Thermo
S C I E N T I F I C

Dionex ED50A Electrochemical Detector Operator's Manual

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For Research Use Only. Not for use in diagnostic procedures.

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1 • Introduction

1.1   Overview

The Thermo Scientific Dionex™ ED50A Electrochemical Detector measures current resulting from the application of potential (voltage) across electrodes in flow-through cells. Depending on the method by which the potential is applied and the current measured, several different properties of the flowing solution can be determined. These measurements help answer the major questions analytical chemists ask: What's in it, and how much is there?

Of course, other detectors are used in high performance liquid chromatography (HPLC). The UV-visible absorbance detector dominates all other forms of detection. Sensitivity is excellent for many analytes, especially aromatic species, and transparent mobile phases are readily available. However, there are numerous analytes that have very poor absorbance and are not detected with sufficient sensitivity by UV absorbance. Most of these nonchromophoric molecules are aliphatic organic molecules and inorganic ions. Low wavelength UV detection can be used, but at a loss in selectivity. Refractive index detection can also be used. However, maintaining a stable baseline can be difficult, and RI detection is less sensitive and substantially less selective than UV detection.

Fortunately, a wide variety of nonchromophoric molecules can be detected with good or excellent sensitivity by one of several forms of electrochemical detection. These molecules include carboxylic, sulfonic, and phosphonic acids; alcohols, glycols, aldehydes, and carbohydrates; primary, secondary, tertiary, and quaternary amines; sulfates, sulfoxides, thiols, sulfides, and mercaptans; and inorganic anions and cations. In addition, when compared to UV absorbance detection, electrochemical detection provides substantial improvements in sensitivity and selectivity for amine and hydroxy-substituted aromatics such as catecholamines.

Several forms of electrochemical detection have become popular for certain HPLC applications. Conductivity is the workhorse detection method in ion chromatography, just as UV detection is for HPLC. DC amperometry is the preferred method for neurochemical analyses. Pulsed amperometry is now established as the superior detection method for carbohydrates. For most of the numerous analytes listed in the previous paragraph, detection by UV-visible absorbance is poor, while one of the three main techniques of electrochemical

detection provided by the Dionex ED50A provides superior sensitivity and selectivity.

Electrochemical detection is not a substitute for UV-visible absorbance detection, but is an important complement. A liquid chromatograph equipped with both a Thermo Scientific Dionex absorbance detector and an electrochemical detector is a versatile and powerful analytical instrument.

1.2 Detection Modes

The Dionex ED50A provides two major forms of electrochemical detection: DC amperometry and integrated amperometry. Pulsed amperometry is a form of integrated amperometry.

- *DC Amperometric detection* is based on the measurement of current resulting from oxidation or reduction (electrolysis) of analyte molecules at the surface of an electrode.

- *Integrated and pulsed amperometric detection* are similar to DC Amperometry in that molecules are oxidized or reduced at the surface of an electrode. However, current is measured by integration during a portion of a repeating potential vs. time waveform.

In addition, the *Voltammetry* mode is used to determine potentials used in DC and integrated amperometry.

> **NOTE** **Dionex ED50A detectors shipped in June 2013 or later are not recommended for conductivity detection. If your detector was shipped before June 2013, refer to *ED50A Electrochemical Detector Operator's Manual* (Document No. 031772) for information about the Conductivity mode. The manual is provided on the Thermo Scientific Reference Library DVD (P/N 053891).**

1.3 Control Modes

The Dionex ED50A can be controlled locally from the front panel or remotely (via the Thermo Scientific Dionex DX-LAN™ interface) from a host computer running Thermo Scientific Dionex Chromeleon® 6.8 Chromatography Data System and the Microsoft® Windows® XP Service Pack 3 operating system.

1.4   About This Manual

Chapter 1 Introduction	Provides a brief overview of the Dionex ED50A. Explains the meaning of safety messages and icons in the manual and safety labels on the detector.
Chapter 2 Description	Describes physical aspects of the Dionex ED50A, including the front panel controls, electronics, and flow cell. Explains the detector operating modes.
Chapter 3 Operation and Maintenance	Describes operating features and how to create, edit, and run methods from the Dionex ED50A front panel. Lists routine preventive maintenance requirements.
Chapter 4 Troubleshooting	Lists possible causes of problems and step-by-step procedures to isolate and eliminate them.
Chapter 5 Service	Contains step-by-step instructions for routine service and parts replacement procedures.
Appendix A Specifications	Lists the Dionex ED50A specifications and installation site requirements.
Appendix B Installation	Describes how to install the Dionex ED50A.
Appendix C Display Screens	Illustrates and describes all operating and diagnostic screens that can be displayed on the front panel.
Appendix D TTL and Relay Control	Describes the Dionex ED50A TTL and Relay control functions. Provides installation instructions.
Appendix E Signal Processor Functions	Lists the functions of the Signal Processor (SP) card.
Appendix F Connector Pinouts	Describes the pinouts for all Dionex ED50A connectors.
Appendix G Reordering Information	Lists spare parts for the detector.

1.4.1 Safety Messages and Notes

This manual contains warnings and precautionary statements that can prevent personal injury and/or damage to the Dionex ED50A when properly followed. Safety messages appear in bold type and are accompanied by icons, as shown below.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Also used to identify a situation or practice that may seriously damage the instrument, but will not cause injury.

Indicates that the function or process of the instrument may be impaired. Operation does not constitute a hazard.

Messages d'avertissement en français

Signale une situation de danger immédiat qui, si elle n'est pas évitée, entraînera des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées. Également utilisé pour signaler une situation ou une pratique qui pourrait gravement endommager l'instrument mais qui n'entraînera pas de blessures.

Warnhinweise in Deutsch

Bedeutet unmittelbare Gefahr. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

ACHTUNG

Bedeutet eine mögliche Gefährdung. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

WARNUNG

Bedeutet eine mögliche Gefährdung. Mißachtung kann zu kleineren oder mittelschweren Verletzungen führen. Wird auch verwendet, wenn eine Situation zu schweren Schäden am Gerät führen kann, jedoch keine Verletzungsgefahr besteht.

VORSICHT

Notes

Informational messages also appear throughout this manual. These are labeled NOTE and are in bold type:

NOTE NOTES call attention to certain information. They alert you to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.4.2 Declaration of Conformity

The cETLus and CE marks on the Dionex ED50A model data label (on the right-side panel) indicate that the Dionex ED50A is in compliance with the standards below.

ThermoFisher
S C I E N T I F I C

Thermo Fisher Scientific
501 Mercury Drive, Sunnyvale, California 94085
Telephone: 408-737-0700
FAX: 408-739-8437

MANUFACTURERS
DECLARATION OF CONFORMITY

Product Identification
Product: Electrochemical Detector
Brand: Dionex
Model: ED50A

Manufacturer
Dionex Corporation, a Thermo Fisher Scientific Company
1228 Titan Way
Sunnyvale, CA 94088
USA

Representative
Ajit Dastane
Dionex Corporation, a Thermo Fisher Scientific Company
1228 Titan Way
Sunnyvale, CA 94088

Function
Director, Engineering

Means of Conformity
The product is in conformity to the listed directives and standards:
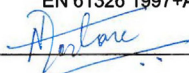
Low Voltage/Safety Directive: 73/23/EEC
EMC Directive: 89/336/EEC

Safety Standards: EN 61010-1:2001
                                  UL 61010C-1:2002 R8.02
                                  CAN/CSA-C22.2 No. 1010.1-92+A2:97

EMC Standards: EN 61326 1997+A1:1998+A2:2001

Signature of Representative _____

Name: Ajit Dastane
Place   Sunnyvale, CA USA
Date   April 29, 2013

1.4.3   **Safety Labels**

The Dionex ED50A meets EN 61010-1:1993 (safety), CAN/CSA-C22.2 No. 1010.1-92 (safety), UL 3101-1/10.93 (safety), EN 50082-1:1992 (susceptibility), EN 55011:1991 (emissions). The TUV GS, C, US Mark safety labels and the CE Mark label on the Dionex ED50A attest to compliance with these standards.

The symbols below appear on the Dionex ED50A or on Dionex ED50A labels.

∼   Alternating current

Protective conductor terminal (earth ground)

│   Power supply is on

Power supply is off

2 • Description

2.1 Front Control Panel

The control panel on the front door of the Dionex ED50A contains the liquid crystal display (LCD), the membrane keypad, and the actuator for the main power switch. The electronics chassis, described in Section 2.3, is located behind the front door.

Power Switches

The main power switch is on a bulkhead inside the electronics chassis (in the front, left-hand corner). The actuator for the power switch is on the front door, below the control panel (see Figure 2-1). The actuator functions only when the front door is fully closed. When the door is open, press the main power switch to turn the Dionex ED50A on and off.

2.1.1 Control Panel Display

The LCD, also called the *screen*, displays Dionex ED50A status and operating information. Fields on the screen that are in reverse video (blue letters on a white background) can be edited, while normal video fields are simply informational displays.

- To adjust the screen contrast, rotate the knurled knob in the recess below the **Help** and **Menu** buttons (see Figure 2-1).

- To adjust the brightness of the screen backlight, select a different **DISPLAY PANEL BACKLIGHT** option on the **MODULE SETUP** screen (see Section C.1.14).
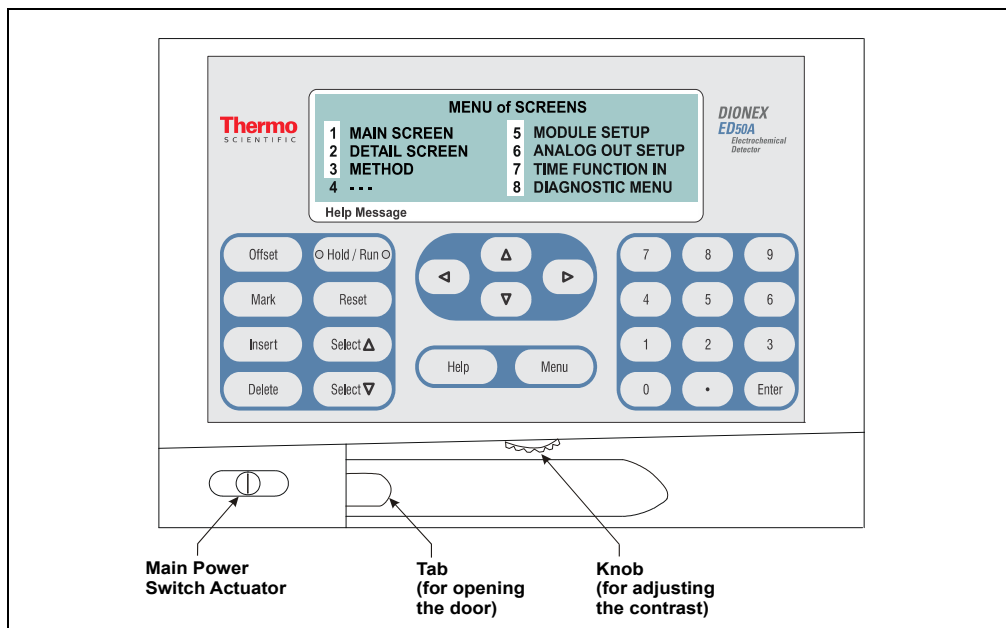
Figure 2-1. Dionex ED50A Front Panel

2.1.2   Control Panel Keypad

Use the keypad to directly control Dionex ED50A operation, as well as to create and modify programmed series of timed events, called *methods*. In summary:

- Press **Menu** to display a list of available screens.

- In the screens, only fields shown in reverse video can be edited. Other fields only display information.

- To edit a field, use the four directional arrow buttons to position the cursor in the reverse video fields. Use the numeric buttons to enter variable values.

- Use the **Select** ∇ and **Select** ∆ buttons to choose predetermined options. Pressing a **Select** button increases (or decreases) a numeric value by one; holding down a **Select** button increases (or decreases) a numeric value continuously.

- Press **Enter** or a cursor arrow button to execute the selected value.

A high-pitched beep sounds when a button is pressed. When an error occurs, this beep is lower in frequency. The beeps can be disabled from the **MODULE SETUP** screen (see Section C.1.14).

Button	Function
Offset	Returns the analog (recorder) output to a predetermined baseline and zeros the display. The resultant value of the offset required is displayed on the **DETAIL** screen. This function can be programmed in a method.
Mark	Sends a 10% positive event mark to the analog (recorder) output. A mark is typically used to indicate a sample injection. This function can be programmed in a method.
Insert	Inserts a new step into a method.
	To add a new step, move the cursor to the **TIME** field and press **Insert**. A new blank step appears below the cursor position. After entering a time value, press **Enter** or a cursor arrow button. Insert steps in any order and they will be automatically reorganized in the correct chronological order.
Delete	Removes the value from the current entry field. To restore the previous value, move the cursor from the field before entering a new value.
	Pressing **Delete** when the cursor is in a step entry field on the **METHOD** screen "blanks" the step parameter value. Moving the cursor to another field does not restore the previous value; instead, the step remains blank, indicating no change from the previous step.
	To delete an entire method step:
	1. Position the cursor in the method's **TIME** field and press **Delete**. The time is removed and the help line prompts you to press **Delete** again to delete the step.
	2. Press **Delete** again. Or, to restore the original time and step parameters, press any button except **Delete**.

Table 2-1. Dionex ED50A Control Panel Button Functions

Button	Function
Hold/Run	Turns the method clock off (**Hold**) and on (**Run**).
	When the method clock is in Hold, pressing **Hold/Run** starts the clock at either the initial step of a new method or, if resuming an interrupted method, at the time at which the clock was put in Hold.
	When the method clock is in Run, pressing **Hold/Run** stops the method clock, thereby "holding" the method and freezing the current conditions.
	If the Dionex ED50A is in Voltammetry mode, pressing **Hold/Run** runs or holds the waveform program.
Reset	Changes the method clock time to **INIT**, causing the initial conditions specified by the method to occur. This button functions only when the detector is under Method control (see Section 2.5.3).
	If the method is running, it continues running. If the method is in Hold, the method clock executes the initial conditions and holds.
Select △ **and Select** ▽	When the cursor is positioned at a field with predetermined parameters, these buttons cycle through the options. In fields with predetermined numerical values, pressing **Select** △ increases the value by one unit; pressing **Select** ▽ decreases the value by one unit. Holding down a **Select** button increases (or decreases) the value continuously. Press **Enter** or a cursor arrow button to confirm the selected value.
△ ◁ ▽ ▷	The four cursor buttons move the cursor, in the direction of the arrow, to the next entry field. If there is no changeable field in that direction, the cursor moves diagonally or remains in its current location.
	In most cases, after entering a new value in an entry field, pressing an arrow button saves and/or executes the change. The exceptions are the **METHOD SAVE TO** field, the **METHOD RUN** field, any calibration command, the **DIAGNOSTIC TESTS** screen, and all menu screens.
Help	Displays a Help screen with information pertaining to the current entry field.

Table 2-1. Dionex ED50A Control Panel Button Functions (Continued)

Button	Function
Menu	Displays one of two menus, depending on the current screen:
	• From an operational screen, pressing **Menu** displays the **MENU of SCREENS**.
	• From a diagnostic screen, pressing **Menu** once returns you to the **DIAGNOSTIC MENU**; pressing **Menu** again returns you to the **MENU of SCREENS**.
Numeric Buttons	Enters numeric values into the current entry field. The numeric buttons are 0 through 9 and the decimal.
	From a menu screen, pressing a numeric button opens the corresponding screen.
Enter	Saves and/or executes changes made in entry fields. If a menu screen is displayed, pressing **Enter** opens the highlighted screen.

Table 2-1. Dionex ED50A Control Panel Button Functions (Continued)

2.2   Rear Panel

The Dionex ED50A rear panel (see Figure 2-2) contains fuses, connectors for line power, and a connection for the optional DX-LAN interface.

Power Entry

The power entry, fusing, and EMI filter are mounted on the rear of the 45 W power supply module. The power entry is socketed for a modular power cord (IEC 320 C13). The detector requires a grounded, single-phase power source. The detector can be operated from 85 to 270 Vac, 47 to 63 Hz power. The input power is 50 W maximum. The line voltage is automatically selected and requires no adjustments.

⚠ **WARNING**

SHOCK HAZARD—To avoid electrical shock, a grounded receptacle must be used. Do not operate or connect to AC power mains without an earthed ground connection.

⚠ **AVERTISSEMENT**

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

⚠ **WARNUNG**   **STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.**
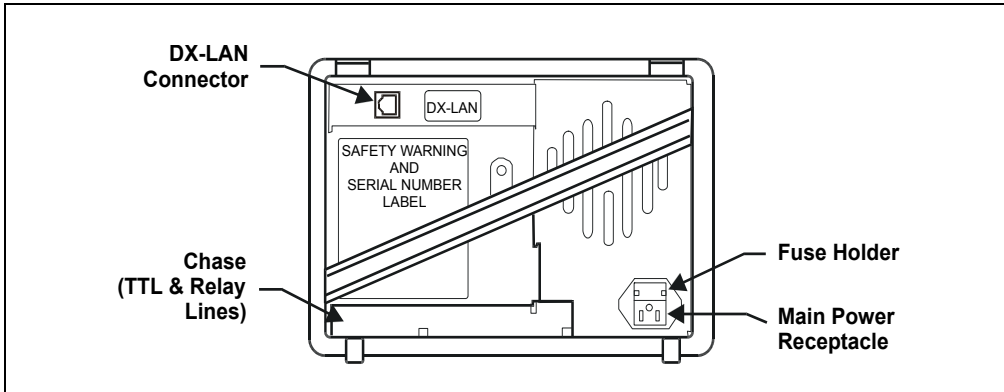
Figure 2-2. Dionex ED50A Rear Panel

Fuses

The Dionex ED50A uses two 3.15 A fast-blow fuses (IEC 127 type 1, P/N 954745). See Section 5.5 for instructions on replacing the fuses.

⚠ **CAUTION**   **For continued protection against risk of fire or shock, always replace with fuses of the same type and rating.**

⚠ **MISE EN GARDE**   **Pour maintenir la protection contre les risques d'incendie ou d'électrocution, remplacez toujours les fusibles par des fusibles dumême type et du même calibre.**

⚠ **VORSICHT**   **Zum Schutz vor Feuer und Stromschlägen müssen beim Sicherungswechsel immer Sicherungen des gleichen Typs und mit gleicher Leistung verwendet werden.**

DX-LAN Connection (Optional)

When you order the DX-LAN network, a DX-LAN connector is factory-installed in the upper left corner of the Dionex ED50A rear panel (see Figure B-1 in Appendix B). See Appendix Bfor DX-LAN interface installation instructions.

External Connection Access

Connections to the front of the electronics chassis, such as TTL and relay cables, are usually routed to the back of the detector through the cable chase in the bottom of the electronics chassis. They may also be passed through slots at the front of the detector. Cables exit the Dionex ED50A through an opening in the rear panel (see Figure B-1).

2.3 Electronics Chassis

The electronics chassis is located immediately behind the front door of the Dionex ED50A. The chassis contains several electronics cards (printed circuit boards) that are used to control the Dionex ED50A. Various connectors on the cards allow communication between the Dionex ED50A and other system modules and accessories. Figure 2-3 identifies the cards and their connectors.

⚠ **CAUTION**
Do not remove any of the electronics cards from the detector. There are no user-serviceable components on the cards. If servicing is required, it must be performed by qualified personnel using appropriate electrostatic discharge (ESD) handling procedures.
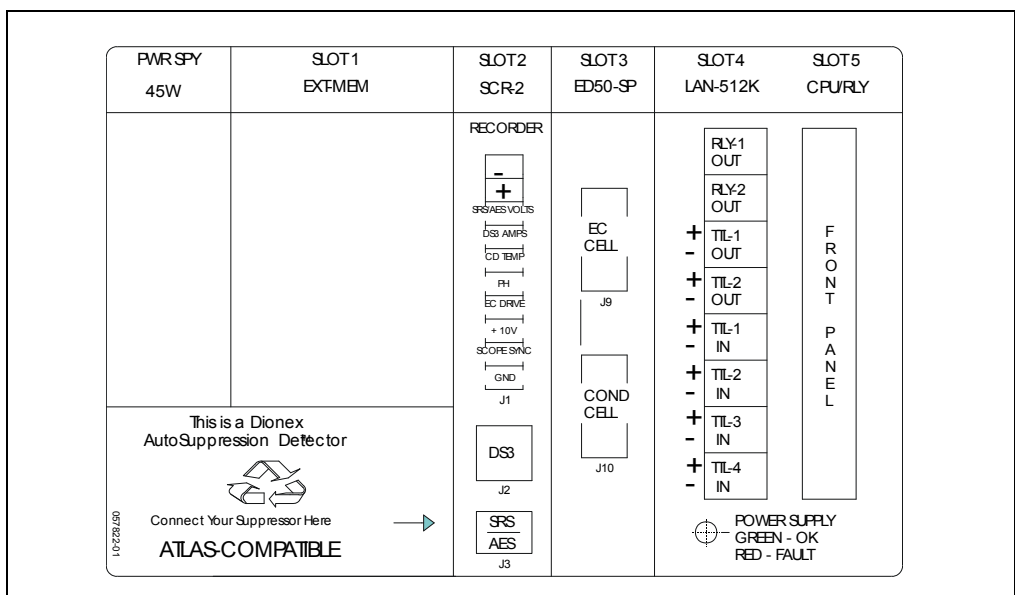
Figure 2-3. Electronics Chassis Components
(Located behind front door)

2.3.1   Connectors

Recorder (Slot 2)

This analog output connector is typically used for a recorder/integrator or diagnostic instruments. For a description of the connector pinouts, see Table F-1 in Appendix F. For connection instructions, see Section B.6.

DS3 (Slot 2)

Disregard the DS3 connector. This connector is not required for amperometry detection.

SRS/AES (Slot 2)

Disregard the SRS/AES connector. This connector is not required for amperometry detection.

EC Cell

The electrochemical (amperometry) cell cable connects here.

Conductivity Cell (Slot 3)

Disregard the Conductivity Cell connector. This connector is not required for amperometry detection.

TTL/Relay (Slot 4)

This strip of eight connectors provides an interface with other modules (whether Dionex or non-Dionex) for TTL and relay control of the detector. See Appendix D for a description of relay and TTL functions and the connections between the Dionex ED50A and other modules.

60-pin Ribbon Connector (Slot 5)

The 60-pin ribbon cable to the Dionex ED50A front panel (display and keypad) connects here.

2.3.2 Cards

Power Supply Card

Provides 45 watts of power for the detector electronics.

Memory Card

Contains memory chips used by the CPU card.

Supply Control/Relay Card

Interfaces to the CPU. The 16-bit recorder output digital-to-analog converter includes an electronic switch for selection of full-scale outputs of 0.01, 0.1, and 1.0 V.

SP (Signal Processor) Card

Contains the digital circuitry to interface to the CPU, as well as all the analog circuitry required for each detection mode. Appendix E lists the SP card functions.

Relay/DX-LAN and CPU Cards

The Dionex ED50A control Moduleware and BIOS reside on the CPU logic and Relay I/O cards.

- The CPU card provides control and monitoring of the other modules. A 60-pin ribbon cable assembly links the logic to the Dionex ED50A front panel display and keypad.

- The Relay I/O card provides two isolated low voltage relay outputs, two TTL outputs, and four TTL inputs.

The cards are in slot 5 of the card cage. The Relay card is a half-card which rides piggyback on the CPU card and extends over the front of slot 4.

The Relay I/O card is short enough to allow a detector interface card to be mounted behind it in slot 4. The interface card is required for communication between the Dionex ED50A and the control software, Chromeleon 6.8.

Below the I/O connections is a multicolor LED that indicates the state of the power supply.

- A green LED indicates normal operation.

- A red or yellow LED indicates a fault. If a fault occurs, the Dionex ED50A enters its diagnostic state and no other control is permitted until the fault is corrected. Turn off the power to the Dionex ED50A for a few seconds and then turn it on again. If the power fault remains, contact Technical Support for Dionex products.

2.4 Amperometry Cell

> **NOTE** **For more details, refer to *User's Compendium for Electrochemical Detection* (Document No. 065340). The manual is the primary source of product information, as well as basic troubleshooting help, for electrochemical cells and electrodes.**

The Dionex ED50A amperometry cell is a three-electrode voltammetric cell. It is a miniature flow-through cell with a titanium cell body (the counterelectrode) (see Figure 2-4), a working electrode, and a combination pH–Ag/AgCl reference electrode. The type of working electrode used depends on the application. Four standard (non-disposable) working electrode types are available: gold, platinum, silver, and glassy carbon. Disposable working electrodes are available for certain applications.

Oxidation or reduction of analyte molecules is accomplished by applying a potential between the working electrode and the reference electrode. The applied potential can be held constant or pulsed. The current is measured between the working electrode and the counterelectrode, either continuously or at predetermined intervals.

Changes in the potential applied between the working electrode and the reference electrode are developed between the working electrode (where analyte reduction or oxidation takes place) and the solution. To maintain a constant potential difference between the reference electrode and the solution, the cell current must be prevented from flowing through the reference electrode. A section of the Dionex ED50A electronic circuit (the *potentiostat*) diverts the cell current through the counterelectrode. The potentiostat automatically compensates for the solution resistance between the reference electrode and the counterelectrode.
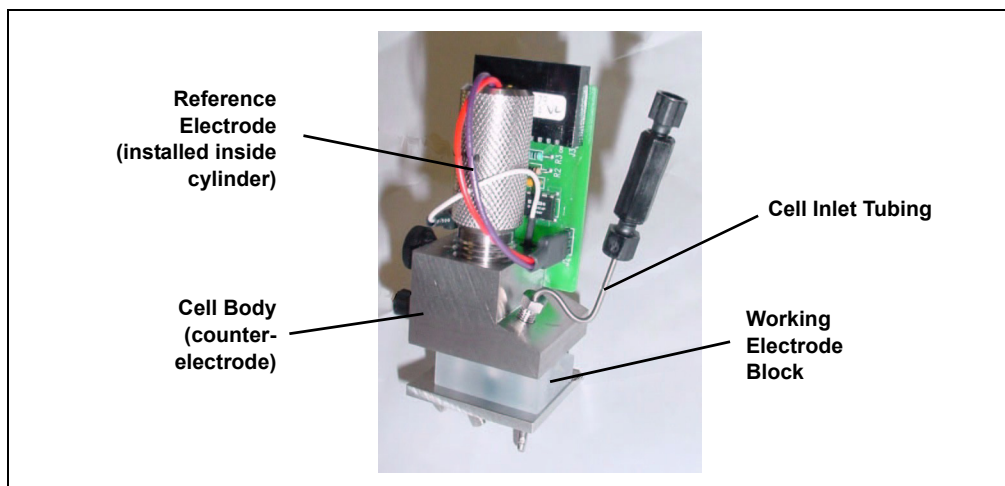
Figure 2-4. Amperometry Cell (Cover removed)

The reference electrode is chosen so that the potential difference between it and the solution is fixed by an electrochemical redox couple. There are two modes of potential referencing: Ag/AgCl and pH–Ag/AgCl. See Section 2.4.1 for details.

Cell Design

The Dionex ED50A amperometry cell is a thin-layer design. Mobile phase flows in a thin channel parallel to the surface of a flat disk electrode. The resulting smooth flow minimizes noise. The low volume (0.2 μL) of the channel also allows operation with high efficiency, narrow bore columns. The cell design minimizes the electrical resistance between the working electrode and the counterelectrode by locating the counterelectrode (the titanium cell body) directly across the thin-layer channel from the working electrode. This results in a wide linear dynamic range. The counterelectrode and a length of titanium inlet tubing at the inlet are connected to ground (see Figure 2-4). This shunts minute electric currents that might conduct from the pump through the flow stream into the working electrode. The working electrode current is processed using low noise analog amplifiers and filters. Additional digital filtering of the analog output is available.

Solvent Compatibility

The Dionex ED50A amperometry cell can be used with common reversed-phase solvents such as methanol and acetonitrile. If a disposable working electrode on

polyester substrate is used, the percentage of methanol should not exceed 30% and the percentage of acetonitrile should not exceed 10%. In addition, prolonged exposure (more than 8 hours) of disposable gold electrodes on polyester substrate to eluents containing hydroxide concentrations greater than 100 mM is not recommended. Shorter rinse periods of 10 to 20 minutes (for example, the carbonate removal step during monosaccharide and disaccharide chromatography) at high hydroxide concentrations do not affect the electrode performance. If sustained highly alkaline eluent conditions are required, use a disposable gold electrode on a PTFE substrate or a conventional gold electrode. Refer to *Product Manual for Disposable Electrode* (Document No. 065040) for additional eluent compatibility information.

Because conventional working electrode blocks are made of Kel-F® and use a gasket made of Ultem®, there is no restriction on the concentration of organic solvents that can be used with them (providing the solvent is compatible with PEEK tubing).

There is also no restriction on the use of organic solvents when disposable gold electrodes on PTFE substrate and PTFE gaskets are used.

Adding a Second Detector

The Dionex ED50A amperometry cell is installed directly after the column (a suppressor is generally not used). A second detector can be installed in-line with the amperometry cell, as long as the pressure at the amperometry cell inlet remains less than 700 kPa (100 psi). Because of the volume within the reference electrode section of the cell (67 μL total cell volume), there may be some band broadening at the second detector. However, this is minimized by the precision flat-bottomed reference electrode.

2.4.1 Combination pH–Ag/AgCl Reference Electrode

The reference electrode is a standard combination pH electrode containing a glass membrane pH half-cell and a Ag/AgCl half-cell. The combination pH electrode monitors mobile phase pH, which is displayed on the **MAIN** and **DETAIL** screens and is also available as an analog output.

The Ag/AgCl half-cell is typically used as the cell reference electrode. The combination pH–Ag/AgCl electrode can be used as the reference electrode during a pH gradient, to minimize changes in the baseline. The potentials at which many redox reactions take place on metallic electrodes are pH-dependent, with the potential shifting -0.059 V per pH unit. This is

especially true for metal oxide formation and reduction reactions. Because the reference potential of the combination pH–Ag/AgCl electrode also shifts by -0.059 V per pH unit, pH-dependent potential shifts at the working electrode are canceled.

At a mobile phase pH of 7, the reference potential of the entire electrode is the same as that of the Ag/AgCl half-cell. As the mobile phase pH is increased, the pH half-cell potential decreases approximately 0.059 V per pH unit. For example, at a mobile phase pH of 12, the reference potential of the pH half-cell would be -0.295 V relative to the Ag/AgCl half-cell. Therefore, at pH 12, the potentials applied to the working electrode must be raised approximately 0.3 V when switching from the "Ag" reference to the "pH" reference.

In acidic mobile phases, the reference potential of the pH half-cell is positive with respect to the Ag/AgCl half-cell, and all applied potentials must be decreased by 0.059 V per pH unit when switching from the "Ag" reference to the "pH" reference.

IMPORTANT

Do not allow the reference electrode to dry out. Make sure that mobile phase is always pumped through the cell. If the cell will not be used for a short time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and install fitting plugs. For longer shutdowns, remove the electrode from the cell and store it in its storage bottle filled with saturated KCl solution. See Section 3.9 for detailed storage instructions.

2.4.2 Monitoring the Amperometry Cell pH Readout

Monitoring the pH readout of a solution with a known composition lets you detect any shift that may occur over time. A shift in the pH reading indicates a change in the Ag/AgCl reference potential. Monitor the pH when the reference electrode is used in the Ag mode, as well as in the pH mode.

At installation, calibrate the pH electrode by following the instructions on the **pH CALIBRATION** screen (see Section C.2.11). Then, when you run your first chromatographic program, note the pH value displayed on the **MAIN** or **DETAIL** screen (see Section C.1.3). Thereafter, by monitoring the pH value, you can determine when the reference electrode needs to be regenerated or replaced. If the pH value drifts by 0.5 pH units from the

value first observed, check the reference electrode by following the instructions in Section 4.12.

You can also monitor the pH reading from Chromeleon 6.8. The value is displayed on the control panel, and you can set upper and lower pH limits in the Program Wizard. An alarm is displayed if the limits are exceeded.

2.5 Functional Description

2.5.1 Operating and Control Modes

The operating mode determines *how* the Dionex ED50A receives operating commands:

- In Local mode, the Dionex ED50A receives commands from the front control panel buttons and screens.

- In Locked Remote mode, Chromeleon 6.8 software sends commands from the host computer via the DX-LAN interface.

The control mode determines *when* operating commands are executed:

- In Direct control, the Dionex ED50A executes commands immediately.

- In Method control, the Dionex ED50A executes commands according to the timed steps in a method. The method is programmed from the Dionex ED50A front panel.

The table below summarizes the various operating and control mode configurations. Select the modes from the front panel **MAIN** screen or **DETAIL** screen, or from the chromatography software.

Operating/Control Mode	Detector Operation
Local/Direct Control	Commands are entered from the Dionex ED50A front control panel and executed immediately after being entered.
Local/Method	Commands are entered from the Dionex ED50A front control panel and executed by running a method programmed from the front panel.
Locked Remote/Direct Control	Commands are sent from Chromeleon 6.8 and executed immediately when received.

2.5.2 Local and Remote Modes

Local Mode

When the Dionex ED50A is powered up, it is always in Local mode. In Local mode, the detector accepts operating commands from two sources:

• Direct input from the front panel keypad and screens. All operating functions are available with direct input.

• TTL inputs from a remote controller (for example, a Dionex gradient pump module or an integrator). TTL signals can be used to offset the recorder, run a method, turn the suppressor off and on, send a mark to the recorder, and increase the recorder range.

Locked Remote Mode

The Dionex ED50A accepts remote operating commands, via the DX-LAN interface, from a host computer. In Locked Remote mode, the front panel keypad is disabled to prevent any changes to operating parameters.

When running Chromeleon 6.8, selecting the Connect check box on the software control panel immediately selects the Locked Remote mode. To return the Dionex ED50A to Local mode, either clear the Connect check box or turn off the Dionex ED50A power.

2.5.3 Method Control

In Method control, commands are executed according to the time-based steps specified in a method. Methods are created, edited, and saved on the **METHOD** screen. See Section 3.3 for details.

Here is a summary of basic information about methods:

• Each method can contain up to 32 separate time-based steps, including the **INIT**ial conditions and time zero (**TIME = 0**) steps.

• Up to 100 methods (0 through 99) can be stored in Dionex ED50A memory. Methods are retained in memory even after the power is turned off.

⌐IMPORTANT⌐ **The total number of methods that can be stored in memory depends on the length of each method and the amount of available memory; thus, the actual total may be less than 100.**

- Pressing **Run** starts the method clock. From the **INIT**ial conditions, the time 0.00 step is executed as soon as **Run** is pressed. The remaining steps are executed according to their programmed times.

- The detector can run under method control while a method is being entered or edited.

- When changes to the currently running method are saved, only parameter changes that affect the method *after* the current time will be implemented in the current run.

- While in Method control, the following parameters cannot be changed from the Dionex ED50A front panel: analog range, offset, mark, TTL and relay settings, and suppressor current.

2.5.4 TTL Input Control

TTL input signals from a remote controller, such as an integrator or other system module, can control any four of the detector functions listed below. The functions are defined from the **TIME FUNCTION IN** screen (see Section C.1.16). See Appendix D for details about TTL control and connection instructions.

- OFFSET

- HOLD/RUN

- SUPPRESSOR OFF/ON

- METHOD NUMBER INCRement

- METHOD NUMBER DECRement

- MARK Recorder

- Increase RANGEX10

The Dionex ED50A accepts TTL signals when it is in Local or Remote mode.

3 • Operation and Maintenance

3.1   Getting Ready to Run

> **NOTE**   **The Dionex ED50A is designed for use with IC (ion chromatography) and HPLC (high-performance liquid chromatography) applications and should not be used for any other purpose. If there is a question regarding appropriate usage, contact Technical Support for Dionex products before proceeding.**

After installing the Dionex ED50A Electrochemical Detector, or after the detector power has been off for some time, use the following check lists to prepare the detector for operation.

All Detection Modes

- Verify that all cables are correctly connected.

- Verify that the Dionex ED50A power cord is plugged into the main power.

- Press the power switch actuator on the Dionex ED50A front panel to turn on the power (see Figure 2-1).

- Verify that the Dionex ED50A passed all of its power-up tests (see Section 3.2).

Integrated Amperometry Mode

- Create a potential vs. time waveform or edit an existing waveform (see Section 3.6). In Local mode, do this from the **WAVEFORM** screen. Verify that the correct waveform is selected on the **MAIN** or **DETAIL** screen or, if using a method, on the **METHOD** screen.

- If necessary, calibrate the reference electrode from the **pH CALIBRATION** screen (press **Menu**, **8**, **0**).

- If necessary, polish the working electrode (see Section 5.2).

- Verify that the cell is installed and that all tubing is properly connected. See Section B.5 for cell installation instructions.

- Turn on the pump.

- Turn on the cell and allow the baseline to stabilize. The detector output normally drifts downward for about 1 hour as the baseline stabilizes.

DC Amperometry Mode

- Enter the applied potential on the **MAIN** or **DETAIL** screen or, if using a method, on the **METHOD** screen.

- If necessary, calibrate the reference electrode from the **pH CALIBRATION** screen (press **Menu**, **8**, **0**).

- If necessary, polish the working electrode (see Section 5.2).

- Verify that the cell is installed and that all tubing has been connected properly. See Section B.5 for cell installation instructions.

- Turn on the pump.

- Turn on the cell and allow the baseline to stabilize.

- When the working electrode is glassy carbon, the detector output typically drifts downward for up to one day. Setting up the Dionex ED50A the day before beginning an analysis allows enough time for the baseline noise to diminish considerably. To conserve mobile phase during this time, set the flow rate to 25% of the value required for the analysis. The Dionex ED50A will stabilize quickly after the flow rate is increased to the proper value.

3.2   Initial Screens

Each time the Dionex ED50A power is turned on, the **POWER-UP** screen is displayed. The revision codes on the **POWER-UP** screen identify the Moduleware and BIOS, in the event that service is ever needed. If the Dionex ED50A is

connected to a host computer, the DX-LAN identification number is displayed, also.

ED50A ELECTROCHEMICAL DETECTOR

MODULEWARE REV n.nn
BIOS REV n.nn
DX LAN ID# nnnnnn

Help Message
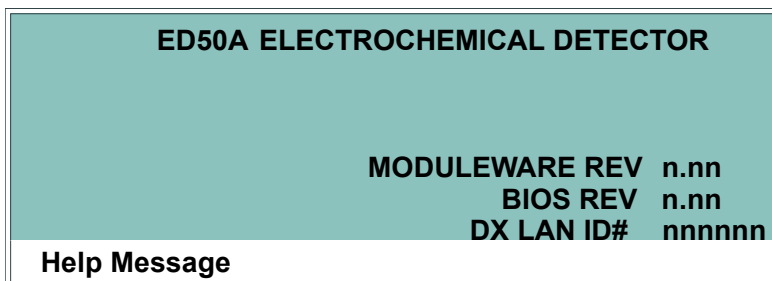
Figure 3-1. Dionex ED50A Power-Up Screen

At power-up, the detector automatically begins running a series of internal diagnostic and calibration routines. If a test failure occurs, an error message is displayed. Press any key to display the **DIAGNOSTIC TESTS** screen (see Section C.2.7) and learn which test failed.

If the Dionex ED50A passes all the tests, the display automatically changes from the **POWER-UP** screen to the **MAIN** screen. The **MAIN** screen shows active data in large characters for easier viewing from a distance. Because each of the Dionex ED50A detection modes requires different parameters, each mode has a unique **MAIN** screen. Figure 3-2 shows the **MAIN** screen for the integrated amperometry mode.

INT AMPEROMETRY   **WAVEFORM** **17**

- 4.36 uC   **CELL** **ON**

          RANGE **1000 nC**

LOCAL   **METHOD** **05**   **134.56** **MIN**
Help Message

Figure 3-2. Main Screen—Integrated Amperometry

Press the **Menu** button to go to the **MENU of SCREENS**. There, begin selecting parameters for the Direct control or Method control operating mode. The operating modes are described in Section 3.4 and Section 3.5, respectively.

3.3 Selecting the Control Mode

To select the control mode from the front panel:

1. Go to the **MAIN STATUS** or **DETAIL STATUS** screen.

2. To select the control mode, position the cursor in the control mode field (see Figure 3-3) and press **Select** Δ or **Select** ∇ to toggle to **DIRECT CNTRL** or **METHOD**.

3. Press **Enter**.

```
┌─────────────────────────────────────────────────┐
│ DETAIL SCREEN        DC AMPEROMETRY   TTL1 0     │
│ OUTPUT   128.2  nA         CELL ON    TTL2 1     │
│ OFFSET    58.7  nA        RANGE 200 nA RLY1 1    │
│  TOTAL   184.9 nA          REF Ag     RLY2 0     │
│    pH     12.2                                   │
│             POTENTIAL +  0.80 V                  │
│ ▶ LOCAL            METHOD  05     123.45 MIN     │
│ Help Message                                     │
└─────────────────────────────────────────────────┘
```
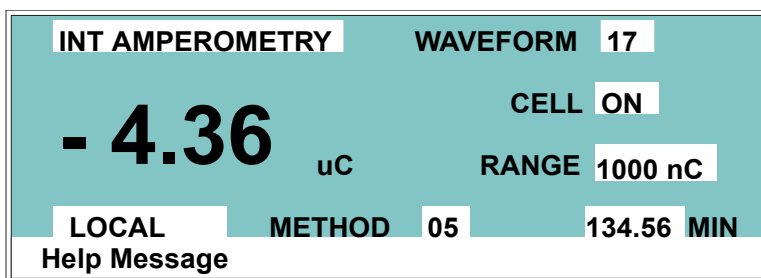
Operating Mode Field

Control Mode Field
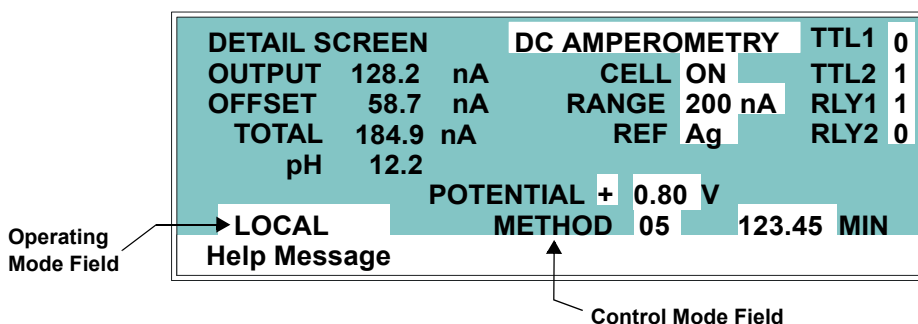
Figure 3-3. DC Amperometry Detail Status Screen—Local Mode, Method Control

3.4 Running Under Direct Control (Local Mode)

When the Direct control operating mode is selected, real-time commands are carried out instantly and all detector settings are in effect until you change them. Changes to parameters are executed when entered. Because there are no time-based steps, the method clock is not used. The **Hold/Run** and **Reset** buttons are not operable in Direct control.

3.5 Running Under Method Control (Local Mode)

In the Method control mode, a series of programmed timed events, known as a *method*, controls the Dionex ED50A. Methods are retained in memory even when the detector power is turned off. The detection mode determines which parameters can be controlled by a method. For detailed information about method parameters, refer to the appropriate section:

• Integrated Amperometry—Section C.1.4

• DC Amperometry—Section C.1.9

3.5.1 Running a Method

1. Go to the **MAIN** or **DETAIL** screen. If necessary, toggle from **DIRECT CNTRL** to **METHOD** and from **REMOTE** to **LOCAL**.

2. In the **METHOD** field, enter the desired method number and press **Enter**. (You can also select the method number from the **METHOD** screen. To do so, move the cursor to the **RUN** field, enter a method number, and press **Enter**.)

3. If the method clock is already running when you enter the method number, the method starts immediately. If the clock is in Hold, press **Hold/Run** to start the method.

4. The elapsed time on the method clock when the method begins determines where (i.e., at what step and parameters) the method begins running:

   • If the method clock is at **INIT** or time zero, the method begins running using the **INIT** condition parameters, followed by the time zero step. The remaining steps will be executed according to their programmed times.

   • If the method clock is greater than zero, the method begins running using the parameters specified in the step for that elapsed time. To start the method at the **INIT** conditions, press **Reset**.

3.5.2   Changing the Running Method

To stop the method that is currently running and run a different method, enter the new method number in the **RUN** field on the **METHOD** screen and press **Enter**. The new method will begin running, using the parameters specified in the step for the current elapsed time. To start the method at the **INIT** conditions, press **Reset**.

3.5.3   Changing a Method-Controlled Parameter

There are three ways to change a method-controlled parameter:

• Edit the currently running method and save the changes. Changes that affect the method after the current time will be implemented. To restart the method at the **INIT** conditions, press **Reset**.

• Abort the method, go to Direct control, and enter the new parameters directly.

• Switch to a different method.

3.5.4   Creating a New Method

1. Go to the **METHOD** screen for the detection mode. In the **EDIT** field, enter an unused method number from 1 through 99 and press **Enter** or a cursor arrow button. A blank method is displayed on the screen.

   The first step of every method is an initial conditions step with **INIT** in the **TIME** field. The second step is always a time step with 0.00 in the **TIME** field. You cannot delete these steps, although you can change their parameters.

2. Enter the parameters for the initial conditions and time 0.00 steps.

   NOTE   **The TIME field is the only field in each method step that *must* have an entered value. Leaving any other field blank indicates that there is no change from**

**the value selected for the parameter in the
preceding step.**

| METHOD | I AMP | | EDIT | 33 | SAVE TO | 33 | RUN | 25 |

Figure 3-4. Method Screen—Integrated Amperometry

3. To create a new method step, move the cursor to a blank **TIME** field, enter the time (in minutes) for the action to be performed, and press **Enter**. Enter the values for each step parameter, or leave a field blank to have the previously selected value remain in effect.

4. Repeat Step 3 to add additional steps. Up to 30 steps can be added after the time 0.00 step.

   Sometimes a method contains more steps than can be displayed on the screen at one time. If there is a small **v** next to the time entry at the bottom of the screen, move the cursor *down* to view the additional steps. If there is a caret (^) next to the top time entry, move the cursor *up* to view the additional steps.

5. To save the new method, move the cursor to the **SAVE TO** field, enter the number that appears in the **EDIT** field, and press **Enter**.

3.5.5   Editing an Existing Method

> **NOTE** **After you save editing changes to a method, there is no way to recall the original method. To make experimental changes to a method while retaining the original method in its unmodified form, save the new method (or a copy of the original method) under a different method number.**

You can modify an existing method by changing, adding, or deleting steps and/or parameters. If you edit a method while it is running, the changes are stored in memory when you **SAVE TO** the method number. Changes take effect as soon as they are saved.

To edit an existing method, go to the **METHOD** screen, enter the method number in the **EDIT** field, and press **Enter** or a cursor arrow button.

Follow the instructions in the sections below. When you finish, save the changes to the current method number or select a new number.

Changing Method Parameters

Move the cursor to the parameter field and enter a new value, using the Dionex ED50A front panel buttons. Press **Enter** or a cursor arrow button after each editing change.

Adding a Method Step

There are two ways to add a step to an existing method:

- Move the cursor on the **METHOD** screen to any **TIME** field. Enter the time and parameters for the new step, and then press **Enter** or a cursor arrow button. If necessary, the new step is moved to the correct chronological point in the method.

- Move the cursor on the **METHOD** screen to the line immediately preceding the intended location of the new step. Press **Insert** to insert a new, blank line below the cursor location. Enter the time and parameters for the new step, and then press **Enter** or a cursor arrow button.

Deleting a Method Step

Move the cursor on the **METHOD** screen to the time of the step to be deleted and press **Delete** twice.

Deleting an Entire Method

Move the cursor on the **METHOD** screen to the **EDIT** field and press **Delete** twice.

Saving a Modified Method

To *replace* the original method with a modified version, enter the number of the original method in the **SAVE TO** field and press **Enter**.

To *retain* the original method and save the modified version elsewhere in memory, enter an unused method number in the **SAVE TO** field and press **Enter**.

3.6 Waveforms

A waveform is a series of steps, defined as points on a plot of potential vs. time. Waveforms must be defined for the Integrated Amperometry and Voltammetry modes. Under Local (front panel) control, waveforms are defined on the **WAVEFORM** screen (press **Menu**, **4**).

Under Remote (Chromeleon 6.8 software) control, waveform definitions are part of a Program File (PGM File) and can be defined using the PGM Wizard or entered manually into the PGM file. The software includes several pre-programmed waveforms.

Figure 3-5 shows an example waveform and the waveform program that created it. After Step 6, the waveform automatically reverts to the Step 0 potential.

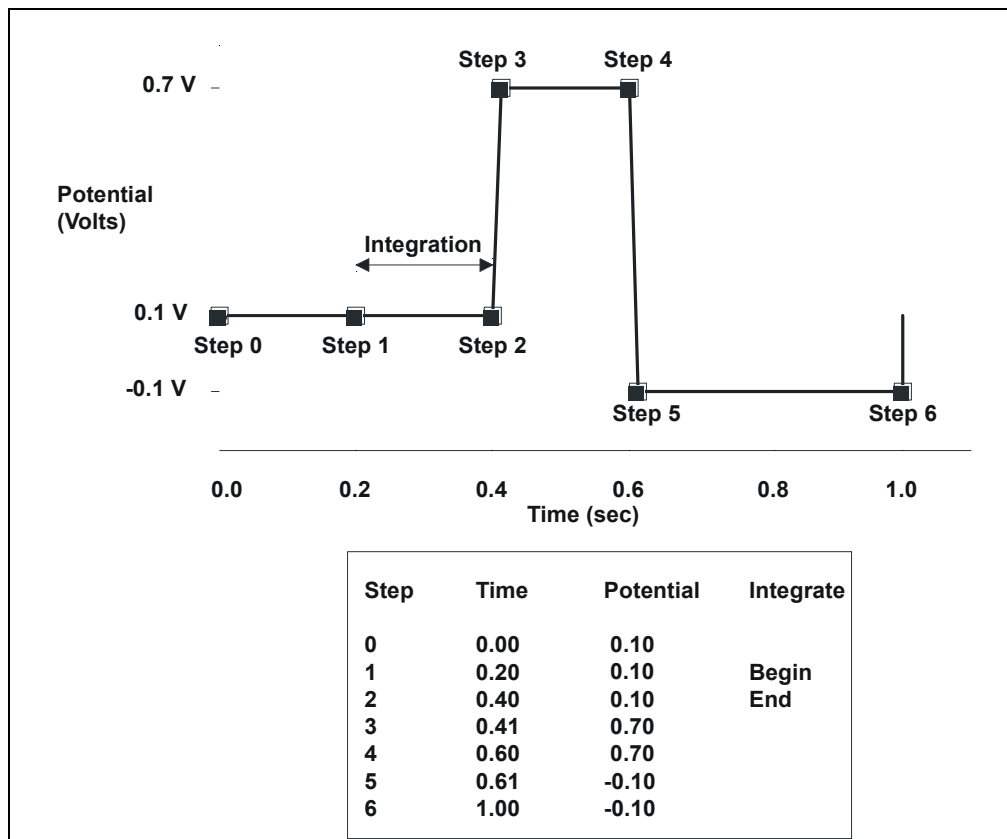| Step	Time	Potential	Integrate
0	0.00	0.10	
1	0.20	0.10	Begin
2	0.40	0.10	End
3	0.41	0.70	
4	0.60	0.70	
5	0.61	-0.10	
6	1.00	-0.10	

Figure 3-5. Sample Waveform

3.7   Cyclic Voltammetry

The Voltammetry mode is used to develop cyclic voltammograms. Cyclic Voltammetry is similar to Integrated Amperometry in that a repeating potential vs. time waveform is applied to the cell. It differs in that the Dionex ED50A output is the cell current, which is continuously monitored and reported as in DC Amperometry. The information gained by studying instantaneous cell current can be useful for developing waveforms for Integrated Amperometry or to determine potentials for DC Amperometry.

With the pump on, and mobile phase and analyte flowing through the amperometry cell, results are similar to those obtained by rotated disk voltammetry in a standard beaker cell. With the flow off, rapid depletion of analyte next to the working electrode is typical of thin-layer voltammetry.

3.7.1   Cyclic Voltammetry with the Dionex ED50A

To monitor cell current in the Voltammetry mode, connect the Dionex ED50A analog output to a recording device.

1. Locate the **RECORDER** connectors on the SCR card in the Dionex ED50A electronics chassis (see Figure 2-3 in this manual or the label on the inside of the Dionex ED50A front door).

2. Connect pin 1 to the (-) contact of the Y input on the XY plotter. Connect pin 2 to the (+) contact of the Y input.

3. Connect pin 7 (EC Drive) to the (+) contact of the X input. Connect pin 10 (Ground) to the (-) contact of the X input.

4. Switch the Dionex ED50A to the Voltammetry mode.

5. Program the waveform (see Section 3.7.2). For example, here are some typical cyclic voltammetry waveforms:

   Glassy carbon electrodes: 0 to 1 V and back to 0
   Gold electrodes: -0.5 to 0.7 V and back to -0.5

   NOTE Waveform programming can be difficult at first. The slowest rate allowed is 0.1 V/s. A beep sounds if this rule is violated. Thermo Fisher Scientific recommends practicing with a Dionex ED50A validation cell (P/N 049928), to avoid subjecting the working electrode to extreme changes while

> **learning how to program the waveform. Contact Technical Support for Dionex products if you notice a problem.**

6. Save the waveform.

7. Go to the **ANALOG OUT SETUP** screen (press **Menu**, **6**). This screen controls the EC Drive (pins 7, 10) by assigning the output change to the potential range of your waveform. Recommended settings are:
   Output: Total
   Zero Position: 50%
   Volts Full Scale: 1.0 V
   Rise Time: 0.00 sec
   Polarity: +

8. Start the flow of electrolyte through the cell by starting the pump.

9. Go to the **DETAIL** screen (press **Menu**, **2**). Select the following settings:
   Range: 30 nA (or as appropriate)
   Ref: Ag
   Cell: On

10. Press the **Hold/Run** button on the front panel to start the run. Keep the X/Y plotter pen in standby at first. Adjust the Y range settings on the XY plotter according to the Dionex ED50A readout. Readjust the Range setting on the **DETAIL** screen, if necessary. Adjust the X range to the settings on the **ANALOG OUT SETUP** screen.

11. Switch the XY plotter from standby to record. Generate cyclic voltammograms.

3.7.2 Programming the Voltammetry Waveform

Voltammetry waveforms are defined by points on an X-Y graph of potential vs. time, as in Integrated Amperometry. Voltammetry waveforms are defined from the **WAVEFORM** screen (press **Menu**, **4**).

VOLTAMMETRY WAVEFORM		SAVE	
STEP	TIME (sec)	POTENTIAL	(V)
0	0.00	-	0.80
1	14.0	+	0.60
2	28.0	-	0.80
3			
4			
Help Message			

Figure 3-6. Waveform Screen

Cyclic voltammetry programs consist of three steps, each with a time and a potential. The first step is always at time zero. Since this cannot be changed, the first value you enter will be the first potential. The first and third steps have the same potential. To create a new waveform step, enter the time first, and then the potential.

In the Voltammetry mode, the Dionex ED50A measures and reports the current every 10 ms. Since the change in potential during each measurement period must be equal, the available potentials are limited to ensure that the potential change is an integer number of mV per 10 ms. (The slowest scan rate is therefore 1 mV per 10 ms, or 0.1 V/s.) If the potential you enter results in a noninteger change, the Dionex ED50A will substitute the closest acceptable potential. You may want to use the **Select** Δ or **Select** ∇ buttons to find available potentials.

To calculate the time for the second step of the waveform, divide the total voltage scanned by the desired sweep rate.

Figure 3-7 shows an example of a triangle wave used in cyclic voltammetry. In this example, the potential is cycled between -0.80 and +0.60 V at a sweep rate of 0.1 V/s.
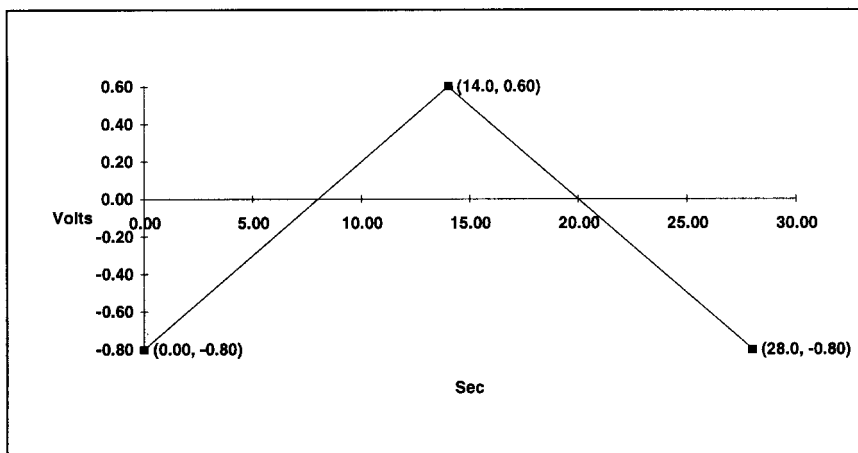
Figure 3-7. Cyclic Voltammetry Example

The first waveform step at 0.00 s is the initial potential of -0.80 V. To calculate the time for the second step, divide the total voltage scanned by the desired sweep rate:

$$\frac{Total\ Voltage\ Scanned}{Sweep\ Rate} \;=\; \frac{1.4\ V}{0.1\ V/s} = 14\ s$$

The time for the second step is 14 s. The third step is an equal interval later, or 28 s.

3.7.3 Running the Waveform

When the cell is turned on, the Dionex ED50A applies the initial potential programmed at time zero. At that point, you may do any of the following:

- To begin the waveform, press **Run**.

- To freeze the scan at the current potential, press **Hold**. Press **Run** to continue from that point.

- To return to the initial potential without stopping the scan, press **Reset**.

- To return to the initial potential and hold at that potential, press **Hold** and **Reset**, in that order.

3.8   Routine Maintenance

This section describes routine maintenance procedures that can be performed by the user. Any other maintenance procedures must be performed by qualified Thermo Fisher Scientific personnel.

> **NOTE   The Dionex ED50A electronic components are not customer-serviceable. Repair of electronic components must be performed by Thermo Fisher Scientific personnel.**

- Periodically check liquid line connections to the cells (inside the chromatography module) for leaks and clean up any spills.

The Dionex ED50A amperometry cells are designed to require minimal maintenance. If you observe the following precautions, the working electrode should rarely require polishing.

- To prevent electrode contamination:

    a.   Run only clean, filtered samples.

    b.   Prepare all eluents with high purity deionized water.

    c.   Avoid contamination of the cell with incompatible eluents.

- Never apply potential to the electrode unless a stream of eluent or water is flowing through the cell.

- Be careful to keep the polished surface of the amperometry cell body clean and dry. The gold, spring-loaded working electrode contact must also remain clean and dry. If a salt bridge forms, it can cause an electrical short between the working electrode contact and the cell body.

- If the working electrode becomes discolored or if you notice a degradation in performance (baseline noise, tailing peaks, etc.), polish the electrode as instructed in Section 5.2.

- Over the lifetime of the working electrode, the gold, silver, platinum, or glassy carbon surface may gradually become pitted or receded. Receded electrodes can be repaired by sanding (use 600 grit sandpaper or similar). Continue sanding until the metal surface is again flush with the Kel-F electrode block surface. Then, polish the electrode with the coarse and fine polishing compounds as instructed in Section 5.2.

- Do not allow the reference electrode to dry out. Make sure that mobile phase is always being pumped through the cell. If the cell will not be used for a short time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and install fitting plugs. For longer shutdowns, follow the procedure in Section 3.9.

- To help determine when the reference electrode needs regenerating or replacing, monitor the pH value displayed on the **DETAIL** screen (see Section C.1.3) or on the Chromeleon 6.8 control panel. Note the pH value displayed after initial calibration and the first chromatographic run. Thereafter, if the pH value drifts by 0.5 pH units from the value first observed, check the reference electrode by following the instructions in Section 4.12.

3.9 Shutdown

- Whenever the amperometry cell is not being used, remove the pH reference electrode and store it in a solution of saturated KCl, as instructed in the procedure below. If the reference electrode is left in the cell and mobile phase is not being pumped through the cell, the reference electrode frit may partially dry out. If this occurs, regenerate the electrode by soaking it in a solution of 1 M KCl plus 1 M HCl.

  Storing the amperometry cell:

  1. Prepare a saturated solution of KCl in deionized water.

  2. Remove the cap of the soaker bottle in which the electrode was shipped.

  3. Fill the soaker bottle at least three-fourths full with the prepared KCl solution.

  4. Remove the pH reference electrode from the cell. Remove the electrode sealing O-ring and O-ring retainer and save them.

  5. Slip the electrode through the hole in the soaker bottle lid until the electrode cap bottoms out on the top of the lid.

  6. Screw the soaker bottle lid, with the electrode attached, onto the soaker bottle.

  7. Store the assembly in the original shipping box.

4 • Troubleshooting

This chapter is a guide to troubleshooting problems that may occur while operating the Dionex ED50A Electrochemical Detector. Turn to the section that best describes the operating problem. There, the possible causes of the problem are listed in order of probability, along with the recommended courses of action.

For instructions on running the Dionex ED50A diagnostics program, refer to Appendix C.

When necessary, refer to *User's Compendium for Electrochemical Detection* (Document No. 065340). The compendium is the primary source of basic troubleshooting help for electrochemical cells and electrodes.

If you are unable to eliminate a problem, contact Thermo Fisher Scientific. In the U.S., call 1-800-346-6390 and select the Technical Support for Dionex products option. Outside the U.S., call the nearest Thermo Fisher Scientific office.

4.1 No Detector Response

- **Cell is off**

  Turn on the cell (from the **MAIN** or **DETAIL** screen).

- **Analog output range set too high; although the display indicates a response, no recorder response observed**

  Select a more sensitive analog output range.

- **Wrong full-scale output (or no full-scale output) selected**

  Select 0.01, 0.10, or 1 volt full-scale.

- **No flow from pump**

  Check the pressure reading on the pump to verify that the pump is on.

- **Detector offset out of range**

  Press **Offset** on the Dionex ED50A front panel.

- **Cell cable disconnected**

  Check the cell cable connection on the electronics chassis (see Section 2.3).

4.2 Low Detector Output

- **Analog output range set too high; although the display indicates a response, no recorder response observed**

  Select a more sensitive analog output range.

- **Insufficient sample injected**

  Increase the injection size or concentration.

- **(DC Amperometry and Integrated Amperometry modes)—Working electrode fouled**

  If a disposable working electrode is being used, replace the electrode.

  For non-disposable electrodes, clean the working electrode with solvent (methanol) and rinse with deionized water. Dry with a clean soft cloth or tissue.

4.3 High Detector Output

- **Auto offset not activated recently**

  Press **Offset** on the Dionex ED50A front panel before making an injection.

- **(Integrated Amperometry mode)—Excessive number of integration periods and/or incorrect potential for the integration**

  Verify that the length and potential of the integration period is correct (refer to the column manual for the settings required for your application).

- **(DC Amperometry and Integrated Amperometry modes)— Amperometry cell working electrode shorted to counterelectrode**

  Clean the working electrode with solvent (methanol) and rinse with deionized water. Dry with a clean soft cloth or tissue.

  Remove any precipitate on the counterelectrode by cleaning the spot directly opposite the working electrode with a wet paper towel and coarse polishing compound (P/N 036319).

- **(DC Amperometry and Integrated Amperometry modes)—Leak between gasket and electrode, or between gasket and cell body**

  Install a new gasket (see Section B.5.1).

4.4   Noisy or Drifting Baseline

- **Flow system leak ahead of cell; erratic baseline**

  Check all fittings and liquid lines for leaks. Tighten or, if necessary, replace all liquid line connections. If the connections are made with ferrule fittings, first refer to *Installation of Dionex Ferrule Fittings* for tightening requirements.

- **Pump not properly primed**

  Prime the pump as instructed in the pump manual.

- **Rapid changes in ambient temperature**

  Direct heating and air conditioning vents away from the cell.

  Install the cell in a chromatography oven.

- **Insufficient system equilibration following any changes to operating parameters; especially apparent when operating at high sensitivities**

  Allow longer system equilibration before beginning operation.

- **(DC Amperometry and Integrated Amperometry modes)—Air bubbles trapped inside cell**

  While wearing gloves and eye protection, generate a slight temporary backpressure by putting your finger over the end of the cell outlet tubing for 5 to 10 seconds. Repeat two or three times. If the baseline does not improve, check for other causes of baseline instability, which are described in this section.

  To prevent air from becoming trapped in the cell in the future, increase the backpressure on the cell by installing backpressure tubing on the cell outlet.

- **(DC Amperometry and Integrated Amperometry modes)—Frequent, random spikes in the baseline**

  The reference electrode diaphragm is plugged. First, try regenerating the reference electrode frit by soaking the electrode in a solution of 1 M KCl plus 1 M HCl. If this does not eliminate the spiking, replace the electrode (P/N 046333).

- **(DC Amperometry and Integrated Amperometry modes)—Regular baseline oscillation on high-sensitivity ranges**

  Reconnect the short length of titanium tubing to the cell inlet.

- **(DC Amperometry and Integrated Amperometry modes)—Dirty or pitted working electrode**

  If a disposable working electrode is being used, replace it. If the working electrode is non-disposable, polish it (see Section 5.2).

- **(Integrated Amperometry mode)—Regular baseline oscillations**

  The water used to prepare the eluent contains trace contaminants. Remake the eluent, using high purity deionized water containing no contaminants.

4.5 Tailing Peaks

- **(DC Amperometry and Integrated Amperometry modes)—Dirty or pitted working electrode**

  Clean the working electrode with solvent (methanol) and rinse with deionized water. Dry with a clean soft cloth or tissue.

  If a disposable working electrode is being used, replace it. If the working electrode is non-disposable, polish it (see Section 5.2).

4.6 Amperometry Cell pH Readout Always 7.0

The pH reading is displayed on the **DETAIL** screen (press **Menu**, **2**).

- **Short circuit in pH reference electrode**

  Check connections to the cell pre-amp board:

  1. Disconnect the inlet and outlet lines from the amperometry cell and disconnect the cell's electrical cable. Remove the cell from its mounting location in the chromatography compartment.

  2. Loosen the cell cover thumbscrew and remove the cover.

3. Verify that the white working electrode lead is connected to junction J1 and the reference electrode cable is connected to J2.

Look for salt on the cell pre-amp board. If salt is present, brush it off with a clean dry brush and then spray with a quick drying solvent to dissolve the remaining salt.

Replace the reference electrode (P/N 046333) (see Section B.5 for instructions).

4.7   Cannot Set Amperometry Cell pH Readout to 7.0

The pH reading is displayed on the **DETAIL** screen (press **Menu**, **2**).

- **Inaccurate calibration buffer**

    Use a pH meter to check the pH of the buffer.

- **Contaminated pH reference electrode**

    Soak the reference electrode in a solution containing 1 M KCl and 1 M HCl.

    Replace the electrode (P/N 046333) (see Section B.5 for instructions).

4.8   Shift in Amperometry Cell pH Readout

- **Faulty reference electrode**

    If the pH value drifts by 0.5 pH units or more from the value observed when the reference electrode was new, check the electrode by following the instructions in Section 4.12. The electrode may need to be regenerated or replaced.

4.9   No Amperometry Cell pH Readout or Intermittent Readout

The pH reading is displayed on the **DETAIL** screen (press **Menu**, **2**).

- **Disconnected or broken pH electrode leads**

    Check the reference electrode connections at junctions J1 and J2 on the cell electronics card (see Figure 5-7).

- **Uncalibrated reference electrode**

    Calibrate the reference electrode from the **pH CALIBRATION** screen (see Section 5.4).

- **Contaminated reference electrode**

    Soak the reference electrode in a solution containing 1 M KCl and 1 M HCl.

    Replace the electrode (P/N 046333) (see Section B.5 for instructions).

- **Dry reference electrode**

    Replace the electrode (P/N 046333) (see Section B.5 for instructions).

    To prevent a reference electrode from drying out, make sure that mobile phase is always being pumped through the cell. If the cell will not be used for a short time (less than 2 days), disconnect the tubing from the inlet and outlet fittings and install fitting plugs. For longer shutdowns, remove the electrode from the cell and store it in its storage bottle filled with saturated KCl solution. See Section 3.9 for detailed instructions.

4.10 Discolored pH Reference Electrode

A slightly discolored reference electrode may continue to function within normal specifications. However, discoloration indicates reference electrode drift. If you observe problems with amperometric detection and the reference electrode appears discolored, perform the potential shift test described in Section 4.12. The reference electrode typically lasts 6 months in normal use.

4.11 Leaking pH Reference Electrode

- **Defective pH reference electrode O-ring**

    Replace the pH reference electrode O-ring (see Section 5.3).

4.12 Shift in Ag/AgCl Reference Potential

- **Faulty reference electrode**

    A shift in reference potential causes a shift in the effective potential applied to the working electrode. For example, an applied potential of 0.1V, using an electrode with a shift of 50 mV, is equivalent to an applied potential of 0.15V for a new reference electrode with no shift.

    Following the steps below, measure the Ag/AgCl reference electrode potential shift by comparing it to the potential shift of a new electrode. You should always keep a spare reference electrode (P/N 046333) on hand for this purpose.

    ### Using a Digital Voltmeter

    1. If you have a digital voltmeter, connect the voltmeter's test probes to the center sockets of the standard and test reference electrodes.

    2. Immerse both reference electrodes in a solution of 0.1M KCl.

    3. Read the potential difference (in mV) between the standard and test electrodes. If it is greater than 50 mV, try regenerating the electrode by soaking it in a solution of 1M KCl plus 1M HCl. If this does not reduce the potential shift, replace the electrode.

    ### Using the Dionex ED50A Electronics

    If you do not have a digital voltmeter, follow this procedure:

    1. Turn off the cell.

    2. Remove the reference electrode from the cell body, unplug the electrode, and rinse it in deionized water. See Figure B-3 for cell assembly drawings.

    3. Locate the reference electrode connector (J2) on the cell pre-amp board (see Figure 5-7). Short the two pins of the connector together, using a short piece of wire or a metal clip. **Do not allow the wire or metal clip to contact the cell body or any other conductor.**

    4. Select **CAL** on the **pH CALIBRATION** screen and press **Enter**. When the "pH 7 Calibration Complete" message appears, remove the wire or clip from J2.

5. Connect the reference electrode being tested to J2 by turning the electrode at right angles and plugging the center connector of the three-connector socket into the pin labeled "pH."

6. Connect the new reference electrode to J2 by turning the electrode at right angles and plugging the center connector of the three-connector socket into the pin labeled "Ag."

7. Immerse both reference electrodes in a saturated solution of KCl.

8. When the pH reading has stabilized, calculate the difference in potential between the two reference electrodes, using the following equation:

Difference (Volt) = (7 − pH reading) × 0.06

For most applications, a difference of less than 50 mV is satisfactory. Therefore, the electrode can still be considered acceptable if the voltage difference is less than 50 mV. If the difference is greater than 50 mV, try regenerating the electrode by soaking it in a solution of 1M KCl plus 1M HCl. If this does not reduce the potential shift, replace the electrode.

4.13 Faulty DX-LAN Communication

• **DX-LAN interface incorrectly installed**

See Section B.3 for 10BASE-T connection instructions.

4.14 Diagnostics

> **NOTE** **Before running the Dionex ED50A diagnostics, use the troubleshooting information in this chapter to isolate problems not related to the electronics.**

The Dionex ED50A Moduleware includes several diagnostic tests of the electronics. To access these, select the **DIAGNOSTIC MENU** from the **MENU of SCREENS**. All of the diagnostic screens are described in Appendix C.

DIAGNOSTIC MENU	
1 POWER-UP SCREEN	6 DIAGNOSTIC TESTS
2 ELAPSED TIME	7 LEAK CAL & STATUS
3 ANALOG STATUS	8 SIGNAL STATISTICS
4 DX-LAN STATUS	9 CALIBRATE CD CELL
5 KEYBOARD TEST	10 pH CALIBRATION
Help Message	
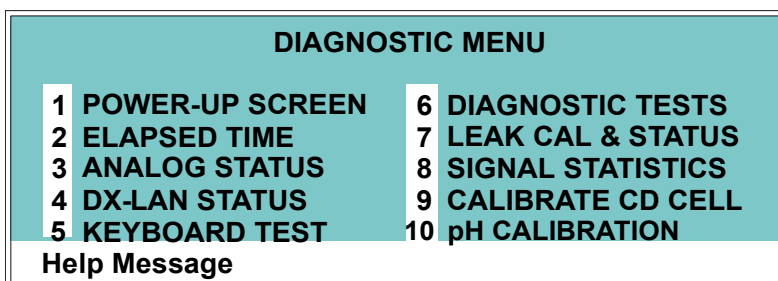
Figure 4-1. Diagnostic Menu Screen

5 • Service

This chapter describes routine service procedures that the user can perform. All other procedures must be performed by Thermo Fisher Scientific personnel.

> **NOTE** **The Dionex ED50A electronics components are not customer-serviceable. Repair of electronics components must be performed by Thermo Fisher Scientific personnel.**

The CPU card contains a lithium battery. If the CPU card is replaced, dispose of the used battery according to the manufacturer's instructions.

Before replacing any parts, refer to the troubleshooting information in Chapter 4 to isolate the cause of the problem. To contact Thermo Fisher Scientific in the U.S., call 1-800-346-6390 and select the Technical Support for Dionex products option. Outside the U.S., call the nearest Thermo Fisher Scientific office.

Substitution of non-Dionex/Thermo Scientific parts may impair Dionex ED50A performance and void the product warranty. For details, see the warranty statement in the Dionex Terms and Conditions.

5.1 Eliminating Liquid Leaks

The PEEK version of the Dionex ED50A is plumbed with 1.60-mm (1/16-in) PEEK tubing, Dionex ferrule fittings (P/N 043276), and 10-32 fitting bolts (P/N 043275). For tightening requirements, see *Installation of Dionex Ferrule Fittings*.

5.2   Polishing the Amperometry Cell Working Electrode

> **NOTE**   These instructions are for non-disposable working electrodes only. Do not polish disposable electrodes; they are designed to be easily replaced when necessary.

Polish carbohydrate gold (P/N 044112), platinum, silver, and glassy carbon working electrodes before initial installation in the amperometry cell (see the steps below). **Do not polish new AAA gold electrodes (P/N 055832) before installation.**

After the working electrode is polished and installed, background signal and analyte sensitivity will stabilize over a period of a few to several hours. Once stabilized, do not polish the electrode unless you observe a loss of signal or severe electrode recession.

> **NOTE**   To avoid electrode fouling, always wear gloves when handling electrodes.

1. Disconnect the inlet and outlet lines from the amperometry cell and disconnect the cell's electrical cable. Remove the cell from its mounting location in the chromatography compartment.

2. Unscrew the wing nuts holding the working electrode to the cell body, and carefully separate the parts (see Figure 5-1). Handle the cell gasket and the inside surfaces of the cell carefully, to prevent scratches which may subsequently cause leaks.

3. Locate the polishing kit (P/N 036313) shipped with the amperometry cell. The kit contains polishing pads (P/N 036321), a bottle of fine polishing compound (P/N 036318), and a bottle of coarse polishing compound (P/N 036319).

4. Using indelible ink, label the plastic side of a pad to designate it for use with the coarse polishing compound. Label another pad for fine polishing compound, and also designate for which working electrode type it is to be used. In addition, designate a pad for no compound, to be used for removal of particles after polishing (see Step 10).

> **NOTE**   Do not use the same fine polishing pad to polish more than one type of working electrode; this can contaminate the electrode surface with microparticles from the other working electrodes. A separate polishing

pad is shipped with each type of working electrode.
Using indelible ink, label each pad to indicate the
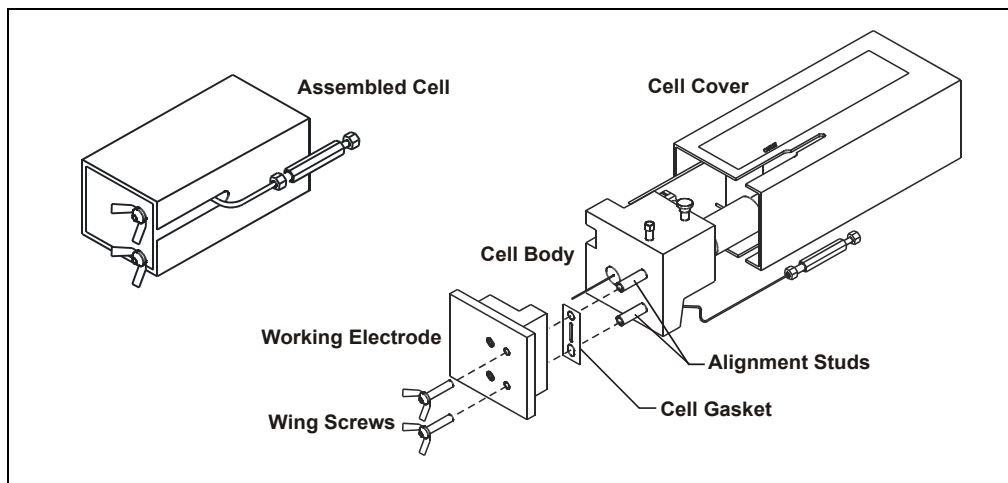working electrode with which it is used.

Figure 5-1. Amperometry Cell Components

5. Moisten the plastic side of the fine polishing pad slightly with water and place
    it on a smooth, flat surface.

6. Sprinkle about one-half gram of polishing compound in the center of the
    suede side of the polishing pad. Add enough deionized water to make a thick
    paste.

    -   If you are polishing the electrode because of degradation of
        performance, such as a noisy baseline or tailing peaks, first use the
        coarse polishing compound.

    -   If you are polishing the electrode before initial installation, use the
        fine polishing compound.

7. Using the working electrode block, spread the paste evenly over the pad.
    Then, applying firm pressure in a figure eight motion, polish the surface of the
    electrode block for about one minute. If the pad dries out while polishing, add
    water sparingly. However, **never** allow the polishing compound to dry on the
    cell body.

8. Use deionized water to rinse off all traces of polishing compound from the
    electrode block. An ultrasonic cleaner is effective for thoroughly cleaning the

electrode block. Carefully wipe the surface of the block with a soft damp cloth or tissue.

9. If you used the coarse polishing compound in Step 5, repeat Steps 5 through 7 with the fine compound.

10. Using a moist piece of polishing cloth (with no polishing compound added), rub the polished surface free of residual polishing compound particles.

11. Inspect the surface of the working electrode to make sure that it is clean. If necessary, repeat Step 9.

> **NOTE** **The polishing pads are reusable. Do not rinse the polishing compound from the pads. After initial use, add only enough polishing compound to maintain the coating on the pad.**

12. Reassemble the cell. Reapply the electrode potential(s) and resume eluent flow. The baseline will drift for more than 1 hour as the cell re-equilibrates. Peak area values may require up to 12 hours to stabilize.

5.3   Replacing the pH Reference Electrode O-Ring

A defective pH reference electrode O-ring can cause liquid leaks from the pH reference electrode or compression nut area when the cell operating pressure is below 700 kPa (100 psi).

5.3.1   Replacing the O-Ring

1. Disconnect the inlet and outlet lines from the amperometry cell and disconnect the cell's electrical cable. Remove the cell from its mounting location in the chromatography compartment.

2. Loosen the cell cover thumbscrew and remove the cover.

3. Disconnect the reference electrode's J2 connector from junction J2 on the electronics card (see Figure 5-2).

4. Unscrew the reference electrode cylinder from the cell body (see Figure 5-2).
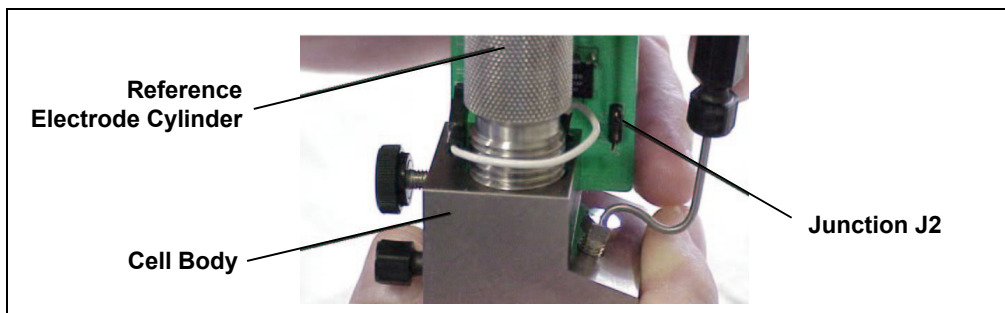
Figure 5-2. Removing the Reference Electrode

5.   While maintaining all parts in a vertical orientation, lift the reference electrode straight up and out of the cell body.

6.   Remove the old reference electrode O-ring by sliding it off the end of the glass body of the reference electrode.

7.   Slide the new O-ring onto the electrode (see Figure 5-3).
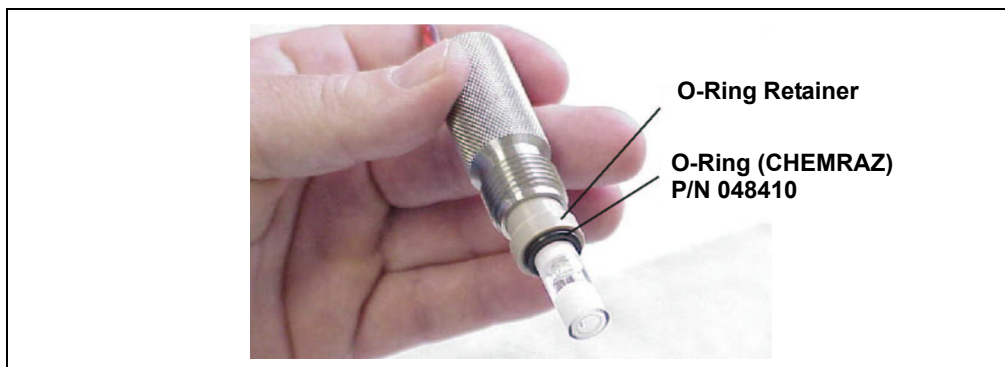
Figure 5-3. Reference Electrode O-Ring

IMPORTANT **The O-ring inside the electrode storage bottle cap and the CHEMRAZ O-ring are made from different materials. To prevent leaks, use only the CHEMRAZ O-ring (see Figure 5-4).**
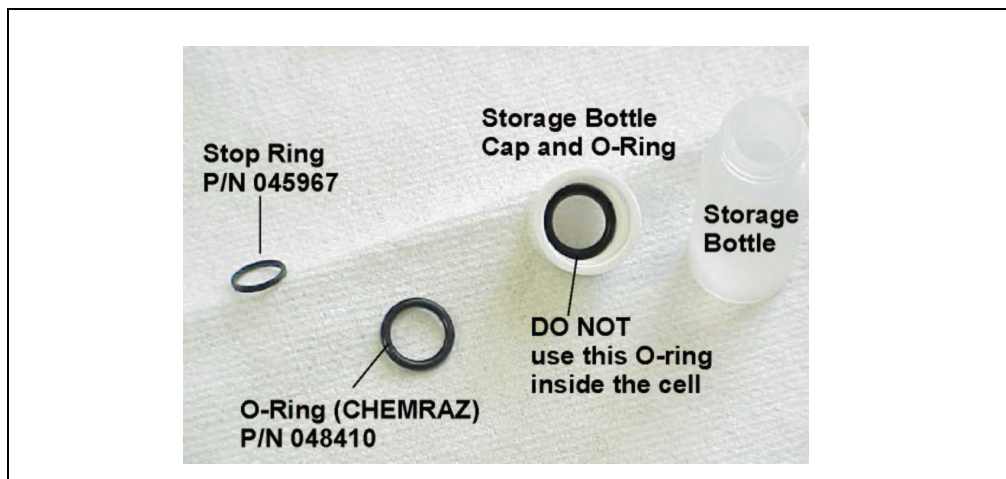
Figure 5-4. Identifying the CHEMRAZ O-Ring

8. Rinse and dry the reference electrode cavity to remove any particulate matter such as salt crystals.

9. Verify that the stop ring (P/N 045967) is in place at the bottom of the reference electrode cavity (see Figure 5-5). The stop ring prevents the reference electrode from bottoming out and thereby blocking the flow path inside the cell.
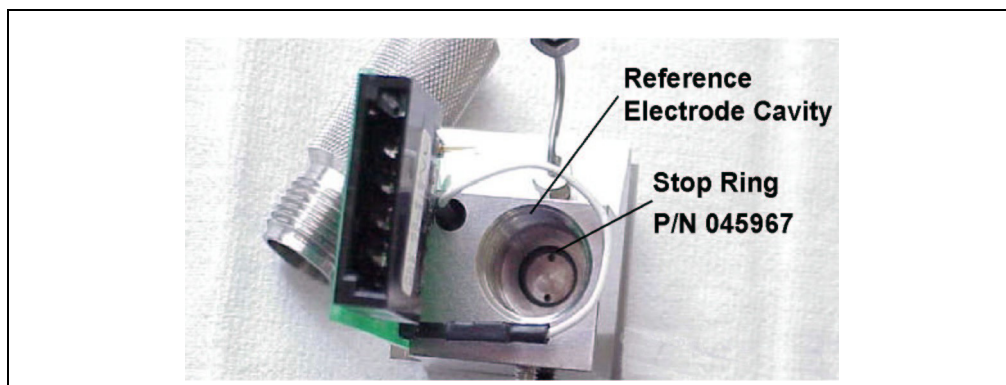
Figure 5-5. Reference Electrode Cavity Stop Ring

10. To avoid any hydraulic pressure buildup when inserting the reference electrode, make sure that fitting plugs are not installed on the cell inlet and outlet fittings.

11. Before reinstalling the electrode, observe the inside of the reference electrode cavity. When installed correctly, the electrode fits into the narrower diameter area at the bottom of the cavity and sits on top of the stop ring.

12. Follow the instructions below to reinstall the reference electrode in the reference electrode cavity.

IMPORTANT **While installing the electrode, maintain all parts in a vertical orientation, with the bottom of the electrode pointing down. This avoids bubble formation and helps ensure correct centering of the electrode inside the narrow area at the bottom of the cavity.**

    a. If you removed the reference electrode cylinder from the electrode, reinstall it by feeding the electrode's cable connector through the opening in the cylinder.

    b. Make sure the reference electrode is centered in the reference electrode cavity and then carefully insert the electrode until it touches the stop ring at the bottom of the cavity (see Figure 5-6).

IMPORTANT **Make sure the electrode is all the way down inside the cavity and not "hung up" on the step between the wider diameter area of the cavity and the narrower diameter area.**
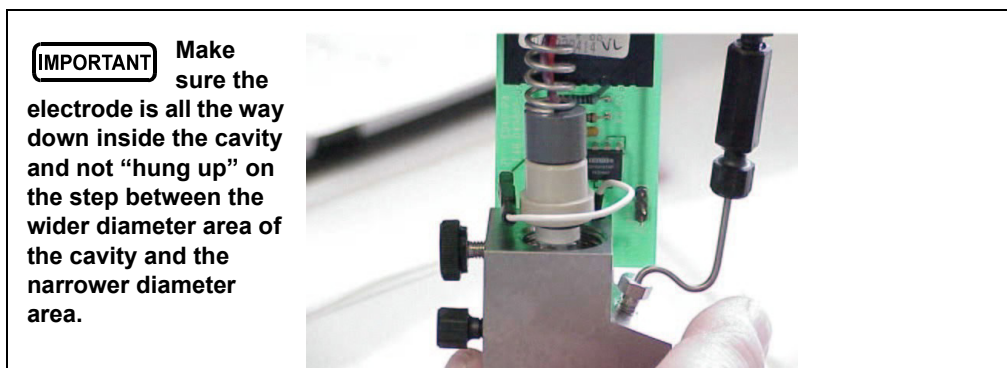
Figure 5-6. Installing the Reference Electrode

    c. While still keeping all parts in a vertical orientation, screw the electrode cylinder into the cell body and tighten firmly with your fingers. This ensures that the O-ring and O-ring retainer are fitted all the way down inside the cavity and there is a good seal around the electrode.

    d. Connect the J2 connector to junction J2 on the electronics card and verify that the white working electrode lead wire is connected to junction J1 (see Figure 5-7).
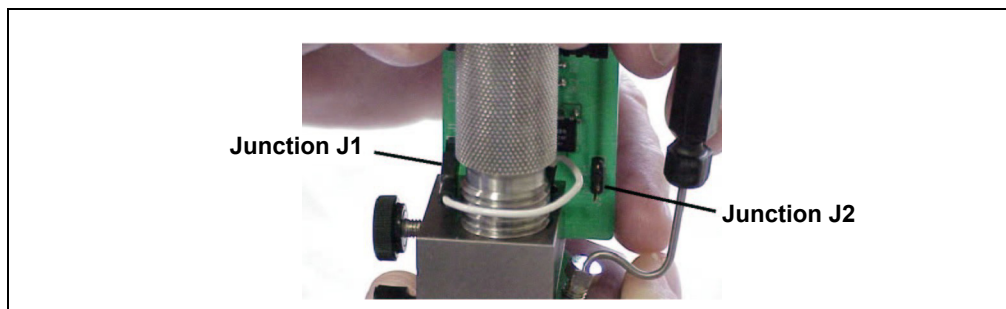
Figure 5-7. Reference Electrode Electronics Card Junctions J1 and J2

13. Slide the cell cover back over the cell body, making sure that the cable connector on the end of the electronics card lines up with the opening in the cell cover. Tighten the thumbscrew.

14. Reinstall the cell in the chromatography compartment. Reconnect the cell's inlet and outlet lines and the electrical cable.

5.4 Calibrating the Reference Electrode

1. Prepare two buffer solutions: one with a pH of 7.00 and one with a different pH of your choice (usually a calibration buffer that most closely matches the pH of the eluent used in your application).

2. Turn off the cell from the **MAIN** or **DETAIL** screen.

3. Disconnect the inlet and outlet lines from the amperometry cell, and disconnect the electrical cable from the cell. Remove the cell from its mounting location in the chromatography compartment.

4. Loosen the cell cover thumbscrew and remove the cover.

5. Disconnect the reference electrode's J2 connector from junction J2 on the electronics card (see Figure 5-8).

6. Unscrew the reference electrode cylinder from the cell body.
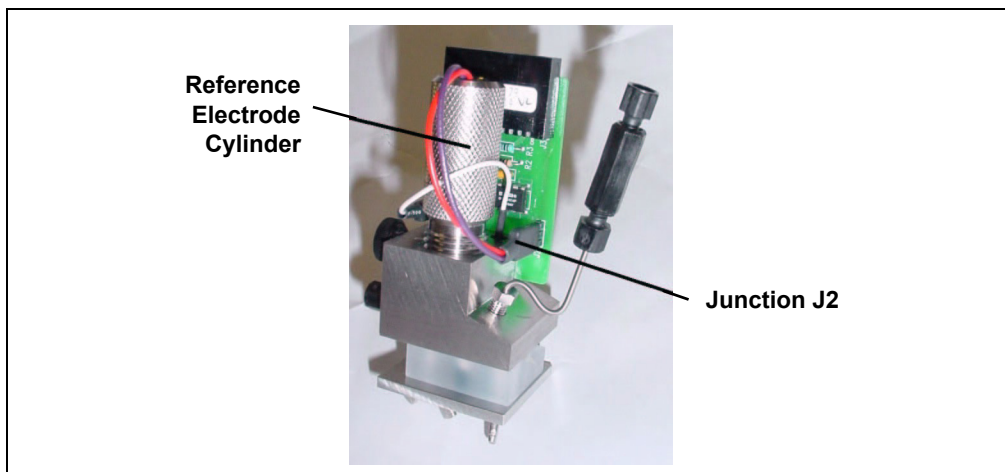
Figure 5-8. Removing the Reference Electrode

7. While maintaining all parts in a vertical orientation, lift the reference electrode with the cylinder straight up and out of the cell body.

8. Rinse the reference electrode thoroughly in deionized water to remove any precipitated salt.

9. Reconnect the reference electrode cable to junction J2 on the cell electronics card.

10. Reconnect the electrical cable to the cell.

11. Turn on the cell.

12. Go to the **pH CALIBRATION** screen (press **Menu**, **8**, and **0**).
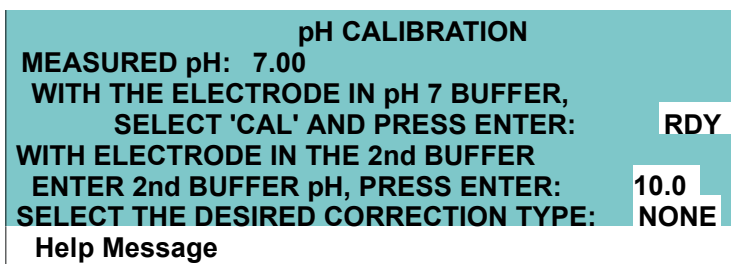
Figure 5-9. pH Calibration Screen

13. Place the electrode in the pH 7.0 buffer. Wait for the pH reading to stabilize (about 1 minute), select **CAL**, and then press **Enter**. The calibration is performed and the **MEASURED pH** field displays 7.00.

14. Remove the electrode from the first buffer, rinse, and then dry it. Place the electrode in the second buffer solution. Allow the pH to stabilize. Move the cursor to the pH entry field. Enter the pH of the second buffer and press **Enter**. The second calibration is performed and the **MEASURED pH** field displays the pH of the second buffer.

15. Turn off the cell. Disconnect the reference electrode cable from junction J2 and disconnect the cell's electrical cable from the cell.

16. Reinstall the reference electrode in the reference electrode cavity (see Section 5.3.1, Step 12).

17. Slide the cell cover back over the cell body, making sure that the cable connector on the end of the electronics card lines up with the opening in the cell cover. Tighten the thumbscrew securely.

18. Reinstall the cell in its mounting location in the chromatography compartment. Reconnect the cell's inlet and outlet lines and the electrical cable.

5.5   Replacing the Main Power Fuses

The fuse holder is in the main power receptacle on the Dionex ED50A rear panel.

1. Turn off the main power.

HIGH VOLTAGE—Disconnect the main power cord from its source and also from the rear panel of the Dionex ED50A.

AVERTISSEMENT HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du Dionex ED50A.

VORSICHT HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des Dionex ED50A.

2. A recessed lock is located on each side of the fuse holder (see Figure 5-10). Using a small screwdriver, push each lock toward the center to release it. The fuse holder pops out slightly when the locks release. When both locks are released, pull the fuse holder straight out of its compartment.
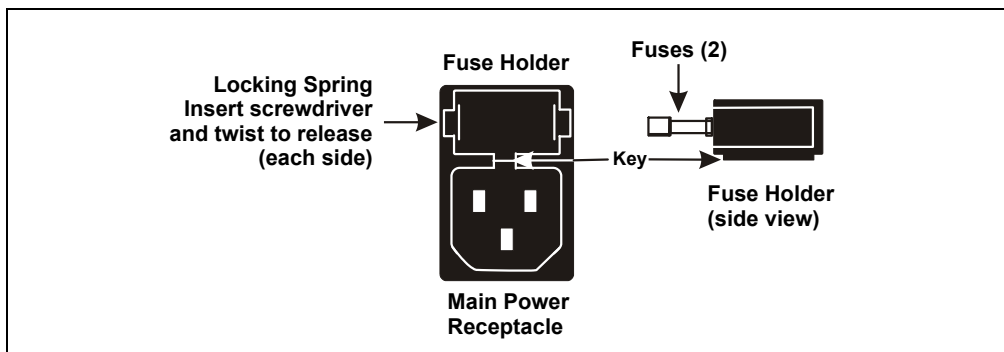

Figure 5-10. Main Power Fuse Holder

3. The holder contains two fuses. Replace both with new 3.15 amp fast-blow IEC127 fuses (P/N 954745). Thermo Fisher Scientific recommends replacing both fuses even though only one has failed.

CAUTION

For continued protection against risk of fire or shock, always replace with fuses of the same type and rating specified in this manual.

MISE EN GARDE

Pour maintenir la protection contre les risques d'incendie ou d'électrocution, remplacez toujours les fusibles par des fusibles du même type et du même calibre.

VORSICHT

Zum Schutz vor Feuer und Stromschlägen müssen beim Sicherungswechsel immer Sicherungen des gleichen Typs und mit gleicher Leistung verwendet werden.

4. Reinsert the fuse holder into its compartment. The fuse holder is keyed to fit only in its proper orientation. Apply sufficient pressure evenly against the holder to engage the two locks. The holder is flush against the panel when both locks are engaged.

5. Reconnect the main power cord and turn on the power.

A • Specifications

A.1 Physical

Dimensions 22.5 cm W x 17.0 cm H x 42.0 cm D
(8.8 in W x 6.6 in H x 16.4 in D)
6 cm (2.4 in) clearance required behind the detector

Weight 8.2 kg (18 lb)

Decibel Level 50 db ("A WEIGHING" setting)

A.2 Environmental

Operating Temperature 4 ºC to 40 ºC (40 ºF to 104 ºF)

Operating Humidity 5 to 95% relative humidity, noncondensing

A.3 Electrical

Main Power 85 to 270 Vac, 47/63 Hz; 40 W Max, 25 W typical. The Dionex ED50A power supply is auto-sensing and requires no voltage adjustment.

Fuses Two 3.15 amp fast-blow IEC127 fuses (P/N 954745)

Analog Output User-selectable full-scale output of 10, 100, or 1000 mV

A.4 Display and Keypad

Display Liquid crystal display with adjustable backlighting

Keypad 26-button keypad for entering commands and numerical values for screen parameters

A.5   Detector

Range	50 pC to 200 μC (Integrated Amperometry) 50 pA to 300 μA (DC Amperometry)
Cell Drive	±2.04 V (DC and Integrated Amperometry)
Local Operation	Front panel controls and display status of all functions
Remote Operation	Control of four functions via TTL or Relay contacts
DX-LAN Operation (Optional)	All functions can be controlled by Chromeleon 6.8 software on a PC connected to the Dionex ED50A via the DX-LAN interface

A.6   Amperometry Cell

Cell Body	Titanium (counterelectrode)
Active volume	~ 0.2 μL
Maximum Pressure	0.7 MPa (100 psi)
Working Electrodes	Conventional electrodes: gold, silver, platinum, glassy carbon Disposable electrodes: gold, silver, platinum, carbon
Reference Electrode	Combination pH–Ag/AgCl

B • Installation

B.1 Facility Requirements

- Make sure the Dionex ED50A installation site meets the electrical and environmental specifications listed in Appendix A.

- Install the Dionex ED50A on a sturdy table or workbench, at a height that ensures convenient viewing of the front panel display.

- Allow at least 6 cm (2.4 in) clearance behind the Dionex ED50A for power connections and ventilation.

IMPORTANT **During installation, or whenever it is necessary to move the detector, lift it only from the bottom or side. Lifting the Dionex ED50A by the front panel door will damage the door hinges.**

B.2 Power Connection

The power to the Dionex ED50A is controlled from the main power switch on the Dionex ED50A rear panel. The power supply is auto-sensing; thus, no adjustment is required to select the line voltage.

Connect the modular power cord (IEC 320 C13), from the main power receptacle on the rear panel (see Figure B-1) to a grounded, single-phase, power source.

CAUTION **The power supply cord is used as the main disconnect device. Ensure that the socket-outlet is located/installed near the module and is easily accessible.**

MISE EN GARDE **Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.**

VORSICHT **Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.**
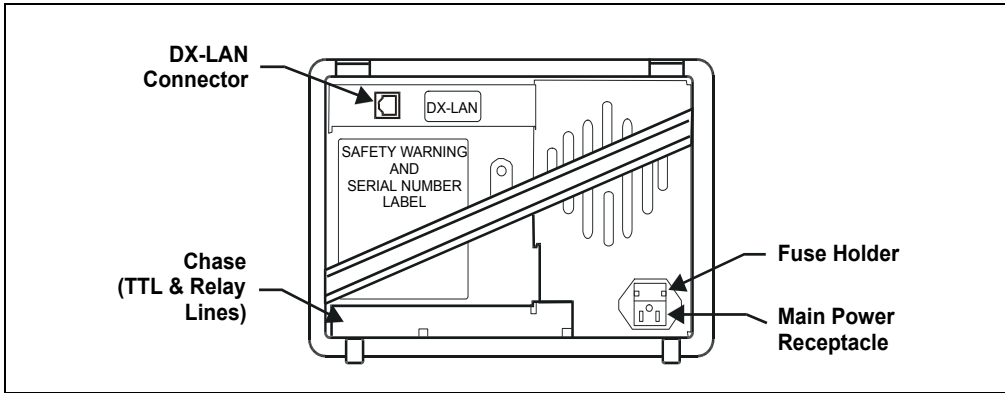
Figure B-1. Dionex ED50A Rear Panel

⚠ **WARNING**

SHOCK HAZARD—To avoid electrical shock, a grounded receptacle must be used. Do not operate or connect to AC power mains without an earthed ground connection.

⚠ **AVERTISSEMENT**

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

⚠ **WARNUNG**

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

⚠ **CAUTION**

Operation at AC input levels outside of the specified operating voltage range may damage the Dionex ED50A.

B.3 Overview of DX-LAN Interface Connections (Optional)

When you order the DX-LAN network, a DX-LAN connector is factory-installed in the upper left corner of the Dionex ED50A rear panel (see Figure B-1).

The DX-LAN interface provides communication between the Dionex ED50A and a host computer running Chromeleon 6.8 software. The DX-LAN interface

consists of a detector interface card, installed in the Dionex ED50A; a computer interface card, installed in the host computer; and cabling between the two cards. The DX-LAN interface uses a 10BASE-T RJ-45 (telephone-style) connector. To install the 10BASE-T cable, see Section B.4.

> **NOTE** **For installation instructions for the host computer's internal DX-LAN card, refer to the Chromeleon 6.8 Help or *Installing the Chromeleon Chromatography Management System with a Dionex Ion Chromatograph (IC)* (Document No. 031883).**

Chromeleon 6.8 runs under the Microsoft Windows XP Service Pack 3 operating system. When you purchase Chromeleon 6.8 and a PC from Thermo Fisher Scientific, the chromatography software and computer hardware are installed at the factory.

B.4   DX-LAN Interface Connections (Optional)

Required Parts

Part	Part Number	Description
10BASE-T DX-LAN cable	960281–6 ft (1.8 m)	Shipped with the detector Cables in these lengths are also available: 960279–10 ft (3 m) 960286–1 ft (0.3 m)
10BASE-T "combo" Ethernet hub	057398	Shipped with Chromeleon 6.8

IMPORTANT **The 10BASE-T DX-LAN cable is a Category 5 unshielded twisted-pair cable. Do not substitute a cable of an inferior grade. Failure to use the correct cable will cause the detector to lose communication with the host computer.**

IMPORTANT **When using 10BASE-T cabling, you must use a hub. If you simply plug the 10BASE-T cable from the detector into the connector on the host computer's DX-LAN card, the connection either will not work or will be unreliable.**

B.4.1 Installing the DX-LAN Cable

1. Install the "combo" 10BASE-T Ethernet hub on a workbench or on the wall. For installation instructions and site requirements, refer to the installation guide shipped with the hub.

2. Plug the 10BASE-T DX-LAN cable into a 10BASE-T port on the hub. See the example in Figure B-2.

3. Connect the other end of the cable into the 10BASE-T DX-LAN connector on the Dionex ED50A rear panel (see Figure B-1).

4. Connect a 10BASE-T cable from a 10BASE-T port on the hub to the 10BASE-T port on the host computer's internal DX-LAN card. If the connection is via port 8 on the hub, set the Normal/Uplink push button to Normal.
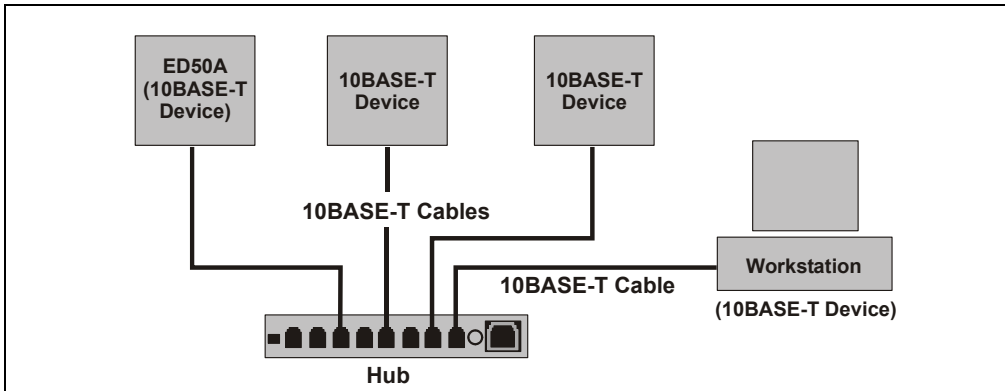
Figure B-2. Example 10BASE-T Network Connections

B.4.2 Cascading Hubs

Cascading, or connecting hubs together through their 10BASE-T ports, increases the number of ports or the number of users supported on the network. For instructions, refer to the installation guide for the hub.

B.5 Amperometry Cell Installation

B.5.1 Preparing the Cell Gasket and Working Electrode

Follow these instructions if you are installing a standard (non-disposable electrode). To install a disposable working electrode, refer to the installation manual shipped with the electrode.

NOTE To avoid electrode fouling, always wear gloves when handling electrodes.

1. Remove the wing screws (P/N 045937) from the assembled cell and remove the working electrode (see Figure B-3). Inspect the cell gasket; if it is scratched or damaged, replace the gasket (P/N 045972).

2. Rinse the gasket with deionized water. Clean the polished surface of the cell with a damp soft cloth or tissue.

3. Install the gasket over the alignment studs on the cell body. When correctly installed, one end of the gasket extends beyond the cell body, to facilitate gasket installation and removal.
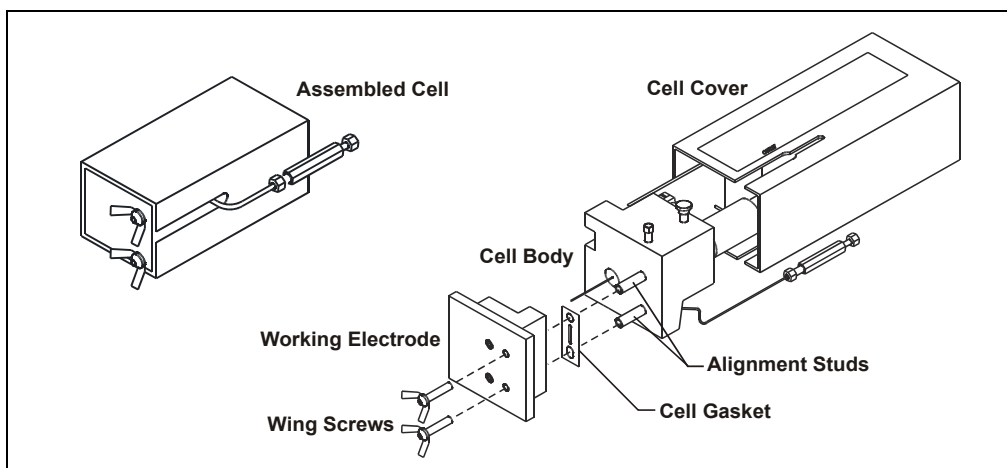
Figure B-3. Amperometry Cell Components

4. **For carbohydrate gold (P/N 044112), platinum, silver, and glassy carbon working electrodes only:** Polish the working electrode block (see Section 5.2) and rinse its surface with deionized water. Wipe it with a damp, soft cloth or tissue.

    NOTE Never polish a new AAA gold electrode (P/N 055832).

5. Install the working electrode block over the alignment studs so that the electrode type stamped on the top of the working electrode faces up. Fasten the working electrode in place with the wing screws. The electrode type is visible with the cover on.

B.5.2 Preparing the Reference Electrode

1. Loosen the cell cover thumbscrew and remove the cover (see Figure B-4). Unscrew the reference electrode cylinder and remove it from the cell body.

    NOTE Figure B-4 shows an example of a mounting plate for a chromatography or thermal compartment. Mounting hardware varies, depending on where the cell is to be installed.
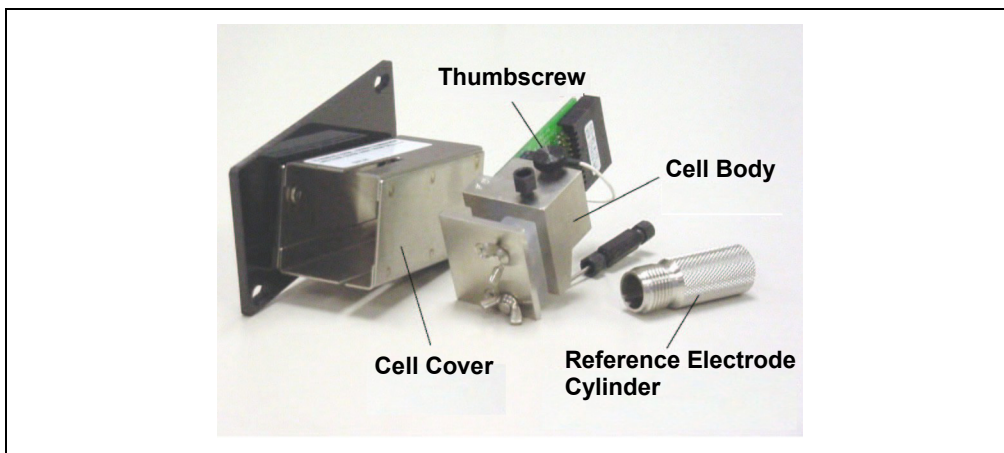
Figure B-4. Removing the Amperometry Cell Cover

2. Remove the reference electrode from its box. Remove the electrode from the storage bottle by partially unscrewing the cap and pulling the electrode out of the opening in the cap. Save the bottle and cap.

IMPORTANT	**Always store the electrode in the storage bottle filled with saturated KCl solution when the cell is not in use. This prevents the reference electrode membrane from drying out and damaging the electrode. See Section 3.9 for storage instructions.**

3. Rinse the electrode thoroughly in deionized water to remove any precipitated salt. Go on to "Calibrating the Reference Electrode."

B.5.3   Calibrating the Reference Electrode

1. Make sure the detector is turned off and then connect the amperometry cell cable to the cell and to the **EC CBL** connector on the SP card (see Figure 2-3.). Connect the other end to the cell's electronics card (see Figure B-5).
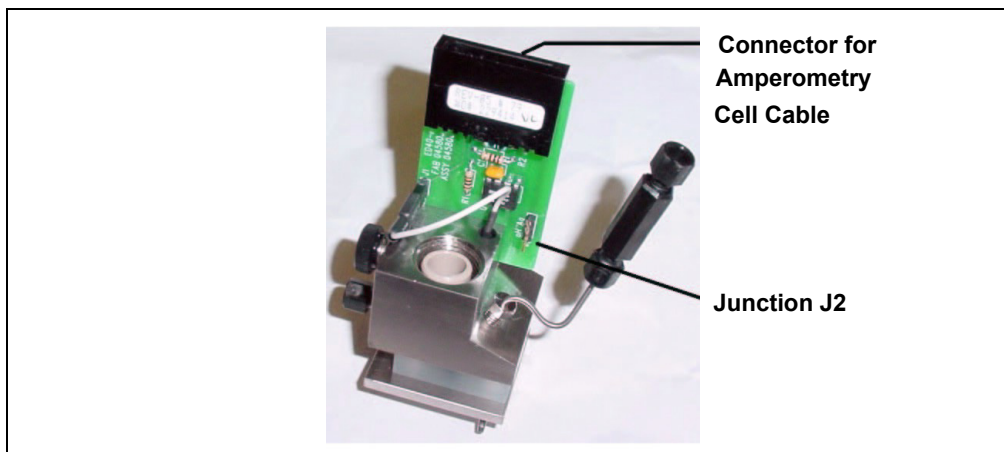
Figure B-5. Cell Electronics Card

2. Connect the reference electrode cable to junction J2 on the cell electronics card (see Figure B-5).

3. Prepare two buffer solutions: one with a pH of 7.00 and one with a different pH of your choice (for example, a calibration buffer that closely matches the pH of the eluent to be used).

4. Turn on the detector and turn on the cell from the **MAIN** screen.

5. Press **Menu**, **8**, and **0** and following the instructions on the **pH CALIBRATION** screen to calibrate the pH reference electrode.

6. After calibration, turn off the detector and disconnect the cables.

B.5.4   Installing the Reference Electrode

1. Remove the O-ring retainer from the reference electrode cavity (see Figure B-6).
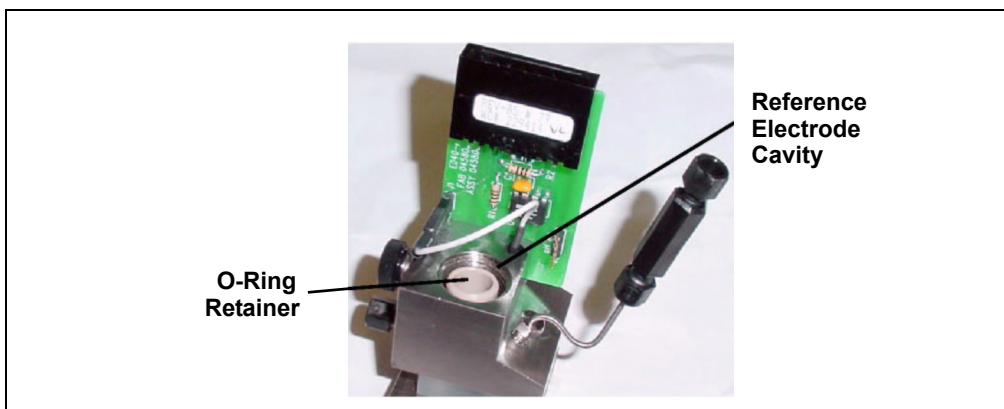
Figure B-6. Reference Electrode Cavity with O-Ring Retainer

2. Verify that the stop ring is at the bottom of the reference electrode cavity (see Figure B-7). The stop ring prevents the reference electrode from bottoming out and thereby blocking the flow path inside the cell.
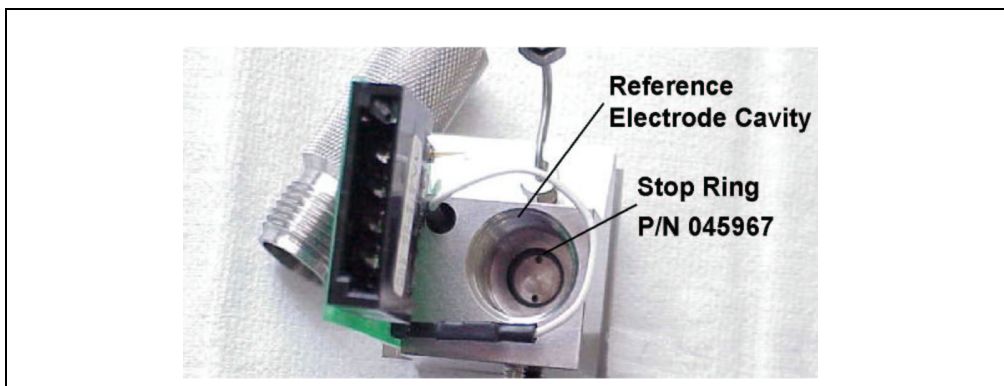
Figure B-7. Reference Electrode Cavity with Stop Ring

3. Verify that you have all of the parts shown in Figure B-8.
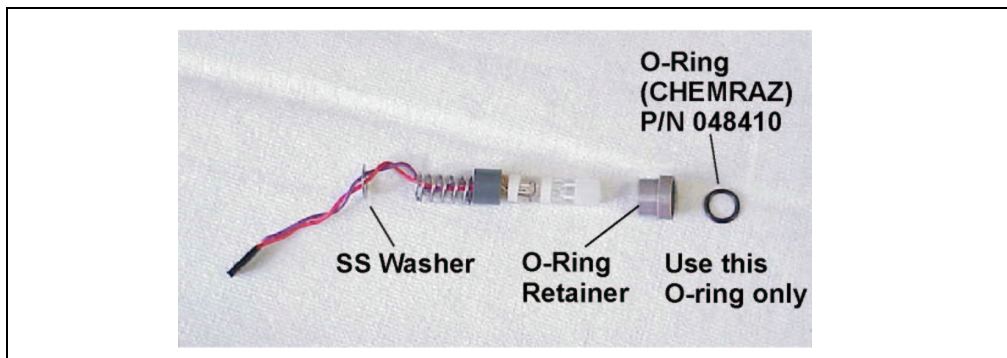
Figure B-8. Reference Electrode Parts

NOTE **The O-ring inside the electrode storage bottle cap and the CHEMRAZ O-ring are made from different materials. To prevent leaks, use only the CHEMRAZ O-ring (see Figure B-9).**
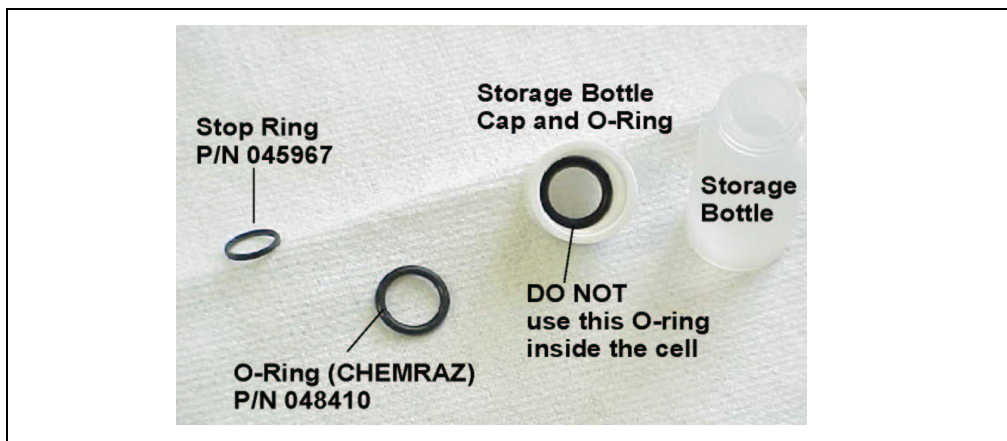
Figure B-9. Identifying the CHEMRAZ O-Ring

4. Pull the J2 connector through the opening in the electrode cylinder (see Figure B-10).

Figure B-10. Installing the Electrode Cylinder

5. Slide the PEEK O-ring retainer and CHEMRAZ O-ring onto the electrode (see Figure B-11).
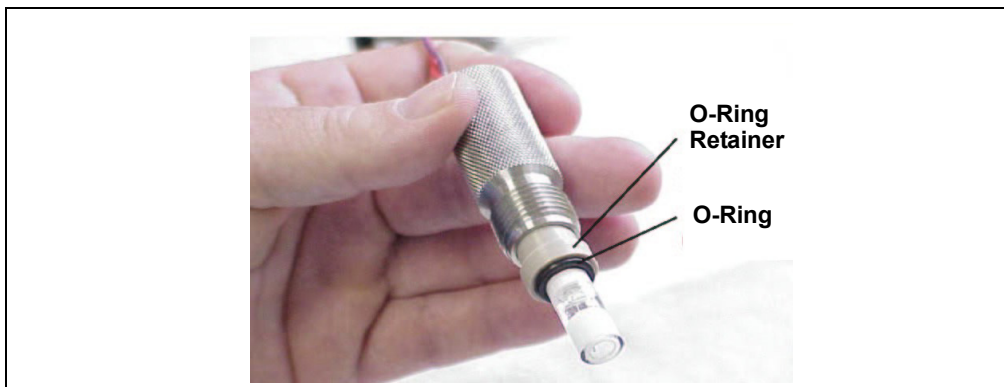
Figure B-11. Installing the O-Ring

6. Before installing the electrode, observe the inside of the reference electrode cavity. When installed correctly, the electrode fits into the narrower diameter area at the bottom of the cavity and sits on top of the stop ring (see Figure B-7).

IMPORTANT **While installing the electrode, maintain all parts in a vertical orientation, with the bottom of the electrode pointing down. This avoids bubble formation and helps ensure correct centering of the electrode inside the narrow area at the bottom of the cavity.**

7. Make sure the reference electrode is centered in the reference electrode cavity and then carefully insert the electrode until it touches the stop ring at the bottom of the cavity (see Figure B-12).

IMPORTANT **Make sure the electrode is all the way down inside the cavity and not "hung up" on the step between the wider diameter area of the cavity and the narrower diameter area.**
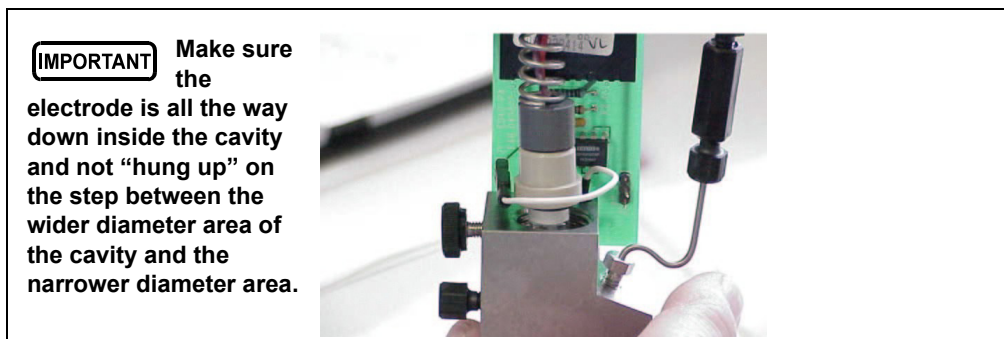
Figure B-12. Installing the Reference Electrode

8. While still keeping all parts in a vertical orientation, screw the electrode cylinder into the cell body and tighten firmly with your fingers. This ensures that the O-ring and O-ring retainer are fitted all the way down inside the cavity and there is a good seal around the electrode.

9. Connect the J2 connector to junction J2 on the electronics card and verify that the white working electrode lead wire is connected to junction J1 (see Figure B-13).

Junction J1
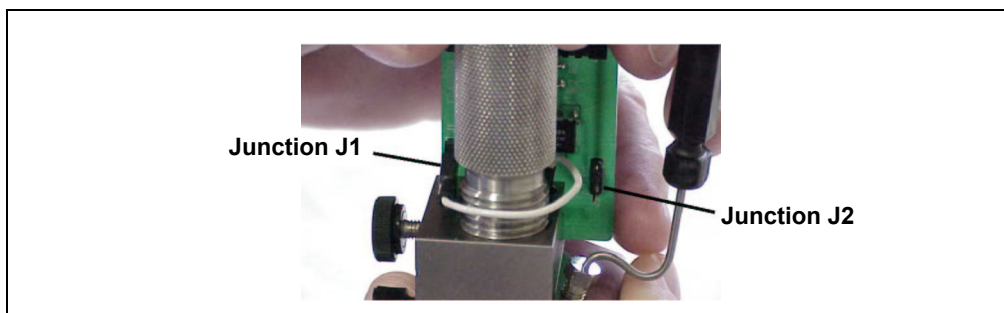
Junction J2

Figure B-13. Reference Electrode Electronics Card Junctions J1 and J2

10. Slide the cell cover back over the cell body, making sure that the cable connector on the end of the electronics card lines up with the opening in the cell cover. Tighten the thumbscrew.

B.5.5   Connecting the Amperometry Cell Cable

1. Make sure the detector is turned off.

2. Connect the amperometry cell cable to the amperometry cell.

3. Mount the cell in the chromatography module or outside the module on the amperometry cell bracket (P/N 048749). If you are using the bracket, minimize the dead volume by locating the bracket as close as possible to the column outlet.

    NOTE   **When properly mounted, the outlet fitting on the amperometry cell is on the uppermost surface of the cell. This ensures proper orientation of the reference electrode within the amperometry cell and helps sweep out bubbles.**

4. Route the amperometry cell cable from the chromatography module to the front of the detector by feeding it from the back of the detector under the card cage and out the front. You can also route it directly to the side of the detector.

5. Connect the cable to the **EC CBL** connector on the SP card (see Figure B-14).
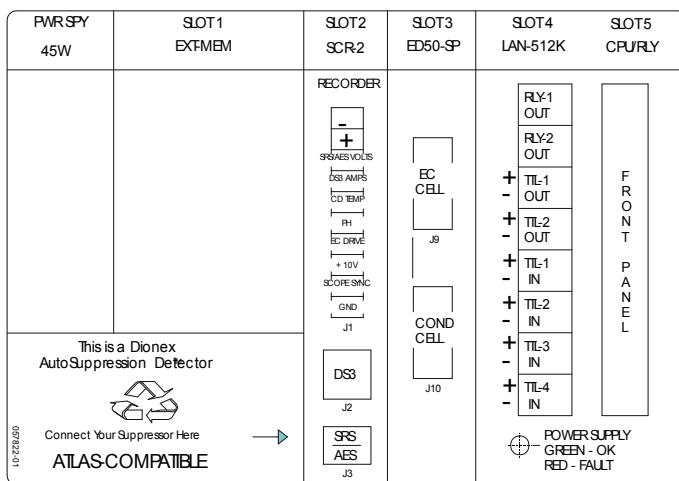
Figure B-14. Electronics Chassis Components (Located behind front door)

B.5.6 Plumbing the Amperometry Cell

Install the Dionex ED50A amperometry cell directly after the column. Figure B-15 shows the plumbing schematic for amperometry detection.

A second detector can be installed before the amperometry cell. However, if a second detector is installed *after* the cell, make sure the pressure at the amperometry cell outlet remains below 700 kPa (100 psi). Because of the volume within the pH reference electrode section of the cell, you may note some band broadening at the second detector. However, this is minimized by the precision flat bottomed pH reference electrode.
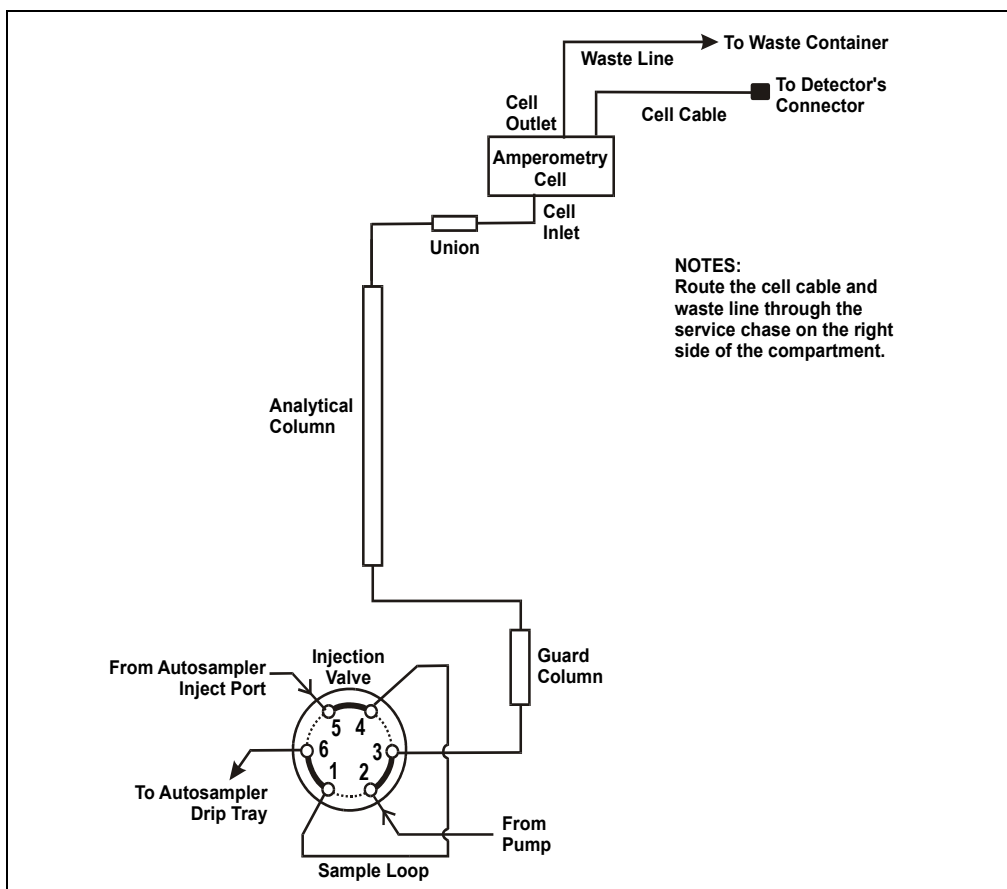
Figure B-15. Amperometry Cell Plumbing Schematic

1. Attach the tubing from the column to the cell inlet.

   NOTE   **The short length of titanium tubing at the cell inlet is an**
   integral part of the cell. DO NOT REMOVE IT. This
   tube extends the counterelectrode, and shields the
   working electrode from electrical noise.

2. Connect the waste line to the cell outlet.

3. Connect enough 0.25-mm (0.010-in) ID black PEEK tubing
   (P/N 042690) to the end of the waste line to create 0.21 to 0.28 MPa
   (30 to 40 psi) of backpressure.

B.6   Recorder/Diagnostic Connection

Connecting a strip chart recorder or integrator to the Dionex ED50A allows you to
record or monitor several parameters, in addition to the cell analog output. For a
list of the pinouts for the cable, see Appendix F.

Use the twisted black and red wires (P/N 043598) provided in the Dionex ED50A
Ship Kit (P/N 059219) to connect a recorder or integrator to the SCR card. (For an
illustration of card locations, see Figure 2-3 in this manual or the label on the
inside of the front door.)

Strip the ends of the wires and insert into the plugs. The signal wire (red) goes on
top and the ground wire (black) goes on the bottom of each plug. Use the
screwdriver (P/N 046985) provided in the Dionex ED50A Ship Kit to tighten the
locking screws.

This appendix describes all of the screens available for display on the front panel of the Dionex ED50A Electrochemical Detector. There are two categories of screens: operational and diagnostic (see Figure C-1).

- *Operational* screens enable you to create, edit, and run methods that control Dionex ED50A operation, and to select default parameters for the detector. Select the operational screens from the **MENU of SCREENS**.

- *Diagnostic* screens provide access to diagnostic information and tests, including some screens that enable you to calibrate various Dionex ED50A functions. Select the diagnostic screens from the **DIAGNOSTIC MENU**, an option on the **MENU of SCREENS**.
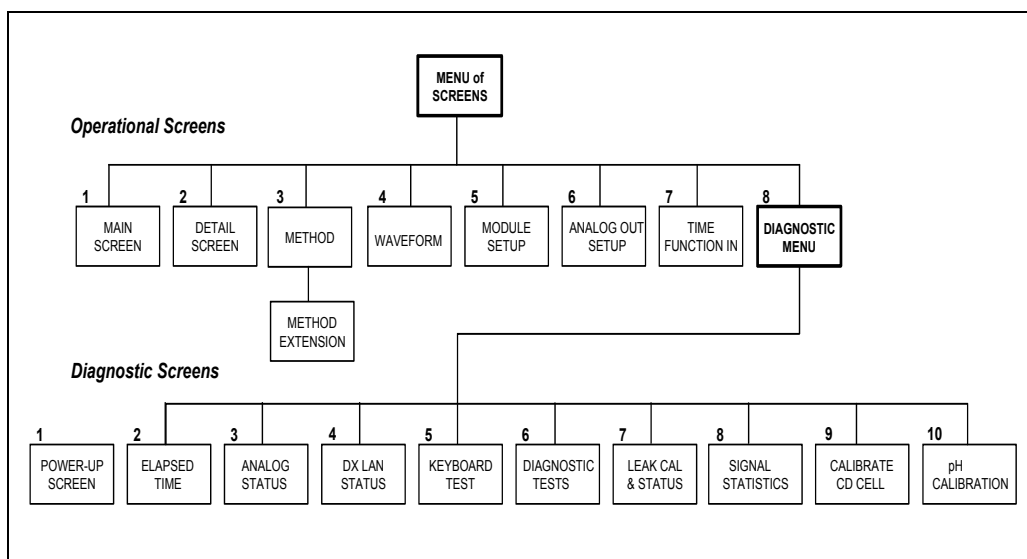
Figure C-1. Dionex ED50A Menu Structure

Select the detection mode from either the **MAIN** or **DETAIL** screen. The **MENU of SCREENS**, the **MAIN** screen, the **DETAIL** screen, the **METHOD** screen, and the **WAVEFORM** screen are unique to each of the detection modes. The remaining screens are common to all detection modes.

C.1   Operational Screens

> **NOTE**   **Dionex ED50A detectors shipped in June 2013 or later are not recommended for conductivity detection. Therefore, operational screens for the Conductivity mode are not described in this manual.**

C.1.1   Menu of Screens—Integrated Amperometry

Figure C-2 shows the **MENU of SCREENS** for the Integrated Amperometry mode.

MENU of INTEGRATED AMPEROMETRY SCREENS

1	**MAIN SCREEN**	**5**	**MODULE SETUP**
2	**DETAIL SCREEN**	**6**	**ANALOG OUT SETUP**
3	**METHOD**	**7**	**TIME FUNCTION IN**
4	**WAVEFORM**	**8**	**DIAGNOSTIC MENU**

Help Message
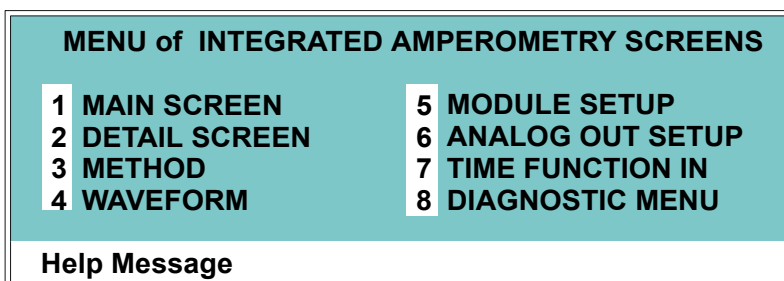
Figure C-2. Menu of Screens—Integrated Amperometry

There are two ways to select a screen from this menu:

- Use the cursor directional buttons to move the cursor to the field containing the screen number and press **Enter**.

- Press the number button on the front panel keypad that corresponds to the screen.

To display a brief description of each menu, press the **Help** button.

C.1.2 Main Screen—Integrated Amperometry

The **MAIN** screen displays the measured charge (coulombs) and other primary functions in large characters that make viewing easier from a distance.

```
INT AMPEROMETRY        WAVEFORM   17
                            CELL  ON
  - 4.36      uC      RANGE  1000 nC
  LOCAL      METHOD   05        134.56 MIN
Help Message
```
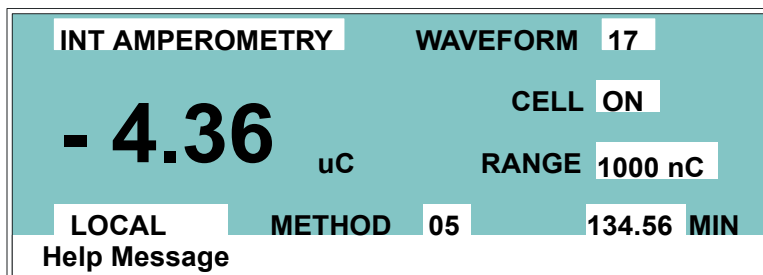
Figure C-3. Main Screen—Integrated Amperometry,
Ag/AgCl Reference Electrode Mode

```
INT AMPEROMETRY        WAVEFORM   17
                            CELL  ON
  - 4.36      uC        P H    7.0
  LOCAL      METHOD   05        134.56 MIN
Help Message
```
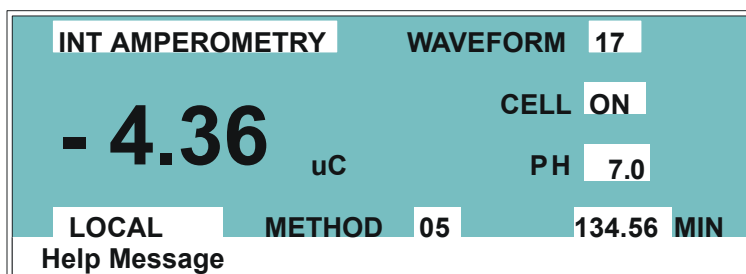
Figure C-4. Detail Screen—Integrated Amperometry
pH–Ag/AgCl Reference Electrode Mode

Screen Field	Description
Detector Operating Mode	Selects the detector operating mode: Conductivity, DC Amperometry, Integrated Amperometry, or Voltammetry.
WAVEFORM	Sets the waveform number to run. Program the waveform from the **WAVEFORM** screen.
CELL	Turns the amperometry cell off and on, disabling or enabling detection.
pH	Displays the eluent pH (shown only when the pH–Ag/AgCl mode is selected for the reference electrode).

Screen Field	Description
RANGE	Sets the detector sensitivity between 50 pC and 200 μC.
Control Mode	Sets the detector to Local, Remote, or Locked Remote control.
METHOD	Sets the method number. Pressing **Select** and **Enter** sets the detector to Direct control.
MIN	Shows the waveform clock elapsed time.

C.1.3 Detail Screen—Integrated Amperometry

The **DETAIL** screen includes all the fields contained on the **MAIN** screen, as well as the TTL and Relay fields and other fields to control detection. Refer to the **MAIN** screen for a description of fields common to both screens.

```
DETAIL SCREEN          INT AMPEROMETRY  TTL1  0
OUTPUT   23.68    nC          CELL  ON        TTL2  1
OFFSET  115.03    nC         RANGE  200 nC    RLY1  1
 TOTAL  138.71   nC            REF  Ag        RLY2  0
    pH     12.2
                     WAVEFORM     02
  LOCAL               METHOD   05       123.45  MIN
 Help Message
```

Figure C-5. Detail Screen—Integrated Amperometry

Screen Field	Description
REF	Sets the reference electrode to use either the combination pH–Ag/AgCl reference mode or the Ag/AgCl mode.
pH	Displays the eluent pH.
TTL1 **TTL2**	Provides TTL control of accessories. In a method, these values occur according to the method timing. In Direct control, select off (0) or on (1).
RLY1 **RLY2**	Provides relay control of accessories. In a method, these values occur according to the method timing. In Direct control, select off (0) or on (1).

C.1.4 Method—Integrated Amperometry

A method consists of a series of timed steps. Each step has a set of parameters associated with it.

Initial conditions are applied when a method is invoked. A lower case **v** next to the last step on the display indicates that the method contains more steps.

Blank fields denote no change from the previous step. The **Delete** button blanks the field.

```
METHOD I AMP    EDIT  33   SAVE TO 33  RUN 25
                                      TTL   RLY
    TIME   WAVE    RANGE   OFFSET MARK  1 2   1 2
    INIT    13     200 uC                0 0   0 0
    0.00                      *      *
    2.00                                 1 1
    4.00                                       0 0
    Help Message
```

Figure C-6. Method Screen—Integrated Amperometry

Screen Field	Description
Detector Operating Mode	Selects the detector operating mode: Conductivity, DC Amperometry, or Integrated Amperometry.
EDIT	Specifies the method number (0 through 99) to edit.
SAVE TO	Specifies the method number (0 through 99) to save the current method to.
RUN	Specifies the method number (0 through 99) to run. The **Hold/Run** button controls the running of the method.
TIME	Specifies the start time for each step. Times are displayed chronologically.
WAVE	Sets the waveform number (0 through 19) to run.
RANGE	Specifies the detection range.

Screen Field	Description
OFFSET	Stores the offset value. The baseline is set by subtracting the offset measured when this step executes from all subsequent measurements. An asterisk (*) indicates that offset will occur at this time.
MARK	Sends a positive pulse to the analog output (recorder) as an event marker. An asterisk (*) indicates a mark will occur at this time.
TTL	Sets TTL1 and TTL2 to off (0) or on (1).
RLY	Sets RLY1 and RLY2 to off (0) or on (1).

C.1.5   Waveform—Integrated Amperometry

Figure C-7 shows the **WAVEFORM** screen for Integrated Amperometry. These entries form points on a plot of potential vs. time.

When the last step displayed is not the last step in the waveform, a lower case **v** is displayed beside the time digits in the last line.

INT AMP	WAVE EDIT	19	SAVE TO	19	RUN	13
STEP	TIME (sec)	POTEN (V)			INTEGRATE	
0	0.00	+	0.10			
1	0.30				BEGIN	
2	0.50				END	
3	0.51	+	0.60			
4	0.60 V	-	0.30			
Help Message						

Figure C-7. Waveform Screen—Integrated Amperometry

Screen Field	Description
WAVE EDIT	Specifies the waveform number (0 through 19) to edit.
SAVE TO	Specifies the waveform number (0 through 19) to save the current waveform definition to.
RUN	Specifies the waveform number (0 through 19) to run.
TIME	Specifies the time for this step. Times are displayed chronologically.
POTENTIAL	The left field sets the polarity; the right field is the point in the waveform for this voltage. If there is no entry, the values from the preceding step remain in effect.
INTEGRATE	Sets the begin and ending times for the integration period. Integration cannot begin on the first waveform step, or end on the last step.

C.1.6   Menu of Screens—DC Amperometry

Figure C-8 shows the **MENU of SCREENS** for the DC Amperometry mode.

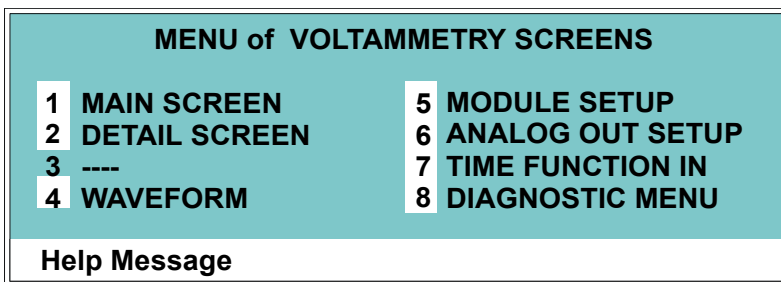| MENU of DC AMPEROMETRY SCREENS	
1 MAIN SCREEN	**5 MODULE SETUP**
2 DETAIL SCREEN	**6 ANALOG OUT SETUP**
3 METHOD	**7 TIME FUNCTION IN**
4 ----	**8 DIAGNOSTIC MENU**
Help Message	
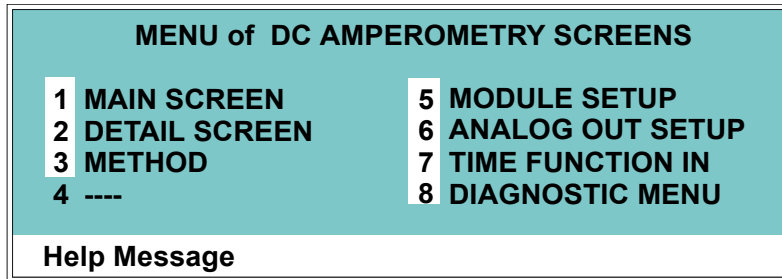
Figure C-8. Menu of Screens Screen—DC Amperometry

There are two ways to select a screen from this menu:

- Use the cursor directional buttons to move the cursor to the field containing the screen number and press **Enter**.

- Press the number button on the front panel keypad that corresponds to the screen.

To display a brief description of each menu, press the **Help** button.

C.1.7 Main Screen—DC Amperometry

The **MAIN** screen displays the measured current (Amperes) and other primary functions in large characters that make viewing easier from a distance.
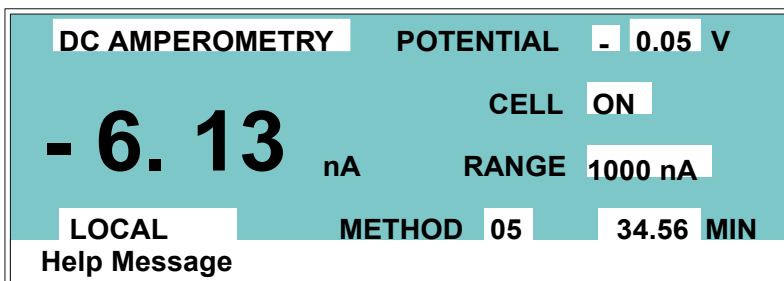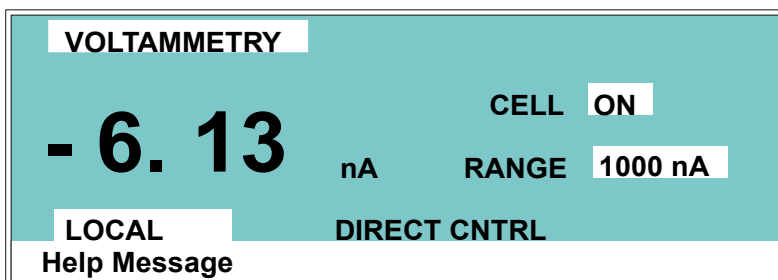

Figure C-9. Main Screen—DC Amperometry

Screen Field	Description
Detector Operating Mode	Selects the detector operating mode: Conductivity, DC Amperometry, Integrated Amperometry, or Voltammetry.
POTENTIAL	The field on the left sets the polarity. The field on the right sets the applied potential.
CELL	Turns the amperometry cell off or on, disabling or enabling detection.
RANGE	Sets the detector sensitivity between 50 pA to 300 μA.
METHOD	Sets the method number. Pressing **Select** and **Enter** sets the detector to Direct control.
Control Mode	Sets the detector to Local, Remote, or Locked Remote control.
MIN	Shows the method clock elapsed time.

C.1.8 Detail Screen—DC Amperometry

The **DETAIL** screen includes all the fields contained on the **MAIN** screen, as well as the TTL and Relay fields and other fields to control detection. Refer to the **MAIN** screen for a description of fields that are common to both screens.

```
DETAIL SCREEN        DC AMPEROMETRY    TTL1  0
OUTPUT   128.2  nA          CELL ON    TTL2  1
OFFSET    58.7  nA        RANGE 200 nA RLY1  1
 TOTAL   184.9  nA          REF Ag     RLY2  0
    pH    12.2
              POTENTIAL + 0.80 V
   LOCAL             METHOD 05      123.45 MIN
 Help Message
```
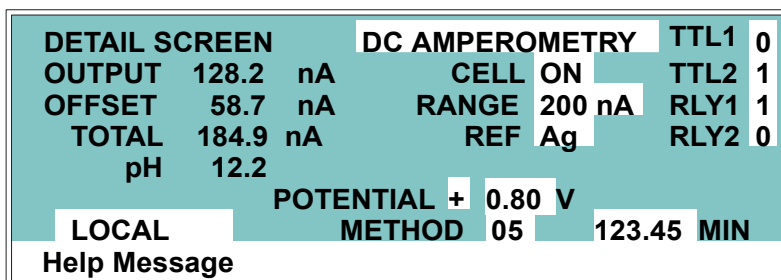
Figure C-10. Detail Screen—DC Amperometry

Screen Field	Description
REF	Sets the reference electrode to use either the combination pH–Ag/AgCl reference mode or the Ag/AgCl mode.
pH	Displays the eluent pH.
TTL1 **TTL2**	Provides TTL control of accessories. In a method, these values occur according to the method timing. In Direct control, select off (0) or on (1).
RLY1 **RLY2**	Provides relay contact closure control of accessories. In a method, these values occur according to the method timing. In Direct control, select off (0) or on (1).

C.1.9 Method—DC Amperometry

A method consists of a series of timed steps. Each step has a set of parameters associated with it.

Initial conditions are applied when a method is invoked. A lower case **v** next to the last step on the display indicates that the method contains more steps.

Blank fields denote no change from the previous step. The **Delete** button blanks the field.

METHOD D AMP	EDIT	33	SAVE TO	33	RUN	25

TIME	VOLT	RANGE	OFFSET	MARK	TTL 1 2	RLY 1 2
INIT	-0.10	200 uA			0 0	0 0
0.00			*	*		
2.00					1 1	
4.00						0 0

Help Message

Figure C-11. Method Screen—DC Amperometry

Screen Field	Description
Detector Operating Mode	Selects the detector operating mode: Conductivity, DC Amperometry, or Integrated Amperometry.
EDIT	Specifies the method number (0 through 99) to edit.
SAVE TO	Specifies the method number (0 through 99) to save the current method to.
RUN	Specifies the method number (0 through 99) to run. The **Hold/Run** button controls the running of the method.
TIME	Specifies the start time for each step. Times are displayed chronologically.
VOLT	Specifies the voltage applied to the cell.
RANGE	Specifies the detection range.

Screen Field	Description
OFFSET	Stores the offset value. The baseline is set by subtracting the offset measured when this step executes from all subsequent measurements. An asterisk (*) indicates that OFFSET will occur at this time.
MARK	Sends a positive pulse to the analog output (recorder) as an event marker. An asterisk (*) indicates that a MARK will occur at this time.
TTL	Sets TTL1 and TTL2 to off (0) or on (1).
RLY	Sets RLY1 and RLY2 to off (0) or on (1).

C.1.10 Menu of Screens—Voltammetry

Figure C-12 shows the **MENU of SCREENS** for the Voltammetry mode.

```
┌─────────────────────────────────────────────┐
│       MENU of  VOLTAMMETRY SCREENS           │
│                                              │
│   1  MAIN SCREEN        5  MODULE SETUP       │
│   2  DETAIL SCREEN      6  ANALOG OUT SETUP   │
│   3  ----               7  TIME FUNCTION IN   │
│   4  WAVEFORM           8  DIAGNOSTIC MENU    │
│                                              │
│   Help Message                               │
└─────────────────────────────────────────────┘
```

Figure C-12. Menu of Screens—Voltammetry

There are two ways to select a screen from this menu:

- Use the cursor directional buttons to move the cursor to the field containing the screen number and press **Enter**.

- Press the number button on the front panel keypad that corresponds to the screen.

To display a brief description of each menu, press the **Help** button.

C.1.11 Main Screen—Voltammetry

The **MAIN** screen displays the measured current (Amperes) and other primary functions in large characters that make viewing easier from a distance.

Figure C-13. Main Screen—Voltammetry

Screen Field	Description
Detector Operating Mode	Selects the detector operating mode: Conductivity, DC Amperometry, Integrated Amperometry, or Voltammetry.
CELL	Turns the amperometry cell off or on, disabling or enabling detection.
RANGE	Sets the detector sensitivity between 1 nA to 100 μA.
DIRECT CNTRL	In Voltammetry mode, the detector is always in Direct control mode. Because methods do not apply to voltammetry, this field cannot be changed.
Control Mode	Sets the detector to Local, Remote, or Locked Remote control.

C.1.12 Detail Screen—Voltammetry

The **DETAIL** screen includes all the fields contained on the **MAIN** screen, as well as the TTL and Relay fields and other fields to control detection. Refer to the **MAIN** screen for a description of fields that are common to both screens.

```
DETAIL SCREEN            VOLTAMMETRY    TTL1  0
OUTPUT   0.152   uA          CELL  ON    TTL2  1
OFFSET   1.209   uA        RANGE  200 uA RLY1  1
 TOTAL   1.361   uA          REF  Ag     RLY2  0
        pH  12.2

   LOCAL                  DIRECT CNTRL
 Help Message
```

Figure C-14. Detail Screen—Voltammetry

Screen Field	Description
REF	Sets the reference electrode to use either the pH or Ag/AgCl half of the cell.
pH	Displays the mobile phase pH.
TTL1 **TTL2**	Provides TTL control of accessories. In a method, these values occur according to the method timing. In Direct control, select off (0) or on (1).
RLY1 **RLY2**	Provides relay control of accessories. Select off (0) or on (1).

C.1.13 Waveform—Voltammetry

Figure C-15 shows the **WAVEFORM** screen for Voltammetry. These entries form points on a plot of potential vs. time.

When the last step displayed is not the last step in the waveform, a lower case **v** is displayed beside the time digits in the last line.

VOLTAMMETRY WAVEFORM	SAVE		
STEP	TIME (sec)	POTENTIAL	(V)
0	0.00	-	0.80
1	14.0	+	0.60
2	28.0	-	0.80
3			
4			
Help Message			

Figure C-15. Waveform Screen—Voltammetry

C.1.14 Module Setup

The backlight intensity, key beep, and error beep are configured from the **MODULE SETUP** screen.

MODULE SETUP

DISPLAY PANEL BACKLIGHT: **MEDIUM**
KEY ACTUATION SOUND: **ON**
ENTRY ERROR SOUND: **ON**
HELP LANGUAGE: **ENGLISH**
HEAT SOURCE: **DS3**

Help Message
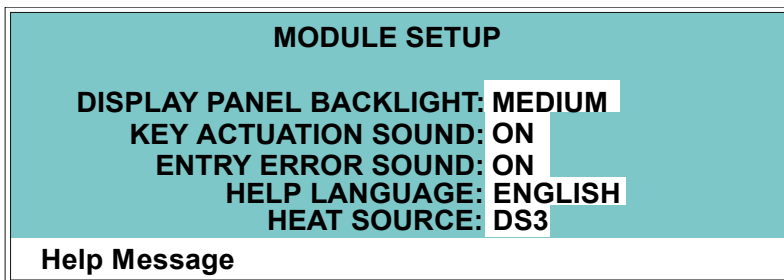
Figure C-16. Module Setup Screen

Screen Field	Description
DISPLAY PANEL BACKLIGHT	Sets the display panel backlight to **LOW**, **MEDIUM**, **HIGH**, or **OFF**.
KEY ACTUATION SOUND	Toggles the keypad touch sound. When this option is on, the detector sounds a beep when a button is pressed.
ENTRY ERROR SOUND	Toggles the error sound. When this option is on, the detector sounds a beep when an invalid entry is made.
HELP LANGUAGE	Sets the language for help messages to **ENGLISH** or **JAPANESE**.
HEAT SOURCE	Sets the source of heat for the cell to **DS3** or **OVEN**.

C.1.15 Analog Out Setup

The **ANALOG OUT SETUP** screen contains parameters for setting the analog output, such as for a recorder or oscilloscope.

```
              ANALOG OUT SETUP
            OUTPUT:   OFFSET
     ZERO POSITION:   10 % FULL SCALE
  VOLTS FULL SCALE:   1.0 V
         RISE TIME:   1.0    sec
          POLARITY:   +

  Help Message
```
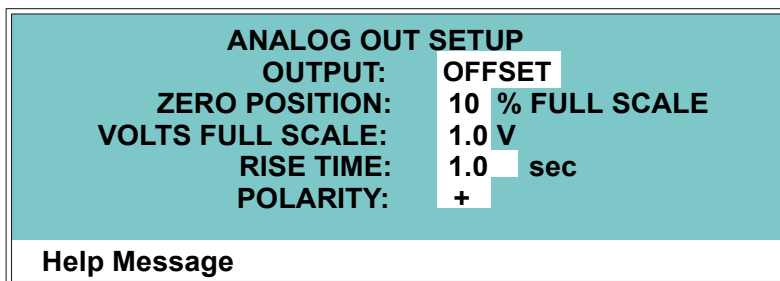
Figure C-17. Analog Out Setup Screen

Screen Field	Description
OUTPUT	Sets the analog output to one of the following: **OFFSET** uses the offset level value. **TOTAL** sets the detector output to the total cell conductivity, charge or current, disabling the offset function. **ZERO** sets the detector output to zero volts. **FULL SCALE** sets the output to the full-scale setting.
ZERO POSITION	Sets the analog (recorder) offset level (0 to 100%).
VOLTS FULL SCALE	Sets the full-scale voltage for a signal equal to the range setting. The discrete settings are 1.0, 0.1, and 0.01 volts.
RISE TIME	Sets the analog output filter rise time to 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, or 10.0 seconds. Rise time is a measure of how quickly the detector responds to a change in signal. The filter is a Bessel filter that ensures optimal noise rejection and low signal distortion.
POLARITY	Determines the output voltage polarity. The output is usually set to positive polarity. Negative polarity is used to reverse peaks from indirect detection.

C.1.16 Time Function In

This screen displays the detector functions that can be controlled with TTL input from another device, and lets you assign any four of the functions to the four TTL inputs. The **MODE** field selects the type of input signal the detector will respond to. The signal type can be changed to match the signal of the controlling device. See Section D.3.1 for details.

Use the **Select** buttons to select the TTL input signal mode and to assign TTL1 through TTL4 to any four of the functions. See Section D.3.2 for details.

```
TIME FUNCTION IN   MODE:    NORMAL   EDGE
             OFFSET: TTL     1
           HOLD/RUN: TTL     2
   SUPPRESSOR ON/OFF: TTL    3      CELL: TTL  -
 METHOD NUMBER  INCR: TTL    4      DECR: TTL  -
               MARK: TTL     -
           RANGEx10: TTL     -
   Help Message
```

Figure C-18. Time Function In Screen

C.2   Diagnostic Screens

To access the Dionex ED50A diagnostics, select the **DIAGNOSTIC MENU** from the **MENU of SCREENS**. While a diagnostic screen is displayed, pressing the **Menu** button returns you to the **DIAGNOSTIC MENU**. From the **DIAGNOSTIC MENU**, pressing **Menu** returns you to the **MENU of SCREENS**.

C.2.1   Diagnostic Menu

The **DIAGNOSTIC MENU** lists the available diagnostic screens. Figure C-19 shows all of the possible menu options; however, the options actually displayed will depend on which detection mode is selected.

- Option 7, **LEAK CAL(IBRATION) & STATUS**, is available only in Conductivity mode and when a leak detector is connected.

- Option 9, **CALIBRATE CD CELL**, is available only in Conductivity mode.

- Option 10, **pH CALIBRATION**, is available only in Integrated Amperometry, DC Amperometry, and Voltammetry modes.

DIAGNOSTIC MENU	
1 POWER-UP SCREEN	6 DIAGNOSTIC TESTS
2 ELAPSED TIME	7 LEAK CAL & STATUS
3 ANALOG STATUS	8 SIGNAL STATISTICS
4 DX-LAN STATUS	9 CALIBRATE CD CELL
5 KEYBOARD TEST	10 pH CALIBRATION
Help Message	
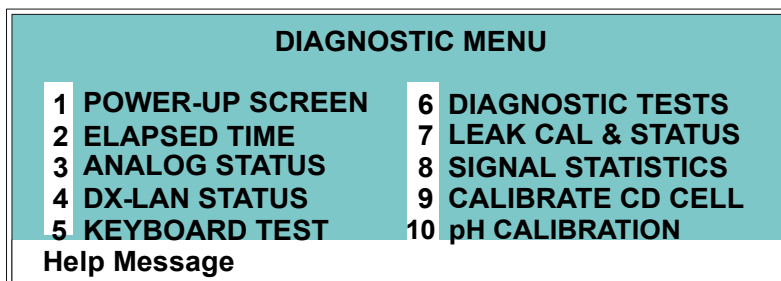
Figure C-19. Diagnostic Menu Screen

NOTE   **Dionex ED50A detectors shipped in June 2013 or later are not recommended for conductivity detection. Therefore, diagnostic screens for the Conductivity mode are not described in this manual.**

C.2.2 Power-Up Screen

This screen displays the revision numbers for the Moduleware and BIOS
code. It also displays the identification number of the optional DX-LAN
interface, if connected.

ED50A ELECTROCHEMICAL DETECTOR

                           MODULEWARE REV n.nn
                                   BIOS REV n.nn
                              DX LAN ID#   nnnnnn

Help Message
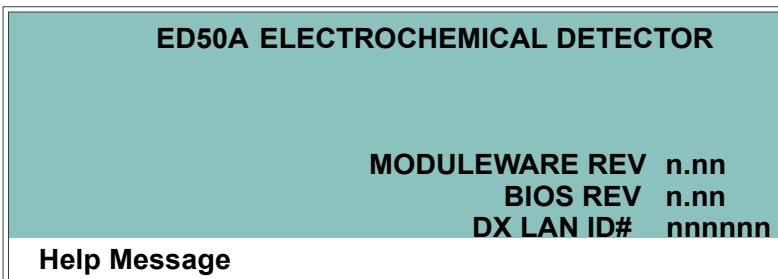
Figure C-20. Power-Up Screen

C.2.3 Elapsed Time

This screen reports for how long various Dionex ED50A parameters have been in use. The status of each parameter is updated in real time.

```
                    ELAPSED TIME
                                        RESET
          MODULE ON:    nnnnnn hours
          BACKLIGHT:    nnnnnn hours
      SUPPRESSOR ON:    nnnnnn hours       *
         EC CELL ON:    nnnnnn hours       *
      ─────────────────────────────────────
       Help Message
```
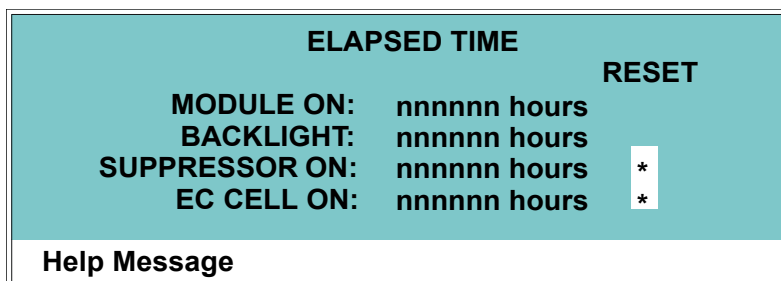
Figure C-21. Analog Status Screen

Screen Field	Description
MODULE ON	Reports the total time the detector has been powered up in its lifetime.
BACKLIGHT	Reports the total time the LCD backlight has been on in its lifetime.
SUPPRESSOR ON	Reports the total time the suppressor has run. Reset this field to zero after changing the suppressor.
EC CELL ON	Reports the total time the amperometry cell has run. Reset this field to zero after replacing the cell.
RESET	Allows a timer to be reset to zero to restart the counter. Reset the appropriate timer after installing a new component.

C.2.4 Analog Status

This screen reports the status of several analog test points. If a run is in progress, the status updates are from the last idle state. If no run is in progress, the values are in real time.

```
               ANALOG STATUS
AES/SRS CONNECTED: Y      DS3  CONNECTED:Y
AES/SRS OVER  CURR: N     DS3  OVER  TEMP:N
AES/SRS OVER   VOLT: N    DS3 UNDER TEMP: N
                      CD CELL CONNECTED: N
                      EC CELL CONNECTED:   Y
         THERMISTOR TEMPERATURE:   nn.n Degrees
 Help Message
```
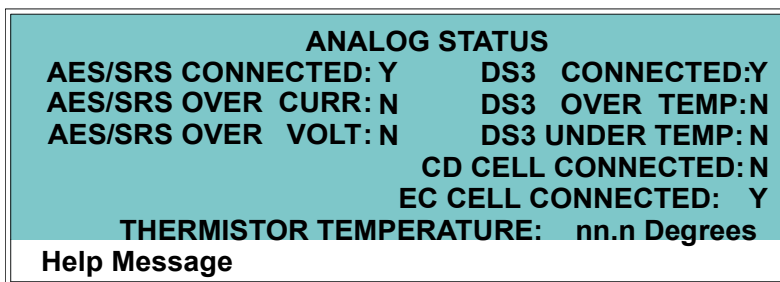
Figure C-22. Analog Status Screen

Screen Field	Description
AES/SRS CONNECTED	Indicates whether a suppressor (Dionex SRS or AES) is connected to the detector.
AES/SRS OVER TEMP	Indicates whether the suppressor is over the temperature specified.
AES/SRS OVER VOLT	Indicates whether the suppressor is over the voltage range specified.
DS3 CONNECTED	Indicates whether a Dionex DS3 Detection Stabilizer is connected to the detector.
DS3 OVER TEMP	Indicates whether the Dionex DS3 is over the temperature specified.
DS3 UNDER TEMP	Indicates whether the Dionex DS3 is under the temperature specified.
CD CELL CONNECTED	Indicates whether a conductivity cell is connected to the detector.
EC CELL CONNECTED	Indicates whether an amperometry cell is connected to the detector.
THERMISTOR TEMPERATURE	Indicates the temperature recorded from the conductivity cell thermistor.

C.2.5 DX-LAN Status

The DX-LAN driver monitors several types of errors that may occur on the network. The detector reads the DX-LAN error counts and displays them on this screen, along with the DX-LAN addresses. Most errors are caused by a defective cable, missing cable, or incorrectly terminated cable. The DX-LAN cable must be RG58U or RG58AU.

```
                DX-LAN STATUS
    UNIQUE DX-LAN ID:FF  FF  FF  FF
     DX-LAN ADDRESS:FF  FF  FF  FF  FF  FF


   COLLISION: nnn    ALIGNMENT: nnn      CRC:nnn
   BUS  WRITE: nnn    BUS  READ: nnn     RUNT: nnn
  UNDERFLOW: nnn    OVERFLOW: nnn    RETRY: nnn
   Help Message
```
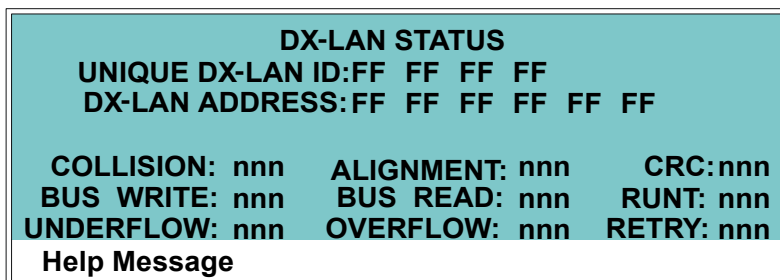
Figure C-23. DX-LAN Status Screen

Screen Field	Description
UNIQUE DX-LAN ID	Displays the three-byte DX-LAN ID programmed into the detector Moduleware (in HEX). The ID is unique to the detector and never changes.
DX-LAN ADDRESS	Displays the six-byte DX-LAN address assigned by the PC (in HEX). The first three bytes are the system assignment; the last three bytes are the assignment within the system.
COLLISION	Indicates that 16 unsuccessful transmissions of the same packet occurred, due to collisions.
BUS WRITE	Indicates that a ready response could not be issued within 2.4 microseconds after the WR signal was asserted. This occurs when the transmit buffer memory is full.
UNDERFLOW	Indicates that data from the transmit section of the hardware buffer memory is not available for serial transmission. The DX-LAN will continue to send out this data frame.
ALIGNMENT	Indicates that a packet was received with an alignment error, meaning that there were one to seven extra bits at the end of the packet. This is usually caused by a collision or a faulty transceiver.

Screen Field	Description
BUS READ	Indicates that a ready response could not be issued within 2.4 microseconds after the ready signal was asserted. This occurs when reading an empty buffer.
OVERFLOW	Indicates that the DX-LAN hardware receive buffer became full and had to reject a packet for lack of space.
CRC	Indicates that a packet was received with a CRC error. This usually means that a collision has corrupted the packet.
RUNT	Indicates that a <169>runt<170> packet (one less than 15 bytes in length) was received. This usually occurs after a collision has truncated the original length.
RETRY	Indicates the number of retries required to transmit the last packet.

C.2.6 Keyboard Test

You can conduct an interactive test of the Dionex ED50A front panel keypad from this screen. Pressing any front panel button changes the corresponding button indicator on the screen to reverse video. This confirms proper operation of that button. When you release the button, the display returns to normal video.

```
OFFSET   RUN/HOLD        UP            7   8   9
                     LEFT      RIGHT
MARK     RESET           DOWN          4   5   6

INSERT   SEL UP                        1   2   3
                     HELP        MENU
DELETE   SEL DOWN                      0   .   E
 Help Message
```

Figure C-24. Keyboard Test Screen

C.2.7   Diagnostic Tests

These tests verify the integrity of the detector electronics and functions.

DIAGNOSTIC TESTS
CELL: INT   NOISE TEST: RDY

DAC RAMP: RDY   SCOPE TEST: RDY

P POWER   P CPU   P AES/SRS   * CELL DRIVE
P LAN   > DS3   * LEAK
Help Message
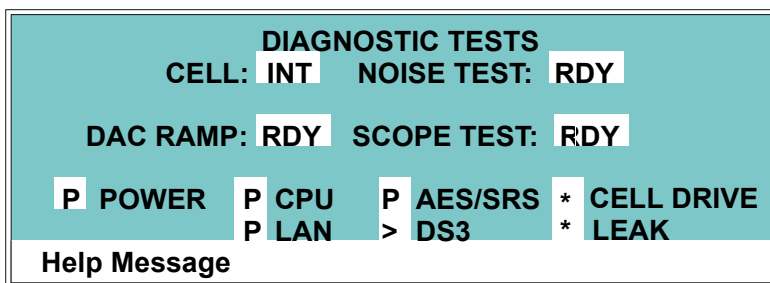
Figure C-25. Diagnostic Tests Screen

Screen Field	Description
CELL	Specifies whether the cell to be tested is internal (INT) or external (EXT).
NOISE TEST	Selects a cell for noise testing. The test modes are: RDY—The system is idle and ready to begin a test. CD—Selects a conductivity cell for testing. EC—Selects an amperometry cell for testing.
DAC RAMP	Selects the DAC test mode. The test linear ramps the output of the selected DA on the SP or SCR card from 0 to full-scale and can be plotted from either the recorder output or the chromatography software. The ramp test modes are: RDY—The system is idle and ready to begin a test. CDO—Tests the CD Offset DAC (eight iterations, one for each gain; the eighth iteration is flat on top). Disconnect the conductivity cell before running this test. REC—Tests the Recorder Output DAC. ECO—Tests the EC Offset DAC (two iterations; one for the ADC fine channel and one for the ADC coarse channel). Disconnect the amperometry cell before running this test.

Screen Field	Description
	ECD⎯Tests the EC Drive DAC. A full-scale ramp is repeated over and over until you exit the test or the screen. Disconnect the amperometry cell before running this test.
SCOPE TEST	Generates test waveforms that can be monitored on test points on the SCR and SP cards, using an oscilloscope or chart recorder. The test modes are:
	RDY⎯The system is idle and ready to begin a test.
	CDF⎯Tests the CD Offset DAC output (TP9 on the SP card) and the CD fine filter circuit (TP19 on the SP card). TP9 outputs a square wave with a frequency of 200 ms and an amplitude from 0 to -0.1 V. TP19 outputs a sine wave with a frequency of 200 ms. The peak-to-peak amplitude is 4.40 V.
	CDT⎯Tests the CD Temperature Compensation DAC (TP26 on the SP card). The output is a square wave in which the bottom and top amplitudes increase and decrease from 11 V to 12 V. Before running this test, connect the Dionex DS3 and set the temperature to 45 °C, or connect a dummy thermistor value of 42 $\kappa\Omega$ to pins 2 and 3 of the conductivity cell connector.
	SCR⎯Tests the SCR DAC for the Dionex DS3 set point temperature (TP13 on the SCR card) and suppressor current set point (TP17 on the SCR card). The output on each test point is a linear ramp that goes from 0 to 10 V in 2.5 seconds. Disconnect the Dionex DS3 and suppressor before running this test.
	PHD⎯Tests the pH DAC (TP10 on the SP card). The output is a waveform with an increasingly linear ramp that goes from approximately 0 to 0.87 VDC in 31 seconds, with a steep slope for the first 5.5 seconds of the ramp. The decreasing side of the ramp is 25.5 seconds in duration.

The following tests can be run from the **DIAGNOSTIC TESTS** screen. To begin a test, select the asterisk (*) in the field beside the test name and press **Enter**. When the test is complete, the entry field displays either **P** (pass) or **F** (fail).

NOTE   **Running the following tests disturbs the equilibration of the detector as services cycle on and off and the system runs through its test modes. After testing, allow the system to equilibrate before resuming operation.**

- POWER—Checks the +5, ±15, and +24 volt monitor on the Relay card.

- CPU—Checks the CPU internal configuration and the Moduleware checksum.

- DX-LAN—Checks the DX-LAN hardware configuration and loop-back.

- AES/SRS—Varies the suppressor power supply and checks the flags.

- DS3—Varies the Dionex DS3 temperature set point and checks the flags.

- CELL DRIVE—Switches in a resistor in place of the cell to provide a calibrated signal to read.

- LEAK—Checks the detector's leak sensor for a correct, open circuit, or short circuit condition.

C.2.8   Leak Sensor Calibration and Status

Dionex ED50A detectors shipped in June 2013 or later are not recommended for conductivity detection. Therefore, operational screens for the Conductivity mode are not described in this manual.

C.2.9   Signal Statistics

This screen enables you to monitor the selected input to the A/D circuitry. When the screen is first displayed, the **MAX** and **MIN** status values are equal to the **INPUT** value, and **DURATION** reads 0. Status values are reported in A/D volts and are updated dynamically.

```
              SIGNAL STATISTICS
   CELL:   NORM
   INPUT:  C FINE
      MAX:     n.nnn volts
      MIN:     n.nnn volts
   DURATION:  nnn.nn Minutes

 Help Message
```
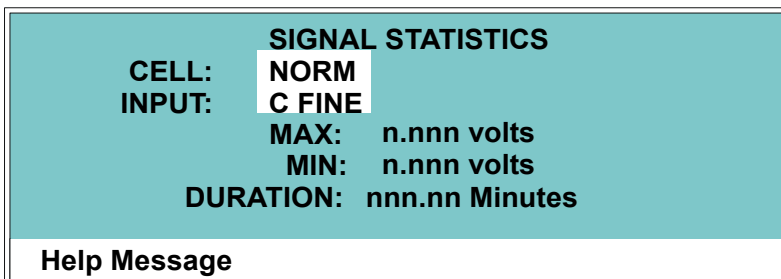
Figure C-26. Signal Statistics Screen

Screen Field	Description
CELL	Selects the cell test mode: NORM—Uses input data from the cell. FIXED—Uses a fixed dummy cell for input.
INPUT	The measured data from the A/D circuit: C FINE—Conductivity cell fine input C COARSE—Conductivity cell coarse input C THER—Conductivity cell thermistor input E FINE—Amperometry cell fine input E COARSE—Amperometry cell coarse input E pH—Amperometry cell pH input LEAK—Leak detector input DRIVE—Cell drive circuit input
MAX	The maximum input data value during the duration of the test.
MIN	The minimum input data value during the duration of the test.
DURATION	The duration (in minutes) of the test. The test starts when you enter this screen and terminates when you exit.

C.2.10 Calibrate Conductivity Cell

Dionex ED50A detectors shipped in June 2013 or later are not recommended for conductivity detection. Therefore, operational screens for the Conductivity mode are not described in this manual.

C.2.11 pH Calibration

This screen allows you to calibrate the pH reference electrode in the amperometry cell. (See Section B.5 for cell disassembly and assembly instructions.) The steps on the screen must be performed in sequence. Two calibrations are required.

- Do the first calibration at pH 7.0. With the electrode in pH 7.0 buffer solution, verify that the **MEASURED pH** field displays 7.0. If not, press **Select** and then **Enter**.

- Do the second calibration with another buffer solution of known pH; for example, pH 10.0.

NOTE **If you are using a NaCl reference electrode, select the Na correction type. This adjusts the detector's signal response for the NaCl electrode, rather than the default AgCl reference electrode.**

```
              pH CALIBRATION
  MEASURED pH:  7.00
   WITH THE ELECTRODE IN pH 7 BUFFER,
         SELECT 'CAL' AND PRESS ENTER:        RDY
 WITH ELECTRODE IN THE 2nd BUFFER
  ENTER 2nd BUFFER pH, PRESS ENTER:       10.0
 SELECT THE DESIRED CORRECTION TYPE:     NONE
   Help Message
```

Figure C-27. pH Calibration Screen

Screen Field	Description
MEASURED pH	Reports the pH measured from the electrode.

Screen Field	Description
SELECT CAL	**RDY** indicates no selection has been made. Calibration will not occur. Select **CAL** and press **Enter** to calibrate the electrode for pH 7.0.
2nd BUFFER	Enter the known pH of the second buffer solution. With the reference electrode in the second buffer solution, press **Enter** to perform the second calibration.
CORRECTION TYPE	Select **Na** to apply a correction for a NaCl electrode.

D • TTL and Relay Control

The strip of eight 2-pin connectors on the Dionex ED50A electronics chassis provides two relay outputs, two TTL outputs, and four TTL inputs (see Figure D-1).

• Connect the outputs to the TTL or relay inputs of a device to control functions in the connected device. The device must be compatible with the Dionex ED50A's TTL and relay signals.

• Connect the inputs to a device to control four detector functions.

Connection instructions are in Section D.1.
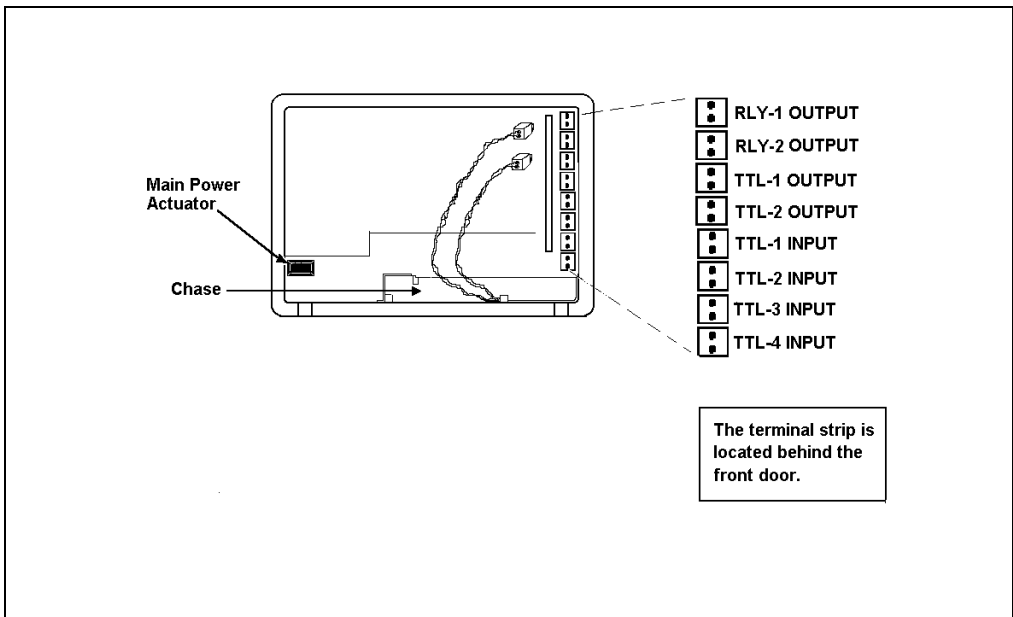
Figure D-1. TTL Connector Strip
(Dionex ED50A front view without door)

D.1   TTL and Relay Connections

The TTL/relay connector strip is located on the electronics chassis behind the upper door (see Figure D-1). Each 2-pin connector includes a signal pin and a ground pin.

1. Twisted pairs of wires (P/N 043598) and 2-pin connector plugs (P/N 921019) are provided in the Dionex ED50A Ship Kit. Attach a 2-pin plug to each end of the twisted pair of wires to be connected. The signal wire goes on the top of each plug; the ground wire goes on the bottom.

2. Connect these plugs to the TTL or relay connectors on the Dionex ED50A and the other module(s) as needed for your application. Check the polarity of each connection. Connect signal wires to signal (+) pins and ground wires to ground (-) pins. If necessary, remove wires from the 2-pin plugs and reinsert them in the correct positions.

3. Route the wires from the Dionex ED50A electronics chassis through the upper chase to the rear panel.

> **NOTE**   **For Relay/TTL connector pinouts, see Table F-3 in Appendix F. Connections 1 and 2 can be programmed to switch any low-voltage control. Switched current must be less than 200 mA and 42 V peak.**

⚠ **CAUTION**

The relay outputs, TTL inputs, and TTL outputs all use a connector of the same style. Do not inadvertently connect relay loads that include power supplies to the TTL inputs or TTL outputs. Relay loads in excess of 200 mA or with included power supplies over 42 V may damage the relay drivers on the CPU module.

D.2 TTL and Relay Output Operation

The Dionex ED50A provides two TTL outputs and two relay contacts for control of functions in external devices such as an integrator, autosampler, or another Thermo Scientific module.

After connecting the TTL and Relay outputs (see Section D.1), toggle the output states on and off from either the **DETAIL** screen or **METHOD** screen. The **METHOD** screen allows programming of the output states in method steps for timed operation.

- To turn on a TTL or relay output, set the corresponding output field on the **DETAIL** screen or **METHOD** screen to **1** (closed).

- To turn off a TTL or relay output, set the corresponding output field to **0** (open).
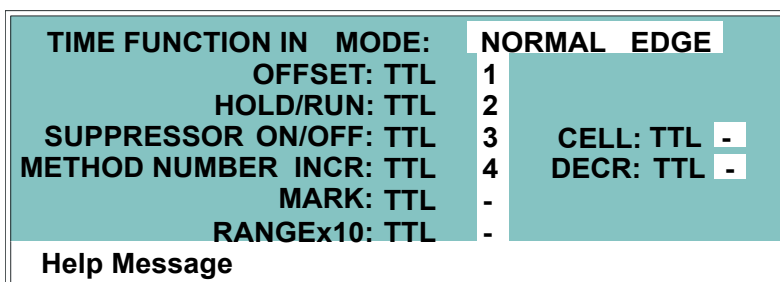
```
DETAIL SCREEN          DC AMPEROMETRY    TTL1  0
OUTPUT    128.2   nA          CELL  ON    TTL2  1
OFFSET     58.7   nA         RANGE  200 nA  RLY1  1
  TOTAL   184.9  nA           REF  Ag     RLY2  0
     pH    12.2
                  POTENTIAL  +  0.80  V
    LOCAL               METHOD  05      123.45  MIN
  Help Message
```

Figure D-2. Detail Screen (DC Amperometry Mode)

D.3   TTL Input Operation

D.3.1   TTL Input Signal Modes

The Dionex ED50A TTL inputs respond to four types of signals to accommodate different types of device output signals. The default signal mode, normal edge, is compatible with the output signals provided by Thermo Scientific Dionex modules. If the device connected to the Dionex ED50A outputs a different signal type, select the appropriate signal mode from the **TIME FUNCTION IN** screen (see Figure D-3).

```
TIME FUNCTION IN   MODE:    NORMAL   EDGE
              OFFSET: TTL   1
            HOLD/RUN: TTL   2
    SUPPRESSOR ON/OFF: TTL  3     CELL: TTL  -
  METHOD NUMBER  INCR: TTL  4     DECR: TTL  -
                MARK: TTL   -
             RANGEx10: TTL   -
  Help Message
```

Figure D-3. Time Function In Screen

The four input signal modes are:

- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the function and the positive (rising) edge turns off the function (see Figure D-4).

- *Inverted Edge*: The inverted edge mode works identically to the normal edge mode, except that the positive and negative edges are reversed in function.

- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.

  The minimum pulse width guaranteed to be detected is 50 ms. The maximum pulse width guaranteed to be ignored as noise or invalid is 4 ms. The action of the Dionex ED50A is undefined for pulses less than 50 ms or greater than 4 ms.

- *Inverted Pulse*: The inverted pulse mode operates identically to the normal pulse mode, except that the positive and negative edges are reversed in function.
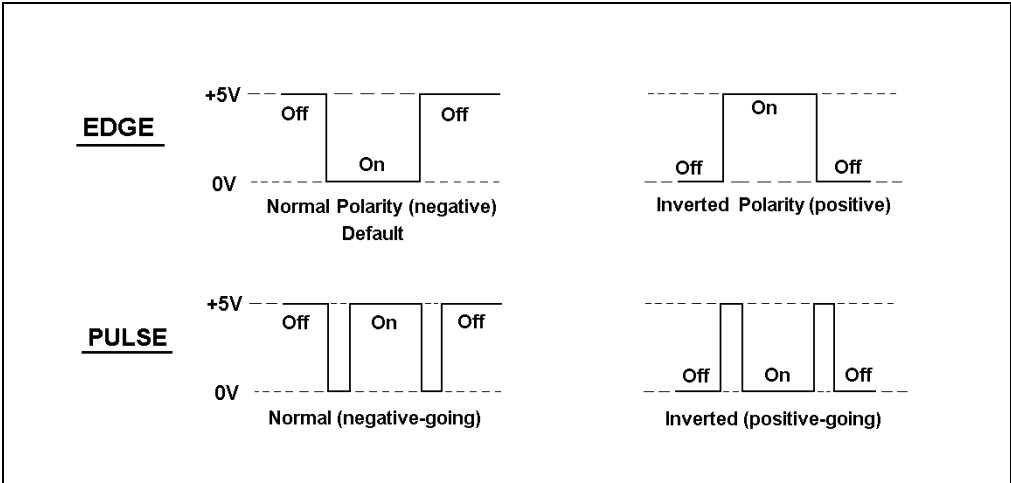
Figure D-4. TTL and Relay Input Signal Modes

D.3.2   TTL Input Functions

The four TTL inputs can be connected to devices capable of providing TTL output signals. Signals from the connected devices can control up to four of the functions listed in the table below. Use the **Select** buttons on the **TIME FUNCTION IN** screen (see Figure D-3) to assign TTL1 through TTL4 to any four of the functions.

TTL Controlled Function	Description
OFFSET	Returns the analog (recorder) output to a predetermined baseline and zeros the display.
HOLD/RUN	Controls the detector method clock. A signal from the controlling device can turn the method clock on (Run) and off (Hold/Reset). Hold/Reset resets the method clock to zero and executes **INIT** conditions.
SUPPRESSOR OFF/ON	Turns the suppressor (Dionex SRS or AES) current off and on.
METHOD NUMBER INCRement	Increases the method number by one. Each additional signal increases the method number by one more.
	When the method clock is zero (or **INIT**), increasing the method number executes the **INIT** conditions of the new method. When the method clock is greater than zero, increasing the method number begins running the new method at the current elapsed method clock time. This has the same result as selecting a new method number when the detector is in Local mode.
METHOD NUMBER DECRement	Decreases the method number by one. The operation is as described under TTL input 3 above, except that the method number decreases.
MARK	Sends a 10% positive event mark to the analog (recorder) output.
RANGE x10	Sets the analog output scale factor between 0.01 and 3000 μS.
CELL	**Amperometry mode only:** Turns the cell off and on.

E • Signal Processor Functions

Table E-1 lists the functions of the Signal Processor (SP) card.

Function	DC Amp.	Int. Amp.	Volt.
5 mS noise filter	X		X
DC amplifier 100 mS filter	X		
Bipolar cell drive analog-to-digital filter	X	X	X
Amperometry cell drive smoothing filter	X	X	X
pH slope and offset corrector	X	X	X
Cell receiver/driver	X	X	X
Fine and coarse integrators		X	
Signal selection (MUX)	X	X	X
16-bit analog-to-digital converter	X	X	X
Digital interface	X	X	X

Table E-1. SP Card Functions

F.1 Recorder/Diagnostic Signal Pinouts

This section describes the Recorder/Diagnostic Signal pinouts. The connector is supplied plugged into the socket. The pins are numbered consecutively from 1 to 10 (top to bottom).

Pin	Signal
1	Recorder Negative
2	Recorder Positive
3	Suppressor Supply Voltage
4	Dionex DS3 Supply Current
5	Conductivity Cell Flow Stream Temperature
6	Amperometry Cell Flow Stream pH
7	Amperometry Cell Voltage, Working to Reference Electrode
8	+10 V Reference from SCR Card
9	Integrated Amperometry Scope Sync. Pulse
10	Common Ground for Signals 3 through 9

Table F-1. Recorder/Diagnostic Cable Pinouts

F.1.1   Signal Electrical Parameters

Pin 1   Attach the negative input of the chart recorder to pin 1.

Pin 2   Select the full-scale output range setting (0 to 0.01 V, 0 to 0.1 V, or 0 to 1.0 V) on the **ANALOG OUT SETUP** screen (see Section C.1.15).

Ilya The output resistance is 1 to 2 kΩ.

Pin 3   The voltage is equal to that developed across the suppressor, where the measured voltage equals the suppressor voltage divided by 15. The suppressor is driven by a regulated current source.

The output resistance is 10 kΩ.

Pin 4   The voltage is proportional to the Dionex DS3 heater current. The maximum heater power produces approximately 1.2 V.

The output resistance is 5 kΩ.

Pin 5   The voltage is related to the inverse exponential of the temperature. Table F-2 lists the amperometry flow stream temperatures.

The output resistance is 1 kΩ.

pH	Volts
0	-0.7
1	-0.6
2	-0.5
3	-0.4
4	-0.3
5	-0.2
6	-0.1
7	0.0
8	0.1
9	0.2
10	0.3
11	0.4
12	0.5
13	0.6
14	0.7

Table F-2. Amperometry Cell Flow Stream Temperatures

F.2 TTL/Relay Pinouts

The TTL and Relay connectors are on the DX-LAN/Relay card. The TTL and Relay connectors all have the same pinout configuration; be careful to use the correct connector.

Connector Number	Pin Number	Description
1	1 and 2	Solid State Relay Contacts Out
2	1 and 2	Solid State Relay Contacts Out
3	1	TTL Out (1 kΩ pull up to +5, 100 mA sink)
	2	Ground
4	1	TTL Out (1 kΩ pull up to +5, 100 mA sink)
	2	Ground
5	1	Input TTL 1
	2	Ground
6	1	Input TTL 2
	2	Ground
7	1	Input TTL 3
	2	Ground
8	1	Input TTL 4
	2	Ground

Table F-3. TTL/Relay Connector Pinouts

F.3   Amperometry Cell Connector Pinouts—SP

The amperometry cell connects to the SP card. The amperometry cell connector is a single-row, shielded BERG-type latching connector. With the connector on the cable facing you and the open metal shield on the left, pin 1 is at the top.

Pin Number	Description	Color (inside cable)
1	Ground Counterelectrode	Black
2	Working Electrode	Red
3	pH Reference Electrode pre-amp out	Brown
4	Ag/AgCl Reference Electrode pre-amp out	Orange
5	+15 V	Yellow
6	-15 V	Blue
7	Amperometry Cell Disconnect	Green
8	Spare	Purple

Table F-4. Amperometry Cell Connector Pinouts

G • Reordering Information

Part Number	Item	Quantity
065038	Amperometry cell	1
060082	AAA-Direct disposable gold working electrode	6, with 2 gaskets (2.0 mil)
060140	AAA-Direct disposable gold working electrode	4 pkgs. of 6, with 8 gaskets (2.0 mil)
060139	Carbohydrate disposable gold working electrode	6, with 2 gaskets (2.0 mil)
060216	Carbohydrate disposable gold working electrode	4 pkgs. of 6, with 8 gaskets (2.0 mil)
064440	Platinum disposable electrode	6, with 2 gaskets (0.002 in)
063003	Silver disposable electrode	6, with 2 gaskets (0.002 in)
069336	Carbon on PEEK disposable working electrode	6, with 2 gaskets
066480	Gold on PTFE disposable working electrode	6, with 2 gaskets
060141	Disposable working electrode gasket, 2.0 mil	4
045972	Amperometry cell gasket, 1.0 mil	1
048749	Amperometry cell bracket	1
045937	Wing screw	1
045796	Cell mounting screws	1
044198	pH reference electrode	
046333	Reference electrode	1
045967	Reference electrode stop ring	1
048410	Reference electrode O-ring	1
057192	Reference electrode O-ring retainer	1
036313	Polishing Kit	1
036319	Coarse polishing compound	1
036318	Fine polishing compound	1
036321	Polishing pads	1

Part Number	Item	Quantity
043276	Dionex ferrule fittings	1
043275	Fitting bolts, 10-32	1
042690	Tubing, 0.25-mm (0.010-in) ID (for cell inlet connection)	Varies with installation site
043598	Twisted black-and-red wires (for recorder/diagnostic and TTL/Relay connections)	1
921019	TTL connector plugs (green)	1
954745	Fuse, 3.15 amp (fast-blow IEC127, type 1)	2

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