USER'S MANUAL

L2000® DXT

CHLORINATED ORGANICS

DEXSIL®

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Introduction to the L2000$_{DXT}$ Analysis System

Congratulations on your purchase of the **L2000$_{DXT}$** Analyzer, a versatile analysis system suitable for the analysis of a wide variety of chlorinated organic compounds in a variety of matrices. The basic principal of the **L2000$_{DXT}$** system is to measure the total organic chlorine content of a sample and equate that to an equivalent concentration of the target or expected analyte. If all of the organic chlorine present is assumed to be derived from the target analyte, then an upper limit is established for the compound in question. (If other organic chlorines are present, in addition to the target analyte, they will be counted as the target analyte.) To accomplish this, all of the organically bound chlorine must be converted into inorganic chloride and the resulting chloride quantified. Once the total chlorine content of the sample is known, a conversion factor is used to convert the chloride concentration into an equivalent concentration of the target analyte. If the contaminant is known, the resulting concentration estimates will accurately correlate with the actual concentration of the analyte in the sample as determined by confirmatory analysis in the lab. If the contaminant is unknown, a conservative or worst case conversion factor is chosen to provide an upper limit for the concentration of the target analyte in the sample.

There are three basic steps involved in the chemical analysis for total halogen by the **L2000$_{DXT}$**:

- Sample Preparation
- Conversion to Inorganic Chloride
- Quantification

The sample preparation step determines the type of chlorine detected, i.e., organic, inorganic, or total, and is matrix dependent. The sample preparation can be as simple as collecting a transformer oil sample, or can involve the extraction of a soil or water sample. In the case of a wipe sample, the surface is wiped and the wipe-gauze is extracted. The steps involved in the conversion to inorganic chloride reaction and the chloride quantification are the same for all matrices. The steps in the conversion to inorganic chloride involve the reaction of the sample with metallic sodium and the extraction of the resulting chloride into an aqueous buffer system. A chloride specific electrode is used to quantify the extracted chloride. Using stored conversion factors, the chloride value is then converted to an equivalent concentration of analyte.

Sample Preparation

The **L2000$_{DXT}$** can be used to analyze the following matrices:

- Transformer Oil
- Soil
- Water
- Surface Wipe

Each matrix requires different preparation prior to the conversion reaction step and subsequent quantification. Each of the matrix preparation steps are described in detail under **Sample Preparation.**

The routine analysis of transformer oil requires no sample preparation other than to collect a clean sample without introducing any extraneous sources of chloride into the sample, such as perspiration or road salt. This is important because, for transformer oil, there is no sample cleanup procedure to remove inorganic chloride contamination. Once collected, the sample is reacted and the resulting chloride is extracted and quantified.

The chlorine quantified in this case is the total chlorine contained in the sample. Transformer oil is typically free of inorganic chlorine, eliminating the need for any sample cleanup procedure. In special cases where transformers have failed due to water contamination or have been removed for service and stored in areas near seawater or road salt, inorganic chloride may cause an elevated reading.

Before a soil sample can be analyzed, the organic contaminants must be extracted using an organic solvent. Because soil samples invariably contain inorganic chlorine, the soil extract is cleaned up to remove all traces of the inorganic chloride. The cleaned extract is then reacted and the resulting chloride is quantified. For soil analyses, only the organic chlorine content is ever quantified. Extraneous sources of chloride contamination such as road salt or sea salt are **not** detected.

As with soil samples, a water sample must also be extracted prior to final analysis. The ratio of the solvent volume to the sample volume determines the sensitivity of the test. The extract is reacted and the chloride is quantified as above. In water samples, only the organic chlorine is quantified.

Wipe tests require that a specific area be wiped using a hexane-soaked gauze. The gauze is extracted with an organic solvent, reacted, and the chlorine content determined. For wipe samples, the standard procedure eliminates most all inorganic chlorine contamination. Areas with very high surface concentration of salts may need to be prepared differently.

Chloride Conversion Reaction

Once the sample has been prepared, the remaining chloride conversion steps are the same for all sample types. The conversion step is a reaction of the sample with an excess of metallic sodium in the presence of a catalyst to convert the covalently bound organic chlorine into free chloride ions. This reaction of metallic sodium with organo-chlorine compounds is vigorous and goes to completion, converting all of the organic chlorine to chloride.

Quantification

Upon the completion of the conversion reaction, the resulting chloride ions are extracted into an aqueous buffer. The chloride content in the final extract/buffer is then quantified using a chloride specific electrode and converted to an equivalent analyte concentration using the conversion factors programmed into the chosen analysis method of the instrument. The conversion factor is made up of the percent chlorine, the sample size multiplier, and the extraction efficiency multiplier. The analyte concentration is determined by first subtracting the blank from the raw chloride reading (except when the Blank Subtraction has been turned off),

and the resulting corrected chloride value is multiplied by the size and extraction multipliers and divided by the chloride fraction (percent chlorine divided by 100):

$$[\text{Analyte}] = ([Cl^-]_{raw} - [Cl^-]_{blank})(\text{size multiplier})(\text{extraction multiplier})/(\text{chlorine fraction})$$

The **L2000$_{DXT}$** Analyzer comes preprogrammed with 28 methods providing for analysis of a large number of organo-chlorine compounds in most matrices. Correction factors are preprogrammed to account for all of the steps necessary to run samples using the standard prepackaged reagents. If the procedures are modified or other analytes are expected, up to 20 custom methods can easily be built.

The operational program of the **L2000$_{DXT}$** has been designed to provide the most versatile data reduction platform possible for the analysis of chlorinated organic compounds in a variety of matrices. At the same time, the program is easy to use for routine analysis and does not require custom method development.

Unpacking

The **L2000$_{DXT}$** is shipped in its own carrying case, complete with all the hardware necessary for operation. Upon receiving the **L2000$_{DXT}$** Analyzer, please verify that all of the items listed below are present and in good working order.

The carrying case for the **L2000$_{DXT}$** Analyzer should contain the following items:

L2000$_{DXT}$ Electronic PCB/Chloride Analyzer
Power cube AC-DC transformer
Portable electronic balance & 100 g Calibration weight
5 mL pipettor
Vial rack
Timer
Marking pen
USB thumb drive
Two empty 20 mL glass vials for RINSE and CALIBRATION solutions
User's Manual, Certificate of Calibration and MSDS

NOTE: DO NOT return meter to case with USB Drive installed.
In addition to the aforementioned items in the carrying case, the following should be included in the same outer shipping box:

Chloride-ion specific electrode[1]
Packet of polishing strips[1]
Test tube rack

[1] These items are shipped in their original packaging from Orion. Once they have been unpacked, they should be carried in the right-hand slot in the carrying case.

To prevent damage to the instrument in the case of a leak, the sample preparation reagents are shipped separately. The exact makeup of the reagent pack will depend on the specific reagent option chosen at the time of ordering. The options available for the **L2000$_{DXT}$** and the components contained in each are the following:

Option 1: Reagents for 40 Oil Test

1 - 250 mL bottle of EXTRACT solution
1 - 250 mL bottle of RINSE solution
1 - 250 mL bottle of CALIBRATION solution
1 - 60 mL bottle of Electrode Filling Solution
1 - tray of 40 empty 20 mL glass vials
1 - box of tissue wipes
1 - **shelf-pack** containing (in a heat sealed foil bag):
  40 - filters
  40 - pipettes
  40 - reaction tubes (black dispenser caps)

Reorder Part No: (LP-ORK)

Option 2: Reagents for 20 Soil Tests (Standard Procedure)

1 - 250 mL bottle of EXTRACT solution
1 - 250 mL bottle of RINSE solution
1 - 250 mL bottle of CALIBRATION solution
1 - 60 mL bottle of Electrode Filling Solution
1 - box of tissue wipes
1 - **40-cell box** containing:
  20 - empty 20 mL glass vials
  20 - bottles containing Soil Extraction Solvent
1 - **shelf-pack** containing (in a heat sealed foil bag):
  20 - filters
  20 - pipettes
  20 - reaction tubes (black dispenser caps)
  20 - metal scoops for obtaining soil samples
  20 - 10 mL plastic syringes
  20 - drying columns (foil packed)
  20 - empty test tubes with white caps

Reorder Part No: (LP-SRK)

Option 2a: Reagents for 20 Soil Tests (Two-Step Extraction Procedure)

1 - 250 mL bottle of EXTRACT solution
1 - 250 mL bottle of RINSE solution
1 - 250 mL bottle of CALIBRATION solution
1 - 60 mL bottle of Electrode Filling Solution
1 - box of tissue wipes
1 - set of instructions
1 - **40-cell box** containing:
  20 - empty 20 mL glass vials

20 - 6 mL black-capped water vials
1 - **shelf-pack** containing (in a heat sealed foil bag):
20 - empty 25 mL soil tubes
20 - filter funnels
20 - pipettes
20 - reaction tubes with black dispenser caps
20 - break-top vials containing Soil Extraction Solvent
20 - metal scoops for obtaining soil samples
20 - syringe filters (in a heat sealed foil bag)
1 - set of instructions

Reorder Part No: (LP-SR2)

Option 3: Reagents for 20 Water Tests

1 - 250 mL bottle of EXTRACT solution
1 - 250 mL bottle of RINSE solution
1 - 250 mL bottle of CALIBRATION solution
1 - 60 mL bottle of Electrode Filling Solution
1 - box of laboratory wipes
1 - **40-cell box** containing:
20 - empty 20 mL glass vials
20 - bottles of Isooctane
1 - **shelf-pack** containing (in a heat sealed foil bag):
20 - filters
20 - pipettes
20 - reaction tubes (black dispenser caps)
20 empty test tubes with white caps
1 - set of instructions

Reorder Part No: (LP-WTR)

Option 4: Reagents for 20 Wipe Tests

1 - 250 mL bottle of EXTRACT solution
1 - 250 mL bottle of RINSE solution
1 - 250 mL bottle of CALIBRATION solution
1 - 60 mL bottle of Electrode Filling Solution
1 - box of tissue wipes
2 - pair of safety goggles (1 pair/10 tests)
2 - pair of neoprene gloves (1 pair/10 tests)
1 - **shelf-pack** containing (in a heat sealed foil bag):
20 - filters
20 - pipettes
20 - reaction tubes (black dispenser caps)
20 - hexane ampules
20 - empty test tubes with white dispensing caps
1 - **box** containing:
20 - gauze pads in 20 mL glass vials
20 - 10 mL glass bottles containing Extraction Solvent (isooctane)

1 - **box** containing:
20 - empty 20 mL glass vials
20 - forceps
1 - set of instructions

Reorder Part No: (LP-WIP)

NOTE: DO NOT STORE REAGENTS IN THE INSTRUMENT CARRYING CASE, AS ANY LEAKS WILL DAMAGE THE INSTRUMENT.

Initial Set Up

Once the **L2000$_{DXT}$** has been unpacked, the components checked and the contents of the reagent pack verified, the **L2000$_{DXT}$** can be set up for analysis. Locate the vial rack, the two empty 20 mL vials and the bottles of RINSE and CALIBRATION solutions. Remove the caps from both vials and label one 20 mL vial "RINSE" and the other "CAL". Fill each vial approximately ½ full with the appropriate solution and set in vial rack. (NOTE: It is helpful to label the rack with the location of the RINSE and CAL vials.) These solutions will be used for the initial setup and calibration of the electrode. They will also be used periodically to re-calibrate the electrode and check the electrode output. Once set up, the electrode should remain in the RINSE solution when not in use.

Prior to running the Analyzer on battery power, it should be charged overnight using the power cube supplied with the instrument. The Analyzer can be operated from line power while the battery is charging and should be left plugged in whenever AC power is available.

Restoring the Electrode after Extended Storage

The electrode is shipped empty and should be stored empty whenever it will be left for an extended period of time or placed in the carry case (see **Electrode Care and Maintenance**). To restore the electrode to operating condition:

1. Remove protective cap from the tip of the electrode.

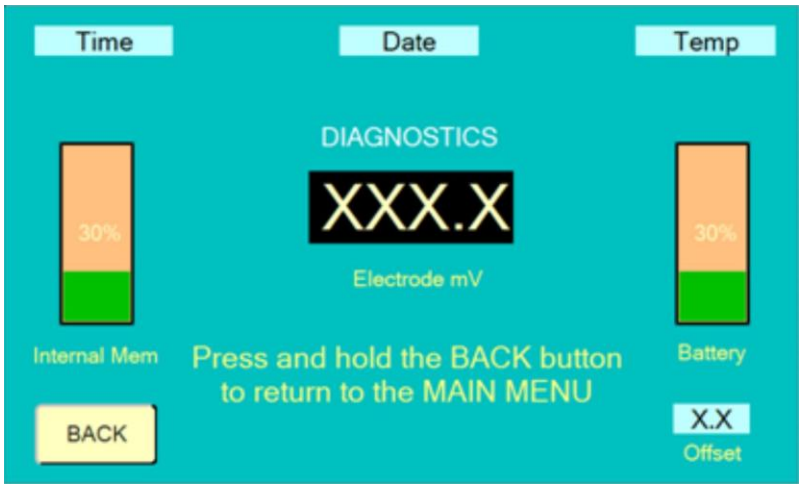
2. Fill the electrode, up to the filling hole in the side, with the Orion Electrode Filling Solution supplied with each lot of reagents. To fill, place the nozzle of the fill solution bottle into the hole on the side of the plastic body and gently squeeze the fill bottle.

3. Drain the electrode, while holding it upright over the waste beaker, by grasping the body of the electrode firmly in one hand and pushing down on the black cap where the cord enters the electrode. The filling solution will drain out of the bottom of the electrode.

4. Refill the electrode and make sure that the fill solution is making contact between the black cone and the plastic shell at the bottom of the electrode. If it is not making contact at all points, drain the electrode again and refill.

5. Connect the electrode to the BNC connector labeled "Electrode" on the back of the **L2000$_{DXT}$** Analyzer and check electrode output.

6. To check the electrode, turn the Analyzer on by pressing the ON Button on the back panel of the instrument. From the **START SCREEN** press ENTER to open the **MAIN MENU**. At the **MAIN MENU**, press DIAG to open the **DIAGNOSTICS** screen. This display:



will indicate the current system information and then continuously update the electrode output in millivolts (mV). Place the electrode in fresh RINSE solution, gently swirl the solution with the electrode and allow to equilibrate. The electrode output should reach 140 mV or greater within 1 minute. If the electrode output does not reach at least 140 mV by the time the 2 minute buzzer sounds, empty the RINSE solution and refill with fresh RINSE solution. If this does not improve the electrode output, drain the electrode, refill it with filling solution and check the output again. NOTE: When setting up the **L2000$_{DXT}$** after the unit and/or electrode has been in storage or is brought from a colder/warmer environment, it is important to allow both the unit and the electrode to equilibrate for as long as possible. It could take up to an hour for the electrode to equilibrate. Once the output is greater than 140 mV, the electrode is functioning correctly and it is safe to proceed with measurements. If the electrode output does not reach 140 mV, see under **Troubleshooting** for remedies.

NOTE: The update rate for the **DIAGNOSTICS** screen is 10-20 seconds, any keys pressed will not register until the end of the current measurement cycle. Therefore, to exit the **DIAGNOSTICS** screen, the BACK button must be pressed until the meter registers the input.

Basic Operation of the L2000DX

General Information

The **L2000$_{DXT}$** meter is equipped with NiMh (Nickel Metal hydride) batteries and can be operated with or without the wall adaptor. A fully charged battery should be sufficient to operate for a full 8-hour day of sample analyses. To preserve the battery, the unit should be plugged into an AC outlet whenever possible.

The operation of the **L2000$_{DXT}$** is controlled by a program organized into a series of "screens". A screen prompts the user for appropriate input or displays output from the processor. There are two screens at the beginning of the program that will be referred to throughout the text. They are, the **START SCREEN** which appears when the analyzer is turned on and is returned to when turning the meter off manually, and the **MAIN MENU** which is the next screen in sequence. All of the functions of the meter can be accessed from the **MAIN MENU**.

From the **MAIN MENU**, the functions available are:

- **Header Management**
- **Analysis**
- **Choose a Method**
- **Help**
- **Data Management**
- **Settings**
- **Diagnostics**

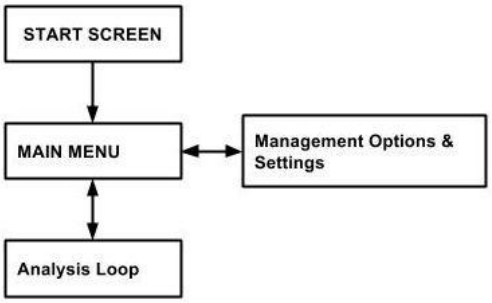
Header Management is used for adding or changing unique identifying information stored in the header of each data file. Access to the main analysis loop for sample analysis is through the **Analysis** button. **Choose a Method** is used to create, edit or select a new method. Pressing **Help** will open the help screens. The **Data Management** option is used to export, review and delete data stored in internal memory. Under **Settings** changes can be made to the time and date. The temperature probe can be disabled from this screen. **Diagnostics** function is available to check the functioning of the electrode.

Most screens will have, in addition to the information or choice specific to the screen, a BACK button and an ENTER button. The BACK button will always bring the user back to the **MAIN MENU** and the ENTER button will complete a screen's transaction, saving any changes or storing any choices and moving to the next screen in sequence. Other active buttons on a given screen may redirect the program operation to other screens or may cause a "pop-up" screen to appear requiring input. Where appropriate, some screens will display the current time, date, and temperature.

Prior to turning the instrument on, the samples should be already prepared as described in Sample Preparation and the extracts allowed to cool for 5 minutes.

To analyze a sample using a System Method from the method list, turn the unit on, press ENTER to get to the **MAIN MENU** and then choose the Analysis button to enter the **Analysis**

Loop. Once in the loop, the program will prompt the user to chose a method, calibrate the electrode, enter a blank and enter a sample ID. Samples can be analyzed without recalibration for up to an hour or 20 samples whichever comes first. When appropriate, the program will prompt for recalibration. (See below for a block diagram of the program.)



Once in the **Analysis Loop**, the Analyzer must be calibrated. The calibration procedure is a single point calibration using a 50 ppm chloride CALIBRATION standard supplied with each batch of reagents. This calibration must be repeated approximately every 20 measurements, every hour or if the ambient temperature varies by more than 5°C, whichever comes first. A counter, a timer, and a thermistor have been built into the instrument to prompt the user for recalibration when necessary. During the calibration procedure, the function of the electrode will also be evaluated. If the electrode potential for the calibration solution is not within the acceptable limits (50 mV – 75 mV), a warning will be displayed and the program will return to the **MAIN MENU**. From the **MAIN MENU** choose DIAG to determine if the electrode is working. (See below under **Diagnostics**.)

Following a successful calibration, the next step is to choose what type of blank to use. Choosing to use the current blank will take the program directly to the SAMPLE ANALYSIS screen. The meter is now ready to measure the prepared samples.

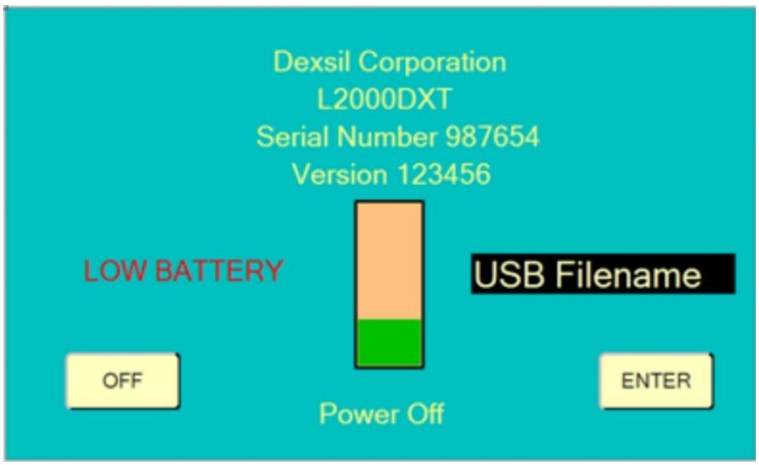
Each time the READ button is pressed, the program prompts for a new sample ID followed by a prompt to place the electrode into the sample. Pressing READ from the prompt screen will initiate the READ sequence. Once the electrode output has stabilized, the meter will display the calculated result along with the relevant sample parameters. Further readings are initiated by pressing the READ button and can be continued from this screen until the recalibration limits have been reached.

Navigating the Operating Program

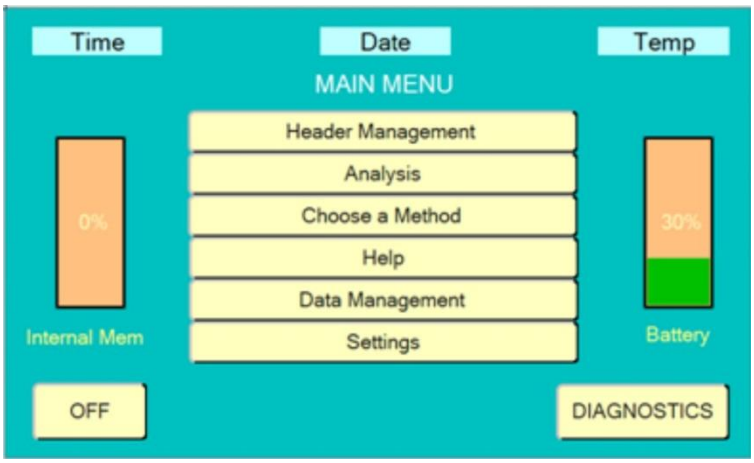
For an overview of the operating program see Appendix D

NOTE: Prior to turning the instrument on, the samples should be already prepared as described in Sample Preparation and the extracts allowed to cool for 5 minutes.

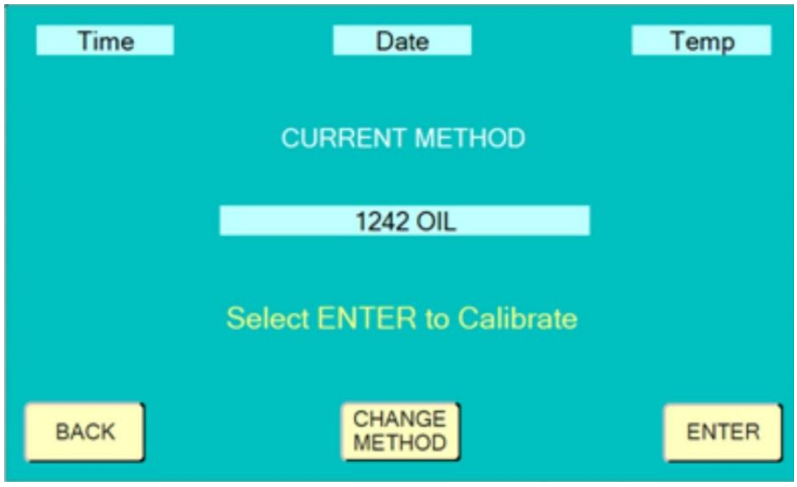
Turn on the Analyzer by pressing the **On** Button on the back panel of the instrument. Press the ON button only once, **DO NOT HOLD**. After a few seconds, the **START SCREEN** will then open. Displayed on the **START SCREEN** should be the serial number of the unit along with the software version number. If a USB drive is plugged in, the name of the data file on the drive will be displayed, otherwise the message *"No Device Found"* will appear. The Analyzer is ready to accept instructions. (If the battery voltage is below the safe limit, the message "*Low Battery*" will appear and the unit will automatically shut off)
NOTE: If the unit does not turn on or the display flickers and turns off, the batteries may be too low to use. Plug the unit in and wait a minute before proceeding with the unit plugged in.



From the **START SCREEN** press ENTER to open the **MAIN MENU:**



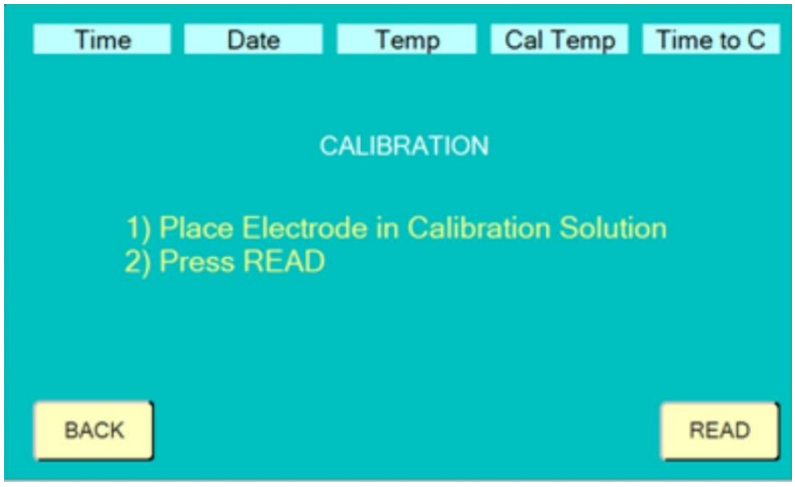
Once in the **MAIN MENU,** select the desired option to proceed. To begin sample analysis, using the previously chosen Method, select Analysis to enter the Analysis Loop, either choice will open the **CHOOSE A METHOD** screen:



Displayed on the screen, along with the current time, date and temp, will be the current method. After verifying that the displayed method is the desired one, press ENTER to select it to move on to the **CALIBRATION** screen.

Calibration

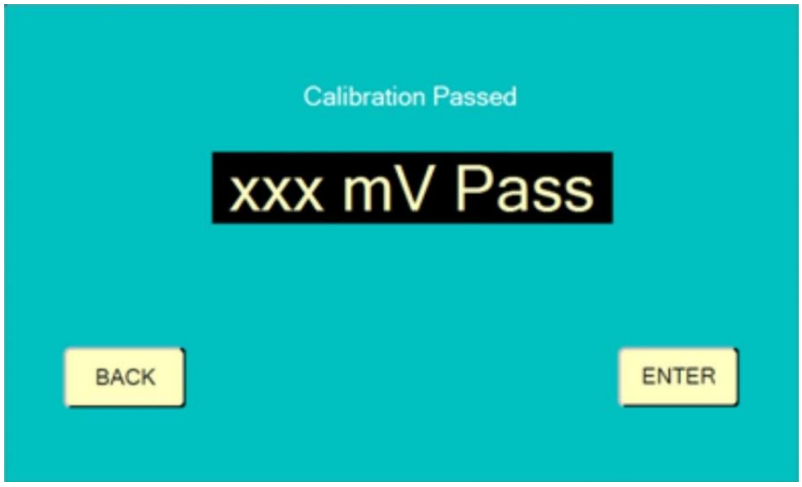
The first step required before any measurements can be made is to calibrate the electrode. The program will jump to the **CALIBRATION** screen when a new method is selected, when the temperature has changed by more than 5°C, or when the calibration timer or counter has triggered. After placing the electrode in the CAL solution, press READ.



A progress timer will display then the final result indicating the mV reading of the electrode.

The acceptable values are 50 to 75 mV. If the reading is outside this range, the screen will display a failure message:

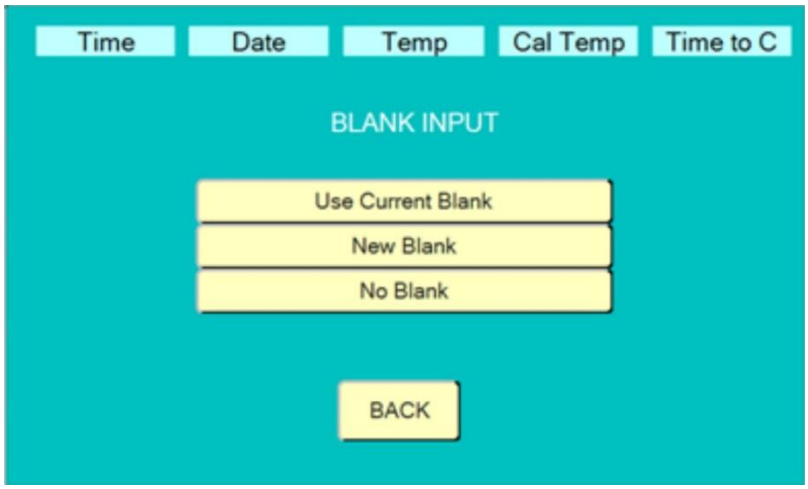
Pressing BACK will return to the **MAIN MENU** screen. If the calibration voltage is acceptable, the "pass" message will appear:



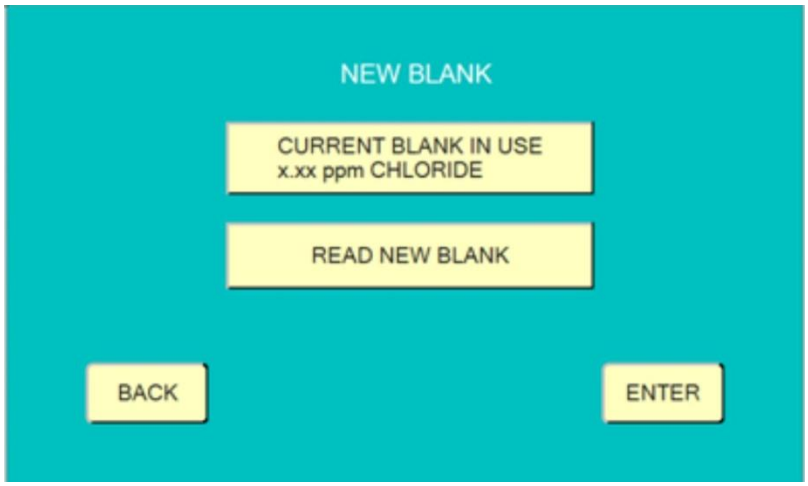
Pressing BACK will return to the **MAIN MENU** and ENTER will jump operation to the **BLANK INPUT** screen.

Blank Determination

Once the electrode has been successfully calibrated, the meter is now ready to measure the prepared samples. Pressing ENTER on the **PASS** screen will bring up the **BLANK INPUT** screen:



To use the current stored blank (displayed in the box) simply press Use Current Blank. This will keep the blank that is displayed and no further input is required before entering the ANALYSIS LOOP. To measure a new blank solution or enter a new blank value from the keypad, touch the New Blank button and the **NEW BLANK** screen will open with 2 choices for entering a new blank.



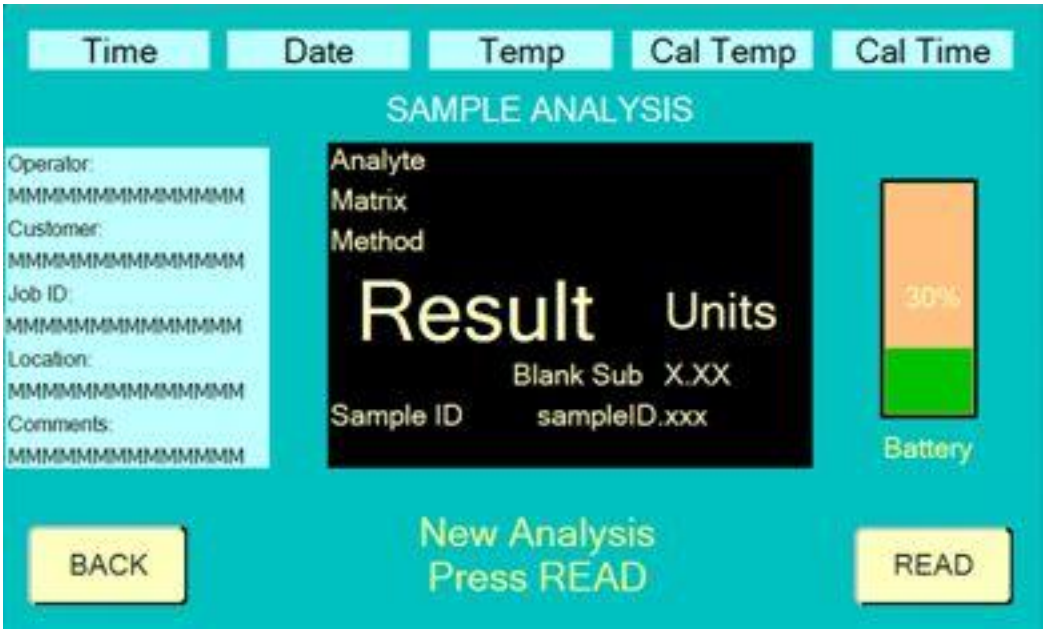
Touching the Current Blank in Use button will open a numeric keypad for manual entry of the desired blank. (NOTE: It is a good practice to periodically measure a "reagent" blank to keep tabs on how the meter is working and to verify that the current lot of reagents is free of extraneous chloride. Keep the blank readings handy and build a "running average" of the blank for each lot of reagents and use it as the blank for measurements.)

Touching the Read New Blank button will open a prompt screen, at which time, put the electrode in the freshly prepared and cooled reagent blank and press read. If the measured blank is within the acceptable range, the program will proceed to the **SAMPLE ANALYSIS** screen and the actual analysis can begin.

Pressing No Blank will set the current blank to zero and proceed to the **SAMPLE ANALYSIS** screen.

Analysis

Prepare the samples for analysis as described under **Sample Preparation**. Once the samples have been prepared and allowed to cool for at least 5 minutes, the method chosen, and the meter calibrated (including any blank determination), analysis can begin. The **SAMPLE ANALYSIS** screen will display instructions and options to complete the analysis. At this time, check to see if the displayed information is correct for the header information, the method chosen, and the blank in use.



Pressing the READ button from this screen will open the **SAMPLE IDENTIFICATION** screen where a custom identifier can be added to each sample of up to 9 characters in length using the pop-up alpha-numeric keypad. A three digit numeric extension will be added to the ID and will automatically increment if the name is re-used without a change. Once the sample ID has been entered, press ENTER to save the ID and begin measurement. NOTE: The meter will prompt for the electrode to be placed in the sample **before** pressing READ. Pressing READ will begin the read cycle, a progress bar will indicate how far along the convergence process is as a percentage of the maximum 2 minutes allowed. Up to 20 samples can be analyzed before a recalibration is required. Additionally, if the ambient temperature changes by more than 5°C or if the one-hour timer expires, the program will prompt for a fresh calibration.

Remove the electrode from the rinse solution and wipe the body carefully with a tissue. **NOTE: DO NOT WIPE THE TIP OF THE ELECTRODE AS THIS MAY DAMAGE IT.** Place the electrode in the vial to be analyzed and swirl it gently for several seconds.

Without further stirring, press the READ button. The meter will take a series of readings. Once the readings have converged on a constant value, the result will be displayed along with crucial method information. A beeper will sound to indicate that the new value is ready.

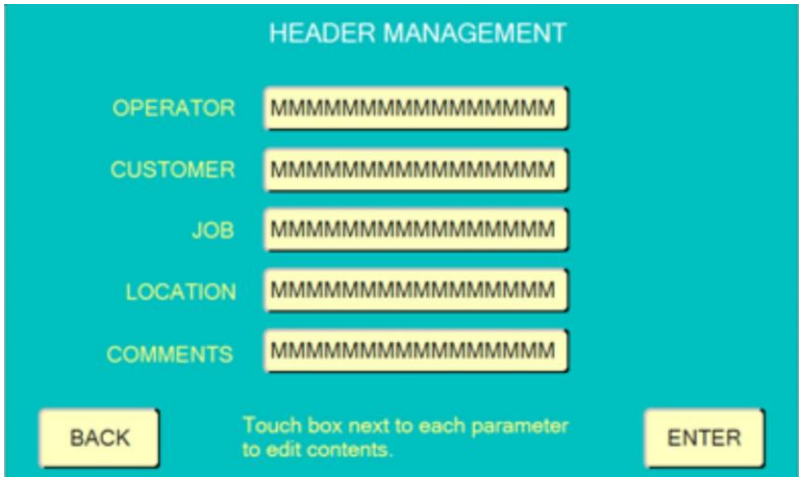
To analyze additional samples, press the READ button. The program will check the ambient temperature, the counter and the timer and, if they are still within the allowable ranges, the program will begin the next analysis. Proceed as above to make the next measurement.

Samples may be saved for analysis at a later time, but the vials should be tightly capped. Once they have been read, samples should be discarded. Do **not** re-analyze samples.

Pipettes and oil should be disposed of as PCB/Organo-chlorine waste. Analysis solution can be disposed of as ordinary aqueous waste containing nickel.

Entering Header Information

There are 5 custom identifiers available in the header of the stored data file which can be up to 15 characters in length and are entered through the **HEADER MANAGEMENT** screen.



Touching any of the active boxes will open a pop-up alpha-numeric screen to enter the desired header label. Once editing is complete, pressing ENTER will save the information and return program operation to the **MAIN MENU**.

NOTE: There is no audible beep when pressing buttons in the pop-up alpha-numeric or numeric screens.

Creating or Editing a Method

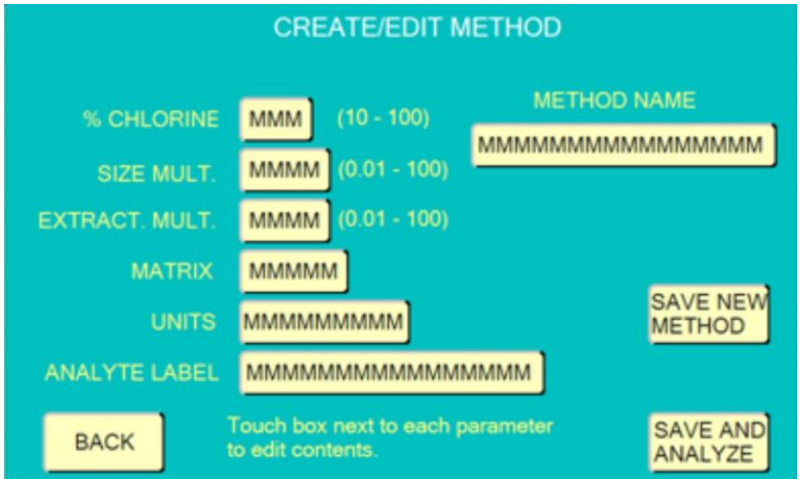
The key to the utility of the **L2000$_{DXT}$** Analyzer is the versatility of the methods that can be developed for the instrument. A "method" is the complete set of parameters that are necessary to convert a chloride reading into an accurate quantification of the targeted analyte. Preprogramed in the meter are a number of methods for the analysis of many common environmental

contaminants. These methods can be modified and custom methods can be built by setting any of the conversion parameters used to convert the chloride reading into an equivalent analyte concentration.

Each method requires 7 parameters to be set. These parameters are determined by the composition of the sample and the chemistry of the sample preparation and/or extraction procedures used to introduce the sample into the system. They can be either calculated from known parameters or determined empirically from preliminary experiments. The parameters common to all methods and their allowable ranges are tabulated below.

Parameter	Range of Values
Chlorine Content	10 - 100
Sample Size Correction	0.01 - 100
Extraction Efficiency Correction	0.01 - 100
Matrix	Oil, Soil, Water, Wipe
Units to be Displayed	ppm, mg/kg, ppb, ug/sdm
Analyte Label	15 character alpha-numeric
Method Name	15 character alpha-numeric

To create a new method or edit an existing method choose Edit/Create Method from the **CHOOSE A METHOD** screen. The **CREATE/EDIT METHOD** screen will open:



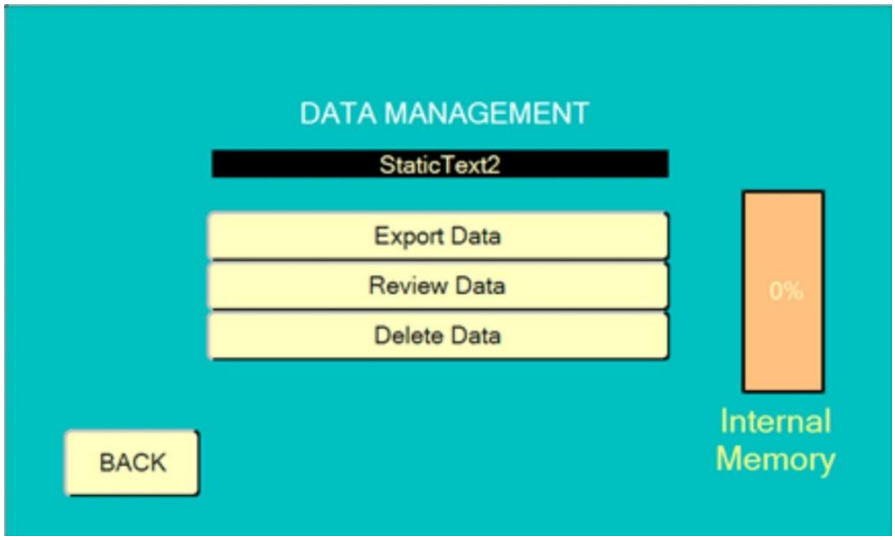
Touching any of the active buttons displaying the current values for each parameter will open a new screen. In the case of the percent chlorine, the size multiplier, or the extraction multiplier, a pop-up numeric screen will open for entering the value of the selected conversion factor. In the case of the matrix or the units, the new screen will display the available options. The options for matrix are: Oil, soil, water and wipe. For units the options are: PPM, PPB, ug/100scm, or mg/kg.

To enter an analyte label a pop-up alpha-numeric data entry screen will open. **NOTE: The matrix, units and analyte parameters are merely labels that appear in the data files and on the display; changing them will not affect the calculations or change the actual results.**

Once all of the parameters have been edited, pressing either the Save New Method or the Save and Analyze buttons will save the new method and exit to the next screen, either back to the **MAIN MENU** or directly to the **CALIBRATION** screen respectively.

Data Management

The **L2000$_{DXT}$** stores all data internally until it is deleted by the user. Data can also be downloaded to a USB drive through the port in the back of the unit. To manage stored data, select the Data Management option from the **MAIN MENU**. From the **DATA MANAGEMENT** screen:



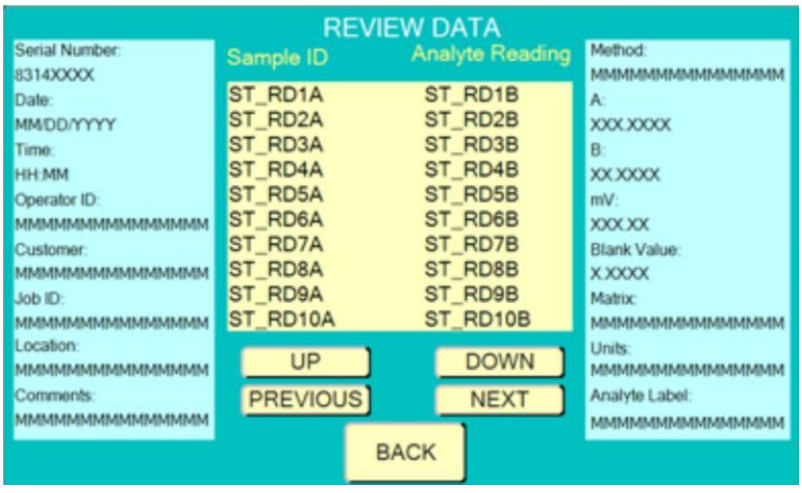
The options available are: **Export Data**, **Review Data**, and **Delete Data**. Choosing any of these options will open further screens with detailed descriptions of the options and actions required for the specific choice.

To export data, a USB drive must be plugged into the port on the back of the unit. Pressing Export Data will download all of the data to a file on the drive beginning with "L_" followed by 2 digits representing, respectively, the current year, month and day as follows: L_YYMMDD.CSV. The data file is in CSV (Comma Separated Values) format and can be read by any text editing program or spreadsheet program. **NOTE: DO NOT remove the USB drive while the upload is in progress. This will cause a system error and cause the meter to reset. The upload process may take several minutes.**

If opened by Excel, the data should look something like:

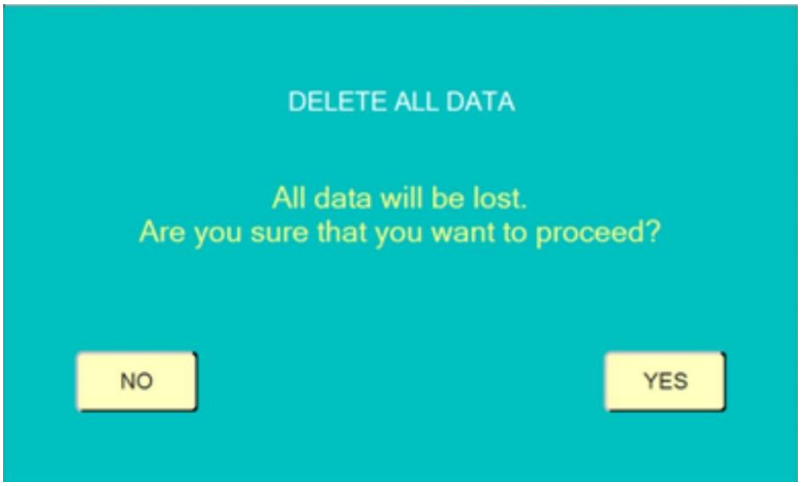
Header Info	Op ID	Cust ID	Job ID	Loc ID	Com	Ser.#			
Cal Info	mm/dd/yyyy	hh:mm	Vers - 4 char	Temp. C	mV	A	B	Offset	Bl Val
Method Info	Method	% Chlorine	Size Cor.	Extrac. Mult.	Matrix	Units	An Label		
Sample	Tot. Pt. 1	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 2	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 3	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Header Info	Op ID	Cust ID	Job ID	Loc ID	Com	Ser.#			
Cal Info	mm/dd/yyyy	hh:mm	Vers - 4 char	Temp. C	mV	A	B	Offset	Bl Val
Method Info	Method	% Chlorine	Size Cor.	Extrac. Mult.	Matrix	Units	An Label		
Sample	Tot. Pt. 4	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 5	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 6	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 7	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 8	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Sample	Tot. Pt. 9	hh:mm	9 Char Samp ID	ID Ext.	Raw Cl	Calc. Res			
Header Info	Op ID	Cust ID	Job ID	Loc ID	Com	Ser.#			
Cal Info	mm/dd/yyyy	hh:mm	Vers - 4 char	Temp. C	mV	A	B	Offset	Bl Val
Method Info	Method	% Chlorine	Size Cor.	Extrac. Mult.	Matrix	Units	An Label		

Pressing Review Data will open the **REVIEW DATA** screen. (See below.) The left-hand box displays the header information, the right-hand box displays the method information and the center box displays the sample information (sample ID and analyte reading) for the first 10 points in the first block of data. Pressing the UP or DOWN buttons will scroll through the data in the block and pressing the PREVOIUS or NEXT buttons will scroll through the blocks of data. (NOTE: Since the sampling cycle is limited to 20 sample points, the DOWN button will only advance one block of data before it repeats.)



If fewer than 10 data points are in a Header Block, pressing DOWN will result in a blank data box. If a data session was aborted prior to taking a reading, a blank data block will be displayed for that header block.

To delete all data stored on the unit, press the Delete Data option. A confirmation screen will open and choosing YES will result in all of the stored data to be deleted.



NOTE: Once deleted, the data cannot be recovered. Pressing Review Data again will result in the message "No Data Present."

Changing the Time, Date or Temperature

To change the time, date or temperature, choose Settings from the **MAIN MENU**. Once in the **SETTINGS** screen, choose the desired parameter and enter the correct values. The date format is month/day/ year and the time format is a 24 hour clock.

Manually changing the temperature will disable the temperature probe and should only be used if the probe is either lost or damaged. Once overridden, the temperature will remain disabled until the unit is turned off and restarted. If the probe is still malfunctioning, the temperature will have to be reset, each time the unit is turned on. Contact **DEXSIL** for service. (NOTE: The operating range of the meter is 13°C to 38°C. A missing or broken temperature probe will read -34 and a shorted probe will read 100.)

Checking the Electrode

The electrode is the most important component in the system. It is, therefore, important that the electrode be properly maintained and the initial setup will determine how well the electrode is functioning. Before turning the **L2000$_{DXT}$** Analyzer on, insure that the electrode is properly connected to the back of the unit. Check the fill level in the electrode and, if necessary, refill the electrode with the Orion filling solution supplied with each lot of reagents. To fill the electrode,

insert the tip of the filling spout of the filling solution bottle into the hole on the side of the electrode. Slowly squeeze the solution into the electrode body until it reaches the level of the hole.

Once the electrode has been filled, check the electrode output by going to **DIAGNOSTICS** from the **MAIN MENU.** Rinse and refill the RINSE vial with fresh rinse solution and swirl the electrode in the solution gently for a few seconds. Allowing the electrode to sit in the rinse solution, verify that the mV reading is greater than 140 mV. If the output does not reach at least 140 mV within a minute, refill the RINSE vial with fresh solution and recheck the output. If this does not improve the output, refill the electrode with fresh fill solution. (See **Electrode Care and Maintenance**).

Sample Preparation

Oil Samples

Before a transformer oil sample can be analyzed with the **L2000$_{DXT}$**, the PCB/Chlorinated Organics must be chemically converted to chloride.

1. Remove the cap from a black-capped tube and add oil up to the 5 mL line using a polyethylene pipettor (See Figure 2). Replace the cap tightly on the tube.

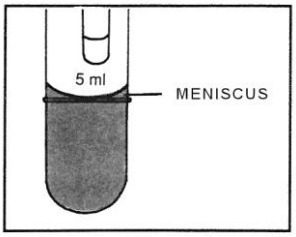


Figure 2

2. Break the bottom (colorless) ampule in the tube. Shake the tube well for 10 seconds.

3. Break the top (gray) ampule in the tube. Shake the tube vigorously for 10 seconds Allow the reaction to proceed for an additional 50 seconds (total of one minute), while shaking intermittently several times.

4. Using the 5 mL pipette, add five milliliters of extract solution to the black-capped tube. Tighten the cap securely and shake vigorously until the foam and dark color disappear. Vent the tube by partially unscrewing the black cap while holding the tube upright. Squeeze the test tube slightly while re-tightening the cap, and shake the tube vigorously for 20 seconds more. Vent again, tighten cap and stand the tube upside-down on the flat top of the cap and allow to settle for two minutes.

5. Place a polyethylene filter funnel in one of the 20 mL glass vials marked with the sample number. Position the black-capped test tube directly over the top of the funnel and open the dispenser nozzle (See Figure 3). Dispense the solution by carefully squeezing the sides of the tube. Stop as soon as the first drop of oil appears. Allow the solution to pass through the funnel, but remove the funnel before any oil can get through. Allow the solution to cool for five minutes. The sample is now ready for analysis.

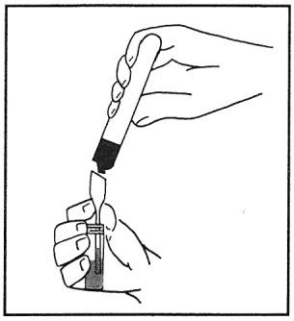


Figure 3

Soil Samples

To analyze a soil sample for PCB/Chlorinated Organics, the analyte must first be extracted from the sample. There are two solvent extraction systems available. Depending on the specific application, either the standard extraction solvent or the two-step procedure will be most appropriate. Both systems provide good, reproducible recoveries on dry sandy loam type soils. The standard procedure is somewhat faster and has fewer steps, but should not be used on wet or heavy clay soils. Regardless of the solvent system used, it is important that split samples be periodically analyzed by a reputable laboratory, not only to identify/confirm the Aroclor present, but also to confirm the extraction efficiency of the **L2000$_{DXT}$** solvent system. Contact Dexsil

before trying to analyze other types of materials. **NOTE: The quality of the final result is directly determined by sampling technique. It is important to use proper protocols for sample collection and homogenization.**

Standard Procedure for Soil Analysis

1. Using the metal spatula and the portable electronic balance supplied with the kit, weigh out ten grams of the soil into the empty, white-capped test tube. NOTE: Be careful not to get any foreign material into the weighed sample, i.e., absorbent material, large rocks, etc. The empty tube can be tared by placing it on the balance and pressing the <ON/OFF/ZERO> key.

2. Remove the black cap from the glass vial containing the extraction solvent and pour the entire contents of the vial into the tube containing the soil. Replace the white cap on the plastic test tube tightly and shake the tube vigorously for one minute. Break up any lumps of soil by squeezing the sides of the test tube during the shaking process (See Figure 4). Allow the tube to settle upright for two minutes.

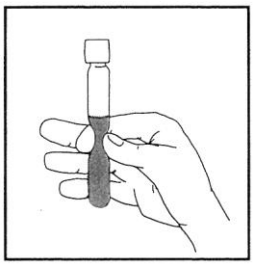


Figure 4

3. Remove the drying column from its foil pouch by poking the pointed end of the column through the foil and remove the red end-cap. Pull the plunger completely out of the 10cc syringe. Attach the end of the blue drying column to the tip of the syringe by sliding it over the collar on the tip of the syringe. This is a tight fit and the drying column may have to be carefully worked onto the syringe. Make sure that it is seated tightly.

4. Remove the black dispensing cap from the plastic test tube that contains two glass ampules. Slide the syringe-drying column assembly part of the way into the test tube which contains the two ampules. Stand the whole assembly upright. Using the polyethylene pipette, remove the extraction solvent from on top of the soil and dispense it into the top of the open syringe barrel. You will need to recover enough extraction solvent to fill the syringe barrel to the 7 mL level. Try not to remove any soil with the solvent as this may clog up the drying column. After 7 mL of solvent has been dispensed into the syringe, replace the plunger into the back of the syringe and apply pressure so that the solvent is forced through the drying column at the rate of 2 or 3 drops per second. **(NOTE: Do not force the solvent through the drying column too fast.)** When the dried solvent fills the test tube to the 5 mL line, pull back on the plunger to stop the flow of solvent. Remove the syringe-drying column assembly from the test tube, and screw the black dispensing cap tightly onto the test tube.

5. Break the bottom (colorless) ampule in the test tube by squeezing the sides of the tube and shake the mixture well for 10 seconds. Break the top (gray) ampule in the test tube and shake the tube vigorously for 10 seconds. Allow the reaction to proceed for additional 50 seconds (total of one minute), while shaking intermittently several times.

6. Using the 5 mL pipettor, add five milliliters of extract solution to the black-capped tube. Tighten the cap securely and shake vigorously until the foam and dark color disappear. Vent the tube by partially unscrewing the black cap while holding the tube upright. Squeeze the test tube slightly while re-tightening the cap, and shake the tube vigorously for 20 seconds more. Vent again, tighten cap and stand the tube upside-down on the flat top of the cap and allow to settle for two minutes.
7. Place a polyethylene filter funnel in one of the 20 mL glass vials marked with the sample number. Position the black-capped test tube directly over the top of the funnel and open the dispenser nozzle. (See Figure 3) Dispense the solution by carefully squeezing the sides of the tube. Stop as soon as the first drop of the organic solvent appears. Allow the solution to pass through the funnel, but remove the funnel before any oil can get through. Allow the solution to cool for five minutes. The sample is now ready for analysis.

Two-Step Procedure for Soil Analysis:

1. Using the metal spatula and the portable electronic balance supplied with the kit, weigh out ten grams of the soil into the empty, white-capped test tube. **NOTE: Be careful not to get any foreign material into the weighed sample, i.e. absorbent material, large rocks, etc.** The empty tube can be tared by placing it on the balance and pressing the <ON/OFF/ZERO> key.

2. Add the contents of one break-top glass solvent vial to the test tube of soil sample. Replace the cap tightly on the tube and shake contents for 3 minutes making sure the entire soil sample is thoroughly wetted.

3. Add the colored water component contained in the 6 ml black-capped vial to the test tube. Recap tightly and shake for an additional 2 minutes.

4. Allow the mixture to separate for 2 minutes.

5. Remove the plunger from a syringe/filter unit in the foil package and remove the black-dispensing cap from the reaction test tube and stand it in the rack.

6. Remove the top layer from the soil test tube (solvent layer) using the polypropylene pipette provided and while holding the syringe/filter over the reaction tube, add 7 ml to the syringe/filter.

7. Add solvent from the syringe/filter up to the 5 ml line of the black-capped test tube. Replace the cap tightly on the tube.

8. Break the bottom (colorless) ampule in the black-capped test tube by squeezing the sides of the tube and shake the mixture for 10 seconds.

9. Break the top (gray) ampule in the test tube and shake the tube vigorously for 10 seconds. Allow the reaction to proceed for an additional 40 seconds (total of one minute), while shaking intermittently several times.

10. Using the 5 milliliter pipettor from the basic **L2000$_{DXT}$** system, add 5 ml of the L2000 Extraction solution to the black-capped tube. Tighten the cap securely and shake the tube vigorously until the foam and dark color disappears. Vent the tube by partially unscrewing the cap while holding the tube upright. Squeeze the test tube slightly while retightening the cap and shake a second time. Vent again, retighten cap and stand the tube upside-down on the flat top of the cap and allow to settle for two minutes.

11. Place a filter funnel in one of the 20 ml glass vials marked with a sample number. Position the black-capped test tube directly over the top of the funnel and open the dispenser nozzle. Dispense the solution by carefully squeezing the sides of the tube. Allow the solution to pass thorough the funnel, but remove the funnel before any oil can get through. Allow the filtered solution to cool for five minutes. The sample is now ready for analysis with the **L2000$_{DXT}$** Analyzer.

Water Samples

High Range (5-2000 ppm)

1. Fill sample tube with 10 grams of water sample.

2. Add 10 mL of isooctane extraction solvent and shake vigorously for 30 seconds.

3. Allow to separate into two phases for a minimum of 2 minutes. (If a emulsion forms, add sodium sulfate[2], shake and allow to separate again). Using the disposable plastic pipette remove 5 mL of the top solvent layer and add to the black capped reaction tube. Proceed with test as for an oil sample and quantify using the appropriate **L2000$_{DXT}$** method.

Low Range (20 ppb - 5 ppm)

1. Collect sample in 1 quart narrow mouth glass bottle with zero head space. Cap tightly and store on ice until analysis.

2. When ready to analyze the sample, invert sample container gently once or twice and, using a plastic pipette, remove 35 mL of water from the sample jar by weighing 35 grams of water into a tared waste container and discard. Then add 10 mL of isooctane to sample container and shake vigorously for 2 minutes.

3. Add sufficient chlorine free distilled water to bring the water level up into the neck of the sample bottle (the solvent level should be just shy of the top of the neck) and allow to set for 3 minutes.

4. Withdraw 5 mL of the upper solvent layer (**Do not remove any water with the solvent**), add to the black capped reaction tube and cap tube tightly.

[2] Available from major chemical suppliers.

5. Proceed with the analysis as for an oil sample and quantify using the appropriate **L2000$_{DXT}$** method.

Wipe Samples

1. Locate the sealed glass vials containing chromatographic grade hexane and carefully break off the tip. Pour the entire contents into the vial containing the gauze pad. Grasp the soaked gauze pad with the disposable forceps and using an approved technique, wipe an area of 1000 cm^2. 1000 cm^2 is equivalent to a square measuring 31.6 cm or 12.5 inches on each side. It is equal to 1.08 ft^2. Allow the hexane to evaporate from the wiping material (approximately 1 minute).

2. Being careful not to contaminate the wipe, place it as loosely as possible into the tube with the white dispenser cap. Pour the extraction fluid (10 mL of isooctane) into the white-capped tube. Tighten the cap and solvate the gauze thoroughly for 30 seconds. Squeeze the tube to make sure that the isooctane completely washes the gauze. This solvent now contains all the PCBs that were removed during the wiping procedure.

3. Remove the black dispenser cap from one of the reaction tubes. Open the spout on the white dispenser-capped test tube and dispense the isooctane extract into the black-capped tube up to the 5 mL line. Replace the cap tightly on the tube.

4. Break the bottom (colorless) ampule in the tube. Shake the tube well for 10 seconds.

5. Break the top (gray) ampule in the tube. Shake the tube vigorously for 10 seconds Allow the reaction to proceed for additional 50 seconds (total of one minute), while shaking intermittently several times.

6. Using the 5 mL pipette, add five milliliters of extract solution to the black-capped tube. Tighten the cap securely and shake vigorously until the foam and dark color disappear. Vent the tube by partially unscrewing the black cap while holding the tube upright. Squeeze the test tube slightly while re-tightening the cap, and shake the tube vigorously for 20 seconds more. Vent again, tighten cap, and stand the tube upside-down on the flat top of the cap and allow to settle for two minutes.

7. Place a polyethylene filter funnel in one of the 20 mL glass vials marked with the sample number. Position the black-capped test tube directly over the top of the funnel and open the dispenser nozzle (See Figure 3). Dispense the solution by carefully squeezing the sides of the tube. Stop as soon as the first drop of oil appears. Allow the solution to pass through the funnel, but remove the funnel before any oil can get through. Allow the solution to cool for five minutes. The sample is now ready for analysis.

Care and Maintenance

General Care

Your **L2000$_{DXT}$** is designed for ease of use and reliability requiring very little maintenance. By following the instructions outlined below, you should be able to obtain maximum life from the electrode and the instrument itself.

Do not allow the instrument to get wet. As with any electronic instrument, water is the quickest way to destroy the **L2000$_{DXT}$** components. Store the instrument in its case when it is not in use and do not expose it to extremely humid environments.

Remove the USB drive from the unit before returning it to the carrying case.

Be careful not to spill any of the solutions on the instrument. They are all acidic and will quickly destroy the circuitry if they come into contact with it. If solutions are spilled onto the instrument, wipe it off quickly with a damp cloth. Do not store solutions in the same case with the instrument, as any leakage may cause serious damage. This is particularly important when the instrument is to be shipped by air.

When using the **L2000$_{DXT}$** where AC power is available, operate the instrument with the AC adapter. This will prolong the life of the battery and insure that the battery is always charged.

Always store the analyzer with fully charged battery. (A completely dead battery could take approximately 6-8 hours to charge fully.)

If the unit is to be stored for prolonged periods of time, it is important to periodically charge the battery. This will prolong the battery life and ensure that the analyzer is always ready for use.

Protect the analyzer from static electric charges. The keypad and case are isolated from the internal circuitry and are not susceptible to static discharge. However, when connecting the electrode to the meter, under certain environmental conditions, the static discharge may reset the power management circuit. Before connecting the electrode, first touch the outer ring of the BNC connector with one hand while holding the metal connector on the electrode in the other. Then connect the electrode to the Analyzer.

The **L2000$_{DXT}$** analyzes for PCBs/Chlorinated Organics by finding the total amount of chlorine in a given sample. Therefore, it is important to keep all extraneous sources of chlorine away from the instrument and the various solutions. Take extra precaution when working near salt water or under very warm conditions when contamination by perspiration is possible. Never pour used CALIBRATION, RINSE, or EXTRACT solution back into a storage bottle as the entire bottle may become contaminated.

Electrode Care and Maintenance

The electrode is the most sensitive component of the **L2000$_{DXT}$** system. Care must be taken not to damage the sensing membrane on the tip of the electrode. If it does become damaged or contaminated, it may be possible to restore the electrode response by polishing. To polish the electrode: Remove one of the membrane polishing strips from the instrument case and place it flat on a solid surface, abrasive side up. Place one or two drops of RINSE solution or distilled water on the abrasive strip. With the electrode perpendicular to the abrasive strip, polish the electrode tip by gently moving it in a circular motion for about 30 seconds. Apply constant pressure, but do not push too hard on the electrode. When finished, soak the electrode for five minutes in rinse solution. Polishing strips can be reused several times. **NOTE: DO NOT OVER POLISH. ELECTRODES SHOULD BE POLISHED ONLY WHEN NECESSARY.**

When an electrode is <u>not</u> to be used for a period of more than one week or for an indefinite period, drain the filling solution from the electrode, flush the inside one or more times with distilled water, and store it dry with the protective black cap to protect the sensing membrane. Make sure to follow the procedures for restoring electrodes before using the electrode again (see **Restoring the Electrode after Extended Storage**).

Otherwise, the electrode filling solution should not be allowed to evaporate causing crystallization. For short periods of time between sample measurements, including up to one week storage, maintain filling solution in the electrode and store the electrode in rinse solution. (NOTE: If a period of 12 hours [overnight] or longer elapses between measurements, drain a portion of the filling solution from the electrode, add additional filling solution to the filling hole, and start with fresh rinse solution.)

Troubleshooting

The instrument does not turn on.

1. The battery is dead. Plug in the AC adapter and retry.

2. The power management circuit has been overloaded and is locked due to a severe static electric discharge during the connection of the electrode. Contact Dexsil Corporation for further technical assistance.

The instrument turns on but the time and date have been lost.

1. The power management circuit has been overloaded and has reset. This is most likely due to a static electric discharge during the connection of the electrode. Re-enter the time and date and proceed with the operation of the instrument. Follow the procedure outline under **Electrode Care** for connecting the electrode. Check electrode output in **DIAGNOSTICS** Mode.

2. The battery has been disconnected and reconnected, resetting the power management circuit. Proceed as above.

The instrument turns off when plugging in the electrode.

1. A large static electric discharge has overloaded the power management circuit. Turn Analyzer on in the normal manner. Follow the procedure outlined under **Electrode Care** for connecting the electrode.

The instrument does not provide a millivolt reading, in *DIAGNOSTICS*, after the electrode has been plugged in.

Check the electrode to verify that it contains the filling solution. If it is empty or low, refill the electrode as described in: **Restoring the Electrode After Extended Storage**.

1. Make sure that the bottom half inch (one centimeter) of the electrode is completely immersed in the rinse solution. Check the cable for loose connections.

The millivolt reading will not exceed 140 mV.

Replace the RINSE solution, and swirl the electrode for several seconds before letting the reading stabilize. Replace the filling solution in the electrode as described in: **Restoring the Electrode After Extended Storage**.

1. Polish the end of the electrode. Remove one of the membrane polishing strips from the instrument case and place it flat on a solid surface, abrasive side up. Place one or two drops of RINSE solution or distilled water on the abrasive strip. With the electrode perpendicular to the abrasive strip, polish the electrode tip by moving it in a circular motion for about 30 seconds. Apply constant pressure, but do not push too hard on the electrode.

2. **DO NOT OVER POLISH!! ELECTRODES SHOULD BE POLISHED ONLY WHEN NECESSARY.**

The electrode will not calibrate.

1. During calibration the output from the electrode is checked. If it is outside the acceptable range, the electrode will not calibrate and the program will jump to **DIAGNOSTICS**. In this mode check the output of the electrode. It should be between 50 mV and 75 mV. To obtain the proper millivolt output, the tip of the electrode must be immersed in calibration solution. If the electrode contains adequate filling solution, and is immersed in **fresh** calibration solution and allowed to equilibrate, the output should reach the correct level.

2. The electrode will not calibrate, even after it has equilibrated:

    a. Change the calibration solution and refill the electrode as described in the **Restoring the Electrode After Extended Storage**.

b. If this does not solve the problem, polish the electrode as outlined in **Care and Maintenance**.

c. If these procedures do not work, the electrode may need to be replaced. Contact Dexsil for return information.

Insufficient quantity of solvent recovered from soil extraction.

Some soils are extremely dry or may contain a large percentage of organic material which can absorb enough extraction solvent so that there is less than the required amount of solvent available to complete the test. When soils of this type are being tested, five grams of sample instead of ten may be used**.** The final reading is then doubled or the Method is modified so that the **Sample Size Correction** is changed to **twice** its normal value. For instance, if after weighing in five grams of soil, the final reading on the **L2000$_{DXT}$** is 35 ppm, the actual result for that sample is 70 ppm. Make sure to use the full quantity of extraction solvent and follow the instructions as you would for any sample. **NOTE: This technique causes a loss of precision and should not be used unless absolutely necessary.**

Error Messages

CAL ERROR: This message is generated during calibration if the electrode output is not between 50 mV and 75 mV. If this message occurs:

1. Check solutions and change if not correct or not fresh.

2. Check electrode output and refill with fresh fill solution if necessary.

CHECK DRIFT: This message indicates that there is excessive drift in the electrode output either during a measurement or calibration. If this message occurs during the measurement of an unknown, the best estimate of the analytical result will be displayed below the warning. This number is for reference only, it may not be reliable. The sample must be re-analyzed to obtain an acceptable result. If this message occurs during a calibration, the electrode mV output will appear below the warning. If the warning appears, check the following:

1. Check the electrode performance as described under **Restoring the Electrode After Extended Storage**. Follow the steps for electrode draining and refilling, then recheck the electrode output. If this message occurs during calibration, the electrode is most likely damaged. See above under **The electrode will not calibrate**.

2. Check electrode leakage - The electrode is designed to leak a small amount of filling solution through the gap between the sensing pellet and the epoxy body. If the leak rate is too slow or too fast the performance of the electrode may be adversely affected. The electrode leak rate should be between 0.2 cm and 3 cm in 24 hours (as measured

from the filling hole to the top of the fill solution).

3. Check for sample contamination. Some samples contain high levels of sulfur, heavy metals, waste oil, or other organics that may carry over to the final extract. If these compounds come into contact with the electrode, they can poison the sensing element. The output from the electrode will deteriorate with repeated exposure to these contaminants. If repeated samples cause a drift error, but the electrode checks out with the standard solutions, check for sample contamination.

CHECK ELECTRODE: This message indicates that the electrode output has exceeded 180 mV. If this message appears, the electrode has been damaged or the wrong electrode has been attached to the **L2000$_{DXT}$** analyzer. Check for the correct electrode then follow steps for restoring an electrode.

Measured Result 9999: This result for an unknown measurement indicates that the calculated reading is above 5000 ppm in analyte concentration. This message only appears during an unknown measurement. If this occurs, re-analyze the sample using a smaller sample size. The result 9999 will be stored in the data file as a result and must be accounted for when interpreting the data as this is not an actual result.

Measured Result -9999: This result indicates that an unknown reading has resulted in a negative analyte concentration. This can be caused by either an electrode malfunction or an improper blank value used, i.e., a large blank value not representative of the true blank. If this occurs, check the blank value used or check the electrode function as described above. If the electrode checks out, investigate possible co-contaminants in the sample that may have adversely affected the electrode. A value of -9999 will be stored in the data file and must be accounted for when interpreting the data as this is not an actual result.

LOW BATTERY: If the battery voltage drops below the operational level of the instrument, the display will read **"LOW BATTERY"** followed by the message **"Power Off"** at which time the instrument will turn off automatically.

TEMPERATURE OUT OF RANGE: A temperature error can be caused by either:

1) The ambient temperature is outside the allowable working temperature of the meter (13°C - 38°C). If the ambient temperature is outside the acceptable range, do not proceed with the analysis. It is important to move to location where the temperature is within the allowable range.

2) The temperature probe is either broken or missing. If the temperature probe is not present, plug it back in and check the temperature using the Check Temperature button. If the correct temperature is displayed, exit the error screen by pressing BACK and beginning the Analysis process again. If the probe is lost or cannot be fixed, any prepared samples can still be analyzed by setting the temperature using the Set Temperature button. This will disable the temperature probe and analysis can continue using the new temperature. **(NOTE: A missing or broken probe will read -34 and a shorted probe will read 100.)** Temperature reading functionality will be restored each time the meter is turned off.

NOTE: A PDF copy of this manual along with copies of the Reagent SDS and the **Dexsil** Product Catalogue are included on the USB drive shipped with the **L2000$_{DXT}$** Analyzer.

Appendix A: Additional Information Available from Dexsil

DTR-10-01 "Alternative Methods of PCB Analysis", Stephen Finch, Dexsil Corporation; Generators Journal, Winter 1990.

DTR-10-02 "One Example Where Chromatography May Not Necessarily Be the Best Analytical Method", S.R. Finch, D.A. Lavigne-Dexsil Corporation, R.P.W. Scott, Ph.D.-Georgetown University; Journal of Chromatographic Science-July 1990.

DTR-11-01 "A Comparison of Current PCB Analytical Techniques", Stephen Finch-Dexsil Corporation; PCB Forum, 3rd International Conference for the Remediation of PCB Contamination, 1991.

DTR-11-02 "Case Study of a New Field Screening Tool for Delineating Soil PCB Contamination", Mark B. Williams, PE and John S. Flickinger-Dames & Moore (Madison, WI), Joseph E. Shefchek, CHMM-Wisconsin Power & Light (Madison, WI), E. Jonathan Jackson, CHMM-Haliburton NUS Environmental Corp. (Aiken, SC); Proceedings: 1991 EPRI PCB Seminar.

DTR-11-03 "PCB Determination, Simple/Low Cost or Complex/Expensive, Which Method is the Most Reliable in the Field?", S. Finch, pp. 45-1 to 45-4; Proceedings: 1991 EPRI PCB Seminar

DTR-12-01 "Application of a New PCB Field Analysis Technique for Site Assessment", Roger D. Griffin-Griffin Environmental; Proceedings of Hazmacon '92 March-1992.

DTR-12-02 "Available Options for the Analysis of PCBs", Stephen Finch; Environmental Science and Engineering p. 15., Feb.-March.

DTR-13-01 "Electrochemical Method for Surface Testing of PCB Contaminated Electrical Equipment", Stephen Finch; 7th Annual Industry and PCB Forum, June 1993, Canadian Electricity Forum.

DTR-13-02 "A Comparison of Popular Field Screening Methods for PCB Contamination in Soil", Alvia Gaskill-Environmental Reference Materials, 1993 EPRI PCB Seminar.

DTR-14-02 "Comparison of the Response of PCB Test Methods to Different PCB Aroclors", Stephen Finch-Dexsil Corporation; Proceedings of "The Tenth Annual Waste Testing and Quality Assurance Symposium", July 11-15, 1994 Arlington, VA.

DTR-14-03 "Effect of Transformer Oil, Petroleum Hydrocarbons and Inorganic Salt as Interferences in Field Screening for PCB Contamination of Soil", Alvia Gaskill; Proceedings of "The Tenth Annual Waste Testing and Quality Assurance Symposium", July 11-15, 1994 Arlington, VA.

DTR-17-01 "Determination of Chlorinated Hydrocarbon Concentrations in Soil Using a Total Organic Halogen Method", T.B. Lynn, J.C. Kneece, B.J. Meyer, A.C. Lynn; Presented at the 13th Annual Waste Testing & Quality Assurance Symposium, July 6-9, 1997, Arlington, VA.

DTR-17-02 "Improved Extraction Efficiency of Polychlorinated Biphenyls From Contaminated Soil Using a Total Halogen Screening Method", W.S. Schutt-Young, Ph.D., A.C. Lynn, T.B. Lynn, Ph.D., B.J. Meyer, M.J. Krumenacher; Presented at "EnvirACS '97" held at the 13th Annual Waste Testing & Quality Assurance Symposium, July 7-9, 1997, Arlington, VA.

DTR-18-03 "Electrochemical Technique/Ion Specific Electrode Dexsil Corporation L2000 PCB/Chloride Analyzer", A.B. Dindal, S. Billetts, Environmental Technology Verification Report, US-EPA, Office of Research and Development, Washington, D.C., EPA/600/R-98/109, August1998

DTR-20-01 PCB Detection Technology Dexsil Corporation L2000DX Analyzer, A.B. Dindal, C.K. Bayne, E.N. Koglin, Draft Environmental Technology Verification Report, US-EPA Office of Research and Development, Washington, D.C. Report, December 2000

DTR-21-01 "Analysis of Water for PPB Range Chlorinated Organics Using a Total Organic Chlorine Analyzer," Theodore B. Lynn, Ph.D., Mary Kate Boggiano, Larry M. Sacramone, David L. Balog, Andrew C. Lynn, Dexsil Corporation, Presented at the Waste Testing and Quality Assurance Symposium 2001, August 13-16, 2001, Arlington, VA

DTR-21-02 "Low Level Detection of PCE in Monitoring Well Samples Using a Total Organic Chlorine Based Field Method," Theodore B. Lynn, Ph.D., Dexsil Corporation, Keith A. Wright, Camino, California, Presented at the Waste Testing and Quality Assurance Symposium 2001, August 13-16, 2001, Arlington, VA

DTP-09-01 "Accurate On-Site Analysis of PCBs in Soil, A Low Cost Approach", Deborah Lavigne-Dexsil Corporation.

DTP-09-02 "Field Test Kit for Quantifying Organic Halogens in Water and Soil", Deborah Lavigne-Dexsil Corporation.

DTP-11-01 "PCB Analysis by Gas Chromatography-What do the Numbers Mean? 1991", Stephen Finch-Dexsil Corporation.

DMR-16-01 EPA Method 9078 "Screening Test Method for Polychlorinated Biphenyls in Soil", 3rd edition SW 846- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, June 1997; Federal Register Vol. 62, No. 114, 6/13/97, Rules & Regulations.

Appendix B: L2000DX System Methods Table

Compound	Blank Subtract	%Chlorine	Size Multiplier	Extraction Multiplier	Matrix	Units	Analyte Label	Method Name
Aroclor 1242	yes	42	1.13	1.11	Oil	ppm	AROCLOR 1242	1242 OIL
Aroclor 1242	yes	42	1	1.33	Soil	ppm	AROCLOR 1242	1242 SOIL
Aroclor 1242	yes	42	1	1.1	Soil	ppm	AROCLOR 1242	2 STEP 1242
Aroclor 1242	yes	42	1	1	Wipe	μg/100scm	AROCLOR 1242	1242 WIPE
Aroclor 1242	yes	42	1	1.25	Water	ppm	AROCLOR 1242	1242 WATER HIGH
Aroclor 1254	yes	54	1.13	1.11	Oil	ppm	AROCLOR 1254	1254 OIL
Aroclor 1254	yes	54	1	1.33	Soil	ppm	AROCLOR 1254	1254 SOIL
Aroclor 1254	yes	54	1	1.1	Soil	ppm	AROCLOR 1254	2 STEP 1254
Aroclor 1254	yes	54	1	1	Wipe	μg/100scm	AROCLOR 1254	1254 WIPE
Aroclor 1254	yes	54	1	1.25	Water	ppm	AROCLOR 1254	1254 WATER HIGH
Aroclor 1260	yes	60	1.13	1.11	Oil	ppm	AROCLOR 1260	1260 OIL
Aroclor 1260	yes	60	1	1.33	Soil	ppm	AROCLOR 1260	1260 SOIL
Aroclor 1260	yes	60	1	1.1	Soil	ppm	AROCLOR 1260	2 STEP 1260
Aroclor 1260	yes	60	1	1	Wipe	μg/100scm	AROCLOR 1260	1260 WIPE
Aroclor 1260	yes	60	1	1.25	Water	ppm	AROCLOR 1260	1260 WATER HIGH
Askarel A	yes	99	1.13	1.11	Oil	ppm	ASKAREL A	ASKAREL A OIL
Askarel A	yes	99	1	1.33	Soil	ppm	ASKAREL A	ASKAREL A SOIL
Askarel A	yes	99	1	1.1	Soil	ppm	ASKAREL A	2 STEP ASKAREL A
Askarel A	yes	99	1	1	Wipe	μg/100scm	ASKAREL A	ASKAREL A WIPE
Askarel A	yes	99	1	1.25	Water	ppm	ASKAREL A	ASK A WATER HIGH

DDT	yes	50	1	1.91	Soil	ppm	DDT	DDT SOIL
Toxaphene	yes	68	1	1.54	Soil	ppm	TOXAPHENE	TOXAPHENE SOIL
Chlordane	yes	69	1	1.42	Soil	ppm	CHLORDANE	CHLORDANE SOIL
PCP*	yes	67	1	2.54	Soil	ppm	PCP	PCP SOIL
Trichloro ethylene	yes	81	1	1.00	Soil	ppm	TRICHLOR	TRICHLOR SOIL
Trichloro ethylene	yes	81	10	1.86	Water	ppb	TRICHLOR	TRICHLOR WATER
1,1,1 Tri-chloro ethane	yes	80	10	2.03	Water	ppb	111 TRICHLETHANE	111 TRICHL WATER
Tetrachloro ethylene	yes	86	1	1.00	Soil	ppm	TETRACHLOR	TETRACHLOR SOIL
Tetrachloro ethylene	yes	86	10	1.89	Water	ppb	TETRACHLOR	TETRACHLOR WATER
Methylene Chloride	yes	83	10	13.0	Water	ppb	METHCHLORIDE	METHCHLOR WATER
Vinyl Chloride	yes	57	10	5.36	Water	ppb	VINYLCHLORIDE	VINYLCHLOR WATER
Dichloro ethylene	yes	73	10	3.46	Water	ppb	DICHLORETHYLENE	DICHLOR WATER
Chloride	yes	100	1	1	None	ppm	CHLORIDE	CHLORIDE

* Requires two-step solvent system with filter omitted.

Appendix C: Technical Data

Physical

Size:	w = 8.5" (216 mm) d = 5.5" (140 mm) h = 2" (50.8 mm)
Weight:	1 lbs. 13 oz. (0.825 kg)
Shipping Weight:	xx lbs. (xx kg)
Case:	ABS

Electrical

Battery Power:	6 – 2,400 mAh, 1.2V, Ni-Mh AA cells
Line Power:	12 W, 115V or 220V Wall Transformer
Charging:	Internal IC Controlled Charging Circuit
Power Management:	Automatic Shut-Off After 10 Minutes of Non-Use With Low-Power Warning and Shut-Off

Digital

Processor:	Microchip - PIC
A/D Converter:	24 Bit Auto-Ranging
Memory:	2 MB EEPROM
Method Storage:	28 Pre-programed Methods + Up to 22 User Defined Methods
Data Storage:	>1000 pts

Input

Range: ± 300 mV	
Electrode:	BNC Connector (Back Panel)Electrode Type:ORION 96-17B Combination Chloride Electrode

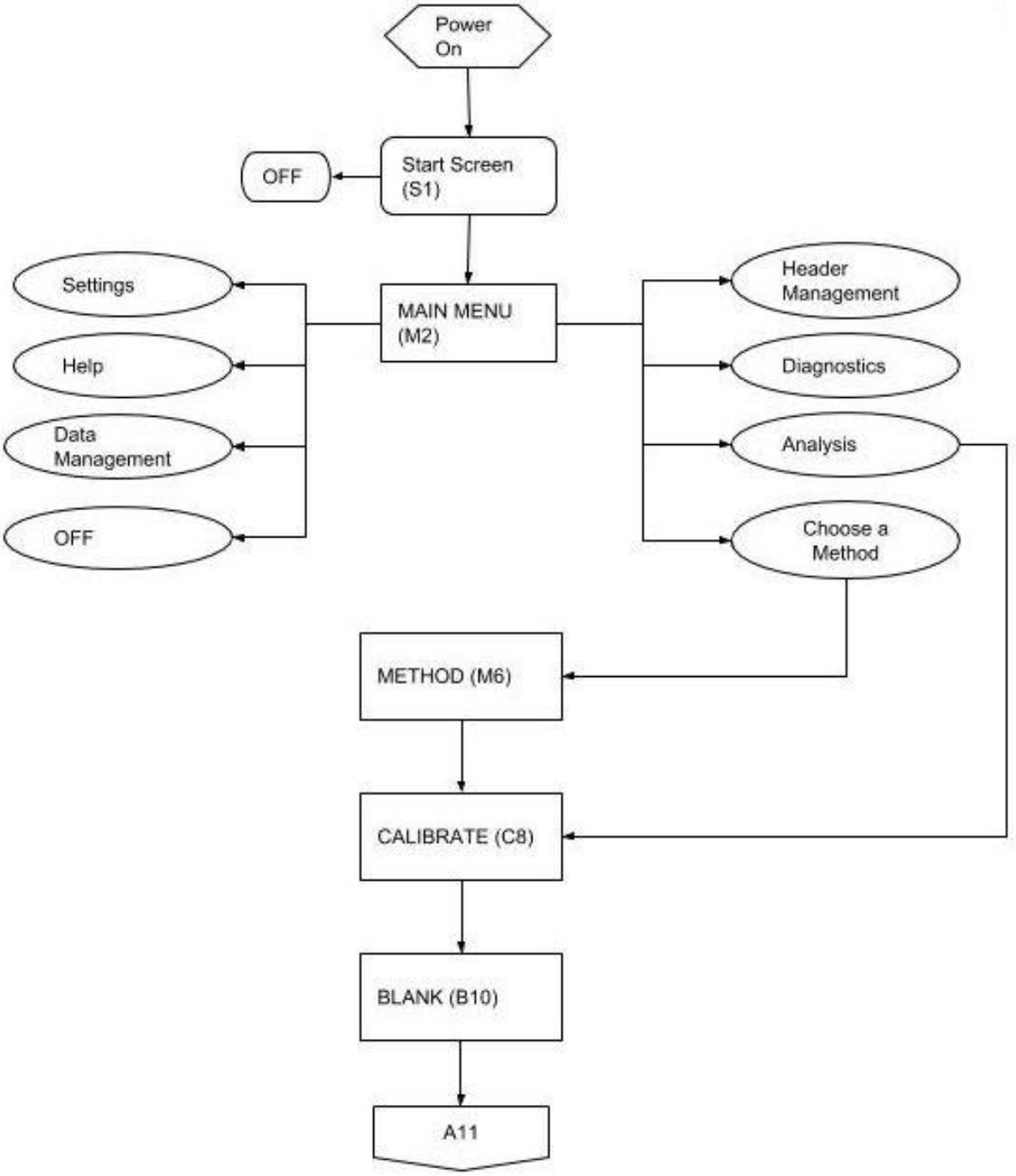
Output

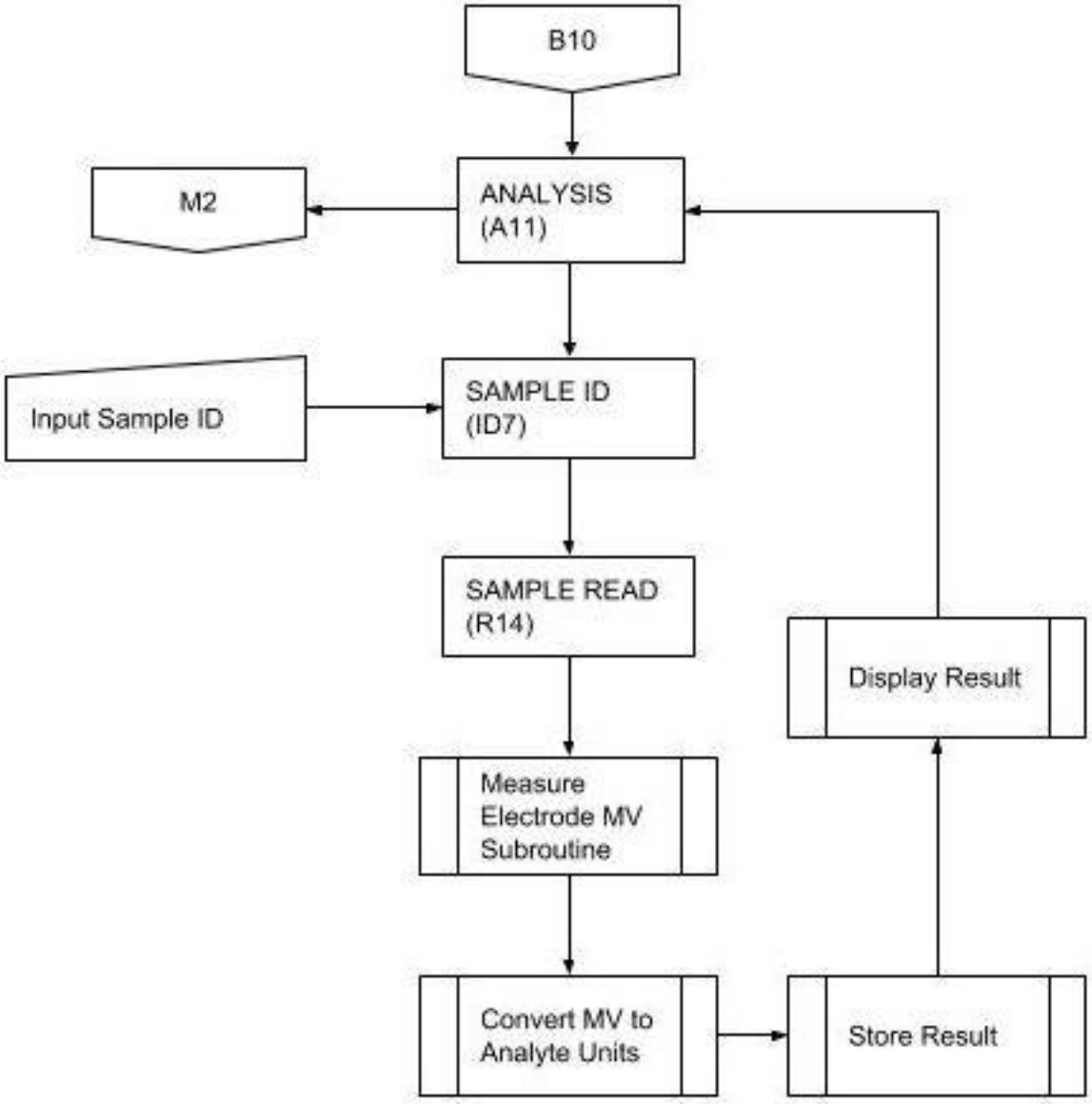
Display:	7” - backlit LCD touch screen
USB Port:	1 - Type A for data upload only

Operating Environment

Temperature:	55 ^{o}F - 100 ^{o}F (13 ^{o}C - 38 ^{o}C)
Humidity:	85% (non-condensing)
Sunlight:	Do Not Operate With Electrode Exposed to Direct or Indirect Sunlight

Appendix D: Program Flow Diagram




B10
ANALYSIS
(A11)
M2
Input Sample ID
SAMPLE ID
(ID7)
SAMPLE READ
(R14)
Measure
Electrode MV
Subroutine
Convert MV to
Analyte Units
Store Result
Display Result