TVA-1000B
Toxic Vapor Analyzer
Operation, Configuration, and Maintenance

Style AA

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General Instructions

Foxboro designs, manufactures, and tests its products to meet many national and international standards. However, for these products to operate within their normal specifications, you must properly install, use, and maintain these products. The following instructions must be adhered to and integrated with your safety program when installing, using, and maintaining Foxboro products.

- ♦ Read and save all instructions prior to installing, operating, and servicing the product.
- ♦ If you do not understand any of the instructions, contact your Foxboro representative for clarification.
- ♦ Follow all warnings, cautions, and instructions marked on and supplied with the product.
- ♦ Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- ♦ To ensure proper performance, use qualified personnel to operate, update, program, and maintain the product.
- ♦ When replacement parts are required, ensure that the qualified service technician uses replacement parts specified by Foxboro. Unauthorized substitutions may result in fire, electrical shock, other hazards, or improper operation of equipment.
- ♦ Except when maintenance is being performed by qualified personnel, ensure that all equipment doors are closed and protective covers are in place, to prevent electrical shock and personal injury.

Introduction

Overview

The TVA-1000B Toxic Vapor Analyzer, illustrated in the figure below, is an advanced-design, portable, organic/inorganic vapor monitor for the gas survey industry. This analyzer uses either a flame ionization detector (FID), or a photoionization detector (PID), or *both* types of detectors to sample and measure concentration of gases.

The vapor concentration may be read immediately on either of two displays — one mounted directly on the hand-held sample probe and the other on the instrument sidepack itself. Vapor concentration can be displayed on both displays in parts per million (ppm), parts per billion (ppb), or percent concentration (%). The data displayed may also be collected and saved in analyzer memory and downloaded to a personal computer for analysis.

Through the sidepack keyboard, you can choose the mode of operation, select concentration units for the display, set alarm thresholds, select data collection mode, and change setup (configuration) parameters.

This unit is shipped with the battery installed. The unit is ready for operation upon completion of setup, calibration, and charging.
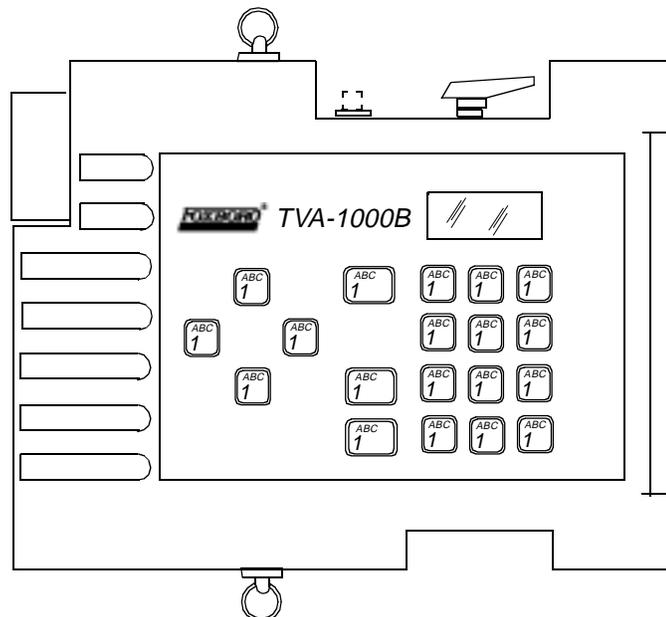
Figure 1. Analyzer Sidepack

Instrument Functions

This analyzer functions in any of four modes:

- ♦ RUN
- ♦ SETUP
- ♦ INFO
- ♦ PC LINK/MEMORY

In the RUN mode, the instrument automatically displays its measured values in units of ppm, ppb, or %. The RUN mode may be operated either as *survey only*, in which the instrument displays measured values but does not store any data, or *survey and log*, in which the instrument displays measured values and also stores the information in memory.

In SETUP mode, you can enter or select operational parameters, such as calibration values, alarm levels, operator ID, datalogging method and interval, date, and time. This may be performed locally by using the analyzer keypad or remotely by using the RS-232 connection to a personal computer (PC).

In INFO mode, you can review operational parameters entered or selected in SETUP mode as well as instrument serial number, battery status, etc.

In PC LINK/MEMORY mode, you can download data stored within the TVA-1000B to a PC for analysis and printing, upload route list, calibration, and configuration parameters from a PC to the TVA-1000B, or clear data memory.

Each of the four modes is explained in detail later in this document.

Using the Instrument

While operating this instrument in the field, you normally carry the TVA-1000B at your side, using the shoulder strap. With the pump on, detector(s) on, and the unit warmed up, you monitor the area of concern. As soon as the instrument analyzes a sample, the probe displays concentration of the vapor. The display on the sidepack duplicates the vapor concentration on the probe display. Using the BASIC probe, you can toggle the display between detector types by pressing the DET button on the probe, log the survey data by pressing the LOG button, and backlight the LCD display by pressing the lamp button. An optional enhanced probe for Fugitive Emissions (FE) monitoring applications allows you to select options from special menus. These probe types will be detailed later in this document.

> *WARNING*: *Do not connect/disconnect any electrical device (such as battery charger, analog output, personal computer, or auxiliary port device) to the instrument in an area classified as hazardous due to the presence of flammable vapors.*

Standard Specifications

Table 1. Specifications

Item	Specification
Accuracy	*PID Instrument* — ±25% of reading or ±2.5 ppm, whichever is greater, from 0.5 to 500 ppm. Accuracy listed is achieved using isobutylene with a 1-point calibration in the range from 100 to 300 ppm (including drift) at the temperature and humidity of the calibration. *FID Instrument* —±25% of reading or ±2.5 ppm, whichever is greater, from 1.0 to 10,000 ppm. Accuracy listed is achieved using methane with a 1-point calibration in the range from 100 to 500 ppm (including drift) at the temperature and humidity of the calibration.
Repeatability	*PID Instrument* — ±1% at 100 ppm of isobutylene *FID Instrument* — ±2% at 100 ppm of methane
Analog Output	Two analog output signals, 0 to 2 V dc, proportional to the count output from each detector.
Dynamic Range	*PID Instrument* — 0.5 to 2,000 ppm of isobutylene *FID Instrument* — 1.0 to 50,000 ppm of methane
Linear Range	*PID Instrument* — 0.5 to 500 ppm of isobutylene *FID Instrument* —1.0 to 10,000 ppm of methane
Minimum Detectable Level	The minimum detectable level is defined as two times the peak-to-peak noise. *PID Instrument* — 100 ppb of benzene *FID Instrument* — 300 ppb of hexane
Response Time using close area sampler	*PID Instrument* — Less than 3.5 seconds for 90% of final value, using 100 ppm of isobutylene *FID Instrument* — Less than 3.5 seconds for 90% of final value, using 10,000 ppm of methane
Recovery Time using close area sampler	*PID Instrument* — Less than 5.0 seconds to return to 10% of base line, using 100 ppm of isobutylene *FID Instrument* — Less than 5.0 seconds to return to 10% of base line, using 10,000 ppm of methane
Response Time using telescoping wand extender	*PID Instrument* — Less than 5.0 seconds for 90% of final value, using 100 ppm of isobutylene *FID Instrument* — Less than 5.0 seconds for 90% of final value, using 10,000 ppm of methane
Recovery Time using telescoping wand extender	*PID Instrument* — Less than 5.0 seconds to return to 10% of base line, using 100 ppm of isobutylene *FID Instrument* — Less than 5.0 seconds to return to 10% of base line, using 10,000 ppm of methane

Table 1. Specifications (Continued)

Item	Specification
Response Time using charcoal filter adapter	*PID Instrument* — Less than 20 seconds for 90% of final value, using 100 ppm of isobutylene *FID Instrument* — Less than 20 seconds for 90% of final value, using 10,000 ppm of methane
Recovery Time using charcoal filter adapter	*PID Instrument* — Less than 20 seconds to return to 10% of original value, using 100 ppm of isobutylene *FID Instrument* — Less than 20 seconds to return to 10% of original value, using 10,000 ppm of methane
Data Storage Interval	*Auto Mode* — 1 per second to 1 per 999 minutes, user selectable *VOC or FE Mode* — 2 to 30 seconds, user-selectable
Sample Flow Rate	1 liter/minute, nominal, at sample probe inlet
Battery	The battery can be fully charged in less than 16 hours. The battery operating time is 8 hours minimum at 20° (32°F). Use of the backlight on the probe display shortens battery life. The battery is replaceable by removing the bottom cover of the instrument. *(**WARNING:** Do not replace battery in an area classified as hazardous due to presence of flammable gases or vapors.)*
Battery Charger	The battery charger is a separate unit capable of operating the analyzer while simultaneously charging the internal battery. An adapter cable is provided to charge the battery separate from the analyzer. The charger can charge a fully discharged battery in a maximum of 16 hours. Charging takes longer if performed while the instrument is operating. Two types of chargers are available, one for 120 V ac, 50/60 Hz and another for 230 V ac, 50/60 Hz. *(**WARNING:** Do not operate battery charger in an area classified as hazardous due to presence of flammable gases or vapors.)*
PID Lamp Life	Greater than 2000 hours for 10.6 eV lamp, with normal cleaning
FID Life	Greater than 2000 hours
Audio Output Level	Greater than 75 dB at 3 feet
Gas Cylinder Capacity	*Pressure* — 15.3 MPa at 25°C (2200 psi at 77°F) maximum *Empty* — 85 cc (5.19in^3)
Hydrogen Supply Operating Time	Greater than 8 hours of continuous operation, starting from a cylinder charged up to 15.3 MPa (2200 psi)
Enclosure Description	The analyzer enclosure and front panel are made from a chemically resistant thermoplastic material. The approximate dimensions are 343 x 262 x 81mm (13.5 x 10.3 x 3.2 in). The enclosure is designed to provide environmental protection.

Table 1. Specifications (Continued)

Item	Specification
Electrical Interface Connections	Mating female connectors for Analog Output, RS-232 Interface (Host), and Battery Charger are provided on the side of the analyzer case below the keypad.
Mechanical Connections	Mechanical connections for Sample Input and for Vent Outlet are provided on the side and bottom surfaces.
Portability	The analyzer is designed to be carried by a removable shoulder strap. The strap, which is provided with every instrument, does not hinder the user when viewing or using the analyzer front panel. The strap is designed to support the probe when the instrument is not in use and to carry accessory tools.
Tool Kit	An accessory tool kit is provided with each instrument. The kit contains special tools for accessing the battery and removing the detector capsules.

Approximate Mass	*Analyzer (PID plus FID):*
	    *PID only —*4.8 kg (10.5 lb)
	    *FID only —*4.8 kg (10.5 lb)
	    Dual — 5.2 kg (11.9 lb)
	Probe Assembly:
	    Standard Probe — 0.55 kg (1.1 lb)
	    *Enhanced Probe —*0.79 kg (1.75 lb)

External Influences

This product is intended for use in indoor and outdoor environments as a portable instrument carried by a user, as specified in the following table. The same environmental conditions also apply to the sample stream being monitored.

¹

Table 2. External Influences

External Influence	Reference Operating Conditions	Normal Operating Conditions	Operative Limits	Transportation and Storage Limits
Ambient Temperature	23±2 °C 73±2 °F	0 to +40°C 32 to 104 °F	0 and +50°C 32 and 122 °F	-20 to +60°C -4 and 140 °F
Ambient Pressure	860 to 1060 mbar	70 to 108 kPa		20 to 108 kPa
Relative Humidity	50%±10%	FID: 20 to 95% PID: 20 to 70% noncondensing	15 and 95% noncondensing	0 to 100%
Radiated Susceptibility	None		30 V/m 27 to 500 MHz	
Conducted Susceptibility		Not Applicable, Battery Operated		
Conducted Emission		Not Applicable, Battery Operated		
Radiated Emission			80 dBμV 0.15 to 30 MHz	
ESD Sensitivity			>6000 Volts	
Battery Charger Supply Voltage	120 or 230 ±1% Vac	120 or 230 +15%, -10% V ac		Not Applicable
Battery Charger Supply Frequency	50/60 Hz ±0.5 Hz	47 to 63 Hz	47 and 63 Hz	Not Applicable

Product Safety Specifications

Table 3. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Conditions of Classification	Electrical Classification Code
FM: intrinsically safe for Class I, Division 1, Groups A, B, C, and D	Temperature Class T4	FAZ
*CENELEC: intrinsically safe for Zone 1 and Zone 2, (EEx ib d IIC)	Temperature Class T4	EBZ
*CSA: intrinsically safe for Class I, Division 1, Groups A, B, C, and D.	Temperature Class T4	CAZ

*Not available at release. Contact Foxboro for current status.

Theory of Operation

Flame Ionization Detection (FID)

A Flame Ionization Detector (FID) measures organic compounds by utilizing a flame produced by the combustion of hydrogen and air. When hydrocarbons in the sample are introduced to the detection zone, ions are produced by the following reaction:

$$RH + O \rightarrow RHO^+ + e^- \rightarrow H_2O + CO_2$$
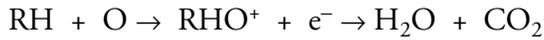
where

R = carbon compound

A collector electrode with a polarizing voltage is also located within the detector chamber, and the ions produced by this reaction are attracted to it. As the ions migrate towards the collector, a current is produced which is directly proportional to the concentration of hydrocarbons introduced to the flame.   This current is then amplified and sent to a microprocessor and/or analog readout device.

The FID has a wide dynamic range. The effective dynamic range can be further expanded by use of a dilutor kit which reduces very high volatile organic compounds (VOC) concentrations to within the dynamic range (or even linear range) of the analyzer. The dilutor kit can also be used to enrich oxygen deficient samples by adding ambient air that is rich in oxygen (20.9% usually). Low oxygen can affect the characteristics of the hydrogen flame, causing readings to be artificially elevated and possibly extinguishing the flame. As a general rule of thumb, greater than 16% oxygen is required to support the flame. If underground gases or samples in gas bags are to be measured by an FID, it is advised that the dilutor be used to combat the problem.
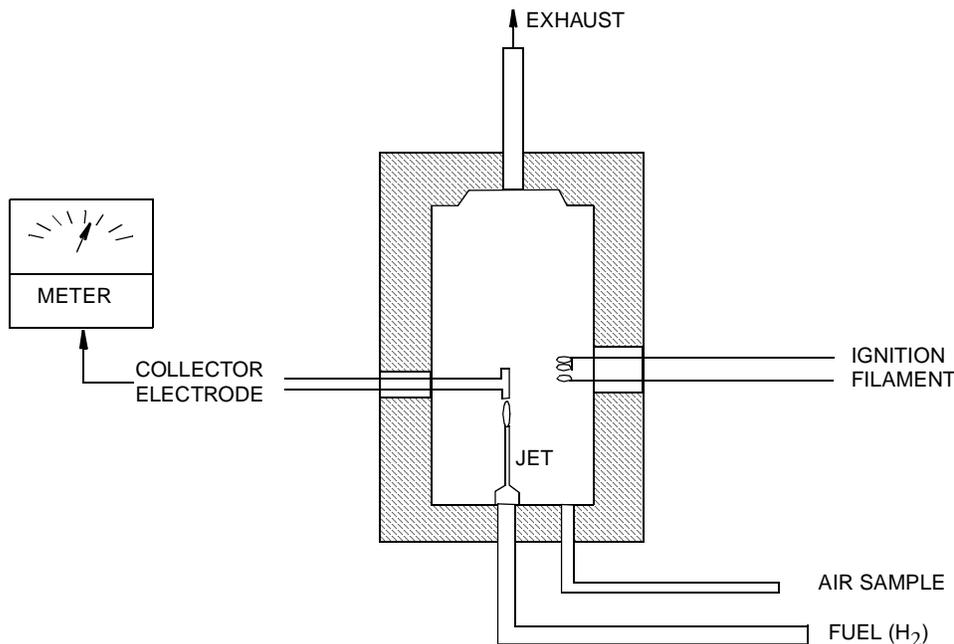
Figure 2. Typical Flame Ionization Detector

Benefits of Flame Ionization Detection

- ♦ Wide dynamic and linear range
- ♦ High sensitivity to hydrocarbon vapors (including methane)
- ♦ Very stable and repeatable response
- ♦ Virtually unaffected by ambient levels of CO, CO_2, and water vapor

Photoionization Detection

A Photoionization Detector (PID) consists of an ultraviolet (UV) lamp of a specific energy and an ionization chamber. Compounds passing through the chamber are excited by photons of UV energy and ionized according to the following equation:

$$R + h\upsilon \rightarrow R+ + e^-$$
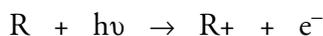
where

R = most organic/inorganic compounds

These ions are attracted to a collecting electrode, producing a current proportional to the concentration of the compound.

Whether or not a compound can be detected by a PID depends upon the energy required to remove an electron from the compound (its ionization potential). If the lamp energy is greater than the compound's ionization potential, the PID will detect it. The standard lamp in the TVA-1000B is 10.6 eV. Other lamps (9.6 and 11.8 eV) are also available. The 11.8 eV lamp permits detection of many compounds not ionized by the standard lamp. The lower energy (10 eV) lamps, however, allow more selectivity by not responding to undesired compounds with a higher ionization potential.

> *NOTE: Refer to MI 611-183 for information and guidance on proper use of the 11.8 eV lamp.*

Because of its smaller dynamic range (0-2000 ppm), the PID is not the detector of choice for measuring high concentrations of vapors. A PID is also more susceptible to interference from water vapor than a FID. However, as a PID does not require hydrogen or oxygen, it is the detector of choice when fuel is limited or unavailable, or when ambient oxygen concentrations are low. The PID is also very sensitive to aromatic and chlorinated compounds, and can even measure some inorganic compounds that the FID does not detect at all (ammonia, carbon disulfide, carbon tetrachloride, chloroform, ethylamine, formaldehyde, and hydrogen sulfide, to name a few).

Benefits of Photoionization Detection

- ♦ High sensitivity to aromatics, unsaturated hydrocarbons and chlorinated hydrocarbons
- ♦ Ability to measure some inorganic gases
- ♦ Very simple operation
- ♦ No support gases required
- ♦ Non-destructive detector allows sample to be recovered
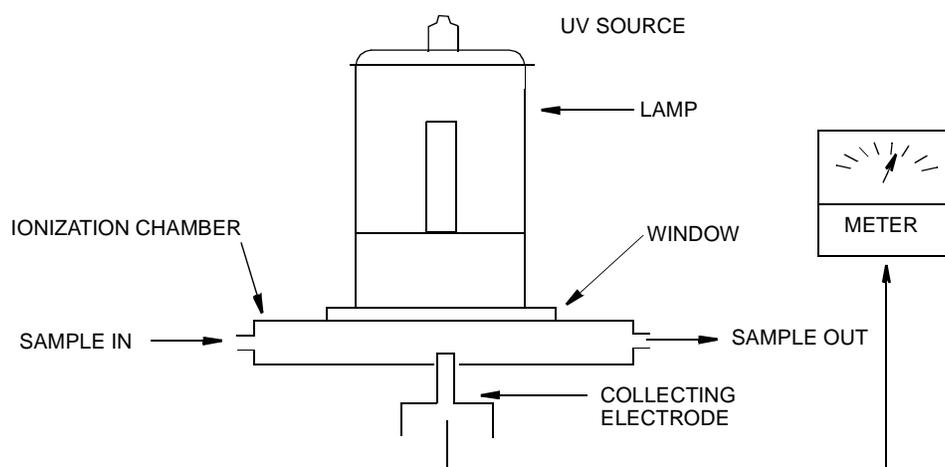
Figure 3. Typical Photoionization Detector

Dual Detectors

The benefits of each individual detector are very clear: both the FID and the PID have their advantages and disadvantages. However, with either detector alone, the number of organic and inorganic vapors that one can detect is limited by the measurement capabilities of that detector.

With the TVA-1000B, users can obtain complete information about more organic and inorganic vapors more quickly and easily than with single detector technology alone.

Since both detectors may be displayed and logged simultaneously, the relative response of the two detectors may give some clues about the identity of the compound being measured. For instance, the PID does not respond to methane at all, but the FID responds very well. A high FID reading with virtually no PID response might indicate the presence of methane. Consequently, PIDs respond very well to some inorganic gases that FIDs cannot detect. A high PID reading with no FID reading might suggest the presence of an inorganic compound. With readings from both detectors readily available, the TVA-1000B can help a user make decisions about the type of compound present and which detector reading to use.

Benefits of Dual Detectors

- ♦ Cost-effective packaging
- ♦ Detector response ratios can help characterize compounds
- ♦ Enhanced analytical capability derived from simultaneous detection
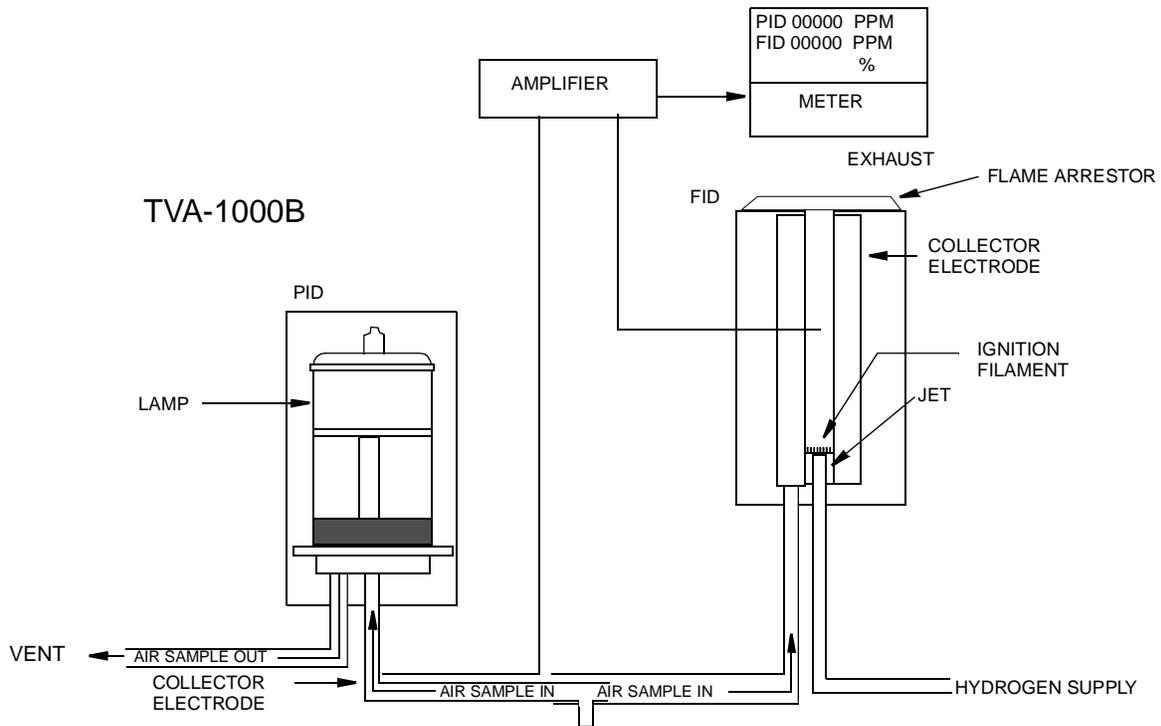
Figure 4. TVA-1000B Dual Detector Configuration

Concentration Calculation and Calibration

The concentration calculation is defined as the process that transforms a detector count into a displayed final concentration. The process is as follows:
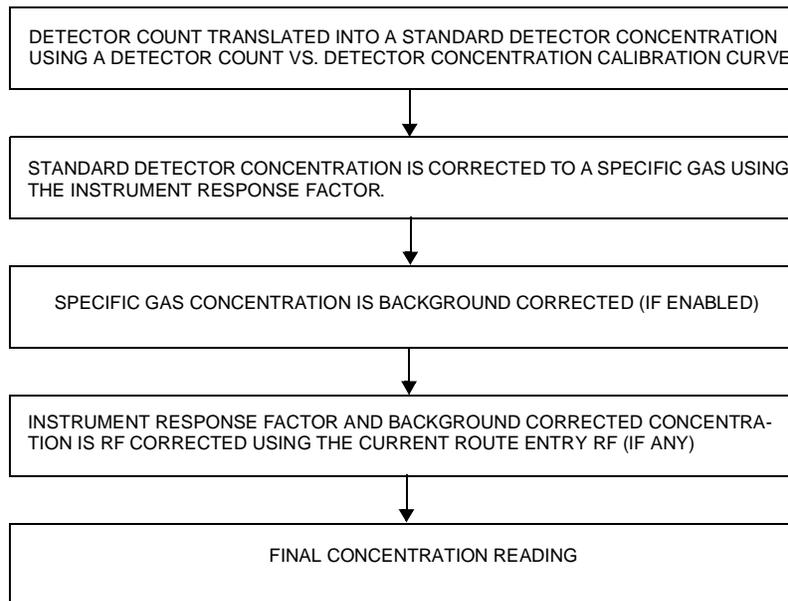
Hardware

NOTE: *A TVA-1000B may be configured in any of several different packaging arrangements. The configuration described in this document is for the BASIC probe and carrying case.*

Instrument Connections

There are six external instrument connections on the TVA-1000B, as shown in the figure below. The umbilical attached to the probe consists of two connections, an electrical cable with locking connector and a sample line with locking fitting. A connector for a serial tag reader (i.e., a laser barcode reader) is located next to the hydrogen on/off valve. These three connections are located on the side of unit above the display.

Three additional connections — analog output, battery charger input, and RS-232 interface — are located on the opposite side of the unit, below the keypad. All mechanical connections are keyed for easy orientation.
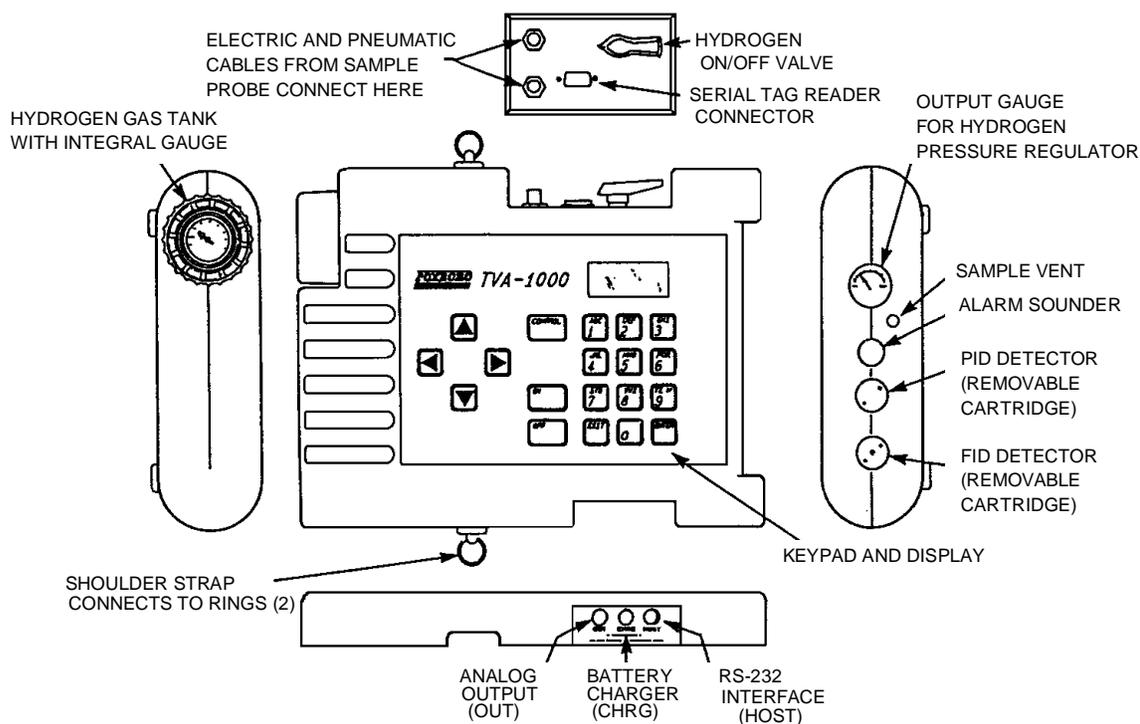
Figure 5. TVA-1000B Instrument Connections

WARNING: *To prevent a potential explosion, never connect or disconnect any devices to the analog output, battery charger, or RS-232 interface ports in an area classified as hazardous due to presence of flammable gases or vapors.*

> **WARNING:** *To prevent a potential explosion, do not operate the instrument with the PID or FID detector caps removed.*

Analog Outputs

The TVA-1000B has two analog output signals, one for each detector (FID and PID). The analog output cable has a single plug at the instrument end and four individual banana plugs at the output end. The orange plug is the FID output, the blue plug is the PID output. The two black plugs are connected to a common ground.

It is important to note that these outputs are *non-calibrated outputs* which are proportional to the raw count output signal from each detector. The outputs are *not* proportional to the PID and FID dynamic ranges of 0-2000 and 0-50000 ppm.

To calibrate these outputs, it is necessary to measure the output voltage at the time of gas calibration. When zero gas is introduced to the unit, measure the output voltage for each detector (this is the zero output voltage). When the span gas is introduced to the unit, measure the output voltage for each detector (this is the span output voltage).

The output voltage for any other concentration can be calculated with the following formula:

$$V_x = V_o + C_x \left[(V_s - V_o)/(C_s) \right]$$

where:

V_x = Output voltage at the concentration of interest

C_x = Concentration of interest

V_s = Span output voltage

C_s = Span concentration

V_o = Zero output voltage

Instrument Sidepack Display

The liquid crystal display (LCD), in the instrument sidepack, as shown in the figure that follows, has four 16-character lines for three types of displays (MENU, ENTRY, and RUN). In *menu* displays, the whole screen is normally dedicated to the menu. In *entry* displays, the screen provides prompts and instructions for inputting new data. The normal *run* display consists of the live measurement data on lines 1 and 2 and menu items on lines 3 and 4. Other display information appears as you page through various menus.

```
┌─────────────────────────┐
│        MAIN MENU        │
│                         │
│         1 = RUN         │
│                         │
│     2 =SETUP  3 =INFO   │
│                         │
│     4 =PCLINK/MEMORY    │
│                         │
└─────────────────────────┘
```
MENU DISPLAY

In menu displays, the whole screen is normally dedicated to the menu.

```
┌─────────────────────────┐
│    ENTER LOW CEIL:      │
│                         │
│    FID:   000.00 PPM    │
│                         │
│    UP/DN  = NEXT UNIT   │
│                         │
│    ENTER   = ACCEPT     │
└─────────────────────────┘
```
ENTRY DISPLAY

In entry displays, the screen provides prompts and instructions for entering new data.

```
┌─────────────────────────┐
│    PID: 0.50 PPM        │
│    FID: 2.50 PPM        │
│    TAG: BLD ─────────   │
│      PRESS CHAR KEY     │
└─────────────────────────┘
```
RUN DISPLAY

The normal run display consists of the live measurement data in Lines 1 and 2 and menu items on lines 3 and 4.

Other display information appears as you page through various menus.

Instrument Sidepack Keypad

The keypad, as shown on the following page, has 19 keys, some of which are dual function. When you press a key, the screen displays the selection. When you make a selection that creates or changes a parameter, you must then press the ENTER key. The left/right arrow keys move the character entry position. The up/down keys make page selections or switch from ppm, ppb, or % to another reading.

The following figure and table show the functions of all keys.
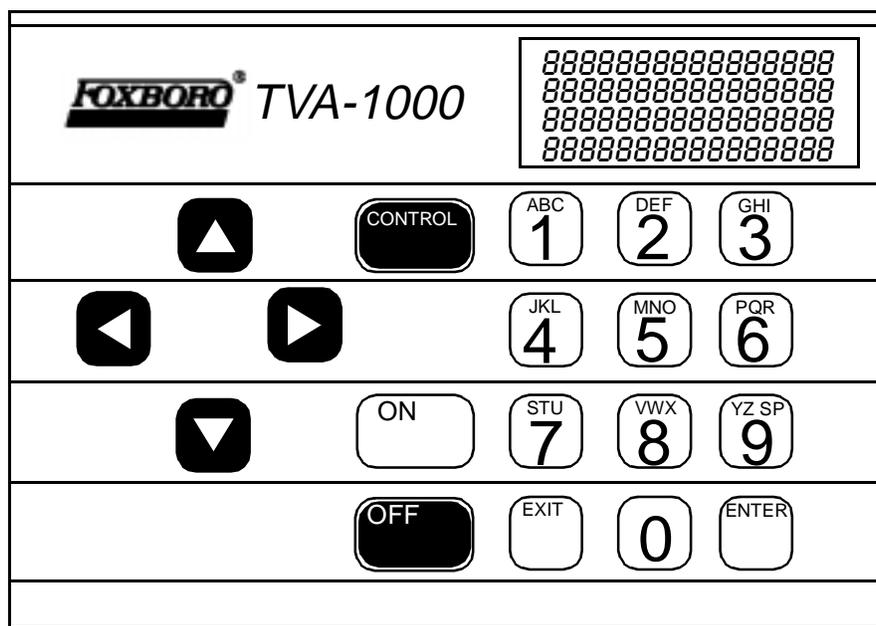
Figure 6. Keypad

NOTE: *To activate OFF, CONTROL, EXIT, and ENTER functions, press and HOLD the key for approximately 1/2 second.*

Key	Function
ON	The ON key enables power from the battery to the instrument.
OFF	The OFF key disables power from the battery to the instrument.
CONTROL	The CONTROL key is multi-function and is used to turn the pump, PID, and FID on or off, and to ignite the FID.
EXIT	The EXIT key clears any entry made in error or bypasses information that you do not want to change, and clears error or warning screens.
ENTER	The ENTER key has three functions: 1. Press ENTER if you have typed one or more characters and wish to keep that information. 2. Press ENTER to respond to a menu question. 3. Press ENTER instead of the LOG key on the standard probe to initiate logging.
Left/Right Arrows	The left and right arrow keys move character entry positions.
Up/Down Arrows	The up and down arrow keys make page selections or scroll through options in SETUP entry screens.

Key	Function
Alphanumeric	The alphanumeric keys enable you to type letters or numbers into various menus. If a display asks for a number only, simply press the desired key. Two steps are required to type an alphanumeric character. First, press the key with the desired letter or number. The screen then displays a selection prompt at the bottom in which 1 = first letter, 2 = second letter, 3 = third letter, and 0 = number. Press the appropriate key to execute the selection. Three uses: ♦ Select menu options ♦ Enter numbers, 0-9, using single keystroke ♦ Enter alphanumeric data, A-Z, 0-9, SPACE, using 2 keystrokes per character

Probe Connections

The sample probe assembly is a hand-held device that enables you to take vapor samples at precise locations. It connects to the instrument by means of an umbilical. The umbilical has two quick-disconnect fasteners (one electrical, one sample line) at the instrument end. Use the slide-on connector, located at the forward end of the probe, to attach various sampling devices. The operator keypad and measurement display are also located on the handle, as shown in the following diagram.

PROBE NUT AND SLEEVE

CLOSE AREA SAMPLING ASSEMBLY

PROBE KEYPAD AND DISPLAY

THE CLOSE AREA SAMPLER (*CHARCOAL FILTER OR WATER TRAP) CAN BE PLACED DIRECTLY INTO THE READOUT UNIT OR EXTENDED BY USING THE OPTIONAL TELESCOPING WAND.

*OPTIONAL
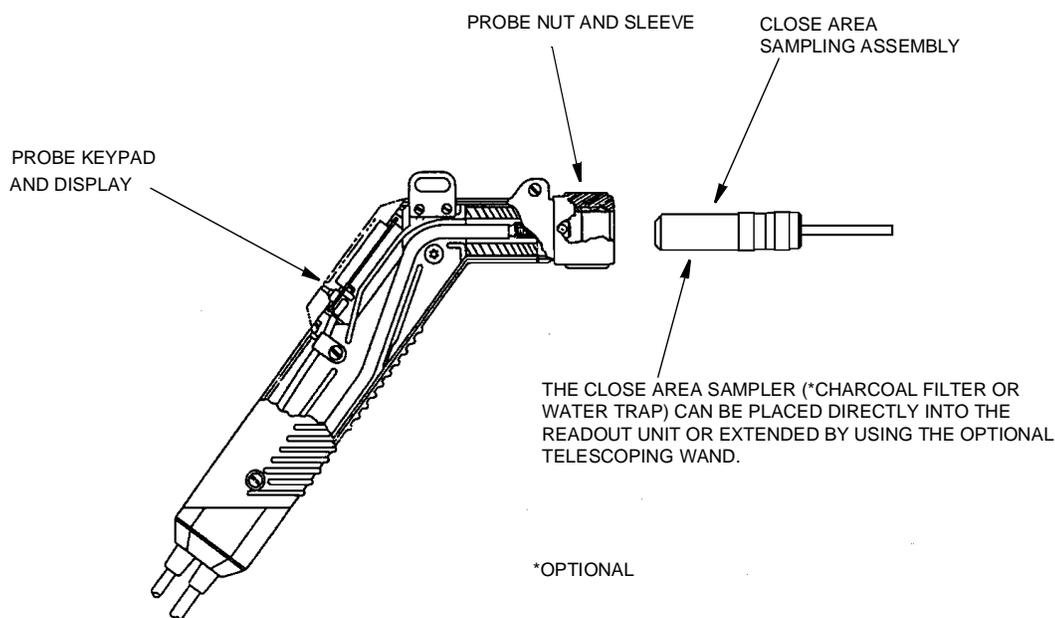
Figure 7. Sample Probe Assembly

BASIC Probe Display

The BASIC sample probe has a 4-character LCD display, as shown below, that displays measurement information. The display also contains an overrange indication, expressed as "">" when active. Three measurement unit types — ppm, ppb, or % — (selected during setup) are displayed to the right of the measurement data. Only those units selected during setup, however, are visible during survey.

A segmented analog bargraph that represents a logarithmic scale for the total analyzer range appears below the digital display. This display, which may be backlit under low light conditions, is active only in the RUN mode. In all other modes, it displays *OFF*.

The measured value display area is used to flash logging prompts during survey and log mode. In addition, errors on the sidepack are indicated by "Err" on the probe. Errors are cleared by using the LOG key.
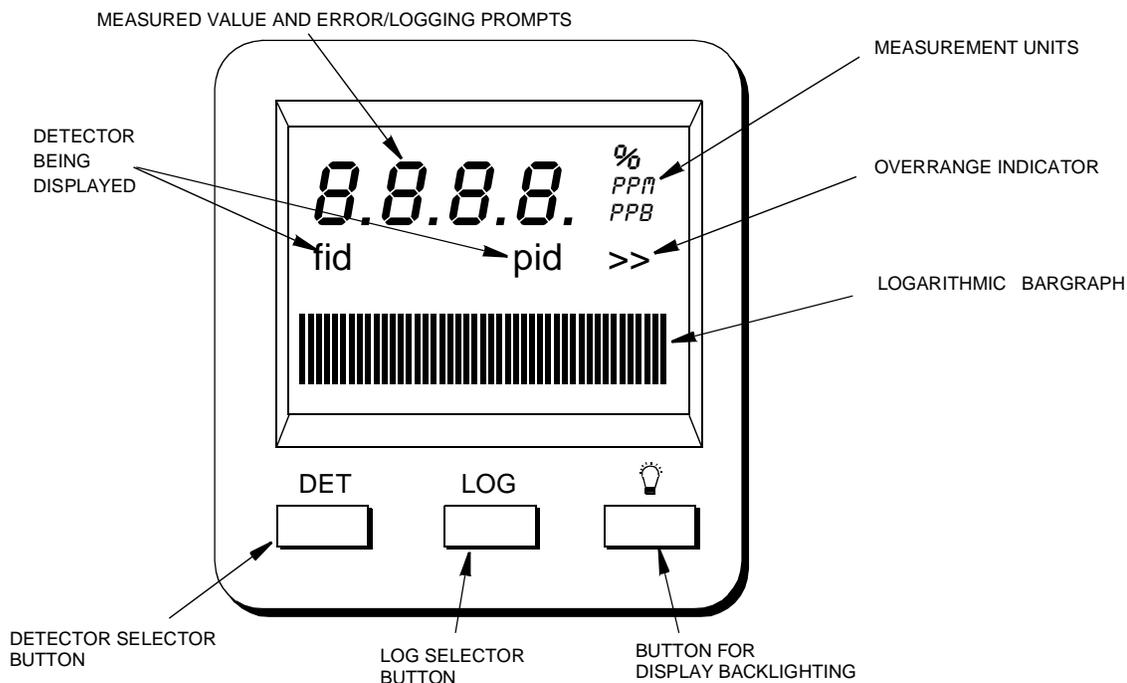
Figure 8.   TVA-1000B BASIC Probe Display

NOTE: Use of the backlight draws additional power from the battery and will shorten the runtime of the TVA-1000B.

BASIC Probe Keys

The BASIC probe keypad has three keys. The keys are labeled with DET, LOG, and a lamp symbol.

Key	Function
DET	Press and release this key to select the display of either the FID or the PID readings in the RUN mode. Press and hold this key (approx. 2 seconds) to cancel selected logging modes.
LOG	Press and release this key to start the datalogging feature. Survey information is then automatically stored in the analyzer memory. The selection in SETUP/Log must be AUTO or VOC. Press and release this key to clear a sidepack error when the display reads " Err".
Lamp Symbol	Press this key to turn the backlight for the probe display on or off. You should use it only during low light conditions as it draws additional power from the battery and thus shortens instrument run time.

Enhanced Probe Display

The enhanced probe also has an LCD screen which displays the basic measurement information. Unlike the BASIC probe, the enhanced probe display is larger (8 line x 20 character display) and is capable of providing several menu-driven functions. These MENU selections allow the user to start a datalogging application, switch detectors, ignite the FID, and perform a background scan. In Fugitive Emissions monitoring applications, the MENU selections also allow the user to step through a tag route, search for a selected tag, start a logging event, log repair data, etc. The display, which may be backlit under low light conditions, is active only in the RUN mode. In all other modes, the display is OFF.
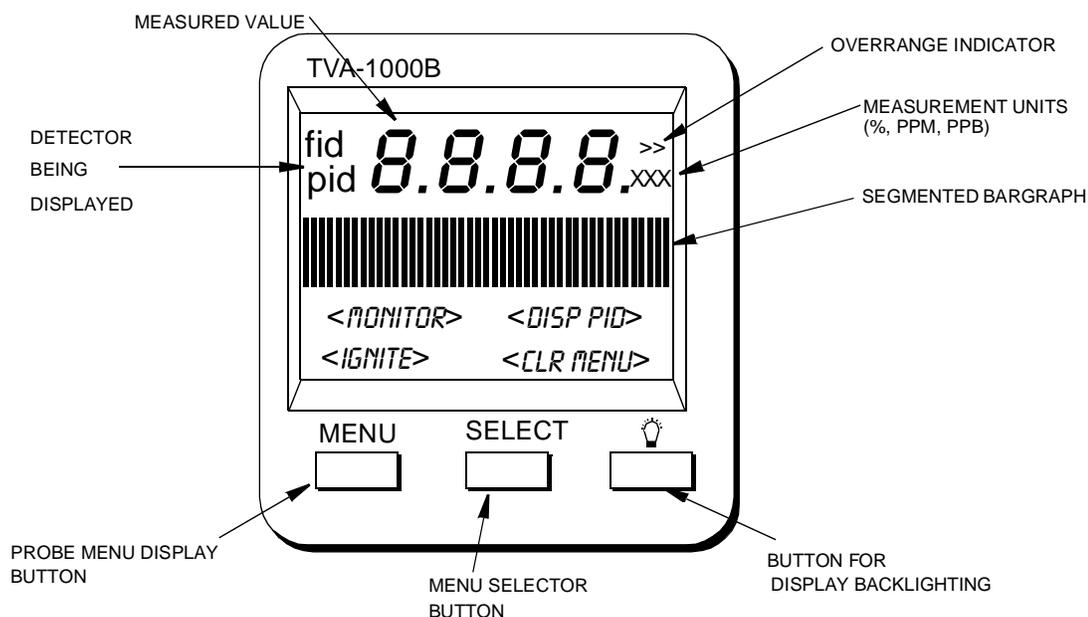
Figure 9. TVA-1000B Enhanced Probe Display - Menu Mode

NOTE: Use of the backlight draws additional power from the battery and will shorten the runtime of the TVA-1000B.

Enhanced Probe Keys

The enhanced probe has three keys, labeled MENU, SELECT, and a lamp Symbol. MENU and SELECT are multi-functional.

Key	Function
MENU	Press and release this key to show the probe display menu or to move to the next menu option. Press and hold this key (approx. 2 seconds) to toggle the info screen on/off.
SELECT	Press and release this key to select the highlighted menu option.
Lamp Symbol	Press this key to turn the backlight for the probe on or off. As it draws additional power from the battery and thus shortens instrument run time, use it only during low light conditions.

Startup and Familiarization

This section shows you how to start the instrument and become familiar with the keypad and display by demonstrating the top level menu structure.

To begin, connect the sample probe (electrical and sample line connections) to the appropriate receptacles on the TVA-1000B, calibrate the instrument per the procedure beginning on page 25, and then follow the procedure described on the next page.

NOTE: If the unit is on but not yet set up/configured, it uses factory default values. To make the instrument function with your specific parameters, follow the setup procedures described under Display Menus in this manual.

The procedure below is a quick start guide for starting up your unit. We strongly recommend that you read the entire manual before using the analyzer for its intended operations.

Quick Start Procedure

Before starting the unit, perform the following steps:

1. Charge battery.
2. Connect sample probe.
3. Fill/install hydrogen tank (FID versions).
4. Open the hydrogen valve (FID versions).

To start the unit, execute the following procedure:

1. Press ON.
2. Press CONTROL.
3. Press 3 to ignite.
4. Press 2 = Setup.
5. Press 1 = Calibrate
6. Press 2 = Span Concentration.
7. Enter Span Concentration for calibration gas being used.

NOTE: If PID only, enter concentration of isobutylene. If FID only, enter concentration of methane. If dual, enter concentration of both gases.

---

8. Press 3 = Zero.
9. Press 1 = Both.
10. Challenge analyzer with zero gas sample.
11. Press ENTER = start.

12. Wait to stabilize.

13. Press ENTER = start.

14. Press 4 = Span

15. (PID 1st) Press 2 = PID.

16. Press ENTER = start.

17. Challenge analyzer with isobutylene span gas and wait for readings to stabilize.

18. Press ENTER to accept.

19. Press 4 = Span.

20. Press 3 = FID.

21. Press ENTER = Start.

22. Challenge analyzer with methane span gas and wait for readings to stabilize.

23. Press ENTER = Accept.

24. Press 5 = Response Factor.

25. Confirm that Response Factor says "RF0:DEFAULT"

26. Press EXIT 2 times to main menu.

27. Press 1 = Run.

You are now in the survey mode.

NOTE: To perform more sophisticated operations, you will need to read the rest of the manual .

To power down this instrument, simply press and hold the OFF key. With FID versions, you must also shut off the gas valve to avoid depleting the tank supply.

Display Menus

Main Menu Structure

The display on the TVA-1000B analyzer is a menu-driven device. The various menus prompt you to select or enter information. With various key strokes, you can accomplish all necessary setup (configuration) and operational tasks.

Whenever you turn on the TVA-1000B, the Main menu screen display is the first usable display to appear. It contains selections that move you to all other menus. When you press the appropriate number key, as described below, the desired menu and the associated display or menu appear automatically.

```
MAIN MENU
 1=RUN
2=SETUP 3=INFO
4=PCLINK/MEMORY
```

Menu Selection	Function
1 = RUN	Use this selection to assign tags to specific surveys and to view/log analysis of organic/inorganic compounds
2 = SETUP	This menu contains configuration procedures and menu structure for performing calibrations, entering ID numbers, setting alarm levels, selecting log modes, entering response multipliers and setting time/date.
3 = INFO	This is a view-only menu structure that allows you to display various information.
4 = PCLink/Memory	Use this menu to download/upload information to/from a personal computer, to perform a remote SETUP from a personal computer, or to clear memory.

Once you are familiar with the various menus and know where to enter specific information, you may want to use a short cut method of tracking the menu structure. The following figure shows the complete menu structure for the TVA-1000B Analyzer.

Warning messages and meanings can be found in the Troubleshooting section of this manual (see "Warning Messages" on page 76).

```
┌─────┐              ┌─────┐              ┌─────┐              ┌─────┐
│  1  │              │  2  │              │  3  │              │  4  │
└─────┘              └─────┘              └─────┘              └─────┘

 RUN                  SETUP (Passcode Protected)    INFO          PCLINK/MEMORY
                      ├─ CALIBRATION                              ├─ PC LINK
                      │   ├─ CONFIG                               │   │
                      │   │   ├─ NUMBER SPAN POINTS               │   ├─ CHANGE TYPE
                      │   │   ├─ BACKGROUND CORRECT               │   └─ ESTABLISH LINK
                      │   │   ├─ ACCEPT MODE                      │
                      │   │   ├─ SAVE MODE                        │
                      │   │   └─ RF CALC MODE                     └─ CLEAR ROUTE & LOGGING
                      │   ├─ SPANCONC (Enter Span Gas                          MEMORY
                      │   │   Conc.)
                      │   ├─ ZERO (CALIB)
                      │   ├─ SPAN (CALIB)
                      │   ├─ RESPONSE FACTOR
                      │   │   ├─ CHANGE
                      │   │   │   ├─ NAME
                      │   │   │   └─ VALUE
                      │   │   └─ ACCEPT
                      │   └─ BACKGROUND (CONC UPDATE)
                      ├─ ALARMS
                      │   ├─ STEL
                      │   ├─ LOW CEILING
                      │   └─ HIGH CEILING
                      ├─ LOG
                      │   ├─ NONE
                      │   ├─ AUTO
                      │   ├─ VOC/FE
                      │   │   ├─ VOC
                      │   │   └─ FE
                      │   └─ CUSTOM
                      ├─ PASSCODE
                      │   ├─ NEW PASSCODE
                      │   ├─ ENABLE
                      │   └─ DISABLE
                      ├─ HARDWARE
                      │   ├─ PROBE DISPLAY
                      │   │   ├─ BASIC
                      │   │   └─ ENHANCED
                      │   └─ BARCODE READER
                      │       ├─ SELECT READER
                      │       │   ├─ NONE
                      │       │   ├─ HP SMART WAND
                      │       │   └─ PSC LASER
                      │       └─ INITIALIZE READER
                      └─ OTHER
                          ├─ USER ID
                          ├─ DATE
                          ├─ TIME
                          └─ USER OPTIONS
                              ├─ KEY CLICK
                              └─ DISPLAY DELAY
```

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Control Menu

The Control menu is used for turning the sampling pump on and off, turning the PID lamp and FID on and off, and for initiating gas ignition of FID. The menu has four options:

1 = Turn Pump ON/OFF
2 = Turn FID ON/OFF
3 = Ignite FID
4 = Turn PID OFF/ON

Selecting Option 1 toggles the pump on or off.

Selecting Option 2 toggles the FID on or off. In the RUN mode, when the FID is off, dashes will appear instead of a reading and all FID alarms are overridden.

Selecting Option 3 initiates the FID flame ignition sequence, which momentarily turns on the ignite coil and simultaneously turns off the pump.

Selecting Option 4 toggles the PID on or off. In the RUN mode, when the PID is off, dashes will appear instead of a reading, and all PID alarms are overridden.

After running the initial startup diagnostic, the Control menu can be accessed at any time.

Setup Procedure

Setup (configuration) of the TVA-1000B is the most important step in obtaining accurate gas samples. During setup, you must set four parameters, as follows:

1. Calibration Settings

2. Alarm Levels

3. Date (year/month/day) (Set once only.)

4. Time of Day (Set once only.)

NOTE: Time may be set only if the date is within the valid range of 1980 to 2037.

You may also set the following parameters:

1. Log Methods

2. Type of Probe Display or Barcode Reader

3. Compound Names and Response Factors

4. Reader Type and Port Initialization (if used)

5. User Identification Number

6. Optional Settings (Calibration Passcode, Key Click, Display Delay, Calibration Mode)

Each parameter is explained in detail in the following.

Passcode Protection

The TVA-1000B Setup Menu can be passcode protected. This option allows you to protect the setup parameters from anyone who is not familiar with your 6-digit passcode. If this feature is enabled, you need to enter your passcode each time you choose to display the SETUP menu.

A selection in the SETUP menu entitled "Passcode" allows you to administer the passcode protection feature. From the SETUP menu, choose option #4 (Passcode). The TVA-1000B will give you three choices:

1. **New Passcode**

This selection allows you to enter and/or change the 6-digit calibration passcode. You may use any characters from the alphanumeric keypad in your passcode. You must then verify the passcode to make sure you have entered it properly.

2. **Enable**

This selection allows you to activate the passcode protection feature. Once this feature is activated, you must enter your passcode whenever you request access to the SETUP menu. *Once passcode protection has been enabled and you exit the SETUP menu, the option can only be disabled by entering the passcode to gain access to the SETUP menu again. REMEMBER YOUR PASSCODE!*

3. **Disable**

This selection allows you to deactivate the passcode protection feature. Once this feature is deactivated, you have unlimited access to the SETUP menu without entering a passcode.

NOTE: In the event you inadvertently forget your passcode, contact Foxboro for assistance.

Calibration

The use of <u>multipoint calibration</u> and <u>multiple response factors/curves</u> with the TVA-1000B must be fully understood before employing these features. To help explain these TVA-1000B capabilities, three scenarios follow:

Scenario 1

To maximize standard accuracy, it is highly recommended that you calibrate with methane for the flame ionization detector and isobutylene for the photoionization detector. Almost all published response factors for FIDs and PIDs are based upon methane and isobutylene, respectively. By employing a *multipoint calibration* for these compounds, you will improve the accuracy of each detector over the *entire dynamic range*. Response factors/curves can then be employed for correcting the detector's response to different compounds. However, once a *multipoint calibration* has been employed, any *response curve* must characterize only the relative response at each concentration, excluding curvature of the calibrated compound. Thus , use of both multipoint calibration and response curves at the same time is difficult, and is not recommended.

Scenario 2

If, for example, you want to measure several different compounds over wide concentration ranges, it is best to use a *single-point calibration* and then enter *response curves* for each specific compound (up to 9 response factors/curves can be entered into the analyzer).

Scenario 3

If, instead, you want to measure in direct readings (response factor = 1) for one specific compound with maximum accuracy over a wide range of concentrations, perform a *multipoint calibration* with the specific compound. Up to 9 span points (plus zero) can be entered for each detector. The use of a response curve is thus unnecessary as the detector is already reading the direct PPM for that specific compound.

CAUTION: If you use multipoint calibration or a gas other than methane or isobutylene and then apply response factors/curves (that have been generated with reference to a single point methane/isobutylene calibration), the resulting measurements will probably be incorrect.

To provide the specified accuracy, the instrument must be calibrated at the beginning of each workday. To reach the CALIBRATION menu from the MAIN MENU, choose 2 = Setup and 1 = Calib. When you reach the CALIBRATION menu, you will see the following selections:

```
CALIBRATION MENU
1=CFG   2=SpanConc
3=Zero 4=Span
5=RF   6=Backgnd
```

The steps involved in calibrating the TVA-1000B are as follows:

1. Configure the calibration variables *(Cfg)*.

2. Define the span concentrations to be used *(SpanConc)*.

3. Zero the instrument using either a zero gas or clean ambient air *(Zero)*.

4. Calibrate the reference point(s) using known span gases. The TVA-1000B can be configured for as many as nine (9) different span gas values *(Span)*.

5. **Optional**: Set instrument response factors if necessary *(RF)*.

6. **Optional**: Take background reading *(Backgnd)*.

NOTE: Prior to performing calibration, the instrument must be on and warmed up for approximately 30 minutes. The pump must be ON, the PID lamp must be ON, and the FID must be ignited throughout the warm-up period.

Calibration Configuration

Before you calibrate the TVA-1000B for the first time, you may want to customize certain calibration settings. Once you have configured these settings, you don't need to set them again every time you calibrate unless you want to change one.

In order to set your calibration options from the CALIBRATION menu, choose menu selection #1 (Cfg). This will produce the following CAL CONFIG MENUs which can be scrolled through by using the Up and Down arrows:

```
Cal Config MENU
1  Number Span Pt.
2Backgnd corrct

 Up/Dn=More
```

```
Cal Config MENU
1=Accept Mode
2=Save Mode

 Up/Dn=More
```

```
Cal Config MENU
1=RF calc mode



 Up/Dn=More
```

Number Span Pt

This selection allows you to determine the number of span points that will be used to calibrate your TVA-1000B. Choosing this selection will produce the following screen:

```
PID:          1
FID:          1

Span Pts.1=Both
2=PID    3=FID
```

From this screen, you may choose which detector you wish to set the number of span points for. Choosing one of these selections produces the following screens:

FID only

```
Number Span Pts:
FID:          1

Select: 1 to 9
```

PID only

```
Number Span Pts:
PID:          1

Select: 1 to 9
```

FID/PID

```
Number Span Pts:
P&F:          1

Select: 1 to 9
```

From these screens, press the number of span points that you wish to use. Both detectors can have up to 9 span points each, and they do not necessarily need to have the same number of span points.

> *IMPORTANT NOTE: If you choose to use more than one span point, data logged by the TVA-1000B cannot be downloaded to the original PC software supplied with old style TVA-1000A units. You must use the new PCIP software supplied with your new TVA-1000B to download this data.*

Background Correct

This selection allows you to choose whether or not to apply background correction to the detector readings displayed and logged in memory. If you choose to apply background correction, the last background reading stored in memory will be subtracted from the measured reading. This corrected reading will be the value displayed and the value logged. Choosing this selection from the CAL CONFIG MENU produces the following display:

```
┌─────────────────────┐
│ Backgrnd Correct:   │
│          Off        │
│                     │
│ 1=Both    2=None    │
│ 3=PID     3=FID     │
└─────────────────────┘
```

The second line of the display shows what option is currently selected. You can change this option by choosing any one of the menu selections. You may choose to apply correction to FID, PID or both detectors.

NOTE: A default background value of 0 is stored in memory until a background reading is taken.

Cal Accept Mode

This selection allows you to choose whether or not calibrations will be automatically accepted. Choosing this selection from the CAL CONFIG MENU produces the following display:

```
┌─────────────────────┐
│ Cal Accept Mode:    │
│          Auto       │
│                     │
│ 1=Manual  2=Auto    │
│                     │
└─────────────────────┘
```

The second line of the display shows what option is currently selected. If "Manual" is chosen, the instrument will display the detector count during calibration and prompt the user to decide when to accept the calibration value:. If "Auto" is chosen, the instrument will automatically determine the value to be stored and when to do it.

Cal Save Mode

This selection allows you to choose whether or not the TVA-1000B will automatically save an accepted calibration. Choosing this selection from the CAL CONFIG MENU produces the following display:

```
┌─────────────────────┐
│ Cal Save Mode:      │
│          Auto       │
│                     │
│ 1=Manual  2=Auto    │
│                     │
└─────────────────────┘
```

The second line of the display shows what option is currently selected. If "Manual" is chosen, after a calibration value has been accepted the instrument will prompt the user to decide whether to save the calibration value or repeat the calibration (1 = Yes or 2 = Again?). If "Auto" is chosen, the instrument will automatically store the accepted calibration value without prompting the user.

RF Calc Mode

This selection allows you to choose how response factor correction will be applied to the reading. Choosing this selection from the CAL CONFIG MENU produces the following display:

```
RF CALC MODE:
            FACTOR

1=FACTOR  2=CURVE
```

The second line of the display shows what option is currently selected. If "Factor" is chosen, the TVA-1000B will use a single constant response factor which is multiplied by the reading. If "Curve" is chosen, the TVA-1000B will use a two constant equation. For more information, refer to the section of the manual on "Response Factors."

Detector Counts

Detector counts are the raw, unscaled detector output values associated with a gas measurement performed by the FID or the PID. Before a detector reading is displayed or recorded, the detector signal is converted from analog to digital. The result is a raw number, or A/D counts.

When a detector is calibrated, the detector counts for the zero gas and each of the span gases are saved in memory. These detector counts are then used as reference points for calculating the concentration values to be displayed or stored.

When calibrating the TVA-1000B in the "Manual" accept mode, the counts from the last calibration (Zero or Span) are displayed before the calibration process is initiated. Once the calibration process is initiated, the live detector counts are then displayed. You can refer to these counts as an indication of when the reading has stabilized, or as a means of tracking the repeatability of your calibrations.

You can also use these counts as an indication of the success of a calibration. The "zero" counts are the counts expected when a zero gas is applied to the detector. The span counts are the counts expected when a span gas of known concentration is applied to the detector. Finally, the detector sensitivity can be calculated by subtracting the zero counts from the span counts and dividing by the span gas concentration. Use the following general observations as a guideline:

Detector	Zero Counts	Detector Sensitivity
FID	2000-4000	160-260 counts/ppm Methane
PID (10.6 eV lamp)	2000-20,000	3500-6000 counts/ppm Isobutylene
PID (11.8 eV lamp)	2000-20,000	300-900 counts/ppm Isobutylene

Example: A TVA-1000B FID is calibrated with zero air and a 100 ppm Methane in air span gas. The counts observed for the zero are 2895 and the counts observed for the span are 27395. The span sensitivity is thus 245 counts/ppm [(27395-2750)/100 ppm]. Since both of these values (2895 zero counts and 245 detector sensitivity) are within the acceptable range, the calibration is a good calibration. Examples of a bad calibration include unusually high zero counts, or unusually low detector sensitivity. These problems can often be attributed to poor calibration gases, contaminated sampling accessories, a faulty detector capsule, or failure to follow the proper calibration procedure. For more information, consult the "Troubleshooting" guide in this manual or contact Foxboro for assistance.

Defining the Span Gas Concentration(s)

NOTES:

1. The span gas concentration is the known concentration of the gas standards used to calibrate your TVA. Methane in air is the recommended calibration standard for the FID, and Isobutylene in air is the recommended calibration standard for the PID. Other gases may be used if desired.

2. If your instrument is equipped with dual detectors, you may choose to calibrate the PID and FID separately or together.

3. If your instrument is configured for multiple span points, be sure to set the concentration for ALL span points.

1. From the CALIBRATION menu display, press 2=SpanConc. The upper display (or two displays if the unit is a dual detector version) will display the concentration value of your span gas (expressed as ppb, ppm, or %) as of the last calibration:

FID only	**PID only**	**FID/PID**
FID: 100 PPM SPAN GAS CONCENT ENTER=NEW CONC	PID: 100 PPM SPAN GAS CONCENT ENTER=NEW CONC	PID: 100 PPM FID: 100 PPM SPAN CONC 1=BOTH 2=PID 3=FID

If the TVA-1000B is configured for multiple calibration points, the span gas concentration values for Point #1 will be displayed. The Up and Down arrow keys can be used to scroll through the span gas concentration values for other points:

FID only	**PID only**	**FID/PID**
FID: 100 PPM SPAN PT 1 (UP/DN) ENTER=NEW CONC	PID: 100 PPM SPAN PT 1 (UP/DN) ENTER=NEW CONC	PID: 100 PPM FID: 100 PPM SPAN PT 1 (UP/DN) 1=BOTH 2PID 3FID

2. To change a span gas concentration value, choose the detector(s) of interest if using a dual detector analyzer, or press ENTER if using a single detector analyzer. The following display will appear:

FID only	**PID only**	**FID/PID**

ᴇɴᴛᴇʀ Sᴘᴀɴ Cᴏɴᴄ:
FID: 000000 ᴘᴘᴍ
Uᴘ/Dɴ=Nᴇxᴛ ᴜɴɪᴛ
   ᴇɴᴛᴇʀ=Aᴄᴄᴇᴘᴛ
	ᴇɴᴛᴇʀ Sᴘᴀɴ Cᴏɴᴄ:
	PID: 000000 ᴘᴘᴍ
	Uᴘ/Dɴ=Nᴇxᴛ ᴜɴɪᴛ
	   ᴇɴᴛᴇʀ=Aᴄᴄᴇᴘᴛ
		ᴇɴᴛᴇʀ Sᴘᴀɴ Cᴏɴᴄ:
		P&F: 000000 ᴘᴘᴍ
		Uᴘ/Dɴ=Nᴇxᴛ ᴜɴɪᴛ
		   ᴇɴᴛᴇʀ=Aᴄᴄᴇᴘᴛ

Use the up and down arrow keys to select the measurement units (%, ppm, or ppb) and the decimal point position.   There are 5 selections to choose from:

Range	Display	Units
5	DD.DD	%
4	DDDDDD	ppm
3	DDDD.D	ppm
2	DDD.DD	ppm
1	DDDDDD	ppb

The range of the instrument is determined by your selection of measurement units and decimal point placement. In the run mode, the instrument will auto range upward only to select the optimum range for displaying measurement information. For example, if you entered a value in Range 3 and the measured value changes to a high value, the instrument will automatically switch to range 4. If it increases further, it will switch to Range 5. *Auto-ranging will not switch ranges beyond the span gas range in the downward direction.*

After you have selected the measurement units and decimal point placement, use the keypad to enter the concentration value. Press ENTER to accept this value and store it in the TVA's memory.

3. If your TVA-1000B is a dual detector analyzer, you may repeat the procedure for the second detector. If your TVA-1000B is configured for more than one span point, you may use the Up/Dn arrow keys to select the next span point and repeat the procedure.

4. When the last gas concentration value has been entered, you can return to the CALIBRATION menu, by pressing the EXIT key.

Defining the Response Factor

Although the FID and PID are calibrated with span gases of known concentration (usually Methane and Isobutylene, respectively), both detectors respond to many different compounds with differing levels of sensitivity.   In order to adjust the analyzer reading from "ppm of Methane" or "ppm of Isobutylene" to ppm of the compound of interest, a correction factor must be applied to the reading. This correction factor is also known as a *Response Factor.* You can choose from up to nine (9) user-defined response factors, or use the default response factor of 1.00.   Each response factor can be assigned a 9-character alphanumeric name.

The TVA-1000B uses one of two different response factor formats: a Multiplier or a Curve.

Response Factor Multiplier

A *response factor multiplier* is defined as follows:

$$\text{Response Factor} = \frac{\text{Actual Concentration}}{\text{Measured Concentration}}$$

Example: If 100 ppm of a compound produces an FID response of 50 ppm on an analyzer calibrated with Methane, then the FID response factor would be 2.00 (100/50).

When using a response factor multiplier to correct a TVA-1000B reading, the analyzer multiplies the reading by the response factor and displays the corrected reading. As in the example give above, if a 50 ppm reading is obtained by the TVA-1000B, the analyzer would automatically multiply 50 times 2.00 to get the actual concentration of 100 ppm.

Response Curve

Response factors can change as concentration changes. The response factor for a compound determined at 500 ppm may not be the same as the response factor determined at 10,000 ppm. By using a *response curve,* you can characterize a compounds response over a broader range of concentrations. If the actual concentration is plotted as *Y* vs. *X* (measured concentration), the resulting curve can be represented by the rational equation

$$Y = \frac{AX}{\left(1 + \frac{BX}{10000\,\text{ppm}}\right)}$$

When using the RF Calc Mode "curve", the terms A and B are entered into the TVA-1000B. A represents the response factor multiplier at very low concentrations and B represents a change to the response for every percent concentration increase.

 The curve can only be defined by collecting response data at several different concentrations and using a xy math spreadsheet to calculate the "best-fit" polynomial expression.

> *NOTE: Once the response curve has been fit, the calibration gas concentrations and number of span points should not be changed without readjusting the curve fit.*

To define and/or choose a response factor, choose 5=RF from the CALIBRATION menu. The following display will appear:

```
┌─────────────────────┐
│ RF0: Default        │
│   Up/Dn=Next RF     │
│                     │
│   Enter=Accept      │
│                     │
│                     │
└─────────────────────┘
```

The top line shows the currently active response factor. If no response factor is applied, the currently active response factor will be the factory DEFAULT (1.00 for FID methane and 1.00 for PID isobutylene). The name and value of the default response factor cannot be

changed. You can scroll through the other response factors by using the Up and Down arrow keys. The other response factor names will show as you scroll through them:

```
RF1: Hexane
  Up/Dn=Next RF
    1=Change
  Enter=Accept
```

If you would like to activate a different response factor, press ENTER=Accept. The TVA-1000 will show an ACCEPTED message. If you would like to modify the response factor name or numbers, press 1=Change:

FID only
```
RF1:  Hexane
PID:   1.00

1=Name   2=Numbers
```

PID only
```
RF1:  Hexane
FID:   1.00

1=Name   2=Numbers
```

FID/PID
```
RF1:  Hexane
PID:   1.00
FID:   1.00
1=Name   2=Numbers
```

If you would like to change the name assigned to the response factor, press 1=Name. If you would like to change the response factor value, press 2=Numbers. If you choose 1=Name, the following display will appear:

```
Enter name:
  RF1: ------------


Press char key
```

Use the alphanumeric keypad to enter a compound name for the response factor. Press enter when you are finished.

If you choose 2=Numbers, the following display will appear:

FID only
```
RF1:  Hexane
PID:   00.00


Enter=Accept
```

PID only
```
RF1:  Hexane
FID:   00.00


Enter=Accept
```

FID/PID
```
RF1:  Hexane
P&F:   00.00


Enter=Accept
```

Use the keypad to enter a new response factor and press ENTER to store it in instrument memory.

NOTES:
1. The TVA-1000B will not accept a response factor of 00.00.

2. If a response curve is used, the TVA-1000B will prompt you to enter two numbers.

Zero Reference Point Calibration

1. From the CALIBRATION menu display, press *3=Zero.*

NOTES:

1. The following sequence shows the procedure when the TVA-1000B is configured with both Cal Accept mode and Cal Save mode = Auto. If either mode is Manual, an extra confirmation is required at the appropriate step.

2. If your instrument is a dual detector type (PID and FID), you can zero the PID and FID separately, both together, or one in zero gas and one in clean ambient air. To do so, follow the same procedure. However, it is suggested that you zero both detectors together.

If you press 3=Zero, the display will show:

FID-only	*PID-only*	*PID/FID*

```
FID:            0
                        PID:            0          PID:            0
   Zero Cal:                                        FID:            0
   Enter=Start
                           Zero Cal:                   Zero Cal: 1=Both
                           Enter=Start                 2=PID     3=FID
```

2. To perform the actual ZERO procedure for an

FID-only:	or PID-only:	or PID/FID:
Press ENTER	Press ENTER	Press 1, 2, or 3

```
Apply Zero Gas          Apply Zero Gas          Apply Zero Gas
 FID                     PID                     At Sample inlet
Enter=Start             Enter=Start             Enter=Start
Exit=Cancel            Exit=Cancel
```

3. Apply the zero gas to the probe at ambient pressure (using a clean and labeled gas sampling bag) and then press ENTER.

```
FID            0        PID            0        PID            0
FID                     PID                     FID:           0
Zero Gas               Zero Gas
Exit=Cancel            Exit=Cancel             Wait for Zero
                                               Exit=Cancel
```

The instrument analyzes the zero sample.

```
FID            0        PID            0        PID            0
FID                     PID                     FID:           0
   ACCEPTED               ACCEPTED               - ACCEPTED -
```

The ACCEPTED message appears for a short time and is then replaced by the normal CALIBRATION menu.

When the ACCEPTED message disappears and the CALIBRATION menu appears, the ZERO reference value is stored. This value is stored in non-volatile memory until the next calibration is performed. The date and time of this calibration are stored and can be accessed through the INFO menu.

NOTE: For optimum accuracy, re-zero the FID every time the hydrogen supply valve is turned on.

Span Reference Point(s)

To set the span reference point, execute the procedure described below. Note that the procedure is the same as that for setting the zero reference except that a span gas is used instead of a zero gas. The procedure is:

1. From the CALIBRATION MENU display, press 4=Span.

NOTES:

1. The following sequence shows the procedure when the TVA-1000B is configured with both Cal mode and Cal Save mode = Auto. If either mode is Manual, an extra confirmation is required at the appropriate step.

2. If your instrument is a dual detector type (PID and FID), you can set the span reference for the PID and FID separately, both together, or one in one type of calibration gas and one in another type of gas. To do so, follow the same procedure.

3. If multiple span points are used, repeat the following procedure for each and every span point.

When you press 4=Span, the display will show:

FID-only	*PID-only*	*PID/FID*

```
┌─────────────────────┐   ┌─────────────────────┐   ┌─────────────────────┐
│ FID     7654321     │   │ PID     7654321     │   │ PID     7654321     │
│ Span P1 (Up/Dn)     │   │ Span P1 (Up/Dn)     │   │ FID     7654321     │
│ Enter=New Calib     │   │ Enter=New Calib     │   │ Span  Pt1 (Up/Dn)   │
│                     │   │                     │   │ 1=Both 2Pid 3Fid    │
└─────────────────────┘   └─────────────────────┘   └─────────────────────┘
```

If more than one reference span gas concentration has been configured, pressing the Up/Dn keys will allow you to scroll through all defined reference gas concentration points.

2. To perform the actual SPAN calibration (for example at 100 ppm):

FID-only: or   *PID-only:*   or   *PID/FID:*
Press ENTER   Press ENTER   Press 1, 2, or 3

```
 Apply Span Gas
 FID: 100.00 ppm
 Enter=Start
```

```
 Apply Span Gas
 PID: 100.00 ppm
 Enter=Start
```

```
 Apply Span Gas
 100.00 ppm
 Enter=Start
```

3. Apply the appropriate span gas to the probe at ambient pressure (using a clean and labeled gas sampling bag) and then press ENTER.

```
 FID     7654321
 FID: 100.00 ppm
 Wait for Span
 Exit=Cancel
```

```
 PID     7654321
 PID: 100.00 ppm
 Wait for Span
 Exit=Cancel
```

```
 PID     7654321
 FID     7654321
 Wait for Span
 Exit=Cancel
```

The instrument analyzes the span sample.

```
 FID     7654321'


   -ACCEPTED-
```

```
 PID     7654321


   -ACCEPTED-
```

```
 PID     7654321
 FID     7654321


   -ACCEPTED-
```

When only one reference span gas concentration is used, the ACCEPTED message appears for a short time and is then replaced by the normal CALIBRATION menu.

When the ACCEPTED message disappears and the CALIBRATION menu appears, the SPAN reference value is stored. This value is stored in non-volatile memory until the next calibration is performed. The date and time of this calibration are stored and can be accessed through the INFO menu.

4. If more than one reference span gas concentration has been defined, the span calibration display returns. Move to the next concentration point (Up/Dn keys) and repeat steps 2-3 above until each reference gas concentration point has been calibrated.

Alarm Levels

The TVA-1000B is supplied with three user-configurable alarms — HI Ceiling, Low Ceiling, and STEL (short term exposure limit). When any of these alarms is exceeded, an alarm message appears on the sidepack display and probe display (enhanced version only) and an alarm tone is generated. Press EXIT to acknowledge the alarm message and sounder. Once acknowledged, the display returns to the live measurement with an upper case letter representing the alarm or alarm combination appearing to the right of the display. The three types of user configurable alarms are:

Alarm Type	Description
Low Ceiling:	This alarm is a warning that a lowest level threshold has been exceeded. Once acknowledged, the letter L appears to the right of the live measurement for the appropriate detector.
High Ceiling:	This alarm is a warning that a second, higher level, threshold has been exceeded. Once this alarm is acknowledged, the letter H appears to the right of the live measurement for the appropriate detector.
STEL:	The Short Term Exposure Limit alarm indicates that measurements averaged over a 15-minute interval have exceeded the set alarm limit. Once this alarm is acknowledged, the letter S appears to the right of the live measurement for the appropriate detector.

The three alarm messages appear on the instrument display as follows:

Low Ceiling	*High Ceiling*	*STEL Level*
ALARM! Low ceiling alarm exceeded! Exit=Clr	ALARM! High ceiling alarm exceeded! Exit=Clr	ALARM! STEL alarm level exceeded! Exit=Clr

---

NOTE: To display and change the alarm menus, the instrument must be ON but does not have to be warmed up.

Accessing the Alarm Menu

1. From the MAIN menu display, press 2=Setup.

2. From the SETUP menu display, press 2=Alarms and follow the procedures for the appropriate alarm settings:

STEL Level Alarm

1. From the ALARM LEVELS display, press 1=STEL. The previous alarm settings for STEL alarm are then displayed, as follows.

FID-only	*PID-only*	*PID/FID*
FID: 80.00 ppm STEL Alarm Enter=New Value	PID: 80.00 ppm STEL Alarm Enter=New Value	PID: 80.00 ppm FID: 80.00 ppm STEL: 1=Both 2=PID 3=FID

2. To change the alarm level to a new value, press ENTER on a single detector instrument or 1, 2, or 3 on a dual detector instrument and see:

FID-only   *PID-only*   *PID/FID*

```
Enter STEL:
FID:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

```
Enter STEL:
PID:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

```
Enter STEL:
P&F:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

Use the up and down arrow keys to select %, PPM, PPB, and decimal point position, then type the numeric value for the alarm level desired.

3. Press ENTER to store new values into instrument memory.

4. Press EXIT to return to the ALARM LEVELS without making a change.

Low Ceiling Alarm

1. From the ALARM LEVELS display, press 2=Low Ceiling. The previous alarm settings for the Low Ceiling alarm are then displayed, as follows.

FID-only   *PID-only*   *PID/FID*

```
FID:    80.00 ppm
Low Ceiling Alarm
Enter=New Value
```

```
PID:    80.00 ppm
Low Ceiling Alarm
Enter=New Value
```

```
PID:    80.00 ppm
FID:    80.00 ppm
Low Ceiling:  1=Both
 2=PID 3=FID
```

2. To change the alarm level to a new value on a single detector instrument, press ENTER; on a dual detector instrument, press 1, 2, or 3, and see:

```
Enter low ceil:
FID:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

```
Enter low ceil:
PID:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

```
Enter low ceil:
P&F:000.00 ppm
Up/Dn=Next Unit
Enter=Accept
```

Use the up and down arrow keys to select %, PPM, PPB, and decimal point position, and then type the numeric value for the alarm level desired.

3. Press ENTER to store the new values into instrument memory.

4. Press EXIT to return to the ALARM LEVELS.

High Ceiling Alarm

1. From the ALARM LEVELS display, press 3=High Ceiling. The previous alarm settings for the High Ceiling alarm are displayed.

FID-only	*PID-only*	*PID/FID*

```
FID:   80.00 PPM
High Ceiling Alarm
Enter=New Value
```

```
PID:   80.00 PPM
High Ceiling Alarm
Enter=New Value
```

```
PID:     80.00 PPM
FID:     80.00 PPM
High Ceiling:  1=Both
  2=PID  3=FID
```

2. To change the alarm level to a new value, press ENTER on a single detector instrument or 1, 2, or 3 on a dual detector instrument and see:

```
Enter high ceil:
FID: 000.00 PPM
Up/Dn=Next Unit
Enter=Accept
```

```
Enter high ceil:
PID: 000.00 PPM
Up/Dn=Next Unit
Enter=Accept
```

```
Enter high ceil:
P&F: 000.00 PPM
Up/Dn=Next Unit
Enter=Accept
```

Use the up and down arrow keys to select %, PPM, PPB, and decimal point position, and then type the numeric value for the alarm level desired.

3. Press ENTER to store the new values into instrument memory.

4. Press EXIT to return to the ALARM LEVELS display.

Log Methods

Selecting the LOG mode not only identifies the way in which data is stored in instrument memory but also governs the way the RUN mode works. Four possible choices in the LOG mode are available. Each is explained below.

Option	Description
1. NONE	Selecting *None* means that no logging action takes place at all. When the instrument is in the RUN mode, you can only display readings.
2. AUTO	When you select and configure the AUTO method, the RUN mode functions automatically once an action is initiated. You choose an automatic logging rate between 1 second and 999 minutes, type a tag* identifier, and start the instrument. You initiate automatic sampling by either pressing the LOG key on the probe or the ENTER key on the instrument. From that point on, the instrument automatically logs the reading of the sample at the end of each countdown and continues to do so until the battery goes low or you press the EXIT key.

Option	Description
3. VOC	The VOC method of sampling is a manual means of triggering a sample/log. Once configured for VOC, the RUN mode prompts you to type a tag* identifier. After you enter the tag, the instrument stands ready until you press either the LOG key on the basic probe or the ENTER key on the instrument. Once LOG is initiated, the instrument counts down. Samples are taken over that count down and the highest reading achieved, or average (or last) reading is logged in memory and displayed on both displays. The stored values are cleared by pressing either the LOG key on the basic probe or the ENTER key on the instrument. Each VOC log must be done manually and individually.
4. F.E.	The F.E. method of sampling is a manual means of triggering a sample/log using a pre-configured monitor route file which has been downloaded and stored in instrument memory. The F.E. method requires use of the optional enhanced FE probe. You choose a sample time of between 2 and 20 seconds and you choose to log either the highest reading or average (or last) reading achieved during the sample time. Once configured for F.E. and the RUN mode entered, the FE probe menu screen guides you through the monitor route, displaying each pre-configured tag identifier in sequential order. A SEARCH function is available at the probe menu to allow you to find tags that are out of order. The probe display prompts you to confirm the tag* identifier, after which the instrument stands ready until you either select LOG from the probe or press the ENTER key on the instrument. Once initiated, the instrument begins a count down, sampling over the configured sample time. The reading sampled during the countdown is displayed on both displays and your are given the option to save the reading in memory or to select LOG again. The stored values are cleared by selecting LOG on the probe display or by pressing ENTER on the instrument. Each F.E. log must be done individually and manually.

*Tags may be entered manually or via a reader.

The RUN mode displays (as governed by the LOG selection) are:

NONE		AUTO, VOC, or F.E.

PID: 80.00 ppm FID: 80.00 ppm Exit=Stop	or	PID: 80.00 ppm FID: 80.00 ppm Logging: 10 sec Exit=Stop

NOTE: To display and change the log menu, the instrument must be ON but does not have to be warmed up.

Accessing the LOG Menu

1. From the MAIN MENU display, press 2=Setup.

2. From the SETUP MENU display, press 3=Log. The following display will appear:

```
Log Mode
      None
1=None    2=Auto
3=VOC/FE 4=Custom
```

The previous log selection is displayed on the second line. Follow the procedure below to set the log mode.

Log None

1. From the LOG MODE Menu, press 1=None.

```
 LOG MODE
Auto, rate=5 sec
1=None      2=Auto
3=VOC/FE  4=Custom
```

Press 1=None to display this message briefly. The screen then returns to the SETUP menu.

```
     None


  -ACCEPTED-
```

Log Auto

From the LOG MODE Menu, press 2=Auto. The previous log selection is then displayed on the second line of the screen.

```
 LOG MODE
    None
1=None      2=Auto
3=VOC/F.E. 4=Custom
```

Press 2=Auto to display this message.

```
Enter log rate:

Auto, rate=000sec

Up/Dn=Sec↔Min

Enter=Accept
```

2. Use the up and down arrow to select minutes (min) or seconds (sec). Then, type the appropriate time interval desired for the automatic sampling.

3. Press ENTER and, after a brief message of acceptance, the automatic sampling is ready to be used in the RUN Mode.

NOTE: To allow for STEL calculations in the personal computer utility, the log rate value must be less than 90 seconds. If a log rate greater than 90 seconds is selected, a warning message will appear. Press EXIT to bypass this message and proceed.

In the LOG AUTO mode, data is logged in the format described below:

1. Every time RUN mode is entered a new header is created.

2. Data is logged periodically, at the user-entered log rate, in the following format:

Date	Time	PID (PPM)	Alarms	FID (PPM)	Alarms
7/28/93	11:20:57:00	187.1	L	157.1	L
7/28/93	11:21:29:00	436.6	H	519.6	L
7/28/93	11:21:54:00	708.4	LH	847.0	LH
7/28/93	11:22:19:00	300.7	L	381.9	L
7/28/93	11:22:36:00	223.8		265.1	

Approximately 9500 data samples may be taken with a single header.

Log VOC

1. From the LOG MODE Menu, press 3=VOC/FE, then 1=VOC.

```
      LOG MODE
  Auto,rate=12 sec
  1=None 2=Auto
  3=VOC 4=F.E.
```

Press 3, then 1 to display this message.

```
  Enter Sampling:
  Voc, Time=00s, Max

  Up/Dn=Next type

    Enter=ACCEPT
```

2. Press the Up/Dn arrow keys to choose the type of sampling to be used (Max, Avg, Smp).

   a. Max=the maximum reading obtained during the log interval.

   b. Avg=the average reading obtained during the log interval.

   c. Smp=the last reading obtained during the log interval.

3. Type the appropriate time interval desired for VOC sampling.

4. Press ENTER, and, after a brief message of acceptance, the VOC method of logging is now ready to be used in the RUN Mode.

NOTE: The allowable Sample Time range is 2-30 seconds. If a Sample Time of less than 2 seconds or greater than 30 seconds is selected, a warning message will appear and you will be required to re-enter the Sample Time.

In the LOG VOC mode, data is logged in the format described below:

1. Every time RUN mode is entered a new header is created.

2. Data is logged in the following format whenever you press the LOG button:

Date	Time	PID (PPM)	Alarms	FID (PPM)	Alarms	Tag
7/28/93	11:20:57:00	187.1	L	157.1	L	TAG1
7/28/93	11:21:29:00	436.6	H	519.6	L	TAG2
7/28/93	11:21:54:00	708.4	LH	847.0	LH	TAG3
7/28/93	11:22:19:00	300.7	L	381.9	L	TAG4
7/28/93	11:22:36:00	223.8		265.1		TAG5

Approximately 4500 data samples may be taken.

Log F.E.

1. From the LOG MODE menu, press 3=VOC/F.E., then 2=F.E. The previous log selection is then displayed on the second line of the screen.

```
    LOG MODE
LOGGING=VOC, TIME=05s,
MAX
1=NONE      2=AUTO
3=VOC/F.E.  4=CUSTOM
```

Press 3=VOC/F.E., then 2=F.E. to display this message.

```
ENTER SAMPLING:
F.E.,TIME=00s, MAX

 UP/DN=NEXT TYPE
ENTER=ACCEPT
```

2. Press the Up/Dn arrow keys to choose the type of sampling to be used (Max, Avg, Smp).

    a. Max = the maximum reading obtained during the log interval.

    b. Avg = the average reading obtained during the log interval.

    c. Smp = the last reading obtained during the log interval.

3. Type the appropriate time interval desired for F.E. sampling.

4. Press Enter, and, after a brief message of acceptance, the F.E. method of logging is now ready to be used in the RUN mode.

NOTE: The allowable Sample Time range is 2-30 seconds. If a Sample Time of less than 2 seconds or greater than 30 seconds is selected, a warning message will appear and you will be require to re-enter the Sample Time.

Log Custom

The TVA-1000B has several pre-designed logging methods. However, if you find that you would prefer to log data in a different fashion, you can use Custom logging to create your own log type. The TVA-1000B will prompt you through a series of questions which will assist you in setting the various logging options. The end result is a logging method which collects data the way you want it to.

The following variable settings can be configured when designing a Custom log method:

1. **Log data type**

This setting allows you to choose the format in which data will be saved. The choices are as follows:

    a. None.

    b. FoxAuto – Data stored in a fashion similar to Auto logging for download to the *Foxboro datalogging software only* (tag, calibration information, Detector Counts, time/date, alarms).

    c. FoxVOC – Data stored in a fashion similar to VOC logging for download to the *Foxboro datalogging software only* (Tag, Calibration Information, Detector Counts, time/date, alarms).

    d. FE – Data stored in a fashion similar to FE logging for download to FEMS or via the Text protocol.

2. **Sample time**

This setting allows you to adjust the sampling interval.

3. **Log time units**

This setting allows you to choose the units for the sample interval (seconds or minutes).

4. **Log sample type**

This setting allows you to choose the way in which sample readings are collected over the sample rate or interval. The choices are as follows:

    a. *Last sample* — the last reading obtained within the sample interval is stored

    b. *Max* — the maximum reading obtained within the sample interval is stored

    c. *Avg* — the average reading obtained over the sample interval is stored

5. **Log unit lock**

This setting allows you to decide whether to enable auto-ranging or lock the TVA-1000 units to one of three choices: ppb, ppm, or %.

6. **Log auto repeat**

This setting allows you to determine whether the TVA-1000B should automatically cycle through logging events (auto repeat ON) or pause for a user command before logging (auto repeat OFF).

7. **Log save accept**

This setting determines whether the TVA-1000B prompts the user before saving a logged reading (Manual) or automatically saves the reading without a user prompt (Auto).

8. **Tag active**

This setting determines whether or not you want to assign tags to logged readings. If you wish to assign tags, choose ON. If you wish to skip tagging, choose OFF.

9. **Route active**

This setting determines whether the logging should follow a pre-loaded route list of tags. If you wish to upload a list of tags to the TVA-1000B and follow that list while logging, choose ON. If you do not wish to use routing, choose OFF.

10. **Barcode reader**

This setting determines whether the barcode reader is used merely to enter tags (Enter tag) or if it is required to verify that the user has read a tag in the monitoring route (Verify tag).

Hardware Configuration (Barcode Reader/Probe Display)

NOTE: To select a barcode reader or probe display, the instrument must be ON but does not have to be warmed up.

The TVA-1000B must be configured to operate with the appropriate barcode reader and probe display. To select which accessories to use:

1. From the MAIN menu display, press 2 = Setup.

2. From the SETUP menu display, press 5 = Hardware. The Hardware menu will appear:

```
HARDWARE MENU


1=PROBE DISPLAY
2=BARCODE READER
```

To select a probe display:

1. From the HARDWARE menu, choose 1 = Probe display. The PROBE DISPLAY menu will appear:

```
PROBE DISPLAY
   BASIC
1=BASIC
2=ENHANCED
```

2. The second line of the display shows the currently configured display type. To choose the basic probe display, press 1. To choose the Enhanced FE probe display, press 2.

To select a barcode reader:

1. From the HARDWARE menu, choose 2 = Barcode reader. The BARCODE menu will appear:

```
BARCODE MENU
     NONE
1=SELECT READER
ENTER=INITIALIZE
```

2. The second line of the display shows the currently configured barcode scanner type. To select a reader, press 1. The BARCODE READERS menu will appear:

```
Barcode Readers
     1=None
2=HP Smart Wand
  3=PSC Laser
```

3. To choose no reader, press 1. To choose the HP Smart Wand, press 2. To choose the PSC laser scanner, press 3.

4. To initialize a reader, ensure that the reader is plugged into the 9-pin reader port and securely fastened in place. From the BARCODE menu screen, press ENTER=Initialize. The message "Barcode reader initialization in progress" will appear. A successful initialization will result in an "Initialization Complete" message. If the reader is not properly connected or if an incorrect model is connected, a "WARNING: Barcode reader not found" message will appear.

WARNING: Not all readers are approved for use in areas classified as hazardous due to the presence of flammable gases or vapors. Contact Foxboro for more information.

User Identification Number

NOTE: To set the User ID number, the instrument must be ON but does not have to be warmed up.

---

1. From the MAIN menu display, press 2=Setup.

2. From the SETUP menu display, press 6=Othr.

3. From the OTHER SETTINGS menu, press 1=User ID.

4. From the User ID prompt, press ENTER.

5. Use the keypad to type your user ID.

6. Press ENTER to store the user ID into memory.

Date

NOTE: To set the correct date, the instrument must be ON but does not have to be warmed up. Date entries earlier than Jan. 1, 1980 or later than 2037 are invalid.

---

1. From the MAIN menu display, press 2=Setup.

2. From the SETUP menu display, press 6=Othr.

3. From the OTHER SETTINGS menu, press 2=Date.

4. The next screen reads the current date. If OK, press EXIT or ENTER to change. EXIT returns to the OTHER SETTINGS menu. ENTER prompts you to type

the correct date. Do so by typing month/day/year, and then press ENTER to store the date in memory. The display then returns to OTHER SETTINGS.

Time of Day

> *NOTE: To set the correct time, the instrument must be ON but does not have to be warmed up. The date must be within the valid range of 1980 to 2037.*

1. From the MAIN menu display, press 2=Setup.

2. From the SETUP menu display, press 6=Othr.

3. From the OTHER SETTINGS menu, press 3=Time.

4. The next screen reads the current time. If it is OK, press EXIT or ENTER to change. EXIT returns to the OTHER SETTING Menu, ENTER prompts you to type the correct time. Do so by typing hour/minute/second. Then press ENTER to store the time in memory. The display then returns to OTHER SETTINGS.

User Options

Key Click

If the key click is on, a chirp is heard every time a key is pressed.

> *NOTE: To select key click on/off, the instrument must be ON but does not have to be warmed up.*

1. From the MAIN MENU display, press 2=Setup.

2. From the SETUP MENU display, press 6=Othr.

3. From the OTHER SETTINGS Menu, press 4=User Options.

4. From the USER OPTION Menu, press 1=Key Click.

5. From the Key click Menu, press 1=On or 2=Off. The screen displays the previous selection. When a new selection is made, the display returns to USER OPTIONS.

Display Delay

This function determines the length of time that temporary messages remain on the screen.

> *NOTE: To select the display delay, the instrument must be ON but does not have to be warmed up.*

1. From the MAIN menu display, press 2=Setup.

2. From the SETUP menu display, press 6=Othr.

3. From the OTHER SETTINGS menu, press 4=User Options.

4. From the USER OPTION menu, press 2=Display Delay.

5. From the Display Delay menu, press 1=Short, 2=Medium or 3=Long. The screen displays the previous selection. When a new selection is made, the display returns to USER OPTIONS.

NOTE: "Short" is approximately 0.5 sec, "Medium" is approximately 1.5 seconds, and "Long" is approximately 3.5 seconds.

Information Menu

The information menu is a view-only list of 14 items/parameters existing in the instrument. No changes may be made in this menu. Enter the INFO Menu from the MAIN menu by pressing 3=Info. Use the up/down keys to page through the list.

The parameters/items you may view are:

♦ Model: TVA-1000B

♦ S/N DDDDDDDDDDDD

♦ Date

♦ Time

♦ Memory: how much is free to use

♦ Reader: Serial reader is found or not found

♦ Ver: Current Software Version No.

♦ PID span calibration: Date and time of last calibration

♦ FID span calibration: Date and time of last calibration

♦ PID zero calibration: Date and time of last calibration

♦ FID zero calibration: Date and time of last calibration

♦ Det: PID, FID, or both

♦ Pump: On or Off

♦ Bat: Battery voltage listed, OK or low

NOTE: To view calibration information, you must return to the calibration menu in SETUP. Press EXIT to return to MAIN menu.

PC Link/Memory

WARNING: The RS-232 port is not approved for use in areas classified as hazardous due to the presence of flammable gases or vapors.

This menu allows you to link the TVA-1000B to a personal computer (PC) through the RS-232 communications port or to clear existing route or log memory within the instrument.

To enter the PCLINK/MEMORY menu from the MAIN menu, press 4=PCLink/Memory. The following display will appear:

```
┌─────────────────────────┐
│     PCLINK/MEMORY        │
│      1 PC Link           │
│     2 Clear Route &      │
│     Logging Memory       │
└─────────────────────────┘
```

Choosing 2 = Clear Route & Logging Memory will erase any downloaded routes or any logged data stored in TVA-1000B memory.   A warning that "You are about to clear all memory" will appear and must be acknowledged before the TVA-1000B will clear its memory. *Be absolutely sure that you wish to clear memory before choosing this action.* Once memory is cleared, it cannot be retrieved.

Choosing 1 = PCLink will allow you to either change the TVA's communications protocol, or begin to send or receive data. One of the following displays will appear:

```
┌────────────────────┐  ┌────────────────────┐  ┌─────────────────────────┐  ┌──────────────────────┐
│       PCLINK       │  │       PCLINK       │  │         PCLINK          │  │        PCLINK        │
│    Type=FEMS       │  │   Type=Foxboro     │  │   Type=Text - Manual    │  │   Type=Text - Auto   │
│   1=Change Type    │  │   1=Change Type    │  │     1=Change Type       │  │    1=Change Type     │
│  2=Send 3=Receive  │  │ 2=Establish Link   │  │   2=Send 3=Receive      │  │  2=Establish Link    │
└────────────────────┘  └────────────────────┘  └─────────────────────────┘  └──────────────────────┘
```

The second line of the display shows the type of communications protocol the TVA-1000B is currently set to use. Choosing 1 = Change type will allow you to select a new communications protocol:

```
┌─────────────────────────┐
│      PCLINK TYPE         │
│    Type=Foxboro          │
│     1=Foxboro            │
│    2=FEMS 3=Text         │
└─────────────────────────┘
```

Choosing 1 = Foxboro will configure your TVA-1000B to communicate with the Foxboro TVA-1000 Datalogging software. Choosing 2=FEMS will allow your TVA-1000B to communicate with Envirometrics' F.E.M.S. (Fugitive Emissions Monitoring Software).   Choosing 3=Text will allow your TVA-1000B to output data in a straight ASCII text format to a serial printer, terminal emulation software, or the PCIP software supplied with your TVA-1000B. This ASCII format can be read and understood by many commercially available spreadsheets and data management software packages. If you choose Text mode, you will also need to select whether the communications will occur automatically (if your software is set up to automatically command the TVA-1000B; e.g., the PCIP) or manually (if you need to send commands from the keypad).

Foxboro TVA-1000B Software Link

NOTE: If you are using a mulitpoint calibration curve, you cannot download your data to the PC via the Foxboro TVA-1000 software. Use the text transfer mode to download to an ASCII file.

---

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1 = Change type) to Foxboro. If the link type is already set to Foxboro, proceed to the next step.

3. From the PC LINK menu, choose 2 = Establish link. The following display will appear:

```
┌─────────────────────┐
│    PC LINK STATUS   │
│   WAITING FOR PC    │
│                     │
│     REQUEST ...     │
│                     │
│    EXIT=CANCEL      │
└─────────────────────┘
```

For more information about the TVA-1000A Datalogging software, refer to MI 611-187, *PC Software.*

F.E.M.S. Software Link

Receive

Before the TVA-1000B can be used in FE logging mode, a previously configured route file must be created in F.E.M.S. and downloaded to the instrument's memory. Use the following instructions to download a route to the TVA-1000B from F.E.M.S.:

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1 = Change type) to F.E.M.S. If the link type is already set to F.E.M.S., proceed to the next step.

3. Before attempting to download, be sure that F.E.M.S. is configured to operate with the TVA-1000B:

    File/Preferences Window: Datalogger set to "Foxboro TVA-1000B"

    Monitor Run/Communications Window: 9600 baud, 8 data bits, 1 stop bit, no parity

    If these parameters are already properly set, proceed to the next step.

4. Follow the F.E.M.S. instruction manual to create a monitoring route for downloading to the TVA-1000B.

5. When F.E.M.S. instructs you to set the datalogger so that it is ready to accept data, choose 3=Receive from the PC LINK menu. A warning will appear informing you

that the new route will erase any existing route. Once you have acknowledged this warning by pressing ENTER, the following display will appear:

```
        PC LINK STATUS
        WAITING FOR PC

        CONNECTION ...

        EXIT=CANCEL
```

NOTE: Do not place the TVA-1000B into this wait mode until F.E.M.S. instructs you to. Doing so will cause the TVA-1000B and F.E.M.S. handshaking to fail.

6. Now that the TVA-1000B is waiting to receive data, click on OK at the F.E.M.S. window, instructing F.E.M.S. to begin the download.

7. Once F.E.M.S. has finished sending the route to the TVA-1000B, the TVA-1000B display will read "PC data transfer successfully completed" and return to the PC LINK menu.

Send

Once the TVA-1000B has been used to collect fugitive emissions data in the FE monitoring mode using a F.E.M.S. created route, the data can then be uploaded to the PC. Use the following instructions to upload data from the TVA-1000B to F.E.M.S.:

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1=Change type) to F.E.M.S. If the link type is already set to F.E.M.S., proceed to the next step.

3. Before attempting to upload, be sure that F.E.M.S. is configured to operate with the TVA-1000B:

    File/Preferences Window: Datalogger set to "Foxboro TVA-1000B"

    Monitor Run/Communications Window: 9600 baud, 8 data bits, 1 stop bit, no parity

If these parameters are already properly set, proceed to the next step.

4. When F.E.M.S. instructs you to set the datalogger so that it is ready to send data, choose 2 = Send from the PC LINK menu. The following display will appear:

```
        PCLINK STATUS
        WAITING FOR PC

        CONNECTION ...

        EXIT=CANCEL
```

NOTE: Do not place the TVA-1000B into this wait mode until F.E.M.S. instructs you to. Doing so will cause the TVA-1000B and F.E.M.S. handshaking to fail.

5. Now that the TVA-1000B is waiting to send data, click on OK at the F.E.M.S. window, instructing F.E.M.S. to begin the upload.

6. Once the analyzer has finished sending the data to F.E.M.S., the TVA-1000B display will read "PC data transfer successfully completed" and return to the PC LINK menu.

Text Transfer

The TVA-1000B is also capable of data transfer to an IBM PC running software to emulate a terminal. The data is formatted as readable ASCII text.

The following information can be *uploaded* from the TVA-1000B to the PC:

    a. Route List

    b. TVA-1000B Configuration

    c. TVA-1000B Calibration Parameters

    d. Logged Data

The following information can be *downloaded* from a PC to the TVA:

    a. Route List

    b. TVA-1000B Configuration

    c. TVA-1000B Calibration Parameters

Two control modes are supported:

    a. Manual – the user requests a specific text upload or download at the TVA-1000.

    b. Auto – the TVA-1000B performs a specific text upload or download as requested by a control character received from the IBM PC. The TVA-1000B stays in this mode until canceled by the user at the TVA-1000B or by a control code from the IBM PC.

Communications

A commercially available PC communications software package is required to establish a link with the TVA-1000B. Examples of such packages include PROCOMM PLUS and Windows Terminal. The following settings should be used:

Baud Rate: 9600
Data Bits: 7
Stop Bit: 1
Parity: Odd
Flow Control: XON/XOFF

The data can be uploaded from the TVA-1000B to a file, a terminal screen or a serial printer. Data can also be downloaded to the TVA-1000B. Downloaded files must follow the format prescribed in this manual precisely to ensure proper data transmission.

Text Data Formats

Messages to be uploaded and downloaded must be written in straight ASCII text and must contain blank spaces between text, not tabs.

For more information on Text Data Formats, see Appendix A.

Downloading Data from the PC to the TVA-1000B (Manual)

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1 = Change type) to Text-Manual. If the link type is already set to Text, proceed to the next step.

3. From the PC LINK menu, choose 3 = Receive.

4. The TVA-1000B will warn you that new data will automatically erase old data. Once you have acknowledged this warning, the following screen will appear:

```
PC LINK STATUS
WAITING FOR PC

TO SEND DATA ...

EXIT=CANCEL
```

5. Following the instructions from your PC software package, command the PC to send the appropriate file.

6. When the text transfer is complete, the TVA-1000B display will read "PC data transfer successfully completed."

NOTE: For more information about sending data with your communications software, consult your software users manual.

Uploading Data from the TVA-1000B to the PC (Manual)

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1 = Change type) to Text-Manual. If the link type is already set to Text, proceed to the next step.

3. Prepare your PC communications software so that it is ready to receive data. For more information, consult your PC communications software users manual.

4. From the PC LINK menu, choose 2 = Send.

5. The TVA-1000B will ask you what data you wish to send (Route, Configuration, Log data, or Calibration).   Select the data that you wish to transmit.

6. The following screen will appear:

```
┌─────────────────────────┐
│    PC LINK STATUS       │
│    SENDING DATA         │
│                         │
│       TO PC...          │
│                         │
│     EXIT=CANCEL         │
└─────────────────────────┘
```

7. When the text transfer is complete, the TVA-1000B display will read "PC data transfer successfully completed."

NOTE: For more information about receiving data with your communications software, consult your software users manual.

Auto Upload/Download

NOTE: Text-Auto is used to communicate with the PCIP software shipped with your unit. For more information, refer to MI 611-186.

1. Connect the cable between the PC serial port and the RS-232 port of the TVA-1000B (marked HOST).

2. Enter the PC LINK menu and change the link type (1 = Change type) to Text-Auto. If the link type is already set to Text-Auto, proceed to the next step.

3. Prepare your PC communications software so that it is ready to send or receive data. For more information, consult your PC communications software users manual.

4. From the PC LINK menu, choose 2 = Establish Link.

5. The following screen will appear:

```
┌─────────────────────────┐
│    PC LINK STATUS       │
│    WAITING FOR PC        │
│                         │
│       REQUEST...         │
│                         │
│     EXIT=CANCEL         │
└─────────────────────────┘
```

6. Follow the instructions included with your software package to send control messages and data to the TVA. Commands to upload data will trigger the TVA-1000B to send the appropriate information to the PC. Commands to download data will trigger the TVA-1000B to wait to receive information from the PC. The following table illustrates which control keys command which activities:

Activity	Information	Auto Control Key
Upload to PC from TVA	Route List	CTRL-E
Upload to PC from TVA	TVA-1000B Configuration	CTRL-G
Upload to PC from TVA	TVA-1000B Calibration	CTRL-L
Upload to PC from TVA	Logged Data	CTRL-D

Activity	Information	Auto Control Key
Download from PC to TVA	Route List	CTRL-R
Download from PC to TVA	TVA-1000B Configuration	CTRL-F
Download from PC to TVA	TVA-1000B Calibration	CTRL-B
Download from PC to TVA	Any of the above	CTRL-Y
Abort the current transfer	N/A	CTRL-A
Terminate link	N/A	CTRL-T

7. After any transfer, the TVA-1000B may then be commanded to perform another transfer. When you are finished transferring data, a CTRL-T command should be sent (or press the EXIT key on the sidepack) to terminate the connection. The TVA-1000B will then display a "Connection terminated" message and return to the PCLink menu.

NOTE: For more information about sending or receiving data with your communications software, consult your software users manual.

Run Mode

How the instrument functions in the RUN mode is governed by the selection made in the SETUP/LOG menu. The LOG menu selects how data is stored in the instrument memory. There are four possible choices in the LOG mode as defined in "Log Methods" on page 39.

The TVA-1000B performs accurately only after it has been properly set up (configured).

The three RUN mode displays (as governed by the *LOG Selection*) are:

NONE   *AUTO, VOC, or F.E.*

```
PID:    80.00 PPM
FID:    80.00 PPM
EXIT=STOP
```

```
PID:    80.00 PPM
FID:    80.00 PPM
SAMPLING:  10 SEC
EXIT=CANCEL
```

If your instrument is equipped with an FID, you should turn the red hydrogen supply valve to ON and wait 2-3 minutes before entering the RUN mode. Upon entering the RUN mode, the pump will automatically turn ON and the FID will ignite.

NOTE: For best performance, prior to entering the RUN mode, the instrument must be ON, warmed up for approximately 15 minutes, and display the main menu. The pump must also be ON throughout the warmup period. If the instrument is FID equipped, and the FID is to be used, the flame must be ignited throughout the warmup period. If the instrument is PID equipped and the PID is to be used, the lamp must be ON throughout the warmup period.

Accessing the Run Menu

From the MAIN MENU display, press 1=Run.

Run: Log None

Whenever the TVA-1000B is in the RUN mode with *Log None* as the logging selection, the instrument operates as a survey tool only. The readings on the probe display and instrument display show the live reading for the samples at that time. No logging action is taking place. Any alarms that are set will function normally.

```
PID:   225.PPM
FID:   225.PPM

  EXIT=STOP
```

Run: Log Auto

Whenever the TVA-1000B is in the RUN Mode with *Log Auto* as the logging selection, the instrument operates as an automatic survey tool that logs its readings into memory at an interval selected in the Setup Menu. After the 1=Run key is pressed, the first screen viewed is the one shown at the right. The tag information should be typed in before starting or a tag read with the barcode scanner. The tag may be left blank if desired.

```
PID:   225.PPM
FID:   225.PPM

 PRESS CHAR KEY
```

Type the tag information in the space provided or scan a tag with the reader. Once the tag information is entered, press the ENTER Key. The screen then changes to the next display.

```
PID:   225.PPM
FID:   225.PPM
TAG: BLDG 19
 PRESS CHAR KEY
```

The instrument is now ready to start logging. The screen displays live readings and the tag name. However, no logging takes place until you press either the LOG key on the basic probe or the ENTER key on the instrument.

```
PID:   225.PPM
FID:   225.PPM
BLDG 19
ENTER=START LOG
```

Press ENTER or the LOG key on the basic probe to start the automatic logging. The instrument counts down from the time selected in the SETUP/Log Menu and stores the reading at the end of the count down. For instance, if 12 seconds was selected as the logging time, the instrument will count down from 12 and display 11,10,9,8,7,6,5,4,3,2,1,store. The instrument logs into memory either the highest, average, or last reading during the countdown.

```
PID:   225.PPM
FID:   225.PPM
SAMPLING: 11SEC
   EXIT=STOP
```

This action continues until the instrument shuts down due to low battery or the EXIT key is pressed.

Run: Log VOC

Whenever the TVA-1000B is in the RUN mode with *Log VOC* as the logging selection, the instrument operates as a manual survey tool that logs its readings into memory whenever you initiate logging. When the 1=Run key is pressed, the first screen viewed is the one shown on the right. The tag information should be typed or a tag read with the bar-code scanner. The tag may be left blank if desired.

```
PID:   225.ppm
FID:   225.ppm

 PRESS CHAR KEY
```

Enter the tag information in the space provided (up to 10 characters) or scan a tag with the reader. Once the tag information is entered, press the ENTER key. The screen then changes to the next display.

```
PID:   225.ppm
FID:   225.ppm
TAG: BLDG 19
  PRESS CHAR KEY
```

The instrument is now ready to start logging. The screen displays live readings and the tag name but no logging takes place until you press either the LOG key on the basic probe or the ENTER key on the instrument.

```
PID:   225.ppm
FID:   225.ppm
TAG: BLDG 19
ENTER= START LOG
```

Press ENTER or LOG to start the VOC logging sequence. After the instrument counts down for the time selected in the SETUP/Log menu, the word *Save* appears. When confirmed, the instrument logs into memory either the highest average or last reading achieved during the countdown sample. After the information is stored into memory, the display returns to live measurements and prompts for a new tag. Each VOC log must be done manually and individually.

```
PID:   225.ppm
FID:   225.ppm
SAMPLING: 9SEC
   EXIT=STOP
```

Run: Log F.E.

Whenever the TVA-1000B is in the RUN mode with Log F.E. as the logging selection, the instrument logs its readings based on a pre-configured route file.

> NOTE: The operation of the Log F.E. mode is menu driven from the hand-held probe display and requires the use of the optional TVA-1000B Enhanced F.E. Probe.

The procedure for using the TVA-1000B for Fugitive Emissions monitoring involves the following four steps:

1. Create a monitoring route using a Fugitive Emissions personal computer software program.
2. Download the route file to the TVA-1000B.
3. Log readings by following the monitoring route shown on the TVA-1000B display.
4. At the end of the monitoring route, upload the logged readings to the personal computer.

Using the Enhanced Probe

This probe/display allows you to perform menu-driven operational/datalogging functions from the handheld unit and reduces the need to access the sidepack keypad.

> *NOTE: In order to use the Enhanced Probe, be sure that the HARDWARE setting in the TVA-1000B SETUP menu is properly configured.*

There are three buttons on the Enhanced Probe which allow you to interact with the TVA-1000B:

- ♦ MENU – Used to cause the menu to appear on the bottom of the probe display and to step through the available selections
- ♦ SELECT – Used to choose the currently highlighted menu selection; e.g., "LOG".
- ♦ Light Bulb Icon – Used to turn the display backlight on and off

The Enhanced Probe and the RUN Mode

1. From the MAIN menu, press 1 = RUN.

2. The enhanced probe display will display the detector reading (FID or PID) at the top and an analog bargraph on the bottom. Press the MENU key on the Enhanced probe display to show the Opening menu:

```
FID 5.70 ppm
  Enter logging mode
- Ignite  - Other det
- Background  - Exit
```

The highlighted menu item is the item surrounded by brackets. Pressing the MENU key will cause the brackets to move from menu item to menu item. When you reach the menu item you wish to choose, press SELECT. The Opening menu items are as follows:

Menu Item	Function
Enter logging mode	Enters FE, VOC, or Auto logging mode, allowing you to enter tags, toggle through route files, log data, etc. If no logging is selected in the SETUP menu, then this selection does not appear.
Ignite	Ignites FID. This selection does not appear in PID-only models.
Other det	Toggles between FID and PID reading. This selection does not appear in single detector models.
Background	Records a new background reading.
Exit	Clears the menu and returns to the Bargraph display.

Auto Logging with the Enhanced Probe

1. In the RUN mode, press the MENU key to cause the menu to appear. Select "Enter logging mode."

2. Use the sidepack or barcode reader to enter a tag, or simply select "Accept" to enter a blank tag.

3. Choose "Start log sampling" to begin Auto logging.

4. The Enhanced probe will display the countdown and continue to log until EXIT is selected at the probe or the sidepack keypad.

5. Once EXIT is selected, you may enter another tag and begin logging again or exit from the RUN mode.

VOC Logging with the Enhanced Probe

1. In the RUN mode, press the MENU key to cause the menu to appear. Select "Enter logging mode."

2. Use the sidepack or barcode reader to enter a tag, or simply select "Accept" to enter a blank tag.

3. Choose "Start log sampling" to begin Auto logging.

4. The Enhanced probe will display the count down for the interval selected in the SETUP menu and freeze on the reading to be saved (either the Maximum, Average, or Last Reading).

5. You may choose to save the reading (SAV), repeat the reading for the same tag (AGAIN), or return to the previous menu (EXIT).

6. Once you have saved a reading, you may enter another tag and begin logging again or exit from the RUN mode.

FE (Fugitive Emissions) Logging with the Enhanced Probe

In FE logging, you follow a preconfigured route list consisting of component records for equipment to be monitored. You should first download a route to the TVA-1000B's memory before entering the RUN mode. For more information on downloading routes, see the PCLink section of the "Display Menus" chapter.

In the RUN mode, press the MENU key to cause the menu to appear. Select "Enter logging mode." The following display will appear on the Enhanced probe:

```
┌─────────────────────────────┐
│ FID  5.70 PPM               │
│                             │
│ TAG: 12345                  │
│ EQP: PMP  SIZE: 2.500       │
│ MAX: 1000                   │
│ 550 PPM LASTLOG             │
│  START LOG SAMPLING         │
│ - NEXT  -PREV   -EXIT       │
└─────────────────────────────┘
```

In addition to the concentration display at the top, the FE mode shows several fields which have been filled in by the downloaded route. The TVA-1000B starts at the first record in the

route and displays the component tag number (Tag), equipment type (Eqp), equipment size (Size), and leak definition (Max). If a reading has already been logged into memory for this record, it will also be displayed followed by the words "LastLog."

Route Entry Response Factor

A secondary response factor correction is based on the response factor associated with the current route entry. This secondary correction adjusts the concentration reading for different component measurements in the same route.

For example, let a route contain two entries, one for propane and one for methane. Assume that propane has only half the detector response of methane. If each route location has a leak of 100 ppm, a single response factor based on methane would produce a concentration reading of 100 ppm for methane, but only 50 ppm for propane. The addition of a secondary response factor allows each entry to be corrected for detector sensitivity. Thus, if the secondary response factor is 1.0 for methane and 2.0 for propane, both route samples will read correctly as 100 ppm.

Only the linear correction mode is used for the secondary route response correction:

Linear: FinalConc = RouteRF x BackConc

The secondary RouteRF is downloaded to the instrument as part of each route entry. This factor is applied to both detectors, as it is expected that when operating in this mode, only one detector will be used. Entries inserted by the instrument default to a RouteRF of 1.0.

Navigating the Route File

Selecting "Next" from the first logging mode screen will allow you to step to the next record in the route. Selecting "Prev" will allow you to step to the previous record in the route. You can also enter a tag via the keypad or barcode scanner and the TVA-1000B will automatically skip to that tag if it is contained within the route. If the tag is not contained within the route, a "TAG NOT FOUND" message will appear and you will be given the option to "Insert" that tag into the route or "Exit."

Logging Data

Once you have reached the correct tag for the component you wish to monitor, you may select "Start log sampling" to begin recording data. The TVA-1000B will display the readings from both detectors and begin counting down for the time interval selected in the SETUP menu. The countdown is shown on the last line of the display:

Once the countdown is complete, the TVA-1000B display will freeze on the reading to be logged and indicate if it is a leak (i.e., if the reading of the active detector exceeds the indicated leak rate). You will be given several options:

```
FID 100.0 PPM

Tag: 12345
Eqp: PMP  Size: 2.500
Max: 1000
     100.0 FID  NoLeak
              - Repair
Sav  -Again  -Exit
```

If you choose "Sav", the TVA-1000B will store the reading in memory (replacing any previously logged readings for that Tag) and proceed to the next component record in the route. If you choose "Again," the TVA-1000B will repeat the countdown and obtain a new reading. If you choose "Exit" the TVA-1000B will return to the previous screen.

Repair Menus

If the reading obtained during the logging interval exceeds the leak definition, the TVA-1000B will indicate that it is a leak by printing "Leaker!" If you wish, you may record what part of the component is leaking and what action was taken as a first attempt at repair. Choose "Repair" instead of "Sav" and the TVA-1000B will proceed to the Repair menus:

```
FID 100.0 PPM

Leak Source: N/A
Repair Method: N/A
Select leak source
-Select repair mthd
   -Exit
```

The two lines below the reading show the currently selected leak source and repair method. Choosing "Select leak source" will allow you to record what part of the component is leaking by choosing from a list of leak sources (Valve Bonnet, Compressor Seal, Downstream Flange, Valve Packing, Pump Seal, Upstream Flange). Choosing "Select repair method" will allow you to record what method was used for the first attempt at repair (Place Cap, Gun Pack Valve, Place Plug, Repack Valve, Replace Gasket, Replace, Seal Job, Steam Seal, Tighten Bonnet, Tighten Cap, Tighten Flange, Tighten Packing, Tighten Plug, Wash Seal). Choosing "Exit" will return you to the previous display.

If you choose a leak source and repair menu, be sure to select "Sav" when you return to this menu so the reading and repair information will be saved in memory before proceeding to the next component record.

Additional Component Information

Displays containing additional information about the component and the TVA-1000B status are available from the handheld unit. If you *press and hold* the MENU key for approximately 2 seconds, the Enhanced display will present an INFO page:

```
FID  5.70 PPM

TAG: 12345
EQP: PMP  SIZE: 2.500
LOC: PLANT1 STATION2
REAGENT FEED PUMP DOWN-
STREAM OF VESSEL
17:33:51 PG  -EXIT
```

The INFO page overwrites the bottom four lines of the record with other fields such as Location (Loc) and Description (the two lines below the location). The Location field contains the Area and the Subarea where the component is located. The Description field displays up to 40 characters of additional information about the component. Selecting "Pg" at the bottom of the display will step you through other INFO pages containing information such as Run ID, Record number, number of points logged, number of leakers found, number of repairs performed, pump status, free memory, barcode reader status, etc. Selecting "Exit" will return you back to the normal component record.

Maintenance

Removable, Renewable Parts

WARNING: Parts replacement and maintenance should not be performed in areas classified as hazardous due to presence of flammable gases or vapors. Opening of the analyzer is not recommended under any circumstances, due to the intrinsic safety rating of the analyzer. Violation of this policy could void the warranty of this product. (Extended Service Plans are available; contact Foxboro Authorized Service for further information.)

Foxboro suggests that you return the entire instrument to the factory or an authorized service center once a year for cleaning, testing, and calibration. Opening the TVA-1000B instrument case could void the warranty.

From time to time, you must remove and renew several components of the TVA-1000B analyzer. Some components may be replaced as normal maintenance functions performed by operating personnel. Other components, however, should be replaced only by personnel thoroughly trained and familiar with the analyzer instrument and its applications.

The components that may be maintained or replaced by operating personnel as part of normal operation are:

1. **Battery** – you may charge the battery in or out of the instrument or replace it with a charged battery.
2. **Hydrogen Tank** – remove the tank to refill it.
3. **PID Cartridge** – remove and clean frequently. Replace when needed.
4. **FID Cartridge** – remove and clean frequently. Replace when needed.
5. **Close Area Sampler** – replace if probe tip is clogged or damaged.
6. **Filter Cups** (in the sampler assembly and sidepack assembly) – clean/replace frequently.
7. **Optional Water Trap** – replace membrane or membrane support if worn or damaged.
8. **Optional Charcoal Filter Adapter** – replace charcoal frequently.
9. **Sample Line Tubing** – replace when dirty.
10. **Sample Line Fitting** – replace if damaged.
11. **FID End Cap and Flame Arrestor** – remove and clean frequently. Replace when required.
12. **FID Cavity** – clean periodically.
13. **PID cavity** – clean periodically.

> *WARNING: Never change an electrical component in an area classified as hazardous due to presence of flammable gases or vapors.*

Normal Operating Maintenance

The items described in this section may be performed as normal operating procedures.

Battery and Battery Charger

> *WARNING: Do not remove or install batteries and do not use the battery charger in any area classified as hazardous due to the presence of flammable gases or vapors.*

The nickel cadmium battery, supplied with the unit, lasts for a minimum of eight hours of continuous use at 20 °C. Extreme heat or cold and/or use of the backlight, however, will shorten that time.

A battery charger with cable is shipped with the instrument. You do not have to remove the battery for charging. Simply plug the output of the charger into the mating connector marked CHRG in the instrument. Then, insert the charger plug into the appropriate wall outlet. A green power indicator is ON when the charger is operating. A yellow indicator is activated when the charger is connected to the instrument and the instrument is ON. Normal charge time for a fully discharged battery is approximately 16 hours, or two hours of charge for every hour of use.

Indicator Light	Condition	Indication
Green	ON	Charger is plugged in and operating.
Green	OFF	Charger is not plugged in.
Yellow	ON	Charger is connected to the TVA-1000B and the TVA-1000B is ON while the charger is operating (i.e., trickle charging).

Do not leave the battery on charge for extended periods (greater than 96 hours). If you wish to remove the battery from the TVA-1000B for charging or swapping with a spare battery, turn the instrument off. Using the special tool supplied with the accessory kit, unscrew the screw on the battery compartment cover on the rear of the instrument and remove the battery cover. As the battery pack fits snugly in the instrument housing, use care in removing the battery pack and its internal connector. As you remove the battery pack, note the location of the battery connector. When re-inserting the battery pack in the instrument, be sure to push the connector into the same location, so that it does not interfere with placement of the battery pack.

To charge the battery outside of the unit, use the adapter supplied in the accessory kit.

Hydrogen Gas Tank

FID instruments are supplied with an 85cc hydrogen gas tank. This tank, which may be pressurized to 2200 psi maximum at 25°C, will provide 8 hours operation when fully charged. The tank has an integrally mounted high pressure gauge that can be easily read when the tank is in or out of the instrument. Install the tank in the instrument by inserting it into the receptacle on the left side and tightening (left hand threads, tighten counterclockwise) until the rubber tank boot is flush with the instrument sidepack and a slight resistance is felt. *Do not overtighten.*

Fuel Refilling Procedure

WARNING: A safe refill operation means there are no hydrogen leaks. Before any valves are opened, use a wrench to firmly tighten connections to the hydrogen supply tanks and the tank fill adapter. If escaping hydrogen is heard during the filling operation, close all valves and correct the leak before proceeding. Leak test with soapy water or equivalent.

NOTES:
1. Use prepurified ZERO grade hydrogen (certified total hydrocarbons as methane <0.5 ppm recommended).
2. The hydrogen filling assembly contains a flow-limiting safety device. Approximately two minutes are required to fill the tank.

CAUTION: Do not fill hydrogen tank to a pressure greater than 15.2 MPa (2200 psig).

Precautions in Handling and Storage

The major hazard associated with the handling of hydrogen is flammability. The following specific rules apply when handling hydrogen:

1. Never use cylinders of hydrogen in areas where flames, excessive heat, or sparks may occur.

2. Use only explosionproof equipment and sparkproof tools in areas where hydrogen is handled.

3. Ground all equipment and lines used with hydrogen.

4. Never use a flame to detect hydrogen leaks — use soapy water.

5. Do not store reserve stocks of hydrogen with cylinders containing oxygen or other highly oxidizing or combustible materials.

6. Store hydrogen tanks in a well ventilated area.

7. Follow all regulatory safety and labeling precautions when shipping hydrogen in the TVA-1000B.

> *NOTE: A bleeder assembly is provided in the tool kit to allow the hydrogen tank to be emptied for common carrier shipment. To use the bleeder, manually screw the bleeder onto the tank valve and allow the hydrogen to vent. This process will take about two minutes to complete.*

> *CAUTION: Observe all hydrogen handling procedures listed above.*

When transporting the instrument, remove the hydrogen tank and place it in its normal location in the carrying case.

To fill the tank, use the following procedure:

> *NOTE: All hydrogen fittings are left hand thread — do not overtighten.*

1. Turn supply tank valve OFF.
2. Attach tank fill adapter to supply tank with valve OFF and with manifold valve on OFF position.
3. Attach TVA-1000B hydrogen tank to tank fill adapter. (Note left hand thread — *do not overtighten.*)
4. Open supply tank valve. Move fill adapter valve to FILL position.
5. Wait for TVA-1000B tank to fill. This may take 2 to 3 minutes because of flow restrictors in the tank and fill adapter.
6. Close fill adapter valve.
7. Remove TVA-1000B tank.
8. Close supply tank valve.
9. Remove tank fill adapter.

Always remove the tank from the instrument before storing in the instrument carrying case.

Servicing the PID Cartridge

To service the PID cartridge, use the following procedure:

1. Turn the instrument OFF.
2. Using the special spanner wrench provided with the instrument tool kit, unscrew the blue cap holding the PID cartridge in place.
3. Screw the special extractor tool provided with the accessory kit into the off-center hole in the cartridge. (Do not exceed three full turns. Refer to Figure 10.)
4. Remove the cartridge by pulling on the extractor. Unscrew the extractor from the cartridge. Clean or replace the cartridge.
5. To insert a new cartridge, reverse the procedure. Note that the standard 10.6 eV PID cartridge is marked with a blue band. Other energy level lamps are marked with different colors (not red).

For NORMAL periodic cleaning of a PID lamp window (other than an 11.8 ev lamp), use the following procedure:

1. Remove the cartridge from the instrument as described above.

2. Clean the lamp window using a cotton swab with isopropyl alcohol.

3. Using a heat gun, dry the cartridge for about 60 seconds to evaporate the alcohol. Reinsert the cartridge into the instrument.

4. Screw in the blue PID detector cap, using the special spanner wrench supplied with the tool kit. Do NOT overtighten cap.

In cases where the lamp window is severely coated, refer to the procedure below for using the optional PID lamp cleaning kit.

EXTRACTOR TOOL

DETECTOR   COLORED BAND
(BLUE FOR PID 10.6 EV LAMP, RED FOR FID)
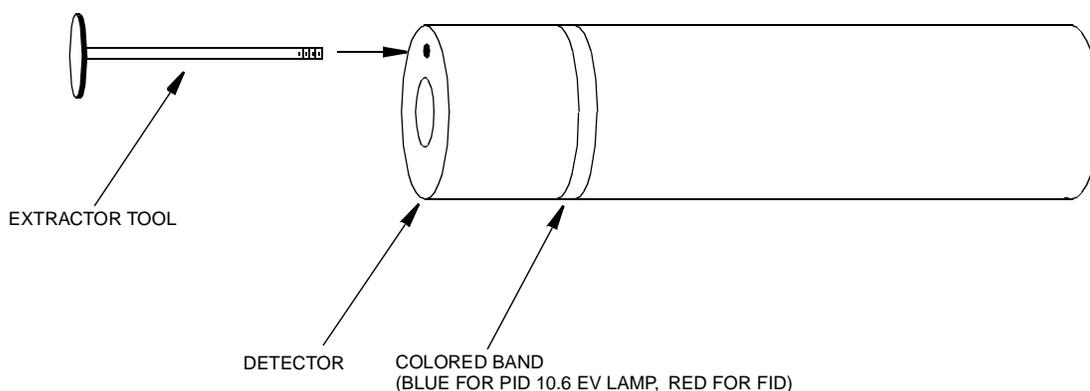
Figure 10. PID Lamp Cleaning Kit

To clean a PID lamp window with the optional PID lamp cleaning kit, use the following procedure:

1. Remove the cartridge from the instrument, as described above.

2. Clean the window of the lamp, using the materials suppled with the optional PID lamp cleaning kit. Follow the instructions included with the cleaning kit, being careful never to touch the window with your fingers.

3. When the cartridge is dry (dry at 40°C to 55°C for 1 hour), screw the extractor into the cartridge and re-insert it into the instrument.

4. Screw in the blue PID detector cap, using the special spanner wrench supplied with the tool kit. *Do NOT overtighten cap.*

NOTE: Refer to MI 611-183 on proper cleaning techniques for an 11.8 eV lamp.

Servicing an FID Cartridge

To remove the FID cartridge, use the following procedure;

1. Close the hydrogen supply valve on the side of the instrument. Turn the instrument off.

2. Using the special spanner wrench provided with the instrument tool kit, unscrew the red cap holding the FID cartridge in place.

3. Screw the special extractor tool provided with the accessory kit into the off-center hole in the cartridge (see Figure 10).

4. Remove the cartridge by pulling on the extractor. Unscrew the extractor from the cartridge. Clean or replace the cartridge.

5. To insert a new cartridge, reverse the procedure. Note that a FID cartridge is marked with a red band.

To clean an FID cartridge, you will need a cotton swab and some isopropyl alcohol. Dip the swab into the isopropyl alcohol and insert it into the center of the cartridge. Swab the surface until clean and discard the swab. Take care not to touch the igniter coil, which is located close to the end of the capsule opposite the threaded hole used to remove capsule. Then dry the cartridge in an oven at 45°C to 55°C for one hour. When dry, re-insert the cartridge into the instrument, reversing the removal procedure. *Do NOT overtighten cap.*

*CAUTION: Do not allow **any** contact with the igniter coil during cleaning.*

Cleaning the FID Detector Cap

To clean the FID detector end cap, use the following procedure:

1. Close the hydrogen supply valve on the side of the instrument and turn off the power.

2. Using the special spanner wrench provided with the tool kit, unscrew and remove the FID red detector cap.

3. Clean the cap using the isopropyl alcohol followed with a deionized or distilled water rinse. Blow out carefully with compressed dry air.

4. Replace the cap.

Replacing the Flame Arrestor

The flame arrestor, located in the center of the red FID end cap, can be either cleaned or replaced. To replace the flame arrestor, use the following procedure:

1. Close the hydrogen supply valve on the side of the instrument and turn off the power.

2. Using the special spanner wrench provided with the tool kit, unscrew and remove the FID red detector cap.

3. Remove spring.

4. Place the detector cap on a flat surface, face up.

5. Place a screwdriver through the center hole of the end cap, resting on the flame arrestor.

6. Strike the end of the screwdriver with a hammer to drive the old flame arrestor out of the end cap.

7. Remove the old flame arrestor.

8. Turn the end cap over so the red outer surface lies flat and the gray surface faces up.

9. Place the new flame arrestor in the center hole.

10. Place a screwdriver on the newly installed flame arrestor.

11. Strike the end of the screwdriver with a hammer to secure the new flame arrestor in place.

12. Replace the spring.

13. Replace the detector cap on the unit.

Cleaning the FID or PID Detector Cavities

1. Close the hydrogen supply valve on the side of the instrument. Turn the instrument off.

2. Using the special spanner wrench provided with the tool kit, unscrew the cap holding the respective detector cap.

3. Using the special extractor tool provided with the tool kit, screw the extractor into the cartridge.

4. Remove the cartridge by pulling on the extractor. Unscrew the extractor from the cartridge.

5. Carefully clean the inside of the detector cavity using a cotton swab and isopropyl alcohol. Be sure to clean the high voltage contacts along the side of the cavity. Be especially careful around the detector signal collector probe at the rear of the cavity (and the thermocouple probe in the FID).

6. Dry the inside of the cavity using a low heat gun.

7. Insert the cartridges into their respective cavities by reversing the procedure. Note that the cartridges must be rotated to properly locate the key tabs.

CAUTION: Do not intermix the detector cartridges.

Cleaning or Replacing a Sintered Metal Filter

To remove the sintered metal filter cup from the close area sampling assembly, simply unscrew the cap from the sampler and tip the assembly so that the filter falls out. The same filter cup and spring are also located behind the sample line quick connect at the sidepack assembly. To remove, unscrew the quick connect so that the filter falls out. The internal spring will not fall out. Refer to the assembly diagram below.

You may clean the filter by immersing it in isopropyl alcohol or equivalent solvent and/or swabbing the surface with a Q-tip or cotton swab. After thoroughly cleaning the surface of the filter, place the filter in an oven and dry it at 40 °C to 55 °C for one hour. You can then re-insert the filter into the sampling assembly (with the closed end of the filter in first) and screw in the cap.

SPRING   **SINTERED METAL FILTER**   **CAP**
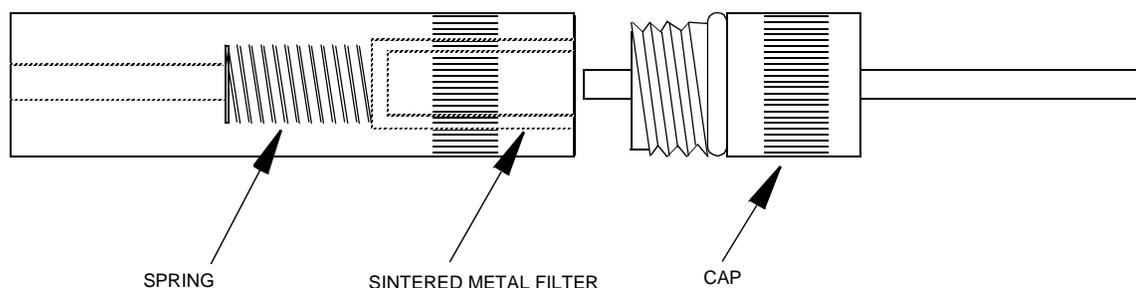
Figure 11. Sintered Metal Filter - Cleaning or Replacing

Replacing Sample Line

To replace the sample line, refer to Figure 12 below and execute the following procedure:

1. Loosen the probe nut and remove the sampling assembly by pulling it free from the probe assembly.

2. Insert a thin rod through the hole in the side of the probe fitting adapter. You will use this rod to pull the adapter and tubing from the probe assembly.

3. Remove the tubing from the quick-connect fitting by pressing firmly on the ring at the back of the fitting (a tool may be necessary) while pulling on the tubing.

4. At the base of the probe handle, gently push the tubing into the probe. At the same time, use the rod to pull the probe fitting adapter and tubing forward from the probe assembly. When the adapter fitting is fully exposed, cut the tubing from the fitting and pull the remainder of the tubing back through the probe assembly until it is completely out of the probe.

5. Cut a new piece of tubing about three inches longer than the old tubing.

6. Insert new tubing through the bottom protective covering (where you connect to the analyzer), and slowly feed the tubing through toward readout handle.

7. Once the tubing exits the top protective covering, insert the new tubing into the probe handle and carefully push it through to the other end. When the tubing is in position, cut the end square and push it over the barbed adapter fitting. (Heating the tube end may aid in fitting the tubing over the adapter.)

8. Grasp the tubing below the probe assembly handle and pull it back through the probe assembly until the adapter fitting is properly seated in the probe assembly.

9. Cut the other end of the tubing to the proper length and insert it into the end of the quick-connect fitting. (Allow 5/8-inch of tubing inside the fitting.)

PROBE NUT

PROBE FITTING ADAPTER

PROBE ASSEMBLY HANDLE

QUICK-CONNECT

QUICK-CONNECT
ELECTRICAL FITTING

UMBILICAL
WITH SPIRAL WRAP
(OR OUTER TUBING)
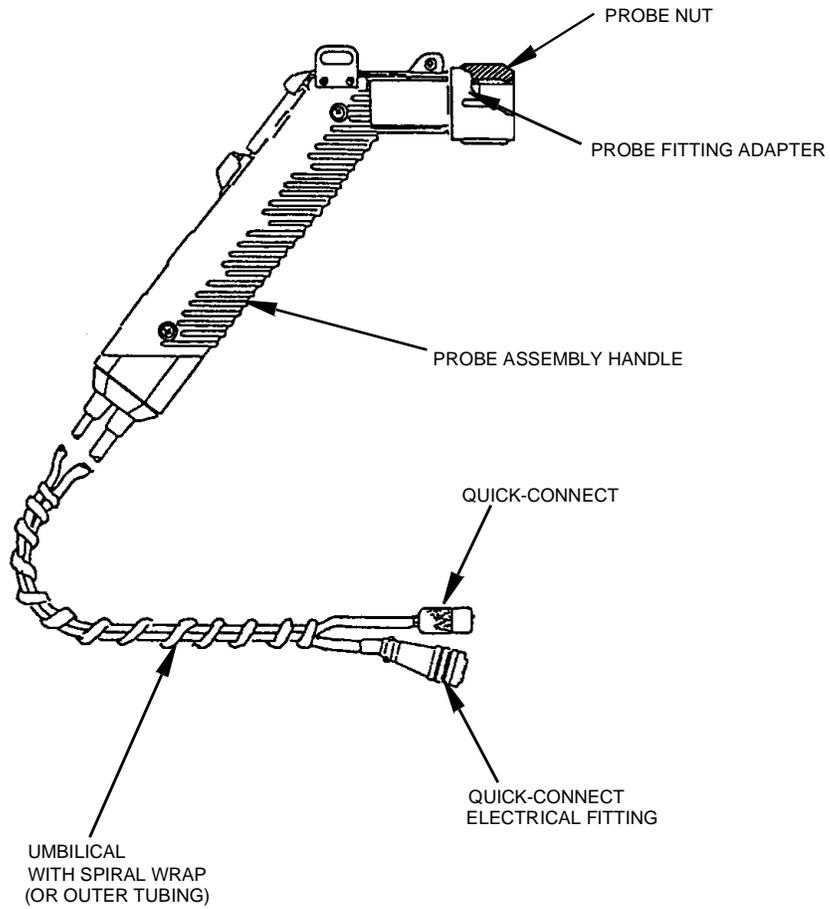
Figure 12. Replacing Sample Line

Troubleshooting

Problem	Possible Reason	Solution/Action
Unit will not turn on	Battery charge low	Charge battery.
	Bad battery connection	Ensure proper battery connection.
	Bad battery	Replace battery.
	Blown fuse or faulty keypad	Contact Foxboro authorized service center.
Pump won't turn on	Defective pump Faulty keypad	Contact Foxboro authorized service center.
Low pump flow	Clogged sample intake	Clean/replace filter cups. Clean/replace sample line. Clean/replace flame arrestor.
	Pump fault	Contact Foxboro authorized service center.
Keypad will not respond	Faulty keypad	Contact Foxboro authorized service center.
Probe display blank or probe buttons will not respond	Faulty probe/display assembly	Replace probe/display assembly. Contact Foxboro authorized service center.
FID won't ignite	Insufficient sample flow	Turn pump on. Clean/replace filter cups. Clean/replace flame arrestor.
	Hydrogen valve off	Turn on hydrogen supply valve and allow 1-2 minutes before igniting.
	Insufficient hydrogen supply (<500 psi)	Check hydrogen gauge on supply tank. Refill tank if necessary.
	Hydrogen leak	Check low pressure hydrogen output gauge. If <10.5 psi, contact Foxboro authorized service center.
	Broken igniter	Inspect igniter coil on FID capsule for breakage. If broken, replace capsule.
	Dirty igniter contacts	Inspect/clean igniter contacts (NOT igniter coils).
	Battery charge low	Charge battery pack.

Problem	Possible Reason	Solution/Action
FID noisy	Water/contamination in the detector chamber	Clean/replace FID capsule and flame arrestor.
		Clean/replace filter cups.
	Erratic pump flow	Clean/replace flame arrestor.
		Ensure proper calibration.
	Bad calibration	
Unable to calibrate FID	FID flame out	Ignite FID.
	Span concentration not properly set	Input correct span gas concentration at CAL menu.
	Cal gases contaminated	Use clean cal gases and sampling equipment.
	Sample line/filter cups contaminated	Clean/replace sample line. Clean/replace filter cups.
	FID capsule contaminated or faulty	Clean/replace FID capsule.
	Contaminated hydrogen tank	Replace hydrogen tank.
	Internal detector fault or contamination	Contact Foxboro authorized service center.
Excessive hydrogen consumption (<8 hours of run time for 2200 psi hydrogen)	Insufficient hydrogen pressure	Refill tank.
	Leaking hydrogen tank	Replace tank.
	Internal hydrogen leak	Contact Foxboro authorized service center.
Flameout problems	Sample hydrocarbon content too high	Use dilutor kit to achieve concentration within the dynamic range of the TVA.
	Insufficient oxygen in the sample (<14%)	Use dilutor kit to dilute sample with air containing sufficient oxygen. Use PID for measurements.
	FID capsule contamination	Clean/replace FID capsule.
	Insufficient sample flow	Clean/replace filter cups. Clean/replace flame arrestor.
Moisture at FID flame arrestor *NOTE: Normal operation produces some moisture. If performance is affected, attempt these solutions.*	Insufficient sample flow	Clean/replace filter cups. Clean/replace flame arrestor.
	Insufficient warmup time	Allow 15-20 minutes warmup.

Problem	Possible Reason	Solution/Action
PID lamp not operating	Bad PID lamp	Replace PID capsule.
PID noisy	Bad PID lamp	Replace PID capsule.
	Dirty PID window	Clean PID window.
	Erratic pump flow	Clean/replace filter cups. Clean/replace flame arrestor.
	Bad calibration	Ensure proper calibration.
Unable to calibrate PID	Pump not on	Turn pump on.
	PID lamp not on	Turn PID lamp on.
	Span concentration not properly set	Input correct span gas concentration at CAL menu.
	Cal gases contaminated	Use clean cal gases and sampling equipment.
	Sample line/filter cups contaminated	Clean/replace sample line. Clean/replace filter cups.
	PID window dirty or capsule contaminated or faulty	Clean PID window. Replace PID capsule.
	Internal detector fault or contamination	Contact Foxboro authorized service center.
Slow response time	Insufficient sample flow	Clean/replace filter cups. Clean/replace flame arrestor. Clean/replace sample line.
	Sampling non-volatile compounds	Contact Foxboro Applications Laboratory.
High background readings	High ambient concentration	N/A.
	Zero drift/improper calibration	Ensure proper zero/span calibration.
	Sample line contamination	Clean/replace sample line. Clean/replace filter cups.
	Detector capsule contamination	Clean/replace FID capsule. Clean PID window. Replace PID capsule.

Warning Messages

Message	Description
WARNING BATTERY POWER IS LOW. EXIT=CLR	This display occurs whenever the battery has reached a low level (approximately 6.0 V). It indicates that approximately 15 minutes of operating time remain. Press EXIT to return to the operating display. The lower right corner of all displays now show ± (blinking). If you continue to operate after the warning is displayed, the unit will eventually shut off automatically. To restart after an auto shut down, you must first recharge or replace the battery. Note that collected data is not lost
WARNING PUMP MUST BE ON TO SELECT MODE. EXIT=CLR	This display occurs when the pump is not on for a function that requires the pump to be on.
WARNING LOGGER MEMORY IS ALREADY FULL. EXIT=CLR	Log memory is full. You cannot continue to log any entries until you have transferred the log memory to a PC or have cleared log memory. The instrument will, however, continue to operate.
WARNING FID FLAMEOUT! IGNITE AGAIN. EXIT=CLR	This display appears whenever the FID flame is extinguished. Press EXIT to clear, then CONTROL key and 2 to ignite. This warning is active only in RUN and CALIBRATE modes. In the RUN mode, once the alarm is acknowledged, a flashing F appears on the sidepack display and the probe display flashes.
WARNING PID LAMP NOT OPERATING EXIT=CLR	This message indicates that the PID lamp activity is low. Check lamp and re-zero the PID. This warning is active only in RUN and CALIBRATE modes. In the RUN mode, once the alarm is acknowledged, a flashing P appears on the sidepack display and the probe display flashes.
WARNING LOG RATE TOO SLOW FOR PC STEL CALC EXIT=CLR	This message appears whenever you enter a log rate value greater than 90 seconds. The data sampling rate is too low for valid STEL calculations in the PC. Press EXIT to bypass the warning.

Message	Description
WARNING Log rate invalid! Exit=Clr	This message appears whenever you enter a log rate of zero. To correct the problem, enter a log rate other than zero.
WARNING Entry is invalid! Exit=Clr	This message appears whenever you enter a value equal to zero (except for alarm levels). To correct the problem, enter numbers other than zero.
WARNING Bad Calibration parameters! Exit=Clr	This warning display appears during calibration if the current zero calibration value equals or exceeds the span calibration value. To correct the problem, perform a re-zero, a re-span, or both.
Hardware Failure	This message appears as a result of a self-test failure. Return the instrument to the factory for service.
WARNING PID lamp must be ON to continue Exit=Clr	The PID has been turned OFF. To continue, use the Control Menu to turn the PID on.

Accessories

Telescoping Extension Option

To use an optional telescoping extension, loosen the probe nut and unplug the sampling assembly. Next, insert the telescoping wand and tighten the probe nut. Then, insert the appropriate sampling assembly into the other end of the extension unit and tighten the retaining nut.
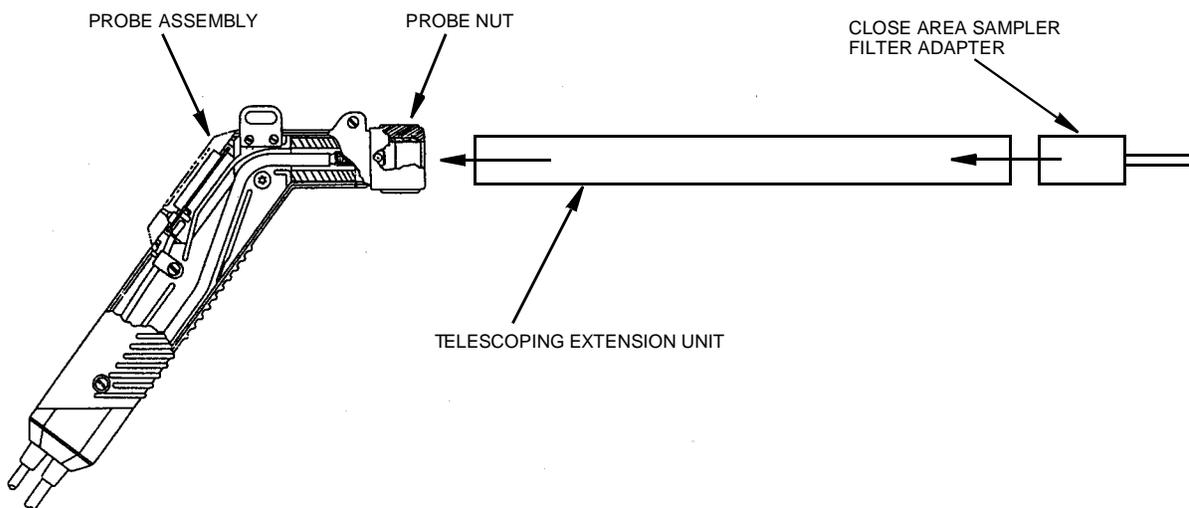
Figure 13. Telescoping Extension Option

Activated Charcoal Filter Adapter

The Activated Charcoal Filter Adapter is an accessory that can be installed or attached to the end of the standard probe or to the end of a telescoping extension. The filter is typically filled with activated charcoal which acts as an adsorbent and effectively filters out organic vapors other than methane or ethane.

A screw cap on the probe end may be removed for refilling the filter with activated charcoal or other filtering medium.

Applications of the filter include:

1. Obtaining a clean air sample for zero baseline check and adjustment.
2. Rapid screening of methane and non-methane organic vapors.
3. Selective screening for natural gas surveys.

The charcoal filter adapter fits directly into the telescoping wand.

The life of the filter depends on the time in use, the types of compounds, and concentrations of the compounds being filtered. Under typical industrial air monitoring conditions, the filter will last for many days of continuous sampling.

To replace charcoal in a charcoal filter, use the following procedure:

1. Remove the sampling assembly from the probe by loosening the probe nut and pulling the sampling assembly free from the probe.

2. Unscrew the cap from the sampling assembly. This will expose the end of the charcoal filter cartridge. See diagram below.

3. Tip the cartridge up and empty the charcoal from the cartridge.

4. Clean the inside of the cartridge with a cotton swab dipped in isopropyl alcohol.

5. Dry the cartridge thoroughly.

6. Re-fill the cartridge with new "dust-free" charcoal of the type specified for the filter.

7. Apply Teflon tape to the male threads of the charcoal cartridge and screw on the cap.

8. Re-insert the sampling assembly into the probe and tighten the probe nut.

CARTRIDGE
FILLED WITH
ACTIVATED
CHARCOAL

THREADED
END WITH
TEFLON
TAPE

CAP
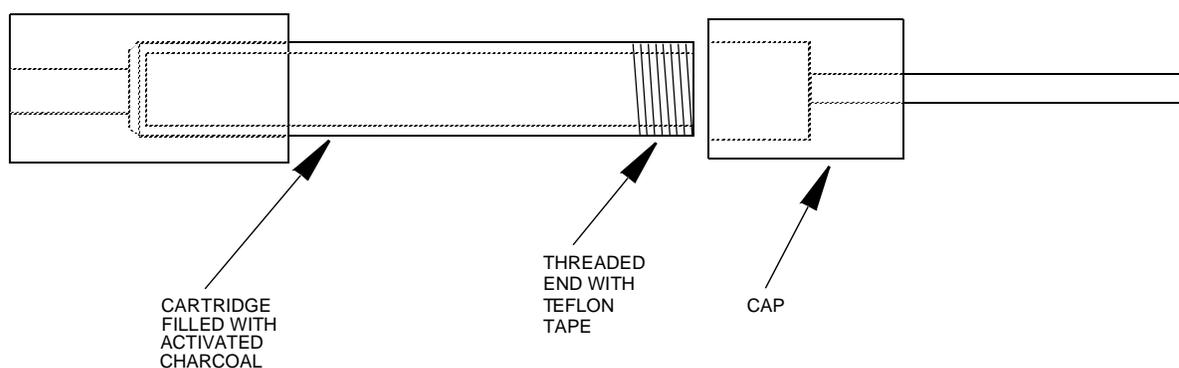
Figure 14. Activated Charcoal Filter Adapter

For information on additional accessories, such as calibration kits, enhanced probes, barcode readers, optional energy lamps (PID), or dilutor kits, please contact The Foxboro Company.

Appendix A: Text Data Formats

Route List File Format

The *route list* format is as follows:

```
Format                                 Comments
ROUTE LIST<CR><LF>                     Title, not processed
VER=x.x                                x=0-9
RUN ID=aaaa<CR><LF>                    a=0-9, A-Z, a-z
<CR><LF>                               Blank line, not processed
<CR><LF>                               Blank line, not processed
<route entry header line 1>            See route entry header below: not processed
<route entry header line 2>            See route entry header below: not processed
<route entry header line 3>            See route entry header below: not processed
<route entry 1>                        See route entry below
<route entry 2>
<route entry 3>
<route entry n>
<CR><LF>                               Blank line, not processed
END<CR><LF>                            Marks end-of-text
```

The first eight lines of the route list constitute the *route header*. The last three lines of the route header are composed of text column headers (route entry header lines 1 and 2) and an underline of dashes (route entry header line 3). The route entry headers are specified below by specification of header text for lines 1 and 2 and starting position (all other characters blank spaces, not tabs). Line 3 is a dash character '-' for all route entry characters except the delimiter (space instead).

The *route entry header* format is as follows:

```
Start    Header Line 1                  Header Line 2
0                                       TAG
17                                      AREA
26                                      SUBAREA
35       LEAK                           RATE
41       RESP                           FACT
46       EQP                            TYP
50       EQUIP                          SIZE
57                DESCRIPTION
105      <CR>
106      <LF>
```

The remaining lines in the route list are *route entries.* Each route entry consists of tag, area, subarea, leak rate, response factor, equipment type, equipment size, and description.

The *route entry* format is as follows:

```
Byte            Length          Item                    Format
0               16              Tag                     text
16              1               delimiter               space
17              8               Area                    text
25              1               delimiter               space
26              8               Subarea                 text
34              1               delimiter               space
35              5               Leak rate               floating point
40              1               delimiter               space
41              4               Response factor         floating point
45              1               delimiter               space
46              3               Equipment type          text
49              1               delimiter               space
50              6               Equipment size          text
56              1               delimiter               space
57              48              Description             text
105             1               <CR>                    0DH
106             1               <LF>                    0AH
```

NOTE: Downloaded route entries may be terminated any time after the tag by the <CR><LF>. Partial text entries are processed as ending in trailing spaces. Partial number entries are processed as if complete. The default value for fields not included in the entry are:

Field	*Default*
Area	*all spaces*
Subarea	*all spaces*
Leak rate	*0.0*
Response factor	*1.0*
Equipment type	*all spaces*
Equipment size	*all spaces*
Description	*all spaces*

Sample Route List File

```
ROUTE LIST
VER= 1.00
RUN ID=0001

                            LEAK  RESP EQP EQUIP
TAG               AREA      SUBAREA  RATE  FACT TYP SIZE    DESCRIPTION
----------------  --------  --------  -----  ----  ---  ------  -----------
1                 AREA1     SUBAREA1       0 1.00 N/A    1.00 DESCRIPTION 1
2                 AREA2     SUBAREA2       0 1.00 BON    0.50 DESCRIPTION 2
3                 AREA3     SUBAREA3       0 1.00 CSL    1.75 DESCRIPTION 3
4                 AREA4     SUBAREA4       0 1.00 DFL   10.00 DESCRIPTION 4
5                 AREA5     SUBAREA5       0 1.00 PKG    5.50 DESCRIPTION 5
6                 AREA6     SUBAREA6       0 1.00 PSL    0.25 DESCRIPTION 6
7                 AREA7     SUBAREA7       0 1.00 RPL  950.50 DESCRIPTION 7
8                 AREA8     SUBAREA8       0 1.00 VLV    0.25 DESCRIPTION 8
9                 AREA9     SUBAREA9       0 1.00 FLG    0.75 DESCRIPTION 9
10                AREA10    S-AREA10       0 1.00 FLG    0.75 DESCRIPTION 10
11                AREA11    S-AREA11       0 1.00 VLV    0.75 DESCRIPTION 11
12                AREA12    S-AREA12       0 1.00 PRV    1.50 DESCRIPTION 12
13                AREA13    S-AREA13       0 1.00 VLV    0.75 DESCRIPTION 13
14                AREA14    S-AREA14       0 1.00 CMP    0.00 DESCRIPTION 14
15                AREA15    S-AREA15       0 2.00 VLV    0.75 DESCRIPTION 15
16                AREA16    S-AREA16       0 5.00 VLV    0.75 DESCRIPTION 16
17                AREA17    S-AREA17       0 .001 VLV    1.50 DESCRIPTION 17
18                AREA18    S-AREA18       0  .01 FLG    1.50 DESCRIPTION 18
19                AREA19    S-AREA19       0 0.01 FLG    0.75 DESCRIPTION 19
20                AREA20    S-AREA20       0   .1 VLV    0.75 DESCRIPTION 20
21                AREA21    S-AREA21    5000 00.1 VLV    0.75 DESCRIPTION 21
22                AREA22    S-AREA22   99999    1 VLV    0.75 DESCRIPTION 22
23                AREA23    S-AREA23   10000   10 VLV    0.75 DESCRIPTION 23
24                AREA24    S-AREA24   40000  100 FLG    0.50 DESCRIPTION 24
25                AREA25    S-AREA25      50 1000 VLV    0.75 DESCRIPTION 25

END
```

Configuration File Format

The configuration format is as follows (options are separated by a ’|’):

```
Format
CONFIGURATION<CR><LF>
VER=X.X<CR><LF>
<CR><LF>
<CR><LF>
MODEL=xxxxxxxxxx<CR><LF>
SERIAL NUMBER=idididid<CR><LF>
DETECTOR=PID|FID|PID&FID<CR><LF>
OPERATOR ID=opopopopop<CR><LF>
<CR><LF>
LOGGING<CR><LF>
-------<CR><LF>
LOG MODE=NONE|AUTO|VOC|FE|CUSTOM<CR><LF>
LOG AUTO REPEAT=OFF|ON<CR><LF>
LOG UNIT LOCK=OFF|PPB|PPM|PERCENT<CR><LF>
LOG SAVE MODE=MANUAL|AUTO<CR><LF>
LOG STORAGE FORMAT=NONE|FOXAUTO|FOXVOC|FEVOC<CR><LF>
LOG SAMPLE TIME=nnnnn<CR><LF>
```

```
LOG SAMPLE TIME UNIT=SEC|MIN<CR><LF>
LOG DATA STORED=SAMPLE|AVERAGE|MAXIMUM<CR><LF>
BARCODE VERIFY=OFF|ON<CR><LF>
ROUTE ACTIVE=OFF|ON<CR><LF>
TAG ACTIVE=OFF|ON<CR><LF>
<CR><LF>
CALIBRATION<CR><LF>
-----------<CR><LF>
CAL AUTO ACCEPT=OFF|ON<CR><LF>
CAL AUTO SAVE=OFF|ON<CR><LF>
CAL UNIT LOCK=OFF|PPB|PPM|PERCENT<CR><LF>
CAL NUM SPAN POINTS (PID)=n<CR><LF>
CAL SPAN PT 1 (PID)=ffffff PPB|PPM|PERCENT<CR><LF>
CAL SPAN PT n (PID)=ffffff PPB|PPM|PERCENT<CR><LF>
CAL NUM SPAN POINTS (FID)=n<CR><LF>
CAL SPAN PT 1 (FID)=ffffff PPB|PPM|PERCENT<CR><LF>
CAL SPAN PT n (FID)=ffffff PPB|PPM|PERCENT<CR><LF>
BACKGROUND CORRECTION (PID)=OFF|ON<CR><LF>
BACKGROUND CORRECTION (FID)=OFF|ON<CR><LF>
<CR><LF>
RESPONSE FACTORS<CR><LF>
----------------<CR><LF>
SELECTED=n<CR><LF>
MODE=FACTOR|CURVE<CR><LF>
RF1 (PID) nnnnnnnnnn xx.xx + yy.yy<CR><LF>
RF9 (PID) nnnnnnnnnn xx.xx + yy.yy<CR><LF>
RF1 (FID) nnnnnnnnnn xx.xx + yy.yy<CR><LF>
RF9 (FID) nnnnnnnnnn xx.xx + yy.yy<CR><LF>
<CR><LF>
ALARMS<CR><LF>
------<CR><LF>
HIGH (PID)=ffffff PPB|PPM|PERCENT<CR><LF>
LOW  (PID)=ffffff PPB|PPM|PERCENT<CR><LF>
STEL (PID)=ffffff PPB|PPM|PERCENT<CR><LF>
HIGH (FID)=ffffff PPB|PPM|PERCENT<CR><LF>
LOW  (FID)=ffffff PPB|PPM|PERCENT<CR><LF>
STEL (FID)=ffffff PPB|PPM|PERCENT<CR><LF>
<CR><LF>
USER OPTIONS<CR><LF>
------------<CR><LF>
BARCODE READER=NONE|HP|PSC<CR><LF>
DIGITAL DATA LOGGING=NONE|FID&PID|PPM<CR><LF>
DISPLAY DELAY=SHORT|MEDIUM|LONG<CR><LF>
KEY CLICK=OFF|ON<CR><LF>
PC LINK TYPE=FOXBORO|FEMS|TEXT-MANUAL|TEXT-AUTO<CR><LF>
PROBE=BASIC|ENHANCED<CR><LF>
<CR><LF>
END<CR><LF>
```

NOTES:

1. Lines containing information on uninstalled detectors (PID) or (FID) are not output.

2. Spaces are allowed in names and other text fields entered by the user.

3. Number fields are right justified, leading spaces.

4. The second detector repeats the RF names. During download, the last RF name encountered is used.

Sample Configuration File

```
CONFIGURATION
VER= 1.00

MODEL=TVA-1000B
SERIAL NUMBER=000007156962
DETECTOR=PID&FID
OPERATOR ID=USERID

LOGGING
-------
LOG MODE=NONE
LOG STORAGE FORMAT=NONE
LOG SAMPLE TIME=0
LOG SAMPLE TIME UNIT=SEC
LOG DATA STORED=SAMPLE
LOG UNIT LOCK=OFF
LOG AUTO REPEAT=OFF
LOG SAVE MODE=MANUAL
TAG ACTIVE=OFF
ROUTE ACTIVE=OFF
BARCODE VERIFY=OFF

CALIBRATION
-----------
```

```
CAL AUTO ACCEPT=OFF
CAL AUTO SAVE=OFF
CAL UNIT LOCK=OFF
BACKGROUND CORRECTION (PID)=ON
BACKGROUND CORRECTION (FID)=ON

RESPONSE FACTORS
----------------
SELECTED=0
MODE=FACTOR
RF0 (PID)=DEFAULT     1.00    0.00
RF1 (PID)=----------  1.00    0.00
RF2 (PID)=----------  1.00    0.00
RF3 (PID)=----------  1.00    0.00
RF4 (PID)=----------  1.00    0.00
RF5 (PID)=----------  1.00    0.00
RF6 (PID)=----------  1.00    0.00
RF7 (PID)=----------  1.00    0.00
RF8 (PID)=----------  1.00    0.00
RF9 (PID)=----------  1.00    0.00
RF0 (FID)=DEFAULT     1.00    0.00
RF1 (FID)=----------  1.00    0.00
RF2 (FID)=----------  1.00    0.00
RF3 (FID)=----------  1.00    0.00
RF4 (FID)=----------  1.00    0.00
RF5 (FID)=----------  1.00    0.00
RF6 (FID)=----------  1.00    0.00
RF7 (FID)=----------  1.00    0.00
RF8 (FID)=----------  1.00    0.00
RF9 (FID)=----------  1.00    0.00

ALARMS
------
STEL (PID)=  0.00 PPM
LOW  (PID)=  0.00 PPM
HIGH (PID)=  0.00 PPM
STEL (FID)=  0.00 PPM
LOW  (FID)=  0.00 PPM
HIGH (FID)=  0.00 PPM

USER OPTIONS
------------
PROBE=BASIC
BARCODE READER=NONE
KEY CLICK=OFF
DISPLAY DELAY=MEDIUM
PC LINK TYPE=TEXT-AUTO
DIGITAL DATA LOGGING=NONE

END
```

Calibration File Format

The calibration header format is as follows:

```
Format                               Comments
CALIBRATION DATA<CR><LF>             Title, not processed
VER=x.x<CR><LF>                      x=0-9
<CR><LF>                            Blank line, not processed
<CR><LF>                            Blank line, not processed
<detector calibration>              PID if available, see below
<detector calibration>              FID if available, see below
END<CR><LF>                         Marks end-of-text
```

The *calibration data* format is as follows (note: from 1 to 9 span gas points are allowed):

```
ddd CALIBRATION:<CR><LF>
<CR><LF>
CALIB      KNOWN        CALIB               MEASURED<CR><LF>
TYPE       CONC         DATE/TIME           CALIB VALUE<CR><LF>
-----    ----------   ------------------   ------------------------<CR><LF>
ZERO     aaaaaa uuu   dd mmm yy hh:mm:ss   bbbbbbbb COUNTS ffffffff<CR><LF>
SPAN1    aaaaaa uuu   dd mmm yy hh:mm:ss   bbbbbbbb COUNTS ffffffff<CR><LF>
  .        .    .      .  .   .   .  .  .     .        .
  .        .    .      .  .   .   .  .  .     .        .
  .        .    .      .  .   .   .  .  .     .        .
SPANn    aaaaaa uuu   dd mmm yy hh:mm:ss   bbbbbbbb COUNTS ffffffff<CR><LF>
<CR><LF>
<CR><LF>
where:
 ddd = detector type
"FID"
"PID"

  aaaaaa = gas concentration, floating point, right justified,
           leading spaces

  uuu = concentration units:
"PPB", parts-per-billion
```

```
"PPM", parts-per-million
"%" , percent
dd = day of calibration, 01-31
mmm = month of calibration, Jan-Dec
yy = year of calibration, 00-99

 hh = hour of calibration, 00-23
 mm = minute of calibration, 00-59
 ss = second of calibration, 00-59

 bbbbbbbb = detector reading for calibration gas, integer,
            right justified, leading spaces

 ffffffff = count status:
"OK"   , no errors
"DET_OFF", detector reading invalid
"DET_FAIL", detector failed, not invalid
"OVERFLOW", A/D overflow, not invalid
"UNDERFLOW", A/D underflow, not invalid or A/D overflow

 n = span gas number, 2-9
```

Sample Calibration File (Dual Detectors)

```
CALIBRATION DATA
VER= 1.00


PID CALIBRATION:

CALIB    KNOWN           CALIB             MEASURED
TYPE     CONC          DATE/TIME         CALIB VALUE
-----    ----------   -------------------  ------------------------
ZERO        0 PPB   01 JAN 80  00:00:00        0 COUNTS OK
SPAN1       0 PPB   01 JAN 80  00:00:00        0 COUNTS OK


FID CALIBRATION:

CALIB    KNOWN           CALIB             MEASURED
TYPE     CONC          DATE/TIME         CALIB VALUE
-----    ----------   -------------------  ------------------------
ZERO        0 PPB   01 JAN 80  00:00:00        0 COUNTS OK
SPAN1       0 PPB   01 JAN 80  00:00:00        0 COUNTS OK


END
```

Logged Data File Format (Upload Only)

The logged data format is as follows:

```
Format                                 Comments
LOGGED DATA<CR><LF>                    Title, not processed
VER=x.x<CR><LF>                        x=0-9
<CR><LF>                               Blank line, not processed
<logged data record 1>                 See below
                  .
                  .
                  .
<logged data record n>
<CR><LF>                               Blank line, not processed
END<CR><LF>                            Marks end-of-text
```

The logged data record is different for each data storage type. A header is printed whenever the data storage type changes. The data type records are:

```
<Auto logging record>
<VOC logging record>
<FE logging record>
```

Auto logged header and data, single detector:

```
<CR><LF>
AUTO DATA  ttttttttttttttttt<CR><LF>
  DATE       TIME       CONCENTRATION<CR><LF>
---------  --------  --------------------<CR><LF>
dd mmm yy  hh:mm:ss  xxxxxx uuu ffffffff<CR><LF>
```

Auto logged header, dual detector:

```
<CR><LF>
AUTO DATA  ttttttttttttttttt<CR><LF>
  DATE       TIME     PID CONCENTRATION     FID CONCENTRATION<CR><LF>
--------- -------- -------------------- --------------------<CR><LF>
dd mmm yy  hh:mm:ss  xxxxxx uuu ffffffffff  xxxxxx uuu ffffffffff<CR><LF>
```

VOC logged header and data, single detector:

```
<CR><LF>
VOC DATA<CR><LF>
  DATE       TIME         TAG            CONCENTRATION<CR><LF>
--------- -------- ---------------- --------------------<CR><LF>
dd mmm yy  hh:mm:ss  tttttttttttttttt  xxxxxx uuu ffffffff<CR><LF>
```

VOC logged header and data, dual detector:

```
<CR><LF>
VOC DATA<CR><LF>
  DATE       TIME         TAG         PID CONCENTRATION     FID CONCENTRATION<CR><LF>
--------- -------- ---------------- -------------------- --------------------<CR><LF>
dd mmm yy  hh:mm:ss  tttttttttttttttt  xxxxxx uuu ffffffff  xxxxxx uuu ffffffff<CR><LF>
```

FE logged header and data:

```
<CR><LF>
FE DATA                                                             LEAK   REPAIR<CR><LF>
  DATE       TIME       TAG        DET   CONCENTRATION       BACKGROUND      SOURCE METHOD<CR><LF>
--------- -------- ---------------- --- -------------------- -------------------- ------  --
----   <CR><LF>
dd mmm yy  hh:mm:ss  tttttttttttttttt  ddd  xxxxxx uuu ffffffff  xxxxxx uuu ffffffff    LLL
RRRRR<CR><LF>
where:
 ttt... = tag

 xxxxxx = concentration, floating point, right justified, leading spaces

 uuu = concentration unit:
"PPB"
"PPM"
"%  "

 ffffffff = data status:
"OK", no errors or alarms
"DET_OFF", detector not valid
"DET_FAIL", detector failed, not "INVALID"
"OVERFLOW ", A/D overflow, not "DET_FAIL"
"UNDERFLOW", A/D underflow, not "OVERFLOW"
"HIGH_ALRM", high alarm, no STEL, not "UNDERFLOW"
"LOW_ALARM", low alarm, no high alarm or STEL, not "UNDERFLOW"
"STEL_ALRM", STEL alarm, no low or high alarm, not "UNDERFLOW"
"HIGH&STEL", high alarm and STEL, not "UNDERFLOW"
"LOW&STEL ", low alarm and STEL, no high alarm, not "UNDERFLOW"

 ddd = detector:
"PID"
"FID"
```

Sample Logged Data File (FE format)

```
LOGGED DATA
VER= 1.00

FE DATA                                                              LEAK   REPAIR
  DATE       TIME       TAG        DET     BACKGROUND          CONCENTRATION      LEAK   SOURCE METHOD
--------- -------- ---------------- --- -------------------- -------------------- ------- ------ ------
18 APR 96  08:53:42 1               PID    0.00 PPM OK         67675 PPM OK         LEAKER!  N/A    N/A

FE DATA                                                              LEAK   REPAIR
  DATE       TIME       TAG        DET     BACKGROUND          CONCENTRATION      LEAK   SOURCE METHOD
--------- -------- ---------------- --- -------------------- -------------------- ------- ------ ------
18 APR 96  09:15:28 19              PID    1208 PPM OK          1056 PPM OK         LEAKER!  N/A    N/A

FE DATA                                                              LEAK   REPAIR
  DATE       TIME       TAG        DET     BACKGROUND          CONCENTRATION      LEAK   SOURCE METHOD
--------- -------- ---------------- --- -------------------- -------------------- ------- ------ ------
18 APR 96  17:26:20 3               FID    0.00 PPM OK          6.33 PPM OK         LEAKER!  N/A    N/A
```

```
                                                                        LEAK   REPAIR
   DATE      TIME        TAG         DET     BACKGROUND         CONCENTRATION      LEAK   SOURCE METHOD
--------- -------- ---------------- --- -------------------- -------------------- ------- ------ ------
18 APR 96 17:49:59 18               FID    0.00 PPM OK          1.94 PPM OK       LEAKER! N/A    N/A

END
```

Sample Logged Data Files

Auto Format, Both PID and FID

```
LOGGED DATA
VER= 1.00

AUTO DATA  MAN 3
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- --------------------
09 MAR 96 01:19:32  0.00 %   OK          0.00 %   OK          0 PPB OK                10 PPB OK
09 MAR 96 01:20:02  0.00 %   OK          0.00 %   OK          0 PPB OK              6376 PPB OK
09 MAR 96 01:20:32  0.00 %   OK         15.00 %   OVERFLOW     0 PPB OK             15.00 %   OVERFLOW
09 MAR 96 01:21:02  0.00 %   OK          0.02 %   OK          0 PPB OK               199 PPM OK
09 MAR 96 01:21:32  0.00 %   OK          0.18 %   OK          0 PPB OK              1843 PPM OK


AUTO DATA  MAN 4
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 01:35:13  0.00 %   OK          0.01 %   OK          0 PPB OK               637 PPB OK
09 MAR 96 01:35:43  0.00 %   OK          3.08 %   OK          0 PPB OK             14.96 %   OK


AUTO DATA  MAN 4
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 01:39:06  0.00 %   OK          0.01 %   OK          0 PPB OK               635 PPB OK
09 MAR 96 01:39:36  0.00 %   OK          3.04 %   OK          0 PPB OK             14.93 %   OK
09 MAR 96 01:40:06  0.00 %   OK          0.18 %   OK          0 PPB OK             15.00 %   OVERFLOW


AUTO DATA  BARCODE
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 02:49:47  0.01 %   OK          7.30 %   OK          101 PPM OK             -96 PPM OK
09 MAR 96 02:50:17  0.01 %   OK          0.00 %   OK          101 PPM OK             -96 PPM OK
09 MAR 96 02:50:47  0.01 %   OK          0.00 %   OK          101 PPM OK             200 PPM OK
09 MAR 96 02:51:17  0.01 %   OK          0.02 %   OK          101 PPM OK             200 PPM OK


AUTO DATA  BARCODE
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 03:03:52  0.01 %   OK          7.39 %   OK          101 PPM OK             -96 PPM OK
09 MAR 96 03:04:22  0.01 %   OK          0.00 %   OK          101 PPM OK             -96 PPM OK
09 MAR 96 03:04:52  0.01 %   OK          0.00 %   OK          101 PPM OK             201 PPM OK
09 MAR 96 03:05:22  0.01 %   OK          0.02 %   OK          101 PPM OK             201 PPM OK


AUTO DATA  BC2
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 03:19:44  0.01 %   OK          0.02 %   OK          101 PPM OK             201 PPM OK
09 MAR 96 03:20:14  0.01 %   OK          0.02 %   OK          101 PPM OK             201 PPM OK


AUTO DATA  BC4
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 03:35:41  0.00 %   OK          0.00 %   OK          0 PPB OK               606 PPM OK
09 MAR 96 03:36:11  0.00 %   OK          0.00 %   OK          0 PPB OK               606 PPM OK
09 MAR 96 03:36:41  0.00 %   OK          0.00 %   OK          0 PPB OK               606 PPM OK


AUTO DATA  1
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- -----------
09 MAR 96 03:53:21  0.00 %   OK          0.00 %   OK          0 PPB OK               128 PPB OK


AUTO DATA  1
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- --------------------
09 MAR 96 03:55:28  0.00 %   OK          0.18 %   OK          0 PPB OK              3.13 %   OK


AUTO DATA  2
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- --------------------
09 MAR 96 03:57:38  0.00 %   OK          0.00 %   OK          0 PPB OK              6395 PPB OK
09 MAR 96 03:58:08  0.00 %   OK          0.00 %   OK          0 PPB OK              6396 PPB OK


AUTO DATA  11
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- --------------------
09 MAR 96 04:28:54  0.00 %   OK          0.02 %   OK          0 PPB OK               201 PPM OK
09 MAR 96 04:29:14  0.00 %   OK          3.23 %   OK          0 PPB OK              3.13 %   OK


AUTO DATA  6
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION     FID BACKGROUND      FID CONCENTRATION
--------- -------- -------------------- -------------------- -------------------- --------------------
09 MAR 96 04:31:34  0.00 %   OK          3.13 %   OK          0 PPB OK              3.13 %   OK
09 MAR 96 04:31:54  0.00 %   OK          0.18 %   OK          0 PPB OK              3.12 %   OK
```

```
AUTO DATA  4
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
09 MAR 96 04:32:40   0.00 %   OK           0.18 %   OK           0 PPB OK              3.14 %   OK


AUTO DATA  6
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
09 MAR 96 05:45:51   0.00 %   OK           8.99 %   OK           0 PPB OK              561 PPB OK
09 MAR 96 05:46:11   0.00 %   OK          26.94 %   OK           0 PPB OK              109 PPB OK


AUTO DATA  7
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
09 MAR 96 05:48:36   0.00 %   OK           8.93 %   OK           0 PPB OK              1457 PPB OK


AUTO DATA  15
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
09 MAR 96 05:59:57   5.39 %   OK           4.47 %   OK          45 PPB OK              112 PPB OK


AUTO DATA  19
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
09 MAR 96 23:59:33   3.37 %   OK           0.02 %   OK          28 PPB OK              1 PPB OK
09 MAR 96 23:59:53   3.37 %   OK           0.24 %   OK          28 PPB OK              11 PPB OK


AUTO DATA  20
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 00:55:09  10.10 %   OK           7.19 %   OK          28 PPB OK              60 PPB OK
10 MAR 96 00:55:29  10.10 %   OK           6.07 %   OK          28 PPB OK              101 PPB OK


AUTO DATA  20
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 00:58:48  10.10 %   OK           7.98 %   OK          28 PPB OK              20 PPB OK


AUTO DATA  23
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 01:46:29   0.00 %   OK          **.** %   OK          112 PPB OK             560 PPB OK
10 MAR 96 01:46:49   0.00 %   OK          88.13 %   OK          112 PPB OK             1980 PPB OK


AUTO DATA  23
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 01:51:41   0.00 %   OK          67.78 %   OK          112 PPB OK             6020 PPB OK


AUTO DATA  DET OFF
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:01:29   0.00 %   OK          ----- --- DET_OFF      0 PPB OK              256 PPB OK
10 MAR 96 02:01:49   0.00 %   OK          ----- --- DET_OFF      0 PPB OK              ----- --- DET_OFF
10 MAR 96 02:02:09   0.00 %   OK          ----- --- DET_OFF      0 PPB OK              256 PPB OK
10 MAR 96 02:02:29   0.00 %   OK          14.76 %   OK           0 PPB OK              256 PPB OK


AUTO DATA  DET OFF
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:07:11   0.00 %   OK          14.76 %   OK           0 PPB OK              ----- --- DET_OFF
10 MAR 96 02:07:31   0.00 %   OK          14.76 %   OK           0 PPB OK              256 PPB OK


AUTO DATA  FLOW-TEST
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:37:13   0.00 %   OK           5.19 %   DET_FAIL      0 PPB OK              658 PPB OK
10 MAR 96 02:37:33   0.00 %   OK          30.71 %   OK           0 PPB OK              20 PPB OK
10 MAR 96 02:37:53   0.00 %   OK           5.04 %   DET_FAIL      0 PPB OK              14 PPB OK


AUTO DATA  FLOW-TEST
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:43:10   0.00 %   OK           5.21 %   DET_FAIL      0 PPB OK              658 PPB OK
10 MAR 96 02:43:30   0.00 %   OK          30.68 %   OK           0 PPB OK              15 PPB DET_FAIL


AUTO DATA  FLOW-TEST
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:45:39   0.00 %   OK           5.21 %   DET_FAIL      0 PPB OK              658 PPB OK
10 MAR 96 02:45:59   0.00 %   OK          30.67 %   OK           0 PPB OK              12 PPB DET_FAIL
10 MAR 96 02:46:19   0.00 %   OK           5.08 %   DET_FAIL      0 PPB OK              12 PPB DET_FAIL


AUTO DATA  FLOW-TEST
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 02:57:38   0.00 %   OK          -1.27 %   UNDERFLOW     0 PPB OK              18 PPB OK
10 MAR 96 02:57:58   0.00 %   OK           5.33 %   OK           0 PPB OK              -142 PPB UNDERFLOW
10 MAR 96 02:58:18   0.00 %   OK          -1.27 %   UNDERFLOW     0 PPB OK              -142 PPB UNDERFLOW


AUTO DATA  FLOW-TEST
   DATE      TIME    PID BACKGROUND        PID CONCENTRATION     FID BACKGROUND        FID CONCENTRATION
--------- --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96 03:01:27   0.00 %   OK          **.** %   OVERFLOW      0 PPB OK              1420 PPB OK
10 MAR 96 03:01:47   0.00 %   OK          **.** %   OK           0 PPB OK              1458 PPB OVERFLOW
```

```
10 MAR 96  03:02:07    0.00 %   OK       **.** %   OVERFLOW      0 PPB OK           1458 PPB OVERFLOW
10 MAR 96  03:02:27    0.00 %   OK       -1.27 %   UNDERFLOW     0 PPB OK           1458 PPB OVERFLOW
```

```
AUTO DATA   ALARM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  03:30:16    0.00 %   OK       30.69 %   LOW_ALARM     0 PPB OK            256 PPB OK
10 MAR 96  03:31:16    0.00 %   OK       30.68 %   LOW_ALARM     0 PPB OK            657 PPB LOW_ALARM
10 MAR 96  03:32:16    0.00 %   OK       14.67 %   OK            0 PPB OK            657 PPB LOW_ALARM
10 MAR 96  03:33:16    0.00 %   OK       57.01 %   HIGH_ALRM     0 PPB OK            657 PPB LOW_ALARM
10 MAR 96  03:34:16    0.00 %   OK       83.68 %   HIGH_ALRM     0 PPB OK           1299 PPB HIGH_ALRM
10 MAR 96  03:35:16    0.00 %   OK       30.66 %   LOW_ALARM     0 PPB OK           1172 PPB HIGH_ALRM
10 MAR 96  03:36:16    0.00 %   OK       14.70 %   OK            0 PPB OK           1172 PPB HIGH_ALRM
10 MAR 96  03:37:16    0.00 %   OK       **.** %   HIGH_ALRM     0 PPB OK            256 PPB OK
```

```
AUTO DATA   25
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  03:44:40    0.00 %   OK       **.** %   HIGH_ALRM     0 PPB OK           -142 PPM UNDERFLOW
10 MAR 96  03:45:40    0.00 %   OK       **.** %   HIGH_ALRM     0 PPB OK           1458 PPM OVERFLOW
```

```
AUTO DATA   STEL-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  04:16:46    0.00 %   OK       30.69 %   STEL_ALRM     0 PPB OK            256 PPB OK
```

```
AUTO DATA   STEL-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  04:30:30    0.00 %   OK       26.95 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  04:35:30    0.00 %   OK       26.95 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  04:40:30    0.00 %   OK       26.96 %   STEL_ALRM     0 PPB OK            563 PPB STEL_ALRM
```

```
AUTO DATA   STEL-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  06:38:45    0.00 %   OK       30.68 %   STEL_ALRM     0 PPB OK            256 PPB OK
```

```
AUTO DATA   STEL-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  06:46:30    0.00 %   OK       26.96 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  06:51:30    0.00 %   OK       26.95 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  06:56:30    0.00 %   OK       26.96 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  07:01:30    0.00 %   OK       26.96 %   STEL_ALRM     0 PPB OK            563 PPB STEL_ALRM
```

```
AUTO DATA   STEL-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:11:18    0.00 %   OK        0.00 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  07:16:18    0.00 %   OK        0.00 %   OK            0 PPB OK            563 PPB OK
10 MAR 96  07:21:18    0.00 %   OK        0.00 %   OK            0 PPB OK            563 PPB STEL_ALRM
```

```
AUTO DATA   MIX-ALM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:33:36    0.00 %   OK       **.** %   OVERFLOW      0 PPB OK           1458 PPB OVERFLOW
```

```
AUTO DATA   MIX-ALM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:34:44    0.00 %   OK       **.** %   OVERFLOW      0 PPB OK           1458 PPB OVERFLOW
```

```
AUTO DATA   MIX-ALM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:36:11    0.00 %   OK       **.** %   LOW&STEL      0 PPB OK           1421 PPB HIGH_ALRM
```

```
AUTO DATA   MIX-ALM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:37:30    0.00 %   OK        6.73 %   STEL_ALRM     0 PPB OK           1421 PPB HIGH&STEL
```

```
AUTO DATA   MIX-ALM-TEST
   DATE      TIME    PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND        FID CONCENTRATION
---------  --------  --------------------  --------------------  --------------------  --------------------
10 MAR 96  07:38:41    0.00 %   OK        6.73 %   STEL_ALRM     0 PPB OK           -140 PPB STEL_ALRM
10 MAR 96  07:39:06    0.00 %   OK       ----- ---  DET_OFF       0 PPB OK           -140 PPB STEL_ALRM
10 MAR 96  07:39:31    0.00 %   OK       ----- ---  DET_OFF       0 PPB OK           -140 PPB STEL_ALRM
```

```
END
```

Auto Format, FID Only

```
LOGGED DATA
VER= 1.00
```

```
AUTO DATA   6
   DATE      TIME    FID BACKGROUND       FID CONCENTRATION
---------  --------  --------------------  --------------------
18 APR 96  15:42:12    0 PPB OK            560 PPB OK
18 APR 96  15:42:32    0 PPB OK            111 PPB OK
```

```
AUTO DATA  20
   DATE      TIME     FID BACKGROUND       FID CONCENTRATION
---------  --------  --------------------  --------------------
18 APR 96  15:51:19      6 PPB OK               60 PPB OK
18 APR 96  15:51:39      6 PPB OK              100 PPB OK
18 APR 96  15:51:59      6 PPB OK               20 PPB OK

END
```

Auto Format, PID Only

```
LOGGED DATA
VER= 1.00

AUTO DATA  6
   DATE      TIME     PID BACKGROUND       PID CONCENTRATION
---------  --------  --------------------  --------------------
17 APR 96  18:55:33   0.00 %    OK            8.99 %    OK
17 APR 96  18:55:53   0.00 %    OK           27.02 %    OK

AUTO DATA  20
   DATE      TIME     PID BACKGROUND       PID CONCENTRATION
---------  --------  --------------------  --------------------
17 APR 96  19:06:41   2.02 %    OK            7.19 %    OK
17 APR 96  19:07:01   2.02 %    OK            6.08 %    OK

END
```

VOC Format, Both PID/FID

```
LOGGED DATA
VER= 1.00

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
07 MAR 96  14:10:02  BARCODE           160 PPM OK            -2.39 PPM OK          160 PPM OK            1322 PPM OK
07 MAR 96  14:13:55  BC2               160 PPM OK             323 PPM OK           160 PPM OK            2.31 %   OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
07 MAR 96  14:48:49  15                256 PPB OK             502 PPB OK           112 PPB OK             112 PPB OK
07 MAR 96  14:53:01  16                640 PPB OK            1255 PPB OK           280 PPB OK             280 PPB OK
07 MAR 96  14:57:23  17                  0 PPB OK            31.30 PPM OK            0 PPB OK               1 PPB OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
07 MAR 96  15:25:15  18                  0 PPB OK             595 PPB OK             2 PPB OK              18 PPB OK
07 MAR 96  15:27:55  19                  0 PPB OK            5513 PPB OK             2 PPB OK              30 PPB OK
07 MAR 96  15:29:36  20                  4 PPB OK            55.14 PPM OK           17 PPB OK             180 PPB OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
07 MAR 96  17:45:18  21                  0 PPB OK             621 PPB OK             6 PPB OK               5 PPB OK
07 MAR 96  17:52:29  22                  0 PPB OK            6398 PPB OK            56 PPB OK              56 PPB OK
07 MAR 96  17:54:22  25                  0 PPB OK             383 PPM OK           56.00 PPM OK           200 PPM OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  10:32:24  21                  0 PPB OK             633 PPB OK             6 PPB OK               6 PPB OK
08 MAR 96  10:33:18  22                  0 PPB OK            6327 PPB OK            56 PPB OK              55 PPB OK
08 MAR 96  10:34:34  25                  0 PPB OK             383 PPM OK           56.00 PPM OK           200 PPM OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  11:07:55  MAX                 0 PPB OK            8.46 %    OK             0 PPB OK              17 PPB OK
08 MAR 96  11:13:25  MAX                 0 PPB OK             196 PPM OK             0 PPB OK            1294 PPB OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  11:38:35  AVERAGE             0 PPB OK            8.43 %    OK             0 PPB OK             572 PPB OK
08 MAR 96  12:30:34  AVERAGE             0 PPB OK             389 PPM OK             0 PPB OK              14 PPB OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  12:53:12  SAMPLE              0 PPB OK             -24 PPB OK             0 PPB OK             -60 PPB OK
08 MAR 96  12:58:03  SAMPLE              0 PPB OK            74.37 PPM OK            0 PPB OK             109 PPB OK

VOC DATA
   DATE      TIME       TAG        PID BACKGROUND       PID CONCENTRATION    FID BACKGROUND       FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  13:15:12  FLOW-TEST           0 PPB OK               0 PPB DET_FAIL       0 PPB OK             658 PPB OK
08 MAR 96  13:17:18  FLOW-TEST           0 PPB OK             200 PPM OK             0 PPB OK              16 PPB DET_FAIL
08 MAR 96  13:24:00  FLOW-TEST           0 PPB OK               0 PPB DET_FAIL       0 PPB OK              16 PPB DET_FAIL
08 MAR 96  13:27:18  FLOW-TEST           0 PPB OK             -48 PPB UNDERFLOW      0 PPB OK              16 PPB OK
```

```
08 MAR 96  13:29:23  FLOW-TEST        0 PPB OK          0 PPB OK          0 PPB OK         -142 PPB UNDERFLOW
08 MAR 96  13:31:13  FLOW-TEST        0 PPB OK        -48 PPB UNDERFLOW   0 PPB OK         -142 PPB UNDERFLOW
08 MAR 96  13:34:16  FLOW-TEST        0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1442 PPB OK
08 MAR 96  13:35:33  FLOW-TEST        0 PPB OK      14.47 %   OK          0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  13:36:29  FLOW-TEST        0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  13:37:26  FLOW-TEST        0 PPB OK        -48 PPB UNDERFLOW   0 PPB OK         1458 PPB OVERFLOW

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  13:59:33  ALARM-TEST       0 PPB OK        200 PPM LOW_ALARM   0 PPB OK          258 PPB OK
08 MAR 96  14:00:48  ALARM-TEST       0 PPB OK        200 PPM LOW_ALARM   0 PPB OK          659 PPB LOW_ALARM
08 MAR 96  14:07:00  ALARM-TEST       0 PPB OK       6286 PPB OK          0 PPB OK          659 PPB LOW_ALARM

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  14:12:58  ALARM-TEST       0 PPB OK       3.10 %    HIGH_ALRM    0 PPB OK          659 PPB LOW_ALARM
08 MAR 96  14:16:20  ALARM-TEST       0 PPB OK       8.44 %    HIGH_ALRM    0 PPB OK         1300 PPB HIGH_ALRM
08 MAR 96  14:22:13  ALARM-TEST       0 PPB OK        200 PPM LOW_ALARM    0 PPB OK         1172 PPB HIGH_ALRM
08 MAR 96  14:26:30  ALARM-TEST       0 PPB OK       6285 PPB OK           0 PPB OK         1172 PPB HIGH_ALRM
08 MAR 96  14:28:39  ALARM-TEST       0 PPB OK      14.90 %    HIGH_ALRM    0 PPB OK          258 PPB OK

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  03:24:02  STEL-TEST        0 PPB OK        201 PPM STEL_ALRM   0 PPB OK          257 PPB OK
08 MAR 96  03:45:34  STEL-TEST        0 PPB OK      74.11 PPM STEL_ALRM   0 PPB OK          563 PPB STEL_ALRM

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  04:28:03  STEL-TEST        0 PPB OK      73.77 PPM STEL_ALRM   0 PPB OK          565 PPB STEL_ALRM

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  -------
08 MAR 96  04:37:50  STEL-TEST        0 PPB OK       6281 PPB OK          0 PPB OK          658 PPB OK
08 MAR 96  04:43:14  STEL-TEST        0 PPB OK       6281 PPB OK          0 PPB OK          658 PPB OK
08 MAR 96  04:48:19  1                0 PPB OK       6282 PPB OK          0 PPB OK          658 PPB STEL_ALRM
08 MAR 96  04:55:39  STEL TEST        0 PPB OK       6283 PPB OK          0 PPB OK          658 PPB STEL_ALRM

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  05:11:38  MIX-ALM-TEST     0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  05:13:52  MIX-ALM-TEST     0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  05:21:59  MIX-ALM-TEST     0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  05:24:00  MIX-ALM-TEST     0 PPB OK      14.71 %   HIGH&STEL   0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  05:33:04  MIX-ALM-TEST     0 PPB OK        -48 PPB DET_FAIL    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  05:39:27  MIX-ALM-TEST     0 PPB OK        -48 PPB UNDERFLOW   0 PPB OK         1438 PPB LOW_ALARM
08 MAR 96  05:45:37  MIX-ALM-TEST     0 PPB OK      ----- --- DET_OFF     0 PPB OK         1440 PPB LOW_ALARM

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION   FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------  --------------------  --------------------
08 MAR 96  06:05:06  MIX-ALM-TEST     0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  06:07:04  MIX-ALM-TEST     0 PPB OK      15.00 %   OVERFLOW    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  06:08:09  MIX-ALM-TEST     0 PPB OK      14.12 %   HIGH&STEL   0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  06:10:37  MIX-ALM-TEST     0 PPB OK        -48 PPB DET_FAIL    0 PPB OK         1458 PPB OVERFLOW
08 MAR 96  06:17:43  MIX-ALM-TEST     0 PPB OK        -48 PPB UNDERFLOW   0 PPB OK         1445 PPB LOW_ALARM
08 MAR 96  06:18:20  MIX-ALM-TEST     0 PPB OK      ----- --- DET_OFF     0 PPB OK         1446 PPB LOW_ALARM

END
```

VOC Format, FID Only

```
LOGGED DATA
VER= 1.00

VOC DATA
   DATE      TIME       TAG      FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------
18 APR 96  16:40:57  8                0 PPB OK         1436 PPB OK

VOC DATA
   DATE      TIME       TAG      FID BACKGROUND    FID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------
18 APR 96  17:01:29  19               2 PPB OK           30 PPB OK

END
```

VOC Format, PID Only

```
LOGGED DATA
VER= 1.00

VOC DATA
   DATE      TIME       TAG      PID BACKGROUND    PID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------
17 APR 96  19:17:02  8                0 PPB OK          600 PPM OK
```

```
VOC DATA
  DATE      TIME      TAG              PID BACKGROUND      PID CONCENTRATION
---------  --------  ----------------  --------------------  --------------------
17 APR 96  19:38:36  20                    4 PPB OK         55.03 PPM OK

END
```

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