DOD Technologies

DOD64 FTIR

Gas Detector
Operating Manual

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Chapter 1 – Overview

1.1 Introduction

The DOD Technologies DOD64-FTIR can sequentially monitor 16 to 64 locations (called sample points) and is designed for fast and accurate multi-sequential analysis of a variety of gases. The DOD64-FTIR incorporates Fourier Transform Infrared gas detection technology to detect low levels of many Infrared active gases. Sample points can be placed up to 400 ft. (121 m) from the central unit, allowing operators to monitor gas concentrations in areas removed from the detector's location. A sample from each point is drawn to the central location of the monitor via tubing and analyzed for toxic, corrosive and flammable gases based on the applications requirements. Contact DOD for specific gas calibration details or for interest in specific calibration requirements which may require a development partnership.

The DOD64-FTIR system can be configured with a maximum of 4 manifolds and each manifold has 16 sample points. Gas detection and analysis occurs in the DOD64's Interferometer located above the pump panel within the service door. Sample activity, data collection and corresponding output action occurs in the DOD64-FTIR onboard PC located in the control box.

The system responds to gases that exceed a programable alarm level or a system fault by:

- Triggering outputs or communication method installed on the unit.
- Displaying the point number, gas type, and gas concentrations in red.
- Electronically storing Alarms, Concentrations, Spectra data, and History.

The DOD64-FTIR triggers outputs for each individual point at two levels of gas concentrations. These programmable limits are selectable and have default factory settings for their respective gas ranges. The DOD64-FTIR is designed for maximum uptime, so routine maintenance and service can be performed quickly and easily. The DOD64-FTIR uses FTIR technology which includes an interferometer with either MCT Sterling cooled detector or a DTGS detector. The preferred detector type should be specified at the time of purchase.

1.2 Sampling and Analyzing

The DOD64 FTIR extracts a sample continuously from each point to reduce sample transport time. Reduction in transport time is achieved with one dedicated transport pump per 16 sampling locations continuously pulling a sample. There is also one independent analysis pump which draws the sample line intended to be analyzed through the DOD64-FTIR's sampling cell after the individual point valve is opened. The DOD64-FTIR also allows for continuous sampling of a single location through the "lock on point feature".

1.3 Nitrogen Purging

Nitrogen purging is a critical to the operation of the DOD64-FTIR. Nitrogen is used to perform periodic background checks to eliminate detector output drift due to humidity and temperature shifts that can occur in different environments. The Nitrogen background function also assist in the correction of changes that occur naturally within the interferometer. These background checks can be initiated manually or can be set to occur automatically at user-defined time intervals.

The nitrogen supply connection is located on the right-hand side of the machine, in the upper left corner. If the system is located in an enclosed area, be sure to take all the safety requirements necessary in the use of nitrogen, which may include monitoring for loss of oxygen in this area. Contact DOD Technologies for additional oxygen deficiency monitoring if needed.

1.4 Sample Line & Exhaust Connections

Flow connections for sample lines and exhaust lines are installed using “quick-connect” ports on the inlet manifolds and right-side panel of the DOD64-FTIR. Sample ports are labeled by number, from 1 to 64 depending on your specific instrument configuration. Exhaust ports are located on the right-side panel of the DOD64-FTIR and are also labeled. Each sample line should be extended a maximum of 400 ft. and each exhaust line should be extended a maximum of 25 ft.

IMPORTANT: Be sure to exhaust system to an appropriate scrubber vent as all samples drawn from location exhaust here at the systems exhaust ports. If gas is present at the locations monitored it will be transported to this area so be sure to place the exhaust appropriately.

1.5 Electrical Connections

Knock out panels for external electrical connections are provided on the right-side panel of the DOD64-FTIR (See installation Package). The DOD64-FTIR can be purchased with a side mounted power switch or internal hard wire option with A/C filter.

1.6 Spectra and Event/Trend File

The DOD64-FTIR stores both Spectra and Event/Trend history to an external solid-state hard drive. All files are transferable to a USB memory stick. A periodic process should be set up to remove this data from the system to avoid memory capacity issues. Trend/Event files will be saved as .CVS files and can easily be opened in common programs such as Excel. The Spectra files are saved in .LAB format or .SPC depending on the interferometer type purchased with the DOD64-FTIR. The files can be viewed on an external PC using the DOD spectra viewer. Spectra data stored in .LAB format can also be converted.SPC format, which is compatible with other spectra open source viewers. Contact DOD Technologies for further information on Spectra Format and viewers. All historical Spectra and Event/Trend files can be retrieved locally on the system if needed. (Section 5.2.3)

Chapter 2 – Features

2.1 External Layout

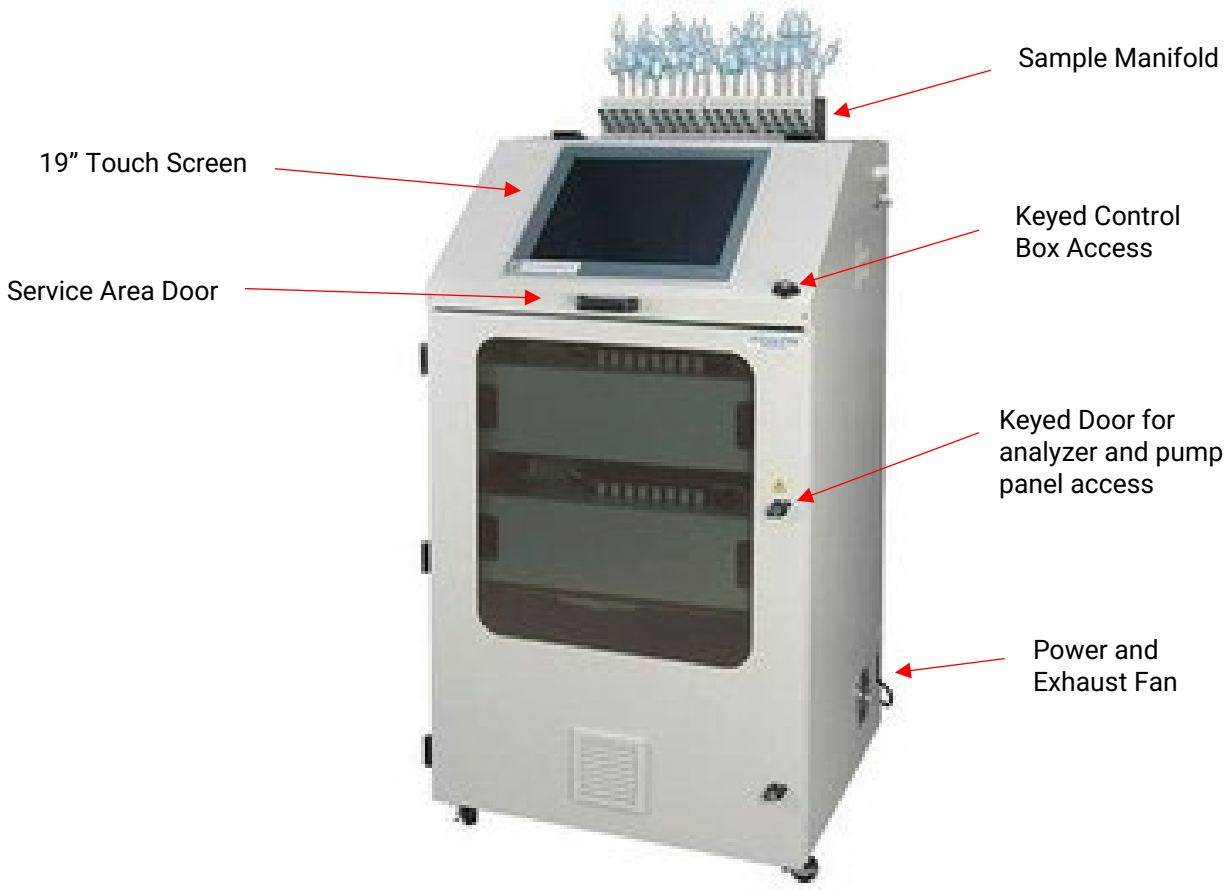


Figure. 2.1

2.1.1 Warning Labels, Descriptions, & Danger Zones

The below table references all warning labels and their meanings that may be encountered while operating and servicing the DOD64-FTIR gas detection system.

	WARNING: Hot Surface. This surface will be hot to touch and may cause injury. Please avoid or take caution when working near this zone.
	WARNING: Protective Earth Ground. Terminal Intended for connection to external conductor for protection against electric shock in case of fault.

	ATTENTION: Please read operators manual for all instruction for this machine. If manual is not in country's native language, requested updated manual before use of equipment.
	WARNING: Electric Shock is possible, please use caution when accessing this zone.
	WARNING: Moving Parts and Hand Crushing possible. Please watch hand placement when working near this zone.

2.2 Touch Screen Display

The DOD64-FTIR features a 19", full color, LCD touchscreen display, enhancing the presentation and visibility of data. All DOD64-FTIR menus and data points are accessible through this state-of-the-art HMI. (Figure 2.1). The display also offers the ability to use USB-type mouse and keyboard during data analysis.

2.3 Compact Flash Drive on PC and Solid-State Storage

The system is controlled using a reliable DIN-rail mounted PC controller. Achieving of data and system operational software are all based on compact flash technologies or solid-state drive which gives the system optimum performance with high reliability. (Figure 2.4)

2.4 Reliable Linear Pump Technology and Control Manifolds

The systems transport and analyzing flow is performed through a reliable linear pump technology (Figure 2.5). The DOD64-FTIR transport and flow pumps require no maintenance with an anticipated two to three-year life (application-specific). The option to replace pumps or rebuild pumps is available.

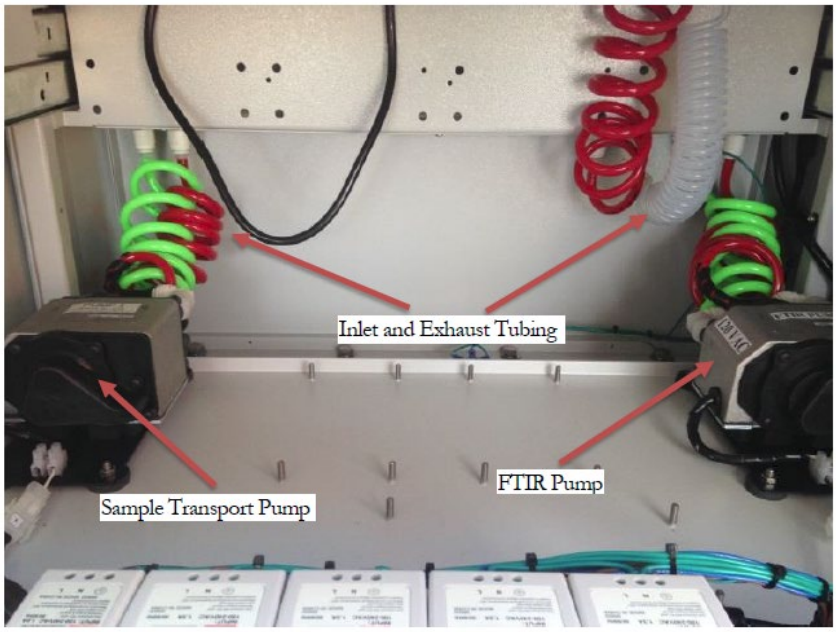


Figure 2.2

2.5 FTIR Interferometer

The DOD64-FTIR features an MKS MCT Detector or PerkinElmer DTGS detector. The MKS detector comes with a patented 400ml IR cell with a 10-meter optical path and an internal cooling system. This design allows a fast sampling time that leads to reduced total time for analysis. The optical path length and MCT detector allow the DOD64-FTIR to obtain the lowest detectable limits in the multi-channel FTIR market today. FTIR Interferometer and Manifold trays slide out on brackets and can be easily removed for modular quick serviceability. (See Figure 2.3)

2.6 Keyed Maintenance Door & Control Access

In order to ensure only trained personnel, have access to the system, both upper and lower service areas are equipped with a key lock. (See Figure 2.1)

IMPORTANT: The maintenance doors should remain closed and latched except when servicing the machine. Do not open the doors while in Analysis Mode.

2.7 Transport Selectable Valve Manifold Trays

The DOD64-FTIR system can be upgraded to implement up to 4 individual manifolds, each capable of transporting sixteen points. The main analysis occurs in the FTIR Interferometer located in the central unit. (See Figure 2.3)

2.8 Status Lamp (Optional)

An optional status lamp is available on the DOD64-FTIR. This lamp indicates status with four different colors (Red, Orange Blue and Green), allowing the status of the machine to be seen quickly and from a distance.

2.9 Tubing Connections

Sample and exhaust tubing use a quick connection system for simple installation. The connections are made on the side panel of the DOD64-FTIR. See section 3.3 for information on connecting the sample and exhaust tubing. See also Appendix C for important information on transport times for gas from the sampling point to the DOD64-FTIR.

End-of-line filters are required at all times on each channel- See Section 6.3.

2.10 Service Areas

The service areas allow easy access to the valves, manifolds, pumps, power supply, and the interferometer. Figure 2.3 shows the internal layout with the service areas open. Service areas are equipped with a lock to restrict internal access.

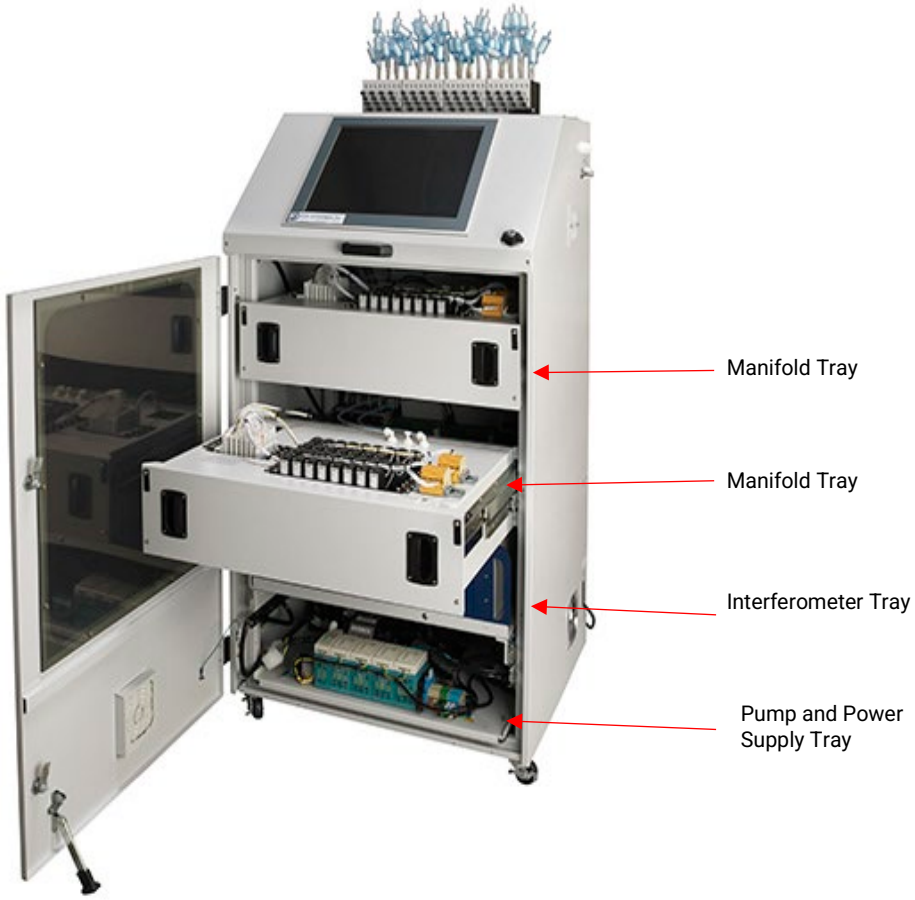


Figure 2.3

	DANGER: Turn off the unit, disconnect A/C power and unplug the 14-pin I/O connector on the side of the unit (if installed) before opening the service door.

2.11 Password and Security

Access to many of the features is controlled through password protection which is entered through the screen displayed in figure 2.4.

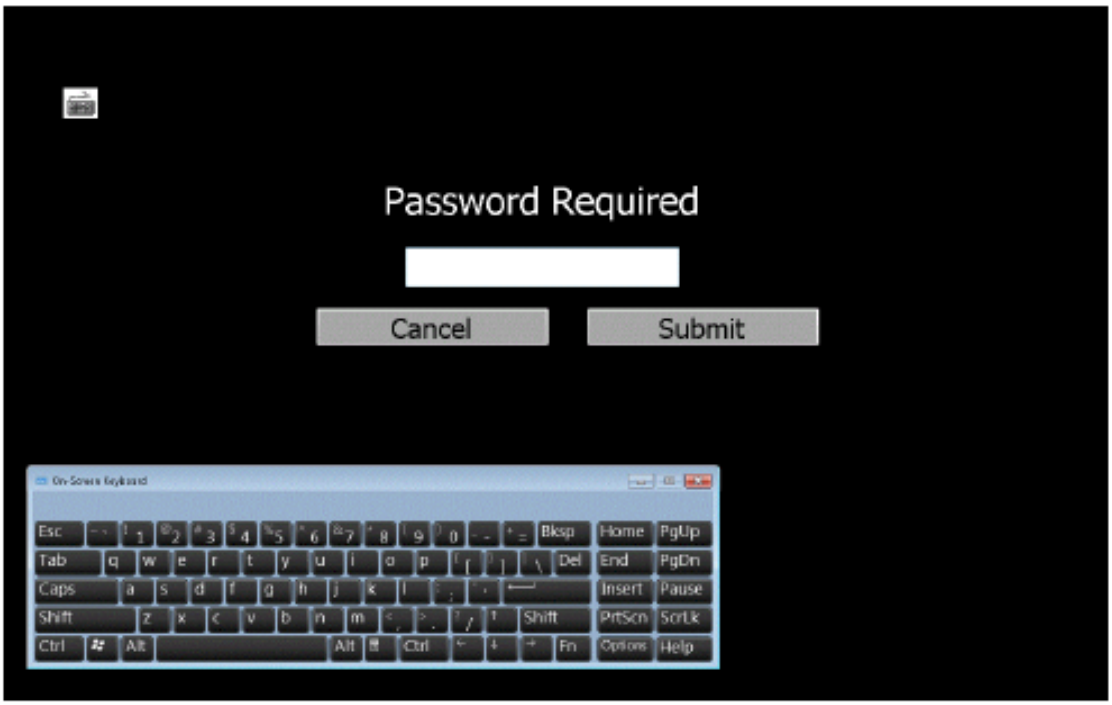


Figure 2.4

Whenever someone attempts to access a screen that is password protected, the screen shown in Figure 2.4 will appear (see important note below). Several of the setup & configuration screens of the DOD64-FTIR require entry of an administrative password. Factory service screens require entry of a service password - see Section 5.

IMPORTANT: Once a password is entered it remains active for 30 seconds after entry so that it does not need to be repeatedly entered when switching between screens. Please remember that anyone using the touch screen may access restricted screen locations during this time if the machine is left unattended.

NOTE: The Administrative Password is included on the first page of this manual. It is suggested that you remove the page and keep in a safe and secure place. If you forget or lose your password please contact DOD Technologies. See Chapter 7 for contact information.

2.12 USB Memory Stick or Solid State

The DOD64-FTIR uses a USB Memory or a Solid-State Drive to store historical information including concentration logging, event history, configuration information, and spectra files. The use of higher speed USB Memory Sticks (2x, etc.) may not be compatible with the DOD64-FTIR. USB Memory Sticks may be purchased through DOD Technologies – see Appendix A.

Chapter 3 – Installation

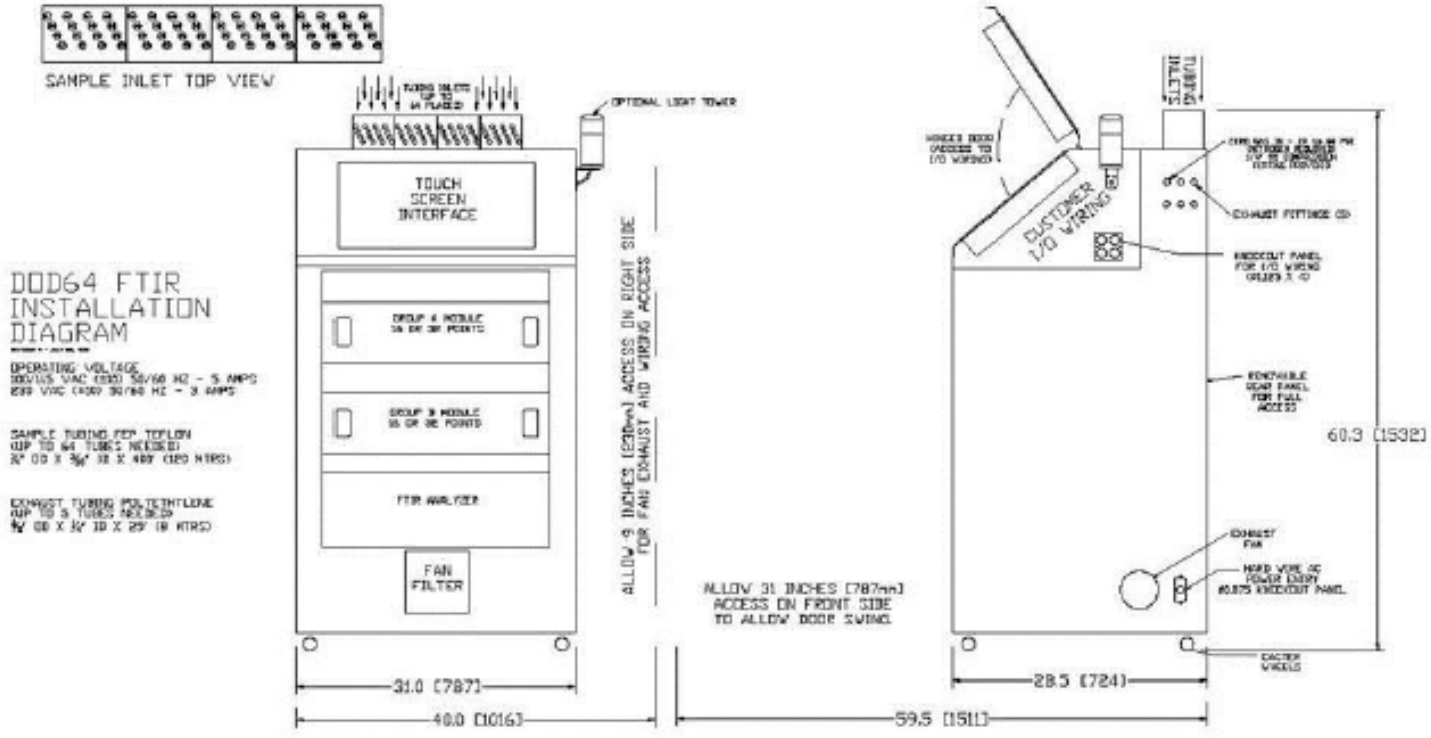
3.1 Selecting A Location

The DOD64-FTIR is designed for safe use under the following conditions:

- Indoor use only
- Altitude up to 2,000 m
- Temperatures 5°C - 40°C
- Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40 °C
- 110 VAC or 220 VAC supply voltage fluctuations up to +/- 10% of the nominal voltage

The DOD Technologies Model DOD64-FTIR is supplied with wheels to allow for easy installation. The system is transported in a wooden crate. The front opening panel door is designed to be used as ramp to roll the system out of the crate (see installation package for details). The DOD64-FTIR rests on four rollers which can be locked in place and bolted to the floor if necessary.

CAUTION: Care must be taken when loading, unloading and moving the DOD64-FTIR. The DOD64-FTIR is a heavy piece of equipment that could cause injury or death if not handled properly. Make sure the rollers are operating properly and only move the DOD64-FTIR on a level surface.



The DOD64-FTIR should be placed in a location as central as possible to the locations being monitored while considering the following restrictions:

- The maximum sample line length is 400 ft. (121 m). Using the shortest possible sample line length will reduce transport times and increase the response time of the DOD64-FTIR. (see Appendix C)
- A/C power is required to the unit. A/C power is required to the unit (110VAC +/- 10% OR 230VAC +/- 10% 50/60 Hz). See serial number label on the right-hand side of instrument for voltage requirements.
- Locate near proper ventilation keeping in mind the maximum length of the exhaust tubing is 25 ft.
- The DOD64-FTIR requires stable temperature and humidity levels within range to operate properly.

3.2 Sample Tubing

Sample tubing is connected to the DOD64-FTIR on the top the unit. All sample tubes require 1/4” OD x 3/16” ID Teflon FEP (400 ft max length) which may be purchased from DOD Technologies, INC (See Appendix A). Fully depress each sample tube into the proper hole when attaching. To detach the tube, push on the collet while pulling the tubing out.

IMPORTANT**:** All sample tubing used with the DOD64-FTIR must be 1/4"OD x 3/16"ID FEP Teflon. Use of any other tubing may damage the DOD64-FTIR and/or cause inaccurate gas concentration readings.

3.2.1 End of Line Particulate Filters

End-of-line particulate filters must be installed on all sample lines at all times to prevent damage to the unit. Unused lines must either be plugged or have a filter installed. Filters require regular maintenance – see chapter 6.

End of line particulate filters should be purchased from DOD technologies (see Appendix A).

IMPORTANT: All points require filtration to prevent dust accumulation in tubing and internal damage to the DOD64-FTIR. Dust that collects in the tubing or the internal system may cause sample loss and inaccurate concentration readings.

3.3 Exhaust Tubing

The exhaust line must be 3/8” OD x 1/4” ID tubing with a maximum length of 25 ft. per sample pump. Excessive lengths will inhibit the flowrate and affect system performance Polyethylene is recommended although polypropylene or Teflon may also be used. Exhaust tubing may be purchased from DOD technologies (see appendix A).

3.4 Zero Gas Inlet

The DOD64-FTIR requires a pure Nitrogen source regulated between 20 and 60 PSI. The DOD64-FTIR periodically uses the inert gas to ensure a clean background. A ¼” OD stainless steel compression fitting is provided for the nitrogen inlet.

3.5 A/C Power

When connecting the A/C power to the DOD64-FTIR ensure that all of the following requirements are met:

- A building circuit breaker is required
- The circuit breaker must be installed in a suitable location that is easily reached
- The circuit breaker must be labeled as the disconnect device for the DOD64-FTIR
- The circuit break must break both poles.

See system specifications in Appendix C for power requirements.

3.6 Output Wiring

See Appendix B for a listing of output module connections.

	DANGER: Turn off the unit, disconnect A/C power and unplug the 14-pin I/O connector on the side of the unit (if installed) before any wiring modifications.

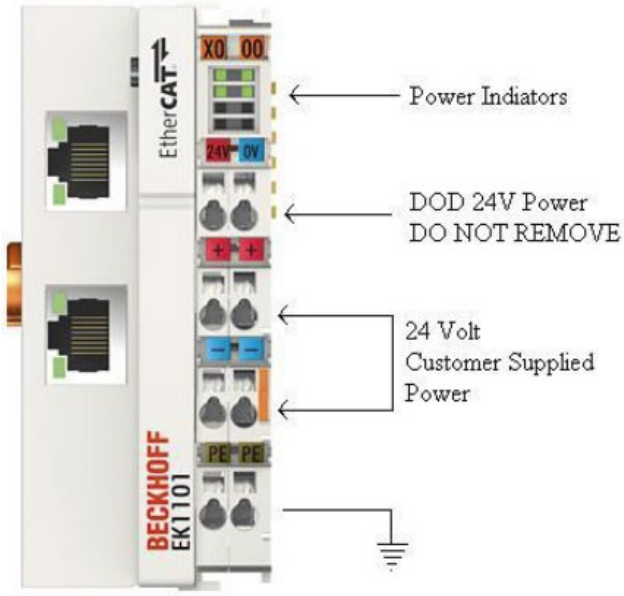
3.6.1 Standard Output Module Wiring

The standard output modules included with the system require an external 24V supply connected to the DOD64-FTIR to supply power for the outputs. Use only AWG22 to AWG18 twisted wire (wire sizes UL1015 and UL1007) Strip from 0.25” to 0.31” (6.5mm to 8.0mm) from each wire to insert into the connector. To connect the wires to the spring-loaded output connector:

- Insert the screwdriver into the square-shaped hole which will open the round hole for the wire.
- Continue to hold the screwdriver while inserting the wire into the round-shaped hole.
- While holding the wire in place, remove the screwdriver which closes the clamp onto the wire.
- IMPORTANT: Be sure the wire is inserted completely into the hole. Failure to do so could result in system failure, electrical shock.
- To remove a wire, re-insert the screwdriver in the hole as described in step 1 and gently pull the wire out while the spring is compressed.

3.6.2 I/O Connection Details

Each analyzer tray (16 or 32 points) has its own output module section and each section is coupled together with an EK1101 module. Two different power sources are used for the module. Power to operate the module itself is supplied by the DOD64-FTIR power and prewired by DOD Technologies - Do NOT remove. Power for all outputs must be supplied by the customer on pins 6 & 7. See Appendix B for detailed information.



IMPORTANT: Verify that all I/O unit terminal screws are securely tightened even if they are not used.

Chapter 4 – Setup & Configuration

4.1 Touch Screen Calibration

After powering on the DOD64-FTIR, the machine will display a crosshair in each corner of the screen. Press the center of each crosshair to configure the touchscreen. Without the correct calibration of the screen and touch function will not work correctly. Power cycle the DOD64-FTIR to access the touch screen set up again.

4.2 Gas Selection

See section 5.3.3.1 for information on selecting a specific gas for each point.

4.3 Alarm Settings

See section 5.3.2.3 for information on how to adjust the alarm settings after the gas has been selected for each point.

4.4 Output Relays

The DOD64-FTIR supports both energized and de-energized relays and may be configured for either latching or non-latching faults/events and alarms. See section 5.3.4 for more information on testing outputs.

When configured for energized relays, the outputs are normally in a high state and change to a low state when the corresponding fault/alarm occurs. De-energized relays work in the opposite manner. When the power is ON, the Power Loss Relay is always in the normally high state.

When latched outputs are selected (Section 5.2.6), any fault or alarm that occurs will remain until the “fault reset” button is touched. If non-latching outputs are selected the output will reset automatically if and when the condition that caused the fault/alarm returns to its normal state.

NOTE: A message is added to the event log each time the “fault reset” button is touched.

4.5 Concentration Log

Three levels of concentration logging can be configured in the DOD64-FTIR.

1. >0 - All concentrations detected >= LDL are added to the concentration log.
2. AP1 - Anytime alarm level 1 is reached, the concentrations are added to the log.
3. AP2 - Anytime alarm level 2 is reached, the concentrations are added to the log.

Regardless of which point the gas is detected on, all points are logged as long as the trigger is active. For AP1 or AP2 logging the system will continue to log concentrations as long as the alarm level is still active.

4.6 USB Memory Stick or Solid-State Drive

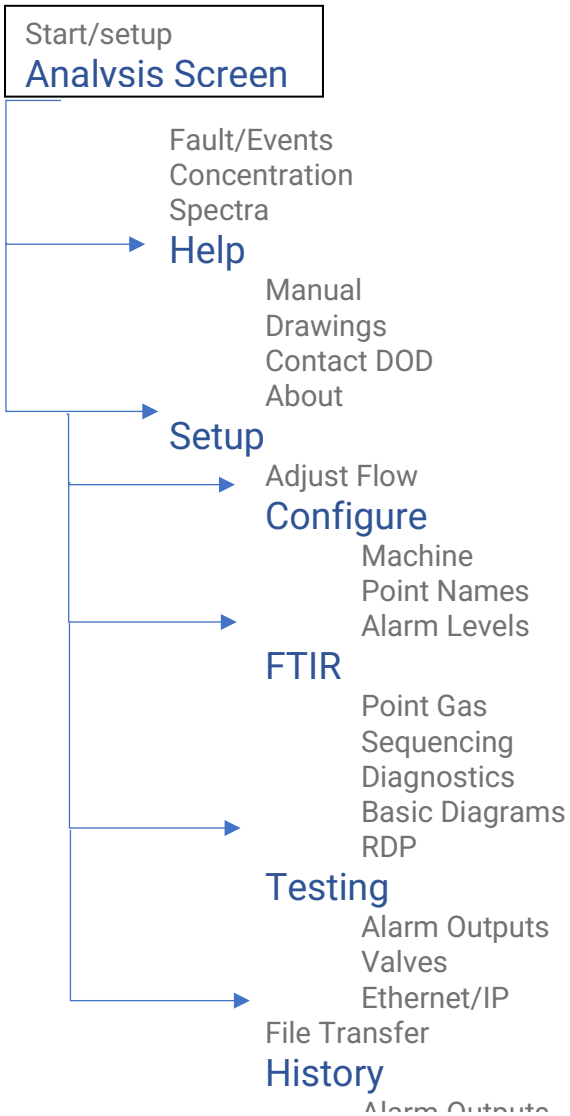
The use of a USB Memory or Solid-state drive is highly recommended to retain historical and performance information including spectra, events, alarms, and gas concentrations. USB Memory or solid-state drive is available from DOD technologies (see Appendix A) and at most retail electronic stores. See section 6.4 for information on inserting and replacing a USB Memory Stick or SSD. See also Appendix F for information on the data stored on the USB Memory Stick or SSD. Purging old data is also recommended at a minimum interval of six months.

4.7 Setup Complete

It is now safe enter analysis.

Chapter 5 – Basic Operation and Menus

5.1 Menu Overview



5.2 General Machine Operation

When the DOD64-FTIR is powered on it will begin with the initialization screen which is followed by a countdown (figure 5.1). The machine will then go into analysis and display the analysis screen. If the operator touches the 'SETUP MODE' button before the timer reaches 0 the, setup screen will appear.

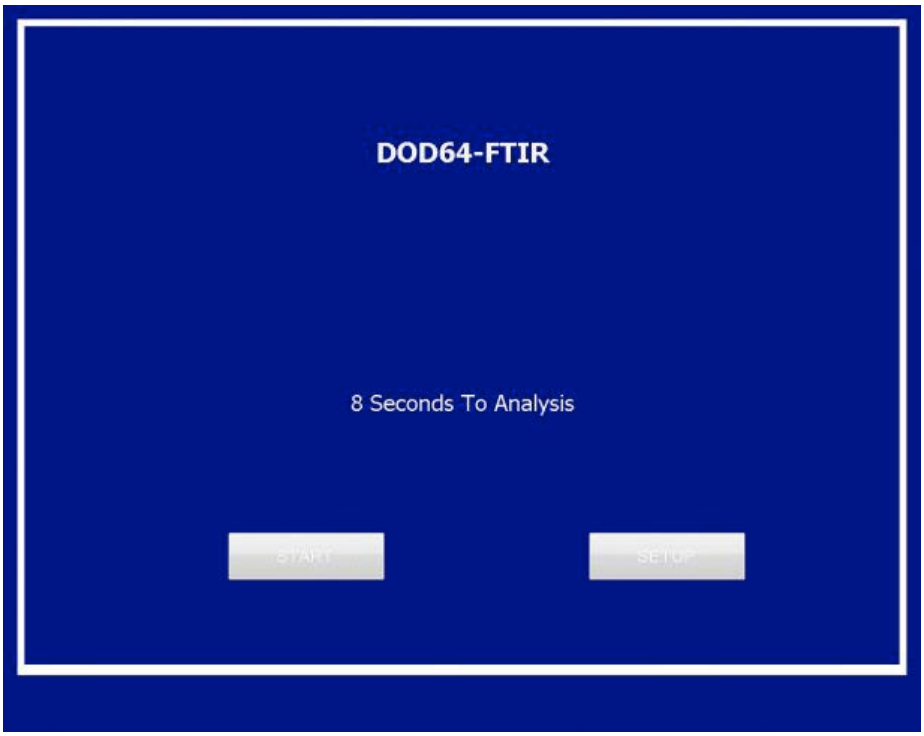


Figure 5.1

The touchscreen on the DOD64-FTIR is used for all configuration and control of the unit. Analysis mode is active by default approximately two minutes after power on unless an operator intervenes. At this point the DOD64-FTIR is designed to continuously monitor for gas. Various tasks can be completed while remaining in analysis, including viewing faults/events, concentration history, individual spectra files and TWA logs, or checking point configuration and flow limits. Access to the help menu is also available while remaining in analysis.

Analysis can be started by either:

1. Powering on without user intervention. (approximately 2 minutes)
2. Returning from setup menu back to the main menu.

Analysis will continue until one of the following occur:

1. Power loss.
2. A Critical System Fault
3. Entering Setup by touching the Setup button on the main menu and entering an appropriate password which will halt analysis on all analyzers.

5.2 Analysis Screen

The analysis screen will appear after the initial countdown upon starting the DOD64-FTIR. Figure 5.3 shows a 16-point system with analysis active. (Figure 5.2). From here, you can view all gas levels detected and live spectra files as the files are collected.

Black points indicate that the points are not installed or inactive on the DOD64-FTIR.

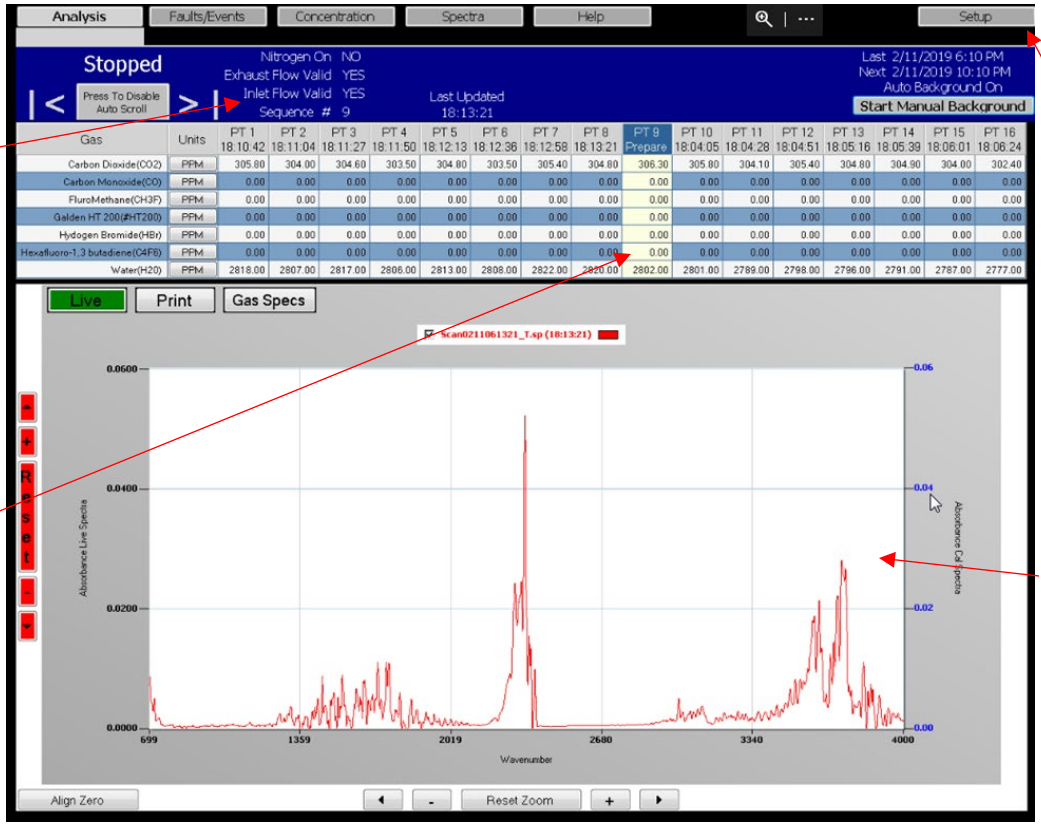
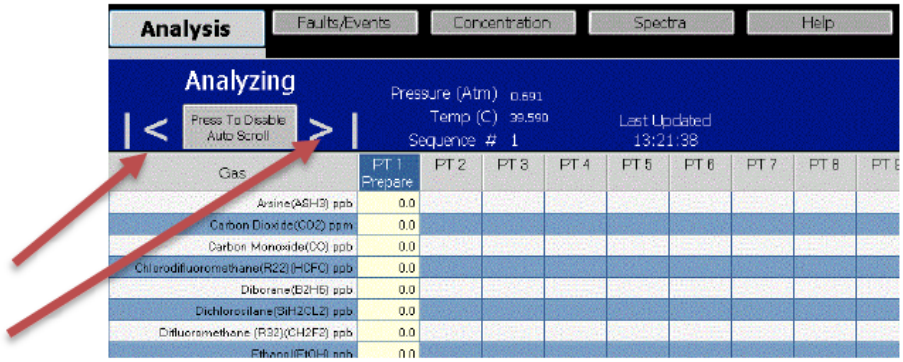


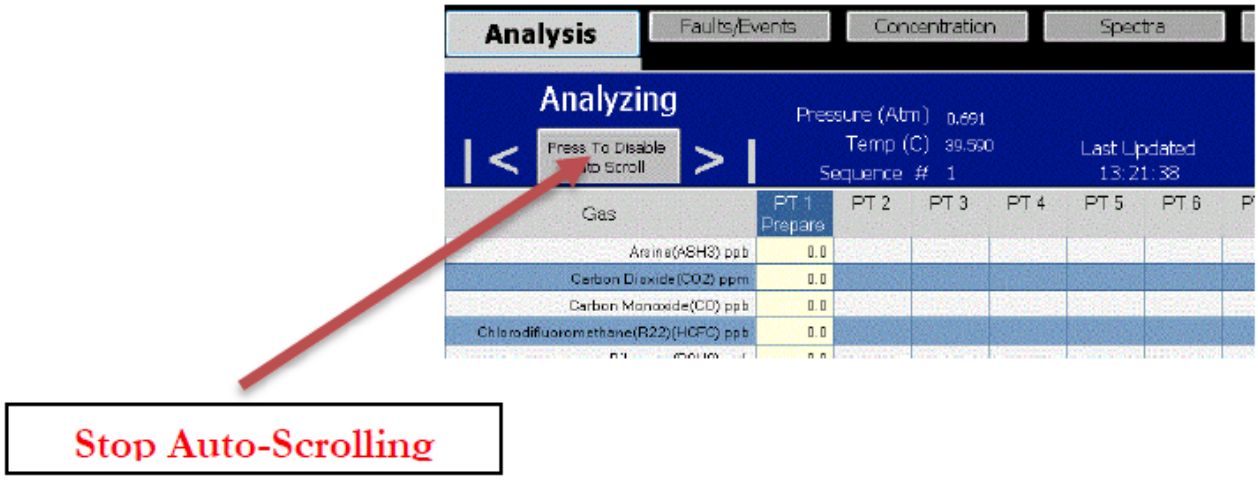
Figure 5.2

From here, you can see the status of each point. If more than one analyzer is installed, additional points can be viewed by pressing the left and right buttons at the top left of the screen.

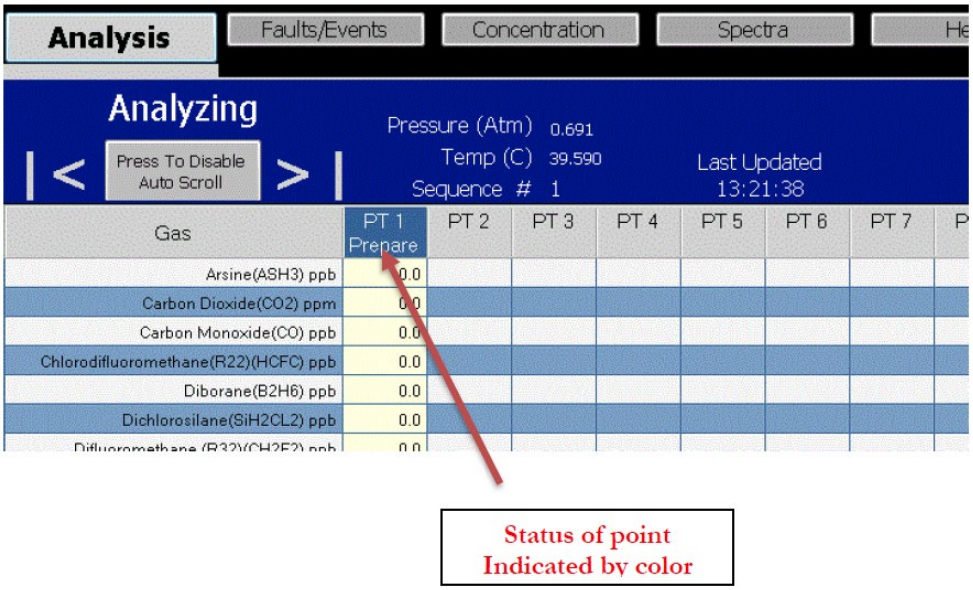


View points on other analyzers (optional)

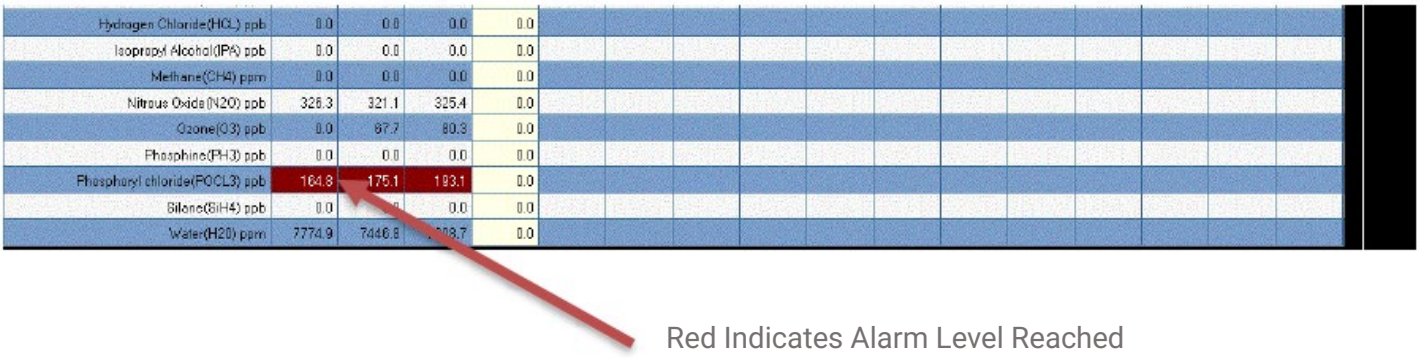
As the machine analyzes through its programmed sequence, the display will scroll through to each new point. This feature can be disabled by pressing the Disable Auto Scroll button.



The status of each point is reported as it changes. Yellow indicates the point is being prepared for analysis. Blue indicates the point is being analyzed. Grey indicates the point is being purged of remaining gas from a previous window.



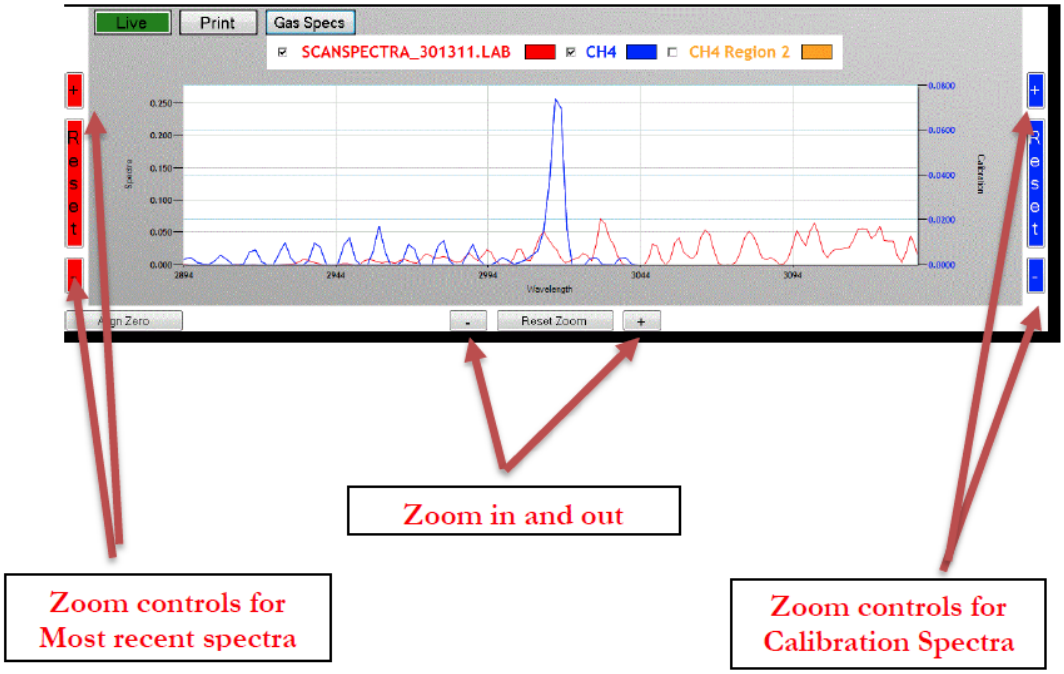
When an alarm level for a specific point has been reached, the concentration box will turn red as seen.



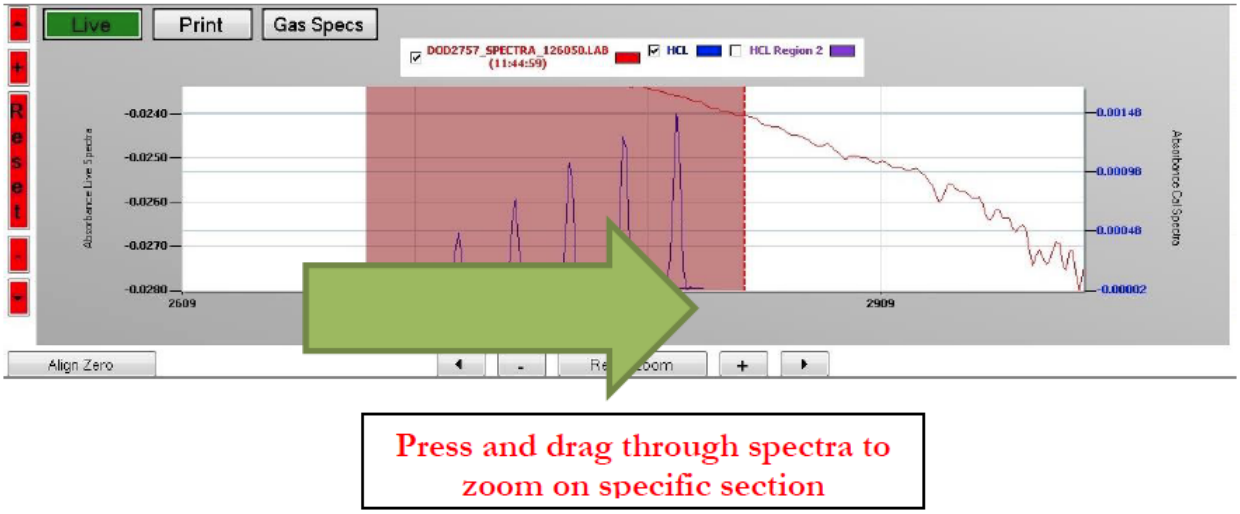
Selecting a gas on the left side of the screen will display that gas in the spectra viewer at the bottom.

Select the blue checkbox in order to display the calibration spectra for the chosen gas. The blue line shows the unique calibration spectra for the gas, while the red line shows the most recent full spectra analysis scan. When the spectra viewer is LIVE, the red spectra line will always show the spectra from the most recent analysis scan and change as each scan ends. Pausing the spectra viewer will keep the current analysis spectra scan from changing as each scan completes.

The spectra can be enlarged by using the + and – buttons, located underneath and to the left of the spectra.



Pressing and dragging through a section of spectra will zoom in on that specific area of the spectra.



5.2.1 Faults and Events

Figure 5.3

Pressing the Faults/Events tab at the top of the Analysis screen will display the Faults/Events screen (figure 5.3), allowing you to view a detailed history of the machine's faults and/or events. You may select any day on the calendar to view a log of that day's events. You must press inside the fault list in order to activate the Page Up, Up, Down, and Page Down Functions.

Green	Events indicate instances when analysis mode was activated
Blue	Event display non-critical events, such as output testing or a new background
Yellow	Events indicate a general fault that does not remove the machine from analysis. This type of fault will trigger the general fault output.
Orange	Events indicate a critical fault that brought the machine out of analysis mode. This type of fault will trigger the critical fault output.
Red	Events indicate a gas alarm level had been reached. This type of event will trigger either gas alarm 1 or 2 outputs.

In the event of a critical fault, the machine will stop analysis and display this screen. Clearing the fault and resuming analysis is possible by pressing the Fault/Alarm Reset button. Check appendix D for a list of faults. This screen can also be accessed from the Setup > History menu.

5.2.2 Concentration

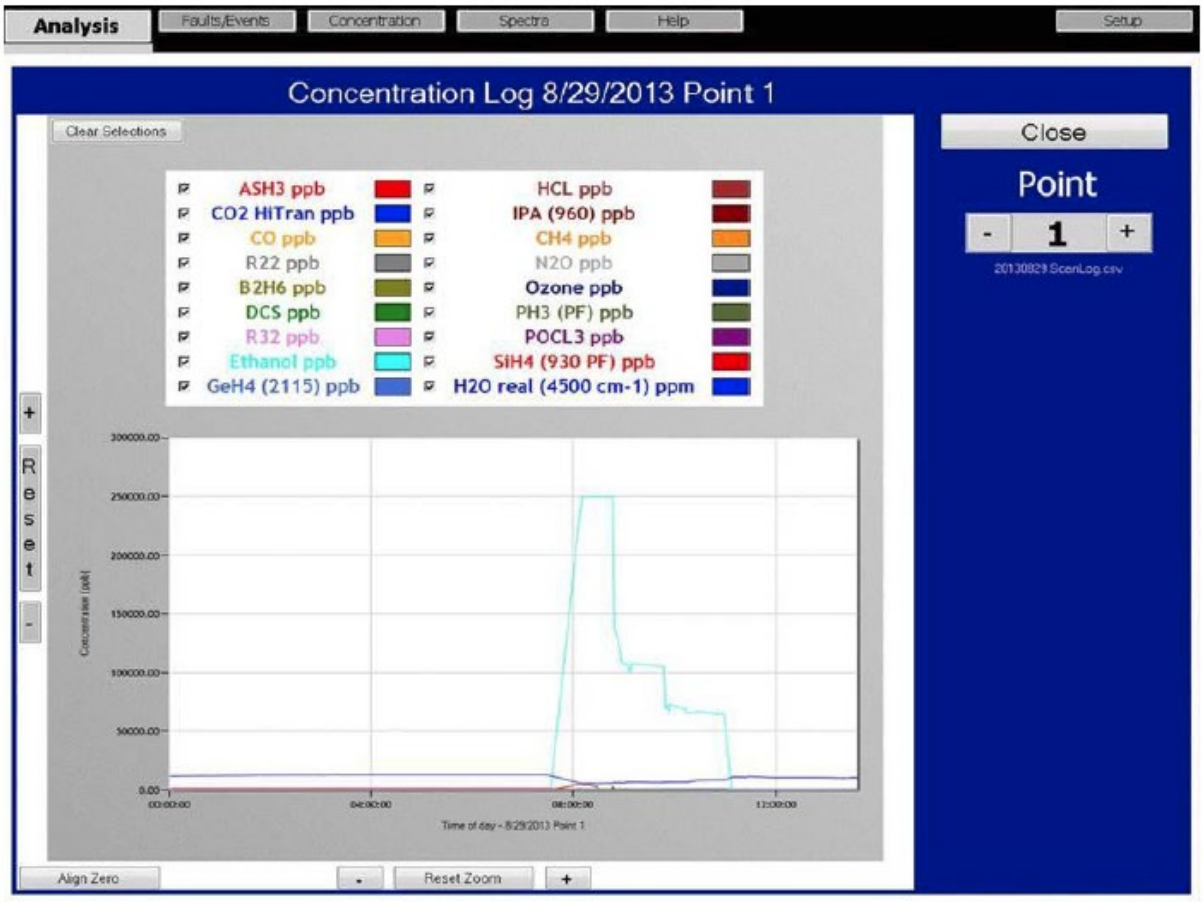


Figure 5.4

Pressing the Concentration tab at the top of the Analysis screen will display the Concentration Log screen (figure 5.4), allowing you to view the history of gas concentrations logged at any specific point. Change which point's history you view by pressing the + or – buttons on the right side of the screen. Select any day on the calendar to view the concentrations logged for the specific day.

This screen allows quick evaluation of the day's trends for all the gases on a specific point. Gases can be added and removed by checking and unchecking the box next to each gas. The point can also be changed by changing point indicated on the upper right-hand side of the screen. To return to the main analysis screen, select close. The DOD64-FTIR will remain in the analysis mode while viewing this screen and the concentration log can also be accessed from the Setup > History menu.

5.2.3 Spectra

Pressing the Spectra tab at the top of the analysis screen will bring you to the spectra viewer (fig 5.5). From here you can view the individual spectra captured at a specific time and date. The box in the lower right corner of this screen will display the concentrations calculated for each gas from the selected scan the + and –

buttons can be used to zoom in on the spectra. Spectra files are saved in .lab format which can be viewed here, or via an optional DOD spectra viewer. This screen can also be accessed from the Setup > History menu.

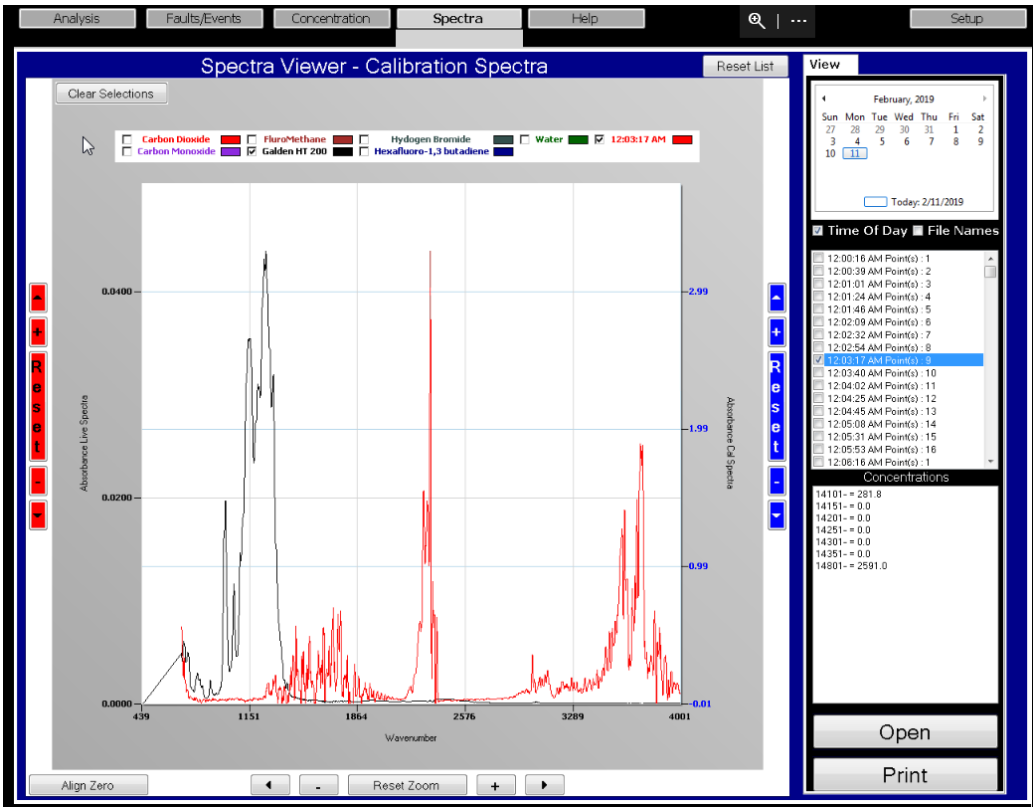


Figure 5.5

5.3 Setup Menu

Entering the Setup Menu will end analysis and the DOD64-FTIR will no longer be actively monitoring the environment for gases. Touching the Setup button at the top of the analysis screen will bring you to the Setup menu and automatically display the Adjust Flow screen.

5.3.1 Setup > Adjust Flow

The Adjust Flow screen (fig 5.8) will display automatically when the Setup menu is entered.
Use the corresponding flow adjustment knobs located, on the inlet manifold, on the top of the machine to adjust the flow. Make sure each level is as close as possible to the black line in the middle of the green section. There is a Pump On/Off button for balancing each set of 16 points.

NOTE: There may be a slight delay between the time the knob is turned, and the updated reading is reflected on the screen. Adjust the knob slowly and wait a few seconds to verify that the level is accurate. Before adjusting flow or if flow adjustment is not working, the set offsets “Begin” button can be pressed to re-record the transducer's output voltage under atmospheric pressure.

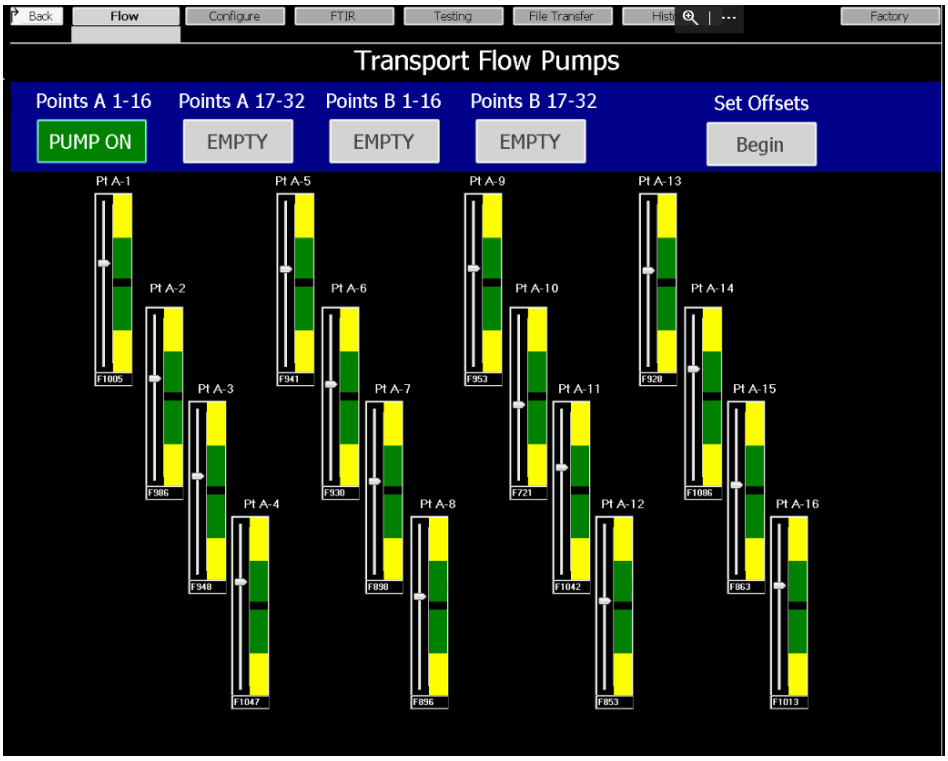


Figure 5.8

Touch the “Back” button to return to the setup menu.

5.3.2 Setup > Configuration

Touching the “Configuration” while in the Setup menu will bring you to the Configuration Menu and display the Machine configuration screen (Fig 5.9).

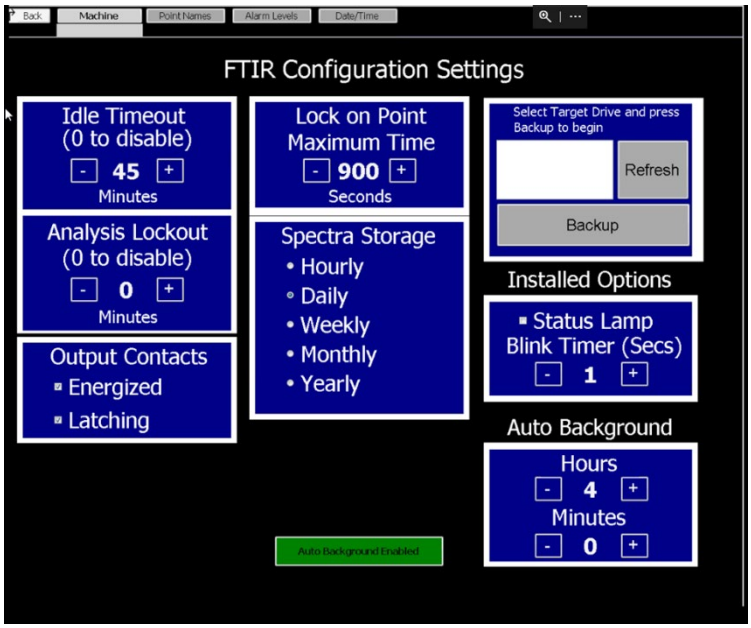


Figure 5.9

5.3.2.1 Setup > Configuration > Machine

From the Machine configuration screen, you can set the customize the following options:

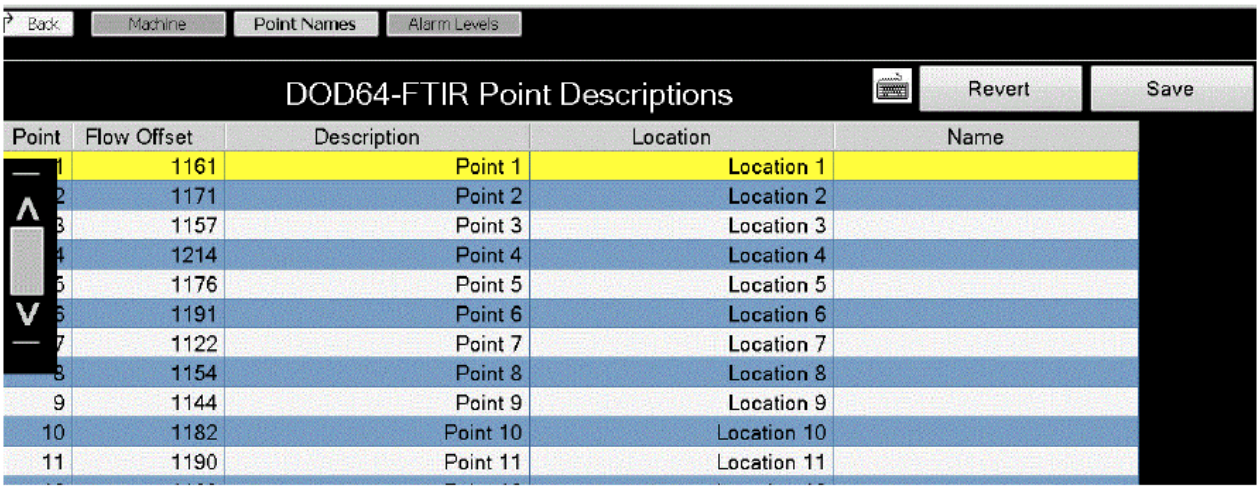
- **Idle Timeout** - The machine can be set to issue a critical fault if it is left out of analysis for a designated length of time. Setting the value to 0 disables this feature. Use the + and - keys to adjust the value from 0 to 45 minutes.
- **Analysis Lockout** - The machine can be set to lock out users after a designated length of time in analysis. Setting this value to zero disables this feature.
- **Output Contacts** - Energized relays determine the normal state of the relays/outputs. When energized is selected the faults, general alarm levels, and point outputs will all be energized under normal conditions. When a fault or alarm occurs, the outputs will become de-energized. The opposite occurs when this checkbox is not selected. Selecting Latching faults causes faults to remain active until the 'Reset Faults/Events' button is pressed to acknowledge the problem.
- **Lock on Point Maximum Time -** If a point is locked on from the analysis screen, this parameter adjusts how long the point will stay locked.
- **Status Lamp Blink Timer-** If an optional status lamp has been installed, its blink rate can be adjusted here.

- **Auto Background-** Determines how often the machine will acquire a new nitrogen background.

NOTE: Flow faults are not affected by the latching faults option. Flow faults will never be latched on the DOD64-FTIR but will always be recorded in the event log when they occur and are cleared.

5.3.2.2 Setup > Configuration > Point Names

Pressing the “Point Names” tab while in the Setup > Configuration menu will bring you to the Point Names screen (Fig 5.10). From here, you can customize each point with specific identifying properties such as name, location, and Description. The transducer offset can also be located on the Point/Names screen.



Point	Flow Offset	Description	Location	Name
1	1161	Point 1	Location 1	
2	1171	Point 2	Location 2	
3	1157	Point 3	Location 3	
4	1214	Point 4	Location 4	
5	1176	Point 5	Location 5	
6	1191	Point 6	Location 6	
7	1122	Point 7	Location 7	
8	1154	Point 8	Location 8	
9	1144	Point 9	Location 9	
10	1182	Point 10	Location 10	
11	1190	Point 11	Location 11	

Figure 5.10

5.3.2.3 Setup > Configuration > Alarm Levels

Pressing the “Alarm Levels” tab while in the Setup > Configuration menu will bring you to the Alarm Levels screen (Fig 5.11).

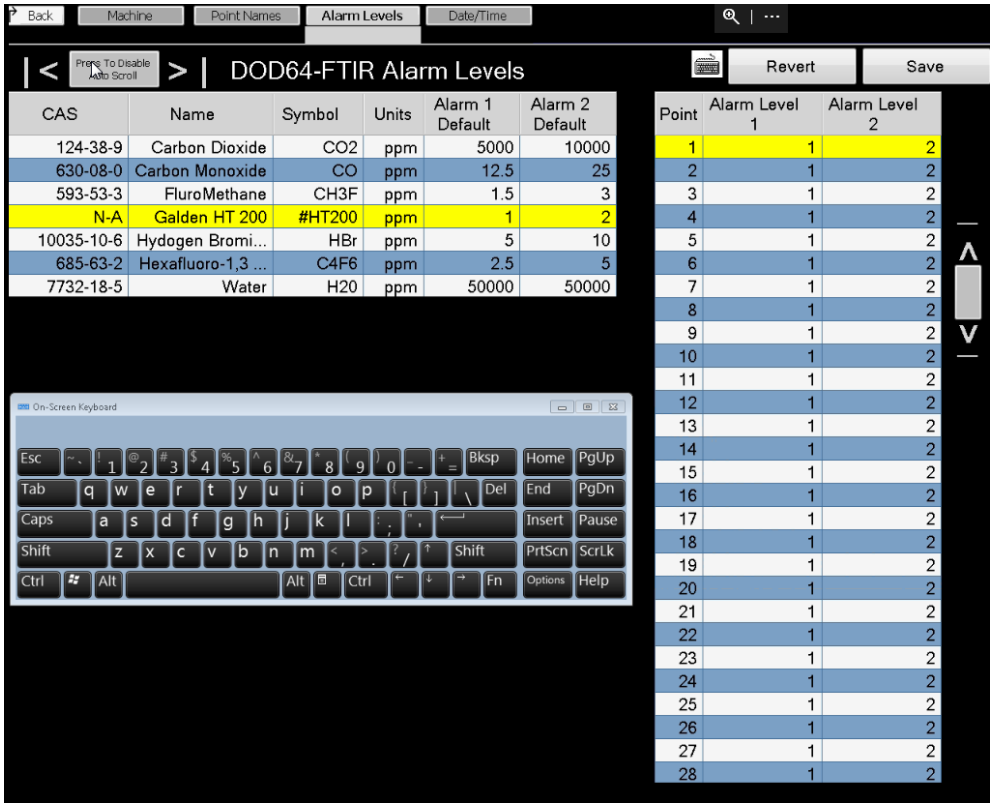


Figure 5.11

From here, you can set the concentration threshold of Alarm Level 1, Alarm Level 2, and Lower Explosive Limit for each individual point. The Revert button will erase any changes and the save button will store all changes

5.3.3 Setup > FTIR

Pressing the “FTIR” button at the top of the Setup Menu will bring you to the FTIR menu and display the Point Gas screen (Fig 5.12). Press the “Back” button at any time while in the FTIR menu to return to the Setup menu.

5.3.3.1 Setup > FTIR > Point Gas

The Point/Gas screen will automatically display upon entering the FTIR menu. From here, you can select which gases each point will be configured to monitor. Press directly on a box to turn a point’s gas on or off (see below). Press the “Save” button to save your changes, or the “Revert” button to reset to defaults. The “Clear All” button will remove the selections for all gases on all points.

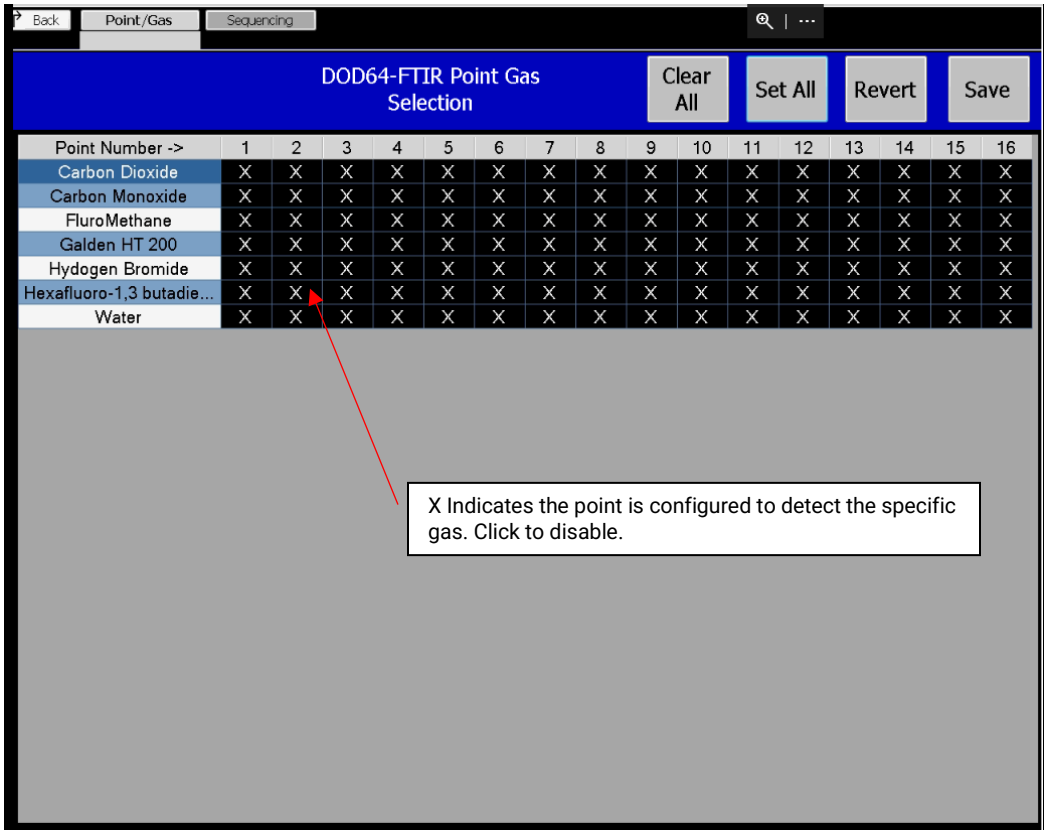


Figure 5.12

5.3.3.2 Setup > FTIR > Sequencing

While in the Setup > FTIR menu, press the “Sequencing” button to bring up the Sequencing screen

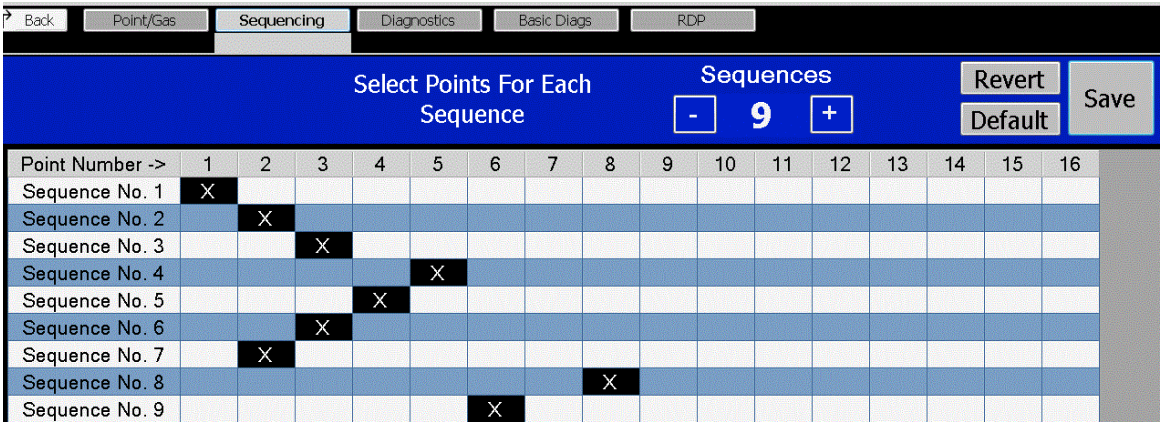


Figure 5.13

This screen allows the selection of the order in which points are sampled from and analyzed. If one location is more important than another it can be scanned more often and take priority by selecting it more often in the sequencing pattern. Add or subtract sequences by pressing the + and – buttons. It takes 20 seconds for each number of the sequence to complete.

5.3.3.3 Setup > FTIR > Diagnostics

This screen displays diagnostic values related to the function of the interferometer and is currently only available on the AIRGARD DOD64-FTIR version. Please contact DOD for more information on the DOD64-FTIR Diagnostics screen.

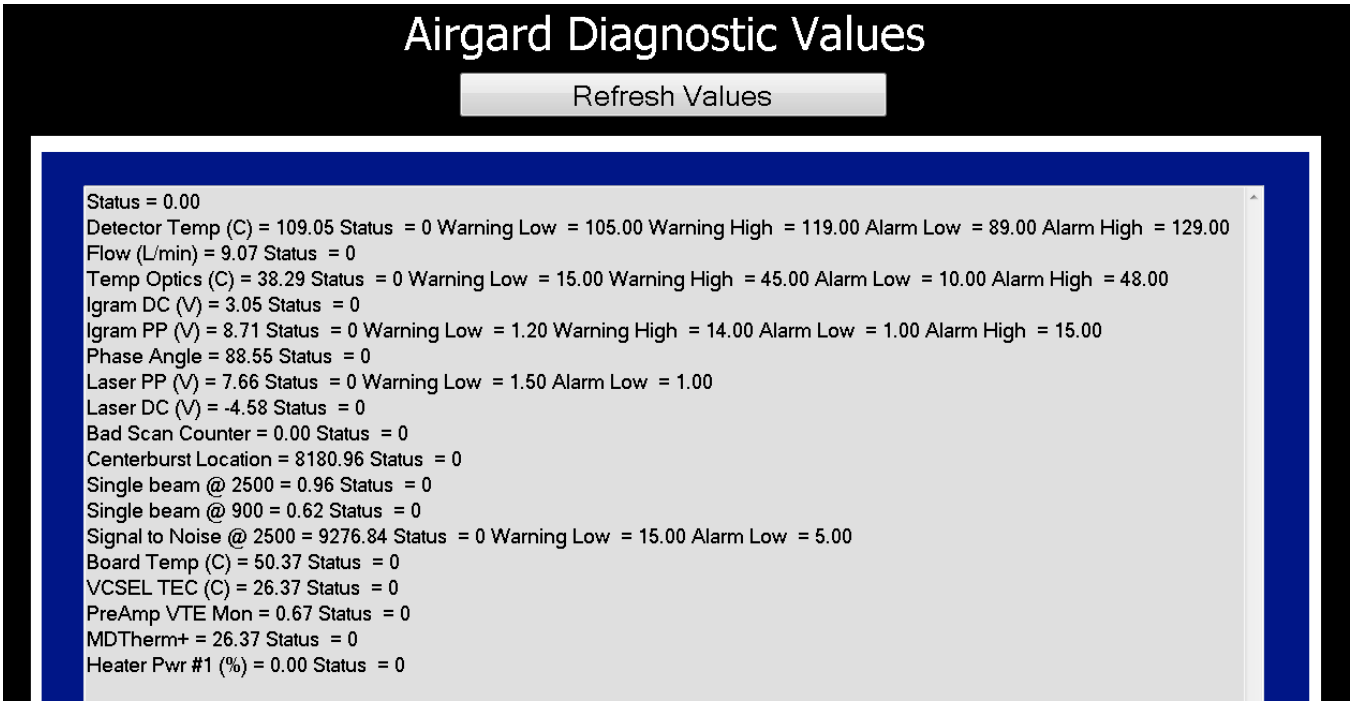


Figure 5.14

5.3.3.4 Setup > FTIR > Basic Diags.

This screen displays additional diagnostic values of related to the function of the interferometer.

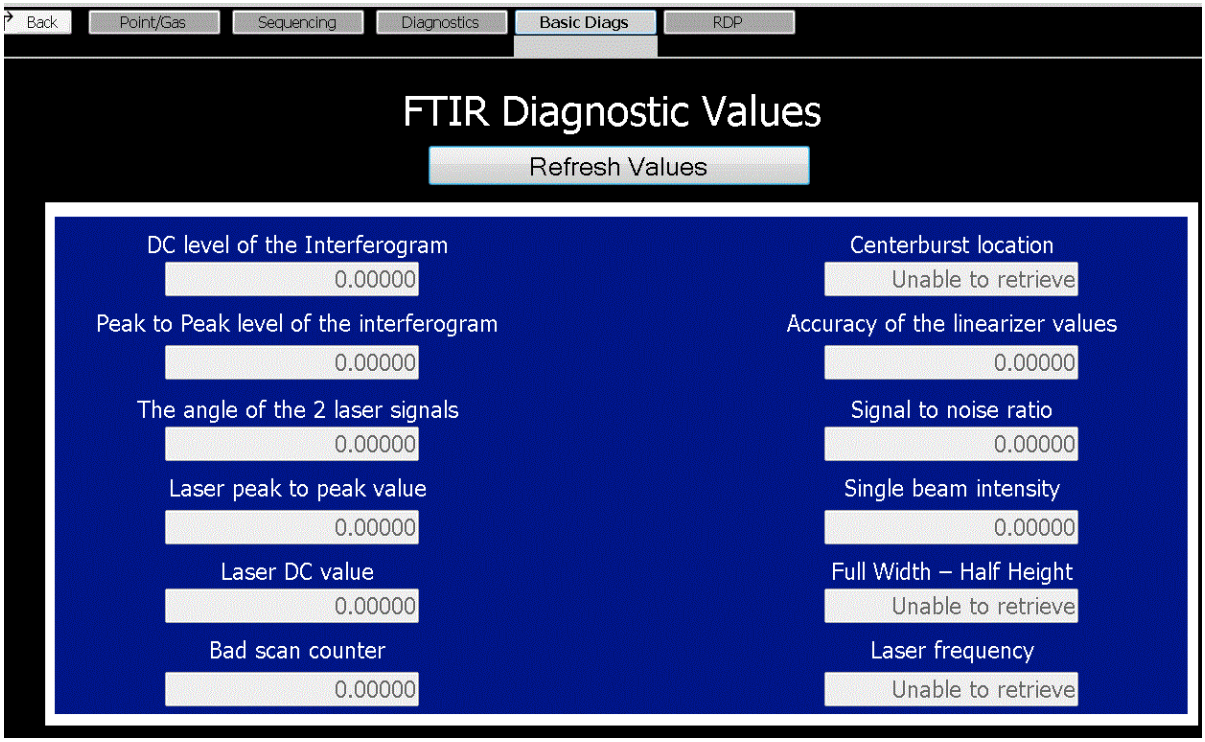


Figure 5.15

5.3.3.5 Setup > FTIR > RDP

This screen allows the operator to connect to the Interferometer. Note: Connecting to the Interferometer will require restarting the DOD64-FTIR. This option should only be used when necessary and by DOD a trained operator.

5.3.4 Setup > Testing

Pressing the “Testing” button while in the Setup menu will bring you to the Testing Menu and display the Alarm Outputs screen (Fig 5.16). Pressing the “Back” button at any time while in the Testing Menu will return you to the Setup Menu.

5.3.4.1 Setup > Testing > Alarm Outputs

This screen automatically displays upon entering the Setup > Testing Menu. From here, you can test each alarm output to ensure they have been installed properly.

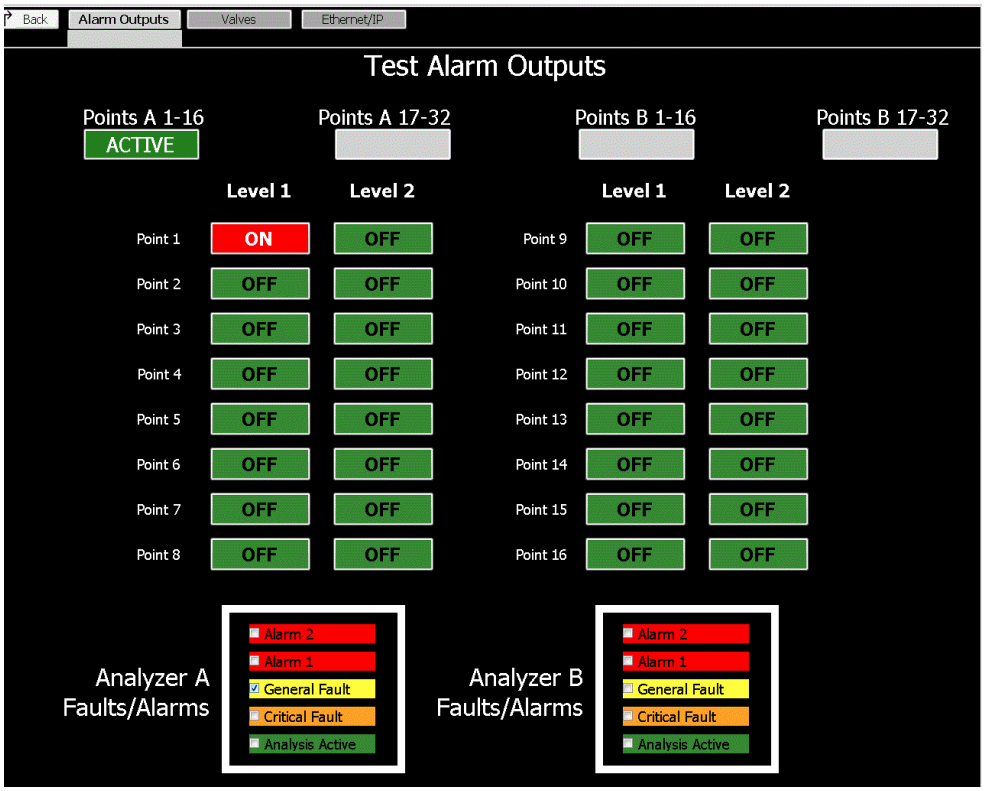


Figure 5.16

Press the button next to each point to generate an Alarm Level 1 or 2. At the bottom of the screen, you can generate all fault types for testing purposes.

5.3.4.2 Setup >Testing > Values

This screen is displayed after pressing the “Valves” button while in the Setup > Testing Menu (Fig 5.17).

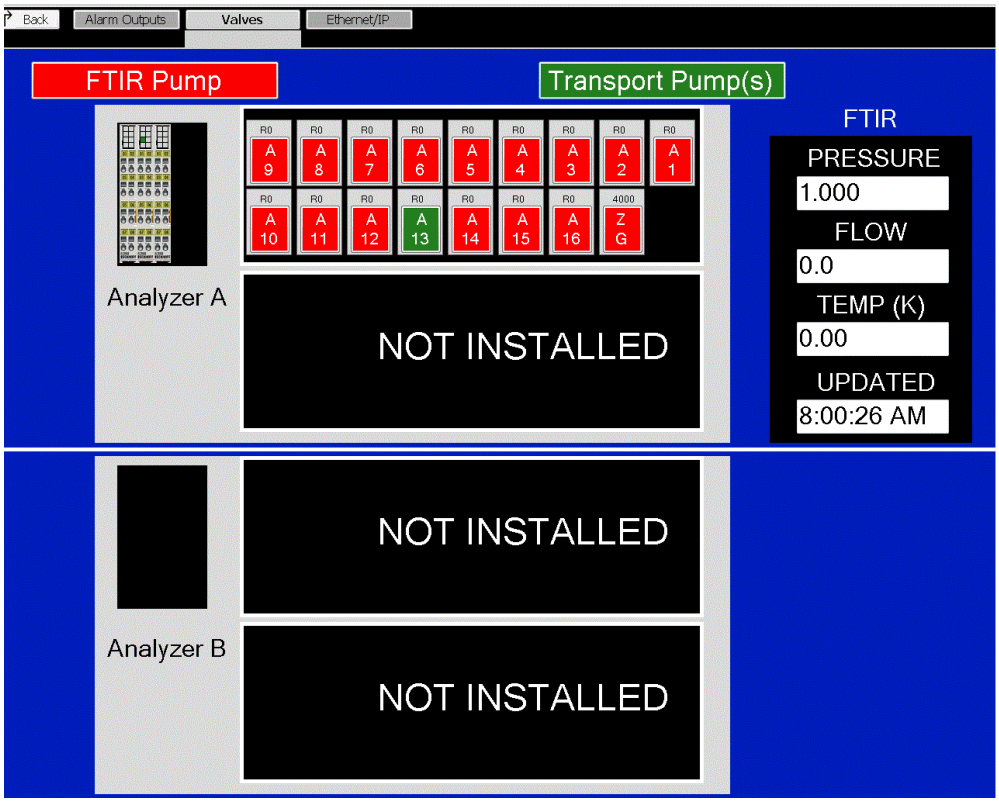


Figure 5.17

In order to test the valve and flow system the Transport or FTIR pump should be activated. Press a specific valve to observe its flow rate, pressure, and temperature (MKS Only). The information on this screen is useful when testing pumps and individual point flow.

5.3.4.3 Setup > Testing > Ethernet/IP

If an optional Ethernet/IP module has been installed, alarms and concentration logging can be tested by pressing the “Ethernet/IP” button while in the Setup > Testing menu.

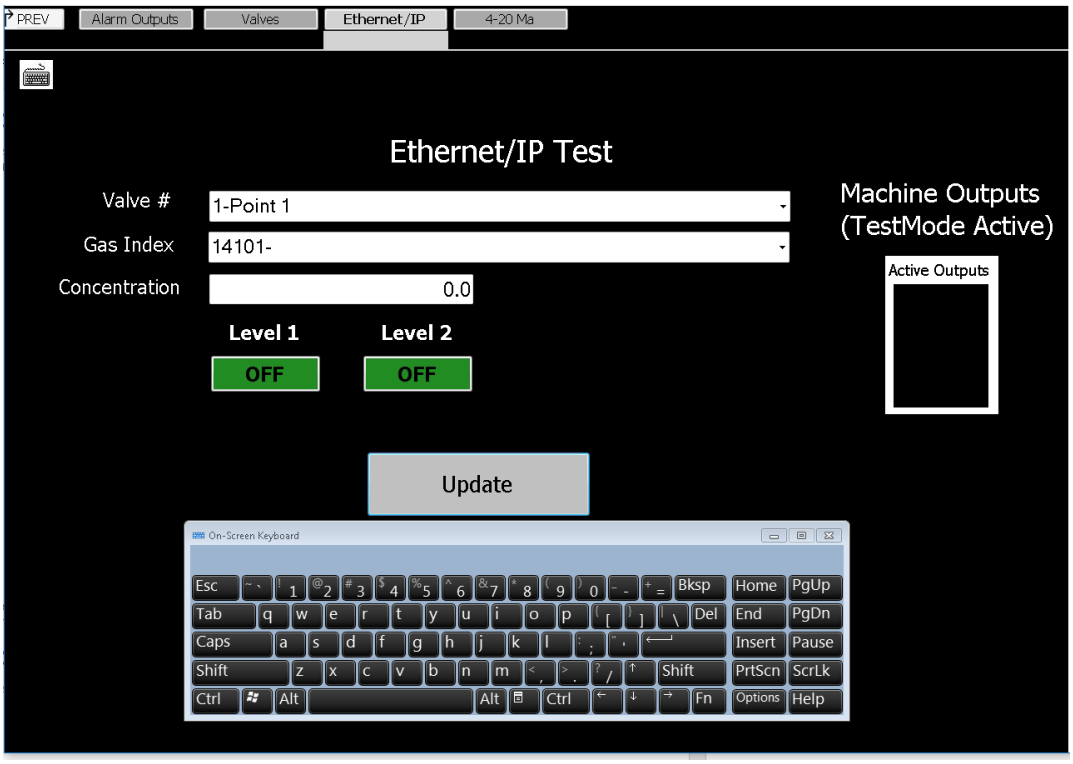


Figure 5.18

5.3.4.4 Setup > Testing > 4-20mA

If the DOD64-FTIR is purchased with the optional analog 4-20mA outputs each output can be tested or adjusted from the Setup > Testing > 4-20 mA screen.

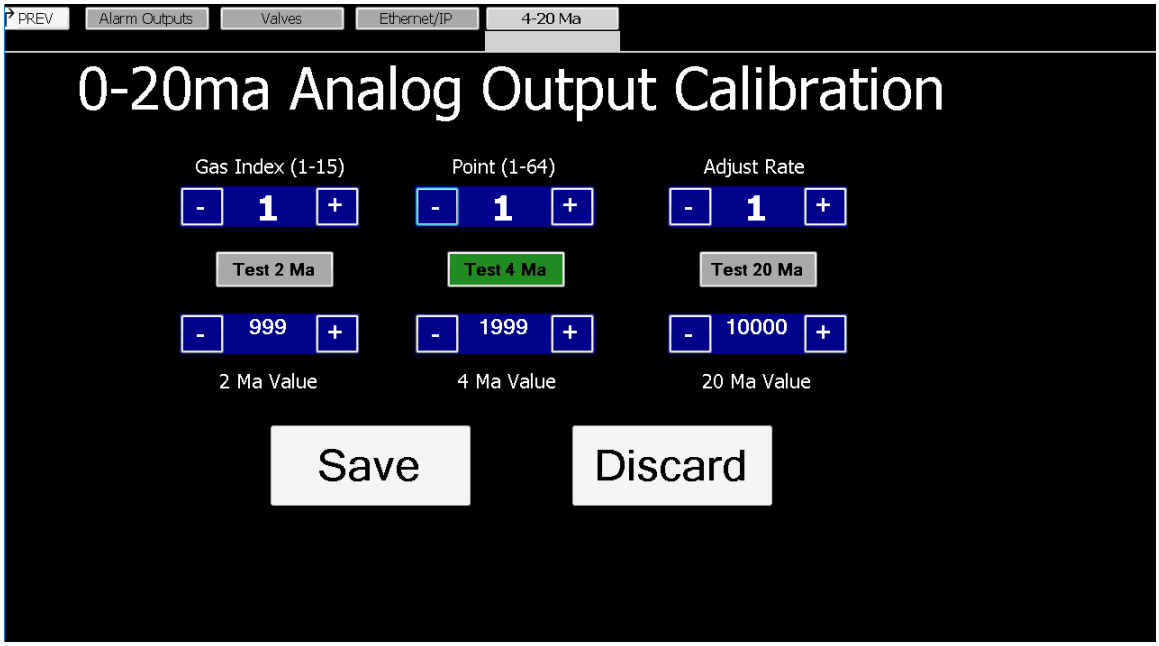


Figure 5.19

5.3.5 Setup > File Transfer

Press the “File Transfer” button while in the Setup menu to view the File Transfer screen (Fig 5.18)

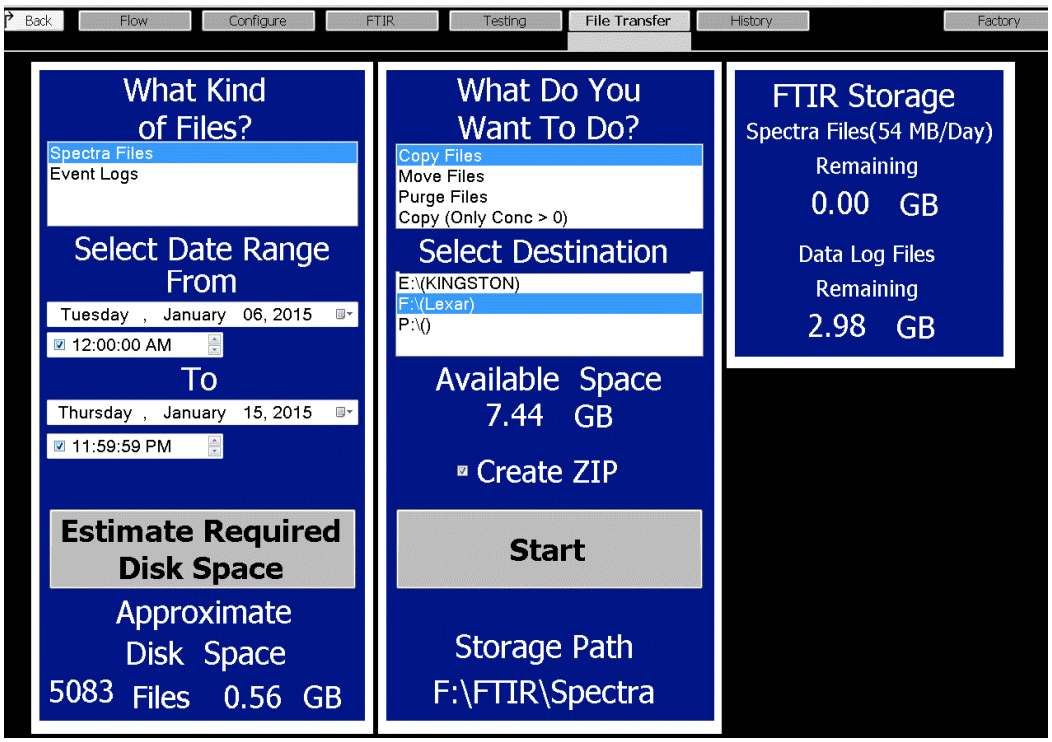


Figure 5.18

From here, you may transfer spectra files or event logs to an external hard drive or USB drive by performing the following steps:

- Select which type of file you wish to transfer (Spectra Files or Event Logs)
- Select a range of days that you want the data from.

Choose an option:

- Copy Files - keeps original files in place.
- Move Files - deletes original files.
- Purge Files - deletes original files without copying them.
- Copy (Only Conc > 0) – Only transfers files where concentrations read above zero

From the screen you can also view the remaining space left on the internal drive of the DOD64-FTIR.

5.3.6 Setup > History

Pressing the “History” button from the Setup Menu will bring you to the History menu and display the “Faults/Events” screen.

5.3.6.1 Setup > History > Faults Events

This screen automatically displays when entering the Setup > History menu from the Setup menu. This screen can also be accessed from the Analysis screen by pressing the “Faults/Events” button at the top of the screen. See section 5.2.1 for a full description.

5.3.6.2 Setup > History > Concentration

Pressing the “Concentration Log” button while in the Setup > History menu will bring you to the Concentration Log. This screen can also be accessed directly from the Analysis screen by pressing the Concentration button at the top. See section 5.2.2 for a full description.

5.3.6.3 Setup > History > Spectra

Pressing the “Spectra” button while in the Setup > History menu will bring you to the Spectra screen. This screen can also be accessed directly from the Analysis screen by pressing the “Spectra” button at the top. See section 5.2.3 for a full description.

Chapter 6 – Maintenance

It is recommended for complete safety that the DOD64 FTIR gas detection system be serviced on-site every 6 months by a certified DOD Service Engineer or by submitting the unit to the manufacturer for routine maintenance. A certificate of repair should be received and kept with the operation documents of the machine. Any malfunctions in the device should be reported and corrected before further use.

For Permanent discontinuation:

Please contact DOD Technologies for the safe return of your equipment. All discontinued units will be accepted back by DOD Technologies so proper recycling may take place. For information on how to return the unit contact us using the below information:

6.1 Return the DOD64-FTIR To A Safe State After Service

Before returning the DOD64-FTIR to service after maintenance, perform verify the following checks:

- Verify all A/C power connections are secured properly
- Check all ground wire connections are secured properly to each panel on the unit
- Verify each analyzer tray is installed on the rails and connected properly.
- Check tubing connections on both sides of each pump.

Verify all sample tubing and exhaust tubing connections on the unit.

6.2 Service Area Door Access

	DANGER: Service must be performed by trained personnel only. Turn off the unit, disconnect A/C power and unplug the 14 pin I/O connector on the side of the unit (if installed) before opening the Service Door.

The maintenance doors are used to access the service areas. Two keyed latches secure the door. Turn both latches with the key to open the maintenance door and be sure to secure both latches when closing the door.

To open the service area doors:

- Insert the key provided into the slot and rotate counterclockwise to unlock the door.
- Turn the latch counterclockwise to unlatch the door.
- Lift the control panel access door until it locks (listen for click).
- The door should remain in the up position until the lock is released.

When service is complete be sure to close the service door and secure the keyed latch to the closed position. Verify that the service door cannot be pulled open – secure the door using the key to lock the door.

IMPORTANT**:** The control box access door should remain closed and latched except when servicing the system.

6.3 End-Of-Line Particulate Filter Replacement

End-Of-Line Particulate Filters – which protect the system and sample tubing from particulates – are required on all points, including points not being monitored. **Dirty sample tubing and/or dirty end-of-line filters can inhibit and/or slow gas response.** The following figure details the type of filter required for each gas. Filters must be replaced regularly as indicated. Filter orientation is not critical in either application.

> **IMPORTANT** : All points require filtration to prevent dust accumulation in tubing and internal damage to the system. Dust that collects in the tubing or the internal system may cause sample loss and inaccurate gas concentration readings.

		
A - Filter For Corrosive Gases Recommended membrane replacement every 30 days, depending on conditions. The internal housing body should be cleaned annually. Part Numbers: Blue Housing: **60009** Filter Membrane: **60010**	**B** - Disposable Filter For Corrosive Gases Recommended replacement every 3-6 months, depending on conditions. Part Number: **2-800-013** (Filter can be interchanged with 60009 / 600010)	**C** – Disposable Filter For Non-Corrosive Gases Part Number: **780248** (Replacement recommended every 6 months)
Target gases include: **Mineral Acids** **Oxidizers (excluding NO2)** **Ammonia (NH3)/Amines** **Hyrdazine (N2H4)** **Nitrogen Fluoride (NF3)** Please contact us if you have questions concerning which filter(s) to specify for a specific target gas.		Target gases include: **Hydrides** **Phosgene (COCL2)** **Nitrogen Dioxide (NO2)** Please contact us if you have questions concerning which filter(s) to specify for a specific target gas.

6.4 Flow Adjustment

Each channel should be adjusted whenever a particulate filter is installed.

6.5 USB and Solid-State Storage Drive Replacement

It is highly recommended to keep a USB flash drive or solid-state inserted in the unit at all times. A general fault is issued anytime a USB or solid-state drive is not inserted or full.

To insert or replace a USB drive follow these steps:

1. Exit Analysis
2. Go to the USB Drive removal screen on the main menu under History.
3. Touch the 'remove' button to halt writing to the disk.
4. Follow the procedures from section 6.3 to open the control panel access door.
5. Remove the USB drive from the system and replace with new drive
6. Wait 5 seconds for the system to initialize.
7. Close and latch the control panel access door.

6.6 Fuse Replacement

The system is protected with a 6-amp fast acting (5x20mm) fuse

	WARNING: Turn off machine and disconnect power cord from the power source before servicing the fuse.

6.7 Detector Service

Refer to the detector user manual for specific maintenance requirements related to either the Spectrum 2 or AIRGARD. Both Detectors contain replaceable air filters and replaceable desiccant to ensure the effects of particles and moisture are limited.

Chapter 7 – Service & Support

For information on service and support contact DOD Technologies via the means below.

For Permanent Discontinuation:
Discontinued units can be returned for recycling. Please contact DOD Technologies to discuss and arrange the safe return of your equipment.

Phone Support

M-F 8:30am – 5pm (Central Time Zone)
815.788.5200

Service Center

675 Industrial Drive Bldg. A.
Cary, IL 60013

Visit Our Website

DODtec.com

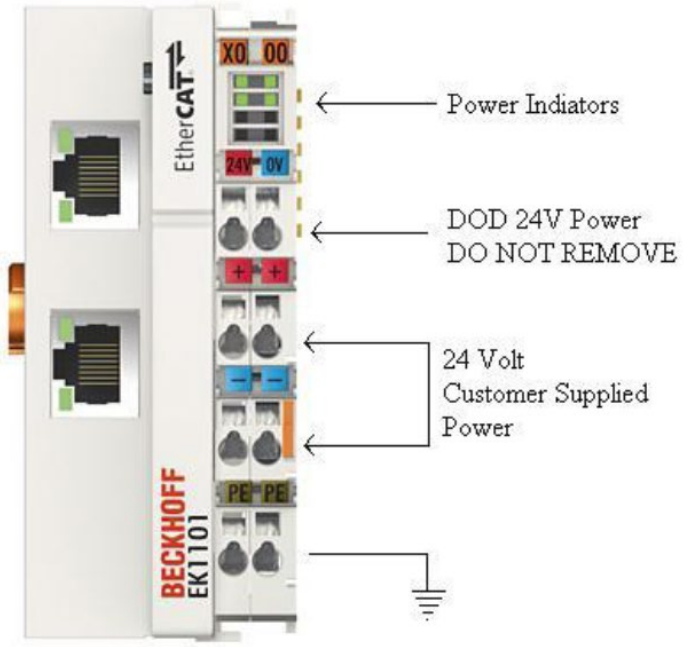
Appendix A – Parts List

Part #	Description	Qty	Price/each
9-200-004	Fuse 2A 5X20 Fast Acting (5V distribution)	up to 4	$7.00
2-200-006	Power Entry Module	1	$88.00
2-200-045	POWER SUPPLY 5VDC 10AMP	1	$195.00
2-200-136	DOD64 FTIR INDUSTRIAL PC	1	$3,150.00
2-200-047	Monitor 19" Touchscreen	1	$2,650.00
2-200-066	POWER SUPPLY 24VDC 4AMP	up to 4	$149.00
2-200-067	EL2008 Output Module 8 Point Source	1	$110.00
2-200-068	EL2088 Output Module 8 Point Sink	up to 6	$110.00
2-200-073	EL1008 Input Module 8 Point Sink	up to 2	$100.00
9-200-096	Fuse 6A 5X20 Fast Acting (AC Power)	1	$7.00
2-200-133	Solenoid Valve 3-way 24VDC Manifold Mount	up to 66	$285.00
2-300-020	Relay Pump NO Solid State 4-28 VDC (new style)	3	$88.00
2-810-A04	FTIR INLET/NEEDLE VALVE MANIFOLD ASSY	up to 6	$1,950.00
2-800-A07	SAMPLE MANIFOLD ASSEMBLY	up to 4	$1,490.00
2-800-A14-96	ASSEMBLY TRANSDUCER PCB (new style)	up to 8	$380.00
2-200-251	Industrial PC For DOD64-FTIR	N/A	$3,600.00
2-800-206	Manifold FTIR Valve	N/A	$740.00
2-800-A33	FTIR Pump Assy - Side Port - 115 VAC (SN: 8399 and Below)	N/A	$430.00
2-800-A34	FTIR Pump Assy - Side Port - 230 VAC (SN: 8399 and Below)	N/A	$430.00
2-300-020	Relay No Solid-State DIN Mount 4-28 VDC Coil Voltage, 3 Amps	N/A	$88.00
2-200-070	EK1101 Coupler Terminal for EtherCAT Extension Hot Connect	N/A	$325.00
2-200-071	EL9011 Bus End Terminal Module EtherCAT	N/A	$20.00
2-800-146	PCB Assembly CL96 Interconnect	N/A	$92.00
2-200-137	CU2005 5 Port 10/100 Unmanaged Switch - DIN Mount	N/A	$199.99
2-200-087	EK1122 Module 2 Port Ethernet Connection	N/A	$185.00
2-200-069	EK1110 Bus Extension with EtherCAT Extension	N/A	$140.00
2-200-058	USB Flash Drive 4GB or Higher	N/A	$60.00
2-200-065	CU8005 USB Hub 4 Port for CL96 Industrial PC	N/A	$310.00
2-200-258	Solid State Drive 128GB USB 3.0	N/A	$180.00
2-800-A14-96	ASSY Transducer PCB CL96 W/Software	N/A	$380.00
2-400-017	Regulator In-line Flow On Demand - Up to 10 LPM	N/A	$580.00
2-200-059	Fan 24VDC CL96 120 mm Square x 25 mm Thick	N/A	$42.00
2-200-060	Fan 24VDC CL96 60mm Sq. X 15 mm Thick CL96 UL Approved	N/A	$24.00
780248	Filter Particulate For Use with Non-corrosive Gases	N/A	$11.00
60009	Assy Filter Housing for Corrosive Gases	N/A	$105.00
60010	Teflon Membranes 100 Pack - 47mm	N/A	$275.00
2-800-013	Filter End of Line Disposable Teflon for Use with Corrosive Gasses	N/A	$35.00

Appendix B – I/O Connection Details (Cont.)

B.1 EK1101 Coupler

Each analyzer tray (16 or 32 point) has its own output module section and each section is coupled together with an EK1101 module. Two different power sources are used for the module. Power to operate the module itself is supplied by the DOD64 power and prewired by DOD Technologies - Do NOT remove. Power for all outputs must be supplied by the customer on pins 6 & 7.

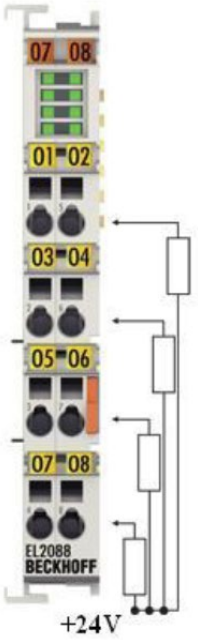


B.2 Standard Output Module (24 v Sinking)

				POINTS 1 - 16 (OPTIONAL)				POINTS 17 - 20 (OPTIONAL)			
	BUS CENTER	FTIR GENERAL	ANALYZER A GENERAL	POINTS 1 - 4	POINTS 5 - 8	POINTS 9 - 12	POINTS 13 - 16	POINTS 17 - 20	POINTS 21 - 24	POINTS 25 - 28	POINTS 29 - 32
	EK11	EL20	EL20	EL20	EL20	EL20	EL20	EL20	EL20	EL20	EL20
Part #	01	88	88	88	88	88	88	88	88	88	88
Note #		1	2	3	3	3	3	3	3	3	3

B.2.1 DOD64 General Outputs

Output #	Description
1	Critical
2	General
3	Alarm 1
4	Alarm 2
5	Analysis Active
6	Watchdog
7	Power On
8	(EMPTY)



B.2.2 Analyzer General

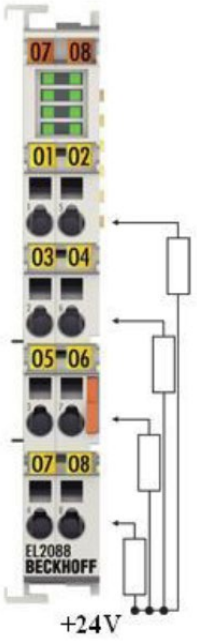
Output #	Description
1	Critical
2	General
3	Alarm 1
4	Alarm 2
5	Analysis Active
6	Watchdog
7	Power On

8	(EMPTY)

B.2.3 Point Outputs**

Output #	Description
1	Pt X Alarm 1
2	Pt X Alarm 2
3	Pt (X+1) Alarm 1
4	Pt (X+1) Alarm 2
5	Pt (X+2) Alarm 1
6	Pt (X+2) Alarm 2
7	Pt (X+3) Alarm 1
8	Pt (X+3) Alarm 2

**For Each Module X = the lowest point #



Appendix C – System Specifications

The DOD64-FTIR Sequential gas monitor is approved for use under the following conditions:

- Indoor use only
- Altitude up to 2,000 m
- Temperatures 5°C - 40°C
- Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40 °C
- A/C power as specified below with +/- 10% of the nominal voltage
- Transient Levels: Impulse withstand (overvoltage) category II of IEC 60364-4-443

WARNING: The detachable power cord or the supply line wiring must meet the ratings specified below.

Detection Principle	FT-IR Technology
Gases Available	Contact DOD Technologies
Monitoring Points	16-32-48-64 Points
Sample Distance	400 ft. (122m) 1/4" OD x 3/16" ID Teflon FEP
Exhaust Tubing	25 ft. (7.62m) 3/8" OD x 1/4" ID Poly-E (Included)
Display	19" Color Touch Screen HMI
Local Alarm Indication	Audible and Visual
Relay Outputs	Programmable Low and High Level
Operating Temperature	40F to 104F (5C to 40C)
Shipping Weight	450 lbs.
Operating Voltage	100/110 VAC 50/60Hz 230 VAC 50Hz
Power Consumption	Less than 6 Amps
Dimensions	H 59" x W 31" x D 28.5" Add 10" to Height for tubing
Spectral Range	450 - 4000
Scan Speed	1 Scan/Second at 4.0cm-1
Selectable Scan Time	1-300 Seconds
Infrared Source	Ceramic Globar at 1500 C
Reference Laser	VCSEL at 850nm
Detector	Stirling Cooled MCT or DTGS
Line Flow	Continuous Line Purge
Line Sample Analysis	Sequential
Gas Cell path Length	10m effective path
Gas Cell Construction	Nickel Coated Aluminum
Mirrors	ZnSe

Appendix D – System Event Message

Event Code	Description	Type	Possible Cause	Resolution
64012	Alarm Level 1	Alarm	Gas Release above Alarm Level 1.	Determine release point
64013	Alarm Level 2	Alarm	Gas Release above Alarm Level 2.	Determine release point
64068	Analysis Ended Due to Fault	Critical Fault		See other Fault message in Event Log for cause
64057	Background Error	Critical Fault	Nitrogen source, Valve Failure Pump Fault	Check for other related error messages or check Nitrogen source, pump, and test all valves
64064	FTIR Diagnostic Alarm	Critical Fault	PerkinElmer	
64009	Gas Configuration Error	Critical Fault	Invalid Configuration, disk fault	Verify Configuration with DOD Technologies
64040	Idle Timeout (System)	Critical Fault	System out of analysis for specified Time	
64017	Modbus Comm Failure	Critical Fault	Network error	Check Network connection
64016	Multi Low Flow-Check Pumps & Trays	Critical Fault	Pump Failure	Test all pumps on test screen for proper flow
64033	Output module failure or not installed	Critical Fault	Wiring error, network error	Check Wiring and Power supplies to output modules
64007	PLC Comm Error	Critical Fault	System Fault	Contact DOD Technologies
64076	Spectrum Comm Failure	Critical Fault	Power Fault with PerkinElmer System, connection error	Check Wiring and Test Spectrum Software interface
64079	Spectrum Diagnostic Fault	Critical Fault	See Spectrum faults	
64077	Spectrum Reset	Critical Fault	Power Failure	
64065	Analysis Ended	General Fault	User ended analysis or system fault	
64055	Background Gas Value	General Fault	Valve failure or Nitrogen source	
64056	Background Pressure	General Fault	Nitrogen source	
64044	Custom Output Module Failure	General Fault	Wiring error, network error	Check Wiring and Power supplies to output modules
64070	DOD Ambient Background Value	General Fault	Gas in specified point used for verification	
64019	Flow Block Comm Failure	General Fault	Wiring problem, faulty transducer	
64063	FTIR Diagnostic Warning	General Fault	See PerkinElmer faults	
64015	High Transport Flow	General Fault	Flow out of balance, positive pressure to system	
64020	Idle Timeout (Analyzer)	General Fault	Single Analyzer out of analysis	
64025	Logging write error - verify disk inserted:	General Fault	Disk Error	

Event Code	Description	Type	Possible Cause	Resolution
64014	Low Transport Flow	General Fault	Flow out of balance or pump failure	
64060	Observation Warning	General Fault	Gas Detected with possible overlap to other gas	
64046	Output Module Offline	General Fault	Wiring error, network error	
64075	Spectrum Comm Error	General Fault	Wiring error or power loss to PerkinElmer System	
64078	Spectrum Diagnostic Warning	General Fault	See PerkinElmer faults	
64062	Exit Analysis for Setup Menu	Information	For information purposes only	
64006	Faults & Alarms Reset	Information	For information purposes only	
64061	File Transfer	Information	For information purposes only	
64027	Flow Offsets Reset	Information	For information purposes only	
64074	FTIR Background Request	Information	For information purposes only	
64054	Invalid FTIR Gas	Information	For information purposes only	
64034	K Factor update	Information	For information purposes only	
64029	Machine configuration updated/saved	Information	For information purposes only	
64050	New FTIR Background	Information	For information purposes only	
64001	No event file found for selected date	Information	For information purposes only	
64059	Output Testing Active	Information	For information purposes only	
64035	Passwords updated	Information	For information purposes only	
64041	PLC Connected	Information	For information purposes only	
64071	PLC Retry	Information	For information purposes only	
64028	Point configuration updated/saved	Information	For information purposes only	
64003	Power On	Information	For information purposes only	
64037	Previous machine settings restored.	Information	For information purposes only	
64072	Retry Scan	Information	For information purposes only	
64032	Simulation Mode	Information	For information purposes only	
64080	Spectrum Remote Desktop Connection	Information	For information purposes only	
64002	Starting new log file	Information	For information purposes only	
64058	Validating FTIR System	Information	For information purposes only	

Appendix E – Gas Specifications

Click the following link to review a list of detectable gases and available system calibrations:

DOD64 FTIR Detectable Gas List

This list can also be accessed and downloaded at DODtec.com by visiting the 'Detectable Gases' section in the corresponding product page(s). Please contact us to inquire into additional target gases or ranges not found on the list.

Appendix F – Data Communications

F.1 Ethernet IP

FTIR Faults/ Alarms (Discrete Outputs)

Token	Description	Type
Machine Critical Fault	Machine has critical fault	Boolean
Machine Maintenance Fault	Machine has a maintenance fault	Boolean
Machine Gas Alarm 1	Level 1 Gas Alarm at Least 1 Machine Point	Boolean
Machine Gas Alarm 2	Level 2 Gas Alarm at Least 1 Machine Point	Boolean
Power On	Power is on to Analyzer	Boolean

Each Point Alarm Indicators

Token	Description	Type
Alarm 1 Active	Level 1 Gas Alarm Active	Boolean
Alarm 2 Active	Level 2 Gas Alarm Active	Boolean

Last Scan

Token	Description	Type
Concentrations	Array of Concentration Values for Last Scan	Real [32]
Sequence#	Sequence Number for Last Scan	Int
Point Valves	Array of Indicators for Active Point(s) during Last Scan	Boolean [64]
Scan Date / Time	Date / Time of last Scan	Ticks Since 1/1/1
Gasses Scanned	Array of DOD Gas ID#s In Method	Unit [32]
Spectra Filename	File Name of Spectra File Created	Char [24]

Due to limitations in the amount of data available via Ethernet/IP the Originator must track the concentrations on each point based on the last scan values. To save the concentrations on each point, monitor for changes in the date/time of the last Scan then update the point concentrations for the point which has the valve open.

Downlink from Master to FTIR

Assembly Instance :102
Size (16-bit Words): 2

Offset (Words)		Size # Words	Data Description	Format
0		2	Connection Status	

Uplink from FTIR to Master

Assembly Instance: 101
Size (16-bit Words): 216

Offset (Words)	Size # Words	Data Description	Format
0	2	Connection Status	
2	2	Last Scan Sequence Number	UINT (16Bit) Number
4	32	Valves Active During Scan	64 Byte Array (1 Byte Per Valve - Boolean)

Offset (Words)	Size # Words	Data Description	Format
36	64	Concentration Results During Scan	Real [32] Array with Conc. For Up To 32 gasses
100	4	Scan Date / Time	**See Note Below
104	64	Alarm Level 1 & 2 Indicators	128 Byte Array – Alarm 1&2 for 64 Pts.
168	4	Faults / Alarms FTIR	8 Byte Array Defined Below
172	32	DOD Gas Identification Number	Array of 32 UINT (16 bit) Numbers
204	12	Last Spectra File Name	Array of 26 Characters

** This is a Microsoft.Net value which represents the number of 100-nanosecond intervals that have elapsed since 12:00:00 midnight, January 1, 0001, which represents Date, Time, Min. Value. It does not include the number of ticks that are attributable to leap seconds.

The Fault/Alarms are indicated as follows:
Byte 0 - Critical Fault
Byte 1 - General Fault
Byte 2 - Alarm Level 1
Byte 3 - Alarm Level 2
Byte 4 - Analysis Active
Byte 5 – Power
Byte 6 – Testing Mode
Byte 7 – Heartbeat

F.2 MODBUS TCP/IP

FTIR Faults/Alarms (Discrete Outputs)

Token	Description	Type
Machine Critical Fault	Machine has critical fault	Boolean
Machine Maintenance Fault	Machine has a maintenance fault	Boolean
Machine Gas Alarm 1	Level 1 Gas Alarm at Least 1 Machine Point	Boolean
Machine Gas Alarm 2	Level 2 Gas Alarm at Least 1 Machine Point	Boolean
Power On	Power is on to Analyzer	Boolean
Watchdog	Toggles On/Off Every X Seconds	Boolean

Each Point Alarm Indicators

Token	Description	Type
Alarm 1 Active	Level 1 Gas Alarm Active	Boolean
Alarm 2 Active	Level 2 Gas Alarm Active	Boolean

Last Scan

Token	Description	Type
Concentrations	Array of Concentration Values for Last Scan	Real [32]
Sequence#	Sequence Number for Last Scan	Int
Point Valves	Array of Indicators for Active Point(s) during Last Scan	Boolean [64]
Scan Date / Time	Date / Time of last Scan	Ticks Since 1/1/1
Gasses Scanned	Array of DOD Gas ID#s In Method	Unit [32]
Spectra Filename	File Name of Spectra File Created	Char [24]

IMPORTANT: Floating Point numbers on the FTIR are stored Little Endian (least significant register first). The Master MODBUS system should use "Read Holding Registers" to read data from the FTIR.

Default Slave ID: 1
Total Size: 208 Words

(Word) Address	# Words	Type	Data Description	Format
40001	1	Bits	FTIR Analyzer Faults	*See Below
40002	1	Bits	Analyzer A Faults	*See Below
40003	1	Bits	Analyzer B Faults	*See Below
40004	1	Bits	Analyzer C Faults	*See Below
40005	192	Float	Concentration Points 1-96	Floating Point (Real-Little Endian)
40197	1	Bits	Analyzer A Alarm Level 1 Indicators	Bit 0-15 = Alarm Level 1 Points 1-16
40198	1	Bits	Analyzer A Alarm Level 1 Indicators	Bit 0-15= Alarm Level 1 Points A 17-32
40199	1	Bits	Analyzer B Alarm Level 1 Indicators	Bit 0 - 15 = Alarm Level 1 points B 1-16
40200	1	Bits	Analyzer B Alarm Level 1 Indicators	Bit 0 - 15 = Alarm Level 1 points B 17-32
40201	1	Bits	Analyzer C Alarm Level 1 Indicators	Bit 0 - 15 = Alarm Level 1 points C 1-16
40202	1	Bits	Analyzer C Alarm Level 1 Indicators	Bit 0 - 15 = Alarm Level 1 points C 17-32
40203	1	Bits	Analyzer A Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points A 1-16
40204	1	Bits	Analyzer A Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points A 17-32
40205	1	Bits	Analyzer B Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points B 1-16
40206	1	Bits	Analyzer B Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points B 17-32
40207	1	Bits	Analyzer C Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points C 1-16
40208	1	Bits	Analyzer C Alarm Level 2 Indicators	Bit 0 - 15 = Alarm Level 2 points C 17-32
40209	96	UINT	Array of 96 Concentrations	Concentration *10 w/o any Decimal Pts.
40305	192	Float	Alarm Level 1 (Points 1-96)	Floating Point (Real-Little Endian)
40497	192	Float	Alarm Level 2 (Points 1-96)	Floating Point (Real-Little Endian)
40689	96	UINT	Full Scale (Points 1-96)	Unsigned Integer Full Scale
40785	96	UINT	Gas Type Code (Points 1-96)	Unsigned Integer Gas ID Code

- The concentrations are available in both floating point format and as an unsigned integer containing the Concentration * 10 (i.e.: Actual conc = 24.7 then value = 247)
- For Analyzer A, B, and C the lower 8 bits (0-7) are for the lower analyzer and the upper 8 bits (8-15) are for the upper analyzer. For the FTIR Fault/Alarms

the alarms indicate the status of the entire machine. See the Appendix B of the FTIR manual for details of the I/O indicators. Bit Descriptions below.

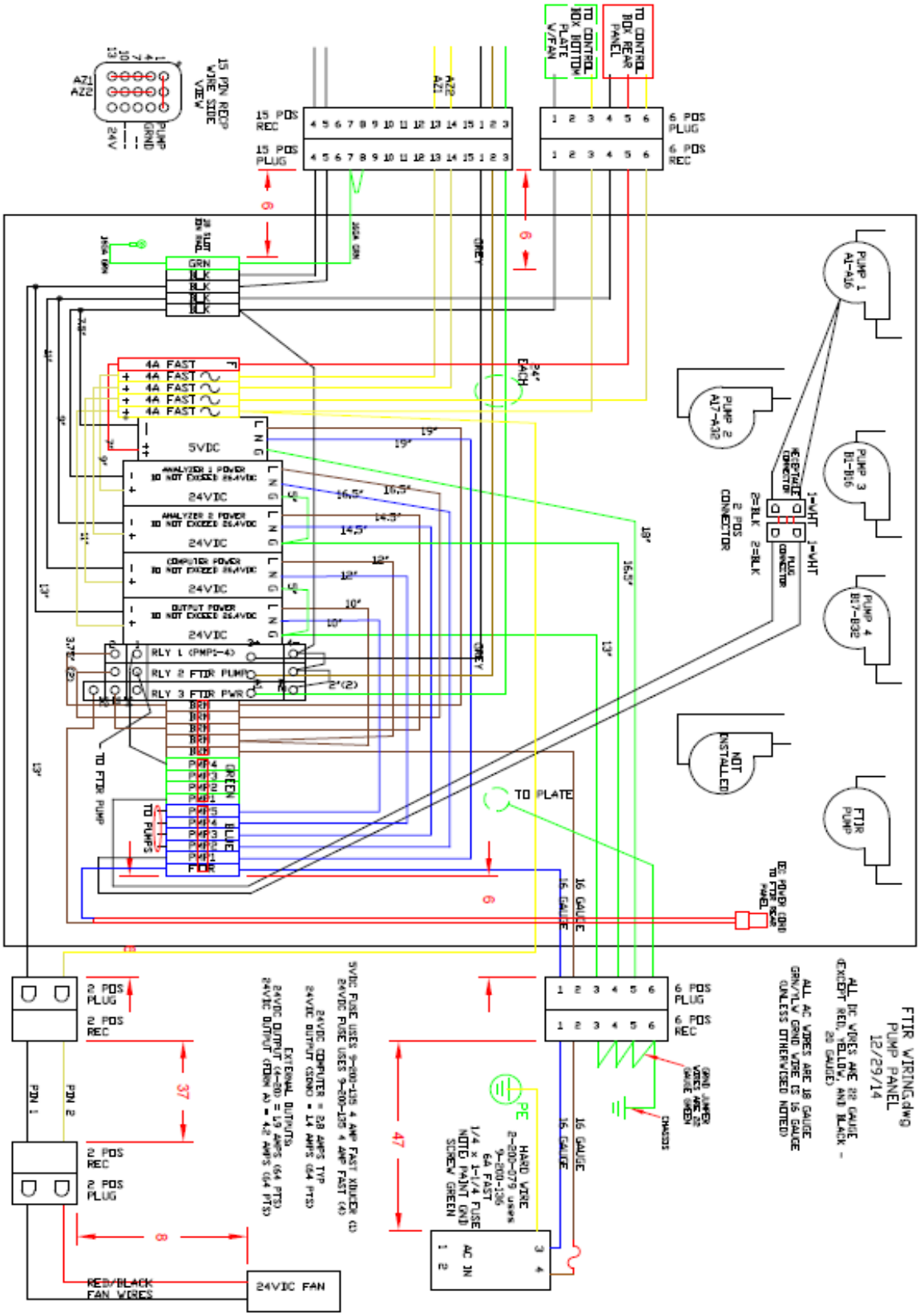
The Fault/Alarms (40001-4004) are indicated as follows:
 Bit 0 - Critical Fault
 Bit 1 - General Fault

- Bit 2 - Alarm Level 1
- Bit 3 - Alarm Level 2
- Bit 4 - Analysis Active
- Bit 5 – Power
- Bit 7 – Watchdog

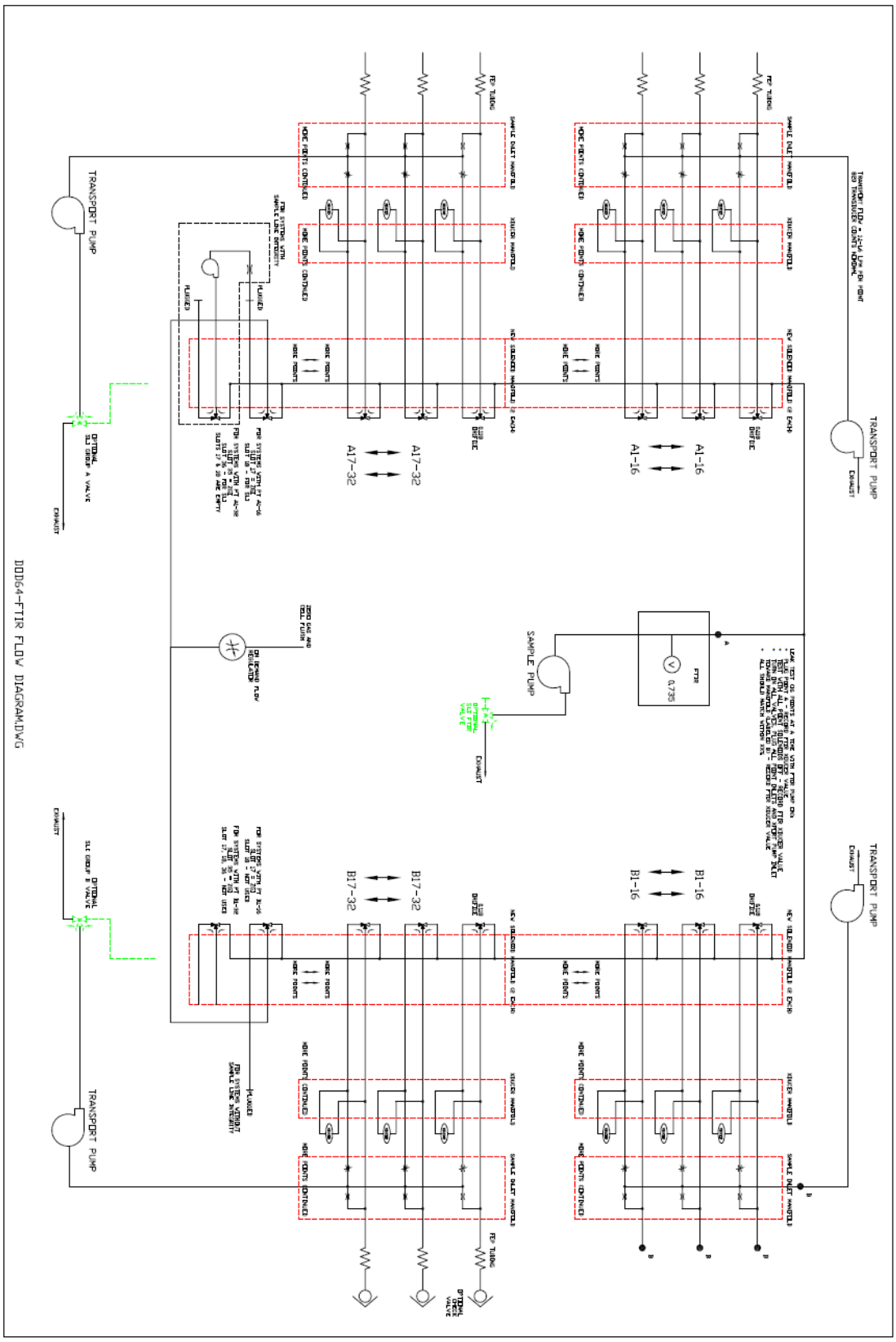
Gas Type Codes & Full Scale
Some Gasses have multiple codes as shown in the next table:

Gas Type Code	Gas & Range	Range
1	AsH3	500ppb
2	B2H6	1000ppb
3	GeH4	2000ppb
4	H2Se	500 ppb
5	PH3	1500 ppb
6	SiH4	50 ppm
8	CL2	5000 ppb
9	H2S	25 ppm
10	HCL	15 ppm
11	HF	10 ppm
12	BF3	3200 ppb
13	HBR	20 ppm
16	COCl2	4000 ppb
17	AsH3	50 ppb
18	H2S	20 ppm
20	AsH3	1000 ppb
21	AsH3	50 ppb
22	Cl2	3200 ppb
23	Br2	1000 ppb
25	NH3	75 ppm
26	F2	3200 ppb
27	NO2	30 ppm
35	HCL	15 ppm
36	HF	10 ppm
37	BF3	3200 ppb
38	HBR	20 ppm

F.3 Pump Panel Diagram



F.4 Flow Diagram



F.4 Control Box Diagram