

**INSTALLATION AND OPERATING
INSTRUCTIONS FOR THE**

chem-ID™

CHEMICAL ANALYSIS SYSTEM



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WARNING – IMPORTANT INFORMATION

Read and follow the instructions in this Operators Manual. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN IMPROPER READINGS WHICH WILL RESULT IN MISSING A CLEAR HAZARD OR MISIDENTIFYING A HAZARD THAT DOESN'T EXIST. People could be hurt or killed and property could be damaged.

The Chem-ID™ has two main functions: analyzing and characterizing the chemicals present in an air sample and potentially identifying the chemicals.

With a careful reading of this Operators Manual, an operator can obtain accurate and repeatable measurements of air samples with very little additional training. However, to identify, analyze, and characterize the chemicals in a sample, personnel must have additional chemical training and experience. Training and experience are necessary for personnel who intend to provide advice on appropriate actions to take in response to a chemical incident or spill.

When working with Chem-ID™, please keep in mind the function that you will be performing and the training and experience that you need to properly and accurately perform this function.

Using the Chem-ID™

A single Chem-ID™ test will give an operator a snapshot of the chemicals present and their concentrations in the air sampled. If another test is performed at the same location at a different time, a different amount of chemicals will be present in the air sample. Interpreting these Chem-ID™ “snapshots” to form a coherent chemical understanding of a location requires training and experience.

A chemical present in a single sample does not mean that the chemical is present over a wide area, only that it is present in the single sample. Conversely, the absence of a chemical in a single sample does not mean that a chemical is not present over a wide area. Taking multiple Chem-ID™ snapshots at different locations while considering air flow, weather effects, and the physical properties of the chemical is required to completely analyze an incident site. With multiple snapshots, trained personnel will have the information needed to make informed decisions.

WARNING!

The Chem-ID™ is not certified as an intrinsically safe instrument. This means that the Chem-ID™ can not be safely used in combustible environments that can be ignited by a spark. Using a Chem-ID™ in such an environment may result in an explosion and potential injury or death.

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1 Quick Start Guide

This section provides **experienced** Chem-ID™ operators a quick check-list for taking a chemical sample and for shutting the Chem-ID™ down. Do not use this Quick Start Guide unless you have already read and understood the entire Operators Manual. Note it is recommended, if possible, to perform an analysis to warm the unit up and purge it of accumulated chemicals before the first analysis of the day.

To take a sample:

1. Insert the metal nozzle into the input hole.
2. Twist the knobs on the front and back of the case to point to “Open.”
3. Check the helium tank gauge on the left side to ensure it has more than 300 PSI of helium.
4. Start helium flowing by opening the door on the right side of the unit and turning the helium flow knob all the way.
5. Turn the Chem-ID™ on via the butterfly switch on the top panel.
6. Make sure the correct Concentration Level for the sample is selected in the Menu.
7. Press the button labeled “Analyze.”
8. Press “Start Sample.”



Step 1: Twist the valve knobs open on the Front and Back.



Step 2: Check the helium gauge for a reading of at least 300 PSI.



Step 3a: Open the side door.



Step 3b: Twist open the helium valve.

To put the Chem-ID™ away:

1. Wait until cleaning cycle is complete
2. Turn off unit via the butterfly switch on the top panel.
3. Turn off the helium flow by turning the knob closed inside the side panel.
4. Twist the valve knobs closed on the front and back of the case.
5. The Chem-ID™ is now sealed and can be decontaminated, if necessary.

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2 Contents

Each Chem-ID™ Kit contains:



1 Chem-ID™



1 Lithium Ion rechargeable battery with battery charger



1 USB Bluetooth radio for a PC



1 Liquid Analyzer Attachment



4 ultra-pure helium tanks

Other Components:

- 10 packets of reference chemical
- 1 installed preconcentrator tube
- 1 extra preconcentrator tube
- 1 extra carrying strap
- 1 extra shoulder strap
- 1 CD containing:
 - This Operators Manual
 - The Chem-ID™ Manager PC Software
 - Database back-up

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3 Introduction

The Chem-ID™ is a precision chemical analysis laboratory in a box designed for easy operation even for someone with no analytical chemical background. The Chem-ID™ measures a detailed signature of an air sample that can be used to identify the chemicals within. If a sampled chemical is part of the Chem-ID™ library, the Chem-ID™ will display the potential identity of the chemical to the operator. The signatures of all chemical samples are maintained in the internal memory and can later be analyzed by trained personnel.



The Chem-ID™ is designed for use in the field in virtually all weather conditions by operators who may be wearing full Hazmat protection. It can be operated by remote control by a Microsoft Windows™-based PC up to 100 meters away via the built-in Bluetooth Class 1 radio. The Bluetooth link can also be used to transmit measured chemical signatures to a nearby PC for quick emailing to any location.

Because the Chem-ID™ is easy to use and performs accurate, repeatable measurements, multiple operators in the field can provide near real-time information to a single trained person at a central location.

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What the Chem-ID™ does and doesn't do

Every operator of the Chem-ID™ should have a clear understanding of what it can do, how it can help you perform your mission, and what it cannot do.

- The Chem-ID™ **will** perform a detailed and accurate analysis of a gas sample, provided the instructions in this manual are followed.
- The Chem-ID™ **will** determine if any of the measured chemical signatures could potentially be a chemical that is present in the Chem-ID™ chemical identification database. If so, the Chem-ID™ will display the potential identification of the chemical(s) recognized.
- The Chem-ID™ **will** display approximate concentrations of the chemicals analyzed. To obtain a higher concentration accuracy, a chemical sample of a known concentration can be measured by the Chem-ID™ and compared to the field sample.
- The Chem-ID™ **will** allow for the Preconcentrator tube to be removed and shipped to a laboratory. This allows important identifications to be verified as quickly as possible.
- The Chem-ID™ **will not** provide an analysis of an incident or situation. It provides a chemical “snapshot” of that specific location at that specific time. Experienced and trained personnel are required to use the “snapshots” provided by the Chem-ID™ to develop an understanding of an incident or situation.

WARNING!

While the Chem-ID™ is easy to use, it must be used correctly by trained personnel and in accordance with this manual to take accurate measurements. Interpreting the results of the analyzed chemicals requires personnel experienced in chemical analysis. Misinterpretation of the data provided by the Chem-ID™ could result in severe injury or death.

4 System Description

The Chem-ID™ weights about 16 pounds and is the size of a large lunch box. It is battery powered and can be operated by the four buttons on the top of the unit or by remote control from a Microsoft Windows™-based PC. The Chem-ID™ analyzes and characterizes airborne chemicals present in the air or outgassed from a liquid or solid.



The Chem-ID™ uses dual gas chromatography to provide a multi-dimensional characterization of each sampled chemical based on the molecular weight of the chemical and the bond-energies between atoms of the molecule. The chromatographic data is measured by precision thermal conductivity detectors that translate chemical information into electrical signals read by the computer. By collating the information from these detectors, the chemicals present in an air sample are separated into individual chemical signatures.

The Chem-ID™ uses a Preconcentrator to concentrate the chemicals in the air so that even minute quantities of a chemical (parts-per-billion) can be analyzed. The Preconcentrator can be easily removed from the Chem-ID™ and sent to a laboratory for further additional testing.

The chemical samples are heated and measured across a range of temperatures, from 40°C to 150°C. This allows the Chem-ID™ to quickly analyze an extremely wide range of chemicals. Despite the high internal temperatures of the Chem-ID™ during operation, the exterior is not hot to the touch.

Section 5 – “How the Chem-ID™ Works” – explains the test process in detail.

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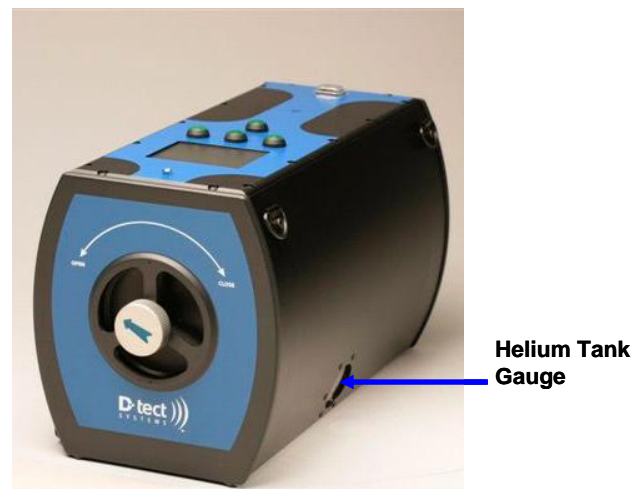
There are several supplies used in the Chem-ID™ that must occasionally be replaced:

- **Battery:** The lithium ion battery, when fully charged, will perform approximately 14 chemical analyses in the field. It is easily removable in the field, even with Hazmat gloves. The battery takes about 45 minutes to charge. The remaining battery life is shown in the upper right corner of the display. The Chem-ID™ will alert the operator on the display when the battery needs to be replaced. The method for replacing the battery is shown in Section 7, “Maintenance”.
- **Helium tank:** The Chem-ID™ contains a canister of ultra-pure helium that is used to separate the chemicals in an air sample and determine their concentrations. A single canister will last about 20 hours of field testing. It is easily replaceable in the field, even with Hazmat gloves. Empty tanks can be refilled by contacting D-tect Systems (see Appendix C for information). The method the replacing the helium tank is shown in Section 7, “Maintenance”.
- **Reference chemical:** The Chem-ID™ dopes every air sample with a small amount of 1,4 dichlorobenzene. This reference chemical is used to calibrate each sample for temperature and pressure variation. The method for replacing the reference chemical is shown in Section 7, “Maintenance”.

4.1 Features and Controls of the Chem-ID™

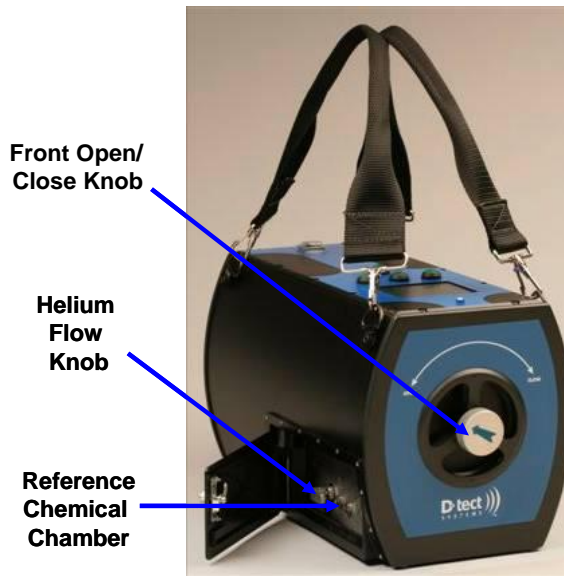


The top of the Chem-ID™

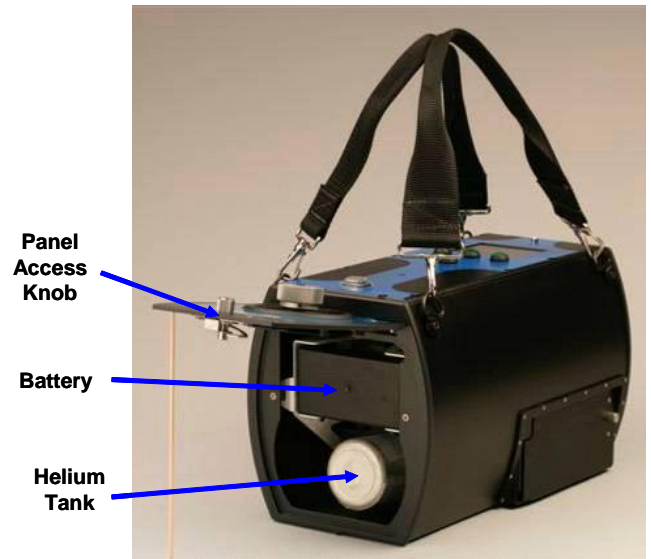


Looking at the front left side

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Looking at the front right side



The back, with the panel open



The sample intake nozzle

5 How the Chem-ID™ Works

The Chem-ID™ uses two-dimensional gas chromatography and thermal conductivity detectors to measure the signature of a chemical sample. Gas Chromatography (GC) is a technique to separate a chemical mixture into its individual chemicals. A single mixed cloud of chemicals goes into a GC column and multiple single-chemical clouds come out, each at a different time (known as Retention Time).

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A GC column is essentially a long coil (15 meters) of very small pipe with a special compound coating the inner wall (called the Stationary Phase). As a cloud of gas passes through the pipe, the molecules in the cloud interact with the wall coating differently, depending on their chemical properties. A chemical that reacts very little with the wall coating will pass through the GC column quickly. A chemical that reacts strongly with the wall coating will pass through the GC column much more slowly.

Two-dimensional gas chromatography analyzes each chemical using by two different columns that separate chemicals based on different characteristics. Thus each sampled chemical is characterized by two dimensions of information. The two GC columns used in the standard Chem-ID™ are commonly called DB-1 (using a dimethylpolysiloxane stationary phase) and DB-Wax (polyethylene glycol stationary phase). Both columns are very good at separating a large variety of chemicals. When used together, they provide the capability to determine a unique signature of many chemicals. The Chem-ID™ can be configured with other types of GC columns to increase sensitivity to meet specific customer requirements.

As the individual chemicals exit the GC columns at different times, they are measured by Thermal Conductivity Detectors (TCDs). TCDs are excellent all-purpose detectors, capable of measuring a very large number of different chemicals.

By default, the Chem-ID™ measures chemical concentrations by comparing the measured signal response against an internal concentration curve calibrated to a set of known chemicals. This is called Relative Concentration mode and is accurate within 30%

Relative Standard Deviation (RSD). The Chem-ID™ also has an Absolute Concentration mode that allows users to create a concentration curve for a specific chemical using laboratory-grade concentration samples. A chemical that has an Absolute Concentration Reference is accurate within 10% RSD. This accuracy slowly degrades to 15% RSD accuracy at the end of 10 days. A new Absolute Concentration curve can be created at any time. Any number of chemicals can have Absolute Concentration curves simultaneously.

5.1 The Chemical Analysis Cycle

The Analysis Cycle of the Chem-ID™ is divided into five phases. These are performed automatically once the operator presses the Analyze button:

1. Warming-up:

Each Chem-ID™ analysis begins at the same temperature to ensure repeatability of results. When the Chem-ID™ is first turned on, different components are heated or cooled to a baseline temperature. This phase can take anywhere from a few seconds in warm environments up to 10 minutes in cold environments.

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2. Air Sampling:

When an analysis is begun, the Chem-ID™ draws in air through the Preconcentrator for 30 seconds to five minutes, depending on the concentration level selected by the user.

3. Analyzing:

Once the collection period is over, the Chem-ID™ stops drawing air. A short pulse of heat into the Preconcentrator rapidly releases a cloud of chemicals it has collected from the outside air. The helium stream moves the chemical cloud into the GC columns.

In each GC column the mixed chemical cloud is pulled apart and separated into smaller clouds of individual chemicals. The chemicals that have little reaction with the wall coatings pass through the columns almost as fast as the helium. The chemicals that react heavily with the wall coatings pass through much more slowly. The columns start out at the baseline temperature and then heat to 150°C to encourage the slow chemicals to move through faster (and thereby shorten the analysis time). By the time the sample reaches the end of the column, each individual chemical has been separated into its own cloud of pure molecules. As these small clouds pass over the Thermal Conductivity Detectors, the detectors measure the time that the beginning of the cloud contacted the detector, the time that the cloud leaves the detector, and the concentration of the cloud.

During the analysis phase, pressing the “Next Page” button will display the raw chemical signature in real-time as each separated chemical passes over the detectors. After the analysis is complete, as the Chem-ID™ begins the cleaning phase, the raw chemical signature is processed, analyzed, calibrated, and displayed. Both the raw chemical signature and processed information are immediately saved in memory.

4. Purging

After the analysis, the Preconcentrator is cleaned by simultaneously heating and drawing a large volume of air through it. This purges the previously collected sample.

5. Cleaning

After the analysis is complete, the Chem-ID™ cleans itself of the collected sample. Internal components are heated to high temperatures for several minutes to burn off any trapped chemical residue. The length of the clean cycle depends on the concentration of the sample measured. Large samples will increase the time the Chem-ID™ spends cleaning.

6. Cooling

After the cleaning cycle, the components of the Chem-ID™ are cooled to the starting temperature before a new sample is taken. This takes several minutes.

After cooling, the Chem-ID™ returns to the Ready Screen and is ready to take and analyze more samples.

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5.2 Concentration Level of a Test

The Chem-ID™ adjusts the quantity of the air sample collected based on the concentration level selected in the Settings menu. In the menu are two choices: Test for Standard or Test for PPB.

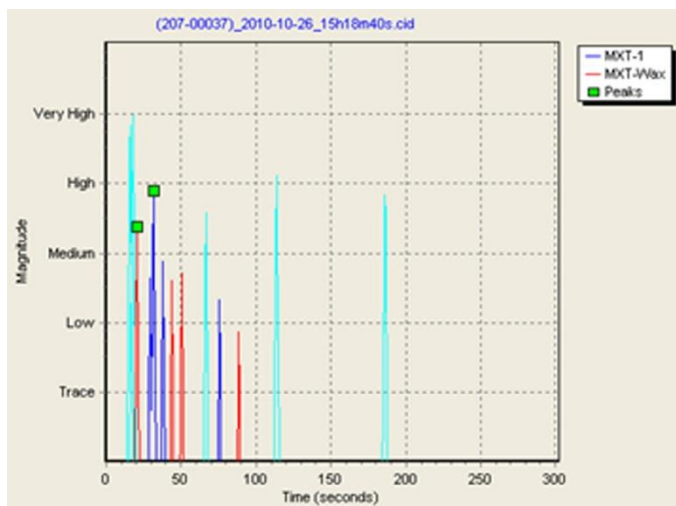
Test for Standard Concentrations should be used in almost all cases. This is the default setting.

Test for PPB Concentrations should only be used if the amount of the target chemical is known to be at a low parts-per-million or parts-per-billion level, or if a situation occurs where an unknown chemical is suspected to be present, but there are no overt signs of the chemical (odors or liquids).

If a PPB concentration test is run in the presence of standard quantities of chemicals, the Chem-ID will collect a very large sample of the chemicals present and will not be able to clean all the chemicals out of itself during the automatic cleaning cycle. Multiple manual cleaning cycles (Section 6.5.4) may have to be run to remove the large quantity of chemicals from the Chem-ID™.

5.3 What is a Chemical Signature?

The result of the analysis is known as a chromatograph. The horizontal axis on the bottom of the graph shows time, from 0 seconds (the start of the analysis) to 300 seconds. Each vertical line represents a cloud of a pure chemical moving across the detector. The color of the peaks indicates which column separated the chemical; the DB-1 column is red and the DB-Wax column is blue. For clarity, common peaks (air, water, dopant) are always displayed in light blue. The height of the peaks shows the approximate concentration of each chemical.



A Chem-ID™ Chromatograph: light blue peaks represent common chemicals

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Air samples will contain a common set of atmospheric elements in addition to the chemicals the operator is trying to identify. Common chemicals include water, gases present in air (nitrogen, oxygen, CO₂), and the Chem-ID™ reference chemical injected into the sample. The Chem-ID™ automatically identifies the signature data from these common chemicals.

Interpreting a chromatograph requires training and experience. The majority of chemicals measured by the Chem-ID™ will have a clear signal (represented by a sharp peak) in each GC column. These peaks represent a signature that is relatively unique.

The Chem-ID™ will compare the chemicals measured in the sample to the chemicals in its identification database and will display any potential matches. Whether a match is found or not, the chromatograph provides a trained chemist with a great deal of information about the type, volatility, boiling point, and relative concentrations of the chemicals measured.

6 Operation of the Chem-ID™

6.1 Test Preparation

To analyze an air sample, turn the unit on and follow the Test Preparation Checklist below. The Chem-ID™ takes very little preparation to use. However, each checklist item is important to ensure the accuracy of the chemical analysis.

The Chem-ID™ is turned on by pressing the butterfly switch on the back of the top panel. When turned on, the Chem-ID™ will boot-up and show the Ready Screen (discussed in Section 6.2.1).

Note: The Chem-ID™ can be turned on without performing any measurements (for instance, to access saved chemical signatures). If no testing is planned, then none of the steps in the Test Preparation Checklist below need to be performed.

6.1.1 Test Preparation Checklist

1. Is the installed battery fully charged? A fully-charged battery will last for 14 tests. The remaining battery charge can be seen on the upper right corner of the display. The Chem-ID™ will alert the operator if there is not enough battery charge left to do a test.
2. Does the helium bottle have over 300 psi remaining? A full bottle (2000 psi) will last for 20 hours of operational use. The Chem-ID™ will alert the operator if there is not enough helium to do a test.
3. Is there reference chemical in the Chem-ID™? The reference chemical lifespan is dependent on the chemicals and concentrations that are measured. It will typically last for several weeks of normal use.
4. Is the helium valve in the side door open? The Chem-ID™ will alert the operator if there is not enough helium to do a test.
5. Are the front and back vents open? These vents are used to allow air flow through the Chem-ID™ to cool it. The Chem-ID™ will alert the operator if either vent is closed.

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6. Is the sample nozzle present?
7. Has the Chem-ID™ been cleaned of its last sample?
8. Is the correct Concentration Level selected? If the Chem-ID™ is over-concentrating a chemical already present in large concentrations, the unit make take several clean cycles to remove the chemical from the unit after the test.

Section 7.0 – “Maintenance” – has detailed instructions on how replace any of the consumables in the Chem-ID™.

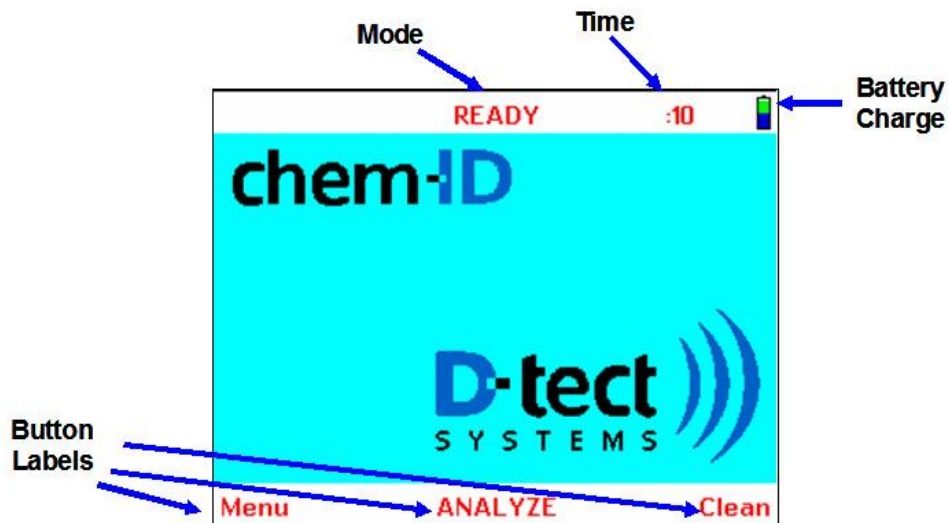
6.2 Buttons and Displays

Once the Test Preparation Checklist has been completed, the Chem-ID™ is ready to analyze. Press the Analyze button on the Chem-ID™ or start the analysis via a PC linked to the Chem-ID™.

6.2.1 Ready Screen

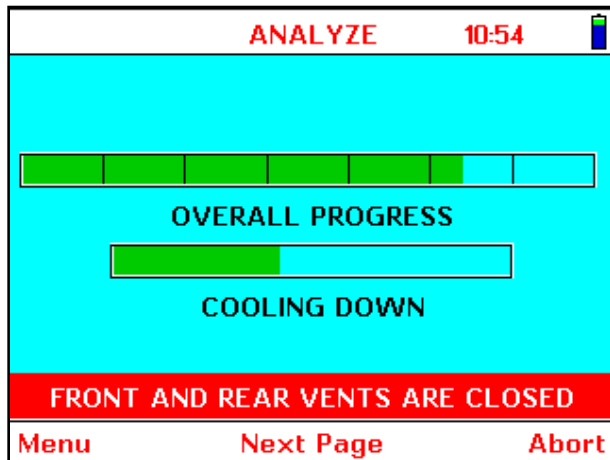
When the Chem-ID™ is turned on, the Ready Screen is displayed, as shown below. The operator has three choices that can be selected by pressing the button under each button label:

1. Menu Button: In the Menu, the operator can select the Concentration Level for chemical measurements, look at previously measured data, adjust operator preferences, and turn on or off the Bluetooth data link.
2. Analyze Button: Start an analysis of an air sample by pressing the Analyze button
3. Clean Button: Access the manual clean selection (see Section 6.5.6).

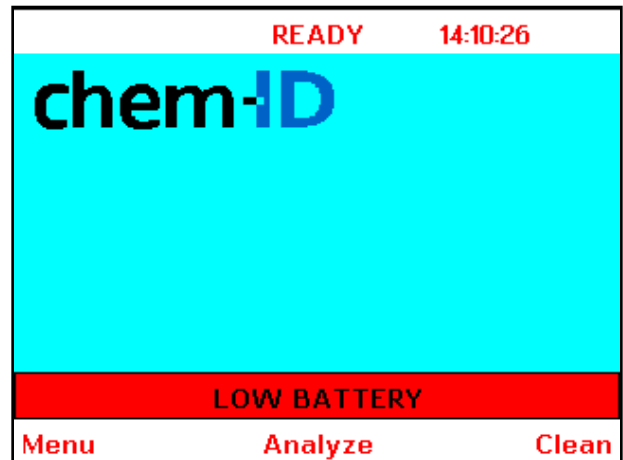


The Ready Screen

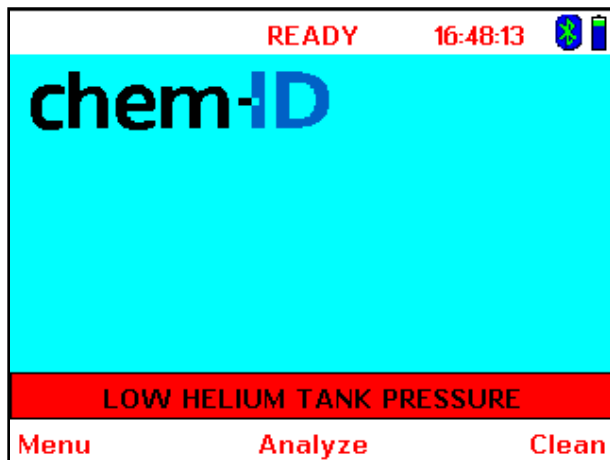
Before entering the Analyze or Clean mode, the Chem-ID™ will automatically check the battery power, helium flow, and that the front and back vents are open. If there is insufficient power or helium flow, or if a vent is closed, the Chem-ID™ will show an alert message on the display and will stop until the operator addresses the problem. The screenshots below show typical Operator alerts.



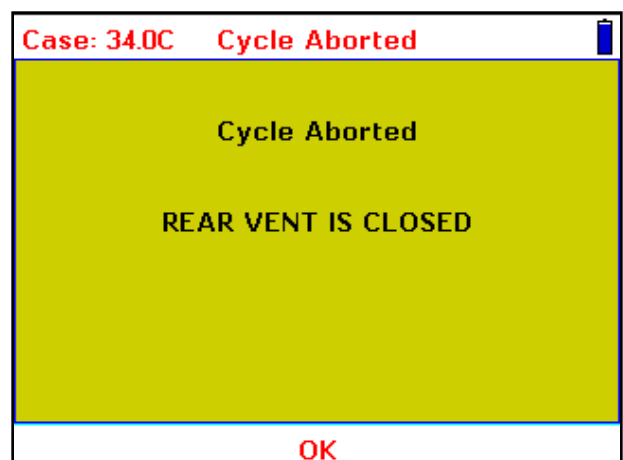
Closed vent alert



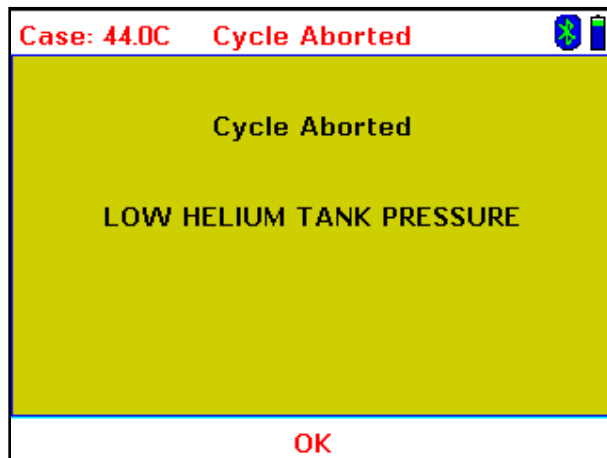
Low battery alert



Low helium alert



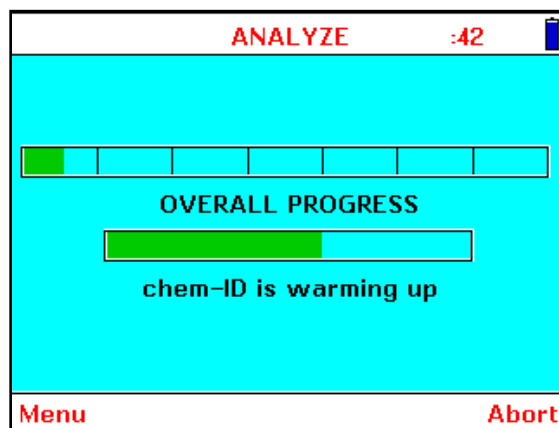
Aborted analysis or cleaning because a vent was closed during the cycle



Aborted analysis or cleaning because there is not enough helium remaining or tank valve was closed

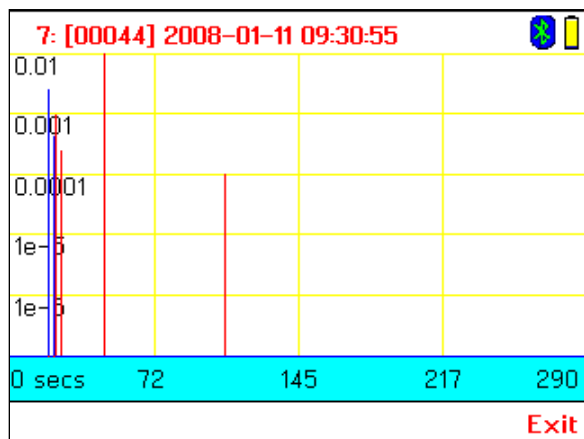
6.2.2 Analyze Button

When the Analyze button is pressed, the Chem-ID™ begins the Chemical Analyze Cycle described in section 5.1. Two status bars appear on the display as shown in the figure below. The top status bar shows the overall progress of the analysis and how many phases are left before completion. The lower status bar shows the name and status of the current phase. When the final phase is complete (the cooling down phase), the Chem-ID™ will return to the Ready Screen and is ready to perform another test.

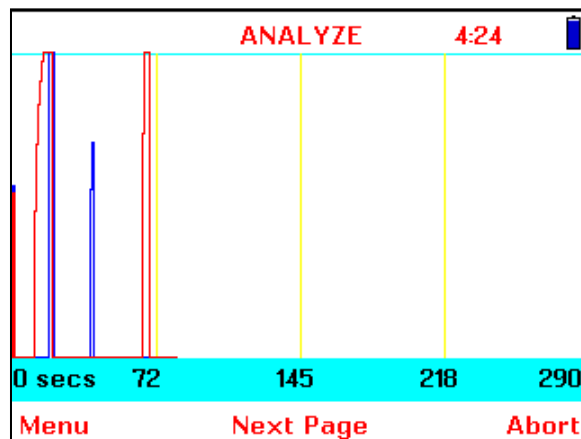


Phase 1: The Chem-ID™ warming up

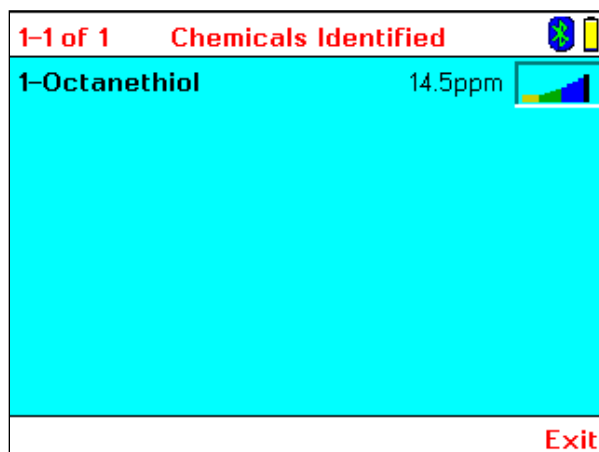
During the Analyzing subphase, a real-time plot of the raw measurements will be displayed. If the Next Page button is pressed, the display will return to the status bar screen. After the analysis is complete, the raw data is processed and the final processed data is displayed, as shown in the figures below. Pressing the Next Page button after the data is processed will display potential chemical identifications.



Raw data is displayed in real-time during measurement



Processed data is displayed after the analysis is completed



Press Next Page to list potential chemical identifications

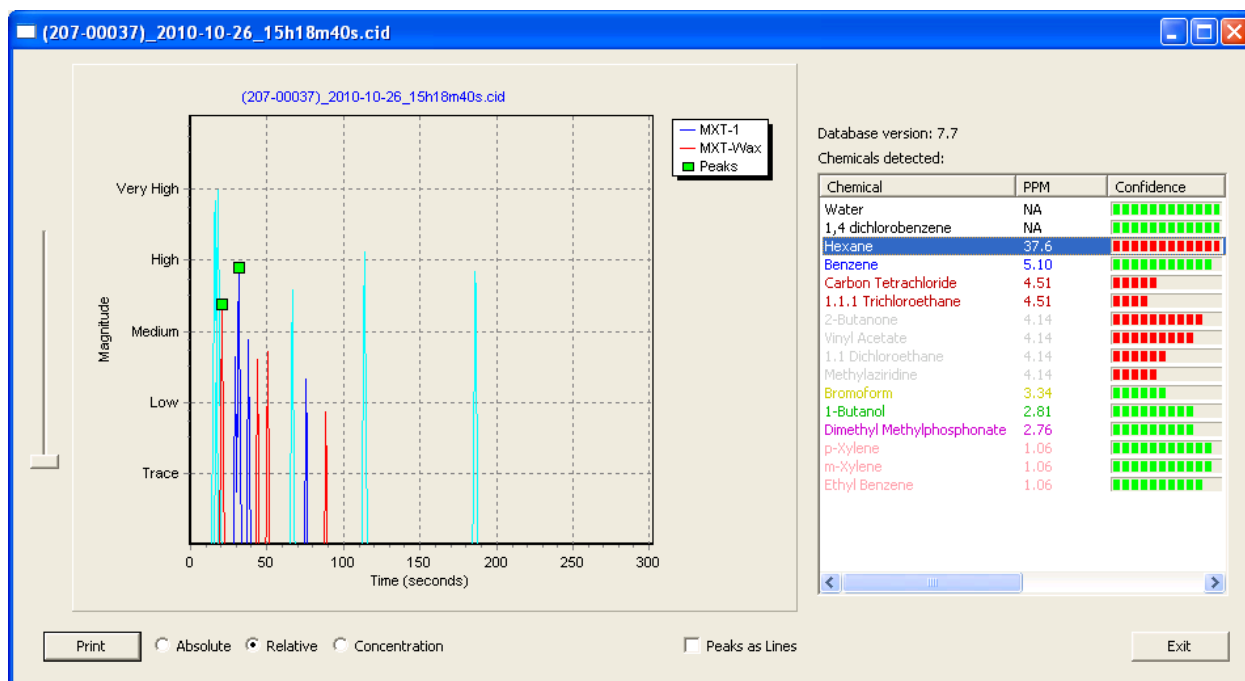
6.2.3 Chemical Identification

The Chem-ID™ will analyze the raw data, eliminate noise from pressure and temperature variations, and determine if any of the chemicals detected can potentially be identified. It is important to remember that all identifications made by the Chem-ID™ are potential identifications. Since there are over twelve million unique known chemicals, there is always some possibility that chemical identification is incorrect.

The reference chemical plays a major role in eliminating noise from temperature variations (such as testing in the summer versus testing in the winter) and pressure variation (testing at sea level versus on a high mountain, or in high winds, etc.). If the reference chemical is not found in the sample, no potential identifications will be made and an alert message will be displayed as shown below. The reference chemical container may be empty (see Section 7.3, “Reference Chemical Replacement”). It is recommended that the reference chemical be replaced and the test repeated.

6.2.4 Identification Confidence

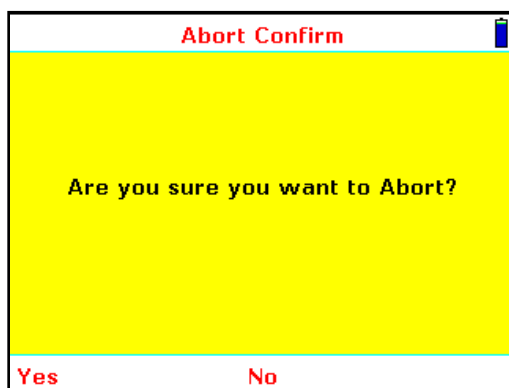
Each identified chemical is displayed with a confidence bar that shows how close the chemical signature matches the database signature. When identification of an unknown chemical shows several possibilities, the confidence bar shows which identification is the closest match to the database.



Confidence bar in the Chem-ID™ Manager Software

6.2.5 Aborting a Test

At anytime during any phase of an Analysis Cycle the operation of the Chem-ID™ can be aborted. If the Abort button is selected, a confirmation screen is displayed asking the operator to confirm the decision. Then the Chem-ID™ will return to the Ready screen.

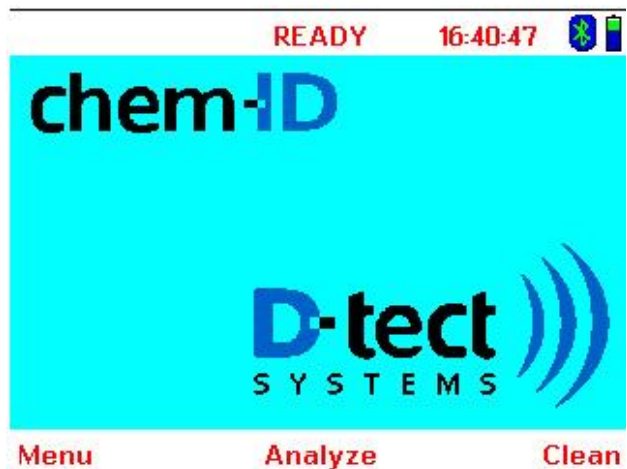


Abort confirmation screen

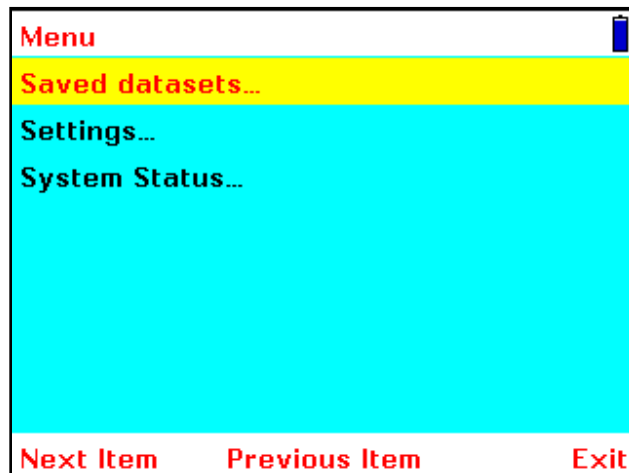
6.2.6 Menu Button

Pressing the Menu button opens the Menu Screen. The Menu screen displays a list that can be navigated by pressing the Next Item or Previous Item buttons to scroll through the list. When the item on the list is highlighted, pressing the Select Button will activate that choice. The Menu list allows the operator to select:

1. Saved Datasets: allows review of all previously taken chemical signatures that are in memory.
2. Settings: allows adjustment of user settings on the Chem-ID™.
3. System Status: displays component information and firmware version numbers.



Press the Menu button to enter the Menu

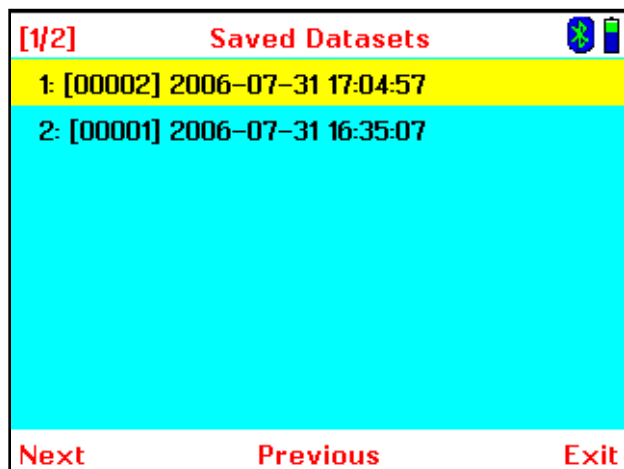


Menu choices

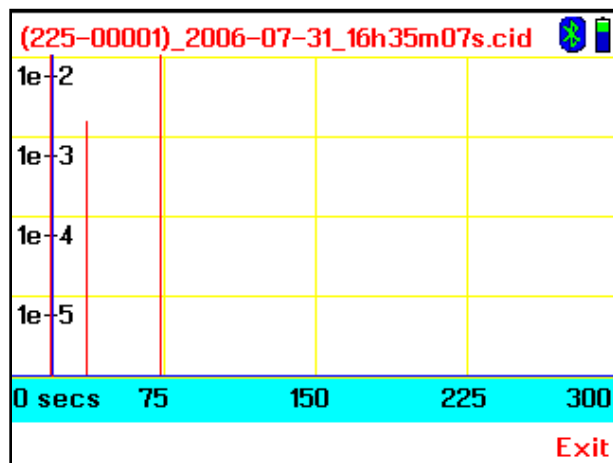
6.2.6.1 Saved Datasets

To examine a previous chemical analysis, highlight the saved dataset of interest. The datasets are listed by test number, date, and time. Press the Select button to open the menu of options for the dataset, including:

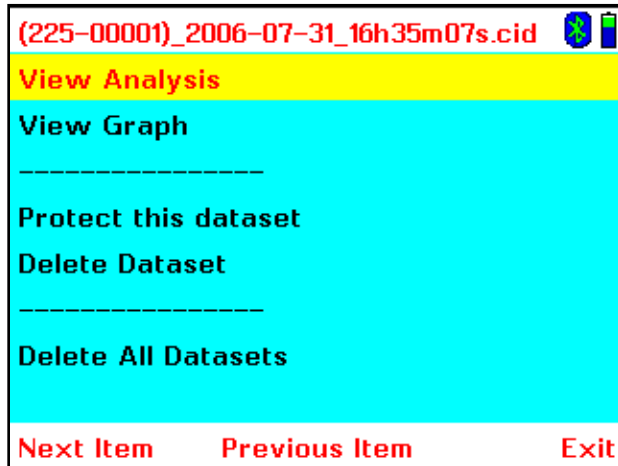
- View the analysis: showing the potentially identified chemicals.
- View graph: showing the chromatograph.
- Protect this dataset: will not allow the dataset to be deleted until the protection is removed.
- Delete Dataset: a confirmation window will be displayed to prevent accidental deletion.
- Delete all Datasets: a confirmation window will be displayed to prevent accidental deletion.



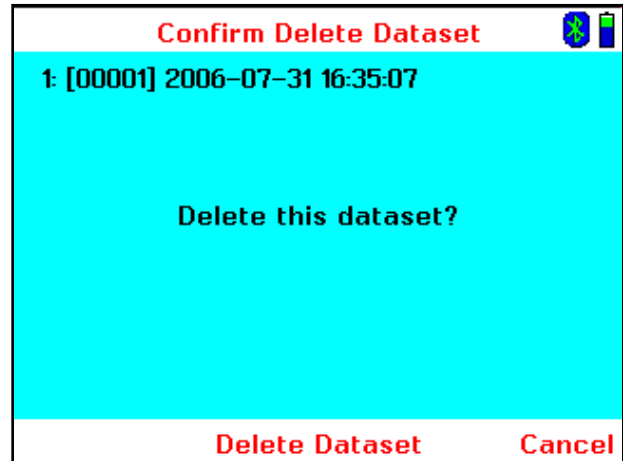
The list of datasets in memory



The View Graph option



Options available once a dataset is selected

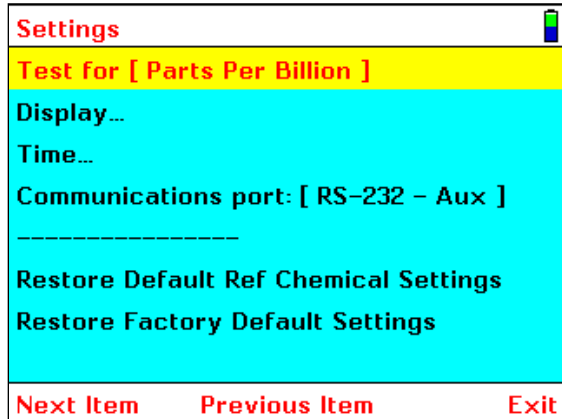


Confirmation screen to prevent an accidental deletion

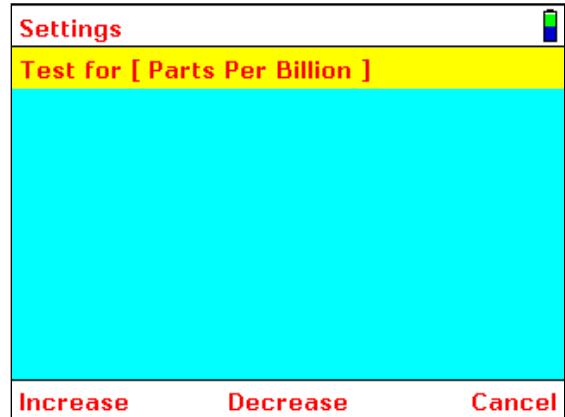
6.2.6.2 Settings

Selecting Settings from the Menu List allows the operator to adjust the following.

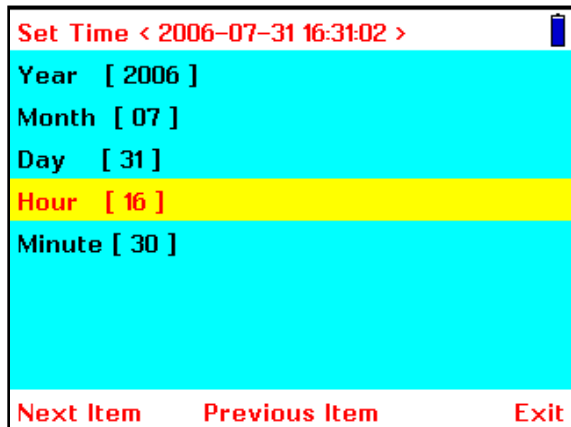
- Test For [Standard or Parts-Per-Billion]: allows the default concentration level of the Chem-ID test to be switched from Standard to PPB (parts-per-billion). This adjusts the air sample draw time.
- Display: allows adjustment of screen brightness and the duration the backlight stays on. The backlight is automatically lit whenever a button is pressed.
- Set Time: allows the clock to be set. Note that the clock can also be set by using the Chem-ID™ PC Manager Software.
- Communications Port: allows the Bluetooth radio to be turned on or off.
- Restore Default Reference Chemical Settings: an operator should only activate this command if instructed by D-tect Maintenance personnel.
- Restore Factory Default Settings: an operator should only activate this command if instructed by D-tect Maintenance personnel.



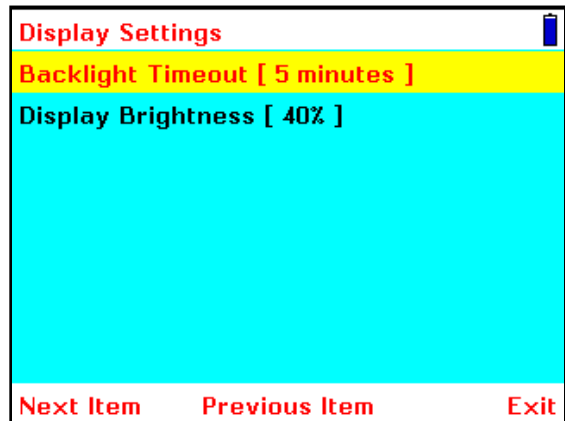
The Settings Menu



To change the test concentration level



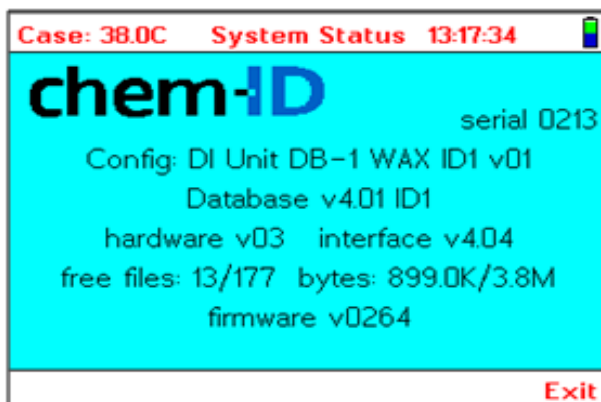
Adjusting the internal clock



Display Controls

6.2.6.3 System Status

Selecting System Status from the Menu allows examination of Chem-ID™ subsystems and firmware version numbers. This information is primarily used by D-tect technicians to calibrate the Chem-ID™ at the factory.



System Status

6.3 After a Test

6.3.1 End of a Test

After a test is completed and the Chem-ID™ has returned to the Ready Screen, the Chem-ID™ can be used for more tests or turned off completely. To most efficiently use the helium, close the helium valve located in the side door whenever there is going to be more than 30 minutes before the next analysis. The Chem-ID™ will alert you if you try and start another test without remembering to open the valve.

DO NOT FORGET to close the helium valve.
A helium tank can last for up to 50 tests if the valve is closed when not in use.

6.3.2 End of the Day

To put the Chem-ID™ back into storage until next use, follow the End-of-Day Checklist below.

6.3.3 End-of-Day Checklist

1. Turn off the helium valve located in the side door; otherwise the helium tank will be empty when next needed.
2. Close the front and back vents.
3. Decontaminate the Chem-ID™ if necessary. This is discussed in Section 6.4.
4. Recharge the battery.

6.4 Decontamination

A Statement about Decontamination

Decontamination is a cleaning process that can render the Chem-ID™ safe to touch, even after exposure to dangerous chemicals. The exact process is dependent on the decontamination rules and processes of the operator’s organization. Declaring that the Chem-ID™ is safe to touch is a decision made by experienced and trained personnel in your local organization. This manual, as well as the manufacturer, makes no claim about what level of decontamination is safe or approved for a specific organization.

When the front and back knobs are twisted to the “closed” position and all doors and panels are closed and latched, the Chem-ID™ is sealed against water incursion. The exterior can now be decontaminated.

Remember that the inside of the Chem-ID™ must also be decontaminated after exposure to a hazardous material before the inside can be accessed without protective measures.

Note: The nylon handle straps and shoulder straps can be washed, but if there is any doubt that chemical residue has been removed from between the threads, they must be considered as hazardous materials and disposed of. Replacement straps are included in the Chem-ID™ kit.

6.5 Operational Notes

6.5.1 Absolute Concentration Mode

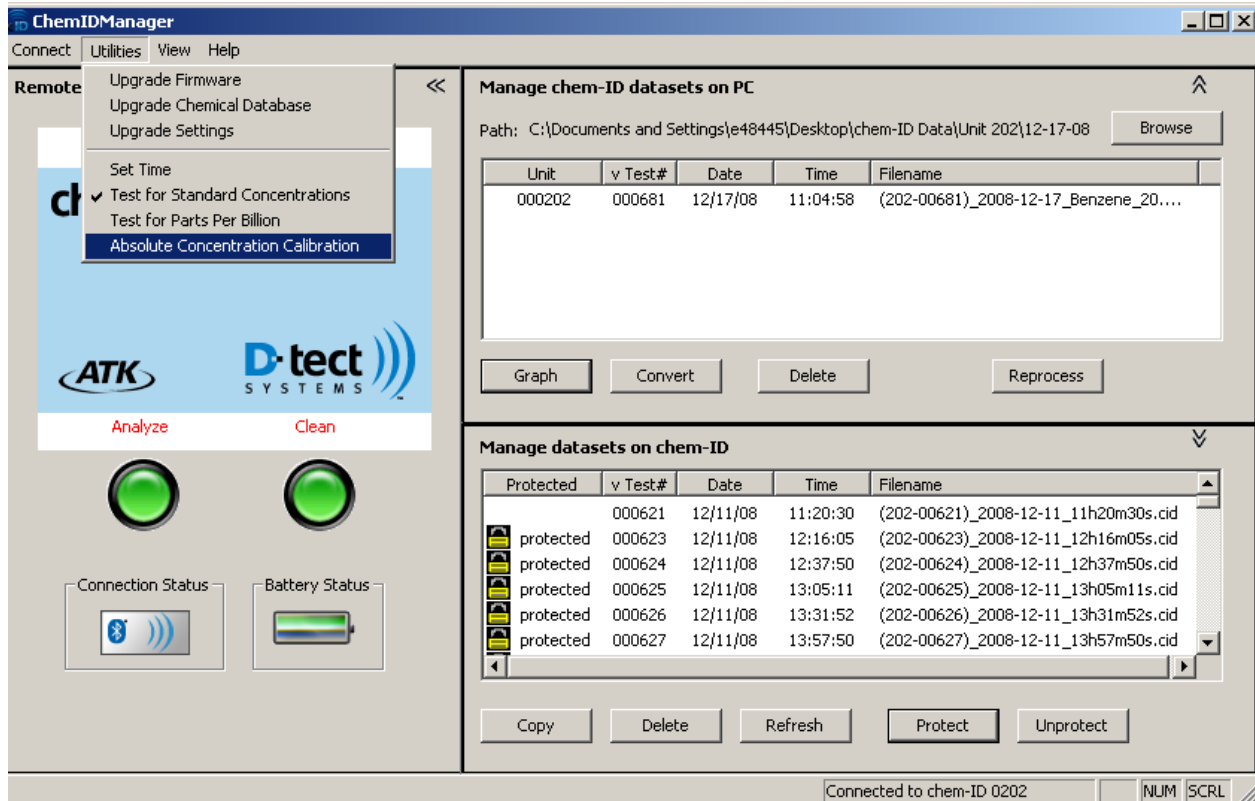
By default, the Chem-ID operates in Relative Concentration mode. All chemical samples are analyzed and their concentrations measured based on a concentration curve derived from a set of reference chemicals. The Chem-ID can measure known chemicals to higher accuracy using the Absolute Concentration (AC) mode. In AC mode, a set of reference measurements are taken of a selected chemical using a set of three or five known laboratory concentrations samples of the chemical. The Chem-ID will automatically generate a concentration curve based on the reference sample and all future samples of that known chemical will be compared against that concentration curve and not the general Relative Concentration curve.

To Generate an Absolute Concentration Curve for a chemical:

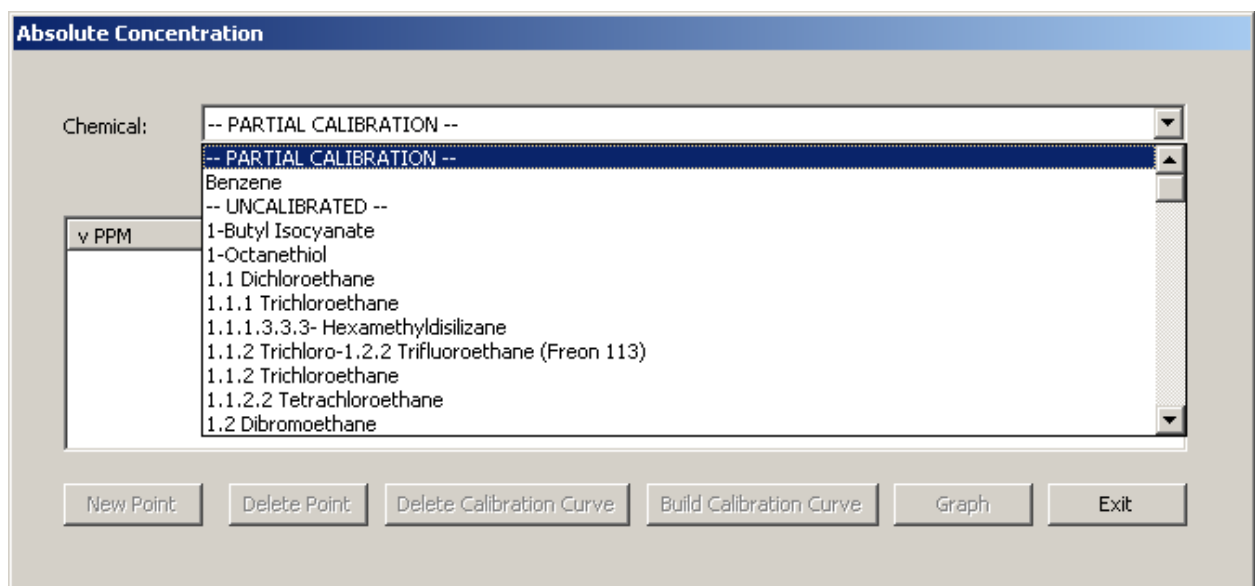
An AC curve can only be generated using the ChemIDManager software. First acquire three or five different concentration samples of the chemical.

1. Select “Absolute Concentration Calibration” from the “Utilities” Menu

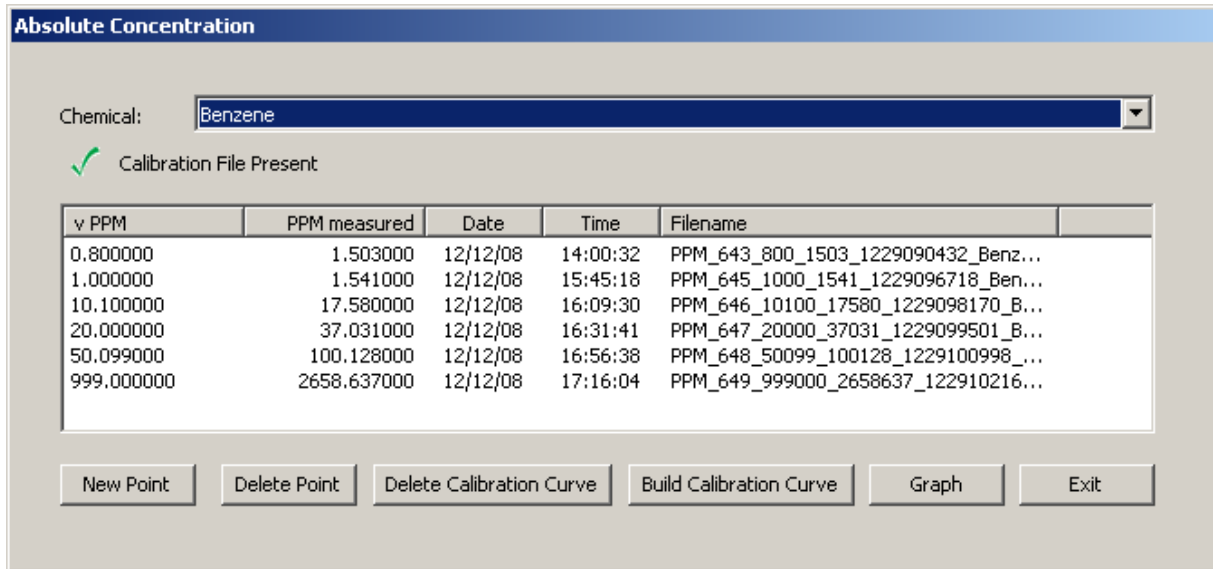
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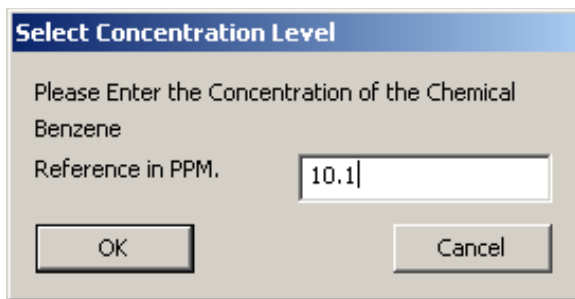
2. Select the chemical to be calibrated from the pull-down menu. The drop-down menu is organized in two sections: “Partial Calibration” and “Uncalibrated.” Once a chemical has at least one calibration test data point, it will appear under the “Partial Calibration” heading.



- When the chemical is selected, information from previous calibration tests (if any) will appear in the white text area below the drop-down menu



- To add a new calibration sample, press the “New Point” button and enter the concentration of the known sample when the “Select Concentration Level” window appears.



- When the desired number of calibration reference points have been measured, select “Build Calibration Curve”. At that point, future concentration measurements of that chemical will be performed using the Absolute Calibration curve created for that chemical.

6.5.2 Collecting Sample for External Verification

If an identification needs to be verified by an external laboratory, removing the Preconcentrator may be the fastest method. To ensure a good sample remains in the Preconcentrator, abort the Analysis Cycle before the Cleaning Phase progresses very far. Remove and replace the Preconcentrator in accordance with the instructions in Section 7.

6.5.3 Using the Liquid Analyzer Attachment

In some cases, an operator may prefer to analyze a chemical sample by bringing the sample to the Chem-ID™ instead of taking the Chem-ID™ to the chemical. The Liquid Analyzer Attachment is used to analyze a chemical sample. The attachment consists of a stainless steel flask, hose, and stopper. Put a small amount of the chemical sample in the flask, just enough to cover the bottom (or a vial containing a sample can be placed into the flask). Put the stopper on the flask, and connect the hose to the intake nozzle of the Chem-ID™. Then press the Analyze button on the Chem-ID™.



6.5.4 Cleaning a sample out of the Chem-ID™

The Chem-ID™ automatically cleans the unit out as part of analysis cycle. The higher the concentration of the chemical detected, the longer the cleaning cycle will take. The Chem-ID™ will automatically adjust the length of the clean cycle to match the concentration of the sample measured.

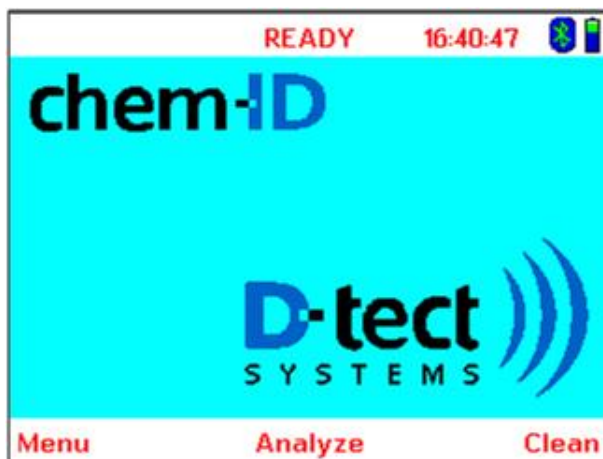
If a high concentration of a chemical has been sampled, several manual clean cycles may be needed to purge the chemical from the Chem-ID™. If a chemical is still detected after leaving the source of the chemical, then further cleaning is necessary. These manual clean cycles are accessed by pressing the “Clean” button from the Ready screen. The two options are as follows.

Standard Clean Cycle: Has the exact same duration as the automatic clean cycle. If there are trace amounts of a previously analyzed chemical, you must manually run another clean cycle.

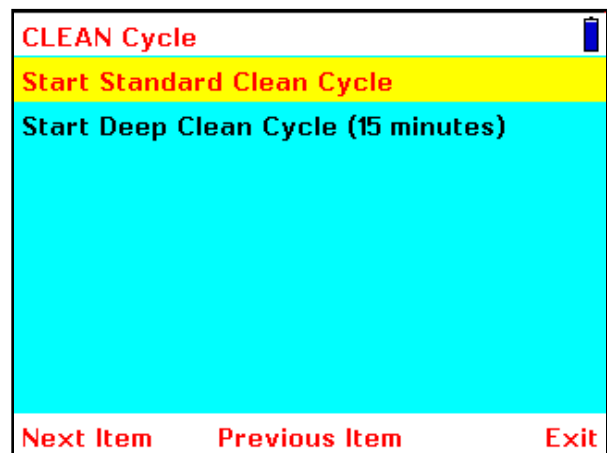
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Deep Clean Cycle: Deep cleans may be necessary when the Chem-ID is used to sample a very high concentration of a chemical. Sampling a large concentration of a chemical may leave detectable amounts of the chemical present, even after the Chem-ID™ performs the normal clean cycle as part of the Analysis Cycle. An operator should instigate a deep clean if he notices significant amounts of a previously measured chemicals still present in new analyses. The deep clean takes 15 minutes and uses a large amount of battery life.

Note that the low-level presence of a chemical that has not yet been cleaned from the system does not reduce the sensitivity or dilute the results of a new chemical test.



Press the Clean button to access manual cleaning modes



The Clean Menu provides two cleaning mode choices

7 Maintenance

7.1 Battery

The Chem-ID™ runs off a Mil-Standard 28.8 volt sealed lithium ion battery. The battery is extremely rugged and can be used in most environmental conditions. The battery will operate the Chem-ID™ for approximately 14 chemical analyses. It is easy to replace and charge.



Lithium ion battery

Remaining battery life can always be checked while the Chem-ID™ is in operation by looking at the small battery icon in the upper right corner of the display screen. The top of the battery also displays a bar graph of the charge remaining.

Manufacturer's Warning for the Battery

Do not Store above 140°F (60°C), crush, mutilate, reverse polarity, disassemble, or dispose of in fire.

The Chem-ID™ will display a low power notice when the battery needs to be changed. Note that operating the Chem-ID™ without taking a chemical analysis (such as looking at previously recorded data) takes very little power and even a low battery can support this level of operation. A chemical analysis will not begin unless there is sufficient battery power to complete the entire analysis cycle. When the battery is too low for an analysis, an alert appears on the display.

When changing the battery in the field, ensure the environment is not explosive. The Chem-ID™ is not an intrinsically safe device.

WARNING!

The Chem-ID™ is not certified as an intrinsically safe instrument. This means that the Chem-ID™ is not to be used in combustible environments that can be ignited by a potential spark. Using a Chem-ID™ in such an environment may result in an explosion and potential injury or death.

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7.1.1 Inserting the Battery



1. Open the back panel by twisting the small knob.



2. Raise the door.



3. Hold the charged battery with the connector on the bottom and label on top.



4. Slide the battery into the metal slot.



5. Push the battery in with your thumb. Apply a little pressure to make sure the battery seats.



6. The charged battery is in place. Close and secure the door.

7.1.2 Charging the Battery

The picture below shows the battery charger included with the Chem-ID™. Connect the power cables together (they only fit one way), plug it to the battery, and plug it into the electrical outlet.



The charging kit and battery

7.2 Helium Tank

The ultra-pure helium tank is Department of Transportation approved and certified. Each Chem-ID™ tank contains 1.5 cubic feet of helium compressed to 2200 psi at 70°F. The tank is coated so that if it is ever exposed to a high temperatures that could potentially weaken the temper of the metal (such as in a fire), the tank will change color and will not be refilled. Helium is nonflammable. Read and follow the safety precautions provided by the tank manufacturer and gas provider.



The helium tank

The tank is easy to replace, even while wearing Hazmat gloves. The valve is automatic, so the tank seals when unscrewed from the Chem-ID™ and opens when screwed into place.

Helium tanks can be refilled and additional tanks can be purchased from Laurus Systems (D-tect Systems' distributor). Please see Appendix C for details. Helium tanks cannot be refilled by any other source than D-tect Systems or its distributor.

WARNING!

The use of standard grades of helium will degrade the performance of the Chem-ID™. Use only D-tect Systems approved ultra-pure helium.

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Manufacturer's Warning Label I

Compressed Helium, Non-Flammable Gas 2

Caution: high pressure gas can cause rapid suffocation. Store and use with adequate ventilation. Use equipment rated for cylinder pressure. Use a back flow prevention device in the piping. Cylinder temperature should not exceed 52°C/125°F. Close valve after each use and when empty. Use in accordance with the Material Safety Data Sheet. Inhaling helium to alter the voice may prove fatal and should not be allowed. First Aid: if inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Manufacturer's Warning Label II

Aluminum high-pressure gas cylinder

- **Explosion Hazard: Improper use, filling, storage, or disposal may result in personal injury, death, or property damage.**
- **Do not alter or modify this cylinder or valve in any way. Do not use any caustic paint strippers or corrosive cleaners.**
- **Always secure cylinder in a cool dry area, out of the reach of children.**
- **Do not expose filled cylinder to any heat source, flame, or condition where the temperature may exceed 130°F. Cylinders exposed to fire or heat in excess of 350°F must be condemned. Cylinders refinished or subjected to elevated temperatures must be hydrostatically tested prior to refilling.**
- **Do not remove, alter, or obscure this warning label.**
- **Only trained personnel should replace valves and pressure relief devices.**
- **Cylinder must be filled by properly trained personnel in accordance with these instructions and C.G.A. pamphlets C-1, C-6.1, G-6, G-6.3, and P-1 available from the Compressed Gas Association at 703-788-2700 or www.cganet.com.**

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7.2.1 Installing the Helium Tank



1. Open the back panel by twisting the small knob.



2. Raise the door.



3. The helium bottle goes in the round hole under the battery.



4. Slide the helium tank into the slot as shown until it touches the connector in the front.



5. Screw it in clockwise until tight.



6. That's it. The helium tank is now installed.

7.3 Reference Chemical

The reference chemical used by the Chem-ID™ is 1,4-dichlorobenzene. If a “Reference Peak Not Found” alert is displayed, the reference chemical may need to be replaced. Unscrew the lid labeled “DOPANT” and replace the small pellet of reference chemical with a new one. Note that if the Chem-ID™ is operated in an atmosphere of extremely high concentrations of solvents, the reference chemical may be used up faster than normal.

7.3.1 Changing the Reference Chemical



1. The reference chemical is located behind the side panel.



2. Open the door by twisting the knob.



3. The reference chemical is located behind the lid labeled “DOPANT”.



4. Take off the lid by twisting counterclockwise.



5. The reference chemical is contained in the little pellet in the lid.



6. Pull out the old pellet and insert a new pellet with hole facing up.



7. Screw the lid back. The reference chemical is now in place for testing.

Reference Chemical Manufacturer's Warning

1,4 dichlorobenzene is commonly available at drug stores. The general warning label provided by the manufacturer is shown below. Both the amount used in the Chem-ID™ as well as the amount that has to be handled are extremely small. Remember to wash your hands after handling.

Manufacturer's Warning Label for 1,4 Dichlorobenzene

WARNING: Causes eye, skin, and respiratory tract irritations. Harmful if swallowed. Avoid contact with eyes, skin and clothing.

NOTICE: This product contains a chemical known to the State of California to cause cancer.

If swallowed:

- Call poison control center or doctor immediately for treatment advice.
- Have person drink several glasses of water.
- Do not induce vomiting.
- Do not give anything by mouth to an unconscious person.

If in eyes:

- Hold eye open and rinse slowly and gently with water for 15-20 min.
- Remove contact lenses, if present, after the first 5 min., then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

If on skin or clothing:

- Remove contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 min.
- Call a poison control center or doctor for treatment advice.

If inhaled:

- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth to mouth if possible.
- Call a poison control center or doctor for treatment advice.

Have the container or label with you when calling a poison control center or doctor, or going in for treatment. You may also contact the Natural Pesticide Information Center at 1-800-858-7378 for information.

7.4 Changing the Preconcentrator

If an important identification needs to be verified by an external laboratory, removing the Preconcentrator may be the fastest method. To ensure a good sample remains in the Preconcentrator, abort the Analysis Cycle before the Cleaning Phase progresses very far.

The red plug that comes with the Preconcentrator is designed to keep water out. It is not a chemical seal or plug. When exposed to or containing hazardous materials, treat the Preconcentrator in accordance with local and Federal laws and guidelines.

7.4.1 Removing the Preconcentrator



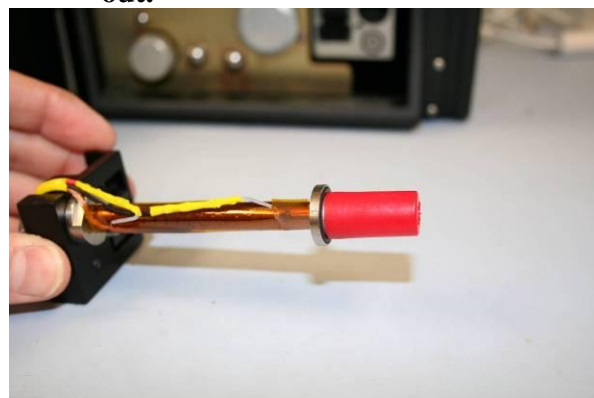
1. The Preconcentrator is the front knob in the side panel with wires.



2. To remove, just twist the knob until the assembly can be pulled out.

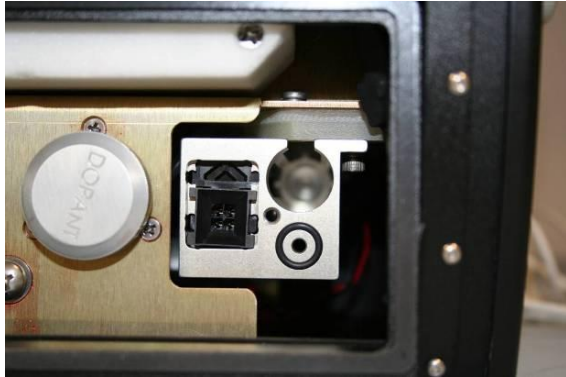


3. The removed Preconcentrator



4. Attach the red plug and place in safe storage. It's now ready to transport.

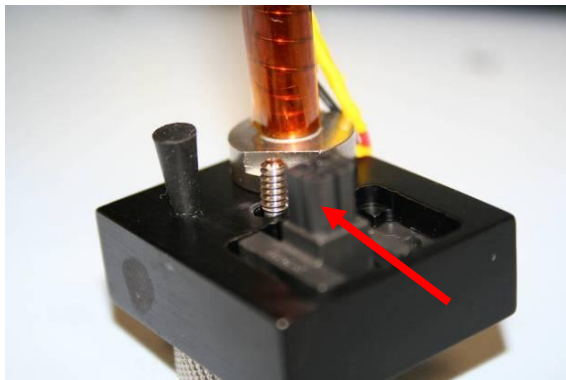
7.4.2 Adding a new Preconcentrator



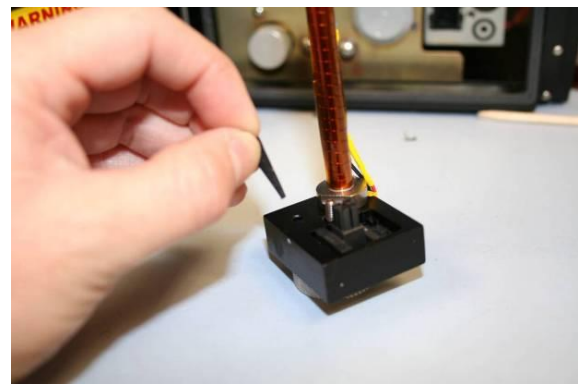
1. The Preconcentrator slot is in the front of the side panel.



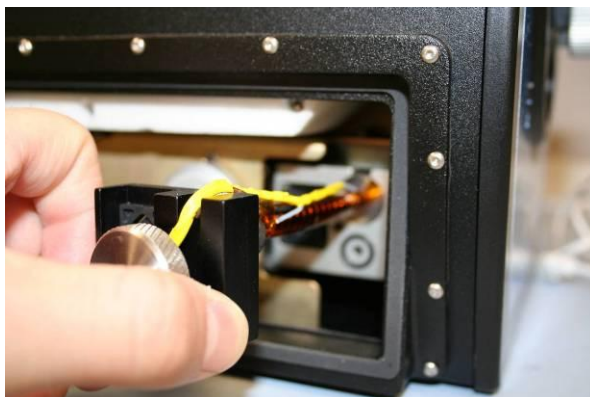
2. A new Preconcentrator is located in the Chem-ID™ storage case.



3. Remove the Preconcentrator from the Chem-ID™ storage case.



4. Pull the cone-shaped plug out.



5. Align the cylinder and connector and slide the Preconcentrator in.



6. Twist the knob closed to lock the Preconcentrator in place.

8 Operating the Chem-ID™ by Remote Control

The Chem-ID™ has a built in Class 1 Bluetooth radio that allows communication with a Bluetooth-enabled Microsoft Windows™-based PC from up to 100 meters away. Across this link, the Chem-ID™ can be operated entirely by remote control, and the results of all chemical analyses can be downloaded to the PC. This link can also be used to update the firmware of the Chem-ID™.

The Chem-ID™ kit includes a USB Bluetooth radio kit that will allow any PC with a USB port to link with the Chem-ID™. Be aware that Bluetooth radios, like any other type of radio, can be interfered with from nearby strong transmitters.

8.1 Installing the Chem-ID™ Manager PC Software

The installer for the Chem-ID™ Manager is located on the CD included in the Chem-ID™ storage case. Insert the CD in the drive, open the PC Manager directory on the CD, double click on the PC Manager Set-Up icon, and follow the instructions.

8.2 Linking to a PC

Follow these steps to allow a Microsoft Windows PC to locate and communicate with the Chem-ID™.

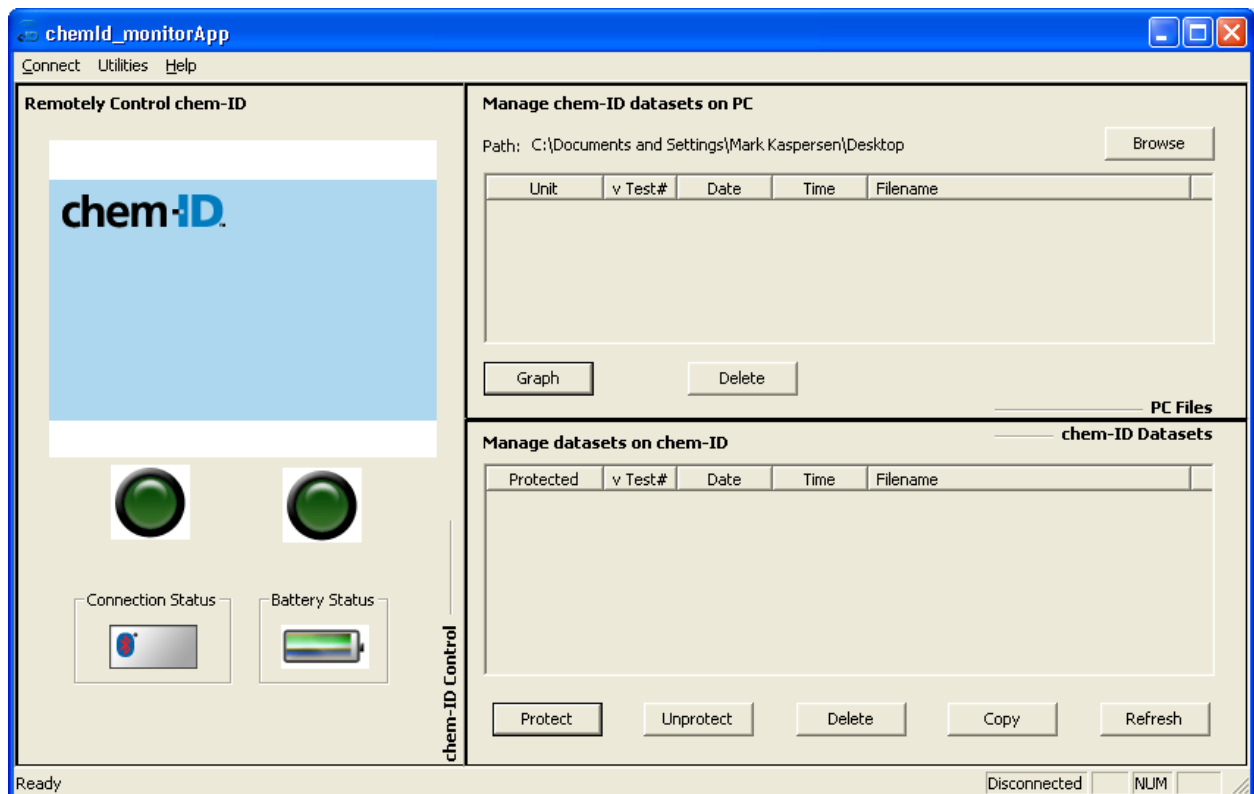
1. Install the included USB Bluetooth device onto the Windows PC, following the directions provided with the device.
2. Turn on the Chem-ID™ Bluetooth radio (Menu Button ► Settings ► Communications Port)
3. Using your Bluetooth-equipped PC:
 - a. Look for Bluetooth devices in the area.
 - b. Find and select the desired Chem-ID™.
 - c. If the PC is using Windows XP with Service Pack 2, it will ask for a passcode. The default passcode is **00000000** (eight zeros).
 - d. Remember the com port value that Microsoft Windows reports.

The Windows PC is now communicating with the Chem-ID™.

8.3 Operating the Chem-ID™ using the Chem-ID™ Manager PC Software

To operate the Chem-ID™ using the Chem-ID™ Manager:

1. Ensure that the Windows PC is communicating to the Chem-ID™.
2. Run the Chem-ID™ Manager software on the PC.



The Chem-ID™ Manager Screen

3. Select “Connect” under the “Connect” menu. A pop-up window will ask which com port Windows is using to communicate with the Chem-ID™. Enter in the com port Windows identified. In the lower left of the Chem-ID™ manager, the Connection status box will show a moving wave when the Chem-ID™ is under control of the Chem-ID™ Manager. The connection status is also shown in the text displayed in the bottom right of the screen.



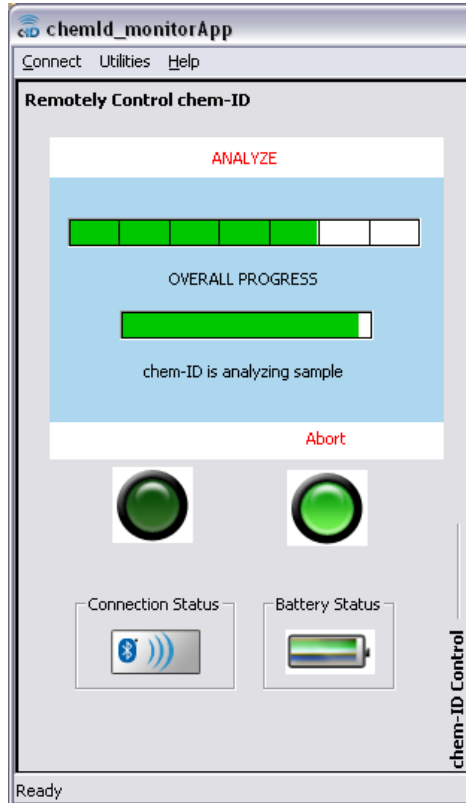
The Chem-ID™ Manager software allows the operator the capability to:

- Operate the Chem-ID™ by remote control.
- Download Chemical Analysis Files from the Chem-ID™.
- Review Chemical Analysis Files stored on the PC. This function does not require a connection to a Chem-ID™.
- Convert the Chemical Analysis Files into CSV format, allowing third party software (such as Microsoft Excel) to be used to evaluate the data. This function does not require a connection to a Chem-ID™.
- Update the Firmware on the Chem-ID™.
- Update the clock on the Chem-ID™.
- Manually calibrate the Chem-ID™ for increased concentration accuracy via AC mode (See Section 6.5.1).

The Chem-ID™ Manager software opens up to three windows: Chem-ID™ Control, Chem-ID™ Datasets, and PC Files.

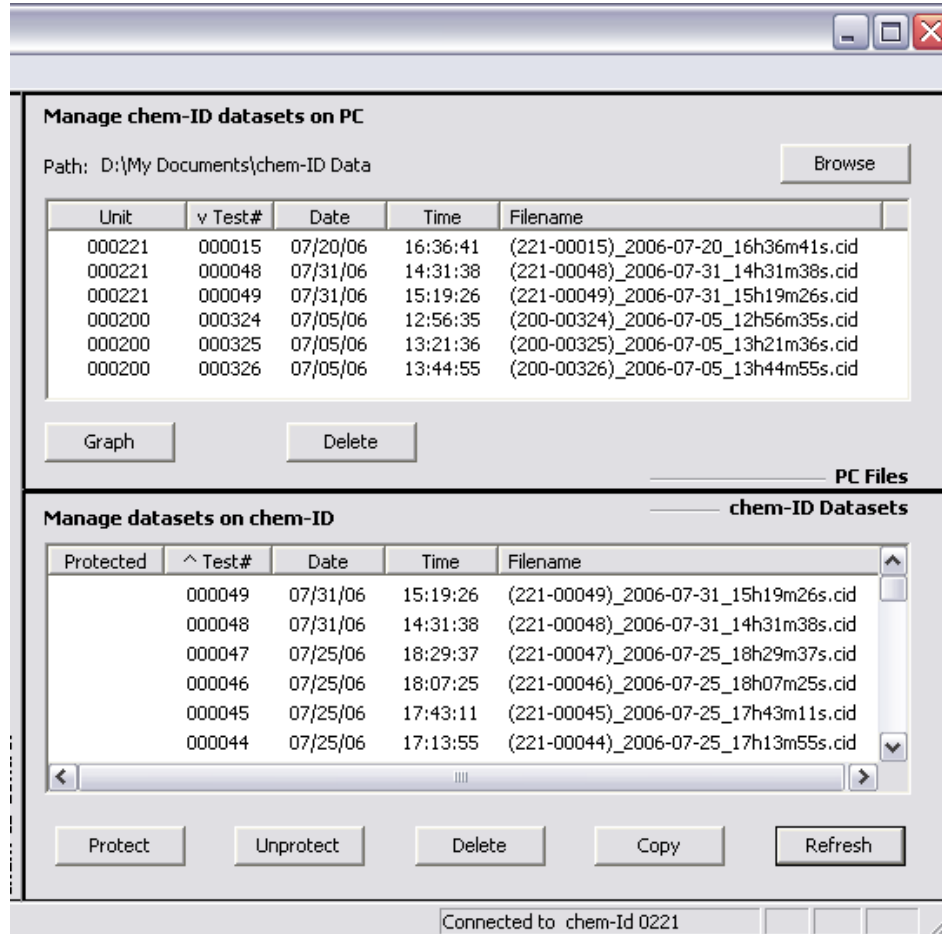
The Chem-ID™ control window allows a user to run the Chem-ID™ by remote control. Operating the Chem-ID™ by remote control is nearly identical to operating it directly. The green buttons and Chem-ID™ display allow the same controls as the controls and display on the unit. The only difference is that the button to control the Chem-ID™ menu is not available from the Chem-ID™ manager software. All other functions are identical.

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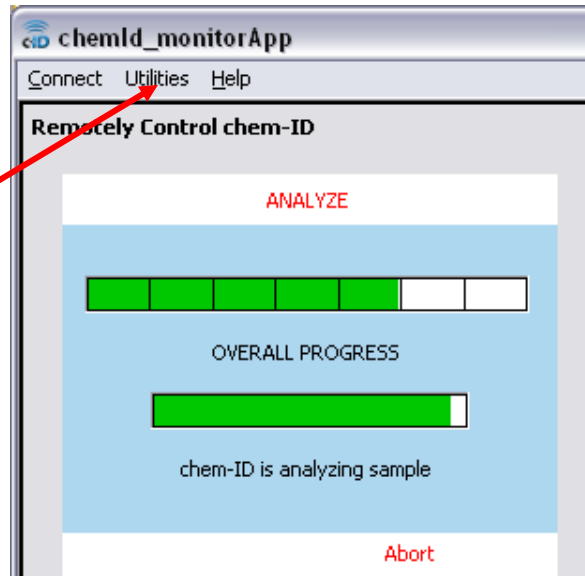
The Remote Control Window

The Chem-ID™ Datasets window displays the chemical analysis files stored on the Chem-ID™. The PC Files window shows the chemical analysis files stored on the PC located at the file location (path) shown above the PC Files window. To download files from the Chem-ID™ to the PC, just drag the files from the Chem-ID™ window to the PC window. Chemical Analysis files stored on the PC can be examined by selecting the file and pressing the graph button. The files can also be saved as CSV files.



The files on the PC are shown in the top window and the files on the Chem-ID™ on the bottom

As software and database updates become available, you will be notified by D-tect Systems and the update will be emailed to you. To update the software, just select “Upgrade Firmware” or “Upgrade Database” from the “Utilities” menu and follow the instructions.



Firmware can be updated under the Utilities menu

9 Training and Certification

Training classes and training certifications are available. While not necessary, the training does provide a supervised environment to learn how to use the Chem-ID™ and interpret the results from a chemical analysis.



Appendices

10 Appendix A: Specifications

Temperature Range of Operation	-25° to 125° F
Relative Humidity	0-100% condensing
Precipitation	Driving Rain per Mil-STD-810
Emissions	FCC certified
Battery	28.8 volt sealed lithium ion
Battery Life	12-14 full Analysis Cycles
Dimensions	16" (14" w/o knobs)L x 8.6"H x 7.5"W
Weight	15.9 lbs



11 Appendix D: Limited Warranty for D-Tect Products

1. What this Warranty Covers and for How Long

D-tect Systems ("D-tect Systems") warrants this device (the "Product") against defects in materials and workmanship under normal use for a period of one year from the date of purchase. This warranty extends to the first end-user purchaser only, and is not transferable. This warranty does not extend to other ancillary and/or consumable products including but not limited to batteries, straps, and shipping cases. D-tect Systems, at its option, will at no charge either repair, replace or refund the purchase price of any Products that do not conform with this warranty. Repair may include the replacement of parts with functionally equivalent reconditioned or new parts. Replacement may include providing a functionally equivalent Certified Reconditioned/Pre-owned or a new Product. Products that have been repaired or replaced are warranted for the balance of the original warranty period or for 90 days from the date that the repaired or replaced Product is received by you, whichever is longer. All Products for which replacements have been provided will become D-tect Systems property.

2. Other Warranty Conditions

This warranty is D-tect Systems' complete warranty for the Product. D-tect Systems assumes no obligation or liability for changes to this warranty unless made in writing and signed by an officer of D-tect Systems.

If D-tect Systems agrees to perform services requested and approved by the customer that are not included in either the Limited or Extended Warranty, these services will be billed to the customer at D-tect Systems' standard prices and terms.

D-tect Systems does not warrant any installation, maintenance, or service that it did not perform. SERVICE WORK PERFORMED BY SERVICE CENTERS NOT AUTHORIZED BY D-TECT SYSTEMS TO PERFORM SUCH WORK WILL VOID THIS WARRANTY.

3. What This Warranty Does Not Cover

- a. Defects or damage resulting from: collision of the Product with hard surfaces, contact with water, rain or extreme humidity, contact with sand, dirt or the like, contact with extreme heat or cold, spills of food or liquid, improper testing, operation, maintenance, installation, adjustment; or any alteration or modification of any kind.
- b. Normal "wear and tear" of the Product such as scratches, scuffs, and marks on the LCD, case and other external features.

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- c. Cracked or broken displays, buttons, or damage to other externally exposed parts caused by abnormal use and/or abuse of the Product.
- d. Products disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
- e. Products on which serial numbers or date tags have been removed, altered or obliterated.

4. How to Get Warranty Service

To get warranty service, please contact your distributor or D-tect Systems at www.dtectsystems.com.

You will receive directions on how to mail the Product to D-tect Systems. All Products shipped to D-tect Systems must be shipped with freight and insurance prepaid. Along with the Product you must include a receipt, bill of sale, or some other comparable proof of purchase, a written description of the problem and, most importantly, your address and telephone number. If additional information is needed, please contact D-tect Systems at the web address indicated above.

5. General Provisions

THIS IS THE COMPLETE WARRANTY FOR THIS PRODUCT BY D-TECT SYSTEMS AND SETS FORTH YOUR EXCLUSIVE REMEDIES. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE GIVEN ONLY IF SPECIFICALLY REQUIRED BY APPLICABLE LAW. OTHERWISE, THEY ARE SPECIFICALLY EXCLUDED. IN NO EVENT SHALL D-TECT SYSTEMS BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT, TO THE FULL EXTENT THESE DAMAGES MAY BE DISCLAIMED BY LAW.

6. Patent and Software Provisions

D-tect Systems will defend at its own expense, any suit brought against you to the extent that it is based on a claim that the Products infringe a United States patent. D-tect Systems will pay those costs and damages finally awarded against you in any such suit which is attributable to any such claim. The defense and payments by D-tect Systems are conditioned on the

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following: (a) that you will notify D-tect Systems promptly in writing any notice of the claim; and (b) that D-tect Systems will have sole control of the defense of the suit and all negotiations for its settlement or compromise; and (c) should the Products become, or in D-tect System's opinion be likely to become, the subject of a claim of infringement of a United States patent, that you will permit D-tect Systems, at its option and expense, either: to procure for you the right to continue using the Products or parts; to replace or modify them so that they become non-infringing; or to grant you a credit for such Products or parts as depreciated and accept their return. The depreciation will be an equal amount per year over the lifetime of the Products, accessories, battery or parts as established by D-tect Systems.

D-tect Systems will have no liability to you with respect to any claim of patent infringement which is based upon the combination of the Products or parts furnished under this limited warranty with software, apparatus or devices not furnished by D-tect Systems. D-tect Systems will have no liability for the use of ancillary or peripheral equipment or software not furnished by D-tect Systems which is attached to or used in connection with the Products. The foregoing states the entire liability of D-tect Systems with respect to infringement of patents by the Products, accessories, batteries or any parts of them.

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State and Jurisdiction Law Rights

Some states and jurisdictions do not allow limitation or exclusion of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or from one jurisdiction to another.

Contact D-tect Systems at:

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12 Appendix C: Additional Supplies and Helium Refills Available

Helium refills and additional supplies can be purchased from Laurus Systems. Please call toll-free at **1-410-465-5558** or email at lauralynch@laurussystems.com.

Supplies available from D-tect Systems

- Additional helium tanks (set of 4)
- Additional Lithium Ion Battery
- Lighter recharger attachment for battery
- Additional Preconcentrator Tubes
- Additional reference chemical
- Handle straps
- Shoulder straps

Helium Tank Refills

Both FedEx and UPS refuse to ship compressed gas tanks of any kind by air. Therefore, please allow three to five business days for tank refills to arrive. D-tect Systems has the option to ship replacement tanks immediately on order, before the empty tanks have arrived.

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