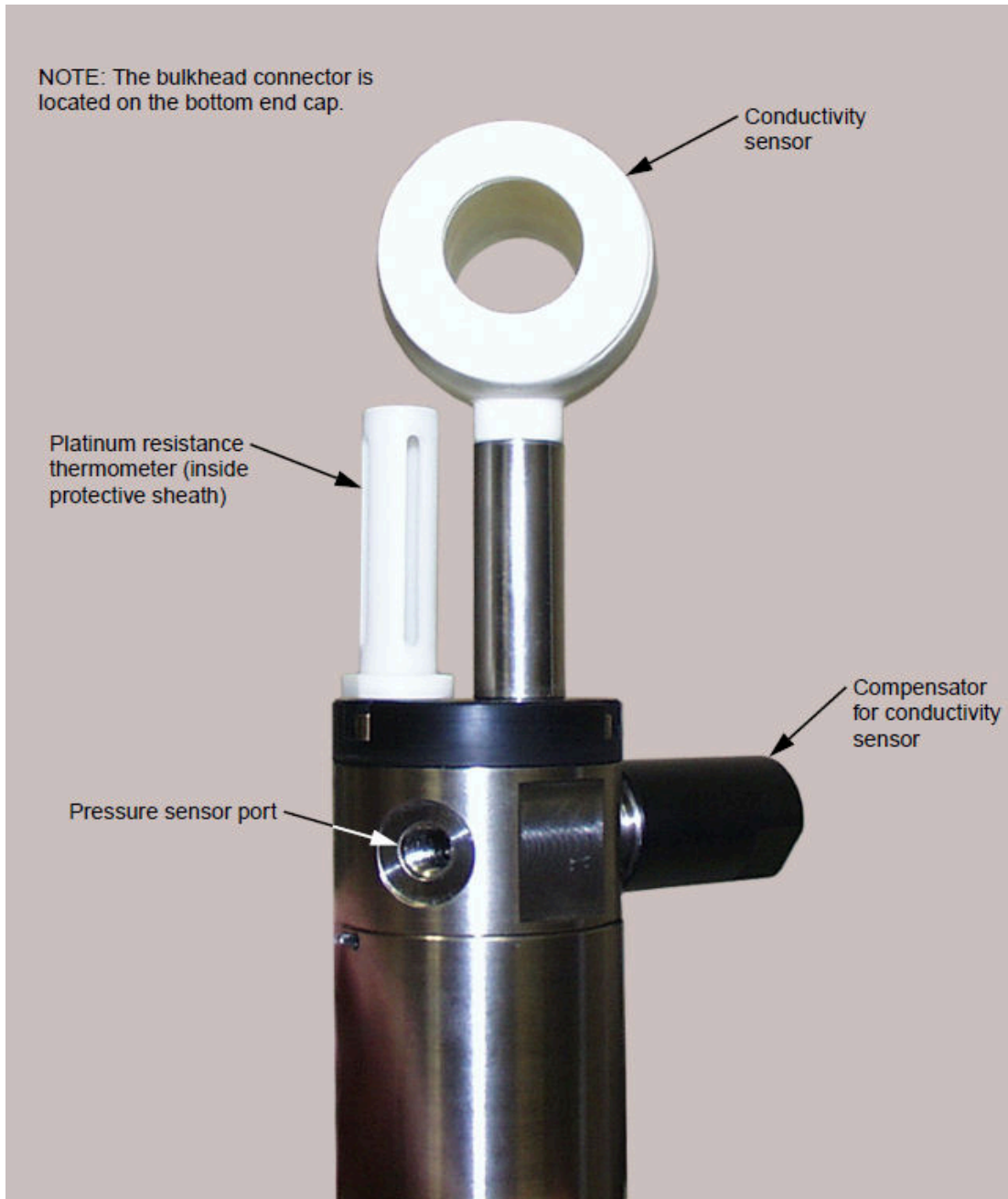


Figure 1. The Location of the CTD-ES Main External Components

CTD-E Options


Depth Rating – CTD-E units are available with the following depth rating: 500 meter (Delrin housing) or 7000 meter (Titanium housing).

Pressure Sensor – The pressure sensor is available in the following ranges (in meters): 20, 100, 200, 350, 500, 667, 1000, 2000, 3000 or 7000.

ES - The CTD-ES models have the conductivity sensor and temperature sensor straight mounted.

ER – The CTD-ER models have the conductivity sensor and temperature sensor mounted at a right-angle.

Communications Port – The bulk head connector can be configured for the following communications: RS-232 or RS-485.



NOTE. CTD options must be defined at time of order.

CTD-E part numbers use a seven field code - 111-22-3-444444-5555-6666-7.

Field 1	Field 2	Field 3	Field 4					Field 5	Field 6	Field 7	
Family Conductivity / Temperature / Depth	Inductive Technology Type ES = Straight Mount ER = Right Angle Mount	External Sensor Interface	Bit 1 = DR = Direct Reading	Bit 2 = Board Electronics Type	Bit 3 = Hardware Interface Type	Bit 4 = Communications Type	Bit 5 = Housing Depth Rating (meters)	Bit 6 = Stem Length 1 = CTD-ER 2 = CTD-ES	Field 5 = Depth Rating of Conductivity (meters)	Field 6 = Press Sensor Option (meters)	Field 7 = OEM Temperature Probe Mounting Position
CT	ES	0 = None	0 = DR	0 = N/A	0 = N/A	0 = N/A	0 = None	0 = No Stem	0 = No Cond	0 = None	0 = N/A
CTD	ER	1 = N/A	1 = N/A	1 = GPO		1 = RS232	1 = 500	1 = 1.037 in	500	20	1 = N/A
				2 = N/A		2 = RS485	2 = 2000	2 = 1.75 in	7000	100	E = external
							3 = 7000			200	
										350	
										500	
										667	
										1000	
										2000	
										3000	
										7000	

Example: CTD-ES-0-010112-500-500-E corresponds to a CTD- Ext Cond, Straight Mount, GPO electronics, 500M Housing, RS232, Shallow Cond, PS 500M, Ext Temp.

Specifications

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



NOTE. These specifications are subject to change without notice.

General

Power requirements:	6–14 VDC @ 120 mA
Depth rating:	500 m standard, Delrin housing 7000 m optional, 64-AVL titanium housing
Sample rate:	1.83, 2.58, 3.03, 4.08, and 4.50 S/sec, selectable
Resolution:	18 bits
DC channels:	6 unipolar, 0–5.0 VDC, 1.22 mV resolution (12 bits)
Communication interface:	RS-232 or RS-485
Baud rate:	300, 1200, 9600, and 19,200
Data format:	8 data bits, 1 stop bit
Real time clock stability:	±12 ppm/year
Warm up:	3 seconds after power up

Conductivity

Sensor type:	Inductive cell
Range:	0 to 70 mS/cm (0 to 7.0 S/m)
Typical Accuracy ¹ :	±0.0030 mS/cm
Typical Drift ² :	±0.001 mS/cm/month
Resolution:	0.0001 mS/cm
Response:	5.0 cm @ 1 m/sec flow

¹@ 22°C & 35psu - Defined as the root sum of the squares (RSS) of endpoint non-linearity, repeatability error and calibration uncertainty.

² over 1 year (Typical)

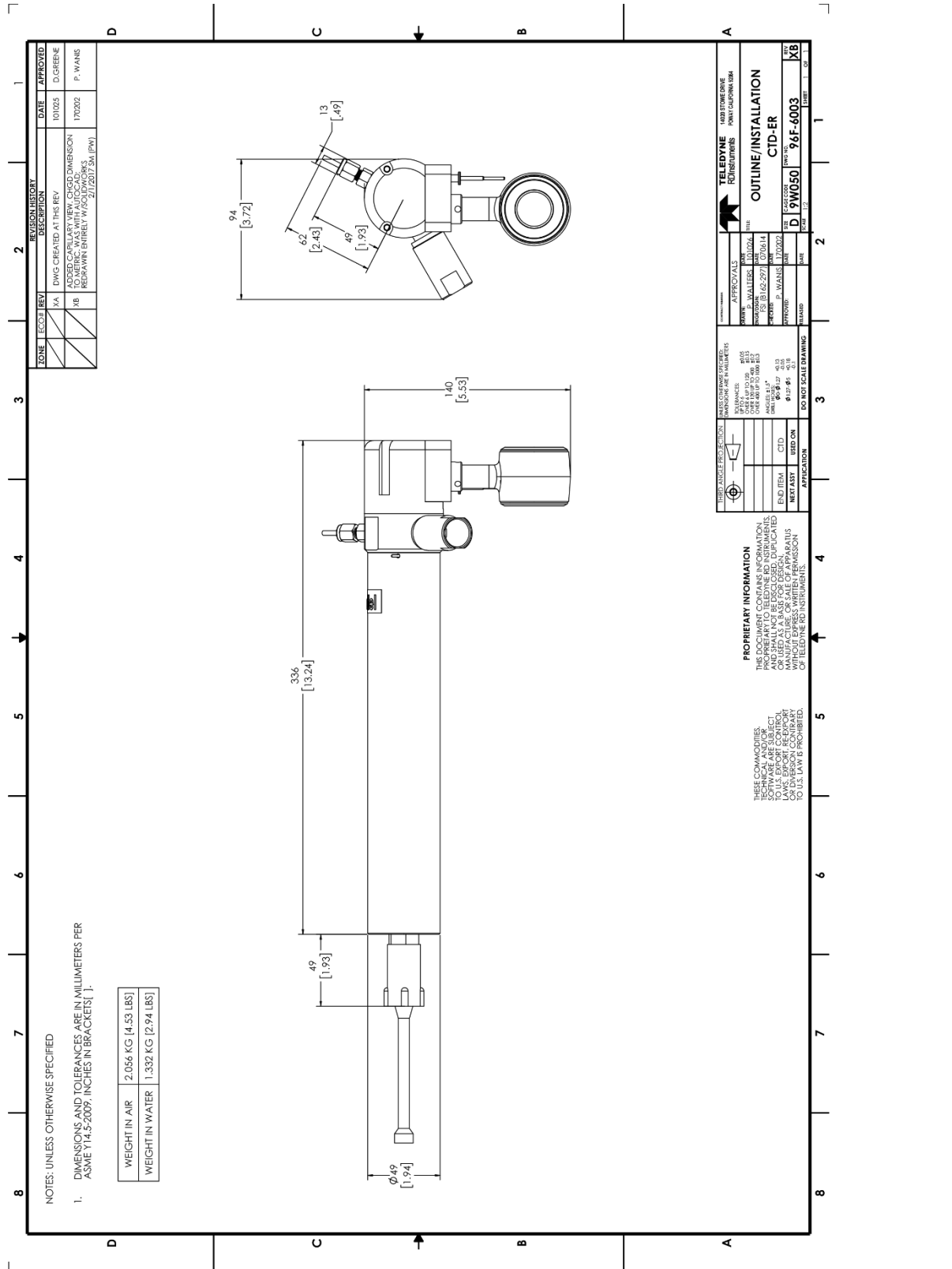
Temperature

Sensor type:	Platinum thermometer
Range:	-2–32°C
Accuracy:	±0.002°C
Stability:	±0.0005°C/month
Resolution:	0.0001°C
Response:	150 msec

Pressure

Sensor type:	Precision micro-machined silicon transducer
Range:	Customer specified
Accuracy:	±0.02% of full scale, higher accuracies available
Stability:	±0.01% of full scale/month
Resolution:	0.001% of full scale
Response:	25 msec

Outline Installation Drawings



Unpacking and Setting up the CTD-E

Before deploying a CTD-E, it must be connected to an available serial port of a computer and configured using CTDAcq. The default serial port for CTDAcq is COM1, and the default baud rate is 9600 bits/sec; however, any serial port from COM1 to COM4 can be used, and baud rates of 110–4800, 14400 and 19200 bits/sec are additionally available. This section provides instructions on how to unpack the CTD-E, how to connect the instrument to your computer, and how to change the serial port that CTDAcq uses.



CAUTION. Changing the baud rate requires that both the baud rate of the CTD-E and the computer's serial port to which it is connected be changed. (See [APPENDIX B: Changing the Baud Rate](#) for instructions on how to change the baud rate.)

Unpacking the CTD-E

Before unpacking the CTD-E, check the shipping container for signs of external damage. If the container appears damaged, report the damage to TRDI and to the freight carrier. When unpacking the CTD-E, 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 TRDI.

Standard Items

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

- CTD-E instrument
- CTD Documentation and Software CD (includes CTDAcq software)
- Test cable
- Dummy connector and locking sleeve
- Pigtail
- Bottle brush (for cleaning the conductivity cells)

Optional Items

Optional items typically include the following:

- Power supply (6–14 VDC, 500 mA)
- Additional test cables
- Additional pigtails
- Male DB25 to female DB9 serial port adapter cable
- RS-485 Interface (includes converter box, power supply and DB25 to DB9 serial port adapter cable)

Most of these items are available from TRDI and are listed with their part numbers in Table 1 below. (See [Customer Service](#) for information on how to contact TRDI to order any of these items).

Table 1: Optional Items Available from TRDI

ITEM	TRDI PART NUMBER
Test Cable	B240-291
RS-485 Interface	MCTD2-485-KIT
Pigtail	2106-ILMC4M

Installing and Starting CTDAcq

The CTD-E is configured using the CTDAcq software which must be installed on the computer to which the instrument will be connected.

Installing CTDAcq

To install CTDAcq:

1. Insert the CTD Documentation and Software CD into your CD-ROM drive. If the CD browser does not appear, navigate to the drive containing the CD and double-click on *Launch.exe*.
2. Click on the **CTD Products** button.
3. Click on the **CTD-ES and CTD-ER** button and then click on the **CTDAcq Software** button. This will start the software installation.

Starting CTDAcq

To start CTDAcq:

1. Select Start > Programs > RD Instruments.
The RD Instruments menu opens.
2. Choose CTDAcq. CTDAcq starts and the CTDAcq Main window opens.

Communication Interfaces

The CTD-E includes an RS-232 serial interface for configuring and downloading data from the instrument. The instrument was prewired from the factory for RS-232 or RS485 depending on what was specified at the time of order. The serial tag on the instrument identifies which interface is installed.

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

Systems ordered with an RS485 are capable only of RS485 communication and will require use of an external RS485/RS232 converter for communication with a computer. A converter can be ordered separately from TRDI or procured independently.

Connecting the CTD-E to Your Computer

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

- Test cable
- Power supply (6–14 VDC, 500 mA)
- An available serial port on the computer
- Male DB25 to female DB9 serial port adapter cable
- RS-485 Interface (includes converter box, power supply and DB25 to DB9 serial port adapter cable)



NOTE. Although any serial port from COM1 to COM4 can be used, use COM1 if it is available, as it is the default serial port setting of CTDAcq. If you use any other serial port, you must select it in CTDAcq as described in [Changing the Serial Port](#).

Connecting to the RS-232 Interface

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

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

1. Disconnect the dummy connector from the bulkhead connector on the instrument and connect the test cable.
2. Connect the DB25 to DB9 serial port adaptor cable to the DB25 connector of the test cable and to the serial port on your computer.
3. Connect the red (+) banana plug of the test cable to the power supply output, and the black (-) banana plug to the power supply common.

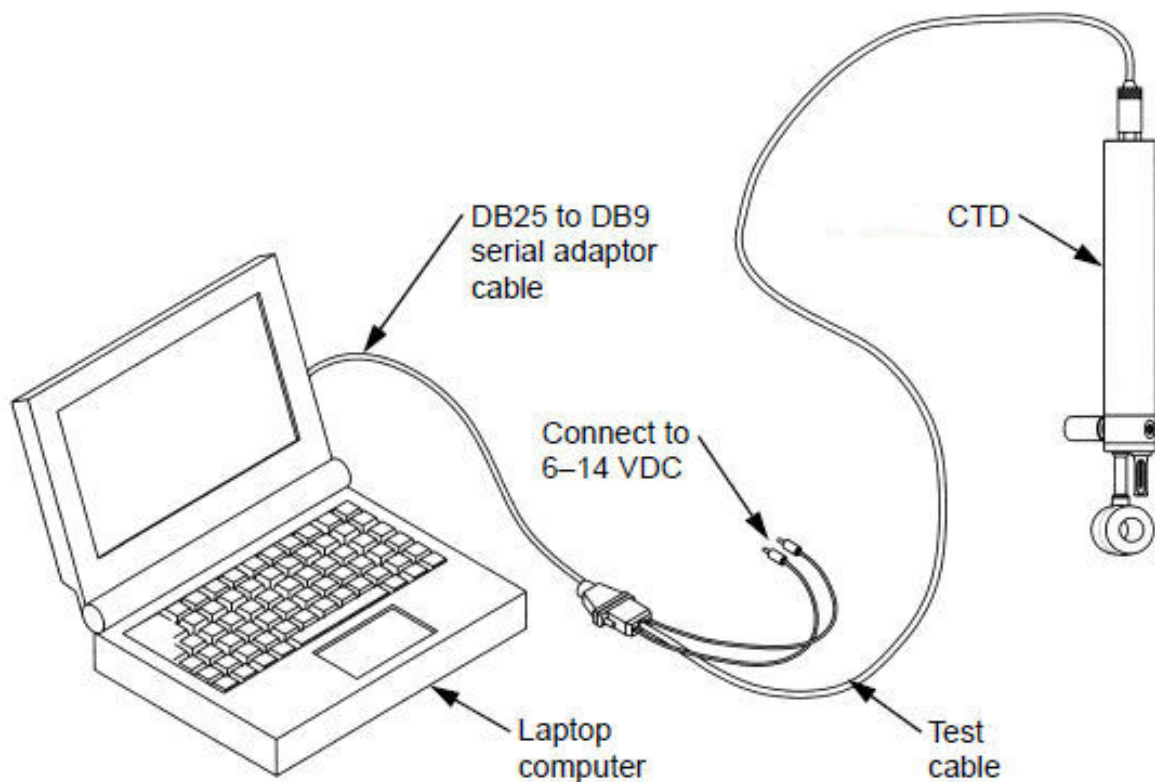


Figure 2. CTD-ES Setup—with RS-232 Interface

Connecting to the RS-485 Interface

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

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

1. Disconnect the dummy connector from the bulkhead connector on the instrument and connect the test cable.
2. Connect the DB25 connector of the test cable to the DB25 input connector on the converter box.
3. Connect the DB25 output connector of the converter box to the selected serial port on the computer using the DB25 to DB9 serial port adaptor cable.
4. Connect the power supply to the converter box.
5. Connect the banana plugs of the test cable to the red (+) and black (-) banana jacks on the converter box.
6. Connect the power supply to a 100–240 VAC, 50–60 Hz power source.

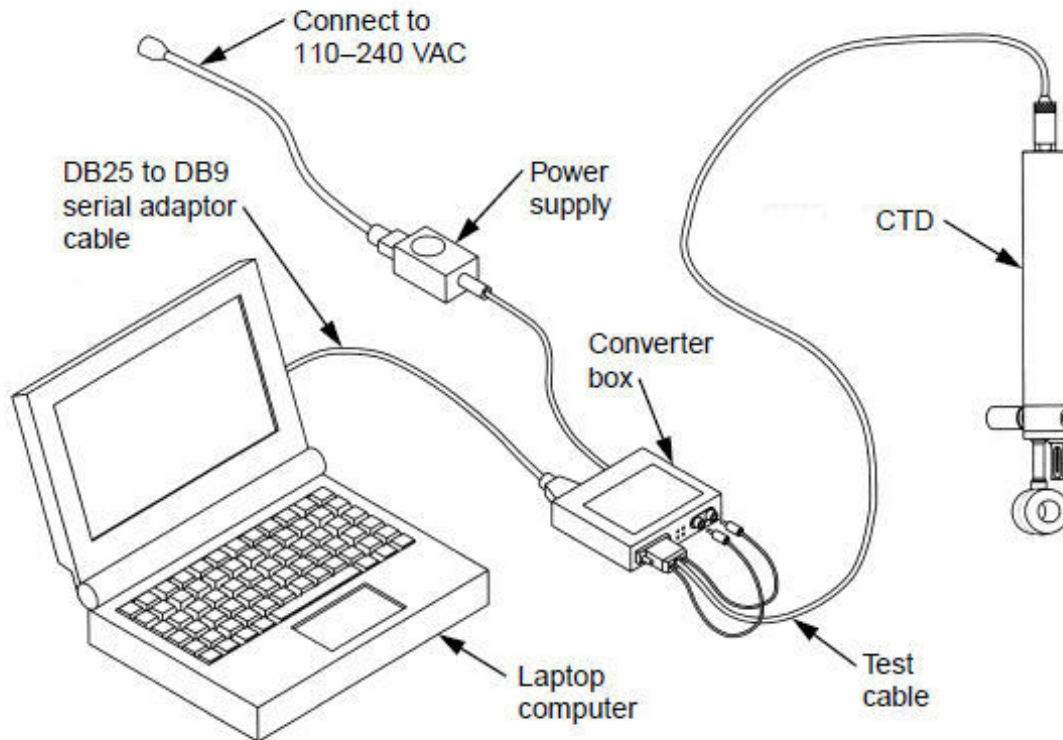


Figure 3. CTD-ES Setup—with RS-485 Interface

Changing the Serial Port

The default serial port for CTDAcq is COM1. However, any one of four serial ports from COM1 to COM4 can be selected.

To change the serial port:

1. Choose Start > Programs > RD Instruments > CTDAcq.
CTDAcq starts and the CTDAcq Main window opens.
2. Choose Communications > Setup.
The Configuration COM Setup dialog box shown in Figure 4 opens.

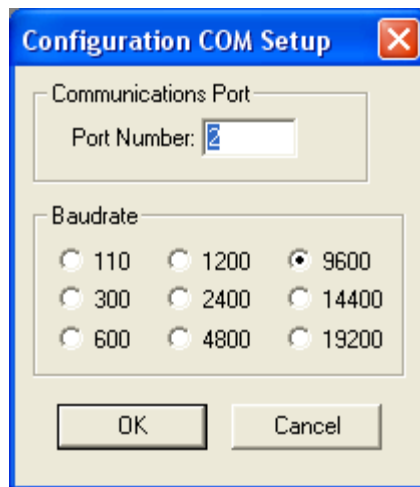


Figure 4. The Configuration COM Setup Dialog Box

3. Select the new serial port in the Communications Port area of the Configuration COM Setup dialog box.



CAUTION. Do not change the baud rate. (See [APPENDIX B: Changing the Baud Rate](#) for instructions on how to change the baud rate of the CTD-E and the serial port to which it is connected.)

4. Click OK to save the new serial port selection and close the Configuration COM Setup dialog box, or click Cancel to close the dialog box without saving the new selection.

Checking and Configuring the CTD-E

After you have connected a CTD-E to your computer's serial port and have applied power as described in [Connecting the CTD-E to Your Computer](#), you are ready to check and configure the instrument. This section describes how to perform these tasks using the Configure menu. In addition, descriptions of each of the configuration settings are provided.

Checking the CTD-E

Before you can configure a CTD-E, you must check the instrument. Checking the instrument establishes communications with it and the computer, and it retrieves the instrument's model number, serial number, firmware version, and calibration date for display. In addition, CTDAcq checks the instrument's address and verifies the serial port to which it is connected.

To check a CTD-E:

1. Connect the CTD-E to your computer and power supply.
2. Choose Start > Programs > RD Instruments > CTDAcq.
CTDAcq starts and the CTDAcq Main window opens.
3. Choose Configure > Check Instrument.

CTDAcq displays which items are being checked during the check instrument process. Then the model number, serial number, firmware version, and calibration date of the instrument are displayed in the Instrument Identification Window in the upper left corner of the Main window as shown in Figure 5. A CTD-E graphic also appears in the middle of the Main window. The Instrument Identification window is fixed in its position and cannot be resized.

You can also have CTDAcq check the instrument automatically when the program is started by choosing File > Properties, selecting the Check for Instrument at Program Start check box in the CTDAcq Settings dialog box, and then clicking OK.

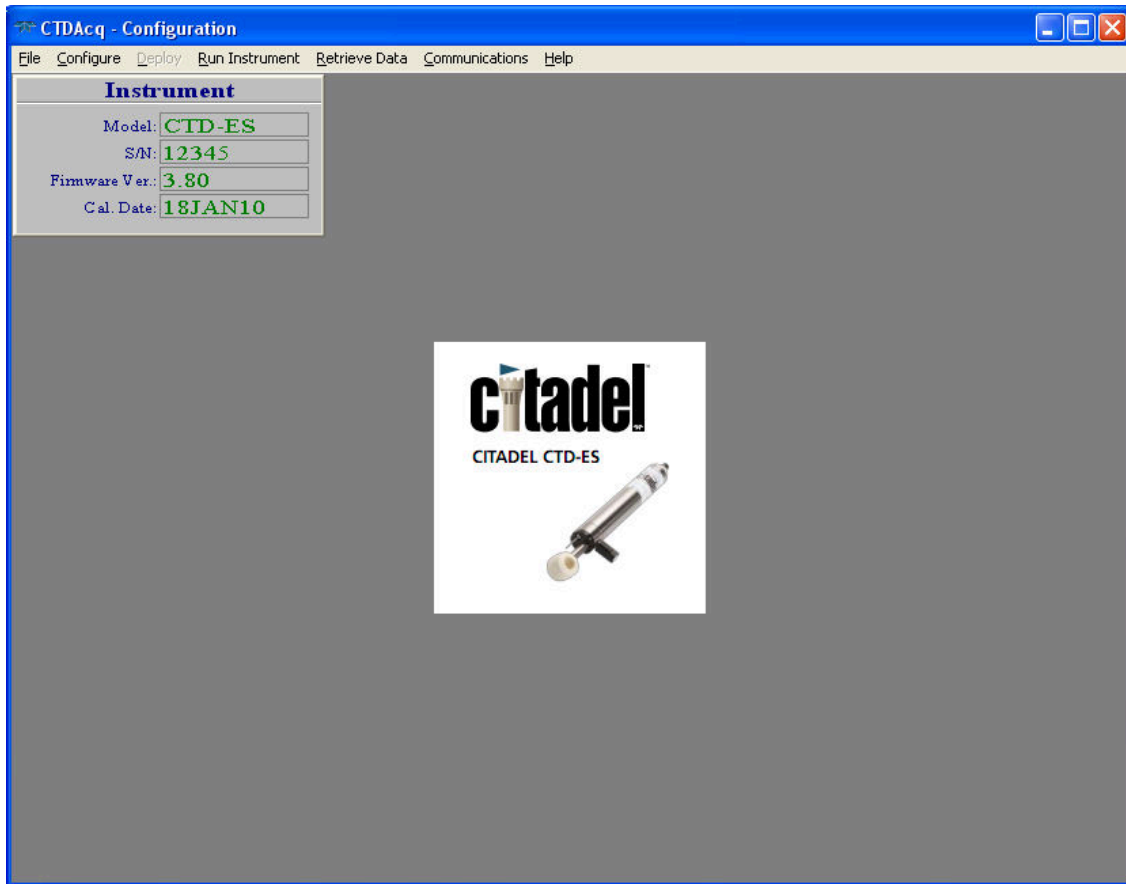


Figure 5. The Main Window after Checking the CTD-ES

Configuring the CTD-E

If you are configuring a CTD-E for the first time, it is recommended that you first become familiar with the instrument's operating modes. (See [Acquiring, Displaying and Saving Data in Real Time](#) for information on the CTD-E operating modes.)

Configuring the CTD-E requires that you make the following settings:

- Select the parameters to be output.
- Select the instrument sampling rate.
- Select whether to scale the output in counts.
- Select whether to average the data.
- Select whether to output data continuously on the RS-232 serial port on power up.
- Set the local time and date.

Once the instrument is configured, the configuration settings can be saved to a file and printed. In addition, the instrument can be configured from a saved file.

The CTD-E is configured from the Configure CTD-E dialog box shown in Figure 6.

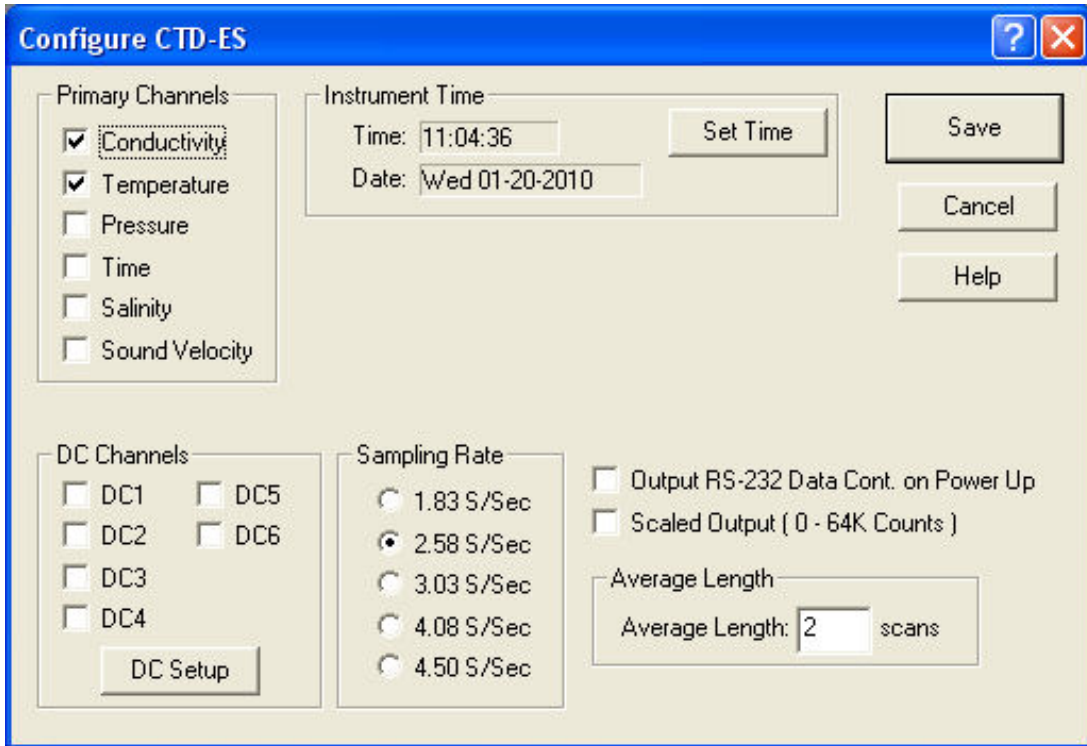



Figure 6. The Configure CTD-E Dialog Box

To open the Configure CTD-E dialog box, choose **Configure > Configure**. The dialog box opens with the settings of the connected instrument shown.



NOTE. If the instrument has not been checked since starting CTDAcq, the Configure item in the Configure menu is grayed and cannot be chosen. (See [Checking the CTD-E](#) for instructions on how to check the instrument.) In addition, when the Configure CTD-E dialog box is opened the first time after checking the instrument, CTDAcq first reads the current configuration of the instrument while displaying which items are being read.

To close the Configure CTD-E dialog box and save your selections, click **Save**. To close the dialog box without saving any changed selections, click **Cancel**.

Selecting the Parameters to be Output

Selecting the parameters to be output by a CTD-E is performed by selecting the corresponding data channels in the Configure CTD-E dialog box. There are two sets of data channels: the Primary Channels and the DC Channels.

The Primary Channels are selected with check boxes in the Primary Channels area of the Configure CTD-E dialog box and consist of the following six parameters:

Conductivity:	The measured water conductivity in mmho/cm.
Temperature:	The measured water temperature in °C.
Pressure:	The measured water pressure in dbars.
Time:	The time in hours, minutes and seconds, and the date in month, day and year on which the selected parameters are output for each sample.
Salinity:	The seawater salinity in accordance to PSS78 (Practical Salinity Scale 1978).
Sound Velocity:	The calculated sound velocity in water in m/sec.

To select the Primary Channel parameters you want to output, select the corresponding check boxes, and clear the check boxes for those you do not.

The DC Channels are selected with check boxes in the DC Channels area of the Configure CTD-E dialog box and consist of six analog input channels that are factory configured. Select the check boxes for the DC Channel parameters you want to output, and clear the check boxes for those you do not.

For each of the DC Channels you can enter a name, the name of the connected instrument for example. You can also enter up to five coefficients for each channel which are saved to a calibration file, a file with extension .c00, and are applied when running CTDPPost. They are not applied to the data for the channel.

To enter a name for one or more of the DC Channels and to edit their coefficients, click DC Setup in the DC Channels area of the Configure CTD-E dialog box. The DC Channel Setup Box shown in Figure 7 opens. Use the Previous and Next buttons to select the channel, and then enter the name in the Name text box and the coefficients in the A–E text boxes for each. Click OK when you are finished. The coefficients can also be loaded from a configuration (CFG) file by clicking Load From File and opening the required file.

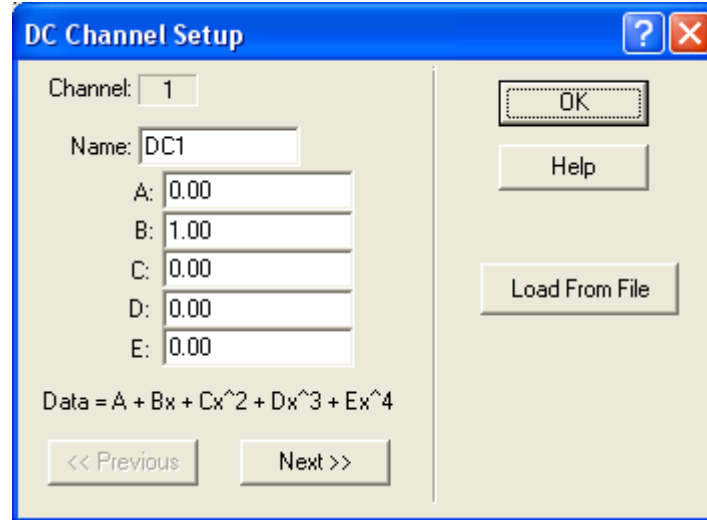


Figure 7. The DC Channel Setup Dialog Box

Selecting the CTD-E Sampling Rate

The CTD-E sampling rate is selected in the Sampling Rate area of the Configure CTD-E dialog box. The sampling rate determines the frequency at which the CTD-E measures and outputs the selected parameters. There are five sampling rates: 1.83 Hz, 2.58 Hz, 3.03 Hz, 4.08 Hz, and 4.50 Hz.

To select the CTD-E sampling rate, select the corresponding option.

Selecting Scaled Output

You can choose to have the instrument output the selected parameter data scaled over a range of 0 to 65535 counts.

To select scaled output, select the Scaled Output (0-64K Counts) check box in the Configure CTD-E dialog box.

Selecting to Average Collected Data

The data that are output by the CTD-E can be averaged over a specified number of scans, where a scan is a single sample of the selected parameter data. To select to average the data, enter the number of scans over which to perform the average in the Average Length text box, which is in the Average Length area of the Configure CTD-E dialog box. The minimum number of scans is 2; the maximum,

Selecting to Output Data on the RS-232 Serial Port

You can choose to have the CTD-E output the selected parameter data on its RS-232 serial port while the instrument is deployed. This allows you to interface any instrument or device that has an RS-232 serial port with the CTD-E, such as a remotely operated vehicle (ROV).

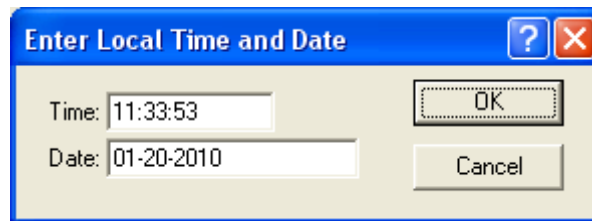
To output the data on the instrument's RS-232 serial port, select the Output RS-232 Data Continuously On Power Up check box in the Configure CTD-E dialog box.

Setting the Local Time and Date

To set the local time and date:

1. Click Set Time in the Configure CTD-E dialog box.

The Enter Local Time and Date dialog box opens:



CAUTION. The displayed time and date in the Enter Local Time and Date dialog box is that which was read by CTDAcq from the computer on which CTDAcq is running. It is not updated while the dialog box is open.

2. Do one of the following:

- Click OK to accept the displayed time and date, which was acquired from the computer on which CTDAcq is running, and close the Enter Local Time and Date dialog box.
- Enter a time in hours, minutes and seconds (hh:mm:ss) format in the Time text box and a date in month, day and year (mm-dd-yyyy) format in the Date text box. Then click OK to save the new time and date and close the Enter Local Time and Date dialog box.
- Click Cancel to close the Enter Local Time and Date dialog box without changing the time and date.

The new time and date is shown in the Instrument Time area of the Configure CTD-E dialog box.

Saving the CTD-E Configuration to a File

Once you configure a CTD-E, you can save the configuration settings to a file. When saved, you can open the configuration file to configure the CTD-E with the saved settings instead of configuring the instrument manually. (See [Configuring the CTD-E from a Saved File](#) for instructions on how to open the configuration file and configure the instrument.)

To save the CTD-E configuration to a file:

1. Choose File ► Save.

The Save As dialog box for configuration files shown in Figure 8 opens. This dialog box is used to create the file in which to save the configuration settings.

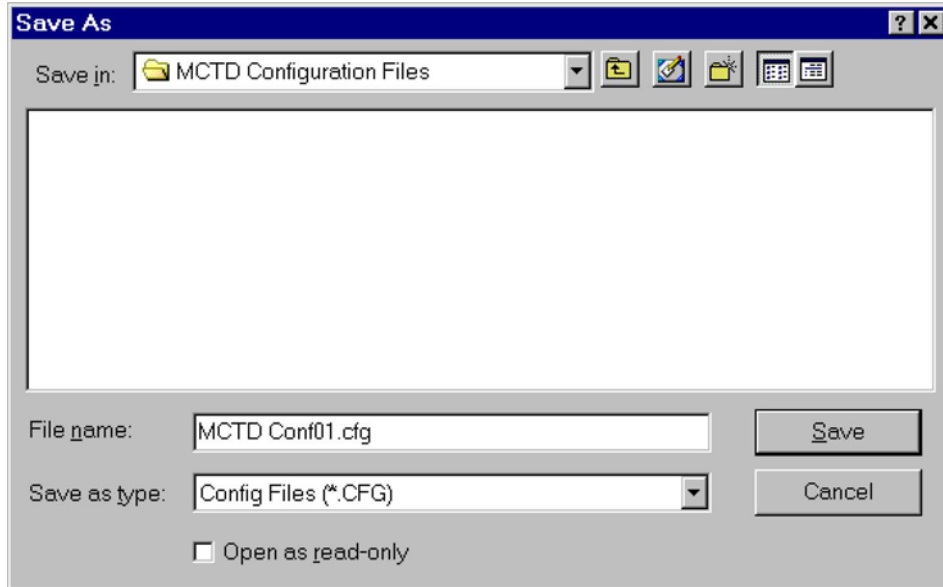


Figure 8. The Save As Dialog Box for Configuration Files

2. Click the arrow in the Save in drop-down list box and select the folder in which to save the configuration file.
3. In the File name text box enter the name of the file in which to save the configuration settings. The extension .cfg is added automatically.
4. Click Save to save the configuration settings to the specified file and close the dialog box, or click Cancel to close the dialog box without saving the settings.

Configuring the CTD-E from a Saved File

CTDAcq allows you to open a CTD-E configuration file, a file with extension .cfg that contains the instrument's configuration settings. Once the file is opened, you can configure a CTD-E with the settings in the file. (See [Saving the CTD-E Configuration to a File](#) for instructions on how to save the instrument configuration to a file.)

To open a CTD-E configuration file and configure the instrument:

1. Choose File > Open.

The Open dialog box for configuration files shown in Figure 9 opens. Although more than one file may be displayed, the example in the figure shows a single file of filename CTD-E Conf01.cfg.

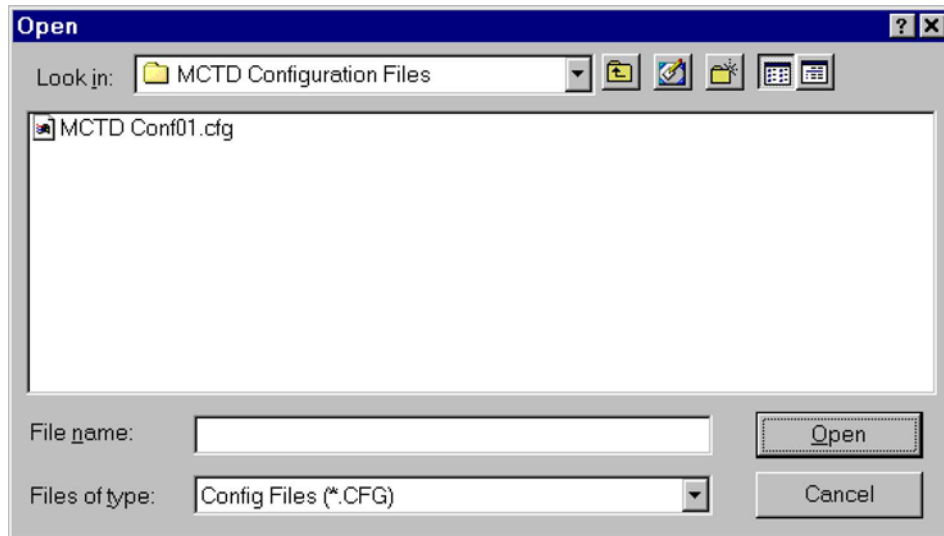


Figure 9. The Open Dialog Box for Configuration Files

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.

2. Click the file you want to open, and then click Open.

The Configure CTD-E dialog box opens with all the settings configured.

3. Click Save to close the Configure CTD-E dialog box and configure the CTD-E, or click Cancel to close the dialog box without configuring the instrument.

Printing the Configuration File

To print a CTD-E configuration file, choose File > Print Configuration, select the printer to use, and then click OK. An example of a printed CTD-E configuration file is shown in Figure 10.

CTDAcq
Teledyne RD Instruments

14020 Stowe Drive
Poway, CA 92064
Phone: (858) 842-2600
Fax: (858) 842-2822

Citadel Configuration

Serial Number: 12345

Calibration Date: 18JAN10

Primary Channels

Conductivity: ON

Temperature: ON

OFF

OFF

OFF

OFF

DC Channels

DC1: OFF

DC2: OFF

DC3: OFF

DC4: OFF

DC5: OFF

DC6: OFF

DC7: OFF

DC8: OFF

Instrument Time: 11:09:21□□

Instrument Date: Wed 01-20-2010

Interval Time: Not Set

Record On Time: Not Set

Delayed Start Date: Not Set

Delayed Start Time: Not Set

Sampling Rate: 2.58 Hz

Will NOT output RS-232 data continuously after power up.

Will NOT output data in scaled units.

Average for 2 mm:ss.

Figure 10. Example CTD-E Configuration File Printout

Acquiring, Displaying and Saving Data in Real Time

Once you have checked and configured a CTD-E, you can acquire, display, and save the selected parameter data in real time by running the instrument directly from the test cable. See [Checking and Configuring the CTD-E](#) for instructions on how to check and configure the instrument. When ready to collect data, the test cable can be replaced with a sea cable for performing up and down casts. See [APPENDIX C: Connector and Test Cable Wiring](#) for information on the connector wiring. The data are displayed on graphics displays, and recording is directly to a text file. During real-time data acquisition, CTDAcq also allows you to reset and fire a water sampler.

This section provides instructions on how to run the CTD-E in three different real-time operating modes and how to display and save the parameter data. In addition, instructions are provided on how to reset and fire a water sampler, change the graphics display settings, and preview and print the graphs.

Real-Time Operating Modes

There are three real-time data acquisition operating modes:

Profile mode where data are continuously acquired, displayed and saved in real time at the selected sample rate.

Towed Acquisition mode similar to Profile mode, but data are displayed in a horizontal format that is more suitable in towed applications.

Run Continuous mode similar to Profile mode, but data are displayed in a digital display only, updated once per second, and can be saved in real time at the selected sample rate.



NOTE. If an Average Length is entered as described in [Selecting to Average Collected Data](#), both the displayed and saved data are averaged data.

Acquiring Real-Time Data in Profile Mode

Data acquired in Profile mode are displayed on a cast graph and saved directly to disk. CTDAcq creates three files for the data: a data (DAT) file with extension .dat, a calibration (COO) file with extension .c00 and a header file (HDR) with extension .hdr. All three files are in ASCII format and can be opened and viewed in any text editor. They can also be input to CTDPst for processing.

To acquire, display and save data in Profile mode:

1. Connect the CTD-E to your computer and power supply.
2. Choose Start > Programs > RD Instruments > CTDAcq.
CTDAcq starts and the CTDAcq Main window opens.
3. Choose Configure > Check Instrument.

CTDAcq displays which items are being checked, and the model number, serial number, firmware version, and calibration date of the instrument are displayed in the Instrument Identification Window.

4. If required, configure the instrument as described in [Configuring the CTD-E](#).
5. Choose File > Acquisition.

The CTDAcq Acquisition window shown in Figure 11 opens.

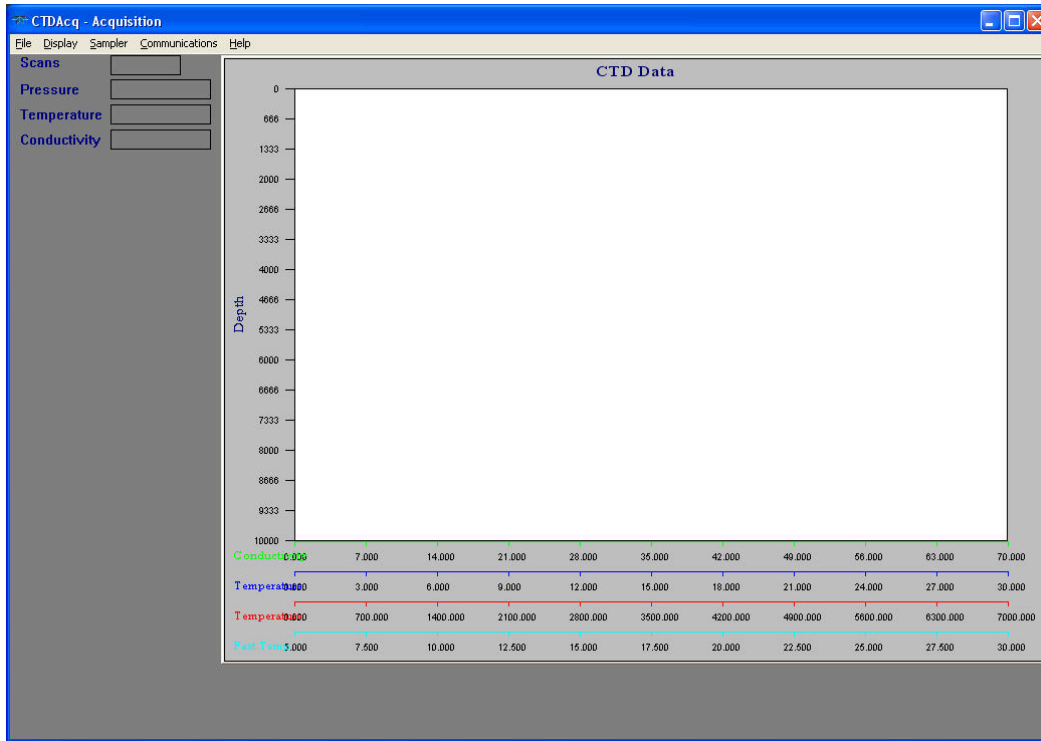


Figure 11. The CTDAcq Acquisition Window

6. Choose File ► Start Down Cast, or Start Up Cast.

The Save As dialog box for data files shown in Figure 12 opens. This dialog box is used to create the file in which to save the parameter data.

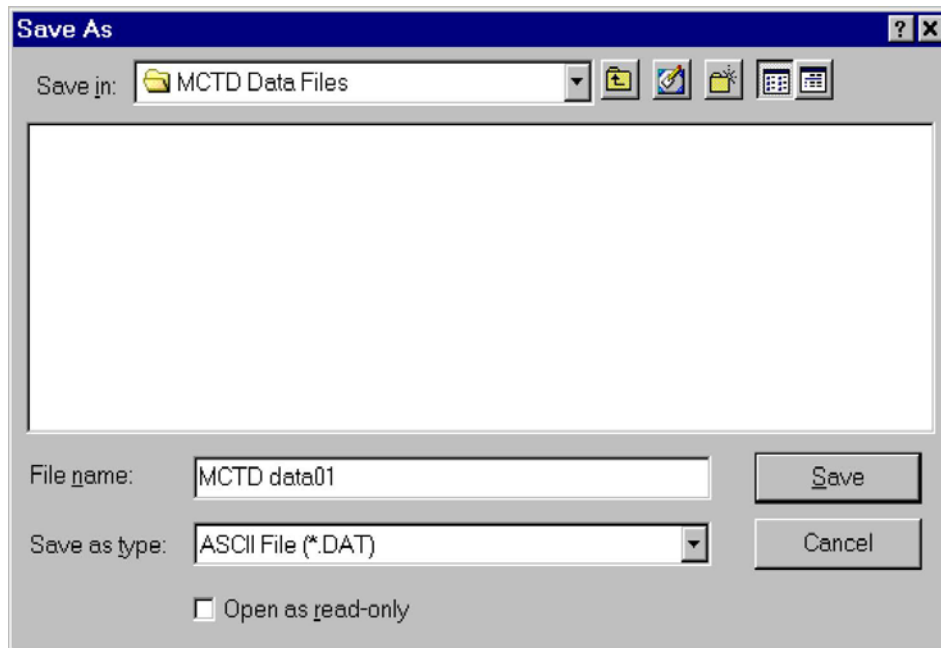


Figure 12. The Save As Dialog Box for Data Files

7. Click the arrow in the Save in drop-down list box and select the folder in which to save the parameter data file.
8. In the File name text box enter the name of the file in which to save the data. The extension .dat is added automatically, as are .c00 and .hdr for the calibration and header files which are saved with the data file.
9. When you are ready to begin the cast, click Save to create the file in which to save the data and close the dialog box.

The instrument begins collecting data. The parameter data are displayed graphically and numerically in the TRDI Acquisition window in real time and saved to the file. (See [Setting up the Graphics Displays](#) for instructions on how to change the settings in the graphics display.)

10. When the cast is complete, choose File ► End Down Cast, or End Up Cast.

The Cast Information window shown in Figure 13 opens.

Figure 13. The Cast Information Window

11. If desired, enter additional cast information in the available text boxes.

The cast information can be saved to the header file.

12. Click OK to save the entries and close the Cast Information window, or click Cancel to close the window without saving the entries.



NOTE. Regardless whether you click OK or Cancel, the information initially displayed in the Cast Information window is saved to the header file.

13. Repeat Steps 6 through 12 for as many up and down casts as required.
14. To close the CTDAcq Acquisition window, choose File > Configure.

Acquiring Real-Time Data in Towed Acquisition Mode

Data acquired in Towed Acquisition mode are displayed on up to four pressure graphs and saved directly to disk. And like Profile mode, CTDAcq creates DAT, COO and HDR files. All three files are in ASCII format and can be opened and viewed in any text editor. They can also be input to CTDPPost for processing.

To acquire, display and save data in Towed Acquisition mode:

1. Connect the CTD-E to your computer and power supply.
2. Choose Start ► Programs ► RD Instruments ► CTDAcq.
CTDAcq starts and the CTDAcq Main window opens.
3. Choose Configure ► Check Instrument.
CTDAcq displays which items are being checked, and the model number, serial number, firmware version, and calibration date of the instrument are displayed in the Instrument Identification Window.
4. If required, configure the instrument as described in [Configuring the CTD-E](#).
5. Choose File ► Tow Acquisition.
The CTDAcq Acquisition window for towed acquisitions shown in Figure 14 opens.
6. Choose File ► Run.
The Save As dialog box for data files shown in Figure 12 opens. This dialog box is used to create the file in which to save the parameter data.
7. Click the arrow in the Save in drop-down list box and select the folder in which to save the parameter data file.
8. In the File name text box enter the name of the file in which to save the data. The extension .dat is added automatically, as are .c00 and .hdr for the calibration and header files which are saved with the data file.

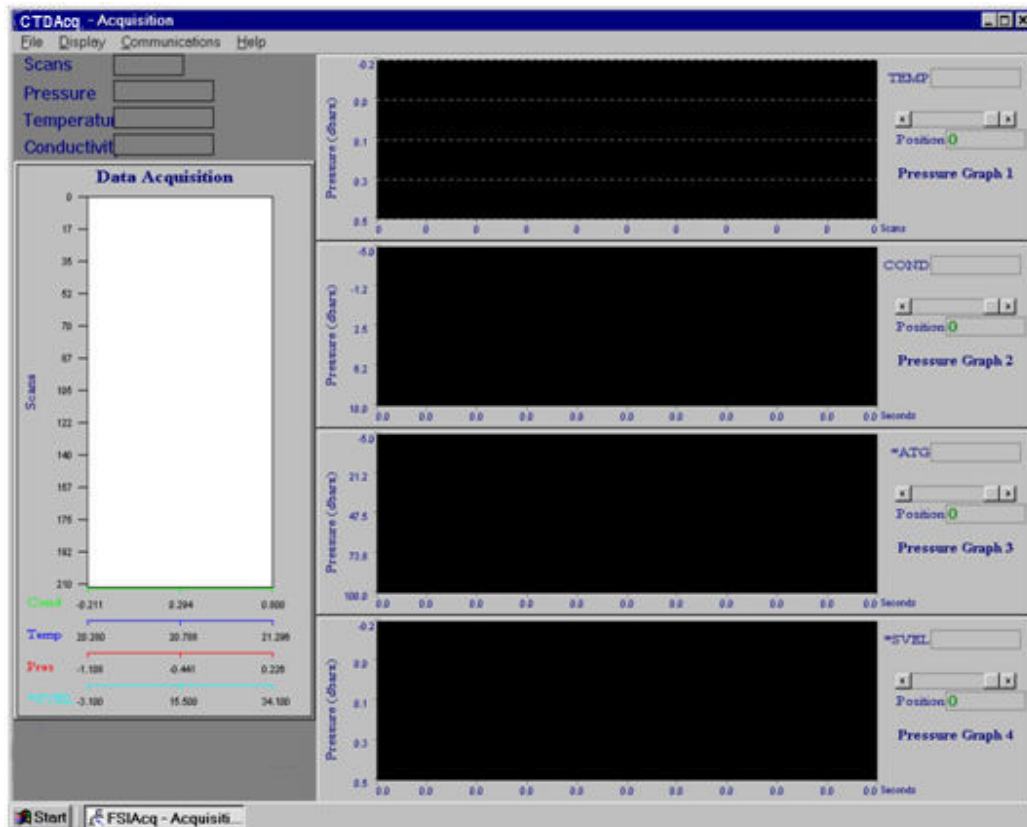


Figure 14. The CTDAcq Acquisition Window—Towed Acquisition

9. When you are ready to begin the cast, click Save to create the file in which to save the data and close the dialog box.

The instrument begins collecting data. The parameter data are displayed graphically and numerically in the TRDI Acquisition window in real time and saved to the file. (See [Setting up the Graphics Displays](#) for instructions on how to change the settings in the graphics display.)

10. When the cast is complete, choose File ► Stop.

The Cast Information window shown in Figure 13 opens.

11. If desired, enter additional cast information in the available text boxes.

The cast information can be saved to the header file.

12. Click OK to save the entries and close the Cast Information window, or click Cancel to close the window without saving the entries.



NOTE. Regardless whether you click OK or Cancel, the information initially displayed in the Cast Information window is saved to the header file.

Acquiring Real-Time Data in Run Continuous Mode

Data acquired in Run Continuous mode are displayed in a digital display, one scan at a time. The displayed data includes all the selected parameter data plus the local time and date for each scan, if selected. If you choose to save the data, CTDAcq creates only a DAT file, which is in ASCII format and can be opened and viewed in any text editor.

To acquire, display and save data in Run Continuous mode:

1. Connect the CTD-E to your computer and power supply.
2. Choose Start ► Programs ► RD Instruments ► CTDAcq.

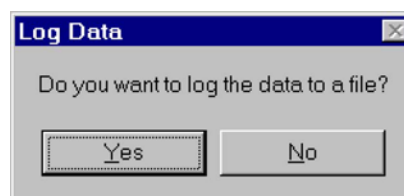
CTDAcq starts and the CTDAcq Main window opens.

3. Choose Configure ► Check Instrument.

CTDAcq displays which items are being checked, and the model number, serial number, firmware version, and calibration date of the instrument are displayed in the Instrument Identification Window.

4. If required, configure the instrument as described in [Configuring the CTD-E](#).
5. Choose Run Instrument ► Continuous Data Mode.

The Log Data window opens:



6. Choose Yes to save the data to a file.

The Save As dialog box for data files shown in Figure 12 opens. This dialog box is used to create the file in which to save the parameter data.

7. Click the arrow in the Save in drop-down list box and select the folder in which to save the parameter data file.
8. In the File name text box enter the name of the file in which to save the data. The extension .dat is added automatically
9. When you are ready to begin acquiring data, click Save to create the file in which to save the data and close the dialog box.

The CTD-E Run Continuous Mode window shown in Figure 15 opens and the instrument begins collecting data. The parameter data are displayed in the window, updated once a second and, if you chose to save the data, saved to the file at the sample rate of the instrument.

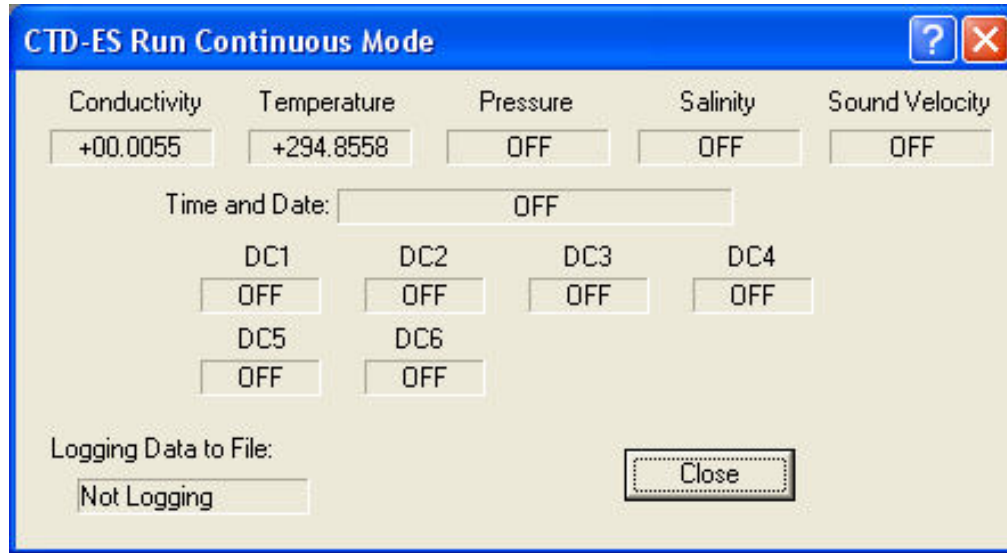


Figure 15. The CTD-E Run Continuous Mode Window

10. To stop displaying and saving data, click Close.

Resetting and Firing a Water Sampler

A water sampler can be reset and fired from the CTDAcq Acquisition window while acquiring real-time data during a cast. An optional water sampler interface, available from TRDI, is required to be installed on the instrument for this purpose.

To reset and fire the water sampler:

1. In the CTDAcq Acquisition window select Choose Sampler > Enable Sampler Interface. The Fire and Reset buttons appear.
2. If required, choose Sampler > Home Sampler to reset the sampler to the first bottle, or click Home, and then click Yes in the Reset Sampler window.
3. When ready to fire a bottle, choose Sampler > Fire Bottle or click Fire. The Sampler Status display indicates how many bottles have been fired.

Setting up the Graphics Displays

CTDAcq provides two graphics displays: a Cast graphics display and a Towed Acquisition graphics display. The Cast graphics display provides a cast graph that allows viewing of real-

time parameter data as a plot when acquiring data in Profile mode. See [Acquiring Real-Time Data in Profile Mode](#). Similarly, the Towed Acquisition display, which includes up to four pressure graphs, allows viewing of real-time data as a plot in Towed Acquisition mode. See [Acquiring Real-Time Data in Towed Acquisition Mode](#).

All the graphs can be individually set up, allowing you to select the parameters to display, the graph scaling, the labeling, and other settings. A numerical display of the scan number, pressure, temperature, and conductivity are also displayed in each graphics display. In addition, in the Towed Acquisition graphics display, you can select whether to also include the cast graph. Both graphics displays can be set up before or during data acquisition.

Before you can set up the graphics displays, the CTD-E must be checked as described in [Checking the CTD-E](#).

Setting up the Graph in the Cast Graphics Display

To set up the graph in the Cast graphics display:

1. Choose File ► Acquisition.

The CTDAcq Acquisition window opens with the Cast graphics display as it appears in Figure 11.

If no graph appears, choose Display ► Graph.

2. Choose Display ► Graph Setup.

The Graph Setup dialog box shown in Figure 16 opens.

3. In the Graph Title text box enter a title for the graph.

The title will appear above the graph.

4. In the Auto-Zoom area of the Graph Setup dialog box select the Enable check box if you want CTDAcq to automatically scale the graph for all the parameters. Clear the check box if you do not.

If you clear the Enable check box, you will need to enter values in the Minimum and Maximum text boxes for each of the parameters as explained below.

Graph Setup

Graph Title:

Y Axis
 Label: Minimum:
 Parameter: Maximum:

OK
 Cancel
 Help

Enable
 Axis 1
 Axis 2
 Axis 3
 Axis 4

Grid Lines

X Axis 1
 Label: Minimum:
 Parameter: Maximum:

X Axis 2
 Label: Minimum:
 Parameter: Maximum:

X Axis 3
 Label: Minimum:
 Parameter: Maximum:

X Axis 4
 Label: Minimum:
 Parameter: Maximum:

Auto-Zoom
 Enable Update Rate:

Note: All Temperature plots are ITS - 90

Figure 16. The Graph Setup Dialog Box for Data Acquisition

5. If you selected the Enable check box, enter the number of scans that are displayed between Auto-Zoom updates in the Update Rate text box.
6. Select the Grid Lines check box if you want to display a grid overlay on the graph. Clear the check box if you do not.
7. In the Y Axis area of the Graph Setup dialog box, enter a label for the Y axis in the Label text box.
8. Click the arrow in the Parameter drop-down list box and select a parameter for the Y axis.



NOTE. The parameter names shown with an asterisk (*) are calculated parameters based on measured conductivity, temperature and pressure. The calculations are made by CTDAcq. The other parameters shown are the Primary Channel and DC Channel parameters that were selected in the Configure CTD-E dialog box when the instrument was configured. For the DC Channels the names are the default names, such as DC1 and DC2, or the names that were entered in the DC Channel Setup dialog box. (See [Selecting the Parameters to be Output](#) for instructions on how to select the Primary Channel and DC Channel parameters, and [APPENDIX A: Measured and Calculated Parameters](#) for a complete list of the parameters.)

9. If you *did not* select the Enable check box, enter the minimum and maximum values in the Minimum and Maximum text boxes for the Y axis parameter selected.
10. In the X Axis 1 area of the Graph Setup dialog box, enter a label for X Axis 1 in the Label text box.
11. Click the arrow in the Parameter drop-down list box and select a parameter for X Axis 1.
12. If you *did not* select the Enable check box, enter the minimum and maximum values in the Minimum and Maximum text boxes for the X Axis 1 parameter selected.
13. Repeat Steps 10 to 13 for the X Axis 2, X Axis 3, and X Axis 4 parameters, or for only those X axis you want to display.
14. In the Enable area select the check boxes for those parameters you want to display. Clear the check boxes for those you do not.
15. Click OK to save the new graph setup and close the Graph Setup dialog box, or click Cancel to close the dialog box without saving any changes.

CTDAcq displays a new graph showing individually colored plots during data acquisition and correspondingly colored X axis labels of the selected parameters as in the example in Figure 19, which shows plots of conductivity, temperature, pressure, and calculated salinity.
16. To close the CTDAcq Acquisition window, choose File ► Configure.

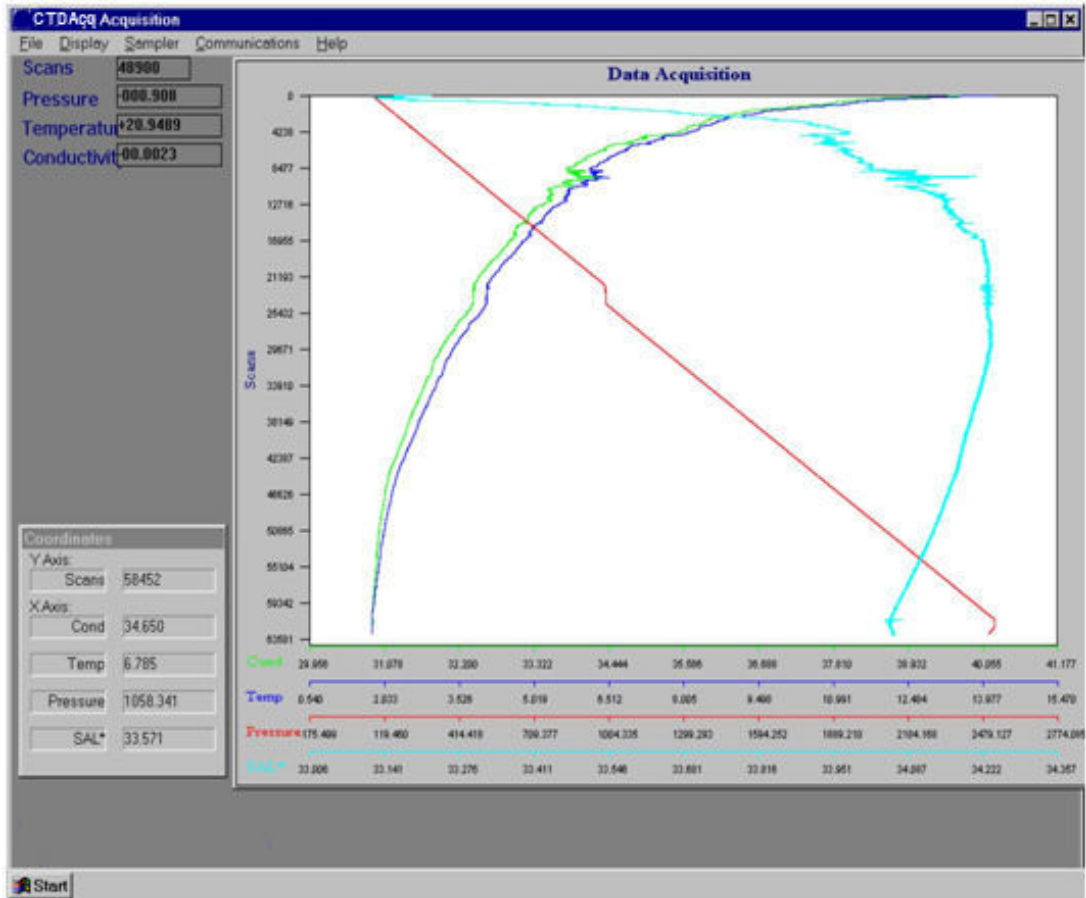


Figure 17. The Cast Graphics Display with Real-Time Plots of Parameter Data

Zooming in and Out of the Cast Graph

To zoom in on the cast graph, 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, choose Display > Graph Zoom All.

Listing the Data with the Cast Graph

Along with displaying plots of the selected parameter data, you can list the data by choosing Display > Listing.

The data are listed in separate columns in a separate window under the graph. Vertical and horizontal scroll bars are provided for viewing hidden scans and columns. To view scans that are not shown, click the up or down arrow in the vertical scroll bar to scroll through the scans one scan at a time. Or drag the scroll box up or down to quickly scroll through the scans. To view columns that are not shown, drag the scroll box in the horizontal scroll bar to the right. This scroll box is available only if one or more columns are hidden.

To stop listing the data choose Display > Listing again.

Opening the Coordinates Window in the Cast Graphics Display

The Coordinates window, which is shown in Figure 18, displays the cast graph coordinates at which the mouse pointer is pointing. As the mouse pointer is moved around the cast graph, the displayed coordinates change accordingly.

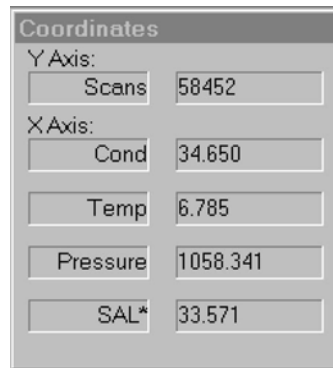


Figure 18. The Coordinates Window

To open the Coordinates window choose Display > Show Graph Coordinates. To close the window choose Display > Show Graph Coordinates again.

The Coordinates window can be moved anywhere on the screen. In Figure 17 the window is shown in the lower left corner. To move the Coordinates window, place the mouse pointer on the window's title bar and press and hold the left mouse button while using the mouse to drag the window to the desired location, and then release the mouse button.

Setting up the Graphs in the Towed Acquisition Graphics Display

1. Choose File > Tow Acquisition.

The TRDI Acquisition window opens. If this is the first time the window is opened, it appears as shown in Figure 14 with four pressure graphs.

Any graphs that do not appear will be opened in the steps that follow.

2. Choose Display > Pressure Graphs > Pressure Graph 1.

The Pressure Graph 1 Setup dialog box shown in Figure 19 opens.

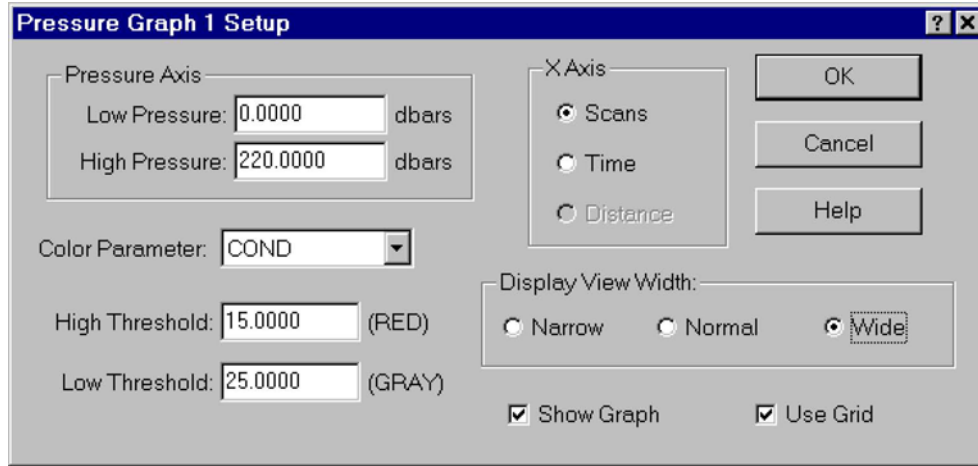


Figure 19. The Pressure Graph 1 Setup Dialog Box for Towed Acquisition

3. Select the Show Graph check box to show the graph. Clear the check box to hide the graph.
4. Select the Use Grid check box if you want to display a grid overlay on the graph. Clear the check box if you do not.
5. Click the arrow in the Color Parameter drop-down list box and select a parameter for the Y axis.



NOTE. The parameter names shown with an asterisk (*) are calculated parameters based on measured conductivity, temperature and pressure. The calculations are made by CTDAcq. The other parameters shown are the Primary Channel and DC Channel parameters that were selected in the Configure CTD-E dialog box when the instrument was configured. For the DC Channels the names are the default names, such as DC1 and DC2, or the names that were entered in the DC Channel Setup dialog box. (See [Selecting the Parameters to be Output](#) for instructions on how to select the Primary Channel and DC Channel parameters, and [APPENDIX A: Measured and Calculated Parameters](#) for a complete list of the parameters.)

6. In the Pressure Axis area of the Pressure Graph 1 Setup dialog box, enter the lowest pressure in dbars at which to display data in the Low Pressure text box; enter the highest pressure in the High Pressure text box.
7. Enter the low threshold in the Low Threshold Text box; enter the high threshold in the High Threshold text box.

When the data value exceeds the high threshold, the plot trace is red. When the data falls below the low threshold, the plot trace is gray. Between the low and high thresholds the data are displayed in eight different colors corresponding to eight equal incremental data values.

8. In the X Axis area select Scans or Time for the X axis of the graph.
9. In the Display View Width area do one of the following:
 - Select Narrow for a display that is 512 scans wide.
 - Select Normal for a display that is 1024 scans wide.
 - Select Wide for a display that is 2048 scans wide.

10. Click OK to save the new graph setup and close the Pressure Graph 1 Setup dialog box, or click Cancel to close the dialog box without saving any changes.
11. Except for Step 1, repeat all the steps above for the Pressure Graph 2, Pressure Graph 3 and Pressure Graph 4 graphs, or for only those graphs you want to display.

If you choose to show all the pressure graphs, CTDAcq displays them as shown in Figure 20, which includes pressure plots of conductivity, temperature, pressure, and calculated sound velocity.

Displaying the Cast Graph in the Towed Acquisition Graphics Display

To display the cast graph in the Towed Acquisition graphics display, choose Display > Cast Graph > Enable.

The cast graph opens to the left of the pressure graphs as shown in Figure 20.

Setting up the Cast Graph from the Towed Acquisition Graphics Display

To set up the cast graph from the Towed Acquisition graphics display, choose Display > Cast Graph > Setup, and then set up the graph as described in [Setting up the Graph in the Cast Graphics Display](#) beginning with Step 3.

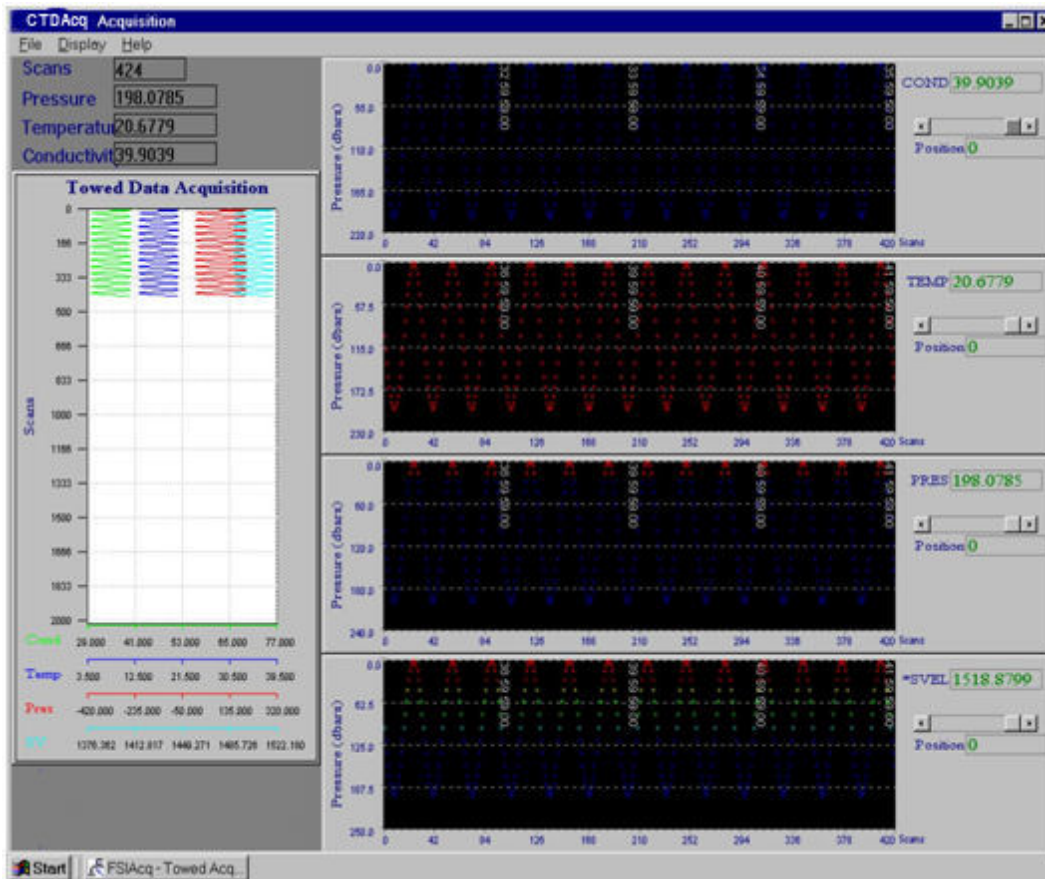


Figure 20. The Towed Acquisition Display with Four Real-Time Pressure Plots of Parameter Data

Opening the Coordinates Window in the Towed Acquisition Graphics Display

The Coordinates window, which is shown in Figure 18, displays the cast graph coordinates at which the mouse pointer is pointing. As the mouse pointer is moved around the cast graph, the displayed coordinates change accordingly.



NOTE. The cast graph must be displayed as described in [Displaying the Cast Graph in the Towed Acquisition Graphics Display](#).

To open the Coordinates window choose Display > Cast Graph > Show Graph Coordinates. To close the window choose Display > Cast Graph > Show Graph Coordinates again.

The Coordinates window can be moved anywhere on the screen. To move the Coordinates window, place the mouse pointer on the window's title bar and press and hold the left mouse button while using the mouse to drag the window to the desired location, and then release the mouse button.

Zooming in and Out of the Cast Graph in the Towed Acquisition Graphics Display

To zoom in on the cast graph in the Towed Acquisition graphics display, 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.

Note: The cast graph must be displayed as described in [Displaying the Cast Graph in the Towed Acquisition Graphics Display](#).

To zoom out to the full view of the graph, choose Display > Cast Graph > Zoom All.

Listing the Data in the Towed Acquisition Graphics Display

To list the data in the Towed Acquisition graphics display, choose Display > Listing.

The pressure graphs are replaced with a listing of the data in separate columns in a separate window. Vertical and horizontal scroll bars are provided for viewing hidden scans and columns. To view scans that are not shown, click the up or down arrow in the vertical scroll bar to scroll through the scans one scan at a time. Or drag the scroll box up or down to quickly scroll through the scans. To view columns that are not shown, drag the scroll box in the horizontal scroll bar to the right. This scroll box is available only if one or more columns are hidden.

To stop listing the data choose Display > Listing again.

Scrolling Through the Pressure Graph Scans

To the right of each pressure graph the selected Y axis parameter is displayed along with the scan number. The displayed scan number is always the last scan processed and is at the right edge of the pressure graph.

To scroll through the scans, do one of the following:

- Click the left arrow to go back one scan; click the right arrow to advance one scan.
- Click in the scroll bar to the left of the scroll box to go back 100 scans; click to the right to advance 100 scans.
- Drag the scroll box to the left to go back quickly through the scans; drag it to the right to advance quickly through the scans.

Previewing and Printing Graphs

After completing data acquisition in either Profile or Towed Acquisition mode, the graphs can be previewed and printed.

Previewing and Printing the Cast Graph

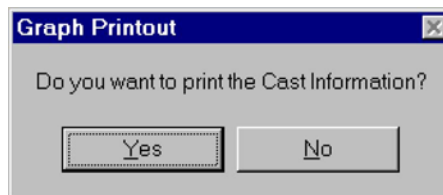
The cast graph can be printed from the Cast or Towed Acquisition graphics display.

To print the cast graph from the Cast graphics display without previewing, choose File ► Print; from the Towed Acquisition graphics display, choose File ► Print Cast Graph. Then follow the printing instructions for your printer.

To preview and print the cast graph:

1. Choose File ► Print Preview.

The Graph Printout window opens:



2. Click Yes to include the cast information with the preview and the printout.

The Print Preview window opens.

3. To print the graph click the Print Graph button in the upper left corner of the Print Preview window and follow the printing instructions for your printer. Or click the Close button to close the window without printing.

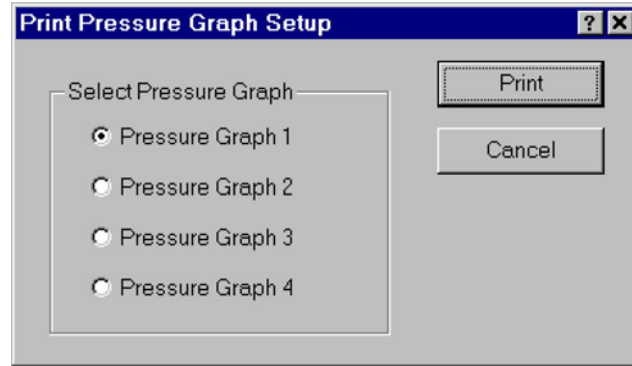
Previewing and Printing the Pressure Graphs

The pressure graphs can be printed from the Towed Acquisition graphics display only.

To print a pressure graph without previewing:

1. Choose File ► Print Pressure Graphs.

The Print Pressure Graph Setup dialog box opens:



2. Select the pressure graph to print, and then click Print.
3. Follow the instructions for your printer to print the graph.

To preview and print a pressure graph:

1. Choose File ► Print Preview Pressure Graphs.
The Print Pressure Graph Setup dialog box opens.
2. Select the pressure graph to print, and then click Print.
The Print Preview window opens.
3. To print the graph click the Print Graph button in the upper left corner of the Print Preview window and follow the printing instructions for your printer. Or click the Close button to close the window without printing.

CTD-E Maintenance

To ensure your CTD-E 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 fill the pressure sensor with oil.

Recommended Maintenance

Table 2. Recommended Maintenance

User Maintenance	
Item	TRDI Recommended Period
Housings/End Caps	Inspect for damage and replace as required.
Hardware (bolts, nuts, washers, etc.)	Manufacturer recommends replacement after every deployment or every at least each year. Damaged hardware should never be used.
O-rings	Manufacturer recommends replacement every time the instrument is opened. Damaged O-rings should never be used.
Connector	Inspect for damage and replace as required. Damaged connectors should never be used.
Conductivity Sensor	Fill with oil prior to each deployment. Manufacturer recommends verification of reasonable performance before each deployment; i.e. a reference comparison.
Temperature	Manufacturer recommends verification of reasonable performance before each deployment; i.e. a reference comparison.
Pressure Sensor	Manufacturer recommends verification of reasonable performance before each deployment; i.e. a reference comparison.
Oil	Manufacturer recommends filling oil with capillary tube before every deployment.
Calibration*	
Item	TRDI Recommended Period
Conductivity Sensor	Manufacturer recommends return every 1 to 2 years for Factory calibration.
Temperature Sensor	Manufacturer recommends return every 1 to 2 years for Factory calibration.
Pressure Sensor	Manufacturer recommends return every 1 to 2 years for Factory calibration.

*The measurement error band of the CTD will widen over time due to component aging. This effect happens regardless of whether or not the instrument is being operated. Due to the stringent accuracy specifications, the effects of drift rapidly become a significant portion of the overall instrument error budget. For example, the error band for the conductivity measurement will reach twice its initial value three months after calibration. Periodic recalibration of the instrument is recommended to return to the original error band.

Factory Maintenance	
Item	TRDI Recommended Period
RTC Battery Replacement	3 to 4 years maximum: return to manufacturer for replacement.
Housing/End Caps	3 to 5 years maximum: return to manufacturer for inspection, shorter periods may be required depending on marine growth.
O-rings	3 to 5 years maximum: return to manufacturer for replacement.
Connector	3 to 5 years maximum: return to manufacturer for replacement.

Cleaning the CTD-E

To ensure your CTD-E continues to provide you with accurate data, you should inspect and clean the instrument after each use.

To remove foreign matter and biofouling:

1. Remove soft-bodied marine growth or foreign matter with soapy water. Waterless hand cleaners remove most petroleum-based fouling. If there is heavy fouling or marine growth, TRDI recommends soaking the affected areas in a 50:50 bath of fresh water and apple cider vinegar for one to two hours to break down the shell-like parts. Use a wooden dowel to carefully break up larger pieces of the shells. Scrubbing with a medium stiffness brush usually removes the remaining soft-bodied parts.



Do NOT use power scrubbers, abrasive cleansers, scouring pads, high-pressure marine cleaning systems or brushes stiffer than hand cleaning brushes as this can scratch surfaces and damage softer parts like urethanes and sealants used in the construction of the system.

Do NOT use excessive force when breaking up larger pieces of shells or you risk damaging the sensitive components on the external or inside of the system.

2. Rinse with fresh water to remove soap or apple cider vinegar residue.
3. Repeat steps 1 – 3, as required to remove heavy marine growth.



Do NOT soak for longer than two hours at any time and always rinse with fresh water between soakings. Soaking for longer than two hours at a time can break down the urethane and other sealants used in the construction of the system.

4. Dry the system with low-pressure compressed air or soft lint-free towels.



Do NOT use high pressure or you may damage softer surfaces.

Always dry the system before placing it in the storage case to avoid fungus or mold growth.

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 rubber portion of the pins with an O-ring quality silicone based lubricant.

Oil Fill Procedure and Capillary Tube Installation

The pressure sensor used in your instrument 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 material compositions of the transducer and instrument housing.

Included with your instrument is a capillary tube installation kit. The following procedure will provide guidance to allow you to install the capillary onto the instrument.

Should you require further assistance please do not hesitate to contact Teledyne RD Instruments and ask to speak to a customer service representative.

The following parts should be included in your kit:

Part Number	Quantity	Description
1400-65361	1	Nalgene Bottle
5400-7510A653	1	Syringe
5400-TS19X1	1	Needle
NY-200-1-2ST	1	Capillary Body Assembly
A150-045	1	Capillary Tube
1605-378372	1 ounce	Oil, Dow Corning 200 CTS
97F-6003-00	1	Needle Cover
AN2005001	1	Oil Fill Procedure

Should you require additional parts from this kit please contact a Teledyne RD Instruments sales representative. Please have the part number on hand to acquire price and delivery information.

**Step #1:**

Place the instrument on a flat surface with the pressure port cavity pointed up.

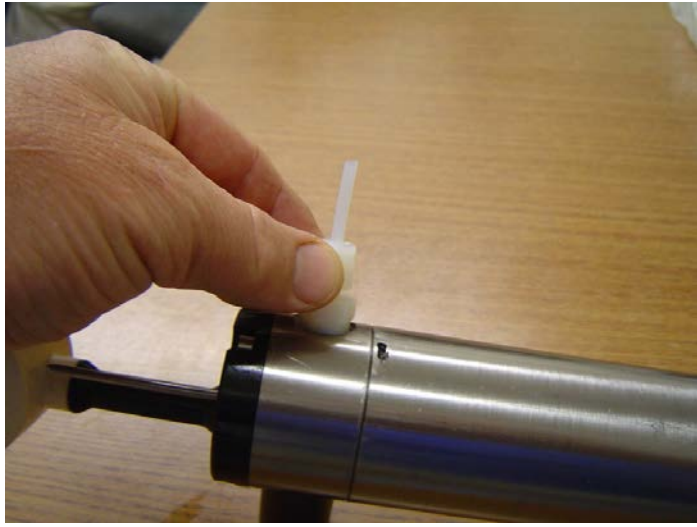
**Step #2:**

Assemble the syringe and insert a small amount of oil from the Nalgene bottle into the syringe. Fill the pressure port cavity to the top with the oil.

**Step #3:**

Thread the capillary assembly into the pressure port slowly. You should see the oil wick up into the capillary tube as you thread the assembly into the end cap.

Have an absorbent paper towel on hand to clean up any overflow that you may have.



Step #4:

Continue threading the assembly until the threads are no longer exposed and the O-ring is seated onto the end cap. Have an absorbent paper towel on hand to clean up any overflow that you may have.



Step #5:

Using hands only, tighten the assembly onto the end cap to four inch-pounds.

***** HAND TIGHTEN ONLY! *****

***** MAXIMUM 4 INCH-POUNDS TORQUE *****

***** DO NOT OVERTIGHTEN *****

Have an absorbent paper towel on hand to clean up any overflow that you may have.

If no oil is observed in the capillary tube repeat steps 1-5.

The installation is complete and the instrument is ready to be deployed.

APPENDIX A: Measured and Calculated Parameters

Conductivity, temperature, and pressure are measured directly by the CTD-E. In addition, the instrument calculates salinity and sound velocity. Any number of the parameters can be selected to output. The time and date on which the parameters are output can also be included with each sample. When acquiring data in any of the real-time operating modes, CTDAcq calculates additional parameters from the measured parameters. Any number of the measured and calculated parameters, including those calculated by CTDAcq during real-time data acquisition can be displayed and saved to a file.

Each parameter, except for time and date, has a corresponding abbreviation in the Parameter drop down list box of the Graph Setup dialog box shown in Figure 16, and in the Color Parameter drop down list box in each of the Pressure Graph Setup dialog boxes, where one is shown in Figure 19. An abbreviation with an asterisk (*) represents a parameter that is calculated by CTDAcq. The abbreviations are in parenthesis for each parameter listed below.

Parameters Measured by the Instrument

The parameters directly measured by the CTD-E are the following:

Conductivity (COND):	The measured water conductivity in mmho/cm.
Temperature (TEMP):	The measured water temperature in °C.
Pressure (PRES):	The measured water pressure in dbars.

Parameters Calculated by the Instrument

The parameters calculated by the CTD-E are following:

Salinity (SAL):	The seawater salinity in accordance to PSS78 (Practical Salinity Scale 1978).
Sound Velocity (SV):	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 for each sample.

Parameters Calculated by CTDAcq

The parameters calculated by CTDAcq are the following:

Scan (SCAN):	A single sample of all the selected parameters.
Adiabatic Temperature Gradient (*ATG):	The water adiabatic temperature gradient in °C/dbar.
Pot (*POT):	The water temperature without the effects of pressure in °C.
Density (*DEN):	The water density in kg/m ³ .
Depth (*DEPTH):	The water depth in meters.
Sound velocity (*SVEL):	The sound velocity in water in m/sec.
Salinity (*SAL):	The seawater salinity in accordance to PSS78 (Practical Salinity Scale 1978).

APPENDIX B: Changing the Baud Rate

The default baud rate for the CTD-E is 9600 bits/sec with one stop bit, eight data bits and no parity. To change the baud rate the CTD-E must be powered and connected to an available serial port of the computer. In addition, when the baud rate of the instrument is changed, the baud rate of the computer's serial port to which the instrument is connected must be changed to the same baud rate.

To change the baud rate of the CTD-E and the computer's serial port:

1. Choose Start > Programs > RD Instruments > CTDAcq.
CTDAcq starts and the CTDAcq Main window opens.
2. Choose Communications > Communications Window.

The Communications Window shown in Figure 21 opens.

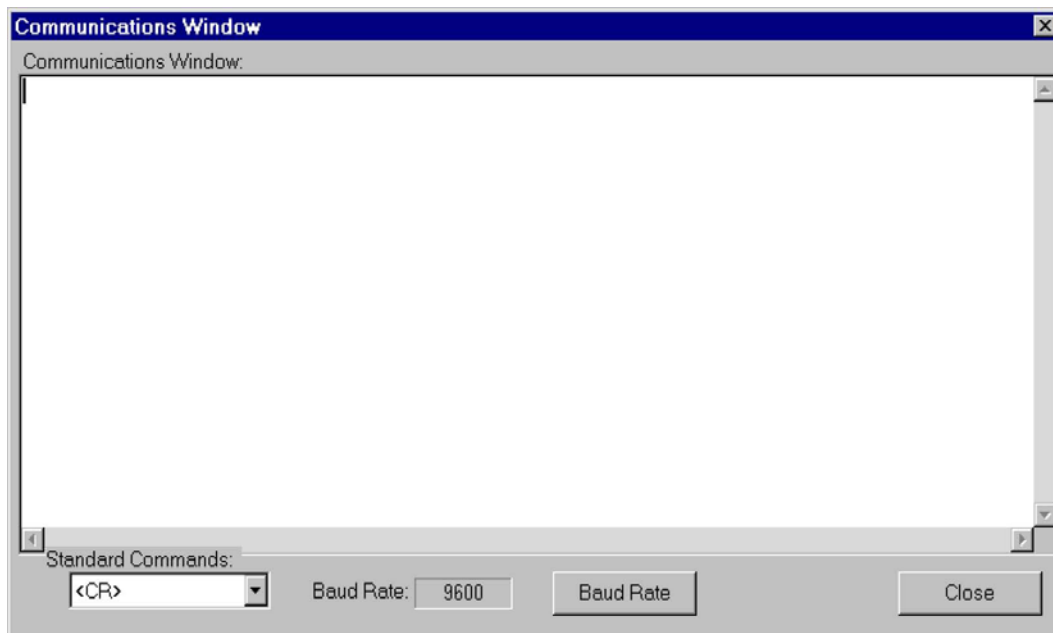


Figure 21. The Communications Window

3. Type *****O**, and then press Enter.
This places the CTD-E in Open mode. To verify this, press Enter again. The words "Open Mode" should be displayed.
4. Do one of the following to select the baud rate of the instrument:
 - Type **SB30**, and then press Enter to set the baud rate to 300 bits/sec.
 - Type **SB12**, and then press Enter to set the baud rate to 1200 bits/sec.
 - Type **SB96**, and then press Enter to set the baud rate to 9600 bits/sec.
 - Type **SB19**, and then press Enter to set the baud rate to 19200 bits/sec.
5. Type *****E**, and then press Enter.

6. Click Close to close the Communications Window.
7. Choose Communications > Setup.

The Configuration COM Setup dialog box shown in Figure 22 opens.

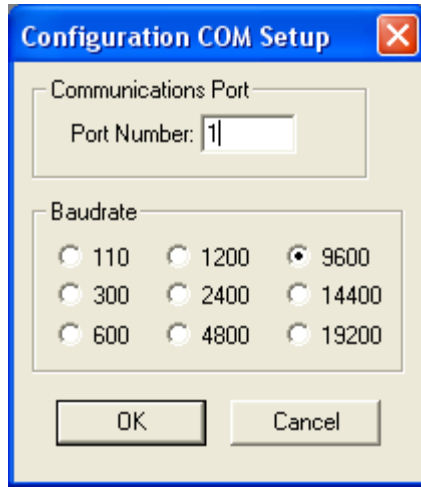



Figure 22. The Configuration COM Setup Dialog Box

8. Select the new baud rate—300, 1200, 9600, or 19200—in the Baudrate area of the Configuration COM Setup dialog box.



CAUTION. If you click Cancel in the next step, the CTD-E will not be able to communicate with your computer.

9. Click OK to save the new baud rate selection and close the Configuration COM Setup dialog box, or click Cancel to close the dialog box without saving the new selection.

APPENDIX C: Connector and Test Cable Wiring

The CTD-E includes a Subconn MCBH4F circular bulkhead connector on the lower end cap for connecting to power and to a computer. The connector components are listed in Table 3.

Table 3: Bulkhead Connector Components

ITEM	SUBCONN PART NUMBER	TRDI PART NUMBER
Bulkhead Connector	MCBH4F	2106-MCBH4F
Pigtail	ILMC4M	2106-ILMC4M
Dummy Plug	MCDC4M	2106-MCDC4M
Locking Sleeve	MCDLSF	2106-MDLSF

Bulkhead Connector Wiring

Refer to Table 4 for the required connections from the bulkhead connector to the computer, and to Table 5 for the connections from the connector to the power supply. Figure 23 shows the bulkhead connector pin orientation as viewed from the face.

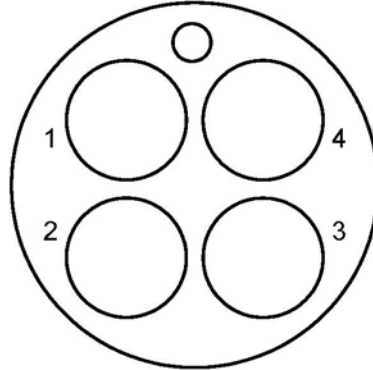


Figure 23. Bulkhead Connector—Face View Female

Table 4: Computer Connections

Bulkhead Connector				Computer DB9 Connector		
PIN	COLOR	LABEL	FUNCTION	PIN	LABEL	FUNCTION
1	Black	GND	Ground	5	GND	Ground
2	White	RXD/RS-485A	Received Data	3	TXD/RS-485B	Transmitted Data
4	Green	TXD/RS-485B	Transmitted Data	2	RXD/RS-485A	Received Data

Table 5: Power Supply Connections

Bulkhead Connector				Power Supply
PIN	COLOR	LABEL	FUNCTION	
1	Black	GND	Ground	Ground
3	Red	Power(+)	Instrument Power	6–14 VDC

Test Cable Wiring

If a test cable is not available, you can fabricate your own cable using a pigtail that mates with the CTD-E bulkhead connector. (See Table 3 for the pigtail part number.) Figure 24 shows the pin orientation of the pigtail connector. Table 6 shows the test cable wiring.

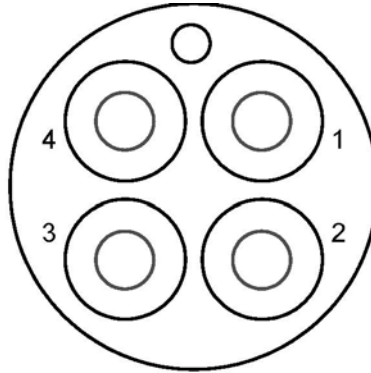


Figure 24. Pigtail Connector for Bulkhead Connector—Face View Male

Table 6: Test Cable Wiring

Pigtail		DB25 Connector		Banana Plugs
PIN	COLOR	PIN	LABEL	
1	Black	7	GND	Black
2	White	2	RXD/RS-485A	—
3	Red	—	Power (+)	Red
4	Green	3	TXD/RS-485B	—

APPENDIX D: Warranty, Liability and RMA Return Procedure

Teledyne RD Instruments Limited Warranty

Teledyne RD Instruments (TRDI) 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, TRDI's obligation is limited to the repair or replacement, at TRDI's option, of any product returned to the TRDI 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 TRDI'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 TRDI 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 TRDI.

Equipment not manufactured by TRDI 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, TRDI 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 TRDI. Shipments without an RMA number will not be accepted.

Liability

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

Returning CTDs to TRDI for Service

When shipping the system to TRDI from either inside or outside the United States, the following instructions will help ensure the CTD arrives with the minimum possible delay. Any deviation from these instructions increases the potential for delay.

- All shipments must be accompanied by two copies of your commercial invoice showing value of material and any reason for return.
- Whenever possible, please send copies of the original export shipping documents with the consignment.
- If the equipment is property of TRDI, please insure for full value.
- If the value is in excess of \$1,000.000, the following shippers oath must be sent with the invoices. (This can be typed on the invoice or on a separate letterhead).

“I, _____, declare that the articles herein specified are, the growth, produce, or manufacture of the United States; that they were exported from the United States; from the Port of _____, on or about _____; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means, that no drawback, bounty, or allowance has been paid or admitted thereof.

Signed _____”

Domestic Shipments

Step 1 - Request a Return Material Authorization

To obtain a Return Material Authorization (RMA) number and shipping instructions for the return of your instrument, do one of the following:

- Open the RMA using the web link: <http://adcp.com/support/sendADCP.aspx>
- Contact Customer Service Administration at rdicsadmin@teledyne.com
- Call +1 (858) 842-2700

When requesting a RMA number, please give us the following information:

- What is being shipped (include the serial number)
- When you plan to send the shipment
- What issue(s) need to be corrected
- Name of the Field Service Engineer that knows about the issue
- When you need the instrument returned

TRDI’s Customer Service will then respond with the RMA number for the shipment. Please include this number on all packages and correspondence.

Step 2 – Provide a MSDS as necessary

Please provide a Material Safety Data Sheet (MSDS) if the system/transducer is painted with antifouling paint.

Step 3 - Ship via air freight, prepaid

Urgent Shipments should be shipped direct to TRDI via overnight or priority air services. Do not send urgent airfreight as part of a consolidated shipment. If you ship consolidated, it will cost less, but may lose up to three days in transit time.

Non-urgent shipments may be shipped as part of a consolidated cargo shipment to save money. In addition, some truck lines may offer equivalent delivery service at a lower cost, depending on the distance to San Diego.

Mark the Package(s)

**To: Teledyne RD Instruments, Inc. (RMA Number)
14020 Stowe Drive
Poway, California 92064**

**Airport of Destination = San Diego
Notify Paxton, Shreve, and Hayes
Phone: +1 (619) 232-8941
Fax: +1 (619) 232-8976**

Step 4 - Urgent shipments

Send the following information by fax or telephone to TRDI.

Attention: Customer Service Administration

Fax: +1 (858) 842-2822

Phone: +1 (858) 842-2700

- Detailed descriptions of what you are shipping (number of packages, sizes, weights, and contents).
- The name of the freight carrier
- Master Air bill number
- Carrier route and flight numbers for all flights the package will take

European Shipments

Step 1 - Request a Return Material Authorization

To obtain a Return Material Authorization (RMA) number and shipping instructions for the return of your instrument, do one of the following:

- Open the RMA using the web link: <http://adcp.com/support/sendADCP.aspx>
- Contact Customer Service Administration at rdiefs@teledyne.com
- Call +33(0) 492-110-930

When requesting a RMA number, please give us the following information.

- What is being shipped (include the serial number)
- When you plan to send the shipment
- What issue(s) need to be corrected
- Name of the Field Service Engineer that knows about the issue
- When you need the instrument returned

TRDI's Customer Service will then respond with the RMA number for the shipment. Please include this number on all packages and correspondence.

Step 2 – Provide a MSDS as necessary

Please provide a Material Safety Data Sheet (MSDS) if the system/transducer is painted with antifouling paint.

Step 3 - Ship Via Air Freight, Prepaid

Urgent Shipments should be shipped direct to TRDI via overnight or priority air services. Do not send urgent airfreight as part of a consolidated shipment. If you ship consolidated, it will cost less, but may lose up to three days in transit time.

Non-urgent shipments may be shipped as part of a consolidated cargo shipment to save money.

Mark the package(s) as follows:

**To: Teledyne RD Instruments, Inc. (RMA Number)
2A Les Nertieres
5 Avenue Hector Pintus
06610 La Gaude, France**

Step 4 - Include Proper Customs Documentation

The Customs statement must be completed. It should be accurate and truthfully contain the following information.

- Contents of the shipment
- Value
- Purpose of shipment (example: "American made goods returned for repair")
- Any discrepancy or inaccuracy in the Customs statement could cause the shipment to be delayed in Customs.

Step 4 - Send the Following Information by Fax or Telephone to TRDI

**Attention: Sales Administration
Phone: +33(0) 492-110-930
Fax: +33(0) 492-110-931**

- Detailed descriptions of what you are shipping (number of packages, sizes, weights, and contents).
- The name of the freight carrier
- Master Air bill number
- Carrier route and flight numbers for all flights the package will take